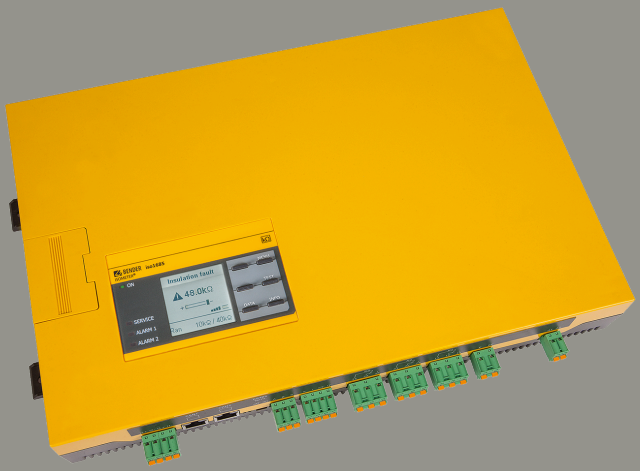
ISOMETER® isoHV1685D

Insulation monitoring device for unearthed
medium-voltage systems up to AC 2000 V, DC 3000 V



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1 General information

1.1 How to use the manual

NOTE

This manual is intended for qualified personnel working in electrical engineering and electronics! Part of the device documentation in addition to this manual is the enclosed supplement "Safety instructions for Bender products".

NOTE

Read the operating manual before mounting, connecting and commissioning the device. Keep the manual within easy reach for future reference.

1.2 Indication of important instructions and information

DANGER

Indicates a high risk of danger that will result in death or serious injury if not avoided.

WARNING

Indicates a medium risk of danger that can lead to death or serious injury if not avoided.

CAUTION

Indicates a low-level risk that can result in minor or moderate injury or damage to property if not avoided.

NOTE

Indicates important facts that do not result in immediate injuries. They can lead to malfunctions if the device is handled incorrectly.

Information can help to optimise the use of the product.

1.3 Service and Support

Information and contact details about customer service, repair service or field service for Bender devices are available on the following website: https://www.bender.de/en/service-support.

1.4 Training courses and seminars

Regular face-to-face or online seminars for customers and other interested parties:

https://www.bender.de/en/know-how/seminars

1.5 Delivery conditions

The conditions of sale and delivery set out by Bender GmbH & Co. KG apply. These can be obtained in printed or electronic format.

1.6 Inspection, transport and storage

Check the shipping and device packaging for transport damage and scope of delivery. In the event of complaints, the company must be notified immediately. Please use the contact form at the following address: https://www.bender.de/en/service-support/take-back-of-old-devices/.

When storing the devices, observe the information under Environment / EMC in the technical data.

1.7 Warranty and liability

Warranty and liability claims for personal injury and property damage are excluded in the case of:

- improper use of the device
- incorrect mounting, commissioning, operation and maintenance of the device
- Failure to observe the instructions in this operating manual regarding transport, commissioning, operation and maintenance of the device
- unauthorised changes to the device made by parties other than the manufacturer
- non-observance of technical data
- Repairs carried out incorrectly
- the use of accessories or spare parts that are not provided, approved or recommended by the manufacturer
- Catastrophes caused by external influences and force majeure
- Mounting and installation with device combinations not approved or recommended by the manufacturer

This operating manual and the enclosed safety instructions must be observed by all persons working with the device. Furthermore, the rules and regulations that apply for accident prevention at the place of use must be observed.

1.8 Disposal of Bender devices

Abide by the national regulations and laws governing the disposal of this device.

Bender GmbH & Co. KG is registered in the waste from electrical and electronic equipment (WEEE) register under the WEEE number: DE 43 124 402. For more information on the disposal of Bender devices, refer to https://www.bender.de/en/service-support/take-back-of-old-devices/

1.9 Safety

If the device is used outside the Federal Republic of Germany, the applicable local standards and regulations must be complied with. In Europe, the European standard EN 50110 applies.

DANGER

Risk of fatal injury due to electric shock!

Touching live parts of the system carries the risk of:

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

Before installing the device and before working on its connections, make sure that the installation is de-energised.

Observe the rules for working on electrical systems.

2 Function

2.1 Intended use

The device isoHV1685Dis used for monitoring the insulation resistance in large power supply systems designed as IT systems. The specific measurement method **AMP^{PLUS}** monitors the insulation resistance also in installations where extremely high system leakage capacitances to earth exist due to interference suppression methods. Adaptation event to high leakage capacitances is automatic.

In order to meet the requirements of the 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 range of application indicated in the technical data.

Intended use also includes

- the observation of all information in the operating manual and
- compliance with the test intervals in accordance with the relevant standards and operating rules.

Caution: This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

Do not make any unauthorised changes to the device. Only use spare parts and optional accessories sold or recommended by the manufacturer.

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

2.2 Product description

The ISOMETER® isoHV1685D is used for insulation monitoring of large systems designed as IT systems. Please refer to the technical data for the exact device specification.

The measurement method especially developed for this purpose monitors the insulation resistance even in installations where extremely high system leakage capacitances against earth exist due to interference suppression methods. The adaptation even to system-related high leakage capacitances is automatic.

2.3 Device features

ISOMETER® for AC IT systems with galvanically connected rectifiers or inverters and for unearthed DC IT systems.

- Isolation monitoring of IT systems
- Measurement of insulation faults 200 Ω…1 MΩ in systems with mains voltages of AC 2000 V and DC 3000 V
- Automatic adjustment to high system leakage capacitances
- Combination of **AMP^{PLUS}** and other profile-specific measurement methods
- Separately adjustable response values R_{an1} (Alarm 1) and R_{an2} (Alarm 2) for prewarning and alarm
- Connection monitoring
- Device self test with automatic alarm message in the event of a fault
- History memory with real-time clock (buffer for 30 days) for storing 1023 alarm messages with date and time
- Freely programmable digital inputs/outputs
- Separate relays for insulation fault 1, insulation fault 2 and device error

Display

- High-resolution graphic LC display for excellent readability and recording of the device status
- Graphical representation of the insulation resistance over time (isoGraph)

Interfaces

- RS-485 interface for data exchange with other Bender devices
- Remote setting of certain parameters via the Internet (COMTRAXX® gateway)
- Remote diagnosis by the Bender service via the Internet

2.4 Functional description

Insulation monitoring is carried out using an active measuring pulse which is superimposed onto the IT system to earth via the integrated coupling. If the insulation resistance between the IT system and earth falls below the set prewarning response value R_{an1}, the LED **ALARM 1** lights up and relay **K1** switches. If the insulation resistance falls below the alarm response value R_{an2}, the LED **ALARM 2** lights up and the alarm relay **K2** switches. The relay **K3** switches in case of device or connection failures.

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

IT systems with several ISOMETER®s
Only one ISOMETER® may be connected in a galvanically connected system. In IT systems that are interconnected via tie switches, ISOMETER®s that are not required must be disconnected from the IT system or switched to inactive.

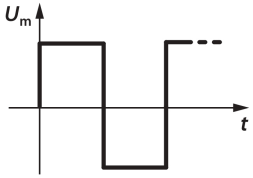
If IT systems are coupled via capacitors or diodes, a central control of the various ISOMETER® must be used.

Prevent measurement errors!
In galvanically coupled DC circuits, an insulation fault can only be detected correctly if a minimum current of > 10 mA flows through the rectifiers.

Unspecified frequency range
Depending on the application and the selected measurement profile, continuous insulation monitoring is also possible in low frequency ranges. For IT systems with frequency components above the specified frequency range, there is no influence on the insulation monitoring.

2.4.1 Insulation monitoring

For insulation monitoring, a pulsating AC measuring voltage is superimposed onto the IT system. The measurement pulse consists of positive and negative rectangular pulses of equal amplitude. The period depends on the system leakage capacitance in each case and the insulation resistance



An insulation fault between the IT system and earth closes the measuring circuit. If the insulation resistance between system and earth falls below the set response values R_{an1} and R_{an2}, the associated alarm relays **K1** or **K2** switch. The response value R_{an1} can be set equal or higher than R_{an2}. Detected insulation faults are signalled to other bus devices via the BMS bus. In addition, the alarm LEDs **ALARM 1** or **ALARM 2** light up.

Assignment of the alarm relays K1, K2, K3
K1 switches when the value falls below the prewarning response value R_{an1}.

K2 switches when the value falls below the alarm response value R_{an2}.
K3 switches in the event of a device error or a connection fault.

2.4.2 Deactivating the device

When the device is deactivated, the coupling unit of the device is galvanically isolated from the system being monitored. The device does not measure the insulation resistance, the message **Device inactive** appears on the display. The IT system is not being monitored! The device uncouples itself from the system to be monitored through an internal system isolating switch.

Activation or deactivation is done via

- a digital input
- the menu item **Alarm settings**
- the BMS bus and Modbus RTU

The standby mode of the ISOMETER®, for example, enables application in coupled systems, since in interconnected systems only one insulation monitoring device may be connected.

2.4.3 History memory

All warnings, alarms and device errors are time-stamped and stored in the device's internal history memory. The times of the start, acknowledgement and end of the event are recorded.

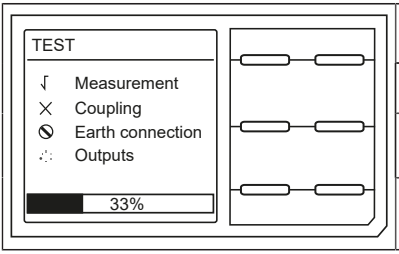
2.5 Self test after connection to the supply voltage

Once connected to the supply voltage, the device checks all internal measurement functions, the components of the process control such as data and parameter memory as well as the connections to earth.

Once the self test is finished, after approx. 60 seconds. The alarm relays (**K1**, **K2**) are not switched during start-up. Afterwards, the normal measuring operation starts.

If a device or connection error is detected, the corresponding alarm is output on the display and via the integrated interfaces as well as via the alarm relays **K1** and **K2**.

The relay **K3** operates permanently in NC operation, i.e. a device fault is signaled even in the event of a complete failure of the device.



√	Test successful
×	Test not successful
⊘	Test not available (e.g. incorrect device settings)
⁘	Test in progress

2.5.1 Automatic self test during operation

All internal supply voltages are continuously monitored. The following tests are continuously carried out in the background:

- Connection E-KE
- Temperature monitoring of the coupling

A self test is automatically run at 24-hour intervals.

During the automatic self test, the alarm relays **K1** and **K2** are not switched. **K3** will *not* be switched either.

2.5.2 Manual self test during operation

The self test is started via the **TEST** button of the ISOMETER® or via the RS-485interface.

The manual self-test checks:

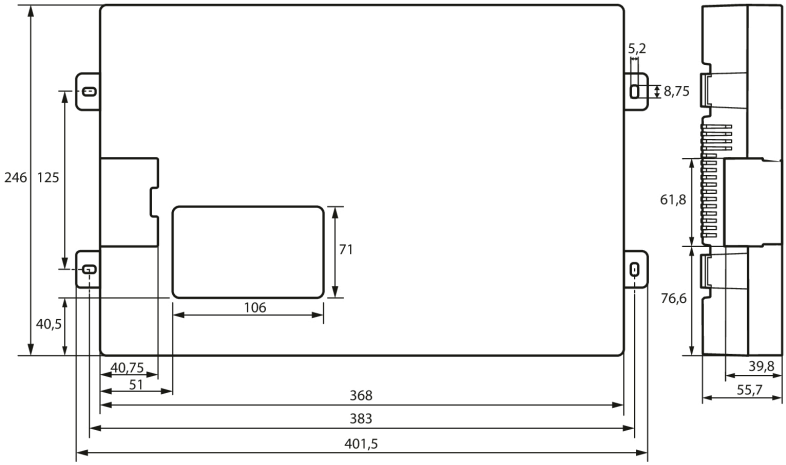
- Internal flash
- CPU register
- Watchdogs
- Oscillator
- Only when started via RS-485:
  Restart of the device including re-initialisation, recalibration and switching of all alarm relays
- Connection monitoring of the system to be monitored

NOTE

Perform a manual self-test at regular intervals specified by the operator to ensure that the device is operating correctly.

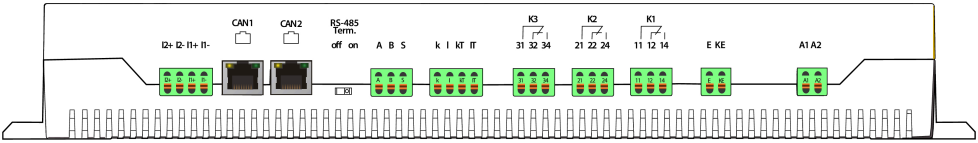
3 Device overview

3.1 Dimensions

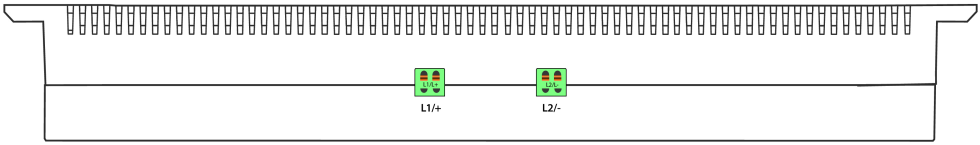


Img.: Dimensions in mm

3.2 Terminals



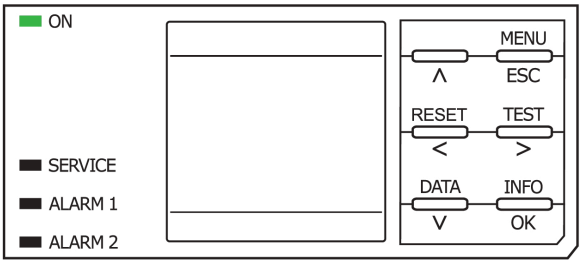
Img. 3-1: Terminals from below



Img. 3-2: Terminals from above

View from below	
I2+, I2–	Digital input
I1+, I1–	Digital input
CAN1, CAN2	No function
RS485 Term. off / on	RS-485 termination
A, B, S	RS-485 bus connection (A, B) BMS protocol: PE potential, connect one end of shield (S)
k, I, kT, IT	no function
31, 32, 34	Relay output for internal device errors (LED **SERVICE**)
21, 22, 24	Relay output for alarm insulation faults (LED **ALARM 2**)
11, 12, 14	Relay output for prewarning insulation faults (LED **ALARM 1**)
E, KE	Separate connection of E (earth) and KE (reference) to PE
A1, A2	Connection to supply voltage (via fuses, 2 A each)
View from above	
L1/+	Connection to L1/+ of the IT system via 1 A fuse
L2/–	Connection to L2/– of the IT system via 1 A fuse

3.3 Display and operating elements



The device display shows information regarding the device and the measurements.

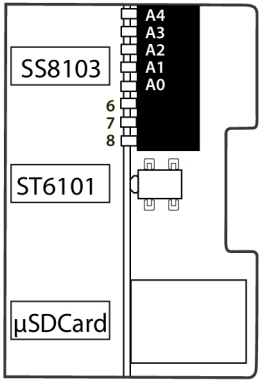
ON (green)	Operation indicator
SERVICE (yellow)	Lights up when an internal device error is detected. If the LED stays lit, please check the error code list.
ALARM 1 (yellow)	• lights (prewarning): insulation resistance is below the response value 1, $R_F < R_{an1}$ • flashes: connection fault, check earth and system (**L1/+**, **L2/–**)
ALARM 2 (yellow)	• lights (alarm): insulation resistance is below the response value 2, $R_F < R_{an2}$ • flashes: connection fault, check earth and system (**L1/+**, **L2/–**)

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

MENU	Opens the device menu.
ESC	Cancels the current process or navigates one step back in the device menu.
EDS	no function
∧	Navigates up in a list or increases a value.
TEST	Starts the device self test.
>	Navigates forwards (e.g. to the next setting step) or selects a parameter.
RESET	Resets alarms.
<	Navigates backwards (e.g. to the previous setting step) or selects a parameter.
INFO	Shows informations (e.g. serial number, device type).
OK	Confirms an action or a selection.
DATA	Indicates data and further values (isoGraph)
∨	Navigates down in a list or reduces a value.

Service lid

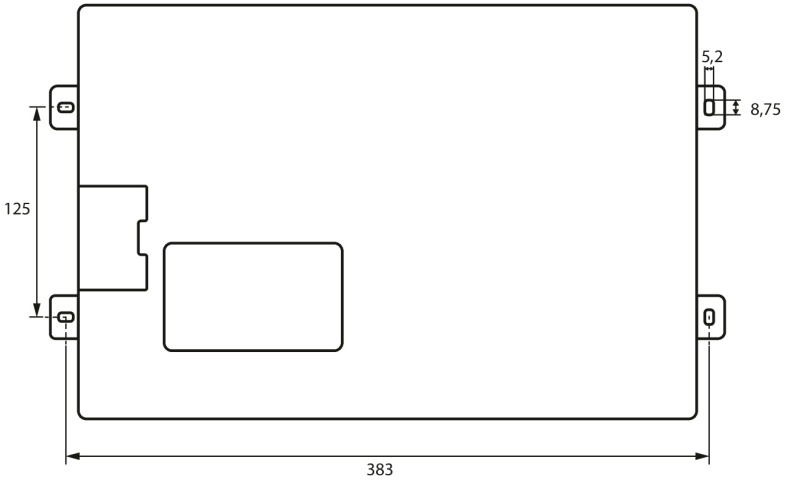
Operating elements in the service lid



Operating elements	Function
DIP switch (SS8103)	no function
Button (ST6101)	Alarm reset (corresponds to the **RESET** button)
Memory card slot (µSD card)	no function

4 Mounting

Mount the device using four M5 screws. Refer also to the dimension diagram where the drilling holes are illustrated. Mount the device so that the control panel can be read during operation and the mains connection is (L1/+, L2/–) positioned at the top.



Img. 4-1: Dimensions in mm

CAUTION

Damage due to unprofessional installation!

If more than one insulation monitoring device is connected to a conductively connected system, the system may be damaged. If several devices are connected, the device does not work and does not signal insulation faults.

Make sure that only one insulation monitoring device is connected.

CAUTION

Heat on the enclosure surface!

The surface temperature of 60 °C can be exceeded under certain operating conditions.

Keep the cooling slots uncovered by keeping a distance of at least 15 cm above and at least 10 cm below the device to adjacent objects in order to ensure constant air circulation.

CAUTION

Sharp-edged terminals!

Lacerations and injuries on hands are possible.

Touch the enclosure and the terminals with due care.

5 Connection

Connection requirements

DANGER

Risk of fatal injury due to electric shock!

Touching live parts of the system carries the risk of:

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

Before installing the device and before working on its connections, make sure that the installation is de-energised.

Observe the rules for working on electrical systems.

Only skilled persons are permitted to carry out the work necessary to install, put into service and run a device or system.

NOTE

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.

Pluggable push-wire terminals

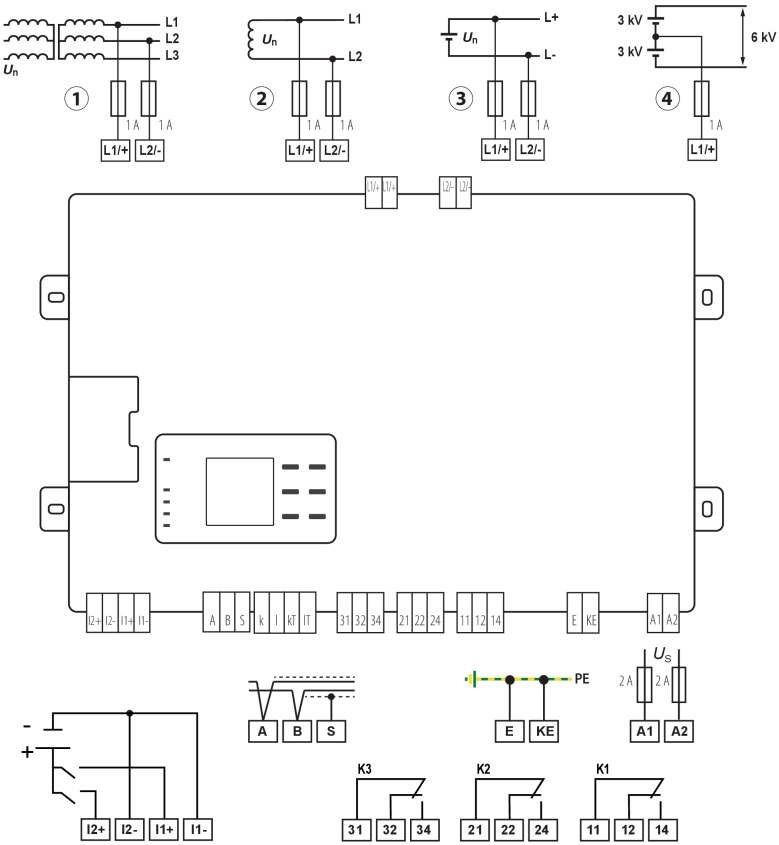
All terminals are pluggable push-wire terminals. Solid connecting wires can be directly plugged in. For connection of flexible cables, the push-wire terminals must be pushed open by pressing the corresponding orange interlocking mechanism with a flat-head screwdriver. Observe the specification in the technical data.

Check proper connection!

Prior to commissioning of the installation, check that the device has been properly connected and check that the device functions.

Perform a functional test using an earth fault via a suitable resistor.

Connection diagram



1 **[L1/+, L2/–]:** Connection to a 3(N)AC system
2 **[L1/+, L2/–]:** Connection to a AC system
3 **[L1/+, L2/–]:** Connection to a DC system
4 **[L1/+]:** Connection to a DC system with center tap
[I1+, I1–, I2+, I2–]: Digital inputs, potential-free (external voltage source required: DC 24 V)
[A, B, S]: RS-485 interface
[E, KE]: Separate connection to earth and control earth
[A1, A2]: Connection to supply voltage
[31, 32, 33] [21, 22, 24] [11, 12, 14]: Connection to the relays K3...K1

Step-by-step connection of the ISOMETER®

Connect the device according to the wiring diagram. Proceed as follows:

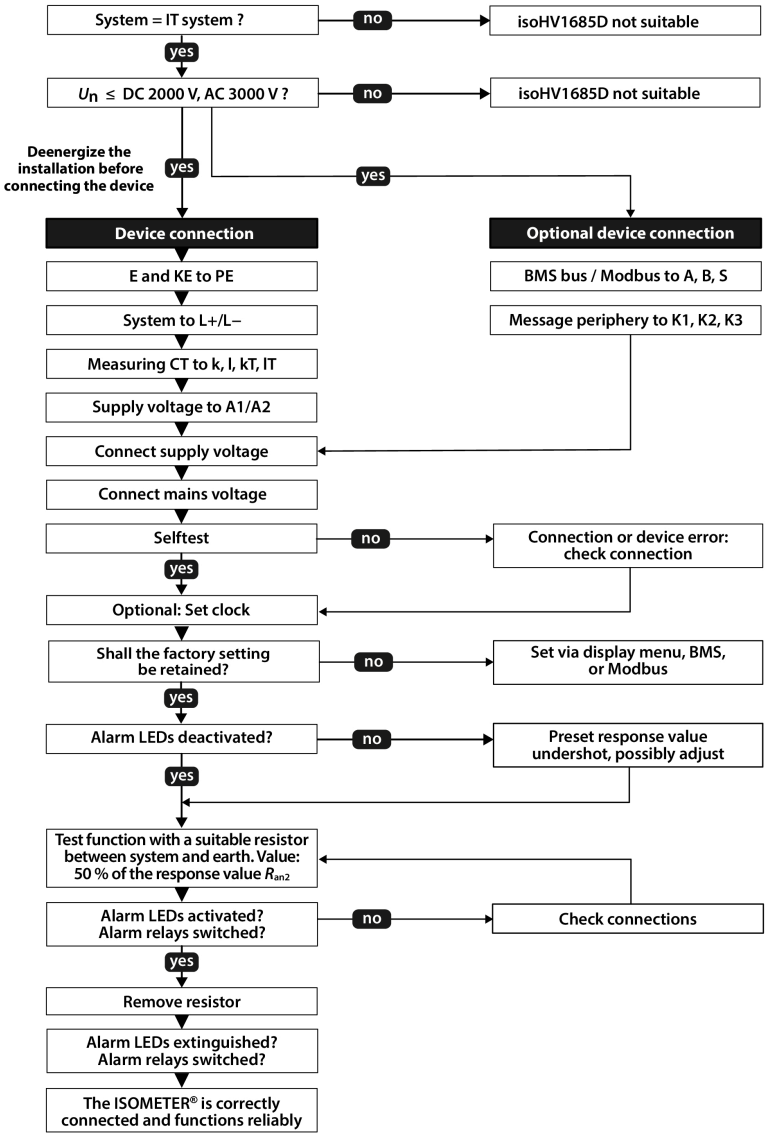
1. Connect terminals **E** and **KE** to earth (PE).
2. Connect terminals **A** and **B** to the BMS bus.
3. Connect terminal **S** to the bus conductor shield (only at one end of the conductor).
4. Connect terminals **I1+**, **I1–** and **I2+**, **I2–** to digital control switches and external voltage source (DC 24 V).
5. Connect terminal **L1/+** to **L1** of the system to be monitored.
6. Connect terminal **L2/–** to **L2** of the system to be monitored.

   *The coupling terminals **L1/+** and **L2/–** are locked. To unplug the terminals, the orange sliders must be slid towards the front (towards the device) to unlock the terminal. Now the terminal can be unplugged.*

7. Connect alarm outputs of the relays **K1**, **K2** and **K3**.
8. Connect terminal **A1**/**A2** to the supply voltage U_s.

6 Commissionig

6.1 Commissioning diagram

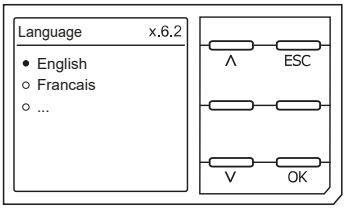


6.2 Initial commissioning

Follow the instructions of the commissioning wizard on the display.

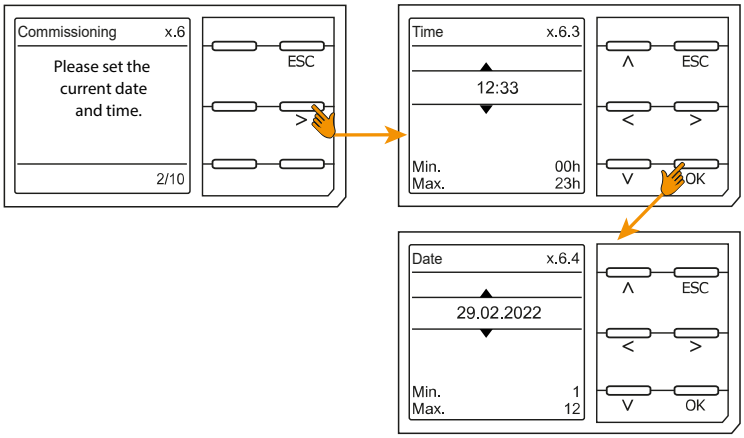
Setting the language

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



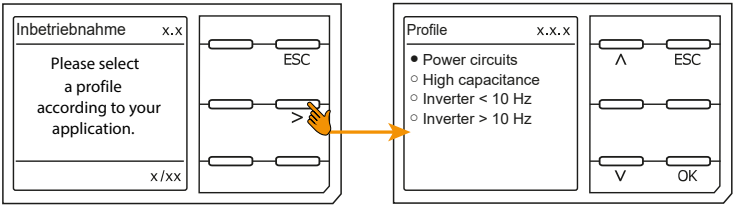
Setting date and time

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



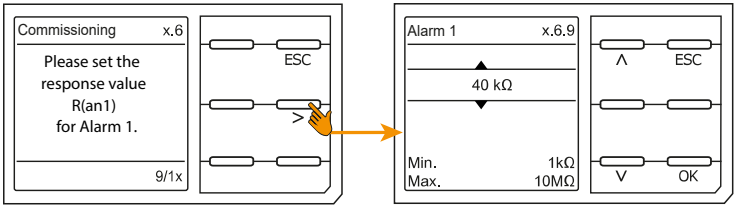
Setting the profile

In order to optimally adapt the insulation monitoring device to the system to be monitored, select a profile that suits your system. For an overview of the profiles, refer to chapter 10.1 Device profiles.

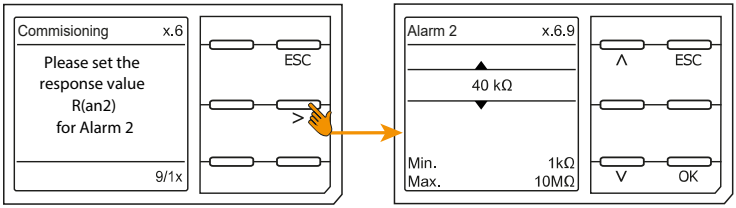


Setting response values

Set the prewarning response value. Recommendation: 300 Ω/V

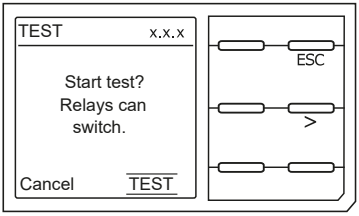


Set the alarm response value. Recommendation: 100 Ω/V



TEST

Start the device test.



During the test, all relays switch and the ALARM 1 and ALARM 2 LEDs light up briefly.

7 Display

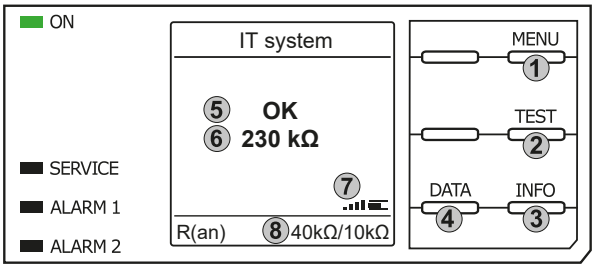
7.1 Standard display

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

	**The signal quality of the measurement is suitable for the selected profile** The better the signal quality, the faster and more exact the device can measure.
	**The signal quality of the measurement is not suitable for the selected profile** Select a different measurement profile. (See "Device profiles", Page 45.)
	Progress bar between two measuring pulses

The set response values for R_{an1} and R_{an2} are shown in the bottom row of the display.

In the example below, R_{an1} = 40 kΩ and R_{an2} = 10 kΩ.



Keypad

1. Menu selection
2. Start Test
3. Device information
4. Measuring data displayed as graph

Display

5. System state
6. Currently measured value
7. Signal quality and progress bar
8. Currently set values for prewarning and alarm

7.2 Fault display (active)

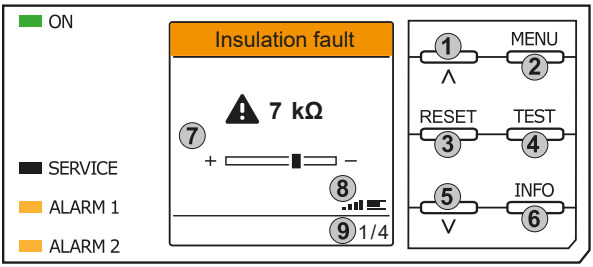
An active fault is displayed by the general warning sign. The upper part of the display turns orange and displays the fault message.

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

In the following example, a resistance has been detected. Since the values R_{an1} and R_{an2} 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 ∨ and ∧ buttons.

If the value falls below R_{an1} in a DC system or a DC offset is detected in an AC system, additional detailed information regarding the DC offset will be displayed.



Keypad

1. Previous fault
2. Menu selection
3. Acknowledge fault
4. Start test
5. Next fault
6. Device information

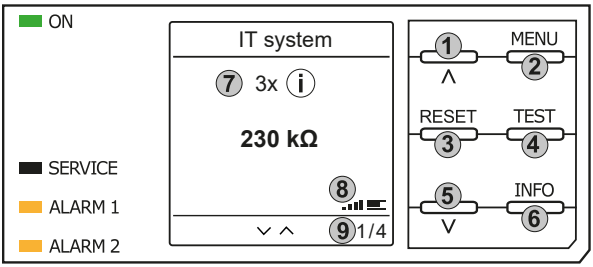
Display

7. Display of fault value and DC shift
8. Signal quality and progress bar
9. xth fault of

7.3 Fault display (inactive)

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

The message shown on the display means that there has been a fault in the past but the device is no longer in active fault condition.



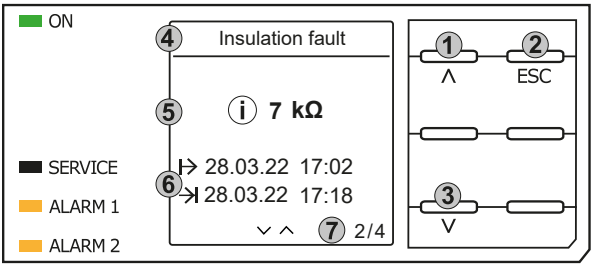
Keypad

1. Previous fault message
2. Menu selection
3. Acknowledge fault
4. Perform manual device test
5. Next fault message
6. Device information

Display

7. Fault number /fault message count
8. Signal quality & measuring pulses
9. Number of the selected fault/Fault message count

If several fault messages have occurred, navigate through the faults using the ∨ and ∧ buttons. 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.



Keypad

1. Previous fault message
2. Exit view
3. Next fault message

Display

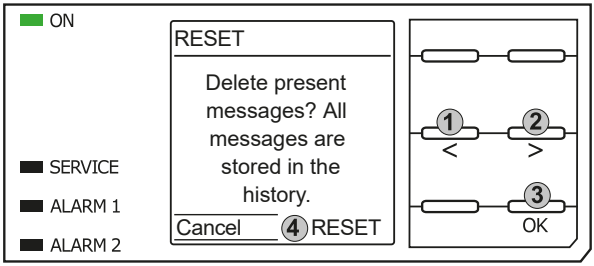
4. Fault description
5. Alarm value
6. Fault appeared / fault disappeared
7. Number of the selected fault/Fault message count

7.4 Acknowledging a fault message

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 fault has been eliminated.

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



Keypad

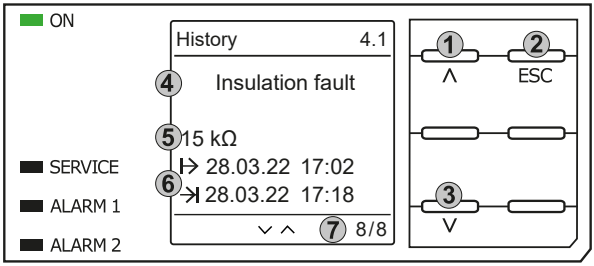
1. Select Cancel.
2. Select RESET.
3. Confirm function.

Display

4. Functions Cancel / Reset

7.5 History memory

Up to 1023 alarm messages and device errors are stored in the history memory with date and time stamp. If the history memory is deleted, the minimum insulation resistance R_{min} will also be reset in the display *Data - isoGraph*.



Keypad

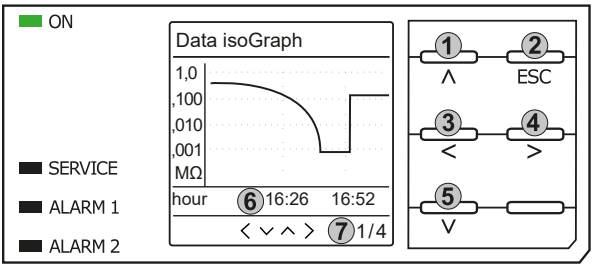
1. Next message
2. Exit view
3. Previous message

Display

4. Fault description
5. Alarm value
6. Fault appeared / fault disappeared
7. Number of the selected fault/Fault message count

7.6 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 show each graph on the display, and the resolution of each graph is determined by these values.



Keypad

1. Switch to previous measured value overview
2. Exit view
3. Change scaling (zoom in)
4. Change scaling (zoom out)
5. Switch to next measured value overview

Display

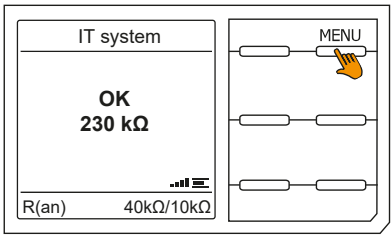
6. Present time scaling
7. xth view of ...

8 Settings

8.1 Operating and navigating

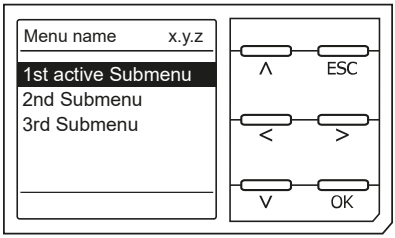
Menu selection

Activate the menu by pressing the **MENU** button.



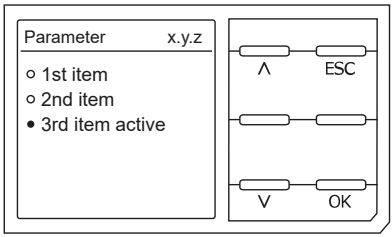
Selection of submenus

Use the and buttons ∧ and ∨ to select the options.
Press the button > or **OK** to jump to the next submenu for the selected options.
Exit the menu by pressing the button < or **ESC**.
To return to the start page, press the ESC button for 2 seconds.



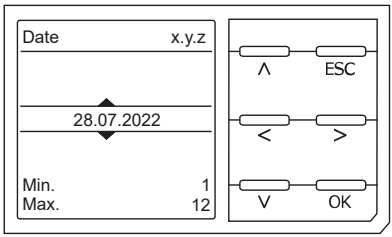
List selection

Use the buttons ∨ and ∧ to select values from a predefined list (menu). The present value is indicated by a black menu item. Confirm the value with the **OK** button. Exit the list selection by pressing **ESC**.



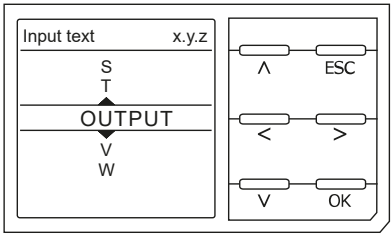
Parameter selection and value adjustment

Use the buttons < and > to select a parameter. The present parameter is highlighted. Values can be changed using the buttons ∨ and ∧. Confirm the value with the **OK** button. Exit the list selection by pressing **ESC**.



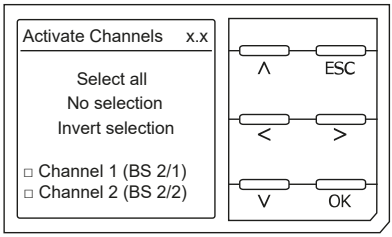
Character input

Use the buttons < and > to to select a character position on the display. Change a character with the buttons ∧ and ∨.
To delete a character, use the < and > buttons to select the position and then select **del** using the ∨ and ∧ buttons.
Confirm the entered text with **OK**. Exit the character input by pressing **ESC**.



Multiple selection in the device menu

Use the buttons ∧ and ∨ to select options (**Select all**, **No selection**, **Invert selection**) and the channels.
Confirm the entered text with **OK**.
For the selected channels, press the > button to activate or to jump to the next submenu.
Exit the menu by pressing **ESC**.



8.2 Menu overview isoHV1685D

1. Alarm settings
   1. Insulation alarm
   2. Profile
   3. Device
   4. Coupling monitoring
   5. Power frequency
   6. Inputs
      1. Digital 1
      2. Digital 2 see Digital 1
   7. Outputs
      1. Relay 1
      2. Relay 2 see Relay 1
      3. Buzzer
2. Data meas. values
3. Control
   1. Test
   2. Reset
   3. EDS
4. History *(nur "Löschen" geschützt)*
   1. History
   2. Delete
5. Devive settings
   1. Language
   2. Clock
   3. Interface
   4. Display
   5. Password
   6. Commissioning
   7. Factory settings
   8. Service
6. Info

8.3 Settings in the device menu

8.3.1 Alarm settings

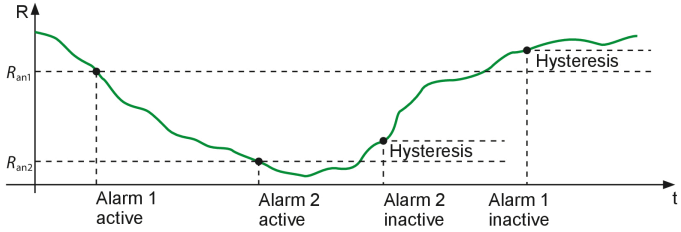
The limit values for the insulation resistances of Alarm 1 and Alarm 2 can be specified in the **Alarm settings** menu and can be adapted to the user profile of the ISOMETER®.

8.3.1.1 Insulation alarm

In the **Insulation alarm** menu, the ISOMETER® limit values for **Alarm 1** and **Alarm 2** can be set.

Activation and deactivation of the two alarm levels R_{an1} for **Alarm 1** and R_{an2} for **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.



Menu item: Alarm 1

For **Alarm 1** an insulation resistance of 1 kΩ…10 MΩ can be set independently of **Alarm 2**.

Menu item: Alarm 2

For **Alarm 2** an insulation resistance of 1 kΩ…10 MΩ can be set independently of **Alarm 1**.

Menu item: Fault memory

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

- **on** If a fault becomes inactive, the programmed outputs remain in fault condition until the system is reset manually.
- **off** If a fault becomes inactive, the programmed outputs automatically change their state.

8.3.1.2 Profile

Adapt the area of application of the ISOMETER® to your system profile. For a description of the profiles, refer to “Device profiles”, Page 45.

The following profiles can be selected:

Power circuits	Suitable for most IT systems
High capacitance	Suitable for systems with high leakage capacitances Limit of measuring range: 200 kΩ
Inverter >10 Hz	Suitable for systems with dynamic frequency control by inverters in the range of 10…460 Hz
Inverter <10 Hz	Suitable for systems with dynamic frequency control by inverters in the range of 0.1…460 Hz
Fast 2000 µF	Suitable for systems with very high leakage capacitances Limit of measuring range: 50 kΩ

8.3.1.3 Device

Switch the measurement of the insulation resistance of the ISOMETER® active or inactive:

- **Active** The device is active.
- **Inactive** The device does not measure the insulation resistance and is disconnected from the monitoring system (system disconnection). The IT system is not monitored!
  The message **Device inactive** appears on the display
  The LEDs **ALARM1** and **ALARM2** light up.

8.3.1.4 Coupling monitoring

The ISOMETER® continuously monitors the coupling of energised systems. The coupling of deenergised systems is monitored at 24 hour intervals. This monitoring function can be activated or deactivated.

- **on** Coupling monitoring is activated.
- **off** Coupling monitoring is deactivated.

8.3.1.5 Power frequency

This setting is used to set the ideal measurement parameters.

- **<= 460 Hz** The mains frequency is parameterised to 460 Hz.
- **> 460 Hz** The mains frequency is parameterised higher than 460 Hz.

8.3.1.6 Single-pole operation

The isoHV1685D-425 can be used in applications up to DC 6 kV. This requires a centre tap to which the device is connected single-pole. (See **4** in “Connection diagram”, Page 18.)

In single-pole operation, coupling monitoring to the system to be monitored is deactivated.

- **on** Activates the function.
- **off** Deactivates the function.

8.3.1.7 Inputs

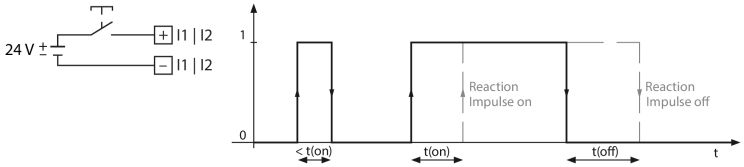
The ISOMETER® isoHV1685D provides 2 digital inputs (I1, I2) that are freely configurable.

8.3.1.7.1 Digital inputs

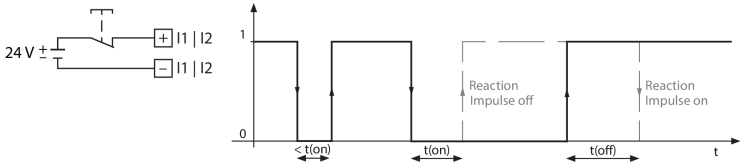
The digital inputs can be set with the following parameters:

Mode

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



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



t(on)

The response time t(on) after a switch-on signal can be set between 100 milliseconds and 5 minutes.

t(off)

The response time t(off) after a switch-off signal can be set between 100 milliseconds and 5 minutes.

Function

The functions of the digital inputs of the ISOMETER®s:

• 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! The device disconnects itself from the system to be monitored through an internal system isolating switch.
• Start initial measurement	All recorded measured values are discarded, and a new measurement will be started.

8.3.1.8 Outputs

The ISOMETER® provides a total of 3 alarm relays. The following parameters can be set for relay 1 and relay 2:

8.3.1.8.1 Relays

Relays 1 and 2

The following relay parameters can be set:

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

Operating mode

The relay mode can be adapted to the application:

- **N/C** N/C operation of the contacts 11-12-14 / 21-22-24
  (in fault-free condition, the alarm relay is energised).
- **N/O** N/O operation of the contacts 11-12-14 / 21-22-24
  (in fault-free condition, the alarm relay is de-energised).

Relay 3

Relay 3 does not appear in the device menu. The operating mode is set to closed-circuit current and cannot be parameterised.

8.3.1.8.2 Buzzer

The following parameters can be set for the buzzer.

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

Functions

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 1	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 faults occurs: – No low-resistance connection between the line conductors. – No low-resistance connection of terminals **E** and **KE** to earth (PE).
Device error	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.
Device inactive	The status of the output changes when the device has been deactivated via a digital input or the control menu.

8.3.2 Data measured values

The ISOMETER® stores certain measured values for a specific period of time. These data can be viewed at the "Data meas. values" menu item. Navigate through the different views using the ∧ and ∨ buttons:

Data - isoGraph	Displays the insulation resistance and chronological sequence.
Data - Insulation	Displays the current insulation resistance and the system leakage capacitance.
Data - Voltage	Displays the system voltages and the partial voltages to earth.

8.3.3 Control

In the control menu, a manual test can be performed and the alarm messages can be reset:

• **TEST**	Manual device test
• **RESET**	Reset of fault and alarm messages
• **EDS**	Start insulation fault location

8.3.4 History

In the history menu, the faults detected by the ISOMETER® are displayed. For a detailed description refer to “History memory”, Page 25.

• **History**	Overview of faults that have occurred
• **Delete**	Resets the history memory

8.3.5 Device settings

Here you can make the basic settings of the ISOMETER®.

8.3.5.1 Language

You can select the following display languages:

- **Deutsch**
- **English (GB)**
- **Español**
- **Français**
- **Norsk**
- **Polski**
- **Português**
- **Suomi**

8.3.5.2 Clock (& Date)

Setting the time and date in the device.

- **Time**
  Setting the current time.
- **Time format**
  Setting the time format.
  - **12 h** 12-hour notation am/pm
  - **24 h** 24-hour notation
- **Summer time**

Setting the mode for the change between summer and winter time.

off	No automatic change between summer time and standard time
DST	Daylight Saving Time
	Automatic time change according to North American Regulation:
	Start: Second Sunday in March from 2:00 a.m. local time to 3:00 a.m. local time.
	End: First Sunday in November from 3:00 a.m. local time to 2:00 a.m. (local time)
CEST	Central European Summer Time
	Automatic time change according to Central European Regulation:
	Start: Last Sunday in March from 02:00 a.m. CET to 03:00 a.m. CEST.
	End: Last Sunday in October from 03:00 a.m. CEST to 02:00 a.m. CET.

- **Date**
  Setting the current date.
- **Date format**
  Setting the format of the displayed date.

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

8.3.5.3 Interface

Set the parameters for connecting additional devices to the ISOMETER® in the menu **Interface**.

- Mode
- BMS
- Modbus/RTU

Mode

Settings for communication with other devices via the BMS bus or Modbus/RTU

- BMS
- Modbus/RTU

BMS

BMS address
Address setting of the BMS bus from 1 to 90.

Modbus RTU

Modbus RTU address

Address setting in the address range 1 to 247

Baudrate

- 9,6 kB
- 19,2 kB
- 37,4 kB
- 57,6 kB
- 115 kB

Parity

- even
- odd
- no

Stop Bits

- 1
- 2
- auto

8.3.5.4 Display

You can adjust the display brightness for the ISOMETER® in the **Display** menu:

Menu item: 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. Then, when a button is pressed, the original brightness is restored.

8.3.5.5 Password

The password function permits protecting device parameters against unauthorised changes.

Menu item: Password

Entering the four-digit device password. The default password is 0000.

Menu item: Status

Decide whether the password query should be used:

- **on** Password query active
- **off** Password query inactive

8.3.5.6 Commissioning

In the meu **Commissioning** you can reopen the ISOMETER®'s commissioning wizard. Pressing the commissioning button immediately starts the commissioning wizard.

After going through all the queried values, the new values are accepted by the device. Press **ESC** to abort the process.

8.3.5.7 Factory settings

Resetting the device to factory settings.

8.3.5.8 Service

The service menu is accessible only by Bender Service.

8.3.5.9 Info

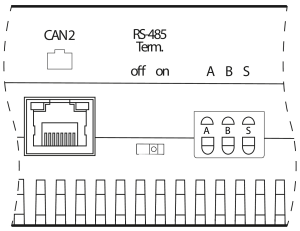
The ISOMETER®'s present settings can be viewed in the **Info** menu. Navigate through the different views using the ∧ and ∨ buttons:

- **Device** Device name, serial number, article number
- **Software** Software version of measuring instruments, software version of HMI
- **Measurement** Set profile
- **RS485** Address of the RS-485 interface

9 Device communication

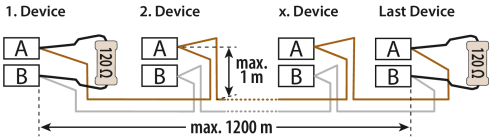
9.1 RS-485 interface

The RS-485 interface, galvanically isolated from the device electronics, serves as a physical transmission medium for the BMS protocol. When an ISOMETER® or other bus-capable devices are interconnected via the BMS bus in a network, the BMS bus must be terminated at both ends with a 120 Ω resistor. The device isoHV1685D is equipped with the terminating switch **RS-485 Term.** (on/off).



Wiring of a RS-485 network

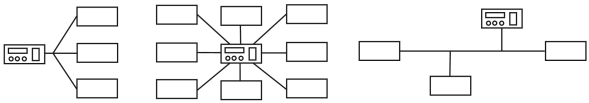
The optimum topology for an RS-485 network is a daisy-chain connection. In this connection, device 1 is connected to device 2, device 2 to device 3, device 3 to device 4 etc. The RS-485 network represents a continuous path without branches.



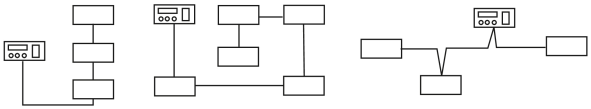
NOTE

An RS-485 network that is not terminated is likely to become unstable and cause malfunctions. Only the first and last device in one line may be terminated. Hence, stub feeders in the network must not be terminated. The length of the stub feeders is restricted to a maximum of 1 m.

Examples for wrong arrangement



Examples for correct arrangement

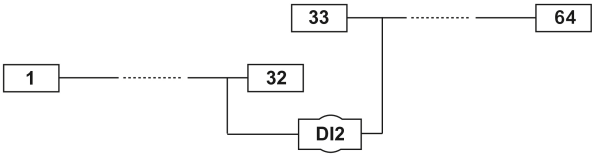


Wiring

The following cable is recommended for wiring the RS-485 network:

Shielded cable, core diameter 0.8 mm (e.g. J-Y(St)Y 2x0.8), shield connected to earth (PE) on one end.

The max number of bus nodes is restricted to 32 devices. If more devices are to be connected, Bender recommends the use of a DI1 repeater.



Commissioning of an RS-485 network

- Interconnect 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 the supply voltage on.
- Assign the master function and address 1 to a bus-capable device.
- Assign addresses (2, 3, 4, … 90) to all other bus devices in consecutive order.

9.2 BMS protocol

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. Only one master may exist in each network. All bus devices are identified by a unique BMS address. The master cyclically scans all other slaves on the bus, waits for their response and then carries out the corresponding commands.

A device receives the master function by assigning bus address 1 to it.

BMS master

A master can query all measured values, alarm and operating messages from a slave. If bus address 1 is assigned to a device, this device automatically operates as master, i.e. all addresses between 1 and 150 are cyclically scanned for alarm and operating messages via the BMS bus. If the master detects incorrect answers from a slave, the fault message **Fault RS-485** is output via the BMS bus.

Possible fault causes:

- Address assigned twice
- Second master on the BMS bus
- Interference signals on the bus lines
- Defective device on the bus
- Terminating resistors not activated or connected

Commissioning of an RS-485 network with BMS protocol

- Interconnect 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 the supply voltage on.
- Assign the master function and address 1 to a bus-capable device.
- Assign addresses (2…90) to all other bus devices in consecutive order.

9.2.1 Set BMS addresses

The ISOMETER® cannot switch on a potential termination at the BMS bus. Even though this is not expected to cause communication problems, the ISOMETER® should be operated as BMS slave if possible (BMS address > 1). If no other device with master capabilities is available on the bus, the ISOMETER® can be set to master (BMS address 1).

Before the ISOMETER® takes over the backup master function after being switched on, it waits to see if another master connects to the system. Waiting period: BMS address minus 1 = waiting period in minutes.

Example: Time the ISOMETER® with BMS address 3 waits for a master to connect: 3 min – 1 min = 2 min

Set the BMS address in the device menu via the following path:

MENU: Device settings > Interface > BMS > BMS adress

9.2.2 Messages via the BMS bus

Messages are transmitted to a maximum of 12 BMS channels. All alarm, operating and error messages are described below.

Alarm messages

Alarm	Channel	Meaning
Alarm 1 (insulation fault)	1	Insulation resistance Prewarning (Value < response value 1, $R_F < R_{an1}$)
Alarm 2 (insulation fault)	2	Insulation resistance Alarm (Value < response value 2, $R_F < R_{an2}$)
Connection system	4	Connection fault system
Connection PE	5	Connection fault earth
Device error	7	Internal device error
Overtemperature coupling	10	Overtemperature coupling **L1/+**
Overtemperature coupling	11	Overtemperature coupling **L2/–**

Operating messages

Alarm	Channel	Meaning
Insulation resistance	1	Current insulation resistance R_F (if $R_F > (R_{an1}$ + Hysteresis))
Insulation resistance	2	Current insulation resistance R_F (if $R_F > (R_{an2}$ + Hysteresis))
Leakage capacitance	4	Leakage capacitance C_e in nF, µF
Mains voltage	5	Current system voltage U_N
Partial voltage U+/PE	6	Current partial voltage terminal **L1/+** to earth
Partial voltage U–/PE	7	Current partial voltage terminal **L2/–** to earth
Temperature coupling	10	Current temperature of the coupling **L1/+**
Temperature coupling	11	Current temperature of the coupling **L2/–**

Error codes

Error code	Component	Error	Action
BMS			
0.10	Connection	CT connection	Check connection
0.30	Connection	Connection earth (**E**/**KE**)	Check connection
0.40	Connection	Connection system (**L1/+**, **L2/–**)	Check connection
4.05	Parameter	Incorrect measurement method selected	Change measurement method
7.63	System	Timeout system management	Restart the device
8.11	Hardware	Self test insulation measurement	Contact service
8.12	Hardware	Hardware measuring voltage source	Replace the device
8.41	Connection	Mains voltage polarity incorrect (**L1/+**, **L2/–**)	Check connection
8.42	Hardware	Supply voltage ADC	Replace the device
8.43	Hardware	Supply voltage +12 V	Replace the device
8.44	Hardware	Supply voltage –12 V	Replace the device
8.45	Hardware	Supply voltage +5 V	Replace the device
8.46	Hardware	Supply voltage +3.3 V	Replace the device
9.61	Parameter	Insulation measurement	Load factory settings and parameterise again
9.62	Parameter	Residual current measurement	Load factory settings and parameterise again
9.64	Parameter	Voltage measurement	Contact service
9.70	System	General software error	Restart the device
9.71	System	Control flow	Restart the device
9.72	System	Programme sequence insulation measurement	Restart the device
9.74	System	Programme sequence voltage measurement	Restart the device
9.75	System	Programme sequence temperature measurement	Restart the device
9.76	System	Programme sequence history memory	Restart the device
9.77	System	Programme sequence console	Restart the device
9.78	System	Programme sequence self test	Restart the device
9.79	System	Stack error	Restart the device
9.80	System	Stack error	Restart the device
9.81	System	Internal programme sequence	Restart the device
9.82	System	Internal programme sequence	Restart the device

Resetting error messages

Recorded errors are presented as alarm messages on the BMS bus.

The fault messages are reset via the device menu. If the fault continues to exist, the message will be generated again. The error can also be reset by means of the acknowledgement command via the BMS bus.

Firmware update via BMS bus

The firmware is updated via the BMS bus with the 'BMS Update Manager', which is available from Bender.

9.3 Modbus RTU protocol

Modbus is an internationally used protocol for data exchange between devices. The Modbus RTU protocol is used by Bender devices for connection in systems with Condition Monitor (e.g. COM465xP) or for connection to third-party systems

The protocol transmits measured values, status messages, control commands or unit parameters in binary form. All measured values, messages and parameters are stored in virtual register addresses. With a read command to a register address, data can be read out. With a write command, data can be written to a register address.

For detailed information about the Modbus RTU protocol, including its properties and commissioning, please refer to the "Modbus RTU" manual at https://www.bender.de/en/service-support/download-area/.

10 Technical data

10.1 Device profiles

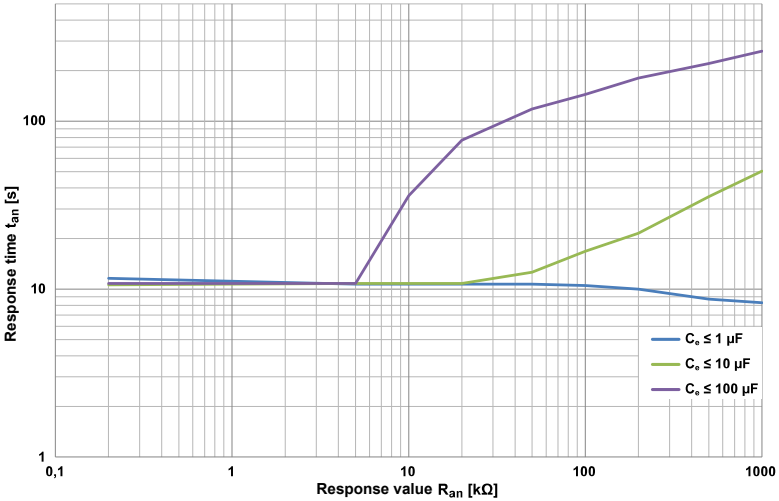
The adaptation to different applications is achieved by selecting a device profile. The following device profiles are available.

Power circuits

Main circuits without dynamic frequency changes. The universal profile is suitable for all systems primarily with constant power frequencies and extraneous DC voltages. When using inverters and dynamic frequency control, select **Inverter > 10 Hz** or **Inverter < 10 Hz**.

Settings profile 'Power circuits'

F_n	C_e	U_m	Response values
DC, 15…460 Hz	0…150 µF	± 50 V	200 Ω … 1 MΩ

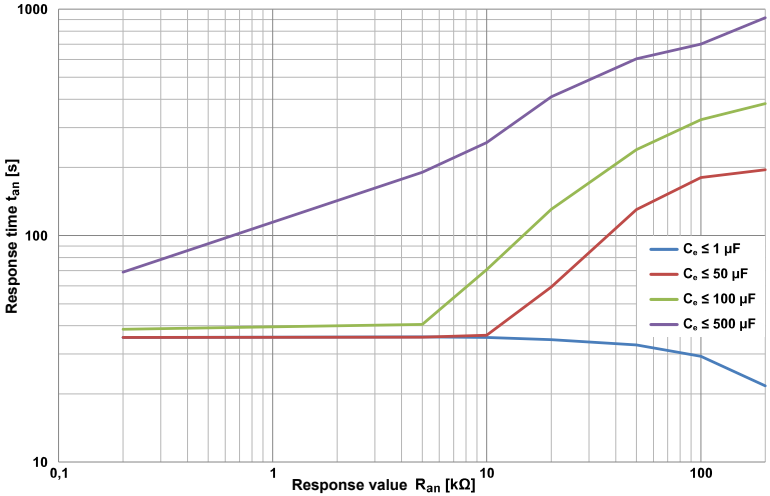


High capacitance

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.

Settings profile 'High capacitance'

F_n	C_e	U_m	Response values
DC, 15…460 Hz	0…500 µF	± 50 V	200 Ω … 200 kΩ

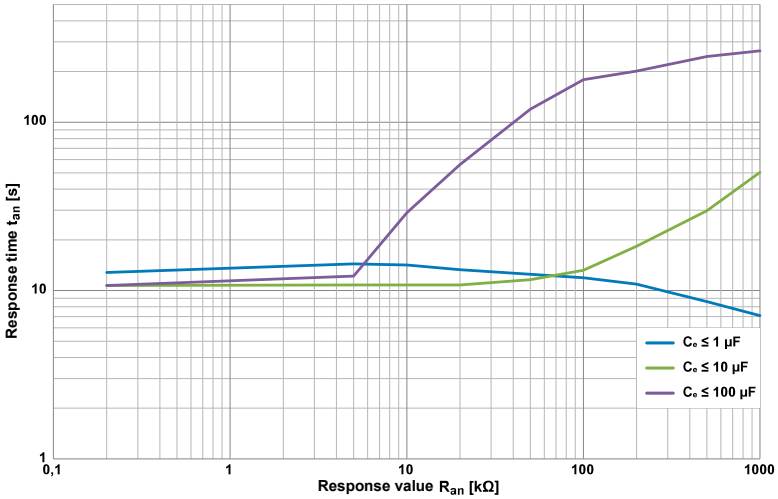


Inverter > 10 Hz

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.

Settings profile 'Inverter > 10 Hz'

F_n	C_e	U_m	Response values
DC, 10…460 Hz	0…150 µF	± 50 V	200 Ω … 1 MΩ

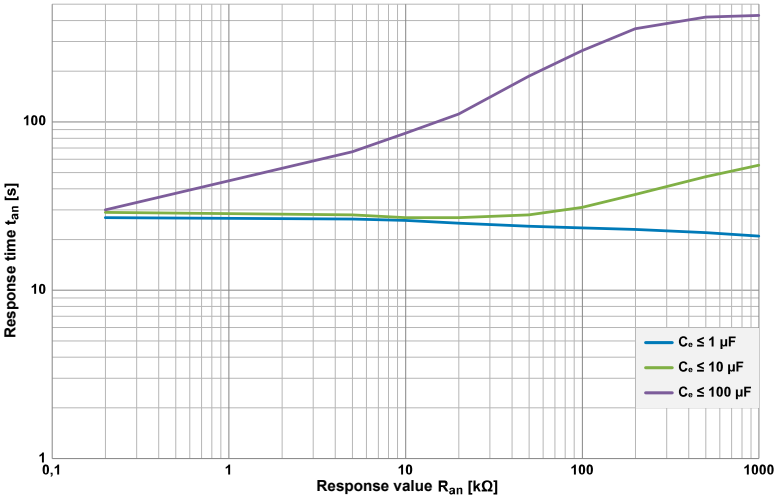


Inverter < 10 Hz

For systems involving extremely low-frequency control in the range of up to 0.1…460 Hz and very slow and continuously changing extraneous DC voltages due to dynamic load conditions in an IT system, continuous insulation monitoring can be optimised using this profile.

Settings profile 'Inverter < 10 Hz'

F_n	C_e	U_m	Response values
DC, 0,1…460 Hz	0…150 µF	± 50 V	200 Ω … 1 MΩ

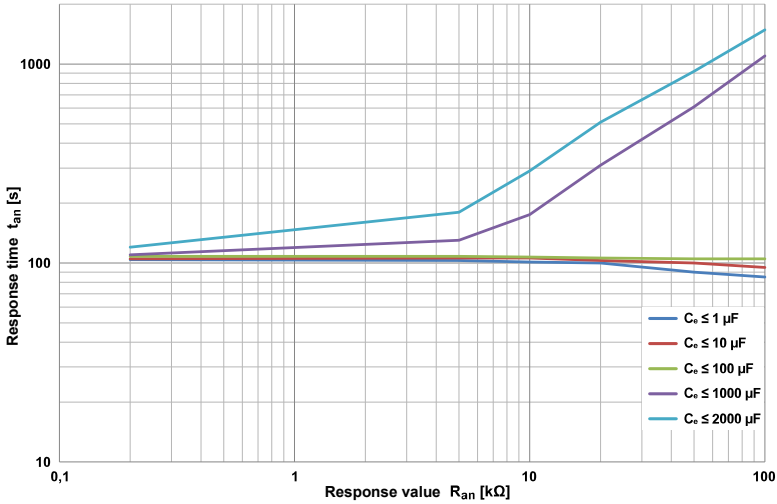


Fast 2000 µF

For systems with very high leakage capacitances, e.g. in large-scale photovoltaic systems, this profile ensures correct measurement.

Settings profile 'Fast 2000 µF'

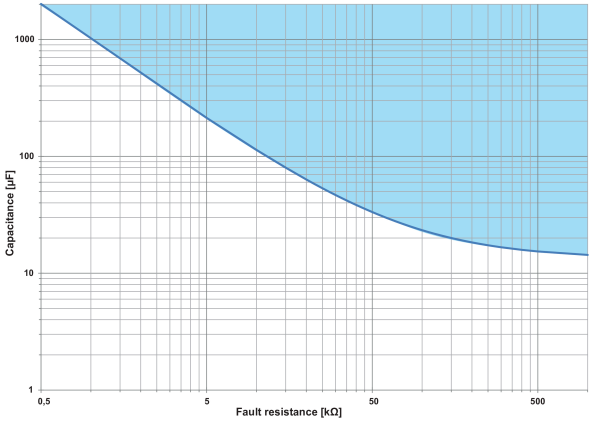
F_n	C_e	U_m	Response values
DC, 15…460 Hz	0…2000 µF	± 50 V	200 Ω … 50 kΩ



Leakage capacitance diagram

The determination of the leakage capacitance depends on the size of the insulation resistance. The following diagrams show the relationship

Example:
Insulation resistance 50 kΩ => min. measurable leakage capacitance 35 µF
Insulation resistance 5 kΩ => min. measurable leakage capacitance 210 µF



10.2 Factory settings

Parameter	Value	Setting via		
		BMS	Display	Modbus RTU
Response value R_{an1} (ALARM 1)	40 kΩ	×	×	×
Response value R_{an2} (ALARM 2)	10 kΩ	×	×	×
Fault memory	off	×	×	×
Relay K1	TEST (on) n/c operation	× ×	× ×	× ×
Relay K2	TEST (on) n/c operation	× ×	× ×	× ×
Device profile	Power circuits	×	×	×
Time	not defined	×	×	×
BMS address	2		×	×
BMS termination*	ON			

* Termination by switch only, see “RS-485 interface”, Page 38

10.3 Tabular data

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

Definitions	
Measuring circuit (IC1)	(L1/+, L2/–), (E, KE)
Supply circuit (IC2)	A1, A2
Output circuit 1 (IC3)	11, 12, 14
Output circuit 2 (IC4)	21, 22, 24
Output circuit 3 (IC5)	31, 32, 34
Control circuit (IC6)	(A, B), (I1+, I1–, I2+, I2–)
Rated voltage	DC 3000 V
Overvoltage category (OVC)	III

Rated impulse voltage	
IC1 / (IC2-5)	16.67 kV
IC2 / (IC3-5)	4 kV
IC2 / IC1+IC6	0.8 kV
IC3 / (IC4-6)	4 kV
IC4 / (IC5-6)	4 kV
IC5 / IC6	4 kV

Rated insulation voltage	
IC1 / (IC2-5)	3000 V
IC2 / (IC3-5)	250 V
IC2 / IC1+IC6	50 V
IC3 / (IC4-6)	250 V
IC4 / (IC5-6)	250 V
IC5 / IC6	250 V
Pollution degree	3

Safe isolation (reinforced insulation) between

IC1 / (IC2-5)	OVC III, 3000 V
IC2 / (IC3-5)	OVC III, 300 V
IC2 / IC1+IC6	OVC III, 50 V
IC3 / (IC4-6)	OVC III, 300 V
IC4 / (IC5-6)	OVC III, 300 V
IC5 / IC6	OVC III, 300 V

Voltage test (routine test) acc. to IEC61010-1

IC1 / (IC2-5)	AC 2.2 kV
IC2 / IC6	DC ±0.5 kV
IC3 / (IC4-6)	AC 2.2 kV
IC4 / (IC5-6)	AC 2.2 kV
IC5 / IC6	AC 2.2 kV

Supply voltage

Supply voltage U_s	DC 18…30 V
Power consumption	≤ 9 W

Voltage range of the system to be monitored

Nominal system voltage range U_n	AC 0…2000 V; DC 0…3000 V
Frequency range f_n	DC 0.1…460 Hz
Tolerance of U_n	AC +10 %; DC +5 %

Measuring circuit for insulation monitoring

Measuring voltage U_m (peak)	± 50 V
Measuring current I_m (at R_F = 0 Ω)	≤ 1.5 mA
Internal DC resistance R_i (two-pole coupling) Internal DC resistance R_i (single-pole coupling)	≥ 210 kΩ ≥ 420 kΩ
Impedance Z_i at 50 Hz (two-pole coupling) Impedance Z_i at 50 Hz (single-pole coupling)	≥ 210 kΩ ≥ 420 kΩ
Permissible extraneous DC voltage U_{fg}	≤ DC 3150 V
Permissible system leakage capacitance C_e (profile-dependent)	0...2000 µF

* for U_n > 500 V no longer in accordance with IEC61557-8

Response values for insulation monitoring

Response values R_{an} (profile-dependent)	200 Ω … 1 MΩ
Condition for response values R_{an1} and R_{an2}	$R_{an1} \geq R_{an2}$
Obere Messbereichsgrenze bei Einstellung C_{emax} = 500 µF (Profil **High capacitance**)	200 kΩ
Upper limit of the measuring range for setting C_{emax} = 2000 µF (Profile **Fast 2000 µF**)	50 kΩ
Relative uncertainty (acc. to IEC 61557-8) 10 kΩ…1 MΩ 0.2 kΩ…< 10 kΩ	 ±15 % ±200 Ω ±15 %
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. 10 s
Hysteresis	25 %, +1 kΩ

Display

Indicator LEDs for alarms and operating states	1 × green, 4 × yellow
Display	Grafic display 127 × 127 pixel, 40 × 40 mm
Display range measured value (profile-dependent)	200 Ω … 50 MΩ

Inputs

Operating mode	active high, active low
Functions	off, test, reset, deactivate device, insulation fault location
High level	10…30 V
Low level	0…0.5 V

Serial interface

Interface	RS-485
Protocols	BMS; Modbus RTU
Connection	Terminals A/B Shield: terminal S
Cable length	≤ 1200 m
Shielded cable (shield to functional earth on one end)	2-core, ≥ 0.6 mm², z. B. J-Y(St)Y 2x0.6
Terminating resistor, can be connected (Term. RS-485)	120 Ω (0.5 W)
Device address, BMS bus	2…90
Device address, Modbus RTU	1…247
Baud rate	9.6 / 19.2 / 38.4 / 57.6 / 115 kB
Parity	even / odd
Stop bits	1 / 2 / auto

Switching elements

Switching elements	3 changeover contacts:
K1	Insulation fault alarm 1
K2	Insulation fault alarm 2
K3	Device error
Operating principle K1, K2	n/c operation; n/o operation
Operating principle K3	n/c operation
Electrical endurance under rated operating conditions	100,000 cycles

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
Minimum contact rating	1 mA bei AC/DC ≥ 10 V

Connection (except mains connection)

Connection type	pluggable push-wire terminals
Connection, rigid/flexible	0.2…2.5 mm² / 0.2…2.5 mm²
Connection, flexible with ferrule, without/with plastic sleeve	0.25…2.5 mm²
Conductor sizes (AWG)	24…12

Mains connection

Connection type	pluggable push-wire terminals
Connection, rigid/flexible	0.2…10 mm² / 0.2…6 mm²
Connection, flexible with ferrule, without/with plastic sleeve	0.25…6 mm² / 0.25…4 mm²
Conductor sizes (AWG)	24…8
Stripping length	15 mm
Opening force	90…120 N

Environment / EMC

EMC	IEC 61326-2-4
Rel. humidity	10…100 %
Area of application	≤ 3000 m NN

Ambient temperature

Stationary use	–40…+70 °C
Transport	–40…+80 °C
Long-term storage	–25…+80 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K23
Transport (IEC 60721-3-2)	2K11
Long-term storage (IEC 60721-3-1)	1K22

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M11
Transport (IEC 60721-3-2)	2M4
Long-term storage (IEC 60721-3-1)	1M12

Other

Operating mode	continuous operation
Position of normal use	vertical, mains connection on top
Tightening torque for enclosure mounting (4× M5)	1.0…1.5 Nm
Degree of protection, internal components	IP30
Degree of protection, terminals	IP30
Enclosure material	polycarbonate
Flammability class	V-0
Software version	D0588 | D0589
Weight	≤1600 g

10.4 Standards and approvals

The ISOMETER® isoHV1685D was developed in compliance with the following standards:

- IEC 61557-8
- IEC 61557-8 Appendix C (for profile **Fast 2000 µF** only)

10.5 Ordering details

Model	Response value	Nom. system voltage	Supply voltage	Art. No.
isoHV1685D-425	200 Ω…1 MΩ	AC 0…2000 V DC 0…3000 V	DC 24 V ±25%	B91065805

Change log manual isoHV1685D

Date	Document version	Software version	Changes
05/2025	00	D0588	First issue
09/2025	01	"	Adjusting factory settings: Relay 1/2 - Test (on)

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