

# Main catalogue part 1

## A-ISOMETER®

Insulation monitoring devices

Insulation fault location systems



**Main catalogue part 1**  
**Insulation monitoring devices**  
**Edition 04.2005**



**Information to further product ranges:**



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# Power in

## **BENDER - power in electrical safety**

Electricity is indispensable. To ensure that electricity can be used everywhere without any hazards in a user-friendly manner comprehensive electrical safety is essential. For BENDER, a pioneer in this field, electrical safety has always been considered a high priority issue.

## **International presence**

Since 1946, BENDER has been developing, producing and distributing electrical safety products. Today, BENDER comprises a workforce of 400 employees. Ten technical offices in Germany and fifty agencies and distributors on all continents makes us flexible to provide close and direct dialogue at customer's site.

## **Innovative right from the start**

When Dipl.-Ing. Walther Bender, the founder of the company, succeeded in obtaining the first patent in the year 1939, not only the idea has become reality but also the philosophy of protecting people and machine against the hazards of electrical current by innovative solutions and to make the use of electricity even safer and more economical.



# electrical safety

## Quality in all areas

The product research and development as well as manufacturing are subject to stringent quality guidelines. BENDER's consistent quality philosophy is clearly reflected in internationally recognized certifications, such as ISO9001.

## Fit for practical application

Take advantage of our expert knowledge. Attending our seminars will be your benefit and will serve as a basis for your success. The range of seminars include basic courses, expert courses or even a tailor-made course just for you.

## Service for you

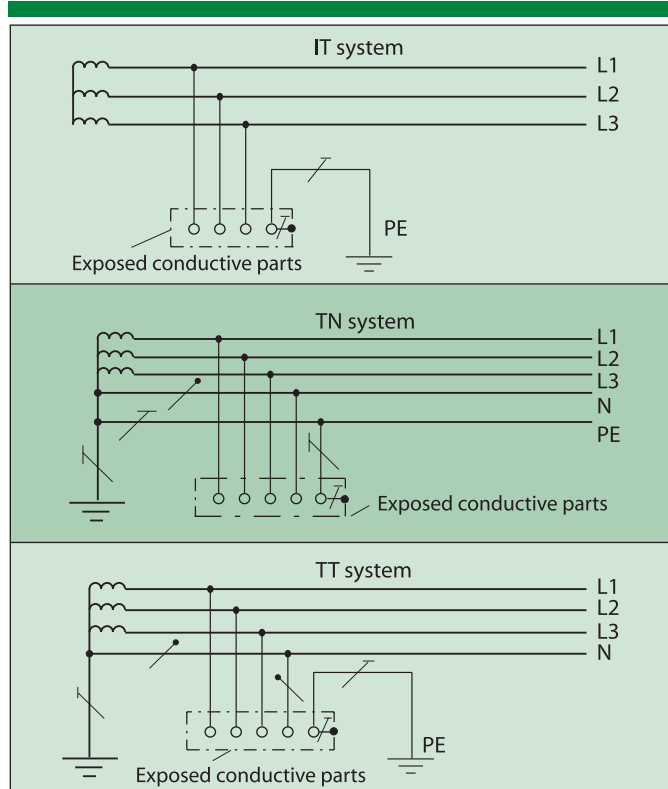
You can rely on BENDER technology as well as on our service and support. We will assist you with specific knowledge in the respective field of application beginning with planning and projecting continuing into training courses and ending with commissioning and maintenance.



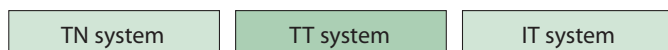
# System voltage and types of distribution systems

## Types of distribution systems

The illustration below shows the different types of distribution systems according to DIN VDE 0100 part 300 / IEC 60364-3.



The three main types of distribution systems are:



The first letter describes the relationship of the power system to earth:

- T direct connection of one point to earth;
- I all live parts isolated from earth, or one point connected to earth through an impedance.

The second letter describes the relationship of the exposed conductive parts of the installation to earth:

- T direct electrical connection of exposed conductive parts to earth, independently of the earthing of any point of the power system;
- N direct electrical connection of the exposed conductive parts to the earthed point of the power system (in AC systems, the earthed point of the power system is normally the neutral point, if a neutral point).

Subsequent letters describe the arrangement of neutral and protective conductors in TN systems:

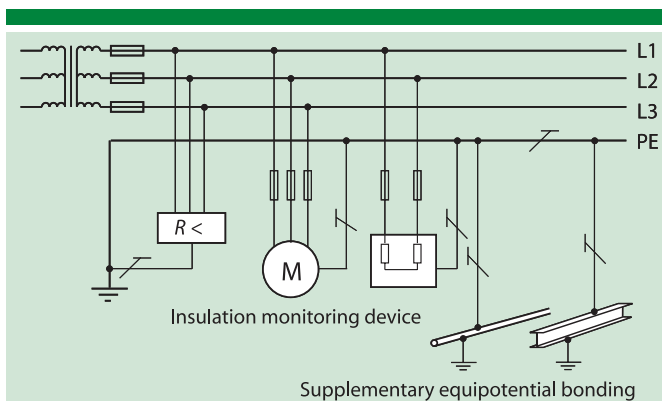
- S protective function provided by a conductor separate from the neutral or from the earthed line conductor;
- C neutral and protective functions combined in a single conductor;
- PE PE conductor;
- N neutral conductor.

## The IT system with supplementary equipotential bonding and insulation monitoring equipment

The IT system is supplied either from an isolating transformer or an independent voltage source, such as a battery or a generator. The peculiarity is that no active conductor is directly connected to earth in this system. The advantage of this is that only a small fault current can flow in the event of an insulation fault. This current is essentially caused by the system leakage capacitance. The upstream fuse does not respond, thus maintaining the voltage supply – and therefore operation – even in case of a phase-to-earth fault.

Continuous insulation monitoring guarantees high reliability in IT systems. The insulation monitoring device recognizes insulation faults as they develop, and reports when the minimum value is reached, before an unforeseen interruption to operation is caused by a second insulation fault.

The following illustration shows the typical arrangement of an IT system.



## Arrangement of an IT system with supplementary equipotential bonding and insulation monitoring.

### TN systems

TN systems have one point directly earthed; the exposed conductive parts of the electrical installation are connected to that point by protective conductors or PEN conductors. For monitoring TN systems, residual current monitors (RCMs) can be applied. For appropriate devices refer to the BENDER main catalogue, part 4.

### TT systems

TT systems have one point directly earthed; the exposed conductive parts of the electrical installation are connected to earth electrodes electrically independent of the earth electrodes of the system. For monitoring TT systems, residual current monitors (RCMs) can be used. For appropriate devices refer to the BENDER main catalogue, part 4.

### Correct abbreviations and their meaning according to DIN EN 61293

Explanation to the abbreviations of the different types of distribution systems:

- AC – single-phase AC system
- 3AC – three-phase AC system without N conductor
- 3(N) AC – three-phase AC system with or without N conductor
- AC / DC – single or three-phase AC systems with galvanically connected DC circuits

# Insulation monitoring in IT systems

## Electrical safety for people and machine

Insulation resistance is a very important factor when the protective goals are being considered. Without adequate insulation resistance

- protection against direct and indirect contact is not guaranteed;
- protective arrangements against overcurrent or fault currents will permanently lead to interruptions to operation;
- short-circuit and earth fault currents may cause fires and destroy parts of the plant;
- interruption to operation and damage can occur entailing high costs.



## Which factors influence the insulation resistance ?

### Electrical



- static overvoltage
- transient overvoltage
- frequency changes
- lightning
- overcurrent
- voltage form

### Mechanical



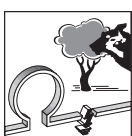
- shock, impact
- flaw, bend
- vibration
- penetration of foreign bodies

### Environmental



- climate
- moisture, temperature
- chemical influences
- pollution, dust, oil
- aggressive exhaust air, fumes
- ageing

### Other effects



- animals (such as biting by rodents)
- plants
- incorrect connection

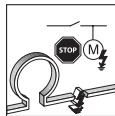
## Consequences of an insulation fault

### Hazards to people, because of:



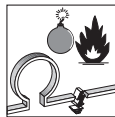
- high touch voltages
- danger of injury

### High costs, because of:



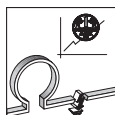
- unavailability of staff due to injuries
- interruption to operation
- material damage

### Fire and explosion hazards, because of:



- arcing
- heat

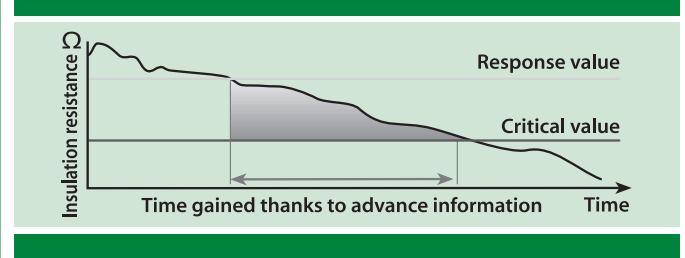
### Interruption to operation on account of:



- unwanted disconnection
- defective equipment
- control malfunction

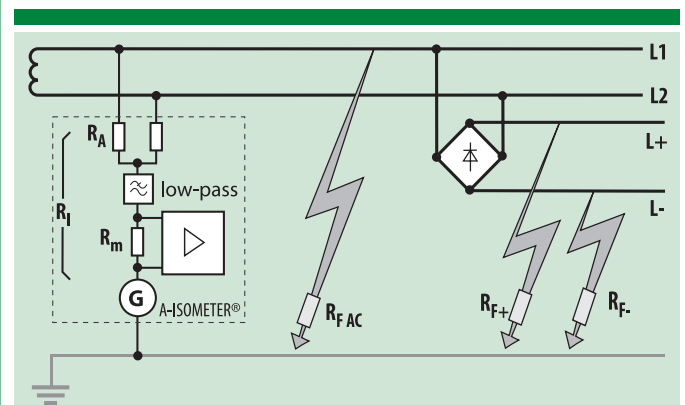
## Advance information in the IT system

It is critically important to have early information about a fall in insulation resistance. An insulation monitoring device provides the necessary advance information.



## Operating principle of insulation monitoring devices

The insulation monitoring device is connected between the active conductors and earth (protective conductor), and it superimposes a measuring voltage on the system. Depending on the system to be monitored, this can be a direct voltage or a pulsating voltage. If an insulation fault occurs, the measuring circuit is closed and a small measuring current will flow. This measuring current is proportional to the insulation resistance and is evaluated by the device's electronic system.



Further information is given in chapter "Annex".

## Reliability of measurement

Modern systems contain a large spectrum of interferences which often prevent insulation resistance measurement or affect the measurement adversely. Using sophisticated measurement technology in combination with carefully selected components, BENDER A-ISOMETER's filter out interferences and provide precise insulation measurement. This is exemplified by the AMP measurement (BENDER patent) which can be used in all IT systems, particularly in those containing converters.

# A-ISOMETER® device overview

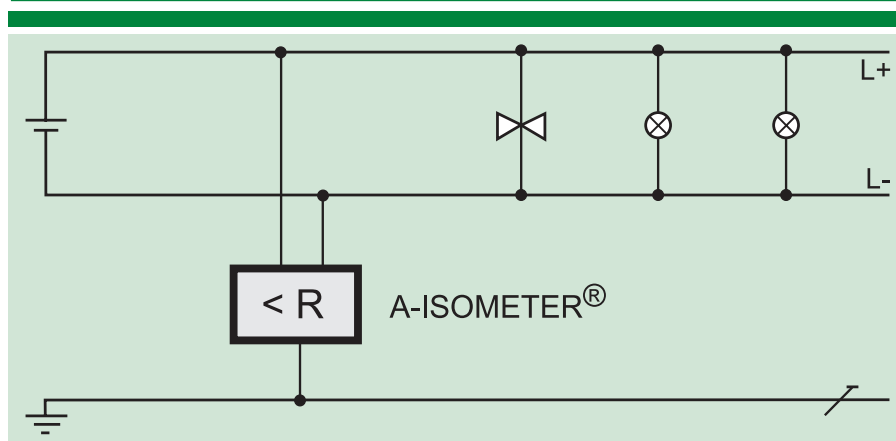
## control and auxiliary circuits

### Control and auxiliary circuits

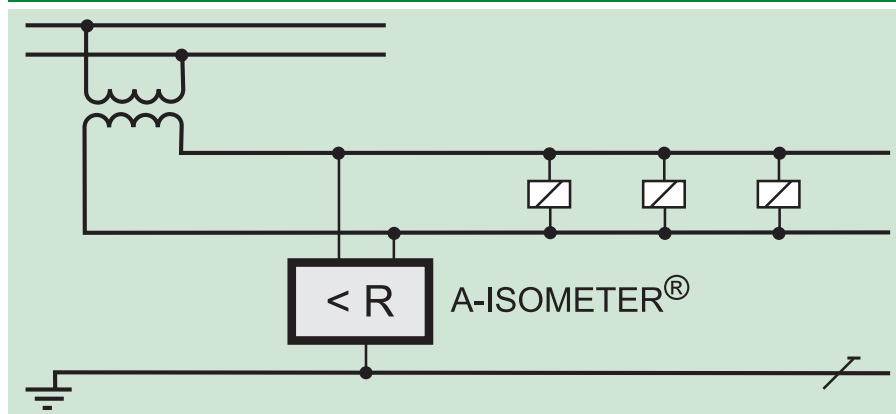
Control and auxiliary circuits are circuits for additional functions, e. g. command input, interlocking, alarm and measuring circuits.

For these circuits, operating reliability is the most important factor. Control circuits, for example machine control systems or safety lighting, normally are small circuits.

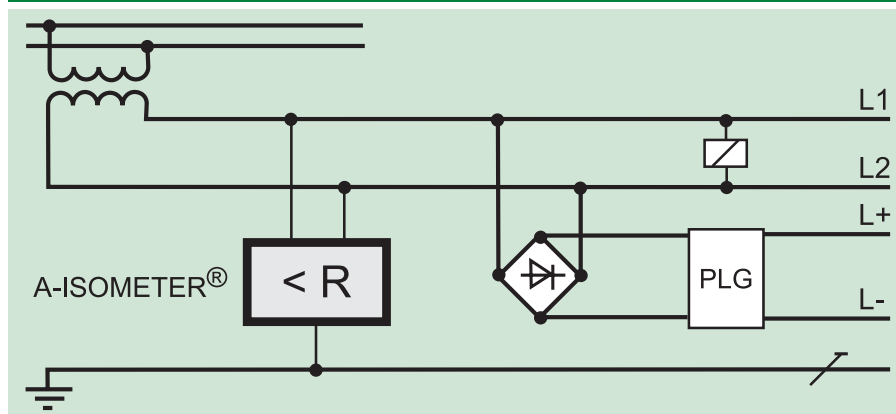
### Examples of application



DC control circuit



AC control circuit



AC / DC control circuit

### Series

Type	▶
Application – control and auxiliary circuits	▶
<b>Application range</b>	
Nominal system voltage $U_n$	▶
Nominal frequency $f_n$	▶
System leakage capacitance $C_e$	▶
<b>Response values / contacts</b>	
Number of response values	▶
Response value	▶
Alarm contacts	▶
Operating principle	▶
<b>Communication</b>	
“Power On” LED	▶
Alarm LED, “Alarm AC”, “Alarm L+”, “Alarm L-”	▶
Alarm LED „Alarm“	▶
<b>General features</b>	
Measuring principle*	▶
TEST / RESET button	▶
Fault memory	▶
Selective fault location L+ / L-	▶
Connection monitoring	▶
Refer to catalogue page	▶

\* see chapter annex – measurement technology



				
<b>IR140Y-3</b>	<b>IR140Y-4</b>	<b>IR125Y-4</b>	<b>IR145Y-3</b>	<b>IR145Y-4</b>
<b>AC</b>	<b>AC</b>	<b>DC</b>	<b>AC, DC, AC/DC</b>	<b>AC, DC, AC/DC</b>
0...138 V	0...300 V	19.2...308 V	0...138 V	0...300 V
40...460 Hz	40...460 Hz	DC	DC, 15...460 Hz	DC, 15...460 Hz
< 20 µF	< 20 µF	< 10 µF	< 20 µF	< 20 µF
1	1	1	1	1
1...20 kΩ	10...200 kΩ	10...200 kΩ	1...20 kΩ	10...200 kΩ
2 changeover contacts	2 changeover contacts	1 changeover contact	2 changeover contacts	2 changeover contacts
N/O / N/C operation	N/O / N/C operation	N/C operation	N/O / N/C operation	N/O / N/C operation
×	×	×	×	×
×	×	--	×	×
--	--	×	--	--
DC	DC	AMP	AMP	AMP
internal / external	internal/external	internal / external (RESET)	internal / external	internal / external
×	×	×	×	×
×	×	--	×	×
×	×	--	×	×
<b>Chapter 1.1 - page 24 – 25</b>	<b>Chapter 1.1 - page 24 – 25</b>	<b>Chapter 1.2 - page 28 – 29</b>	<b>Chapter 1.3 - page 32 – 33</b>	<b>Chapter 1.3 - page 32 – 33</b>

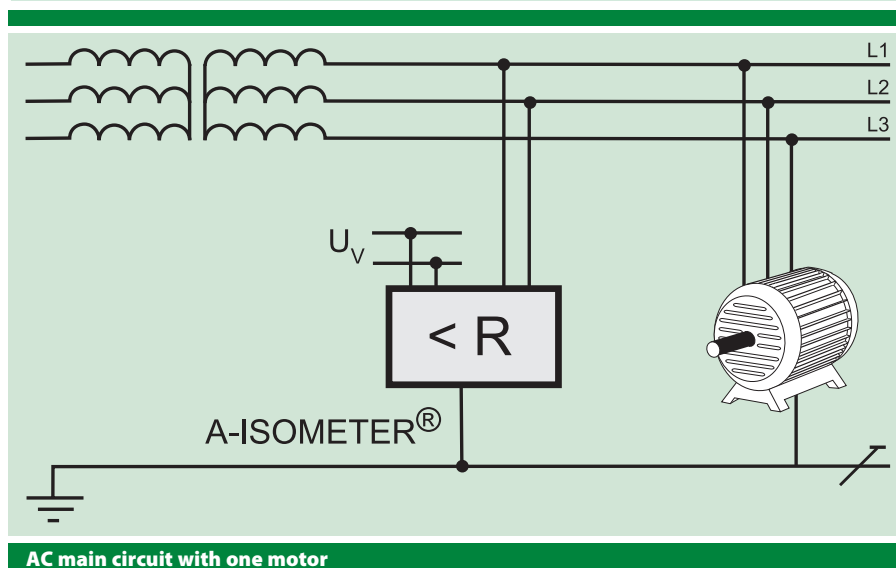
# A-ISOMETER® device overview

## main circuits AC, 3(N) AC

### Main circuits

Main circuits provide the power supply for entire electrical installations or buildings. These circuits contain electrical equipment for generating, converting, distributing, switching and consuming of electrical energy. These can be pure AC loads (e. g. motors), or loads containing electronic components (e. g. converters), but can also consist of DC loads only (e. g. battery systems).

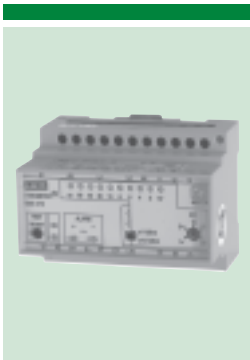
### Example of application



### Series

Type	▶
Application – main circuits	▶
<b>Application field</b>	
Nominal system voltage $U_n$	▶
Nominal frequency $f_n$	▶
System leakage capacitance $C_e$	▶
Nominal voltage range $U_n$ (extendable via coupling devices)	▶
<b>Response values / contacts</b>	
Number of response values	▶
Response value	▶
Contact main alarm	▶
Contact prewarning	▶
<b>Communication</b>	
Measured value display	▶
Main alarm display	▶
Prewarning display	▶
<b>General features</b>	
Measuring principle*	▶
TEST / RESET button	▶
Fault memory	▶
Selective fault location L+ / L-	▶
Connection monitoring	▶
Refer to catalogue page	▶

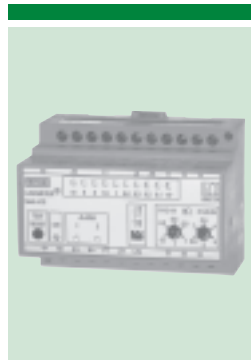
\* see chapter annex – measurement technology



**IR470LY**  
AC, 3(N) AC



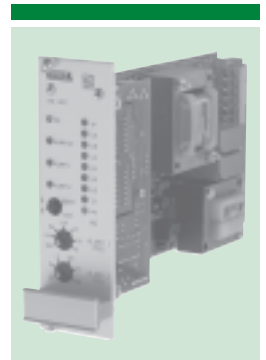
**IR470LY2-4061**  
AC, 3(N) AC



**IR470LY2-60**  
AC, 3(N) AC



**IR1570**  
AC, 3(N) AC



**IRD1007L**  
AC, 3(N) AC

0...793 V
40...460 Hz
< 20 µF
×

0...793 V
40...460 Hz
< 20 µF
×

0...793 V
40...460 Hz
< 10 µF
×

0...480 V
30...460 Hz
< 20 µF
--

0...575 V
40...460 Hz
< 1 µF
×

1
1...200 kΩ
2 changeover contacts
--

2
10 kΩ...100 kΩ/35 kΩ...500 kΩ
1 changeover contact
1 changeover contact

2
100 kΩ...1 MΩ/500 kΩ...5 MΩ
1 changeover contact
1 changeover contact

2
2 kΩ...1 MΩ
1 changeover contact
1 changeover contact

2
2 kΩ...2 MΩ/20 kΩ...20 MΩ
1 changeover contact
1 changeover contact

LED bar graph indicator
×
--

LED bar graph indicator
×
×

LED bar graph indicator
×
×

LC display
×
×

LED bar graph indicator
×
×

DC
internal / external
×
×
×

DC
internal / external
×
--
×

DC
internal / external
×
--
×

DC
internal / external
×
×
×

DC
internal / external
×
alarm LED "DC"
--

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# A-ISOMETER® device overview

## main circuits AC, 3(N) AC, DC, AC/DC

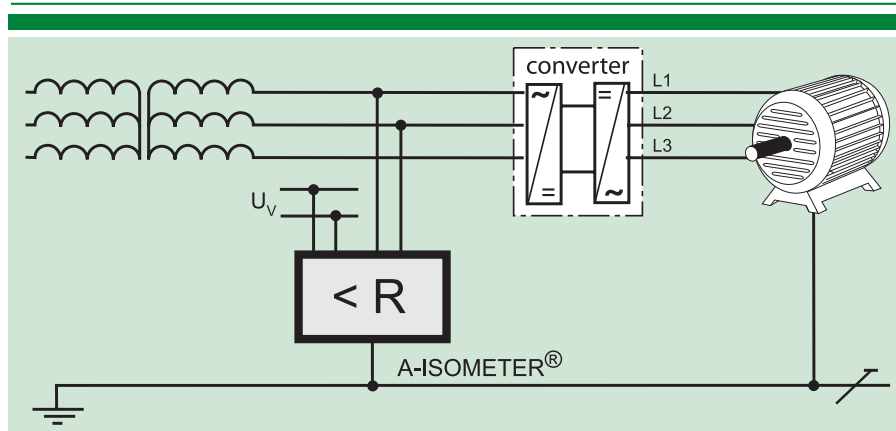
### DC main circuits

These are, for example, battery systems, solar systems or voltages generated via rectifiers.

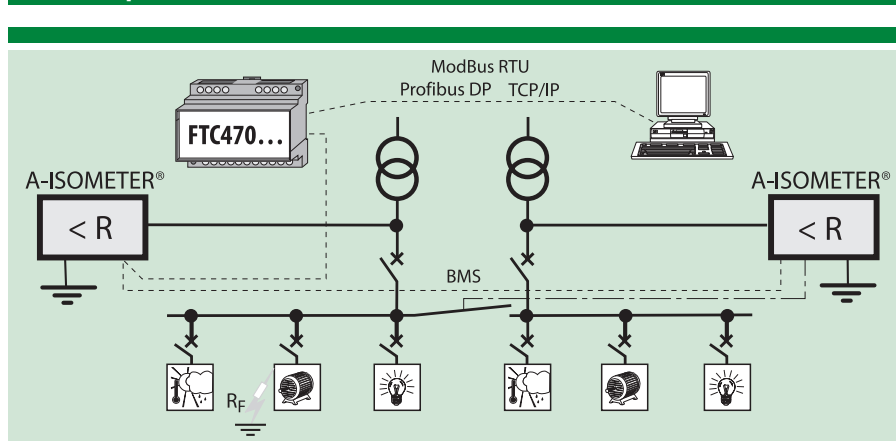
### AC / DC main circuits

AC systems with galvanically connected DC components such as converters, rectifiers or UPS systems.

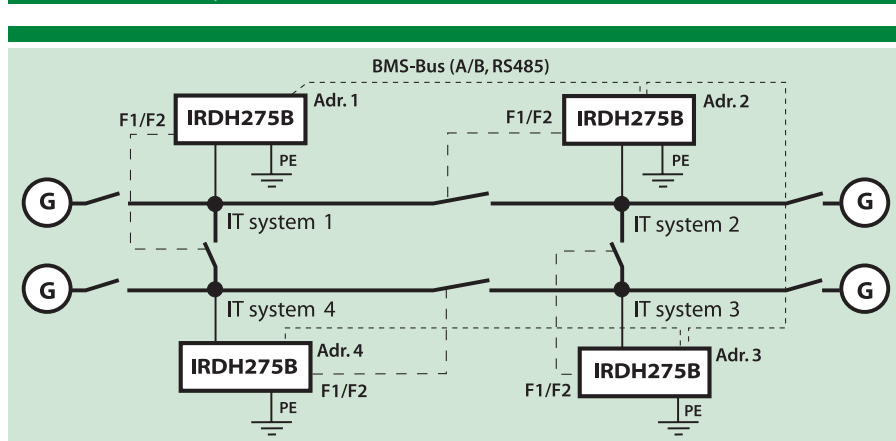
### Examples of application



### Variable-speed drive



### Interconnected IT system with FTC470...



### Interconnected IT system with several A-ISOMETERs® IRDH275

### Series

Type ▶

Application – main circuits ▶

### Application field

Nominal system voltage  $U_n$  ▶

Nominal frequency  $f_n$  ▶

System leakage capacitance  $C_e$  ▶

Nominal voltage range  $U_n$  (extendable via coupling devices) ▶

### Application

Interconnected IT systems ▶

### Response values/ contacts

Number of response values ▶

Response value ▶

Contact main alarm ▶

Contact prewarning ▶

Contact system fault ▶

### Communication

Measured value display ▶

Prealarm display ▶

RS485 interface ▶

Real-time clock ▶

### General features

Measuring principle\* ▶

TEST / RESET button ▶

Fault memory ▶

Selective fault location L+ / L- ▶

Connection monitoring ▶

Historical memory ▶

A-ISOMETER® disconnecting relays ▶

Refer to catalogue page ▶

\* see chapter annex – measurement technology



**IRDH275**  
AC, 3(N) AC, AC/DC

AC 0...793 V DC 0...650 V
DC, 0.2...460 Hz
< 150 (500) µF
×

B version

2
1 kΩ...10 MΩ
1 changeover contact
1 changeover contact
--

LC display
×
BMS protocol (B version)
B version

<b>AMP<sup>PLUS</sup></b>
internal / external
×
×
×
B version
B version

Chapter 1.5 - page 50 – 53



**IRDH375**  
AC, 3(N) AC, AC/DC

AC 0...793 V DC 0...650 V
DC, 0.2...460 Hz
< 150 (500) µF
×

B version

2
1 kΩ...10 MΩ
1 changeover contact
1 changeover contact
1 changeover contact

LC display
×
BMS protocol (B version)
B version

<b>AMP<sup>PLUS</sup></b>
internal / external
×
×
×
B version
B version

Chapter 1.5 - page 54 – 57



**IR1575**  
AC, 3(N) AC, DC, AC/DC

AC 0...480 V DC 0...480 V
DC, 30...460 Hz
< 60 µF
--

--

2
2 kΩ...1 MΩ
1 changeover contact
1 changeover contact
--

LC display
×
--
--

<b>AMP</b>
internal / external
×
×
×
--
--

Chapter 1.5 - page 58 – 60



**IRDH1065B-4**  
AC, 3(N) AC, AC/DC

AC/DC 0...575 V
DC, 1...460 Hz
< 150 (500) µF
×

--

2
10 kΩ...990 kΩ
1 changeover contact
1 changeover contact
--

LC display
×
×
×

<b>AMP</b>
internal / external
×
×
×
--
--

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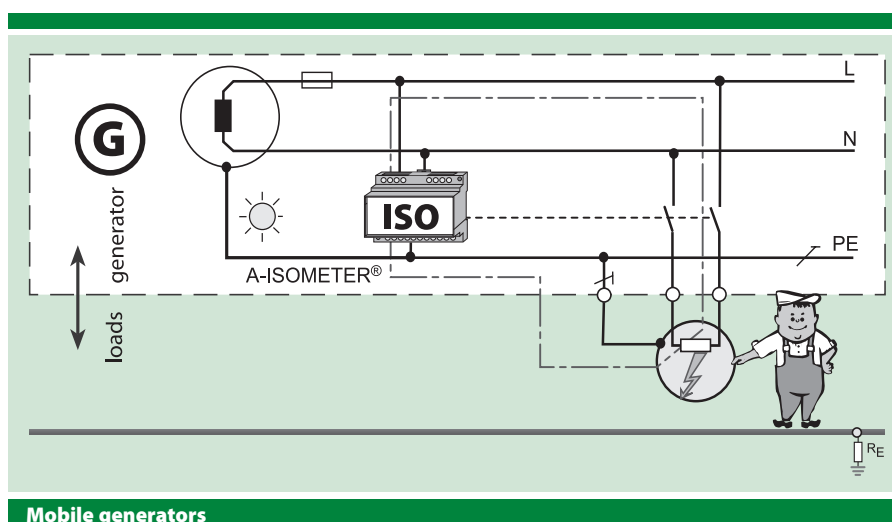
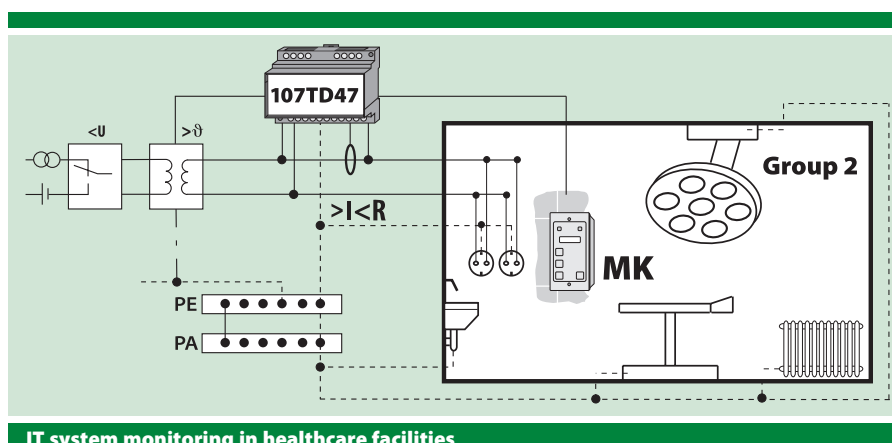
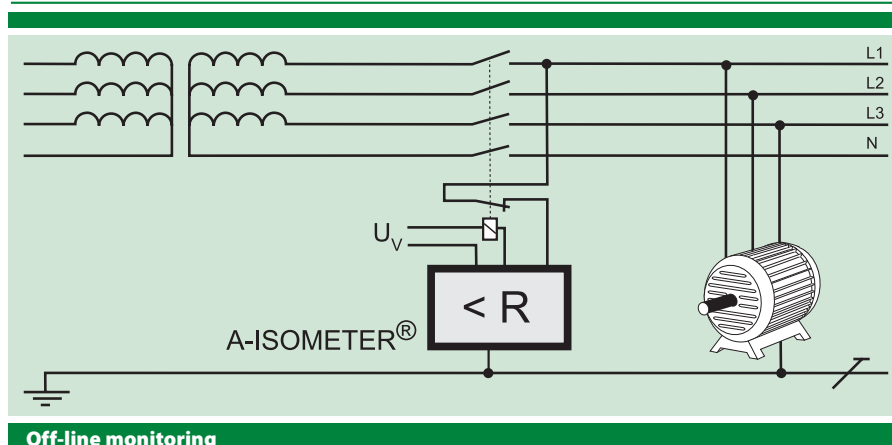
# A-ISOMETER® device overview

## special applications

### Special applications

Our product range includes a variety of products tailored to special applications. Our sales engineers are always available for consultation.

### Examples of application



### Series

- Type ▶
- Application – main circuits ▶
- Application field ▶

### Application field

- Nominal system voltage  $U_n$  ▶
- Nominal frequency  $f_n$  ▶
- System leakage capacitance  $C_e$  ▶
- Nominal voltage range  $U_n$  (extendable via coupling devices) ▶

### Response values / contacts

- Number of response values ▶
- Response value ▶
- Contact main alarm ▶
- Contact prewarning ▶


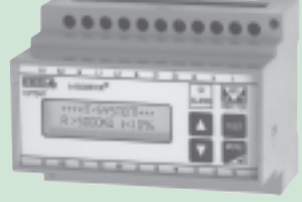

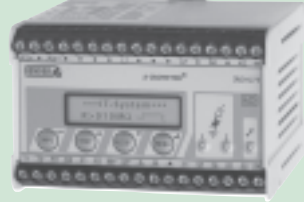
### Communication

- Measured value display ▶
- Alarm LED main alarm ▶
- Alarm LED prewarning ▶
- RS485 interface (BMS protocol) ▶

### General features

- Measuring principle\* ▶
- TEST / RESET button ▶
- Fault memory ▶
- Selective fault location L+ / L- ▶
- Connection monitoring ▶
- Load, temperature monitoring ▶
- Refer to catalogue page ▶

\* see chapter annex – measurement technology

			
<b>IREH470Y2-6</b>	<b>107TD47</b>	<b>IR450Y</b>	<b>IRDH275BU-6</b>
<b>AC, DC, 3(N) AC</b>	<b>AC, 3(N) AC</b>	<b>AC, 3 AC</b>	<b>DC / AC / 3 AC</b>
<b>offline monitoring</b>	<b>medically used rooms</b>	<b>generators</b>	<b>Mittelspannungsnetze mit Umrichtern</b>
0...793 V TN, TT, IT systems	0...264 V	0...276 V	AC/DC 0...3.6 kV with AGH575
DC, 40...460 Hz	40...460 Hz	40...460 Hz	DC 0.2...460 Hz
< 10 µF	< 5 µF	< 5 µF	≤ 10 µF
×	--	--	--
2	1	1	2
100 kΩ...2 MΩ / 500 kΩ...10 MΩ	50 kΩ...500 kΩ	10 kΩ...100 kΩ	100 kΩ...10 MΩ / 100 kΩ...10 mΩ
1 changeover contact	1 changeover contact	1 changeover contact	1 changeover contact
1 changeover contact	--	--	1 changeover contact
external measuring instrument	LC display	--	LC display
×	×	×	×
×	--	--	×
--	×	--	×
DC	AMP	DC	<b>AMP<sup>PLUS</sup></b>
internal	internal / external	internal / external	internal / external
×	×	×	×
--	×	--	×
--	×	--	--
--	×	--	--
<b>Chapter 1.6 - page 66 – 67</b>	<b>Chapter 1.6 - page 68 – 71</b>	<b>Chapter 1.6 - page 72 – 73</b>	<b>Chapter 1.1 - page 74 – 76</b>

# A-ISOMETER® device overview

## insulation fault location system EDS

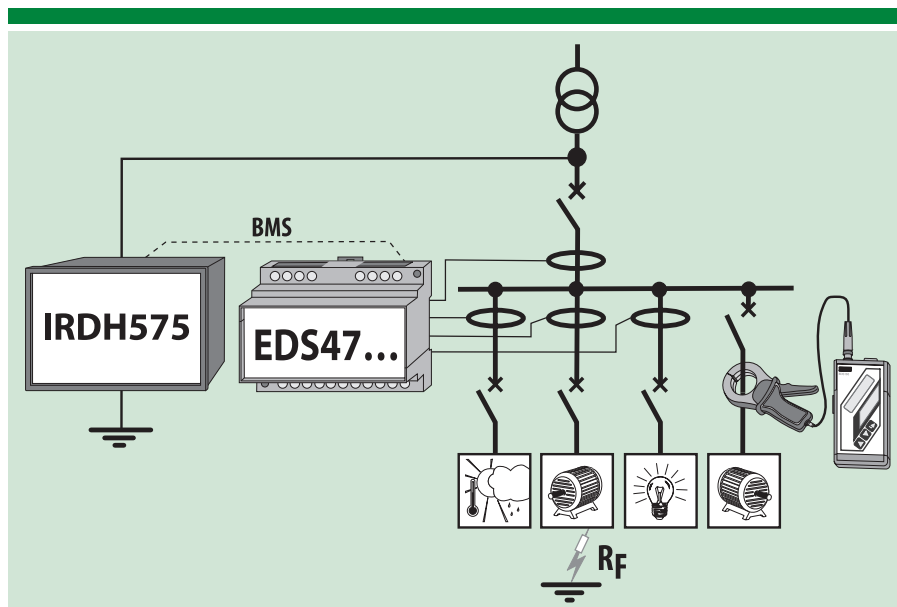
### Insulation fault location system EDS – The special extra for increasing the reliability of your electrical installations

In order to achieve high availability and to avoid costly shut-down periods of electrical installations, it is necessary to recognize insulation faults at an early stage – before interruption to operation occurs. For this reason, unearthed systems (IT systems) with insulation monitoring are used for the power supply of essential electrical installations and loads. The A-ISOMETER® provides the necessary advance information.

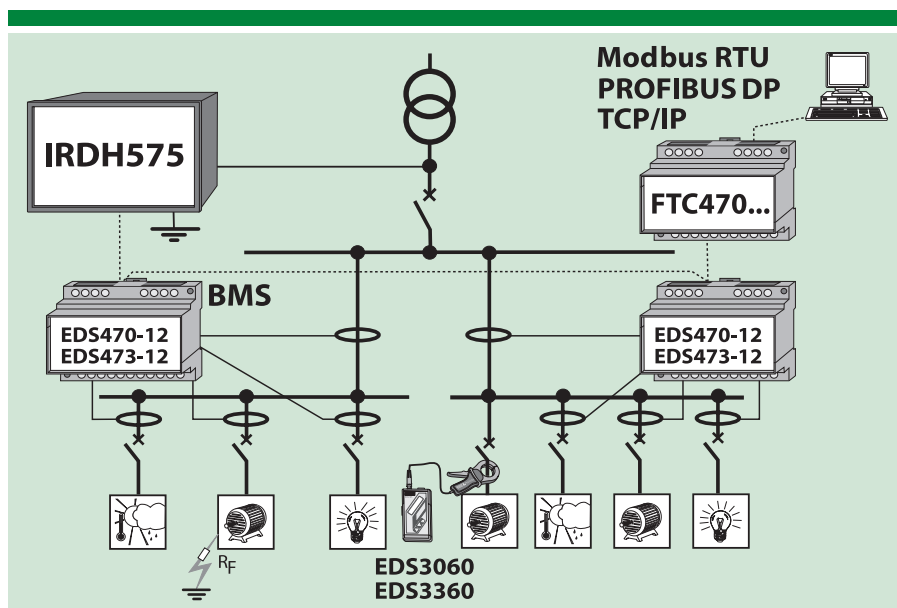
Fast localisation and elimination of insulation faults is required by DIN VDE 0100-410: 1997-01, IEC 60364-4-41.

The EDS system is a modular system ideally suited for this task.

### Examples of application



Insulation fault location



Insulation fault location in combination with communication devices

### Series

Type	▶
Fields of application	▶
Application	▶
Automatic location	▶
System design	▶
Stationary systems	▶
Stationary systems with an existing A-ISOMETER®	▶
Functions	▶
Insulation monitoring device	▶
Evaluator	▶
Control and indicating device	▶
Test device	▶
Technical data	▶
Test device	▶
Nominal system voltage AC	▶
Nominal system voltage DC	▶
Max. test current	▶
Evaluator	▶
Sensitivity	▶
Number of channels	▶
Total of channels	▶
Indicating device	▶
Display	▶
Note	▶
Catalogue page	▶





**IRDH575**

main circuits

control circuits

×	×
---	---

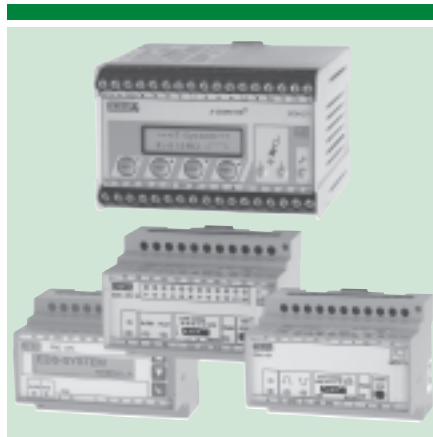
×	×
--	--

IRDH575	
EDS470-12	EDS473-12
IRDH575	
IRDH575	

IRDH575	
AC,3(N) AC 20...575 V (IRDH575B1-)	
AC,3(N) AC 340...760 V (IRDH575B2-)	
DC 20...575 V (IRDH575B1-)	
DC 340...575 V (IRDH575B2-)	
10/25/(50) mA	1/2.5 mA
EDS470-12	
5 mA	0.5 mA
12	12
704	704

IRDH575	
4 x 20 characters	
--	

Chapter 1.7 - page 82 – 86



**EDS470**

main circuits

×
---

--
×

various types	
EDS470-12	
PRC470 / PRC1470	
PGH471	

PGH471	
AC,3(N) AC 20...575 V	
with coupling device AGE470 500...790 V	
DC 20...504 V	
with coupling device AGE470 400...960 V	
10/25 mA	
EDS470-12	
5 mA	
12	
704	

PRC470/PRC1470	
2 x 16 characters (PRC470)	
4 x 20 characters (PRC1470)	
recommended A-ISOMETERs®: IRDH275 and IRDH375	

Chapter 1.7 - page 88 – 89



**EDS473**

control circuits

×
---

--
×

various types	
EDS473-12	
PRC470 / PRC1470	
PGH473	

PGH473	
AC,3(N) AC 20...265 V	
DC 20...308 V	
1/2.5 mA	
EDS473	
0.5 mA	
12	
704	

PRC470 / PRC1470	
2 x 16 characters (PRC470)	
4 x 20 characters (PRC1470)	
recommended A-ISOMETERs®: IRDH275 and IRDH375	

Chapter 1.7 - page 88 – 89

# A-ISOMETER® device overview

## Portable insulation fault location systems

### Series

#### Type ▶

#### Field of application ▶

### Application

#### Automatic location ▶

#### Manual location ▶

### System design

#### Portable systems ▶

#### Portable system to supplement stationary systems ▶

### Functions

#### Insulation monitoring device ▶

#### Evaluators ▶

#### Control and indicating device ▶

#### Test device ▶

### Technical data

#### Test device ▶

#### Nominal system voltage AC ▶

#### Nominal system voltage DC ▶

#### Max. test current ▶

#### Evaluator ▶

#### Sensitivity ▶

#### Number of channels ▶

#### Total number of channels ▶

#### Indicating device ▶

#### Display ▶

#### Note ▶

#### Catalogue page ▶



<b>EDS3060</b>	<b>EDS3360</b>
<b>main circuits</b>	<b>control circuits</b>

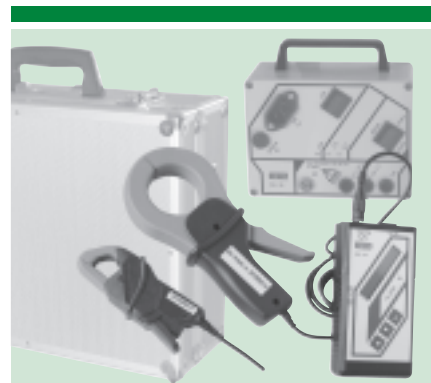
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×	×

--	--
×	×

various types	
EDS165	EDS165-3
EDS165	EDS165-3
--	--

--	--
EDS470 system available	EDS473 system available
--	--
10/25 mA	1/2.5 mA
EDS165	EDS165-3
5 mA	0.5 mA
1	1
1	1
EDS165	EDS165-3
2 x 16 characters	
recommended A-ISOMETERS®: IRDH275 and IRDH375	

**Chapter 1.7 – page 104**



<b>EDS3065</b>	<b>EDS3365</b>
<b>main circuits</b>	<b>control circuits</b>

--	--
×	×

×	×
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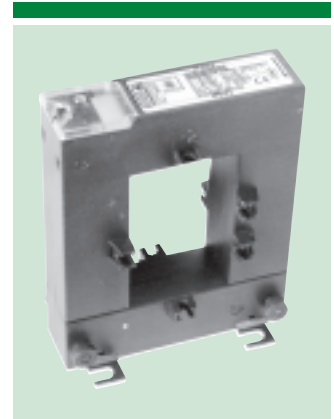
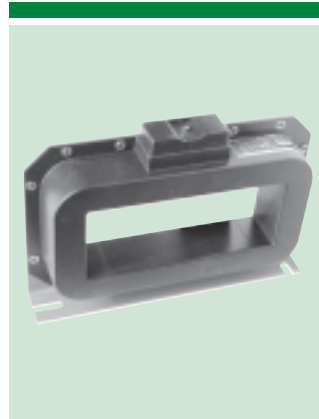
various types	
EDS165	EDS165-3
EDS165	EDS165-3
PGH185	PGH183

PGH185	PGH183
AC,3(N)AC 20...575 V, with AGE185 AC,3(N)AC 500...790 V	3(N)AC 20...265 V
DC 20...500 V, with AGE185 DC 400...960 V	DC 20...308 V
10/25 mA	1/2.5 mA
EDS165	EDS165-3
5 mA	0.5 mA
1	1
1	1
EDS165	EDS165-3
2 x 16 characters	
recommended A-ISOMETERS®: IRDH275 and IRDH375	

**Chapter 1.7 – page 105**

## Device overview

### Measuring current transformers for EDS systems



<b>Series</b>	<b>W</b>	<b>WR</b>	<b>WS</b>
<b>Design</b>	<b>standard</b>	<b>rectangular</b>	<b>split-core</b>

**Dimensions in mm (h x w)** **for EDS470 systems**

ø 10	W10/600	--	--
ø 15	W0-S15	--	--
ø 35	W1-S35	--	--
ø 70	W2-S70	--	--
ø 105	W3-S105	--	--
ø 140	W4-S140	--	--
ø 210	W5-S210	--	--
70 x 175	--	WR70x175S	--
115 x 305	--	WR115x305S	--
150 x 350	--	WR150x350S	--
200 x 500	--	WR200x500S	--
50 x 80	--	--	WS50x80S
80 x 80	--	--	WS80x80S
80 x 120	--	--	WS80x120S
80 x 160	--	--	WS80x160S







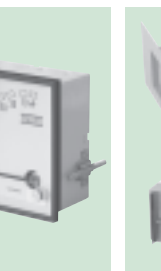
**Dimensions in mm (h x w)** **for EDS473 systems**

ø 10	W10/8000	--	--
ø 35	W1-S35/8000	--	--
20 x 30	--	--	WS20x30/8000
50 x 80	--	--	WS50x80/8000

<b>Catalogue page</b>	<b>Chapter 1.7 - page 90 – 91</b>	<b>Chapter 1.7 - page 90 – 91</b>	<b>Chapter 1.7 - page 90 – 91</b>
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## Device overview – accessories

Series							
Type	AGH150W-4	AGH204S	AGH520S	AGH575	SM0480-12	SMI471-12	DI-1
Application	Extension of the nominal voltage range for A-ISOMETER®				Communication		
Function	Coupling device	Coupling device	Coupling device	Coupling device	Signal converter	Signal converter	Repeater
<b>For device family</b>							
IR470LY...	--	×	×	--	--	--	--
IRDH275/375	×	×	×	--	--	--	×
IRDH575	--	--	--	--	--	--	×
IREH470LY2	--	×	×	--	--	--	--
IRDH275BU	--	--	--	×	--	--	--
EDS systems	--	--	--	--	×	×	×
<b>Voltages</b>							
Nominal voltage range	DC 0...1760 V	AC 0...1650 V AC/DC 0...1300 V	3(N) AC 0...7200 V	AC 0,2...460 Hz/ DC 0...3.6 kV	--	--	--
Supply voltage	--	--	--	--	AC 230 V	AC 230 V	DC 10...30 V
<b>Device features</b>							
Inputs	--	--	--	--	RS485 (BMS protocol)	12 digital inputs	RS485
Outputs	--	--	--	--	1 NO contact per measuring channel	RS485 (BMS protocol)	RS485
PROFIBUS-DP	--	--	--	--	--	--	--
Modbus RTU	--	--	--	--	--	--	--
TCP/IP	--	--	--	--	--	--	--
Web server	--	--	--	--	--	--	--
E-mail notification	--	--	--	--	--	--	--
Catalogue page	Chapter 1.8.1 page 110	Chapter 1.8.1 page 111	Chapter 1.8.1 page 112	Chapter 1.8.1 page 113	Chapter 1.8.2 page 116 – 117	Chapter 1.8.2 page 118 – 119	Chapter 1.8.2 page 120

						
DI-2	FTC470...	RK170	kΩ display	kΩ display	kΩ display	X470
Communication			Measuring instruments			
Repeater	Protocol converter	Measuring converter	for A-ISOMETER® R <sub>i</sub> = 120 kΩ	for A-ISOMETER® R <sub>i</sub> = 1.2 MΩ	for A-ISOMETER® R <sub>i</sub> = 120 kΩ	Panel mounting frame 144 x 72 mm
--	--	×	×	--	--	×
×	×	×	×	--	B version	--
×	×	--	--	--	×	--
--	--	×	--	×	--	×
--	--	--	--	--	--	--
×	×	--	--	--	--	×
--	--	--	--	--	--	--
DC 10...30 V	AC 230 V	DC 20...297 V AC 19...264 V	--	--	--	--
RS485	RS485 (BMS protocol)	0...400 μA	0...400 μA	0...400 μA	0...20 mA	--
RS485	--	0(4)...20 mA 0...10 V	--	--	--	--
--	FTC470XDP	--	--	--	--	--
--	FTC470XMB	--	--	--	--	--
--	FTC470XET	--	--	--	--	--
--	FTC470XET	--	--	--	--	--
--	FTC470XET	--	--	--	--	--
<b>Chapter 1.8.2 page 121</b>	<b>Chapter 1.8.3 page 130 – 135</b>	<b>Chapter 1.8.2 page 122 – 123</b>	<b>Chapter 1.8.2 page 124</b>	<b>Chapter 1.8.2 page 124</b>	<b>Chapter 1.8.2 page 124</b>	<b>Chapter 1.8.2 page 125</b>





**A-ISOMETER® for AC systems  $\leq 230\text{ V}$**   
e. g. AC control and auxiliary circuits or  
contactor and relay control circuits



IR140Y

### Device characteristics

- Insulation monitoring for IT systems AC 0...138 V resp. 0...300 V
- Adjustable response values
- Connection monitoring system / earth
- Power On LEDs and alarm LEDs for the indication of insulation faults AC, L+, L-
- Combined TEST and RESET button
- Connection for external TEST / RESET button
- Alarm relay with two voltage-free changeover contacts
- N/O or N/C operation, selectable
- Fault memory, selectable
- 45 mm enclosure with transparent dust cover for ingress protection

### Product description

The A-ISOMETERS® of the IR140Y series monitor the insulation resistance of unearthed AC control circuits (IT systems) up to 138 V respectively 300 V.

Due to a separate supply voltage source it is possible to monitor de-energized systems too. The systems should not contain DC components. Due to the DC measuring principle, insulation faults behind directly connected rectifiers are indicated with increased response sensitivity. The preset response values apply to the pure AC system only. The versions IR140Y-40 and IR140Y-60 operate with higher measuring voltages, therefore the response sensitivity for insulation faults on the DC side will be reduced.


### Application

- AC control circuits (without directly connected rectifiers) in industry, mechanical engineering, power plants, elevator controls, automation systems etc.
- AC control and auxiliary circuits in accordance with DIN EN 60204-1: 1998-11 "Elektrische Ausrüstung von Maschinen" (Electrical equipment of machines), IEC 60204-1: 1997, EN 60204-1: 1997
- AC auxiliary circuits in accordance with DIN VDE 0100-725 (VDE 0100 part 725): 1991-11
- Small AC IT systems, e. g. lighting systems, mobile generators

### Function

If the insulation resistance between the system conductor and earth falls below the preset response value, the alarm relay switches and the alarm LEDs light up, even in case of interruption of the earth or system connection. The alarm LEDs AC, DC+ and DC- allow to distinguish between insulation faults at the AC side and insulation faults at the DC side. The fault message can be stored. Pressing the RESET button resets the fault message. By pressing the TEST button, the function of the A-ISOMETER® can be tested.

### Measuring principle

 Superimposed DC measuring voltage with reversing stage (see chapter annex – measurement technology).

### Standards

The IR140Y series complies with the standards: DIN EN 61557-8 (VDE 0413 part 8): 1998-05; EN 61557-8: 1997-03, IEC 61557-8: 1997-02, ASTM F 1669M-96.

### Certifications



### Ordering details

Type	Supply voltage $U_S$	Art. No.
IR140Y-3	AC 230 V	B 9101 5504
IR140Y-313	AC 90...132 V*	B 9101 5509
IR140Y-321	DC 9.6...84 V*	B 9101 5508
IR140Y-4	AC 230 V	B 9101 6505
IR140Y-413	AC 90...132 V*	B 9101 6523
IR140Y-421	DC 9.6...84 V*	B 9101 6513
IR140Y-6	AC 230 V	B 9101 6507
IR140Y-613	AC 90...132 V*	B 9101 6519
IR140Y-621	DC 9.6...84 V*	B 9101 6515
IR140Y-40	AC 230 V	B 9101 6506
IR140Y-4013	AC 90...132 V*	B 9101 6524
IR140Y-4021	DC 9.6...84 V*	B 9101 6514
IR140Y-60	AC 230 V	B 9101 6508
IR140Y-6013	AC 90...132 V*	B 9101 6521
IR140Y-6021	DC 9.6...84 V*	B 9101 6516
Mounting plate	--	B 990 056

Other voltages on request

\*absolute values

### Response values / measuring circuit

Type	Response value $R_{an}$	System leakage capacitance $C_e$	*Response time $t_{an}$ at $R_f = 0.5 \times R_{an}$	Measuring voltage $U_m$
IR140Y-3	1...20 k $\Omega$	$\leq 20 \mu F$	$\leq 0.8 s$	$\leq 20 V$
IR140Y-4	10...200 k $\Omega$	$\leq 20 \mu F$	$\leq 0.8 s$	$\leq 20 V$
IR140Y-40	10...200 k $\Omega$	$\leq 20 \mu F$	$\leq 0.8 s$	$\leq 40 V$
IR140Y-6	0.5...5 M $\Omega$	$\leq 10 \mu F$	$\leq 2 s$	$\leq 20 V$
IR140Y-60	0.5...5 M $\Omega$	$\leq 10 \mu F$	$\leq 2 s$	$\leq 40 V$

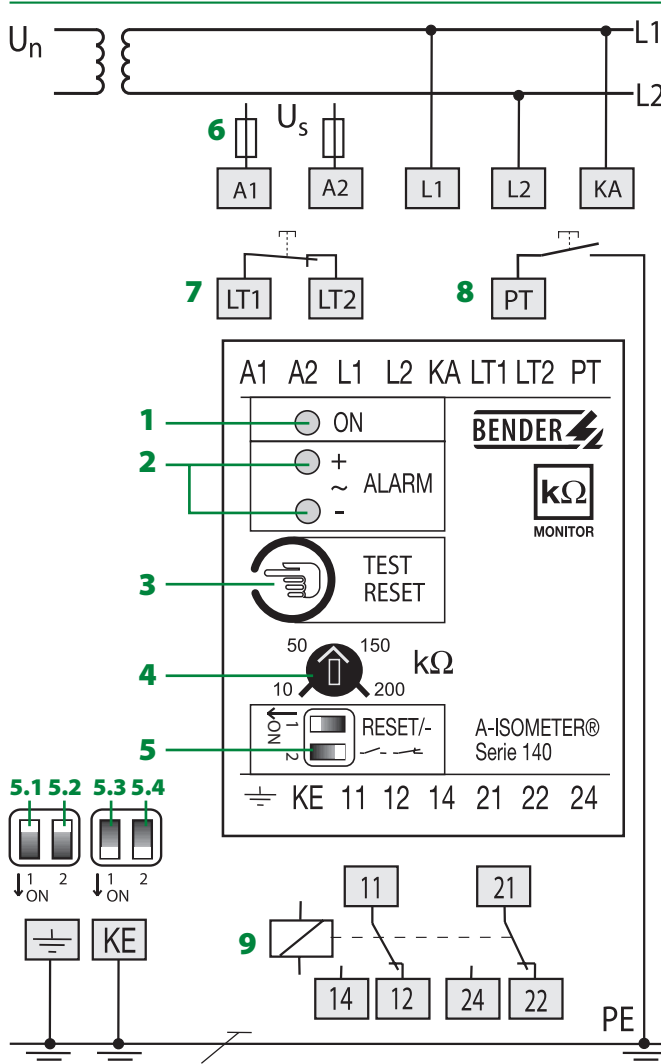
  

Type	Measuring current max. $I_m$	Internal resistance/impedance $R_i$	Max. admissible extraneous DC voltage $U_{fg}$	Nominal voltage range $U_n$
IR140Y-3	$\leq 0.72 mA$	$\geq 28 k\Omega / 24 k\Omega$	$\leq 138 V$	AC 0...138 V
IR140Y-4	$\leq 0.17 mA$	$\geq 120 k\Omega / 98 k\Omega$	$\leq 300 V$	AC 0...300 V
IR140Y-40	$\leq 0.34 mA$	$\geq 120 k\Omega / 110 k\Omega$	$\leq 300 V$	AC 0...300 V
IR140Y-6	$\leq 17 \mu A$	$\geq 1.2 M\Omega / 980 k\Omega$	$\leq 300 V$	AC 0...300 V
IR140Y-60	$\leq 34 \mu A$	$\geq 1.2 M\Omega / 1.1 M\Omega$	$\leq 300 V$	AC 0...300 V

\* The response time applies to an insulation fault  $0.5 \times R_{an}$  at  $1 \mu F$  system leakage capacitance according to IEC 61557-8.



Wiring diagram / operating elements



- 1 - Power On LED
- 2 - Alarm LEDs, illuminate when the insulation resistance falls below the preset response value and flash in case of interruption of the connecting leads earth / KE or L1 / L2
- 3 - Combined TEST and RESET button, short-time pressing (< 1 s) = RESET, long-time pressing (> 2 s) = TEST
- 4 - Potentiometer for the adjustment of the response value  $R_{an}$  ( $R_{ALARM}$ )
- 5 - DIP switch for the selection of the operating principle of the alarm relay and the latching properties in case of fault alarm
  - 5.1 - without fault memory
  - 5.2 - alarm relay in N/C operation
  - 5.3 - with fault memory
  - 5.4 - alarm relay in N/O operation
- 6 - Fuse 6 A,  $U_s$  see ordering details
- 7 - External RESET button for fault memory
- 8 - External TEST button
- 9 - Alarm relay with two changeover contacts

Technical data A-ISOMETER® IR140Y...

Insulation coordination acc. to IEC 60664-1

Rated voltage	AC 250 V
Rated impulse voltage / pollution degree	4 kV/3

Voltage ranges

Nominal system voltage $U_n$	see table "response values / measuring circuit"
Nominal frequency $f_n$	40...460 Hz
Supply voltage $U_s$	see ordering details
Operating range of $U_s$	0.8...1.15 x $U_s$
Frequency range $U_s$	50...460 Hz
Power consumption	≤ 3 VA

Response values

see table "response values/measuring circuit"

Measuring circuit

see table "response values/measuring circuit"

Outputs

TEST / RESET button	internal / external
---------------------	---------------------

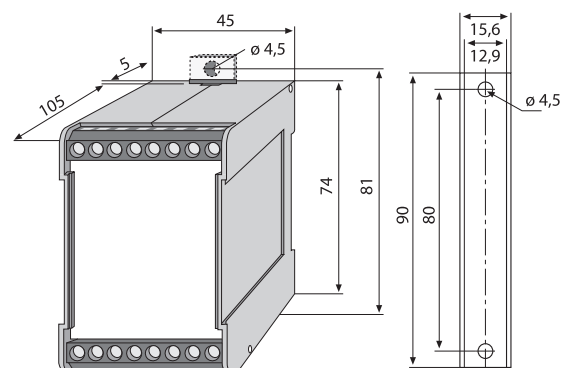
Switching elements

Switching elements	2 changeover contacts
Operating principle	N/O / N/C operation
Factory setting	N/O operation
Electrical endurance	12000 cycles
Contact class	IIB acc. to DIN IEC 60255 part 0-20
Rated contact voltage	AC 250 V / DC 300 V
Making capacity	UC 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

Shock resistance acc. to IEC 60068-2-27 (device in operation)	15 g / 11 ms
Bumping acc. to IEC 60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance acc. to IEC 60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance acc. to 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 according to IEC 60721-3-3	3K5
Operating mode	continuous operation
Mounting	any position
Connection	screw terminals
Wire cross section, rigid, flexible	0.2...4 mm <sup>2</sup> / 0.2...2.5 mm <sup>2</sup>
Degree of protection, int. components / terminals (DIN EN 60529)	IP30 / IP20
Screw fixing	with mounting plate
DIN rail mounting according to	DIN EN 60715 / IEC 60715
Flammability class	UL94V-0
Instruction leaflet	101001
Weight approx.	280 g

Dimension diagram, enclosure XM45 Dimensions in mm







### A-ISOMETER® for DC systems $\leq 220$ V

e. g. DC control and auxiliary circuits or small battery systems

## A-ISOMETER® IR125Y-4

Insulation monitoring device for unearthed DC systems (IT systems)



IR125Y-4

### Device characteristics

- Insulation monitoring for IT DC systems of 19.2...308 V
- Adjustable response values 10...200 kΩ
- Power On LEDs and alarm LEDs for the indication of insulation faults
- Combined TEST and RESET button
- Connection for external RESET button
- Alarm relay with one voltage-free changeover contact
- N/C operation
- Fault memory, selectable

### Certifications



### Product description

The A-ISOMETERS® of the IR125Y-4 series monitor the insulation resistance of unearthed DC control circuits (IT systems) of DC 19.2...308 V. The supply voltage is taken from the system to be monitored.

In contrast to insulation monitoring devices which use the passive voltage asymmetry principle for insulation fault detection, this series uses the active AMP measuring principle. This creates the possibility to detect and indicate both symmetrical and asymmetrical insulation faults.

### Application

- DC control and auxiliary circuits in accordance with DIN EN 60204-1: 1998-11: "Elektrische Ausrüstung von Maschinen" (Electrical equipment of machines), IEC 60204-1: 1997, EN 60204-1: 1997
- DC auxiliary circuits in accordance with DIN VDE 0100-725 (VDE 0100 part 725): 1991-11
- Simple battery systems

### Function

If the insulation resistance between the system conductor and earth falls below the preset response value, the alarm relay switches and the alarm LEDs light up. The fault indication can be stored. Pressing the RESET button resets the fault message. By pressing the TEST button, the function of the A-ISOMETER® can be tested.

### Measuring principle

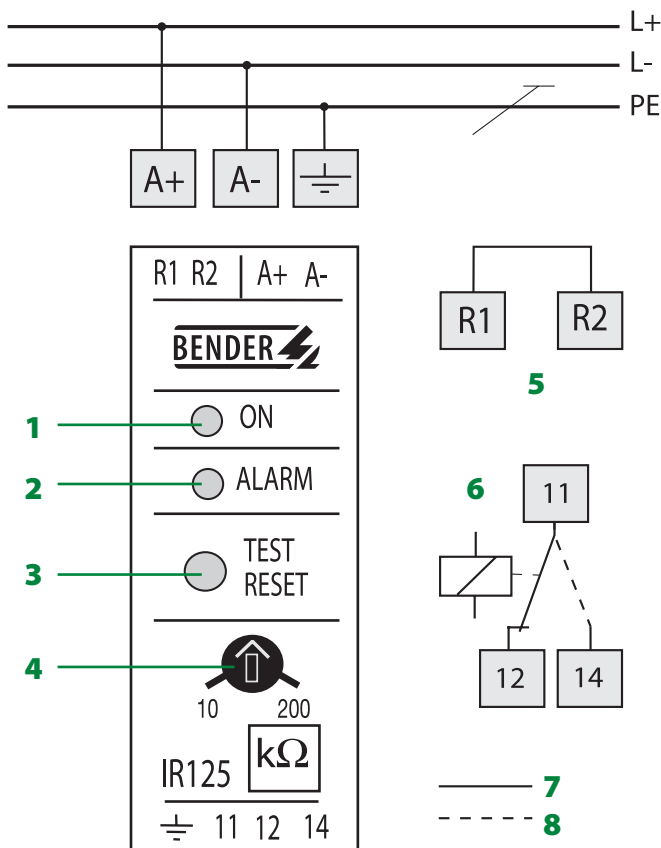


The IR125Y series uses a variant of the AMP measuring principle (see chapter annex – measurement technology).

### Standards

The IR125Y series complies with the standards: DIN EN 61557-8 (VDE 0413 part 8): 1998-05; EN 61557-8: 1997-03; IEC 61557-8: 1997-02, ASTM F 1669M-96.

Wiring diagram / operating elements



- 1 - Power On LED
- 2 - Alarm LED
- 3 - Combined TEST and RESET button, short-time pressing (< 1 s) = RESET, long-time pressing (> 2 s) = TEST
- 4 - Adjustable response value 10...200 kΩ
- 5 - R1 / R2 bridged: fault memory activated
- 6 - Alarm relay in N / C operation
- 7 - Alarm
- 8 - No alarm

Response values / measuring circuit

Type	Response value $R_{an}$	Response time $t_{an}$	System leakage capacitance $C_e$ max.
IR125Y-4...	10...200 kΩ	≤ 6 s	≤ 10 μF
Type	Measuring voltage $U_m$	Measuring current $I_m$	Internal resistance $R_i$
IR125Y-4...	13 V	≤ 0.12 mA	112 kΩ

Ordering details A-ISOMETER® IR125Y-4

Type	Nominal system voltage $U_n$	Art. No.
IR125Y-4...	DC 19.2...308 V	B 9102 3005
Mounting plate	--	B 990 056

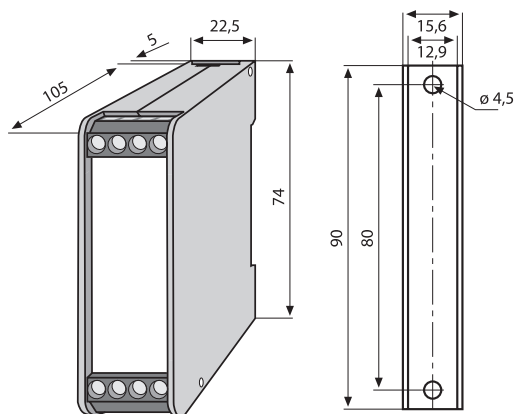
\* absolute value

Technical data A-ISOMETER® IR125Y-4

Insulation coordination acc. to IEC 60664-1	
Rated insulation voltage	AC 250 V
Rated impulse voltage / pollution degree	4 kV/3
Voltage ranges	
Nominal system voltage $U_n$	DC 19.2...308 V
Supply voltage $U_S$	= $U_n$
Power consumption	≤ 1.5 W
<b>Response values</b>	see table "response values / measuring circuit"
<b>Measuring circuit</b>	see table "response values / measuring circuit"
Outputs	
TEST button	internal
RESET button	internal / external
Switching elements	
Switching elements	1 changeover contact
Operating principle	N / C operation
Electrical endurance	12000 cycles
Contact class	IIB acc. to DIN IEC 60255 part 0-20
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
General data	
Shock resistance acc. to IEC 60068-2-27 (device in operation)	15 g / 11 ms
Bumping acc. to IEC 60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance acc. to IEC 60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance acc. to 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 according to IEC 60721-3-3	3K5
Operating mode	continuous operation
Mounting	any position
Connection	screw terminals
Wire cross section, rigid, flexible	0.2...4 mm <sup>2</sup> / 0.2...2.5 mm <sup>2</sup>
Degree of protection, int. components / terminals (DIN EN 60529)	IP30 / IP20
Screw fixing	with mounting plate
DIN rail mounting according to	DIN EN 60715 / IEC 60715
Flammability class	UL94V-0
Instruction leaflet	102005
Weight approx.	130 g

1.2

Dimension diagram, enclosure XM22 Dimensions in mm







**A-ISOMETER® for AC, AC / DC or DC systems < 230 V**

e. g. AC control and auxiliary circuits with galvanically connected DC components



IR145Y-...

### Device characteristics

- Insulation monitoring for IT AC, AC / DC systems 0...300 V
- Adjustable response values
- Connection monitoring system / earth
- Power ON LED and alarm LEDs, indicating AC, DC+ and DC- insulation faults
- Combined TEST and RESET button
- Connection for external TEST and RESET button
- Alarm relay with two voltage-free changeover contacts
- N/O or N/C operation, selectable
- Fault memory, selectable

### Certifications



### Product description

The A-ISOMETERS® of the IR145Y series monitor the insulation resistance of unearthed AC, DC or AC / DC control circuits (IT systems) 0...138 V respectively 0 300 V. DC-supplied components existing in AC/DC systems do not influence the operating characteristics. The response values correspond to the scale printed on the front plate. The supply voltage is taken from the system being monitored. A separate supply voltage source creates the possibility to monitor de-energized systems too.

### Application

- Control circuits in the industrial sector, mechanical engineering, power plants, elevators, automation systems etc.
- Control and auxiliary circuits in accordance with DIN EN 60204-1: 1998-11 "Elektrische Ausrüstung von Maschinen" (Electrical equipment of machines), IEC 60204-1: 1997, EN 60204-1: 1997
- Auxiliary circuits in accordance with DIN VDE 0100-725: 1991-11
- Small IT systems in lighting systems, computer networks, battery systems etc.

### Function

If the insulation resistance between the system conductors and earth falls below the set response value, the alarm relay switches and the alarm LEDs light up. This also applies in case of interruption of the system and earth connection. Different alarm LEDs AC, DC+ and DC- allow to distinguish between insulation faults on the AC and the DC side. The fault message can be stored. The fault memory can be reset by pressing the RESET button. By pressing the TEST button, the function of the device can be tested.

### Measuring principle



The IR145Y devices use a variant of the AMP measuring principle (see chapter annex – measurement technology). The frequency range of the system being monitored can be within the DC range or 15...460 Hz. If frequencies of 0...15 Hz occur, it is recommended to use devices of the IRDH275, 375 or 575 series.

### Standards

The IR145Y series complies with the standards: DIN EN 61557-8 (VDE 0413 part 8): 1998-05; EN 61557-8: 1997-03; IEC 61557-8: 1997-02, ASTM F 1669M-96.

### Response values / measuring circuit

Type	Response value $R_{an}$	Response time $t_{an}$	System leakage capacitance $C_e$ max.	Measuring voltage $U_m$
IR145Y-3...	1...20 k $\Omega$	$\leq 3$ s	$\leq 20$ $\mu$ F	$\leq 15$ V
IR145Y-4...	10...200 k $\Omega$	$\leq 5$ s	$\leq 20$ $\mu$ F	$\leq 15$ V

Type	Measuring current $I_m$	Max. internal resistance $R_i$	Nominal system voltage $U_n$
IR145Y-3...	$\leq 0.47$ mA	$\geq 28/25$ k $\Omega$	AC/DC 0...138 V*
IR145Y-4...	$\leq 0.11$ mA	$\geq 120/115$ k $\Omega$	AC 0...300 V / DC 0...300 V*

<sup>1)</sup> Operating times at 1  $\mu$ F leakage capacitance

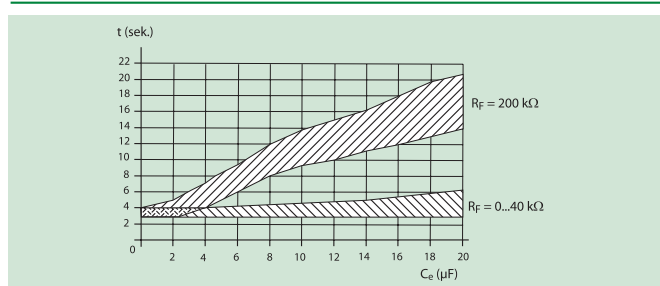
<sup>2)</sup> Internal resistance as internal d. c. resistance / impedance

### Fault indications

Indication	Alarm LED		Alarm relay
	+	-	
AC fault	×	×	×
DC fault L+	×		×
DC fault L-		×	×
Interruption $\frac{\text{---}}{\text{---}}/KE$ resp. L1/L2	o	o	×

o = flashing; × = continuous indication

### Measuring time IR145Y-4...



$C_e$  = system leakage capacitance –  $R_f$  = insulation fault –  $t$  = measuring time

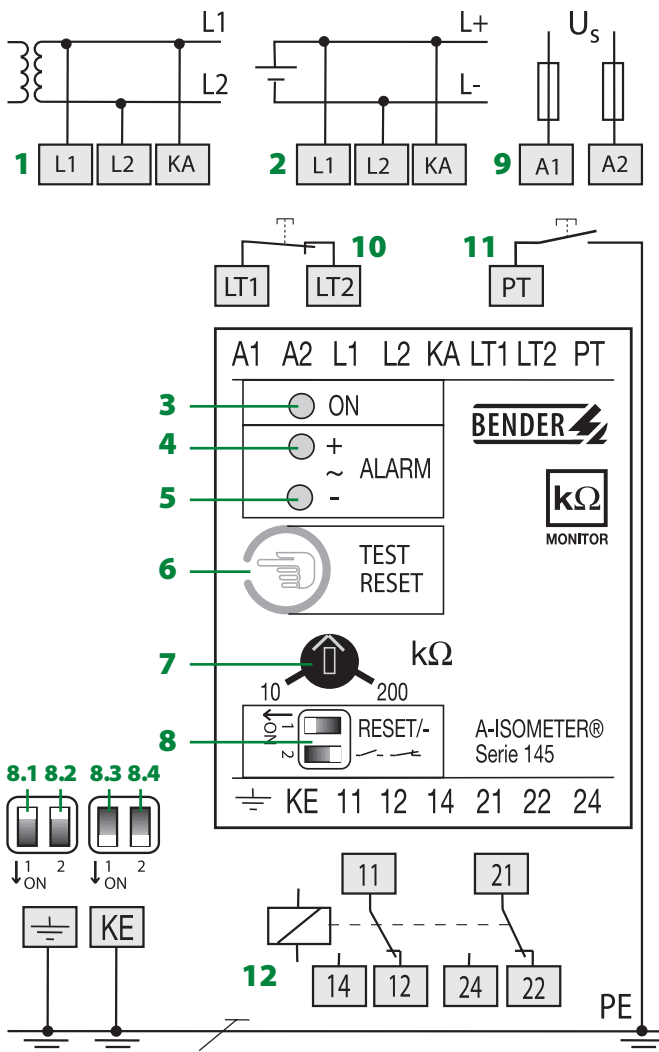
### Ordering details

Type	Supply voltage $U_S$	Art. No.	Type	Supply voltage $U_S$	Art. No.
IR145Y-3	AC 230 V	B 9103 5502	IR145Y-413	AC 90...132 V*	B 9103 6505
IR145Y-313	AC 90...132 V*	B 9103 5505	IR145Y-421	DC 9.6...84 V*	B 9103 6504
IR145Y-321	DC 9.6...84 V*	B 9103 5504	IR145Y-423	DC 77...286 V*	B 9103 6517
IR145Y-4	AC 230 V	B 9103 6502	Mounting plate	--	B 990 056

\* absolute values



**Wiring diagram / operating elements**



- 1 - System to be monitored:  $U_n$  AC
- 2 - System to be monitored:  $U_n$  DC
- 3 - Power On LED
- 4 - Alarm LEDs light up when the insulation value falls below the preset value and flash in case of interruption of the connecting leads earth / KE or L1 / L2
- 5 - Combined TEST and RESET button; short-time pressing (< 1 s) = RESET; long-time pressing (> 2 s) = TEST
- 6 - Potentiometer for the adjustment of the response value  $R_{an}$  ( $R_{ALARM}$ )
- 7 - DIP switch for the selection of the operating principle of the alarm relay and the fault memory in case of fault alarm
  - 8.1 - without fault memory
  - 8.2 - alarm relay in N/C operation
  - 8.3 - with fault memory
  - 8.4 - alarm relay in N/O operation
- 9 -  $U_s$  see ordering details, 6 A fuse
- 10 - External RESET button for fault memory
- 11 - External TEST button
- 12 - Alarm relay with 2 changeover contacts

**Technical data A-ISOMETER® IR145Y**

<b>Insulation coordination acc. to IEC 60664-1</b>	
Rated insulation voltage	AC 250 V
Rated impulse voltage / pollution degree	4 kV/3

<b>Voltage ranges</b>	
Nominal system voltage $U_n$	see table "response values / measuring circuit"
Nominal frequency $f_n$	DC, 15...460 Hz
Supply voltage $U_s$	see ordering details
Operating range of $U_s$	0.8...1.15 x $U_s$
Frequency range $U_s$	50...460 Hz
Power consumption	≤ 3 VA

<b>Response values</b>	see table "response values/measuring circuit"
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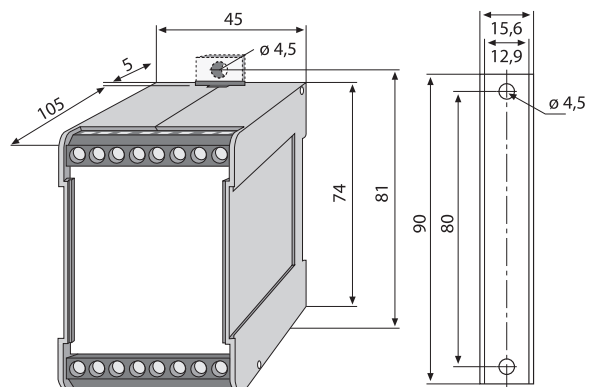
<b>Measuring circuit</b>	see table "response values/measuring circuit"
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<b>Outputs</b>	
TEST / RESET button	internal / external

<b>Switching elements</b>	
Switching elements	2 changeover contacts
Operating principle / factory setting	N/O / N/C operation / N/O operation
Electrical endurance	12000 cycles
Contact class	IIB acc. to DIN IEC 60255 part 0-20
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)

<b>General data</b>	
Shock resistance acc. to IEC 60068-2-27 (device in operation)	15 g / 11 ms
Bumping acc. to IEC 60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance acc. to IEC 60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance acc. to 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 according to IEC 60721-3-3	3K5
Operating mode	continuous operation
Mounting	any position
Connection	screw terminals
Wire cross section, rigid, flexible	0.2...4 mm <sup>2</sup> / 0.2...2.5 mm <sup>2</sup>
Degree of protection, int. components / terminals (DIN EN 60529)	IP30 / IP20
Screw fixing	with mounting plate
DIN rail mounting according to	DIN EN 60715 / IEC 60715
Flammability class	UL94V-0
Instruction leaflet	103001
Weight approx.	280 g

**Dimension diagram, enclosure XM45** Dimensions in mm



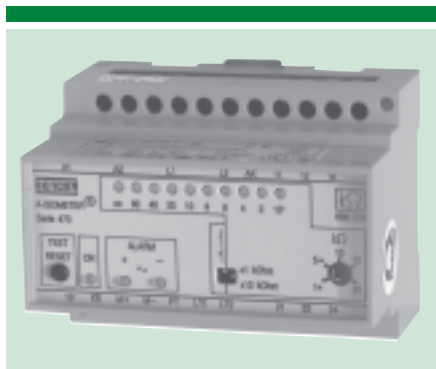




**A-ISOMETER® for AC systems > 230 V**  
e. g. main circuits with motors, pumps,  
fans and similar devices

# A-ISOMETER® IR470LY...

Insulation monitoring device for unearthed AC and 3(N)AC systems (IT systems)



IR470LY

## Device characteristics

- Insulation monitoring for IT AC / 3(N) AC systems 0...793 V
- Nominal voltage extendable via coupling device
- Adjustable response values 1...200 kΩ
- Connection monitoring system / earth
- Power On and alarm LEDs indicating insulation faults AC, L+, L-
- LED bar graph indicator for the insulation resistance value
- Connection for external kΩ indication
- Combined TEST and RESET button
- Connection for external TEST and RESET button
- Alarm relay with 2 voltage-free change-over contacts
- N/O / N/C operation, selectable
- Fault memory, selectable

## Product description

The A-ISOMETERS® of the IR470LY series monitor the insulation resistance of unearthed AC and three-phase systems (IT systems), AC / 3(N) AC 0...793 V. In combination with a coupling device, the A-ISOMETERS® can also be used for higher voltages. Due to a separate supply voltage source it is possible to monitor de-energized systems.

The systems to be monitored should not include DC components. Due to the measuring principle, insulation faults behind directly connected rectifiers are indicated with increased response sensitivity. The preset response values apply to the pure AC system.

## Application

AC / 3(N) AC main circuits (without directly connected rectifiers) such as motors, pumps, rolling mills without variable-speed drives, air cooling and air conditioning systems, lighting systems, heating systems, mobile generators, building installation etc.

## Function

If the insulation resistance between the system conductors and earth falls below the set response value, the alarm relay switches and the alarm LEDs light up. In case of interruption of the system and earth connection, the alarm LEDs flash. The measured value is indicated on the LED bar graph indicator or an external measuring instrument. Different alarm LEDs AC, DC+ and DC- allow to distinguish between insulation faults on the AC and the DC side. In this way changes such as the connection of branch circuits can easily be detected. The fault message can be stored. The fault memory can be reset by pressing the RESET button. By pressing the TEST button, the function of the device can be tested.

## Measuring principle



Superimposed DC voltage with reversing stage (see chapter annex – measurement technology).

## Standards

The IR470LY series complies with the standards: DIN EN 61557-8 (VDE 0413 part 8): 1998-05; EN 61557-8: 1997-03, IEC 61557-8: 1997-02, ASTM F 1669M-96.

## Certifications

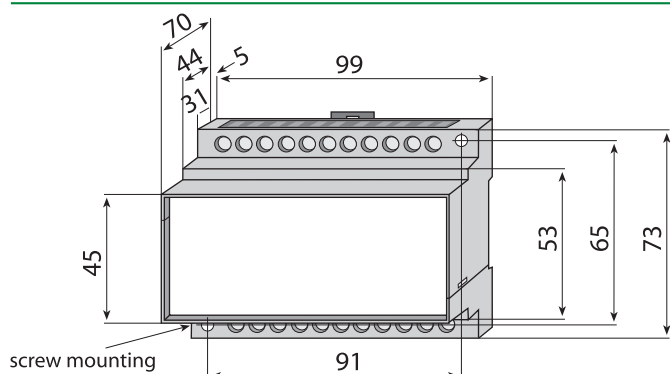


## Response delay

Type	Response time $t_{an}$ in the range of 10...200 kΩ	Response time $t_{an}$ in the range of 1...20 kΩ	System leakage capacitance $C_e$
IR470LY-40...	≤ 1 s	≤ 3 s	≤ 20 μF

\*) Response times acc. to IEC 61557-8 at  $R_F = 0.5 \times R_{an}$  and at 1 μF system leakage capacitance.

## Dimension diagram, enclosure X470 Dimensions in mm



## Ordering details

Type	Supply voltage $U_S$	Art. No.	Type	Supply voltage $U_S$	Art. No.
IR470LY-40	AC 230 V	B 9104 8007	IR470LY-4016	AC 500 V	B 9104 8018
IR470LY-4011	AC 24 V	B 9104 8012	IR470LY-4017	AC 690 V	B 9104 8017
IR470LY-4012	AC 42 V	B 9104 8002	IR470LY-4018	AC 440 V	B 9104 8024
IR470LY-4013	AC 90...132V*	B 9104 8011	IR470LY-4021	DC 9.6...84V*	B 9104 8006
IR470LY-4015	AC 400 V	B 9104 8008	IR470LY-4023	DC 77...286V*	B 9104 8026

Other supply voltages on request. \* absolute values

## Accessories

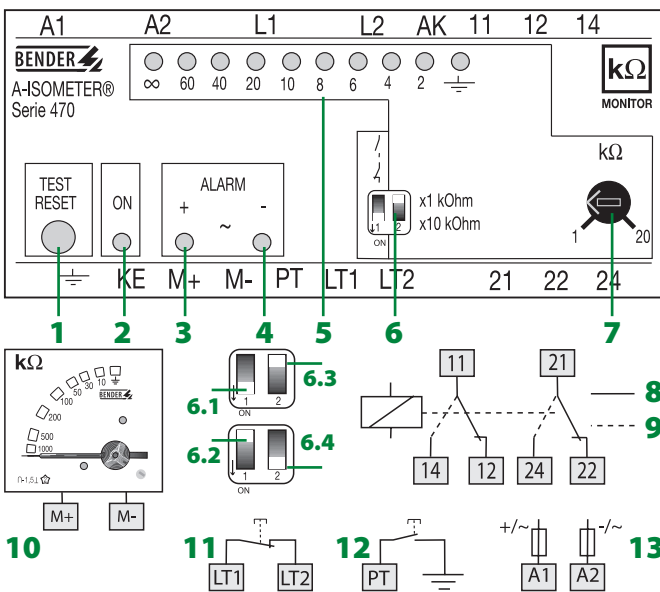
### External kΩ measuring instruments

Type	Art. No.
7204-1421	B 986 763
9604-1421	B 986 764

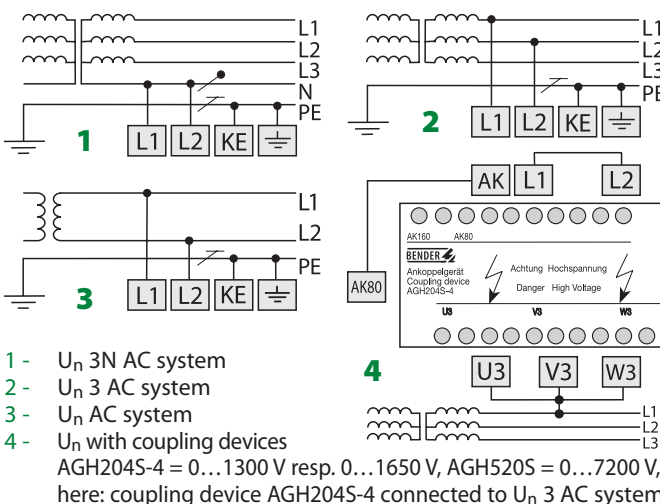
### Coupling devices

Type	Nominal system voltage $U_n$	Art. No.
AGH204S-4	AC 0...1650 V	B 914 013
AGH520S	AC 0...7200 V	B 913 033

Wiring diagram – operating elements



- 1 - Combined TEST and RESET button; short-time pressing (< 1 s) = RESET; long-time pressing (> 2 s) = TEST
- 2 - Power On LED
- 3, 4 - Alarm LEDs yellow, light up when the insulation value falls below the preset value and flash in case of interruption of the connecting leads earth / KE or L1 / L2
- 5 - kΩ LED line
- 6 - Operating principle of the alarm relay and setting range  $R_{ALARM}$   
 6.1 - N/O operation      6.3 - x 10 kΩ  
 6.2 - N/C operation      6.4 - x 1 kΩ
- Changing the setting range from x 1 kΩ to x 10 kΩ automatically changes the indication of the kΩ values on the LED bar graph indicator. Setting range x 1 kΩ: meter scale point x 1 kΩ. Setting range x 10 kΩ: the meter scale point has to be multiplied by 10 kΩ.
- 7 - Potentiometer for the adjustment of the response value ( $R_{ALARM}$ )
- 8 - Alarm relay – N/O operation (basic setting)
- 9 - Alarm relay – N/C operation
- 10 - External kΩ meter
- 11 - External RESET button or contact bridge for fault memory
- 12 - External TEST button
- 13 -  $U_5$  see ordering details, 6 A fuse (recommended)



- 1 -  $U_n$  3N AC system
- 2 -  $U_n$  3 AC system
- 3 -  $U_n$  AC system
- 4 -  $U_n$  with coupling devices  
 AGH204S-4 = 0...1300 V resp. 0...1650 V, AGH520S = 0...7200 V, here: coupling device AGH204S-4 connected to  $U_n$  3 AC system

Technical data A-ISOMETER® IR470LY...

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 630 V
Rated impulse voltage / pollution degree	6 kV/3

Voltage ranges

Nominal system voltage $U_n$	AC, 3(N) AC 0...793 V
Nominal frequency $f_n$	40...460 Hz
Supply voltage $U_5$	see ordering details
Operating range of $U_5$	0.8...1.15 x $U_5$
Frequency range $U_5$	50...460 Hz
Power consumption	≤ 3 VA

Response values

Response value $R_{an1}$ (ALARM1)	1 kΩ...200 kΩ
Response time $t_{an}$ at $R_f = 0.5 \times R_{an}$ and $C_e = 1 \mu F$	
Range 10...200 kΩ	≤ 1 s
Range 1...10 kΩ	≤ 3 s

Measuring circuit

Measuring voltage $U_m$	≤ 40 V
Measuring current $I_m$ max. (at $R_f = 0 \Omega$ )	≤ 200 $\mu A$
Internal d.c. resistance $R_i$	≥ 200 kΩ
Internal impedance $Z_i$ at 50 Hz	≥ 180 kΩ
Max. admissible extraneous DC voltage $U_{fg}$	≤ 800 V
System leakage capacitance $C_e$	≤ 20 $\mu F$

Outputs

TEST / RESET button	internal / external
Current output at measuring instrument (scale centre point = 120 kΩ)	0...400 $\mu A$
Max. load	25 kΩ

Switching elements

Switching elements	2 changeover contacts
Operating principle	N/O / N/C operation
Factory setting	N/O operation
Electrical endurance	12000 cycles
Contact class	IIB acc. to DIN IEC 60255 part 0-20
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

Shock resistance acc. to IEC 60068-2-27 (device in operation)	15 g / 11 ms
Bumping acc. to IEC 60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance acc. to IEC 60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance acc. to 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 according to IEC 60721-3-3	3K5
Operating mode	continuous operation
Mounting	any position
Connection	screw terminals
Wire cross section, rigid, flexible	0.2...4 mm <sup>2</sup> / 0.2...2.5 mm <sup>2</sup>
Degree of protection, int. components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Screw fixing	2 x M4
DIN rail mounting according to	DIN EN 60715 / IEC 60715
Flammability class	UL94V-0
Instruction leaflet	104001
Weight approx.	360 g

# A-ISOMETER® IR470LY2-4061

Insulation monitoring device for unearthed AC and 3(N) AC systems (IT systems)



IR470LY2-4061

## Product description

The A-ISOMETERs® of the IR470LY2-4061 series monitor the insulation resistance of unearthed AC and three-phase systems (IT systems) AC / 3(N) AC 0...793 V. Two separately adjustable response values respectively alarm relays allow to distinguish between pre-warning and alarm. In combination with a coupling device, the A-ISOMETERs® can also be used for higher voltages

The systems to be monitored should not include DC components. Due to the measuring principle, insulation faults behind directly connected rectifiers are indicated with increased response sensitivity. The preset response values apply to the pure AC system.

## Application

AC / 3(N) AC main circuits (without directly connected rectifiers) such as motors, pumps, rolling mills without variable-speed drives, air cooling and air conditioning systems, lighting systems, heating systems, mobile generators, building installation etc.

## Device characteristics

- Insulation monitoring for IT AC / 3(N) AC systems 0...793 V
- Voltage range extendable via coupling device
- Two separately adjustable response values 10 kΩ...100 kΩ / 35 kΩ...500 kΩ
- Connection monitoring system / earth
- Power On and alarm LEDs for insulation fault AC
- LED bar graph indicator for insulation resistance indication
- Connection for external kΩ display
- Combined TEST and RESET button
- Two separate alarm relays with one voltage-free changeover contact each
- N/O or N/C operation, selectable
- Fault memory, selectable

## Function

If the insulation resistance between the system conductors and earth falls below the set response value, the alarm relay switches and the alarm LEDs light up. In case of interruption of the system and earth connection, the alarm LEDs flash. The measured value is indicated on the LED bar graph indicator or an external measuring instrument. Different alarm LEDs AC, DC+ and DC- allow to distinguish between insulation faults on the AC and the DC side. In this way changes such as the connection of branch circuits can easily be detected. The fault message can be stored. The fault memory can be reset by pressing the RESET button. By pressing the TEST button, the function of the device can be tested.

## Measuring principle



Superimposed DC voltage with reversing stage (see chapter annex – measurement technology).

## Standards

The IR470LY2-4061 series complies with the standards: DIN EN 61557-8 (VDE 0413 part 8): 1998-05; EN 61557-8: 1997-03, IEC 61557-8: 1997-02, ASTM F 1669M-96.

## Certifications



## Ordering details

Type	Supply voltage $U_S$	Art. No.
IR470LY2-4061	AC 230 V	B 9104 8052

Other supply voltages on request.

## Accessories

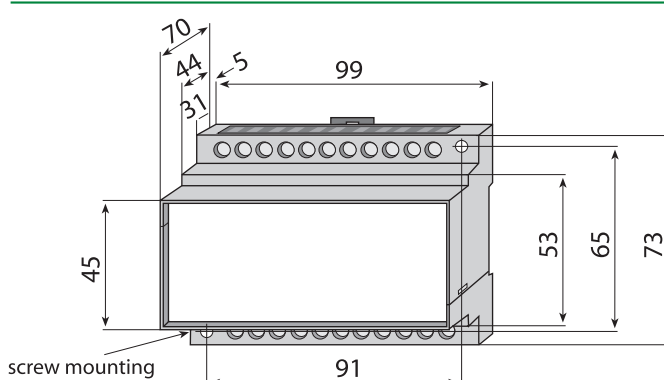
### External kΩ measuring instruments

Type	Art. No.
7204-1421	B 986 763
9604-1421	B 986 764

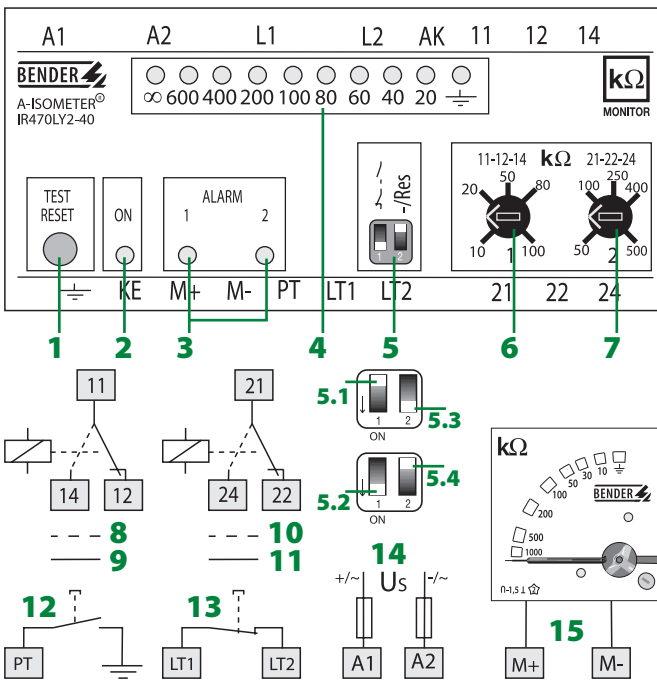
### Coupling devices

Type	Nominal voltage range $U_n$	Art. No.
AGH204S-4	AC 0...1650 V	B 914 013
AGH520S	AC 0...7200 V	B 913 033

## Dimension diagram, enclosure X470 Dimensions in mm

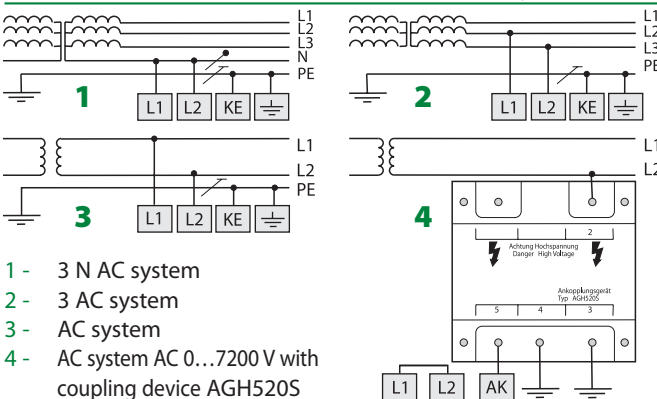


Wiring diagram – operating elements



- 1 - Combined TEST and RESET button; short-time pressing (< 1 s) = RESET; long-time pressing (> 2 s) = TEST
- 2 - Power On LED
- 3 - Alarm LEDs yellow, light up when the insulation value falls below the preset value and flash in case of interruption of the connecting leads earth / KE or L1 / L2
- 4 - kΩ LED line
- 5 - Operating principle of the alarm relay – fault memory
  - 5.1 - N/O operation
  - 5.2 - N/C operation
  - 5.3 - without fault memory
  - 5.4 - with fault memory
- 6 - Potentiometer for the adjustment of the response value ( $R_{ALARM1}$ )
- 7 - Potentiometer for the adjustment of the response value ( $R_{ALARM2}$ )
- 8 - Alarm relay 1: N/O operation
- 9 - Alarm relay 1: N/C operation
- 10 - Alarm relay 2: N/O operation
- 11 - Alarm relay 2: N/C operation
- 12 - External TEST button
- 13 - External RESET button or bridge for fault memory
- 14 -  $U_S$  see ordering details, 6 A fuse (recommended)
- 15 - External kΩ meter

Wiring diagram – connection to the power supply



- 1 - 3 N AC system
- 2 - 3 AC system
- 3 - AC system
- 4 - AC system AC 0...7200 V with coupling device AGH520S

Technical data A-ISOMETER® IR470LY2-4061

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 630 V
Rated impulse voltage / pollution degree	6 kV/3
Test voltage acc. to IEC 60255	3 kV

Voltage ranges

Nominal system voltage $U_n$	AC, 3(N) AC 0...793 V
Nominal frequency $f_n$	40...460 Hz
Supply voltage $U_S$	see ordering details
Operating range of $U_S$	0.8...1.15 x $U_S$
Frequency range $U_S$	50...460 Hz
Power consumption	≤ 3 VA

Response values

Response value $R_{an1}$ (ALARM1)	10 kΩ...100 kΩ
Response value $R_{an2}$ (ALARM2)	35 kΩ...500 kΩ
Response time $t_{an}$ at $R_F = 0.5 \times R_{an}$ and $C_e = 1 \mu F$	≤ 1 s

Measuring circuit

Measuring voltage $U_m$	≤ 40 V
Measuring current $I_m$ max. (at $R_F = 0 \Omega$ )	≤ 200 $\mu A$
Internal d.c. resistance $R_i$	≥ 200 kΩ
Internal impedance $Z_i$ at 50 Hz	≥ 180 kΩ
Max. admissible extraneous d.c. voltage $U_{fg}$	≤ 800 V
System leakage capacitance $C_e$	≤ 20 $\mu F$

Outputs

TEST / RESET button	internal / external
Current output at measuring instrument (scale centre point = 120 kΩ)	0...400 $\mu A$
Max. load	25 kΩ

Switching elements

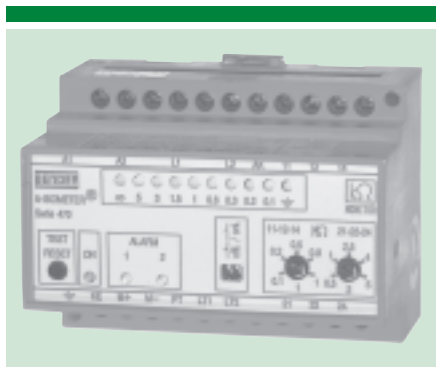
Switching elements	2 x 1 changeover contact
Operating principle	N/O / N/C operation
Factory setting	N/O operation
Electrical endurance	12000 cycles
Contact class	IIB acc. to DIN IEC 60255 part 0-20
Rated contact voltage	AC 250 V / DC 300 V
Making capacity	AC/DC 5 A
Breaking capacity	2 A, AC 230 V, $\cos \phi = 0.4$ 0.2 A, DC 220 V, L/R = 0.04 s
Minimum contact current at DC 24 V	2 mA (50 mW)

General data

Shock resistance acc. to IEC 60068-2-27 (device in operation)	15 g / 11 ms
Bumping acc. to IEC 60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance acc. to IEC 60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance acc. to 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 according to IEC 60721-3-3	3K5
Operating mode	continuous operation
Mounting	any position
Connection	screw terminals
Wire cross section, rigid, flexible	0.2...4 mm <sup>2</sup> / 0.2...2.5 mm <sup>2</sup>
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Screw fixing	2 x M4
DIN rail mounting according to	DIN EN 60715 / IEC 60715
Flammability class	UL94V-0
Instruction leaflet	104010
Weight approx.	360 g

# A-ISOMETER® IR470LY2-60...

Insulation monitoring device for unearthed AC and 3(N) AC systems (IT systems) and de-energized loads (off-line)



IR470LY2-60

## Device characteristics

- Insulation monitoring for IT AC / 3(N) AC systems 0...793 V
- Off-line monitoring for TN, TT and IT systems 0...793 V
- Nominal voltage extendable via coupling devices
- Selectable operating mode, insulation monitoring / off-line monitoring
- Two separately adjustable response values 100 kΩ...1 MΩ / 500 kΩ...5 MΩ
- Connection monitoring system / earth
- Power On LED, alarm LEDs signalling insulation fault AC, L+, L-
- LED bar graph indicator for insulation resistance indication
- Connection for external kΩ indication
- Combined TEST and RESET button
- Two separate alarm relays with one voltage-free changeover contact each
- N/O / N/C operation, selectable
- Fault memory, selectable

## Certifications



## Product description

The A-ISOMETERS® of the IR470LY2-60 series monitor the insulation resistance of unearthed AC and three-phase systems (isolated power) AC / 3(N) AC 0...793 V. The devices are particularly suitable for systems requiring a high insulation level. They can also be used for monitoring de-energized loads. Two separately adjustable response values respectively alarm relays allow to distinguish between prewarning and alarm. In combination with a coupling device, the A-ISOMETERS® can also be used for higher voltages.

The systems to be monitored should not include DC components. Due to the measuring principle, insulation faults behind directly connected rectifiers are indicated with increased response sensitivity. The preset response values apply to the pure AC system.

## Application

- AC / 3(N) AC main circuits (without directly connected rectifiers) such as motors, pumps, rolling mills without variable-speed drives, air cooling and air conditioning systems, lighting systems, heating systems, mobile generators, building installation etc.
- De-energized loads such as fire extinguisher pumps, slide-valve drives (gas, water, oil etc.), flue gas valves, cranes

## Function

If the insulation resistance between the system conductors and earth falls below the set response value, the alarm relay switches and the alarm LEDs light up. In case of interruption of the system and earth connection, the alarm LEDs flash. The measured value is indicated on the LED bar graph indicator or an externally connected measuring instrument. In this way any changes such as the connection of branch circuits can easily be detected. The fault message can be stored. The fault memory can be reset by pressing the RESET button. By pressing the TEST button, the function of the device can be tested.

## Measuring principle



Superimposed DC voltage with reversing stage (see chapter annex – measurement technology).

## Standards

The IR470LY2-60 series complies with the standards: DIN EN 61557-8 (VDE 0413 part 8): 1998-05; EN 61557-8: 1997-03, IEC 61557-8: 1997-02, ASTM F 1669M-96.

## Off-line mode

This mode will be activated when the system voltage between the terminals L1 and L2 falls below 80 V. When the value has fallen below this limit, the device is informed that the load is deenergized. When the voltage between the terminals L1 and L2 exceeds the value of 80 V, insulation monitoring is automatically activated again and will be indicated by a flashing LED ∞ in the LED line.

## Ordering details

Type	Supply voltage U <sub>s</sub>	Art. No.
IR470LY2-60	AC 230 V	B 9104 8010
IR470LY2-6013	AC 90...132 V*	B 9104 8013
IR470LY2-6015	AC 400 V	B 9104 8009
IR470LY2-6021	DC 9.6...84 V*	B 9104 8014

Other supply voltages on request.

\* absolute values

## Accessories

### External kΩ measuring instruments

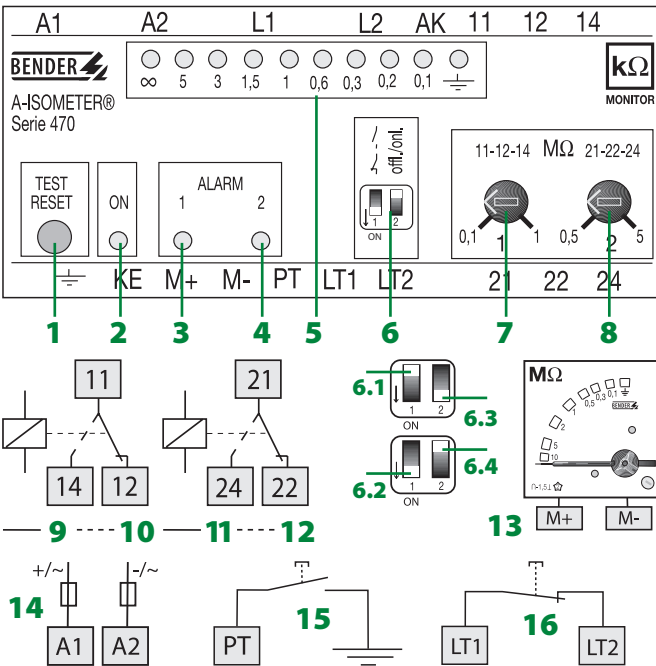
Type	Art. No.
7204-1621	B 986 700
9604-1621	B 986 782

### Coupling devices

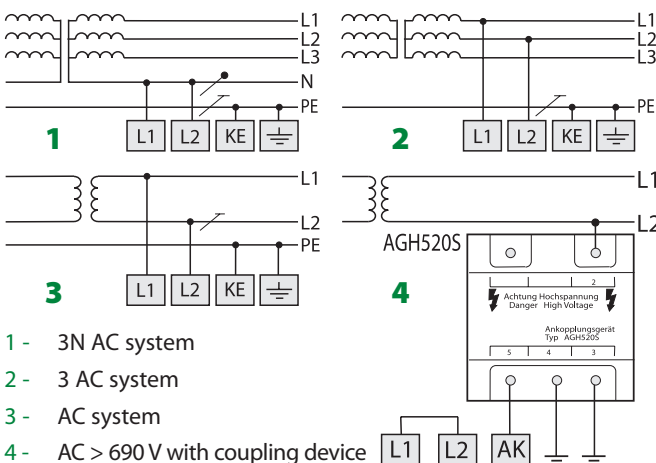
Type	Nominal voltage range U <sub>n</sub>	Art. No.
AGH520S	AC 0...7200 V	B 913 033



Wiring diagram – Operating elements



- 1 - Combined TEST and RESET button; short-time pressing (< 1 s) = RESET; long-time pressing (> 2 s) = TEST
- 2 - Power On LED
- 3,4 - Alarm LEDs yellow, light up when the insulation value falls below the preset value and flash in case of interruption of the connecting leads earth / KE or L1/L2
- 5 - MΩ LED line
- 6 - Operating principle of the alarm relay – On-line / Off-line
  - 6.1 - N/O operation
  - 6.2 - N/C operation
  - 6.3 - Off-line
  - 6.4 - with On-line
- 7 - Potentiometer for the adjustment of the response value  $R_{an1}$  ( $R_{ALARM1}$ )
- 8 - Potentiometer for the adjustment of the response value  $R_{an2}$  ( $R_{ALARM2}$ )
- 9 - Alarm relay 1: N/O operation (basic setting)
- 10 - Alarm relay 1: N/C operation
- 11 - Alarm relay 2: N/O operation (basic setting)
- 12 - Alarm relay 2: N/C operation
- 13 - External MΩ indicating instrument
- 14 -  $U_5$  see ordering details, 6 A fuse (recommended)
- 15 - External TEST button
- 16 - External RESET button



- 1 - 3N AC system
- 2 - 3 AC system
- 3 - AC system
- 4 - AC > 690 V with coupling device

Technical data A-ISOMETER® IR470LY2-60

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 630 V
Rated impulse voltage / pollution degree	6 kV/3

Voltage ranges

Nominal system voltage $U_n$	AC, 3(N) AC 0...793 V
Nominal frequency $f_n$	40...460 Hz
Supply voltage $U_S$	see ordering details
Operating range of $U_S$	0.8...1.15 x $U_S$
Frequency range $U_S$	50...460 Hz
Power consumption	≤ 3 VA

Response values

Response value $R_{an1}$ (ALARM1) / $R_{an2}$ (ALARM2)	100 kΩ...1 MΩ / 500 kΩ...5 MΩ
Response time $t_{an}$ at $R_F = 0.5 \times R_{an}$ and $C_e = 1 \mu F$	≤ 4 s

Measuring circuit

Measuring voltage $U_m$	≤ 40 V
Measuring current $I_m$ max. (at $R_F = 0 \Omega$ )	≤ 33 $\mu A$
Internal d.c. resistance $R_i$	≥ 1.2 MΩ
Internal impedance $Z_i$ at 50 Hz	≥ 1 MΩ
Max. admissible extraneous d.c. voltage $U_{fg}$	≤ 800 V
System leakage capacitance $C_e$	≤ 10 $\mu F$

Outputs

TEST / RESET button	internal / external
Current output at measuring instrument (scale centre point = 120 kΩ)	0...400 $\mu A$
Max. load	25 kΩ

Switching elements

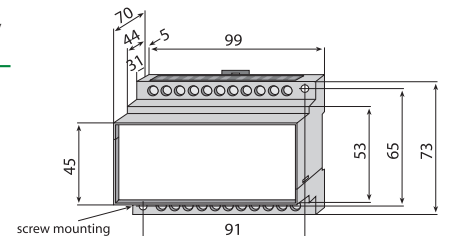
Switching elements	2 x 1 changeover contact
Operating principle – Factory setting	N/O / N/C operation – N/O operation
Electrical endurance	12000 cycles
Contact class	IIB acc. to DIN IEC 60255 part 0-20
Rated contact voltage	AC 250 V / DC 300 V
Making capacity	AC / DC 5 A
Breaking capacity	2 A, AC 230 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

Shock resistance acc. to IEC 60068-2-27 (device in operation)	15 g / 11 ms
Bumping acc. to IEC 60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance acc. to IEC 60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance acc. to 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 according to IEC 60721-3-3	3K5
Operating mode	continuous operation
Mounting	any position
Connection	screw terminals
Wire cross section, rigid, flexible	0.2...4 mm <sup>2</sup> / 0.2...2.5 mm <sup>2</sup>
Degree of protection, int. components / terminals (DIN EN 60529)	IP30 / IP20
Screw fixing / DIN rail mounting according to	2 x M4 / DIN EN 60715 / IEC 60715
Flammability class	UL94V-0
Instruction leaflet	104002
Weight approx.	360 g

Dimension diagram, enclosure X470

Dimensions in mm



## A-ISOMETER® IR1570

Insulation monitoring device for  
IT AC 3(N) AC systems up to 480 V



A-ISOMETER® IR1570

### Device characteristics

- Insulation monitoring for IT AC / 3(N) AC systems 0...480 V
- Two separately adjustable response values 2 kΩ...1 MΩ
- Selective fault location L+ / L-
- Connection monitoring system / earth
- Alarm LEDs for ALARM 1 and ALARM 2
- LC display, 2 x 16 characters
- TEST and RESET button
- Two separate alarm relays with one voltage-free changeover contact each
- N/O or N/C operation, selectable
- Fault memory, selectable
- Illuminated clear text display
- Self monitoring with automatic alarm message
- Plug-in connection terminals
- Enclosure for door mounting, 96 x 96 mm

### Product description

A-ISOMETERS® of the series IR1570 monitor the insulation resistance of unearthed AC and three-phase systems (isolated power) AC / 3(N) AC 0...480 V. Two separately adjustable response values respectively alarm relays allow to distinguish between prewarning and main alarm.

The systems to be monitored should include DC components. Due to the measuring principle, insulation faults behind directly connected rectifiers are indicated with increased response sensitivity. The preset response values apply the pure AC system only.

### Application

AC / 3(N) AC main circuits (without directly connected rectifiers), such as motors, pumps, rolling mills without variable-speed drives, air cooling and air conditioning systems, lighting systems, heating systems, mobile generators, building installation.

### Function

If the insulation resistance between the system conductors and earth falls below the set response value, the alarm relays switch and the alarm LEDs light up. The measured value is indicated on the LC display. In this way any changes such as the connection of branch circuits can easily be recognized. The fault messages can be stored. The fault memory can be reset by pressing the RESET button. By pressing the TEST button, the function of the device and the connection to the system and earth can be tested. When a fault occurs during this test, it will be signalled by alarm relay K2. The parameterization of the device can be carried out via the LC display or the function keys integrated in the front plate.

### Measuring principle

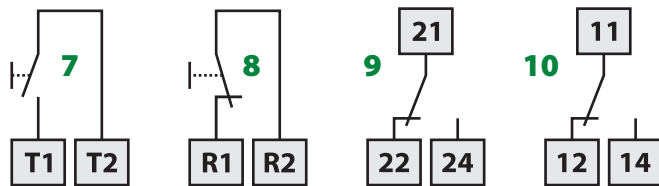
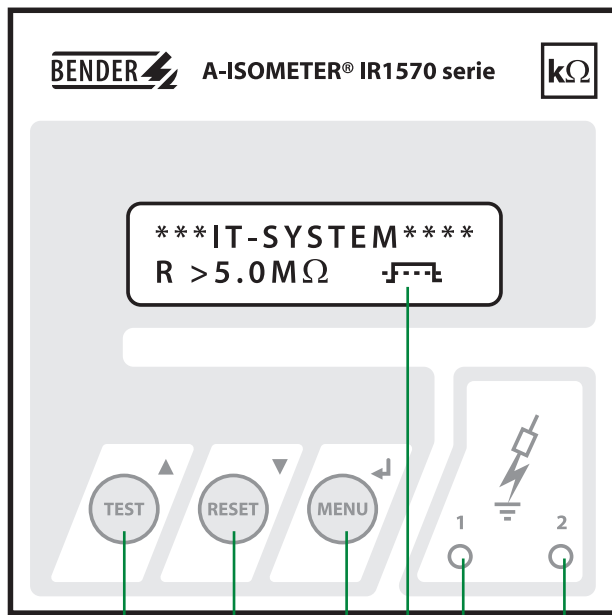


Superimposed DC voltage with reversing stage (see chapter annex – measurement technology).

### Standards

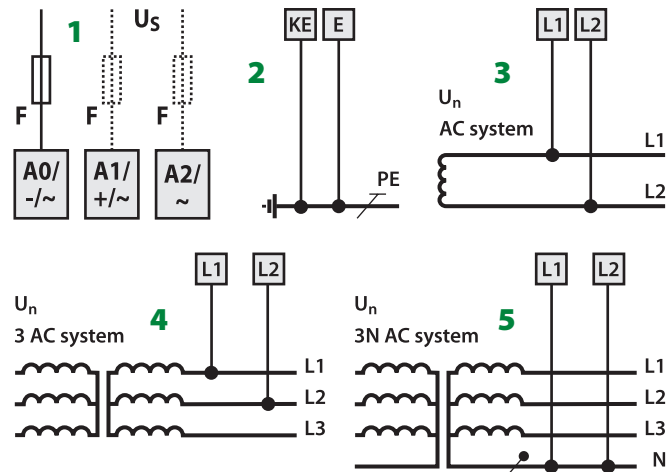
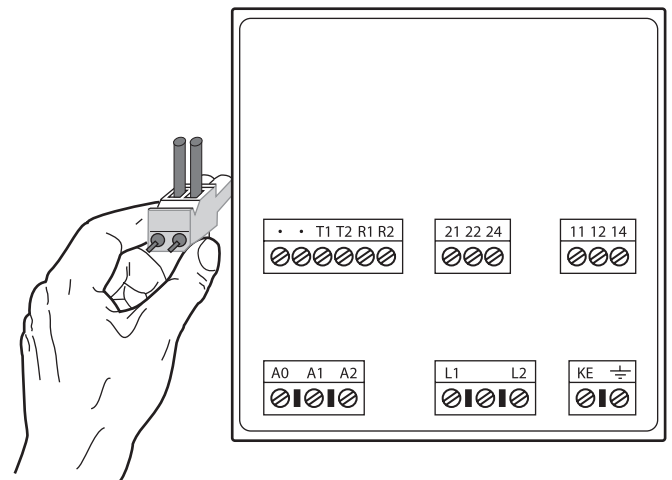
The IR1570 series complies with the standards: DIN EN 61557-8 (VDE 0413 part 8), EN 61557-8: 1997-03, IEC 61557-8: 1997-02, ASTM F 1669M-96.

Wiring diagram – Operating elements



- 1 - TEST button: to call up the self test  
Up key: parameter change, scrolling
- 2 - RESET button: to delete insulation and fault messages  
Down key: parameter change, scrolling
- 3 - MENU button: to activate the menu system  
Enter key: confirmation parameter change
- 4 - Double-line 16 character display, illuminated
- 5 - Alarm LED 1 lights up:  
insulation fault, first warning level reached
- 6 - Alarm LED 2 lights up: insulation fault, second warning level reached or system fault
- 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, factory setting: memory off
- 9 - Alarm relay: ALARM 2
- 10 - Alarm relay: ALARM 1

Wiring diagram – connection to the power supply



- 1 - Supply voltage  $U_5$  via 6 A fuse:  
Terminal A0 / A1: AC 88...264 V, DC 77...286 V  
Terminal A0 / A2: AC 340...460 V
- 2 - Separate connection of E and KE to PE
- 3 - Connection of the AC system to be monitored:  
connect terminal L1, L2 to conductor L1, L2
- 4,5 - Connection of the 3 AC system to be monitored:  
connect terminals L1, L2 to neutral conductor N or terminals L1, L2 to conductor L1, L2

1.4

## Technical data IR1570

### Insulation coordination acc. to IEC 60664-1

Rated voltage	AC 500 V
Rated impulse voltage / pollution degree	4 kV / 3

### Voltage range

Nominal voltage range $U_n$	AC, 3(N) AC 0...480 V
Nominal frequency $f_n$	30...420 Hz
Supply voltage $U_s$	see ordering details
Power consumption	≤ 5 VA

### Response values

Response value $R_{an1}$ (ALARM 1)	2 kΩ...1 MΩ
Response value $R_{an2}$ (ALARM 2)	2 kΩ...1 MΩ
Relative percentage error	0...+20% / min. +2kΩ
Response time $t_{an}$ $R_f = 0.5 \times R_{an}$ and $C_e = 1 \mu F$	≤ 1 s
Hysteresis	25%

### Measuring circuit

Measuring voltage $U_m$	DC 20 V
Measuring current $I_m$ max. (at $R_f = 0 \Omega$ )	≤ 170 μA
Internal DC resistance $R_i$	≥ 119 kΩ
Internal impedance $Z_i$ bei 50 Hz	≥ 114 kΩ
Permissible extraneous DC voltage $U_{fg}$	DC 680 V
Permissible system leakage capacitance $C_e$	20 μF

### Displays

Display, illuminated	double-line display
Characters (number of)	2 x 16 (4.5 mm)
Display range, measuring value	1 kΩ...5 MΩ
Absolute error (1 kΩ...10 kΩ)	± 1 kΩ
Relative percentage error (10 kΩ...5 MΩ)	± 10%

### Outputs

TEST / RESET button	internal / external
---------------------	---------------------

### Switching elements

Switching elements	2 x 1 changeover contacts
Operating principle	N / O or N / C operation
Factory setting (Alarm1 / Alarm2)	N / O operation
Contact class	IIB acc. to DIN IEC 60255 part 0-20
Rated contact voltage	AC 250 V / DC 300 V
Making capacity	AC / DC 5A
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)

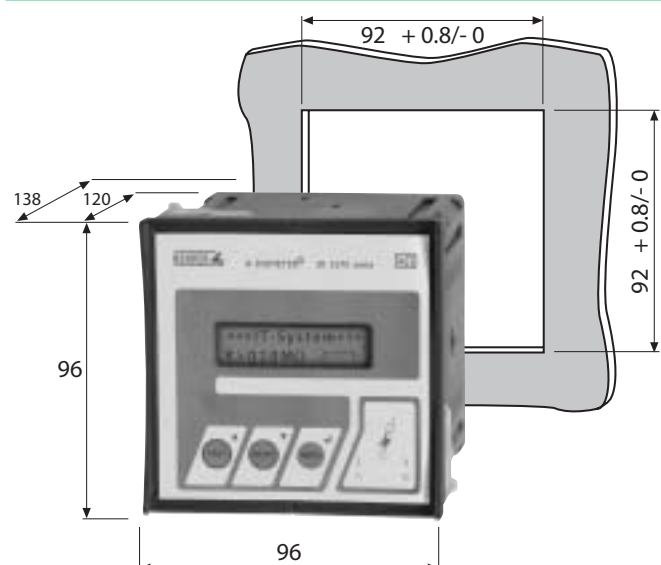
### General data

Shock resistance IEC60068-2-27 (device in operation)	15 g / 11 ms
Bumping IEC60068-2-29 (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 DIN IEC 60721-3-3	3K5
Operating mode	continuous operation
Mounting	as indicated on the display
Connection	screw terminals
Connection, rigid / flexible	0.2...4 / 0.2...2.5 mm <sup>2</sup>
Connection, flexible with connector sleeve, without / with plastic sleeve	0.25...2.5 mm <sup>2</sup>
Conductor sizes (AWG)	24-12
Tightening torque, terminal screws	0.5...0.6 Nm (4.3...5.3 lb-in)
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Type of enclosure panel mounting	96 x 96 mm
Flammability class	UL94V-2
Weight approx.	400 g

## Ordering details

Type	Supply voltage $U_s$	Art. No.
IR1570-435	AC 88...264 V / DC 77...286 V / AC 340...460 V	B 9104 4000
IR1570W-435		B 9104 4000W

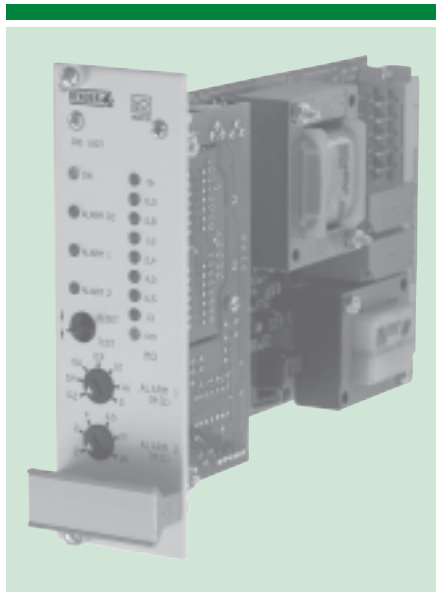
## Dimension diagram, enclosure Dimensions in mm





## A-ISOMETER® IRD1007L...

Insulation monitoring device for unearthed AC and 3(N) AC systems (IT systems)



IRD1007L...

### Device characteristics

- Insulation monitoring device for IT AC / 3(N) AC systems 0...575 V
- Nominal voltage extendable via coupling devices
- Two separately adjustable response values
- Response range 2 kΩ...20 MΩ in different variants
- Adjustable response delay 0...90 s
- Power On LED, alarm LEDs signalling insulation fault ALARM 1, ALARM 2, DC
- LED bar graph indicator for insulation resistance indication
- Connection for external kΩ indication
- Combined TEST and RESET button
- Connection external TEST / RESET button
- Alarm relay with two voltage-free changeover contacts
- N/O / N/C operation, selectable
- Alarm output with optocoupler
- Input for measurement suppression
- Fault memory, selectable

### Product description

The A-ISOMETERS® of the IRD1007L series monitor the insulation resistance of unearthed AC and three-phase systems (IT systems) AC / 3(N) AC 0...793 V. In combination with a coupling device, the A-ISOMETERS® can also be used for higher voltages. Due to a separate supply voltage source it is possible to monitor de-energized systems.

The systems to be monitored should not include DC components. Due to the measuring principle, insulation faults behind directly connected rectifiers are indicated with increased response sensitivity. The preset response values apply to the pure AC system.

Two separately adjustable response values respectively alarm relays allow to distinguish between prewarning and alarm.

### Application

- AC / 3(N) AC main circuits (without directly connected rectifiers) such as motors, pumps, rolling mills without variable-speed drives, air cooling and air conditioning systems, lighting systems, heating systems, mobile generators, building installation practice etc.
- 19" systems for plug-in units

### Function

If the insulation resistance between the system conductors and earth falls below the set response value, the alarm relay switches and the alarm LEDs light up. In case of interruption of the system and earth connection, the alarm LEDs flash. Different alarm LEDs Alarm1, Alarm2 and Alarm DC, allow to distinguish between insulation faults on the AC and the DC side. The measured value is indicated on the LED bar graph indicator or an externally connected measuring instrument. In this way any changes such as the connection of branch circuits can easily be detected. The fault message can be stored. The fault memory can be reset by pressing the RESET button. By pressing the TEST button, the function of the device can be tested. The optocoupler output and the alarm relay switches respectively flashes at the same time with switch S5 in closed position. The input "measurement suppression" can be used for deactivating the measurement process, e. g. during insulation fault location.

### Measuring principle

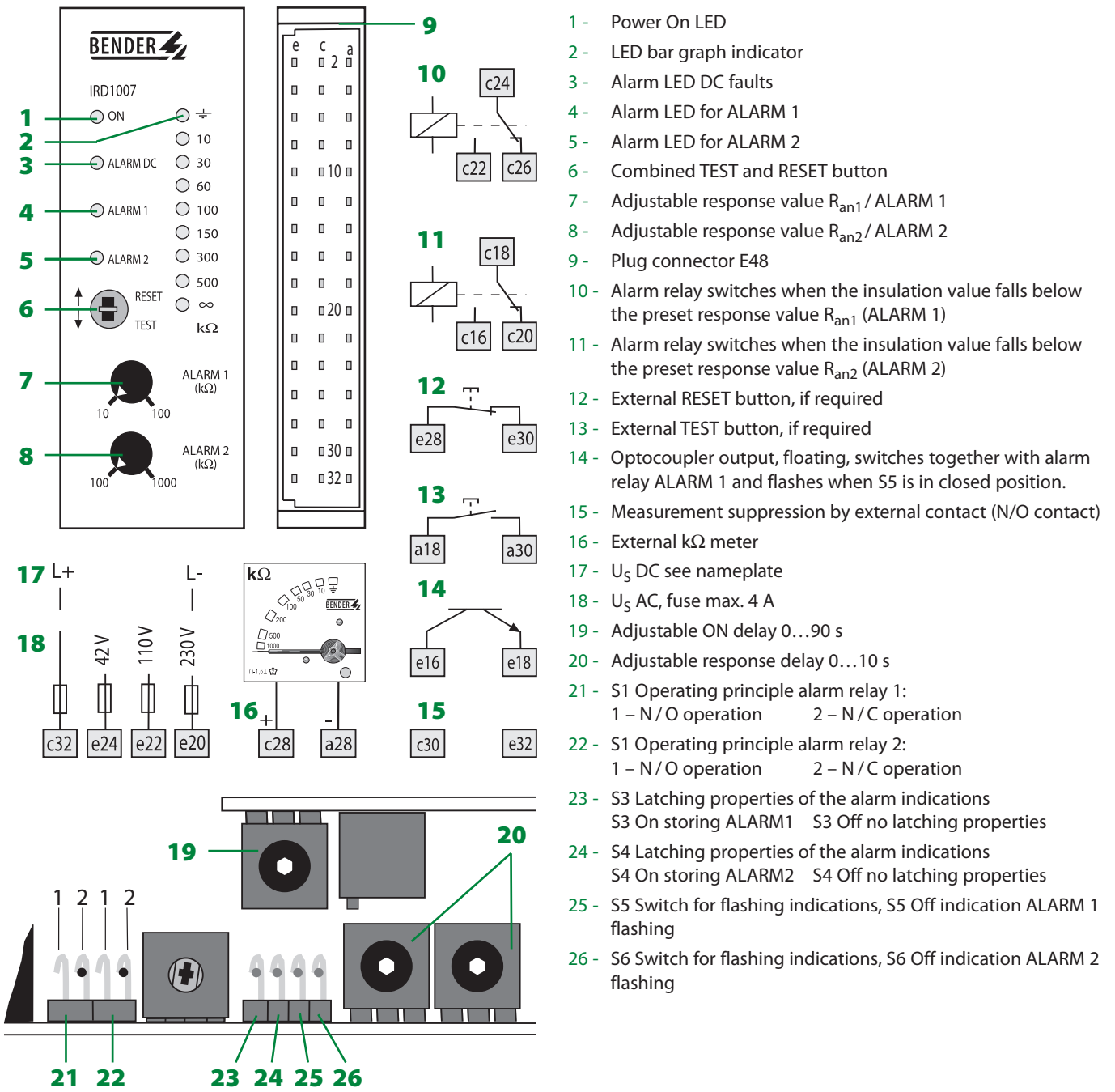


Superimposed DC voltage with reversing stage (see chapter annex – measurement technology).

### Standards

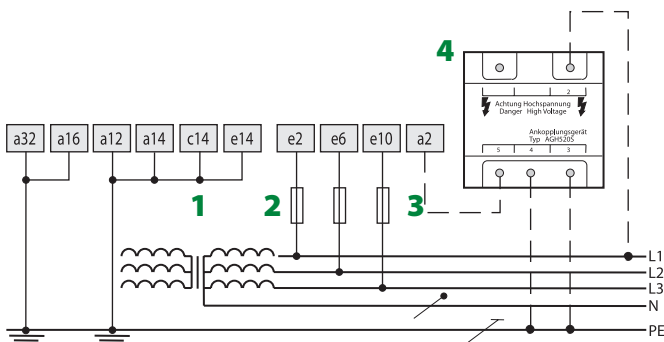
The IRD1007L... series complies with the standards: DIN EN 61557-8 (VDE 0413 part 8): 1998-05; EN 61557-8: 1997-03, IEC 61557-8: 1997-02, ASTM F 1669M-9.

Wiring diagram – operating elements



1.4

### Wiring diagram – system connection



- 1 -  $U_n - 3 / (N) / AC 50 \dots 400 \text{ Hz } 0 \dots 575 \text{ V}$
- 2 - Fuse max. 6 A
- 3 - Connection for coupling device at  $U_n > 575 \text{ V}$
- 4 - AGH520S  $U_n 0 \dots 7200 \text{ V}$

### Response values / measuring circuit

Type	Internal resistance $R_i$	Response value 1 $R_{an1}$	Response value 2 $R_{an2}$	Max. extraneous d.c. voltage $U_{fg}$
IRD1007L-3	$\geq 28 \text{ k}\Omega$	$2 \text{ k}\Omega \dots 20 \text{ k}\Omega$	$20 \text{ k}\Omega \dots 200 \text{ k}\Omega$	$\leq 230 \text{ V}$
IRD1007L-4	$\geq 120 \text{ k}\Omega$	$10 \text{ k}\Omega \dots 100 \text{ k}\Omega$	$100 \text{ k}\Omega \dots 1 \text{ M}\Omega$	$\leq 500 \text{ V}$
IRD1007L-5	$\geq 240 \text{ k}\Omega$	$20 \text{ k}\Omega \dots 200 \text{ k}\Omega$	$200 \text{ k}\Omega \dots 2 \text{ M}\Omega$	$\leq 500 \text{ V}$
IRD1007L-6	$\geq 1.2 \text{ M}\Omega$	$100 \text{ k}\Omega \dots 1 \text{ M}\Omega$	$1 \text{ M}\Omega \dots 10 \text{ M}\Omega$	$\leq 500 \text{ V}$
IRD1007L-7	$\geq 2.8 \text{ M}\Omega$	$200 \text{ k}\Omega \dots 2 \text{ M}\Omega$	$2 \text{ M}\Omega \dots 20 \text{ M}\Omega$	$\leq 500 \text{ V}$

Other supply voltages on request.

### Ordering details

Type	Nominal system voltage $U_n$	Supply voltage $U_S$	Art. No.
IRD1007L-3	AC / 3(N) AC 0...575 V	AC 42 / 110 / 230 V	B 913 571
IRD1007L-4	AC / 3(N) AC 0...575 V	AC 42 / 110 / 230 V	B 913 543
IRD1007L-5	AC / 3(N) AC 0...575 V	AC 42 / 110 / 230 V	B 913 574
IRD1007L-6	AC / 3(N) AC 0...575 V	AC 42 / 110 / 230 V	B 913 587
IRD1007L-7	AC / 3(N) AC 0...575 V	AC 42 / 110 / 230 V	B 913 050

### Accessories

#### External k $\Omega$ measuring instrument

A-ISOMETER®	Type k $\Omega$ measuring instrument	Art. No k $\Omega$ measuring instrument
IRD1007L-3	9604-1321	B 986 796
IRD1007L-4	9604-1421	B 986 764
IRD1007L-5	9604-RB	B 986 792
IRD1007L-6	9604-1621	B 986 782

#### Coupling devices

Type	Nominal system voltage $U_n$	Art. No.
AGH204S-4	AC 0...1650 V / 0...1300 V	B 914 013
AGH520S	AC 0...7200 V	B 913 033

### Technical data A-ISOMETER® IRD1007L...

#### Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 500 V
Rated impulse voltage / pollution degree	4 kV/3

#### Voltage ranges

Nominal system voltage $U_n$	AC, 3(N) AC 0...575 V
Nominal frequency $f_n$	40...460 Hz
Supply voltage $U_S$	AC 230 / 110 / 42 V
Operating range of $U_S$	0.8...1.15 x $U_S$
Frequency range $U_S$	40...460 Hz
Power consumption	$\leq 3 \text{ VA}$

#### Response values

Response value $R_{an1}$ (ALARM1)	see table "response values"
Response value $R_{an2}$ (ALARM2)	see table "response values"
Response time $t_{an}$ at $R_F = 0.5 \times R_{an}$ and $C_e = 1 \mu\text{F}$	Adjustable 0...10 s

#### Measuring circuit

Measuring voltage $U_m$	$\leq 15 \text{ V}$
Measuring current $I_m$ max. (at $R_F = 0 \Omega$ )	$\leq 5.4 \mu\text{A} \dots 536 \mu\text{A}$
Internal d.c. resistance $R_i$	see table "response values"
Internal impedance $Z_i$ at 50 Hz	$> 1 \text{ M}\Omega$
Max. admissible extraneous d.c. voltage $U_{fg}$	230 V (-) / 500 V (-) V
Max. system leakage capacitance $C_e$	1 $\mu\text{F}$

#### Outputs

TEST / RESET button	internal / external
Current output at measuring instrument (scale centre point = $R_i$ )	400 $\mu\text{A}$
Max. load	12.5 k $\Omega$

#### Switching elements

Switching elements	2 x 1 changeover contact
Operating principle	N/O / N/C operation
Factory setting	N/O operation
Electrical endurance	12000 cycles
Contact class	IIB acc. to DIN IEC 60255 part 0-20
Rated contact voltage	AC 250 V / DC 300 V
Making capacity	AC / DC 2 A
Breaking capacity	2 A, AC 230 V, $\cos \phi = 0.4$ 0.2 A, DC 220 V, L/R = 0.04 s

#### General data

Shock resistance acc. to IEC 60068-2-27 (device in operation)	15 g / 6 ms
Bumping acc. to IEC 60068-2-29 (during transport)	40 g / 11 ms
Vibration resistance acc. to IEC 60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance acc. to IEC 60068-2-6 (during transport)	2 g / 10...150 Hz
Ambient temperature, during operation	-10 °C...+60 °C
Storage temperature range	-40 °C...+80 °C
Climatic class according to IEC 60721-3-3	3K5
Operating mode	continuous operation
Mounting	any position
Connection	plug-in connectors E48; DIN 41612
Type of enclosure / dimension diagram	Eurocard 100 x 160 mm 8 TE, E48
Flammability class	UL94V-0
Instruction leaflet	104003
Weight approx.	300 g





**A-ISOMETER® for AC, AC / DC  
or DC systems > 230 V**

e. g. main circuits with variable-speed  
drives, frequency converters, battery  
systems, solar systems and the like

# A-ISOMETER® IRDH275

Insulation monitoring device for unearthed AC, AC / DC and DC systems (IT systems)



IRDH275

## Device characteristics

- Insulation monitoring device for IT AC, AC / DC systems 0...793 V and DC systems 0...650 V
- Nominal voltage extendable via coupling devices
- Two separately adjustable response values 1 kΩ...10 MΩ
- **AMP<sup>Plus</sup>** measuring principle
- Automatic adaptation to the system leakage capacitance
- INFO key for additional information such as device parameters and system leakage capacitance
- Self-monitoring with automatic alarm message
- Automatic device self test, selectable
- Connection for external kΩ indication
- TEST and RESET button
- Connection external TEST / RESET button
- Two separate alarm relays with two voltage-free changeover contacts
- N/O / N/C operation, selectable
- Illuminated plain text display
- RS485 interface

## Certifications



## Product description

The A-ISOMETERs® of the IRDH275 series monitor the insulation resistance of unearthed main circuits (IT systems). AC, AC / DC 0...793 V respectively DC 0...650 V. Thanks to the **AMP<sup>Plus</sup>** measuring principle they particularly meet the requirements of modern power supply systems which often include rectifiers, converters, thyristor-controlled DC drives and directly connected DC components. In these systems often high leakage capacitances against earth occur due to interference suppression measures. The IRDH275 automatically adapts itself to the existing system conditions.

In combination with a coupling device, the device can also be used for higher voltages. Due to a separate supply voltage source it is possible to monitor de-energized systems. For door mounting into distribution panels refer to type IRDH375(B).

## Application

- AC, DC or AC / DC main circuits
- AC / DC main circuits with directly connected DC components such as rectifiers, converters, thyristor-controlled DC components
- UPS systems, battery systems
- Heaters with phase control
- Systems including switched-mode power supply units
- IT systems with high leakage capacitances
- Coupled IT systems

## Function

If the insulation resistance between the system conductors and earth falls below the set response value, the alarm relay switches and the alarm LEDs light up. Two separately adjustable alarm relays allow to distinguish between "prewarning" and "alarm". The measured value is indicated on the LC display or an externally connectable measuring instrument. In this way any changes, e. g. the connection of branch circuits, can easily be detected. The fault message can be stored. The fault memory can be reset by pressing the RESET button. By pressing the TEST button, the function of the device as well as the connections to system and earth can be tested. Pressing the INFO key provides additional information such as the system leakage capacitance or device parameter values.

The function of the device and the system and earth connections are continuously monitored. If a fault occurs, the system fault relay switches and the alarm LED "system fault" lights up. The parameterization of the device can be carried out via the LC display or the function keys integrated in the front plate.

## Additional characteristics IRDH275B

Version IRDH275B includes the following additional functions:

- Historical memory with real-time clock to store all alarm messages with date and time stamp
- Galvanically isolated RS485 interface (BMS protocol) for data exchange with other BENDER devices
- Decoupling relays for internal disconnection of the A-ISOMETER® from the system being monitored; e. g. when several A-ISOMETERs® are interconnected
- Current output (0(4)...20 mA (electrically isolated)

## Application in interconnected IT systems

Only one A-ISOMETER® may be active when several IT systems are interconnected. Decoupling relays and the control inputs F1 / F2 integrated in version IRDH275B guarantee that this requirement will always be met and make them suitable for coupled systems too.

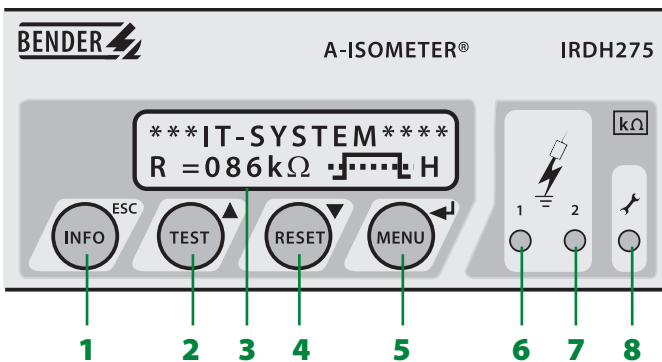
## Measuring principle

**AMP<sup>Plus</sup>** The IRDH275(B) series uses the patented **AMP<sup>Plus</sup>** measuring principle (see chapter annex – measurement technology). This measuring method allows concise monitoring of modern power supply systems also in case of extensive directly connected DC components and high system leakage capacitances.

## Standards

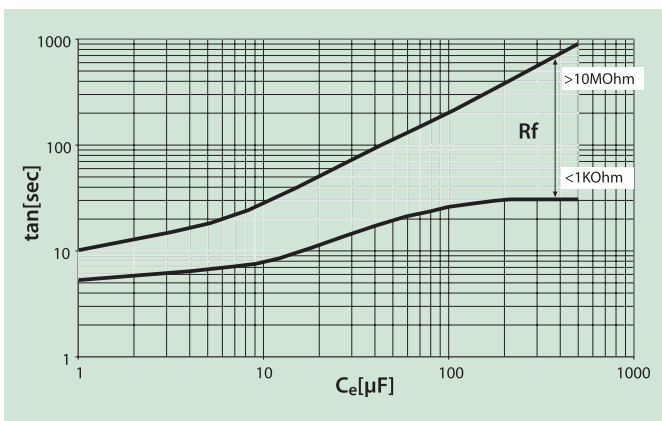
The IRDH275(B) series complies with the standards: DIN EN 61557-8 (VDE 0413 part 8): 1998-05; EN 61557-8: 1997-03, IEC 61557-8: 1997-02, ASTM F 1669M-96, ASTM F 1207M-96.

Operating elements IRDH275



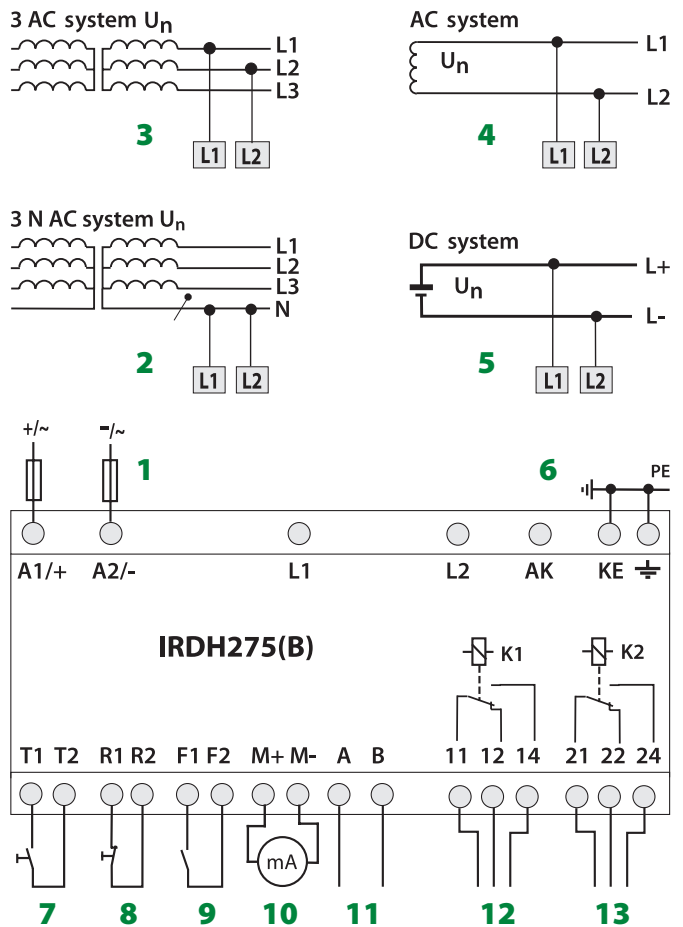
- 1 - INFO key: to query standard information  
ESC key: back to the menu function
- 2 - TEST button: to call up the self test  
Up key: parameter change, scrolling
- 3 - Display
- 4 - RESET button: to delete insulation and fault messages  
Down key: parameter change, scrolling
- 5 - MENU key: to activate the MENU system  
Enter key: confirmation parameter change
- 6 - Alarm LED1 lights up: insulation fault, first warning level reached
- 7 - Alarm LED2 lights up: insulation fault, second warning level reached
- 8 - LED lights: indicating a system fault

Response times



A-ISOMETER® response times in relation to system leakage capacitances:  $C_e = 1 \dots 500 \mu F$ ,  $U_n = 0 \dots 793 V / 50 Hz$

Wiring diagram

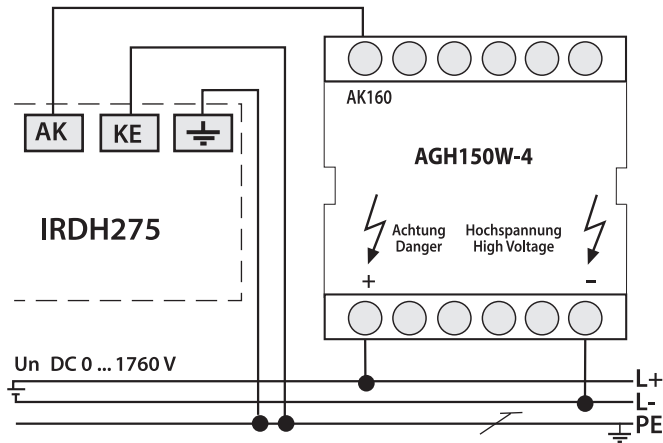


- 1 - Supply voltage  $U_S$  (see ordering details) via 6 A fuse
- 2,3 - Connection of the 3AC system to be monitored; connect the terminals L1, L2 to neutral conductor N or terminals L1, L2 to conductor L1, L2
- 4 - Connection of the AC system to be monitored: connect terminals L1, L2 to conductor L1, L2
- 5 - Connection of the DC system to be monitored: connect terminal L1 to conductor L+, terminal L2 to conductor L-
- 6 - Separate connection of the equipotential conductor to PE and KE
- 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
- 10 - IRDH275: current output, electrically isolated:  $0 \dots 400 \mu A$   
IRDH275B: current output, electrically isolated:  $0 \dots 20 mA$  or  $4 \dots 20 mA$
- 11 - RS485 interface
- 12 - Alarm relay: ALARM 1
- 13 - Alarm relay: ALARM 2 / system fault

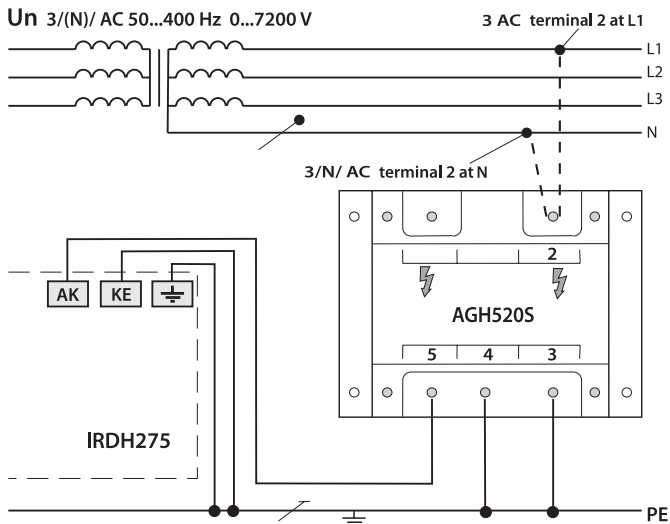
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**Wiring diagrams –  
IRDH275 connected to different types of coupling devices**

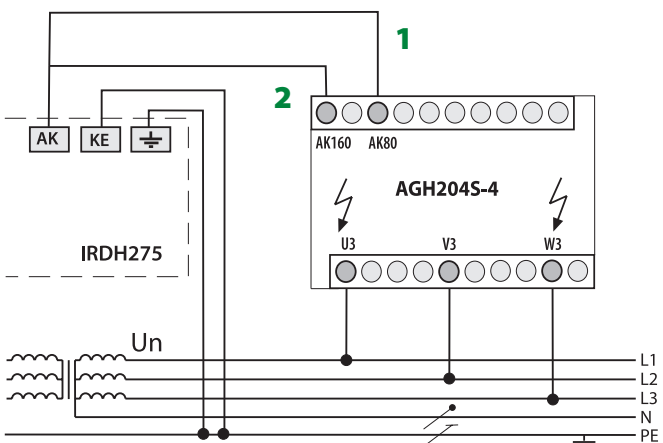
**A-ISOMETER® IRDH275 in combination with coupling device AGH150W-4**



**A-ISOMETER® IRDH275 in combination with coupling device AGH520S**



**A-ISOMETER® IRDH275 in combination with coupling device AGH204S-4**



- 1 - without rectifiers:  $U_n = 3 \text{ AC } 0 \dots 1650 \text{ V}$  (DC max. 1000 V)
- 2 - with rectifiers:  $U_n = 3 \text{ AC } 0 \dots 1300 \text{ V}$  (peak voltage after rectifiers or intermediate circuit max. 1840 V)

**Ordering details A-ISOMETER® IRDH275 and accessories**

**Ordering details A-ISOMETER® IRDH275**

Type	Nominal system voltage $U_n$	Supply voltage $U_s$	Art. No.
IRDH275-435	AC 0...793 V / DC 0...650 V*	AC 88...264 V / DC 77...286 V*	B 9106 5100
IRDH275B-435	AC 0...793 V / DC 0...650 V*	AC 88...264 V / DC 77...286 V*	B 9106 5101
IRDH275-427	AC 0...793 V / DC 0...650 V*	DC 19.2...72 V	B 9106 5104
IRDH275B-427	AC 0...793 V / DC 0...650 V*	DC 19.2...72 V	B 9106 5105

\*absolute values

**Accessories**

**External kΩ measuring instruments 400 μA**

Type	Art. No.
7204-1421	B 986 763
9604-1421	B 986 764

**External kΩ measuring instruments 20 mA**

Type	Art. No.
9620-1421	B 986 841

**Coupling devices**

Type	Nominal system voltage $U_n$	Art. No.
AGH150W-4	DC 0...1760 V	B 9801 8006
AGH204S-4	AC 0...1650 (1300) V	B 914 013
AGH520S	AC 0...7200 V	B 913 033

**Technical data A-ISOMETER®IRDH275**

**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 $U_n$	AC, 3(N) AC 0...793 V, DC 0...650 V
Nominal frequency $f_n$	DC, 0.2...460 Hz
Supply voltage $U_S$	AC 88...264 V, DC 77...286 V
Frequency range $U_S$	20...460 Hz
Power consumption	≤ 14 VA

**Response values**

Response value $R_{an1}$ (ALARM 1)	1 kΩ...10 MΩ
Response value $R_{an1}$ (ALARM 2)	1 kΩ...10 MΩ
Absolute error (1 kΩ...10 kΩ)	+ 2 kΩ
Relative percentage error (10 kΩ...10 MΩ)	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 curve (page 51)
Hysteresis (1 kΩ...10 kΩ) (10 kΩ...10 MΩ)	+ 2 kΩ/25 %

**Measuring circuit**

Measuring voltage $U_m$ (peak value)	± 50 V
Measuring current $I_m$ max. (at $R_F = 0 \Omega$ )	≤ 278 $\mu A$
Internal d.c. resistance $R_i$	≥ 180 kΩ
Internal impedance $Z_i$ at 50 Hz	≥ 180 kΩ
Max. admissible extraneous d.c. voltage $U_{fg}$	≤ 1200 V
System leakage capacitance $C_e$	≤ 500 $\mu F$
Factory setting	150 $\mu F$

**Displays**

Display, illuminated	two-line display
Characters (number of characters, height)	2 x 16 characters / 4 mm
Display range, measuring value	1 kΩ ... 10 MΩ
Absolute error (1 kΩ...10 kΩ)	± 1 kΩ
Relative percentage error (10 kΩ...10 MΩ)	± 10 %

**Outputs**

TEST / RESET button	internal / external
Current output at measuring instrument	120 kΩ
Max. load	400 $\mu A$ (12.5 kΩ)
Max. load B-version	20 mA (500 Ω)

**Serial interfaces**

IRDH275	RS485 / ASCII
IRDH275B	RS485 / BMS
Max. cable length	1200 m
Recommended cable (screened, screen on one side connected to PE)	J-Y(ST)Y 2 x 0.6
Terminating resistor	120 Ω (0.5 W)

**Switching elements**

Switching elements	2 x 1 changeover contact
Operating principle	N/O / N/C operation
Factory setting	N/O operation
Electrical endurance	12000 cycles
Contact class	IIB acc. to DIN IEC 60255 part 0-20
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**

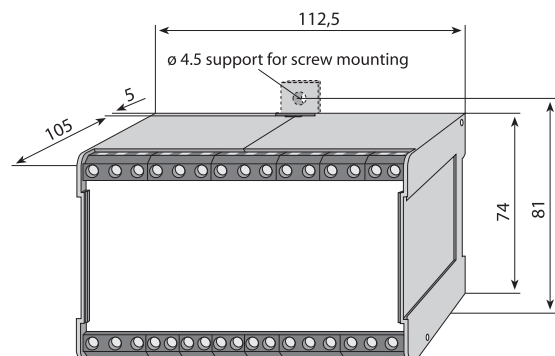
Shock resistance acc. to IEC 60068-2-27 (device in operation)	15 g / 11 ms
Bumping acc. to IEC 60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance acc. to IEC 60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance acc. to IEC 60068-2-6 (during transport)	2 g / 10...150 Hz
Ambient temperature, during operation	- 10 °C...+ 55 °C
Storage temperature range	- 40 °C...+ 70 °C
Climatic class according to IEC 60721-3-3	3K5
Operating mode	continuous operation
Mounting	as indicated on the display
Connection	plug-in terminals
Wire cross section, rigid, flexible	0.2...4 mm <sup>2</sup> / 0.2...2.5 mm <sup>2</sup>
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
DIN rail mounting according to	DIN EN 60715 / IEC 60715
Screw mounting, adaptor 990056	2 x M4
Flammability class	UL94V-0
Weight approx.	510 g

**Option „W“**

Shock resistance acc. to IEC 60068-2-27 (device in operation)	30 g / 11 ms
Bumping acc. to IEC 60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance acc. to IEC60068-2-6	1.6 mm / 10...25 Hz, 4 g / 25...150 Hz
Ambient temperature, during operation	- 25 °C...+ 70 °C
Storage temperature range	- 40 °C...+ 85 °C

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**Dimension diagram, enclosure XM112** Dimensions in mm



## A-ISOMETER® IRDH375

Insulation monitoring device for unearthed AC, AC / DC and DC systems (IT systems)



A-ISOMETER® IRDH375

### Device characteristics

- Insulation monitoring device for IT AC, AC/DC systems 0...793 V and DC systems 0...650 V
- Nominal voltage extendable via coupling devices
- Two separately adjustable response values 1 kΩ...10 MΩ
- **AMP<sup>Plus</sup>** measuring principle
- Automatic adaptation to the system leakage capacitance
- INFO key for additional information such as device parameters and system leakage capacitance
- Continuous self-monitoring with automatic alarm message
- Automatic device self test, selectable
- Connection for external kΩ indication
- TEST and RESET button
- Connection external TEST / RESET button
- Two separate alarm relays with two voltage-free changeover contacts
- N/O / N/C operation, selectable
- Alarm relay for system fault (N/C operation)
- Illuminated plain text display
- RS485 interface
- Plug-in connection terminals

### Certifications



### Product description

The A-ISOMETERs® of the IRDH375 series monitor the insulation resistance of unearthed main circuits (IT systems). AC, AC / DC 0...793 V respectively DC 0...650 V. Thanks to the **AMP<sup>Plus</sup>** measuring principle they particularly meet the requirements of modern power supply systems which often include rectifiers, converters, thyristor-controlled DC drives and directly connected DC components. In these systems often high leakage capacitances against earth occur due to interference suppression measures. The IRDH375(B) automatically adapts itself to the existing system conditions.

In combination with a coupling device, the devices can also be used for higher voltages. A separate supply voltage source makes it possible to monitor de-energized systems.

### Application

- AC, DC or AC / DC main circuits
- AC / DC main circuits with directly connected DC components such as rectifiers, converters or thyristor-controlled DC drives
- UPS systems, battery systems
- Heaters with phase control
- Systems including switched-mode power supply units
- IT systems with high leakage capacitances
- Coupled IT systems

### Function

If the insulation resistance between the system conductors and earth falls below the set response value, the alarm relay switches and the alarm LEDs light up. Two separately adjustable alarm relays allow to distinguish between “prewarning” and “alarm”. The measured value is indicated on the LC display or an externally connectable measuring instrument. In this way any changes, e. g. the connection of branch circuits, can easily be detected. The fault message can be stored. The fault memory can be reset by pressing the RESET button. By pressing the TEST button, the function of the device as well as the connections to system and earth can be tested. Pressing the INFO key provides additional essential information such as the system leakage capacitance or device parameter values.

The function of the device and the system and earth connections are continuously monitored. If a fault occurs, the system fault relay switches and the alarm LED “system fault” lights up. The parameterization of the device can be carried out via the LC display or the function keys integrated in the front plate.

### Additional characteristics IRDH375B

Version IRDH375B includes the following additional functions:

- Historical memory with real-time clock to store all alarm messages with date and time stamp
- Electrically isolated RS485 interface (BMS protocol) for data exchange with other BENDER devices
- Decoupling relays for internal disconnection of the A-ISOMETER® from the system being monitored; e. g. when several A-ISOMETERs® are interconnected
- Current output 0 (4)...20 mA

### Application in interconnected IT systems

Due to decoupling relays and the control inputs F1 / F2 version IRDH375B can also be used in coupled IT systems. That ensures that only one A-ISOMETER® is active.

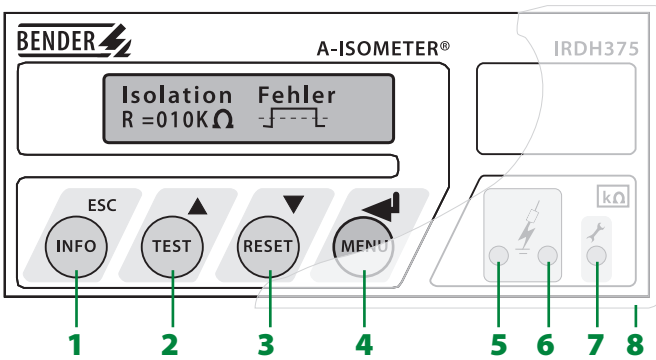
### Measuring principle

**AMP<sup>Plus</sup>** The IRDH375(B) series uses the patented **AMP<sup>Plus</sup>** measuring principle (see chapter annex – measurement technology). This measuring method allows concise monitoring of modern power supply systems also in case of extensive directly connected DC components and high system leakage capacitances.

### Standards

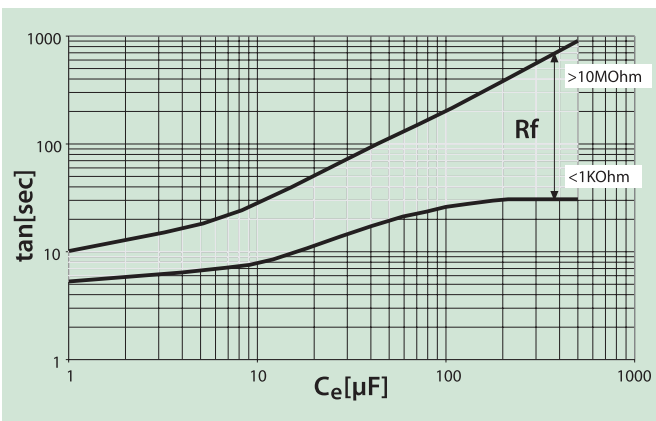
The IRDH375(B) series complies with the standards: DIN EN 61557-8 (VDE 0413 part 8): 1998-05; EN 61557-8: 1997-03; IEC 61557-8: 1997-02, ASTM F 1669M-96.

Operating elements IRDH375

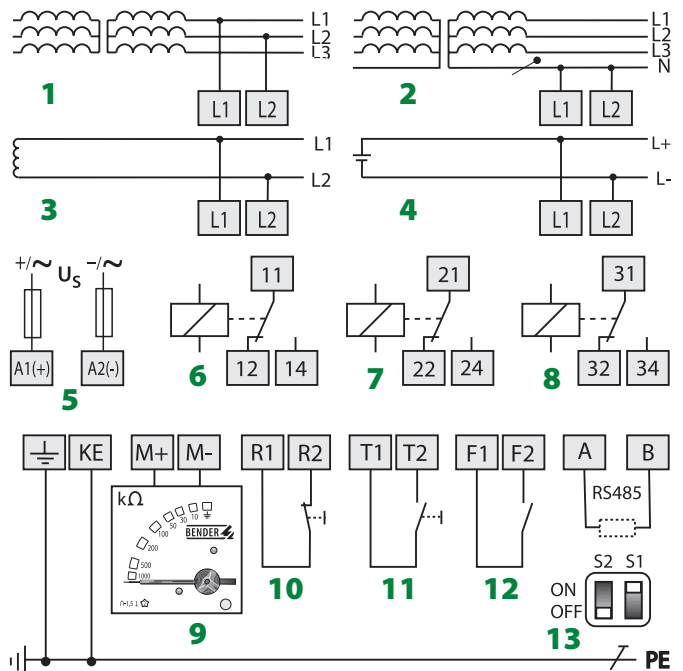


- 1 - INFO key: to query standard information  
ESC key: back to the menu function
- 2 - TEST button: to call up the self test  
Up key: parameter change, scrolling
- 3 - RESET button: to delete insulation and fault messages  
Down key: parameter change, scrolling
- 4 - MENU key: to activate the MENU system  
Enter key: confirmation parameter change
- 5 - Alarm LED1, yellow, lights up when the value falls below  $R_{ALARM1}$
- 6 - Alarm LED2, yellow, lights up when the value falls below  $R_{ALARM2}$
- 7 - Alarm LED, yellow, lights up in case of of connection fault system/earth and system fault
- 8 - Front plate with transparent cover (accessory)

Response times

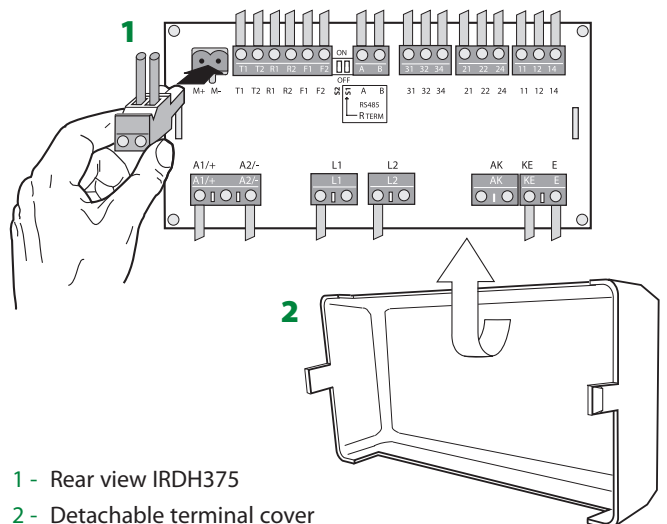


Wiring diagram



- 1 - 3 AC system
- 2 - 3N AC system
- 3 - AC system
- 4 - DC system
- 5 - Supply voltage  $U_s$  (see ordering details) via 6 A fuse
- 6 - Alarm relay  $R_{ALARM1}$
- 7 - Alarm relay  $R_{ALARM2}$
- 8 - Alarm relay system fault
- 9 - External  $k\Omega$  indication 0...400  $\mu A$  or current output 0 (4)...20 mA (option)
- 10 - External RESET button (NC contact or wire jumper), when the terminals R1 / R2 are open, the fault message will not be stored
- 11 - External TEST button, if required
- 12 - Measurement suppression, measurement is not active with the contact in closed position, system decoupling (option)
- 13 - DIP switch, S1 "on" – RS485 terminated (120  $\Omega$  on), S2 unassigned

Wiring diagram rear view IRDH375

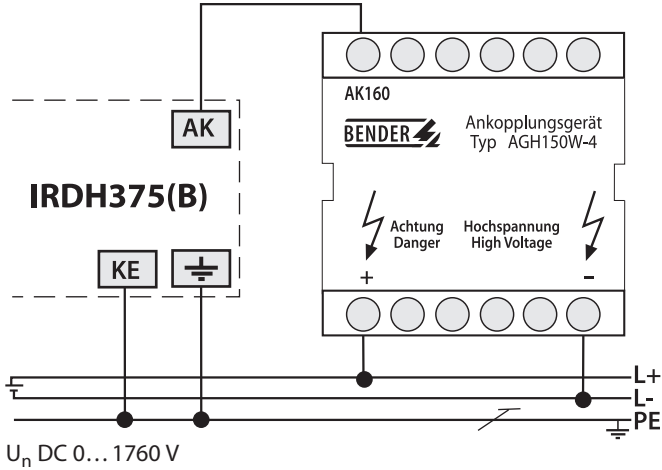


- 1 - Rear view IRDH375
- 2 - Detachable terminal cover

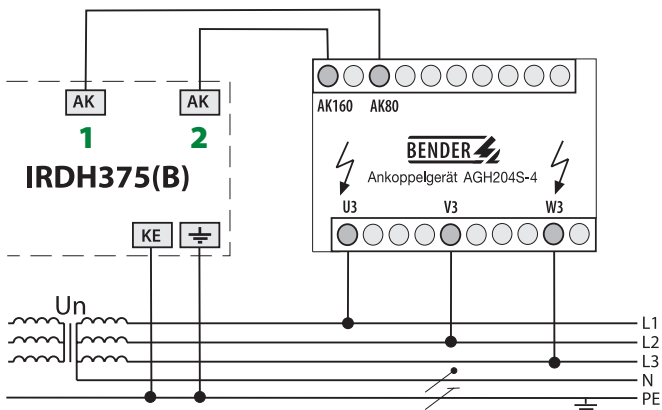
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**Wiring diagrams –  
IRDH375 connected to different types of coupling devices**

**A-ISOMETER® IRDH375 in combination with coupling device AGH150W-4**

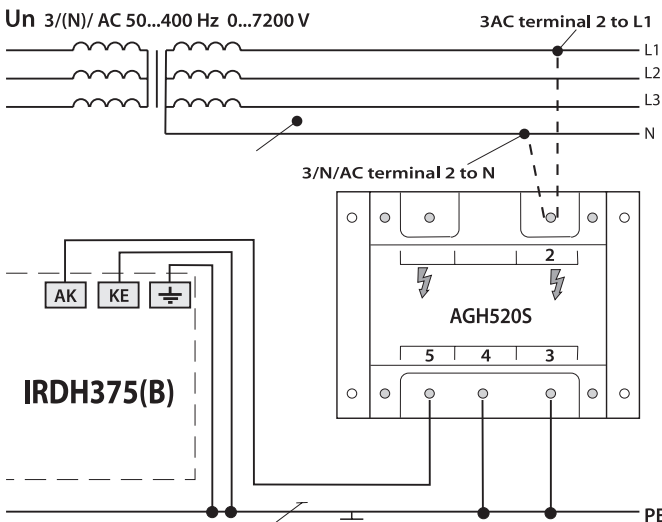


**A-ISOMETER® IRDH375 in combination with coupling device AGH204S-4**



- 1 - without rectifiers  $U_n = 3$  AC 0...1650 V
- 2 - with rectifiers  $U_n = 3$  AC 0...1300 V  
(rectifiers or intermediate circuit max. DC 1840 V)

**A-ISOMETER® IRDH375 in combination with coupling device AGH520S**



**Ordering details**

Type	Nominal system voltage $U_n$	Supply voltage $U_s$	Art. No.
IRDH375-435	AC 0...793 V / DC 0...650 V*	AC 88...264 V / DC 77...286 V*	B 9106 5000
IRDH375-427	AC 0...793 V / DC 0...650 V*	DC 19.2...72 V*	B 9106 5002
IRDH375B-435	AC 0...793 V / DC 0...650 V*	AC 88...264 V / DC 77...286 V*	B 9106 5004
IRDH375B-427	AC 0...793 V / DC 0...650 V*	DC 19.2...72 V*	B 9106 5006

\* Absolute values

**Accessories**

**External kΩ measuring instruments (400 μA)**

Type	SKMP*2)	Art. No.
7204-1421	120 kΩ	B 986 763
9604-1421	120 kΩ	B 986 764

\*2) SKMP = scale centre point

**External kΩ measuring instruments 20 mA**

Type	Art. No.
9620-1421	B 986 841

**Transparent front plate cover IP65**

Type	Art. No.
144 x 72	B 9806 0005

**Coupling devices**

Type	Nominal system voltage $U_n$	Art. No.
AGH150W-4	DC 0... 1760 V	B 9801 8006
AGH204S-4	AC 0...1300 V / 0...1650 V	B 914 013
AGH520S	AC 0...7200 V	B 913 033



**Technical data A-ISOMETER®IRDH375**

**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 $U_n$	AC, 3(N)AC 0...793 V, DC 0...650 V
Nominal frequency $f_n$	DC, 0.2...460 Hz
Supply voltage $U_S$	see ordering details
Frequency range $U_S$	20...460 Hz
Power consumption	≤ 14 VA

**Response values**

Response value $R_{an1}$ (ALARM1)	1 kΩ...10 MΩ
Response value $R_{an1}$ (ALARM2)	1 kΩ...10 MΩ
Absolute error (1 kΩ...10 kΩ)	+ 2 kΩ
Relative percentage error (10 kΩ...10 MΩ)	0%...+ 20%
Measuring time	see characteristic curves (page 55)
Hysteresis (1 kΩ...10 kΩ) (10 kΩ...10 MΩ)	+ 2 kΩ / 25%

**Measuring circuit**

Measuring voltage $U_m$	≤ 40 V
Measuring current $I_m$ max. (at $R_f = 0 \Omega$ )	≤ 220 μA
Internal d.c. resistance $R_i$	≥ 180 kΩ
Internal impedance $Z_i$ at 50 Hz	≥ 180 kΩ
Max. admissible extraneous d.c. voltage $U_{fg}$	≤ 1200 V
System leakage capacitance $C_e$	≤ 500 μF
Factory setting	150 μF

**Displays**

Display, illuminated	two-line display
Characters (number of characters, height)	2 x 16 characters / 5 mm
Display range, measuring value	1 kΩ...10 MΩ
Absolute error (1 kΩ...10 kΩ)	± 1 kΩ
Relative percentage error (10 kΩ...10 MΩ)	± 10%

**Outputs**

TEST / RESET button	internal / external
Current output at measuring instrument	scale centre point 120 kΩ
Max. load	400 μA (12.5 kΩ)
Max. load B-version	20 mA (500 Ω)

**Serial interfaces**

IRDH375	RS485 / ASCII
IRDH375B	RS485 / BMS
Max. cable length	1200 m
Recommended cable (screened, screen on one side connected to PE)	J-Y(ST)Y 2 x 0.6
Terminating resistor	120 Ω (0.5 W)

**Switching elements**

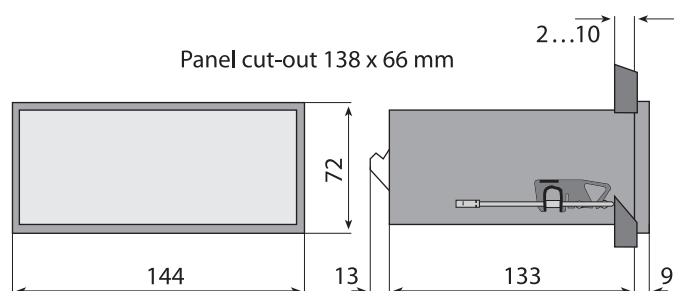
Switching elements	3 x 1 changeover contact
Operating principle	N/O / N/C operation
Factory setting	N/O operation
Electrical endurance	12000 cycles
Contact class	IIB acc. to DIN IEC 60255 part 0-20
Rated contact voltage	AC 250 V / DC 300 V
Making capacity	AC/DC 5 A
Breaking capacity	2 A, AC 230 V, cos 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**

Shock resistance acc. to IEC 60068-2-27 (device in operation)	15 g / 11 ms
Bumping acc. to IEC 60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance acc. to IEC 60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance acc. to 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 according to IEC 60721-3-3	3K5
Operating mode	continuous operation
Mounting	any position
Connection	plug-in terminals
Wire cross section, rigid, flexible	0.2...4 mm <sup>2</sup> / 0.2...2.5 mm <sup>2</sup>
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Flammability class	UL94V-1
Instruction leaflet	technical manual 1352
Weight approx.	650 g

**1.5**

**Dimension diagram, enclosure X300** Dimensions in mm



## A-ISOMETER® IR1575

Insulation monitoring device for  
AC / 3(N) AC systems up to 480 V  
and DC systems up to 480 V



A-ISOMETER® IR1575

### Device characteristics

- Insulation monitoring for unearthed systems (IT systems)  
AC, AC/DC 0...480 V, DC 0...480 V
- Two separately adjustable response values 2 k $\Omega$ ...1 M $\Omega$
- AMP measuring principle
- Automatic adaptation to the system leakage capacitance
- Alarm LEDs for ALARM 1 and ALARM 2
- Fault memory, selectable
- Connection monitoring system / earth
- TEST and RESET button
- Connection external TEST, RESET button
- Two separate alarm relays with one voltage-free changeover contact each
- N/O or N/C operation, selectable
- Illuminated clear text display
- Self monitoring with automatic alarm message
- Plug-in connection terminals
- Enclosure for door mounting, 96 x 96 mm

### Product description

A-ISOMETERs® of the series IR1575 monitor the insulation resistance of unearthed AC systems (IT systems) AC / 3(N) AC 0...480 V resp. DC systems of 0...480 V.

Thanks to the AMP measuring principle, they can be used in systems containing directly connected DC components. For optimization of the measuring time, the IR1575 automatically adapts itself to the existing leakage capacitances. Separate supply voltage allows monitoring of deenergized systems.

Please note that the frequency range of the IR1575 is limited to DC, 30...420 Hz. For application in systems containing variable-speed drives, we recommend to use the IRDH275 / 375 series.

### Application

- AC or AC / DC main circuits
- AC / DC main circuits with directly connected DC components
- UPS systems, battery systems
- Heaters with phase control
- Systems with switched-mode power supplies

### Function

When the insulation resistance between the system conductors and earth falls below the set response value, the alarm relays switch and the alarm LEDs light up. Two separately adjustable response values resp. alarm relays allow to distinguish between prewarning and alarm. The measured value is indicated on the LC display. The fault messages can be stored. The fault memory can be reset by pressing the RESET button. By pressing the TEST button, the function of the device and the connection to the system and earth can be tested. When a fault occurs during this test, it will be signalled by alarm relay K2. The parameterization of the device can be carried out via the LC display and the function keys integrated in the front plate.

### Measuring principle

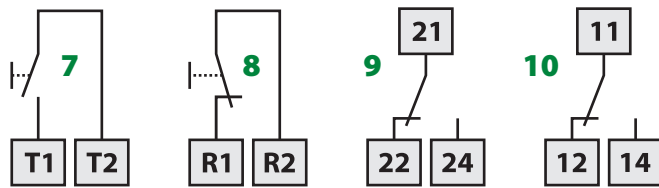
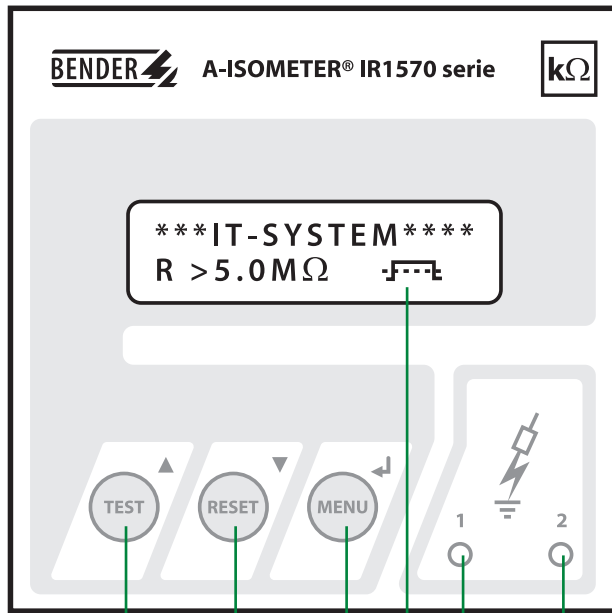


AMP measuring principle (see chapter annex – measurement technology).

### Standards

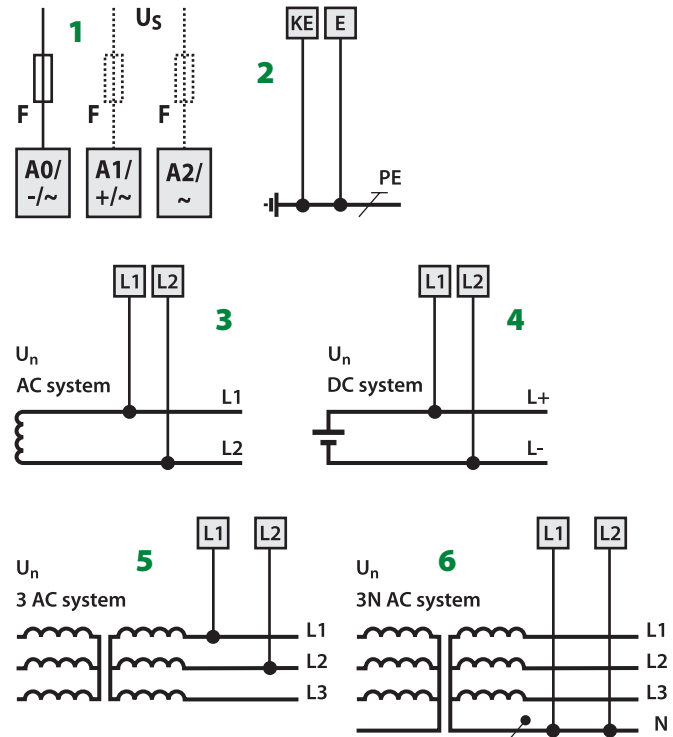
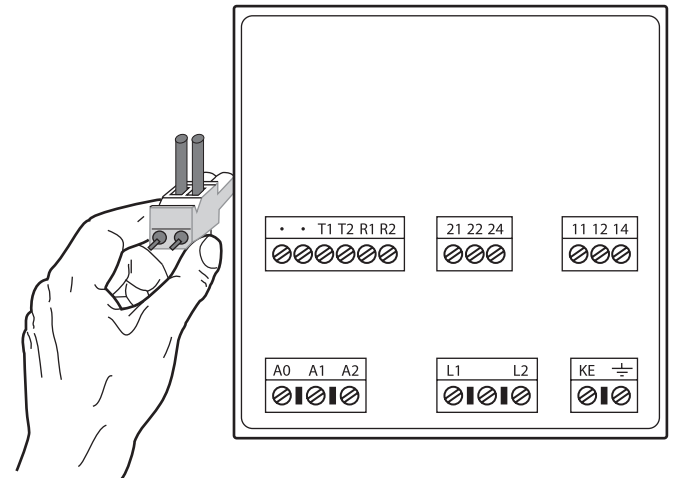
The IR1575 series complies with the standards: DIN EN 61557-8 (VDE 0413 part 8), EN 61557-8:1997-03, IEC 61557-8:1997-02, ASTM F 1669M-96.

Wiring diagram – Operating elements



- 1 - TEST button: to call up the self test  
Up key: parameter change, scrolling
- 2 - RESET button: to delete insulation and fault messages  
Down key: parameter change, scrolling
- 3 - MENU button: to activate the menu system  
Enter key: confirmation, parameter change
- 4 - Double-line 16 character display, illuminated
- 5 - Alarm-LED 1 lights up: insulation fault, first warning level reached
- 6 - Alarm-LED 2 lights up: insulation fault, second warning level reached or system fault
- 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, factory setting: memory off!
- 9 - Alarm relay: Alarm 2
- 10 - Alarm relay: Alarm 1

Wiring diagram – connection to the power supply



- 1 - Supply voltage  $U_s$  (see nameplate) via 6 A fuse:  
Terminal A0 / A1: AC 88...264 V, DC 77...286 V  
Terminal A0 / A2: AC 340...460 V
- 2 - Separate connection of E and KE to PE
- 3 - Connection of the AC system to be monitored:  
connect terminal L1, L2 to conductor L1, L2
- 4 - Connection of the DC system to be monitored:  
connect terminal L1 to conductor L+,  
terminal L2 to conductor L-
- 5,6 - Connection of the 3 AC system to be monitored:  
connect terminals L1, L2 to neutral conductor N or terminals  
L1, L2 to conductor L1, L2

1.5

## Technical data IR1575

Insulation coordination acc. to IEC 60664-1	
Rated voltage	AC 500 V
Rated impulse voltage / pollution degree	4 kV / 3
Voltage range	
Nominal voltage range $U_n$	AC, 3(N) AC 0...480 V, DC 0...480 V
Nominal frequency $f_n$	30...420 Hz
Supply voltage $U_S$	see ordering details
Power consumption	≤ 5 VA
Response values	
Response value $R_{an1}$ (ALARM 1)	2 kΩ...1 MΩ
Response value $R_{an2}$ (ALARM 2)	2 kΩ...1 MΩ
Relative percentage error	0...+20% / min. +2 kΩ
Response time $t_{an}$ $R_F = 0,5 \times R_{an}$ and $C_e = 1 \mu F$	≤ 5 s
Measuring time	see characteristic curve
Hysteresis	25%
Measuring circuit	
Measuring voltage $U_m$	± 20 V
Measuring current $I_m$ max. (at $R_F = 0 \Omega$ )	≤ 170 μA
Internal DC resistance $R_i$	≥ 119 kΩ
Internal impedance $Z_i$ at 50 Hz	≥ 14 kΩ
Permissible extraneous DC voltage $U_{fg}$	DC 680 V
Permissible system leakage capacitance $C_e$	60 μF
Displays	
Display, illuminated	double-line display
Characters (number of)	2 x 16 (4.5 mm)
Display range, measuring value	1 kΩ...5 MΩ
Absolute error (1 kΩ...10 kΩ)	± 1 kΩ
Relative percentage error (10 kΩ...5 MΩ)	± 10%
Outputs	
TEST / RESET button	internal / external

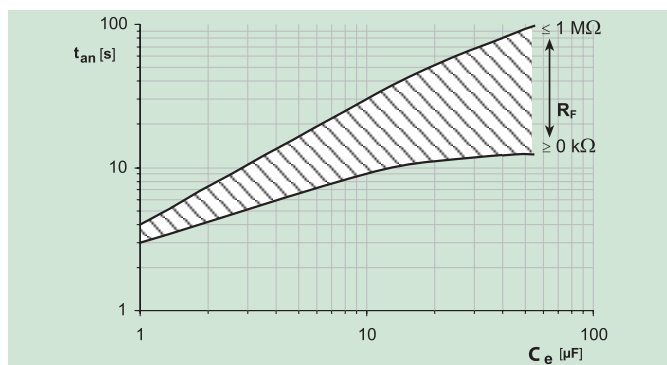
## Switching elements

Switching elements	2 x 1 changeover contacts
Operating principle	N / O or N / C operation
Factory setting (Alarm1 / Alarm2)	N / O operation
Contact class	IIB (IEC 60255-0-20)
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

Shock resistance IEC60068-2-27 (device in operation)	15 g / 11 ms
Bumping IEC60068-2-29 (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 DIN IEC 60721-3-3	3K5
Operating mode	continuous operation
Mounting	as indicated on the display
Connection	screw terminals
Connection, rigid / flexible	0.2...4 / 0.2...2.5 mm <sup>2</sup>
Connection, flexible with connector sleeve, without / with plastic sleeve	0.25...2.5 mm <sup>2</sup>
Conductor sizes (AWG)	24...12
Tightening torque, terminal screws	0.5...0.6 Nm (4.3...5.3 lb-in)
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Type of enclosure	panel mounting
Flammability class	UL94V-2
Weight approx.	400 g

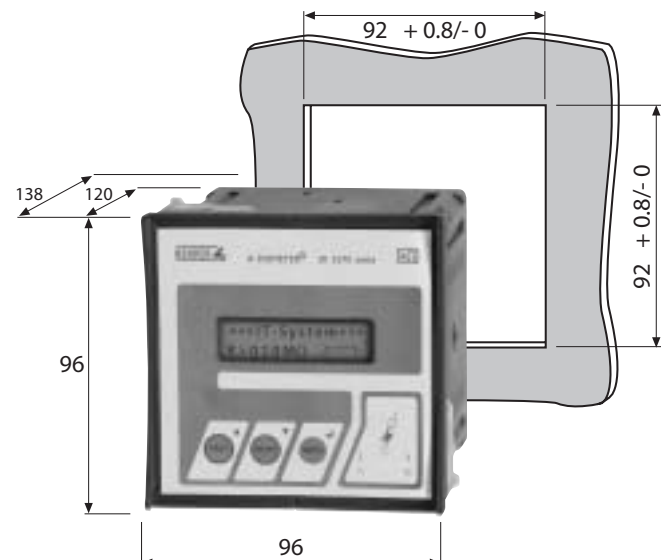
## Response times



## Ordering details

Type	Supply voltage $U_S$	Art.-No.
IR1575-435	AC 88...264 V / DC 77...286 V / AC 340...460 V	B 9106 4000
IR1575W-435		B 9106 4000W

## Dimension diagram, enclosure Dimensions in mm





## A-ISOMETER® IRDH1065B-4...

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems)



IRDH1065B-4..

### Device characteristics

- Insulation monitoring device for IT AC, AC/DC and DC systems 0...575 V
- Nominal voltage extendable via coupling devices
- Two separately adjustable response values 10 kΩ...990 kΩ
- AMP measuring principle
- Automatic adaptation to the system leakage capacitance
- Automatic device self test, selectable
- Connection for external kΩ indication
- Current output 0(4)...20 mA / 0...400 μA
- Combined TEST and RESET button
- Connection external TEST / RESET button
- Two separate alarm relays with two voltage-free changeover contacts
- N/O / N/C operation, selectable
- Alarm relay for system fault indication (N/C operation)
- Illuminated plain text display
- RS485 interface

### Product description

The A-ISOMETERS® of the IRDH1065B-... series monitor the insulation resistance of unearthed main circuits (IT systems). AC, AC/DC and DC 0...575 V. Thanks to the AMP measuring principle they particularly meet the requirements of modern power supply systems which often include rectifiers, converters, thyristor-controlled DC drives and directly connected DC components. In these systems often high leakage capacitances against earth occur due to interference suppression measures. The IRDH1065B-... automatically adapts itself to the existing system conditions.

In combination with a coupling device, the devices can also be used for higher voltages. A separate supply voltage source allows monitoring of de-energized systems.

### Application

- AC, DC or AC/DC main circuits
- AC/DC main circuits with directly connected DC components such as rectifiers, converters or thyristor-controlled DC drives
- UPS systems, battery systems
- Heaters with phase control
- Systems including switched-mode power supply units
- IT systems with high leakage capacitances
- Coupled IT systems

### Function

If the insulation resistance between the system conductors and earth falls below the set response value, the alarm relays switch and the alarm LEDs light up. Two separately adjustable response values resp. alarm relays allow to distinguish between "prewarning" and "alarm". The measured value is indicated on the LC display or an externally connectable measuring instrument. In this way any changes, e. g. the connection of branch circuits, can easily be detected. The fault message can be stored. The fault memory can be reset by pressing the RESET button. By pressing the TEST button, the function of the device as well as the connections to system and earth can be tested. The optocoupler output switches with alarm relay ALARM 1.

The function of the device and the system and earth connections are continuously monitored. If a fault occurs, the alarm LEDs 1 and 2 flash. The parameterization of the device can be carried out via the LC display or the function keys integrated in the front plate.

### Measuring principle

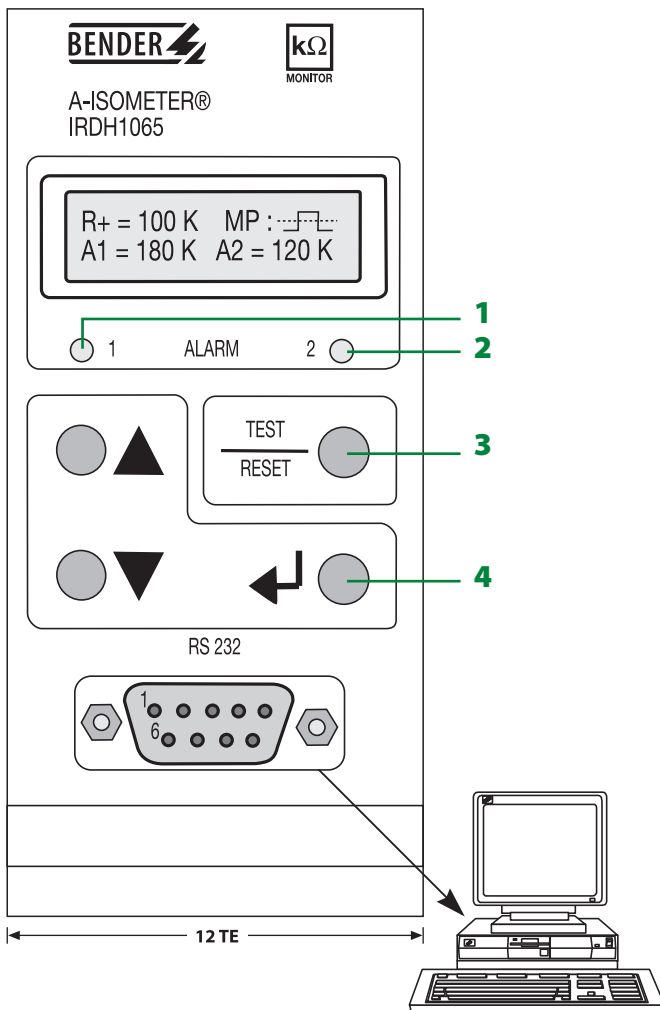


The IRDH1065B-4... series uses the patented AMP measuring principle (see chapter annex – measurement technology). This measuring method allows concise monitoring of modern power supply systems also in case of extensive directly connected DC components and high system leakage capacitances.

### Standards

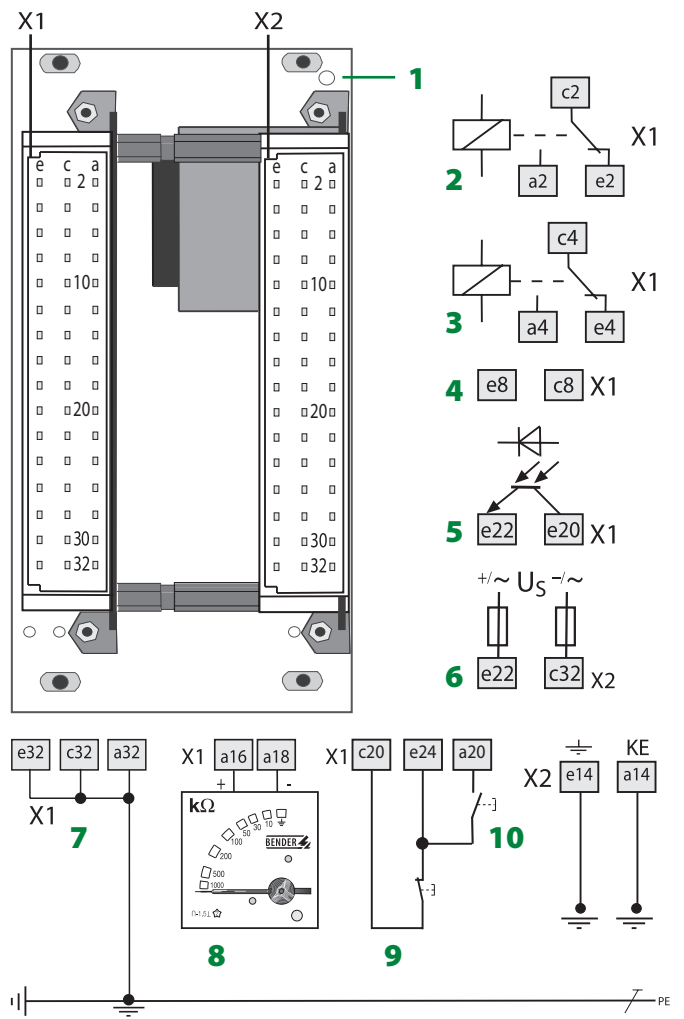
The IRDH1065B-4... series complies with the standards: DIN EN 61557-8 (VDE 0413 Teil 8): 1998-05; EN 61557-8: 1997-03, IEC 61557-8: 1997-02, ASTM F 1669M-96.

Operating elements IRDH1065B-...



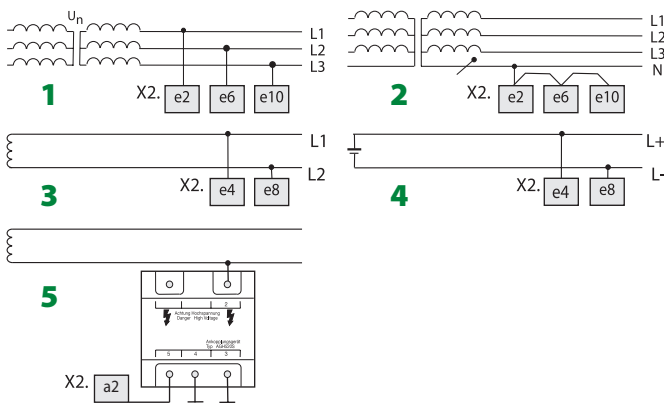
- 1 - Alarm LED 1, yellow, lights up when the value falls below  $R_{ALARM1}$
- 2 - Alarm LED 2, yellow, lights up when the value falls below  $R_{ALARM2}$
- 3 - Combined TEST / RESET button, short-time pressing (< 1 s) = RESET, long-time pressing (> 2 s) = TEST
- 4 - Function keys

Wiring diagram



- 1 - Rear view IRDH1065B-4...
- 2 - Alarm relay  $R_{an1}$  (ALARM1)
- 3 - Alarm relay  $R_{an2}$  (ALARM2)
- 4 - RS485 interface (electrically isolated)
- 5 - Optocoupler output
- 6 -  $U_5$  see ordering details, 6 A fuse
- 7 - Front panel earth connection
- 8 - Current output 0(4)...20 mA, 0...400  $\mu$ A
- 9 - External RESET button (NC contact or wire jumper), when the terminals LT are open, the fault message will not be stored
- 10 - External TEST button, if required

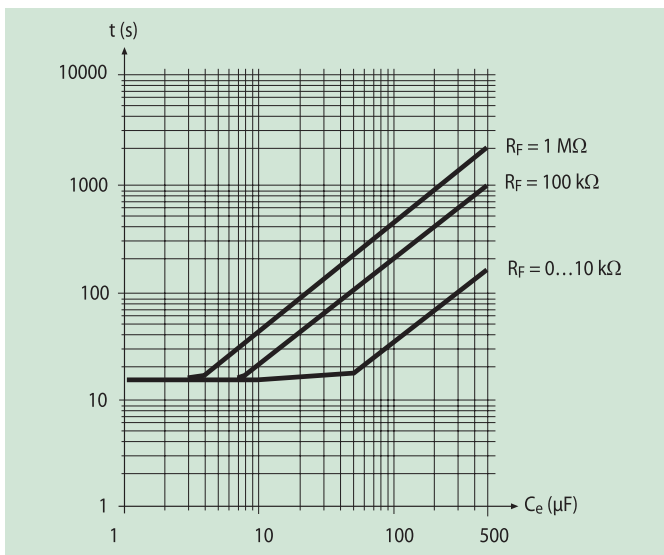
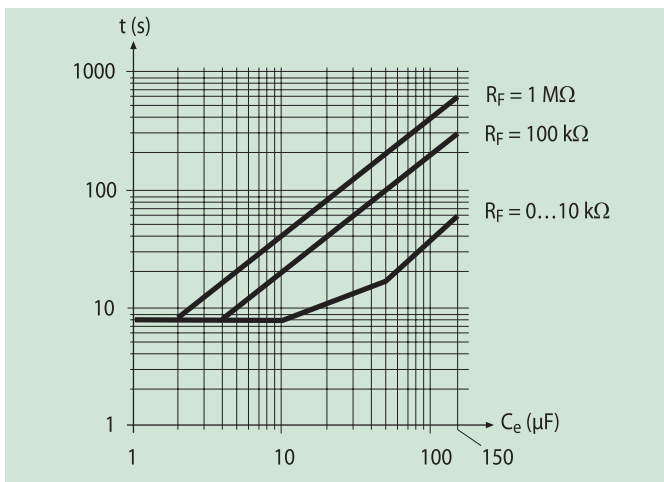
Wiring diagram – system connection



- 1 - 3 AC system
- 2 - 3N AC system
- 3 - AC system
- 4 - DC system
- 5 - 3 AC / DC > 575 V with coupling device: AGH520S AC 0...7200 V, AGH204S-4 AC 0...1650 V or AGH150W-4 DC 0...1760 V

1.5

## Response times



## Ordering details

Type	Nominal system voltage $U_n$	Supply voltage $U_S$	Art. No.
IRDH1065B-4	AC/DC 0...575 V	AC 230 V	B 9106 8033
IRDH1065B-425	AC/DC 0...575 V	DC 18...36 V*	B 9106 8028

Other voltages on request

\*Absolute values

## Accessories

### External kΩ measuring instruments

Type	Art. No.
7204-1421	B 986 763
9604-1421	B 986 764

### Coupling devices

Type	Nominal system voltage $U_n$	Art. No.
AGH150W-4	DC 0...1760 V	B 9801 8006
AGH204S-4	AC 0...1300 V / 0...1650 V	B 914 013
AGH520S	AC 0...7200 V	B 913033

## Technical data A-ISOMETER® IRDH1065B-4...

### Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 500 V
Rated impulse voltage / pollution degree	4 kV/3

### Voltage ranges

Nominal system voltage $U_n$	AC, 3(N) AC 0...575 V, DC 0...575 V
Nominal frequency $f_n$	DC, 1...460 Hz
Supply voltage $U_S$	AC 230 V
Operating range of $U_S$	0.8...1.15 x $U_S$
Frequency range $U_S$	40...460 Hz
Power consumption	≤ 10 VA

### Response values

Response value $R_{an1}$ (ALARM1)	10 kΩ...990 kΩ
Response value $R_{an2}$ (ALARM2)	10 kΩ...990 kΩ
Response time $t_{an}$ at $R_f = 0.5 \times R_{an}$ and $C_e = 1 \mu F$	approx. 6 s / see curves response times

### Measuring circuit

Measuring voltage $U_m$	≤ 27 V
Measuring current $I_m$ max. (at $R_f = 0 \Omega$ )	≤ 225 $\mu A$
Internal d.c. resistance $R_i$	≥ 120 kΩ
Internal impedance $Z_i$ at 50 Hz	≥ 250 kΩ
System leakage capacitance $C_e$	≤ 150 (500) $\mu F$

### Displays

Display, illuminated	two-line display
Characters (number of characters, height)	2 x 16 characters / 3 mm
Display range, measuring value	< 1 kΩ... > 10 MΩ

### Outputs

TEST / RESET button	internal / external
Current output at measuring instrument (scale centre point 120 kΩ)	120 kΩ
Max. load	0...400 $\mu A$ (12.5 kΩ) or 0 / 4...20 mA (400 $\Omega$ )

### Switching elements

Switching elements	1 changeover contact each
Operating principle	N/O / N/C operation
Factory setting	N/O operation
Electrical endurance	12000 cycles
Contact class	IIB acc. to DIN IEC 60255 part 0-20
Rated contact voltage	AC 250 V / DC 300 V
Making capacity	AC / DC 2 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

Shock resistance acc. to IEC 60068-2-27 (device in operation)	15 g / 11 ms
Bumping acc. to IEC 60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance acc. to IEC 60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance acc. to IEC 60068-2-6 (during transport)	2 g / 10...150 Hz
Ambient temperature (during transport)	-10 °C...+70 °C
Storage temperature range	-40 °C...+70 °C
Operating mode	continuous operation
Mounting	any position
Connection	plug-in connectors DIN 41612 / E48
Type of enclosure / dimension diagram	Eurocard 100 x 160 mm, 12 TE
Technical manual	TGH 1264
Weight approx.	920 g

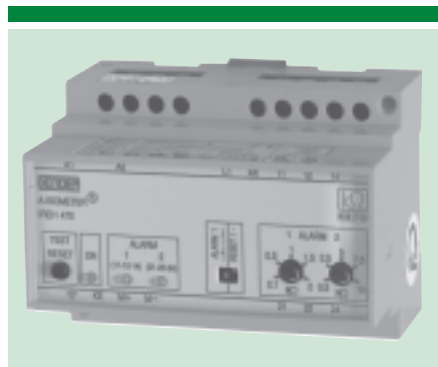




**A-ISOMETER® for special applications**  
e. g. generators, healthcare facilities or  
disconnected loads

# A-ISOMETER® IREH470Y2-6...

Off-line monitor for disconnected AC, DC and 3(N) AC loads in TN, TT and IT systems



IREH470Y2

## Device characteristics

- Insulation monitoring device for off-line TN, TT and IT systems
- AC, 3(N) AC and DC systems 0...793 V
- Nominal voltage extendable via coupling devices
- Two separately adjustable response values 100 kΩ...2 MΩ / 500 kΩ...10 MΩ
- Power On LEDs and alarm LEDs for the indication of insulation faults, ALARM1 and ALARM2
- Connection for external kΩ indication
- Combined TEST and RESET button
- Two separate alarm relays with one voltage-free changeover contact each
- Alarm relay 1 N/C operation  
Alarm relay 2 N/O operation
- Fault memory, selectable

## Certifications



## Product description

The A-ISOMETERS® of the IREH470Y2-6 series monitor the insulation resistance of deenergized TN, TT and IT systems and energized systems with voltages 0...793 V. These loads, e. g. fire extinguisher pumps, slide-valve drives etc., are only switched on in "case of emergency". During the shutdown periods, however, humidity or other effects may cause insulation faults in the supply leads or loads which may go undetected. Switching the device on may then lead to the tripping of the protective device to or may even result in motor fires so that operation of the device is no longer possible. In combination with a coupling device, the A-ISOMETERS® can also be used for higher voltages.

## Application

Disconnected loads such as fire extinguisher pumps, emergency drives, ship cranes, slide-valve drives in supply lines (gas, water, oil), motor-driven closing systems, diving pumps, drives for anchors, elevators, flue gas valves and stand-by generators.

## Function

If the insulation resistance between the system conductors and earth falls below the set response value, the alarm relays switch and the alarm LEDs light up. The measured value is indicated on an externally connectable measuring instrument. In this way changes, e. g. the connection of branch circuits, can easily be detected. The fault message can be stored. The fault memory can be reset by pressing the RESET button. By pressing the TEST button, the function of the device can be tested. Two separately adjustable response values and two separate alarm relays allow prewarning already in case of very high-resistance insulation faults. When the lower response level is reached an interlocking function will be activated and the connection of a defective load can be prevented.

The insulation resistance can be measured via the output L1 or via a contact to the system being monitored. The contact is controlled via the contact element K1. With the contact in closed position, the system is deenergized and the insulation resistance is being measured. If the system or load is in operation, K1 opens the contact and insulation monitoring is deactivated. Note that the main switch disconnects all poles. Ensure a low-resistance connection between all line conductors (e. g. by motor windings) so that the measuring voltage can be superimposed onto the system.

**Note:** If the IREH470Y2-6 is operated via a coupling device, the auxiliary contact (NC contact) of K1 between the A-ISOMETER® and the coupling device need not to be designed for the nominal voltage of the system. A rated contact voltage of AC 230 V will be sufficient.

## Measuring principle



Superimposed DC measuring voltage with reversing stage (see chapter annex – measurement technology).

## Standards

The IREH470Y2-6.. series complies with the standards: DIN EN 61557-8 (VDE 0413 part 8): 1998-05; EN 61557-8: 1997-03, IEC 61557-8: 1997-02, ASTM F 1669M-96, ASTM F 1134-94.

## Ordering details

Type	Supply voltage $U_S$	Art. No.
IREH470Y2-6	AC 230 V	B 9107 8001
IREH470Y2-615	AC 400 V	B 9107 8003
IREH470Y2-613	AC 90...132 V*	B 9107 8002

Other voltages on request \*Absolute values

## Accessories

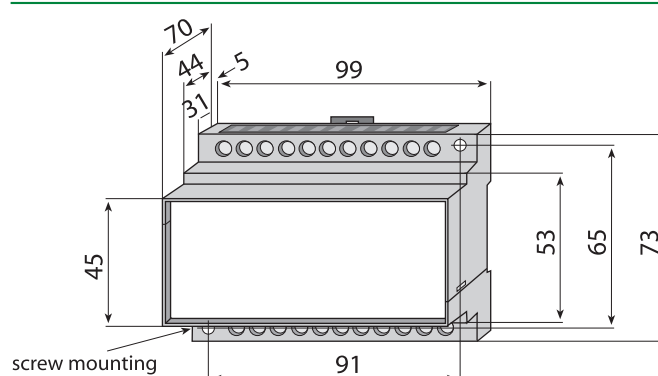
### External kΩ measuring instruments

Type	Art. No.
7204-1621	B 986 700
9604-1621	B 986 782

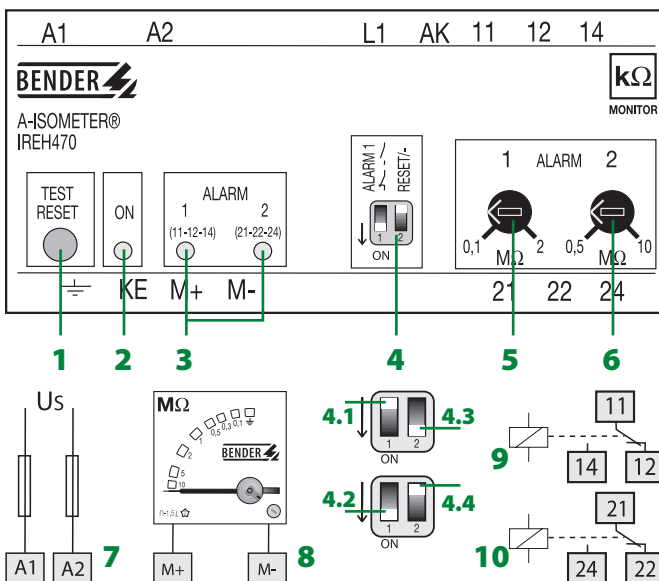
### Coupling devices

Type	Nominal system voltage $U_n$	Art. No.
AGH520S	AC 0...7200 V	B 913 033

## Dimension diagram, enclosure X470 Dimensions in mm

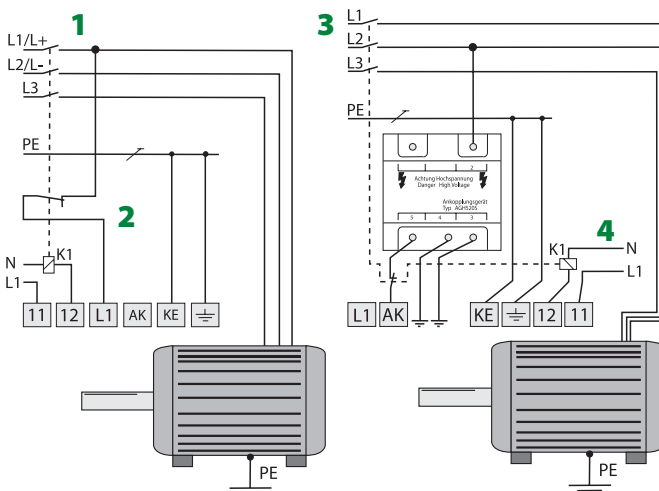


Wiring diagram – operating elements



- 1 - Combined TEST and RESET button: short-time pressing (< 1 s) = RESET, long-time pressing (> 2 s) = TEST
- 2 - Power On LED
- 3 - Alarm LEDs, yellow, illuminate when the insulation level falls below the pre-set response value
- 4 - DIP switch alarm relay ALARM1:  
4.1 - not active                      4.2 - active  
DIP switch RESET:  
4.3 - with fault memory            4.4 - without fault memory
- 5 - Potentiometer for the adjustment of the response value  $R_{an1}$  (ALARM1)
- 6 - Potentiometer for the adjustment of the response value  $R_{an2}$  (ALARM2)
- 7 -  $U_S$  see nameplate, 6 A fuse
- 8 - External  $M\Omega$  measuring instrument
- 9 - Alarm relay ALARM1 in N/C operation
- 10 - Alarm relay ALARM2 in N/O operation

Wiring diagram – system connection



- 1 - 3(N) AC system
- 2,4 - Auxiliary voltage for main contactor
- 3 - 3(N) AC system AGH520S 0...7200 V

Technical data A-ISOMETER® IREH470Y2-6...

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 630 V
Rated impulse voltage / pollution degree	6 kV/3

Voltage ranges

Nominal system voltage $U_n$	AC, 3(N) AC 0...793 V, DC 0...793 V
Nominal frequency $f_n$	DC, 40...460 Hz
Supply voltage $U_S$	see ordering details
Operating range of $U_S$	0.8...1.15 x $U_S$
Frequency range $U_S$	50...460 Hz
Power consumption	≤ 3 VA

Response values

Response value $R_{an1}$ (ALARM1)	100 k $\Omega$ ...2 M $\Omega$
Response value $R_{an2}$ (ALARM2)	500 k $\Omega$ ...10 M $\Omega$
Response time $t_{an}$ at $R_F = 0.5 \times R_{an}$ and $C_e = 1 \mu F$	≤ 4 s

Measuring circuit

Measuring voltage $U_m$	≤ 20 V
Measuring current $I_m$ max. (at $R_F = 0 \Omega$ )	≤ 17 $\mu A$
Internal d.c. resistance $R_i$	≥ 1.2 M $\Omega$
Internal impedance $Z_i$ at 50 Hz	≥ 1 M $\Omega$
Max. permissible extraneous DC voltage $U_{fg}$	≤ 800 V
System leakage capacitance $C_e$	≤ 10 $\mu F$

Outputs

TEST / RESET button	internal / external
Current output at measuring instrument (scale centre point 120 k $\Omega$ )	0...400 $\mu A$
Max. load	25 k $\Omega$

Switching elements

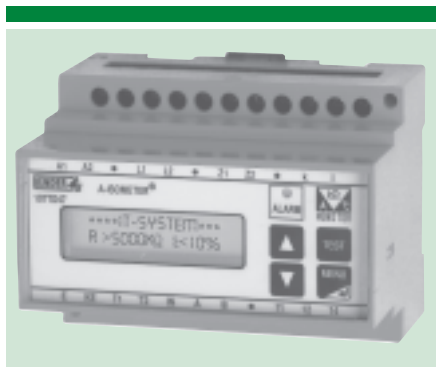
Switching elements	2 x 1 changeover contact
Operating principle ALARM1	N/O operation
Operating principle ALARM2	N/C operation
Electrical endurance	12000 cycles
Contact class	IIB acc. to DIN IEC 60255 part 0-20
Rated contact voltage	AC 250 V / DC 300 V
Making capacity	AC/DC 5 A
Breaking capacity	2 A, AC 230 V, cos phi = 0.4 0.2 A, DC 220 V, L/R = 0.04 s

General data

Shock resistance acc. to IEC 60068-2-27 (device in operation)	15 g / 11 ms
Bumping acc. to IEC 60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance acc. to IEC 60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance acc. to IEC 60068-2-6 (during transport)	2 g / 10...150 Hz
Ambient temperature (during transport)	-10 °C...+70 °C
Storage temperature range	-40 °C...+70 °C
Climatic class according to IEC 60721-3-3	3K5
Operating mode	continuous operation
Mounting	any position
Connection	screw terminals
Wire cross section, rigid, flexible	0.2...4 mm <sup>2</sup> / 0.2...2.5 mm <sup>2</sup>
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Screw mounting	2 x M4
DIN rail mounting according to	DIN EN 60715 / IEC 60715
Flammability class	UL94V-0
Instruction leaflet	107001
Weight approx.	350 g

## A-ISOMETER® 107TD47

Insulation monitoring device with load current and temperature monitoring for IT systems in medical locations in accordance with DIN VDE 0100-710 (VDE 0100 part 710): 2002-11 and IEC 60364-7-710: 2002-11



107TD47

### Device characteristics

- Insulation monitoring device for medical IT systems AC / 3(N) AC systems
- Adjustable response value 50 kΩ...500 kΩ
- Load current and temperature monitoring
- Alarm LED
- Monitoring of essential connections such as
  - system and PE connection
  - current transformer connection
  - temperature sensor connection
- TEST button
- External TEST button can be connected
- BMS bus interface
- Collective alarm relay with one potential-free changeover contact
- Illuminated plain text display

### Certifications



### Product description

The A-ISOMETERS® of the 107TD47 series monitor the insulation resistance of single and three-phase AC IT systems in medical locations. In addition, the IT system transformer is monitored for overload and overtemperature. In combination with the alarm indicator and test combination MK2418 they particularly comply with the requirements of DIN VDE 0100-710 (VDE 0100 Teil 710): 2002-11 and IEC 60364-7-710: 2002-11.

### Application

- IT systems for power supplies in medically used rooms in hospitals, in medical practices and outpatient operating theatre centres

### Function

If one of the measured values exceeds the limiting value (insulation resistance, load current, temperature), an alarm is initiated. The alarm relay switches, the ALARM LED lights up and a message appears on the LC display. This alarm message is transferred to remote MK2418 alarm indicator and test combinations installed in the medical location via two-wire interface so that the technical or medical staff is informed immediately.

The measuring leads to the system and PE, to the current transformer and to the temperature sensor are monitored continuously. If one of these measuring leads is interrupted or short-circuited, a message will appear. The function of the device can be checked by pressing the TEST button.

The insulation resistance of operating theatre lamps often is monitored by another insulation monitoring device that activates a relay contact in case of alarm (voltage-free NO contact). The alarm message of this contact is recorded by the 107TD47 and transferred via the BMS (BENDER Measuring Device Interface) bus to other BENDER devices such as a remote alarm indicator and test combination.

In order to detect the load current in three-phase systems, an LSD470 measuring adaptor is required which in combination with the STW2 current transformers measures the current of the phase conductors. The highest value of the load current is evaluated by the electronics and is made available at the input k/l of the 107TD47.

### Measuring principle

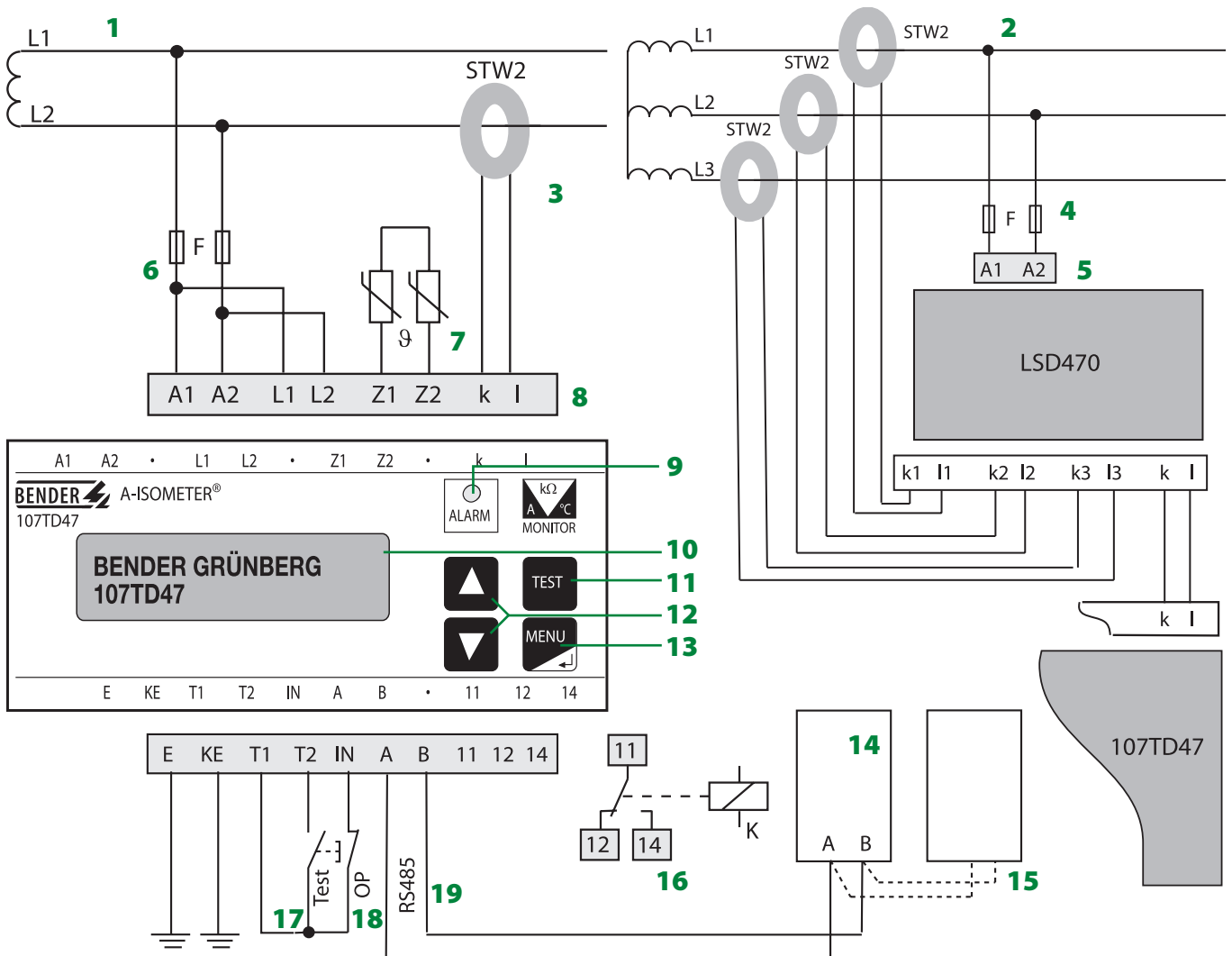


The A-ISOMETER® 107TD47 uses the AMP measuring principle (see chapter annex – measurement technology). That ensures safe monitoring of modern power supply systems, even in case of insulation faults including DC components (e. g. patient monitoring).

### Standards

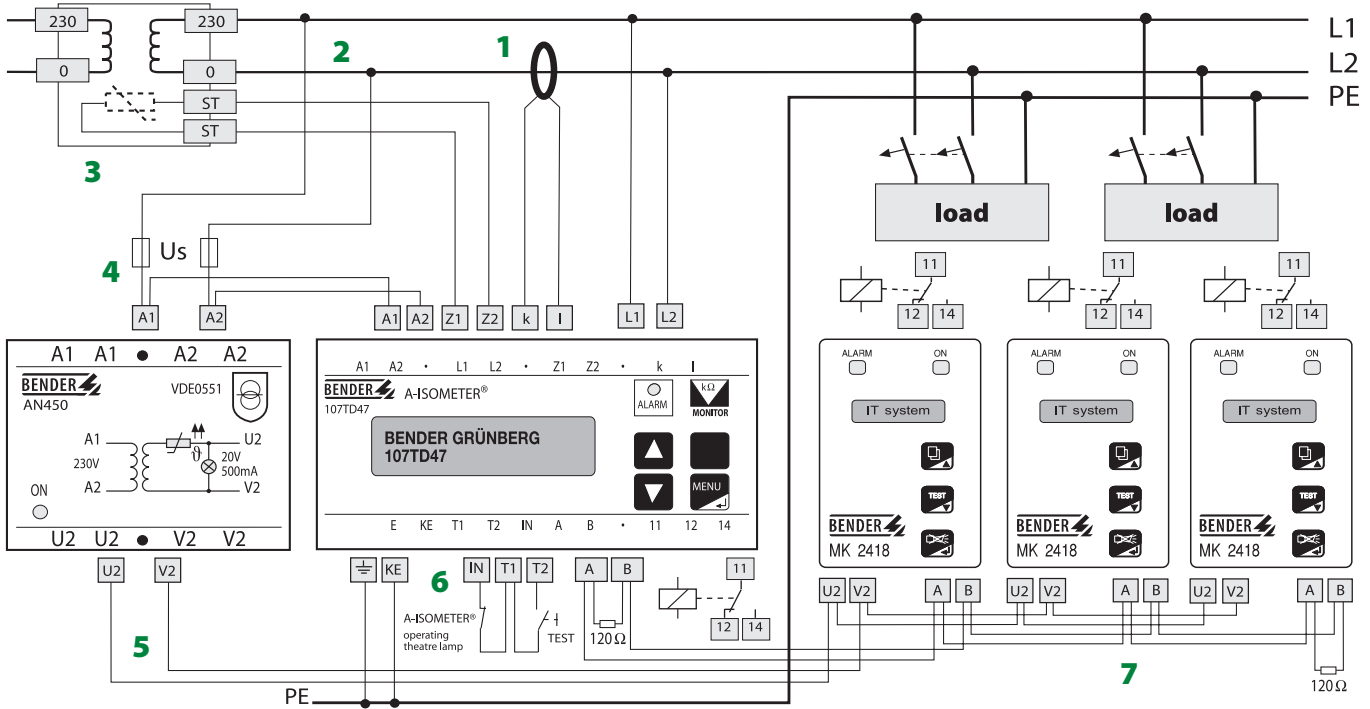
The A-ISOMETER® 107TD47 complies with the requirements of the standards and regulations for electrical installations: DIN EN 61557-8 (VDE 0413 part 8): 1998-05; EN 61557-8: 1997-03, IEC 61557-8: 1997-02, DIN VDE 0100-710 (VDE 0100 part 710): 2002-11 and IEC 60364-7-710: 2002-11.

Wiring diagram – operating elements



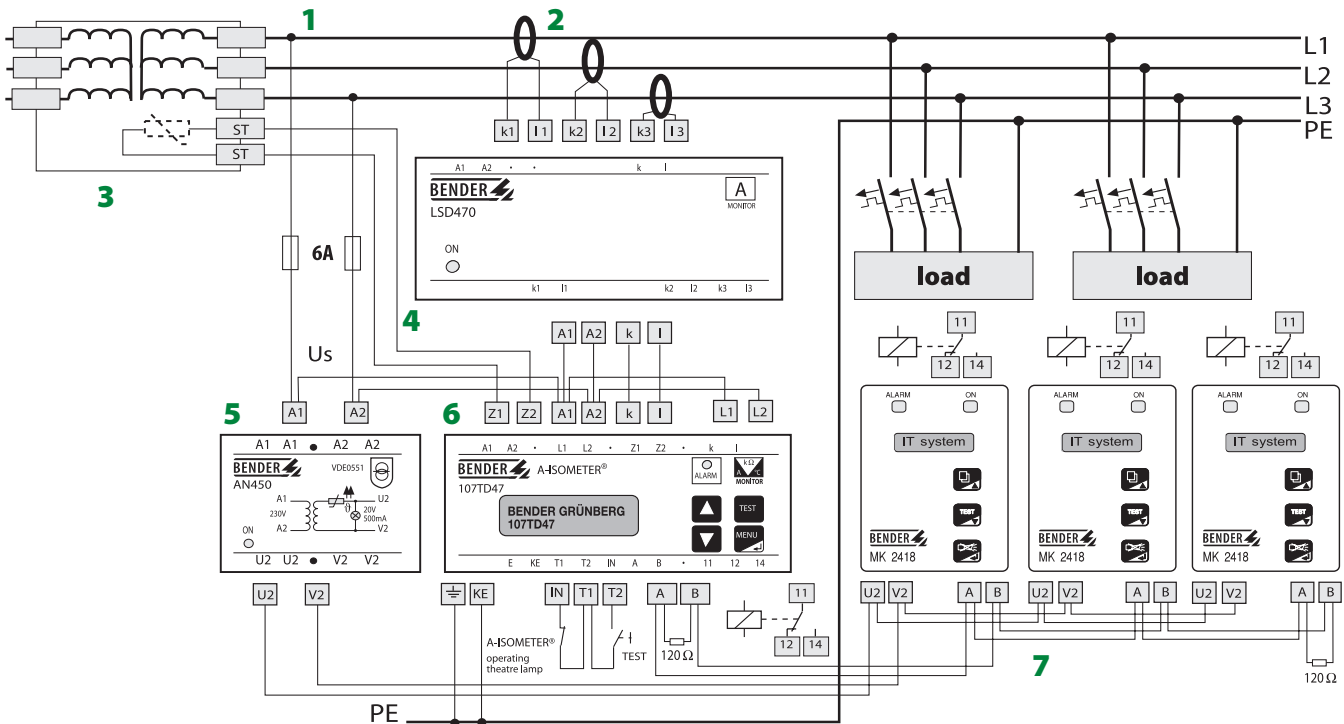
- 1 - AC IT system
- 2 - 3 AC IT system
- 3 - STW2 current transformer for load current monitoring
- 4 - Short-circuit protection for supply voltage 6 A fuse (recommended)
- 5 - LSD470 measuring adaptor for load current monitoring in three-phase systems
- 6 - Short-circuit protection for supply voltage 6 A (recommended)
- 7 - PTC thermistors (or NC contacts) in the transformer windings. Respond in case of transformer core overtemperature. No more than 6 PTC thermistors should be connected in series.
- 8 - L1, L2, k, I, Z1, Z2, E, KE are measuring connections that are monitored for interruption respectively short-circuit (k, I). A1 and A2 are intended for power supply of 107TD47 respectively LSD470.
- 9 - ALARM LED
- 10 - LC display
- 11 - TEST key in the display mode: activates the TEST function (self test). In the MENU mode, causes a return to the display mode from any position. If activated during parameter change, the last change will not be stored.
- 12 - Arrow keys in the MENU mode: for navigation within the menus and for setting parameters. In the display mode: no function.
- 13 - Changes from the display mode to the menu mode. In the menu mode, Enter-key function.
- 14 - MK2418-12 remote alarm indicator and test combination
- 15 - TM operator panels
- 16 - Alarm relay without fault memory to signal insulation faults, overcurrent condition, overtemperature and device errors.
- 17 - Optional external TEST button to test insulation monitoring (42 kΩ test resistance) and the measuring circuits for load current and temperature.
- 18 - Input allowing the message "insulation fault operating theatre light" to be displayed, initiated by the NC contact of the respective insulation monitoring device.
- 19 - BMS bus interface for the connection of alarm indicators and operator panels.

**Interconnection diagram AC system**



- 1 - Measuring current transformer for load current monitoring
- 2 - AC system
- 3 - Temperature sensor, isolating transformer ES0107
- 4 - 6 A fuse recommended
- 5 - Power supply unit AN450 for max. 3 MK2418
- 6 - A-ISOMETER® 107TD47
- 7 - MK2418 alarm indicator and test combination

**Interconnection diagram 3AC system**



- 1 - 3N AC system
- 2 - Measuring current transformer for load current monitoring
- 3 - Temperature sensor, isolating transformer DS0107
- 4 - LSD470 measuring adapter
- 5 - Power supply unit AN450 for max. 3 MK2418
- 6 - A-ISOMETER® 107TD47
- 7 - MK2418 alarm indicator and test combination

**Technical data A-ISOMETER® 107TD47**

<b>Insulation coordination acc. to IEC 60664-1</b>	
Rated insulation voltage	AC 250 V
Rated impulse voltage / pollution degree	4 kV/3
<b>Voltage ranges</b>	
Nominal system voltage $U_n$	see ordering details
Nominal frequency $f_n$	see ordering details
Supply voltage $U_S$	see ordering details
Operating range of $U_S$	0.85...1.15 x $U_S$
Frequency range $U_S$	40...460 Hz
Power consumption	≤ 3 VA
<b>Measuring circuit insulation monitoring</b>	
Response value $R_{an}$	50...500 kΩ
Relative percentage error	0...+10 %
Response time $t_{an}$ at $R_F = 0,5 \times R_{an}$ and $C_e = 1 \mu F$	3 s
Hysteresis	25 %
Measuring voltage $U_m$	≤ 12 V
Measuring current $I_m$ max. (at $R_F = 0 \Omega$ )	≤ 50 μA
Internal DC resistance $R_i$	≥ 240 kΩ
Impedance $Z_i$ bei 50 Hz	≥ 200 kΩ
Permissible extraneous DC voltage $U_{fg}$	≤ DC 375 V
Permissible system leakage capacitance $C_e$	≤ 5 μF
<b>Measuring circuit load current monitoring</b>	
Response value	5...50 A
Hysteresis	4 %
Influence of temperature	< 0.15 %/°C
<b>Measuring circuit temperature monitoring</b>	
Response value	4 kΩ
Release value	1.6 kΩ
PTC thermistors acc. to DIN 44081	max. 6 in series
<b>Displays</b>	
Display, illuminated	LC display
Characters (number of characters, height)	2 x 16 (3.5 mm)
Display range, measuring value	10 kΩ...5000 kΩ
Relative percentage error (50 kΩ...500 kΩ) acc. to IEC 61557-8	± 10 %

<b>Inputs</b>	
"TEST" key	NO contact
Alarm message "Insulation fault operating theatre light"	NC contact
Cable length inputs max.	10 m
<b>Outputs</b>	
TEST button	internal / external
<b>Serial interfaces</b>	
Interface / protocol	RS485 / BMS
Max. cable length	1200 m
Recommended cable (screened, screen on one side connected to PE)	J-Y(ST)Y 2 x 0.6
Terminating resistor	120 Ω (0.25 W)
<b>Switching elements</b>	
Switching elements	1 changeover contact
Operating principle	N/O / N/C operation
Factory setting	N/O operation
Electrical endurance	12000 cycles
Contact class	IIB acc. to DIN IEC 60255 part 0-20
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)
<b>General data</b>	
Shock resistance acc. to IEC 60068-2-27 (device in operation)	15 g / 11 ms
Bumping acc. to IEC 60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance acc. to IEC 60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance acc. to IEC 60068-2-6 (during transport)	2 g / 10...150 Hz
Ambient temperature (during transport)	- 10 °C...+ 55 °C
Storage temperature range	- 40 °C...+ 70 °C
Climatic class according to IEC 60721-3-3	3K5
Operating mode	continuous operation
Mounting	any position
Connection	screw terminals
Wire cross section, rigid, flexible	0.2...4 mm <sup>2</sup> / 0.2...2.5 mm <sup>2</sup>
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Screw mounting	2 x M4
DIN rail mounting according to	DIN EN 60715 / IEC 60715
Flammability class	UL94V-0
Weight approx.	350 g

**Ordering details**

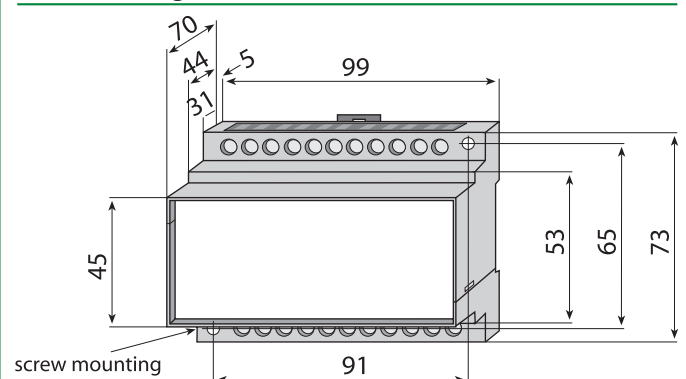
Type	Nominal system voltage $U_n$	Supply voltage $U_S$	Art. No.
107TD47	AC 230 V, 50...60 Hz	AC 230 V, 50...60 Hz	B 9201 6003
107TD47-133	AC 127 V, 50...60 Hz	AC 127 V, 50...60 Hz	B 9201 6004

**Accessories**

**Measuring current transformer**

Type	Nominal system voltage $U_n$	Supply voltage $U_S$	Art. No.
STW2 (CT)	--	--	B 942 709
AN450	--	AC 230 V	B 924 201
AN450-133	--	AC 127 V	B 924 203
LSD470 (Measuring adaptor)	--	AC 230 V	B 986 782

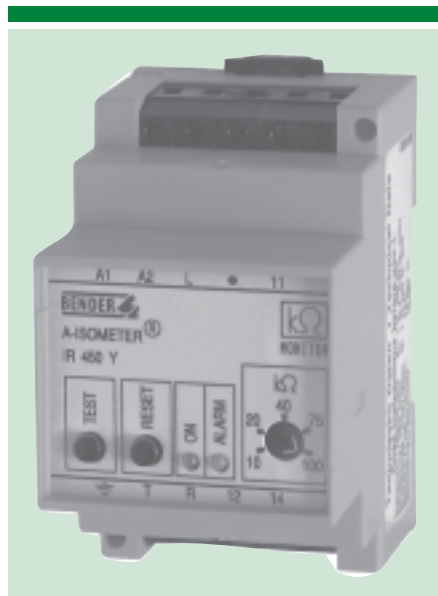
**Dimension diagram, enclosure X470** Dimensions in mm



1.6

## A-ISOMETER® IR450...

Insulation monitoring device for unearthed AC and 3 AC systems (IT systems) in particular for mobile generators



IR450...

### Device characteristics

- Insulation monitoring for IT AC / 3 AC systems 0...276 V
- Response values:  
IR450YR-4 10 kΩ...100 kΩ  
IR450R 23 kΩ
- Power ON and ALARM LEDs indicating insulation faults
- TEST button, RESET button
- Alarm relay with one potential-free changeover contact
- N/C operation
- Fault memory, selectable
- Enclosure for installation into standard distribution panels

### Ordering details

Type	Supply voltage $U_S$	Art. No.
IR450R-4	AC 230 V (196...276 V)	B 9101 6029
IR450YR-4	AC 230 V (196...276 V)	B 9101 6030
IR450R-421	DC 9.6...84 V*	B 9101 6031
IR450YR-421	DC 9.6...84 V*	B 9101 6033

\*Absolute values

### Product description

The A-ISOMETERs® of the IR450... series monitor the insulation resistance of unearthed AC / 3 AC systems (IT systems) of 0...276 V. The device is supplied by the system being monitored.


### Application

Mobile generators with the protective measure "Protective separation with insulation monitoring and disconnection" in accordance with DIN VDE 0100-551: 1997-08 Low voltage power supply systems (IEC 60364-5-551: 1994; German version HD 384.5.551 S1: 1997).

### Function

If the insulation resistance between the system conductors and earth falls below the set response value, the alarm relay switches and the alarm LEDs light up. The fault message can be stored. The fault memory can be reset by pressing the RESET button. By pressing the TEST button, the function of the device can be tested.

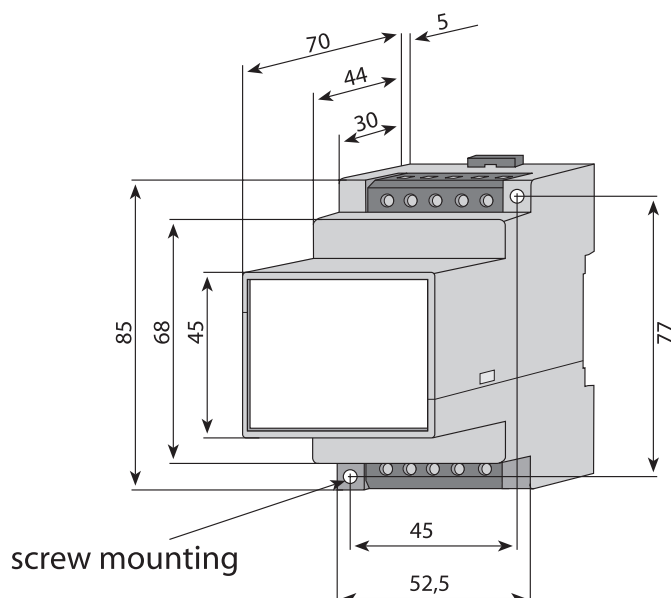
### Measuring principle

 Superimposed DC measuring voltage with reversing stage (see chapter annex - measurement technology).

### Standards

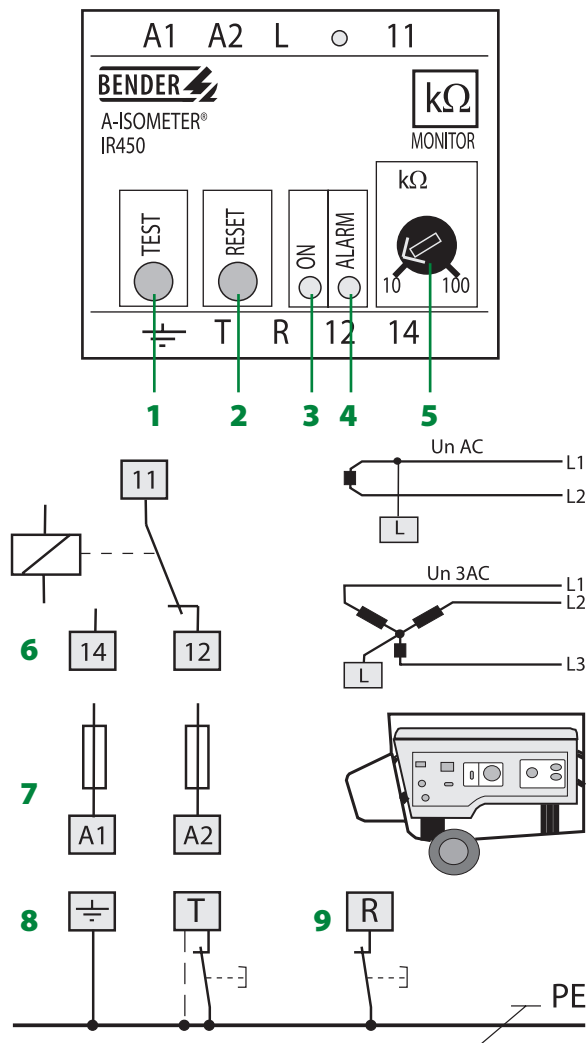
The IR450... series complies with the standards: DIN EN 61557-8 (VDE 0413 part 8): 1998-05; EN 61557-8: 1997-03, IEC 61557-8: 1997-02, ASTM F 1669M-96, VDE 0100 part 551.

### Dimension diagram, enclosure X440 Dimensions in mm





Wiring diagram



- 1 - TEST button
  - 2 - RESET button
  - 3 - Power On LED
  - 4 - ALARM LED illuminates wenn the value falls below the preset response value or in case of interruption of the connecting leads earth or T
  - 5 - Potentiometer for the adjustment of the response value  $R_{an}$  (only version IR450Y), Factory setting: left-hand position (10 kΩ)
  - 6 - Alarm relay
  - 7 -  $U_S$  see ordering details – 6 A fuse recommended
  - 8 - External TEST button; pressing = TEST or bridge connection T / PE
  - 9 - External RESET button, if required; pressing = RESET; without RESET button the fault memory is inactive
- The device needs a recovery time of 5 seconds after disconnection.

Technical data A-ISOMETER® IR450...

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 250 V
Rated impulse voltage / pollution degree	4 kV/3

Voltage ranges

Nominal system voltage $U_n$	AC 0...276 V (400 V / 1 min.)
Nominal frequency $f_n$	40...460 Hz
Supply voltage $U_S$	see ordering details
Frequency range $U_S$	50...460 Hz
Power consumption	≤ 2 VA

Response values

Response value $R_{an1}$ (ALARM1)	$R = 23 \text{ k}\Omega$ , $R_Y = 10...100 \text{ k}\Omega$
Response time $t_{an}$ at $R_F = 0.5 \times R_{an}$ and $C_e = 1 \mu\text{F}$	< 1 s

Measuring circuit

Measuring voltage $U_m$	≤ 15 V
Measuring current $I_m$ max. (at $R_F = 0 \Omega$ )	≤ 200 $\mu\text{A}$
Internal d.c. resistance $R_i$	≥ 75 kΩ
Internal impedance $Z_i$ at 50 Hz	≥ 65 kΩ
Max. permissible extraneous DC voltage $U_{i0}$	≤ 300 V
System leakage capacitance $C_e$	≤ 5 $\mu\text{F}$

Outputs

TEST / RESET button	internal / external
---------------------	---------------------

Switching elements

Switching elements	1 changeover contact
Operating principle	N / C operation
Electrical endurance	12000 cycles
Contact class	IIB acc. to DIN IEC 60255 part 0-20
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

Shock resistance acc. to IEC 60068-2-27 (device in operation)	30 g / 11 ms
Bumping acc. to IEC 60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance acc. to IEC 60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance acc. to IEC 60068-2-6 (during transport)	2 g / 10...150 Hz
Ambient temperature (during transport)	- 25 °C... + 60 °C
Storage temperature range	- 40 °C... + 70 °C
Climatic class according to IEC 60721-3-3	3K5
Operating mode	continuous operation
Mounting	any position
Connection	screw terminals
Wire cross section, rigid, flexible	0.2...4 mm <sup>2</sup> / 0.2...2.5 mm <sup>2</sup>
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Screw mounting	2 x M4
DIN rail mounting according to	DIN EN 60715 / IEC 60715
Flammability class	UL94V-0
Instruction leaflet	101004
Weight approx.	200 g

## A-ISOMETER® IRDH275BU-6 with coupling device AGH575

Device combination for insulation monitoring  
in unearthed AC, AC / DC and DC systems (IT systems)



### Device features

- Insulation monitoring for drives including medium voltage converters
- Two separately adjustable response values 100 kΩ...10 MΩ
- **AMP<sup>PLUS</sup>** measuring principle (European Patent: EP 0 654 673 B1)
- Automatic adaptation to the system leakage capacitance
- Info key to display device settings and the system leakage capacitance
- Memory with real-time clock to store alarm messages with date and time stamp
- BMS interface (BENDER Measuring Device Interface) for data exchange with other BENDER devices (RS485 galvanically separated)
- Current output 0(4)...20mA (electrically isolated) analogue to the measured insulation value of the IT system
- Self monitoring with automatic alarm message
- Automatic self test, selectable
- Connection for external kΩ indication
- TEST and RESET button
- Connection external TEST and RESET button
- Two separate alarm relays with two voltage-free changeover contacts
- N/O or N/C operation, selectable
- Illuminated two-line plain text display
- Remote setting of certain parameters via Internet (option; FTC470XET required)

### Product description

The A-ISOMETER® IRDH275BU-6 and coupling device AGH575S-6 (detailed description in chapter 1.8.1) monitors the insulation resistance of IT medium voltage systems. It is suitable for universal use in 3/(N) AC, AC / DC and DC systems. AC systems may include extensive DC-supplied loads. Thanks to the **AMP<sup>PLUS</sup>** measuring principle they particularly meet the requirements of modern power supply systems which often include rectifiers, converters, thyristor-controlled DC drives and directly connected DC components. In these systems often high leakage capacitances against earth occur due to interference suppression measures. The IRDH275BU-6 automatically adapts itself to the existing system conditions.

### Application

- AC, DC or AC / DC medium voltage systems
- AC / DC medium voltage systems with directly connected DC components, such as rectifiers, converters, and thyristor-controlled DC drives

### Function

When the insulation resistance between the system conductors and earth falls below the set response value, the alarm relays switch and the alarm LEDs light up. Two separately adjustable alarm relays allow to distinguish between prewarning and alarm. The measured value is indicated on the LC display or an externally connectable measuring instrument. In this way any changes, for example when circuits are connected to the system, can be recognized easily. The fault message can be stored. The fault memory can be reset by pressing the RESET button. By pressing the TEST button, the function of the device as well as the connections to system and earth can be tested. Pressing the INFO key provides additional information, such as the existing system leakage capacitance or device settings. The function of the device and the system and earth connections are continuously monitored. When a fault occurs, the system fault relay switches and the alarm LED "system fault" lights up. The parameterization of the device can be carried out via the LC display or the function keys integrated in the front plate.

Version IRDH275BU-6 includes the following additional functions:

- Historical memory with real-time clock to store all alarm messages with date and time stamp.
- Galvanically isolated RS485 interface (BMS protocol) for data exchange with other BENDER devices
- Current output 0(4)...20 mA (electrically isolated)

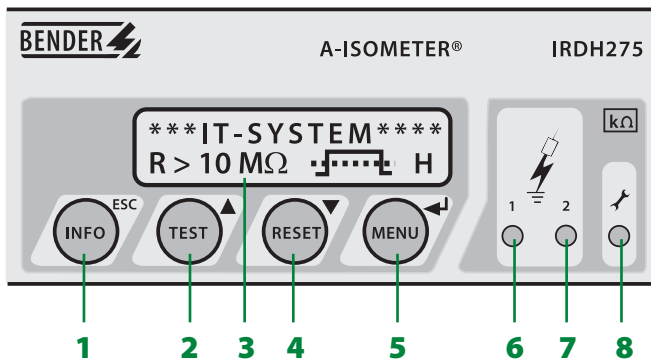
### Measuring principle

The IRDH275BU series uses the patented **AMP<sup>PLUS</sup>** measuring principle (chapter annex - measurement technology). This measuring method allows concise monitoring of modern power supply systems, also in case of extensive, directly connected DC components and high system leakage capacitances.

### Standards

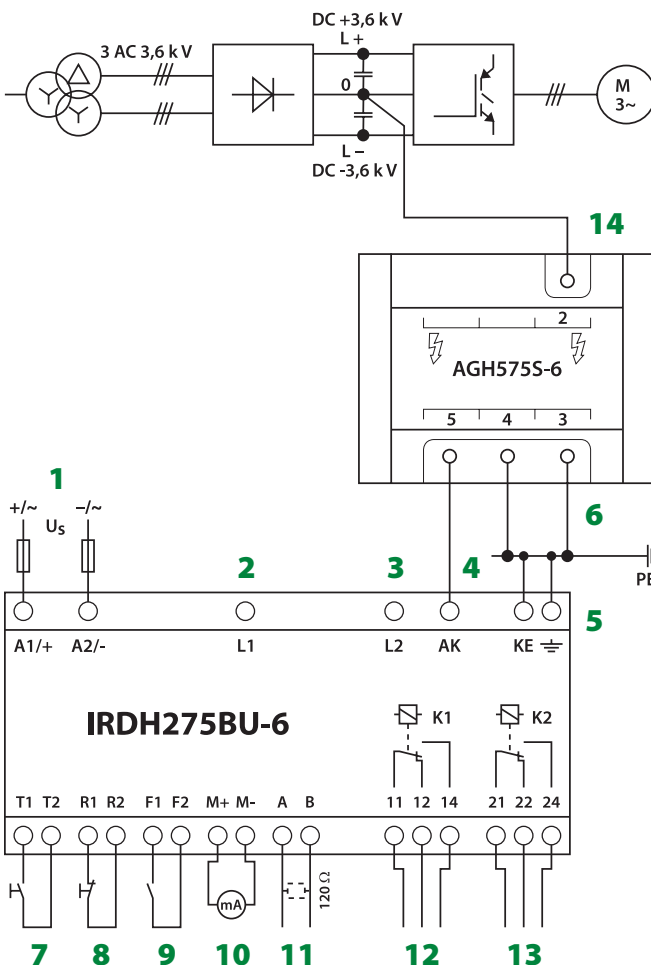
The IRDH275BU-6 and the coupling device AGH575S comply with the standards DIN EN 61557-8 (VDE 0413 Teil 8): 1998-05, EN 61557-8: 1997-03, IEC 61557-8: 1997-02, ASTM F 1669M-96, EN 61326, DIN VDE 0110-1 (VDE 0110 part 1) 1997-04, DIN VDE 0110-3 (VDE 0110 part 3) 1997-05.

Wiring diagram – operating elements



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

Wiring diagram – mains connection



- 1 - Supply voltage  $U_S$  (see ordering details) 6 A fuse
- 2 - Terminals L1, L2 are unconnected!
- 3 - Terminals L1, L2 are unconnected!
- 4 - Connection to the coupling device AGH575S-6:  
Connect terminal AK with terminal 5 of the coupling device
- 5 - Separate connection of earth and KE to PE
- 6 - Connect the terminals 3 and 4 of the AGH575S-6 separately 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
- 10 - Current output, electrically isolated: 0...20 mA or 4...20 mA
- 11 - Serial interface RS485 (termination with a 120  $\Omega$  resistor)
- 12 - Alarm relay 1; changeover contacts available
- 13 - Alarm relay 2 (system fault relay); changeover contacts available
- 14 - Connection of the coupling device to the converter: terminal 2 to the mid-point of the DC intermediate circuit

1.6

**Technical data A-ISOMETER® IRDH275BU-6**
**Insulation coordination acc. to IEC 60664-1:**

Rated insulation voltage	AC 800 V
Rated impulse withstand voltage	8 kV/3

**Voltage ranges**

Nominal system voltage	via AGH575S-6 (0...3.6 kV)
Supply voltage $U_S$	see also ordering details
Nominal frequency	DC, 0.2...460 Hz
Frequency range of $U_S$	42...460 Hz
Power consumption	≤ 14 VA

**Response values**

Response value $R_{an1}$ (Alarm 1)	100 k $\Omega$ ...10 M $\Omega$
Response value $R_{an2}$ (Alarm 2)	100 k $\Omega$ ...10 M $\Omega$
Relative percentage error	0%...+20%
Response time $t_{an}$	≤ 5 min
Hysteresis	25%

**Measuring circuit**

Measuring voltage $U_m$	≤ 50 V
Measuring current $I_m$ (at $R_F = 0 \Omega$ )	≤ 42 $\mu$ A
Internal DC resistance $R_i$	≥ 1.2 M $\Omega$
Impedance $Z_i$ at 50 Hz	≥ 1.2 M $\Omega$
Permissible extraneous DC voltage $U_{fg}$	via AGH575S-6
Permissible system leakage capacitance $C_e$	≤ 10 $\mu$ F
Factory setting	5 $\mu$ F

**Displays**

Display, illuminated	two-line display
Characters (number of characters)	2 x 16
Display range, measuring value	50 k $\Omega$ ...10 M $\Omega$
Relative percentage error	± 10%

**Outputs/Inputs**

TEST / RESET button	internal / external
Cable length TEST / RESET button	≤ 10 m
Current output for measuring instrument SKMP (scale centre point = 1.2 M $\Omega$ )	
Current output (load)	0/4...20 mA (≤ 500 $\Omega$ )
Accuracy current output (100 k $\Omega$ ...10 M $\Omega$ )	± 10%

**Serial interface**

Interface / protocol IRDH275B	RS485 / BMS
Connection	terminals A / B
Cable length	≤ 1200 m
Recommended cable (shielded, shield on one side connected to PE)	J-Y(ST)Y 2 x 0.6
Terminating resistor	120 $\Omega$ (0.5 W)
Device address, BMS bus	1...30 (factory setting = 3)

**Switching elements**

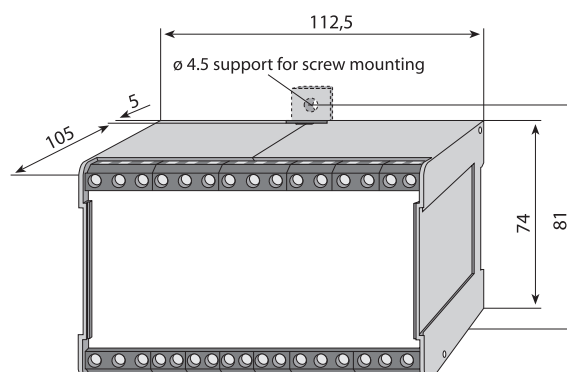
Switching components	2 changeover contacts: K1 (Alarm 1), K2 (Alarm 2, system fault)
Operating principle K1, K2 (Alarm 1 / Alarm 2)	N/O or N/C operation
Factory setting (Alarm 1 / Alarm 2)	N/O operation
Electrical endurance, number of cycles	12000
Contact class	IIB acc. to DIN IEC 60255 part 0-20
Rated 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**

Shock resistance acc. to 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 (during transport)	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	as indicated in the display
Connection	screw terminals
Technical data IRDH275BU-6 with AGH575S-647	TGH 1384 / 12.2004
Connection, rigid / flexible	0.2...4 mm <sup>2</sup> / 0.2...2.5 mm <sup>2</sup>
Connection, flexible with connector sleeve, without/with plastic sleeve	0.25...2.5 mm <sup>2</sup>
Conductor sizes (AWG)	24-12
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
DIN rail mounting according to	DIN EN 60715 / IEC 60715
Flammability class	UL94 V-0
Weight	approx. 510 g

**Ordering details**

Type	Nominal voltage	Supply voltage	Art. No.
IRDH276BU-635	--	AC 88...264 V/ DC 77...286 V	B 9106 5111
AGH575S-6	AC/DC 0...3.6 kV	--	B 913 053

**Dimension diagram, enclosure XM112** Dimensions in mm


**A-ISOMETER® for insulation fault location**  
**Insulation fault location systems**  
**Device components**

**Chapter 1.7**

Insulation fault location systems  
(EDS systems) for stationary and  
portable application



# Insulation fault location system EDS

## Insulation fault location system EDS

In order to achieve high reliability and to avoid costly shut-down periods of electrical installations, it is necessary to recognize insulation faults at an early stage – before interruption to operation occurs. For this reason, unearthed systems (IT systems) with insulation monitoring are used for the power supply of essential electrical installations and loads. The A-ISOMETER® provides the necessary advance information.

Fast localisation and elimination of insulation faults is required by DIN VDE 0100-410 (VDE 0100 part 410: 1997-01) and IEC 60364-4-41: 2001.

The EDS system is a modular system ideally suited for this task. There is a variety of application fields for EDS systems.

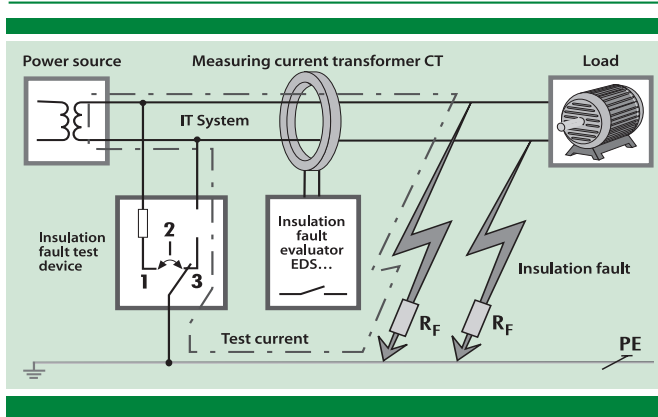
### Typical fields of application

- Industrial, cement and chemical plants, steel, paper and car industry,
- Energy: power plants, power distribution
- Traffic engineering: ships, airports, railway
- Food industry: breweries, beverage industry, dairies
- Hospitals: operating theatres, intensive care units and a lot of other sectors

### Main advantages at a glance

- Insulation fault location without disconnecting the electrical installation
- Selective fault location by fast and precise localisation of the faulty subcircuit
- Increased productivity because interruptions to operation are avoided
- Shut-down periods of electrical installations are avoided due to preventive maintenance
- Reduced maintenance costs
- Centralized indication and operation with LC text display
- Time and cost-saving bus system

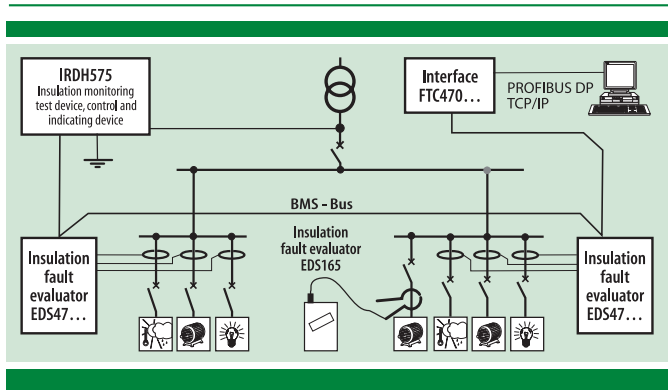
## Principle of operation of EDS systems



A basic insulation fault location system usually consists of an insulation fault test device and an insulation fault evaluator in combination with the respective measuring current transformer.

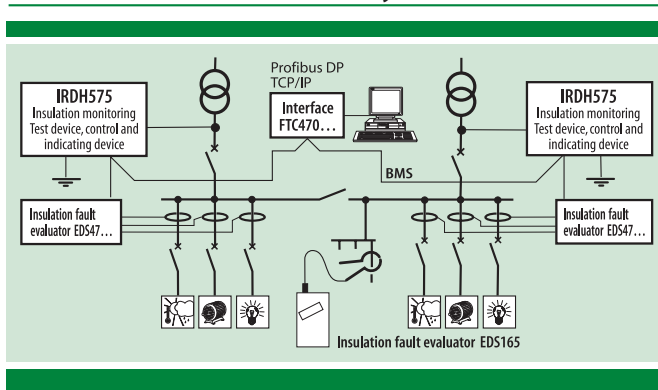
When an insulation fault occurs in an IT system, it is detected and indicated by the insulation monitoring device A-ISOMETER®. With this fault indication insulation fault location can be started automatically or manually. Then the insulation fault test device PGH or the A-ISOMETER® equipped with the appropriate function generates a test current the amplitude of which is dependent on the existing system voltage and the insulation fault. In the event of low-resistance insulation faults, the test current is limited and the maximum value can be set. No extraneous voltage will be superimposed to the system. The test signal flows from the insulation fault test device via the live conductors to the location of insulation fault. From there it flows via the insulation fault and the PE conductor back to the insulation fault test device. This current pulse signal is then detected by the measuring current transformers located in the insulation fault path, and is evaluated by the connected insulation fault evaluators EDS. Then the point of fault can easily be localized by assigning the measuring current transformers to the respective circuit.

## Automatic and manual insulation fault location



When the A-ISOMETER® IRDH575 detects an insulation fault, insulation fault location is started automatically. The insulation resistance and the faulty subcircuits are indicated on the LC display. The faulty subcircuit is locally indicated at the insulation fault evaluator EDS47... via an alarm LED. Information is transmitted via fieldbus or Ethernet by an interface of the FTC470 series.

## Insulation fault in interconnected systems



In interconnected systems, the two A-ISOMETERs®/e. g. IRDH575, exchange all essential information. That ensures that only one device generates a test current signal. However, on the LC display of both IRDH575 A-ISOMETERs® the faulty subcircuits including the associated insulation resistance values are indicated. For subordinated circuits without a permanently connected transformer, the portable insulation fault evaluator EDS165 is recommended. It detects the test current signal sent by the A-ISOMETER®.

**EDS system components**

- Principally, an IT system must include an A-ISOMETER® for monitoring the insulation resistance and starting insulation fault location when the measured value falls below the preset response value.
- Insulation fault test device PGH (integrated in the A-ISOMETER® IRDH575)
- Control and indicating device PRC, optional (integrated in the A-ISOMETER® IRDH575)
- Insulation fault evaluator EDS with the associated measuring current transformers or measuring clamps.

**a) Systems including an A-ISOMETER® IRDH575**

The A-ISOMETER® IRDH575 is suitable for panel mounting and includes the insulation monitoring device as well as the insulation fault test device and control and indicating device. The required insulation fault evaluators EDS47... have to be fitted into the electrical installation and connected to the IRDH575 via the RS485 interface. The measuring current transformers have also to be installed and connected to the measuring inputs of the insulation fault evaluators. The selection of the appropriate evaluators and measuring current transformers depends on whether the devices are to be used in main circuits or control circuits.

**b) Systems with a separate or integrated A-ISOMETER®**

The A-ISOMETER® must have a DC internal resistance of 120 kΩ. Preferred types are devices of the IRDH265-4, IRDH275 and IRDH375 series. Insulation fault location is started via an alarm contact of the A-ISOMETER® and the respective input at the insulation fault test device PGH47.... The selection of the appropriate insulation fault evaluators and measuring current transformers depends on whether the devices are to be used in main circuits or control circuits.

**c) Portable insulation fault location systems EDS306.../336...**

When an EDS system and an insulation fault test device (IRDH575, PGH...) is already installed in an electrical installation, the portable system EDS3060 / EDS3360 is to be used. This location system does not include an insulation fault test device.

If no EDS system exists in the electrical installation, a portable insulation fault test device is required. The systems EDS3065 / 3365 include an insulation fault test device. The mobile insulation fault evaluator EDS165 / 165-3 integrated in these systems in combination with the current clamps PSA... is intended to be used for manual localisation of insulation faults.

**Directions for installation**

The following features apply to systems where insulation fault location systems are intended to be used:

**Main circuits – Typical features:**

- System voltage up to  $U_n$  690 V
- Extended systems, system capacity up to 20000 μFV (capacity multiplied with system voltage)
- High AC – residual currents up to max. 10 A
- Loads causing interferences (rectifiers, converters, etc.)

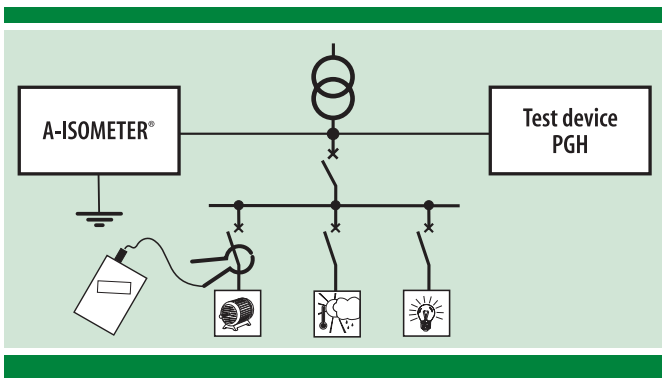
**Control circuits – Typical features:**

- System voltage up to  $U_n$  230 V
- Small systems, system capacity up to 300 μFV (capacity multiplied with system voltage)
- Low AC – residual currents up to max. 1 A
- No loads causing disturbances

**Diode-decoupled systems – Typical features:**

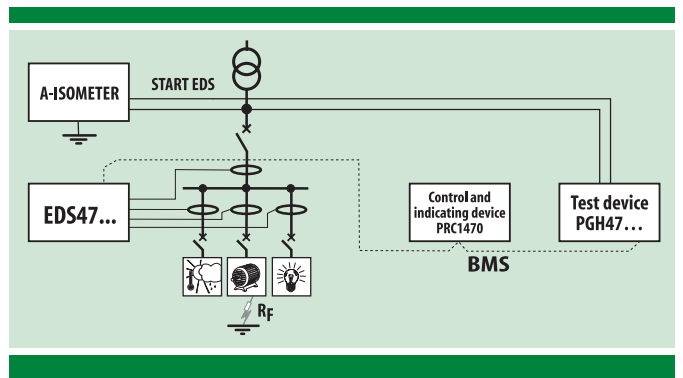
- Loads are supplied from two or more DC systems via decoupled

**Manual insulation fault location**



Manual insulation fault location is carried out with a mobile insulation fault test device respectively insulation fault evaluator. Manual location is only carried out in relatively small IT systems. The insulation fault test device is preferably connected at the supply input of the system. The individual subcircuits are encircled with the current clamp and checked whether a test current signal is available in this subcircuit.

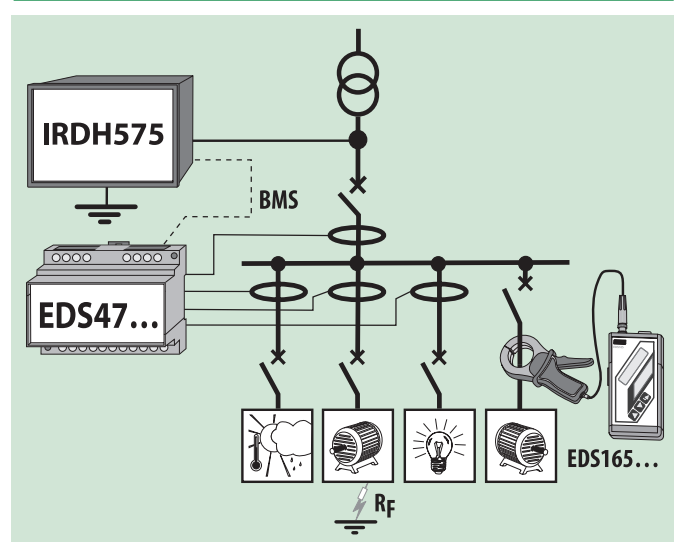
**Retrofitting of existing installations**



When the A-ISOMETER® detects an insulation fault, insulation fault location is automatically started via a contact. The faulty subcircuits are indicated on the LC display. Locally the faulty subcircuit is indicated on the insulation fault evaluator EDS47... via an alarm LED. Before installing the device, please consider that the A-ISOMETER® has a DC internal resistance of > 120 kΩ and that eventually the connection to the system to be monitored is being disconnected during fault location.

## Example for practical application – Automatic insulation fault location

Example 1



**Functions**

<b>Description</b>	
<b>IT system</b>	
<b>System components</b>	<b>Optional components</b>
<b>A-ISOMETER®</b> 	Type Rated insulation voltage $U_n$ Max. test current LC display
<b>Insulation fault evaluator</b> 	Type No. of channels per device Max. No. of devices/channels Alarm LED Response sensitivity
<b>Measuring current transformer</b> 	circular type rectangular type split-core type circular type split-core type
<b>Portable</b> 	Type Insulation fault evaluators Insulation fault test device Current clamp 20 mm Current clamp 52 mm Current clamp 100 mm
<b>Communication</b> 	via BMS bus PROFIBUS gateway J-Bus / Modbus gateway Ethernet gateway
<b>Note</b>	

**Automatic insulation fault location with local and centralized indication**

Automatic insulation fault location with the A-ISOMETER® IRDH575 is carried out with permanently installed components and can be used in various IT systems. The IRDH575 is preferably installed at the supply input of the IT system. It also provides the test signal for insulation fault location. The test signal in the faulty subcircuit is detected via the measuring current transformers installed in the individual subcircuits and is evaluated in the insulation fault evaluators EDS47... The faulty subcircuit is indicated on the LC display of the IRDH575. Locally the message is indicated on the EDS47... by an alarm LED. For subordinated circuits a mobile EDS165... can be used.

	Main circuits	Control circuits
<b>IRDH575</b>	3(N) AC/DC 20...575 V / 340...760 V 1 / 2.5 / 10 / 25 / 50 mA 4 x 16 characters	3(N) AC/DC 20...575 V / 340...760 V 1 / 2.5 / 10 / 25 / 50 mA 4 x 16 characters
<b>EDS470-12</b>	12 59 / 708 per channel 5 mA	EDS473-12 12 59 / 708 per channel 0.5 mA
<b>W...S...</b>	--	--
<b>WR...S...</b>	--	--
<b>WS...S...</b>	--	W.../8000
<b>EDS3060</b>	EDS3060	EDS3360
<b>EDS165*</b>	EDS165*	EDS165-3*
<b>PSA3020*</b>	PSA3020*	PSA3020*
<b>PSA3052*</b>	PSA3052*	PSA3052*
<b>PSA3165</b>	PSA3165	--
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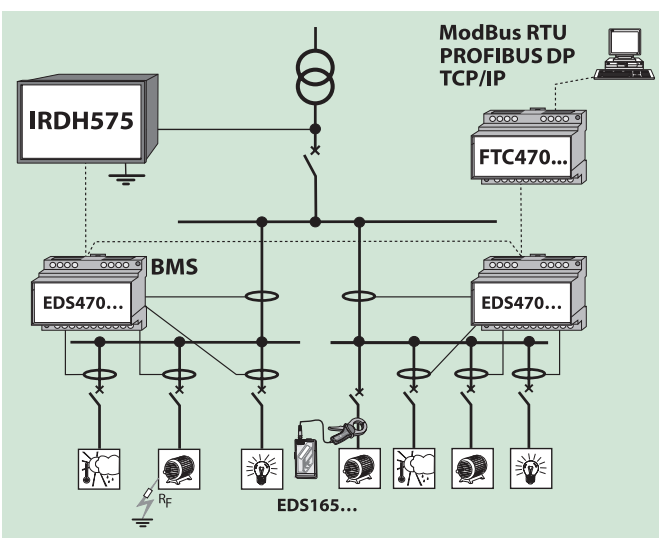
\*All components are incorporated in EDS3065

\*All components are incorporated in EDS3365



## Example for practical application – Automatic insulation fault location

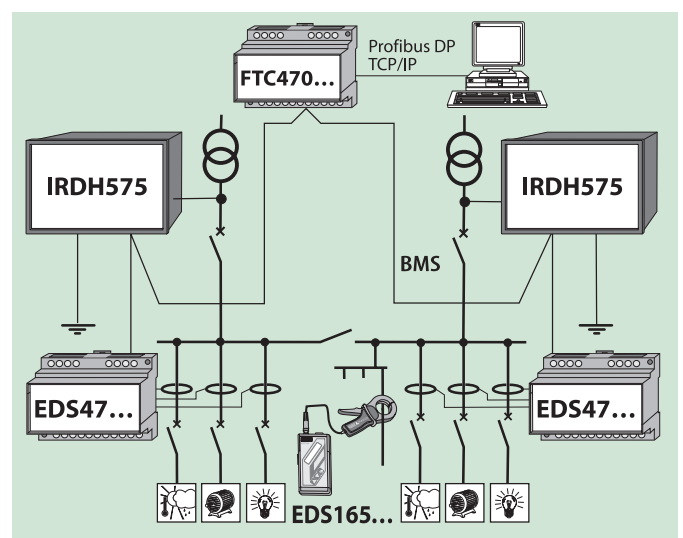
Example 2



### Automatic insulation fault location with local and centralized indication and higher-level information exchange

Function same as example No. 1. In addition, alarm and status messages can be transferred by the FTC470... via Ethernet or other bus systems to the central building process control system. Also parameterization and control can be carried out by the building process control system.

Example 3



### Automatic insulation fault location in interconnected systems, with local and centralized indication and higher-level information exchange

Function same as example No. 2. In addition, alarm messages are sent and indicated via the BMS bus to every IRDH575. The maximum number of interconnected systems can be up to 30 systems.

Main circuits	Control circuits
IRDH575 3 (N) AC/DC 20...575 V / 340...760 V 1 / 2.5 / 10 / 25 / 50 mA 4 x 16 characters	IRDH575 3 (N) AC/DC 20...575 V / 340...760 V 1 / 2.5 / 10 / 25 / 50 mA 4 x 16 characters
EDS470-12 12 59 / 708 per channel 5 mA	EDS473-12 12 59 / 708 per channel 0.5 mA
W...S... WR...S... WS...S... -- --	-- -- -- W.../8000 WS.../8000
EDS3060 EDS165* -- PSA3020* PSA3052* PSA3165	EDS3360 EDS165-3* -- PSA3020* PSA3052* --
× FTC470XDP FTC470XMB FTC470XET	× FTC470XDP FTC470XMB FTC470XET

\*All components are incorporated in EDS3065

\*All components are incorporated in EDS3365

Main circuits	Control circuits
IRDH575 3 (N) AC/DC 20...575 V / 340...760 V 1 / 2.5 / 10 / 25 / 50 mA 4 x 16 characters	IRDH575 3 (N) AC/DC 20...575 V / 340...760 V 1 / 2.5 / 10 / 25 / 50 mA 4 x 16 characters
EDS470-12 12 59 / 708 per channel 5 mA	EDS473-12 12 59 / 708 per channel 0.5 mA
W...S... WR...S... WS...S... -- --	-- -- -- W.../8000 WS.../8000
EDS3060 EDS165* -- PSA3020* PSA3052* PSA3165	EDS3360 EDS165-3* -- PSA3020* PSA3052* --
× FTC470XDP FTC470XMB FTC470XET	× FTC470XDP FTC470XMB FTC470XET

\*All components are incorporated in EDS3065

\*All components are incorporated in EDS3365

## A-ISOMETER® IRDH575

**Insulation monitoring device for unearthed AC, DC and AC / DC systems (IT systems), with integrated insulation fault location system and control and indication function**



**A-ISOMETER® IRDH575**

### Device characteristics

- Universal application in IT 3(N) AC, AC / DC and DC systems 20...575 V / 340...760 V
- Response range 1 kΩ...10 MΩ
- INFO key for the indication of various parameters and system leakage capacitance
- Comprehensive self-monitoring function including system fault alarm relay
- Internal and external TEST and RESET button
- Two separate alarm relays, N/C / N/O operation selectable
- Illuminated plain text display 4 x 16 characters
- RS485 interface
- Data memory, internal disconnection of the A-ISOMETER® from the system being monitored when several A-ISOMETERs® are interconnected, 0 / 4...20 mA output
- Can be extended to an insulation fault location system for 708 circuits
- Adjustable test current for insulation fault location
- Can be used in combination with insulation fault evaluators EDS470/473

### Certifications



### Product description

The A-ISOMETERs® of the IRDH575 series monitor the insulation resistance of unearthed systems (IT systems). They are suitable for universal use in 3(N) AC, AC / DC and DC systems. AC systems may include extensive DC supplied loads, such as rectifiers, converters or thyristor-controlled DC drives. In combination with insulation fault evaluators of the EDS47... series and the appropriate measuring current transformers they can be extended to an insulation fault location system.

### Insulation monitoring function

If the reading is below the selected response values ALARM1 / ALARM2, the associated alarm relays respond and the alarm LEDs light up. Two separately adjustable alarm relays allow to distinguish between "prewarning" and "alarm". The measured value is indicated on the LC display or an externally connectable measuring instrument. In this way any changes can easily be detected, e. g. when subcircuits are connected to the system. The fault message can be stored. The fault memory can be reset by pressing the RESET button. By pressing the TEST button, the function of the device as well as the connections to system and earth can be tested. By pressing the INFO key essential information is indicated e. g. existing system leakage capacitance or device parameters.

### Insulation fault location function

Insulation fault location is carried out in combination with the insulation fault evaluators EDS47... and the respective measuring current transformers. When the IRDH575 detects an insulation fault, insulation fault location is started automatically or manually. The IRDH575 generates a test current the amplitude of which is dependent on the existing system leakage capacitances and the insulation fault. In the event of low-resistance insulation faults, the test current is limited by the IRDH575. The maximum value can be set via the respective menu. The test current signal flows from the test device via the live conductors to the location of the insulation fault. From there it flows via the insulation fault and the PE conductor back to the IRDH575. This current pulse is then detected by the measuring current transformers located in the insulation fault path, and is evaluated by the connected insulation fault evaluators EDS47... When the test current in the measuring current transformer exceeds the response value, the associated alarm LED at the EDS47... lights up indicating the faulty subcircuit. This information is also indicated on the LC display of the IRDH575. The point of fault can easily be localized by assigning the measuring current transformers to the respective circuit.

### Additional functions

99 alarm messages with date and time can be stored in the data memory of the IRDH575. The device also includes decoupling relays for internal disconnection of the A-ISOMETER® from the system being monitored, e. g. if several A-ISOMETERs® are used in interconnected IT systems. An integrated RS485 interface (BMS protocol) allows information exchange with other BENDER devices.

Via the 0 / 4...20 mA output details about the insulation resistance can be transferred to higher-level control and indication devices.

The function of the IRDH575 is continuously monitored. When a system fault occurs, the associated alarm LED lights up and the alarm relay switches.

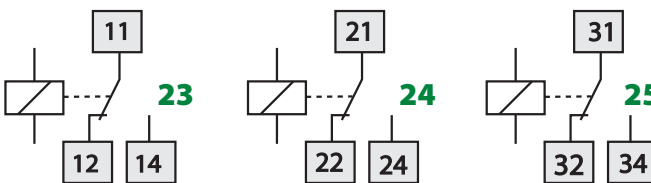
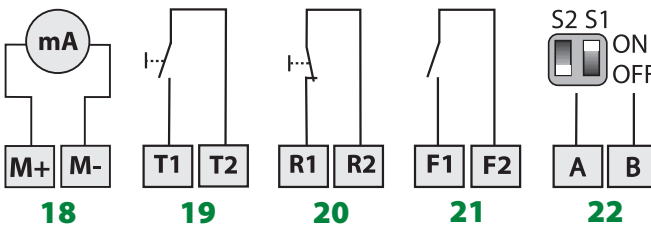
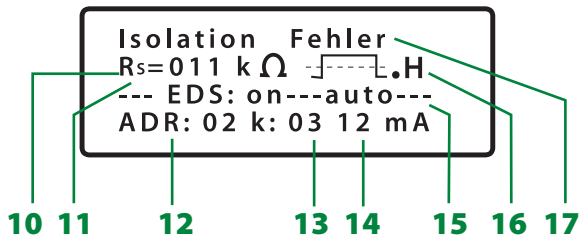
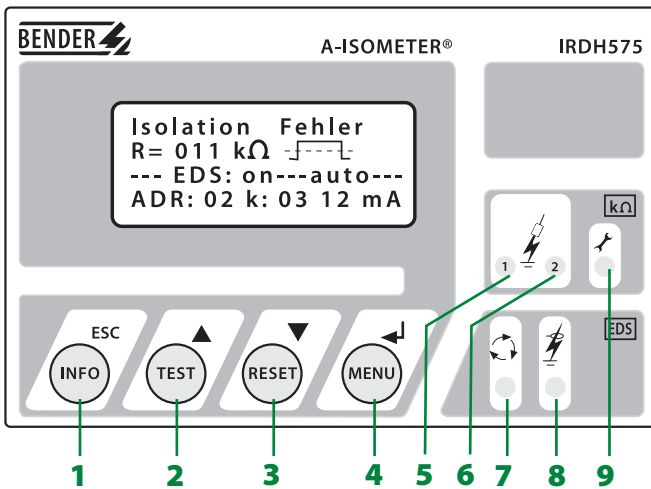
### System design

Generally an EDS system consists of an IRDH575 and one or several insulation fault evaluators EDS47... with the associated measuring current transformers. Information exchange between the EDS47... and the IRDH575 is carried out via a time and cost saving two-wire interface. Such a system may include up to 59 EDS47... so that a total of 708 circuits can be monitored.

### Standards

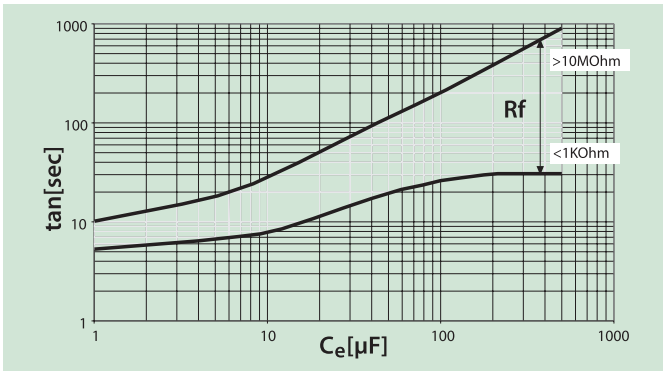
The IRDH575 series complies with the standards: DIN EN 61557-8 (VDE 0413 part 8): 1998-05; EN 61557-8: 1997-03, IEC 61557-8: 1997-02, ASTM F 1669M-96 and DIN EN 61557-9 (VDE 0413 part 9): 2000-08, EN 61557-9: 1999, IEC 61557-9: 1999.

Wiring diagram – operating elements

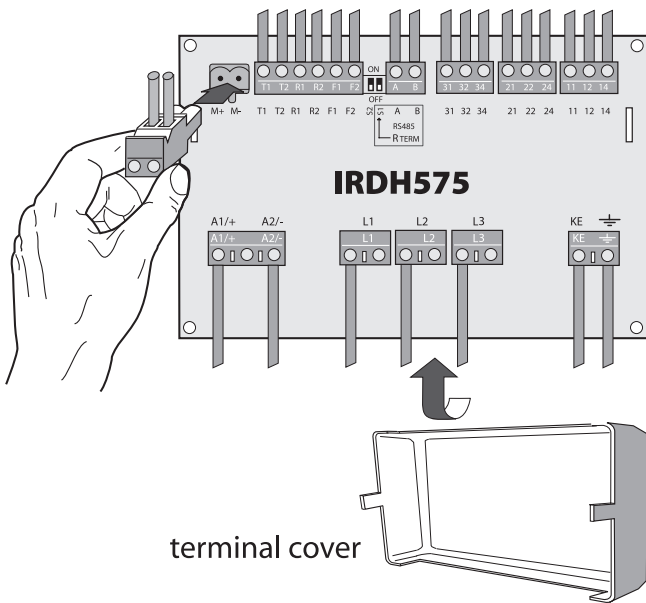


- 1 - INFO key: to query standard information  
ESC key: back to the MENU function
- 2 - TEST button: to call up the self test  
Up key: parameter change, scrolling
- 3 - RESET button: to delete insulation and fault messages  
Down key: parameter change, scrolling
- 4 - MENU key: to activate the MENU  
ENTER key: confirmation parameter change
- 5 - ALARM LED 1 illuminated: insulation fault, first warning level reached
- 6 - ALARM LED 2 illuminated: insulation fault, second warning level reached
- 7 - EDS LED lights: insulation fault location has been started
- 8 - EDS alarm LED lights: insulation fault has been detected
- 9 - LED illuminated: system fault
- 10- Indication of the insulation resistance in kΩ
- 11 - Additional information about the insulation resistance:  
+ = insulation fault at L+; - = insulation fault at L-;  
s = a new measuring process has been started;
- 12 - Bus address of the active EDS47...  
(indicates the EDS47... that detected the fault)
- 13 - Channel being monitored by the EDS74...  
(indicates the faulty subcircuit)
- 14 - Test current in mA or μA
- 15 - EDS is running in the AUTO mode. Further modes are: on, off,  
pos: manual setting of address and channel (in the Master  
mode only), 1 cycle: after testing all the channels once, the  
EDS is deactivated.
- 16 - Polarity of the test current pulse, point = valid BMS traffic,  
H = a new entry is made in the memory data base
- 17 - Messages in plain text
- 18 - Current output 0...20 mA or 4...20 mA
- 19 - External TEST button (NO contact)
- 20 - External RESET button (NC contact or wire jumper), when  
the terminals are open, the fault message will not be stored
- 21 - STANDBY, when the contact is closed, insulation fault mea-  
surement does not take place
- 22 - RS485 termination (120 Ω) with micro switch S1 and con-  
nection BMS bus; S1 = ON = BMS bus is terminated,  
S2 = unassigned
- 23 - Alarm relay: ALARM1 (A-ISOMETER®)
- 24 - Alarm relay ALARM2 (A-ISOMETER®)
- 25 - Alarm relay: system fault and EDS alarm (Adr.:1)

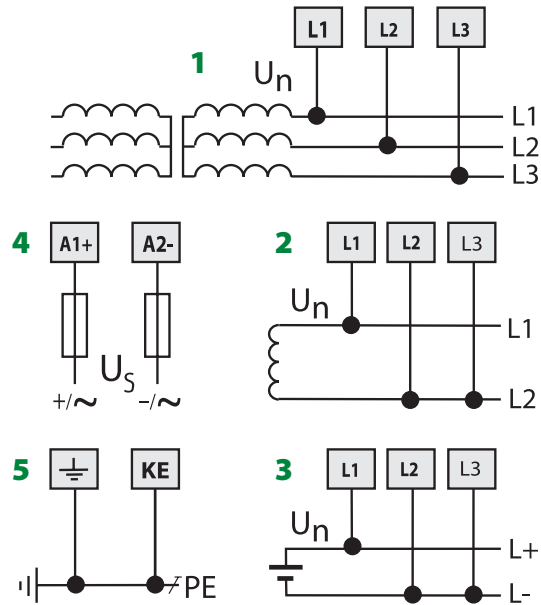
**Characteristic curve response times**



**Wiring diagram – rear view**



**Wiring diagram – system connection**

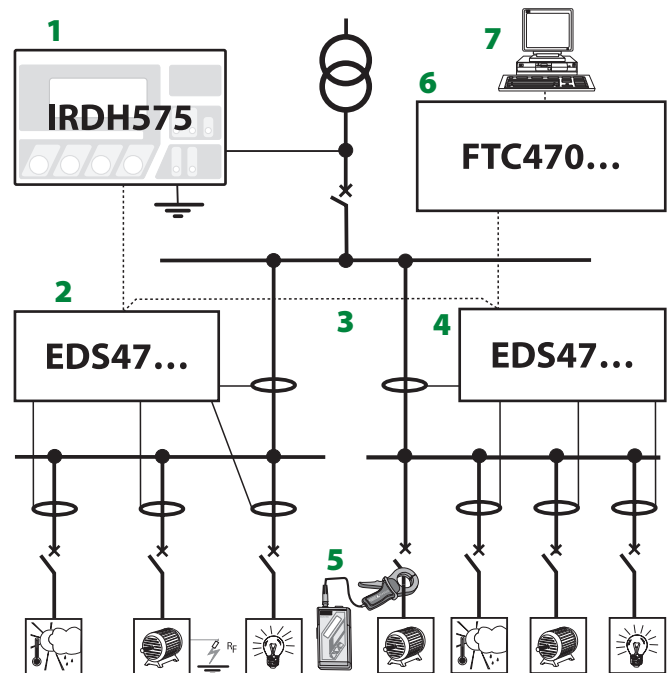


- 1 - System connection 3 AC
- 2 - System connection AC
- 3 - System connection DC
- 4 -  $U_S$  see ordering details, 6 A fuse recommended

supply voltage  $U_S$  applied in IT systems requires two fuses.

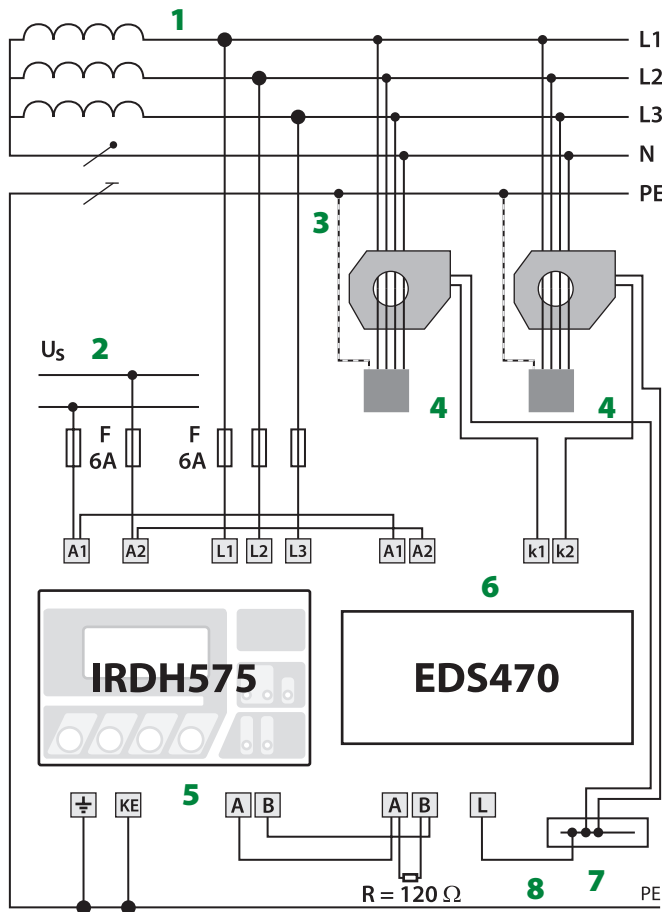
- 5 - PE connection

**Example of a system design**



- 1 - A-ISOMETER® IRDH575
- 2 - EDS470-12 / EDS473-12
- 3 - RS485 / BMS protocol
- 4 - EDS470-12 / EDS473-12
- 5 - EDS3060 / EDS3360
- 6 - FTC470... protocol converter
- 7 - PROFIBUS DP, TCP/IP, J-Bus / Modbus

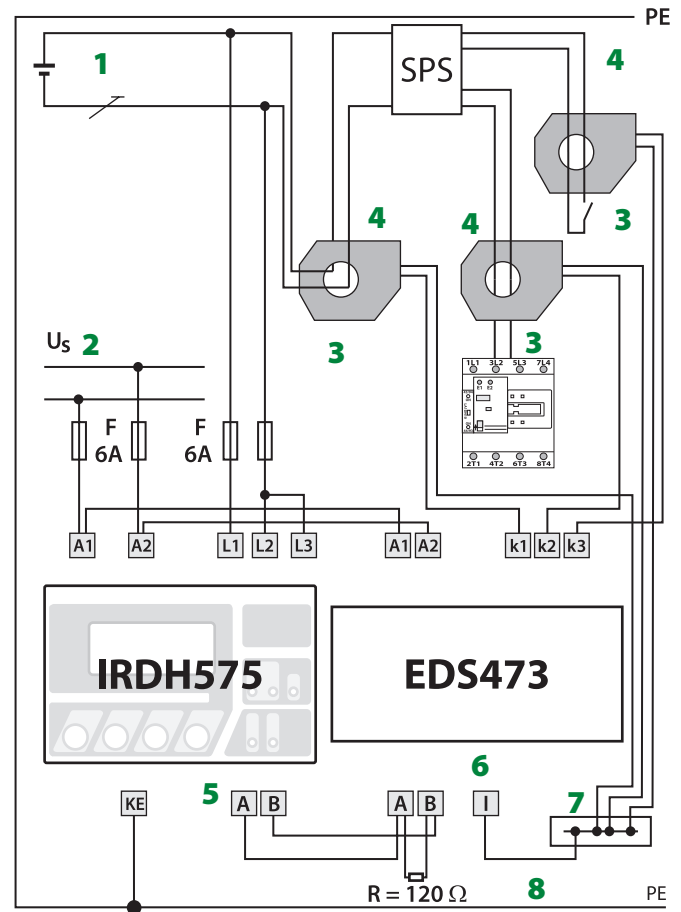
Example of an interconnection diagram of an EDS470 system with IRDH575



EDS470 system with IRDH575, EDS470-12 and measuring current transformers W1-S35 in a 3AC system

- 1 - 3 AC / 3N AC / AC 20...575 V
- 2 -  $U_S$  see ordering details, 6 A fuse recommended, Note: supply voltage  $U_S$  applied in IT systems requires two fuses
- 3 - Measuring current transformers W...
- 4 - Subcircuits to the loads
- 5 - A-ISOMETER® IRDH575
- 6 - Insulation fault evaluator EDS470-12
- 7 - Terminal box for L connections
- 8 - Cable length max. 25 cm, cross-section  $\varnothing$  2,5 mm<sup>2</sup>

Example of an interconnection diagram of an EDS473 system with IRDH575



- 1 - DC 20...308 V
- 2 -  $U_S$  see ordering details, 6 A fuse recommended, Note: supply voltage  $U_S$  applied in IT systems requires two fuses
- 3 - Measuring current transformers W.../8000
- 4 - Subcircuits PLC: inputs and outputs
- 5 - A-ISOMETER® IRDH575
- 6 - Insulation fault evaluator EDS473-12
- 7 - Terminal box for I connections
- 8 - Cable length max. 25 cm, cross-section  $\varnothing$  2,5 mm<sup>2</sup>

**Design of an EDS473 system**

In the example above an EDS system is used for the supply of a programmable logic controller (PLC) in a DC system. The inputs of PLC systems are very sensitive, therefore the use of EDS473 devices is recommended. The test current of the IRDH575 must be set to max. 2.5 mA or if necessary to 1 mA in order to avoid influences on the PLC system.

## Technical data A-ISOMETER® IRDH575

Insulation coordination acc. to IEC 60664-1	
Rated insulation voltage	AC 800 V
Rated impulse voltage / pollution degree	8 kV / 3
Voltage ranges	
System being monitored IRDH575B1-435	
Nominal system voltage $U_n$	AC, 3(N) AC 20...575 V*
Nominal frequency $f_n$	50...460 Hz
Nominal system voltage $U_n$	DC 20...575 V*
System being monitored IRDH575B2-435	
Nominal system voltage $U_n$	AC, 3(N) AC 340...760 V*
Nominal frequency $f_n$ (for $f < 50$ Hz see characteristic curve)	50...460 Hz
Nominal system voltage $U_n$	DC 340...575 V*
Supply voltage	
Supply voltage $U_s$ (see nameplate)	AC 40...460 Hz 88...264 V* / DC 77...286 V*
Power consumption	$\leq 14$ VA
Response values	
Response value $R_{an1}$ (ALARM1)	1 k $\Omega$ ...10 M $\Omega$
Response value $R_{an2}$ (ALARM2)	1 k $\Omega$ ...10 M $\Omega$
Relative percentage error (10 k $\Omega$ ...10 M $\Omega$ )	0%...+20% / (1...10 k $\Omega$ ) + 2 k $\Omega$
Response time $t_{an}$ at $R_f = 0.5 \times R_{an}$ and $C_e = 1 \mu F$	see characteristic curves
Measuring time	see characteristic curves
Hysteresis	25%, + 2 k $\Omega$
Measuring circuit for insulation measurement	
Measuring voltage $U_m^{**}$	$\leq 40$ V
Measuring current $I_m$ max. (at $R_f = 0 \Omega$ )	$\leq 220 \mu A$
Internal d.c. resistance $R_i$	$\geq 180$ k $\Omega$
Internal impedance $Z_i$ at 50 Hz	$\geq 180$ k $\Omega$
Max. permissible extraneous DC voltage $U_{fg}$	version B1 $\leq$ DC 810 V / version B2 $\leq$ DC 1060 V
System leakage capacitance $C_e$	max. 150 (500) $\mu F$
Measuring circuit for insulation fault location	
Test current $I_p$ DC max.	1; 2.5; 10; 25; 50 mA
Test pulse/break	2 s / 4 s
Displays	
Display (illuminated)	LC display
Characters (number of characters, height)	4 x 16 characters / 5 mm
Display range, measuring value	1 k $\Omega$ ...10 M $\Omega$
Operating error	(10 k $\Omega$ ...10 M $\Omega$ ) $\pm 10\%$ / (1...10 k $\Omega$ ) $\pm 1$ k $\Omega$

Outputs	
TEST / RESET button	internal / external
Current output	0 / 4...20 mA
Max. load	0 / 4...20 mA (500 $\Omega$ )
Interfaces	
Interface / protocol	RS485 / BMS
Max. cable length	1200 m
Recommended cable (shielded, shield on one side connected to PE)	J-Y(ST)Y 2 x 0.6
Terminating resistor	120 $\Omega$ (0.5 W)
Switching elements	
Switching elements	3 x 1 changeover contact
Operating principle	N/O / N/C operation
Factory setting	N/O operation
Electrical endurance	12000 cycles
Contact class	IIB acc. to DIN IEC 60255 part 0-20
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
Operating principle system fault / EDS alarm (31-32-34)	N/C operation
Minimum contact current at DC 24 V	2 mA (50 mW)

General data	
Shock resistance acc. to IEC 60068-2-27 (device in operation)	15 g / 11 ms
Bumping acc. to IEC 60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance acc. to IEC 60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance acc. to 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 according to IEC 60721-3-3	3K5
Operating mode	continuous operation
Mounting	as indicated on the display
Connection	plug-in terminals
Wire cross section, rigid, flexible	0.2...4 mm <sup>2</sup> / 0.2...2.5 mm <sup>2</sup>
Degree of protection, internal components (DIN EN 60529)	IP 30
Degree of protection, terminals (DIN EN 60529)	IP 20
Degree of protection in case of door mounting	IP 40
Flammability class	UL94V-1
Technical manual	TGH 1364
Weight approx.	900 g

\*absolute values

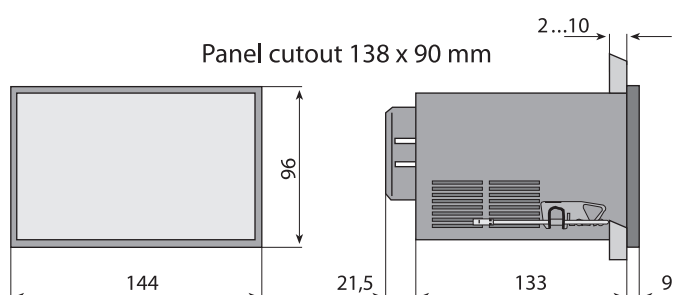
## Ordering details

Type	Nominal system voltage $U_n$	Supply voltage $U_s$	Art. No.
IRDH575B1-427	AC / DC 20...575 V	DC 19.2...72 V	B 9106 5502
IRDH575B1-435	3(N) AC / DC 20...575 V*	AC 84...264 / DC 77...286 V*	B 9106 5500
IRDH575B1-4227**	3(N) AC / DC 20...150 V*	DC 19.2...72 V*	B 9106 5505
IRDH575B1-4235	AC / DC 20...150 V	AC 88...264 V / DC 77...286 V	B 9106 5504
IRDH575B2-435	3(N) AC 340...760 V / DC 340...575 V*	AC 84...264 / DC 77...286 V*	B 9106 5503

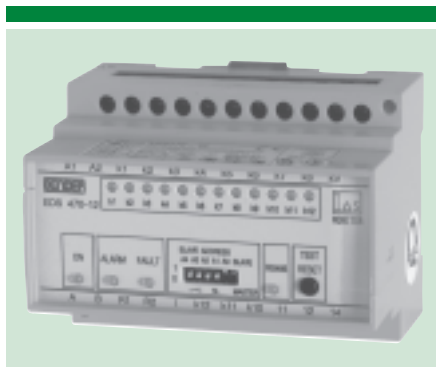
\*absolute values

\*\* Measuring voltage  $U_m$  10 V (version -4227)

## Dimension diagram, enclosure X500 Dimensions in mm







EDS47...-12

### Product description

The insulation fault evaluator EDS47... in combination with measuring current transformers is intended to be used to evaluate the test current signals generated by the insulation monitoring device IRDH575 or the insulation fault test device PGH47.... Up to 12 measuring current transformers can be connected per device. Up to 59 EDS47... can be interconnected via an RS485 interface (BMS protocol) in one EDS system so that up to 708 subcircuits can be monitored.

### Application

Insulation fault evaluator for insulation fault location systems EDS.

### Function

After starting insulation fault location via the insulation fault test device PGH47... or the A-ISOMETER® IRDH575, the insulation fault evaluator EDS47... starts scanning each measuring current transformer (channel). During the scanning process, the respective alarm LED k1...k12 lights. If the fault current detected by a measuring current transformer exceeds the response value of 5 mA / 0.5 mA, the respective alarm LED of the LED chain lights continuously and the alarm relay switches. When the response value is not exceeded, the alarm LED extinguishes. When all of the 12 channels have been scanned, insulation fault location starts again and keeps running until it is stopped. The connecting leads between the measuring current transformers and the evaluators are continuously monitored. An alarm message is signalled when a connecting lead is interrupted.

If the fault memory of the EDS47... is activated, the alarm messages of the individual channels remains stored until the RESET button is pressed or an automatic RESET command via the interface is given. If the fault memory is not activated, the alarm message remains stored for the time the fault is present. Eliminating this fault before starting a new scanning cycle eliminates the alarm message too. When several insulation fault evaluators EDS47... exist in one system, all devices are scanned simultaneously.

### Certifications

EDS470-12



EDS473-12



### Device characteristics

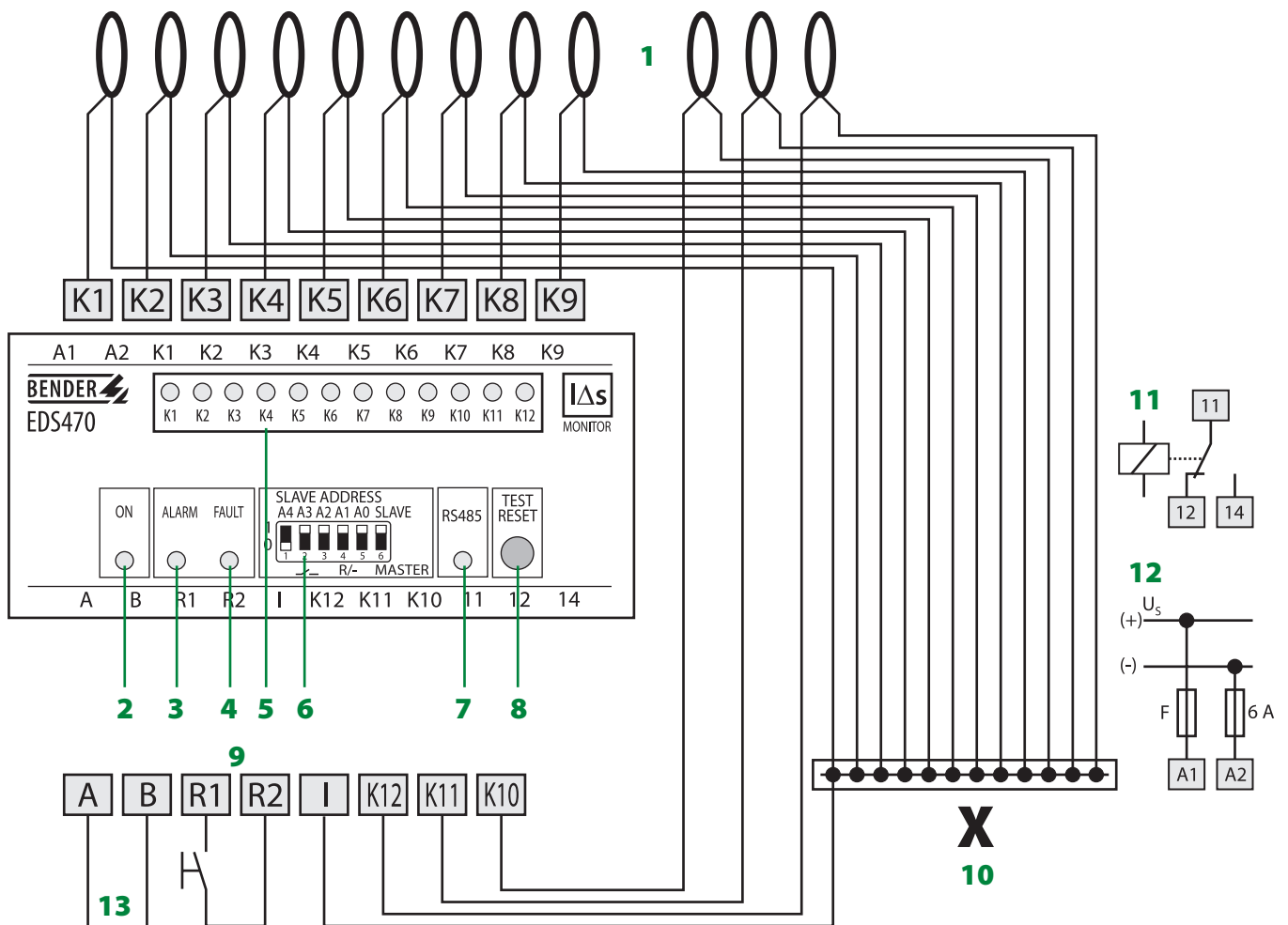
- Response sensitivity:  
EDS470-12: 5 mA for main circuits  
EDS473-12: 0.5 mA for control circuits
- Alarm LED for collective alarm
- Alarm LED k1...k12 for alarm message per channel
- Alarm LED FAULT for FAULT alarm in case of interruption of the CT connection
- Combined TEST and RESET button
- Alarm relay with one potential-free changeover contact
- N/O / N/C operation, selectable
- Memory to store alarm messages
- Transparent dust cover for ingress protection, 45 mm

### Technical data

	EDS470	EDS473	EDS470	EDS473
<b>Insulation coordination acc. to IEC 60664-1</b>				
Rated insulation voltage	AC 250 V	AC 250 V	15 g / 11 ms	15 g / 11 ms
Rated impulse voltage / pollution degree	4 kV/3	4 kV/3	40 g / 6 ms	40 g / 6 ms
<b>Voltage ranges</b>				
Nominal system voltage $U_n$	dependent on PGH47... resp. IRDH575		1 g / 10...150 Hz	1 g / 10...150 Hz
Supply voltage $U_s$	see ordering details		2 g / 10...150 Hz	2 g / 10...150 Hz
Nominal frequency $U_s$	50...60 Hz	50...60 Hz	Ambient temperature, during operation	-10 °C...+55 °C
Power consumption	≤ 3 VA	≤ 3 VA	Storage temperature range	-40 °C...+70 °C
<b>Response values</b>				
Response value for test current	DC > 5 mA	DC > 0.5 mA	Climatic class according to IEC 60721-3-3	3K5
<b>Interfaces</b>				
Interface / protocol	RS485 / BMS	RS485 / BMS	Operating mode	continuous operation
Switching elements	1 changeover contact	1 changeover contact	Mounting	any position
Rated contact voltage	AC 250 V / DC 300 V	AC 250 V / DC 300 V	Connection	screw terminals
Electrical endurance	12000 cycles	12000 cycles	Wire cross section, rigid, flexible	0.2...4 mm <sup>2</sup> / 0.2...2.5 mm <sup>2</sup>
Making capacity	AC / DC 5 A	AC / DC 5 A	Degree of protection, int. components (DIN EN 60529)	IP30
Breaking capacity	2 A, AC 230 V, cos phi=0.4 0.2 A, DC 220 V, L/R=0.04 sec		Degree of protection, terminals (DIN EN 60529)	IP20
			Enclosure / dimension diagram	X470
			Screw fixing	2 x M4
			DIN rail mounting according to	DIN EN 60715 / IEC 60715
			Flammability class	UL94V-0
			Technical manual	TGH 1243
			Weight approx.	400 g



**Wiring diagram**



- 1 - Measuring current transformer
- 2 - Power On LED
- 3 - Alarm LED, lights up when an insulation fault has been detected in a channel
- 4 - Alarm LED FAULT, lights up in the event of interruption or short-circuit in a current transformer circuit (this function can be deactivated)
- 5 - Alarm LEDs, flash when the respective current transformer circuit is being scanned and light up when an insulation fault has been detected
- 6 - DIP switches to set the device address, the operating principle of the alarm relays, the memory behaviour and MASTER / SLAVE mode
- 7 - RS485 LED, indicates activities on the BMS bus
- 8 - TEST and RESET button: < 1 s = RESET, > 2 s = TEST
- 9 - External TEST and RESET button: press < 1 s = RESET, > 2 s = TEST
- 10 - Terminal strip X for measuring transformer I connections. Maximum length between terminal I and terminal strip X is 25 cm at a cross section of 2.5 mm<sup>2</sup> (15 cm at a cross section of 1.5 mm<sup>2</sup>)
- 11 - Alarm relay (collective alarm)
- 12 - U<sub>s</sub> see ordering details, 6 A fuse recommended. Note: supply voltage U<sub>s</sub> in IT systems requires two fuses.
- 13 - Connection BMS bus

**Ordering details**

Type	Supply voltage U <sub>s</sub>	BMS bus address range	Art. No.
EDS470-12	AC 230 V	2...30	B 9501 2002
EDS470-1213	AC 90...132 V*	2...30	B 9501 2005
EDS470-1221	DC 10.5...80 V*	2...30	B 9501 2006
EDS470-1223	DC 77...286 V*	2...30	B 9501 2010
EDS470E-12	AC 230 V	61...90	B 9501 2016

\* absolute values

Type	Supply voltage U <sub>s</sub>	BMS bus address range	Art. No.
EDS473-12	AC 230 V	2...30	B 9501 2019
EDS473-1213	AC 90...132 V*	2...30	B 9501 2020
EDS473-1221	DC 10.5...80 V*	2...30	B 9501 2021
EDS473-1223	DC 77...286 V*	2...30	B 9501 2036
EDS473E-12	AC 230 V	61...90	B 9501 2032

\* absolute values

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## Measuring current transformers for EDS systems

### Measuring current transformers for EDS systems

Different types of measuring current transformers are available for application in insulation fault location systems EDS470 to meet the requirements of the individual electrical installation.

Measuring current transformers which are commercially available are not suitable for the EDS system and must not be used.

All measuring current transformers listed in the table below are highly sensitive and convert even small residual currents into evaluable signals. The measuring current transformers are connected to the evaluator by two connecting leads. Particular attention shall be paid that all current-carrying leads of the respective subcircuit are passed through the current transformer with the **exception of the PE conductor**.

### Technical data measuring current transformers

EDS system	EDS470	EDS473
Rated insulation voltage	AC 720 V	AC 720 V
Rated impulse withstand voltage	3 kV	3 kV
Rated transformation ratio	600:1	8000:1
Rated burden	180 Ω	24 kΩ
Rated primary current	10 A	1 A
Rated continuous thermal current	100 A	6 A
Rated short-time thermal current	14 kA / 1 s	0.75 kA / 1 s
Dynamic rated impulse current	35 kA / 30 ms	4.2 kA / 30 ms
Nominal power	50 mVA	0.375 mVA
Accuracy class	3	5
Ambient temperature	-10°C...+55°C	-10°C...+55°C
Flammability class	UL94V-0	UL94V-0
Length of the connecting leads		
Single wire $\geq 0.75 \text{ mm}^2$	0...1 m	0...1 m
Single wire, twisted $\geq 0.75 \text{ mm}^2$	1...10 m	1...10 m
Shielded cable $\geq 0.6 \text{ mm}^2$ (shield on one side to line conductor)	10...40 m	1...40 m

### Ordering details measuring current transformers

Type	Internal diameter (mm)	Art. No.	Suitable for EDS system
W10/600	10	B 911 761	EDS470
W0-S15	15	B 911 753	EDS470
W1-S35	35	B 911 731	EDS470
W2-S70	70	B 911 732	EDS470
W3-S105	105	B 911 733	EDS470
W4-S140	140	B 911 734	EDS470
W5-S210	210	B 911 735	EDS470
WR 70 x 175S	70 x 175	B 911 738	EDS470
WR 115 x 305S	115 x 305	B 911 739	EDS470
WR 150 x 350S	150 x 350	B 911 740	EDS470
WR 200 x 500	200 x 500	B 911 763	EDS470
WS 50 x 80S	50 x 80	B 911 741	EDS470
WS 80 x 80S	80 x 80	B 911 742	EDS470
WS 80 x 120S	80 x 120	B 911 743	EDS470
WS 80 x 160 S	80 x 160	B 911 755	EDS470
W10/8000	10	B 911 759	EDS473
W1-35/8000	35	B 911 756	EDS473
WS 50 x 80/8000	50 x 80	B 911 757	EDS473
WS 20 x 30/8000	20 x 30	B 911 764	EDS473

**Dimensions (mm) and weights (kg)**

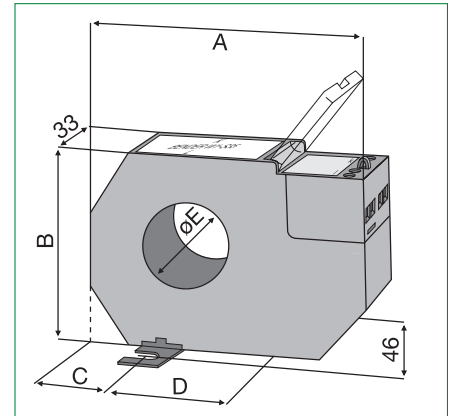
\* Measuring current transformers for EDS473 systems

**Measuring current transformers of the series: W1-S35..., WS-210, W1-35/8000, W0-S15, W10/600 and W10/8000**



Type	A	B	C	D	ø E	Weight	Art. No.
W10/600	--	--	--	--	10	0.05 kg	B 911 761
W10/8000*	--	--	--	--	10	0.05 kg	B 911 759
W0-S15	--	--	--	--	15	0.15 kg	B 911 753
W1-S35	100	79	26	48.5	35	0.25 kg	B 911 731
W1-35/8000*	100	79	26	48.5	35	0.25 kg	B 911 756
W2-S70	130	110	32	66	70	0.38 kg	B 911 732
W3-S105	170	146	38	94	105	0.60 kg	B 911 733
W4-S140	220	196	48.5	123	140	1.50 kg	B 911 734
W5-S210	299	284	69	161	210	2.20 kg	B 911 735

**W1... W5...**

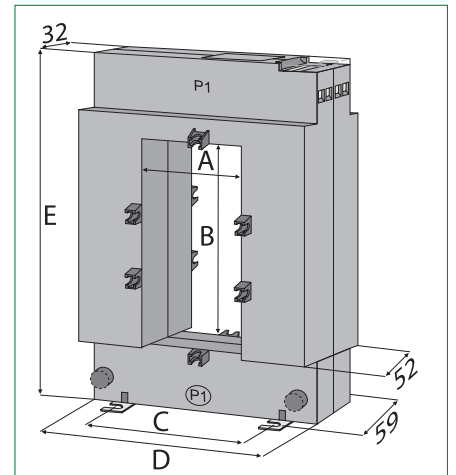


**Split-core measuring current transformers of the WS... series**

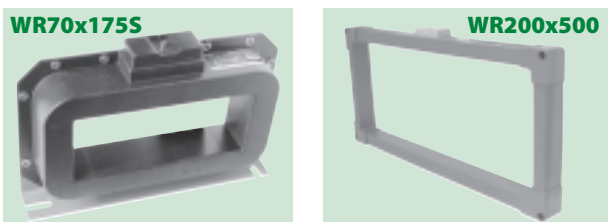


Type	A	B	C	D	E	Weight	Art. No.
WS 20x30/8000*	20	30	51	89	111	0.75 kg	B 911 764
WS 50x80S	50	80	78	114	145	0.90 kg	B 911 741
WS 50x80/8000*	50	80	78	114	145	0.90 kg	B 911 757
WS 80x80	80	80	108	144	145	1.20 kg	B 911 742
WS 80x120S	80	120	108	144	185	1.25 kg	B 911 743
WS 80x160S	80	160	120	184	245	2.90 kg	B 911 755

**WS ...**

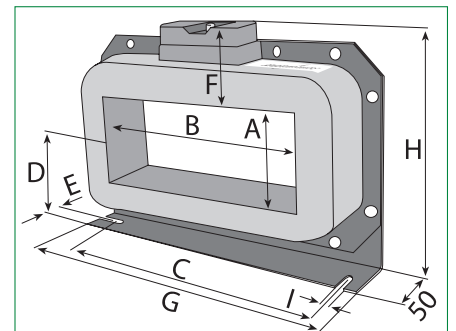


**Measuring current transformers of the WR... series**



Type	A	B	C	D	E	F	G	H	I	Weight	Art. No.
WR 70x175S	70	175	225	85	22	46	261	176	7.5	2.90 kg	B 911 738
WR 115x305S	115	305	360	116	25	55	402	240	8	6.30 kg	B 911 739
WR 150x350S	150	350	415	140	28	55	460	285	8	8.25 kg	B 911 740
WR 200x500S	200	500	568.5	142.5	--	62	585	285	--	9.00 kg	B 911 763

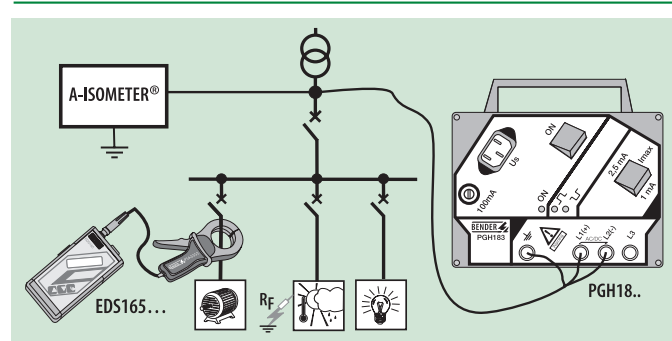
**WR...**



**1.7**

## Examples for practical application – Portable systems / retrofitting of existing installations

Example 4



**Functions**

<b>Description</b>	
<b>IT system</b>	
<b>System components</b>	<b>Optional components</b>
<b>A-ISOMETER®</b> 	Type Nominal system voltage $U_n$ Internal DC resistance
<b>Insulation fault test device</b> 	Type Nominal system voltage $U_n$ Max. test current
<b>Control and indicating device</b> 	Type LC display, characters Function keys Historical memory Acoustical alarm Alarm contacts
<b>Insulation fault evaluator</b> 	Type Channels per device Max. no. of devices/channels Alarm LED Response sensitivity
<b>Measuring current transformers</b> 	Circular type Rectangular type Split-core type Circular type Split-core type
<b>Portable</b> 	Type Insulation fault evaluators Insulation fault test device Current clamp 20 mm Current clamp 52 mm Current clamp 100 mm
<b>Communication</b> 	Via BMS bus PROFIBUS gateway JBus / ModBus gateway Ethernet gateway
<b>Note</b>	

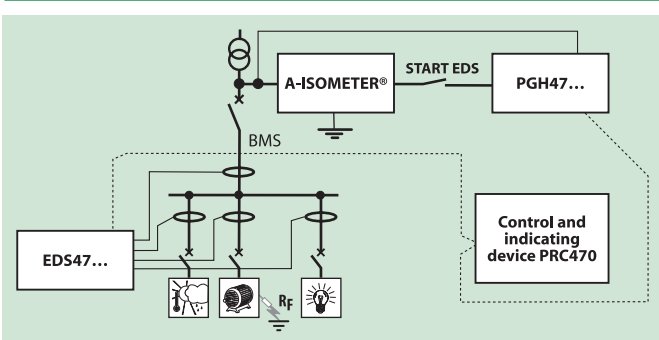
**Manual insulation fault location with local indication**

Manual insulation fault location is carried out with a portable insulation fault test device and evaluation device. It is only used in small IT systems. It is advisable to connect the insulation fault test device as near as possible to the supply input of the IT system. It generates the test current signal for insulation fault location. The individual subcircuits are encircled with the current clamp to check whether the test current signal is present in this subcircuit. The faulty subcircuit is indicated on the LC display and is signalled by a buzzer of the EDS165.

Main circuits	Control circuits
IRDH275 / 375, IRDH265-4 see insulation fault test device $\geq 120 \text{ k}\Omega$	IRDH275 / 375, IRDH265-4 see insulation fault test device $\geq 120 \text{ k}\Omega$
PGH185* AC, 3(N) AC 20...575 / DC 20...504 V 10; 25 mA	PGH185-3* AC, 3(N) AC 20...565 / DC 20...308 V 1; 2.5 mA
--	--
--	--
--	--
--	--
--	--
<b>EDS3065</b> <b>EDS165*</b> <b>PGH185*</b> <b>PSA3020*</b> <b>PSA3052*</b> <b>PSA3165</b>	<b>EDS3365</b> <b>EDS165-3*</b> <b>PGH183*</b> <b>PSA3320*</b> <b>PSA3352*</b> --
--	--
--	--
--	--
--	--
<b>*All components are incorporated in EDS3065</b>	
<b>*All components are incorporated in EDS3365</b>	

## Examples for practical applications – Portable systems / retrofitting of existing installations

**Example 5**



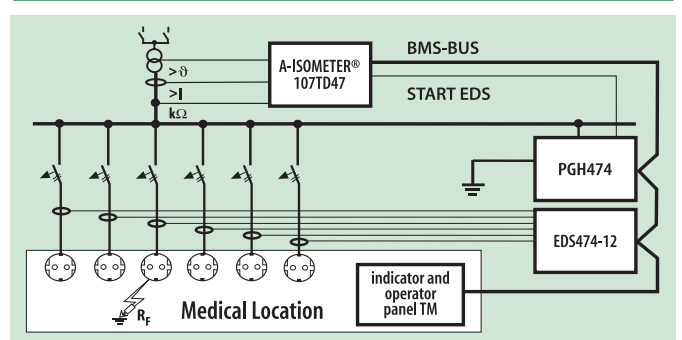
### Automatic insulation fault location with local and central indication

Automatic insulation fault location is carried out with permanently installed components. This method can be used for various types of IT systems. It is advisable to connect the insulation fault test device PGH47... as near as possible to the supply input of the IT system. The insulation fault test device generates the test current signal for insulation fault location. The test signal is detected in the faulty subcircuit via the measuring current transformers located in the individual subcircuits and is then evaluated by the insulation fault evaluators EDS47.... The faulty subcircuit is indicated on the LC display of the PRC470/1470 (optional). The message is locally indicated on the EDS47... via an alarm LED. For subordinated circuits, a portable evaluator of the series EDS3...60 can be used. The A-ISOMETER® should have an internal resistance of  $\geq 120 \text{ k}\Omega$ .

Main circuits	Control circuits
IRDH275 / 375, IRDH265-4 see insulation fault test device $\geq 120 \text{ k}\Omega$	IRDH275 / 375, IRDH265-4 see insulation fault test device $\geq 120 \text{ k}\Omega$
PGH471 AC,3(N) AC 20...575 / DC 20...504 V 10; 25 mA	PGH473 AC,3(N) AC 20...565 / DC 20...308 V 1; 2.5 mA
PRC470 / PRC1470 2 x 16 characters / 4 x 20 characters 3/5 no / yes no / yes 2/8	PRC470 / PRC1470 2 x 16 characters / 4 x 20 characters 3/5 no / yes no / yes 2/8
EDS470-12 12 59 / 708 per channel 5 mA	EDS473-12 12 59 / 708 per channel 0.5 mA
W...S... WR...S... WS...S... -- --	-- -- -- W.../8000 WS.../8000
<b>EDS3060</b> <b>EDS165*</b> -- <b>PSA3020*</b> <b>PSA3052*</b> <b>PSA3165</b>	<b>EDS3360</b> <b>EDS165-3*</b> -- <b>PSA3320*</b> <b>PSA3352*</b> --
× <b>FTC470XDP</b> <b>FTC470XMB</b> <b>FTC470XET</b>	× <b>FTC470XDP</b> <b>FTC470XMB</b> <b>FTC470XET</b>

The control and indicating device can optionally be used for system control. Without the PRC470, the PGH47... operates in the Master mode. \*All components are included in the EDS3...60.

**Example 6**



### Automatic insulation fault location in IT systems for medical locations

Insulation fault location in medical locations is carried out with permanently installed components. This method can be used for all AC IT systems up to 265 V. It is advisable to connect the insulation fault test device PGH47... as near as possible to the supply input of the IT system. The insulation fault test device generates the test current signal for insulation fault location. The test signal is detected in the faulty subcircuit via the measuring current transformers located in the individual subcircuits and is then evaluated in the insulation fault evaluators EDS474. The message is locally indicated on the EDS47... via an alarm LED. The EDS system can also be controlled by a TM operator panel and the alarm messages can be indicated at a central place.

Medical locations
107TD47* AC 0...265 V $\geq 120 \text{ k}\Omega$
PGH474* AC 20...265 V 1 mA
TM3 panel 4 x 20 characters 5 yes yes 8
EDS474-12* 12 59 / 708 per channel 0.5 mA
-- -- -- W.../8000* WS.../8000
-- -- -- -- --
× <b>FTC470XDP</b> <b>FTC470XMB</b> <b>FTC470XET</b>

\*The UFC107E system can be delivered as a ready-to-connect module.

1.7

# Insulation fault test device PGH471 / PGH473



**PGH471 / PGH473**

### Device characteristics

- Test current:  
PGH471: max. 25 / 10 mA;  
PGH473: max. 2.5 / 1 mA
- Power On LED
- Alarm LED RS485 active
- Two alarm LEDs to indicate the negative or positive test cycle
- Alarm relay with one voltage-free NO contact to signal that insulation fault location is running
- Start / Stop button to activate resp. deactivate insulation fault location

### Certifications



### Product description

The intended use of the insulation fault test device PGH47... is to generate a test current signal for insulation fault location. The variants differ in the value of the maximum permissible test current. It is suitable for systems already equipped with an insulation monitoring device.

### Application

Insulation fault test device for insulation fault location systems:  
PGH471: IT main circuits, PGH473: IT control circuits

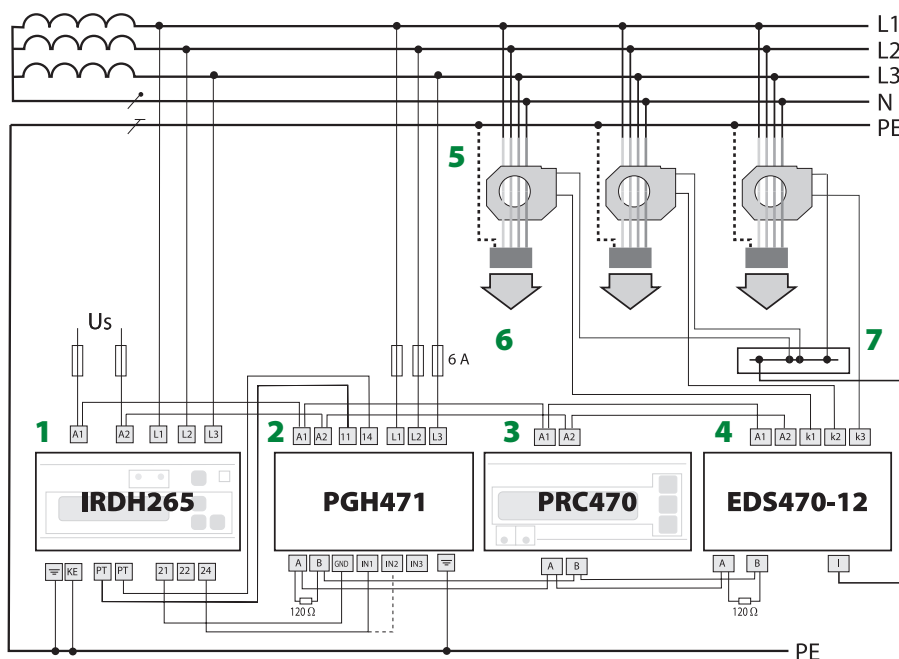
### Function

The insulation fault test device PGH47... generates a test current signal depending on the existing system voltage. Depending on the selected input, permanent insulation fault location can be started or only 1 pass can be selected. After activating the test current, the alarm LEDs indicate the current mode of the test cycle either positive or negative.

### Standards

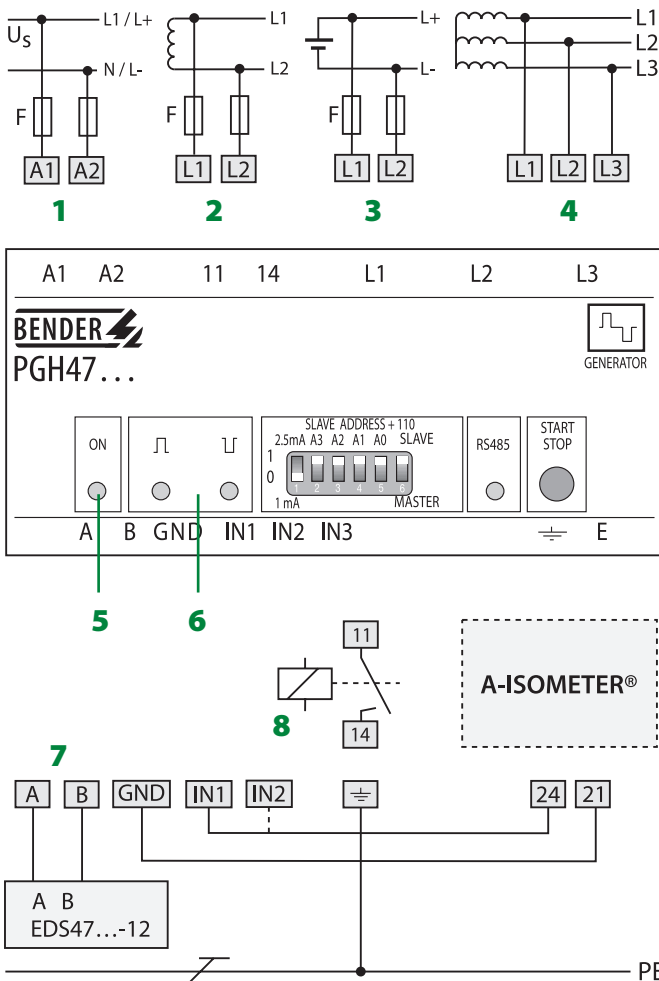
The PGH47... series complies with the standards: DIN EN 61557-9 (VDE 0413 part 9): 2000-08, EN 61557-9: 1999, IEC 61557-9: 1999.

### Insulation fault test device PGH471 / PGH473 in the EDS system (example of an interconnection diagram)



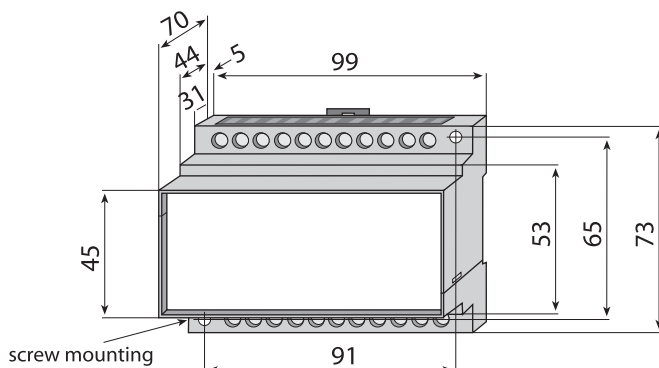
- |   |                                      |
|---|--------------------------------------|
| 1 - A-ISOMETER® IRDH265                             | 5 - Measuring current transformer    |
| 2 - Insulation fault test device PGH471             | 6 - Subcircuits to the loads         |
| 3 - Control and indicating device PRC470 (optional) | 7 - Terminal block for I-connections |
| 4 - Insulation fault evaluator EDS470-12            |                                      |

**Wiring diagram**



- 1 -  $U_S$  see nameplate, 6 A fuse recommended, Note: supply voltage  $U_S$  in IT systems requires two fuses.
- 2 - IT system AC
- 3 - IT system DC
- 4 - IT system 3 AC
- 5 - Power ON LED
- 6 - LEDs test cycle
- 7 - Connection BMS bus
- 8 - Alarm relay

**Dimension diagram, enclosure X470** Dimensions in mm



**Ordering details**

Type	Supply voltage $U_S$	Nominal system voltage $U_n$	BMS address range	Art. No.
PGH471	AC 230 V	AC 20...575 V / DC 20...504 V*	111...119	B 9501 8004
PGH471-13	AC 90...132 V*	AC 20...575 V / DC 20...504 V*	111...119	B 9501 8005
PGH471-21	DC 10.5...80 V*	AC 20...575 V / DC 20...504 V*	111...119	B 9501 8006
PGH471-23	DC 77...286 V*	AC 20...575 V / DC 20...504 V*	111...119	B 9501 8007
PGH471E	AC 230 V	AC 20...575 V / DC 20...504 V*	121...150	B 9501 8008
PGH473	AC 230 V	AC 20...265 V / DC 20...308 V*	111...119	B 9501 8009
PGH473-13	AC 90...132 V*	AC 20...265 V / DC 20...308 V*	111...119	B 9501 8010
PGH473-21	DC 10.5...80 V*	AC 20...265 V / DC 20...308 V*	111...119	B 9501 8011
PGH473E	AC 230 V	AC 20...265 V / DC 20...308 V*	121...150	B 9501 8015
PGH473E-21	DC 10.5...80 V*	AC 20...265 V / DC 20...308 V*	121...150	B 9501 8016

\*absolute values

**Technical data PGH47...**

**Insulation coordination acc. to IEC 60664-1**

Rated insulation voltage	AC 500 V
Rated impulse voltage / pollution degree	4 kV / 3

**Voltage ranges**

Nominal system voltage $U_n$ PGH473	AC, 3(N) AC 45...400 Hz, 20...575 V / DC 20...308 V
Nominal system voltage $U_n$ PGH471	AC, 3(N) AC 45...400 Hz, 20...575 V / DC 20...500 V
Supply voltage $U_S$	see ordering details
Operating range of $U_S$	0.85...1.15 x $U_S$
Power consumption	≤ 3 VA

**Measuring circuit**

Test current	PGH473 ≤ 2.5 mA / 1 mA; PGH471 ≤ 25 mA / 10 mA
Test pulse / pause	2 s / 4 s

**Switching elements**

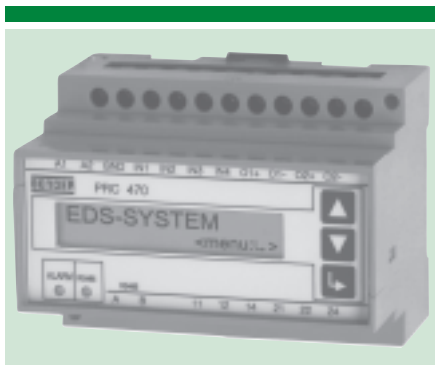
Switching elements	1 NO contact
Rated contact voltage	AC 250 V / DC 300 V
Making capacity	AC / DC 5 A
Breaking capacity	2 A, AC 230 V, cos phi = 0.4 0.2 A, DC 220 V, L/R = 0.04 s

**General data**

Shock resistance acc. to IEC 60068-2-27 (device in operation)	15 g / 10 ms
Bumping acc. to IEC 60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance acc. to IEC 60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance acc. to 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 according to IEC 60721-3-3	3K5
Operating mode	continuous operation
Mounting	any position
Connection	screw terminals
Wire cross section, rigid, flexible	0.2...4 mm <sup>2</sup> / 0.2...2.5 mm <sup>2</sup>
Degree of protection, internal components (DIN EN 60529)	IP 30
Degree of protection, terminals (DIN EN 60529)	IP 20
Screw mounting	2 x M4
DIN rail mounting according to	DIN EN 60715 / IEC 60715
Flammability class	UL94V-0
Technical manual	PGH470 TGH1243 / PGH473 TGH1321
Weight approx.	350 g

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## Control and indicating device PRC470



PRC470

### Device characteristics

- Indication of alarm messages
- Illuminated LC display / 2 x 16 characters
- Control inputs to start insulation fault location
- Alarm LED, collective alarm
- Alarm LED, indicates activities on the RS485 interface
- Alarm relay with two voltage-free changeover contacts for collective alarm message
- Three function keys for the parameterization of EDS systems
- Test function for testing all connected devices and measuring current transformers

### Certifications



### Product description

The control and indicating device PRC470 takes over the central display and operating functions in EDS systems. Parameterization of the system is also carried out via this device. Information exchange with all connected devices takes place via the RS485 interface (BMS protocol).

### Application

Control and indicating device for EDS insulation fault location systems.

### Function

All the parameters for devices connected via the RS485 interface (e. g. EDS47..., PGH47...) can be set: operation mode of the alarm relays (N/O / N/C operation), setting of measuring current transformer types, storage of the alarm messages, duration of insulation fault location, position function etc.

During insulation fault location all faulty subcircuits are subsequently indicated on the LC display. Indicated are the respective insulation fault evaluator, the respective channel, and the determined test current. By assigning the measuring current transformers to the respective circuit the point of fault can easily be localized. The position function allows specific continuous scanning of individual channels for insulation faults.

### Standards

The EDS47... series complies with the standards: DIN EN 61557-9 (VDE 0413 part 9): 2000-08, EN 61557-9: 1999, IEC 61557-9: 1999.

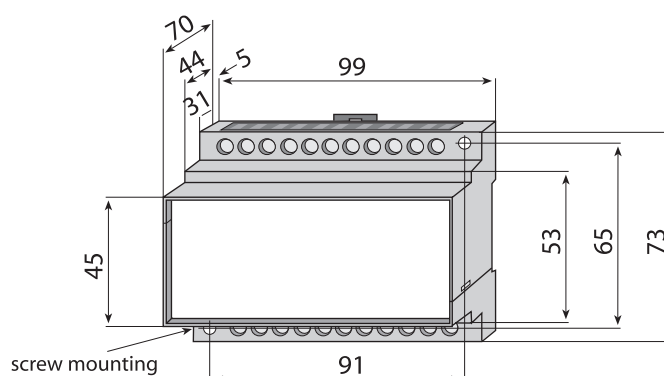
### Ordering details

Type	Supply voltage $U_S$	Art. No.
PRC470	AC 230 V	B 9501 2001
PRC470-13	AC 90...132 V*	B 9501 2004
PRC470-21	DC 10.5...80 V*	B 9501 2007
PRC470-23	DC 77...286 V*	B 9501 2009
PRC470E**	AC 230 V	B 9501 2014

\* absolut values

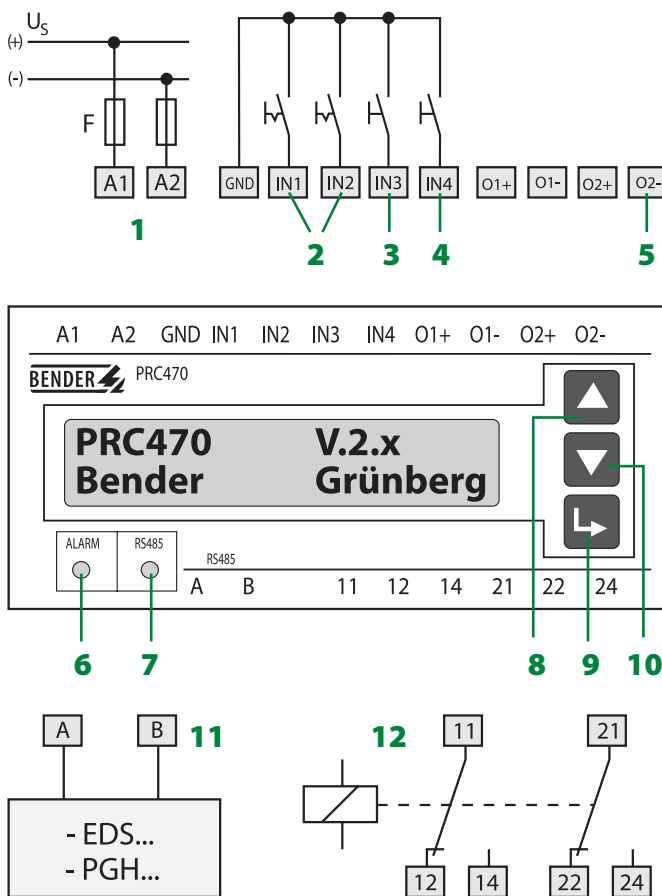
\*\* required for EDS470E-12 and PGH470E

### Dimension diagram, enclosure X470 Dimensions in mm





**Wiring diagram / operating elements**



- 1 -  $U_5$  see ordering details, 6 A fuse recommended. Note: supply voltage  $U_5$  in IT systems requires two fuses
- 2 - Control inputs EDS470 (EDS473) for system start
- 3 - Connection for external RESET button
- 4 - Connection for external TEST button
- 5 - Optocoupler outputs, no function in standard EDS systems
- 6 - Alarm LED lights when the thresholds of the response value at one of the insulation fault evaluators (collective alarm) have been exceeded
- 7 - RS485 LED, indicates activities on the RS485 bus
- 8 - Function key "UP"
- 9 - Function key "ENTER"
- 10 - Function key "DOWN"
- 11 - Connection BMS bus
- 12 - Alarm relays switch when a threshold of the response value is exceeded (collective alarm)

**Technical data control and indicating device PRC470**

**Insulation coordination acc. to IEC 60664-1**

Rated insulation voltage	AC 250 V
Rated impulse voltage / pollution degree	4 kV / 3

**Voltage ranges**

Supply voltage $U_5$	see ordering details
Operating range of $U_5$	$0.85 \dots 1.15 \times U_5$
Power consumption	$\leq 3$ VA

**Measuring circuit**

Tests for EDS systems, selectable	continuously / 1 cycle / 5 min.
Tests for RCMS470 systems	continuously

**Inputs**

Max. voltage	DC 5 V
--------------	--------

**Interfaces**

Interface / protocol	RS485 / BMS
----------------------	-------------

**Switching elements**

Switching elements	2 changeover contacts
Operating principle	N/O / N/C operation selectable
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

**General data**

Shock resistance acc. to IEC 60068-2-27 (device in operation)	15 g / 10 ms
Bumping acc. to IEC 60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance acc. to IEC 60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance acc. to 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 according to IEC 60721-3-3	3K5
Operating mode	continuous operation
Mounting	any position
Connection	screw terminals
Wire cross section, rigid, flexible	0.2...4 mm <sup>2</sup> / 0.2...2.5 mm <sup>2</sup>
Degree of protection, internal components (DIN EN 60529)	IP 30
Degree of protection, terminals (DIN EN 60529)	IP 20
Screw mounting	2 x M4
DIN rail mounting according to	DIN EN 60715 / IEC 60715
Flammability class	UL94V-0
Technical manuals	TGH1243 / TGH1321
Weight approx.	400 g

## PRC1470 control and indication panel

To be used in combination with  
EDS and RCMS systems



PRC1470 control and indication panel

### Features

- Large backlit clear text display for user-programmable alarm text messages and additional information
- Ease of connection to other systems via 8 (16) relay outputs, EIB interface and 16 digital input options
- Memory with real-time clock for storing 650 alarm and warning messages
- Five function keys allow convenient operation and setting of the PRC1470
- Multiple PRC1470 may be connected to the external RS485 interface
- Language of the menu text selectable in German or English
- Set-up of alarm text messages via the external RS485 interface and the RS232 interface via PC software
- Easy-to-clean lexan front foil

### Certifications



### Product description

The PRC1470 control and indication panel provides alarm / fault message indication plus control functions for RCMS residual current monitoring systems and EDS470 / 473 insulation fault location systems. Information exchange takes place via a two-wire interface (RS485) so that time and costs are considerably reduced.

### Clear text display

The back-lit text display continuously provides unambiguous information, supporting medical staff in decision-making. The text display has four lines of 20 characters, 8 mm high. It has a further three lines of alarm / warning information accessible via scroll keys. Three LEDs are arranged below the display to provide normal (green), warning (yellow) and alarm (yellow) indication. Operation is via five function keys for the acknowledgement of alarm and warning messages, for lamp test and basic settings of the device. The alarm text is programmed via PC software.

### Programming

750 alarm text messages can be programmed via PC software. For this purpose, the PC has to be connected to the RS232 and RS485 interface.

### Historical memory

Alarm and warning messages with date and time are automatically stored in the memory. Up to 650 test messages can be stored and can be read out via the function keys or PC software.

### Mechanical design

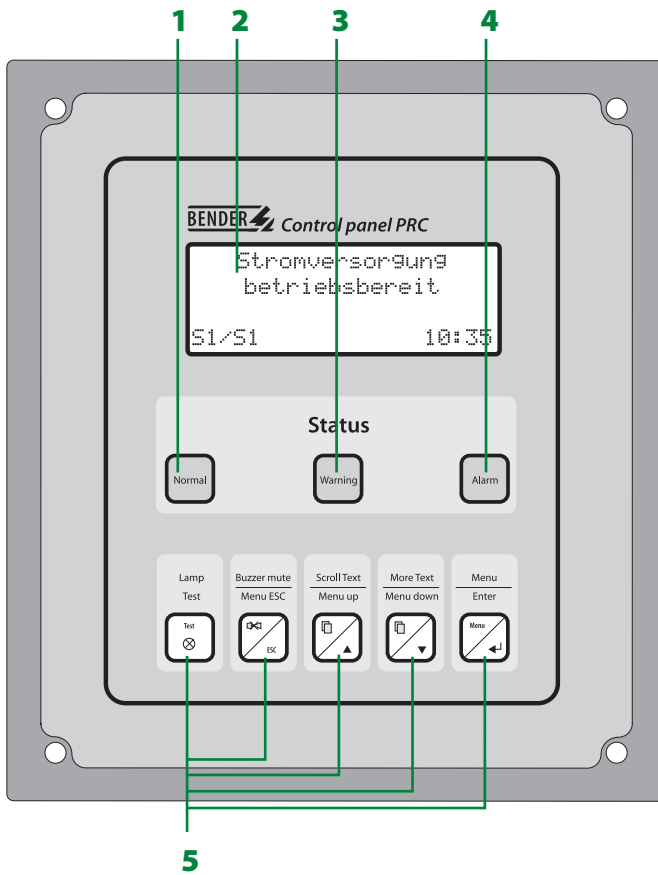
The PRC1470 is intended for industrial applications and for healthcare facilities as well. It is available as surface-mounting and flush-mounting type.

### Information exchange via the BENDER measuring device interface

The PRC1470 control and indication panel has two RS485 interfaces (BMS protocol). Due to the fact that one internal and one external interface are provided, it is possible to group the devices or systems accordingly. All RCMS and EDS evaluators, for example, can be connected to the internal RS485 interface. If several PRC1470 are to be interconnected, the external RS485 interface is recommended. If an alarm message occurs at one of the PRC1470, this alarm message can be displayed on any PRC connected to the collective external interface.

Each bus node on the internal interface has a unique address number. Each PRC1470 has an internal and external address number. There is one Master for each interface. With this structured bus and addressing arrangement, it is quite easy to arrange for any PRC1470 to display messages from any other device connected to a collective system.

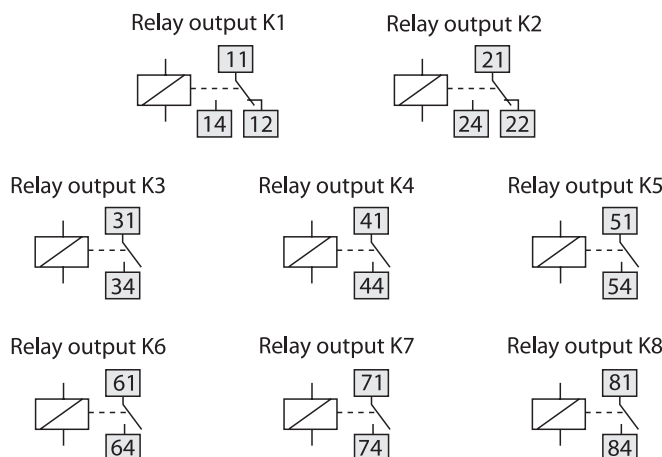
**Wiring diagram / operating elements**



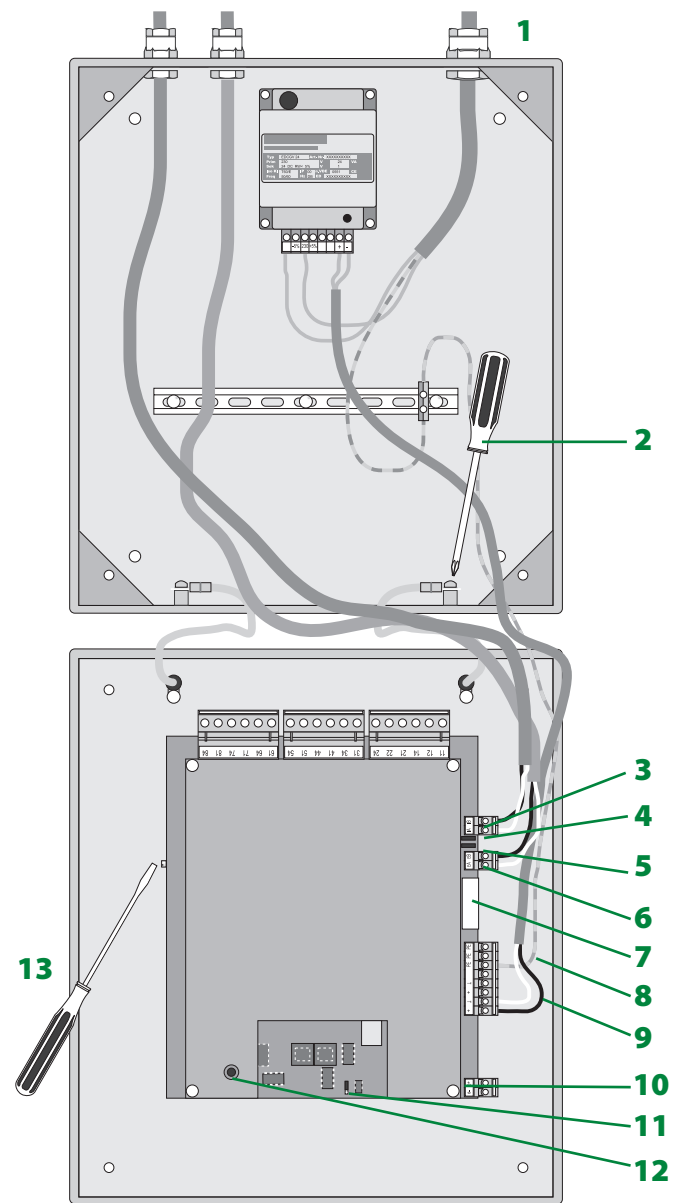
Eight relay outputs with voltage free contacts are provided to control external devices. To each of the output relays one alarm text message can be assigned so that a switching command can be triggered when the response value in a certain circuit is exceeded.

- 1 - Power On LED
- 2 - LC display, four lines, 4x 20 characters (8 mm high)
- 3 - Alarm LED, warning
- 4 - Alarm LED, alarm
- 5 - Function keys

**Wiring diagram / relay outputs**



**Wiring diagram / inside view**



- 1 - Supply voltage
- 2 - For fixing the surface-mount enclosure, the front plate can be removed (if required) by loosening the two retaining cables and the plug-in connectors.
- 3 - Connection internal BMS bus
- 4 - DIP switch (JP15) for terminating resistor of the internal RS485 interface
- 5 - DIP switch (JP14) for terminating resistor of the external interface
- 6 - Connection A and B of the external RS485 interface
- 7 - Service interface RS232, 9-pole D-sub
- 8 - PE connection (protective earth)
- 9 - Supply voltage + 24 V DC. Two terminals are provided for the power supply of other loads.
- 10 - Connection for EIB bus (option)
- 11 - Plug-in jumper on-board firmware update automatic (unassigned)
- 12 - RESET button
- 13 - Contrast setting of the LC display

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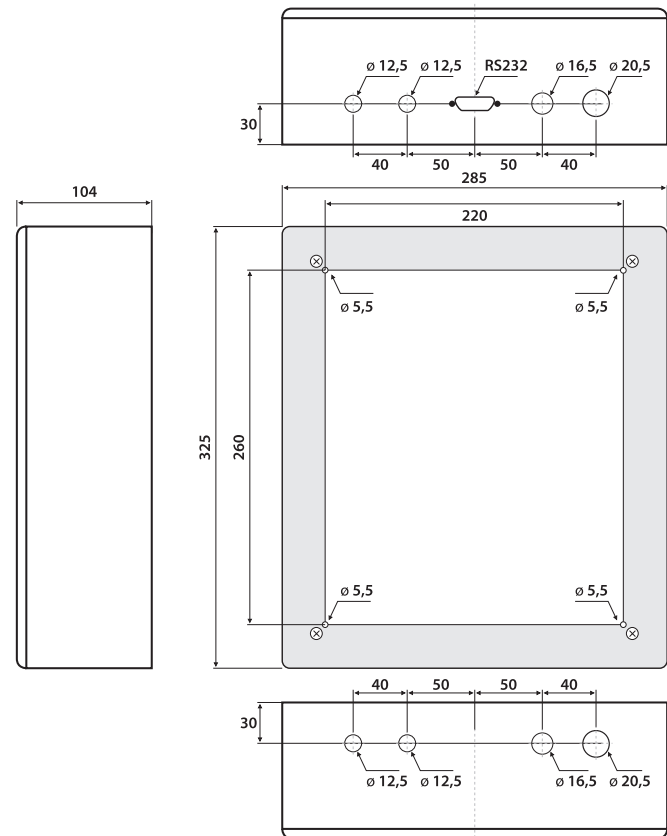
**Technical data control and indication panel PRC1470**

<b>Insulation coordination acc. to IEC 60664-1</b>	
Rated insulation voltage	AC 250 V
Rated impulse voltage / pollution degree	4 kV / 3
<b>Voltage ranges</b>	
Supply voltage $U_S$	AC 230 V
Operating range of $U_S$	0.85...1.1 x $U_S$
Frequency range $U_S$	50...60 Hz
Power consumption	≤ 5 VA
<b>Features</b>	
LC display (backlit)	LC display
Characters (number of characters, height)	4 x 20 charactes, 8 mm high
Text messages	750
Memory text messages	650
<b>Inputs</b>	
Digital inputs (optional)	16
Operating principle, selectable	N/C / N/O operation
Voltage range AC / DC	high 10...30 V / low 0...5 V
<b>Interfaces</b>	
Interface / protocol	2 x RS485 / 1 x RS232 / BMS
EIB bus (optional)	1
Max. cable length	1200 m
Recommended cable (shielded, shield on one side connected to PE)	J-Y(ST)Y 2x 0.6
Terminating resistor	120 Ω
<b>Switching elements</b>	
Switching elements	2 changeover contacts / 6 NO contacts
Operating principle	N/O / N/C operation
Factory setting	N/O operation
Electrical endurance	12000 cycles
Contact class	IIB acc. to DIN IEC 60255 part 0-20
Rated contact voltage	AC 250 V / DC 300 V
Making capacity	AC / DC 8 A (NO contact 5 A)
Breaking capacity	2 A; AC 230 V, cos. phi = 0.4 – 0.2 A, DC 220 V, L/R = 0.04 s
<b>General data</b>	
Shock resistance acc. to IEC 60068-2-27 (device in operation)	15 g / 11 ms
Bumping acc. to IEC 60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance acc. to IEC 60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance acc. to IEC 60068-2-6 (during transport)	2 g / 10...150 Hz
Ambient temperature, during operation	- 5 °C...+ 55 °C
Storage temperature range	- 25 °C...+ 60 °C
Climatic class according to IEC 60721-3-3	3K5
Operating mode	continuous operation
Mounting	any position
Connection	screw terminals
Wire cross section, rigid, flexible	0.2...4 mm <sup>2</sup> / 0.2...2.5 mm <sup>2</sup>
Degree of protection, internal components / terminals (DIN EN 60529)	IP 30 / IP 20
Screw mounting	2 x M4
Flammability class	UL94V-0
Technical manuals	TGH1356
Weight approx.	3000 g

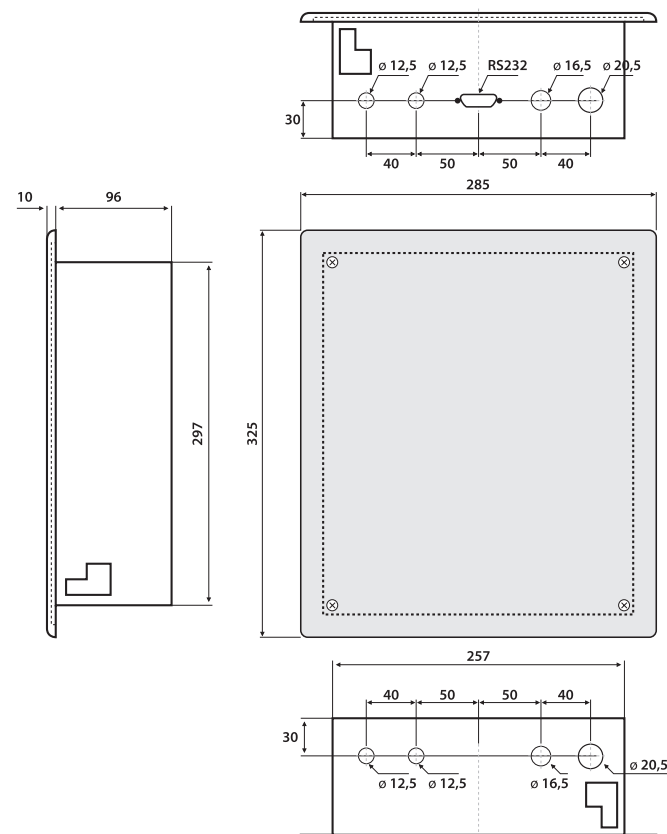
**Ordering details**

Type	Description	Art. No.
PRC1470AP	surface-mount enclosure	B 9501 2024
PRC1470	flush-mount enclosure	B 9501 2025

**Dimension diagram, surface-mount enclosure** Dimensions in mm

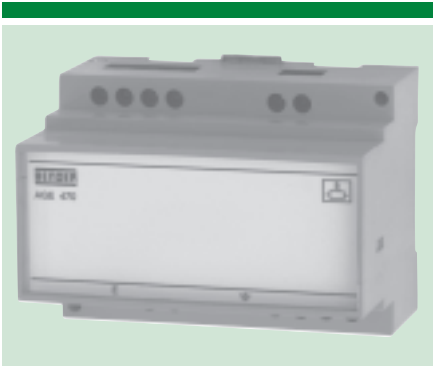


**Dimension diagram, flush-mount enclosure** Dimensions in mm



## EDS470 system – accessories

### Coupling device AGE470



AGE470

#### Coupling device AGE470

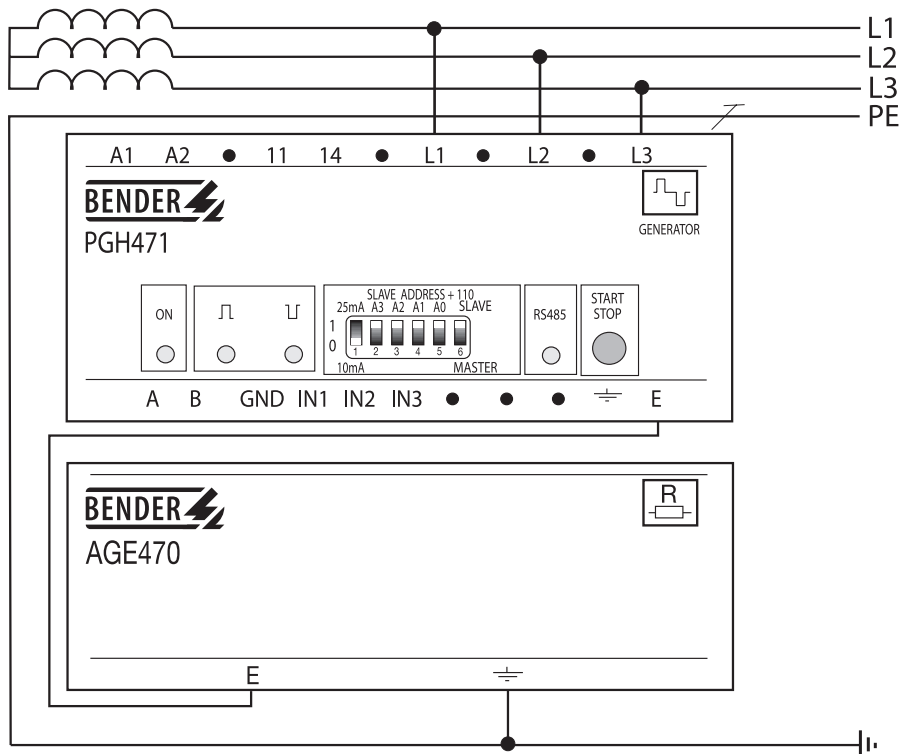
The EDS470 system is suitable for monitoring and scanning IT systems AC, 3(N) AC 20...575 V and DC 20...504 V.

With the coupling device AGE470 AC IT systems up to 790 V and DC IT systems up to 960 V can be monitored.

#### Certifications



#### Connection between insulation fault test device PGH471 and coupling device AGE470

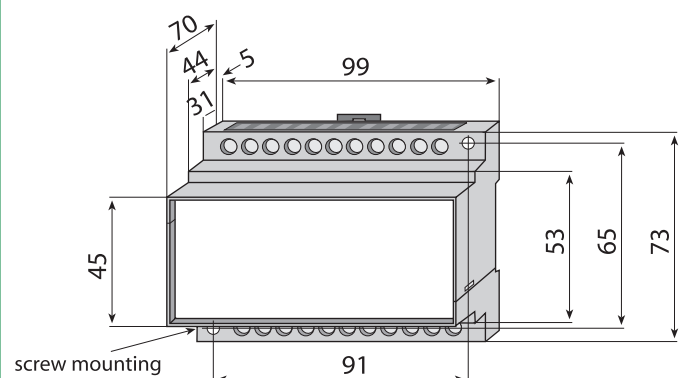


#### Ordering details

Type	Nominal system voltage $U_n$	Art. No.
AGE470	AC, 3(N) AC 500...790 V / DC 400...960 V*	B 9801 8002

\* absolute values

#### Dimension diagram, enclosure X470 Dimensions in mm



## EDS470 / EDS473 system overview

### Components of EDS470 / EDS473 systems

	EDS470 systems	EDS473 systems
Components	IRDH575, PRC470/PRC1470, PGH471, AGE470, EDS470-12, SMO480-12, DI-1, FTC470...	IRDH575, PRC470/PRC1470, PGH473, EDS473-12, SMO480-12, DI-1, FTC470...
Measuring current transformers	W..., WR..., WS...	W... / 8000, WS... / 8000
Portable systems	EDS3065 and EDS3060 with PGH185; EDS165, PSA3020, PSA3052 and PSA3165	EDS3365 and EDS3360 with PGH183; EDS165-3, PSA3320 and PSA3352
Max. test current	25 / 10 mA	2.5 / 1 mA
Response value	5 mA	0.5 mA
Insulation resistance	low response value	increased response value (x 10)
Max. system leakage capacitance	20000 $\mu$ FV ( $C_e \times U_n$ )	300 $\mu$ FV ( $C_e \times U_n$ )
Max. AC residual current	10 A	1 A

### EDS470 or EDS473 ?

Selection according to	EDS470 system	EDS473 system
System voltage	AC 20...575 V, DC 20...504 V; with AGE470: AC 500...790 V, DC 400...960 V; with IRDH575B2: AC 340...760 V, DC 340...575 V	AC 20...265 V DC 20...308 V
Application	extended IT systems, IT systems with variable-speed drives, IT systems with electrical interferences	Auxiliary circuits, circuits with PLC, diode-decoupled control circuits
Residual current	max. 10 A	max. 1 A



# Portable insulation fault location systems

## EDS3060 / EDS3360

### in combination with EDS470 / 473 systems



EDS3060 / EDS3360

#### Device characteristics

- Insulation fault location system for IT systems including EDS470 / 473 systems
- Response values: EDS3060 5 mA, EDS3360 0.5 mA
- LC display
- Alarm LED
- Changeable operating mode: insulation fault location / residual current measurement
- Supplied by accumulator
- Accumulator charging set included in the scope of delivery
- RS232 interface
- Current clamps 20 mm / 52 mm
- Current clamp 100 mm optional for EDS3060
- Residual current measurement in TN / TT systems  
EDS3060: 10 mA...10 A  
EDS3360: 10 mA...1 A

#### Product description

The EDS3060 / 3360 is a portable system intended to be used for the location of insulation faults in unearthed power supply systems (IT systems). The robust aluminium case incorporates the following components: EDS165 / 165-3 evaluator, different types of current clamps as well as various accessories. The EDS3060 / 3360 system is intended to be used to complement systems already including an EDS470 / EDS473.

#### Application

- EDS3060 system for IT systems including an EDS470 system
- EDS3360 system for IT systems including an EDS473 system
- For insulation fault location in system subcircuits not being monitored by measuring current transformers.

#### Function

After activating the installed test device PGH47..., the current clamps of the portable EDS165 / 165-3 are used to encircle the individual circuits (with the exception of PE). When the measuring value in a faulty subcircuit exceeds the response value, the alarm LED lights up and an audible alarm sounds. The value of the test current is indicated on the display. The alarm message can be stored. For measuring value detection current clamps can be used and permanently installed or split-core measuring current transformers as well.

An additional function also allows measuring residual currents in earthed power supply systems (TN / TT systems). The operating mode can be changed via a selector switch. Residual currents of 10 mA...1 A (EDS165-3) and 10 mA...10A (EDS165) can be measured.

#### Displays

The LC display indicates the measured test current, the type of measuring current transformer or current clamps connected, the activation of the alarm memory, the activation of the buzzer and the preset nominal frequency.

#### Standards

The EDS system complies with the standards: DIN EN 61557-9 (VDE 0413 part 9): 2000-08, EN 61557-9: 1999, IEC 61557-9: 1999.

#### Technical data EDS3060 / 3360

##### Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	EDS3060 AC 500 V / EDS3360 AC 250 V
Rated impulse voltage / pollution degree	4 kV / 3

##### Voltage ranges

Nominal system voltage $U_n$	AC 20...575 V, DC 20...504 V
Supply voltage $U_S$	see ordering details
Operating range of $U_S$	0.85...1.15 x $U_S$
Power consumption	≤ 3 VA

##### Test current

Max. selectable	EDS3060 10 / 25 mA; EDS3360 1 / 2.5 mA
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##### Response values

Response value for the test current	EDS3060 5 mA; EDS 3360 0.5 mA
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##### Outputs

Interfaces	RS232
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##### Displays

Display	LC 2 x 16 characters
LED	alarm

##### General data

Shock resistance acc. to IEC 60068-2-27 (device in operation)	15 g / 11 ms
Bumping acc. to IEC 60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance acc. to IEC 60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance acc. to 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 according to IEC 60721-3-3	3K5
Operating mode	continuous operation
Mounting	any position
Degree of protection according to DIN EN 60529	IP 20
Flammability class	UL94V-0
Technical manuals	EDS3060 TGH 1266; EDS3360 TGH 1320
Weight approx.	7000 (8500 g mit PSA3165)

#### Ordering details

Type	Supply voltage $U_S$	Nominal system voltage $U_n$	Art. No.
EDS3060	--	--	B 9108 2006
EDS3360	--	--	B 9108 2013
EDS3065	AC 230 V	AC 20...575 V, DC 20...504 V*	B 9108 2004
EDS3065-13**	AC 90...132 V*	AC 20...575 V, DC 20...504 V*	B 9108 2005
EDS3365	AC 230 V	AC 20...265 V, DC 20...308 V*	B 9108 2011
EDS3365-13**	AC 90...132 V*	AC 20...265 V, DC 20...308 V*	B 9108 2012

\*\* without charging set \* absolute values



# Portable insulation fault location system

## EDS3065 / EDS3365



EDS3065 / EDS3365

### Device characteristics

- Insulation fault location system for IT systems  
EDS3065 AC 20...575 V / DC 20...504 V, EDS3365 AC 20...265 V / DC 20...308 V
- Response values: EDS3065 5 mA, EDS3365 0.5 mA
- LC display
- Alarm LED
- Changeable operating mode: insulation fault location / residual current measurement
- Supplied by accumulator
- RS232 interface
- Current clamps 20 mm / 52 mm
- Accumulator charging set included in the scope of delivery
- Current clamp 100 mm optional for EDS3065
- Residual current measurement in TN / TT systems  
EDS3065: 10 mA...10 A  
EDS3365: 10 mA...1 A
- Portable insulation fault test device

### Product description

The EDS3065 / 3365 is a portable system intended to be used for the location of insulation faults in unearthed power supply systems (IT systems). The EDS3065 is intended to be used in systems AC 20...575 V / DC 20...504 V, the EDS3365 is intended to be used in systems AC 20...265 V / DC 20...308 V. The robust aluminium case accommodates the following components: EDS165 / 165-3 evaluator, a test device, different types of current clamps as well as various accessories.

### Application

- EDS3065 system for insulation fault location in main circuits
- EDS3365 system for insulation fault location in control circuits
- For occasional location of insulation faults in small or medium-sized IT systems

### Function test device

The PGH18x test device is recommended to be connected at the supply input of the system to be tested. After switching on, the PGH18x generates a defined test current signal. The voltage present in the system is used to drive the test current. The value of the test current generated therefore depends on the value of the existing insulation fault and the system voltage. The test current is limited to a maximum of 25 / 2.5 mA or 10 / 1 mA depending on the switch position and device type. The cycle of the test current is indicated by LEDs.

### Function evaluator

After activating the installed test device PGH185 / 183, the cable of the individual subcircuits (with the exception of PE) can be encircled with the current clamp of the portable evaluator EDS165 / EDS165-3.

When the measuring value in a faulty subcircuit exceeds the response value, the alarm LED lights up and an audible alarm sounds. The value of the test current is indicated on the display. The alarm message can be stored. Beside current clamps also permanently installed or split-core measuring current transformers can be used for measuring value detection.

An additional function allows measuring residual currents in earthed power supply systems (TN / TT systems). The operating mode can be changed via a selector switch. Residual currents of 10 mA...1 A (EDS165-3) and 10 mA...10 A (EDS165) respectively can be measured.

### Displays

The LC display indicates the measured test current, the type of measuring current transformer or current clamps connected, the activation of the alarm memory, the activation of the buzzer and the preset nominal frequency.

### Standards

The EDS system complies with the standards: DIN EN 61557-9 (VDE 0413 part 9): 2000-08, EN 61557-9: 1999, IEC 61557-9: 1999.

### Technical data EDS3360 / 3365

#### Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	EDS3065 AC 500 V / EDS3365 AC 250 V
Rated impulse voltage / pollution degree	4 kV / 3

#### Voltage ranges

Nominal system voltage $U_n$	see ordering details
Supply voltage $U_S$	see ordering details
Operating range of $U_S$	0.85...1.15 x $U_S$
Power consumption	≤ 3 VA

#### Test current

Max. selectable test current	EDS3065 10 / 25 mA; EDS3365 1 / 2.5 mA
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#### Response values

Response value for the test current	EDS3065 5 mA; EDS 3365 0.5 mA
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#### Outputs

Interfaces	RS232
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#### Displays

Display	LC 2 x 16 characters
LED	alarm

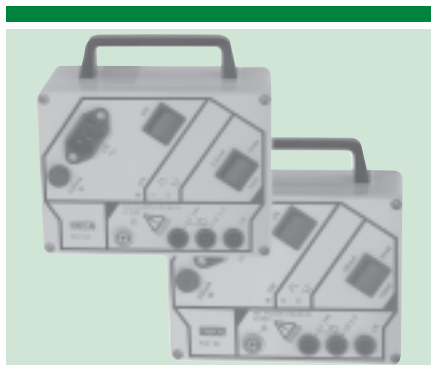
#### General data

Shock resistance acc. to IEC 60068-2-27 (device in operation)	15 g / 11 ms
Bumping acc. to IEC 60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance acc. to IEC 60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance acc. to 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 according to IEC 60721-3-3	3K5
Operating mode	continuous operation
Mounting	any position
Protection class according to DIN EN 60529	IP 20
Flammability class	UL94V-0
Technical manuals	EDS3065 TGH 1266; EDS3365 TGH 1320
Weight approx.	7000 (8500 g mit PSA3165)

## System components EDS3060 / EDS3360 systems and EDS3065 / EDS3365 systems at a glance



**Current clamp PSA3052 / current clamp PSA3352 Insulation fault evaluator EDS165(-3)**



**Insulation fault test device PGH185 / 183**



**Current clamp PSA3020 / current clamp PSA3320**



**Aluminium case**

The primary function of the EDS3...6... is that of insulation fault location in IT systems. For this purpose, a combination of the individual components of the EDS3...6... is used.

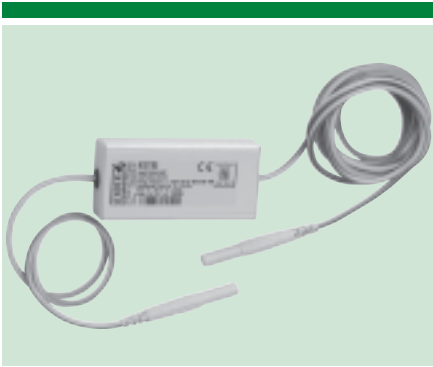
Not illustrated:

- Power supply cord (protective contact type / non-heating devices) for the insulation fault test device PGH18...
- Safety measuring leads 3 x black and 1 x green / yellow
- Safety claw grip to connect the PGH18... to the system conductors and to PE
- BNC adapter unit, 4 mm, safety sockets for the connection of measuring current transformers
- Flat connector, 4 mm
- Accumulator charging set for EDS165(-3)

### Components and technical data EDS3060 / EDS3360 systems and EDS3065 / EDS3365 systems

Selection	EDS3060	EDS3360	EDS3065	EDS3365
<b>EDS system</b>	<b>EDS470 system already installed in the system</b>	<b>EDS473 system already installed in the system</b>	<b>No EDS470 installed in the system</b>	<b>No EDS473 installed in the system</b>
Nominal system voltage	AC, 3(N) AC 20...575 V DC 20...504 V	AC, 3(N) AC 20...265 V DC 20...308 V	AC, 3(N) AC 20...575 V DC 20...504 V with AGE185: AC, 3(N) AC 500...790 V DC 400...960 V	AC, 3(N) AC 20...265 V DC 20...308 V
According to application	extended IT systems, IT systems with variable-speed drives and electrical interferences	auxiliary circuits, auxiliary circuits with PLC, diode-decoupled control circuits	extended IT systems, IT systems with variable-speed drives and electrical interferences	auxiliary circuits, auxiliary circuits with PLC, diode-decoupled control circuits
According to residual current	max. 10 A	max. 1 A	max. 10 A	max. 1 A
Components	aluminium case with carrying belt EDS165 PSA3020 PSA3052 PSA3165 optional accumulator charging set  Technical manual TGH1266	aluminium case with carrying belt EDS165-3 PSA3320 PSA3352  accumulator charging set  Technical manual TGH1320	aluminium case with carrying belt EDS165 PSA3020 PSA3052 PSA3165 optional accumulator charging set PGH185 AGE185 optional Technical manual TGH1266	aluminium case with carrying belt EDS165-3 PSA3320 PSA3352  accumulator charging set PGH183  Technical manual TGH1320
<b>Max. test current</b>	<b>25 / 10 mA</b>	<b>2.5 / 1 mA</b>	<b>25 / 10 mA</b>	<b>2.5 / 1 mA</b>
<b>Response value</b>	<b>5 mA</b>	<b>0.5 mA</b>	<b>5 mA</b>	<b>0.5 mA</b>
Insulation resistance	low response value	higher response value (x 10)	low response value	higher response value (x 10)
Max. system leakage capacitance	20000 µFV (C <sub>e</sub> x U <sub>n</sub> )	300 µFV (C <sub>e</sub> x U <sub>n</sub> )	20000 µFV (C <sub>e</sub> x U <sub>n</sub> )	300 µFV (C <sub>e</sub> x U <sub>n</sub> )

## EDS3065 system – accessories Coupling device AGE185



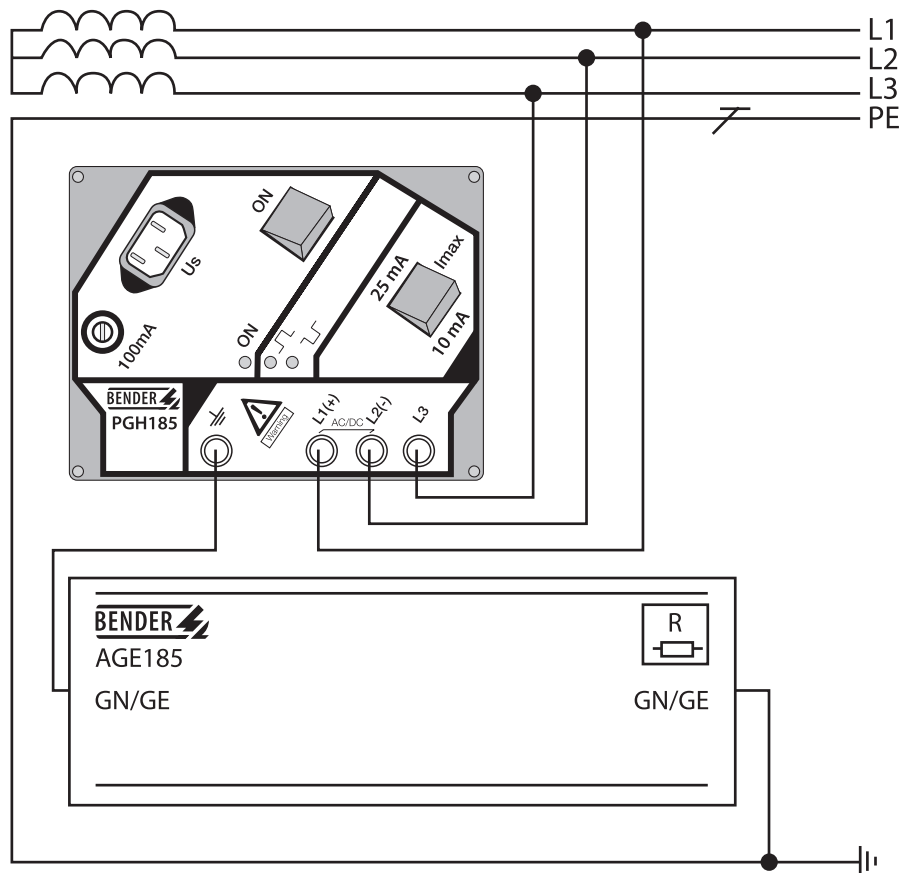
**AGE185**

### Coupling device AGE185

The EDS3065 system allows monitoring and scanning of IT systems AC, 3(N) AC 20...575 V and DC 20...504 V.

In combination with the coupling device AGE185, AC IT systems of up to 790 V and DC systems up to 960 V can be monitored.

### Connection insulation fault test device PGH185 and coupling device AGE185



### Ordering details

Type	Nominal system voltage $U_n$	Art. No.
AGE185	AC, 3(N) AC 500 ... 790 V / DC 400 ... 960 V	B 980 305

### Certifications

All the components of the EDS system bear the following markings of certification:





Coupling devices to extend the nominal voltage range of A-ISOMETERS®



# Coupling device

## AGH150W-4



**Coupling device AGH150W-4**

### Ordering details

Type	Nominal system voltage $U_n$	Art. No.
AGH150W-4	DC 1760 V	B 9801 8006

### Technical data coupling device AGH150W-4

#### Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	DC 1600 V
Rated impulse voltage / pollution degree	12 kV / 3

#### Voltage ranges

Nominal system voltage $U_n$	DC 0...1760 V
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#### General data

Shock resistance acc. to IEC 60068-2-27 (device in operation)	15 g / 11 ms
Bumping acc. to IEC 60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance acc. to IEC 60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance acc. to 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 according to IEC 60721-3-3	3K5
Operating mode	continuous operation
Mounting	any position
Connection	modular terminals
Wire cross section, rigid, flexible	0.2...4 mm <sup>2</sup> / 0.2...2.5 mm <sup>2</sup>
Degree of protection, internal components (DIN EN 60529)	IP 30
Degree of protection, terminals (DIN EN 60529)	IP 20
DIN rail mounting according to	DIN EN 60715 / IEC 60715
Flammability class	UL94V-0
Instruction leaflet	109001
Weight approx.	900 g

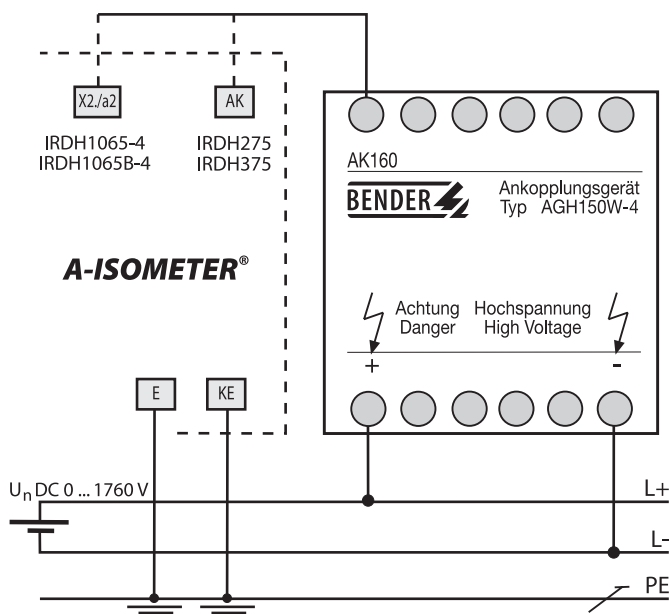
### Product description

The AGH150W-4 coupling device is designed to extend the nominal voltage range of the A-ISOMETERs® IRDH265-4 / IRDH365-4 / IRDH-1065B-4 to DC 0...1760 V. A two-pole connection is to be made between the coupling device and the system to be monitored, and terminal AK160 is to be connected to terminal AK of the A-ISOMETER®.

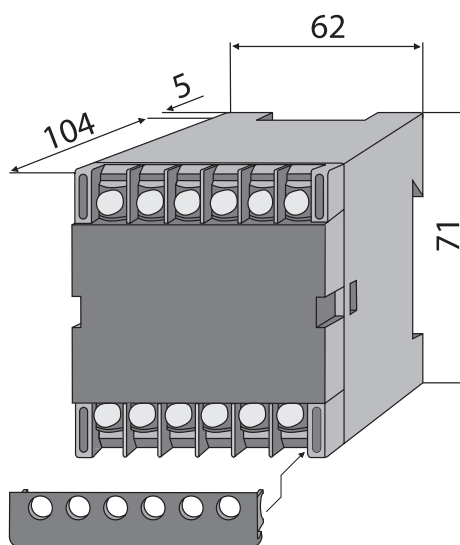
### Certifications



### Wiring diagram



### Dimension diagram, enclosure X150 Dimensions in mm



Terminal cover

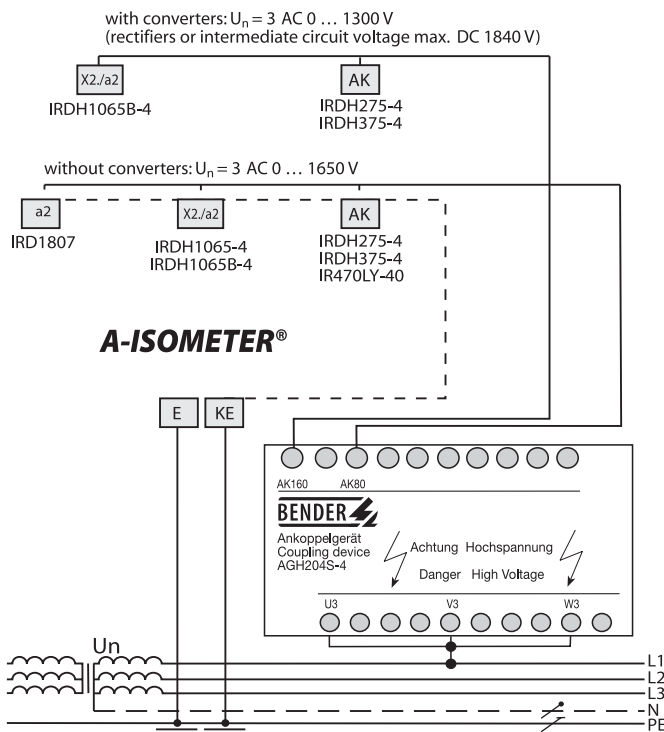
### Product description

The AGH204S-4 coupling device is designed to extend the nominal voltage range of the A-ISOMETERs® described in the wiring diagram below to AC, 3(N) AC 50...400 Hz, 0...1650/0...1300 V. The coupling device is to be connected to the system to be monitored according to the wiring diagram below. Terminal AK... is to be connected to terminal of the respective A-ISOMETER®.

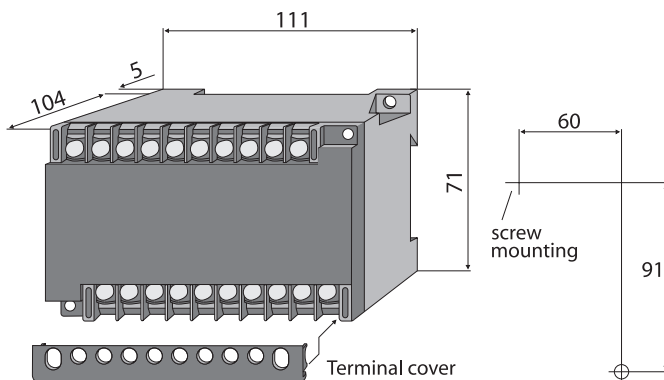
### Certifications



### Wiring diagram



### Dimension diagram, enclosure X200 Dimensions in mm



**Coupling device AGH204S-4**

### Ordering details

Type	Nominal system voltage $U_n$	Art. No.
AGH204S-4	AC 0...1650 V / 0...1300 V	B 914 013

### Technical data coupling device AGH204S-4

#### Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	DC 1500 V
Rated impulse voltage / pollution degree	12 kV / 3

#### Voltage ranges

Nominal system voltage $U_n$	AC, 3(N) AC 50...400 Hz 0...1650 V / 0...1300 V
------------------------------	---

#### General data

Shock resistance acc. to IEC 60068-2-27 (device in operation)	15 g / 11 ms
Bumping acc. to IEC 60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance acc. to IEC 60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance acc. to 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 according to IEC 60721-3-3	3K5
Operating mode	continuous operation
Mounting	any position
Connection	modular terminals
Wire cross section, rigid, flexible	0.2...4 mm <sup>2</sup> / 0.2...2.5 mm <sup>2</sup>
Degree of protection, internal components (DIN EN 60529)	IP 30
Degree of protection, terminals (DIN EN 60529)	IP 20
Screw mounting	2 x M4
DIN rail mounting according to	DIN EN 60715 / IEC 60715
Flammability class	UL94V-0
Instruction leaflet	109002
Weight approx.	1350 g

# Coupling device AGH520S



Coupling device AGH520S

## Ordering details

Type	Nominal system voltage $U_n$	Art. No.
AGH520S	3(N) AC 0...7200 V	B 913 033

## Technical data coupling device AGH520S

### Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 6.3 V
Rated impulse voltage / pollution degree	17 kV / 3

### Voltage ranges

Nominal system voltage $U_n$	3(N) AC 0...7200 V
Nominal frequency $f_n$	50...400 Hz

### General data

Shock resistance acc. to IEC 60068-2-27 (device in operation)	15 g / 11 ms
Bumping acc. to IEC 60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance acc. to IEC 60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance acc. to 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 according to IEC 60721-3-3	3K5
Operating mode	continuous operation
Mounting	any position
Connection	screw terminals
Degree of protection, internal components (DIN EN 60529)	IP 64
Degree of protection, terminals (DIN EN 60529)	IP 20
Type of enclosure	resin-encapsulated
Screw mounting	4 x M5
Flammability class	UL94V-0
Instruction leaflet	109003
Weight approx.	4500 g

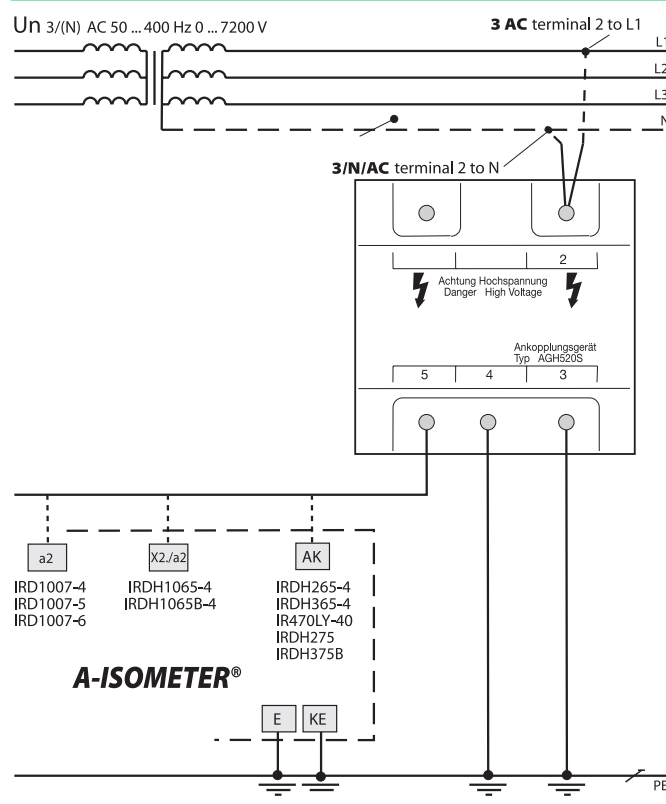
## Product description

The AGH520S coupling device is designed to extend the nominal voltage range of the A-ISOMETERs® described in the wiring diagram below to (3) AC 50...400 Hz, 0...7200 V. The coupling device is to be connected via one pole to the system to be monitored. Terminal 5 is to be connected to terminal AK of the respective A-ISOMETER®.

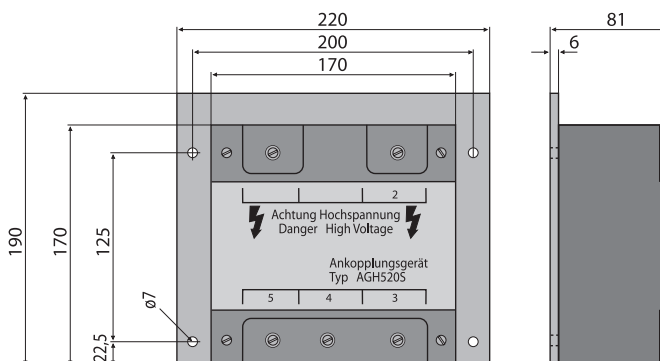
## Certifications



## Wiring diagram



## Dimension diagram, enclosure Dimensions in mm

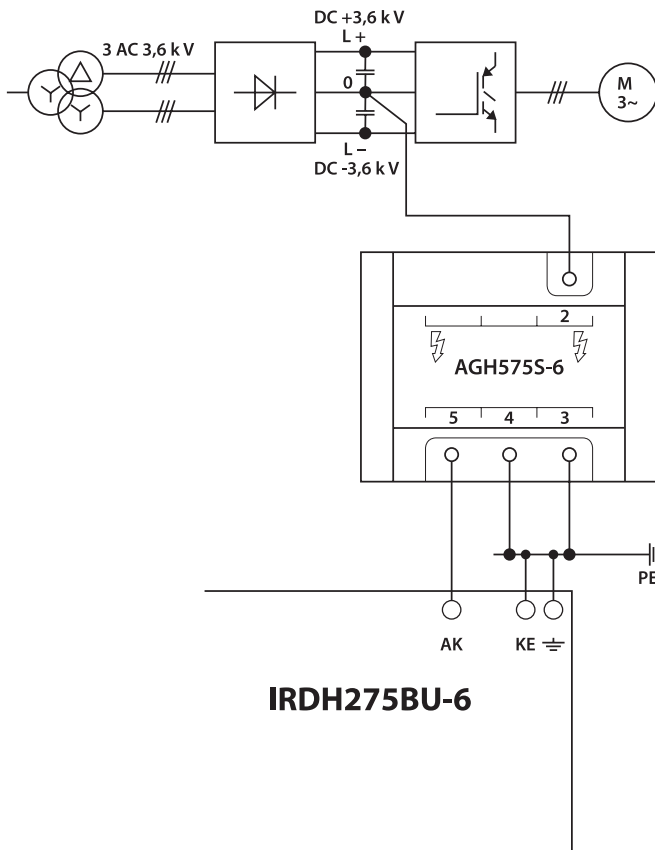




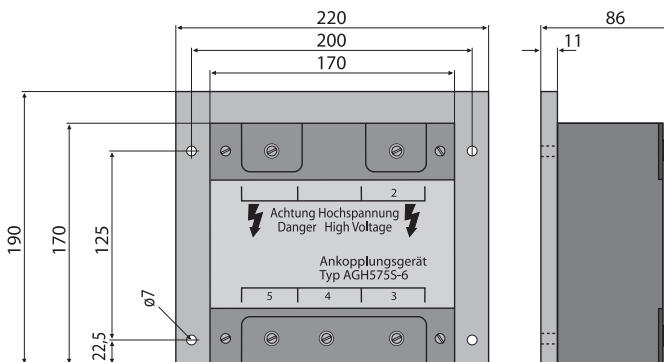
## Product description

The AGH575S-6 coupling device is designed to extend the nominal voltage range of the A-ISOMETER® IRDH275BU-6 to AC / DC 0...3.6 kV. The coupling device is to be connected via one pole to the system to be monitored. Terminal 5 is to be connected to terminal AK of the A-ISOMETER®.

## Wiring diagram



## Dimension diagram, enclosure Dimensions in mm



Coupling device AGH575S-6

## Ordering details

Type	Nominal voltage $U_n$	Art. No.
AGH575S-6	AC / DC 0...3.6 kV	B 913 053

## Technical data coupling device AGH575S-6

### Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 6.3 kV
Rated impulse voltage / pollution degree	17 kV / 3

### Voltage ranges

Nominal system voltage $U_n$	0...3.6 kV
Nominal frequency $f_n$	DC, 0.2...460 Hz

### Allgemeine Daten

Shock resistance acc. to IEC 60068-2-27 (device in operation)	15 g / 11 ms
Bumping acc. to IEC 60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance acc. to IEC 60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance acc. to 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 according to IEC 60721-3-3	3K5
Operating mode	continuous operation
Mounting	any position
Connection	screw terminals
Degree of protection, internal components (DIN EN 60529)	IP 64
Degree of protection, terminals (DIN EN 60529)	IP 20
Type of enclosure	resin-encapsulated
Screw mounting	4 x M5
Flammability class	UL94V-0
Instruction leaflet	109018
Weight approx.	4500 g



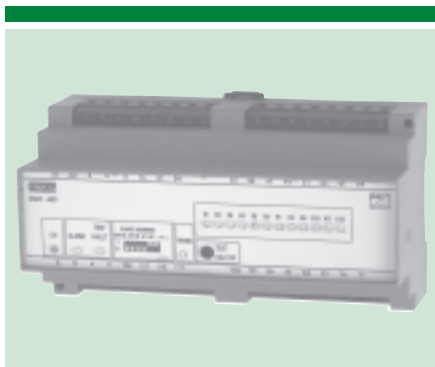
## Accessories – E / A modules, measuring instruments

# Chapter 1.8.2

E / A modules and measuring instruments to be used in combination with A-ISOMETER®s



## Signal converter SMO480-12



Signal converter SMO480-12

### Product description

The signal converter SMO480-12 converts alarm messages from the BMS bus into relay contact signals. The relay contacts are also suitable for very small currents ( $> 5 \text{ mA}$ ). One SMO480-12 each must be assigned to **one** device with communication capability.

### Application

- For use in EDS, RCMS and MEDICS systems to convert BMS signals to relay contact signals, e. g. for the control of signals and information
- Selective control and / or disconnection of faulty circuits with EDS and RCMS systems
- Transfer of information to central building automation control and building services management systems

### Function

The signal converter SMO480-12 must be assigned to an evaluator, e. g. EDS470-12. When the evaluator detects an insulation fault in one channel, this message is transferred to the SMO480-12 via the BMS bus. The SMO480-12 converts this message into a relay message. For this purpose each of the twelve alarm relays of the signal converter must be assigned to an one channel of the evaluator. It is not possible to assign several SMO480-12 to one evaluator.

The alarm relays are assigned to the respective evaluator according to the device address.

### Standards

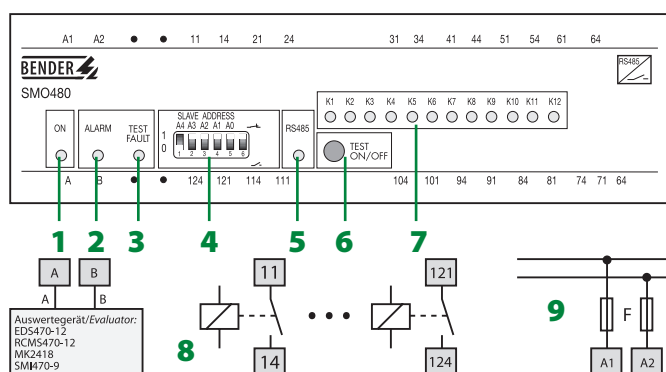
The SMO480-12 series meets the requirements of protective separation for AC 230 V according to EN 50178: 1997-10.

**Note:** For using the SMO480-12, a BMS bus Master is required.

### Device characteristics

- One relay output for each channel of an associated BENDER device with communication capability, such as EDS470-12 or RCMS470-12
- Alarm LED for each channel
- TEST button for relay function
- LEDs: Power On, Alarm, Test/Fault
- RS485 interface (BMS protocol)

### Wiring diagram



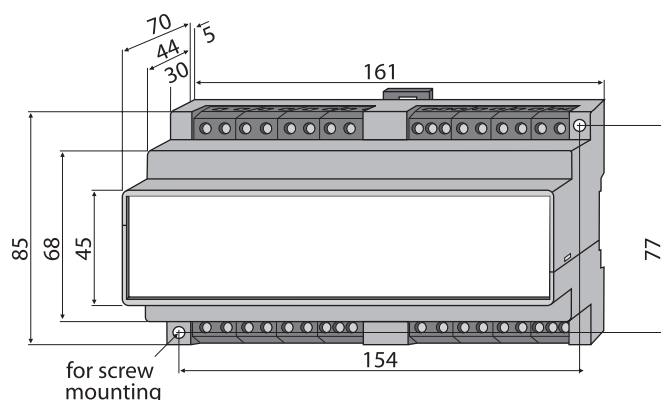
- 1 - Power ON LED
- 2 - ALARM LED: lights when one or several relays respond and in the TEST mode
- 3 - LED "TEST/FAULT": lights when no associated evaluator has been found and lights in the TEST mode
- 4 - DIP switches to set the device address of SMO480-12 (address = parameter value + 30) and the operating principle of the alarm relay
- 5 - LED "RS485": indicates activities on the BMS bus
- 6 - TEST button: switches all alarm relays
- 7 - LED "K1...K12": status indication
- 8 - Alarm relay
- 9 -  $U_5$  see ordering details

### Ordering details

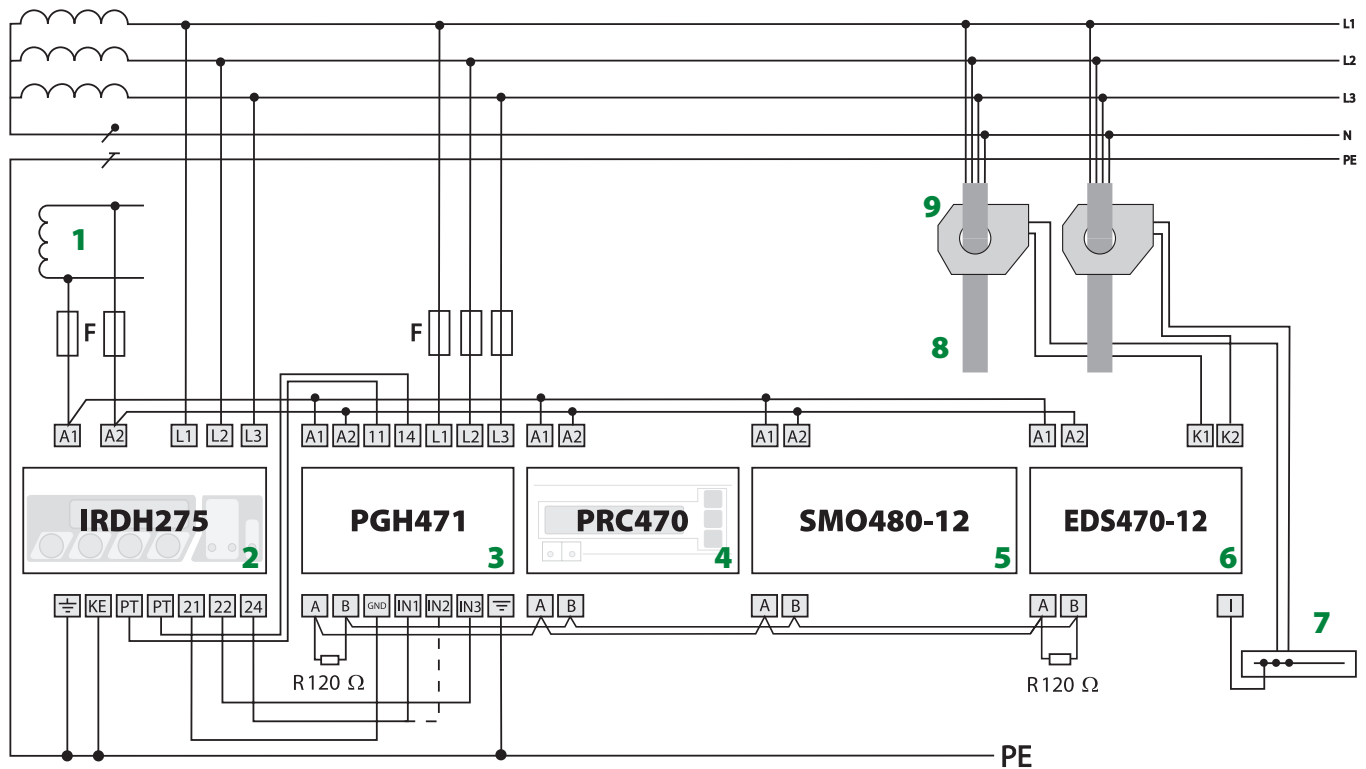
Type	Supply voltage $U_5$	Art. No.
SMO480-12	AC 230 V	B 9501 2011
SMO480-1213	AC 90...132 V	B 9501 2017

\* absolute values

### Dimension diagram, enclosure X480 Dimensions in mm



Wiring diagram – signal converter SMO480-12 in an EDS system



- 1 - U<sub>S</sub> IT system
- 2 - A-ISOMETER® IRDH275  
R<sub>i</sub> = 120 kΩ
- 3 - Insulation fault test device PGH471
- 4 - Control and indicating device PRC470
- 5 - Signal converter SMO480-12
- 6 - Evaluator EDS470-12
- 7 - Terminal block for I-connections
- 8 - Subcircuits to the loads
- 9 - Measuring current transformers

Technical data signal converter SMO480-12

Insulation coordination according to IEC 60044-1	
Rated voltage / Rated impulse voltage	AC 250 V / 3 kV
Voltage ranges	
Supply voltage U <sub>S</sub>	see ordering details
Operating range / Frequency range of U <sub>S</sub>	0.8...1.15 x U <sub>S</sub> / 50...60 Hz
Power consumption	≤ 7 VA
Inputs	
Current input	DC 0...400 μA
Permissible current	≤ 0...400 μA
Rated input resistance	approx. 2.5 kΩ
Outputs	
Outputs	Two outputs with common ground
Voltage output	DC 0...10 V
Open-circuit voltage	≤ DC 12 V
Load	≥ 1 kΩ
Current output	DC 0 / 4...20 mA
Short circuit current	≤ DC 30 mA short-circuit proof
Load	≤ 500 Ω
Accuracy at T <sub>u</sub> = 23 °C	class 0.2
Temperature coefficient	0.025 % / °C
Rated rise time T 0.9	50 ms
Dielectric strength Input / output / supply	AC 2500 V

General data	
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 (device out of operation)	2 g / 10...150 Hz
Ambient temperature (during operation)	-10 °C...+50 °C
Storage temperature range	-40 °C...+70 °C
Climatic category DIN IEC 60721-3-3	3K5
Operating mode	continuous operation
Position	any position
Connection	screw terminals
Cross sectional area of connecting cable, rigid / flexible	0.2...4 mm <sup>2</sup> / 0.2...2.5 mm <sup>2</sup>
Flexible with ferrules without / with plastic collar	0.25...2.5 mm <sup>2</sup>
Degree of protection DIN EN 60529	Internal components IP30 Terminals IP20
Type of enclosure	X480
Enclosure, material	polycarbonate
Screw fixing	2 x M4
DIN rail mounting according to	DIN EN 60715 / IEC 60715
Flammability class	UL94V-0
Instruction leaflet	108005
Weight	approx. 470 g

1.8.2

## Converter module SMI472-12



Converter module SMI472-12

### Product description

The SMI472-12 converter module converts digital signals (alarm and status messages) into serial information for the BMS bus. 12 digital inputs are provided which can be divided in two groups to distinguish between alarm and status messages. Factory set are 8 inputs for alarm messages and 4 inputs for status messages.

### Function

One alarm LED is available for each of the inputs IN1 to IN12. With the DIP switch the operating principle can be set to N/O or N/C operation. One common alarm relay in N/O operation is available for transferring alarm messages.

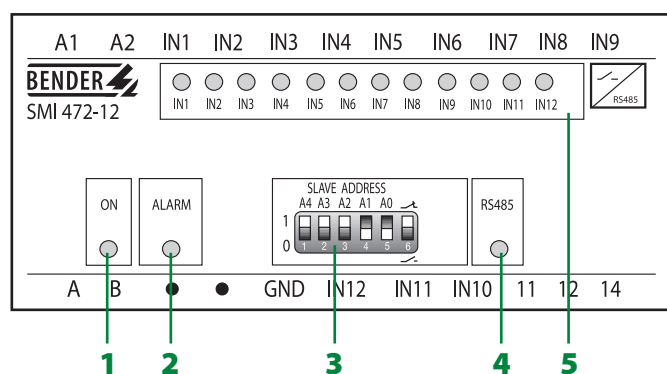
The SMI472-12 converts the input signals into serial information for the BMS bus. Via this interface messages can be transferred to other BENDER devices (e. g. MK2418C alarm indicators or TM operator panels). The MK2418C-12 alarm indicator and operator panel can monitor the SMI472-12 for failure.

**Note:** For using the SMI472-12, a BMS bus Master is required.

### Device characteristics

- 12 digital inputs
- Alarm LED for each channel
- Power ON LED, ALARM LED, ALARM LED indicates activities on RS485
- RS485 interface (BMS protocol)
- N/O / N/C operation mode selectable

### Operating elements



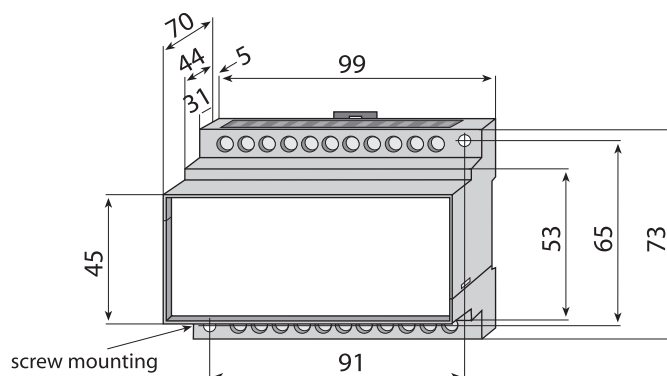
### Legend to operating elements

- 1 - Power ON LED
- 2 - ALARM LED: lights up when an alarm message exists on one of the alarm inputs.
- 3 - DIP switches for the setting of the device address and the operating mode of the digital inputs.
- 4 - LED RS485: lights in case of activities on the BMS bus.
- 5 - ALARM LEDs IN1...IN12, when an input receives a digital signal, the respective LED lights up.

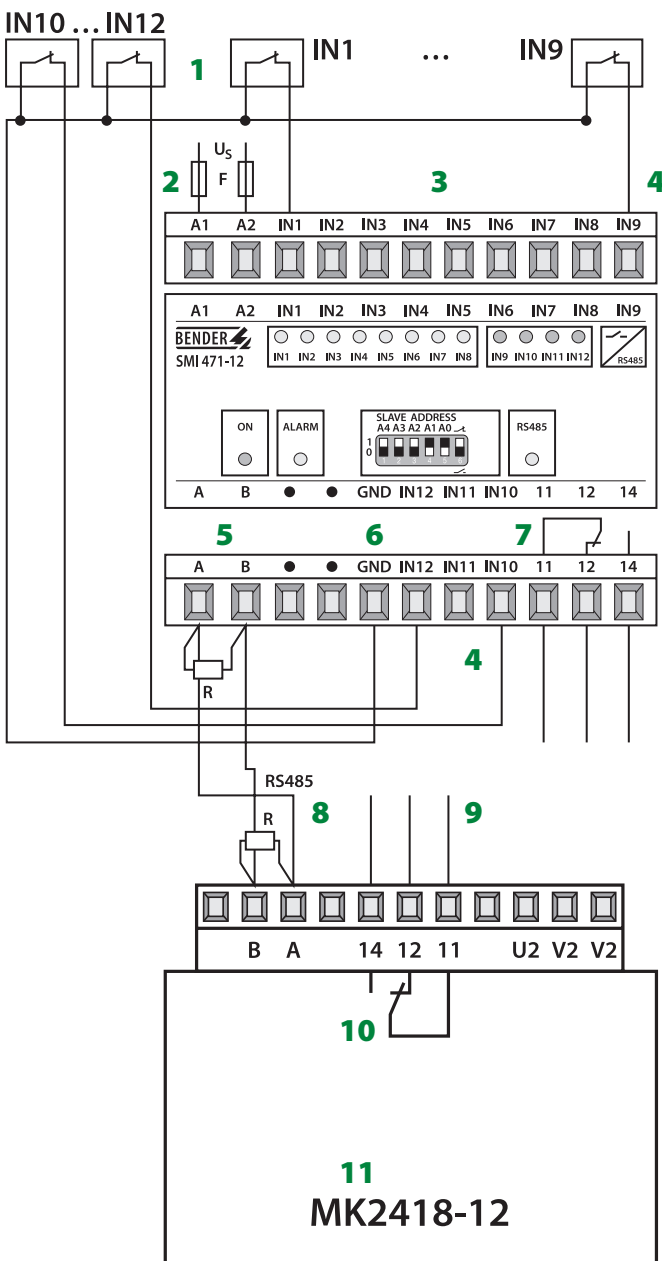
### Ordering details

Type	Supply voltage $U_s$	Art. No.
SMI472-12	AC 230 V 50...60 Hz	B 9204 7011
SMI472-1221	DC 10.5...80 Hz	B 9204 7013

### Dimension diagram, enclosure X470 Dimensions in mm



Wiring diagram



- 1 - Voltage-free changeover contacts
- 2 - Short-circuit protection for supply voltage  $U_S$ , recommendation: 6 A
- 3 - IN1...IN8 digital inputs for alarm messages
- 4 - IN9...IN12 digital inputs for status messages
- 5 - BMS bus
- 6 - GND = common ground for digital inputs
- 7 - 11, 12, 14 = voltage-free changeover-contacts, trip in case of alarm
- 8 - R = terminating resistor for BMS bus:  $R = 120 \Omega$
- 9 - common alarm
- 10 - lower terminal block
- 11 - MK2418C-12 = alarm indicator and operator panel, alarm text messages can be set as required

Technical data signal converter SMI472-12

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 250 V
Rated impulse voltage / pollution degree	4 kV / 3

Voltage ranges

Supply voltage $U_S$	AC 230 V
Operating range of $U_S$	0.8...1.15 x $U_S$
Frequency range $U_S$	50...60 Hz
Power consumption	$\leq 5$ VA

Inputs

Digital inputs IN1 ... IN12	12
Electrical isolation	no
Connection to the digital inputs	via voltage-free contacts

Switching elements

Switching elements	1 changeover contact
Operating principle	N/O operation
Electrical endurance	12000 cycles
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

Interfaces

Interface / protocol	RS485 / BMS
Max. cable length	0...1200 m
Recommended cable (shielded, shield on one side connected to PE)	J-Y(ST)Y 2 x 0.6
Terminating resistor	120 $\Omega$ , 0.25 W
Address range	3...30
Factory setting device address	3

General data

Shock resistance acc. to IEC 60068-2-27 (device in operation)	15 g / 11 ms
Bumping acc. to IEC 60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance acc. to IEC 60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance acc. to 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 according to IEC 60721-3-3	3K5
Operating mode	continuous operation
Mounting	any position
Connection	screw terminals
Wire cross section, rigid, flexible	0.2...4 mm <sup>2</sup> / 0.2...2.5 mm <sup>2</sup>
Flexible with ferrules, without / with plastic collar	0.25...2.5 mm <sup>2</sup>
Protection class, internal components (DIN EN 60529)	IP 30
Protection class, terminals (DIN EN 60529)	IP 20
Screw mounting	2 x M4
DIN rail mounting according to	DIN EN 60715 / IEC 60715
Flammability class	UL94V-0
Instruction leaflet	204010
Weight approx.	470 g

1.8.2

# RS485 repeater DI-1

Repeater for the extension of the RS485 bus



## Device features

- Plastic enclosure for DIN rail mounting
- Electrical separation between input and output circuit
- Adjustable baud rate
- Supply voltage DC 10...30 V

## Product description

The RS485 repeater DI-1 is intended to be used for signal amplification on the RS485 interface (BMS bus). This is required when the bus line exceeds a length of 1200 m and when more than 30 bus nodes exist.

## Application

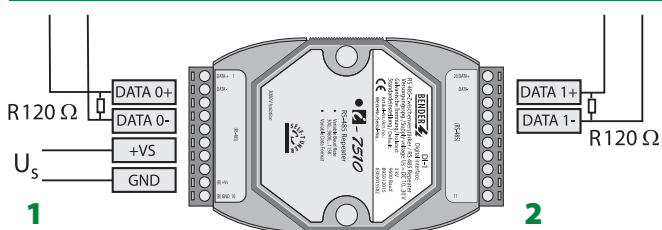
- Extension of the maximum possible bus length by 1200 m each in BMS systems (EDS, RCMS, MEDICS® systems)
- To increase the number of bus nodes by 32
- Protection against spikes by electrical separation between input and output circuit.

## Approvals



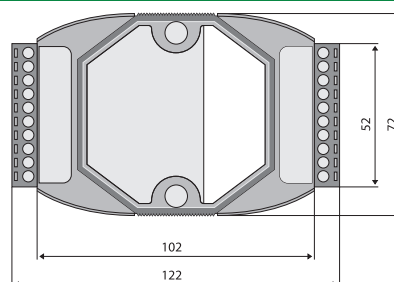
RS485 repeater DI-1

## Wiring diagram EDS system with DI-1



1 -  $U_s$  DC 10...30 V      2 - Repeater DI-1

## Dimension diagram, enclosure DI-1 Dimensions in mm



## Ordering details

Type	Supply voltage $U_s$	Art. No.
DI-1	DC 10...30 V*	B 9501 2015

\* Absolute value

## Technical data RS485 repeater DI-1

Insulation coordination according to IEC 60044-1	
Rated impulse voltage	3 kV DC

Voltage ranges	
Supply voltage	DC 10...30 V
Power consumption	$\leq 2.2$ VA

Interfaces	
Interface / protocol	RS485 / BMS
Connection terminals A / B: shielded cable $\geq 0.6$ mm <sup>2</sup> , shield on one side connected to PE	0...1200 m cable type, e. g. JY(ST)Y 2 x 0.6
Terminating resistor	120 $\Omega$ (0.25 W)

Factory settings	
Baud rate	9600 bps
Data format	10 bits (1 start bit, 8 data bits, 1 stop bit)

General data	
Ambient temperature (during operation)/Storage temperature range	0 °C...+70 °C/-25 °C...+80 °C
Humidity	5...95% without condensing water
Cross sectional area of connecting cable, rigid, flexible	0.5...2.5 mm <sup>2</sup>
Weight	approx. 150 g

## SW1 – Data format setting

Data format	1	2
9 bits	--	--
10 bits*	×	--
11 bits	--	×
12 bits	×	×

## SW2 – Baud rate setting

Baudrate	1	2	3	4	5	6	7	8	9
1200 bps	×	--	--	--	--	--	--	--	--
2400 bps	--	×	--	--	--	--	--	--	--
4800 bps	--	--	×	--	--	--	--	--	--
9600 bps*	--	--	--	×	--	--	--	--	--
19.2 kbps	--	--	--	--	×	--	--	--	--
38.4 kbps	--	--	--	--	--	×	--	--	--
57.6 kbps	--	--	--	--	--	--	×	--	--
115.2 kbps	--	--	--	--	--	--	--	×	--
RS422	--	--	--	--	--	--	--	--	×

-- Switch open / × switch closed, \* Factory setting

## Explanations

The parameters can be set using the DIP switches (SW1 and SW2) on the inner side of the enclosure. For this purpose remove the two fastening screws of the device, then unscrew the two Philips screws at the back of the device to open the cover of the enclosure.





**Protocol converter DI-2 / DI-3-Set**

**Device features**

- Plastic enclosure for DIN rail mounting
- Electrical separation between input and output circuit
- Supply voltage DC 10...30 V

**Product description**

The DI-2 converter is capable of connecting personal computers utilizing an RS232 interface to BENDER devices utilizing an RS485 interface. The hardware and software of the computers need not to be changed. Example: A personal computer can be connected to a BMS network via a DI-2 converter.

**Application**

- RS232 signals are converted into RS485 signals
- Parameterization of alarm indicator and operator panels utilizing an RS485 interface via personal computer utilizing an RS232 interface with software

**Function**

Most industrial computers (PCs and workstations) are series-produced and utilize an RS232 interface. Although this interface is widely accepted, there are some restrictions with regard to transmission rate, bandwidth and network capabilities. The RS485 / RS422 standard overcomes these limitations by using different voltage levels for data and control signals. The connected devices are protected against spikes by electrical separation between input and output (DC 3000 V). Additional internal measures protect the device against voltage spikes.

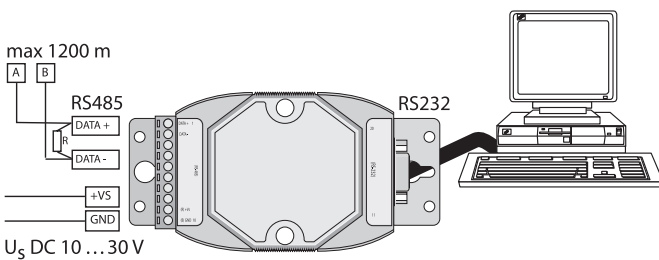
**DI-3-Set – Additional function**

The version DI-3-Set additionally contains a power supply unit for AC 230 V, a BMS and RS232 power supply cable.

**Approvals**



**Wiring diagram (example)**



DI-2 for the connection of a personal computer utilizing an RS232 interface to a BMS network.

**Note:**

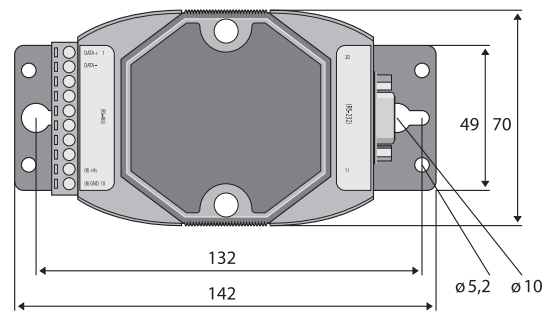
- Terminate both ends of the BMS bus with 120 Ω (R) resistor.

**Ordering details**

Type	Supply voltage U <sub>s</sub>	Art. No.
DI-2	DC 10...30 V*	B 9501 2022
DI-3-Set	AC 230 V	B 9501 2028

\* Absolute value

**Dimension diagram, enclosure DI-2** Dimensions in mm



**Technical data protocol converter DI-2**

**Insulation coordination according to IEC 60044-1**

Rated impulse voltage	3 kV
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**Voltage ranges**

Supply voltage	DC / 10...30 V
Power consumption	≤ 2.2 W

**Interfaces**

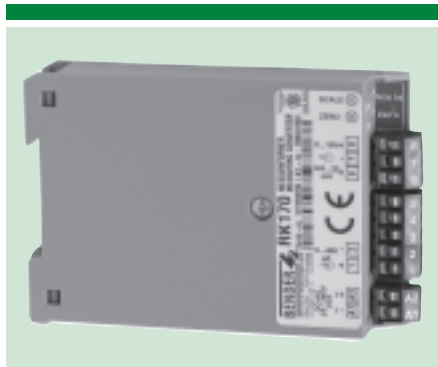
Interface / protocol	RS485/BMS
Connection terminals A / B: shielded cable ≥ 0.6 mm <sup>2</sup> , shield on one side connected to PE	0...1200 m cable type, e.g. JY(ST)Y 2 x 0.6
Terminating resistor	120 Ω (0.25 W)

**General data**

Ambient temperature (during operation)	0 °C...+70 °C
Storage temperature range	-25 °C...+80 °C
Humidity	5...95 % without condensing water
Cross sectional area of connecting cable, rigid, flexible	0.5...2.5 mm <sup>2</sup>
Weight	approx. 150 g

**1.8.2**

# Measuring transducer RK170



Measuring transducer RK170

### Device characteristics

- Plastic enclosure for DIN rail mounting
- Zero point setting 0 or 4 mA
- Electrical separation between input and output circuit

### Product description

The measuring transducer RK170 is intended to convert current signals (0 ... 400  $\mu$ A) of measuring instruments for A-ISOMETERS<sup>®</sup> and residual current monitors (RCM, RCMA) into standardized current signals 0(4)...20 mA (0...10 V). These currents are usually required in process technology.

### Application

- To convert input signals of 0...400  $\mu$ A into output signals of 0(4)...20 mA or 0...10 V
- for A-ISOMETERS<sup>®</sup> and residual current monitors RCM, RCMA with measuring instrument output of 0...400  $\mu$ A

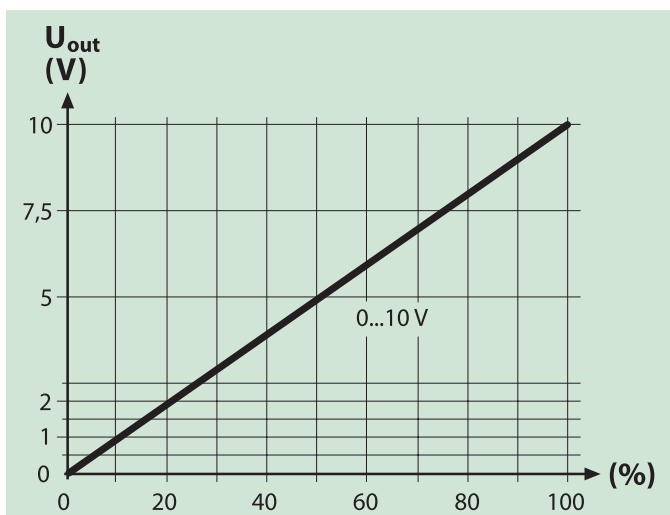
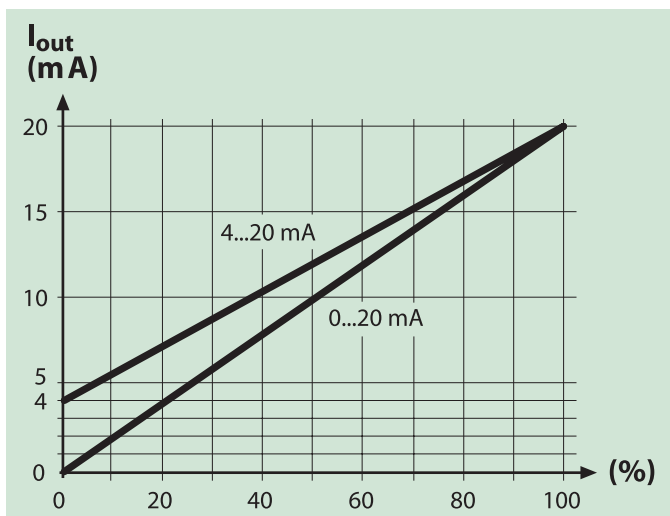
### RK170 adjustment

The signals at the outputs 0(4)...20 mA and 10 V are simultaneously available and their own nominal load must not be exceeded.

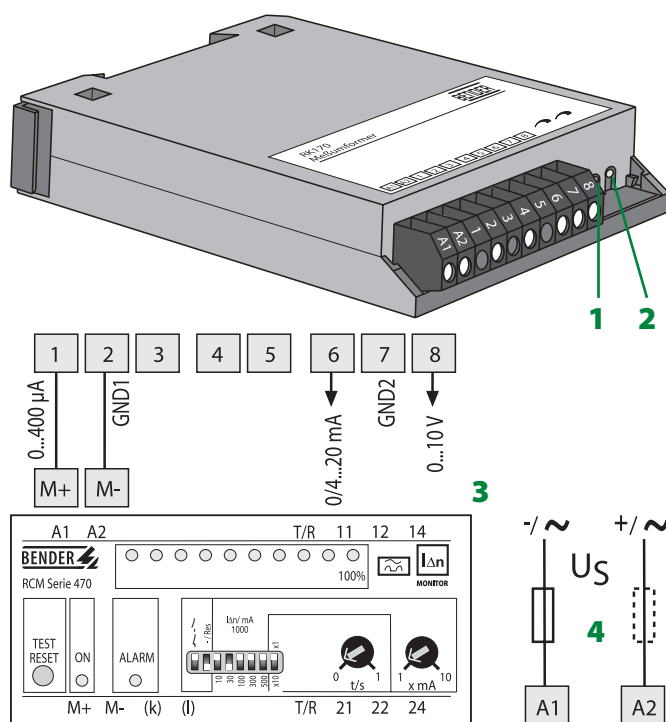
Setting the zero point (zero) and the upper limit (scale) will have an effect on both outputs. Hence, optimum adjustment is only possible for one output at a time.

When the input signal is 0...400  $\mu$ A, the measuring transducer RK170 provides an isolated output signal 0...20 mA or 0...10 V (factory setting). When an output signal of 4...20 mA is required or when an adjustment of the measuring transducer RK170 is necessary for other reasons, the trimmers "zero" and "scale" are to be used.

### Characteristic curves



### Wiring diagram



- 1 - Zero: offset
- 2 - Scale: upper range value
- 3 - Device of the RCM series
- 4 -  $U_S$  see nameplate, 2 A fuse recommended

### Ordering details

Type	Supply voltage $U_S$	Art. No.
RK170	DC 20...297 V / AC 19...264 V*	B 9804 1500

\*absolute value

**Technical data measuring transducer RK170**
**Voltage ranges**

Supply voltage $U_S$	DC 20...297 V / AC 19...264 V
Frequency range $U_S$	20...120 Hz
Power consumption	$\leq 3$ VA

**Inputs**

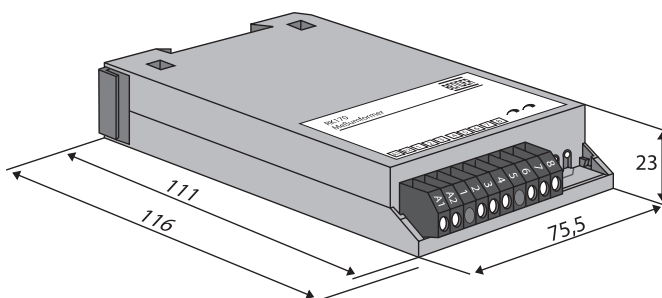
Current input	DC 0...400 $\mu$ A
Permissible current	DC 50 mA
Rated input resistance	approx. 2.5 k $\Omega$

**Outputs**

Outputs	two outputs with common ground
Voltage output	DC 0...10 V
Open-circuit voltage	$\leq$ DC 12 V
Load	$\geq 1$ k $\Omega$
Current output	DC 0/4...20 mA
Short circuit current	$\leq$ DC 30 mA short-circuit proof
Load	$\leq 500 \Omega$
Accuracy at $T_u = 23$ °C	class 0.2
Temperature coefficient	0.025 % / °C
Rated rise time T 0.9	50 ms
Dielectric strength Input / output / supply	AC 2500 V

**General data**

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 (device out of operation)	2 g / 10...150 Hz
Ambient temperature (during operation)	0 °C...+50 °C
Storage temperature range	-20 °C...+70 °C
Climatic category DIN IEC 60721-3-3	3K5
Operating mode	continuous operation
Position	any position
Connection	screw terminals
Cross sectional area of connecting cable, rigid / flexible	0.5...2.5 mm <sup>2</sup> / 0.14...1.5 mm <sup>2</sup>
Degree of protection DIN EN 60529	Internal components IP40 Terminals IP20
Dimensions	75 x 22.5 x 110 mm
DIN rail mounting according to	DIN EN 60715 / IEC 60715
Flammability class	UL94V-0
Instruction leaflet	109006
Weight	approx. 200 g

**Dimension diagram, enclosure RK170** Dimensions in mm


## Measuring instruments 9604 / 7204 / 9620



Measuring instruments 9604 / 7204 / 9620

### Device characteristics

- Dimensions: 72 x 72 mm (7204) or 96 x 96 mm (9604 / 9620)
- Version S: increased protection against shock and vibration
- Colour of scale: white, imprint: black

### Product description

The analog measuring instruments of the 9604 / 7204 series are designed for indication of measuring values provided by BENDER devices equipped with the appropriate output. These are for example A-ISOMETERs® and residual current monitors RCM / RCMA.

### Measuring instruments for A-ISOMETERs®

Please consider the internal resistance of the respective insulation monitoring device. The internal resistance must be equal to the scale centre point (e. g. 120 kΩ). The scales are available with hairline graduation or sector graduation.

### “Standard” version

The enclosures are made of polycarbonate, which is self-extinguishing and of non-melting material according to UL94V0. For saving space, several instruments can be installed „closely together“ without spacers. Connection is made via hexagon head bolts with spring-loaded terminal clamps. The enclosure is delivered with connection protection against accidental contact according to BGV A3.

### “S” version

The measuring instruments of the “S” series are designed to meet the requirements of rough service conditions, e. g. for use on ships.

### Ordering details and A-ISOMETER® allocation

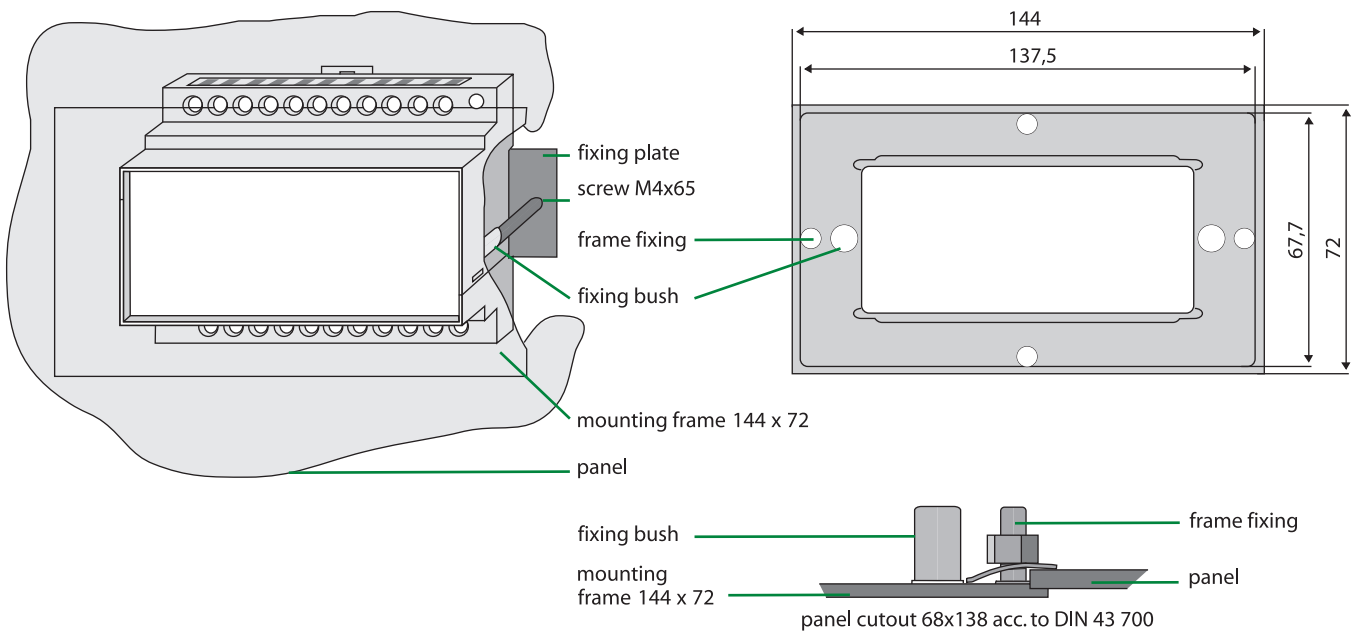
Type	Input current	Dimensions	Art. No.	Possible A-ISOMETER®
7204-1421	0...400 µA	72 x 72 mm	B 986 763	IR470 LY-4..., IRD1007L-4..., IRDH275 / 375
9604-1421	0...400 µA	96 x 96 mm	B 986 764	IR470 LY-4..., IRD1007L-4..., IRDH275 / 375
7204S-1421	0...400 µA	72 x 72 mm	B 986 804	IR470 LY-4..., IRD1007L-4..., IRDH275 / 375
9604S-1421	0...400 µA	96 x 96 mm	B 986 784	IR470 LY-4..., IRD1007L-4..., IRDH275 / 375
9620-1421	0...20 mA	96 x 96 mm	B 986 841	IRDH275B / 375B / 575
9620S-1421	0...20 mA	96 x 96 mm	B 986 842	IRDH275B / 375B / 575

### Technical data

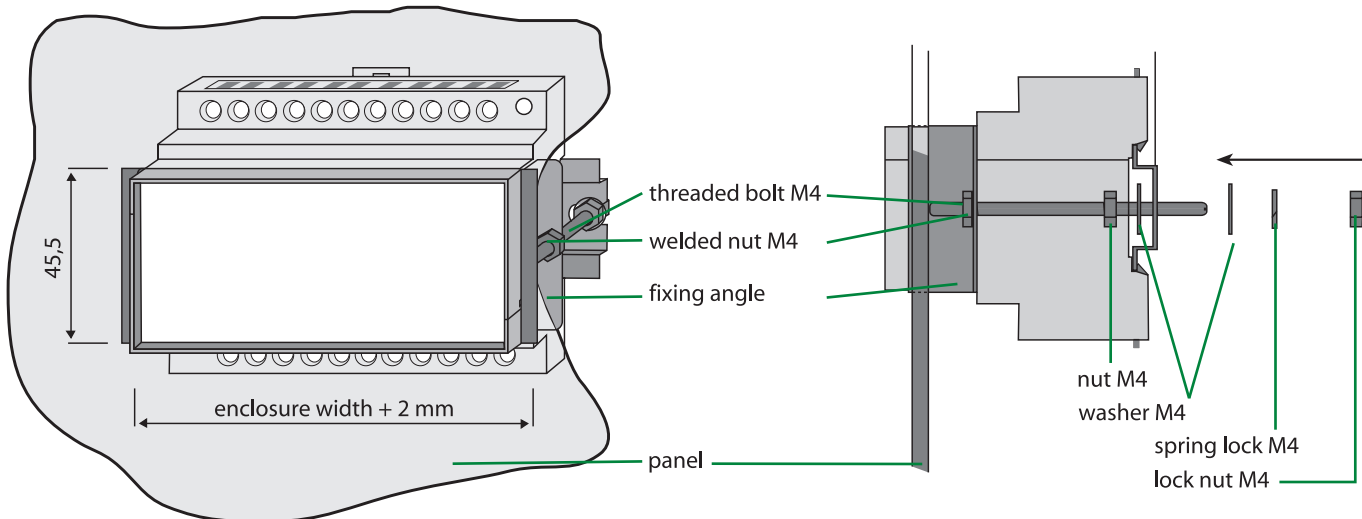
Test voltage	3kV	Degree of protection acc. to DIN 60529	
Accuracy class acc. to DIN 43780	1.5	Enclosure	IP52
Position of normal use	vertical + 5 degree	Terminals	IP00
Temperature range	-25...+40 °C	Terminals with protection against accidental contact	IP20

## Fixing sets

### Mounting frames for enclosure fixing in control panels Dimensions in mm



### Fixing set for enclosures X440, X460 and X470 for 45 mm standard panel cutout Dimensions in mm



#### Ordering details

Enclosure	Art. No. mounting frame	Art. No. fixing set
X440	--	B 990 992
X460	--	B 990 993
X470	B 990 991	B 990 990



Communication solutions for the connection of A-ISOMETERS® including a BMS interface to PROFIBUS DP, Modbus RTU and Ethernet – TCP / IP



## BENDER communication solutions

### The BMS bus

The BMS bus (BENDER Measuring Device Interface) is BENDER's own development and enables optimum data exchange between all BENDER products with communication capability.

The BMS bus is an RS485 interface utilizing a protocol especially developed for BENDER devices.

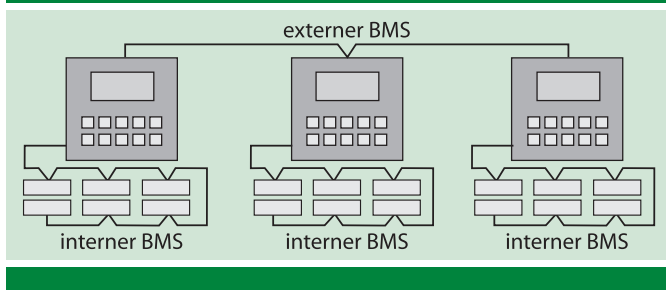
The BMS bus transmits alarm and status messages on a cyclic basis. In addition, the protocol includes commands for requests and for changing device parameters as well as various control commands.

### Function – Master Slave principle

The BMS bus operates according to the Master-Slave principle. That means, one device operates as the Master whereas all other devices are Slaves. Hence, only one Master may exist on each BMS bus. The Master requests all devices on the bus on a cyclic basis, listens to their signals and carries out the respective commands. During operation, the Master function can temporarily be taken over by a Slave. One unique address must be assigned to each device connected to the BMS bus. Address 1 is assigned to the Master. Exceptions are PGH47..., PRC470(E) and EDS47...-12. These devices include a separate DIP switch for Master / Slave selection.

### Internal and external bus

Several BMS bus systems can be interconnected to one common system. For this purpose, a PRC1470 or a TM operator panel is required. Several PRC1470 or TM operator panels communicate with



each other via the external bus. A consecutive address must be assigned to each device. The Master function is taken over according to the passing-token principle. That means, the Master function is consecutively assigned to each PRC1470 or TM operator panel for a certain period of time.

On the internal bus each PRC1470 or TM operator panel communicates with devices of the associated BMS system. The respective device acts as Master with address 1 assigned to it

### Cables and cable lengths (internal and external BMS bus)

The specification of the RS485 interface restricts the maximum length of the interface to 1200 m. With longer cables, additional measures are necessary (installation of a DI-1 repeater). A shielded cable is recommended to be used as an interface cable. A suitable cable type is, for example, J-Y(ST)Y 2x0.6.

When interface cables are implemented as spur cables, the maximum length is limited to 1 m. When longer spur cables are used, safe communication cannot be guaranteed.

The number of devices on a bus must not exceed 32. By using repeaters (e. g. BENDER DI-1) another 32 devices can be connected or the cable length can be extended by another 1200 m.

### Terminating resistors (internal and external BMS bus)

The BMS bus must be terminated at both ends with a 120  $\Omega$  (0.25 W) terminating resistor. The resistors are to be connected in parallel to the terminals A and B. A BMS bus without terminating resistors may become unstable and may cause malfunctions.

### Basic rules for the design of a BMS bus

1. Every BMS bus must be controlled by a MASTER.
2. There may only be one MASTER in each BMS bus system.
3. To each node one individual address must be assigned for unique identification.
4. Never assign one address twice.
5. The BMS bus must be terminated at both ends with 120  $\Omega$  terminating resistors.
6. The maximum cable length must not exceed 1200 meters unless DI-1 repeaters are used.
7. The number of devices on a BMS bus must not exceed 32 unless DI-1 repeaters are used.
8. The BMS bus must provide a favourable topology (without branch circuits).
9. The bus cable ( J-Y(ST)Y 2x 0,6) must be shielded and earthed at one side.
10. Take care not to mix up bus terminal A with B.

When the basic rules above are observed, you won't have any problems with a BMS bus.

### Addresses and address ranges

One unique address is assigned to all devices connected to the BMS bus. Address 1 is assigned to the Master. Address 000 is the "broadcast address" which addresses all other nodes and may therefore not be assigned to any other device. 150 of 255 addresses theoretically available (1 byte address, 28 = 256) are currently used. This is due to address ranges defined for special device families. Since an address range of 1...30 is not sufficient for systems like EDS and RCMS, extended address ranges had to be created. For the extended address range, specially adapted devices such as RCMS470E-12, EDS47...E-12, PGH47...E, are available.

### Master redundancy

Some of the latest BMS device versions such as FTC470XDP, FTC-470XMB are capable of operating as redundant Master. In this case such a device takes over the Master function in order to control the BMS bus after about 60 seconds in case of failure of the regular Master (address 1). When the regular Master becomes active again, the FTC470 will return the Master function. Devices with BMS address 2 automatically have this Master function.

### Interrogation of all connected devices (internal BMS bus)

During normal operation, the Master interrogates all address ranges for the number of alarm messages. If alarm messages exist, all channels of the respective device are interrogated. Then the address ranges are asked for the number of operating messages and in case of existing messages the channels of the respective devices are interrogated, too. In addition every other second all Slaves are interrogated for possible interruptions via the broadcast address 0. That guarantees that new alarm messages are available on the bus after 2 seconds at the latest.



**Technical data – BMS bus**

**Hardware characteristics**

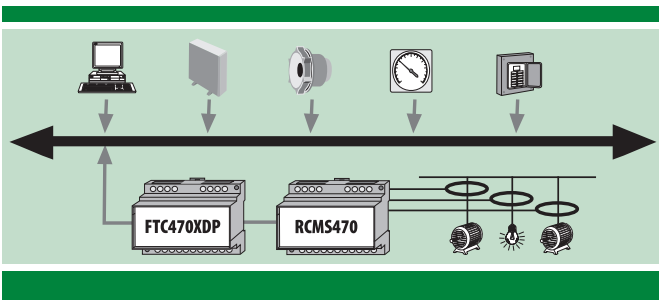
Connection	half-duplex
Communication	Master/Slave
Nodes	≤ 32
Transmission rate	9600 bits/s
Cable length	≤ 1200 m
Recommended cable: Shielded cable (screened, screen one side connected to PE)	2 x 0.6 mm <sup>2</sup>
Recommended cable type e. g.	J-Y(ST)Y 2 x 0.6
Terminating resistor	120 Ω (0.25 W)

**Interface parameters**

Transmission	1 star tbit, 7 data bits, 1 parity bit, 1 stop bit
Baud rate	9600 baud
Parity	even
Checksum / sum of all transmitted bytes	0 (without CR and LF)
Data transmission	with ASCII characters, yet not all characters are permitted

**BENDER communication solutions**

In the field of automation of electrical installations, the use of modern fieldbus technologies and the use of Ethernet technology has become a must. Protocol converters and open interfaces allow communication of such systems with the BMS bus developed by BENDER.



**PROFIBUS**

PROFIBUS is a fast, open bus system widely known in the field of automation. It is internationally standardized (IEC 61158 and EN 50170). Three variants are available:

- PROFIBUS FMS (Fieldbus Message Specification)
- PROFIBUS PA (Process Automation)
- PROFIBUS DP (Decentral Periphery)

The protocol converter FTC470XDP supports the PROFIBUS DP. Here, central control devices (e.g. programmable controllers) communicate with decentralized input and output modules via a fast serial connection. BMS bus devices are connected with the PROFIBUS DP via the FTC470XDP. For control purposes, a PROFIBUS Master is required.

**Jbus / Modbus**

Modbus is an open serial communication protocol based on the Master / Slave principle. It can easily be implemented on any serial interface and has therefore become very popular. The Modbus protocol initially has been developed for networking control systems but is now often used for the connection of input and output modules. Owing to the low transmission rate of maximum 57.6 kbaud, the Modbus is specifically designed for systems with limited bus nodes or for time-critical applications.

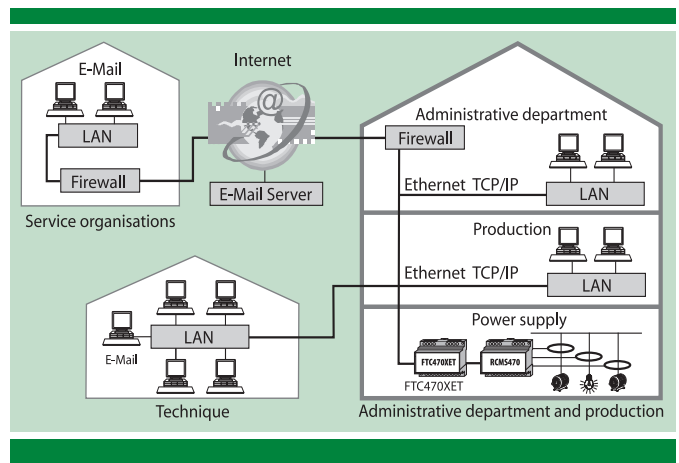
The protocol converter FTC470XMB allows connection of BMS devices to Modbus RTU. A Modbus Master is required for the control of the FTC470XMB.

**Ethernet / TCP/IP**

The Ethernet is a widely used, manufacturer-independent technology enabling data transfer of 10, 100 or 1000 millions bits per second (Mbps) in the Local Area Network (LAN). The Ethernet belongs to the classic systems among the bus systems and has established itself as a standard in the IT world.

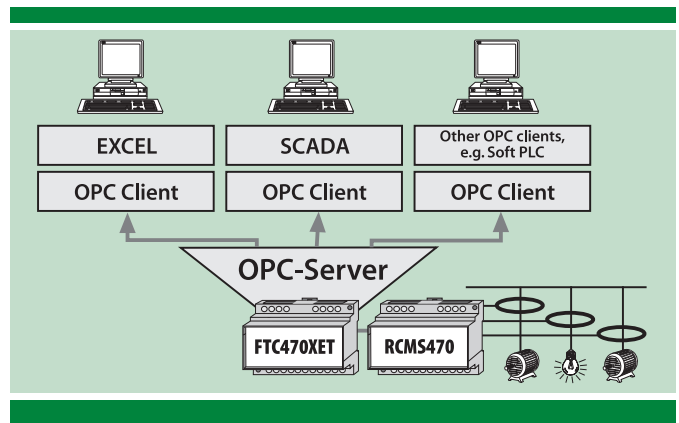
With the FT470XET protocol converter BENDER provides the solution for this application. A complete web server integrated in the protocol converter allows easy operation and control of BENDER systems by means of standard browsers via any personal computer. The integrated OPC server allows data to be transferred to building service management systems or to visualization software.

**OPC**



The OPC (OLE for Process Control) is a standardized software technology. OPC is a standardized software interface in the field of automation technology and is based on Microsoft COM and DCOM technology. In this way different programs of different manufacturers can interact with each other.

OPC is not a protocol intended to replace field buses. OPC is a client / server application. Data made available by the OPC server can be accessed by the OPC clients. The OPC server of the FTC470XET supports the specification DA (Data Access) 1.0 and 2.0.



**1.8.3**

# Protocol converter FTC470XDP

Protocol converter for the connection of the BMS bus to the PROFIBUS-DP



FTC470XDP

## Product description

The protocol converter FTC470XDP is capable of transmitting data from the BMS (BENDER Measuring Device Interface) bus to the PROFIBUS DP and vice versa. In this way, BENDER products such as EDS, RCMS or MEDICS® systems with communication capability can be integrated into a PROFIBUS DP system. Programming and adaptations on the PROFIBUS DP side are to be carried out by the user.

## Application

- Converting BMS data to PROFIBUS DP data
- Setting, observing and analysing BENDER products with communication capability, such as RCMS, EDS and MEDICS® systems
- Transmitting all BMS data to PROFIBUS DP
- Representation of BENDER data on software with PROFIBUS capability
- Reactions on the PROFIBUS side to events on the BMS side
- Connection to building services management systems with PROFIBUS capability
- Reactions on the BMS side to events on the PROFIBUS DP

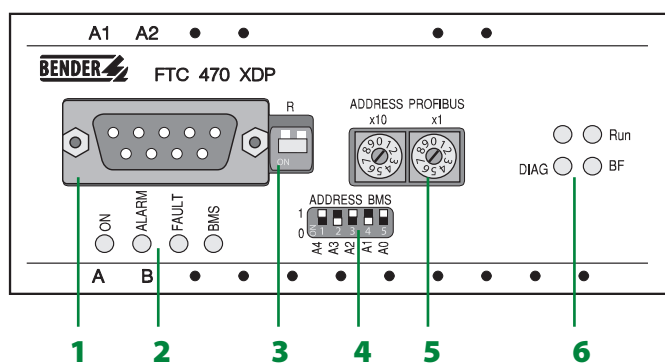
## Function

The protocol converter FTC470XDP is integrated in the PROFIBUS DP network in the function of a Slave. On the BMS side, it can be operated either as Master or as Slave. On the BMS side, it can be operated either as Master or as Slave. The PROFIBUS DP Master, e. g. a personal computer with PROFIBUS DP card or an SPC must be programmed in a way that the protocol converter is capable of sending the respective requests and obtaining the answers. For appropriate programming, the user is required to have a thorough PROFIBUS DP knowledge. The necessary documentation and the associated entire command syntax is a component of the FTC470XDP manual.

## Approvals



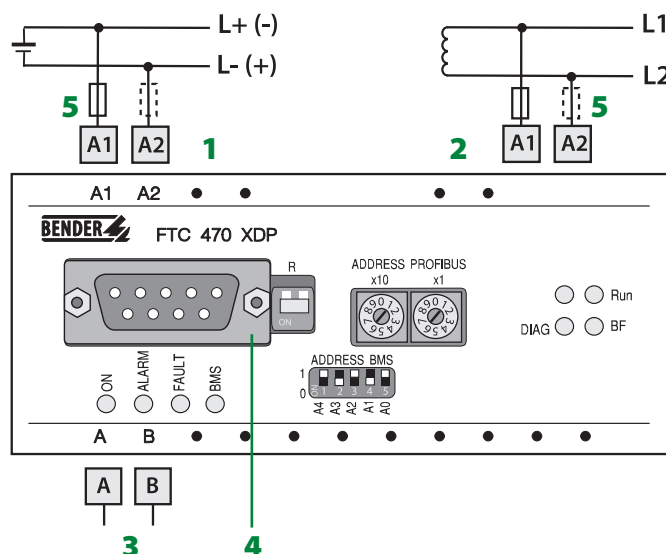
## Operating elements



### Legend to operating elements

- 1 - Socket for PROFIBUS DP cable: 9 pole Sub-D
- 2 - BMS bus status indication
- 3 - Micro switch for PROFIBUS DP termination: "ON" = terminating resistor activated
- 4 - Switch for BMS bus setting: 1...30
- 5 - Rotary switch for PROFIBUS DP address setting: 01...99
- 6 - PROFIBUS DP status indication

## Wiring diagram



- 1 - Connection to supply voltage  $U_S = DC 85...276 V$
- 2 - Connection to supply voltage  $U_S = AC 85...276 V$
- 3 - Connection to BMS bus
- 4 - PROFIBUS-DP: 9 pole Sub-D
- 5 -  $U_S$  see ordering details, a 6 A fuse is recommended

**Technical data FTC470XDP**

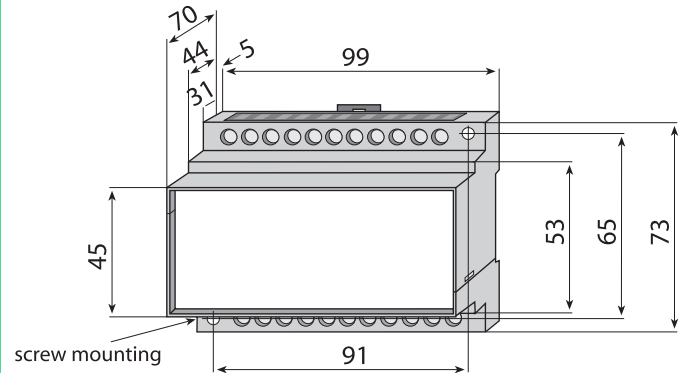
<b>Isolationskoordinaten nach IEC 60664-1</b>	
Rated insulation voltage	AC 250 V
Rated impulse voltage / pollution degree	4 kV / 3
<b>Voltage ranges</b>	
Supply voltage $U_S$	AC / DC 85...276 V
Frequency range of $U_S$	DC 50...400 Hz
Power consumption	≤ 12 VA
<b>Displays and LEDs</b>	
PROFIBUS DP	diagnosis LEDs: run / DIAG / bus error
BMS bus	4 diagnosis LEDs: ON / ALARM / FAULT / BMS
<b>Interfaces</b>	
PROFIBUS DP	RS485 9 pole Sub D, electrically isolated / slave acc. to EN50170
BMS bus	RS485 / BMS protocol
Connection A / B:	shielded cable ≥ 0.6 mm <sup>2</sup> 0...1200 m shield on one side connected to PE Cable type, e. g. J-Y(ST)Y 2 x 0.6
Terminating resistor PROFIBUS DP	DIP switch
Terminating resistor BMS	120 Ω (0.5 W)
PROFIBUS DP addressing	rotary switch, 1...99
BMS addressing	DIP switch, 1...30
Baud rate PROFIBUS DP	9.6 kbit/s...12 Mbit/s with automatic baud rate recognition
Baud rate BMS	9.6 kbit/s
<b>General data</b>	
Shock resistance IEC60068-2-27 (device in operation)	15 g / 11 ms
Bumping IEC60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance IEC60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance IEC60068-2-6 (during transport)	2 g / 10...150 Hz
Ambient temperature (during operation)	-10 °C...+55 °C
Storage temperature range	-40 °C...+70 °C
Climatic category DIN IEC 60721-3-3	3K5
Operating mode	continuous operation
Position	any position
Connection	screw terminals
Cross sectional area of connecting cable, rigid, flexible	0.2...4 mm <sup>2</sup> / 0.2...2.5 mm <sup>2</sup>
Flexible with ferrules without / with plastic collar	0.25...2.5 mm <sup>2</sup>
Conductor sizes (AWG)	24-12
Degree of protection DIN EN 60529	
Internal components	IP30
Terminals	IP20
Type of enclosure	X470
Enclosure, material	polycarbonate
Screw fixing	2 x M4
DIN rail mounting according to	DIN EN 60715 / IEC 60715
Flammability class	UL94V-0
Technical manual	TGH 1358
Weight approx.	350 g

**Ordering details**

Type	Supply voltage $U_S$	Art. No.
FTC470XDP	AC / DC 85...276 V*	B 9506 1000

\* Absolute value

**Dimension diagram, enclosure X470** Dimensions in mm



# Protocol converter FTC470XMB

Protocol converter for the connection to the BMS bus (BENDER Measuring Device Interface) to Modbus RTU



FTC470XMB

## Product description

The protocol converter FTC470XMB is designed to transmit data from the BMS bus to the Modbus RTU and vice versa. In this way, information from BENDER products such as EDS, RCMS or MEDICS® systems with communication capability can be integrated into a Modbus RTU system. Programming and adaptations on the Modbus RTU side are to be carried out by the user.

## Application

- Transmitting all BMS data to the Modbus RTU
- Representation of BENDER data on software with Modbus RTU capability
- Responds on the Modbus RTU side to events on the BMS side
- Control of BMS systems via Modbus RTU
- Connection to building services management systems with Modbus RTU capability
- Responds on the BMS side to events on the Modbus RTU side

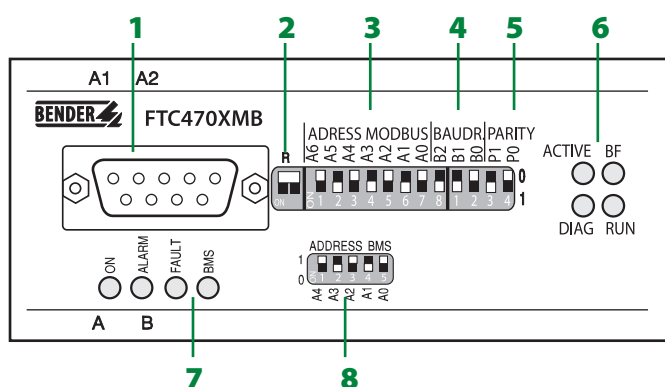
## Function

The protocol converter FTC470XMB is integrated in the Modbus RTU network in the function of a Slave. On the BMS side, it can be operated either as Master or as Slave. The Modbus RTU Master, e. g. a personal computer with Modbus RTU interface or an SPC must be programmed in a way that the protocol converter is capable of sending the respective requests and obtaining the answers. For appropriate programming, the user is required to have a thorough Modbus RTU knowledge. The necessary documentation and the associated entire command syntax is a component of the FTC470XMB manual.

## Approvals



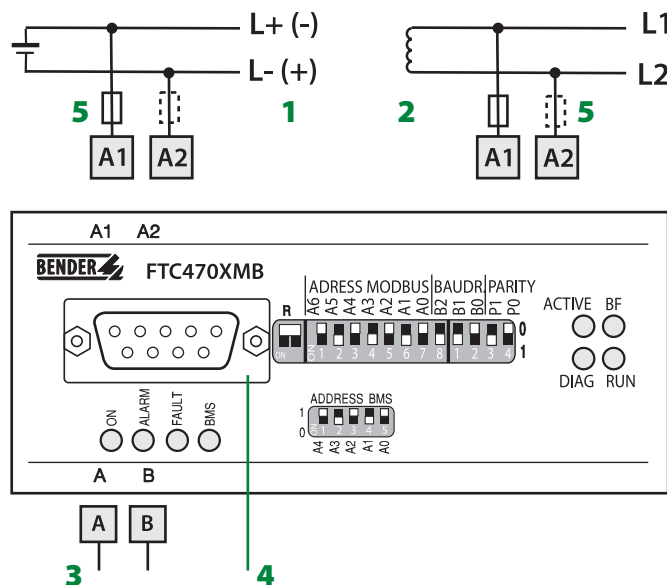
## Operating elements



## Legend to operating elements

- 1 - Socket for Modbus RTU cable: 9 pole Sub-D
- 2 - Micro switch for Modbus RTU termination: "ON" = terminating resistor activated
- 3 - DIP switch for binary addressing of the ModBus RTU: 1...127
- 4 - DIP switch for binary baud rate setting of the ModBus RTU: 1200...57600 bit/s
- 5 - DIP switch for binary parity setting of the ModBus RTU: none / even / odd
- 6 - Modbus RTU status indication
- 7 - BMS bus status indication
- 8 - DIP- switch for binary BMS bus setting: 1...30

## Wiring diagram



- 1 - Connection to supply voltage  $U_S = DC 85...276 V$
- 2 - Connection to supply voltage  $U_S = AC 85...276 V$
- 3 - Connection to BMS bus
- 4 - Modbus RTU: 9 pole Sub-D
- 5 -  $U_S$  see ordering details, a 6 A fuse is recommended

**Technical data FTC470XMB**
**Isolationskoordinaten nach IEC 60664-1**

Rated insulation voltage	AC 250 V
Rated impulse voltage / pollution degree	4 kV / 3

**Voltage ranges**

Supply voltage $U_S$	AC / DC 85...276 V
Frequency range of $U_S$	DC 50...400 Hz
Power consumption	≤ 12 VA

**Displays and LEDs**

Modbus RTU	4 diagnosis LEDs: processing / bus error / bus ready / HW setting status
BMS bus	4 diagnosis LEDs: ON / ALARM / FAULT / BMS

**Interfaces**

RS485	BMS
RS485 Sub D	Modbus RTU
Connection A / B: shielded cable ≥ 0.6 mm <sup>2</sup> shield on one side connected to PE Cable type, e. g. J-Y(ST)Y 2 x 0.6	0...1200 m
Terminating resistor BMS	120 Ω (0.5 W)
Terminating resistor Modbus RTU	DIP switch

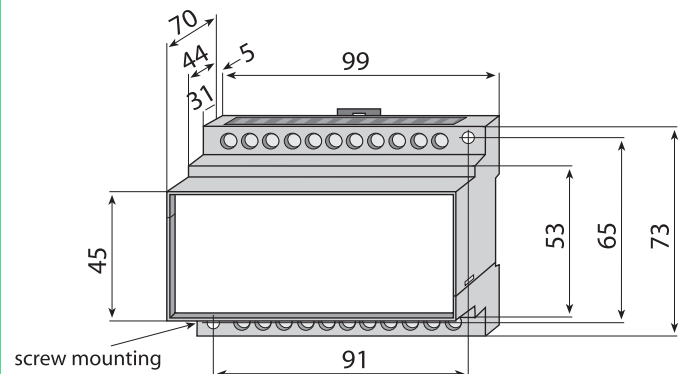
**General data**

Shock resistance IEC60068-2-27 (device in operation)	15 g / 11 ms
Bumping IEC60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance IEC60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance IEC60068-2-6 (device out of operation)	2 g / 10...150 Hz
Ambient temperature (during operation)	-10 °C...+55 °C
Storage temperature range	-40 °C...+70 °C
Climatic category DIN IEC 60721-3-3	3K5
Operating mode	continuous operation
Position	any position
Connection	screw terminals
Cross sectional area of connecting cable	
rigid, flexible	0.2...4 mm <sup>2</sup> / 0.2...2.5 mm <sup>2</sup>
Flexible with ferrules without / with plastic collar	0.25...2.5 mm <sup>2</sup>
Conductor sizes (AWG)	24-12
Degree of protection DIN EN 60529	
Internal components	IP30
Terminals	IP20
Type of enclosure	X470
Enclosure, material	polycarbonate
Screw fixing	2 x M4
DIN rail mounting according to	DIN EN 60715 / IEC 60715
Flammability class	UL94V-0
Technical manual	TGH 1367
Weight approx.	350 g

**Ordering details**

Type	Supply voltage $U_S$	Art. No.
FTC470XMB	AC / DC 85...276 V*	B 9506 1002

\* Absolute value

**Dimension diagram, enclosure X470** Dimensions in mm


# Protocol converter FTC470XET

Protocol converter for the connection of the BMS bus (BENDER Measuring Device Interface) to TCP/IP via Ethernet



FTC470XET

## Product description

The protocol converter FTC470XET is used as an Ethernet gateway with web server. Data from the BMS bus is converted to TCP/IP protocol (Ethernet). In this way, data from BMS systems can be displayed with a web browser of a personal computer. Additional software installation is not required.

## Application

- BMS data are converted to TCP/IP protocol (Ethernet)
- Setting, observing and analysing BENDER products with communication capability, such as RCMS, EDS and MEDICS® systems
- Data transmission to building services management systems and visualization systems via an integrated OPC interface

## Function

The protocol converter FTC470XET can be integrated into existing EDP systems like a personal computer. After entering an IP address and connection to the network and to the BMS system, a standard web browser (e. g. Internet Explorer, Netscape Navigator) of a personal computer allows access to the entire data of a BMS system. In this way, all essential measuring data of the system are directly available. The parameterization of the BENDER systems is protected by a password.

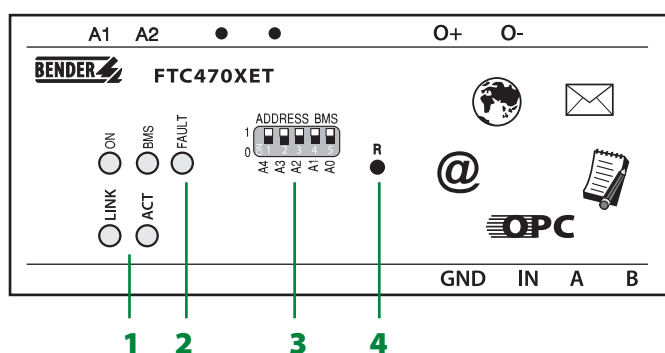
## Device features

- Indication of BMS data via standard web browser
- Fast and easy parameterization of BENDER systems from a central point
- Indication of status messages, alarm messages and measuring values
- Detailed information at a glance
- Indication of historical data
- Useful data logging function
- OPC interface for communication with high-level systems (building management systems or visualization software)
- Easy installation and commissioning
- E-Mail notification in case of alarm and system faults
- Remote maintenance and remote diagnosis via LAN, WAN or Internet
- Independent of hard and software

## Approvals



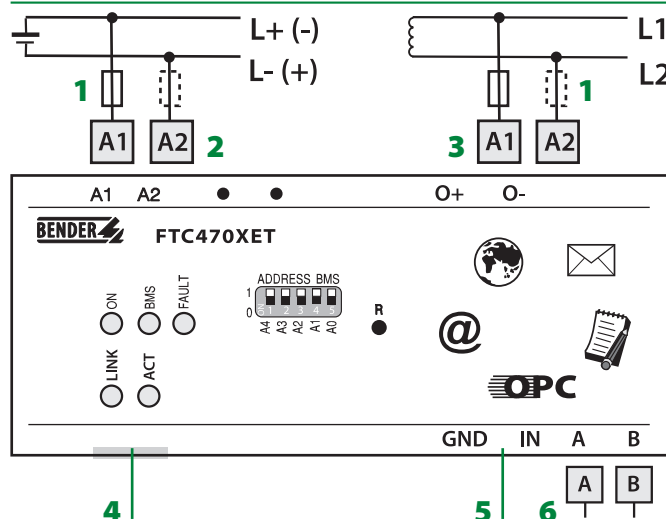
## Operating elements



### Legend to operating elements

- 1 - Ethernet status indication
- 2 - BMS bus status indication
- 3 - DIP switch for binary BMS bus address setting: 1...30
- 4 - Reset button

## Wiring diagram



- 1 - Us see ordering details, a 6 A fuse is recommended
- 2 - Connection to supply voltage  $U_s = DC 85...276 V$
- 3 - Connection to supply voltage  $U_s = AC 85...276 V$
- 4 - Connection to Ethernet
- 5 - Digital input for service purposes
- 6 - Connection to BMS bus

**Technical data protocol converter FTC470XET**

**Insulation coordination acc. to IEC 60664-1**

Rated insulation voltage	AC 250 V
Rated impulse voltage / pollution degree	4 kV / 3

**Voltage ranges**

Supply voltage $U_S$	AC / DC 85...276 V
Frequency range of $U_S$	DC 50...400 Hz
Power consumption	≤ 12 VA

**Displays and LEDs**

Ethernet	2 diagnosis LEDs: link / act
BMS bus	4 diagnosis LEDs: ON / FAULT / BMS

**Interfaces**

RS485	BMS
RJ45	Ethernet
Connection A / B: shielded cable ≥ 0.6 mm <sup>2</sup> shield on one side connected to PE Cable type, e. g. J-Y(ST)Y 2 x 0.6	0...1200 m
Terminating resistor BMS	120 Ω (0.5 W)
Software interface	OPC data access 2.0 server

**Allgemeine Daten**

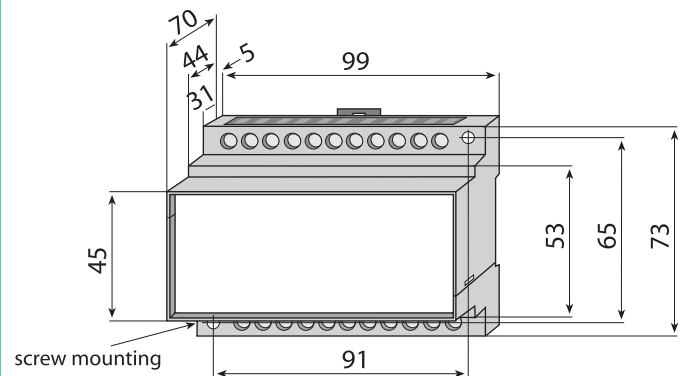
Shock resistance IEC60068-2-27 (device in operation)	15 g / 11 ms
Bumping IEC60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance IEC60068-2-6 (device in operation)	1 g / 10...150 Hz
Vibration resistance IEC60068-2-6 (during transport)	2 g / 10...150 Hz
Ambient temperature (during operation)	-10 °C...+55 °C
Storage temperature range	-40 °C...+70 °C
Climatic category DIN IEC 60721-3-3	3K5
Operating mode	continuous operation
Position	any position
Connection	screw terminals
Cross sectional area of connecting cable	
rigid, flexible	0.2...4 mm <sup>2</sup> / 0.2...2.5 mm <sup>2</sup>
Flexible with ferrules without / with plastic collar	0.25...2.5 mm <sup>2</sup>
Conductor sizes (AWG)	24-12
Degree of protection DIN EN 60529	
Internal components	IP30
Terminals	IP20
Type of enclosure	X470
Enclosure, material	polycarbonate
Screw fixing	2 x M4
DIN rail mounting according to	DIN EN 60715 / IEC 60715
Flammability class	UL94V-0
Technical manual	TGH 1375
Weight approx.	400 g

**Ordering details**

Type	Supply voltage $U_S$	Art. No.
FTC470XET	AC / DC 85...276 V*	B 9506 1001

\* Absolute value

**Dimension diagram, enclosure X470** Dimensions in mm







**Measurement technique and  
definitions of technical terms  
Standards to be applied**

**Annex**

## Standards

### The EMC directive

All the devices in this catalogue carry the CE symbol, that means that they fulfil the requirements of the EMC directive. The corresponding standards and limiting values are listed below. The technical data applies to all the products listed in this catalogue, as far as the EMC directive is applicable.

### Tests of electromagnetic compatibility (EMC)

Interference immunity according to EN 61326	
Emission according to EN 61326	
Emissions according to En 55011 / CISPR11	class B*, (A*)

\* Class A devices are only suitable for use in the industrial sector. For use in other sectors, interference suppression measures must be implemented.

Class B devices are suitable for use in the household and industrial sector.

### Classification of the EMC standards for BENDER devices

Device family	Interference immunity	Emissions
A-ISOMETER®	EN 61326/A2: 2001-05	EN 61326/A2: 2001-05
RCM	EN 61543: 1995-07	EN 61000-6-4: 2001-10
Measuring and monitoring relays	EN 61000-6-2: 2001-10	EN 61000-6-4: 2001-10
EDS	EN 61000-6-2: 2001-10	EN 61000-6-4: 2001-10
UMC	EN 61000-6-2: 2001-10	EN 61000-6-4: 2001-10

For all other devices, the data indicated for measuring and monitoring relays shall apply.

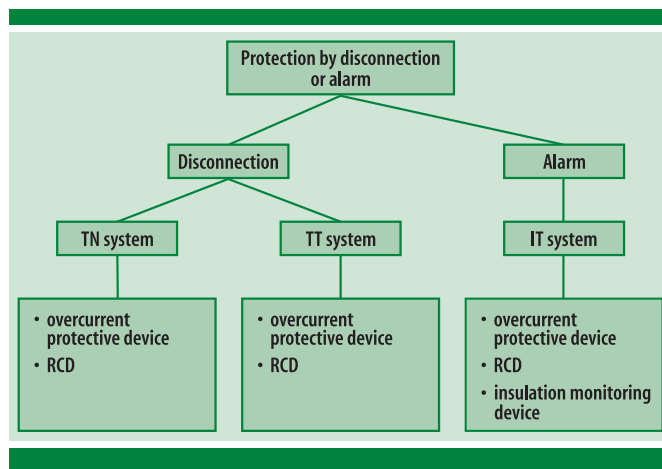
### Standards for protective measures

Protection of people and animals against hazardous body currents is basically regulated in DIN VDE 0100 part 410 (IEC 60364-4-41). These standards define the measures for protection against direct contact, as well as in the case of indirect contact. The hazard resulting from direct contact with live parts is easily understood. Comprehensible measures can achieve protection in this case. Measures like disconnection or alarm are necessary to achieve protection against indirect contact. Protective measures with protective conductors require the type of distribution system and the protective device to be coordinated.

The types of distribution systems (IT, TT, and TN system) have been explained before. Permissible protective devices are:

- overcurrent protective devices
- insulation monitoring devices
- RCDs

The following illustration gives an overview about the protective measures and the coordination of the type of distribution system with the appropriate protective device.



### Standards for insulation monitoring devices

The special requirements for insulation monitoring devices are stipulated in DIN EN 61557-8 (VDE 0413 part 8): 1998-05, EN 61557-8: 1997-03 and IEC 61557-8: 1997-02. This standard describes devices which are used in pure AC systems and can also be used in AC, DC and mixed AC/DC systems. DIN EN 61557-8 (VDE 0413 part 8): 1998-05, EN 61557-8: 1997-03 and IEC 61557-8: 1997-02 is very precise with respect to the special requirements of the devices with regard to type of construction, measurement technology, documentation and tests / inspections.

DIN EN 61557-9 (VDE 0413 part 9): 2000-08, EN 61557-9: 1999, IEC 61557-9: 1999 specifies the requirements for insulation fault location systems.

All devices in this catalogue satisfy the requirements of the before mentioned standards.

The use of insulation monitoring devices in IT systems is specified in various standards. Additionally requirements may also be stipulated in these standards. Thus insulation monitoring devices for medical locations must additionally comply with DIN VDE 0100-710. DIN VDE 0118 applies to the mining sector. DIN VDE 0105 specifies the requirements for electric railroad systems. Where BENDER devices comply with other standards, a special reference will be made.

### Preventive maintenance

The availability of electrical installations and preventive maintenance are addressed directly or indirectly in various standards. The German standard DIN 31051 deals directly with maintenance. Measures to maintain and restore the intended condition of technical equipment in a system are specified here.

Further information about the maintenance of electrical installations can be found in EN 50110. This standard distinguishes between "preventive maintenance" and "corrective maintenance". Regular tests, such as the insulation resistance test, are required. The requirements of this standard are intended to achieve safe operation of electrical installations and safety of work in the vicinity of such installation. Hence, measures like tests or measurements, cited in the standard, help to avoid operational shutdowns and to reduce costs.

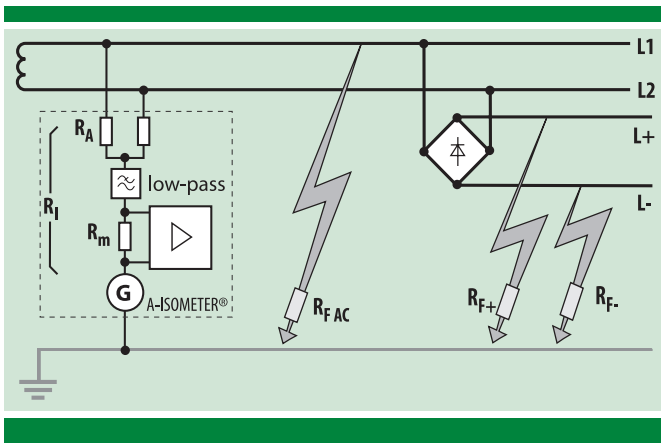
# The measurement technology of insulation monitoring devices

The high reliability of IT systems is ensured by continuous insulation monitoring. The insulation monitoring device detects insulation faults as they are developing and signals when the threshold is exceeded at an early stage.

The measuring principle to be used by the insulation monitoring device depends on the type of IT system and / or the influencing variables which occur in it.

## Superimposition of a DC measuring voltage


**DC** One frequently used measuring principle is the superimposition of a DC measuring voltage between the system and the protective conductor. This is the standard measuring principle for pure AC and three-phase systems. The positive pole of the measuring voltage  $U_m$  is connected to the system via high-impedance coupling resistors  $R_i$  and the negative pole is connected to earth via the electronic circuitry of the device. If an insulation fault occurs in the system, the measuring circuit closes via the insulation fault  $R_F$  and a DC measuring current  $I_m$  starts to flow. The measuring current is evaluated electronically via the measuring resistance  $R_m$ .

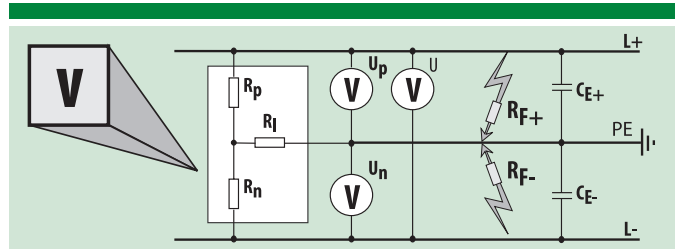


This measuring principle is suitable for monitoring conventional AC, 3(N) AC systems.

When this measuring principle is used in AC, 3(N) AC systems including galvanically connected DC components, these components may falsify the measurement result, i. e. insulation faults on the DC side are indicated with increased response sensitivity. Therefore insulation monitoring devices with AMP measuring principle are used for such systems. Typical installation parts with DC components are rectifiers, current converters, frequency converters, switched-mode power supply units etc.

## The voltage asymmetry principle

 This passive measuring principle does not involve the superimposition of a measuring voltage on the system; instead the system voltage is used as the driving voltage. The system to be monitored is connected via two poles and is monitored by a bridge connection.



The displacement voltage created by an earth fault  $R_{F+}$  or  $R_{F-}$  drives a measuring current  $I_m$  which is recorded in an electronic measuring circuit. When the response value is reached, the alarm relay switches. Conditioned by the measuring principle, symmetrical insulation faults are not recorded and direct display of the insulation resistance in  $k\Omega$  is not possible. The devices are only applicable in DC systems. The special term for these devices is "earth fault relay" and they are not insulation monitoring devices as defined in DIN EN 61557-8 (VDE 0413 part 8): 1998-05, EN 61557-8: 1997-03 and IEC 61557-8: 1997-02.

## The AMP / AMP<sup>plus</sup> measuring principle

**AMP** **AMP<sup>plus</sup>** The AMP measuring principle patented by BENDER is based on a specially clocked measuring voltage controlled by a microcontroller, automatically adapting to the respective system conditions. Software-supported evaluation differentiate between system leakage current components occurring as interference variables on the evaluation circuit and the measurement variable proportional to the ohmic insulation resistance. Hence broadband interference influences (such as those occurring when a frequency converter is in operation) do not have a negative influence on the exact determination of the insulation resistance.

The **AMP<sup>plus</sup>** measuring principle provides an even more improved interference suppression.

The adjustment parameters, response values and special alarm and display functions, are programmable and can be stored in a non-volatile memory. For connection to power system management several devices are equipped with interfaces. Devices with this measuring principle are suitable for universal use in AC, DC and AC / DC systems, e. g. systems with voltage and frequency variations, high system leakage capacitances or DC components. Thus these devices meet the requirements of today's modern distribution systems, which usually contain such influencing variables (converters, EMC).

## Summary of the measuring principles

The IT system, its structure and components are directly interrelated with the measuring principle of the insulation monitoring device. For planning purposes, it is therefore important to know the appropriate insulation monitoring device and its measuring principle. The table on the following page shows the selection of the measuring principles under consideration of the system parameters.

## Application fields and applicable standards for A-ISOMETERS®

Type of distribution system	Generation	Description	A-ISOMETER®
Pure AC system	<ul style="list-style-type: none"> <li>transformer</li> <li>generator</li> <li>inverter</li> </ul>	single or polyphase	
DC system	<ul style="list-style-type: none"> <li>battery</li> <li>rectifier</li> <li>solar cell</li> <li>fuel cell</li> </ul>	<ul style="list-style-type: none"> <li>without AC components</li> <li>with AC components from one-way and multi-way rectifiers</li> </ul>	
AC system with DC components	<ul style="list-style-type: none"> <li>transformer</li> <li>generator via galvanically connected rectifiers</li> </ul>	single or polyphase	
AC system $\Delta$ Y with electronic actuators	<ul style="list-style-type: none"> <li>thyristors</li> <li>triac</li> <li>GTOs a electronic actuators</li> </ul>	<ul style="list-style-type: none"> <li>high harmonic currents</li> <li>DC components</li> </ul>	
AC system $\Delta$ v with variable frequency	<ul style="list-style-type: none"> <li>frequency converters</li> </ul>	wide range of frequencies	

### Fuse protection for insulation monitoring devices

Most insulation monitoring devices have two connections, these are:

- the connection to the supply voltage  $U_S$
- and the coupling of the measuring circuit to the system to be monitored

Basically, each form of protection for an insulation monitoring device is to be regarded as line protection. A fuse protection in compliance with IEC 60364-4-473 always becomes necessary when the current-carrying capacity is reduced by reduced wire cross section, by a different type of routing, by different line conductor insulation or by a different number of leads. Safety devices for overload protection may be omitted in lines and cables where the occurrence of overload currents is not to be expected, provided that they neither have spurs nor plug appliances. It can generally be assumed that these conditions can be fulfilled both for the system coupling and the supply voltage connection of insulation monitoring devices.

The situation is different with regard to short-circuit protection. The supply voltage for insulation monitoring devices must be fitted with short-circuit protective devices to afford protection in the event of a short-circuit. The use of 6 A fuses is recommended. The fuse protection also makes it easier to access the devices for service work. For the system coupling, safety devices providing protection in the case of a short-circuit can only be omitted if the possibility of a short-circuit is reduced to a minimum (please also refer to IEC 60364-4-473). In these cases, cabling which is proof against short-circuits and short-circuits to earth is advisable as the minimum. It is often very difficult to reduce the danger of short-circuits to a minimum, and to decide whether this goal has been achieved. In cases of doubt, it is also appropriate to install protective devices in the system coupling, to provide protection by means of 6 A fuses in the event of a short-circuit. On devices with integrated connection monitoring, a protection failure is signalled as line interruption.

For all IT systems DIN VDE 0100-410 (VDE 0100 part 410): 1997-01, IEC 60364-4-41: 1992 "Protection against electric shock" applies.

According to chapter 413.1.5 IT systems, and 413.1.5.4 the following applies: an insulation monitoring device shall be provided to indicate the occurrence of a first fault from a live part or to earth which shall initiate an audible and / or visual signal.

### Location of use

- General applications ▶
- Railway ▶
- Construction sites ▶
- Mines ▶
- Chemical industry ▶
- Electric road vehicles ▶
- Explosive gas atmospheres ▶
- Furnaces ▶
- Fire brigades ▶
- Airports ▶
- Variable-speed drives ▶
- Lifting + hoisting devices ▶
- Industrial robots ▶
- Power plants and power distributions ▶
- Medically used rooms ▶
- Military facilities ▶
- Construction sites ▶
- Pipeline construction ▶
- Ships ▶
- Ships (Navy) ▶
- Safety lighting ▶
- Solar systems ▶
- Open-cast mining, quarries or similar ▶
- Traffic engineering ▶

Application field	Typical device	Standards and regulations
control circuits	IR125, IR140 or IR145	IEC 60204-1: 1997; EN 60204-1: 1997, DIN EN 60204-1 (VDE 0113 part 1): 1998-11
signal towers, level crossings, track conductors, point heaters, pole-mounted switches	IRDH265, IR125, IR207 or IR470LY2-40, IRDH275	DIN EN 50122-1 (VDE 0115 part 3): 1997-12 EBA approval
mobile generators	IR140, IR450 or IR470LY2-4061	IEC 60364-5-551, DIN VDE 0100-704 (VDE 0100 part 704): 2001-05 DIN VDE 0100-551 (VDE 0100 part 551): 1997-08
all systems > AC 50 V or DC 120 V	on request	DIN VDE 0118-1 (VDE 0118 part 1): 2001-11, part 2: 2001-11, part 3: 2001-11
500 V IT systems	IRDH265	Namur
charging systems	on request	UL2231-2; UL2231-1; DIN VDE 0122 (VDE 0122): 2001-11
floor conveyors, cables and cords	IR145	EN 60079-14 (VDE 0165 part 1): 1998-08; IEC 60079-14: 1996 DIN EN 50019 (VDE 0170 part 6): 1996-03
	on request	DIN VDE 0116 (VDE 0116): 1989-10
Fire-fighting vehicles Generators > 12 kW	IR470LY2-4061	DIN 14686
aviation ground lighting systems	IRDH1065, FTC470XDP (PROFIBUS-DP)	EN 50231: 1997; DIN EN 50231 (VDE V 0161 part 231): 1998-04
main circuits	IRDH275 or IRDH375	DIN EN 50178 (VDE 0160): 1998-04; EN 50178: 1997
control circuits	IR125, IR140, IR145	IEC 60204-32: 1998 EN 60204-32: 1998; DIN EN 60204-32 (VDE 0113 part 32): 1999-06
control circuits	IR145	IEC 60204-1: 1997, EN 60204-1: 1997; DIN EN 60204-1 (VDE 0113 part 1): 1998-11
battery systems	IRDH275 or IRDH375, IRDH575	EN 50272-2: 2001
rooms of application group 2	107TD47	IEC 60364-7-710: 2002; DIN VDE 0100-710 (VDE 0100 part 710): 2002-11
mobile generators	IR140RS	IEC 60364-5-551: 1994; DIN VDE 0100-551 (VDE 0100 part 551): 1997-08
mobile generators	IR140, IR450 or IR470LY2-4061	IEC 60364-5-551: 1994; DIN VDE 0100-551 (VDE 0100 part 551): 1997-08
mobile generators	IR140, IR450 or IR470LY2-4061	IEC 60364-5-551: 1994; DIN VDE 0100-551 (VDE 0100 part 551): 1997-08
control systems	IR125, IR145 or IRDH265-222	IEC 60204-1: 1997, EN 60204-1: 1997; DIN EN 60204-1 (VDE 0113 part 1): 1998-11
submarines, frigates, minesweepers, speedboats	IRDH275 or IRDH375 IRDH265 or IRDH365	ASTM F 1134-88 and F 1669M-96, Stannag BV30
communal facilities	on request	IEC 60364-5-56 DIN VDE 0108-1 (VDE 0108 part 1): 1989-10
solar power plants	IRDH275 or IRDH375	IEC 60364-4-41, IEC 60364-7-712
conveyor systems and transport systems	on request	DIN VDE 0168 (VDE 0168): 1992-01
Transrapid, ICE, railway carriage, sleeping car, railway locomotives	IR5003 or on request	DIN EN 61851-1; DIN EN 61851-2 (VDE 0122-1): 2001-11, DIN EN 50122-1 (VDE 0115 part 3): 1997-12

## Technical terms

It is inevitable that system protection technology is heavily oriented towards standards and regulations. Of course, this also applies to the terminology. For this reason, the maximum possible number of terms from the standards are applied in order to exclude uncertainties and to speak one language.

<b>A-ISOMETER®</b>	Registered trademark of Dipl. Ing W. Bender GmbH & Co. KG, Grünberg. An A-(absolute) ISOMETER® actively measures the insulation resistance in IT systems with a measuring voltage superimposed on the system voltage.
<b>Relative (percentage) error (A)</b>	Response value minus the specified response value, divided by the specified response value, multiplied by 100 and stated as a percentage.
<b>Response value (<math>R_{an}</math>)</b>	The value of the insulation resistance at which the device responds under specified conditions.
<b>Response time (<math>t_{an}</math>)</b>	Time required by an insulation monitoring device to respond under specified conditions.
<b>Output voltage (<math>U_a</math>)</b>	Voltage across the measuring equipment terminals where this equipment does or can output electric power.
<b>Rated operating conditions</b>	A set of specified measuring ranges for performance characteristics and specified operating ranges for influence quantities, within which the variations of operating errors of an instrument are specified and determined.
<b>Touch voltage (<math>U_t</math>)</b>	Voltage appearing during an insulation fault between simultaneous accessible parts.
<b>Conventional touch voltage limit (<math>U_L</math>)</b>	Maximum value of the touch voltage which is permitted to be maintained indefinitely in specified conditions of external influences and which is usually equal to AC 50 V, r. m. s or 120 V ripple free DC.
<b>Specified operating range</b>	Range of values of a single influence quantity which forms a part of the rated operating conditions.
<b>Operating voltage in a system</b>	The value of the voltage under normal conditions at a given, specific point of the system.
<b>Fiducial value</b>	A clearly specified value to which reference is made in order to define the fiducial error.
<b>Variation</b>	The difference between the indicated values for the same value of the measured quantity of an indicating or recording instrument, or the (conventional) true values of a supply instrument, when a single influence quantity assumes successively two different values.
<b>Influence quantity</b>	A quantity which is not the subject of the measurement, but which influences the value of the measured quantity, or the indication of measuring equipment.
<b>Earth</b>	The conductive mass of the earth whose electric potential at any point is conventionally taken as equal to zero.
<b>Fault voltage (<math>U_f</math>)</b>	Voltage appearing under fault conditions between exposed conductive and / or extraneous conductive parts and earth.
<b>Extraneous DC voltage (<math>U_{fg}</math>)</b>	A DC voltage occurring in AC systems between the AC conductors and earth (caused by DC components).
<b>Extraneous voltage</b>	Voltage to which the measuring equipment can be subjected by external influences. This is not required for the operation of the measuring equipment, but can interfere with its operation.
<b>Total earthing resistance (<math>R_A</math>)</b>	The resistance between the main earthing terminal and earth.
<b>Internal DC resistance (<math>R_i</math>)</b>	Resistance of the insulation monitoring device between the terminals to the system to be monitored and earth.
<b>Insulation fault location system</b>	An insulation fault location system usually consists of an insulation monitoring device according to IEC 61557-8, a control device, a test device, a coupling device, measuring transformers and evaluators. The system detects occurring insulation faults and indicates the fault location.

<b>Insulation monitoring device</b>	Insulation monitoring devices are measuring devices which permanently monitor the insulation resistance of IT systems to earth. This applies regardless of the method of measuring. Insulation monitoring devices must be capable, in accordance with their specified measuring principle, of recognising symmetrical and asymmetrical insulation deteriorations. Note: Earth fault relays using a voltage asymmetry in the presence of an earth fault as the only measurement criterion, are not insulation monitoring devices as defined in IEC 61557-8.
<b>Insulation resistance (<math>R_f</math>)</b>	Resistance in the system being monitored, including the resistance of all the connected appliances to earth.
<b>Performance characteristic</b>	One of the quantities (described by values, tolerances, ranges) assigned to an equipment in order to define its performance.
<b>Rated contact voltage</b>	Voltage for which a relay contact is rated to open and close under specified conditions.
<b>Short-circuit current (<math>I_k</math>)</b>	Current flowing across the short-circuited terminals of the measuring equipment.
<b>Open-circuit voltage (<math>U_q</math>)</b>	Voltage present across unloaded terminals on the measuring equipment.
<b>(absolute) error (of a measuring instrument)</b>	The indication of a measuring instrument minus the (conventional) true value of the measured quantity.
<b>(percentage) fiducial error</b>	(Absolute) error of measuring equipment expressed as a percentage of the fiducial value.
<b>(relative) error</b>	The ratio of the error (expressed in the units of the measured or supplied quantity) to the conventional true value.
<b>Measuring voltage (<math>U_m</math>)</b>	Voltage present at the measuring terminals during the measurement.
<b>Measuring current (<math>I_m</math>)</b>	Maximum current that can flow between the system and earth, limited by the internal resistance $R_i$ from the measuring voltage source of the insulation monitoring device.
<b>Nominal frequency (<math>f_n</math>)</b>	Frequency for which the measuring equipment is intended to be used and designed.
<b>Nominal voltage of the measuring equipment (<math>U_{me}</math>)</b>	Voltage for which the measuring equipment is intended to be used and the value of which is marked on the equipment.
<b>Nominal voltage range</b>	Voltage range for which the measuring and monitoring equipment is intended to be used and for which it has been designed.
<b>Nominal current (<math>I_n</math>)</b>	Current of the measuring equipment under normal conditions.
<b>Leakage capacitance of the distribution system (<math>C_e</math>)</b>	Maximum permissible value of the total capacitance to earth of the system to be monitored, including any connected appliances, up to which value the insulation monitoring device can work as specified.
<b>Nominal voltage of the distribution system (<math>U_n</math>)</b>	Voltage by which a distribution system or equipment is designated and to which certain operating characteristics are referred.
<b>Specified response value (<math>R_{an}</math>)</b>	Value of the insulation resistance permanently set or adjustable on the device and monitored if the insulation falls below this limit.
<b>Voltage against earth (<math>U_o</math>)</b>	a) In distribution systems with an earthed neutral point, the voltage between a phase conductor and the earthed neutral point; b) In all other distribution systems, the voltage present between the remaining phase conductors and earth when one of the phase conductors is shorted to earth.
<b>Supply voltage (<math>U_s</math>)</b>	Voltage at a point where the measuring equipment does or can accept electric power.
<b>Effect of the supply voltage</b>	Effect influencing the functioning of measuring equipment, and consequently the measured value produced by it.
<b>Internal AC resistance (<math>Z_i</math>) at 50 Hz</b>	Total impedance of the insulation monitoring device between the terminals to the system being monitored and earth, measured at nominal frequency.
<b>Reference to technical literature</b>	„Protective measures with insulation monitoring“ 2nd edition 2000, VDE-Verlag











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