ISOMETER® iso685-...
Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems)
Product description

The ISOMETER® is an insulation monitoring devices in accordance with IEC 61557-8 for IT systems. The devices are universally applicable in AC, 3(N)AC, AC/DC and DC systems. AC systems may include extensive DC-supplied loads (such as rectifiers, inverters, variable-speed drives).

Application

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

Function

The insulation monitoring device continuously monitors the entire insulation resistance of an IT system during operation and triggers an alarm when the value falls below a preset response value. To obtain a measurement the device has to be connected between the IT system (unearthed system) and the protective earth conductor (PE). A measuring current in the μA range is superimposed onto the system which is recorded and evaluated by a microprocessor-controlled measuring circuit. The measuring time is dependent on the selected measurement profiles, the system leakage capacitance, the insulation resistance and possible system-related disturbances.

The response values and other parameters are set using a commissioning wizard as well as via different setup menus using the device buttons and a high-resolution graphical LC display. The selected settings are stored in a permanent fail-safe memory. Different languages can be selected for the setup menus as well as the messages indicated on the display.

The device utilises a clock for storing fault messages and events in a history memory with time and date stamp. The settings can be password protected to prevent unauthorised changes.

To ensure proper functioning of connection monitoring, the device requires the setting of the system type 3AC, AC or DC and the required use of the appropriate terminals L1/+, L2, L3/-.

If the preset response value falls below the value of Alarm 1 and/or Alarm 2, the associated alarm relays switch, the LEDs ALARM 1 or ALARM 2 light and the measured value is shown on the LC display (in case of insulation faults in DC systems, a trend graph for the faulty conductor L+/L- is displayed). If the fault memory is activated, the fault message will be stored. Pressing the RESET button resets the insulation fault message, provided that the current insulation resistance displayed at the time of resetting is at least 25 % above the actual response value.

As additional Information, the quality of the measuring signal and the time required to update the measured value are shown on the display. A poor signal quality (1-2 bars) may be an indication that the wrong measurement profile has been selected.

The ISOMETER® is able to synchronise itself with other ISOMETER®s. This makes it possible to monitor capacitive coupled IT systems without interfering with each other.
Interfaces

- Communication protocol Modbus TCP
- BCOM for Bender device communication via Ethernet
- BS bus for communication of Bender devices (RS-485)
- Integrated web server for reading out measured values and for parameter setting.

Device variants

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

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

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

Operating elements

![Operating elements diagram]

- **1 - ON** The LED “ON” lights when the device is turned on.
- **2 - SERVICE** The LED “SERVICE” lights when there is either a device fault or a connection fault, or when the device is in maintenance mode.
- **3 - ALARM 1** The LED “ALARM 1” lights when the insulation resistance of the IT system falls below the set response value $R_{an1}$.
- **4 - ALARM 2** The LED “ALARM 2” lights when the insulation resistance of the IT system falls below the set response value $R_{an2}$.
- **5 - Display** The device display shows information regarding the device and the measurements.
- **6 - ▹** Navigates up in a list or increases a value.
- **7 - MENU** Opens the device menu
  - **ESC** Cancels the current process or navigates one step back in the device menu.
- **8 - RESET** Resets alarms.
  - **<** Navigates backwards (e.g. to the previous setting step) or selects a parameter.
- **9 - TEST** Starts the device self test.
  - **>** Navigates forwards (e.g. to the next setting step) or selects a parameter.
- **10 - DATA** Indicates data and values.
  - **▼** Navigates down in a list or reduces a value.
- **11 - INFO** Shows information.
  - **OK** Confirms an action or a selection.

Measurement method

**AMPPlus** The iso685 series uses the patented **AMPPlus** measurement method. This measurement method allows concise monitoring of modern power supply systems, also in case of extensive, directly connected DC components and high system leakage capacitances.

Standards

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

- DIN EN 61557-8 (VDE 0413-8):2015-12
- IEC 61557-8:2014-12
- DIN EN 61557-8 Ber 1 (VDE 0413-8 Ber 1):2016-12

Certifications

![Certification logos]
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. (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.

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

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

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

For UL applications:
Use 60/70°C copper lines only!
UL and CSA 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>

**Dimension diagram iso685-...**

Dimensions in mm

**Dimension diagram Panel cut-out FP200**

Dimensions in mm

**Connection to FP200**
Technical data

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

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

Rated voltage
- 1000 V

Overvoltage category
- III

Rated impulse voltage:
- IC1/(IC2-5) 8 kV
- IC2/(IC3-5) 250 V
- IC3/(IC4-5) 250 V
- IC4/IC5 4 kV

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

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

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

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

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

Supply voltage

Supply via A1+/-, A2+/-:
- Supply voltage range Ui
  - AC/DC up to 240 V
- AC/DC 24…240 V
- Tolerance of Ui
  - ± 5 %
- Maximum permissible input current of Ui
  - 650 mA
- Frequency range of Ui
  - DC 0…400 Hz
- Tolerance of the frequency range of Ui
  - ± 15 %
- Power consumption, typically DC
  - ≤ 12 W
- Power consumption, typically AC 25…690 V
  - ≤ 2 W/21 VA
- Power consumption, typically 50/60 Hz
  - ≤ 12 W/45 VA

Supply via X1:
- Supply voltage Ui
  - DC 24 V
- Tolerance of Ui
  - DC ± 15 %

IT system being monitored

Nominal system voltage range Ua
- AC 0…690 V
- DC 0…1000 V
- AC/DC 0…600 V (for UL applications)

Tolerance of Ua
- ± 1 %

Frequency range of Ua
- DC 0…460 Hz

Max. AC voltage Ua in the frequency range f = 0.1…4 Hz
- Umax = 50 V/Hz² * (1 + f²)

Response values
- Response value Rmax (alarm 1) 1 kΩ to 10 MΩ
- Response value Rmin (alarm 2) 1 kΩ to 10 MΩ

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

Hysteresis
- 25 %, at least ± 1 kΩ

Time response
- Response time tth at R1 = 0.5 x Rmax (Rmax = 10 kΩ) and C1 = 1 μF according to IEC 61557-8
- 1 kΩ to 10 MΩ
- 1 μF to 10 MΩ

Relative uncertainty (acc. to IEC 61557-8) profile dependent, typ. 4 s (see diagrams in manual)

Measuring circuit

Measuring voltage Ua
- Profile dependent, ± 10 V, ± 50 V (see profile overview)

Measuring current Ia
- 403 μA

Internal resistance R, Z
- 124 kΩ

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

Permissible extraneous AC voltage Ue
- 1200 V

Permissible system leakage capacitance Cz
- Profile dependent, ± 1000 μF

Measuring ranges

Measuring range f
- 0.1…460 Hz

Voltage range measurement of pa
- ± 1 % ± 1 Hz

Tolerance measurement of f
- ± 5 % ± 5 V

Measuring range of Ue
- ± 10 % ± 10 μF

Frequency range measurement of Cz
- DC 30…400 Hz

Insulation resistance measurement of Cz
- Profile dependent, typ. > 10 kΩ

Display

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

Display range measured value
- ± 15 %, at least ± 1 kΩ

Display voltage
- ALARM 1 yellow
- ALARM 2 yellow

Display LEDs
- ON (operation LED) green
- SERVICE yellow

In/Outputs (X1-Interface)

Cable length X1 (shielded cable)
- ≤ 10 m

Cable length X1 (shielded cable, shield connected to earth (PE) on one end, recommended: 1.5S/0 mm² 2x68)
- ≤ 100 m

Max. total supply output current via X1+X1.GND for each output
- max. 1 A

Max. total supply output current via A1/A2 on X1
- max. 200 mA

Max. total supply output current via A1/A2 on X1 between 16,8 V and 40 V
- (max) = 10mA + 7mA/V * U1

(negative values are not allowed for (max))

Digital Inputs (I1, I2, I3)

Number
- 3

Operating mode, adjustable
- active high, active low

Functions
- off, test, reset, deactivate device, start initial measurement

Voltage
- Low DC 3…5 V, High DC 11…32 V

Tolerance Voltage
- ± 10 %

Digital Outputs (Q1, Q2)

Number
- 2

Operating mode, adjustable
- active, passive

Functions
- off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm 3
- DC+ alarm 4, symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm

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

Analogue Output (M+)

Number
- 1

Operating mode
- linear, midscale point 28 kΩ/120 kΩ

Functions
- insulation value, DC offset

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

Voltage
- 0…10 V (± 1 kΩ), 2…10 V (> 1 kΩ)

Tolerance related to the current/voltage final value
- ± 20 %
### 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%
- Cable length: ≤ 100 m
- Connection: RJ45
- IP address: DHCP/manual
- 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 kbaud/s
- Cable length: ≤ 1200 m
- Termination: terminating pair, one end of shield terminated to PE, recommended: J-Y(St)Y min. 2x0.8
- Cable: twisted pair, one end of shield connected to PE

**Wireless interface/protocol:**
- Data rate: 9.6 kBaud/s
- Interface/protocol: RS-485/BS

**Other:**
- Operating mode: N/C operation/N/O operation
- Number of switching elements: 2 changeover contacts
- Device address, BS bus: 1…90
- Terminating resistor at the beginning and at the end of the transmission path

**Cable:**
- Multiple conductor, flexible with TWIN ferrule with plastic sleeve: 0.5…1.5 mm²
- Multiple conductor, flexible with ferrule 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:**
- Nominal current: ≤ 10 A
- Conductors sizes: AWG 24-12
- Stripping length: 7 mm
- Screw terminals:
  - Conductors sizes: AWG 24-16
  - Stripping length: 10 mm
- Push-wire terminals:
  - Nominal current: ≤ 8 A
  - Conductors sizes: AWG 24-16
  - Stripping length: 10 mm

**Push-wire terminals X1:**
- Nominal current: ≤ 8 A
- Conductors sizes: AWG 24-16
- Stripping length: 10 mm
- Flexible with ferrule without plastic sleeve: 0.25…1.5 mm²
- Flexible with TWIN ferrule with plastic sleeve: 0.25…0.75 mm²

#### Switching elements

**Number of switching elements:**
- 2 changeover contacts

**Operating mode:**
- N/C or 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

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

**Ambient temperatures:**
- Operating temperature: +40…+70 °C
- Transport: -40…+85 °C
- Long-term storage: -40…+70 °C

**Degree of protection:**
- Internal components: IP40

**Classification of climatic conditions acc. to IEC 60721:**
- Stationary use (IEC 60721-3-3): 3K4 (condensation and formation of ice possible)
- Long-term storage (IEC 60721-3-1): 3K5 (condensation and formation of ice possible)

**Certifications:**
- UL: 0.15 mm²
- CE: IEC EN 60721-3-1 (Condensation and formation of ice possible)
- RCMP: 0.15 mm²
- FCC: 0.15 mm²

**Degree of protection internal components:**
- IP40

**Package:**
- Dimensions (W x H x D): 108 x 93 x 110 mm
- Weight: ≤ 290 g

#### Screw-type terminals

**Nominal current:**
- ≤ 10 A

**Tightening torque:**
- 0.5…0.6 Nm (5…7 lb-in)

**Conductor sizes:**
- AWG 24-12

**Stripping lengths:**
- 7 mm

**Flexible with ferrules:**
- 0.2…2.5 mm²

**Flexible with TWIN ferrule with plastic sleeve:**
- 0.25…2.5 mm²

**Rigidity/flexibility:**
- 0.2…1.5 mm²

**Other:**
- Maximum: 300 m NN
- Degree of protection: IP20
- DIN rail mounting acc. to IEC 60715
- Screws fixing: x M4 with mounting clip
- Enclosure material: polycarbonate
- Flammability class: V-0
- ANSI code: 64
- ANSI code: 64
- Nominal current: ≤ 8 A
- Copper: 0.64 mm²
- Terminal block: 390 g
- Dimensions (W x H x D): 108 x 93 x 110 mm

**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): 3K4 (condensation and formation of ice possible)
- Long-term storage (IEC 60721-3-1): 3K5 (condensation and formation of ice possible)

**Classification of mechanical conditions acc. to IEC 60721:**
- Stationary use (IEC 60721-3-3): 3M7
- Long-term storage: 3K5
- Long-term storage: 3K5
- Long-term storage: 3K5
- Ambient temperature: -40…+70 °C
- Relative humidity: 0…95 %
- Temperature: -40…+70 °C
- Relative humidity: 0…95 %
- Temperature: -40…+70 °C
# 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>0...690 V; 0.1...460 Hz</td>
<td>0...1000 V</td>
<td>integrated</td>
<td>–</td>
<td>iso685-D</td>
<td>B91067010</td>
</tr>
<tr>
<td>0...1000 V</td>
<td>24...240 V; 50...400 Hz</td>
<td>24...240 V</td>
<td>–</td>
<td>iso685SW-D</td>
<td>B91067010W</td>
</tr>
<tr>
<td>0...1000 V</td>
<td>–</td>
<td>detached</td>
<td>–</td>
<td>iso685-S + FP200</td>
<td>B91067210</td>
</tr>
<tr>
<td>0...1000 V</td>
<td>–</td>
<td>–</td>
<td>iso685SW-S + FP200W</td>
<td>B91067210W</td>
<td></td>
</tr>
</tbody>
</table>

## Accessories

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

1) included in the scope of delivery

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

## Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device version without display</td>
<td>iso685-S</td>
<td>B91067110</td>
</tr>
<tr>
<td>Display for front panel mounting</td>
<td>iso685SW-S</td>
<td>B91067110W</td>
</tr>
<tr>
<td>Coupling devices</td>
<td>FP200</td>
<td>B91067904</td>
</tr>
<tr>
<td></td>
<td>FP200W</td>
<td>B91067904W</td>
</tr>
<tr>
<td></td>
<td>AGH150W-4</td>
<td>B98018006</td>
</tr>
<tr>
<td></td>
<td>AGH2045-4</td>
<td>B914013</td>
</tr>
<tr>
<td></td>
<td>AGH5205</td>
<td>B913033</td>
</tr>
<tr>
<td></td>
<td>AGH6765-4</td>
<td>B913055</td>
</tr>
</tbody>
</table>

Suitable measuring instruments on request!