ISOMETER®IRDH275

AC/DC   IRDH275B

**Insulation monitoring device for IT AC systems
with galvanically connected rectifiers and converters
and for IT DC systems
Software version IRDH275: D0160 V1.8
Software version IRDH275B: D159 V1.8**

![BENDER logo]

Table of Contents

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:

DANGER	*This signal word indicates that there is a **high risk of danger** that will result in **electrocution** or **serious injury** if not avoided.*
WARNING	*This signal word indicates a **medium risk of danger** that can lead to **death** or **serious injury** if not avoided.*
CAUTION	*This signal word indicates a **low-level risk** that can result in **minor** or **moderate injury** or **damage to property** if not avoided.*
(i)	*This symbol denotes information intended to assist the user in making **optimum use** of the product.*

1.2   Technical support: service and support

For commissioning and troubleshooting Bender offers you:

1.2.1   First level support

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

- Questions concerning specific customer applications
- Commissioning
- Troubleshooting

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

1.2.2   Repair service

Repair, calibration, update and replacement service for Bender products

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

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

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

> Bender GmbH, Repair-Service,
> Londorfer Str. 65,
> 35305 Grünberg

1.2.3 Field service

On-site service for all Bender products

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

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

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

1.3 Training courses

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

1.4 Delivery conditions

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

1.5   Inspection, transport and storage

Inspect the dispatch and equipment packaging for damage, and compare the contents of the package with the delivery documents. In the event of damage in transit, please contact Bender immediately.

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   Warranty and liability

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

- 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 and the use of replacement parts or accessories not approved by the manufacturer.
- Catastrophes caused by external influences and force majeure.
- Mounting and installation with device combinations not recommended by the manufacturer.

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

1.7 Disposal

Abide by the national regulations and laws governing the disposal of this device. Ask your supplier if you are not sure how to dispose of the old equipment.

The directive on waste electrical and electronic equipment (WEEE directive) and the directive on the restriction of certain hazardous substances in electrical and electronic equipment (RoHS directive) apply in the European Community. In Germany, these policies are implemented through the "Electrical and Electronic Equipment Act" (ElektroG). According to this, the following applies:

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

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

2. Safety instructions

2.1 General safety instructions

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

2.2 Work activities on electrical installations

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

DANGER

Risk of electrocution due to electric shock!
Touching live parts of the system carries the risk of:
- An electric shock
- Damage to the electrical installation
- Destruction of the device

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

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

2.3 Device-specific safety information

WARNING

Children and unauthorised persons must not have access to or contact with the ISOMETER®.

CAUTION

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

CAUTION

Make sure that the basic settings meet the requirements of the IT system.

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

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

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

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

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

2.4 Intended use

The ISOMETER® is intended for:

- monitoring the insulation resistance of IT systems

Use for the intended purpose also includes

- compliance with all information in the operating instructions, and
- compliance with test intervals.

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.

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

2.5   Directions for installation

<table>
<tr>
<td>⚠️
CAUTION</td>
<td>***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.</td>
</tr>
</table>

<table>
<tr>
<td>⚠️
CAUTION</td>
<td>***Ensure disconnection from the IT system!***
When insulation or voltage tests are to be carried out, the device shall be isolated from the system for the test period. Otherwise the device may be damaged.</td>
</tr>
</table>

The terminals ⏚ and KE shall be connected by a separate wire to the protective conductor (PE). If the terminals L1, L2 of the device are connected to a system under operation, the terminals ⏚ and KE must not be disconnected from the protective conductor (PE).

<table>
<tr>
<td>ⓘ</td>
<td>***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 resistance that is suitable for the mains voltage.</td>
</tr>
</table>

(i) ***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 5…10 mA.

BENDER

3. Function

3.1   Common characteristics (IRDH275 and IRDH275B)

- ISOMETER® for IT AC systems with galvanically connected rectifiers and for IT DC systems (IT = unearthed systems)
- The operating range of the nominal voltage U_n can be extended via coupling devices.
- Automatic adaptation to the existing system leakage capacitance
- AMP^{Plus} measuring principle (European Patent: EP 0 654 673 B1)
- Two separately adjustable ranges of the response value1 kΩ…10 MΩ (Alarm 1, Alarm 2)
- Two-line LC display
- Connection monitoring (monitoring of the measuring leads)
- Automatic device self test
- Option "W":
This option provides: improved shock and vibration resistance for use in ships, on rolling stock and in seismic environment.

3.2   Additional characteristics IRDH275B

- Memory with real-time clock to store all alarm messages with date and time stamp.
- BMS interface (BMS protocol) for data exchange with other Bender devices (RS-485 electrically isolated).
- Internal disconnection of the ISOMETER from the IT system to be monitored (using a control signal; terminals F1/F2) , e.g. if several ISOMETERs® are interconnected.
- Current output 0(4)…20mA (galvanically separated) in relation to the measured insulation value.
- Remote setting of certain parameters via the Internet (option; COM465 additionally required)

3.3 Product description

The ISOMETER® type IRDH275 monitors the insulation resistance of IT systems. It is suitable for universal use in 3(N)AC, AC/DC and DC systems. AC systems may include extensive DC supplied loads, such as converters or thyristor-controlled DC drives. The device automatically adapts itself to the existing system leakage capacitance.

Suitable coupling devices are available to extend the nominal voltage range U_n.

The IRDH275B can be used in combination with a control and indicating device, e.g. PRC1470 version 2 or higher, on the BMS (BMS = Bender Measuring Device Interface) bus.

3.4 Function

The ISOMETER® IRDH275 is connected between the unearthed system (IT system) and the protective conductor (PE).
The response values and other function parameters are set via the function keys. The parameters are indicated on the LC display and are stored in a non-volatile memory (EEPROM) after the setting is completed.
A microprocessor-controlled pulsating AC measuring voltage is superimposed on the IT system to be monitored (**AMP^Plus** measuring principle*).
The measuring cycle consists of positive and negative pulses of the same amplitude. The period of these pulses depends on the respective system leakage capacitances and the insulation resistances of the IT system to be monitored. An insulation fault between the IT system and earth closes the measuring circuit. From the measured current value, the microprocessor calculates the insulation resistance which is indicated on the LC display or the external kΩ measuring instrument.
The measuring time is determined by the system leakage capacitances, the insulation resistance, and the system-related interference disturbances. System leakage capacitances do not influence the measuring accuracy.

If the reading is below the selected response values Alarm 1/Alarm 2, the associated alarm relays respond and the alarm LEDs "Alarm 1/2" light up and the measuring value is indicated on the LC display (in the event of DC insulation faults, the faulty supply line is indicated). If the terminals R1/R2 are bridged (external RESET button [NC contact] or wire bridge), the fault indication will be stored. Pressing the RESET button, resets the insulation fault message, provided that the currently displayed insulation resistance is at least 25% above the set response value when the reset is carried out. The fault memory behaviour can also be set in the "ISO SETUP" menu, by selecting the sub menu Memory: on/off.

The connections for external kΩ display supplied by the current output 0…400 µA or 0/4…20 mA (IRDH275B) at M+/M- are galvanically isolated.

*) **AMP**^{Plus} measuring principle "adaptive measuring pulse", a measuring principle developed by Bender (European Patent: EP 0 654 673 B1).

Self test

A self test can be carried out manually using the TEST button or automatically. In order to guarantee high functional reliability, the ISOMETER® IRDH275 provides comprehensive self test functions. After switching the supply voltage on, all internal measuring functions, the components of the process control such as data and parameter memory as well as system and earth connections are checked using the self test functions. The progress of the self test is indicated on the display by a bar graph. Depending on the conditions in the IT system to be monitored, the self test is running for 15…20 seconds, then the message "Test ok!" appears on the LC display for approximately 2 seconds. Then the device returns to normal measuring mode and the current measuring value is displayed after the expiry of the measuring time.

When a device error or connection fault is found, the message "!Error!" appears on the display, the device fault LED lights up, the relay K2 (21-22-24) switches and the respective fault message (see table) is indicated. If such a device fault occurs, a self test is started again every minute. If no more malfunction is detected, the fault message is deleted automatically and the device fault LED extinguishes.

During operation, the self test function can be started by pressing the TEST button (internal or external). The self test can also be started automatically every hour or every 24 hours by selecting "ISO ADVANCED: Autotest" menu. The alarm relays Alarm1/2 only switch after starting the self test function by pressing the TEST button, that means if an automatic self test has been selected, the alarm relays do not switch.

Behaviour of the analogue output

Setting	Manual test	Automatic test
0-20 mA	20 mA while test procedure	0 mA The current value depends on the insulation value
4-20 mA	20 mA while test procedure	4 mA The current value depends on the insulation value

Error message	Meaning	Steps to be taken
System connection?	No low-resistance connection of terminals L1, L2, L3 to the IT system	10. Check the wiring of terminal L1, L2 to the IT system 11. Press the test button 12. Switch the supply voltage off and on. 13. Check the fuses
Connection PE?	No low-resistance connection of the terminals ⏚ and KE to earth (PE)	1. Check wiring of terminal ⏚ and KE to earth (PE) 2. Press TEST button 3. Switch the supply voltage off and on
Device error x	Internal device error	1. Press TEST button 2. Switch the supply voltage off and on 3. Contact Bender

If the on/off switching of the supply voltage is not possible for technical reasons, a RESET of the process control can be carried out by pressing the "INFO", "RESET" and "MENU" key.

3.5   Additional functions IRDH275B

Current output for external measuring instrument

The current output of IRDH275B provides 0(4)…20 mA. The current output is galvanically isolated from the device electronics and the RS-485 interface. The ISO SETUP menu, on page 47, allows to switch over between 0…20 mA and 4…20 mA.

Real-time clock

The real-time clock serves as a time base for the memory and self test functions. At first, the correct time and date must be set in the menu "ISO ADVANCED". If time and date are not set, a „C" (clock) is flashing in the standard display. In the event of a supply voltage failure, time and date will be stored for at least thirty days.

If the 24 h test is activated in the "ISO ADVANCED" menu, a special time of day can be selected for the execution of the self test in the menu "TEST: 12:00". Then a self test will be started automatically once a day exactly at the preset time. If the 1 h auto test has been selected, the self test is automatically carried out every full hour.

Interconnected IT systems

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

Function input F1/F2 for connection or disconnection of IT systems being monitored

The ISOMETER® can be disconnected from the IT system and set to STANDBY mode with the function input F1/F2. If the input F1/F2 is bridged, the connections L1/L2 are switched off via internal coupling relays, the measuring function is stopped and the message "STANDBY" appears on the display. Software version 1.4 or higher does not indicate the measured insulation resistance during the disconnection, but indicates the value > 10 MΩ. Furthermore, the alarm relays and alarm LEDs no longer provide alarm messages. After opening the function input F1/F2, the connection to the IT system will be restored and a completely new measuring cycle for insulation monitoring is started.

With this function, selective disconnection of an IRDH275B in interconnected IT systems can be carried out via auxiliary contacts of the respective coupling switch. One coupling switch each in a line-type or ring-type arrangement can deactivate a subsequent IRDH275B. This arrangement guarantees that only one ISOMETER® is active in each galvanically connected system. In a ring-type arrangement with all coupling switches closed, it can be assumed that all ISOMETER®s are deactivated. In order to prevent this, a BMS Master (IRDH275B BMS address 1) monitors the condition of the function input F1/F2 of all slave ISOMETER®s.

When all slave ISOMETER®s are in the STANDBY mode, the insulation monitoring function of the Master ISOMETER® and hence the function input F1/F2 of the Master are without function in this mode.
Details are shown in the graphic below.
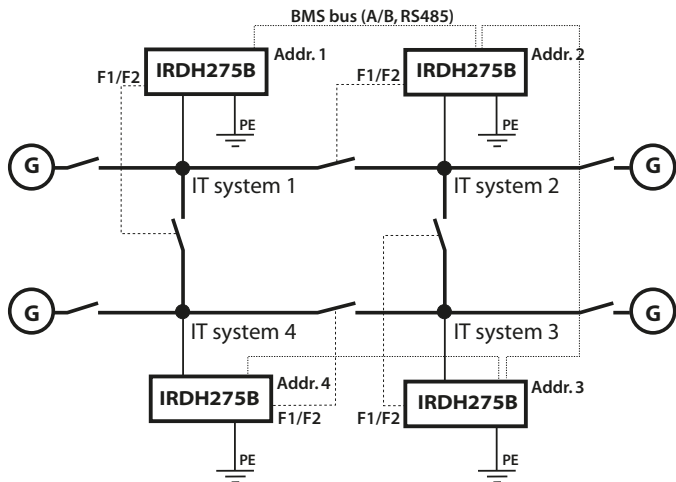
ISOnet Function (COM SETUP)

Select "ISOnet=ON" from the COM SETUP menu to activate this function. This function is a type of scanning function. The BMS Master activated via the ISOnet function controls the ISOnet slave devices via the BMS bus. Once an ISOMETER® has finished its measurement cycle, the authorization for measuring the insulation resistance is passed on from the ISOnet Master to the next slave.

While an ISOMETER® is carrying out a measurement all other ISOMETER®s are in the STANDBY mode. In this way it can be prevented that the ISOMETERs® disturb each other in interconnected systems.

In comparison to the solution coupling switches and function input F1/F2, the response time is prolonged, since no continuous measurement takes place. The advantage is that no auxiliary contacts of a coupling switch are required. Furthermore, this solution is ideally suited for capacitive IT systems or IT systems connected via diodes.

An ISOnet slave checks whether there is a Master available in the network. If there is no Master available, the fault message "ISOnet Master?" appears on the display after approximately 1 hour. Additionally, the LED for device errors lights and the Relay K2 switches. When the ISOnet function is activated, the function input F1/F2 will be disconnected.
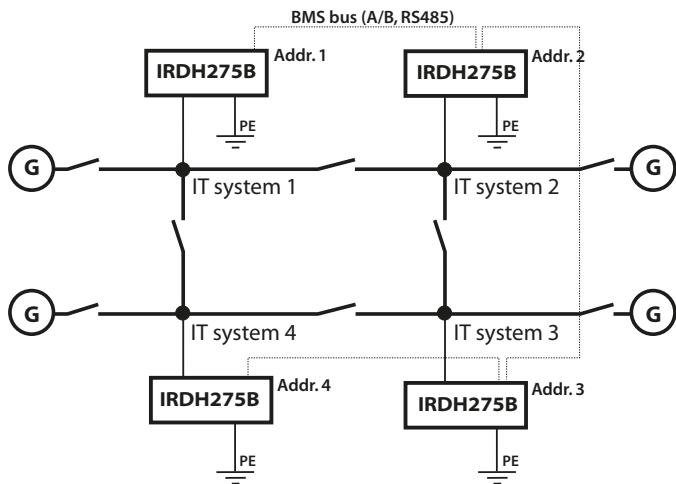
4. Connection

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!
⚠ DANGER	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.

4.1 Wiring

Connect the terminals A1/+ and A2/- to the supply voltage U_S in accordance with IEC 60364-4-43. The connections to the supply voltage shall be provided with protective devices to afford protection in the event of a short circuit (a 6 A fuse is recommended).
For UL and CSA applications, the use of 5 A fuses is mandatory.

Devices for protection against short-circuit in conformity with IEC 60364-4-43 for the IT system coupling L1/L2 can be omitted if the wiring is carried out in such a manner as to reduce the risk of a short-circuit to a minimum (a short-circuit-proof and earth-fault-proof wiring is recommended).

Only one ISOMETER® may be connected to an external TEST or RESET button. A galvanic parallel connection of several TEST and RESET inputs for collective testing of ISOMETER®s is not permitted.

External coupling devices connected via the terminal AK cannot be switched off via the internal coupling relays. If no coupling device is used, the terminal AK remains free.
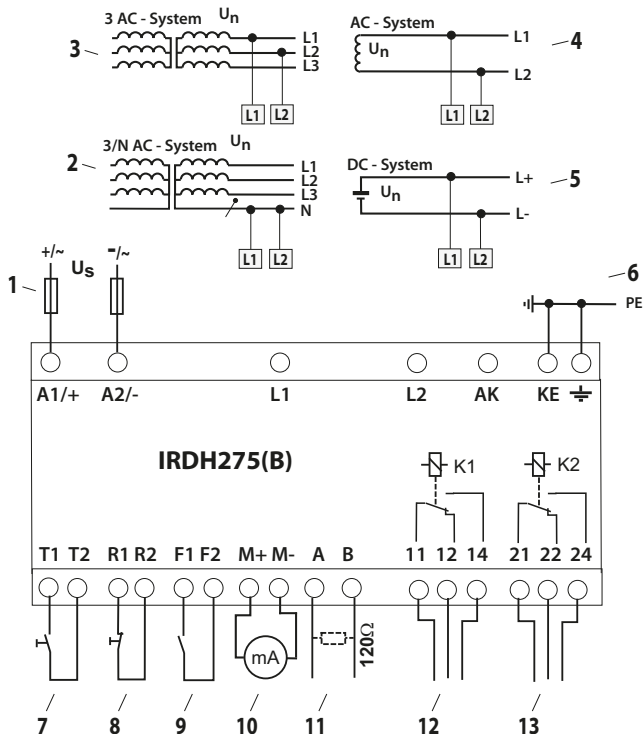
Legend to wiring diagram:

1	Supply voltage U_s (see nameplate) via 6 A fuse For UL and CSA applications, the use of 5 A fuses is mandatory
2, 3	Connection to the 3AC system to be monitored: connect terminals L1, L2 to neutral conductor N or terminals L1, L2 to conductor L1, L2
4	Connection to the AC system to be monitored: connect terminals L1, L2 to conductor L1, L2
5	Connection to the DC system to be monitored: connect terminal L1 to conductor L+, terminal L2 to conductor L-
6	Separate connection of ⏚ and KE to PE
*7	External TEST button (NO contact)
*8	External RESET button (NC contact or wire jumper), when the terminals are open, the fault message will not be stored
*9	STANDBY by means of the function input F1, F2: When the contact is closed, insulation measurement does not take place; system disconnection (only IRDH275B)
10	IRDH275: current output, galvanically separated: 0…400 μA IRDH275B: current output, galvanically separated: 0…20 mA or 4…20 mA
11	Serial interface RS-485 (termination 120 Ω resistor)
12	Alarm relay 1; changeover contacts provided
13	Alarm relay 2; (device fault relay) changeover contacts provided

* **The terminal pairs 7, 8 and 9 must be wired so that they are galvanically isolated and must not have a connection to PE!**

4.2 Wiring diagrams with coupling devices

> **ⓘ** *Please observe the settings in the "ISO ADVANCED AGH" menu ! Adapt the settings to the coupling device to be used.*

> **ⓘ** **Tolerances of coupling devices**
> *The tolerance of the coupling device used affects the measured value of the insulation monitoring device and must be considered accordingly.*

4.2.1 Connection with AGH150W-4

Connected to the ISOMETER® this coupling device extends the nominal voltage range to DC 1760 V in DC systems.

![BENDER]
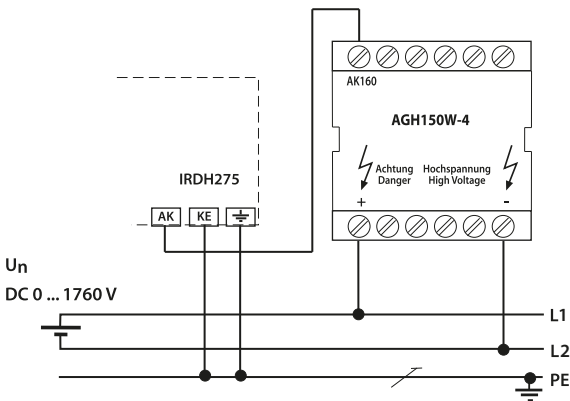
4.2.2 Connection with AGH520S

Connected to the ISOMETER® this coupling device extends the nominal voltage range to AC 7200 V in pure AC systems. In case of 3 AC systems, Pin 2 of AGH520S must be connected to L1, in case of 3/N/AC systems, Pin 2 must be connected to the N conductor.
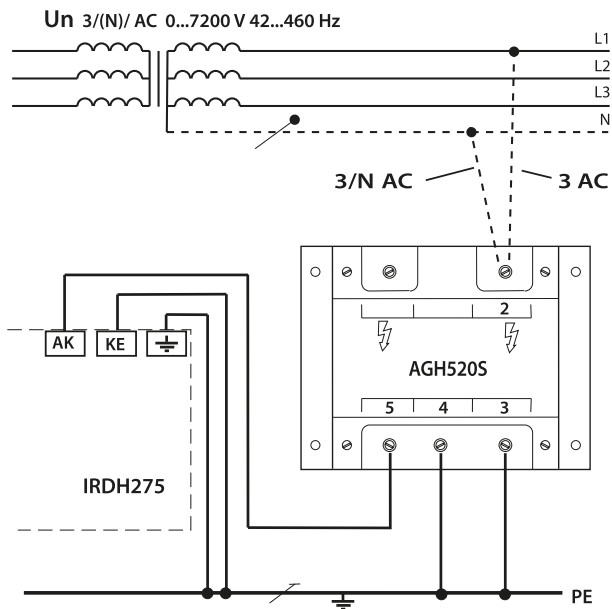
4.2.3 Connection with AGH204S-4

This coupling device extends the nominal voltage range of ISOMETER®s used in AC systems including rectifiers.
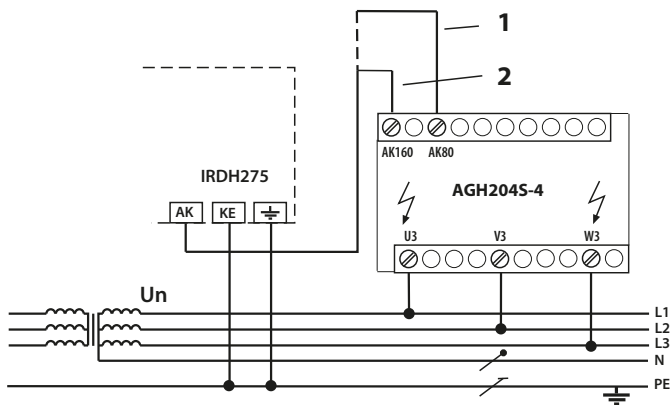
1	without rectifiers	U_n = 3AC 0….1650 V (DC max. 1000 V)
2	with rectifiers	U_n = 3AC 0….1300 V (max. AC voltage; max. DC voltage after rectifiers in intermediate circuits of frequency converters:1840 V)

The maximum DC voltage is the voltage permitted to occur in the AC part of an IT system to PE when the IRDH275 is coupled with AGH204S-4 in this part of the system. This voltage is dependent on the level of the nominal voltage, the type of rectification 6 pulse, 12 pulse,…), the type of converter intermediate circuit (current… or voltage…), and the converter technology. In case of converters, the maximum DC voltage in the intermediate circuit usually corresponds to the phase-to-phase voltage of the supplying AC system multiplied by 1.414. In case of current-controlled intermediate circuits of frequency converters, higher DC voltages are to be expected.

The given voltage values for AC/DC systems take into account values found by previous experience (factor 1.414 between DC voltage and AC voltage). The maximum DC voltage in case of insulation faults in the DC part of the IT system, for example converter intermediate circuit, is DC 1840 V. From this, the maximum nominal AC voltage is calculated:

U_{max} = DC 1840 V / 1.414 = AC 1300 V

5. Commissioning flow chart (threepart)

The encircled figures in the flow chart correspond to the figures in the legend to the wiring diagram.

Commissioning of the ISOMETER® (1)

Is the system to be monitored an unearthed system (IT system)?	no →	The IRDH275 is not suitable for this application(contact BENDER).

Is the maximum nominal voltage $U_n \le$ AC 793 V or $U_n \le$ DC 650 V	no →	U_n is too high for direct connection. A coupling device providing the respective voltage range must be connected.

Deenergize the installation before connecting the device!

yes ↓

Recommended wire cross section of connecting cable
single wire 0.2...4 mm^2
flexible 0.2... 2.5 mm^2

yes ↓

Device connection

Optional device connection

The two PE connections ⏚ and KE must be connected separately to the equipotential bonding.	6

An external kΩ measuring instrument at M+/M- with a display range of 10 kΩ...1000 kΩ, Scale centre point: 120 kΩ Output current IRDH275: 0...400 μA Output current IRDH275B: 0/4...20 mA	10

The terminals L1 and L2 must be connected to U_n of the system to be monitored according to the wiring diagram.	2 3 4 5

External TEST button (NO contact) to the terminals T1 and T2	7

Connect the supply voltage Us to the terminals A1/+ and A2/-. Consider the details indicated on the nameplate.	1

External RESET button (NC contact) to the terminals R1 and R2	8

When using the RS485 interface, take care that a 120 Ω resistor is connected at the beginning and the end of the network.	11

The output contacts of the alarm relays System fault (21-22-24) Alarm 1 (11-12-14) Alarm 2 (21-22-24)	12 13

Commissioning of the ISOMETER® (2)

```
Connect the supply
voltage $U_S$
```

```
Connect the voltage $U_n$ of the
IT system to be monitored
```
→
```
The ISOMETER carries out a
self test. The display indicates
the insulation value after finishing
the measurement.
```

```
Only IRDH275B:
set the clock
```

```
Shall the basic setting
be changed?
Alarm1 = 40 k$\Omega$
Alarm2 = 10 k$\Omega$
K1/K2 = N/O operation
Memory = off
```
— yes →
```
Select ISO SETUP
(see chapter operation and setting)
```

no

```
Does one of the alarm LEDs
light up?
```
— yes →
```
The insulation value of the system
being monitored is below the preset
response value. Change the response
value or improve the insulation
condition of the system.
```

no

Commissioning of the ISOMETER® (3)

In order to check the proper connection, a functional test using a resistance that is suitable for the mains voltage is to be carried out.
Size of the resistance:
50% of the present response value Alarm2.

Do both alarm LEDs light up?
Did the alarm relays switch ?

no →

Check the connecting leads !
Is voltage Un applied to the terminals L1/L2 ?
When a coupling device is used, is it correctly connected ?
Check the voltages with a voltmeter !

yes

Do both alarm LEDs light ?
Did the alarm relays switch?

yes →

Remove the resistor !

no

Alarm LEDs extinguished ?
Did the output relays change their position ?

yes

The IRDH275 is correctly connected and functions reliably !

6. Operation and setting

6.1 Operating features and displays IRDH275(B)

1	INFO key: to query standard information / ESC key: back (menu function), confirmation parameter change
2	TEST button: to call up the self test / Up key: parameter change, moving up in the menu
3	RESET button: to delete insulation fault alarms Down key: parameter change, moving down in the menu
4	MENU key: to activate the menu system / Enter key: confirmation parameter change
5	Alarm LED 1 lights: insulation fault, first warning level reached
6	Alarm LED 2 lights: insulation fault, second warning level reached
7	Device fault LED lights: IRDH275 defective
8	Two-line display for standard and menu mode

A detailed description of the operating elements is given on the following pages.

6.1.1 Display in the standard mode

```
  Insulation   Fault ──── 4
1 ─ Rs=011kΩ  ⌐_⌐.H ──── 3
2 ─
```
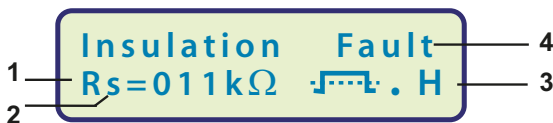
1	Indication of the insulation resistance in kΩ
2	Additional information about the insulation resistance: "+" = insulation fault at L+ "−" = insulation fault at L− "s" = new measurement has started
3	⌐_⌐ = polarity of the measuring pulse • = valid bus communication signals H = new entry in the memory data base C = flashing, clock is to be set
4	Messages: - Insulation fault - Connection system? - Connection PE? - Device error x - ****STANDBY*****

6.1.2 Display in the menu mode

```
1. EXIT
2. HISTORY INFO
```

⬆ Parameter change is
   permitted

🔒 Parameter change is blocked,
   enabling by a password

6.1.3 Function keys

Two functions are assigned to each function key. In addition to the basic function marked with a circle, all the keys allow navigation within the menu.

ESC

INFO

Pressing the INFO key provides the following information without opening the menu:

- Device name, firmware version
- Response values Alarm 1 and Alarm 2
- Leakage capacitance C_e (only indication if insulation resistances > 20 kΩ)
- Setup status (for details refer to the table of the status numbers on page 81)
- COM-Setup (IRDH275 bus address)

Please have the details above on hand if you have a problem and if you contact Bender for technical questions.
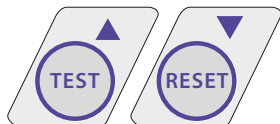
Activating the TEST button starts the ISOMETER® self test.

Pressing the RESET button resets insulation fault alarms stored in the ISOMETER®. The memory function is only available after activating the fault memory in the ISO SETUP menu or after bridging the terminals R1/R2. Furthermore, the ISOMETER® can only be reset when the present insulation value is 25 % higher than the set response value.
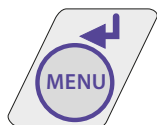
The menu system is called up by pressing the MENU key.

For controlling the menu system, the arrow keys, the ENTER key and the ESC key are used:

Arrow up key:
Moving up in the menu, increasing a parameter

Arrow down key:
Moving down in the menu, reducing a parameter

ENTER key
Selecting a menu item or sub menu item, confirming or storing a parameter change and going back to the associated sub menu item or going to the next input area.

MENU

ESC key:
Returning from a sub menu to the previous menu.

If you do not quit the menu, the device automatically returns to the standard mode again after approximately five minutes.

ESC
INFO

For the sake of clarity, the following symbols are used for the functions ENTER, UP/DOWN and ESCAPE in the menu diagrams of this operating manual:

◄┘   ↕   **ESC**

6.2 Menu structure and menu mode

Switchover to the menu mode
After pressing the MENU key, you can change from the standard mode to the menu mode. From the menu mode you can link to the different sub menus.

Navigation within the menu
Select the desired menu item using the UP/DOWN keys. The selected menu item is indicated by a flashing cursor. Press the ENTER key to open the associated sub menu.
Use the UP/DOWN keys again to select the desired parameters. Move the cursor to the edit field by pressing the ENTER key.
If you have reached the end of the main menu list, it will be indicated by the "Arrow UP" symbol.

Changing the parameters
When password protection is activated, indicated by the symbol "padlock closed" 🔒 , the first thing to enter is the correct password before the parameters can be changed using the UP/DOWN keys. Entering the correct password once allows all parameters to be changed as long as you do not leave the menu.

Changing the parameter usually has an immediate effect on the measuring and alarm functions. The changed parameter is stored in a volatile memory by pressing the ENTER or ESC key after returning to the sub menu (flashing cursor in column 1). During menu operations, all measuring and alarm functions carry on working as usual in the background.

Changing from the menu mode to the standard mode
Pressing the ESC key allows fast changing from the menu mode to the standard mode. Thus, the menu item "EXIT" need not to be activated. Automatic switchover from the menu mode to the standard mode takes place when no key is pressed for approximately 5 minutes in a main or sub menu.

6.2.1 Diagram menu structure
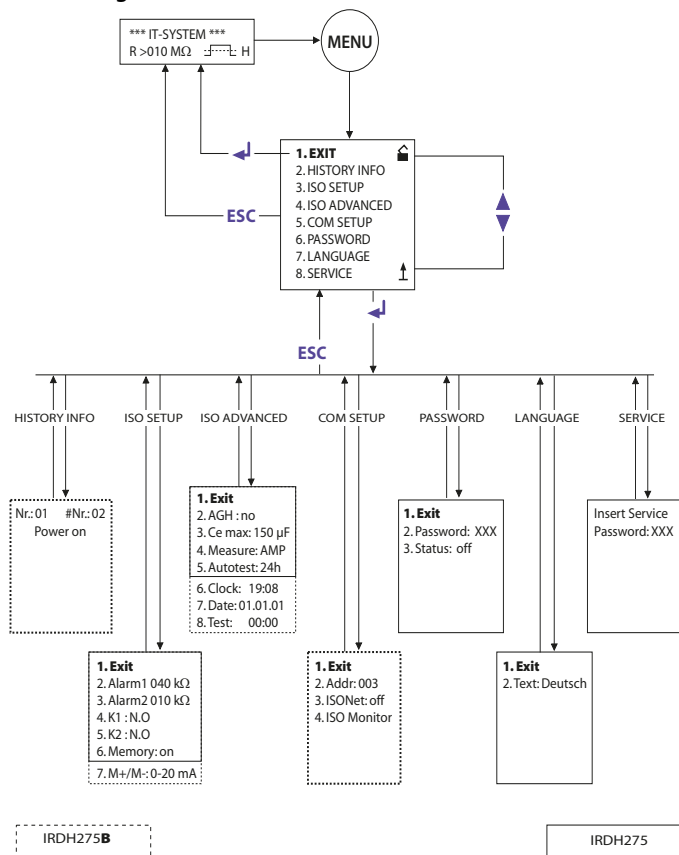
6.3   Menu HISTORY INFO (IRDH275B)

99 events with date and time stamp can be stored in the memory database. The database is designed as a ring memory, i.e. the eldest entry is overwritten. Data is written into a non-volatile memory and therefore provides protection against voltage failure.

Data record	Event	Display indication
1	Switch the supply voltage on	Power On
2	Lowest measured insulation value	Rmin
3...99	Response value Alarm 1 released	● Alarm1
3...99	Response value Alarm 1 cleared	○ Alarm1
3...99	Response value Alarm 2 released	● Alarm2
3...99	Response value Alarm 2 cleared	○ Alarm2
3...99	Error system connection released	● System connection?
3...99	Error system connection cleared	○ System connection?
3...99	Error PE connection released	● PE connection?
3...99	Error PE connection cleared	○ PE connection?
3...99	Device error released	● Device error
3...99	Device error cleared	○ Device error
3...99	System reset (watchdog)	System reset

Before storing the events with the actual date and time stamp, set the real-time clock in the ISO ADVANCED menu (refer to page 54).
The following function keys are provided to query data from the "HISTORY INFO" menu: the UP/DOWN keys to change the data record number, the ENTER key to change from the data record number to the menu item "Clear all:on" to delete the memory storage, and the ESC key to leave the menu.
A new entry into the memory is signalled with an "H" on the display in the standard mode. The "H" will be deleted as soon as the "HISTORY INFO" menu is called up.

⚡ BENDER

6.3.1 Diagram HISTORY INFO (IRDH275B)
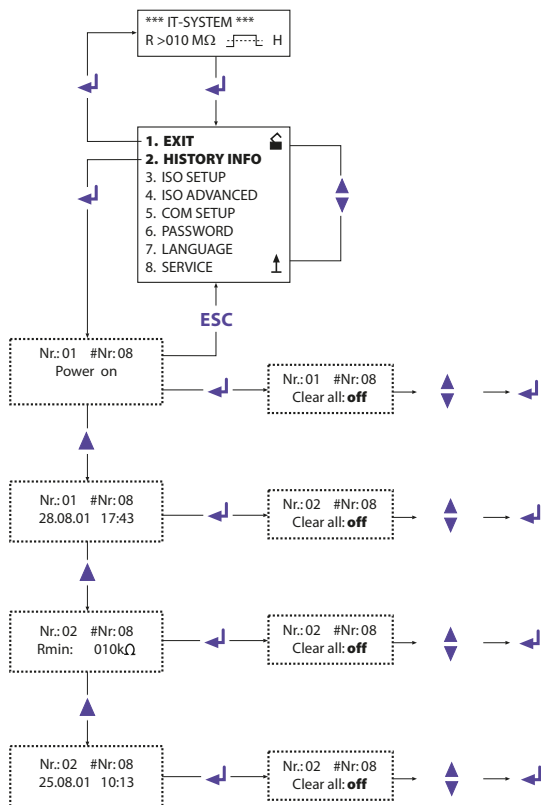
6.4 Menu ISO SETUP: Setting of the basic ISOMETER® functions

All alarm functions such as Alarm 1 and Alarm 2 (prewarning and main alarm), the operating principle of the alarm relays K1 and K2 (N.O = N/O operation, N.C = N/C operation) and the fault storage behaviour are set in this menu. The current output for the IRDH275B can be selected from two value ranges.

6.4.1 Response values Alarm 1 and Alarm 2
The response values Alarm 1 and Alarm 2 are selected with the UP/DOWN keys and stored with the ENTER key.

6.4.2 Operating principle of the alarm relays
K1/K2 are factory set to N.O Test, that means N/O operation. When the supplement "Test" has been selected, the alarm relays switch over during a manual self test.

If, for any reason, the alarm relays may not switch over during a manual self test, the settings N.C or N.O are to be selected.

K1: N.C Test = N/C operation contacts 11-12-14, with relay test
(the alarm relay is energized during normal operation)

K1: N.O Test = N/O operation contacts 11-12-14, with relay test
(the alarm relay is deenergized during normal operation)

K1: N.C = N/C operation contacts 11-12-14, without relay test
(the alarm relay is energized during normal operation)

K1: N.O = N/O operation contacts 11-12-14, without relay test
(the alarm relay is deenergized during normal operation)

K1: Flash = Flashing function contacts 11-12-14
(the alarm relay and the LED flash in the event of an alarm
message, approximately 0.5 Hz

K2: N.C Test = N/C operation contacts 21-22-24, with relay test
(the alarm relay is energized during normal operation)

K2: N.O Test = N/O operation contacts 21-22-24, with relay test
(the alarm relay is deenergized during normal operation)

K2 : N.C = N/C operation contacts 21-22-24, without relay test
(the alarm relay is energized during normal operation)

K2 : N.O = N/O operation contacts 21-22-24, without relay test
(the alarm relay is deenergized during normal operation)

K2 : Flash = Flashing function contacts 21-22-24
(the alarm relay and the LED flash in the event of an alarm
message, approximately 0.5 Hz)

Diagram ISO SETUP
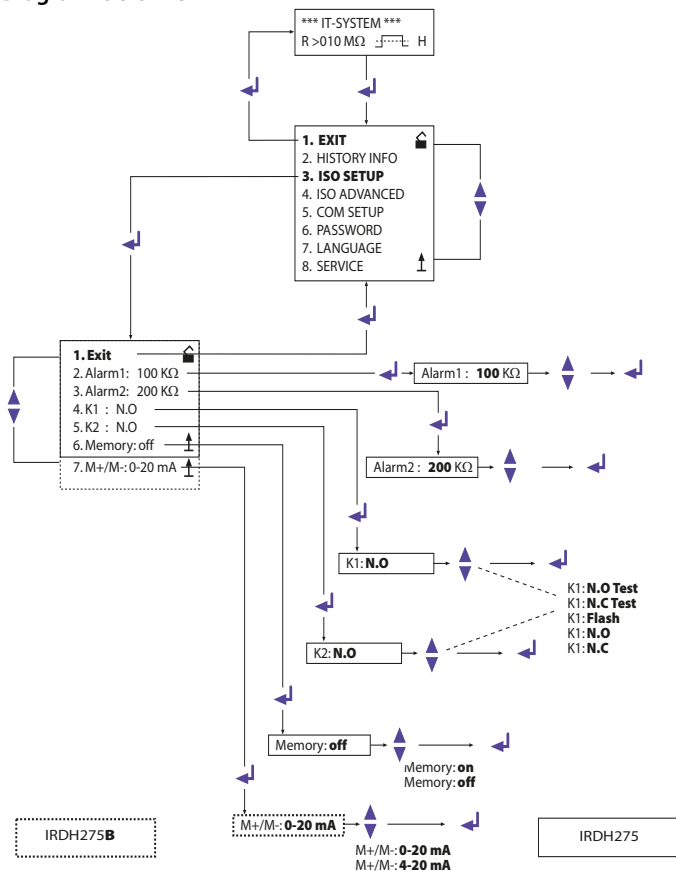
During the automatic self test, the alarm relays are not switched over.

When a device fault occurs at the ISOMETER®, the relay K2 will automatically be activated as a device fault relay.

6.4.3   Memory setting (on/off)

Memory: on   = Fault memory is activated
                         The device must be reset with the RESET button after clearing the fault.

Memory: off   = Fault memory deactivated (factory setting)

6.4.4   Current output for external measuring instruments (IRDH275B)

Factory setting: 0…20 mA

The current output of the IRDH275 can be set to "0…20 mA" or "4…20 mA" via the menu point "M+/M-:". The maximum load is 500 Ω.

Function 0…20 mA:
R_F = insulation fault, I= current in mA

$$R_F = \frac{20\ mA \times 120\ k\Omega}{I} - 120\ k\Omega$$

Function 4…20 mA:
R_F = insulation fault, I= current in mA

$$R_F = \frac{16\ mA \times 120\ k\Omega}{I - 4\ mA} - 120\ k\Omega$$

The associated characteristic curves are illustrated on page 79.

6.5 Menu ISO ADVANCED: Setting of the extended functions

6.5.1 External coupling devices (AGH: no)

Basic setting "no", when no coupling device is used (factory setting).

AGH: 204 AK80

Terminal AK of the IRDH275 is connected to terminal AK80 of the AGH204S-4. The nominal voltage range is extended to 3AC 0…1650 V. Only current converters with an output voltage not exceeding DC 1000 V are allowed to be connected (see "operation with coupling device" on page 33).

AGH: 520S

Terminal AK of the IRDH275 is connected to terminal 5 of the AGH520S. The nominal voltage range is extended to AC 0…7200 V. Only current converters with an output voltage not exceeding DC 1000 V are allowed to be connected.

AGH: 204 AK160

Terminal AK of the IRDH275 is connected to terminal AK160 of the AGH204S-4. The nominal voltage range is extended to 3AC 0…1300 V. Only current converters with an output voltage not exceeding DC 0…1840 V are allowed to be connected (see page 33).

AGH: 150 AK160

Terminal AK of the IRDH275 is connected to terminal AK160 of the AGH150W-4. The nominal voltage range is extended to DC 0…1760 V.

> ⓘ *The coupling monitoring is deactivated when an external coupling device is connected.*

6.5.2 Adaptation to the system leakage capacitance (Cemax: 150 μF)

This menu allows to adapt the ISOMETER® to the maximum system leakage capacitance (max. 500 μF). Please note that the basic measuring time will be increased to approximately 10 seconds when the setting is C_e = 500 μF. Factory setting = 150 μF.

6.5.3 Changing the measuring principle from AMP to DC (Measure: AMP)

The DC measuring principle is only suitable for pure AC systems.
Factory setting = AMP.

6.5.4 Setting the repetition time for automatic self tests (Autotest: 24h)

The time for the repetition of automatic self tests can either be set to 1 hour or to 24 hours or can be deactivated.
Factory setting = 24 h

6.5.5 Setting the real-time clock (Clock) (IRDH275B)

The setting of the real-time clock is the time base for the memory and for the automatic self test. In case of failure of the supply voltage, the real-time clock keeps running for approximately 30 days. When the device will be switched on after this period, a flashing "C" appears on the display and the clock has to be set again.

6.5.6 Setting the date (Date) (IRDH275B)

As well as the time, the date is required for the memory, too. In the event of power supply failure, the date function is not influenced for at least 30 days. If the device is switched on again after this period, a new setting of date and time of the real-time clock is required.

6.5.7 Specifying the starting time of the automatic self test (Test) (IRDH275B)

If the 24h self test is activated in the ISO ADVANCED menu, it is possible to set the time (hour) when the self test is to be carried out by means of the "TEST: 12:00" sub menu. Then the self test is automatically carried out once a day at a given time. If the 1 hour auto test has been selected, the self test will be carried out at every full hour.

6.5.8 Diagram ISO ADVANCED


```
*** IT-SYSTEM ***
R >010 MΩ  ⌐····L H
```

1. EXIT
2. HISTORY INFO
3. ISO SETUP
4. ISO ADVANCED
5. COM SETUP
6. PASSWORD
7. LANGUAGE
8. SERVICE

1. Exit
2. AGH: no
3. Ce max : 150µF
4. Measure: AMP
5. Autotest: 24h
6. Clock: 21:09
7. Date: 01.01.01
8. Test: 12:00

AGH: **no**

no
150 AK160
204 AK160
520S
204 AK80

Ce max : **150**µF

150µF
500µF

Measure: **AMP**

DC
AMP

Autotest: **24**h

24h
no
01h

Clock: **21:09**

Date: **01.01.01**

Test: **00:00**

00:00
⋮
23:00

IRDH275**B**

IRDH275

6.6   Menu COM SETUP: Setting the BMS interface

6.6.1   Bus address „Addr:" (IRDH275B)

This menu item is used to set the BMS bus address of the IRDH275. Since there are several ISOMETERs in one system, take care that the bus address is not assigned twice.

The device is factory set to address 3 and hence acts as a slave.

> **ⓘ**   *If several IRDH275 are operated on one BMS bus, the addresses of other ISOMETER®s must be assigned one after the other, since only one device may represent the Master.*

6.6.2   ISOnet function (IRDH275B)

In the ISOnet = ON sub menu of the COM SETUP, the ISOnet function can be set. The ISOnet function of all ISOMETERs existing in the system must be in "ON" position.

A BMS Master with the ISOnet function activated, controls the ISOnet slave devices via the BMS bus. If an ISOMETER® has completed the measuring cycle, the permission for insulation measurement is given from the ISOnet Master to the next slave. During the measurement process carried out by an ISOMETER®, all other ISOMETER®s are in the STANDBY mode.

6.6.3   ISO monitor (IRDH275B)

This function allows to query the current measured value as well as the messages of all bus-capable ISOMETERs existing in the BMS network. After selecting the bus address, the entire information stored by the selected device is indicated on the display. The display indication is structured similar to the standard indication, but instead of the indication of the measuring pulse, the selected bus address is indicated. Without pressing a key, the indication changes to the standard indication of the IRDH275B after about five minutes. If there is no information available from the selected ISOMETER®, the message "!!!!NO DATA!!!!" will be displayed.

Information is being searched

```
<<BUS SCANNING>>
R=          ADR:02
```

No data found

```
!!!!NO  DATA!!!!
R=   K     ADR:02
```

Current data address 03

```
Insulation Fault
R= 010K     ADR:03
```

⚡BENDER

6.6.4 Diagram COM SETUP (IRDH275B)


```
                        *** IT-SYSTEM ***
                        R >010 MΩ  ⌐····⌐ H

                        1. EXIT           ⌂
                        2. HISTORY INFO
                        3. ISO SETUP
                        4. ISO ADVANCED
                        5. COM SETUP
                        6. PASSWORD
                        7. LANGUAGE
                        8. SERVICE        ↥
```

```
1. Exit            ⌂
2. Addr: 003                          Addr : 003      ⟶   ADR: 001
3. ISONet: off                                            ⋮
4. ISO Monitor   ↥                                        ADR: 030
```

```
                                      ISONet : off    ⟶   ISONet : off
                                                          ISONet : on
```

```
IRDH275
```

```
IRDH275B
```

```
!!!! NO DATA !!!!    ⟶   ADR: 01
R=        ADR: 01              ⋮
                              ADR: 30
```
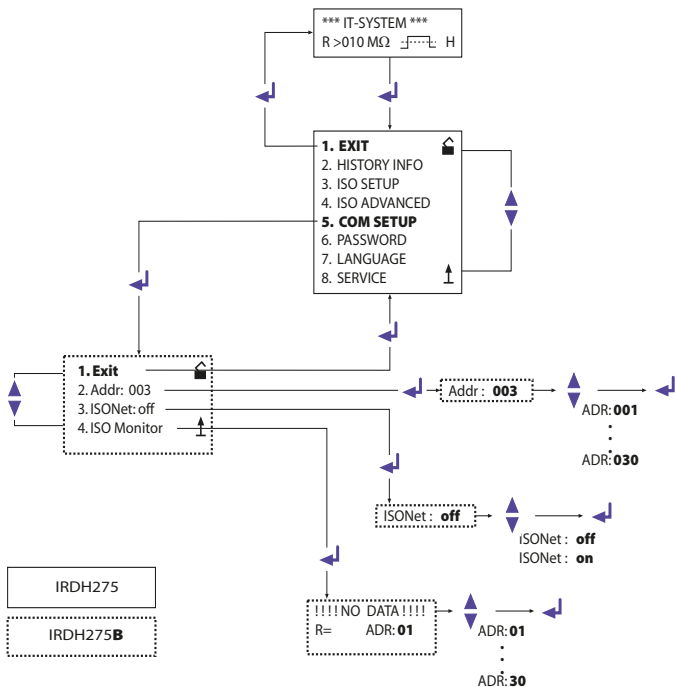
6.7 Menu PASSWORD

6.7.1 Activating and setting the password

This menu can be used to activate a "Password" query. This protects the
ISOMETER® against unauthorized settings and modifications. The desired
password (menu item 2. Password: xxx) can be set with the UP/DOWN keys
and confirmed with the ENTER key. The password can be activated in the
menu item "3. Status: on" by clicking the ENTER key. The basic setting is
"3. Status: off", that means that the password is deactivated.

6.7.2 Diagram PASSWORD


```
*** IT-SYSTEM ***
R >010 MΩ  ⌐····⌐ H
```

1. **EXIT**
2. HISTORY INFO
3. ISO SETUP
4. ISO ADVANCED
5. COM SETUP
6. **PASSWORD**
7. LANGUAGE
8. SERVICE

1. **Exit**
2. Password: XXX
3. Status: off

Password: **XXX**

Password: **XXX**
Password: **000**
Password: **...**
Password: **999**

Status: **off**

Status: **off**
Status: **on**
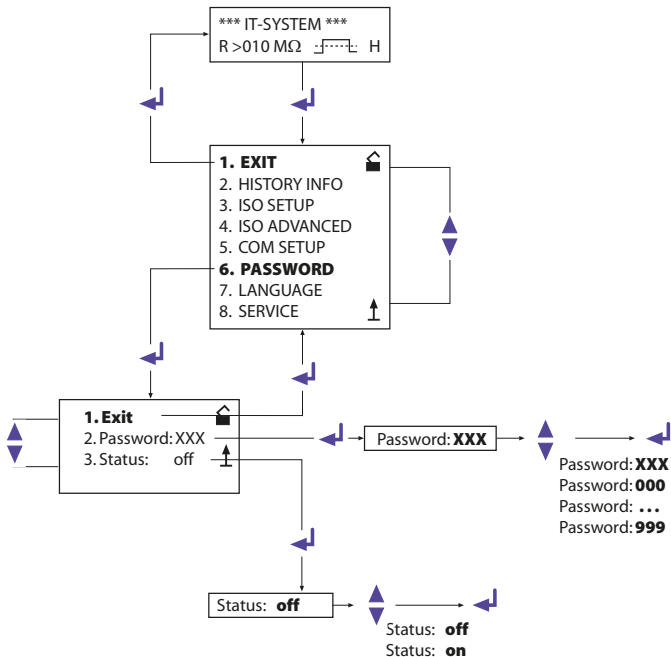
6.8 Menu LANGUAGE

6.8.1 Setting the national language

The menu item "Language" allows fault messages of the ISOMETER® to be set to different languages. There is the choice of "German" and "English".
The device menu is not influenced by the language selection.

6.8.2 Diagram Language
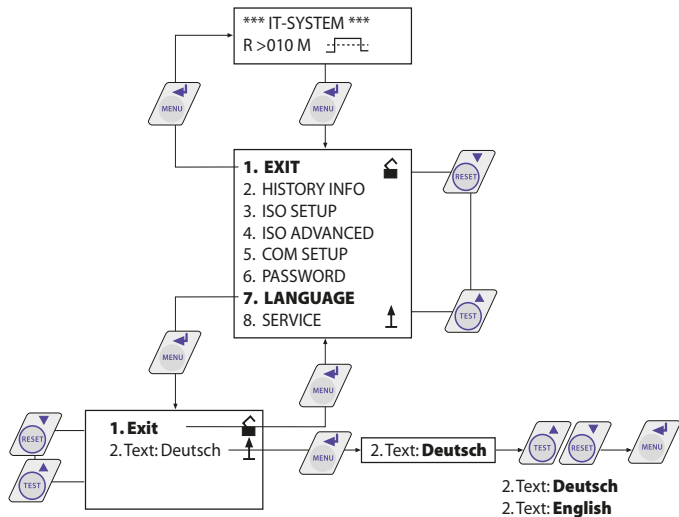
6.9   Menu SERVICE

This menu item is provided for the Bender service personnel and is protected by a password against erroneous settings. It is intended to provide fast fault clearance by qualified experts in the event of a device error.

6.10 Parameterization via Internet

The parameters of an IRDH275B indicated below can be checked and set from a remote place of use by using a personal computer. In addition, a browser (viewing program for Internet application) and the BMS-Ethernet-Gateway COM465 are required.
Remote setting is possible for:

- Response value Alarm 1 (1 kΩ…10 MΩ)
- Response value Alarm 2 (1 kΩ…10 MΩ)
- Operating principle alarm relay 1 (e.g. N/O operation)
- Operating principle alarm relay 2 (e.g. N/O operation)
- Measuring principle (AMP or DC)
- Current output ranges for external measuring instruments (0/4…20 mA)
- Maximum system leakage capacitance (150 µF or 500 µF)
- Time for repetition of the automatic self test (off/ 1 h/ 24 h
- Starting time of the automatic self test (0.00…23.00 h)
- Language of the alarm messages to be displayed (D, GB)
- Setting the fault memory to ON or OFF

7. Serial interfaces

The ISOMETER®s IRDH275 and IRDH275B have differently designed serial interfaces.

IRDH275	- RS-485 and IsoData protocol - galvanically isolated - ASCII, unidirectional
IRDH275B	- RS-485 and BMS protocol - galvanically isolated - ASCII, bidirectional

7.1   RS-485 interface with IsoData protocol (IRDH275)

Data transmission is continuously carried out and can neither be interrupted by the data slave station nor be influenced in any other way. This protocol cannot be used in combination with the BMS protocol.
For data evaluation via PC or Laptop, the terminal software "IsoData" and an interface converter of the ASCII RS-485/RS-232 type is required. To obtain the software, please contact Bender Service. Contact details are found on page 8.

Interface data:
- RS-485 interface galvanically isolated from the device electronics
- Connection to terminal A and B
- Maximum cable length 1200 m
- Transmission protocol 9600 baud - 1 start bit - 1 stop bit - 8 data bit
- After each valid measurement, the following data block is provided:

BENDER

Start | US= Unit separator | US | US

| 02H | 0FH | 30H | 30H | 30H | 31H | 32H | 38H | 0FH | 30H | 30H | 30H | 30H | 36H | 30H | 0FH |

Measuring value
e.g. 128 kΩ

Response value
Alarm1 e.g. 60 kΩ

US | US | US | US | End | LF | CR

| 30H | 30H | 30H | 31H | 32H | 30H | 0FH | 30H | 0FH | 30H | 0FH | 30H | 0FH | 03H | 10H | 13H |

Response value
Alarm2 e.g. 120 kΩ

30H = No alarm
31H = Alarm1
32H = Alarm2
33H = Alarm1/2

30H = K1 off, K2 off
31H = K1 on, K2 off
32H = K1 off, K2 on
33H = K1 on, K2 on
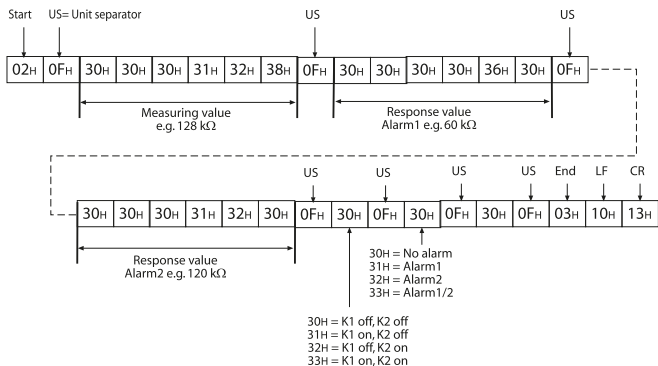
Example: terminal display

0 0 0 1 2 8 0 0 0 0 6 0 0 0 0 1 2 0 2 2 0

Measuring value
128 KΩ

Alarm1
60 KΩ

Alarm2
120 KΩ

AC fault

Alarm2

K1 off, K2 on

7.2 RS-485 interface with BMS protocol (IRDH275B)

The RS-485 interface galvanically isolated from the device electronics and current output serves as a physical transmission medium for the BMS protocol. If several IRDH275B or other bus-capable devices are interconnected in a network via the BMS bus, the BMS bus must be terminated at both ends with a 120 Ω resistor.

An RS-485 network that is not terminated, is likely to get instable and may result in malfunctions. Only the first and the last device in one line may be terminated. Devices in between must not be terminated with 120 Ω. Hence, stub feeders in the network must not be terminated. The length of the stub feeders is restricted to 1 meter.

1st device   ... device   last device

A   B   A   B   A   B

120 Ω
0.4 W

Stub feeder
maximum 1 m

120 Ω
0.4 W

Maximum length of the RS485 bus: 1200 m
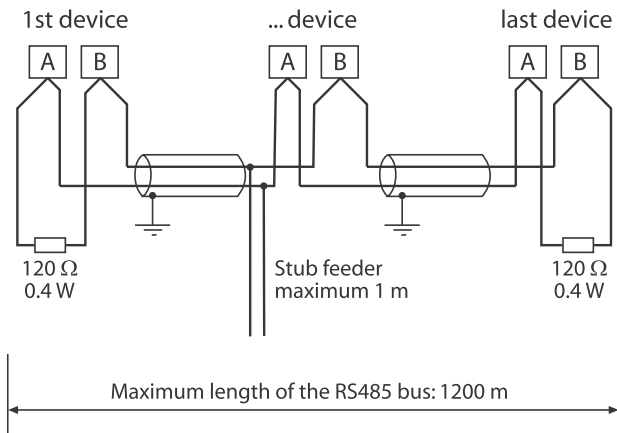
7.3 Topology RS-485 network (IRDH275B)

The optimum topology for the 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.

7.3.1 Correct arrangement

Three examples for correct arrangement:
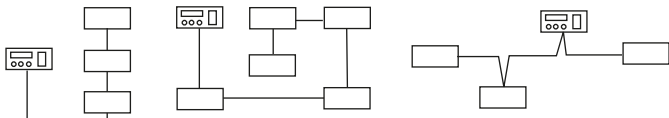
7.3.2 Wrong arrangement

Three examples for wrong arrangement:
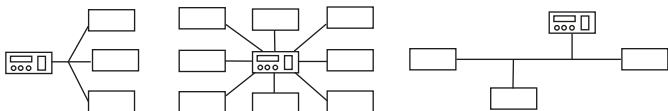
7.3.3 Wiring

A suitable type of cable for the wiring of the RS-485 network is:
screened cable, core diameter 0.6 mm
(e.g. J-Y(St)Y 2 x 0.6), screen on one side connected to earth (PE).
Connection to the terminals A and B.
The number of bus nodes is restricted to 32 devices. When more devices are to be connected, Bender recommends to use an RS-485 repeater DI1.
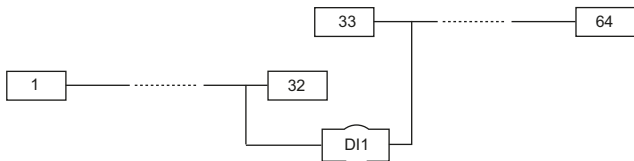
7.4   BMS protocol (IRDH275B)

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

- •   Baud rate: 9,600 baud
- •   transmission: 1 start bit, 7 data bits, 1 parity bit, 1 stop bit (1, 7, E, 1)
- •   Parity: even
- •   Checksum: sum of all transmitted bytes = 0 (without CR and LF)

The BMS bus protocol works according to the MASTER-SLAVE principle. That means that one device represents the MASTER while all other bus nodes are SLAVES. It is important that only one MASTER is present in each network. All bus nodes are identified by a unique address. The MASTER scans all other devices on the bus cyclically, listens to their signals and then carries out specific commands. Bus address 1 must be assigned to the Master, thus to one of the IRDH275B devices.

7.4.1   BMS Master

A Master can query all warning and operating messages from a slave.
If the bus address 1 has been selected for one IRDH275B, this device automatically represents the Master, that means that 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 five subsequent addresses, the scanning cycle is started again. If the Master recognizes incorrect answers from a slave, the fault message "Fault RS485" is issued by the Master.

Fault RS485
Rs=011kΩ   ⊐⌐⌐.H

Faults may be caused when:
- 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

7.4.2 BMS Slave

All IRDH275B are factory set to slave mode (address 3). In a BMS network, one address must be selected from the address range 2…30 for each slave. There may be no gaps of more than five subsequent addresses, so that all slaves can be scanned by the Master. For IRDH275B a BMS address can be selected from the address range 1…30. When assigning the addresses, also other devices such as the EDS47x-12 must be considered.

The correct reception of BMS data is indicated by a flashing point on the display on the right of the measuring pulse indication.
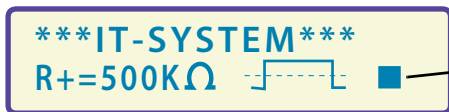
Flashing point: BMS data received

If no flashing point appears, it may be attributed to the following:
- no Master available in the network
- more than one Master available in the network
- RS-485 interface (terminal A/B) not connected or reversed

The following table gives an overview about essential alarm messages and the assignment of the messages indicated on the display or operator panels, e.g. PRC1470.

Message	Channel	Meaning
Insulation Fault	1	Insulation resistance < setting Alarm 1
Insulation Fault	2	Insulation resistance < setting Alarm 2
Connection system	3	Connection error L1/L2 against system
Connection PE	4	Connection error ⏚ /KE against PE conductor
Device error	5	Internal device error

The BMS function is completely available in the standby mode (Stand-by: F1/F2).

7.4.3 Commissioning of an RS-485 network with BMS protocol

- Connect the terminals A and B of all bus nodes in one line
- Switch the terminating resistors on at the beginning and end of the RS-485 network or in case of devices without a terminating switch, at the end of the bus, connect a 120 Ω resistor to the terminals A and B.
- Switch the supply voltage U_S on.
- Determine one IRDH275 as the Master and assign address 1.
- Assign the addresses (2…30) subsequently to all other IRDH275B devices and other bus nodes (see table below).
- Check whether a flashing point appears on all devices (BMS commands are being received).
- The sub menu "ISO-Monitor" in the COM SETUP menu allows insulation values of the ISOMETER®s to be queried. Before starting the query, the address of the ISOMETER® has to be entered.

BMS-bus address ranges

Addresses*	Device	Meaning
0		There is no device with address 0 ! Information sent to address 0 applies to all devices connected to the interface (broadcast)
1	PRC1470	Control and indicating device
1…30	IRDH275B/ 375B/575	Insulation monitoring device
1…30	COM465	Protocol converter
2…30	EDS47x-12	Insulation fault evaluators (localisation)
31…60	SMO480-12	Signal converter relay
61…90	EDS47xE-12	Insulation fault evaluators (localisation)
111…119	PGH47x	Test device for insulation fault location
121…150	PGH47xE	Test device for insulation fault location

ⓘ **_Malfunctions due to wrong address assignment!_**
Assigning wrong addresses to external devices may cause malfunctions. Assign the addresses in a way that there are no gaps of more than five subsequent addresses (1…30, 31…60, 61…90, 111…119 and 121…151).

8. Factory settings

Menu	Submenu	Factory setting
1. EXIT		
2. HISTORY INFO		
3. ISO SETUP	1. Exit	
	2. Alarm1:	40 kΩ
	3. Alarm2:	10 kΩ
	4. K1:	N.O
	5. K2:	N.O
	6. Memory:	off
	7. M+/M-:*	0-20 mA*
4. ISO ADVANCED	1. Exit	
	2. AGH:	no
	3. Ce. max:	150 µF
	4. Measure:	AMP
	5. Autotest:	24 h
	6. Clock:*	CET (HH:MM)*
	7. Date:*	current date (DD.MM.YYYY)*
	8. Test:*	12:00*
5. COM SETUP*	1. Exit*	
	2. Addr:*	3*
	3. ISOnet:*	off*
	4. ISO Monitor:*	
6. PASSWORD	1. Exit	
	2. Password:	000
	3. Status:	off

Menu	Submenu	Factory setting
7. LANGUAGE	1. Exit	
	2. Text:	German
8. SERVICE (Access only for Bender service personell)		

* Settings apply only to IRDH275B.

Please check if the basic setting of the ISOMETER® complies with the requirements of the system to be monitored.

9. Technical data IRDH275(B)

9.1 Data in tabular form

The values marked with * are absolute values

Insulation coordination acc. to IEC 60664-1

Rated voltage .... AC 800 V

Rated impulse voltage/pollution degree 8 kV/3

Voltage ranges

IRDH275...:

Nominal voltage range U_n .... 1AC/3(N)AC 0...793 V*

Nominal frequency f_n (for $f < 50$ Hz see characteristic curve on page 77) .... 0.1...460 Hz

Nominal voltage range U_n .... DC 0...650 V*

IRDH275...-435:

Supply voltage U_s (see nameplate) .... AC 88...264 V*

Frequency range U_s .... 42...460 Hz

Supply voltage U_s (see nameplate) .... DC 77...286 V*

IRDH...-427:

Supply voltage U_s (see nameplate) .... AC 19.2...55 V*

Frequency range U_s .... 42...460 Hz

Supply voltage U_s (see nameplate) .... DC 19.2...72 V*

IRDH275...:

Power consumption .... ≤ 14 VA

Response values

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

Response value R_{an2} (Alarm 2) .... 1 kΩ...10 MΩ

Relative uncertainty (20 kΩ...1 MΩ) (acc. to IEC 61557-8:2007-01) .... ±15 %

Relative uncertainty (1 kΩ...20 kΩ) .... +2 kΩ/+20 %

Relative uncertainty (1 MΩ...10 MΩ) .... 0.2 MΩ/+20 %

Response time t_{an} at $R_F = 0.5 \times R_{an}$ and $C_e = 1\ \mu F$ .... ≤ 5 s

Measuring time .... see characteristic curve

Hysteresis (1 kΩ...10 kΩ) .... +2 kΩ

Hysteresis (10 kΩ...10 MΩ) .... 25 %

Measuring circuit

Measuring voltage U_m .... ≤ 50 V

Measuring current I_m max. (at $R_F = 0$ Ω) .... ≤ 280 µA

Internal DC resistance R_i .... ≥ 180 kΩ

Internal impedance Z_i at 50 Hz .... ≥ 180 kΩ

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

Permissible system leakage capacitance C_e .... ≤ 500 µF

Factory setting .... 150 µF

Displays

Display, illuminated .... two-line display

Characters (number of characters) .... 2 x 16

Display range, measuring value .... 1 kΩ...10 MΩ

Operating uncertainty (20 kΩ...1 MΩ) (acc. to IEC 61557-8:2007-01) .... ±15 % **

Operating uncertainty (1 kΩ...20 kΩ) .... ±1 kΩ/±15 % **

Operating uncertainty (1 MΩ...10 MΩ) .... ±0.1 MΩ/±15 % **

** = under test conditions according to IEC 61326-2-4, the tolerances may double

Outputs/inputs

TEST/RESET button .... internal/external

Cable length TEST/RESET button external .... ≤ 10 m

Current output for measuring instrument SKMP (scale centre point = 120 kΩ): ....

Current output IRDH275 (load) .... 400 µA (≤ 12.5 kΩ)

Current output IRDH275B (load) .... 20 mA (≤ 500 Ω)

Accuracy current output (1 kΩ...1 MΩ)

in relation to the displayed measured value .... ±10 %, ±1 kΩ

Serial interface

Interface/Protocol IRDH275 .... RS-485/ASCII-IsoData

Interface/Protocol IRDH275B RS-485/BMS

Connection .... terminals A/B

Cable length .... ≤ 1,200 m

Shielded cable (shield on one side to PE) .... two-core, ≥ 0.6 mm^2, e.g. J-Y(St)Y 2 x 0.6

Terminating resistor .... 120 Ω (0.5 W)

Device address, BMS bus .... 1...30 (factory setting = 3)

Switching components

Switching components..2 changeover contacts: K1 (Alarm 1), K2 (Alarm 2, device fault)

Operating principle K1, K2 (Alarm 1, Alarm 2)..N/O or N/C operation

Factory setting (Alarm 1/Alarm 2)... N/O operation

Electrical endurance..12,000 switching operations

Contact class .... IIB (IEC 60255-23)

Rated contact voltage .... AC 250 V/DC 300 V

Making capacity .... AC/DC 5 A

Breaking capacity .... 2 A, AC 230 V, cos phi = 0.4

.... 0.2 A, DC 220 V, L/R = 0.04 s

Minimum contact current at DC 24 V .... 2 mA (50 mW)

General data

EMC .... acc. to IEC 61326-2-4:2006-06 Ed. 1.0

Shock resistance IEC 60068-2-27 (device in operation) .... 15 g/11 ms

Bumping IEC 60068-2-29 (during transport) .... 40 g/6 ms

Vibration resistance IEC 60068-2-6 (device in operation).. 1 g/10…150 Hz

Vibration resistance IEC 60068-2-6 (during transport) .... 2 g/10…150 Hz

Ambient temperature (during operation) .... -10 °C…+55 °C

Storage temperature range .... -40 °C…+70 °C

Climatic class acc. to IEC 60721-3-3 .... 3K5

Operating mode .... continuous operation

Mounting .... as indicated on the display

Distance to adjacent devices ....≥ 30 mm

Connection .... screw terminals

Connection, rigid, flexible.. 0.2…4 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

Tightening torque .... 0.5 Nm

Protection class, internal components (DIN EN 60529) IP30

Protection class, terminals (DIN EN 60529) IP20

Type of enclosure .... X112, free from halogen

DIN rail mounting .... IEC 60715

Flammability class UL94 V-0

Software version IRDH275 .... D160 V1.8

Software version IRDH275B D159 V1.8

Weight approx. .... 510 g

Option „W"

Shock resistance IEC 60068-2-27 (Device in operation) .... 30 g/11 ms

Bumping IEC 60068-2-29 (during transport) .... 40 g/6 ms

Vibration resistance IEC 60068-2-6 ....1.6 mm/10. . .25 Hz

.... 4 g/25 . . .150 Hz

Ambient temperature (during operation) .... -40 ℃. . .+70 ℃

Storage temperature range .... -40 ℃. . .+85 ℃

Screw mounting ....2 x M4

* Absolute values

9.2   Standards, approvals and certifications

The ISOMETER® was designed under consideration of the following standards:

- DIN EN 61557-8 (VDE 0413-8): 2007-12
- IEC 61557-8: 2007 + Corrigendum 2007-05
- IEC 61326-2-4: 2006-06 Ed. 1.0
- DIN EN 60664-1 (VDE 0110-1): 2008-01
- DIN EN 60664-3 (VDE 0110-3): 2003-09
- ASTM F1669M-96 (2007)
- ASTM F1207M-96 (2007)

Subject to change! The specified standards take into account the edition valid until 07.2018 unless otherwise indicated.

9.3   Characteristic curves

ISOMETER® response times in relation to system leakage capacitances of:

$C_e = 1…500\ \mu F$, $U_n = 0…793\ V/50\ Hz$
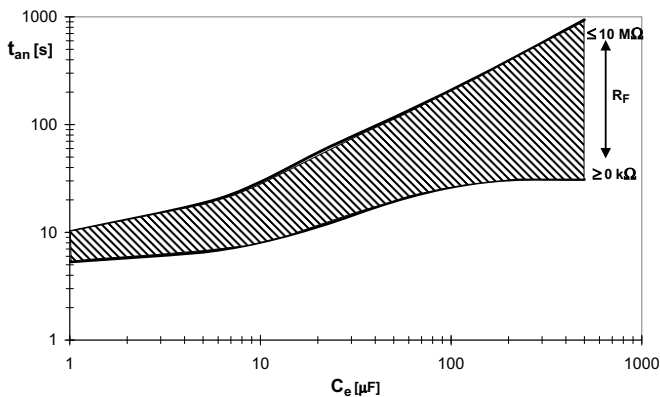
Max. AC voltage between the IT system and earth in the frequency range <50 Hz

Current output 0…400 μA (only IRDH275)

R_F [kΩ]
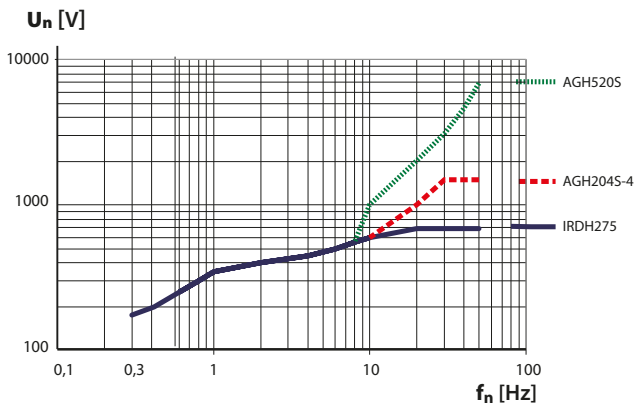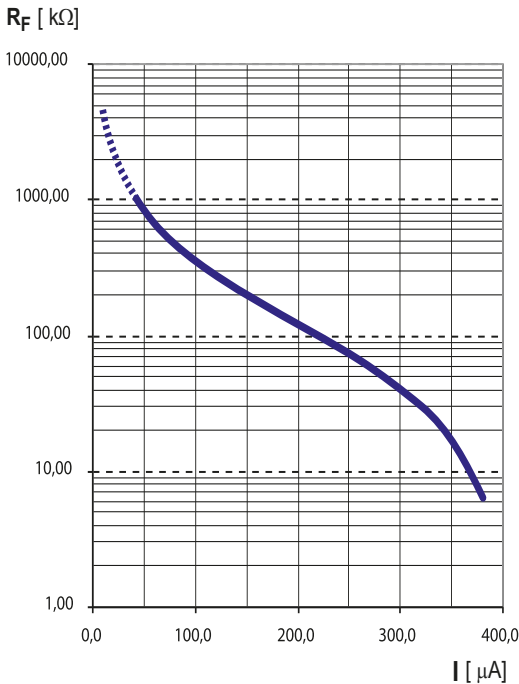
$$R_F = \frac{400\ \mu A \times 120\ k\Omega}{I} - 120\ k\Omega$$

R_F =Insulation fault in kΩ
I =Current output in mA

≥ BENDER

Current output 0…20 mA (IRDH275B)

R_F [kΩ]
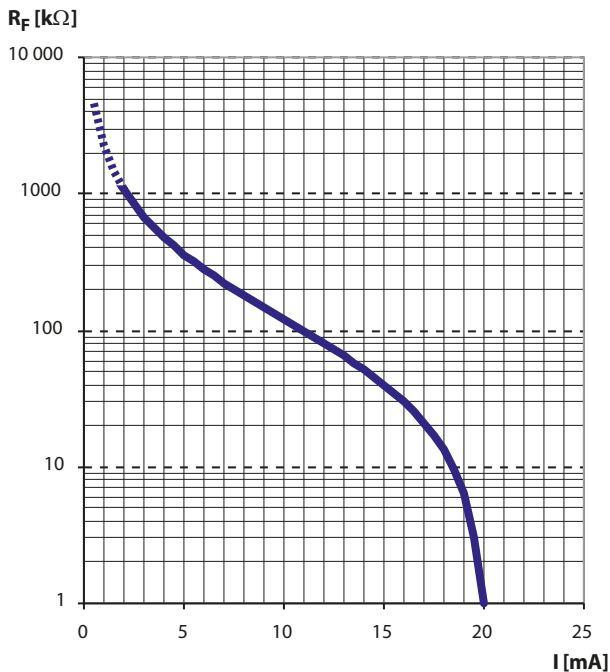
$$R_F = \frac{20 \text{ mA} \times 120 \text{ k}\Omega}{I} - 120 \text{ k}\Omega$$

R_F = Insulation fault in kΩ
I = Current output in mA

Current output 4…20 mA (IRDH275B)

R$_F$ [kΩ]
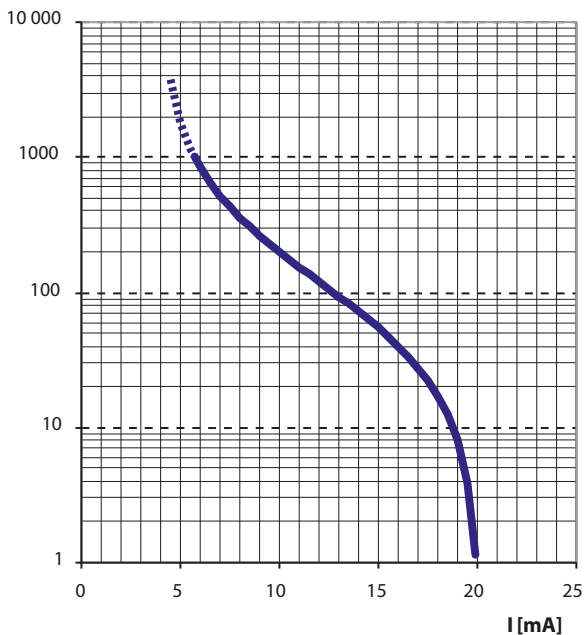
$$R_F = \frac{16 \text{ mA} \times 120 \text{ k}\Omega}{I - 4 \text{ mA}} - 120 \text{ k}\Omega$$

R_F = Insulation fault in kΩ
I = Current output in mA

Status number

Position of numbers from the left	Value of the respective number				
	0 =	1 =	2 =	3 =	4 =
1	K1: N/O operation Test	K1: N/C operation Test	K1: flashing function	K1: N/O operation	K1: N/C operation
2	K2: N/O operation Test	K2: N/C operation Test	K2: flashing function	K2: N/O operation	K2: N/C operation
3	no external coupling	AK AGH204S 80K	AK AGH520S	AK AGH204S 160K	AK AGH150W 160K
4	Cemax 1 µF **	Cemax 10 µF **	Cemax 150 µF	Cemax 500 µF	
5					
6	Self test every 24 hours	Self test every hour	no periodic self test		
7	Language German	Language English			
8	Password protection not activated	Password protection activated			
9	AMP measuring principle	DC measuring principle			
10	max. filter frequency 0.1Hz **	max. filter frequency 1Hz **	max. filter frequency 10Hz **	max. filter frequency 50Hz **	
11	min. filter frequency 0.1Hz **	min. filter frequency 1Hz **	min. filter frequency 10Hz **	min. filter frequency 50Hz **	
12	BMS mode **	Isodata **	test data **		
13	Bus address in the tens place IRDH275				▲ Value: 5 … 9
14	Bus address in the units place IRDH275				▲ Value: 5 … 9
15	Number of pulses 2-9 **				Value: 5 … 9

** The parameters marked with two asterisks are settable via the Service menu item! A password is required for that purpose !

Dimension diagram enclosure IRDH275(B)
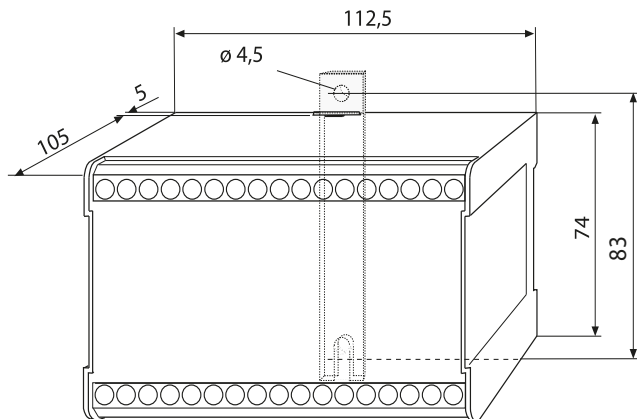
All dimensions in mm

- DIN rail mounting according to IEC 60715
  or
- Screw mounting
  by means of a plug-in trapezoidal support
  Order No.: B990056 (Option W)

9.4 Ordering details

9.4.1 ISOMETER®

Type	Nominal voltage U_n	Supply voltage U_s	Art.-No.
IRDH275-435	3(N)AC 0…793 V DC 0…650 V	AC 88…264 V DC 77…286 V	B91065100
IRDH275W-435	„	„	B91065100W
IRDH275B-435	„	„	B91065101
IRDH275BW-435	„	„	B91065101W
IRDH275-427	3(N)AC 0…793 V DC 0…650 V	AC 19.2…55 V 42…460 Hz DC 19.2…72 V	B91065104
IRDH275W-427	„	„	B91065104W
IRDH275B-427	„	„	B91065105
IRDH275BW-427	„	„	B91065105W
IRDH275-425	„	10.2…36 V	B91065108
IRDH275B-425	„	„	B91065109

Series …B…

The 275B series provides a BMS interface, a memory with real-time clock and other features. An overview about these features is shown in the menu structure on page 43 and in the product and function description on page 19.

Option "W"

Devices with ending "W" provide improved shock and vibration resistance. A special varnish of the electronics provides higher resistance against mechanical stress and moisture. This makes the devices suitable for use in ships, on rolling stock and in seismic environment.

9.4.2   Coupling devices

Type	Nominal voltage range U_n	Art. No.
AGH204S-4	AC 0…1650 V	B914013
AGH520S	AC 0…7200 V	B913033
AGH150W-4	DC 0…1760 V	B98018006

9.4.3   Measuring instruments

Type	Measuring range	Dimensions	Art. No.
7204-1421	0…400 µA	72 x 72 mm	B986763
9604-1421	0…400 µA	96 x 96 mm	B986764
7204S-1421	0…400 µA	72 x 72 mm	B986804
9604S-1421	0…400 µA	96 x 96 mm	B986784
9620-1421	0…20 mA	96 x 96 mm	B986841
9620S-1421	0…20 mA	96 x 96 mm	B986842
7220-1421	0…20 mA	72 x 72 mm	B986844
7220S-1421	0…20 mA	72 x 72 mm	B986848

INDEX

BENDER

Bender GmbH & Co. KG
Londorfer Str. 65 • 35305 Grünberg • Germany
P.O. Box 1161 • 35301 Grünberg • Germany

Tel.: +49 6401 807-0
Fax: +49 6401 807-259

E-mail: info@bender.de
Web: http://www.bender.de

Photos: Bender archives.

BENDER Group