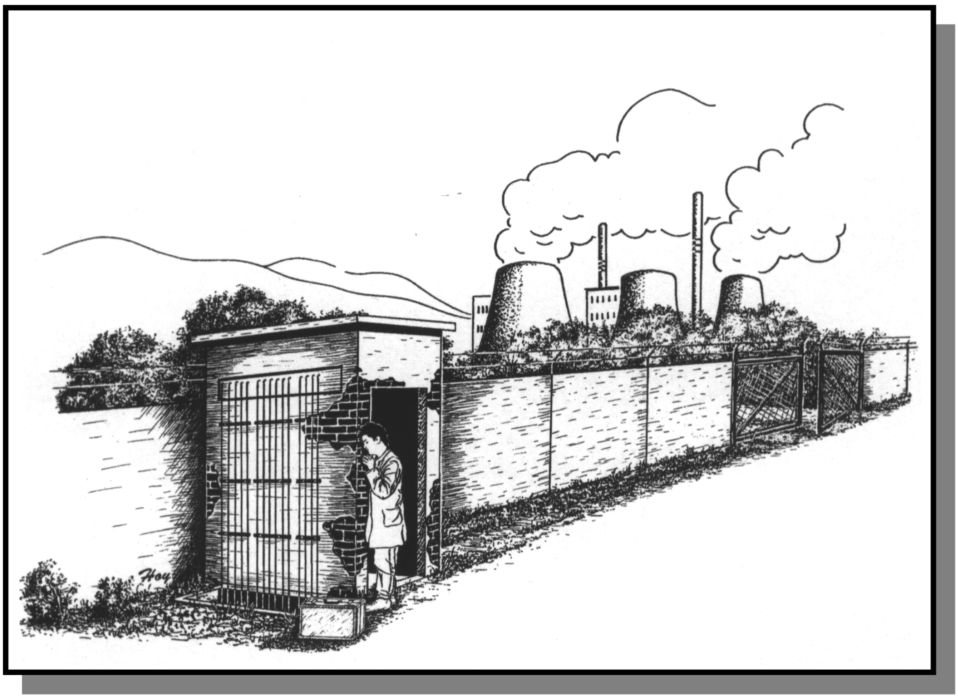
EDS3365 and EDS3360

Portable Insulation Fault Location System for IT AC and DC Systems and Residual Current Measurements in earthed Systems



Operating Manual

TGH1320E

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Quality System Certified
ISO 9001

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1 About the EDS3365

What is EDS3365

The EDS3365 is a portable insulation fault location system for IT systems (unearthed systems). It enables insulation faults to be located during operation and without disconnection from supply.

The EDS3365 consists of:

- PGH183 insulation fault test device
- EDS165-3 insulation fault evaluator
- PSA3320 and PSA3352 current clamps
- optional accessories

Furthermore there is the **EDS3360** version. This version does **not** contain a PGH183 but otherwise it is identical to EDS3365. The **EDS3360** is suitable for:

- residual current measurement in TT and TN systems
- insulation fault location in IT systems if there is a stationary insulation fault location system with a PGH473 test device installed

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 locate the faults. Modern fault location systems such as the EDS3365, PKA3001, EDS473 or EDS470 (as permanently installed systems) make the fault location a good deal easier and shorter, and contribute in this way to a better supply voltage.

While insulation fault location is being undertaken with the EDS3365, any insulation monitoring device which may be present must be disconnected from the system for the duration of the fault location. 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.

The EDS3365 or components of it can be used to accomplish the following measuring tasks:

- insulation fault location in IT systems, AC 20-265 V / DC 20-308 V
- insulation fault evaluation in IT systems, AC 20-265 V / DC 20-308 V in combination with a permanently installed EDS473 insulation fault location system
- residual current measurement in TT and TN systems (AC, earthed systems)

Critical use

Danger !

For higher voltages we recommend to use our EDS3065 system.

Before making use of the EDS3365 portable insulation fault location system, the user must have a very accurate knowledge of its possiblities, the special circumstances relating to its system, 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 PGH183, this is a maximum of 2.5 mA or 1 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 shoud be set, or the fault location system should not be used in this system.

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 type of distribution system.

Planning the installation of a safe, reliable power supply aiming the highest availability means:

- Set-up of the power supply as an IT system. In comparison with a distribution system with intentional earth connection of the active conductors, an improved reliability, improved fire protection, improved accident prevention as well as a higher permissible earth resistance are thereby achieved.

- Use of the suitable monitoring devices. The advantages named in the previous paragraph stand or fall by the selection of the appropreate A-Isometer for the respective application. Unless there is a 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 downtimes thanks to the use of an insulation fault location system. Rapid location of an insulation fault immediately after it has occured 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 of possible night and weekend work. The actual repair can be carried out at an appropriate time. The system operator makes the decision as to whether the insulation fault location system to be used should be a permanently installed or a portable system.

- An alternative to supply voltage 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 location systems. 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.

For the reliability of the power supply, it is decisive to maintaine the good state of insulation. 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. Weekend work was frequently necessary in order to localise the fault or faults while the system was switched off.

Modern BENDER monitoring devices such as the EDS3365, EDS3065, EDS470, EDS473 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 down the system.

Basic standards

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

IEC 60364-4-41, Point 413.1.5.4 (Note),
DIN VDE 0100 Part 410:1997-01, Point 413.1.5.4 (Note)

It is recommended that the first fault should be eliminated with the shortest practical delay.

Rapid insulation fault location is made possible thanks to insulation fault locating systems such as the EDS3365, EDS3065, EDS473, EDS470 or RCMS470. In this way, the risk of the supply voltage being switched off because of a possible second fault is considerably reduced.

The standard IEC61557-9 deals with devices for insulation fault location in IT AC systems during operation, IT AC systems with galvanically connected DC circuits and IT DC systems. This international standard lays down some special requirements for insulation fault location systems in IT systems of up to AC 1000 V and DC 1500 V.

BENDER's insulation fault location systems are based on this standard IEC61557-9. As far as possible, this operating manual attempts to use the terminology of the draft standard, including the term 'insulation fault location system´. This indicates not only that insulation faults with 0 Ω (earth faults) are found, but also resistive faults.

In addition, IEC 61010-1 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 that comes to flow through an insulation fault.
$I_{\Delta n}$ = rated residual operating current. The fault current at which the evaluator unit responds under specified conditions.
$I_{\Delta s}$ = measured value of the selective fault current of the evaluator unit.

IMD = Insulation Monitoring Device
RCM = Residual Current Monitor
RCD = Residual Current Protective Device

2 Safety instructions

Intended use

The intended use of the EDS3365 is to:

- locate insulation faults in IT systems, AC 50, 60 and 400 Hz, 20-265V and DC 20-308 V.

In addition to this, the EDS165-3 insulation fault evaluator – which is a component of the EDS3365 – can be used to:

- evaluate insulation faults in combination with a permanently installed EDS473 insulation fault location system (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.

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

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:

- Inproper use of the EDS3365.
- Improper assembly/fitting, commissioning, operation and maintenance of the EDS3365.
- Failure to take note of the information in the operating instructions concerning transport, storage, assembly/fitting, commissioning, operation and maintenance of the EDS3365.
- Unauthorised structural modifications to the EDS3365.
- 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.

In order to handle the EDS3365 in accordance with safety requirements and to ensure ist trouble-free operation, the fundamental prerequisite is a knowledge of the basic safety information and the safety regulations.

Personnel

Everyone who works with the EDS3365 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 EDS3365. 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.

Risks when operating the system

The EDS3365 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 EDS3365 system or other items of property may be impaired. The EDS3365 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. Inadmissable 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.

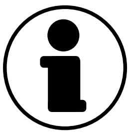
Explanation of symbols and notes

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

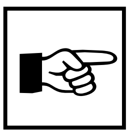
This symbol means an immediate threat of danger to human life and health.
Failure to observe these warnings means that death, severe bodily injuries or substantial damage to property **will** occur if the corresponding precautions are not taken.

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

This symbols means a possible 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 EDS3365.
Failure to comply with this information may result in faults on the EDS3365 or in its environment.



This symbol guides you to application tips and particulary useful items of information.
These will help you to make optimal use of all the functions on the EDS3365.

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 EDS3365 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 for fault-free execution and faultless material quality on the EDS3365 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 to or which modifications have been made. Any warranty whatsoever shall lapse if the EDS3365 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 EDS3365 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 consequential damage, regardless of whether these may be attributable to legal, illegal or other actions.

About this manual

Great care has been taken in the preparation of this manual. However, faults and errors can not be completely ruled out. BENDER shall not assume any liability for personal injury or damage to property resulting from faults or errors in this operating manual.

The copyright of this operating manual is left to the BENDER companies. This operating manual is only meant for the operating authority and its staff.

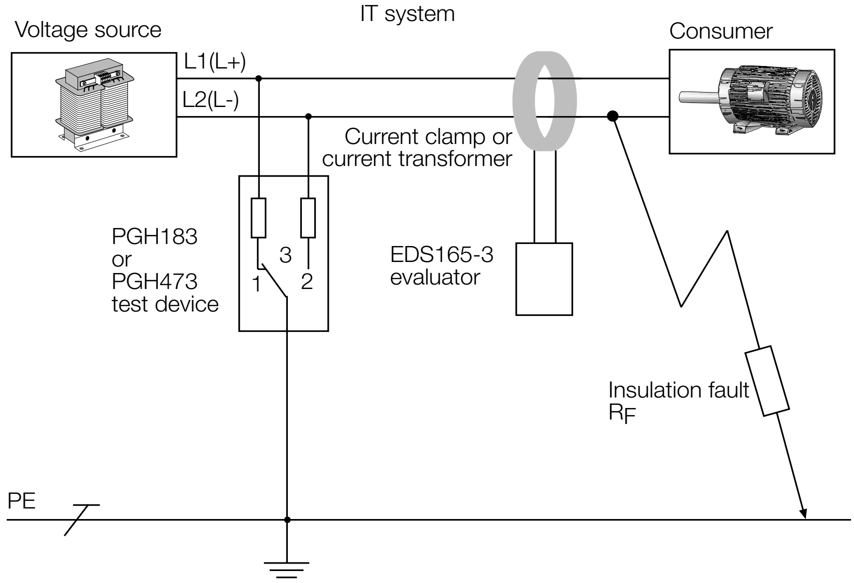
It contains rules and comments which shall be neither entirely nor partly duplicated, spread or published in any other way. Contraventions may entail criminal prosecution.

Operating principle insulation fault location (EDS-mode)

When a first insulation fault occurs in IT systems, a fault current flows which is essentially determined by the system leakage capacitances. 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 includes a signal that can be evaluated.

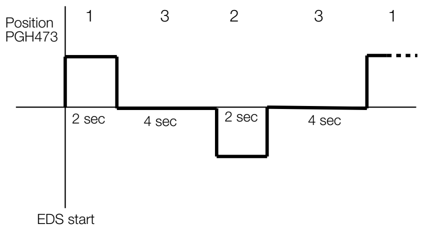
Attention

The test current is generated periodically by the PGH183 (which is a component of the EDS3365 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 present insulation fault, and on the system voltage. It is limited to a maximum of 2.5 mA, and when I_{max} = 1 mA is set, it is limited to 1 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 conductors, taking the shortest path to the location of the insulation fault. From there, it flows via the insulation fault and the earth conductor (PE conductor) back to the test device. This current pulse ist then detected by the current clamps or measuring current transformers located in the insulation fault path, and is reported by the connected EDS165-3 evaluator.

The current clamps 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 current clamps or measuring current transformers must not be used.



The test cycle of PGH183 in different switch positions (1, 2, 3) is shown in the diagram on the left.

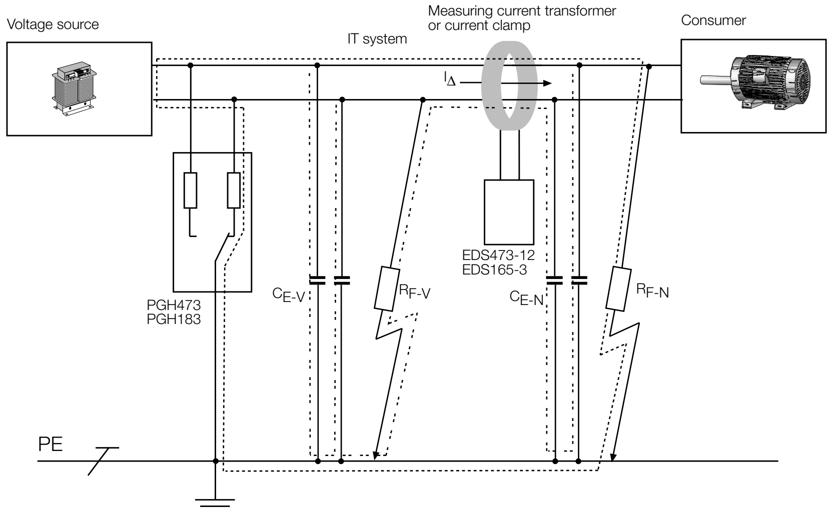
Response values

The response value is determined by the sensitivity of the EDS165-3 evaluator. In DC as well as AC systems, this is **0.5 mA as an arithmetic mean value** .

The accuracy is +/- 0.2 mA of the displayed measurement value. System interferences and excessively high system leakage capacitances may have a negative influence on the accuracy.

Terminology

In this operating manual, certain measurement engineering terms will occur repeatedly. The most important of these terms are demonstrated and explained with the help of the following sketch.



I_{Δ}	Residual current through the measuring current transformer: $I_{\Delta max}$ 1 A = FAULT
C_{E-V}	Upstream capacitances, system leakage capacitances upstream the measuring current transformer
C_{E-N}	Downstream capacitances, system leakage capacitances downstream the measuring transformer
R_{F-V}	Insulation fault upstream the measuring current transformer
R_{F-N}	Insulation fault downstream the measuring current transformer
PGH183, PGH473	Insulation fault test device
EDS165-3, EDS473-12	Insulation fault evaluators
- - - - -	Earth fault loop of the test current I_{pr} ($I_{pr\ min}$ = 0.5 mA, $I_{pr\ max}$ = 2.5/1 mA)
-- -- -- --	Residual currents I_{Δ}

The insulation fault location system EDS3365 detects insulation faults downstream of the measuring current transformer (R_{F-N}), subject to the condition that the test current is more than 0.5 mA.

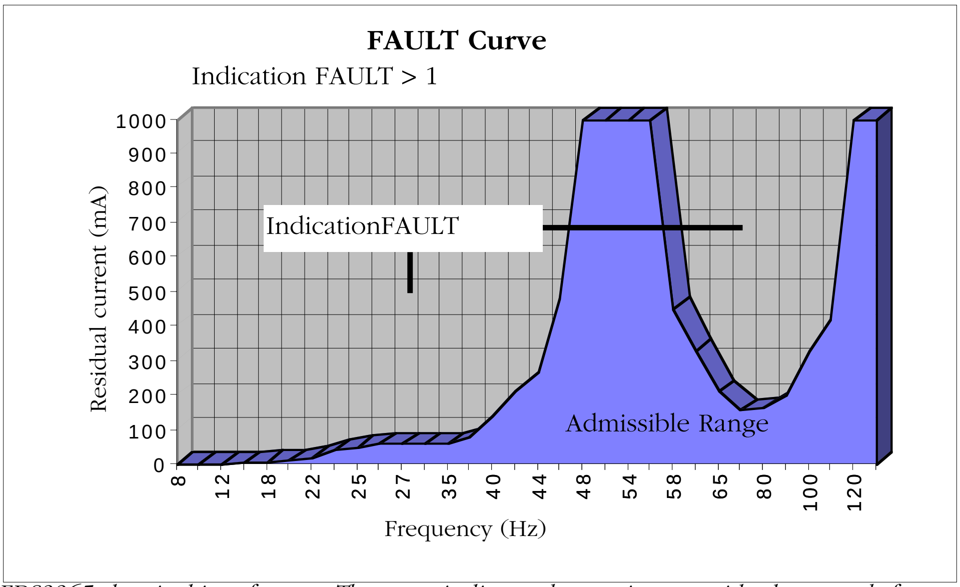
The total residual current through the measuring current transformer consists of the test current and the residual currents which result from the capacitances C_{E-V}, C_{E-N}, and/or insulation faults R_{F-N}. The total residual current through the measuring current transformer may be a maximum of 1 A. If higher residual currents occur, a FAULT message to this effect is given, and no evaluation is possible on this channel. On this point, please refer to the FAULT curve on the next page as well.

The upstream capacitances C_{E-V} must be at least as large as the downstream capacitances C_{E-N} ($C_{E-V} \geq C_{E-N}$). If this condition is not satisfied, false tripping signals may be given.

Note: under certain circumstances, balanced insulation faults downstream of the measuring current transformer are not detected.

FAULT curve

The possible frequency range is shown by the curve (FAULT curve) which follows. This indicates the range in which residual currents are displayed as a FAULT. In general, residual currents > 1 A are displayed accordingly, and independently of the frequency.
Outside of the admissible range, FAULT messages may be given if residual currents occur. Likewise, excessively high leakage capacitances can lead to FAULT messages. These messages are displayed in the menu of the EDS165-3.



EDS3365 electrical interference. The curve indicates the maximum residual current before a FAULT indication is given.

A sophisticated filter circuit and electronic system avoids malfunctions due to extraneous currents < 1 A.

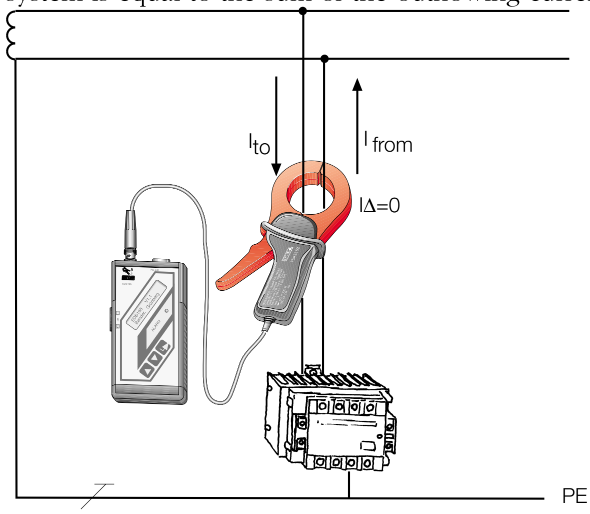
The following FAULT conditions may be indicated on the display of the EDS165-3:

- Short circuited current clamp or current transformer connection. Display: no A
- Interrupted current transformer connection, or no current clamp or current transformer connected. Display: no A
- A residual current > 1 A through the current clamp or the current transformer.
- The current transformer signal cannot be evaluated due to interferences.
- The leakage capacitances in the system, or in an output of the system, are too high.

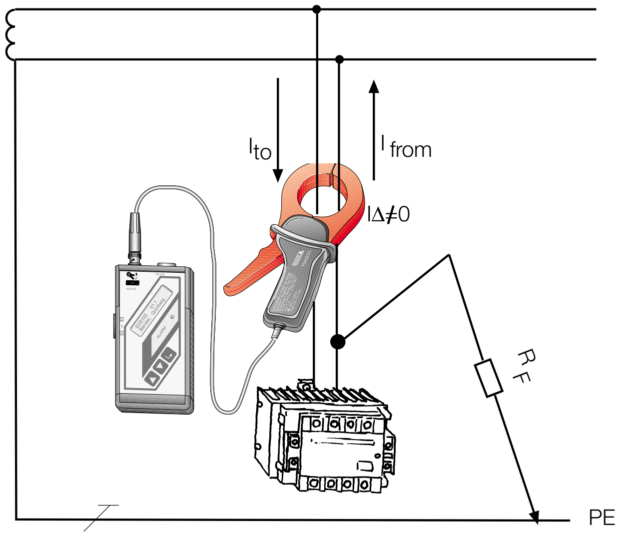
Function in the RCM mode

In the RCM mode (RCM=Residual Current Monitor), the EDS3365 operates according to the principle of residual current measurement. In this case, only the EDS165-3 evaluator unit with the current clamp is used, and the PGH183 test device is not required.

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



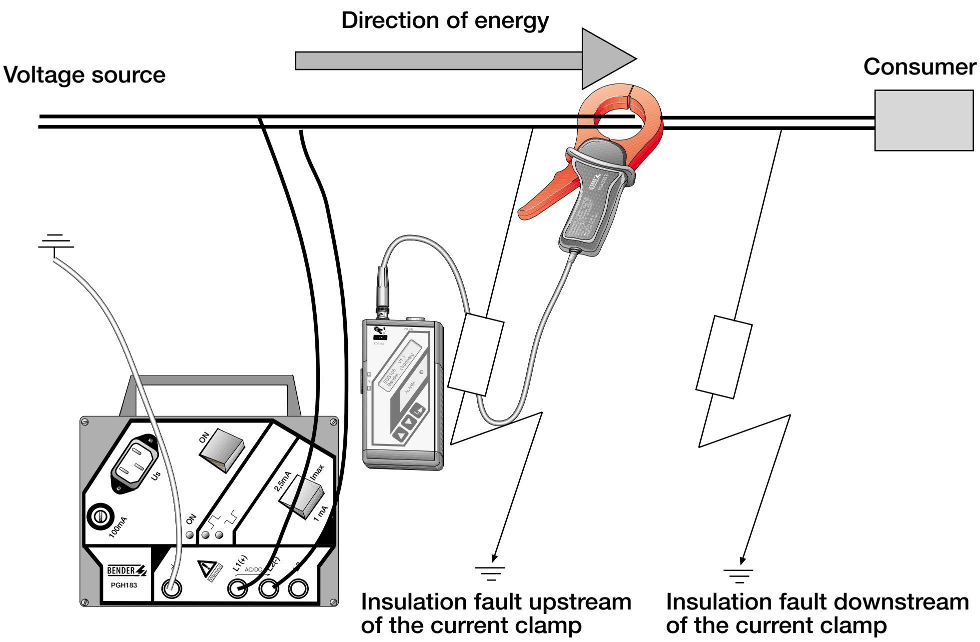
The two currents I_{to} and I_{from} are equal in quantity but have different directions, so that the resultant sum is zero.The EDS165-3 recognises this and no message is generated.



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 EDS165-3 will generate a message.

In the RCM mode, residual currents can be measured in one- and three-phase TT or TN systems (AC). If the system leakage capacitance upstream of the current clamp is sufficiently high, the EDS165-3 can also be used for measurements in one-and three-phase IT systems (AC). Its suitability for this purpose must be checked in each individual case.

Direction of energy



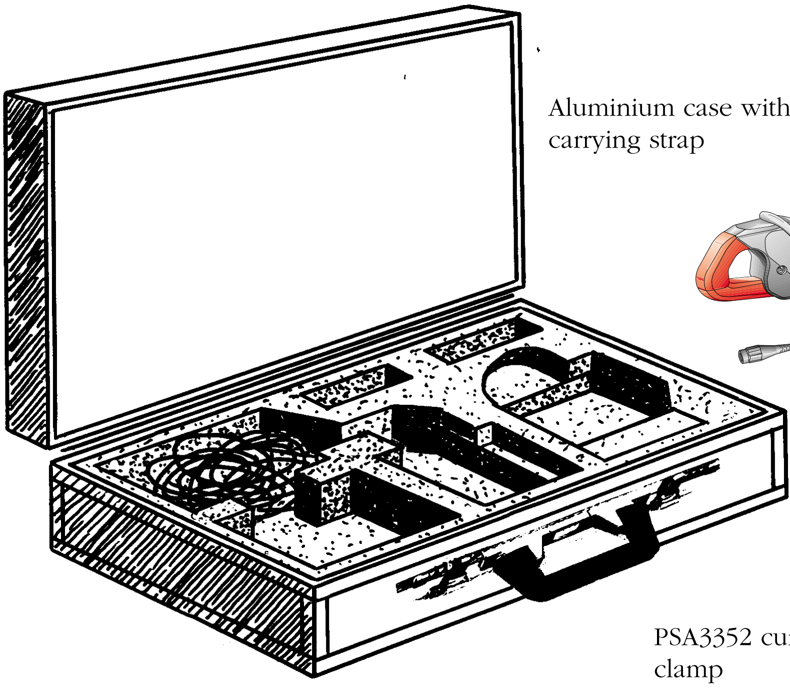
When using the EDS3365, the direction of energy must always be taken into account. This applies for the EDS mode (insulation fault location).

Insulation faults may arise up or downstream of the current clamp (or the measuring current transformer). The illustration above shows both those options. **However, in the EDS mode faults can only be located DOWNSTREAM of the current clamp.**

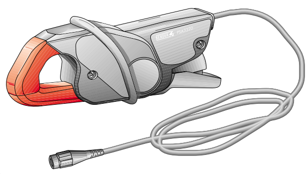
Please consider this fact when using EDS3365. For this reason it is advisable to start the insulation fault location near the voltage source in order to move towards the consumer. This statement applies incidentally to all insulation fault location systems.

The system components at a glance

The primary function of the EDS3365 is that of an insulation fault location system in IT systems. The individual components of the EDS3365 are used in combination for this purpose.



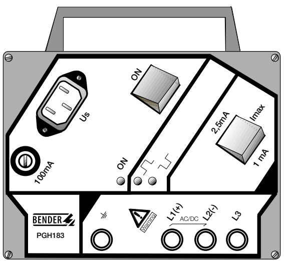
Aluminium case with carrying strap

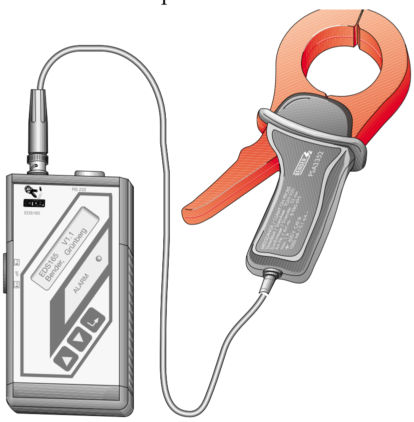


PSA3320 current clamp

PSA3352 current clamp

PGH183 test device





EDS165-3 insulation fault evaluator

Not illustrated:
Power supply cable (europlug with connector for cold conditions) for PGH183 insulation fault test device.
Safety measuring leads, 3 x black and 1 x green/yellow.
Safety claw grip with 2 A fuses to connect the PGH183 with the system conductors and the PE.
BNC adapter unit/banana plug to connect measuring current transformers.
Banana plug
Accumulator charging set for EDS165.

Parts list

The EDS3365 insulation fault location system comprises the following components:

1 pc. Aluminium case with carrying strap
1 pc. PGH183 test device
1 pc. EDS165-3 insulation fault evaluator, accumulators included
1 pc. PSA3320 current clamp (diameter 20mm)
1 pc. PSA3352 current clamp (diameter 52mm)
1 pc. Power supply 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) with 2A fuses
1 pc. BNC Adaptor / banana plug -> transformer
2 pcs. Banana plug
1 pc. Accumulator charging set (not with the EDS3365-13 version)
1 pc. TGH1320E operating manual

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

There are two different EDS3365 insulation fault location systems available:
- EDS3365
- EDS3365-13

The difference between them is the supply voltage for the PGH183:
- PGH183 - supply voltage: AC 230 V
- PGH183-13 - supply voltage: AC 90 …132 V

Attention

Prior to commissioning, it is absolutely essential to check whether the supply voltage of the EDS3365 system matches the voltage of the mains supply. Operation of the EDS3365 with the wrong supply voltage can result in the destruction of the PGH183 test device.

When working with the EDS3365, only use those components which are supplied with the system. In particular, do not use other current clamps, measuring leads or measuring terminals.

Options

The EDS3365 represents a complete system. In addition to the PSA3320 and PSA3352 current clamps which are supplied with the system, measuring current transformers can be connected to the EDS165-3 insulation fault evaluator. These may be BENDER measuring current transformers which are already installed in the system.

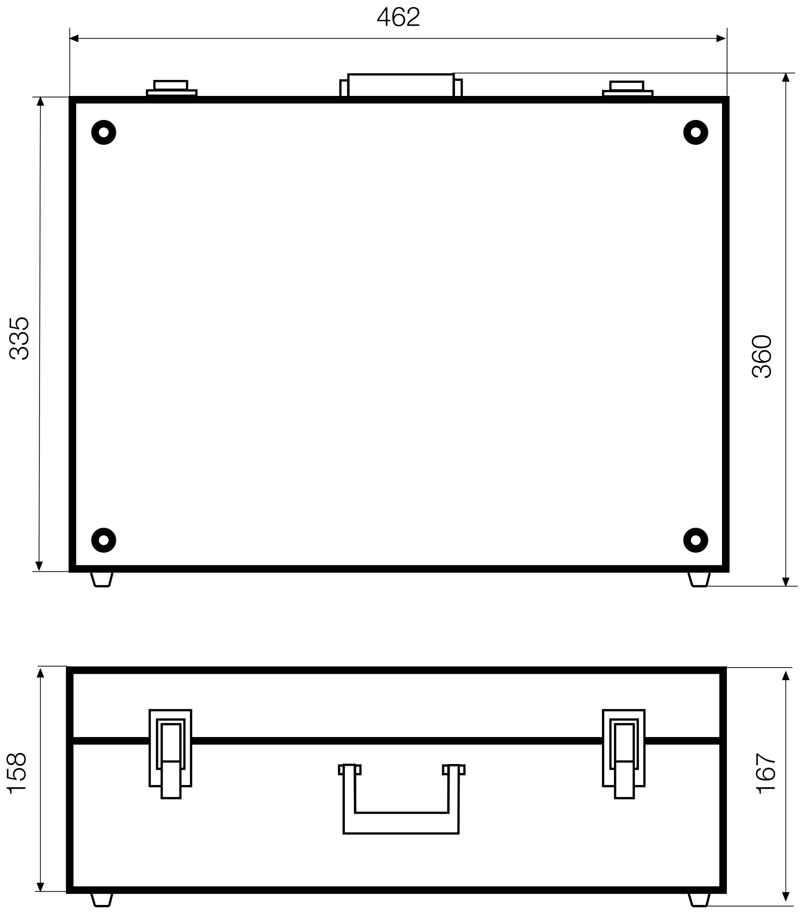
The following types of transformers are suitable:
Measuring current transformer W1-35/8000 or W08/8000
Split-core type measuring transformer WS50x80/8000

Important: normal commercial measuring transformers must not be used!
This also applies to additional current clamps 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. 1 should be short-circuited.

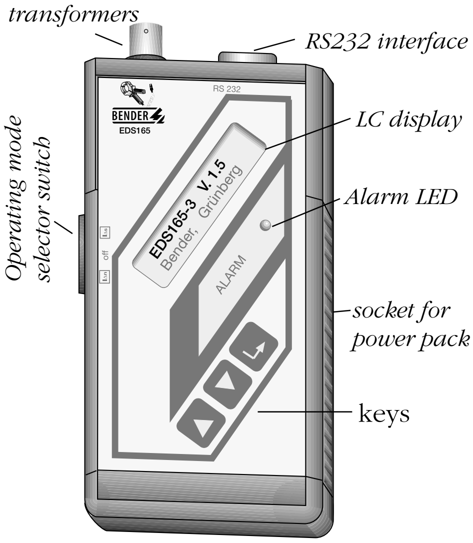
Aluminium case

All the components of the EDS3365 are accommodated in a stable aluminium case with foam inlays.



All dimensions in mm

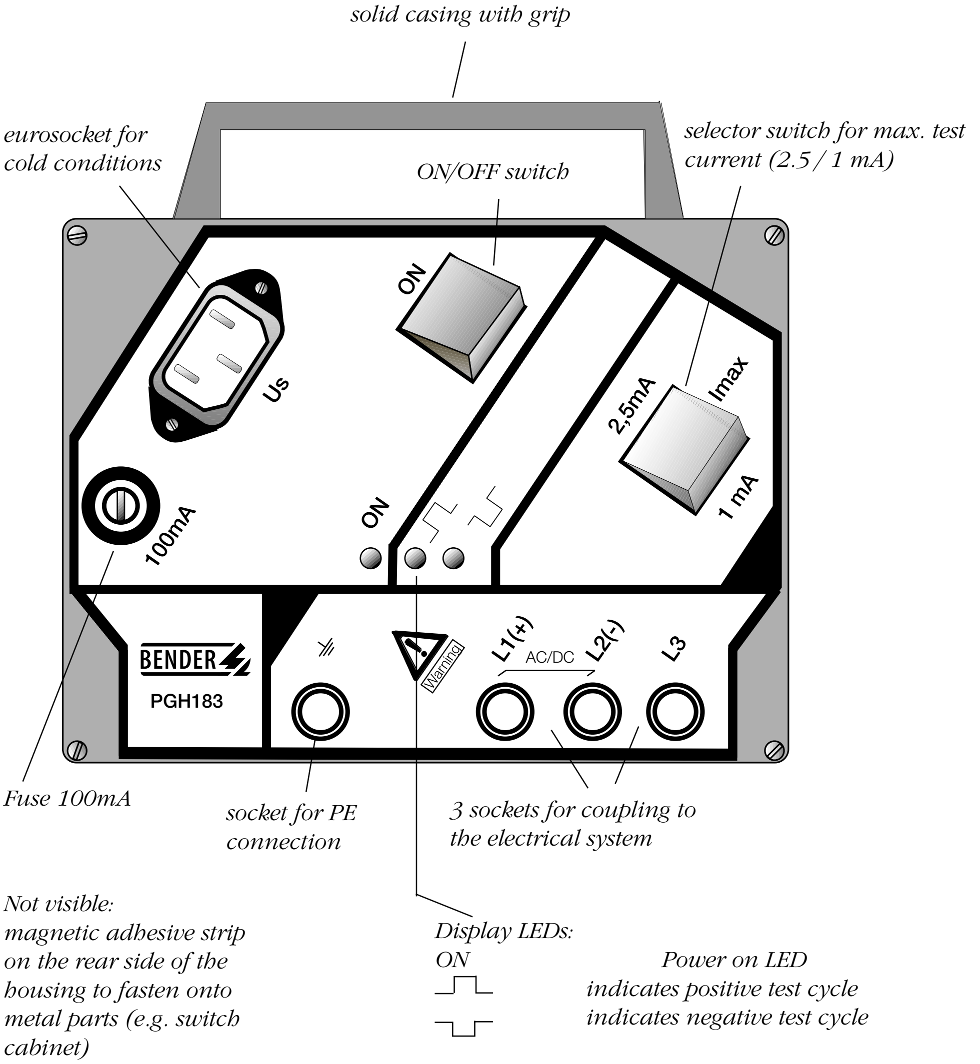
EDS165-3 insulation fault evaluator



The operating mode switch on the EDS165-3 has three positions:

Middle position:	*OFF – the device is switched off*
Position $I_{\Delta s}$:	*Function as evaluator within an EDA3365 or EDS473 system (EDS mode)*
Position $I_{\Delta N}$:	*Function as residual current measuring device (RCM mode)*

Test device PGH183



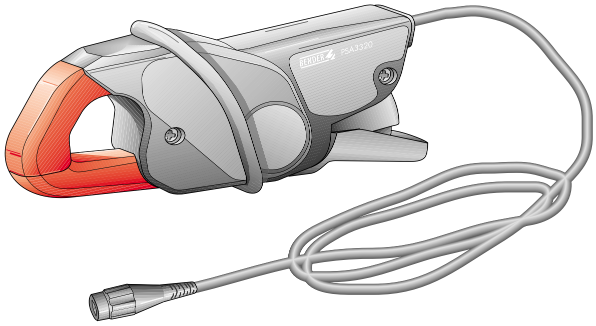
The PGH183 is activated by using its ON/OFF switch, and it generates a defined test current signal. The voltage present in the system is used to drive the test current. The value of the test current which is generated therefore depends on the value of the insulation fault that is present, and on the system voltage. The test current is limited to a maximum of 2.5 mA or to 1 mA when the switch is under the 1mA position.
The test current flows from the system via the PGH183 and then through the protective conductor (PE) and the insulation fault (or faults) back to the system. The test current signal is detected by the current clamps or measuring current transformers located in the fault current circuit, and the defective circuits are indicated by the EDS165-3 insulation fault evaluator whenever the response value of 0.5 mA is exceeded.
If the PGH183 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).

Attention

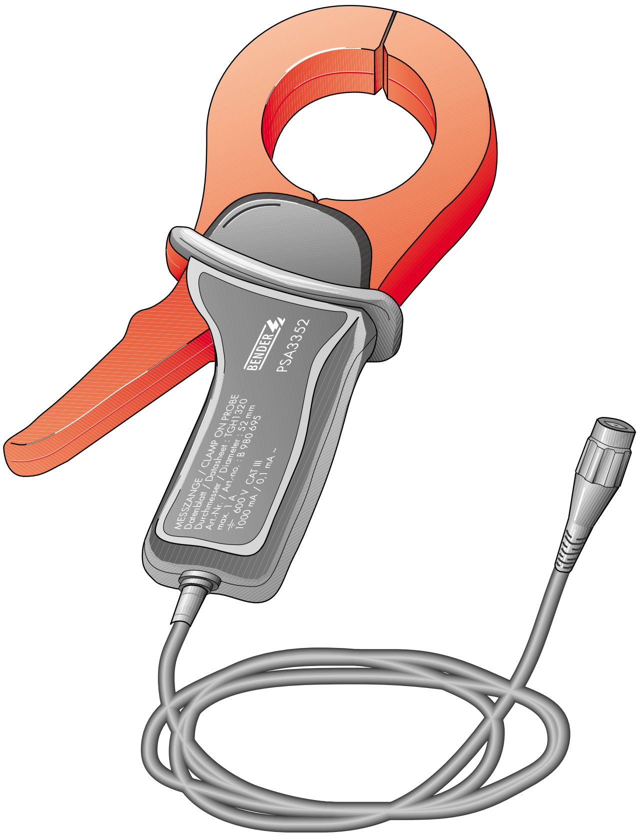
The test current flows between the system and earth. If unfavourable combinations of circumstances arise (low-impedance insulation fault in combination with the test cycle), control errors cannot be ruled out on very sensitive system components (SPC, miniature relays). This possibility should be taken into account prior to use. If this possiblity exists, then setting I_{max} = 1 mA should be selected.

PSA3320 current clamp

The PSA3320 current clamp can be used to encircle leads of up to 20 mm in diameter. The connection to the EDS165-3 insulation fault evaluator is made via a BNC connector and measuring lead with a length of approximately 2m.



PSA3352 current clamp



The PSA3352 current clamp can be used to encircle leads of up to 52mm in diameter. The connection to the EDS165-3 insulation fault evaluator is made via a BNC connector and measuring lead with a length of approximately 2 m.

Technical data EDS3365

EDS3365 insulation fault location system

Insulation coordination acc. to IEC 664-1:	dependend on the current sensor used
Type of operation:	continuous operation

Technical data PGH183

PGH183 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:	20-265 V
Operating range of rated mains voltage, DC:	20-308 V
Supply voltage	
Supply voltage, U_s:	AC 185-265 V for PGH183 AC 90-132 V for PGH183-13
Fuse protection for supply voltage:	fine-wire fuse, 100 mA, slow-acting
Measuring cycle	
Maximum test current:	2.5 / 1 mA
Test cycle:	2 s
Pause time:	4 s
Type tests	
Test of electromagnectic compatibility (EMC):	
Immunity against electromagnetic interference acc. to prEN 50 082-2	
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
Climatic class acc. to IEC 721:	3K5, except condensation and formation of ice
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:	IP20
Weight:	approximately 700 g
Dimensions:	160x148x81 mm

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

Technical data EDS165-3

Insulation coordination acc. to DIN VDE 0110 T1:	depends on the current clamp used
Type of operation:	continuous operation

Monitored system:

Rated insulation voltage U_n:	see PGH183 and/or current clamps
System frequency in EDS mode:	50,60,400 Hz (adjustable) or DC
System frequency in RCM mode:	47 … 65 Hz

Supply voltage

Operating range supply voltage U_S:	DC 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 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_{Ds}- function (EDS mode in combination with EDS473 systems)

Response value:	0.5 mA
Accuracy:	+/- 0.2 mA

Measurement input for $I_{\Delta n}$- function (RCM mode, residual current measurement)

Measuring range with current clamps:	AC 10 mA … 1.6 A
Measuring range with measuring current transformers:	AC 10 mA … 1 A
Response range for alarm indication:	AC 10 mA … 1 A
Accuracy:	+/- 10 %
Weight:	approximately 370 g

Technical data current clamps

Current clamps:

Insulation coordination acc. to IEC 1010-2-032	
Nominal insulation voltage, PSA3320 and PSA3352:	AC 600 V CAT III and AC 300 V CAT IV
Protection class acc. to DIN 40 050	IP40
Measurement output	BNC plug
Dimensions, PSA3352	216x111x45 mm
Dimensions, PSA3320	135x65x30 mm
Permissible cable diameter, PSA3352 :	52 mm
Permissible cable diameter, PSA3320 :	20 mm
Weight, PSA3352 :	approximately 550 g
Weight, PSA3320 :	approximately 200 g

5 Operation and Setting

Factory settings

The components of the EDS3365 are delivered with factory settings, which are suitable for many standard applications. The following list shows the factory settings for the individual devices:

PGH183 test device

I_{max} = 2.5 mA

EDS165-3 insulation fault evaluator (with the switch in position $I_{\Delta s}$)

Fault memory:	off
Buzzer:	on
Frequency:	50 Hz
Sensor:	current clamp PSA3320

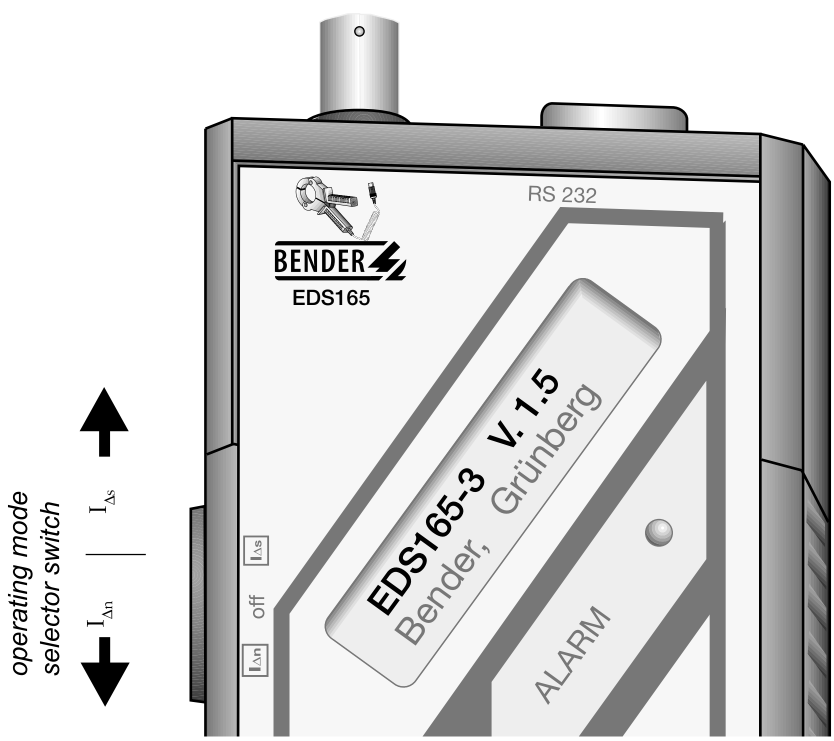
Settings on the EDS165-3 evaluator

Except for the changeover of the maximum test current, all the settings to the EDS3365 systems are performed on the EDS165-3 insulation fault evaluator.

Switching on the EDS165-3

The **operating mode selector** switch on the left hand side of the EDS3365 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 EDS3365 or within the EDS473 system (EDS mode)
Left-hand position:	$I_{\Delta n}$ - function as a residual current measuring device (RCM mode)

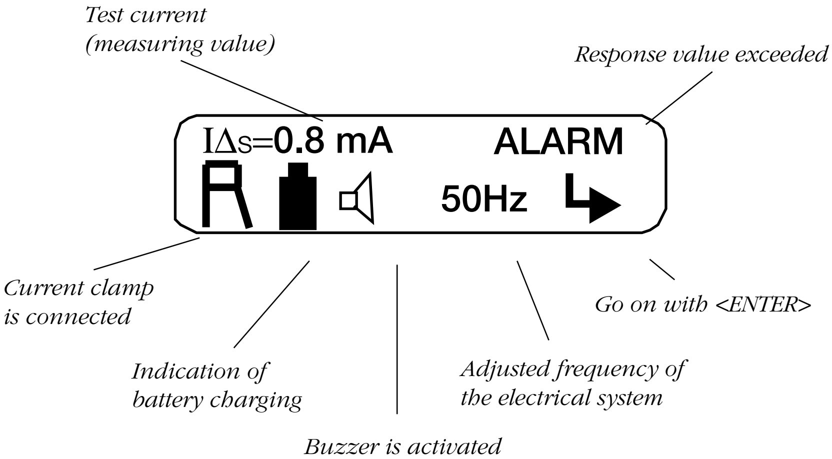


Three keys are used to operate the EDS165-3:

UP DOWN ENTER

The EDS165-3 display

Here is an example of a display on the EDS165-3 in the EDS mode:



5 menus

The EDS165-3 provides 5 menus in order to parameterize:

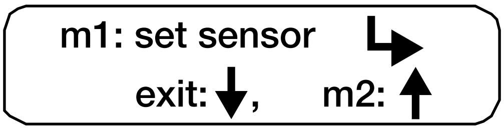
m1 (set sensor)	For the setting of the connected current clamp or the connected measuring current transformer.	
m2 (reset)	Resets all the displayed alarm messages.	
m3 (memory)	For the setting of the memory behaviour of the alarm message and of the alarm LED.	
m4 (buzzer)	Activates and deactivates the internal buzzer.	
m5 (freq)	**In the EDS mode:**	adapting the EDS3365 to the respective system frequency.
	In the RCM mode :	setting the response value of the residual current.

The EDS165-3 in the EDS mode

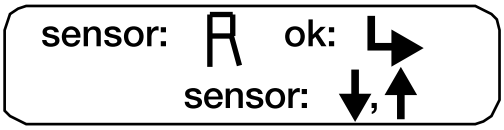
The EDS165-3 is operated and set using three control keys and the LCD display. When making any of the settings, you must press the relevant control keys for about 1 second. The different settings which are possible in the EDS mode (position $I_{\Delta s}$) are described below.
If you move the operating mode selector switch to position $I_{\Delta s}$ the EDS 165-3 will be in the EDS mode. As soon as you have done this, you will see the display menu (see above).

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: set sensor



Menu 1 (m1) allows you to set the sensor which is connected. Press:
<ENTER> to reach the menu for modification,
<UP> to move on to the next menu, m2 or <down> to return to the display mode.

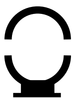


The sensor which is set at present is the PSA3320 current clamp. The possible settings are described below. Press:
<ENTER> to accept the current setting and return to the display mode,
<UP/DOWN> to select the current clamp or measuring current transformers.

The following settings are possible:


PSA3320 current clamp


PSA3352 current clamp


Split-core measuring current transformers WS50x80/8000

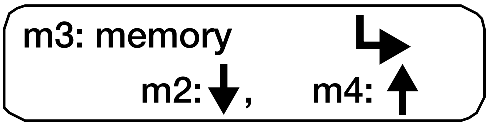

Standard measuring current transformers:
W1-35/8000
W08/8000

Menu 2: reset

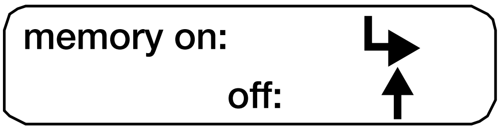
The next menu (m2) is the reset menu. Press:
<ENTER> to call up the reset program,
<UP> to call up the next menu (m3) or <down> to return to the previous menu (m1).

Press the <ENTER> key to implement the selected setting and return to the display mode; use the <UP> key to select *reset* or *no reset*.

Menu 3: memory

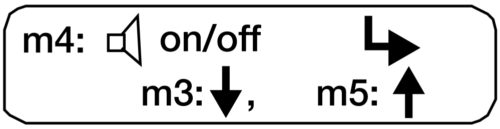


The menu m3 is used to specify the memory behaviour for the alarm message and the alarm LED. Press: <ENTER> key to call up the subroutine, <UP> to reach the next menu (m4) or <down> to return to the previous menu (m1).

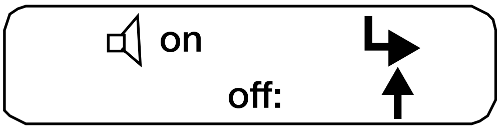


Press the <UP> key to modify the present setting; press <ENTER> to confirm the setting displayed in the top line and to return to the display mode.

Menu 4: buzzer



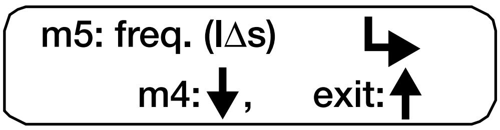
Menu 4 is used to activate or deactivate the internal buzzer. Press: <ENTER> to reach the buzzer program, <UP> to go to the next menu (m5) or <down> to return to the previous menu (m1).



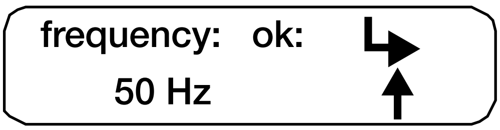
The top line shows the present status of the buzzer – in this example, the buzzer is activated (on). Press <UP> to change the setting to off, or press <ENTER> to confirm the setting and then to return to the display mode.

Note: the buzzer setting will only remain active until the next time the EDS165-3 is switched off!

Menu 5: frequency



Use menu (m5) to adapt the EDS165-3 to the respective system frequency. Press <ENTER> to call up the system frequency adaptation menu, <UP> to return to the display mode or <down> to return to the previous menu (m4).



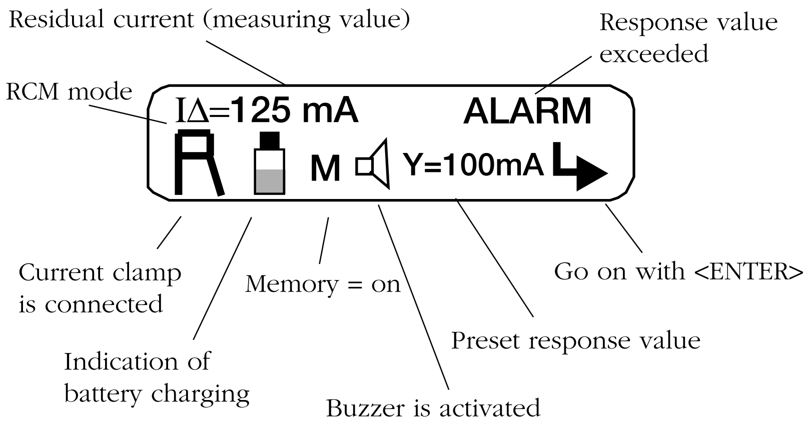
The top line displays the system frequency that is set at the moment, which is 50Hz in this case. Use the <UP> key to modify the frequency: the values available are 50, 60 and 400 Hz.

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 leaving the individual menus (m1 … m5), you will always be returned to the display mode.

The EDS165-3 in the RCM mode

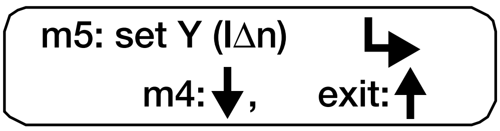
If the operating mode selector switch is moved to position $I_{\Delta n}$, EDS165-3 operates in the RCM mode, and can be used as a portable residual current measuring device in AC systems.

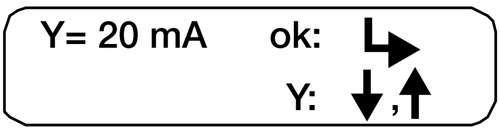


The way the menus are set corresponds largely to the description already given for the EDS mode. However, there is a difference in menu 5 (m5). In the RCM mode, the response value is set here in mA or A respectively.

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

Menu 5: set Y

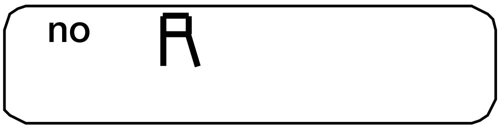




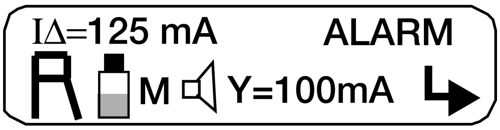
The top line indicates the current setting of the response value. Use the arrow keys (<UP>, <DOWN>) to modify the response value between 10 mA and 1 A. Up to 500 mA to 1 A, the modification is made in 10 mA steps; from 500 mA to 1 A, in steps of 50 mA. Press <ENTER> to accept the set value and return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

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

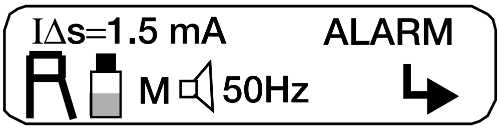
The EDS165-3 issues a fault message if no current clamps or measuring current transformers are connected. The fault message is given acoustically and visually. The BUZZER ON or BUZZER OFF setting does not influence the acoustic message if no current clamp is present. The message is given in the EDS mode as well as the RCM mode.
Attention: no fault message is given if an incorrect current clamp or an incorrect measuring current transformer are connected. In this case the indications of test current and residual current can be quite different.



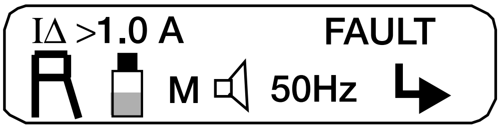
When the response value is exceeded in the RCM mode ($I_{\Delta n}$), this is shown on the display by the ALARM message and indication of the residual current.



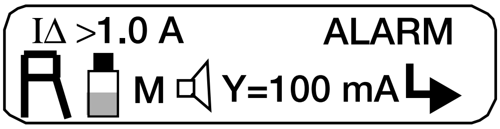
In the top line, $I_{\Delta n}$ shows the currently measured residual current; and in the lower line, Y shows the response value that has been set.



In the EDS mode ($I_{\Delta s}$), a selective test current which is greater than 0.5 mA will result in an alarm message.



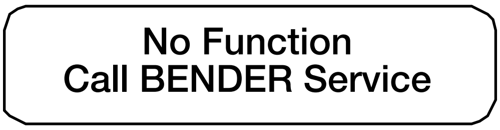
Residual currents that are greater than 1 A lead to different messages. In the EDS mode, a FAULT message is generated:



In the RCM mode, an ALARM message is generated:

If there is no current clamp connected to the system or if there is a short-circuit in the line of the current clamp, the display shows: no

When internal faults or high EMC interferences occur, it may be that no recognition of the set mode is possible anymore. In this case a general fault message is displayed. This indication may occur also in the case of an empty accumulator.



Call ++ - 6401 - 807 - 0 for technical support.

Serial interface

The standard RS232 interface makes it possible to connect system independent components. These may be computer systems, stored-program controllers, 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 baud
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:

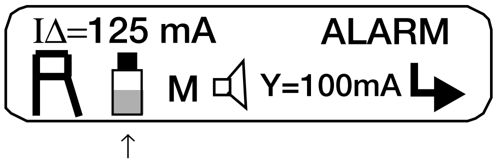
Master	:;XXX:ABCDE 12345&XYZ<CR><LF>
Slave	::XXX:ABCDE 12345&XYZ<CR><LF>

:;	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)

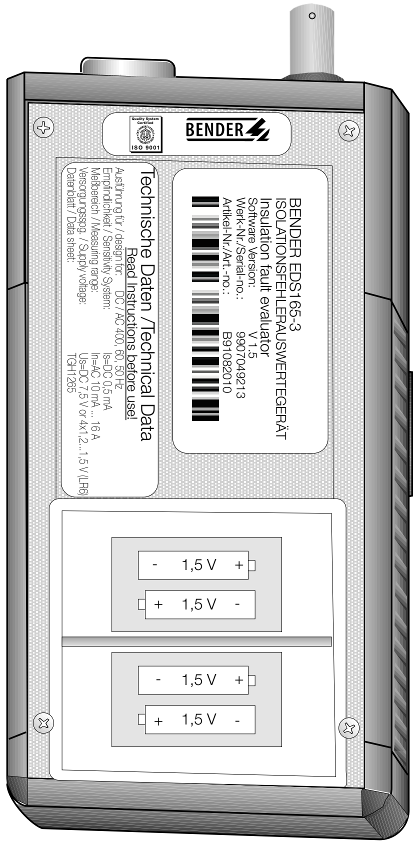
The command and the data may be smaller than 5 bytes, or may be omitted altogether. In every case, the end is recognised from the start byte to the next character type.

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.



The battery compartment is located on the rear side of the EDS165-3; it contains batteries or rechargeable accumulators.



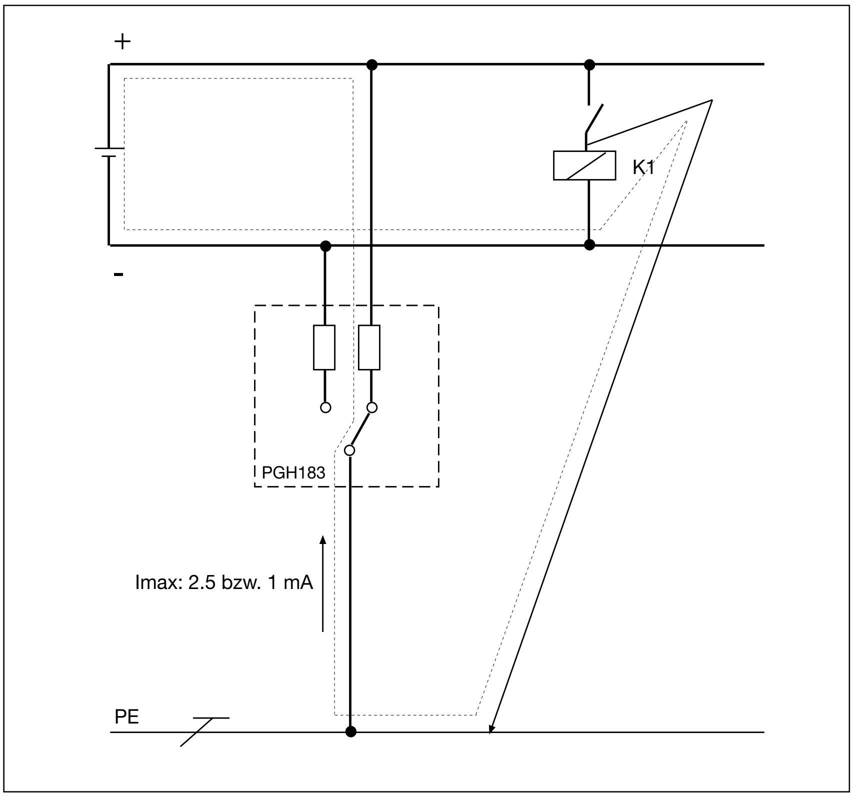
In order to change the accumulators, the black cover flap on the rear side of the EDS165-3 has to be opened. To do this, carefully lift off the flap with the use of a screwdriver (blade width: 3-5 mm).
Then insert the new accumulators according to the imprinted positioning diagram. Also note that the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

The EDS3365 makes it possible to search for insulation faults in IT systems, AC 20-265 V and DC 20-308 V. This 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 EDS3365, such as:

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

Reduced measuring current

Especially in DC control voltage systems in the power station and supply companie sector, relays or SLCs 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 PGH183. In such a case, the I_{max} switch on the PGH183 must be moved to the 1 mA position.

Also, when the EDS3365 is being used with the activated test current limitation of 1 mA, 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 EDS3365 is 0.5 mA. Hence the maximum insulation resistance which can be deteced is dependent on the voltage wave form, the level of the voltage and the system leakage capacitance that is present.

In order to start insulation faults location 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 (curve 1)
- the maximum permissible system leakage capacitance, in relation to the system voltage (curve 2)
- the reduction in response sensitivity when system leakage capacitances are higher (curve 3)

An example:

In a 110 V DC IT system, the insulation monitoring device which is already present shows an insulation fault of 500 kΩ. The system leakage capacitances are less than 0.1 µF and are therefore negligible.
A look at characteristic curve 1 shows that an insulation fault of about 200 kΩ can be found in a DC system with 110 V. Therefore it makes no sense in this case to start insulation fault location with the EDS3365.

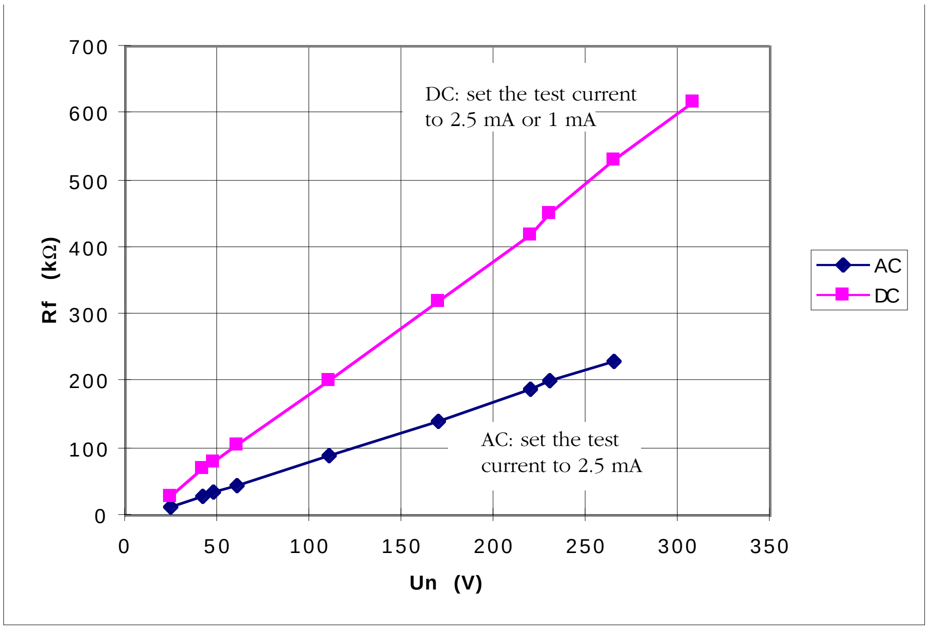
Another example:

In a 230 V AC IT system, the insulation monitoring device which is already present shows an insulaion fault of 100 kΩ. Characteristic curve 1 shows that in a 230 V DC system, an insulaion fault can be found from about 200 kΩ upwards. Therefore in this case, it makes sense to start insulation fault location, and the chances of finding the fault are very good.

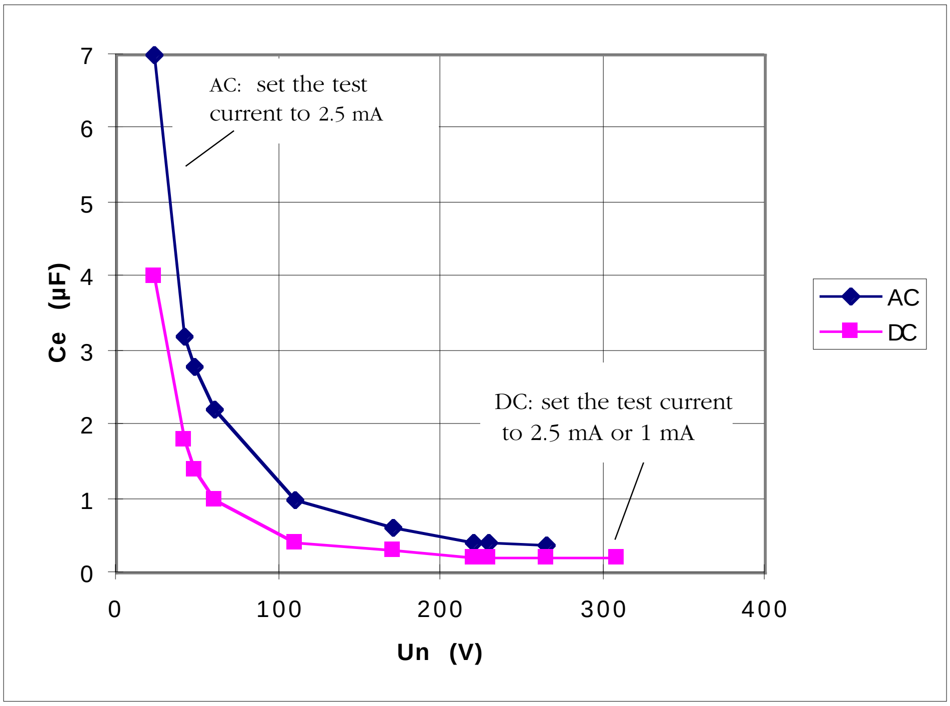
As a basic rule, it is necessary to take account of the possibility that the total insulation resistance of a system is made up from the parallel connection of several insulation faults. It is not known which individual faults contribute to this.
If a fault is not found with the EDS3365, even though 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 EDS3365.

Another reason why insulation faults are not found may be an excessively high system leakage capacitance (on this point, see characteristic curves). When considering the system leakage capacitances, a point to note is that the division to the capacitances upstream and downstream of the current clamp is not arbitrary. The upstream 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.

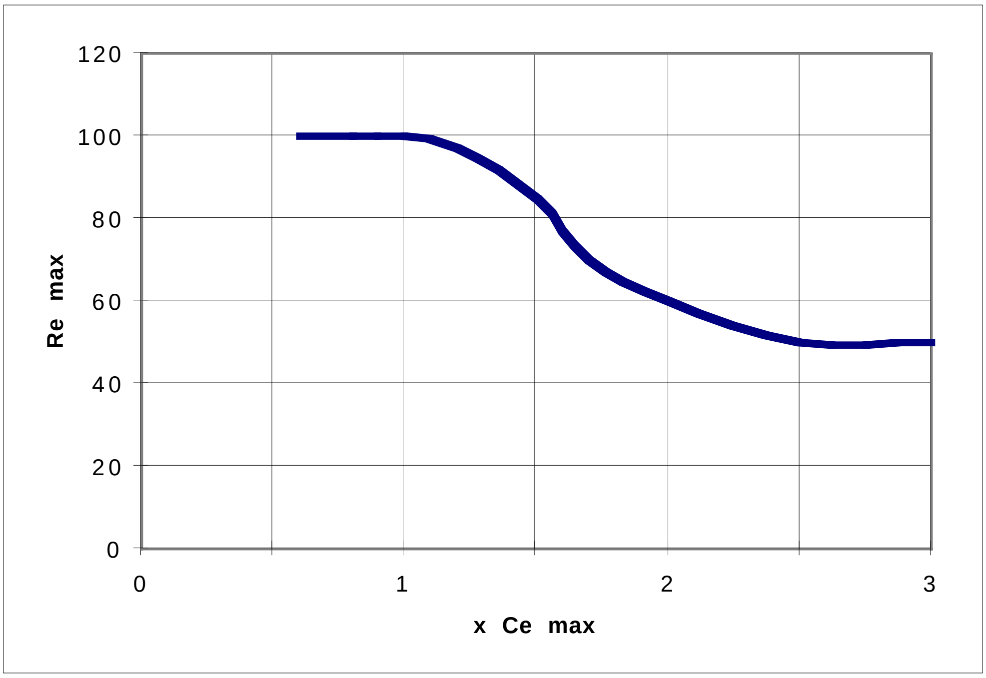
Characteristic curves



Curve 1: *response value Rf in relation to the system voltage (AC 20-265 V and DC 20-308 V) with a maximum system leakage capacitance C_e as shown by curve 2.*



Curve 2: *maximum permissible system leakage capacitance in relation to the nominal voltage (AC 20-265 V, DC 20-308 V). Up to this system leakage capacitance, the EDS3365 has the sensitivity shown in curve 1.*



Curve 3: *Reduction of response sensitivity when system leakage capacitances are greater than the maximum permissible value for C_e taken from curve 2.*

When considering the curves, a point to be taken into account is that the sum of the 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 300 µFV. In a 220 V system, therefore, this is 300 µFV/220 V = 1.4 µF. If the limit value is exceeded, there may be false trippings.

All the charcteristic curves on the foregoing pages are valid for the indicated test currents.

Limitation of the test current to 1 mA is particulary intended for the use of the EDS3365 in DC control systems with consumers which may already operate at very low currents. If the test current 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 2.5 mA as well.
Recommendation: select 2.5 mA as the setting for the test current in AC systems.

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 technique of the EDS3365. Modern suppply systems nowadays contain a large number of components which may lead to influences and faults.

Interferences for the EDS 3365 system are for example:

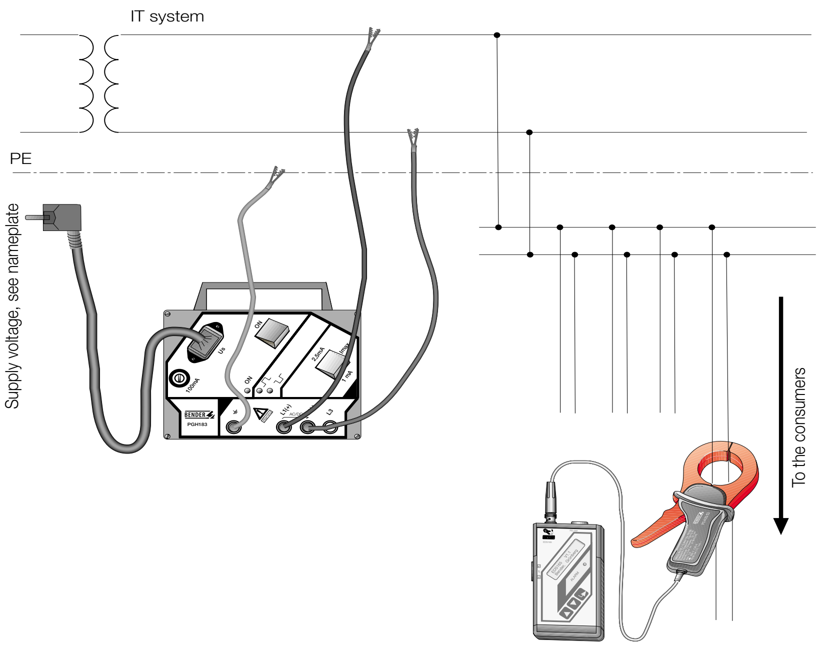
- high system leakage capacitances
- excessively high leakage currents
- transient leakage currents
- low-frequency leakage currents

The limit conditions are cited in this operating manual. However, because of the large number of possibilities, we cannot make unambiguous statements about every type of interference compatibility, nor about functional limits. In case of doubt, you must clarify the suitablility of the EDS3365 for the application in question by consulting a BENDER adviser.

The conditions, and the reactions of the EDS3365 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: curve 2 in this chapter shows the response sensitivity dependent on the leakage capacitance of the total system. If the leakage capacitance exceeds the permissible value in one subcircuit downstream of the current clamp, incorrect messages may appear on the EDS165-3 evaluator.
- Maximum leakage currents: the maximum permissible system-dependent leakage current under which the evaluation will still function properly is limited to 1 A. If the leakage current exceeds 1 A, selective fault location can no longer be undertaken. Leakage currents > 1 A are shown by the indication (I_Δ > 1 A) in the display of the EDS165-3.
- Transient leakage currents: switching and controlling 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 interferences 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 false trippings. 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 false trippings on the EDS165-3 if their frequency is equal to, or approximately equal to the test cycle frequency of the test device (PGH473, PGH183).

Use as a portable insulation fault location system



The EDS3365 is primarily used as a portable insulation fault location system in IT systems, AC 20 …265 V and DC 20 … 308 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 can be started. The sequence of insulation fault location is described below, with the use of examples.

- Testing the nominal system voltage: does this fall within the permissible limits for the EDS3365?

- Check whether the insulation fault indicated 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 via the PE socket of the PGH183 insulation fault test device with the PE of the system. It is advisable to connect the test device as near to the incoming supply (transformer or battery) as possible.

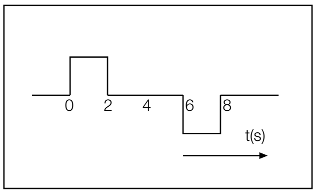
- Connect the PGH183 insulation fault test device to the system which is to be checked, using the two connection leads supplied with the device. **When you do this, you must comply with the general guidelines for live working.**
  In a three-phase system: connect sockets L1, L2 and L3.
  In a single-phase system, AC or DC: connect sockets L1 and L2.

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

- Disconnect the insulation monitoring device which is present in the IT 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 PGH183. The factory setting is 2.5 mA. If the IT system contains components which might already operate at low currents, then it may be necessary to select the 1 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. Note: in AC systems set 2.5 mA, in DC systems 2.5 or 1 mA.

- Switch on the PGH183 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 cycle, a 4-second pause period and a 2-second negative cycle.
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 current clamps to the EDS165-3 insulation fault evaluator. Switch on the EDS165-3 and set the operating mode switch to position $I_{\Delta s}$. After the basic menu has appeared on the display of the EDS165-3, test whether the correct nominal system frequency has been set. The factory setting is 50 Hz/DC.

- Check whether the correct current clamp and/or the correct measuring current transformer are set in menu 1 (m1). The factory setting is current clamp PSA3320.

- It is advisable to keep the contact surfaces of the current clamps clean.

- First, encircle the green-yellow lead between the PGH183 and earth with the current clamp. If the EDS165-3 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 current clamp. The current clamp 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 current clamp is encircling live conductors, it must not be disconnected from the EDS165-3. In an "open" operation of this sort, the current clamp may be destroyed!

- Inside the current clamp, you should aim for the maximum possible balancing of the conductors. Keep the current clamp steadily during the measurement! Make sure that you do not exert any pressure on the current clamp arms.

- An alarm message on the display of the EDS165-3 signals an insulation fault downstream of the current clamp. It is advisable to carry out the fault location with the buzzer activated.

- Measure along the conductor with the EDS165-3 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 current clamp is at least 0.5 mA.

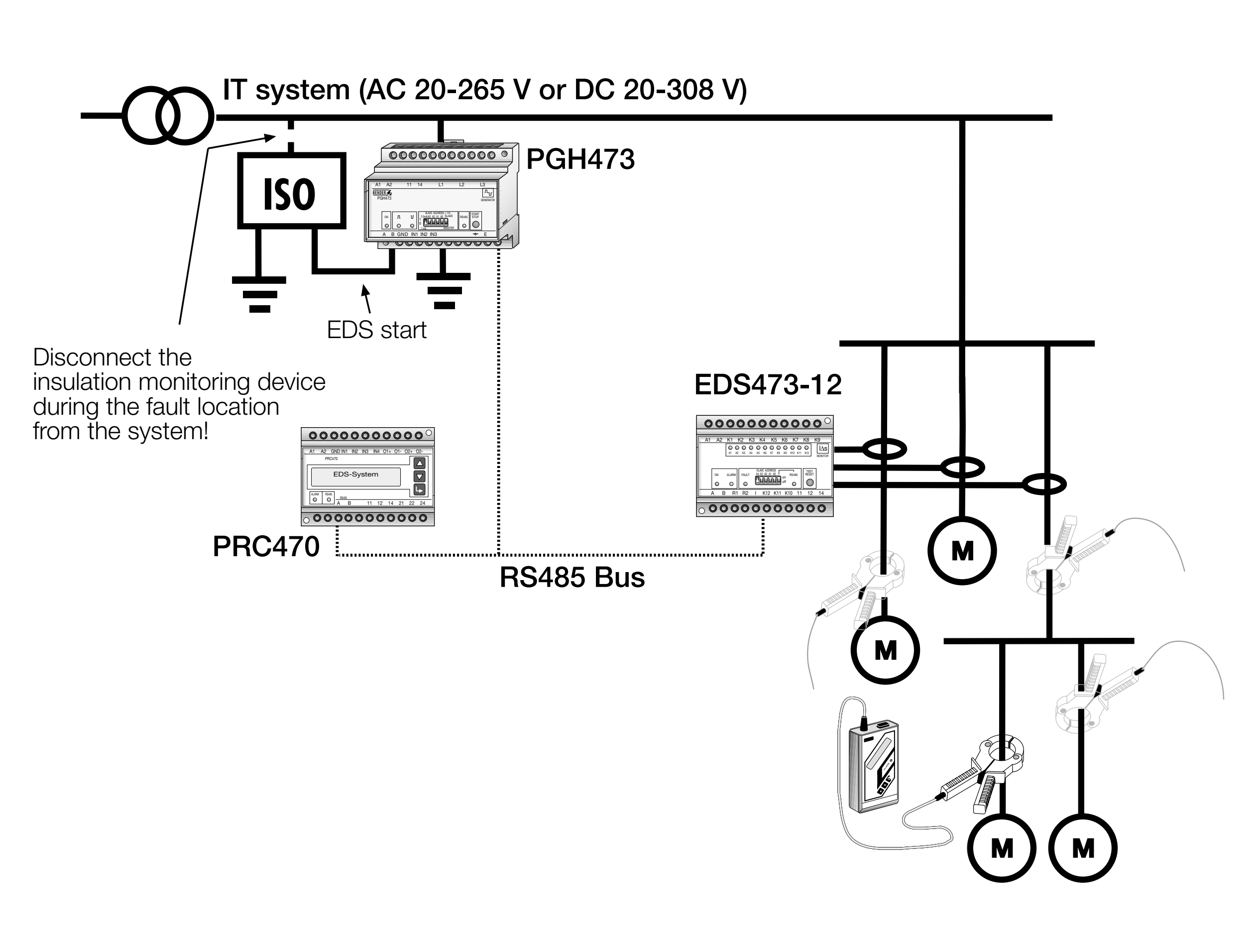
For operating currents < 1 AC, measurement is also possible by encircling one conductor only. **Attention:** for DC currents > 10 A, this may produce the effect that the current clamp can no longer be opened. This danger is particularly present in direct current sytems. If this behaviour occurs, under no circumstances use force, since this would destroy the current clamp. Instead, you must switch off the relevant system. After this has been done, the current clamp can be opened without the application of force.

Using the EDS165-3 within an EDS473 system

The EDS165-3 insulation fault evaluator can also be used without the PGH183 test device within a system such as an EDS473, as a permanently installed system. In this case, it detects the test pulses from the PGH473 test device. Insulation fault evaluation is only possible in live IT systems.
The practical use of the EDS165-3 within a permanently installed EDS473 insulation fault location system is described below:

- The central insulation monitoring device has signalled an insulation fault below its response value.
- The insulation monitoring device has to be disconnected from the system with all poles.
- The insulation fault location system is activated by pressing the START key of the PGH473 and it starts fault location; the test device is clocking. The insulation fault evaluation continues as long as the test device is clocking.
- Connect the current clamp (or the measuring current transformer) via a BNC adapter.
- Move the operating mode switch of the EDS165-3 to the $I_{\Delta s}$ position; wait until the basic menu appears on the display.
- Check whether the correct nominal system frequency is set. The factory setting for the frequency is 50 Hz.
- Check whether the correct current clamp and/or the correct measuring current transformer are set in menu 1 (m1 – set sensor). The factory setting is current clamp PSA3320.
- At subcircuits where no measuring current transformer is installed, or downstream of installed measuring current transformers, fault location can now be continued with the EDS165-3.
  Attention: do not connect the core of the current clamp to system voltages above the nominal insulation voltage.
- All system conductors, **but not the PE** , must be encircled by the current clamp.
  Attention: do not encircle any shielded leads!
- When the current clamp is encircling live conductors, it must not be disconnected from the EDS165-3. In this type of ”open” operation, the current clamp may be destroyed!
- During the measurement, the current clamp must be held steadily. The conductors should be encircled as symmetrically as possible. Make sure that you do not exert any pressure on the arms of the current clamp. An alarm message is given within 30 seconds after closing of the current clamp.

- An alarm message signals an insulation fault downstream of the sensor.
- Measure along the lead with the EDS165-3 until you have found the fault location.
- The fault location is found when the test current through the current clamp is at least 0.5 mA. On this point, see the chapter on SETTINGS AND ADAPTATIONS in the EDS473 operating manual.
- For operating currents < 1 A, measurement is also possible by encircling one conductor only. **Attention:** for currents > 10 A, this may produce the effect that the current clamp 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 current clamp. Instead, you must switch off the relevant system. After this has been done, the current clamp can be opened without the application of force.
- For each measurement, wait for one cycle of the PGH473 test device (approximately 30 seconds).



Use of an EDS165-3 in an IT system with a permanently installed EDS473 insulation fault location system. In addition to the messages from PRC470 and EDS473-12, the portable EDS165-3 insulation fault evaluator can be used to check individual subcircuits and to display the test currents.

Using the EDS165-3 as a residual current monitor

The EDS165-3 can also be used without the PGH183 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 current clamp.
- Move the operating mode selector switch on the EDS165-3 to position $I_{\Delta n}$, and wait until the basic menu appears on the display.
- Check whether the correct current clamp is set in menu 1 (m1 – set sensor). The factory setting is current clamp PSA3320.
- Check whether an response 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 incoming supply as possible and move on radially in the direction of the consumers.
- During the measurement, the current clamp must be held steadily. The conductors should be encircled as symmetrically as possible. Make sure that you do not exert any pressure on the arms of the current clamp.
- During measurement, encircle all the system conductors, **but not the PE** . Do not encircle any shielded leads.
- When the current clamp is encircling live conductors, it must not be disconnected from the EDS165-3. In this type of "open" operation, the current clamp 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 long time measurements at one point of the system, the fault memory must be activated (memory on) in menu 3 (m3 – 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.

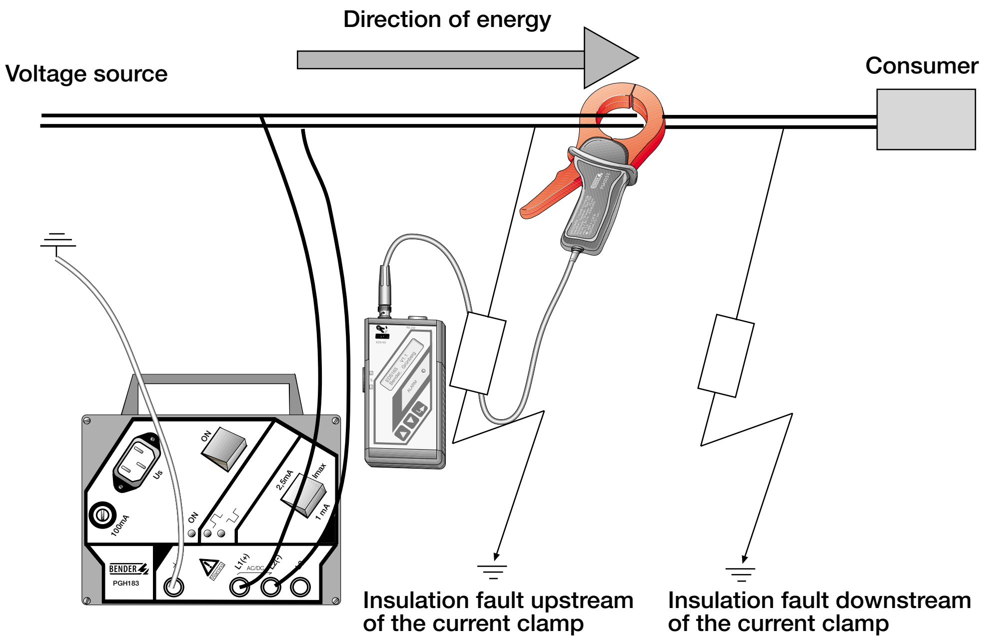
Insulation fault location with the EDS3365 in diode-decoupled systems

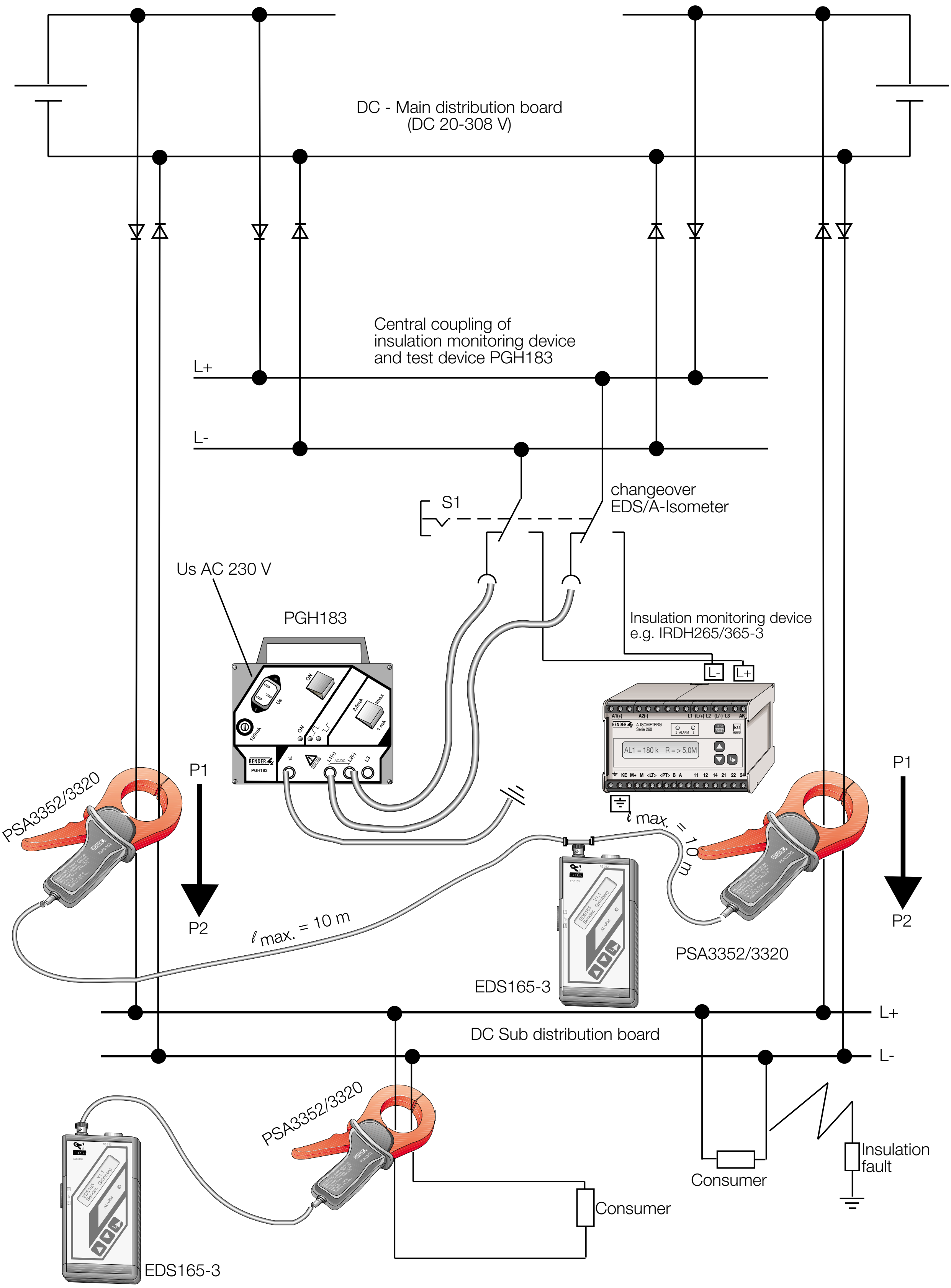
In diode-decoupled DC systems occur transient currents in and between the decoupled circuits. The direction and size of these transient currents depend on the voltage ratio of the system, the characteristics of the decoupling diodes, and on the nature of the consumer.

When using the EDS3365 insulation fault location system in systems like that, these transient currents become noticeable as faults which interfere with the measuring safety. Therefore we recommend the use of the EDS3365 in diode-decoupled systems according to the enclosed sketch.

Following points are to be observed:

- Always use two current clamps of the same type. **Attention:** This type of the current clamp must also be set in the menu of the EDS165-3.
- Use a 50Ω Coaxial cable and a T-piece in order to connect both the current clamps to the EDS165-3 evaluator.
- The maximum length of 10 m of the Coaxial cable (per current clamp) must be taken into consideration.
- Use both the current clamps absolutely in a way that the direction of energy corresponds to the lettering on the current clamp P1=>P2.





DC - Main distribution board
(DC 20-308 V)
Central coupling of
insulation monitoring device
and test device PGH183
L+
L-
S1
changeover
EDS/A-Isometer
Us AC 230 V
PGH183
Insulation monitoring device
e.g. IRDH265/365-3
L-
L+
PSA3352/3320
P1
P2
ℓ max. = 10 m
ℓ max. = 10 m
EDS165-3
PSA3352/3320
P1
P2
L+
L-
DC Sub distribution board
PSA3352/3320
EDS165-3
Consumer
Consumer
Insulation
fault

Sequence of the insulation fault location

- The central insulation monitoring device has signalled an insulation fault that is below the insulation value the EDS system is able to locate. Please observe the characteristic curves with it in chapter "Points to be considered before use".
- Reading the relevant insulation restistance on the LC display of the insulation monitoring device:
  Is the read value of the insulation resistance smaller than the maximum insulation fault of the EDS system that can be localized, change from the ISOMETER to the EDS mode using S1.
- Connecting the PGH183 to the test current feeding points according to the enclosed sketch.
- Preparing the EDS163 evaluator:
- Connect the two current clamps of similar construction (PSA3352, PSA3320) to the BNC extension leads and to the BNC adaptor.
- Switch the operating mode selector switch to the EDS mode ($I_{\Delta n}$).
- Carry out the following software settings:
  menu m1: set sensor to the current clamp in use (PSA3352, PSA3320)
  menu m3: memory off
  menu m4: on
  menu m5: frequency 50 Hz
- Start of the EDS system
  First encircle the PE conductor of the PGH183 with **one** of the two connected current clamps. When the measured test current $I_{\Delta s}$ on the LC-Display of the EDS165-3 exceeds 1 mA, then a successful location of the insulation fault is possible.
  Afterwards disconnect the current clamp from the PE conductor.
  Now run the L+ and the L- through the current clamps, under no circumstances through the PE conductor though.

- Insulation fault location in the installation with the EDS system:
  Encircle the two redundant supply conductors leading to the consumers, each with one current clamp. When you do this, take into consideration that you really encircle the supply conductors belonging to the same consumer. Pay attention to the identical direction of energy of both current clamps (see sketch). Encircle all the parallel consumer subcircuits with the current clamps. Consumer subcircuits with insulation faults will be indicated by an alarm message on the
  EDS165-3.
  Attention: An alarm message occurs approximately 30 seconds after connecting both the current clamps.

8 Ordering information

Type	Designation	Article no.
EDS3365	Insulation fault location system Supply voltage AC195-265 V	B91 082 011
EDS3365-13	Insulation fault location system Supply voltage AC90-132 V	B91 082 012
EDS3360	Insulation fault location system Supply voltage charging set: AC 230 V	B91 082 013
PSA3320	Current clamp 20 mm	B980 696
PSA3352	Current clamp 52 mm	B980 695
W1-35/8000	Measuring current transformer 35 mm, circular type	B911 759
W08/8000	Measuring current transformer 8 mm, circular type	B911 756
WS50x80S/8000	Measuring current transformer split-core	B911 757
EDS165 accessory set for diode descoupled systems	with 2 x 8 m BNC cable, BNC T-adaptor and further adaptors	B91 082 007