EN Manual

BENDER
The Power in Electrical Safety©

ISOMETER® iso1685FR
iso1685FRM

AC

Insulation monitoring device
for unearthed AC systems
(IT systems) up to AC 5 kV
iso1685FR: Software version D0407 V1.1x
iso1685FRM with analogue output: Software version D0563 V1.0x

iso1685FR(M)_D00002_02_M_XXEN/06.2017

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Fotos: Bender archive.

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1. Important information

1.1 How to use this manual

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

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

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

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

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

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

This operating manual describes the iso1685FR ISOMETER® series, which consists of the iso1685FR and iso1685FRM devices.

1.2 Technical support

For commissioning and troubleshooting Bender offers you:

1.2.1 First level support

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

- Questions concerning specific customer applications
- Commissioning
- Troubleshooting

Telephone: +49 6401 807-7760*
Fax: +49 6401 807-259
only in Germany: 0700BenderHelp (Telephone and Fax)
E-mail: support@bender-service.de

1.2.2 Repair service

Repair, calibration, update and replacement service for Bender products

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

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

Please send the devices for **repair** to the following address:
Bender GmbH, Repair-Service,
Londorfer Str. 65,
35305 Grünberg

1.2.3 Field service

On-site service for all Bender products

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

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

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

1.3 Training courses

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

1.4 Delivery conditions

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

1.5 Storage

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

1.6 Disposal

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

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

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

2. Safety instructions

2.1 General safety instructions

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

2.2 Work activities on electrical installations

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

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

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

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

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

2.3 Device specific safety information

Danger as a result of excessive locating current or excessive locating voltage!
An excessive locating current of the internal locating current injector may damage sensitive loads (e.g. control circuits) or trigger unwanted switching operations. Select a low locating current for these systems. In case of doubt, please contact our service department (refer to "chapter 1.2 Technical support").

Risk of electric shock!
When opening the device, you may come into contact with live parts. Switch off the mains voltage before opening the device!

Make sure that the basic settings meet the requirements of the IT system. Persons without the required expertise, in particular children, must not have access to or contact with the ISOMETER®.

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

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

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

When using ISOMETER®s in IT systems, make sure that only one active ISO-METER® 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.

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

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

2.4 Address setting and termination

Correct address setting and termination is essential for proper functioning of the device.

CAUTION

Risk of bus errors!
Double assignment of addresses on the respective BMS or CAN busses can cause serious malfunctions.

Ensure correct address setting and termination of the device!

2.5 Intended use

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

The device is used for the insulation monitoring of IT (i.e. unearthed) systems which need very fast signaling or disconnection and a small leakage capacitance .
The measuring method, especially developed to provide a quick-release solution, monitors the impedance to ground even in thyristor-controlled systems where the mains voltage is not purely sinusoidal.

Intended use also implies:

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

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

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

3. Function

3.1 Features

- Insulation monitoring of AC and 3(N)AC systems with low leakage capacitance (< 200 nF)
- Fast tripping due to the patented SSCP (Synchronous Sine Correlation Principle) measuring method: Notification of an insulation fault or shutdown within 150 ms
- Measuring the impedance between the system and earth (detection of ohmic and capacitive insulation faults)
- Response value Zan: 10 kΩ…1000 kΩ
- Configurable interference detection for the active method (Interference level, consecutive number of disturbed measurement periods) with the possibility of triggering a device fault in the event of continuous interference
- Measuring the neutral point shift to earth (UN-PE)
- Visual signalling of alarms, or connection or device errors via LEDs
- 2 redundant signaling relays for the notification of insulation faults
- Connection monitoring of L1/+, L2/–
- Monitoring of the earth connections E/KE
- Self test at device start with automatic notification in the event of a fault
- iso1685FR: RS-485 interface (BMS bus) to output measured values and for configuration
- iso1685FRM: RS-485 interface (BMS bus and Modbus RTU; switched using the DIP switch)
  The BMS bus is used to output measured values and to configure the device.
  Modbus RTU is used to communicate with the Modbus-analogue converter M-7024. By means of the converter, the iso1685FRM provides an analogue output.
- µSD card with data logger and history memory for alarms
- Protection against unauthorized or accidental parameter changes

3.2 Product description

3.2.1 General product description

The ISOMETER® iso1685FR… is an insulation monitoring device for IT systems in accordance with IEC 61557-8. It is applicable for use in AC systems.

3.2.2 Particularities of the ISOMETER® iso1685FRM

The only difference between the ISOMETER® iso1685FRM and the ISOMETER® iso1685FR is the following:
By means of the Modbus-analogue converter M-7024, the ISOMETER® iso1685FRM provides an analogue output. Communication takes place via Modbus RTU. The DIP switch can be used to switch between the BMS and Modbus protocol.

Further information is available in the following chapter:

- Activating the Modbus RTU protocol: "chapter ISOMETER®s iso1685FRM DIP switch assignment"
- Connection: "chapter 5.2.3 Anschlussplan mit Modbus RTU (ISOMETER® iso1685FRM)" und "chapter 5.2.5 Step-by-step connection of the iso1685FRM ISOMETER®"

- Commissioning: "chapter 5.3.2 Commissioning of the ISOMETER® iso1685FRM"
- Modbus RTU protocol: "chapter 6.2 Device communication with Modbus RTU"

3.3 Functional description

Insulation monitoring is carried out using an active measuring signal which is superimposed onto the IT system to earth via the integrated coupling.
If the impedance value Z_e between the IT system and earth falls below the set response value Z_{an}, the Alarm LEDs ALARM 1 and ALARM 2 light up and the Alarm relays K1 and K2 are switched.
In addition to the active method, an optional passive method can be activated which monitors the imbalance of the IT network by measuring the voltage between the neutral point and earth of the IT network. If the voltage $U_{N\text{-}PE}$ between the neutral point and earth exceeds the set response value U_{an}, the Alarm LEDs ALARM 1 and ALARM 2 light up and the Alarm relays K1 and K2 are switched.
Both measuring methods (active and passive) act in parallel to the alarm relays K1 und K2.
The integrated µSD card is used as data logger for storing all relevant events.

The following measured values, statuses and alarms are stored during operation:

- Impedance Z_e between the system and earth
- Insulation fault R_e between the system and earth (when the system capacitance has been set)
- Voltage between the neutral point and earth
- System frequency
- Insulation fault
- Connection fault
- Device fault

Following each start-up, a new log file is generated. If the current file size exceeds 10 MByte during operation, a new file is generated. The file name contains the time and date of when the file was created. The typical time needed until the maximum file size is reached is approximately 1 day. Hence, a µSD card with a memory space of 2 Gbytes can record data for approx. 800 days. When the maximum data limit is reached on your card, the oldest file in each case will be overwritten.
If the card cannot be written to despite an inserted µSD card, a device error occurs. With this fault, relay K3 (31, 32, 34) is not switched.
If no µSD card has been inserted, a device error notification will be sent via the BMS bus.
The generation of the device error notification when the µSD card has not been inserted can be activated or deactivated by means of the DIP switch 7. (See "chapter 4.3 Display and operating elements").
The history memory that is also copied to the µSD card contains all alarms in .csv format.

3.3.1 Insulation monitoring

3.3.1.1 Active method (SSCP)

For insulation monitoring, a sinusoidal AC measuring voltage is superimposed onto the IT system. An insulation fault between the IT system and earth closes the measuring circuit. If the insulation impedance between the IT system and earth falls below the set response value Z_{an}, the associated alarm relay K1 (11, 12,14) and K2 (21, 22, 24) are switched. Detected insulation faults are signalled to other bus devices via the BMS bus. In addition, the alarm LEDs Alarm 1 and Alarm 2 light up.

The active method includes configurable interference detection. The sensitivity and duration can be configured via the parameters "Störgrad" (Interference level) and "Störanzahl" (Number of interferences) respectively until a device fault is triggered.An interference occurs when the current interference level exceeds the set threshold (Störgrad, i.e. interference level). If the detected fault remains uninterrupted for a time longer than that set in the parameter "Störanzahl" (Number of interferences) * half the measuring period (20 ms), then a device fault

is triggered. This function can be used to prevent the active process from being continuously interrupted, which in turn means that insulation errors could then be found.

3.3.1.2 Passive method

Parallel to the active measuring method, a passive method is integrated for single-phase faults on the respective live conductors (phases), which monitors the voltage between the neutral point of the IT network and earth.
If the voltage $U_{N\text{-}PE}$ between the neutral point and earth exceeds the set response value U_{an}, the Alarm LEDs ALARM 1 and ALARM 2 light up and the Alarm relays K1 and K2 are switched.

Both measuring methods (active and passive) work in parallel to the alarm relays K1 und K2 as well as the Alarm LEDs ALARM 1 and ALARM 2. Redundant changerover contacts are therefore available for the notification of insulation faults.

3.3.2 Connection monitoring

The following tests are continuously carried out in the background:

- Connection E-KE
- Connection to the system (L1/+, L2/–)

3.3.3 Assignment of the alarm relays K1, K2, K3

- Alarm relay K1 switches when the value falls below the response value Z_{an} (insulation impedance).
- Alarm relay K2 switches when the value falls below the response value Z_{an} (insulation impedance).
- Alarm relay K3 switches in the event of a device error or a connection fault.

If the passive method is enabled, then the relays also switch.

- Alarm relay K1 switches when the voltage $U_{N\text{-}PE}$ exceeds the set response value U_{an}.
- Alarm relay K2 switches when the voltage $U_{N\text{-}PE}$ exceeds the set response value U_{an}.
- Alarm relay K3 switches in the event of a device error or a connection fault.

3.3.4 Measured value transmission

All recorded measured values, operating messages and alarms are made available via the BMS bus.

3.4 History memory

All warnings, alarms and device errors are stored in the internal history memory with date and time stamp. The time the event started, the time of acknowledgement and the end of the event are recorded.
The history data are copied from the internal EEPROM to the History.csv file on the µSD card under the following conditions:

- Follo
- a compatible µSD card has been inserted
- For the evaluation of the history memory, the Excel tool "iso1685 History.xlsx" can be made available.

3.5 Self test

3.5.1 Self test after connection to the supply voltage

Once connected to the supply voltage, all internal measurement functions as well as the process control components, such as data and parameter memory, are checked.

- All internal measuring functions
- Flash memory
- RAM memory
- Parameter memory
- CPU clock (Oscillator)
- CPU register
- External watchdog
- All internal watchdogs

Once the self test is finished, after approx. 3 s the normal measurement mode begins.

If a device error is detected, the corresponding alarm will be signalled via the BMS bus as well as via the alarm relay K3 (31-32-34). This relay continuously operates in N/C mode, i.e. it de-energises even in case of a complete device failure.During this self test, which occurs during device start up, the alarm relays K1 and K2 are not switched.

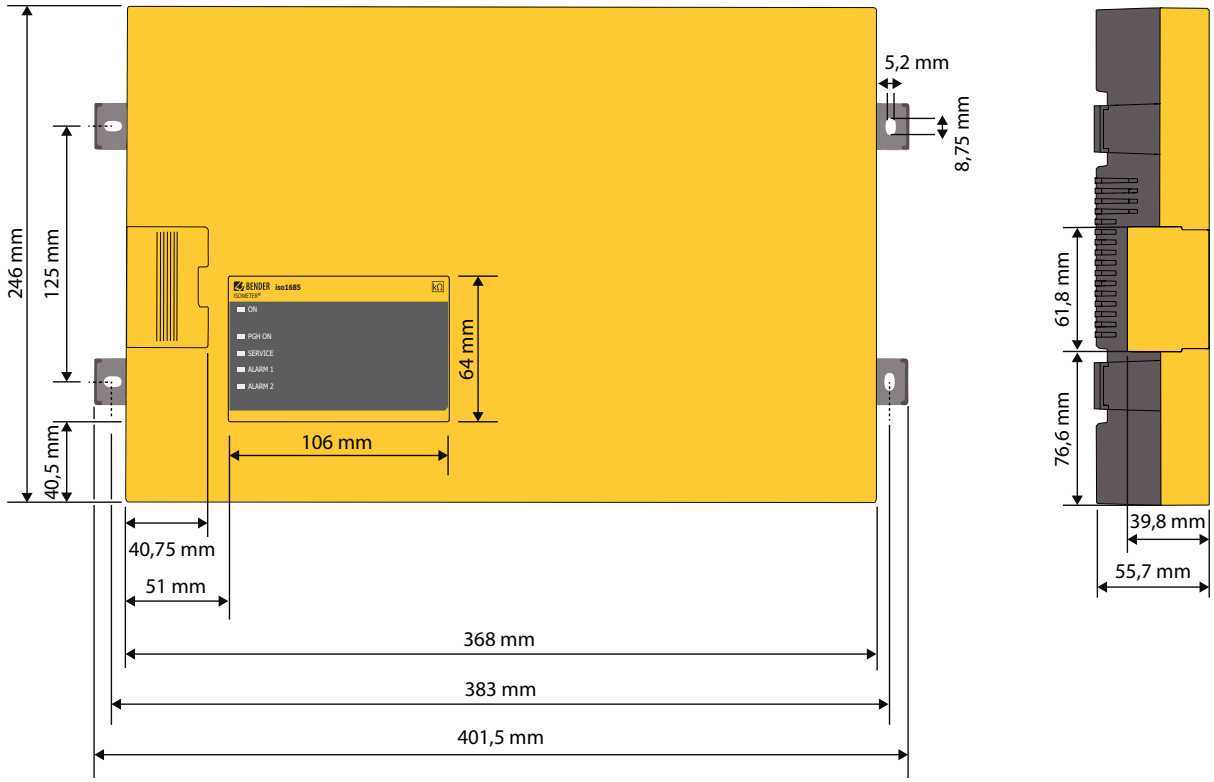
3.5.2 Continuous self test during operation

The following tests are continuously carried out in the background:

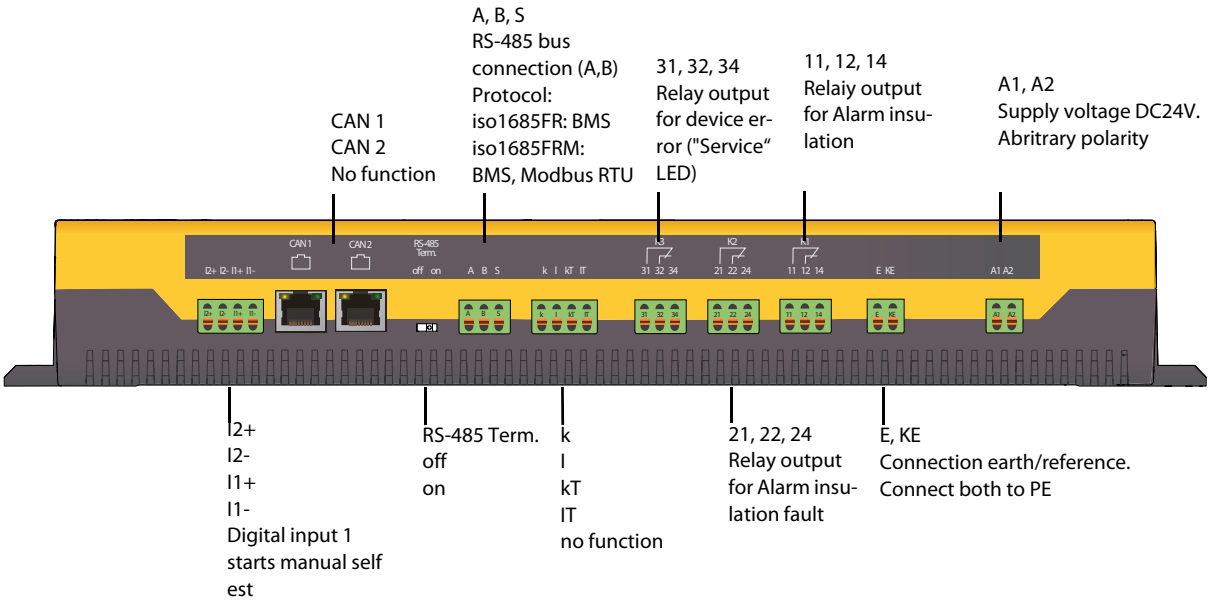
- Stack
- CPU clock (Oscillator)
- CPU register
- Monitoring of the supply voltage U_s
- Temperature monitoring (of?) coupling
- Measuring voltage generator
- Data, parameter and Flash memories
- RAM memory

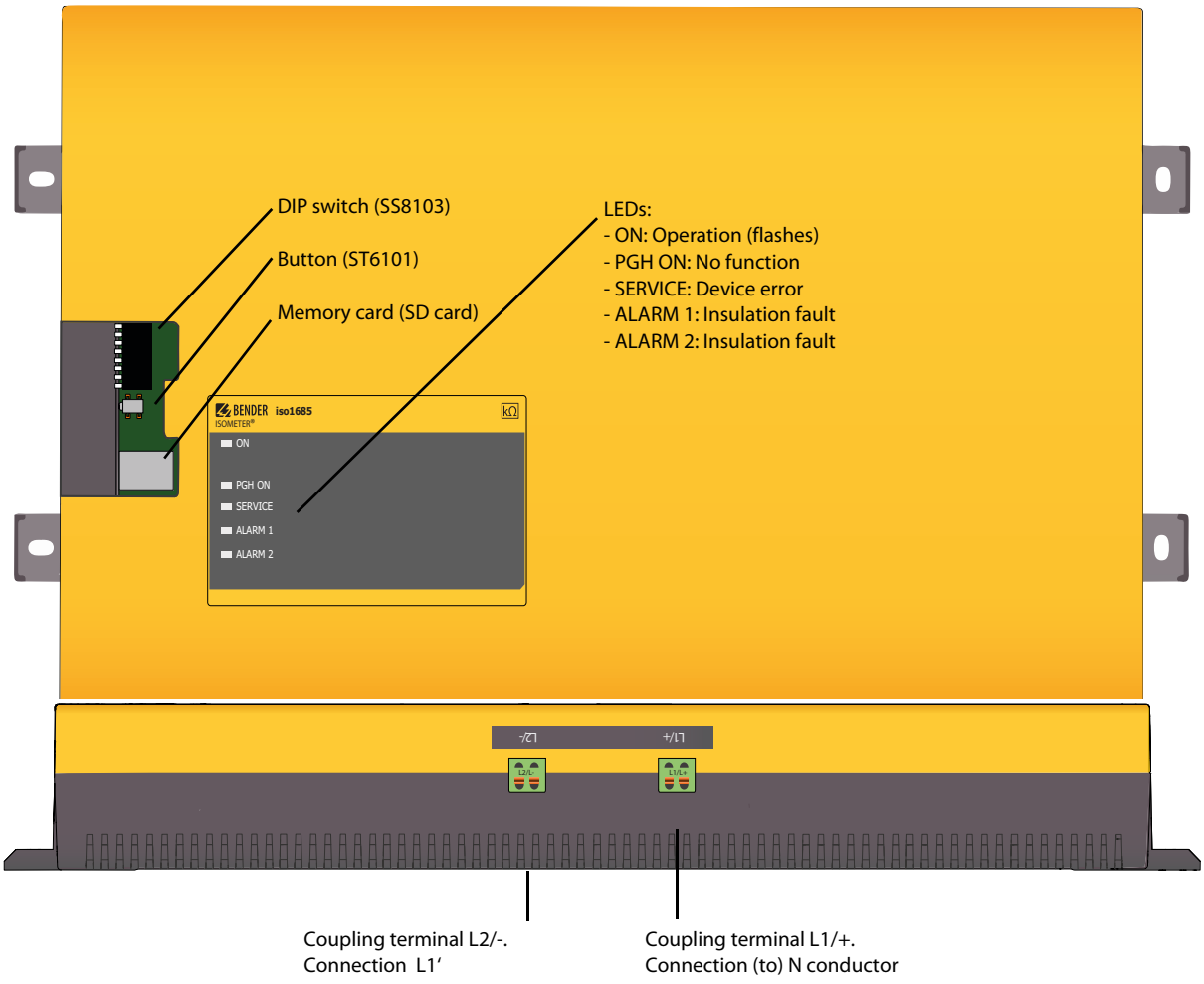
4. Device overview

4.1 Dimensions



4.2 Connections

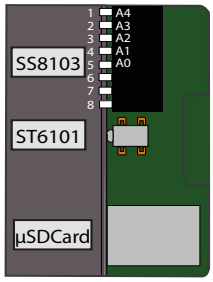




4.3 Display and operating elements

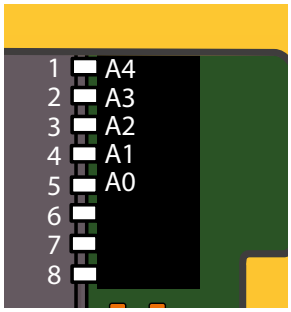
4.3.1 Operating elements

The representation below shows the position of the operating elements



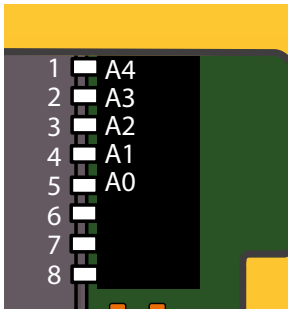
Operating elements	Function
DIP switch (SS8103)	Setting the BMS address
Button (ST6101)	Reset device fault messages
Memory card (SD Card)	Memory for log files and history memory (µSD card);

ISOMETER®s iso1685FR DIP swich assignment



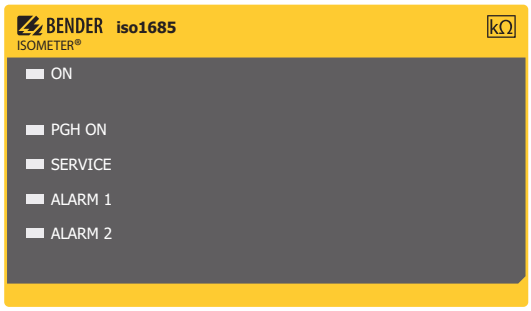
DIP switch number	Function
1…5	Setting the BMS address
6	Locking the parameter function ON = Parameter **cannot** be changed OFF = Parameter can be changed
7	Device error notification when the µSD card has not been inserted ON = Device error will be signalled. The device-error relay K3 (31/32/34) does **not** switch! OFF = Device error will **NOT** be signalled.
8	Not used

ISOMETER®s iso1685FRM DIP switch assignment



DIP switch number	Function
1	Switching between BMS/Modbus RTU protocols ON = Modbus RTU OFF = BMS
2…5	Setting BMS address
6	Locking the parameter function ON = Parameter **cannot** be changed OFF = Parameter can be changed
7	Device error notification when the µSD card has not been inserted ON = Device error will be signalled. The device-error relay K3 (31/32/34) does **not** switch! OFF = Device error will **NOT** be signalled.
8	Not used

4.3.2 Melde-LEDs auf dem Gehäuseoberteil



LED	Description
ON (green)	Power On indicator: • Flashes with a pulse duty factor of approx. 80 % and 1 Hz. Device error: • Lights continuously, when the device stops functioning (device stopped). Software update: • Flashes approx. three times faster during a firmware update: Update time < 4 minutes
PGH ON (green)	No function
SERVICE (yellow)	Internal device and connection error (system, earth): Lights continuously. Also refer to the list of error codes on page 31
ALARM 1 (yellow)	Insulation fault: Lights continuously when the insulation impedance falls below the response value $Z_e < Z_{an2}$
	Passive methodLights continuously when the voltage $U_{N\text{-}PE}$ exceeds the set response value U_{an} überschreitet, $U_{N\text{-}PE} > U_{an}$
ALARM 2 (yellow)	Insulation fault 2 (alarm): Lights continuously when the insulation impedance falls below the response value $Z_e < Z_{an2}$
	Passive methodLights continuously when the voltage $U_{N\text{-}PE}$ exceeds the set response value U_{an} überschreitet, $U_{N\text{-}PE} > U_{an}$

5. Installation, connection and commissioning

5.1 Installation

Install the device using four M5 screws, refer also to the dimension diagram.Install the device so that it is in a vertical position with the system coupling (L1/+, L2/–) positioned at the top when it is being operated.

5.2 Connection

All enclosed plug-in terminals are labelled.

5.2.1 Connection requirements

Risk of electric shock!
Touching uninsulated live conductors can result in death or serious injury. Therefore avoid any physical contact with active conductors and ensure compliance with the regulations for working on electrical installations.

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

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

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.

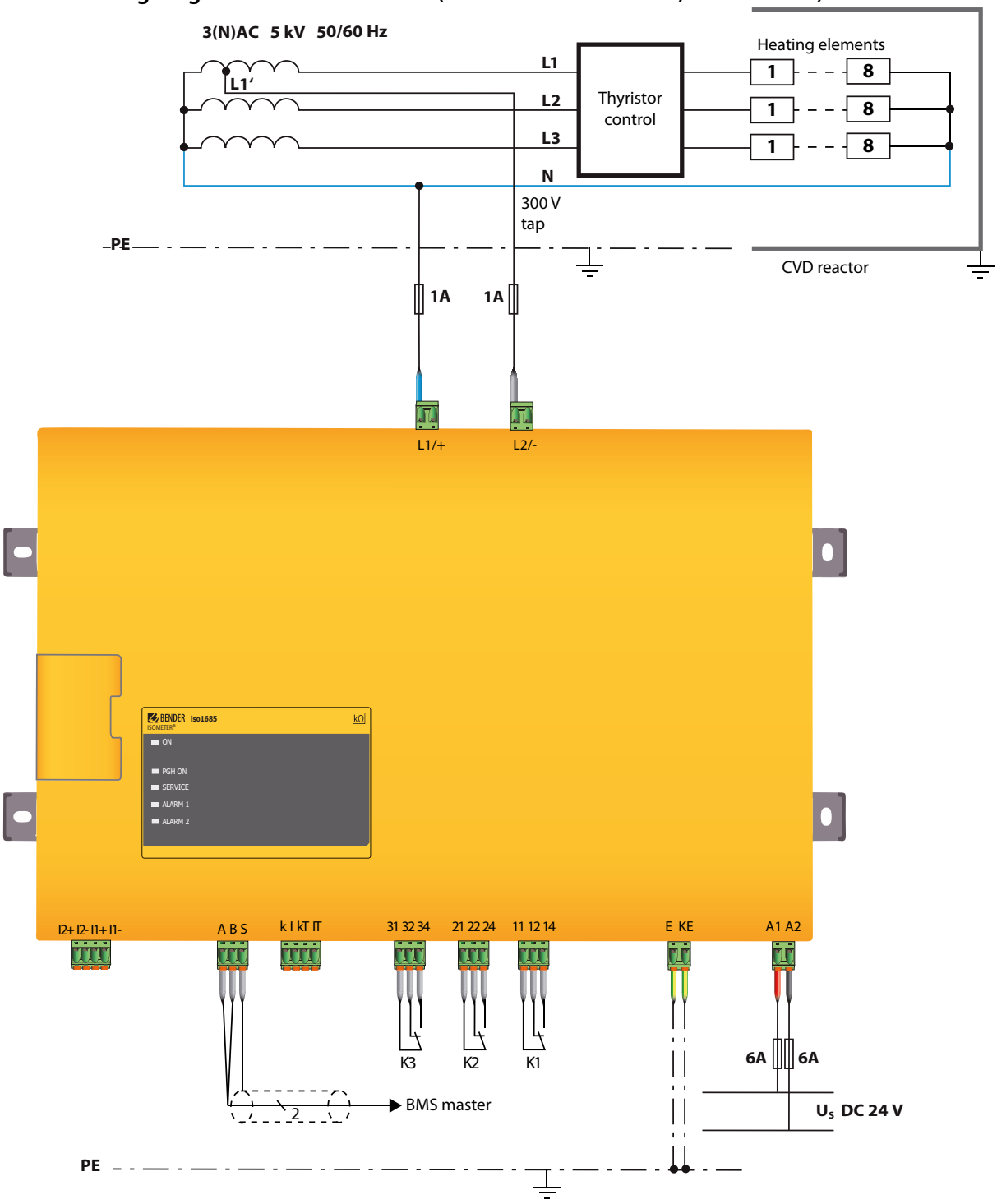
Ensure disconnection from the IT system!
When insulation or voltage tests are to be carried out, the device must be isolated from the system for the test period. Otherwise the device may be damaged.

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.

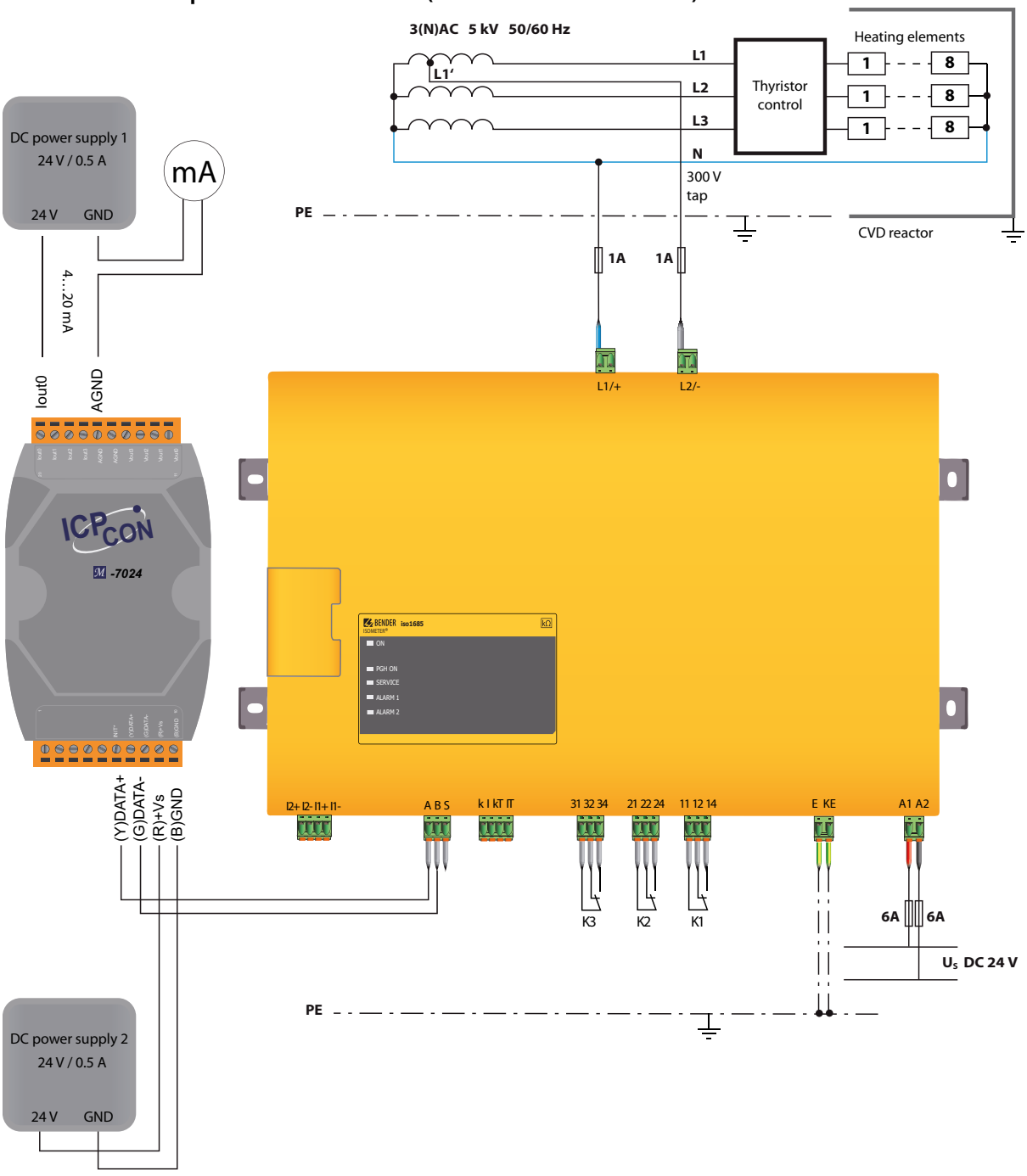
Prevent measurement errors!
When an AC system being monitored contains galvanically coupled DC circuits, take into consideration that: an insulation fault can only be detected correctly when the rectifier valves carry a minimum current of > 10 mA.

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.

5.2.2 Wiring diagram with Modbus RTU (ISOMETER® iso 1685FR, iso1685FRM)



5.2.3 Anschlussplan mit Modbus RTU (ISOMETER® iso1685FRM)



Terminal, Socket	Connections
I2+, I2–	Digital input - currently has no function
I1+, I1–	Digital input - currently has no function
A, B, S	• Connection to BMS bus, RS-485, S= shielded (internally connected to PE), terminating switch "RS-485 Term." • Modbus RTU connection (iso1685FRM only)
k, l/kT, lT	No function
31, 32, 34	Alarm relay K3 for internal device errors and connection faults
21, 22, 24	Alarm relay K2 for insulation faults
11, 12, 14	Alarm relay K1 for insulation faults
E, KE	Separate connection of E and KE to PE
A1, A2	Connection to U_S = DC 24 V via fuses, 6 A each
L1/+	Connection to N line
L2/-	Connection to L1' (300 V tap)

5.2.4 Step-by-step connection of the ISOMETER®iso1685FR

Connect the device with the help of the connection and terminal diagram. Proceed as follows:

1. Connect terminal E and KE to earth (PE)
2. Connect terminal A and B to the BMS bus
3. Connect terminal S to the shield of the bus line (only to one end of the line)
4. Connect terminal L1/+ to the N conductor (neutral point) of the system to be monitored
5. Connect terminal L2/- to L1' (300 V tap) of the system to be monitored
6. Connect terminal A1/A2 to DC 24 V
7. Connect the signal outputs 11/12/14 and 21/22/24 (Insulation fault alarm for the active and passive methods) and 31/32/34 (device error) for external signalling. The relay outputs 11/12/14 and 21/22/24 are implemented redundantly.

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.

5.2.5 Step-by-step connection of the iso1685FRM ISOMETER®

Connect the device with the help of the connection and terminal diagram. Proceed as follows:

1. Connect terminal E and KE to earth (PE)
2. BMS: Connect terminal A and B to the BMS bus
   OR
   Modbus RTUConnect terminal A to terminal (Y)DATA+ and terminal B to terminal (G)DATA- of the Modbus analog converter
3. When using the Modbus RTU interface:
   "RS485 Term." switchSet (RS485-Terminierung) to "On".
4. Connect terminal L1/+ to the N conductor (neutral point) of the system to be monitored
5. Connect terminal L2/- to L1' (300 V tap) of the system to be monitored
6. Connect terminal A1/A2 to DC 24 V
7. Connect the signal outputs 11/12/14 and 21/22/24 (Insulation fault alarm for the active and passive methods) and 31/32/34 (device error) for external signalling. The relay outputs 11/12/14 and 21/22/24 are implemented redundantly.

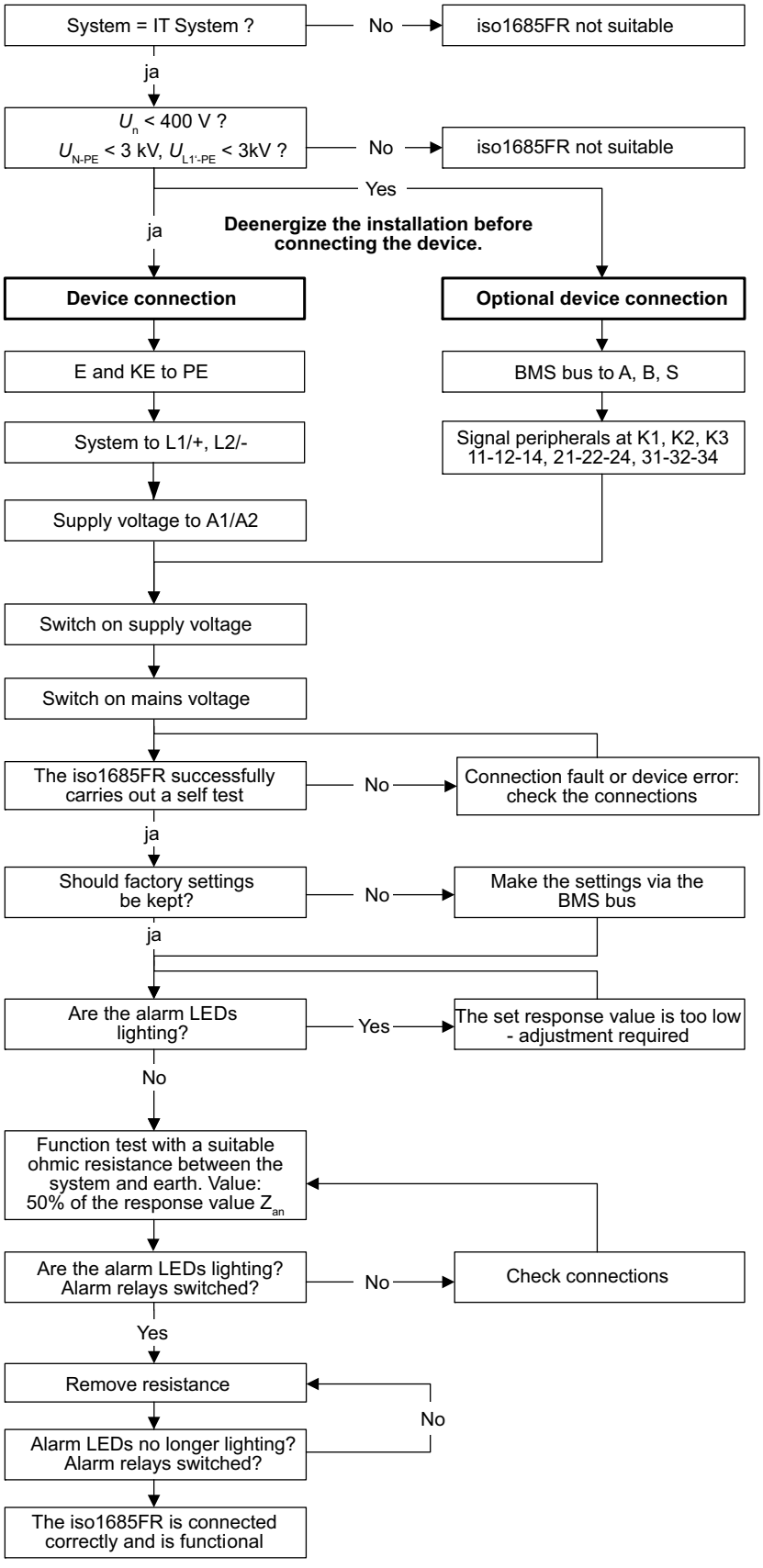
The coupling terminals L1/+ and L2/– are locked. To unplug the terminals, the orange sliders must be slid towards the front (towards the device) to unlock the terminal. Now the terminal can be unplugged.

The ISOMETER® must be switched on after or simultaneously with the Modbus analog converter.

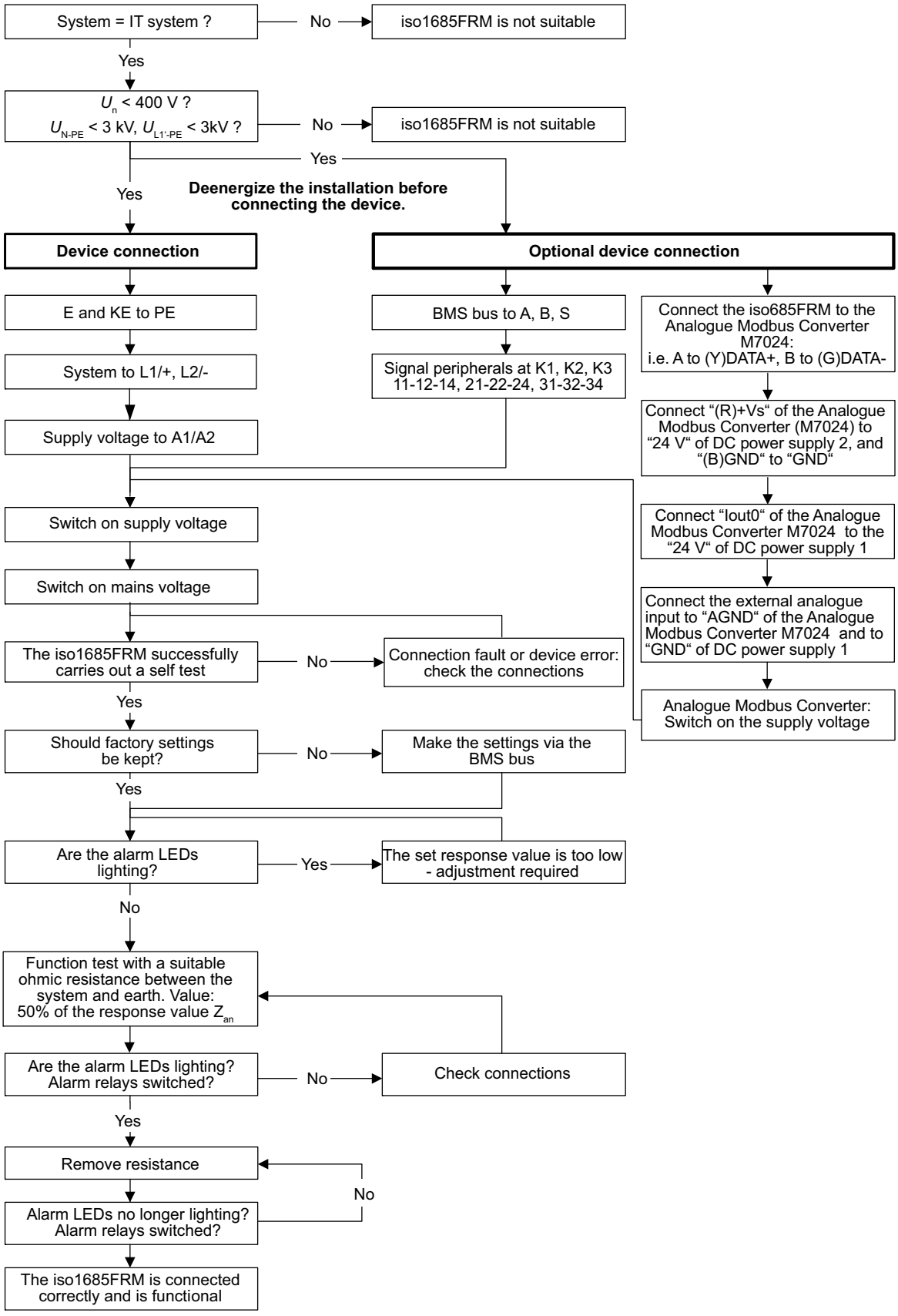
5.3 Commissioning

Refer to "chapter 7.1.2 Parameter description" for further information concerning device parameterization.

5.3.1 Commissioning of the ISOMETER® iso1685FR



5.3.2 Commissioning of the ISOMETER® iso1685FRM



6. Device communication

6.1 Device communication via the BMS bus

6.1.1 RS-485 interface with BMS protocol

The RS-485 interface, galvanically isolated from the device electronics, serves as a physical transmission medium for the BMS protocol (Bender measuring device interface). When one device 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. For this purpose, the device is equipped with the terminating switch RS-485 Term. (off/on).

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. Stub feeders in the network (if any) must not be terminated. The length of the stub feeders is restricted to 1 meter.

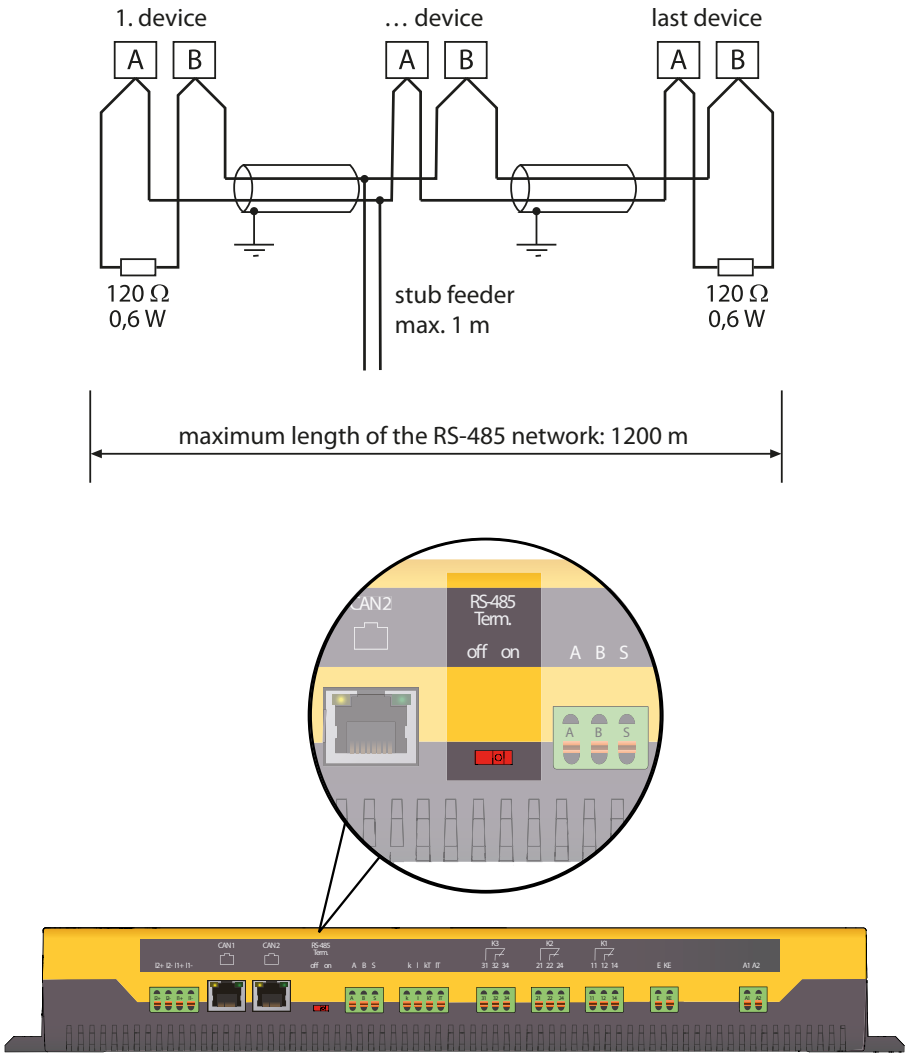


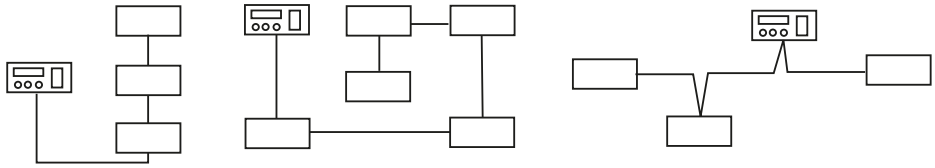
Abb. 6.1: Wiring and termination of the BMS bus with the device housing

6.1.2 Topology of the 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 n etc. The RS-485 network represents a continuous path without branches.

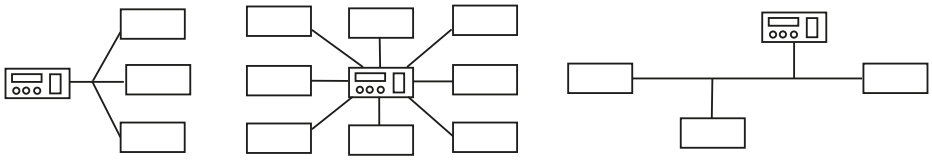
Correct arrangement

Three examples for correct arrangement:



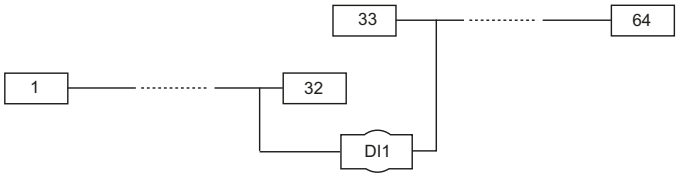
Wrong arrangement

Three examples for wrong arrangement



Wiring

The following type of wiring is recommended for the RS-485 network:
≥Shielded cable, core diameter 0.8 (e.g. J-Y(St)Y 2x0.8), shield connected to earth (PE) at one end.
Connection to terminals A and B.
The number of bus nodes is restricted to 32 devices. If more devices are to be connected, Bender provides a DI-1DL repeater.



6.1.3 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, listens to their signals and then carries out the corresponding commands.
A device receives the MASTER function when it is assigned bus address 1.

The ISOMETER® can only be operated as a BMS SLAVE!

General description of a 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 represents the master, i.e. all addresses between 1 and 150 are cyclically scanned via the BMS bus for alarm and operating messages. If the master receives no answer from 5 subsequent addresses, the scanning cycle will start again. If the master recognises incorrect answers from a slave, the fault message "Fault RS-485" will be output via the BMS bus.

Fault causes may be:

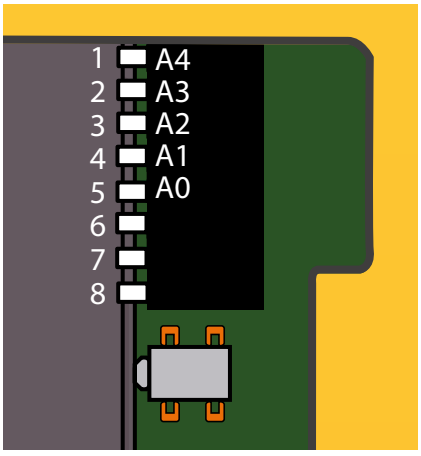
- Addresses are assigned twice
- A second master exists on the BMS bus
- Interference signals occur on the bus lines
- A defective device is connected to the bus
- Terminating resistors are not activated or connected

6.1.4 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...33) to all other bus devices in consecutive order.

6.1.5 Setting BMS address

The factory setting of the BMS address can be changed using the DIP switch SS8103. Factory setting BMS address = 2



	DIP-Schalter (SS8103)				
BMS- Adr.	**A4**	**A3**	**A2**	**A1**	**A0**
2	0	0	0	0	0
3	0	0	0	0	1
4	0	0	0	1	0
5	0	0	0	1	1
6	0	0	1	0	0
7	0	0	1	0	1
8	0	0	1	1	0
9	0	0	1	1	1
10	0	1	0	0	0
..	..	..	..	..	..
…	…	…	…	…	…
33	1	1	1	1	1

6.1.6 Alarm and operating messages via the BMS bus

Messages are transmitted to a maximum of 12 BMS channels. All alarm and operating messages that may occur are described below.

6.1.6.1 Alarm messages

Alarm	Channel	Meaning
Insulation fault alarm Ze/kΩ	1	Insulation impedance < response value Z_{an} (Active measuring method)
Alarm coupling	4	Terminal L1 and/or terminal L2 is not connected
Alarm E/KE	5	E-KE connection is not available
Device error alarm	7	Internal device error
U_{N-PE} alarm (Star point/earth)	8	Voltage U_{N-PE} > response value U_{an} (Passive measuring method)
Overtemperature coupling terminal L1	10	Temperature of the coupling L1 > 150 °C
Overtemperature coupling terminal L2	11	Temperature of the coupling L2 > 150 °C

6.1.6.2 Operating messages

Alarm	Channel	Meaning
Insulation impedance Z_e/kΩ	1	Insulation impedance ≥ response value Z_{an}
System leakage capacitance C_e/n_F	2	Leakage capacitance C_e in nF
Insulation resistance R_e/kΩ	3	Insulation resistance R_e in kΩ
Proposal $C_{eto-set}$	6	Proposal for the system capacitance
Voltage U_{N-PE} (Star point/earth)	8	Voltage U_{N-PE}
Temperature coupling L1	10	Temperature of the coupling L1 > 150 °C
Temperature coupling L2	11	Temperature of the coupling L2 > 150 °C
Method of shutdown	12	Method by which the shutdown has occurred • Active method • Passive method • Interference detection

6.1.7 Error codes

The following list contains all relevant error codes output via the BMS bus. The right-hand column describes the relevant action to be taken in each case.

The device error relay K3 (31, 32, 34) switches for all device errors with the sole exception of error 3.10 in order to prevent a system shutdown in the event of an SD card error.

Error code	Components	Fault	Action
0.30	Connection	Connection earth (E/KE)	Check connection
0.40	Connection	Connection system (L1/+, L2/–)	Check connection
3.10	Micro-SD card	Write access not possible **OR** SD card has not been inserted (when DIP switch 7 = ON)	Change the SD card **OR** Insert the SD card or set the DIP switch 7 = OFF if this message is not required.
8.11	Hardware	Self test insulation measurement	Contact service
8.12	Hardware	Hardware measuring voltage source	Replace device
8.42	Hardware	Supply voltage ADC	Replace device
8.43	Hardware	Supply voltage +12 V	Replace device
8.44	Hardware	Supply voltage –12 V	Replace device
8.45	Hardware	Supply voltage +5 V	Replace device
8.46	Hardware	Supply voltage +3.3 V	Replace device
8.47	Hardware	Hardware	Replace device
8.51	Hardware	Monitoring the hardware temperature	Replace device
8.52	Hardware	Monitoring the sensor temperature	Replace device
9.61	Parameter, calibration value	Insulation measurement	Load factory settings, set parameters and calibrate
9.62	Calibration value	System frequency analysis	Calibrate device
9.65	Calibration value	Measuring technique, ADC's	Calibrate device
9.70	System	General programme sequence	Restart the device
9.71	System	Insulation measurement programme sequence	Restart the device
9.72	System	Sytem frequency analysis programme sequence	Restart the device
9.73	System	Voltage measurement programme sequence	Restart the device
9.76	System	Programme sequence history memory	Restart the device
9.78	System	Self test programme sequence	Restart the device
9.80	Calibration	Hardware	Restart the device
9.81	System	ADC channel U_n overload	Check system/connection
9.82	System	ADC channel U_g overload	Check system/connection

Error code	Components	Fault	Action
9.83	System	ADC channel U_{E-KE} overload	Check system/connection
9.84	System	ADC channel $U1_{supply1}$ overload	Check system/connection
9.85	System	ADC channel U_{Temp} overload	Check system/connection
9.86	System	ADC channel U_{posPE} overload	Check system/connection
9.87	System	ADC channel U_{MVS} overload	Check system/connection
9.88	System	ADC channel U_{PCP} overload	Check system/connection
9.89	System	ADC channel $U1_{supply2}$ overload	Check system/connection
9.90	System	ADC channel U_{negPE} overload	Check system/connection

6.1.8 Resetting error messages

Recorded errors are provided as alarm messages on the BMS bus.
Pressing the reset button ST6101 will reset these error messages. 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.

6.1.9 Starting the firmware update via the BMS bus

The firmware can be updated via the BMS bus using the BMS Update Manager which can be obtained from Bender.
can be obtained from Bender.

6.2 Device communication with Modbus RTU

The ISOMETER® iso1685FRM provides an analogue output by means of the Modbus-analogue converter.Communication takes place via Modbus RTU.
The Modbus RTU protocol can only be used for communication between the ISOMETER® and the Modbus analog converter.The Modbus RTU protocol is not available for further functions.

- The Modbus RTU protocol is activated with the ISOMETER® DIP switch (see "chapter ISOMETER®s iso1685FRM DIP switch assignment").
- The wiring/connection diagram for the ISOMETER® iso1685FRM and Modbus analog converter can be found under "chapter 5.2.3 Anschlussplan mit Modbus RTU (ISOMETER® iso1685FRM)". The connection is also described in chapter "chapter 5.2.5 Step-by-step connection of the iso1685FRM ISOMETER®".
- For further information regarding commissioning, refer to "chapter 5.3.2 Commissioning of the ISOMETER® iso1685FRM".
- Both the data sheet and manual of the Modbus analog converter M7024 contain further information about the device and the Modbus protocol.You can find these documents on our homepage at ICP DAS.

7. Parameterization via the BMS bus

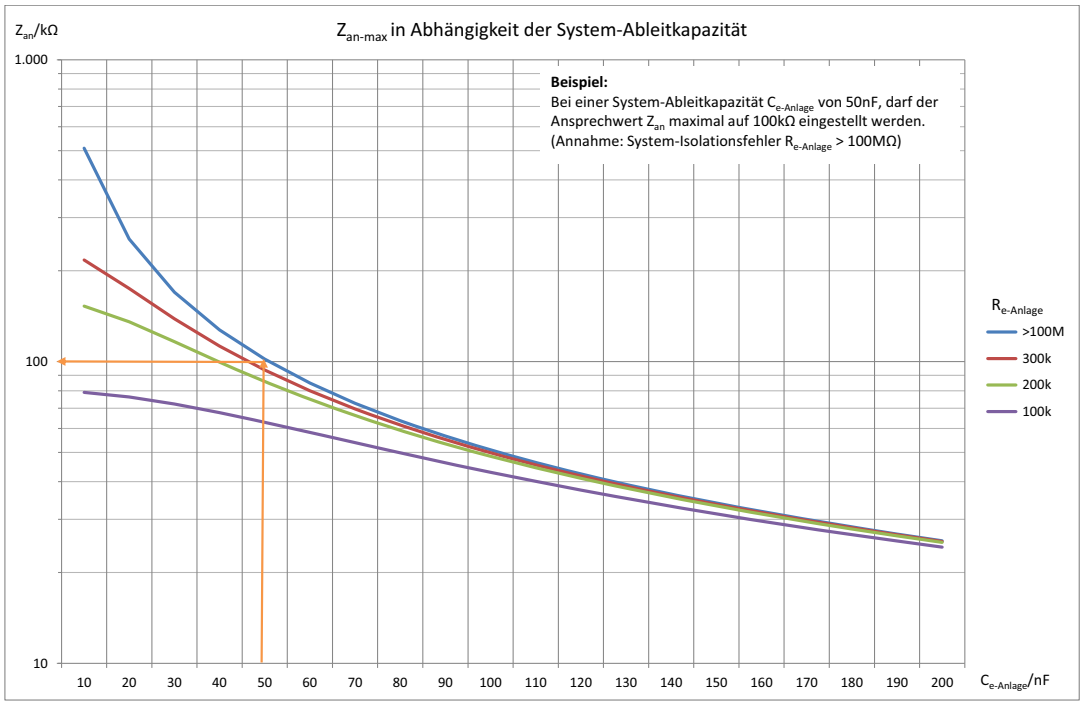
7.1 Parameter

7.1.1 Tabel overview

Channel	BMS command	Description	Setting range
1	Ze/kO	Response value for insulation measurment (active method)	10…1000 (Default: 25, Step size: 1)
2	Ce-instal-lation /nF	Ce value [nF] (Fixed), (System leakage capacitance)	1…200 (Default: 1, Step size: 1)
3	Re-instal-lation /kO	R_e value [kΩ] (Fixed) System insulation fault (Good condition)	10…500 (Default: 180, Step size: 1)
4	MPT	|Ze| measured data buffer size	1…10 (Default: 4, Step size: 1)
8	EWL	Response value for insulation measurement (passive method, threshold U_{an} [V])	0…3000 (Default: 125, Step size: 1 0 = disabled
9	SFL	Response value for interference detection over area [%]	0…50 (Default: 15, Step size: 1 0 = disabled
10	ANZ	Monitoring of system coupling L,N	1: on (Monitoring enabled) 0: off (Monitoring disabled) (Default: 1
11	AER	Monitoring E/KE coupling.	1: on (Monitoring enabled) 0: off (Monitoring disabled) (Default: 1
12	SZL	Number of interferences until a device error [-]	0…10 (Default: 6, Step size: 1 0 = disabled

7.1.2 Parameter description

- **Channel 1 (Z_{an}/kΩ): Response value for insulation measurment (active method)**
  This parameter defines the response threshold for the active measurement procedure. If the insulation value Z_e measured by the ISOMETER® exceeds the response value Z_{an}, then the ISOMETER® triggers an alarm.
  Depending on the system leakage capacitance $C_{e\text{-}Anlage}$ and the system insulation resistance $R_{e\text{-}system}$, the response value Z_{an} may not exceed a certain value so that the ISOMETER® enters the normal operating condition taking into account the hysteresis (no alarm signal). The following diagram shows how high the response value Z_{an} can be set for different insulation conditions of the installation.



- **Channel 2 ($C_{e\text{-}Anlage}$/nF) and channel 3 ($R_{e\text{-}Anlage}$/kΩ): Insulation parameters during commissioning:** When the device is operated, the insulation condition of the installation can be stored as "good condition" via these two parameters.
- **Channel 4 (MPT) Measured data buffer size**This parameter defines the buffer size for the measurement results.The triggering time of the ISOMETER® depends linearly on the buffer size: A new measurement is entered into the buffer every 20 ms. The advantage of a higher buffer depth is that the insulation level of the system can be determined more reliably.The disadvantage is that the reaction time is extended.The larger the buffer size is set, the longer it takes for the mean value of the buffer entries to fall below the threshold value. A tripping time of 150 ms, as specified in the technical data, applies to a maximum buffer size of 4 (factory setting).
- **Channel 5 (FAN) Step-wise readjustment of the sampling frequency:** Service parameters.
- **Kanal 6 (CCN) Parameters for coupling monitoring of the N-conductor connection:** Service parameters.
- **Kanal 7 (CCN) Parameters for coupling monitoring of the L-conductor connection:** Service parameters.
- **Channel 8 (EWL – U_{an}/*V*): Response offset voltage $U_{N\text{-}PE}$ (passive method)** This parameter defines the response threshold for the passive measurement method. In the case of unsymmetric insulation faults on one or more phases, an offset voltage develops between the star point of the IT network and earth.If the offset voltage $U_{N\text{-}PE}$ exceeds the set response value U_{an}, the ISOMETER® triggers an alarm.
- **Channel 9 (SFL): Measurement suppression response value (Interference detection active method)** Interference detection is implemented for the active measuring method in order to prevent incorrect measurements and therefore avoid false alarms.Active method interferences happen, for example, because of spontaneous voltage spikes or voltage pulses in the network being monitored.The ISOMETER® compares the voltage profile of successive network periods and discards the current determined measured value if the difference of the voltage profile considered exceeds the set response value.

- **Channel 10 (ANZ): Coupling monitoring of the system connection**
  This parameter is used to switch off the coupling monitoring of the system connection (terminals L1/L + and L2/L-).
- **Channel 11 (AER): Coupling monitoring of the earth connection**
  This parameter is used to switch off the coupling monitoring of the earth connection (terminal E/KE).
- **Channel 12 (SZL): Interference counter (actives method)**
  In addition to interference detection (see channel 9), the ISOMETER® can trigger a device error during a prolonged fault.The SZL parameter is used to specify how many consecutive detected interferences lead to a device error.This prevents the device from being "blind" due to interference - which means that no measured values can be recorded for a long time.The sensitivity of the interference detection can be parameterized via channel 9, and the maximum duration of the interference via channel 12.

7.2 Parameterization of the installation parameter $R_{e\text{-}Anlage}$ and $C_{e\text{-}Anlage}$

7.2.1 General information

The ISOMETER® monitors the impedance and not the purely ohmic insulation resistance of the installation.However, the purely resistive insulation resistance is also determined by means of the measured impedance and the system leakage capacitance and can be requested.
In order to be able to determine the ohmic insulation resistance (R_e) of the network to be monitored, the following two parameters must be parameterized in the order shown during the initial commissioning of the installation using the iso1685FR tool set provided:

- Expected ohmic insulation resistance of the application during operation: $R_{e\text{-}Anlage}$ [kΩ]
- Expected system leakage capacitance of the application during operation: $C_{e\text{-}Anlage}$ [nF]

It is important that both parameters are set only once during the commissioning of a new installation and that they cannot be changed during the lifetime.
Assuming a constant system leakage capacitance during the lifetime of the application, the ohmic insulation resistance (R_e) curve, determined by means of the set parameters provides a valid statement about the purely ohmic insulation condition of the installation.

DIP switch 6 (SS8103) can be used to disable parameter changes.

- DIP switch 6 is set to ON = Parameters cannot be changed
- DIP switch 6 is set to OFF = Parameters can be changed

7.2.2 Parameterization with the iso1685FR-Set tool

The ISOMETER® can be parameterized with the iso1685FR-Set tool.

- You can download the software at:
  http://www.bender-de.com/en/service-support/download/software.html

The iso1685FR-Set tool can only be used if there is no master in the BMS system.

By using the iso1685FR-Set program you confirm the following conditions:
Bender provides this software free of charge and without any warranty. By using this software you agree that you are using the software at your own risk. Bender does not assume any responsibility for possible software errors or defects and does not guarantee that the software works error-free and reliably. Furthermore, Bender does not accept liability for direct or indirect damage that may arise from the use of the software.

7.2.3 Error handling

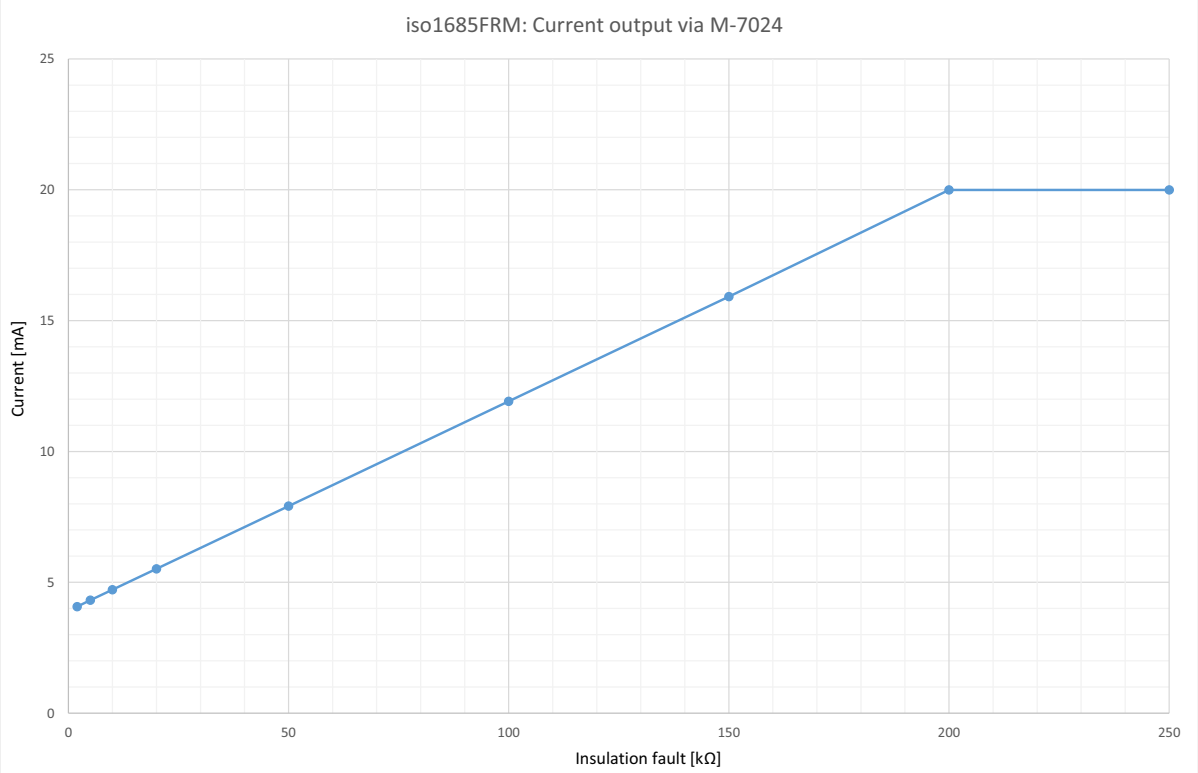
If the displayed values do not correspond to the conditions of the installation after parameterization, $R_{e\text{-}Anlage}$ and $C_{e\text{-}Anlage}$ must be set again. Refer to the iso1685FR-Set quickstart for operating instructions.

If the parameters do not correspond with the conditions of the installation, an ohmic insulation value deviating from R_{e_Anlage} is output for R_e instead of the real value after initial commissioning.If the value of R_e cannot be determined, a default value of 1 MΩ is output instead.

The following errors can lead to these deviating outputs:

- Incorrect parameterization of R_{e_Anlage}:
  Consequences: The value to be parameterized for C_{e_Anlage} (= Ce to set) cannot be correctly determined. Error cases: a.) Ohmic insulation resistance of the installation is higher than the parameterized value:
  Output R_e = 1 MΩ
  Error handling: R_{e_Anlage} and C_{e_Anlage} must be parameterized again
  b.) Ohmic insulation resistance of the installation is LOWER than the parameterized value: Output $R_e = R_e$ = 1 MΩ:
  Error handling: R_{e_Anlage} and C_{e_Anlage} must be parameterized again
- Incorrect parameterization of C_{e_Anlage}:
  Consequences: The resulting ohmic insulation resistance value does not correspond to the expected value of the installation.
  Error cases:
  a.) System leakage capacitance of the installation is HIGHER than the parameterized value:
  Output $R_e \neq R_{e\_Anlage}$
  Error handling: C_{e_Anlage} must be parameterized again
  b.)System leakage capacitance of the installation is LOWER than the parameterized value:
  Output R_e = 1 MΩ
  Error handling: C_{e_Anlage} must be parameterized again

8. Diagram for the calculation of Z_e



The following formula for calculating the insulation value measured by ISOMETER® is applicable for $Z_e \leq 200$ kΩ.

$$Z_e[k\Omega] = \frac{((I_a[mA] - 4) * 200)}{16}$$

9. Information about the measuring method

The device can report an insulation fault or a permanent interference via the following methods:

- Active method parameter:Response value Z_{an}, Measured data buffer size cannot be switched off
- Passive method parameter:Response value U_{an} can be switched off by setting U_{an} to 0
- Interference detection parameter: Interference level (SFL), number of interferences until a device error (SZL) can be switched off by setting SZL to 0

Coupling monitoring

- Monitoring a coupling network: switched off
- Monitoring PE coupling (E/KE).switched off

Useful default settings:

- Active methodResponse value: 25 kΩ; Measuring buffer depth:4
- Passive methodResponse value: 200 V
- Interference detection: Degree of interference: 20 %; Number of interferences until a device error:6 (120 ms)

Important:
When interference detection is switched off, the shutdown time of the active method is somewhat longer for phase faults because the disturbed measured values from the switching moment are registered in the measuring buffer.
When interference detection is activated, the shutdown times are at least 20 ms shorter because the disturbed measured values are discarded.

In the case of continuous interference, the device can only trigger via either the passive method or the interference detection.

10. Technical data

10.1 Tabular data

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

Insulation coordination according to IEC 60664-1
Rated insulation voltage (terminals L1/L2 to E/KE) ..... 5 kV
Overvoltage category II
Pollution degree 2

Voltage ranges

Nominal system voltage U_n L1+/L2- ..... AC 0...400 V**
Phase-to-phase voltage ..... AC 0...5 kV
Voltage component L1/+ to PE (U_{N-PE}) ..... AC 0...3 kV***
Voltage component L2/- to PE ($U_{L1'-PE}$) ..... AC 0...3 kV***
Supply voltage U_S (Also refer to the device name plate) ..... DC 18...30 V
Power consumption ..... ≤ 7 W
Power consumption ..... ≤ 7 VA

Measuring circuit for insulation monitoring

Measuring voltage U_m (effective value) ..... 34 V
Measuring current I_m (when $R_e = 0\ \Omega$) ..... ≤ 150 µA
Internal DC resistance R_i ..... ≥ 260 kΩ
Impedance Z_i at 50 Hz ..... ≥ 260 kΩ
Permissible extraneous DC voltage U_{fg} ..... 0 V
Permissible system leakage capacitance C_e ..... ≤ 200 nF

Response values for insulation monitoring (active method)

Response value Z_{an} (Alarm) ..... 10...1000 kΩ (25 kΩ)*
Relative uncertainty (100 kΩ...1 MΩ) (acc. to IEC 61557-8:2007-01) ..... ±15 %
Relative uncertainty (10...100 kΩ) ..... ± 5 kΩ ± 15 %
Response time t_{an} (for measurement buffer size MPT = 3) ..... ≤ 150 ms
Hysteresis ..... 25 %

Response values for insulation monitoring (passive method)

Response value U_{an} (Alarm) ..... 0...3000 V (125 V)*
Relative uncertainty (100...3000 V) ..... ± 5 %
Relative uncertainty (1...100 V ..... ± 5 V ± 5 %
Response time t_{an} (for measurement buffer size MPT = 3) ..... ≤ 150 ms
Hysteresis ..... 25 %

Displays, memory

LEDs for alarms and operating states ..... 1 x green, 3 x yellow
µSD card for history memory and log files ..... ≤ 32 GB

Digital inputs

I1+, I1- (high active) ..... no function
I2+, I2- ..... no function

Analog output (via ICP M-7024 Modbus analog converter):

Number 1
Operating principle ..... linear, 0...200 kΩ (refer to diagram)
Function ..... insulation value Z_e
Current ..... 4...20 mA (< 600 Ω)
Tolerance ..... ±10 %

Serial interfaces

Interface/protocol iso1685FR ..... RS-485 / BMS (slave)
Interface/protocol iso1685FRM ..... RS-485 / BMS (Slave), Modbus RTU (switchable)
Connection ..... bus: Terminals A/B
..... Shield: Terminal S
Cable length ..... ≤ 1200 m
Shielded cable (shield to PE on one side) ..... 2-core, Ø 0.6 mm^2, e.g. J-Y(St)Y 2 x 0.6
Terminating resistor, switchable (switch RS-485 Term.) ..... 120 Ω (0.5 W)
Device address, BMS bus, adjustable (DIP switch) iso1685FR ..... 2 . . . 33 (2)*
Device address, BMS bus, adjustable (DIP switch) iso1685FRM ..... 2 . . . 17 (2)*

Switching elements

Switching elements ..... 3 changeover contacts: K1 (insulation fault), K2 (insulation fault redundant), K3 (device error)
Operating principle K1, K2 ..... N/C operation, not changeable
Operating principle K3 ..... N/C operation, cannot be changed
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 V24 V110 V220 V
Rated operational current ..... 5 A 3 A 1 A 0.2 A 0.1 A
Minimum contact rating ..... 1 mA at AC/DC ≥ 10 V

Connection via terminals (except system coupling)

Connection type ..... pluggable push-wire terminals
Connection, rigid/flexible ..... 0.2 . . . 2.5 mm^2/0.2 . . . 2.5 mm^2
Connection flexible with connector sleeve, without/with plastic sleeve ..... 0.25 . . . 2.5 mm^2
Conductor sizes (AWG) ..... 24 . . . 12

Connection of the system coupling

Connection type ..... pluggable push-wire terminals
Connection, rigid/flexible ..... 0.2 . . . 10 mm^2 / 0.2 . . . 6 mm^2
Connection, flexible with ferrules, without/with plastic sleeve ..... 0.25 . . . 6 mm^2/0.25 . . . 4 mm^2
Connection AWG/kcmil ..... min. 24
Conductor cross section AWG/kcmil ..... max. 8

Environmental conditions

EMC EN 61326-2-4
EMC except, IEC 61000-4-3 (Radiated immunity 80MHz - 1GHz): 8V/m
Ambient temperatures:
Operating temperature ..... -25 . . . + 70 °C
Transport ..... -25 . . . + 80 °C
Long-term storage ..... -25 . . . + 80 °C
Classification of climatic conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3) ..... 3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2) 2K3
Long-time storage (IEC 60721-3-1) 1K4
Classification of mechanical conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3) 3M4
Transport (IEC 60721-3-2) 2M2
Long-term storage (IEC 60721-3-1) 1M3

Other

Operating mode ..... continuous operation
Position of normal use..... vertical, system coupling on top
Degreee of protection, internal components..... IP30
Degree of protection, terminals IP30
Software version D407 V1.13
Weight ..... 650 g
( )* = ...Factory settings

** = The specification refers only to the differential voltage between the coupling terminals, not to earth. Higher voltages lead to a device fault notification (ADC overload), but not to a defect in the device.Maximum permissible voltage between terminals L1 and L2 = 3.0 kV

*** =Corresponds to a maximum phase voltage of the system to be monitored of 5 kV.

10.2 Factory settings

Parameter Software	Value Condition	can be set via
Insulation measurement response value Z_{an} (Active method)	25 kΩ	BMS
Leakage capacitance of the installation $C_{e\text{-}Anlage}$	1 nF	BMS
Insulation resistance of the installation $R_{e\text{-}Anlage}$	180 kΩ	BMS
Measured data buffer size for $\|Z_e\|$ (active method)	4	BMS
Offset voltage response value U_{an} (passive method)	125 V	BMS
Response value of measured value suppression (Interference detection active method)	15 %	BMS
Coupling monitoring system connection	1 (Monitoring enabled)	BMS
Monitoring earth connection E/KE	1 (Monitoring enabled)	BMS
Response value of the interference counter (actives method)	6	BMS
Relay K1 (11/12/14)	N/C operation	-
Relay K2 (21/22/24)	N/C operation	-
BMS address	2	DIP switch
Parameterization lock	OFF (Lock off)	DIP switch 6
BMS termination	ON (Termination enabled)	Switch "RS-485-Term."
Relay K3 (31/32/34)	N/C operation	-

Special faetures of the iso1685FRM

RS485 protocol	Value	can be set via
BMS	OFF	DIP switch 1

10.3 Standards and certifications

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8
- IEC 61326-2-4
- DIN EN 60664-1 (VDE 0110-1)
- EN 50178:1998-04

10.4 Ordering details

Type	Response value range	Nominal voltage	Supply voltage *	Communication	Art. No.
iso1685FR-525	10 kΩ…1000 kΩ	AC 0…400 V	DC 18…30 V	BMS	B91065800
iso1685FRM-525	10 kΩ…1000 kΩ	AC 0…400 V	DC 18…30 V	BMS / Modbus RTU	B91065804

The data labelled with an * are absolute values

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The Power in Electrical Safety©

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