

Operating Manual



A-ISOMETER® IR1575H

Insulation monitoring device
for IT AC and DC systems
D275 V1.3



Dipl.-Ing. W. Bender GmbH & Co.KG
Londorfer Str. 65 • 35305 Grünberg • Germany
Postfach 1161 • 35301 Grünberg • Germany

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

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



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1. Safety information

1.1 Intended use

The A-ISOMETER® is intended for:

- monitoring the insulation resistance of IT systems

Any other use, or use which goes beyond the foregoing, is deemed to be use other than for the intended purpose. The BENDER companies shall not be liable for any losses or damage arising therefrom.

Use for the intended purpose also includes:

- compliance with all information in this operating manual and
- compliance with test intervals.

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

1.2 Warranty and liability

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

- Use of the A-ISOMETER® other than for the intended purpose
- Incorrect assembly or installation, commissioning, operation and maintenance of the A-ISOMETER®
- Failure to comply with the information in the operating instructions regarding transport, commissioning, operation and maintenance of the A-ISOMETER®
- Unauthorized structural modifications to the A-ISOMETER®
- Failure to comply with the technical data
- Improperly executed repairs, and the use of spare parts or accessories which are not recommended by the manufacturer
- Cases of disaster and force majeure.
- Assembly and installation with device combinations not recommended by the manufacturer

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

1.2.1 Personnel

Only appropriately qualified personnel may work on the A-ISOMETER®. Qualified means familiar with the installation, commissioning and operation of the product and with training appropriate to the work. Personnel must have read and understood the safety section and warning information in this operating manual.

1.2.2 About the operating manual

This manual has been compiled with great care. Nevertheless, errors and omissions cannot be entirely excluded. The BENDER companies assume no liability whatsoever for any injury to persons or damage to property which may be sustained as a result of faults or errors in this operating manual.

1.2.3 Hazards when handling the A-ISOMETER®

The A-ISOMETER® is constructed according to the state-of-the-art and the recognized technical safety rules. Nevertheless, when it is being used, hazards may occur to the life and limb of the user or third parties or there may be adverse effects on the A-ISOMETER® or on other valuable property. The A-ISOMETER® must only be used:

- for the purpose for which it is intended;
- when it is in perfect condition as far as safety is concerned;

Any faults which may impair safety must be eliminated immediately. Impermissible modifications and the use of spare parts and additional devices which are not sold and recommended by the manufacturer of the devices may cause fires, electric shocks and injuries.

Unauthorized persons must not have access to or contact with the A-ISOMETER®.

Warning signs must always be easily legible. Damaged or illegible signs must be replaced immediately.

1.2.4 Inspection, transport and storage

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

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

1.2.5 Note

Make sure that the operating voltage is correct!

Prior to insulation and voltage tests, the A-ISOMETER® must be disconnected from the power system for the duration of these tests.

In order to check the proper connection of the device, it is recommended to carry out a functional test.

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

Children and unauthorized persons must not have access to or contact with the A-ISOMETER®.

1.3 Explanation of symbols and warnings

In order to make it easier for you to find specific text passages and references in this manual, important information is emphasized by symbols. The meaning of these symbols is explained below:



Information intended to assist the user to make optimum use of the product are marked with the Info symbol.



Information calling attention to hazards are marked with this warning symbol.

1.4 Directions for installation



Only one insulation monitoring device may be used in each interconnected IT system.

When insulation or voltage tests are to be carried out, the device must be isolated from the system for the test period.



The terminals \equiv 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 \equiv and KE must not be disconnected from the protective conductor (PE).

In order to check the proper connection of the device, it is recommended to carry out a functional test using a genuine insulation fault R_F , e.g. via a suitable resistance.

The device variant -4.. is delivered with the following factory setting:

ISO SETUP:	Alarm 1 / Alarm 2 = 40 k Ω / 10 k Ω
ISO SETUP:	Operating mode K1/K2 = N/O operation
ISO SETUP:	Memory = off

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



When an AC system being monitored contains galvanically coupled DC circuits:

An insulation fault can only be monitored correctly when the rectifiers carry a continuous load current of 5...10 mA.

2. Function

2.1 Features

- A-ISOMETER® for IT AC systems (IT = unearthed electrical systems)
- Two separately adjustable response ranges of 2 k Ω ... 1 M Ω each (Alarm 1, Alarm 2)
- Two-line LC display
- Connection monitoring of the measuring leads to the IT system and to earth
- Automatic device self test
- Option „W“ provides:
Increased shock and vibration resistance for use in ships, in rolling stock and in seismic regions
- A-ISOMETER® for IT AC systems with galvanically connected rectifiers and for IT DC systems U_n up to 793 V
- Automatic adaptation to the existing system leakage capacitance C_e up to 100 μ F
- AMP measuring principle (European Patent: EP 0 654 673 B1)

2.2 Product description

The A-ISOMETER® IR1575H monitors the insulation resistance of IT systems. The IR1575H is designed for use in 3(N)AC, AC and DC systems. AC systems may include extensive DC-supplied loads (such as converters). The adaptation to the existing system leakage capacitances takes place automatically.

2.3 Function

The device is connected between the unearthed 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).

The IR1575H superimposes a microprocessor-controlled pulsating AC meas-

uring voltage on the system being monitored (AMP measuring principle). The "adaptive measuring pulse", is a measuring method developed and patented by BENDER (European Patent: EP 0 654 673 B1). The measuring pulse consists of positive and negative cycles of the same amplitude. The period depends on the respective system leakage capacitances and the insulation resistance of the system to be monitored.

An insulation fault between system and earth closes the measuring circuit. The evaluation circuit calculates the insulation resistance which is indicated on the LC display or the external $k\Omega$ measuring instrument after the measuring time has expired.

The measuring time is determined by the system leakage capacitance, the insulation resistance and the system-related disturbances. System leakage capacitances do not influence the measuring accuracy.

If the reading is below the selected response values ALARM1/ALARM2, the associated alarm relays respond and the alarm LEDs "ALARM1/2" light up and the LC display indicates the measured value (in the event of DC insulation faults, the faulty system conductor will be indicated on the LC display). If the terminals R1/R2 are bridged (external RESET button [N/C contact] or wire jumper), the fault message will be stored. Pressing the reset button, resets the fault message, provided that the insulation resistance is at least above 25% above the preset response value. The fault memory behaviour can also be set in the "ISO SETUP" menu, by selecting the submenu Memory: on/off.

By pressing the test button, the function of the A-ISOMETER® can be tested. All essential measuring functions as well as connections to the IT system and to earth will be checked. This self test will automatically be carried out every 24 hours. The self test is automatically carried out once the supply voltage has been switched on.



Self test

In order to guarantee high functional reliability, the A-ISOMETER® 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 system conditions, the self test is completed after 15...20 seconds, then the message "Test ok!" appears

on the display for approximately two seconds. Then the device returns to the normal measuring mode and the currently measured value will be displayed once the measuring time has elapsed.

When a device or connection fault is found, the message "Error!" appears on the display, the system fault LED lights, the relay K2 (21-22-24) switches and the corresponding fault message (see table) will be indicated. If such a system fault occurs, another self test will be started after approximately one minute. If no more faults are detected, the fault message will automatically be deleted, the system fault LED will go out.

During operation, the self test function can be started by pressing the test button (internal or external). The alarm relays Alarm1/2 only switch after starting the self test function by pressing the test button.

Fault message	Description	Appropriate actions
System connection?	No low-resistance connection between the terminals L1, L2 and the system	<ol style="list-style-type: none"> 1. Check the wiring between the terminals L1, L2 and the system 2. Press the test button 3. Switch the supply voltage off and on 4. Check the fuses
Connection PE?	No low-resistance connection between the terminals  and KE and the earth (PE).	<ol style="list-style-type: none"> 1. Check the wiring of the terminals  and KE and the earth (PE) 2. Press the test button 3. Switch the supply voltage off and on
Device errorx	Internal device error	<ol style="list-style-type: none"> 1. Press the test button 2. Switch the supply voltage off and on 3. Please contact BENDER

Reset run control



If, for operational reasons, the supply voltage cannot be switched on and off, a reset of the run control can be carried out by pressing the buttons "RESET", "MENU" and Test" sequentially.

Proceed as follows:

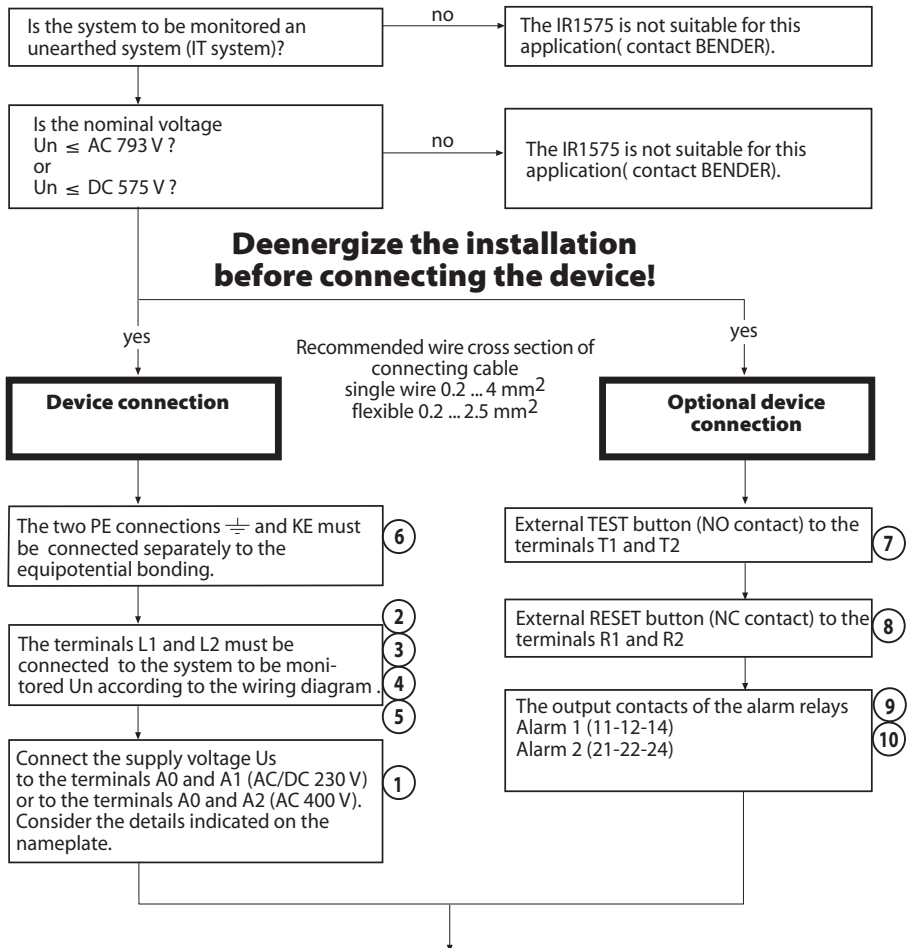
1. Press and hold down the "RESET" button
2. Press and hold down the MENU button
3. Press the "TEST" button for at least two seconds

After these steps are run through, the run control and the self test will be started again.

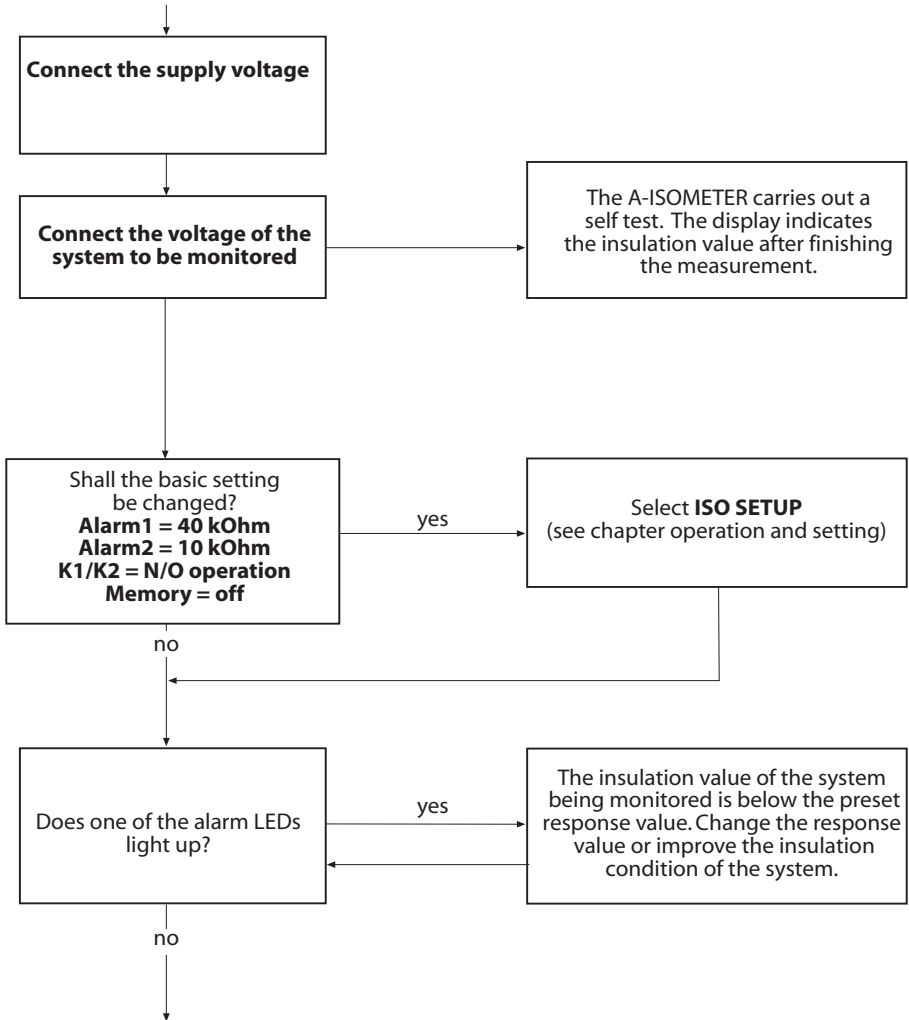
3. Commissioning flow chart

In the three-page commissioning flow chart, the encircled numbers correspond to the numbers in the legend to wiring diagram (see page 19).

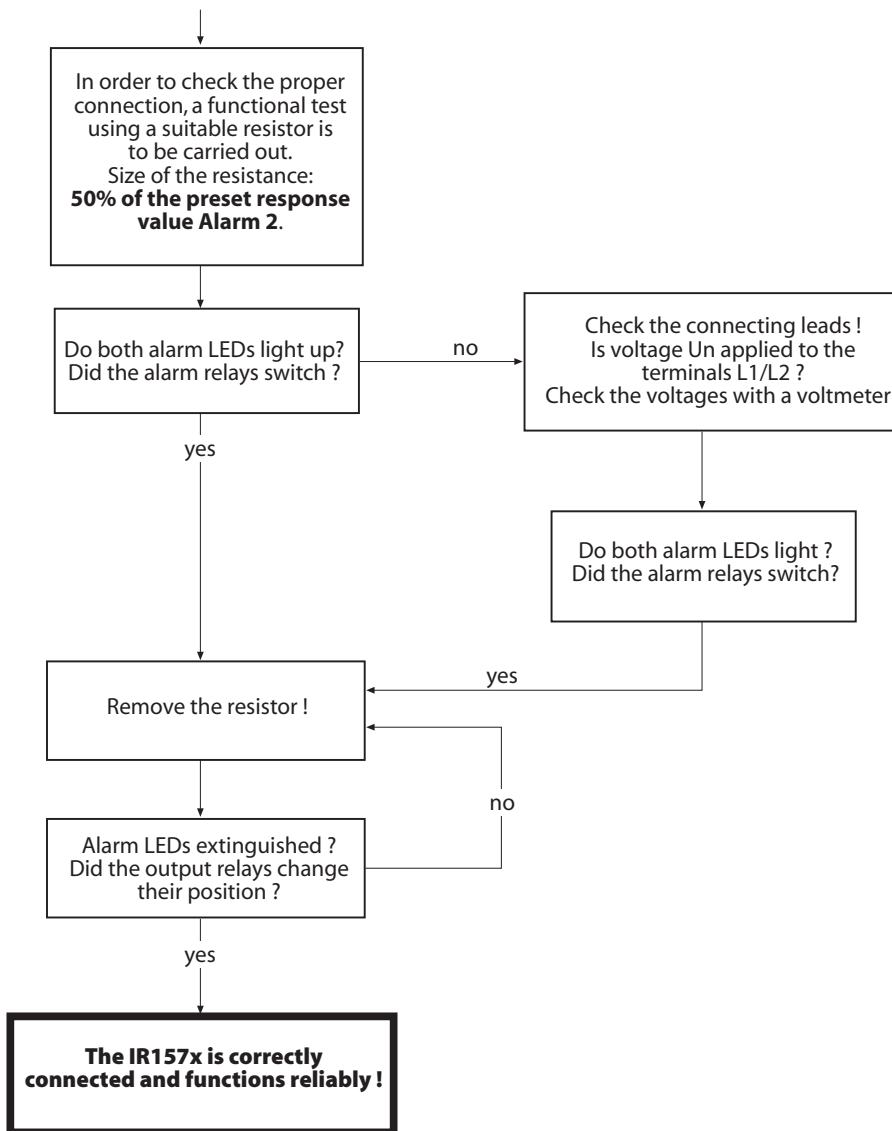
Commissioning of the A-ISOMETER® (1)



Commissioning of the A-ISOMETER® (2)



Commissioning of the A-ISOMETER® (3)



4. Connection

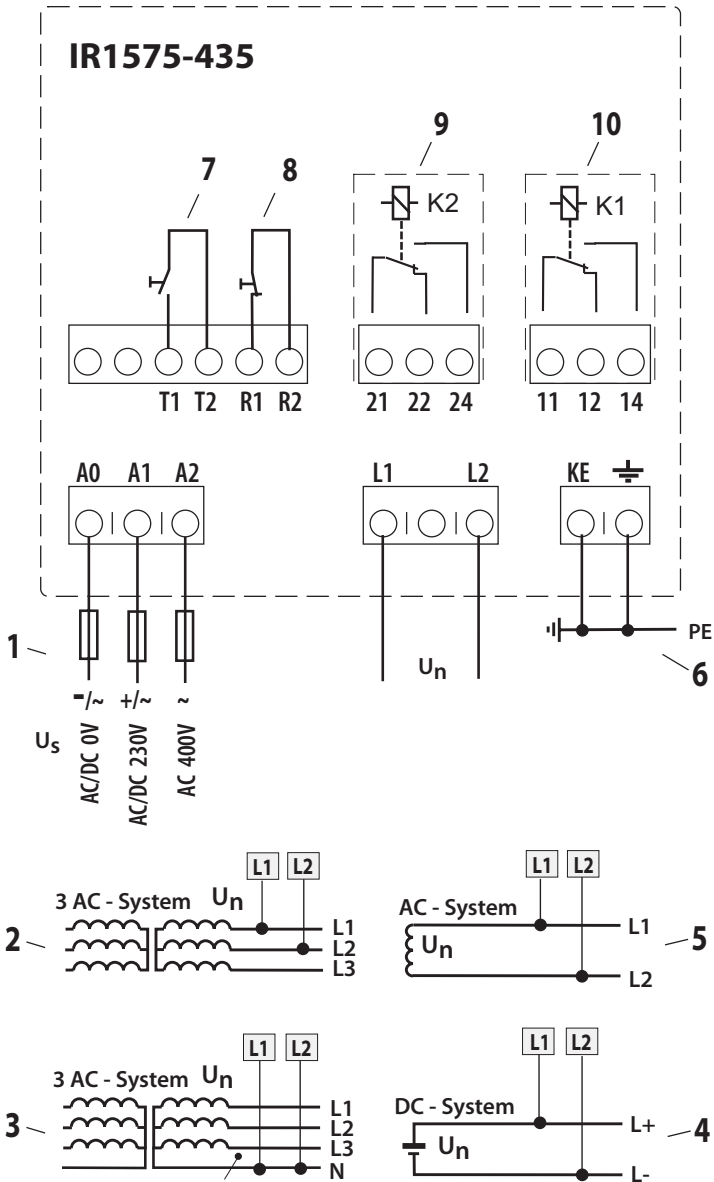
4.1 Wiring diagram

The A-ISOMETER® provides plug-in terminals.

The connections A0/A1 resp. A0/A2 to the supply voltage U_s have to be provided with protective devices according to IEC 60364-4-43. (a 6 A fuse is recommended).

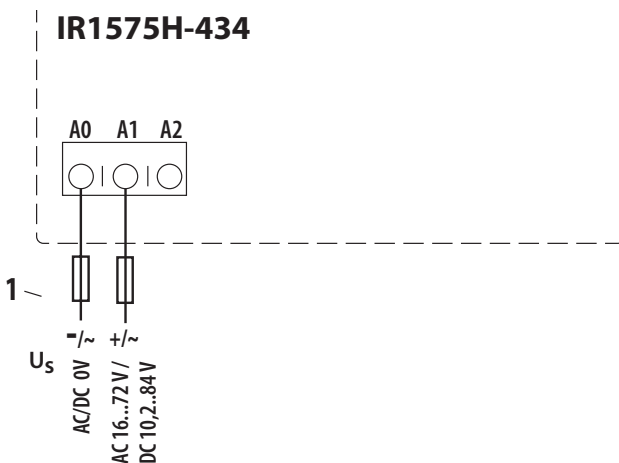
Devices for protection against short-circuit in conformity with IEC 60364-4-43 for the coupling of terminals L1/L2 to the IT system being monitored can be omitted if the wiring is carried out in such a manner as to reduce the risk of a short-circuit to a minimum. (a short-circuit-proof and earth-fault-proof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

An external test button or an external reset button may only be connected to one A-ISOMETER®. A parallel connection of several test and reset inputs for collective A-ISOMETER® testing is not allowed.



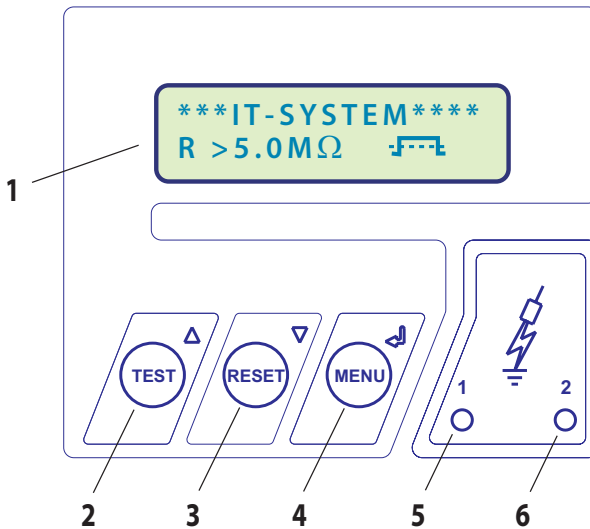
Legend wiring diagram:

- 1** Supply voltage U_s (see nameplate, technical data on page 31 or ordering information) via 6 A fuse:
- Connection to the 3AC system being monitored:
- 2, 3** Connect the terminals L1, L2 to neutral conductor N or terminals L1, L2 to conductor L1, L2.
- Connection to the DC systems being monitored:
- 4** Connect terminal L1 to conductor L+, terminal L2 to conductor L-
- Connection of the AC system to be monitored:
- 5** connect terminals L1, L2 to conductor L1, L2.
- 6** Separate connection of E \equiv and KE to PE
- 7** External test button (N/O contact)
- External reset button (N/C contact or wire jumper). When the terminals are open, the fault message will not be stored. Factory setting: Memory off!
- 8**
- 9** Alarm relay K2
- 10** Alarm relay K1



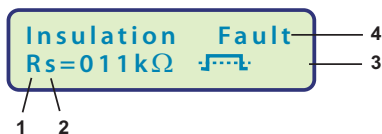
5. Operation and setting


5.1 Display and operating elements



- 1 Two-line display for standard and menu mode
- 2 TEST button: to call up the self test/
Up key: parameter change, to move up in the menu
- 3 RESET button: to delete stored insulation fault alarms
Down key: parameter change, to move down in the menu
- 4 MENU key: to activate the menu system
ENTER key: To confirm parameter change.
- 5 ALARM LED 1 lights: insulation fault, first warning level reached.
- 6 ALARM LED 2 lights: Insulation fault, second warning level reached
or system fault alarm



5.1.1 Display in standard mode



- | | |
|---|---|
| 1 | Indication of the insulation resistance in $k\Omega$
Additional information about the insulation resistance: |
| 2 | „+“ = Insulation fault at L+
„-“ = Insulation fault at L-
„s“ = A new measuring process has been started |
| 3 |  = Polarity of the test current pulse (AMP)
Messages:
- Insulation fault |
| 4 | - Connection system?
- Connection PE?
- Device error x |

5.1.2 Display in menu mode



-  Parameter change is permitted
-  Parameter change is blocked, enabling by a password

5.1.3 Function keys

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



Press the TEST button to start the self test of the A-ISOMETER®.

Press the RESET key to reset insulation fault alarms stored in the A-ISOMETER®. Activate the fault

memory in the ISO-Setup menu or bridge R1/R2 to make this function available. Furthermore, the A-ISOMETER® can only be reset when the measured insulation value is at least 25% higher than the actual response value.



Press the MENU key to call up the menu system.

Use the Arrow up and Arrow down keys and the ENTER key to scroll through the menu system:



UP key:

To move up in the menu, to increase the parameter value



DOWN key:

To move down in the menu, to decrease the parameter value



ENTER key

To select a menu item or submenu item,

To confirm or save a parameter change and return to the associated submenu item or skip to the next input field.

When the menu is not terminated, the device will return to the display mode after approximately five minutes.

For the sake of clarity, the following symbols are used in the menu diagrams for the representation of ENTER, UP/DOWN:



5.2 Menu structure and menu mode

To switch to the menu mode

Press the MENU key to switch from the standard mode to the menu mode and to the main menu. From here you can branch to the different submenus.


Navigation within the menu

Use the UP and DOWN keys to select the appropriate menu item. A flashing cursor indicates which submenu is selected. Press the ENTER key to call up the submenu of the associated menu item.

In the submenus, the appropriate parameters are also selected by means of the UP and DOWN keys. Press the ENTER key to move the cursor to the edit field.

The "Arrow up" symbol tells you that you have reached the end of the menu list.

Parameter change

If the password protection is activated and the symbol "padlock closed" appears on the display,  you have to enter the valid password before changing the parameters by means of the UP/DOWN keys. Once the password is entered correctly, all parameters can be changed as long as you stay in the menu.

Changing the parameters usually has an immediate effect on the measuring and alarm functions. The changed parameter is stored in a non-volatile memory after returning to the submenu by pressing the ENTER key (flashing cursor in column 1).

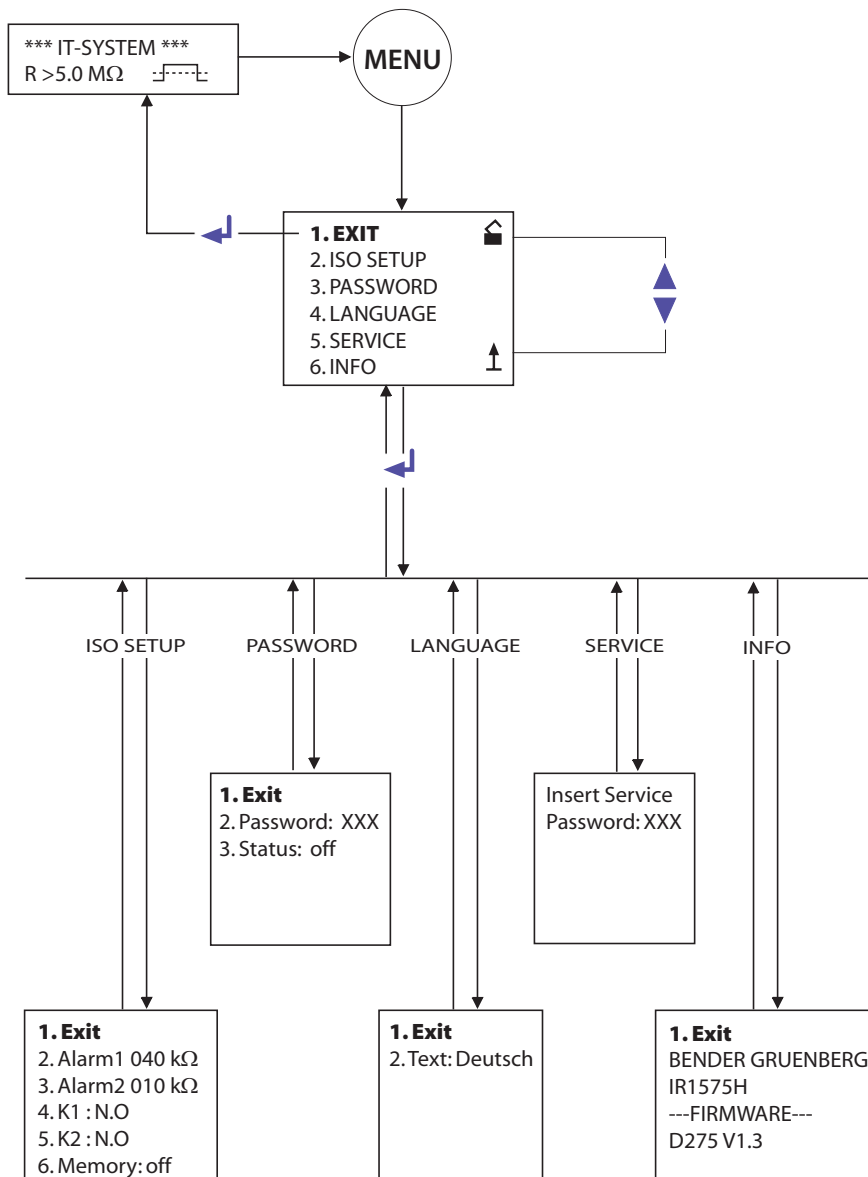
During menu operations, all measuring and alarm functions work normally.

To switch from the menu to the standard mode

After selecting the menu item "EXIT" and confirming this with the ENTER key, you will leave the respective menu and reach the next higher level. This either will be the main menu or the standard mode.

If no key is pressed in a main or submenu, the system will automatically return to the from the menu mode to the standard mode after approximately five minutes.

5.2.1 Diagram menu structure



5.3 Menu ISO SETUP: Setting of the A-ISOMETER® functions

All alarm functions such as Alarm1 and Alarm2 (prewarning and alarm), the operating principle of the alarm relays K1 and K2 (N.O = N/O operation, N.C = N/C operation) and the fault memory behaviour are set in this menu.

5.3.1 Response values Alarm1 and Alarm2

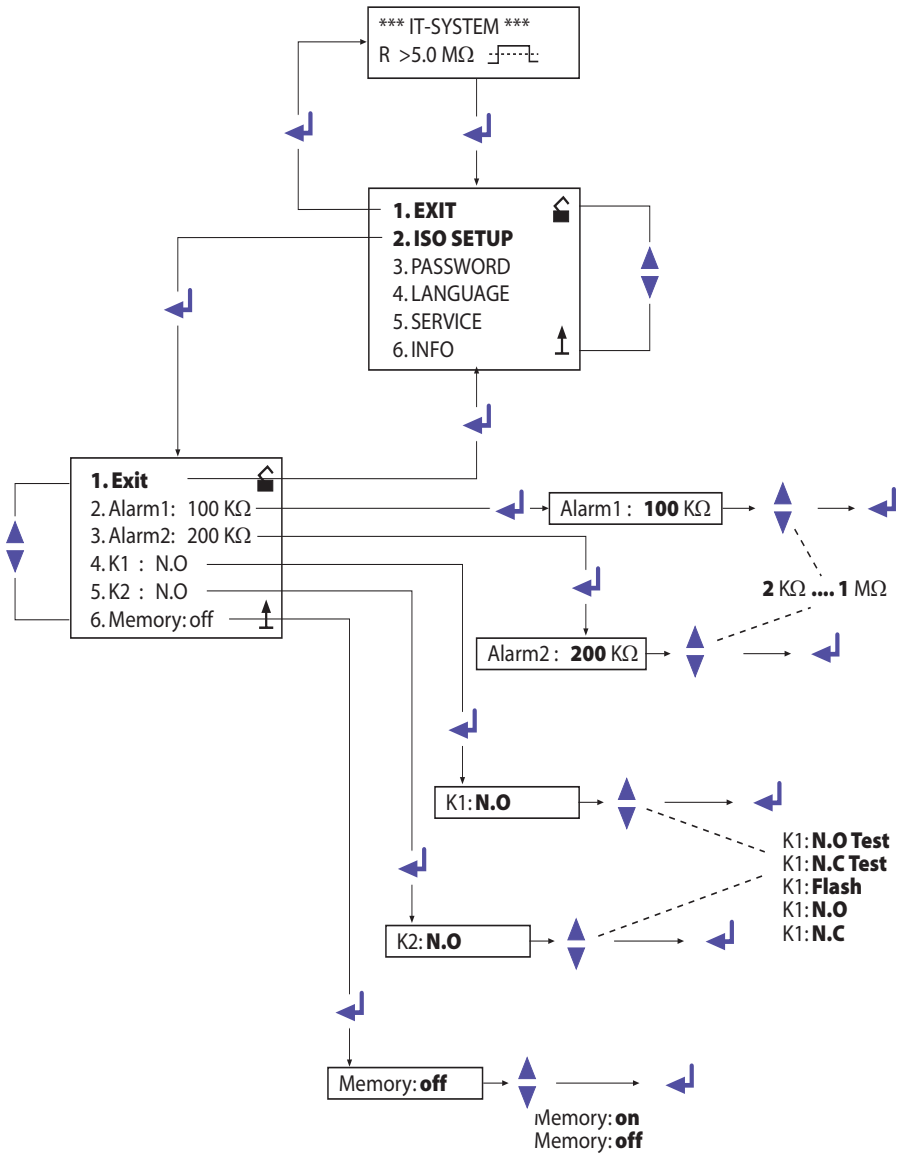
The alarm values Alarm1 and Alarm2 are selected with the Up/Down key and with the Enter key.

5.3.2 Operating principle

K1/K2 are factory-set to N.O Test, that means N/O operation. The term "Test" points out that the alarm relays are switched over during a manual self test. In order to prevent the alarm relays from switching during a manual self test, for any other reason, select N.C or N.O.

- 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 switches and the LED flashes in the event of an alarm message at approx. 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 deenergized 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 switches and the LED flashes in the event of an Alarm message at approx. 0.5 Hz)

5.3.3 ISO SETUP diagram



During the 24 h self test, the relays are not switched over.



In the event of a system fault of the A-ISOMETER®, both the alarm LED 2 and relay K2 will automatically be activated as system fault relays.

5.3.4 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)

5.4 PASSWORD menu

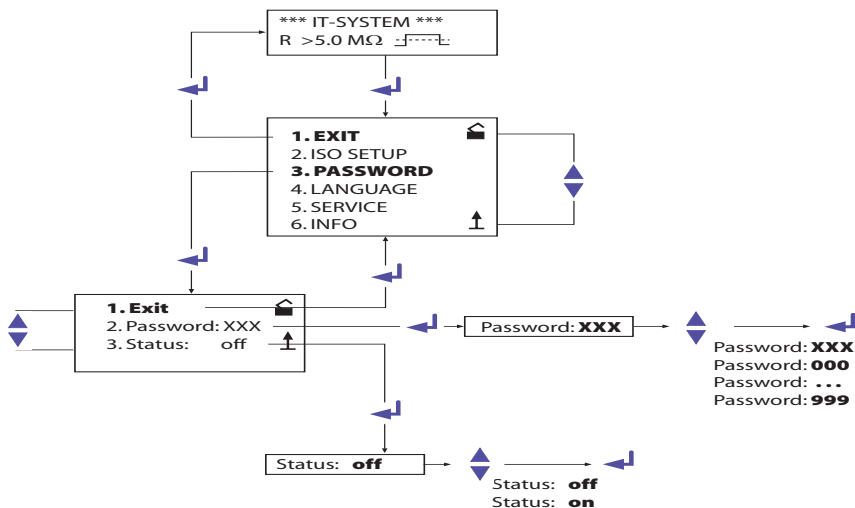
5.4.1 Setting and activating the password

The "Password" query can be activated in this menu. This protects the A-ISOMETER® against unauthorized settings and modifications.

Use the arrow keys to select the desired password (menu item 2. password: xxx) and confirm with ENTER to finish the action.

Select the menu item "3. Status: on" with the ENTER key. By default, the password is deactivated "3. Status: off".

5.4.2 PASSWORD diagram



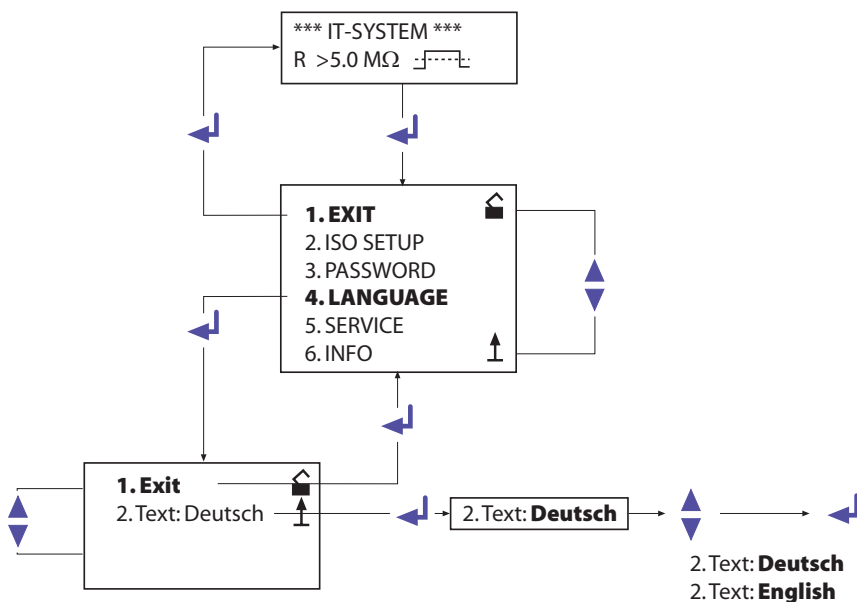
5.5 LANGUAGE Menu

5.5.1 Language setting

Use this menu item to set the language for the fault messages. You have the choice between German and English.

All the device menus are displayed in English, irrespective of the selected language.

5.5.2 Language diagram



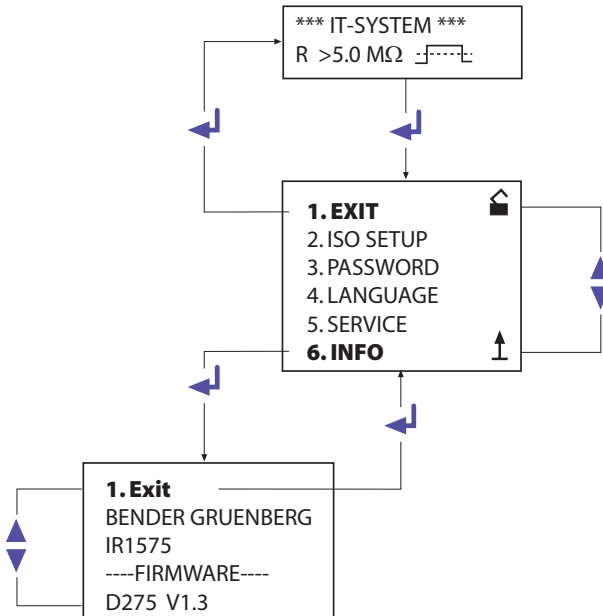
5.6 SERVICE menu

This menu item is provided for the BENDER service personnel and 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.

5.7 INFO menu

Use this menu to query the type of the respective device. In addition, the software version used in the device appears on the display.

5.7.1 INFO diagram



6. Technical data IR1575H

6.1 Data in tabular form

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 800 V
Rated impulse voltage/pollution degree	8 kV/3

Voltage ranges

Nominal system voltage U_n	1AC / 3(N)AC 0...793 V
Nominal frequency f_n	15...460 Hz
Nominal system voltage U_n	DC 0...575 V

IR1575H-435:

Supply voltage U_s at A0/A1 (see also device nameplate)	AC 88...264 V
Frequency range of U_s	42...460 Hz
Supply voltage U_s at A0/A2 (see also device nameplate)	AC 340...460 V
Frequency range of U_s	47...63 Hz
Supply voltage U_s at A0/A1 (see also device nameplate)	DC 77...286 V

IR1575H-434:

Supply voltage U_s at A0/A1 (see also device nameplate)	AC 16...72 V
Frequency range of U_s	42...460 Hz
Supply voltage U_s at A0/A1 (see also device nameplate)	DC 10.2...84 V

IR1575H:

Power consumption	≤ 5 VA
-------------------------	-------------

Response values

Response value R_{an1} (Alarm1)	2 k Ω ... 1 M Ω
Response value R_{an2} (Alarm2)	2 k Ω ... 1 M Ω
Relative percentage error (2 k Ω ...10 k Ω)	+2 k Ω
Relative percentage error (10 k Ω ... 1 M Ω)	0 % ... +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 curves
Hysteresis (2 k Ω ...10 k Ω)	+2 k Ω
Hysteresis (10 k Ω ...1 M Ω)	25 %

Measuring circuit

Measuring voltage U_m	≤ 20 V
Measuring current I_m (at $R_F = 0\Omega$)	$\leq 110 \mu A$

Internal DC resistance R_i	$\geq 185 \text{ k}\Omega$
Impedance Z_i , at 50 Hz	$\geq 182 \text{ k}\Omega$
Permissible extraneous DC voltage U_{ig}	$\leq \text{DC } 1000 \text{ V}$
System leakage capacitance C_e	$\leq 100 \mu\text{F}$

Displays

Display	backlit two-line display
Characters (number of characters)	2 x 16
Display range, measuring value	1 k Ω ...5 M Ω
Relative percentage error (1 k Ω ...10 k Ω)	1 k Ω
Relative percentage error (10 k Ω ...5 M Ω)	$\pm 10 \%$

Outputs/Inputs

Test/reset button	internal/external
Max. cable length test/reset button external	10 m

Switching elements

Switching elements	2 changeover contacts
Operating principle	N/O or N/C operation
Factory setting (Alarm 1/Alarm 2)	N/O operation
Electrical endurance, number of cycles	12 000
Contact class	IIB (EN 60255-23)
Rated contact voltage	AC 250 V/DC 300 V
Making capacity	AC/DC 5 A
Breaking capacity	2 A, AC 230 V, $\cos \varphi = 0.4$
.....	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 immunity	acc. to EN 61326
EMC emission	acc. to EN 61326
Shock resistance IEC 60068-2-27 (during operation)	15 g/11 ms
Bumping IEC 60068-2-29 (Transport)	40 g / 6 ms
Vibration resistance IEC 60068-2-6 (during 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 DIN IEC 6072160721-3-3	3K5
Operating mode	continuous operation
Mounting	display-oriented
Connection	plug-in 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
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529).....	IP20
Type of enclosure.....	modular DIN rail enclosure 96 x 96 mm
Flammability class	UL94 V-2
Weight approx. 400 g	

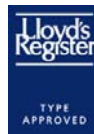
Option „W“

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	-25 °C...+70 °C
Ambient temperature, during operation, for U _s = AC 340...460 V at A0/A2	-25 °C...+55 °C
Storage temperature range -40 °C...+85 °C	

6.2 Standards and certifications

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

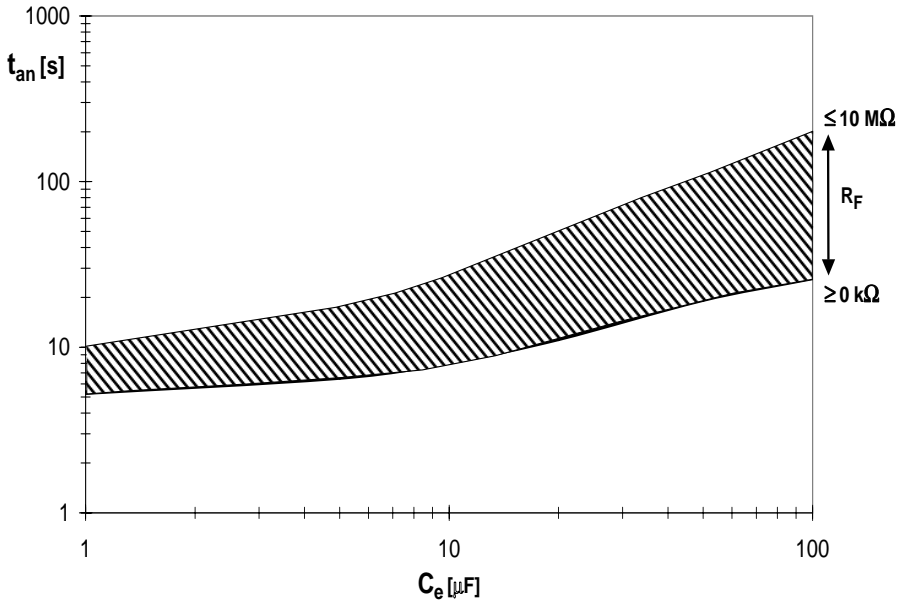
- IEC 61557-8:2007-01
- IEC 61326-2-4:2006-06
- IEC 60664-1:2007-04
- IEC 60664-3:2007-09
- ASTM F1669M-96(2002)
- ASTM F1207M-96(2002)



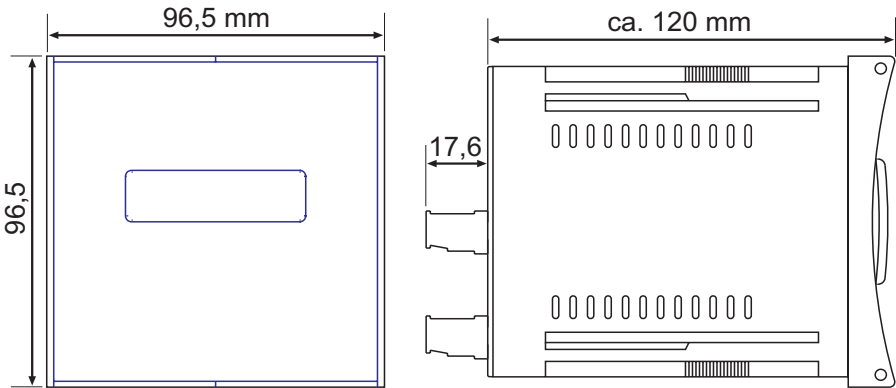
6.3 Characteristic curves

A-ISOMETER® response times in relation to system leakage capacitances:

$$C_e = 1 \dots 100 \mu\text{F}, \quad U_n = 0 \dots 793 \text{ V} / 50 \text{ Hz}$$

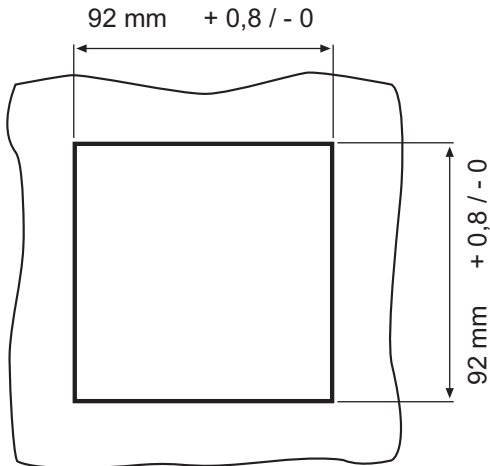


6.4 Dimension diagram enclosure IR1575H



designed for panel mounting.

The required knock-outs are illustrated in the figure below:



6.5 Ordering information

Type	Nominal voltage U_n	Supply voltage U_s	Art. No.
IR1575H-435	3(N)AC 0...793 V AC 0...793 V DC 0...575 V	AC 88...264 V AC 340...460 V DC 77...286 V	B 9106 4005

6.5.1 Label for modified versions

There will only be a label in this field, if the A-ISOMETER® is different from the standard version.



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Dipl.-Ing. W. Bender GmbH & Co.KG

Londorfer Str. 65 • 35305 Grünberg • Germany

Postfach 1161 • 35301 Grünberg • Germany

Tel.: +49 6401-807-0

Fax: +49 6401-807-259

E-Mail: info@bender-de.com

Web: <http://www.bender-de.com>

