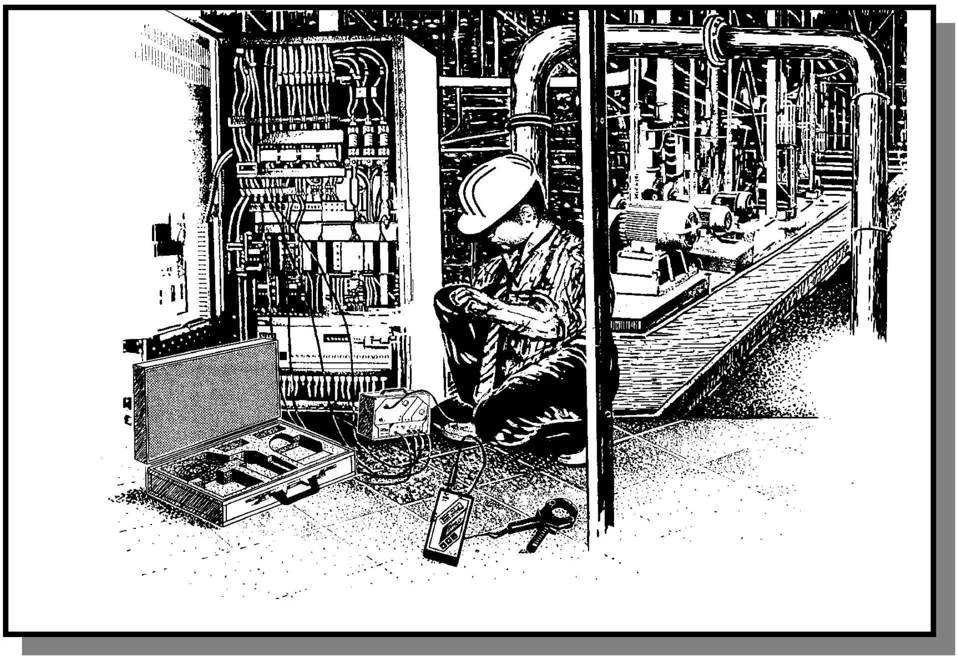
BENDER

EDS3065

Portable Insulation Fault Location Device



Operating Manual

TGH1266E

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1 General

What is EDS3065

The EDS3065 is a portable insulation fault location device for IT systems (unearthed systems). It enables insulation faults to be located during operation and without system shutdowns.

The EDS3065 consists of:

- PGH185 Insulation Fault Test Device
- EDS165 Insulation Fault Evaluator
- PSA3020 and PSA3052 Clamp-on Probes

In the past, classical insulation fault location consisted of disconnecting system sections one after another and then carrying out often laborious and protracted work to search for the faults. Modern fault location devices such as the EDS3065, PKA3001 or EDS470 (installed as a fixed system) make the fault location a good deal easier and shorter, and contribute in this way to a better power supply.

While insulation fault location is being undertaken with the EDS3065, any insulation monitoring device which may be present must be disconnected from the system for the duration of the fault location, if its internal resistance R is < 120 kΩ. This must be done by effecting an all-pole interruption of the system coupling - it is not sufficient to switch off the supply voltage to the insulation monitoring device.
Insulation monitoring devices with an R_i of 28 kΩ bring about a current conduction against earth of approximately 14 mA. When a device is used with an R_i of 120 kΩ the influence is negligible, and in this case there is no need to disconnect.

The EDS3065 can be used to accomplish the following measurement tasks:

- insulation fault location in IT systems, AC 19.2 ... 575 V / DC 19.2 ... 504 V
- insulation fault location in IT systems, AC 19.2 ... 575 V / DC 19.2 ... 504 V in combination with an EDS470 insulation fault location device as a fixed installation
- residual current measurement in TT and TN systems (earthed systems)

Critical Use

Before making use of the EDS3065 portable insulation fault location device, the user must have a very accurate knowledge of its possibilities, the special circumstances relating to its systems, and of certain hazards which are possible. Among the relevant points to be considered, particular attention must be paid to the maximum test current. Depending on the switch position of the PGH185, this is a maximum of 25 mA or 10 mA respectively.
The test current flows between the system and earth, not as a load current. Under unfavourable combinations of circumstances (low impedance insulation fault in connection with the test cycle of the test current), control errors cannot be ruled out in the case of sensitive system components (SPC, relays). Account must be taken of this possibility prior to use. If appropriate, a lower test current should be set, or the fault location device in this system should not be used.

Attention: the test current of the PGH185 may cause triggering of RCDs. Although the test current is limited to a maximum of 25 mA (or 10 mA respectively), 30 mA RCD (for example) may already respond between 15 and 30 mA.

The Insulation Resistance

One determining factor for the availability of an electrical system is the insulation resistance. It appears at the head of the list of protection goals for electrical safety. This applies as a fundamental principle, regardless of the form of the system.

A planning decision to construct a safe and reliable power supply with the goal of achieving maximum availability means:

- constructing the power supply as an IT system. By doing so, greater operational safety and reliability, greater fire safety, greater safety from accidents and a higher reliable resistance to earth are achieved than in the case of a system form where the active conductors are connected to earth.

- use of the correctly selected insulation monitoring device. The advantages cited in the foregoing paragraph stand or fall with the selection of the A-ISOMETER which is appropriate to the respective application. Unless there is functional monitoring, it is impossible to utilise the advantages of the IT system. The desired high level of insulation resistance cannot be maintained in the long term without continuous monitoring.

- reduction of maintenance costs and outage times thanks to the use of an insulation fault location device. Rapid location of an insulation fault immediately after it has occurred is a long-cherished wish on the part of the maintenance staff. The fault is reported and located without interruption of operations, and without the need for possible night and weekend work. The actual repair can then be carried out at a suitable point in time. The system operator makes the decision as to whether the insulation fault location device to be used should be a fixed installation or a portable device.

- An alternative to power supply in the form of an IT system may be offered by a TT or TN system which is equipped with residual current monitors and residual current detection devices. While this does not make it possible to avoid switching off when a first low-impedance fault occurs, it nevertheless guarantees a time advantage as far as information is concerned. As a result, deteriorations in the insulation and creeping insulation faults are detected at an early stage and a considerable number of shutdowns are prevented in this way.

Ensuring that the insulation is well-maintained is a decisive factor as far as the reliability of the power supply is concerned. This is only possible with the use of suitable monitoring devices. These devices cannot prevent the insulation fault or the deterioration of the insulation. However, early and rapid detection with information about the location of the fault will simplify maintenance to an extraordinary degree.

Without suitable tools, fault location was (and continues to be) time-consuming and troublesome. Week-end work was frequently necessary in order to locate the fault or faults while the system was switched off.

Modern monitoring devices such as the EDS3065, EDS470 or RCMS470 solve these problems. Thanks to the automatic location of the insulation fault, the necessary fault elimination is made very simple and the required high level of insulation is maintained. Localising takes place during continuous operation and it is not necessary to shut the system down.

Basic Standards

If a power supply is constructed as an IT system, the relevant standards require that the first insulation fault to occur must be eliminated as quickly as possible.

IEC 364-4-41, Point 413.1.5.4 (Note)
It is recommended that the first fault should be eliminated with the shortest practical delay.

DIN VDE 0100 Part 410:1983-11, Point 6.1.5.7
It is recommended that the first insulation fault should be eliminated as quickly as possible.

Rapid insulation fault location is made possible thanks to insulation fault location devices such as the EDS3065, EDS470 or RCMS470. In this way, the risk of the power supply being switched off because of a possible second fault is considerably reduced.

At the present time, work is in progress on IEC1557-9. This document deals with devices for insulation fault location in operational IT AC systems, IT AC systems with electrically connected DC circuits and IT DC systems. This international draft standard lays down some special requirements for insulation fault location devices in IT systems of up to AC 1000 V and DC 1500 V.

BENDER's insulation fault location devices are based on this draft of IEC1557-9. As far as possible, this operating manual attempts to use the terminology of the draft Standard, including the term 'insulation fault location device'. This indicates not only that insulation faults with 0 Ω (faults to earth) are found, but also insulation faults which involve resistance.

In addition, IEC 1010-1 is applicable. The title of this international Standard is "Safety requirements for electrical equipment for measurement, control, and laboratory use".

Terms and Definitions

I_{Δ} = fault current. The current which comes to flow through an insulation fault.

$I_{\Delta n}$ = nominal fault current. The fault current at which the evaluator unit responds under specified conditions.

$I_{\Delta s}$ = measured value of the discriminating fault current of the evaluator unit.

2 Safety Instructions

Proper Use

The intended use of the EDS3065 is to:

- locate insulation faults in IT systems, AC 50, 60 and 400 Hz, 19.2 ... 575 V and DC 19.2 ... 504 V.

In addition to this, the EDS165 insulation fault evaluator - which is a component of the EDS3065 - can be used to:

- evaluate insulation faults in combination with an EDS470 insulation fault-finding device as a fixed installation (EDS mode);
- measure residual currents in TN and TT systems (RCM mode)

Any other use, or any use which goes beyond the foregoing, is deemed to be improper. The BENDER companies shall not be liable for any loss and damages arising therefrom.

Warranty and Liability

As a basic principle, our "General Conditions of Sale and Delivery" shall apply. These shall be available to the operator no earlier than the time when the contract is concluded.
Warranty and liability claims in the event of injury to persons or damage to property are excluded if they can be attributed to one or more of the following causes:

- improper use of the EDS3065
- improper assembly/fitting, commissioning, operation and maintenance of the EDS3065.
- failure to take note of the information in the operating instructions concerning transport, storage, assembly/fitting, commissioning, operation and maintenance of the EDS3065.
- unauthorised structural modifications to the EDS3065
- failure to take note of the technical data
- improperly performed repairs and the use of spare parts or accessories which are not recommended by the manufacturer
- cases of disaster brought about by the effect of foreign bodies and force majeure
- the assembly and installation of non-recommended combinations of devices.

Copyright

In order to handle the EDS3065 in accordance with safety requirements and to ensure its trouble-free operation, the fundamental prerequisite is a knowledge of the basic safety information and the safety regulations.

Everyone who works with the EDS3065 must take note of this operating manual, and in particular of the safety information.
In addition to this, the rules and regulations concerning accident prevention which are valid for the operating location must be obeyed.

Only suitably qualified staff may work with the EDS3065. The term 'qualified' means that such staff are familiar with the assembly, commissioning and operation of the product and that they have undergone training which is appropriate to their activities.
The staff must have read and understood the safety chapter and the warnings in these operating instructions.

Safety Instructions

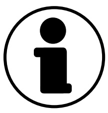
Explanation of Symbols and Notes

The following designations and symbols for hazards and warnings are used in BENDER documentation:

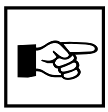
This symbol means an immediate threat of danger to human life and health.
Failure to observe these warnings means that death, severe bodily injuries or substantial damage to property **will** occur if the corresponding precautions are not taken.

This symbol means a possible threat of danger to human life and health.
Failure to observe these warnings means that death, severe bodily injury or substantial damage to property **may** occur if the corresponding precautions are not taken.

This symbol means a possibly hazardous situation.
Failure to observe these warnings means that slight bodily injuries or damage to property may occur if the corresponding precautions are not taken.



This symbol gives important information about the correct way to handle the EDS3065.
Failure to comply with this information may result in faults on the EDS3065 or in its environment.



This symbol guides you to application tips and particularly useful items of information.
These will help you to make optimal use of all the functions on the EDS3065.

Risks when Operating the System

The EDS3065 is built according to the state-of-the-art and the recognised safety engineering rules. During use, it is nevertheless possible that dangers will arise to the life and limb of the user or of third parties, or that the EDS3065 system or other items of property may be impaired. The EDS3065 must only be used:

- for the purposes for which it is intended
- when it is in perfect condition as regards safety engineering aspects

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

Special Notes

Note the maximum nominal insulation voltage!
No unauthorised persons may have access to the EDS3065.
Warning signs must always be easy to read. Damaged or illegible signs must be replaced immediately.

Inspection, Transport and Storage

Inspect the despatch and equipment packaging for damage, and compare the contents of the package with the delivery documents. In the event of transport damage, please notify the BENDER company immediately.
The components of the EDS3065 must only be stored in rooms where they will be protected against dust, moisture, and sprayed or dripping water, and where the indicated storage temperatures are maintained.

Warranty Obligations

BENDER provides a warranty of fault-free execution and faultless material quality on the EDS3065 with all its components for a period of 12 months as from the date of delivery, under normal operating conditions.
This warranty does not extend to any maintenance work, regardless of its nature.
The warranty is only valid for the initial purchaser, and does not extend to products or individual parts thereof which have not been correctly used or to which modifications have been made. Any warranty whatsoever shall lapse if the EDS3065 system is operated under abnormal conditions.

The warranty obligation is limited to the repair or exchange of a product which has been sent in to BENDER within the warranty period. It is also a qualifying condition of warranty that BENDER shall acknowledge that the product is faulty, and that the fault cannot be attributed to improper handling or modification of the device, or to abnormal operating conditions.

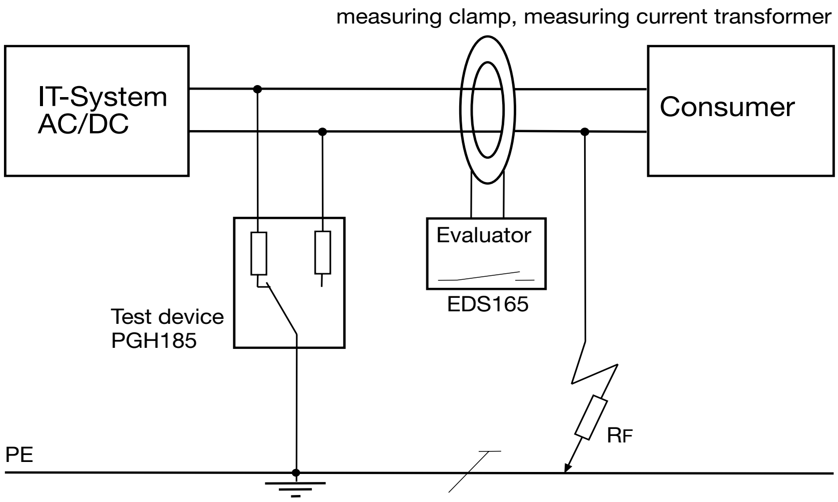
Any warranty obligation whatsoever shall lapse if repairs to the EDS3065 are undertaken by persons who are not authorised by BENDER.
The foregoing warranty conditions shall apply exclusively, and in the place of all other contractual or legal warranty obligations, including (but not limited to) the legal warranty of marketability, suitability for use and expediency for a specified purpose of use.
BENDER shall not assume any liability for direct and indirect concomitant or consequent damages or losses, regardless of whether these may be attributable to legal, illegal or other actions.

Operating Principle of Insulation Fault Location

When a first insulation fault occurs in IT systems, a fault current flows which is essentially determined by the leakage capacitances of the system. The basic concept in fault location is therefore to close the fault current circuit for a short period over a defined resistance. As a result of this principle, the system voltage itself drives a test current which receives a signal that can be evaluated.

Caution

The test current is generated periodically by the PGH185 test device (which is a component of the EDS3065 system). The test current is limited in amplitude and time. As this happens, the system conductors are connected alternately to earth over a defined resistance. The fault current which is generated in this manner depends on the size of the insulation fault present, and on the system voltage. It is limited to a maximum of 25 mA, and when I_{max} = 10mA is set, it is limited to 10 mA. For planning purposes, it should be noted that no system components are present in which this test current can bring about a damaging reaction, even in unfavourable cases.



The test current pulse flows from the test device via the 'live' leads, taking the shortest path to the location of the insulation fault. From there, it flows via the insulation fault and the earth lead (PE conductor) back to the test device. This current pulse is then detected by the clamp-on probes or measuring current transformers located in the insulation fault path, and is reported by the connected EDS165 evaluator.

The clamp-on probes and/or measuring current transformers are used as residual current transformers - that is to say, the PE conductor is not passed through the transformer.
Important: normal commercial clamp-on probes or measuring current transformers must not be used.

Response Values

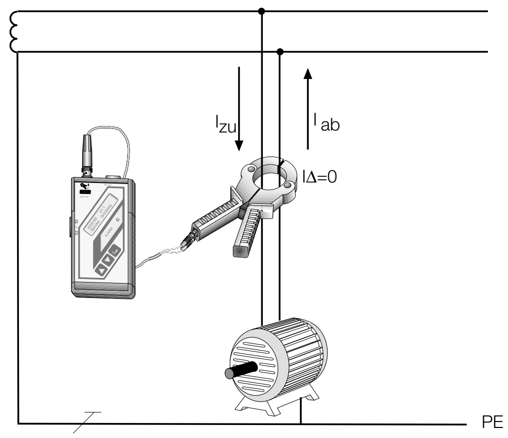
The response value is determined by the sensitivity of the EDS165 evaluator. In DC as well as AC and 3 AC systems, this is 5 mA as an arithmetic average value.

The accuracy is +/- 2 mA of the displayed measurement value. System faults and excessively high system leakage capacitances may have a negative influence on the accuracy.

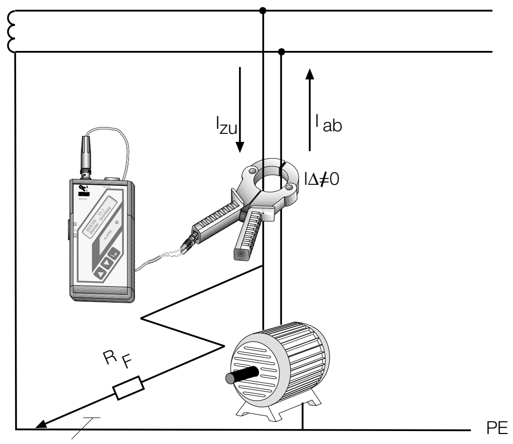
Operation in the RCM-Mode

In the RCM mode, the EDS3065 operates according to the principle of residual current measurement. In this case, only the EDS165 evaluator unit with the clamp-on probe is used, and the PGH185 test device is not required.

In accordance with Kirchhoff's Law, the sum of the inflowing currents at every intersection in a network is equal to the sum of the outflowing currents.



The two currents I_{to} and I_{from} are equal in quantity but have different directions, so that the resultant sum is zero. The EDS165 recognises this and no message is generated.



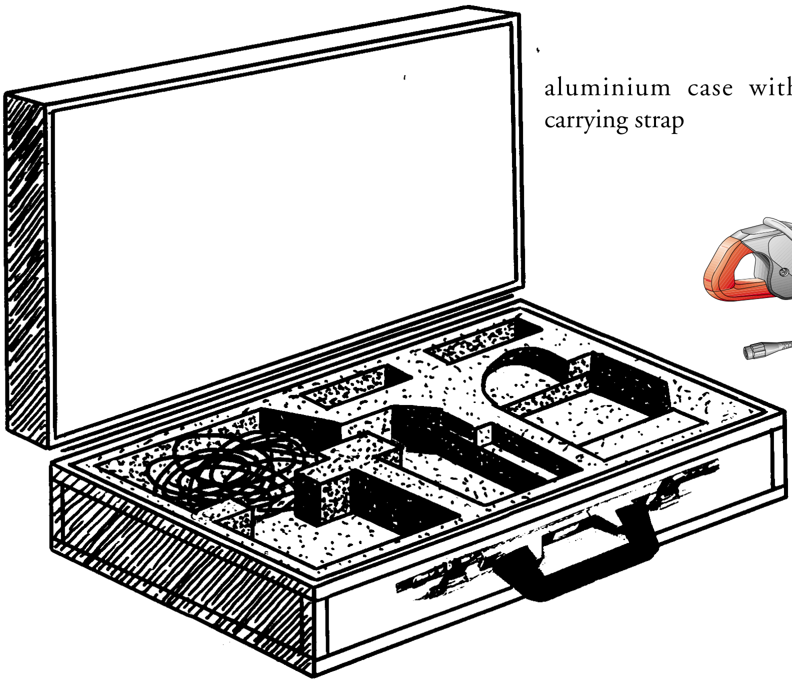
A portion of the current is flowing away via an insulation fault R_F. The sum of the currents is no longer zero. If the residual current is equal to or greater than the response value, the EDS165 will generate a message.

In the RCM mode, residual currents can be measured in one- and three-phrase TT or TN systems. If the system leakage capacitance upstream of the clamp-on probe is sufficiently high, the EDS165 can also be used for measurements in one- and three-phase IT systems. Its suitability for this purpose must be checked in each individual case.

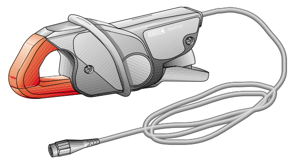
4 Product Description

The primary function of the EDS3065 is that of an insulation fault location device in IT systems. The individual components of the EDS3065 are used in combination for this purpose.

The System Components at a Glance

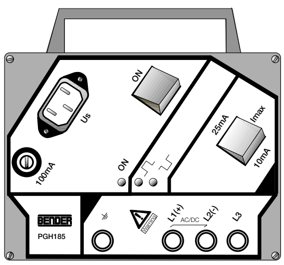


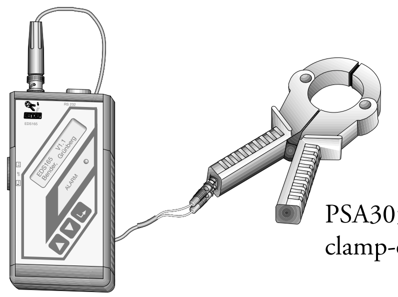
aluminium case with carrying strap



PSA3020 clamp-on probe

PGH185 Test device





PSA3052 clamp-on probe

EDS165 Evaluator

Not illustrated:
Power supply lead (europlug with connector for cold conditions) for PGH185 Insulation Fault Test Device.
Safety measuring leads, 3 x black and 1 x green/yellow.
Safety claw grip to connect the PGH185 with the system conductors and PE.
BNC adapter unit/banana plug to connect measuring current transformers.
Banana plug.
Accumulator charging set for EDS165.
Accessory: clamp-on probe PSA3165 (internal diameter 100 mm)

Product Description

Parts List

The EDS3065 Insulation Fault Location Device comprises the following components:

1 pc. **Aluminium Case with Carrying Strap**
1 pc. **PGH185 Test Device**
1 pc. **EDS165 Insulation Fault Evaluator Unit, inclusive of accumulators**
1 pc. **PSA3020 Clamp-on Probe (diameter 12 mm)**
1 pc. **PSA3052 Clamp-on Probe (diameter 52 mm)**
1 pc. **Mains Cable**
3 pcs. **Safety Measuring Lead, black**
1 pc. **Safety Measuring Lead, green/yellow**
4 pcs. **Safety Claw Grip (3 x black, 1 x green/yellow)**
1 pc. **BNC Adapter / Banana Plug -> Transformer**
2 pcs. **Banana Plug**
1 pc. **Accumulator Charging Set**
1 pc. **TGH1266 Operating Manual**

Caution

Before commissioning, please check that all the components listed above are included. Do not undertake any work with an incomplete system. If any components are missing, please contact a Technical Adviser at BENDER.

Supply Voltage

Two different EDS3065 Insulation Fault Location Devices are available. The difference between them is the supply voltage for the PGH185 Insulation Fault Test Device:

- PGH185 - supply voltage: AC 230 V
- PGH185-13 - supply voltage AC 90 ... 132 V

Prior to commissioning, it is absolutely essential to check whether the supply voltage of the EDS3065 system matches the voltage of the mains supply. Operation of the EDS3065 with the wrong supply voltage can result in the destruction of the PGH185 Test Device.

Caution

When working with the EDS3065, only use those components which are supplied with the system. In particular, do not use any other clamp-on probes, measuring leads or measuring terminals.

Options

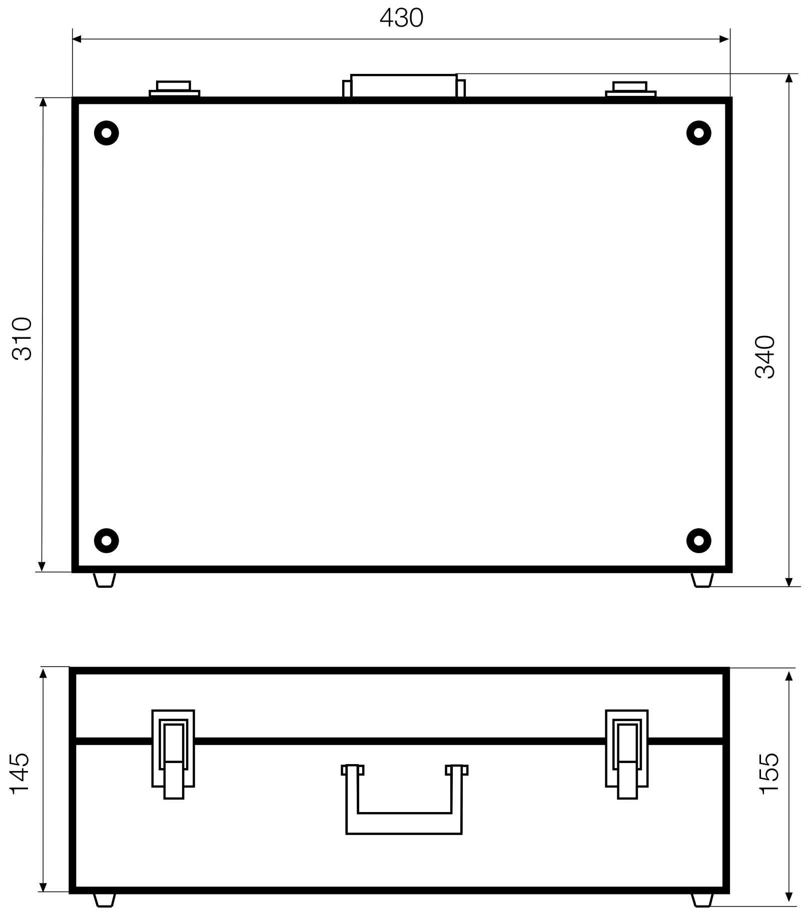
The EDS3065 represents a complete system. In addition to the PSA3020 and PSA3052 clamp-on probes which are supplied with the system, measuring current transformers can be connected to the EDS165 insulation fault evaluator. These may be BENDER Measuring Current Transformers which are already installed in the system.

The following types of transformers are suitable:
Measuring Current Transformers, Model Series W1-S35 ... W5-S210
Rectangular Measuring Current Transformers, Model Series WR ...
Split-Core Type Measuring Current Transformers, Model Series WS ...

Important: normal commercial measuring transformers must not be used!
This also applies to additional clamp-on probes or measuring current transformers from the BENDER range.
Attention: if transformers are not being used, they must not be left open in the system. In this case, the transformer terminals k u. l should be shorted.

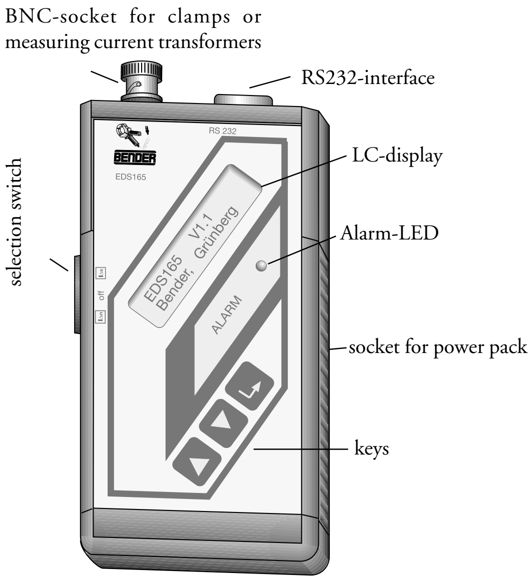
Aluminium Case

All the components of the EDS3065 are accommodated in a stable aluminium case with foam inlays.



All dimensions in mm

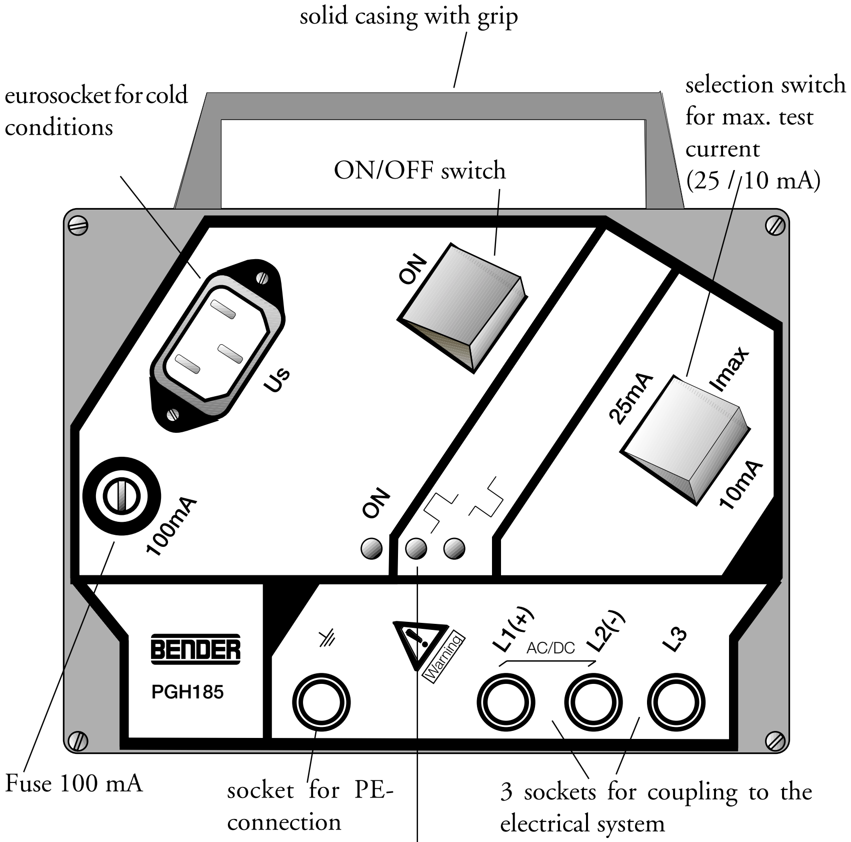
EDS165 Insulation Fault Evaluator



The operating mode switch on the EDS165 has three positions:

Middle Position:	OFF - the device is switched off.
Position IΔs:	Function as evaluator within an EDS3065 or EDS470 system (EDS mode)
Position IΔn:	Function as residual current measuring device (RCM mode)

Test Device PGH185



Not visible:
magnetic adhesive strip on the rear side of the housing to fasten onto metal parts (switch cabinet).

Display-LEDs:

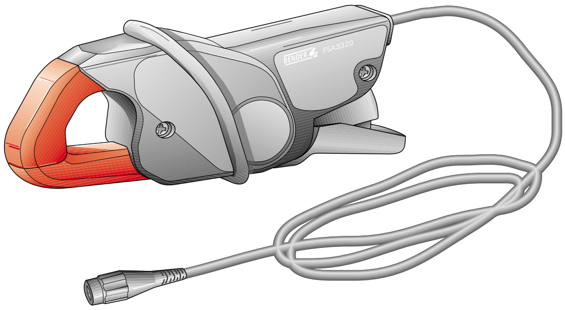
ON	Operating-LED
⎍	indicates positive test cycle
⊔	indicates negative test cycle

The PG185 is activated by using its ON/OFF switch, and it 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 which is generated therefore depends on the value of the insulation fault that is present, and on the system voltage. The test current is limited to a maximum of 25 mA, or to 10 mA when the switch is in the 10 mA position. The test current flows from the system via the PGH185 and then through the protective conductor (PE) and the insulation fault (or faults) back into the system. The test current signal is registered by the clamp-on probes or measuring current transformers located in the fault current circuit, and the sections affected by faults are displayed by the EDS165 insulation fault evaluators whenever the operating threshold of 5 mA is exceeded.
If the PGH185 is active, the cycle LEDs light up alternately in time with the test cycle.
If the device is connected by terminals L1, L2, L3 (or L1, L2) to a system that is 'live' for operational reasons the terminal must not be disconnected from the protective conductor (PE).

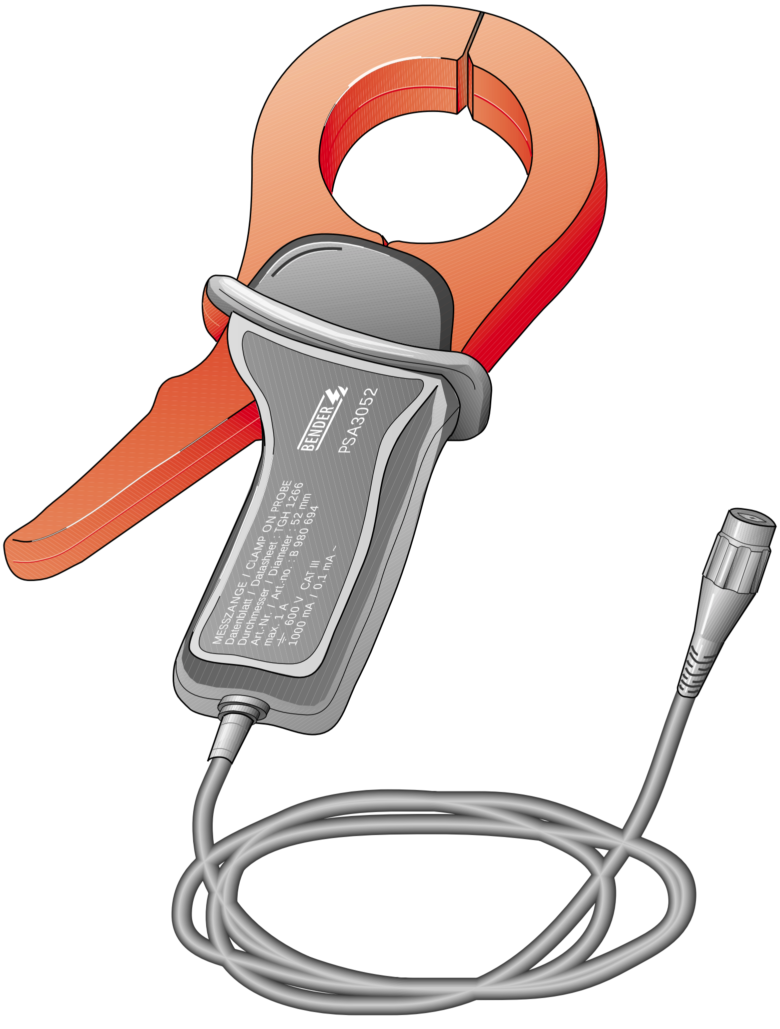
The test current flows between the ⏚ system and earth. If unfavourable combinations of circumstances arise (low-impedance insulation fault in combination with the test cycle), control errors cannot be ruled out on very sensitive system components (SPC, miniature relays). This possibility should be taken into account prior to use. If this possibility exists, then setting I_{max} = 10 mA should be selected.

PSA3020 Clamp-on Probe

The PSA3020 clamp-on probe can be used to encircle leads of up to 20 mm in diameter. The connection to the EDS165 insulation fault evaluator is made via a BNC connector and measuring lead with a length of approximately 2 m.



PSA3052 Clamp-on Probe



The PSA3052 clamp-on probe can be used to encircle leads of up to 52 mm in diameter. The connection to the EDS165 insulation fault evaluator is made via a BNC connector and measuring lead with a length of approximately 2 m.

Technical Data EDS3065

EDS3065 Insulation Fault Location Device	
Insulation co-ordination acc. to IEC 664-1:	dependent on the current sensor used
Type of operation:	continuous operation
PGH185 Insulation Fault Test Device	
Rated insulation voltage:	AC 500 V
Rated impulse withstand voltage/contamination level:	4 kV / 3
Monitored System	
Operating range of Rated mains voltage, AC:	19.2 ... 575 V
Operating range of Rated mains voltage, DC:	19.2 ... 504 V
Supply Voltage	
Supply voltage, U_S:	AC 230 V for PGH185
Operating range at AC 230V :	0.8 ... 1.15 x U_N
	AC 90 ... 132 V for PGH185-13
Fuse protection for supply voltage:	Fine-wire fuse, 100 mA, slow-acting
Measuring Cycle	
Maximum test current:	25 / 10 mA
Test cycle:	2 s
Pause time	4 s
Type Tests	
Test of electromagnetic compatibility (EMC):	
Immunity against electromagentic interference acc. to EN 50 082	
Emissions acc. to EN 50 081:	
Emissions acc. to EN 55 011/CISPR11:	Class B *)
Mechanical Tests	
Shock resistance, to IEC 68-2-27:	15 g / 11 ms
Bumping acc. to IEC 68-2-29:	40 g / 6 ms
Vibration strength acc. to IEC 68-2-6:	10 .... 150 Hz / 0.15 mm - 2 g
Environmental Conditions	
Ambient temperature during operation:	-10 ... +55 °C
Ambient temperature during storage:	-40 ... +70 °C
Climate class acc. to IEC 721:	3K5, but without dew and ice formation
General Data	
Operating position:	as desired
Type of connection:	flexible safety leads with safety terminals
Set-up mode:	upright, horizontal, or on metal parts with the use of magnetic strips
Protection class acc. to EN 50529:	IP20
Weight:	approximately 700 g
Dimensions, WxHxD:	160x148x81 mm

*) Class B devices are suitable for the use in industrial application as well as in house holds.

Technical Data EDS165

Insulation co-ordination acc. to IEC 664-1:	depends on the clamp-on probe used
Type of operation:	continuous operation

Monitored System:

Rated insulation voltage:	see PGH185 and/or clamp-on probes
System frequency in EDS mode:	50, 60, 400 Hz (adjustable)
System frequency in RCM mode:	45 ... 65 Hz

Supply Voltage

Supply voltage U_S:	DC 6 V
Operating range:	4.2 ... 6.2 V

Supply: via 4 round cells, type LR6 AA - 1.5 V or 4 NC cells, 1.2 V, or via accumulators or power unit

For supply via external power unit:	DC 7.5 V
I_{max}:	100 mA
Polarity:	+ ⊙ -

Operating lifetime of the batteries:	minimum 8h
Power consumption:	0.6 W

Measurement Input for $I_{\Delta s}$ Function
(EDS Mode, in combination with EDS470 Systems)

Operating value:	5 mA
Accuracy:	+/- 2 mA

Measurement Input for $I_{\Delta n}$ Function
(RCM Mode, Residual Current Measurement)

Measuring range with clamp-on probes:	10 mA ... 16 A
Measuring range with measuring current transformers:	10 mA ... 10 A
Operating range for alarm:	10 mA ... 10 A
Accuracy:	+/- 10 %

RS232 Interface with 9-Channel Sub-D Plug Connector

Weight:	approximately 370 g

Technical Data Clamp-on Probes

Clamp-on probes:

Insulation co-ordination acc. to IEC 664-1	
Nominal insulation voltage, PSA3020	AC 250 V
Nominal insulation voltage, PSA3052 a. PSA3165	AC 630 V
Voltage test acc. to IEC 348:	
PSA3020	AC 3 kV
PSA3052 a. PSA3165	AC 2 kV
Type of protection acc. to DIN 40 050	IP40
Protection class acc. to VDE 0411	Class III
Measurement output	BNC plug
Dimensions, PSA3052	216x111x45
Dimensions, PSA3020	135x65x30
Dimensions, PSA3165	308x150x43
Permissible cable diameter, PSA3052	52 mm
Permissible cable diameter, PSA3020	20 mm
Permissible cable diameter, PSA3165	100 mm
Weight, PSA3052:	approximately 550 g
Weight, PSA3020:	approximately 200 g
Weight, PSA3165:	approximately 1700 g

Factory Settings

The components of the EDS3065 are delivered with factory settings, which are suitable for many standard applications. The following list shows the factory settings for the individual devices:

PGH185 Test Device

I_{max} = 25 mA

EDS165 Insulation Fault Evaluator (with the switch in position $I_{\Delta s}$)

Alarm storage:	off
Buzzer:	on
Frequency:	50 Hz
Sensor:	Clamp-on Probe PSA3052

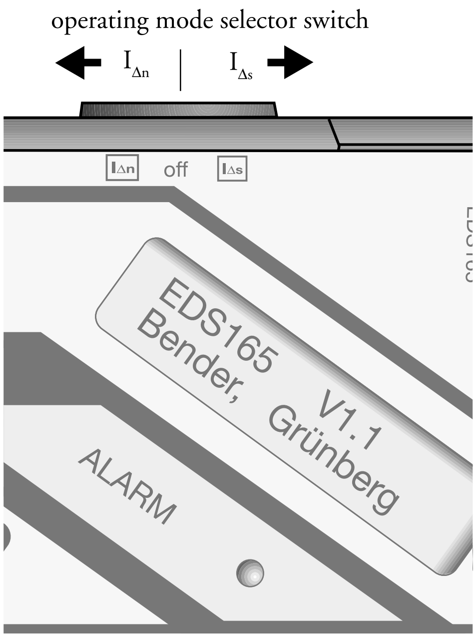
Settings on the EDS165 Evaluator

Except for the changeover of the maximum test current, all the settings to the EDS3065 system are performed on the EDS165 Insulation Fault Evaluator.

Switching On the EDS165

The **operating mode selector switch** on the left-hand side of the EDS165 has three positions:

middle position	:	OFF - the device is switched off
right-hand position	:	$I_{\Delta s}$ - function as an insulation fault evaluator within the EDS3065 or one within the EDS470 system (EDS mode)
left-hand position:		$I_{\Delta n}$ - function as a residual current measuring device (RCM mode)

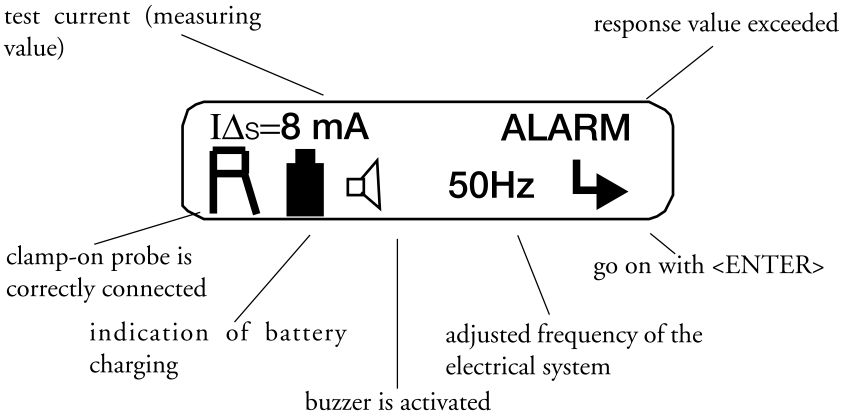


Three buttons are used to operate the EDS165:

UP **DOWN** **ENTER**

The EDS165 Display

Here is an example of a display on the EDS165 in the EDS mode:

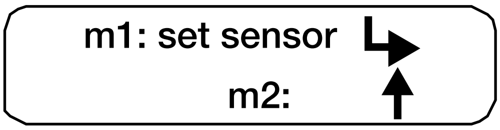


The EDS165 is operated and set using three control buttons and the LCD display. When making any of the settings, you must press the relevant control buttons for about 1 second. The different settings which are possible in the EDS mode (position $I_{\Delta s}$) are described below.
If you move the operating mode selector switch to position I_{Δ}, the EDS165 will be in the EDS mode. As soon you have done this, you will see the display menu (see above).

The EDS165 in the EDS-Mode

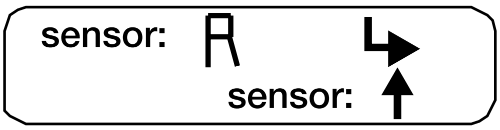
From the display menu, press the <ENTER> key to reach the setting menus. The <ENTER> key activates whichever sub-menu you have called up; use the <UP> key to move to the next menu.

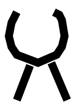
Menu 1 (m1) allows you to set the sensor which is connected. The possible settings are:
clamp-on probes
split-core measuring current transformers
closed measurng current transformers.



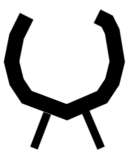
Press <ENTER> to reach the menu for modification; press <UP> to move on to the next menu, m2.

The sensor which is set at present is the PSA3052 clamp-on probe. Press <ENTER> to accept this setting and then return to the display; or use the <DOWN> key to set the PSA3020 clamp-on probe and/or split-core measuring current transformers or closed measuring current transformers. The following settings are possible:

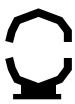



PSA3052 Clamp-on Probe


PSA3020 Clamp-on Probe


PSA3165 Clamp-on Probe


Standard Measuring Current Transformers: W1-S35 ... W5-S210; W1-P ... W4-P, WR ...

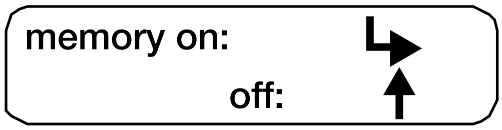

Split-Core Measuring Current Transformers in the WS ... series

The next menu (m2) is the Reset Menu. Press <ENTER> to call up the reset program, and press <UP> to call up the next menu (m3).

Press the <ENTER> key to implement the reset; use the arrow keys to go back to the previous menu without a reset.

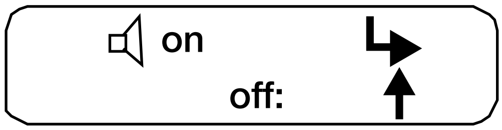
Menu 3, 'Memory' (m3) is used to specify the memory behaviour for the alarm message and the message LED. Press the <ENTER> key to call up the sub-program, and press the <UP> key to reach the next menu, m4.

Press the <UP> key to modify the present setting; press <ENTER> to accept the value displayed in the top line and return to the display menu.



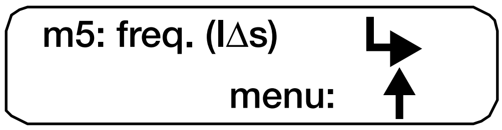
Menu 4 (m4) is used to activate or deactivate the internal buzzer. Press <ENTER> to reach the buzzer program, and press <UP> to go to the next menu, m5.

The top line shows the present status of the buzzer - in this example, the buzzer is activated (on). Press <UP> to change the setting to 'off', or press <ENTER> to accept the displayed setting and then return to the display menu.

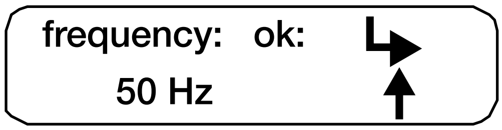


Note: the buzzer setting will only remain active until the next time the EDS165 is switched off!

Use Menu 5 (m5) to adapt the EDS165 to the respective system frequency. Press <ENTER> to call up the system frequency adaptation menu; press <UP> to return to the display menu.



The top line displays the system frequency that is set at the moment, which is 50 Hz in this case. Use the <UP> key to modify the frequency: the values available are 50, 60 and 400 Hz. Press <ENTER> to accept the set value and return to the display. You must always set the frequency which is present in the respective system.

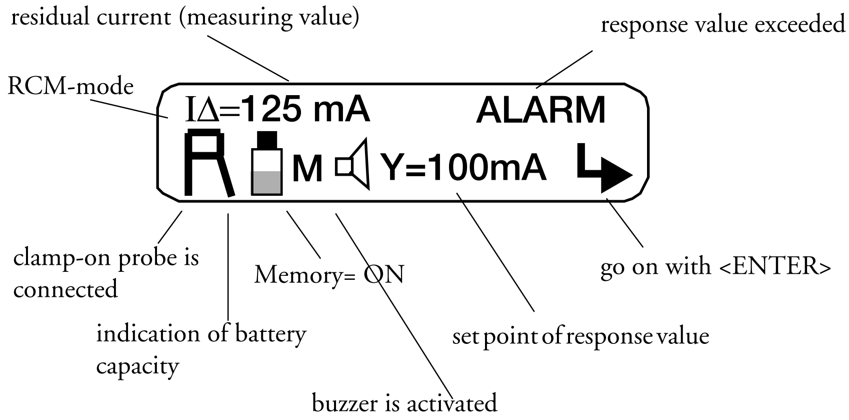


In pure DC systems only, you must set the frequency of the system from which the DC is obtained.

Note: after you exit the individual menus (m1 ... m5), you will always be returned to the display menu.

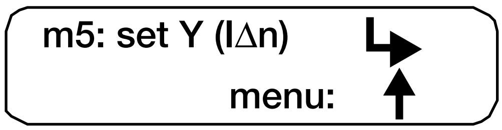
The EDS165 in the RCM-Mode

If the operating mode selector switch is moved to position $I_{\Delta v}$, the EDS165 operates in the RCM mode, and can be used as a portable residual current measuring device.

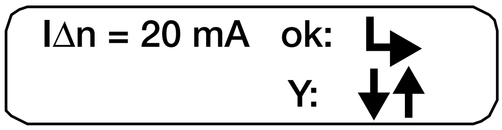


The way the menus are set corresponds largely to the description already given for the EDS mode. However, there is a difference in menu 5 (m5). In the RCM mode, the response value is set here in mA or A respectively.

Use <ENTER> in order to start the program to set the response value, or press <UP> to return to the display menu.



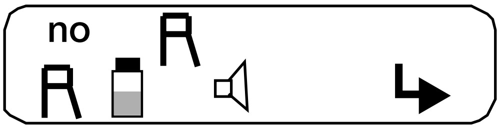
The top line indicates the current setting of the response value. Use the arrow keys (<UP>, <DOWN>) to modify the response value between 10 mA and 10 A. Up to 500 mA, the modification is made in 10 mA steps; from 500 mA to 1 A, in steps of 50 mA; and above 50 mA, in steps of 100 mA.
Press <ENTER> to accept the set value and return to the display menu.



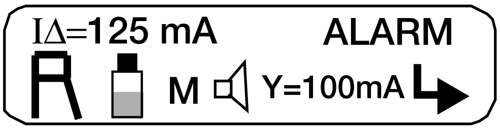
Note: The settings in menus m1, m2, m3 and m4 are always valid for the EDS mode and the RCM mode.

Error Messages

The EDS165 issues a fault message if no clamp-on probes or measuring current transformers are connected. The fault message is given acoustically and visually. The BUZZER ON or BUZZER OFF setting does not influence the acoustic message if no clamp-on probe is present. The message is given in the EDS mode as well as the RCM mode.
Attention: no fault message is given if an incorrect clamp-on probe or an incorrect measuring current transformer are connected.

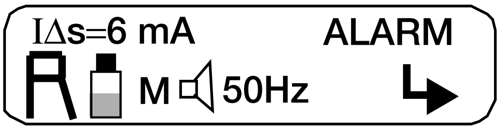


When the response value is exceeded in the RCM mode (I_{Dn}), this is shown on the display by the ALARM message and an indication of the residual current.

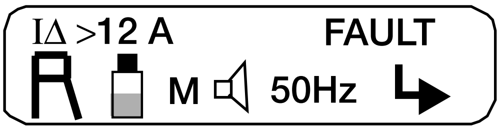


In the top line, $I_{\Delta n}$ shows the currently measured residual current, and in the lower line, Y shows the response value that has been set.

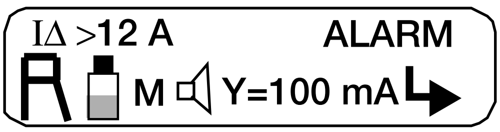
In the EDS mode ($I_{\Delta s}$), a discriminating fault current which is greater than 5 mA will result in an alarm message.



Residual currents that are greater than 10 A give rise to different messages.
In the EDS mode, a FAULT message is generated:



In the RCM mode, an ALARM message is generated:



In case of internal error or in case of heavy disturbances an universal error message will appear. Please contact the BENDER company under phone +49 6401 807 313 or call your local dealer.

Serial Interface

The standard RS232 interface makes it possible to connect non- system devices. These may be computer systems, SPC control units, or similar items. With knowledge of the interface protocol being used, it is possible for the user to write his own programs and use them. The protocol for data transmission corresponds to the format for BENDER measuring device interfaces.

Data transmission generally makes use of ASCII characters. The interface data are:

Baud rate:	9600 bauds
Transmission:	1 start bit, 7 data bits, 1 parity bit, 1 stop bit (1,7,E,1)
Parity:	even (P=0)
Checksum:	sum of all transmitted bytes = 0 (without CR and LF)
Address:	001 ... 255 and 000 (=general address)

Interface Protocol

Protocols:

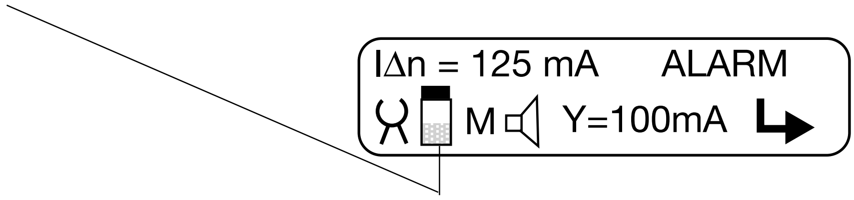
Master	:;XXX:ABCDE 12345&XYZ<CR><LF>
Slave	::XXX:ABCDE 12345&XYZ<CR><LF>

:;	recognition of start of master transmission
::	recognition of start of slave transmission
XXX	address
:	start byte for command
ABCDE	command, consisting of a maximum of 5 ASCII characters
(blank character)	start byte for data
12345	data, consisting of a maximum of 5 ASCII characters, maximum size: 65 535
&	start byte for checksum
XYZ	checksum, consisting of a maximum of 3 ASCII characters
<CR><LF>	end of transmission (carriage return, line feed)

The command and the data may be smaller than 5 bytes, or may even be omitted altogether. In every case, the end is recognised from the start byte of the next character type.

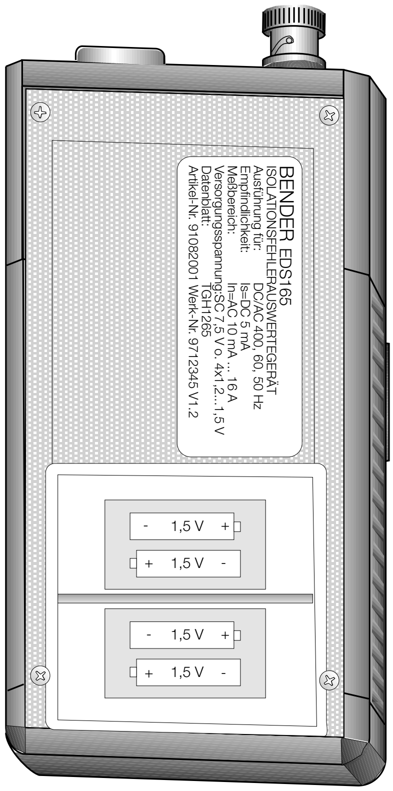
Replacing the Accumulators

The charge status of the accumulators or the batteries is indicated in the display menu. The illustration below shows an accumulator or a battery whose capacity is more or less half used up.



When accumulators are used, the battery status display only shows about 75% even when the accumulator is fully charged. This is because of the rather lower voltage on the accumulators compared with batteries.

The battery compartment is located on the rear side of the EDS165; it contains the batteries or the re-chargeable accumulators.



To change the accumulators, the large cover flap on the rear side of the EDS165 has to be opened. To do this, carefully lift off the flap with the use of a screwdriver (blade width: 3-5 mm).
Then insert the new accumulators according to the imprinted positioning diagram.
Also note that the device parameters that have been set will remain the same when the batteries are replaced.

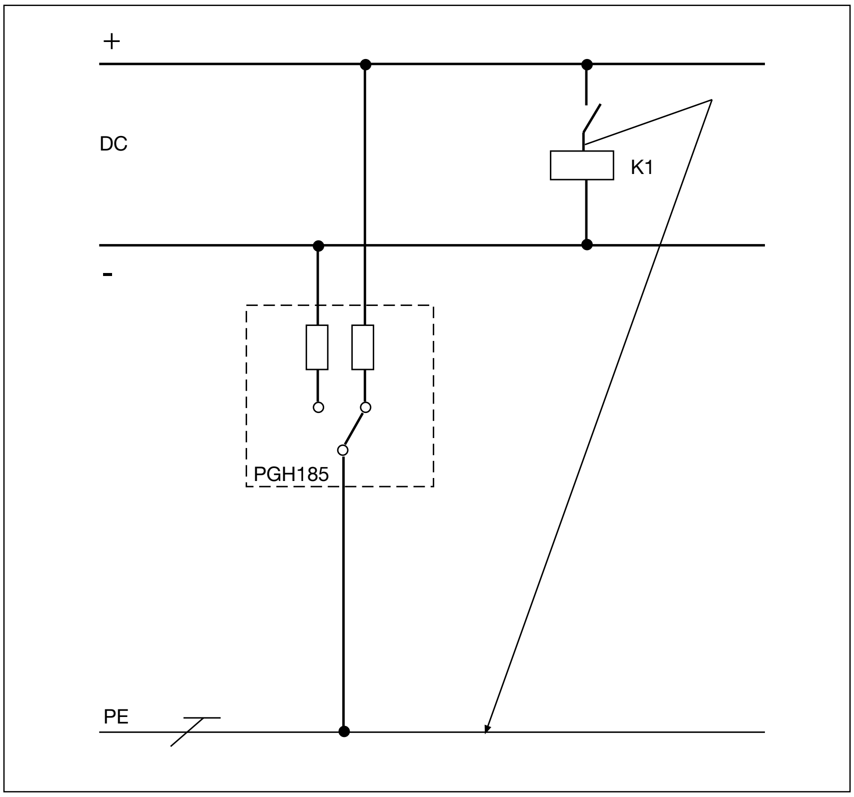
6 Points to be Considered before Use

The EDS3065 makes it possible to search for insulation faults in IT systems, AC 19.2 ... 575 V and DC 19.2 ... 504 V. The system is particularly well suited for use in control voltage systems where control errors may be caused as a result of high fault currents; this is due to the special features of the EDS3065, such as:

- low test current =>no control errors
- high sensitivity
- relatively insensitive to system leakage capacitances and faults
- extended time measurement
- data transmission with possibility of evaluation

Reduced Measurement Current

Especially in DC control voltage systems in the power station and energy supply utility sector, relays or SPCs may be installed which are already triggered by relatively low currents.



The sketch above shows a DC system. Relay K1 can be caused to operate by an insulation fault in combination with the test cycle of the PGH185. In such a case, the I_{max} switch on the PGH185 must be moved to the 10 mA position.

Also, when the EDS3065 is being used with the 'test current limited to 10 mA' feature activated, it is necessary to check whether any sensitive system components might be caused to operate unintentionally.

A Sensible Approach to Fault Location

The sensitivity of the EDS3065 is 5 mA. Hence the maximum insulation resistance which can be detected is dependent on the form of the voltage, the level of the voltage, and the system leakage capacitance that is present.

In order to start the search for insulation faults in a sensible manner, it is advisable to consult the following characteristic curves beforehand. These show:

- the insulation fault which can be found, in relation to the system voltage (characteristic curves 1a and 1b);
- the maximum permissible system leakage capacitance, in relation to the system voltage (characteristic curves 2a and 2b);
- the reduction in response sensitivity when system leakage capacitances are higher (characteristic curve 3);
- the maximum test current with the insulation fault present (characteristic curve 4).

An example:

In a 400 V 3AC IT system, the insulation monitoring device which is already present shows an insulation fault of 100kΩ. The system leakage capacitances of the system are less than 1 μF and are therefore negligible.
A look at characteristic curve 1b shows that an insulation fault of about 50 kΩ can be found in a 3 AC system with 400 V. Therefore it makes no sense in this case to start searching for the fault with the EDS3065.

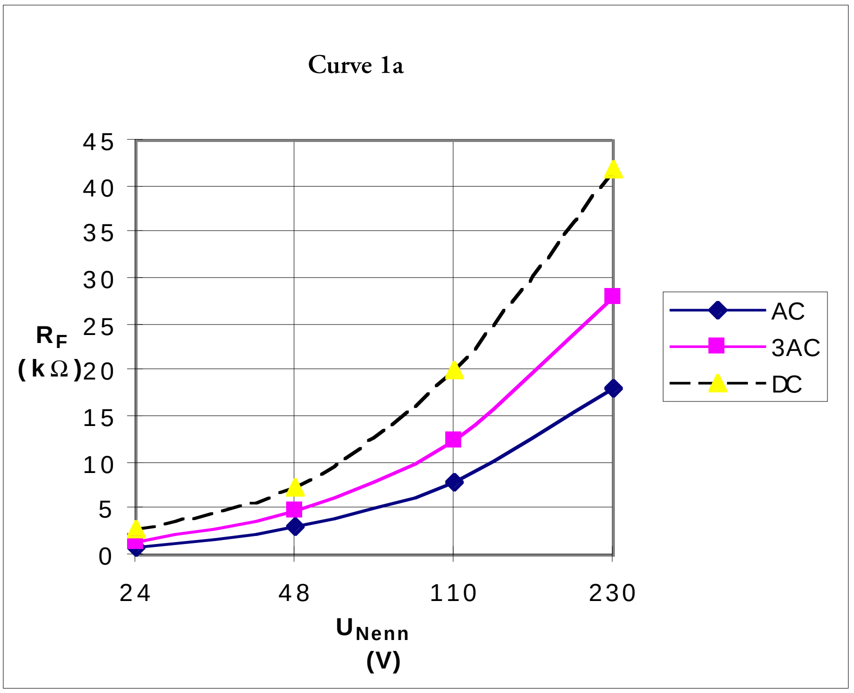
Another example:

In a 110 V DC IT system, the insulation monitoring device which is already present shows an insulation fault of 10 kΩ. Characteristic curve 1a shows that in a 110 V DC system, an insulation fault can be found from about 20 kΩ upwards. Therefore in this case, it makes sense to start the search for the insulation fault, and the chances of finding the fault are very good.

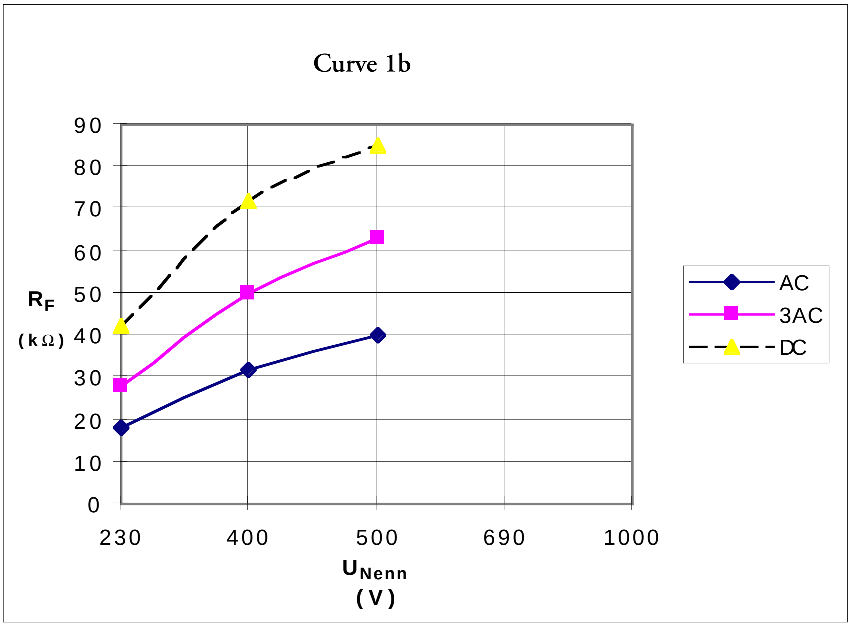
As a basic rule, it is necessary to take account of the possibility that the total insulation resistance of a system is made up from the parallel connection of several insulation faults. It is not known which individual faults contribute to this. If a fault is not found with the EDS3065, even though this ought to be the case according to the characteristic curves, the cause may be the sum of a number of individual faults. In this instance, none of the individual faults is of sufficiently low impedance that it can be detected by the EDS3065.

Another reason why insulation faults are not found may be an excessively high system leakage capacitance (on this point, see characteristic curves 2 and 3). When considering the system leakage capacitances, a point to note is that the division of the capacitances upstream and downstream of the clamp-on probe is not arbitrary. The pre-capacitance of the entire system must account for at least 50% of the total capacitance. Otherwise a reduction in the response sensitivity must be expected.

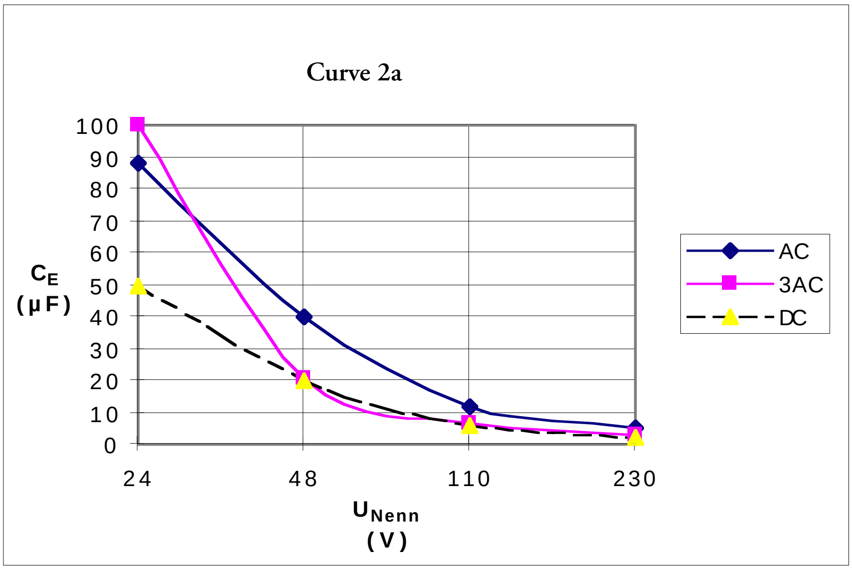
Characteristic Curves



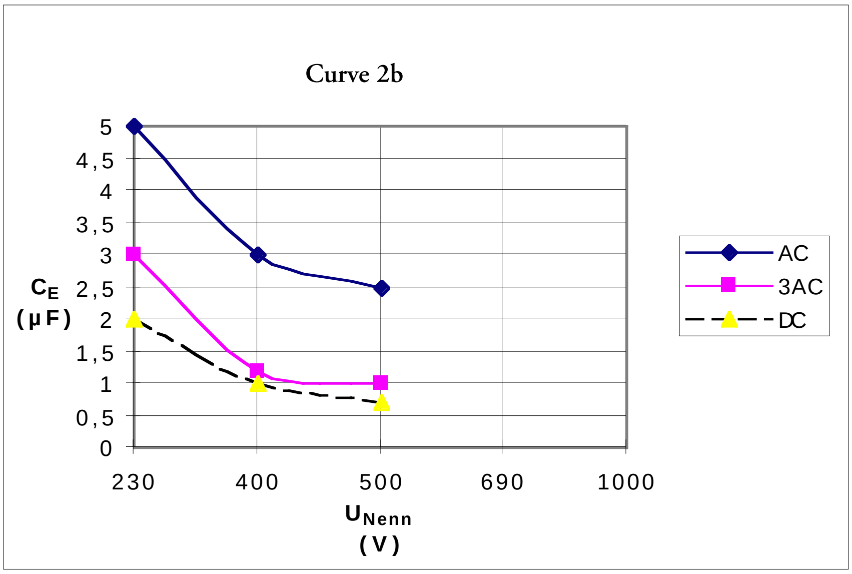
Curve 1a: Response value in relation to the system voltage (24 ... 230 V) with a maximum system leakage capacitance C_E as shown by curve 2a.



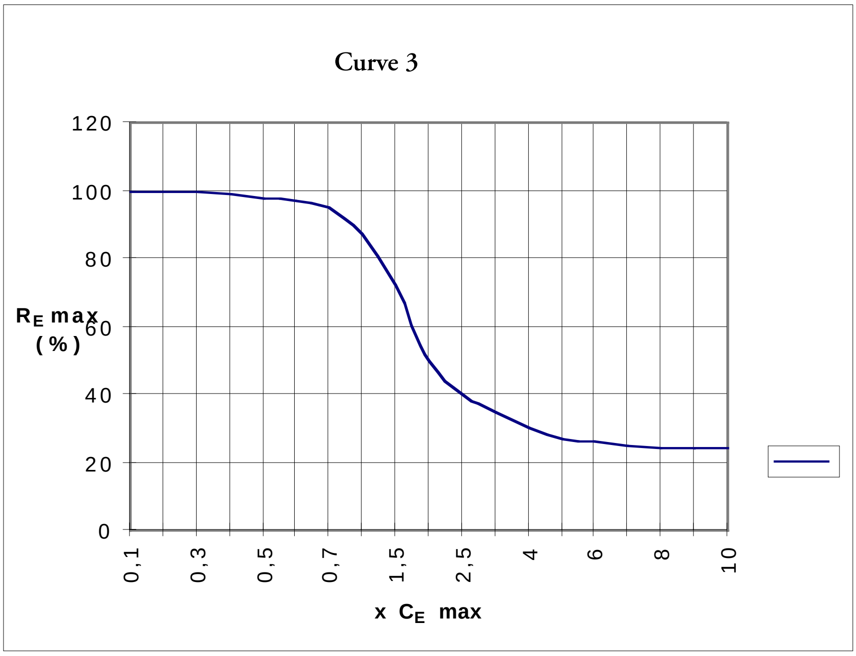
Curve 1b: Response value in relation to the system voltage (230 ... 500 V) for a maximum system leakage capacitance C_E as shown by curve 2b.



Curve 2a: Maximum permissible system leakage capacitance in relation to the nominal voltage, 24 ... 230 V. Up to this system leakage capacitance, the EDS3065 has the sensitivity shown in curve 1a.



Curve 2b: Maximum permissible system leakage capacitance in relation to the nominal voltage 230 ... 500V. Up to this system leakage capacitance, the EDS3065 has the sensitivity shown in curve 1b.



Curve 3: Reduction of response sensitivity when system leakage capacitances are greater than the maximum permissible value for C_E taken from curves 2a and 2b.

When considering the curves, a point to be taken into account is that the sum of the pre-capacitances upstream of the individual measuring current transformer must amount to at least 50% of the total capacitance. Otherwise, a reduction in sensitivity must be expected.

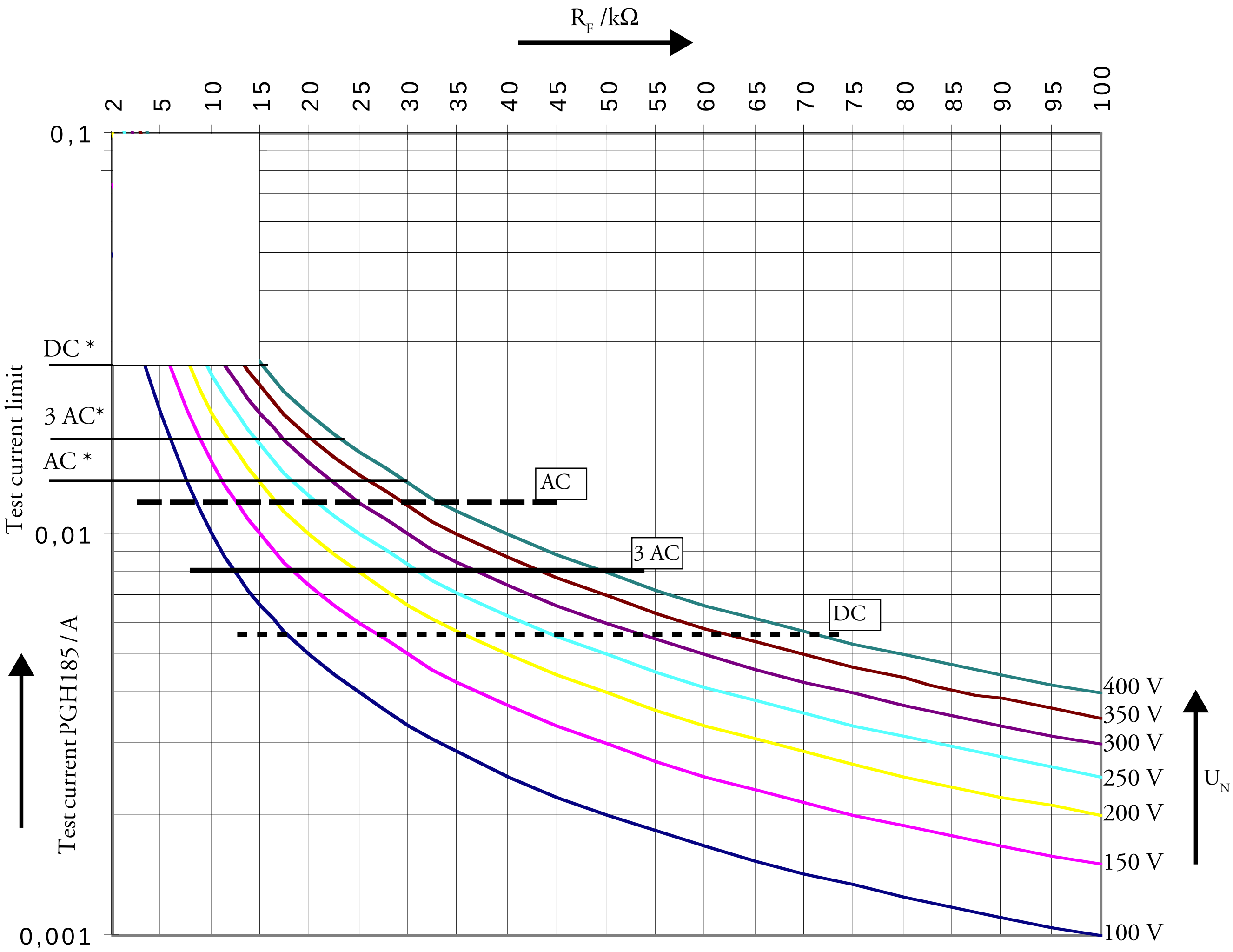
The maximum system leakage capacitance is taken to be a value of 20000 µFV. In a 400 V system, therefore, this is 20000 µFV/400 V = 50 µF. If the limit value is exceeded, there may be false alarms.

Curve 4

This curve shows which maximum test current is generated by the PGH185 in AC, 3AC and DC systems when an insulation fault R_F is present in the system. (Example: when U_N = 400 V and R_F = 40 kΩ : test current = 10 mA).

The horizontal lines identified as AC, 3AC and DC serve the exclusive purpose of determining the maximum value of the insulation resistance which can be detected by an EDS165 evaluator.
Examples:

U_N = DC 200 V: R_{Fmax} = 35 Ω
U_N = AC 400 V: R_{Fmax} = 50 Ω
U_N = AC 230 V: R_{Fmax} = 18 Ω



*

Test current limitation	for DC:	25 mA
	for 3AC:	17 mA
	for AC :	13 mA

Note: observe the voltage limits, 500 V for AC/3AC and 360 V for DC!

All the characteristic curves on the foregoing pages are valid for a maximum test current of 25 mA. If the test current has been limited to 10 mA, the DC axis of the test current limitation in characteristic curve 4 is shifted accordingly to this value of 10 mA.

Limitation of the test current to 10 mA is particularly intended for the use of the EDS3065 in DC control systems with consumers which may already operate at very low currents. If the test current limitation is activated in AC systems, the maximum test current is then reduced to factor 0.5 in AC systems or 0.67 in 3AC systems respectively. Of course, these factors are valid for a maximum test current of 25 mA as well (see characteristic curve 4).

Limits of Insulation Fault Location

It is a well-known fact that everything in this world has its limits. This principle even applies to the measurement technology of the EDS3065. Modern supply systems nowadays contain a large number of components which may give rise to influences and faults.

Here are some examples of faults from the viewpoint of the EDS3065:

- system leakage capacitances
- excessively high leakage currents
- transient leakage currents
- low-frequency leakage currents

The limit conditions are cited in this operating manual. However, because of the large number of possibilities, we cannot make definitive statements about every type of fault compatibility, nor about functional limits. In case of doubt, you must clarify the suitability of the EDS3065 for the application in question by consulting a BENDER adviser.

The conditions, and the reactions of the EDS3065 if the conditions are exceeded, should be explained at this point:

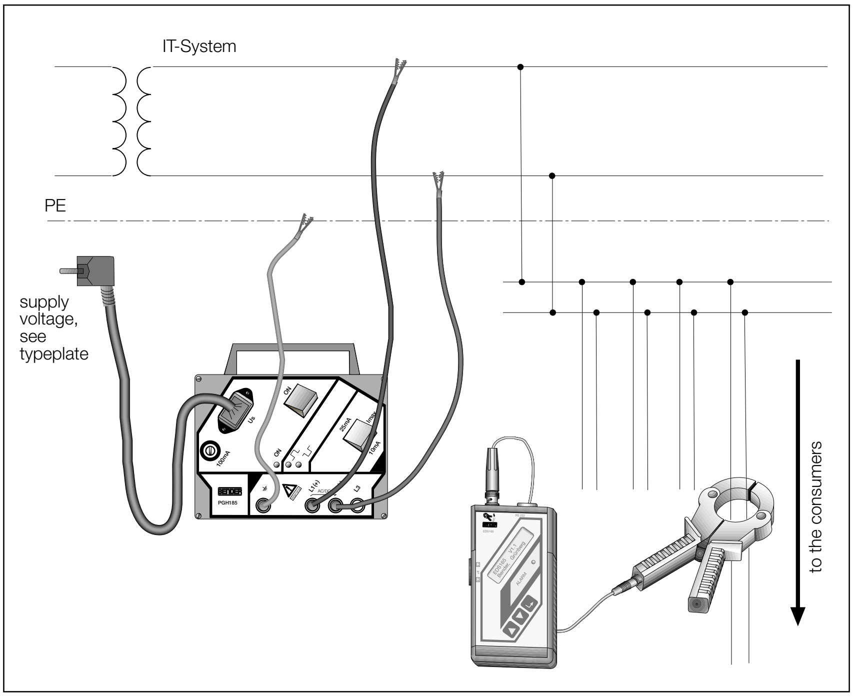
- response sensitivity: for this purpose, curve 3 in this chapter should be taken into account.

- influence of system leakage capacitances: curves 2a and 2b in this chapter show the response sensitivity in relation to the leakage capacitance of the total system. If the leakage capacitance exceeds the permissible value at one junction downstream of the clamp-on probe, incorrect messages may appear on the EDS165 evaluator.

- maximum leakage currents: the maximum permissible system-related leakage current under which the evaluation will still function properly is limited to 10 A. If the leakage current exceeds 10 A, discriminating fault detection can no longer be undertaken. Leakage currents > 10 A are shown by the indication {I_Δ > 10 A} in the display of the EDS165.

- transient leakage currents: switching and adjusting activities in the system may generate transient leakage currents which influence the evaluation of the test signal. These transient leakage currents can only be filtered out to a certain extent. It cannot be ruled out that periodic disturbances which happen to have the same periodic duration, amplitude and signal frequency as the internal signal scanning may result in faulty measurements and may therefore lead to actuating errors.
  However, the probability of this happening is extremely low. It is not possible to give a precise definition of these limit conditions because they depend on the nature of the system.

- low-frequency leakage currents: these may be brought about by the use of frequency converters. They may lead to actuating errors on the EDS165 if their frequency is equal to, or approximately equal to the test cycle frequency of the test device (PGH470, PGH185)



Connecting the EDS3065 Insulation Fault Location Device in an AC IT system.

7 Practical Use

Use as a Portable Insulation Fault Location Device

The primary application of the EDS3065 is as a portable insulation fault location device in IT systems, AC 19,2 ... 575 V and DC 19,2 ... 504 V.
After concluding considerations as to whether it is possible and/or sensible to search for insulation faults, and about the technical measurement limits of the system, the actual fault location operation may be started. The sequence of a search for insulation faults is described below, with the use of examples.

- Test the nominal system voltage: does this fall within the permissible limits for the EDS3065?

- Check whether the insulation fault reported by the insulation monitoring device can be found. On this point, consult the chapter on POINTS TO BE CONSIDERED BEFORE USE.

Warning

- Before making a connection to the system which is to be checked, it is absolutely essential to connect the green-yellow lead over the PE socket of the PGH185 insulation fault test device with the PE of the system. It is advisable to connect up the test device at the supply input (transformer or battery).

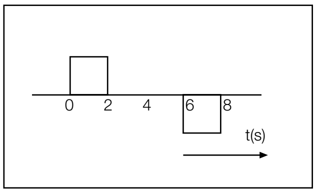
- Connect the PGH185 insulation fault test device to the system which is to be checked, using the two connection leads supplied with the device. **When you do this, you must comply with the general guidelines for 'live' work.**
  In a three-phase (rotary) system: connect sockets L1, L2 and L3.
  In a single-phase system, AC or DC: connect sockets L1 and L2.

- Connect the insulation fault test device to the power supply, using the mains connection cable supplied with the device. When you do this, note the level of the supply voltage and compare it with the manufacturer's nameplate. Do not connect a supply voltage which is different from the one stated on the manufacturer's nameplate!

- If the insulation monitoring device which is present in the IT system has **an internal ohmic resistance < 120 kΩ,** disconnect it from the system. When you do this, disconnect all poles of the system coupling. It is not sufficient to switch off the supply voltage to the insulation monitoring device.

- Check the switch position I_{max} on the PGH185. The factory setting is 25 mA. If the IT system contains components which might already operate at low currents, then it may be necessary to select the 10 mA switch position. Note: the maximum test current flows between the system and earth, not as a load current. Undesired operation is therefore only possible if an insulation fault is combined with the test cycle.

- Switch on the PGH185 insulation fault test device. The ON LED must light up, the two test cycle LEDs must light up in time with the cycle and then go out again.
  The test cycle corresponds to the illustration opposite, with a 2-second positive phase, a 4-second pause period and a 2-second negative phase. If the LEDs fail to show any activity whatsoever, the supply voltage and the built-in 100 mA fine-wire fuse should be checked.



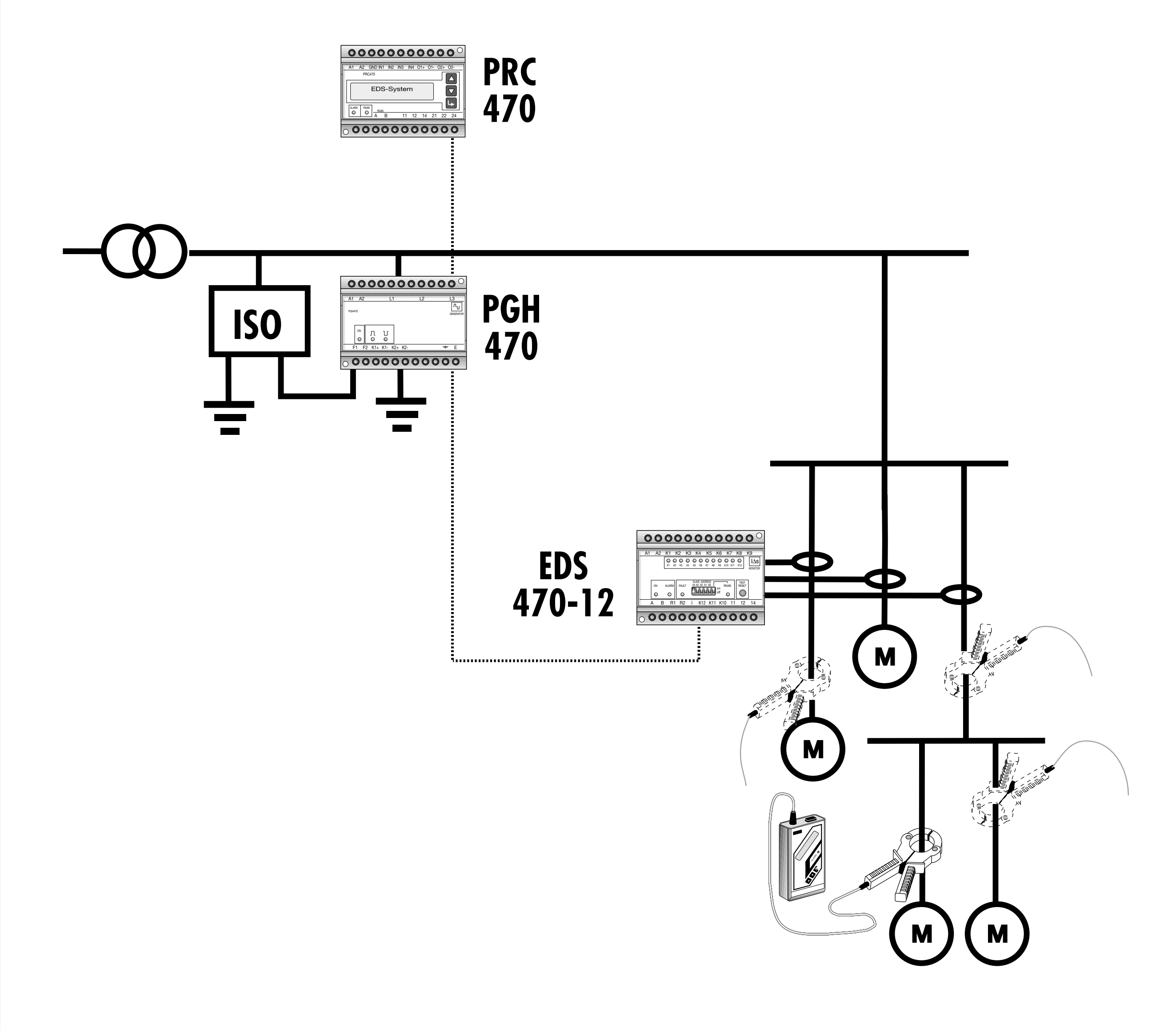
- Connect one of the clamp-on probes to the EDS165 insulation fault evaluator. Switch on the EDS165 and set the operating mode switch to position $I_{\Delta s}$.
- After the basic menu has appeared on the display of the EDS165, test whether the correct nominal system frequency has been set. The factory setting is 50 Hz.
- Check whether the correct clamp-on probe and/or the correct measuring current transformer are set in menu 4 (m4). The factory setting is clamp-on probe PSA3052.
- It is advisable to keep the contact surfaces of the clamp-on probes clean.
- First, encircle the green-yellow lead between the PGH185 and earth with the clamp-on probe. If the EDS165 insulation fault evaluator does not react, the insulation fault has too high an resistance and it cannot be found.
- For fault location at a central position of the IT system, encircle **all system conductors, but not the PE conductor,** with the clamp-on probe. The clamp-on probe should not be used in the immediate vicinity of devices which generate magnetic fields, such as transformers or throttles, nor in the vicinity of adjacent conductors with high operating currents.
- When the clamp-on probe is encircling ‘live’ conductors, it must not be disconnected from the EDS165. In an ”open” operation of this sort, the clamp-on probe may be destroyed!
- Inside the clamp-on probe, you should aim for the maximum possible symmetry of the conductors. Keep the clamp-on probe still during the measurement! Make sure that you do not exert any pressure of the clamp-on probe arms.
- An alarm message on the display of the EDS165 signals an insulation fault downstream of the clamp-on probe. It is advisable to carry out the fault search with the buzzer activated.
- Measure along the conductor with the EDS165 until the fault is found. Penetrate radially into the sub-distributions as you do this.
- The fault location is found when the fault current downstream of the clamp-on probe is at least 5 mA.
- For operating currents <10 A, measurement is also possible by encircling one conductor only. **Attention:** for currents > 10 A, this may produce the effect that the clamp-on probe can no longer be opened. This danger is particularly present in direct current systems. If this behaviour occurs, under no circumstances use force, since this would destroy the clamp-on probe. Instead, you must switch off the relevant system. After this has been done, the clamp-on probe can be opened without the application of force.

Using the EDS165 within an EDS470 system

The EDS165 insulation fault evaluator can also be used without the PGH185 test device within a system such as an EDS470, as a fixed installation. In this case, it detects the test pulses from the PGH470 test device. Insulation fault evaluation is only possible in voltage-operating IT systems. The practical use of the EDS165 within a fixed EDS470 insulation fault location device is described below:

- The central insulation monitor has reported an insulation fault below its response value.
- The insulation fault location device is activated and it starts the fault search; the test device is generating the test current. The insulation fault evaluation continues as long as the test device is clocking.
- Connect the clamp-on probe or the measuring current transformer (via a BNC adapter).
- Move the operating mode switch of the EDS165 to the $I_{\Delta s}$ position; wait until the basic menu appears on the display.
- Check whether the correct nominal frequency for the network is set. The factory setting for the frequency is 50 Hz.
- Check whether the correct clamp-on probe and/or the correct measuring current transformer are set in menu 4 (m4 - set sensor). The factory setting is clamp-on probe PSA3052.
- At junctions where no measuring current transformer is installed, or downstream of installed measuring current transformers, the search can now be continued with the EDS165. Attention: do not connect the core of the clamp-on probe to system voltages above the nominal insulation voltage.
- All system conductors, **but not the PE**, must be encircled by the clamp-on probe. Attention: do not encircle any shielded leads!
- When the clamp-on probe is encircling 'live' conductors, it must not be disconnected from the EDS165. In this type of 'open' operation, the clamp-on probe may be destroyed!
- During the measurement, the clamp-on probe must be held still. The conductors should be encircled as symmetrically as possible. Make sure that you do not exert any pressure on the arms of the clamp-on probe.
- An alarm message signals an insulation fault downstream of the sensor.
- Measure along the lead with the EDS165 until you have found the fault location.
- The fault location is found when the test current through the clamp-on probe is at least 5 mA. On this point, see the chapter on SETTINGS AND ADAPTATIONS in the EDS470 operating manual.
- For operating currents <10 A, measurement is also possible by encircling one conductor only. **Attention:** for currents > 10 A, this may produce the effect that the clamp-on probe can no longer be opened. This danger is particularly present in direct voltage systems. If this behaviour occurs, under no circumstances use force, since this would destroy the clamp-on probe. Instead, you must switch off the relevant system. After this has been done, the clamp-on probe can be opened without the application of force.

- For each measurement, wait for one cycle of the PGH470 test device (approximately 24 seconds).



Use of an EDS165 in an IT system with an EDS470 insulation fault location device as a fixed installation. In addition to the messages from PRC470 and EDS470-12, the portable EDS165 insulation fault evaluator can be used to check individual junctions and to display the test currents.

Using the EDS165 as a Residual Current Monitor

The EDS165 can also be used without the PGH185 test device as a residual current measuring device in TN and TT systems, and provided that certain system conditions are fulfilled, it can also operate in IT systems. The residual current measurement is only possible in 'live' systems.

- Test whether the system is 'live'.
- Connect the Clamp-on Probe.
- Move the operating mode selector switch on the EDS165 to position $I_{\Delta n}$, and wait until the basic menu appears on the display.
- Check whether the correct Clamp-on Probe is set in menu 4 (m4 - set sensor). The factory setting is Clamp-on Probe PSA3052.
- Check whether an operating value ($I_{\Delta n}$ = XX mA) has been set which is suitable for practical purposes. The factory setting is a response value of 100 mA.
- Start measurement at a suitable position in the system. When you do this, start as near to the supply as possible and move on radially in the direction of the consumers.
- During the measurement, the clamp-on probe must be held still. The conductors should be encircled as symmetrically as possible. Make sure that you do not exert any pressure on the arms of the clamp-on probe.
- During the measurement, encircle all the system conductors, **but not the PE**. Do not encircle any shielded leads.
- When the clamp-on probe is encircling 'live' conductors, it must not be disconnected from the EDS165. In this type of 'open' operation, the clamp-on probe may be destroyed!
- The residual current at each measuring point is shown on the display. If the residual current is greater than the set response value, an acoustic signal will also be given provided that the buzzer is activated.

For extended period measurements at one point of the system, the fault memory must be activated ('memory on') in menu 2 (m2 - memory). In this way, it is also possible to find intermittent residual currents, provided that they are higher than the set response value.
The highest measured residual current is stored

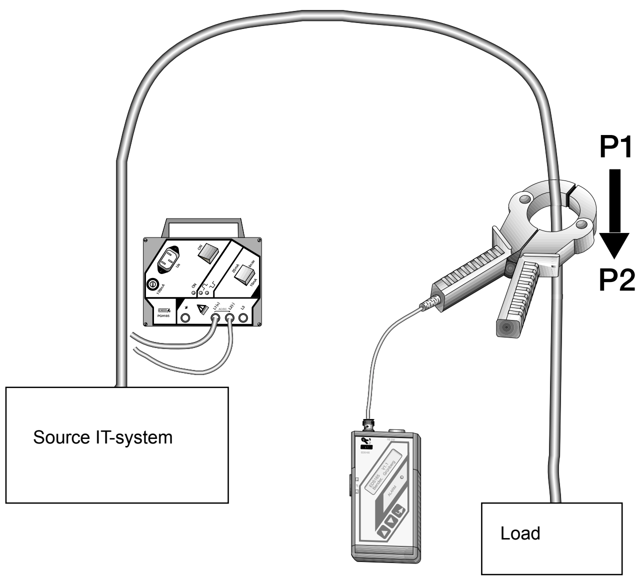
EDS3065 in diode decoupled systems

In some applications DC systems are diode decoupled. Between these decoupled circuits compensating currents may occur. The quantity of the currents and its direction depend on the system voltage, the characteristics of the diodes and the kind of loads installed in the system.

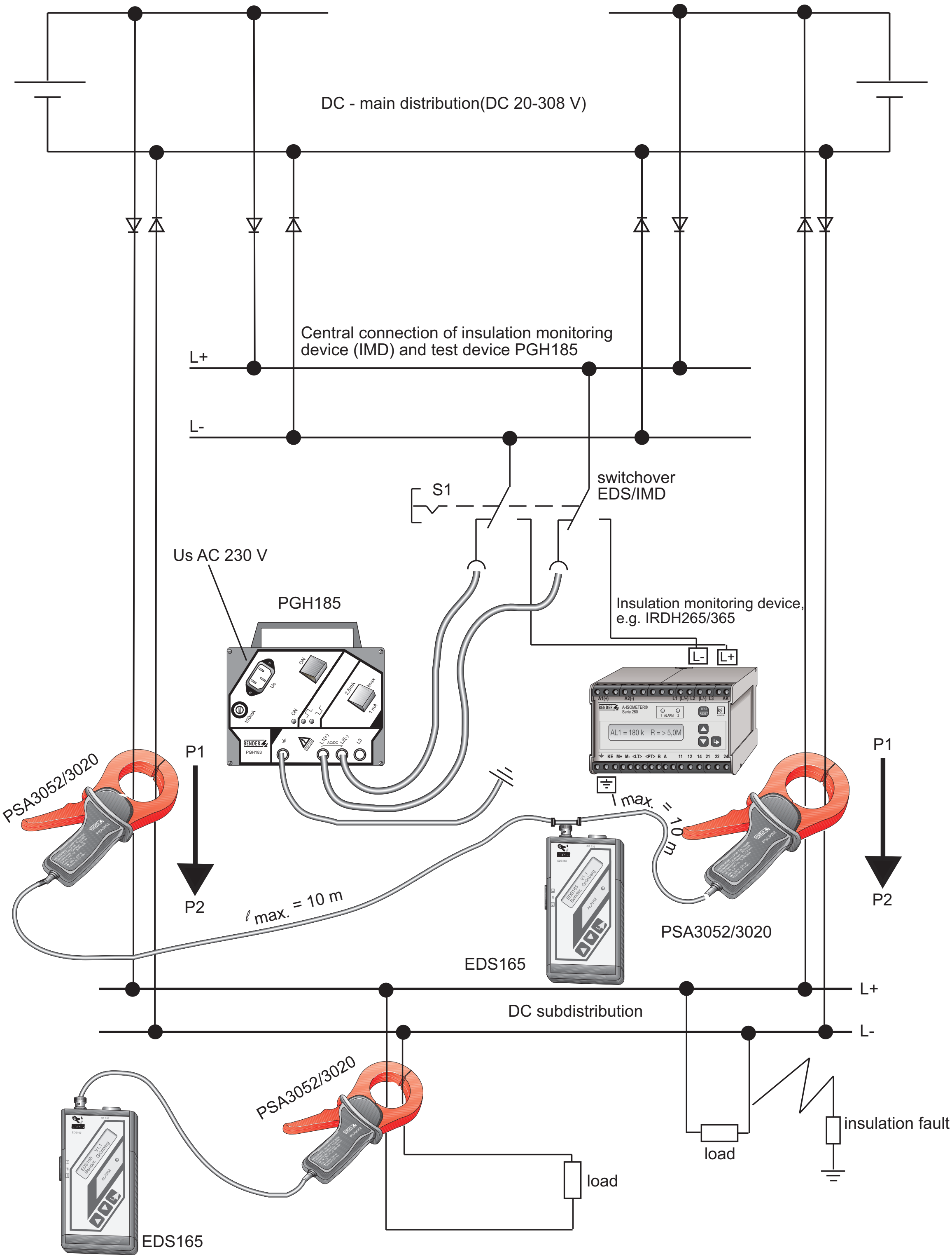
When the portable insulation fault location device EDS3065 is used in diode-decoupled systems, the aforementioned compensating (or circulating) currents will disturb the EDS3065 and will cause measuring faults. Therefore BENDER recommends the use of the EDS3065 in diode-decoupled system only according to the drawing on the previous page.

Additionally please consider the following:

- Always use two identical clamp-on probes. **Caution:** Do not forget to set the correct clamp-on probe in the corresponding menu of the EDS165.
- Use only 50Ω coaxial cable and a T-adaptor to connect both of the clamp-on probes to the evaluating device EDS165.
- Do not exceed the max. length of the coaxial cable of 10 m per clamp-on probe.
- Using two clamp-on probes according the BENDER drawing will reduce the sensitivity of the EDS3065 by about 10 %.
- Always use the clamp-on probe in a way, that the energy flow direction corresponds to the marking on the clamp-on probes (P1 => P2).



EDS3065 in diode decoupled systems



EDS3065 in diode decoupled systems

How to find insulation faults:

- The central insulation monitoring device (IMD) has indicated an insulation fault which is detectable by the EDS3065. Please refer to chapter „Points to be considered before use“ in the EDS3065 manual TGH1266E.

- Read the current insulation resistance from the insulation monitors indication, e.g. the LC display when the IRDH265/365 is used. If the indicated value of the insulation resistance is lower than the max. detectable insulation fault of the EDS3065, then switch with S1 from the insulation monitor th the EDS 3065.

- Connect the test device PGH185 according to the drawing on previous page to the electrical system. It is important to use the recommended connecting points for the EDS185.

- Now prepare the evaluating device EDS165:
  - connect the two identical clamp-on probes (PSA3052 or PSA3020) with the coaxial cables and the T-adaptor.
  - set the operating mode selector switch to position IΔn
  - set following parameters:
    menu 2: memory off
    menu 3: buzzer on
    menu 4: set sensor to the used clamp-on probe
    menu 5: frequency 50 Hz

- Start of the EDS3065:
  embrace the PE conductor of the PGH185 with one of the connected clamp-on probes. If the test current IΔn indicated on the LC display of the EDS165 is higher than 10 mA, a successful insulation fault location is possible. Remove the clamp-on probe from the PE conductor.
  Now embrace the L+ and L- conductors with the clamp-on probe but not the PE conductor.

- Fault location in the system:
  Embrace the conductors (not the PE) of the redundant lines to the consumers with a clamp-on probe each. Consider to embrace the correct corresponding redundant lines. Consider the energy flow direction (P1 => P2) of the clamp-on probes.
  Embrace systematically and one after the other all parallel lines to the consumers with the clamp-on probes. Insulation faults behind a clamp-on probe will be indicated on the EDS165 display.
  Caution: an alarm will be indicated about 30 seconds after embracing the conductors with the clamp-on probe.

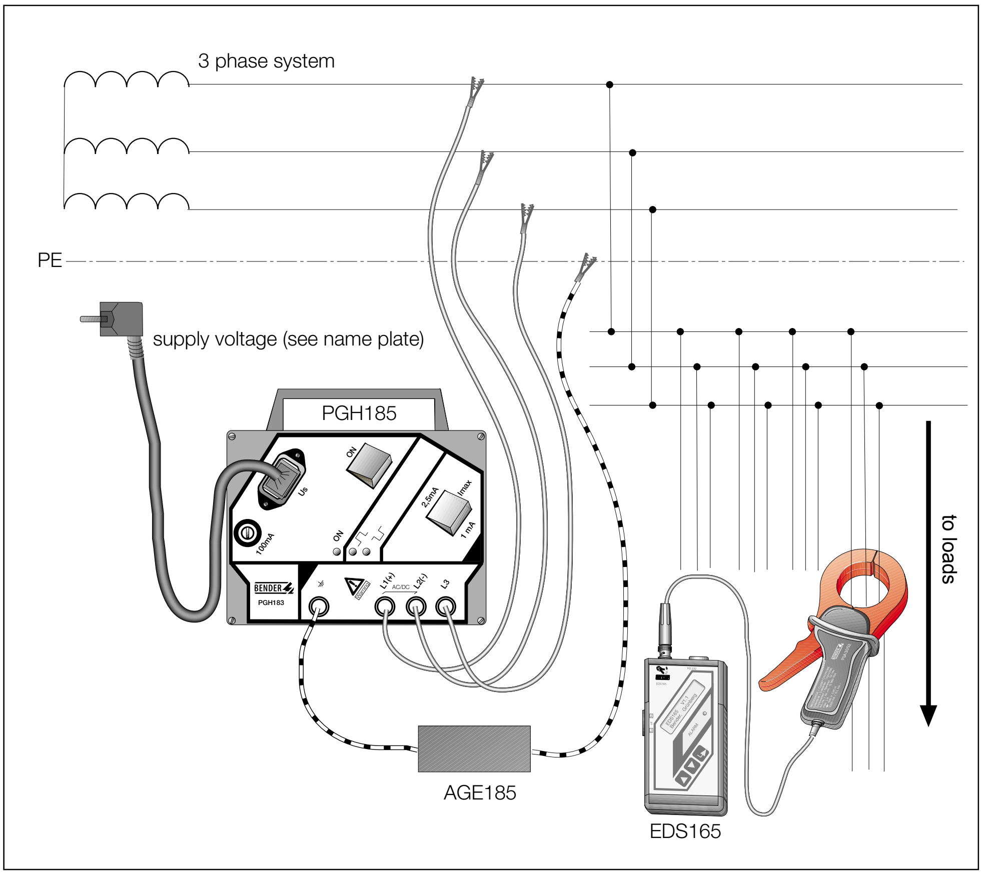
Coupling unit AGE185 for higher voltages

Proper use
The coupling device AGE185 is used within an insulation fault location system EDS3065. This systems locates insulation faults in IT systems. It extends the nominal voltage range of an EDS3065 system up to AC 790 V and DC 960 V

Function
The coupling device AGE185 reduces the heat loss in the insulation fault test device PGH185 and allows the connection to higher nominal voltages as described above.

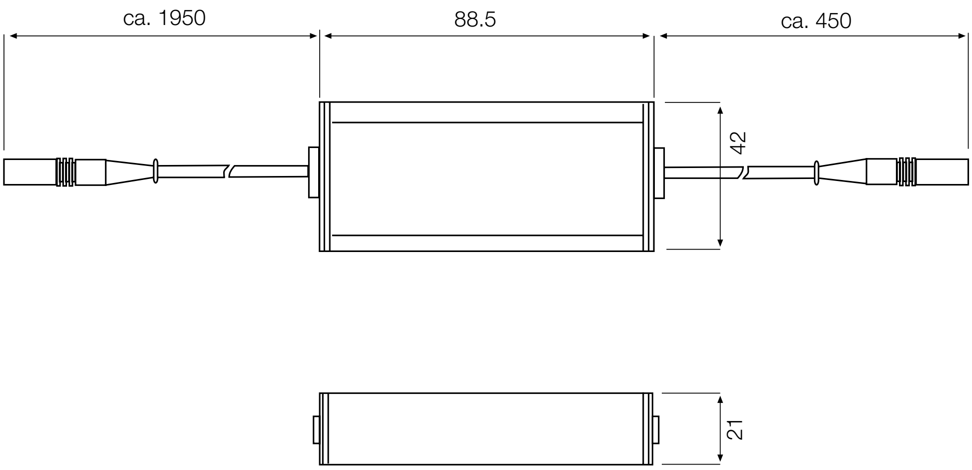
Installation, connection, commissioning.
Electrical equipment shall only be installed by qualified personnel in consideration of the current safety regulations.

Connect the wires of AGE185 according your indivual requirements to the terminals PE and of the PGH185. No polarity has to be considered.



Coupling unit AGE185 for higher voltages

Technical data	
Insulation coordination acc. to IEC 664-1	
Rated insulation voltage	AC1000 V
Rated impulse withstand voltage/contamination level	4 kV / 3
System being monitored	
Nominal voltage range AC	45-400 Hz, 500 ... 790 V
Nominal voltage range DC	400 ... 960 V
Tests of electromagnetic compatibility (EMC)	
Interferences acc. to EN 50082-2	
Emissions acc. to EN 50081:	
Emissions acc. to EN 55011/CISPR11	class B
Ambient temperature during operation	-10°C ... +55°C
Storage temperature range	-40°C ... +70°C
Climatic class acc. to IEC 721	3K5, except condensation and formation of ice
Connection/cable:	
Safety connector with connection wire, green/yellow 1mm²	
Protection class acc. to EN 60529	IP 30
Weight approx.	200 g



Dimensions of the coupling unit AGE185; all dimensions in mm.

8 Ordering Information

Type	Designation	Article No.
EDS3065	Insulation fault location device Supply Voltage AC 230 V	91 082 004
EDS3065-13	Insulation fault location device Supply Voltage AC 90-132 V	91 082 005
PSA3020	Clamp-on Probe 20 mm	980 693
PSA3052	Clamp-on Probe 52 mm	980 694
PSA3165	Clamp-on Probe 100 mm	980 697
W1-S35	Measuring Current Transformer 35 mm, round opening	911 731
W2-S70	Measuring Current Transformer 70 mm, round opening	911 732
W3-S105	Measuring Current Transformer 105 mm, round opening	911 733
W4-S140	Measuring Current Transformer 140 mm, round opening	911 734
W5-S210	Measuring Current Transformer 210 mm, round opening	911 735
W1-P23	Measuring Current Transformer 23 mm, round opening	911 710
W2-P40	Measuring Current Transformer 40 mm, round opening	911 726
W3-P60	Measuring Current Transformer 60 mm, round opening	911 727
W4-P100	Measuring Current Transformer 100 mm, round opening	911 728
WR 70x175S	Measuring Current Transformer rectangular	911 738
WR 115x305S	Measuring Current Transformer rectangular	911 739
WR 150x350S	Measuring Current Transformer rectangular	911 740
WS 50x80S	Measuring Current Transformer Split-Core	911 741
WS 80x80S	Measuring Current Transformer Split-Core	911 742
WS 80x120S	Measuring Current Transformer Split-Core	911 743
AGE185	Coupling Device	980 305
EDS165 accessory set for diode descoupled systems with 2 x 8 m BNC cable, BNC T-adaptor, further adaptors		B 91 082 007