EN Manual

BENDER
The Power in Electrical Safety©

# ISOMETER® iso685-D
AC/DC

# iso685W-D

# iso685-S

# iso685W-S


**Insulation Monitoring Device for IT AC systems with galvanically connected rectifiers and inverters and for IT DC systems**

iso685-D_D00022_06_M_XXEN/04.2017

PLEASE READ THIS MANUAL AND ANY ACCOMPANYING DOCUMENTS CAREFULLY
AND KEEP THEM IN A SECURE PLACE FOR FUTURE REFERENCE.

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# 1. Important information

## 1.1 How to use this manual

*This manual is intended for **qualified personnel** working in electrical engineering and electronics!*

Always keep this manual within easy reach for future reference.
To make it easier for you to understand and revisit certain sections in this manual, we have used symbols to identify important instructions and information. The meaning of these symbols is explained below:


*This signal word indicates that there is a **high risk of danger** that will result in **electrocution** or **serious injury** if not avoided.*


*This signal word indicates a **medium risk of danger** that can lead to **death** or **serious injury** if not avoided.*


*This signal word indicates a **low level risk** that can result in **minor or moderate injury** or **damage to property** if not avoided.*

*This symbol denotes information intended to assist the user in making **optimum use** of the product.*

## 1.2 Technical support

For commissioning and troubleshooting Bender offers you:

### 1.2.1 First level support

Technical support by phone or e-mail for all Bender products

- Questions concerning specific customer applications
- Commissioning
- Troubleshooting

**Telephone:** +49 6401 807-760*
**Fax:** +49 6401 807-259
In Germany only: 0700BenderHelp (Tel. and Fax)
**E-mail:** support@bender-service.de

### 1.2.2 Repair service

Repair, calibration, update and replacement service for Bender products

- Repairing, calibrating, testing and analysing Bender products
- Hardware and software update for Bender devices
- Delivery of replacement devices in the event of faulty or incorrectly delivered Bender devices
- Extended guarantee for Bender devices, which includes an in-house repair service or replacement devices at no extra cost

**Telephone**: +49 6401 807-780** (technical issues)
+49 6401 807-784**, -785** (sales)
**Fax:** +49 6401 807-789
**E-mail:** repair@bender-service.de

Please send the devices for **repair** to the following address:

Bender GmbH, Repair-Service,
Londorfer Strasse 65,
35305 Grünberg

### 1.2.3 Field service

On-site service for all Bender products

- Commissioning, parameter setting, maintenance, troubleshooting for Bender products
- Analysis of the electrical installation in the building (power quality test, EMC test, thermography)
- Training courses for customers

**Telephone:** +49 6401 807-752**, -762 **(technical issues)
+49 6401 807-753** (sales)
**Fax:** +49 6401 807-759
**E-mail:** fieldservice@bender-service.de
**Internet:** www.bender-de.com

*Available from 7.00 a.m. to 8.00 p.m. 365 days a year (CET/UTC+1)
**Mo-Thu 7.00 a.m. - 8.00 p.m., Fr 7.00 a.m. - 13.00 p.m.

## 1.3 Training courses

Bender is happy to provide training regarding the use of test equipment.
The dates of training courses and workshops can be found on the Internet at www.bender-de.com -> Know-how -> Seminars.

## 1.4 Delivery conditions

Bender sale and delivery conditions apply.
For software products the "Softwareklausel zur Überlassung von Standard-Software als Teil von Lieferungen, Ergänzung und Änderung der Allgemeinen Lieferbedingungen für Erzeugnisse und Leistungen der Elektroindustrie" (software clause in respect of the licensing of standard software as part of deliveries, modifications and changes to general delivery conditions for products and services in the electrical industry) set out by the ZVEI (Zentralverband Elektrotechnik- und Elektronikindustrie e. V.) (German Electrical and Electronic Manufacturer's Association) also applies.
Sale and delivery conditions can be obtained from Bender in printed or electronic format.

## 1.5 Storage

The devices must only be stored in areas where they are protected from dust, damp, and spray and dripping water, and in which the specified storage temperatures can be ensured.



## 1.6 Disposal

Abide by the national regulations and laws governing the disposal of this device. Ask your supplier if you are not sure how to dispose of the old equipment.
The directive on waste electrical and electronic equipment (WEEE directive) and the directive on the restriction of certain hazardous substances in electrical and electronic equipment (RoHS directive) apply in the European Community. In Germany, these policies are implemented through the "Electrical and Electronic Equipment Act" (ElektroG). According to this, the following applies:

- Electrical and electronic equipment are not part of household waste.
- Batteries and accumulators are not part of household waste and must be disposed of in accordance with the regulations.
- Old electrical and electronic equipment from users other than private households which was introduced to the market after 13 August 2005 must be taken back by the manufacturer and disposed of properly.

For more information on the disposal of Bender devices, refer to our homepage at www.bender-de.com -> Service & support.

# 2. Safety instructions

## 2.1 General safety instructions

Part of the device documentation in addition to this manual is the enclosed "Safety instructions for Bender products".

## 2.2 Work activities on electrical installations

*Only **qualified personnel** are permitted to carry out the work necessary to install, commission and run a device or system.*

**DANGER**

***Risk of electrocution due to electric shock!***
*Touching live parts of the system carries the risk of:*

- *An electric shock*
- *Damage to the electrical installation*
- *Destruction of the device*

***Before installing and connecting the device, make sure** that the **installation** has been **de-energised**. Observe the rules for working on electrical installations.*

If the device is used outside the Federal Republic of Germany, the applicable local standards and regulations must be complied with. The European standard EN 50110 can be used as a guide.

## 2.3 Device-specific safety information

**WARNING**

*Make sure that the basic settings meet the requirements of the IT system. Children and unauthorised persons must not have access to or contact with the ISOMETER®.*

**CAUTION**

***Make sure that the operating voltage is correct!***
*Prior to insulation and voltage tests, the ISOMETER® must be disconnected from the IT system for the duration of the test. In order to check the correct connection of the device, a functional test has to be carried out before starting the system.*

*In the event of an alarm message of the ISOMETER®, the insulation fault should be eliminated as quickly as possible.*

*If the ISOMETER® is installed inside a control cabinet, the insulation fault message must be audible and/or visible to attract attention.*

*When using ISOMETER®s in IT systems, make sure that only one active ISOMETER® is connected in each interconnected system. If IT systems are interconnected via coupling switches, make sure that ISOMETER®s not currently used are disconnected from the IT system and deactivated. IT systems coupled via diodes or capacitances may also influence the insulation monitoring process so that a central control of the different ISOMETER®s is required.*

Safety instructions

***Prevent measurement errors!***
*When a monitored IT system contains galvanically coupled DC circuits, an insulation fault can only be detected correctly if the rectifier valves (e.g. rectifier diode, thyristors, IGBTs, frequency inverters, …) carry a minimum current of > 10 mA.*

***Unspecified frequency range***
*When connecting to an IT system with frequency components below the specified frequency range, the response times and response values may differ from the indicated technical data. However, depending on the application and the selected measurement method, continuous insulation monitoring is also possible in this frequency range.*
*There is no influence on the insulation monitoring for IT systems with frequency components above the specified frequency range, e.g. within the range of typical switching frequencies of frequency inverters (2…20 kHz).*

## 2.4 Intended use

*Only **qualified personnel** are permitted to carry out the work necessary to install, commission and run a device or system.*

The ISOMETER® monitors the insulation resistance of unearthed AC/DC main circuits (IT systems) with mains voltages of AC 0…690 V or DC 0…1000 V. The nominal voltage range Un can be extended via coupling devices. DC components existing in AC/DC systems do not influence the operating characteristics. Due to the separate supply voltage, de-energised systems can also be monitored. The maximum permissible system leakage capacitance is 0…1000 µF, depending on the profile.

Intended use also implies:

- The observation of all information in the operating manual
- Compliance with test intervals

In order to meet the requirements of applicable standards, customised parameter settings must be made on the equipment in order to adapt it to local equipment and operating conditions. Please heed the limits of the area of application indicated in the technical specifications.

Any other use than that described in this manual is regarded as improper.

## 3.1 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.
- An adjustable response value for insulation monitoring in the range of 1 kΩ…10 MΩ (factory setting = 5 kΩ) and a response value of 150 V for the DC offset voltage.
- High-resolution graphic LC display for excellent readability and recording of the device status.
- Connection monitoring (monitoring of the measuring lines).
- Automatic device self test.
- History memory with real-time clock (buffer for three days) for storing 1023 alarm messages with date and time.
- Current 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 Internet.
- RS-485/BS (Bender sensor bus) for communication with other Bender devices
- BCOM, Modbus TCP and web server

## 3.2 Product description

### 3.2.1 General 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).

### 3.2.2 Special characteristics of ISOMETER® iso685-S with front panel

The ISOMETER® iso685-D and iso685W-D are devices of the iso685 device family with integrated display. This manual applies in full to these ISOMETER®s.
The ISOMETER® iso685-S and iso685W-S are sensor variants of the iso685 device family without display. The only difference between these variants and the ISOMETER®s iso685-D and iso685W-D is that they do not feature a display. The ISOMETER®s iso685-S and iso685W-S must be used in combination with a front panel because the devices are operated via the front panel. The operation of the front panel is equal to the operation of the ISOMETER®s with integrated display, which is described in this manual.

*Only the sensor variant (ISOMETER® iso685-S or* iso685W-S*) can be connected to the front panel. Connection to the display variant (ISOMETER® iso685-D or iso685W-D) is not possible.*

Hereafter, the ISOMETER®s with integrated display are described. This description is similar to the combination of ISOMETER® sensor variants and the front panel FP200. The devices to which this manual applies will be referred to as ISOMETER®s hereafter.

## 3.3 Functional description

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 protected against unauthorised modifications by entering a password. 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/-.

To extend the nominal voltage range, different coupling devices are available as accessories which can be selected from a menu where the required adjustments can also be made. The insulation monitoring device iso685 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. Different measurement profiles which can be selected from a setup menu allow optimum adaptation of the measurement technique to the specific application.

If the resistance value falls below a set response value $R_{an}$, the associated alarm relay turns off, the LED ALARM 1 lights and the LCD shows the measured value. The error message is saved. Pressing the RESET button resets the insulation fault message, provided that the insulation resistance is at least 25 % above the preset 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.

## 3.4 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



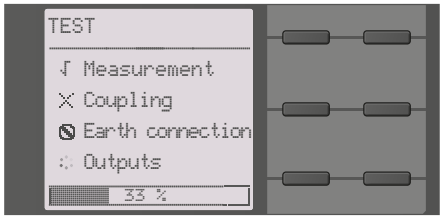
## 3.5 Self test

After switching on the supply voltage, the ISOMETER® automatically and continuously checks all internal measuring functions, the components of the process control such as the data and parameter memory, as well as the connections to the IT system and earth.

The self test can also be activated manually by means of the test button to check the functions of the relays (depending on the configuration) or it can be selected via the "Control" menu (refer to "Control" on page 38).

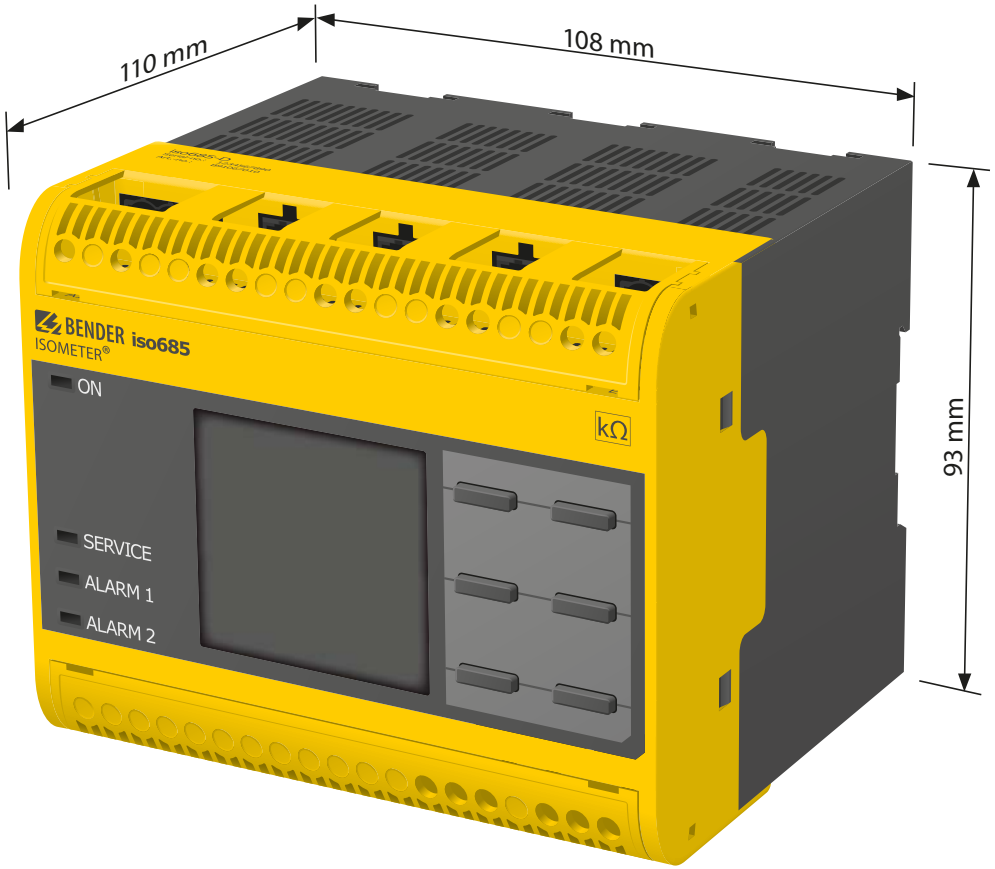
The progress of the manual self test is shown on the LC display by a bar graph. Depending on the conditions in the IT system being monitored, the self test is completed after 15…20 seconds. The device then returns to the standard mode (measurement mode) and the actual measured value will be displayed after the measuring time has expired. The display shows the message `Initial measurement` until the first valid value is measured (refer to "Initial measurement" on page 29).

If a fault is detected during the self test, the respective LEDs of the device light (refer to "Alarm messages" on page 59). In addition, the respective message will be indicated on the display and a previously programmed output will provide the respective signal.




| | |
|---|---|
| √ | The test has been run and the result was positive. |
| X | The test has been run and the result was negative. |
| ⊘ | The test is not available and is not carried out (e.g. due to specific device settings). |
| ⁘ | The test is running. |

## 4.1 Dimensions



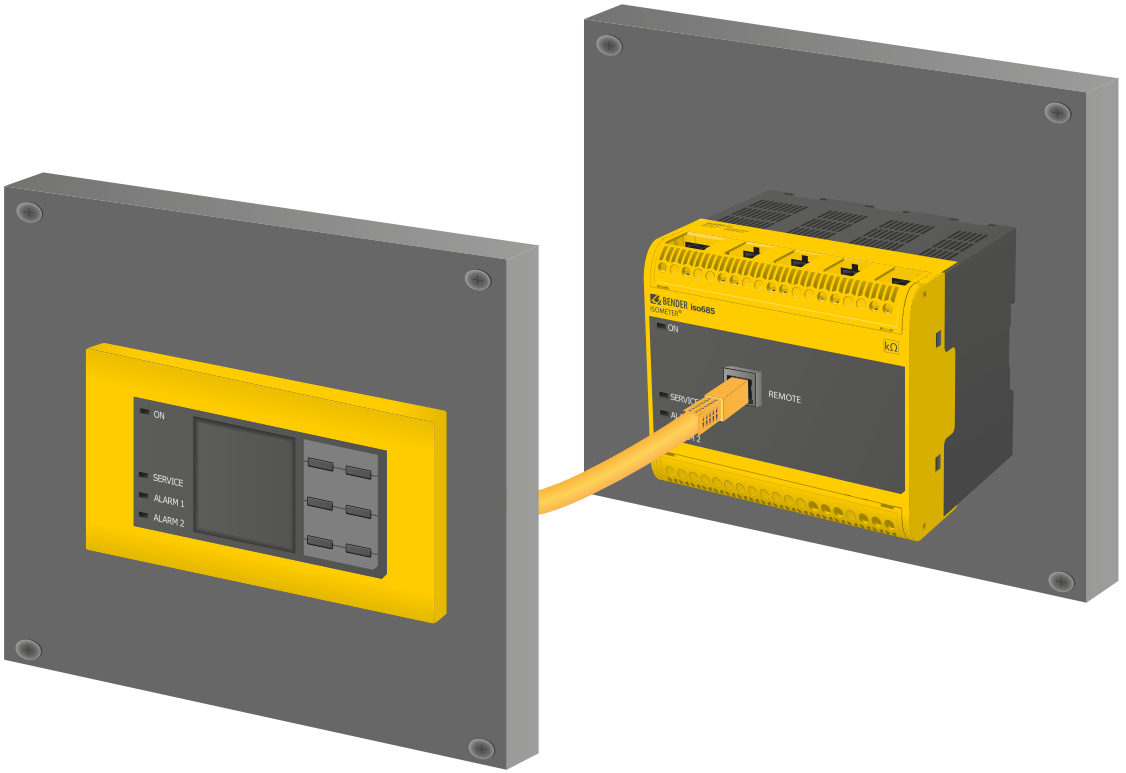
## 4.2 Device variants

**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).

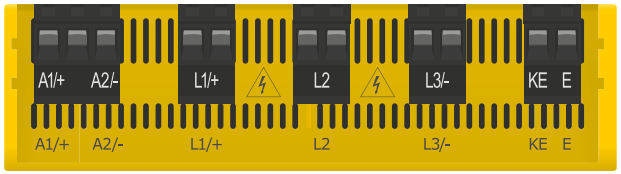

ISOMETER® iso685-D




ISOMETER® iso685-S with front panel FP200 connected via an RJ45 cable

## 4.3 Connections and panel

**Top**

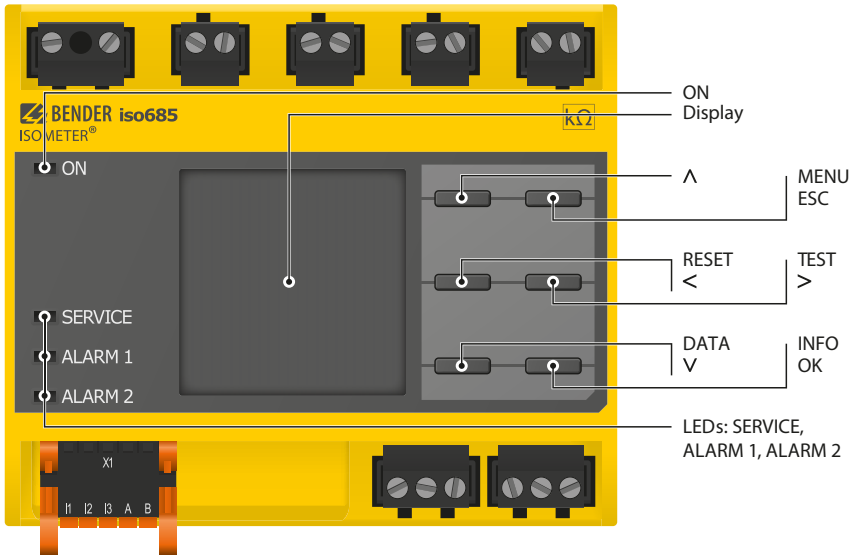



| | |
|---|---|
| A1/+, A2/- | Connection to the power supply voltage $U_s$ |
| L1/+ | Connection to the IT system to be monitored |
| L2 | Connection to the IT system to be monitored |
| L3/- | Connection to the IT system to be monitored |
| KE, E | Connection to PE |

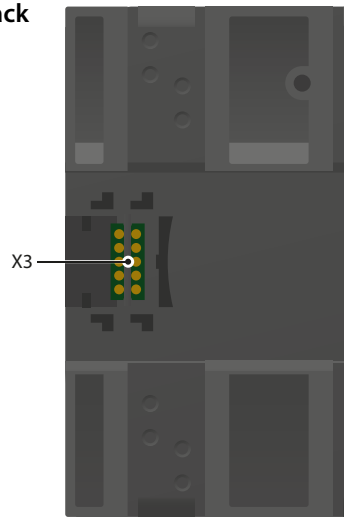
iso685-S

**Front**


iso685-D

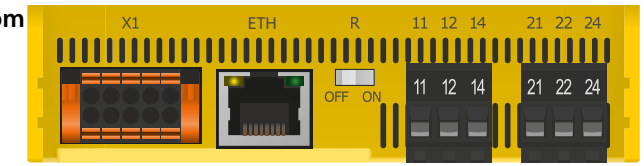



**Back**




| | |
|---|---|
| X3 | Optional expansion module for Bender devices (e. g. BB-Bus) |
| X4 | REMOTE interface to connect to the FP200 |

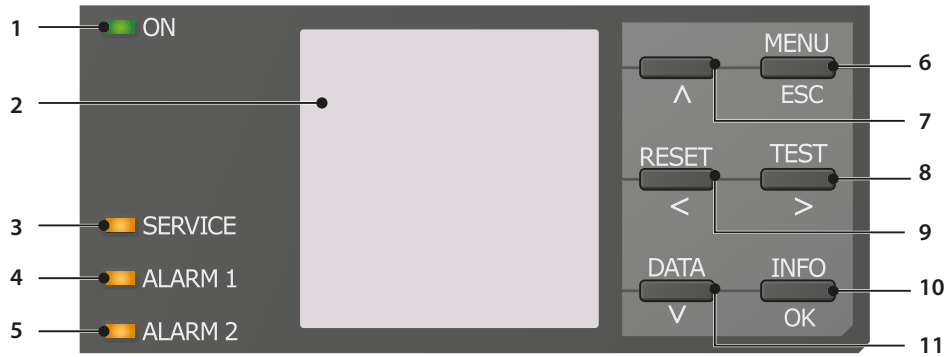
**Bottom**




| | |
|---|---|
| X1 | Digital interface |
| ETH | Ethernet interface |
| R | Selectable resistance R |
| 11 12 14 | Connector for alarm relay 1 |
| 21 22 24 | Connector for alarm relay 2 |

Device overview

## 4.4 Display elements and device buttons




**Display elements**

| | | |
|---|---|---|
| 1 | ON | The LED "ON" lights when the device is turned on. |
| 2 | | The device display shows information regarding the device and the measurements.<br>Other information is available in the chapter "Display" from page 26. |
| 3 | SERVICE | The LED "SERVICE" lights when there is either a device fault or a connection fault, or when the device is in maintenance mode. |
| 4 | ALARM 1 | The LED "ALARM 1" lights when the insulation resistance of the IT system falls below the set response value $R_{an1}$. |
| 5 | ALARM 2 | The LED "ALARM 2" lights when the insulation resistance of the IT system falls below the set response value $R_{an2}$. |

**Device buttons**

You can adjust the device settings in the respective menu using the menu buttons. Depending on the menu entry, one of the options displayed below is assigned to the buttons.

| | | |
|---|---|---|
| 6 | MENU | Opens the device menu. |
| | ESC | Cancels the current process or navigates one step back in the device menu. |
| 7 | ∧ | Navigates up in a list or increases a value. |
| 8 | TEST | Starts the device self test. |
| | > | Navigates forwards (e.g. to the next setting step) or selects a parameter. |
| 9 | RESET | Resets alarms. |
| | < | Navigates backwards (e.g. to the previous setting step) or selects a parameter. |
| 10 | Info | Shows information. |
| | OK | Confirms an action or a selection. |
| 11 | DATA | Indicates data and values. |
| | ∨ | Navigates down in a list or reduces a value. |

## 5.1 General instructions

*Only **qualified personnel** are permitted to carry out the work necessary to install, commission and run a device or system.*

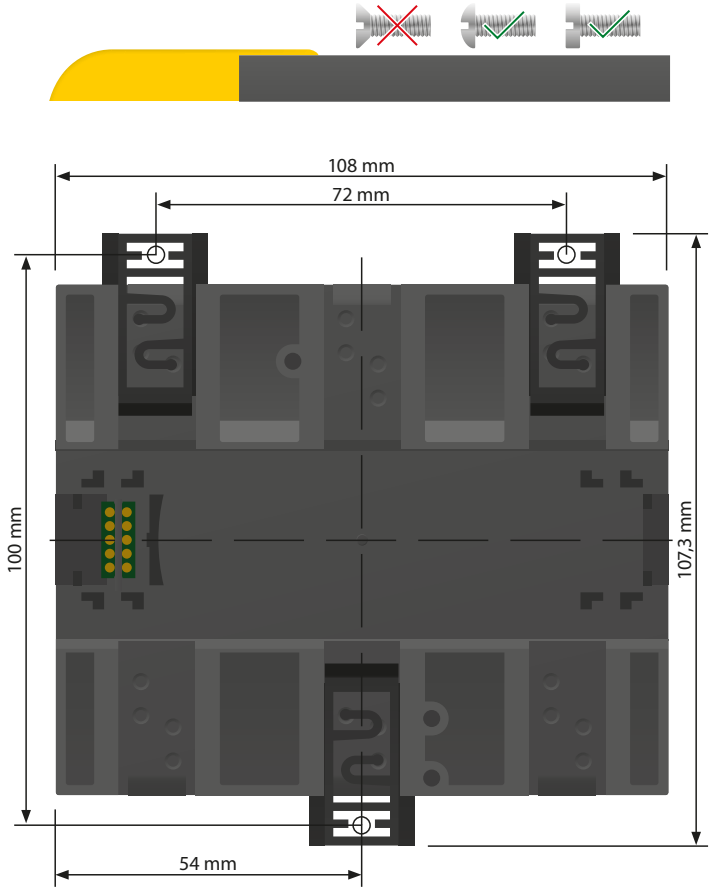

***Risk of electrocution due to electric shock!***
*Touching live parts of the system carries the risk of:*

- *An electric shock*
- *Damage to the electrical installation*
- *Destruction of the device*

***Before installing and connecting the device, make sure** that the **installation** has been **de-energised**. Observe the rules for working on electrical installations.*

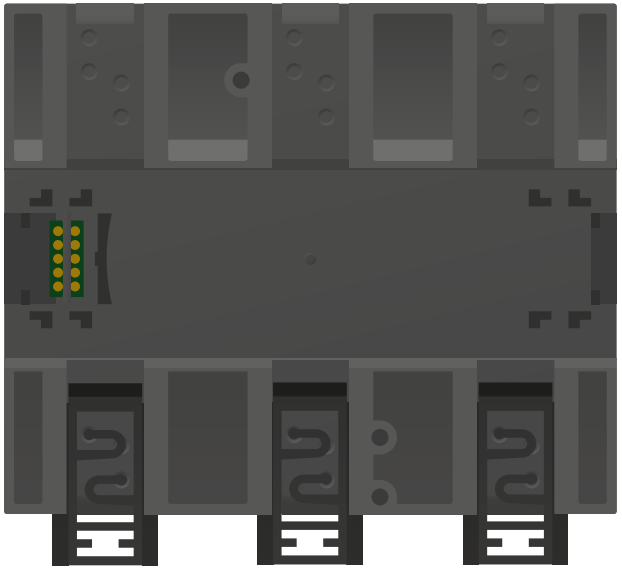
## 5.2 Screw mounting

19. Fix the three mounting clips delivered with the device (two of them packed separately) manually or using a tool, as illustrated below.
20. Drill the mounting holes for the M4 thread according to the dimensioned drilling template.
21. Fix the ISOMETER® using three M4 screws.



## 5.3 DIN rail mounting

1. Fix the three mounting clips delivered with the device (two of them packed separately) manually or using a tool, as illustrated below.
2. Fix the ISOMETER® onto the DIN rail until it snaps into place.



# 6. Connection

## 6.1 Connection requirements

Consider the minimum distance to adjacent devices:
lateral 0 mm, top 20 mm, bottom 20 mm.

*Only **qualified personnel** are permitted to carry out the work necessary to install, commission and run a device or system.*

**DANGER**

***Risk of electrocution due to electric shock!***
*Touching live parts of the system carries the risk of:*

- *An electric shock*
- *Damage to the electrical installation*
- *Destruction of the device*

***Before installing and connecting the device, make sure** that the **installation** has been **de-energised**. Observe the rules for working on electrical installations.*

**DANGER**

***Risk of electric shock!***
*Nominal voltages up to 1000 V may be present on the terminals L1/+ to L3/- which can be lethal. Make sure the terminal covers are properly mounted and clicked in before putting the device into operation.*

**DANGER**

***Risk of electric shock!***
*High voltage is applied at the terminals, which in case of direct contact can be life-threatening. If the terminals L1/+, L2, L3/- of the device are connected to a live IT system, the terminals E and KE must not be disconnected from the protective conductor (PE).*

**WARNING**

***Warning of insulation monitoring devices that do not work correctly!***
*Connect the terminals KE and E individually to the protective earth conductor PE.*

Connection

CAUTION

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

CAUTION

***Risk of injury from sharp-edged terminals!***
*Risk of lacerations.*
*Touch the enclosure and the terminals with due care.*

CAUTION

***Ensure disconnection from the IT system!***
*When insulation or voltage tests are to be carried out, the device must be isolated from the system for the test period. Otherwise the device may be damaged.*

CAUTION

***Risk of property damage due to unprofessional installation!***
*If more than one insulation monitoring device is connected to a conductively connected system, the system can be damaged. If several devices are connected, the device does not function and does not signal insulation faults. Make sure that only* ***one*** *insulation monitoring device is connected in each conductively connected system.*

CAUTION

***Risk of property damage due to unprofessional installation!***
*The connecting lines L1/+, L2, L3/- to the system to be monitored must be carried out as spur lines. Inadmissible load current can result in damage to property and personal injury. Do not apply any load current to the terminals.*

***Check proper connection!***
*Prior to commissioning of the installation, check that the device has been properly connected and check the device functions. Perform a functional test using an earth fault via a suitable resistance.*

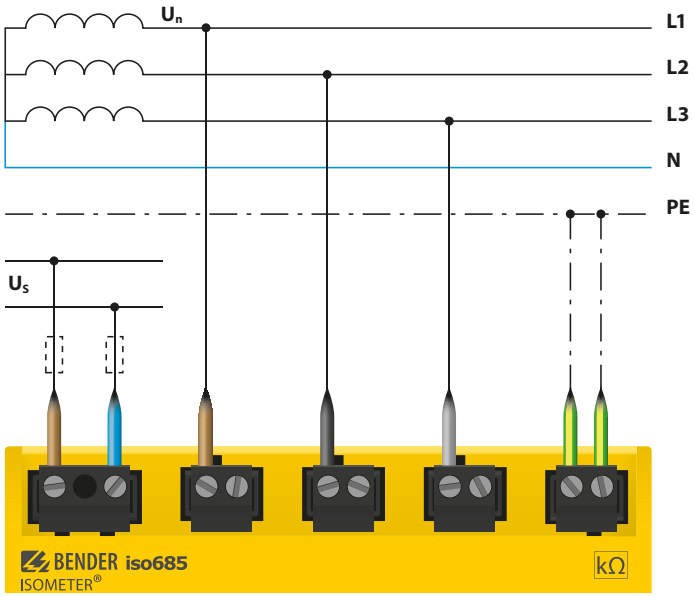
***Prevent measurement errors!***
*When an AC system being monitored contains galvanically coupled DC circuits, take into consideration that: an insulation fault can only be detected correctly when the rectifier valves carry a minimum current of >10 mA.*

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

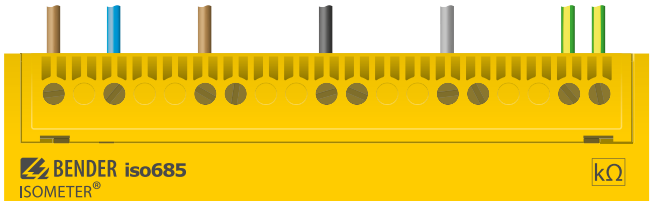
## 6.2 Connection to a 3(N)AC system

**WARNING**

***Risk of injury, fire and damage to property due to a short circuit!***
*According to DIN VDE 0100-430, devices used to protect against a short circuit when terminals L1/+, L2 und L3/- are coupled to the IT system to be monitored can be omitted 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.*




Position the terminal cover and click it into place

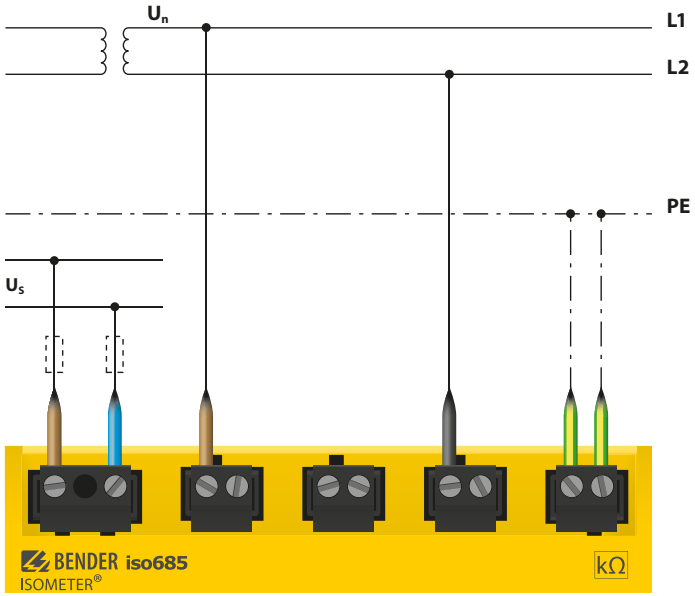



Connection

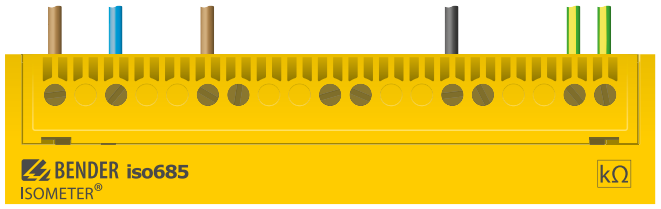
## 6.3 Connection to an AC system

**WARNING**

***Risk of injury, fire and damage to property due to a short circuit!***
*According to DIN VDE 0100-430, devices used to protect against a short circuit when terminals L1/+, L2 und L3/- are coupled to the IT system to be monitored can be omitted 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.*



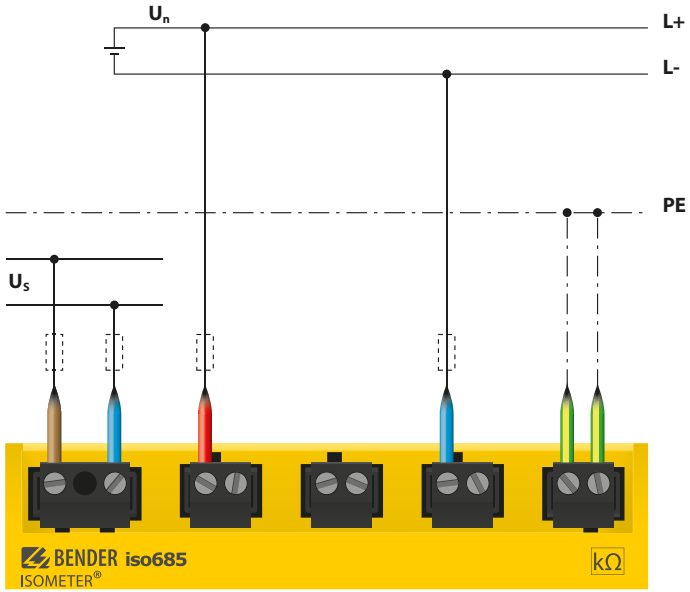

Position the terminal cover and click it into place



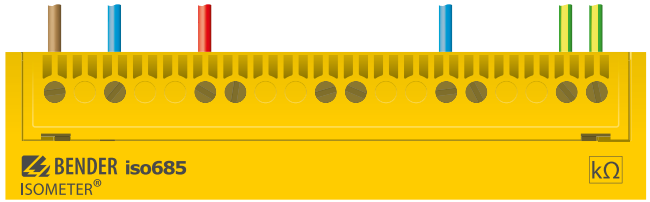
## 6.4 Connection to a DC system

**WARNING**

***Risk of injury, fire and damage to property due to a short circuit!***
*According to DIN VDE 0100-430, devices used to protect against a short circuit when terminals L1/+, L2 und L3/- are coupled to the IT system to be monitored can be omitted 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.*



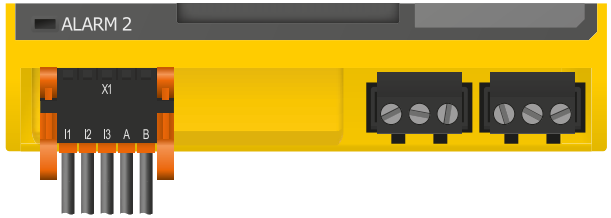

Position the terminal cover and click it into place

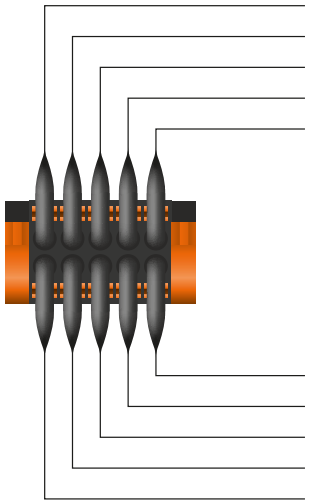



For systems > 690 V and with overvoltage category III a fuse for the connection to the system to be monitored must be provided. Recommendation: 2 A fuses.



## 6.5 Connection to the X1 interface

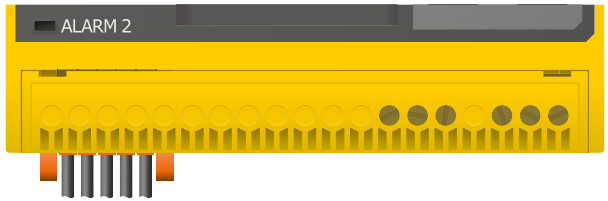


**I1** Input 1
**I2** Input 2
**I3** Input 3
**A** RS-485 A
**B** RS-485 B

**⊥** Ground
**M+** Analogue output
**Q2** Output 2
**Q1** Output 1
**+** +24 V Electrical overload protection. Auto shut-off in the event of a short circuit and transients (resettable)

Position the terminal cover and click it into place

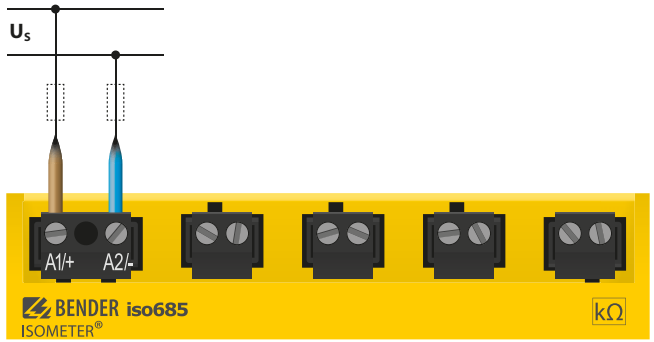


## 6.6 Connection to the supply voltage

*External Power supply for powering the ISOMETER® via terminal X1 must fulfil immunity and emission standards of the required application. For wiring longer than 1 m the use of a shielded cable is prescribed.*

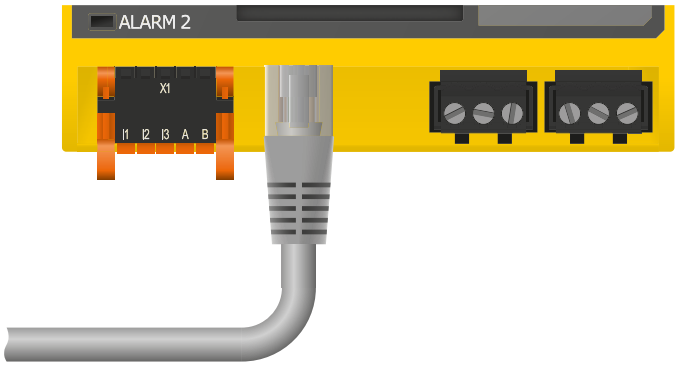
**CAUTION**

***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.*

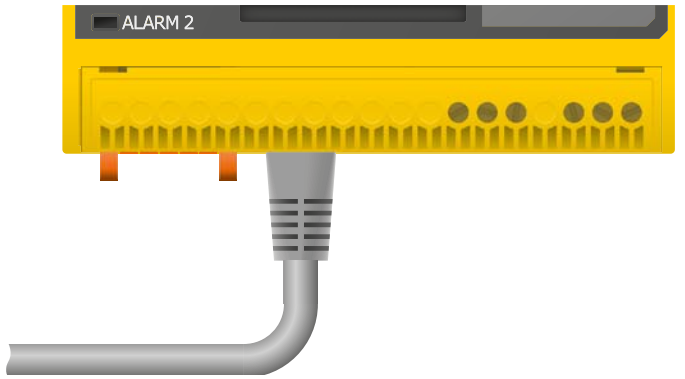




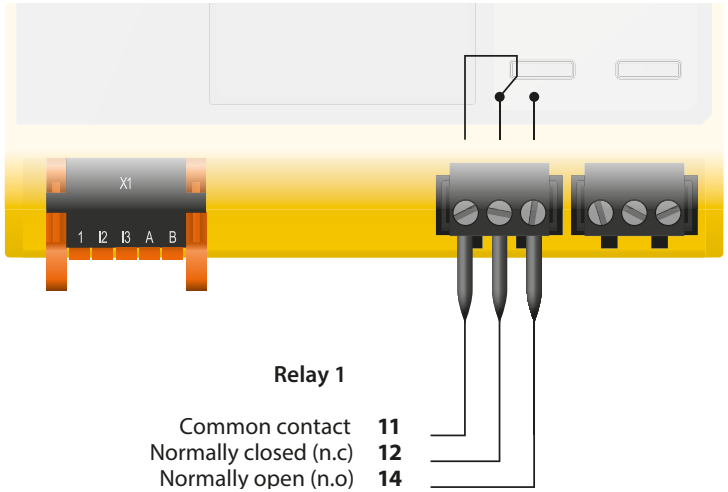

## 6.7 Connection to the Ethernet interface



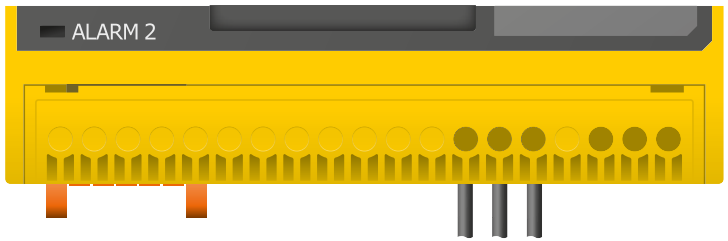

Position the terminal cover and click it into place



## 6.8 Connection to the relay 1 interface (11 12 14)

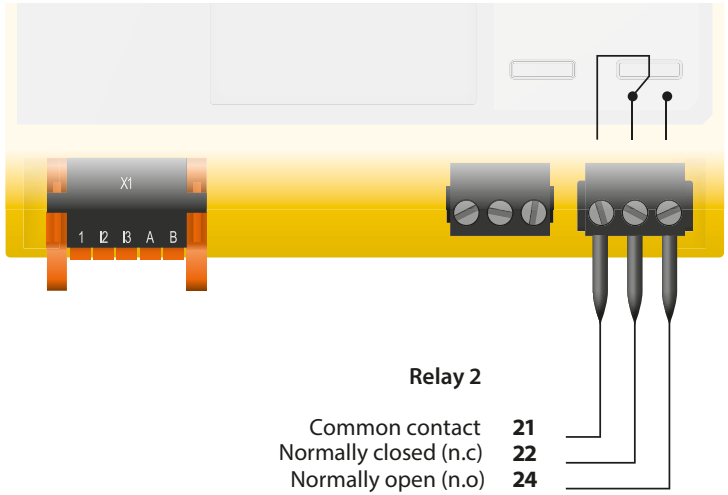



Position the terminal cover and click it into place

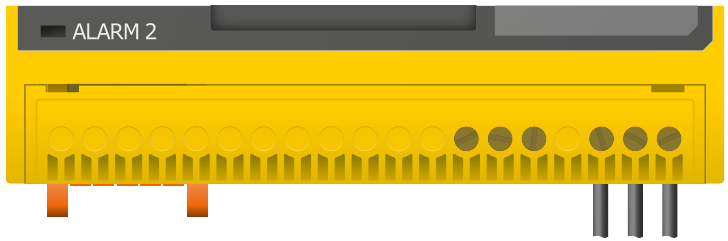





## 6.9 Connection to the relay 2 interface (21 22 24)




Position the terminal cover and click it into place



## 7.1 General initial commissioning process

1. Check that the ISOMETER® is properly connected to the system to be monitored.
2. Connect the supply voltage to the ISOMETER®. Adjust the device using the commissioning wizard. Afterwards, the ISOMETER® performs a self test in four steps. The alarm relays are not checked during this test. After completion of the test, the measured insulation resistance is shown on the display. If the value exceeds the response values indicated in the lowest line of the display, the message "OK" will additionally be displayed.

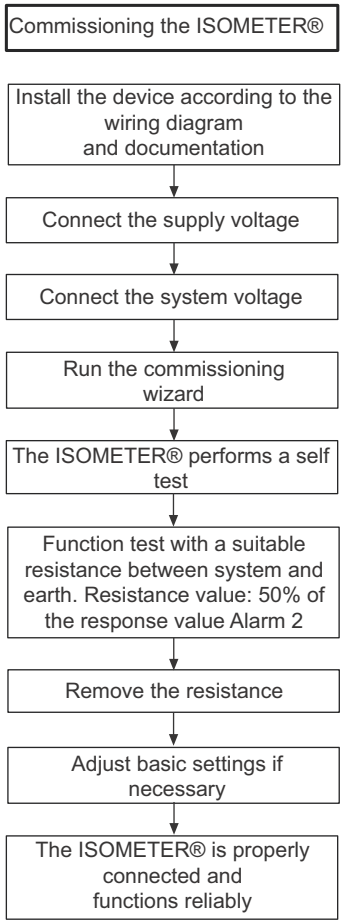
*For customer-specific configured devices, the commissioning wizard might be deactivated and cannot be run. In this case, the device is preset. However, the commissioning wizard can be started as described at* "Recommissioning" on page 25.

3. Check the ISOMETER® in the system being monitored, e.g. using a suitable resistance to earth.

***Observe device status!***
*The device is in an alarm state until initial commissioning has been completed.*

After setting the response value $R_{an2}$ for alarm 2, the device starts a self test, makes the first measurement and outputs the measured insulation resistance values of the IT system being monitored, then commissioning is completed.

**Commissioning flow chart**




For further information regarding device settings, refer to chapter "Settings" from page 32.

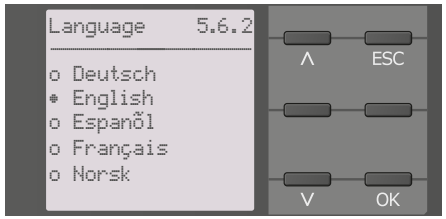
## 7.2 Initial commissioning

***Check network function!***
*When the device is integrated into a network, the influence on the network has to be checked with the device switched on and off.*

Follow the instructions of the commissioning wizard on the display.

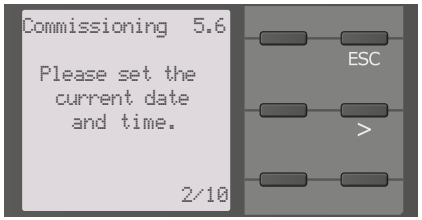
### 7.2.1 Set language

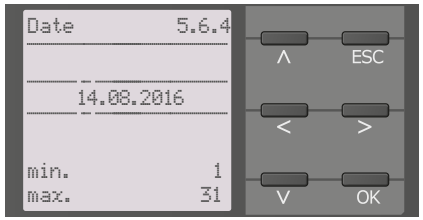
The language selected here will be used in the menu and for device messages.




### 7.2.2 Set time and date

Alarm messages in the history memory and the insulation resistance value over time can only be assigned correctly to the isoGraph when the date and time are set correctly.

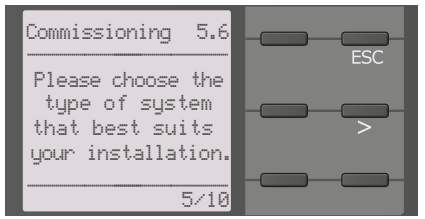


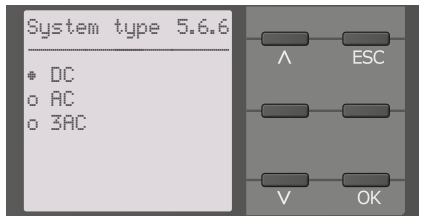






### 7.2.3 Set system type

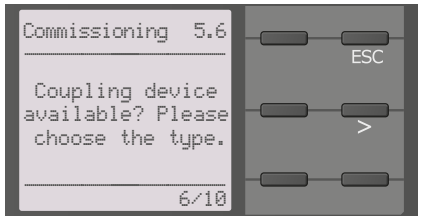
By setting the system type the insulation monitoring device can be optimally adapted to the system to be monitored. The system type is essential information for the insulation monitoring device in order to determine the insulation resistance correctly.

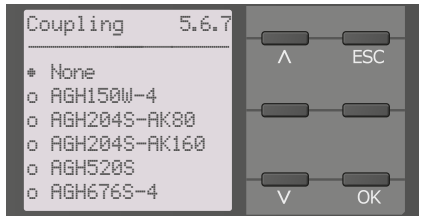



### 7.2.4 Select a coupling device

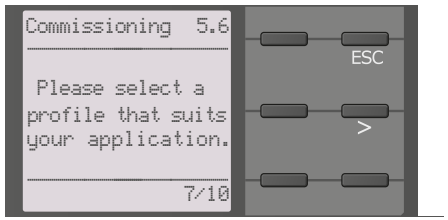
A coupling device connected to the insulation monitoring device (to increase the nominal system voltage) must be programmed here. The measurement of the insulation resistance takes into account the parameters of the connected coupling device. If no coupling device is available, press OK.

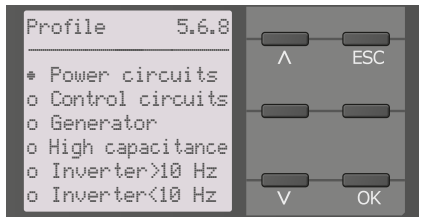



### 7.2.5 Set profile

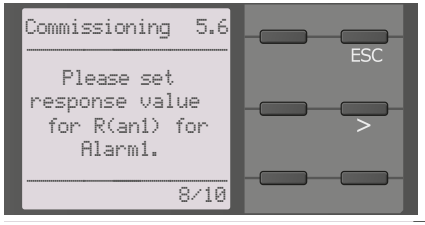
In order to adapt the insulation monitoring device optimally to the system to be monitored, select a profile here that suits your system. For an overview of the profiles refer to "Device profiles" on page 47. The profile "power circuits" is suitable for most IT systems.

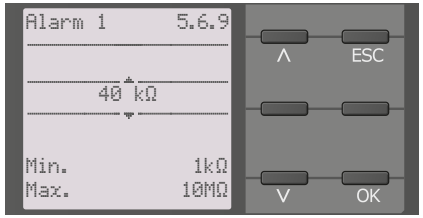


### 7.2.6 Set response value $R_{an1}$ for Alarm 1

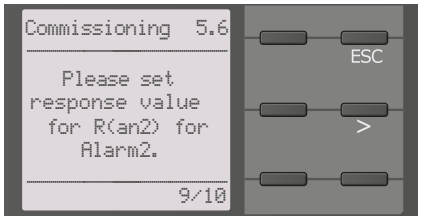
You can set the prewarning response value here.
A value of 100 Ω/V is recommended for prewarning.

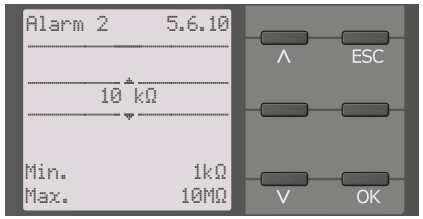



### 7.2.7 Set response value $R_{an2}$ for Alarm 2

You can set the response value for the main alarm here.
A value of 50 Ω/V is recommended for the main alarm.






## 7.3 Recommissioning

If the device has already been put into operation before, the self test will be started shortly after the supply voltage has been connected. Start the commissioning wizard using the menu path:

**Menu/Device settings/Commissioning**

This menu can be used to modify settings made previously.

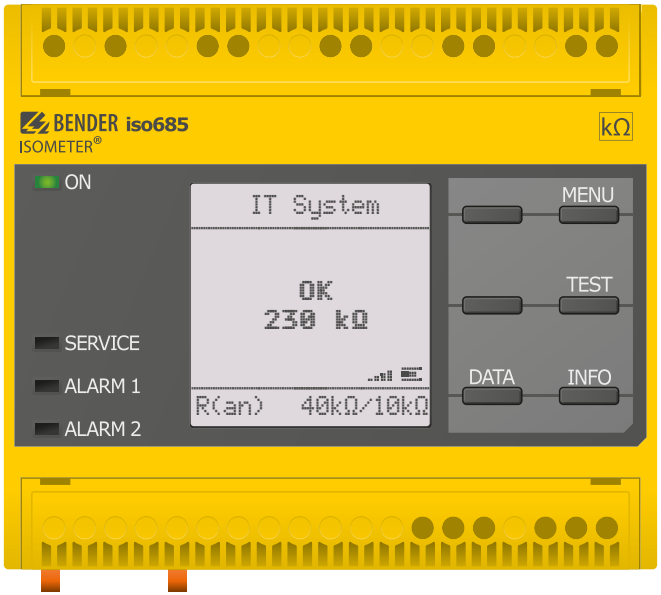
***Observe the device status!***
*The device changes from the alarm state to normal state after completing initial commissioning and initial measurement by adhering to the response values set.*

## 8.1 Standard display

During normal operation, the ISOMETER® displays the message OK and below, the currently measured insulation resistance.

| | |
|---|---|
|  | The signal quality of the measurement suits the selected profile. The better the signal quality, the faster and more exact the device can measure. |
|  | The signal quality of the measurement does not suit the selected profile. Select a different measurement profile. |
|  | Update period between the test pulses |

In the bottom line of the display, the set limit values for R(an) are indicated.
In the example below, $R_{an1}$=40 kΩ and $R_{an2}$=10 kΩ.



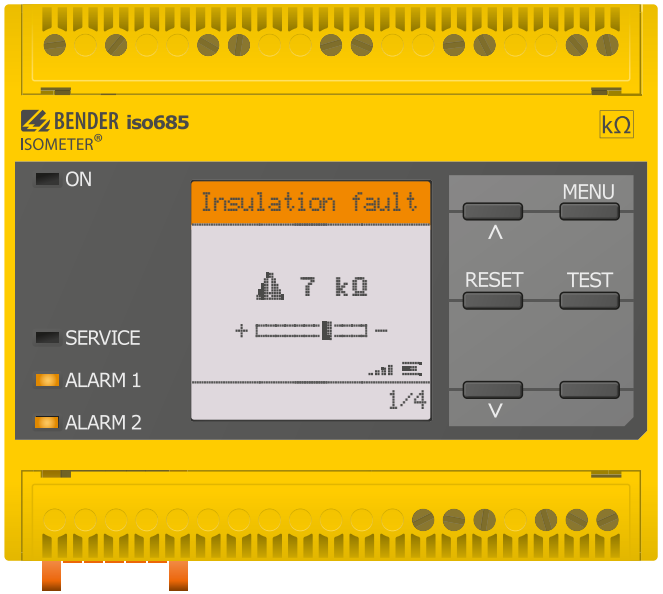

## 8.2 Fault display (active)

An active fault is displayed by  . The upper part of the display will become orange and displays the fault message.

Depending on the type of fault, the LEDs ALARM 1, ALARM 2 or SERVICE are activated.

In the example below, the insulation resistance is still 7 kΩ. Since the values $R_{an1}$=40 kΩ and $R_{an2}$=10 kΩ are both below the set response value, ALARM 1 and ALARM 2 have been triggered.

If several fault messages have appeared, you can navigate through the faults using the V and Λ button.




If the value falls below $R_{an1}$ in a DC system or a DC shift is recognised in an AC system, additional detailed information regarding the DC shift will be displayed, as illustrated above.

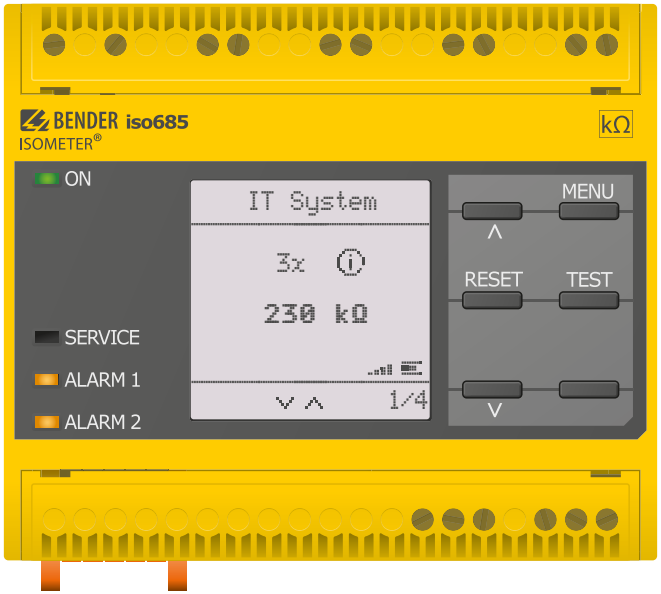
Display

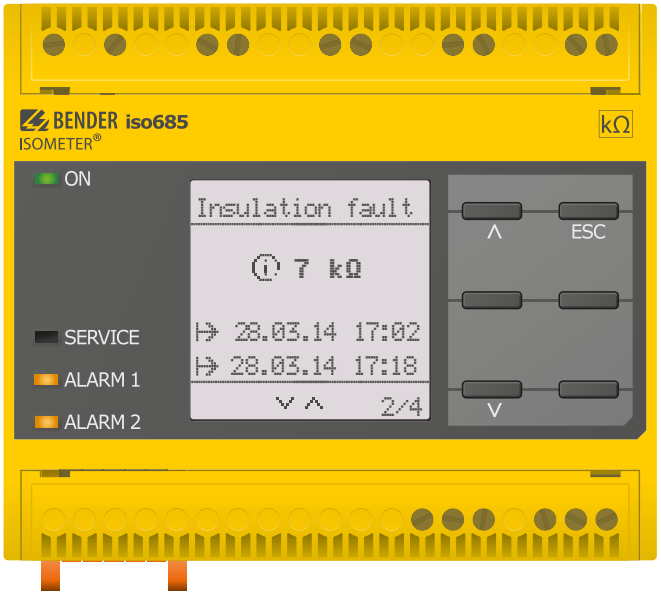
## 8.3 Fault display (inactive)

An inactive fault is displayed by ⓘ. If several faults have occurred, the number of faults will also be indicated.

This message means that there has been a fault in the past but the device is no longer in fault condition.

If several fault messages occur, navigate through the faults using the V and Λ button. In addition to the type of fault and the associated alarm value when the fault has occurred and how long it has been active will be shown.



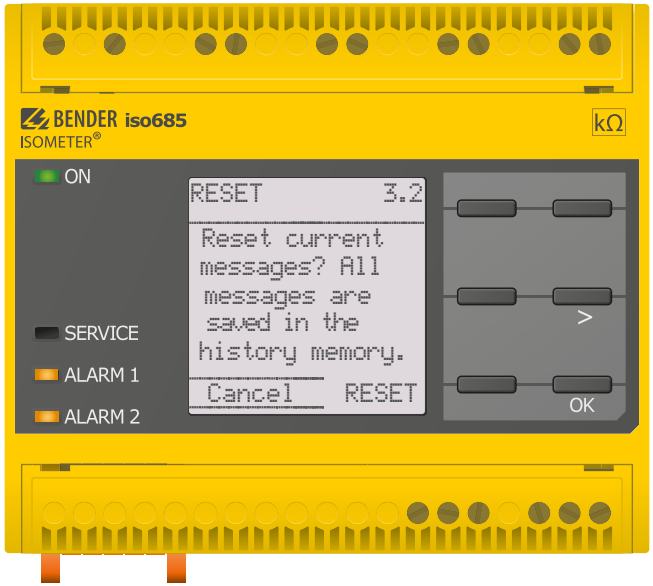



## 8.4 Acknowledge fault memory

In order to acknowledge the fault message and return to the ISOMETER®'s standard display, all faults must be acknowledged by means of the reset button.

This means that fault messages can only be reset when the cause of the fault has been eliminated.

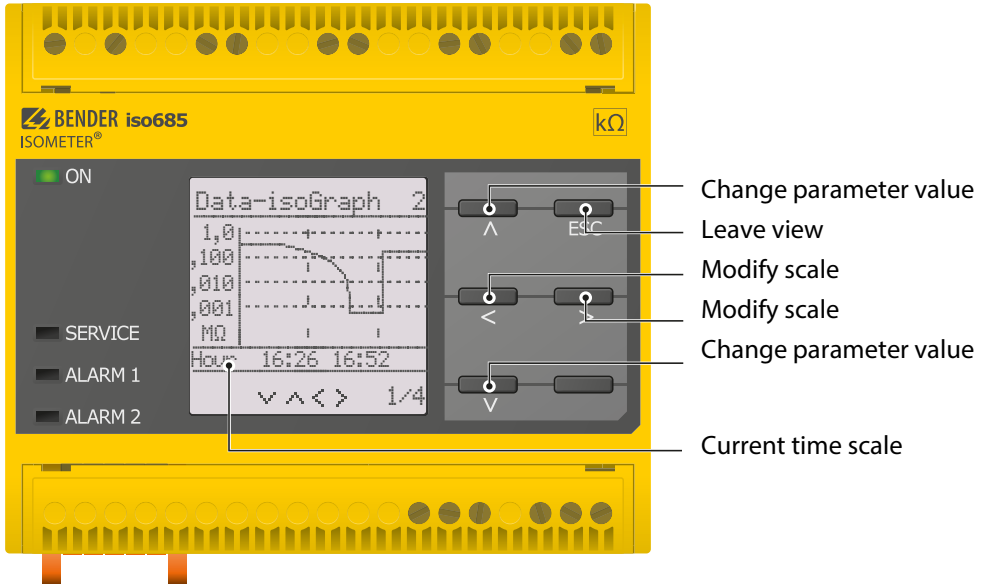
Press the reset button, then > and OK to clear the fault memory.
The ISOMETER® then returns to the standard display.





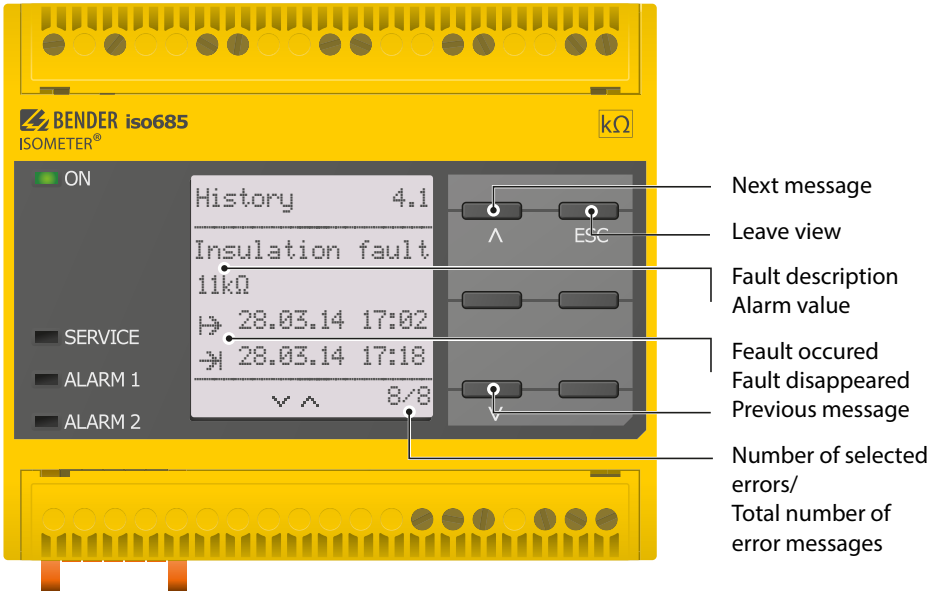

## 8.5 Data-isoGraph

The isoGraph represents the chronological sequence of the insulation resistance over time. This graphical representation can be displayed over the following time periods: hour, day, week, month and year.
The measured values for individual representations are stored in a separate memory. Up to 100 measured values are available to represent each graph. and the resolution of each graph is determined by these values.



## 8.6 History memory

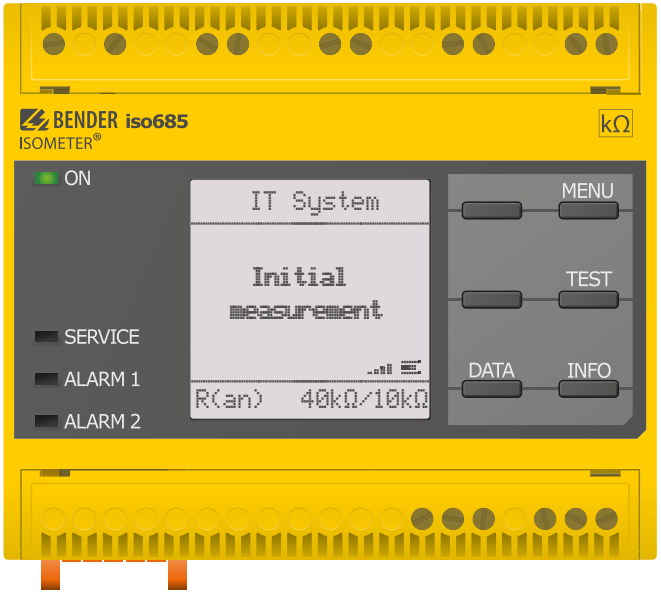
Up to 1023 alarm messages and device errors are stored in the history memory with date and time stamp. When the history memory is deleted, the minimum insulation resistance $R_{min}$ will also be reset at Menu/Data Measured values - Data insulation.



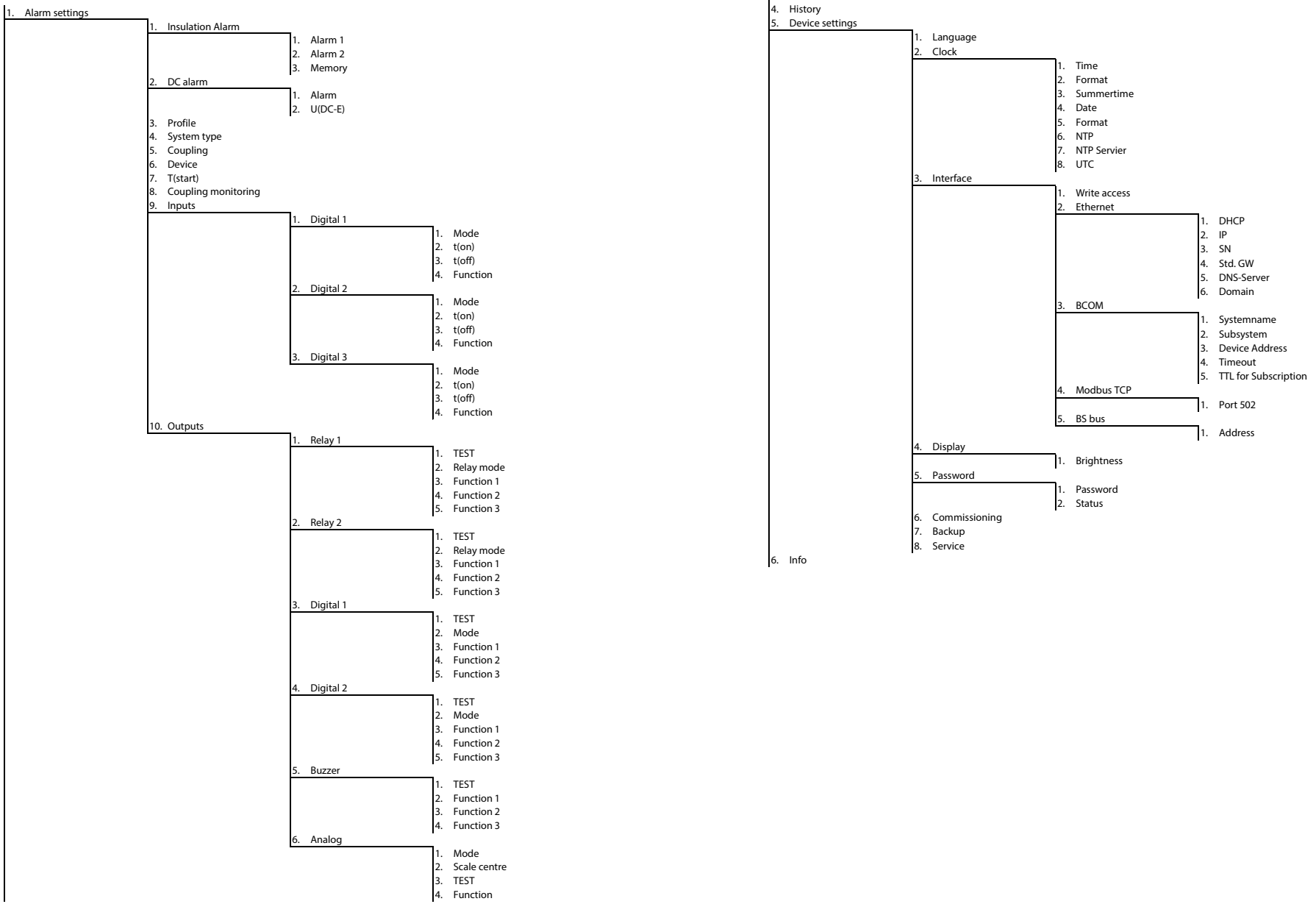



## 8.7 Initial measurement

During the initial measurement, the device records all measured values.
All measured values that may have been recorded before will be discarded if a new initial measurement is started.



## 9.1 Menu structure



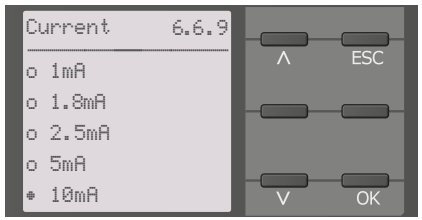
## 9.2 Operating and navigating

Navigate through the device menu using the device buttons. The functions of the device buttons are described in the chapter "Display elements and device buttons" on page 15.

### 9.2.1 Easy operation

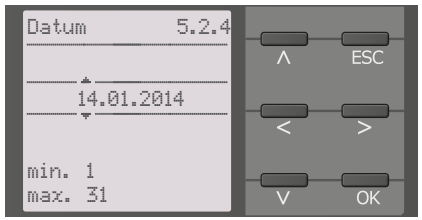
**Navigation in lists**

To make a selection in a list, navigate using the V and Λ buttons to the required menu item. Then click "OK".




**Navigation with arrows**

You can increase or decrease a value using the V and Λ buttons. You can move to the left or the right to set different values using the < and > buttons. The value positioned between the ▲▼ symbols is the value that is set.




**Text input**

Go step by step through the numbers and letters indicated on the display by using the V button (forwards) and the Λ button (backwards). Navigate to the right using the > button to enter the next character. To delete a character that has been entered, use the< and > buttons to navigate to the character to be deleted and then select "del" using the V and Λ buttons. Confirm the entered text with "OK".

## 10.1 Settings in the device menu

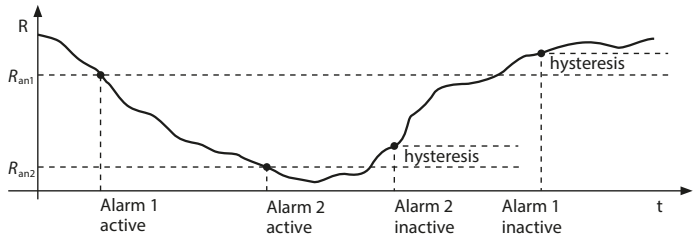
The settings of the ISOMETER® are explained in the order of the device menu.

### 10.1 (1.0)Alarm settings

The limit values for the insulation resistances of alarm 1 and alarm 2 can be specified in the alarm settings menu and can be adapted to the user profile of the ISOMETER®.
A device password is required for entering the settings. You can adjust the following functions:

### 10.1 (1.1) Insulation alarm

In the Insulation alarm menu, the ISOMETER® limit values for alarm 1 and alarm 2 can be set.
Activation or deactivation of the two alarm levels $R_{an1}$ (alarm 1) and $R_{an2}$ (alarm 2) are illustrated in the following graphic:
An alarm will become inactive as soon as the hysteresis of the set operating value is exceeded.




### 10.1 (1.1.1) Alarm 1

For ALARM 1 an insulation resistance of 1 kΩ…10 MΩ can be set irrespective of ALARM 2.

### 10.1 (1.1.2) Alarm 2

For ALARM 2 an insulation resistance of 1 kΩ…10 MΩ can be set irrespective of ALARM 1.

### 10.1 (1.1.3) Fault memory

Automatic reset of inactive faults at the outputs relay 1, relay 2, digital output 1, digital output 2:

| | |
|---|---|
| •on | If a fault becomes inactive, the programmed outputs remain in fault condition until they are reset manually. |
| •off | If a fault becomes inactive, the programmed outputs automatically change the state. |

### 10.1 (1.2) DC alarm

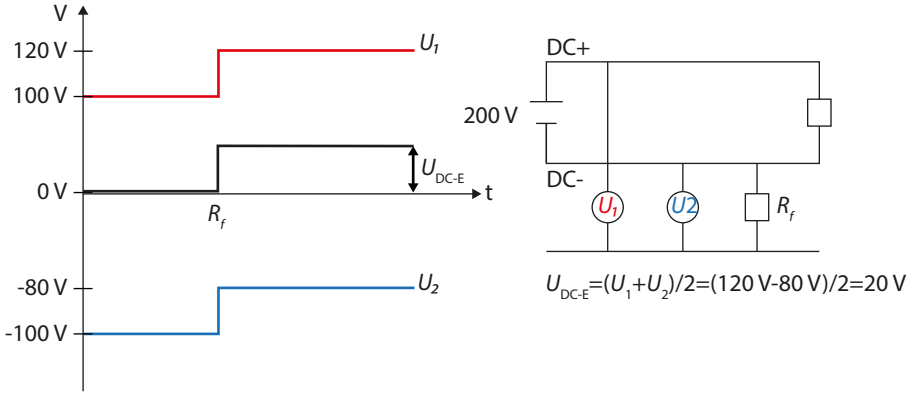
The DC alarm is triggered in the event of a DC offset voltage ($U_{DC-E}$) in the system.

### 10.1 (1.2.1) Alarm

| | |
|---|---|
| •on | The DC alarm is triggered in the event of a DC offset voltage. |
| •off | The DC alarm is NOT triggered in the event of a DC offset voltage. |

### 10.1 (1.2.2) U(DC-E)

Set the DC alarm to a value between 20 V and 1 kV.



### 10.1 (1.3) Profile

Adapt the area of application of the ISOMETER® to your system profile. For a description of the profiles, refer to "Device profiles" on page 47.
The following can be selected:

| | |
|---|---|
| •Power circuits | Suitable for most IT systems. |
| •Control circuits | Not recommended for voltages > 230 V. |
| •Generator | Fast measuring times, fast fault location possible. |
| •High capacitance | Suitable for system with high leakage capacitances. |
| •Inverter > 10 Hz | Suitable for systems with dynamic frequency control by inverters in the range 10 to 460 Hz. |
| •Inverter < 10 Hz | Suitable for systems with extremely low frequency control in the range 1…460 Hz. |

### 10.1 (1.4) System type

Adapt the ISOMETER® to the IT system to be monitored. The following can be selected:

| | |
|---|---|
| •DC | DC system<br>(refer to "Connection to a DC system" on page 20) |
| •AC | Single-phase AC system<br>(refer to "Connection to an AC system" on page 19) |
| •3AC | 3AC system<br>(refer to "Connection to a 3(N)AC system" on page 19) |



### 10.1 (1.5) Coupling

Adapt the ISOMETER® to the requirements of Bender coupling devices. For a description about the connection of coupling devices refer to "Coupling devices" on page 48. You may select:

- •None
- •AGH150W-4
- •AGH204S-AK80
- •AGH204S-AK160
- •AGH520S
- •AGH676S-4

### 10.1 (1.6) Device

Set the ISOMETER® insulation resistance measurement function to active or inactive:

| | |
|---|---|
| •Active | The device is active. |
| •Inactive | The device DOES NOT measure the insulation resistance, the message Device inactive appears on the display. The IT system is NOT being monitored! |

### 10.1 (1.7) T(Start)

The ISOMETER® can be operated with a start-up delay of 0…120 seconds. The start-up is delayed until the initial measurement takes place.

### 10.1 (1.8) Coupling monitoring

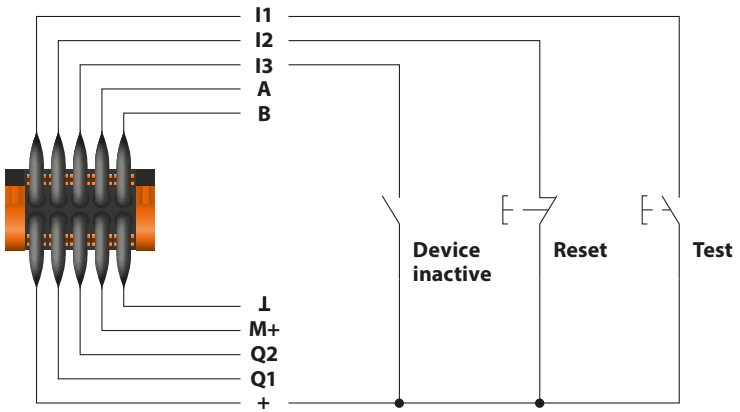
The ISOMETER® continuously monitors the coupling of energised systems. The coupling of de-energised systems is monitored at 8-hour intervals. This monitoring function can be activated or deactivated.

| | |
|---|---|
| •on | Coupling monitoring is activated. |
| •off | Coupling monitoring is deactivated. |

Settings

## 10.1 (1.9) Inputs

The ISOMETER® provides a total of three digital inputs.
The exemplary wiring diagram shows how the digital inputs can be wired:



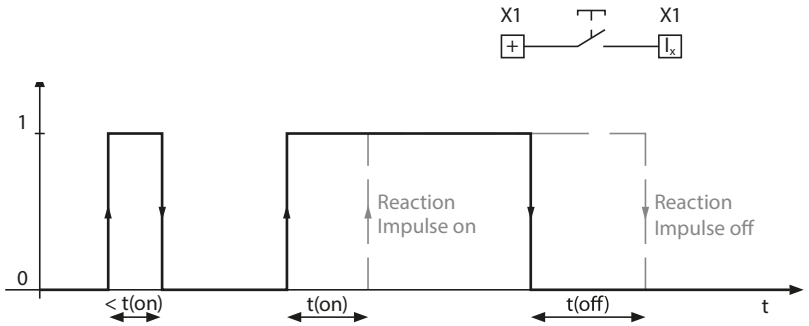

### 10.1 (1.9.1) Digital 1

The following parameters can be set for the digital input:

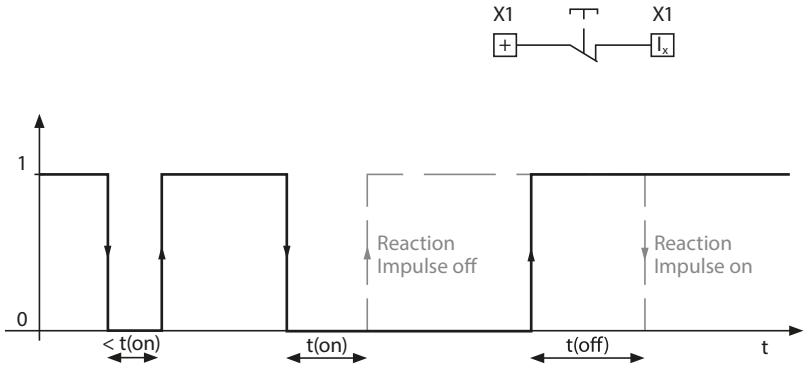
#### 10.1 (1.9.1.1) Mode

The operating mode for the digital input can be set to the following values:

| | |
|---|---|
| •Active high | An event is carried out on the rising edge of the digital input (low to high).<br>Response time t(on)/t(off) after a switch-on signal. |




| | |
|---|---|
| •Active low | An event is carried out on the falling edge of the digital input (high to low).<br>Response time t(on)/t(off) after a switch-off signal. |




#### 10.1 (1.9.1.2) t(on)

The response time t(on) after a switch-on signal can be set between 100 milliseconds and 300 seconds (refer to "10.1 (1.9.1.1) Mode").

#### 10.1 (1.9.1.3) t(off)

The response time t(off) after a switch-off signal can be set between 100 milliseconds and 300 seconds (refer to "10.1 (1.9.1.1) Mode").

#### 10.1 (1.9.1.4) Function

The parameters for the function of the digital inputs of the ISOMETER® can be set differently:

| | |
|---|---|
| •off | Digital input without function |
| •TEST | Device self test |
| •RESET | Reset of fault and alarm messages |
| •Deactivate device | The device DOES NOT measure the insulation resistance, the message Device inactive appears on the display.<br>The IT system is NOT being monitored! |
| •Start initial measurement | All recorded measurements are discarded and a new measurement is started |

### 10.1 (1.9.2) Digital 2

Refer to "10.1 (1.9.1) Digital 1".

### 10.1 (1.9.3) Digital 3

Refer to "10.1 (1.9.1) Digital 1".

### 10.1 (1.10) Outputs

The ISOMETER® provides a total of six outputs.
The following parameters can be set for the outputs:

### 10.1 (1.10.1) Relay 1

The following parameters can be set for each relay:

### 10.1 (1.10.1.1) TEST

The functional test of the relay can be activated or deactivated. This only applies to the manual test and not to the cyclic device self test:

| | |
|---|---|
| •on | The manual test checks the switching function of the relay |
| •off | The manual test does not check the switching function of the relay |

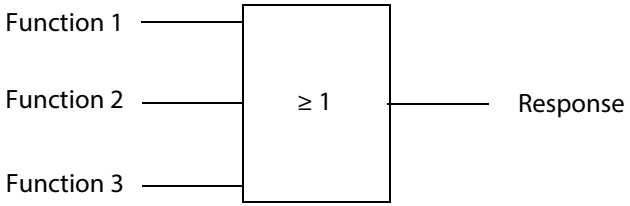
### 10.1 (1.10.1.2) Relay mode

The relay mode can be adapted to the application:

| | |
|---|---|
| •N/C | Normally closed- N/C operation contacts11-12-14 / 21-22-24 (in fault-free condition, the alarm relay is energised). |
| •N/O | Normally opened - N/O operation contacts 11-12-14 / 21-22-24 (in fault-free condition, the alarm relay is de-energised). |

### 10.1 (1.10.1.3) Function 1

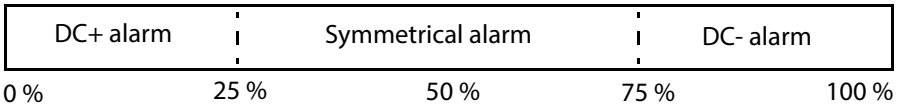
Up to three functions can be assigned to one output. The functions are linked to an OR operator:






Select the appropriate setting for function 1. The following parameters can be set.

| | |
|---|---|
| •off | The function is not used. |
| •Ins. Alarm 1 | The status of the output changes when the value falls below the set response value $R_{an1}$. |
| •Ins. Alarm 2 | The status of the output changes when the value falls below the set response value $R_{an2}$. |
| •Connection fault | The status of the output changes when one of the following connection fault occurs:<br>• No low-resistance connection between the line conductors.<br>• No low-resistance connection between the terminals E and KE to earth (PE).<br>• The load connected to the current output is too low<br>• The load connected to the current output is too high.<br>• Load on X1 too high. |
| •DC alarm | The status of the output changes in case of an earth fault in the direction of DC when 75 % of the value are exceeded. This does not concern symmetrical faults. This function will only be carried out when the value falls below the response value $R_{an1}$ and when the nominal system voltage is $U_n \geq 50$ V. |
| •DC+ alarm | The status of the output changes in case of an earth fault in the direction of DC+ when 25 % of the value are exceeded. This does not concern symmetrical faults. This function will only be carried out when the value falls below the response value $R_{an1}$ and when the nominal system voltage is $U_n \geq 50$ V. |
| •Symmetrical alarm | The status of the output changes in the event of a resistance ratio between DC+ and DC- of 25 % to 75 %. |



| | |
|---|---|
| *Device fault | The status of the output changes in the event of an internal device fault. |
| *Common alarm | The status of the output changes on the occurrence of any alarm and fault messages (Ins. alarm 1 & 2, DC- / DC+ alarm, symmetrical alarm, connection and device faults). |
| *Measurement complete | The status of the output changes at the end of the initial measurement. |
| *Device inactive | The status of the output changes when the device has been deactivated via a digital input or the control menu. |
| *DC offset alarm | The status of the output changes on the occurrence of a DC offset voltage in the system. |

### 10.1 (1.10.1.4) Function 2

Refer to "10.1 (1.10.1.3) Function 1".

### 10.1 (1.10.1.5) Function 3

Refer to "10.1 (1.10.1.3) Function 1".

### 10.1 (1.10.2) Relay 2

Refer to "10.1 (1.10.1) Relay 1".

### 10.1 (1.10.3) Digital 1

The following parameters can be set for each of the digital outputs:

### 10.1 (1.10.3.1) TEST

The functional test of the digital output can be activated or deactivated. This only applies to the manual test and not to the cyclic device self test:

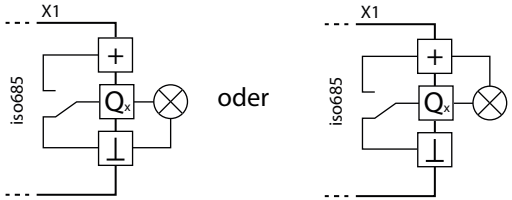
| | |
|---|---|
| *on | The manual test changes the status of the digital output. |
| *off | The manual test does not change the status of the digital output. |



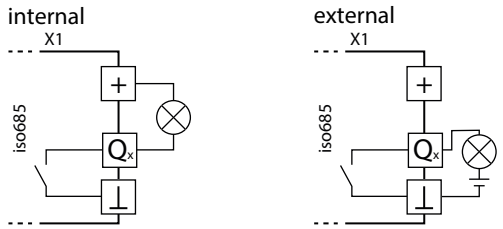
### 10.1 (1.10.3.2) Mode

The following settings can be used to set the operating mode for the digital output:

| | |
|---|---|
| *Active | In the active mode +24 V will be internally applied across the output. |




| | |
|---|---|
| *Passive | In the passive mode ≤ 32 V are externally connected (see technical data). The output switches the applied potential to ground. |




***Observe the maximum output current!***
*Maximum output current in case of internal voltage supply via A1/+ and A2/-: 200 mA in total to X1.*
*Also refer to the formula for calculating $I_{LmaxX1}$ in the Technical Data under* "Digital Outputs (Q1, Q2)" on page 62.

### 10.1 (1.10.3.3) Function 1

Refer to "10.1 (1.10.1.3) Function 1".

### 10.1 (1.10.3.4) Function 2

Refer to "10.1 (1.10.1.3) Function 1".

### 10.1 (1.10.3.5) Function 3

Refer to "10.1 (1.10.1.3) Function 1".

### 10.1 (1.10.4) Digital 2

Refer to "10.1 (1.10.3) Digital 1".

### 10.1 (1.10.5) Buzzer

The following parameters can be set for the buzzer:

### 10.1 (1.10.5.1) TEST

The functional test of the buzzer can be activated or deactivated. This only applies to the manual test and not to the cyclic device self test:

| | |
|---|---|
| *on | The manual test activates the buzzer sound. |
| *off | The manual test does not activate the buzzer sound. |

### 10.1 (1.10.5.2) Function 1

Refer to "10.1 (1.10.1.3) Function 1".

### 10.1 (1.10.5.3) Function 2

Refer to "10.1 (1.10.1.3) Function 1".

### 10.1 (1.10.5.4) Function 3

Refer to "10.1 (1.10.1.3) Function 1".

### 10.1 (1.10.6) Analogue

The following parameters can be set for the analogue output:

### 10.1 (1.10.6.1) Mode

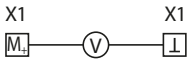
The following values can be set for the operating mode of the analogue output

Current output


| | |
|---|---|
| *0-20 mA | Permissible load ≤ 600 Ω |
| *4-20 mA | Permissible load ≤ 600 Ω |
| *0-400 µA | Permissible load ≤ 4 kΩ |



Voltage output

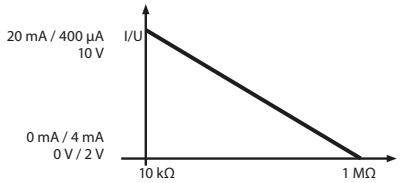



| | |
|---|---|
| *0-10 V | Permissible load ≥ 1 kΩ |
| *2-10 V | Permissible load ≥ 1 kΩ |

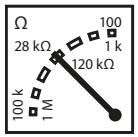
### 10.1 (1.10.6.2) Midscale

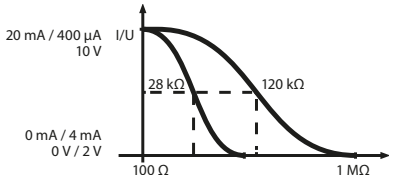
Select the appropriate midscale. The following parameters can be set:

| | |
|---|---|
| *Linear | The switching signal is linear to the insulation resistance in the indicated measuring range. |




| | |
|---|---|
| *28 kΩ<br>*120 kΩ | The switching signal is analogue to the mid scale of 28 kΩ or 120 kΩ on a measuring instrument. |




Calculation of the insulation resistance using the analogue output:

$$R_F = \frac{(A_2 - A_1) * R_{SKM}}{A_3 - A_1} - R_{SKM}$$

$A_3$= Measured value analogue output

$R_{SKM}$= 28 kΩ or 120 kΩ/midscale

$R_F$= Insulation fault in kΩ

| Lower value<br>Analogue output $A_1$ | Upper value<br>Analogue output $A_2$ |
|---|---|
| 0 mA | 20 mA |
| 4 mA | 20 mA |
| 0 µA | 400 µA |
| 0 V | 10 V |
| 2 V | 10 V |

### 10.1 (1.10.6.3) TEST

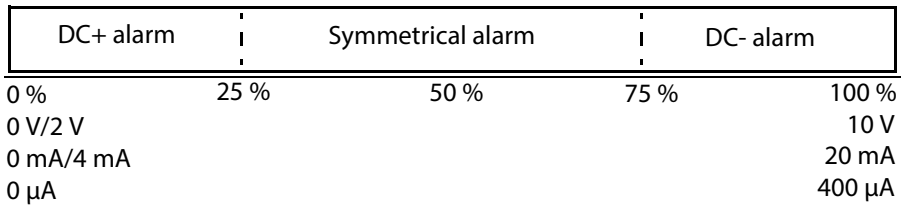
The functional test of the analogue output can be activated or deactivated. In this way, the analogue output is adjusted once for the entire range. This only applies to the manual test and not to the cyclic device self test:

| | |
|---|---|
| •on | The manual test checks the analogue output function. |
| •off | The manual test does not check the analogue output function. |

### 10.1 (1.10.6.4) Function

Select the appropriate setting for the analogue output. The following parameters can be set.

| | |
|---|---|
| •Insulation value | Depending on the measured insulation value, an analogue current or voltage signal is provided at the output. |
| •DC offset | Depending on the measured DC offset, an analogue current or voltage signal is provided at the output. This setting can only be used when Linear is selected in the menu "Midscale". |






### 10.1 (2.0) Data measured values

The ISOMETER® stores certain measured values for a specific period of time. You can view these data at the "Data meas. values" menu point. Navigate through the different views using the Λ and V buttons:

| | |
|---|---|
| •isoGraph data | Displays the insulation resistance and chronological sequence. See “Device communication” on page 42. |
| •Insulation data | Displays the current insulation resistance, the minimum insulation resistance measured and the system leakage capacitance. |
| •IT system data | Displays the system phase-to-phase voltages and the mains frequency (r.m.s. values) |
| •IT system data | Displays the system phase-to-earth voltages |

### 10.1 (3.0) Control

In the control menu, you can start a manual test reset, reset alarm messages and start an initial measurement:

| | |
|---|---|
| •TEST | Manual device test |
| •RESET | Reset of fault and alarm messages |
| •Start initial measurement | All recorded measurements are discarded and a new measurement is started |

### 10.1 (4.0) History

In the history menu, the faults detected by the ISOMETER® are displayed. For a detailed functional description, refer to “History memory” on page 29.

| | |
|---|---|
| •History | Overview of faults that have occurred |
| •Delete | Reset the history memory |

Settings

### 10.1 (5.0) Device settings

The device settings menu allows you to configure the basic settings for the ISOMETER®.

### 10.1 (5.1) Language

Choose the language to be displayed by the ISOMETER®. For example, you can set the languages:

- *German
- *English
- *...

### 10.1 (5.2) Clock

In the clock menu you can set the display format of time and date for the ISOMETER®:

### 10.1 (5.2.1) Time

Based on the selected time format you can set the current time to display 24-hour or 12-hour notation (am/pm).

### 10.1 (5.2.2) Format (time)

Select the appropriate time format to be displayed:

| | |
|---|---|
| *12 h | 12-hour notation am/pm |
| *24 h | 24-hour notation |

### 10.1 (5.2.3) Summer time

Summer time can be considered in the following settings:

| | |
|---|---|
| *off | No automatic change between summer time and standard time. |
| *DST | Daylight Saving Time<br>Automatic change between summer and standard time according to North American regulation.<br>North American summer time begins on each second Sunday in March at 02:00 local time by setting the clock forward by one hour from 2:00 to 03:00 local time. Summer time always ends the first Sunday in October at 03:00 local time by setting the clock back one hour from 3:00 to 2:00. |
| *CEST | Central European Summer Time<br>Automatic change between summer time and standard time according to Central European regulation.<br>Central European summer time begins on each last Sunday in March at 02:00 CEST by setting the clock forward by one hour from 2:00 to 03:00. Central European summer time always ends on the last Sunday in October at 03:00 CEST by setting the clock back one hour from 3:00 to 2:00. |

*When set to DST or CEST, changing between summer time and normal time is only done on the date of the official time change.*

### 10.1 (5.2.4) Date

Based on the selected date format you can set the current date.

### 10.1 (5.2.5) Format (date)

Select the appropriate date format you want to be displayed:

| | |
|---|---|
| *dd.mm.yy | day, month, year |
| *mm-dd-yy | month, day, year |

### 10.1 (5.2.6) NTP

Select if you would like to synchronise the current time via NTP. You have to configure the NTP server in order to use this function (see"NTP server" on page 39).

| | |
|---|---|
| *on | Synchronisation via NTP server is activated. |
| *off | Synchronisation via NTP server is deactivated. |

### 10.1 (5.2.7) NTP server

Set the IP address of the NTP server.

Settings

### 10.1 (5.2.8) UTC

Set the time according to UTC (coordinated world time). For Germany, set +1 for wintertime (MEZ) and +2 for summer time (MESZ).

### 10.1 (5.3) Interface

Set the parameters for the connection of other devices to the ISOMETER® in the interface menu:

### 10.1 (5.3.1) Write access

Set whether the device can be parameterised externally via Modbus or web server. Displaying and reading out data via Modbus and web server is always possible, regardless of this setting.

| | |
|---|---|
| *Allow | Allow external parameter setting. |
| *Deny | Refuse external parameter setting. |

### 10.1 (5.3.2) Ethernet

Set the parameters for communication with other devices via the Ethernet interface. The Ethernet interface can be used for communication with Modbus, web server and BCOM.

### 10.1 (5.3.2.1) DHCP

Select whether you want to use automatic address assignment via your DHCP server. When the automatic IP address assignment is activated, the IP address, subnet mask and the standard gateway are assigned automatically. When the automatic IP address assignment is deactivated, you have to make these settings manually in the menu.
The IP address can be viewed in the "Info" menu (see "Info" on page 41).

| | |
|---|---|
| *on | Activate automatic IP address assignment. |
| *off | Deactivate automatic IP address assignment. |

### 10.1 (5.3.2.2) IP

Set the appropriate IP address for the ISOMETER®.

### 10.1 (5.3.2.3) SN

Set the appropriate subnet mask.

### 10.1 (5.3.2.4) Std. GW

If a standard gateway is used, enter the IP address here.

### 10.1 (5.3.2.5) DNS server

If a DNS server is used, enter the server's IP address.
Contact your network administrator in case you have questions about the configuration of the DNS server.

### 10.1 (5.3.2.6) Domain

Enter the domain.
Contact your network administrator in case you have questions about the configuration of the domain.

### 10.1 (5.3.3) BCOM

Set the parameters for communication with other devices via BCOM.
For further information, refer to "BCOM" on page 42.

### 10.1 (5.3.3.1) System name

Set the system name of the network in which the devices are located. In order to guarantee that all devices are able to communicate via BCOM, all devices must have the same system name.

### 10.1 (5.3.3.2) Subsystem

Configure the subsystem address of the network in which the devices are located. The devices can communicate with subsystems with the same or different subsystem addresses.

### 10.1 (5.3.3.3) Device address

Assign a device address. Each device must have a different address to distinguish it from another in the system and ensure correct communication.

### 10.1 (5.3.3.4) Timeout

Set the timeout for messages between 100 ms…10 s.
This time specification defines the maximum permissible time for a device to respond.

### 10.1 (5.3.3.5) TTL for subscription

Set a time between 1 s…1092 min.
This time defines the intervals at which the ISOMETER® sends messages to e.g. a gateway. Severe alarms (e.g. insulation alarms or substantial value changes) are always sent immediately.

### 10.1 (5.3.4) Modbus TCP

Settings for communication with other devices via Modbus TCP.
For further information, refer to "Modbus TCP" on page 42.

### 10.1 (5.3.4.1) Port 502

Choose whether Modbus TCP should be used:

| | |
|---|---|
| •on | Modbus TCP can be used for communication with other devices. |
| •off | Modbus TCP cannot be used for communication with other devices. |

### 10.1 (5.3.5) BS bus

Set the parameters for communication with other devices via the Bender sensor bus.
For further information, refer to "BS bus" on page 46.

### 10.1 (5.3.5.1) Address

Select an address between 1 and 90 for the Bender sensor bus.

### 10.1 (5.4) Display

Adjust the display brightness for the ISOMETER® in the display menu:

### 10.1 (5.4.1) Brightness

Adjust the display brightness between 0 % and 100 % in steps of 10.
If no button is pressed on the display for 15 minutes, the brightness of the display is reduced. If now a button is pressed, the normal brightness is restored.

### 10.1 (5.5) Password

Use the password function to protect the device parameters against unauthorised adjustment. The default password is 0000.

### 10.1 (5.5.1) Password

Enter an individual four-digit password.

### 10.1 (5.5.2) Status

Decide if the password query should be used:

| | |
|---|---|
| •on | Password query active |
| •off | Password query inactive |

Settings

### 10.1 (5.6) Commissioning

In the commissioning menu you can open the ISOMETER®'s commissioning wizard again.

### 10.1 (5.7) Data backup

In the data backup menu device settings can be saved or device settings already saved can be restored.

| | |
|---|---|
| •Save | The ISOMETER® saves your device settings. |
| •Restore | The ISOMETER® restores your initial device settings. |

### 10.1 (5.8) Service

The service menu can only be accessed by Bender Service staff.

### 10.1 (6.0) Info

The ISOMETER®'s current settings can be viewed in the Info menu. Navigate through the different views using the Λ and V buttons:

| | |
|---|---|
| •Device | Device name, serial number, article number |
| •Software | Software version measurement technique, software version HMI |
| •Measurement -technique | Selected profile, selected system type |
| •Clock | Time, date, summer time |
| •Ethernet | IP address, DHCP status, MAC address |
| •BS bus | BS address of the device |

# 11. Device communication

## 11.1 Ethernet interface

The Ethernet interface can be used for communication with Modbus, web server and BCOM.

## 11.2 BCOM

BCOM is intended for communication between Bender devices via Ethernet.

All devices that communicate via BCOM must have the same system name. Devices can be organised in subsystems. Each device requires an individual device address.
For more information regarding BCOM, refer to the BCOM manual (D00256)

at http://www.bender.de/manuals.

*When address 0 has been set for communication via BCOM the device can be accessed via the network (e.g. for parameter setting, etc.) but it cannot communicate with other devices.*

## 11.3 Modbus TCP

Modbus is an international widely used protocol for data transfer between devices.

All measured values, messages and parameters are stored in virtual register addresses. Data can be read out with a read command on the register address. With a write command, data can be written into a register address.
The register addresses of the individual measured values und parameters can be found in the manual "iso685-D Annex A" with the title "ISOMETER® iso685 device family - Modbus settings" at http://www.bender.de/manuals.

*A maximum of 5 TCP/IP connections can be used simultaneously.*

*In order to be able to parameterise the device externally via Modbus, the menu item "Allow" must have been set in the "Write access" menu (see “Write access” on page 40).*

## 11.4 Web server

The ISOMETER® has an integrated web server which displays ISOMETER® data comfortably on every PC via a web browser. The web server can be used to read out measured values and parameterise the ISOMETER®s. You can access the web server by entering the IP address of the ISOMETER® into the browser (e.g. http://192.168.0.5). The Info menu provides information about the ISOMETER®'s IP address (see 10.1 (6.0) "Info" on page 41).

The web server offers the following functions:

- Visualisation
  - Indication of device information (e.g. device type, software version, etc.)
  - Indication of current device settings.
  - Indication of alarm messages.
  - Indication of the Modbus information of the individual parameters.
  - Indication of the interfaces in use.
  - Overview of the current measured values.
  - Detailed graphic representation of the insulation resistance (isoGraph).
  - Fast and simple visualisation without any programming.
- Parameter setting
  - Easy and fast parameter setting of the device.
  - Easy assignment and edition options of device and measuring channel texts.
- Maintenance
  - Data storage of specific events for fast support by Bender Service.

*A maximum of 5 TCP/IP connections can be used simultaneously.*

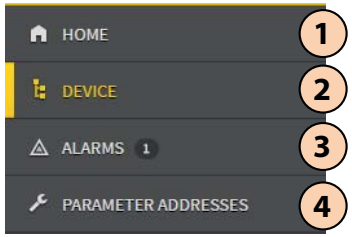
*Only one device may access the web server at the same time. If several devices try to access the web server it may result in timeouts.*

Device communication

*The write access is deactivated by default in the device menu (= Deny). To be able to set parameters via the web server the write access must first be activated in the device menu (= Allow) (see "Write access" on page 40).*

*Use the web server preferably with the following web browsers: Google Chrome, Mozilla Firefox or Internet Explorer.*

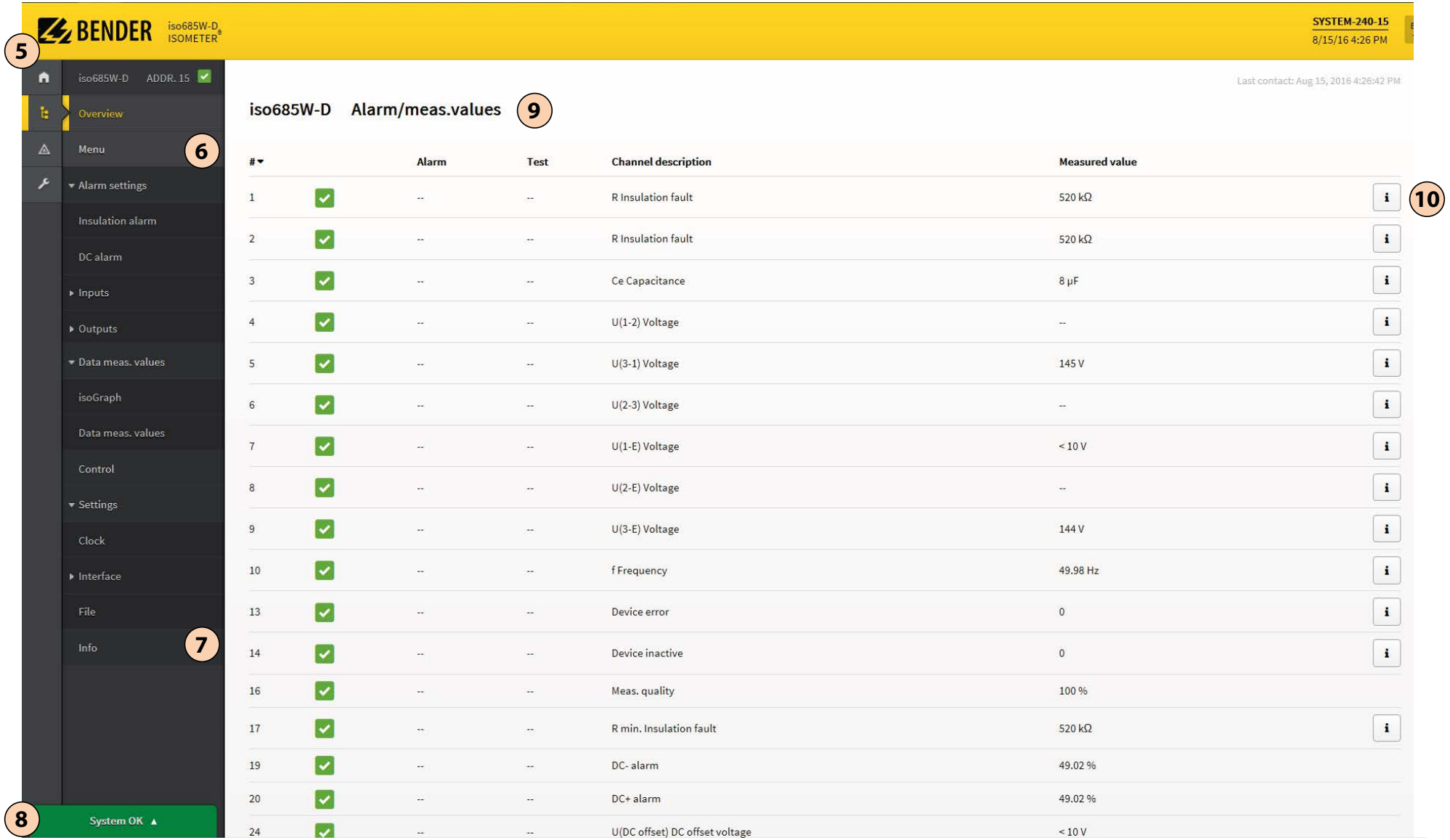
**Web server device menu (first level)**




**Legend for web server device menu (first level)**

| | | |
|---|---|---|
| 1 | START | Indication of general device information. |
| 2 | DEVICE | Indication of an overview of alarm values and measured values. Indication of the settings. Settings can be changed here. |
| 3 | ALARMS | Indication of alarm messages. |
| 4 | PARAMETER ADDRESSES | Activate and deactivate the indication of the Modbus information by selecting or deselecting the selection box for the question "Display additional Modbus information for each parameter?". |

## Web server user interface




| # | | Alarm | Test | Channel description | Measured value |
|---|---|---|---|---|---|
| 1 | ✓ | -- | -- | R Insulation fault | 520 kΩ |
| 2 | ✓ | -- | -- | R Insulation fault | 520 kΩ |
| 3 | ✓ | -- | -- | Ce Capacitance | 8 µF |
| 4 | ✓ | -- | -- | U(1-2) Voltage | -- |
| 5 | ✓ | -- | -- | U(3-1) Voltage | 145 V |
| 6 | ✓ | -- | -- | U(2-3) Voltage | -- |
| 7 | ✓ | -- | -- | U(1-E) Voltage | < 10 V |
| 8 | ✓ | -- | -- | U(2-E) Voltage | -- |
| 9 | ✓ | -- | -- | U(3-E) Voltage | 144 V |
| 10 | ✓ | -- | -- | f Frequency | 49.98 Hz |
| 13 | ✓ | -- | -- | Device error | 0 |
| 14 | ✓ | -- | -- | Device inactive | 0 |
| 16 | ✓ | -- | -- | Meas. quality | 100 % |
| 17 | ✓ | -- | -- | R min. Insulation fault | 520 kΩ |
| 19 | ✓ | -- | -- | DC- alarm | 49.02 % |
| 20 | ✓ | -- | -- | DC+ alarm | 49.02 % |
| 24 | ✓ | -- | -- | U(DC offset) DC offset voltage | < 10 V |

Device communication

### Legend for user interface

| | | |
|---|---|---|
| 5 | | Main menu of the web server (first level)<br>• START (1)<br>• DEVICE (2)<br>• ALARMS (3)<br>• PARAMETER ADDRESSES (4)<br>Refer to "Web server device menu (first level)" on page 43. |
| 6 | Menu | Adjust device settings here. |
| 7 | Info | • Indication of device information regarding software, measurement technique, Ethernet and BS bus address.<br>• Indication of Modbus information for the individual parameters. To be able to see this information, the selection box at PARAMETER ADDRESSES (4) for the question "Display additional Modbus information for each parameter?" must be activated. |
| 8 | System OK/ alarms | Indication of the system status "System OK" (green button) and "Alarms" (red button).<br>If there are pending alarms, click on the red button or go to menu point "ALARMS" (3) to obtain further information. |
| 9 | Alarm/ meas.values | Overview of alarm values and measured values. |
| 10 | i symbol | Click on the "i" symbol on the right side to obtain further information regarding measured values. |

Device communication

## 11.5 BS bus

The BS bus is used to extend Bender measuring devices (e.g. ISOMETER®) with Bender sensor devices. It is an RS-485 interface with a specially developed protocol for Bender devices. On the BS bus, the transmission of alarm messages takes priority over the transmission of all other messages. For further information, refer to the BS bus manual (document number: D00278) at www.bender.de/manuals.

**CAUTION**

*When using interface converters, a galvanic separation is required.*

*The compatibility of the BS bus and the BMS bus is restricted!*

### Master-slave principle

The BS bus works according to the master-slave principle. This means that the measuring device operates as the MASTER, while all sensor devices operate as SLAVES. The master is responsible for the communication that is necessary for the measuring function. The master also provides the required bus bias voltage for the operation of the BS bus. The measuring device on the BS bus is the master and has address 1. All sensor devices connected to the BS bus require unique addresses.

### Addresses and address ranges on the BS bus

Address 1 is assigned to the master. All sensor devices receive unique addresses starting with address 2, assigned in consecutive order without gaps. In the event of a device failure, a maximum gap of 5 addresses is permissible.

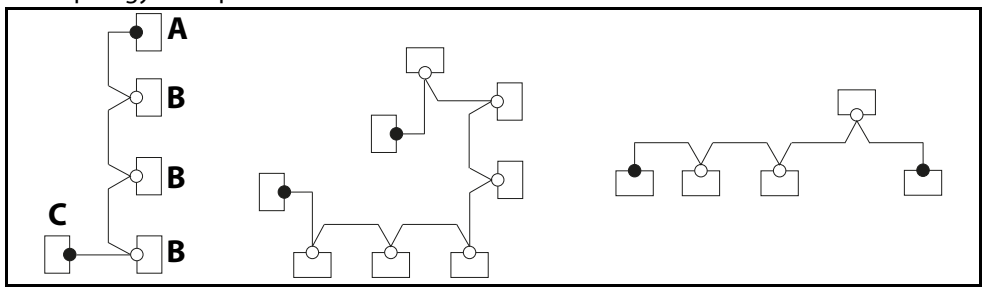
### RS-485 specifications/cables

The RS-485 specification restricts the cable length to 1200 m and requires a daisy chain connection. The number of devices on the BS bus is only limited by the BS bus master. Use twisted pair, shielded cables for bus cabling. For example, cable type J-Y(St)Y n x 2 x 0.8 is suitable. The shield must have a single-ended connection to earth. The BS bus must be terminated at both ends with terminating resistors (120 Ω, 0.25 W). The terminating resistors are connected in parallel to the terminals A and B. Some devices feature integrated terminating resistors and can be activated or deactivated via the "R" button.

### Cable routing

The optimum cable routing for the BS bus is a double-terminated bus topology. The length of the branch line is limited to 1 m. These branch lines do not have to be terminated.

Bus topology examples:




### Termination

| | | |
|---|---|---|
| A | Master | Terminating resistor activated via switch on device (ON) or external terminating resistor between terminals A and B |
| B | Slave | Terminating resistor deactivated via switch on device (OFF) |
| C | Slave | Terminating resistor activated via switch on device (ON) or external terminating resistor between terminals A and B |

**CAUTION**

*Only the first and last device in one line may be terminated. Therefore, check all devices.*

# 12. Device profiles

Adjustment to different applications can be carried out very easily by selecting a device profile.

| | Nominal system voltage | Mains frequency | System leakage capacitance | Measuring voltage | Description |
|---|---|---|---|---|---|
| **Power circuits** | AC 0…690 V/<br>DC 0…1000 V | 15…460 Hz | 0…150 µF | ±50 V | Main circuits without dynamic frequency changes.<br>The universal profile is suitable for all systems primarily with constant mains frequencies and extraneous DC voltages. When using inverters and dynamic frequency control, select Inverter > 10 Hz or Inverter < 10 Hz. |
| **Control circuits** | AC 0…230 V/<br>DC 0…230 V | 15…460 Hz | 0…150 µF | ±10 V | This profile is used to reduce the measurement voltage to ±10 V in control systems with lower nominal voltages in order to reduce the impact by the ISOMETER® on sensitive switching elements. |
| **Generator** | AC 0…690 V | 50…60 Hz | 0…5 µF | ±50 V | This profile allows the realisation of a very fast measuring time, e.g. as required for generator monitoring. Furthermore, this profile can be used to support fast fault location in an IT system. The generator profile is suitable for AC systems containing DC components. |
| **High capacitance** | AC 0…690 V/<br>DC 0…1000 V | 15…460 Hz | 0…1000 µF | ±50 V | For systems with high leakage capacitances, e.g. ship applications, the impact of leakage capacitances on the measuring result can be significantly reduced by selecting this profile. |
| **Inverter > 10 Hz** | AC 0…690 V/<br>DC 0…1000 V | 10…460 Hz | 0…20 µF | ±50 V | This profile is used for systems with dynamic frequency control by inverters in the range 10 to 460 Hz in order to optimise the measurement with respect to the measuring time and quality. |
| **Inverter < 10 Hz** | AC 0…690 V/<br>DC 0…1000 V | 1…460 Hz | 0…20 µF | ±50 V | For systems involving extremely low-frequency control in the range of up to 1…460 Hz and very low and continuously changing extraneous DC voltages due to dynamic load conditions in an IT system, continuous insulation monitoring can be optimised using this profile. |

Response times see "Diagrams" on page 55.

# 13. Coupling devices

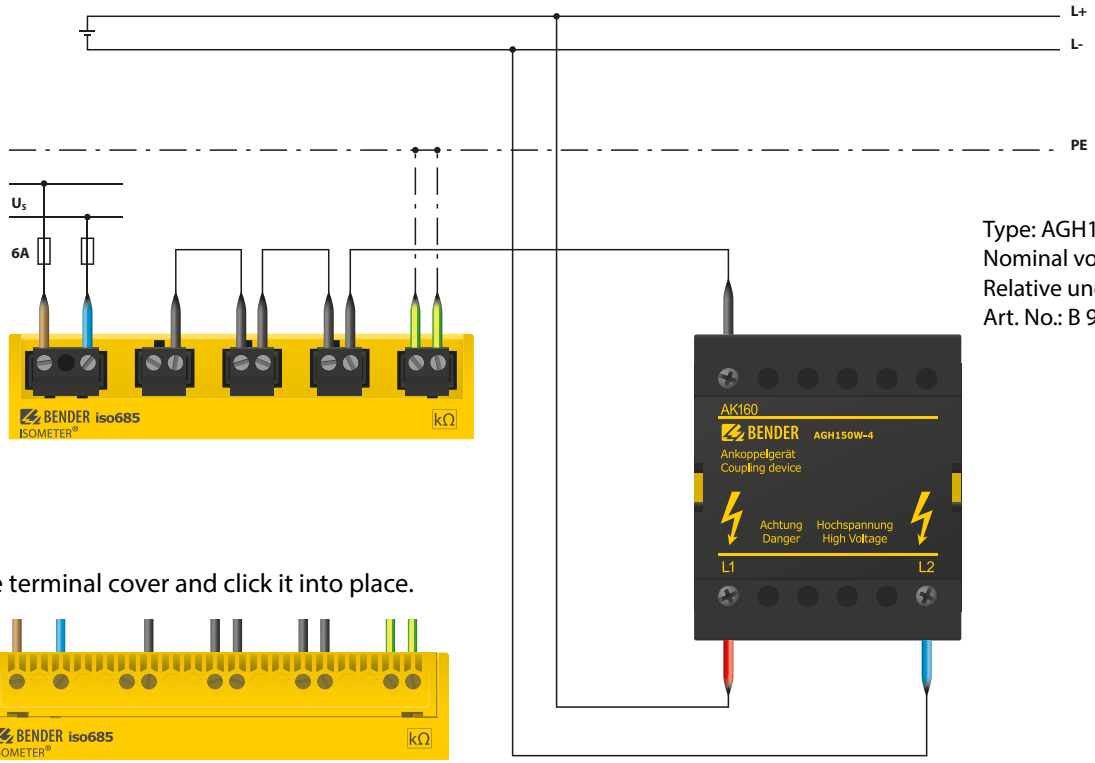
*If a coupling device is selected during the commissioning or in the device menu, the ISOMETER® automatically sets the system type to 3AC. This setting must not be changed.*

*If the ISOMETER® is operated with a coupling device, this device must be specified in the commissioning assistant during commissioning or in the device menu later on.*

*If the ISOMETER® is operated with a coupling device, the DC alarm and the coupling monitoring are deactivated.*

*If the ISOMETER® is operated with a coupling device, the values of the coupling monitoring, the DC offset and the measured values are not determined correctly.*

## 13.1 Connection using the AGH150W-4(DC)




Type: AGH150W-4
Nominal voltage: DC 0…1760 V
Relative uncertainty: 15 % min. ± 5 kΩ
Art. No.: B 98 018 006

Position the terminal cover and click it into place.

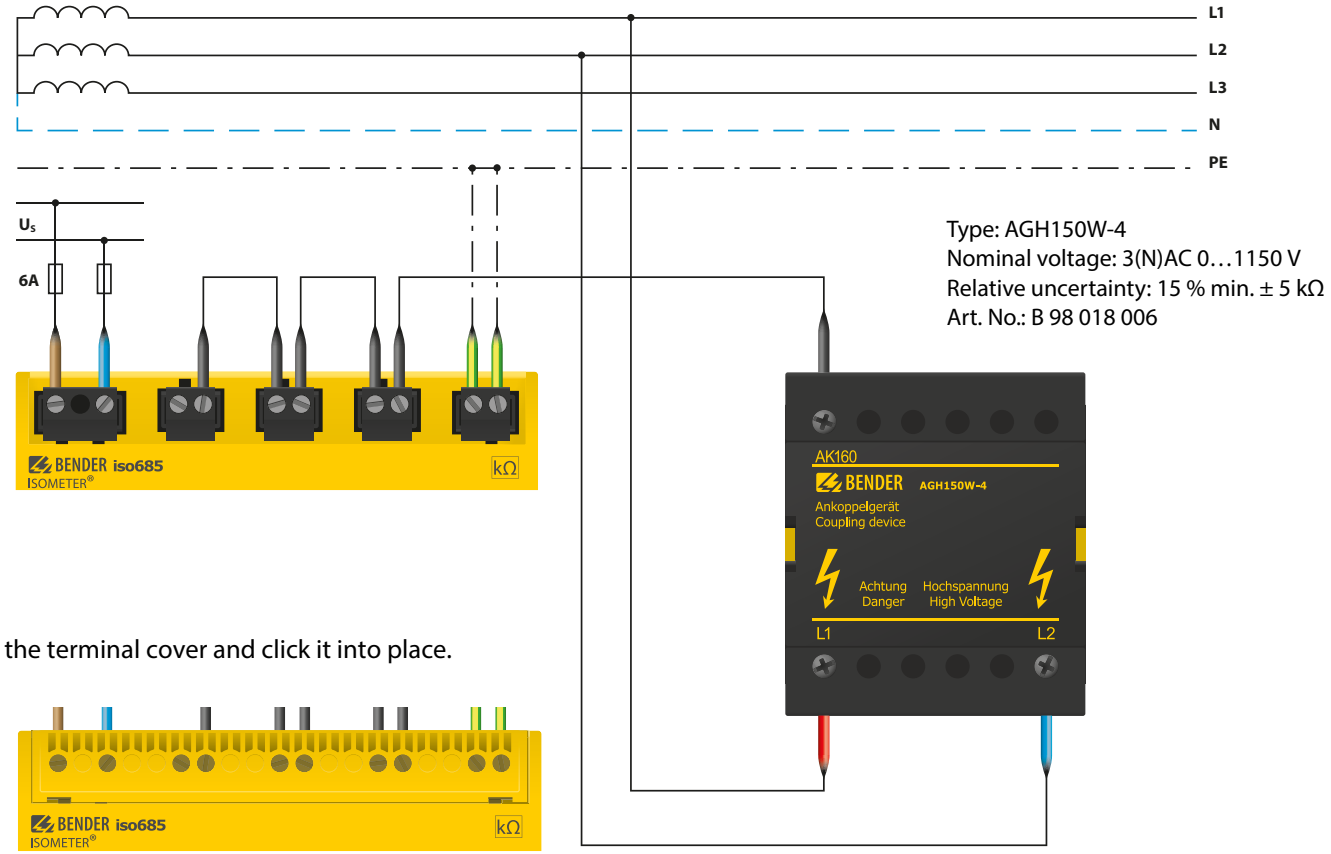



**DANGER**

***Risk of electric shock!***

*The coupling device is operated with high voltage, which can be life-threatening in case of direct contact. Make sure that only electrically skilled persons work on or with the device. Read the operating manual of the coupling device carefully.*

## 13.2 Connection using the AGH150W-4 (3(N)AC)




Type: AGH150W-4
Nominal voltage: 3(N)AC 0…1150 V
Relative uncertainty: 15 % min. ± 5 kΩ
Art. No.: B 98 018 006

Position the terminal cover and click it into place.

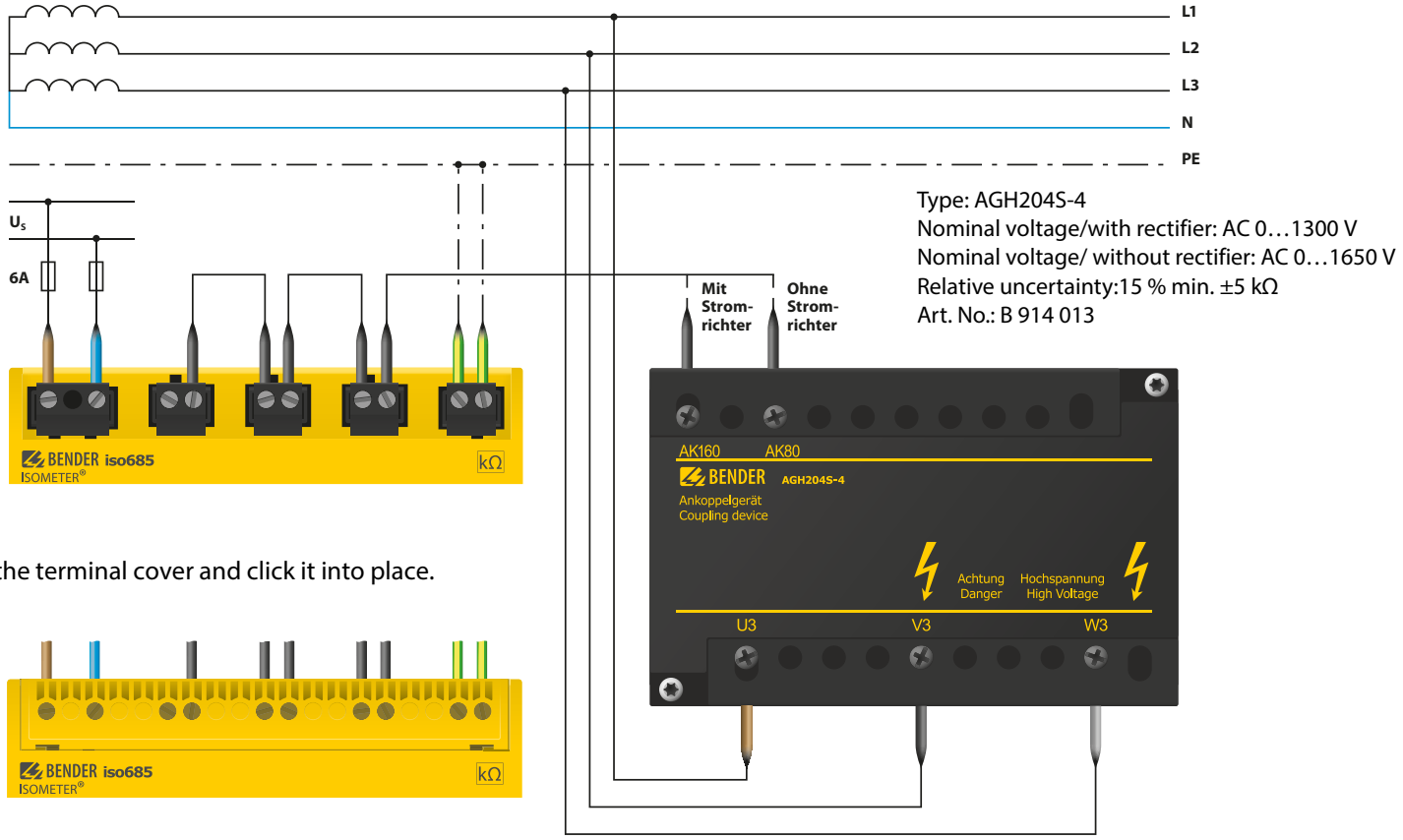



**DANGER**

***Risk of electric shock!***

*The coupling device is operated with high voltage, which can be life-threatening in case of direct contact. Make sure that only electrically skilled persons work on or with the device. Read the operating manual of the coupling device carefully.*

## 13.3 Connection using theAGH204S-4




Type: AGH204S-4
Nominal voltage/with rectifier: AC 0…1300 V
Nominal voltage/ without rectifier: AC 0…1650 V
Relative uncertainty:15 % min. ±5 kΩ
Art. No.: B 914 013

Position the terminal cover and click it into place.

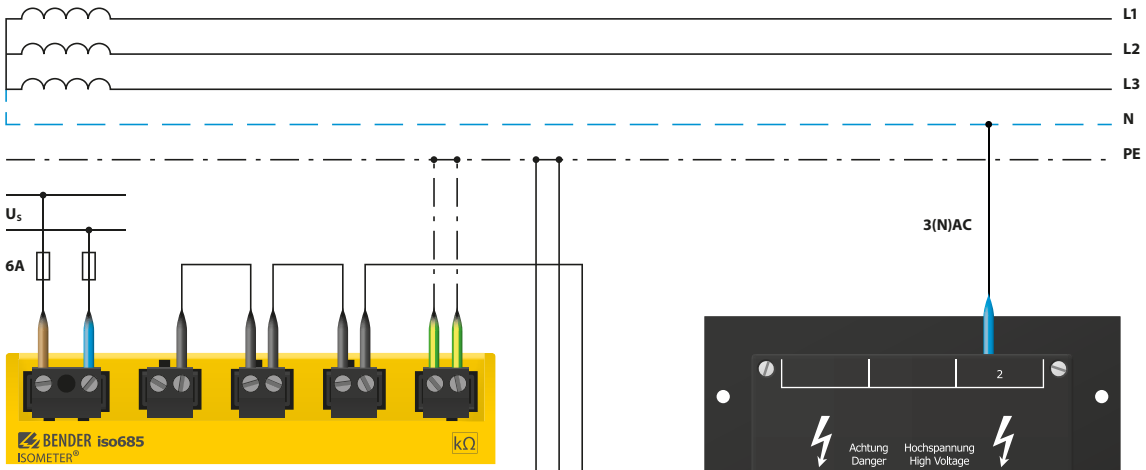



**DANGER**

***Risk of electric shock!***

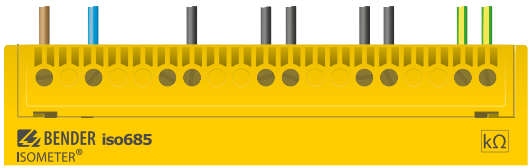
*The coupling device is operated with high voltage, which can be life-threatening in case of direct contact. Make sure that only electrically skilled persons work on or with the device. Read the operating manual of the coupling device carefully.*

## 13.4 3(N)AC connection using the AGH520S




Type: AGH520S
Nominal voltage: AC 0…7200 V
Relative uncertainty: 15 % min. ±5 kΩ
Art. No.: B 913 033

Position the terminal cover and click it into place.

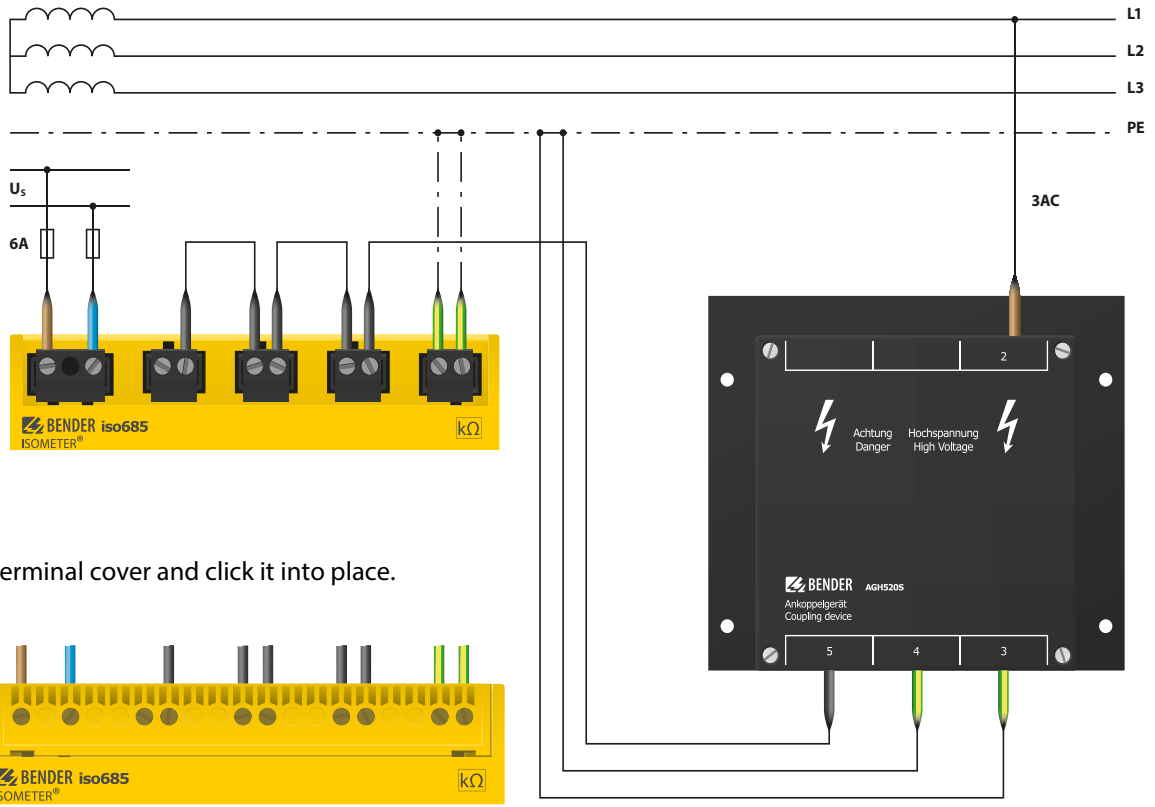



**DANGER**

***Risk of electric shock!***

*The coupling device is operated with high voltage, which can be life-threatening in case of direct contact. Make sure that only electrically skilled persons work on or with the device. Read the operating manual of the coupling device carefully.*

## 13.5 3AC connection using the AGH520S




Type: AGH520S
Nominal voltage: AC 0…7200 V
Relative uncertainty: 15 % min. ±5 kΩ
Art. No.: B 913 033

Position the terminal cover and click it into place.

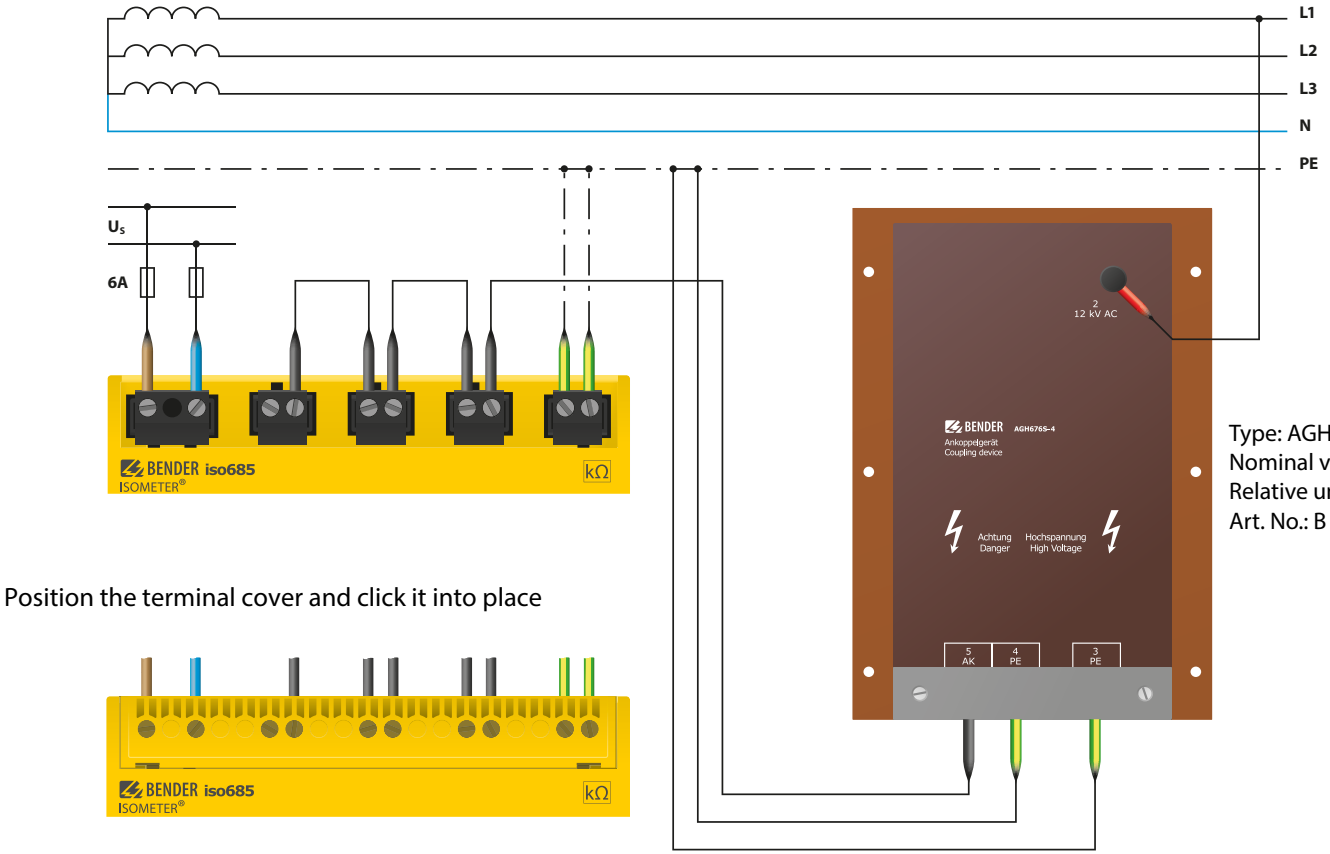



**DANGER**

***Risk of electric shock!***

*The coupling device is operated with high voltage, which can be life-threatening in case of direct contact. Make sure that only electrically skilled persons work on or with the device. Read the operating manual of the coupling device carefully.*

## 13.6 Connection using the AGH676S-4




Type: AGH676S-4
Nominal voltage: AC 12 kV
Relative uncertainty: 15 % min. ± 5 kΩ
Art. No.: B 913 055

Position the terminal cover and click it into place



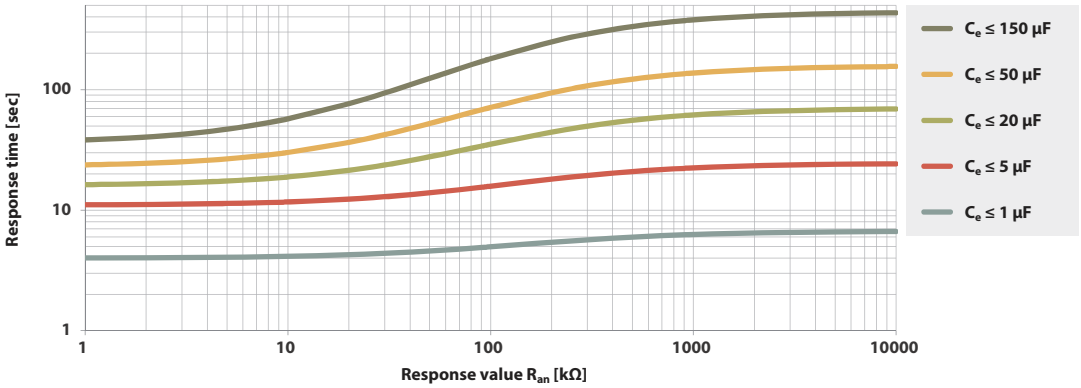

**DANGER**

***Risk of electric shock!***

*The coupling device is operated with high voltage, which can be life-threatening in case of direct contact. Make sure that only electrically skilled persons work on or with the device. Read the operating manual of the coupling device carefully.*

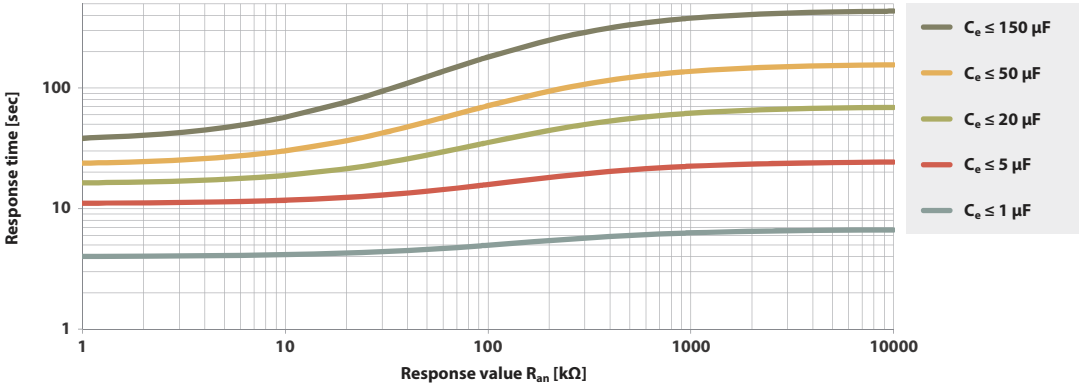
## 14.1 Response time profile power circuits

**Response time as a function of the response value ($R_{an}$) and system leakage capacitance ($C_e$) according to IEC 61557-8 ($U_n$ = AC 690 V, $f_n$ = 50 Hz)**



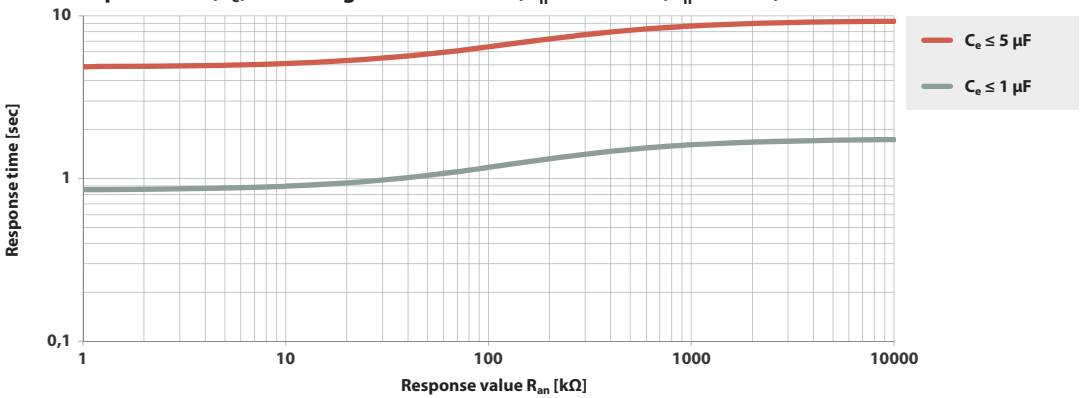

## 14.2 Response time profile control circuits

**Response time as a function of the response value ($R_{an}$) and system leakage capacitance ($C_e$) according to IEC 61557-8 ($U_n$ = AC 230 V, $f_n$ = 50 Hz)**



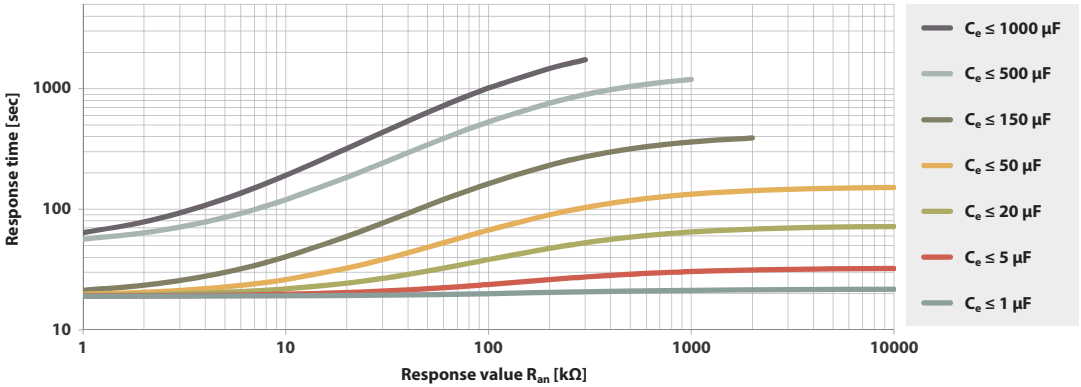
## 14.3 Response time profile generator

**Response time as a function of the response value ($R_{an}$) and system leakage capacitance ($C_e$) according to IEC 61557-8 ($U_n$ = AC 690 V, $f_n$ = 50 Hz)**



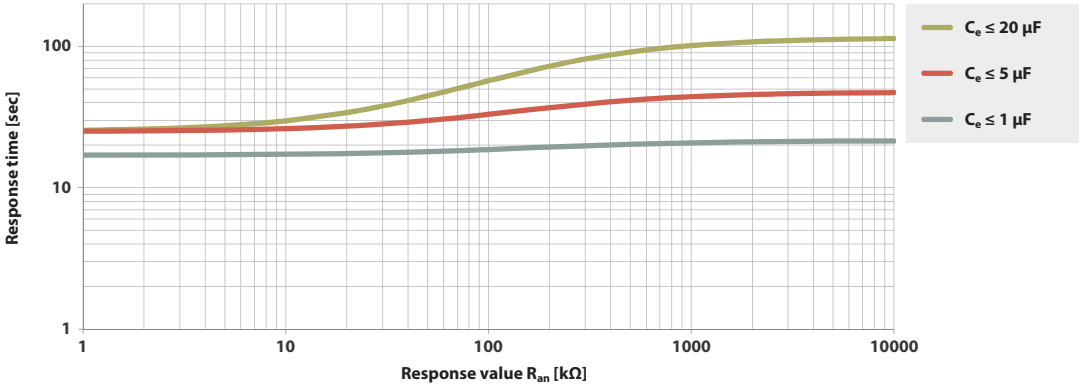

## 14.4 Response time profile high capacitance

**Response time as a function of the response value ($R_{an}$) and system leakage capacitance ($C_e$) according to IEC 61557-8 ($U_n$ = AC 690 V, $f_n$ = 50 Hz)**



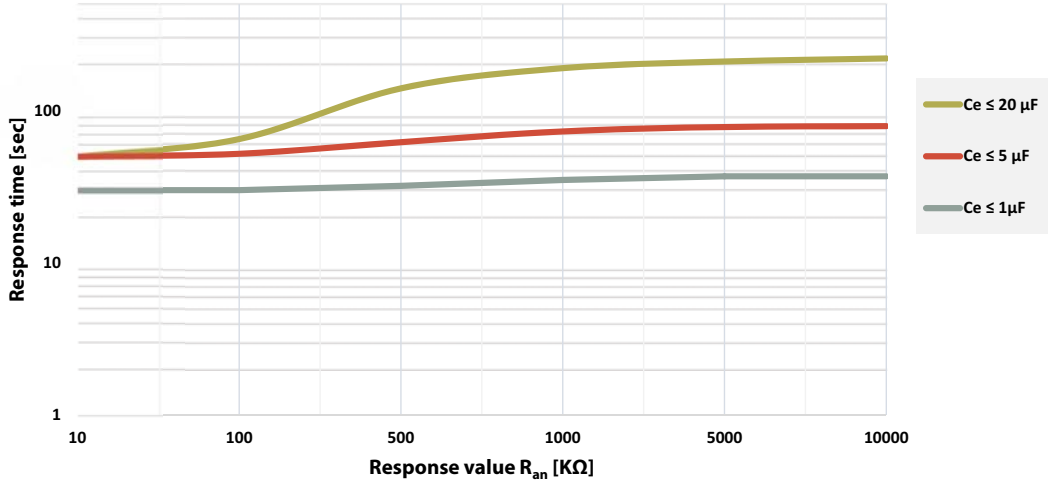
## 14.5 Response time profile inverter > 10 Hz

**Response time as a function of the response value ($R_{an}$) and system leakage capacitance ($C_e$) according to IEC 61557-8 ($U_n$ = AC 690 V, $f_n$ = 50 Hz)**



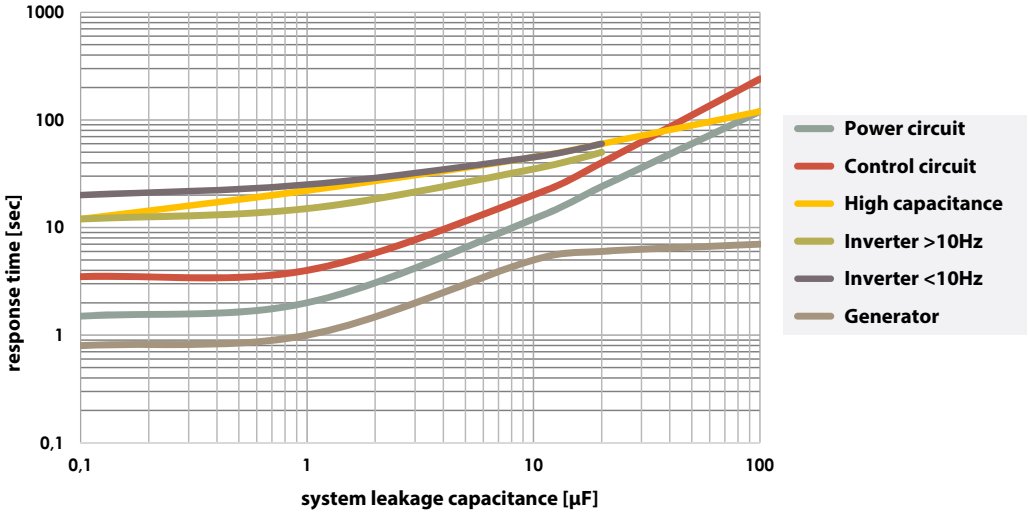

## 14.6 Response time profile inverter < 10 Hz

**Response time as a function of the response value ($R_{an}$) and system leakage capacitance ($C_e$) according to IEC 61557-8 ($U_n$ = AC 690 V, $f_n$ = 50 Hz)**



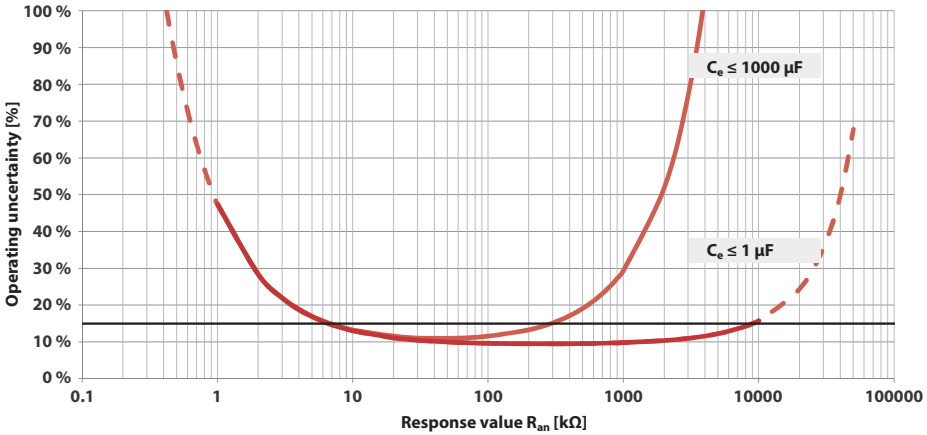
## 14.7 Response time DC alarm

**Typical response time for DC alarm for $R_F$ =100KΩ depending on system profile and system leakage capacitance**




## 14.8 Relative uncertainty

**Relative uncertainty as a function of the response value ($R_{an}$) and system leakage capacitance ($C_e$) according to IEC 61557-8 ($U_n$ = AC 690 V, $f_n$ = 50 Hz)**



# 15. Alarm messages

| Alarm message | Description | Measures | Reference | LED indicators |
|---|---|---|---|---|
| Insulation fault | An insulation fault exists. The insulation resistance falls below the response value $R_{an1}$. | • Observe insulation resistance in the monitored system and, if necessary, eliminate fault.<br>• Reset fault message by pressing the reset button | "Functional description" on page 10 | ALARM 1 lights |
| Insulation fault | An insulation fault exists. The insulation resistance falls below the response value $R_{an2}$. | • Eliminate insulation fault in the system being monitored<br>• Reset fault message by pressing the reset button | "Functional description" on page 10 | ALARM 2 lights |
| Check L1-L2-L3 for correct connection! | No low-resistance connection between the line conductors | • Check the wiring of terminals L1/+, L2 and L3/- to the IT system<br>• Press the test button<br>• Check mains voltage<br>• Check fuses<br>• Check set system type | "Connection" on page 17<br>& menu setting<br>"System type" on page 33 | ALARM 1 + ALARM 2 flash alternately |
| Check E-KE connections for interruptions! | No low-resistance connection between terminals E and KE to earth (PE) | • Check the wiring of terminals E and KE to earth (PE)<br>• Press the test button | "Connection" on page 17 | ALARM 1 + ALARM 2 flash in common mode |
| Service mode active! | The device is in maintenance condition | • Contact Bender Service | | SERVICE lights up |
| The profile does not suit the application! | Wrong profile selected for this application | • Check measured system capacitance or mains frequency in the Info menu<br>• Select another profile taking into consideration the characteristics | "Device profiles" on page 47 &<br>"Profile" on page 33 | |
| No DHCP server found! | Connection problem at the Ethernet interface | • Check cable connection at the Ethernet interface<br>• Check the DHCP server's availability<br>• Check the DHCP's interface configuration in the device | "DHCP" on page 40 | |
| Check time and date! | Time and date have not been set yet | • Set local time and date<br>(in case of voltage failure a buffer for three days) | "Clock" on page 39 | |
| Load on X1 too high! | Sum of the external loads on X1 is too high | • Check load at X1.+, X1.Q1 and X1.Q2<br>• Check ambient temperature | | |
| Device error x.xx | Internal device fault | • Press the TEST button<br>• Switch the supply voltage off and on<br>• Contact Bender Service | | SERVICE lights up |
| DC offset voltage | There is a DC offset voltage in the system. | • Check insulation fault and eliminate fault of DC components. | "DC alarm" on page 32 | |
| Undervoltage | Operating outside the specified supply voltage range | • Check supply voltage | | |
| Overvoltage | Operating outside the specified supply voltage range | • Check supply voltage | | |

# 16. Factory settings

| Parameter | Value |
|---|---|
| **Response values/alarms** | |
| Response value $R_{an1}$ (ALARM 1) | 40 kΩ |
| Response value $R_{an2}$ (ALARM 2) | 10 kΩ |
| DC alarm | off |
| DC-offset voltage for DC alarm | 65 V |
| Fault memory | off |
| Coupling monitoring | on |
| **System** | |
| System type | 3AC |
| Profile | Power circuits |
| **Coupling devices** | |
| Coupling | none |
| **Time response** | |
| Start-up delay $T_{start-up}$ | 0 s |
| **Digital inputs** | |
| **Digital input 1** | |
| Mode (Operating mode) | Active high |
| Function | TEST |
| **Digital input 2** | |
| Mode (Operating mode) | Active low |
| Function | RESET |
| **Digital input 3** | |
| Mode (Operating mode) | Active high |
| Function | Deactivate device |

| Parameter | Value |
|---|---|
| **Digital outputs** | |
| **Digital output 1** | |
| Function 1 | off |
| Function 2 | off |
| Function 3 | off |
| **Digital output 2** | |
| Function 1 | off |
| Function 2 | off |
| Function 3 | off |
| **Switching elements** | |
| **Relay 1** | |
| Test | on |
| Operating mode | N/C operation |
| Function 1 | Ins. alarm 1 |
| Function 2 | Connection fault |
| Function 3 | off |
| **Relay 2** | |
| Test | on |
| Operating mode | N/C operation |
| Function 1 | Ins. alarm 2 |
| Function 2 | Device fault |
| Function 3 | Connection fault |
| **Interfaces** | |
| DHCP | off |
| IP address | 192.168.0.5 |
| Net mask | 255.255.255.0 |
| BCOM address | system-1-0 |
| Device address BS bus | 3 |

## 17.1 Tabular 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 ... III

Rated impulse voltage:

- IC1 / (IC2-5) ... 8 kV
- IC2 / (IC3-5) ... 4 kV
- IC3 / (IC4-5) ... 4 kV
- IC4 / IC5 ... 4 kV

Rated insulation voltage:

- IC1 / (IC2-5) ... 1000 V
- IC2 / (IC3-5) ... 250 V
- IC3 / (IC4-5) ... 250 V
- IC4 / IC5 ... 250 V

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

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

Protective separation (reinforced insulation) between:

- IC1 / (IC2-5) ... Overvoltage category III, 1000 V
- IC2 / (IC3-5) ... Overvoltage category III, 300 V
- IC3 / (IC4-5) ... Overvoltage categoryIII, 300 V
- IC4 / IC5 ... 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 $U_s$ ... 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 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 . . . 690 V

... DC 0 . . . 1000 V

... AC/DC 0 . . . 600 V (for UL applications)

Tolerance of $U_n$ ... AC/DC +15 %

Frequency range of $U_n$ ... DC, 1 . . . 460 Hz

Max. AC voltage $U_{\sim}$ in the frequency range $f_n$ = 1 . . . 10 Hz ... $U_{\sim\ max} = 38\ V/Hz^2 * (1 + f_n^2)$

### Response values

Response value $R_{an1}$ (alarm 1) ... 1 kΩ . . . 10 MΩ

Response value $R_{an2}$ (alarm 2) ... 1 kΩ . . . 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 $t_{an}$ at $R_F = 0.5 \times R_{an}$ ($R_{an}$ = 10 kΩ) and $C_e$ = 1 µF according to IEC 61557-8 ...

... profile dependent, typ. 4 s (see diagrams)

Response time DC alarm at $C_e$ = 1 µF ... profile dependent, typ. 2 s (see diagram)

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

Permissible extraneous DC voltage $U_{fg}$ ... ≤ 1200 V

Permissible system leakage capacitance $C_e$ ... profile dependent, 0 . . . 1000 µF

### Measuring ranges

Measuring range $f_n$ ... 10 . . . 460 Hz

Tolerance measurement of $f_n$ ... ±1 % ±0.1 Hz

Voltage range measurement of $f_n$ ... AC 25 . . . 690 V

Measuring range $U_n$ ... AC 25 . . . 690 V

... DC 25 . . . 1000 V

Voltage range measurement of $U_n$ ... AC/DC > 10 V

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, 30 . . . 460 Hz

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

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## Display

Indication ..... graphic display 127 x 127 pixels, 40 x 40 mm [2)]
Display range measured value ..... 0.1 kΩ . . . 20 MΩ

## LEDs

ON (operation LED) ..... green
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: 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 on X1 ..... max. 200 mA
Total max. supply output current via A1/A2 on X1 between 16,8 V and 40 V .....
..... $I_{LmaxX1} = 10mA + 7mA/V * U_s$ [3)]
..... (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
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)], 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 ..... ±20 %

## Interfaces

### Field bus:

Interface/protocol ..... web server/Modbus TCP/BCOM
Data rate ..... 10/100 Mbit/s, autodetect
Max. amount Modbus requests ..... < 100/s
Cable length ..... ≤ 100 m
Connection ..... RJ45
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 kBaud/s
Cable length ..... ≤ 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 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 / 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

Technical data

## Environment/EMC

EMC ..... IEC 61326-2-4 [5]
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

**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 ..... ≤ 10 A
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:**

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 [6]
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" 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
..... -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) ..... 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 CAT2 (300V) may be connected.
2) Indication limited outside the temperature range -25 . . . +55 °C.
3) $U_s$ [Volt] = supply voltage ISOMETER®
4) For $U_n \geq 50$ 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) 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.

## 17.2 Option "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.

*Combination of ISOMETER® sensor variant with FP200:*
*The requirements of Option "W" will only be fulfilled when the ISOMETER® sensor variant is mounted on DIN rail and connected to the FP200 via the patch cable.*
*Refer also to the quick-start guide FP200 (Document number D00169).*

Technical data

## 17.3 Standards and certifications

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

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## 17.4 Ordering details

| Type | Supply voltage $U_S$ | Art. No. |
|---|---|---|
| iso685-D | AC 24…240 V; 50…400 Hz<br>DC 24…240 V | B91067010 |
| iso685W-D* | AC 24…240 V; 50…400 Hz<br>DC 24…240 V | B91067010W |
| Combination<br>iso685-S + FP200 | AC 24…240 V; 50…400 Hz<br>DC 24…240 V | B91067210 |
| Combination<br>iso685W-S + FP200W* | AC 24…240 V; 50…400 Hz<br>DC 24…240 V | B91067210W |

* Option "W": Increased shock and vibration resistance 3K5, 3M7; -40…+70 °C

### Accessories

| Description | Art. No. |
|---|---|
| iso685 Mechanical accessories comprising:<br>Terminal cover and 2 mounting clips* | B91067903 |
| iso685 Plug kit, screw terminals* | B91067901 |
| iso685 plug kit, with push-wire terminals | B91067902 |
| Transparent cover 144x72 (IP65) for FP200 ** | B98060005 |

* included in the scope of delivery
** 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. |
|---|---|---|
| Suitable measuring instruments<br>SKMP**: 28 kΩ,120 kΩ<br>Current values: 0…400 µA, 0…20 mA<br>(additonal information here) | 7204-1421 | B986763 |
| | 9604-1421 | B986764 |
| | 9620-1421 | B986841 |
| Display for front plate mounting | FP200 | B91067904 |
| | FP200W | B91067904W |
| iso685-S<br>(only in combination with FP200) | Supply voltage:<br>AC 24…240 V; 50…400 Hz<br>DC 24…240 V | B91067110 |
| iso685W-S*<br>(only in combination with FP200) | Supply voltage:<br>AC 24…240 V; 50…400 Hz<br>DC 24…240 V | B91067110W |

* Option "W": Increased shock and vibration resistance 3K5, 3M7; -40…+70 °C
** SKMP = midscale point

# 18. Glossary

| | |
|---|---|
| • BCOM | Protocol for communication between Bender devices via an IP-based network. |
| • BS bus | The Bender sensor bus is an interface which enables Bender devices to communicate with each other (RS-485 interface). |
| • DHCP | Dynamic Host Configuration Protocol. It is used to assign the network configuration to Clients via a server. |
| • Modbus TCP | Modbus is an international widely spread protocol for data transfer. |
| • System (BCOM) | The system is the entire installation that is visible for the customer and defined by the customer. The BCOM communication takes place within this system. Naturally, different systems can exist independently in one network. |
| • Subsystem (BCOM) | The subsystem structures parts of the system as units defined by the customer, e.g. all PQ devices. A typical subsystem are also "non BCOM-capable" devices that are hidden behind a proxy. |
| • Web server | A web server presents the device functions graphically. The web server can be used for reading out measured values and for parameter setting. |

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