ISOMETER® iso685-…-P
Insulation monitoring device with integrated locating current injector for IT AC systems with galvanically connected rectifiers or converters and for IT DC systems
Device features

- ISOMETER® for IT AC systems with galvanically connected rectifiers or inverters and for IT DC systems (IT = unearthed systems).
- Automatic adaptation to the existing system leakage capacitance.
- Combination of AMPPlus and other profile-dependent measurement methods.
- Two separately adjustable response value ranges of 1 kΩ…10 MΩ for Alarm 1 and Alarm 2.
- High-resolution graphic LC display for excellent readability and recording of the device status.
- Connection monitoring (monitoring of the measuring lines).
- Automatic device self-test.
- Graphical representation of the insulation resistance over time (isoGraph).
- History memory with real-time clock (buffer for three days) for storing 1023 alarm messages with date and time.
- Current or voltage output 0(4)…20 mA, 0…400 µA, 0…10 V, 2…10 V (galvanically separated), which is analogous to the measured insulation value of the system.
- Freely programmable digital inputs and outputs.
- Remote setting of certain parameters via the Internet (option; COMTRAXX® gateway).
- Worldwide remote diagnosis via the Internet (made available by Bender Service only).
- RS-485/BS (Bender sensor bus) for communication with other Bender devices.
- ISOnet: Internal separation of the ISOMETER® from the IT system to be monitored (e.g. if several IT systems are interconnected)
- BCOM, Modbus TCP and web server
- Locating current injection for selective insulation fault location
- Indication of the insulation faults selectively located by the EDS system
- Parameter setting of EDS systems
- Customer-specific texts for each measuring channel

Product description

The ISOMETER® is an insulation monitoring device for IT systems in accordance with IEC 61557-8 and IEC 61557-9. It is 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).

In combination with the insulation fault locators of the EDS44x series or the appropriate measuring current transformers, an insulation fault location system can be set up with the iso685-…-P.
Insulation monitoring function
The insulation monitoring device ISOMETER® 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 micro-controlled measuring circuit. The measuring time depends 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 or via different setup menus using the device buttons and a high-resolution graphic LC display. The selected settings are stored in a permanent fail-safe memory. Different languages can be selected for the setup menus and 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 protected against unauthorised modifications by a password.

Insulation fault location function
The insulation fault location is carried out by means of insulation fault locators of the EDS44x series and the appropriate measuring current transformers. If the iso685-…-P detects an insulation fault, the insulation fault location is automatically or manually started. In addition, the iso685-…-P generates a locating current, the level of which depends on the existing mains voltage and the insulation fault. The locating current is limited by the iso685-…-P to configurable values in order to avoid malfunctions in control systems.

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

iso685-S-P
The iso685-S-P variant itself does not feature a display and can only be used in combination with an FP200. The iso685-S-P is thereby operated indirectly via the FP200.

Option "W"
Device variants with Option "W" are available for extreme climatic and mechanical conditions.

System setup
In general, an EDS system is constituted by an iso685-…-P as well as one or more EDS44x insulation fault locators with the appropriate measuring current transformers. The information is exchanged between the EDS44x and the iso685-…-P via a backbone bus or a 2-wire sensor bus in order to save time and costs.

The insulation monitoring device iso685-…-P and the insulation fault locators EDS44x constitute a complete IT system monitoring unit. In a system like this, up to 255 channels can be monitored. The insulation monitoring devices can be connected to various gateways via an Ethernet interface, whereby an almost infinite amount of channels distributed in different IT systems can be monitored.

Measurement method
AMPPlus
The iso685-…-P 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 61557-8:2016-01, DIN EN 61557-9 (VDE 0413-9):2015-10, IEC 61557-9:2014-12
Operating elements

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

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” 1)</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>iso685-D-P</td>
<td>B 9106 7030</td>
<td></td>
</tr>
<tr>
<td>AC 24...240 V; 50...400 Hz</td>
<td>DC 24...240V</td>
<td>-40...+70°C, 3K5, 3M7</td>
<td>iso685W-D-P 1)</td>
<td>B 9106 7030W</td>
<td></td>
</tr>
<tr>
<td>–</td>
<td>–</td>
<td>–</td>
<td>iso685-S-P + FP200</td>
<td>B 9106 7230</td>
<td></td>
</tr>
<tr>
<td>–</td>
<td>–</td>
<td>-40...+70°C, 3K5, 3M7</td>
<td>iso685W-S-P + FP200W 1)</td>
<td>B 9106 7230W</td>
<td></td>
</tr>
</tbody>
</table>

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

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A set of screw-type terminals 1)</td>
<td>B 9106 7901</td>
</tr>
<tr>
<td>A set of push-wire terminals</td>
<td>B 9106 7902</td>
</tr>
<tr>
<td>Enclosure accessories (terminal cover, 2 mounting clips) 1)</td>
<td>B 9106 7903</td>
</tr>
<tr>
<td>Front cover 144x72 transparent (for IP65)</td>
<td>B 9806 0005</td>
</tr>
<tr>
<td>BB bus 6TE Connector</td>
<td>B 9811 0001</td>
</tr>
</tbody>
</table>

1) included in the scope of delivery

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device version without display</td>
<td>iso685-S-P</td>
<td>B 9106 7130</td>
</tr>
<tr>
<td>iso685W-S-P</td>
<td>B 9106 7130W</td>
<td></td>
</tr>
<tr>
<td>Display for front panel mounting</td>
<td>FP200</td>
<td>B 9106 7904</td>
</tr>
<tr>
<td>FP200W</td>
<td>B 9106 7904W</td>
<td></td>
</tr>
</tbody>
</table>

Suitable measuring instruments on request!
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
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. (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.
**ISOMETER® iso685-…-P**

**Dimension diagram iso685-…-P**
Dimensions in mm

**Dimension diagram Panel cut-out FP200**
Dimensions in mm

**Connection to FP200**

**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>

**Digitale Ausgänge**
- Passive: X1, X1
- Active: X1, X1

**Digitale Eingänge**
- High-Active: X1, X1
- Low-Active: X1, X1

**Analoger Ausgang**
- Stromausgang: X1, X1
- Spannungsausgang: X1, X1

**Beispiel**

Gerät deaktivieren
Reset
Test
Connection example ISOMETER® with insulation fault locators

System setup
**Technical data**

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

**Definitions:**
- Measuring circuit (IC1): (L1+/+, L2, L3/-)
- Supply circuit (IC2): A1, A2
- Output circuit 1 (IC3): 11, 12, 14
- Output circuit 2 (IC4): 21, 22, 24
- Control circuit (IC5): (E, KE), (X1, ETH, X3, X4)
- Rated voltage: 1000 V
- Overvoltage category (OVC): III

**Rated impulse voltage:**
- IC1/IC2-S: 8 kV
- IC2/IC3-S: 4 kV
- IC3/IC4-S: 4 kV
- IC4/IC5: 4 kV

**Rated insulation voltage:**
- IC1/IC2-S: 1000 V
- IC2/IC3-S: 250 V
- IC3/IC4-S: 250 V
- IC4/IC5: 250 V

**Pollution degree for accessible parts on the outside of the device housing:**
- IC1/IC2-S: OVC III, 1000 V
- IC2/IC3-S: OVC III, 1000 V
- IC3/IC4-S: OVC III, 1000 V
- IC4/IC5: OVC III, 1000 V

**Voltage test (routine test) according to IEC 61010-1:**
- IC4/IC5: OVC III, 300 V
- IC3/(IC4-5): OVC III, 300 V
- IC2/(IC3-5): OVC III, 300 V
- IC1/(IC2-5): OVC III, 300 V

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

**Supply via A1/+,- A2/-:**
- Supply voltage range $U_S$: AC/DC 24 ... 240 V
- Tolerance of $U_S$: ±20 ... +15%
- Maximum permissible input current of $U_S$: 650 mA
- Frequency range of $U_S$: DC, 50 ... 400 Hz
- Tolerance of the frequency range of $U_S$: ±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 $U_S$: DC 24 V
- Tolerance of $U_S$: ±20 ... +25%

**IT system being monitored:**
- Nominal system voltage range $U_n$: AC 0 ... 690 V
- AC/DC 0 ... 1000 V
- AC/DC 0 ... 600 V (for UL applications)
- Tolerance of $U_n$: ±15%
- Frequency range of $U_n$: DC, 1 ... 460 Hz
- Max. AC voltage $U_{max}$ in the frequency range $f_n = 1 ... 10 Hz$: $U_{max} = 38 V/Hz^2 * (1 + f_n)$

**Response values:**
- Response value $R_{M1}$ (alarm 1): 1 kΩ, ±10 MΩ
- Response value $R_{M2}$ (alarm 2): 1 kΩ, ±10 MΩ
- Relative uncertainty (acc. to IEC 61557-8): ±15%, at least ±1 kΩ
- Hysteresis: 25%, at least 1 kΩ

**Time response:**
- Response time $t_{res}$ at $R_i = 0.5 x R_M$ ($R_M = 10 kΩ$) and $C_e = 1 μF$ according to IEC 61557-8
- Response time $t_{res}$ at $R_i = 0.5 x R_M$ ($R_M = 10 kΩ$) and $C_e = 1 μF$ according to IEC 61557-8
- Response time $t_{res}$ for $C_e = 1 μF$ and $t_{res} ≤ 10 s$ (see diagrams in manual)

**Measuring circuit:**
- Measuring voltage $U_m$: profile dependent, ±10 V, ±50 V (profile overview)
- Measuring current $I_m$: ±403 µA
- Internal resistance $R_i$: ≥ 124 kΩ
- Permissible extraneous DC voltage $U_{EI}$: ≤ 1200 V
- Permissible system leakage capacitance $C_e$: profile dependent, 0 ... 1000 µF

**Measuring circuit for insulation fault location (EDS):**
- Locating current $I_L$: 1/1.8/2.5/10/25/50 mA

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

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

**Digital inputs:**
- Number: 3
- Operating mode, adjustable: active high, active low
- Functions: off, test, reset, deactivate device, start initial measurement, insulation fault location
- Voltage: Low DC -3 ... 5 V, High DC 11 ... 32 V
- Operating mode, adjustable: active, passive
- Functions: off, alarm 1, alarm 2, connection fault, DC-alarm 1, DC + alarm 2, symmetrical alarm, device fault, common alarm
- Measurement complete, device inactive, DC offset alarm, common alarm EDS
- Voltage: DC 3 ... 5 V, High DC 11 ... 32 V
- Cable length X1 (unshielded cable): ≤ 10 m
- Cable length X1 (shielded cable, shielded cable, shield connected to earth (PE) on one end, recommended: J-Y(St)Y min. 2x0,8): ≤ 100 m

**Digital outputs:**
- Number: 2
- Operating mode, adjustable: active, passive
- Functions: off, alarm 1, alarm 2, connection fault, DC-alarm 1, DC + alarm 2, symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm, common alarm EDS
- Voltage: DC 0 ... 32 V, active DC 0/19.2 ... 32 V
- Max. current internal per channel: max. 1 A
- Cable length X1 (unshielded cable): ≤ 10 m
- Cable length X1 (shielded cable, shielded cable, shield connected to earth (PE) on one end, recommended: J-Y(St)Y min. 2x0,8): ≤ 100 m
Analogue output

Number 1
Operating mode Linear, mid-scale point 28/120 kΩ
Functions Insulation value, DC offset
Current 0…20 mA (< 600 Ω), 4…20 mA (< 600 Ω), 0…400 µA (< 4 kΩ)
Voltage 0…10 V (> 1 kΩ), 2…10 V (> 1 kΩ)
Tolerance ±20 %

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
ISOnet:
Number ISOnet devices ≤ 20

Sensor bus:
Interface/protocol RS-485/BS
Data rate 9.6 kbit/s
Cable length ≤ 1200 m
Cable: twisted pair, one end shield connected to PE recommended: J-Y(St)Y min. 2x0.8
Connection terminals X1A, X1B
Terminating resistor at the beginning and at the end of the transmission path
Device address, BS bus 1…90

Switching elements

Number of switching elements 2 changeover contacts
Operating mode N/O operation/N/O operation
Contact 11-12-14 LH, Ins. alarm 1, Ins. alarm 2, connection fault, DC alarm 5), symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm, common alarm EDS
Contact 21-22-24 LH, Ins. alarm 1, Ins. alarm 2, connection fault, DC alarm 5), 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:

- 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
- 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 61326-2-4/4
- 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-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

- Nominal current ≤ 10 A
- Tightening torque 0.5…0.6 Nm (5…7 lb-in)
- Conductor sizes AWG 24-12
- Stripping length 7 mm
- Conductor, rigid 0.2…2.5 mm²
- Flexible with ferrules, 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…1.1 mm²
- Multiple conductor, flexible with TWIN ferrule with plastic sleeve 0.5…1.5 mm²

Push-wire terminals:

- Nominal current ≤ 10 A
- Conductor sizes AWG 24-16
- Stripping length 10 mm
- Conductor, rigid 0.2…2.5 mm²
- Flexible with ferrule without plastic sleeve 0.25…2.5 mm²
- Flexible with TWIN ferrule with plastic sleeve 0.25…0.75 mm²

Push-wire terminals X1:

- Nominal current ≤ 8 A
- Conductor sizes AWG 24-16
- Stripping length 10 mm
- Conductor, rigid 0.2…2.5 mm²
- Flexible with ferrule without plastic sleeve 0.25…2.5 mm²
- Flexible with TWIN ferrule with plastic sleeve 0.25…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 < 510 g

Option „W“ data different from the standard version

Rated operational current of switching elements max. 3 A (for UL applications)
Ambient temperatures:
- Operating temperature -40…+70 °C
- Transport -40…+65 °C (for UL applications)
- Long-term storage -40…+70 °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

1) At a frequency > 200 Hz, the connection of X1 must be insulated. Only permanently installed devices which at least have overvoltage category CAT2 (300V) may be connected.
2) Indication limited outside the temperature range -25…+55 °C.
3) For Ua ≥ 50 V only.
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.