Operating Manual

MK800

Alarm indicator and test combination

Software version: 3.2

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1. How to use this operating manual effectively

1.1 How to use this manual

This operating manual describes the MK800 alarm indicator and test combination with the software version indicated on the cover page. The functions and processes described may vary from those featured in other versions. It is designed for electrically skilled persons working in electrical engineering and electronics; and in particular for those designing, installing and operating electrical equipment in the medical sector.

Chapter 7. Operation can also be used as a quick reference guide by medical personnel.

Before using the equipment, please read this operating manual, the supplement entitled “Important safety instructions for Bender Products" and the instruction leaflets supplied with the individual system components. This document must be kept in an easily accessible location near to the equipment.

Should you have any further questions, please contact our Technical Sales Department. We are also happy to provide on-site service. Please contact our Service Department for more information.

Although great care has been taken in the drafting of this operating manual, it may nevertheless contain errors and mistakes. The Bender companies do not accept any liability for injuries to persons or damage to equipment resulting from errors or omissions in this manual.

1.2 Explanations of symbols and notes

The following terms and symbols are used to denote hazards and instructions in Bender documentation:

This symbol indicates an immediate risk to life and limb.
Failure to observe the associated instructions and take appropriate precautions will result in death, severe bodily injury or substantial damage to property.

This symbol indicates a potential risk to life and limb.
Failure to observe the associated instructions and take appropriate precautions may result in death, severe bodily injury or substantial damage to property.

This symbol indicates a potentially dangerous situation.
Failure to observe the associated instructions and take appropriate precautions may result in minor bodily injury or damage to property.

This symbol indicates important information about the correct use of the equipment purchased.
Failure to observe the associated instructions can result in equipment malfunctioning or cause problems in the environment in which it is being used.

This symbol indicates tips for using the equipment and particularly useful information. This type of information will help you to optimise your use of the equipment.

2. Safety information

2.1 Intended use

The universal MK800 alarm indicator and test combination is used for visual and audible indication of operating status and alarm messages from Bender's EDS, RCMS and MEDICS® systems. In MEDICS® monitoring systems, the MK800 meets the requirements of IEC 60364-7-710:2002-11 and DIN VDE 0100-710:2002-11 in respect of test functions for IT system monitoring and alarms from changeover equipment. IT system monitoring equipment is tested using the programmable "TEST" button.

Important display functions:

- Normal operation indicator (green LED)
- Insulation fault
- Overload
- Overtemperature
- Messages from EDS... insulation fault location systems and RCMS... residual current monitoring systems
- Interruption of the phase conductor or PE conductor of the A-ISOMETER®
- Supply line failure
- Power supply fault conditions and changeover system faults
- Device failure
- Test results
- Measured values

The LC text display makes this information easy to understand. The connection between the MKs and the changeover and monitoring modules is implemented with bus technology. During normal operation, the MK800 indicates the readiness for operation of the system. The MK800-11 features 16 digital inputs allowing messages from other technical equipment to be recorded and displayed on the MK800, for example from medical gases or UPS systems.

MK800 are used in:

- healthcare facilities;
- industrial and office buildings
- public buildings

Please note the limits of the area of application indicated in the technical data. Use deviating from or beyond the scope of this is considered non-compliant.

Intended use also implies:

- Device-specific settings compliant with local equipment and operating conditions.
- The observation of all information in the operating manual.
- Compliance with test intervals.

2.2 Skilled persons

Only electrically skilled persons may work on Bender products. Skilled means, persons who are familiar with the assembly, commissioning and operation of the equipment and have undergone appropriate training. Such persons must have read this manual and understood all instructions relating to safety.

2.3 General safety instructions

Bender equipment is designed and built in accordance with the state of the art and accepted rules in respect of technical safety. However, the use of such devices may introduce risks to the life and limb of the user or third parties and/or result in damage to Bender equipment or other property.

- Only use Bender equipment:
  - within the scope of its intended use
  - in perfect working order
  - in compliance with the accident prevention regulations and guidelines applicable in the location of use
- Rectify any faults that may impair safety immediately.
- Do not make any unauthorised changes and only use replacement parts and

optional accessories purchased from or recommended by the manufacturer of the equipment. Failure to

- observe this requirement can result in fire, electric shock and injury.
- Reference plates must always be clearly legible. Replace damaged or illegible plates immediately.
- Make sure that the dimensioning of the UPS (special safety power supply source), the generator system and the whole wiring is adequate. Observe the applicable national and international standards within this context. Only in this way selective operation of safety devices can be achieved and a high degree of safety in case of overload and short circuit can be ensured.

2.4 Delivery conditions, guarantee, warranty and liability

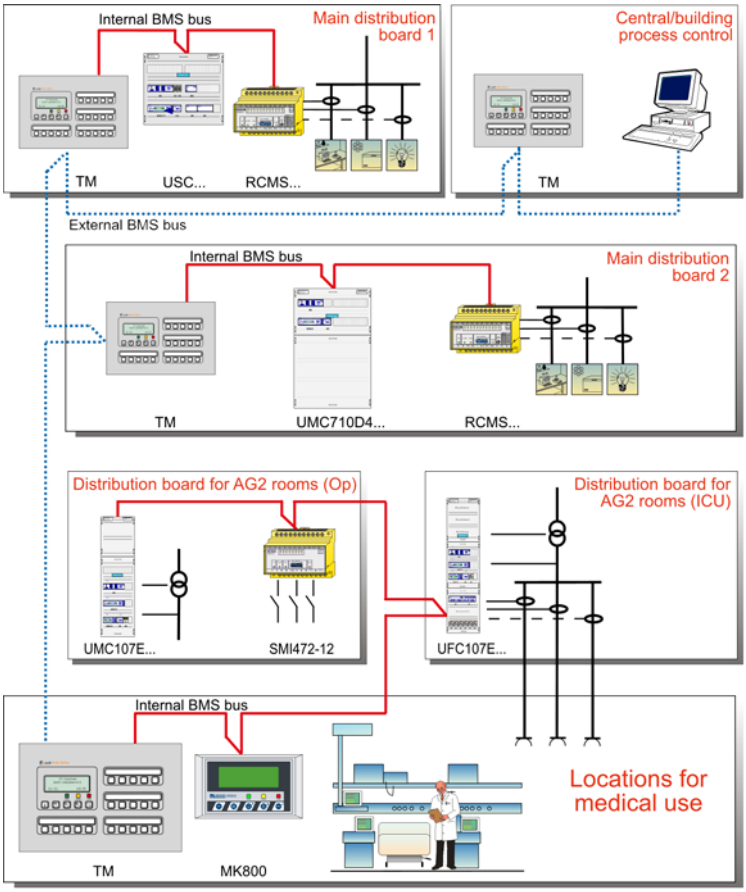
The conditions of sale and delivery set out by Bender shall apply. Conditions of sale and delivery can be obtained from Bender in printed or electronic format.

3. System description

3.1 MEDICS®

The MK800 alarm indicator and test combinations are integral components of the MEDICS® system. MEDICS® is an intelligent system that guarantees safe power supply in medical locations.

Example of a section of a hospital with the MEDICS® system:



Key for example

MK800	Alarm indicator and test combination
RCMS...	Residual current monitoring system for TN-S systems
SMI472	Signal converter for third-party systems (e.g. med. gases, UPS)
TM...	Alarm indicator and operator panel
UFC107E...	Changeover and monitoring module for IT systems with EDS... insulation fault location system
UMC107E...	Changeover and monitoring module for IT systems
UMC710D...	Changeover module for main distribution boards
USC710D...	Control module for changeover modules (preferably in main distribution boards)

MEDICS® features

- Display and control units, such as TM... operator panels or MK... alarm indicator and test combinations
- Single and three-phase monitoring modules. Examples of modules in the MEDICS® system include UMC..., USC..., UFC... and EDS.... insulation fault location systems.
- Communication between these components takes place via the BMS bus (two-wire connection).
- The connection of third-party systems by means of protocol converters (gateways), via digital inputs and relay outputs.

The real strength of MEDICS® is to be found in communication between all involved components and the resulting information provided to the user. Readiness for operation is monitored continuously. Operating states, irregularities, faults and equipment failures are displayed. From the user's point of view, this means high operational reliability.

3.2 Features

On its backlit LC display (4 x 20 characters), the MK800 displays messages from all BMS bus devices assigned via alarm addresses. As well as being used as a standalone indicator, the MK800 also supports parallel indication. In the event of an alarm message the yellow "WARNING“ LED or the red "ALARM" LED lights up and the message appears on the LC display in plain text format. At the same time there is an audible signal (acknowledgeable). If a second

message is received whilst the first is still pending, the audible signal will sound again and the messages will flash up alternately on the LC display. The address of the device triggering the alarm can also be called up. The audible signal sounds again once a configurable period of time has elapsed (repetition can be deactivated).

Internal device parameters (alarm addresses, test addresses, …) and the parameter setting for EDS and RCM systems can be accessed via the menu system. As a master, the MK800 can also be used in installations with a number of IT and EDS systems.
The test button can be used to check the operation of an A-ISOMETER® 107TD47 or IRDH.... A message is only output on the MK800 on which the test button was pressed. The test and its individual evaluations are carried out sequentially. Once the process is complete, a message indicating that the test has been successful or a fault message is output.

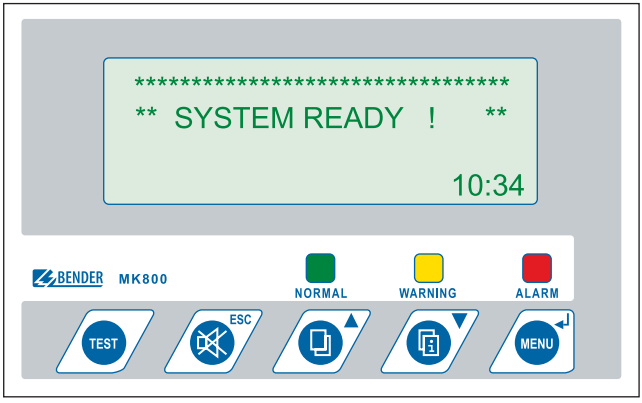
MK800 features

- Display of operating status, warning and alarm messages in accordance with IEC 60364-7-710:2002-11, DIN VDE 0100-710:2002-11 and other standards.
- Backlit clear LC text display (4 x 20 characters)
- Predefined standard texts in 20 languages
- 1000 freely programmable message texts (with TMK-SET PC software).
- Bus technology for easy installation and reduced fire load.
- Acknowledgeable audible alarm.
- Menu-based parameter setting (German/English) for MK800 basic parameters and for EDS46x, EDS47x, EDS49x, RCMS460, RCMS470, RCMS490 via BMS bus.
- Types available for flush and surface mounting.
- Easy commissioning due to predefined text messages.
- 16 digital inputs (MK800-11 only).
- History memory with real-time clock to store 1000 warnings and alarms.

3.3 Functionality

3.3.1 Display/operating elements

The backlit display features four lines of 20 characters. It supplies medical and technical personnel with information that is always clear and unambiguous, in order to help them to make decisions. Every alarm message comprises three lines which appear spontaneously and three additional lines which can be displayed at the touch of a button. The 4th line contains status information (number of messages, test procedures, menu information).
Three LEDs are located below the text display. They indicate:
Normal operation (green), warnings (yellow) or alarms (red).
Five buttons are available for acknowledging alarms and warnings, for the A-ISOMETER® test and for the menu system.



3.3.2 Programming

Standard message texts can be activated by enabling alarm addresses. These texts are available in 20 languages. Alarm addresses can be activated via the device menu system (without PC). Individual message texts, each comprising 6 lines of 20 characters can be programmed with the TMK-SET software.
An LED (yellow or red) and an audible signal can be assigned to each message. For this purpose, the PC is connected to the USB interface or BMS bus (RS-485).

3.3.3 History memory

Warnings and alarms are written to the history memory automatically with date and time stamp. 1000 text messages can be saved. Each subsequent message overwrites the oldest message (message 1001 overwrites message 1). The history memory can be read out via the operating menu or the TMK-History PC software.

3.4 Versions

3.4.1 MK800-12

The MK800-12 is used for visual and audible indication of alarms from Bender's EDS, RCMS and MEDICS® systems and to trigger the A-ISOMETER® test function via the BMS bus. Furthermore, the MK800-12 can also be used as parallel indication in conjunction with MK800-11. The programmed message texts are displayed on the LCD in the selected language.

3.4.2 MK800-11

The MK800-11 features all the functions of the MK800-12 plus 16 digital inputs and a programmable relay output.

All digital inputs are electrically isolated in four groups of 4. The input voltage is AC/DC 10...30 V / 2 ... 5 mA (HIGH=10...30 V; LOW=0...2 V). In practice, these digital inputs (IN1… IN16) are controlled via potential free contacts (N/C or N/O operation configurable). The voltage required for the inputs is provided via the power supply unit, which also supplies power to the MK800. Any message text can be assigned to the inputs.

3.4.3 Interfaces

MK800 systems feature

- an internal BMS bus,
- an external BMS bus
- and a USB interface.

3.4.3.1 Internal BMS bus

The internal BMS bus is used for communication with MEDICS® components,

- e.g. modules like UMC..., UFC..., LFC...
- or devices like RCMS..., EDS..., SMI..., SMO..., alarm indicator and operator panels

The MK800 is the master whenever the address is set to 1.
An address setting of 2...150 denotes operation as a slave. This setting is only possible when the external BMS bus has been switched off before.

The Master is responsible for specific tasks:

- As a "master clock", it synchronises the time of all devices on the internal BMS bus.
- It controls data traffic on the BMS bus.

3.4.3.2 External BMS bus

The external BMS bus is used for the coupling of alarm indicator and operator panels, MK800 and central data acquisition devices via SMI472-12.
The device with address 1 (master) synchronises as "master clock" the time of all devices on the external BMS bus.
The master function will be cyclically passed on from address 1 to the next higher one.

3.4.3.3 USB interface

A PC can also be connected to the MK800 via the USB interface with a USB cable (Type A plug onto Type B plug). The interface can only be accessed when the MK800 has been removed. Only the currently connected MK800 can be read out and set via the USB interface.

Programming and reading the MK800

Connect the MK800 to a PC:

- directly via the USB interface or
- via an RS-232/RS-485 adapter DI-2 or a USB/RS-485 adapter DI-2USB to the internal or external BMS bus.

You can display and change the settings of the MK800 using the PC software TMK-SET. You can read out the history memory of the MK800 using the PC software TMK-HISTORY.

4. Installation and connection

4.1 Installation

4.1.1 Flush-mounting enclosure

4.1.1.1 Dimension diagram flush-mounting enclosure UP800

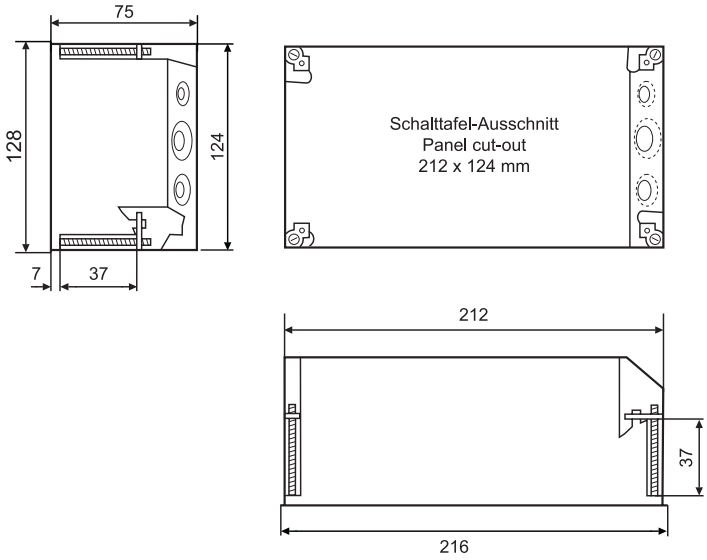


Fig. 4.1: MK800 in flush-mounting enclosure. <<F>Dimensions in mm. The MK800 is secured in its enclosure with four screws.

4.1.1.2 Flush-mounting

1. Insert the supplied cardboard into the flush-mounting enclosure to improve the shape stability and to provide protection against pollution.
2. Insert the enclosure so that it is flush with the wall surface. The flush-mounting enclosure must not be installed lopsidedly or warped, and must not be installed too deep below the surface.

4.1.1.3 Cavity wall mounting

The flush-mounting enclosure is already enclosed in the scope of delivery of MK800-11/MK800-12. Please order the bezel frame separately (see "Ordering information" on page 84).

1. Make a hole into the cavity wall that fits accurately the enclosure.
2. Insert the flush-mounting enclosure and secure it with screws.
3. Insert the MK800 and secure it with four screws.
4. Place the bezel frame onto the cutout.

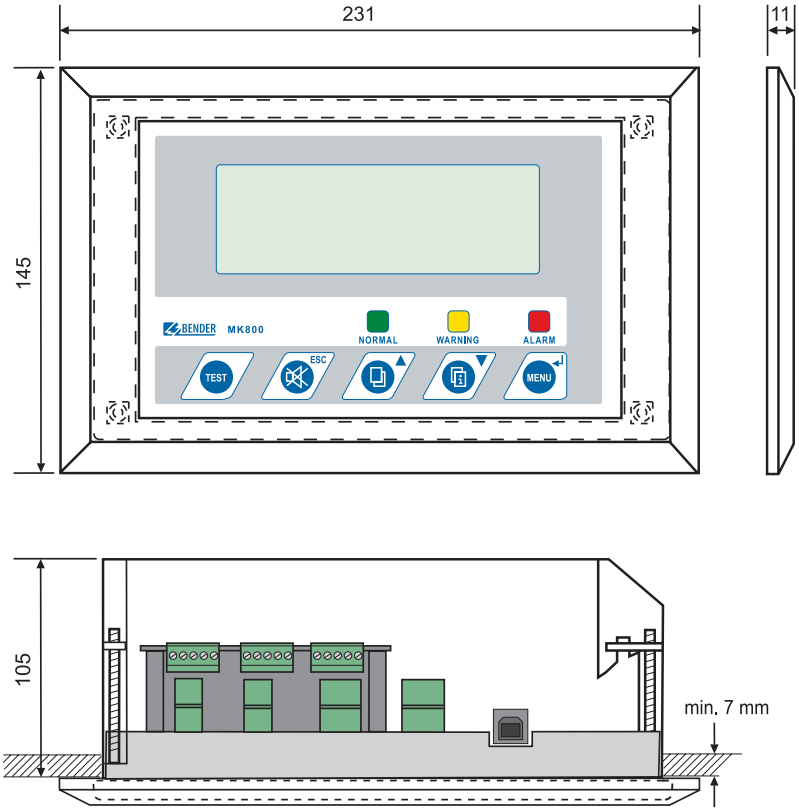


Fig. 4.2: Dimension diagram MK800-11 / MK800-12 with bezel frame BR800 and flush-mounting enclosure UP800. Dimensions are given in mm. Example: cavity wall mounting

4.1.1.4 Panel mounting without enclosure

MK800 is also available for panel mounting without an enclosure: Version MK800E... (see "Ordering information" on page 84).

1. Make a panel cutout and drill the holes as described in the illustration below.
2. Insert the MK800 into the cutout from the outside.
3. Fasten the MK800 with four screws into the front panel.

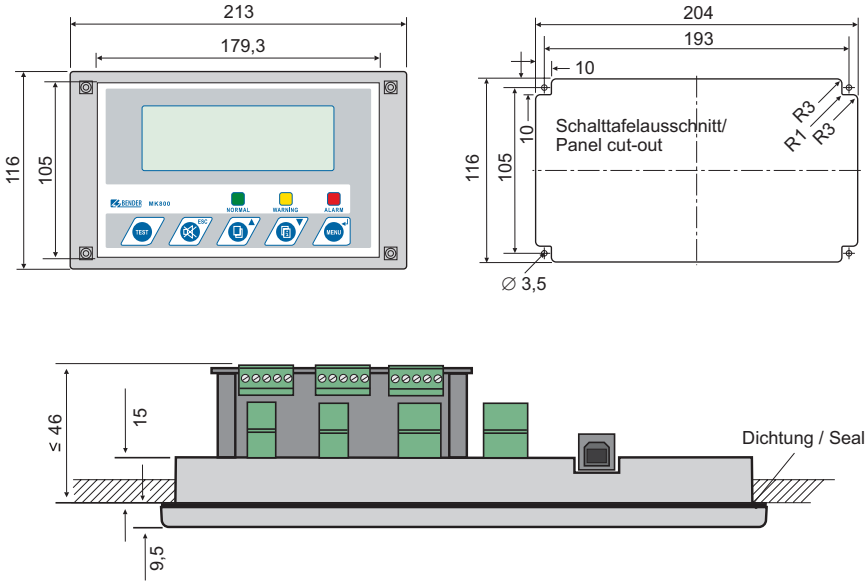


Fig. 4.3: Dimension diagram MK800(E)-11 / MK800(E)-12. Dimensions are given in mm. Example: door mounting

4.1.1.5 Panel mounting with enclosure

Even when the MK800 is mounted into a panel, it can be protected by an enclosure:

1. Make a panel cutout and drilling holes according to the illustration below.
2. Insert the MK800 from the outside into the cutout.
3. Hold the flush-mounting enclosure against the MK800 from the back.
4. Firmly secure the MK800 with four screws in the flush-mounting enclosure.

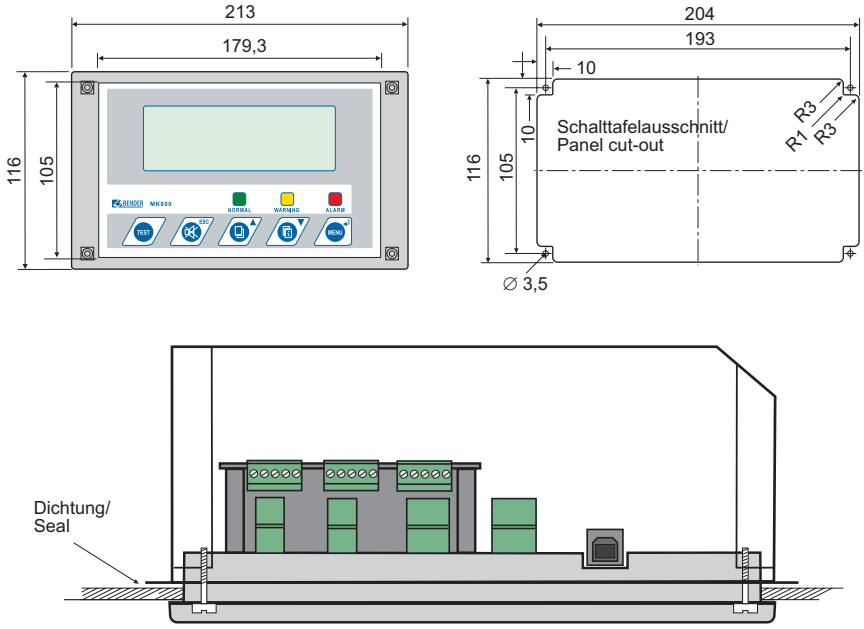
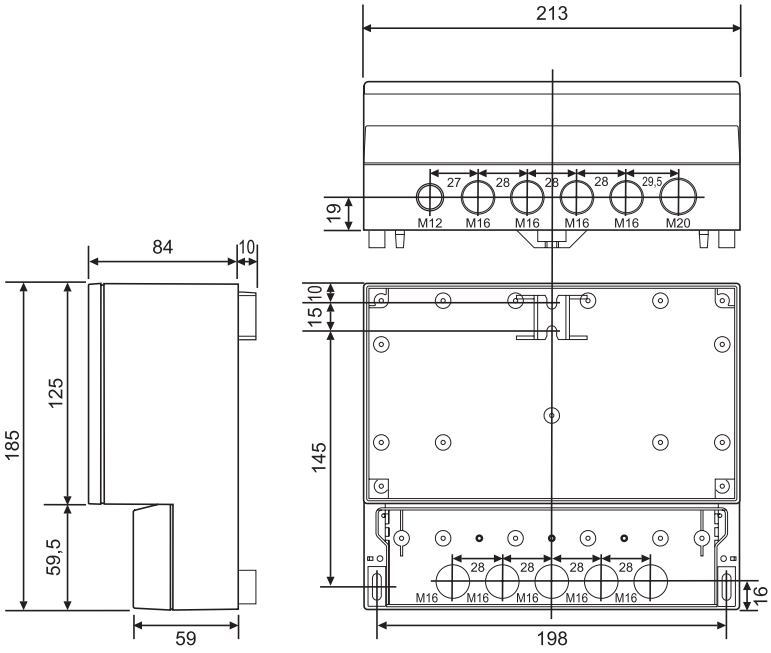


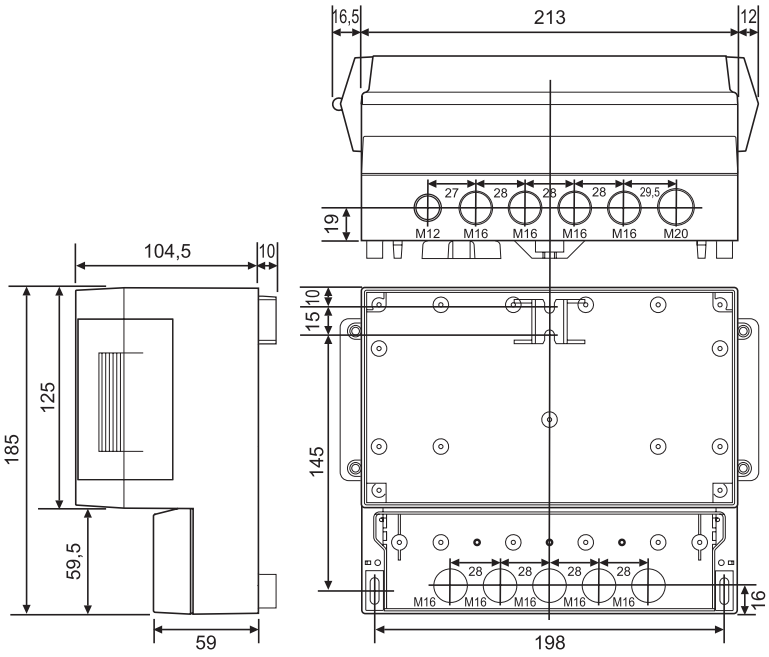
Fig. 4.4: Dimension diagram MK800(E)-11 / MK800(E)-12. Dimensions are given in mm. Example: Flush-mounting enclosure for door mounting

4.1.2 Surface-mounting enclosure

Dimension diagram surface-mounting enclosure MK800A-11 / MK800A-12



Dimension diagram surface-mounting enclosure with door MK800AF-11 / MK800AF-12



4.1.2.1 Installation of the surface-mounting enclosure

A smooth and even surface is a precondition for installation. Only use fastening screws of the size specified below. Failure to observe this can result in deformation or damage to the enclosure.

1. Use the empty enclosure as a template for marking the drilling holes.
2. Make the drilling holes so that it matches the material of the subsurface.
3. Fix the empty enclosure with screws. Maximum diameter of the screws: Thread of screw 3 mm, bolt head 7 mm
4. MK800AF only: Connect the aluminium front plate to the PE conductor (PE).
5. Fix the MK800 in the enclosure with screws.

4.2 Connection

Before fitting the enclosure and working on the device connections, make sure that the power supply voltage has been disconnected. Failure to comply with this requirement will expose personnel to the risk of electric shock. Furthermore, the electrical installation may sustain damage and the device be destroyed beyond repair.

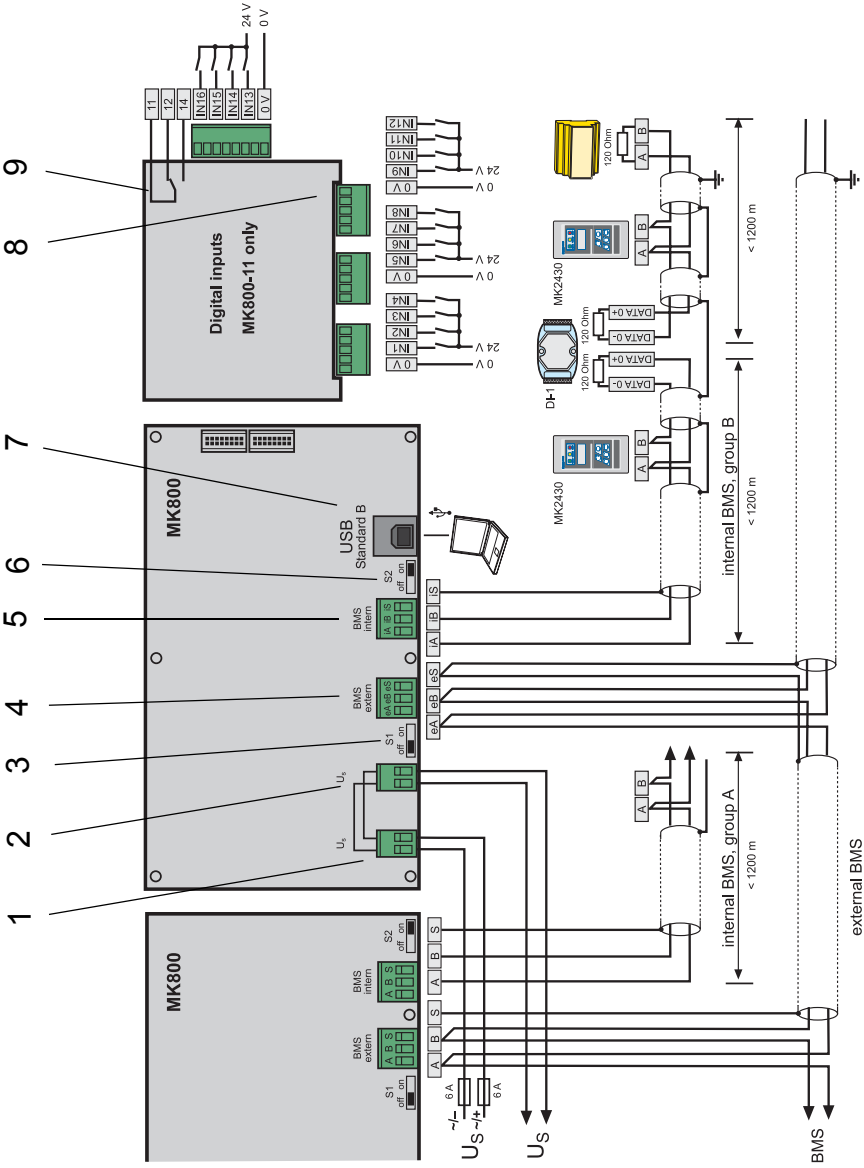
You must only connect the MK800 as illustrated in the diagram in this chapter. Do not change the internal wiring. Non-compliant connection or arbitrary changes can lead to serious malfunctions or even the complete failure of the MK800.

The device contains components that can be damaged by electrostatic discharges (ESD). When work activities are carried out at the opened device, the safety precautions for the dissipation of electrostatic electricity have to be observed.

4.2.1 Notes on connection

- Connect the MK800 to the supply voltage U_S (terminals +/-).
  - If you are connecting the MK800 to a DC 24 V power supply: you must take the line voltage drop into account if you are using long supply cables for the supply voltage.
  - Consider the maximum permissible cable lengths for the supply voltage U_S when the MK800 is supplied by the AN450 power supply unit (see "Technical data" on page 81).
- Connect the internal and external BMS bus according to the instructions in the "BMS bus" leaflet. Use a shielded cable for interface connection, for example J-Y(St)Y 2x0.6. The shield must be connected to earth at one end.
- Use the DIP switches S1 and S2 to set the terminating resistor for the internal and external BMS bus: S1 = external BMS bus; S2 = internal BMS bus. Factory setting S1 and S2: off.
- MK800-11 only: Use cables with a cross section of at least 0.75 mm ^{2} when connecting the digital inputs and the relay output. The maximum cable length per connection is 500 m.

4.2.2 Wiring diagram



4.2.2.1 Legend to wiring diagram

1	Supply voltage U_S (see "Technical data" on page 81) **Note: Make sure that the power supply of MK800 is isolated against PE. If this is not taken into consideration and if a PC is connected to the USB interface, the MK800 and the PC may sustain damage.** MK800AF only: Connect the aluminium front plate to the PE conductor (PE).
2	Looped through connection for supply voltage (e.g. for control voltage relay contacts)
3	Switch S1 to terminate the external BMS bus. If two or more devices are connected to each other via the BMS bus, each bus line must be terminated with a resistor (R = 120 Ω) at the start and end of the BMS bus.
4	External BMS bus connection. The external BMS bus is primarily used for the connection of several MK800 or TM800. But also SMI472-12 signal converters can be connected.
5	Internal BMS bus connection. Different Bender devices with a BMS bus can be connected to the BMS bus. These can be, for example: 107TD47 insulation monitoring devices, PRC487 control devices, RCMS470 residual current evaluators and others.
6	Switch S2 to terminate the internal BMS bus. If two or more devices are connected to each other via the BMS bus, each bus line must be terminated with a resistor (R = 120 Ω) at the start and end of the BMS bus.
7	USB interface. For PC connection. The TMK-SET PC software is used to programme the MK800.
8	MK800-11 only: Digital inputs. The digital inputs may be controlled either via internal or external voltage or potential-free contacts. When the digital inputs are controlled via an external voltage, the common conductor 0(-) is connected to terminal 0 and the 1(+)-signal is connected to the respective input IN1…IN16.
9	MK800-11 only: Relay output. Programmable contact for device error, Test A-ISOMETER®, device failure, common alarm, buzzer

4.2.2.2 Terminal assignment MK800-12

The device version MK800-12 receives all messages via the BMS bus. It receives these messages for example from the 107TD47, an MK800-11, the signal converter SMI47x, the EDS... or the RCMS....

U_s	Supply voltage U_S : looped through connection for the supply voltage U_S. **Note: Make sure that the power supply of MK800 is isolated against PE. If this is not taken into consideration and if a PC is connected to the USB interface, the MK800 and the PC may sustain damage.**
eA, eB, eS	External BMS bus, with shield S
iA, iB, iS	Internal BMS bus, with shield S
USB	USB connection. Cable: Type A plug on type B plug.
S1, S2	Switch S1 to terminate the external BMS bus and switch S2 to terminate the internal BMS bus.

4.2.2.3 Terminal assignment MK800-11

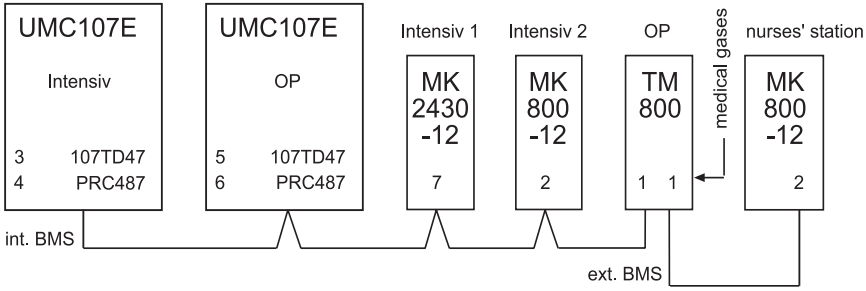
The MK800-11 alarm indicator and test combination provides additional terminal strips for the 16 digital inputs and one optional relay output.

IN1...IN16	Digital inputs 1...16
0 V (IN1...4)	Common connection "0" for the digital inputs 1...4
0 V (IN5...8)	Common connection "0" for the digital inputs 5...8
0 V (IN9...12)	Common connection "0" for the digital inputs 9...12
0 V (IN12...16)	Common connection "0" for the digital inputs 12...16
11, 12, 14	Relay output

4.2.3 Examples for BMS bus connection and addressing

Missing or incorrectly installed terminating resistors (e.g. in the middle of the bus) will cause bus instability. Please also note the information on the "BMS-Bus" instruction leaflet.

Example 1: Operating theatre or intensive care unit with two IT systems and three rooms

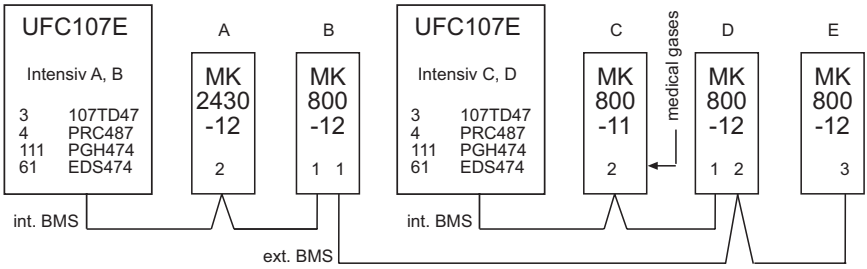


The MK... alarm indicator and test combination in the intensive care units 1 and 2 display alarm messages of the associated UMC107E MEDICS® module and alarm messages for medical gases.
The TM800 detects the alarm messages for medical gases via the digital inputs. In addition, the TM800 displays alarm messages from the associated UMC107E (OP) MEDICS® module.
The alarm indicator and test combination located in the nurses' station displays all alarm messages and monitors all devices for failure. This MK... can also be used to initiate a test of all insulation monitoring devices connected.

Device	Parameters	Address int. BMS bus	Address ext. BMS bus
First changeover and monitoring module UMC107E			
107TD47	Bus address	3	--
PRC487	Address	4	--

Device	Parameters	Address int. BMS bus	Address ext. BMS bus
Second changeover and monitoring module UMC107E			
107TD47	Bus address	5	--
PRC487	Address	6	--
Remote alarm indicator and test combinations			
MK2430-12 (Intensive 1)	Address	7	--
	Test address	3	--
	Alarm address	3, 4	--
MK800-12 (Intensive 2)	Address	2	Off
	Test address	3	--
	Alarm address	3, 4	--
TM800 (OP)	Address	1	1
	Test address	5	--
	Alarm address	5, 6	--
MK800-12 (nurses' station)	Address	Off	2
	Test address		ext./int.: 1/3, 1/5
	Alarm address		ext./int.: 1/0**, 1/2, 1/3, 1/4, 1/5, 1/6, 1/7

Example 2: Intensive care unit with two IT systems and four rooms



The MK... alarm indicator and test combinations in intensive care units A and B resp. C and D display all alarm messages of the associated UFC107E MEDICS® module. This MK... can also be used to trigger a test for all insulation monitoring devices connected.
The MK800-11 (C) records all alarm messages for medical gases. The MKs B, C, D and E display the alarm messages from medical gases.
The MK800-12 (E) is used to monitor the entire system. It displays all alarm messages and monitors all devices for failure. This MK... can also be used to initiate a test of all insulation monitoring devices connected.

Device	Parameters	Address int. BMS bus	Address ext. BMS bus
UFC107E changeover and monitoring module (Intensive A, B)			
107TD47	Bus address	3	--
PRC487	Address	4	--
PGH474	Address	111	--
EDS474-12	Address	61	--
UFC107E changeover and monitoring module (Intensive C, D)			
107TD47	Bus address	3	--
PRC487	Address	4	--

Device	Parameters	Address int. BMS bus	Address ext. BMS bus
PGH474	Address	111	--
EDS474-12	Address	61	--
Remote alarm indicator and test combinations			
MK2430-12 (Intensive A)	Address	2	--
	Test address	3	--
	Alarm address	1, 3, 4, 111	--
	Individual alarms	61*	--
MK800-12 (Intensive B)	Address	1	1
	Test address	3	--
	Alarm address	2, 3, 4, 111	2/2
	Individual alarms	61*	--
MK800-11 (Intensive C)	Address	2	Off
	Test address	3	--
	Alarm address	1, 3, 4, 111	--
	Individual alarms	61*	--
MK800-12 (Intensive D)	Address	1	2
	Test address	3	--
	Alarm address	2, 3, 4, 111	--
	Individual alarms	61*	--
MK800-12 (Monitoring E)	Address	--	3
	Test address	--	ext./int.: 1/3, 2/3
	Alarm address	--	ext./int.: 1/0**, 1/2, 1/3, 1/4, 1/111, 2/0**, 2/2, 2/3, 2/4, 2/111,
	Individual alarms	--	1/61*, 2/61*

Remarks on example 1 and example 2:

* *Program individual assignments to each EDS channel.*

** *Refer to chapter "Address settings and their meaning" on page 33.*

4.2.4 Address settings and their meaning

Display		Meaning:	Setting on TM/MK800	Setting TMK-SET
External address	Internal address			
0 (ext bus on)	0	--	--	--
0 (ext bus on)	1	TM/MK itself	--	dig. IN*
0 (ext bus off)	M = own addr.	TM/MK itself	--	dig. IN*
0 (ext bus off)	M <> own addr.	Device M on the int. bus of your own device	ext: 0 / int: M	int. bus: int M
N = own addr.	0	Device N on ext. bus	--	dig. IN*
N = own addr.	1	TM/MK itself	--	dig. IN*
N = own addr.	M > 1	Device M on the int. bus of your own device	--	int. bus: int M
N <> own addr.	0	Device N on ext. bus	ext: N / int: 0	ext. bus: ext: N, int: 0
N <> own addr.	1	Device N on ext. bus	--	ext. bus: ext: N, int: 0
N <> own addr.	M > 1	Device M on the int. bus of device N	ext: N / int: M	ext. bus: ext: N, int: M

Remarks on digital inputs (*)

Alarm messages *from digital inputs on TM/MK800 are* ***always*** *displayed on the device itself regardless of whether an individual message has been programmed or not (Exception: Channel is deactivated).*

An entry into the alarm address table is not required.

- *If no individual message is programmed, the standard text will be displayed.*
- *If an alarm message need not to be displayed, the message can be programmed without text/ LED / buzzer (****silent message****).*
- *Note: Flashing alarm messages are not allowed.*

All ALARM messages will always be saved in the ***history memory*** *(Exception: Channel is deactivated):*

- *If no individual message is programmed, the standard text will be displayed resp. will be saved in the history memory.*
- *If the message has been programmed without a text (silent message), its source (DigIn resp. address and channel No.) will be saved in the history memory (no individual text possible!).*
- *TEST messages are only saved in the memory of that device where the messages had been triggered.*

Transmission via BMS bus:

- *All ALARM messages will be actively sent (i.e. as a new message) via the external BMS bus resp. are sent fast via the internal BMS bus.*

Operating messages *will actively be sent via the external BMS bus and will not be saved in the history memory.*

- *Note: Flashing messages should be avoided, where possible, and on no account be signalled via the int. / ext. BMS bus!*

.. The first 16 digital inputs can be parameterised as "flashing" and will not be signalled via the external BMS bus. This is only permissible for messages with a flashing frequency of 0.5 Hz!

Inputs that are assigned to operating messages or switching commands will not be displayed with a text message or saved into the history memory.

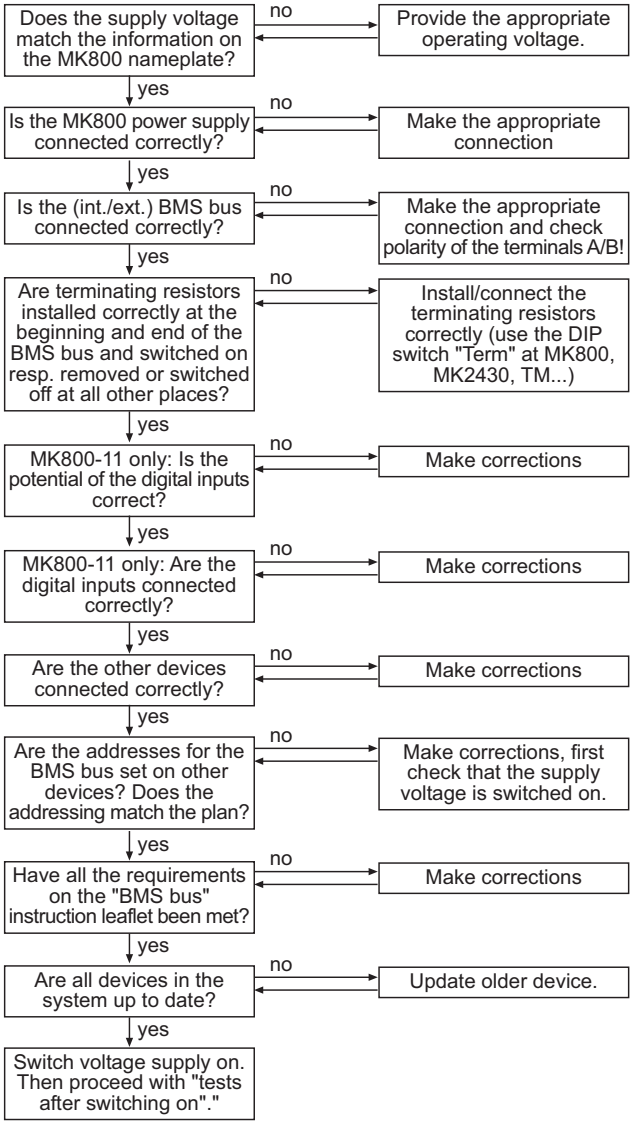
5. Commissioning and testing

Accomplish start-up according to the following start-up pattern:

1. Tests before switching on
2. Tests after switching on
3. Make parameter settings
   - Settings at the MK800
   - Settings in the software TMK-SET
4. Tests after parameter setting

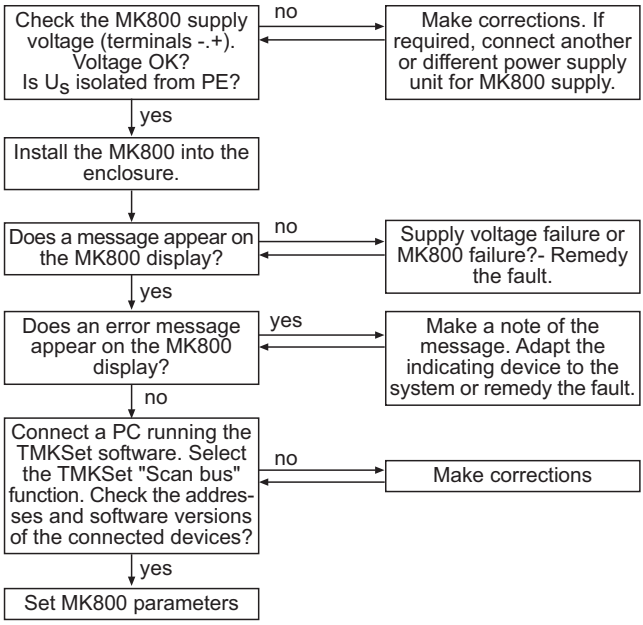
Please note down all settings and attach these to the equipment or installation documentation.

5.1 Tests before switching on



Continue with chapter "Tests after switching on" on page 37.

5.2 Tests after switching on



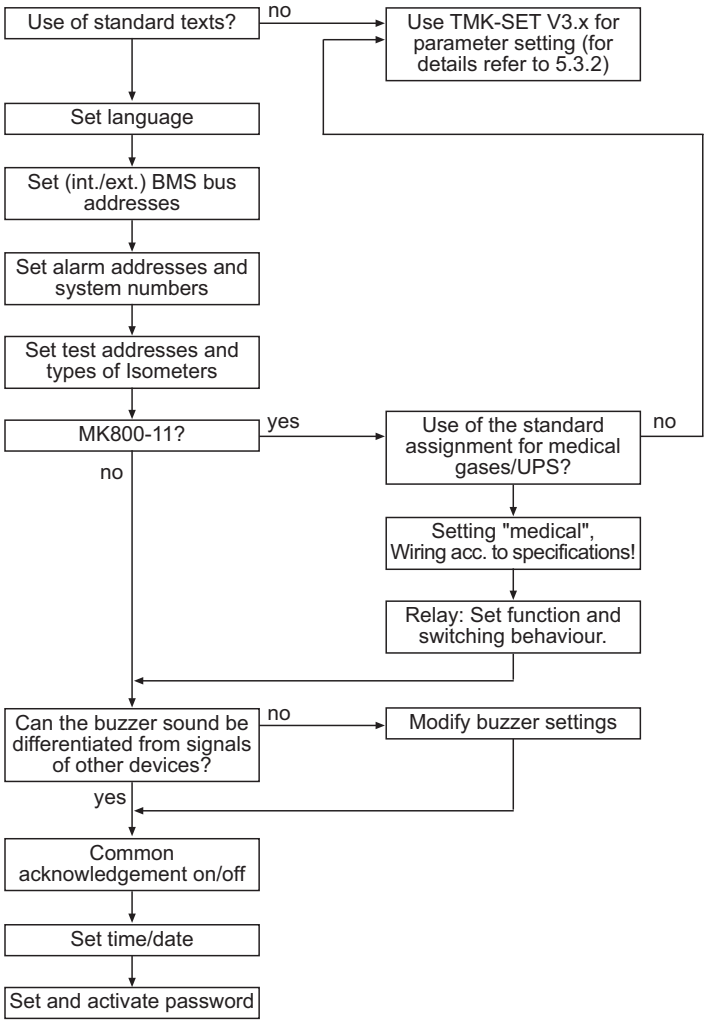
Continue with chapter "Parameter setting" on page 37.

5.3 Parameter setting

***All** settings can be carried out via the TMK-SET software. Alternatively, some settings can be carried out via the MK800 menu (see diagrams).*

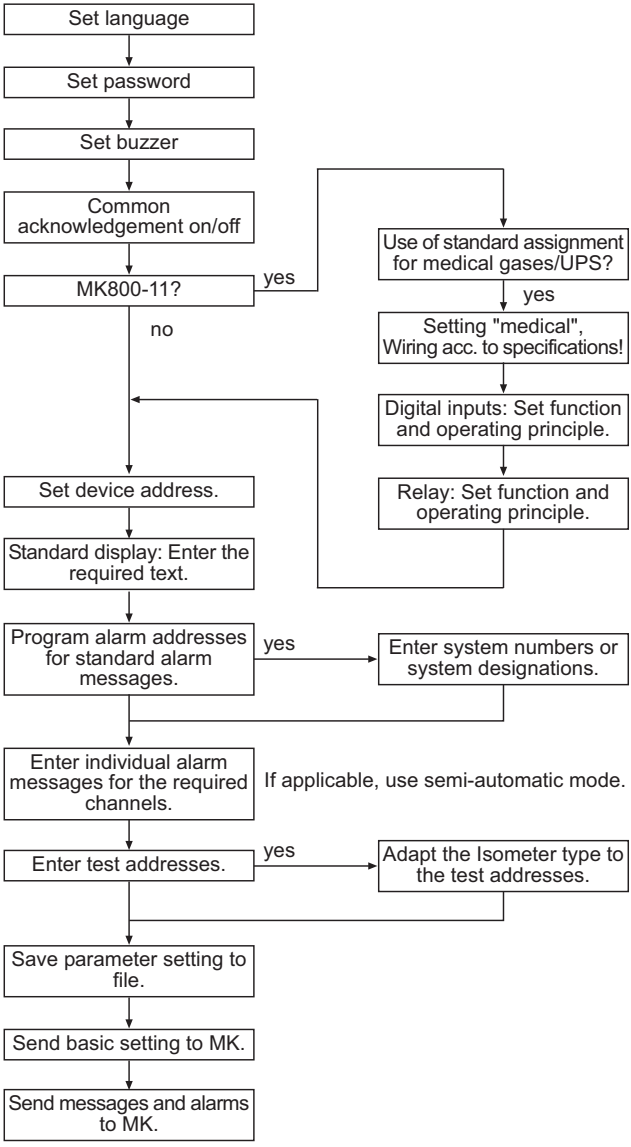
5.3.1 Settings at the MK800

Details see "Menu 4: Settings" on page 61



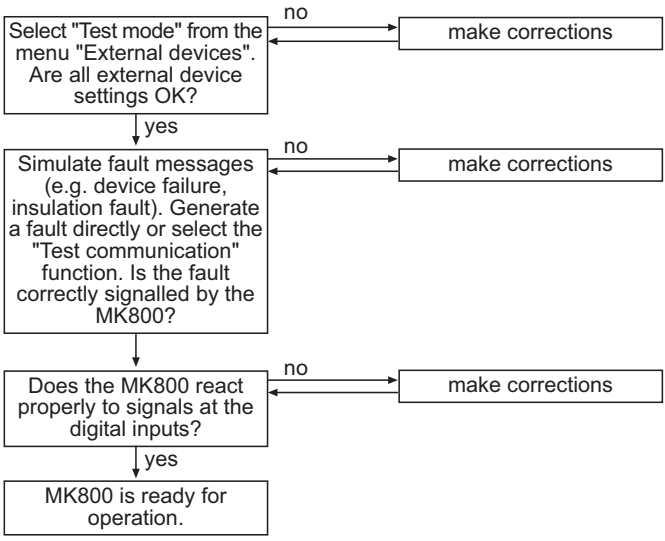
Continue with chapter "Tests after parameter setting" on page 40.

5.3.2 Settings in the TMK-SET software



Continue with chapter "Tests after parameter setting" on page 40.

5.3.3 Tests after parameter setting



(*) Messages which can be created by a BMS device will be simulated.

5.4 Periodic verification and service

5.4.1 Periodic verification

The following periodic verification must be performed on electrical installations in compliance with the local or national regulations that apply. We recommend for your Bender products:

Test	To be performed by	Interval
Functional test of IT system monitoring (insulation, load current, transformer temperature and connection monitoring) by pressing the TEST button on the alarm indicator and test combination or on the alarm indicator and operator panel.	Medical personnel	once every working day
Functional test of the changeover module*: Test of the automatic changeover modules. Please observe the information in chapter "Testing of the changeover module“!	Skilled person	every 6 months
Functional test of the IT system monitoring (insulation, load current, transformer temperature and connection monitoring) on the insulation monitoring device.	Skilled person	every 6 months
Testing the set values and the changeover periods	Skilled person	every 12 months
Testing of the changeover module, the IT system monitoring, the connection to the SCADA system (Supervisory Control And Data Acquisition) (if applicable) and the interaction of the components in the system. The test includes the following services: - Inspection: Marking, display elements, mechanical components, wiring, parameterisation, connection of third-party systems, evaluation of fault memory - Measurement: Internal/external supply voltages/potentials, bus voltage, bus protocol, bus scan - Practice test: Device function, device communication - Documentation: Test results, recommendations for remedial action	Bender Service	every 24 months

* *This test must only be performed by an electrically skilled person who has been commissioned to do so in agreement with the person responsible for the medical location.*

Before carrying out the tests, please refer to the instructions relating to the functional tests in the check list. If no national directives apply, you should perform the tests recommended by DIN VDE 0100-710 (VDE 0100 Part 710): 2002-11, section 710.62.

5.4.2 Service

Bender would be delighted to provide on-site service for commissioning and periodic verification. Please contact our Service Department for more information:

Service-Hotline:
0700-BenderHelp (Telephone and Fax)

Carl-Benz-Straße 10 • 35305 Grünberg • Germany
Tel: +49 6401 807-760 • Fax: +49 6401 807-629
E-Mail: info@bender-service.com • www.bender-de.com

5.4.3 Maintenance

MK800 does not contain any parts that require maintenance. Despite this, the intervals specified for periodic verification should be adhered to.

6. Troubleshooting

6.1 Error messages of MK800

The following errors are recognised by the MK800 and indicated on the display. In addition, the buzzer emits a beep code every 10 seconds corresponding to the number of the error.
MK800..-11 only: If the function "device error" has been set in the "Settings menu 11: Relay", also the alarm relay switches.

No.	Display	Description	Actions
1	DISPLAY ERROR	Display defective	Replace the MK800*
2	I^2C-BUS ERROR(X)	Error code (X): 1 Fault I^2C-Bus 2 Ack error transmitting address 3 Ack error transmitting data 4 Ack error receiving addresses 5 Ack error receiving data 6 Communication problem	Interrupt supply voltage to MK800 for ≥ 3 minutes. If the fault continues to exist, MK800 or I^2C-Buscable defective -> replace*.
3	RTC ERROR	Clock module defective	Replace the MK800*
4	FLASH ERROR	Memory module D5 defective	Replace memory module D5 (socketed), replace MK800*
5	Address intern ERROR (XXX)	Address of the MK800 on the internal BNS bus is already occupied (XXX=current address)	Change the MK800 address in the menu

No.	Display	Description	Actions
6	Overflow ERROR (03)	More than 80 alarm addresses are present.	Reduce number of messages
	Overflow ERROR (05)	More than 1000 device failure messages are present	Reduce number of messages
	Overflow ERROR (07)	More than 99 text messages are present	Reduce number of messages
	Overflow ERROR (08)	Automatic correction of the history memory is carried out because of voltage interruption.	none
	Overflow ERROR (11)	Stack Error	Please make a note of the error code. Contact Bender Service.
7	Checksum ERROR	Program memory defective	Replace the MK800*
8	Address extern ERROR (XXX)	Address of the MK800 on the external BMS bus is already occupied (XXX=current address)	Change the MK800 address in the menu
9	I^2C-0-Error	I^2C-Bus-Interrupt	Replace the MK800*
10	I^2C-1-Error	I^2C-Bus-Interrupt	Replace the MK800*

* *Please make a note of the cause of error, the error number and if applicable the error code. This information facilitates the diagnosis and repair of the equipment.*

6.2 Malfunctions

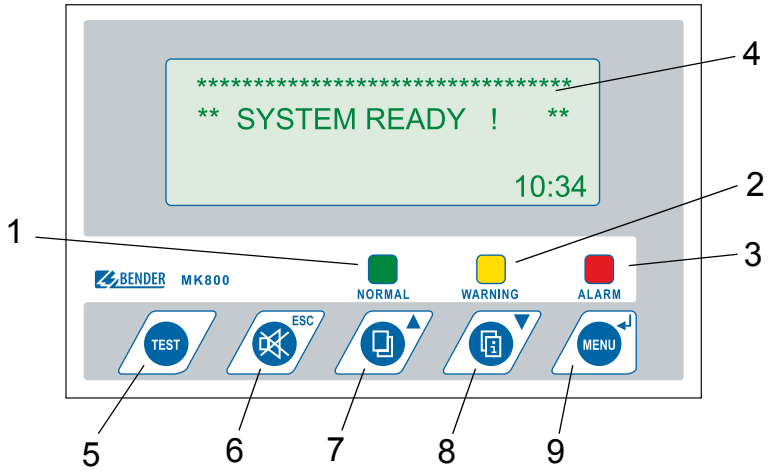
List of possible errors and proposals for their correction.
Possible error codes occurring during a test are listed in the chapter "Test function" on page 52f.

Errors	Possible cause and course of action
No indication on the display of the MK800.	Check AC/DC 24 V power supply.
No characters on the display although the display is illuminated.	Replace the MK800
Function buttons do not operate.	Replace the MK800
LEDs not working	Replace the MK800
Character matrix can be seen on the display, but firmware does not start.	Processor not starting up; replace the MK800.
Time set will get lost in case of voltage failure.	Replace the MK800
Error transferring the assignments or basic settings via the USB interface.	MK800 address set incorrectly (menu); MK800 address does not match setting of TMK-SET configuration software; USB cable defective; wrong serial interface (com port) set in TMK-SET.
Error on internal BMS bus.	Device addresses improperly set on the internal bus; Interface cables A/B interchanged; RS-485 bus improperly terminated or not terminated at all; incorrect parameterisation with TMK-SET.
Error in respect of function of digital inputs.	Digital inputs not programmed correctly with TMK-SET. Defective connection (does not match pre-assignment). Incorrect setting "neutral/medical".

7. Operation

This chapter can also be used as a quick reference guide by medical operating personnel.

7.1 Operator control and display elements



LED and LCD

1	LED "NORMAL": Power On indicator, green (only lights up if no warnings or alarms are pending)
2	LED "WARNING": Warnings, yellow
3	LED "ALARM": Alarm messages, red
4	LCD: Display of operating status, warning and alarm messages as well as menu functions

The pushbuttons provide the following functions:

	In the operating mode	In the menu mode
5	"TEST" button Press and release: LED test Press and hold down: Opens the menu for testing of assigned devices (insulation monitoring devices, line isolation monitors and ground fault circuit interrupters).	No function
6	"Mute" button Set buzzer to mute following alarm	"ESC" button Exit function (without saving) resp. go up one menu level. When the buzzer is sounding, you can press ESC to set it to mute.
7	"Scroll" button To scroll through the warning and alarm messages listed on the display	UP button to scroll up in the menu
8	"Add. text" button Alternate indication between normal text and additional text.	DOWN button to scroll downwards the menu
9	"MENU" button Starts menu mode in order to make the MK800 settings; for display and control functions	"↵" button (ENTER button) Confirm menu option selection

7.2 Quick reference guide

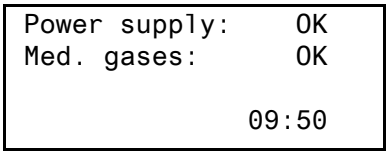
The following images have been provided by way of example only.

7.2.1 Display in error-free operation

There are no warnings or alarms pending.

- The green "Normal" LED is lit.
- The programmed standard information appears on the LC display.
- A maximum of 3 measuring values can be indicated in the lines 1...3.

Example:

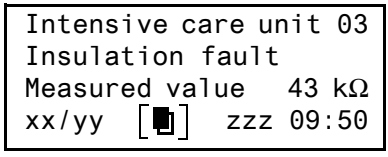


– Lines 1...3: User-definable standard display text
– Line 4 Status bar, indicates the time of day

7.2.2 Display in fault condition

A warning or an alarm is pending.

- Depending on the type of fault, either the yellow LED "Warning" or the red LED "Alarm" will light up. The green LED "Normal" goes out.
- The buzzer sounds at the same time. If the cause of the message cannot be remedied immediately, the buzzer can be deactivated by pressing "Mute" (6).
- Information about the message appears on the LC display.



– Line 1: Standard display: "System: 03"
User-defined text here: "Intensive care unit 03"
– Lines 2...3: Message text, may contain measured value

– Line 4 status line
xx = Consecutive number of message displayed
yy = Number of pending messages
= Message text page, in this case page 1
zzz = Fault location or test in progress (see table)
09:50 = Time of day (example)

Possible displays during insulation fault location or testing:

zzz	Meaning:
EDSa	EDS insulation fault location in progress (automatic)
EDSp	Continuous EDS insulation fault location in progress
EDSs	Single-pass EDS fault location in progress
EDS	EDS insulation fault location complete
TEST	A-ISOMETER® test in progress. "TEST" flashes if the message on the display is associated with the test.

Only when the external bus is set to "Off“:

noMA	No master on the internal bus.
MAST	Device is "substitute master" on the internal bus.

- Press the "Add. text" button (7) for detailed information.

```
since: 25:01:05  16:52
Device:        Isometer
Addr/Ch:        003/01
xx/yy           17:30
```

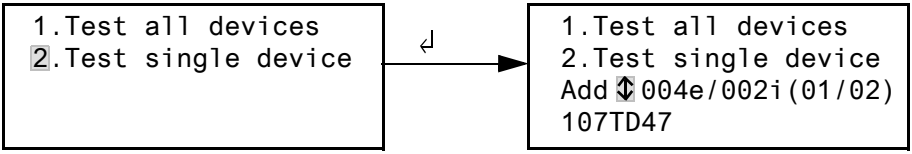
– Line 1: Date and time the message occurred
– Line 2: Device triggering the message
– Line 3: Address and channel of device triggering message.
– Line 4 Status line:

xx = Consecutive number of message displayed
yy = Number of pending messages
▀ = Message text page, in this case page 1
zzz = Fault location or test in progress (see table)
09:50 = Time of day (example)

The display may deviate accordingly in case of user-defined messages.
If messages are pending and one of the arrow buttons is pressed, the current message will appear on the display. If no further button is pressed, this indication will be displayed for 15 seconds.

7.2.3 Test function

Press and hold down the "TEST" button for at least one second to check the function of the associated insulation monitoring devices (e.g. 107TD47, IRDH...), line isolation monitors (LIM) and ground fault circuit interrupters (GFCI). A message is only output on the MK800 on which the test button was pressed.



1. Test all devices — Tests all devices which are set in the menu "Test addresses"
2. Test single device — Use the arrow buttons to select a device and confirm with the "↲" button.

During the test, the text "TEST" will appear in the status line. "TEST" flashes if the message on the display is associated with the test.

The associated devices are checked one after another. The MK800 automatically evaluates the messages that appear. Once the process is complete, either a common message indicating that the test has been successful or a fault message is output.

If more than one device has been tested, a separate error code will be displayed for each device failing the test. The following error codes are displayed in the event of an A-ISOMETER® failing the test:

Error code	Meaning for the 107TD47 (hospital Isometer)	Meaning for the IRDH... (Industrial Isometer)	Note
0	No messages received from Isometer despite it confirming the test command.	No messages received from Isometer despite it confirming the test command.	
1	Only insulation fault message received.	Only insulation fault message received from channel 1.	Channel 1

Error code	Meaning for the 107TD47 (hospital Isometer)	Meaning for the IRDH... (Industrial Isometer)	Note
2	Only overload fault message received.	Only insulation fault message received from channel 2.	Channel 2
3	Only insulation fault message and overload message received.		Channel 1 and 2
4	Only overtemperature message received.		Channel 3
5	Only insulation fault message and overtemperature message received.		Channel 1 and 3
6	Only overload message and overtemperature message received.		Channel 2 and 3
14	Unable to send test command as request not received (slave).	Unable to send test command as request not received (slave).	Slave only
15	Isometer did not confirm test (no response).	Isometer did not confirm test (no response).	

Notes about error codes

- For MK800 operating as "slaves" on the BMS bus, a time-out of 50 seconds is applicable for error codes 0 and 14.
- Error code 14 is displayed if the test has been requested on a slave but the test command cannot be sent because the MK800 was not scanned. This can be the case if the address gap upstream of the MK800 is so large that the master does not scan the MK800. This error code is less of an indicator that an A-ISOMETER® is faulty and much more of an indicator of a fault on the BMS bus system.

8. Menu mode: Operation and setting

8.1 Switching on and calling up the main menu

When the MK800 is connected to the power supply, the following information appears on the display for approx. 3 seconds. It indicates the address and firmware version of the device. This information can also be accessed in the "Info" menu.

```
MK800-11 Addr.:01/001
Software  3.20   D279
Date:        25.06.09
BENDER GmbH Grünberg
```

If the MK800 was not supplied with voltage for several days, the starting procedure can require longer time (approx. 30 seconds). Enter afterwards time and date again.

If there are no messages pending, the standard display will appear after the start.

```
********************
*** SYSTEM READY! **
Bender GmbH Grünberg
               09:50
```

The standard display and the message texts can be modified in the TMK-SET software.

Press the "Menu" button for approx. 2 seconds to open the main menu.

```
1.Exit
2.Values
3.History
4.Settings
```

The following buttons are used in the main menu:

ESC	Exit function or go up one menu level.
▲, ↴	Select menu items
↵	Confirm selected menu item (Enter)

The menu mode is exited automatically if no buttons are pressed in a menu for more than five minutes (exception: "position mode" and "test communication" in the "Control" menu).

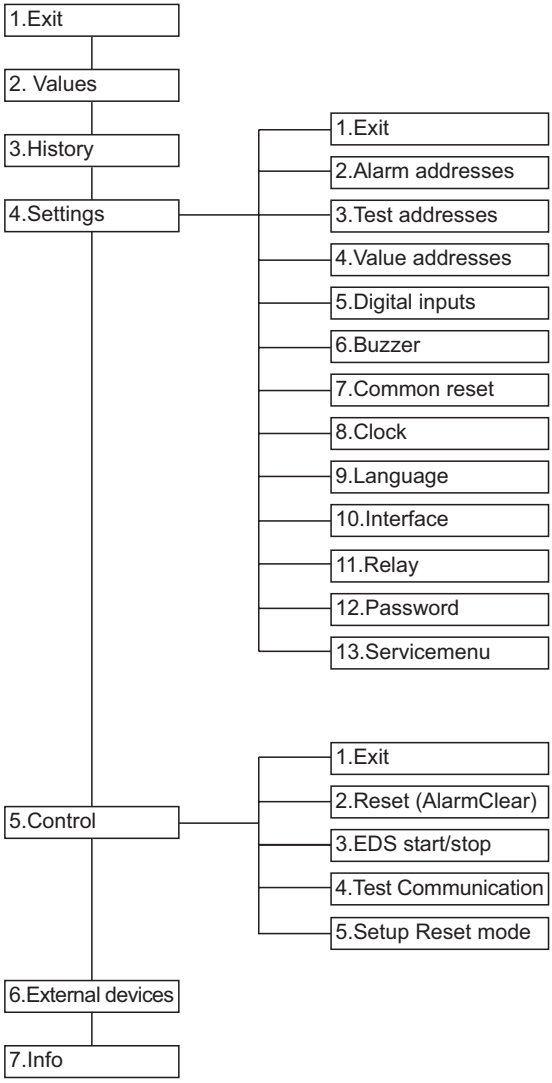
Some menus are password protected. Password protection is only effective if the password has been activated (switched on).
When an attempt is made to open a window, the password entry screen appears automatically:

```
Please enter
  Password
 ↕0 0 0
```

Once a valid password has been entered, full access will be granted to all menus (except the Service menu) until menu mode is excited.

8.2 Menu overview diagram

The following diagram will help you to familiarise yourself with the menu:



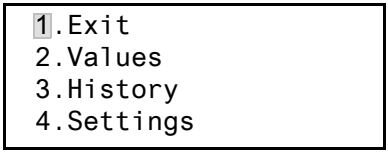
8.3 Main menu functions

Menu item	Function	Page
1. Exit	Exit menu mode	
2. Values	No function	
3. History	Displays history with information about messages, acknowledgements and associated times.	59
4. Settings	Various settings for this MK800.	61
5. Control	This menu offers various options for controlling the overall system.	73
6. External devices	Settings on the connected evaluators (e.g. EDS4xx and RCMS4xx).	75
7. Info	Information about the device type, the firmware version and the last time the assignments were transmitted.	77

8.4 The main menu

8.4.1 Exit

Exits menu mode.



8.4.2 Menu 2: Values

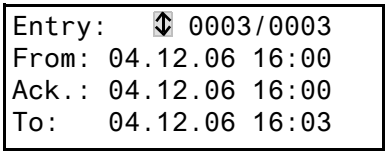
This menu does not have any function.

8.4.3 Menu 3: History

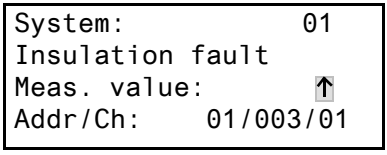
The MK800 can store up to 1000 messages in the history memory (ring buffer). Once the MK800 reaches the limit of 1000 messages, message 1001 will overwrite message 1.

The "History" menu provides information about messages, acknowledgements and associated times. It also indicates whether an alarm is still pending or when it was acknowledged with the "Mute" button. The complete content of the history memory with additional texts and address of the device sending the message can be displayed on a PC and printed out using the TMK-HISTORY software version V3 or higher. All interfaces of MK800 can be used for connection.

1. Select the appropriate entry using the Up/Down buttons.
   First of all, the last entry is displayed. Older entries can be selected with the Up/Down buttons.



2. Press "↵" to call up the message text for the selected entry. The path the message took to reach MK800 (In this case insulation fault, external BMS bus address 01, internal BMS bus address 003, channel 01) appears in the last line. The table on the following page contains information about other possible displays.



3. As shown in the example above the min. and max. values display can be called up by pressing "▲".
4. Press "↵" again to go back to the entry selection screen.

Repeat this process for all required messages. Then press "ESC" to exit the menus.

Possible displays in the last line of the history memory message text display:

Text	Meaning
Address: ee/iii/kk	Address of the device triggering the message (ee = external BMS bus address, iii = internal BMS bus address, kk= channel no. of message).
Digital Inp Nr.: kk	Number (kk) of digital input on this MK which triggered the message.
TESTex	Note that the current history entry was created as the result of a test initiated on this MK.
TESTin	Note that the current history entry was created as the result of a test initiated on the corresponding A-ISOMETER®.

8.4.4 Menu 4: Settings

The following menu items are available for configuring the MK800:

Menu item	Function	Page
1. Exit	Exit "Settings" menu; go up one menu level	
2. Alarm addresses	Setting of bus addresses for devices whose alarm messages are to be displayed on this MK800.	62
3. Test addresses	Setting of bus addresses for devices which are to carry out a test when the "TEST" button is pressed.	63
4. Value addresses	No function	64
5. Digital inputs	MK800-11 only: Setting of the operational characteristics of digital inputs.	65
6. Buzzer (and LED)	Setting of the frequency and repetition rate of buzzer signal.	67
7. Common reset	Setting whether this MK800 should respond to a common acknowledgement initiated via the reset button on a higher-level device.	67
8. Clock	Setting of the date and time on the real-time clock on this MK800. At the same time this setting is sent via BMS bus and all other devices are synchronised. The device with address 1 (MK800 alarm indicator and operator panel) synchronises all other devices every hour.	68
9. Language	Selection of operating language for the MK800 (German or English).	69
10. Interface	Setting of the device address and baud rate for this MK800.	70
11. Relay	Mode of operation and function of the common alarm relay (alarm relay) on the MK800-11.	71
12. Password	Change password, activate/deactivate password.	72
13. Servicemenu	Reserved for settings made by authorised Bender Service personnel. Call up information about the device status, make settings for specific operating conditions and run firmware update.	72

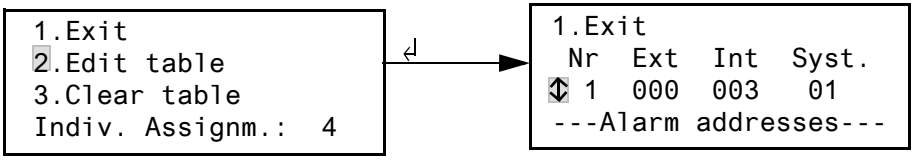
8.4.4.1 Exit

Exit menu mode.

```
1.Exit
2.Alarm addresses
3.Test addresses
4.Value addresses
```

8.4.4.2 Settings menu 2: Alarm addresses

Setting of bus addresses for devices whose alarm messages are to be displayed as standard messages on this MK800. The text of individual assignments can be modified using the TMK-SET software.
Select the addresses of devices whose messages are to be displayed. Set addresses are monitored for presence on the BMS bus; if a device cannot be found on the bus, a corresponding message will appear.
If a number of systems or areas (e.g. several operating theatres) are connected to the MK800, the numbers 1..4 can be assigned to them.



1. Exit	Back to the main menu.
2. Edit table	Use the arrow buttons to select the line "No" and confirm with the "↵" button. Use the arrow buttons to set the external BMS bus address "Ext" and confirm with the "↵" button. Use the arrow buttons to set the internal BMS bus address "Int" and confirm with the "↵" button. Use the arrow buttons to select the external system number "Syst." and confirm with the "↵" button. MK800 always adds a new line at the end of the table which can be changed (e.g. 4 000 000 00). In this way, other alarm addresses can be activated.
3. Clear table	Deactivate all addresses (off). "Clear table" is only possible when there are no test addresses activated.
Line 4 in the table	Number of programmed individual assignments.

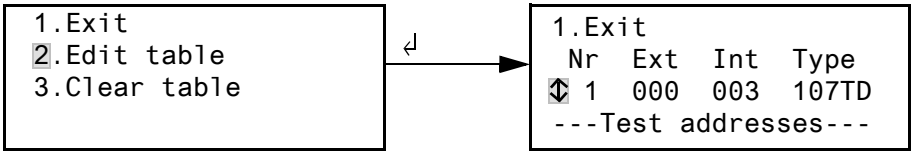
Possible system number "Syst." settings:

Syst.	Meaning
00	No text appears in line 1 of the alarm message.
01...04	Texts "System 01" to "System 04" are displayed.
T	Programmed text is displayed.
Off	Deletes the current line of the table.

8.4.4.3 Settings menu 3: Test addresses

Setting of the bus addresses for insulation monitoring devices (e.g. 107TD47, IRDH...), line isolation monitors (LIM) and ground fault circuit interrupters (GFCI) which are to carry out a test when the "TEST" button is pressed. The setting can only be made for devices which have also been activated in the "Alarm addresses" menu and/or programmed for individual alarm texts. Individual alarm texts are a minimum requirement for:

- Channel 1...3 (setting "107TD47")
- Channel 1 , 2 (setting "IRDHxxx")
- Channel 1 (setting "GFCI")
- Channel 1, 2, 3, 6, 7, 9 (setting "LIM")



1. Exit — Back to the main menu.
2. Edit table — Use the arrow buttons to select the line "No" and confirm with the "↵" button.
Use the arrow buttons to set the external BMS bus address "Ext" and confirm with the "↵" button.
Use the arrow buttons to set the internal BMS bus ad-

dress "Int" and confirm with the "↵" button.
Use the arrow buttons to select "IsoT" and confirm with the "↵" button.
MK800 always adds a new line at the end of the table which can be changed (e.g. 4 000 000 Off). In this way other test addresses can be activated.

3. Clear table — Deactivate all addresses (off).

Possible settings for "Type":

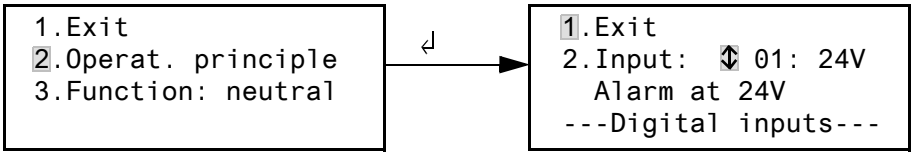
Syst.	Meaning
MED-I	Insulation monitoring device, e.g. 107TD47
IND-I	Industrial insulation monitoring device, e.g. IRDH...
GFCI	Ground Fault Circuit Interrupter
LIM	Line Isolation Monitor
Off	Deletes the current line of the table

8.4.4.4 Settings menu 4: Value addresses

Currently no function.

8.4.4.5 Settings menu 5: Digital inputs

Setting of the operational characteristics of digital inputs IN1...IN16 (MK800-11 only). The setting can be made individually for each input: "24V" (high) or "0V" (low). If "24V" is set for an input, an alarm message will be output if 24 Volt are present there. If "0V" is set for an input, an alarm message will be output if 0 V is present here. It is for this reason that you should always set unused digital inputs to "Off".



1. Exit	Back to the main menu.
2. Operat. principle	Use the arrow buttons to select the digital input and confirm with "↲" button, use the arrow buttons to select "0 V", "24 V" or "Off". Press "↲" to accept the entry. Repeat the procedure to set more digital inputs.
3. Function	Set the message text category "neutral" or "medical", see chapter "Digital input alarm texts".

Alarm messages for medical gases are signalled by the red "ALARM" LED and the buzzer sounding. The buzzer can be set to mute. It will sound again after 15 minutes by way of a reminder.
Non-standard settings can only be made using the TMK-SET software.

Digital input alarm texts

A general or specific alarm message can be assigned to all digital inputs. A general alarm message (neutral) indicates the alarm, the channel and the address of the device triggering the alarm. In comparison, specific alarm messages (medical) signal non-modifiable pre-programmed alarms, e.g. "Alarm: Oxygen". Assign the inputs in accordance with table "General and specific alarm messages" on page 66.
Other messages can be assigned to individual or all digital inputs with the TMK-SET PC software.

The alarm messages in the following table are sent to other MK... or alarm indicator and operator panels via BMS bus and displayed there in plain text format. If freely programmable alarm messages need to be displayed on a different MK800 or an alarm indicator and operator panel, the same alarm messages must have been programmed in the displaying device.

Specific alarm messages

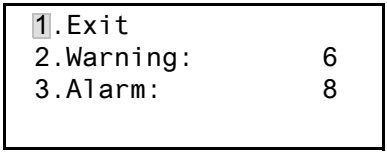
These messages contain instructions for medical gases and UPS systems. Alarm messages for medical gases are signalled by the red "ALARM" LED and the buzzer sounding. The buzzer can be set to mute. It will sound again after 15 minutes by way of reminder.

General and specific alarm messages

Inputs	General alarm messages "Function: neutral"	Specific alarm messages "Function: medical"
IN1	Alarm: Address/channel XXX/01	Alarm: Oxygen
IN2	Alarm: Address/channel XXX/02	Alarm: Vacuum
IN3	Alarm: Address/channel XXX/03	Alarm: Nitrous oxide
IN4	Alarm: Address/channel XXX/04	Alarm: Compressed air 5 bar
IN5	Alarm: Address/channel XXX/05	Alarm: Compressed air 8 bar
IN6	Alarm: Address/channel XXX/06	Alarm: Nitrogen
IN7	Alarm: Address/channel XXX/07	Alarm: CO2
IN8	Alarm: Address/channel XXX/08	Alarm: UPS battery operation
IN9	Alarm: Address/channel XXX/09	Alarm: UPS overload
IN10	Alarm: Address/channel XXX/10	Alarm: UPS converter failure
IN11	Alarm: Address/channel XXX/11	Alarm: UPS fault
IN12	Alarm: Address/channel XXX/12	Alarm: UPS test run
IN13	Alarm: Address/channel XXX/13	Alarm: UPS mains operation
IN14	Alarm: Address/channel XXX/14	Alarm: Failure air conditioning
IN15	Alarm: Address/channel XXX/15	Alarm: OP light battery operation
IN16	Alarm: Address/channel XXX/16	Alarm: Sat OP light battery operation

8.4.4.6 Settings menu 6: Buzzer (and LED)

The buzzer will sound in the event of an alarm. Setting the frequency and repetition rate of the two consecutive buzzer tones.



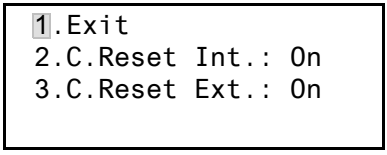
1. Exit — Back to the main menu.
2. Warning
3. Alarm — Various standard signals can be selected for "Warning" and "Alarm". An individual buzzer sound can be selected via TMK-SET.

During setting the selected buzzer signal will sound and the LED will light up or flash.

8.4.4.7 Settings menu 7: Common reset

Setting indicating whether this MK800 should respond to the acknowledgement of the buzzer initiated by pressing "Buzzer off" button on another MK... or TM... operator panel (On) or not (Off).

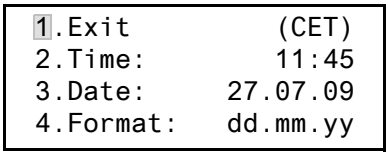
Activating the common acknowledgement function can for example make it possible to acknowledge an alarm (buzzer tone) on an MK800 located in a neighbouring building from an MK800 in a central location. The alarm message itself is displayed until the fault is eliminated.



1. Exit — Back to the main menu.
2. C.Reset Int. — Setting of the common acknowledgement for the internal BMS bus:
   - On — Buzzer can be acknowledged externally
   - Off — Buzzer cannot be acknowledged externally.
2. C.Reset Ext. — Setting of the common acknowledgement for the external BMS bus:
   - On — Buzzer can be acknowledged externally
   - Off — Buzzer cannot be acknowledged externally.

8.4.4.8 Settings menu 8: Clock

This menu is used to set the time of day, date and date format display. These settings remain stored for approx. 5 days following a power supply failure. The clock switches automatically to central European summer time (CEST) and winter time (CET). Reset the clock if the time of day no longer matches your local time following automatic switchover. Automatic switchover can be deactivated (see also "A choice of settings" on page 78).



1. Exit	Back to main menu
2. Time	Set time of day (hours and minutes)
3. Date	Set date (DD.MM.YY)
4. Format	Select German or American (mm/dd/yy)
5. Summer time	Setting for automatic switchover to central European summer time: auto automatic switchover off no switchover

In a networked system the MK800 or the TM... operator panel with address 1 determines the time of day and date for the entire system. The settings are transferred to all other MK800 or alarm indicator and operator panels. You can, however, set the system time of day and date on any MK800 or alarm indicator and operator panel.

8.4.4.9 Settings menu 9: Language

Selection of the language for using the menus and displaying messages (alarm and operating messages) on the MK800. Changes take effect immediately.

```
1.Exit
2.Menu:       English
3.Messg.:     English
```

1. Exit — Back to the main menu.
2. Menu — Set the operating language for the menu: English or German.
3. Messg. — Set the display language for the messages. You may select:

Deutsch	English	French	Italian
Spanish	Portuguese	Portuguese (Brazilian)	Dutch
Norwegian	Swedish	Finnish	Danish
Polish	Hungarian	Czech	Slovenian
Croatian	Serbian	Turkish	Indonesian

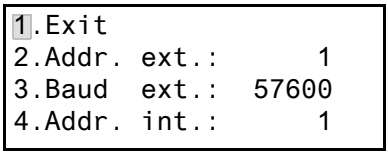
The language setting activates the language-specific special characters.

However, user-defined alarm texts remain unchanged.

A Russian device version is also available (see Chapter 9.2 Ordering information).

8.4.4.10 Settings menu 10: Interface

Setting of the device address of this MK800 and transmission speed (baud rate) for the connection to the BMS bus.



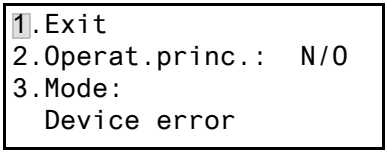
1. Exit	Back to the main menu.
2. Addr. ext.	Setting of the external BMS bus address. Addresses between 1 and 99 may be selected, (factory setting: 1). "Off“ = switch off external bus
3. Baud ext.	The baud rate of the external bus is selectable: 19200, 38400 or 57600 bit/s, (factory setting: 57600 bit/s). This setting can also be carried out when the external bus is switched off.
2. Addr. int.	Setting of the internal BMS bus address. Addresses between 1 and 150* may be selected, (factory setting: 1). This setting can only be changed when the external BMS bus has been switched off before. On the internal BMS bus the fixed pre-assigned baud rate is 9600 bits/s.

Change the corresponding device address if a number of MK800 are connected to one BMS bus. One MK800 must have the address 1 (master). All other MK800 are addressed in consecutive order: 2,3,4.... The function of the system can only be assured if there are no gaps between addresses.
Data exchange will only work between devices with the same baud rate.

* *The addresses 100...103 are not adjustable since they are intended for special tasks (e.g. programming).*

8.4.4.11 Settings menu 11: Relay

Set the mode of operation and function of the optional alarm relay on the alarm indicator and test combination.
This menu only exists on the MK800..-11.

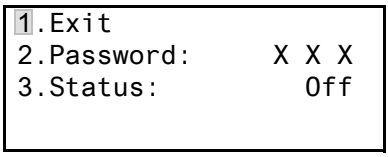


1. Exit — Back to the main menu.
2. Operat. princ. — Set the mode of operation:
   N/O N/O operation
   N/C N/C operation
3. Mode — Alarm relay switches in the event of the following settings:

Setting	Description
Programmable	Programming via TMK-SET -> individual alarms or operating messages
Device error	Relay switches in case of an internal fault on the MK800-11
Common alarm	Relay switches in case of any warning or alarm message
Device failure	Relay switches as soon as the MK800 recognises a device failure
TEST-Monitor	Relay switches for approx. 1 second once an A-ISOMETER® test is started by pressing the "TEST“ button
Buzzer	Once the buzzer sounds, the relay is activated

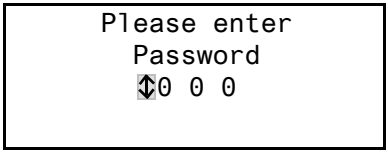
8.4.4.12 Settings menu 12: password

Change, activate/deactivate password.



1. Exit — Back to the main menu.
2. Password — Change password. Factory setting: 807
3. Status: — Activate or deactivate password protection.

Some menus are password-protected. Password protection is only effective if the password has been activated (switched on).
When an attempt is made to open a window, the password entry screen appears automatically:



Once a valid password has been entered, full access will be granted to all menus (except the Service menu) until menu mode is exited.

8.4.4.13 Settings menu 13: Servicemenu

The Service menu is reserved for settings made by authorised Bender service personnel. It can only be accessed subject to the entry of a master password.

In the Service menu, information about the device status can be called up and settings for specific operating conditions can be made.

8.4.5 Menu 5: Control

This menu offers various options for controlling individual devices or the overall system:

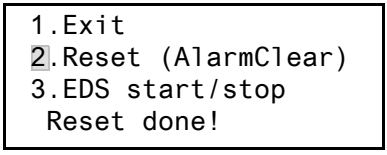
Menu item	Function	Page
1. Exit	Exit "Control" menu; go up one menu level	
2. Reset (AlarmClear)	Resetting all fault messages pending on the BMS bus	73
3. EDS start/stop	Manual starting/stopping of test procedures on EDS system	74
4. Test Communication	Testing of communication via the BMS bus (MK800-11 only).	74
5. Setup Reset mode	Determine whether a reset is to be carried out via the internal BMS bus only or also via the external BMS bus.	75

8.4.5.1 Exit

Exit menu mode.

8.4.5.2 Control menu 2: Reset (AlarmClear)

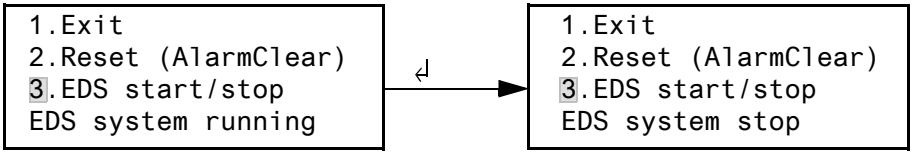
Press "↵" to reset all pending fault messages on the BMS bus. "Reset complete!" will then appear in the last line.



This reset command is sent via the BMS bus. Note that some devices (e.g. PRC487) do not react to this reset.

8.4.5.3 Control menu 3: EDS start/stop

Press "↵" to start and stop the test procedure manually on the EDS system. The current status appears in the last line.



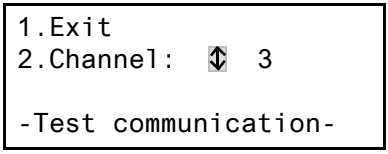
EDS system running	Once started, EDS4xx-12 and PGH47x run continuously. If you exit the menu, the standard display "EDSp" will appear in the last line in order to indicate continuous running*.
EDS system stop	Stops the continuous pass of EDS4xx-12 and PGH47x. If you exit the menu, the standard display "EDS" will appear in the last line until the current test pass finishes.

*Other abbreviations that can be displayed in the last line:

EDSa	Automatic mode: Insulation fault location has been started by A-ISOMETER® on PGH47x.
EDSs	Single mode: A single pass has been started by IN2 on PGH47x.

8.4.5.4 Control menu 4: Test Communication

Testing of communication via the BMS bus. For this purpose, a fault message is simulated on a digital input. This fault message is sent to evaluators devices (e.g. alarm indicator and operator panels, other MK800, SMO...). Check that these devices are responding to the fault message as requested.



Channel 3	Setting of the channel whose message is to be activated.

8.4.5.5 Control menu 5: Setup Reset mode

Set whether the reset command should have an effect on internal BMS bus only or also on the external bus: Setting possibilities

- internal bus only
- internal and external bus

8.4.6 Menu 6: External devices

This menu is used to set and control external devices. Functions include for example displaying information about connected devices (address, software version, device type) or continuous displaying a channel on a connected evaluator.

Select the BMS bus to which the external device is connected.

```
1. Exit
2. Internal Interface
3. External Interface
```

Internal Interface — Devices connected to the internal BMS bus of this MK800 can be displayed and set.

External Interface — Devices connected to the external BMS bus of this MK800 can be displayed and set. If other Bender devices are addressed with an internal bus (MK800, alarm indicator and operator panel), the devices connected to this internal bus can also be displayed and set.
Devices which can be parameterised:
EDS46x, EDS47x, EDS49x,
RCMS460, RCMS470, RCMS490

The device connected to the bus selected will be displayed. Select the address of the external device to be displayed (e.g. EDS4xx-12 or RCMS4xx-12).

```
1. Exit    (internal!)
001:   MK800-11   V3.20
002:   EDS470     V3.20
003:   107TD47    V2.52
```

Address, type and version of the connected device will be displayed. If no device is detected under this address, the character "?" will be indicated. Use the arrow buttons to select the address of the external device and confirm your selection with the "↵" button.

If the device has been recognised, the MK800 will read the current settings of the connected device. The device type is displayed in the first line. Use the arrow buttons to select the required function or device setting and confirm your selection with the "↵" button. Example:

```
1. Exit     (107TD47)
2. Position mode
```

```
1. Exit     (107TD47)
2. Channel: ⇕    1
   Re= 20 KΩ
```

Numerous setting options are available in the EDS or RCMS menu. These are described in more detail in the operating manuals for the corresponding systems.

```
1. Exit     (EDS470)
2. General
3. Channel
4. Relay
```

8.4.7 Menu 7: Info

```
MK800-11 Addr.:01/001
Software  3.20   D279
Date:        25.06.09
BENDER GmbH Grünberg
```

Information about the device type, the firmware version and the last time the assignments were transmitted.

Select:

ESC — To leave the menu mode

▲ — Show date of last assignment transmission:

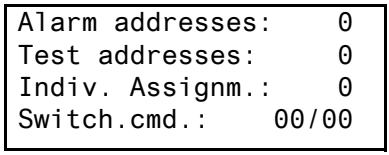
```
Assignments
programmed
on:   12.07.09  07:07
```

Assignments are settings carried out via a PC software (e.g. TMK-SET):
- Enter standard text
- Assign text and functions to alarm messages and digital inputs of the MK800
- Set parameters

▼ (Press once) — Show version of standard texts and version of the boot loader (internal software for updates).

```
Text version:    2.00
Bootloader       2.20
```

▼ (press twice) The number of the programmed alarm addresses, test addresses and individual assignments will be displayed.
Switching commands (Contact defs.): MK800 provides no function.



↵ Go back to the main menu

8.5 A choice of settings

Die MK800 supports various setting modes. The table below shows where the individual parameters can be set.

Parameter				Setting via			
Name	**Range**	**Factory setting**	**User setting**	**MK800 Menu item**	**MK800 Service menu**	**TMK-SET Parameter menu**	**Note**
Buzzer (and LED)	(0),1..9	6 / 8		4.6 (preset only)	–	Signal settings	Setting of frequency 1, 2, buzzer and LED interval for ALARM and WARNING, selection of predefined messages (preset)
Common reset int. (ext.)	y/n (y/n)	y (j)		4.7	–	Buzzer mute via int./ext. BMS bus	Setting if it should be possible that alarm acknowledgements mute the buzzer on parallel displays connected via the int. (ext.) BMS bus.
Clock / date / S/W-Time	auto / off	auto		4.8	–	Time of day / date / CEST automatic	Setting time and date / automatic CEST summertime/wintertime on / off
Language	German / English			4.9	–	Language	Setting of the menu language
Interface RS-485 intern RS-485 extern	 On/Off On/Off	 on on		4.10	–	RS-485 settings External Internal	Switch off unused external interface Parallel panel: faster communication external Single panel: faster communication internal
RS-485 settings Address ext. (int.) Baud rate ext. (int.)	 1..99 (1..150) 19800.. 57600 (9600)	 1 (1) 57600		4.10	 – –	RS-485 settings	Settings for the ext. (and int.) BMS bus. The address of the int. Interface can only be set when the ext. Interface has been switched off.
Relay	Function, operating mode			4.11		Digital output 1	Setting of the 1st dig. output resp. relay function: test / device error / common alarm / device failure / programmable
Password prompt	y/n	y		4.12	–	Password prompt	Activate/deactivate password prompt
Password	nnn	807		4.12	–	Change password	Enter / change the password
Reset mode	int. / int. + ext.	int.		5.5	–	Reset mode int./ int. and ext.	Determine the effect of the RESET command via BMS
History memory	–	–	--	–	2.2 History clear	History memory reset	Clear all data records in the history memory
Reset counter	–	–	--	–	3 Reset counter 3.2. Clear Reset Count.	Reset counter reset	Indication and reset of Power-Down, Watchdog and External counter
--	–	–	--	–	4. Digital IN/Taskbits	–	Indication of the digital input states and tasks
--	–	–	--	–	5. BI800-In/BMIxx-Out	–	a) Test of single outputs: Set the number of the output. b) Indication of the buttons in depressed position.

Parameter				Setting via			
Name	**Range**	**Factory setting**	**User setting**	**MK800 Menu item**	**MK800 Service menu**	**TMK-SET Parameter menu**	**Note**
Time-Out int. Time-Out ext.		42 ms 10 ms		--	6. Setting Timeout/SP 6.2. Timeout int. 6.3. Timeout ext.	Timeout RS-485 int. / RS-485 ext.	Timeout on int. BMS: 060 ms Timeout on ext. BMS: 010 ms at 56 kBd Change only for test purposes! Indication of stack load in % (R: program stack; C: data stack)
--	--	--	--	--	7. Timing Analysis 1	--	Indication (and reset) of the max. response times of the associated address on the int. and ext. bus
MaxSlaveTime	500..3000 ms	3000 ms		--	8. Timing Analysis 2 8.2. MaxSlaveTime	MaxSlaveTime RS-485 ext.	a) Indication (and setting) of the MaxSlvTime (3000 ms) When the time is exceeded, the ext. Interface will be processed first b) Indication of the SlaveTimeExt (ms) c) Indication of the M.-Delay Ext (ms)
Backlight	auto / on	auto		--	9. Backlight	LCD Backlight	Backlight automatically when operated or when the alarm is activated or continuously activated.
Max.Adress Gap	1..9	3		--	10. Addr.Gap/FaultCnt 10.2 Max.Address Gap	Max.Address Gap RS-485 ext.	Max. permissible address gap (3) and Fault Count (2): Number of passes on the ext. BMS until a failure messages is created
Max.Fault Count	0..3	2		--	10.3 Max.Fault Count	Max.Fault Count Device failure alarm	Max. permissible number of missing answers until a failure message is created.
Buzzer	On/Off for 1..9 h	On	--	--	11. Buzzer On/Off	--	Z.B. for the time of commissioning, the buzzer can be switched off **for 1...9** h
DigInput Setting Extern	0/1	0		--	12. DigIn setting ext	--	Deactivating the forwarding of operating messages of the digital inputs 1-16 to the external bus (for flashing message)
MaxVariation	0..50 %	25 %		--	13. Value resend cond	MaxVariation	Max. deviation from analogue values of the int. BMS. If the values are exceeded, status and alarm messages will be resent via the external bus (def.: 30 %)
ALMI Idle-Time	1..2 s	2 s		--	14. ALMI Idle-Time	ALMI Idle-Time RS485 int.	Time between 2 ALMI queries on the internal BMS
Message interval		5 s		--	15. Time/Message	Interval for messages	Time interval at which messages are displayed alternately, if different messages occur simultaneously.
				--	16. Factory setting 16.2. Reset Parameter 16.3. Reset all	--	Reset of the memory contents
				--	17. Firmware-Update	--	Carry out manual firmware update (only required if a fault occurs during program-controlled updates).

9. Technical data

9.1 Technical data

Insulation coordination acc. to IEC 60664-1

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

Supply voltage

Supply voltage U_S ..... AC / DC 24 V
Frequency range U_S ..... 0 / 40 . . . 60 Hz
Operating range U_S ..... AC 18 . . . 28 / DC 18 . . . 30 V
Power consumption ..... ≤5 VA

Stored energy time in the event of power system failure

Time set ..... > 5 days
Restart in the event of voltage failure for at least ..... 1.5 s

Displays and LEDs

Display, characters ..... four lines, 4 x 20 characters
Standard message texts in ..... 20 languages
Alarm addresses ..... ≤ 250
Programmable text messages 1000
History memory (messages) 1000
Standard text message ..... 3 x 20 characters
Additional text message (press button to access) ..... 3 x 20 characters
Alarm LEDs (a set of LEDs) ..... NORMAL (green)
..... WARNING (yellow)
..... ALARM (red)
Menu texts ..... German/ English
buttons ..... 5 (A-ISOMETER® test, buzzer mute, additional text, scroll, menu)

Buzzer

Buzzer message ..... can be acknowledged, adoption of characteristics of new value
Buzzer interval ..... configurable
Buzzer frequency ..... configurable
Buzzer repetition ..... configurable

Inputs (MK800-11 only)

Digital inputs ..... 16 (IN1 . . . IN16)
Galvanic separation ..... yes
Control of digital inputs ..... via voltage-free contacts/extraneous voltage
Operating principle N/O or N/C operation can be selected for each input
Factory setting ..... N/O operation
Voltage range (high) ..... AC / DC 10 . . . 30 V
Voltage range (low) ..... AC / DC 0 . . . 2 V

Interfaces

Interfaces ..... 2 x RS-485 and 1 x USB (V2.0/V1.1)
Technical data for the RS-485 interface:
Protocol ..... BMS
Int. / ext. baud rate ..... 9.6 kbit/s / 57.6 kbit/s
Cable length ..... ≤ 1200 m
Recommended cable (shielded, shield connected to PE at one end) ..... at least J-Y(St)Y 2 x 0.6
Terminating resistor ..... 120 Ω (0.25 W), connectable via DIP switch
..... Factory setting: both of them in "Off" position
Device address, BMS bus int. / ext. ..... 1 . . . 150 / 1 . . . 99
Int. / ext. device address factory setting ..... 1 (master) / 1 (master)

Programming

Interfaces ..... RS-485 or USB (V2.0/V1.1), USB cable: Type A plug on type B plug.
Software TMK-SET ..... V 3.0 and higher
Factory setting password ..... activated

Cable length in case MK800 is supplied by AN450

0.28 mm^2 ..... 50 m
0.5 mm^2 ..... 90 m
0.75 mm^2 ..... 150 m
1.5 mm^2 ..... 250 m
2.5 mm^2 ..... 400 m

Colours

Front foil ..... RAL 7035 (light grey) / RAL 7012 (basalt grey)
Marking ..... buttons: RAL 5002 (ultramarine blue) / Text: RAL 7035 (light grey)
Front plate ..... RAL 7035 (light grey)

Switching elements (MK800-11 only)

Number ..... 1 (MK800-11 only)
Function ..... programmable

Operating principle ..... N/C or N/O operation (programmable)
Electrical service life, number of cycles 10.000
Contact data acc. to IEC 60947-5-1
Utilisation category AC-13 AC-14 DC-12
Rated operational voltage ..... 24 V 24 V 24 V
Rated operational current ..... 5 A 3 A 1 A
Minimum contact load ..... 1 mA at AC / DC > 10 V

General data

EMC immunity ..... acc. to EN 61000-6-2
EMC emission ..... acc. to EN 61000-6-4
Operating temperature ..... - 5 . . . +55 °C
Climatic class acc. to IEC 60721
Stationary use 3K5
Transport 2K3
Long-term storage 1K4
Classification of mechanical conditions acc. to IEC 60721
Stationary use 3M4
Transport 2M2
Long-term storage 1M3
Operating mode ..... continuous operation
Mounting ..... any position
Connection ..... plug-in terminals
Connection properties (supply voltage, BMS bus)
rigid / flexible / conductor sizes ..... 0.2 . . . 2,5 / 0.2 . . . 2.5 mm^2/ AWG 24-12
flexible with ferrules, without/with plastic sleeve ..... 0.25 . . . 2.5 / 0.25 . . . 2.5 mm2
Connection properties (inputs)
rigid/flexible/conductor sizes ..... 0.08 . . . 1.50.08 . . . 1.5 mm^2/AWG 28-16
flexible with ferrules, without/with plastic sleeve ..... 0.25 . . . 1.5 / 0.25 . . . 0.5 mm2
Stripping length ..... 7 mm
Tightening torque ..... 0.5 . . . 0.6 Nm
Degree of protection, internal components (DIN EN 60529) IP50
Degree of protection, terminals (IEC 60529) IP20
Flammability class UL94V-0

Weight

Flush-mounting (MK800) ..... < 950 g
Surface-mounting (MK800A) ..... < 880 g
Surface-mounting(MK800AF) ..... < 1150 g

9.1.1 Standards

The MK800 alarm indicator and test combination meets the requirements of the regulations for installation IEC 60364-7-710:2002-11 and DIN VDE 0100-710 (VDE 0100 Teil 710): 2002-11.

9.2 Ordering information

Type	Description	Art. No.
MK800-11	Alarm indicator and test combination according to IEC 60364-7-710:2002-11 / DIN VDE 0100-710, featuring a BMS bus and a USB interface , 16 digital inputs, one relay output, alarm texts programmable via interfaces and PC, standard text display. Version: Flush-mounting enclosure; menu languages German/English.	B 9510 0100
MK800-12	Alarm indicator and test combination according to IEC 60364-7-710:2002-11 / DIN VDE 0100-710, featuring a BMS bus and a USB interface, alarm texts can be programmed via interfaces and PC, standard text display. Version: Flush-mounting enclosure; menu languages German/English.	B 9510 0101
MK800-11 Russian version	Alarm indicator and test combination according to IEC 60364-7-710:2002-11 / DIN VDE 0100-710, featuring a BMS bus and a USB interface , 16 digital inputs, one relay output, alarm texts programmable via interfaces and PC, standard text display. Version: Flush-mounting enclosure; menu languages English/Russian.	B 9510 0124
MK800-12 Russian version	Alarm indicator and test combination according to IEC 60364-7-710:2002-11 / DIN VDE 0100-710, featuring a BMS bus and a USB interface, alarm texts can be programmed via interfaces and PC, standard text display. Version: Flush-mounting enclosure; menu languages English/Russian.	B 9510 0125
MK800A-11	As MK800-11, but with surface-mounting enclosure.	B 9510 0102
MK800A-12	As MK800-12, but with surface-mounting enclosure.	B 9510 0103

Type	Description	Art. No.
MK800AF-11	As MK800-11, but with surface-mounting enclosure and front door.	B 9510 0104
MK800AF-12	As MK800-12, but with surface-mounting enclosure and front door.	B 9510 0105
MK800E-11	As MK800-11, but with built-in type device without enclosure.	B 9510 0106
MK800E-12	As MK800-12, but with built-in type device without enclosure.	B 9510 0107
UP800	Flush-mounting enclosure for MK800	B 9510 0110
BR800-1	Bezel frame silver for MK800	B 9510 0111
BR800-2	Bezel frame white for MK800	B 9510 0112
TMK-SET	- TMK-SET V 3.0 for parameterising of MK2430, MK800, TM800, - TMK-HISTORY V 3.x for MK2430, MK800, TM800, TM1000 and PRC1470 - USB driver for MK2430, MK800 and TM800 - MEDISET V1.x for parameterising of TM1000 and PRC1470	B 9602 0087

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