EN Manual

BENDER
The Power in Electrical Safety©

ISOMETER® iso685-D

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

iso685-D_D00022_02_M_XXEN/10.2014

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

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Table of contents

1.1 Explanation of symbol and notes

This manual is intended for qualified personnel working in electrical engineering and electronics!
To make it easier for you to understand and revisit certain sections of text and instructions in this manual, we have used symbols to identify important instructions and information.

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

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

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

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

1.2 Intended use

The ISOMETER® iso685-D 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 U_n 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.
Any other use than that described in this manual is regarded as improper. The Bender companies shall not be liable for any losses or damage resulting from improper use. Intended use implies:

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

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.

As a basic principle, our "General Conditions of Sale and Delivery" shall apply. At the latest, these shall be available to the operator when the contract is concluded.

1.3 Warranty and liability

Warranty and liability claims in the event of injury to persons or damage to property are excluded if they can be attributed to one or more of the following causes:

- Use of the ISOMETER® other than for its intended purpose
- Incorrect assembly or installation, commissioning, operation and maintenance of the ISOMETER®
- Non-observance of instructions in this operating manual regarding transport, commissioning, operation and maintenance of the ISOMETER®
- Unauthorised changes to the ISOMETER® made by parties other than the manufacturer
- Non-observance of technical data. Repairs carried out incorrectly and the use of replacement parts or accessories not approved by the manufacturer
- Disasters and force majeure
- Assembly and installation with device combinations not recommended by the manufacturer

This operating manual, especially the safety instructions, must be observed above all by personnel who work on the ISOMETER®. In addition, the rules and regulations that apply for accident prevention at the place of use must be observed.

1.3.1 Personnel

Only appropriately qualified personnel may work with the ISOMETER®. Personnel who are familiar with the assembly, commissioning and operation of the product and have undergone appropriate training are considered qualified. Personnel must have read this manual and understood all instructions relating to safety.

1.3.2 About the operating manual

This manual has been compiled with great care. It may nevertheless contain errors and mistakes. Bender cannot accept any liability for injury to persons or damage to property resulting from errors or mistakes in this manual.

1.3.3 Hazards when handling the ISOMETER® iso685-D

The ISOMETER® iso685-D is built in accordance with state-of-the-art technology and accepted recognised safety regulations. However, the use of such devices may introduce risks to the life and limb of the user or third parties and/or result in damage to the ISOMETER® or other property.
Only use the ISOMETER®:

- As intended
- In perfect working order

Immediately rectify any faults that may endanger safety. Do not make any unauthorised changes and only purchase spare parts and optional accessories recommended by the manufacturer of the devices. Failure to observe this requirement can result in fire, electric shock and injury.
Unauthorised persons must not have access to or contact with the ISOMETER®.
Reference signs must always be clearly legible. Replace damaged or illegible signs immediately.

1.3.4 Inspection, transport and storage

Inspect the dispatch packaging and equipment packaging for damage, and compare the contents of the package with the delivery documents. In the event of damage in transit, please inform the Bender company immediately.
The devices must only be stored in areas where it is protected from dust, damp and spray or dripping water, and in which the specified storage temperatures can be assured.

1.3.5 Note

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 proper connection of the device, a functional test has to be carried out before starting the system.
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®.

2.1 Features

- ISOMETER® for IT AC systems with galvanically connected rectifiers or inverters and for IT DC systems (IT = unearthed systems).
- The nominal voltage range U_n can be extended via coupling devices.
- Automatic adaptation to the existing system leakage capacitance.
- Combination of AMP*Plus** and other profile-specific measurement methods.
- Two separately adjustable response ranges of 1 kΩ…10 MΩ for Alarm1 and Alarm2.
- High-resolution graphic LC display for excellent readability and recording of the device status.
- Connection monitoring (monitoring of the measuring lines).
- Automatic device self test.
- Graphical representation of the insulation resistance over time (isoGraph).
- History memory with real-time clock (buffer for three days) for storing 1023 alarm messages with date and time.
- Current and voltage output 0(4)…20 mA, 0…400 µA, 0…10 V, 2…10 V (galvanically separated) which is analogous to the measured insulation value of the system.
- Freely programmable digital inputs and outputs.
- Remote setting of certain parameters via Internet (Option; COMTRAXX® Gateway).
- Worldwide remote diagnosis via Internet (made available by Bender Service only).
- RS-485/BMS (Bender Measuring Device Interface) for communication with other Bender devices.

2.2 Product description

The ISOMETER® iso685-D is an insulation monitoring devices for IT systems in accordance with IEC 61557-8. It is universally applicable in AC, 3(N)AC, AC/DC and DC systems. AC systems may include extensive DC-supplied loads (such as rectifiers, inverters, variable-speed drives).

2.3 Description of function

The insulation monitoring device iso685-D 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,

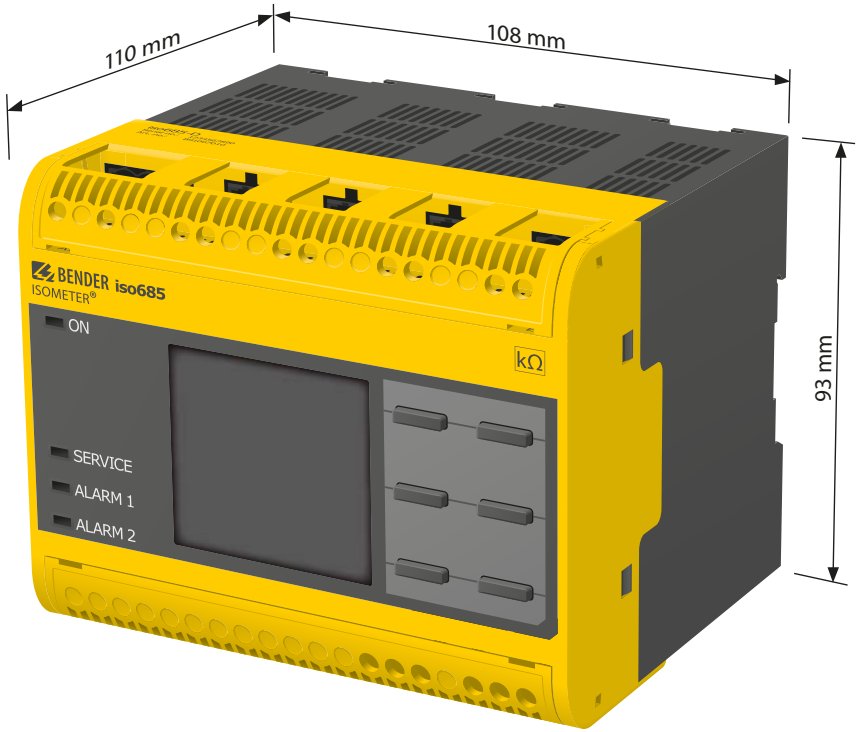
which can be selected from a setup menu allow optimum adaptation of the measurement technique to the specific application.

If the preset response value falls below the value of Alarm1 and/or Alarm2, the associated alarm relays switch, the ALARM 1 or ALARM 2 LED lights and the measured value is shown on the LC display (in the case of insulation faults in DC systems, a trend graph for the faulty conductor L+/L- is displayed). If the fault memory is activated, the fault message will be stored. Pressing the RESET button, resets the insulation fault message provided that the 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. Poor signal quality (1-2 bars) may be an indication that the wrong measurement profile has been selected.

2.4 Self test

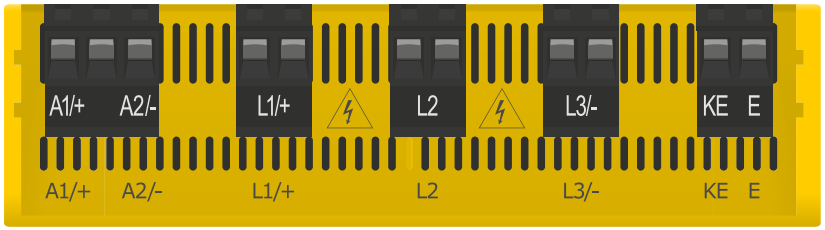
After switching on the supply voltage, the ISOMETER automatically and continuously checks all internal measuring functions, the components of the process control such as the data and parameter memory, as well as the connections to the IT system and earth.
When a device error is detected, the SERVICE LED lights. In the case of a connection fault, the ALARM 1 or ALARM 2 LED flashes. In both cases, the respective message will be indicated on the display and a previously programmed output will provide the respective signal.
A manual self test can also be activated by means of the TEST button to check the functions of the relays (depending on the configuration). 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 and the measured value at the time will be displayed after the measuring time has expired. The display shows the message `Initial measurement` until the first valid value is measured.

3.1 Dimensions



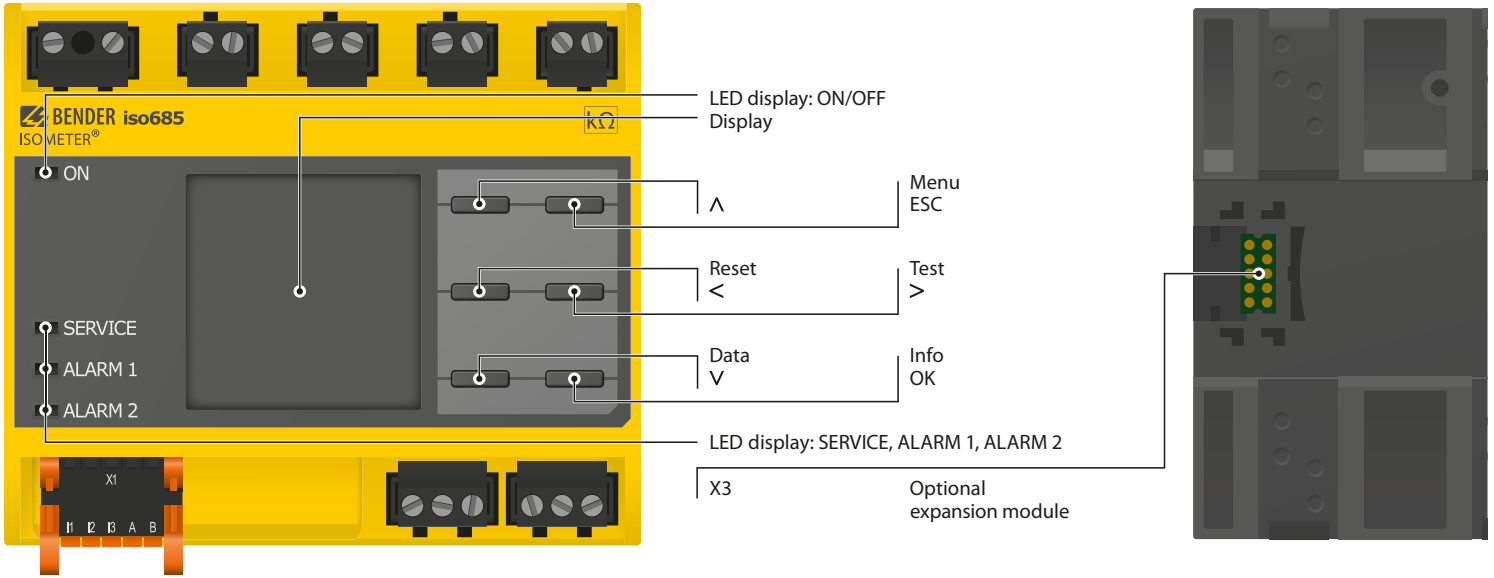
3.2 Connections and panel

Top

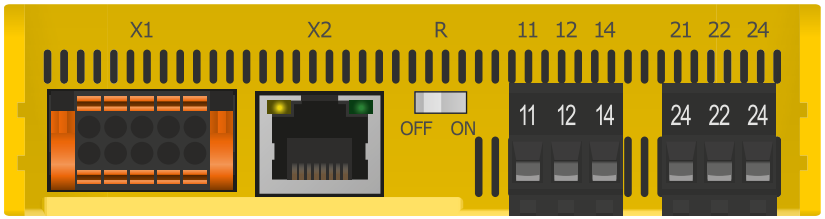


A1/+, A2/-	Connection to the power supply voltage U_s
L1/+	Connection to the monitored IT-Systems
L2	Connection to the monitored IT-Systems
L3/-	Connection to the monitored IT-Systems
KE, E	Connection to PE

Front



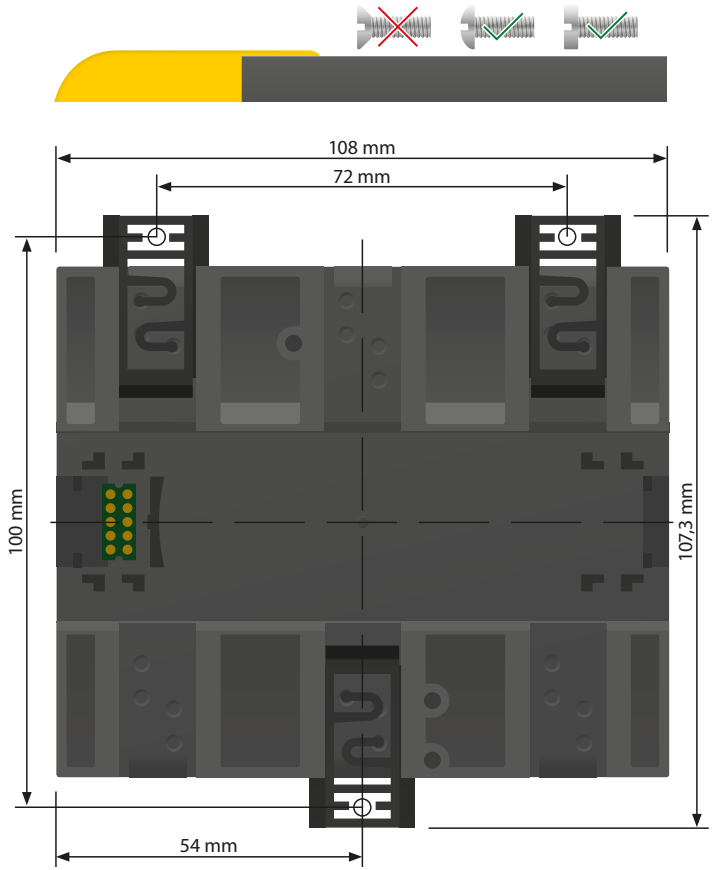
Bottom



X1	Digital interface
X2	Ethernet interface
R	Selectable resistance R
11 12 14	Connector for Alarm relay 1
21 22 24	Connector for Alarm relay 2

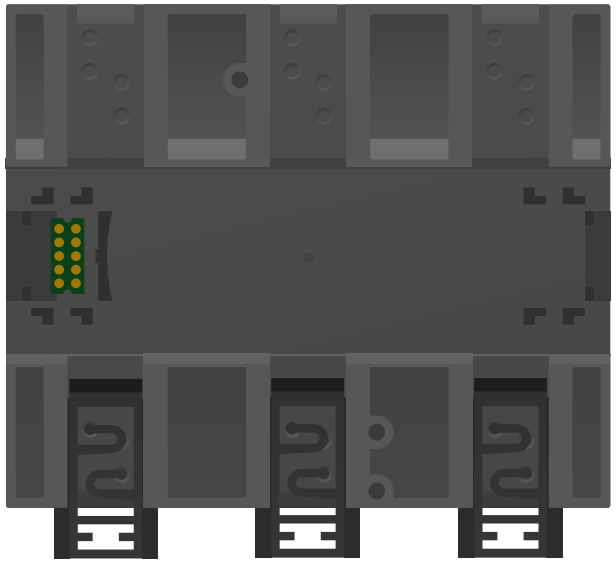
4.1 Screw mounting

1. Fix the three mounting clips delivered with the device (two of them packed separately) manually or using a tool, as illustrated below.
2. Drill the mounting holes for the M4 thread according to the dimensioned drilling template.
3. Fix the ISOMETER® iso685-D using three M4 screws.



4.2 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® iso685-D onto the DIN rail until it snaps into place.



5.1 Connection conditions

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

DANGER

Danger of electric shock!
Nominal voltages up to 1000 V may be present on terminals L1/+ to L3/- which can be lethal if direct contact is made. Make sure the terminal covers are properly mounted and clicked in before you use the device.

DANGER

Danger of electric shock!
High voltage is applied to the terminals which can be lethal if direct contact is made. If the device is connected via terminals L1/+, L2, L3/- to an IT system that is live for operational reasons, terminals KE and E must not be disconnected from the protective earth conductor (PE).

WARNING

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

CAUTION

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

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.

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

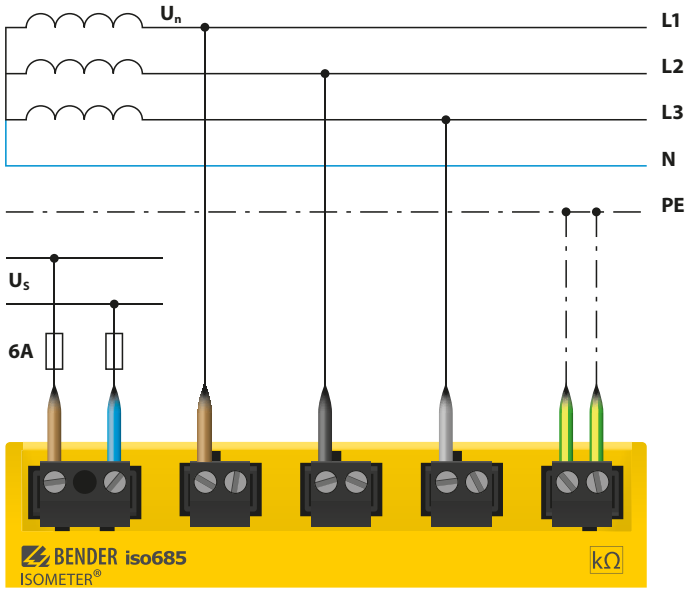
Check proper connection!
Prior to commissioning of the installation, check that the device has been properly connected and check the device functions. Perform a functional test using an earth fault via a suitable resistance.

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.

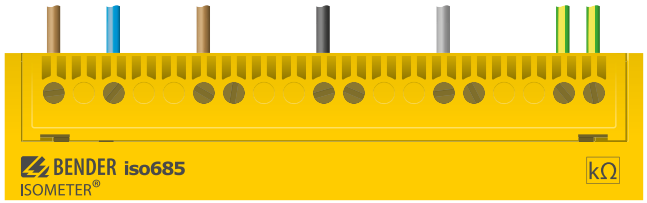
5.2 Connection to a 3(N)AC system/system type 3AC

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 and 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.



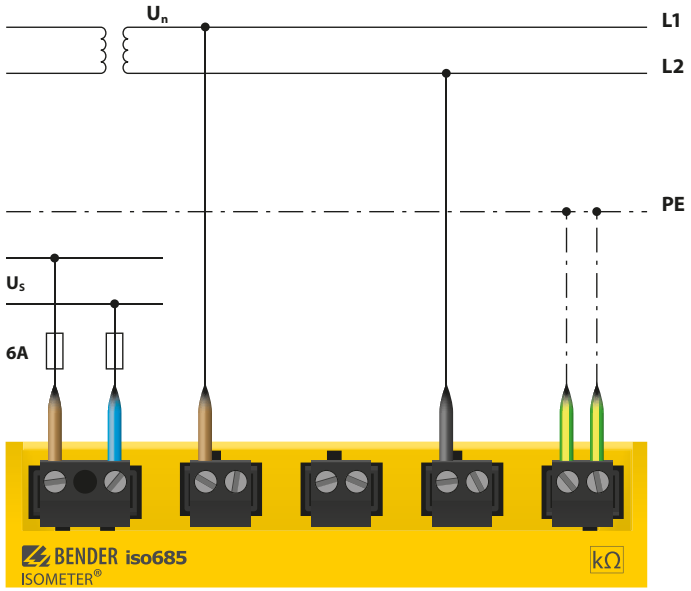
Position the terminal cover and click it into place.



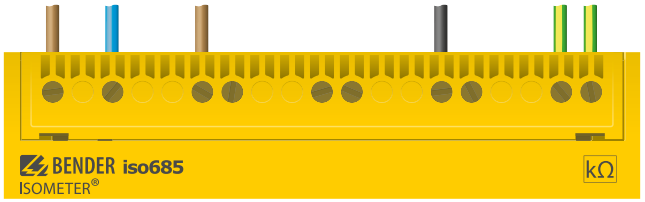
5.3 Connection to an AC system/system type AC

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 and 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.



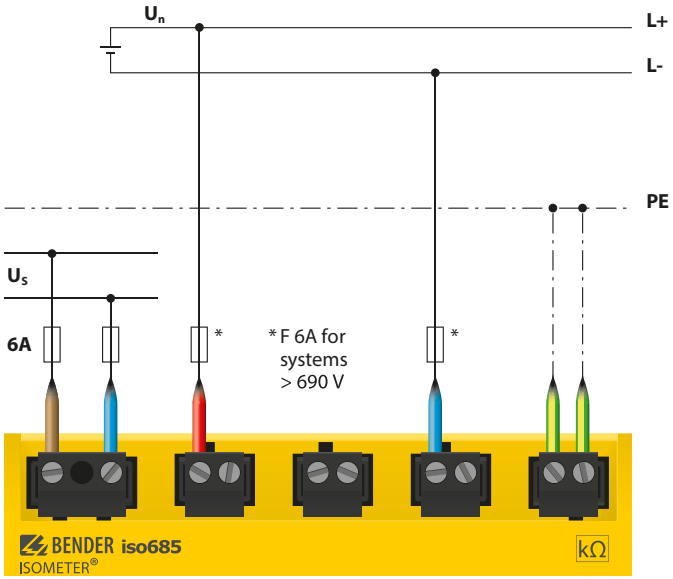
Position the terminal cover and click it into place.



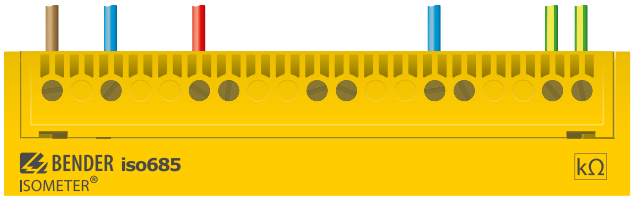
5.4 Connection to a DC system/system type DC

WARNING

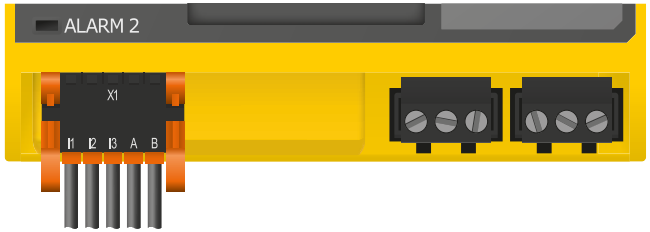
Risk of injury, fire and damage to property due to a short-circuit!
According to DIN VDE 0100-430, devices used to protect against a short circuit when terminals L1/+, L2 and L3/- are coupled to the IT system to be monitored can be omitted if the wiring is carried out in such a manner as to reduce the risk of a short-circuit to a minimum. Ensure short-circuit-proof and earth-fault-proof wiring.

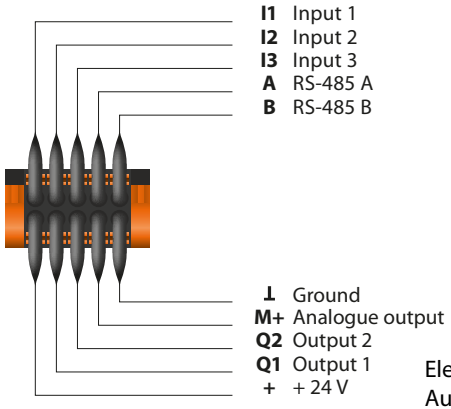


Position the terminal cover and click it into place.



5.5 Connection to the X1 interface



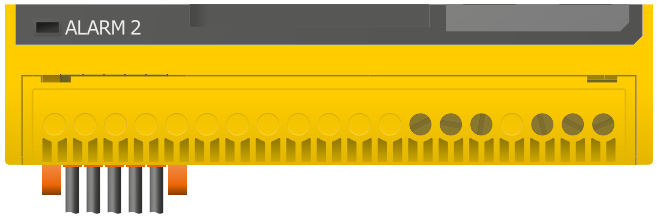


I1 Input 1
I2 Input 2
I3 Input 3
A RS-485 A
B RS-485 B

⊥ 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.

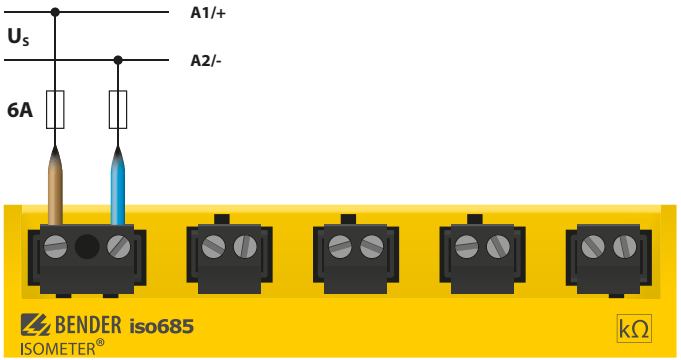


5.6 Connection to the power supply voltage

5.6.1 Connection to A1/+, A2/-

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.



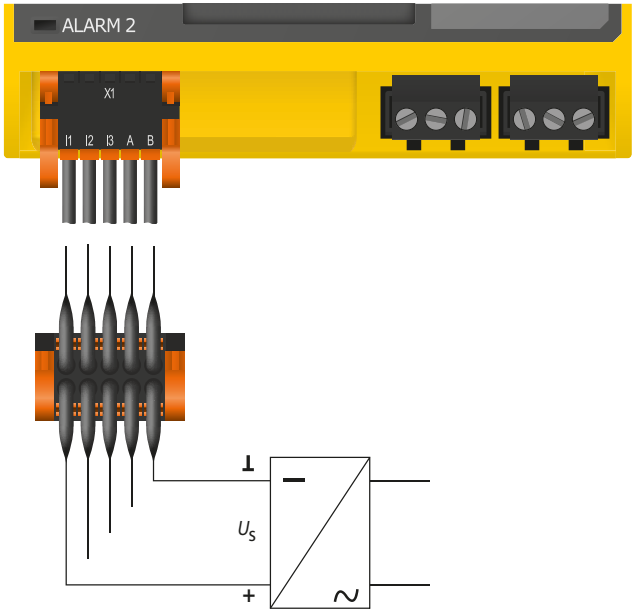
5.6.2 Connection to X1

CAUTION

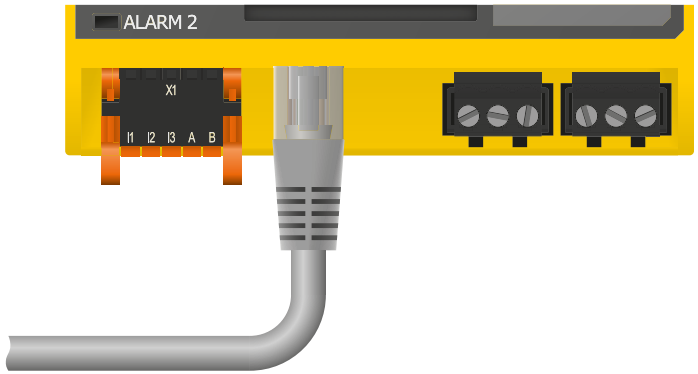
Danger of damage to property due to faulty connections!
The device can be damaged if the unit is simultaneously connected to the supply voltage via the X1 interface, and A1/+ and A2/- terminals. Do not connect the device simultaneously via X1, and A1/+ and A2/- to different supply voltages.

CAUTION

Danger of damage to property due to incorrect nominal voltage!
When the device is powered via the X1 interface, the nominal voltage must be 24 V otherwise the unit may be damaged. Only connect a nominal voltage of 24 V to the X1 interface.



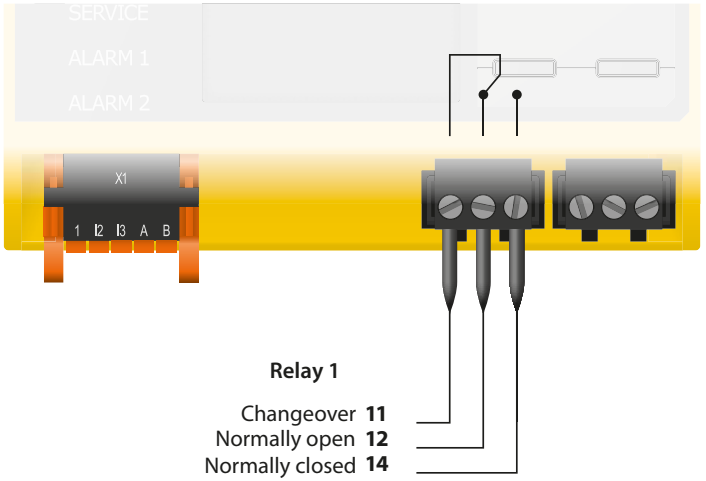
5.7 Connection to the Ethernet interface



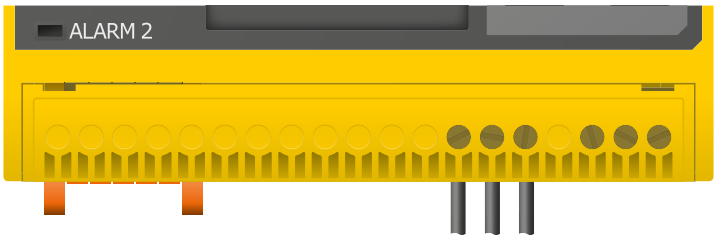
The Ethernet interface connection is only available for Bender Service.

Position the terminal cover and click it into place.

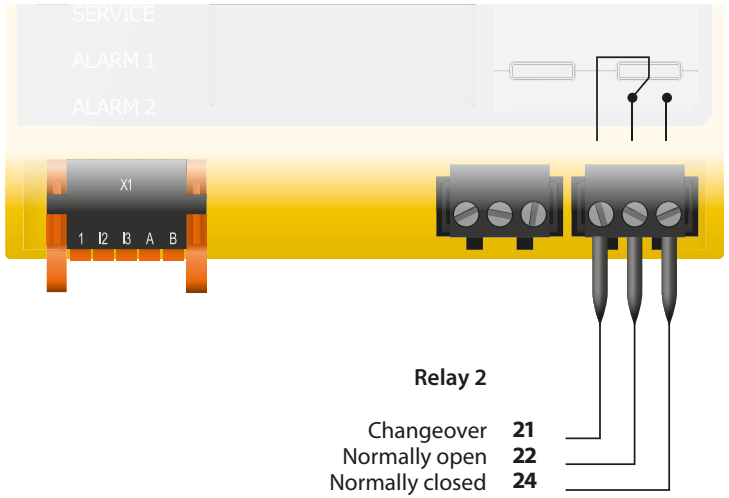
5.8 Connection to the relay 1 interface (11 12 14)



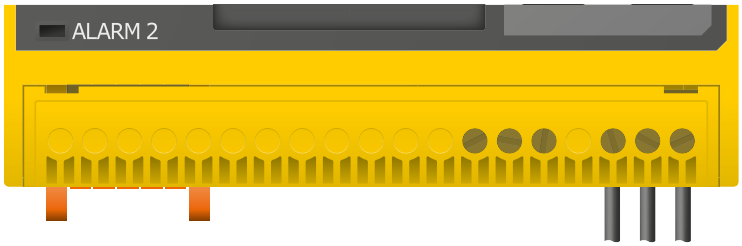
Position the terminal cover and click it into place.



5.9 Connection to the relay 2 interface (21 22 24)

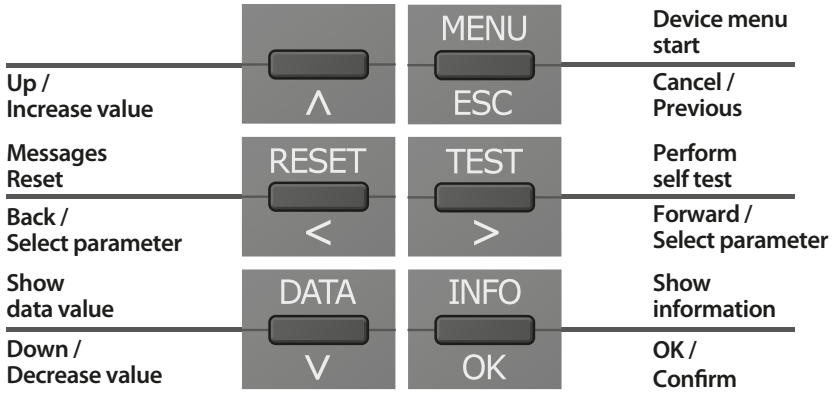


Position the terminal cover and click it into place.



6.1 Device buttons

You can adjust the settings at the device using the menu buttons in the respective menu. Depending on the menu entry, one of the options displayed below are assigned to the buttons. The individual functions are:



6.2 General intitial commissioning process

1. Check that the ISOMETER® iso685-D has been properly connected to the system to be monitored.
2. Connect the supply voltage to the ISOMETER® iso685-D. Adjust the device using the commissioning wizard. Then 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.
3. Check the ISOMETER® iso685-D in the system being monitored, e.g. using a suitable resistance against earth.

Take the status of the device into account!
The device is in the 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.

6.3 Initial commissioning

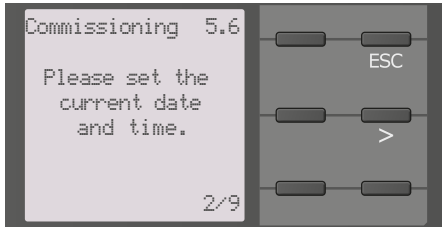
Follow the commissioning wizard instructions on the display.

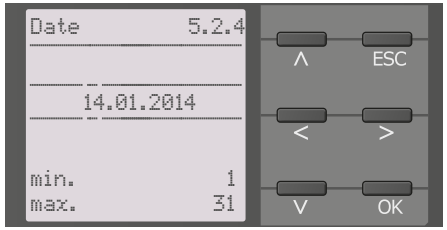
6.3.1 Set language

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

6.3.2 Set time and date

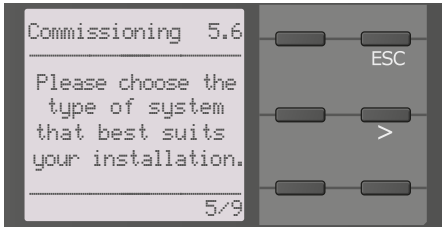
Alarm messages in the history memory and the insulation resistance value over time can only be assigned correctly to the isoGraph when the date and time are set correctly.

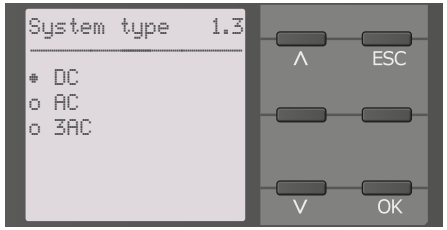




6.3.3 Set system type

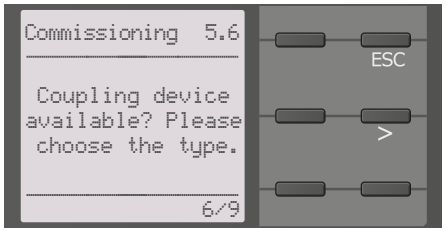
By setting the system type the insulation monitoring device can be optimally adapted to the system to be monitored. The system type is essential information for the insulation monitoring device in order to determine the insulation resistance correctly.

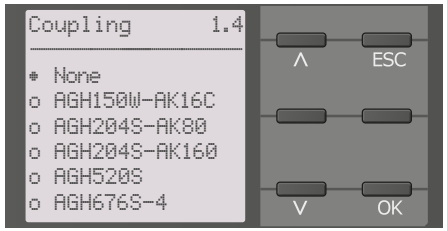




6.3.4 Select a coupling device

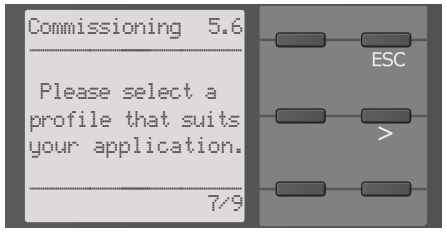
A coupling device connected to the insulation monitoring device (to increase the nominal system voltage) must be programmed here. The measurement of the insulation resistance takes into account the parameters of the connected coupling device. If no coupling device is available, press OK

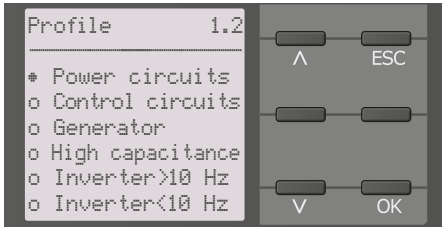




6.3.5 Set profile

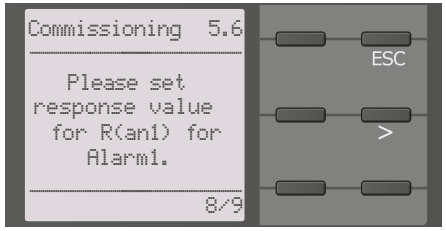
In order to adapt the insulation monitoring device optimally to the system to be monitored, you can select a profile here that suits your system. For an overview of the profiles refer to "Profile overview" on page 32. The profile **Power circuits** is suitable for most IT systems.

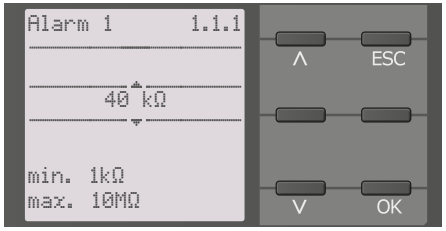




6.3.6 Set response value R_{an1} for Alarm 1

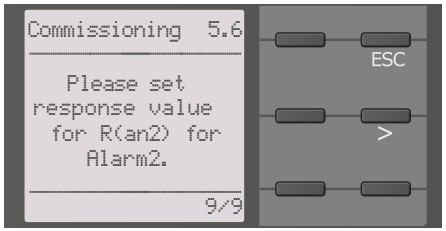
You can set the prewarning response value here.
A value of 100 Ω/V is recommended for prewarning





6.3.7 Set response value R_{an2} for Alarm 2

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



6.4 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. You can start the commissioning wizard using the menu path:

Menu/Device settings/Commissioning

This menu can be used to modify settings made previously.

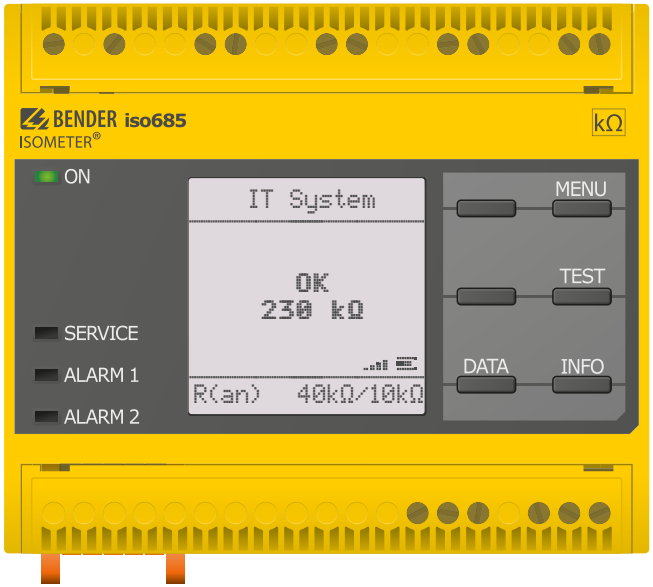
Take the status of the device into account!
The device changes from the alarm state to normal state after completing the initial commissioning and initial measurement by adhering to the response values set.

7.1 Standard display

In normal operation the ISOMETER® iso685-D displays the message **OK** and below it the most recent measured insulation resistance.

	The signal quality of the measurement suits the selected profile.
	The signal quality of the measurement does not suit the selected profile. Select a suitable profile.
	Update period between the test pulses

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



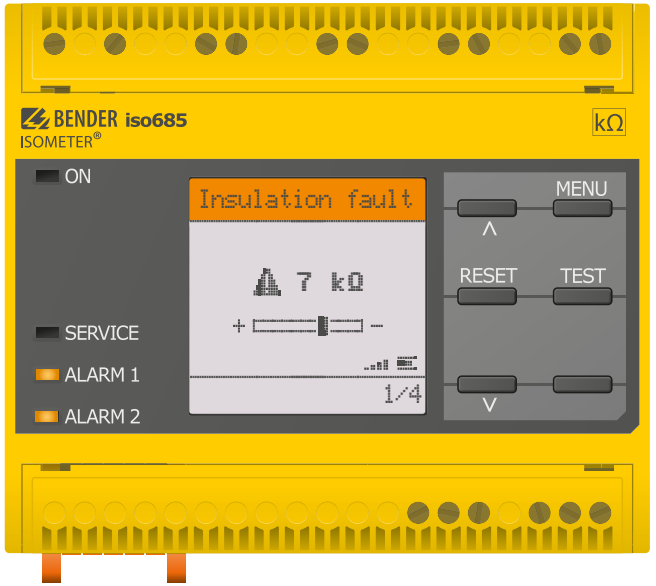
7.2 Fault display (active)

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 still outside the set response values, ALARM 1 and ALARM 2 are triggered.

If there are several fault messages, you can navigate through the faults using the ∨ and ∧ button.



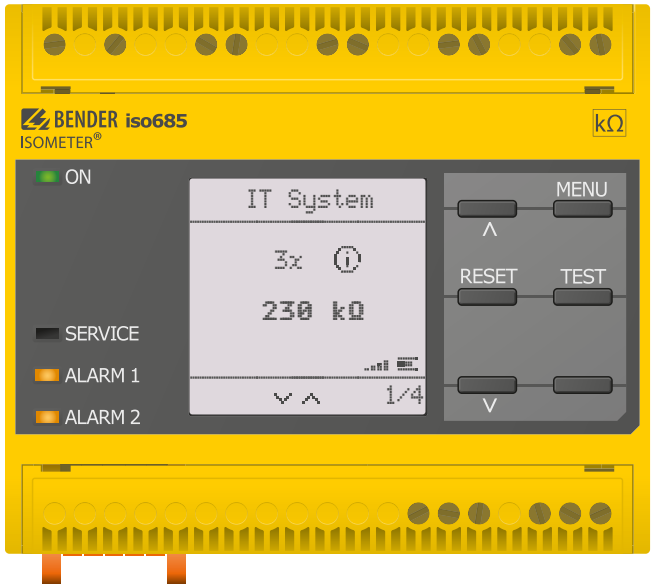
If the value falls below R_{an1} in a DC system or a DC shift is recognised in an AC system, detailed information regarding the DC shift will be displayed, as illustrated above.

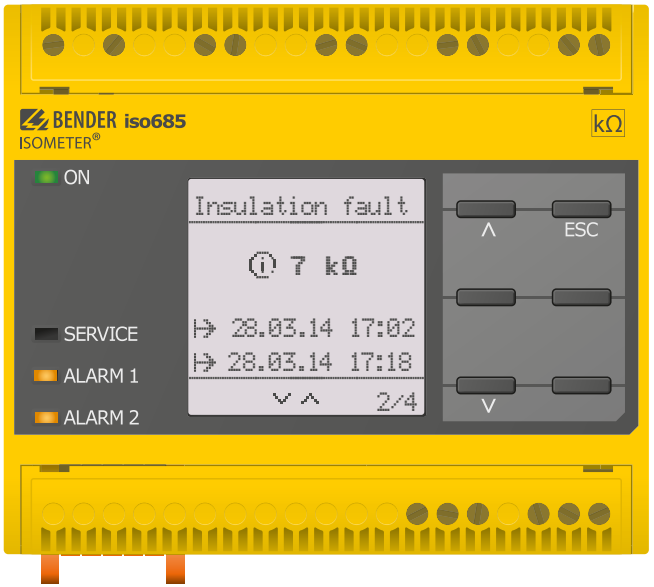
7.3 Fault display (inactive)

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, you can navigate through the faults using the ∨ and ∧ button. In addition to the type of fault and the associated alarm value, you can see when the fault has occurred and how long it has been active.

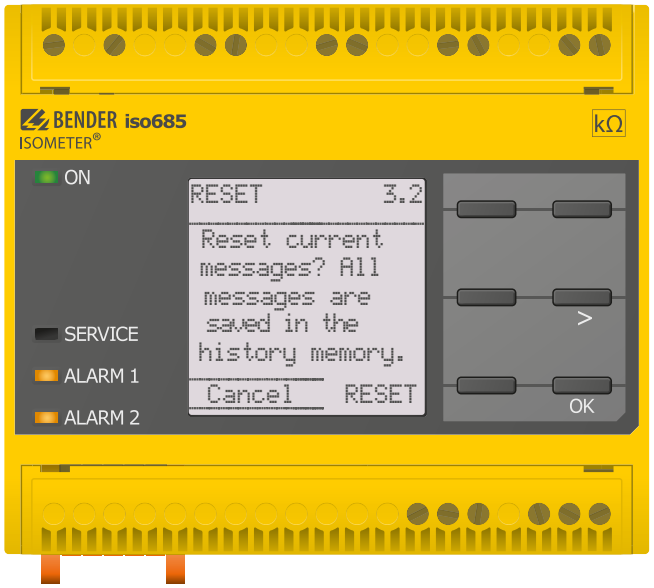


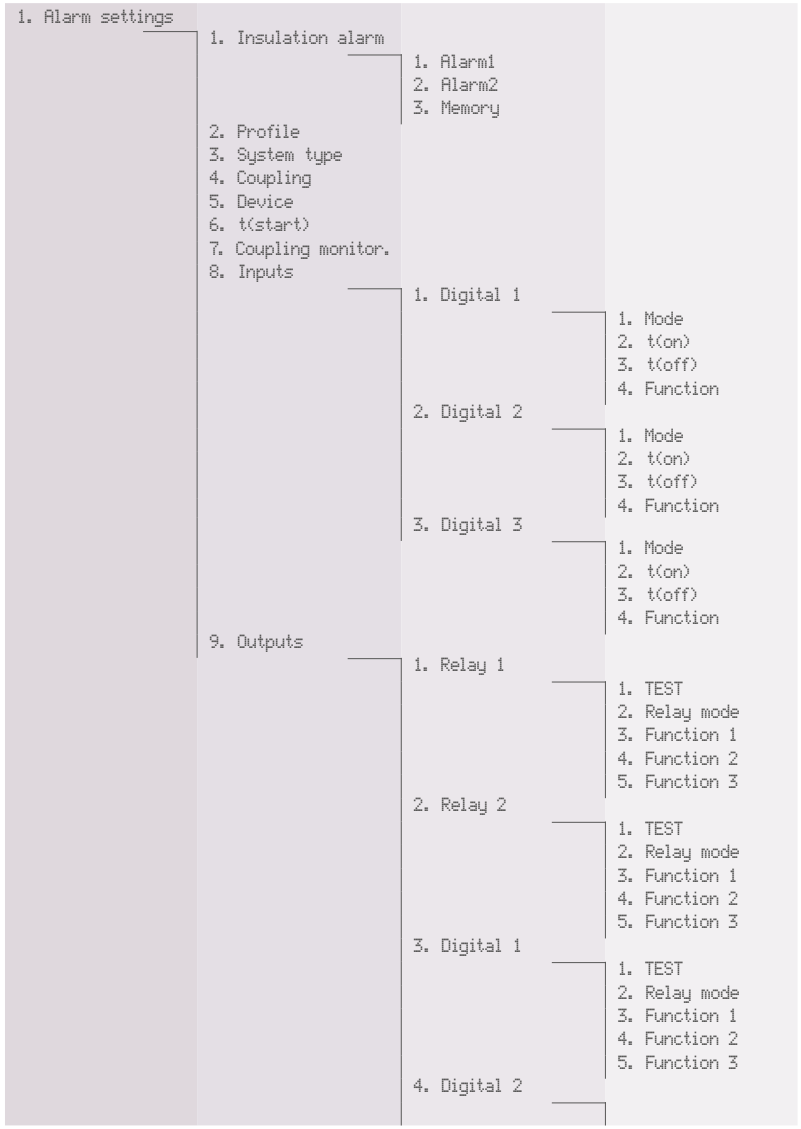


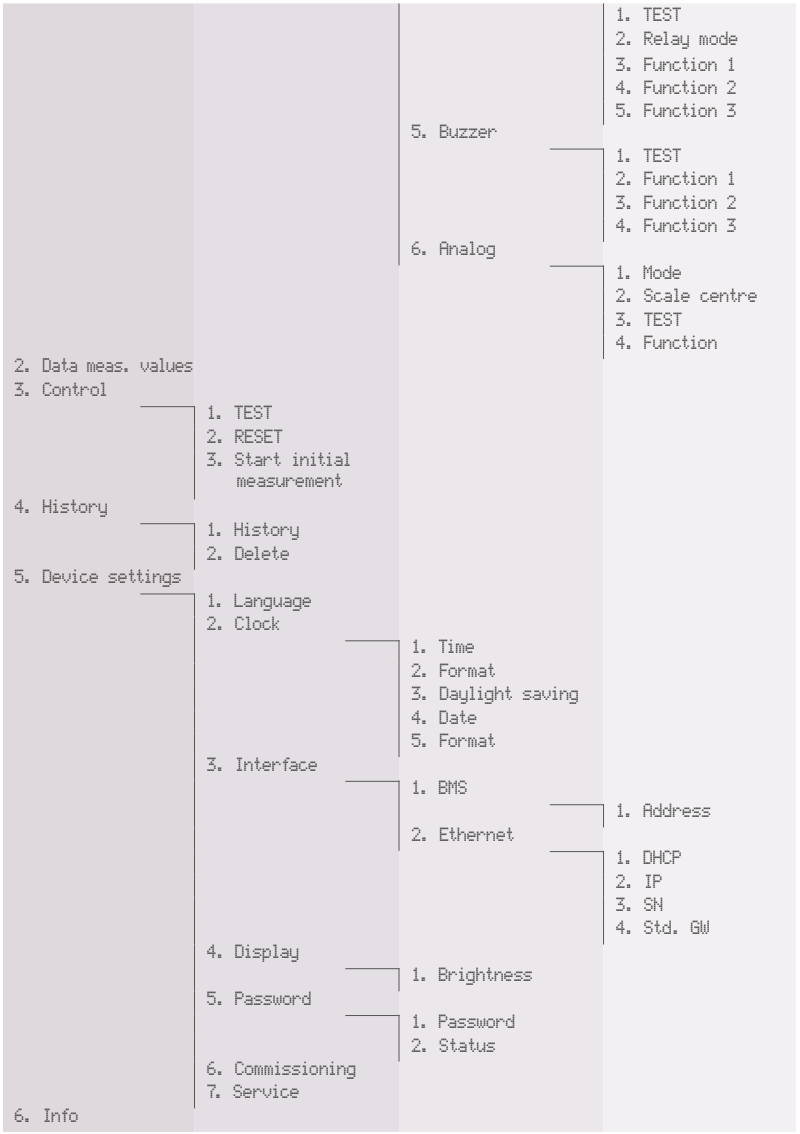
7.4 Clear fault memory

In order to acknowledge the fault message and to return to the iso685-D 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® iso685-D then returns to the standard display.




1. Alarm settings
1. Insulation alarm
1. Alarm1
2. Alarm2
3. Memory
2. Profile
3. System type
4. Coupling
5. Device
6. t(start)
7. Coupling monitor.
8. Inputs
1. Digital 1
1. Mode
2. t(on)
3. t(off)
4. Function
2. Digital 2
1. Mode
2. t(on)
3. t(off)
4. Function
3. Digital 3
1. Mode
2. t(on)
3. t(off)
4. Function
9. Outputs
1. Relay 1
1. TEST
2. Relay mode
3. Function 1
4. Function 2
5. Function 3
2. Relay 2
1. TEST
2. Relay mode
3. Function 1
4. Function 2
5. Function 3
3. Digital 1
1. TEST
2. Relay mode
3. Function 1
4. Function 2
5. Function 3
4. Digital 2


1. TEST
2. Relay mode
3. Function 1
4. Function 2
5. Function 3
5. Buzzer
1. TEST
2. Function 1
3. Function 2
4. Function 3
6. Analog
1. Mode
2. Scale centre
3. TEST
4. Function
2. Data meas. values
3. Control
1. TEST
2. RESET
3. Start initial measurement
4. History
1. History
2. Delete
5. Device settings
1. Language
2. Clock
1. Time
2. Format
3. Daylight saving
4. Date
5. Format
3. Interface
1. BMS
1. Address
2. Ethernet
1. DHCP
2. IP
3. SN
4. Std. GW
4. Display
1. Brightness
5. Password
1. Password
2. Status
6. Commissioning
7. Service
6. Info

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 iso685-D ISOMETER® user profile. A device password is required for entering the settings. You can adjust the following functions:

1.1 Insulation alarm

In the **Insulation alarm** menu you can set the iso685-D ISOMETER® limit values for ALARM 1 and ALARM 2:

1.1.1 ALARM 1

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

1.1.2 ALARM 2

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

1.1.3 Fault memory

Automatic reset of inactive faults at the outputs of 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.

1.2 Setting

Adapt the applicabilty of the ISOMETER® iso685-D to your system profile. For a description of the profiles refer to "Profile overview" on page 32.
You may select:

•Power circuits	Suitable for most IT systems.
•Control circuits	Not recommended for voltages >230 V.
•Generator	
•High capacitance	
•Inverter >10 Hz	
•Inverter <10 Hz	

1.3 System type

Adapt the ISOMETER® iso685-D to the IT system to be monitored. You may select:

•DC

•AC

•3AC

1.4 Coupling

Adapt the ISOMETER® iso685-D to the requirements of Bender coupling devices. For a description about the connection of coupling devices refer to "Coupling devices" on page 38. You may select:

•None

•AGH150W-AK160

•AGH204S-AK80

•AGH204S-AK160

•AGH520S

•AGH676S-4

1.5 Device

Set the iso685-D ISOMETER®'s 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!

1.6 T(Start)

The ISOMETER® iso685-D can be operated with a startup delay of 0…120 seconds. The startup is delayed until the first measurement is taken.

1.7 Coupling monitoring

The ISOMETER® iso685-D 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.

1.8 Inputs

The ISOMETER® iso685-D provides a total of three inputs.

1.8.1 Digital 1

The following parameters can be set for the digital input:

1.8.1.1 Mode

The operating mode for the digital input can be set to the following values. For a description of the operating modes refer to "Digital input mode" on page 33. You may select:

*active high

*active low

1.8.1.2 t(on)

The response time t(on) after a switch-off signal can be set between 100 milliseconds and 300 seconds. For a description of the operating modes refer to "Digital input mode" on page 33.

1.8.1.3 t(off)

The response time t(off) after a switch-off signal can be set between 100 milliseconds and 300 seconds. For a description of the operating modes refer to "Digital input mode" on page 33.

1.8.1.4 Function

The parameters for the digital input functions of the ISOMETER® iso685-D 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. The IT system is NOT being monitored!
*Start initial measurement	All recorded measurements are discarded and a new measurement will be started

1.8.2 Digital 2

See Digital 1 under 1.8.1

1.8.3 Digital 3

See Digital 1 under 1.8.1

1.9 Outputs

The ISOMETER® iso685-D provides a total of six outputs:.
The following parameters can be set for the outputs:

1.9.1 Relay 1

The following parameters can be set for each relay:

1.9.1.1 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 relay's switching function
•off	The manual test does not check the relay's switching function

1.9.1.2 Relay mode

The relay mode can be adapted to the application:

•N/C	Normally closed- N/C operation contacts 11-12-14 / 21-22-24 (The alarm relay is energised in normal operation).
•N/O	Normally open - N/O operation contacts 11-12-14 / 21-22-24 (The alarm relay is de-energised in normal operation).

1.9.1.3 Function 1

Select the appropriate setting for function 1. The following parameters can be set. For a detailed functional description refer to "Description of the output functions" on page 34:

- •off
- •Iso. Alarm 1
- •Iso. Alarm 2
- •Connection fault
- •DC- Alarm
- •DC+ Alarm
- •Symmetrical alarm
- •DeviceError
- •Common alarm
- •Measurement ended
- •Device inactive

1.9.1.4 Function 2

See function 1 under 1.9.1.3

1.9.1.5 Function 3

See function 1 under 1.9.1.3

1.9.2 Relay 2

See relay 1 under 1.9.1

1.9.3 Digital 1

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

1.9.3.1 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.

1.9.3.2 Mode

The operating mode for the digital output can be set to the following values. For a detailed functional description refer to “Digital output mode” on page 34:

*Active

*Passive

1.9.3.3 Function 1

See Function 1 under 1.9.1.3

1.9.3.4 Function 2

See Function 1 under 1.9.1.3

1.9.4 Digital 2

See Digital 1 under 1.9.3

1.9.5 Buzzer

The following parameters can be set for the buzzer:

1.9.5.1 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.

1.9.5.2 Function 1

See Function 1 under 1.9.1.3

1.9.5.3 Function 2

See Function 1 under 1.9.1.3

1.9.5.4 Function 3

See Function 1 under 1.9.1.3

1.9.6 Analogue

The following parameters can be set for the analogue output:

1.9.6.1 Mode

The operating mode for the analogue output can be set to the values listed below. For a detailed functional description refer to “Description of the analogue output” on page 35:

*0–20 mA

*4–20 mA

*0–400 µA

*0–10 V

*2–10 V

1.9.6.2 Midscale

Select the appropriate midscale. The parameters below can be set. For a detailed description refer to “Description of the analogue output” on page 35.

*linear

*28 kΩ

*120 kΩ

1.9.6.3 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.

1.9.6.4 Function

Select the appropriate setting for Function 3. The following parameters can be set. For a detailed description refer to "Function" on page 36.

•Insulation value

•DC shift

2.0 Data measured values

The ISOMETER® iso685-D stores certain measured values for a specific period of time. You can view these data in the **Data meas. value** menu. Navigate through the different views using the ^ and v buttons:

•Data – isoGraph	Displays the insulation resistance and chronological sequence. See "Data-isoGraph" on page 31.
•Data – Insulation	Displays the actual insulation resistance, the minimum insulation resistance measured R_{min}, and the system leakage capacitance.
•Data – IT system	Displays the system phase-to-phase voltages and the system frequency.
•Data – IT system	Displays the system phase-to-earth voltages.

3.0 Control

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

•TEST	Manual device test.
•RESET	Reset of fault and alarm messages.
•Start initial measurement	All previously recorded measurements are discarded and a new measurement will be started.

4.0 History

In the history menu, the faults detected by the ISOMETER® iso685-D are displayed. For a detailed functional description refer to "History memory" on page 31:

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

5.0 Device settings

The device settings menu allows you to configure the basic settings for the ISOMETER® iso685-D:

5.1 Language

Choose the language to be displayed by the ISOMETER® iso685-D.

*Deutsch

*English

*...

5.2 Clock

In the clock menu you can set the display format of time and date for the ISOMETER® iso685-D:

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).

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.

5.2.3 Daylight saving

Summer time can be considered in the following settings:

*off	No automatic change between summer time and standard time.
*DST	Daylight Saving Time Automatic change between summer and standard time according to North American regulation. 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 1 hour from 3:00 to 2:00.
*CEST	Central European Summer Time Automatic change between summer and standard time according to Central European regulation. Central European summer time begins on each last Sunday in March at 02:00 Uhr 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 1 hour from 3:00 to 2:00.

5.2.4 Date

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

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

5.3 Interface

Set the parameters for connection of other devices to the ISOMETER® iso685-D in the interface menu:

5.3.1 BMS

Set the parameters for communication with other devices via the BMS.

5.3.1.1 Address

Select an address between 1 and 90 for the BMS.

5.3.2 Ethernet

Set the parameters for communication with other devices via the Ethernet interface.

5.3.2.1 DHCP

Decide whether you want to use the DHC protocol:

*on

*off

5.3.2.2 IP

Set the appropriate IP address.

5.3.2.3 SN

Set the appropriate subnetmask.

5.3.2.4 Std. GW

If you use a standard gateway, enter the address here.

5.4 Display

Adjust the brightness for the ISOMETER® iso685-D display here.

5.4.1 Brightness

Adjust the brightness for the display between 0 and 100 %.

5.5 Password

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

5.5.1 Password

Enter an individual four-digit password.

5.5.2 Status

Decide whether you want to use the password query:

*on	Password query active
*off	Password query inactive

5.6 Commissioning

Open the ISOMETER® iso685-D commissioning wizard again in the commissioning menu. This navigates through the menus described in 5.1, 5.2, 1.3, 1.4, 1.2, 1.1.

5.7 Service

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

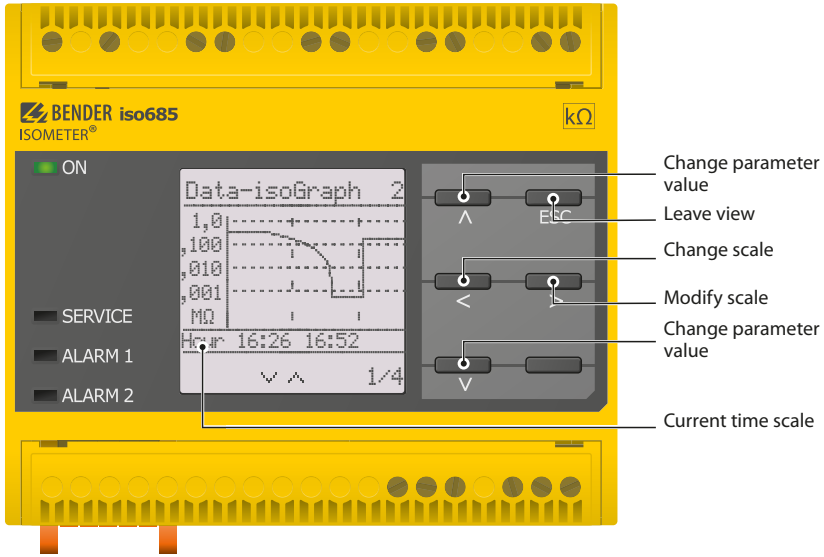
6.0 Info

You can view the iso685-D current settings in the **Info** menu. Navigate through the different views using the ^ and v buttons:

*Info – Device	Device name, serial number, article number
*Info – Version	Software version measurement technique, software version HMI
*Info – Measurement technique	Selected profile, selected system type
*Info – Clock	Time, date, summer time
*Info – Ethernet	IP address, DHCP status, MAC address
*Info – BMS	Address of the RS-485 interface

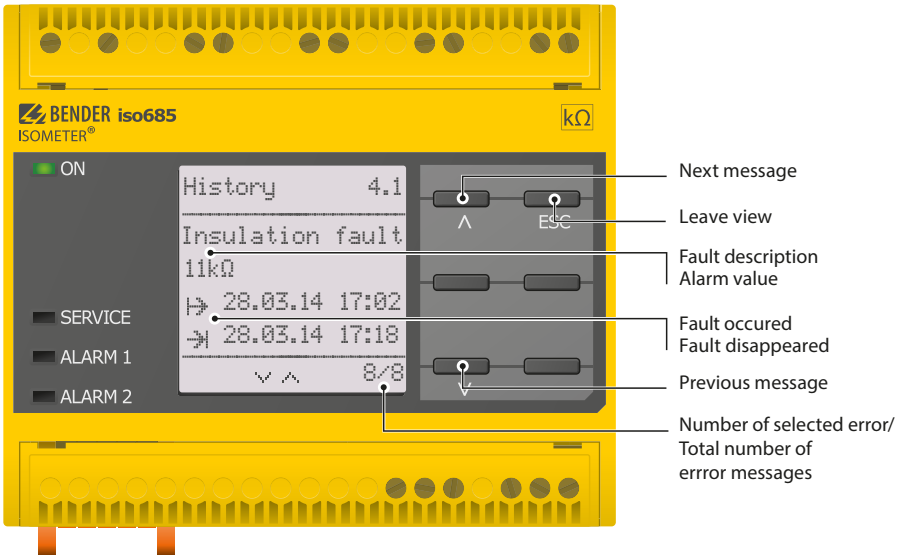
9.1 Data-isoGraph

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.



9.2 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 then be reset (refer to MENU/Data measured values/ Data - insulation.



10.1 Profile overview

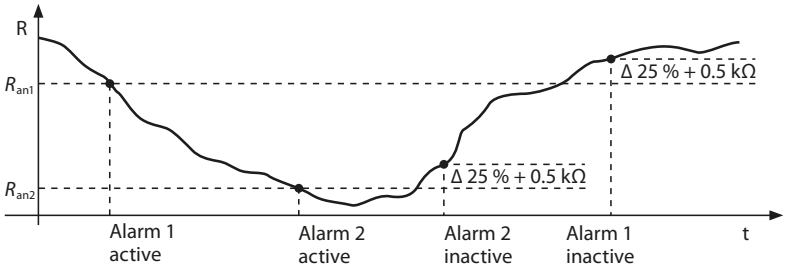
	Nominal system voltage	System frequency	System leakage capacitance	Description
Power circuits	AC 0…690 V/ DC 0…1000 V	15…460 Hz	0…150 µF	Main circuits without dynamic frequency changes. The universal profile is suitable for all systems primarily with constant system frequencies and extraneous DC voltages. When using inverters and dynamic frequency control, select inverters > 10 Hz or inverters < 10 Hz.
Control circuits	AC 0…230 V/ DC 0…230 V	15…460 Hz	0…150 µF	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 on sensitive switching elements.
Generator	AC 0…690 V/ DC 0…1000 V	15…460 Hz	0…5 µF	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 localisation in an IT system.
High capacitance	AC 0…690 V/ DC 0…1000 V	15…460 Hz	0…1000 µF	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/ DC 0…1000 V	10…460 Hz	0…20 µF	This profile is used for systems with dynamic frequency control by inverters in the range 10…460 Hz in order to optimise the measurement with respect to the measuring time and quality.
Inverter <10 Hz	AC 0…690 V/ DC 0…1000 V	1…460 Hz	0…20 µF	For systems involving extremely low frequency control in the range 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.

For response times see "Diagrams" on page 42.

10.2 Insulation alarm settings

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 +25 % +0.5 kΩ of the set operating value is exceeded.

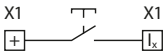


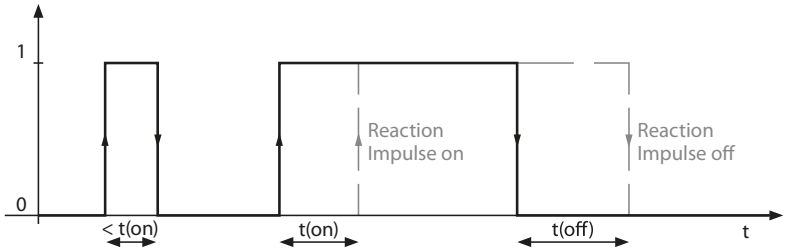
10.3 Digital input mode

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

*active high

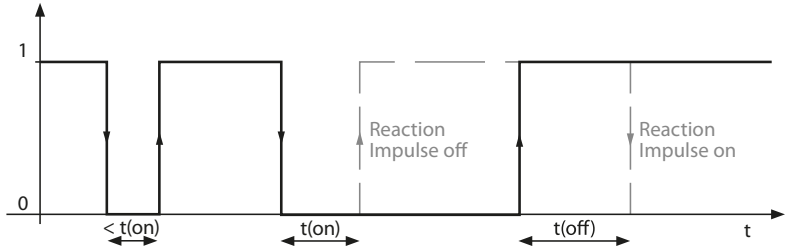
Response time t(on) / t(off) after the signal switches from low to high.





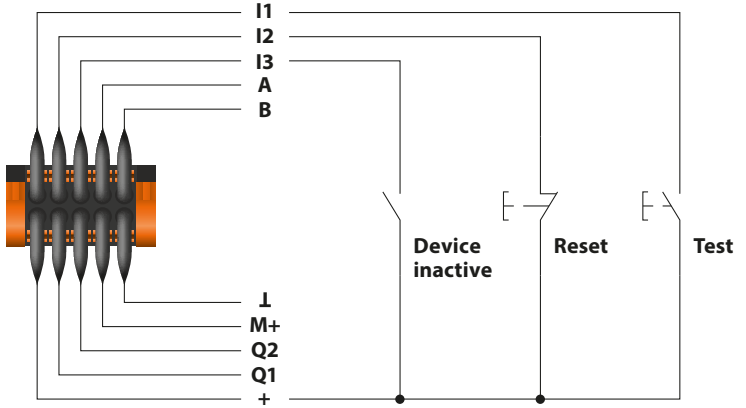
*active low

Response time t(on) / t(off) after the signal switches from high to low.



10.4 Typical circuit diagram of the digital inputs

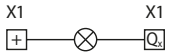
The digital inputs can be wired as follows:



10.5 Digital output mode

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

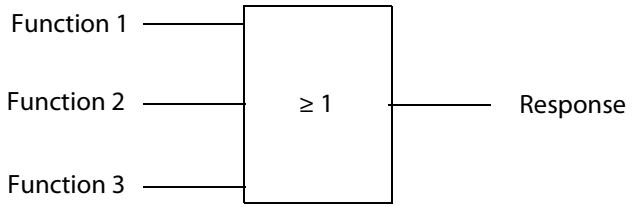
* Active	In the active mode + 24 V will be applied across the output.
*Passive	In the passive mode the output of the applied potential switches to ground.



Take the maximum output current into account!
Maximum output current in case of internal voltage supply via A1/+ and A2/- : 200 mA in total to X1.
Maximum output current in case of external voltage supply via X1.+ : 1 A per output

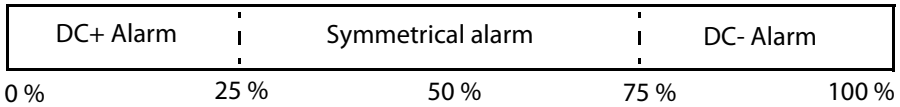
10.6 Description of the output functions

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



The following output functions are possible:

*off	The function will not be used.
*Iso. Alarm 1	The status of the output changes when the value falls below the set response value R_{an1}.
*Iso. Alarm 2	The status of the output changes when the value falls below the set response value Ran2.
*Connection fault	The status of the output changes when one of the following connection fault occurs: • No low-resistance connection between the line conductors. • No low-resistance connection between the terminals E and KE to earth (PE). • The connected load resistor for the voltage output is too low. • The load connected to the current output is too high. • The sum of the external loads to X1 is too high, resp. operation is outside the temperature limit 0…55 °C.
*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 is performed only when the value falls below the response value R_{an1}.
*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 is performed only when the value falls below the response value R_{an1}.
*Symmetrical alarm	The status of the output changes in the event of a resistance ratio between DC+ and DC- of 25 % to 75 %.



*DeviceError	The status of the output changes in the event of an internal device error.
*Common alarm	The status of the output changes on the occurrence of any alarm and fault messages (Iso. Alarm 1 & 2, DC- / DC+ Alarm, symmetrical alarm, connection and device faults).
*Measurement ended	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.

10.7 Description of the analogue output

10.7.1 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

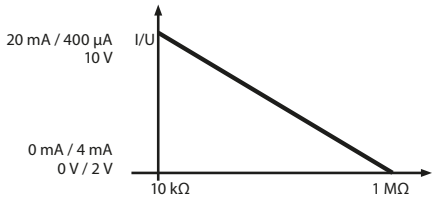
Voltage output

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

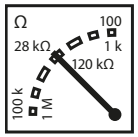
10.7.2 Midscale

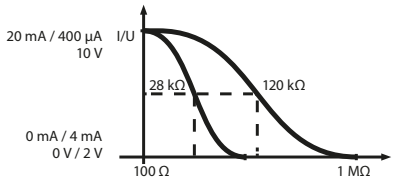
Select the appropriate midscale. The following parameters can be set:

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



*28 kΩ
*120 kΩ — The switching signal is analogous to the midscale of 28 kΩ or 120 kΩ on a measuring instrument.





Calculation of the insulation resistance using the analogue output:

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

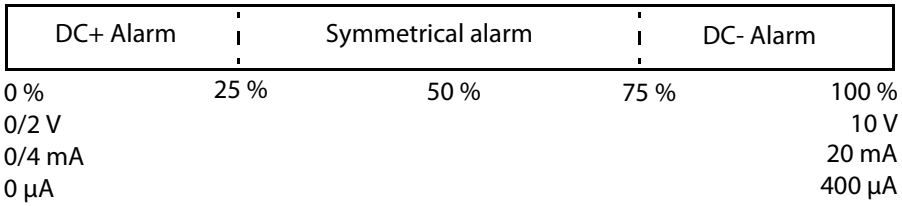
R_{SKM}= 28 kΩ or 120 kΩ/midscale
A_3= Measured analogue output
R_F= Insulation in kΩ

Lower value Analogue output A_1	Upper value Analogue output A_2
0 mA	20 mA
4 mA	20 mA
0 µA	400 µA
0 V	10 V
2 V	10 V

10.7.3 Function

Select the appropriate setting for function 3. The following parameters can be set:

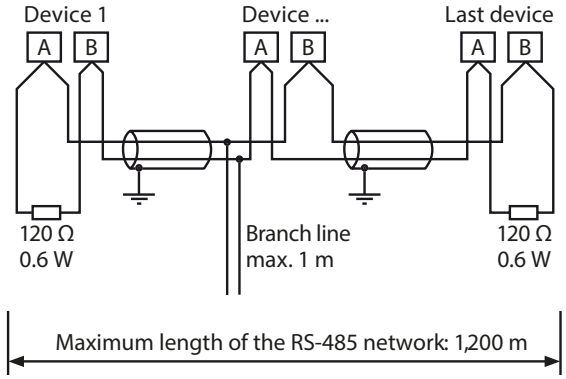
*Insulation value	Depending on the measured insulation value, an analogue current or voltage signal is provided at the output.
*DC shift	Depending on the measured DC shift, an analogue current or voltage signal is provided at the output. This setting can only be used when Linear is selected in the menu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



10.8 Description of the sensor bus functions

10.8.1 RS-485 interface with BMS protocol

The RS-485 interface is electrically isolated from the device electronics and the current output serves as the physical transmission medium for the BMS protocol. If several ISOMETER® iso685-D or other bus-capable devices are interconnected in a network via the BMS bus, the BMS bus must be terminated at both ends with a 120 Ω resistor.
An RS-485 network that is not terminated is likely to become unstable and may result in malfunctions. Only the first and last device in one line may be terminated. Devices in between must not be terminated. Stub feeders in the network are not to be terminated. The length of the stub feeders is restricted to 1 meter.



10.8.2 BMS protocol

This protocol is an essential part of the Bender Measuring Device Interface (BMS bus protocol). Data transmission generally makes use of ASCII characters. Interface data are:

Baud rate:	9600 baud
Transmission	1 start bit, 7 data bits, 1 parity bit, 1 stop bit (1, 7, E, 1)
Parity	Even
Checksum	Sum of all transmitted bytes = 0 (without CR and LF)

The BMS bus protocol works according to the Master-Slave principle. That means that one device represents the master while all other bus devices are slaves. It is important that only one master is present in each network. All bus devices are identified by a unique address. The master scans all other devices on the bus cyclically, listens to their signals and then carries out specific commands. Bus address 1 must be assigned to the master, thus to one of the ISOMETER® iso685-D.

10.8.3 BMS master

A master can query all warning and operational messages from a slave. If bus address 1 has been selected, the ISOMETER® iso685-D operates as the BMS master - that means all addresses between 1 and 150 are cyclically scanned for alarm and operational messages via the BMS bus. If the master receives no answer from five subsequent addresses, the scanning cycle will be started again.

10.8.4 BMS slave

All iso685-D ISOMETER®s are factory-set to slave mode (address 3). In a BMS network, one address must be selected from the address range 2...90 for each slave. There may be no gaps of more than five subsequent addresses, so that all slaves can be scanned by the master. For ISOMETER® iso685-D a BMS address can be selected from the address range 1…90.

The following table gives a survey of the major alarm messages and their assignment when being displayed on alarm indicator and operator panels, e.g. MK800.

Alarm	Channel	Note	Operating status message	Alarm message
Insulation fault	1	Insulation resistance/ Response value Alarm 1	X	X
Insulation fault	2	Insulation resistance/ Response value Alarm 2	X	X
Capacitance	3	System leakage capacitance	X	
Connection fault	4	Connection fault system, earth		X
Device error	5	Internal device error		X

10.8.5 Commissioning of an RS-485 network with BMS protocol

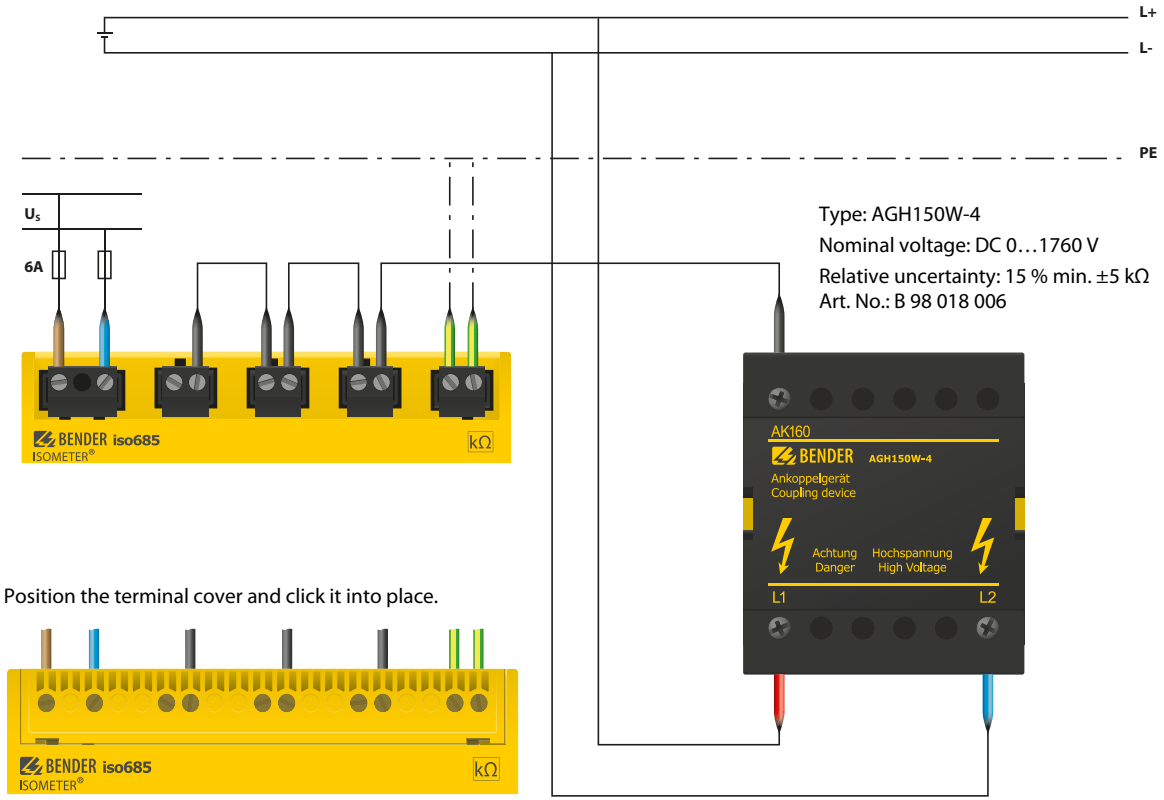
- Connect the terminals A and B of all bus devices in one line.
- Switch the terminating resistors on at the start and the end of the RS-485 network. If a device at the end of the bus is not terminated, connect a 120 Ω resistor to terminals A and B.
- Switch on the supply voltage U_S.
- Assign the master function to one ISOMETER® iso685-D and set address 1.
- Assign the addresses (2...90) subsequently to all other iso685-D ISOMETER®s and other bus devices (see note below).

Malfunctions due to wrong address assignment!
Assigning wrong addresses to external devices may cause malfunctions.
Assign the addresses in a way that there are no gaps of more than five subsequent addresses (1…30, 31…60, 61…90).

10.9 Description of the Ethernet interface functions

The Ethernet interface connection can only be used by Bender Service staff.

11.1 Connection using the AGH150W-4.



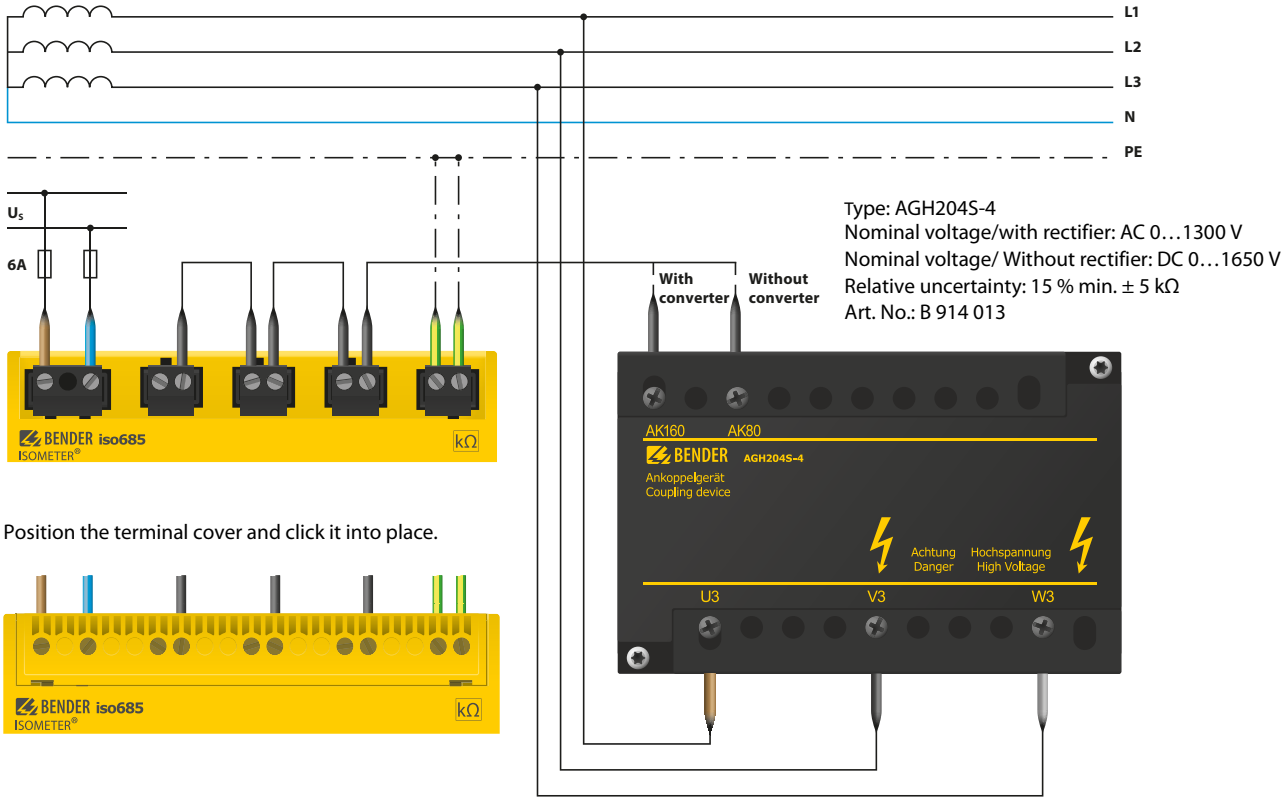
Position the terminal cover and click it into place.

DANGER

Danger 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.

11.2 Connection using theAGH204S-4



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

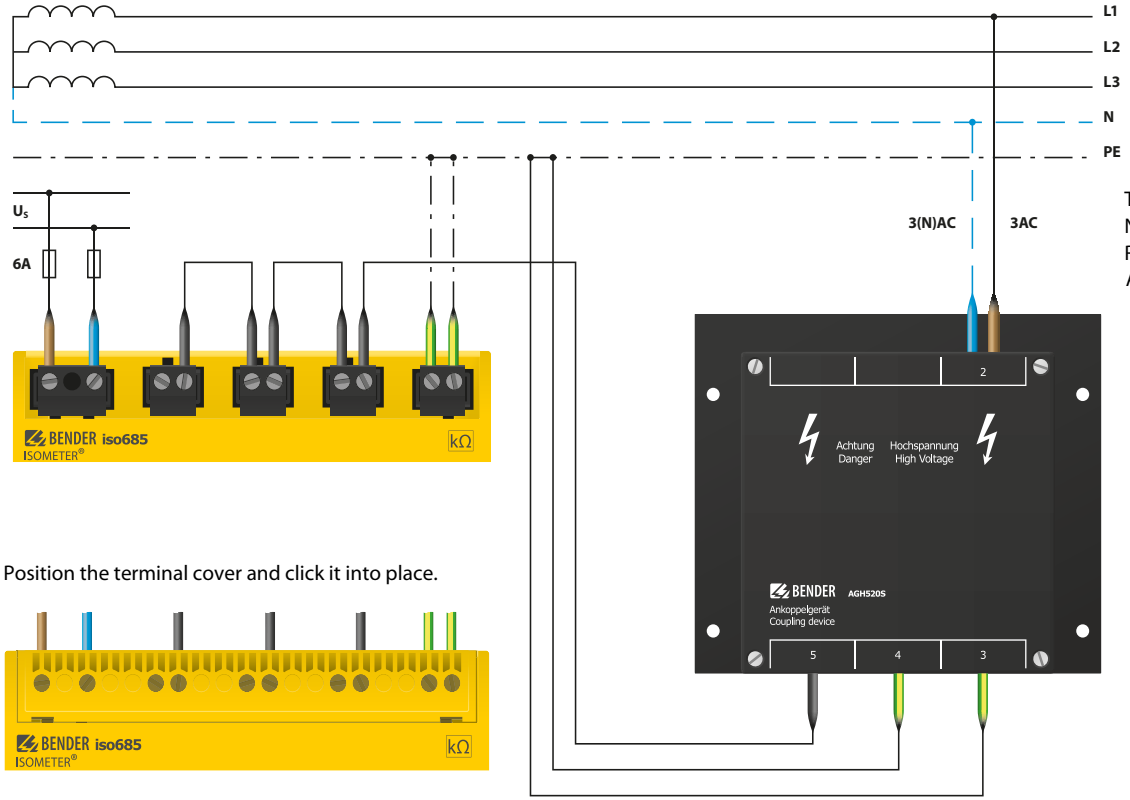
Position the terminal cover and click it into place.

DANGER

Danger 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.

11.3 Connection using the AGH520S



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

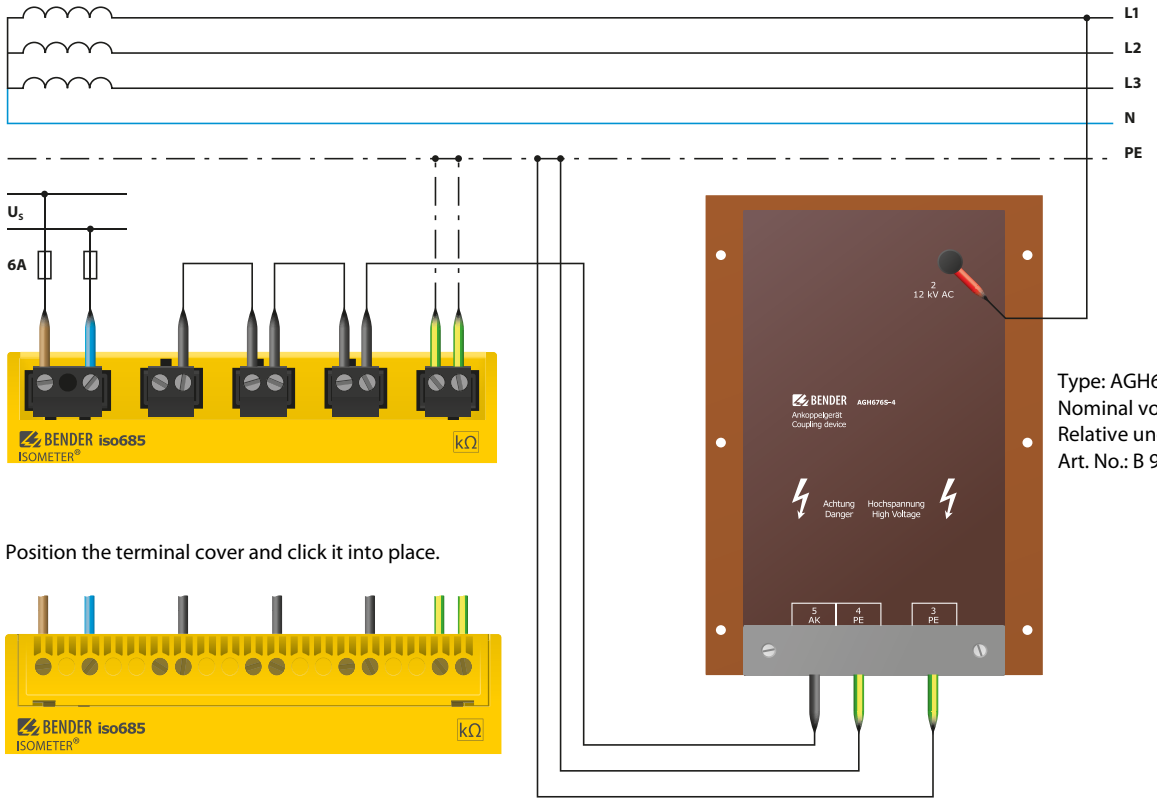
Position the terminal cover and click it into place.

DANGER

Danger 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.

11.4 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.

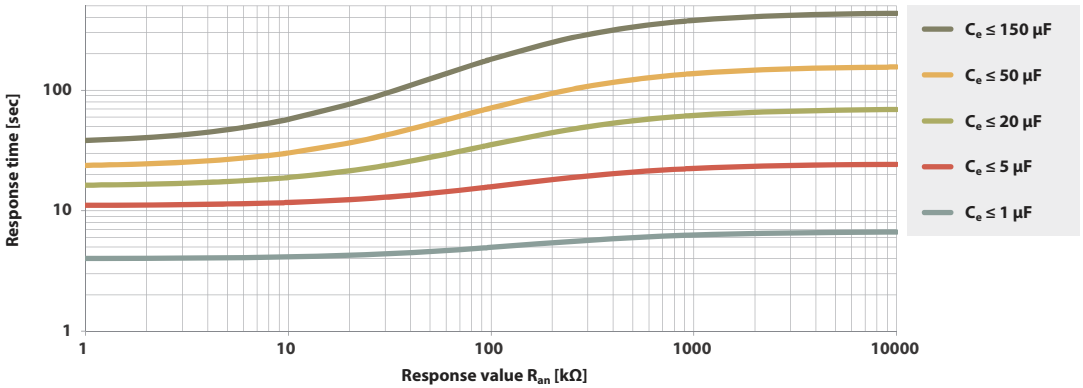
DANGER

Danger 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.

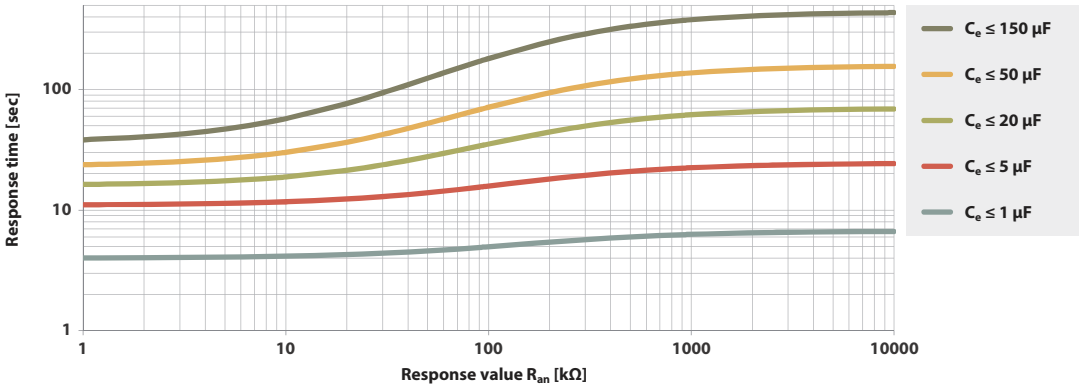
12.1 Response time profile power circuits

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)



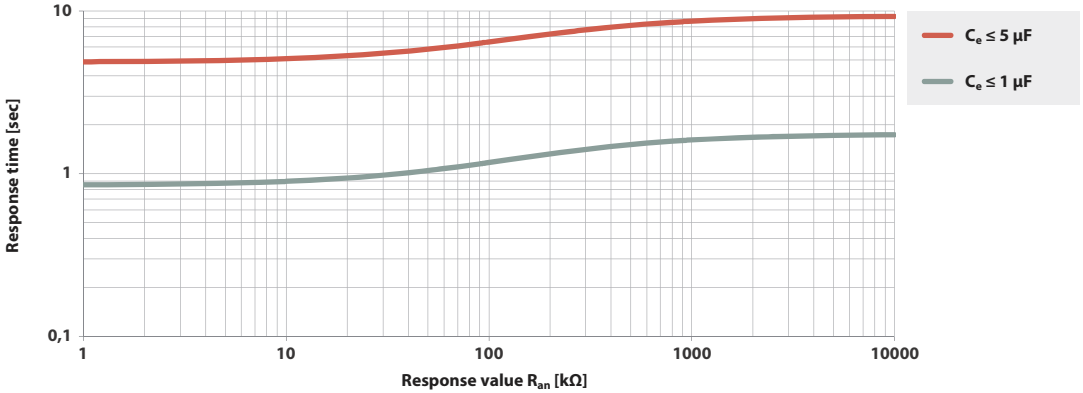
12.2 Response time profile control circuits

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 690 V, f_n = 50 Hz)



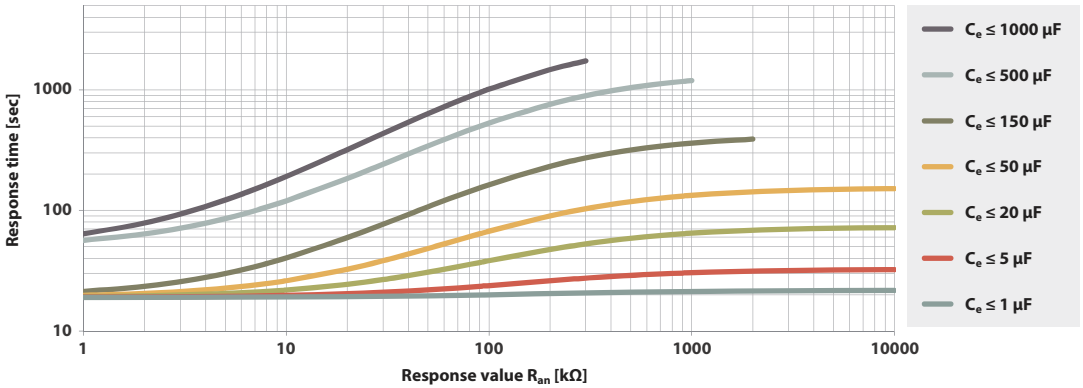
12.3 Response time profile generator

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)



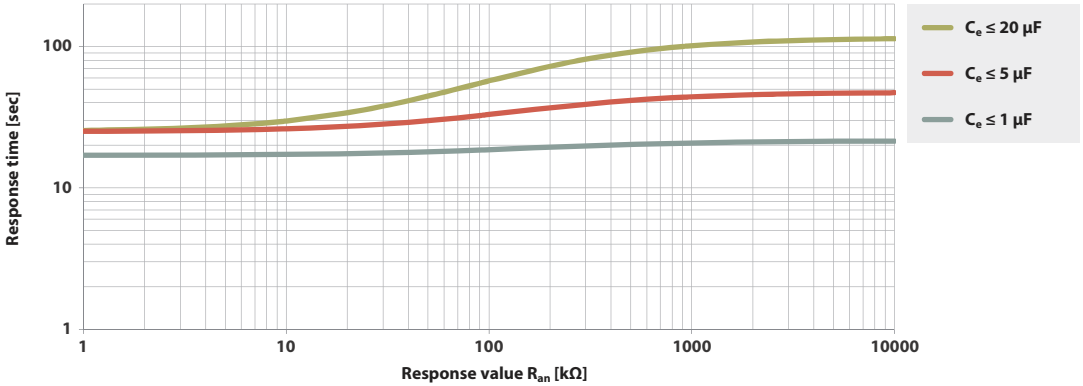
12.4 Response time profile high capacitance

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)



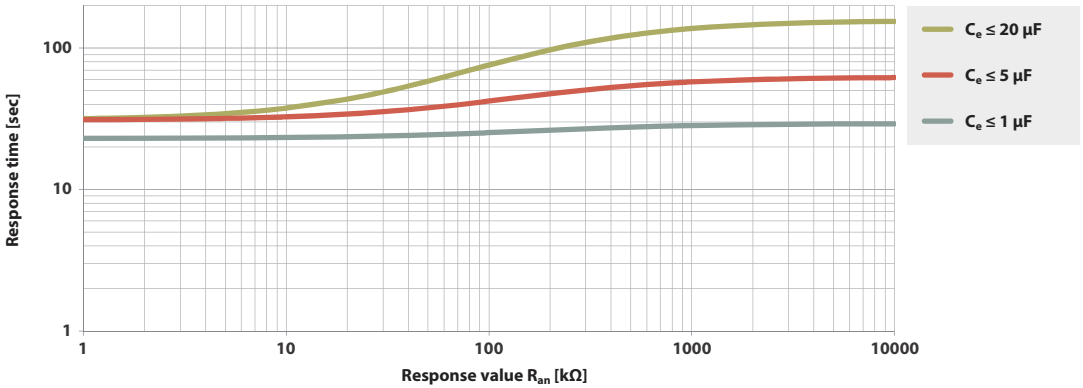
12.5 Response time profile inverter > 10 Hz

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)



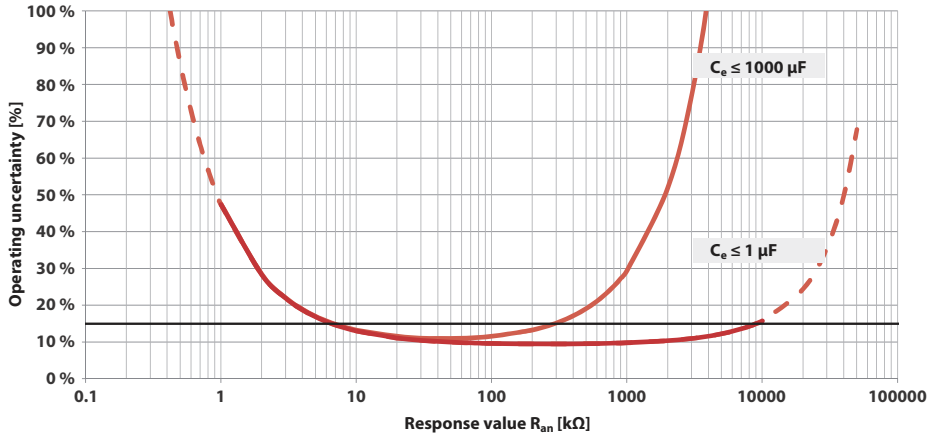
12.6 Response time profile inverter < 10 Hz

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)



12.7 Relative uncertainty

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)Op



13. Alarm messages

Alarm message	Description	Actions	Reference	LED indicators
Check L1-L2-L3 for correct connection!	No low-resistance connection between the line conductors	• Check the wiring of the terminals L1/+, L2 and L3/- to the IT system • Press the test button • Check mains voltage • Check the fuses	Chapter 5.	ALARM 1 + ALARM 2 flash alternately
E-KE please check connection!	No low-resistance connection between the terminals E and KE to earth (PE)	• Check the wiring of the terminals E and KE to earth (PE) • Press the test button	Chapter 5.	ALARM 1 + ALARM 2 flash in common mode
Service mode active!	The device is in maintenance condition	• Contact Bender Service		SERVICE lights up
Profile does not suit the application!	Wrong profile selected for this application	• Check measured system capacitance resp. system frequency in the Info menu • Select another profile taking the characteristics into consideration	Chapter 10.1/ Chapter 8. (menu 1.2)	
No DHCP server found!	Connection problem at the Ethernet interface	• Check cable connection at the Ethernet interface. • Check the DHCP server's availability. • Check the DHCP's interface configuration in the device/see menu 5.3.2.1		
Check time and date!	Time and date have not yet been set.	• Set local time and date (in case of voltage failure a buffer for three days)	Chapter 8. (menu 5.2)	
Resistance at the analogue output too low! R ≥ 1 kΩ	The load resistance connected to the voltage output is too low.	• Check the connections at the analogue output for short-circuit/ see chapter 9.4 • Check the connected load resistor • Ceck operating mode (voltage output)	Chapter 10.7	
Resistance at the analogue output too high! R ≤ 600 Ω	The load connected to the current output is too high	• Check the connections at the analogue output for interruption. • Check connected load/indicating instrument • Check operating mode (current output).	Chapter 10.7	
Load at Dig. Out too high! I_L ≤ 200 mA @ 0…55°C	The sum of the external loads to X1 is too high, resp. operation is outside the temperature limit 0…55 °C	• Check load at X1.+, X1.Q1 and X1.Q2 • Check ambient temperature	Chapter 10.5	
Device error x	Internal device fault	• Press the TEST button • Switch the supply voltage on and off • Contact Bender Service		SERVICE lights up

14.1 Data

()* = Factory setting
()** = The serial interface (RS-485) is considered a high-symmetrical wire pair

Insulation coordination

Rated insulation voltage (IEC 60664-1) ..... 1000 V
Rated impulse voltage (IEC 60664-1) ..... 8 kV
Overvoltage category III
Pollution degree (U_n <690 V) 3
Pollution degree (U_n <1000 V) 2
Protective separation (reinforced insulation) between ..... (A1, A2) - (11, 12, 14) - (21, 22, 24) - [(L1/+, L2, L3/-) (E, KE), (X1, X2)]
Voltage test (IEC 61010-1) ..... 4.3 kV

Supply voltage

Supply via A1/+, A2/-:

Supply voltage range U_S ..... AC/DC 100 . . . 240 V
Tolerance of U_S ..... AC -15 . . . +10 %
DC -15 . . . +15 %
Frequency range of U_S ..... DC, 47 . . . 460 Hz
Power consumption typically 50 Hz (460 Hz) ..... 5.7 W/20 VA (7.9 W/45.5 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
Tolerance of U_n ..... AC/DC + 15 %
Frequency range of U_n ..... DC, 1 . . . 460 Hz

Response values

Response value R_{an1} (Alarm 1) ..... 1 kΩ . . . 10 MΩ (40 kΩ)*
Response value R_{an2} (Alarm 2) ..... 1 kΩ . . . 10 MΩ (10 kΩ)*
Relative uncertainty (acc. to IEC 61557-8) ..... dependent on the profile, ± 15 %, at least 1 kΩ
Hysteresis ..... 25 %, at least 1 kΩ

Time response

Response time t_{an} at $R_F = 0.5 \times R_{an}$ (R_{an} = 10 kΩ) and C_e = 1 µF acc. to IEC 61557-8 ..... profile-dependent, typ. 4 s (see diagrams)
Startup delay $T_{startup}$ ..... 0 . . . 120 s (0 s)*

Measuring circuit

Measuring voltage U_m ..... profile-dependent, ± 10 V, ± 50 V
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 of U_n (without external coupling device) ..... AC 25 . . . 690 V
DC 25 . . . 1000 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 of C_e ..... DC, 30 . . . 460 Hz
Min. insulation resistance measurement of C_e ..... depends on profile and coupling mode, typ. > 10 kΩ

Display

Graphic display ..... 127 x 127 pixel, 40 x 40 mm
Display range measured value ..... 0.1 kΩ . . . 20 MΩ

LEDs:

LED "On" (operation LED) ..... green
SERVICE ..... yellow
ALARM 1 ..... yellow
ALARM 2 ..... yellow

Digital inputs

Number 3
Operating mode, adjustable ..... active high, active low
Functions ..... none, test, reset, start measurement, deactivate device
Voltage ..... Low DC -3 . . . 5 V, High DC 11 . . . 32 V

Digital outputs

Number 2
Operating mode, adjustable ..... active, passive
Functions ..... none, pre-alarm, main alarm, connection fault, Alarm DC-, Alarm DC+, symmetrical insulation fault, device error, common alarm, measurement complete, device inactive
Voltage ..... passive DC 0 . . . 32 V, active DC 0/19.2 . . . 32 V
Max. current internal sum X1 ..... max. 200 mA
Max. current external per channel ..... max. 1 A

Analogue output

Number 1
Operating mode ..... linear, midscale point 28 kΩ/120 kΩ
Functions ..... insulation value, DC shift
Current, voltage ..... 0 . . . 20 mA (< 600 Ω), 4 . . . 20 mA (< 600 Ω), 0 . . . 400 µA (< 4 kΩ), 0 . . . 10 V (>1 kΩ), 2 . . . 10 V (>1 kΩ)
Tolerance ..... ±20 %

Interfaces

Field bus:
Interface/protocol ..... Telnet/HTTP
Data rate ..... 10/100 Mbit/s, autodetect
Cable length ..... ≤100
Connection RJ45
IP address ..... DHCP / manual* 192.168.0.5*
Network mask 255.255.255.0*
Function ..... service interface

Sensor bus:

Interface/protocol RS-485/BMS
Data rate ..... 9.6 kBaud/s
Cable length ..... ≤1200 m
Cable (twisted pair, shield connected to PE on one side) ..... recommended: J-Y(St)Y min. 2 x 0.8
Connection ..... terminals X1.A, X1.B
Terminating resistor ..... 120 Ω, can be connected internally
Device address, BMS bus ..... 1 . . . 90 (3)*

Switching elements

Number of switching elements ..... 2 changeover contact
Operating mode ..... N/C operation*/N/O operation
Contact 11-12-14 ..... none, prealarm, main alarm, connection fault, Alarm DC-, Alarm DC+, symmetrical insulation fault, device error, common alarm, measurement complete, device inactive
Contact 21-22-24 ..... none, prealarm, main alarm, connection fault, Alarm DC-, Alarm DC+, symmetrical insulation fault, device error, common alarm, measurement complete, device inactive
Electrical endurance under rated operating conditions, number of cycles 10,000
Contact data acc. to IEC 60947-5-1:
Utilisation category ..... AC-13 / AC-14 / DC-12 / DC-12 / DC-12
Rated operational voltage ..... 230 V / 230 V / 24 V / 110 V / 220 V
Rated operational current ..... 5 A / 3 A / 1 A / 0.2 A / 0.1 A
Rated insulation voltage ≤ 2000 m NN ..... 250 V
Rated insulation voltage ≤ 3000 m NN ..... 160 V
Minimum contact rating ..... 1 mA at AC/DC ≥10 V

Environment/EMC

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

Ambient temperatures:

Operation ..... -25 . . . +55 °C
Transport ..... -40 . . . +85 °C
Storage ..... -25 . . . +70 °C
Classification of climatic conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3) ..... 3K5 (except condensation and formation of ice)
Transportation (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
Transportation (IEC 60721-3-2) 2M2
Storage (IEC 60721-3-1) 1M3
Area of application ..... ≤3000 m NN

Connection

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

Screw-type terminals:

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 mm^2
flexible with ferrules, with/without plastic collar ..... 0.25 . . . 2.5 mm^2
Multiple conductor, rigid ..... 0.2 . . . 1 mm^2
Multiple conductor, flexible ..... 0.2 . . . 1.5 mm^2
Multiple conductor, flexible with ferrule without plastic sleeve ..... 0.25 . . . 1 mm^2
Multiple conductor, flexible withTWIN ferrule with plastic sleeve ..... 0.5 . . . 1.5 mm^2

Push-wire terminals:

Conductor sizes ..... AWG 24-12
Stripping length ..... 10 mm
rigid/flexible ..... 0.2 . . . 2.5 mm^2
flexible with ferrules, with/without plastic collar ..... 0.25 . . . 2.5 mm^2
Multiple conductor, flexible withTWIN ferrule with plastic sleeve ..... 0.5 . . . 1.5 mm^2

Push-wire terminals X1:

Conductor sizes ..... AWG 24-16
Stripping length ..... 10 mm
rigid/flexible ..... 0.2 . . . 1.5 mm^2
flexible with ferrule without plastic sleeve ..... 0.25 . . . 1.5 mm^2
flexible with TWIN ferrule with plastic sleeve ..... 0.25 . . . 0.75 mm^2

Other

Operating mode ..... continuous operation
Mounting ..... display oriented, cooling slots must be ventilated vertically
Degree of protection internal components IP40
Degree of protection terminals IP20
DIN rail mounting acc. to ..... IEC 60715
Screw fixing ..... 3 x M4 with mounting clip
Enclosure material ..... polycarbonate
Flammability class V-0
Dimensions (W x H x D) ..... 108 x 93 x 110 mm
Documentation number D00022
Weight ..... ≤450 g

14.2 Approvals and certifications

The ISOMETER® was developed in compliance with the following standard:
DIN EN 61557-8 (VDE 0413-8)

14.3 Ordering details

Type	Supply voltage U_S	Art. No.
iso685-D	AC/DC 100…240 V	B 9106 7010

Accessories

Definition	Art. No.
iso685 Mechanical accessories comprising: Terminal cover and 2 mounting clips*	B 9106 7903
iso685 Plug kit, screw terminals*	B 91067 901
iso685 Plug kit, push-wire terminals	B 9106 7902

* included in the scope of delivery

14.4 Disposal

Please observe national regulations on the disposal of the device. Ask your supplier if you are not sure how to dispose of the old unit.

Within the European Community, Directive 2002/96/EC on waste electrical and electronic equipment, and Directive 2002/95/EC on the restriction of hazardous substances in electrical and electronic equipment apply. In Germany these policies are implemented through the "Electrical and Electronic Equipment Act" of 16 March 2005. After that, the following applies:

- Electrical and electronic equipment do not belong in household waste. This is indicated by the following symbol:

- Batteries or accumulators do not belong in household waste but should be disposed of in accordance with the statutory provisions.
- Old Equipment from users other than private households, which was bought new after 13 August 2005 can be returned to the manufacturer for disposal.

More information on the disposal of Bender devices can be found at www.bender-de.com under Service and Support.

Index

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