The Power in Electrical Safety
Main Catalogue Edition 2020/2021
Insulation monitoring devices
ISOMETER®

Equipment for insulation fault location
ISOSCAN®

Residual current monitoring systems
LINETRAXX®

Neutral Grounding Resistor Monitor (NGR)
LINETRAXX®

Power Quality and Energy Measurement
LINETRAXX®

Measuring and monitoring relays
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. With over 800 employees we are globally present in over 70 countries.
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<th>ISOMETER® iso685-…-B</th>
<th>ISOMETER® iso685-…-P</th>
<th>ISOMETER® isoNAV685-D</th>
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<td>DC</td>
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<th>Suitable system components</th>
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<td>AGH150W-4</td>
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<td>AGK204S-4</td>
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<td>AGH520S</td>
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<td>AGH675S-7</td>
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<td>AGH676S-4</td>
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<td>ISOMETER® IRDH275</td>
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<td><strong>Oil &amp; Gas</strong></td>
<td><strong>Railway</strong></td>
<td><strong>AC, DC or AC/DC medium voltage systems</strong></td>
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<tr>
<td>AC 0…1000 V, 3AC 0…690 V, DC 0…1300 V</td>
<td>AC, 3(N)AC 0…690 V, DC 0…1000 V</td>
<td>AC, 3(N)AC 0…690 V, DC 0…365 V</td>
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<td>≤ 1000</td>
<td>≤ 1000</td>
<td>≤ 500</td>
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**Suitable system components**

|                      |                      |                      |                      |                      |                      |
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|                      |                      |                      |                      |                      |                      |

**Type P. Suitable system components**

- FP200
- AGH150W-4
- AGH204S-4
- AGH520S
- AGH675S-7
- AGH676S-4
- ISOMETER® iso685-…
- ISOMETER® iso685-…-B
- ISOMETER® iso685-…-P
- ISOMETER® isoNAV685-D
- ISOMETER® isoNAV685-D-B
- ISOMETER® isoHR685W-…-B
- ISOMETER® isoRW685W-D
- ISOMETER® IRDH275
- ISOMETER® IRDH275BM-7
- ISOMETER® IRDH375
- ISOMETER® IRDH575

**Special applications**
- Quick response to combined resistance and offset voltage measurement
- De-energised loads/frequency converters
- Oil & Gas Railway AC, DC or AC/DC medium voltage systems
- Equipment for insulation fault location

**Nominal system voltage**
- **U_n**
  - AC, 3(N)AC 0…690 V
  - DC 0…1000 V
  - AC, 3(N)AC 0…690 V
  - DC 0…565 V
  - AC, 3(N)AC 0…690 V
  - DC 0…565 V (absolute)
  - AC, 3(N)AC 0…690 V
  - DC 0…1000 V

**System leakage capacitance**
- **C**
  - AC, 3(N)AC 0…690 V
  - DC 0…1000 V
  - AC, 3(N)AC 0…690 V
  - DC 0…1000 V
  - AC, 3(N)AC 0…690 V
  - DC 0…565 V

**Tolerance of**
- **U_n**
  - + 15 %
  - + 15 %
  - + 15 %
  - + 15 %
  - + 15 %
  - + 15 %

**System leakage capacitance**
- **C**
  - ≤ 1000
  - ≤ 500
  - ≤ 5
  - ≤ 500
  - ≤ 500 (150)

**Response value**
- **R_an**
  - 1…10000
  - 1…10000
  - 1…10000
  - 100…10000
  - 1…10000
  - 1…10000

**Coupled systems**
- Locating current injector for insulation fault location

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

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

**2020/2021 Insulation monitoring devices | Device overview**
### Overview insulation monitoring devices ISOMETER®

<table>
<thead>
<tr>
<th>ISOMETER®</th>
<th>ISOMETER®</th>
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<tr>
<td>IR420-D4</td>
<td>IR425</td>
<td>iso1685P</td>
<td>iso1685DP</td>
<td>isoHV1685D</td>
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</table>

<table>
<thead>
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<th>Page</th>
<th>16</th>
<th>19</th>
<th>22</th>
<th>25</th>
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#### Special applications

<table>
<thead>
<tr>
<th>Circuits</th>
<th>ISOMETER® IR420-D4</th>
<th>ISOMETER® IR425</th>
<th>ISOMETER® iso1685P</th>
<th>ISOMETER® iso1685DP</th>
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<tr>
<td>Control circuits</td>
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<td>Auxiliary circuits</td>
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<tr>
<td>Main circuits</td>
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#### Voltage system

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<th>AC</th>
<th>AC/DC</th>
<th>DC</th>
<th>ISOMETER® IR420-D4</th>
<th>ISOMETER® IR425</th>
<th>ISOMETER® iso1685P</th>
<th>ISOMETER® iso1685DP</th>
<th>ISOMETER® isoHV1685D</th>
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#### Nominal system voltage $U_n$

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<th>ISOMETER® iso1685DP</th>
<th>ISOMETER® isoHV1685D</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 0...250 V</td>
<td>AC/DC 0...300 V</td>
<td>AC 0...1000 V, DC 0...1500 V</td>
<td>AC 0...1000 V, DC 0...1500 V</td>
<td>AC 0...2000 V, DC 0...3000 V</td>
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#### Tolerance of $U_n$

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<th>ISOMETER® IR420-D4</th>
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<th>ISOMETER® iso1685DP</th>
<th>ISOMETER® isoHV1685D</th>
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</thead>
<tbody>
<tr>
<td>+20 %</td>
<td>+20 %</td>
<td>+10 %, +6 %</td>
<td>+10 %, +5 %</td>
<td>+10 %, +5 %</td>
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#### System leakage capacitance $C_e\ \mu F$

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<tr>
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<th>ISOMETER® IR425</th>
<th>ISOMETER® iso1685P</th>
<th>ISOMETER® iso1685DP</th>
<th>ISOMETER® isoHV1685D</th>
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<td>≤ 20</td>
<td>≤ 20</td>
<td>≤ 500</td>
<td>≤ 2000</td>
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#### Response value $R_{an}\ \Omega$

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#### Coupled systems

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#### Locating current injector for insulation fault location

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#### Installation

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

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#### Interfaces

- Web server
- Modbus
- BCOM
- BS
- BMS
- isoData

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#### Suitable system components

- FP200: 65
- AGH150W-4: 324
- AGH204S-4: 326
- AGH520S: 327
- AGH675S-7: 328
- AGH676S-4: 339
### ISOMETER® Insulation Monitoring Devices

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<th>ISOMETER® IR1575</th>
<th>ISOMETER® IR427</th>
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**Inspected installing work platforms**

**Medical locations**

**Medical locations with a low level of insulation**

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<th>Voltage System</th>
<th>Nominal System Voltage</th>
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<tr>
<td>DC 0…100 V,</td>
<td>DC 0…1000 V, DC 0…1500 V</td>
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<tr>
<td>AC 0…1000 V,</td>
<td>DC 0…1500 V</td>
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<tr>
<td>AC 0…1500 V,</td>
<td>DC 0…3000 V</td>
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<td>AC 0…2000 V,</td>
<td>DC 0…3000 V</td>
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<tr>
<td>AC 0…4000 V,</td>
<td>DC 0…4000 V</td>
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<tr>
<td>AC 0…7000 V,</td>
<td>DC 0…7000 V</td>
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<tr>
<td>AC 0…10000 V,</td>
<td>DC 0…10000 V</td>
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<table>
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<tr>
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<th>+ 10%</th>
<th>+ 5%</th>
<th>+ 10%</th>
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<td>+20%</td>
<td>+15%</td>
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<td>+5%</td>
<td>+10%</td>
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### System Leaks Capacitance

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<th>C&lt;sub&gt;e&lt;/sub&gt; µF</th>
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<th>≤ 2000</th>
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### Response Value

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<th>1…200</th>
<th>200…1000</th>
<th>200…1000</th>
<th>200…1000</th>
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### Coupled Systems

- Locating current injector for insulation fault location

### Installation

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

### Interfaces

- Web server
- Modbus RTU
- B-COM
- B-S
- B-M
- isoData

### Suitable System Components

<table>
<thead>
<tr>
<th>Suitable System Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>FP200 65</td>
</tr>
<tr>
<td>AGH150W-4 324</td>
</tr>
<tr>
<td>AGH204S-4 326</td>
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<tr>
<td>AGH520S 327</td>
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<tr>
<td>AGH675S-7 328</td>
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<td>AGH676S-4 330</td>
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2020/2021 Insulation monitoring devices | Device overview
Overview insulation monitoring devices ISOMETER®

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<th>AC</th>
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<th>DC</th>
<th>Nominal system voltage $U_n$</th>
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<td></td>
<td></td>
<td></td>
<td>via AGH-PV</td>
<td>+ 10%</td>
<td>≤ 2000</td>
<td>0.2...100</td>
<td>DIN rail</td>
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<td></td>
<td>3(N)AC 0...793 V DC 0...1000 V</td>
<td>+ 15%</td>
<td>≤ 500</td>
<td>1...990</td>
<td>Screw mounting</td>
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<td>99</td>
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<td></td>
<td></td>
<td>DC 0...1000V, AC 0...690V, 15...460Hz</td>
<td>+ 6%</td>
<td>≤ 2000</td>
<td>0.2...990</td>
<td>Panel mounting/ wall fastening</td>
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<td>105</td>
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<td>DC 0...1500V</td>
<td>offline</td>
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<td>100...10000</td>
<td>Web server</td>
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<td>offline</td>
<td>AC 0...250V</td>
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<td>1...200</td>
<td>Modbus</td>
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Suitable system components

<table>
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<tr>
<td>FP200</td>
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<td>AGHS20S</td>
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<td>AGH675S-7</td>
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<td>AGH676S-4</td>
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### Suitable system components

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<thead>
<tr>
<th>ISOMETER® IR123</th>
<th>ISOMETER® IR155</th>
<th>ISOMETER® isoEV425</th>
<th>ISOMETER® isoCHA425</th>
<th>ISOMETER® iso165C</th>
<th>ISOMETER® isoRW425</th>
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<td>111</td>
<td>114</td>
<td>118</td>
<td>122</td>
<td>125</td>
<td>128</td>
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<tr>
<td>Mobile generators</td>
<td>Electric mobility</td>
<td>Electric mobility</td>
<td>Electric mobility</td>
<td>Electric mobility</td>
<td>Railway</td>
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#### Special applications
- Photovoltaic
- Disconnected loads
- Mobile generators
- Electric mobility
- Railway

#### Voltage system
- 3(N)AC
- AC
- AC/DC
- DC

<table>
<thead>
<tr>
<th>Name</th>
<th>Voltage System</th>
<th>Tolerance</th>
<th>System leakage capacitance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3(N)AC 0…793 V</td>
<td>+ 10 %</td>
<td>≤ 2000 µF</td>
</tr>
<tr>
<td></td>
<td>DC 0…1000 V</td>
<td>+ 15 %</td>
<td>≤ 500 µF</td>
</tr>
<tr>
<td></td>
<td>AC 0…690 V 15…460 Hz</td>
<td>+ 6 %</td>
<td>≤ 2000 µF</td>
</tr>
<tr>
<td></td>
<td>DC 0…400 V</td>
<td>+ 15 %</td>
<td>≤ 10 µF</td>
</tr>
<tr>
<td></td>
<td>DC 0…600 V</td>
<td>+ 20 %</td>
<td>≤ 5 µF</td>
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<tr>
<td></td>
<td>AC/DC 0…400 V</td>
<td>+ 0 %</td>
<td>≤ 1 µF</td>
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</tbody>
</table>

#### Response value
- 0.2…100 Ω
- 1…990 Ω
- 0.2…990 Ω
- 100…10000 Ω
- 1…200 kΩ
- 46/23 kΩ
- 1…300 kΩ

#### Coupled systems
- Locating current injector (only isoPV1685PFR)

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

#### Interfaces
- Web server
- Modbus
- RTU
- BCOM
- BS
- BMS
- isoData
- RTU
- RTU
- RTU
- RTU

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# Overview insulation monitoring devices ISOMETER®

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<tr>
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<th>ISOMETER® isoES425</th>
<th>ISOMETER® isoGEN423</th>
<th>ISOMETER® isoGEN523</th>
<th>ISOMETER® isoHV425</th>
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<tr>
<th>Special applications</th>
<th>Unearthed DC systems</th>
<th>Energy storage VDE-AR-E 2510-2</th>
<th>Generators acc. to standard DIN VDE 0100-551</th>
<th>Generators acc. to standard DIN VDE 0100-551</th>
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<th>Circuits</th>
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<td>Auxiliary circuits</td>
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<tr>
<td>Main circuits</td>
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<tr>
<td>3(N)JAC</td>
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<td>AC</td>
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<td>AC/DC</td>
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<tr>
<td>DC</td>
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<table>
<thead>
<tr>
<th>Voltage system</th>
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<tbody>
<tr>
<td>Nominal system voltage $U_n$</td>
<td>DC 12…120 V</td>
<td>3(N)JAC, AC 0…400 V, DC 0…400 V</td>
<td>3(N)JAC, AC 0…400 V, DC 0…400 V</td>
<td>3(N)JAC, AC 0…400 V, DC 0…400 V with AGH422 AC 0…1000 V, DC 0…1000 V</td>
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<tr>
<th>Tolerance of $U_n$</th>
<th>+20 %</th>
<th>+25 %</th>
<th>+25 %</th>
<th>+25 %</th>
<th>+10 %</th>
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<tbody>
<tr>
<td>System leakage capacitance $C_e \mu F$</td>
<td>≤ 50</td>
<td>≤ 100</td>
<td>≤ 5</td>
<td>≤ 5</td>
<td>≤ 150</td>
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<tr>
<td>Response value $R_{an} \Omega$</td>
<td>2…100</td>
<td>2…990</td>
<td>$R_{an2}$…200</td>
<td>$R_{an2}$…200</td>
<td>11…500</td>
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<td>Locating current injector for insulation fault location</td>
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<td>Installation</td>
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<tr>
<td>DIN rail</td>
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<tr>
<td>Screw mounting</td>
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<tr>
<td>Panel mounting/wall fastening</td>
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<tr>
<td>Web server</td>
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<tr>
<td>Modbus</td>
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<td>RTU</td>
<td>RTU</td>
<td>RTU</td>
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<td>BMS</td>
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<table>
<thead>
<tr>
<th>Type</th>
<th>P.</th>
<th>Suitable system components</th>
</tr>
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<tbody>
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<td>FP200</td>
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Coupling devices

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| AGH2045S-4 | 326 |
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### ISOMETER® isoHV525

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<td>isoHV525</td>
<td>Insulation monitoring device</td>
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#### Specifications

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<th>Parameter</th>
<th>Value</th>
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<tr>
<td>Voltage</td>
<td>0…1000 V, DC 0…1000 V</td>
</tr>
<tr>
<td>Tolerance</td>
<td>+10 %</td>
</tr>
<tr>
<td>Leakage</td>
<td>≤ 150 µF, ≤ 250 µF, ≤ 250 µF, ≤ 150 µF</td>
</tr>
<tr>
<td>Response</td>
<td>Ränk: 2…100 Ω, Ränk: 2…990 Ω, Ränk: 2…200 Ω, Ränk: 11…500 Ω</td>
</tr>
<tr>
<td>Interfaces</td>
<td>Web server, Modbus RTU, BCOM, BS, BMS, isoData</td>
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</tbody>
</table>

#### Installation Methods

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

#### Coupling Devices

- AGH150W-4
- AGH204S-4
- AGH520S
- AGH675S-7
- AGH676S-4
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® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- EN 61557-8
- IEC 61557-8
- ASTM F 1207M-96 (2007)

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

Ordering information

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<tr>
<th>Supply voltage Uₚ</th>
<th>Type</th>
<th>Art. No.</th>
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<tbody>
<tr>
<td>AC 16…72 V, 42…460 Hz</td>
<td>IR420-D4-1</td>
<td>B91016409</td>
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<tr>
<td>DC 9.6…94 V</td>
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<tr>
<td>AC 70…300 V, 42…460 Hz</td>
<td>IR420-D4-2</td>
<td>B91016405</td>
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<td>DC 70…300 V</td>
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Accessories

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<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>

1) Absolute values
Insulation monitoring devices | Control and auxiliary circuits

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, KE, T/R) -(11, 12, 14) -(21, 22, 24)

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

Supply voltage: 2.2 kV

**ISOMETER® IR420-D4**

**Dimension diagram** (dimensions in mm)

**Supply voltage**

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

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

**Power consumption** ≤ 4 VA

**IT system being monitored**

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

**Response values**

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

**Preset mode**

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

**Relative uncertainty** 1…5 kΩ/5…200 kΩ ±0.5 kΩ/±15 %

**Hysteresis** 1…5 kΩ/5…200 kΩ +1 kΩ/+25 %

**Time response**

- Response time $t_{an}$ at $R_F = 0.5 \times R_an$ and $C_e = 1 \mu F$ ≤ 7 s
- Start-up delay (start time) $t_0$: 0…10 s (0 s)*
- Response delay $t_{on}$: 0…99 s (0 s)*

**Measuring circuit**

- Measuring voltage $U_m$: ±12 V
- Measuring current $I_m$: (at $R_F = 0 \Omega$) ≤ 200 μA
- Internal DC resistance $R_i$: ≥ 62 kΩ
- Impedance $Z_i$ at 50 Hz ≥ 60 kΩ
- Permissible extraneous DC voltage $U_{fg}$: ≤ DC 300 V
- Permissible system leakage capacitance $C_e$: ≤ 20 μF

**Displays, memory**

- Display: LC display, multi-functional, non-illuminated
- Display range, measured value: 1 kΩ…1 MΩ
- Operating uncertainty (1…5 kΩ): ±5 kΩ
- Operating uncertainty (5 kΩ…1 MΩ): ±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 / 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): JK5 (except condensation and formation of ice)
- Transport (IEC 60721-3-2): JK5 (except condensation and formation of ice)
- Long-time storage (IEC 60721-3-1): JK4 (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: screw-type terminal or push-wire terminal

**Screw-type terminal**

- Connection properties:
  - rigid/flexible/AWG: 0.2…4/0.2…2.5 mm²/AWG 24…12
  - Stripping length: 8 mm
  - Tightening torque, terminal screws: 0.5…0.6 Nm

**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
- 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
## Wiring Diagram

<table>
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<tr>
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<th>Description</th>
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<tbody>
<tr>
<td>1</td>
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<tr>
<td>2</td>
<td>E, KE</td>
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<td>3</td>
<td>L1, L2</td>
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<tr>
<td>6</td>
<td>T/R</td>
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</table>
ISOMETER® IR425
Insulation monitoring device for unearthed AC/DC control circuits (IT systems)

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

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

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

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage ¹ Uₘ</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Screw-type terminal</td>
<td>Push-wire terminal</td>
</tr>
<tr>
<td>AC</td>
<td>DC</td>
<td></td>
</tr>
<tr>
<td>16…72 V, 15…460 Hz</td>
<td>9.6…94 V</td>
<td>IR425-D4-1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IR425-D4W-1</td>
</tr>
<tr>
<td>70…300 V, 15…460 Hz</td>
<td>70…300 V</td>
<td>IR425-D4-2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IR425-D4W-2</td>
</tr>
</tbody>
</table>

¹ Absolute values

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting</td>
<td>B98060008</td>
</tr>
<tr>
<td>(1 piece per device)</td>
<td></td>
</tr>
</tbody>
</table>
## Technical data

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

- **Rated insulation voltage**: 250 V
- **Rated impulse voltage/pollution degree**: 4 kV/3
- **Protective separation (reinforced insulation)**: between (A1, A2) - (L1, L2, E, KE, T/R) - (11, 12, 14) - (21, 22, 24)

<table>
<thead>
<tr>
<th>Voltage test acc. to IEC 61010-1</th>
<th>2.2 kV</th>
</tr>
</thead>
</table>

### Supply voltage

**IR425-D4-1, IR425-D4W-1:**
- **Supply voltage** $U_S$: AC 16…72 V/DC 9.6…94 V
- **Frequency range** $U_S$: 15…460 Hz / DC

**IR425-D4-2, IR425-D4W-2:**
- **Supply voltage** $U_S$: AC/DC 70…300 V
- **Frequency range** $U_S$: 15…460 Hz, DC

- **Power consumption**: $\leq 4$ VA

### IT system being monitored

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

### Response values

- **Response value $R_{an1}$ (ALARM 1)**: 1…200 kΩ
- **Response value $R_{an2}$ (ALARM 2)**: 1…200 kΩ

### Preset mode

- **$U_n \leq 72$ V $R_{an1}$**: 20 kΩ/10 kΩ
- **$R_{an2}$**: 46 kΩ/23 kΩ

- **Relative uncertainty** (1…5 kΩ)/(5…200 kΩ): $\pm 0.5$ kΩ/$\pm 15$
- **Hysteresis** (1…5 kΩ)/(5…200 kΩ): $+1$ kΩ/$+25$

### Time response

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

### Measuring circuit

- **Measuring voltage** $U_m$: $\pm 12$ V
- **Measuring current** $I_m$ (at $R_F = 0$ Ω): $\leq 200$ μA
- **Internal DC resistance** $R_i$: $\leq 62$ kΩ
- **Impedance** $Z_i$ at 50 Hz: $\geq 60$ kΩ
- **Admissible extraneous d.c. voltage** $U_f$: $\leq DC 300$ V
- **Permissible system leakage capacitance**: $\leq 20$ μF

### Displays, memory

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

### Inputs

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

### Switching elements

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

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

- **Utilisation category**: AC-11, AC-14, DC-12, DC-12, DC-12
- **Rated operational voltage**: 230 V, 220 V, 110 V, 24 V
- **Rated operational current**: 5 A, 3 A, 0.1 A, 0.2 A, 1 A
- **Minimum contact rating**: 1 mA at AC/DC $\geq 10$ V

### Environment/EMC

- **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)**: 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
- **for option W**: 3M7
- **Transport (IEC 60721-3-2)**: 2M2
- **Long-time storage (IEC 60721-3-1)**: 1M3

### Connection

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

### Screw-type terminal

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

### Push-wire terminals

- **Connection properties**: rigid/flexible 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
- **Degree of protection, internal components (DIN EN 60529)**: IP30
- **Enclosure material**: polycarbonate
- **Class of protection**: UL94 V-0
- **DIN rail mounting acc. to IEC 60715**: 4 x M4 with mounting clip
- **Documentation number**: D00039
- **Weight**: $\leq 150$ g

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### Dimension diagram (dimensions in mm)

![Dimension diagram](image-url)
Wiring diagram

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

Note: Line protection by a fuse in accordance with IEC 60364-4-43 (6 A fuse recommended). In case of supply (A1/A2) from an IT system, both lines have to be protected by a fuse.
ISOMETER® iso1685P

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems) up to AC 1000 V/DC 1500 V

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

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

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

**Approvals**

**Ordering information**

<table>
<thead>
<tr>
<th>Response value range</th>
<th>Nominal voltage</th>
<th>Supply voltage</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 Ω…1 MΩ</td>
<td>0…1000 V</td>
<td>0…1500 V</td>
<td>iso1685P-425</td>
<td>B91065801</td>
</tr>
<tr>
<td></td>
<td>0…1500 V</td>
<td>18…30 V</td>
<td>iso1685PW-425</td>
<td>B91065801W</td>
</tr>
</tbody>
</table>

1) Absolute values
Insulation monitoring device ISOMETER® iso1685P

2020/2021 Insulation monitoring devices | Main circuits

Insulation monitoring device ISOMETER® iso1685P

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) iso1685P iso1685PWS
Transport (IEC 60721-3-2) 2M2
Long-term storage (IEC 60721-3-1) 1M3

Deviation from the classification of climatic conditions:
Ambient temperature during operation -40...+70 °C
Ambient temperature for transport -40...+80 °C
Ambient temperature for long-term storage -25...+80 °C
Area of application ≤ 3000 m AMSL

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

(*) = Factory setting
ISOMETER® iso1685P

Dimension diagram (dimensions in mm)

Wiring diagram

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

Device features
- ISOMETER® for IT AC systems with galvanically connected rectifiers or inverters and for IT DC systems (IT = unearthed systems)
- Automatic adaptation to the existing system leakage capacitance
- Combination of and other profile-specific measurement methods
- Two separately adjustable response value ranges of 1 kΩ…10 MΩ for Alarm 1 and Alarm 2
- High-resolution graphical LC display
- Connection monitoring (monitoring of the measuring lines)
- Automatic device self test
- Graphical representation of the insulation resistance over time (isoGraph)
- History memory with real-time clock (buffer for three days) for storing 1023 alarm messages with date and time
- Freely programmable digital inputs and outputs
- Remote setting via the Internet or Intranet (COMTRAXX® gateway)
- Worldwide remote diagnosis via the Internet (made available by Bender Service only)
- RS-485 interface for data exchange to other Bender devices

ISO1685DP-425
- measuring insulation faults 200Ω …100 MΩ

ISO1685DP-425
- measuring insulation faults 20 Ω…100 kΩ

ISOHV1685DP-425
- measuring insulation faults 200 Ω…1 MΩ at mains voltages AC 2000 V, DC 3000 V

ISO1685DP-425 and ISO1685DP-325
- 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

Standards
The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8
- IEC 61557-8 Appendix C (only applies to profile Fast 2000 µF)
- DIN EN 61557-9 (VDE 0413-9)
- IEC 61557-9
- 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>Supply voltage 1)</th>
<th>Response value range</th>
<th>Nominal voltage</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC</td>
<td></td>
<td>AC</td>
<td>DC</td>
<td></td>
</tr>
<tr>
<td>18…30 V</td>
<td>20 Ω…100 kΩ</td>
<td>0…690 V</td>
<td>0…690 V</td>
<td>isoLR1685DP-325</td>
</tr>
<tr>
<td></td>
<td>200 Ω…1 MΩ</td>
<td>0…2000 V</td>
<td>0…3000 V</td>
<td>isoHV1685DP-425</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0…1000 V</td>
<td>0…1500 V</td>
<td>iso1685DP-425</td>
</tr>
</tbody>
</table>

1) Absolute values
### Technical data

#### Isolationskoordination nach IEC 60664-1/IEC 60664-3

**Definitions:**
- Measuring circuit (IC1)  
  \((L1/+, L2/-), (E, KE)\)
- Supply circuit (IC2)  
  \(A1, A2\)
- Output circuit 1 (IC3)  
  \(11, 12, 14\)
- Output circuit 2 (IC4)  
  \(21, 22, 24\)
- Control circuit (IC6)  
  \(A, B, (1\text{-}1, 12\text{-}12, L2)\)

**Rated voltage** for isoHV1685D  
1500V [3000V]

**Overvoltage category**  
III

**Rated impulse voltage:**
- \((IC1/(IC2-5))\) for isoHV1685D  
  10 kV [16,670 kV]
- \((IC2/(IC3-5))\)  
  4 kV
- \((IC3/(IC4-6))\)  
  4 kV
- \((IC5/(IC6))\)  
  4 kV

**Rated insulation voltage:**
- \((IC1/(IC2-6))\) for isoHV1685D  
  1500 V [3000 V]
- \((IC2/(IC3-5))\)  
  250 V
- \((IC3/(IC4-6))\)  
  250 V
- \((IC5/(IC6))\)  
  250 V

**Pollution degree**  
3

**Safe insulation (reinforced insulation) between:**
- \((IC1/(IC2-5))\) for isoHV1685D  
  Überspannungskategorie III, 1500 V [3000 V]
- \((IC2/(IC3-5))\)  
  Überspannungskategorie III, 300 V
- \((IC3/(IC4-6))\)  
  Überspannungskategorie III, 300 V
- \((IC4/(IC5-6))\)  
  Überspannungskategorie III, 300 V

**Voltage range**
- Nominal system voltage range \(U_n\)
  - iso1685DP  
    \(AC 0 \ldots 1000 V; DC 0 \ldots 1500 V\)
  - isoHV1685D  
    \(AC 0 \ldots 2000 V; DC 0 \ldots 3000 V\)
  - isoLR1685DP  
    \(AC 0 \ldots 690 V; DC 0 \ldots 690 V\)
- Supply voltage \(U_s\)
  \(-\text{DC} 10 \ldots 30 V\)
- Frequency range of \(U_n\)  
  \(DC 1 \ldots 400 HZ\)
- Frequency range of \(U_s\)
  \(DC 1 \ldots 30 V\)
- Power consumption  
  \(\leq 9 W\)

**Measuring circuit for insulation monitoring**
- Measuring voltage \(U_{m}\) (peak value)  
  \(\pm 50 V\)
- Measuring current \(I_{m}\) (bei \(R_i = 0 \Omega\))  
  \(\leq 1.5 mA\)
- \(\text{iso1685DP, isoHV1685DS}\)  
  \(\leq 3.5 mA\)
- Internal DC resistance \(R_i\)
  \(\geq 70 k\Omega\)
- Impedance \(Z\) at 50 Hz
  \(\geq 15k\Omega^2\)
- Permissible extraneous DC voltage \(U_{ed}\)
  \(\leq DC 1600 V\)
- \(\text{iso1685DP}\)  
  \(\leq DC 3150 V\)
- \(\text{isoHV1685D}\)  
  \(\leq DC 720 V\)
- Permissible system leakage capacitance \(C_s\)
  \(\text{profile dependent, } 0 \ldots 2000 \mu F\)

### Response values for insulation monitoring

- Response value \(R_{ref}\) (alarm 1) and (alarm 2)
  - \(\text{iso1685DP, isoHV1685DS}\)  
    \(200 \Omega \ldots 1 M\Omega (40 \Omega /10 k\Omega /100 k\Omega /1 M\Omega)\)
  - \(\text{isoLR1685DP}\)  
    \(20 \Omega \ldots 100 k\Omega (4 k\Omega /14 k\Omega /100 k\Omega /1 M\Omega)\)
- Condition response value  
  \(R_{ref} \Rightarrow 2 R_{ref}\)
- Upper limit of the measuring range when set to \(C_{max} = 2000 \mu F\)  
  \(50 k\Omega\)
- Upper limit of the measuring range when set to \(C_{max} = 500 \mu F\)  
  \(200 k\Omega\)
- Relative uncertainty (iso1685DP; isoHV1685DS)
  
  (10 kΩ ± 2 %)

**Time response**
- Response time \(t_{an}\) at \(R_i = 0.5 x R_{ref}, \phi_{an} = 10 k\Omega\) and \(C_s = 1 \mu F\) acc. to IEC 61557-8  
  \(\text{profile dependent, typ. } 10 s\)

**Measuring circuit for insulation fault location (EFS) (only iso1685DP)**
- Locating current IL DC  
  \(\leq 50 mA (1/2,5/5/10/25/50 mA)\)
- Test cycle/pause  
  \(2 \ldots 4 s\)

**Indication**
- Display
  - graphic display 127 x 127 pixel, 40 x 40 mm
- Display range measured value
  - iso1685DP, isoHV1685D  
    \(200 \Omega \ldots 1 M\Omega\)
  - isoLR1685DP  
    \(20 \Omega \ldots 1 M\Omega\)
- LEDs
  - ON (operation LED)  
    green
  - PGH ON  
    yellow
  - SERVICE  
    yellow
  - ALARM 1  
    yellow
  - ALARM 2  
    yellow

**Digital inputs**
- Operating mode, adjustable  
  - active high, active low
- Functions
  - none, test, reset, deactivate device, insulation fault location
- High level  
  \(10 \ldots 30 V\)
- Low level  
  \(0 \ldots 0.5 V\)

**Serial interface**
- Interface/protocol
  - RS-485/BMS/Modbus/RTU
- Connection
  - terminals A/B
- Cable length  
  \(\leq 1200 m\)
- Shielded cable (shield to functional earth on one end)  
  2-core, \(0.6 \text{~mm}^2\), e.g. J-Y(St)Y 2x0.6
- Shield
  - terminal S
- Terminating resistor, can be connected (Term. RS-485)  
  120 \Omega (0.5 W)
- Device address, BMS bus
  \(1 \ldots 90 (1 \ldots 21^*)\)
- Device address Modbus/RTU  
  \(1 \ldots 247\)
- Baudrate  
  9,6/19,2/38,4/57,6/115 kB
- Stop Bits  
  1/2/auto
- Parity  
  even/odd

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

**Contact data acc. to IEC 60947-5-1:**
- Utilisation category
  - AC 13
  - AC 14
  - DC 12
  - DC 12
  - DC 12
- Rated operational current
  - 5 A
  - 3 A
  - 1 A
  - 0.2 A
  - 0.1 A
- Rated operational voltage
  - 230 V
  - 220 V
  - 24 V
  - 110 V
- Utilisation category
  - AC 13
  - AC 14
  - DC-12
  - DC-12
  - DC-12
- Electrical endurance under rated operating conditions, number of cycles  
  \(100,000\)

**Contact data acc. to IEC 60947-5-1:**
- Utilisation category
  - AC 13
  - AC 14
  - DC 12
  - DC 12
  - DC 12
- Rated operational current
  - 5 A
  - 3 A
  - 1 A
  - 0.2 A
  - 0.1 A
- Rated operational voltage
  - 230 V
  - 220 V
  - 24 V
  - 110 V
- Utilisation category
  - AC 13
  - AC 14
  - DC-12
  - DC-12
  - DC-12
- Electrical endurance under rated operating conditions, number of cycles  
  \(100,000\)

**Connection (except system coupling)**
- Connection type
  - pluggable push-wire terminals
- Connection, rigid/flexible
  - 0.2…2.5 mm²
- Connection, flexible with ferrule, without/with plastic sleeve
  - 0.25…2.5 mm²
- Conductor sizes (AWG)
  - 24…12

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**ISO 1685DP**

**ISO LR1685DP**

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The document provides detailed technical specifications for insulation monitoring devices, including various electrical parameters, response values, and physical specifications for different models. It also includes information on the device’s interface, indication, digital inputs, and switching elements, ensuring comprehensive coverage of its functional and technical aspects.
Technical data (continued)

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 female, without/with plastic sleeve  0.25…6 mm²/0.25…4 mm²
Conductor sizes (AWG)  24…8
Stripping length  15 mm
Opening force  90…120 N

Environment/EMC

EMC  IEC 61326-2-4

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) for iso1685DP  3M4
Transport (IEC 60721-3-2)  2M2
Long-term storage (IEC 60721-3-1)  1M3

Deviation from the classification of climatic conditions:
Ambient temperature during operation  -40…+70 °C
Ambient temperature transport  -40…+80 °C
Ambient temperature long-term storage  -25…+80 °C
Area of application  ≤ 3000 m AMSL

Other

Operating mode  continuous operation
Position of normal use  vertical, system coupling on top
 Tightening torque of the screws for enclosure mounting  1.0…1.5 Nm
Degree of protection, internal components  IP30
Degree of protection, terminals  IP30
Enclosure material  polycarbonate
Flammability class  V-0
Documentation number  D00272
Weight  ≤ 1600 g

(*) = Factory settings

1) for $U_n > 500$ V not acc. to IEC61557-8
2) Values in brackets are factory settings
Wiring diagram

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

AC System

DC System
ISOMETER® isoHR1685DW–925
Insulation monitoring device for mobile, insulated elevating work platforms

Device features

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

Typical applications

- Isolationsüberwachung von Hubarbeitsbühnen/Oberleitungs­fahrzeugen.

Approvals

Standards

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

Further information

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

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage 1)</th>
<th>Response value range</th>
<th>Nominal system voltage</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC 18…30 V</td>
<td>100 kΩ…100 MΩ</td>
<td>0…1000 V</td>
<td>0…1500 V</td>
<td>isoHR1685DW–925</td>
</tr>
</tbody>
</table>

1) Absolute values
### Technical data

#### Insulation monitoring devices acc. to IEC 60664-1/IEC 60664-3

**Definitions:**
- Measuring circuit (IC1)  
- Supply circuit (IC2)  
- Output circuit 1 (IC3)  
- Output circuit 2 (IC4)  
- Control circuit (IC6)  

**Rated voltage:** 1500 V  
**Overvoltage category:** III

#### Rated impulse voltage:

<table>
<thead>
<tr>
<th>Circuit</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC2/IC3-5</td>
<td>10 kV</td>
</tr>
<tr>
<td>IC2/IC3-5</td>
<td>4 kV</td>
</tr>
<tr>
<td>IC2/IC3-4-6</td>
<td>4 kV</td>
</tr>
<tr>
<td>IC4/IC6-6</td>
<td>4 kV</td>
</tr>
</tbody>
</table>

#### Rated insulation voltage:

<table>
<thead>
<tr>
<th>Circuit</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC1/IC2-6</td>
<td>1500 V</td>
</tr>
<tr>
<td>IC2/IC6</td>
<td>250 V</td>
</tr>
<tr>
<td>IC2/IC6</td>
<td>50 V</td>
</tr>
<tr>
<td>IC2/IC6</td>
<td>250 V</td>
</tr>
<tr>
<td>IC5/IC6</td>
<td>250 V</td>
</tr>
</tbody>
</table>

**Pollution degree:** 3

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

<table>
<thead>
<tr>
<th>Circuit</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC1/IC2-5</td>
<td>Overvoltage category III, 1500 V</td>
</tr>
<tr>
<td>IC2/IC6</td>
<td>Overvoltage category III, 1500 V</td>
</tr>
<tr>
<td>IC2/IC6</td>
<td>Overvoltage category III, 50 V</td>
</tr>
<tr>
<td>IC2/IC6</td>
<td>Overvoltage category III, 1500 V</td>
</tr>
<tr>
<td>IC2/IC6</td>
<td>Overvoltage category III, 1500 V</td>
</tr>
<tr>
<td>IC5/IC6</td>
<td>Overvoltage category III, 1500 V</td>
</tr>
</tbody>
</table>

**Voltage ranges**

- Nominal system voltage range: U_{n}
- AC O … 1000 V  
- DC O … 1500 V

**Tolerance of U_{n}**  
AC +10%/DC +5%

**Frequency range of U_{n}**  
DC 0.1 … 400 Hz

**Supply voltage U_{S}**  
DC 18 … 30 V

**Power consumption**  
≤ 9 W

#### Measuring circuit for insulation monitoring

**Measuring voltage U_{IM} (peak value)**  
± 50 V

**Measuring current I_{IM} (at f = 0 Hz)**  
≤ 1 μA

**Inner resistance R_{IM}**  
≤ 50 MΩ

**Impedance Z_{IM} at 50 Hz**  
≤ 50 MΩ

**Permissible extraneous DC voltage U_{DC}**  
≤ DC 1600 V

**Permissible system leakage capacitors C_{S} isoHR1685DW-925**  
profile-dependent, 0 … 1 μF

#### Response values for insulation monitoring

**Response value R_{HI} (alarm 1) and R_{LO} (alarm 2)**  
100 kΩ … 100 MΩ

**Response value condition**  
R_{HI} ≥ R_{LO}

**Upper limit of the measuring range when setting measuring profile to**

- “High capacity” Z_{MAX} = 5 μF  
- 24 MΩ

**Relative uncertainty (acc. to IEC 61557-8)**  
± 15%

**100 kΩ … 10 MΩ**  
±200 kΩ ± 15%

**Hysteresis**  
25%

#### Time response

**Response time t_{FA} at f = 0.5 x R_{HI} (R_{HI} = 100 kΩ) and C_{S} = 1 μF acc. to IEC 61557-8**  
profile-dependent, typ. 10 s

**Display**

- Display graphic display 127 x 127 pixels, 40 x 40 mm
- Display range, measured value 100 kΩ … 50 GΩ

**LEDs**

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

**Digital inputs**

- Operating mode, variable  
- active high, active low

**Functions**

- off, test, reset, disable device, insulation fault location

**High level**  
10 … 30 V

**Low level**  
0 … 0.5 V

#### Serial interface

**Interface/Protocol:**  
RS-485/BMS/Modbus RTU

**Connection**  
Terminals A/B

**Cable length**  
≤ 1200 m

**Shielded cable (shield to functional earth on one side)**  
2-core, ≥ 0.6 mm², e.g. J-Y(ST)Y 2x0.6

**Shied**  
Terminal S

**Terminating resistance, engageable (term. RS-485)**  
120 Ω (C 0.5 W)

**Device address, BMS bus**  
(1) 2 … 90 (2)*

**Device address, Modbus RTU**  
1 – 247

**Baud rate**  
9.6/19.2/38.4/57.6/115 kbps

**Parity**  
even/uneven

**Stop bits**  
1/2/auto

#### Connection (except mains coupling)

**Type of connection**  
Pluggable push-wire terminals

**Connection, rigid/flexible**  
0.2 … 2.5 mm² (0.2 … 2.5 mm²)

**Connection, flexible with ferrule, without/with plastic sleeve**  
0.25 … 2.5 mm²

**Conductor sizes (AWG)**  
24 … 12

#### Connection of the mains coupling

**Type of connection**  
Pluggable push-wire terminals

**Connection, rigid/flexible**  
0.2 … 2.5 mm²

**Connection, flexible with ferrule, without/with plastic sleeve**  
0.25 … 2.5 mm²

**Conductor sizes (AWG)**  
24 … 8

#### Switching elements

**Switching elements**

- 3 changeover contacts: K1 (insulation fault alarm 1), K2 (insulation fault alarm 2), K3 (device fault)

**Operating mode K1, K2**

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

**Operating mode K3**

- N/C operation, not modifiable

**Electrical endurance under rated operating conditions**  
100,000 cycles

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

**Utilisation category**

- AC 13  
- AC 14  
- DC-12  
- DC-12  
- DC-12

**Rated operational voltage**

- 230 V  
- 230 V  
- 24 V  
- 110 V  
- 220 V

**Rated operational current**

- 5 A  
- 3 A  
- 1 A  
- 0.2 A  
- 0.1 A

**Rated insulation voltage**  
250 V

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

#### Environment/EMC

- IEC 61326-2-4

**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

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

- 3K4

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

**Environment/EMC**

- IEC 61326-2-4

**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

#### 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

**Deviation from climate classes:**

**Long-term storage (IEC 60721-3-1)**

- 1M3

**Ambient temperature during long-term storage**

- -25 … +80 °C

**Application range**  
≤ 3000 m AMSL

#### Other

**Operating mode**

- Continuous operation

**Position of normal use**

- Vertical, mains coupling at top

**Tightening torque for screws (4x M5) to fasten enclosure**

- 1.0 … 1.5 Nm

**Other**

**Degree of protection, internal components**

- IP30

**Flammability class**

- V-0

**Enclosure material**

- Polycarbonate

**Tightening torque for screws (4x M5) to fasten enclosure**

- 1.0 … 1.5 Nm

**Other**

**Degree of protection, internal components**

- IP30

**Flammability class**

- V-0

**Enclosure material**

- Polycarbonate

**Degrees of protection, terminals**

- IP30

**Degree of protection, terminals**

- IP30

**Enclosure material**

- Polycarbonate

**Flammability class**

- V-0

**Degree of protection, terminals**

- IP30

**Weight**

- ≤ 1600 g

**Appearance**

- Factory setting

**Degree of protection, terminals**

- IP30

**Enclosure material**

- Polycarbonate

**Flammability class**

- V-0

**Other**

- ≤ 1600 g

**Factory setting**

- 7 - 9 kg

**Weight**

- ≤ 1600 g

**Enclosure material**

- Polycarbonate

**Flammability class**

- V-0

**Other**

- ≤ 1600 g

**Factory setting**

- 7 - 9 kg
**Wiring diagram**

1. **12+, 12–** Initial measurement, digital input
2. **I1+, I1–** Test, digital input
3. **A, B, S** Connection to RS-485 with BMS bus, Modbus RTU, S = shield (connect to PE on one side), can be terminated with S700
4. **31, 32, 34** Alarm relay K3 for internal device faults
5. **21, 22, 24** Alarm relay K2 for insulation faults, alarm 2
6. **E, KE** Separate connections of E and KE to PE and/or vehicle chassis
7. **A1, A2** Connection to \( U_S = 24 \text{ VDC} \) via fuses, 2 A each
8. **L1/+, L2/-** Connection of both coupling terminals L1/+ and L2/- to lifting arm of the work platform
Device features

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

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.

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

Further information

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

<table>
<thead>
<tr>
<th>Nominal system voltage range $U_n$</th>
<th>Supply voltage $U_S$</th>
<th>Display</th>
<th>Option “W”</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>DC</td>
<td>AC</td>
<td>DC</td>
<td>integrated</td>
<td>–</td>
</tr>
<tr>
<td>0…690 V; 0.1…460 Hz</td>
<td>0…1000 V</td>
<td>24…240 V; 50…400 Hz</td>
<td>24…240 V</td>
<td>iso685W-D</td>
<td>B91067010W</td>
</tr>
<tr>
<td>detached</td>
<td>–</td>
<td>iso685-S + FP200</td>
<td>B91067210</td>
<td></td>
<td></td>
</tr>
<tr>
<td>–40…+70 °C</td>
<td>3K5, 3M7</td>
<td>iso685W-S + FP200W</td>
<td>B91067210W</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Technical data

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

<table>
<thead>
<tr>
<th>Definitions:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring circuit (IC1)</td>
<td>$(L1/+, L2/L3/-)$</td>
</tr>
<tr>
<td>Supply circuit (IC2)</td>
<td>A1, A2</td>
</tr>
<tr>
<td>Output circuit 1 (IC4)</td>
<td>11, 12, 14</td>
</tr>
<tr>
<td>Output circuit 2 (IC4)</td>
<td>21, 22, 24</td>
</tr>
<tr>
<td>Control circuit (IC5)</td>
<td>(E, KE), (X1, ETH, X3, X4)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th>1000 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overvoltage category</td>
<td>III</td>
</tr>
<tr>
<td>Rated impulse voltage:</td>
<td></td>
</tr>
<tr>
<td>IC1/(IC2-5)</td>
<td>8 kV</td>
</tr>
<tr>
<td>IC2/(IC3-5)</td>
<td>4 kV</td>
</tr>
<tr>
<td>IC3/(IC4-5)</td>
<td>4 kV</td>
</tr>
<tr>
<td>IC4/IC5</td>
<td>4 kV</td>
</tr>
<tr>
<td>Rated insulation voltage:</td>
<td></td>
</tr>
<tr>
<td>IC1/(IC2-5)</td>
<td>1000 V</td>
</tr>
<tr>
<td>IC2/(IC3-5)</td>
<td>250 V</td>
</tr>
<tr>
<td>IC3/(IC4-5)</td>
<td>250 V</td>
</tr>
<tr>
<td>IC4/IC5</td>
<td>250 V</td>
</tr>
</tbody>
</table>

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

- 3

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

- 2

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

- 1

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

- A1, A2

**Supply voltage range:**

- $U_{\text{IT}}$ system being monitored

<table>
<thead>
<tr>
<th>Supply voltage</th>
<th>DC 24 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage U1</td>
<td>AC/DC 24…240 V</td>
</tr>
<tr>
<td>Tolerance of U1</td>
<td>-30…+15%</td>
</tr>
<tr>
<td>Maximum permissible input current of U1</td>
<td>650 mA</td>
</tr>
<tr>
<td>Frequency range of U1</td>
<td>DC 50…400 Hz</td>
</tr>
<tr>
<td>Tolerance of the frequency range of U1</td>
<td>±5…+15%</td>
</tr>
<tr>
<td>Power consumption, typically DC</td>
<td>≤ 12 W</td>
</tr>
<tr>
<td>Power consumption, typically 50/60 Hz</td>
<td>≤ 12 W/21 VA</td>
</tr>
<tr>
<td>Power consumption, typically 400 Hz</td>
<td>≤ 12 W/45 VA</td>
</tr>
</tbody>
</table>

**Supply via X1:**

| Supply voltage U1 | DC 24 V |
| Tolerance of U1 | DC 20…+25% |

**IT system being monitored**

- Nominal system voltage range $U_{n}$
- AC 0…690 V
- DC 0…1000 V
- AC/DC 0…600 V (for UL applications)
- $U_{\text{IT}}$ system being monitored
- $U_{n}$

<table>
<thead>
<tr>
<th>Tolerance of $U_{n}$</th>
<th>AC/DC 15%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency range of $U_{n}$</td>
<td>DC 0.1…460 Hz</td>
</tr>
<tr>
<td>Max. AC voltage U$<em>{\text{IT}}$ in the frequency range $f</em>{n}$ = 0.1…4 Hz</td>
<td>$U_{\text{IT, max}} = 50 \sqrt{U_{n}} \left(1 + f_{n} \right)$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Response values</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Response value $R_{\text{a1}}$ (alarm 1)</td>
<td>1 kΩ…10 MΩ</td>
</tr>
<tr>
<td>Response value $R_{\text{a2}}$ (alarm 2)</td>
<td>1 kΩ…10 MΩ</td>
</tr>
<tr>
<td>Relative uncertainty (acc. to IEC 61557-8)</td>
<td>profile dependent, ±15% at least ±1 kΩ</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>25% at least 1 kΩ</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time response</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Response time $t_{\text{a1}}$ at $R_{\text{a1}} = 0.5 \times R_{\text{a1}}$ (ax = 10 kΩ) and $C_{\text{a1}} = 1 \mu F$ according to IEC 61557-8</td>
<td>profile dependent, typ. 4 s (see diagrams in manual)</td>
</tr>
<tr>
<td>Response time DC alarm at $C_{\text{a1}} = 1 \mu F$</td>
<td>profile dependent, typ. 2 s (see diagram in manual)</td>
</tr>
<tr>
<td>Start-up delay $t_{\text{start-up}}$</td>
<td>0…120 s</td>
</tr>
</tbody>
</table>

### Insulation monitoring devices | Main circuits

#### Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device version with display</td>
<td>iso685-S</td>
<td>B91067110</td>
<td>–</td>
</tr>
<tr>
<td>Display for front panel mounting</td>
<td>FF200</td>
<td>B91067906</td>
<td>65</td>
</tr>
<tr>
<td>Coupling devices</td>
<td>AGH150W-4</td>
<td>B98018006</td>
<td>324</td>
</tr>
<tr>
<td>AGH204S-4</td>
<td>B914013</td>
<td>326</td>
<td></td>
</tr>
<tr>
<td>AGH520S</td>
<td>B913033</td>
<td>327</td>
<td></td>
</tr>
<tr>
<td>AGH6765-4</td>
<td>B913055</td>
<td>330</td>
<td></td>
</tr>
</tbody>
</table>

*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

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

- ±15%, at least ±1 kΩ

**LEDs**

<table>
<thead>
<tr>
<th>Description</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>SERVICE</td>
<td>yellow</td>
</tr>
<tr>
<td>ALARM 1</td>
<td>yellow</td>
</tr>
<tr>
<td>ALARM 2</td>
<td>yellow</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Description</th>
<th>Number</th>
<th>Operating mode, adjustable</th>
<th>active high, active low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number 1</td>
<td>3</td>
<td>_functions</td>
<td>off, test, reset, deactivate device, start initial measurement</td>
</tr>
<tr>
<td>Voltage</td>
<td>Low DC 3…5 V, High DC 11…32 V</td>
<td>Tolerance Voltage</td>
<td>±10%</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Description</th>
<th>Number</th>
<th>Operating mode, adjustable</th>
<th>active, passive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number 2</td>
<td>2</td>
<td>_functions</td>
<td>off, ins. alarm 1, ins. alarm 2, connection fault, DC - alarm 1, DC+ alarm 2, symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm</td>
</tr>
<tr>
<td>Voltage</td>
<td>passive DC 0…32 V, active DC 0/19.2…32 V</td>
<td>Tolerance related to the current/voltage final value</td>
<td>±20%</td>
</tr>
</tbody>
</table>

**Analogue Output (M+)**

<table>
<thead>
<tr>
<th>Description</th>
<th>Number</th>
<th>Operating mode</th>
<th>linear, msdscale point 28 kΩ/120 kΩ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functions</td>
<td><em>functions</em></td>
<td>insulation value, DC offset</td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td>0…20 mA (≤ 600 Ω), 4…20 mA (≤ 600 Ω, 0…400 μA (≤ 4 kΩ)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage</td>
<td>0…10 V (≤ 1 kΩ), 2…10 V (≤ 1 kΩ)</td>
<td>Tolerance related to the current/voltage final value</td>
<td>±20%</td>
</tr>
</tbody>
</table>
Technical data (continued)

Interfaces

Field bus:
- Interface/protocol: web server/Modbus TCP/BCOM
- Data rate: 10/100 Mbit/s, autodetect
- Max. amount Modbus requests: < 100/s
- Cable length: ≤ 100 m
- Connection: RJ-45
- IP address: DHCP/Manual 192.168.0.5
- Network mask: 255.255.255.0
- BCOM address: System 1-0
- Function: Communication interface

Sensor bus:
- Interface/protocol: RS-485/BS
- Data rate: 9.6 kbit/s/s
- Cable length: ≤ 1200 m
- Cable: twisted pair, one end of shield connected to PE recommended: J-VSH/4Y min. 2x0.8
- Connection terminals: X1 A, X1 B
- Terminating resistor at the beginning and at the end of the transmission path: 120 Ω, can be connected externally
- Device address, B5 bus: 1...90

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 4, 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 4, symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm

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

Contact data acc. to IEC 60947-5-1:
- Utilisation category: AC-13 AC-14 DC-12 DC-12 DC-12
- Rated operational voltage: 230 V
- Rated operational current: 5 A
- Rated insulation voltage ≤ 3000 m NN: 160 V
- Rated insulation voltage ≤ 2000 m NN: 250 V
- Rated operational current of switching elements: max. 3 A

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

Enclosure material: Polycarbonate

Weight: < 390 g

Ambient temperatures:
- Operating temperature: -25...+55 °C
- Transport: -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): 1K8

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

Area of application: ≤ 3000 m NN

Other

Degree of protection terminals: IP20
Degree of protection internal components: IP40
Degree of protection field bus: IP20

Mounting: Continuous operation
- Mounting (0°): display oriented, cooling slots must be ventilated vertically
- Degree of protection internal components: IP40
- Degree of protection field bus: IP20

Environment/EMC

EMC: IEC 61326-2-4

Ambient temperatures:
- Operating temperature: -25...+55 °C
- Transport: -40...+70 °C

Classification of climatic conditions acc. to IEC 60721:
- Stationary use (IEC 60721-3-3): 3K5 (exception condensation and formation of ice)
- Transport (IEC 60721-3-2): 2K3
- Long-term storage (IEC 60721-3-1): 1K8

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

Connection

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

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

Other

Degree of protection field bus: IP20
Degree of protection internal components: IP40
Degree of protection field bus: IP20

Mounting (0°): display oriented, cooling slots must be ventilated vertically
- Degree of protection internal components: IP40
- Degree of protection field bus: IP20

Environment/EMC

EMC: IEC 61326-2-4

Ambient temperatures:
- Operating temperature: -25...+55 °C
- Transport: -40...+70 °C

Classification of climatic conditions acc. to IEC 60721:
- Stationary use (IEC 60721-3-3): 3K5 (exception condensation and formation of ice)
- Transport (IEC 60721-3-2): 2K3
- Long-term storage (IEC 60721-3-1): 1K8

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

1) At a frequency > 200 Hz, the connection of X1 must be insulated. Only permanently installed devices which at least have overvoltage category CA2 (500V) may be connected.
2) Indication limited outside the temperature range -25...+55 °C.
3) At a frequency > 200 Hz, the connection of X1 must be insulated. Only permanently installed devices which at least have overvoltage category CA2 (500V) may be connected.
4) For U0 ≥ 50 V only.
5) This is a class A product. In a domestic environment, this product may cause radio interference.
6) In this case, the user may be required to take corrective actions.
7) Recommended: Devices mounted at 0° (display-oriented, cooling slots must be ventilated vertically).
Wiring diagram

1. Connection to an AC system $U_n$
2. Connection to a DC system $U_n$
3. Connection to an IT system with coupling device
4. Connection to a 3(N)AC system
5. Connection to the IT system to be monitored (L1/+, L2, L3/-)
6. Separate connection of KE, E to PE
7. (K1) Alarm relay 1, available changeover contacts
8. (K2) Alarm relay 2, available changeover contacts
9. Switchable resistor $R$ for RS-485 bus termination
10. Ethernet interface
11. Digital interface
12. For systems $>690\,\text{V}$ 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 $\leq 690\,\text{V}$ to be monitored if the wiring is carried out in such a manner as to reduce the risk of a short circuit to a minimum. (Recommendation: Ensure short-circuit-proof and earth-fault-proof wiring).

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

For UL applications:

Use 60/70°C copper lines only!

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

Digital interface X1

<table>
<thead>
<tr>
<th>Digital interface</th>
<th>Terminal</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I1</td>
<td>Input 1</td>
</tr>
<tr>
<td></td>
<td>I2</td>
<td>Input 2</td>
</tr>
<tr>
<td></td>
<td>I3</td>
<td>Input 3</td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>RS-485 A</td>
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<td></td>
<td>B</td>
<td>RS-485 B</td>
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<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>
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<tr>
<td></td>
<td>M+</td>
<td>Analogue output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ground</td>
</tr>
</tbody>
</table>
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 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 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® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8

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

**Typical applications**
- 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

**Approvals**

**Ordering information**

<table>
<thead>
<tr>
<th>Nominal system voltage range $U_n$</th>
<th>Supply voltage $U_S$</th>
<th>Display</th>
<th>Option “W”</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 0...690 V; 1...460 Hz</td>
<td>DC 0...1000 V</td>
<td>-</td>
<td>-</td>
<td>iso685-D-B</td>
<td>B91067020</td>
</tr>
<tr>
<td>24...240 V; 50...400 Hz</td>
<td>24...240 V</td>
<td>-</td>
<td>-40...+70 ºC, 3K5, 3M7</td>
<td>iso685W-D-B</td>
<td>B91067020W</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>iso685-S-B +FP200</td>
<td>-</td>
<td>B91067220</td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>-40...+70 ºC, 3K5, 3M7</td>
<td>iso685W-S-B +FP200W</td>
<td>-</td>
<td>B91067220W</td>
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</tr>
</tbody>
</table>
### 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)

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

#### Power consumption, typically 50/60 Hz

- ≤ 12 W/21 VA

- ≤ 12 W

#### Frequency range of

- an1 (alarm 1) 1 kΩ
- Response value 1 kΩ... 20 MΩ

- n1 AC/DC 10 V
- Tolerance measurement of 0.1 kΩ... 600 V

#### Response time

- DC alarm at an1 = 1 μF
- Response time DC alarm at an1 = 1 μF

#### Permissible system leakage capacitance C

- Profile dependent, typ. > 10 kΩ

#### Measuring ranges

- Voltage range measurement of an1 1 kΩ
- Tolerance measurement of 1 kΩ... 600 V

#### Tolerance of

- ±5 %
- ±5 V

#### Display

- Display range measured value 0.1 kΩ...

#### Operation

- Disconnect

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

- Number 3
- Type active, passive
- Functions off, test, reset, deactivate device, start initial measurement

#### Digital Outputs (Q1, Q2)

- Number 2
- Type active, passive
- Functions

#### Analogical Output (M+)

- Operation

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

1) included in the scope of delivery

2) if the "transparent front cover 144x72 (IP65)" is used, the cutout in the control cabinet must be increased in height from 66 mm to 68 mm (+ 0.7 / -0 mm).
Connection to FP200

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

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

Push-wire terminals:
- Nominal current  ≤ 10 A
- Conductor size  AWG 24-12
- Stripping length  10 mm
- rigid/flexible  0.2...2.5 mm²
- flexible with ferrules, with/without plastic sleeve  0.25...2.5 mm²
- Multiple conductor, flexible with TWIN ferrule with plastic sleeve  0.5...1.5 mm²

Other
- Operating mode  continuous operation
- Mounting (0°)  display oriented, cooling slots must be ventilated vertically 1)
- 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
- Weight  < 390 g

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

Ambient temperatures:
- Operating temperature  -40...+70 °C
- -40...+65 °C (for UL applications)
- Transport  -40...+45 °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
  1) At a frequency > 200 Hz, the connection of X1 must be insulated. Only permanently installed devices which at least have overvoltage category CA12 (300V) may be connected.
  2) Indication limited outside the temperature range -25...+55 °C.
  3) In this case, the user may be required to take corrective actions.
  4) For U₄ ≥ 50 V only.
  5) This is a class A product. In a domestic environment, this product may cause radio interference. In this case, the user may be required to take corrective actions.
  6) This is to improve the reliability of the operation of the product, this product may cause radio interference. In this case, the user may be required to take corrective actions.

Connection

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/192.168.0.1
- BCM address  system-1-0
- Function  communication interface

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

Sensor bus:
- Interface/protocol  RS-485/BS
- Data rate  9.6 kBaud/s
- Cable length  ≤ 1200 m
- Cable: twisted pair, one end of shield connected to PE
- Recommended: J-Y(St)Y min. 2x0.8
- Cable length  ≤ 1200 m
- Data rate  9.6 kBaud/s
- Stationary use (IEC 60721-3-3) 3M4
- Classification of mechanical conditions acc. to IEC 60721:
  - Long-term storage (IEC 60721-3-1) 1K4
  - Transport (IEC 60721-3-2) 2K3
  - Stationary use (IEC 60721-3-3) 3K5 (except condensation and formation of ice)
  - Classification of climatic conditions acc. to IEC 60721:
    - Long-term storage  -40...+70 °C
    - Transport  -40...+85 °C
    - Operating temperature  -25...+55 °C
    - Ambient temperatures :
      - Rated operational current of switching elements  max. 3 A (for UL applications)

Technical data (continued)

Switching elements

Number of switching elements  2
- Operating mode  N/C operation/N/O operation
- Contact 11-12-14
  - Off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm 6), 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 6), symmetrical alarm, device fault, common alarm,
  - measurement complete, device inactive, DC offset alarm
- Terminating resistor at the beginning and at the end of the transmission path 120 Ω, can be connected internally
- Device address, BS bus 1...90

Environment/EMC

EMC  IEC 61000-6-4 1)
- Ambient temperatures:
  - Operating temperature  -25...+55 °C
  - Transport  -40...+65 °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) 2M3
- Long-term storage (IEC 60721-3-1) 1M3
- Area of application  ≤ 3000 m NN

Other

Utilisation category  AC-13 AC-14 DC-12 DC-12 DC-12
- Contact data acc. to IEC 60947-5-1:
  - Rated operational voltage  230 V 230 V 24 V 110 V 220 V
  - Electrical endurance under rated operating conditions, number of cycles 10.000

Other

Weight  < 390 g
- Dimensions (W x H x D  108 x 93 x 110 mm

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

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

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

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

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

Digital interface X1

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

(K1) Alarm relay 1, available changeover contacts  
(K2) Alarm relay 2, available changeover contacts  
Switchable resistor R for RS-485 bus termination  
Ethernet interface  
Digital interface  
For systems > 690 V and with overvoltage category III a fuse for the connection to the system to be monitored must be provided. Recommendation: 2A screw-in fuses.
ISOMETER® iso685—...-P

Insulation monitoring device with integrated locating current injector for IT AC systems with galvanically connected rectifiers or converters and for IT DC systems

Device features

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

EDS44x
- Insulation fault location in AC, 3AC and DC IT systems
- Up to 12 measuring current transformers of the W…, WR…, WS… measuring current transformer series can be connected
- Response sensitivity insulation fault location: EDS440 2…10 mA, EDS441 0.2…1 mA
- Response sensitivity residual current measurement: EDS440 100 mA…10 A, EDS441 100 mA…1 A
- Communication of the components via BS bus (RS-485) or BB bus

Device variants

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

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

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

Standards

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

Further information

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

<table>
<thead>
<tr>
<th>Nominal system voltage range $U_n$</th>
<th>Supply voltage $U_S$</th>
<th>Display</th>
<th>Option &quot;W&quot;</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0…690 V; 0.1…460 Hz</td>
<td>0…1000 V</td>
<td>integrated</td>
<td>–</td>
<td>iso685-D-P</td>
<td>B91067030</td>
</tr>
<tr>
<td></td>
<td>24…240 V; 50…400 Hz</td>
<td>–</td>
<td>–40…+70 °C, 3K5, 3M7</td>
<td>iso685SW-D-P</td>
<td>B91067030W</td>
</tr>
<tr>
<td></td>
<td>24…240 V</td>
<td>detached</td>
<td>–</td>
<td>iso685SW-S-P +FP200</td>
<td>B91067230</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>–40…+70 °C, 3K5, 3M7</td>
<td>iso685SW-S-P +FP200W</td>
<td>B91067230W</td>
</tr>
</tbody>
</table>

### Insulation fault locators

<table>
<thead>
<tr>
<th>Description</th>
<th>Supply voltage $U_S$</th>
<th>Response value</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulation fault locators</td>
<td>AC/DC 24…240V</td>
<td>2…10mA</td>
<td>EDS440-S-1</td>
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<td>154</td>
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<td>EDS440-L-4</td>
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<td>EDS440W-L-4</td>
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<td>0.2…1mA</td>
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<td>B91080207W</td>
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<td>Relay module</td>
<td>DC 24 V</td>
<td>–</td>
<td>IOM441-S</td>
<td>B95012057</td>
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<td>IOM441W-S</td>
<td>B95012057W</td>
<td>373</td>
</tr>
</tbody>
</table>

1) Absolute values

### 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>B91067901</td>
</tr>
<tr>
<td>A set of push-wire terminals</td>
<td>B91067902</td>
</tr>
<tr>
<td>Enclosure accessories (terminal cover, 2 mounting clips) ¹</td>
<td>B91067903</td>
</tr>
<tr>
<td>Transparent cover 144x72 (IP65) for FP200 ²</td>
<td>B90860005</td>
</tr>
<tr>
<td>BB bus 6TE connector ³</td>
<td>B98110001</td>
</tr>
</tbody>
</table>

1) included in the scope of delivery
2) If the "transparent front cover 144x72 (IP65)" is used, the cutout in the control cabinet must be increased in height from 65 mm to 68 mm (+ 0.7/-0 mm).
3) Necessary for the connection of the ISOMETER’s with an EDS44…-S

### Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device version without display</td>
<td>iso685-S-P</td>
<td>B91067130</td>
<td>–</td>
</tr>
<tr>
<td>Display for front panel mounting</td>
<td>iso685SW-S-P</td>
<td>B91067130W</td>
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<td>FP200</td>
<td>B91067904</td>
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<td></td>
<td>FP200W</td>
<td>B91067904W</td>
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</tbody>
</table>

Suitable measuring instruments on request!
Insulation monitoring device ISOMETER® iso685-...-P

Technical data (continued)

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)
- Control circuit (IC6)
- Output circuit 2 (IC5)
- Control circuit (IC8)

Rated voltage: 1000 V

Overvoltage category: III

Rated impulse voltage:
- IC1/(IC2-5) 8 kV
- IC2/(IC3-5) 4 kV
- IC4/K5 4 kV

Rated insulation voltage:
- IC1/(IC2-5) 1000 V
- IC2/(IC3-5) 250 V
- IC3/(IC4-5) 250 V
- IC4/K5 250 V

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

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

Protective separation (reinforced insulation) between:
- IC1/(IC2-5) Overvoltage category III, 1000 V
- IC2/(IC3-5) Overvoltage category III, 100 V
- IC3/(IC4-5) Overvoltage category III, 100 V
- IC4/K5 Overvoltage category III, 100 V

Voltage test (routine test) according to IEC 61501-1:
- IC2/(IC3-5) AC 2.2 kV
- IC3/(IC4-5) AC 2.2 kV
- IC4/K5 AC 2.2 kV

Supply voltage:

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

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

IT system being monitored

Nominal system voltage range Un AC 0...690 V
- DC 0...1000 V
- AC/DC 0...600 V (for Un applications)
- Frequency range of oh AC 50...60 Hz
- Max. AC voltage Un in the frequency range fn 0.1...4 Hz
- Min. measurement of Un 50 Hz
- Max. measurement of Un 50 Hz

Response values
- Response value Rn (alarm 1) 1 kΩ...10 MΩ
- Response value Rn (alarm 2) 1 kΩ...10 MΩ
- Relative uncertainty (acc. to IEC 61557-8) dependent on the profile, ±15 %, at least ±1 kΩ
- Hysteresis 25 %, at least 1 kΩ

Time response
- Response time tmax at fmax = 0.5 x Rn (Rn = 10 kΩ) and Cn = 1 μF according to IEC 61557-8 profile dependent, typ. 4 s (see diagram in manual)
- Response time DC alarm at Ce = 1 μF profile dependent, typ. 3 s (see diagram in manual)
- Start-up delay 0...120 s

Measuring circuit
- Measuring output Un profile dependent, ±10 V, ±30 V (see profile overview)
- Measuring current Im ≤ 405 µA
- Internal resistance Rn ≥ 124 kΩ
- Internal resistance on decoupled systems (inactive by I/O, inactive by ISOnet or cut-off) typ. 50 MΩ
- Permissible extraneous DC voltage Un ≤ 1200 V
- Permissible system leakage capacitance Cn profile dependent, 0...1000 μF

Measuring ranges
- Measuring range fn 0.1...460 Hz
- Tolerance measurement of fn ±1 % ±0.1 Hz
- Voltage range measurement of fn AC 25...690 V
- Measuring range Un AC 25...690 V
- DC 0...1000 V
- Voltage range measurement of Un AC/DC > 10 V
- Tolerance measurement of Un ±5 % ±5 V
- Measuring range Cn 0...1000 μF
- Tolerance measurement of Cn ±10 % ±10 μF
- Frequency range measurement of Cn DC 30...460 Hz

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

Display

Indication graphic display 127 x 127 pixels, 40 x 40 mm ²

Display range measured value 0.1 kΩ...20 MΩ

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

LEDs

ON (operation LED) green
Pf (+Q) yellow
SERVICE yellow
ALARM 1 yellow
ALARM 2 yellow

In-/Outputs (X1-Interface)

Cable length X1 (unshielded cable) ≤ 10 m
Cable length X1 (shielded cable, shield connected to earth (PE) on one end, recommended: JYS(YJY) mm. 2x0,8) ≤ 100 m

Total max. supply output current for each output (device supplied by X1+X1,GND) max. 1 A
Total max. supply output current on X1 (device supplied by A1+/A2-) max. 200 mA
Total max. supply output current on X1 (device supplied by A1+/A2-) between 16,8 V and 40 V

Digital Inputs (I1, I2, I3)

Number 3

Operating mode, adjustable active high, active low

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

Voltage Low DC 3...5 V, High DC 11...32 V

Tolerance Voltage ±10 %

Digital Outputs (Q1, Q2)

Number 2

Operating mode, adjustable active, passive

Functions off, inc. alarm 1, inc. alarm 2, connection fault, DC- alarm ³, DC alarm ³, symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm, common alarm EDS

Voltage passive DC 0...32 V, active DC 0/19.2...32 V

Analog Output (M+)

Number 1

Operating mode linear, midscale point 28 kΩ/120 kΩ

Functions insulation value, output DC

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/BACnet
Data rate 10/100 Mbit/s, autodetect
Max. amount Modbus requests < 1000
Max. amount BACnet requests < 1000
Connection RS485
IP address DHCP/manual 192.168.0.5
Network mask 255.255.255.0
BACnet address system-1-0
Function communication interface

ISOnet:
Number ISOnet devices 0...20 devices
Max. nominal system voltage range ISOnet AC 690 V/DC 1000 V

EDSync:
Number EDSync devices 2...10 devices

ISOloop:
Number ISOloop devices 2...10 devices
Technical data (continued)

Sensor bus:
Interface/protocol RS-485/BB-Bus
Data rate 9.6 kBaud/s
Cable length ≤ 1200 m
Cable: twisted pair, one end of shield connected to PE recommended: J-YS/Y min. 2x0.8
Connection terminals X1 A, X1 B
Terminating resistor 120 Ω, can be connected internally
Device address 1 ... 90

Switching elements
Number of switching elements: 2 changeover contacts
Operation mode N/C operation/N/O operation
Contact T1-12-14 off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm 4,
DC+ alarm 6, symmetrical alarm, device fault, common alarm,
measurement complete, device inactive, DC offset alarm, common alarm EDS
Contact 21-22-24 off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm 4,
DC+ alarm 6, symmetrical alarm, device fault, common alarm,
measurement complete, device inactive, DC offset alarm, common alarm EDS

Electrical endurance under rated operating conditions, number of cycles 10,000
Contact data acc. to IEC 60947-5-1:
Utilisation category AC-13 AC-14 DC-12 DC-12 DC-12
Rated operational voltage 230 V 230 V 24 V 110 V 220 V
Rated operational current 5 A 3 A 1 A 0.2 A 0.1 A
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 61326-2-4

Ambient temperatures:
Operating temperature -25 ... +55 °C
Transport -40 ... +65 °C (for UL applications)
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 60721-3-3) 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 60721-3-2) 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 terminals:
Nominal current ≤ 10 A
Tightening torque 0.5 ... 0.6 Nm (5 ... 7 lb-in)
Conductor sizes AWG 24-12
Stripping length 7 mm
rigid/flexible 0.2 ... 2.5 mm²
flexible with ferrules, with/without plastic sleeve 0.25 ... 2.5 mm²
Multiple conductor, rigid 0.2 ... 1 mm²
Multiple conductor, flexible 0.2 ... 1.5 mm²
Multiple conductor, flexible with ferrule without plastic sleeve 0.25 ... 1 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve 0.5 ... 1.5 mm²

Push-wire terminals:
Nominal current ≤ 8 A
Conductor sizes AWG 24-16
Stripping length 10 mm
rigid/flexible 0.2 ... 1.5 mm²
flexible with ferrule without plastic sleeve 0.25 ... 1.5 mm²
flexible with TWIN ferrule with plastic sleeve 0.25 ... 0.75 mm²

Degree of protection internal components IP-40
Degree of protection terminals IP-20

Option “W” data different from the standard version
Rated operational current of switching elements max. 3 A (for UL applications)
Ambient temperatures:
Operating temperature -40 ... +70 °C
Transport -40 ... +85 °C

Classification of climatic conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3) 3K5 (condensation and formation of ice possible)
Stationary use (IEC 60721-3-3) 3M7

Classification of mechanical conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3) 3M7 (condensation and formation of ice possible)
Stationary use (IEC 60721-3-3) 3K5

1) At a frequency > 200 Hz, the connection of X1 ande Remote must be insulated. Only permanently
   installed devices which at least have overvoltage category CAT2 (300V) may be connected.
2) In case, the user may be required to take corrective actions.
3) This is a class A product. This product may cause radio interference in residential areas. In this
   case, the user may be required to take corrective actions.
4) For Ui, ≥ 50 V only.
5) This is a class A product. This product may cause radio interference in residential areas. In this
   case, the user may be required to take corrective actions.
6) Recommendation: Devices mounted at 0° (display oriented, cooling slots must be ventilated vertically)
   For devices mounted at an angle of 45°, the max. working temperature is reduced by 10 °C.
   For devices mounted at an angle of 90°, the max. working temperature is reduced by 20 °C.
**Insulation monitoring devices | Main circuits**

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

---

**Wiring diagram**

1. Connection to an AC system $U_n$
2. Connection to a DC system $U_n$
3. Linked with two IT systems which can be interconnected via a coupling switch. Information regarding the state of the coupling switch is not necessary.
4. Connection to a 3(N)AC system
5. Connection to the IT system to be monitored (L1/+, L2, L3/-)
6. Separate connection of KE, E to PE
7. (K1) Alarm relay 1, available changeover contacts

**Provide line protection!**

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

**Note**

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

(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>
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<tr>
<td></td>
<td>I3</td>
<td>Input 3</td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>RS-485 A</td>
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<tr>
<td></td>
<td>B</td>
<td>RS-485 B</td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>+24 V</td>
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<tr>
<td></td>
<td>Q1</td>
<td>Output 1</td>
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<tr>
<td></td>
<td>Q2</td>
<td>Output 2</td>
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<tr>
<td></td>
<td>M+</td>
<td>Analogue output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ground</td>
</tr>
</tbody>
</table>

---

For systems $> 690$ V and with overvoltage category III a fuse for the connection to the system to be monitored must be provided. Recommendation: 2A screw-in fuses.
Connection example ISOMETER® with insulation fault locators

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

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
- CE
- UL
- KTL

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

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

Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage range (U_n)</th>
<th>Supply voltage (U_S)</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 0…690 V; 1…460 Hz</td>
<td>0…1000 V</td>
<td>24…240 V; 50…600 Hz</td>
<td>24…240 V</td>
</tr>
</tbody>
</table>

Accessories

<table>
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<tr>
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<tr>
<td>Enclosure accessories (terminal cover, 2 mounting clips)</td>
<td>B91067903</td>
</tr>
<tr>
<td>Front cover 144x72 transparent (for IP65)</td>
<td>B91060005</td>
</tr>
</tbody>
</table>

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

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

Rated voltage: 1000 V

Overvoltage category: III

Rated impulse voltage:
- IC1/(IC2-5): 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

Tolerance of
- f: ±5 % ±5 V
- U: ±5 % ±5 V

Measuring range
- C: 0…1000 μF
- f: 60 Hz

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

Startup delay:
- Tstartup: 0…120 s

Supply voltage

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

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

IT system being monitored

Nominal system voltage range: Un
- AC 0…690 V
- DC 0…1000 V
- AC 0…600 V (for UL applications)
- Tolerance of Un: AC/DC +15 %
- Frequency range of Un: 60 Hz

Response values

Response value R Alv (alarm 1): 1 kΩ – 10 MCΩ
Response value DC residual voltage (Alarm 2) (Ur): 20 V – 3 V
Relative uncertainty (acc. to IEC 61557-8) profile dependent, ±15 %, at least ±1 kΩ
Hysteresis: 25 %, at least 1 kΩ

Time response

Response time tresp for DC residual voltage > 1 x Ur (or Alarm 1) max. 150 ms
Response time tresp at Rd = 0.5 x Rd (tresp = 10 kΩ) and Cr = 1 μF acc. to IEC 61557-8
profile dependent, typ. 4 s (see diagrams in manual)

Startup delay: Fstartup
- 0…120 s

Measuring circuit

Measuring voltage Un: ±50 V
Measuring current In: ±403 μA
Internal resistance Rz: ≥ 124 kΩ
Permissible extraneous DC voltage Ur: ≤ 1200 V
Permissible system leakage capacitance Ce: profile dependent, 0…150 μF

Measuring ranges

Measuring range f:
- 10…460 Hz
- Tolerance measurement of f: ±1 % ±0.1 Hz
- Voltage range measurement of f: AC 25…690 V
- Measuring range Un: AC 25…690 V
- Voltage range measurement of Un: AC/DC > 10 V
- Tolerance measurement of Un: ±5 % ±5 V
- Measuring range Cr:
- 0…1000 μF
- Tolerance measurement of Cr: ±10 % ±10 μF

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

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Technical data

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

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

In-Outputs (X1-Interface)
- Cable length X1 (unshielded cable): ≤ 10 m
- Cable length X1 (shielded cable, shield connected to earth (PE) on one end, recommended)
  - Overvoltage category: III
  - 1000 V

Max. amount Modbus requests: < 100/s
- Data rate: 10/100 Mbit/s, autodetect
- Interface/protocol: web server/Modbus TCP/BCOM
- Field bus:
  - Interfaces: Communication interface
  - Functions: insulation value, DC offset

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

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

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

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

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

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

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 voltage:
  - 230 V: 230 V: 24 V: 24 V
  - 110 V: 220 V: 24 V
- Rated operational current
  - S A: S A: T A: 0.2 A: 0.1 A
- Rated insulation voltage: ≤ 2000 m NN
- Rated insulation voltage: ≤ 3000 m NN
- Minimum contact rating: 1 mA at AC/DC = 10 V

---

Insulation monitoring devices | Main circuits
Insulation monitoring device ISOAVARIS-D
Technical data (continued)

Environment/EMC

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC</td>
<td>IEC 61326-2-4</td>
</tr>
</tbody>
</table>

Ambient temperatures:

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

Classification of climatic conditions acc. to IEC 60721:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stationary use</td>
<td>3K5 (except condensation and formation of ice)</td>
</tr>
<tr>
<td>Transport</td>
<td>2K2</td>
</tr>
<tr>
<td>Long-term storage</td>
<td>1K4</td>
</tr>
</tbody>
</table>

Classification of mechanical conditions acc. to IEC 60721:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stationary use</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>

Area of application: ≤ 3000 m NN

Connection:

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

Screw-type terminals:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal current</td>
<td>≤ 10 A</td>
</tr>
<tr>
<td>Tightening torque</td>
<td>0.5...0.6 Nm (5...7 lb-in)</td>
</tr>
<tr>
<td>Stripping length</td>
<td>7 mm</td>
</tr>
<tr>
<td>flexible with ferrule, with/without plastic sleeve</td>
<td>0.2...2.5 mm²</td>
</tr>
<tr>
<td>Multiple conductor, rigid</td>
<td>0.2...1 mm²</td>
</tr>
<tr>
<td>Multiple conductor, flexible</td>
<td>0.2...1.5 mm²</td>
</tr>
<tr>
<td>Multiple conductor, flexible with ferrule</td>
<td>0.25...1 mm²</td>
</tr>
<tr>
<td>Multiple conductor, flexible with TWIN ferrule with plastic sleeve</td>
<td>0.5...1.3 mm²</td>
</tr>
</tbody>
</table>

Push-wire terminals:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal current</td>
<td>≤ 10 A</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>flexible with ferrule, with/without plastic sleeve</td>
<td>0.2...2.5 mm²</td>
</tr>
<tr>
<td>Multiple conductor, flexible with TWIN ferrule</td>
<td>0.25...1.5 mm²</td>
</tr>
</tbody>
</table>

Push-wire terminals X1:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal current</td>
<td>≤ 8 A</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>flexible with ferrule, without plastic sleeve</td>
<td>0.2...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:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree of protection internal components</td>
<td>IP40</td>
</tr>
<tr>
<td>Degree of protection terminals</td>
<td>IP20</td>
</tr>
<tr>
<td>DIN rail mounting acc.</td>
<td>IEC 60715</td>
</tr>
<tr>
<td>Screw fixing</td>
<td>3 x M4 with mounting clip</td>
</tr>
<tr>
<td>Enclosure material</td>
<td>polycarbonate</td>
</tr>
<tr>
<td>Flammability class</td>
<td>V-0</td>
</tr>
<tr>
<td>ANSI code</td>
<td>64</td>
</tr>
<tr>
<td>Dimensions (W x H x D)</td>
<td>108 x 93 x 110 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>&lt; 390 g</td>
</tr>
</tbody>
</table>

Notes:

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

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

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

4) $U_s$ [Volt] = supply voltage ISOMETER

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

6) Recommendation: Devices mounted at 0 ° (display-oriented, cooling slots must be ventilated vertically).

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

Dimension diagram (dimensions in mm)
### Wiring Diagram

#### Connection Points:
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** ($L_1/+$, $L_2$, $L_3/-$)
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 $L_1/+ and L_3/-$ 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 $L_1/+$, $L_2$, $L_3/-$ 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

### Standards

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

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

### Further information

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

---

### Ordering information

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

### Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
</table>
| A set of screw-type terminals
1) included in the scope of delivery               | B91067901  |
| A set of push-wire terminals                      | B91067902  |
| Enclosure accessories (terminal cover, 2 mounting clips)
Suitable measuring instruments on request!       | B91067903  |

1)
Insulation monitoring devices | Main circuits

**Insulation monitoring devices ISOMETER® isoNAV685-D-B**

**Measuring current**

- (I/IC2-5) 8 kV
- (IC2-IC3) 4 kV
- (IC3-IC4-S) 4 kV/IC4/KS

**Rated insulation voltage**

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

Pollution degree for accessible parts on the outside of the device housing (Us < 600 V) 3

Pollution degree for accessible parts on the outside of the device housing (Us > 600 V) 2

**Supply voltage**

Supply via A1+/A2-

- Supply voltage range Us: AC/DC 24...240 V
- Tolerance of Us: ±30...±15 kV
- Maximum permissible input current of Us: 650 mA
- Frequency range of Us: DC, 30...400 Hz 1)
- Power consumption, typically 50/60 Hz: ≤ 12 W
- Power consumption, DC: ≤ 12 W
- Power consumption, typically 50/60 Hz: ≤ 12 W/24 VA
- Power consumption, typically 50%: ≤ 12 W/45 VA

**Supply via X1**

Supply voltage Us

- Voltage test (routine test) according to IEC 61010-1: IC1/(IC2-5) 1000 V
- IC2/(IC3-5) 250 V
- IC3/(IC4-5) 250 V
- IC4/KS 250 V

**Optional circuits**

Control circuit (IC5) 21, 22, 24

- Control circuit (IC4) 21, 22, 24

**IT system being monitored**

- Nominal system voltage range Us: AC 0...690 V/DC 0...1000 V
- Circuit capacity internal mains switch: AC 0...690 V/DC 0...1000 V
- Voltage passive DC 0...32 V

**Response values**

Response value Rmax1 (alarm 1) 1 kΩ...10 MΩ

Response value Rmax2 (alarm 2) 1 kΩ...10 MΩ

Relative uncertainty (acc. to IEC 61557-8) profile dependent, ±5 %, at least ±1 kΩ

Hysteresis 25 %, at least 1 kΩ

**Time response**

Response time tmax = 0.5 x Rmax1 (Rmin = 10 kΩ) and tmax = 1 µs according to IEC 61557-8 30 ms

Start-up delay (tON/OFF) 0...120 s

**Measuring circuit**

Measuring voltage Umin

- ±5 V

Measuring current Im

- ±13.4 mA

Internal resistance Rmin, Zmin 5.322 kΩ

Permissible extraneous DC voltage Ud 2500 V

Permissible system leakage capacitance G 150 µF

**Display**

- Indication: graphic display 127 x 127 pixels, 40 x 40 mm²
- Display range measured value: ±15 %, at least ±1 kΩ

**LEDs**

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

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

- Cable length X1 (unshielded cable): ≤ 10 m
- Cable length X1 (shielded cable, shield connected to earth (PE) on one end): 3

Total supply output current for each output (device supplied by A1+/A2-)

- max. 1 A
- max. 200 mA

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

\[ I_{max} = 10 \text{ mA} + 7 \text{ mA/V} \times U_{s} \]

(negative values are not allowed for \( I_{max} \))

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

- Number: 3

Operating mode, adjustable

- active high, active low

Functions

- none, test, reset, device deactivated

Voltage: Low DC -3...5 V, High DC 11...32 V

Tolerance Voltage ± 10 %

**Digital Outputs (Q1, Q2)**

- Number: 2

Operating mode, adjustable

- active, passive

Functions

- off, connection fault, Alarm L1, Alarm L2, Alarm L3, device fault, common alarm

Voltage

- passive DC 0...32 V, active DC 0/19...32 V

**Interfaces**

Field bus:

- Interface/protocol: web server/Modbus TCP/BCOM

Data rate

- 10/100 Mbit/s, autodetect

Max. amount Modbus requests

- < 1000

Cable length

- ≤ 100 m

Connection

- RS485

IP address

- DHCP/manual 192.168.0.5

Network mask

- 255.255.255.0

BCOM address

- system-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

- off, connection fault, Alarm L1, Alarm L2, Alarm L3, device fault, common alarm

Contact 21-22-24

- off, connection fault, Alarm L1, Alarm L2, Alarm L3, device fault, common alarm

**Electrical endurance under rated operating conditions, number of cycles**

10.000

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

- Utilisation category: AC-13 AC-14 DC-12 DC-12 DC-12

- 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 61326-2-4

**Ambient temperatures:**

- Operating temperature: -25...+55 °C

- Transport: -40...+85 °C

- Long-term storage: -40...+70 °C

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

- Stationary use (IEC 60721-3-3):
  - K4:3

- Transport (IEC 60721-3-2):
  - 2K

- 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 terminals:
- Nominal current: ≤ 10 A
- Tightening torque: 0.5…0.6 Nm (5…7 lb-in)
- Conductor sizes: AWG 24–12
- Stripping length: 7 mm
- Screw-type terminals:
  - Nominal current: ≤ 10 A
  - Tightening torque: 0.5…0.6 Nm (5…7 lb-in)
  - Conductor sizes: AWG 24–12
  - Stripping length: 7 mm

Push-wire terminals:
- Nominal current: ≤ 10 A
- Conductor sizes: AWG 24–12
- Stripping length: 10 mm
- Push-wire terminals:
  - Nominal current: ≤ 10 A
  - Conductor sizes: AWG 24–12
  - Stripping length: 10 mm

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

1) At a frequency > 200 Hz, the connection of X1 must be insulated. Only permanently installed devices which at least have overvoltage category CAT2 (300V) may be connected.
2) Indication limited outside the temperature range -25…+55 °C.
3) 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.
4) This is a class A product. In a domestic environment, this product may cause radio interference. In this case, the user may be required to take corrective actions.
5) Recommendation: Devices mounted at 0 ° (display-oriented, cooling slots must be ventilated vertically).
For devices mounted at an angle of 45°, the max. working temperature is reduced by 10 °C.
For devices mounted at an angle of 90°, the max. working temperature is reduced by 20 °C.
Connection to a 3(N)AC system

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

Connection to the IT system to be monitored ($L_1/+$, $L_2$, $L_3/-$)

Separate connection of KE, E to PE

(K1) Alarm relay 1, available changeover contacts

(K2) Alarm relay 2, available changeover contacts

Switchable resistor $R$ for RS-485 bus termination

Ethernet interface

Digital interface

*6 A fuse for systems $> 690$ V

NOTE:
According to DIN VDE 0100-430, devices for protection against a short circuit can be omitted for the coupling of terminals $L_1/+$, $L_3/-$ 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 $L_1/+$, $L_2$, $L_3/-$ 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 $60/70 ^\circ C$ copper lines only!
UL and CSA application require the supply voltage to be protected via 5 A fuses.
**Anschluss an einen Frequenzumrichter zur Überwachung im abgeschalteten Zustand (Offline)**

**Digital interface X1**

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

**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® isoHR685W-x-I-B
Insulation monitoring device for IT AC systems with galvanically connected rectifiers and inverters and for IT DC systems

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

Device variants
- isoHR685W–D–I–B
  The device version isoHR685W-D-I-B features a high-resolution graphical LC display and control elements for direct operation of the device functions. It cannot be combined with an FP200.
- isoHR685W–S–I–B
  The isoHR685W–S–I–B device contains no display and no operating unit. It can only be used in combination with FP200W and is indirectly operated via this front panel.

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

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

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

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage range U*n</th>
<th>Supply voltage U*S</th>
<th>Display</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>DC</td>
<td>AC</td>
<td>DC</td>
<td></td>
</tr>
<tr>
<td>0...1000 V 0,1...460 Hz</td>
<td>0...1300 V</td>
<td>24...240 V, 50...400 Hz</td>
<td>24...240 V</td>
<td></td>
</tr>
<tr>
<td>detached isoHR685W–S–I–B + FP200W</td>
<td></td>
<td>isoHR685W–S–I–B</td>
<td>B91067225W</td>
<td></td>
</tr>
</tbody>
</table>

1) Only available in combination
Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device version without display</td>
<td>isoHR685W-S-1-B</td>
<td>B91067125W</td>
<td>57</td>
</tr>
<tr>
<td>Display for front panel mounting</td>
<td>FP200W</td>
<td>B91067904W</td>
<td>65</td>
</tr>
<tr>
<td>Coupling devices</td>
<td>AGH150W-4</td>
<td>B98018006</td>
<td>324</td>
</tr>
<tr>
<td></td>
<td>AGH2045-4</td>
<td>B910413</td>
<td>326</td>
</tr>
<tr>
<td></td>
<td>AGHS5205</td>
<td>B913033</td>
<td>327</td>
</tr>
<tr>
<td></td>
<td>AGH6765-4</td>
<td>B913055</td>
<td>330</td>
</tr>
</tbody>
</table>

Suitable measuring instruments on request!

**Time response**

- Response time \( t_{\text{response}} \) at \( R_n \) (without test): \( 1 \, \text{MΩ} \to R_n (\text{with test}) = 0.5 \times R_n (R_0 = 20 \, \text{kΩ}) \) and \( C_n = 1 \, \text{μF} \) acc. to IEC 61557-8
- Profile dependent, typ. 10 s (see diagram in manual)

**Response time**

- Response time \( t_{\text{response}} \) at \( R_n (\text{with test}) = 1 \, \text{MΩ} \) and \( C_n = 1 \, \text{μF} \) profile dependent, typ. 5 s (see diagram in manual)

**Start-up delay** \( t_{\text{start-up}} \) 0…120 s

**Measuring circuit**

- Measuring voltage \( U_{\text{MS}} \)
  - Profile dependent, \( \pm 10 \, \text{V} \), \( \pm 50 \, \text{V} \) (see profile overview)
  - Measuring current \( I_n \) \( \leq 403 \, \mu\text{A} \)

**Overview**

- Internal resistance \( R_n \), \( Z_n = 124 \, \text{kΩ} \)
- Internal resistance on decoupled systems (invasive by I/O, invasive by isolation or cut-off) typ. 50 MΩ
- Permissible extraneous DC voltage \( U_{\text{EX}} \) \( \leq 1500 \, \text{V} \)
- Permissible system leakage capacitance \( C_{\text{L}} \) profile dependent, \( 0 \ldots 1000 \, \text{μF} \)

**Measuring ranges**

- Measuring range \( f_0 \) \( 0.1 \ldots 460 \, \text{Hz} \)
- Tolerance measurement of \( f_n \) \( \pm 1 \% \), \( \pm 0.1 \, \text{Hz} \)
- Voltage range measurement of \( U_n \) DC 25…690 V
- Measuring range \( U_n \) (without an external coupling device) AC 25…1000 V, 3AC 25…690 V, DC 0…1300 V
- Voltage range measurement of \( U_n \) AC/DC 25…1000 V
- Tolerance measurement of \( U_n \) \( \pm 5 \% \) \( \pm 5 \, \text{V} \)
- Measuring range of \( C_n \) \( 0 \ldots 1000 \, \text{μF} \)
- Tolerance measurement of \( C_n \) \( \pm 10 \% \) \( \pm 10 \, \text{μF} \)
- Frequency range measurement of \( C_n \) DC 10…460 Hz
- Min. insulation resistance measurement of \( C_n \)

**Display**

- Graphic display 127 x 127 pixels, 40 x 40 mm
- Display range measured value \( 0.1 \, \text{kΩ} \ldots 30 \, \text{GΩ} \)
- Operating uncertainty (according to IEC 61557-8) \( \pm 15 \%, \text{at least} \pm 1 \, \text{kΩ} \)

**LEDs**

- ON (operation LED) green
- SERVICE yellow
- ALARM 1 yellow
- ALARM 2 yellow
- Indication graphic display 127 x 127 pixels, 40 x 40 mm
- Display range measured value \( 0.1 \, \text{kΩ} \ldots 30 \, \text{GΩ} \)
- Operating uncertainty (according to IEC 61557-8) \( \pm 15 \%, \text{at least} \pm 1 \, \text{kΩ} \)

**Cable length X1 (unshielded cable)**

- Up to 10 m

**Cable length X1 (shielded cable, shield connected to earth (PE))**

- 10 m
- Max. supply output current for each output (device supplied by X1/+.X1.GND) max. 1 A
- Total max. supply output current on X1 (device supplied by A1+/A2-) max. 200 mA
- Total max. supply output current on X1 (device supplied by A1+/A2-) between 15,8 V and 40 V
- \( \lambda_{\max} = 10 \, \text{mA} \leq 7 \, \text{mA} /\text{V} \) \( U_{\max} \)

**Digital inputs (11, 12, 13)**

- 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
- Voltage tolerance \( \pm 10 \% \)

**Digital outputs (Q1, Q2)**

- Number \( 2 \)
- Operating mode, adjustable active, passive
- Functions off, ins. alarm 1, ins. Alarm 2, connection fault, DC-alarm \( \lambda^+ \), \( \lambda^+ \)-alarm \( \lambda^+ \), symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm
- Voltage passive DC 0…32 V, active DC 0/19.2…32 V
Technical data (continued)

### Analogue output (M+)

<table>
<thead>
<tr>
<th>Number</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating mode</td>
<td>linear, midscale point 28 kΩ/120 kΩ</td>
</tr>
<tr>
<td>Functions</td>
<td>insulation value, DC shift</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 related to the current/voltage final value</td>
<td>± 20 %</td>
</tr>
</tbody>
</table>

### Interfaces

**Field bus:**
- **Interface/protocol:** webserver/Modbus TCP/IEC61000-5-2
- **Data rate:** 10/100 Mbit/s, autodetect
- **Max. number of Modbus requests:** <100/s
- **Cable length:** ≤ 100 m
- **Connection:** RJ45
- **IP address:** DHCP/manual*, 192.168.0.5
- **Network mask:** 255.255.255.0*
- **BCOM address:** system-1-0
- **Function:** communication interface

**ISOsync:**
- **Number ISOsync devices:** ≤ 10

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

**isoData:**
- **Interface/Protocol:** RS-485/isoData
- **Data rate mode 1:** 9.6 kbaud/s
- **Data rate mode 2:** 115.2 kbaud/s
- **Data rate mode 3:** 115.2 kbaud/s
- **Leitungslänge (dependant on the Baudrate):** ≤1200 m
- **Cable:** twisted pair, one end of shield connected to PE, recommended: J-Y(St)Y min. 2x0.8
- **Connection terminals:** X1,A, X1,B
- **Terminating resistor:** 120 Ω, can be connected internally

**Device address:** 1…90

### 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 5, DC+ alarm 5, 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 5, DC+ alarm 5, symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm

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

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

<table>
<thead>
<tr>
<th>Utilisation category</th>
<th>AC-13</th>
<th>AC-14</th>
<th>DC-12</th>
<th>DC-12</th>
<th>DC-12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated operational voltage</td>
<td>230 V</td>
<td>230 V</td>
<td>24 V</td>
<td>110 V</td>
<td>220 V</td>
</tr>
<tr>
<td>Rated operational current</td>
<td>5 A</td>
<td>3 A</td>
<td>1 A</td>
<td>0.2 A</td>
<td>0.1 A</td>
</tr>
<tr>
<td>Rated insulation voltage</td>
<td>≤ 2000 m NN</td>
<td>250 V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated insulation voltage</td>
<td>≤ 3000 m NN</td>
<td>160 V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum contact rating</td>
<td>1 mA at AC/DC ≥ 10 V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Environment/EMC and temperature range

<table>
<thead>
<tr>
<th>EMC</th>
<th>IEC 60533, IEC 61236-2-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>-25...+55 °C</td>
</tr>
<tr>
<td>Transport</td>
<td>-40...+65 °C</td>
</tr>
<tr>
<td>Long-term storage</td>
<td>-40...+70 °C</td>
</tr>
</tbody>
</table>

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

- **Stationary use (IEC 60721-3-3):** 3K5 (condensation and formation of ice possible)
- **Transport (IEC 60721-3-2):** 2K2
- **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):** 1M3
- **Area of application:** ≤3000 m NN

### Connection

**Connection type:** plugable screw terminal or push-pulse terminal

### Screw-type terminals:

- **Nominal current:** ≤ 10 A
- **Tightening torque:** 0.5…0.6 Nm (5…7 lb-in)
- **Conductor sizes:** AWG 22-12
- **Stripping length:** 7 mm
- **rigid/flexible:** 0.2…2.5 mm²
- **flexible with ferrules, without plastic collar:** 0.25…2.5 mm²
- **Multiple conductor, rigid:** 0.2…1.5 mm²
- **Multiple conductor, flexible:** 0.2…1.5 mm²
- **Multiple conductor, flexible with ferrule without plastic sleeve:** 0.25…1.5 mm²
- **Multiple conductor, flexible with TWIN ferrule with plastic sleeve:** 0.5…1.5 mm²

### Push-wire terminals:

- **Nominal current:** ≤ 10 A
- **Conductor sizes:** AWG 22-12
- **Stripping length:** 10 mm
- **rigid/flexible:** 0.2…2.5 mm²
- **flexible with ferrule without plastic sleeve:** 0.25…2.5 mm²
- **flexible with ferrule with plastic sleeve:** 0.25…0.75 mm²

### Other

- **Operating mode:** continuous operation
- **Mounting (0°):** display oriented, cooling slots must be ventilated vertically
- **Degree of protection internal components:** IP60
- **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
- **Weight:** < 390 g

---

1) At a frequency > 200 Hz, the connection of X1 and Remote must be insulated. Only permanently installed devices which at least have overvoltage category CAT2 (300V) may be connected.
2) Deactivation of voltage metering in a DC system at Us > DC 1000 V and asymmetric insulation fault at Rl < 500 kΩ. Reactivation of voltage metering if Rl > 500 kΩ
3) Indication limited outside the temperature range -25...+55 °C.
4) Us [Volt] = ISOMETER® supply voltage
5) For Us ≤ 50 V only.
6) This is a class A product. This product may cause radio interference in residential areas. In this case, the user may be required to take corrective actions.
7) Recommendation: Devices mounted at 0° (display oriented, cooling slots must be ventilated vertically)
1. Connection to an AC system $U_n$
2. Connection to a DC system $U_n$
3. Linked with two IT systems which can be interconnected via a coupling switch. Information regarding the state of the coupling switch is not necessary.
4. Connection to an IT system with coupling device
5. Connection to a 3(N)/AC system
6. Connection to the IT system to be monitored (L1/+, L2, L3/-)
7. Separate connection of KE, E to PE

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

**NOTE**
According to DIN VDE 0100-430, devices for protection against a short-circuit can be omitted for the coupling of terminals L1/+, L2 and L3/- to the IT system ≤ 690 V to be monitored if the wiring is carried out in such a manner as to reduce the risk of a short-circuit to a minimum.

Ensure short-circuit-proof and earth-fault-proof wiring.

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

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

### Digital interface X1

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

**X1**

- **Active adjustable**
- **Passive adjustable**

**RS-485**

- **Deactiv. Device**
- **RESET**
- **TEST**
- **low active**
- **high active**
- **Currentmeter**
- **Voltagermeter**
- **+24 V**
ISOsync for coupled IT systems

Insulation monitoring devices | Main circuits

Insulation monitoring device ISOMETER® isoHR685W-x-I-B
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
- ISOMETER® for IT AC systems with galvanically connected rectifiers or inverters and for IT DC systems (IT = unearthed systems)
- Nominal system voltage $U_n$, expandable via coupling devices
- Automatic adaptation to the existing system leakage capacitance
- Combination of AMP® and other profile-specific measurement methods
- Two separately adjustable response value ranges of 1 kΩ…10 MΩ for alarm 1 and alarm 2
- High-resolution graphic LC display for excellent readability and recording of the device status
- Connection monitoring (monitoring of the measuring lines)
- Automatic device self test
- Graphical representation of the insulation resistance over time (isoGraph)
- History memory with real-time clock (buffer for three days) for storing 1023 alarm messages with date and time
- Current and voltage output 0(4)…20 mA, 0…400 μA, 0…10 V, 2…10 V (galvanically separated) which is analogous to the measured insulation value of the system
- Freely programmable digital inputs and outputs
- Remote setting via the Internet or Intranet (Webserver / Option: COMTRAXX® Gateway)
- Worldwide remote diagnosis via the Internet (made available by Bender Service only)
- RS-485/BS (Bender sensor bus) for communication with other Bender devices
- BCOM, Modbus TCP and web server

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

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

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

Accessories

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

1) included in the scope of delivery

Matching system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coupling devices</td>
<td>AGH150W-4</td>
<td>B98018006</td>
<td>324</td>
</tr>
<tr>
<td></td>
<td>AGH204S-4</td>
<td>B914013</td>
<td>326</td>
</tr>
<tr>
<td></td>
<td>AGH520S</td>
<td>B913033</td>
<td>327</td>
</tr>
<tr>
<td></td>
<td>AGH676S-4</td>
<td>B913055</td>
<td>330</td>
</tr>
</tbody>
</table>

Suitable measuring instruments on request!
### Technical data

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

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

### Rated voltage

- 1000 V

### Overvoltage category
- III

### Rated impulse voltage:

<table>
<thead>
<tr>
<th>Category</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC1/(IC2-5)</td>
<td>8 kV</td>
</tr>
<tr>
<td>IC2/(IC3-5)</td>
<td>4 kV</td>
</tr>
<tr>
<td>IC3/(IC4-5)</td>
<td>4 kV</td>
</tr>
<tr>
<td>IC4/IC5</td>
<td>4 kV</td>
</tr>
</tbody>
</table>

### Rated insulation voltage:

- 1000 V

### Pollution degree for accessible parts on the outside of the device housing ($U_{p}$): ±5 %

### Protective separation (reinforced insulation) between:

- Overvoltage category III, 1000 V
- Overvoltage category III, 1000 V
- Overvoltage category III, 300 V
- Overvoltage category 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
- IC1/(IC2-5)  AC 2,2 kV

### Power supply

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

- Supply voltage range $U_{i}$: AC/DC 24…240 V
- Tolerance of $U_{i}$: ±10 % ±15 %
- Maximum permissible input current of $U_{i}$: 650 mA
- Frequency range of $U_{i}$: 50…400 Hz
- Tolerance of the frequency range of $U_{i}$: ±5 % ±15 %
- Power consumption, typically 50/60 Hz: 12 W/21 VA
- Power consumption, typically 480 Hz: 12 W/45 VA

#### Supply via X1:

- Supply voltage $U_{i}$: DC 24 V
- Tolerance of $U_{i}$: DC ±10 % ±25 %

#### IT system being monitored

- Nominal system voltage range $U_{i}$: AC 0…690 V
- DC 0…1000 V
- AC/DC 0…600 V (for UL applications)
- AC/DC 0…690 V
- DC 0…400 Hz
- Max. AC voltage $U_{i}$ in the frequency range $f_{i} = 0.1…4$ Hz
- $U_{i} = 50$ V Hz$^{-1} [1 + f_{i}]$

#### Response values

- Response value $R_{0}$ (alarm 1): 1 kΩ ±10 %
- Response value $R_{0}$ (alarm 2): 2 kΩ ±10 %
- Relative uncertainty (acc. to IEC 61557-8): profile dependent, ±15 %, at least ±1 kΩ
- Hysteresis: 25 %, at least 1 kΩ

#### Time response

- Response time $t_{R}$ at $R_{0} = 0.5$ kΩ ($R_{0}$ = 10 kΩ) and $C_{1}$ = 1 µF according to IEC 61557-8: profile dependent, typ. 4 s (see diagrams in manual)
- Response time $t_{DC}$ alarm at $C_{1}$ = 1 µF: profile dependent, typ. 2 s (see diagram in manual)
- Start-up delay $t_{start-up}$: 0…120 s

#### Measuring circuit

- Measuring resistance $R_{m}$: 403 µA
- Internal resistance $R_{i}$, $Z_{i}$: 124 kΩ
- Permissible extraneous DC voltage $U_{L}$: 1200 V
- Permissible system leakage capacitance $C_{L}$: profile dependent, 0…1000 µF

### Measuring ranges

#### Measuring range $f_{r}$

<table>
<thead>
<tr>
<th>Range</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$f_{r}$</td>
<td>10…400 Hz</td>
</tr>
</tbody>
</table>

#### Tolerance measurement of $f_{r}$

<table>
<thead>
<tr>
<th>Tolerance</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>±1 %</td>
<td>±0.1 Hz</td>
</tr>
</tbody>
</table>

#### Voltage range measurement of $f_{r}$

<table>
<thead>
<tr>
<th>Range</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$f_{r}$</td>
<td>AC 25…690 V</td>
</tr>
</tbody>
</table>

#### Measuring range $U_{i}$

<table>
<thead>
<tr>
<th>Range</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$U_{i}$</td>
<td>AC 25…690 V</td>
</tr>
</tbody>
</table>

#### Tolerance measurement of $U_{i}$

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

#### Measuring range $C_{L}$

<table>
<thead>
<tr>
<th>Range</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_{L}$</td>
<td>0…1000 µF</td>
</tr>
</tbody>
</table>

#### Tolerance measurement of $C_{L}$

<table>
<thead>
<tr>
<th>Tolerance</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>±10 %</td>
<td>±10 µF</td>
</tr>
</tbody>
</table>

#### Frequency range measurement of $C_{L}$

<table>
<thead>
<tr>
<th>Range</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_{L}$</td>
<td>DC 30…400 Hz</td>
</tr>
</tbody>
</table>

#### Min. insulation resistance measurement of $C_{L}$

<table>
<thead>
<tr>
<th>Range</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_{L}$</td>
<td>1000 V</td>
</tr>
</tbody>
</table>

### Display

#### Indication

- Graphic display 127 x 127 pixels, 40 x 40 mm$^{2}$

#### Display range measured value

<table>
<thead>
<tr>
<th>Value</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>±1 kΩ</td>
<td>±20 %</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Value</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>±15 %</td>
<td>±1 kΩ</td>
</tr>
</tbody>
</table>

### LEDs

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

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

- Cable length $X_{1}$ (unshielded cable): ≤ 10 m
- Cable length $X_{1}$ (shielded cable, shield connected to earth (PE) on one end): ≤ 100 m
- Total max. supply output current for each output (device supplied by A1, X1, GT): max. 1 A
- Total max. supply output current on X1 (device supplied by A1/A2): max. 200 mA
- Total max. supply output current on X1 (device supplied by A1+/A2- between 16.8 V and 40 V): $I_{max} = 10$ mA + 7 mA/ $V_{i} - 100$ (negative values are not allowed for $I_{max}$)

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

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

#### Voltage

- Low DC: 3…5 V, High DC: 11…32 V
- Tolerance Voltage: ±10 %

### Digital Outputs (Q1, Q2)

- Number: 2
- Operating mode, adjustable: active, passive
- Functions: off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm $4^{a}$, DC+ alarm $4^{a}$, symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm

#### Voltage

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

### Analogue Output (M+)

- Number: 1
- Operating mode: linear, midpoint scale 28 kHz/120 kHz
- Functions: insulation value, DC offset
- Current: 0…20 mA (< 600 Ω), 4…20 mA (< 600 Ω), 0…400 µA (< 4 kHz)
- 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/RCom
- Data rate: 10/100 Mbit/s, autodetect
- Max. amount Modbus requests: ≤ 100/s
- Cable length: ≤ 100 m
- Connection: RS485
- IP address: DHCP/manual 192.168.0.5
- Network mask: 255.255.255.0
- BCom address: system-1-0
- Function: communication interface

#### Sensor bus:

- Interface/protocol: RS-485/BS
- Data rate: 9.6 kbit/s
- Cable length: ≤ 1200 m
- Cable: twisted pair, one end of shield connected to PE recommended. J-Y(SY) min. 2x0.8
- Connection: terminals X1, A, B
- Terminating resistor at the beginning and at the end of the transmission path: 120 Ω, can be connected internally
- Device address, BS bus: 1…90
Switching elements
Number of switching elements 2 changeover contacts
Operating mode N/C operation/N/O operation
Contact 11-12-14 off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm 4, DC+ alarm 4, symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm
Contact 21-22-24 off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm 4, DC+ alarm 4, symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm

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 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 max. 5 A (for UL applications)
Rated insulation voltage ≤ 2000 m NN 250 V
Rated insulation voltage ≤ 3000 m NN 160 V
Minimum contact rating 1 mA at AC/DC ≥ 10 V

Environment/EMC
EMC IEC 50121-3-2, IEC 61326-2-4
Ambient temperatures:
Operating temperature -40…+70 °C
-40…+65 °C (for UL applications)
Transport -40…+85 °C
Long-term storage -40…+70 °C

Classification of climatic conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3) 3K7 (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) 3K8
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 terminals:
Nominal current ≤ 10 A
Tightening torque 0.5…0.6 Nm (5…7 lb-in)
Conductor sizes AWG 24-12
Stripping length 7 mm
rigid/flexible 0.2…2.5 mm²
flexible with ferrules, with/without plastic sleeve 0.25…2.5 mm²
Multiple conductor, rigid 0.2…1 mm²
Multiple conductor, flexible 0.2…1.5 mm²
Multiple conductor, flexible with ferrule without plastic sleeve 0.25…1 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve 0.5…1.5 mm²

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

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

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.
Degree of protection components -25…+55 °C.
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
Weight < 390 g

1) At a frequency > 200 Hz, the connection of X1 must be insulated. Only permanently installed devices which at least have overvoltage category CAT2 (300V) may be connected.
2) Indication limited outside the temperature range -25…+55 °C.
3) 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.
4) Recommendation: Devices mounted at 0° (display-oriented, cooling slots must be ventilated vertically).
5) For devices mounted at an angle of 45°, the max. working temperature is reduced by 10 °C.
6) For devices mounted at an angle of 90°, the max. working temperature is reduced by 20 °C.
Connection to an AC system $U_n$
Connection to a DC system $U_n$
Connection to an IT system with coupling device
Connection to a 3(N)AC system
Connection to the IT system to be monitored (L1/+, L2, L3/-)
Separate connection of KE, E to PE
(K1) Alarm relay 1, available changeover contacts
(K2) Alarm relay 2, available changeover contacts
Switchable resistor $R$ for RS-485 bus termination
Ethernet interface, connection to Ethernet interface by Bender Service staff only
Digital interface
For systems > 690 V and with overvoltage category III a fuse for the connection to the system to be monitored must be provided. Recommendation: 2 A 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.

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>

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

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 24 V/-20…+25 %</td>
<td>typ. 3 W</td>
<td>FP200</td>
<td>B91067904</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FP200W①</td>
<td>B91067904W</td>
</tr>
</tbody>
</table>

① Device version Option "W" with increased shock and vibration resistance

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FP200 mechanical accessories comprising:</td>
<td>B91067907</td>
</tr>
<tr>
<td>2 screw attachments</td>
<td></td>
</tr>
<tr>
<td>Front cover 144x72 transparent (for IP65)</td>
<td>B98060005</td>
</tr>
<tr>
<td>Patch cable CAT5e (without UL, temperature</td>
<td>B91067906</td>
</tr>
<tr>
<td>range 0...+60 °C, included in the scope of</td>
<td></td>
</tr>
<tr>
<td>delivery</td>
<td></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 co-ordination (IEC 60664-1/IEC 60664-3)

**Rated voltage** 50 V

**Overvoltage category (OVC)** III

**Rated impulse voltage** 800 V

**Rated insulation voltage** 50 V

**Pollution degree for accessible parts on the outside of the device housing** 3

Supply voltage

**Supply voltage U_S** DC 24 V (via iso685-S variant)

**Power consumption** 1.2 W

Display

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

LEDs

**ON (operation LED)** green

**SERVICE** yellow

**ALARM 1** yellow

**ALARM 2** yellow

Interfaces

**Interface/protocol** Internal Bender

**Cable length** ≤ 5 m

**REMOTE Cable** Patch cable at least CAT5e

Environment/EMC

**EMC** IEC 61326-2-4; EN 50121-3-2; EN 50121-4

**Ambient temperatures**

**Operating temperature** -25...+55 °C

**Transport** -40...+85 °C

**Long-term storage** -40...+70 °C

Classification of climatic conditions acc. to IEC 60721:

- Stationary use (IEC 60721-3-3) 3K5 (except condensation and formation of ice)
- Transport (IEC 60721-3-2) 2K3
- Long-time storage (IEC 60721-3-1) 1K4

Classification of mechanical conditions acc. to IEC 60721:

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

Area of application ≤3000 m NN

Connection

**Connection type** plug connectors

**Operating mode** continuous operation

**Mounting (0°)** display oriented, cooling slots must be ventilated vertically

**Degree of protection, built-in components (DIN EN 60529)** IP40

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

**Degree of protection with transparent cover** IP65

**Panel cut-out** 138 x 66 mm

**Permissible tolerance of panel cut-out** +0.5 /–0

**Screw mounting** with mounting brackets

**Torque screw mounting** 0.3 Nm ±10%

**Enclosure material** polycarbonate

**Flammability class** UL94V-0

**Dimensions (W x H x D)** 144 x 72 x 35.6 mm

**Weight** < 180 g

**Option „W“ data different from the standard version**

(Only for remote mounting)

**Ambient temperatures:**

- Operating temperature -40...+70 °C
- Transport -40...+85 °C
- Long-term storage -40...+70 °C

Classification of climatic conditions acc. to IEC 60721:

- Stationary use (IEC 60721-3-3) 3K5 (condensation and formation of ice possible)

Classification of mechanical conditions acc. to IEC 60721:

- Stationary use (IEC 60721-3-3) 3M7

(*) = factory setting

1) Recommendation: Devices mounted at 0° (display-oriented, cooling slots must be ventilated vertically). For devices mounted at an angle ≠ 0°, the max. working temperature is reduced by 10 °C for devices with a "W" in the device name.
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™ 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)

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

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

Ordering information

<table>
<thead>
<tr>
<th>RS-485 interface</th>
<th>Coupled IT systems</th>
<th>Output</th>
<th>Supply voltage $U_5^{(1)}$</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 19.2…55 V 19.2…72 V</td>
<td>IRDH275-435</td>
<td>B91065100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>–</td>
<td>10.2…36 V</td>
<td>IRDH275-425</td>
<td>B91065108</td>
</tr>
<tr>
<td>BMS</td>
<td>applicable</td>
<td>Current output 0(4)…20 mA</td>
<td>88…264 V 77…286 V 19.2…55 V 19.2…72 V</td>
<td>IRDH275B-435</td>
<td>B91065101</td>
</tr>
<tr>
<td></td>
<td></td>
<td>–</td>
<td>10.2…36 V</td>
<td>IRDH275B-425</td>
<td>B91065105</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>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>External kΩ measuring instruments</td>
<td>7204-1421</td>
<td>B986763</td>
<td>369</td>
</tr>
<tr>
<td></td>
<td>9604-1421</td>
<td>B986764</td>
<td>369</td>
</tr>
<tr>
<td></td>
<td>9620-1421</td>
<td>B986841</td>
<td>369</td>
</tr>
<tr>
<td>Coupling devices</td>
<td>AGH150W-4</td>
<td>B98018006</td>
<td>324</td>
</tr>
<tr>
<td></td>
<td>AGH2045-4</td>
<td>B914013</td>
<td>326</td>
</tr>
<tr>
<td></td>
<td>AGHS205</td>
<td>B913033</td>
<td>327</td>
</tr>
</tbody>
</table>
Technical data

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage
AC 800 V

Rated impulse voltage/pollution degree
8 kV/kW

Voltage ranges

IRDH275...:
Nominal system voltage $U_2$
AC 1/N/UK 0...793 V
Nominal frequency $f_2$ (for $< 50$ Hz see characteristic curve in the manual)
0.1...460 Hz
Nominal system voltage $U_0$
DC 0...650 V

IRDH275...-435:
Supply voltage $U_0$ (also see nameplate)
AC 88...264 V
Frequency range $f_2$
42...460 Hz
Supply voltage $U_0$ (also see nameplate)
DC 77...286 V

IRDH275...-427:
Supply voltage $U_0$ (also see nameplate)
AC 19.2...55 V
Frequency range $f_2$
42...460 Hz
Supply voltage $U_0$ (also see nameplate)
DC 19.2...72 V

Power consumption
$\leq 14$ VA

Response values

Response value $R_{\text{on}}$ (Alarm 1)
1 kΩ...10 MΩ
Response value $R_{\text{on}}$ (Alarm 2)
1 kΩ...10 MΩ
Relative uncertainty (20 kΩ...1 MΩ) (acc. to IEC 61557-8)
$\pm 15\%$
Relative uncertainty (1...10 MΩ)
$\pm 20\%$
Relative uncertainty (1...10 MΩ)
$0.2$ kΩ/20% Response time $t_\text{res}$
$< 5$ s
Hysteresis (1...10 kΩ)
$+2$ kΩ
Hysteresis (10 kΩ...10 MΩ)
$25\%$

Measuring circuit

Measuring voltage $U_{\text{cm}}$
$\leq 50$ V
Measuring current $I_{\text{cm}}$
at $R_0$ = 0 $\Omega$
$< 280$ µA
Internal DC resistance $R_0$
$\geq 1800$ kΩ
Impedance $Z$ at 50 Hz
$\geq 1800$ kΩ
Permissible extraneous DC voltage $U_{\text{ex}}$
$\leq 5$ DC 1200 V
Permissible system leakage capacitance $C_{\text{sys}}$
$\leq 500$ µF
Factory setting
150 µF

Displays

Display, illuminated
two-line display
Characteristics (number)
2 x 16
Display range measured value
1 kΩ...10 MΩ
Operating uncertainty (20 kΩ...1 MΩ)
$\pm 15\%$
Operating uncertainty (1...10 MΩ)
$\pm 15\%$
Operating uncertainty (1...10 MΩ)
$\pm 0.1$ MΩ/15%***

Outputs/Inputs

Test/reset button
internal/external
Current output for measuring instrument SKMP (scale centre point = 120 kΩ)
400 µA (± 12.5 kΩ)
Current output IRDH275B (load)
20 mA (± 500 Ω)
Accuracy current output (1 kΩ...1 MΩ)
related to the value indicated
$\pm 10\%$, $\pm 1$ kΩ

Serial interface

Interface/protocol IRDH275
RS-485/ASCII-IsoData
Interface/protocol IRDH275B
RS-485/BMS
Connection
terminals A/B
Cable length
$\leq 1200$ m
Cable (twisted in pairs, one end of shield connected to PE) recommended: J-Y(St)Y min. 2 x 0.8 mm²
Terminating resistor
120 Ω (0.5 W)
Device address, BMS bus
1...30 (factory setting = 3)

Switching elements

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
12000
Contact class
IB (DIN IEC 60255-1)
Rated contact voltage
AC 250 V/DC 300 V
Breaking capacity
$2$ A, AC $230$ V, cos phi = 0.4
$0.2$ A, DC $220$ V, L/R = $0.4\ s$
Contact rating at DC 24 V
$\geq 2$ mA (50 mW)

Environment/EMC

EMC
acc. to IEC 61326-2-4 Ed. 1.0
Shock resistance IEC 60664-2-27 (device in operation)
15 g/11 ms
Bumping IEC 60664-2-29 (transport)
$40$ g/6 ms
Vibration resistance IEC 60664-2-6 (device in operation)
$1$ g/10...150 Hz
Vibration resistance IEC 60664-2-6 (transport)
$2$ g/10...150 Hz
Ambient temperature (during operation)
$-10...+65^\circ\ C$
Ambient temperature (during storage)
$-40...+70^\circ\ C$
Climatic class acc. to IEC 60721-3-3
3K5

Other

Operating 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)
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
$\leq 510$ g

Option “W”

Shock resistance IEC 60664-2-27 (device in operation)
$30$ g/11 ms
Bumping IEC 60664-2-29 (transport)
$40$ g/6 ms
Vibration resistance IEC 60664-2-6
$1.6$ mm/10...25 Hz
$4$ g/25...150 Hz
Ambient temperature (during operation)
$-40...+70^\circ\ C$
Storage temperature range
$-40...+85^\circ\ C$

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)
**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, L2.
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**

1. without rectifiers
   - $U_n = 3 AC 0…1650 V$ (DC max. 1000 V)

2. with rectifiers
   - $U_n = 3 AC 0…1300 V$ (peak voltage downstream of the rectifier or intermediate circuit voltage of max. 1840 V)
ISOMETER® IRDH275BM-7 with coupling device AGH675-7 and AGH675-7MV15

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

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

Typical applications
- AC, DC or AC/DC medium voltage systems
- AC/DC medium voltage systems with directly connected DC components, such as rectifiers, converters, and thyristor-controlled DC drives

Approvals

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

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

Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage $U_n$</th>
<th>Supply voltage $U_S$</th>
<th>Cable length</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
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<tbody>
<tr>
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<tr>
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<td>19.2…35 V</td>
<td>19.2…72 V</td>
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<td>–</td>
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<tr>
<td>0…15.5 kV, 0…460 Hz</td>
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<td>–</td>
<td>500 mm</td>
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<td>B913060</td>
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</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>External kΩ measuring instruments</td>
<td>9620-1421</td>
<td>B986849</td>
<td>369</td>
</tr>
</tbody>
</table>
Insulation monitoring device ISOMETER® IRDH275BM-7 with coupling device AGH675-7 and AGH675-7MV15

Technical data IRDH275BM-7

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** $U_n$ via AGH675S-7
- **Supply voltage** $U_S$ (also see nameplate):
  - AC 19.2…55 V*
  - Frequency range $U_S$ 42…460 Hz
  - DC 19.2…72 V*
- **Power consumption** ≤14 VA

Response values

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

Measuring circuit

- **Measuring voltage** $U_m$ ≤ 50 V
- **Measuring current** $I_m$ (at RF = 0 Ω) ≤ 21 μA
- **Internal DC resistance** $R_i$ ≥ 2.4 MΩ
- **Internal impedance** $Z_i$, at 50 Hz ≥ 2.4 MΩ
- **Permissible extraneous DC voltage** $U_{fg}$ with AGH675S-7...
- **Permissible system leakage capacitance** $C_e$ 5 μF
- **Factory setting** 2 μF

Displays

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

Outputs/inputs

- **TEST/RESET button** internal/external
- **Cable length** TEST/RESET button external ≤ 10 m

Current output for measuring instrument SKMP (scale centre point = 1.2 MΩ):

- **Current output (load)** 20 mA (≤ 500 Ω)
- **Accuracy current output** (100 kΩ…10 MΩ) ±10 %, ≤ 100 kΩ

Serial interface

- **Interface/Protocol** IRDH275BM
  - **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**
- **Electrical endurance** 12 000 switching operations
- **Contact class** H (IEC 60066-2-23)
- **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 60068-2-27 (device in operation) 15 g/11 ms
- **Bumping IEC 60068-2-29 (during transport)** 40 g/6 ms
- **Vibration resistance** IEC 60068-2-6 (device in operation)
  - 1 g/10…150 Hz
- **Vibration resistance** IEC 60068-2-6 (during transport)
  - 2 g/10…150 Hz
- **Ambient temperature during operation** −10…+55 °C
- **Storage temperature range** −40…+70 °C
- **Climatic class acc. to IEC 60721-3-3** 3K5

Connection

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

Other

- **Operating mode** continuous operation
- **Mounting** as indicated on the display
- **Protection class, internal components (DIN EN 60529)** IP30
- **Protection class, terminals (DIN EN 60529)** IP20
- **Type of enclosure** XT12, 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 coordination acc. to DIN EN 61800-5-1

**AGH675S-7**
- Rated insulation voltage: AC 7.2 kV
- Voltage test acc. to DIN EN 61800-5-1
  - Type test:
    - Voltage impulse test (basic insulation): 40 kV
    - AC voltage test (basic insulation): 20 kV
    - Partial discharge test: 14 kV
  - Routine test:
    - AC voltage test: 40 kV

**AGH675S-7MV15**
- Rated insulation voltage: AC 15.5 kV
- Voltage test acc. to DIN EN 61800-5-1
  - Type test:
    - 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 $R_i$: $\geq 2.39 \, \Omega$

**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 $R_i$: $\geq 4.7 \, \Omega$

**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 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: $0.2...4 \, \text{mm}^2/0.2...2.5 \, \text{mm}^2$
- Connection flexible with connector sleeve: $0.25...2.5 \, \text{mm}^2$

**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 HB
- Documentation number: D00095
- Weight approx.: $\leq 5100 \, \text{g}$

**Technical data AGH675S-7…**

**Dimension diagrams (dimensions in mm)**
Supply voltage $U_S$ (see ordering information) via 6 A fuse

Terminals L1, L2 are not connected!

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

Separate connection of KE to PE

Separate connection of the terminals 3 and 4 of the AGH675S-7 or AGH675S-7MV15 to PE

External TEST button (NO contact)

External RESET button (NC contact or wire jumper), when the terminals are open, the fault message will not be stored

STANDBY by means of the function input F1, F2: When the contact is closed, insulation measurement does not take place.

Current output, galvanically separated: 0…20 mA or 4…20 mA

Serial interface RS-485 (termination 120 Ω resistor)

Alarm relay 1; changeover contacts provided

Alarm relay 2 (system fault relay); changeover contacts provided

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)

Standards

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

- DIN EN 61557-8 (VDE 0413-8)
- EN 61557-8
- IEC 61557-8
- IEC 61326-2-4
- DIN EN 60664-1 (VDE 0110-1),
- DIN EN 60664-3 (VDE 0110-3)
- ASTM F1669M-96
- ASTM F1207M-96

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

Ordering information

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

**Voltage ranges**

<table>
<thead>
<tr>
<th>IRDH375...</th>
<th>DC 0...500 V(^a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal system voltage (U_n)</td>
<td>AC, 3/(N)AC 0...793 V(^a)</td>
</tr>
<tr>
<td>Nominal frequency (f_n) (for (f &lt; 50) Hz see characteristic curve in the manual)</td>
<td>0.1...460 Hz</td>
</tr>
<tr>
<td>Nominal system voltage (U_n)</td>
<td>DC 0...500 V(^a)</td>
</tr>
</tbody>
</table>

**IRDH375...-435:**

- Supply voltage \(U_s\) (also see nameplate): AC 88...264 V\(^a\)
- Frequency range \(f_s\): 42...460 Hz
- Supply voltage \(U_s\) (also see nameplate): DC 77...286 V\(^a\)

**IRDH375...-427:**

- Frequency range \(f_s\): 42...460 Hz
- Supply voltage \(U_s\) (also see nameplate): DC 19.2...72 V\(^a\)

**Power consumption**

≤ 14 W

**Response values**

- Response value \(R_{an1}\) (Alarm1): 1 kΩ...10 MCΩ
- Response value \(R_{an2}\) (Alarm2): 1 kΩ...10 MCΩ
- Relative uncertainty (20 kΩ...1 MCΩ) (acc. to IEC 61557-8): ± 15 %
- Relative uncertainty (1...20 kΩ): +2 kΩ/+20 %
- Relative uncertainty (1...10 MCΩ): 0.2 MCΩ/+20 %
- Response time \(t_{res}\) at \(R_s\) = 0.5 s \(R_{an1}\) and \(C_s = 1 \mu F\): ≤ 5 s
- Hysteresis (1...10 kΩ): +2 kΩ
- Hysteresis (10 kΩ...10 MCΩ): 25 %

**Measuring circuit**

- Measuring voltage \(U_{tm}\): ≤ 40 V
- Measuring current \(I_{tm}\) (at \(R_t = 0 \Omega\)): ≤ 220 μA
- Internal DC resistance \(R_t\): ≥ 180 kΩ
- Impedance \(Z_i\) at 50 Hz: ≥ 180 kΩ
- Permissible extraneous DC voltage \(U_{tm}\): ≤ DC 1200 V
- Permissible system leakage capacitance \(C_e\): ≤ 500 μF
- Factory setting: 150 μF

**Displays**

- Display, illuminated: two-line display
- Display range measured value: 1 kΩ...10 MCΩ
- Operating uncertainty (20 kΩ...1 MCΩ) (acc. to IEC 61557-8): ± 15 %**
- Operating uncertainty (1...20 kΩ): ±1 kΩ/+15 %**
- Operating uncertainty (1 MCΩ...10 MCΩ): ±0.1 MCΩ/+15 %**

**Outputs/Inputs**

- Test/reset button: internal/external
- Cable length test/reset button, external: ≤ 10 m
- Current output for measuring instrument SKMP (scale centre point = 120 kΩ):
  - Current output IRDH375 (load): 400 μA (≤ 12.5 kΩ)
  - Current output IRDH375B (load): 20 mA (≤ 300 Ω)
- Accuracy current output (1 kΩ...1 MCΩ) related to the value indicated: ±10 %, ±1 kΩ

**Serial interface**

- Interface/protocol IRDH375: RS-485/ASCII
- Interface/protocol IRDH375B: RS-485/BMS
- Connection: terminals A/B
- Cable length: ≥ 1200 m
- Cable (twisted in pairs, one end of shield connected to PE): recommended: J-Y(5)SY min. 2 x 0.8
- Terminating resistor: 120 Ω (0.5 W)
- Device address, BMS bus: 1...30 (factory setting = 3)

**Switching elements**

- Switching elements: 3 changeover contacts
  - K1 (Alarm 1), K2 (Alarm 2), K3 (device error)
- Operating principle K1, K2 (Alarm 1/Alarm 2): N/O or N/C operation
- Operating principle K3 (device error): N/C operation
- Electrical endurance, number of cycles: 12000
- Contact class: IRB acc. to DIN IEC 60255 Part 2-0
- Rated contact voltage: AC 250 V/DC 300 V
- Making capacity: AC 10 A
- Breaking capacity: 2 A, AC 230 V, cos phi = 0.4
- Voltage resistance IRDH375-2-6 (device in operation): 0.2 A, DC 220 V, L/R = 0.04 s
- Contact rating at DC 24 V: ≥ 2 mA (50 mW)

**Environment/EMC**

- EMC: according 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 IRDH375-2-6 (device in operation): 1 g/10...150 Hz
- Vibration resistance IEC 60068-2-6 (transport): 2 g/10...150 Hz
- Ambient temperature (during operation): -10...+55 °C
- Ambient temperature (during storage): -40...+70 °C
- Climatic class acc. to IEC 60721-3-3: 3K5

**Connection**

- Connection: screw-type terminals
- Connection properties: rigid/flexible
  - 0.2...4 mm²/0.2...2.5 mm²
- Flexible with ferrules without/plastic sleeve
  - 0.25...2.5 mm²
- Conductor sizes (AWG): 24...12

**Other**

- Operating mode: continuous operation
- Mounting: display-oriented
- Distance to adjacent devices: ≥ 30 mm
- Degree of protection, internal components (DIN EN 60529): IP30
- Degree of protection, terminals (DIN EN 60529): IP20
- Type of enclosure: X300, free from halogen
- DIN rail mounting acc. to: IEC 60715
- Flammability class: UL94-V0
- Documentation number: D00124
- Weight: ≤ 510 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 IRDH368-2-6: 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 devices | Main circuits**

**Insulation monitoring device ISOMETER® IRDH375**

1. Rear view IRDH375
2. Detachable terminal cover
3. 3AC system
4. 3NAC system
5. AC system
6. DC system
7. Supply voltage \(U_s\) (see ordering information) via 6 A fuse; for UL and CSA applications, it is mandatory to use 5 A fuses.
8. Alarm relay \(R_{ALARM1}\)
9. Alarm relay \(R_{ALARM2}\)
10. Alarm relay system fault

11. External kΩ indication 0…400 µA or current output 0(4)…20 mA (option).
12. 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.
13. External test button "T1/T2" (N/O contact)
14. Standby by means of the function input "F1, F2": with the contact in closed position no insulation measurement takes place
15. 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!*

**Wiring diagrams**

1. ISOMETER® IRDH375 with coupling device AGH150W-4
2. ISOMETER® IRDH375 with coupling device AGH204S-4
3. ISOMETER® IRDH375 with coupling device AGH520S

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**Wiring diagrams**

1. ISOMETER® IRDH375 with coupling device AGH520S
2. ISOMETER® IRDH375 with coupling device AGH520S

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**Wiring diagrams**

1. ISOMETER® IRDH375 with coupling device AGH520S
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

Typical applications

- Insulation resistance monitoring in IT systems
- Localisation of insulation faults with additional insulation fault locators EDS4…

Approvals


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

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

- DIN EN 61557-8 (VDE 0413-8)
- EN 61557-8
- IEC 61557-8
- IEC 61326-2-4
- DIN EN 60664-1 (VDE 0110-1)
- DIN EN 60664-3
- DIN EN 61557-9
- VDE 0413-9
- IEC 61557-9
- ASTM F1669M-96
- ASTM F1207M-96

Further information

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

Ordering information

<table>
<thead>
<tr>
<th>Permissible extraneous DC voltage $U_{fg}$</th>
<th>Nominal system voltage $U_{n}$</th>
<th>Supply voltage $U_{S}$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 810 V</td>
<td>20…575 V</td>
<td>–</td>
<td>19.2…72 V</td>
<td>IRDH575B1-427</td>
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<tr>
<td></td>
<td>20…575 V</td>
<td>77…286 V</td>
<td>88…264 V</td>
<td>B91065502</td>
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<tr>
<td></td>
<td>20…150 V</td>
<td>77…286 V</td>
<td>88…264 V</td>
<td>B91065500</td>
</tr>
<tr>
<td></td>
<td>340…760 V</td>
<td>77…286 V</td>
<td>88…264 V</td>
<td>B91065504</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>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel seal for IP 42</td>
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<td>B98060006</td>
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<tr>
<td>Transparent cover for IP 65</td>
<td>–</td>
<td>B98060007</td>
<td>411</td>
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<tr>
<td>Adapter for DIN rail mounting</td>
<td>–</td>
<td>B98060010</td>
<td>–</td>
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<tr>
<td>Measuring instruments</td>
<td>9620-1421</td>
<td>B986841</td>
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<td>96205-1421</td>
<td>B986842</td>
<td>369</td>
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</tbody>
</table>
### Technical data

**Insulation monitoring device acc. to IEC 60664-1**

<table>
<thead>
<tr>
<th>Specification</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

| IRDH575B1-423: | Nominal system voltage $U_n$ AC, 3(N)AC 20 – 200 V |
| IRDH575B1-425: | Nominal system voltage $U_n$ AC, 3(N)AC 20 – 575 V |
| IRDH575B2-435: | Nominal system voltage $U_n$ AC, 3(N)AC 340 – 760 V |
| IRDH575B2-427: | Nominal system voltage $U_n$ DC 19.2 – 72 V |

#### Response values

<table>
<thead>
<tr>
<th>Response Value</th>
<th>Factory setting</th>
<th>Measuring current</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response value $R_{\text{ref}}$ (Alarm 1)</td>
<td>1 kΩ</td>
<td>10 MΩ</td>
</tr>
<tr>
<td>Response value $R_{\text{ref}}$ (Alarm 2)</td>
<td>0.5 kΩ</td>
<td>10 MΩ</td>
</tr>
<tr>
<td>Relative uncertainty ($20 \text{ kΩ} \ldots 1 \text{ MΩ}$)</td>
<td>±15 %</td>
<td>±15 %</td>
</tr>
<tr>
<td>Relative uncertainty ($1 \ldots 20 \text{ kΩ}$)</td>
<td>±2 kΩ</td>
<td>±20 %</td>
</tr>
<tr>
<td>Operating uncertainty ($1 \ldots 10 \text{ MΩ}$)</td>
<td>±0.2 MΩ</td>
<td>±20 %</td>
</tr>
<tr>
<td>Measuring time</td>
<td>see characteristics curves</td>
<td></td>
</tr>
<tr>
<td>Hysteresis ($1 \ldots 10 \text{ kΩ}$)</td>
<td>±2 kΩ</td>
<td></td>
</tr>
<tr>
<td>Hysteresis ($10 \text{ kΩ} \ldots 10 \text{ MΩ}$)</td>
<td>25 %</td>
<td></td>
</tr>
</tbody>
</table>

#### Measuring circuit for insulation measurement

| Measuring | ≤ 40 V |
| Measuring current $I_{\text{m}}$ | ≤ 40 VA |
| Measuring voltage $U_{\text{ref}}$ (IRDH575B1-4227) | ≤ 10 V |
| Measuring current $I_{\text{m}}$ (at $R_i = 0$) | 0.2 μA |
| Internal DC resistance $R_i$ | ≥ 180 kΩ |
| Impedance $Z_i$ at 50 Hz | ≥ 180 kΩ |
| Permissible extraneous DC voltage $U_{\text{e}}$ (variant B1) | ≤ DC 810 V |
| Permissible extraneous DC voltage $U_{\text{e}}$ (variant B2) | ≤ DC 1060 V |
| System leakage capacitance $C_s$ | 500 μF |
| Factory setting $C_f$ | 150 μF |

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

| Measuring | ≤ 100 V |
| Measuring current $I_{\text{m}}$ | ≤ 40 VA |
| Measuring voltage $U_{\text{ref}}$ (IRDH575B1-4227) | ≤ 10 V |
| Measuring current $I_{\text{m}}$ (at $R_i = 0$) | 0.2 μA |
| Internal DC resistance $R_i$ | ≥ 180 kΩ |
| Impedance $Z_i$ at 50 Hz | ≥ 180 kΩ |
| Permissible extraneous DC voltage $U_{\text{e}}$ (variant B1) | ≤ DC 810 V |
| Permissible extraneous DC voltage $U_{\text{e}}$ (variant B2) | ≤ DC 1060 V |
| System leakage capacitance $C_s$ | 500 μF |
| Factory setting $C_f$ | 150 μF |

### Environment/EMC

- **EMC**: acc. to IEC 61326-2-4 Ed. 1.0
- **Shock resistance IEC 60664-2-27**: (device in operation) 15 g/11 ms
- **Bumping IEC 60664-2-29 (transport)**: 40 g/6 ms
- **Vibration resistance IEC 60664-2-26 (during operation)**: 1 g/10 … 150 Hz
- **Vibration resistance IEC 60664-2-6 (transport)**: 2 g/10 … 150 Hz
- **Ambient temperature (during operation)**: -10 … +55 °C
- **Ambient temperature (during storage)**: -40 … +70 °C
- **Climatic class acc. to DIN IEC 60721-3-3**: SK3

### Connection

- **Connection**: screw-type terminals
- **Connection properties**: rigid/flexible
- **Conductor sizes (AWG)**: 24 … 12

### Other

- **Operating mode**: continuous operation
- **Mounting**: display-oriented
- **Distance to adjacent devices**: ≤ 30 cm
- **Degree of protection, internal components (DIN EN 60529)**: IP00
- **Degree of protection, terminals (DIN EN 60529)**: IP20
- **Degree of protection, for door mounting (DIN EN 60529)**: IP40
- **Degree of protection, for door mounting with panel sealing (DIN EN 60529)**: IP42
- **Degree of protection, for mounting the transparent front plate cover (DIN EN 60529)**: IP65
- **Type of enclosure**: suitable for panel mounting
- **Flammability class**: UL94 V-0
- **Weight**: ≤ 900 g

**Option “W”**

- **Shock resistance IEC 60664-2-27**: (device in operation) 30 g/11 ms
- **Bumping IEC 60664-2-29 (transport)**: 40 g/6 ms
- **Vibration resistance IEC 60664-2-6**: 1.6 mm/10 … 150 Hz
- **Vibration resistance IEC 60664-2-6 (transport)**: 4 g/25 … 150 Hz
- **Ambient temperature, during operation**: > 55 °C (not for continuous operation in the insulation fault location mode with 50 mA)
- **Ambient temperature for storage**: -40 … +85 °C

The data labelled with an * are absolute values

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

### Diagram

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

![Diagram Image](image-url)
1. Rear view IRDH575
2. Detachable terminal cover
3. Connection to the 3AC system to be monitored:
   Connect terminals L1, L2, L3 to conductor L1, L2, L3
4. Connection to the AC system to be monitored:
   Connect L1 to conductor L1 and terminals L2, L3 to conductor L2
5. Connection to the DC system to be monitored:
   Connect L1 to conductor L+ and terminals L2, L3 to conductor L-
6. For external indicating instrument
   Current output 0…20 mA or 4…20 mA
7. * External test button “T1, T2” (N/O contact)
8. * 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)
9. ** STANDBY, when the contact is closed, no insulation measurement
    is carried out; disconnection from the IT system being monitored
10. S1 = ON : Termination of the serial RS-485 interface (A/B) with 120 Ω
    S2 = not wired)
11. Serial RS-485 interface (BMS bus)
12. Alarm relay “K3” (device error and EDS alarm) (addr.: 1)
13. Alarm relay “K2” (insulation fault 2); available changeover contacts
14. Alarm relay “K1” (insulation fault 1); available changeover contacts
15. Supply voltage $U_S$ (see nameplate) via 6 A fuse; for UL and CSA
    applications, it is mandatory to use 5 A fuses.
16. Separate connection of $\bar{N}$ and KE to PE
   * The terminal pairs 2, 3 and 4 have to be wired electrically isolated
     and must not be connected to PE!

---

**System configuration – Example**

1. ISOMETER® IRDH575
2. RS-485/BMS protocol
3. EDS460/EDS461
4. EDS3090/EDS3091
**Wiring example EDS system with EDS460 and IRDH575**

1. **3AC, 3NAC, DC 20…575 V bzw. 3AC, 3NAC, DC 340…760 V**
2. **Uₚ** see ordering information, 6 A fuse recommended.
3. Note: Supply voltage **Uₚ** in the IT system requires two fuses.
4. Measuring current transformers W…
5. Outgoing circuits to the loads
6. ISOMETER® IRDH575
7. Insulation fault locator EDS460

**Wiring example EDS system with EDS461 and IRDH575**

1. **AC 20…265V/DC 20 V…308 V**
2. **Uₚ** see ordering information, 6 A fuse recommended.
   - Note: Supply voltage **Uₚ** in the IT system requires two fuses.
3. Measuring current transformers W…/8000
4. Outgoing circuits PLC: inputs and outputs
5. ISOMETER® IRDH575
6. Insulation fault locator EDS461

**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.
ISOMETER® IR1575
Insulation monitoring device for unearthed AC, 3(N)AC systems up to 480 V and DC systems up to 480 V

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

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

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

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

Ordering information

<table>
<thead>
<tr>
<th>Design</th>
<th>Supply voltage U5 (\text{V}^1)</th>
<th>Type</th>
<th>Art. No.</th>
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<tbody>
<tr>
<td>Standard</td>
<td>AC 88...264 340...460 V DC 77...286 V</td>
<td>IR1575-435</td>
<td>B91064000</td>
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<td></td>
<td>IR1575PG1-435 B91064002</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>16...72 10.2...84 V</td>
<td>IR1575-434</td>
<td>B91064003</td>
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<td></td>
<td>IR1575PG1-434 B91064004</td>
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<td></td>
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<tr>
<td>Increased shock and vibration resistance</td>
<td>AC 88...264 340...460 V DC 77...286 V</td>
<td>IR1575W-435</td>
<td>B91064000W</td>
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<td></td>
<td>IR1575PG1W-435 B91064002W</td>
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<td></td>
</tr>
</tbody>
</table>

\(^1\) Absolute values
Insulation monitoring device ISOMETER® IR1575

### Technical data

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

- Rated voltage: AC 500 V
- Rated impulse voltage/pollution degree: 4 kV/3

### Voltage ranges

**IR1575-…:**
- Nominal system voltage \( U_n \)
- Nominal frequency \( f_n \)
- IR1575PG1-…:
  - Nominal system voltage \( U_n \)
  - IR1575x-435:
    - Nominal system voltage \( U_s \)
    - IR1575x-434:
      - Nominal system voltage \( U_s \)

### Response values

- Response value \( R_{an1} \) (Alarm1): \( 2 \ldots 1 \text{ M}\Omega \)
- Response value \( R_{an2} \) (Alarm2): \( 2 \ldots 1 \text{ M}\Omega \)
- Specified response value (2 k\( \Omega \), 10 k\( \Omega \)): \( 2 \ldots 1 \text{ M}\Omega \)

### Measuring circuit for insulation measurement

- Measuring voltage \( U_m \): ±20 V
- Measuring current \( I_m \): ≤ 170 \( \mu \)A
- Internal DC resistance \( R_i \): ≥ 119 k\( \Omega \)
- Internal impedance \( Z_i \): ≥ 14 k\( \Omega \)
- Permissible extraneous DC voltage \( U_{ex} \): ≤ 680 V
- Permissible system leakage capacitance \( C_e \): ≤ 60 \( \mu \)F

### Measuring circuit for insulation fault location (EDS) (only IR1575PG1-…)

- Test current \( I_p \): DC 10/25 mA
- Test pulse/break: 2 s/4 s

### Displays

- Display, illuminated: LC display
- Display range measuring value: 1 k\( \Omega \)...5 M\( \Omega \)

### Outputs

- Test and reset button internal/external

### Switching elements

- Switching elements: 2 x 1 changeover contact
- Operating principle: N/O or N/C operation
- Factory setting (Alarm1/Alarm2): N/O operation
- Admissible number of operations/h: 12 000 cycles
- Contact class: IIB (DIN EN 60255-23)
- Rated contact voltage: AC 250 V/DC 300 V
- Making capacity: 5 A
- Breaking capacity: 2 A, AC 230 V, cos \( \varphi \) = 0.4
  - 0.2 A, DC 220 V, L/R = 0.04 s
  - Minimum contact current at DC 24 V: ≥ 2 mA (50 mV)

### Environment

- EMC immunity: acc. to EN 61326
- EMC emission: acc. to EN 61326
- 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 acc. to IEC 6068-2-6 (device in operation): 1 g/10...150 Hz
- Vibration resistance acc. to IEC 6068-2-6 (transport): 2 g/10...150 Hz
- Ambient temperature (during operation): -10...+55 °C
- Ambient temperature (during storage): -40...+85 °C

### Connection

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

### Other

- Operating mode: continuous operation
- Mounting 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: UL94 V-2
- Documentation number: D00357
- Weight: ≤ 400 g

### Option „W“

- Shock resistance acc. to IEC 6068-2-27 (during operation): 30 g/11 ms
- Bumping acc. to IEC 6068-2-29 (during transport): 40 g/6 ms
- Vibration resistance acc. to IEC 6068-2-6:
  - 1.6 mm/10...25 Hz: 4 g/25...150 Hz
  - Ambient temperature (during operation):
    - -10 °C...+55 °C
  - Storage temperature range:
    - -40 °C...+85 °C
Wiring diagram

1. Connection to the AC system to be monitored:
   Connect terminals L1, L2 to conductor L1, L2

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

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

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

5. Separate connection of E and KE to PE

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 message will not be stored

8. Alarm relay: Alarm 2

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

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

Device features

ISOMETER® IR427

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

Remote alarm indicator and test combination MK7

- Easy-to-clean front foil surface
- 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® has been developed in compliance with the following standards:

- IEC 60364-7-710
- IEC 61557-8
- DIN VDE 0100-710

Further information

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

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage $U_s$</th>
<th>Nominal system voltage $U_n$, 1)</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>DC</td>
<td>AC</td>
<td></td>
</tr>
<tr>
<td>70…264 V, 42…60 Hz</td>
<td>–</td>
<td>IR427-2</td>
<td>B92075300</td>
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<tr>
<td>–</td>
<td>18…28 V</td>
<td>–</td>
<td>B95100201</td>
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</table>

1) Absolute values

Accessories

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

Suitable system components

<table>
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<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
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</thead>
<tbody>
<tr>
<td>Measuring current transformers</td>
<td>STW2</td>
<td>B942709</td>
</tr>
<tr>
<td>Temperature sensor (PTC)</td>
<td>E50107</td>
<td>B924186</td>
</tr>
<tr>
<td>Mounting frame</td>
<td>XM420</td>
<td>B990994</td>
</tr>
</tbody>
</table>
Insulation monitoring device ISOMETER® IR427

**Technical data IR427**

**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, Z, ii –1, 11, 12, 14)
- Voltage test acc. to IEC 61010-1: 2.21 kV

**Supply voltage**
- Supply voltage $U_S$: $U_n$
- Power consumption: $\leq 4$ VA

**IT system being monitored**
- Nominal system voltage $U_n$: AC 70...264 V
- Nominal frequency $f_n$: 47...63 Hz

**Insulation monitoring**
- Response value $R_{ut}$: 50...500 kΩ (50 kΩ)*
- Relative uncertainty: $\pm 10\%$
- Hysteresis: 25%
- Response time $t_R$ at $R_{ut}$: $0.5 \times R_{ut}$ and $C_e = 0.5 \mu F$, $\leq 5$ s
- Permissible system leakage capacitance $C_e$: $\leq 5 \mu F$

**Measuring circuit**
- Measuring voltage $U_m$: $\pm 12$ V
- Measuring current $I_m$ (at $R_{ut}$): $\leq 50 \mu A$
- Internal DC resistance $R_i$: $\geq 240$ kΩ
- Impedance $Z_i$ at 50 Hz: $\geq 200$ kΩ
- Permissible extraneous DC voltage $U_{fe}$: $\leq DC 300$ V

**Load current monitoring**
- Response value, adjustable: $5...50$ A (5 A)*
- Relative uncertainty: $\pm 5\%$
- Hysteresis: 4%

**Temperature monitoring:**
- Response value (fixed value): $4$ kΩ
- Release value (fixed value): $1.6$ kΩ
- PTC resistors acc. to DIN 44081: max. 6 in series
- Response time overload: (50 % to 120 %): $< 5$ s
- Response time for measuring current transformer monitoring: at restart, test or every 1 h

**Temperature monitoring:**
- Response value (fixed value): $16$ kΩ
- Release value (fixed value): $1.5$ kΩ
- PTC resistors acc. to DIN 44081: max. 6 in series
- Response time overload: (50 % to 120 %): $< 2$ s
- Response time for measuring current transformer monitoring: at restart, test or every 1 h

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

**Interface for MK7**
- Cable length, twisted in pairs, shielded: 200 m
  - Recommended: J-Y(St)Y min. 2x0.6
- Power supply (terminals 1 and 2): $U_{ut}$: DC 24 V
  - $I_{ut}$ (max. 4 MK7): $80$ mA
- Communication (terminal 3 and 4):
  - Interface/protocol: RS-485/proprietary, no BMS
  - Terminating resistor: 120 (0.25 W), internal, switchable

**Cable lengths for the connection of the measuring current transformer STW2 and the temperature sensor**
- Single wire: $\leq 1$ m
- Single wire, twisted: $\leq 10$ m
- Twisted in pairs, twisted: $\leq 40$ m
- Cable (shield on one side connected to PE): recommended: J-Y(St)Y min. 2x0.6

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

**Contact data acc. to IEC 60947-5-1**
- Utilisation category: AC-13, AC-14, DC-12, DC-12
- 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

**Classification of climatic 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 type**
- Screw-type terminals
- Push-wire terminals

**Connection properties:**
- rigid/flexible/AWG: 0.2...4/0.2...2.5 mm²/AWG 24...12
- Stripping length: 8 mm
- Tightening torque, terminal screws: 0.5...0.6 Nm

**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
- Screw mounting: 2 x M4
- DIN rail mounting acc. to: IEC 60715
- Documentation number: D00118
- Weight: $\leq 150$ g

Note: (*) = Factory setting
Technical data MK7

Insulation coordination acc. to IEC 60664-1/IEC 60664-3
- Rated insulation voltage: 50 V
- Rated impulse voltage/pollution degree: 500 V/3

Supply voltage
- Supply voltage U0: DC 18...28 V
- Power consumption: 0.5 VA

Environment/EMC
- EMC: IEC 61243
- 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)
- 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): 2M2
- Storage (IEC 60721-3-1): 1M3

Alarm messages LEDs

<table>
<thead>
<tr>
<th></th>
<th>IR427</th>
<th>MK7</th>
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<tbody>
<tr>
<td>Operation</td>
<td>&quot;ON&quot;</td>
<td>ON</td>
</tr>
<tr>
<td>System fault</td>
<td>flashing</td>
<td>Ins. fault</td>
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<tr>
<td></td>
<td>&quot;AL1&quot;</td>
<td>Overload</td>
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<tr>
<td>Insulation fault</td>
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<td>flashing</td>
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<tr>
<td>Overcurrent</td>
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<td>Overtemp.</td>
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<tr>
<td>Overtemperature</td>
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<tr>
<td>No communication betw. IR 427+MK7</td>
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<td>flashing</td>
</tr>
</tbody>
</table>

1) Detailed alarm information on LCD
**Wiring diagram**

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**

- **IR427**
- **Protective earth**
- **Equipotential bonding**
- **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® has been developed in compliance with the following standards:

- IEC 60364-7-710
- IEC 61557-8
- IEC 61557-9
- DIN VDE 0100-710

Further information

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

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage $U_s=U_n$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 70...264 V, 42...460 Hz</td>
<td>isoMED427P-2</td>
<td>B72075301</td>
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</tbody>
</table>

Supplementary values of the voltage range

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060098</td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring current transformers</td>
<td>STW2</td>
<td>B942709</td>
</tr>
<tr>
<td>Temperature sensor (PTC)</td>
<td>ES0107</td>
<td>B924186</td>
</tr>
<tr>
<td>Three phase load monitor</td>
<td>CMS460-D4-2</td>
<td>B94053030</td>
</tr>
<tr>
<td>Mounting frame</td>
<td>XM420</td>
<td>B990994</td>
</tr>
</tbody>
</table>
### Technical data

**Insulation monitoring device ISOMETER® isoMED427P**

- **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, L) – (L1, L2, E)
- **Voltage test acc. to IEC 61010-1**: 2.2 kV

#### Voltage supply

- **Supply voltage U0**: = U
- **Power consumption**: ≤ 0.5 VA

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

- **Nominal system voltage U0**: AC 70…264 V
- **Nominal frequency f**: 47…63 Hz

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

- **Response value R**: 50…50 000 kΩ (50 kΩ)*
- **Relative uncertainty**: ± 10 %
- **Hysteresis**: 25 %
- **Response time t**: ≤ 5 s
- **Response time for PE connection monitoring**: ≤ 1 h
- **Permissible system leakage capacitance C**: 5 μF

#### Measuring circuit

- **Measuring voltage U**: 12 V
- **Measuring current I**: ± 5 mA, ± 0.2 A
- **Password**: on, off/0…999 (off, 0)*

#### Load current monitoring

- **Response value, adjustable**: 5…50 A (7 A)*
- **Relative uncertainty**: ± 5 %
- **Hysteresis**: 4 %
- **Nominal frequency f**: 47…63 Hz
- **Setting values for load current measurement**: Transformer: 3150 VA, 4000 VA, 5000 VA, 6300 VA, 8000 VA, 10000 VA

#### Temperature monitoring:

- **Response value (fixed value)**: 4 kΩ
- **Rated frequency f**: 47…63 Hz
- **Release value (fixed value)**: 1.6 kΩ
- **PTC resistors acc. to DIN 44081**: max. 6 in series
- **Relative uncertainty**: ± 10 %
- **Response time overtemperature**: < 2 s
- **Response time connection fault PTC resistors**: < 2 s

#### Displays, memory

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

#### Operating uncertainty

- **± 10 %**, **± 2 kΩ**

#### Measured value insulation resistance

- **10 kΩ…1 MΩ**

#### Operating mode

- **Continuous operation**

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

- **IP20**

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

- **IP30**

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

- **Stationary use (IEC 60721-3-3)**: 3K3 (no condensation, no formation of ice)
- **Operating temperature**: -25…+55 °C
- **Rated insulation voltage**: 250 V

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

- **Stationary use (IEC 60721-3-3)**: 3M4
- **Connection type**: push-wire terminals
- **Connectors**: 1 changeover contact
- **Classification of mechanical conditions acc. to IEC 60721**: 3M4

#### Connection properties

- **Flexible without ferrule**: 0.2…2.5 mm² (AWG 24…14)
- **Flexible with ferrule**: 0.75…2.5 mm² (AWG 19…14)
- **Rigid**: 0.2…1.5 mm² (AWG 24…16)

#### Connection

- **Connection type**: push-wire terminals
- **Class of mechanical conditions acc. to IEC 60721**: 3M4
- **Weight**: ≤ 150 g

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

- **Cable lengths**: single wire > 0.5 mm² ≤ 1 m
- **Twisted pair, twisted > 0.5 mm²**: ≤ 10 m
- **Twisted pair, shielded > 0.5 mm²**: ≤ 40 m

#### 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

- **Utilization 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 DC/DC 10 V
- **Environment/EMC**

#### Operating temperature

- **-25…+55 °C**
- **Rated insulation voltage**: 250 V

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

- **Stationary use (IEC 60721-3-3)**: 3K3 (no condensation, no formation of ice)
- **Transport (IEC 60721-3-2)**: 2K3
- **Long-term storage (IEC 60721-3-1)**: 1K4
- **Long-term storage (IEC 60721-3-1)**: 1K4

## Alarm messages LEDs

<table>
<thead>
<tr>
<th>isoMED427P</th>
<th>“DN”</th>
<th>“AL1”</th>
<th>“AL2”</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

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

- **Cable lengths**: single wire > 0.5 mm² ≤ 1 m
- **Twisted pair, twisted > 0.5 mm²**: ≤ 10 m
- **Twisted pair, shielded > 0.5 mm²**: ≤ 40 m

**Cable lengths**:

- **Single wire**: > 0.5 mm² ≤ 1 m
- **Twisted pair, twisted**: > 0.5 mm² ≤ 10 m
- **Twisted pair, shielded**: > 0.5 mm² ≤ 40 m

**Cable lengths**: single wire > 0.5 mm² ≤ 1 m

---

**E³**

**Dimensions diagram (dimensions in mm)**
Wiring diagram

1. E, KE  Connect the leads E and KE separately to PE
2. L1, L2  Connection to the IT system being monitored.
   Supply voltage (see nameplate) 6 A fuse recommended
3. Z, Z/k  Connection to the temperature sensor (PTC)
4. Z/k, l  Connection to the measuring current transformer (STW2)
5. T1, T2  Connection for external test button
6. A, B   RS-485 interface, Terminate the connection with switch R (on, off) if the device is connected at the end of the bus.
7. 11, 12, 14  Alarm relay K1

Example of application

- E, KE: Protective earth
- EB: Equi-potential bonding
- SEB: Supplementary equipotential bonding
ISOMETER® isoPV with coupling device AGH-PV

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems) for photovoltaic systems up to AC 793 V/DC 1100 V

Device features
isoPV
- ISOMETER® for IT AC systems with galvanically connected rectifiers or converters and for IT DC systems (IT = unearthed systems)
- Particularly suitable for monitoring photovoltaic systems
- isoPV is always operated in combination with the coupling device AGH-PV
- Automatic adaptation to the existing system leakage capacitance
- Choice of measurement methods to meet different requirements
- Two separately adjustable response ranges of 0.2…100 kΩ each (Alarm 1, Alarm 2)
- Two-line LC display
- Automatic device self test
- Memory with real-time clock to store alarm messages with date and time stamp
- BMS interface (Bender Measuring Device Interface) for communication with other Bender devices (RS-485 galvanically isolated)
- Internal disconnection of the ISOMETER® (via control signal; terminals F1/F2) from the IT system to be monitored (e.g. if several ISOMETER®s are interconnected)
- Current output 0(4)…20mA (electrically isolated) in relation to the measured insulation value

AGH-PV
- Coupling device required for ISOMETER® isoPV, each AGH-PV is specially designed for the corresponding isoPV
- Nominal voltage range AC 0…793 V and DC 0…1100 V
- DIN rail mounting

Typical applications
- AC, DC or AC/DC main circuits
- Solar systems with directly connected inverters
- Solar systems with large system capacitances of up to 2000 µF
- Solar systems with high but slow voltage fluctuations
- Installations including switch mode power supplies
- Coupled IT systems

Approvals

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® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8
- IEC 61326-2-4
- DIN EN 60664-1 (VDE 0110-1)
- DIN EN 60664-3 (VDE 0110-3)
- UL 508
- UL 1998 (Software)

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

Ordering information

<table>
<thead>
<tr>
<th>Nominal voltage $U_n$</th>
<th>Supply voltage $U_S$</th>
<th>Set comprising</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3(N)AC</td>
<td>DC</td>
<td>AC</td>
<td>DC</td>
</tr>
<tr>
<td>0…793 V</td>
<td>0…1100 V</td>
<td>19.2…55 V</td>
<td>19.2…72 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>88…264 V</td>
<td>77…286 V</td>
</tr>
</tbody>
</table>

Devices are available as a set.

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw mounting</td>
<td>B990056</td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>External kΩ measuring instruments</td>
<td>9620-1421</td>
<td>B986841</td>
<td>369</td>
</tr>
</tbody>
</table>

For further information refer to our product range on www.bender.de.
Insulation monitoring device ISOMETER® isoPV with coupling device AGH-PV

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

**Definitions:**
- Supply circuit (IC2)
- Output circuit (IC3)
- Control circuit (IC4)
- Rated voltage

**Overvoltage category:**
- III

**Rated impulse voltage:**
- (IC2)/(IC3-4) 4 kV
- (IC 3)/(IC4) 4 kV

**Rated insulated voltage:**
- (IC2)/(IC3-4) 250 V
- (IC 3)/(IC4) 250 V

**Polution degree:**
- 3

**Protective separation (reinforced insulation) between:**
- (IC2)/(IC3-4) Overvoltage category III, 300 V
- (IC 3)/(IC4) Overvoltage category III, 300 V

**Voltage test (routine test) according to IEC 61010-1:**
- (IC2)/(IC3-4) AC 2.2 kV
- (IC 3)/(IC4) AC 2.2 kV

**Voltage ranges:**
- Nominal system voltage \( U_n \)
  - via AGH-PV
- Supply voltage \( U_s \) (also see nameplate)
  - AC 88...264 V**
  - Frequency range \( f_s \)
  - 42...460 Hz
  - Power consumption \( P_s \)
  - ≤ 21.5 VA
  - Supply voltage \( U_s \) (also see nameplate)
  - DC 77...286 V**
  - Power consumption \( P_s \)
  - ≤ 5.5 VA

**isoPV-327:**
- Supply voltage \( U_s \) (also see nameplate)
  - AC 192...55 V**
  - Frequency range \( f_s \)
  - 42...460 Hz
  - Power consumption \( P_s \)
  - ≤ 5 VA

**For UL-application:**
- Nominal system voltage \( U_n \)
  - via AGH-PV

**IsoPV-335:**
- Supply voltage \( U_s \) (also see nameplate)
  - AC 68...250 V
  - Frequency range \( f_s \)
  - 42...460 Hz
  - Power consumption \( P_s \)
  - ≤ 21.5 VA
  - Supply voltage \( U_s \) (also see nameplate)
  - DC 80...250 V
  - Power consumption DC
  - ≤ 5.5 VA

**ISO PV-327:**
- Supply voltage \( U_s \) (also see nameplate)
  - DC 24...65 V
  - Power consumption \( P_s \)
  - ≤ 5 VA

**Response values:**
- Response value \( R_{res} \)
  - 0.2...100 kΩ
- Factory setting \( R_{res1} \) (Alarm 1)
  - 4 kΩ
- Response value \( R_{res2} \)
  - 0.2...100 kΩ
- Factory setting \( R_{res2} \) (Alarm 2)
  - 1 kΩ

**Relative uncertainty (\( U_{rel} \):≤ 100 kΩ) (in accordance with IEC 61557-8:2007-01)**
- ± 15 %

**Response time \( t_{res} \)**
- see table in manual

**Hysteresis**
- 25 %, +1 kΩ

**Measuring circuit:**
- Measuring voltage \( U_m \) (peak value)
  - ± 50 V
- Measuring current \( I_m \) (at \( R_i = 0 \) kΩ)
  - ≤ 5.5 mA
- Internal DC resistance \( R_i \)
  - ≥ 25 kΩ
- Impedance \( Z_i \) at 50 Hz
  - ≥ 35 kΩ
- Permissible extraneous DC voltage \( U_{Ex} \)
  - ≤ DC 1100 V
- Max. system leakage capacitance \( C_{sys} \)
  - ≤ 2000 μF (2000 μF)*

**Displays:**
- Displays, illuminated
  - two-line display
- Characters (number/height)
  - 2 x 16/4 mm
- Display range measured value
  - 0.2 kΩ...1 MΩ
- Operating uncertainty
  - ± 15 %, ± 1 kΩ

**Outputs/Inputs:**
- Test/reset button
  - internal/external
- Cable length test/reset button, external
  - ≤ 10 m
- Current output (load)
  - 0/4...20 mA (≤ 500 Ω)
- Accuracy current output, related to the value indicated (1...100 kΩ)
  - ± 15 %, ± 1 kΩ

**Serial interface:**
- Interface/protocol
  - RS-485/BMS
- Connection
  - terminals A/B
- Cable length
  - ≤ 1200 m
- Shielded cable (shield PE on one end)
  - 2-core, ≥ 0.6 mm2, z. B. J-Y(St)Y 2 x 0.6
- Terminating resistor
  - 120 Ω (0.5 Ω)
- Device address, BMS bus
  - 1...30 (3)*

**Switching elements:**
- Switching elements
  - 2 changeover contacts: K1 (Alarm 1), K2 (Alarm 2, device error)
- Operating mode K1, K2
  - N/C operation n.c./N/O operation n.o. (N/O operation n.o.)*

**Contact data acc. to IEC 60947-5-1:**
- Utilisation category
  - AC 13  AC 14  DC-12  DC-12  DC-12
  - Rated operational voltage
    - AC 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 kΩ at AC/DC ≥ 10 V

**Environment/EMC:**
- EMC:
  - not suitable for household and small companies
  - IEC 61326-2-4
  - Operating temperature
    - -25...+65 °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)
  - for screw fixing with accessories B990056
  - 3M7
  - for DIN rail mounting
  - DIN EN 60721-3-2
  - 2M2
  - Long-time storage (IEC 60721-3-1)
  - 1M3

**Connection:**
- Connection
  - screw-type terminals
- Connection, rigid/flexible
  - 0.2...4 mm²/0.2...2.5 mm²
- Connection flexible with connector sleeve, without/with plastic sleeve
  - 0.2...2.5 mm²
  - Tightening torque
    - 0.6...0.8 Nm
- Conductor sizes (AWG)
  - 24...12
  - Cable length between isoPV and AGH-PV
    - ≤ 0.5 m

**Other:**
- Operating mode
  - continuous operation
- Mounting
  - display oriented
- Distance to adjacent devices
  - ≥ 30 mm
- Degree of protection, internal components (DIN EN 60529)
  - IP30
- Degree of protection, terminals (DIN EN 60529)
  - IP20
- Type of enclosure
  - X112, free from halogen
- DIN rail mounting
  - DIN EN 60715/IEC 60715
- Screw mounting by means of support (see Seite 67 in manual)
  - 2 x M4
- Connection to shielded cable (shield PE on one end)
  - ≥ 0.6 mm², z. B. J-Y(St)Y 2 x 0.6
- Terminating resistor
  - 120 Ω (0.5 Ω)
- Device address, BMS bus
  - 1...30 (3)*

*° = factory setting
The values marked with ** are absolute values
Technical data coupling device AGH-PV

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

Voltage ranges
Nominal system voltage $U_n$  AC, 3(N)AC 0…793 V, DC 0…1100 V
Nominal frequency $f_n$  DC, 10…460 Hz
Max. AC voltage $U_{\text{~}}$ in the frequency range $f_n = 0.1…10 \text{ Hz}$: $U_{\text{~ max}} = 110 \text{ V/Hz} \times f_n$

Environment/EMC
EMC  IEC61326-2-4
Operating temperature  -25…+65 ºC

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-term storage (IEC 60721-3-1)  1M3

Connection
Connection  screw-type terminals
Connection, rigid/flexible  0.2…4 mm²/0.2…2.5 mm²
Connection flexible with connector sleeve, without/with plastic sleeve  0.25…2.5 mm²
Tightening torque  0.5 Nm
Conductor size (AWG)  24…12
Maximum cable length between isoPV and AGH-PV  ≤ 0.5 m

Other
Operating mode  continuous operation
Mounting  cooling slots must be ventilated vertically!
Distance to adjacent devices  ≥ 30 mm
Degree of protection, internal components (DIN EN 60529)  IP30
Degree of protection, terminals (DIN EN 60529)  IP20
Type of enclosure  X200, free from halogen
DIN rail mounting  DIN EN 60715/IEC 60715
Screw fixing  2 x M4
Flammability class  UL94 V-0
Weight  < 230 g

| Dimension diagrams (dimensions in mm) |

**isoPV**

**AGH-PV**

*The values marked with ** are absolute values.*
Insulation monitoring devices | Application-specific selection – photovoltaic

**Typical application**

- PV generator unearthed (IT system) with nominal voltage ≤ DC 1100 V and ISOMETER® isoPV with coupling device AGH-PV

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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. **Connection to the coupling device AGH-PV**
6. **Separate connection of** and KE to PE
7. **External test button “T1, T2” (N/O contact)**
8. **External reset button (N/C contact or wire jumper), when the terminals are open, the fault message will not be stored.**
9. **STANDBY by means of the function input “F1, F2”:**
   - when the contact is closed, the insulation resistance is not measured. Disconnection from the IT system
10. **Current output, electrically isolated:** 0…20 mA or 4…20 mA
11. **Serial interface RS-485**
   - (termination by means of a 120 Ω resistor)
12. **Alarm relay “K1”: available changeover contacts**
13. **Alarm relay “K2” (device error relay); available changeover contacts**

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**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 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 $\frac{1}{2} E$ and KE to PE
6. External test button “T1, T2” (N/O contact)
7. External reset button (N/C contact or wire jumper), when the terminals are open, the fault message will not be stored.
8. STANDBY by means of the function input “F1, F2”: when the contact is closed, the insulation resistance is not measured. Disconnection from the IT system
9. Current output, electrically isolated: 0…20 mA or 4…20 mA
10. Serial interface RS-485 (termination by means of a 120 Ω resistor)
11. Alarm relay “K1”: available changeover contacts
12. Alarm relay “K2” (device error relay); available changeover contacts
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

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

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

<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>AC 0…690 V</td>
<td>DC 0…1000 V</td>
<td>≤ 500 μF</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>
Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:
- Supply circuit (IC2) A1, A2
- Output circuit (IC3) 11, 14, 24
- Control circuit (IC4) E, KE, T/R, A, B, AK1, GND, AK2

Rated voltage: 240 V

Overvoltage category: III

Rated impulse voltage:
- (IC2)/(IC3-4) 4 kV
- (IC3)/(IC4) 4 kV

Rated insulating voltage:
- (IC2)/(IC3-4) 250 V
- (IC3)/(IC4) 250 V

Polution degree: 3

Protective separation (reinforced insulation) between:
- (IC2)/(IC3-4) Overvoltage category III, 300 V
- (IC3)/(IC4) Overvoltage category III, 300 V

Voltage test (routine test) according to IEC 61010-1:
- (IC2)/(IC3-4) AC 2.2 kV
- (IC3)/(IC4) AC 2.2 kV

Supply voltage
- Supply voltage Uₖ AC 100…240 V DC 24…240 V
- Tolerance of Uₖ ± 30…± 15 %
- Frequency range Uₖ 47…63 Hz
- Power consumption ≤ 3 W, ≤ 9 VA

IT system being monitored
- Nominal system voltage Uₑ with AGH420 3(N)AC, AC 0…690 V/DC 0…1000 V
- Tolerance of Uₑ AC ± 15 %, DC ± 10 %
- Nominal system voltage range Uₑ with AGH420 (UL508) AC/DC 400 V
- Frequency range of Uₑ DC, 15…460 Hz

Measuring circuit
- Permissible system leakage capacitance Cₛ at insulation value ≤ 300 kΩ ≤ 1000 µF
- Permissible system leakage capacitance Cₛ at insulation value ≥ 300 kΩ ≤ 500 µF
- Permissible extraneous DC voltage Uₓ ≤ 1150 V

Response values
- Response value Rₛ ≤ 2…500 kΩ (10 kΩ)*
- Response value Rₓ ≤ 1…490 kΩ (5 kΩ)*
- Relative uncertainty Rᵤ ≤ ± 15 %, at least ± 1 kΩ
- Hysteresis Rₓ ≤ 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 ± 5 V
- Relative uncertainty depending on the frequency ≥ 200 Hz ≤ 0.03 %/Hz
- Hysteresis U ≤ 5 %, at least ± 5 V

Time response
- Response time tₑ ≤ 0.5 x Rₛ and Cₛ = 1 µF acc. to IEC 61557-B ≤ 10 s
- Start-up delay tₒ ≤ 0…10 s (0 s)*
- Response delay tₑ ≤ 0…99 s (0 s)*
- Delay on release tᵪ ≤ 0…99 s (0 s)*

 Displays, memory
- Display LC display, multi-functional, not illuminated
- Display range measured value insulation resistance (Rₑ) ± 1 kΩ…1 MΩ
- Operating uncertainty at Rₑ ≤ 1 MΩ ≤ ± 15 %, at least ± 1 kΩ
- Display range measured value nominal system voltage (Uₑ) 30…1.15 kV ± m.s.
- Operating uncertainty U ≤ ± 5 %, at least ± 5 V
- Relative uncertainty depending on the frequency ≥ 200 Hz ≤ 0.03 %/Hz
- Display range measured value system leakage capacitance at Rₑ ≥ 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
- Interface/protocol RS-485/BMS, Modbus RTU, isodata
- Baud rate BMS (9.6 kBit/s), Modbus RTU (selectable), isodata (115.2 kBits/s)
- Cable length (9.6 kBit/s) ≤ 1200 m
- Min. J-Y(St)Y 2x0.6
- Terminating resistor 120 Ω (0.25 W), internal, can be connected
- Device address, BMS bus, Modbus RTU 3…90 (3)
Insulation monitoring device ISOMETER® isoPV425

Technical data AGH420

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

**Definitions:**
- Measuring circuit (IC1)  L1+/ L2-
- Control circuit (IC2)  AK1, GND, AK2, Up, E

**Rated voltage:** 1000 V
**Overvoltage category:** III
**Rated impulse voltage:**
- IC1/IC2  8 kV

**Rated insulated voltage:**
- IC1/IC2  1000 V

**Pollution degree:** 3

**Protective separation (reinforced insulation) between:**
- IC1/IC2  Overvoltage category III, 1000 V

**Monitored IT system**

**Nominal system voltage range:**
- U_n  AC/DC 0…1000 V
- Tolerance of U_n  ±10 %

**Rated system voltage range (UL508):**
- U_n  AC/DC 0…600 V

**Measuring circuit**

**Measuring voltage:** U_m  ±45 V
**Measuring current:** I_m  ≤400 μA
**Internal resistance:** DC R_i  ≥120 kΩ

**Environment/EMC**

**EMC:** IEC 61326-2-4

**Ambient temperatures:**
- Operation  -40…+70 °C
- Transport  -40…+85 °C
- Storage  -40…+70 °C

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

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

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

**Screw-type terminals:**
- Nominal current  ≤10 A
- Tightening torque  0.5…0.6 Nm (5…7 lb-in)
- Conductor sizes  AWG 24-12
- Stripping length  8 mm
- Rigid/flexible  0.2…2.5 mm²
- Flexible with ferrules with/without plastic sleeve  0.25…2.5 mm²
- Multi-conductor rigid  0.2…1.5 mm²
- Multi-conductor flexible  0.2…1.5 mm²
- Multi-conductor flexible with ferrules without plastic sleeve  0.25…1.5 mm²
- Multi-conductor flexible with TWIN ferrules with plastic sleeve  0.25…1.5 mm²

**Push-wire terminals:**
- Nominal current  ≤10 A
- Conductor sizes  AWG 24-14
- Stripping length  10 mm
- Rigid  0.2…2.5 mm²
- Flexible without ferrules  0.75…2.5 mm²
- Flexible with ferrules with/without plastic sleeve  0.25…2.5 mm²
- Multi-conductor flexible with TWIN ferrules with plastic sleeve  0.5…1.5 mm²
- Opening force  50 N
- Test opening, diameter  2.1 mm

**Simple cables for terminals Up, AK1, GND, AK2:**
- Cable lengths  ≤0.5 m
- Connection properties  ≥0.75 mm²

**Other**

- Operating mode: Continuous operation
- Mounting: Cooling slots must be ventilated vertically
- Distance to adjacent devices: from U_n > 800 V  ≥30 mm
- Degree of protection internal components (DIN EN 60529)  IP30
- Degree of protection terminals (DIN EN 60529)  IP20
- Enclosure material: Polycarbonate
- DIN rail mounting acc. to  IEC 60715
- Screw mounting: 2 x M4 with mounting clip
- Weight: ≤150 g

---

**Dimension diagram (dimensions in mm)**

[Diagram]
1. A1, A2 Connection to the supply voltage via fuse (line protection). If being supplied from an IT system, both lines have to be protected by a fuse.*
2. E, E, KE Connect each terminal separately to PE. The same wire cross section as for A1, A2 must be used.
3. L1/+, L2/-- Connection to the 3(N)AC, AC or DC system to be monitored.
4. Up, AK1, GND, AK2 Connect the terminals of the AGH420 to the corresponding terminals of the isoPV425.
5. T/R Connection for external combined test and reset button.
6. 11, 14 Connection to alarm relay K1
7. 11, 24 Connection to alarm relay K2
8. A, B RS-485 communication interface with selectable terminating resistance.

* For UL applications:
Only use 60/75°C copper lines!
For UL and CSA applications, it is mandatory to use 5 A fuses for the protection of the supply voltage.
ISOMETER® isoPV1685...
Insulation monitoring device for unearthed DC systems
in photovoltaic installations up to 1500 V

Device features

- Only device version isoPV1685P provide a locating current injector.
- Insulation monitoring of large-scale photovoltaic systems
- Measurement of low-resistance insulation faults
- Separately adjustable response values $R_{an1}$ (alarm 1) and $R_{an2}$ (alarm 2) (both 200 Ω…1 MΩ) for prewarning and alarm. $R_{an1} \geq R_{an2}$ applies.
- Automatic adjustment 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 (isoPV1685SP only)
- Device self test with automatic message in the event of a fault
- Alarm relays separately adjustable for insulation fault 1, insulation fault 2
- CAN interface to output measured values, statuses and alarms
- RS-485 interface
  - isoPV1685SP: BMS bus, e.g. to control the insulation fault location
  - isoPV1685RTU: BMS bus or Modbus (can be switched using the DIP switch)
- µSD card with data logger and history memory for alarms

Standards

The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8
- IEC 61557-9 (isoPV1685P)
- IEC 61326-2-4
- IEC 60730-1
- DIN EN 60664-1 (VDE 0110-1)
- UL1998 (software, isoPV1685RTU only)

Approvals

- for isoPV1685RTU only

Typical applications

- Große als IT-System ausgeführten PV-Anlagen bis DC 1500 V

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>Incl. µSD card</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>200Ω…1MΩ</td>
<td>DC 18…30 V</td>
<td>–</td>
<td>isoPV1685RTU-425</td>
<td>B91065603</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■</td>
<td>isoPV1685P-425</td>
<td>B91065604</td>
</tr>
</tbody>
</table>

1) Absolute values
Insulation monitoring devices | Application-specific selection – photovoltaic

Technical data

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

Insulation coordination acc. to IEC 60664-1
Rated voltage
DC 1500 V
Rated impulse voltage/pollution degree
8 kV/2

Voltage ranges
Nominal system voltage \( U_n \)
DC 0 … 1500 V
Tolerance of \( U_n \)
DC ± 6 %
Supply voltage \( U_s \) (refer also to device name plate)
DC 18 … 30 V
Power consumption
\( \leq 7 \) W

Measuring circuit for insulation monitoring
Measuring voltage \( U_{med} \) (peak value)
\( \pm 50 \) V
Measuring current \( i_{med} \) (at \( R \) = 0 \( \Omega \))
\( \leq 1.5 \) mA
Internal DC resistance \( R_i \)
\( \geq 70 \) k\( \Omega \)
Impedance \( Z \) at 50 Hz
\( \geq 70 \) k\( \Omega \)
Permissible extraneous DC voltage \( U_{g}\)
\( \leq DC 1500 \) V
Permissible system leakage capacitance \( C_L \)
\( \leq 2000 \mu F \) (500 \( \mu F \))

Response values for insulation monitoring
Response value \( R_{inv} \) (Alarm 1)
200 \( \Omega \) … 1 \( \Omega \) (10 \( k\Omega \))
Response value \( R_{inv} \) (Alarm 2)
200 \( \Omega \) … 1 \( \Omega \) (1 \( k\Omega \))
Upper limit of the measuring range when set to \( C_{med} = 2000 \mu F \)
50 \( k\Omega \)
Relative uncertainty (10 \( k\Omega \) … 1 \( \Omega \) (acc. to IEC 61557-4))
\( \pm 15 \) %
Relative uncertainty (0.2 \( k\Omega \) … 10 \( k\Omega \))
\( \pm 200 \mu F \) \( \pm 15 \) %
Response time \( t_{res} \)
see graphic
Hysteresis
25 \( \% \), \( +1 \) \( k\Omega \)

isoPV1685P only:
Measuring circuit for insulation fault location (EDS)
Locating current \( i \), DC
\( \leq 50 \) mA
Test cycle/pause
2/4 s

Displays, memory
LEDs for alarms and operating states
2 x green, 4 x yellow
MicroSD card (Spec. 2.0) for history memory and log files
\( \leq 32 \) GByte

Inputs
Digital inputs Digin1/Digin2:
High level
10 … 30 V
Low level
0 … 0.5 V

Serial interfaces
BMS/Modbus:
Interface/protocol
RS-485/BMS(Slave)/Modbus RTU (Slave); Protocol switchable
Connection
Terminals A/B
Shield: Terminal S
Cable length
\( \leq 1200 \) m
Shielded cable (shielded to functional earth on one end)
2-core, \( \geq 0.6 \) mm\(^2\), e.g. J-Y(ST)Y 2 x 0.6
Terminating resistor, switchable (RS-485 Term.)
120 \( \Omega \) (3.5 W)
Device address, BMS bus or Modbus adjustable (DIP switch)
isoPV1685RTU: 2 … 17 (10)
Device address, BMS bus adjustable (DIP switch)
isoPV1685SP: 2 … 33 (10)

CAN:
Protocol
acc. to SFA/Bender specification V2.5
Frame format
CAN 2.0A 11-bit identifier
Baud rate
300 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
\( \leq 130 \) m
Shielded cable
CAT 5 with RJ45 plug
Terminating resistor, can be connected (Term. CAN)
120 \( \Omega \) (0.5 W)
Potential of the socket housing
functional earth potential

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

Operating principle K1, K2
N/C operation or N/O operation (N/C operation)*
Operating principle K5
N/C operation, not changeable

Contact data acc. to IEC 60947-5-1:
Utilisation category
AC 13 AC 14 DC-12 DC-12 DC-12
Rated operational voltage
230 V 230 V 24 V 110 V 220 V
Rated operational current
5 A 3 A 1 A 0.2 A 0.1 A
Minimum contact rating
1 mA at AC/DC \( \geq 10 \) 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, 6 A in case of a power factor of 0.75 to 0.80
AC 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
ngd/flexible
0.2 … 10 mm\(^2\)/0.2 … 6 mm\(^2\)
flexible with ferrule, without/plastic sleeve
0.25 … 2.5 mm\(^2\)
Conductor sizes (AWG)
24 … 12

Connection of the system coupling
Connection type
pluggable push-wire terminals
Connection
ngd/flexible
0.2 … 10 mm\(^2\)/0.2 … 6 mm\(^2\)
flexible with ferrule, without/plastic sleeve
0.25 … 6 mm\(^2\)/0.25 … 4 mm\(^2\)
Conductor sizes (AWG)
24 … 8

Stripping length
15 mm
Opening force
90 … 120 N

Environment/EMC
EMC
IEC 61326-2-4 Ed. 1.0
Classification of climatic conditions acc. to IEC 60721:
Without solar radiation, precipitation, water, icing. Condensation permissible temporarily:
Stationary use (IEC 60721-3-3)
3K5
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
Deviation from the classification of climatic conditions:
Ambient temperature during operation
\(-40 \ldots +70 \) °C
Ambient temperature for transport
\(-40 \ldots +80 \) °C
Ambient temperature for long-term storage
\(-25 \ldots +80 \) °C
Relative humidity
10 … 100 \%
Atmospheric pressure
700 … 1060 hPa (max. height 4000 m)

Other
Operating mode
continuous operation
Position of normal use
vertical, system coupling on top
PCB fixation
lens head screw DIN7985TX
Tightening torque
4.5 Nm
Degree of protection, internal components
IP30
Degree of protection, terminals
IP30
Weight
\( \leq 1300 \) g

Notes:
(1) = Factory settings

100 Insulation monitoring devices | Application-specific selection – photovoltaic
Insulation monitoring device ISOMETER® isoPV1685...
2020/2021
BENDER
12+ I2– Currently has no function, digital input.

2 I1+ I1– Digital input

isoPV168SP: Starting the insulation fault location in the manual mode.

3 CAN2, CAN1 Connection to CAN bus, 2 x RJ-45, can be terminated with CAN 120-Ω termination plug.

4 A, B, S Connection to Modbus or BMS bus, RS-485, S= shield (connect one end to PE), can be terminated with RS-485 Term. switch.

5 31, 32, 34 Alarm relay K3 for internal device errors

6 21, 22, 24 Alarm relay K2 for insulation faults.

7 11, 12, 14 Alarm relay K1 for insulation faults.

8 E, KE Separate connections for E and KE to PE.

9 A1, A2 Connection to \( U_5 = \text{DC 24 V} \) via a 6 A fuse on each line.

10 L+ Connection to L+ of the PV generator via 1 A fuse.

11 L– 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 combination with the coupling device AGH-LR
- Automatic adaptation to the existing system leakage capacitance
- AMPPlus measurement method (European patent: EP 0 654 673 B1)
- Choice of measurement methods to meet different requirements
- Two separately adjustable response ranges of 0.2…100 kΩ (Alarm 1, Alarm 2)
- Two-line LC display
- Automatic device self test
- History memory with real-time clock to store alarm messages with date and time stamp
- BMS interface (Bender Measuring Device Interface) for communication with other Bender devices (RS-485 electrically isolated)
- Internal disconnection of the ISOMETER® from the IT system to be monitored (via control signal; terminals F1/F2) (e.g. if several ISOMETERs® are interconnected)
- Current output 0(4)…20mA (electrically isolated) analogously to the measured insulation value

**AGH-LR**
- Appropriate coupling device for ISOMETER® isoLR275
- Nominal voltage range AC 0…793 V and DC 0…1100 V
- DIN rail mounting

Typical applications

- AC, DC or AC/DC main circuits
- IT systems with directly connected inverters
- IT systems with high system capacitances of up to 500 μF
- IT systems with high but slow voltage fluctuations
- Installations including switch mode power supplies
- Coupled IT systems

Standards

The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8
- IEC 61326-2-4 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><strong>AC</strong></td>
<td><strong>DC</strong></td>
<td><strong>Type</strong></td>
</tr>
<tr>
<td>19.2…55 V</td>
<td>19.2…72 V</td>
<td>isoLR275-327</td>
</tr>
<tr>
<td>88…264 V</td>
<td>77…286 V</td>
<td>isoLR275-335</td>
</tr>
</tbody>
</table>

Devices are available as a set.

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw mounting</td>
<td>B990056</td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>External kΩ measuring instruments</td>
<td>9620-1421</td>
<td>B986841</td>
<td>369</td>
</tr>
</tbody>
</table>
**Technical data ISOMETER® isoLR275**

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

| Rated insulation voltage for isoLR275-3 | AC 250 V |
| Rated impulse voltage/pollution degree | 6 kV/III |

**Protective separation (reinforced insulation) between**

- (A1, A2) - (11, 12, 14, 21, 22, 24) |
- (AK1, AK2, KE, PE, T1, T2, R1, F1, F2, M+, M-, A, B) |

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

- 3.536 kV |

**Rated insulation voltage**

- AC 250 V |

**Rated impulse voltage/pollution degree**

- 4 kV/III |

**Basic insulation between:**

- (11, 12, 14) - (21, 22, 24) |

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

- 2.21 kV |

**Voltage ranges**

- Nominal system voltage $U_s$ via AGH-LR |

**isoLR275-335:**

- Supply voltage $U_0$ (also see nameplate) AC...264 V** |

**Frequency range $f_0$**

- 42...460 Hz |

**Power consumption**

- $\leq 16$ VA |

**Supply voltage $U_0$ (also see nameplate)**

- DC...286 V** |

**Power consumption**

- $\leq 8$ W |

**isoLR275-327:**

- Supply voltage $U_0$ (also see nameplate) AC 19.2...55 V** |

**Frequency range $f_0$**

- 42...460 Hz |

**Supply voltage $U_0$ (also see nameplate)**

- DC 19.2...72 V** |

**Power consumption**

- $\leq 5$ W |

**Response values**

- Response value $R_{01}$
  - 0.2...100 kΩ |
- Factory setting $R_{01}$ (Alarm1)
  - 4 kΩ |
- Response value $R_{02}$
  - 0.2...100 kΩ |
- Factory setting $R_{02}$ (Alarm2)
  - 1 kΩ |
- Relative uncertainty ($7...100$ kΩ) (acc. to IEC 61557-8)
  - $\pm 15$% |
- Relative uncertainty (0.2...7 kΩ)
  - $\pm 1$% |
- Response time $t_{20}$
  - see table in the manual |

**Hysteresis**

- 25 %, $+1$ kΩ |

**Measuring circuit**

- Measuring voltage $U_{m}$ (peak value)
  - $\pm 50$ V |
- Measuring current $I_m$ (at $F = 0$)
  - $\leq 1.5$ mA |
- Internal DC resistance $R_i$
  - $\geq 35$ kΩ |
- Impedance $Z_i$ at 50 Hz
  - $\geq 35$ kΩ |
- Permissible extraneous DC voltage $U_{04}$
  - DC 1100 V |

**Permissible system leakage capacitance $C_L$**

- $\leq 500$ μF (150 μF)* |

**Displays**

- Display, illuminated
two-line display |
- Characters (number/height)
  - 2 x 16/4 mm |
- Display range measured value
  - 0.2 kΩ...71 MΩ |
- Operating uncertainty
  - $\leq 15$%, $\pm 1$ kΩ |

**Outputs/inputs**

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

---

**Technical data coupling device AGH-LR**

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

- Rated insulation voltage AC 800 V |
- Rated impulse voltage/pollution degree 8 kV/III |

**Voltage ranges**

- Nominal system voltage $U_s$ AC, 3(N)AC 0...793 V, DC 0...1100 V |
- Nominal frequency $f_0$ DC 10...460 Hz |
- Max. AC voltage $U_{max}$ in the frequency range $f_0 = 0.1...10$ Hz
  - $U_{max} \approx 110$ V/Hz **m |

**Environment/EMC**

- EMC
  - Type of enclosure X200 |
- Operating temperature
  - $-25...+65$ °C |

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

- Stationary use (IEC 60721-3-3)
  - 3K5 (with condensation and formation of ice) |
  - 2K3 (with condensation and formation of ice) |
  - 1K4 (with condensation and formation of ice) |

**Connection**

- Connection properties
  - rigid/flexible
  - 0.2...4 mm²/0.2...2.5 mm² |
  - 0.25...2.5 mm² |
- Tightening torque
  - 0.5 Nm |
- Conductor sizes (AWG)
  - 24...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 x M4 |
- DIN rail mounting acc. to
  - IEC 60715 |
- Flammability class
  - UL94 V-0 |
- Weight
  - $\leq 510$ g |

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**ISOMETER® isoLR275 with AGH-LR**

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

**Dimension diagrams (dimensions in mm)**

**ISO LR275**
- Support for screw mounting: Ø 4.5
- 112.5

**AGH-LR**
- Terminal cover: Ø 5.5 for screw mounting
- 106

**Wiring diagrams**

1. Supply voltage U_s (see nameplate) via 6 A fuse; For UL and CSA applications, it is mandatory to use 5 A fuses
2. Connection to the 3AC system to be monitored:
   - Connect the terminals L1, L2 to neutral conductor N or terminals L1, L2 to conductor L1, L2.
3. Connection to the AC system to be monitored:
   - Connect terminals L1, L2 to conductor L1, L2.
4. Connection to the DC system to be monitored:
   - Connect terminal L1 to conductor L+, terminal L2 to conductor L-.
5. Connection to the coupling device AGH-PV
6. Separate connection of and KE to PE
7. *External test button (N/O contact)*
8. Current output, electrically isolated: 0…20 mA or 4…20 mA
9. Serial interface RS-485 (termination by means of a 120-Ω resistor)
10. Alarm relay "K1"; available changeover contacts
11. Alarm relay "K2" (device error relay); available changeover contacts
12. The terminal pairs 7, 8 and 9 have to be wired electrically isolated and do not have to be connected to earth!
ISOMETER® IR420-D6
Offline monitor for de-energised AC, DC and 3(N)AC loads in TN, TT, and IT systems

Device features
- Insulation monitoring for de-energised TN, TT, and unearthed systems AC, 3(N)AC and DC
- Nominal voltage extendable via coupling device
- Two separately adjustable response values 100 kΩ…10 MΩ
- LEDs: Power On LED, LEDs Alarm 1, Alarm 2 for signalling insulation faults
- Combined test/reset button
- Two separate alarm relays with one changeover contact each
- Fault memory behaviour, selectable
- Push-wire terminal (two terminals per connection)

Typical applications
- De-energised loads such as automatic fire extinguisher pumps, emergency drives, ship cranes, slide-valve drives in supply lines (gas, water, oil), motor-driven closing systems, diving pumps, drives for anchors, elevators, flue-gas valves and emergency power generators

Standards
The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- EN 61557-8
- IEC 61557-8
- IEC 61326-2-4
- DIN EN 60664-1 (VDE 0110-1)
- DIN EN 60664-3 (VDE 0110-3)
- ASTM F1669M-96 (2007)
- ASTM F1207M-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>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AC</td>
<td>DC</td>
</tr>
<tr>
<td>16…72 V, 42…460 Hz</td>
<td>IR420-D6-1</td>
<td>B91016415</td>
</tr>
<tr>
<td>70…300 V, 42…460 Hz</td>
<td>IR420-D6-2</td>
<td>B91016407</td>
</tr>
<tr>
<td></td>
<td>IR420-D6-4</td>
<td>B91016408</td>
</tr>
</tbody>
</table>

1 Absolute values

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B 9006 0008</td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coupling device</td>
<td>AGH520S</td>
<td>B913033</td>
<td>327</td>
</tr>
<tr>
<td></td>
<td>AGH676-4</td>
<td>B913055</td>
<td>330</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>(A1, A2) - (11, 12, 14) - (21, 22, 24) 300 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated insulation voltage</td>
<td>(L1, AK, E, KE, T/R) 500 V</td>
</tr>
<tr>
<td>Rated impulse voltage</td>
<td>6 kV</td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>III</td>
</tr>
<tr>
<td>Pollution degree</td>
<td>3</td>
</tr>
</tbody>
</table>

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

(A1, A2) - (L1, AK, E, KE, T/R) - (11, 12, 14) - (21, 22, 24)

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

| 2.2 kV |

**Supply voltage**

**IR420-D6-1:**

- **Supply voltage $U_s$**
  - AC 16...72 V/DC 9.6...94 V
- **Frequency range $f_s$**
  - 42...460 Hz/DC

**IR420-D6-2:**

- **Supply voltage $U_s$**
  - AC/DC 70...300 V
- **Frequency range $f_s$**
  - 42...460 Hz, DC

**Power consumption**

≤ 3 VA

**System being monitored**

**Nominal system voltage $U_n$**

- AC 0...400 V
- Tolerance of $U_n +25 %$
- Frequency range of $U_n$ 42...460 Hz

**Response values**

- **Response time $t_{on}$ at $R_F = 0.5 \times R_{an}$ and $C_e = 1 \mu F$**
  - ≤ 4 s
- **Starting delay $t_{start}$**
  - 0...10 s (0 s)*
- **Response delay $t_{res}$**
  - 0...99 s (0 s)*

**Measuring circuit**

- **Measuring voltage $U_m$**
  - ±12 V
- **Measuring current $I_m$**
  - ≤ 10 μA
- **Internal d.c. resistance $R_i$**
  - ≥ 1.2 MΩ
- **Internal impedance $Z_e$ (50 Hz)**
  - ≥ 1.1 MΩ
- **Admissible extraneous d.c. voltage $U_{sy}$**
  - ≤ DC 300 V
- **System leakage capacitance $C_e$**
  - ≤ 10 μF

**Displays, memory**

- **Display**
  - LC display, multi-functional, non-illuminated
- **Display range, measuring value**
  - 10 kΩ...20 MΩ
- **Percentage operating error**
  - ± 15 %
- **Password**
  - off/0...999 (off)*
- **Fault memory (alarm relay)**
  - on/off (off)*

**Inputs**

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

**Switching elements**

<table>
<thead>
<tr>
<th>Number of</th>
<th>2 (changeover contacts K1, K2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating principle</td>
<td>N/O operation, N/C operation (N/O operation n.o.)*</td>
</tr>
<tr>
<td>Endurance</td>
<td>100000 switching operations</td>
</tr>
</tbody>
</table>

**Contact data according IEC 60947-5-1**

<table>
<thead>
<tr>
<th>Utilization category</th>
<th>AC-13</th>
<th>AC-14</th>
<th>DC-12</th>
<th>DC-12</th>
<th>DC-12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated operational voltage</td>
<td>230 V</td>
<td>230 V</td>
<td>220 V</td>
<td>110 V</td>
<td>24 V</td>
</tr>
<tr>
<td>Rated operational current</td>
<td>5 A</td>
<td>3 A</td>
<td>0.1 A</td>
<td>0.2 A</td>
<td>1 A</td>
</tr>
<tr>
<td>Minimum current</td>
<td>1 mA at AC/DC ≤ 10 V</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

**Environment/EMC**

<table>
<thead>
<tr>
<th>EMC</th>
<th>acc. to IEC 61326</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>-25 °C...+55 °C</td>
</tr>
</tbody>
</table>

**Climatic categories acc. to IEC 60721:**

- Stationary use (IEC 60721-3-3) (except condensation and formation of ice) 3K5
- Transport (IEC 60721-3-2) (except condensation and formation of ice) 2K3
- Storage (IEC 60721-3-1) (except condensation and formation of ice) 1K4

**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**

<table>
<thead>
<tr>
<th>Connection</th>
<th>screw-type terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection properties:</td>
<td>rigid/flexible/AWG</td>
</tr>
<tr>
<td>0.2...4/0.2...2.5 mm² (AWG 24...12)</td>
<td></td>
</tr>
<tr>
<td>Two conductors with the same cross section:</td>
<td>rigid/flexible</td>
</tr>
<tr>
<td>0.2...1.5/0.2...1.5 mm²</td>
<td></td>
</tr>
<tr>
<td>Stripping length</td>
<td>8 mm</td>
</tr>
<tr>
<td>Tightening torque, terminal screws</td>
<td>0.5...0.6 Nm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Connection</th>
<th>push-wire terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection properties:</td>
<td>rigid</td>
</tr>
<tr>
<td>0.2...2.5 mm² (AWG 24...14)</td>
<td></td>
</tr>
<tr>
<td>flexible without ferrules</td>
<td>0.75...2.5 mm² (AWG 19...14)</td>
</tr>
<tr>
<td>flexible with ferrules</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>
</tbody>
</table>

**Other**

| Operating mode | continuous |
| Position | any position |
| Degree of protection internal components (EN 60529) | IP30 |
| Degree of protection terminals (EN 60529) | IP20 |
| Enclosure material | polycarbonate |
| Flammability class | UL94 V-0 |
| DIN rail mounting acc. to | IEC 60715 |
| Screw fixing | 2 x M4 with mounting clip |
| Weight | approx. 150 g |

(*) = Factory setting

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**Dimension diagram (dimensions in mm)**

![Dimension Diagram](image-url)
Supply voltage \( U_S \) (see ordering details) via fuse

Separate connection of E, KE to PE

Connection of the AC system to be monitored:

Alarm relay "K1": Alarm 1

Alarm relay "K2": Alarm 2

Combined test and reset button "TEST RESET"

short-time pressing (< 1.5 s) = RESET

long-time pressing (> 1.5 s) = TEST

Line protection by a fuse in accordance with IEC 60364-4-43

(6 A fuse recommended). In case of supply (A1/A2) from an IT system, both lines have to be protected by a fuse.

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 LED: 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)

Typical applications

• IEC 60364-7-717, DIN VDE 0100-717 (2005) Electrical installations in mobile or transportable units
• DIN VDE 0100-551 (VDE 0100-551), IEC 60364-5-551 Low-voltage generating sets (mobile generators)
• GW 308 “Mobile Stromerzeuger für Rohrleitungsbaustellen 8/00” (Mobile auxiliary power generators on pipeline sites) (DNV)
• BGI 867 (German Berufsgenossenschaft Information) Auswahl und Betrieb von Ersatzstromerzeugern auf Bau-und Montagestellen (Selecting and operating standby generators on construction and installation sites)

Standards

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

Further information

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

Ordering information

<table>
<thead>
<tr>
<th>Version</th>
<th>Supply voltage</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AC</td>
<td>DC</td>
<td>AC/DC</td>
</tr>
<tr>
<td>Standard</td>
<td>16…72 V, 30…460 Hz</td>
<td>9.6…94 V</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>–</td>
<td>–</td>
<td>70…300 V, 30…460 Hz</td>
</tr>
<tr>
<td>High mechanical stress</td>
<td>16…72 V, 30…460 Hz</td>
<td>9.6…94 V</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>–</td>
<td>–</td>
<td>70…300 V, 30…460 Hz</td>
</tr>
</tbody>
</table>

1) Absolute values

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>
**Technical data**

### Insulation monitoring device ISOMETER® IR423

**Rated insulation voltage** 250 V

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

**Protective separation (reinforced insulation) between**

(A1, A2) -(L1, L2, E, KE, T/R) -(11, 12, 14) -(21, 22, 24)

**Voltage test acc. to IEC 61010-1** 2.21 kV

**Supply voltage**

Supply voltage $U_S$ see ordering information

Frequency range $f_S$ 30…460 Hz

**Power consumption** ≤ 4 VA

**IT system being monitored**

**Nominal system voltage**

Nominal voltage $U_n$ AC 0…300 V

Nominal frequency $f_n$ 30…460 Hz

**Response values**

Response value $R_{an1}$ (Alarm 1) 1…200 kΩ (46 kΩ)*

Response value $R_{an2}$ (Alarm 2) 1…200 kΩ (23 kΩ)*

Relative uncertainty 1…5 kΩ/5…200 kΩ ±0.5 kΩ/±15 %

Hysteresis 1…5 kΩ/5…200 kΩ +3 kΩ/+25 %

**Time response**

Response time $t_{an}$ at $R_F = 0.5 \times R_{an}$ and $C_e = 1 \mu F$ ≤ 1 s

Start-up delay (start time) $t_0$ 0…10 s (0 s)*

Response delay $t_on$ 0…99 s (0 s)*

**Measuring circuit**

Measuring voltage $U_m$ ±12 V

Measuring current $I_m$ (at $R_F = 0 \Omega$) ≤ 200 µA

Internal DC resistance $R_i$ ≥ 62 kΩ

Impedance $Z_i$ at 50 Hz ≥ 60 kΩ

Permissible extraneous DC voltage $U_{fg}$ ≤ DC 300 V

Permissible system leakage capacitance ≤ 5 µF

**Displays, memory**

Display LC display, multi-functional, non-illuminated

Display range, measured value 1 kΩ…1 MΩ

Operating uncertainty 1…5 kΩ/5 kΩ…1 MQ ±0.5 kΩ/±15 %

Password off/0…999 (off)*

Fault memory (alarm relay) on/off*

**Outputs**

Cable length test and reset button ≤ 10 m

**Switching elements**

Number of switching elements 2 x changeover contact

Operating principle NC or N/O operation (N/O operation)*

Electrical endurance, number of cycles 10,000

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

**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

**Contact rating** 1 mA at AC/DC ≥ 10 V

**Environment/EMC**

EMC acc. to IEC 61326

Operating temperature -25…+55 °C

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

Stationary use (IEC 60721-3-3) 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 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 any position

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

Degree of protection, terminals (DIN EN 60529) IP20

Flammability class UL94 V-0

DIN rail mounting acc. to IEC 60715

Screw mounting 2 x M4 with mounting clip

Documentation number D00038

Weight ≤ 150 g

**Ambient temperature** -40…+70 °C

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

Stationary use (IEC 60721-3-3) 3K5 (with condensation and formation of ice)

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

Stationary use (IEC 60721-3-3) 3M7

Vibration resistance acc. to IEC 60068-2-6

For DIN rail mounting 3 g/30…150 Hz

For screw mounting 6 g/30…150 Hz

(*) = factory setting

---

**Dimension diagram** (dimensions in mm)
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
$U_n \leq AC 230 V$: Terminals L1/L2 to L1/L2 of the generator
$U_n \leq 3AC 400 V$: Terminals L1/L2 to N of the generator

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
• Certonal coating
• Permanently set response value for the insulation resistance 23/46 kΩ
• Second response range 40/80 kΩ selectable via a jumper

Typical applications
• Monitoring of unearthed AC systems (IT systems) in mobile generators

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

Ordering information

<table>
<thead>
<tr>
<th>Connection</th>
<th>Nominal system voltage $U_n$</th>
<th>Supply voltage $U_S$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connectors</td>
<td>100…300 V, 22…460 Hz</td>
<td>$U_S = U_n$</td>
<td>IR123P-4-2</td>
<td>B91016308</td>
</tr>
</tbody>
</table>

$^1$ 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:
Voltage test acc. to IEC 61010-1 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 $R_{\text{an2}}$ (Alarm 2) (46 kΩ)*
Response value $R_{\text{an1}}$ (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 $t_{\text{an}}$ at $R_F = 0.5 \times R_{\text{an}}$ and $C_s = 1 \mu F$ $\leq 1$ s

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

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 $U_C$ 24 V, $I_C$ 10 mA
Optocoupler, measured value $U_C$ DC 24 V, $I_C$ $\leq 10$ mA
PWM signal, duty cycle 0 % $= \infty$ kΩ
PWM signal, duty cycle 50 % $= 120$ kΩ

Contact data acc. to IEC 60947-5-1:
Rated operational voltage AC 230 V, 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) 1K5 (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 60723-3-3) 3M7
Transport (IEC 60723-3-2) 2M2
Storage (IEC 60723-3-1) 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
Documentation number D00113
Weight $\leq 150$ g

(*) = factory setting

Dimension diagrams (dimensions in mm)
Wiring diagrams

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 -KE- "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 (M_HS/M_LS output)
- Protective coating (SL 1301ECO-FLZ)

**Typical applications**

- Monitoring for unearthed DC drive systems (IT systems) in electric vehicles

**Standards**

- IEC 61557-8
- IEC 61010-1
- ISO 6469-3
- ISO 23273-3
- ISO 16750-1
- ISO 16750-2
- ISO 16750-4
- E1 (ECE regulation No. 10 version 5)
- acc. 72/245/EWG/EEC
- DIN EN 60068-2-38
- DIN EN 60068-2-30
- DIN EN 60068-2-14
- DIN EN 60068-2-64
- DIN EN 60068-2-27

**Further information**

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

### Ordering information

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Response value $R_{in}$</th>
<th>$F_{ave}$</th>
<th>Undervoltage detection</th>
<th>Measured value output</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuously set value</td>
<td>100 kΩ</td>
<td>10</td>
<td>300 V</td>
<td>Low-side</td>
<td>IR155-3203</td>
<td>B91068138V4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0 V (inactive)</td>
<td>High-side</td>
<td>IR155-3204</td>
<td>B91068139V4</td>
</tr>
<tr>
<td>Customer-specific setting</td>
<td>100 kΩ…1 MΩ</td>
<td>1…10</td>
<td>0 V…500 V</td>
<td>Low-side</td>
<td>IR155-3203</td>
<td>B91068138CV4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>High-side</td>
<td>IR155-3204</td>
<td>B91068139CV4</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>
Technical data

Insulation coordination acc. to IEC 60664-1

Protective separation (reinforced insulation)

between (L+/L-) − (Kl. 31, Kl. 15, E, KE, MS, A, O, E)

Voltage test

AC 3500 V/1 min

Supply/IT system being monitored

Supply voltage $U_s$

DC 10 ... 36 V

Max. operating current $I_s$

150 mA

Max. current $I_s$

2 A

HV voltage range (L+/E-) $U_h$

6 A/2 ms inrush current

AC 0 ... 1000 V (peak value)

0 ... 660 V r.m.s. (10 Hz ... 1 kHz)

DC 0 ... 1000 V

Power consumption

$< 2 \text{ W}$

Response values

Response value hysteresis (DCP)

25 %

Response value $R_{an}$

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 (≤ 2 s)

good > 2$^\circ$ $R_{an}$, bad < 0.5$^\circ$ $R_{an}$

Relative uncertainty DCP

0 ... 85 kΩ $\pm 20$ kΩ

(default setting 100 kΩ)

100 kΩ ... 10 MΩ $\pm 15$ %

Relative uncertainty output M (fundamental frequency)

$\pm 5$ % at each frequency

(10 Hz; 20 Hz; 50 Hz; 100 Hz; 50 Hz)

Relative uncertainty undervoltage detection

$U_s \geq 100 \text{ V} \implies \pm 10$ %; at $U_s \leq 100$ V $\implies \pm 5$ %

Relative uncertainty (SST)

“Good condition” $\geq 2^\circ$ $R_{an}$

“Bad condition” $< 0.5^\circ$ $R_{an}$

Response time $t_{an}$ (DCP)

$t_{an} \leq 2$ s (typ. $< 1$ s at $U_s > 100$ V)

$t_{an} \leq 20$ s (at $F_{ave} = 10^4$)

$t_{an} \leq 17.5$ s (at $F_{ave} = 9$)

$t_{an} \leq 17.5$ s (at $F_{ave} = 8$)

$t_{an} \leq 15$ s (at $F_{ave} = 7$)

$t_{an} \leq 12.5$ s (at $F_{ave} = 6$)

$t_{an} \leq 12.5$ s (at $F_{ave} = 5$)

$t_{an} \leq 10$ s (at $F_{ave} = 4$)

$t_{an} \leq 7.5$ s (at $F_{ave} = 3$)

$t_{an} \leq 7.5$ s (at $F_{ave} = 2$)

$t_{an} \leq 5$ s (at $F_{ave} = 1$)

during the self test $t_{an} > 10$ s

Switch-off time $t_{an}$ (OK; DCP)

(taking changing over from $R_{an}/2 = 10$ MΩ to $R_i$; at $C_t = 1 \mu$F; $U_s = DC 1000$ V)

$t_{an} \leq 40$ s (at $F_{ave} = 10$)

$t_{an} \leq 40$ s (at $F_{ave} = 9$)

$t_{an} \leq 33$ s (at $F_{ave} = 8$)

$t_{an} \leq 33$ s (at $F_{ave} = 7$)

$t_{an} \leq 28$ s (at $F_{ave} = 6$)

$t_{an} \leq 26$ s (at $F_{ave} = 5$)

$t_{an} \leq 26$ s (at $F_{ave} = 4$)

$t_{an} \leq 20$ s (at $F_{ave} = 2$)

$t_{an} \leq 20$ s (at $F_{ave} = 1$)

during the self test $t_{an} > 10$ s

Duration of the self test

10 s

(every five minutes; should be added to $t_{an}/t_{ab}$)

Measuring circuit

System leakage capacitance $C_L$

$\leq 1 \mu$F

Smaller measurement range and increased measuring time at $C_L$

(e.g. max. range 1 MΩ @ 3 µF; $t_{ab} = 68$ s when changing over from $R_i = 1$ MΩ to $R_{an}/2$)

Measuring voltage $U_{ab}$

$\pm 40$ V

Measuring current $I_s$ at $R_i = 0$

$\pm 33$ µA

Impedance $Z_i$ at 50 Hz

$\geq 1.2 \text{ MΩ}$

Internal DC resistance $R_i$

$\geq 1.2 \text{ MΩ}$

Output

Measurement output (M)

$M_{an}$ switches to $U_{ab} = 2$ V (3204)

(external pull-down resistor to Kl. 31 necessary 2.2 kΩ)

$0$ Hz

$H_i$ = short circuit to

$U_{ab} +$ (Kl. 15); Low > IMD off or short circuit to Kl. 31

10 Hz

Normal condition

Insulation measurement DCP;

starts two seconds after power on;

First successful insulation measurement at $< 17.5$ s

PWM active 5...95 %

20 Hz

undervoltage condition

Insulation measurement DCP (continuous measurement); starts two seconds after power on;

PWM active 5...95 %

First successful insulation measurement at $< 17.5$ s

Undervoltage detection 0...500 V

(Bender configurable)

30 Hz

Speed start measurement

Insulation measurement (only good/bad evaluation)

starts directly after power on $< 2$ s;

PWM 5...10 % (good) and 90...95 % (bad)

40 Hz

Device error

Device error detected; PWM 47.5...52.5 %

50 Hz

Connection fault-earth

Fault detected on the earth connection (Kl. 31)

PWM 47.5...52.5 %

* $F_{ave} = 10$ is recommended for electric and hybrid vehicles
Status output (OKHS)

OKHS switches to U5 = 2 V (external pull-down resistor to KL 31 required 2.2 kΩ)

- High: No fault; Rf > response value detected
- 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 MΩ (≈)
  - Duty cycle 50% = 1200 kΩ
  - Duty cycle 95% = 0 kΩ

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

\[ d_{\text{meas}} = \text{measured duty cycle (5\%...95\%)} \]

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 \( \Delta V \) 10...30% \( V_{\text{out}} \) max. 6 V/μs
- Slew rate off \( \Delta V \) 70...40% \( V_{\text{out}} \) max. 8 V/μs

Timing 3204 (inverse to 3203)

- \( V_{\text{OUT}} \)
- \( dV/dt \) on
- \( dV/dt \) off
- \( t_{\text{on}} \)
- \( t_{\text{off}} \)

Technical data (continued)
**Wiring diagram**

**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**

![Diagram of a vehicle's electrical system with ISOMETER® components](image-url)
ISOMETER® isoEV425 with coupling device AGH420
Insulation monitoring device for unearthed DC circuits (IT systems)
for charging electric vehicles

Device features

- Monitoring for DC charging stations (mode 4 according to IEC 61851-23) for charging electric vehicles
- Mains voltage measurement (r.m.s.) with under-/overvoltage detection
- DC voltage measurement to earth (L+/PE and L-/PE)
- Automatic adaptation to the system leakage capacitance up to 5 µF
- Automatic device self-test with connection monitoring
- Selectable start-up delay, response delay and delay on release
- Two separately adjustable response value ranges of 1…500kΩ (Alarm 1, Alarm 2)
- Alarm signalling via LEDs (AL1, AL2), a display and alarm relays (K1, K2)
- N/C operation or N/O operation selectable
- Measured value indication via multi-functional LCD
- Fault memory can be activated
- RS-485 (galvanically isolated) including the following protocols:
  - BMS interface (Bender measuring device interface) for data exchange with other Bender components
  - Modbus RTU
  - IsoData (for continuous data output)
- Password protection to prevent unauthorised parameter changes

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

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

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

Typical applications

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

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage $U_S$</th>
<th>System leakage capacitance $C_e$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 100…240 V, 47…63 Hz</td>
<td>≤ 5 µF</td>
<td>isoEV425-D4-4 with AGH420</td>
<td>B91036401</td>
</tr>
<tr>
<td>DC 24…240 V</td>
<td>≤ 20 µF</td>
<td>isoEV425HC-D4-4 with AGH420</td>
<td>B71036401</td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>
### Technical data ISOMETER® isoEV425

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

**Definitions:**
- Supply circuit (IC)
- Output circuit (IC)
- Control circuit (IC)
- Rated voltage
- Overvoltage category
- Rated impulse voltage:
  - IC2/(IC3-4) 4 kV
  - IC 3/(IC4) 4 kV
- Rated insulated voltage:
  - IC2/(IC3-4) 250 V
  - IC 3/(IC4) 250 V
- Polution degree
- Protective separation (reinforced insulation) between:
  - IC2/(IC3-4) Overvoltage category III, 300 V
  - IC 3/(IC4) Overvoltage category III, 300 V

**Voltage test (routine test) according to IEC 61010-1:**
- IC2/(IC3-4) AC 2.2 kV
- IC 3/(IC4) Overvoltage category III, 300 V

#### Supply voltage

- Supply voltage \( U_i \) 100…240 V/DC 24…240 V
- Tolerance of \( U_i \) 15 %, DC +10 %
- Frequency range \( f \) 47…63 Hz
- Power consumption ≤ 2 W, ≤ 9 VA

#### IT system being monitored

- Nominal system voltage \( U_n \) with AGH420
  - 3(N)AC, AC 0…690 V/DC 0…1000 V
- Tolerance of \( U_n \) 15 %, DC +10 %
- Frequency range of \( U_n \) 47…63 Hz
- Overvoltage detection 31…1.15 kV (off)*
- Undervoltage detection 30…1.14 kV (off)*
- Relative uncertainty \( U \) ± 5 %, at least ± 5 V
- Hysteresis \( U \) 5 %, at least 5 V

#### Measuring circuit

- Permissible system leakage capacitance \( C_e \) (isoEV425) ≤ 20 μF
- Permissible system leakage capacitance \( C_e \) (isoEV425HC) ≤ 5 μF

#### Measuring circuit

- Response value \( R_{an} \) (isoEV425HC) 2…500 kΩ
- Response value \( R_{an} \) (isoEV425) 1…490 kΩ
- Relative uncertainty depending on the frequency ≥ 200 Hz -0.03 %/Hz
- Operating uncertainty ± 5 %, at least ± 5 V

#### Time response

- Time response \( t_{an} \) at \( R_i = 0.5 \times R_{an} \) and \( C_e = 1 \mu F \) acc. to IEC 61557-8
  - ≤ 10 s
- Start-up delay \( t \)
  - 0…10 s (0 s)*
- Response delay \( t_{an} \)
  - 0…99 s (0 s)*
- Delay on release \( t_{an} \)
  - 0…99 s (0 s)*

#### Display, memory

- LC display, multi-functional, not illuminated
- Display range measured value insulation resistance \( R_i \)
  - 1 kΩ…1 MCΩ
- Operating uncertainty \( R_i \) ≤ 5 kΩ
  - ± 15 %, at least ± 1 kΩ
- Operating uncertainty \( R_i \) > 100 kΩ ≤ 5 μF
  - ± 5 % \( R_i \) /100 kΩ +10%
- Display range measured value nominal system voltage \( U_n \)
  - 10…1.15 kV r.m.s.
- Operating uncertainty ± 5 %, at least ± 5 V
- Relative uncertainty depending on the frequency ≥ 200 Hz -0.03 %/Hz
- Display range measured value system leakage capacitance \( R_i > 10 \mu F \) (isoEV425)
  - 0…10 μF
- Display range measured value system leakage capacitance \( R_i > 10 \mu F \) (isoEV425HC)
  - 0…25 μF
- Operating uncertainty ± 15 %, at least ± 2 μF
- Password off/0…999 (0, off)*
- Fault memory alarm messages on/(off)*

#### Interface

- Interface/protocol RS-485/BMS, Modbus RTU, isoData
- Baud rate 9.6 kBit/s, Modbus RTU (selectable), isoData (115.2 kBit/s)
- Cable length (9.6 kBit/s)
  - ≤ 1200 m
- Cable: twisted pairs, shield connected to PE on one side min. 3-Y(S)Y 2x0.6
- Terminating resistor 120 Ω (0.25 W), internal, can be connected
- Device address, BMS bus, Modbus RTU 3…90 (3)*

#### Switching elements

- Switching elements 2 x 1 N/O contacts, common terminal 11
- Operating principle N/C operation/N/O operation (N/O operation)*
- Electrical endurance, number of cycles 10000

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

- Utilisation category AC-12 AC-14 DC-12 DC-12 DC-12
- Rated operational voltage 230 V 230 V 24 V 110 V 220 V
- Rated operational current 5 A 2 A 1 A 0.2 A 0.1 A
- Minimum contact rating 1 mA at AC/DC ≥ 10 V

#### Environment/EMC

- EMC IEC 61326-2-4

#### Ambient temperatures

- Operation -40…+70 °C
- Transport -40…+85 °C
- Storage -40…+70 °C

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

- Stationary use (IEC 60721-3-3) 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) 1K3 (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 type screw-type terminal or push-wire terminal
- Screw-type terminals:
  - Nominal current ≤10 A
  - Tightening torque 0.5…0.6 Nm (5…7 lb-in)
  - Conductor sizes AWG 24-12
  - Stripping length 8 mm
  - Rigid/flexible 0.2…2.5 mm²
  - Flexible with ferrules with/without plastic sleeve 0.25…2.5 mm²
  - Multi-conductor rigid 0.2…1.5 mm²
  - Multi-conductor flexible 0.2…1.5 mm²
  - Multi-conductor flexible with ferrules without plastic sleeve 0.25…2.5 mm²
  - Multi-conductor flexible with TWIN ferrules with plastic sleeve 0.5…1.5 mm²

#### Push-wire terminals:

- Nominal current ≤10 A
- Conductor sizes AWG 24-14
- Stripping length 10 mm
- Rigid 0.2…2.5 mm²
- Flexible without ferrules 0.75…2.5 mm²
- Flexible with ferrules with/without plastic sleeve 0.25…2.5 mm²
- Multi-conductor-flexible with TWIN ferrules with plastic sleeve 0.5…1.5 mm²
- Opening force 50 N
- Test opening, diameter 2.1 mm

#### Wiring of the terminals

- Up, AK7, GND, AK2 refer to technical data AGH420 under the heading “Connection”

#### Other

- Operating mode continuous operation
- Degree of protection, built-in components (DIN EN 60529) IP30
- Degree of protection, terminals (DIN EN 60529) IP20
- DIN rail mounting acc. to IEC 60715
- Screw fixing 2 x M4 with mounting clip
- Documentation number D00126
- Weight ≤ 150 g

----

* (* = factory setting)
### Insulation monitoring device ISOMETER® isoEV425 with coupling device AGH420

#### Technical data coupling device AGH420

<table>
<thead>
<tr>
<th>Category</th>
<th>Specification</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) between (L1/+, L2/-) and (AK1, GND, AK2, Up, E)</td>
<td>4.3 kV</td>
</tr>
<tr>
<td>Voltage test, routine test (IEC 61010-1)</td>
<td></td>
</tr>
</tbody>
</table>

#### IT system being monitored

- **Nominal system voltage range \( U_n \):**
  - AC/DC 0...1000 V
- **Tolerance of \( U_n \):**
  - AC/DC +10 %
- **Nominal system voltage range \( U_n \) (UL508):**
  - AC/DC 0...600 V

#### Measuring circuit

- **Measuring voltage \( U_m \):**
  - ±45 V
- **Measuring current \( I_m \) at \( R_f \):**
  - ≤ 400 μA
- **Internal 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

#### Connection

- **Connection type:**
  - push-wire terminal
- **Nominal current:**
  - ≤ 10 A
- **Conductor size:**
  - AWG 24...14
- **Shimming 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 \( U_n > 800 \text{ V} \):**
  - ≥ 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)

[Dimension diagram image]

---

**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) between (L1/+, L2/-) and (AK1, GND, AK2, Up, E)</td>
<td>4.3 kV</td>
</tr>
<tr>
<td>Voltage test, routine test (IEC 61010-1)</td>
<td></td>
</tr>
</tbody>
</table>

**IT system being monitored**

- **Nominal system voltage range \( U_n \):**
  - AC/DC 0...1000 V
- **Tolerance of \( U_n \):**
  - AC/DC +10 %
- **Nominal system voltage range \( U_n \) (UL508):**
  - AC/DC 0...600 V

**Measuring circuit**

- **Measuring voltage \( U_m \):**
  - ±45 V
- **Measuring current \( I_m \) at \( R_f \):**
  - ≤ 400 μA
- **Internal 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

**Connection**

- **Connection type:**
  - push-wire terminal
- **Nominal current:**
  - ≤ 10 A
- **Conductor size:**
  - AWG 24...14
- **Shimming 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 \( U_n > 800 \text{ V} \):**
  - ≥ 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)**

[Dimension diagram image]
Wiring diagram

Example of application

1. A1, A2 Connection to the supply voltage via a fuse. If supplied from an IT system, both lines have to be protected by a fuse.*
2. E, E, KE Connect each terminal separately to PE: The same wire cross section as for A1, A2 is to be used.
3. L1/+ , L2/- Connection to the 3(N)AC, AC or DC system to be monitored.
4. Up, AK1, GND, AK2 Connect the terminals of the AGH420 to the corresponding terminals of the ISOMETER®.
5. T/R Connection for external combined test and reset button.

* For UL applications: Only use 60/75°C copper lines! UL and CSA applications require the supply voltage to be protected via 5 A fuses.
**ISOMETER® isoCHA425**

Insulation monitoring device for unearthed DC systems (IT systems) DC 50 V up to 500 V

Suitable for the charging of electric vehicles acc. to Japanese charging standard CHAdeMO

**Device features**

- Monitoring the insulation resistance for DC charging stations according to Japanese charging standard CHAdeMO
- Detection of asymmetrical insulation faults in the DC system voltage range between 50 V and 500 V within 1 s
- Detection of symmetrical insulation faults within 10 s
- Measurement of the system voltage (true RMS) with undervoltage and overvoltage detection
- Measurement of DC system voltages to earth (L+/PE and L-/PE)
- Automatic adaptation to the system leakage capacitance up to 2 μF
- Selectable start-up delay, response delay and delay on release
- Two separately adjustable response value ranges of 5...250 kΩ (Alarm 1, Alarm 2)
- Alarm signalling via LEDs (AL1, AL2), a display and alarm relays (K1, K2)
- Automatic device self test with connection monitoring
- Selectable N/C or N/O relay operation
- Measured value indication via multifunctional LCD
- Fault memory can be activated
- RS-485 (galvanically isolated) including the following protocols:
  - BMS interface (Bender measuring device interface) for data exchange with other Bender components
  - Modbus RTU
  - IsoData (for continuous data output)
- Password protection to prevent unauthorised parameter changes

**Standards**

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

- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8
- CHAdeMO Spec V1.0

**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>System leakage capacitance C_e</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>≤ 2 μF</td>
<td>isoCHA425-D4-4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>B71036395</td>
</tr>
</tbody>
</table>

**Accessories**

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>
Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:

- Measuring circuit (IC1): L-, L+
- Supply circuit (IC2): A1, A2
- Output circuit (IC3): 11, 14, 24
- Control circuit (IC4): E, KE, T/R, A, B
- Rated voltage: 400 V
- Overvoltage category: III
- Rated impulse voltage:
  - IC1/(IC2-4): 6 kV
  - IC2/(IC3-4): 4 kV
  - IC3/IC4: 4 kV
- Rated insulation voltage:
  - IC1/(IC2-4): 400 V
  - IC2/(IC3-4): 250 V
  - IC3/IC4: 250 V
- Pole size: 3
- Protective separation (reinforced insulation) between:
  - IC1/(IC2-4): Overvoltage category III, 600 V
  - IC2/(IC3-4): Overvoltage category III, 300 V
  - IC3/IC4: Overvoltage category III, 300 V
- Voltage test (routine test) according to IEC 61010-1:
  - IC2/(IC3-4): AC 2.2 kV
  - IC1/(IC2-4): 6 kV
- Supply voltage
  - AC 100…240 V/DC 24…240 V
- Supply circuit (IC2)
  - IC 3/IC4: AC 2.2 kV
- Control circuit (IC4)
  - E, KE, T/R, A, B
- Output circuit (IC3)
  - 11, 14, 24
- Insulation resistance:
  - ±15 %, at least ±2 kΩ
- Delay on release t:
  - 0…99 s (0 s)*
- Response delay t:
  - 0…99 s (0 s)*
- Start-up delay t:
  - 0…10 s (0 s)*
- Response time an of
  - ±25 %, at least 1 kΩ
- Time response
  - Response time t20 of R20 = 0.5 s R20 and C2 = 1 μF according to IEC 61557-8 ≤ 1 s
- Relative uncertainty of R20 ±15 %, at least ±2 kΩ
- Hysteresis R20 ±25 %, at least 1 kΩ
- Overvoltage detection U< 10 V…>10 V; (off/10 V)*
- Hysteresis U5 %, at least 5 V
- Overvoltage detection U>
  - U<500 V; (off/500 V)*
- Response range:
  - ±5 %, at least ±5 V
- Time response
  -Response time t20 of R20 = 0.5 s R20 and C2 = 1 μF according to IEC 61557-8 ≤ 1 s

Interview

- 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: 1200 m
- Cable: twisted pair, shielded, connected to PE on one side
- Terminating resistors: 120 Ω (0.25 W), internal, can be connected
- Device address, BMS bus, Modbus RTU: 3…90 (3)*

Switching elements

- Switching elements: 2 x 1 contacts, common terminal 11
- Operating principle: N/C operation/N/O operation (N/C operation)*
- Electrical endurance, number of cycles: 10 000

Environment/EMC

- Ambient temperatures:
  - Operation: -40…+70 °C
  - Transport: -40…+85 °C
  - Storage: -40…+70 °C

Classification of mechanical conditions acc. to IEC 60721:

- Stationary use (IEC 60721-3-3):
  - JK7 (without condensation and formation of ice)
  - Transport (IEC 60721-3-2): JK4 (without condensation and formation of ice)
- Long-time storage (IEC 60721-3-1):
  - JKS (without condensation and formation of ice)

Connection

- Connection type: push-wire terminal
- Nominal current: ≤ 10 A
- Conductor sizes: AWG 24-14
- Stripping length: 10 mm
- Rigid: 0.2…2.5 mm²
  - Flexible without ferrules: 0.75…2.5 mm²
  - Flexible with ferrules with/plastic sleeve: 0.25…2.5 mm²
  - Multi-conductor flexible with THW ferrules with plastic sleeve: 0.5…1.5 mm²
  - Opening force: 50 N
- Test opening, diameter: 2.1 mm

Other

- Operating mode: continuous operation
- Mounting: cooling slots must be ventilated vertically
- Degree of protection, built-in components (DIN EN 60529): IP30
- Degree of protection, terminals (DIN EN 606529): IP20
- Enclosure material: polycarbonate
- DIN rail mounting acc. to IEC 60715
- Screw fixing: 2 x M4 with mounting clip
- Weight: ≤ 150 g

(*) = factory setting
1 A1, A2 Connection to the supply voltage via fuse (line protection): If supplied from an IT system, both lines have to be protected by a fuse.*
2 E, KE Connect each terminal separately to PE: The same wire cross section as for A1, A2 is to be used.
3 L+, L- Connection to the IT system to be monitored.
4 T/R Connection for the external combined test and reset button
5 11, 14 Connection to alarm relay K1
6 11, 24 Connection to alarm relay K2
7 A, B RS-485 communication interface with connectable terminating resistance.
   Example: Connection of a BMS-Ethernet-Gateway COM465IP

* For UL applications:
  Only use 60/75 °C copper lines!
  For UL and CSA applications, it is mandatory to use 5 A fuses for the protection of the supply voltage.
ISOMETER® 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 ground faults and lost ground line
- Measurement of a second voltage
- The device works when:
  - HV is unstable
  - HV is powered off
  - There are symmetric or asymmetric insulation faults
  - Faults exist between HV lines and the supply voltage
- Galvanic insulation of all signals from the HV side
- HV coupled network
- CAN bus interface
- Light weight: < 220 g (including housing and connection frame)
- iso165C-1 only: The iso165C-1 variant features Error and Warning signals on the separated high-side driver

Typical applications
- Monitoring for unearthed DC drive systems (IT systems) in electric vehicles

Approvals

Standards – corresponding norms and regulations

General
IEC 61557-8; IEC 60664-1; ISO 6469-3; ISO 23273-3

EMV
CISPR 25; ISO 7637-2; ISO 11452-2; ISO 11452-4; ISO 10605; IEC 61326-2-4; IEC 61000-4-4; E1 gem. 72/245/EWG/EEC; ISO 16750-2

Environmental
ISO 16750-1; ISO 20653; ISO 16750-3; IEC 60668-2-14; IEC 60668-2-27; IEC 60668-2-32; IEC 60668-2-64; ISO 16750-4; IEC 60668-2-1; IEC 60668-2-2; IEC 60668-2-38; IEC 60668-2-60; IEC 60668-2-78

Normative exclusion
The device has gone through an automotive test procedure in accordance with multi customer requirements as outlined by reg. ISO 16750-x. IEC 61557-8 will be fulfilled by creating an LED warning function and test button at the customer site if necessary.

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

Ordering information

<table>
<thead>
<tr>
<th>Nominal voltage</th>
<th>Supply voltage</th>
<th>Response value range</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC</td>
<td>DC</td>
<td>Alarm 1 (Warning): 30 kΩ…1 MΩ (default: 300 kΩ); Alarm 2 (Err): 40 kΩ…2 MΩ (default: 55 kΩ)</td>
<td>iso165C</td>
<td>B91068175</td>
</tr>
<tr>
<td>0…600 V</td>
<td>12 V</td>
<td>Alarm 1 (Warning): 30 kΩ…1 MΩ (customer setting: XXX kΩ); Alarm 2 (Err): 40 kΩ…2 MΩ (customer setting: XXX kΩ)</td>
<td>iso165C</td>
<td>B91068175C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Alarm 1 (Warning): 30 kΩ…1 MΩ (default: 300 kΩ); Alarm 2 (Err): 40 kΩ…2 MΩ (default: 55 kΩ)</td>
<td>iso165C-1</td>
<td>B91068176</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Alarm 1 (Warning): 30 kΩ…1 MΩ (customer setting: XXX kΩ); Alarm 2 (Err): 40 kΩ…2 MΩ (customer setting: XXX kΩ)</td>
<td>iso165C-1</td>
<td>B91068176C</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 $I_C$  5 A
Power dissipation $P_S$  < 2.5 W

Supervised IT system
Rated voltage range $U_n$  DC 0...600 V
Tolerance  +15 %
Frequency range  10 Hz...1 kHz
System leakage capacitance $C_e$  $\leq$ 1 μF
Withstand voltage test  AC 1.9 kV/1 min

Measuring circuit
Measurement method  Bender DCP technology
Measuring current $I_m$ at $R_F = 0$  ±33 μA
Impedance $Z_i$ at 50 Hz (HV1)  ≥ 1.2 MΩ (≥ 2.4 MΩ each, each line, high resistance in off state)
Internal resistance $R_i$ (HV1)  ≥ 1.2 MΩ (≥ 2.4 MΩ each, 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  0 Ω...50 MΩ
Insulation resistance duration/Pulse (normal operation)  ≥ 1.6 s (≥ 1 μF/0 MΩ)
Relative error (DCP)  100 kΩ...5 MΩ, ±15 %
Absolute error (DCP)  0 Ω...100 kΩ, ±15 kΩ
High-voltage range  0...600 V
High-voltage tolerance  0...100 V, ±5 V
100...600 V, ±5 %

High-side driver output (iso165C-1)
HST_1*  High-side driver 1, iso Warning
Maximum current, Iout_max  80 mA
HST_2*  High-side driver 2, iso Error
Maximum current, Iout_max  80 mA

Response values
iso165C
Response value Alarm 1 (Warning)  30 kΩ...1 MΩ (default: 300 kΩ)
Response value Alarm 2 (Error)  40 kΩ...2 MΩ (default: 55 kΩ)
iso165C-1
Response value Alarm 1 (Warning)  30 kΩ...1 MΩ (default: 400 kΩ)
Response value Alarm 2 (Error)  40 kΩ...2 MΩ (default: 250 kΩ)

Environment/EMC
EMC  IEC 61326-2-4
Overvoltage category/degree of pollution  II/2
Temperature range  -40...+85 °C
Range of application  5,000 m above sea level

Connectors (Tyco)
Receptacle housing type  1719183-1, 1719183-2, 1719183-3 (black, white, blue)
Receptacle drawing number  C-1719183
Contact type (tin plated)  5-963715-1
Contact wire range  0,50...0,75 mm²
Contact drawing number  929454
Crimp hand tool  539635-1

Other
Operating mode  Continuous operation
Degree of protection  IP5K0

Software version
iso165C  V1.0 - Release S010 (VIFC: V5.0 , IMC V5.0)
iso165C-1  V2.0 - Release S010 (VIFC: V10.0 , IMC V5.0)

Mounting
Recommended screws for mounting  4 x M5 (not included)
Max. tightening torque  2.25 ± 0.25 Nm (XX lvs-in)

* External 2.2 kΩ pull-down resistor to chassis ground (KL.31) is required.
Not protected against a short circuit in the event that KL.31 is missing.
Therefore, a 100 Ω resistor is required on each driver output.

** Fave = 10 is recommended for electric vehicles

Dimension diagram (dimensions in mm)
Typical application

Electrical Chassis / Protective equipotential bonding

Connectivity

<table>
<thead>
<tr>
<th>Connector</th>
<th>Type</th>
<th>Code</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>1719183-1</td>
<td>A</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>1719183-2</td>
<td>B</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>1719183-3</td>
<td>C</td>
</tr>
</tbody>
</table>

Please refer to “Technical Data” for detailed connector information.

Recommended screws (not included)

4 x M5
Fastening torque: 2.25 ± 0.25 Nm

Section view A-A
Scale: 2:1
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® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- DIN EN 50155
- IEC 61557-8
- DIN EN 45545-2

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

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

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 DC AC DC</td>
<td>0…440 V</td>
<td>15…460 Hz 100…240 V 47…63 Hz 24…240 V</td>
<td>&lt; 300 µF</td>
<td>isoRW425-D4W-4 B91037000W B71037000W</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>B980600008</td>
</tr>
</tbody>
</table>
Insulation monitoring devices | Application-specific selection – Railway

Technical data

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

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

Rated voltage: 440 V

Overvoltage category: III

Rated impulse voltage:
- IC1/(IC2-4): 6 kV
- IC2/(IC3-4): 4 kV
- IC3/(IC4): 4 kV

Rated insulated voltage:
- IC1/(IC2-4): 500 V
- IC2/(IC3-4): 250 V
- IC3/(IC4): 250 V

Polarity degree: 3

Protective separation (reinforced insulation) between:
- IC1/(IC2-4)
- Overvoltage category III, 600 V

Rated operational current:
- 5 A
- 2 A
- 1 A
- 0.2 A
- 0.1 A

Minimum contact rating: 1 mA at AC/DC ≥ 10 V

Contact data acc. to IEC 60947-5-1:
- Utilisation category: AC-12
- Rated operational voltage: 230 V
- Rated operational current: 5 A
- Minimum contact rating: 1 mA

Switching elements
- Switching elements: 2 x 1 N/O contacts, common terminal 11

Operating principle:
- N/C operation/N/O operation (N/O operation)*

Electrical endurance, number of cycles: 10000

Environment/EMC
- EMC: IEC 61326-2-4, DIN EN50121-3-2

Ambient temperatures:
- Operation: -40…+70 °C
- Transport: -50…+85 °C
- Storage: -55…+85 °C

Climatic class acc. to IEC 60721
- Static operation: Th (9.6 kbit/s), Modbus RTU (selectable), isoData (115.2 kbits/s)

Stationary use (IEC 60721-3-3)
- Temperature: 3K7
- Transport: (IEC 60721-3-2) 2K4
- Long-time storage (IEC 60721-3-1) 1K6

Classification of mechanical conditions acc. to IEC 60721
- Stationary use (IEC 60721-3-3) 3K7
- Transport (IEC 60721-3-2) 2M2
- Long-term storage (IEC 60721-3-1) 1M3

Connection
- Connection type: 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: 10 mm
- Rigid: 0.2…2.5 mm²
- Flexible without ferrules: 0.25…2.5 mm²

Multi-conductor rigid:
- 0.2…1.5 mm²
- Multi-conductor flexible:
- 0.2…1.5 mm²

Multi-conductor flexible with THW ferrules with plastic sleeve:
- 0.25…1.5 mm²

Push-wire-terminal:
- Nominal current: ≤ 10 A
- Conductor sizes: AWG 24-14
- Stripping length: 10 mm
- Rigid: 0.2…2.5 mm²
- Flexible without ferrules: 0.25…2.5 mm²

Multi-conductor flexible with THW ferrules with plastic sleeve:
- 0.25…1.5 mm²

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

Other
- Operating mode: continuous operation
- Mounting: cooling slots must be ventilated vertically
- Degree of protection, built-in components (DIN EN 60529):
  - IP30
- Degree of protection, terminals (DIN EN 60529):
  - IP20
- Exposure material: polycarbonate
- DIN rail mounting acc. to:
  - DIN 43860
- Screw fixing:
  - 2 x M4 with mounting clip
- Documentation number: DI0052
- Weight:
  - ≤ 150 g

* Factory setting
ISOMETER® isoRW425

Wiring diagram

1. A1, A2 - Connection to the supply voltage via fuse (line protection). If supplied from an IT system, both lines have to be protected by a fuse.*

2. E, KE - Connect each terminal separately to PE. The same wire cross section as for A1, A2 is to be used.

3. L1+, L2/- - Connection to the 3(N)AC, AC or DC system to be monitored

4. T/R - Connection for the external combined test and reset button.

5. 11, 14 - Connection to alarm relay K1

6. 11, 24 - Connection to alarm relay K2

7. A, B - RS-485 communication interface with connectable terminating resistance.

For UL applications:
- Only use 60/75°C copper lines!
- For UL and CSA applications, it is mandatory to use 5 A fuses for the protection of the supply voltage.

* For UL applications:
- Only use 60/75°C copper lines!
**ISOMETER® isoUG425**

Insulation monitoring device for unearthed DC systems (IT systems) up to 120 V

---

**Device features**

- Überwachung des unsymmetrischen Isolationswiderstandes für ungeerdete DC-Systeme
- Messung der Netzspannung (RMS und DC) mit Unter-/Überspannungserkennung
- Messung der DC-Spannungen Netz gegen Erde (L+/PE und L-/PE)
- Parametrierbare Anpassung an die Netzableitkapazität bis 50 μF
- Anlauf-, Ansprech- und Rückfallverzögerung einstellbar
- Zwei getrennt einstellbare Ansprechwert-Bereiche von 1…100 kΩ (Alarm 1, Alarm 2)
- Alarme werden über LEDs (AL1, AL2), ein Display und Alarmrelais (K1, K2) ausgegeben
- Ruhe- oder Arbeitsstromverhalten der Relais wählbar
- Messwertaufzeichnung über multifunktionales LC-Display
- Fehlerspeicherung aktivierbar
- RS-485 (galvanisch getrennt) mit folgenden Protokollen:
  - BMS-Schnittstelle (Bender-Messgeräte-Schnittstelle) zum Datenaustausch mit anderen Bender-Komponenten
  - Modbus RTU
  - IsoData (für kontinuierliche Datenausgabe)
- Passwortschutz gegen unbefugtes Ändern von Parametern

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**Standards**

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

- DIN EN 50155

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**Further information**

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

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**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</td>
<td>DC</td>
<td>DC</td>
<td></td>
<td>isoUG425-D4-4</td>
</tr>
<tr>
<td>100…240 V, 47…63 Hz</td>
<td>24…240 V</td>
<td>12…120 V</td>
<td>≤ 50 μF</td>
<td>isoUG425-D4-4</td>
</tr>
</tbody>
</table>

---

**Accessories**

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting</td>
<td>B98060008</td>
</tr>
</tbody>
</table>
### Technical data

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

**Definitions:**
- Measuring circuit (IC1): L1/+, L2/-
- Supply circuit (IC2): A1, A2
- Output circuit (IC3): 11, 14, 24
- Control circuit (IC4): E, KE, 1/2 R, A, 0

#### Rated parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>400 V</td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>III</td>
</tr>
<tr>
<td>Rated impulse voltage:</td>
<td></td>
</tr>
<tr>
<td>(IC1)/(IC2-4)</td>
<td>6 kV</td>
</tr>
<tr>
<td>(IC2)/(IC3-4)</td>
<td>4 kV</td>
</tr>
<tr>
<td>(IC3)/(IC4)</td>
<td>4 kV</td>
</tr>
<tr>
<td>Rated insulated voltage:</td>
<td></td>
</tr>
<tr>
<td>(IC1)/(IC2-4)</td>
<td>400 V</td>
</tr>
<tr>
<td>(IC2)/(IC3-4)</td>
<td>250 V</td>
</tr>
<tr>
<td>(IC3)/(IC4)</td>
<td>250 V</td>
</tr>
<tr>
<td>Pollution</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Protective separation (reinforced insulation) between:
- Overvoltage category III, 600 V
- Overvoltage category III, 100 V
- Overvoltage category III, 100 V

#### Voltage test (routine test) according to IEC 61010-1:
- Overvoltage category III, 600 V
- Overvoltage category III, 300 V

### Supply voltage

<table>
<thead>
<tr>
<th>Supply voltage</th>
<th>AC 100…240 V/DC 24…240 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tolerance of U</td>
<td>-30…+15 %</td>
</tr>
<tr>
<td>Frequency range</td>
<td>47…63 Hz</td>
</tr>
<tr>
<td>Power consumption</td>
<td>≤ 3 W, ≤ 9 VA</td>
</tr>
</tbody>
</table>

#### IT system being monitored

<table>
<thead>
<tr>
<th>Nominal system voltage</th>
<th>DC 12…120 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tolerance of U</td>
<td>+20 %</td>
</tr>
</tbody>
</table>

#### Measuring circuit

- Internal resistance R ≤ 115 kΩ
- Permissible system leakage capacitance C ≤ 50 μF

#### Response values

<table>
<thead>
<tr>
<th>Response value</th>
<th>2…100 kΩ (50 kΩ)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>R&lt;sub&gt;min&lt;/sub&gt;</td>
<td>1…95 kΩ (25 kΩ)*</td>
</tr>
<tr>
<td>Relative uncertainty</td>
<td>±15 %, at least ±2 kΩ</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>25 %, at least 1 kΩ</td>
</tr>
</tbody>
</table>

#### Undervoltage detection U<sub>DC</sub>

| Under detection | 8…143 V (off)* |

#### Overvoltage detection U<sub>DC</sub>

| Over detection | 8.1…144 V (off)* |

#### Hysteresis

| DC | 5 %, at least 1 V |

#### Time response

<table>
<thead>
<tr>
<th>Time response</th>
<th>t (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start-up delay</td>
<td>0…10 s (8 Ω)*</td>
</tr>
<tr>
<td>Response delay</td>
<td>0…99 s (8 Ω)*</td>
</tr>
<tr>
<td>Delay on release</td>
<td>0…59 s (8 Ω)*</td>
</tr>
</tbody>
</table>

### Displays, memory

- Display: LC display, multi-functional, not illuminated
- Display range measured value insulation resistance (R<sub>0</sub>): 1 kΩ…1 MΩ
- Operating uncertainty: ±15 %, at least ±2 kΩ
- Display range measured value nominal system voltage (U<sub>0</sub>): 0…150 V (U<sub>0</sub> =∞: 300 V, R<sub>0</sub> = 0 kΩ: 150 VP)

#### Operating uncertainty

- U<sub>DC</sub>: ±5 %, at least ±0.5 V
- Hysteresis U<sub>DC</sub>: 5 %, at least 1 V

### 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)

### Environment/EMC

- EMC: IEC 61326-2-4

### Ambient temperatures:

- Operation: -40…+70 °C
- Transport: -40…+65 °C
- Storage: -40…+70 °C

### 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 terminal
- Nominal current: ≤ 10 A
- Conductor size: AWG 24-14
- Stripping length: 10 mm
- Rigid: 0.2…2.5 mm²
- Flexible without ferrules: 0.75…2.5 mm²
- Flexible with ferrules with/without plastic sleeve: 0.25…2.5 mm²
- Multi-conductor flexible with TWI ferrules with plastic sleeve: 0.5…1.5 mm²
- Opening force: 50 N
- Test opening, diameter: 2.1 mm

### Other

- Operating mode: continuous operation
- Mounting: cooling slots must be ventilated vertically
- Degree of protection, built-in components (DIN EN 60529): IP30
- Degree of protection, terminals (DIN EN 60529): IP20
- Enclosure material: polycarbonate
- DIN rail mounting acc. to IEC 60715
- Screw fixing: 2 x M4 with mounting clip
- Documentation number: D00220
- Weight: ≤ 150 g

### Interface/protocol

- RS-485/BMS, Modbus RTU, isoData
- Baud rate: BMS (9.6 kbit/s), Modbus RTU (selectable), isoData (115.2 kbit/s)
- Cable length (9.6 kbit/s): ≤ 1200 m
- Cable: twisted pairs, shield connected to PE on one side
- Terminating resistor: 120 Ω (0.25 W), internal, can be connected
- Device address, BMS bus, Modbus RTU: 3…90 (3)
1 A1, A2 Connection to the supply voltage via fuse (line protection). If being supplied from an IT system, both lines have to be protected by a fuse.*

2 E, KE Connect each terminal separately to PE: The same wire cross section as for A1, A2 is to be used

3 L1/+, L2/– Connection to the DC system to be monitored

4 T/R Connection for the external combined test and reset button

5 11, 14 Connection to alarm relay K1

6 11, 24 Connection to alarm relay K2

7 A, B RS-485 communication interface with connectable terminating resistor

*For UL applications:
Only use 60/75°C copper lines!
For UL and CSA applications, it is mandatory to use 5 A fuses for the protection of the supply voltage.
ISOMETER® isoES425
Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems) for energy storage devices up to AC/DC 400 V

Device features
- Insulation monitoring for unearthed systems AC/DC
- Measurement of the mains voltage (r.m.s.) with undervoltage and overvoltage detection
- Measurement of DC voltages system to earth (L1+/PE und L2-/PE)
- Automatic adaptation to the system leakage capacitance up to 100 μF
- Selectable start-up delay, response delay and delay on release
- Two separately adjustable response value ranges of 1…990 kΩ (Alarm 1, Alarm 2)
- Alarm signalling via LEDs (AL1, AL2), a display and alarm relays (K1, K2)
- Automatic device self test with connection monitoring
- N/C operation or N/O operation of the relays selectable
- Measured value indication via multifunctional LCD
- Fault memory can be activated
- RS-485 (galvanically isolated) including the following protocols:
  - BMS interface (Bender measuring device interface) for data exchange with other Bender components
  - IsoData (for continuous data output)
- Password protection to prevent unauthorised parameter changes

Typical applications
- Monitoring the earth connection during network operation and monitoring the electrical installation during isolated operation.

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

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

<table>
<thead>
<tr>
<th>Nominal system voltage $U_n$</th>
<th>Supply voltage $U_S$</th>
<th>System leakage capacitance $C_e$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC/DC</td>
<td>AC</td>
<td>DC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0…400 V, 15…460 Hz</td>
<td>100…240 V, 47…63 Hz</td>
<td>24…240 V</td>
<td>&lt; 100 μF</td>
<td>isoES425-D4-4</td>
</tr>
</tbody>
</table>

Accessories
- Mounting clip for screw mounting (1 piece per device)

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

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

Rated voltage: 400 V

Overvoltage category: III

Rated impulse withstand voltage:
- IC1/(IC2-4) 6 kV
- IC2/(IC3-4) 4 kV
- IC 3/(IC4) 4 kV

Rated insulation voltage:
- IC1/(IC2-4) 400 V
- IC2/(IC3-4) 250 V
- IC 3/(IC4) 250 V

Pollution degree: 3

Protective separation (reinforced insulation) between:
- IC1/(IC2-4) Overvoltage category III, 600 V
- IC2/(IC3-4) Overvoltage category III, 300 V
- IC 3/(IC4) Overvoltage category III, 300 V

Voltage tests (routine test) acc. to IEC 61010-1:
- K2/(K3-4) DC 2.2 kV
- IC 3/(IC4) AC 2.2 kV

Supply voltage
- Supply voltage U_{in} AC 100…240 V/DC 24…240 V
- Tolerance of U_{in} ± 15 %, at least ±1 kΩ
- Frequency range U_{in} 47…63 Hz
- Power consumption ≤ 3 W, ≤ 9 VA

Measuring circuit
- Measuring voltage U_{m} ± 12 V
- Measuring current I_{m} ≤ 110 μA
- Internal resistance R_{i} ≥ 115 kΩ
- Permissible leakage capacitance C_{e} ≤ 100 μF
- Permissible external DC voltage U_{e} ≤ 700 V

Response values
- Response value R_{R1} 2…990 kΩ (69 kΩ)
- Response value R_{R2} 1…980 kΩ (23 kΩ)
- Operating uncertainty R_{U} ± 15 %, at least ±1 kΩ
- Hysteresis R_{H} 25 %, at least 1 kΩ
- Undervoltage detection U_{L} 10…499 V (off)*
- Overvoltage detection U_{H} 11…500 V (off)*
- Operating uncertainty U_{S} ± 5 %, at least ±5 V
- Frequency dependent operating uncertainty ≥ 400 Hz
- Hysteresis U_{H} 5 %, at least 5 V

Time response
- Response time t_{R} at R_{H} = 0.5 x R_{R1} and C_{e} = 1 μF acc. to IEC 61557-8 ≤ 10 s
- Start-up delay t_{S} 0…10 s (0 s)*
- Response delay t_{R} 0…99 s (0 s)*
- Delay on release t_{U} 0…99 s (0 s)*

Displays, memory
- Display LC display, multi-functional, not illuminated
- Display range measured value insulation resistance (R_{H}) 1 kΩ…4 MΩ
- Operating uncertainty ± 15 %, at least ±1 kΩ
- Display range measured nominal system voltage value (U_{l}) 0…500 V ± 1 μs
- Operating uncertainty U_{L} ± 5 %, at least ±5 V
- Display range measured leakage capacitance value for R_{H} > 10 kΩ 0…105 μF
- Operating uncertainty ± 15 %, mindestens ±2 μF
- Password off/0…999 (0, off)*
- Fault memory alarm message on/(off)*

Environment/EMC
- EMC IEC 61326-2-4,
- Ambient temperatures:
  - Operation -25…+70 °C
  - Transport -40…+85 °C
  - Storage -25…+70 °C

Climatic class acc. to IEC 60721:
- Stationary use (IEC 60721-3-3) 3K8 (without condensation and icing)
- Transport (IEC 60721-3-2) 2K3 (without condensation and icing)
- Long-time storage (IEC 60721-3-1) 1K4 (without condensation and icing)

Classification of mechanical conditions acc. to IEC 60721:
- Stationary use (IEC 60721-3-3) 3MA
- Transport (IEC 60721-3-2) 2MA
- 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
- Cross-section rigid 0.2…2.5 mm²
- Flexible without ferrules 0.75…2.5 mm²
- Flexible with ferrules, with/witout plastic collar 0.25…2.5 mm²
- Multiple conductor, flexible with TWIN ferrule with plastic sleeve 0.5…1.5 mm²
- Opening force 50 N
- Test opening, diameter 2.1 mm

Other
- Operating mode Continuous operation
- Temperature Cooling slots must be ventilated vertically
- Degree of protection, built-in components (DIN EN 60529) IP30
- Degree of protection, terminals (DIN EN 60529) IP20
- Enclosure material Polycarbonate
- DIN rail mounting acc. to IEC 60715
- Screw fixing 2 x M4 with mounting clip
- Weight ≤ 150 g

(* = Factory setting)
1 A1, A2 Connection to the supply voltage via a fuse. If supplied from an IT system, both lines have to be protected by a fuse.*
2 E, KE Connect each terminal separately to PE. The same wire cross section as for A1, A2 is to be used.
3 L1+, L2– Connection to the AC or DC system to be monitored.
4 T/R Connection for external combined test and reset button.
5 11, 14 Connection to alarm relay K1
6 11, 24 Connection to alarm relay K2
7 A, B RS-485 communication interface with selectable terminating resistance.

* For UL applications: Only use 60/75°C copper lines!
For UL and CSA applications, it is mandatory to use 5 A fuses for the protection of the supply voltage.
**ISOMETER® isoGEN423**

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems) up to 3(N)AC, AC 400 V, DC 400 V, suitable for the application of generators acc. to standard DIN VDE 0100-551

---

- **Device features**
  - Monitoring the insulation resistance for unearthed AC/DC systems
  - Measurement of the system voltage (true r.m.s.) with undervoltage and overvoltage detection
  - Measurement of DC system voltages to earth (L1+/PE and L2-/PE)
  - Two operating modes: GEn and DC
  - Automatic adaptation to the system leakage capacitance up to 5 μF
  - Selectable start-up delay, response delay and delay on release
  - Two separately adjustable response value ranges of 5…200 kΩ (Alarm 1, Alarm 2)
  - Alarm signalling via LEDs (AL1, AL2), a display and alarm relays (K1, K2)
  - Automatic device self test with connection monitoring
  - Selectable N/C or N/O relay operation
  - Measured value indication via multifunctional LCD
  - Fault memory can be activated
  - RS-485 (galvanically isolated) including the following protocols:
    - BMS interface (Bender measuring device interface) for data exchange with other Bender components
    - Modbus RTU
    - IsoData (for continuous data output)
  - Password protection to prevent unauthorised parameter changes

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

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### Ordering information

<table>
<thead>
<tr>
<th>Version</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Push-wire terminal</td>
<td>isoGEN423-04-4</td>
<td>B71063625</td>
</tr>
</tbody>
</table>

### Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>
Insulation monitoring device ISOMETER® isoGEN423

### Technical data

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

**Definitions:**
- Measuring circuit (IC1)
- Supply circuit (IC2)
- Control circuit (IC4)

#### Rated operational values:

- **Rated voltage:** 400 V
- **Overvoltage category:** III

#### Rated impulse voltage:

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

- **Rated insulation voltage:**
  - (IC1)/(IC2-4) 400 V
  - (IC2)/(IC3-4) 250 V
  - (IC3)/(IC4) 250 V

#### Pollution degree

3

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

- Overvoltage category III, 600 V
- Overvoltage category III, 300 V
- Overvoltage category III, 100 V

#### Supply voltage

- Supply voltage $U_{n}$
- AC 100...240 V/DC 24...240 V

#### Measuring circuit

- Measuring value $U_{m}$
- Measuring current $I_{m}$, $Z_{m} = 0$
- Internal resistance $R_{i}$
- Permissible system leakage capacitance $C_{p}$
- Permissible extraneous DC voltage $U_{dB} \leq 700 V$

#### Response values

- Response value $R_{1}$
- $R_{2} \ldots 200 k\Omega$ (46 kΩ)*
- Response value $R_{3}$
- $5 k\Omega \ldots R_{x} (23 k\Omega)^{*}$
- Relative uncertainty
  - ±15 %, at least ±2 kΩ
- Hysteresis $R_{h}$
- 25 %, at least 1 kΩ
- Undervoltage detection $U_{<}$
- $10 V \ldots (off/10 V)^{*}$
- Overvoltage detection $U_{>}$
- $U_{<} \ldots 500 V$ (off/500 V)*
- Relative uncertainty
  - ±5 %, at least ±5 %
- Hysteresis $U_{h}$
- 5 %, at least 5 V

#### Time response

- Response time $t_{R}$ of $R_{0} = 0.5 x R_{0}$, and $C_{p} = 1 \mu F$ according to IEC 61557-8
  - $t_{R} \leq 1 s$
- Start-up delay $t_{S}$
  - 0...10 s (B)*
- Response delay $t_{R}$
  - 0...99 s (B)*
- Delay on release $t_{D}$
  - 0...99 s (B)*

#### Displays, memory

- **Display**
  - LC display, multi-functional, not illuminated
- **Display range measured value insulation resistance ($R_{0}$)**
  - 1 kΩ...2 MΩ
- **Operating uncertainty**
  - ±15 %, at least ±2 kΩ
- **Display range measured value nominal system voltage ($U_{n}$)**
  - 0...500 V RMS
- **Operating uncertainty**
  - ±5 %, at least ±5 V
- **Display range measured value system leakage capacitance of ($R_{0} > 10 k\Omega$)**
  - ±17 μF
- **Operating uncertainty of RF ≥ 20 kΩ and $C_{p} < 5 \mu F$**
  - ±15 %, at least ±0.1 μF
- **Password**
  - 0...999 (0, off)*
- **Fault memory alarm messages**
  - on/off(*)

#### Interface/protocol

- **Interface**
  - 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, shielded pair PE on one side
  - min. 3 x yellow / black 0.6
- **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 contacts, common terminal T1
- **Operating principle**
  - N/O operation/N/O operation (N/O operation)*
- **Electrical endurance, number of cycles**
  - 10 000
- **Contact data acc. to IEC 60947-5-1:**
  - Utilisation category
    - AC-12, AC-14, DC-12, DC-12, DC-12
  - **Rated operational voltage**
    - 230 V, 230 V, 24 V, 110 V, 220 V
  - **Rated operational current**
    - 5 A, 2 A, 1 A, 0.2 A, 0.1 A
  - **Minimum contact rating**
    - 1 mA at AC/DC ≥ 10 V

#### Environment/EMC

- **EMC**
  - IEC 61326-2-4
- **Ambient temperatures:**
  - Operation
    - −40...+70 °C
  - Transport
    - −40...+85 °C
  - Storage
    - −40...+70 °C

#### Climatic class acc. to IEC 60721:

- **Stationary use**
  - IEC 60721-3-3
  - 3K7 (without condensation and formation of ice)
- **Transport (IEC 60721-3-2)**
  - 2K4 (without condensation and formation of ice)
- **Long-time storage (IEC 60721-3-1)**
  - 1K5 (without 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 type**
  - push-wire terminal
- **Nominal current**
  - ≤ 10 A
- **Conductor sizes**
  - AWG 24–14
- **Stripping length**
  - 10 mm
- **rigid**
  - 0.2...2.5 mm² flexible without ferrules
  - 0.75...2.5 mm² flexible with ferrules with/plastic sleeve
  - 0.25...2.5 mm² Multi-conductor flexible with TWIN ferrules with plastic sleeve
  - 0.5...1.5 mm²
  - 50 kN
  - Test opening, diameter
    - 2.1 mm

#### Other

- **Operating mode**
  - continuous operation
- **Mounting**
  - cooling slots must be ventilated vertically
- **Degree of protection, terminals (DIN EN 60529)**
  - IP00
- **Degree of protection, terminals (DIN EN 60529)**
  - IP20
- **Enclosure material**
  - polycarbonate
- **DIN rail mounting acc. to IEC 60715**
  - 2 x M4 with mounting clip
- **Documentation number**
  - D00221
- **Weight**
  - ≤ 150 g

(*) = factory setting
1 A1, A2  Connection to the supply voltage via fuse (line protection).
   If supplied from an IT system, both lines have to be protected by a fuse.*
2 E, KE  Connect each terminal separately to PE:
   The same wire cross section as for A1, A2 is to be used.
3 L1/+, L2/-  Connection to the IT system to be monitored
4 T/R  Connection for the external combined test and reset button.
5 11, 14  Connection to alarm relay K1
6 11, 24  Connection to alarm relay K2
7 A, B  RS-485 communication interface with connectable terminating resistance.

* For UL applications:
   Only use 60/75°C copper lines!
   For UL and CSA applications, it is mandatory to use 5 A fuses for the protection of the supply voltage.
**ISOMETER® isoGEN523**

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems) up to 3(N)AC, AC 400 V, DC 400 V, suitable for use in applications using generators according to DIN VDE 0100-551

### Device features
- Monitoring the insulation resistance for unearthed AC/DC systems
- Measurement of the system voltage (true r.m.s.) with undervoltage and overvoltage detection
- Measurement of DC system voltages to earth (L1+/PE and L2-/PE)
- Two operating modes: GEn and DC
- Automatic adaptation to the system leakage capacitance up to 5 μF
- Selectable start-up delay, response delay and delay on release
- Two separately adjustable response value ranges of 5…200 kΩ (Alarm 1, Alarm 2)
- Automatic device self test with connection monitoring
- Selectable N/C or N/O relay operation
- 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)

### Standards
The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8
- DIN VDE 0100-551

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

<table>
<thead>
<tr>
<th>Version</th>
<th>Supply voltage $U_s$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital interface</td>
<td>100…240 V, 24…240 V</td>
<td>isoGEN523-34-4</td>
<td>B91016330</td>
</tr>
</tbody>
</table>
### Technical data

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

<table>
<thead>
<tr>
<th>Definitions</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring circuit (IC1)</td>
<td>3 (1.1+) + 4 (0.2)</td>
</tr>
<tr>
<td>Supply circuit (IC2)</td>
<td>1 (A), 2 (K2)</td>
</tr>
<tr>
<td>Output circuit (IC3)</td>
<td>9 (11), 10 (14), 11 (24)</td>
</tr>
<tr>
<td>Control circuit (IC4)</td>
<td>12 (E), 5 (KE), 6 (TR), 7 (A), 8 (IB)</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>400 V</td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>III</td>
</tr>
<tr>
<td>Rated impulse voltage:</td>
<td></td>
</tr>
<tr>
<td>IC1/(IC2-4)</td>
<td>6 kV</td>
</tr>
<tr>
<td>IC2/(IC3-4)</td>
<td>4 kV</td>
</tr>
<tr>
<td>IC3/IC4</td>
<td>4 kV</td>
</tr>
<tr>
<td>Rated insulation voltage:</td>
<td></td>
</tr>
<tr>
<td>IC1/(IC2-4)</td>
<td>400 V</td>
</tr>
<tr>
<td>IC2/(IC3-4)</td>
<td>250 V</td>
</tr>
<tr>
<td>IC3/IC4</td>
<td>250 V</td>
</tr>
<tr>
<td>Pollution degree</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Measurability

- **Relative uncertainty**: ± 5 %, at least ± 5 V
- **Measuring voltage**: ± 5 %, at least ± 5 V
- **Measuring current**: \( m \) at \( i \), \( R \)
- **Permissible system leakage capacitance**: \( C_e \) \( \leq 5 \mu F \)
- **Hysteresis**: \( \text{Response value} \) \( an_2 \) \( \geq 5 \, \text{k} \)
- **RHysteresis**: 24 \( \mu F \) \( \geq \) and \( 5 \mu F \)
- **F = 0.5 \times \) \( R \geq 20 \text{k} \)

<table>
<thead>
<tr>
<th>Measurements, storage</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured value insulation resistance ( R_h )</td>
<td>1 \text{ko} \ldots 2 \text{MC}</td>
</tr>
<tr>
<td>Operating uncertainty</td>
<td>( \pm 15 % ), at least ( \pm 2 ) \text{ko}</td>
</tr>
<tr>
<td>Measured value nominal system voltage ( U_{n} )</td>
<td>0 \ldots 500 \text{Vr.m.s}</td>
</tr>
</tbody>
</table>
| Operating uncertainty | \( \pm 5 \% \), at least \( \pm 5 \text{V} \)
| Measured value system leakage capacitance at \( R_h > 10 \text{ko} \) ("dc" mode only) | \( \ldots 17 \mu F \) |
| Operating uncertainty at \( R_h > 20 \text{ko} \) and \( C_e \leq 5 \mu F \) | \( \pm 5 \% \), at least \( \pm 0.1 \mu F \) |
| Password | off/0 \ldots 999 (0, off) |
| Fault memory alarm messages | on/(off) |

#### Interface

- **Interface/protocol**: RS-485/BMS, Modbus RTU, isoData
- **Baud rate**: BMS (9.6 kbits/s), Modbus RTU (selectable), isoData (115.2 kbits/s)
- **Cable length**: \( 0.6 \text{kbits/s} \) \( \leq 1200 \text{m} \)
- **Cable**: twisted pair, shield connected to PE on one side
- **Min. J-Y(St)Y**: 2 x 0.6
- **Terminating resistor**: 120 \text{Ω} (+0.25 \text{V}), external
- **Device address**: BMS bus, Modbus RTU
- **Communication interface**: 3 \ldots 90 (3) |

#### Ambient temperatures

- **Operation**: -40 \ldots +70 °C
- **Transport**: -40 \ldots +85 °C
- **Storage**: -40 \ldots +70 °C

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

- **Stationary use (IEC 60721-3-2) ** | 3K8 |
- **Long-term storage (IEC 60721-3-1)** | 1K6 |
- **Classification of mechanical conditions acc. to IEC 60721:** | 3M7 |
- **Long-term storage (IEC 60721-3-1)** | 1M3 |

#### Connection type

- **Connection type**: 0.8 m connecting wire
- **Minimum bending radius of the connecting cable**: \( > 40 \mu m \)

#### Other

- **Operating mode**: continuous operation
- **Degree of protection, built-in components (DIN EN 60529)**: IP65
- **Enclosure material**: polycarbonate (filled with Wevo PUR403FL)
- **Screw mounting**: 2 x M4
- **Tightening torque**: max. \( 2 \times 25 \text{lb-in} \)
- **Fitting function**: max. 3 \text{Nm} (26 lb-in)
- **Documentation number**: D00320
- **Weight**: \( \leq 600 \text{g} \)

---

#### Dimension diagram

- **Signal cable**: 86
- **Front view**: 23.5
- **Side view**: 70
- **Bottom view**: 95

---

**Technical data**

<table>
<thead>
<tr>
<th>Dimensions (in mm)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal cable (Wires 1-12)</td>
<td></td>
</tr>
<tr>
<td>Front view</td>
<td></td>
</tr>
<tr>
<td>Side view</td>
<td></td>
</tr>
<tr>
<td>Bottom view</td>
<td></td>
</tr>
</tbody>
</table>
### Wiring diagram

**Wire number** | **Terminal** | **Connections** |
---|---|---|
1 | A1 | 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 | A2 | |
3 | L1 | Connection to the system to be monitored |
4 | L2 | Connection to the system to be monitored |
5 | KE | Connect to PE |
6 | T/R | Connection for the external combined test and reset button |

<table>
<thead>
<tr>
<th>Wire number</th>
<th>Terminal</th>
<th>Connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>A</td>
<td>Serial communication interface</td>
</tr>
<tr>
<td>8</td>
<td>B</td>
<td>Example: Connection of a BMS Ethernet gateway COM465IP</td>
</tr>
<tr>
<td>9</td>
<td>11</td>
<td>Common connection for K1 and K2</td>
</tr>
<tr>
<td>10</td>
<td>14</td>
<td>Connection to alarm relay K1</td>
</tr>
<tr>
<td>11</td>
<td>24</td>
<td>Connection to alarm relay K2</td>
</tr>
<tr>
<td>12</td>
<td>E</td>
<td>Connect to PE</td>
</tr>
</tbody>
</table>
ISOMETER® isoHV425 with coupling device AGH422

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT system) up to 3(N)AC, AC 1000 V, DC 1000 V

Device features

- Monitoring the insulation resistance for unearthed AC/DC systems
- Measurement of the mains voltage (true r.m.s.) with undervoltage and overvoltage detection
- Measurement of DC system voltages to earth (L1+/PE and L2-/PE)
- Automatic adaptation to the system leakage capacitance up to 150 μF
- Selectable start-up delay, response delay and delay on release
- Two separately adjustable response value ranges of 10…500 kΩ (Alarm 1, Alarm 2)
- Alarm signalling via LEDs (AL1, AL2), a display and alarm relays (K1, K2)
- Automatic device self test with connection monitoring
- Selectable N/C or N/O relay operation
- Measured value indication via a multifunctional LC display
- Fault memory can be activated
- RS-485 (galvanically separated) including the following protocols:
  – BMS interface (Bender measuring device interface) for data exchange with other Bender components
  – Modbus RTU
  – IsoData (for continuous data output)
- Password protection to prevent unauthorised parameter changes

Standards

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

- DIN EN 61557-8 (VDE 0413-8)
- DIN EN 50155
- IEC 61557-8
- DIN EN 45545-2

Further information

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

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage Uₘ</th>
<th>Nominal voltage Uₙ</th>
<th>Version</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…1000 V</td>
<td>Push-wire terminal</td>
<td>isoHV425-D4-4 with AGH422 B71036501</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>isoHV425W-D4-4 with AGH422W B71036501W</td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>

Typical applications

- AC main circuits up to 1000 V
- DC main circuits up to 1000 V
- Systems including switched-mode power supplies
Technical data ISOMETER® isoHV425

Insulation monitoring devices | Main circuits

Insulation monitoring device ISOMETER® isoHV425 with coupling device AGH422

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Contact data acc. to IEC 60947-5-1:
Utilisation category
AC-12
AC-14
DC-12
DC-12
DC-12

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

Rated operational current
5 A
2 A
1 A
0.2 A
0.1 A

Minimum contact rating
1 mk at AC/DC ≥ 10 V

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

Ambient temperatures:
Operation
-40…+85 °C
Transport
-40…+70 °C
Storage
-40…+70 °C

Classification of climatic conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-1)

for W variant
3K7

Transport (IEC 60721-3-1)
2K4

Environmental conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3)
3M4

for W variant
3M7

Connection
Connection type
push-wire terminal

Pull wires:
Nominal current
≤ 10 A

Conductor sizes
AWG 24 – 14

Stripping length
10 mm

Rigid
0.2…2.5 mm²

Flexible without ferrules
0.35…2.5 mm²

Flexible with ferrule with/plastic sleeve
0.25…2.5 mm²

Multiple conductor, flexible with TWIN ferrule with plastic sleeve
0.5…1.5 mm²

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, terminals (DIN EN 60529)
IP20

Degree of protection, built-in components (DIN EN 60529)
IP30

Enclosure material
carbon

Dimensions:
DIN rail mounting acc. to
IEC 60715

Screw mounting 2 x M4 with mounting clip

Document number
D00002

Weight
≤ 150 g

(* = Factory setting
( ) = Factory setting

Technical data ISOMETER® isoHV425

Insulation monitoring devices | Main circuits

Insulation monitoring device ISOMETER® isoHV425 with coupling device AGH422

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Insulation monitoring devices | Main circuits

**Insulation monitoring device ISOMETER® isoHV425 with coupling device AGH422**

**Technical data coupling device AGH422**

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

**Definitions:**
- Measuring circuit (IC1) L1/+, L2/-
- Control circuit (IC2) AK1, GND, AK2, Up, E

**Rated voltage:** 1000 V
**Overvoltage category:** III
**Rated impulse voltage:** IC1/IC2 8 kV

**Rated insulation voltage:**
- IC1/IC2 1000 V

**Pollution degree:** 3
**Safe isolation (reinforced insulation) between:** IC1/IC2 Overvoltage category III, 1000 V

**IT system being monitored**

- Nominal system voltage range $U_n$ AC 0…1000 V/DC 0…1000 V
- Tolerance of $U_n$ AC +10 %/DC +10 %

**Measuring circuit**
- Measuring voltage $U_m$ ±45 V
- Measuring current $I_m$ for $R_F \leq 120 \mu A$
- Internal resistance $R_i \geq 390 k\Omega$

**Environment/EMC**

- **EMC** IEC 61326-2-4, EN 50121-3-2

**Ambient temperatures:**
- Operation -40…+55 °C
- Transport -40…+85 °C
- Storage -40…+70 °C

**Classification of climatic conditions acc. to IEC 60721:**
- Stationary use (IEC 60721-3-3)
  - 3K5 (except condensation and formation of ice)
  - for W variant 3K7
- 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
  - for W variant 3M7
- Transport (IEC 60721-3-2)
  - 2M2
- Long-term storage (IEC 60721-3-1)
  - 1M3

**Connection**

**Connection type** push-wire terminal

**Push-wire terminals:**
- Nominal current 10 A
- Conductor sizes AWG 24 - 14
- Stripping length 10 mm
- Rigid 0.2…2.5 mm²
- Flexible without ferrules 0.75…2.5 mm²
- Flexible with ferrule with/without plastic sleeve 0.25…2.5 mm²
- Multiple conductor, flexible with TWIN ferrule with plastic sleeve 0.5…1.5 mm²

**Opening force** 50 N
**Test opening, diameter** 2.1 mm
**Connection type** terminals Up, AK1, GND, AK2

**Single cables for terminals Up, AK1, GND, AK2:**
- Cable length 0.5 m
- Connection properties $\geq 0.75 \text{ mm}^2$

**Other**

- **Operating mode** continuous operation
- **Mounting** cooling slots must be ventilated vertically
- **Distance to adjacent devices from** $U_n > 800 \text{ V}$ $\geq 30 \text{ mm}$
- **Minimum horizontal distance between the devices (DIN EN 45545)** see note *
- **Degree of protection, built-in components** (DIN EN 60529) IP30
- **Degree of protection, terminals** (DIN EN 60529) IP20
- **Enclosure material** polycarbonate
- **DIN rail mounting acc. to** IEC 60715
- **Screw mounting** 2 x M4 with mounting clip
- **Weight** 150 g

* If the devices are used in railway vehicles according to the requirements of DIN EN 45545-2 observe that:
  - A horizontal mounting distance of $\geq 20 \text{ mm}$ must be ensured, or
  - Sufficiently dimensioned separating material according to DIN EN 45545-2 chapter 5.3.6 must be installed, or
  - The device combination is installed in a control cabinet that complies with the fire safety requirements of DIN EN 45545-2 chapter 4.2 h.

**Dimension diagram (dimensions in mm)**
1. A1, A2 Connection to the supply voltage via fuse (line protection). If being supplied from an IT system, both lines have to be protected by a fuse.

2. E, KE Connect each terminal separately to PE. The same wire cross section as for A1, A2 is to be used.

3. L1/+, L2/- Connection to the IT system to be monitored.

4. Up, AK1, GND, AK2 Connect the terminals of the AGH422 to the corresponding terminals of the ISOMETER®.

5. T/R Connection for the external combined test/reset button.

6. 11, 14 Connection to alarm relay K1.

7. 11, 24 Connection to alarm relay K2.

8. A, B RS-485 communication interface with connectable terminating resistor.
**Industrial insulation monitoring devices**

**ISOmeter® isoHV525**

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems) up to 3(N)AC, AC/DC 0…1000V or DC 0…1000 V

### Device features

#### isoHV525-M4-4
- Monitoring the insulation resistance for unearthed AC/DC systems
- Automatic adaptation to the system leakage capacitance up to 150 μF
- Two separate response values for Alarm 1 and Alarm 2
- Alarms are signalled via alarm relays (K1, K2)
- 0…10 V analogue output (galvanically separated)

#### isoHV525-S4-4
- Monitoring the insulation resistance for unearthed AC/DC systems
- Measurement of the mains voltage (true rms) with undervoltage and overvoltage detection
- Measurement of DC system voltages to earth (L1+/PE and L2-/PE)
- Automatic adaptation to the system leakage capacitance up to 150 μF
- Two separate response values for Alarm 1 and Alarm 2
- Alarms are signalled via alarm relays (K1, K2)
- Selectable N/C or N/O relay operation
- Selectable start-up delay, response delay and delay on release
- Fault memory can be activated
- RS-485 (galvanically separated) including the following protocols:
  - BMS interface (Bender measuring device interface) for data exchange with other Bender components
  - Modbus RTU
  - IsoData (for continuous data output)

### Standards

The ISOmeter® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- DIN EN 50155
- IEC 61557-8
- EN 45545-2 + A1
- UL94 V0

### Further information

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

### Ordering information

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<thead>
<tr>
<th>Supply voltage U_S</th>
<th>Nominal voltage U_n</th>
<th>Version</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>DC</td>
<td>AC, 3(N)AC</td>
<td>Analogue output</td>
<td>isoHV525-M4-4</td>
</tr>
<tr>
<td>100…240 V, 47…63 Hz</td>
<td>24…240 V</td>
<td>0…1000 V</td>
<td>Serial interface</td>
<td>isoHV525-S4-4</td>
</tr>
</tbody>
</table>
Insulation monitoring devices | Main circuits

Insulation monitoring device ISOMETER® isoHV525

Relative uncertainty

Response value

Fault memory alarm messages   on/(off)*

Password   off/0…999 (0, off)*

Operating uncertainty  ±15 %, at least ±3 kΩ

Cable: twisted pairs, shield connected to PE on one side  min. 3-F(YSF)F 2x0.6

Terminating resistor  120 Ω (0.25 W, internal, can be connected

Device address, BMS bus, Modbus RTU  3…99 (3)*

Analogue output (valid for isoHV525-M4-4 only)

Operating mode  mid-scale 120 kΩ

Functions

Insulation value

Rated operational current   5 A 2 A  1 A  0.2 A  0.1 A

Minimum contact rating  1 mk at AC/DC  ≥ 10 V

Environmental/EMC

IEC 61236-2-4, EN 50121-3-2

Ambient temperatures:

Operation:

(Us < 700) -55…+70 °C

(Us > 700) -55…+55 °C

Transport -55…+85 °C

Storage -55…+20 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3) 3K8

Transport (IEC 60721-3-2) 2K4

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 type

isoHV525-M4-4 0.5 m cable

isoHV525-S4-4 3 m cable

Minimum bending radius of the connection cable  > 40 mm

Other

Operating mode continuous operation

Degree of protection, built-in components (DIN EN 60529) IP65

Enclosure material polycarbonate (filled with Wevo PUR403FL)

Screw mounting 4 x M4 (screw depth max. 7 mm)

Weight ≤ 1100 g

(* = Factory setting

Technical data

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

Definitions:

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

Supply circuit (IC2) A1, A2

Output circuit (IC3) 11, 14, 24

Control circuit (IC4) E, KE, T/R, A/N, B/N-

Rated voltage 1000 V

Overvoltage category III

Rated impulse voltage:

(C1)/(IC2-4) 8 kV

(C2)/(IC3-4) 4 kV

Rated insulation voltage:

(IC1)/(IC2-4) 1000 V

(IC2)/(IC3-4) 250 V

(IC3)/(IC4) 250 V

Pollution degree 3

Safe isolation (reinforced insulation) between:

Overvoltage category III, 1000 V

Overvoltage category III, 300 V

Overvoltage category III, 800 V

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

IC1/(IC2-4) Overvoltage category III, 1000 V

IC2/(IC3-4) Overvoltage category III, 300 V

IC3/(IC4) Overvoltage category III, 800 V

Supply voltage

Supply voltage U₀

AC 100…240 V/DC 24…240 V

Tolerance of U₀ -30…+15 %

Frequency range of U₀ 47…63 Hz

Power consumption ≤ 3 W, ≤ 9 VA

IT system being monitored

Nominal system voltage U₀

AC 0…1000 V/DC 0…1000 V

Tolerance of U₀ AC +10 %, DC +10 %

Frequency range of U₀ DC, 15…460 Hz

Measuring circuit

Permissible system leakage capacitance Cₛ ≤ 150 µF

Permissible extraneous DC voltage Uₜ ≤ 1600 V

Measuring voltage Uₘ ≤ ±45 V

Measuring current Iₛ ≤ 120 µA

Internal resistance Rₛ ≥ 390 kΩ

Response values

isoHV525-S4-4:

Response value Rₛ₁: 11…500 kΩ (50 kΩ)*

Response value Rₛ₂: 10…490 kΩ (25 kΩ)*

Relative uncertainty Rₛ ≥ ±15 %, at least ±3 kΩ

Hysteresis Rₛ 25 %, at least 1 kΩ

Undervoltage detection 10…1.09 kV (off)*

Overvoltage detection 10…110 kV (off)*

Relative uncertainty Uₛ ≥ ±5 %, at least 1 kΩ

Relative uncertainty depending on the frequency ≥ 200 Hz ≥ ±5 %, at least 5 V

Hysteresis Uₛ ≤ ±0.75 %, at least 5 V

isoHV525-M4-4:

Response value Rₛ₁: (for customized variant refer to the name plate) 50 kΩ*

Response value Rₛ₂: (for customized variant refer to the name plate) 25 kΩ*

Relative uncertainty Rₛ ≥ ±15 %, at least ±3 kΩ

Hysteresis Rₛ 25 %, at least 1 kΩ

Time response (valid for isoHV525-S4-4 only)

Response time tₛ₁ for Rₛ = 0.5 x Rₛ₂ and Cₛ =1 µF acc. to IEC 61557-8 ≤ 20 s

Start-up delay tₛ₁ ≤ 10 s (0 s)*

Response delay tₛ₂ ≤ 99 s (0 s)*

Delay on release tₛ₃ ≤ 99 s (0 s)*

Measured values, storage

isoHV525-S4-4:

Insulation resistance measured value range (Rₛ)

1 kΩ…4 MΩ

Operating uncertainty ±15 %, at least ±3 kΩ

Insulation monitoring devices | Main circuits

Insulation monitoring device ISOMETER® isoHV525

Baud rate BMS (9.6 kbit/s), Modbus RTU (selectable), isoData (115.2 kbit/s)

Cable length (9.6 kbit/s) ≤ 1200 m

Cable: twisted pairs, shield connected to PE on one side  min. 3-F(YSF)F 2x0.6

Terminating resistor  120 Ω (0.25 W, internal, can be connected

Device address, BMS bus, Modbus RTU  3…99 (3)*

Analogue output (valid for isoHV525-M4-4 only)

Operating mode mid-scale 120 kΩ

Functions

Operating principle N/C operation/N/O operation (N/O operation)*

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

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

Utilisation category AC-12 AC-14 DC-12 DC-12 DC-12

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

Rated operational current 5 A 2 A 1 A 0.2 A 0.1 A

Ambient conditions:

Stationary use (IEC 60721-3-3) 3K8

Transport (IEC 60721-3-2) 2K4

Long-term storage (IEC 60721-3-1) 1K6

Classification of climatic 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 type

isoHV525-M4-4 0.5 m cable

isoHV525-S4-4 3 m cable

Minimum bending radius of the connection cable  > 40 mm

Other

Operating mode continuous operation

Degree of protection, built-in components (DIN EN 60529) IP65

Enclosure material polycarbonate (filled with Wevo PUR403FL)

Screw mounting 4 x M4 (screw depth max. 7 mm)

Tightening torque max. 3 Nm (26 Ib-in)

Documentation number D00297

Weight ≤ 1100 g

(*) = Factory setting
**Insulation monitoring devices | Main circuits**

**Insulation monitoring device ISOMETER® isoHV525**

**Wiring diagram**

**isoHV525-M4-4**

<table>
<thead>
<tr>
<th>Wire number</th>
<th>Terminal</th>
<th>Connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>A1</td>
</tr>
<tr>
<td>2</td>
<td>A2</td>
<td>Connection to the supply voltage via fuse (line protection). If supplied from an IT system, both lines have to be protected by a fuse.</td>
</tr>
<tr>
<td>3 and 4</td>
<td>5</td>
<td>E KE</td>
</tr>
<tr>
<td>6</td>
<td>T/R</td>
<td>Connection for the external combined Test/Reset button</td>
</tr>
<tr>
<td>9</td>
<td>11</td>
<td>Common connection for K1 and K2</td>
</tr>
<tr>
<td>10</td>
<td>24</td>
<td>Connection to alarm relay K1</td>
</tr>
<tr>
<td>11</td>
<td>24</td>
<td>Connection to alarm relay K2</td>
</tr>
<tr>
<td>7</td>
<td>M-</td>
<td>Analogue communication interface</td>
</tr>
<tr>
<td>8</td>
<td>M+</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Red Blue</td>
<td>L1+/–</td>
</tr>
<tr>
<td>6</td>
<td>Red Blue</td>
<td>Connection to the system to be monitored</td>
</tr>
</tbody>
</table>

**isoHV525-S4-4**

<table>
<thead>
<tr>
<th>Wire number</th>
<th>Terminal</th>
<th>Connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>A1</td>
</tr>
<tr>
<td>2</td>
<td>A2</td>
<td>Connection to the supply voltage via fuse (line protection). If supplied from an IT system, both lines have to be protected by a fuse.</td>
</tr>
<tr>
<td>3 and 4</td>
<td>5</td>
<td>E KE</td>
</tr>
<tr>
<td>6</td>
<td>T/R</td>
<td>Connection for the external combined Test/Reset button</td>
</tr>
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</tr>
<tr>
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<td>24</td>
<td>Connection to alarm relay K1</td>
</tr>
<tr>
<td>11</td>
<td>24</td>
<td>Connection to alarm relay K2</td>
</tr>
<tr>
<td>7</td>
<td>A</td>
<td>Serial communication interface (external terminating resistor include)</td>
</tr>
<tr>
<td>8</td>
<td>B</td>
<td>Example: Connection of a BMS Ethernet gateway COM465IP</td>
</tr>
<tr>
<td>6</td>
<td>Red Blue</td>
<td>L1+/–</td>
</tr>
<tr>
<td>6</td>
<td>Red Blue</td>
<td>Connection to the system to be monitored</td>
</tr>
</tbody>
</table>
Insulation monitoring devices
ISOMETER®

Equipment for insulation fault location
ISOSCAN®

Residual current monitoring systems
LINETRAXX®

Neutral Grounding Resistor Monitor (NGR)
LINETRAXX®

Power Quality and Energy Measurement
LINETRAXX®

Measuring and monitoring relays
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
Technical terms
Alphabetical list of devices
Service
### Device overview Equipment for insulation fault location ISOSCAN®

<table>
<thead>
<tr>
<th>ISOSCAN®</th>
<th>ISOSCAN®</th>
<th>ISOSCAN®</th>
<th>ISOSCAN®</th>
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<tbody>
<tr>
<td>EDS440</td>
<td>EDS441</td>
<td>EDS441-LAB</td>
<td>EDS460/490</td>
<td>EDS461/491</td>
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<tr>
<th>Page</th>
<th>154</th>
<th>154</th>
<th>154</th>
<th>161</th>
<th>161</th>
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</table>

#### Special applications

- **High-resistance insulation faults in case of high system leakage capacitances and low test current value**

<table>
<thead>
<tr>
<th>Application</th>
<th>Stationary</th>
<th>Stationary</th>
<th>Stationary</th>
<th>Stationary</th>
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<tbody>
<tr>
<td>Control circuits</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
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<tr>
<td>Main circuits</td>
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<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
</tbody>
</table>

#### Circuits

- **Control circuits**: ✔️
- **Main circuits**: ✔️

#### Voltage system

- **3N/AC**: ✔️
- **AC**: ✔️
- **AC/DC**: ✔️
- **DC**: ✔️

#### Nominal voltage Uₙ max

- **see Locating current injector (e. g. ISOMETER® iso685-D-P)**
- **AC 230 V, DC 220 V**
- **AC 230 V, DC 220 V**
- **see Locating current injector (e. g. ISOMETER® iso685-D-P)**
- **AC 230 V, DC 220 V**

#### System leakage capacitance Cₑ µF

- **acc. to characteristic curve**
- **acc. to characteristic curve**
- **acc. to characteristic curve**
- **acc. to characteristic curve**
- **acc. to characteristic curve**

#### Response value Rₑ kΩ

- **acc. to characteristic curve**
- **acc. to characteristic curve**
- **acc. to characteristic curve**
- **acc. to characteristic curve**
- **acc. to characteristic curve**

#### Installations

- **DIN rail**: ✔️
- **Screw mounting**: ✔️

#### Interfaces

- **BB**: EDS440-S, EDS441-S
- **BS**: EDS440-L, EDS441-L
- **BMS**: ✔️

#### Type

- **Suitable system components**

<table>
<thead>
<tr>
<th>Type</th>
<th>P.</th>
</tr>
</thead>
<tbody>
<tr>
<td>iso685-D-P</td>
<td>40</td>
</tr>
<tr>
<td>IRDM75</td>
<td>77</td>
</tr>
<tr>
<td>isoMED427P</td>
<td>88</td>
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<tr>
<td>isoPV1685P</td>
<td>99</td>
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<tr>
<td>iso1685D0</td>
<td>25</td>
</tr>
<tr>
<td>CTAC…</td>
<td>334</td>
</tr>
<tr>
<td>W…</td>
<td>–</td>
</tr>
<tr>
<td>W…–8000</td>
<td>–</td>
</tr>
<tr>
<td>WR…5(P)</td>
<td>341</td>
</tr>
<tr>
<td>WS…</td>
<td>343</td>
</tr>
<tr>
<td>WS…–8000</td>
<td>343</td>
</tr>
<tr>
<td>W…AB</td>
<td>–</td>
</tr>
<tr>
<td>AN410</td>
<td>365</td>
</tr>
<tr>
<td>AN450</td>
<td>367</td>
</tr>
<tr>
<td>AN450–133</td>
<td>367</td>
</tr>
</tbody>
</table>
### Special applications

- **High-resistance insulation faults in case of high system leakage capacitances and low test current value**

  - **Medical locations**
    - **EDS3096PG** for de-energised systems

  - **Application**
    - **stationary**
    - **portable**

#### Nominal voltage

- **AC 230 V,** **DC 220 V**
- **AC 230 V,** **DC 220 V**
- **AC 20…276 V,** **DC 20…308 V**

#### System leakage capacitance

- **C**
- **µF**

#### Response value

- **R**
- **Ω**

### Interfaces

- **BB**
- **BS**
- **BMS**

### Suitable system components

- **Suitable ISOMETER®s**
  - **with integrated PGH**
  - **iso685-D-P**
  - **IRDH575**
  - **isoMED427P**
  - **isoPV1685P**
  - **iso1685DP**

- **Measuring current transformers**
  - **CTAC…**
  - **W…**
  - **WR…S(P)**
  - **WS…**
  - **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…
- Optional extension by 12 relay channels
- Fault memory behaviour selectable
- Up to 50 EDS insulation fault locators in the system, 600 measuring channels
- Response sensitivity: EDS440 2…10 mA, EDS441 0.2…1 mA
- AC residual current measurement with configurable response value
- Two alarm relays with one N/O contact each
- N/O or N/C operation selectable
- External test/reset
- Central indication of faulty outgoing circuits
- Serial interface RS-485, BS bus address range 2…79
- Connection to higher-level control and visualisation systems possible

Typical applications

- Insulation fault location in AC, 3AC and DC IT systems
- Main circuits and control circuits in industrial plants and ships
- Diode-decoupled DC IT systems in power plants
- Systems for medical locations

Standards

Observe the applicable national and international standards. The EDS44x series meets the device standards:

- DIN VDE 0100-410 (VDE 0100-410)
- DIN EN 61557-9 (VDE 0413-9)
- IEC 61557-9
- DIN EN 50155 (VDE 0115-200)

Further information

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

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage $U_s$ 1)</th>
<th>Response value</th>
<th>LED display</th>
<th>Option “W”</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC/DC</td>
<td></td>
<td></td>
<td>–</td>
<td>EDS440-S-1</td>
<td>B91080201</td>
</tr>
<tr>
<td></td>
<td>2…10 mA</td>
<td></td>
<td></td>
<td>EDS440W-S-1</td>
<td>B91080201W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>EDS440L-4</td>
<td>B91080202</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td>EDS440W-L-4</td>
<td>B91080202W</td>
</tr>
<tr>
<td>24…240 V</td>
<td>–</td>
<td>–</td>
<td>EDS441-S-1</td>
<td>B91080204</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.2…1 mA</td>
<td></td>
<td></td>
<td>EDS441W-S-1</td>
<td>B91080204W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>EDS441L-4</td>
<td>B91080205</td>
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<td></td>
<td></td>
<td>EDS441W-L-4</td>
<td>B91080205W</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>EDS441LAB-4</td>
<td>B91080207</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>EDS441W-LAB-4</td>
<td>B91080207W</td>
</tr>
</tbody>
</table>

1) Absolute values

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plug kit, screw terminals 1)</td>
<td>B91080901</td>
</tr>
<tr>
<td>Plug kit, push-wire terminals</td>
<td>B91080902</td>
</tr>
<tr>
<td>Mechanical accessories (terminal cover, 2 mounting clips) 1)</td>
<td>B91080903</td>
</tr>
<tr>
<td>BB bus 4TE Connector 2)</td>
<td>B98110002</td>
</tr>
</tbody>
</table>

1) included in the scope of delivery

2) included in the scope of delivery of EDS44x-S-4
Response value insulation fault location (ΔL) EDS441
- 0.2…1 mA

Response value residual current measurement (IΔn) EDS440
- 100 mA…10 A

Response value residual current measurement (IΔn) EDS441
- 100 mA…1 A

Tolerance ±30 %, ±2 mA

Response value residual current measurement (IΔn) EDS44x (61…1000 Hz)
- 20…0 %

Tolerance ±30 %, ±2 mA

Scanning time for all channels insulation fault location (ΔL)
profile-dependent, min. 6 s

Measuring ranges insulation fault location (IΔn)
Ac 250 V

Supply voltage
Supply voltage range (U1)
AC/DC 24…240 V

Rated impulse voltage (IEC 60664-1)
4 kV

Rated insulation voltage (measuring current transformer)
800 V

Rated insulation voltage (IEC 60664-1)
AC 250 V

Insulation coordination
Rated insulation voltage (IEC 60664-1)
AC 250 V

Rated impulse voltage (IEC 60664-1)
4 kV

Overvoltage category
III

Pollution degree
3

Protective separation (reinforced insulation) between
(A1,A2)-(13,14)-(23,24)-(X1,X2,X3)

Voltage test acc. to IEC 60101-1
2.2 kV

Supply voltage
Supply voltage range (U1)
AC/DC 24…240 V

Tolerance of (U1) EDS440
-20…+15 %

Frequency range of (U1)
DC, 50…400 Hz

Tolerance of the frequency range of (U1)
-5…+15 %

Power consumption, typically 50 Hz (400 Hz) EDS44…-L
≤4 W/7 VA (≤4 W, 28 VA)

Power consumption, typically (DC via BB-Bus) EDS44…-S
≤1 W

Response values
Response value insulation fault location (IΔn) EDS440
2…10 mA

Response value insulation fault location (IΔn) EDS441
0…2 mA

Relative uncertainty (IΔn) EDS440
±30 %, ±2 mA

Relative uncertainty (IΔn) EDS441
±30 %, ±2 mA

Response value residual current measurement (IΔn) EDS440
100 mA…10 A

Response value residual current measurement (IΔn) EDS441
100 mA…1 A

Relative uncertainty (IΔn) EDS44x (42…60 Hz)
±5 %

Relative uncertainty (IΔn) EDS44x (61…1000 Hz)
-20…0 %

Hysteresis
20 %

Time response
Scanning time for all channels insulation fault location (IΔn)
profile-dependent, min. 6 s

Response time residual current measurement (IΔn)
≤ 400 ms

Response time for measuring current transformer monitoring
max.18 min

Measuring circuit
Nominal system voltage (U0) EDS440
refer to locating current injector (e.g. ISOMETER® iso685-D-P)

Nominal system voltage (U0) EDS441
AC 230 V, DC 220 V

Tolerance of (U0) EDS441
±15 %, DC ±30 %

Measuring current transformer external for EDS440 type
W…/8000, WS…/8000

Measuring current transformer external for EDS441 type
W…/8000, WS…/8000

Measuring current transformer external for EDS44x-LAB type
W…AB

Load EDS440
47 Ω

Load EDS441
1.3 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 insulation fault location (IΔn)
Rated frequency range
DC, 16.7…1000 Hz

Measuring range insulation fault location (IΔn) EDS440
1.5…25 mA

Measuring range insulation fault location (IΔn) EDS441
0.15…5 mA

Max. residual current
see diagrams in manual

Measuring ranges residual current measurement (IΔn)
Rated frequency range EDS440
50…1000 Hz

Measuring range residual current measurement (IΔn) EDS440
10 mA…20 A

Rated frequency range EDS441
50…60 Hz

Measuring range residual current measurement (IΔn) EDS441
100 mA…2 A

Measuring ranges residual current measurement (IΔn)
Rated frequency range EDS441
50…60 Hz

Insulation fault locator
ISOSCAN® EDS440/EDS441
<table>
<thead>
<tr>
<th>Environment/EMC</th>
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</tr>
</thead>
<tbody>
<tr>
<td>EMC</td>
<td>IEC 61326-2-4</td>
</tr>
<tr>
<td>Ambient temperatures:</td>
<td></td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-25…+55 °C</td>
</tr>
<tr>
<td>Transport</td>
<td>-40…+85 °C</td>
</tr>
<tr>
<td>Storage</td>
<td>-25…+70 °C</td>
</tr>
</tbody>
</table>

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

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

Screw-type terminal:
- Tightening torque: 0.5…0.6 Nm (5…7 lb-in)
- Conductor sizes: AWG 24-12
- Stripping length: 7 mm
- rigid/flexible: 0.2…2.5 mm²
- flexible with 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:
- Conductor sizes: AWG 24-12
- Stripping length: 10 mm
- rigid/flexible: 0.2…2.5 mm²
- flexible with ferrules, with/without plastic sleeve: 0.25…2.5 mm²
- Multiple conductor, flexible with TWIN ferrule with plastic sleeve: 0.5…1.5 mm²

Push-wire terminals X1, X2:
- Conductor sizes: AWG 24-16
- Stripping length: 10 mm
- rigid/flexible: 0.2…1.5 mm²
- flexible with ferrule without plastic sleeve: 0.25…1.5 mm²
- flexible with TWIN ferrule with plastic sleeve: 0.25…0.75 mm²

Other:
- Operating mode: continuous operation
- Mounting: at an ambient temperature >55 °C vertical mounting required
- at an ambient temperature <55 °C mounting optional

Degree of protection internal components: IP40
Degree of protection terminals: IP20
DIN rail mounting acc. to: IEC 60715

Screw fixing: 2 x M4 with mounting clip

Enclosure material: polycarbonate

Flammability class: UL 94V-0

Dimensions (W x H x D): 72 x 93 x 63

Documentation number: D00201

Weight: approx. 122 g (EDS44x-S)
 approx. 242 g (EDS44x-L)

Option “W” data different from the standard version

Devices with the suffix „W“ feature increased shock and vibration resistance. The electronics is covered with a special varnish to provide increased protection against mechanical stress and moisture.

Ambient temperatures:
- Operating temperature: -40…+70 °C
- Transport: -40…+85 °C
- Long-term storage: -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

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.
Connection to the voltage supply

Connection of relays

Connection to the X1 interface

Connection to the k1-12/l1-12 interface

Alarm relay 1

ON

First and last device in a bus

OFF

All devices between the first and the last device in the bus system.

Activating a terminating resistor to define the first and the last device in the bus system.
For insulation fault location, the measuring current transformers of the CTAC… (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-D-P

Wiring diagram to DC system with iso685-D-P
Wiring diagram to AC system with iso685-D-P

Connection example: iso685-D-P, 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

Standards
Observe the applicable national and international standards. The EDS… series meets the requirements of the following equipment standards:
- IEC 60364-4-41
  Low-voltage electrical installations - Part 4-41: Protection for safety – Protection against electric shock;
- IEC 61557-9
  Electrical safety in low voltage distribution systems up to 1000 V a.c. and 1500 V d.c. - Equipment for testing, measuring or monitoring of protective measures - Part 9: Equipment for insulation fault location in IT systems

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 1)</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDS-Funktion</td>
<td>RCM-Funktion</td>
<td></td>
<td>AC</td>
<td>DC</td>
<td>AC/DC</td>
</tr>
<tr>
<td>2…10 mA</td>
<td>100 mA…10 A</td>
<td>2 x 1 changeover contact</td>
<td>16…72 V, 42…460 Hz</td>
<td>16…94 V</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>42…460 Hz</td>
<td>–</td>
</tr>
<tr>
<td>0.2…1 mA</td>
<td>10 mA…1 A</td>
<td>2 x 1 changeover contact</td>
<td>16…72 V, 42…460 Hz</td>
<td>16…94 V</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>42…460 Hz</td>
<td>–</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 1)</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
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<tbody>
<tr>
<td>EDS-Funktion</td>
<td>RCM-Funktion</td>
<td></td>
<td>AC</td>
<td>DC</td>
<td>AC/DC</td>
</tr>
<tr>
<td>2…10 mA</td>
<td>100 mA…10 A</td>
<td>2 x 1 changeover contact</td>
<td>16…72 V, 42…460 Hz</td>
<td>16…94 V</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>42…460 Hz</td>
<td>–</td>
</tr>
<tr>
<td>0.2…1 mA</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>42…460 Hz</td>
<td>–</td>
</tr>
</tbody>
</table>

1) Absolute values
Technical data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulation coordination acc. to IEC 60664-1/IEC 60664-3</td>
<td>for versions with a supply voltage of AC/DC 70...276 V/AC 42...460 Hz</td>
</tr>
</tbody>
</table>

- Rated insulation voltage: AC 250 V
- Rated impulse voltage/pollution degree: 6 kV/3
- Protective separation (reinforced insulation) between: (A1, A2) -(k1, l...k12, R, T/R, T, A, B), (C11, C12, C14), (C21, C22, C24), (11, 14, 21, 24, 31, 34, 41, 44, 51, 54, 61, 64), (71, 74), (81, 84), (91, 94), (101, 104), (111, 114), (121, 124)

- Voltage test acc. to IEC 61010-1: 3.536 kV
- Rated insulation voltage: AC 250 V
- Rated impulse voltage/pollution degree: 4 kV/3
- Basic insulation between: (k1, l...k12, R, T/R, T, A, B) -(C11, C12, C14), (C21, C22, C24), (11, 14, 21, 24, 31, 34, 41, 44, 51, 54, 61, 64), (71, 74), (81, 84), (91, 94), (101, 104), (111, 114), (121, 124)
- Voltage test acc. to IEC 61010-1: 2.21 kV

- Insulation coordination acc. to IEC 60664-1/IEC 60664-3 | for versions with a supply voltage of DC 16...72 V/AC 16...72 V/42...460 Hz |

- Rated insulation voltage: AC 100 V
- Rated impulse voltage/pollution degree: 2.5 kV/3
- Protective separation (reinforced insulation) between: (A1, A2) -(k1, l...k12, R, T/R, T, A, B)
- Voltage test acc. to IEC 61010-1: 1.344 kV
- Rated insulation voltage: AC 250 V
- Rated impulse voltage/pollution degree: 4 kV/3
- Basic insulation between: (A1, A2) -(k1, l...k12, R, T/R, T, A, B) -(C11, C12, C14), (C21, C22, C24), (11, 14, 21, 24, 31, 34, 41, 44, 51, 54, 61, 64), (71, 74), (81, 84), (91, 94), (101, 104), (111, 114), (121, 124)

- Voltage test acc. to IEC 61010-1: 2.21 kV
- Rated insulation voltage: AC 250 V
- Rated impulse voltage/pollution degree: 6 kV/3
- Protective separation (reinforced insulation) between: (C11, C12, C14), (C21, C22, C24), (11, 14, 21, 24, 31, 34, 41, 44, 51, 54, 61, 64), (71, 74), (81, 84), (91, 94), (101, 104), (111, 114), (121, 124)

- Voltage test acc. to IEC 61010-1: 3.536 kV

Supply voltage

- Supply voltage $U_s$: see ordering information
- Frequency range $f_s$: AC 42...460 Hz
- Power consumption: ≤ 10 W (EDS460, EDS461)
- Power consumption: ≤ 14 VA (EDS490, EDS491)

Measuring circuit

- Nominal system voltage $U_n$: see BDSHT57, PGK (EDS460, EDS490)
- Nominal system voltage $U_n$: AC 20...276 V, DC 20...308 V (EDS461)
- External measuring current transformers type CT, AC...S(P), WS... (EDS460, EDS490)

CT monitoring: on/off (on*)
- Load: 10 Ω (EDS460, EDS461)
- Load: 1.5 kΩ (EDS461, EDS491)
- Rated insulation voltage (measuring current transformer): 300 V
- Response sensitivity: 2...20 mA (EDS460, EDS461)
- Response sensitivity: 0.2...2 mA (EDS461, EDS491)
- Rated frequency: DC, AC 400, 50 Hz
- Measuring range EDS function: 1.5...50 mA (EDS460/490)
- Measuring range EDS function: 0.15...5 mA (EDS461/491)
- Measuring range RCM function: 100 mA...10 A (EDS460/490)
- Measuring range RCM function: 10 mA...1 A (EDS461/491)

Number of measuring channels (per device/system): 12/1080

Timing:

- Response delay $t_{rp}$: 0...24 s
- Delay on release $t_{rd}$: 0...24 s
- Scanning time for all channels: approx. 8...24 s (EDS460/490)
- Scanning time for all channels: approx. 14...30 s (EDS461/491)

Display, memory

- LEDs: ON/ALARM (EDS4... -D)
- LC display: backlit graphical display (EDS4... -D)
- Fault memory alarm relay: on/off (off)*
- Alarm memory relay: alarm (off), non-alarm (on)

Inputs/outputs

- Test/reset button: internal/external
- Cable length for external test/reset button: 0...10 m

Interface

- Interface/protocol: RS-485/BMS
- Baud rate: 9.6 kbit/s
- Cable length: 0...1200 m
- Cable (twisted pair, one end of shield connected to PE): recommended: J-Y(St)Y min. 2x0.8

Terminating resistor: 100 Ω
- Terminating resistor: 120 Ω (0.25 W) connectable via DIP switch
- Terminating resistor: device address, BMS bus 1...90 (2)*

Connection: EDS-measuring current transformer

- Single wire: ≥ 0.75 mm²
- Single wire, twisted: ≥ 0.75 mm²
- Cable length: 0...10 m
- Cable length: 10...40 m

Shielded cable: ≥ 0.5 mm²
- Shielded cable: ≥ 0.5 mm²
- Shielded cable: shielded cable (shielded on one side connected to L-conductor, not connected to earth)

- Recommended: J-Y(St)Y min. 2x0.8

Switching elements

- Number of relays: 2 relays, each with one contact changeover (EDS461/491)
- Number of relays: 12 relays, each with one N/O contact (EDS491)

Operating principle: NC or N/O operation (N/O operation)*
- Electrical endurance, number of cycles: 10,000

Contact data acc. to IEC 60947-5-1

- Utilisation category: AC-13, AC-14, DC-12, DC-12, DC-12
- Rated operational voltage: 230 V, 230 V, 24 V, 110 V, 220 V
- Rated operational current (common alarm relays): 2 A, 0.5 A, 2 A, 0.2 A, 0.1 A
- Minimum contact rating: 1 mA at AC/DC ≥ 10 V

Environment/EMC

- EMC: IEC 61236-2-4 Ed. 1.0
- Operating temperature: -25...+55 °C

Classification of climatic conditions acc. to IEC 60721

- Stationary use (IEC 60721-3-3): 3K4 (except condensation and formation of ice)
- Transport use (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 use (IEC 60721-3-2): 2M2
- Long-time storage (IEC 60721-3-1): 1M1
Technical data (continued)

<table>
<thead>
<tr>
<th>Connection</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection</td>
<td>Operating mode</td>
</tr>
<tr>
<td></td>
<td>screw-type terminals</td>
</tr>
<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>

Dimension diagrams (dimensions in mm)

**EDS46…-D/-L**

**EDS49…-D/-L**

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>EDS491: 10 mA…1 A</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>–</td>
<td>–</td>
<td>12 x 1 N/O contact</td>
</tr>
<tr>
<td>Enclosure</td>
<td>XM460</td>
<td>XM490</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other

- Address range: 1…90
- Internal clock: ■
- History memory: ■
- Alarm contact "Common alarm" for all channels: 2 x 1 changeover contact
- Alarm contact per channel: –
- Enclosure: XM460

( * factory setting

Weight:
- ≤ 360 g (EDS460)
- ≤ 530 g (EDS490)

Documentation number:
- D00085

Technical data (continued)

Connection: screw-type terminals

Connection:
- 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

Response value:
- EDS460: 2…10 mA
- EDS490: 2…10 mA
- EDS461: 0.2…1 mA
- EDS491: 0.2…1 mA

Residual current indication:
- EDS460: 100 mA…10 A
- EDS490: 100 mA…10 A
- EDS461: 10 mA…1 A
- EDS491: 10 mA…1 A

Backlit graphics LC display: ■

7-segment display and LED line: ■

Parameter setting function: ■

Error code indication: ■

Address range: 1…90

Internal clock: ■

History memory: ■

Alarm contact “Common alarm” for all channels: 2 x 1 changeover contact

Alarm contact per channel: –

Enclosure: XM460

Other:

- Operating mode: continuous operation
- Position of normal use: any
- Degree of protection, terminals (DIN EN 60529): IP20
- Enclosure material: polycarbonate
- Flammability class: UL94 V-0
- Screw mounting: 2 x M4
- DIN rail mounting acc. to: IEC 60715
- Documentation number: D00085
- Weight: ≤ 360 g (EDS460)
- ≤ 530 g (EDS490)

( * factory setting

Weight:
- ≤ 360 g (EDS460)
- ≤ 530 g (EDS490)

Documentation number:
- D00085

Technical data (continued)

Connection: screw-type terminals

Connection:
- 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

Response value:
- EDS460: 2…10 mA
- EDS490: 2…10 mA
- EDS461: 0.2…1 mA
- EDS491: 0.2…1 mA

Residual current indication:
- EDS460: 100 mA…10 A
- EDS490: 100 mA…10 A
- EDS461: 10 mA…1 A
- EDS491: 10 mA…1 A

Backlit graphics LC display: ■

7-segment display and LED line: ■

Parameter setting function: ■

Error code indication: ■

Address range: 1…90

Internal clock: ■

History memory: ■

Alarm contact “Common alarm” for all channels: 2 x 1 changeover contact

Alarm contact per channel: –

Enclosure: XM460

Other:

- Operating mode: continuous operation
- Position of normal use: any
- Degree of protection, terminals (DIN EN 60529): IP20
- Enclosure material: polycarbonate
- Flammability class: UL94 V-0
- Screw mounting: 2 x M4
- DIN rail mounting acc. to: IEC 60715
- Documentation number: D00085
- Weight: ≤ 360 g (EDS460)
- ≤ 530 g (EDS490)

( * factory setting

Weight:
- ≤ 360 g (EDS460)
- ≤ 530 g (EDS490)

Documentation number:
- D00085
**Wiring diagrams**

1. **A1, A2**  Supply voltage $U_S$ (see ordering information), 6 A fuse recommended; two-pole fuses should be used on IT systems. For UL and CSA applications, the use of 5 A fuses is mandatory.

2. **k1, l...k12, l**  Connection of measuring current transformers 1...12

3. **A, B**  BMS bus (RS-485 interface with BMS protocol)

4. **R, R/T**  External reset button (N/O contact)*

5. **T, R/T**  External test button (N/O contact)*

6. **C11, C12, C14**  Common alarm relay K1: Alarm 1, common alarm for alarm or device error.

7. **C21, C22, C24**  Common alarm relay K2: Alarm 2, common alarm for alarm or device error.

8. **Rev/off**  Activate or deactivate the BMS bus terminating resistor (120 Ω).

*The external test/reset buttons of several devices must not be connected to one another.*
ISOSCAN® EDS150/EDS151
Insulation fault locator with integrated measuring current transformers for EDS systems

Device features
• Insulation fault location in AC, AC/DC and DC IT systems
• 6 measuring channels with measuring current transformer per EDS150/151
• Up to 528 measuring channels can be combined by the BMS bus in the IT system being monitored:
  88 x 6 measuring channels
• Response sensitivity EDS150: 5 mA, EDS151 0.5 mA
• A response time of up to 8 s in the AC system acc. to IEC 61557-9
• RS-485 interface with BMS protocol
• BMS address range 3…90
• Cyclical self test

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 1) $U_S$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDS function</td>
<td>RCM function</td>
<td>AC</td>
<td>DC</td>
<td></td>
</tr>
<tr>
<td>5…25 mA</td>
<td>5 mA</td>
<td>10 A</td>
<td>EDS150</td>
<td>B91080103</td>
</tr>
<tr>
<td>0.5…2.5 mA</td>
<td>0.5 mA</td>
<td>1 A</td>
<td>EDS151</td>
<td>B91080101</td>
</tr>
</tbody>
</table>

1) Absolute values

Accessories

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<th>Type designation</th>
<th>Art. No.</th>
</tr>
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<tr>
<td>Mounting clip for enclosure XM150</td>
<td>B91080110</td>
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Suitable system components

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<th>Voltage supply</th>
<th>Output voltage</th>
<th>Explanation</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
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</thead>
<tbody>
<tr>
<td>Power supply unit</td>
<td>AC 90…240 V/DC 120…370 V/47…63 Hz</td>
<td>DC 24 V, 420 mA</td>
<td>For the supply of max. 6 EDS15…</td>
<td>AN410</td>
<td>B924209</td>
<td>365</td>
</tr>
<tr>
<td></td>
<td>AC 230 V/50…60 Hz</td>
<td>AC 20 V, 500 mA</td>
<td>For the supply of max. 6 EDS15…</td>
<td>AN450</td>
<td>B924201</td>
<td>367</td>
</tr>
<tr>
<td></td>
<td>AC 127 V/50…60 Hz</td>
<td>AC 20 V, 500 mA</td>
<td>For the supply of max. 6 EDS15…</td>
<td>AN450-133</td>
<td>B924203</td>
<td>367</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/k3

#### Voltage ranges
- **IT system being monitored:**
  - Nominal system voltage $U_n$: see IRDH575, PGH (EDS150)  $AC 20…276 V, DC 20…308 V$ (EDS151)
  - Nominal frequency $f_n$: $42…460$ Hz

#### Supply voltage:
- Supply voltage $U_S$: AC $17…24 V$, DC $14…28 V$
- Frequency range of the supply voltage: $50…60$ Hz
- Power consumption AC: $\leq 3$ VA
- Power consumption DC: $\leq 1.5$ VA

#### Measuring circuit
- Number of measuring channels (per device/system): 6/528

#### EDS function:
- Response value:
  - EDS150: $5$ mA
  - EDS151: $0.5$ mA
- 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: $\leq 8$ s

#### RCM function:
- Response value:
  - EDS150: $10$ A
  - EDS151: $1$ A
- Relative uncertainty: $\pm 30$ %
- Frequency range: $42…68$ Hz

#### Displays
- **LEDs:**
  - ON/COM, green: operation indicator/bus activity
  - Alarm K1…K6, yellow: EDS and RCM function

#### Interface
- Interface/protocol: RS-485/BMS
- Connection: terminals A/B
- Cable (twisted pair, one end of shield connected to PE): two-core, recommended: J-Y(St)Y min. $2x0.8$
- Cable length: $\leq 1200$ m
- Terminating resistor: $120$ Ω (0.25 W)
- Device address, BMS bus: $3…90$ (3)*

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

#### For UL application:
- **Maximum ambient temperature:** $55$ °C
- **Classification of climatic conditions acc. to IEC 60721:**
  - Stationary use (IEC 60721-3-3): K5 (except condensation and formation of ice)
  - Transport (IEC 60721-3-2): K3 (except condensation and formation of ice)
  - Long-term storage (IEC 60721-3-1): K4 (except condensation and formation of ice)
- **Classification of mechanical conditions acc. to IEC 60721:**
  - Stationary use (IEC 60721-3-3): M4
  - Transport (IEC 60721-3-2): M2
  - Storage (IEC 60721-3-1): M3

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

#### For UL application:
- **Only use 60/75°C copper conductors!**
- **Connection rigid/flexible/conductor sizes:**
  - Multi-conductor connection (2 conductors of the same cross section):
    - rigid: $0.2…1.5$ mm² (AWG 24…16)
    - flexible: $0.2…1.5$ mm²
    - flexible with ferrule without plastic sleeve: $0.25…1.5$ mm²
    - flexible with ferrule with plastic sleeve: $0.25…0.75$ mm²
  - Stripping length: $10$ mm

#### Other
- **Operating mode:** continuous operation
- **Position of normal use:** any
- **Enclosure material:** polycarbonate
- **Flammability class:** UL94 V-0
- **Screw mounting:** $2 \times M6$
- **Stiffening torque:** $1.5$ Nm
- **Documentation number:**
  - EDS150: D00106
  - EDS151: D00107
- **Weight:** $\leq 340$ g

(3) = factory setting

---

### Dimension diagrams (dimensions in mm)

![Dimension Diagrams](image-url)
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. 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 Uₚ, 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)

Insulation fault locator EDS195PM
- Backlit LC display, 3 x 16 characters
- Measuring clamps 20/52 mm included in the scope of delivery
- Accumulator (delivered with a power supply unit)
- Response value insulation fault location 2…10 mA for main circuits
- Response value insulation fault location 0.2…1 mA for control circuits
- Response value residual current measurement 10 mA…10 A
- Selectable operating mode insulation fault location/residual current measurement

Typical applications
- IT systems with or without an incorporated equipment for insulation fault location (EDS)
- TN/TT systems
- Main and control circuits
- Photovoltaic systems

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.

Ordering information

<table>
<thead>
<tr>
<th>Main circuits with EDS</th>
<th>Control circuits without EDS</th>
<th>Nominal voltage $U_n$</th>
<th>Supply voltage $U_S$ Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC DC</td>
<td>AC DC</td>
<td>AC DC</td>
<td>AC DC</td>
<td></td>
</tr>
<tr>
<td>EDS460/490</td>
<td>–</td>
<td>20…75 V, 42…460 Hz</td>
<td>20…504 V</td>
<td>EDS3090</td>
</tr>
<tr>
<td>–</td>
<td>–</td>
<td>20…75 V, 42…460 Hz</td>
<td>20…504 V</td>
<td>EDS3090PG</td>
</tr>
<tr>
<td>–</td>
<td>–</td>
<td>0…75 V, 42…460 Hz</td>
<td>0…504 V</td>
<td>EDS3090PG</td>
</tr>
<tr>
<td>–</td>
<td>–</td>
<td>20…30 V, 42…460 Hz</td>
<td>20…100 V</td>
<td>EDS3090PG</td>
</tr>
<tr>
<td>–</td>
<td>–</td>
<td>20…30 V, 42…460 Hz</td>
<td>20…100 V</td>
<td>EDS3090PG</td>
</tr>
<tr>
<td>–</td>
<td>–</td>
<td>20…25 V, 42…460 Hz</td>
<td>20…100 V</td>
<td>EDS3090PG</td>
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<tr>
<td>–</td>
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<td>20…25 V, 42…460 Hz</td>
<td>20…100 V</td>
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<td>–</td>
<td>–</td>
<td>20…25 V, 42…460 Hz</td>
<td>20…100 V</td>
<td>EDS3090PG</td>
</tr>
<tr>
<td>–</td>
<td>–</td>
<td>20…25 V, 42…460 Hz</td>
<td>20…100 V</td>
<td>EDS3090PG</td>
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<tr>
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<td>20…25 V, 42…460 Hz</td>
<td>20…100 V</td>
<td>EDS3090PG</td>
</tr>
</tbody>
</table>

Equipment for insulation fault location ISOSCAN® EDS30...
The technical data listed in this chapter apply to the components: PGH18…, EDS195PM, AGH185.

### Technical data EDS309… system

#### Environment/EMC
- **EMC**: IEC 61326-2-4
- **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)
  - **Storage (IEC 60721-3-1)**: 1K4 (except condensation and formation of ice)

#### Other
- **Operating mode**: continuous operation
- **Position of normal use**: any
- **Weight EDS309…**: ≤ 7000 g
- **Weight EDS309… with PSA3165**: ≤ 8500 g
- **Weight EDS3092**: ≤ 9000 g
- **Dimensions WxHxD**: 430 x 340 x 155 mm
- **Documentation number**: D00012

### Technical data PGH18…

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

#### Nominal system voltage \( U_{n} \)
- **PGH183**: AC 20…265 V / 42…460 Hz, DC 20…308 V
- **PGH185**: 3AC/AC 20…575 V / 42…460 Hz, DC 20…504 V
- **PGH186**: 3AC/AC 0…575 V / 42…460 Hz, DC 0…504 V

#### Voltage supply
- **Supply voltage \( U_{S} \)**: AC 230 V/50…60 Hz
- **Operating range of \( U_{S} \)**: 0.85…1.15 x \( U_{S} \)
- **Supply voltage \( U_{S} \) version -13**: AC 90…132 V/50…60 Hz

#### PGH183, PGH185:
- **Power consumption**: ≤ 3 VA

#### PGH186:
- **Power consumption**: ≤ 6 VA

#### Locating current
- **PGH183**
  - Test current, selectable, max.: 1/2.5 mA
- **PGH185/186**
  - Locating current \( I_{LL} \), selectable, max.: 10/25 mA
- **PGH183/185/186**
  - Clock pulse: 2 s
  - Idle time: 4 s

#### Measuring voltage \( U_{m} \)
- **PGH186**: DC 50 V

#### Other
- **Degree of protection, internal components DIN EN 60529 (VDE 0470-1)**: IP40
- **Enclosure material**: ABS plastic
- **Flammability class**: UL94 V-0
- **Weight**: ≤ 700 g
- **Dimensions WxHxD**: 160 x 148 x 81 mm

### Technical data EDS195PM

#### Insulation coordination acc. to IEC 60664-1/IEC 60664-3
- **Rated insulation voltage**: 50 V
- **Rated impulse withstand voltage/pollution degree**: 0.8 kV/3

#### Voltage supply
- **Supply voltage \( U_{S} \) accumulators, batteries or USB power supply unit**
  - **Accumulators**: 3 x NiMh ≥ 2000 mAh
  - **Size**: AA 6 R6
  - **Batteries**: 3 x LR6 AA – 1.5 V
  - **USB power supply unit**:
    - **Primary**: DC 5 V, ±10 %, ≤ 0.5 W

#### Measuring circuit insulation fault location
- **Nominal system voltage**: conductors uninsulated, including measuring clamp up to 600 V
- **Rated frequency**: DC, 42…2000 Hz

#### Main circuit \( I_{\text{max}} = 50 \) mA
- **Measuring range**: 2 mA…50 mA
- **Measuring clamps**: PSA3020, PSA3052, PSA3165
  - **Response value \( I_{LL} \), adjustable**: 2…10 mA (5 mA)*
  - **Relative uncertainty**: ±30 %/±2 mA of the reference value

#### Control circuit \( I_{\text{max}} = 5 mA \)
- **Measuring range**: 0.2 mA…5 mA
- **Measuring clamps**: PSA3320, PSA3352
  - **Response value \( I_{LL} \), adjustable**: 0.2…1.0 mA (0.5 mA)*
  - **Relative uncertainty**: ±30 %/±0.2 mA of the reference value

#### Measuring circuit residual current
- **with measuring clamps PSA3020, PSA3052, PSA3165**
  - **Measuring range**: 5 mA…10 A (crest factor up to 3)
  - **Response value \( I_{LL} \), adjustable**: 10 mA…10 A (100 mA)*
  - **Relative uncertainty**: ±30 %/±2 mA of the reference value

#### Type of connection measuring clamp
- **BNC plug**, **µUSB plug**

#### Indication
- **LED**: 3 x 16 characters, selectable illumination
- **Alarm**

#### Other
- **Degree of protection, internal components DIN EN 60529 (VDE 0470-1)**: IP40
- **Protection class acc. to IEC 60947-1, DIN EN 60947-1 (VDE 0660-100)**: Class III
- **Enclosure material**: ABS plastic
- **Flammability class**: UL94 V-0
- **Dimensions WxHxD**: 84 x 197 x 30 mm
- **Weight**: ≤ 350 g

(*) = Factory settings
Technical data measuring clamps

**Electrical safety**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>Standard</td>
<td>IEC 61010-2-030</td>
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<tr>
<td>Pollution degree</td>
<td>2</td>
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<tr>
<td>Installation category</td>
<td>III</td>
</tr>
<tr>
<td>Operating voltage</td>
<td>600 V</td>
</tr>
<tr>
<td>Nominal insulation voltage</td>
<td>AC 600 V CAT III resp. AC 300 V CAT IV</td>
</tr>
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</table>

**Transmission ratio**

<table>
<thead>
<tr>
<th>Model</th>
<th>Transmission ratio</th>
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<tbody>
<tr>
<td>PSA30…</td>
<td>10 A/10 mA</td>
</tr>
<tr>
<td>PSA33…</td>
<td>1 A/0.1 mA</td>
</tr>
<tr>
<td>PSA3165</td>
<td>10 A/10 mA</td>
</tr>
</tbody>
</table>

**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
- Weight PSA3020/3320 ≤ 100 g
- Weight PSA3165 ≤ 1300 g

Technical data AGE185

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Rated insulation voltage</td>
<td>AC 1000 V</td>
</tr>
<tr>
<td>Rated impulse voltage/pollution degree</td>
<td>4 kV/3</td>
</tr>
<tr>
<td>Nominal system voltage Uₚ</td>
<td>1AC, AC 500…790 V, DC 400…960 V/42…460 Hz</td>
</tr>
</tbody>
</table>

**Other**

- Degree of protection, internal components DIN EN 60529 (VDE 0470-1) IP30
- Type of connection/cable: safety plug with green-yellow connecting wire 1 mm²
- Weight ≤ 400 g
- Dimensions W x H x D 84 x 197 x 30 mm
- Weight ≤ 200 g
- Dimensions W x H x D 88.5 x 42 x 21 mm

### Dimension diagram PSA3020/3320 (dimensions in mm)

- Shielded cable 2 m
- BNC plug

### Dimension diagram PSA3052/3352 (dimensions in mm)

- Shielded cable 2 m
- BNC plug

### Dimension diagram PSA3165 (dimensions in mm)

- Shielded cable 2 m
- BNC plug

### Dimension diagram aluminium case (dimensions in mm)

- 145 x 310 x 340 mm
Portable equipment for insulation fault location

ISOSCAN® EDS30...

Operating elements EDS195PM

1. Micro USB connection for charging the device’s rechargeable battery
2. BNC connection for the measuring clamp
3. LC display, backlit, 3 lines à 16 characters
4. LED “ALARM”, lights when the response value is exceeded
5. Button for the selection of the operating mode:
   - IS = insulation fault location in IT systems (EDS mode)
   - Δn = residual current measurement in TN-S systems in (RCM mode)
6. Button for transformer selection
   - for ITmax = 50 mA: P20 = PSA3020 = PSA3320
   - for ITmax = 5 mA: P52 = PSA3052 = PSA3352
   - P165 = PSA3165
   - WS = W…-8000
   - W/WR = W…/WR… = W…-8000
8. ESC button: to exit the menu function without changing parameters
9. “MENU” button: to toggle between the standard display and the menu selection
10. On-Off button
11. “HOLD” button: to store the currently indicated measured value
12. Arrow up button: Parameter changes, scroll
13. Arrow down button: Parameter changes, scroll
14. 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
Insulation fault location system EDS3096PV in unearthed photovoltaic systems (IT systems)

![Diagram of 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

![Diagram of insulation fault location system EDS3090/3091 in unearthed systems (IT systems)]
# 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>
</tr>
</thead>
<tbody>
<tr>
<td>Application range</td>
<td>Main circuits or Control circuits</td>
</tr>
</tbody>
</table>

**Insulation monitoring device ISOMETER®/Locating current injector PGH**

<table>
<thead>
<tr>
<th>Type</th>
<th>ISO685-x-P</th>
<th>ISOx1685xP</th>
<th>IRDH575</th>
<th>IRDH575</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal system voltage $U_n$</td>
<td>AC 0...690 V, DC 0...1000 V</td>
<td>isoLR1685DP: AC 0...690, DC 0...690 V</td>
<td>isoLR1685DP: AC 0...1000 V, DC 0...1500 V</td>
<td>3AC, AC 20...150 V, DC 20...150 V</td>
</tr>
<tr>
<td>Locating current $I_L$</td>
<td>1/2/5/10/25/50 mA</td>
<td>1/2/5/10/25/50 mA</td>
<td>10/25/50 mA</td>
<td>1/2.5 mA</td>
</tr>
<tr>
<td>Response values</td>
<td>1 kΩ ... 10 MΩ</td>
<td>1 kΩ ... 10 MΩ</td>
<td>1 kΩ ... 10 MΩ</td>
<td>1 kΩ ... 10 MΩ</td>
</tr>
<tr>
<td>LC display</td>
<td>graphic display</td>
<td>graphic display</td>
<td>4 x 20 characters</td>
<td>4 x 20 characters</td>
</tr>
<tr>
<td>Alarm relay</td>
<td>2 changeover contacts</td>
<td>3 changeover contacts</td>
<td>3 changeover contacts</td>
<td>3 changeover contacts</td>
</tr>
<tr>
<td>Interface/protocol</td>
<td>RS-485 (BS)</td>
<td>RS-485 (BS)</td>
<td>RS-485 (BMS)</td>
<td>RS-485 (BMS)</td>
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<tr>
<td>Address range</td>
<td>1...90</td>
<td>1...90</td>
<td>1...30</td>
<td>1...30</td>
</tr>
</tbody>
</table>

**Insulation fault locator**

<table>
<thead>
<tr>
<th>Type</th>
<th>EDS195PM</th>
</tr>
</thead>
<tbody>
<tr>
<td>LC display</td>
<td>3 x 16 characters</td>
</tr>
<tr>
<td>Evaluating current $I_L$</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>

**Messzangen**

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<thead>
<tr>
<th>Type</th>
<th>PSA3020</th>
<th>PSA3052</th>
<th>PSA3165 (optional)</th>
<th>PSA3320</th>
<th>PSA3352</th>
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<tr>
<td>20 mm</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>52 mm</td>
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<tr>
<td>115 mm</td>
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<td>✔</td>
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<td>✔</td>
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**Complete systems**

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<th>Type</th>
<th>EDS3090</th>
<th>EDS3091</th>
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<tr>
<td>Comprising</td>
<td>Aluminium case, EDS195PM, PSA3020, PSA3052, power supply unit</td>
<td>Aluminium case, EDS195PM, PSA3020, PSA3052, power supply unit</td>
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</tbody>
</table>
Device selection for IT systems
without a permanently installed equipment for insulation fault location

Application Main circuit Control circuit

energised offline energised

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…380 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 $I_{\text{L}}$ max.</td>
<td>10/25 mA</td>
<td>10/25 mA</td>
<td>1/2.5 mA</td>
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</tbody>
</table>

Insulation fault locator

<table>
<thead>
<tr>
<th>Type</th>
<th>EDS195PM</th>
</tr>
</thead>
<tbody>
<tr>
<td>LC display</td>
<td>3 x 16 characters</td>
</tr>
<tr>
<td>Evaluating current $I_{\Delta L}$</td>
<td>0.2…50 mA</td>
</tr>
<tr>
<td>Response value</td>
<td>0.2…1/2…10 mA selectable</td>
</tr>
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</table>

Measuring clamps

<table>
<thead>
<tr>
<th>Type</th>
<th>PSA3020</th>
<th>PSA3032</th>
<th>PSA3165 (optional)</th>
<th>PSA3320</th>
<th>PSA3352</th>
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<tbody>
<tr>
<td>20 mm</td>
<td>[ ]</td>
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<td>[ ]</td>
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<tr>
<td>52 mm</td>
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<tr>
<td>115 mm</td>
<td>[ ]</td>
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Components EDS309...

<table>
<thead>
<tr>
<th>Device type</th>
<th>Accessories</th>
<th>PGH18... with accessories for Measuring clamps</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDS3090</td>
<td>1</td>
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<tr>
<td>EDS3090PG</td>
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<tr>
<td>EDS3090PG-13</td>
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<tr>
<td>EDS3091</td>
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<td>EDS3092PG</td>
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<tr>
<td>EDS3096PG</td>
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</tr>
<tr>
<td>EDS3096PG-13</td>
<td>1</td>
<td>1</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>
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<tbody>
<tr>
<td>AC, 3N/LAC</td>
<td>DC</td>
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<td>500…790 V</td>
<td>400…960 V</td>
<td>AGE185</td>
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<td>B980305</td>
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Wiring diagram

Locating current injector PGH185 and coupling device AGE185
Device overview residual current monitors LINETRAXX®

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<th>183</th>
<th>186</th>
<th>189</th>
<th>196</th>
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<tbody>
<tr>
<td>Special applications</td>
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<td>42…2000 Hz</td>
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<td>12 (per device)</td>
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<td>Response value</td>
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<tr>
<td>$\Delta n_1$</td>
<td>50…100 % x $I_{A2}$</td>
<td>50…100 % x $I_{B2}$</td>
<td>50…100 % x $I_{C2}$</td>
<td>10…100 % x $I_{A2}$ min. 5 mA</td>
<td>50…100 % x $I_{B2}$</td>
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<td>$\Delta n_2$</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)</td>
<td>6 mA…20 A (Type A)</td>
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<td>0…10 s</td>
<td>0…10 s</td>
<td>0…10 s</td>
<td>0…99 s</td>
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<td>Start-up delay $t_{off}$</td>
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<td>0…10 s</td>
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<td>0…99 s</td>
<td>0…600 s</td>
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<td>Delay on release $t_{on}$</td>
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<td>Operating principle, alarm relays</td>
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<td>N/C operation or N/O operation</td>
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Suitable system components

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<thead>
<tr>
<th>Type</th>
<th>S.</th>
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<tbody>
<tr>
<td>Measuring current transformers</td>
<td></td>
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<tr>
<td>CTAC…</td>
<td>334</td>
<td></td>
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<tr>
<td>CTEB100</td>
<td>337</td>
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<tr>
<td>WR…S/P</td>
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<tr>
<td>WS…</td>
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<td>WF…</td>
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<tr>
<td>RS-485 repeater</td>
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<td>DK-1DL</td>
<td>370</td>
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<tr>
<td>Power supply units</td>
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<td>STEP-PS</td>
<td>362</td>
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</table>
### Fault current monitoring of electric vehicle AC charging stations

<table>
<thead>
<tr>
<th>MRCD application</th>
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<tbody>
<tr>
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<table>
<thead>
<tr>
<th>DC 6 mA</th>
<th>10 mA…10 A</th>
<th>30 mA…3 A</th>
<th>3.5…100 mA (DC)</th>
<th>3.5…100 mA (DC)</th>
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<td>RMS 30 mA</td>
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<td>3.5…100 mA (r.m.s.)</td>
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<table>
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<tr>
<th>0 s…60 min</th>
<th>50 ms…60 min</th>
<th>0 s…60 min</th>
<th>0 s…60 min</th>
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<th>2 s (after reset)</th>
<th>N/C operation</th>
<th>N/C operation or N/O operation</th>
<th>N/C operation or N/O operation</th>
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### Suitable system components

<table>
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<tr>
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<th>CTUB100</th>
<th>WR…S(P)</th>
<th>WS…</th>
<th>W F…</th>
<th>RS-485</th>
<th>Power supply</th>
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<td>Dl-1DL</td>
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</tbody>
</table>

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**LINETRAXX**
- **RCMB42…**
- **MRCDB300 series**
- **RCMB131-01**
- **RCMB131-02**
- **RCMB132-01**
LINETRAXX® RCM420
Residual current monitor for AC current monitoring in TN and TT systems

Device features
- AC and pulsed DC sensitive residual current monitor Type A according to IEC 62020
- r.m.s. value measurement (AC)
- Two separately adjustable response values
- Frequency range 42…2000 Hz
- Start-up delay, response delay and delay on release
- Restart function
- Digital measured value display via LC display
- Measured value memory for operating value
- CT connection monitoring
- LEDs: Power On, Alarm 1, Alarm 2
- Internal/external test/reset button
- Two separate alarm relays (one changeover contact each)
- N/O or N/C operation and fault memory behaviour selectable
- Password protection for device setting
- Device self monitoring
- Sealable transparent cover
- Internal/external test/reset button
- Two-module enclosure (36 mm)
- RoHS compliant
- Push-wire terminal (two terminals per connection)

Typical applications
- Residual current monitoring in earthed 2, 3 or 4-conductor systems
- Current monitoring of, in the normal case, de-energised single conductors
- Socket-outlet circuits for devices which are operated unattended for a long time and which may not fail
- Alarm systems, safety devices
- Air conditioning systems, EDP systems
- Cooling equipment with valuable frozen goods
- Canteen kitchens
- Monitoring of earthed power supplies for stray currents
- Monitoring of earthed power supplies for stray currents
- Impact on N conductors
- Trace heating systems

Approvals

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

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage ¹</th>
<th>DC</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 16…72 V, 40…460 Hz</td>
<td>9.6…94 V</td>
<td>RCM420-D-1</td>
<td>B94014001 B74014001</td>
</tr>
<tr>
<td>70…300 V, 40…460 Hz</td>
<td>70…300 V</td>
<td>RCM420-D-2</td>
<td>B94014002 B74014002</td>
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</table>

¹ Absolute values

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
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</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B 9806 0008</td>
</tr>
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</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type of construction</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
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<tbody>
<tr>
<td>Measuring current transformers</td>
<td>circular CTAC…</td>
<td>B981100…</td>
<td>334</td>
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<tr>
<td></td>
<td>rectangular WR…S(P)</td>
<td>B9117…</td>
<td>341</td>
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<tr>
<td></td>
<td>split-core WR…</td>
<td>B980806…</td>
<td>343</td>
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<tr>
<td></td>
<td>flexible WF…</td>
<td>B780802…</td>
<td>347</td>
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</tbody>
</table>
## Technical data

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

**RCM420-D-1**
- Rated insulation voltage: 100 V
- Rated impulse voltage/pollution degree: 2.5 kV/3
- 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...72 V
- Operating range \( U_s \): AC 16...72 V/DC 9.6...94 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...2000 Hz

### Operating characteristics

- Overvoltage category: III
- Rated impulse voltage/pollution degree: 2 kV/3
- Rated insulation voltage: 100 V

### Response values

- Rated residual operating current \( I_{\Delta n1} \) (prewarning, AL1): \( 50...100 \% \times I \)\
- Rated residual operating current \( I_{\Delta n2} \) (Alarm, AL2): \( 10 mA...10 A (30 mA) \)
- Hysteresis: \( 10...25 \% (15\%) \)

### Specified time

- Starting delay \( t_s \): \( 0...10 s (0.5 \ s) \)
- Response delay \( t_{\text{rd},1} \) (Alarm): \( 0...10 s (0 \ s) \)
- Response delay \( t_{\text{rd},2} \) (prewarning): \( 0...10 s (1 \ s) \)
- Delay on release \( t_{\text{dl}} \): \( 0...300 s (1 \ s) \)
- Operating time \( t_{\text{op}} \) at \( I_{\Delta n1} \): \( < 180 \ ms \)
- Operating time \( t_{\text{op}} \) at \( I_{\Delta n2} \): \( < 30 \ ms \)
- Response time \( t_{\text{rs}} \): \( t_{as} = t_{dc} + t_{\text{rs},2} \)
- Recovery time \( t_r \): \( < 300 \ ms \)
- Number of reload cycles: \( 0...100 \ (0) \)

### Cable lengths for measuring current transformers

- Single wire: \( \geq 0.75 \ mm^2 \)
  - 0...1 m
- Single wire, twisted: \( \geq 0.75 \ mm^2 \)
  - 0...10 m
- Shielded cable: \( \geq 0.75 \ mm^2 \)
  - 0...40 m
- Recommended cable (shielded, shield on one side connected to terminal 1 of the RCM420, not connected to earth):
  - >50Y (min. 2x0.8)

### Connection

- Screw terminals

### Displays, memory

- Display range, measured value: \( 3 mA...16 A \)
- Error of indication: \( \pm 1.5 \% \pm 2 \ digit \)
- Measured-value memory for alarm values: data record measured values
- Password: off/0...999 (OFF)
- Fault memory alarm relay: on/off (OFF)

### Dimension diagram (dimensions in mm)

![Dimension diagram](image)

### Switching elements

- Number of switching elements: 2 x 1 changeover contact
- Operating principle: N/C operation/ N/O operation (N/O operation)
- Electrical service life under rated operating conditions: 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

- Operating temperature: \(-25...+55 ^\circ C \)
- Classification of climatic conditions IEC 60721
  - 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 application: use 60/70°C copper conductors only
- Connection type: screw-type terminal or push-wire terminal

### Screw-type terminal

- Connection properties:
  - rigid/flexible/AWG: 0.2...2.5 mm²/AWG 24...12

### 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: 8 mm
  - Tightening torque, terminal screws: 0.5...0.6 Nm
  - Test opening, diameter: 2.1 mm

### Other

- Operating mode: continuous operation
- Protection class, internal components (DIN EN 60529): IP30
- Degree of protection, terminals (DIN EN 60529): IP20
- Enclosure material: polycarbonate
- Flammability class: UL94V-0
- DIN rail mounting acc. to: IEC 60715
- Screw mounting: 2 x M4 with mounting clip
- Documentation number: D00057
- Weight: \( \leq 150 \ g \)

*(*) = factory setting
Wiring diagram

1. A1, A2  Supply voltage $U_S$ see ordering information, 6 A fuse recommended
2. k, l  Connection of the external measuring current transformer
3. 11, 12, 14  Alarm relay "K1": configurable for alarm $I_{\Delta n1}/I_{\Delta n2}$/TEST/ERROR
4. 21, 22, 24  Alarm relay "K2": configurable for alarm $I_{\Delta n1}/I_{\Delta n2}$/TEST/ERROR
5. T/R  Combined test and reset button "T/R" short-time pressing (< 1.5 s) = RESET long-time pressing (> 1.5 s) = TEST

* when a shielded cable is used

Do not route the PE conductor through the measuring current transformer!
**LINETRAXX® RCMA420**

Residual current monitor for monitoring AC, DC and pulsed DC currents in TN and TT systems

**Device features**
- AC/DC sensitive residual current monitor Type B acc. to IEC 62020 and IEC/TR 60755
- r.m.s. value measurement (AC+DC)
- Two separately adjustable response values 10…500 mA
- Frequency range 0…2000 Hz
- Start-up delay, response delay and delay on release
- Digital measured value display via LC display
- Measured value memory for operating value
- CT connection monitoring
- LEDs: Power On, Alarm 1, Alarm 2
- Internal/external test/reset button
- Two separate alarm relays (one changeover contact each)
- N/O or N/C operation and fault memory selectable
- Continuous self monitoring
- Multi-functional LC display
- Password protection for device settings
- Sealable transparent cover
- Two-module enclosure (36 mm)
- RoHS compliant

**Typical applications**
- AC/DC sensitive residual current monitoring in earthed two, three or four conductor systems (TN and TT systems)
- Monitoring of variable-speed drives, UPS systems, construction site equipment, printing machines, battery systems, laboratory equipment, wood working machines, MF welding systems, furniture industry, medical electrical equipment, etc.
- AC/DC sensitive current monitoring of, in the normal case, de-energised single conductors (e.g. N and PE conductors)

**Approvals**

![CE, EAC, UL, cULus](image)

**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>
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<tbody>
<tr>
<td></td>
<td>AC</td>
<td>DC</td>
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<tr>
<td>16…72 V, 42…460 Hz</td>
<td>RCMA420-D-1</td>
<td>B94043001</td>
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<tr>
<td>70…300 V, 42…460 Hz</td>
<td>RCMA420-D-2</td>
<td>B94043002</td>
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* Absolute values

**Accessories**

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<th>Description</th>
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<td>Mounting clip for screw mounting</td>
<td>B 9806 0008</td>
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<tr>
<td>(1 piece per device)</td>
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<tr>
<th>Description</th>
<th>Type of construction</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
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<tbody>
<tr>
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<td>circular</td>
<td>CTUB100</td>
<td>B781200…</td>
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<td>Connecting cables for Measuring</td>
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<td>B9811008…</td>
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### Technical data

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

<table>
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<th>Value</th>
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<tbody>
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<td>100 V</td>
</tr>
<tr>
<td>Overvoltage category/pollution degree</td>
<td>III/3</td>
</tr>
<tr>
<td>Rated impulse voltage</td>
<td>2,5 kV/3</td>
</tr>
</tbody>
</table>

#### RCA240-D-1:

- **Rated insulation voltage**: 250 V
- **Overvoltage category/pollution degree**: III/3
- **Rated impulse voltage**: 4 kV

#### Supply voltage

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
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<tbody>
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<td>Supply voltage range U₀</td>
<td>AC 24…60 V/DC 24…78 V</td>
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<tr>
<td>Operating range Uᵢ</td>
<td>AC 16…72 V/DC 9.6…94 V</td>
</tr>
<tr>
<td>Frequency range Uᵦ</td>
<td>DC, 42…460 Hz</td>
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</tbody>
</table>

#### RCA240-D-2:

- **Rated insulation voltage**: 250 V
- **Overvoltage category/pollution degree**: III/3
- **Rated impulse voltage**: 4 kV

#### Supply voltage

<table>
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<th>Description</th>
<th>Value</th>
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<tbody>
<tr>
<td>Supply voltage range U₀</td>
<td>AC 100…250 V</td>
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<tr>
<td>Operating range Uᵢ</td>
<td>AC/DC 70…300 V</td>
</tr>
<tr>
<td>Frequency range Uᵦ</td>
<td>42…460 Hz</td>
</tr>
</tbody>
</table>

#### Protective separation (reinforced insulation) between

- A1, A2
- k, l
- T, R
- 11, 12, 14
- 21, 22, 24

#### Voltage test according to IEC 61010-1

- **Rated insulation voltage (measuring current transformer)**: 800 V

#### Rated insulation voltage

- **RCMA420-D-1**: 250 V
- **RCMA420-D-2**: 100 V

#### Frequency range

- **RCMA420-D-1**: ≥ 16…≤ 1000 Hz: 0…-35 %
- **RCMA420-D-2**: > 2…<16 Hz: -35…+100 %

#### Measuring circuit

- **External measuring current transformer**: CTUB10x-CTBC20(P), CTUB10x-CTBC35(P), CTUB10x-CTBC60(P)
- **Rated impulse voltage**: 4 kV
- **Overvoltage category/pollution degree**: III/3
- **Rated insulation voltage**: 250 V

#### Measuring range

- **AC/DC 70…300 V**
- **AC 24…60 V/DC 24…78 V**
- **AC/DC 100…250 V**
- **AC 24…60 V/DC 24…78 V**
- **AC 16…72 V/DC 9.6…94 V**

#### Measuring range DC

- **0…600 mA**
- **0…600 mA**
- **0…1.5 A**
- **0…1.5 A**
- **0…1.5 A**

#### Measuring range AC

- **0…1.5 A**
- **0…1.5 A**
- **0…1.5 A**

#### Connection

- **For UL applications**: use 60°C/70°C copper conductors only

#### Screw-type terminal

- Rigid/flexible: 0.2…2.5 mm² (AWG 24…14)
- Flexible with ferrules: 0.2…1.5 mm² (AWG 24…16)
- Flexible without ferrules: 0.75…2.5 mm² (AWG 19…14)

#### Push-wire terminals

- Rigid: 0.2…2.5 mm² (AWG 24…14)
- Flexible without ferrules: 0.25…2.5 mm² (AWG 19…14)
- Flexible with ferrules: 0.2…1.5 mm² (AWG 24…16)

#### Operating temperature

- -25…+55 °C

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

- **Rated residual operating current**: Iᵣ ≤ 5 A
- **Rated operational voltage UL**: 200 V
- **Utilization category**: AC-13

#### Contact properties

- **Rated residual operating current Iᵣ**: 50…100 % x Δn₁/² (50 mA)*
- **Rated operational current Iᵢ**: 10…500 mA (30 mA)*
- **Hysteresis**: 10…25 % (15%)*

#### Mechanical properties

- **Dead zone**: Δn₁/² ≤ 180 ms
- **Response time**: tᵣ ≤ 300 ms
- **Operating mode**: continuous operation
- **Operating principle**: N/C operation/N/O operation (N/C operation)*

#### Environment/EMC

- **Class of climatic conditions IEC 60721**
- **Class of mechanical conditions acc. to IEC 60721**

#### Classification of climatic conditions IEC 60721

- **Stationary use (IEC 60721-3-2)**: 3K4 (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 60721-3-1)**: 3M4
- **Storage (IEC 60721-3-1)**: 1M3

#### UL applications

- Use with M4 flange

#### Connection properties

- **Rated residual operating current Iᵣ (perwarning, AL1)**: 50…100 % x Δn₁/² (50 mA)*
- **Rated residual operating current Iᵣ (Alarm, AL2)**: 10…500 mA (30 mA)*
- **Hysteresis**: 10…25 % (15%)*

#### Displaying properties

- **Display range, measured value AC**: 0…1.5 A
- **Display range, measured value DC**: 0…600 mA
- **Error of indication**: ±17.5 %/± 2 digit
- **Measured-value memory for alarm value**: data record measured values
- **Password**: off/on (off)*
- **Fault memory alarm relay**: on/off (on)*

#### Inputs/outputs

- **Cable length for external test/reset button**: 0…10 m

#### Cable lengths for measuring current transformers

- **Connection CTX**: 1 m/2.5 m/5 m/10 m
- **or alternatively**: single wire 6 x 0.75 mm²

#### Switching elements

- **Number of switching elements**: 2 x 1 changeover contact
- **Operating principle**: N/C operation/N/O operation (N/C operation)*

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

- **Utilization category**: AC-13
- **Rated operational voltage**: 230 V
- **Rated operational voltage UL**: 200 V
- **Rated operational current**: 5 A
- **Minimum contact load**: 1 mA at AC/DC ≥ 10 V

#### Environment/EMC

- **EMC**: IEC 62020
- **Operating temperature**: -25…+55 °C

#### Classification of climatic conditions IEC 60721

- **Stationary use (IEC 60721-3-3)**: 3M4
- **Transportation (IEC 60721-3-2)**: 2M2
- **Storage (IEC 60721-3-1)**: 1M3

### Other

- **Position of normal use**: display-oriented
- **Degree of protection, terminals (IEC 60529)**
- **Enclosure material**: polycarbonate
- **Flammability class**: UL94V-0
- **DIN rail mounting acc. to**: IEC 60715
- **Screw fixing**: 2 x M4 with mounting clip
- **Documentation number**: D00059
- **Weight**: ≤ 150 g

---

### Dimension diagram

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

1. A1, A2  
   - Supply voltage $U_s$ see ordering information, 6 A fuse recommended

2. Connector for the external CTUB10x-CTBC20…CTUB10x-CTBC60 series measuring current transformer

3. 11, 12, 14  
   - Alarm relay "K1": $I_{\Delta n1}$ (preading)

4. 21, 22, 24  
   - Alarm relay "K2": alarm $I_{\Delta n2}$ (alarm)

5. T/R  
   - 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 CTX… connecting cable.

Colour coding for CTX…:  
- $k$ = yellow, $l$ = green, $-12V$ = black, GND = brown, $+12V$ = red, Test (T) = orange
LINETRAXX® RCMA423
Residual current monitor for monitoring AC, DC and pulsed DC currents in TN-and TT systems

Device features
- AC/DC sensitive residual current monitor Type B acc. to IEC 62020 and IEC/TR 60755
- r.m.s. value measurement (AC+DC)
- Two separately adjustable response values 30…3 A
- Frequency range 0…2000 Hz
- Start-up delay, response delay and delay on release
- Digital measured value display via LC display
- Measured value memory for operating value
- CT connection monitoring
- LEDs: Power On, Alarm 1, Alarm 2
- Internal/external test/reset button
- Two separate alarm relays (one changeover contact each)
- N/O or N/C operation and fault memory selectable
- Continuous self monitoring
- Multi-functional LC display
- Password protection for device settings
- Sealable transparent cover
- Internal/external test/reset button
- Two separate alarm relays (one changeover contact each)
- N/O or N/C operation and fault memory selectable
- Continuous self monitoring
- Multi-functional LC display
- Password protection for device settings
- Sealable transparent cover
- Two-module enclosure (36 mm)

Typical applications
- AC/DC sensitive residual current monitoring in earthed two, three
  or four conductor systems (TN and TT systems)
- Monitoring of variable-speed drives, UPS systems, construction
  site equipment, printing machines, battery systems, laboratory
  equipment, wood working ma-
  chines, MF welding systems,
  furniture industry, medical electrical
  equipment, etc.
- AC/DC sensitive current monitoring
  of, in the normal case, de-energised
  single conductors (e.g. N conductors)

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

Approvals

Ordering information

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Residual current monitoring system | 1-channel, AC/DC sensitive residual current monitoring RCMA

### Technical data

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

- **RCMA423-D-1:**
  - Rated insulation voltage: 100 V
  - Overvoltage category/pollution degree: III/3
  - Rated impulse voltage: 2.5 kV

- **RCMA423-D-2:**
  - Rated insulation voltage: 250 V
  - Overvoltage category/pollution degree: III/3
  - Rated impulse voltage/pollution degree: 4 kV

#### Supply voltage

- **RCMA423-D-1:**
  - Supply voltage range \( U_s \):
    - AC 24…60 V/DC 24…78 V
  - Operating range \( U_s \):
    - AC/DC 70…240 V
  - Frequency range \( f_s \):
    - 42…460 Hz

- **RCMA423-D-2:**
  - Supply voltage range \( U_s \):
    - AC 100…250 V
  - Operating range \( U_s \):
    - AC/DC 70…300 V
  - Frequency range \( f_s \):
    - 42…460 Hz

#### Response values

- Rated residual operating current \( I_{\Delta n1} \) (prewarning, AL1): 50…100 % of response values
- Rated residual operating current \( I_{\Delta n2} \) (alarm, AL2): 30 mA…3 A (30 mA)*
- Operating time \( t_{an} = t_{ae} + t_{on1/2} \)
- Response time \( t_{an} \)

#### Specifications

- Start-up delay \( t_{0} \)
- Response delay \( t_{r} \) (prewarning)
- Response delay \( t_{r} \) (alarm)
- Delay on release \( t_{on} \)
- Operating time \( t_{on} \) bei \( t_{on} = 1 \times t_{on1/2} \)
- Operating time \( t_{on} \) bei \( t_{on} = 5 \times t_{on1/2} \)
- Recovery time \( t_{r} \)

#### 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…99 (off)*
- Fault memory alarm relay: on/off (on)*

#### Dimensions (dimensions in mm)

- Width: 36 mm
- Height: 20 mm
- Depth: 84 mm

### Environmental/EMC

- **EMC**
  - EN 61326-1

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

- **Stationary use** (IEC 60721-3-3)
  - 3M4
  - Temperature: -25…+70 °C
  - Humidity: 30…98 %

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

- **Stationary use** (IEC 60721-3-3)
  - 3M3
  - Impact: 3G
  - Bending test: 10 mm

### Connection

- **For Ul application**
  - Use 60/70°C copper conductors only
  - Connection type: screw-type terminal or push-wire terminal

### Screw-type terminal

- **Connection properties:**
  - Rigid/flexible/AWG: 0.2…4/0.2…2.5 mm²/AWG 24…12

### Push-wire terminals

- **Connection properties:**
  - Rigid: 0.2…1.5 mm²/AWG 24…12
  - Flexible without ferrules: 0.75…2.5 mm²/AWG 19…14
  - Flexible with ferrules: 0.2…1.5 mm²/AWG 24…16

### Other

- **Operating mode:** continuous operation
- **Position of normal use:** display-oriented
- **Degree of protection, internal components (IEC 60529):** IP20
- **Degree of protection, terminal components (IEC 60529):** IP40
- **Enclosure material:** polycarbonate
- **Flammability class:** UL 94V-0
- **DIN rail mounting acc. to IEC 60715**
- **Screw mounting:** 2 x M4 with mounting clip
- **Weight:** ≤ 150 g

### Switching elements

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

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

- **Utilisation category:**
  - AC 13
  - AC 14
  - DC 12
  - DC 12

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

- **Rated operational voltage UL:**
  - 200 V
  - 200 V
  - 24 V
  - 110 V
  - 200 V

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

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

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2020/2021

Residual current monitor LINETRAXX® RCMA423

Documentation number D00063

Weight ≤ 150 g

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2020/2021

Residual current monitoring system | 1-channel, AC/DC sensitive residual current monitoring RCMA

Residual current monitor LINETRAXX® RCMA423

Documentation number D00063

Weight ≤ 150 g
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$_{\Delta n1}$ (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!

Connection of measuring current transformers

Connection to the RCMA423 residual current monitor using the CTX-… connecting cable. Colour coding for CTX-…: k = yellow, l = green, -12 V = black, GND = brown, +12 V = red, Test (T) = orange
LINETRAXX® RCMS460-D/-L – RCMS490-D/-L
Multi-channel AC, pulsed DC and AC/DC sensitive residual current monitors for earthed AC, DC and AC/DC systems (TN and TT systems)

Device features
- Optional AC, pulsed DC or AC/DC sensitive measurement by selecting the respective measuring current transformer for each channel
- True r.m.s. value measurement
- 12 measuring channels per device for residual current measurement or digital input
- Up to 90 RCMS... monitors, up to 1080 measuring channels in the system
- Fast parallel scanning for all channels
- Response ranges:
  - 10 mA...10 A (0...2000 Hz), 6 mA...20 A (42...2000 Hz), 100 mA...125 A (42...2000 Hz) RCMS...-D4
- Preset function
- Adjustable time delays
- The frequency response characteristics can be set for the protection of persons, fire and plant protection
- History memory with date and time stamp for 300 data records
- Data logger for 300 data records/channel
- Analysis of the harmonics, DC, THF
- Two alarm relays with one changeover contact each
- Device version RCMS490 with one alarm contact per channel
- N/O or N/C operation and fault memory selectable
- Connection external test/reset button
- Backlit graphical display and alarm LEDs
- Data exchange via BMS bus
- Password protection for device setting
- Continuous CT connection monitoring
- RoHS compliant

Standards
The LINETRAXX® RCMS460/490 series complies with the requirements of the device standards:
- DIN EN 62020 (VDE 0663)
- IEC 62020.

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

Typical applications
- Measuring and evaluating residual, fault and rated currents of loads and installations in the frequency range of 0...2000 Hz (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

Approvals

2020/2021
Residual current monitoring systems | Multichannel residual current monitoring RCMS
Residual current monitors LINETRAXX® RCMS460-D/-L – RCMS490-D/-L
### Ordering information RCMS460/490-D

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<td>6 mA…20 A</td>
<td>2 x 1 changeover contact</td>
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<td>6 mA…20 A</td>
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<td>16…72 V, 50/60 Hz</td>
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<td>6 mA…20 A</td>
<td>10 mA…10 A</td>
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1) Absolute values
2) For UL application: $U_s$ max = DC 250 V; AC 250 V, 50/60 Hz
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<td>100 mA…125 A</td>
</tr>
<tr>
<td>Rated residual operating current $I_{\Delta n 2}$ (Alarm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated residual operating current $I_{\Delta n 1}$ (prewarning)</td>
<td>10…100 %, min. 5 mA</td>
<td>10…100 %, min. 5 mA</td>
<td>10…100 %, min. 5 mA</td>
<td>10…100 %, min. 5 mA</td>
</tr>
<tr>
<td>Function selectable per channel off, &lt;, &gt;, I/O</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>Cut-off frequency adjustable for personnel, plant and fire protection</td>
<td>✗</td>
<td>*</td>
<td>✗</td>
<td>*</td>
</tr>
<tr>
<td>Preset function for $I_{\Delta n 2}$ and I/O</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>2…40 %</td>
<td>2…40 %</td>
<td>2…40 %</td>
<td>2…40 %</td>
</tr>
<tr>
<td>Factor for additional CT</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>Switching elements</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common alarm relay 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 relay per channel</td>
<td>–</td>
<td>–</td>
<td>12 x 1 N/O contact</td>
<td>12 x 1 N/O contact</td>
</tr>
<tr>
<td>Start-up delay 0…99 s</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>Response delay ty, adjustable 0…999 s</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>Operating time at $I_{\Delta n} = 1 \times I_{\Delta n 2}$ ≤ 180 ms</td>
<td>✗</td>
<td>*</td>
<td>✗</td>
<td>*</td>
</tr>
<tr>
<td>$I_{\Delta n} = 5 \times I_{\Delta n 2}$ ≤ 30 ms</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>Displays, memory</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analysis of the harmonics ($I_s$, DC, THF)</td>
<td>✗</td>
<td>*</td>
<td>✗</td>
<td>*</td>
</tr>
<tr>
<td>History memory 300 data records</td>
<td>✗</td>
<td>–</td>
<td>✗</td>
<td>–</td>
</tr>
<tr>
<td>Data logger for 300 data records/ channel</td>
<td>✗</td>
<td>–</td>
<td>✗</td>
<td>–</td>
</tr>
<tr>
<td>Internal clock</td>
<td>✗</td>
<td>–</td>
<td>✗</td>
<td>–</td>
</tr>
<tr>
<td>Password</td>
<td>✗</td>
<td>–</td>
<td>✗</td>
<td>–</td>
</tr>
<tr>
<td>Language English, German, French, Swedish</td>
<td>✗</td>
<td>–</td>
<td>✗</td>
<td>–</td>
</tr>
<tr>
<td>Backlight graphics LC display</td>
<td>✗</td>
<td>–</td>
<td>✗</td>
<td>–</td>
</tr>
<tr>
<td>7-segment display and LED line</td>
<td>✗</td>
<td>–</td>
<td>✗</td>
<td>–</td>
</tr>
</tbody>
</table>

* only in conjunction with RCMS4xx-D, MK2430 or COM460IP
### Technical data

#### a) RCMS4x0-D1

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>Ux</td>
</tr>
<tr>
<td>DC/AC 24...75 V/AC 24...60 V (AC/DC ±20 %)</td>
<td></td>
</tr>
<tr>
<td>Supply voltage frequency</td>
<td>Vx</td>
</tr>
<tr>
<td>DC, 50/60 Hz</td>
<td></td>
</tr>
<tr>
<td>Rated insulation voltage</td>
<td>100 V</td>
</tr>
<tr>
<td>Rated impulse voltage/pollution degree</td>
<td>2.5 V/K</td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>III</td>
</tr>
<tr>
<td>Protective separation (reinforced insulation) between channels (1-12)</td>
<td>(K1, K2) - (R, T, X, B)</td>
</tr>
<tr>
<td>Voltage test acc. to IEC 61010-1</td>
<td>3.34 V</td>
</tr>
</tbody>
</table>

#### b) RCMS4x0-D2

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>Ux</td>
</tr>
<tr>
<td>AC/DC 100...240 V (±20...+15 %)</td>
<td></td>
</tr>
<tr>
<td>Supply voltage frequency</td>
<td>Vx</td>
</tr>
<tr>
<td>DC, 50/60 Hz</td>
<td></td>
</tr>
<tr>
<td>Rated insulation voltage</td>
<td>250 V</td>
</tr>
<tr>
<td>Rated impulse voltage/pollution degree</td>
<td>6 V/K</td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>III</td>
</tr>
<tr>
<td>Protective separation (reinforced insulation) between channels (1-12)</td>
<td>(K1, K2) - (R, T, X, B)</td>
</tr>
<tr>
<td>Voltage test acc. to IEC 61010-1</td>
<td>2.21 V</td>
</tr>
</tbody>
</table>

### Measuring circuit

**External measuring current transformers**

W..., WR..., WS..., WF... series (Type A), W..., WA... series (Type B)

**CT monitoring**

on/off (on/off)

**Rated burden currents**

- 48 Ω
- 64 Ω

**Rated burden voltages**

- 48 V
- 64 V

**Rated insulation voltage**

(measuring current transformer) 800 V

**Operating characteristics**

- According to IEC/TR 60755
- Type A and Type B depending on measuring current transformer series (10 A)

**Rated frequency**

- 0...2000 Hz (Type B) / 42...2000 Hz (Type A)

**Cut-off frequency**

non, IEC, 50 Hz, 60 Hz (non)

**Measuring range**

RCMS...-D/-L 0...30 A (measuring current transformer Type A)

**Crest factor up to 10 A = 4, up to 20 A = 2**

**Measuring range**

- 48 V
- 64 V

**Rated residual operating current Δn2 (alarm)**

- 10 mA
- 10 A (Type B)
- 6 mA
- 20 A (Type A)

**Rated residual operating current Δn2 (alarm) overcurrent**

- 100 mA

**Rated residual operating current Δn3 (alarm)**

- 100 mA
- 125 A (16 A overcurrent)

**Rated residual operating current Δn3 (alarm) overcurrent**

- 100 mA
- 125 A (16 A overcurrent)

**Digital input**

<table>
<thead>
<tr>
<th>T</th>
<th>1 - 1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>0 - 250</td>
</tr>
</tbody>
</table>

**Preset for alarm**

<table>
<thead>
<tr>
<th>T</th>
<th>0...100</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>0 - 250</td>
</tr>
</tbody>
</table>

**Offset**

<table>
<thead>
<tr>
<th>T</th>
<th>0 - 20 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>0 - 20 mA</td>
</tr>
</tbody>
</table>

**Relative uncertainty**

- 0...10 %

**Hysteresis**

<table>
<thead>
<tr>
<th>T</th>
<th>0...20 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>2...40 %</td>
</tr>
</tbody>
</table>

**Factor for additional CT**

<table>
<thead>
<tr>
<th>T</th>
<th>1/10; 1/1; 75/50 (x)</th>
</tr>
</thead>
</table>

**Number of measuring channels (per device/system)**

<table>
<thead>
<tr>
<th>T</th>
<th>12/1080</th>
</tr>
</thead>
</table>

### Time response

- Start-up delay (from start-up) per device 0...99.9 s (0 ms)
- Response delay Δn3 per channel 0...99.9 s (200 ms)
- Delay on release Δt per channel 0...99.9 s (200 ms)
- Operating time Δt R Δt = 1 x Δt R/Δt
- Operating time Δt R Δt = 5 x Δt R/Δt
- Response time Δt R for residual current measurement
- Operating time Δt R digital inputs
- Scanning time for all measuring channels (residual current measurement)
- Recovery time t0

### Displays, memory

- Measured value display range RCMS...-D/-L
  - 0...30 A (CT Type A)
  - 0...20 A (CT Type B)
- Display range, measured value RCMS...-D/-L (channels 9...12)
  - 0...125 A (CT Type A)

### Interface

- Interface/protocol
  - RS-485/BMS
- Baud rate
  - 9.6 kbit/s
- Cable length
  - 0...1200 m
- Cable (shielded, shield connected to PE on one side) recommended: min. 1-Y(St)Y min. 26 x 0.8
- For UL application: Copper lines
- at least 60/70 °C
- Terminating resistor
  - 120 Ω (0.25 W) connectable via DIP switch
- Device address, BM5 bus
  - 1...99 (2)
- Cable lengths for W..., WR..., WS..., WF... series measuring current transformers
  - Single wire ≥ 0.75 mm²
  - Single wire, twisted ≥ 0.75 mm²
- Single wire, twisted ≥ 0.75 mm²
- Single wire, twisted ≥ 0.75 mm²
- Single wire, twisted ≥ 0.75 mm²
- Single wire, twisted ≥ 0.75 mm²
- Single wire, twisted ≥ 0.75 mm²
- Single wire, twisted ≥ 0.75 mm²
- Single wire, twisted ≥ 0.75 mm²

### Environment/EMC

- EMC
  - IEC 62020
- Operating temperature
  - -25...+55 °C

### Climatic class acc. to IEC 60721

- Stationary use (IEC 60721-3-3)
  - 3K5 (except condensation and formation of ice)
- Transport (IEC 60721-3-3)
  - 2K3 (except condensation and formation of ice)
- Long-term 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)
  - 3K4
- Transport (IEC 60721-3-3)
  - 2K4
- Long-term storage (IEC 60721-3-3)
  - 1M4
## Technical data (continued)

### Connection

<table>
<thead>
<tr>
<th>Connection</th>
<th>screw terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection properties:</td>
<td></td>
</tr>
<tr>
<td>Rigid/Flexible/conductor sizes</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>Mounting</td>
<td>display-oriented</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>UL94V-0</td>
</tr>
<tr>
<td>DIN rail mounting acc. to</td>
<td>IEC 60715</td>
</tr>
<tr>
<td>Software version measurement technique</td>
<td>D235 VZ.42</td>
</tr>
<tr>
<td>Software version display</td>
<td>D256 V2.29</td>
</tr>
<tr>
<td>Power consumption</td>
<td>≤ 10 VA (RCMS460)</td>
</tr>
<tr>
<td></td>
<td>≤ 12 VA (RCMS490)</td>
</tr>
<tr>
<td>Documentation number</td>
<td>D00667</td>
</tr>
<tr>
<td>Weight</td>
<td>≤ 360 g (RCMS460), ≤ 510 g (RCMS490)</td>
</tr>
</tbody>
</table>

( )* factory setting
** In the frequency range of < 15 Hz, the relative uncertainty is between -35 % and 100 %.

### Dimension diagrams (dimensions in mm)

#### RCMS460-D/L

[Diagram of RCMS460-D/L]

#### RCMS490-D/L

[Diagram of RCMS490-D/L]

### Wiring diagrams

1. **A1, A2** Connection of supply voltage U₁ (see ordering information): we recommend the use of 6 A fuses.
2. **k1, l… k12, l** Connection of measuring current transformers CT₁…CT₁₂. Either Type A or Type B measuring current transformers can be selected for each measuring channel. Six CTUB100 series measuring current transformers require one STEP-PS power supply unit. The channels k₉…k₁₂ of the device versions RCMS460-D/-L4 require the connection of Type A measuring current transformers.
3. **A, B** BMS bus (RS-485 interface with BMS protocol)
4. **R, T/R** External reset button (N/O contact). The external reset buttons of several devices must not be connected to one another.
5. **T, T/R** External test button (N/O contact). The external test buttons of several devices must not be connected to one another.
6. **C11, C12, C14** Common alarm relay K1: Alarm 1, common message for alarm, prewarning, device error.
7. **C21, C22, C24** Common alarm relay K2: ALARM 2, common message for alarm, prewarning, device error.
8. **R_{on/ff}** Activate or deactivate the terminating resistor of the BMS bus (120 Ω).
9. **CT** Measuring current transformers (CTAC…, CTUB100, WR…, WS…, WF… series)
**Digital Input**

- **Potential-free contact**
  - 0: Resistance between k and l > 250 Ω
  - 1: Resistance between k and l < 100 Ω

- **Measuring current transformers**

**Connection CTAC…, WR…S(P), WS… series measuring current transformers (pulsed current sensitive)**

**Connection CTUB100 series measuring current transformer (AC/DC current sensitive)**

**Connection WF… series measuring current transformers**
Example for a system design – minimum system consisting of an RCMS460-D and 12 measuring points

Example for a system design – 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 CTUB100 series are used, a STEP-PS 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.
LINETRAXX® RCMS150
Residual current monitor type B with integrated measuring current transformers for unearthed AC/DC systems (TN and TT systems)

Device features

- Continuous residual current monitoring in compliance with DGUV Vorschrift 3 (German Social Accident Insurance Regulation 3)
- AC/DC sensitive residual current monitor type B with 6 channels K1…6 (each channel features 2 measuring channels: 1 x r.m.s., 1 x DC)
- Compatible with RCMS460/490 in a system setup
- Ideal for applications with space limitations
- Easy DIN rail or screw mounting to standard distribution panels
- 2 separately adjustable response values (DC or r.m.s.) per channel
- Continuous self monitoring
- Fully shielded measuring current transformers to avoid external influences due to magnetic fields that may cause disturbances
- Compatible with Bender gateways of type 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 U_S</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC</td>
<td>RCMS150</td>
<td>B 9405 3025</td>
</tr>
<tr>
<td>24 V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for DIN rail</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>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition Monitor with integrated gateway</td>
<td>COM465IP</td>
<td>B95061065</td>
<td>382</td>
</tr>
<tr>
<td>Condition Monitor</td>
<td>CP700</td>
<td>B95061030</td>
<td>394</td>
</tr>
<tr>
<td>RS-485 repeater</td>
<td>DI-1DL</td>
<td>B95012047</td>
<td>370</td>
</tr>
<tr>
<td>Power supply</td>
<td>STEP-PS</td>
<td>B940531…</td>
<td>362</td>
</tr>
<tr>
<td>Residual current monitor1)</td>
<td>RCMS460-D</td>
<td>B940530…</td>
<td>189</td>
</tr>
<tr>
<td></td>
<td>RCMS490-D</td>
<td>B940530…</td>
<td>189</td>
</tr>
</tbody>
</table>

1) from function C
2) suitable for measured value and alarm indication only, not suitable for parameter setting
Insulation coordination according to IEC 60664-1

The data are valid for the monitored primary circuit to the output circuit

<table>
<thead>
<tr>
<th>Output circuit</th>
<th>(+, -, A, B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated insulation voltage</td>
<td>300 V</td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>III</td>
</tr>
<tr>
<td>Rated impulse withstand voltage monitored circuit/output circuit</td>
<td>≤ 2000 m AMSL</td>
</tr>
<tr>
<td>Rated insulation voltage</td>
<td>250 V</td>
</tr>
<tr>
<td>Pollution degree</td>
<td>3</td>
</tr>
</tbody>
</table>

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 Us with galvanic separation

| DC 24 V |

Power consumption

< 4 W

Residual current measuring range

<table>
<thead>
<tr>
<th>Frequency range</th>
<th>Measuring range</th>
<th>1 % of the set response value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0…1000 Hz</td>
<td>±500 mA</td>
<td></td>
</tr>
</tbody>
</table>

Response values

<table>
<thead>
<tr>
<th>Residual current IΔN2 RMS</th>
<th>DC 0…300 mA (30 mA)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio IΔN2 RMS/IΔN2 DC</td>
<td>0.2…5</td>
</tr>
<tr>
<td>Preaming IΔN1 RMS/DC</td>
<td>50…100 % (50 %)*</td>
</tr>
<tr>
<td>Response tolerance IΔN2</td>
<td>DC 50…1000 Hz</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>10…25 % (15 %)</td>
</tr>
</tbody>
</table>

Time response

<table>
<thead>
<tr>
<th>Start-up delay tstart-up</th>
<th>0.5…600 s (0.5 s)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response delay</td>
<td>0…600 s (0 s)*</td>
</tr>
<tr>
<td>Delay on release</td>
<td>0…600 s (1 s)*</td>
</tr>
<tr>
<td>Stripping length</td>
<td>10 mm</td>
</tr>
</tbody>
</table>

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 (flashing) measured value range exceeded

<table>
<thead>
<tr>
<th>Interface/protocol</th>
<th>RS-485/BMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection</td>
<td>terminals A/B</td>
</tr>
<tr>
<td>Shielded cable (one end of shield connected to PE)</td>
<td>twisted pair, e.g.: J-Y5(Y)Y 2x0.8</td>
</tr>
<tr>
<td>Cable length</td>
<td>≤ 1200 m</td>
</tr>
<tr>
<td>Bus terminating resistor external</td>
<td>120 Ω (0.25 W)</td>
</tr>
<tr>
<td>Device address, BMS bus</td>
<td>2…90 (2)*</td>
</tr>
</tbody>
</table>

Environment/EMC

EMC
- Immunity IEC 61000-6-2
- Emission IEC 61000-6-3

Operating temperature

-25…+70 °C

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)
- 3K5
- 2K3
- 1K4

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)
- 3M4
- 2M2
- 1M3

Connection

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

Connection properties:

- rigid, flexible/conductor sizes AWG
- 0.2…1.5 mm²/AWG 24…16

Multi-conductor connection (2 conductors with the same cross section):

- rigid 0.2…1.5 mm²
- flexible 0.2…1.5 mm²
- flexible with ferrule without plastic sleeve 0.25…1.5 mm²
- flexible with ferrule with plastic sleeve 0.25…0.75 mm²

Stripping length

10 mm

Other

Operating mode
- continuous operation

Enclosure material
- polycarbonate

Flammability class
- UL94 V-0

Screw mounting to standard distribution panels with 12 TE
- 2 x M6

DIN rail mounting
- mounting clip (accessories)

Tightening torque
- 1.5 Nm

Documentation number
- D00259

Weight
- 170 g

Measuring current transformer

<table>
<thead>
<tr>
<th>Diameter cable gland</th>
<th>10 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load current</td>
<td>32 A</td>
</tr>
</tbody>
</table>

Bus parameter

<table>
<thead>
<tr>
<th>Alarm</th>
<th>threshold value exceeded, system fault</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured value</td>
<td>measured value, DC component, r.m.s. (resolution 0.1 mA)</td>
</tr>
<tr>
<td>Times</td>
<td>response delay, delay on release, start-up delay</td>
</tr>
</tbody>
</table>

( * = factory settings)

Technical data

<table>
<thead>
<tr>
<th>Interface</th>
<th>Interface/protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>Nominal supply voltage U_s with galvanic separation</td>
</tr>
<tr>
<td>Power consumption</td>
<td>DC 24 V</td>
</tr>
<tr>
<td>Power supply</td>
<td>&lt; 4 W</td>
</tr>
<tr>
<td>Rated insulation voltage</td>
<td>250 V</td>
</tr>
<tr>
<td>Pollution degree</td>
<td>3</td>
</tr>
<tr>
<td>Insulation BI: Overvoltage category III</td>
<td></td>
</tr>
<tr>
<td>Insulation DI: Overvoltage category II</td>
<td></td>
</tr>
<tr>
<td>Voltage test acc. to IEC 61010-1</td>
<td>AC 2.2 kV</td>
</tr>
<tr>
<td>Power supply</td>
<td>Nominal supply voltage U_s with galvanic separation</td>
</tr>
<tr>
<td>Power supply</td>
<td>DC 24 V</td>
</tr>
<tr>
<td>Power supply</td>
<td>&lt; 4 W</td>
</tr>
<tr>
<td>Residual current measuring range</td>
<td>Frequency range 0…1000 Hz</td>
</tr>
<tr>
<td>Residual current measuring range</td>
<td>Measuring range ±500 mA</td>
</tr>
<tr>
<td>Residual current measuring range</td>
<td>Resolution measured value 1 % of the set response value</td>
</tr>
<tr>
<td>Response values</td>
<td>Residual current IΔN2 RMS 0…300 mA (30 mA)*</td>
</tr>
<tr>
<td>Response values</td>
<td>Ratio IΔN2 RMS/IΔN2 DC 0.2…5</td>
</tr>
<tr>
<td>Response values</td>
<td>Preaming IΔN1 RMS/DC 50…100 % (50 %)*</td>
</tr>
<tr>
<td>Response values</td>
<td>Response tolerance IΔN2 DC 50…1000 Hz</td>
</tr>
<tr>
<td>Response values</td>
<td>Hysteresis 10…25 % (15 %)</td>
</tr>
<tr>
<td>Time response</td>
<td>Start-up delay tstart-up 0.5…600 s (0.5 s)*</td>
</tr>
<tr>
<td>Time response</td>
<td>Response delay tΔN2 RMS/DC 0…600 s (0 s)*</td>
</tr>
<tr>
<td>Time response</td>
<td>Delay on release tΔN1 RMS 0…600 s (1 s)*</td>
</tr>
<tr>
<td>Time response</td>
<td>Delay on release tΔN2 RMS 0…600 s (1 s)*</td>
</tr>
<tr>
<td>Indication (LEDs)</td>
<td>ON</td>
</tr>
<tr>
<td>Indication (LEDs)</td>
<td>green (normal operation indication)</td>
</tr>
<tr>
<td>Indication (LEDs)</td>
<td>green (flashing quickly) internal device fault or BMS bus address set incorrectly</td>
</tr>
<tr>
<td>Indication (LEDs)</td>
<td>green (flashing slowly) indication BMS bus address (after device start/address modification)</td>
</tr>
<tr>
<td>Indication (LEDs)</td>
<td>ALARM K1…6</td>
</tr>
<tr>
<td>Indication (LEDs)</td>
<td>yellow (flashing) measured value range exceeded</td>
</tr>
<tr>
<td>Indication (LEDs)</td>
<td>yellow (flashing) measured value range exceeded</td>
</tr>
</tbody>
</table>

Dimension diagrams (dimensions in mm)
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® RCMB42…
AC/DC sensitive residual current monitor

Device features
- DC sensor with additional AC tripping (type B characteristic)
- Response value 2 – AC/DC 30 mA: r.m.s. value measurement
- Response value 1: DC 6 mA
- Frequency range residual current 0…2000 Hz
- Frequency range load current 45…65 Hz
- Monitoring of the connection to the measuring current transformer
- Fully shielded residual current transformer to avoid influences due to external disturbances
- Connection via push-wire terminals
- Variants: One-channel and two-channel residual current measurement

Typical applications
- Residual current monitoring of AC charging stations for electric vehicles

Standards
The LINETRAXX® RCMB42… series complies with the following device standard:
- IEC 62752

Approvals

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

Ordering information

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>Frequency range</th>
<th>Number of measuring current transformers (Ø 15 mm, 1.5 m cable)</th>
<th>Channels</th>
<th>Supply voltage Ui</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC</td>
<td>r.m.s.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0…6 mA</td>
<td>0…30 mA</td>
<td>0…2000 Hz</td>
<td>2</td>
<td>2 x residual current</td>
<td>110…240 V, 50/60 Hz</td>
<td>150…220 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>–</td>
<td>18…36 V</td>
</tr>
<tr>
<td>1</td>
<td>1 x residual current</td>
<td></td>
<td></td>
<td>110…240 V, 50/60 Hz</td>
<td>150…220 V</td>
<td>RCMB422-2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>–</td>
<td>18…36 V</td>
<td>RCMB422-25</td>
</tr>
</tbody>
</table>

Delivery incl. measuring current transformers. Measuring current transformers available with shorter cable on request (minimum order quantity 250 pcs.)

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>
Residual current monitoring system | 1-and 2-channel, AC/DC sensitive residual current monitoring RCMB

**Technical data**

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

**Definitions**
- Supply circuit (IC1)
- Measuring circuit (IC2)
- Output circuit 1 (IC3)
- Output circuit 2 (IC4)
- Monitored current circuit (IC5)

<table>
<thead>
<tr>
<th>Insulation coordination</th>
<th>Rated voltage</th>
<th>Overvoltage category (OVPC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC1/IC2</td>
<td>40 V</td>
<td>III</td>
</tr>
<tr>
<td>IC3/IC4-IC5</td>
<td>250 V</td>
<td></td>
</tr>
<tr>
<td>IC4/IC5</td>
<td>250 V</td>
<td></td>
</tr>
</tbody>
</table>

**Rated insulation voltage**
- IC1/IC2, IC3/IC4-IC5, IC4/IC5: 40 V
- IC1-IC2: 250 V
- IC3-IC5: 250 V

**Rated impulse voltage**
- IC1/IC2: 800 V
- IC1-IC2: 4 kV
- IC2-IC5: 4 kV

**Safe isolation (reinforced insulation) between**
- IC1/IC2: 250 V
- IC3/IC4-IC5: 250 V
- IC4/IC5: 250 V

**Basic insulation between**
- IC3/IC4: 250 V

**Functional insulation between**
- IC1/IC2: DC 1 kV 60 s

**Voltage tests (routine test) acc. to IEC 61010-1**
- IC1-IC2: AC 2.2 kV
- IC2-IC5: AC 2.2 kV
- IC3/IC4: AC 2.2 kV

**Residual current measuring range**
- Rated frequency: 0 ... 2000 Hz
- Measuring range: ±300 mA

**Response values**
- Residual current Iφ1: 6 mA
- Response tolerance Δn1: -50 ... 0 %
- Residual current Iφ2: 30 mA (r.m.s.)
- Response tolerance Δn2: -20 ... 0 %
  - for f ≤ 1 kHz
  - for f > 1 kHz
- Restart sequence value
  - DC 6 mA: < 3 mA
  - AC/DC 30 mA (r.m.s.) for f ≤ 1 kHz: < 12 mA
  - AC/DC 30 mA (r.m.s.) for f > 1 kHz: < 22 mA
- Operating time tφ1: 1 x Iφ1
- Operating time tφ2: 2 x Iφ2
- Operating time tφ3: 5 x Iφ2

**Inputs and operation**
- Test button: on front side
- Transformer connection: external
- Cable length Test/Err, GND: < 10 m
- LED device function: green
- LED alarm channel 1: yellow
- LED alarm channel 2: yellow

**Output**
- Common alarm signal: Err Open-Collector (nPN)
- No error: 0 ... 0.6 V
- Error: 11.4 ... 12.6 V

**Switching elements**
- Alarm relays K1, K2: Iφ ≥ 6 mA DC
  - Iφ ≥ 30 mA r.m.s.
- Switching elements: 2 x 1 N/O contacts
- Operating principle: N/C operation
- Electrical endurance, number of cycles: 10,000

**Contact data according to IEC 60947-5-1**
- Stationary use (IEC 60721-3-3): 3K5 (except condensation and formation of ice)
- Transport (IEC 60721-3-2): 2K2
- Long-term storage (IEC 60721-3-1): 1K2

**Environment/EMC**
- Stationary use (IEC 60721-3-3): 3K5
  - Temperature: -30 ... +75 °C
  - EMC: IEC 61851-1, IEC 61851-22
- Transport (IEC 60721-3-2): 2K2
- Long-term storage (IEC 60721-3-1): 1K2

**Connection**
- Connection type: push-wire terminals
- Connection properties:
  - Rigid: 0.2 ... 2.5 mm² (AWG 24 ... 14)
  - Flexible without ferrules: 0.75 ... 2.5 mm² (AWG 19 ... 14)
  - Flexible with ferrules: 0.2 ... 1.5 mm² (AWG 24 ... 16)
- Stripping length: 10 mm
- Opening force: 50 N
- Test opening, diameter: 2.1 mm
Ein wichtiges Zukunftsthema für die Automobilindustrie ist die Elektromobilität. Elektrofahrzeuge sollen künftig zunehmend dazu beitragen, die Erdölabhängigkeit zu verringern und die CO₂-Belastung zu reduzieren. Mit der Messe eCarTec und dem dazugehörigen Kongress wurde eine internationale Plattform ins Leben gerufen, die sich ausschließlich mit dem Thema Elektromobilität beschäftigt.

Vom 13. bis 15. Oktober präsentiert KEBA auf der eCarTec erstmals in Deutschland die outdoorfähige Stromladestation KeContact, mit der alle Arten von elektrobetriebenen Fahrzeugen, wie Autos, Motorroller, Fahrräder, Segways oder Rollstühle einfach und sicher aufgeladen werden können – und das rund um die Uhr.


**Technical data (continued)**

<table>
<thead>
<tr>
<th>Other</th>
<th>Measuring current transformer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating mode</td>
<td>continuous operation</td>
</tr>
<tr>
<td>Degree of protection, internal components</td>
<td>IP 30</td>
</tr>
<tr>
<td>Degree of protection, terminals</td>
<td>IP 20</td>
</tr>
<tr>
<td>Area of application</td>
<td>≤ 2000 m AMSL</td>
</tr>
<tr>
<td>Quick 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>Diameter cable gland measuring current transformer</td>
<td>15 mm</td>
</tr>
<tr>
<td>Cable length</td>
<td>1.5 m</td>
</tr>
<tr>
<td>Max. cable cross section</td>
<td>4 x 6 mm²</td>
</tr>
<tr>
<td>Mounting</td>
<td>with cable ties</td>
</tr>
<tr>
<td>Connection to RCMB42</td>
<td>plug-in connector with 6 poles</td>
</tr>
<tr>
<td>Rated voltage Uₚ</td>
<td>3(N) AC 400/230 V</td>
</tr>
<tr>
<td>Rated current Iₚ</td>
<td>3x32 A</td>
</tr>
<tr>
<td>Rated impulse withstand voltage U_imp</td>
<td>4 kV</td>
</tr>
</tbody>
</table>

**Dimension diagram (dimensions in mm)**

**Wiring diagrams**

**RCMB420EC with 2 channels with Iₘ = DC ≥ 6 mA and Iₘ = AC/DC ≥ 30 mA (r.m.s.)**

**RCMB422EC with 1 channel with Iₘ = DC ≥ 6 mA and Iₘ = AC/DC ≥ 30 mA (r.m.s.)**
LINETRAXX® MRCDB300 series
AC/DC sensitive residual current monitoring modules
for MRCD applications

Device features
- Structure of a protective device in accordance with IEC 60947-2 Annex M in combination with a circuit breaker providing isolating properties
- Monitoring of the connected circuit breaker by means of contact feedback
- RS-485 interface with Modbus RTU (reading out measured values/setting parameters)
- Integrated switching outputs with two changeover contacts K1 and K2 (galvanically isolated)
- Fulfils the protection goals protection of persons, fire protection and plant protection (depending on the variant)
- Frequency range DC…100 kHz
- Combined test and reset button
- Multicolour LED indicating operation, exceeded response value, disturbances and status messages
- AC/DC sensitive type B measured value acquisition acc. to IEC 60755
- AC/DC sensitive type B+ measured value acquisition acc. to VDE 0664-400
- Exchangeable electronic enclosure without mechanical separation of the primary conductors
- Extension/retrofitting or modification of functionalities in case of changed monitoring requirements
- Insensitive to load currents due to full magnetic shield (CTBC20P…210P only)
- Connection monitoring of the measuring current transformer with cyclical test current
- Use of all MRCDB300 for all CTBC… measuring current transformer sizes
- Supply voltage DC 24

Typical applications
- for MRCD applications

Approvals
- CE
- EAC
- UL

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

Ordering information

Electronic modules

<table>
<thead>
<tr>
<th>Supply voltage U_s</th>
<th>Variant</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC 24V (19.2…28.8V)</td>
<td>Protection of persons</td>
<td>MRCDB301</td>
<td>B74043120</td>
</tr>
<tr>
<td></td>
<td>Fire protection</td>
<td>MRCDB302</td>
<td>B74043121</td>
</tr>
<tr>
<td></td>
<td>Protection of persons, fire protection and plant protection (freely configurable)</td>
<td>MRCDB303</td>
<td>B74043122</td>
</tr>
</tbody>
</table>

Measuring current transformers

<table>
<thead>
<tr>
<th>Internal diameter</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 mm</td>
<td>CTBC20</td>
<td>B98120001</td>
</tr>
<tr>
<td></td>
<td>CTBC20P</td>
<td>B98120002</td>
</tr>
<tr>
<td>35 mm</td>
<td>CTBC35</td>
<td>B98120003</td>
</tr>
<tr>
<td></td>
<td>CTBC35P</td>
<td>B98120004</td>
</tr>
<tr>
<td>60 mm</td>
<td>CTBC60</td>
<td>B98120005</td>
</tr>
<tr>
<td></td>
<td>CTBC60P</td>
<td>B98120006</td>
</tr>
<tr>
<td>120 mm</td>
<td>CTBC120</td>
<td>B98120007</td>
</tr>
<tr>
<td></td>
<td>CTBC120P</td>
<td>B98120020</td>
</tr>
<tr>
<td>210 mm</td>
<td>CTBC210</td>
<td>B98120008</td>
</tr>
<tr>
<td></td>
<td>CTBC210P</td>
<td>B98120021</td>
</tr>
</tbody>
</table>

P = full magnetic shield

Required terminals are included in the scope of delivery.

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface converter USB to RS-485</td>
<td>B95012045</td>
</tr>
<tr>
<td>Terminal block for MRCD module</td>
<td>B74043124</td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>max. connected current transformers</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage supply</td>
<td>4 STEP-PS/1 AC/24 DC/0.5</td>
<td>STEP-PS/1 AC/24 DC/0.5</td>
<td>B94053110</td>
<td>362</td>
</tr>
<tr>
<td></td>
<td>14 STEP-PS/1 AC/24 DC/1.75</td>
<td>STEP-PS/1 AC/24 DC/1.75</td>
<td>B94053111</td>
<td>362</td>
</tr>
<tr>
<td></td>
<td>34 STEP-PS/1 AC/24 DC/4.2</td>
<td>STEP-PS/1 AC/24 DC/4.2</td>
<td>B94053112</td>
<td>362</td>
</tr>
</tbody>
</table>
Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:
- Measuring circuit (IC1)
- Secondary (IC2)
- Control circuit 1 (IC3)
- Control circuit 2 (IC4)

Primary conductors routed through the current transformer:
- Terminal block 1 (24 V, GND, D1, D2, T/R, GND, A, B, X, X2)
- Terminal block 2 (21, 22, 24)

Rated insulation voltage:
- 800 V

Overvoltage category:
- III

Area of application:
- ≤ 2000 m AMSL

Rated impulse voltage:
- IC1/(IC2-IC4) 800 V
- IC3/(IC4) AC 2.2 kV
- IC3/IC4 300 V
- IC3/IC4 250 V
- IC3/IC4 4 kV
- IC2/(IC3-IC4) 4 kV

Relative uncertainty:
- 0…-35 %

Ripple:
- ≤ 1 %

Characteristics according to IEC 62020 and IEC/TR 60755:
- AC/DC sensitive, type B

Internal diameter measuring current transformer:
- see dimension diagrams page 204

Pre alarm:
- 50 %…100 % \( \Delta n \) (freely configurable), (60 %)*

Possible response values (to be set on the evaluator):

- CTCB20, CTCB20P 80 A
- CTCB60, CTCB60P 160 A
- CTCB120, CTCB120P 630 A

Response delay \( \tau_p \):
- \( 0 \) s…300 ms (freely configurable), (0 s)*

Start-up delay \( \tau_s \):
- 0 s…60 min (freely configurable), (0 s)*

Delay on release \( \tau_d \):
- 2 s after reset

Operating time \( \Delta n \):
- at 1 x \( \Delta n \) ≤ 180 ms
- at 2 x \( \Delta n \) ≤ 110 ms
- at 5 x \( \Delta n \) ≤ 20 ms

Response time:
- \( \Delta t \) = \( \tau_p \) + \( \tau_s \)

Recovery time:
- ≤ 1 s

Indication:
- Multicolour LED red/green, see table "System states: LED and output relays" on page 204

Inputs:
- T/R, GND, D1, D2

Outputs:
- Number of changeover contacts: 2

Switching outputs (K1, K2):
- 250 V, 5 A

Switching capacity:
- 1500 VA/144 W

Contact data acc. to IEC 60947-5-1
- Rated operational voltage AC:
  - 250 V
  - 250 V
- Utilisation category:
  - AC-1/AC-14
- Rated operational AC:
  - 5 A/3 A
- Rated operational AC (for UL applications):
  - 3 A/3 A
- Rated operational voltage DC:
  - 220/110 V
- Utilisation category:
  - DC12
- Minimum current:
  - 0.1/0.1 A
- Electrical endurance, number of cycles:
  - 10,000

Environment/EMC:
- EMC:
  - IEC 60947-2 Annex M
  - 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):
  - 2K11 (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):
  - 2M4
- Long-term storage (IEC 60721-3-1):
  - 2M1

Connection:
- Required terminals are included in the scope of delivery.

Terminal block 1:
- Manufacturer:
  - Phoenix Contact

Terminal block 2, 3:
- Manufacturer:
  - Phoenix Contact

Other:
- Operating mode:
  - continuous operation

Mounting:
- Degree of protection, internal components (DIN EN 60529):
  - IP40
- Degree of protection, terminals (DIN EN 60529):
  - IP20

Flammability class:
- UL94 V-0

Software:
- D0579

Documentation number:
- D00343

Weight:
- MRCD300 ≤ 100 g
- CTCB20 ≤ 160 g
- CTCB60 ≤ 220 g
- CTCB120 ≤ 240 g
- CTCB20P ≤ 320 g
- CTCB60P ≤ 460 g
- CTCB120P ≤ 620 g
- CTCB60 ≤ 1390 g
- CTCB120 ≤ 1750 g
- CTCB210 ≤ 4220 g
- CTCB210P ≤ 6070 g

(*) Factory setting

The use of the power supply units listed at "Accessories" is recommended.

The use of a surge protection device is mandatory for these power supply units.
The LED indicates the system state by means of colours and lighting/flashing. The N/O contacts of relay outputs K1 and K2 have defined switching positions for each system state.

<table>
<thead>
<tr>
<th>System state</th>
<th>LED</th>
<th>Notes</th>
<th>Changeover contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device switched off</td>
<td>off</td>
<td>off</td>
<td>de-energised</td>
</tr>
<tr>
<td>Normal operating state</td>
<td>lights</td>
<td>off</td>
<td>energised</td>
</tr>
<tr>
<td>Prewarning</td>
<td>lights</td>
<td>Flashes briefly</td>
<td>de-energised</td>
</tr>
<tr>
<td>Alarm state</td>
<td>off</td>
<td>lights</td>
<td>de-energised</td>
</tr>
</tbody>
</table>
The use of a type 2 surge protection device (SPD) is mandatory due to possible impulse voltages and in order to comply with normative requirements.

The surge protection device must be connected upstream of the power supply unit on the supply side.

Features of the surge protection device:
- Nominal discharge current $I_n$ (8/20 μs): 20 kA
- Response time: 25 ns
- Two-stage: 1 varistor + 1 spark gap

Alternatively, the power supply unit must be connected to a CAT II supply without a surge protection device.
LINETRAXX® RCMB300 series
AC/DC sensitive residual current monitoring modules with an integrated measuring current transformer

Device features
- Continuous residual current monitoring in compliance with DGUV Vorschrift 3 (German Social Accident Insurance Regulation 3)
- Easy DIN rail or screw mounting
- RS-485 interface with Modbus RTU (reading out measured values/setting parameters)
- Integrated switching outputs with two changeover contacts K1 and K2 (galvanically isolated)
- Frequency range DC…100 kHz
- Combined test and reset button
- Multicolour LED indicating operation, exceeded response value, disturbances and status messages
- AC/DC sensitive type B measured value acquisition acc. to IEC 60755
- AC/DC sensitive type B+ measured value acquisition acc. to VDE 0664-400
- The AC and DC components as well as the r.m.s. value of the residual current can be evaluated separately
- Exchangeable electronic enclosure without mechanical separation of the primary conductors
- Extension/retrofitting or modification of functionalities in case of changed monitoring requirements
- Use of the RCMB301 for all CTBC… measuring current transformer sizes
- Supply voltage DC 24 V

Typical applications
- AC and DC fault currents in earthed systems (TN and TT systems).

Approvals

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

Evaluation electronics

<table>
<thead>
<tr>
<th>Supply voltage U_s</th>
<th>Variant</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC 24 V (19.2…28.8 V)</td>
<td>Modbus RTU</td>
<td>RCMB301</td>
<td>B74043100</td>
</tr>
</tbody>
</table>

Required terminals are included in the scope of delivery.

Measuring current transformers

<table>
<thead>
<tr>
<th>Internal diameter</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 mm</td>
<td>CTBC20</td>
<td>B98120001</td>
</tr>
<tr>
<td></td>
<td>CTBC20P</td>
<td>B98120002</td>
</tr>
<tr>
<td>35 mm</td>
<td>CTBC35</td>
<td>B98120003</td>
</tr>
<tr>
<td></td>
<td>CTBC35P</td>
<td>B98120004</td>
</tr>
<tr>
<td>60 mm</td>
<td>CTBC60</td>
<td>B98120005</td>
</tr>
<tr>
<td></td>
<td>CTBC60P</td>
<td>B98120006</td>
</tr>
<tr>
<td>120 mm</td>
<td>CTBC120</td>
<td>B98120007</td>
</tr>
<tr>
<td></td>
<td>CTBC120P</td>
<td>B98120020</td>
</tr>
<tr>
<td>210 mm</td>
<td>CTBC210</td>
<td>B98120008</td>
</tr>
<tr>
<td></td>
<td>CTBC210P</td>
<td>B98120021</td>
</tr>
</tbody>
</table>

P = full magnetic shield

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface converter USB to RS-485</td>
<td>B95012045</td>
</tr>
<tr>
<td>Terminal block for RCMB301 module</td>
<td>B74043124</td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>max. connected current transformers</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage supply</td>
<td>4 STEP-PS/1 AC/24 DC/0.5</td>
<td>B94053110</td>
<td>362</td>
<td></td>
</tr>
<tr>
<td></td>
<td>14 STEP-PS/1 AC/24 DC/1.75</td>
<td>B94053111</td>
<td>362</td>
<td></td>
</tr>
<tr>
<td></td>
<td>34 STEP-PS/1 AC/24 DC/4.2</td>
<td>B94053112</td>
<td>362</td>
<td></td>
</tr>
</tbody>
</table>
### Technical data

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

- Definitions:
  - Measuring circuit (IC1)
  - Secondary (IC2)
  - Control circuit 1 (IC3)
  - Control circuit 2 (IC4)
- Terminal block 1 (24 V, GND, T/R, GND, A, B, K1, K2)
- Terminal block 2 (11, 12, 24)
- Rated insulation voltage: 800 V
- Overvoltage category: III
- Area of application: ≤ 2000 m AMSL
- Rated impulse voltage:
  - IC1/(IC2-IC4) 800 V
  - IC2/(IC3-IC4) 250 V
  - IC3/IC4 300 V
- Pollution degree: 2
- Safe isolation (reinforced insulation) between:
  - IC1/(IC2-IC4) 800 V
  - IC2/(IC3-IC4) 250 V
  - IC3/IC4 300 V
- Voltage test (routine test) acc. to IEC 61010-1:
  - IC1/(IC2-IC4) 800 V
  - IC2/(IC3-IC4) 250 V
  - IC3/IC4 250 V
- Rated operational voltage AC: 300 mA…10 A
- Possible response values (to be set on the evaluator):
  - IC1/(IC2-IC4) 800 V
  - IC2/(IC3-IC4) 250 V
  - IC3/IC4 300 V
- Relative uncertainty: 0…-35 %
- Ripple:
  - at 1 x
  - at 2 x
  - at 5 x
- Response time:
  - Δn = 30 mA 80 A
  - Δn = 300 mA 125 A
  - Δn = 100 mA 63 A
  - Δn = 3000 mA 1000 A

#### Outputs

- Number of changeover contacts: 2
- Operating principle:
  - N/C or N/O principle (freely configurable), (N/C principle)*
  - Switching outputs (K1, K2) 250 V, 5 A
- Switching capacity: 150 VA/144 W

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

- Rated operational voltage AC: 250 V/250 V
- Utilisation category:
  - AC-13/AC-14
  - AC-13
- Rated operational current AC: 5 A
- Rated operational current AC (for UL applications): 3 A
- Rated operational voltage DC: 220/110/24 V
- Utilisation category: DC12
- Rated operational current DC: 0.1/0.2/0.1 A
- Minimum current: 10 mA at DC 5 V
- Electrical endurance, number of cycles: 10,000

#### Environment/EMC

- EMC:
  - IEC 62020
- Operating temperature: -25…70 °C

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

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

#### Connection

- Required terminals are included in the scope of delivery.

#### Terminal block 1

- Measuring circuit
- Internal diameter measuring current transformer: see dimension diagrams on page 208
- Characteristics according to IEC 62020 and IEC/TR 61010:
  - AC/DC sensitive, type B
- Measuring range: 5 mA…20 A
- Measuring circuit
- Inrush current: 1.7 A for 1 ms
- Power consumption: ≤ 2.5 W
- Connection properties
  - Type: Deltacontact
  - The connection conditions of the manufacturer apply.
- Terminal block 2, 3

#### Other

- Operating mode: continuous operation
- Mounting:
  - any position
- Degree of protection, internal components (DIN EN 60529):
  - IP 40
- Degree of protection, terminal (DIN EN 60529):
  - IP 20
- Flammability class:
  - UL94 V-0
- Software:
  - DO610
- Documentation number:
  - D00372
- Weight:
  - RCBM301 ≤ 100 g
  - RCB40 ≤ 160 g
  - RCB20P ≤ 220 g
  - RCB35 ≤ 240 g
  - RCB35P ≤ 320 g
  - RCB60 ≤ 460 g
  - RCB60P ≤ 620 g
  - RCB120 ≤ 1390 g
  - RCB120P ≤ 1750 g
  - RCB210 ≤ 4220 g
  - RCB210P ≤ 4870 g


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**Notes:**

- (* Factory setting
- The use of a surge protection device is mandatory for these power supply units.
- The use of a surge protection device is mandatory for these power supply units.
- The use of a surge protection device is mandatory for these power supply units.
- The use of a surge protection device is mandatory for these power supply units.
### Dimension diagram

### System states: LED and output relays

The LED indicates the system state by means of colours and lighting/flashing. The N/O contacts of relay outputs K1 and K2 have defined switching positions for each system state.

<table>
<thead>
<tr>
<th>System state</th>
<th>LED</th>
<th>Notes</th>
<th>Changeover contact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>K1</td>
</tr>
<tr>
<td>Device switched off</td>
<td>off</td>
<td>Device is de-energised, no monitoring, no monitoring function</td>
<td>de-energised</td>
</tr>
<tr>
<td>Normal operating state</td>
<td>lights</td>
<td>The device is supplied with the specified voltage and monitors the primary circuit. No residual current flows which would lead to tripping.</td>
<td>energised</td>
</tr>
<tr>
<td>Prewarning</td>
<td>lights</td>
<td>The device is supplied with the specified voltage and monitors the primary circuit. A fault current flows which exceeds the set limit of the prewarning.</td>
<td>de-energised</td>
</tr>
<tr>
<td>Alarm state</td>
<td>off</td>
<td>The device is supplied with the specified voltage and monitors the primary circuit. A fault current flows which exceeds the set limit of the alarm.</td>
<td>de-energised</td>
</tr>
</tbody>
</table>

### Dimensions (mm)

<table>
<thead>
<tr>
<th>Type</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
<th>f</th>
<th>g</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCMB301-CTBC20(P)</td>
<td>81</td>
<td>112</td>
<td>37</td>
<td>ø 20</td>
<td>46</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>RCMB301-CTBC35(P)</td>
<td>97</td>
<td>130</td>
<td>47</td>
<td>ø 35</td>
<td>46</td>
<td>61</td>
<td></td>
</tr>
<tr>
<td>RCMB301-CTBC60(P)</td>
<td>126</td>
<td>158</td>
<td>57</td>
<td>ø 60</td>
<td>56</td>
<td>78</td>
<td></td>
</tr>
<tr>
<td>RCMB301-CTBC120(P)</td>
<td>188</td>
<td>232</td>
<td>96</td>
<td>ø 120</td>
<td>65</td>
<td>96</td>
<td>139</td>
</tr>
<tr>
<td>RCMB301-CTBC210(P)</td>
<td>302</td>
<td>346</td>
<td>153</td>
<td>ø 210</td>
<td>67</td>
<td>113</td>
<td>277</td>
</tr>
<tr>
<td>RCMB301</td>
<td>74</td>
<td>37</td>
<td>44</td>
<td>2</td>
<td>4,6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Tolerance: ±0.5 mm
- The use of a type 2 surge protection device (SPD) is mandatory due to possible impulse voltages and in order to comply with normative requirements.
- The surge protection device must be connected upstream of the power supply unit on the supply side.
- Features of the surge protection device:
  - Nominal discharge current $I_n$ (8/20 μs): 20 kA
  - Response time: 25 ns
  - Two-stage: 1 varistor + 1 spark gap
- Alternatively, the power supply unit must be connected to a CAT II supply without a surge protection device.
RCMB131-01
AC/DC sensitive residual current monitoring module
for measuring AC and DC currents up to ±100 mA

Device features
- AC/DC sensitive leakage and fault current monitoring for preventive maintenance
- Suitable for PCB mounting
- High resolution for implementing equipment leakage current monitoring
- Measured value and alarm transmission via Modbus RTU (RS-485)
- Frequency range DC…2 kHz
- Compact design for monitoring nominal loads up to \( I_n = 32 \) A
- Low load current sensitivity due to fully shielded measuring current transformer
- Continuous monitoring of the connection to the measuring current transformer
- Integrated test function
- Supply voltage DC 12…24 V

Typical applications
- Designed for installation in PDUs and outlet boxes
- Communication with a master via an RS-485 interface via Modbus RTU

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

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Output range</th>
<th>Supply voltage U_S</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0…100 mA (r.m.s.)</td>
<td>DC 12…24 V</td>
<td>RCMB131-01</td>
<td>894042131</td>
</tr>
</tbody>
</table>
Insulation coordination according to IEC 60664-1

Primary circuit monitored primary conductors
Secondary circuit Connections Vcc, GND, A, B, S1, S2
All following specifications apply to the insulation between the primary and secondary circuit
- Rated voltage: 300 V
- Overvoltage category: III
- Rated impulse voltage: 4 kV
- Operating altitude: up to 3000 m AMSL
- Rated insulation voltage: 320 V
- Pollution degree: 2
- Safe separation (reinforced insulation) between primary and secondary circuit
- Voltage test acc. to IEC 61010-1: AC 2.2 kV

Voltage supply
- Supply voltage $U_S$: DC 12…24 V
- Ripple: 100 mV
- Power consumption: < 0.75 W

Measuring circuit
- Internal diameter primary conductor opening: 15 mm
- Measured value evaluation: DC, r.m.s.
- Measuring range: AC/DC ±300 mA
- Characteristics according to IEC 60755: AC/DC sensitive, type B

- $I_{\Delta n1}$
  - Response value: DC 3.5…100 mA (* 6 mA)
  - Response tolerance: 0.7…1.0 x $I_{\Delta n1}$
- $I_{\Delta n2}$
  - Response value: r.m.s. 3.5…100 mA (* 30 mA)
  - Response tolerance: 0.7…1.0 x $I_{\Delta n2}$
  - DC…1 kHz: 0.7…1.0 x $I_{\Delta n2}$
  - 1…2 kHz: 1.0…2.0 x $I_{\Delta n2}$
- Output range: 0…100 mA (r.m.s.)
- Resolution: < 0.2 mA
- Frequency range: DC…2 kHz
- Measuring time: 180 ms

Operating uncertainty
- DC…500 Hz: ±(5 % +0.5 mA)
- 501…1000 Hz: ±(15 % +0.5 mA)
- 1…2 kHz: ±(50 % +0.5 mA)

Time response
- Response time $t_{ae}$ (relay switching time of 10 ms considered)
  - for 1 x $I_{\Delta n1}$: ≤ 200 ms
  - for 2 x $I_{\Delta n1}$: ≤ 140 ms
  - for 3 x $I_{\Delta n1}$: ≤ 30 ms
- Recovery time $t_b$: ≤ 2s

Disturbances
- Load current $I_h$: 32 A

Response value assignment
- $I_{\Delta n1}$ (DC): S1
- $I_{\Delta n2}$ (r.m.s.): S2

Outputs
- Interface: RS-485
- Protocol: Modbus RTU
- Switching outputs: Open Collector, not short-circuit-proof
- Switching capacity: 40 V / 50 mA
- Output voltage LOW level: 0…0.6 V
- Output voltage HIGH level: 3.1…3.6 V
- Hysteresis: ≤ 30 %

Environment/EMC
- EMC: DIN EN 62020:2003 (VDE 0663), where applicable
- Ambient temperature (incl. primary conductors routed through module): -25…+70 °C

Classification of climatic conditions acc. to IEC 60721
- Stationary use (IEC 60721-3-3): 3K5 (except condensation and formation of ice)
- Transport (IEC 60721-3-2): 2K11 (except condensation and formation of ice)
- Long-term storage (IEC 60271-3-1): 1K22 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60271
- Stationary use (IEC 60721-3-3): 3M4
- Transport (IEC 60721-3-2): 2M4
- Long-term storage (IEC 60271-3-1): 1M12

Other
- Operating mode: continuous operation
- Mounting: any position
- Protection class: IP 30
- Flammability rating: UL94 V-0
- Service life at 40 °C: 10 years
- Software: D0604
- Documentation number: D0035B

* = factory settings

Dimension diagram (dimensions in mm)
Terminating resistor 120 Ω must only be set on the last device in the RS-485 bus chain.
RCMB131-02
AC/DC sensitive residual current monitoring module
for measuring AC and DC currents up to ±100 mA

- AC/DC sensitive leakage and fault current monitoring for preventive maintenance
- Suitable for PCB mounting
- High resolution for implementing equipment leakage current monitoring
- Measurement signal output via PWM output
- Frequency range DC...2 kHz
- Compact design for monitoring nominal loads up to $I_n = 32\ A$
- Low load current sensitivity due to fully shielded measuring current transformer
- Continuous monitoring of the connection to the measuring current transformer
- Integrated test function
- Supply voltage DC 12...24 V

Typical applications
- Designed for installation in PDUs and outlet boxes
- Outputs the r.m.s. value of the residual current via a PWM output, which is read out and evaluated by a higher-level circuit

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

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Output range</th>
<th>Supply voltage $U_S$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0...100 mA (r.m.s.)</td>
<td>12...24 V</td>
<td>RCMB131-02</td>
<td>B94042132</td>
</tr>
</tbody>
</table>
### Technical data

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

- **Primary circuit**: monitored primary conductors
- **Secondary circuit**: Connections Vcc, GND, T, PWM, S1, ERR

All following specifications apply to the insulation between the primary and secondary circuit:

- **Rated voltage**: 300 V
- **Overvoltage category**: III
- **Rated impulse voltage**: 4 kV

**Operating altitude**: up to 3000 m AMSL

**Rated insulation voltage**: 320 V

**Pollution degree**: 2

**Safe separation (reinforced insulation)**: between primary and secondary circuit

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

**Voltage supply**

- **Supply voltage**: DC 12…24 V
- **Operating range of the supply voltage**: ±20 %
- **Ripple**: 100 mV
- **Power consumption**: < 0.75 W

**Measuring circuit**

- **Internal diameter primary conductor opening**: 15 mm

**Characteristics according to IEC 60755**: AC/DC sensitive, type B

**Response value**

\[ I_{\Delta n1} (DC) = 3.5 \ldots 100 \text{ mA} \]  (* 6 mA*)

**Response tolerance**

\[ I_{\Delta n1} = 0.7 \ldots 1.0 \times I_{\Delta n1} \]

**Measuring range**: AC/DC ±300 mA

**Resolution**: < 0.2 mA

**Frequency range**: DC…2 kHz

**Measuring time**: 180 ms

**Operating uncertainty**

- **DC…500 Hz**: ±(5 % + 0.5 mA)
- **501…1000 Hz**: ±(15 % + 0.5 mA)
- **1001…2000 Hz**: ±(50 % + 0.5 mA)

**Time response**

- **Response time** (relay switching time of 10 ms considered)
  - for 1 x \( I_{\Delta n1} \): \( \leq 290 \text{ ms} \)
  - for 2 x \( I_{\Delta n1} \): \( \leq 140 \text{ ms} \)
  - for 5 x \( I_{\Delta n1} \): \( \leq 30 \text{ ms} \)

**Recovery time** \( t_b \)

\( \leq 2s \)

**Disturbances**

- **Load current** \( I_{\text{L}} \): 32 A

**Outputs**

- **Switching outputs S1, ERR**: Open Collector, not short-circuit-proof
- **Switching capacity**: 40 V / 50 mA
- **Hysteresis**: \( \leq 30 \% \)
- **PWM**
  - **Internal resistance PWM signal**: 4.7 kΩ
  - **Voltage HIGH level**: 3.1…3.6 V
  - **Voltage LOW level**: 0…0.6 V
  - **Frequency PWM signal**: 8 kHz
  - **Specification of the PWM signal**: (0…100 %) = (0…100) mA
  - **Output resistance**: not short-circuit-proof

**Response value assignment**

- **S1 (DC)**: Internal error
- **ERROR**: Internal error

**Environment/EMC**

- **EMC**: DIN EN 62020:2003 (VDE 0663), where applicable

**Classification of climatic conditions acc. to IEC 6071**

- **Stationary use (IEC 60721-3-3)**: 3K5 (except condensation and formation of ice)
- **Transport (IEC 60721-3-2)**: 2K11 (except condensation and formation of ice)
- **Long-term storage (IEC 60721-3-1)**: 1K22 (except condensation and formation of ice)

**Classification of mechanical conditions acc. to IEC 6071**

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

**Other**

- **Operating mode**: continuous operation
- **Mounting**: any position
- **Protection class**: IP 30
- **Flammability rating**: UL94 V-0
- **Service life at 40 °C**: 10 years
- **Software**: D0604
- **Documentation number**: D00354

* = factory settings

---

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

Customer Controller

L1
L2
L3
N
PE

RCMB131-02

Vcc

ERR
S1

Vcc

ERR
S1

Vcc

ERR

Vcc

ERR
S1

Vcc
**RCMB132-01**

**AC/DC sensitive residual current monitoring module**

for measuring AC and DC currents up to ±100 mA

---

### Device features

- AC/DC sensitive leakage and fault current monitoring for preventive maintenance
- High resolution for implementing equipment leakage current monitoring
- Measured value and alarm transmission via Modbus RTU (RS-485)
- Frequency range DC…2 kHz
- Compact design for monitoring nominal loads up to \( I_n = 32 \) A
- Low load current sensitivity due to fully shielded measuring current transformer
- Continuous monitoring of the connection to the measuring current transformer
- Integrated test function
- Supply voltage DC 12…24 V

---

### Typical applications

- Designed for installation in PDUs and outlet boxes
- Communication with a master via an RS-485 interface via Modbus RTU
- Connection of several devices in a daisy chain. For this purpose, the RCMB132-01 provides two identical connectors for RS-485 (incl. power supply)

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### Further information

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

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### Approvals

[CE]

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### Ordering information

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>Supply voltage ( U_s )</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC/DC ±100 mA</td>
<td>DC 12…24 V</td>
<td>RCMB132-01</td>
<td>B94042136</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mounting foot MCCT20</td>
<td>B91080111</td>
</tr>
</tbody>
</table>

---

_____

Residual current monitoring system | 1-channel, AC/DC sensitive residual current monitoring

AC/DC sensitive residual current monitoring module RCMB132-02
Technical data

Insulation coordination according to IEC 60664-1

Primary circuit monitored primary conductors
Secondary circuit Connections Vcc, GND, A, B, S1, S2
All following specifications apply to the insulation between the primary and secondary circuit

- Rated voltage 300 V
- Overvoltage category III
- Rated impulse voltage 4 kV

Operating altitude up to 3000 m AMSL
Rated insulation voltage 320 V
Pollution degree 2
Safe separation (reinforced insulation) between primary and secondary circuit
Voltage test acc. to IEC 61010-1 AC 2.2 kV

Voltage supply
Supply voltage \( U_S \) DC 12…24 V
Operating range of the supply voltage \( \pm 20\% \)
Ripple 100 mV
Power consumption < 0.75 W

Measuring circuit
Internal diameter primary conductor opening 15 mm
Measured value evaluation DC, r.m.s.
Measuring range AC/DC ±300 mA
Characteristics according to IEC 60755 AC/DC sensitive, type B

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>( i_{\Delta n1} ) Response value</td>
<td>DC 3.5…100 mA (* 6 mA)</td>
</tr>
<tr>
<td>( i_{\Delta n1} ) Response tolerance</td>
<td>0.7…1.0 ( i_{\Delta n1} )</td>
</tr>
<tr>
<td>( i_{\Delta n2} ) Response value</td>
<td>r.m.s. 3.5…100 mA (* 30 mA)</td>
</tr>
</tbody>
</table>
| \( i_{\Delta n2} \) Response tolerance | DC…1 kHz 0.7…1.0 \( i_{\Delta n2} \) 
| | 1…2 kHz 1.0…2.0 \( i_{\Delta n2} \) |
| Output range | 0…100 mA (r.m.s.) |
| Resolution | < 0.2 mA |
| Frequency range | DC…2 kHz |
| Measuring time | 180 ms |

Operating uncertainty
DC…500 Hz \( \pm (5\% + 0.5\% \) |
501…1000 Hz \( \pm (15\% + 0.5\% \) |
1…2 kHz \( - (50\% + 0.5\% \) |

Time response
Response time \( t_{sp} \) (relay switching time of 10 ms considered)
- for 1 \( i_{\Delta n} \) \( \leq 200 \) ms
- for 2 \( i_{\Delta n} \) \( \leq 140 \) ms
- for 5 \( i_{\Delta n} \) \( \leq 30 \) ms
Recovery time \( t_b \) \( \leq 2 \) s

Disturbances
Load current \( i_n \) 32 A

Response value assignment
\( i_{\Delta n1} \) (DC) S1
\( i_{\Delta n2} \) (r.m.s.) S2

Outputs
Interface RS-485
Protocol Modbus RTU
Switching outputs Open Collector, not short-circuit-proof
Switching capacity 40 V / 50 mA
Output voltage LOW level 0…0.6 V
Output voltage HIGH level 3.1…3.6 V
Hysteresis \( \leq 30\% \)

Environment/EMC
EMC DIN EN 62020:2003 (VDE 0663), where applicable

Ambient temperature (incl. primary conductors routed through module) -25…+70 °C

Classification of climatic conditions acc. to IEC 60721
Stationary use (IEC 60721-3-3) 3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2) 2K11 (except condensation and formation of ice)
Long-term storage (IEC 60271-3-1) 1K22 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60271
Stationary use (IEC 60721-3-3) 3M4
Transport (IEC 60721-3-2) 2M4
Long-term storage (IEC 60271-3-1) 1M12

Other
Operating mode continuous operation
Mounting any position
Protection class IP 30
Flammability rating UL94 V-0
Service life at 40 °C 10 years
Software D0604
Plug (included in scope of delivery) Phoenix Contact, PTSM 0.5/4-P-2.5
Documentation number D00356
* = factory settings

Dimension diagram (dimensions in mm)

Rail mounting
with mounting foot MCCT20 (accessories, see ordering data)
Wiring diagram

Terminating resistor 120 Ω must only be set on the last device in the RS-485 bus chain.

An external protective circuit is especially required for inductive loads.
Insulation monitoring devices
ISOMETER®

Equipment for insulation fault location
ISOSCAN®

Residual current monitoring systems
LINETRAXX®

Neutral Grounding Resistor Monitor (NGR)
LINETRAXX®

Power Quality and Energy Measurement
LINETRAXX®

Measuring and monitoring relays
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 neutral grounding resistance monitoring (NGR) LINETRAXX®

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<thead>
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<th>Page</th>
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</thead>
<tbody>
<tr>
<td><strong>Special applications</strong></td>
<td>Neutral grounding resistance monitoring (NGR monitoring)</td>
<td>Neutral grounding resistance monitoring (NGR monitoring)</td>
</tr>
<tr>
<td><strong>System type</strong></td>
<td>HRG</td>
<td></td>
</tr>
<tr>
<td><strong>Fault currents</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Phase monitoring L1, L2, L3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>System voltage L-L</strong></td>
<td>600 V...2500 V</td>
<td>600 V...2500 V</td>
</tr>
<tr>
<td><strong>Harmonic analysis</strong></td>
<td>RMS 0...32</td>
<td></td>
</tr>
<tr>
<td><strong>Analysis range</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Relay operating mode</strong></td>
<td>Configurable fail-safe or non-fail-safe</td>
<td>Configurable fail-safe or non-fail-safe</td>
</tr>
<tr>
<td><strong>Communication</strong></td>
<td>Webserver, BCOM, Modbus RTU, Modbus TCP</td>
<td>Webserver, BCOM, Modbus RTU, Modbus TCP</td>
</tr>
<tr>
<td><strong>Maximum altitude</strong></td>
<td>2000 m</td>
<td>5000 m</td>
</tr>
<tr>
<td><strong>Mounting</strong></td>
<td>Detachable HMI for front panel mounting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DIN rail</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Screw mounting</td>
<td></td>
</tr>
</tbody>
</table>

* Freely configurable in the device, taking suitable coupling devices into account.
# Device overview: Coupling devices for NGR monitoring

<table>
<thead>
<tr>
<th>Special applications</th>
<th>Coupling device for HRG applications</th>
<th>Coupling device for HRG applications</th>
<th>Coupling device for HRG applications</th>
<th>Coupling device for HRG applications</th>
<th>Coupling device for HRG applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>System voltage L-L (U_nga voltage)</td>
<td>Up to U_nga = 690 V (U_nga = 400 V)</td>
<td>Up to U_nga = 1000 V (U_nga = 600 V)</td>
<td>Up to U_nga = 4300 V (U_nga = 2500 V)</td>
<td>Up to U_nga = 14400 V (U_nga = 8400 V)</td>
<td>Up to U_nga = 25 kV (U_nga = 14.5 kV)</td>
</tr>
<tr>
<td>Mounting</td>
<td>Screw mounting</td>
<td>Screw mounting</td>
<td>Screw mounting</td>
<td>Screw mounting</td>
<td>Screw mounting</td>
</tr>
</tbody>
</table>

## Recommended minimum value RNGR (tripping level 50 %)

<table>
<thead>
<tr>
<th>U SYS (V)</th>
<th>CD1000</th>
<th>CD1000-2</th>
<th>CD5000</th>
<th>CD14400</th>
<th>CD25000</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 A</td>
<td>231 Ω</td>
<td>398 Ω</td>
<td>386 Ω</td>
<td>386 Ω</td>
<td>386 Ω</td>
</tr>
<tr>
<td>10 A</td>
<td>(23 Ω)</td>
<td>35 Ω</td>
<td>35 Ω</td>
<td>35 Ω</td>
<td>35 Ω</td>
</tr>
<tr>
<td>15 A</td>
<td>(15 Ω)</td>
<td>(23 Ω)</td>
<td>(23 Ω)</td>
<td>(23 Ω)</td>
<td>(23 Ω)</td>
</tr>
<tr>
<td>20 A</td>
<td>(17 Ω)</td>
<td>(20 Ω)</td>
<td>(17 Ω)</td>
<td>(20 Ω)</td>
<td>(17 Ω)</td>
</tr>
<tr>
<td>25 A</td>
<td>(16 Ω)</td>
<td>(23 Ω)</td>
<td>(23 Ω)</td>
<td>(23 Ω)</td>
<td>(23 Ω)</td>
</tr>
<tr>
<td>30 A</td>
<td>(19 Ω)</td>
<td>(20 Ω)</td>
<td>(19 Ω)</td>
<td>(20 Ω)</td>
<td>(19 Ω)</td>
</tr>
<tr>
<td>40 A</td>
<td>(35 Ω)</td>
<td>(61 Ω)</td>
<td>(61 Ω)</td>
<td>(61 Ω)</td>
<td>(61 Ω)</td>
</tr>
<tr>
<td>50 A</td>
<td>(39 Ω)</td>
<td>(61 Ω)</td>
<td>(61 Ω)</td>
<td>(61 Ω)</td>
<td>(61 Ω)</td>
</tr>
<tr>
<td>100 A</td>
<td>(24 Ω)</td>
<td>(36 Ω)</td>
<td>(36 Ω)</td>
<td>(36 Ω)</td>
<td>(36 Ω)</td>
</tr>
</tbody>
</table>

Temperature range –40…+70 °C, field calibration at 25 °C

(Limited temperature range 0…+40 °C, field calibration at 25 °C)
LINETRAXX® NGRM500
Neutral Grounding Resistor Monitor

Device features
- Determination of $R_{NGR}$ with passive and active measurement methods
- Continuous monitoring of the $R_{NGR}$ even if the installation is de-energised;
- Alarm or trip on ground fault
- Monitoring of the current $I_{NGR}$
- Monitoring of the voltage $U_{NGR}$
- Ethernet communication
- Web server
- Language selection (German, English GB and US, Spanish, French)
- Test button (internal, external) with/without tripping
- FFT analysis of the measuring signals
- Pulser for manual ground fault location
- Relay for detection of ground faults and resistor faults
- Relay for shutdown of the installation after a configurable time
- Can be combined with RCMS… for automatic shutdown of feeders
- Graphical user interface
- Wide supply voltage range (24 to 240 Vac/Vdc)
- Range of use up to 2000 m AMSL
- Fault/History memory
- Analogue output of measured values (0…10 V, 4…20 mA, etc., selectable parameters)
- Password protection
- Tripping on RMS, fundamental component signal or harmonics
- Detection of AC and DC ground faults

Typical applications
- For use in high-resistance grounded systems

Approvals
UL in preparation

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

<table>
<thead>
<tr>
<th>Supply voltage $U_s$ / Frequency range Hz</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>DC</td>
<td>NGRM500</td>
</tr>
<tr>
<td>48…240 V, 40…70 Hz</td>
<td>48…240 V</td>
<td></td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coupling device</td>
<td>CD…</td>
<td>B980390…</td>
<td>233</td>
</tr>
<tr>
<td>Measuring current transformer</td>
<td>CTUB…</td>
<td>B781200…</td>
<td>337</td>
</tr>
<tr>
<td></td>
<td>W…AB</td>
<td>B980800…</td>
<td>—</td>
</tr>
<tr>
<td>Voltage supply for measuring current transformers</td>
<td>STEP-PS</td>
<td>B940531…</td>
<td>362</td>
</tr>
<tr>
<td></td>
<td>AN420</td>
<td>B94053100</td>
<td>—</td>
</tr>
</tbody>
</table>
### Technical Data

#### Insulation coordination according to IEC 60664-1/IEC 60664-3/DIN EN 50187

<table>
<thead>
<tr>
<th>Definitions</th>
<th>Measuring accuracy (A1, A2) DC/50/60 Hz/50…3200 Hz 5 A</th>
<th>Measuring accuracy (A1, A2) DC/50/60 Hz/50…3200 Hz 5 A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply circuit (IC1)</td>
<td>Measurement accuracy (A1, A2) DC/50/60 Hz/50…3200 Hz 5 A</td>
<td>Measurement accuracy (A1, A2) DC/50/60 Hz/50…3200 Hz 5 A</td>
</tr>
<tr>
<td>Measuring circuit/Control circuit (IC2)</td>
<td>Measurement accuracy (A1, A2) DC/50/60 Hz/50…3200 Hz 5 A</td>
<td>Measurement accuracy (A1, A2) DC/50/60 Hz/50…3200 Hz 5 A</td>
</tr>
<tr>
<td>Output circuit 1 (IC1)</td>
<td>Measurement accuracy (A1, A2) DC/50/60 Hz/50…3200 Hz 5 A</td>
<td>Measurement accuracy (A1, A2) DC/50/60 Hz/50…3200 Hz 5 A</td>
</tr>
<tr>
<td>Output circuit 2 (IC4)</td>
<td>Measurement accuracy (A1, A2) DC/50/60 Hz/50…3200 Hz 5 A</td>
<td>Measurement accuracy (A1, A2) DC/50/60 Hz/50…3200 Hz 5 A</td>
</tr>
<tr>
<td>Output circuit 3 (IC5)</td>
<td>Measurement accuracy (A1, A2) DC/50/60 Hz/50…3200 Hz 5 A</td>
<td>Measurement accuracy (A1, A2) DC/50/60 Hz/50…3200 Hz 5 A</td>
</tr>
</tbody>
</table>

#### Rated voltage
- 250 V

#### Overvoltage category
- III

#### Rated impulse voltage
- IC1/(IC2…5) 4 kV
- IC2/(IC3…5) 4 kV
- IC3/(IC4…5) 4 kV
- IC4/(IC5) 4 kV

#### Rated insulation voltage
- IC1/(IC2…5) 250 V
- IC2/(IC3…5) 250 V
- IC3/(IC4…5) 250 V
- IC4/(IC5) 250 V

#### Pollution degree exterior
- 3

#### Safe isolation (reinforced insulation) between
- IC1/(IC2…5) overvoltage category III, 300 V
- IC2/(IC3…5) overvoltage category III, 300 V
- IC3/(IC4…5) overvoltage category III, 300 V
- IC4/(IC5) overvoltage category III, 300 V

#### Voltage tests (routine test) acc. to IEC 61010-1
- IC1/(IC2…5) AC 2.2 kV
- IC2/(IC3…5) AC 2.2 kV
- IC3/(IC4…5) AC 2.2 kV
- IC4/(IC5) AC 2.2 kV

#### Supply voltage
- Nominal supply voltage $U_{nom}$
  - for UL applications DC/AC, 48…240 V
  - for AS/NSZ 2081 AC/DC, 48…240 V
- Tolerance $U_{tol}$
  - $\pm 15\%$
- Tolerance $U_{tol}$ (for UL applications)
  - $\pm 5\%$
- Tolerance $U_{tol}$ (for AS/NSZ 2081)
  - $\pm 25\%$
- Frequency range $f_{nom}$
  - DC, 40…70 Hz
- Power consumption (max.)
  - $\leq 7\ W/16\ VA$

#### Monitoring NGR

##### Measuring input $I_{nom}$
- $< 33\ V RMS$

##### Measuring range NGR (with $R_0 = 20\ k\Omega$) active
- 0…10 kΩ

##### Measurement uncertainty for $T = 0…+40\ °C$
- $\pm 20\ Ohm$
- $\pm 40\ Ohm$

##### Measurement range NGR (with $R_0 = 100\ k\Omega$) active
- 0…10 kΩ

##### Measurement accuracy for $T = 0…+40\ °C$
- $\pm 30\ Ohm$
- $\pm 80\ Ohm$

##### Setting range $U_{nom}$
- $15\…5\ k\Omega$

##### Response value $R_{nom}$
- $10^{\…90}\ Ohm$
- $110…200\ Ohm$

##### Response delay NGR relay
- 0…60 s

##### Response delay trip relay
- 0…60 s

#### Coupling

<table>
<thead>
<tr>
<th>$R_0$ for $U_{sys} \leq 4.3\ kV$</th>
<th>$\leq 4.3\ kV$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_0$ for $U_{sys} &gt; 4.3\ kV$</td>
<td>$&gt; 4.3\ kV$</td>
</tr>
</tbody>
</table>

#### Monitoring (NGR)

<table>
<thead>
<tr>
<th>Overload capacity</th>
<th>Voltage response value</th>
<th>Response delay ground-fault relay</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 x $U_{nom}$ for 10 s</td>
<td>0…90 % $U_{nom}$</td>
<td>$\leq 40\ ms$ (±10 ms)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Response delay trip relay (configurable)</th>
<th>Tolerance $t_{min}$ when set to</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 ms…24 h, $\infty$</td>
<td>RMS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tolerance $t_{min}$ when set to</th>
</tr>
</thead>
<tbody>
<tr>
<td>RMS</td>
</tr>
<tr>
<td>-20…0 ms</td>
</tr>
</tbody>
</table>

### Digital inputs

- Galvanic separation
  - no
- Length connecting cables
  - max. 10 m

#### Digital outputs

- Galvanic separation
  - no
- Length connecting cables
  - max. 10 m

#### GND immunity

- in active $NGR$ measurement
  - $U_{sys} \leq 4.3\ kV$
  - $U_{sys} > (4.3 /\sqrt{3}) \…(25/\sqrt{3})\ kV$

#### Environmental/EMC

<table>
<thead>
<tr>
<th>Stationary use</th>
<th>3M7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact data acc. to IEC 60947-5-1</td>
<td>250 V/250 V</td>
</tr>
<tr>
<td>Rated operational voltage AC</td>
<td>250 V</td>
</tr>
<tr>
<td>Utilisation category</td>
<td>AC-UL-UC-14</td>
</tr>
<tr>
<td>Rated operational current AC (for UL applications)</td>
<td>3 A</td>
</tr>
<tr>
<td>Rated operational voltage DC</td>
<td>220/110/24 V</td>
</tr>
<tr>
<td>Utilisation category</td>
<td>DC12</td>
</tr>
<tr>
<td>Rated operational current DC</td>
<td>0.7/1.2/1 A</td>
</tr>
<tr>
<td>Minimum current</td>
<td>1 mA at AC/DC &gt; 10 V</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Classification of mechanical conditions acc. to IEC 60721</th>
<th>Stationary use</th>
<th>Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport (IEC 60721-3-2)</td>
<td>2M3</td>
<td></td>
</tr>
<tr>
<td>Transport (IEC 60721-3-3)</td>
<td>3M7</td>
<td></td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-40…+60 °C</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Long-term storage (IEC 60721-3-1)</th>
<th>1K3 (except condensation and formation of ice)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linearity</td>
<td>$(400/\sqrt{3}) \…\leq (4300/\sqrt{3})\ V$</td>
</tr>
<tr>
<td>Harmonics</td>
<td>$(25/\sqrt{3})\ kV$</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Humidity</th>
<th>≤ 98 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact data acc. to IEC 60947-5-1</td>
<td>250 V/250 V</td>
</tr>
<tr>
<td>Rated operational voltage AC</td>
<td>250 V</td>
</tr>
<tr>
<td>Utilisation category</td>
<td>AC-UL-UC-14</td>
</tr>
<tr>
<td>Rated operational current AC (for UL applications)</td>
<td>3 A</td>
</tr>
<tr>
<td>Rated operational voltage DC</td>
<td>220/110/24 V</td>
</tr>
<tr>
<td>Utilisation category</td>
<td>DC12</td>
</tr>
<tr>
<td>Rated operational current DC</td>
<td>0.7/1.2/1 A</td>
</tr>
<tr>
<td>Minimum current</td>
<td>1 mA at AC/DC &gt; 10 V</td>
</tr>
</tbody>
</table>

#### Environment/EMC

- EMC immunity (IEC 61000-6-2/IEC 60525-26 Ed. 3.0) DIN EN 61000-6-2
- EMC emission (IEC100-6-2/IEC 60525-26 Ed. 3.0) DIN EN 61000-6-4

#### Operating temperature

- -40…+60 °C

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

<table>
<thead>
<tr>
<th>Stationary use</th>
<th>3M7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport</td>
<td>2M3</td>
</tr>
<tr>
<td>Long-term storage</td>
<td>1M3</td>
</tr>
</tbody>
</table>
Technical data (continued)

Connect

Screw-type terminals

<table>
<thead>
<tr>
<th>Tightening torque</th>
<th>0.5...0.6 Nm (5...7 lb-in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stripping length</td>
<td>7 mm</td>
</tr>
</tbody>
</table>

Recommended connecting cables

<table>
<thead>
<tr>
<th>Type</th>
<th>Stripping length</th>
<th>Recommended connecting cables</th>
</tr>
</thead>
<tbody>
<tr>
<td>rigid/flexible</td>
<td>7 mm</td>
<td>0.2...2.5 mm² (AWG 24...13)</td>
</tr>
<tr>
<td>flexible with ferrule</td>
<td>7 mm</td>
<td>0.25...2.5 mm² (AWG 24...13)</td>
</tr>
<tr>
<td>without plastic sleeve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiple conductor, rigid</td>
<td>7 mm</td>
<td>0.2...1 mm² (AWG 24...18)</td>
</tr>
<tr>
<td>Multiple conductor flexible</td>
<td>7 mm</td>
<td>0.2...1.5 mm² (AWG 24...16)</td>
</tr>
<tr>
<td>Multiple conductor flexible with ferrule without plastic sleeve</td>
<td>7 mm</td>
<td>0.25...1 mm² (AWG 24...18)</td>
</tr>
<tr>
<td>Multiple conductor, flexible with TWIN ferrule with plastic sleeve</td>
<td>7 mm</td>
<td>0.5...1.5 mm² (AWG 24...16)</td>
</tr>
</tbody>
</table>

Other

<table>
<thead>
<tr>
<th>Operating mode</th>
<th>continuous operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting</td>
<td>display-oriented</td>
</tr>
<tr>
<td>Altitude</td>
<td>max. 2000 m AMSL</td>
</tr>
<tr>
<td>Degree of protection, internal components (DIN EN 60529)</td>
<td>IP30</td>
</tr>
<tr>
<td>Flammability class</td>
<td>UL 94V-0</td>
</tr>
<tr>
<td>Protective coating measurement equipment</td>
<td>SL1307, UL file E80315</td>
</tr>
<tr>
<td>Documentation number</td>
<td>D00373</td>
</tr>
<tr>
<td>Weight</td>
<td>500 g</td>
</tr>
</tbody>
</table>

The "N" connection of the CD-series coupling device should be as close to the transformer star point as possible.
The "N" connection of the CD-series coupling device should be as close to the transformer star point as possible. An intermediate relay may be required between the power contactor of the pulser and the digital output at X1 of the FP200-NGRM.

If no star point is available, the following circuit can create an artificial neutral.
Measuring current transformer connection

Depending on the system to be monitored, a suitable measuring current transformer has to be chosen. All common measuring current transformers (50 mA or 5 A on the secondary side) can be used. The following table helps you with the choice:

<table>
<thead>
<tr>
<th>System type</th>
<th>AC + DC</th>
<th>AC + DC</th>
<th>AC</th>
<th>AC</th>
</tr>
</thead>
<tbody>
<tr>
<td>i</td>
<td>1…10 A</td>
<td>1…10 A</td>
<td>5…25 A</td>
<td>5…25 A</td>
</tr>
<tr>
<td>f</td>
<td>0…3800 Hz</td>
<td>0…3800 Hz</td>
<td>42…3800 Hz</td>
<td>50/60 Hz</td>
</tr>
<tr>
<td>Conversion ratio</td>
<td>600:1</td>
<td>600:1</td>
<td>600:1</td>
<td>60:5</td>
</tr>
<tr>
<td>Length connecting cables</td>
<td>max. 10 m (supplied cable or 0,75…1,5 mm² / AWG18…16)</td>
<td>max. 10 m (supplied cable or 0,75…1,5 mm² / AWG18…16)</td>
<td>max. 40 m (supplied cable or 0,75…1,5 mm² / AWG18…16)</td>
<td>max. 25 m (4 mm²) / max. 40 m (6 mm²)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IΔn</th>
<th>CTUB…</th>
<th>W35…120AB</th>
<th>W20…120</th>
<th>CTB31…41</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>STEP-PS</td>
<td>AN420</td>
<td>W1-S35…W5-S210</td>
<td>CTB</td>
</tr>
<tr>
<td>CT:k</td>
<td>NGRM500: 50 mA</td>
<td>NGRM500: 50 mA</td>
<td>NGRM500: 50 mA</td>
<td>NGRM500: 5 A</td>
</tr>
<tr>
<td>CT:l</td>
<td>NGRM500: C</td>
<td>NGRM500: C</td>
<td>NGRM500: C</td>
<td>NGRM500: C</td>
</tr>
</tbody>
</table>
LINETRAXX® NGRM700
Neutral Grounding Resistor Monitor

Device features
- Determination of $R_{NGR}$ with passive and active measurement methods
- Continuous monitoring of the $R_{NGR}$ even if the installation is de-energised;
- Alarm or trip on ground fault
- Monitoring of the current $I_{NGR}$
- Monitoring of the voltage $U_{NGR}$
- Phase-to-ground fault indication (optional; up to 690 V direct coupling, otherwise via potential transformers)
- Ethernet communication
- Web server
- Language selection (German, English GB and US, Spanish, French)
- Test button (internal, external) with/without tripping
- FFT analysis of the measuring signals
- Pulser for manual ground fault location
- Relay for detection of ground faults and resistor faults
- Relay for shutdown of the installation after a configurable time
- Can be combined with RCMS… for automatic shutdown of feeders
- Graphical user interface
- Wide supply voltage range (24 to 240 Vac/Vdc)
- Range of use up to 5000 m AMSL
- Fault/History memory
- Analogue output of measured values (0…10 V, 4…20 mA, etc., selectable parameters)
- Detachable HMI for door mounting
- Password protection
- Tripping on RMS, fundamental component signal or harmonics
- Detection of AC and DC ground faults

Typical applications
- For use in high-resistance grounded systems

Approvals

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

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage $U_s$/ Frequency range Hz</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 24…240 V, 40…70 Hz</td>
<td>NGRM700</td>
<td>B94013700</td>
</tr>
<tr>
<td>DC 24…240 V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art.-Nr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessory for FP200-NGRM: Transparent front cover 144x72 (for IP65)</td>
<td>B98060005</td>
</tr>
<tr>
<td>Accessory for FP200-NGRM: Front mounting fixing clips</td>
<td>B91067907</td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coupling device</td>
<td>CD</td>
<td>B900490…</td>
<td>233</td>
</tr>
<tr>
<td>Measuring current transformer</td>
<td>CTU…</td>
<td>B781200…</td>
<td>337</td>
</tr>
<tr>
<td>Voltage supply for measuring current transformers</td>
<td>W…AB</td>
<td>B980800…</td>
<td>–</td>
</tr>
</tbody>
</table>

1) When using the “transparent front cover 144x72 (IP 65)” the cutout in the switchboard cabinet must be extended in height from 66 mm to 68 mm (+0.7/-0 mm).

The degree of protection IP65 applies only to the user interface FP200-NGRM when using the front cover. The degree of protection for the complete device is still IP30.
Technical data

Insulation coordination according to IEC 60664-1/IEC 60664-3/DIN EN 50187

Definitions
- Measuring circuit 1 (IC1) (L1, L2, L3)
- Supply circuit (IC2) (A1, A2)
- Measuring circuit/Control circuit (IC3) (RS, E, CT), (X1, Ethernet)
- Output circuit 1 (IC4)
- Output circuit 2 (IC5)
- Output circuit 3 (IC6)

Rated voltage
- Overvoltage category III

Rated impulse voltage
- IC1/(IC2…6): 8 kV
- IC2/(IC3…6): 4 kV
- IC3/(IC4…6): 4 kV
- IC4/(IC5…6): 4 kV
- IC5/(IC6): 4 kV

Rated insulation voltage
- IC1/(IC2…6): 800 V
- IC2/(IC3…6): 250 V
- IC3/(IC4…6): 250 V
- IC4/(IC5…6): 250 V
- IC5/(IC6): 250 V

Pollution degree exterior
- 3

Safe isolation (reinforced insulation) between
- IC1/(IC2…6): overvoltage category III, 800 V
- IC2/(IC3…6): overvoltage category III, 300 V
- IC3/(IC4…6): overvoltage category III, 300 V
- IC4/(IC5…6): overvoltage category III, 300 V
- IC5/(IC6): overvoltage category III, 300 V

Voltage tests (routine test) acc. to IEC 61010-1
- IC2/(IC3…6): AC 2.2 kV
- IC3/(IC4…6): AC 2.2 kV
- IC4/(IC5…6): AC 2.2 kV
- IC5/(IC6): AC 2.2 kV

Supply voltage
- Nominal supply voltage $U_s$
  - ≤ 2000 m: AC/DC, 24…240 V
  - > 2000 m (for UL applications): AC/DC, 48…240 V
  - ≤ 2000 m (for AS/NZS 2081): AC/DC, 48…230 V
  - > 2000…≤ 5000 m: AC/DC, 48…120 V
  - > 2000…≤ 5000 m (for UL applications, AS/NZS 2081): AC/DC, 48…100 V

Tolerance $U_s$
- ±15 %

Tolerance $U_s$ (for UL applications)
- -50…+15 %

Tolerance $U_s$ (for AS/NZS 2081)
- -25…+20 %

Frequency range – Power consumption (typ. 50/60 Hz)
- DC, 40…70 Hz ≤ 0.3 W/13 VA

Phase monitoring
- Nominal measuring voltage $U_n$
  - 3 AC 100…690 V, CAT III
- Measuring range 1.2 x $U_n$
- Measurement accuracy ±3 % of $U_n$
- Power consumption per phase ≤ 0.5 W

Overload capacity
- 2 x $U_n$ continuous

Input resistance
- 1.76 MΩ

PT ratio primary
- 1 … 10,000

PT ratio secondary
- 1 … 10,000

Measuring range with PT
- 100 V … 25 kV

Monitoring fNGR
- Measuring input $R_t$
  - < 33 V RMS
- Measuring range NGR (with $R_t = 20$ kΩ) active
  - 0 … 10 kΩ
  - Measurement uncertainty for $T = 0…+40 ^\circ C$ ±20Ω
  - Measurement uncertainty for $T = -40…+70 ^\circ C$ ±40Ω
  - Measurement range NGR (with $R_t = 100$ kΩ) active
  - 0 … 10 kΩ
  - Measurement uncertainty for $T = 0…+40 ^\circ C$ ±30Ω
  - Measurement uncertainty for $T = -40…+70 ^\circ C$ ±60Ω

Setting range $R_{fNGR,nom}$
- 15 Ω … 5 kΩ

Response value $R_{fNGR,nom}$
- 10…90 % $R_{fNGR,nom}$
- 110…200 % $R_{fNGR,nom}$

Response delay NGR relay
- $t_s = 1 ± 0.5 s$

Response delay trip relay
- 0 … 60 s

Monitoring fGR
- Measuring circuit 5 A
  - Nominal measuring current $I_n$
  - DC/50/60 Hz/50…3200 Hz 5 A
  - Maximum continuous current $I_n$
  - 2 x $I_n$
  - Overload capacity
  - 10 x $I_n$ for 2 s
  - Measurement accuracy ±2 % of $I_n$
  - Load
  - 10 mΩ
  - Measuring circuit 50 mA
  - Nominal measuring current $I_n$
  - DC/50/60 Hz/50…3200 Hz 50 mA
  - Maximum continuous current $I_n$
  - 2 x $I_n$
  - Overload capacity
  - 10 x $I_n$ for 2 s
  - Measurement accuracy ±2 % of $I_n$
  - Load
  - 68 Ω
  - Overvoltage category 5 A and 50 mA
  - Response value $R_{fGR,nom}$
  - 10…90 % $R_{fGR,nom}$
  - Response delay ground-fault relay
  - ≤ 40 ms (±10 ms)
  - Response delay trip relay (configurable)
  - 100 ms … 24 h

Tolerance $R_{fGR,nom}$ when set to RMS
- -50 %, -20 %…0 ms

Fundamental
- 0 … +150 ms (filter time)

Harmonics
- 0 … +150 ms (filter time)

Measuring current transformer ratio primary
- 1 … 10,000

Measuring current transformer ratio secondary
- 1 … 10,000

Measuring range
- 2 x $R_{fGR,nom}$

Coupling
- $R_s$ for $U_{fGR,nom} \leq 4.3$ kV
  - CD1000, CD1000-2, CD5000 (20 kΩ)
- $R_s$ for $U_{fGR,nom} > 4.3$ kV
  - CD14400, CD25000 (100 kΩ)

Voltage immunity of the fGR
- $U_{fGR,nom}$ with $R_s = 20$ kΩ
  - DC/50/60 Hz/50…3200 Hz: > (4.3 / $\sqrt{3}$) V
  - Measuring range
  - 1.2 x $U_{fGR,nom}$
  - Overload capacity
  - 2 x $U_{fGR,nom}$ for 10 s
  - Measurement accuracy 2 % of $U_{fGR,nom}$ with $U_{fGR,nom} = (U_{fGR, B} \pm C D V V)$
  - Voltage response value
  - 0 … 100 % $U_{fGR,nom}$
  - Response delay ground-fault relay
  - ≤ 40 ms (±10 ms)
  - Response delay trip relay (configurable)
  - 100 ms … 24 h

Tolerance $R_{fGR,nom}$ when set to RMS
- -50 %, -20 %…0 ms

Fundamental
- 0 … +150 ms (filter time)

Harmonics
- 0 … +150 ms (filter time)

PT ratio primary
- 1 … 10,000

PT ratio secondary
- 1 … 10,000

DC immunity in case of active NGR measurement
- with $R_s = 20$ kΩ
  - DC ±12 V
- with $R_s = 100$ kΩ
  - DC ±60 V

Digital inputs
- Galvanic separation
  - no
- Length connecting cables
  - max. 10 m
  - $U_{fGR}$
  - DC 0 V, 24 V
- Overload capacity
  - -5 … 32 V

Digital outputs
- Galvanic separation
  - no
- Length connecting cables
  - max. 10 m
- Currents (sink) for each output
  - max. 300 mA
- Voltage
  - 24 V
- Overload capacity
  - -5 … 32 V

Analogue output (M+)
- Operating mode
  - Linear
- Functions $I_{fGR}, U_{fGR}$
- Current
  - 0 … 40 mA (≤ 500 Ω), 0 … 20 mA (≤ 600 Ω)
- Voltage
  - 0 … 10 V (≤ 1 kΩ), 2 … 10 V (≥ 1 kΩ)
- Tolerance related to the current/voltage end value
  - ±20 %

Neutral Grounding Resistor Monitor (NGR) LINETRAXX® NGRM700
Neutral Grounding Resistor Monitor (NGR) LINETRAXX® NGRM700

### Technical data (continued)

#### Ground-fault, NGR, trip relay

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switching elements</td>
<td>changeover contacts</td>
</tr>
<tr>
<td>Operating mode</td>
<td>configurable fail-safe/non-fail-safe</td>
</tr>
<tr>
<td>Electrical endurance, number of cycles</td>
<td>10,000</td>
</tr>
<tr>
<td>Switching capacity</td>
<td>2000 VA/150 W</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated operational voltage AC</td>
<td>250 V/250 V</td>
</tr>
<tr>
<td>Utilisation category</td>
<td>AC-13/AC-14</td>
</tr>
<tr>
<td>Rated operational current AC</td>
<td>5 A/3 A</td>
</tr>
<tr>
<td>Rated operational current AC (for UL applications)</td>
<td>3 A/3 A</td>
</tr>
<tr>
<td>Rated operational voltage DC</td>
<td>220/110/24 V</td>
</tr>
<tr>
<td>Utilisation category</td>
<td>DC12</td>
</tr>
<tr>
<td>Rated operational current DC</td>
<td>0.1/0.2/1 A</td>
</tr>
<tr>
<td>Minimum current</td>
<td>1 mA at AC/DC &gt; 10 V</td>
</tr>
</tbody>
</table>

#### Environment/EMC

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC immunity (IEC61000-6-2/IEC 60255-26 Ed. 3.0)</td>
<td>DIN EN 61000-6-2</td>
</tr>
<tr>
<td>EMC emission (IEC61000-6-2/IEC 60255-26 Ed. 3.0)</td>
<td>DIN EN 61000-6-4</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-40...+70 °C</td>
</tr>
<tr>
<td>Humidity</td>
<td>≤ 98 %</td>
</tr>
</tbody>
</table>

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

- Stationary use (IEC 60721-3-3): 3K5 (except condensation and formation of ice)
- Transport (IEC 60721-3-3): 2K2 (40...+85 °C) (except condensation and formation of ice)
- Long-term storage (IEC 60721-3-1): 1K4 (40...+70 °C) (except condensation and formation of ice)

#### Classification of mechanical conditions acc. to IEC 60721/IEC 60255-21/DIN EN 60068-2-6

- Stationary use: 3M7
- Transport: 2M2
- Long-term storage: 1M3

#### Connection

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw-type terminals</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/without plastic sleeve</td>
<td>0.25...2.5 mm²</td>
</tr>
<tr>
<td>Multiple conductor, rigid</td>
<td>0.2...1 mm²</td>
</tr>
<tr>
<td>Multiple conductor flexible</td>
<td>0.2...1.5 mm²</td>
</tr>
<tr>
<td>Multiple conductor flexible with ferrule without plastic sleeve</td>
<td>0.25...1 mm²</td>
</tr>
<tr>
<td>Multiple conductor, flexible with TWIN ferrule with plastic sleeve</td>
<td>0.5...1.5 mm²</td>
</tr>
</tbody>
</table>

| Push-wire terminals X1                             |       |
| Conductor sizes                                    | AWG 24-16 |
| Stripping length                                   | 10 mm |
| rigid/flexible                                      | 0.2...1.5 mm² |
| Flexible with ferrule without plastic sleeve       | 0.25...1.5 mm² |
| Flexible with ferrule with plastic sleeve          | 0.25...0.75 mm² |

#### Other

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting</td>
<td>display-oriented</td>
</tr>
<tr>
<td>Altitude</td>
<td>5000 m AMSL</td>
</tr>
<tr>
<td>Degree of protection, internal components (DIN EN 60529)</td>
<td>IP30</td>
</tr>
<tr>
<td>Flammability class</td>
<td>UL 94V-0</td>
</tr>
<tr>
<td>Protective coating measurement equipment</td>
<td>SL 1380, UL file E80315</td>
</tr>
<tr>
<td>Documentation number</td>
<td>D00292</td>
</tr>
<tr>
<td>Weight</td>
<td>1050 g</td>
</tr>
</tbody>
</table>

#### Dimension diagram NGRM700 (dimensions in mm)

![Dimension diagram NGRM700](image)

#### Dimension diagram FP200-NGRM (dimensions in mm)

![Dimension diagram FP200-NGRM](image)
Connection star connection: $U_{sys} \leq 690$ V

For these voltages, the phase monitor of the NGRM700 can be connected directly to the conductors to be monitored.

The "N" connection of the CD-series coupling device should be as close to the transformer star point as possible.

Connection Star connection: $U_{sys} \leq 690$ V with pulser

The "N" connection of the CD-series coupling device should be as close to the transformer star point as possible.

An intermediate relay may be required between the power contactor of the pulser and the digital output at X1 of the FP200-NGRM.
Connection star connection: $U_{sys} > 690\, V$

For these voltages, the phase monitor of the NGRM700 can only be connected to the conductors to be monitored via potential transformers (PT).

Note: * PT ratio „primary:secondary“ can be adjusted in the NGRM700.

The "N" connection of the CD-series coupling device should be as close to the transformer star point as possible.

Connection artificial neutral (delta connection): zigzag transformer

If no star point is available, the following circuit can create an artificial neutral.
Measuring current transformer connection

Depending on the system to be monitored, a suitable measuring current transformer has to be chosen. All common measuring current transformers (50 mA or 5 A on the secondary side) can be used. The following table helps you with the choice:

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<th>AC + DC</th>
<th>AC + DC</th>
<th>AC</th>
<th>AC</th>
</tr>
</thead>
<tbody>
<tr>
<td>i</td>
<td>1…10 A</td>
<td>1…10 A</td>
<td>5…25 A</td>
<td>5…25 A</td>
</tr>
<tr>
<td>f</td>
<td>0…3800 Hz</td>
<td>0…3800 Hz</td>
<td>42…3800 Hz</td>
<td>50/60 Hz</td>
</tr>
<tr>
<td>Conversion ratio</td>
<td>600:1</td>
<td>600:1</td>
<td>600:1</td>
<td>60:5</td>
</tr>
<tr>
<td>Length connecting cables</td>
<td>max. 10 m</td>
<td>max. 10 m</td>
<td>max. 40 m</td>
<td>max. 25 m (4 mm²) max. 40 m (6 mm²)</td>
</tr>
<tr>
<td>$I_{\Delta n}$</td>
<td><img src="CTUB.png" alt="Diagram" /></td>
<td><img src="W...AB.png" alt="Diagram" /></td>
<td><img src="W.../W...S.png" alt="Diagram" /></td>
<td><img src="CTB.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>CTUB…</th>
<th>W…AB</th>
<th>W…/W…S</th>
<th>CTB…</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEP-PS</td>
<td><img src="AN420.png" alt="Diagram" /></td>
<td><img src="AN420.png" alt="Diagram" /></td>
<td><img src="AN420.png" alt="Diagram" /></td>
<td><img src="AN420.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>

| CT: k | NGRM700: 50 mA | NGRM700: 50 mA | NGRM700: 50 mA | NGRM700: 5 A |
| CT: l | NGRM700: C | NGRM700: C | NGRM700: C | NGRM700: C |
CD1000
Coupling device

Device features
- Coupling device for NGRM
- Range of use up to AC 690 V/DC 400 V system voltage
- Range of use up to 2000 m

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

Typical applications
- The coupling device is suitable for HRG applications up to AC 690 V and/or DC 400 V.

Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage $U_{LL}$ ($U_{NGR}$)</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to $U_{LL} = 690$ V ($U_{NGR} = 400$ V)</td>
<td>CD1000</td>
<td>B98039010</td>
</tr>
</tbody>
</table>

Technical data

**Insulation coordination DIN EN 50178:1997**

- Definition
  - Measuring circuit (IC1)
  - Output circuit (IC2)
  - Protective circuit (IC3)
- Rated voltage 400 V
- Overvoltage category III
- Pollution degree 2
- Rated insulation voltage
  - no galvanic separation between the circuits!
  - IC1/(IC2 – IC3) 400 V
  - IC2/IC3 50 V

**Voltage range**

- $U_a$
  - DC / 50/60 Hz / 50…3200 Hz 400 V
- $I_n$
  - 30 mA

**Overload capacity**

- $1.15 \times I_n$ for < 30 minutes

**Resistance**

- 20 kΩ
- ±5 %
- Temperature coefficient 25 ppm/K

**Environment**

- Ambient temperature –40…+70 °C
- Ambient temperature for $U_a$ –40…+60 °C
- Humidity ≤ 98 %

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

(Except condensation and formation of ice)

- Stationary use (IEC 60721-3-3) 3K5
- Transport (IEC 60721-3-2) 2K3 (–40…+85 °C)
- Long-term storage (IEC 60721-3-1) 1K4 (–40…+70 °C)

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

- Stationary use 3M7
- Transport 2M2
- Long-term storage 1M3

**Connection**

- Tightening torque 0.5…0.6 Nm (5…7 lb-in)
- Conductor sizes AWG 24-12
- Stripping length 7 mm
- Conductor, rigid 0.2…4 mm²
- Conductor, flexible 0.2…2.5 mm²
- Multiple conductor, flexible with ring cable lug
  - without plastic sleeve 0.25…1.5 mm²
  - with plastic sleeve 0.25…2.5 mm²

**Other**

- Tightening torque mountings screws (M4x30) 2.5 Nm (22.1 lb-in)
- Operating mode continuous operation
- Mounting any position
- Operating altitude up to 2000 m AMSL
- Degree of protection, internal components (DIN EN 60529) IP30
- Flammability class UL94 HB
- Documentation number D00397
- Weight < 190 g

Nominal system voltage $U_{LL}$ ($U_{NGR}$) Type Art. No.

- Up to $U_{LL} = 690$ V ($U_{NGR} = 400$ V) CD1000 B98039010

Technical data

**Nominal system voltage $U_{LL}$ ($U_{NGR}$) Type Art. No.**
Neutral Grounding Resistor Monitor (NGR)
Coupling device CD1000

**Dimension diagram (dimensions in mm)**

- $\phi_i = 4.5$
- $\phi_a = 10.0$
- $t = 3.2$
- $i = \text{internal}$
- $a = \text{external}$
- $t = \text{depth}$

**Wiring diagram**

- **NGR monitor**
- **RC48N**

**Internal wiring diagram CD1000**

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Use</th>
<th>Connecting cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Connection to the star point of the HRG system</td>
<td><strong>Metrical</strong>: 1.5 mm$^2$  <strong>Imperial</strong>: AWG16</td>
</tr>
<tr>
<td>G1</td>
<td>Connection to $R_i$ of the NGRM…</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>Connection to E of the NGRM… (internally connected to PE, see internal wiring diagram)</td>
<td></td>
</tr>
<tr>
<td>PE</td>
<td>Connection to enclosure</td>
<td><strong>Metrical</strong>: $\geq 1.5$ mm$^2$  <strong>Imperial</strong>: AWG16 or greater</td>
</tr>
</tbody>
</table>
CD1000-2
Coupling device

Device features
- Coupling device for NGRM
- Range of use up to AC 1000 V/DC 600 V system voltage
- Application up to 5000 m

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

Typical applications
- The coupling device is suitable for HRG applications up to AC 1000 V and/or DC 690 V.

Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage $U_n$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to $U_{LL} = 1000$ V ($U_{NGR} = 600$ V)</td>
<td>CD1000-2</td>
<td>B98039053</td>
</tr>
</tbody>
</table>

Technical data

Insulation coordination DIN EN 50178:1997

Definition
- Measuring circuit (IC1)
- Output circuit (IC2)
- Protective circuit (IC3)

Rated voltage 600 V

Overvoltage category III

Pollution degree 2

Rated insulation voltage no galvanic separation between the circuits!

IC1/(IC2–IC3) 600 V

IC2/IC3 50 V

Voltage range

$U_n$ DC / 50/60 Hz / 50...3200 Hz 600 V

$I_n$ 30 mA

Overload capacity 1.15 x $I_n$ for < 30 minutes

Resistance
- 20 kΩ ±0.5 %

Temperature coefficient 20 ppm/K

Environment
- Ambient temperature -40...+70 °C
- Ambient temperature for $U_n$ -40...+60 °C
- Humidity ≤ 98 %

Classification of climatic conditions acc. to IEC 60721
(except condensation and formation of ice)
- Stationary use (IEC 60721-3-3) 3K5
- Transport (IEC 60721-3-2) 2K3 (-40...+85 °C)
- Long-term storage (IEC 60721-3-1) 1K4 (-40...+70 °C)

Classification of mechanical conditions acc. to IEC 60721
- Stationary use 3M7
- Transport 2M2
- Long-term storage 1M3

Connection
- Tightening torque 0.5...0.6 Nm (5...7 lb-in)
- Conductor sizes AWG 24-12
- Stripping length 7 mm
- Conductor, rigid 0.2...4 mm²
- Conductor, flexible 0.2...2.5 mm²
- Multiple conductor, flexible with ferrule without plastic sleeve 0.25...1.5 mm²
- with plastic sleeve 0.25...2.5 mm²
- Multiple conductor, flexible with TWIN ferrule with plastic sleeve 0.5...1.5 mm²

Other
- Tightening torque mounting screws (M4x30) 2.5 Nm (22.1 lb-in)
- Operating mode continuous operation
- Mounting any position
- Operating altitude up to 5000 m AMSL
- Degree of protection, internal components (DIN EN 60529) IP30
- Flammability class UL 94V-0
- Documentation number D00345
- Weight < 700 g
Neutral Grounding Resistor Monitor (NGR)

**Coupling device CD1000-2**

**Dimension diagram (dimensions in mm)**

<table>
<thead>
<tr>
<th>S: Ø 4.5 M4x30 2.5 Nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
</tr>
<tr>
<td>120</td>
</tr>
<tr>
<td>130</td>
</tr>
<tr>
<td>300</td>
</tr>
</tbody>
</table>

**Wiring diagram**

**Wiring diagram**

**Internal wiring diagram CD1000-2**

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Use</th>
<th>Connecting cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Connection to the star point of the HRG system</td>
<td>1.5 mm²</td>
</tr>
<tr>
<td>Rs</td>
<td>Connection to Rs of the NGRM…</td>
<td>1.5 mm²</td>
</tr>
<tr>
<td>E</td>
<td>Connection to E of the NGRM… (internally connected to PE, see internal wiring diagram)</td>
<td>≥ 1.5 mm²</td>
</tr>
<tr>
<td>PE</td>
<td>Connection to the protective conductor (internally connected to E, see internal wiring diagram)</td>
<td>≥ 1.5 mm²</td>
</tr>
</tbody>
</table>

Cable: 1.5 mm² (AWG16)
CD5000
Coupling device

Device features
- Coupling device for NGRM
- Range of use up to AC 4300 V/DC 2500 V system voltage
- Range of use up to 2000 m

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

Typical applications
- The coupling device is suitable for HRG applications up to AC 4300 V and/or DC 2500 V.

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage $U_{\text{LL}}$ (U$_{\text{NGR}}$)</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to $U_{\text{LL}} = 4300$ V (U$_{\text{NGR}} = 2500$ V)</td>
<td>CD5000</td>
<td>B98039011</td>
</tr>
</tbody>
</table>

Technical data

Insulation coordination DIN EN 50178:1997

- Definition
  - Measuring circuit (IC1) N
  - Output circuit (IC2) G1
  - Protective circuit (IC3) G, PE
- Rated voltage: 3 kV
- Overvoltage category: III
- Pollution degree: 2
- Rated insulation voltage:
  - IC1/(IC2 – IC3): 3 kV
  - IC2/IC3: 50 V

Voltage range
- $U_{\text{n}}$: DC / 50/60 Hz / 50…3200 Hz 2500 V
- $I_{\text{n}}$: 125 mA
- Overload capacity: $1.15 \times U_{\text{n}}$ for < 5 minutes
- Resistance:
  - 20 kΩ: ±1 %
  - Temperature coefficient: 20 ppm/K

Environment
- Ambient temperature: -40…+70 °C
- Ambient temperature for $U_{\text{n}}$: -40…+60 °C
- Humidity: ≤ 98 %

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

- Stationary use (IEC 60721-3-3): 3K5
- Transport (IEC 60721-3-2): 2K3 (-40…+85 °C)
- Long-term storage (IEC 60721-3-1): 1K4 (-40…+70 °C)

Classification of mechanical conditions acc. to IEC 60721

- Stationary use: 3M7
- Transport: 2M2
- Long-term storage: 1M3
- Tightening torque G1 and G: 0.5…0.6 Nm (5…7 lb-in)
- Conductor sizes:
  - AWG 24-12
- Connection G1 and G:
  - Cable lug
- Conductor: ≥ 1.5 mm²
- Connection PE:
  - Cable lug M6
- Conductor: ≥ 2.5 mm²
- Connection N:
  - Cable lug M6, M10

Other

- Operating mode: continuous operation
- Mounting: any position
- Operating altitude: up to 2000 m AMSL
- Degree of protection, internal components (DIN EN 60529): IP0
- Flammability class: UL 94V-0
- Documentation number: D03918
- Weight: < 3800 g
**Neutral Grounding Resistor Monitor (NGR)**

**Coupling device CD5000**

- **Dimension diagram** (dimensions in mm)
  - CD5000
  - CD5000

- **Wiring diagram**
  - NGR monitor
  - RC48N

  - Internal wiring diagram CD5000

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Use</th>
<th>Connecting cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Connection to the star point of the HRG system</td>
<td></td>
</tr>
<tr>
<td>G1</td>
<td>Connection to $R_n$ of the NGRM…</td>
<td>via cable lug M6 or M10</td>
</tr>
<tr>
<td>G</td>
<td>Connection to E of the NGRM… (internally connected to PE, see internal wiring diagram)</td>
<td>1.5 mm²</td>
</tr>
<tr>
<td>PE</td>
<td>Connection to the protective conductor (internally connected to E, see internal wiring diagram)</td>
<td>≥ 1.5 mm²</td>
</tr>
</tbody>
</table>
CD14400
Coupling device

Device features
- Coupling device for NGRM
- Range of use up to 14400 V system voltage
- Application up to 5000 m
- IP54

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

Typical applications
- The coupling device is suitable for HRG applications up to a system voltage of 14400 V.

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage $U_n$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to $U_n = 14400$ V ($U_{NGR} = 8400$ V)</td>
<td>CD14400</td>
<td>B98039054</td>
</tr>
</tbody>
</table>

Technical data

Insulation coordination DIN EN 50178:1997
Definitions
- Measuring circuit (IC1)
- Output circuit (IC2)
- Protective circuit (IC3)
Rated voltage 8400 V
Overvoltage category III
Pollution degree 2
Rated insulation voltage no galvanic separation between the circuits!
$IC1/(IC2 – IC3) = 8400$ V
$IC2/IC3 = 50$ V
Voltage range $U_n = 84$ mA
Operating time
- without ground fault (1900 V) unlimited
- with ground fault (4200 V) 90 seconds
- with ground fault (8400 V) 60 seconds
Cool-down period 120 minutes
Overload capacity $1.15 	imes U_n$ for < 30 seconds
Resistance 100 kΩ ±0.5 %
Temperature coefficient 20 ppm/K
Environment
- Ambient temperature -40...+70 °C
- Ambient temperature for $U_n$ -40...+60 °C
- Humidity ≤ 98 %
Classification of climatic conditions acc. to IEC 60721
(Excluding condensation and formation of ice)
- Stationary use (IEC 60721-3-3) 3K5
- Transport (IEC 60721-3-2) 2K3 (-40...+85 °C)
- Long-term storage (IEC 60721-3-1) 1K4 (-40...+70 °C)
Classification of mechanical conditions acc. to IEC 60721
- Stationary use 3M7
- Transport 2M2
- Long-term storage 1M3

Connection
- Connection $A_0$ and $E$
  - Tightening torque 0.5...0.6 Nm (4.4...5.3 lb-in)
  - Conductor sizes AWG 24-12
  - Stripping length 7 mm
  - Conductor, rigid 0.2...4 mm²
  - Conductor, flexible 0.2...2.5 mm²
- Multiple conductor, flexible with ferrule
  - with plastic sleeve 0.25...1.5 mm²
  - with plastic sleeve 0.25...2.5 mm²
- Multiple conductor, flexible with TWIN ferrule
  - with plastic sleeve 0.5...1.5 mm²

Connection $N$ and $PE$
- Tightening torque cable lug M10 17 Nm (150 lb-in)
- Tightening torque cable lug M5 2.2 Nm (19.5 lb-in)

Other
- Tightening torque cover screws 2.5 Nm (22.1 lb-in)
- Mounting screws 21 Nm (186 lb-in)
- Operating mode in case of a ground fault maximum 60 s
- Mounting any position
- Operating altitude up to 5000 m ANS
- Degree of protection, internal components (DIN EN 60529) IP54
- Flammability class UL 94V-0
- Documentation number D30346
- Weight < 4.4 kg
**Neutral Grounding Resistor Monitor (NGR)**

**Coupling device CD14400**

---

**Dimension diagram (dimensions in mm)**

![Dimension diagram](image)

- **Isolation Insulator**
- **CD14400**

**Wiring diagram**

- **Wiring diagram**
- **Internal wiring diagram CD14400**

**Terminal Use Connecting cable**

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Use</th>
<th>Connecting cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_S$</td>
<td>Connection to $R_S$ of the NGRM…</td>
<td>Metrical: 1.5 mm², Imperial: AWG16</td>
</tr>
<tr>
<td>$E$</td>
<td>Connection to $E$ of the NGRM…; internally connected to PE</td>
<td>Metrical: 1.5 mm², Imperial: AWG16 or greater</td>
</tr>
<tr>
<td>$N$</td>
<td>Connection to the star point of the HRG system; via cable lug M5 or M10</td>
<td>Metrical: 1.5 mm², Imperial: AWG16 or greater</td>
</tr>
<tr>
<td>PE</td>
<td>Connection to protective earth conductor; internally connected to $E$, cable lug M5</td>
<td>Metrical: 1.5 mm², Imperial: AWG16 or greater</td>
</tr>
</tbody>
</table>

**Tightening torque cover screws**: 2.5 Nm (22.1 lb-in)

**Minimum distance to adjacent devices**
CD25000
Coupling device

Device features

- Coupling device for NGRM
- Range of use up to AC 25 kV/DC 14.5 kV system voltage
- Application up to 5000 m

Further information

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

Typical applications

- The coupling device is suitable for HRG applications up to AC 25 kV and/or DC 14.5 kV

Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage $U_n$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to $U_{LL} = 25$ kV ($U_{NGR} = 14.5$ kV)</td>
<td>CD25000</td>
<td>B98039055</td>
</tr>
</tbody>
</table>

Technical data

Insulation coordination DIN EN 50178:1997

<table>
<thead>
<tr>
<th>Definition</th>
<th>IC1</th>
<th>IC2</th>
<th>IC3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring circuit</td>
<td>N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output circuit</td>
<td>$R_s$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protective circuit</td>
<td>$E$, $PE$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated voltage</td>
<td>14500 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>III</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pollution degree</td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Voltage range

- $U_n$ : DC / 50/60 Hz / 50…3200 Hz 14500 V
- $I_n$ : 145 mA

Operating time

- without ground fault (2800 V) unlimited
- with ground fault (14500 V) 10 seconds
- Cool-down period: 120 minutes
- Overload capacity: 1.15 x $U_n$ for < 10 seconds

Resistance

- 100 kΩ ±0.5 %
- Temperature coefficient: 20 ppm/K

Environment

- Ambient temperature: -40…+70 °C
- Ambient temperature for $U_n$: -40…+60 °C
- Humidity: ≤ 98 %

Classification of climatic conditions acc. to IEC 60721

- Stationary use (IEC 60721-3-3) 3K5 (except condensation and formation of ice)
- Transport (IEC 60721-3-2) 2K3 (-40…+85 °C) (except condensation and formation of ice)
- Long-term storage (IEC 60721-3-1) 1K4 (-40…+70 °C) (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721 / IEC 60255-21 / DIN EN 60068-2-6

- Stationary use: 3M8
- Transport: 2M2
- Long-term storage: 1M3

Connections

- Connection $R_s$, $E$, and $PE$
- Tightening torque: 0.5…0.6 Nm (4.4…5.3 lb-in)
- Conductor sizes: AWG 24-12
- Stripping length: 3 mm
- Conductor, rigid: 0.2…4 mm²
- Conductor, flexible: 0.2…2.5 mm²
- Multiple conductor, flexible with ferrule without plastic sleeve: 0.25…1.5 mm²
- Multiple conductor, flexible with ferrule with plastic sleeve: 0.25…2.5 mm²
- Multiple conductor, flexible with TWIN ferrule with plastic sleeve: 0.5…1.5 mm²

Connections for cable lug

- Tightening torque cable lug M5: 2.2 Nm (19.5 lb-in)
- Connection via HV line with open end: cable lug provided by the customer

Other

- Operating mode: in case of a ground fault maximum 10 s
- Mounting: any position
- Operating altitude (when mounted on insulators): up to 5000 m AMSL
- Degree of protection, internal components (DIN EN 60529): IP54
- Flammability class: UL 94V-0
- Documentation number: D00347
- Weight: < 11 kg
- Tightening torque cover screws: 2.5 Nm (22.1 lb-in)

Nominal system voltage $U_n$, Type, Art. No.

| Up to $U_{LL} = 25$ kV ($U_{NGR} = 14.5$ kV) | CD25000 | B98039055 |

2020/2021
**Neutral Grounding Resistor Monitor (NGR)**

**Coupling device CD25000**

### Dimension diagram (dimensions in mm)

![Dimension diagram](image)

### Wiring diagram

**Wiring diagram**

**Internal wiring diagram CD25000**

![Internal wiring diagram](image)

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Use</th>
<th>Connecting cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rs</td>
<td>Connection to Rs of the NGRM…</td>
<td>1.5 mm² / AWG16</td>
</tr>
<tr>
<td>E</td>
<td>Connection to E of the NGRM… (internally connected to PE, see internal wiring diagram)</td>
<td>1.5 mm² / AWG16</td>
</tr>
<tr>
<td>N</td>
<td>Connection to the star point of the HRG system (cable lug M5 or M10)</td>
<td>≥ 1.5 mm² / AWG16 or greater</td>
</tr>
<tr>
<td>PE</td>
<td>Connection to the protective conductor (internally connected to E, cable lug M5)</td>
<td>≥ 1.5 mm² / AWG16 or greater</td>
</tr>
<tr>
<td>Page</td>
<td>Section</td>
<td></td>
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<tr>
<td>------</td>
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<td></td>
</tr>
<tr>
<td>1</td>
<td>Insulation monitoring devices</td>
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<td>2</td>
<td>Equipment for insulation fault location</td>
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<td>3</td>
<td>Residual current monitoring systems</td>
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<tr>
<td>4</td>
<td>Neutral Grounding Resistor Monitor (NGR)</td>
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<tr>
<td>5</td>
<td>Power Quality and Energy Measurement</td>
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<td>6</td>
<td>Measuring and monitoring relays</td>
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<td>COMTRAXX® Gateways</td>
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<td>Measuring current transformers</td>
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<td>Measuring instruments</td>
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<td></td>
<td>COMTRAXX® Alarm indicator and test combinations</td>
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<td>Transformers</td>
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<td>Interface converters</td>
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<td>COMTRAXX® condition monitors</td>
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<td>Measuring transducers</td>
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<td>Interface repeaters</td>
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<td>Visualisation</td>
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<td>8</td>
<td>Switching equipment</td>
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<td>ATICS® transfer switching and monitoring devices</td>
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<tr>
<td>9</td>
<td>Test systems</td>
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<td>UNIMET® Safety analyser</td>
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<td>10</td>
<td>Annex</td>
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<td>Standards and guidelines applied</td>
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<tr>
<td></td>
<td>Technical terms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alphabetical list of devices</td>
<td></td>
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<tr>
<td></td>
<td>Service</td>
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</tbody>
</table>
Device overview Universal Devices for Power Quality and Energy Measurement PEM

<table>
<thead>
<tr>
<th>Parameters</th>
<th>LINETRAXX® PEM353</th>
<th>LINETRAXX® PEM575</th>
<th>LINETRAXX® PEM735</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Normative requirements</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accuracy class according to IEC 62053-22</td>
<td>0.5 s</td>
<td>0.2 s</td>
<td>0.2 s</td>
</tr>
<tr>
<td>DIN EN 50160 (report)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>DIN EN 61000-4-7 (harmonic)</td>
<td>Class II</td>
<td>Class I</td>
<td>Class I</td>
</tr>
<tr>
<td>DIN EN 61000-4-15 (flicker) DIN EN 61000-4-30 (PQ measurement method)</td>
<td>–</td>
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</tr>
<tr>
<td><strong>Parameters</strong></td>
<td></td>
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<tr>
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<td>Modbus RTU &amp; TCP</td>
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</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 263 to 266), 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 PEM353**

**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 $\cos(\phi)$
  - 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 $I$
- **Limit value monitoring (setpoints)** with alarm forwarding
- **Energy and power measurement with log and tariff system**
- **Configurable start page with 4 measured quantities**
- **Measurement and monitoring of the N conductor**
- **Energy and power measurement, e.g. as part of energy data monitoring**

**Standards**
PEM353 was designed in accordance with the following standards:
- **DIN EN 62053-22 (VDE 0418 Part 3-22)**
  Electricity metering equipment (a.c.) - Particular requirements - Part 22: Static meters for active energy (classes 0.2 S and 0.5 S) (IEC 62053);
- **DIN EN 61557-12 (VDE 0413-12)**
  Electrical safety in low voltage distribution systems up to 1000 V a.c. and 1500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 12: Performance measuring and monitoring devices (PMD)
- **DIN IEC 61554:2002-08**

**Typical applications**
- Modern indicating instrument for electrical quantities, e.g. as a replacement for analogue indicating instruments
- Power quality monitoring
- Limit value monitoring (setpoints) with alarm forwarding
- Measurement and monitoring of the N conductor
- Energy and power measurement, e.g. as part of energy data monitoring

**Approvals**

**Ordering information**

<table>
<thead>
<tr>
<th>Properties</th>
<th>PEM353</th>
<th>PEM353-P</th>
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</tr>
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</tr>
<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td><strong>Current inputs (I1, I2, I3)</strong></td>
<td>5 A / 1 A</td>
<td></td>
</tr>
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<td><strong>I4</strong></td>
<td>-</td>
<td>5 A</td>
</tr>
<tr>
<td></td>
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<td>-</td>
<td>up to the 31st</td>
</tr>
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<td>3,2 kHz</td>
<td></td>
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<td>9</td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td><strong>Data recorder</strong></td>
<td>-</td>
<td>-</td>
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<tr>
<td></td>
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<td>5</td>
<td>-</td>
</tr>
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<td></td>
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<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
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<td>2 x relay</td>
<td>2 x relay</td>
</tr>
<tr>
<td></td>
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<td>2 x pulse</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><strong>Supply voltage</strong></td>
<td>95...250 V, DC, AC 47...440 Hz</td>
<td></td>
</tr>
<tr>
<td></td>
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<td>RS-485 (Modbus RTU, BACnet MS/TP, DNIP)</td>
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</tr>
<tr>
<td></td>
<td><strong>Language</strong></td>
<td>English</td>
<td></td>
</tr>
</tbody>
</table>

For further information refer to our product range on www.bender.de.
Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Pollution degree 2
Climate category operation 3K6
Max. installation altitude above NN: 2000 m

Definitionen

Measuring circuit 1 (IC1)
TN and TT system
Nominal voltage 400/690 V
Overvoltage category/Rated insulation voltage III/600 V
IT system
Nominal voltage 480 V
Overvoltage category/Rated insulation voltage III/300 V
Nominal voltage 690 V
Overvoltage category/Rated insulation voltage III/1000 V
Measuring circuit 2 (IC2)
Overvoltage category/Rated insulation voltage III/300 V
Supply circuit (IC3)
Overvoltage category/Rated insulation voltage III/300 V
Output circuit 1 (IC4) at PEM353-N and PEM353 (DO13, DO14)
Overvoltage category/Rated insulation voltage III/300 V
Output circuit 2 (IC5) at PEM353-P (E2+, E2-)
Overvoltage category/Rated insulation voltage III/300 V
Output circuit 1 (IC4) at PEM353-N and PEM353 (DO23, DO24)
Overvoltage category/Rated insulation voltage III/300 V
Supply circuit (IC3) (A1/+, A2/-)
Overvoltage category/Rated insulation voltage III/300 V
Measuring circuit 2 (IC2) (•I11, I12, •I21, I22, •I31, I32)
Overvoltage category/Rated insulation voltage III/300 V

Technical data

Internal resistance
L1-N, L2-N, L3-N > 12 MΩ
Rated frequency 45…65 Hz

Overvoltage category/Rated insulation voltage
- III/50 V
- III/300 V
- III/600 V

Overvoltage category/Rated insulation voltage
- III/1000 V
- III/3000 V
- III/5000 V

Measuring range
10…828 V (120 % Uman, max)
Rated frequency
45…65 Hz
Internal resistance ∆R1, ∆R2, ∆R3-N > 12 MΩ

Measuring current transformer inputs
Phase voltage U1-N, U2-N, U3-N ±0.2 % OMV, +0.05 % OFS
Current I1, I2, I3 ±0.2 % OMV, +0.05 % OFS
Neutral current In (PEM353-N) ±0.2 % OMV
Frequency f ±0.02 Hz
Phasing ±1°
Active power, reactive power ±0.5 % OMV, +0.05 % OFS
Power factor E ±0.5 %

Measurement of the active energy acc. to DIN EN 62053-22 (VDE 0418 part 3-22)
Accuracy class with 5 A measuring current transformers 0.5 S
Accuracy class with 1 A measuring current transformers 1 S
Measurement of the phase current rms values
- PEM353-P acc. to DIN EN 61557-12 (VDE 0413-12), chapter 4.7.6
- PEM353-N acc. to DIN EN 61557-12 (VDE 0413-12), chapter 4.7.7
Frequency measurement
- PEM353-P acc. to DIN EN 61557-12 (VDE 0413-12), chapter 4.7.5
- PEM353-N acc. to DIN EN 61557-12 (VDE 0413-12), chapter 4.7.4

Interface
- Interface: Protocol RS-485: Modbus RTU, BACnet MS/TP, DNP
- Baud rate 1.2…38.4 kbit/s
- Recommended cable (shielded) J-Y(ST)Y min. 2 x 0.8

Switching elements
- Outputs
  - 2 N/O contacts
- Operating principle
  - N/O operation
- Relay contacts, N/O operation
  - PEM353-N, PEM353
  - 1 mA at AC/DC ≥ 10 V
- Pulse output
  - max. DC 30 V, max. 30 mA
- Cable length < 30 m

Inputs
- 4 common galv. isolated digital inputs
- Pulse output max. DC 30 V, max. 30 mA
- Cable length < 30 m
- Environment/EMC
  - EMC
  - IEC 61326-1
  - Operating temperature -25…+55 °C
- Classification of climatic conditions acc. to IEC 60721 (stationary use)
  - 3K6
- Classification of mechanical conditions acc. to IEC 60721 (stationary use)
  - 3M4
- Range of use < 2000 m

Connection
- Connection type screw-type terminals, plug-in connector

Other
- Degree of protection, installation
  - IP20
- Degree of protection, front (with rubber seal)
  - IP54
- Document number D00335
- Weight ≤ 350 g

5.1

LINETRAXX® PEM353
1. Measuring voltage inputs:
The measuring leads should be protected with appropriate fuses.

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. Measuring current inputs I4 (only PEM353-N)

4. RS-485 bus connection

5. Digital inputs

6. Digital outputs (N/O contacts)

7. Measuring current inputs I1...3

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<tr>
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<th>DO c</th>
<th>DO d</th>
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<td>E1-</td>
<td>E2+</td>
<td>E2-</td>
</tr>
</tbody>
</table>

- Measuring voltage inputs:
The measuring leads should be protected with appropriate fuses.

- 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.

- Measuring current inputs I4 (only PEM353-N)

- RS-485 bus connection

- Digital inputs

- Digital outputs (N/O contacts)

- Measuring current inputs I1...3

<table>
<thead>
<tr>
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<th>DO a</th>
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<tr>
<td>PEM353(-N)</td>
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<tr>
<td>PEM353-P</td>
<td>E1+</td>
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</table>
Wiring diagrams direct connection (without voltage transformer)

Single-phase 2-wire system 1P2W L-N
When using this wiring, the connection type (Setup > Basic > Wiring Mode) must be set to 1P2W L-N.

3P3W with 3 measuring current transformers
When used in a 3-wire system, the connection type (Setup > Basic > Wiring Mode) must be set to 3P3W.

Single-phase 2-wire system 1P2W L-L
When using this wiring, the connection type (Setup > Basic > Wiring Mode) must be set to 1P2W L-L.

3P3W with 2 measuring current transformers (Aron circuit)

Single-phase 3-wire system 1P3W with 2 measuring current transformers
When used in a 3-wire system, the connection type (Setup > Basic > Wiring Mode) must be set to 1P3W.

3P4W with 3 (4) measuring current transformers
When using this wiring, the connection type (Setup > Basic > Wiring Mode) must be set to 3P4W.

Y Isolating terminal of the measuring current transformers
i₄ Measurement i₄ for PEM353-N only
Wiring diagrams with voltage transformers (medium and high voltage)

Three-phase 3-wire system 3P3W with 3 measuring current transformers
When used in a 3-wire system, the connection type (Setup > Basic > Wiring Mode) must be set to 3P3W.

Three-phase 4-wire system (example TN-S system) 3P4W with 3 voltage transformers
When using this wiring, the connection type (Setup > Basic > Wiring Mode) must be set to 3P4W.

Y Isolating terminal of the measuring current transformers
PT The transformation ratio in the PEM353 can be set by specifying the primary and secondary transformation ratio. Odd ratios can also be configured.

Y Isolating terminal of the measuring current transformers
I₄ Measurement I₄ for PEM353-N only
PT The transformation ratio in the PEM353 can be set by specifying the primary and secondary transformation ratio. Odd ratios can also be configured.
Power Quality and Energy Measurement PEM575

Device features

- Accuracy class according to IEC 62053-22: 0.2 S
- Measured quantities
  - Phase voltages $U_{L1}$, $U_{L2}$, $U_{L3}$ in V
  - Line conductor voltages $U_{L1L2}$, $U_{L2L3}$, $U_{L3L1}$ in V
  - Phase currents $I_1$, $I_2$, $I_3$ in A
  - Neutral current (calculated) $I_0$ in A
  - Neutral current (measured) $I_4$ in A
  - Frequency $f$ in Hz
  - Phase angle for $U$ and $I$ in °
  - Power per phase conductor $S$ in kVA, $P$ in kW, $Q$ in kvar
  - Total power $S$ in kVA, $P$ in kW, $Q$ in kvar
  - Displacement factor cos ($\varphi$)
  - Power factor $\lambda$
  - Active and reactive energy import in kWh, kvarh
  - Active and reactive energy export in kWh, kvarh
  - Voltage unbalance in %
  - Current unbalance in %
  - Harmonic distortion (THD) for $U$ and $I$
  - $k$-Factor for $I$
- Programmable setpoint monitoring
- LED pulse outputs for active and reactive energy
- Modbus RTU and Modbus TCP
- 3 digital outputs
- Requirements of energy and current for particular time frames
- Peak demands with timestamps
- Individual, current/voltage harmonics up to the 63rd harmonic
- Minimum and maximum values
- Waveform recording (12.8 kHz)
- Data recorder
- Sag/swell detection
- High-resolution waveform recording
- Detection of transient events

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

PEM575 was designed in accordance with the following standards:

- **DIN EN 62053-22 (VDE 0418 Part 3-22)**
  Electricity meter equipment (AC) - Particular requirements - Part 22: Static meters for active energy (classes 0.2 S and 0.5 S (IEC 62053));

- **DIN EN 61557-12 (VDE 0413-12)**
  Elektrische Sicherheit in Niederspannungsnetzen bis AC 1000 V und DC 1500 V – Geräte zum Prüfen, Messen oder Überwachen von Schutzmaßnahmen – Teil 12: (Electrical safety in low voltage distribution systems up to AC 1000 V and DC 1500 V - Equipment for testing, measuring or monitoring of protective measures – Part 12) Performance measuring and monitoring device (PMD))

Further information

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

Ordering information

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<tr>
<td></td>
<td>1 A</td>
<td>PEM575-151</td>
<td>B93100580</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 $U_{S}$: AC/DC 95...415 V
- Frequency range of $U_{S}$: DC, 44...440 Hz
- Power consumption: $\leq 11$ VA

**Measuring circuit**
- Measuring voltage inputs $U_{L1-N}, U_{L2-N}, U_{L3-N}$: 230 V, 69 V (only -151, -155)
- Measuring voltage inputs $U_{L1-L2}, U_{L2-L3}, U_{L3-L1}$: 400 V, 120 V (only -151, -155)
- Measuring range: 10...120 % $U_{n}$
- Rated frequency: 45...65 Hz
- Internal resistance (L-N): $> 500$ kΩ

**Measuring current inputs**
- External measuring current transformer should at least comply with accuracy class 0.5 S
- Measuring range: 0.1...120 % $I_{n}$
- Measuring current transformer ratio: $1...6000$

**Accuracies (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 $I_{0}$: 0.5 % of full scale value
- Frequency: $\pm 0.01$ Hz
- Phase position: $\pm 1^\circ$

**Interface**
- Interface/protocol: RS-485, Modbus RTU
- Baud rate: 1.2...19.2 kbit/s
- Cable length: 0...1200 m
- Shielded cable (shield connected to terminal SH on one side) recommended: 3-Y(YS)YY min. 2x0.8

**Switching elements**
- Outputs: 3 N/O contacts
- Operating principle: N/O operation
- Rated operational voltage: AC 230 V, DC 24 V, AC 110 V, DC 12 V
- Rated operational current: 5 A, 5 A, 5 A, 6 A
- Minimum contact rating: 1 mA at AC/DC $\geq 10$ V
- Inputs: 6 electrically separated digital inputs
- $I_{min}$: 2.4 mA, $U_{DI}$: 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: 3M4
- Weight: to 4000 m

**Dimension diagram**

- Panel cut-out (dimensions in mm)
- Interface/protocol: Ethernet, Modbus TCP
- Baud rate: 100 kbit/s
- Degree of protection, installation: IP20
- Degree of protection, front: IP52
- Weight: $\leq 1100$ g

---

### Interface

- Interface/protocol: RS-485, Modbus RTU
- Baud rate: 1.2...19.2 kbit/s
- Cable length: 0...1200 m
- Shielded cable (shield connected to terminal SH on one side) recommended: 3-Y(YS)YY min. 2x0.8
- Interface/protocol: Ethernet, Modbus TCP
- Baud rate: 100 kbit/s

### Switching elements

- Outputs: 3 N/O contacts
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- Operating temperature: -25...+55 °C
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  - Classification of mechanical conditions acc. to DIN EN 60721
  - Stationary use: 3M4
- Weight: to 4000 m

### Dimension diagram

- Panel cut-out (dimensions in mm)

---

### Interface

- Interface/protocol: RS-485, Modbus RTU
- Baud rate: 1.2...19.2 kbit/s
- Cable length: 0...1200 m
- Shielded cable (shield connected to terminal SH on one side) recommended: 3-Y(YS)YY min. 2x0.8
- Interface/protocol: Ethernet, Modbus TCP
- Baud rate: 100 kbit/s

### Switching elements

- Outputs: 3 N/O contacts
- Operating principle: N/O operation
- Rated operational voltage: AC 230 V, DC 24 V, AC 110 V, DC 12 V
- Rated operational current: 5 A, 5 A, 5 A, 6 A
- Minimum contact rating: 1 mA at AC/DC $\geq 10$ V
- Inputs: 6 electrically separated digital inputs
- $I_{min}$: 2.4 mA, $U_{DI}$: 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: 3M4
- Weight: to 4000 m

### Dimension diagram

- Panel cut-out (dimensions in mm)
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).

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 µs)
- Sampling rate: 512 samples/cycle
- Freely configurable recorders for waveform, consumption and long-term recording

Standards

PEM735 was designed in accordance with the following standards:

- DIN EN 50160
  Merkmale der Spannung in öffentlichen Elektrizitätsversorgungsnetzen (Voltage characteristics of electricity supplied by public distribution networks)
- DIN EN 61000-4-30 VDE 0847-4-30
  Elektromagnetische Verträglichkeit (EMV)
  Teil 4-30: Prüf- und Messverfahren – Verfahren zur Messung der Spannungsqualität
  (Electromagnetic compatibility (EMC); Part 4-30: Testing and measurement techniques – Power quality measurement methods) (IEC 61000-4-30)
- DIN EN 61557-12 (VDE 0413-12)
  Elektrische Sicherheit in Niederspannungsnetzen bis AC 1000 V und DC 1500 V – Geräte zum Prüfen, Messen oder Überwachen von Schutzmaßnahmen – Teil 12: Kombinierte geräte zur Messung und Überwachung des Betriebsverhaltens
  (Electrical safety in low voltage distribution systems up to AC 1000 V and DC 1500 V – Equipment for testing, measuring or monitoring of protective measures - Part 12: Performance measuring and monitoring devices (PMD)
- DIN EN 62053-22 (VDE 0418 Teil 3-22)
  Wechselstrom-Elektrizitätszähler - Besondere Anforderungen – Teil 22: Elektronische Wirkverbrauchszähler der Genauigkeitsklassen 0,2 S und 0,5 S
  (Electricity meter equipment (AC) - Particular requirements – Part 22: Static meters for active energy (classes 0.2 S and 0.5 S) (IEC 62053)

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>
</tr>
</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>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring current transformers</td>
<td>CBT41</td>
<td>B980860…</td>
<td>263</td>
</tr>
<tr>
<td></td>
<td>CBT51</td>
<td>B980860…</td>
<td>263</td>
</tr>
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<td></td>
<td>KBR18</td>
<td>B980860…</td>
<td>263</td>
</tr>
<tr>
<td></td>
<td>KBR32</td>
<td>B980860…</td>
<td>263</td>
</tr>
</tbody>
</table>
Technical data

Insulation coordination

Measuring circuit
Rated insulation voltage 600 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 $\leq 14$ VA

Measuring circuit
Measuring voltage inputs
$U_{L1-N}, U_{L2-N}, U_{L3-N}$ 400 V
$U_{L1-L2}, U_{L2-L3}, U_{L3-L1}$ 690 V
Measuring range 10 ... 120 % $U_n$
CT transformation ratio
Primary 1 ... 1,000,000 V
Secondary 100 ... 690 V (ULL (1 ... 3))
Secondary 1 ... 400 V (U4)
Internal resistance (L-N) > 6 MΩ

Measuring current inputs
External measuring current transformer should at least comply with accuracy class 0.2 S
Burden n.A., internal current transformers
Measuring range 0.1 ... 120 % $I_n$
Transducer ratio, secondary 1 ... 5 A
Transducer ratio, primary 1 ... 30,000 A

Accuracies (of measured value/of full scale value)
Phase voltage $U_{L1-N}, U_{L2-N}, U_{L3-N}$ ±0.1 % of the measured value.
Current ±0.1 % of measured value ±0.05 % of full scale value.
Neutral current $I_0$ 0.5 % of $U_n$
Frequency ±0.005 Hz
Phase position $\pm 1^\circ$
Active energy measurement acc. to DIN EN 61036-22 (VDE 0418 Part 3-22)
R.m.s. voltage measurements acc. to DIN EN 61557-12 (VDE 0413-12), chapter 4.7.6
R.m.s. 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 kbit/s
Cable length 0 ... 1200 m
Shielded cable (shield connected to PE on one side) recommended J-Y(S)Y min. 2x0.8

Switching elements
2 electronic outputs (DO)
outputs max. 80 V
Inputs max. 50 mA
Output principle N/O operation
Rated operational voltage AC 250 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

Environment/EMC
EMC IEC 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 IEC 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 D00084
Weight $\leq 2000$ g

Dimension diagram (dimensions in mm)
Panel cut-out (dimensions in mm)
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
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>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEM735 measuring case</td>
<td>B 9830 0014</td>
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</table>

Scope of delivery

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 flexible current transformers for measurements up to 4000 A</td>
</tr>
<tr>
<td>1 current measuring clamp 1000 A, 5 kHz</td>
</tr>
<tr>
<td>1 current measuring clamp 250/500/1000 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>Circuit Type</th>
<th>Voltage</th>
<th>Category</th>
<th>Pollution Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring</td>
<td>600 V</td>
<td>III</td>
<td>2</td>
</tr>
<tr>
<td>Supply</td>
<td>300 V</td>
<td>II</td>
<td>2</td>
</tr>
</tbody>
</table>

#### Measuring circuit

- **Rated insulation voltage**: 600 V
- **Overvoltage category**: III
- **Pollution degree**: 2

#### Supply circuit

- **Rated insulation voltage**: 300 V
- **Overvoltage category**: II
- **Pollution degree**: 2

#### Measuring voltage inputs

- **Rated voltage**: U₁₁, U₂₂, U₃₃, U₄₄ = 400 V
- **Measuring range**: 10...120 % U₉
- **Rated frequency**: 45...65 Hz

#### Measuring current inputs

- **Rated current**: I₉
- **Conversion ratio**: secondary 1...5 A
- **Conversion ratio**: primary 1...30000 A

#### Accuracies

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Accuracy</th>
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</thead>
<tbody>
<tr>
<td>Phase voltage (Uₐₙ, Uₐ₂, Uₐ₃)</td>
<td>±0.1 % mv</td>
</tr>
<tr>
<td>Current</td>
<td>±0.1 % mv +0.05 % fs</td>
</tr>
<tr>
<td>Frequency</td>
<td>±0.005 Hz</td>
</tr>
<tr>
<td>Phasing</td>
<td>±1°</td>
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</tbody>
</table>

#### Interface

- **Protocol**: RJ-45, Modbus TCP

#### Switching elements

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outputs (RO)</td>
<td>2 x N/O contacts</td>
</tr>
<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 110 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

- **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
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

Wiring diagram of the front plate

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

Wiring panel side
LINETRAXX® PEM735 measuring case

5.1

Wiring panel measuring case

Measuring current transformer included in the scope of delivery

Material for voltage measurement
Measuring current transformer for universal measuring devices

Window-type/Split-core current transformer

Device features

CTB41/CTB51
• Window-type current transformer
• Screwless connection technique
• Maintenance-free, gas-tight connection
• Max. operating voltages up to 1.2 kV
• Can also be used in 690 V systems
• Unbreakable plastic enclosure, self-extinguishing, UL94-V0, flame-resistant

KBR18/KBR32
• Split-core current transformer (mounting without disconnecting the primary conductor)
• Incl. connecting cable (2.5 m)
• Max. operating voltages up to 0.72 kV

Standards

The measuring current transformers were designed in accordance with the following standards:
• IEC 61869-1
• IEC 61869-2
• IEC 61010-1

Further information

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

Approvals

Ordering details window-type current transformer

<table>
<thead>
<tr>
<th>Primary current</th>
<th>Secondary current</th>
<th>Accuracy</th>
<th>Type</th>
<th>Model</th>
<th>Art. No.</th>
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<tbody>
<tr>
<td>60</td>
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<td>WL605 KL. 1</td>
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<td>WL601 KL. 1</td>
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<td>WL751 KL. 1</td>
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<td>WL1251 KL. 1</td>
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<td>150</td>
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<td>WL1505 KL. 0.5</td>
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<td>WL2001 KL. 1</td>
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<td>WL2505 KL. 0.5</td>
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<td>B98086021</td>
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<table>
<thead>
<tr>
<th>Primary current</th>
<th>Secondary current</th>
<th>Accuracy</th>
<th>Type</th>
<th>Model</th>
<th>Art. No.</th>
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<tbody>
<tr>
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<td>1</td>
<td>WL6005 KL. 0.5</td>
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<td>B98086035</td>
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<td>5</td>
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<td>WL10005 KL. 1</td>
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<td>B98086038</td>
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<td>WL10005 KL. 0.5</td>
<td>CTB51</td>
<td>B98086039</td>
</tr>
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</table>

Further information

For further information refer to our product range on www.bender.de.
Ordering details split-core current transformer

<table>
<thead>
<tr>
<th>Primary current</th>
<th>Secondary current</th>
<th>Accuracy</th>
<th>Type</th>
<th>Model</th>
<th>Art. No.</th>
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</thead>
<tbody>
<tr>
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<td>3FSS</td>
<td>WLS501 KL. 3FSS</td>
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<td>KBR32</td>
<td>B9086050</td>
</tr>
</tbody>
</table>

Selection guide current transformer/PEM

Design specifications of the measuring ranges current transformer/PEM

The secondary current of the current transformer has to be adjusted to the current input of the measuring device. The following table will help you to select the device type.

<table>
<thead>
<tr>
<th>Current transformer secondary current</th>
<th>PEM353(-x) (5 A)</th>
<th>PEMxxx(-xx5) (5 A)</th>
<th>PEMxxx-xx1 (1 A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 A</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
</tbody>
</table>

Note: In principle, measuring current transformers can also be operated with 1 A secondary current on measuring devices with 5 A current input. In this case, the accuracy class is expected to be reduced by one class (e.g. 0.5 to 1).

The measurement accuracy classes of the system

The measurement accuracy class of the system is influenced by both the accuracy classes of the measuring current transformers and the measuring device. Refer to DIN EN 61557-12, Annex E.2.

<table>
<thead>
<tr>
<th>Accuracy classes of measuring current transformers</th>
<th>PEM3xx (0.5 S)</th>
<th>PEM5xx (0.5 S)</th>
<th>PEM735 (0.2 S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>0.5</td>
<td>1</td>
<td>1</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Technical Data

CTB41
Rated continuous thermal current \(I_{cth}\) \(1.2 \times I_N\)
Rated short-time thermal current \(I_{th}\) \(60 \times I_N, 1 \text{s}\)
Max. operating voltage \(U_{OM}\) \(1.2 \text{ kV}, U_{eff}\)
Insulation test voltage \(6 \text{ kV}, U_{eff}, 50 \text{ Hz}, 1 \text{ min}\)
Nominal frequency \(50/60 \text{ Hz}\)
Insulation class E
Operating temperature \(-5 \ldots 50 \degree\ C\)

KBR18
Rated continuous thermal current \(I_{cth}\) \(1.2 \times I_N\)
Rated short-time thermal current \(I_{th}\) \(60 \times I_N, 1 \text{s}\)
Max. operating voltage \(U_{OM}\) \(0.72 \text{ kV}, U_{eff}\)
Insulation test voltage \(3 \text{ kV}, U_{eff}, 50 \text{ Hz}, 1 \text{ min}\)
Nominal frequency \(50 \text{ Hz}\)
Insulation class E
Operating temperature \(-5 \ldots 50 \degree\ C\)

CTB51
Rated continuous thermal current \(I_{cth}\) \(1.2 \times I_N\)
Rated short-time thermal current \(I_{th}\) \(60 \times I_N, 1 \text{s}\)
Max. operating voltage \(U_{OM}\) \(1.2 \text{ kV}, U_{eff}\)
Insulation test voltage \(6 \text{ kV}, U_{eff}, 50 \text{ Hz}, 1 \text{ min}\)
Nominal frequency \(50/60 \text{ Hz}\)
Insulation class E
Operating temperature \(-5 \ldots 50 \degree\ C\)

KBR32
Rated continuous thermal current \(I_{cth}\) \(1.2 \times I_N\)
Rated short-time thermal current \(I_{th}\) \(60 \times I_N, 1 \text{s}\)
Max. operating voltage \(U_{OM}\) \(0.72 \text{ kV}, U_{eff}\)
Insulation test voltage \(3 \text{ kV}, U_{eff}, 50 \text{ Hz}, 1 \text{ min}\)
Nominal frequency \(50 \text{ Hz}\)
Insulation class E
Operating temperature \(-5 \ldots 50 \degree\ C\)
5.1 Power Quality

Measuring current transformer for universal measuring devices

### Dimensions (mm)

**CTB41**

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Value</th>
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<tbody>
<tr>
<td>Busbar 1</td>
<td>40 x 10</td>
</tr>
<tr>
<td>Busbar 2</td>
<td>30 x 15</td>
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<td>Circular conductor</td>
<td>44</td>
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<tr>
<td>Installation width</td>
<td>85</td>
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<tr>
<td>Installation height</td>
<td>105.25</td>
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<tr>
<td>Overall depth</td>
<td>52</td>
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</table>

**CTB51**

<table>
<thead>
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<th>Dimensions</th>
<th>Value</th>
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<td>Busbar 1</td>
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<td>85</td>
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<td>Installation height</td>
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<td>Overall depth</td>
<td>52</td>
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**KBR18**

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<th>Value</th>
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<tr>
<td>Installation height</td>
<td>64.5</td>
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<td>Installation depth incl. fixation clips</td>
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**KBR32**

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<td>Installation width</td>
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<td>Installation height</td>
<td>96.4</td>
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<tr>
<td>Installation depth incl. fixation clips</td>
<td>89.2</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>
</tr>
</thead>
<tbody>
<tr>
<td>Energy meter 1Ph/32 A MID Modbus RTU</td>
<td>ALD1</td>
<td>B93101005</td>
</tr>
<tr>
<td>Energy meter 3Ph/65 A MID Modbus RTU</td>
<td>ALE3</td>
<td>B93101006</td>
</tr>
<tr>
<td>Energy meter 3Ph/6 A MID Modbus RTU</td>
<td>AWD3</td>
<td>B93101007</td>
</tr>
<tr>
<td>50 pulse counter (four-fold) with Modbus RTU</td>
<td>PCD7</td>
<td>B93101008</td>
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</table>

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>B93101009</td>
</tr>
<tr>
<td>Sealable cover for ALE3/AWD3 (four per counter)</td>
<td>–</td>
<td>B93101010</td>
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</tbody>
</table>

Technical data ALD1
- Accuracy class B acc. to EN 50470-3
- Operating voltage AC 230 V, 50 Hz
- Tolerance -20 %/+15 %
- Reference current/maximum current \( I_{ref} = 5 \text{ A}, I_{max} = 32 \text{ A} \)
- Starting current/minimum current \( I_{st} = 20 \text{ mA}, I_{min} = 0.25 \text{ A} \)
- Power consumption active power 0.4 W per phase
- Counting range 00000.00…99999.99
- Pulses per kWh LC display 2000 imp/kWh

Technical data ALE3
- Accuracy class B acc. to EN 50470-3
- Operating voltage 3 x AC 230/400 V, 50 Hz
- Tolerance -20 %/+15 %
- Reference current/maximum current \( I_{ref} = 10 \text{ A}, I_{max} = 65 \text{ A} \)
- Starting current/minimum current \( I_{st} = 40 \text{ mA}, I_{min} = 0.5 \text{ A} \)
- Power consumption active 0.4 W per phase
- Counting range 00000.00…99999.99
- LC display with background illumination, 6 mm high digits
- Display without mains voltage capacitor supported LCD maximum for two periods of 10 days
- Pulses per kWh LED 1000 imp/kWh

Technical data AWD3
- Accuracy class B acc. to EN 50470-3
- Operating voltage 3 x AC 230/400 V, 50 Hz
- Tolerance -20 %/+15 %
- Transformer measurement S...1500 A
- Reference current/maximum current \( I_{ref} = 5 \text{ A}, I_{max} = 6 \text{ A} \)
- Starting current/minimum current \( I_{st} = 10 \text{ mA}, I_{min} = 0.05 \text{ A} \)
- Power consumption active 0.4 W per phase
- Counting range 00000.00…99999.99
- LC display with background illumination, 6 mm high digits
- Display without mains voltage capacitor supported LCD maximum for two periods of 10 days
Dimension diagram (dimensions in mm)

1 phase

3 phase

Wiring diagrams

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®

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<th>278</th>
<th>281</th>
<th>282</th>
<th>275</th>
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<tbody>
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<td><strong>Special applications</strong></td>
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<td>Power plant</td>
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<td>Energy backup for device series VMD258</td>
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<td>690/500/480/440/400/230/110/100 V</td>
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<td>Current monitoring</td>
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<td>1 AC with $U_s$</td>
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<td>3 AC with $U_s$</td>
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<td>DIN rail</td>
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### Special applications

<table>
<thead>
<tr>
<th>Interface Protection System/Decoupling protection relay</th>
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<tbody>
<tr>
<td>System/Decoupling protection relay</td>
</tr>
<tr>
<td>System/Decoupling protection relay</td>
</tr>
<tr>
<td>Loop monitoring</td>
</tr>
</tbody>
</table>

### Voltage monitoring

- **VMD420/VMD421H**: AC/DC systems
  - 0…300 V
  - 9,6…150 V
  - 70…300 V
  - 3AC 690/500/480/440/400/230/110/100 V
  - (L-N) 0…288 V
  - (L-L) 0…500 V

- **VMD460**: 3(N)AC
  - 690/500/480/440/400/230/110/100 V
  - (L-N) 0…300 V
  - (L-L) 0…520 V

- **VMD461/CD440**
  - 3(N)AC 250…690 V
  - (L-N) AC 250…690 V
  - (L-L) AC 440…1200 V
  - (DC+/DC-) DC 250…1200 V

### Current monitoring

- **VMD420/VMD421H**: 1 AC with
  - AC with
  - 3 AC with

### Special function

- **RS-485 interface**
- **Islanding detection**:
  - -ROCOF (df/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 \( U <, U >, f <, f > \)
- Start-up delay, response delay and delay on release
- Adjustable switching hysteresis
- rms value measurement (AC+DC)
- Digital measured value display via multi-functional LC display
- Preset function (automatic setting of basic parameters)
- LEDs: Power On, Alarm 1, Alarm 2
- Measured value memory for operating value
- Continuous self monitoring
- Internal test/reset button
- Two separate alarm relays (one changeover contact each)
- N/C or N/O operation and fault memory behaviour selectable
- Password protection for device setting
- Sealable transparent cover
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)
- RoHS compliant

Typical applications
- 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) (U_S)</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(16 \ldots 72,\text{V}, 15 \ldots 460,\text{Hz})</td>
<td>AC</td>
<td>DC</td>
</tr>
<tr>
<td>9,6 \ldots 94,\text{V}</td>
<td>VME420-D-1</td>
<td>B93010001</td>
</tr>
<tr>
<td>70 \ldots 300,\text{V}, 15 \ldots 460,\text{Hz}</td>
<td>VME420-D-2</td>
<td>B93010002</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>
Technical data

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

- Rated insulation voltage: 250 V
- Rated impulse voltage/pollution degree: 4 kV/3
- Overvoltage category: III
- Protective separation (reinforced insulation) between:
  (A1, A2) -(U1/+, U2/-) -(11-12-14) -(21-22-24)

Supply voltage

**VME420-D-1:**
- Supply voltage $U_s$: AC 16...72 V/DC 9.6...94 V
- Frequency range $f_s$: 15...460 Hz

**VME420-D-2:**
- Supply voltage $U_s$: AC/DC 70...300 V
- Frequency range $f_s$: 15...460 Hz
- Power consumption: ≤ 4 VA

Operating time, voltage

- AC 15...460 Hz: ≤ 310 ms
- DC/AC 16.7 Hz: ≤ 130 ms, AC 42...460 Hz: ≤ 70 ms
- Operating time, voltage response $t_{on}$: AC 15...460 Hz: ≤ 310 ms
- Recovery time $t_{off}$: ≤ 300 ms

Display, memory

- Display: LC display, multifunctional, not illuminated
- Operating uncertainty at 50/60 Hz: ± 1.5 %, ± 2 digits
- Operating uncertainty, voltage in the range of 15...460 Hz: ± 3 %, ± 2 digits
- Operating uncertainty, frequency in the range of 15...460 Hz: ± 0.2 %, ± 1 digit
- History memory (HIS) for the first alarm value: data record, measured values
- Password: off/0...999 (off)*
- Fault memory (M) alarm relay: on/off/con (on)*

Switching elements

- Number: 2 x 1 changeover contacts (K1, K2)
- Operating principle: N/C operation, N/O operation
  - K2: Err, $U < U_r$, Hz < Hz, S.AI (undervoltage $U < U_r$ N/C operation n.c.)*
  - K1: Err, $U < U_r$, Hz < Hz, S.AI (overvoltage $U > U_r$ N/O operation n.a.)*
- 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 220 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): JKS (no condensation, no formation of ice)
- Transport (IEC 60721-3-2): 2K3
- Long-term storage (IEC 60721-3-1): 1K4

Connection

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

Screw-type terminal

- Properties of connection:
  - rigid/flexible/AWG: 0.2...4/0.2...2.5 mm²/AWG 24...12
- Two conductors with the same cross section:
  - rigid/flexible: 0.2...1.5/0.2...1.5 mm²
  - Tightening torque, terminal screws: 0.5...0.6 Nm

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: 8 mm
  - Tightening torque, terminal screws: 0.5...0.6 Nm

Other

- Operating mode: continuous operation
- Mounting:
  - any position
  - Degree of protection, internal components (DIN EN 60529): IP30
  - DIN rail mounting acc. to IEC 60715
  - Flammability class: UL94 V-0

Documentation number: D00026

- Weight: ≤ 150 g

Linearisation of the operating range of the rated frequency 15...460 Hz only

** = factory setting

** = Technical data applies to the operating range of the rated frequency 15...460 Hz only
**Dimension diagram** (dimensions in mm)

**Wiring diagram**

1. U1/+, U2/- Connection to the system/load being monitored
2. A1, A2 Supply voltage $U_s$ (see ordering information)
3. 11, 12, 14 Alarm relay "K1": Configurable for $U<$/>$<$/f<$/f>ERROR
4. 21, 22, 24 Alarm relay "K2": Configurable for $U<$/>$<$/f<$/f>ERROR
5. Line protection according to IEC 60364-4-43: A fuse is recommended. If being supplied from an IT system, both lines have to be protected by a fuse.
LINETRAXX® VME421H
Multi-functional monitoring relay for undervoltage, overvoltage and frequency monitoring in AC/DC systems without separate supply voltage

Device features
- Monitoring undervoltage, overvoltage and frequency of AC/DC systems of 9.6…150 V (VME421H-D-1), 70…300 V (VME421H-D-2)
- Without external supply voltage
- Integrated energy backup
- Various monitoring functions selectable \( U <, U >, f <, f > \)
- Start-up delay, response delay, delay on release
- Adjustable switching hysteresis
- rms value measurement (AC+DC)
- Digital measured value display via multi-functional LC display
- Preset function (automatic setting of basic parameters)
- LEDs: Power On, Alarm 1, Alarm 2
- Measured value memory for operating value
- Continuous self monitoring
- Internal test/reset button
- Two separate alarm relays (one changeover contact each)
- N/C or N/O operation and fault memory behaviour selectable
- Password protection for device setting
- Sealable transparent cover
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)
- RoHS compliant

Typical applications
- Voltage and frequency monitoring of single-phase machines and electrical installations
- Earth fault monitoring in medium-voltage systems via voltage transformers
- Monitoring of battery systems
- Switching machinery and equipment on and off at a certain voltage level

Approvals

Further information
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>Screw-type terminal</td>
<td>B93010003</td>
</tr>
<tr>
<td>DC 9.6…150 V</td>
<td>Push-wire terminal</td>
<td>B73010003</td>
</tr>
<tr>
<td>AC 70…300 V, 15…460 Hz</td>
<td>Screw-type terminal</td>
<td>B93010004</td>
</tr>
<tr>
<td>DC 70…300 V</td>
<td>Push-wire terminal</td>
<td>B73010004</td>
</tr>
</tbody>
</table>

\(^1\) Absolute values

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>
Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3
Rated insulation voltage 250 V
Rated impulse voltage/pollution degree 4 kV/3
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 $U_d$)

Supply voltage $U_s$ none (internally supplied by $U_d$)

Power consumption $\leq 6$ VA

Measuring circuit
Measuring range (rms value) (VME421H-D-1) AC/DC 0…150 V
Measuring range (rms value) (VME421H-D-2) AC/DC 0…300 V
Rated frequency $f_s$ DC, 15…460 Hz Frequency display range 10…500 Hz

Response values
VME421H-D-1:
Undervoltage $U < (\text{Alarm 2})$ AC/DC 9.6…150 V
Overvoltage $U > (\text{Alarm 2})$ AC/DC 9.6…150 V

Preset function:
Undervoltage $U < (0.85 U_s)^*$ for $U_d = 120/60/24$ V 102/51/20.4 V
Overvoltage $U > (1.3 U_s)^*$ for $U_d = 120/60/24$ V 132/66/26.4 V
Resolution of setting $U_s$ 49.5 V
Resolution of setting $U$ 150 V

VME421H-D-2:
Undervoltage $U < (\text{Alarm 2})$ AC/DC 70…300 V
Overvoltage $U > (\text{Alarm 1})$ AC/DC 70…300 V
Resolution of setting $U$ 70…300 V

Response time
VME421H-D-1:
Relative uncertainty voltage at 50/60 Hz 1.5 %, 2 digits
Relative uncertainty voltage in the range 15…460 Hz $\pm 3$ %, $\pm 2$ digit
Hysteresis $U$ 1…40 % ($5$ %)*

Underfrequency $f <$ 10…500 Hz**

Overfrequency $f >$ 10…500 Hz**

Resolution of setting $f$ 100…99.9 Hz

Resolution of setting $f$ 100…500 Hz

VME421H-D-2:
Resolution of setting $f$ 100…300 Hz

Preset function:
Underfrequency for $f_s = 400/60/50/16.7$ Hz 399/59/49/15.7 Hz
Overfrequency for $f_s = 400/60/50/16.7$ Hz 401/61/51/17.7 Hz
Hysteresis frequency $Hys$ Hz 0.1…2 Hz (0.2 Hz)*

Relative uncertainty, frequency in the range of 15…460 Hz $\pm 0.2$ %, $\pm 1$ digit

Time response
Start-up delay $t$ 0…30…100 s (0 $s^*$)
Response delay $t_{on 1/2}$ 0…300 s (0 $s^*$)
Delay on release $t_{off}$ 0…300 s (0.5 $s^*$)

Resolution of setting $f_s, t_{on 1/2}, t_{off}$ 0…10 $s^*$
Resolution of setting $t_s, t_{off}$ 0.1 $s^*$
Resolution of setting $t_{off}$ 1 $s^*$
Resolution of setting $t_{on 1/2}$ 100…300 s

Operating time, voltage $f_{on}$ DC/AC 16.7 Hz $\leq 130$ ms, AC 42…460 Hz $\leq 70$ ms
Operating time frequency $f_{on}$ AC 15…460 Hz $\leq 310$ ms

Response time $t_{off}$ $t_{on 1/2} = t_{off} + f_{on} t_{on 1/2}$

Discharging time energy backup on power failure (VME421H-D-1) 3 s
Discharging time energy backup on power failure (VME421H-D-1) 2.5 s at $f_s < 42$ Hz
Discharging time energy backup (VME421H-D-2) $\geq 4$ s at DC 70 V

Charging time energy backup (VME421H-D-1) 60 s
Charging time energy backup (VME421H-D-2) 120 s
Recovery time $t_r$ $\leq 300$ ms

Displays, memory
Display LC display, multifunctional, not illuminated
Display range measured value (VME421H-D-1) AC/DC 0…150 V
Display range measured value (VME421H-D-2) AC/DC 0…300 V
Operating uncertainty at 50/60 Hz $\pm 1.5$ %, $\pm 2$ digits
Operating uncertainty voltage in the range of 15…460 Hz $\pm 3$ %, $\pm 2$ digits
Operating uncertainty in the frequency range 15…460 Hz $\pm 0.2$ %, $\pm 1$ digit

History memory (HiS) for the first alarm value data record measured values
Password off/999 (off)*
Fault memory (M) alarm relay on/off/on/on/on/on

Switching elements
Number 2 x 1 changeover contacts (K1, K2)
Operating principle N/C operation/N/O operation
K1: Err, $U < U >, Hz < Hz$, S AL (undervoltage $U <$; N/C operation n.c.)*
K1: Err, $U < U >, Hz < Hz$, S AL (overvoltage $U >$; N/O operation n.o.)*

Electrical endurance, number of cycles 10,000

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

Environment/EMC
EMC IEC 61326-1
Operating temperature $-25…+55$ °C

Classification of climatic conditions acc. to IEC 60721
Stationary use (IEC 60721-3-1) 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 screw-type terminal or push-wire terminal

Screw-type terminal
Connection properties:
rigid/flexible/AWG 0.2…4/0.2…2.5 mm$^2$/AWG 24…12
Two conductors with the same cross section:
rigid/flexible 0.2…1.5/0.2…1.5 mm$^2$
Stripping length 8 mm
Tightening torque, terminal screws 0.5…0.6 Nm

Push-wire terminals
Connection properties:
rigid 0.2…2.5 mm$^2$ (AWG 24…14)
flexible without ferrules 0.75…2.5 mm$^2$ (AWG 19…14)
flexible with ferrules 0.2…1.5 mm$^2$ (AWG 24…16)
Stripping length 10 mm
Opening force 50 N
Test opening, diameter 2.1 mm

Other
Operating mode continuous operation
Mounting any position
Degree of protection, internal components (DIN EN 60529) IP30
Degree of protection, terminals (DIN EN 60529) IP20

Enclosure material polycarbonate
Screw mounting 2 x M4 with mounting clip
DIN rail mounting acc. to IEC 60715
Flammability class UL94 V-0

Weight $\leq 240$ g

Documentation number D00141

(*) = factory setting

** = The technical data applies to the operating range of the rated frequency 15…460 Hz only.
Dimensions (dimensions in mm)

Wiring diagram

1. U1+, U2- Connection to the system/load being monitored
2. 11, 12, 14 Alarm relay “K1”: Configurable for U< U>/f<f>/ERROR
3. 21, 22, 24 Alarm relay “K2”: Configurable for U< U>/f<f>/ERROR
4. Line protection according to IEC 60364-4-43:
   A fuse recommended. If being supplied from an IT system, both lines have to be protected by a fuse.
LINETRAXX® VMD258
Undervoltage/overvoltage relay for monitoring three-phase AC systems (window function) for power plant applications

Device features
• High availability due to purely analogue technology
• Undervoltage and overvoltage monitoring for 3AC systems
• No separate supply voltage required
• Separate alarm relays for undervoltage and overvoltage with two potential-free changeover contacts
• Adjustable response value: 0.7…0.95 \times U_n / 1.05…1.3 \times U_n
• Nominal system voltages: 3AC 690/500/480/440/400/230/110/100 V
• Adjustable response delay: 0…5 s
• LEDs for operation, overvoltage, undervoltage

Typical applications
• Monitoring of the power supply of machines and electrical installations
• Monitoring of loads
• Switching electrical systems on and off at a certain voltage level
• Monitoring of stand-by and emergency supply systems

Standards
The LINETRAXX® VMD258 series complies with the requirements of the device standards:
• DIN EN 60255-1 VDE 0435-300
• E DIN IEC 60255-127 VDE 0435-3127.

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

Ordering details

<table>
<thead>
<tr>
<th>Connection</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3AC, 100 V</td>
<td>VMD258 3AC 100 V</td>
<td>B93010060</td>
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<tr>
<td>3AC, 110 V</td>
<td>VMD258 3AC 110 V</td>
<td>B93010061</td>
</tr>
<tr>
<td>3AC, 230 V</td>
<td>VMD258 3AC 230 V</td>
<td>B93010062</td>
</tr>
<tr>
<td>3AC, 400 V</td>
<td>VMD258 3AC 400 V</td>
<td>B93010063</td>
</tr>
<tr>
<td>3AC, 440 V</td>
<td>VMD258 3AC 440 V</td>
<td>B93010064</td>
</tr>
<tr>
<td>3AC, 480 V</td>
<td>VMD258 3AC 480 V</td>
<td>B93010065</td>
</tr>
<tr>
<td>3AC, 500 V</td>
<td>VMD258 3AC 500 V</td>
<td>B93010066</td>
</tr>
<tr>
<td>3AC, 690 V</td>
<td>VMD258 3AC 690 V</td>
<td>B93010067</td>
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</table>

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
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</thead>
<tbody>
<tr>
<td>Additional mounting clips (screw mounting)</td>
<td>B 9806 0008</td>
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</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy backup</td>
<td>E5258</td>
<td>B93010068</td>
<td>281</td>
</tr>
</tbody>
</table>
## Technical data

### Insulation coordination acc. to DIN EN 60255-27

<table>
<thead>
<tr>
<th>Supply voltage Uₚ AC (V)</th>
<th>690</th>
<th>480/500</th>
<th>400/440</th>
<th>230</th>
<th>100/110</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage AC (V)</td>
<td>1000</td>
<td>1000</td>
<td>600</td>
<td>300</td>
<td>150</td>
</tr>
<tr>
<td>Rated impulse voltage (kV)</td>
<td>12</td>
<td>12</td>
<td>8</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

### Overvoltage category

- Nominal supply voltage Uₚ 3AC (V)
  - 690: 110
  - 500: 100
  - 480: 90
  - 440: 80
  - 400: 70
  - 230: 60
  - 100/110: 50

### Voltage ranges

- Frequency range of Uₚ 45...66 Hz
- Operating range 0.5...1.5 x Uₚ
- Nominal supply voltage Uₚ 3AC (V)
  - 690: 110
  - 500: 100
  - 480: 90
  - 440: 80
  - 400: 70
  - 230: 60
  - 100/110: 50

### Power consumption at 50 Hz, 1.3 x Uₚ (VA)

<table>
<thead>
<tr>
<th>Nominal supply voltage Uₚ 3AC (V)</th>
<th>690</th>
<th>500</th>
<th>480</th>
<th>440</th>
<th>400</th>
<th>230</th>
<th>100/110</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power consumption 0.5...1.5 x Uₚ</td>
<td>19</td>
<td>15</td>
<td>12</td>
<td>14</td>
<td>9</td>
<td>16</td>
<td>15</td>
</tr>
<tr>
<td>Power consumption 0.7...1.3 x Uₚ</td>
<td>11</td>
<td>9</td>
<td>8</td>
<td>8</td>
<td>6</td>
<td>9</td>
<td>7</td>
</tr>
</tbody>
</table>

### Measuring circuit

- Nominal system voltage Uₙ 3AC 690/500/480/440/400/230/110/100 V
- Setting range 0.7...1.3 x Uₙ
- Frequency range Uₙ 45...66 Hz
- Max. permissible measuring voltage 1.5 x Uₙ
- Response value Uₙ adjustable

### Response values

- Undervoltage U < (alarm) 0.7...0.95 x Uₙ
- Overvoltage U > (alarm) 1.05...1.3 x Uₙ
- Relative uncertainty at the setting limits 45...66 Hz ±3 %
  47.5...63 Hz ±2 %
- Hysteresis < 3 %
- Repetition accuracy ±1 %
- LED ON: LED (yellow)
  - Alarm for U <
  - LED (green)
  - Alarm for U >

### Time response

- Start-up delay tₕ 500 ms ±20 %
- Delay on release tₕ 0.5...1.0 ms ±10 %
- Operating time tₕ at overvoltage 100 ms ±20 %
- Operating time tₕ at undervoltage 100 ms* ±20 %
- Response time tₕ = tₕ + tₕ
- Long-term influence −10 %
- Overshoot time tov < 60 ms

### Connection for external energy storage device

| UₑDC | DC 24 V |
| UₑDC | DC 68 V |
| UₑDC | 42...47 V ±15 % |

### Connection properties

- Rigid/flexible 0.2...2.5 mm²
- Flexible with connector sleeve 0.25...2.5 mm²
- Without/with plastic sleeve 0.25...2.5 mm²
- Conductor sizes (AWG) 24...13
- Tightening torque 0.5...0.6 Nm
- Each max. 3 A

### Environment/EMC

- EMC immunity acc. to IEC 60255-26
- EMC emission acc. to IEC 60255-25
- Operating temperature −20...+70 °C

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

- 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

### Connection

- Connection screw terminals
  - Connection properties
  - Rigid/flexible 0.2...2.5 mm²
  - Flexible with connector sleeve 0.25...2.5 mm²
  - Without/with plastic sleeve 0.25...2.5 mm²
- Conductor sizes (AWG) 24...13
- Tightening torque 0.5...0.6 Nm
- Each max. 3 A

### Environment

- DIN rail mounting acc. to IEC 60715
- Screw mounting 4 x M4

### Documentation number

- D00068
- Weight 825 g

### Switching elements

- Number of switching elements 2 x 2 changeover contacts
- Operating mode N/C operation (undervoltage)
  - N/O operation (overvoltage)
- Electrical endurance, number of cycles 10,000

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

- Rated operational voltage AC 230 V/230 V
- Utilisation category AC-13/AC-14
- Rated operational current AC 5 A/3 A
- Rated operational voltage DC 220/110/24 V
- Utilisation category DC12
- Rated operational current DC 1/0.2 /0.1 A
- Minimum current 1 mA at AC/DC > 10 V

### 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 UL94 V-0
- DIN rail mounting acc. to IEC 60715
- Screw mounting 4 x M4
- Documentation number D00068

### Other

- Degree of protection, internal components (DIN EN 60529) IP20
- Degree of protection, terminals (DIN EN 60529) IP20
- DIN rail mounting acc. to IEC 60715
- Screw mounting 4 x M4
- Weight 825 g

* Operating time tₕ overvoltage increase from 100 % to 130 %, switching threshold at 105 %
** Operating time tₕ undervoltage decrease from 100 % to 0 %, switching threshold at 95 %
Z+, Z- Connection ES258 for a backup time of > 5 s
ES258
Energy backup for undervoltage/overvoltage relays

Typical applications
- Supplementary device for the undervoltage/overvoltage relay VMD258.

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

Ordering information

<table>
<thead>
<tr>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES258</td>
<td>B93010068</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

Approvals

Dimension diagram (dimensions in mm)

Wiring diagram

1. Energy backup
2. Undervoltage/overvoltage relay

max. 0.5 m
LINETRAXX® VMD420

Multi-functional voltage relay for 3(N)AC systems, frequency/overvoltage/undervoltage, phase, phase failure, asymmetry

Device features
- Undervoltage, overvoltage and frequency monitoring in 3(N)AC systems 0…500 V
- Asymmetry, phase failure and phase sequence monitoring
- Various monitoring functions selectable \( U_\text{<}, U_\text{>}, f_\text{<}, f_\text{>} \)
- Start-up delay, response delay and delay on release
- Adjustable switching hysteresis
- rms value measurement (AC+DC)
- Digital measured value display via multi-functional LC display
- Preset function (automatic setting of basic parameters)
- LEDs: Power On, Alarm 1, Alarm 2
- Measured value memory for operating value
- Continuous self monitoring
- Internal test/reset button
- Two separate alarm relays (one changeover contact each)
- N/C or N/O operation and fault memory behaviour selectable
- Password protection for device setting
- Sealable transparent cover
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)
- RoHS compliant

Typical applications
- Monitoring of voltage-sensitive machines and electrical installations
- Switching machinery and equipment on and off at a certain voltage level
- Monitoring of stand-by and emergency supply systems
- Supply voltage monitoring of portable loads
- Protection of three-phase motors against phase failure and phase open-circuit
- Transformer protection, asymmetrical load can be recognised

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

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage (^1) ( U_S )</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</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>

\(^1\) Absolute values

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>
Technical data

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

<table>
<thead>
<tr>
<th>Operating time, voltage</th>
<th>Resolution of setting</th>
<th>Overvoltage category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overvoltage</td>
<td>(N, L1, L2, L3)</td>
<td>III</td>
</tr>
<tr>
<td>Voltage test acc. to IEC 61000-1:</td>
<td>(A1, A2)</td>
<td>III</td>
</tr>
<tr>
<td>(N, L1, L2, L3) - (A1, A2), (11, 12, 14)</td>
<td>- (21, 22, 24)</td>
<td>III</td>
</tr>
<tr>
<td>Overvoltage</td>
<td>(N, L1, L2, L3)</td>
<td>III</td>
</tr>
<tr>
<td>Voltage test acc. to IEC 61000-1:</td>
<td>(A1, A2)</td>
<td>III</td>
</tr>
<tr>
<td>(N, L1, L2, L3) - (A1, A2), (11, 12, 14)</td>
<td>- (21, 22, 24)</td>
<td>III</td>
</tr>
</tbody>
</table>

Supply voltage

VMD420-D-1:
- Supply voltage $u_s$: AC 16…72 V/DC 9.6…94 V
- Frequency range $f_s$: 15…460 Hz

VMD420-D-2:
- Supply voltage $u_s$: AC/DC 70…300 V
- Frequency range $f_s$: 15…460 Hz
- Power consumption $P_s$: ≤ 4 VA

Measuring circuit

- Measuring range (rms value) $U_m$: AC 0…288 V
- Measuring range (rms value) $I_m$: AC 0…500 V
- Rated frequency $f_m$: 15…460 Hz
- Frequency display range: 10…500 Hz

Response values

- Type of distribution system: 3(N)AC/3AC (3AC)*
- Undervoltage $U < (1.1 \times U_n)$ for $U_n = 230/120$ V: 196/102 V
- Overvoltage $U > (1.1 \times U_n)$ for $U_n = 230/120$ V: 253/132 V
- Asymmetry: 5…30 % (30 %)*
- Phase sequence: clockwise/anticlockwise rotation (off)*

- Relative uncertainty, voltage at 50/60 Hz: ±0.2 %, ±1 digit
- Hysteresis, frequency $Hys$: 0.1…2 Hz (0.2 Hz)*
- Relative uncertainty, frequency range 15…460 Hz: ±0.2 %, ±1 digit

Time response

- Start-up delay $t_{on1/2}$: 0…300 s (0 s)*
- Response delay $t_{on1/2}$: 0…300 s (0 s)*
- Delay on release $t_{off}$: 0…300 s (0.5 s)*
- Resolution of setting $t_{on1/2}$, $t_{off}$: 0…300 s (0.5 s)*
- Resolution of setting $t_{on1/2}$, $t_{off}$: 0…300 s (0.5 s)*
- Resolution of setting $t_{on1/2}$, $t_{off}$: 10 s
- Operating time, voltage $t_{on1/2}$: ≤ 140 ms
- Operating time, frequency $t_{on1/2}$: ≤ 140 ms
- Response time $t_{on1/2}$: $t_{on1/2} = t_{on1/2} + t_{on1/2}$
- Recovery time $t_{off}$: ≤ 300 ms

Displays, memory

- Display: LC display, multifunctional, not illuminated
- Display range measured value: AC/DC 0…500 V
- Operating uncertainty, voltage at 50/60 Hz: ±1.5 %, ±2 digits
- Operating uncertainty, voltage in the range of 15…460 Hz: ±3 %, ±2 digits
- Operating uncertainty, frequency in the range of 15…460 Hz: ±0.2 %, ±1 digit
- History memory (HS) for the first alarm value: data record measured values
- Password: off/0…999 (off/0)*
- Fault memory (M) alarm relay: on/off/on (on)*

Switching elements

- Number: 2 x 1 changeover contacts (K1, K2)
- Operating principle: N/C operation n.c. or N/O operation n.o.
  - K1: $U < (1.1 \times U_n)$, $U > (0.85 \times U_n)$
  - K2: $U < (1.1 \times U_n)$, $U > (0.85 \times U_n)$
- 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 10 V 220 V
- Rated operational current: 5 A 5 A 1 A 0.2 A 0.1 A
- Minimum contact rating: 1 mA at AC/DC 0…10 V

Environment/EMC

- EMC: IEC 61526-1
- Operating temperature: -25…+55 °C

Classification of climatic conditions acc. to IEC 60721

- Stationary use (IEC 60721-3-3): 3M4
- Long-term storage (IEC 60721-3-1): 1K4

Classification of mechanical conditions acc. to IEC 60721

- Stationary use (IEC 60721-3-3): 3M4
- Long-term storage (IEC 60721-3-1): 1M3

Connection

- Connection type: screw-type terminal or push-wire terminal
- Screw-type terminal connection properties:
  - rigid/flexible/AWG: 0.2…4/0.2…2.5 mm²/AWG 24…12
- Flexible with ferrules:
  - 0.2…1.5 mm²/AWG 19…14
  - 0.2…1.5 mm²/AWG 24…16
- Stripping length: 8 mm
- Tightening torque, terminal screws: 0.5…0.6 Nm

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
- Degree of protection, internal components (DIN EN 60529): IP30
- Degree of protection, terminals (DIN EN 60529): IP20
- Enclosure material: polycarbonate
- Screw mounting: 2 x M4 with mounting clip
- DIN rail mounting acc. to IEC 60715
- Flammability class: UL94V-0
- Documentation number: D00137
- Weight: ≤ 150 g

[^*]: Factory setting
[^**]: The technical data can only be ensured in the operating range of the nominal frequency 15…460 Hz.
Three-phase voltage and frequency monitoring relay LINETRAXX® VMD420

**Wiring diagram**

1. L1, L2, L3, (N) Connection to the system/load to be monitored
2. A1, A2 Supply voltage \(U_s\) (see ordering information)
3. 11, 12, 14 Alarm relay "K1". Configurable for \(U_{<}/U_{>}/f_{<}/f_{>}/Asy/PHS/ERROR\)
4. 21, 22, 24 Alarm relay "K2". Configurable for \(U_{<}/U_{>}/f_{<}/f_{>}/Asy/PHS/ERROR\)
5. Line protection according to IEC 60364-4-43: A fuse recommended. If being supplied from an IT system, both lines have to be protected by a fuse.
LINETRAXX® VMD421H
Multi-functional voltage relay for 3(N)AC systems, frequency/overvoltage/undervoltage, phase, phase failure, asymmetry

Device features
- Undervoltage, overvoltage and frequency monitoring in 3(N)AC systems 70…500/288 V
- Without external supply voltage
- Integrated energy backup
- Asymmetry, phase failure and phase sequence monitoring
- Various monitoring functions selectable $U_\text{<}$, $U_\text{>}$, $f_\text{<}$, $f_\text{>}$
- Start-up delay, response delay, delay on release
- Adjustable switching hysteresis
- rms value measurement (AC+DC)
- Digital measured value display via multi-functional LC display
- Preset function (automatic setting of basic parameters)
- LEDs: Power On, Alarm 1, Alarm 2
- Measured value memory for operating value
- Continuous self monitoring
- Internal test/reset button
- Two separate alarm relays (one changeover contact each)
- N/C or N/O operation and fault memory behaviour selectable
- Password protection for device setting
- Sealable transparent cover
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)
- RoHS compliant

Typical applications
- Monitoring of voltage-sensitive machines and electrical installations
- Switching machinery and equipment on and off at a certain voltage level
- Monitoring of stand-by and emergency supply systems
- Supply voltage monitoring of portable loads
- Protection of three-phase motors against phase failure and phase open-circuit
- Transformer protection, asymmetrical load can be recognised

Standards
The LINETRAXX® VMD421H series complies with the requirements of the device standards:
- IEC 61010-1

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

Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage U_n (V)</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>70…500 V, 15…460 Hz</td>
<td>VMD421H-D-3</td>
<td>B93010007 B73010007</td>
</tr>
</tbody>
</table>

1) Absolute values

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>
### Insulation coordination acc. to IEC 60664-1/IEC 60664-3

<table>
<thead>
<tr>
<th>Rated insulation voltage</th>
<th>400 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated impulse voltage/pollution degree</td>
<td>4 kV/3</td>
</tr>
</tbody>
</table>

**Overvoltage category**
III

**Protective separation (reinforced insulation) between**
(N, L1, L2, L3) -(11, 12, 14) -(21, 22, 24)

**Voltage test acc. to IEC 60101-1:**
(N, L1, L2, L3) -(11, 12, 14) 3.22 kV
(N, L1, L2, L3) -(21, 22, 24) 2.21 kV

### Supply voltage

<table>
<thead>
<tr>
<th>Supply voltage</th>
<th>none (internally supplied by Uc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power consumption</td>
<td>≤ 6 VA</td>
</tr>
</tbody>
</table>

#### Measuring circuit

**Measuring range (rms value) (L-N):**
AC 0...288 V

**Measuring range (rms value) (L-L):**
AC 0...500 V

**Rated frequency f_{50}**
15 Hz

**Frequency display range**
10...500 Hz

#### Response values

**Type of distribution system:**
UNJAC/3AC (3AC)*

**Undervoltage U < (Alarm 1) (measurement method: 3Ph/3n):**
AC 70...500/70...288 V

**Overvoltage U > (Alarm 1) (measurement method: 3Ph/3n):**
AC 70...500/70...288 V

**Resolution of setting U**
1 V

**Overvoltage category III**

**Charging time energy storage**
60 s

**Discharging time energy backup on power failure**
2.5 s

**Relative uncertainty voltage in the range 15...460 Hz**
±3 %, ±2 digits

**Relative uncertainty, voltage at 50/60 Hz**
±1.5 %, ±2 digits

**Relative uncertainty, frequency in the range of 15...460 Hz**
±0.2 %, ±1 digit

**Hysteresis frequency Hys Hz**
0.2...2 Hz (0.2 Hz)*

**Relative uncertainty, frequency in the range of 15...460 Hz**
±0.2 %, ±1 digit

### Time response

**Start-up delay t_{on}**
0...300 s (0 s)*

**Delay on release t_{off}**
0...300 s (0 s)*

**Operating time, voltage fae**
≤ 140 ms

**Operating time, frequency fae**
≤ 335 ms

**Response time fae**
fae = fae + fae/12

**Discharging time energy backup on power failure**
2.5 s

**Charging time energy storage**
60 s

**Recovery time t_{a}**
≤ 300 ms

### Displays, memory

**Display**
LC display, multifunctional, not illuminated

**Display range measured value**
AC/DC 0...500 V

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

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

**Fault memory on/off**
on/off/con (on)*

### Technical data

**Technical data**

<table>
<thead>
<tr>
<th>Classification of climatic conditions acc. to IEC 60721</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stationary use (IEC 60721-3-1)</td>
</tr>
<tr>
<td>Transport (IEC 60721-3-2)</td>
</tr>
<tr>
<td>Long-term storage (IEC 60721-3-3-1)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Classification of mechanical conditions acc. to IEC 60721</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stationary use (IEC 60721-3-1)</td>
</tr>
<tr>
<td>Transport (IEC 60721-3-2)</td>
</tr>
<tr>
<td>Long-term storage (IEC 60721-3-3-1)</td>
</tr>
</tbody>
</table>

**Connection type**

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

**Screw-type terminals**

Connection properties:
- rigid/flexible/AWG 0.2…4/0.2…2.5 mm²/AWG 24…12
- two conductors with the same cross section:
  - rigid/flexible 0.2…1.5/0.2…1.5 mm²
  - flexible with ferrules 0.2…1.5 mm²
  - flexible without ferrules 0.2…1.5 mm²

**Test opening, diameter**
2.1 mm

**Flammability class**
UL94 V-0

**Degree of protection, terminals (IEC 60529)**
IP30

**Degree of protection, internal components (IEC 60529)**
IP30

**Enclosure material**
polycarbonate

**Operating temperature**
-25...+55 °C

**EMC**
IEC 61326-1

**Environment/EMC**

<table>
<thead>
<tr>
<th>Environment/EMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Classification of mechanical conditions acc. to IEC 60721</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stationary use (IEC 60721-3-1)</td>
</tr>
<tr>
<td>Transport (IEC 60721-3-2)</td>
</tr>
<tr>
<td>Long-term storage (IEC 60721-3-3-1)</td>
</tr>
</tbody>
</table>

**Overfrequencies**

- by preset function:
  - Overfrequency Hz > 10...500 Hz
  - Underfrequency Hz < 10...500 Hz

**Resolution of setting**
- Overfrequency Hz > 10...500 Hz
- Underfrequency Hz < 10...500 Hz

**Hysteresis Hz**
200 Hz (20 Hz)*

**Relative uncertainty frequency in the range of 15...460 Hz**
±0.2 %, ±1 digit

### Switching elements

<table>
<thead>
<tr>
<th>Switching elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
</tr>
<tr>
<td>2 x 1 changeover contacts (K1, K2)</td>
</tr>
</tbody>
</table>

**Operating principle**

- N/C operation of c.n. or N/O operation of n.o.

<table>
<thead>
<tr>
<th>Operating principle</th>
</tr>
</thead>
<tbody>
<tr>
<td>K2: Err, U &lt;, Hz &gt;, Hz &lt;, Hz &gt;, PHS (undervoltage U &lt;, asymmetry Asy, N/C operation n.c.)*</td>
</tr>
<tr>
<td>K1: Err, U &lt;, Hz &gt;, Hz &lt;, Hz &gt;, PHS (overvoltage U &gt;, asymmetry Asy, N/O operation n.o.)*</td>
</tr>
</tbody>
</table>

**Electrical endurance, number of cycles**
10,000

**Fault memory**
on/off/con (on)*
**Dimension diagram (dimensions in mm)**

![Dimension diagram](image)

**Wiring diagram**

![Wiring diagram](image)

1. L1, L2, L3, (N) Connection to the system/load to be monitored
2. 11, 12, 14  Alarm relay "K1": Configurable for <U>/U/<f>/f/Asy/PHS/ERROR
3. 21, 22, 24  Alarm relay "K2": Configurable for <U>/U/<f>/f/Asy/PHS/ERROR
4. Fuse as line protection. 6 A fuse recommended. If being supplied from an IT system, both lines have to be protected by a fuse.
LINETRAXX® VMD423/VMD423H
Three-phase voltage and frequency monitoring relay for CHPs (Combined Heat and Power plants), wind power stations, hydroelectric power plants and photovoltaic systems in accordance with DIN V VDE V 0126-1-1

**Device features**
- VMD423 with separate supply voltage
- VMD423H is supplied by the system being monitored
- Undervoltage, overvoltage and underfrequency and overfrequency monitoring in 3(N)AC systems AC 0…500 V
- Monitoring of overvoltage by average determination of the latest 10-minute measuring interval
- Asymmetry, phase failure and phase sequence monitoring
- Start-up delay, response delay and delay on release
- Adjustable switching hysteresis
- rms value measurement (AC+DC)
- Digital measured value display via multi-functional LC display
- LEDs: Power On, Alarm 1, Alarm 2
- Measured value memory for operating value
- Continuous self monitoring
- Internal test/reset button
- Two separate alarm relays (one changeover contact each)
- N/C or N/O operation and fault memory behaviour selectable
- Password protection for device settings
- Sealable transparent cover
- Push-wire terminal (two terminals per connection)
- Two-module enclosure (36 mm)
- RoHS compliant

**Certificates of non-objection**
- DIN V VDE V 0126-1-1 (France, Switzerland)
- DIN V VDE V 0126-1-1 and EN 50438 (Czech Republic)
- C 10/11 (Belgium)

**Typical applications**
- Monitoring of automatic switching points between private electric- ity generation power system in parallel operation with the public low voltage grid
- Applications according to DIN V VDE V 0126-1-1 (VDE V 0126-1-1), C 10/11, EN 50438
- Universally applicable for photovoltaic systems, CHPs (Combined Heat and Power plants), wind power and hydro power plants

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

### Ordering information

<table>
<thead>
<tr>
<th>Response value</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 10…500 V</td>
<td>VMD423-D-1</td>
<td>B93010020</td>
</tr>
<tr>
<td>DC 9,6…94 V</td>
<td>Push-wire terminal</td>
<td>B73010020</td>
</tr>
<tr>
<td>AC 10…500 V</td>
<td>VMD423-D-2</td>
<td>B93010021</td>
</tr>
<tr>
<td>DC 70…300 V</td>
<td>Push-wire terminal</td>
<td>B73010021</td>
</tr>
<tr>
<td>AC 70…500 V</td>
<td>VMD423H-D-3</td>
<td>B93010022</td>
</tr>
<tr>
<td>DC 70…500 V</td>
<td>Push-wire terminal</td>
<td>B73010022</td>
</tr>
</tbody>
</table>

1) Absolute values

### Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>
Measuring and monitoring relays  |  voltage relays

VME423 and VME423H:

- Supply voltage: U_{S} AC 16...72 V/DC 9...4 V
- Frequency range: f_{S} 50...500 Hz

VME423-D-1:

- Supply voltage: U_{S} AC/DC 70...300 V
- Frequency range: f_{S} 15...460 Hz

VME423-D-2:

- Supply voltage: U_{S} AC/DC 70...300 V
- Frequency range: f_{S} 15...460 Hz

Power consumption ≤ 6 VA

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: screw-type terminal or push-wire terminal

Switching elements

- Number: 2 x 1 changeover contacts (K1, K2)
- Operating principle K1/K2: N/O operation n.o./N/C operation n.c.
  - K1: (undervoltage < U, overvoltage > U), asymmetry Asy,
  - underfrequency < Hz, overfrequency > Hz, alarm when starting SAL, N/C operation n.c.*
  - K2: (device error Err, undervoltage < U, overvoltage > U, asymmetry Asy,
  - underfrequency < Hz, overfrequency > Hz, phase sequence PHS, overvoltage > U2), alarm when starting SAL, N/C operation n.c.*

Electrical endurance, number of cycles: 10,000

Fault memory on/off/con (off)*

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: 5 A, 3 A, 1 A, 0.2 A, 0.1 A
- Minimum contact rating: 1 mA at AC/DC ≥ 10 V

Other

- Operating mode: continuous operation
- 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
- For operation at elevation up to 2000 m
- Weight: ≤ 150 g (VMD423H), ≤ 240 g (VMD423H)

(*): Factory setting

Compliance with the following standards:

- IEC 61810: Safety requirements for electrical equipment for measurement, control and laboratory use
- IEC 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements
- IEC 61010-2-40: Overvoltage category III
- IEC 61010-2-30: Overvoltage category IV
- IEC 61010-2-20: Undervoltage category III
- IEC 61010-2-10: Overcurrent category III
- IEC 61010-2-21: Overcurrent category IV
- IEC 61010-2-22: Overcurrent category V
- IEC 61010-2-31: Short-circuit current category II
- IEC 61010-2-32: Short-circuit current category III
- IEC 61010-2-33: Short-circuit current category IV
- IEC 61010-2-34: Short-circuit current category V
- IEC 61010-2-35: Short-circuit current category VI
- IEC 61010-2-36: Short-circuit current category VII
- IEC 61010-2-37: Short-circuit current category VIII
- IEC 61010-2-38: Short-circuit current category IX
- IEC 61010-2-39: Short-circuit current category X
- IEC 61010-2-40: Overvoltage category III
- IEC 61010-2-41: Overvoltage category IV
- IEC 61010-2-42: Undervoltage category III
- IEC 61010-2-43: Undervoltage category IV
- IEC 61010-2-44: Overcurrent category III
- IEC 61010-2-45: Overcurrent category IV
- IEC 61010-2-46: Overcurrent category V
- IEC 61010-2-47: Overcurrent category VI
- IEC 61010-2-48: Overcurrent category VII
- IEC 61010-2-49: Overcurrent category VIII
- IEC 61010-2-50: Overcurrent category IX
- IEC 61010-2-51: Overcurrent category X
- IEC 61010-2-52: Short-circuit current category II
- IEC 61010-2-53: Short-circuit current category III
- IEC 61010-2-54: Short-circuit current category IV
- IEC 61010-2-55: Short-circuit current category V
- IEC 61010-2-56: Short-circuit current category VI
- IEC 61010-2-57: Short-circuit current category VII
- IEC 61010-2-58: Short-circuit current category VIII
- IEC 61010-2-59: Short-circuit current category IX
- IEC 61010-2-60: Short-circuit current category X
- IEC 61010-2-61: Short-circuit current category XI
- IEC 61010-2-62: Short-circuit current category XII
- IEC 61010-2-63: Short-circuit current category XIII
- IEC 61010-2-64: Short-circuit current category XIV
- IEC 61010-2-65: Short-circuit current category XV
- IEC 61010-2-66: Short-circuit current category XVI
- IEC 61010-2-67: Short-circuit current category XVII
- IEC 61010-2-68: Short-circuit current category XVIII
- IEC 61010-2-69: Short-circuit current category XIX
- IEC 61010-2-70: Short-circuit current category XX
- IEC 61010-2-71: Short-circuit current category XXI
- IEC 61010-2-72: Short-circuit current category XXII
- IEC 61010-2-73: Short-circuit current category XXIII
- IEC 61010-2-74: Short-circuit current category XXIV
- IEC 61010-2-75: Short-circuit current category XXV
- IEC 61010-2-76: Short-circuit current category XXVI
- IEC 61010-2-77: Short-circuit current category XXVII
- IEC 61010-2-78: Short-circuit current category XXVIII
- IEC 61010-2-79: Short-circuit current category XXIX
- IEC 61010-2-80: Short-circuit current category XXX
- IEC 61010-2-81: Short-circuit current category XXXI
- IEC 61010-2-82: Short-circuit current category XXXII
- IEC 61010-2-83: Short-circuit current category XXXIII
- IEC 61010-2-84: Short-circuit current category XXXIV
- IEC 61010-2-85: Short-circuit current category XXXV
- IEC 61010-2-86: Short-circuit current category XXXVI
- IEC 61010-2-87: Short-circuit current category XXXVII
- IEC 61010-2-88: Short-circuit current category XXXVIII
- IEC 61010-2-89: Short-circuit current category XXXIX
- IEC 61010-2-90: Short-circuit current category XLI
- IEC 61010-2-91: Short-circuit current category XLII
- IEC 61010-2-92: Short-circuit current category XLIII
- IEC 61010-2-93: Short-circuit current category XLIV
- IEC 61010-2-94: Short-circuit current category XLV
- IEC 61010-2-95: Short-circuit current category XLVI
- IEC 61010-2-96: Short-circuit current category XLVII
- IEC 61010-2-97: Short-circuit current category XLVIII
- IEC 61010-2-98: Short-circuit current category XLIX
- IEC 61010-2-99: Short-circuit current category L
- IEC 61010-2-100: Short-circuit current category L1
- IEC 61010-2-101: Short-circuit current category L2
- IEC 61010-2-102: Short-circuit current category L3
- IEC 61010-2-103: Short-circuit current category L4
- IEC 61010-2-104: Short-circuit current category L5
- IEC 61010-2-105: Short-circuit current category L6
- IEC 61010-2-106: Short-circuit current category L7
- IEC 61010-2-107: Short-circuit current category L8
- IEC 61010-2-108: Short-circuit current category L9
- IEC 61010-2-109: Short-circuit current category LA
- IEC 61010-2-110: Short-circuit current category LB
- IEC 61010-2-111: Short-circuit current category LC
- IEC 61010-2-112: Short-circuit current category LD
- IEC 61010-2-113: Short-circu...
### 5.2 LINETRAXX® VMD423/VMD423H

#### Dimension diagrams (dimensions in mm)

![VMD423](image1)

![VMD423H](image2)

#### Wiring diagram – VMD423

1. L1, L2, L3, (N) Connection to the system/load to be monitored
2. A1, A2 Supply voltage $U_S$ (see ordering information)
3. 11, 12, 14 Alarm relay “K1”:
   - Configurable for $U < U_1$/$U_1 < U_2$/$U_2 < f$/$f < f$/$f / Asy / PHS / ERROR
4. 21, 22, 24 Alarm relay “K2”:
   - Configurable for $U < U_1$/$U_1 < U_2$/$U_2 < f$/$f < f$/$f / 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

#### Wiring diagram – VMD423H

1. L1, L2, L3, (N) Connection to the system/load to be monitored
2. 11, 12, 14 Alarm relay “K1”:
   - Configurable for $U < U_1$/$U_1 < U_2$/$U_2 < f$/$f < f$/$f / Asy / PHS / ERROR
3. 21, 22, 24 Alarm relay “K2”:
   - Configurable for $U < U_1$/$U_1 < U_2$/$U_2 < f$/$f < f$/$f / Asy / PHS / ERROR
4. Fuse as line protection.
   - 6 A fuse recommended. If being supplied from an IT system, both lines have to be protected by a fuse
LINETRAXX® VMD460-NA
Network and system protection (NS protection)
for monitoring the power feed-in of power generation systems

Device features

- 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)
  - Backlit graphics LC display
  - Remote shutdown via ripple control signal receiver
  - Password protection for device setting
  - Sealable enclosure

Typical applications

- Central NS protection (VDE-AR-N 4105)
- Protective disconnection (VDE-AR-N 4110, BDEW)
- Interface Protection (IP) (Engineering Recommendations, EREC G99, G59, G83, G59)
- Protezione di interfaccia (CEI 0-21)
- Automatic disconnection device between a generating plant parallel to the network and the public network
- Universal for generating plants for safe network decoupling

Approvals

Certificates of non-objection/certificate of conformity

- VDE-AR-N 4105
- VDE-AR-N 4110
- BDEW technical guideline
- G99/1
- G59/2
- G59/3
- G98/1
- G83/2
- CEI 0-21
- C10/11
- DIN V VDE V 0126-1-1

Standards

- UL 508
- CSA (22.2 No. 14-13)

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>100...240 V AC</td>
<td>VMD460-NA-D-2</td>
<td>B93010045</td>
</tr>
</tbody>
</table>

Device version with push-wire terminal on request.

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>
Technical data

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

Rated voltage 400 V
Rated impulse voltage/pollution degree 6 kV/2
Overvoltage category III
Protective separation (reinforced insulation) between
(A1, A2) - (L1, L2, L3, N) - (11, 12, 14, 21, 22, 24)
(D1, D2, D3, D4, DG1/2, DG3/4, RTG, RT1) - (A1, A2, L1, L2, L3, N)
Voltage test according to IEC 61010-1:
(N, L1, L2, L3) - (A1, A2), (11, 12, 14, 21, 22, 24) 3.32 kV

Supply voltage
Nominal supply voltage $U_S$ AC/DC 100…240 V
DC/50/60 Hz
Operating range $U_S$ AC/DC 75…300 V
DC/40…70 Hz
Power consumption at AC 230 V < 7.5 VA/< 3.5 W
maximum 9 VA/3.5 W

Measuring circuit
Nominal system voltage $U_{nom}$ (rms value) (L-N) AC 0…300 V
Nominal system voltage $U_{nom}$ (rms value) (L-L) AC 0…520 V
Rated frequency $f_{nom}$ ($U_{nom} > 20 V$) 45…65 Hz
Relative uncertainty, voltage $U_{nom} \leq 280 V$: $\leq \pm 1 \%$
$U_{nom} > 280 V$: $\pm 3 \%$
Resolution of setting, voltage $1 \%$

Recording of measurement values, condition for connection
L-N, L-L 0…1.5 $U_{nom}$
$f < f<< 45…60 Hz$
$f > f>> 50…65 Hz$

Recording of measurement value, condition for disconnection
L-N, L-L 0…1.5 $U_{nom}$
$f < f<< 45…60 Hz$
$f > f>> 50…65 Hz$
$df/dt 0.05…9.9 Hz/s$
Vector shift 1…25 %
Unbalance 1…50 %
(Neural-Voltage-Displacement 59 (N))

Time response
Delay time for connection $t_{on}$ 40 ms…60 min
Resolution of setting $t_{on}$ $< 30$ ms: 5 ms
50…200 ms: 10 ms
200 ms…5 s: 50 ms
5 s…10 s: 0.1 s
10 s…60 s: 1 s
60 …300 s: 10 s
300 s…60 min: 1 min
Operating time voltage $t_{ov}$ half a supply period
Operating time, frequency $t_{ov}$ $\leq 40$ ms
Recovery time $t_{r}$ 300 ms

Digital inputs
Monitoring of potential-free contacts or voltage inputs:
closed = low; 0…4 V, $I_{in} < -5 mA$
open = high; > 6…< 30 V
D1 feedback signal contact K1
D2 feedback signal contact K2
D3 local control (mode)
D4 external signal (mode)
RT1 remote trip
DG1/2, DG3/4, RTG GND
Max. length of the connecting cables of digital inputs 3 m

Displays, memory
Display LC display, multi-functional, illuminated
Display range, measured value AC/DC 0…520 V
Operating uncertainty, voltage $U \leq 280 V$: $\leq \pm 1 \%$
$U > 280 V$: $\pm 0.1 \%$
Operating uncertainty, frequency $\leq \pm 0.1 \%$
History memory for the last 300 messages 1 data record of measured values each
Password off/on/0…999 (off)*

Switching elements
Number of changeover contacts 2 x 1 (R1, K2)
Operating mode N/C operation / N/O operation
Electrical endurance in rated operating conditions 10 000 cycles

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

Environment/EMC
EMC DIN EN 60255-26/CEI 0-21
Operating temperature -25…+55 °C
Classification of climatic conditions acc. to IEC 60721
Stationary use (IEC 60721-3-3) 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) 2M2
Long-term storage (IEC 60721-3-1) 1M3

Connection
Connection type screw-type terminals or push-wire terminals
Connection properties:
rigid 0.2…4 mm² (AWG 24…12)
flexible 0.2…2.5 mm² (AWG 24…14)
Stripping length 8…9 mm
Tightening torque 0.5…0.6 Nm

Other
Operating mode continuous operation
Mounting any position
Degree of protection, internal components (DIN EN 60529) IP30
Degree of protection, terminals (DIN EN 60529) IP20
Enclosure material polycarbonate
Flammability class UL94 V-0
IEC rail mounting acc. to IEC 60715
Screw mounting 2 x M4 with mounting clips
Documentation number D00001
Weight $\leq 360$ g

(1*) = Factory setting
**Dimension diagrams** (dimensions in mm)

**Wiring diagram VMD460 (VDE-AR-N-4105)**

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

2. **L1, L2, L3, N**
   - Power supply connection

3. **K1, K2**
   - Relay connections

4. **DG1/2, D1, D2**
   - Contact monitoring, coupling switch
   - DG1/2: GND
   - D1: Feedback signal contact K1
   - D2: Feedback signal contact K2
   - (feedback signal contacts optionally NC/NO/off)*

5. **RTG, RT1**
   - RTG: GND
   - RT1: Remote trip input (optionally NC/NO/off)*

6. **A, B**
   - Service interface

7. **$R_{av/off}$**
   - Activate or deactivate the terminating resistor of the BMS bus (120 Ω)
   - NO (in non-operating state open)
   - NC (in non-operating state closed)
   - off (contact monitoring switched off)
Within the scope of VDE-AR-N 4110, the VMD460-NA can be used as protective disconnection device for the generating unit or as higher-level protective disconnection, the latter, however, only if the Q-U protection function may be dispensed with. According to VDE-AR-N 4110 chapter 10.3.3.4 par. 5, this is possible after consultation with the network operator and under the following conditions:

- Generating plants with limited dynamic network support or
- Generating plants < 1 MVA

Both types of application are possible when the generating plant is connected to the busbar of a substation (MV-busbar) or when the generating plant is connected to the medium-voltage network (MV-network).
**Intended use**

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

2. **L1, L2, L3, N**  
   Power supply connection

3. **K1, K2**  
   Relay connections

4. **DG1/2, D1, D2**  
   Contact monitoring, coupling switch  
   D1: Feedback signal contact K1  
   D2: Feedback signal contact K2  
   (feedback signal contacts optionally NC/NO/off)*

5. **DG3/4, D3, D4**  
   Digital inputs (external monitoring)  
   DG3/4: GND  
   D3: local control (CEI 0-21 8.6.2.1.1)**  
   D4: external signal (CEI 0-21 8.6.2.1.2)**  
   (optionally NC/NO/off)*

6. **RTG, RT1**  
   RTG: GND  
   RT1: Remote trip input (optionally NC/NO/off)*

7. **A, B**  
   Service interface

8. **$R_{on/off}$**  
   Activate or deactivate the terminating resistor of the BMS bus (120 Ω)  
   * NO (in non-operating state open)  
   NC (in non-operating state closed)  
   off (contact monitoring switched off)*

**In order to evaluate the inputs D3 and D4, the mode can be adjusted correspondingly in the menu (menu: 3. Settings --> 1. General --> 4. Mode)**

---

**Principle of a plant according to CEI 0-21; VDE-AR-N 4105 (ab 30 kW), C10/11, BDEW technical guideline, DIN V VDE V 0126-1-1/A1, G59/2, G59/3, G83/2**
LINETRAXX® VMD461 with CD440 coupling device
Multifunctional voltage relay for AC, DC, 3(N)AC systems

Device features
- When combined with a CD440 coupling device, DC systems up to 1200 V, 1AC systems up to 690 V, 3AC systems up to 1200 V and 3NAC systems up to 690 V can be monitored
- All functions are represented in ANSI codes
- Monitoring of DC, 1AC, 3(N)AC systems DIN EN 60255-1:2010-9
- Single-fault safety
- Unbalance, phase failure and phase sequence monitoring
- Monitoring of the connected switches and/or disconnectors (configurable: NC/NO/off)
- Islanding detection df/dt (ROCOF)
- Vector shift function
- RS-485 interface (data exchange/parameter setting/software update)
- Test function to determine the switch-off time
- Test button for the trigger circuit
- The last 300 network faults can be recalled with time stamp/real-time clock
- Continuous monitoring of the phase voltage and line-to-line voltage
- Special switch-on conditions after an infringement of a response value
- Language selection (German, English, French)
- Backlight graphic LC display
- Password protection for device setting
- Remote shutdown via ripple control signal receiver
- Sealable enclosure

Standards
The device fulfils the requirements of the following standards:
- DIN EN 60255-127 (IEC 60255-127)
- VDE 0435-3127
- UL File: E173157

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

Ordering information

<table>
<thead>
<tr>
<th>Description</th>
<th>Supply voltage U_s</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multifunctional voltage relay</td>
<td>100...240 V</td>
<td>VMD461-D-2</td>
<td>B93010047</td>
</tr>
<tr>
<td>Coupling device</td>
<td>–</td>
<td>CD440</td>
<td>B73010046</td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting</td>
<td>B98060008</td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Device variants / Supply voltage U_s</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition Monitor</td>
<td>with an integrated gateway: Bender system/Ethernet</td>
<td>COM465IP</td>
<td>B950610...</td>
<td>382</td>
</tr>
<tr>
<td></td>
<td>for the connection of Bender BMS devices and universal measuring devices to TCP/IP systems</td>
<td>CP700</td>
<td>B95061030</td>
<td>394</td>
</tr>
<tr>
<td>RS-485 repeater</td>
<td>AC/DC 24 V ± 20 %</td>
<td>DI-PSM</td>
<td>B95012044</td>
<td>–</td>
</tr>
</tbody>
</table>
## Technical data

### Insulation coordination of the device combination VMD461/CD440:

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th>≤ 1000 V acc. to IEC 60664-1/IEC 60664-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>&gt; 1000 V acc. to EN 50178:1998</td>
</tr>
</tbody>
</table>

### Definitions

<table>
<thead>
<tr>
<th>Measuring circuit (IC1)</th>
<th>CD440 (L1, L2/DC+, L3, N/DC–)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring circuit (IC2)</td>
<td>VMD461 (L1, L2/DC+, L3, N/DC–)</td>
</tr>
<tr>
<td>Supply circuit (IC3)</td>
<td>VMD461 (AT, A2)</td>
</tr>
<tr>
<td>Control circuit (IC4)</td>
<td>VMD461 (D1, D2, DG1/2, RTG, RT1)</td>
</tr>
<tr>
<td>Output circuit 1 (IC5)</td>
<td>VMD461 (11, 12, 14)</td>
</tr>
<tr>
<td>Output circuit 2 (IC6)</td>
<td>VMD461 (21, 22, 24)</td>
</tr>
<tr>
<td>Output circuit 3 (IC7)</td>
<td>VMD461 (A, B)</td>
</tr>
</tbody>
</table>

### Rated voltage

<table>
<thead>
<tr>
<th>IC1</th>
<th>DC, 3AC, 1200 V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1AC, 3NAC, 690 V</td>
</tr>
</tbody>
</table>

### Rated impulse voltage

<table>
<thead>
<tr>
<th>Overvoltage category</th>
<th>Max. altitude</th>
<th>IC1/IC2 … IC6</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC, 3AC</td>
<td>2000 m</td>
<td>10.5 kV</td>
</tr>
<tr>
<td>DC, 50/60 Hz</td>
<td></td>
<td>4 kV</td>
</tr>
<tr>
<td>DC, 100/120 Hz</td>
<td></td>
<td>4 kV</td>
</tr>
</tbody>
</table>

### Rated insulation voltage

<table>
<thead>
<tr>
<th>Pollution degree</th>
<th>DC, 3AC, 1250 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC1/IC3 … IC6</td>
<td>1AC, 3NAC, 800 V</td>
</tr>
<tr>
<td>IC2/IC3 … IC6</td>
<td>400 V</td>
</tr>
<tr>
<td>IC3/IC4 … IC6</td>
<td>400 V</td>
</tr>
<tr>
<td>IC4/IC5 … IC6</td>
<td>400 V</td>
</tr>
<tr>
<td>IC5/IC6</td>
<td>4 kV</td>
</tr>
</tbody>
</table>

### Protective separation (reinforced insulation):  

| IC1/IC3 … IC6   | DC, 3AC, Overvoltage category III, 1250 V |
| IC2/IC3 … IC6   | 1AC, 3NAC, Overvoltage category III, 1000 V |
| IC3/IC4 … IC6   | 300 V            |
| IC4/IC5 … IC6   | 300 V            |
| IC5/IC6         | 300 V            |

### Voltage test (routine test) acc. to IEC 60255-27/DIN EN 50178:1998

| IC2/IC3 … IC6   | 2.21 kV         |
| IC3/IC4 … IC6   | 2.21 kV         |
| IC4/IC5 … IC6   | 2.21 kV         |
| IC5/IC6         | 2.21 kV         |

### Supply voltage

| Nominal supply voltage | 100 … 240 V |
| Tolerance Uf         | ±25 %       |
| Nominal frequency range Uf | DC, 50/60 Hz |
| Power consumption at AC 230 V | ≤ 3,5 W/7.5 VA |

### Measuring circuit

#### VMD461

<table>
<thead>
<tr>
<th>System type</th>
<th>DC, 1AC, 3AC, 3NAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal voltage Uf</td>
<td>L-N</td>
</tr>
<tr>
<td></td>
<td>AC 50 … 260 V</td>
</tr>
<tr>
<td></td>
<td>(L-L)</td>
</tr>
<tr>
<td></td>
<td>AC 87 … 450 V</td>
</tr>
<tr>
<td></td>
<td>(DC+/DC–)</td>
</tr>
<tr>
<td>Measuring range</td>
<td>0 … 1.15 x Uf</td>
</tr>
<tr>
<td>Overload capacity</td>
<td>1.5 x Uf, max for 5 s</td>
</tr>
<tr>
<td>Response values</td>
<td>≤ ±100 %</td>
</tr>
<tr>
<td>Operating uncertainty Uf</td>
<td>≤ ±1 %</td>
</tr>
<tr>
<td>Resolution of setting Uf</td>
<td>1 %</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>DC, 50/60 Hz</td>
</tr>
<tr>
<td>Frequency range</td>
<td>DC, 45 … 65 Hz</td>
</tr>
<tr>
<td>Resolution of setting f</td>
<td>0.05 Hz</td>
</tr>
<tr>
<td>Relative uncertainty f</td>
<td>≤ ±0.1 %</td>
</tr>
</tbody>
</table>

### VMD461 with CD440

<table>
<thead>
<tr>
<th>System type</th>
<th>DC, 1AC, 3AC, 3NAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal voltage Uf</td>
<td>L-N</td>
</tr>
<tr>
<td></td>
<td>AC 250 … 690 V</td>
</tr>
<tr>
<td></td>
<td>(L-L)</td>
</tr>
<tr>
<td></td>
<td>AC 440 … 1200 V</td>
</tr>
<tr>
<td></td>
<td>(DC+/DC–)</td>
</tr>
<tr>
<td>Nominal voltage Uf</td>
<td>for Canada</td>
</tr>
<tr>
<td></td>
<td>AC 250 … 600 V</td>
</tr>
<tr>
<td></td>
<td>(L-N)</td>
</tr>
<tr>
<td></td>
<td>AC 440 … 600 V</td>
</tr>
<tr>
<td></td>
<td>(DC+/DC–)</td>
</tr>
<tr>
<td>Measuring range</td>
<td>0 … 1.15 x Uf</td>
</tr>
<tr>
<td>Overload capacity</td>
<td>1.5 x Uf, max for 5 s</td>
</tr>
<tr>
<td>Response values</td>
<td>≤ ±2 %</td>
</tr>
<tr>
<td>Operating uncertainty Uf</td>
<td>≤ ±2 %</td>
</tr>
<tr>
<td>Resolution of setting Uf</td>
<td>1 %</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>DC, 50/60 Hz</td>
</tr>
<tr>
<td>Frequency range</td>
<td>DC, 45 … 65 Hz</td>
</tr>
<tr>
<td>Resolution of setting f</td>
<td>0.05 Hz</td>
</tr>
<tr>
<td>Relative uncertainty f</td>
<td>≤ ±0.1 %</td>
</tr>
</tbody>
</table>

### Recording of measurement values, switch-on condition

| DC, Uf, Uf, Uf | 100 … 100 % |
| Uf, Uf, Uf   | 100 … 150 % |
| Uf, Uf, Uf   | 45 … 60 Hz  |
| Uf, Uf, Uf   | 50 … 65 Hz  |
| Vector shift  | 1 … 25 %    |
| Unbalance     | 1 … 50 %    |

### Time response

| Start-up delay tStart | 200 ms … 60 min (200 ms)* |
| Switch-on delay ta   | off, 50 ms … 60 min (100 ms)* |
| Response delay tR    | off, 50 ms … 60 min (100 ms)* |
| Operating time voltage tP | half a supply period |
| Operating time, frequency fP | ≤ 40 ms |
| Recovery time tR     | 300 ms       |

### Digital inputs

| Monitoring of potential-free contacts or voltage inputs: |
| closed = low; 0 … 4 V; | Iin ≤ –5 mA |
| open = high; 6 … 50 V; | 30 V |
| D1 Feedback signal contact of alarm relay K1 |
| D2 Feedback signal contact of alarm relay K2 |
| RTI remote trip |
| DG1/2, RTG |
| max. length of the connecting cables of the digital inputs |
| (shielded cable recommended) |
| 10 m |
| Cable length for external test/reset button | 0 … 10 m |

### Displays, memory

| Display        | LC display, multi-functional, illuminated |
| Display range, measured value | 0 … 9,999 kV |
| History memory for the last 300 messages | per 1 data record measured values |
| Password       | on/off/0 … 999 (off)* |

### Interface

| Interface/protocol | RS-485/BMS |
| Baud rate          | 9.6 kBit/s |
| Cable length       | 500 m |
| Recommended cable (shielded, shielded connected to PE on one side) |
| min. J-Y(St)Y min. 2 x 0.8 |
| Terminating resistor | 120 Ω (0.25 W) connectable via DIP switch |

**Note:**  
1. Measuring and monitoring relays  
2. Voltage relays  
3. LINETRAXX® VMD461 with CD440  
4. LINETRAXX® VMD461 with CD440
Technical data (continued)

### Switching elements
- Number of changeover contacts: 2 x 1 (K1, K2)
- Operating principle K1, K2: N/C operation or N/O operation (N/C)*
- Electrical endurance under rated operating conditions, number of cycles: 10,000

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

### Environment/EMC
- EMC: DIN EN 60255-26
- Operating temperature: –25…+55 °C

### Classification of climatic conditions acc. to IEC 60721:
- Stationary use (IEC 60721-3-3): 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

### Connection
- **Connection VMD461**
  - Connection: screw-type terminals
  - Connection properties:
    - Rigid: 0.2…4 mm² (AWG 24…12)
    - Flexible with ferrule: 0.2…2.5 mm² (AWG 24…14)
- **Connection CD440**
  - Connection: push-wire terminals
  - Rigid: 0.2…2.5 mm² (AWG 24…14)
  - Flexible without ferrule: 0.75…2.5 mm² (AWG 19…14)
  - Flexible with ferrule: 0.2…1.5 mm² (AWG 24…16)
- Stripping length: 10 mm
- Opening force: 50 N
- Test opening, diameter: 2.1 mm

### Other
- Operating mode: continuous operation
- Mounting: any position
- Degree of protection, internal components (DIN EN 60529): IP30
- Degree of protection, terminals (DIN EN 60529): IP20
- Enclosure material: polycarbonate
- Flammability class: UL94 V-0
- DIN rail mounting acc. to: IEC 60715
- Screw mounting CD440: 2 x M4 with mounting clip
- Screw mounting VMD461: 2 x M4
- Software version, measurement technology: D570 V1.2x
- Software version, display: D256 V2.3x
- Weight:
  - VMD461: ≤ 360 g
  - CD440: ≤ 125 g

(*) Factory setting

---

**Dimension diagram (dimensions in mm)**

<table>
<thead>
<tr>
<th>VMD461</th>
<th>CD440</th>
</tr>
</thead>
<tbody>
<tr>
<td>108</td>
<td>40.5</td>
</tr>
<tr>
<td>74</td>
<td>33.2</td>
</tr>
<tr>
<td>47.5</td>
<td>27.2</td>
</tr>
<tr>
<td>97.5</td>
<td>24.5</td>
</tr>
<tr>
<td>45</td>
<td>10</td>
</tr>
<tr>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>98</td>
<td>65</td>
</tr>
</tbody>
</table>

---

LINETRA® VMD461 with CD440
LINETRAXX® VMD461 with CD440

5.2 Measuring and monitoring relays | voltage relays
Multifunctional voltage relay LINETRAXX® VMD461 with CD440 coupling device

Connection DC: VMD461 with CD440
Connection AC: VMD461 with CD440 (earthed system)
Connection AC: VMD461 with CD440 (unearthed system)
Connection 3(N)AC: VMD461 with CD440 (earthed system)
Connection 3(N)AC: VMD461 with CD440 (unearthed system)
Possible wiring diagram with 2 circuit breakers
A1, A2 Supply voltage $U_S$ (see ordering details)
L1, L2/DC+, L3, N/DC- Power supply connection
11, 12, 14 Connection to alarm relay K1
21, 22, 24 Connection to alarm relay K2

DG1/2, D1, D2 Contact monitoring
DG1/2: GND
D1: Feedback signal contact to alarm relay K1
D2: Feedback signal contact to alarm relay K2
(feedback signal contacts optionally NC/NO/off)*
RTG, RT1 RTG: GND
RT1: Remote-trip input (optionally NC/NO/off)*
A, B Connection to communication interface BMS bus
$R_{on/off}$ Activate or deactivate the terminating resistor of the BMS bus (120 Ω)
Q1, Q2 Circuit breakers
NO (closed in non-operating state)
NC (open in non-operating state)
aus (switched off)
Schematic diagram with circuit breakers

Example for a system design
LINETRAXX® CME420
Multi-functional current relay, AC, overcurrent/undercurrent/window discriminator function

Device features
• Undercurrent and overcurrent monitoring in AC systems 0.1…16 A without measuring current transformer
• Indirect current monitoring with standard current transformers x/1 A, x/5 A, x/10 A
• Transformation ratio n allows adaptation to all standard current transformers x/1 A, x/5 A, x/10 A
• Different monitoring functions selectable < I, > I or < I/> I
• Start-up delay, response delay, delay on release
• Adjustable switching hysteresis
• r.m.s. value measurement (AC)
• Digital measured value display via multi-functional LC display
• LEDs: Power On, Alarm 1, Alarm 2
• Measured value memory for operating value
• Continuous self monitoring
• Internal test/reset button
• Two separate alarm relays (one changeover contact each)
• N/C or N/O operation and fault memory behaviour selectable
• Password protection for device setting
• Sealable transparent cover
• Two-module enclosure (36 mm)
• Push-wire terminal (two terminals per connection)
• RoHS compliant

Typical applications
• Current consumption of motors, such as pumps, elevators, cranes
• Monitoring of lighting circuits, heating circuits, charging stations
• Monitoring of emergency lighting
• Monitoring of screw conveyors, e.g. in sewage plants
• Dust removal in wood working

Approvals

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

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage 1) U_S</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AC</td>
<td>DC</td>
</tr>
<tr>
<td>16…72 V, 42…460 Hz</td>
<td>CME420-D-1</td>
<td>B93060001</td>
</tr>
<tr>
<td>70…300 V, 42…460 Hz</td>
<td>CME420-D-2</td>
<td>B93060002</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</td>
<td>B 9806 0008</td>
</tr>
<tr>
<td>(1 piece per device)</td>
<td></td>
</tr>
</tbody>
</table>
## Technical data

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

- **Rated insulation voltage**: 250 V
- **Rated impulse voltage/overvoltage category**: 4 kV/III
- **Pollution degree**: 3
- **Protective separation (reinforced insulation) between** (A1, A2) -(k, l) -(11, 12, 14) -(21, 22, 24)
- **Maximum nominal voltage of the system being monitored**
  - With protective separation: AC 230 V
  - Without protective separation: AC 400 V

### Supply voltage

- **CME420-D-1**
  - Supply voltage \( U_s \)
    - AC 16…72 V/DC 9.6…94 V
  - **Frequency range** \( U_s \)
    - 42…460 Hz

- **CME420-D-2**
  - Supply voltage \( U_s \)
    - AC/DC 70…300 V
  - **Frequency range** \( U_s \)
    - 42…460 Hz

### Power consumption

- \( \leq 4 \text{ VA} \)

### Measuring circuit

- **Measuring range (r.m.s. value, screw-type terminal)**: AC 0.05…16 A
- **Measuring range (r.m.s. value, push-wire terminal)**: AC 0.05…12 A

### Overload capability

- < 1 s: 40 A

### Rated frequency

- \( f_n \): 42…2000 Hz

### Response values

#### Undercurrent

- Undercurrent \( I_c < \) (alarm \( I_2 \)), direct connection:
  - Push-wire terminal: AC 0.1…12 A (1 A)*
  - Screw-type terminal: AC 0.1…16 A (1 A)*
- or external current transformer

- Undercurrent \( I_c < \) (prewarning \( I_1 \))
  - 100…200 % (150 %)*

#### Overcurrent

- Overcurrent \( I_c > \) (alarm \( I_2 \)), direct connection:
  - Push-wire terminal: AC 0.1…12 A (1 A)*
  - Screw-type terminal: AC 0.1…16 A (1 A)*
- or external current transformer

- Overcurrent \( I_c > \) (prewarning \( I_1 \))
  - 10…100 % (50 %)*

### Others

- **External current transformer**
  - x/1 A, x/5 A, x/10 A
- **Transformation ratio factor** \( n \)
  - 1…2000 (1)*
- **Relative percentage error at 50/60 Hz**
  - \( \leq 3 \% \), \( \leq 2 \text{ digits} \)

- **Relative percentage error in the range of 42…2000 Hz**
  - \( \leq 5 \% \), \( \leq 2 \text{ digits} \)
- **Hysteresis**
  - 10…40 % (15 %)*

### Specified time

- **Starting delay**
  - 0…300 s (0.5 s)*
- **Response delay** \( t_{d1} \)
  - 0…300 s (1 s)*
- **Response delay** \( t_{d2} \)
  - 0…300 s (0 s)*
- **Delay on release \( t_{d3} \)
  - 0…300 s (1 s)*
- **Operating time** \( t_{ae} \)
  - \( \leq 70 \text{ ms} \)
- **Response time** \( t_{fx} = t_{ae} + t_{d1/2} \)
- **Recovery time** \( t_b \)
  - \( \leq 300 \text{ ms} \)

### Displays, memory

- **Display**
  - LC display, multi-functional, not illuminated
- **Display range**
  - Measured value x transformation ratio factor
- **Operating error at 50/60 Hz**
  - \( \leq 3 \% \), \( \leq 2 \text{ digits} \)
- **Operating error in the range of 42…2000 Hz**
  - \( \leq 5 \% \), \( \leq 2 \text{ digits} \)

### Environment/EMC

- **EMC**
  - IEC 61326
- **Operating temperature**
  - \(-25…+55 \text{ °C}\)

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

- **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

### Push-wire terminals

- **Connection properties**:
  - Rigid: 0.2…2.5 mm² (AWG 10…12)
  - Flexible without ferrules: 0.75…2.5 mm² (AWG 12…14)
  - Flexible with ferrules: 0.2…1.5 mm² (AWG 14…16)
- **Stripping length**
  - 8 mm
- **Tightening torque, terminal screws**
  - 0.5…0.6 Nm

### Connection

- **Connection type**
  - Screw-type terminal or push-wire terminal

### Push-wire terminals

- **Connection properties**:
  - Rigid: 0.2…2.5 mm² (AWG 12…14)
  - Flexible without ferrules: 0.75…2.5 mm² (AWG 12…14)
  - Flexible with ferrules: 0.2…1.5 mm² (AWG 14…16)
- **Stripping length**
  - 10 mm
- **Opening force**
  - 50 N
- **Test opening, diameter**
  - 2.1 mm

### Other

- **Operating mode**
  - Continuous operation
- **Position**
  - Any position
- **Degree of protection DIN EN 60529, internal components**
  - IP30
- **Degree of protection DIN EN 60529, terminals**
  - IP20

### Further information

- **Enclosure material**
  - Polycarbonate
- **Flammability class**
  - UL 94 V-0
- **DIN rail mounting acc. to**
  - IEC 60715
- **Screw mounting**
  - 2 x M4 with mounting clip
- **Documentation number**
  - 000034
- **Weight**
  - \( \leq 160 \text{ g} \)

\(^*\) Factory settings
### Wiring diagram

1. **k, l** Connection to the system/load being monitored
2. **A1, A2** Supply voltage $U_S$ (see ordering information)
3. **11, 12, 14** Alarm relay "K1": configurable for $I<$, $I>$ or $I<$/$I>$/ERROR/TEST
4. **21, 22, 24** 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
- rms value measurement AC
- Digital measured value display via multi-functional LC display
- LEDs: Power On, Alarm 1, Alarm 2
- Fault memory for the operating value
- 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
- Sealsable transparent cover
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)
- RoHS compliant

Typical applications
- Current consumption of motors, such as pumps, elevators, cranes
- Monitoring of lighting circuits, heating circuits, charging stations
- Monitoring of emergency lighting
- Monitoring of screw conveyors, e.g. in sewage plants
- Dust removal in wood working

Approvals

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

Ordering information

<table>
<thead>
<tr>
<th>Suitable for current transformer types</th>
<th>Response value</th>
<th>Supply voltage ( U_S )</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>DC</td>
<td>AC/DC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>x/1A</td>
<td>0.1…1 A x n</td>
<td>16…72 V, 15…460 Hz</td>
<td>CMD420-D-1</td>
<td>B93060006</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9.6 V…94 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>70…300 V, 15…460 Hz</td>
<td>CMD420-D-2</td>
<td>B93060007</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9.6 V…94 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>x/5A</td>
<td>0.5…5 A x n</td>
<td>16…72 V, 15…460 Hz</td>
<td>CMD421-D-1</td>
<td>B93060008</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9.6 V…94 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>70…300 V, 15…460 Hz</td>
<td>CMD421-D-2</td>
<td>B93060009</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>
**Technical data**

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

- Rated insulation voltage: AC 250 V
- Rated impulse voltage/pollution degree: 6 kV/3
- Protective separation (reinforced insulation) between (A1, A2) - (k, l) - (11, 12, 14) - (21, 22, 24)
- Protective separation (reinforced insulation) between (k1, k2, l1, k3, l3) - (11, 12, 14)
- Voltage test acc. to IEC 60100-3-2: 1.556 kV
- Rated insulation voltage: AC 250 V
- Rated impulse voltage/pollution degree: 4 kV/3
- Basic insulation between: (k1, k2, l1, k3, l3) - (A1, A2), (21, 22, 24)
- Basic insulation between: (11, 12, 14) - (21, 22, 24)
- Voltage test acc. to IEC 60100-3-2: 2,250 V

**Supply voltage**

- CMD420-D-1, CMD421-D-1:
  - Supply voltage: AC 16…72 V DC 9…94 V
  - Frequency range: 15…460 Hz
- CMD420-D-2, CMD421-D-2:
  - Supply voltage: AC/DC 70…300 V
  - 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 < s: 5 A
- Load per measuring input: 50 mΩ
- Rated frequency: 42…2000 Hz

**Response values CMD420**

- Undercurrent Lo < (Alarm 2) n = 1: AC 0.1…1 A (0.3 A)*
- Undercurrent Lo < (Alarm 1) n = 1: 100…200 % (150 %)*
  - Take a maximum nominal current of 1 A into consideration!
- Overcurrent Hi > (Alarm 2) n = 1: AC 0.1…1 A (0.3 A)* (Hi)*
- Overcurrent Hi > (Alarm 1) n = 1: 50…100 % (50 %)* (Hi)*
- Window Lw > (Alarm 2) n = 1: AC 0.1…1 A (0.3 A)*
- Window Lw > (Alarm 1) 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: ±5 %, ±2 digits
- Hysteresis: 3…40% (15 %)*

**Measuring circuit CMD421**

- Nominal measuring range (r.m.s. value) n = 1: AC 0…5 A
- Overload capability, continuous: 7.5 A
- Overload capability < s: 7.5 A
- Load per measuring input: 3 mΩ
- Rated frequency: 42…460 Hz

**Response values CMD421**

- Undercurrent Lo < (Alarm 2) n = 1: AC 0.5…5 A (1.5 A)*
- Undercurrent Lo < (Alarm 1) n = 1: 100…200 % (150 %)*
  - Take a maximum nominal current of 5 A into consideration!
- Overcurrent Hi > (Alarm 2) n = 1: AC 0.5…5 A (1.5 A)* (Hi)*
- Overcurrent Hi > (Alarm 1) n = 1: 50…100 % (50 %)* (Hi)*
- Window Lw > (Alarm 2) n = 1: AC 0.5…5 A (1.5 A)*
- Window Lw > (Alarm 1) 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: ±5 %, ±2 digits
- Hysteresis: 3…40% (15 %)*

**Display, memory**

- Display: LC display, multifunctional, not illuminated
- Display range, measured value (r.m.s. value) x transformation ratio n: CMD420: AC 0…1 A x n
  - CMD421: AC 0…5 A x n
- Operating uncertainty in the range of 42…460 Hz: ±5 %, ±2 digits
- Measured-value memory (HiS) for the first alarm value
- Password: on/off/999 (OFF)*
- Fault memory (MI) alarm relay: on/off/con (on)*

**Switching elements**

- Number: 2 x 1 changeover contacts (K1, K2)
- Operating principle: N/C operation/N/O operation
  - (device error Err, overcurrent prewarning > I1, test button tES)*
  - (device error Err, overcurrent alarm > I2, test button tES)*
- 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 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): 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
  - Stationary use (IEC 60721-3-3): 3M4
  - Transport (IEC 60721-3-2): 2M2
  - Storage (IEC 60721-3-1): 1M3

**Connection**

- Type: contact type screw-type terminal or push-wire terminal
- Screw-type terminal: rigid/flexible/AWG 0.2…4/0.2…2.5 mm²/AWG 24…12
  - Tightening torque, terminal screws: 8 mm
  - Torquing tongue, terminal screws: 0.5…0.8 Nm
- Push-wire terminals
  - Connection properties: rigid/flexible
  - Connection: rigid
  - Flexible without ferrules: 0.2…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
- Mounting: any position
- Degree of protection, internal components (IEC 60529): IP30
- Degree of protection, terminals (IEC 60529): IP20
- Enclosure material: polycarbonate
- Flammability class: UL94 V-0
- DIN rail mounting acc. to: IEC 60715
- Screw mounting: 2 x M4 with mounting clip
- Documentation number: D00101
- Weight: ≤ 150 g

( )* = factory setting
**Dimension diagram (dimensions in mm)**

**Wiring diagram**

1. **k, l** Connection to the conductors to be monitored; using current transformers
2. **A1, A2** Supply voltage $U_S$ (see ordering information)
3. **11, 12, 14** Alarm relay “K1”: configurable for $I_\text{<}$, $I_\text{>}$, or $I_\text{<}$/ERROR/TEST
4. **21, 22, 24** Alarm relay “K2”: configurable for alarm $I_\text{<}$, $I_\text{>}$, or $I_\text{<}$/ERROR/TEST
5. **Line protection according to IEC 60364-4-43:**
   - 6 A fuse recommended. If being supplied from an IT system, both lines have to be protected by a fuse.
LINETRAXX® CMS460-D
Multi-channel AC, pulsed DC sensitive load current evaluator
for AC systems (TN, TT and IT systems)

Device features
- Optional AC or pulsed DC sensitive measurements for each channel
- rms value measurement
- 12 measuring channels per individual device for load current
- Up to 90 evaluators CMS460-D in the system (1080 measuring channels)
- Fast parallel scanning for all channels
- Response ranges 100 mA...125 A (42...2000 Hz)
- Preset function
- Adjustable time delays
- Adjustable frequency behaviour (e.g. fire and plant protection)
- History memory with date and time stamp for 300 data records/channel
- Data logger for 300 data records/channel
- Analysis of the harmonics, THD
- Two alarm relays with one changeover contact each
- N/O or N/C operation and fault memory selectable
- Connection external test and reset button
- Backlit graphical display (7-segment display) and alarm LEDs
- Data exchange via BMS bus
- Password protection for device setting
- RoHS compliant

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

Typical applications
- Monitoring of loads and installations for load currents in the frequency range of 42...2000 Hz
  (measuring current transformers CTAC..., WR...S(P), WS..., WF...)
- Monitoring of currents regarded as fire hazards in flammable atmospheres
- EMC monitoring of TN systems for “stray currents” and additional N-PE connections
- Monitoring of N conductors for overload caused by harmonics
- Monitoring of PE and equipotential bonding conductors to ensure they are free of current

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage 1) U S</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC 16…94 V</td>
<td>AC 16…72 V, 42...460 Hz</td>
<td>CMS460-D-1</td>
</tr>
<tr>
<td></td>
<td>70…276 V, 42...460 Hz</td>
<td>CMS460-D-2</td>
</tr>
</tbody>
</table>

1) Absolute values

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>XM460 mounting frame, 144 x 82 mm</td>
<td>B990995</td>
</tr>
</tbody>
</table>

Suitable system components
Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3 for the versions:

a) CMS460-D1

Supply voltage $U_s$: DC 24...75V/AC 24...60 V (AC/DC ±20 %)
Supply voltage frequency: DC 50/60 Hz
Rated insulation voltage: 100 V
Overvoltage category/pollution degree: III/3
Rated impulse voltage: 2.5 kV

Protective separation (reinforced insulation) between:
(A1, A2) - (91, 94); (101, 104); (111, 114); (121, 124)

Rated insulation voltage: 250 V
Overvoltage category/pollution degree: III/3
Rated impulse voltage: 4 kV

Basic insulation between:
(A1, A2), (k1, l...k12, R, T/R, T, A, B) - (C11, C12, C14), (C21, C22, C24), (11, 14, 21, 24, 31, 34), (41, 44, 51, 54, 61, 64), (71, 74), (81, 84), (91, 94), (101, 104), (111, 114), (121, 124)

Rated impulse voltage: 6 kV
Rated insulation voltage: 250 V
Overvoltage category/pollution degree: III/3

Voltage test acc. to IEC 61010-1
Voltage category: III/3
Overvoltage category: III/3
Rated insulation voltage: 250 V
Rated impulse voltage: 2.5 kV

b) CMS460-D2

Supply voltage $U_s$: AC/DC 100...240 V (-20...+15 %)
Supply voltage frequency: DC 50/60 Hz
Rated insulation voltage: 100 V
Overvoltage category/pollution degree: III/3
Rated impulse voltage: 6 kV

Basic insulation between:
(A1, A2), (k1, l...k12, R, T/R, T, A, B) - (C11, C12, C14), (C21, C22, C24), (11, 14, 21, 24, 31, 34), (41, 44, 51, 54, 61, 64), (71, 74), (81, 84), (91, 94), (101, 104), (111, 114), (121, 124)

Rated impulse voltage: 4 kV
Rated insulation voltage: 100 V

Voltage test acc. to IEC 61010-1
Voltage category: III/3
Overvoltage category: III/3
Rated insulation voltage: 100 V
Rated impulse voltage: 2.5 kV

Measuring circuit

External measuring current transformers: CTAC..., WR..., WS..., WF... series (type A)
Load: 1 Ω
Rated insulation voltage (measuring current transformer): 800 V
Operating characteristics acc. to IEC 60733: type A depending on measuring current transformer series (type A)
Rated frequency: 42...2000 Hz (type A)
Cut-off frequency: none, IEC, 50 Hz, 60 Hz (none) *

Measuring range: 100 mA...125 A (measuring current transformer A type) 100 mA...30 A (measuring current transformer Flex)
(Test factor up to 10 A = 4, up to 125 A = 2)

Rated operating current In2 (alarm): 100 mA...125 A (16 A overcurrent)
Rated operating current In (prewarning): 10...100 % in 2s *

Relative uncertainty: ±10...+20 %
Hysteresis: 2...40 % (20 %) *
Factor for additional CT: 1...2; 10...10 (1x) *
Number of measuring channels (per device/system): 12/1080

Time response

Start-up delay $t_{s}$ (start-up per device): 0...99 s (0 ms) *
Response delay $t_{y}$ (per channel): 0...999 ms (200 ms) *
Delay on release $t_{p}$ (per channel): 0...999 ms (200 ms) *

Operating time $t_{a}$ = $t_{s}$ + $t_{y}$:
- $t_{a}$ = 160 ms
- $t_{a}$ = 30 ms

Response time $t_{y}$ (current measurement): $t_{y}$ = $t_{a}$ + 180 ms

Scanning time for all measuring channels (current measurement): 500...600 ms

Displays, memory

Display range, measuring value: < 10 mA...30 A (CT type A) < 10 mA...125 A (CT type A)

Operating uncertainty: ±10 %

LEDS: display backlight graphical display

History memory: 300 data records

Data logger: 300 data records per measuring channel

Password: off/0...999 (off) *

Language: D, GB, F (GB) *

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

Inputs/outputs

Test/reset button: internal/external

Cable length for external test/reset button: 0...10 m

Interface

Interface/protocol: RS-485/MBUS

Baud rate: 9.6 kbit/s

Cable length: 0...1200 m

Recommended cable (shielded, shield connected to PE on one side):
(min. J-Y(St) min. 2x0.8)

For light applications: Copper lines at least 60/70 °C

Terminating resistor:
120 Ω (0.25 W) connectable via DIP switch

Address device, BMS bus: 1...90 (2) *

Cable lengths for CTAC..., WR..., WS..., WF... series 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
- Recommended cable: shielded, shield connected to terminal at one end, must not be earthed

Switching elements

Number of changeover contacts: 2 x 1 changeover contacts

Operating mode:
- N/C or N/O operation (N/O operation) *

Electrical endurance, number of cycles: 10,000

Contact data acc. to IEC 60947-5-1

Utilization category: AC-13 AC-14 DC-12 DC-12 DC-12
Rated operational voltage:
- 230 V
- 230 V
- 24 V
- 110 V
- 220 V
Rated operational current (common alarm relay):
- 5 A
- 3 A
- 1 A
- 0.2 A
- 0.1 A
Rated operational current (alarm relay):
- 2 A
- 0.5 A
- 5 A
- 0.2 A
- 0.1 A
Minimum contact rating:
1 mA at AC/DC ≥ 10 V

Environment/EMC

EMC:
- IEC 61326-1
- Operating temperature: -25 °C

Climatic class acc. to IEC 60721

Stationary use (IEC 60721-3-3):
- 3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2):
- 2K5 (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):
- 2M2
Long-term storage (IEC 60721-3-1):
- 1M3

Connection

Connection:
screw-type terminals

Connection properties:
- Rigid/flexible/conductor sizes: 0.2...4/0.2...2.5 mm²/AWG 24...12
- Multi-conductor connection (2 conductors with the same cross section):
  - Rigid/flexible: 0.2...1.5/0.2...1.5 mm²
  - Stripping length: 8...9 mm
  - Tightening torque: 0.5...0.6 Nm

Other

Operating mode: continuous operation

Mounting:
display-oriented

Degree of protection, internal components (IEC 60529):
- IP30
Degree of protection, terminals (IEC 60529):
- IP20

Enclosure material: polycarbonate

Flammability class: UL94V-0

Screw fixing: 2 x M4

DIN rail mounting acc. to:
- IEC 60715

Power consumption: ≤ 10 VA

Weight: ≤ 360 g

(*) Factory setting
Multi-functional load current evaluator LINETRAXX® CMS460-D

Dimension diagrams (dimensions in mm)

Wiring diagrams

1. A1, A2 Connection of supply voltage US (see ordering information), 6 A fuse recommended.
2. I, k1…k12 Connection of measuring current transformers CT1…CT12
3. A, B RS-485 interface with BMS protocol
4. R External reset button “R” (N/O contact)
5. T, T/R External test button “T” (N/O contact).
   The external “T/R” buttons of several devices must not be connected to one another.
6. C11, C12, C14 Alarm relay “K1”: Alarm 1, common alarm for alarm, prewarning, device error, ext. alarm (adjustable)
7. C21, C22, C24 Alarm relay “K2”: Alarm 2, common alarm for alarm, prewarning, device error, ext. alarm (adjustable)
8. R<sub>en/off</sub> 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 memory
- 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**

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

**Ordering information**

| Supply voltage ¹ U₅ | Type | Art. No. 
<table>
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<tr>
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<tr>
<td></td>
<td>Screw-type terminal</td>
<td>Push-wire terminal</td>
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<tr>
<td><strong>AC</strong></td>
<td><strong>DC</strong></td>
<td></td>
</tr>
<tr>
<td>16…72 V, 15…460 Hz</td>
<td>9.6…94 V</td>
<td>GM420-D-1</td>
</tr>
<tr>
<td>70…300 V, 15…460 Hz</td>
<td>70…300 V</td>
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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>B98060008</td>
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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

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<td>Rated impulse voltage/pollution degree</td>
<td>4 kV/3 kV</td>
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Protective separation (reinforced insulation) between: (A1, A2) - (E, KE) - (11-12-14) - (21-22-24)

Voltage test acc. to IEC 61010-1:
- (E, KE) - (A1-A2) - (11-12-14) - (21-22-24)
- 3.2 kV
- (A1-A2) - (11-12-14) - (21-22-24)
- 2.21 kV

Supply voltage

Supply voltage U<sub>S</sub>: see ordering information
Frequency range U<sub>f</sub>: see ordering information
Power consumption ≤ 4 VA

Measuring circuit

Loop resistance R<sub>m</sub>:
- Measuring range R<sub>m</sub> 0…100 Ω
- Measuring current I<sub>m</sub> DC 20 mA
- Measuring voltage U<sub>m</sub> ≤ DC 24 V

Extraneous voltage U<sub>f</sub>:
- Measuring range U<sub>f</sub> AC 0…50 V
- Rated frequency f<sub>S</sub> 42…460 Hz
- Disconnection of the measuring loop at U<sub>f</sub> ≥ 12 V
- Reconection of the measuring loop ≤ 10 V
- Permissible extraneous voltage U<sub>f</sub> ≤ 440 V
- Permissible extraneous DC voltage, without influence on the measurement DC 0 V

Response values

Loop resistance > R (Alarm 1) 0.1…100 Ω
Resolution of setting R = 0.1…10 Ω
Resolution of setting R = 10…100 Ω

Preset function:
- Loop resistance (> R) = ((R<sub>m</sub> + 0.5 Ω) x 1.5)<sup>*</sup>
- Relative uncertainty 0…1 Ω ±20 %, ±1 digit
- Relative uncertainty 1…100 Ω ±5 %, ±1 digit
- Hysteresis > R 1…40 % (25 %)<sup>*</sup>
- Extraneous voltage > U (Alarm 2) 1…50 V (25 V)
- Resolution of setting U<sub>f</sub> 1…50 V (25 V)
- Relative uncertainty U<sub>f</sub> ( > U) in the range of 50/60 Hz ±2 %, ±1 digit
- Relative uncertainty U<sub>f</sub> ( > U) in the range of 42…460 Hz ±10 %, ±1 digit
- Hysteresis > U 1…40 % (5 %)<sup>*</sup>

Time response

Start-up delay t 0…99 s (0 s)<sup>*</sup>
Response delay t<sub>res1/2</sub> 0…99 s (0 s)<sup>*</sup>
Delay on release t<sub>del</sub> 0…99 s (0.5 s)<sup>*</sup>

Operating time

In the case of loop interruption (R > 50 kΩ) t<sub>ES</sub> ≤ 40 ms
In the case of the closed loop (> R) t<sub>ES</sub> ≤ 500 ms
In the case of extraneous voltage (> U) and overload (OL) t<sub>ES</sub> ≤ 100 ms
Response time t<sub>ES</sub> t<sub>ES</sub> = t<sub>ES</sub> + t<sub>ES</sub><sup>*</sup>
Recovery time t<sub>ES</sub> ≤ 300 ms
Recovery time t<sub>ES</sub> after safety shutdown ≤ 1 s

Displays, memory

Display LC display, multifunctional, not illuminated
Display range, measuring value R<sub>m</sub> 0…100 Ω
Display range, measuring value U<sub>f</sub> AC 0…50 V
Operating uncertainty, loop resistance 0…1 Ω ±20 %, ±1 digit
Operating uncertainty loop resistance 1…100 Ω ±5 %, ±1 digit
Operating uncertainty voltage in the range of 50/60 Hz ±2 %, ±1 digit
Operating uncertainty voltage in the range of 42…460 Hz ±10 %, ±1 digits
History memory (HIS) for the first alarm value data record measured values
Password off/off (999 (off))<sup>*</sup>
Fault memory (M) alarm relay on/off (on)<sup>*</sup>

Switching elements

Number 2 x 1 changeover contacts (K1, K2)
Operating principle N/C operation or N/O operation
K1: Err, > R, OL, > U, HES (device error, loop resistance, measuring current disconnection: N/O operation n.o.)<sup>*</sup>
K2: Err, > R, OL, > U, HES (overvoltage: N/O operation n.o.)

Electrical endurance, number of cycles 10,000

Contact data acc. to IEC 60947-5-1

Utilisation category AC-13 AC-14 DC-12 DC-12 DC-12
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
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

Connection type screw-type terminal or push-wire terminal

Screw-type terminal

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

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)
  - Stopping 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 DIN EN 60715
Flammability class UL94 V-0
Document number 000112
Weight ≤ 150 g

( )* = factory setting
5.2 Measuring and monitoring relays | Application-specific selection – Loop resistance

**Loop monitor LINETRAXX® GM420**

---

### Wiring diagram

1. **A1, A2** Supply voltage $U_s$ (see ordering details) via fuse
2. **E** Connection of E to the PE conductor
3. **KE** Connection of KE to the loads or the monitoring conductor
4. **11, 12, 14** Alarm relay “K1”:
   - Alarm 1 configurable for $> R$, OL, $> U_i$, ERROR, TEST
5. **21, 22, 24** Alarm relay “K2”:
   - Alarm 2 configurable for $> R$, OL, $> U_i$, ERROR, TEST
6. Line protection by a fuse in accordance with DIN VDE 0100-430/IEC 60364-4-43 (6 A fuse recommended). In case of supply (A1/A2) from an IT system, both lines have to be protected by a fuse.
Insulation monitoring devices
ISOMETER®

Equipment for insulation fault location
ISOSCAN®

Residual current monitoring systems
LINETRAXX®

Neutral Grounding Resistor Monitor (NGR)
LINETRAXX®

Power Quality and Energy Measurement
LINETRAXX®

Measuring and monitoring relays
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>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>
</tr>
<tr>
<td>Nominal system voltage $U_n$</td>
<td>AC 0…1150 V, DC 0…1760 V</td>
<td>AC 0…1300 V / AC 0…1650 V</td>
<td>AC/3(N)AC 0…7200 V</td>
<td>AC, 3(N)AC, DC 0…7.2 kV</td>
<td>AC, 3(N)AC, DC 0…15.5 kV</td>
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<td>IRDH275/375</td>
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<td>IRDH275BM</td>
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<td>IR420-D64</td>
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<td>iso685-D</td>
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<tr>
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<td>iso685-S</td>
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## Device overview measuring current transformers

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<td>CT type</td>
<td></td>
<td></td>
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<tr>
<td>Dimension (mm)</td>
<td>Inside diameter</td>
<td>Width x height</td>
<td>Strip length</td>
</tr>
<tr>
<td>W0-S20…W5-S210, W10/600</td>
<td>20</td>
<td>35</td>
<td>170</td>
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<tr>
<td>CTAC…</td>
<td>20</td>
<td>35</td>
<td>250</td>
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<tr>
<td>CTUB100-CTBC…</td>
<td>20</td>
<td>35</td>
<td>500</td>
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<td>Device family</td>
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### Characteristic

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<thead>
<tr>
<th></th>
<th>split-core</th>
<th>split-core</th>
<th>flexible</th>
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#### Dimensions (mm)

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<th>Inside diameter</th>
<th>Width x height</th>
<th>Strip length</th>
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<tbody>
<tr>
<td>70 x 175</td>
<td>10 20 35 70 105 140 210</td>
<td>170 250 500 800 1200 1800</td>
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</tr>
<tr>
<td>115 x 305</td>
<td></td>
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<tr>
<td>150 x 350</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>200 x 500</td>
<td></td>
<td></td>
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<tr>
<td>20 x 30 50 x 80 80 x 120</td>
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<tr>
<td>20 x 30 50 x 80 80 x 120</td>
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<td>50 x 80 80 x 80 80 x 120 80 x 160</td>
<td>170 250 500 800 1200 1800</td>
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Device overview isolating transformers, transformers for operating theatre lights

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<tr>
<td><strong>Application</strong></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>
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<tr>
<td><strong>Type of distribution system</strong></td>
<td>single-phase</td>
<td>three-phase</td>
<td>single-phase</td>
</tr>
<tr>
<td><strong>Input</strong></td>
<td>AC 230 V</td>
<td>3AC 400 V</td>
<td>AC 230 V (±5 %, ±10 %)</td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td>AC 230 V</td>
<td>3NAC 230 V</td>
<td>AC 23...28 V</td>
</tr>
<tr>
<td><strong>Frequency range</strong></td>
<td>50...60 Hz</td>
<td>50...60 Hz</td>
<td>50...60 Hz</td>
</tr>
<tr>
<td><strong>Power</strong></td>
<td>3150 VA 4000 VA 5000 VA 6300 VA 8000 VA 10000 VA</td>
<td>2000 VA 3150 VA 4000 VA 5000 VA 6300 VA 8000 VA 10000 VA</td>
<td>120 VA 160 VA 280 VA 400 VA 630 VA 1000 VA</td>
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<tr>
<td><strong>Design type</strong></td>
<td>vertical</td>
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<tr>
<td></td>
<td>horizontal</td>
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<tr>
<td></td>
<td>encapsulated (protection class B)</td>
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Device overview measuring transducer

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Device overview power supply units

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<td>AC 85…264 V, 45…65 Hz DC 95…250 V</td>
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<td>AC 90…264 V</td>
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<td>AC 230 V, 50…60 Hz</td>
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<td>AC 127 V, 50…60 Hz</td>
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Device overview measuring instruments

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<td>for measuring current transformers</td>
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<td>0…20 mA</td>
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<td>0…400 μA</td>
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<tr>
<td>369</td>
<td>0…20 mA</td>
<td>369</td>
<td>0…20 mA</td>
<td>369</td>
<td>0…20 mA</td>
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<td>96 x 96</td>
<td>96 x 96</td>
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<td>IRDH275/375</td>
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<td>IRDH275B/375B</td>
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<td>IRDH575</td>
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<td>iso685…</td>
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### Device overview interface converters and repeaters

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<tr>
<td>DI-1DL</td>
<td><img src="image" alt="DI-1DL" /></td>
<td></td>
</tr>
<tr>
<td>DI-2USB</td>
<td><img src="image" alt="DI-2USB" /></td>
<td></td>
</tr>
</tbody>
</table>

#### Application
- **DI-1DL**: Interface repeater BMS bus
- **DI-2USB**: Interface converter BMS/USB

#### Input
- **DI-1DL**: RS-485, screw-type terminal, ≤ 1200 m
- **DI-2USB**: RS-485, screw-type terminal, ≤ 1200 m

#### Output
- **DI-1DL**: RS-485, screw-type terminal, ≤ 1200 m
- **DI-2USB**: USB, ≤ 5 m

#### Expansion of bus devices
- **DI-1DL**: ≤ 30
- **DI-2USB**: ≤ 30

#### Supply voltage U_s
- **DI-1DL**: AC 85…260 V, 50…60 Hz
- **DI-2USB**: via USB

#### Particular features
- **DI-1DL**: Driver CD

### Device overview Relay module

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<th>Relay module</th>
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<tbody>
<tr>
<td>IOM441</td>
<td><img src="image" alt="IOM441" /></td>
<td></td>
</tr>
</tbody>
</table>

#### Application
- **IOM441**: for extension of EDS44x applications

#### Relay number
- **IOM441**: 12 N/O contacts

#### Supply voltage U_s
- **IOM441**: via BB bus

#### Interface
- **IOM441**: BB bus

#### Connection
- **IOM441**: push-wire terminal / 80bus PCB

#### Relay operation
- **IOM441**: configurable

### Device overview Charge Controller

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<th>Charge Controller</th>
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<tbody>
<tr>
<td>CCG12</td>
<td><img src="image" alt="CCG12" /></td>
<td></td>
</tr>
</tbody>
</table>

#### Application
- **CCG12**: Charge Controller

#### DC 6 mA sensor
- **CCG12**: [ ]

#### Supply voltage U_s
- **CCG12**: DC 12 V

#### Interface
- **CCG12**: Modbus

#### Modem
- **CCG12**: 3G modem (optional)
## Device overview gateways

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<th>COMTRAXX® COM462RTU</th>
<th>COMTRAXX® COM465IP</th>
<th>COMTRAXX® COM465DP</th>
<th>COMTRAXX® COM465ID</th>
<th>COMTRAXX® CP700</th>
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<td>Condition Monitor/Gateway</td>
<td>Condition Monitor/PROFIBUS-Gateway</td>
<td>Condition Monitor/Gateway</td>
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<tr>
<td><strong>Protocol input</strong></td>
<td>BMS</td>
<td>BMS/Modbus RTU/TCP</td>
<td>BMS/Modbus RTU/TCP</td>
<td>isoData/Modbus TCP</td>
</tr>
<tr>
<td><strong>Protocol output</strong></td>
<td>Modbus RTU</td>
<td>Ethernet/Modbus TCP</td>
<td>Ethernet/Modbus TCP, PROFIBUS DP</td>
<td>Ethernet/Modbus TCP</td>
</tr>
<tr>
<td><strong>Display</strong></td>
<td>LCD/LED</td>
<td>LED</td>
<td>LED</td>
<td>LED</td>
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<tr>
<td><strong>Alarm messages</strong></td>
<td>1, 2)</td>
<td>1, 2)</td>
<td>1, 2)</td>
<td>1, 2)</td>
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<tr>
<td><strong>Measured values</strong></td>
<td>1, 2)</td>
<td>1, 2)</td>
<td>1, 2)</td>
<td>1, 2)</td>
</tr>
<tr>
<td><strong>Device parameter setting</strong></td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
</tr>
<tr>
<td><strong>Alarm list</strong></td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
</tr>
<tr>
<td><strong>History memory</strong></td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
</tr>
<tr>
<td><strong>Diagrams</strong></td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
</tr>
<tr>
<td><strong>Visualisation</strong></td>
<td>1)</td>
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<td>1)</td>
<td>1)</td>
</tr>
<tr>
<td><strong>E-mail notification</strong></td>
<td>1, 4)</td>
<td>1, 4)</td>
<td>1, 4)</td>
<td>1, 4)</td>
</tr>
<tr>
<td><strong>Device tests</strong></td>
<td>1, 2)</td>
<td>1, 2)</td>
<td>1, 2)</td>
<td>1, 2)</td>
</tr>
<tr>
<td><strong>PEM… and energy meter support</strong></td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
</tr>
<tr>
<td><strong>SNMP</strong></td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
</tr>
<tr>
<td><strong>Data logger</strong></td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
</tr>
<tr>
<td><strong>Connection</strong></td>
<td>BMS</td>
<td>screw-type terminal</td>
<td>screw-type terminal</td>
<td>screw-type terminal</td>
</tr>
<tr>
<td><strong>Modbus RTU</strong></td>
<td>screw-type terminal</td>
<td>screw-type terminal</td>
<td>screw-type terminal</td>
<td>screw-type terminal</td>
</tr>
<tr>
<td><strong>isoData</strong></td>
<td>screw-type terminal</td>
<td>screw-type terminal</td>
<td>screw-type terminal</td>
<td>screw-type terminal</td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td>screw-type terminal</td>
<td>RJ 45</td>
<td>RJ 45, Sub-D 9-pole</td>
<td>RJ 45</td>
</tr>
<tr>
<td><strong>Supply voltage U5</strong></td>
<td>AC/DC 76…276 V</td>
<td>AC/DC 24…240 V, DC 24V</td>
<td>AC/DC 24…240 V, DC 24V</td>
<td>AC/DC 24…240 V</td>
</tr>
<tr>
<td><strong>Browser</strong></td>
<td>Internet Explorer, Chrome, Firefox etc.</td>
<td>Internet Explorer, Chrome, Firefox etc.</td>
<td>Internet Explorer, Chrome, Firefox etc.</td>
<td>Internet Explorer, Chrome, Firefox etc.</td>
</tr>
</tbody>
</table>

1) Functions available on the web server – accessible via a personal computer with browser
2) Available via the protocol
3) On the device’s own LC display
4) TLS/SSL Support
## Device overview alarm indicator and test combinations

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<th>COMTRAXX® MK800 (D4000)</th>
<th>COMTRAXX® MK2430</th>
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<td>RCMS Residual current monitoring system</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>EDS insulation fault locator</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Installation type</strong></td>
<td>Flush-mounting</td>
<td></td>
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<td></td>
<td>Cavity wall mounting</td>
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<tr>
<td></td>
<td>Cable-duct mounting</td>
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<td></td>
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<td></td>
<td>Panel mounting</td>
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<td></td>
<td>Surface mounting</td>
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<td><strong>Inputs/outputs</strong></td>
<td>Digital inputs (potential free)</td>
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<td>0/16</td>
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<td>N/O or N/C operation</td>
<td>selectable</td>
<td>selectable</td>
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<td></td>
<td>Relay outputs</td>
<td>1</td>
<td>1</td>
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<td></td>
<td>N/O or N/C operation</td>
<td>programmable</td>
<td>programmable</td>
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<td></td>
<td>Common alarm</td>
<td>programmable</td>
<td>programmable</td>
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<td>System fault alarm</td>
<td>programmable</td>
<td>programmable</td>
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<td><strong>Parameter setting/text message</strong></td>
<td>Languages selectable</td>
<td>25</td>
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<td>Standard display</td>
<td>Graphic LCD (7&quot;, 15.6&quot;, 24&quot;)</td>
<td>4 x 20 characters</td>
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<td>Additional text display</td>
<td>3 x 20 characters</td>
<td>3 x 20 characters</td>
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<td>Standard texts</td>
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<td>History memory, maximum number of data records</td>
<td>1000</td>
<td>1000</td>
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<td>Real-time clock</td>
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<td>Parameterisation software</td>
<td>integrated</td>
<td>TMK-Set V 4.xx (USB, BMS)</td>
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<td>Messages/alarms, medical gases</td>
<td>acc. to EN475, EN737-3</td>
<td>acc. to EN475, EN737-3</td>
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<td>1…150</td>
<td>internal: 1…150, external: 1…99</td>
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<td>Master redundancy, BMS internal</td>
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<tr>
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<td>Master redundancy, BMS external</td>
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<td>USB</td>
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<td>Ethernet (TCP/IP)</td>
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<tr>
<td><strong>Supply voltage U_s</strong></td>
<td>DC 24 V/AC 250 V</td>
<td>AC/DC 24 V</td>
<td>AC/DC 24 V</td>
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<tr>
<td><strong>Stored energy time in the event of power failure</strong></td>
<td>≥ 15 s</td>
<td>≤ 2 s</td>
<td>≤ 15 s</td>
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## Device overview POWERSCOUT®

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<tr>
<td>Logger</td>
<td>Unlimited (all measured values)</td>
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<td>Real-time capable (alerting)</td>
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<td>Parameterisation of sensors/devices</td>
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<td>Cloud</td>
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<td>On-premise installation</td>
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<tr>
<td>Max. number of devices/data points</td>
<td>Unlimited</td>
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<td>Event aggregation on the main page</td>
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<td>Configuration of an individual main page</td>
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<td>Export data</td>
<td>csv export</td>
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<td>Import data</td>
<td>csv import</td>
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<td>Sankey diagram</td>
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<td>Bar graph</td>
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</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

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<th>Art. No.</th>
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<td>B915576</td>
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<tr>
<td>AC 0…1760 V</td>
<td>AGH150W-4</td>
<td>B98018006</td>
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</table>

Technical data

Insulation coordination acc. to DIN EN 61800-5-1 (VDE 0160-105-1)

**AGH150W**
- Rated insulation voltage AC 1000 V
- Voltage test acc. to IEC 60255 12 kV

**AGH150W-4**
- Rated insulation voltage AC 1600 V
- Voltage test acc. to IEC 60255 17 kV

Voltage test acc. to DIN EN 61800-5-1 (VDE 0160-105-1)

**AGH150W**
- Voltage impulse test (basic insulation) ≥ AC 8 kV
- AC voltage test (basic insulation) ≥ AC 4.3 kV

**AGH150W-4**
- Voltage impulse test (basic insulation) ≥ AC 11 kV
- AC voltage test (basic insulation) ≥ AC 6.6 kV

Voltage ranges

**AGH150W**
- Nominal system voltage $U_n$ AC 0…1150 V, DC 0…1100 V
- Frequency range of $f_{n, [max]}$ DC 1…460 Hz
- Overvoltage category/rated impulse voltage CAT III≥2.8 kV
- Internal DC resistance $R_i$ ≥80 kΩ
- Tolerance of internal DC resistance $R_i$ ±2 kΩ

**AGH150W-4**
- Nominal system voltage $U_n$ AC 0…1150 V, DC 0…1760 V
- Frequency range of $f_{n, [max]}$ DC 1…460 Hz
- Overvoltage category/rated impulse voltage CAT III≥11 kV
- Internal DC resistance $R_i$ ≥160 kΩ
- Tolerance of internal DC resistance $R_i$ ±4 kΩ

Environment

- Shock resistance IEC 60068-2-27 (device in operation) 15 g/11 ms
- Bumping IEC 60068-2-29 (transport) 40 g/6 ms
- Vibration resistance IEC 60068-2-6 (device in operation) 1 g/10…150 Hz
- Vibration resistance IEC 60068-2-6 (transport) 2 g/10…150 Hz
- Ambient temperature (during operation) -10…+55 °C
- Ambient temperature (during storage) -40…+70 °C
- Climatic class acc. to DIN IEC 60721-3-3 3K5 (except condensation and formation of ice)

Connection

- Connection flat terminals
- Connection properties rigid/flexible 0.2…4/0.2…2.5 mm²

Other

- Operating mode continuous operation
- Mounting any position
- Degree of protection, internal components (DIN EN 60529) IP30
- Degree of protection, terminals (DIN EN 60529) IP20
- DIN rail mounting acc. to IEC 60715
- Flammability class UL94 V-0
- Weight ≤ 900 g

* The tolerance range affects the measured value of the insulation monitoring device used and must be taken into account accordingly
**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**

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

**Ordering information**

<table>
<thead>
<tr>
<th>Nominal system voltage U_n</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0…1650 V/0…1300 V</td>
<td>AGH204S-4</td>
<td>B914013</td>
</tr>
</tbody>
</table>

**Technical data**

- **Insulation coordination acc. to DIN EN 61800-5-1 (VDE 0160-105-1)**
  - Rated insulation voltage: AC 1500 V

- **Voltage test acc. to DIN EN 61800-5-1 (VDE 0160-105-1)**
  - Impulse voltage test (basic insulation) ≥ AC 10.4 kV
  - AC voltage test (basic insulation) ≥ AC 5 kV
  - Partial discharge test ≥ 3 kV

- **Voltage ranges**
  - Nominal system voltage U_n (including DC components) 0…1300 V
  - Nominal system voltage U_n (AC only) 0…1650 V
  - Nominal frequency f_n 50…400 Hz
  - Overvoltage category/rated impulse voltage III/≥10.4 kV

- **Internal DC resistance R_i**
  - Coupling to AK80 80 kΩ
  - Coupling to AK160 160 kΩ

- **Environment**
  - Shock resistance IEC 60068-2-27 (device in operation) 15 g/11 ms
  - Bumping IEC 60068-2-29 (transport) 40 g/6 ms
  - Vibration resistance IEC 60068-2-6 (device in operation) 1 g/10…150 Hz
  - Vibration resistance IEC 60068-2-6 (transport) 2 g/10…150 Hz
  - Ambient temperature (during operation) -10…+55 °C
  - Ambient temperature (during storage) -40…+70 °C
  - Climatic class acc. to DIN IEC 60721-3-3 3K5 (except condensation and formation of ice)

- **Connection**
  - Connection screw-type terminals
  - Connection properties rigid/flexible 0.2…4 mm²/0.2…2.5 mm²
  - Tightening torque 0.5 Nm
  - Conductor sizes (AWG) 24…12
  - Length of the connecting lead between the ISOMETER® and AGH ≤ 0.5 m

- **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
  - Type of enclosure X112, free from halogen
  - Screw mounting 2 x M4
  - DIN rail mounting DIN EN 60715/IEC 60715
  - Flammability class UL94 HB
  - Documentation number D00094
  - Weight ≤ 1350 g

**Dimension diagram** (dimensions in mm)

**Wiring diagram**
**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**

![Approvals logo]

**Further information**

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

**Ordering information**

<table>
<thead>
<tr>
<th>Nominal system voltage $U_n$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(3)AC 0…7200 V</td>
<td>AGH520S</td>
<td>B913033</td>
</tr>
</tbody>
</table>

**Technical data**

- **Insulation coordination acc. to IEC 61800-5-1**
  - Operating voltage: AC 6.3 kV
- **Voltage test according to IEC 61800-5-1**
  - Overvoltage category/impulse voltage test (basic insulation): III /AC 35 kV
  - AC voltage test (basic insulation): AC 17.5 kV
  - Partial discharge test: 12 kV
- **Voltage ranges**
  - Nominal system voltage $U_n$: AC, 3(N)AC 0…7.2 kV
  - Nominal system voltage $U_n$ for UL applications: AC, 3(N)AC 0…6 kV
  - Nominal frequency $f_n$: 50…400 Hz
  - Internal DC resistance $R_i$: $\geq 80$ kΩ
  - Impedance $Z_i$ at 7.2 kV and 50 Hz: $\geq 6$ MΩ
- **Environmental conditions**
  - Classification of mechanical conditions acc. to IEC 60721:
    - Stationary use (IEC 60721-3-3): 3M4
    - Transport (IEC 60721-3-2): 2M2
    - Storage (IEC 60721-3-1): 1M3
  - Ambient temperature (during operation): -10…+55 °C
  - Ambient temperature for UL applications (during operation): -10…+45 °C
  - Ambient temperature (during storage): -20…+70 °C
  - Climatic class acc. to IEC 60721-3-3: 3K5 (except condensation and formation of ice)
- **Connection**
  - Connection terminals 2 (medium voltage): screw-type terminal
  - Connection terminals 3, 4, 5: screw-type terminals
  - Connection properties: rigid/flexible
  - Tightening torque: 2.9 Nm
- **General data**
  - Operating mode: continuous operation
  - Position: any position
  - Degree of protection, internal components (DIN EN 60529): IP64
  - Degree of protection, terminals (DIN EN 60529): IP20
  - Type of enclosure: resin-encapsulated block
  - Screw mounting: 4 x M5
  - Flammability class: UL94 HB
  - Documentation number: D00073
  - Weight: ≤ 4500 g

**Dimension diagram (dimensions in mm)**

**Wiring diagram**

- UL 3(N)AC 0…7200 V, 50…400 Hz
- 3 AC terminal 2 to L1, L2, L3
- 3(N)AC terminal 2 to N
- ISOMETER®
**Typical applications**

- Extension of the nominal voltage range to AC/DC 0…15.5 kV for the ISOMETER® IRDH275BM-7

**Approvals**

![CE EAC]

**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><strong>AC/DC</strong></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>B913060</td>
</tr>
<tr>
<td>2000 mm</td>
<td>AGH675S-7-2000</td>
<td>B913061</td>
<td></td>
</tr>
<tr>
<td>0…15.5 kV, 0…460 Hz</td>
<td>500 mm</td>
<td>AGH675S-7-MV15-500</td>
<td>B913058</td>
</tr>
</tbody>
</table>

**Technical data**

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

**AGH675S-7**
- Rated insulation voltage: AC 7.2 kV
- Voltage test according to IEC 61800-5-1
  - Type test:
    - AC voltage test (basic insulation): 40 kV
    - Partial discharge test: 14 kV
- Voltage ranges
  - Nominal system voltage $U_n$: AC, 3(N)AC, DC 0…7.2 kV
  - Nominal frequency $f_n$: 0…460 Hz
  - Internal DC resistance $R_{i}$: $\geq 2.39 \, \Omega$

**AGH675S-7-MV15**
- Rated insulation voltage: AC 15.5 kV
- Voltage test according to IEC 61800-5-1
  - Type test:
    - Impulse voltage test (basic insulation): 111 kV
    - AC voltage test (basic insulation): 70 kV
    - Partial discharge test: 29 kV
  - Routine test:
    - AC voltage test: 40 kV
- Voltage ranges
  - Nominal system voltage $U_n$: AC, 3(N)AC, DC 0…15.5 kV
  - Nominal frequency $f_n$: 0…460 Hz
  - Internal DC resistance $R_{i}$: $\geq 4.7 \, \Omega$

**Environment/EMC**

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

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

- Stationary use (IEC 60721-3-3): 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 (3M7 Y axis)
- 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 eyelet: M4
- Connection type terminals 3, 4, 5: screw-type terminals
- Connection
  - rigid/flexible: 0.2…4 mm²/0.2…2.5 mm²
  - flexible connector sleeve: 0.25…2.5 mm²

**Other**

- Operating mode: continuous operation
- Degree of protection, internal components (DIN EN 60529): IP 64
- Degree of protection, terminals (DIN EN 60529): IP 20
- Type of enclosure: resin-encapsulated block
- Flammability class: UL94 HB
- Documentation number: D00095
- Weight: $\leq 5100 \, g$
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.

### Technical data

#### Insulation coordination acc. to IEC 61800-5-1
- Rated insulation voltage: AC 12 kV

#### Voltage test acc. to IEC 61800-5-1
- Type test:
  - Voltage impulse test: ≥ 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 Zj 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
- Climatic class acc. to IEC 60721-3-3: 3K5 (except condensation and formation of ice)

### Connection
- Connection medium voltage: high-voltage cable (encapsulated on the device side)
- Connection, flexible with ring terminal: MB
- Connection terminals 3, 4, 5: screw terminals
- Connection properties: ng/flexible
- Nominal system voltage Un: 0.2…4 mm²/0.2…2.5 mm²

### Other
- Operating mode: continuous operation
- 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 HB
- Documentation number: D00096
- Weight: ≤ 8400 g

### Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage Un AC, 3(N)AC 0…12 kV</th>
<th>Cable length 2000 mm</th>
<th>Type AGH676S-4</th>
<th>Art. No. B913055</th>
</tr>
</thead>
</table>

**System components | Individual components and accessories | Coupling devices for ISOMETER® and RCM**

**BENDER**

2020/2021
### Dimension diagram (dimensions in mm)

![Dimension diagram](image)

### Wiring diagram offline (IR420-D64)

![Wiring diagram offline](image)

### Wiring diagram online (iso685/IRDH275-4xx/IRDH375-4xx)

![Wiring diagram online](image)
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>Approvals</th>
<th>Type</th>
<th>Art. No.</th>
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<td>EAC</td>
<td>LR</td>
</tr>
<tr>
<td>10 mm</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>20 mm</td>
<td>–</td>
<td>III</td>
<td>III</td>
</tr>
<tr>
<td>35 mm</td>
<td>III</td>
<td>III</td>
<td>II</td>
</tr>
<tr>
<td>70 mm</td>
<td>III</td>
<td>III</td>
<td>–</td>
</tr>
<tr>
<td>105 mm</td>
<td>III</td>
<td>III</td>
<td>–</td>
</tr>
<tr>
<td>140 mm</td>
<td>III</td>
<td>III</td>
<td>–</td>
</tr>
<tr>
<td>210 mm</td>
<td>III</td>
<td>III</td>
<td>–</td>
</tr>
</tbody>
</table>
### Technical data

#### Insulation coordination acc. to IEC 60044-1

- Highest system voltage for electrical equipment \( U_{m} \): AC 720 V
- Rated impulse withstand voltage \( U_{\text{imp}} \): 3 kV

#### Measuring circuit

- Rated transformation ratio: 600/1
- Rated burden: 180 \( \Omega \) (18 \( \Omega \) at 100 A)
- Phase displacement: \(<4^\circ\)
- Rated primary current: \( \leq 10 \text{ A} \) (100 A)
- Rated primary current: \( \geq 10 \text{ mA} \)
- Nominal power: 50 mA/kVA
- Rated frequency: 15...600 Hz
- Internal resistance: 5...8 \( \Omega \)
- Secondary overvoltage protection: with suppressor diode P6K6V8CP
- Accuracy class: 3
- Rated continuous thermal current: 100 A
- Rated short-time thermal current: 14 kA 1 s
- Rated dynamic current: 35 kA 30 ms

#### Environment

- Shock resistance IEC 60068-2-27 (device in operation): 15 g/11 ms
- Bumping IEC 60068-2-29 (transport): 40 g/6 ms
- Vibration resistance IEC 60068-2-6 (device in operation)
  - W1/S1...W5/S10: 1 g/10...150 Hz
  - W4/S140, W5/S210: 1 g/10...150 Hz/0.075 mm
- Vibration resistance IEC 60068-2-6 (device not in operation): 2 g/10...150 Hz
- Ambient temperature (during operation/during storage): -10...+50 °C/-40...+70 °C
- Climatic class acc. to DIN IEC 60721-3-3: 3K5

#### Connection

- Connection: rigd/flexible 0.2.../4...2.5 mm²
- Conductor sizes (AWG): 24...12
- Flexible with ferrules with/without plastic sleeve 0.25...2.5 mm²
- Shileded cable ≥ 0.6 mm²
- Recommended cable: J-Y(St)Y min. 2 x 0.6

#### Other

- Operating mode: continuous operation
- Mounting: any position
- Degree of protection, internal components (DIN EN 60529): IP40
- Degree of protection, terminals (DIN EN 60529): IP20
- Screw mounting: M5
- Flammability class: UL94 V-0
- Documentation number:
  - D00142 (W(0-5)-S)
  - D00143 (W10)

### Dimension diagrams

**Type W10/600**

- Dimensions (mm): A: 37, B: 10, C: 18, D: –, E: –, F: –, G: 85 g

**Type W0-S20**

- Dimensions (mm): A: 32.4, B: 60, C: 46, D: 23.2, E: 20, F: –, G: 70 g

**Type W1-S35...W5-S210**


### 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>Weight</th>
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</thead>
<tbody>
<tr>
<td>W10/600</td>
<td>ø37</td>
<td>ø10</td>
<td>18</td>
<td>–</td>
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<td>–</td>
<td>–</td>
<td>85 g</td>
</tr>
<tr>
<td>W0-S20</td>
<td>32.4</td>
<td>60</td>
<td>ø46</td>
<td>23.2</td>
<td>ø20</td>
<td>–</td>
<td>–</td>
<td>70 g</td>
</tr>
<tr>
<td>W1-S35</td>
<td>100</td>
<td>79</td>
<td>26</td>
<td>48.5</td>
<td>33</td>
<td>46</td>
<td>ø35</td>
<td>250 g</td>
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<tr>
<td>W2-S70</td>
<td>130</td>
<td>110</td>
<td>32</td>
<td>66</td>
<td>33</td>
<td>46</td>
<td>ø70</td>
<td>380 g</td>
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<tr>
<td>W3-S105</td>
<td>170</td>
<td>146</td>
<td>38</td>
<td>94</td>
<td>33</td>
<td>46</td>
<td>ø105</td>
<td>700 g</td>
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<tr>
<td>W4-S140</td>
<td>220</td>
<td>196</td>
<td>48.5</td>
<td>123</td>
<td>33</td>
<td>46</td>
<td>ø140</td>
<td>1500 g</td>
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<td>W5-S210</td>
<td>299</td>
<td>284</td>
<td>69</td>
<td>161</td>
<td>33</td>
<td>46</td>
<td>ø210</td>
<td>2500 g</td>
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</tbody>
</table>
LINETRAXX® CTAC...
Measuring current transformers

Device features

Measuring current transformers CTAC...
• For RCMS460/490 residual current monitoring systems
• For RCM420 residual current monitors
• For EDS470, EDS460/490 and EDS440 insulation fault locators in AC and DC systems

Measuring current transformers CTAC…/01
• For EDS461/EDS491 and EDS441 insulation fault locators

Typical applications
• For residual current monitoring systems of the series RCM or RCMS
• Suitable for use in insulation fault location for IT systems (EDS)

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

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Mounting</th>
<th>Inside diameter</th>
<th>Type</th>
<th>Art. No.</th>
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<tbody>
<tr>
<td>Mounting brackets, DIN rail</td>
<td>20 mm</td>
<td>CTAC20</td>
<td>B98110005</td>
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<td></td>
<td>35 mm</td>
<td>CTAC35</td>
<td>B98110007</td>
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<td>60 mm</td>
<td>CTAC60</td>
<td>B98110017</td>
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<td>Mounting brackets</td>
<td>120 mm</td>
<td>CTAC120</td>
<td>B98110019</td>
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<tr>
<td></td>
<td>210 mm</td>
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<td>B98110020</td>
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</table>

1) For EDS461/491 and EDS473/474 insulation fault locators

Accessories

<table>
<thead>
<tr>
<th>Type designation</th>
<th>Art. No.</th>
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<tbody>
<tr>
<td>Snap-on mounting for CTAC20 and CTAC20/01</td>
<td>B91080111</td>
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<tr>
<td>Snap-on mounting for CTAC35 and CTAC35/01</td>
<td>B91080112</td>
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Selection list

<table>
<thead>
<tr>
<th>Type</th>
<th>RCM420</th>
<th>RCMS460</th>
<th>RCMS490</th>
<th>EDS440</th>
<th>EDS440</th>
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<td>CTAC210</td>
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<tr>
<td>CTAC20/01</td>
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<td>CTAC35/01</td>
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<td></td>
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<td>CTAC60/01</td>
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### Technical data

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

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

**Measuring current transformer circuit CTAC…**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Rated primary residual current</td>
<td>10 A</td>
</tr>
<tr>
<td>Rated secondary residual current</td>
<td>0.0167 A</td>
</tr>
<tr>
<td>Rated transformation ratio ( K_n )</td>
<td>10/0.0167 A</td>
</tr>
<tr>
<td>Rated burden</td>
<td>max. 180 Ω</td>
</tr>
<tr>
<td>Rated output</td>
<td>0.05 VA</td>
</tr>
<tr>
<td>Rated continuous thermal current ( I_{cth} )</td>
<td>30 A</td>
</tr>
<tr>
<td>Rated short-time thermal current ( I_{th} )</td>
<td>60 x ( I_{cth} = 2.4 \text{ kA/s} )</td>
</tr>
<tr>
<td>Rated dynamic current ( I_{dyn} )</td>
<td>2.5 x ( I_{th} = 6.0 \text{ kA/40 ms} )</td>
</tr>
</tbody>
</table>

**CTAC20 at \( I_{th} \geq 30 \text{ mA} \)**

- Rated primary residual current: 40 A
- Rated secondary residual current: 63 A
- Rated continuous thermal current \( I_{cth} \): 80 A
- Rated short-time thermal current \( I_{th} \): 125 A
- Rated dynamic current \( I_{dyn} \): 160 A
- Rated short-time thermal current \( I_{th} \): 250 A
- Rated dynamic current \( I_{dyn} \): 330 A
- Rated short-time thermal current \( I_{th} \): 630 A

**CTAC20/01 at \( I_{th} \geq 0.75 \text{ mm}^2 \)**

- Single wire: 0.75 mm²
- Single wire, twisted: 0.75 mm²
- Shielded cable: 0.5 mm²
- Shielded cable: 0.8 mm²

**CTAC60/01 at \( I_{th} \geq 0.75 \text{ mm}^2 \)**

- Single wire, twisted: 0.75 mm²
- Shielded cable: 0.5 mm²
- Shielded cable: 0.8 mm²

**CTAC120 at \( I_{th} \geq 0.75 \text{ mm}^2 \)**

- Single wire, twisted: 0.75 mm²
- Shielded cable: 0.5 mm²
- Shielded cable: 0.8 mm²

**CTAC20/01 at \( I_{th} \geq 0.75 \text{ mm}^2 \)**

- Single wire, twisted: 0.75 mm²
- Shielded cable: 0.5 mm²
- Shielded cable: 0.8 mm²

**Environment**

- Operating temperature: -25…+70 °C

**Climatic class acc. to IEC 60721**

- Stationary use (IEC 60721-3-3): 3K5 (except condensation and formation of ice)
- Transport (IEC 60721-3-2): 2K11 (except condensation and formation of ice)
- Long-time storage (IEC 60721-3-1): 1K22 (except condensation and formation of ice)

**Classification of mechanical conditions IEC 60721**

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

**Connection**

- Terminal type: MSTB 2,5/2-ST-5,08
- Manufacturer: Phoenix Contact Connection
- Connection type: screw type terminal
- The connection conditions of the manufacturer apply.

**Connection EDS, RCM(S) measuring current transformers**

- Connection properties:
  - rigid: 0.2…2.5 mm² (AWG 24…12)
  - flexible: 0.2…2.5 mm² (AWG 24…12)
- Stripping length: 7 mm

**Mounting**

- Screw Type:
  - CTAC20…60(01) DIN EN ISO 7045 - M5x
  - CTAC120…210 DIN EN ISO 7045 - M6
- Washer type:
  - CTAC20…60(01) DIN EN ISO 7089/7090 - 5
  - CTAC120…210 DIN EN ISO 7089/7090 - 6
- Tightening torque:
  - CTAC20…35(01): 0.6 Nm
  - CTAC60(01): 1 Nm

**Other**

- Degree of protection, internal components (DIN EN 60529): IP40
- Degree of protection, terminals (IEC 60529): IP20
- Flammability class: UL94 V-0
- Documentation number: D00386
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>
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</thead>
<tbody>
<tr>
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<td>37</td>
<td>ø20</td>
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<td>B  CTAC35(/01)</td>
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<td>100</td>
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<td>ø35</td>
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<td>61</td>
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<td>C  CTAC60(/01)</td>
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<td>ø120</td>
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<td>ø210</td>
<td>40</td>
<td>74</td>
<td>277</td>
</tr>
</tbody>
</table>

Tolerance: ±0,5 mm

Wiring diagram

Measuring current transformers CTAC...
Connection to the respective residual current monitoring system RCMS, residual current monitors RCM or to insulation fault location systems EDS

Measuring current transformers CTAC…/01
Connection to the respective EDS474(E)-12, EDS461, EDS491 and EDS441 insulation fault locator
LINETRAXX® CTUB100 series
AC/DC sensitive measuring current transformer (Type B)

Device features
- Combined test and reset button
- Multicolour LED for operation, fault and status messages
- Exchangeable electronic module without mechanical separation of the primary conductors
- Extension/retrofitting or modification of functionalities in case of changed monitoring requirements
- Insensitive to load currents due to full magnetic shield (CTUB10x-CTBC20P…210P only)
- Monitoring of the connection to the measuring current transformer
- Supply voltage DC ±12 V/DC 24 V
- CTUB101-CTBC20…60 for AC/DC sensitive residual current monitors of the RCMA420 series
- CTUB10x-CTBC20…210 for residual current monitoring systems of the RCMS460/490 series as well as for RCMA423 residual current monitor
- CTUB10x-CTBC20P…210P for residual current monitoring systems of the RCMS460/490 series as well as for RCMA420/423 residual current monitors. Can be used for short-term system-related load currents.

Typical applications
- For RCMS460/490 residual current monitoring systems
- For RCMA20 residual current monitors

Standards
CTUB100 series measuring current transformers comply with the following device standard:
- IEC 62020 in combination with an evaluator (RCMS460/490 or RCMA420/423)

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

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage</th>
<th>Current transformer diameter</th>
<th>Shielding</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC ±12 V</td>
<td>Ø 20</td>
<td></td>
<td>CTUB101-CTBC20</td>
<td>B78120010</td>
</tr>
<tr>
<td></td>
<td>Ø 20</td>
<td></td>
<td>CTUB101-CTBC20P</td>
<td>B78120020</td>
</tr>
<tr>
<td></td>
<td>Ø 35</td>
<td></td>
<td>CTUB101-CTBC35</td>
<td>B78120012</td>
</tr>
<tr>
<td></td>
<td>Ø 35</td>
<td></td>
<td>CTUB101-CTBC35P</td>
<td>B78120022</td>
</tr>
<tr>
<td></td>
<td>Ø 60</td>
<td></td>
<td>CTUB101-CTB60</td>
<td>B78120014</td>
</tr>
<tr>
<td></td>
<td>Ø 60</td>
<td></td>
<td>CTUB101-CTBC60P</td>
<td>B78120024</td>
</tr>
<tr>
<td></td>
<td>Ø 120</td>
<td></td>
<td>CTUB101-CTBC120</td>
<td>B78120016</td>
</tr>
<tr>
<td></td>
<td>Ø 120</td>
<td></td>
<td>CTUB101-CTBC120P</td>
<td>B78120026</td>
</tr>
<tr>
<td></td>
<td>Ø 210</td>
<td></td>
<td>CTUB101-CTBC210</td>
<td>B78120018</td>
</tr>
<tr>
<td></td>
<td>Ø 210</td>
<td></td>
<td>CTUB101-CTBC210P</td>
<td>B78120028</td>
</tr>
<tr>
<td>DC 24 V</td>
<td>Ø 20</td>
<td></td>
<td>CTUB102-CTBC20</td>
<td>B78120011</td>
</tr>
<tr>
<td></td>
<td>Ø 20</td>
<td></td>
<td>CTUB102-CTBC20P</td>
<td>B78120021</td>
</tr>
<tr>
<td></td>
<td>Ø 35</td>
<td></td>
<td>CTUB102-CTBC35</td>
<td>B78120013</td>
</tr>
<tr>
<td></td>
<td>Ø 35</td>
<td></td>
<td>CTUB102-CTBC35P</td>
<td>B78120023</td>
</tr>
<tr>
<td></td>
<td>Ø 60</td>
<td></td>
<td>CTUB102-CTB60</td>
<td>B78120015</td>
</tr>
<tr>
<td></td>
<td>Ø 60</td>
<td></td>
<td>CTUB102-CTBC60P</td>
<td>B78120025</td>
</tr>
<tr>
<td></td>
<td>Ø 120</td>
<td></td>
<td>CTUB102-CTBC120</td>
<td>B78120017</td>
</tr>
<tr>
<td></td>
<td>Ø 120</td>
<td></td>
<td>CTUB102-CTBC120P</td>
<td>B78120027</td>
</tr>
<tr>
<td></td>
<td>Ø 210</td>
<td></td>
<td>CTUB102-CTBC210</td>
<td>B78120019</td>
</tr>
<tr>
<td></td>
<td>Ø 210</td>
<td></td>
<td>CTUB102-CTBC210P</td>
<td>B78120029</td>
</tr>
</tbody>
</table>
Electronic modules

<table>
<thead>
<tr>
<th>Supply voltage $U_s$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC $\pm 12 V$</td>
<td>CTUB101</td>
<td>B78120050</td>
</tr>
<tr>
<td>24 V (19.2…28.8 V)</td>
<td>CTUB102</td>
<td>B78120051</td>
</tr>
</tbody>
</table>

Required terminals or connecting cables are optionally available.

Connecting cables

<table>
<thead>
<tr>
<th>Length (m)</th>
<th>Connection to</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RCMA42…</td>
<td>CTX-100</td>
<td>B98110080</td>
</tr>
<tr>
<td>2.5</td>
<td></td>
<td>CTX-250</td>
<td>B98110081</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>CTX-500</td>
<td>B98110082</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>CTX-1000</td>
<td>B98110083</td>
</tr>
<tr>
<td>1</td>
<td>RCMS46…</td>
<td>CTXS-100</td>
<td>B98110090</td>
</tr>
<tr>
<td>2.5</td>
<td></td>
<td>CTXS-250</td>
<td>B98110091</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>CTXS-500</td>
<td>B98110092</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>CTXS-1000</td>
<td>B98110093</td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>max. connected current transformers</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage supply</td>
<td>4 STEP-PS/1 AC/24 DC/0.5</td>
<td>B94053110</td>
<td>362</td>
<td></td>
</tr>
<tr>
<td></td>
<td>14 STEP-PS/1 AC/24 DC/1.75</td>
<td>B94053111</td>
<td>362</td>
<td></td>
</tr>
<tr>
<td></td>
<td>34 STEP-PS/1 AC/24 DC/4.2</td>
<td>B94053112</td>
<td>362</td>
<td></td>
</tr>
</tbody>
</table>

Technical data

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

Definitions:
- Measuring circuit (IC1) primary conductors routed through the current transformer connections terminal block
- Secondary (IC2) connections terminal block

Rated insulation voltage: 800 V

Overvoltage category: III

Area of application: $\leq 2000$ m AMSL

Rated impulse voltage:
- IC1/IC2: 8 kV

Rated insulation voltage (reinforced insulation):
- IC1/IC2: 800 V

Pollution degree: 2

Supply voltage

CTUB101
- Description: $+12 V$, GND, $-12 V$
- Supply voltage $U_s$: DC $\pm 12 V$
- Operating range of $U_s$: $\pm 2 \%$
- Ripple $U_s$: $\leq 1 \%$
- Power consumption: $\leq 2.5 W$
- Inrush current: 500 mA

CTUB102
- Description: 24 V, GND
- Supply voltage $U_s$: DC 24 V
- Operating range of $U_s$: $\pm 20 \%$
- Ripple $U_s$: $\leq 1 \%$
- Power consumption: $\leq 2.5 W$
- Inrush current: 1 A

Measuring current circuit

Internal diameter measuring current transformer see dimension diagrams on page 339

<table>
<thead>
<tr>
<th>Rated current $I_n$</th>
<th>Rating</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTBC20 at $I_{Im} = 30 , mA$</td>
<td>40 A</td>
<td>B98120001</td>
</tr>
<tr>
<td>CTBC20 at $I_{Im} = 30 , mA$</td>
<td>63 A</td>
<td>B98120002</td>
</tr>
<tr>
<td>CTBC20P</td>
<td>80 A</td>
<td>B98120003</td>
</tr>
<tr>
<td>CTBC35 at $I_{Im} = 30 , mA$</td>
<td>125 A</td>
<td>B98120004</td>
</tr>
<tr>
<td>CTBC35P</td>
<td>160 A</td>
<td>B98120005</td>
</tr>
<tr>
<td>CTBC60 at $I_{Im} = 30 , mA$</td>
<td>160 A</td>
<td>B98120006</td>
</tr>
<tr>
<td>CTBC60P</td>
<td>250 A</td>
<td>B98120007</td>
</tr>
<tr>
<td>CTBC120P</td>
<td>320 A</td>
<td>B98120008</td>
</tr>
<tr>
<td>CTBC120</td>
<td>630 A</td>
<td>B98120009</td>
</tr>
<tr>
<td>CTBC210P at $I_{Im} = 100 , mA$</td>
<td>630 A</td>
<td>B98120010</td>
</tr>
<tr>
<td>CTBC210P at $I_{Im} = 100 , mA$</td>
<td>630 A</td>
<td>B98120010</td>
</tr>
<tr>
<td>CTBC210</td>
<td>1000 A</td>
<td>B98120011</td>
</tr>
</tbody>
</table>

Measurement accuracy: $\pm 1 \%$

Test winding: yes

Rated continuous thermal current $I_{th}$: 30 A

Rated short-time thermal current $I_{th}$: 2.4 kA/1 s

Rated dynamic current $I_{dyn}$: 6 kA/40 ms

Possible response values (to be set on the evaluator)

CTBC20, CTBC20P: 10 mA…500 mA

CTBC35, CTBC35P, CTBC60, CTBC60P: 30 mA…10 A

CTBC120, CTBC120P: 100 mA…10 A

CTBC210, CTBC210P: 300 mA…10 A

Indication

Multicolour LED see table “System states: LED” on page 340
### Technical data (continued)

#### Output

- **Name**: S1 (L), S2 (T)
- **Scaling**: 400 mV/1 A
- **Max. voltage**: ±10 V
- **Max. connector length**: 10 m
- **Output resistance**: 172 Ω

**Input**

- **Name**: T (only on CTUB101)
- **Current-carrying capacity**: < 300 mA

#### Environment/EMC

**EMC**: IEC 62020: 2005-11

- **Operating temperature**: -25…70 °C

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

- **Stationary use (IEC 60721-3-3)**: 3K5
- **Transport (IEC 60721-3-2)**: 2K11
- **Long-term storage (IEC 60721-3-1)**: 1K22

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

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

#### Connection

**Connecting cables are optionally available**

**Terminal block**

- **Manufacturer**: Phoenix Contact
- **Type**: DFMC 1.5/4-ST-3.5 BK

**Connection properties**

<table>
<thead>
<tr>
<th>Type</th>
<th>Connection conditions of the manufacturer apply.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>rigid</strong></td>
<td>0.2…1.5 mm² (AWG 24…16)</td>
</tr>
<tr>
<td><strong>flexible</strong></td>
<td>0.2…1.5 mm²</td>
</tr>
<tr>
<td><strong>with ferrule</strong></td>
<td>0.25…0.75 mm²</td>
</tr>
</tbody>
</table>

#### Mounting CTBC...

- **Screw type**
  - CTBC20…60(P)
  - CTBC120…210(P)
  - DIN EN ISO 7045 – M5
  - DIN EN ISO 7045 – M6

- **Washer type**
  - DIN EN ISO 7089/7090 – 5
  - DIN EN ISO 7089/7090 – 6

- **Tightening torque**
  - CTBC20…35 (P) 0.6 Nm
  - CTBC60…210 (P) 1 Nm

**Other**

- **Operating mode**: continuous operation

**Mounting**

- **any position**

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

- IP40

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

- IP20

**Flammability class**: UL94 V-0

**Software**: D591

**Weight**

- CTUB10…-CTBC20 (P) ≤ 230 g
- CTUB10…-CTBC20P (P) ≤ 290 g
- CTUB10…-CTBC35 (P) ≤ 310 g
- CTUB10…-CTBC35P (P) ≤ 390 g
- CTUB10…-CTBC60 (P) ≤ 530 g
- CTUB10…-CTBC60P (P) ≤ 690 g
- CTUB10…-CTBC120 (P) ≤ 1460 g
- CTUB10…-CTBC120P (P) ≤ 1820 g
- CTUB10…-CTBC210 ≤ 4290 g
- CTUB10…-CTBC210P ≤ 4940 g

The use of the power supply units listed at "Accessories" is recommended.

The use of a surge protection device is mandatory.

#### Dimension diagrams

### Dimensions (mm)

<table>
<thead>
<tr>
<th>Type</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
<th>f</th>
<th>g</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CTUB10…-CTBC20(P)</td>
<td>75</td>
<td>83</td>
<td>37</td>
<td>ø 20</td>
<td>46</td>
<td>60.5</td>
<td></td>
</tr>
<tr>
<td>CTUB10…-CTBC35(P)</td>
<td>97</td>
<td>130</td>
<td>47</td>
<td>ø 35</td>
<td>46</td>
<td>61</td>
<td></td>
</tr>
<tr>
<td><strong>B</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CTUB10…-CTBC60(P)</td>
<td>126</td>
<td>151</td>
<td>57</td>
<td>ø 60</td>
<td>56</td>
<td>78</td>
<td></td>
</tr>
<tr>
<td><strong>C</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CTUB10…-CTBC120(P)</td>
<td>188</td>
<td>225</td>
<td>96</td>
<td>ø 120</td>
<td>65</td>
<td>96</td>
<td>139</td>
</tr>
<tr>
<td>CTUB10…-CTBC210(P)</td>
<td>302</td>
<td>339</td>
<td>153</td>
<td>ø 210</td>
<td>67</td>
<td>113</td>
<td>277</td>
</tr>
<tr>
<td><strong>D</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CTUB10…</td>
<td>74</td>
<td>44</td>
<td>30</td>
<td>ø 32</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Tolerance: ±0.5 mm
System states: LED

The LED indicates the system state by means of colours and lighting/flashing. The priority specifies which system state is displayed if different conditions exist.

<table>
<thead>
<tr>
<th>System state</th>
<th>LED</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device switched off</td>
<td>off</td>
<td>Device is deenergised</td>
</tr>
<tr>
<td>Normal operating state</td>
<td>lights</td>
<td>The device is supplied with the specified voltage and the measuring current transformer core is connected to the electronic module.</td>
</tr>
<tr>
<td>Device error</td>
<td>off</td>
<td>The device is supplied with the specified voltage but there is no connection to the measuring current transformer core.</td>
</tr>
</tbody>
</table>

### Wiring diagram

The measuring range must be selected according to the response value \( I_{\Delta N} \) set on the RCMS460 or RCMA420/423 evaluator. If, however, a larger measuring range is selected, the resolution deteriorates.

<table>
<thead>
<tr>
<th>Measuring range setting</th>
<th>#</th>
<th>Potentiometer setting</th>
<th>Response value RCMA/RCMS</th>
<th>Measuring range r.m.s.</th>
<th>Measuring range peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>( I_{\Delta N} \leq 0.1 \text{ A} )</td>
<td>0…450 mA</td>
<td>0…900 mA</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>0.1 A &lt; ( I_{\Delta N} \leq 0.5 \text{ A} )</td>
<td>0…0.75 A</td>
<td>0…3.5 A</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>( I_{\Delta N} &gt; 0.5 \text{ A} )</td>
<td>0…10 A</td>
<td>0…20 A</td>
<td></td>
</tr>
</tbody>
</table>

- The use of a type 2 surge protection device (SPD) is mandatory due to possible impulse voltages and in order to comply with normative requirements.
- The surge protection device must be connected upstream of the power supply unit on the supply side.
- The surge protection device 7P.22.8.275.1020 from Finder or an equivalent alternative can be used.
WR70x175S(P)…WR200x500S(P) series
Measuring current transformers

Typical applications
- For RCMS460/490 residual current monitoring systems
- For RCM420 residual current monitors
- For EDS470, EDS460/490 and EDS440 insulation fault locators in AC and DC systems
- The WR…SP measuring current transformers are particularly suitable for use in busbar systems. This series is to be used for load currents ≥ 500 A.

Standards
WR70x175S(P)…WR200x500S(P) measuring current transformers comply with the device standards:
- DIN EN 60044-1
- IEC 61869.

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

Ordering information

<table>
<thead>
<tr>
<th>Screening</th>
<th>Internal dimensions</th>
<th>Approvals</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>without screening</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70 x 175 mm</td>
<td>☐</td>
<td>WR70x175S</td>
<td>B911738</td>
<td></td>
</tr>
<tr>
<td>115 x 305 mm</td>
<td>☐</td>
<td>WR115x305S</td>
<td>B911739</td>
<td></td>
</tr>
<tr>
<td>150 x 350 mm</td>
<td>☐</td>
<td>WR150x350S</td>
<td>B911740</td>
<td></td>
</tr>
<tr>
<td>200 x 500 mm</td>
<td>–</td>
<td>WR200x500S</td>
<td>B911763</td>
<td></td>
</tr>
<tr>
<td>Screening integrated</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70 x 175 mm</td>
<td>–</td>
<td>WR70x175SP</td>
<td>B911790</td>
<td></td>
</tr>
<tr>
<td>115 x 305 mm</td>
<td>–</td>
<td>WR115x305SP</td>
<td>B911791</td>
<td></td>
</tr>
<tr>
<td>150 x 350 mm</td>
<td>–</td>
<td>WR150x350SP</td>
<td>B911792</td>
<td></td>
</tr>
<tr>
<td>200 x 500 mm</td>
<td>–</td>
<td>WR200x500SP</td>
<td>B911793</td>
<td></td>
</tr>
</tbody>
</table>
Technical data

**Insulation coordination acc. to IEC 61869-2**

- Highest system voltage for electrical equipment $U_{m}$: AC 720 V
- Rated impulse withstand voltage $U_{imp}$: 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...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**

- Shock resistance IEC 60068-2-27 (device in operation): 15 g/11 ms, Bumping IEC 60068-2-29 (transport): 40 g/6 s
- Vibration resistance IEC 60068-2-6 (device in operation): 1 g/10...150 Hz, Vibration resistance IEC 60068-2-6 (transport): 2 g/10...150 Hz
- Ambient temperature (during operation): -10...+50 °C, Ambient temperature (during storage): -40...+70 °C
- Climatic class acc. to DIN IEC 60721-3-3: 3K5

**Connection**

- Connection rigid/flexible: 0.2...4/0.2...2.5 mm², flexible with female with/without plastic sleeve: 0.25...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: D00144

**Dimensions diagrams**

<table>
<thead>
<tr>
<th>WR70x175S(P)...WR150x350S(P)</th>
<th>WR200x500S(P)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Dimension diagrams" /></td>
<td><img src="image2" alt="Dimension diagrams" /></td>
</tr>
</tbody>
</table>

**Wiring diagram**

```
PE L1 L2 L3 N
k
S1 (k)
P1 (k)  RCM, RCMS, EDS
P2 (L1)
S2 (L)
to the loads
```

**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>
WS…/WS…-8000 series
Split-core type measuring current transformers

Typical applications

**WS… measuring current transformers**
- For RCMS460/490 residual current monitoring systems
- For RCM420/RCM460 residual current monitors
- For EDS470, EDS460/490 and EDS440 insulation fault locators in AC and DC systems

**WS…-8000 measuring current transformer**
- For EDS473(E)-12, EDS474(E)-12, EDS461 and EDS491 insulation fault locators

Standards

WS… and WS…-8000 measuring current transformers comply with the device standard: IEC 61869-1.

Further information

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

### Ordering information

<table>
<thead>
<tr>
<th>Mounting</th>
<th>Internal dimensions</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting brackets</td>
<td>20 x 30 mm</td>
<td>WS20x30</td>
<td>B98080601</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WS20x30-8000</td>
<td>B98080602</td>
</tr>
<tr>
<td></td>
<td>50 x 80 mm</td>
<td>WS50x80</td>
<td>B98080603</td>
</tr>
<tr>
<td></td>
<td>80 x 120 mm</td>
<td>WS80x120</td>
<td>B98080606</td>
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</table>

1) For EDS461/491 and EDS473/474 insulation fault locators

### Selection list

<table>
<thead>
<tr>
<th>Type</th>
<th>RCM420</th>
<th>RCMS460/RCMS490</th>
<th>EDS460/EDS490</th>
<th>EDS461/EDS491</th>
<th>EDS440</th>
<th>EDS441</th>
<th>EDS441-LAB</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS20x30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WS50x80</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>
</tr>
<tr>
<td>WS20x30-8000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>WS50x80-8000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WS20x30-8000</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>WS50x80-8000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
WS…/WS…-8000 measuring current transformers

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)
- 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
- rigid/flexible conductor sizes: 0.08…2.5 mm² (AWG 28…12)
- Stripping length: 8…9 mm
- Connection EDS, RCM(S) measuring current transformers
  Single wire ≥ 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 (DIN EN 60529): IP20
- Screw mounting: MS with mounting brackets
- Flammability class: UL94 V-0
- Documentation number: D00077
- Approvals and certifications: UL under development

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>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS20x30</td>
<td>93</td>
<td>106.15</td>
<td>23</td>
<td>33</td>
<td>64</td>
<td>≤ 600 g</td>
</tr>
<tr>
<td>WS50x80</td>
<td>125</td>
<td>158.15</td>
<td>55</td>
<td>85</td>
<td>96</td>
<td>≤ 1040 g</td>
</tr>
<tr>
<td>WS80x120</td>
<td>155</td>
<td>198.15</td>
<td>85</td>
<td>125</td>
<td>126</td>
<td>≤ 1400 g</td>
</tr>
<tr>
<td>WS120x30-8000</td>
<td>93</td>
<td>106.15</td>
<td>33</td>
<td>33</td>
<td>64</td>
<td>≤ 630 g</td>
</tr>
<tr>
<td>WS120x80-8000</td>
<td>125</td>
<td>158.15</td>
<td>85</td>
<td>85</td>
<td>96</td>
<td>≤ 1080 g</td>
</tr>
</tbody>
</table>

WS… series measuring current transformers
Connection to the respective RCMS series residual current monitoring system, RCM series residual current monitors or to EDS series insulation fault location systems

WS…-8000 measuring current transformer
Connection to the respective EDS461 and EDS491 insulation fault locator
WS50x80S…WS80x160S series
Split-core type measuring current transformers

Typical applications
- For residual current monitors (RCM)
- For residual current monitoring systems (RCMS)
- For insulation fault locators with additional EDS in AC and DC systems

Standards
WS… measuring current transformers comply with the device standard:
- IEC 61869-1.

Approvals

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

Ordering information

<table>
<thead>
<tr>
<th>Internal dimensions</th>
<th>UL</th>
<th>EAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 x 80 mm</td>
<td>III</td>
<td>III</td>
</tr>
<tr>
<td>80 x 80 mm</td>
<td>III</td>
<td>III</td>
</tr>
<tr>
<td>80 x 120 mm</td>
<td>III</td>
<td>III</td>
</tr>
<tr>
<td>80 x 160 mm</td>
<td>—</td>
<td>III</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 $U_{\text{isol}}$: 3 kV

Measuring circuit
- Rated transformation ratio: 600/1
- Rated burden: 180 Ω
- Rated primary current: ≤ 10 A (100 A)
- Rated primary current: ≥ 10 mA
- Nominal power: 50 mW
- Rated frequency: 50...400 Hz
- Internal resistance: 5...8 Ω
- Secondary overvoltage protection: with 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 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...+50 °C
- Storage temperature range: -40...+70 °C
- Climatic class acc. to DIN IEC 60721-3-3: 3K5

Connection
- Connection: screw-type terminals
- Connection rigid/flexible: 0.2...4/0.2...2.5 mm²
- Connection with ferrules with/without plastic sleeve: 0.25...1.5 mm²
- Conductor sizes (AWG): 24...12
- Connection to the evaluator: 0.75 mm²
- Single wire, twisted: ≥ 0.75 mm²
- Shielded cable: ≥ 0.6 mm²
- Shielded cable (shield on one side connected to PE): recommended: 1-Y(5)Y min. 2 x 0.6

Other
- Operating mode: continuous operation
- Mounting: any position
- Degree of protection, internal components (DIN EN 60529): IP40
- Degree of protection, terminals (DIN EN 60529): IP20
- Screw mounting: M5
- Flammability class: UL94 V-0
- Documentation number: D00145
### Dimensions (mm)

<table>
<thead>
<tr>
<th>Type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS50x80S</td>
<td>50</td>
<td>80</td>
<td>78</td>
<td>114</td>
<td>145</td>
<td>32</td>
<td>45</td>
<td>59</td>
<td>900 g</td>
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<tr>
<td>WS80x80S</td>
<td>80</td>
<td>80</td>
<td>108</td>
<td>144</td>
<td>145</td>
<td>32</td>
<td>45</td>
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<tr>
<td>WS80x120S</td>
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<td>108</td>
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<td>185</td>
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<td>59</td>
<td>1250 g</td>
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<tr>
<td>WS80x160S</td>
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<td>160</td>
<td>120</td>
<td>184</td>
<td>225</td>
<td>32</td>
<td>52</td>
<td>59</td>
<td>2550 g</td>
</tr>
</tbody>
</table>
LINETRAXX® Series WF...
Consisting of an RCC420 signal converter and a W…F measuring current transformer
Flexible WF170, WF250, WF500, WF800, WF1200, WF1800 measuring current transformers

Device features
- Flexible measuring current transformer in different lengths
- Space-saving design, quick installation
- Easy retrofitting into existing installations
- Can be installed without the need to disconnect the conductors
- Connection monitoring WF… measuring current transformers
- For RCMS460/490 series residual current monitoring systems
- For RCM420 series residual current monitors
- Analogue output (U, I) for external measuring devices
- RCC420 with push-wire terminals (two terminals per connection)

Typical applications
- Residual, fault and nominal current monitoring of loads and systems which cannot be switched off
- EMC monitoring of TN-S systems for "stray currents" and additional N-PE connections in the central earthing point (CEP)
- Monitoring of PE and equipotential bonding conductors to ensure they are free of current

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

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Length A measuring current transformer</th>
<th>Supply voltage $U_{S}\text{[1)}$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DC</td>
<td>AC</td>
<td></td>
</tr>
<tr>
<td>170 mm</td>
<td>9.6…94 V</td>
<td>16…72 V, 42…460 Hz</td>
<td>WF170-1</td>
</tr>
<tr>
<td></td>
<td>70…300 V</td>
<td>70…300 V, 42…460 Hz</td>
<td>WF170-2</td>
</tr>
<tr>
<td>250 mm</td>
<td>9.6…94 V</td>
<td>16…72 V, 42…460 Hz</td>
<td>WF250-1</td>
</tr>
<tr>
<td></td>
<td>70…300 V</td>
<td>70…300 V, 42…460 Hz</td>
<td>WF250-2</td>
</tr>
<tr>
<td>500 mm</td>
<td>9.6…94 V</td>
<td>16…72 V, 42…460 Hz</td>
<td>WF500-1</td>
</tr>
<tr>
<td></td>
<td>70…300 V</td>
<td>70…300 V, 42…460 Hz</td>
<td>WF500-2</td>
</tr>
<tr>
<td>800 mm</td>
<td>9.6…94 V</td>
<td>16…72 V, 42…460 Hz</td>
<td>WF800-1</td>
</tr>
<tr>
<td></td>
<td>70…300 V</td>
<td>70…300 V, 42…460 Hz</td>
<td>WF800-2</td>
</tr>
<tr>
<td>1200 mm</td>
<td>9.6…94 V</td>
<td>16…72 V, 42…460 Hz</td>
<td>WF1200-1</td>
</tr>
<tr>
<td></td>
<td>70…300 V</td>
<td>42…460 Hz, 70…300 V</td>
<td>WF1200-2</td>
</tr>
<tr>
<td>1800 mm</td>
<td>9.6…94 V</td>
<td>16…72 V, 42…460 Hz</td>
<td>WF1800-1</td>
</tr>
<tr>
<td></td>
<td>70…300 V</td>
<td>42…460 Hz, 70…300 V</td>
<td>WF1800-2</td>
</tr>
</tbody>
</table>

1) Absolute values

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>XM420 (RCC420)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>
### Technical data

#### Electrical safety
- **Standard:** RCC420
- **Pollution degree:** 3
- **Rated insulation voltage:** 250 V
- **Standard:** WF…
- **Pollution degree:** CAT III
- **Rated insulation voltage:** 1000 Vrms or DC

#### Supply voltage
- **Supply voltage $U_s$:** see ordering information
- **Power consumption:** $\leq$ 3 VA

#### Measuring circuit
- **Measuring range:** 100 mA…20 A
- **Rated transformation ratio:** $K_n (U - I): 100$ mV/A, $K_n (k - l): 1.67$ mA/A
- **Rated burden (signal output k, l):** 1 kΩ
- **Rated continuous thermal current $I_{cth}$:** 60 kA/1 s
- **Rated dynamic current $I_{dyn}$:** 150 kA/40 ms

#### Environment/EMC
- **EMC:** IEC 62020
- **Operating temperature:** -25…+55 °C
- **Classification of 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
  - flexible with ferrule
- **Stripping length:** 15 mm
- **Opening force:** 50 N
- **Test opening, diameter:** 2.1 mm
- **Connection measuring current transformer W…F:** PS/2 plug
- **Cable length WF…:** 2 m

#### 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 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
  - WF800 ≤ 230 g
  - WF1200 ≤ 310 g
  - WF1800 ≤ 430 g

**Note:** The measuring current transformer is adapted to the associated signal converter RCC420.

### Dimension diagrams (dimensions in mm)

#### XM420 (RCC420)

#### WF… measuring current transformers
- **A:** For details about the length of the measuring current transformer refer to ordering information.

### Dimension diagrams (dimensions in mm)

Locking connector measuring current transformer WF500…WF1800
- Keep the locking connector clean

Locking connector WF170…WF250
- $\phi$ 6 mm
Connection to the respective RCM460/490 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".

---

### Wiring Diagram

- **To the loads**
- **Signal converter RCC420**
- **Analogue output**
- **Residual current monitor RCM460/490**
- **100 mV/ A**
Isolating transformer ES710
Single-phase isolating transformers for the design of medical IT systems

Device features
- Built-in temperature sensors acc. to DIN 44081 (120 °C)
- Screen winding with brought-out insulated connection terminal
- Insulated mounting angles
- Degree of protection, IP00 (open design)
- Degree of protection, IP23 (with enclosure)
- Protection class I
- Protection class II (option: encapsulated version)
- Reinforced insulation
- Classification of insulation: ta40/B
- Connections: screw terminals
- Noise level < 35 dB (A) (no-load and nominal load)
- Vector group: II0
- Inrush current $I_{GL} < 8 \times I_n$

Typical applications
- For IT systems in medical locations

Approvals
- VDE test mark for all ES710/3150…
- ES710/10000 and ES…GL types,
- ES…SK2, ES…SN-GL are not VDE certified,

Standards
- ES710 isolating transformers comply with the device standards and the regulations for installation:
  - DIN EN 61558-1 (VDE 570-1)
  - IEC 61558-1
  - DIN VDE 0100-710 (VDE 0100-710)
  - DIN EN 61558-2-15 (VDE 0570-2-15)
  - IEC 61558-2-15
  - IEC 60364-7-710

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

### Type ES710/3150

<table>
<thead>
<tr>
<th>Type</th>
<th>ES710/4000</th>
<th>ES710/5000</th>
<th>ES710/6300</th>
<th>ES710/8000</th>
<th>ES710/10000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power/voltages/currents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated power</td>
<td>3150 VA</td>
<td>4000 VA</td>
<td>5000 VA</td>
<td>6300 VA</td>
<td>8000 VA</td>
</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>
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<tr>
<td>Rated input voltage</td>
<td>AC 230 V</td>
<td>AC 230 V</td>
<td>AC 230 V</td>
<td>AC 230 V</td>
<td>AC 230 V</td>
</tr>
<tr>
<td>Rated input current</td>
<td>14.2 A</td>
<td>18 A</td>
<td>22.5 A</td>
<td>28.5 A</td>
<td>36 A</td>
</tr>
<tr>
<td>Rated output current</td>
<td>13.7 A</td>
<td>17.4 A</td>
<td>21.7 A</td>
<td>27.4 A</td>
<td>34.7 A</td>
</tr>
<tr>
<td>Inrush current</td>
<td>&lt; 12 x I(0)</td>
<td>&lt; 12 x I(0)</td>
<td>&lt; 12 x I(0)</td>
<td>&lt; 12 x I(0)</td>
<td>&lt; 12 x I(0)</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>
</tr>
</tbody>
</table>

### Environmental conditions

| Ambient temperature | ≤ 40 °C | ≤ 40 °C | ≤ 40 °C | ≤ 40 °C | ≤ 40 °C | ≤ 40 °C |
| No-load temperature rise | ≤ 20 °C | ≤ 20 °C | ≤ 20 °C | ≤ 20 °C | ≤ 20 °C | ≤ 20 °C |
| Full-load temperature rise | ≤ 69 °C | ≤ 60 °C | ≤ 60 °C | ≤ 60 °C | ≤ 60 °C | ≤ 60 °C |
| Noise level (under no-load conditions and nominal load) | ≤ 35 dB(A) | ≤ 35 dB(A) | ≤ 35 dB(A) | ≤ 35 dB(A) | ≤ 35 dB(A) | ≤ 35 dB(A) |

### Other

| Insulation classification | t<t>40/B | t<t>40/B | t<t>40/B | t<t>40/B | t<t>40/B | t<t>40/B |
| Degree of protection | IP00 | IP00 | IP00 | IP00 | IP00 | IP00 |
| Protection class | IIP | IIP | IIP | IIP | IIP | IIP |
| Core U/I | 100/93 | 210/63 | 210/63 | 210/63 | 210/63 | 210/63 |
| Core U/I GL version | 100/93 | 210/63 | 210/63 | 210/63 | 210/63 | 210/63 |
| Recommended use when used in accordance with DIN VDE 0100-710 | 25 A gl/g6 | 35 A gl/g6 | 35 A gl/g6 | 35 A gl/g6 | 35 A gl/g6 | 35 A gl/g6 |
| Recommended use when used in accordance with DIN VDE 0100-710 GL version | 25 A gl/g6 | 25 A gl/g6 | 35 A gl/g6 | 35 A gl/g6 | 35 A gl/g6 | 35 A gl/g6 |
| Induction | 0.86 T | 0.94 T | 1.00 T | 1.05 T | 1.05 T | 1.05 T |
| Power factor | ≥ 0.5 | ≥ 0.5 | ≥ 0.5 | ≥ 0.5 | ≥ 0.5 | ≥ 0.5 |
| Core | 0.255 Q | 0.135 Q | 0.100 Q | 0.080 Q | 0.064 Q | 0.050 Q |
| Efficiency | 95 % | 95 % | 96 % | 96 % | 96 % | 96 % |

### Documentation number: D00109

### Loss at 20...22 °C ambient temperature

| Fe loss (iron loss) | < 55 W | < 60 W | < 80 W | < 105 W | < 110 W | < 150 W |
| Fe loss (iron loss) GL version | < 18 W | < 20 W | < 26 W | < 33 W | < 38 W | < 42 W |
| Cu loss (copper loss) | < 90 W | < 80 W | < 100 W | < 125 W | < 165 W | < 190 W |
| Cu loss (copper loss) GL version | < 90 W | < 80 W | < 100 W | < 125 W | < 165 W | < 190 W |

### Heat dissipation loss at 40 °C ambient temperature and 100 % continuous load

| Heat dissipation loss | < 165 W | < 160 W | < 202 W | < 265 W | < 320 W | < 380 W |
| Heat dissipation loss GL version | < 125 W | < 115 W | < 140 W | < 185 W | < 230 W | < 270 W |

* Option: completely encapsulated version

Energy efficient version GL = Green Line

---

## Green Line transformer (energy efficient version) – High degree of energy saving over the life time (16 years AfA)

(German AfA table for depreciation of wear and tear)

This general illustration is based on calculations of the transformer’s energy consumption while energy costs remained constant at 13.4 ct/kWh (source: first energy) for 16 years. The wide variety of bandwidths result from the different transformer capacities.

AfA = Deprecation of wear and tear

GL = Standard version

GL version (Green Line) = A higher purchase price of approx. 15-20%

ROI (Return on Investment) after about 1-3 years
Isolating transformer ES710

System components | Individual components and accessories | Isolating transformers

6.1

Standard
Dimension B is the depth incl. terminals

SK2 series

S series
Dimension E is the depth incl. terminals

K series

LG series

SN-GL series

Enclosure ESDS0107-1

Enclosure ESDS710
### Ordering information

<table>
<thead>
<tr>
<th>Dimensions (mm)</th>
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<th>Weight (kg)</th>
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<th>Type</th>
<th>Art. No.</th>
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### Ordering information enclosure

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<td>300</td>
<td>315</td>
<td>550</td>
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**Nameplate**

ES: single-phase isolating transformer
DS: three-phase isolating transformer

Nominal power

Type series without = standard
K = terminals on top
LG = horizontal position
SK2 = encapsulation according to protection class II
S = terminals on top side end
S-GL = terminals front side (energy efficient)
SN-GL = terminals front side, low type of construction (energy efficient)

**Wiring diagram**

**Terminal diagram**

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<th>Standard, K series, LG series</th>
<th>SK2 series</th>
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**Connection properties**

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<th>Screen winding flexible/rigid</th>
<th>Control terminals flexible/rigid</th>
<th>Control terminals for protection class II flexible/rigid</th>
<th>Output terminals flexible/rigid</th>
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<td>16/25 mm²</td>
<td>4/6 mm²</td>
<td>2.5/4 mm²</td>
<td>16/25 mm²</td>
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<tr>
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<td>16/25 mm²</td>
<td>4/6 mm²</td>
<td>2.5/4 mm²</td>
<td>16/25 mm²</td>
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<td>16/25 mm²</td>
<td>4/6 mm²</td>
<td>2.5/4 mm²</td>
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<td>3150 VA</td>
<td>4000 VA</td>
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<td>3NAC 230 V</td>
<td>3NAC 230 V</td>
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<td>7.9 A</td>
<td>10 A</td>
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<td>&lt; 12 x I&lt;sub&gt;n&lt;/sub&gt;</td>
<td>&lt; 12 x I&lt;sub&gt;n&lt;/sub&gt;</td>
<td>&lt; 12 x I&lt;sub&gt;n&lt;/sub&gt;</td>
<td>&lt; 12 x I&lt;sub&gt;n&lt;/sub&gt;</td>
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<td>≤ 0.5 mA</td>
<td>≤ 0.5 mA</td>
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<td>≤ 3.0 %</td>
<td>≤ 3.0 %</td>
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<td>≤ 224 V</td>
<td>≤ 236 V</td>
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<td>≤ 3 %</td>
<td>≤ 2.8 %</td>
<td>≤ 2.8 %</td>
<td>≤ 2.5 %</td>
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### Environmental conditions

- Ambient temperature: ≤ 40 °C
- No-load temperature rise: ≤ 25 °C
- Full-load temperature rise: ≤ 50 °C
- Noise level (no load and full load): ≤ 35 dB(A)

### Other

- Recommended fuse when used in accordance with DIN VDE 0100-710:
  - Induction: 10 A gl/gG
  - Primary: 1.12 Ω
  - Secondary: 0.42 Ω
- Fe loss (iron loss): 65 W
- Cu loss (copper loss): 60 W
- Efficiency: 95 %

Documentation number: D00105

* Option: completely encapsulated version
6.1 System components  | Individual components and accessories  | Isolating transformers
Isolating transformer DS0107
Isolating transformers DS0107

Ordering information

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Ordering information enclosure

<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>
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<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
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<td>380</td>
<td>490</td>
<td>385</td>
<td>420</td>
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<td>600</td>
<td>420</td>
<td>490</td>
<td>555</td>
<td>460</td>
</tr>
</tbody>
</table>
### 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

- **Type**: Input terminals, Screen winding, Control terminals, Output terminals
- **Flexible/Rigid**: 10/16 mm², 2.5/4 mm², 16/25 mm²

### 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>
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<td>DS0107/3150</td>
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<td>2.5/4 mm²</td>
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<tr>
<td>DS0107/4000</td>
<td>10/16 mm²</td>
<td>10/16 mm²</td>
<td>2.5/4 mm²</td>
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<td>DS0107/8000</td>
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<td>10/16 mm²</td>
<td>2.5/4 mm²</td>
<td>16/25 mm²</td>
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<tr>
<td>DS0107/10000</td>
<td>16/25 mm²</td>
<td>16/25 mm²</td>
<td>2.5/4 mm²</td>
<td>16/25 mm²</td>
</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
- DIN EN 61558-2-6 (VDE 0570-2-6)
- IEC 61558-2-6

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

Typical applications
- For the supply of operating theatre lights in group 2 medical locations

Approvals

Technical data

<table>
<thead>
<tr>
<th>Type</th>
<th>ESL0107/120</th>
<th>ESL0107/160</th>
<th>ESL0107/280</th>
<th>ESL0107/400</th>
<th>ESL0107/630</th>
<th>ESL0107/1000</th>
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<tr>
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<td>t a 40/E</td>
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<td>Degree of protection/protection class</td>
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Power/voltages/currents

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<thead>
<tr>
<th>Type</th>
<th>Rated power</th>
<th>Rated frequency</th>
<th>Rated input voltage</th>
<th>Rated input current</th>
<th>Rated output voltage</th>
<th>Rated output current</th>
<th>Inrush current Ii</th>
<th>Leakage current Ile</th>
<th>No-load input current Ile</th>
<th>No-load output voltage</th>
<th>Short-circuit voltage</th>
<th>Environmental conditions</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>120 VA</td>
<td>50…60 Hz</td>
<td>230 V</td>
<td>0.6 A</td>
<td>23…28 V</td>
<td>4.3 A</td>
<td>&lt; 15 x Ile</td>
<td>≤ 5 µA</td>
<td>≤ 120 mA</td>
<td>≤ 31.7 V</td>
<td>≤ 11 %</td>
<td>Ambient temperature 40 °C, No-load temperature rise ≤ 17 °C, No-load temperature rise ≤ 66 °C, Noise level (no load and full load) ≤ 35 dB(A)</td>
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<tr>
<td></td>
<td>160 VA</td>
<td>50…60 Hz</td>
<td>230 V</td>
<td>0.8 A</td>
<td>23…28 V</td>
<td>5.7 A</td>
<td>&lt; 15 x Ile</td>
<td>≤ 5 µA</td>
<td>≤ 140 mA</td>
<td>≤ 30.7 V</td>
<td>≤ 8.8 %</td>
<td>≤ 28 °C, ≤ 71 °C, ≤ 64 °C, ≤ 35 dB(A)</td>
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<tr>
<td></td>
<td>280 VA</td>
<td>50…60 Hz</td>
<td>230 V</td>
<td>1.4 A</td>
<td>23…28 V</td>
<td>10 A</td>
<td>&lt; 15 x Ile</td>
<td>≤ 5 µA</td>
<td>≤ 237 mA</td>
<td>≤ 30.6 V</td>
<td>≤ 7.9 %</td>
<td>≤ 26 °C, ≤ 62 °C, ≤ 64 °C, ≤ 35 dB(A)</td>
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<tr>
<td></td>
<td>400 VA</td>
<td>50…60 Hz</td>
<td>230 V</td>
<td>1.9 A</td>
<td>23…28 V</td>
<td>14.3 A</td>
<td>&lt; 15 x Ile</td>
<td>≤ 5 µA</td>
<td>≤ 210 mA</td>
<td>≤ 29.7 V</td>
<td>≤ 5.3 %</td>
<td>≤ 26 °C, ≤ 62 °C, ≤ 64 °C, ≤ 35 dB(A)</td>
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<td>630 VA</td>
<td>50…60 Hz</td>
<td>230 V</td>
<td>3 A</td>
<td>23…28 V</td>
<td>22.5 A</td>
<td>&lt; 15 x Ile</td>
<td>≤ 5 µA</td>
<td>≤ 320 mA</td>
<td>≤ 30 V</td>
<td>≤ 5 %</td>
<td>≤ 26 °C, ≤ 62 °C, ≤ 64 °C, ≤ 35 dB(A)</td>
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<tr>
<td></td>
<td>1000 VA</td>
<td>50…60 Hz</td>
<td>230 V</td>
<td>4.6 A</td>
<td>23…28 V</td>
<td>35.7 A</td>
<td>&lt; 15 x Ile</td>
<td>≤ 5 µA</td>
<td>≤ 35 A</td>
<td>≤ 30 V</td>
<td>≤ 4.3 %</td>
<td>≤ 26 °C, ≤ 62 °C, ≤ 64 °C, ≤ 35 dB(A)</td>
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Other

Recommended fuse when used in accordance with DIN VDE 0100-710

<table>
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<tr>
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<th>6 A gl/g6</th>
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<th>16 A gl/g6</th>
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<td>1.23 T</td>
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<td>1.14 T</td>
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<td>1.06 T</td>
<td>1 T</td>
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<tr>
<td>Primary</td>
<td>15.3 Ω</td>
<td>8.9 Ω</td>
<td>4.7 Ω</td>
<td>2 Ω</td>
<td>1.2 Ω</td>
<td>0.6 Ω</td>
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<tr>
<td>Secondary</td>
<td>0.2 Ω</td>
<td>0.095 Ω</td>
<td>0.05 Ω</td>
<td>0.028 Ω</td>
<td>0.016 Ω</td>
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<tr>
<td>FE loss (iron loss)</td>
<td>5.5 W</td>
<td>6.3 W</td>
<td>9 W</td>
<td>15 W</td>
<td>18 W</td>
<td>26 W</td>
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<tr>
<td>Cu loss (copper loss)</td>
<td>15.8 W</td>
<td>16 W</td>
<td>25 W</td>
<td>23 W</td>
<td>33 W</td>
<td>44 W</td>
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<tr>
<td>Efficiency</td>
<td>85 %</td>
<td>88 %</td>
<td>89 %</td>
<td>91 %</td>
<td>92 %</td>
<td>94 %</td>
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Documentation number: D00110
### Ordering information

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<th>Cu weight (kg)</th>
<th>Weight (kg)</th>
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<th>Art. No.</th>
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<tr>
<td>96  96  105  84  82  65  5.5</td>
<td>0.5</td>
<td>2.3</td>
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<td>6.7</td>
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<td>150 135  150  122 130 108  6.5</td>
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<td>10.2</td>
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<td>16.5</td>
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### Ordering information enclosure

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<th>Dimensions (mm)</th>
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<th>Art. No.</th>
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<td>A   B   C   D   E   F   G   H   I</td>
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<tr>
<td>240 280 220 220 300 320 M6 φ 29 φ 21</td>
<td>3.5</td>
<td>ESL0107-0</td>
<td>B924204</td>
</tr>
</tbody>
</table>

### Terminal diagram

- **Primary**
  - 230 V
  - 400 V
  - 380 V
- **Secondary**
  - 230 V
  - 24 V
  - 25 V
  - 27 V
  - 28 V

### Connection properties

- **Type**
  - ESL0107/120
  - ESL0107/160
  - ESL0107/280
  - ESL0107/400
  - ESL0107/630
  - ESL0107/1000

- **Input terminals flexible/rigid**
  - 4/6 mm²

- **Screen winding flexible/rigid**
  - 4/6 mm²

- **Output terminals flexible/rigid**
  - 4/6 mm²

- **ESL0107/120**
  - 4/6 mm²
  - 4/6 mm²

- **ESL0107/160**
  - 4/6 mm²
  - 4/6 mm²

- **ESL0107/280**
  - 4/6 mm²
  - 4/6 mm²

- **ESL0107/400**
  - 4/6 mm²
  - 4/6 mm²

- **ESL0107/630**
  - 10/16 mm²
  - 4/6 mm²

- **ESL0107/1000**
  - 10/16 mm²
  - 10/16 mm²
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 ¹ U_s</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 19...264 V 20...297 V</td>
<td>RK170</td>
<td>B98041500</td>
</tr>
</tbody>
</table>

1) Absolute values

Technical data

Voltage ranges
- Supply voltage U_s
- Frequency range U_i
- Power consumption

Inputs
- Current input
- Max. permissible current
- Rated input resistance

Outputs
- Voltage output
- Max. no load voltage
- Rated burden
- Current output
- Short-circuit current
- Rated burden

Outputs
- Outputs two outputs with common ground
- Voltage output
- Max. no load voltage
- Rated burden
- Current output
- Short-circuit current
- Rated burden

Accuracy at T_a = 23 °C
- Temperature coefficient
- Rated rise time T 0.9
- Dielectric strength input/output/supply

Environment
- Shock resistance IEC 60068-2-27 (device in operation)
- Vibration resistance IEC 60068-2-6 (device in operation)
- Vibration resistance IEC 60068-2-6 (transport)
- Ambient temperature (during operation)
- Ambient temperature (during storage)
- Classification of climatic conditions acc. to IEC 60721-3-3

Connection
- Connection type modular terminals
- Connection properties rigid/flexible

Other
- Operating mode continuous operation
- Mounting any position
- Degree of protection, internal components (IEC 60529)
- Degree of protection, internal components (IEC 60529)
- DIN rail mounting acc. to IEC 60715
- Flammability class UL94 V-2
- Documentation number D00132
- Weight ≤ 200 g
**Dimenision diagram (dimensions in mm)**

![Dimension diagram](image)

**Wiring diagram**

![Wiring diagram](image)

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
6.1

**STEP-PS**

For supply of Bender devices with a supply voltage of DC 24 V

---

**Device features**

- Easy DIN rail and wall mounting
- Maximum energy efficiency thanks to low idling losses
- Fast commissioning with LED function monitoring
- High operational reliability thanks to long power failure buffering under full load and high MTBF (> 500,000 h)
- Can be used worldwide in all industrial sectors due to a wide-range input and an international approval package
- Wide temperature range from -25 °C to +70 °C
- Can be connected in parallel to increase power

---

**Typical applications**

- For supply of Bender devices with a supply voltage of DC 24 V
- The compact design makes them especially suitable for installation distributors and flat control panels

---

**Further information**

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

---

**Approvals**

---

**Ordering information**

<table>
<thead>
<tr>
<th>Rated input voltage $U_{IN}$</th>
<th>Rated voltage</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 85…264 V, 45…65 Hz, DC 95…250 V</td>
<td>DC 24 V</td>
<td>STEP-PS/1 AC/24 DC/0.5</td>
<td>B94053110</td>
</tr>
<tr>
<td></td>
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<td>STEP-PS/1 AC/24 DC/1.75</td>
<td>B94053111</td>
</tr>
<tr>
<td></td>
<td></td>
<td>STEP-PS/1 AC/24 DC/4.2</td>
<td>B94053112</td>
</tr>
</tbody>
</table>
Technical data

### Input data

Nominal input voltage range | AC 100…240 V
AC input voltage range | AC 85…264 V
DC input voltage range | DC 95 V…250 V
AC frequency range | 45…65 Hz
DC frequency range | 0 Hz

**STEP-PS/1AC/24DC/0.5 (12 W)**

Current consumption | approx. 0.28 A (AC 120 V)
Inrush current limitation | < 15 A (typical)
Power failure buffering | > 15 ms (AC 120 V)
Typical turn-on time | < 0.5 s
Input fuse, integrated | 1.25 A (slow acting, internal)

### Output data

Nominal output voltage | DC 24 V ±1 %

**STEP-PS/1AC/24DC/0.5 (12 W)**

Output current | 0.5 A (-25…55 °C)
0.55 A (-25…40 °C permanent)
1 A (maximum output current)

Control deviation | < 1 % (change in load, static 10…90 %)
< 2 % (change in load, dynamic 10…90 %)
< 0.1 % (change in input voltage ±10 %)

Efficiency | > 88 % (for AC 230 V and nominal values)

Residual ripple | < 25 mVrms (with nominal values)
Peak switching voltages | yes, for increased power

### Power supply unit

**STEP-PS/1AC/24DC/0.5 (12 W)**

Maximum power dissipation idling | 0.7 W

**STEP-PS/1AC/24DC/1.75 (40 W)**

Maximum power dissipation idling | 5 W

**STEP-PS/1AC/24DC/4.2 (100 W)**

Maximum power dissipation idling | 7 W

### Environmental conditions

- Ambient temperature (operation) | -25…70 °C (> 55 °C derating)
- Ambient temperature (storage/transport) | -40…85 °C
- Max. perm. humidity (operation) | ≤ 95 % (at 25 °C, no condensation)
- Pollution degree acc. to EN 50178 | 2
- Shock | 30 g in all directions, acc. to IEC 60068-2-27
- Vibration (operation) | ≤ 15 Hz, amplitude ±2.5 mm acc. to IEC 60068-2-6
- Max. perm. humidity (operation) | ≤ 95 % (at 25 °C, no condensation)
- Ambient temperature (operation) | -25…70 °C (> 55 °C derating)
- Pollution degree acc. to EN 50178 | 2
- Shock | 30 g in all directions, acc. to IEC 60068-2-27
- Vibration (operation) | ≤ 15 Hz, amplitude ±2.5 mm acc. to IEC 60068-2-6
- Max. perm. humidity (operation) | ≤ 95 % (at 25 °C, no condensation)
- Ambient temperature (operation) | -25…70 °C (> 55 °C derating)
- Pollution degree acc. to EN 50178 | 2
- Shock | 30 g in all directions, acc. to IEC 60068-2-27
- Vibration (operation) | ≤ 15 Hz, amplitude ±2.5 mm acc. to IEC 60068-2-6
- Max. perm. humidity (operation) | ≤ 95 % (at 25 °C, no condensation)
- Ambient temperature (operation) | -25…70 °C (> 55 °C derating)
- Pollution degree acc. to EN 50178 | 2
- Shock | 30 g in all directions, acc. to IEC 60068-2-27
- Vibration (operation) | ≤ 15 Hz, amplitude ±2.5 mm acc. to IEC 60068-2-6
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- Ambient temperature (operation) | -25…70 °C (> 55 °C derating)
- Pollution degree acc. to EN 50178 | 2
- Shock | 30 g in all directions, acc. to IEC 60068-2-27
- Vibration (operation) | ≤ 15 Hz, amplitude ±2.5 mm acc. to IEC 60068-2-6
- Max. perm. humidity (operation) | ≤ 95 % (at 25 °C, no condensation)
### Standards
- Electrical equipment of machines: EN 60204
- Safety isolating transformers for switch mode power supplies: IEC 61558-2-17
- Electrical safety of information technology equipment: IEC 60950-1/VDE 0805 (SELV)
- Electronic equipment for use in power installations: EN 50178/VDE 0160 (PELV)
- Protective extra-low voltage: IEC 60950-3 (SELV) and EN 60204 (PELV)
- Protective separation: DIN VDE 0100-4-110
- Protection against electric shock: DIN VDE 0106-100
- Protection against electric shock, basic requirements for protective separation in electrical equipment: DIN VDE 0106-101
- Limits for harmonic current emissions: EN 61000-3-2

### Dimension diagram (dimensions in mm)
- **STEP-PS/1AC/24DC/0.5 (12 W)**

### Connection to different systems
- **TN-S**
- **TN-C**
- **TT**
- **IT**

### Approvals and certifications
- **STEP-PS/1AC/24DC/0.5 (12 W)**
  - UL approvals: UL/C-UL Listed UL 508
  - UL/C-UL Recognized UL 60950
  - NEC Class 2 as per UL 1310
- **STEP-PS/1AC/24DC/1.75 (40W)**
  - UL approvals: UL/C-UL Listed UL 508
  - UL/C-UL Recognized UL 60950
  - NEC Class 2 as per UL 1310
- **STEP-PS/1AC/24DC/4.2 (100 W)**
  - UL approvals: UL/C-UL Listed UL 508
  - UL/C-UL Recognized UL 60950
  - Shipbuilding sector: Germanischer Lloyd

### Connection to different systems
- **TN-S**
- **TN-C**
- **TT**
- **IT**
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

Typical applications
- To supply Bender devices with DC 24 V and maximum 10 VA power consumption

Standards
The AN410 series complies with the requirements of the device standard: EN 61204.

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

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Rated input voltage $U_{IN}$</th>
<th>Rated output voltage</th>
<th>ABB type</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 90…264 V, 47…63 Hz</td>
<td>DC 24 V</td>
<td>CP-D 24/0.42/Art. No. 15VR 427 041 R0000</td>
<td>AN410</td>
<td>B924209</td>
</tr>
<tr>
<td>–</td>
<td>–</td>
<td>CP-D RU/Art. No. 15VR 427 049 R0000</td>
<td>AN420-R</td>
<td>B95100250</td>
</tr>
<tr>
<td>DC 9…35 V</td>
<td>DC 9…35 V</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

Technical data

Insulation coordination acc. to IEC 60664-1
- Rated impulse voltage/pollution degree: 3 kV/2
- Insulation voltage $U_i$ input circuit/output circuit: 3 kV

Input circuits
- Rated input voltage $U_{IN}$: see ordering information
- Power consumption: ≤ 3 W
- Stored energy time in the event of power system failure: ≤ 3 ms
- Typical current/power consumption:
  - at AC 110 V: 184 mA/11.62 W
  - at AC 230 V: 120.6 mA/12 W
- Primary fuse (internal device protection, not accessible): 1 A time-lag/AC 250 V

Output circuit
- Rated output voltage: DC 24 V (± 1 %)
- Rated output current: 420 mA
- Derating of the output current: 60 °C < $T_j$ ≤ 70 °C: 2.5 %/K
- Parallel connection option: with redundance unit AN420-R
- Protection against short circuits/no-load: continuous protection against short circuits/no-load

Environment/EMC
- EMC immunity: acc. to EN 61000-6-2
- EMC emission: acc. to EN 61000-6-3
- Ambient temperature (during operation/during storage): -25…+70 °C/-25…+85 °C
- Classification of mechanical conditions acc. to IEC/EN 60068-2

Connection
- Connection: screw-type terminals
- Rigid, flexible (with or without ferrule)/conductor sizes: 0.2…2 mm² (AWG 24…14)
- Stripping length: 6 mm (0.24 inches)
- Tightening torque: 0.36…0.56 Nm

Standards, approvals and certifications

UL 508, CAN/CSA C22.2 No. 14
UL 1310, CAN/CSA C22.2 No. 223 (Class 2 Power Supply) (*)
UL 60950, CAN/CSA C22.2 No. 60950 (*)
CCC (*)
Mark
CE

Other
- Status indicators: 2 LEDs: output voltage present, output voltage low
- Operating mode: continuous operation
- Mounting: vertically (terminals +/– at the top)
- Degree of protection, internal components: DIN EN 60529 (VDE 0470-1): IP30
- Degree of protection, terminals: DIN EN 60529 (VDE 0470-1): IP20
- Protection class: II
- Minimum distance to adjacent devices vertically/horizontally: 25/25 mm
- Enclosure dimensions (W 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: D00009
- Weight: ≤ 70 g

*) Approval relating to the rated input voltage $U_{IN}$
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**

AN410 AN410AN420-R

<table>
<thead>
<tr>
<th>L+</th>
<th>L-</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN1 IN2 IN1 IN2</td>
<td></td>
</tr>
<tr>
<td>AN420-R</td>
<td></td>
</tr>
<tr>
<td><strong>+</strong> <strong>-</strong></td>
<td></td>
</tr>
<tr>
<td>OUT</td>
<td></td>
</tr>
<tr>
<td>output voltage</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>L+</th>
<th>L-</th>
</tr>
</thead>
<tbody>
<tr>
<td>L N</td>
<td></td>
</tr>
</tbody>
</table>

input voltage 1

<table>
<thead>
<tr>
<th>L+</th>
<th>L-</th>
</tr>
</thead>
<tbody>
<tr>
<td>L N</td>
<td></td>
</tr>
</tbody>
</table>

input voltage 2
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)
- IEC 61558-1

Further information

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

Typical applications

- Supply of Bender devices with AC 20 V and a power consumption of maximum 9 VA

Ordering information

<table>
<thead>
<tr>
<th>Output voltage</th>
<th>Supply voltage ( U_s )</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 20 V, 50…60 Hz</td>
<td>230 V, 50…60 Hz</td>
<td>AN450</td>
<td>B924201</td>
</tr>
<tr>
<td></td>
<td>127 V, 50…60 Hz</td>
<td>AN450-133</td>
<td>B924203</td>
</tr>
</tbody>
</table>

Technical data

Insulation coordination acc. to IEC 60664-1

- Rated voltage: AC 250 V
- Overvoltage category/pollution degree: III/2
- Rated impulse voltage: 4 kV
- Altitude: ≤ 2000 m NN

Voltage ranges

- Nominal voltage: see ordering details
- Frequency range: see ordering details
- Operating range of rated voltage: 0.85…1.1
- Output voltage: AC 20 V, 50…60 Hz
- Rated output Power: ≤ 9 VA
- Internal secondary protection: PTC resistor

Environment/EMC

- EMC immunity: acc. to EN 61000-6-2
- EMC emission: acc. to EN 61000-6-4

Classification of climatic conditions acc. to IEC 60721

- Stationary use: 3K5 (except condensation, water and formation of ice)
- Transport: 2K2
- Storage: 1K2
- Operating temperature: -10…+55 °C

Classification of mechanical conditions acc. to IEC 60721

- Stationary use: 3M4
- Transport: 2M2
- Storage: 1M3

Connection

- Connection: screw terminals
- Connection properties:
  - rigid/semi-flexible/Conductor sizes: 0.2…4/0.2…2.5 mm²/AWG 24-12
  - Stripping length: 8 mm
  - Tightening torque, terminal screws: 0.5 Nm

Other

- Operating mode: continuous operation
- Mounting: any position
- Protection class internal components/terminals: IP20/IP20
- Screw fixing: 2 x M4
- DIN rail mounting acc. to: DIN EN 60715/IEC 60715
- Flammability class: UL94V-0
- Standards: IEC 61558-2-6
- Weight: ≤ 400 g
### Dimension diagram (dimensions in mm)

![Dimension diagram](image)

- **ø 4.5** screw mounting
- **45** x **52.5**

### 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. **U2, V2** Alarm indicator and test combination
7204/7220/9604/9620
Measuring instruments

- **Device features**
  - Dimensions: 72 x 72 mm (7204/7220) or 96 x 96 mm (9604/9620)
  - Version 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**

---

**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>IRDH275/375, iso685…</td>
<td>0...400 µA</td>
<td>72 x 72 mm</td>
<td>120 kΩ</td>
<td>7204-1421</td>
<td>B986763</td>
</tr>
<tr>
<td></td>
<td></td>
<td>96 x 96 mm</td>
<td>120 kΩ</td>
<td>7204-1421</td>
<td>B986804</td>
</tr>
<tr>
<td>IRDH275B/375B/575, iso685…</td>
<td>0...20 mA</td>
<td>96 x 96 mm</td>
<td>120 kΩ</td>
<td>9604-1421</td>
<td>B986764</td>
</tr>
<tr>
<td>iso685…</td>
<td>0...400 µA</td>
<td>96 x 96 mm</td>
<td>1,2 MΩ</td>
<td>9604-1621</td>
<td>B986784</td>
</tr>
<tr>
<td>IRDH275B/375B/575, iso685…</td>
<td>0...20 mA</td>
<td>72 x 72 mm</td>
<td>120 kΩ</td>
<td>7220-1421</td>
<td>B986841</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7220S-1421</td>
<td>B986842</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**

<table>
<thead>
<tr>
<th>Enclosure</th>
<th>Terminals</th>
<th>Terminals with contact protection</th>
<th>Documentation number</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP52</td>
<td>IP00</td>
<td></td>
<td>D00092</td>
</tr>
</tbody>
</table>

**Dimension diagram**

- **7204/7220**
  - Min. installation depth: 62.5 mm
  - Cut-out dimensions: 68 x 68 mm
- **9604/9620**
  - Min. installation depth: 62.5 mm
  - Cut-out dimensions: 92 x 92 mm

---

2020/2021
DI-1DL
RS-485 interface repeater for RS-485 bus extension

Device features
- Plastic enclosure for DIN rail mounting
- Dynamic baud rate setting
- Galvanic separation between the input and output circuit and the power supply – overvoltage protection
- Supply voltage AC 85...260 V, 50...60 Hz
- Automatic baud rate changeover – can therefore be used for the internal BMS bus without limitations

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>B95012047</td>
</tr>
</tbody>
</table>

Technical data

Supply voltage
- AC 85...260 V, 50...60 Hz
- 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-Y(St)Y min. 2x0.8
  - Data direction switching: automatic
  - Cascading option: yes
  - Number of bus devices: 31 additional bus devices per repeater, cascading allows a virtually unrestricted number of connections
  - Terminating resistor and bus bias voltage can be activated by a switch
  - Device address, BMS bus:
  - Alarm LEDs
    - activity indication: direction and faults (green)
    - internal operating voltage (red)

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 CN-2-1
- Documentation number: D00125
- Weight: approx. 90 g

Dimension diagram (dimensions in mm)

* depending on used transceivers
Wiring diagram

Settings

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.

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.

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><strong>A</strong> Master</td>
</tr>
<tr>
<td><strong>B</strong> Slave</td>
</tr>
<tr>
<td><strong>C</strong> RS-485 interface repeater DI-1DL</td>
</tr>
<tr>
<td><strong>D</strong> RS-485 interface repeater DI-1DL</td>
</tr>
<tr>
<td><strong>E</strong> 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
- Galvanic separation between the input and output circuit
- Power supply via USB port
- USB cable and driver CD included in the scope of delivery

**Typical applications**
- Conversion of USB interface into RS-485 interface
- Parameterisation of alarm indicator and operator panels (MK800, MK2430) via RS-485 interface by means of software
- Parameterisation of Modbus RTU devices via RS-485 interface by means of software

**Approvals**

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

**Ordering information**

<table>
<thead>
<tr>
<th>Supply voltage</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>from USB port, no additional power supply required</td>
<td>DI-2USB</td>
<td>B 9501 2045</td>
</tr>
</tbody>
</table>

**Technical data**

**Insulation coordination acc. to IEC 60664-1**
- Rated voltage: 3 kV/3

**Supply voltage**
- Supply voltage U_{S} see ordering details
- Power consumption: 95 mVA

**Interfaces**
- RS-485 Interface/protocol: 1 x RS-485/–
- Baud rate: 9.6…115.2 kbit/s
- Cable length: ≤ 1200 m
- Cable (twisted in pairs, one end of shield connected to PE) recommended: J-Y(St)Y min. 2x0.8
- Mode: A, B
- Integrated terminating resistors, selectable via jumper, factory setting: terminating resistors included
- Device address: –
- USB Serial interface: 1 x USB
- Alarm LEDs: ON (yellow), R x Data (green), T x Data (red)

**Environment/EMC**
- EMC immunity/EMC emission: EN 61000-6-2/EN 61000-6-4
- Operating temperature: -10…+55 °C

**Classification of climatic conditions acc. to IEC 60721**
- Stationary use: 3K5
- Transport: 2K3
- Long-term storage: 1K4

**Classification of mechanical conditions acc. to IEC 60721**
- Stationary use: 3M4
- Transport: 2M2
- Long-term storage: 1M3

**Connection**
- Connection: screw-type terminals/USB plug type B
- Connection properties: rigid/flexible/conductor sizes 0.5…2.5 mm² (AWG 22…12)

**Other**
- Operating mode: continuous operation
- Mounting: any position
- Screw mounting: 2 x M3
- DIN rail mounting acc. to IEC 60715
- Operating manual: manual of third-party manufacturer
- Documentation number: D00103
- Weight: ≤ 25 g

**Dimension diagram (dimensions in mm)**

![Dimension diagram](image)

**Wiring diagram**

![Wiring diagram](image)

Di-2USB to connect a personal computer utilising a USB interface to a BMS network.

**Note:**
Consider BMS bus termination
Device features

- Extension of Bender devices by 12 relays
- N/O and N/C selectable

Further information

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

Typical applications

- Extension of the measuring channels during insulation fault location by potential-free contacts

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage ( U_s )</th>
<th>Option “W”</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC 24 V</td>
<td></td>
<td>IOM441-S</td>
<td>B95012057</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>IOM441W-S</td>
<td>B95012057W</td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plug Kit Pushin (^1)</td>
<td>B95012902</td>
</tr>
</tbody>
</table>

\(^1\) included in the scope of delivery

Technical data

Insulation coordination according to IEC 60664-1

Definitions:
- Supply circuit
- Output circuits

relay contacts \((11, 13), (12, 14), (23, 24), (33, 34), (43, 44), (53, 54), (63, 64), (73, 74), (83, 84), (93, 94), (103, 104), (113, 114), (123, 124)\)

Protective separation (reinforced insulation) between \((BB \.break bus) \break \break \break (relay \break contacts))

Rated voltage 250 V

Overvoltage category III

Pollution degree 2

Rated impulse voltage 6 kV

Voltage test (routine test) acc. to IEC 61010-1 \( AC \ 3.51 \break kV \)

Basic insulation between \((relay \break contact) \break (relay \break contact))

Rated voltage 250 V

Overvoltage category III

Pollution degree 2

Rated impulse voltage 4 kV

Voltage test (routine test) acc. to IEC 61010-1 \( AC \ 2.21 \break kV \)

Supply voltage

Supply voltage \( U_s \) DC 24 V

Tolerance of \( U_s \) 5 %

Power consumption \(< 1.7 \ W \)

LEDs

ON (operation LED) green

Switching elements

Number 12 N/O contacts

Rated operational voltage AC 250 V/DC 30 V

Rated operational current 5 A

Minimum contact rating 1 mA at \( \geq \ DC \ 5 \ V \)

Environment/EMC

EMC IEC 61326-2-4

Ambient temperatures:

Operating temperature \(-25 \ldots +55 \ ^\circ C \)

Transport \(-40 \ldots +85 \ ^\circ C \)

Storage \(-25 \ldots +70 \ ^\circ C \)

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) \( 2K11 \)

Long-term storage (IEC 60721-3-1) \( 1K22 \)

Classification of mechanical conditions acc. to IEC 60721:

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

Transport (IEC 60721-3-2) \( 2M4 \)

Long-term storage (IEC 60721-3-1) \( 1M12 \)

Area of application \( \leq 2000 \ m \) AMSL
Technical data (continued)

Connection
- Connection type: pluggable push-wire terminal
- Conductor sizes: AWG 24-12
- Stripping length: 10 mm
- Rigid/flexible: 0.2…2.5 mm²
- Flexible with ferrule, with/without plastic sleeve: 0.25…2.5 mm²
- Multiple conductor, flexible with TWIN ferrule with plastic sleeve: 0.5…1.5 mm²

Other
- Operating mode: continuous operation
- Degree of protection internal components: IP40
- Degree of protection terminals: IP20
- DIN rail mounting acc. to: IEC 60715
- Screw fixing: 2 x M4 with mounting clip
- Enclosure material: polycarbonate
- Flammability class: UL 94V-0
- Dimensions (W x H x D): 72 x 93 x 63
- Documentation number: D00300
- Weight: approx. 180 g

Device version “W”
- Devices with the suffix “W” feature increased shock and vibration resistance.
- The electronics is covered with a special varnish to provide increased protection against mechanical stress and moisture.

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

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

Wiring diagram
6.2 System components | Communication systems | Charge Controller

Charge Controller CC612

Device features

- Charge controller acc. to IEC 61851-1 (mode 3)
- It can be configured as either a Master or Slave
- The charge controller can be integrated into a single or three-phase system up to 80 A
- Smart Grid enabled using standard OCPP functionality
- OCPP 1.5 and OCPP 1.6 compliant with JSON, SOAP and Binary implementation
- Supports 4G (LTE), 3G (UMTS) und 2G (GSM) mobile networks with an integrated 4G modem in all data gateways with 4G modem
- Two USB interfaces:
  - CONFIG for local configuration
  - Other is used an extension port for peripheral USB devices (Ethernet/WiFi home applications)
- Master/slave hardware configuration
- Control Pilot and Proximity Pilot signal management
- Universal charge plug control (support for different vendors of sockets)
- Configurable support for one additional household socket
- Can connect to eHZ or Modbus meters and to meters with an S0 interface
- User interface board for customer-specific applications
- Configurable 3-channel input/output extension interface for additional functionality
- Only an external RCD type A is required.
- Internal temperature sensors
- A Peer Group Mechanism or Dynamic Load Management where a set current is shared between a group of charge controllers
- Optional integrated ISO/IEC 15118 power line communication (PLC) for plug & charge and load management systems
- Local and remote configuration

Standards

The charge controller has been developed in compliance with the following standards:
- EN 50581
- EN 61851-1
- EN 301 489-1: V2.2.0 Draft
- EN 301 511 V12.5.1
- EN 301 908-13 V11.1.2
- EN 62311
- EN 61851-22
- EN 301 489-52 V1.1.0 Draft
- EN 301 908-1 V11.1.1
- EN 301 908-2 V11.1.2

Further information

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

Typical applications

- Electric vehicle (EV) charging stations, wall boxes or street light charging points

Approvals

CE

6.2
### Technical data

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

- **Rated voltage**: 12.5 V
- **Overvoltage category/Pollution degree**: III/3
- **Rated impulse withstand voltage**: 800 V
- **Altitude**: ≤ 2000 m AMSL

**Supply voltage**

- **Nominal voltage**: DC 12 V
- **Operating range of the supply voltage**: DC 11.4 V…12.6 V
- **Nominal current**: 1 A

**RDC-MD**

- **Measuring range**: 100 mA
- **Response values:**
  - Residual current ($I_{\Delta n}$): DC 6 mA
  - Response tolerance ($I_{\Delta n}$): -50…0 %
- ** Restart sequence value:** DC 6 mA < 3 mA

**Wireless parameters (Optional for data gateways with 4G modem only)**

- **Frequency bands**: 800 MHz/850 MHz/900 MHz/1,800 MHz/2,100 MHz/2,600 MHz
- **Impedance**: 50 Ω
- **Data rate**
  - **GSM**:
    - GPRS: UL 85.6 kBit/s; DL 107 kBit/s
    - EDGE: UL 23.6 kBit/s; DL 296 kBit/s
  - **UMTS**:
    - WCDMA: UL 384 kBit/s; DL 384 kBit/s
    - DC-HSDPA: DL 42 kBit/s
    - HSUPA: UL 5.76 MBit/s
  - **LTE**:
    - LTE FDD: UL 5 MBit/s; DL 10 MBit/s
    - LTE TDD: UL 3.1 MBit/s; DL 8.96 MBit/s

**Required antenna**

- Panorama Antennas B4BE-7-27-05SP

**Inputs/outputs and display**

- **LED ALARM**: yellow
- **LED READY**: green
- **LED PLC (Optional)**: green
- **USB Extension interface (Ethernet, WLAN, …)**: USB socket type A
- **CONFIG (Configuration interface)**: Micro socket type A
- **SIM card (For data gateways with 4G modem only)**: micro SIM

**Terminal A:**

- **IN**: Actuator IN
- **OUT**: Actuator pull-up output

**Terminal B:**

- **12V**: +12 V IN
- **OV**: 0 V IN
- **11**: Relay 1 NO
- **14**: Relay 1 NO

**Terminal C:**

- **PP**: Proximity Pilot
- **CP**: Control Pilot (Optional Powerline Communication PLC acc. to ISO/IEC 15118)
- **Maximum cable length (PP, CP)**: < 15 m
- **21**: Relay 2 NO
- **24**: Relay 2 NO
- **IN1**: Input 1
- **IN1+**: Input 1+
- **IN2**: Input 2
- **IN2+**: Input 2+
- **CT**: Current transformer

**Input 1 and Input 2:**

- **Input voltage**: DC 11.4 V…25.2 V
- **Input current**: 1.7…3.8 mA
- **Meter Interface**: User interface

---

### Accessories

**Designation** | **Art. No.**
--- | ---
RFID110-L1 with RJ45 cable (length 500 mm) | B94060110
RFID114 with RJ45 cable (length 500 mm) | B94060114
Measuring current transformer**1) W15BS (Cable length 1500 mm) | B98080065
Measuring current transformer**1) W15BS-02 (Cable length 180 mm) | B98080067
Measuring current transformer**1) W15BS-03 (Cable length 320 mm) | B98080068
DPM2x16FP (display module) | B94060120

**1) The charge controller with optional RDC-MD only works in combination with the measuring current transformer, which must be ordered separately. Various cable lengths are available (see table below).**

- **2) Optional and enabled by a software update**

---

### System components | Communication systems | Charge Controller

Charge Controller CC612

---

6.2

---

376
Technical data (continued)

Switching elements

<table>
<thead>
<tr>
<th>Relay</th>
<th>Function</th>
<th>Contact data acc. to IEC 60947-5-1:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relay 1</td>
<td>configurable</td>
<td>Relay 1: N/O contacts</td>
</tr>
<tr>
<td>Relay 2</td>
<td>charging contactor</td>
<td>Relay 2: 1 N/O contact</td>
</tr>
<tr>
<td>Switching elements</td>
<td>2 x 1 N/O contacts</td>
<td></td>
</tr>
<tr>
<td>Operating principle</td>
<td>N/C operation</td>
<td></td>
</tr>
</tbody>
</table>

Electrical service life: 10,000 switching cycles

Environment/EMC

EMC: EN 61851-1, IEC 61851-21-2 FDIS:2017-09
EN 301 489-1, EN 301 489-52

Operating temperature: -30°C to +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): 2K2
- Long-term storage (IEC 60721-3-1): 1K2

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): 1M12

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...12)
    - 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: IP20
- DIN rail mounting: IEC 60715
- Weight: 160 g

*) Surge test is carried out at Phoenix power supply STEP-PS/1AC/12DC/1.5.
   The 12V cable length is less than 1 meter.

Dimension diagram (dimensions in mm)

[Diagram showing the dimensions of the device]
Wiring diagram

<table>
<thead>
<tr>
<th>Assignment of the terminals</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>IN</td>
<td>C1</td>
</tr>
<tr>
<td>A2</td>
<td>+</td>
<td>C2</td>
</tr>
<tr>
<td>A3</td>
<td>OUT</td>
<td>C3</td>
</tr>
<tr>
<td>A4</td>
<td>–</td>
<td>C4</td>
</tr>
<tr>
<td>B1</td>
<td>12V</td>
<td>C5</td>
</tr>
<tr>
<td>B2</td>
<td>0 V</td>
<td>C6</td>
</tr>
<tr>
<td>B3</td>
<td>11</td>
<td>C7</td>
</tr>
<tr>
<td>B4</td>
<td>14</td>
<td>C8</td>
</tr>
</tbody>
</table>

- Connection locking engine
- Connection socket User Interface
- Connection socket
- Connection Current Transformer (CT)
- Terminal User Interface (RJ45)
- Terminal Modbus/eHZ meter (RJ10)
- RCD Type A
- Voltage supply DC 12 V
- Current Transformer (CT) with plug
- Contactor
- Type 2 socket *
- Type 2 plug *
- Connection Proximity Pilot
- Connection Control Pilot
- Relay 1: Control pin intermediate relay
- Output relay 2
- Intermediate relay
- Optocoupler input 1
- Optocoupler input 2
**COMTRAXX® COM462RTU**  
BMS Modbus RTU gateway

### 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

### 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 [1], 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>B95061022</td>
</tr>
<tr>
<td>76…250 V, 10…35 mA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[1] Absolute values

---

**Typical applications**

- Usage of professional visualisation programs by converting BMS data to Modbus RTU protocols.
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<td></td>
<td></td>
<td></td>
<td></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: ≤ 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)*

- Modbus RTU:
  - Interface/protocol: RS-485/Modbus RTU
  - Operating mode: slave
  - Baud rate Modbus RTU: 9.6...57.6 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, Modbus RTU: terminals D+, D
  - Terminating resistor: 120 Ω (0.25 W)
  - Device address, Modbus RTU: 2...247 (2)*

#### Environment/EMC
- EMC: EN 61326-1
- Operating temperature: -10...+55 °C

#### Classification of climatic conditions acc. to IEC 60721
- 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

#### 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
- Degree of protection, internal components (IEC 60529): IP30
- Degree of protection, terminals (IEC 60529): IP20
- Type of enclosure: X60
- DIN rail mounting acc. to IEC 60715
- Flammability class: UL94V-0
- Documentation number: D00010
- Weight: ≤ 310 g

(*) = factory setting

---

### Dimension diagram (dimensions in mm)

![Dimension Diagram](image-url)
<table>
<thead>
<tr>
<th>1</th>
<th>A1, A2</th>
<th>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.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>A, B</td>
<td>Connection to the BMS bus (internal) with shielded cable (e.g. J-Y(St)Y 2x0.8)</td>
</tr>
<tr>
<td>3</td>
<td>AMB, BMB</td>
<td>Connection Modbus RTU with shielded cable (e.g. J-Y(St)2x0.8)</td>
</tr>
<tr>
<td>4</td>
<td>R&lt;sub&gt;on/off&lt;/sub&gt; (A, B)</td>
<td>Switch for BMS bus termination. When the device is installed at the end of the bus, set the terminating switch to “on”.</td>
</tr>
<tr>
<td>5</td>
<td>R&lt;sub&gt;on/off&lt;/sub&gt; (AMB, BMB)</td>
<td>Switch for Modbus RTU termination. When the device is installed at the end of the bus, set the terminating switch to “on”</td>
</tr>
<tr>
<td>6</td>
<td>IN1, GND1/2, IN2</td>
<td>Zurzeit ohne Funktion (Digitale Eingänge)</td>
</tr>
<tr>
<td>7</td>
<td>11, 14</td>
<td>Zurzeit ohne Funktion (Alarmrelais K1)</td>
</tr>
<tr>
<td>8</td>
<td>IN3, GND3/4, IN4</td>
<td>Zurzeit ohne Funktion (Digitale Eingänge)</td>
</tr>
</tbody>
</table>
**COMTRAXX® COM465IP**

Condition Monitor with integrated gateway for the connection of Bender devices to Ethernet TCP/IP networks

### Device features

- Condition Monitor for Bender systems
- Integrated modular gateway between Bender systems and TCP/IP enables remote access via LAN, WAN or 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
- CUL
- Listed
- Register of Approvals

### 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.
- Device documentation can be created by any device in the system. Present measured values, settings and software statuses are stored.
- System documentation can be created. It documents all devices in the system at once.

Generating device documentations 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

- Quick and easy parameterisation of all devices* assigned to the gateway via web browser.
- Backups can be generated and restored from all devices in the system.

* Parameter setting of BMS bus devices is only possible when the gateway is connected to the internal BMS bus.

### Approvals
**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 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 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>–</td>
<td>≤ 6.5 VA/≤ 4 W</td>
<td>Condition Monitor with integrated gateway: Bender system/Ethernet</td>
<td>COM465IP-230 V B95061065</td>
</tr>
<tr>
<td>–</td>
<td>24 V</td>
<td>≤ 3 W</td>
<td></td>
<td>COM465IP-24 V B95061066</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 test messages for all devices/channels, device failure monitoring, e-mail in the event of an alarm</td>
<td>Function module A</td>
<td>B75061011</td>
</tr>
<tr>
<td>Modbus TCP server for max. 98 * 139 BMS nodes as well as BCOM and universal measuring devices, SNMP server</td>
<td>Function module B</td>
<td>B75061012</td>
</tr>
<tr>
<td>Parameter setting of BMS devices as well as BCOM and universal measuring devices</td>
<td>Function module C</td>
<td>B75061013</td>
</tr>
<tr>
<td>Visualisation of Bender systems, System visualisation</td>
<td>Function module D</td>
<td>B75061014</td>
</tr>
<tr>
<td>Virtual devices</td>
<td>Function module E</td>
<td>B75061015</td>
</tr>
<tr>
<td>Integration of third-party devices</td>
<td>Function module F</td>
<td>B75061016</td>
</tr>
</tbody>
</table>

**Examples:**

- To write parameters via Modbus, the function modules B and C are required.
- To read parameters via Modbus, the function module B is required.

**Further information**

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

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

<table>
<thead>
<tr>
<th>(For 230 V variants B95061060)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated insulation voltage</td>
<td>250 V</td>
<td>AC</td>
<td></td>
</tr>
<tr>
<td>Rated impulse voltage/Overvoltage category</td>
<td>4 kV/III</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pollution degree</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protective separation (reinforced insulation) between</td>
<td>(A1/+, A2/-) - [(AMB, BMB), (ABMS, BBMS), (X2), (X3, X4)]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>(For 24 V variants B95061061)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated insulation voltage</td>
<td>50 V</td>
<td>DC</td>
<td></td>
</tr>
<tr>
<td>Rated impulse voltage/Overvoltage category</td>
<td>0.5 kV/III</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pollution degree</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Supply voltage

| Supply voltage U₀ | see ordering information |
| Frequency range Uₚ | see ordering information |
| Power consumption | see ordering information |

### Indications

- **LEDs:**
  - ON: operation indicator
  - DATA: Ethernet/Modbus
  - STATUS: Ethernet/BCOM
  - POWER: Ethernet/BCOM
  - TX: Ethernet/BCOM
  - RX: Ethernet/BCOM
  - TXERR: Ethernet/Modbus
  - RXERR: Ethernet/Modbus

### Environment/EMC

- **EMC:** EN 61326-1
- **Pollution degree:** 3
- **Pollution degree:** 3
- **Supply voltage:** 230 V
- **Frequency range:** 48…63 Hz
- **Power consumption:** 0.25 W

### Memory

- **Data loggers:** 30
- **Number of data points per data logger:** 10,000
- **Number of history memory entries:** 1,000
- **Number of devices or channels, 150 text elements:** 50
- **Data points for “third-party devices” on Modbus TCP and Modbus RTU:** 50
- **Option “W” data different from the standard version:**
  - Classification of climatic conditions acc. to IEC 60721
  - Stationary use (IEC 60721-3-3): 3K5 (except condensation and formation of ice possible)
  - Stationary use (IEC 60721-3-3): 3M4
  - Transport (IEC 60721-3-2): 2M2
  - Long-term storage (IEC 60721-3-1): 1K4

### Push-wire terminals

- **Conductor sizes:**
  - AWG 24-12
  - AWG 24-16
- **Length:**
  - Stripping length: 10 mm
  - Flexible: 0.2…2.5 mm²
  - Rigid/Flexible: 0.2…2.5 mm²
  - Flexible with ferrule, with/plastic sleeve: 0.25…2.5 mm²
  - Flexible with ferrule, without plastic sleeve: 0.25…2.5 mm²

### Terminal connections

- **Connection type:**
  - Push-wire terminal X1
  - Push-wire external (X2)
  - Terminals for “third-party devices” on Modbus TCP and Modbus RTU
  - Terminals for “third-party devices” on Modbus TCP and Modbus RTU

### Other

- **Degree of protection, terminals (IEC 60529):** IP20
- **Degree of protection, internal components (IEC 60529):** IP30
- **Rated impulse voltage/Overvoltage category:** 4 kV/III
- **Rated insulation voltage:** 250 V
- **Rated insulation voltage:** 50 V
- **Rated insulation voltage:** 250 V
- **Rated impulse voltage/Overvoltage category:** 0.5 kV/III
- **Rated insulation voltage:** 50 V
- **Rated impulse voltage/Overvoltage category:** 384 V
- **Rated impulse voltage/Overvoltage category:** 2020/2021
### Operating controls and connections

<table>
<thead>
<tr>
<th>No.</th>
<th>Connection</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ON</td>
<td>LED &quot;ON&quot;: Flashes during start-up. The LED lights permanently as soon as the device is ready for operation.</td>
</tr>
<tr>
<td>2</td>
<td>ETHERNET/IP, ISODATA 1, ISODATA 2</td>
<td>LEDs show activities on the different interfaces</td>
</tr>
<tr>
<td>3</td>
<td>A1/+ , A2/-</td>
<td>Supply voltage: see nameplate and ordering information</td>
</tr>
<tr>
<td>4</td>
<td>X1</td>
<td>Interface Modbus RTU</td>
</tr>
<tr>
<td>5</td>
<td>X1</td>
<td>BMS bus (Bender measuring device interface)</td>
</tr>
<tr>
<td>6</td>
<td>X2</td>
<td>Ethernet port (RJ45) for connection to the PC network as well as BCOM</td>
</tr>
<tr>
<td>7</td>
<td>RMB on/off</td>
<td>Terminating resistor Modbus RTU switch</td>
</tr>
<tr>
<td>8</td>
<td>RBMS on/off</td>
<td>Terminating resistor BMS bus switch</td>
</tr>
<tr>
<td>9</td>
<td>X3</td>
<td>Micro USB interface (currently without function)</td>
</tr>
<tr>
<td>10</td>
<td>X4</td>
<td>Mini HDMI interface (currently without function)</td>
</tr>
</tbody>
</table>

For UL applications, the following has to be observed:
- Maximum ambient temperature: 55 °C
- Use 60/75°C copper wires only
COMTRAXX® COM465DP
Condition Monitor with integrated gateway for the connection of Bender devices to PROFIBUS DP and Ethernet TCP/IP networks

Device features
- Condition Monitor for Bender systems
- Integrated modular gateway between Bender systems and TCP/IP enables remote access via LAN, WAN or 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/alarm messages and parameters*.
- Gateway for coupling of associated devices with the PROFIBUS DP.
- 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.
- Supports external applications (such as visualisation programs or PLCS) via the PROFIBUS DP protocol
- Reading-out of current measured values, operation/alarm 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.

*) 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 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.
- Device documentation can be created by any device in the system. Present measured values, settings and software statuses are stored.
- System documentation can be created. It documents all devices in the system at once.

*) 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
• Quick and easy parameterisation of all devices* assigned to the gateway via web browser.
• Backups can be generated and restored from all devices in the system.
* Parameter setting of BMS bus devices is only possible when the gateway is connected to the internal BMS bus.

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.

Examples:
• To write parameters via Modbus, the function modules B and C are required.
• To read parameters via Modbus, the function module B is required.
• For parameterisation via PROFIBUS, the function module C is required.

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

### Ordering information

<table>
<thead>
<tr>
<th>Application</th>
<th>Function module (software licence)</th>
<th>Art. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual text messages for all devices/ channels, device failure monitoring, e-mail in the event of an alarm</td>
<td>Function module A</td>
<td>B75061011</td>
</tr>
<tr>
<td>Modbus TCP server for max. 98 * 139 BMS nodes as well as BCOM and universal measuring devices, SNMP server</td>
<td>Function module B</td>
<td>B75061012</td>
</tr>
<tr>
<td>Parameter setting of BMS devices as well as BCOM and universal measuring devices</td>
<td>Function module C</td>
<td>B75061013</td>
</tr>
<tr>
<td>Visualisation of Bender systems, System visualisation</td>
<td>Function module D</td>
<td>B75061014</td>
</tr>
<tr>
<td>Virtual devices</td>
<td>Function module E</td>
<td>B75061015</td>
</tr>
<tr>
<td>Integration of third-party devices</td>
<td>Function module F</td>
<td>B75061016</td>
</tr>
</tbody>
</table>

### Function modules

<table>
<thead>
<tr>
<th>Supply voltage/frequency range Us</th>
<th>Power consumption</th>
<th>Application</th>
<th>Type</th>
<th>Art. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC/DC 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>24 V</td>
<td>≤ 3 W</td>
<td></td>
<td>COM465DP-24 V</td>
<td>B95061061</td>
</tr>
</tbody>
</table>
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/kV
Pollution degree  3
Protective separation (reinforced insulation) between
(A1/-, A2/-) - [(AMB, BMB), (ABMS, BBMS), (X2), (X3, X4), (PROFIBUS DP)]

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/kV
Pollution degree  3

Supply voltage
Supply voltage U_S see ordering information
Frequency range U_f see ordering information
Power consumption see ordering information

LEDs:
ON operation indicator
PROFIBUS data traffic PROFIBUS DP
ETHERNET IP 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 50

Quantity
Data loggers 30
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
Ethernet
Port RS485
Data rate 10/100 MBit/s, autodetect
DHCP on/off (on*)
IP address nnn.nnn.nnn.nnn, can be reached over: 192.168.0.254, (169.254.0.1)
Netmask nnn.nnn.nnn.nnn (255.255.0.0)*
Protocols (depending on the function module selected)
TCP/IP, Modbus TCP, Modbus RTU, DHCP, SMTP, NTP

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 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: 3-FYSTF 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/internal 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 Parallel data access by different clients max. 8

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

PROFIBUS DP
Interface/protocol RS-485 galanvically 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 1...125 (3)*

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) 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

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 AWG 24-12
Stripping length 10 mm
rigid/flexible 0.2...2.5 mm²
flexible with ferrule, with/without plastic sleeve 0.25...2.5 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve 0.5...1.5 mm²

Push-wire terminal X1
Conductor sizes AWG 24-16
Stripping length 10 mm
rigid/flexible 0.2...1.5 mm²
flexible with ferrule without plastic sleeve 0.25...1.5 mm²
flexible with TWIN 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) IP20
Degree of protection, terminals (IEC 60529) IP20
DIN rail mounting acc. to IEC 60715
 Screw fixing 2 x M4
Enclosure type 3A80
Enclosure material polycarbonate
Fire rating UL 94V-0
Dimensions (W x H x D) 107.5 x 93 x 62.9 mm
Document number D00216
Weight ≤ 240 g

(*) = factory setting
Operating controls and connections

1. **ON**: LED "ON": Flashes during start-up. The LED lights permanently as soon as the device is ready for operation.

2. **ETHERNET/IP MODBUS/RTU BMS**: LEDs show activities on the different interfaces

3. **A1/+, A2/-**: Supply voltage: see nameplate and ordering information

4. **PROFIBUS DP**: Connection PROFIBUS DP

5. **X1**: Interface Modbus RTU

6. **X1**: BMS bus (Bender measuring device interface)

7. **X2**: Ethernet (RJ45) for connection to the PC network as well as BCOM

8. **RMB on/off**: Terminating resistor Modbus RTU switch

9. **RBMS on/off**: Terminating resistor BMS bus switch

10. **X3**: Micro USB interface (currently without function)

11. **X4**: Mini HDMI interface (currently without function)

For UL applications, the following must be observed:
- Maximum ambient temperature: 55 °C
- Only 60/75 °C copper wires must be used
**COMTRAXX® COM465ID**

Condition Monitor with an integrated gateway for the connection of Bender isoData 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
- Integration of devices that are connected via IsoData or BCOM
- OPC UA interface for data transmission

### Typical applications

- Optimum display and visualisation of device and plant statuses in the web browser
- Collecting information from the Bender system and making it available via Modbus TCP and OPC UA
- Specific system overview through individual installation description
- Selective notification to various users in case of alarms
- Information from the Bender system can be transmitted to POWERSCOUT® for analysis and archiving.
- Commissioning and diagnosis of Bender systems
- Remote diagnosis, remote maintenance

### Approvals

![CE Mark](image)

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### Range of functions

**Basic device (without function modules)**

- Condition Monitor with a web interface for use with Bender isoData and BCOM as well as universal measuring devices.
- Support for devices that are connected
  - via IsoData (1 device per interface),
  - via the BCOM interface (see the BCOM operating manual),
  - via Modbus TCP (max. 247 devices).
- Remote display of present measured values, operating status and alarm messages.
- Gateway to Modbus TCP: Reading the latest subsystem measured values, operating status and alarm messages from addresses 1…10 via Modbus TCP.
- Ethernet interface with 10/100 Mbit/s for remote access via LAN, WAN or the Internet.
- Setting for internal parameters and for configuration of Bender universal measuring devices and energy meters.*
- Time synchronisation for all assigned devices.
- History memory (1,000 entries).
- Data loggers, freely configurable (30 * 10,000 entries).
- 50 data points from third-party devices (via Modbus TCP) can be integrated into the system.
- A virtual device with 16 channels can be created.

*) Individual parameters can be set via a web-based application and externally (via BCOM), but not via Modbus.

The parameters of assigned devices can only be read; in order to change settings, function module C is required!

No reports can be generated – also not for your own device.

**Function module A**

- Assigning individual texts for devices, channels (measuring points) and alarms
- Device failure monitoring
- E-mail notification in the event of alarms or system faults to different users
- Configuration of e-mail notifications
- Device documentation can be created by any device in the system. Present measured values, settings and software statuses are stored.
- System documentation can be created. It documents all devices in the system at once.

**Function module B**

- Supports external applications (e.g. visualisation programs or PLCs) by means of the Modbus TCP protocol.
- Reading the latest measured values, operating status and alarms messages from all assigned devices. Uniform access to all assigned devices by means of Modbus TCP via an integrated server.
- Control commands: From an external application (e.g. visualisation software or PLC), commands can be sent to devices by means of Modbus TCP.
- Access to alarms and measurement values via SNMP protocol (V1, V2c or V3).

**Function module C**

- Quick and easy parameterisation of all devices* assigned to the gateway via web browser.
- Backups can be generated and restored from all devices in the system.

*) Only BCOM devices can be parameterised. IsoData devices cannot be parameterised.

**Function module D**

Fast, simple visualisation without programming. Device statuses, alarms or readings can be arranged and displayed (e.g. a spatial plan) in front of a background image.

- Display of an overview covering several pages. Jump to another view page and return to the overview page.
- Graphical display of the data loggers with scaling of the time axis.

*) Currently, the Silverlight web interface is still necessary for this function.
Function module E
• 100 virtual devices with 16 channels each can be created.

Function module F
• 1,600 data points from third-party devices (via Modbus TCP) can be integrated into the system.

Examples:
• To write parameters via Modbus, the function modules B and C are required.
• To read parameters via Modbus, the function module B is required.

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

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 24…240 V, 50…60 Hz</td>
<td>≤ 6.5 VA/≤ 4 W</td>
<td>Condition Monitor with an integrated gateway: Bender system/Ethernet</td>
<td>COM465ID-230 V</td>
<td>B95061070</td>
</tr>
</tbody>
</table>

Function modules

<table>
<thead>
<tr>
<th>Application</th>
<th>Function module (software licence)</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual texts for devices/channels, device failure monitoring, e-mail in case of an alarm</td>
<td>Function module A</td>
<td>B75061011</td>
</tr>
<tr>
<td>Modbus TCP server for max. 98 * 139 BMS nodes as well as BCOM and universal measuring devices, SNMP server</td>
<td>Function module B</td>
<td>B75061012</td>
</tr>
<tr>
<td>Parameter setting of BMS devices as well as BCOM and universal measuring devices</td>
<td>Function module C</td>
<td>B75061013</td>
</tr>
<tr>
<td>Visualisation of Bender systems, System visualisation</td>
<td>Function module D</td>
<td>B75061014</td>
</tr>
<tr>
<td>Virtual devices</td>
<td>Function module E</td>
<td>B75061015</td>
</tr>
<tr>
<td>Integrating third-party devices</td>
<td>Function module F</td>
<td>B75061016</td>
</tr>
</tbody>
</table>
Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3  
(For 230 V variants B95061070)

- Rated 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)

Supply voltage
- Supply voltage U_s: see ordering details
- Frequency range U_s: see ordering details
- Power consumption: see ordering details

Indication

LEDs:
- ON: operation indicator
- ETHERNET IP: data traffic Ethernet
- ISODATA1: data traffic ISODATA1
- ISODATA2: data traffic ISODATA2
- Ethernet (X2 terminal) lights during network connection, flashes during data transmission

Internal 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: 50
- Data loggers: 30
- 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

- Ethernet
  - Port: RJ45
  - Data rate: 10/100 Mbit/s, autodetect
  - DHCP: on/off (on)*
  - tDHCP (DHCP): 5…60 s (30 s)*
  - IP address: nnn.nnn.nnn.nnn, can always be reached over: 192.168.0.254, (169.254.0.1)*
  - Netmask: nnn.nnn.nnn.nnn (255.255.0.0)*
  - Protocols (depending on function module selected): TCP/IP, Modbus TCP, Modbus RTU, DHCP, SMTP, NTP, OPC UA

- SNMP
  - Versions: 1, 2c, 3
  - Devices supported: Queries to all devices (channels) possible (no trap functionality)

- ISO DATA
  - Interface/protocol: RS-485/ISO DATA
  - Operating mode: master
  - Baud rate ISO DATA: 9.6 kbit/s
  - Cable length: ≤ 1200 m
  - Cable: twisted pair, shielded, one end of shield connected to PE recommended: J-Y(St)Y min. 2x0.8
  - Connection X1 (A-ID1, B-ID1, A-ID2, B-ID2):
  - Connection type: refer to connection “push-wire terminal X1”
  - Terminating resistor: 120 Ω (0.25 W), can be connected internally
  - Device address: ISO DATA (2); ISO DATA (3)

- 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
  - Parallel data access by different clients: max. 8

Environment/EMC

- EMC: EN 61326-1

Ambient temperatures

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

Classification of climatic conditions acc. to IEC 60721

- Stationary use (IEC 60721-3-3): 3K5 (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

Connection

- Connection type: pluggable push-wire terminals

- Push-wire terminals
  - Conductor sizes: AWG 24-12
  - Stripping length: 10 mm
  - rigid/flexible: 0.2…2.5 mm²
  - flexible with ferrule, with/without plastic sleeve: 0.25…2.5 mm²
  - Multiple conductor, flexible with TWIN ferrule with plastic sleeve: 0.5…1.5 mm²

- Push-wire terminal X1
  - Conductor sizes: AWG 24-16
  - Stripping length: 10 mm
  - rigid/flexible: 0.2…1.5 mm²
  - flexible with ferrule without plastic sleeve: 0.25…1.5 mm²
  - flexible with ferrule with plastic sleeve: 0.25…0.75 mm²

Other

- Operating mode: continuous operation
- Mounting: front-oriented, cooling slots must be ventilated vertically
- Degree of protection, internal components (IEC 60529): IP30
- Degree of protection, terminals (IEC 60529): IP20
- DIN rail mounting acc. to IEC 60715
  - Screw fixing: 2 x M4
  - Enclosure type: J460
  - Enclosure material: polycarbonate
  - Flammability class: UL94V-0
  - Dimensions (W x H x D): 107.5 x 93 x 62.9 mm
  - Weight: ≤ 240 g

( )* = Factory settings
Operating controls and connections

1. ON
   - The LED flashes during start-up.
   - The LED lights permanently as soon as the device is ready for operation.

2. ETHERNET/IP
   - ISODATA 1
   - ISODATA 2
   - LEDs show activities on the different interfaces

3. A1/+, A2/-
   - Voltage supply: see nameplate and ordering details

4. X1
   - IsoData 1 interface 1

5. X1
   - IsoData 1 interface 2

6. X2
   - Ethernet port (RJ45) for connection to the PC network as well as BCOM

7. RMB on/off
   - IsoData 1 terminating resistor switch

8. RBS on/off
   - IsoData 2 terminating resistor switch
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
- 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>B95061030</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>B75061015</td>
</tr>
<tr>
<td>Integration of third-party devices</td>
<td>Function module F</td>
<td>B75061016</td>
</tr>
</tbody>
</table>
### 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 $U_s$: see ordering information
- Frequency range $f_s$: see ordering information
- Power consumption: see ordering information

#### Displays, memory
- Display: 7" TFT WYG 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)*
- **Netmask:** nnn.nnn.nnn.nnn (255.255.0.0)*
- **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
- **EMC:** EN 61326-1
- **Operating temperature:** 0...+55 °C
- **Ventilation:** fanless

#### Classification of climatic conditions acc. to IEC 60721
- **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:** 1M4

#### Connection
- **Connection:** plug connectors

#### General data
- **Operating mode:** continuous operation
- **Mounting:** display oriented
- **Degree of protection, on the front (IEC 60529):** IP65
- **Degree of protection, on the rear (IEC 60529):** IP20
- **Type of enclosure:** panel mounting
- **Screw mounting:** with mounting brackets
- **Flammability class:** UL94V-0
- **Weight:** ≤ 1200 g

(*) = factory setting

### Dimension diagram (dimensions in mm)

![Dimension diagram](image)

### Control panel cut-out (dimensions in mm)

![Control panel cut-out](image)
6.2 System components | Communication systems | Condition Monitor

Condition Monitor COMTRAXX® CP700

**Operating elements and Wiring diagram**

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

**Interfaces**

1. Interface Modbus RTU
2. Switch and LED master/slave for interface Modbus RTU
3. BMS bus (Bender measuring device interface)
4. Switch and LED master/slave for BMS bus
5. USB interface, without function
6. Connection of supply voltage, DC 24 V
7. Functional earth
8. USB interfaces, without function
9. Ethernet 10/100/1000, port for connection to the personal computer resp. to the local network (hub, switch, router)
10. RS-232 interface, without function

**Rear cover**

1. Mode/node switch x16
2. Mode/node switch x1
3. Buttons: Power, Reset
4. LEDs: Power, CF, Link, Run
5. Battery
6. SD memory card slot
7. Compact flash card slot
COMTRAXX® CP9xx
Alarm indicator and operator panel for medical locations and other areas

Device features
- Display size 7", 15" and 24" with tempered and anti-reflective glass
- Easy to clean and to desinfect, degree of protection IP54
- Screwless mounted front plate
- User-friendly touch-sensitive monitoring system for medical locations and other applications
- Particularly simple operation
- Additional information for medical and technical personnel
- Visual and acoustic notification in the event of an alarm
- Clear menu structure with self-explanatory interactive images
- Clearly marked safety functions
- Silent due to operation without fan
- High-quality representation with excellent contrast, high resolution and a wide viewing angle
- Possibility of graphical integration of building plans or status display in photo quality
- Easy integration of external subsections like charging stations for operating theatre table controls and intercom systems with front foil
- Simple conversion and expansion with minimal service interruptions

Typical applications
Monitoring, operation and display of:
- IT systems
- Supply systems for medical gases
- Ventilation and air-conditioning systems
- Room lighting
- Operating theatre lights
- Special power supply systems (BSV (battery-based safety power supply) or UPS (uninterruptible power supply))
- Further systems from different manufacturers.

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

Ordering information

<table>
<thead>
<tr>
<th>Type</th>
<th>Display size</th>
<th>Supply</th>
<th>Device dimensions (W x H x D)</th>
<th>Weight</th>
<th>Display unit</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP907</td>
<td>7&quot; (17.6 cm)</td>
<td>DC 24 V, &lt; 15 W; PoE possible as an alternative</td>
<td>226 x 144 x 78 mm</td>
<td>1.1 kg</td>
<td>Glass, tempered, white</td>
<td>B95061080</td>
</tr>
<tr>
<td>CP915</td>
<td>15.6&quot; (38.6 cm)</td>
<td>AC 100…240 V, &lt; 30 W</td>
<td>505 x 350 x 92 mm</td>
<td>6.1 kg</td>
<td>Glass, tempered, white</td>
<td>B95061081</td>
</tr>
<tr>
<td>CP924</td>
<td>24&quot; (54.5 cm)</td>
<td>AC 100…240 V, &lt; 55 W</td>
<td>654 x 441 x 100 mm</td>
<td>9.1 kg</td>
<td>Glass, tempered, gray</td>
<td>B95061084</td>
</tr>
</tbody>
</table>

Scope of delivery: display unit, flush-mounting enclosure incl. mounting plate with electronics, CP9xx connecting cable and plug connector kit.

Components separately

<table>
<thead>
<tr>
<th>Device series</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP907</td>
<td>Flush-mounting enclosure</td>
<td>B95100140</td>
</tr>
<tr>
<td>CP915</td>
<td>Display unit white</td>
<td>B95061090</td>
</tr>
<tr>
<td></td>
<td>Display unit gray</td>
<td>B95061110</td>
</tr>
<tr>
<td></td>
<td>Flush-mounting enclosure incl. mounting plate with electronics</td>
<td>B95061092</td>
</tr>
<tr>
<td>CP924</td>
<td>Display unit white</td>
<td>B95061111</td>
</tr>
<tr>
<td></td>
<td>Display unit gray</td>
<td>B95061097</td>
</tr>
<tr>
<td></td>
<td>Flush-mounting enclosure incl. mounting plate with electronics</td>
<td>B95061099</td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP9xx replacement plug connector kit</td>
<td>B95061910</td>
</tr>
<tr>
<td>CP9xx suction lifter</td>
<td>B95061911</td>
</tr>
</tbody>
</table>

* The suction lifter is needed to remove the display.

Other project-specific versions with foil surface or with additional internal components available on request:
- Charging tray for operating theatre table remote controls
- Intercom systems
- Operating theatre light controls
- Programmable backlit keypads
- Digital/Analogue inputs/outputs for installation in panel enclosures or control cabinets
- Data coupling to third-party systems
- Project-specific built-in enclosures
- Integration of third-party systems
- Antibacterial or highly transparent foil
- Exchange of existing control panels (Retrofit)
- etc.
### Technical data

#### Insulation coordination CP907 acc. to IEC 60664-1

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th>50 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overvoltage category</td>
<td>III</td>
</tr>
<tr>
<td>Pollution degree</td>
<td>2</td>
</tr>
<tr>
<td>Rated impulse voltage</td>
<td>800 V</td>
</tr>
</tbody>
</table>

#### Insulation coordination CP915 acc. to IEC 60664-1

<table>
<thead>
<tr>
<th>Rated insulation voltage</th>
<th>AC 250 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overvoltage category</td>
<td>III</td>
</tr>
<tr>
<td>Pollution degree</td>
<td>2</td>
</tr>
<tr>
<td>Rated impulse voltage</td>
<td>4 kV</td>
</tr>
</tbody>
</table>

#### Supply CP907 via plug-in terminal (A1/+;A2/-)

<table>
<thead>
<tr>
<th>Nominal voltage CP907</th>
<th>DC 24 V SELV/PELV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal voltage tolerance</td>
<td>±20 %</td>
</tr>
<tr>
<td>Typical power consumption at DC 24 V</td>
<td>&lt; 15 W</td>
</tr>
<tr>
<td>Connection</td>
<td>plug-in terminal (A1/+;A2/-)</td>
</tr>
<tr>
<td>Maximum cable length when supplied via B95061210 (DC 24 V power supply unit 1.75 A):</td>
<td>0.28 mm²</td>
</tr>
<tr>
<td></td>
<td>0.5 mm²</td>
</tr>
<tr>
<td></td>
<td>0.75 mm²</td>
</tr>
<tr>
<td></td>
<td>1.5 mm²</td>
</tr>
<tr>
<td></td>
<td>2.5 mm²</td>
</tr>
</tbody>
</table>

#### Supply via PoE

<table>
<thead>
<tr>
<th>Nominal voltage</th>
<th>DC 48 V SELV/PELV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal voltage tolerance</td>
<td>-25...+15 %</td>
</tr>
<tr>
<td>Typical power consumption for PoE</td>
<td>&lt; 15 W</td>
</tr>
<tr>
<td>Maximum cable length when supplied via AWG 26/7; 0.14 mm²</td>
<td>100 m</td>
</tr>
</tbody>
</table>

#### Supply CP915 via terminal block (L1; N)

<table>
<thead>
<tr>
<th>Nominal voltage CP915 via external power supply unit</th>
<th>AC 100...240 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal voltage tolerance</td>
<td>-15...+10 %</td>
</tr>
<tr>
<td>Frequency range Us</td>
<td>50...60 Hz</td>
</tr>
<tr>
<td>Typical power consumption at AC 230 V</td>
<td>&lt; 10 W</td>
</tr>
<tr>
<td>Connection</td>
<td>terminal block (L1; N)</td>
</tr>
</tbody>
</table>

#### Stored energy time in the event of voltage failure

<table>
<thead>
<tr>
<th>Time, date after voltage interruption</th>
<th>min. 3 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restart after voltage interruption</td>
<td>min. 15 seconds</td>
</tr>
</tbody>
</table>

#### Displays, memory

<table>
<thead>
<tr>
<th>Display CP907</th>
<th>7&quot; TFT touch display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display CP915</td>
<td>15.6&quot; TFT touch display</td>
</tr>
<tr>
<td>Display CP924</td>
<td>24&quot; TFT touch display</td>
</tr>
<tr>
<td>E-mail configuration and device failure monitoring</td>
<td>up to 250 entries</td>
</tr>
</tbody>
</table>

#### Hardware endurance under rated operating conditions, number of cycles

| Displayable devices | 247 |
| Number of data points for “third-party devices” to Modbus TCP and Modbus RTU | 50 |
| Number of data loggers | 30 |
| Number of data points per data logger | 10,000 |
| Number of entries in the history memory | 1,000 |

#### Visualisation

| Number of pages | 20 |
| Background image size | max. 3 MB/image; max. 50 MB total memory |

#### Interfaces

| Ethernet | RJ45 |
| Data rate | 10/100 Mb/s, autodetect |
| DHCP | on/off/off (off) |
| ToF (DHCP) | 5...66 s (30 s) |
| IP address | nnn.nnn.nnn.nnn (192.168.0.254)*, can be reached via: 169.254.0.1 |
| Net mask | nnn.nnn.nnn.nnn (255.255.0.0)* |
| Protocols (depending on function module selected) | TCP/IP, Modbus RTU, DHCP, SMTP, NTP |

| BCOM subsystem name | (SYSTEM)* |
| BCOM subsystem address | 1...255 (1)* |
| BCOM address | 1...255 (1)* |
| USB | |

| Number | 2 |
| Operating mode | USB-2.0-Host (5 V, 500 mA) |
| Data rate | 480 Mb/s |

#### Modbus TCP

| Interface/protocol | Ethernet/Modbus TCP |
| Operating mode | Client for PEM and „third-party devices“ assigned |
| Operating mode | Server for access to process image and for Modbus control commands |

| Versions | 1, 2c, 3 |
| Devices supported | Queries to all devices (channels) possible (no trap functionality) |

#### BMS bus

| Interface/protocol | RS-485/BMS internal |
| Operating mode | master/slave (master)* |
| Baud rate | 9.6 kbit/s |
| Cable length | < 1200 m |
| Connection | plug-in terminal |

| Terminating resistor | 120 Ω (0.25 W), can be switched on internally (see plug-in terminal) |
| Supported Modbus RTU slave addresses | 1...247 |

#### Digital inputs (1-12)

| Number | 12 |
| Galvanic separation | yes |

| Operating mode | selectable for each input: active-high or active-low |
| Factory setting | active-high |
| Voltage range (high) | AC/DC 10...30 V |
| Voltage range (low) | AC/DC 0...2 V |
| Connection | plug-in terminal: (1;1;2;...12;12) |
| Maximum cable length | < 1000 m |

<table>
<thead>
<tr>
<th>Switching elements</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>1 changeover contact</td>
</tr>
<tr>
<td>Operating mode</td>
<td>N/C operation / N/O operation</td>
</tr>
<tr>
<td>Function</td>
<td>programmable</td>
</tr>
<tr>
<td>Electrical endurance under rated operating conditions, number of cycles</td>
<td>10,000</td>
</tr>
</tbody>
</table>

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

| Utilisation category | AC-13, AC-14, DC-12 |
| Rated operational voltage | 24 V |
| Rated operational current | 2 A |
| Minimum contact rating | 1 mA at AC/DC > 10 V |

| Connection | plug-in terminal: (11;12;13;14) |

#### Buzzer

| Buzzer message | can be acknowledged, adoption of characteristics of new value |
| Buzzer interval | configurable |
| Buzzer frequency | configurable |
| Buzzer repetition | configurable |

#### Audio (for CP015 and CP924 only)

| Line IN | STEREO signal input via 3.5 mm jack plug |
| Line OUT | Output to a STEREO playback device via 3.5 mm jack plug |

#### Device connections

| Terminal block (L1; N; PE) (for CP015 and CP924 only) | |
| Conductor sizes | AWG 20-12 |
| Shimming length | 10...11 mm |
| Flexible | 0.4...4 mm² |
| Flexible with ferrule with/without plastic sleeve | 0.4...4 mm² |
| Multiple conductor, flexible with TWIN ferrule with plastic sleeve | 0.4...4 mm² |

| Plug-in terminal (A1/+;A2/-) (11;12;14) | |
| Conductor sizes | AWG 24-12 |
| Shimming length | 10 mm |
| 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 |

#### Specifications

<table>
<thead>
<tr>
<th>System components</th>
<th>Communication systems</th>
<th>Alarm indicator and operator panel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm indicator and operator panel COMTRAXX® CP9xx</td>
<td>2020/2021</td>
<td></td>
</tr>
</tbody>
</table>
### Technical data (continued)

#### Plug-in terminal (l1;k1;l2;k2…l12;k12) (AMB;BMB;ABMS;BBMS;SBMS;SBMS)

- **Conductor sizes**: AWG 24-16
- **Stripping length**: 10 mm
- **rigid/flexible**: 0.2…1.5 mm²
- **Flexible with ferrule without plastic sleeve**: 0.25…1.5 mm²
- **Flexible with ferrule with plastic sleeve**: 0.25…0.75 mm²

#### Environment/EMC

<table>
<thead>
<tr>
<th>Environment</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC</td>
<td>IEC 61326-1</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-10…+55 °C</td>
</tr>
<tr>
<td>Range of use</td>
<td>≤ 2000 m AMSL</td>
</tr>
<tr>
<td>Humidity</td>
<td>≤ 98%</td>
</tr>
</tbody>
</table>

#### 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)**: 2K11
- **Long-term storage (IEC 60721-3-1)**: 1K22

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

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

#### Other

- **Operating mode**: continuous operation
- **Mounting**: display-oriented
- **Degree of protection, front**: IP54
- **Degree of protection, enclosure**: IP20
- **Flammability class**: UL 94V-0

#### Dimensions

- **Dimensions**
  - CP907 (W × H × D): 226 × 144 × 78 mm
  - CP915 (W × H × D): 505 × 350 × 92 mm
  - CP924 (W × H × D): 654 × 441 × 100 mm

- **Documentation number**: D00349

- **Weight**
  - CP907: approx. 1.1 kg
  - CP915: approx. 6.1 kg
  - CP924: approx. 9.1 kg

#### External dimensions

- **Type** | Dimensions (mm) |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CP907</td>
<td>a: 226</td>
</tr>
<tr>
<td>CP915</td>
<td>a: 505</td>
</tr>
<tr>
<td>CP924</td>
<td>a: 654</td>
</tr>
</tbody>
</table>

- **Glass thickness**: 3 mm

#### Installation dimensions – panel cut-out

<table>
<thead>
<tr>
<th>Type</th>
<th>Abmessungen (mm)</th>
<th>Required installation depth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a</td>
<td>b</td>
</tr>
<tr>
<td>CP907</td>
<td>212</td>
<td>124</td>
</tr>
<tr>
<td>CP915</td>
<td>461</td>
<td>306</td>
</tr>
<tr>
<td>CP924</td>
<td>610</td>
<td>398</td>
</tr>
</tbody>
</table>

#### Compliance

- **Plug-in terminal (l1;k1;l2;k2…l12;k12) (AMB;BMB;ABMS;BBMS;SBMS;SBMS)**

- **Technical data (continued)**

- **Components and Communication systems**

- **Alarm indicator and operator panel**

- **Technical data (continued)**

- **Advanced Communication Systems**

- **Alarm indicator and operator panel COMTRAX® CP9xx**
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)
- IEC 60364-7-710

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

### Ordering information

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<td>B95100100</td>
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<td>MK800-12</td>
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<td>MK800AF-11</td>
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<td>3 LEDs</td>
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<td>MK800AF-12</td>
<td>B95100105</td>
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<tr>
<td>Built-in type without enclosure</td>
<td>LCD</td>
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<tr>
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<td>DI400-11</td>
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<td>DI400-12</td>
<td>B95100114</td>
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### Accessories

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<td>Parameterisation software</td>
<td>TMK-SET V3.xx as Internet download</td>
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<tr>
<td>Flush-mounting enclosure for MK800</td>
<td>U800</td>
<td>B95100110</td>
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<tr>
<td>Bezel frame silver for MK800</td>
<td>BR800-1</td>
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<tr>
<td>Bezel frame white for MK800</td>
<td>BR800-2</td>
<td>B95100112</td>
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### Suitable system components

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<tbody>
<tr>
<td>Power supply unit</td>
<td>AN410</td>
<td>B924209</td>
<td>365</td>
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</table>

Remote alarm indicator and test combination COMTRAXX® MK800 (DI400)
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 \( U_f \) AC 40...60 Hz/DC
Operating range \( U_I \) AC 18...28/DC 18...30 V
Power consumption \( I \) ≤ 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
Display, characters 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
Factory setting Off
Operation mode N/O, N/C operation, off, selectable for each input
Control of digital inputs via potential-free contacts/extraneous voltage
Digital inputs 16 (IN1…IN16)

Inputs (MK800...-11/DI400-11 only)
Digital inputs 16 (IN1…IN16)
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 ≤ 1200 m
Cable: twisted pair, shield connected to PE on one side recommended: J-Y(St)Y min. 2 x 0.8
Terminating resistor 120 Ω (0.25 W) can be connected via DIP switch
Factory setting both on „off“ position
Device address, BMS bus internal/external 1...1501...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
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)
Marking RAL 5005 (signal blue)
Front plate RAL 7035 (light grey)

DI400
Front foil RAL 7035 (light grey)/RAL 7012 (basalt grey)
Marking buttons RAL 5002 (ultramarine blue), lettering: RAL 7035 (light grey)
Front plate RAL 7035 (light grey)

Switching elements (MK800-11/DI400-11 only)
Number 1 changewee contact
Function programmable
Operation mode N/C or N/O operation (programmable)
Electrical service life under rated operating conditions 10,000 switching operations

Utilisation category AC-13 AC-14 DC-12
Rated operational voltage 24 V 24 V 24 V
Rated operational current 5 A 3 A 1 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) 3K3 (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

Option „W“ data different from the standard version
Classification of climatic conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3) 3K3 (condensation and formation of ice is possible)
Stationary use (IEC 60721-3-3) 3M7

Connection
Connection pluggable screw terminals
Connection properties (supply voltage, BMS bus):
Rigid/flexible/conductor 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):
Rigid/flexible/conductor 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
Documentation number D0053 (MK800)
D00104 (DI400)

Weight:
Flush-mounting/cavity wall (MK800) ≤ 950 g
Surface-mounting (MK800A(DI400)) ≤ 880 g
Surface-mounting (MK800AF) ≤ 1150 g
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
- History memory with real-time clock to store 250 warning and alarm messages
- MK2418 can easily be exchanged for MK2430/MK2007

Standards
The MK2430 alarm indicator and test combination meets the requirements for installation:
- DIN VDE 0100-710 (VDE 0100 Part 710)
- IEC 60364-7-710

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

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

Ordering information

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<th>Enclosure included in the scope of delivery</th>
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<th>factory-programmed</th>
<th>Type</th>
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<td>Flush-mounting</td>
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<td>B95100008C</td>
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<td>Surface-mounting</td>
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<td>–</td>
<td>MK2430A-11</td>
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Accessories

<table>
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<tr>
<th>Type designation</th>
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<tr>
<td>Parameterisation software TMK-SET</td>
<td>as Internet download</td>
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<tr>
<td>MK2430 mounting kit, complete</td>
<td>B95101000</td>
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<tr>
<td>Flush-mounting enclosure</td>
<td>B923710</td>
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Suitable system components

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<td>Power supply unit</td>
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<td>B924209</td>
<td>365</td>
</tr>
<tr>
<td></td>
<td>AN450</td>
<td>B924201</td>
<td>367</td>
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</tbody>
</table>
**Technical data**

**Insulation coordination acc. to IEC 60664-1**
- Rated insulation voltage: AC 250 V
- Rated impulse withstand voltage: AC/DC 24 V
- Operating range: AC 18…28 V/DC 18…30 V
- Voltage failure without reset: ≤ 15 s

**Supply voltage**
- Supply voltage $U_s$: AC/DC 24 V
- Frequency range $f_s$: 0/40…60 Hz
- Rated impulse withstand voltage: 4 kV
- Rated insulation voltage: AC 250 V

**Operation range**
- Frequency range: S 0/40…60 Hz
- Power consumption: ≤ 3 VA

**Displays and LEDs**
- Display characters: four lines, 4 x 20 characters
- Alarm addresses configurable: 150
- Programmable test messages: 200
- History memory: 250
- Standard text message: 3 x 20 characters

**Buzzer**
- Buzzer message: can be acknowledged, adoption of characteristics of new value operation
- Buzzer interval: configurable
- Buzzer frequency: configurable
- Buzzer repetition: configurable

**Inputs (MK2430...-11 only)**
- Digital inputs: 12 (IN1…IN12)
- Galvanic separation: yes
- Activation of the digital inputs: via potential-free contacts/externaneous voltage
- Operating principle: N/O or N/C operation individually selectable for each input
- Factory setting: N/O operation
- Voltage range (high): AC/DC 10…30 V
- Voltage range (low): AC/DC 0…2 V
- Recommended cable: J-Y(St)Y min. x 0.8
- Cable length: ≤ 500 m

**Interfaces**
- Protocols: RS-485 and USB (V2.0/V1.1)
- Baud rate: 9.6 kbit/s
- Cable length: ≤ 1200 m
- Terminating resistor: 120 Ω (0.25 W) connectable via DIP switch
- Device address, BMS bus: 1…150
- Factory setting device address: 1 (master)

**Programming**
- Interfaces: RS-485 or USB (V2.0/V1.1), USB cable: Type A plug on Type B plug
- Software: TMK-SET V 4.0 or higher
- Factory setting password: activated

**Max. cable length in case of power supply of 1/2/3 MK24.. from one AN410**
- 0.28 mm² (e.g. J-Y(St)Y n x 0.6): 160/40/– m
- 0.5 mm² (e.g. J-Y(St)Y n x 0.8): 250/70/– m
- 0.75 mm²: 400/100/– m
- 1.5 mm²: 800/210/10 m
- 2.5 mm²: 1300/360/20 m

**Max. cable length in case of power supply of 1/2/3 MK24.. from one AN410**
- 0.28 mm² (e.g. J-Y(St)Y n x 0.6): 300/150/100 m
- 0.5 mm² (e.g. J-Y(St)Y n x 0.8): 500/250/150 m
- 0.75 mm²: 750/375/250 m
- 1.5 mm²: 1500/750/500 m
- 2.5 mm²: 2500/1200/750 m

**Colours**
- Front foil: RAL 7035 (light grey), RAL 7040 (basalt grey)
- Marking: RAL 5005 (ultramarine blue)
- Front plate: RAL 7035 (light grey)

**Switching elements (MK2430...-11 only)**
- Number: 1 changeover contact
- Function: programmable
- Operation mode: N/C or N/O operation (programmable)
- Electrical endurance, number of cycles: 10 000

**Contact data acc. to IEC 60947-5-1**
- Utilisation category: AC-13, AC-14, DC-12
- Rated operational voltage: 24 V
- Rated operational current: 5 A
- Minimum contact rating: 1 mA at AC/DC > 10 V

**Environment/EMC**
- EMC immunity: DIN EN 61000-6-2
- EMC emission: DIN EN 61000-6-3
- Operating temperature: -5...+55 °C

**Classification of climatic conditions acc. to IEC 60721:**
- Stationary use: 3K5
- Transport: 2K3
- Long-term storage: 1K4

**Classification of mechanical conditions acc. to IEC 60721:**
- Stationary use: 3M4
- Transport: 2M2
- Long-term storage: 1M3

**Connection**
- Connection: pluggable screw terminals

**Connection properties (supply voltage, BMS bus):**
- Connection of single conductors: rigid/flexible/conductor sizes
  - 0.2…0.3/0.2…0.5 mm²
  - 0.4…0.6/0.2…1.0 mm²
  - 1.0…1.5/0.2…1.5 mm²
- Multi-conductor connection (2 conductors of the same cross section):
  - rigid/flexible: 0.2…1/0.2…1.5 mm²
  - flexible with ferrule without plastic sleeve: 0.25…1 mm²
  - flexible with TWIN ferrules with plastic sleeve: 0.5…1.5 mm²

**Connection properties (inputs):**
- Connection of single conductors: rigid/flexible/conductor sizes
  - 0.08…0.3/0.08…0.5 mm²
  - 0.5…0.75 mm²
- Multi-conductor connection (2 conductors with the same cross section):
  - rigid/flexible: 0.08…0.15/0.08…0.25 mm²
  - flexible with ferrules without plastic sleeve: 0.25…0.34 mm²
  - flexible with TWIN ferrules with plastic sleeve: 0.5 mm²

**Other**
- Operating mode: continuous operation
- Mounting: display-oriented
- Degree of protection (DIN EN 60529): IP50
- Flammability class: UL94V-0
- Documentation number: D00129
- Weight: flush mounting ≤ 210 g, surface mounting ≤ 400 g
**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.
POWERSCOUT®
Recognising connections – optimising maintenance

Device features

- Transmission of measured values every 15 min
- Resolution of the data as a function of the velocity of the bus system
- 16 visible dashboards
- 256 public dashboards
- Commissioning wizards
  - Residual current
  - Stray currents
  - Neutral conductor
  - Central earthing point
- Dashboard management
- Tree views management
- Report management
- Automated sending of reports
- Integration via CP700, COM465IP and COM465DP
- Integration of third-party devices
- A web-based application for all types of devices
- Languages
  - English
  - German
- User management
- Supported browsers
  - Chrome
  - Firefox
  - Internet Explorer

Typical applications

- **Commissioning wizards**
  The wizards support the user in generating dashboards and reports. With just a few steps, meaningful dashboards related to a specific subject of electrical safety can be generated.

- **Residual current**
  The commissioning wizard supports you in creating a dashboard that allows evaluating the level of the residual current at a glance. The ratio of residual current and load current is calculated.

- **Stray currents**
  The wizard for stray currents indicates the system parts where excessive stray currents exist.

- **Central earthing point**
  The central earthing point wizard generates a meaningful visualisation for the user by querying the current at the CEP and the corresponding phase current.

- **Neutral conductor**
  The excessive load on the neutral conductor challenges many system operators. The commissioning wizard evaluates the neutral currents and indicates whether they are too high.

Further information

For further information refer to our product range on www.bender.de.
### Overview price model

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<th>User</th>
<th>Type</th>
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<td>10</td>
<td>POWERSCOUT 2</td>
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<td>up to 5</td>
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<td>POWERSCOUT 5</td>
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<td>up to 10</td>
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<td>POWERSCOUT 10</td>
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<td></td>
<td>&gt; 10</td>
<td>&gt; 40</td>
<td>POWERSCOUT project</td>
<td>B95061507</td>
</tr>
</tbody>
</table>

- If you choose the Hosted model, we will operate POWERSCOUT for you in a German data centre. We take care of updates and maintenance for you.
- If you choose the On-Premise model, POWERSCOUT will be installed on one of your servers.

### System architecture

- [Diagram of system architecture](#)
Insulation monitoring devices
ISOMETER®

Equipment for insulation fault location
ISOSCAN®

Residual current monitoring systems
LINETRAXX®

Neutral Grounding Resistor Monitor (NGR)
LINETRAXX®

Power Quality and Energy Measurement
LINETRAXX®

Measuring and monitoring relays
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>
</table>
| **Functional safety SIL2 according to IEC 61508**  
guarantees protection against malfunction hazards | **Easy to operate and perfect overview**  
due to clear menu structure and user guidance |
| **Continuous self monitoring**  
of electronic system and circuit paths with automatic notification | **Correct information at the correct time**  
due to clear messages via an illuminated graphic display and via bus |
| **Preventive safety**  
by automatic reminders for prescribed tests | **Safe manual changeover during service**  
due to integrated manual/automatic mode with mechanical restart interlock |
| **Maximum reliability during changeover**  
- Patented changeover system with mechanical and electrical interlock  
- Weld-free switching contacts with circuit breaker mechanism  
- Insensitive to voltage fluctuations or shocks, for example, due to stable operating position and constant contact pressure  
- Monitoring for short circuits | **Complete documentation of events**  
- Changeover procedures  
- Testing  
- Parameter changes |
| **Compact**  
Compact design  
of electronic system and switching elements in one enclosure | **External functional test or replacement without service interruption**  
by optional bypass switch |
| **Changeover, IT system monitoring and locating current injector**  
in one device | |
| **Simple wiring**  
due to integrated design | |
| **Completely pluggable** | |

**Efficient**

<table>
<thead>
<tr>
<th>Efficient</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Small space required</strong></td>
</tr>
<tr>
<td><strong>Tests according to the regulations without interruption of the power supply</strong></td>
</tr>
<tr>
<td><strong>Easy integration into existing installations</strong></td>
</tr>
</tbody>
</table>
### Device overview ATICS® switchover and monitoring devices

<table>
<thead>
<tr>
<th>Page</th>
<th>ATICS®-…-ISO</th>
<th>ATICS®-…-DIO</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Application</strong></td>
<td>Unearthed safety power supplies</td>
<td>Safety power supplies</td>
</tr>
<tr>
<td><strong>Rated insulation voltage</strong></td>
<td>2-pole: 250 V</td>
<td>2-pole: 250 V 4-pole: 400 V</td>
</tr>
<tr>
<td><strong>Voltages</strong></td>
<td>AC 230 V (AC 160…276 V)</td>
<td>2-pole: AC 230 V 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</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Measuring range</strong></td>
<td>10 kΩ…1 MΩ</td>
<td></td>
</tr>
<tr>
<td><strong>Response value R_{an1}</strong></td>
<td>50…500 kΩ</td>
<td></td>
</tr>
<tr>
<td><strong>Digital inputs/relays</strong></td>
<td>1/1</td>
<td>4/4</td>
</tr>
<tr>
<td><strong>Interface/protocol</strong></td>
<td>RS-485/BMS</td>
<td>RS-485/BMS</td>
</tr>
<tr>
<td><strong>Generation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pluggable screw terminals</strong></td>
<td></td>
<td>(up to 125 A)</td>
</tr>
<tr>
<td><strong>Screw terminals</strong></td>
<td></td>
<td>(160 A)</td>
</tr>
<tr>
<td><strong>Installation</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>DIN rail</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Screw mounting</strong></td>
<td>4 x M5</td>
<td>6 x M5</td>
</tr>
</tbody>
</table>
ATICS®-…-ISO
Automatic transfer switching devices with monitoring function for unearthed safety power supplies

Device features

**Perfectly suitable for space-saving installation/retrofitting**
- Compact device for easy setup of safety power supplies with functional safety in accordance with DIN EN 61508 (SIL 2) e.g. for group 2 medical locations in compliance with DIN VDE 0100-710 (VDE 0100-710)/IEC 60364-7-710
- Increased safety and availability by integrating changeover and IT system monitoring in one compact device
- All-in-one: Integration of switch disconnector, control and monitoring electronics for unearthed safety power supplies
- Solutions for any application

**Safe operation**
- Robust switch disconnector contacts
- Mechanical locking
- Manual operation directly on the device
- Functional safety SIL 2
- Certification by TÜV SÜD in accordance with EN 61508 (VDE 0803) SIL 2 and DIN VDE 0100-710 (VDE 0100-710)

**Convenient installation and commissioning**
- Saves time and money

**Uninterrupted maintenance**
- Plug connectors and optional bypass switch
- Excellent communication and parameterisation options

**Standards**
The transfer switching device conforms to the following standards:
- DIN VDE 0100-710 (VDE 0100-710)*
- DIN VDE 0100-718 (VDE 0100-718)
- ÖVE/ÖNORM E 8007
- IEC 60364-7-710*
- DIN EN 61508-1 (VDE 0803-1)*
- IEC 61508-1 (2010-04) Ed. 2.0*
- DIN EN 61508-2 (VDE 0803-2)*
- IEC 61508-2 (2010-04) Ed. 2.0*
- DIN EN 61508-3 (VDE 0803-3)*
- IEC 61508-3 (2010-04) Ed. 2.0*
- DIN EN 60947-6-1 (VDE 0660-114)
- IEC 60947-6-1 (2013-12) Ed. 2.1
- DIN EN 61557-8 (VDE 0413-8)

Standard-compliant isolating transformer monitoring according to:
- DIN EN 61558-1 (VDE 0570-1)
- DIN EN 61558-1/A1 (VDE 0570-1/A1)

The standards marked with * were part of the test conducted by TÜV SÜD.

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

### Ordering information

<table>
<thead>
<tr>
<th>Rated operational voltage $U_e$</th>
<th>Nominal system voltage $U_n$</th>
<th>Rated operational current $I_e$</th>
<th>Type</th>
<th>Art. No.</th>
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<tr>
<td><strong>AC</strong></td>
<td><strong>AC</strong></td>
<td><strong>AC</strong></td>
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<td></td>
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<td>230V</td>
<td>63 A</td>
<td>ATICS-2-63A-ISO</td>
<td>B92057202</td>
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<td>230V</td>
<td>80 A</td>
<td>ATICS-2-80A-ISO</td>
<td>B92057203</td>
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<tr>
<td></td>
<td>400V</td>
<td>63 A</td>
<td>ATICS-2-63A-ISO-400</td>
<td>B92057204</td>
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<td>400V</td>
<td>80 A</td>
<td>ATICS-2-80A-ISO-400</td>
<td>B92057205</td>
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<tr>
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<td>230V</td>
<td>63 A</td>
<td>ATICS-2-63A-ISO-ES</td>
<td>B92057206</td>
</tr>
<tr>
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<td>230V</td>
<td>80 A</td>
<td>ATICS-2-80A-ISO-ES</td>
<td>B92057207</td>
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</tbody>
</table>
Supply voltage $U_S$ see ordering details

Frequency range

Overvoltage category III

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

Rated operational voltage

Pollution degree outside, inside 2

Voltage test according to IEC 61010-1 (basic insulation/protective separation) 2.21 kV/3.54 kV

Protective separation between line 1 – line 2; line 1, 2, 3 – relay outputs

Rated insulation voltage 250 V

Voltage monitoring/changeover refer to the manual, table "Utilisation category acc. to DIN EN 60947"

Current during changeover process 17 A ≤ 30 ms

Power consumption at 80 A ≤ 28 W

Power consumption at 63 A ≤ 16 W

Nominal system voltage

Cable: twisted pairs, shield to terminal 1 at one end, must not be earthed

Shielded cable 0.5 mm² 10…40 m

Single wire, twisted ≥ 0.75 mm² 1…10 m

Single wire ≥ 0.75 mm² 0…1 m

Cable length:

Hysteresis for short-circuit alarm 5 %

Crest factor min. 2

Response value for short-circuit detection ATICS-ISO (versions 63 A and 80 A) with STW3 170 A

Cable: twisted pairs, shield to terminal 1 at one end, must not be earthed recommended: J-Y(St)Y min. n x 2 x 0.8

Hysteresis for short-circuit alarm 5 %

Crest factor for short-circuit alarm 5 %

IT system monitoring

Nominal system voltage (operating range) 80…275 V

Measuring range 10 kΩ 2…1 MΩ

Measurement method AMP (adaptive measuring pulse)

Response value $R_{TP}$ (ALARM 1) 50…250 kΩ

Relative uncertainty ±15 %

Hysteresis ≤ 25 %

Response time $t_{TA}$ at $R_T = 0.5 \times R_{TP}$ and $C_T = 1 \mu F$ ≤ 5 s

Measuring voltage $U_T$ DC 12 V

Measuring current $I_{TP}$ at $R_T = 0.2 \mu A$ ≤ 53 μA

Internal resistance $R_T$ ≥ 240 kΩ

Impedance $Z_T$ ≥ 220 kΩ

Internal resistance/impedance during test ≥ 100 kΩ

Permissible extraneous DC voltage $U_T$ ≤ DC 370 V

Permissible system leakage capacitance $C_T$ ≤ 5 μF

Automatic self test every hour

Response time for loss of earth connection as well as loss of network connection maximum 1 hour

Load current monitoring (IT system transformer)

Measuring current transformers STW2, STW3, SWL-100 A

Measuring range IL (TRMS) 10…110 % of the response value

Adjustable response value (STW2, STW3, SWL-100 A) 5…(50) 100 A (1-A steps)

Relative uncertainty ±5 %

Crest factor ≤ 2

Response time < 1 s

Response delay $t_{TA}$ 0…100 ms (step-by-step in 1-ms steps)

Response delay $t_{TO}$ 0…100 ms (step-by-step in 1-ms steps)

Hysteresis 5…30 %

Response time CT connection monitoring approx. 1 h (or immediately in case of "TEST Isometer")

Cable length:

Single wire ≥ 0.75 mm² 0…1 m

Single wire, twisted ≥ 0.75 mm² 1…10 m

Shileded cable 0.5 mm² 10…40 m

Cable: twisted pairs, shield to terminal 1 at one end, must not be earthed recommended: J-Y(St)Y min. n x 2 x 0.8

Temperature monitoring (IT system transformer)

Response value 4 kΩ

Relative uncertainty ±10 %

Release value 1.6 kΩ

Response time (overtemperature or open-circuit temperature sensor) ≤ 2 s

PIT sensors acc. to DIN 44081 max. 6 in series

Insulation fault location

Test current $I_T$ < 1 mA

Test cycle/pause 2/4 s

Displays and data memory

Display: graphic display languages DE, EN, FR

Alarm LEDs line 1, line 2, alarm, com

History memory 500 data records

Data logger 500 data records/channel

Config. logger 300 data records

Test logger 100 data records

Service logger 100 data records

Suitable system components

Nominal system voltage $U_{n}$ refer to ordering details

Frequency range $f_n$ 48…62 Hz

Crest factor ≤ 1.2

Number of switching cycles (mechanical) ≥ 8000

Short circuit current $I_{cc}$ and fuses refer to the manual, table "Utilisation category acc. to DIN EN 60947"
## Technical data (continued)

### Input
- **Digital inputs**: 1
- **Galvanic separation**: yes
- **Control**: via potential-free contacts
- **Mode of operation**: active at 0 V (low) or 24 V (high), adjustable
- **Voltage range high/low**: AC/DC 10…30 V/AC/DC 0…0.5 V
- **Adjustable function**: switching back interlocking function, manual/automatic mode, bypass operation, function test, changeover of the preferred line, alarm input for operating theatre lights, alarm input for other devices

### Output
- **Switching element**: 1 potential-free changeover contact
- **Mode of operation**: adjustable
  - N/O or N/C operation
- **Adjustable function**: refer to the manual, settings menu S: “Relay”
- **Electrical endurance under rated operating conditions, number of cycles**: 10 000

### Contact data according to IEC 61810
- **Rated operational current AC (resistive load, cos φ=1)**: 5 A/AC 250 V
- **Rated operational current DC**: 5 A/DC 30 V
- **Overvoltage category**: III
- **Minimum contact rating**: 10 mA at DC > 5 V

### BMS interface
- **Interface/protocol**: RS-485/BMS
- **Baud rate**: 9.6 kbit/s
- **Cable length**: ≤ 1200 m
- **Cable (twisted pairs, shielded, shield connected to PE on one side)**: recommended: 1-Y(St)Y min. n x 2 x 0.8 mm²
- **Terminating resistor**: 120 Ω (0.25 W)
- **Device address, BMS bus**: 2…90

### Environment/EMC
- **EMC**: EN 61326 (see CE declaration)
- **Classification of climatic conditions acc. to IEC 60721:**
  - Stationary use (IEC 60721-3-3): 3K5 (except condensation and formation of ice)
  - Transport (IEC 60721-3-2): 2K3
  - Long-term storage (IEC 60721-3-1): 1K4
  - Operating temperature: -25…+55 °C
- **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

### Terminals
- **Power section**:
  - Connection directly on ATICS®, for plug connections: screw-type terminals
  - rigid (flexible)/conductor sizes: 10…70 mm² (6…50 mm²)/8 (10…0 AWG)
  - Stripping length: 15 mm
  - Tightening torque (hexagon socket 4 mm): 5 Nm
  - Connection type: pluggable screw-type terminals
- **Conductor cross section, rigid min/max**: 1.5/35 mm²
- **Conductor cross section, flexible min/max**: 1.5 mm²/25 mm²
- **Conductor cross section AWG/min/max**: 20/2
- **Stripping length (do not use ferrules)**: 20 mm
- **Tightening torque (Torx® screwdriver 120 or slotted screwdriver 2.5 x 1.2 mm)**: 2.5 Nm (≤ 25 mm²)
  - 4.5 Nm (≥ 25 mm²)
- **Torque setting for manual operation (Allen 5 mm)**: approx. 6 Nm

### Electronics
- **Connection**: screw-type terminals
- **rigid/flexible/conductor sizes**: 0.14…1.5 mm²/28…16 AWG
- **Stripping length**: 7 mm
- **Tightening torque (slotted screws, screwdriver 2.5 x 0.4 mm)**: 0.22…0.25 Nm

### Other
- **Operating mode**: continuous operation
- **Mounting**: display-oriented
- **Operating altitude up to a maximum of**: 2000 m AMSL
- **Protection class**: Class I
- **Protection class LCD under foil (DIN EN 60529)**: IP40
- **Enclosure material**: polycarbonate
- **Flammability class**: UL94V-0
- **DIN rail mounting**: acc. to IEC 60715
- **Screw mounting**: 4 x M5
- **Dimensions incl. terminals (W x H x D)**: 234 x 270 x 73 mm
- **Weight**: approx. 3400 g

### Dimension diagram (dimensions in mm)

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**Technical data (continued)**

**Switching equipment and test systems** | **Switchover and monitoring devices**
---

**Automatic transfer switching devices ATICS®-...-ISO**

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**7.1**

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**Technical data (continued)**

**Switching equipment and test systems** | **Switchover and monitoring devices**
---

**Automatic transfer switching devices ATICS®-...-ISO**

---

**7.1**
**Application example operating theatre**

- ATICS®-2-63A-ISO: Changeover between the preferred and the redundant line while monitoring the medical IT system with transformer load and temperature monitoring
- IR426-D47: Monitoring of the operating theatre light IT system (optional)
- MK2430/MK800/TM800: Alarm at at least two points with independent power supplies for functional safety
- ATICS-ES: Energy storage (B92057206, B92057207 only)

**Example intensive care unit**

- ATICS®-2-63A-ISO: Changeover between the preferred and the redundant line while monitoring the medical IT system with transformer load and temperature monitoring
- ED5151: Insulation fault locator or fast insulation fault localisation (recommended)
- ATICS®-BP: Bypass switch for uninterrupted test/maintenance (recommended)
- MK: Alarm at at least two points with independent power supplies for functional safety
- ATICS-ES: Energy storage (B92057206, B92057207 only)
ATICS®-...-DIO
Automatic transfer switching devices for 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), in computing centres, industry, or in group 2 medical locations in accordance with DIN VDE 0100-710 (VDE 0100-710)/IEC 60364-7-710
- All-in-one: Integration of switch disconnector and control electronics
- Compact design
- Solutions for any application

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 parameterization options

Typical applications
- Design of safety power supplies, e.g. for
  - main distribution boards
  - computing centres
  - industry
- Retrofit

Standards
The transfer switching device conforms to the following standards:
- DIN VDE 0100-710 (VDE 0100 Part 710)*
- DIN VDE 0100-718 (VDE 0100-718)
- ÖVE/ÖNORM E 8007
- IEC 60364-7-710*
- DIN EN 61508-1 (VDE 0803-1)*
- IEC 61508-1 (2010-04) Ed. 2.0*
- DIN EN 61508-2 (VDE 0803-2)*
- IEC 61508-2 (2010-04) Ed. 2.0*
- DIN EN 61508-3 (VDE 0803-3)*
- IEC 61508-3 (2010-04) Ed. 2.0*
- DIN EN 60947-6-1 (VDE 0660-114)
- IEC 60947-6-1 (2013-12) Ed. 2.1

Standard-compliant isolating transformer monitoring according to:
- DIN EN 61558-1 (VDE 0570-1)
- DIN EN 61558-1/A1 (VDE 0570-1/A1)

The standards marked with * were part of the test conducted by TÜV SÜD.

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

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></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>63 A</td>
<td>1 x STW3, bridge, connectors, terminal cover</td>
<td>ATICS-2-63A-DIO</td>
<td>B92057212</td>
<td></td>
</tr>
<tr>
<td>80 A</td>
<td>1 x STW3, bridge, connectors, terminal cover</td>
<td>ATICS-2-80A-DIO</td>
<td>B92057213</td>
<td></td>
</tr>
<tr>
<td>Bypass switch set</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>63 A</td>
<td>Bridge, terminal cover, auxiliary contacts, LEDs green/red</td>
<td>ATICS-BP-2-63A-SET</td>
<td>B92057252</td>
<td></td>
</tr>
<tr>
<td>80 A</td>
<td>Bridge, terminal cover, auxiliary contacts, LEDs green/red</td>
<td>ATICS-BP-2-80A-SET</td>
<td>B92057253</td>
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Ordering information ATICS®-...-DIO 4-pole

<table>
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<th>Version</th>
<th>Rated operational current $I_e$</th>
<th>Scope of delivery</th>
<th>Type</th>
<th>Art. No.</th>
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<td>AC</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>80 A</td>
<td>4 x STW3, bridge, connectors, terminal cover</td>
<td>ATICS-4-80A-DIO</td>
<td>B92057222</td>
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<tr>
<td>125 A</td>
<td>4 x STW4, bridge, connectors, terminal cover</td>
<td>ATICS-4-125A-DIO</td>
<td>B92057223</td>
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<tr>
<td>160 A</td>
<td>4 x STW4, bridge, terminal cover</td>
<td>ATICS-4-160A-DIO</td>
<td>B92057224</td>
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<tr>
<td>Bypass switch set</td>
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<tr>
<td>80 A</td>
<td>Bridge, terminal cover, auxiliary contacts, LEDs green/red</td>
<td>ATICS-BP-4-80A-SET</td>
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<tr>
<td>125 A</td>
<td>Bridge, terminal cover, auxiliary contacts, LEDs green/red</td>
<td>ATICS-BP-4-125A-SET</td>
<td>B92057262</td>
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</tbody>
</table>
Technical data

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

Overvoltage category III
Pollution degree outside, inside 2
Rated insulation voltage ATICS-2-DIO/ATICS-4-DIO 250 V/400 V
Protective separation between Line 1 – Line 2; Line 1, 2, 3 – RS-485
Line 1, 2, 3 – digital inputs; Line 1, 2, 3 – relay outputs
Voltage test according to IEC 61010-1 (basic insulation/protective separation) 2.21 kV/3.54 kV

Supply voltage
Rated operational voltage $U_s$ from monitored system
AC 50…60 Hz, 230 V
Supply voltage $U_s$ 2.21 kV/3.54 kV
Power consumption ATICS-2-63A-DIO  $\leq 16$ W
Power consumption ATICS-4-125A-DIO  $\leq 87$ W
Power consumption ATICS-4-160A-DIO  $\leq 119$ W
Current during the changeover process $17 \times < 30$ ms

Power section/switching elements
Nominal system voltage $U_n$ (operating range) ATICS-2-DIO/ATICS-4-DIO
AC 230 V/380 V/400 V
Frequency range $f_s$ 48…62 Hz
Crest factor $\leq 1.2$
Number of switching cycles (mechanical) $\geq 8000$
Short-circuit current loc and fuses refer to table “Utilisation category acc. to DIN EN 60947” in manual

Voltage monitoring/changeover
Frequency range $f_s$ 40…70 Hz
Undervoltage response value (Alarm 1) 160…202 V (1-V steps)
Overvoltage response value (Alarm 2) 240…275 V (1-V steps)
Response delay $t_{dev}$ 50 ms…100 s (resolution of setting 50 ms)
Delay on release $t_{rel}$ 200 ms…100 s (resolution of setting 50 ms)
Hysteresis 2…10 % (1-% steps)
Frequency measurement 40…70 Hz (resolution 0.1 Hz)
Display range measured value ATICS-2-DIO 20…276 V
Display range measured value ATICS-4-DIO 20…520 V
Operating uncertainty $\pm 1\%$

Current monitoring (output current)
Measuring current transformers STW3, STW4
Measuring range in (TRMS) STW3: 0…150 A; STW4: 0…260 A
Response value for short-circuit detection ATICS-DIO (versions 63 A and 80 A) with STW3 130 A
Response value for short-circuit detection ATICS-DIO (versions 125 A and 160 A) with STW4 250 A
Crest factor min. 2
Hysteresis for short-circuit alarm $5\%$

Cable length:
Single wire $\geq 0.75$ mm² 0…1 m
Single wire, twisted $\geq 0.75$ mm² 1…10 m
Shielded cable 10…40 m
Cable: twisted pairs, shield to terminal 1 at one end, must not be earthed recommended: $J\cdot Y[S] \text{ min. } n \times 2 \times 0.8$

Displays and data memory
Display: graphic display
Alarm LEDs line 1, line 2, alarm, comm
History memory 500 data records
Data logger 500 data records/channel
Config. logger 300 data records
Test data logger 100 data records
Service logger 100 data records

Input
Digital inputs 4
Galvanic separation yes
Control via potential-free contacts
Mode of operation active at 0 V (low) or 24 V (high), adjustable
Voltage range high/low AC/DC 10…30 V/AC/DC 0…0.5 V
Adjustable function switching back interlocking function, manual/automatic mode, bypass mode, function test, changeover to the preferred line, alarm input for operating theatre lights, alarm input for other devices

Relay output 1
Switching element 1 potential-free changeover contact
Mode of operation adjustable N/O or N/C operation
Adjustable function see “Settings menu 4: Relay” in manual
Electrical endurance under rated operating conditions, number of cycles 10,000

Contact data according to IEC 61810
Rated operational current AC (resistive load, $\cos \varphi = 1$) 5 A/AC 250 V
Rated operational current DC 5 A/DC 30 V
Overvoltage category III
Minimum contact rating $10 \mathrm{mAt} \text{ at } DC > 5 \mathrm{V}$

Relay outputs 2…4
Switching element 1 potential-free N/O contact
Mode of operation adjustable N/O or N/C operation
Adjustable function see “Settings menu 4: Relay” in manual
Electrical endurance under rated operating conditions, number of cycles 80,000

Contact data according to IEC 61810
Rated operational current AC (resistive load, $\cos \varphi = 1$) 5 A/AC 150 V
Rated operational current DC 5 A/DC 30 V
Overvoltage category III
Minimum switching capacity 120 mW

BMS interface
Interface/protocol RS-485/BMS
Baud rate 9.6 kBit/s
Cable length $\leq 1200$ m
Cable (twisted pairs, shielded, shielded for PE on one side) recommended: $J\cdot Y[S] \text{ min. } n \times 2 \times 0.8$
Terminating resistor $120 \Omega (0.25 \mathrm{W})$
Device address, BMS bus 2…90

Environment/EMC
EMC EN 61326 (see CE declaration)

Classification of climatic conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3) 3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2) 2K3
Long-term storage (IEC 60721-3-1) 1K4
Operating temperature $-25$…+55°C

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

Terminals
Power section
Connection type (up to 125 A) pluggable screw terminals
Conductor cross section, rmg min./max. 1.5/5 mm²
Conductor cross section, flexible min./max. 1.5 mm²/25 mm²
Conductor cross section AWG/min./max. 16/2
Stripping length (without ferrules) 20 mm
 Tightening torque (Torr® screwdriver T20 or slotted screwdriver 6.5 x 1.2 mm) 4.5 Nm (≤ 25 mm²)
Connection directly on ATICS®, for plug connections and connection of 160 A version screw-type terminals
rigid (flexible)/conductor sizes 10…95 mm² (6…70 mm²)/8 (10)…000 (00) AWG
Stripping length 15 mm
Tightening torque (hexagon socket 4 mm) 5 Nm
Tightening torque for manual operation (Allen 5 mm) approx. 6 Nm

Electronics
Connection screw terminals
rigid/flexible/conductor sizes 0.14…1.5 mm²/28…16 AWG
Shortening length 7 mm
Tightening torque (slotted screws, screwdriver 2.5 x 0.4 mm) 0.22…0.25 Nm

Other
Operating mode continuous operation
Mounting display-oriented
For use at altitudes up to 2000 m AMSL
Protection class Class I
Enclosure material polycarbonate
Flammability class UL94V-0
DIN rail mounting acc. to IEC 60715
Screw mounting $1.2 \times 8$ mm
Dimensions incl. terminals (W x H x D) 234 x 270 x 73
Weight ATICS-2-DIO approx. 340 g
ATICS-4-DIO approx. 4800 g

Switching equipment and test systems | Switchover and monitoring devices
Automatic transfer switching devices ATICS®…-DIO
2-pole

4-pole

* Version 80 A/125 A. Version 160 A without connectors.

Typical applications

Example application data centre
- ATICS®-...-DIO: Changeover between the preferred and the redundant line
- MK2430/MK800/TM800: Alarm at at least two points for functional safety
Safety Analyser

For over 30 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

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<th>UNIMET® 300ST</th>
<th>UNIMET® 400ST</th>
<th>UNIMET® 610ST</th>
<th>UNIMET® 810ST</th>
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<td>Electrical equipment</td>
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<td>Voltage measurement Measuring range</td>
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<td>Load current measurement</td>
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<td>0.01…16 A</td>
<td>0.01…16 A</td>
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<td>semi-automatic</td>
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<tr>
<td><strong>Data exchange</strong></td>
<td>UNIData300</td>
<td>UNIData300/400</td>
<td>UNIMET® 610ST 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
- ÖVE E8701-1

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

Ordering information

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<th>Version</th>
<th>Type</th>
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<tr>
<td></td>
<td>CH      UNIMET®300ST</td>
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Suitable system components

<table>
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<th>Type</th>
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<td>Non-heating appliances VK701-7</td>
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<td>Adapter kit 16 A for DS32A VK701-8</td>
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<td>Test probe</td>
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<td>Test terminal</td>
<td>–        Testterminal</td>
<td>B928741</td>
<td>–</td>
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<tr>
<td>Barcode scanner</td>
<td>–        PS/2</td>
<td>B96020082</td>
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<tr>
<td>Converter</td>
<td>–        USB1,RS-232converter</td>
<td>B96020086</td>
<td>–</td>
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<tr>
<td>Flex keyboard</td>
<td>–        Flexkeyboard</td>
<td>B96020093</td>
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<td>Three-phase adapter</td>
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<td>DS32A(CH/CH)</td>
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<td>DS32DCT</td>
<td>B96020100</td>
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</tbody>
</table>
UNIMET® 300ST test system

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: ±5 % of MV ±2 digits
                          1.001…29.999 Ω: ±5 % of MV ±2 digits

Leakage current, differential measurement method
Measuring range  0.02…19.99 mA
Measuring accuracy  ±5 % of MV ±5 digits

Leakage current, direct measurement
Measuring range  0.001…19,999 mA
Measuring accuracy  ±5 % of MV ±5 digits

Equipment leakage current -Alternative method
Measuring range  0.001…19.999 mA
Measuring accuracy  ±5 % of MV ±2 digits
Test voltage (Equipment leakage current measurement – alternative method)  approx. system voltage, system frequency
Test current  max. 3.5 mA

Insulation resistance
Test voltage  approx. DC 500 V
Max. test current  2.5 mA
Measuring range  0.01…199.99 MΩ
Measuring accuracy  0.01…99.99 MΩ: ±5 % of MV ±2 digits
                          100.00…199.99 MΩ: ±10 % of MV ±2 digits

Load current measurement
Measuring range  0.01 A to 16 A
Measuring accuracy  ±2.5 % of MV, ±3 digits

Voltage measurement
Measuring range  90…264 V
Measuring accuracy  ±2.5 % of MV, ±2 digits

Apparent power
Measuring range  5…3700 VA
Measuring accuracy  ±5 % of MV, ±5 digits

Other
Dimensions (without bag)  ca. 168 x 272 x 124 mm (W x D x H)
Weight (without accessories or bag)  approx. 2.2 kg
Calibration interval  36 months
Documentation number  D00135

Insulation resistance
Test voltage  approx. DC 500 V
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Apparent power
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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**
   - 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

Device features
- Easy operation and handling
- Automatic and manual test procedure
- Data input via keyboard or barcode scanner
- Visual inspection, functional testing and electrical testing
- 4mm socket for testing applied parts
- 600 data records can be stored
- Data exchange and storage via UNIData 300/400
- Compatible with common application programs such as visual FM, MT Data and Fundamed

Typical applications
- Safe testing of medical electrical equipment with patient connections, hospital and care beds and electrical equipment.

Standards
The UNIMET® 400ST series carries out tests in accordance with the requirements of the device standards:
- IEC 62353
- DIN EN 62353 (VDE 0751-1)
- ÖVE/ÖNORM EN 62353
- DIN VDE 0701-0702
- ÖVE E8701-1

Approvals

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

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Suitable system components

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<td>Non-heating appliances</td>
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<td>Three-phase adapter</td>
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Technical data

Supply voltage  AC 230 V ±10 %
Frequency range  45…65 Hz
Power consumption  max. 50 VA
Maximum load current  16 A
Max. connectable load at 230 V  3700 VA
Protection class  II
Ambient temperature  0…50 °C
Storage temperature  -10…+70 °C
Degree of protection  IP20

Testing of PE resistance

Test voltage  approx. 5 V, system frequency
Short-circuit current  > 2 A
Measuring range  0.001…29.999 Ω
Measuring accuracy  0.001…1.0 Ω: ±2.5 % of MV ±2 digits
                      1.001…29.999 Ω: ±5 % of MV ±2 digits

Leakage current, differential measuring method

Measuring range  0.02 mA…19.99 mA
Measuring accuracy  ±5 % of MV ±5 digits

Leakage current, direct measurement

Measuring range  0.001…19,999 mA
Measuring accuracy  0.001…9,999 mA: ±5 % of MV ±5 digits
                      10,000…19,999 mA: ±7 % 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, ±3 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 (dimensions in mm)

![Dimension Diagram](image-url)
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.

9. 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® 610ST
Test system for electrical equipment and machines

Device features
• The Windows user interface provides an easy-to-use solution
• Data exchange and storage via Control Center
• Automatic, semi-automatic or manual test sequences
• Data input via touch screen, keyboard or barcode scanner
• Visual inspection, electrical safety and functional test user-definable
• Test sequences user-definable
• Data storage > 10,000 data records
• Filter function for fast data selection
• Management of test dates
• Multitenancy
• Catalogue systems
• Test probe with two switching contacts – for semi-automatic testing of parts not connected to PE
• Compatible with all common application programs

Areas of application
• Electrical equipment
  "Inspection after repair, modification of electrical appliances – Periodic inspection on electrical appliances" acc. to DIN VDE 0701-0702 (VDE 0701-0702).
• DIN EN 60204-1/VDE 0113
  Safety of machinery - Electrical equipment of machines - Part 1: General requirements

Certifications

Standards
The UNIMET® 610ST series tests according to the device standards:
• DIN VDE 0701-0702
• DIN VDE 0113/ EN 60204-1
• ÖVE/ÖNORM E 8701-1

Further information
For further information, refer to our product area at www.bender.de.

Ordering details

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<tr>
<th>Nominal voltage range</th>
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<th>Type</th>
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<tr>
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<td>100…120 V and 220…240 V</td>
<td>16 A</td>
<td>Standard (DE/DE)</td>
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Suitable system components

<table>
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<th>Variant</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
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</thead>
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<tr>
<td>Adapter</td>
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<td>VK701-6</td>
<td>B96020067</td>
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</tr>
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<td></td>
<td>Non-heating devices</td>
<td>VK701-7</td>
<td>B96020066</td>
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<td></td>
<td>Adapter kit 16 A for DS32A</td>
<td>VK701-8</td>
<td>B96020097</td>
<td>441</td>
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<td>Cable</td>
<td>For connecting the test system to a PC, 9-pin, female-female (null-modem cable)</td>
<td>RS-232/RS-232 interface cable</td>
<td>B96012012</td>
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<td></td>
<td>Measuring lead, 150 cm, 4-mm connector</td>
<td>Cable 150 cm</td>
<td>B928703</td>
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<td>Test probe</td>
<td>TP800 active test probe (with switch)</td>
<td>TP800</td>
<td>B96020080</td>
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<tr>
<td></td>
<td>Measuring lead, 1 m, with black test probe</td>
<td>–</td>
<td>B928748</td>
<td>–</td>
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<tr>
<td>Test terminal</td>
<td>Black</td>
<td>–</td>
<td>B928741</td>
<td>–</td>
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<td>Touchscreen pen</td>
<td>–</td>
<td>Stylus pen</td>
<td>B928749</td>
<td>–</td>
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<td>Barcode scanner</td>
<td>for UNIMET® 610ST (PS/2 port)</td>
<td>–</td>
<td>B96020082</td>
<td>–</td>
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<tr>
<td>Flex keyboard</td>
<td>for UNIMET® 610ST (USB port)</td>
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<td>B96020093</td>
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<tr>
<td>Test kit</td>
<td>various adapters for connecting medical electrical equipment to test systems</td>
<td>PK3</td>
<td>B96020004</td>
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<tr>
<td>Three-phase adapter</td>
<td>for testing three-phase devices during operation</td>
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### Technical data

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<td>Power consumption</td>
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<td>Maximum output current</td>
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<td>Protection class</td>
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#### Testing of PE resistance

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<tr>
<td>Measuring voltage</td>
<td>max. AC 8 V</td>
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<td>Intrinsic uncertainty</td>
<td>±2.5 % of MV ±5 digits</td>
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<tr>
<td>Operating uncertainty</td>
<td>±2.5 % of MV ±10 digits</td>
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#### Insulation resistance

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<tr>
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<td>±5 % of MV ±2 digits</td>
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<td>Operating uncertainty</td>
<td>±7.5 % of MV ±10 digits</td>
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#### Equipment leakage current - alternative method

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<td>max. AC 250 V</td>
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<tr>
<td>Measuring current</td>
<td>max. 3 mA</td>
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<td>Intrinsic uncertainty</td>
<td>±5 % of MV ±5 digits</td>
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<td>Operating uncertainty</td>
<td>±7.5 % of MV ±10 digits</td>
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#### Leakage current, direct measurement

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<td>Intrinsic uncertainty</td>
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<tr>
<td>Operating uncertainty</td>
<td>±7.5 % of MV ±4 digits</td>
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<td>Frequency response</td>
<td>up to 100 kHz ±3 dB</td>
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#### Voltage measurement

<table>
<thead>
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<tr>
<td>Intrinsic uncertainty</td>
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#### Load current measurement

<table>
<thead>
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</thead>
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<tr>
<td>Intrinsic uncertainty</td>
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#### Apparent power

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<tr>
<td>Intrinsic uncertainty</td>
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#### Environment/EMC

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<td>Storage temperature</td>
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<td>Relative humidity</td>
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#### Other

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<th>Degree of protection</th>
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<tr>
<td>Dimensions (without bag)</td>
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<td>Weight (without accessories or bag)</td>
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<tr>
<td>Calibration interval</td>
<td>36 months</td>
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<td>Documentation number</td>
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## Dimension diagram (dimensions in mm)

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

1. Touch screen for operation and display. For this purpose, a stylus is included in the scope of delivery.
2. Durable plastic enclosure, with push buttons for safe storage in the carrier bag.
3. 10 sockets (1…10) for the connection of VK adapters to test extension lines.
4. Measuring terminals
   - [B] (violet) for the connection of the single-pole test probe supplied with the product.
   - [A] for active test probe TP800 with push button (optional).
   - Socket [C] for equipotential bonding (e.g. connection for single-pole line extension with clip for the testing of permanently installed equipment).
   - Socket [D] for functional earth
5. Test socket: This is where the DUT’s power supply cable is plugged in.
6. Connection to the supply voltage and power switch with thermo-magnetic circuit breaker.
7. Without function.
8. Interfaces:
   - PS/2 port for external keyboard
   - RS-485 serial interface for Bender Service
   - RS-232 interface, 9-pin, electrically isolated, for connection to a PC
   - USB interface for connection to a printer, a USB stick, an external keyboard or a barcode scanner (2 x host) and a PC (1 x device, for Bender Service only)
   - Ethernet network connection (optional)

Wiring diagram
UNIMET® 810ST
Test system for medical electrical equipment

Device features
- Easy operation by Windows user interface
- Data exchange and storage via Control Center
- Automatic, semi-automatic or manual test sequence
- Data input via touch screen, keyboard or barcode scanner
- Visual inspection, electrical tests, functional tests, user-definable
- Test sequences user-definable
- Data memory > 10,000 data records
- Filter function for fast data selection
- Management of test dates
- Multitenancy
- Catalogue systems
- Test probe with two switching contacts – for semi-automatic testing of conductive parts not connected to PE
- Compatible with common application programs such as visual FM, MT Data and Fundamed

Standards
The UNIMET® 810ST series carries out tests in accordance with the requirements of the device standards:
- IEC 60601-1
- IEC 62353
- DIN EN 62353 (VDE 0751-1)
- IEC 61010-1
- ÖVE/ÖNORM EN 62353
- DIN VDE 0701-0702
- ÖVE E8701-1

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)

Approvals

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>
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<tr>
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<tr>
<td>100…120 V and 220…240 V</td>
<td>16 A</td>
<td>Standard (DE/DE)</td>
<td>UNIMET®810ST</td>
<td>B96028020</td>
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<td>13 A</td>
<td>GB/GB</td>
<td>UNIMET®810ST</td>
<td>B96028024</td>
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<td>10 A</td>
<td>B/B</td>
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Further system components

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<th>Page</th>
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<tbody>
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<td></td>
<td>Non-heating appliances</td>
<td>VK701-7</td>
<td>B96020066</td>
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<td>Adapter kit 16 A for DS32A</td>
<td>VK701-8</td>
<td>B96020097</td>
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<td>Cable</td>
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<td>B96012012</td>
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<td>Test probe</td>
<td>Test probe active (with switch)</td>
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<td>B96020080</td>
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<td>3 m measuring lead with black test probe</td>
<td>–</td>
<td>B928748</td>
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<tr>
<td>Test terminal</td>
<td>black</td>
<td>–</td>
<td>B928741</td>
<td>–</td>
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<td>Touchscreen pen</td>
<td>–</td>
<td>Styluspen</td>
<td>B928749</td>
<td>–</td>
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<td>Barcode scanner</td>
<td>for the UNIMET® 810ST (PS/2 connection)</td>
<td>–</td>
<td>B96020082</td>
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<tr>
<td>Flex keyboard</td>
<td>for the UNIMET® 810ST (USB connection)</td>
<td>–</td>
<td>B96020093</td>
<td>–</td>
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<tr>
<td>Test kit</td>
<td>various adapters for connecting medical electrical equipment to test systems</td>
<td>PK3</td>
<td>B96020004</td>
<td>–</td>
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<td>Test box</td>
<td>for testing test systems</td>
<td>TB3</td>
<td>B96020025</td>
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<td>Three-phase adapter</td>
<td>for testing three-phase devices during operation</td>
<td>DS32A</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>B96028050</td>
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</table>
Technical data

Nominal voltage range   AC 100…120 V/±10 %, AC 220…240 V/±10 %
Frequency range         48…62 Hz
Power consumption       max. 100 VA
Maximum output current   see ordering information
Protection class         SKII

Testing of PE resistances

Measuring range         0.001… 29.999 Ω
Measuring current       max. AC 8 A
Measuring voltage       max. AC 8 V
Intrinsic uncertainty   0.001… 1.000 Ω: ±2.5 % v. M. ±5 digits
                        1.001… 29.999 Ω: ±5 % v. M. ±2 digits
Operating uncertainty   0.001… 1.000 Ω: ±5 % v. M. ±10 digits
                        1.001… 29.999 Ω: ±7.5 % v. M. ±10 digits

Insulation resistance

Measuring range         0.01… 199.99 MΩ
Measuring voltage       max. DC 550 V
Measuring current       max. 2.5 mA
Intrinsic uncertainty   0.01… 99.99 MΩ: ±5 % v. M. ±2 digits
                        100.00… 199.99 MΩ: ±10 % v. M. ±2 digits
Operating uncertainty   0.01… 99.99 MΩ: ±7.5 % v. M. ±4 digits
                        100.00… 199.99 MΩ: ±10 % v. M. ±4 digits

Equipment leakage current - alternative method

Measuring range         0.001… 19.999 mA
Measuring voltage       max. AC 250 V
Measuring current       max. 3 mA
Intrinsic uncertainty   ±5 % v. M. ±5 digits
Operating uncertainty   ±7.5 % v. M. ±10 digits

Leakage current, differential measurement method

Measuring range         0.02… 19.99 mA
Intrinsic uncertainty   ±5 % v. M. ±2 digits
Operating uncertainty   ±7.5 % v. M. ±4 digits
Frequency response      40…100 kHz ±1 dB

Leakage current, direct measurement

Measuring range         0.001… 19.999 mA
Intrinsic uncertainty   ±5 % v. M. ±2 digits
Operating uncertainty   ±7.5 % v. M. ±4 digits
Frequency response      up to 100 kHz ±3 dB

Voltage measurement

Measuring range         AC 90…264 V
Frequency range         48…62 Hz
Intrinsic uncertainty   ±2.5 % v. M. ±3 digits

Load current measurement

Measuring range         0.005…16 A
Frequency range         48…62 Hz
Intrinsic uncertainty   ±2.5 % v. M. ±3 digits

Apparent power

Measuring range         5…3600 VA
Frequency range         48…62 Hz
Intrinsic uncertainty   ±5 % v. M. ±3 digits

Environment/EMC

EMC                      IEC 61326-1
Ambient temperature     0…+40 °C
Storage temperature     -10…+70 °C
Relative humidity (up to 31 °C)  max. 80 %
Relative humidity (> 31…40 °C)  decreasing linearly, max. 50 %
Height above sea level   max. 2000 m

Other

Degree of protection, enclosure: IP40, connections: IP20
according to DIN VDE 0470 Part 1/EN 60529
Dimensions (without bag) approx. 300x277x126 mm (W x D x H)
Documentation number    D00008
Weight (without accessories or bag) approx. 3.5 kg
Calibration interval     36 months
Documentation number     D00008

of MV = of measured value
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**

[Diagram showing the connections and components of the UNIMET® 810ST test system]
### EPS800
External power source 25 A for UNIMET® 800/810ST

#### Device features
- To be used in conjunction with the appropriate UNIMET® 800/810ST

#### Standards
The EPS800 series carries out tests in compliance with the device standard:
- IEC 60601-1
- IEC 61010-1

#### Typical applications
- External 25 A power source for standard-compliant protective earth resistance measurement acc. to IEC 60601-1 and IEC 61010-1

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

#### Approvals

#### Ordering information

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</tr>
</tbody>
</table>

#### Technical data

- Nominal voltage: AC 207…253 V, 48 … 62 Hz
- Power consumption: 400 VA
- Measuring current: AC 25 A ±10 % (0 … 0.3 Ω)
- Output power: 230 VA
- Operating mode: continuous operation
- Protection class: II
- Micro-fuse: 5 x 20 mm, fast 5 A/250 V

#### 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 % condensation must be avoided
- Height above sea level: max. 2000 m
- Degree of protection: IP20
- Dimensions: ca. 244 x 164 x 120 mm (W x D x H)
- Documentation number: D00146
- Weight: ≤ 4 kg

#### Dimension diagram (dimensions in mm)
1 Insert the control cable of the EPS800 into the "EPS800" connector socket on the rear of the UNIMET® 800ST/810ST.

   Note: The plug clicks into place and is secured against being pulled out accidentally. The plug can only be removed after sliding back the movable handle piece.

2 Connect the supply line of the EPS800 to the power socket.

3 Connect the supply line of the UNIMET® 800ST/810ST to the power socket.

4 Switch on the power switch of the UNIMET® 800ST/810ST.

5 Switch on the power switch of the EPS800. The sound of the internal ventilator can be heard.

6 Connect the DUT. Determine the test sequence according to the classification.
DS32A
3AC three-phase adapter with differential current measurement

Device features
- To be used in conjunction with an UNIMET test system

Standards
The DS32A series carries out tests in compliance with the device standard:
- DIN VDE 0701-0702
- DIN EN 62353

Typical applications
- Three-phase adapter for testing medical electrical three-phase devices during operation

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

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS32A</td>
<td>B96020098</td>
</tr>
<tr>
<td>DS32A (CH/CH)</td>
<td>B96020110</td>
</tr>
</tbody>
</table>

Technical data

Electrical safety
- Protection class: 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

EMC
- 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)
**VK701-8**

**Adapter kit 16 A for DS32A**

### 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>B96020097</td>
</tr>
</tbody>
</table>

### Technical data

- **Nominal voltage**
  - Nominal voltage: 3AC 400 V
  - Max. current: 16 A
  - Documentation number: D00172

### Wiring diagram

[Diagram showing connection between VK701-8, DS32A, UNIMET®, and test socket UNIMET®]
Device features

- Test box for UNIMET® 800/810ST
- Time and cost saving through simple handling
- Simulation of a standardised DUT
- 10 patient sockets for individual calibration
- Magnetic adhesive stripes allow simple fixing to the safety tester

Typical applications

- Testing the measured values of safety testers
- Comprehensive system self test

Further information

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

Ordering information

<table>
<thead>
<tr>
<th>Version</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard (German)</td>
<td>TB3testbox</td>
<td>B96020025</td>
</tr>
<tr>
<td>CH</td>
<td>TB3testbox</td>
<td>B96020055</td>
</tr>
</tbody>
</table>

Technical data

Insulation coordination acc. to IEC 60664-1

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

Voltage ranges

- Nominal system voltage $U_n$: 100…240 V
- Rated frequency $f_n$: AC 48…62 Hz
- Output voltage $U_{12}$: 7.39 V (±2.5 %)
- Max. power consumption: 35 VA at 50 Hz, 230 V

Evaluation of tolerance values

- Precalculation: 110 %
- Tolerance: 10 %
- Built-in resistors:
  - R-MD (safety tester): 1000 Ω
  - R-PE: 0.233 Ω
  - R3: 25 000 Ω
  - R4: 1 000 000 Ω
  - R5: 1 500 000 Ω
  - R6: 100 000 000 Ω
  - R7: 1 000 000 Ω
  - R8: 100 000 Ω
  - R9: 130 000 Ω

Other

- Ambient temperature (during operation): 0…+50 ℃
- Ambient temperature (during storage): -10…+70 ℃
- 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)
Displays and controls

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”.

- Buchsen seitlich

8. Jumpers allow simulation of different test situations

Connections

1. Jumpers. Insert the jumpers in such a way that the following sockets are connected:

<table>
<thead>
<tr>
<th></th>
<th>μP601</th>
<th>UNIMET® 810ST</th>
</tr>
</thead>
<tbody>
<tr>
<td>a-b</td>
<td>a-b</td>
<td></td>
</tr>
<tr>
<td>d-e</td>
<td>d-f</td>
<td></td>
</tr>
<tr>
<td>h-i</td>
<td>h-i</td>
<td></td>
</tr>
</tbody>
</table>

2. Connect the patient sockets 1 and 2 of the safety tester (at UNIMET® 810ST socket 2 only) to the respective socket of the test box TB3.

3. Insert the mains plug of TB3 into the test socket of the safety tester, as illustrated. Please observe the plug-in direction.
   - at UNIMET® 810ST, insert the supply cable from the top
   - In case of wrong plug-in direction test results will become unusable.

4. Contact the test probe of the safety tester with the socket PE of TB3

5. UNIMET® 800/810ST test system
Insulation monitoring devices

ISOMETER®

Equipment for insulation fault location

ISOSCAN®

Residual current monitoring systems

LINETRAXX®

Neutral Grounding Resistor Monitor (NGR)

LINETRAXX®

Power Quality and Energy Measurement

LINETRAXX®

Measuring and monitoring relays

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
<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_f )</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_\Delta )</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>Term</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Internal DC resistance $R_i$</td>
<td>Resistance of the insulation monitoring device between the terminals to the system being monitored and earth.</td>
</tr>
<tr>
<td>Internal impedance $Z_i$</td>
<td>Total impedance of the insulation monitoring device between the terminals to the system being monitored and earth, measured at the nominal frequency.</td>
</tr>
<tr>
<td>ISOMETER®</td>
<td>Registered trademark of Bender GmbH &amp; Co. KG, Grünberg. An ISOMETER® actively measures the insulation resistance in IT systems with a measuring voltage which is superimposed between the system and the PE conductor.</td>
</tr>
<tr>
<td>Leakage current</td>
<td>Electric current in an unwanted conductive path under normal operating conditions.</td>
</tr>
<tr>
<td>Live part</td>
<td>Conductor or conductive part intended to be energised in normal operation, including a neutral conductor, but by convention not a PEN conductor or PEM conductor or PEL conductor.</td>
</tr>
<tr>
<td>Locating current $I_L$</td>
<td>r.m.s. value of the current that is injected by the locating current injector during the location process. The locating current can be generated by an independent locating voltage source, or an independent locating current source, or it can be driven directly from the system to be monitored.</td>
</tr>
<tr>
<td>Locating voltage $U_L$</td>
<td>r.m.s. value of the voltage present at the measuring terminals of the locating current injector during the measurement when the device has an independent locating voltage or current source.</td>
</tr>
<tr>
<td>Measuring current $I_m$</td>
<td>Maximum current that can flow between the system and earth, limited by the internal resistance from the measuring voltage source of the insulation monitoring device.</td>
</tr>
<tr>
<td>Measuring voltage $U_m$</td>
<td>Voltage present at the measuring terminals during the measurement.</td>
</tr>
<tr>
<td>Nominal current $I_n$</td>
<td>Current of the measuring equipment under nominal conditions.</td>
</tr>
<tr>
<td>Nominal frequency ($f_n$)</td>
<td>Frequency for which the measuring equipment is intended to be used and designed.</td>
</tr>
<tr>
<td>Nominal voltage of the distribution system ($U_n$)</td>
<td>Voltage by which a distribution system or equipment is designated and to which certain operating characteristics are referred.</td>
</tr>
<tr>
<td>Nominal voltage of the measuring equipment ($U_{me}$)</td>
<td>Voltage for which the measuring equipment is intended to be used and the value of which is marked on the equipment.</td>
</tr>
<tr>
<td>Nominal voltage range</td>
<td>Voltage range for which the measuring and monitoring equipment is intended to be used and for which it has been designed.</td>
</tr>
<tr>
<td>Open-circuit voltage ($U_q$)</td>
<td>Voltage present across unloaded terminals on the measuring equipment.</td>
</tr>
<tr>
<td>Operating voltage in a system</td>
<td>The value of the voltage under normal conditions at a given, specific point of the system.</td>
</tr>
<tr>
<td>Origin (of the electrical installation)</td>
<td>Point at which electric energy is delivered to the electrical installation.</td>
</tr>
<tr>
<td>Output voltage ($U_o$)</td>
<td>Voltage across the measuring equipment terminals where this equipment does or can output electric power.</td>
</tr>
<tr>
<td>Performance characteristic</td>
<td>One of the quantities (described by values, tolerances, ranges) assigned to an instrument in order to define its performance.</td>
</tr>
<tr>
<td>Protective conductor PE</td>
<td>Conductor provided for purposes of safety for example protection against electric shock.</td>
</tr>
<tr>
<td>Pulsating direct current</td>
<td>Current of pulsating waveform which assumes, in each period of the rated power frequency, the value 0 or the value not exceeding 0.006 A d.c. during one single interval of time, expressed in angular measure, of at least 150°.</td>
</tr>
<tr>
<td>Rated contact voltage</td>
<td>Voltage for which a relay contact is rated to open and close under specified conditions.</td>
</tr>
<tr>
<td>Rated operating conditions</td>
<td>A set of specified measuring ranges for performance characteristics and specified operating ranges for influence quantities, within which the variations of operating errors of an instrument are specified and determined.</td>
</tr>
<tr>
<td>Rated residual operating current $I_{\Delta n}$</td>
<td>The value of the residual operating current, assigned to the RCM by the manufacturer, at which the RCM shall operate under specified conditions.</td>
</tr>
<tr>
<td>RCM directionally discriminating</td>
<td>RCM used in IT systems, capable of directionally discriminating between supply side and load side residual currents.</td>
</tr>
<tr>
<td>RCM type A</td>
<td>RCM for which actuation is ensured for residual sinusoidal alternating currents and residual pulsating direct currents, whether suddenly applied or slowly rising.</td>
</tr>
<tr>
<td>Technical term</td>
<td>Definition</td>
</tr>
<tr>
<td>----------------</td>
<td>------------</td>
</tr>
<tr>
<td>RCM type B</td>
<td>RCM for which actuation is ensured for residual sinusoidal alternating currents, residual pulsating direct currents or smooth residual direct currents, whether suddenly applied or slowly rising.</td>
</tr>
<tr>
<td>Residual current $I_\Delta$</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>Residual current monitor</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>Residual current monitoring system</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>Residual operating current</td>
<td>Value of the residual current which causes the RCM to operate under specified conditions.</td>
</tr>
<tr>
<td>Response sensitivity</td>
<td>Value of the evaluating current or insulation resistance at which the evaluator responds under specified conditions.</td>
</tr>
<tr>
<td>Response time $t_{an}$</td>
<td>Time required by an insulation monitoring device to respond under specified conditions.</td>
</tr>
<tr>
<td>Response value $R_{an}$</td>
<td>Value of the insulation resistance at which the device responds under specified conditions.</td>
</tr>
<tr>
<td>Short circuit to exposed-conductive part</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>Short circuit current ($I_k$)</td>
<td>Current flowing across the short-circuited terminals of the measuring equipment.</td>
</tr>
<tr>
<td>Solid short circuit, short circuit to exposed-conductive parts, short circuit to earth</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>Specified operating range</td>
<td>Range of values of a single influence quantity which forms a part of the rated operating conditions.</td>
</tr>
<tr>
<td>Specified response value $R_{an}$</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>Supply voltage ($U_S$)</td>
<td>Voltage at a point where the measuring equipment does or can accept electric energy as a supply.</td>
</tr>
<tr>
<td>System leakage capacitance $C_e$</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>Total earthing resistance $R_A$</td>
<td>The resistance between the main earthing terminal and the earth.</td>
</tr>
<tr>
<td>Touch voltage ($U_t$)</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>True value</td>
<td>The value which characterises a quantity perfectly defined, under the conditions which exist when the quantity is considered.</td>
</tr>
<tr>
<td>Variation</td>
<td>The difference between the indicated values for the same value of the measured quantity of an indicating or recording instrument, of the (conventional) true value of a supply instrument, when a single influence quantity assumes successively two different values.</td>
</tr>
</tbody>
</table>
| Voltage against earth ($U_o$) | a) In distribution systems with an earthed neutral point, the voltage between a phase conductor and the earthed neutral point.  
  b) In all other distribution systems, the voltage present between the remaining phase conductors and earth when one of the phase conductors is shorted to earth. |
### Short forms of residual current protective devices

<table>
<thead>
<tr>
<th>Short form</th>
<th>German term</th>
<th>English term</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRCD</td>
<td>Gerät oder Anordnung von Geräten, das/die eine StrommessEinrichtung und eine Auswerteeinheit zur Erkennung und Bewertung sowie zur Ansteuerung des Kontaktöffnens einer Abschaltvorrichtung enthält.</td>
<td>device or an association of devices comprising a current sensing means and a processing device designed to detect and to evaluate the residual current and to control the opening of the contacts of a current breaking device</td>
</tr>
<tr>
<td>PRCD</td>
<td>ortsveränderliche FI-bzw. DI-Schutzeinrichtung (auch OVS)</td>
<td>portable residual current protective device</td>
</tr>
<tr>
<td>PRCD-S</td>
<td>OVS mit erweitertem Schutzzweck und Sicherstellung der bestimmungsgemäßen Nutzung des Schutzeinrichtungsgegenstandes</td>
<td>portable residual current protective device-safety</td>
</tr>
<tr>
<td>RCBO</td>
<td>FI-bzw. DI-Schutzeinrichtung mit eingebautem Überstromschalter (FI/LS-bzw. DI/LS-Schalter)</td>
<td>residual-current-operated circuit breakers with integrated overcurrent protection</td>
</tr>
<tr>
<td>RCCB</td>
<td>FI-bzw. DI-Schutzeinrichtung ohne eingebauten Überstromschutz</td>
<td>residual-current-operated circuit breakers without integrated overcurrent protection</td>
</tr>
<tr>
<td>RCD (generic term)</td>
<td>Fehlerstrom-Schutzeinrichtung (RCD ohne Hilfsspannung, spannungsunabhängig) bzw. Differenzstrom-Schutzeinrichtung (RCD mit Hilfsspannung, spannungsabhängig)</td>
<td>residual current protective device</td>
</tr>
<tr>
<td>RCM</td>
<td>Differenzstrom-Überwachungsgerät</td>
<td>residual current monitors</td>
</tr>
<tr>
<td>SRCD</td>
<td>ortsfeste FI-bzw-DI-Schutzeinrichtung in Steckdoseausführung</td>
<td>fixed socket-outlets residual current protective device</td>
</tr>
</tbody>
</table>
# Alphabetical list of devices

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Catalogue page</th>
</tr>
</thead>
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<td>7204</td>
<td>MEASURING INSTRUMENT</td>
<td>369</td>
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<tr>
<td>7220</td>
<td></td>
<td>369</td>
</tr>
<tr>
<td>9604</td>
<td></td>
<td>369</td>
</tr>
<tr>
<td>9620</td>
<td></td>
<td>369</td>
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<tr>
<td>AGE</td>
<td>AGE185 COUPLING DEVICE</td>
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<tr>
<td>AGH</td>
<td>AGH150W-4 COUPLING DEVICE</td>
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<td>AGH204S-4</td>
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</tr>
<tr>
<td>AGH520S</td>
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<td>327</td>
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<tr>
<td>AGH675S-7</td>
<td></td>
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</tr>
<tr>
<td>AGH675S-7MV</td>
<td></td>
<td>328</td>
</tr>
<tr>
<td>AGH676S-4</td>
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<td>330</td>
</tr>
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Support during all stages
Comprehensive service for your installation: remote, by phone, on site

From planning to modernisation – Our extensive know-how is at your disposal during all project phases.

Furthermore, with our first-class service we guarantee maximum safety for your electrical installations.
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Secure yourself:
- High availability of your installation thanks to fast reaction to fault messages
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- Targeted operating expenditure (OpEx) due to less downtimes and shorter service visits
- Support for your prospective system monitoring and regular tests of your system/power quality/monitoring devices
- Automatic control, analysis, correction, new settings/updates
- Competent assistance with setting changes and updates

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