Electrical safety costs little …

… a human life is priceless

Content

Electrical safety in hospitals is vital

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Electrical safety in hospitals is vital

The benefits offered by modern medical knowledge and technical equipment are overruled by unexpected loss of electrical power.
In intensive care units TIME is of the essence and the absolute reliability of electrical systems is of VITAL importance.

Safe and secure electrical power systems
Bender systems have provided the answer for reliable and cost effective electrical safety solutions for healthcare facilities for over 60 years. Hospitals around the world rely on Bender products and the technical support of Bender ENGINEERS, where the safety of patients and the critical performance of their medical electrical equipment is at stake.

Bender – Electrical safety for hospitals

Bender – Your partner in the application of the new international Standard for electrical safety in hospitals

Bender is acknowledged as the expert in the design and installation of power systems according to the international standard IEC 60364-7-710: 2002-11: Electrical installations of buildings – Requirements for special installations or locations – medical locations.

Bender systems are specially developed for electrical safety management in health care facilities, they provide early detection of critical errors or insulation deteriorations in the power supply of medical electrical equipment.

Principles for an electrical safety management in healthcare facilities

- Insulation faults must not lead to a power failure.
- Fault currents in an electrical system must be reduced to an uncritical level.
- Permanent monitoring of the power supply for medical locations must be guaranteed.
- Fault repairs must be able to be planned in advance to suit patient needs.
- The provision of clear unambiguous labelling of power outlets and distribution switchboards with readily available system documentation.

Optimal electrical safety

Whoever takes responsibility for the building or running of a hospital or any other healthcare facility has to ensure a maximum of electrical safety.
Bender is a reliable partner worldwide developing the appropriate system solution in accordance with the international Standard IEC 60364- 7-710: 2002-11.

As there can be no compromise concerning the safety of patients and staff, we create flexible solutions for your needs. Let us be your partner and take advantage from our expert knowledge

…in the design stage

- Professional advice
- Design support
- Drafting of invitation to tender

…during the installation

- Installation of devices and systems
- Functional test and commissioning
- Fault location / fault clearance
- Adaptation / optimisation
- Operator training

… and later on

- Support
- Inspection / maintenance
- Repair / spares
- Retro-fitting, modifications, extensions

In the intensive care unit

All around the world hospitals rely on Bender safety: St. Louis Hospital, Thailand

We want to inform you about the five most important topics concerning electrical safety in healthcare facilities as follows:

A **Which power supply system ensures maximum safety?**

B **How do you avoid dangerous overloads?**

C **How do you inform your staff?**

D **What else can you do for increased safety?**

E **How do you avoid dangers in case of public electricity supply failure?**

A Which power supply system ensures maximum safety?

Safety standards in medical locations
According to IEC 60364-7-710: 2002-11 the medical procedures carried out in a room, define the rooms Group classifications.

710.3.5 Group 0

- Medical locations where no applied parts are intended to be used.

710.3.6 Group 1
Medical locations where applied parts are intended to be used as follows:

- externally
- invasively to any part of the body, but not to the heart, except where 710.3.7 applies.

710.3.7 Group 2
Medical locations where applied parts are intended to be used in applications such as intracardiac procedures, operating theatres and vital treatment where failure of the supply can cause danger to life.

The highest demands are made in Group 2 medical locations
A first fault must not result in power supply interruption and hence to failure of life-support equipment.
IEC 60364-7-710: 2002-11 requires the IT system (unearthed system) for all Group 2 medical locations

710.413.1.5
In Group 2 medical locations, the medical IT system shall be used for:

- Circuits supplying medical electrical equipment and systems intended for life-support or surgical applications
- Other technical equipment in the patient environment

The following rooms are of special concern:

- Anaesthetic rooms
- Operating theatres
- Operating preparation rooms
- Operating recovery rooms
- Heart catheterization rooms
- Intensive care rooms
- Angiographic examination rooms
- Premature baby rooms

Operating room
Examples of Group 2 locations
Picture: www.trilux.de

Intensive care unit

Picture: www.trilux.de

Premature

Picture: www.trilux.de

Photos Source: Fa. TRILUX GmbH & Co. KG, Arnsberg

A IT systems (unearthed systems) – for a reliable power supply

The IT system in medical locations

The use of an IT system is the backbone of a reliable power supply in medical locations. Contrary to an earthed system (TN system) there is no conductive connection between active conductors and the protective earthing conductor within the IT system.

Thus four essential demands are met:

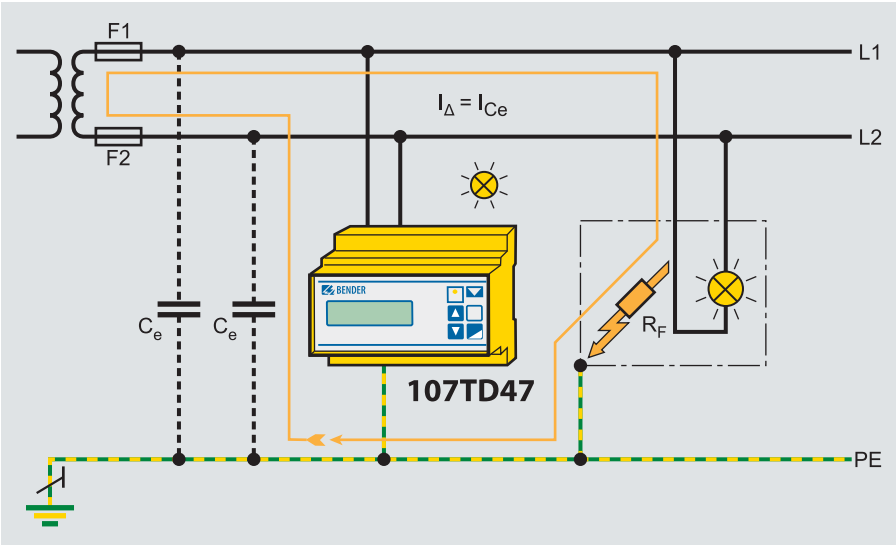
- When a first insulation fault occurs the power supply is not interrupted by the tripping of a protective device.
- Medical electrical equipment continues to function.
- Fault currents are reduced to an uncritical level.
- No panic breaks out in the operating theatre because power failure is averted.
- Many national and international standards regard the use of the IT system as the backbone of a safe power supply in medical locations, for example:

Special brochure for:
NEC / NFPA / UL / CSA / JES / AS

International:	IEC 60364-7-710
Germany:	DIN VDE 0100-710
Austria:	ÖVE / ÖNORM E 8007
France:	NFC 15-211
Italy:	CEI 64-4
Brazil:	NBR 13543

UK:	BS 7671 GN7/HTM2007
Norway:	64/747/FDIS
Spain:	UNEE 2 0-615-80
Belgium:	T 013
Finland:	SFS 6000
Hungary:	MSZ 2040

Ireland:	ETCI 10.1
Netherlands :	NEN 3134
Slovakia:	STN 33 2140
South-Africa:	SABS 051
Russia:	GOST P 50571
China:	GB16895/GB50333-2002



IT system with insulation monitoring by A-ISOMETER® 107TD47

A Insulation monitoring – safety plus thanks to advance information

The medical IT system consists of an isolating transformer, a monitoring device to monitor insulation resistance, transformer load and temperature and an remote alarm indicator and test combination, installed in the operating theatre, or at a manned nurse station, nearby. Continuous insulation monitoring (IEC 60364-7-710: 2002-11, section 413.1.5) ensures that a deterioration in insulation resistance is immediately detected and signalled but (this is the decisive factor) there is no power supply interruption and continuity of operation is guaranteed.

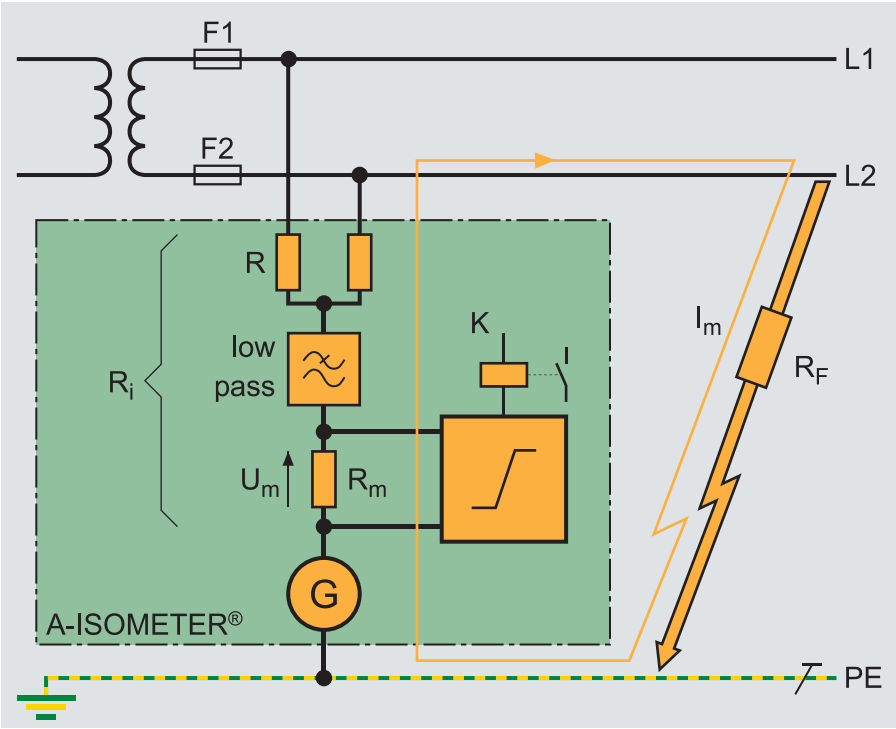
The IT system transformer

In accordance with IEC 60364-7-710: 2002-11, section 512.1.6, the rated output of the transformer shall not be less than 0.5 kVA and shall not exceed 10 kVA. Single-phase transformers are recommended. The secondary voltage shall not exceed AC 250 V, even if three-phase systems are fitted.

The insulation monitoring device

The insulation monitoring device 107TD47 is a vital unit to ensure the availability of the IT system. Connected between system and earth, it continuously monitors the insulation resistance. The integrated AMP measuring principle allows insulation faults with DC components to be precisely recorded and indicated.

Simultaneously, the A-ISOMETER® 107TD47 monitors the load current and the temperature of the transformer. Additionally it meets the requirements of IEC 60364-7-710: 2002-11, section 413.1.5 and IEC 61557-8: 2007-01.



Function principle of insulation monitoring

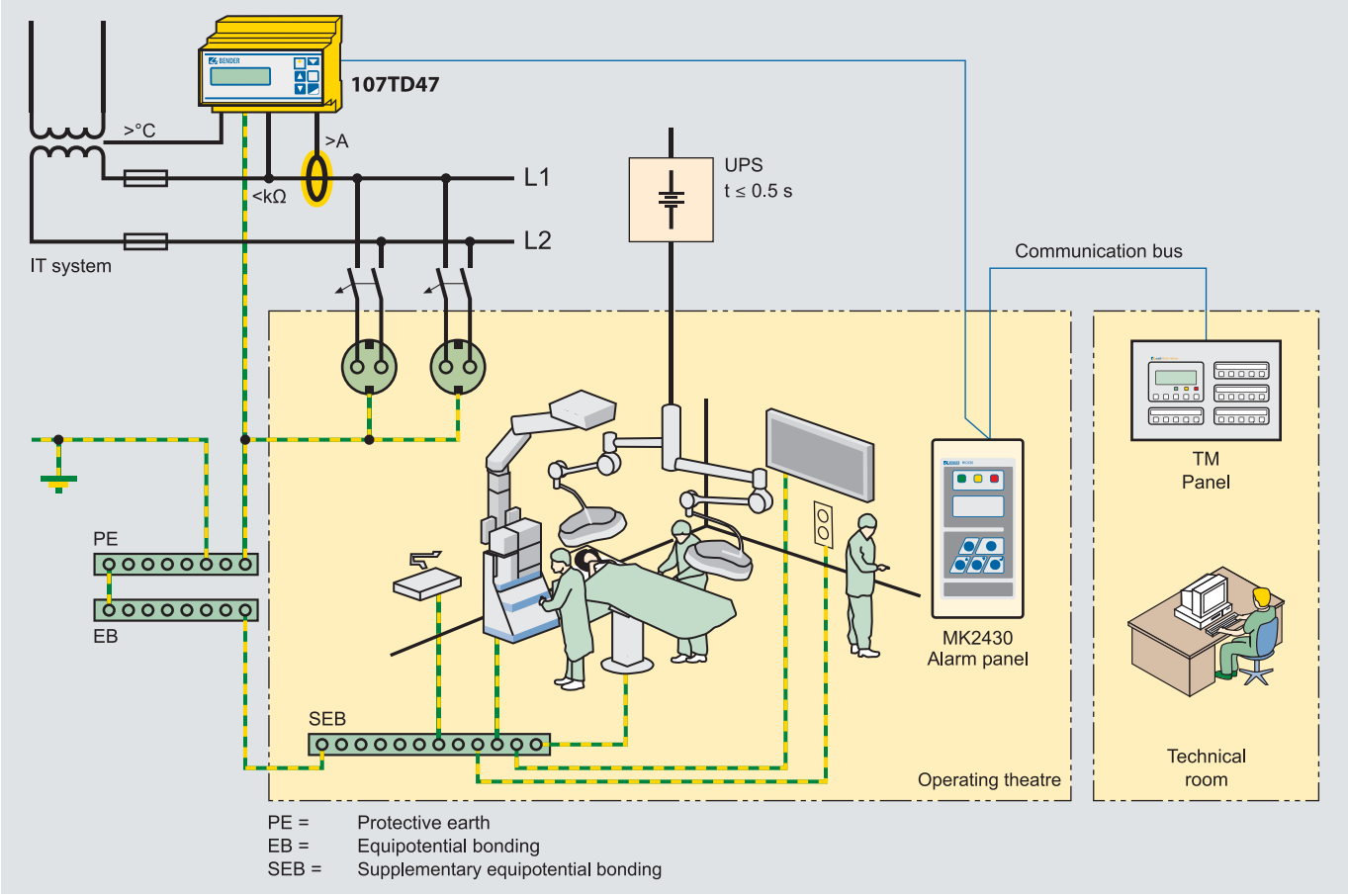
B How do you avoid dangerous overloads?

Load and temperature monitoring

The load an IT system transformer can put at the user's disposal is not endless. Therefore monitoring of overload and transformer temperature according to IEC 60364-7-710 2002-11, section 413.1.5 is required.

- Measurement and indication of excessive heating of the transformer sensed by PTC resistors.
- Measuring and recording of the load current sensed via measuring current transformers.
- Thus, an overload of the system can effectively be signalled and the staff is informed by an optical and acoustical signal, so that the load can be reduced by switching off unnecessary equipment.

In the main feeder of the IT system transformer, overcurrent protective devices are only used for protection against short-circuits, so that an overload does not lead to a power failure.
Consequently the running of the medical technical equipment is not at risk.



IT system with load and temperature monitoring

C How do you inform your staff?

Continuous information about the status of the electrical installation is vital where reliability of supply is of paramount importance.

Remote alarm indicator and test combination MK series

The remote alarm indicator and test combinations of the MK series meet the requirements of IEC 60364-7-710: 2002-11, section 413.1.5, for modern information and communication systems in hospitals in various ways.

Installed in medical locations, the MK series provides audible and visual signals, to immediately inform the staff.

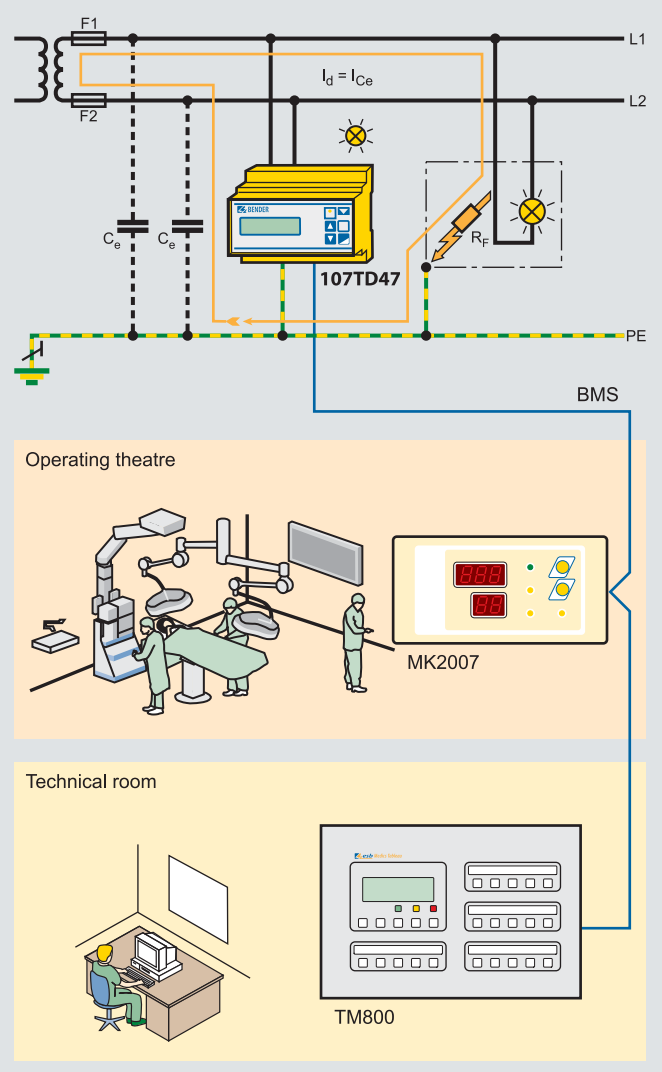
The MK2007 contains a seven-segment-display to indicate the insulation resistance and the load current as well as various alarm LEDs and buttons for "Isometer testing" and "buzzer off".

The LC text display of MK2430 only shows the important information required in a given situation, in this way confusion caused by a flood of information is prevented. As users have the choice of 16 national languages, the MK2430 is perfectly designed for international use.

The MK2430 version allows programming of individual alarm text messages, for eight additional digital inputs from other electrical equipment (e. g. monitoring of medical gases) via the bus.

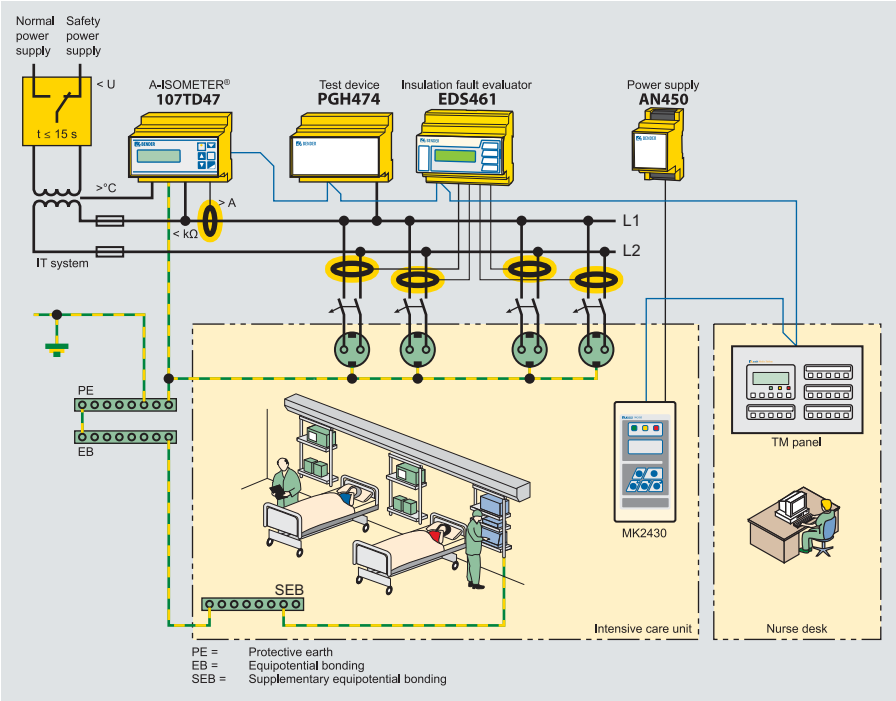
Cost-saving installation

The exchange of information between the A-ISOMETER® 107TD47 and the MK series takes place via a time and cost-saving installation of a two-wire bus. This facilitates the installation of simple parallel indications and information networks.



Staff information with MK2007

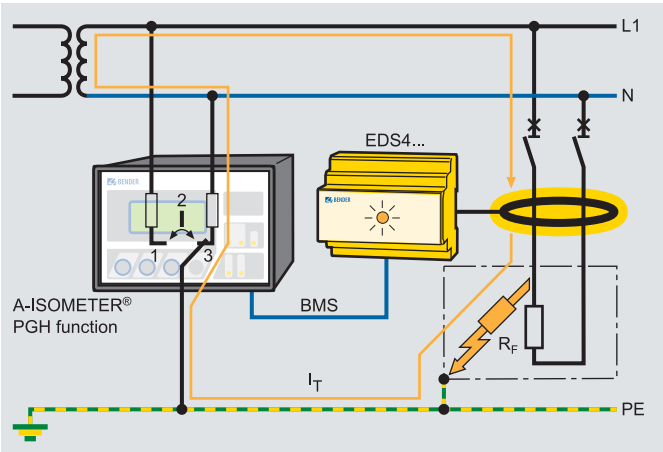
D What else can you do for increased safety? Insulation fault location for intensive care units



EDS461 insulation fault location system applied in an intensive care unit

Insulation fault location in IT systems with the EDS461 system

In medical locations, IT systems with insulation monitoring are intended to supply medical electrical equipment. That ensures reliable power supply, even when a first fault occurs. But sometimes the insulation monitoring device is not sufficient for fast localisation and elimination of the insulation fault. Particularly in the view of the variety of electrical equipment (e. g. socket outlet circuits) used in intensive care units, insulation fault location is disruptive and costly in terms of time and money. The EDS461 insulation fault location system is the modular solution for this problem. It facilitates precise localisation of insulation faults without disruption to the operation of the power system.



Function principle of the EDS461 system

Advantages:

- Insulation fault location during operation
- Fast localisation of faulty circuits
- Reduced maintenance costs
- Central indication via LC text display at remote alarm indicator and operator panel

System functions:

- Indication of faulty branch circuits
- Easily retrofitting with existing installations due to the modular design
- Measuring current transformers in different sizes and designs
- Up to 708 sub circuits can be monitored
- Communication via two-wire connection
- Universally applicable for all IT systems

Function principle:

The EDS461 system works in combination with a central insulation monitoring device, e. g. an A-ISOMETER®, 107TD47. After an alarm message the EDS461 system activates automatically the fault location. A test device generates a test signal for a defined period of time. Its amplitude and duration are limited. The signal flows via the location of the insulation fault and through all measuring current transformers within the insulation fault path. The EDS461 system scans all measuring current transformers.

The test signal is detected by the current transformers and evaluated by the electronics of the EDS461 system. The EDS461 with its LEDs or the central control and indicating device provides fault location information.

D What else can you do for increased safety? Residual current monitoring for TN-S systems

TN-S systems: advance information with RCM and RCMS

In order to avoid leakage currents, the IEC 60364-7-710 recommends the installation of the TN-S system (five conductors) downstream of the main distribution board of the building. This standard also recommends to monitor the system in order to ensure a high insulation level of all conductors.

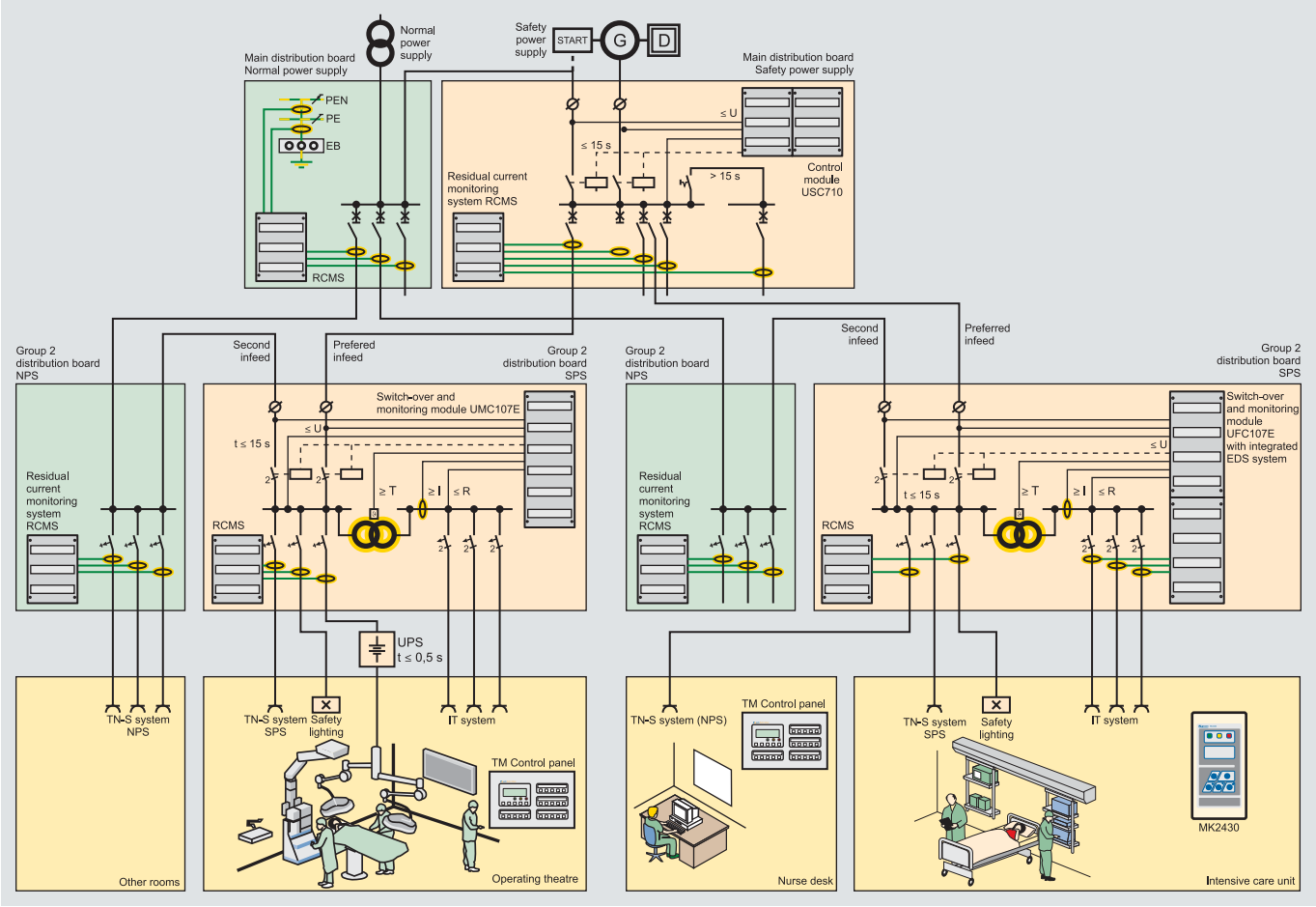
For fulfilling the task of monitoring, the use of RCM (residual current monitors) respectively RCMS (residual current monitoring systems), which detect and indicate fault currents at an early stage instead of unintentional switching off, has proved to be successful.

According to IEC 60364-7-710: 2002-11, the use of the TN-S system (earthed system) in medical Group 2 locations is restricted to the supply of:

- Circuits for the supply of operating tables
- Circuits for X-ray units
- Circuits for large equipment with a rated power greater than 5 kVA
- Circuits for non-critical electrical equipment (non life support)

Advantages:

- Prewarning before unexpected interruptions occur, prevention of fire risks and damage to property
- Convenient monitoring of the electrical installation from a central control room
- Adjustment to the system ambient conditions by individual adjustable response values



RCMS system in a hospital
NPS = Normal power supply – SPS = Safety power supply

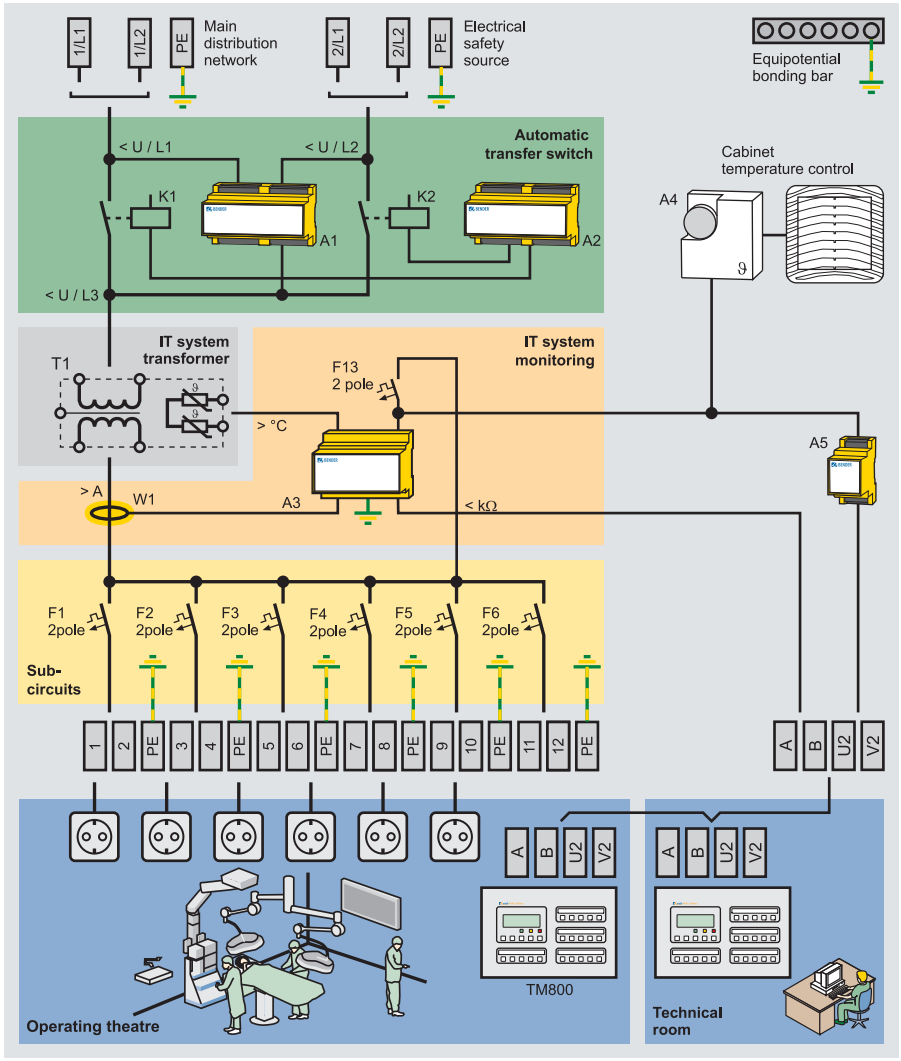
E How do you avoid dangers in case of public electricity supply failure?

Due to the vital importance of electrical safety in hospitals, healthcare facilities mostly have at least two independent sources of power supply at their disposal (e. g. public electricity supply, generators, UPS). In this way, power failures of the public electricity supply do not lead to a failure of medical electrical equipment that exposes patients to danger.

According to IEC 60364-7-710: 2002-11, section 313, in medical locations, the distribution system should be designed and installed to facilitate the automatic changeover from the main distribution system to the electrical safety power source feeding essential loads.

IEC 60364-7-710, section 556.5.2.1.1: In medical locations, a power supply for safety services is required, which, in case of a failure of the normal power supply source, shall be energised to feed the equipment with electrical energy for a defined period of time and within a predetermined changeover period.

Depending on their medical tasks, Group 1 and Group 2 medical locations have different needs concerning the permitted changeover period and the tolerable duration of a power interruption.



Power supply for Group 2 medical locations

Power supply sources with…

… a changeover period < 0.5 s

- Luminaires of operating theatre tables and other essential luminaires for a minimum period of 3 hours.

… a changeover period < 15 s

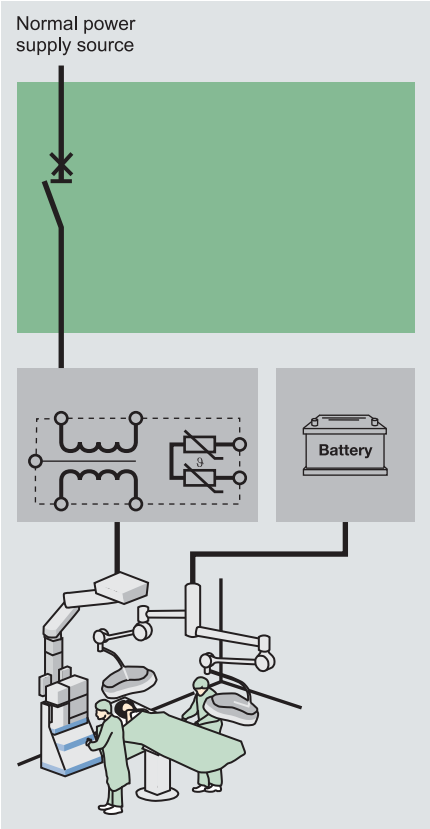
- Safety lighting
- Medical electrical equipment in Group 2 medical locations
- Equipment of medical gas supply
- Fire detection

… a changeover period > 15 s

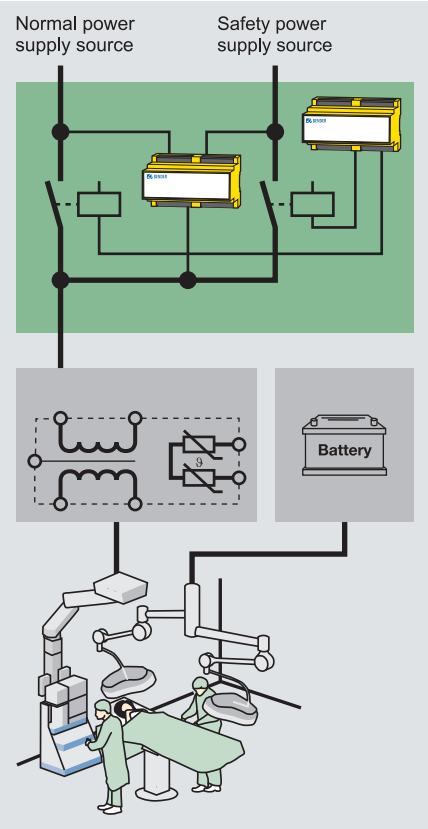
- Equipment essential for maintaining hospital services (e. g. cooling equipment, cooking equipment, sterilisation equipment)

E

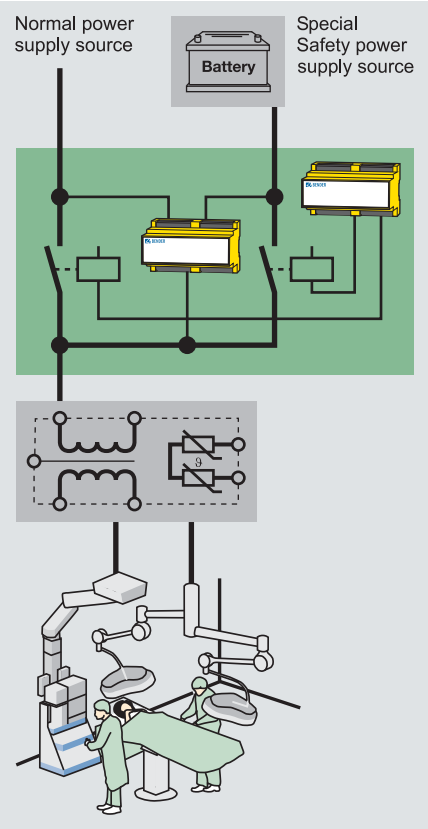
Three supply options for IT systems:



IT system with one supply cable



IT system with two supply cables



IT system with two supply cables and a special safety power supply source

1. One supply cable
The IT system is supplied by only one supply cable. If the supply cable is interrupted, a complete power failure is tolerated. (This system is not permitted in Germany and Austria).

2. Two supply cables
The IT system is supplied by two supply cables. In the event the first cable fails, automatic transfer to the second cable, takes place.

3. Two supply cables but with a safety power source
The second cable derives the power from a special safety power supply source. That ensures the supply of life-support equipment, independently from the external and internal power supply.

In case, the UMC107E changeover and monitoring module is installed, the following tasks are carried out:

- Voltage monitoring of the preferred and second supply
- Transfer to the second supply if the voltage at one or several line conductors drops by more than 10 % of the nominal voltage
- Monitoring of the switching elements
- Automatic return to the preferred supply on recovery of its voltage
- Insulation, load and temperature monitoring of the IT system

Additionally, the technical staff has optical and acoustical status information of the medical IT system by MK… remote alarm indicators and test combinations.

Products & technical details

A-ISOMETER® 107TD47 –
Insulation-, load- and temperature monitoring device

A-ISOMETER® 107TD47

The A-ISOMETER® 107TD47 monitors the insulation resistance of unearthed power supply systems (IT systems) in medical locations in accordance with IEC 60364-7-710: 2002-11 and DIN VDE 0100-710 (VDE 0100-710): 2002-11.
In addition, the IT system transformer is monitored for overload and temperature.

Features:

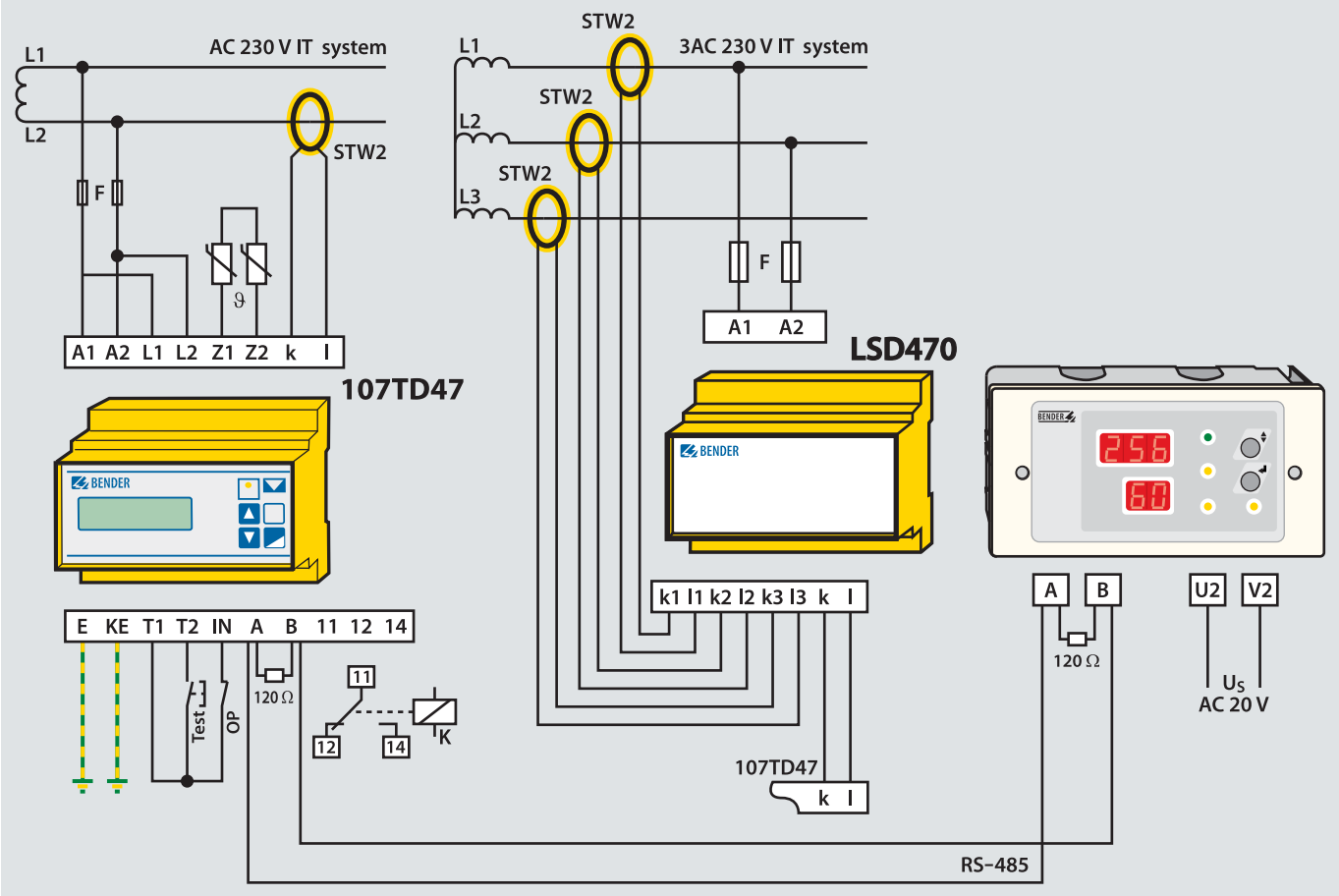
- Compact multifunction device for monitoring IT systems
- Insulation resistance alarm adjustable 50…500 kΩ
- Transformer load current adjustable 5…50 A
- Transformer temperature
- AMP measuring principle to ensure safe monitoring of the insulation resistance in accordance with IEC 61557-8 even in unearthed IT AC systems with galvanically connected DC circuits
- Increased safety due to continuous monitoring of the measuring connections such as:
  - system and PE connections
  - current transformer connection
  - temperature sensor connection
- Simple set-up and clear indications by LC text display and user-friendly menu control
- Two-wire interface for data exchange with MK2430 and MK2007 remote alarm indicators and test combinations

Standards:

The 107TD47 series complies with the requirements of the standards and regulations for electrical installations: DIN EN 61557-8 (VDE 0413-8): 2007-12, EN 61557-8: 2007, IEC 61557-8: 2007-01 + Corrigendum 2007-05, DIN VDE 0100-710 (VDE 0100-710): 2002-11 and IEC 60364-7- 710: 2002-11.

Technical data

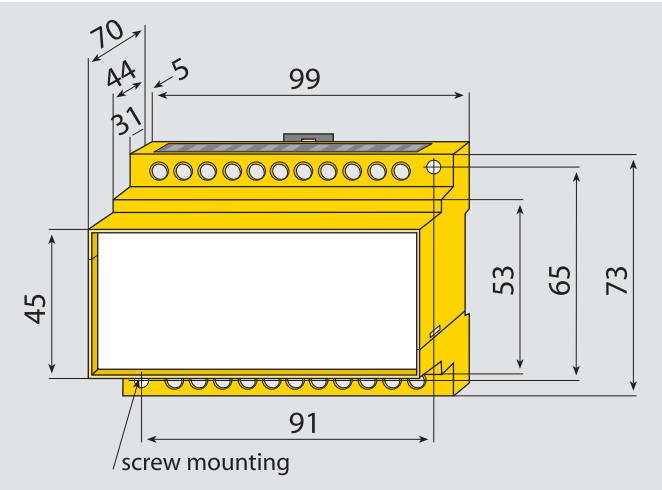
Rated impulse withstand voltage	4 kV
Supply voltage U_S	AC 50…60 Hz / 230 V
Insulation monitoring	
System to be monitored	AC 50…400 Hz / 0…264 V
Response value, adjustable	50…500 kΩ
Measuring time at 1 µF	≤ 3 s
Measuring voltage U_m	12 V
Measuring current I_m	max. 50 µA
Internal resistance R_i	≥ 240 kΩ
Impedance Z_i	≥ 200 kΩ
Load current monitoring	
Response value, adjustable	5…50 A
Temperature monitoring	
Response value	4 kΩ
PTC resistors acc. to DIN 44081	max. 6 in series
Interface	
Serial interface	RS-485 (BMS protocol)
Wire length	≤ 1200 m
Switching components	1 changeover contact
Test of the Electromagnetic Compatibility (EMC)	
Interference emission	acc. to EN 61000-6-2
Emissions acc. to EN 55011 / CISPR11	class B
Ambient temperature during operation	- 10 °C…+ 55 °C



Wiring diagram 107TD47

Ordering details:		
Type	**Supply voltage U_S**	**Art. No.**
107TD47	AC 230 V	B 9201 6003
107TD47-133	AC 127 V	B 9201 6004

Accessories:		
LSD470	3ph-adapter for load monitoring	B 9201 6001
STW2	current transformer	B 942 709
ES0107	temperature sensor	B 924 186



Dimension diagram 107TD47

MK2007 –
Remote alarm indicator and test combination

MK2007

The MK2007 remote alarm indicator and test combination duplicates fault, alarm and operating messages of monitoring devices in accordance with IEC 60364- 7-710: 2002-11 and DIN VDE 0100-710 (VDE 0100-710): 2002-11. The insulation resistance in kΩ (3 digits) and the percentage value of the load current (2 digits) are clearly indicated by a seven-segment display. The MK2430 / MK2007 remote alarm indicators and test combinations, the A-ISOMETER® 107TD47 and the UMC107 changeover / monitoring module, are connected via a two-wire connection.

Features:

- Clear digital display for the indication of the insulation resistance and the load current values
- Time and cost-saving installation via a two-wire connection
- Easy-to-clean lexan front foil
- Simple parallel indication through two-wire interface

Technical data:

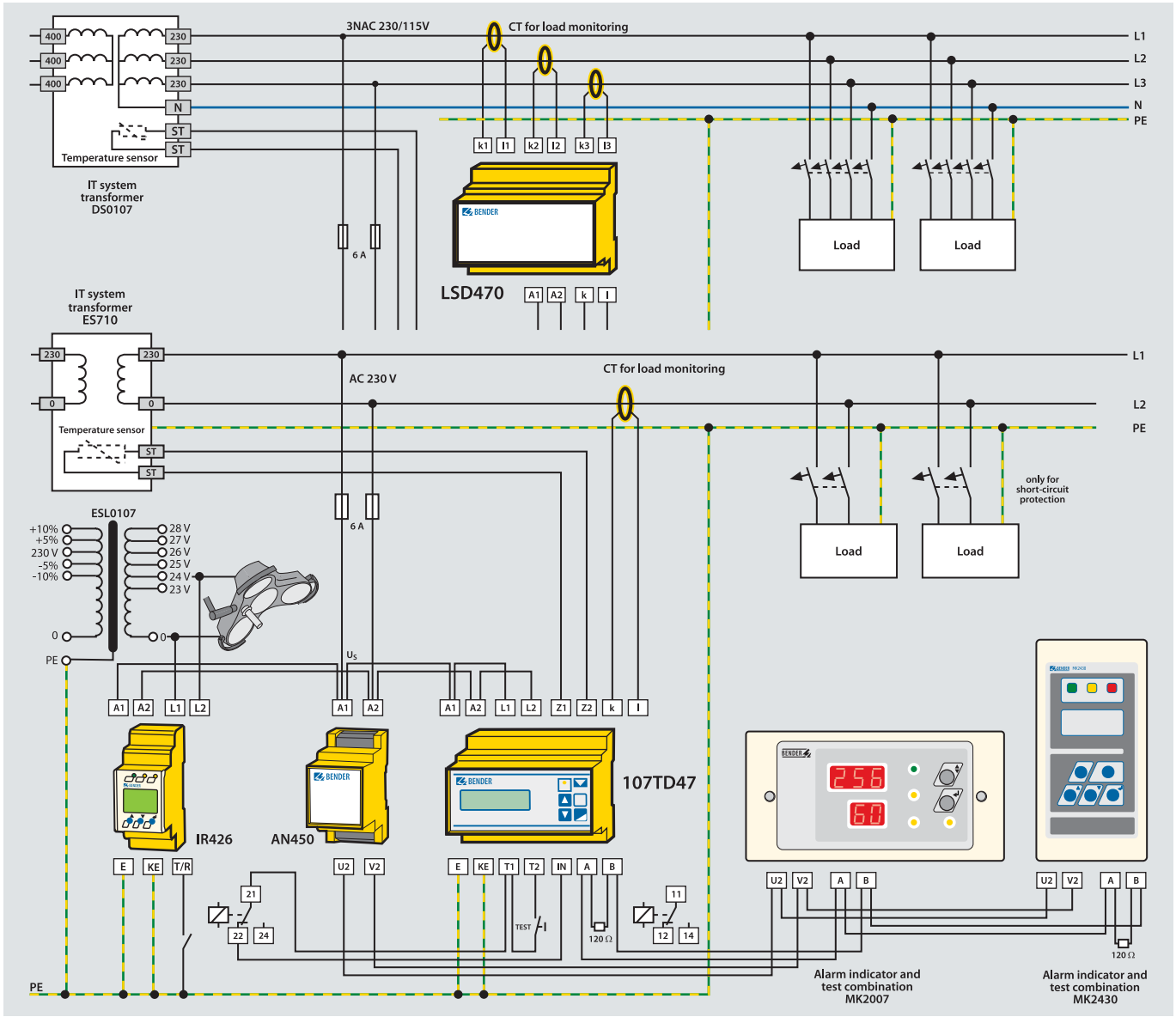
Supply voltage U_S	AC / DC 40. . .60 Hz / 12. . .28 V
Seven-segment display	12 mm high
Insulation resistance	3 digits
Load current	2 digits
Audible buzzer	one

Inputs / outputs:

Serial interface	RS-485 (BMS protocol)
Wire length	≤ 1200 m
Power On and alarm LEDs to signal	operation, overload, overtemperature, insulation fault
Buttons	test insulation monitor, mute

Test of the Electromagnetic Compatibility (EMC):

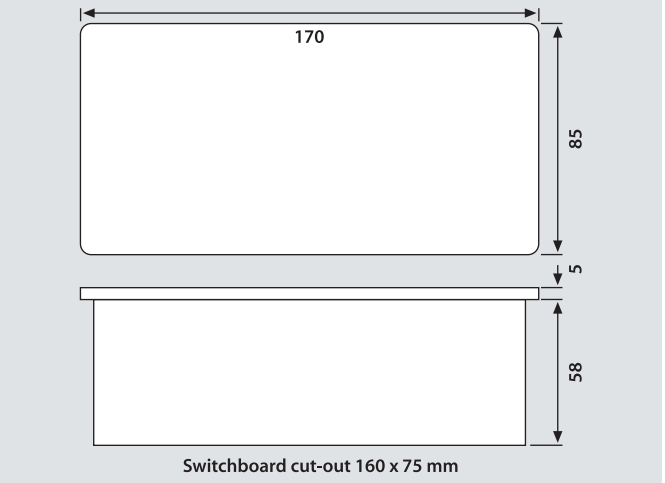
Interference emission acc.	to EN 61000-6-2
Emissions acc. to EN 55011 / CISPR11	Class B
Ambient temperature during operation	- 5 °C. . .+ 55 °C



IT system with insulation, load and temperature monitoring device 107TD47 as well as remote alarm indicator and test combination MK2007 / MK2430

Ordering details:

Type	Description	Art. No.
MK2007CBMT	front plate English text	B 923 801
MK2007CBM	front plate symbols	B 923 813
AN450	power supply	B 924 201



Dimension diagram MK

MK2430 –
Remote alarm indicator and test combination

MK2430

The remote alarm indicator and test combination duplicates fault, alarm and operating messages of monitoring devices in accordance with IEC 60364-7-710: 2002-11 and DIN VDE 0100-710 (VDE 0100-710): 2002- 11. The LC text display provides medical staff with clear and concise information. Additional information for the technical staff can be retrieved by pressing a special button. A two-wire connection between the MK2430 / MK2007 remote alarm indicators and the changeover and monitoring modules allows a time and cost-saving installation.

Typical applications:

- Intensive care unit with several IT systems and EDS
- Operating theatres
- Industrial applications with EDS / RCMS

Features:

- Comprehensive information: suitable for utilisation with MEDICS, several IT systems or EDS / RCMS systems
- Programmable display of customised alarms
- Signalling of medical gases messages in compliance with the relavant standards
- Display of test possibilities for several IT systems with evaluation and display of results
- Display of messages from UPS systems
- Individual texts for better information
- The complete list of languages for message texts supported: D, GB, F, I, E, P, BR, NL, N, S, FIN, DK, PL, H, CZ, SLO, CRO, SCG, TR, ID
- Display of messages from EDS / RCMS systems
- Standard configuration for systems like 4 IT systems with EDS
- Easy-to-clean lexan front foil
- Simple parallel indication by two-wire connection
- Available for flush-mounting, surface-mounting and cable-duct mounting

Technical data:

Supply voltage U_S	AC 40…60 Hz / 18…28 V / DC 19…30 V
LC display, illuminated	4 x 20 characters

Inputs (MK2430-11):

Digital inputs	12
Voltage range (high)	15 V…30 V AC / DC
Voltage range (low)	0 V…2 V AC / DC

Interfaces:

Serial interface	RS-485 (BMS protocol)
Wire length	≤ 1200 m
USB	V 2.0 / V 1.1

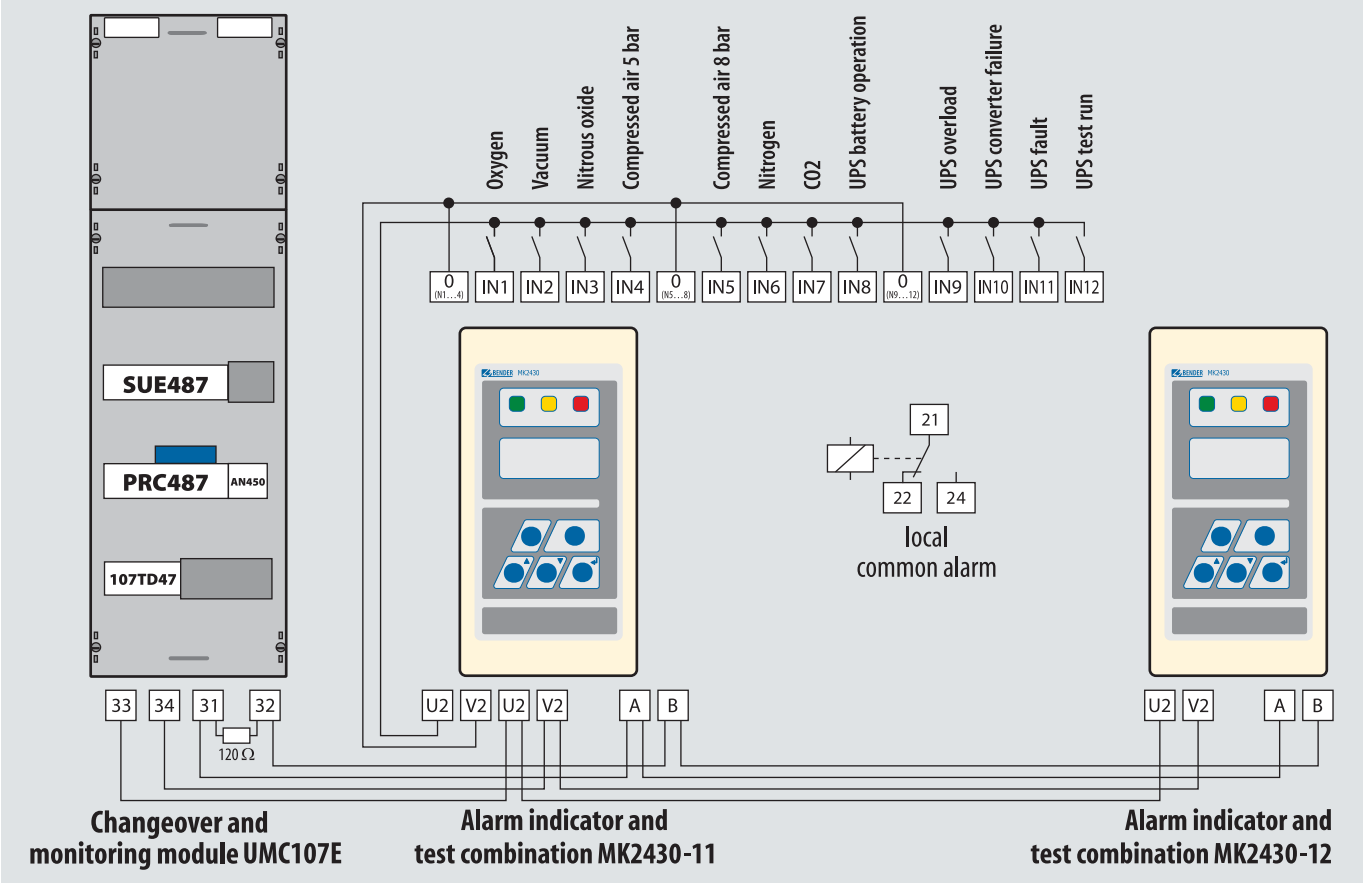
Test of the Electromagnetic Compatibility (EMC):

EMC immunity	to EN 61000-6-2
EMC emission	to EN 61000-6-4
Ambient temperature during operation	- 5 °C…+ 55 °C

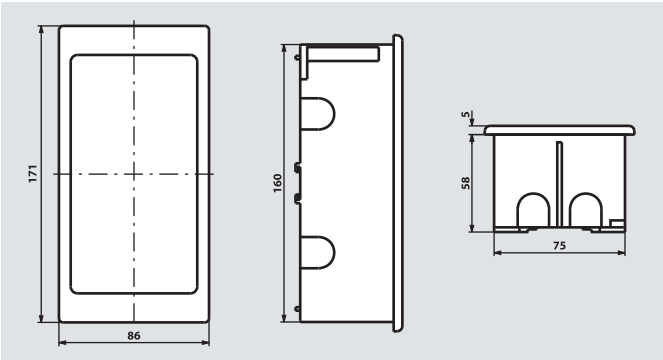
Relay (MK2430-11):

Switching elements	1 changeover contact
Operating principle, adjustable	N / C operation
Rated operational voltage	24 V AC / DC
Function	programmable (test, fault, device failure)

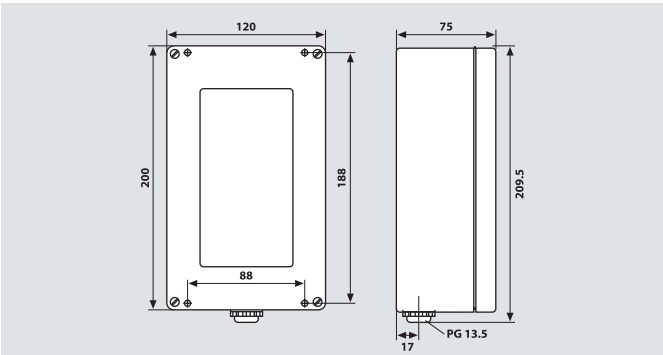
Programming software	TMK-Set V3.x optional



UMC107E change over and monitoring module, MK2430-12 and MK2430-11 remote alarm indicator and test combination with 12 digital inputs for the communication of additional data



Dimension diagram – Flush-mounting version



Dimension diagram – Surface-mounting version

Ordering details:		
Type	**Description**	**Item no.**
MK2430-11	Remote alarm indicator and test combination, 12 digital inputs	B 9510 0001
MK2430-12	Remote alarm indicator and test combination	B 9510 0002
MK2430A-11	As MK2430-11 but with surface-mounting enclosure	B 9510 0005
MK2430A-12	As MK2430-12 but with surface-mounting enclosure	B 9510 0006
MK24… cavity mounting kit		B 923 711
MK24… panel mounting kit		B 923 780
MK2430 mounting bracket kit	for flush-mounting enclosure. For snap-on mounting only	B 9510 1000
Flush-mounting backbox	included in scope of supply	B 923 710
AN450	Power supply	B 924 201

TM –
Alarm indicator and operator panel

TM-series – Alarm and Control Panel

TM features:

- The large, backlit text display indicates user-programable alarm text messages and additional information
- Three LEDs provide normal (green), warning (yellow), and alarm (red) indication
- The internal Bus interface allows the connection of Bender BMS bus components
- Multiple TM control panels may be connected in parallel to the external BMS-Bus interface
- Relay outputs, digital inputs and output options provide ease of connection to other systems
- Alarm / warning messages are automatically stored with date and time stamp. 1000 text messages may be stored in memory; they may be accessed via the function keys or PC software
- Five function illuminated key panel modules allow simple operation and set-up of the TM
- The alarm/warning/status text messages may be programmed via USB interface and PC software
- Illuminated key panel modules and special purpose modules can be combined individually to meet costumers' needs
- Flush and surface mounted enclosures are available.

Alarm indicator and operator panels

Surgeon control panels

Variety of applications

- Healthcare facilities
- Industrial, residential and functional buildings

Alarm indicator and operator panels

- Text display
- Membrane surface, anti bacterial

Surgeon control panels

- Multifunctional
- Stainless steel frame and fascia

TM-series w / digital timer

TM-series w / digital timer, analogue clock and medical gases alarm panel

FM-series w / digital timer and clock

Illuminated door signs

SCP Surgeons control panel, stainless steel series

Touch Panel

SCP-TM, Surgeons control panel, TM series w / additonal x-ray film viewer section

ES710 –
Single-phase isolating transformer

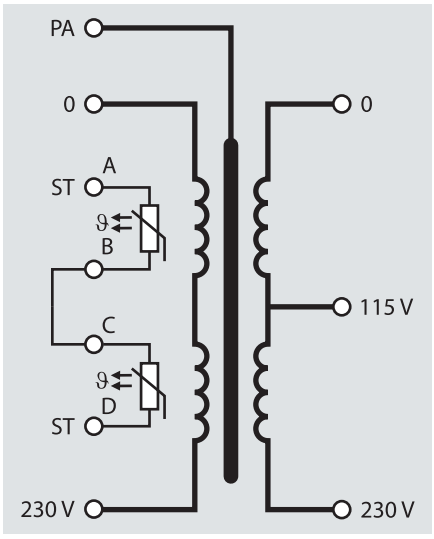
ES710

Isolating transformers of the ES710 series for the power supply of single-phase IT systems in accordance with IEC 60364-7- 710: 2002-11 and DIN VDE 0100-710 (VDE 0100-710): 2002-11. A static screen is installed between the primary and secondary windings, which is connected to an isolated terminal. The mounting angles are isolated from the transformer core.

Features:

- The single-phase isolating transformers meet the requirements of the following standards: IEC 60364-7-710: 2002-11, DIN VDE 0100-710: 2002-11, IEC 61558-1: 1997, DIN EN 61558-1 (VDE 0570-1): 1998 IEC 61558-2-15: 1999, DIN EN 61558-2-15 (VDE 0570-2-15): 2001
- Rated power 3.15…10 kVA
- Built-in temperature sensors
- Low noise level < 35 dB (A)
- High overload capability
- VDE ENEC mark

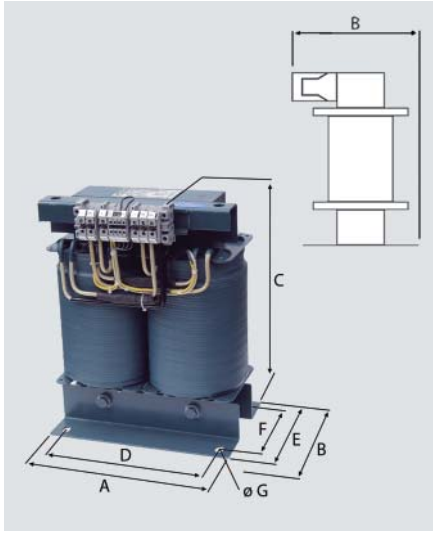
Type series



Wiring diagram ES710

Technical data:

Primary voltage	AC 230 V
Secondary voltage	AC 230 V
Frequency	50…60 Hz
Operating mode	continuous operation
Insulation class	B
Max. ambient temperature	40 °C
Protection class	IP 00
Connections	separate terminal block
Protection class	Class I
PTC resistor	1 resistor per transformer winding



Dimension diagram

Dimensions, weight, ordering details

Nominal power kVA	Measures in mm A	B	C	D	E	F	G	Total weight kg	Art. No.
3.15	240	230	325	200	200	160	11	49	B 924 211
4	280	220	370	240	190	150	11	59	B 924 212
5	280	230	370	240	200	160	11	61	B 924 213
6.3	280	245	370	240	215	175	11	65	B 924 214
8	280	260	370	240	230	190	11	74	B 924 215
10	320	280	420	270	233	193	13	85	B 924 216

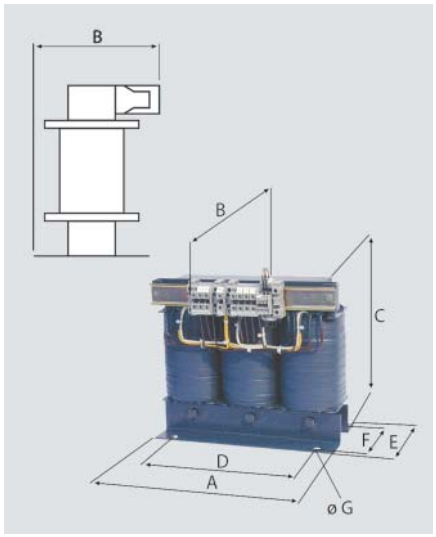
DS0107 –
Three-phase isolating transformer

DS0107

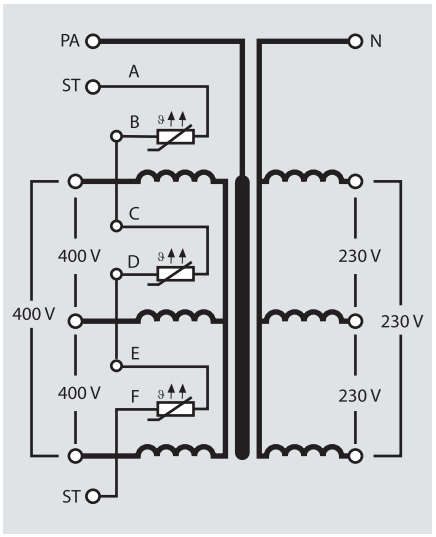
Isolating transformers of the DS0107 series for the power supply of three-phase IT systems in accordance with IEC 60364-7-710: 2002-11 and DIN VDE 0100-710 (VDE 0100 Teil 710): 2002-11. A static screen is installed between the primary and secondary windings, which is connected to an isolated terminal. The mounting angles are isolated from the transformer core.

Features:

- The three-phase isolating transformers meet the requirements of the following standards: IEC 60364-7-710: 2002-11, DIN VDE 0100-710: 2002-11, IEC 61558-1: 1997, DIN EN 61558-1 (VDE 0570-1): 1998 IEC 61558-2-15: 1999, DIN EN 61558-2-15 (VDE 0570-2-15): 2001
- Rated power 3.15…10 kVA
- Built-in temperature sensors



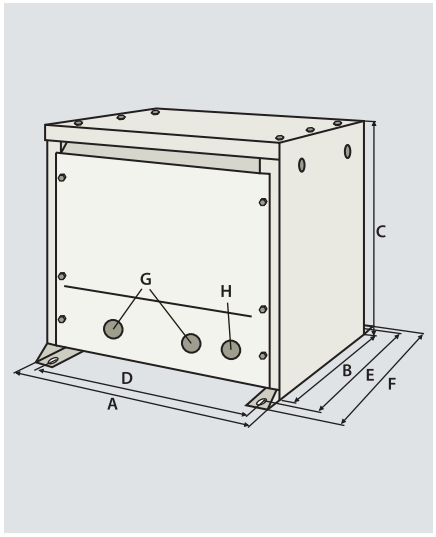
Dimension diagram



Wiring diagram DS0107

Technical data:

Primary voltage	3AC 400 V
Secondary voltage	3NAC 230 / 127 V
Frequency	50…60 Hz
Operating mode	continuous operation
Insulation class	B
Max. ambient temperature	40 °C
Protection class	IP 00
Connections	separate terminal block
Protection class	Class I
PTC resistor	1 resistor per transformer winding



Dimension diagram

Dimensions, weight, ordering details

Nominal power kVA	Measures in mm A	B	C	D	E	F	G	Total weight kg	Art.-No.
3.15	360	210	325	310	170	135	11	63	B 924 106
4	360	225	325	310	185	150	11	70	B 924 121
5	360	240	325	310	200	165	11	77	B 924 112
6.3	420	230	370	370	200	160	11	97	B 924 107
8	420	245	370	370	215	175	11	107	B 924 628
10	420	260	370	370	230	190	11	130	B 924 672

Enclosures for transformers

Type	Measures in mm A	B	C	D	E	F	G	H	Total weight kg	Art.-No.
ESDS0107-1	430	380	500	385	420	450	ø 37.5	ø 20.5	16	B 924 673[1]
ESDS0107-2	600	420	490	555	460	490	ø 50.5	ø 20.5	23	B 924 674[2]

[1] for ES710 / 3150…ES710 / 10000 and DS0107 / 3150…DS0107 / 5000
[2] for DS0107 / 6300…DS0107 / 10000

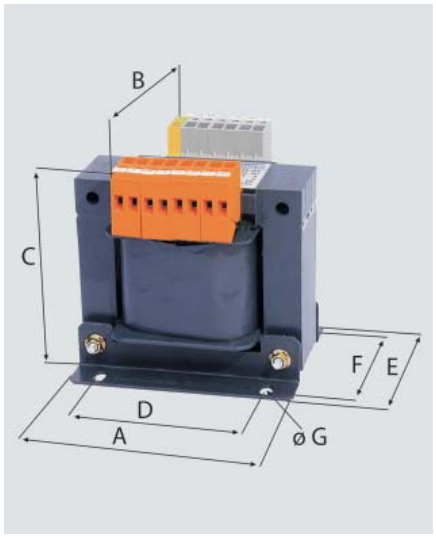
ESL0107 –
Isolating transformer for operating theatre lamps

ESL0107

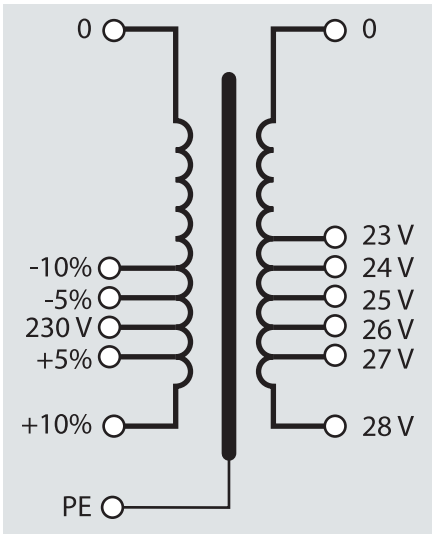
Isolating transformers of the ESL0107 series for the power supply of single-phase IT systems for operating theatre lamps in accordance with IEC 60364-7- 710: 2002-11 and DIN VDE 0100-710: 2002-11. A static screen is installed between the primary and secondary windings, which is connected to an isolated terminal. The mounting angles are isolated from the transformer core.

Features:

- The single-phase isolating transformers meet the requirements of the following standards: IEC 60364-7-710: 2002-11, DIN VDE 0100-710: 2002-11, IEC 61558-1: 1997, DIN EN 61558-1 (VDE 0570-1): 1998, DIN EN 61558-1: 1998-07 (IEC 61558-1: 1997), DIN EN 61558-2-6: 1998-07 (IEC 61558-2-6: 1997)



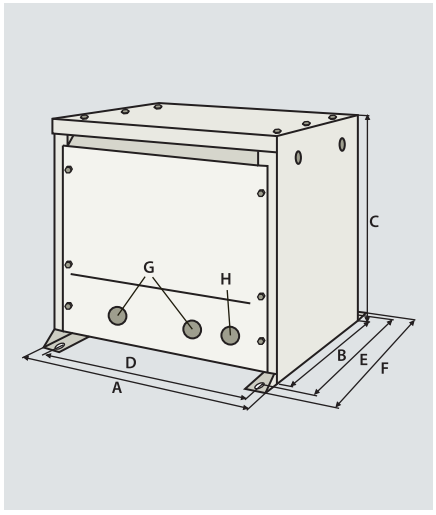
Dimension diagram ESL0107



Wiring diagram ESL0107

Technical data:

Primary voltage	230 V, - 5 %, - 10 %, + 5 %, + 10 %
Secondary voltage	AC 23, 24, 25, 26, 27, 28 V
Frequency	50 . . . 60 Hz
Operating mode	continuous operation
Insulation class	B
Max. ambient temperature	40 °C
Protection class	IP 00
Connections	separate terminal blocks
Protection class	Class I



Dimensions diagram enclosure

Dimensions, weight, ordering details

Nominal power kVA	Measures in mm A	B	C	D	E	F	G	Total weight kg	Art. No.
0.12	96	96	105	84	82	65	5,5	2,3	B 924 632
0.16	96	106	105	84	92	75	5,5	2,8	B 924 633
0.28	120	102	125	90	92	74	5,5	4	B 924 634
0.4	120	134	125	90	124	90	5,5	6,7	B 924 637
0.63	150	130	150	122	130	108	6,5	9,7	B 924 638
1	174	145	175	135	150	120	6,5	16,1	B 924 639

Enclosures for transformers:

Type	Measures in mm A	B	C	D	E	F	H	I	Total weight kg	Art. No.
ESL0107-0	240	280	220	220	300	320	ø 29	ø 20.5	3.5	B 924 204

A-ISOMETER® IR426-D47 –
Insulation monitoring device for operating theatre lamps

A-ISOMETER® IR426-D47

The A-ISOMETER® IR426-D47 monitors the insulation resistance of IT systems (isolated power) for operating theatre lamps.

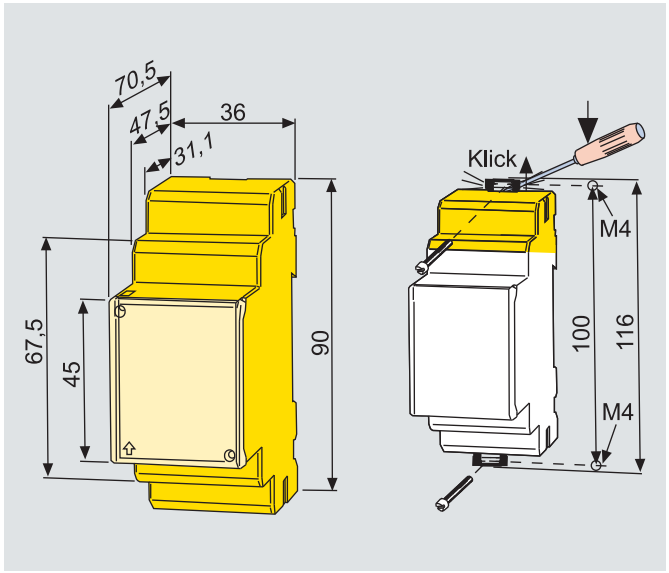
Features:

- For DC / AC IT systems 0…132 V
- Response value 10…200 kΩ
- Built-in test button
- Built-in POWER-ON and alarm LED
- Two alarm relays with changeover contacts

Standards:

The A-ISOMETER® IR426-D47 complies with IEC 61557-8: 2001-01 + Corrigendum 2007-05, DIN EN 61557-8 (VDE 0413-8): 2001-12, ASTM F 1669M-96 (2002). When installing the device, the safety instructions supplied with the equipment must be observed!

Ordering details		
Type	**Supply voltage U_S**	**Art. No.**
IR426-D47-2	DC / AC 70…300 V	B 9101 6307
Mounting clip for screw fixing (1 piece per device)		B 9806 0008



Dimension diagram XM420

Technical data

Insulation coordination acc. to IEC 60664-1 / IEC 60664-3	
Rated insulation voltage	AC 250 V
Rated impulse withstand voltage / contamination level	2.5 kV / III
Voltage range	
Operating range of U_n	DC 0…132 V / AC 42…62 Hz 0…132 V
Supply voltage	
Supply voltage U_S	DC 70…300 V / AC 150…460 Hz 70…300 V
Power consumption	≤ 3 VA
Response value	
Response value R_{an}	10…200 kΩ (50 kΩ)*
Response delay (R_F = 0,5 x R_{an}, C_e = 1 µF)	≤ 3 s
Measuring circuit	
Measuring voltage U_m	± 12 V
Measuring current I_m	≤ 100 µA
Internal DC resistance R_i	≥ 120 kΩ
Impedance Z_i at 50 Hz	≥ 117 kΩ
Admissible extraneous DC voltage	≤ DC 132 V
Admissible system leakage capacitance C_e	≤ 20 µF
Test of the Electromagnetic Compatibility (EMC)	
IEC 61326	
General Data	
Ambient temperature, during operation	- 25 °C…+ 55 °C

* factory setting

EDS461 –
Insulation fault location system

Basically, every EDS461 system consists of the following components: the PGH474 test device, the MK2430 control and indicating device, and one or several EDS461-L-2 evaluators with the accompanying measuring current transformers. Information exchange between the EDS461-L-2 evaluators and the remote alarm indicator and test combination MK2430 takes place via a two wire connection.

EDS461-L-2

EDS461-L-2:
Together with the measuring current transformer the EDS461-L-2 is used to evaluate test current signals generated by the PGH474.
The device subsequently evaluates the signals from all connected measuring current transformers. If the fault current detected by a measuring current transformer exceeds the response value, the respective alarm LED of the LED line and the alarm LED on the EDS461-L-2 light up and the alarm relay switches.
Up to 12 measuring current transformer can be connected to each EDS461-L-2.
All settings within the EDS system are carried out via bus at the remote alarm indicator and test combination MK2430, TM control panel or FTC470XET (see page 35, Communication).

PGH474

PGH474:
After detecting the insulation fault through the insulation monitoring device, insulation fault location can be started automatically or manually. Once the insulation fault test device is started, it produces a defined test current signal limited to approx. 1 mA.

W10/8000

W10/8000:
The measuring current transformer W10/8000 (internal diameter 10 mm) is a highly sensitive current sensor and converts even very small test currents into evaluable signals. Connection to the EDS461 is carried out via two connecting leads.

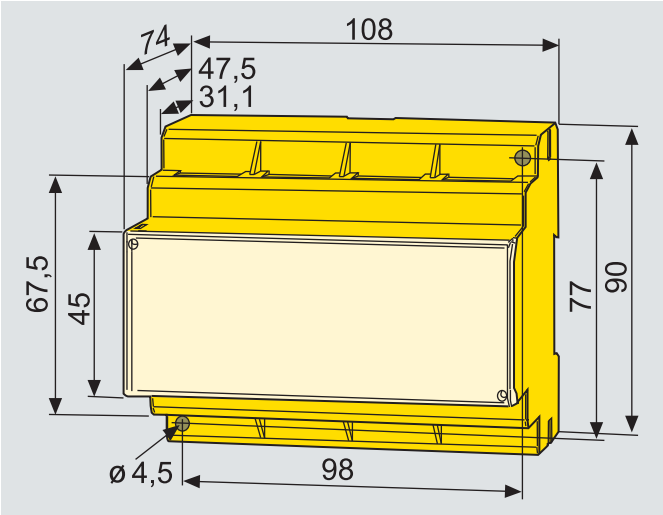
W10/8000-6:
W10/8000-6 contains 6 W10/8000 on a plastic strip for monitoring closely to clipped-on DIN rail circuit breakers.

Standards:

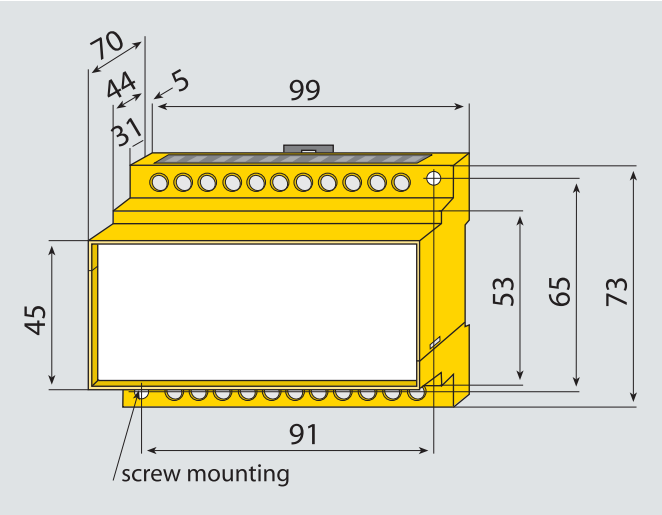
The EDS461 system fulfills the requirements of IEC 61557-9: 1999-09: Electrical safety in low voltage distribution systems up to AC 1000 V and DC 1500 V – Equipment for testing, measuring or monitoring of protective measures – Part 9: Equipment for insulation fault location in IT systems.

Ordering details:

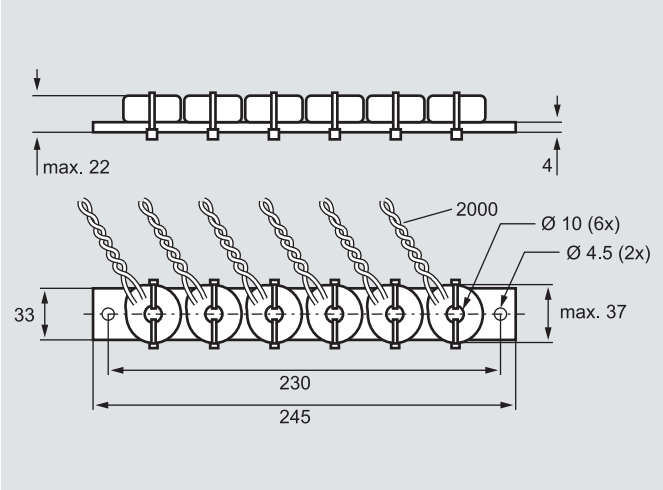
Type	Supply voltage U_S / Description	Art. No.
EDS461-L-2	AC 230 V	B 9108 0008
PGH474	AC 230 V	B 9501 8012
W10/8000	CT for EDS461, internal diameter 10 mm	B 911 759
W10/8000-6	CTs for EDS461, 6 fold, internal diameter 10 mm	B 911 900



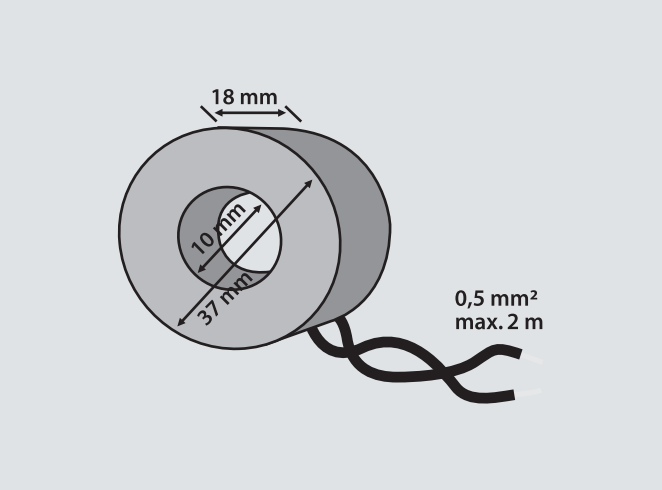
Dimension diagram EDS461-L-2



Dimension diagram PGH474

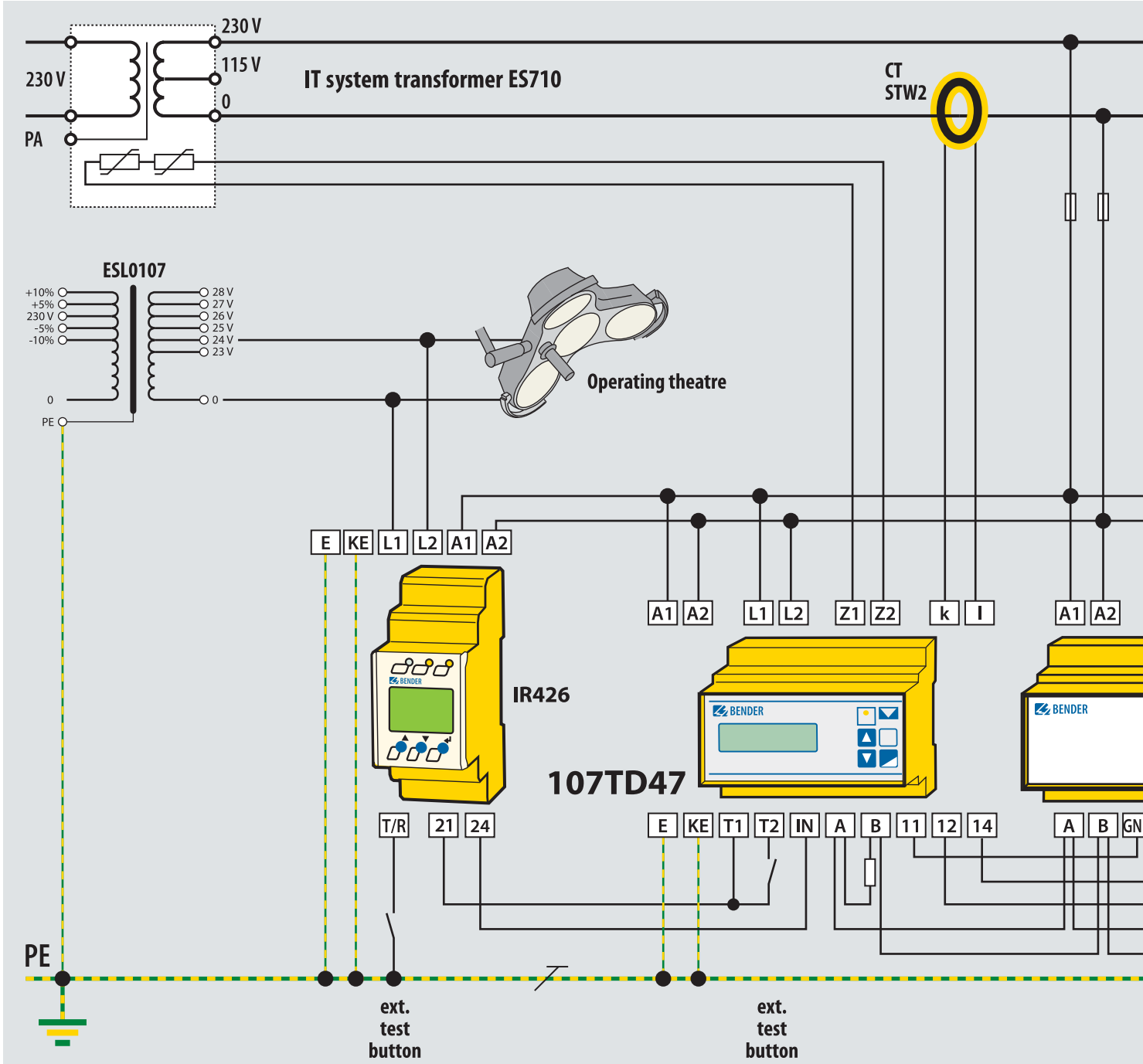


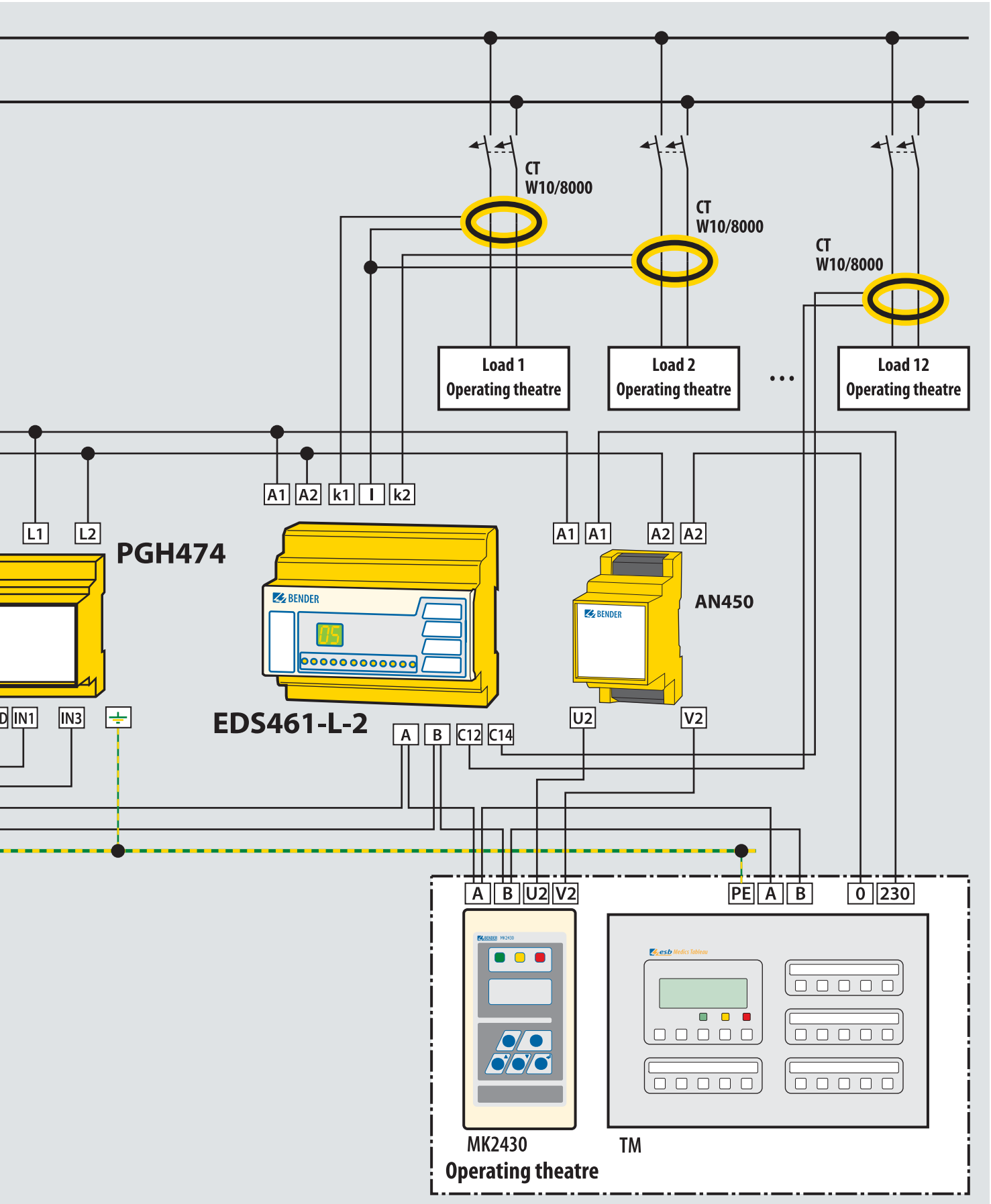
Dimension diagram W10/8000-6



Dimension diagram W10/8000

Wiring diagram – Insulation fault location system




CT
W10/8000
CT
W10/8000
CT
W10/8000
Load 1
Operating theatre
Load 2
Operating theatre
Load 12
Operating theatre
L1
L2
A1
A2
k1
I
k2
PGH474
EDS461-L-2
A1
A1
A2
A2
AN450
IN1
IN3
A
B
C12
C14
U2
V2
A
B
U2
V2
PE
A
B
0
230
MK2430
TM
Operating theatre

UMC107E –
Changeover and monitoring module

UMC107E

The factory-prefabricated UMC107E changeover and monitoring modules are used for the power supply in Group 2 medical locations. Due to the short changeover time of < 0.5 s they are universally applicable. The fault, alarm and operating messages are indicated on the LC text display. The alarm text messages are transmitted to the remote alarm indicators and test combinations MK2430 or TM alarm indicator and operator panel via a two-wire connection. For common alarm, two voltage-free contacts can be used. All power conductors connection are wired short circuit and earth fault prove in accordance to DIN VDE 0100-520. The modules can be installed onto customary rack systems (1 field 6 rows).

Features

The modules contain all the monitoring devices required by the standard IEC 60364-7-710: 2002-11, such as:

- Voltage monitoring and changeover
- Insulation monitoring
- Transformer load and temperature monitoring

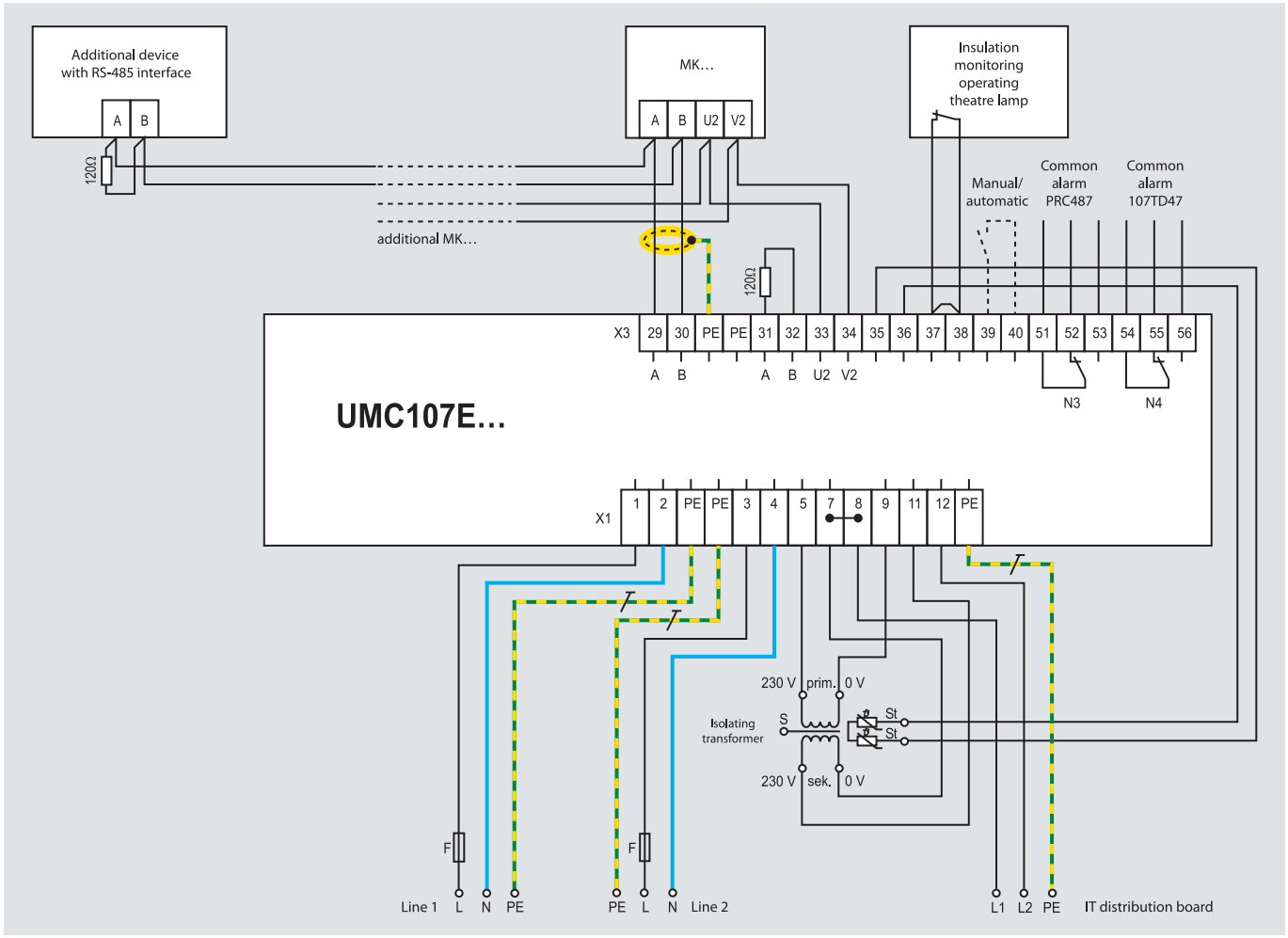
Standards and tests

The UMC107… series complies with the requirements of the standards and regulations for electrical installations: DIN EN 61557-8 (VDE 0413-8): 2007-12, EN 61557- 8: 2007, IEC 61557-8: 2007-01 + Corrigendum 2007-05, DIN EN 60439-1 (VDE 0660-500): 2000-08, DIN VDE 0200-557 (VDE 0100-557): 2007-06, DIN VDE 0100-520 (VDE 0100-520): 2003-06, DIN VDE 0100-710 (VDE 0100-710): 2002-11, DIN VDE 0100-718 (VDE0100-718): 2005-10 and IEC60364-7-710: 2002-11.

An optional test has been carried out on the UMC107E series by TÜV Süddeutschland. The test report confirms the fulfilment of all requirements of the above-mentioned standards and regulations.

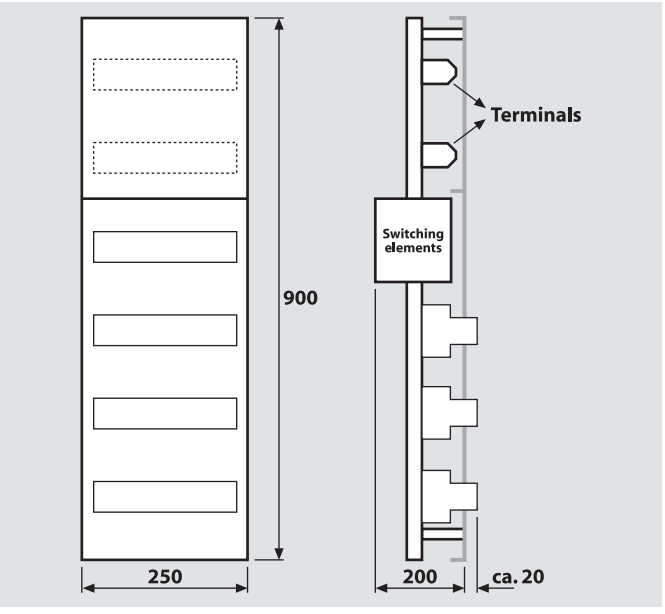
Technical data

Rated voltage	AC 50…60 Hz 230 V
Rated current	
UMC107E-65	65 A
UMC107E-80	80 A
Changeover time	≤ 0.5 s
Switching components	contactors
Insulation monitoring	
Response value, adjustable	50…500 kΩ
Transformer monitoring	
Load current, response value, adjustable	5…50 A
Load current, indication	0…99 %
Voltage monitoring	
Response value, adjustable	0.7…0.85 x U_n
Overvoltage	1.15 x U_n
Response delay, adjustable	0…10 s
Return transfer time, adjustable	0…10 s
Outputs	
Galvanically separated interface	RS-485 (BMS protocol)
Power supply for MK	AC 20 V / 500 mA
Ambient temperature, during operation	- 5 °C…+ 55 °C



Wiring diagram UMC107E

Ordering details:		
Type	**Rated current**	**Art.-No.**
UMC107E-65	65 A	B 9205 6002
UMC107E-80	80 A	B 9205 6003



Dimension diagram UMC107E

IPS – Isolated power system
the time and cost saving overall solution

S-IPS-F
(floor-standing cabinet, with EDS option)

S-IPS-W
(wall-mounted enclosure, with EDS option)

IPS (Isolated Power System) presents a ready-to-connect solution for the power supply in medical locations. All IPS are pre-wired to a terminal strip ready for field connection and are optionally available as distribution panels in floor-standing cabinets or wall mounted enclosures. Individual demands can be flexibly answered. Please contact your local Bender technical support.

Floor-standing cabinets and wall-mounted enclosures

The isolated power systems are incorporated in a floor-mounted sheet-steel enclosure with backed enamel finish. The enclosures comply at least with protection class IP 21. With closed doors the panel complies with protection class IP 54. The enclosure shall be lockable and front accessible.

Isolated power systems comply with

- IEC 60364-7-710: 2002-11 „Electrical installations of buildings – Part 7-710: requirements for special installations or locations – medical locations"
- DIN VDE 0100-710 (VDE 0100- 710): 2002-11: Electrical installations of buildings – Requirements for special installations or locations Part 710: Medical locations
- BS 7671: „Special locations guidance note 7, chapter 10, HTM-20011 and HTM2007 Electrical services supply and distribution."
- IEC 60439-1: 2005-01 + EN 60439- 1: 2005-01 DIN VDE 0660 – Part 500: „Low voltage switchgear and control gear assemblies."

Typical isolated power systems consists of:

- An isolating transformer complying with IEC 60364-7-710: 2002-11, DIN VDE 0100-710 (VDE 0100-710: 2002-11, IEC 61558-1: 2005-09, IEC 61558-2-15: 1999-02, Nominal power range: 3.15…10 kVA (S-IPS-F only)
- An A-ISOMETER® 107TD47 for monitoring the IT system: insulation resistance, load current, transformer temperature, system, earth and CT connection.
- Power supply for up to 3 remote alarm indicator and test combinations MK…
- An isolator switch
- Six two-pole circuit-breakers
- Equipotential bonding terminal
- EDS insulation fault location system (optional)

Common dimensions of the enclosure:

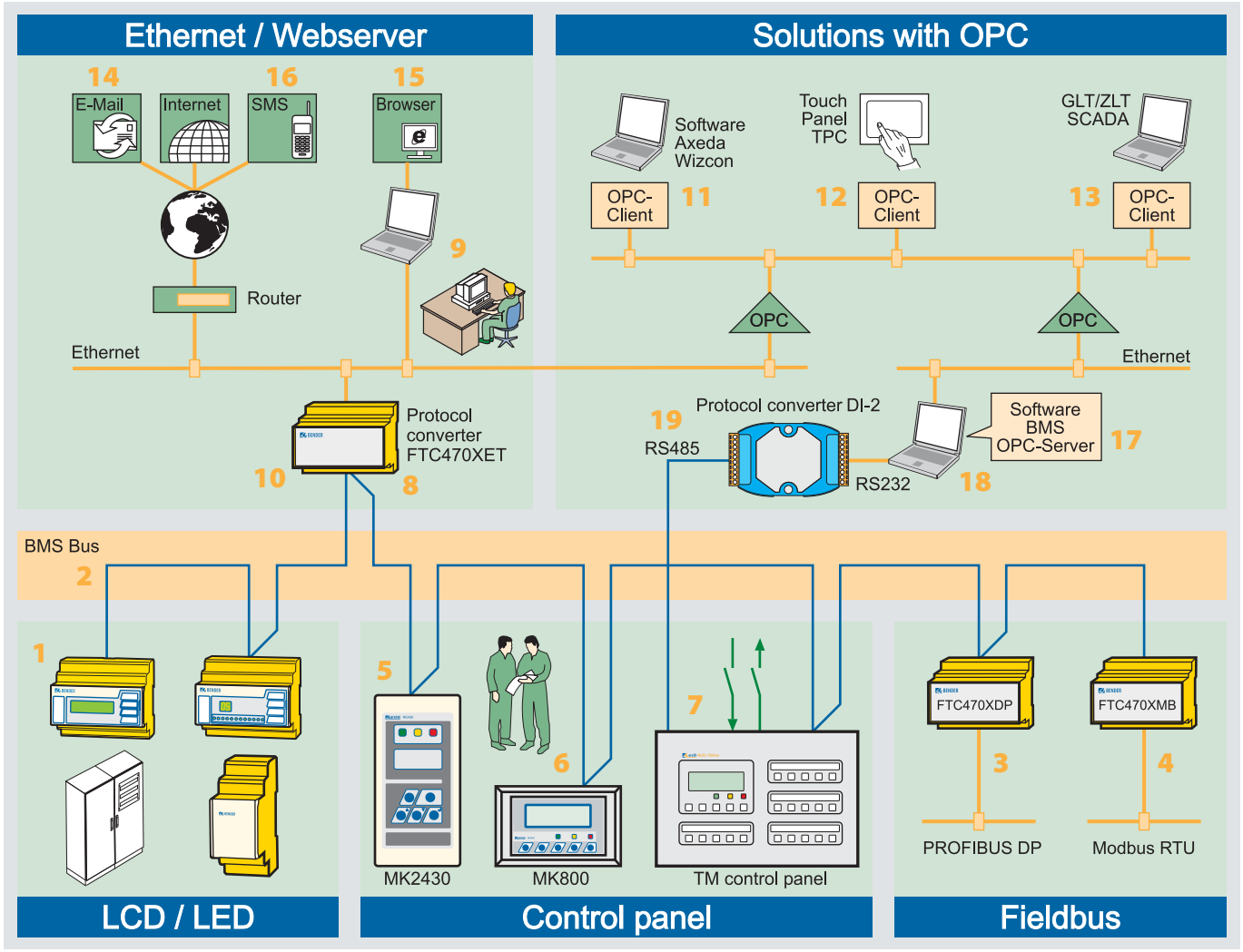
	measures in mm		
	(W)	(D)	(H)
S-IPS-F	374	425*	1913
D-IPS-F	624	425*	1913
T-IPS-F	874	425*	1913
S-IPS-W	324	140	974
D-IPS-W	574	140	974
T-IPS-W	824	140	974

*10 kVA: D: 625
F = floor-standing, W = wall-mounted

Bender communication solutions

Device communication

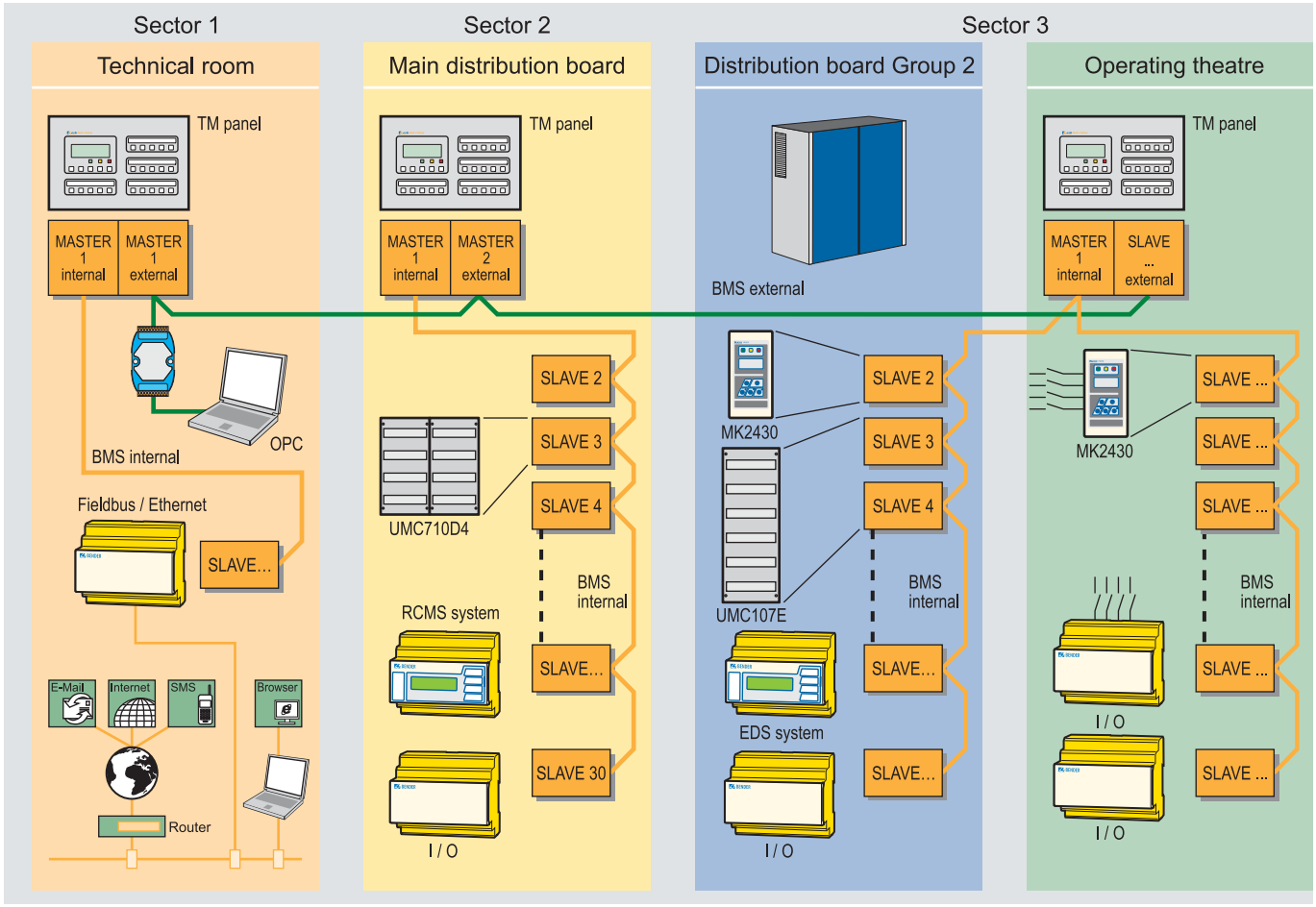
Due to the fact that increasing demands are placed on communication capability, data transparency and flexibility, the use of modern fieldbus technologies and network technologies has become a must. However continuous communication and data visualisation can only be achieved with components that can easily be integrated into Bender communication solutions. Hence, operating, warning and fault messages via the Web or network, for example, substantially contribute to increasing the transparency of power supply systems, also allow a fast reaction to critical operating states. In addition, essential messages can be transferred via short text messages or e-mail to mobile phones or laptops of the service personnel. Early information about location and the cause of fault allow time and cost-efficient deployment of service personnel and can avoid equipment failure or the damage of expensive devices.



Communication possibilities with Bender systems and devices

1 - Bender systems or devices with BMS bus, such as RCMS, EDS, MEDICS® systems, A-ISOMETER® IRDH275, 375, 575
2 - Bender BMS bus (internal)
3 - Protocol converter FTC470XDP, BMS bus / PROFIBUS DP
4 - Protocol converter FTC470XMB, BMS bus / Modbus RTU
5 - Remote alarm indicator and test combination MK2430
6 - TM alarm indicator and operator panel
7 - Bender BMS bus (external)
8 - Protocol converter FTC470XET, BMS bus / Ethernet (TCP / IP), Web server, OPC interface
9 - PC with standard-browser (Internet-Explorer, Firefox, Opera etc.)
10 - OPC server in FTC470XET
11 - OPC client: Axeda Wizcon visualization software
12 - OPC client: Touch Panel TPC
13 - OPC client: Scada software
14 - FTC470XET functionality: E-mail notification via Internet
15 - FTC470XET functionality: Operation of Bender systems via Web browser
16 - FTC470XET functionality: text messaging to mobile phones
17 - BMS OPC server
18 - PC with software BMS OPC server
19 - Protocol converter DI-2 BMS bus (RS-485) / RS-232

External and internal BMS bus structure



FTC470XET

FTC470XET

- Ethernet (TCP/IP)
- Web browser
- History memory
- E-mail notification
- System parameter setting
- OPC server
- Data logging
- Interface to visualisation systems

FTC470XDP, FTC470XMB

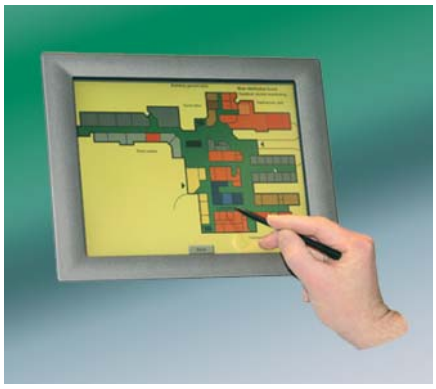
Fieldbus

FTC470XDP for PROFIBUS DP

- Connection to PROFIBUS DP
- Control via PROFIBUS Master
- 8-byte output and input data
- Query of alarms, measured values and parameters

FTC470XMB for Modbus RTU

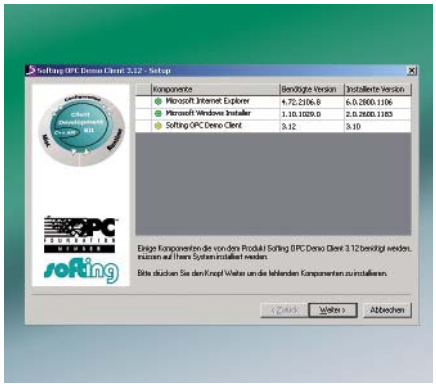
- Connection to Modbus RTU
- Control via Modbus Master
- Illustration of 10 Bender devices with bus capability
- Query of alarms, measured values and parameters



Touch Panel

Touch Panel

- 5.7 / 12 / 15" Touch Panel
- Visualisation software Advantech Studio
- OPC and Modbus driver
- Customised visualisation



OPC solution

BMS OPC server

- Connection to BCS (Building System Control) / CPCS (Central Process Control) via TM alarm indicator and operator panels
- Query of alarm information
- Configurable via text file
- Interface for visualisation
- Configuration and customised visualisation

References hospital equipment

Omni International Hospital

Hospital Sao Luiz, Sao Paulo, Brazil

St. Louis Hospital, Bangkok, Thailand

Country	City	Name
Argentina	Buenos Aires City	Clínica de la Ciudad
		Clínica Obra Social Ministerio de Economía
		Hospital Britanico de Buenos Aires
		Sanatorio Mitre
	Gonzalez Catán, Buenos Aires	Hospital Municipal Gonzalez Catán
	Junín, Buenos Aires	Hospital de Junín
	Mar del Plata, Buenos Aires	Hospital de Mar del Plata
	Neuquen	Hospital Castro Rendón
	San Martin	Buenos Aires Hospital de San Martin
Austria	Bregenz	Landeskrankenhaus Bregenz
	Graz	Landeskrankenhaus Graz
	Innsbruck	Landeskrankenanstalten Innsbruck
	Klagenfurt	Unfallkrankenhaus Klagenfurt
	Linz	Krankenhaus der Elisabethinen Linz
		Landes-, Frauen- u. Kinderklinik
		Unfallkrankenhaus Linz
	Salzburg	County Hospital Salzburg
		Landeskliniken Salzburg
	Villach	Landeskrankenhaus Villach
	Wien	Allgemeines Krankenhaus-Unikliniken Wien
		Landeskrankenhaus Mödling
		SMZ OST-Donauspital
	Wiener Neustadt	Allg. Öff. Krankenhaus
	St. Pölten	Zentralklinikum St. Pölten
	Zell am See	Krankenhaus Zell am See
Belgium	Antwerp	Universitair Ziekenhuis
	Bruges	St. Lucas Hospital
	Bruxelles	University Hospital V.U.B.-Jette
		Centre Hospitalier Universitaire Saint-Luc
	Genk	St. Jan Hospital Oost-Jette
		Ziekenhuis Oost Limburg
	Gent	A.Z. Sint Lucas
	Liège	C.H.R. de la Citadelle
	Overpelt	Maria Ziekenhuis
Brazil	Brasilia	Hospital das Forças Armadas - INCOR
		Hospital Santa Luzia
	Caxias	Hospital UNIMED
	Curitiba	Hospital Evangélico
	Manaus	Hospital Adriano Jorge
	Porto Alegre	Hospital Mãe de Deus
	Rio de Janeiro	Hospital Barra Dór
		Hospital Naval Marcilio Dias
	São Paulo	Hospital AACD
		Hospital Albert Einstein
		Hospital Alemao Oswaldo Cruz
		Hospital Avorada
		Hospital Maternidade Sao Luiz
		Hospital Santa Catarina
	Vitória	Hospital Da Polícia Militar
Czech Republic	Brno	The Faculty Hospital of Brno
	Havirov	Hospital of Havirov
	Olomouc	Military Hospital
	Prague	The Faculty Thomayer's Hospital of Prague
	Prostejov	Hospital of Prostejov
	Zlin	Country Bata's Hospital of Zlin
Chile	Santiago de Chile	Asociación Chilena de Seguridad
		Clínica Alemana
		Clínica Las Condes
		Hospital Clinico UC

Country	City	Name
China	Beijing	Children Hostial
		Tiantan Hospital
		University Hospital
	Changsha Xiangya	No. 2 Hospital
	Chongqing	No. 2 People's Hospital
		No. 3 People's Hospital
	Guangdong	Provincial People's Hospital
	Guangzhou	No. 1 People's Hospital
	Kunming	Red Cross Hospital (picture attached)
	Nanjing	No. 1 Hospital
	Shanghai	Changhai Hospital
		Renji Hospital
	Wuhan	Tongji Hospital
		Wugang Hospital
	Xi'an	Xijing Hospital
Denmark	Faroe Islands, Torshavn	Frederikssund Sygehus
		Hillerod Sygehus
		Landssygehuset
Germany	Berlin	Charite – Virchow Klinikum Berlin
	Dresden	Universitätsklinikum Dresden
	Hamburg	Unfallkrankenhaus Eppendorf-Hamburg
	Hannover	Medizinische Hochschule Hannover
	Magdeburg	Uniklinikum Magdeburg
	München	Uniklinikum München-Großhadern
	Würzburg	Klinikum Würzburg
Great Britain	Coventry& Walsgrave	Coventry& Walsgrave Hospital
	Dartford	Dartford & Gravesham, New Acute General Hosp.
	Dudley	Russells Hall
	Edinburgh	New Royal Infirmary
	London	Kings College University Hospital
		Lewisham Hospital
	Norfolk	Norfolk & Norwich, New General Hosp.
	Plymouth	Derriford Hospital
	Sussex	Royal Sussex County Hospital
Indonesia	Jakarta	Dr. Cipto Mangunkusumo Hospital
	Jakarta	Puri Indah Hospital
	Klimanta	Wahab Syahrani Hospital
	Palembang	Dr. Mohammad Hoesin Hospital
		Eka Hospital
	Serpong	Eka Hospital
		Omni International Hospital
Jordan		Arab Heart & Special Surgery Centre
Korea		Sang Pyeong Mediplan
		Korea Veterans Welfare Corp.
Lebanon	Beirut	Governmental University Hosp.
		Hasbaya Hospital
Luxembourg	Ettelbruck	Clinique Saint-Louis Ettelbrück
	Kirchberg	Hôpital du Kirchberg
	Luxembourg	Centre Hospitalier Universitaire du Luxembourg
	Luxembourg	Hospital Princesse Marie-Astrid
	Wilz sur Alzette	Clinique de la Ville de Eich
		Clinique sacre Coeur
Malta	Taxien	General Hospital
Northern Ireland	Belfast	Lagan Valley Hospital
		Royal Victoria Hospital
		Royal Victoria Infirmary

Country	City	Name
Nigeria	Abuja	National Women and Childrens Hospital
Norway	Drammen	Buskerud Sentralsykehus
		Sykehuset Buskerud HF
	Hamar	Sykehuset Innlandet
	Kristiansand	Sørlandets Sykehus
	Lillehammer	Lillehammer Fylkessykehus
	Oslo	Aker Sykehus
		Rikshospitalet
		Sykehuset Asket & Bærum
		Ullevål Universitetssykehus
	Skien	Telemark Sentralsykehus
	Stavanger	Rogaland Sentralsykehus
	Tønsberg	Vestfold Sentralsykehus
	Trondheim	St. Olavs Hospital
Poland	Grodzisk	Mazowiecki Szpital Zachodni City
	Katowice	Akademii Medycznej
		Centralny Szpital Kliniczny Slaskiej
	Warszawa	Centralny Szpital Kliniczny MSWiA City
		Centrum Zdrowia Dziecka
		Instytut Hematologii Tranfuzjologii City
	Warszawa-Anin	Instytut Kardiologii City
Portugal	Lisboa	Hospital de Santa Maria
		Hospital de Sao José
	Porto	Hospital de S. António
		Hospital de S. Joao
	Setúbal	Hospital Distrital de Setúbal
Republic of Ireland	Cork	University Hospital
	Dublin	St.Vincents Hospital
	Galway	University College Hospital
	Limerick	Regional Hospital
Russia	Kogalym	Kogalym Hospital
	Lipetsk	Lipetsk Hospital
	Moscow	Institute Bakulev
		62nd and 31st Hospital
Saudi Arabia	Riyadh	Dr. Mishari private hospital
		King Abdul Aziz Hospital
		King Fahd Medical City
		Security Forces Hospital
Singapore		Ang Mo Kio Community Hospital
		National University Hospital
		Changi General Hospital
		Singapore General Hospital
Slovenia	Ljubljana	University Clinic Ljubljana
Sri Lanka	Colombo	National Hospital
Sweden	Göteborg	Hospital Götebourg
Switzerland	Basel	Kantonsspital Basel
	Bern	Universitäts - Inselspital Bern
	Genève	Hopital Cantonal Genève
	Lugano	Ospedale Viganello
	Zurich	Universitätsspital Zürich
Taiwan		Ramkamheang Hospital
		Thai Nakarin Hospital
Thailand	Bangkok	St. Louis Hospital
Venezuela	Cagua, Edo. Aragua	Centro Clinico Cagua
		Hospital San Cristobal, Edo

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- Earth fault relays

Electrical safety for earthed power supplies

- Residual current monitors RCM, RCMA
- Residual current monitoring systems RCMS
- For AC, pulsed DC and smooth DC currents (AC / DC sensitive)

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- MEDICS®-Changeover and monitoring modules for medical locations in accordance with DIN VDE 0100-710: 2002-11 and IEC 60364-7-710: 2002-11
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- Complete distribution systems
- IT system transformers

Measuring and monitoring relays

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- For special applications such as mining, mobile generators, welding robots, solar photovoltaic systems and many more

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- Protocol converter for standard bus systems (PROFIBUS, Modbus), Protocol converter for Ethernet /TCP / IP
- Visualisation of data via Axeda Wizcon and Active X
- Communication via OPC

Testing systems

- For electrical safety of medical electrical equipment and general electrical equipment
- Function testers for medical electrical equipment
- Equipment management software

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Dipl.-Ing. W. Bender GmbH & Co. KG
P.O. Box 1161 • 35301 Grünberg • Germany
Londorfer Straße 65 • 35305 Grünberg • Germany
Tel.: +49 6401 807-0 • Fax: +49 6401 807-259
E-Mail: info@bender-de.com • www.bender-de.com

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