# ISOMETER® isoHR685W-x-I-B

Insulation monitoring device for IT AC systems with galvanically connected rectifiers and inverters and for IT DC systems
with isoData for logging measurement events
with ISOsync for capacitive coupled IT-systems


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**ISOMETER® isoHR685W-D-I-B**

## 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-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

## Product description

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

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).

## Application

- 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

## 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 micro-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 or 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/-.

The insulation monitoring device isoHR685W-x-I-B is able to measure the insulation resistance reliably and precisely in all common IT systems (unearthed systems). Due to various applications, system types, operating conditions, application of variable-speed drives, high system leakage capacitances etc., the measurement technique must be able to meet varying requirements in order to ensure an optimised response time and relative uncertainty. Therefore different measuring profiles can be selected with which the device can optimally adjusted.

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® has an internal system isolating switch, which makes it possible to operate several ISOMETER®s in coupled IT systems. For this purpose, the ISOMETER®s are connected via an Ethernet bus. The integrated ISOnet function ensures that only one ISOMETER® is actively measuring at a time, while the other devices are completely isolated from the system and waiting in standby mode for measuring permission.

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.

AC/DC

## Interfaces

- Communication protocol Modbus/TCP
- BCOM to communicate with Bender devices via Ethernet
- BS bus for communication of Bender devices (RS-485)
- isoData to record and manage measured values
- Integrated web server to read measured values and for parameter setting

## 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.

## Measurement method

AMP*Plus* The isoHR685W-x-I-B series uses the patented *AMP*$^{Plus}$ 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.

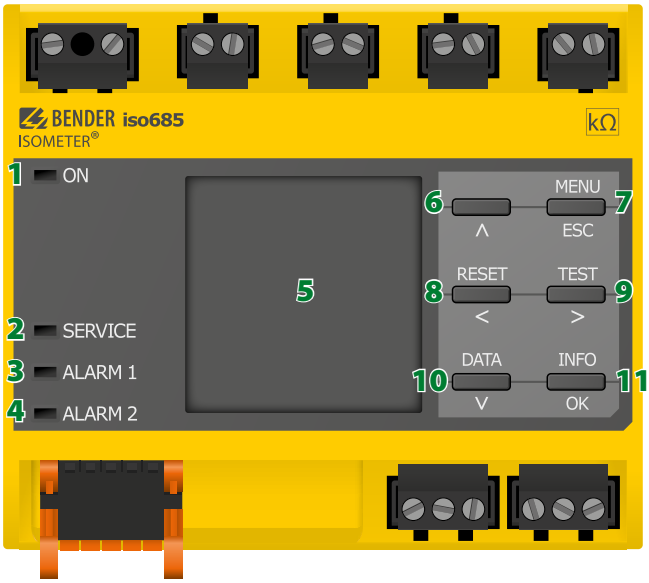
## Standards

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
- IEC 61557-8:2014/COR1:2016
- DIN EN 61557-8 Ber 1 (VDE 0413-8 Ber 1):2016-12

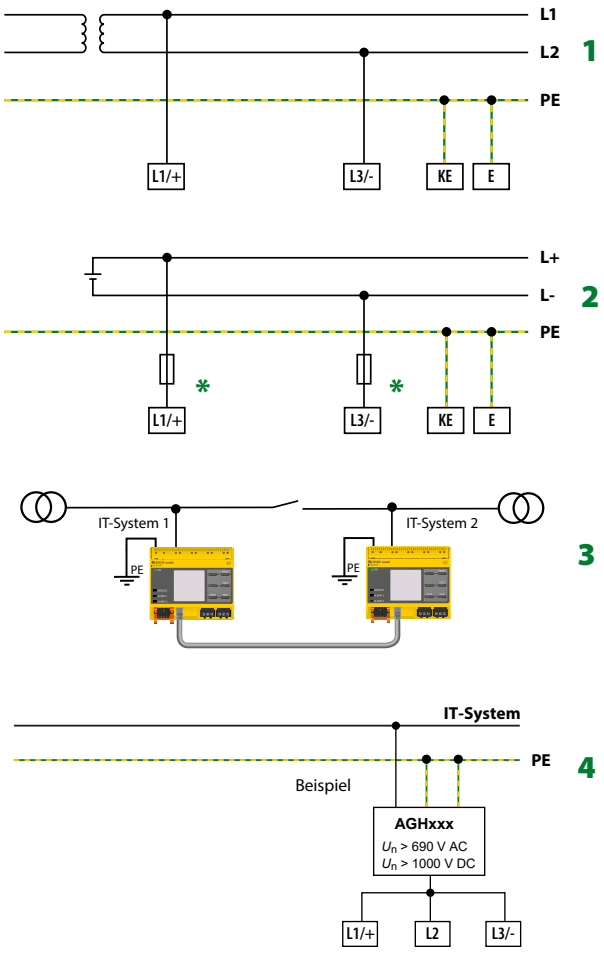
## Certifications

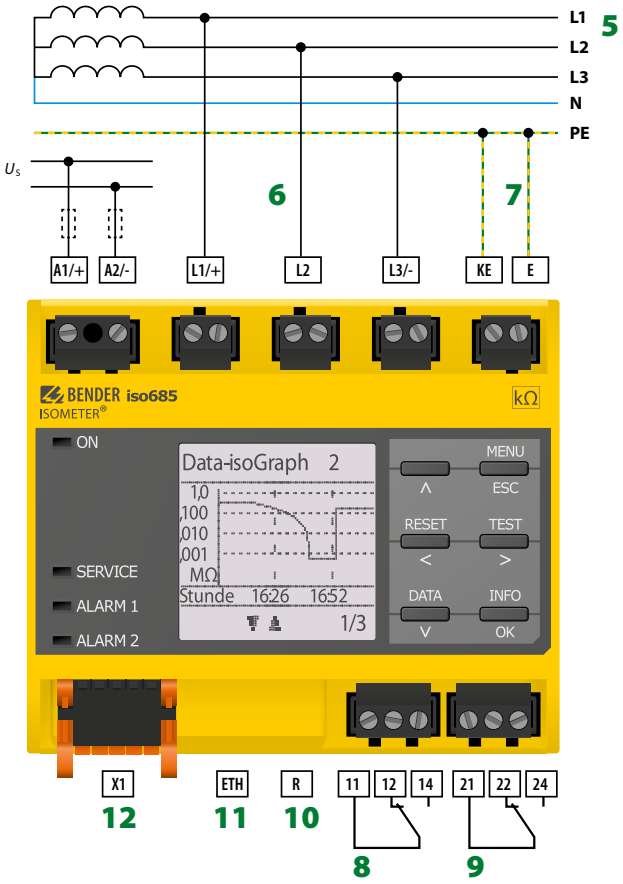
## Operating elements




| | | |
|---|---|---|
| 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 - | Λ | 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. |
| | V | Navigates down in a list or reduces a value. |
| 11 - | INFO | Shows information. |
| | OK | Confirms an action or a selection. |

## 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 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
8 - (K1) Alarm relay 1, available changeover contacts
9 - (K2) Alarm relay 2, available changeover contacts
10 - Switchable resistor R for RS-485 bus termination
11 - Ethernet interface
12 - 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.

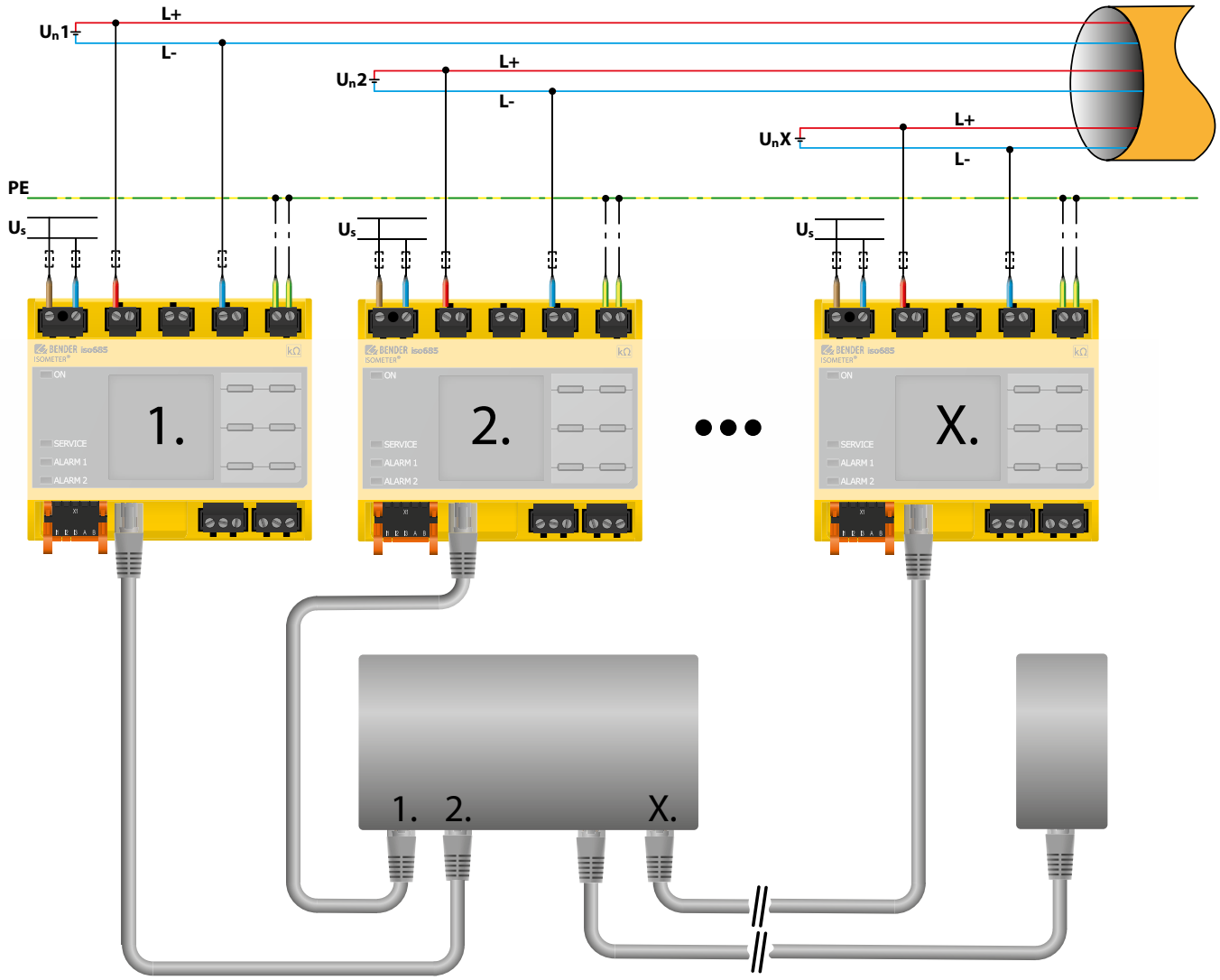
***Provide line protection!***
*According to DIN VDE 0100-430, a line protection shall be provided for the supply voltage.*

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

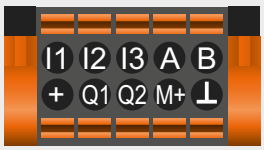
*The connecting lines L1/+, L2, L3/- to the system to be monitored must be carried out as spur lines. No load current may be conducted through the terminals.*

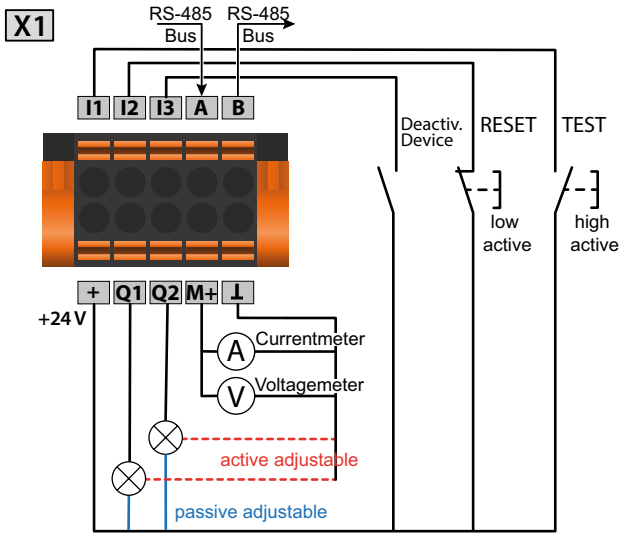
***For UL applications:***
*Use 60/70°C copper lines only!*
*UL and CSA application require the supply voltage to be protected via 5 A fuses.*

## ISOsync for coupled IT systems



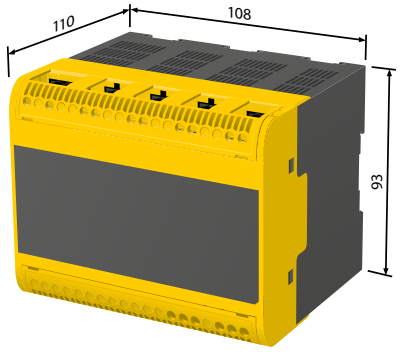
## Digital interface X1

| Digital interface | Terminal | Colour |
|---|---|---|
|  X1 | I1 | Input 1 |
| | I2 | Input 2 |
| | I3 | Input 3 |
| | A | RS-485 A |
| | B | RS-485 B |
| | + | +24 V |
| | Q1 | Output 1 |
| | Q2 | Output 2 |
| | M+ | Analogue output |
| | ⊥ | Ground |



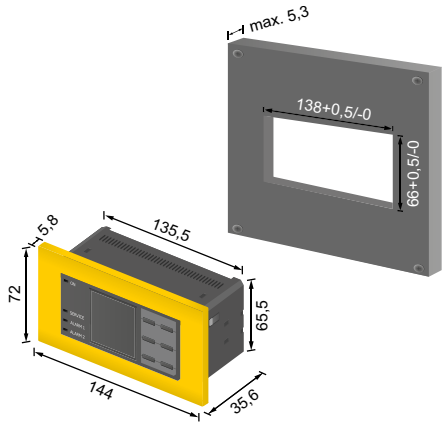

## Dimension diagram isoHR685W-x-I-B

Dimensions in mm

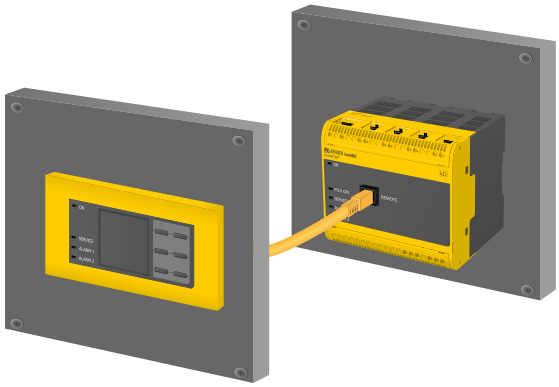



## Dimension diagram Panel cut-out FP200

Dimensions in mm




## Connection to FP200



## Ordering information

| Nominal system voltage range $U_n$ | | Supply voltage $U_S$ | | Display | Type | | Art. no. |
|---|---|---|---|---|---|---|---|
| AC | DC | AC | DC | | | | |
| 0…1000 V<br>0.1…460 Hz | 0…1300 V | 24…240 V;<br>50…400 Hz | 24…240 V | integrated | **isoHR685W–D–I–B** |  | **B91067025W** |
| | | | | detached | **isoHR685W–S–I–B + FP200W** [1] |  | **B91067225W** |

[1] Only available in combination

## Accessories

| Description | Art. no. |
|---|---|
| A set of screw terminals[1] | **B91067901** |
| A set of push-wire terminals | **B91067902** |
| Enclosure accessories (terminal cover, 2 mounting clips) [1] | **B91067903** |
| Transparent cover 144x72 (IP65) for FP200 [2] | **B98060005** |

[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

| Description | Type | Art. no. |
|---|---|---|
| Device version without display | **isoHR685W-S-I-B** | **B91067125W** |
| Display for front panel mounting | **FP200W** | **B91067904W** |
| Coupling devices | **AGH150W-4** | **B98018006** |
| | **AGH204S-4** | **B914013** |
| | **AGH520S** | **B913033** |
| | **AGH676S-4** | **B913055** |

Suitable measuring instruments on request!

## Technical data

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

| | |
|---|---|
| Definitions: | |
| Measuring circuit (IC1) | L1/+, L2, L3/- |
| Supply circuit (IC2) | A1, A2 |
| Output circuit 1 (IC3) | 11, 12, 14 |
| Output circuit 2 (IC4) | 21, 22, 24 |
| Control circuit (IC5) | (E, KE), (X1, ETH, X3, X4) |
| Rated voltage | 1300 V |
| Overvoltage category | II |
| Rated impulse voltage: | |
| IC1/( IC2-5 ) | 8 kV |
| IC2/( IC3-5 ) | 4 kV |
| IC3/(IC4-5) | 4 kV |
| IC4/IC5 | 4 kV |
| Rated insulation voltage: | |
| IC1/(IC2-5) | 1000 V |
| IC2/(IC3-5) | 250 V |
| IC3/(IC4-5) | 250 V |
| IC4/IC5 | 250 V |
| Pollution degree for accessible parts on the outside of the device housing ($U_n$ < 690 V) | 3 |
| Pollution degree for accessible parts on the outside of the device housing ($U_n$ >690 < 1000 V) | 2 |
| Safe isolation (reinforced insulation) between: | |
| IC1/(IC2-5) | Overvoltage category III, 1000 V<br>Overvoltage category II, 1300 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 | |
| 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 $U_S$ | AC/DC 24…240 V |
| Tolerance of $U_S$ | -30…+15 % |
| Maximum permissible input current of $U_S$ | 650 mA |
| Frequency range of $U_S$ | DC, 50…400 Hz[1] |
| Tolerance of the frequency range of $U_S$ | -5…+15 % |
| Power consumption, typically DC | ≤ 12 W |
| Power consumption, typically 50/60 Hz | ≤ 12 W/21 VA |
| Power consumption, typically 400 Hz | ≤ 12 W/45 VA |

**Supply via X1:**

| | |
|---|---|
| Supply voltage $U_S$ | DC 24 V |
| Tolerance of $U_S$ | DC -20…+25 % |

### IT system being monitored

| | |
|---|---|
| Nominal system voltage range $U_n$ | AC 0…1000 V; DC 0…1300 V<br>AC/DC 0…1000 V (for UL applications) |
| Tolerance of $U_n$ | AC/DC +15 % |
| Frequency range of $U_n$ | DC 0.1…460 Hz |
| Max. AC voltage $U_{\sim}$ in the frequency range $f_n$ = 0.1… 4 Hz | $U_{\sim max} = 50\ V/Hz^2 * (1 + f_n^2)$ |

### Response values

| | |
|---|---|
| Response value $R_{an1}$ (Alarm 1) | 1 kΩ…3 GΩ |
| Response value $R_{an2}$ (Alarm 2) | 1 kΩ…3 GΩ |
| 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 $t_{an}$ at $R_{F\ (without\ fault)}$ = 1 MΩ -> $R_{F\ (with\ fault)}$ = 0,5 x $R_{an}$ ($R_{an}$ = 20 kΩ) and $C_e$ = 1 µF acc. to IEC 61557-8 | profile dependent, typ. 10 s (see diagrams in manual) |
| Response time DC Alarm at $R_{F\ (without\ fault)}$ = 1 MΩ und $C_e$ = 1 µF | profile dependent, typ. 5 s (see diagram in manual) |
| Start-up delay $T_{start-up}$ | 0…120 s |

### Measuring circuit

| | |
|---|---|
| Measuring voltage $U_m$ | profile dependent, ±10 V, ±50 V (see profile overview) |
| Measuring current $I_m$ | ≤ 403 µA |
| Internal resistance $R_i$, $Z_i$ | ≥ 124 kΩ |
| Internal resistance on decouppled systems (inactive by I/O, inactive by ISOnet or cut-off) | typ. 50 MΩ |
| Permissible extraneous DC voltage $U_{fg}$ | ≤ 1500 V |
| Permissible system leakage capacitance $C_e$ | profile dependent, 0…1000 µF |

### Measuring ranges

| | |
|---|---|
| Measuring range $f_n$ | 0.1…460 Hz |
| Tolerance measurement of $f_n$ | ±1 % ±0.1 Hz |
| Voltage range measurement of $f_n$ | AC 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 10…1000 V[2] |
| Tolerance measurement of $U_n$ | ±5 % ±5 V |
| Measuring range $C_e$ | 0…1000 µF |
| Tolerance measurement of $C_e$ | ±10 % ±10 µF |
| Frequency range measurement of $C_e$ | DC, 10…460 Hz |
| Min. insulation resistance measurement of $C_e$ | depending on the profile and coupling mode, typ. > 10 kΩ |

### Display

| | |
|---|---|
| Indication | graphic display 127 x 127 pixels, 40 x 40 mm[3] |
| Display range measured value | 0.1 kΩ…10 GΩ |
| Operating uncertainty (according to IEC 61557-8) | ±15 %, at least ±1 kΩ |

### LEDs

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

### Inputs/outputs (X1-Schnittstelle)

| | |
|---|---|
| Cable length X1 | (unshielded cable) ≤ 10 m |
| Recommended cable (shielded, shield connected to PE on one side: J-Y(St)Y min. 2x0.8) | ≤ 100 m |
| Total max. supply output current via X1.+/X1.GND for each output | max. 1 A |
| Total max. supply output current via A1/A2 in total on X1 | max. 200 mA |
| Total max. supply output current via A1/A2 in total on X1 between 16.8 V and 40 V | $I_{LmaxX1} = 10\ mA + 7\ mA/V * U_S$[4]<br>(negative values are not allowed for $I_{LmaxX1}$) |

### 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 |
| Voltage tolerance | ± 10 % |

### Digital outputs (Q1, Q2)

| | |
|---|---|
| Number | 2 |
| Operating mode, adjustable | active, passive |
| Functions | 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 |
| 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 shift |
| 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. 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 | ≤ 50 |

**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:**

| | | | | | |
|---|---|---|---|---|---|
| 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 and temperature range

| | |
|---|---|
| EMC | IEC 60533, IEC 61326-2-4 [6] |
| Operating temperature | -25…+55 °C |
| Transport | -40…+85 °C |
| Long-term storage | -40…+70 °C |

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

| | |
|---|---|
| Staionary use (IEC 60721-3-3) | 3K5 (condensation and formation of ice possible) |
| Transport (IEC 60721-3-2) | 2K3 |
| Long-term storage (IEC 60721-3-1) | 1K4 |

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

| | |
|---|---|
| Stationary use (IEC 60721-3-3) | 3M7 |
| 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 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 collar | 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 withTWIN ferrule with plastic sleeve | 0.5…1.5 mm² |

**Push-wire terminals:**

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

**Push-wire terminals X1:**

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

### Other

| | |
|---|---|
| Operating mode | continuous operation |
| Mounting (0°) | display oriented, cooling slots must be ventilated vertically [7] |
| 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 ande 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 $U_n$ > DC 1000 V and asymmetric insulation fault at $R_f$ < 500 kΩ. Reactivation of voltage metering if $R_f$ > 500 kΩ

[3] Indication limited outside the temperature range -25…+55 °C.

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

[5] For $U_n$ ≥ 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)

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.

BENDER
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