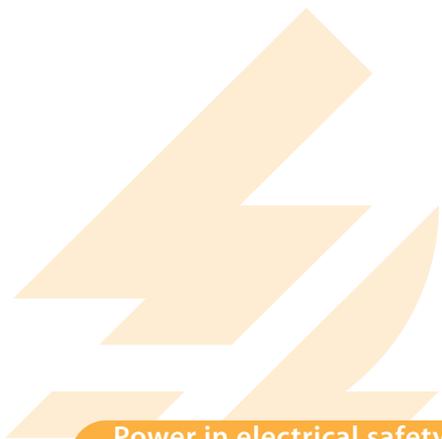


Operating manual



UNIMET® 1000ST and UNIMET® 1100ST

Test systems for electrical safety



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1. Effective use of this manual

1.1 About the operating manual

This operating manual describes version 6.00 and higher of UNIMET® 1000ST and UNIMET® 1100ST. The functions and processes described may vary from those featured in other versions. In the interest of increased clarity, this operating manual refers only to Unimet or UNIMET® 1100ST. It has been designed for skilled personnel working in electrical engineering and electronics.

Please read this operating manual before using the devices. This document must be kept in an easily accessible location near to the device.

Although great care has been taken in the drafting of this operating manual, it may nevertheless contain errors and mistakes. The BENDER Group cannot accept any liability for injury to persons or damage to property resulting from errors or mistakes in this operating manual.

1.2 Technical support

As a BENDER customer, you will receive technical support and assistance in the event of queries relating to equipment you have purchased. Please contact the technical sales department at BENTRON®.

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1.3 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, serious physical 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, serious physical 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 physical 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.

1.4 Overview of chapters

- Chapter 1: Effective use of this manual
... provides information about using this manual.
- Chapter 2: Safety instructions
... provides information about risks affecting installation and operation.
- Chapter 3: System description
... provides information about the features, functions and components of the system.
- Chapter 4: Operation and setting
... provides information about first use, the principle of operation and settings.
- Chapter 5: Testing and measuring
... describes classification, testing and test evaluation.
- Chapter 6: PC-compatible functions of UNIMET® 1100ST
... explains how remote control works and how to perform updates.
- Chapter 7: Maintenance and calibration
... describes what to do in the event of calibration or if a fault occurs.
- Chapter 8: Options and accessories
... provides information about UNIMET® 1100ST versions and available accessories.
- Chapter 9: Data
... provides information about standards, test procedures and technical data.

2. Safety instructions

2.1 Delivery

Check the shipment container and device packaging for damage and compare the delivery documentation with the content of the package. Equipment damaged in transit must not be used. If equipment has been damaged in transit, contact BENTRON® immediately.

Equipment may only be stored in areas where it is protected against dust, damp, spray and dripping water and where compliance with specified storage temperatures can be assured.

The selling company's "General conditions of sale and delivery" always apply.

2.2 Intended use

Unimet test systems have been designed exclusively for use in the area of application described in the chapter entitled "System description".

Intended use also implies:

- Observance of all instructions in this operating manual and
- Compliance with possible test intervals

Use deviating from or beyond the scope of this is considered non-compliant. The BENDER Group cannot accept any liability for damage resulting from such use.

2.3 Qualified personnel

Only appropriately qualified personnel may work on BENDER products. Qualified means familiar with the installation, commissioning and operation of the equipment and have and with training appropriate to the work. Such personnel must have read this manual and understood all instructions relating to safety. BENTRON® would be happy to provide training in respect of the use of the test equipment.

2.4 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:
 - As intended
 - In perfect working order
 - In compliance with the accident prevention regulations and guidelines applicable in the location of use
- Rectify any faults that may endanger 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.

2.5 Warranty and liability

In the event of physical injury or damage to property, no claims in respect of warranty or liability can be accepted if such injury or damage can be attributed to one or more of the following causes:

- Not in accordance with its intended use
- Incorrect assembly, commissioning, operation and maintenance
- Operation of equipment with faulty safety devices or safety and protection devices which have been fitted incorrectly or are not in perfect working order
- Non-observance of instructions in this operating manual and the enclosed sheet entitled "Important safety instructions for BENDER products" in respect of transport, storage and assembly.
- Constructional changes made by parties other than the manufacturer
- Non-observance of technical data
- Repairs carried out incorrectly and the use of replacement parts or accessories not approved by the manufacturer
- Catastrophes, uncontrollable external factors or force majeure

2.6 Guarantee

BENTRON[®] provides a guarantee of error-free design and perfect material quality lasting 36 months from date of delivery for the UNIMET[®] 1100ST test system when stored or operated under standard conditions.

This guarantee does not cover maintenance work of any type whatsoever.

The guarantee is only valid for the first buyer and does not cover products or individual components which have not been correctly used or to which changes have been made. Using the test system other as for the intended purpose or under abnormal operating conditions will render any guarantee null and void.

The guarantee obligation is restricted to repairing or replacing equipment returned to BENTRON[®] within the guarantee period. In order for claims made under the terms of the guarantee to be accepted, BENTRON[®] must acknowledge that the product is faulty and that the fault concerned cannot be attributed to the incorrect handling or modification of equipment, non-compliant use or abnormal operating conditions.

Any guarantee will be rendered null and void if repairs or changes have been made to equipment by persons other than those authorised to do so by BENTRON[®].

These guarantee provisions are valid exclusively and supersede all other contractual or legal warranty obligations, including, but not restricted to, the legal warranty in respect of marketability, fitness for purpose and serviceability for a specific application.

BENTRON[®] does not accept any liability for direct and indirect collateral or consequential damage, regardless of whether this can be attributed to action considered permissible, impermissible or otherwise.

3. System description

3.1 Areas of application

UNIMET® 1100ST is used to test electrical safety. It has been designed for use in various areas of application:

- Testing of medical electrical equipment to DIN EN 60601-1 (VDE 750 Part 1):1996-03, ANSI/AAMI ES1, UL 60601-1, IEC 61010-1:2001-02
- Periodic testing and testing prior to first use of medical electrical equipment or systems to DIN VDE 0751-1:2001-10
- Periodic testing of care beds and hospital beds
- Single-phase electrical appliances:
“Repair, modification and inspection of electrical appliances” DIN VDE 0701-1:2000-09,
“Periodic inspections on electrical appliances” DIN VDE 0702:2004-06
- As an option, the PE conductor resistance of the DUT is measured with a test current of 25 A.
- With an appropriate adapter (DS601), also includes testing of three-phase electrical appliances in safety classes I and II to VDE 0701-1 and VDE 0702-1.



UNIMET® 1100ST has been designed solely for use in earthed systems. If the test system is used other than for the intended purpose, i.e. in an IT system, the measured values of any leakage currents will not be reproducible. The test result cannot be used.

3.2 Function

The test system performs measurement results which it evaluates immediately in order to categorise the test as “passed” or “failed”. In addition to the electrical tests, the test sequence, which follows classification, contains a visual inspection and a functional test. This test procedure is saved in the type catalogue. The test can be carried out automatically or manually for each DUT.

The test results can be displayed on-screen, saved or printed to an external printer. In the event of unexpected results, the DUT can be inspected in more detail by carrying out a single test. Once tested, devices can be saved to the device catalogue. The internal data memory (FLASH disk) has space for 1000 entries in each of the type and device catalogues.

Tests can be transferred to a PC software program via an RS-232 interface (this is an option, see “Standard version, options and accessories” on page 83). For periodic testing, this data, which is stored in the PC software, is transferred back to the UNIMET® 1100ST. The RS-232 interface is also used for possible subsequent updates of the internal operating software on the test system.

The test engineer name catalogue can be useful if more than one person is working with the test system. Test engineers already registered on the system can simply be selected in the test engineer names catalogue. There is no need to re-enter the test engineer’s name. Up to 9 test engineer names can be stored.

The large colour display is backlit. Graphics illustrate how to connect the DUT. Operation is quick and easy via the keypad.

Optional accessories such as three-phase current adapters or portable printers extend the scope of the test system (see page 83).

3.3 Tests conforming to standards

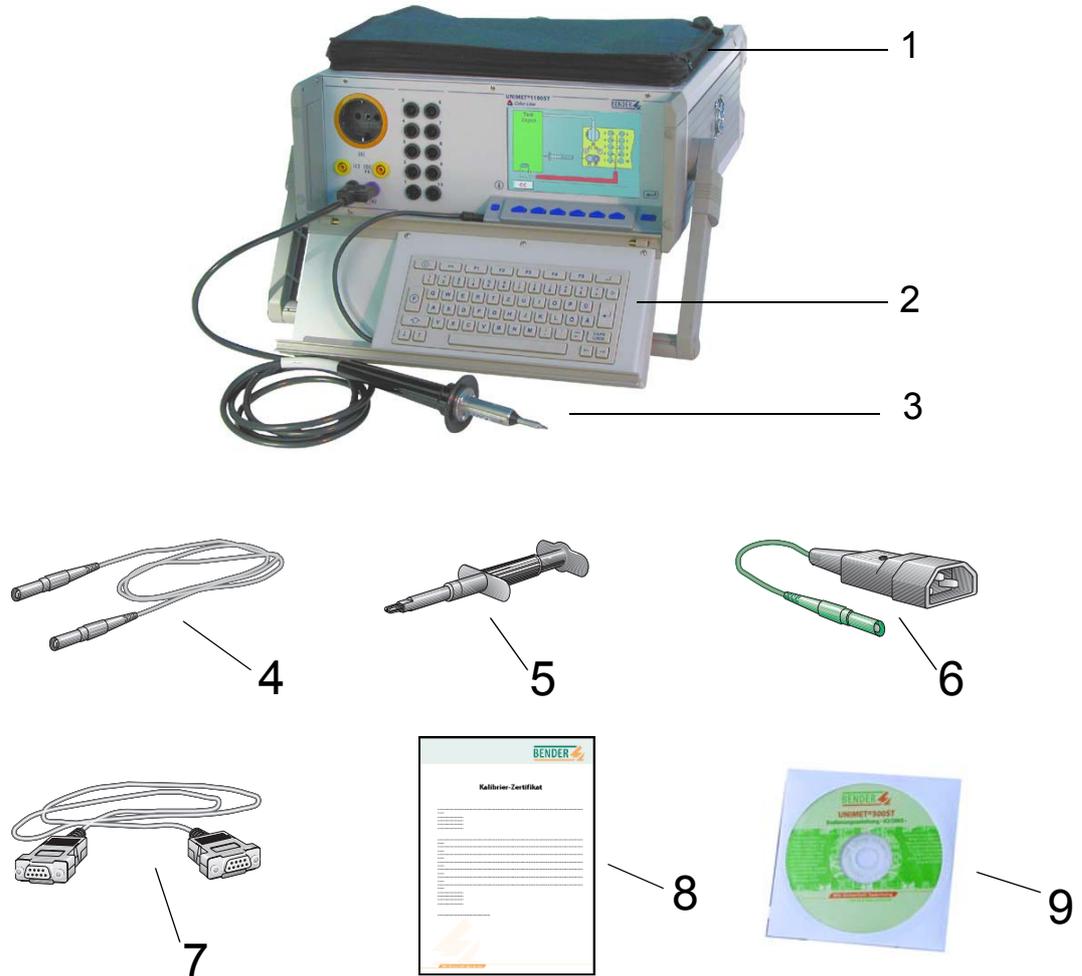
UNIMET® 1100ST carries out measurements and tests based on the following standards (see also the chapter entitled “Standards” on page 91):

- IEC 60601-1:1988
- DIN EN 60601-1:1996-03/VDE 0750 T1
- DIN VDE 0751 Part 1: 2001-10
- DIN VDE 0702:2004-06
- DIN VDE 0701-1:2000-09
- ANSI/AAMI ES1
- UL 60601-1
- IEC 61010-1

Tests to DIN EN 60601-1:1996-3 are carried out with the exception of the measurement of PE impedance. PE impedance is measured in accordance with IEC 60601-1:1988.

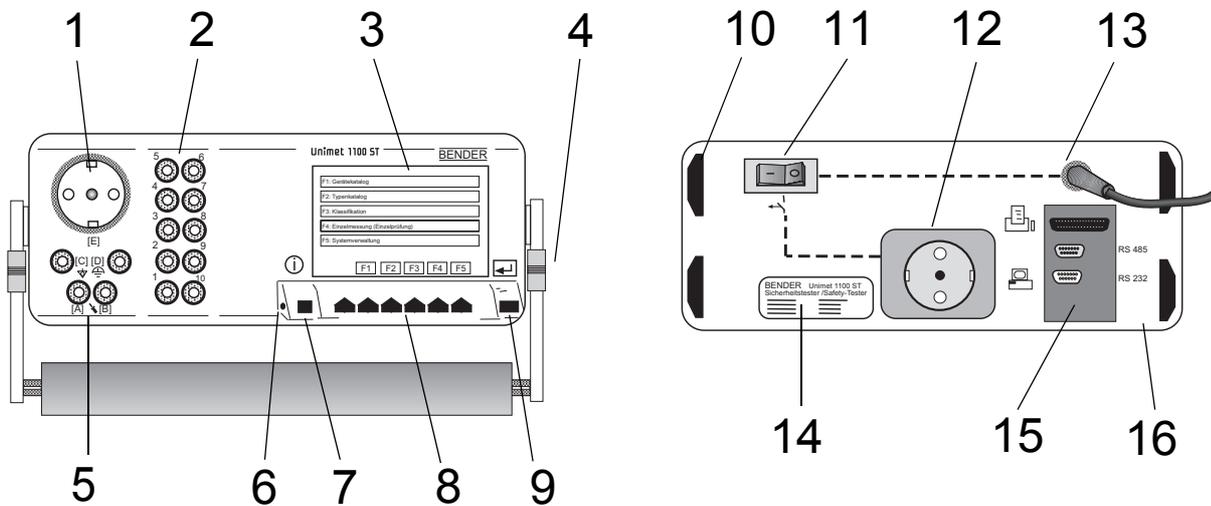
3.4 System components

The following accessories are supplied with the UNIMET® 1100ST:



1	Carrier bag	For the storage and transportation of accessories such as test probes, measuring cables and interface cables.
2	TM1000 keypad module	Keypad module for entering text and numbers
3	Active test probe TP2	Active test probe with pushbutton (cable length 1.8 m). Press the test probe to start single tests during manual and semi-automatic testing.
4	measuring cable	Used as a passive test probe (inserted into bush "B") or to test permanently installed equipment.
5	Test clip (safety claw grip)	For connection to the accessible parts of the DUT.
6	VK701-7 adapter, non-heating devices	For testing device power supply cords.
7	Interface cable (null modem cable)	Enables data to be exchanged between the test system and a PC.
8	Calibration certificate	Proof of the calibration work carried out in the factory.
9	Operating manual (CD)	This manual on CD-ROM.

3.5 Operating elements



1	Test socket: The DUT's power supply cord is plugged in here.
2	10 bushes (1...10) for the connection of patient electrodes.
3	Colour LCD with backlighting
4	Set-up and carrying handle
5	Measuring sockets - [B] (violet) for the connection of the single-pole measuring cable supplied with the product. - [A] for the active test probe (TP2) with pushbutton supplied with the product. - Bush [C] for equipotential bonding (e.g. connection for single-pole line extension with clip for the testing of permanently installed equipment). - Bush [D] for functional earth
6	Connection for the TM1000 keypad module integrated in the housing cover.
7	Info key
8	Function keys 1...6
9	ENTER key
10	Positioning feet
11	Power switch with thermo-magnetic circuit breaker
12	Socket outlet with earthing contacts, 16 A for external printer, switched via power switch (11).
13	Permanently attached power supply cord for connection to the supply voltage.
14	Nameplate
15	Interfaces (viewed from top to bottom): - Printer Centronics interface for printer connection. Important: Only connect printers that are not earthed. Follow the instructions in chapter "Printer" on page 87. - RS-485 Serial interface for BENTRON® Service - RS-232 9-pole galvanically isolated serial interface for connection with computer systems or barcode scanner.
16	Rugged metal enclosure, with pushbuttons for safe storage in the accessories carrier or the optional carrying bag.

4. Operation and setting

4.1 Unpacking

Unpack all the parts supplied with the system. Do not use tools with sharp edges which might damage the content of the package. Compare your order with our delivery note to check that you have received all products in full. The article number printed on the nameplates provides an easy means of uniquely identifying each device.



Check all parts supplied for any evidence of damage in transit. Equipment damaged in transit must not be used. If a device has sustained damage, please contact BENTRON®. Details of who to contact are indicated on the delivery documents.



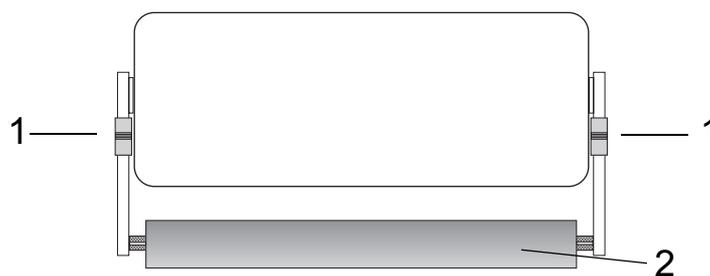
When storing the devices in an environment where the temperature is wintry and cold: Leave the devices to stand for 3 to 4 hours at room temperature before connecting the power supply. When the devices are moved from a cold to a warm environment, condensation will be evident on all parts. Putting damp devices into operation risks damaging electrical components and there is a danger of electric shock on contact.

4.2 Commissioning

4.2.1 Setting up

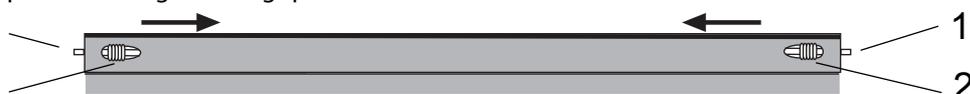
Set the UNIMET® 1100ST down on an even surface with the accessories carrier face up. The carrying handle also serves as a stand so that the UNIMET® 1100ST can be set down on an even surface. Set up the handle as follows:

1. Pull both adjusting wheels (1) towards the handle (2) and keep hold of them.
2. Move the handle to the required position.
3. Let go of the two adjusting wheels (1). Move the handle a little until the adjusting wheels snap into place.



4.2.2 Connection of keypad purchased as an optional accessory

1. Push the two grip ends (2) on the fixing axes inwards at the same time. Slot the keypad into place and let go of the grip ends.



2. Connect the connecting cable for the external keypad to the keypad bush on Unimet.

4.2.3 Switching on



Vorsicht

UNIMET® 1100ST must always be connected to the supply voltage indicated on the nameplate. Failure to observe this requirement may lead to the test system and any DUT connected to it sustaining damage.



Gefahr!

During testing, the UNIMET® 1100ST test socket is live. Do not touch the earthing contacts on the socket.

Do not connect DUTs during the start-up phase. If the DUT is faulty, its enclosure may be live. You risk dangerous electrical shocks by touching it.

The system voltage and automatic adaptation to this voltage are only checked once UNIMET® 1100ST has started up. Changes to the system voltage made during active measuring will not be detected. Therefore, before any changes are made to the system voltage, UNIMET® 1100ST must be switched off via the power switch. The new system voltage will be detected properly when Unimet is restarted. If the system voltage is changed without UNIMET® 1100ST having been switched off in advance, this may damage the current and voltage sources.

UNIMET® 1100ST is a test system for medical electrical and electrical equipment; it is not an medical electrical device per se. Under no circumstances, therefore, must patients be connected to UNIMET® 1100ST. Similarly, patients must not be connected to medical electrical devices connected in turn to UNIMET® 1100ST. Failure to observe these instructions can lead to hazardous electrical currents.

1. Connect the UNIMET® 1100ST to the supply voltage using the permanently attached power supply cord.
2. Switch the device on using the power switch.

The test system requires approx. 20 seconds to start up and carry out self testing. The system tests the system voltage and the voltage to PE. If the test system detects an IT system (e.g. in the operating theatre) or an error, a message will appear.

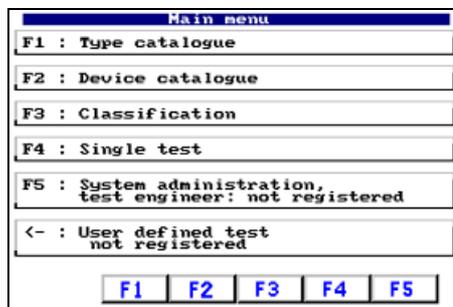


If the test system is used other than for the intended purpose, i.e. in an IT system, the measured values of any leakage currents will not be reproducible. The test result cannot be used. Disconnect the test system and connect it to an earthed socket outlet.

During start-up, the firmware version and company name will be displayed. The company name can be changed in the system administration settings.



The test system's main menu appears:



The test system is now ready for operation.

4.2.4 Switching off

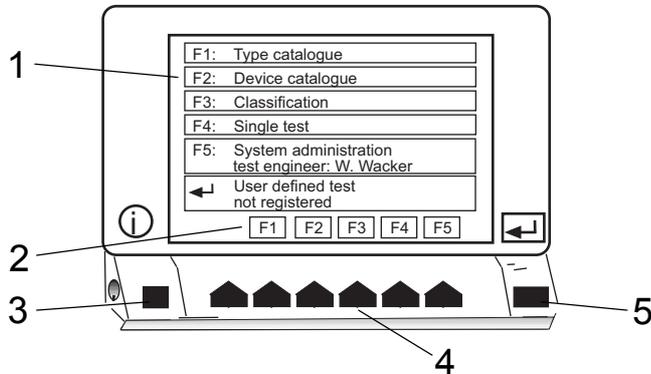
1. Quit all functions so that the main menu appears.
2. Switch the device off using the power switch.



Data may be lost if you switch the UNIMET® 1100ST off whilst data is being accessed.

4.3 Principle of operation

4.3.1 Calling up functions

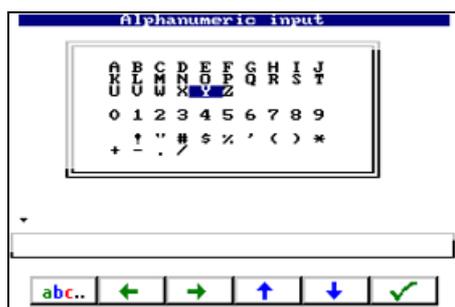


1	Selection menu (the example shows the main menu)
2	Current assignment of function keys: F1 Branch to type catalogue F2 Branch to device catalogue Etc.
3	The Info key shows the telephone number of the BENTRON® hotline.
4	Function keys are used to activate each function.
5	Press Enter to confirm your entries.

Press the required function key. Press Enter to confirm your entries. The menu take you through the individual functions.

4.3.2 Entering text and numbers

The following input screen will appear if entries need to be made:

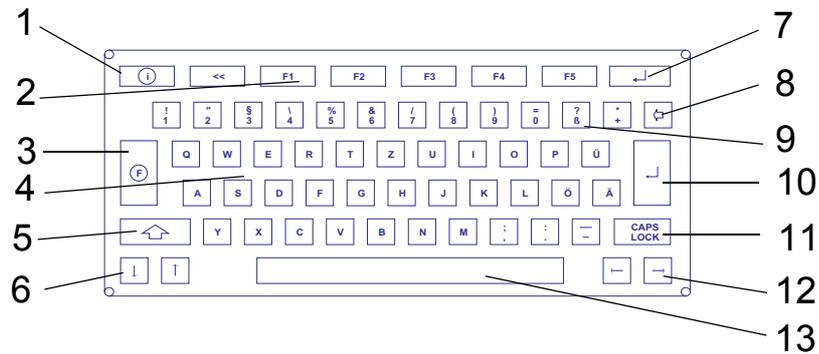


Entries can also be made as follows:

- Using the keypad
- By selecting letters and numbers using the arrow keys (on-screen keypad)
- Import via barcode scanner

Press Enter to apply the entries you make via the keypad or on-screen keypad. The Enter key on the device and Enter on the keypad have the same function.

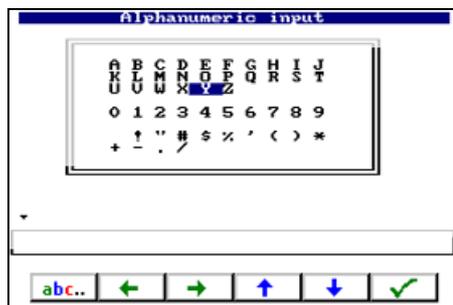
4.3.2.1 How to use the TM1000 keypad module



1	The Info key shows the telephone number of the BENTRON® hotline.
2	Function keys are used to activate each function (as on UNIMET® 1100ST).
3	No function
4	Letter keys
5	Shift key for upper case and special characters
6	Up/down arrow keys
7	Enter key (same function as 10, same function as on Unimet)
8	Backspace key, deletes entry to the left of the cursor.
9	Numbers and special characters
10	Press Enter to confirm your entries.
11	Caps Lock key
12	Right/left arrow keys
13	Spacebar

Entry and edit operations on the TM1000 keypad module and on the on-screen keypad can be combined.

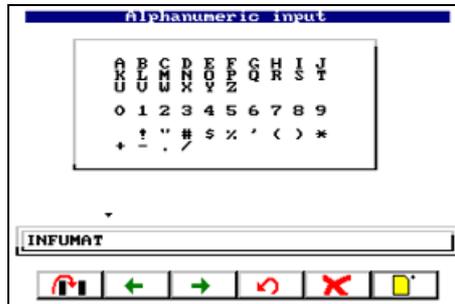
4.3.2.2 How to use the on-screen keypad



1. Select a letter or number using the arrow keys.
2. Confirm the character selected by pressing ✓
3. Select the next character and confirm your selection in the same way.
4. To edit characters, press:

Editing text:

The keys now have the following function:



	Insert character here.
Arrow keys	Move change marker to the required position.
	Undo previous action.
	Delete character here.
	Delete entire entry.

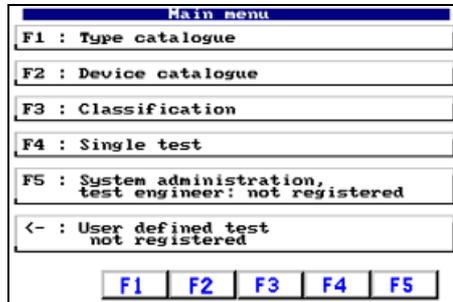
4.3.3 Selecting catalogue entries

There are various ways of selecting and activating an entry in the type, device or test engineer names catalogue.

1. Select the entry using the arrow keys. Double arrows can be used to scroll page by page. Once you have made your selection, activate the entry by pressing the Enter key.
2. Using the keypad, type in the first letter(s) of the entry. If there are a number of similar entries, you can use the arrow keys to select the required entry. Press Enter to activate the entry.
3. If a barcode scanner is used to read the barcode of an existing entry, this entry is selected immediately. This provides a means, for example, of starting periodic testing quickly.

4.4 Main menu

All UNIMET® 1100ST functions and sub-menus can be accessed from the main menu.



F1: Type catalogue	The type catalogue contains saved type names and associated test procedures.
F2: Device catalogue	The device catalogue contains saved device IDs and associated test results.
F3: Classification	Answer the questions that appear on the screen. The test system will identify the required tests and limiting values to be observed. The assisted test sequence will guide you through all the necessary steps to be taken. You can save this test procedure under a type name in the type catalogue.
F4: Single test	Test steps can be called up in the form of single tests and repeated as often as required.
F5: System administration	Settings for test engineer name, language, nominal voltage, etc.
↵: User-defined test	If a type or device has been selected for user-defined test, its name will appear here. To start testing, simply press Enter.

Activate the required function using the function keys on the device or on the keypad.

4.5 System administration

The “System administration” screen provides extensive options for configuring and administering your UNIMET® 1100ST..



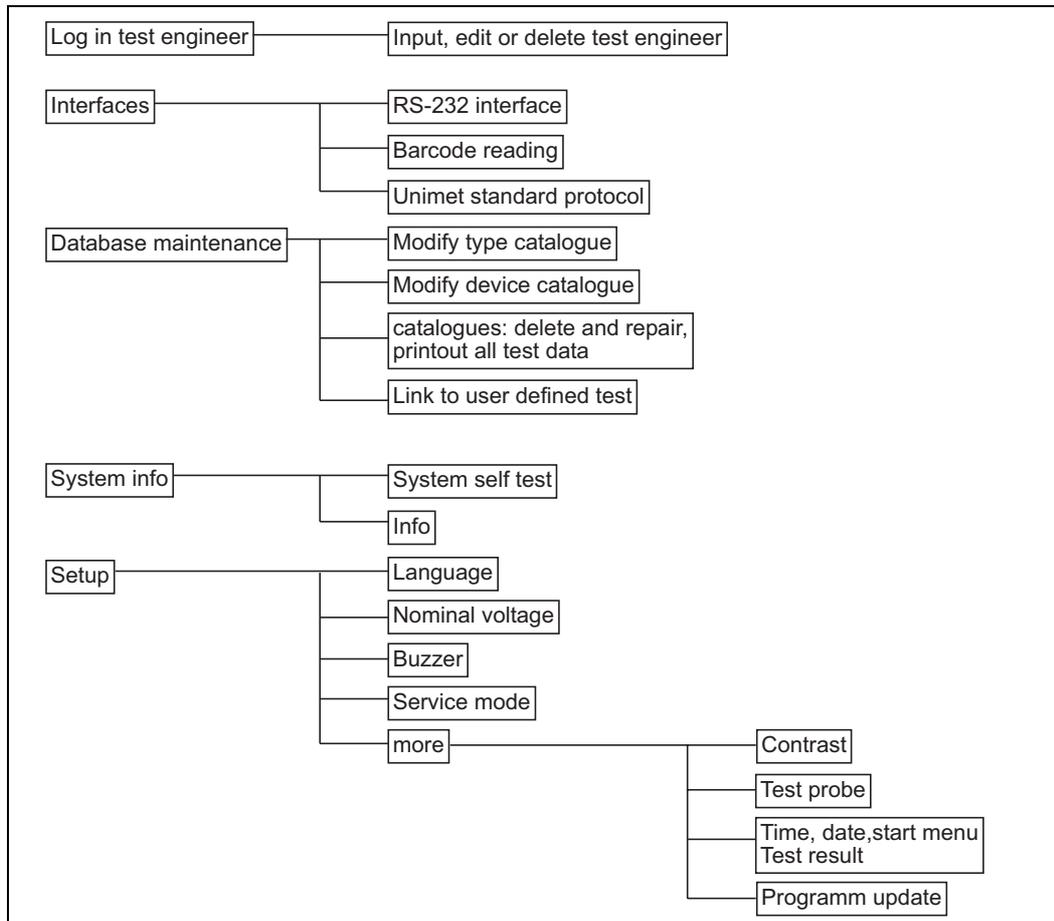
F1: Log in test engineer	Enter, select, change, delete test engineer name.
F2: Interfaces	<ul style="list-style-type: none"> - Change RS-232 interface baud rate - Log on barcode scanner/pen - Activate remote status
F3: Database maintenance Test step editor User-defined test	<ul style="list-style-type: none"> - Editing the type catalogue and device catalogue: Delete entries, select for user-defined test, edit test steps. - Print all data, delete catalogues, delete all data, repair database. - Delete user-defined test
F4: System info	<ul style="list-style-type: none"> - System self test - Show hardware and software version
F5: Setup	Make settings for language, nominal voltage, buzzer, service mode, contrast, probe, etc.; run program updates.

4.5.1 Basic settings

Some of the settings in the “System administration” menu are essential in order for testing to be successful or are used in generating reports to record test results. You should therefore check the following settings before carrying out the first test:

Setting	See chapter/page
Test engineer name	Log in test engineer / 24
Log on barcode scanner (if you are using one)	Barcode reading / 25
Language selection	Language / 40
Nominal voltage	Select nominal voltage / 40
Buzzer	Buzzer / 42
Contrast	Contrast / 43
Test probe	Test probe, VK701 / 43
System time	Setting the system time and date / 48
Start menu	Modifying the start menu / 48
Test result	Test result / 49

The following diagram will help you to familiarise yourself with the system settings



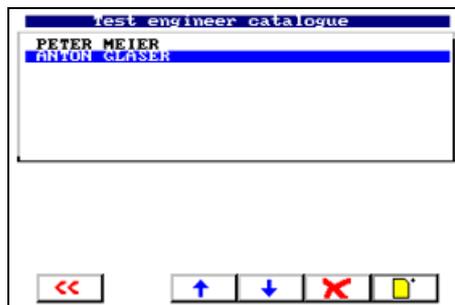
Each chapter contains a short format description of how to access this function:
 Example:
 [-> Main menu -> F5: System administration -> F5: Setup -> F2: Select nominal voltage]

4.5.2 Log in test engineer

[-> Main menu -> F5: System administration -> F1: Log in test engineer]

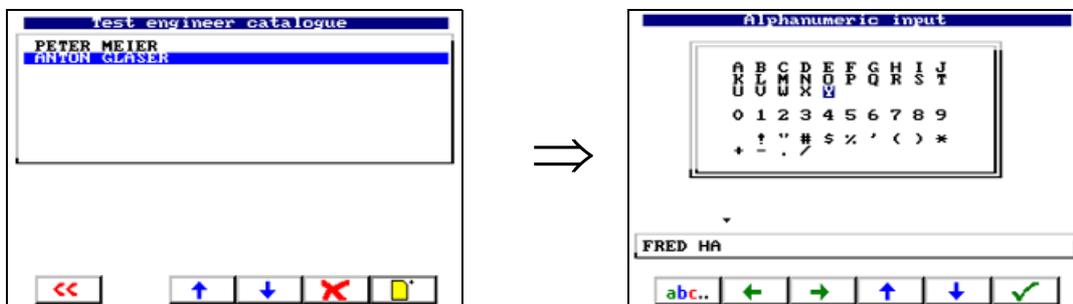
The names of the test engineers are stored in the test engineer names catalogue. The tester whose name appears in the test protocol is logged on here. You should therefore set the test engineer name before carrying out the first test: The test engineer names catalogue will be empty the first time the test system is used.

The test engineer name catalogue can be useful if more than one person is working with the test system. Test engineers already registered on the system are simply selected in the test engineer name catalogue. There is no need to re-enter the test engineer's name. Up to nine test engineer names can be saved. The test engineer name can contain a maximum of nineteen characters.



	Exit menu without making changes
 , 	Select the test engineer name. Press Enter to confirm your selection. The name of the tester currently logged on is assigned to all subsequent test results. The test engineer name can be printed on the test protocol for a device, for example.
	Delete selected test engineer name.
	Open the alphanumeric input function (create new tester).

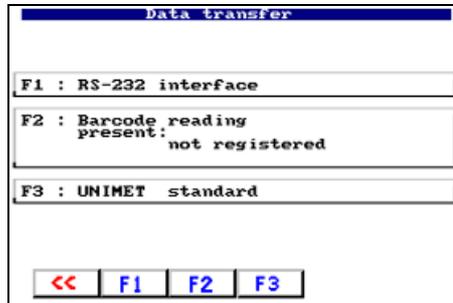
Press  to open the alphanumeric input function. Enter a new test engineer name using the keypad, software keypad or barcode scanner. Press Enter to confirm your entry.



4.5.3 Interfaces

[-> Main menu -> F5: System administration -> F2: Interfaces]

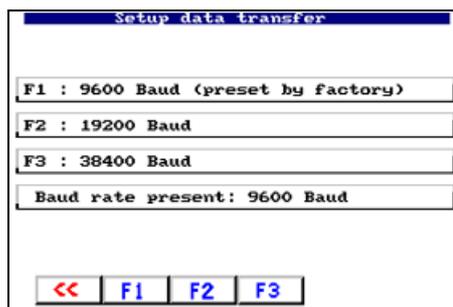
The menu features setting options for the RS-232 interface and the barcode scanner.



4.5.3.1 RS-232 interface

[-> Main menu -> F5: System administration -> F2: Interfaces -> F1: RS-232 interface]

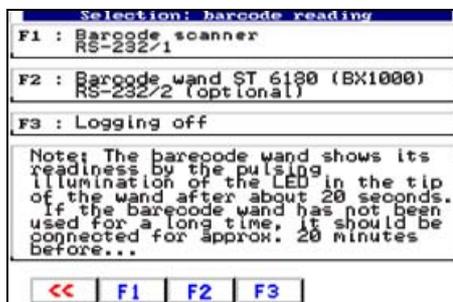
The UNIMET® 1100ST can be connected to a PC via the RS-232 interface. The baud rate indicates the data transmission rate in bits per second. You should set both the UNIMET® 1100ST and the PC software to the same baud rate.



4.5.3.2 Barcode reading

[-> Main menu -> F5: System administration -> F2: Interfaces -> F2: Barcode reading]

A barcode scanner or barcode reading wand, which can be purchased as an option, can be connected to the UNIMET® 1100ST via the RS-232 interface. You can only use a barcode scanner if you log it on in the following menu: Select "F3: Log off" if you are not using a barcode scanner. Please also refer to the instructions in chapter "ST6180 barcode reading wand, DLC7070 barcode scanner" on page 88.





Following logon and every time the UNIMET® 1100ST is started up, the ST6180 barcode reading wand will need about 20 seconds before it is ready for operation. The red LED in the tip of the reading wand will flash to indicate readiness for operation.

If you are using the RS-232/1 interface, select setting "F1: Barcode scanner RS-232/1" on all versions of UNIMET® 1100ST and on UNIMET® 1000ST.



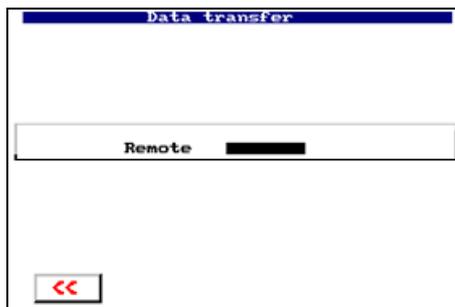
If a barcode scanner has been logged on, it will not be possible to transfer data via the RS-232 interface. This affects both the transfer of test data and the running of software updates.

4.5.3.3 Unimet standard protocol

[-> Main menu -> F5: System administration -> F2: Interfaces -> F3: Unimet standard protocol]

The UNIMET® 1100ST can be controlled remotely via the RS-232 interface using PC software.

Select "Unimet standard protocol" to switch the UNIMET® 1100ST to remote control mode.



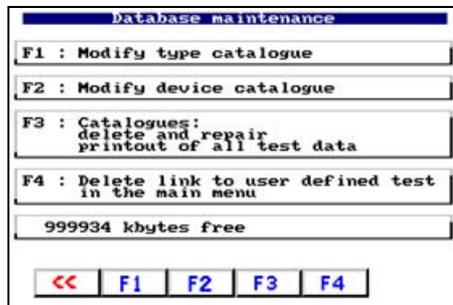
In this operating mode, data can be transferred or UNIMET® 1100ST actions initiated.

On some software products it is sufficient for the UNIMET® 1100ST to appear in the main menu. In such cases, Unimet remote mode can then be called via the PC software.

4.5.4 Database maintenance, test step editor, user-defined test

[-> Main menu -> F5: System administration -> F3: Database maintenance...]

The following options are available in this menu:



F1: Modify type catalogue	Delete entries, select for user-defined test, edit test steps.
F2: Modify device catalogue	Delete entries, select for user-defined test, edit test steps.
F3: Catalogues: Delete and repair, Print all	Print all, delete catalogues, delete all data, repair database.
F4: Delete link to user-defined test in main menu	User-defined test is removed from the main menu.
xxxx kbytes free	Indicates how much memory is still free for the type and device catalogues.

4.5.4.1 Modify type catalogue

[-> Main menu -> F5: System administration -> F3: Database maintenance... -> F1: Modify type catalogue]

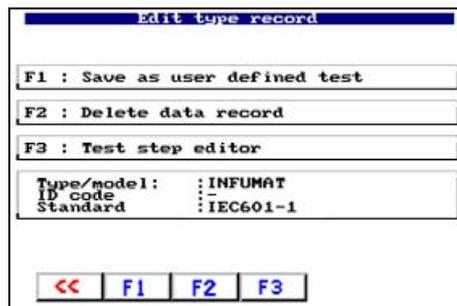
Entries saved in the type catalogue (types) can be edited.

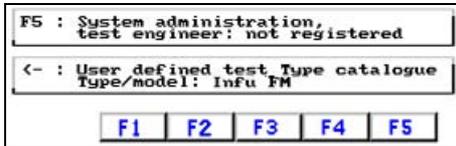
1. Start by selecting a type.



2. Press Enter to confirm your selection.

3. Next, select an action for this type:



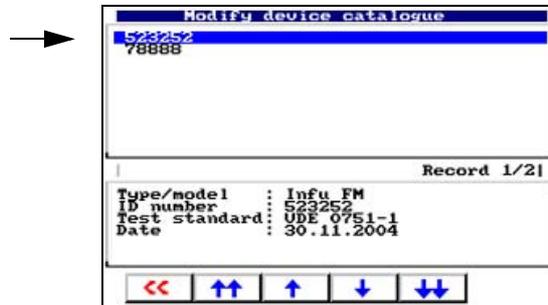
F1	<p>The type is saved for user-defined test in the main menu, from where it can be selected directly by pressing the associated function key. This accelerates the start of the process for testing a type which undergoes testing particularly frequently.</p> 
F2	Deletes the data record. A prompt appears to prevent accidental deletion.
F3	The test step editor features functions for adding or deleting test steps (See "How to use the test step editor" on page 30).

4.5.4.2 Modify device catalogue

[-> Main menu -> F5: System administration -> F3: Database maintenance... -> F2: Modify device catalogue]

Entries saved in the device catalogue (devices) can be edited.

1. Start by selecting a device.



2. Press Enter to confirm your selection.

3. Next, select an action for this device:



F1	The device is saved for user-defined test in the main menu, from where it can be selected directly by pressing Enter. This accelerates the start of the process for testing a type which undergoes testing particularly frequently.
F2	Deletes the data record. A prompt appears to prevent accidental deletion.
F3	The test step editor features functions for adding or deleting test steps (See "How to use the test step editor" on page 30).

4.5.4.3 How to use the test step editor



Warnung

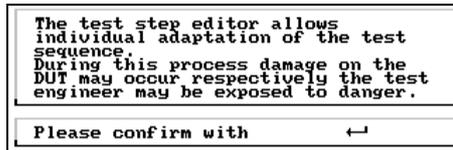
The test step editor can be used to customise the test sequence to meet individual requirements.

Running the modified test sequence can put test personnel (electric shock) and the DUT (damage beyond repair) at risk.

You should therefore first run a test sequence without the DUT and check whether all tests are completed as required. Only at this point should you connect the DUT. During testing, do not touch any metal conductive parts of the DUT or measuring cables.

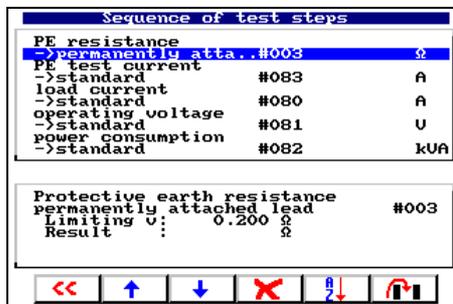
From the main menu, select

1. F5: System administration -> F3: Database maintenance...
2. F1: Modify type catalogue or
F2: Modify device catalogue
3. Select the catalogue entry to be edited and confirm your selection by pressing Enter.
4. Press F4 to launch the test step editor. The following message appears:



Read the warning notice. If you wish to use the test step editor, press Enter.

5. The current sequence of test steps is displayed:



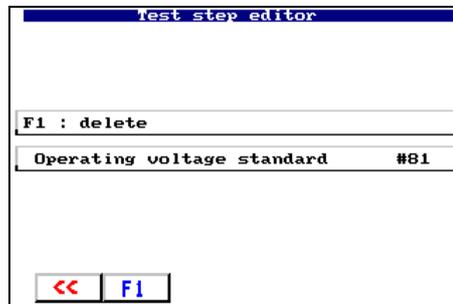
	Exit test step editor
 , 	Select test step
	Delete selected test step
	Sorting test steps
	Adds a new test step before the selected test step. The test step selection screen appears.

How to delete a test step

1. Select the test step to be deleted using the arrow keys (here: insulation test #106):



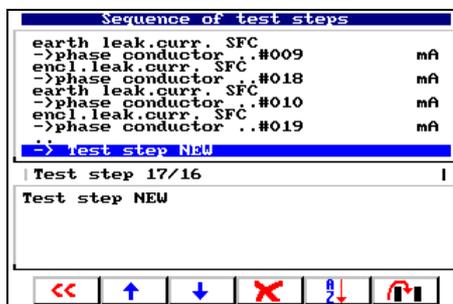
2. Press  to delete the selected test step.



3. Press F1 to confirm the deletion of the test step.
Press  to exit the function without making any changes.
4. Save all changes on exiting the test step editor.

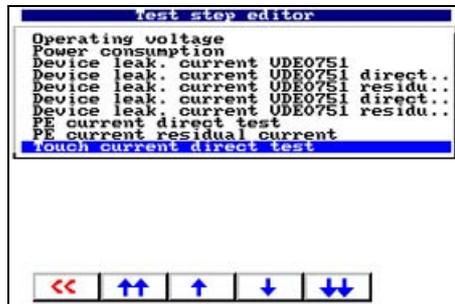
How to add a test step:

1. Select either "Test step NEW" at the end of the list of test steps or a test step before which you wish to add the new test step:



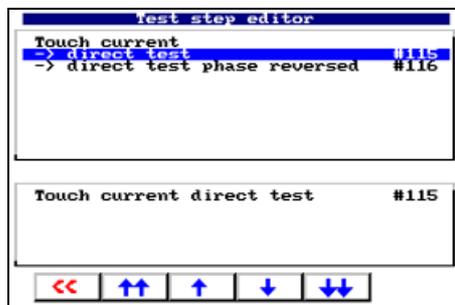
2. Press  to add a new test step before the selected test step. The test step selection screen appears.

3. Select the group of messages to which the required test step belongs (e.g. touch current direct test).



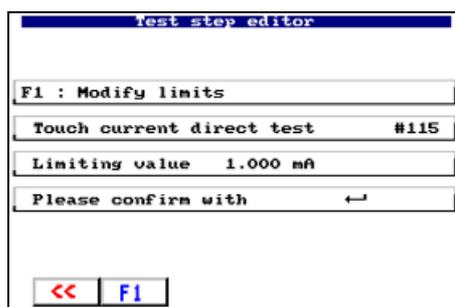
Press Enter to select the group.

4. Select the test step to be added.



Press Enter to select the test step.

5. Unimet will suggest a limiting value. You may change this value if you wish. If you change the limiting value, you must ensure observance of applicable standards.



Press Enter to apply the suggested test value.

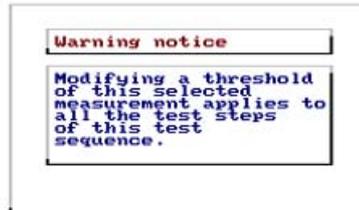
6. Press "F1" to modify the limiting value and confirm the change by pressing Enter (see also "How to modify the limiting value for test steps" on page 33).
7. Press  to go back to the previous step in the operation.

How to modify the limiting value for test steps



If you change a limiting value, it will be changed for all test steps of the same name in this test sequence. Check if any other test steps have the same name and whether they are compatible with the change in limiting value for these test steps.

This warning will appear on the UNIMET® 1100ST screen.



1. Edit the limiting value:

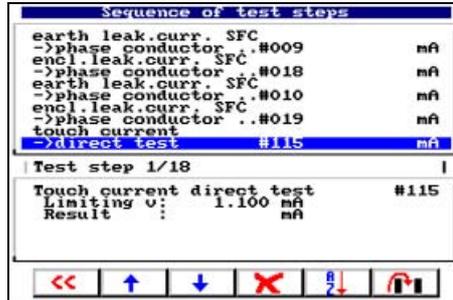


	Go back to the previous step in the operation without making changes.
	Move the change marker to the limiting value digit to be changed.
 , 	Select the numerical value for the current limiting value digit.
	Reset the limiting value to the default setting.

2. Press Enter to confirm the changes.
3. Press Enter again to apply the limiting value.
4. Press "F1" to add the test step to the test sequence.



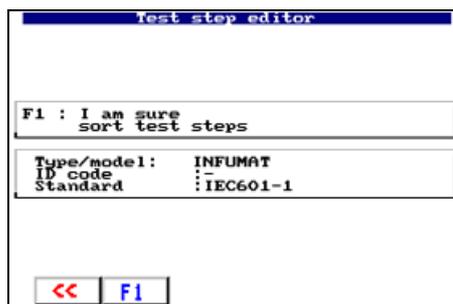
5. The test step now appears in the list of test steps.



6. Repeat the procedure to add other test steps to the test sequence (e.g. touch current test direct test phase reversed # 116).

How to sort the test step sequence

1. Once all test steps required have been added and all test steps not required have been deleted, the UNIMET® 1100ST can work out a sensible sequence for the test steps. Press  to sort the test steps.



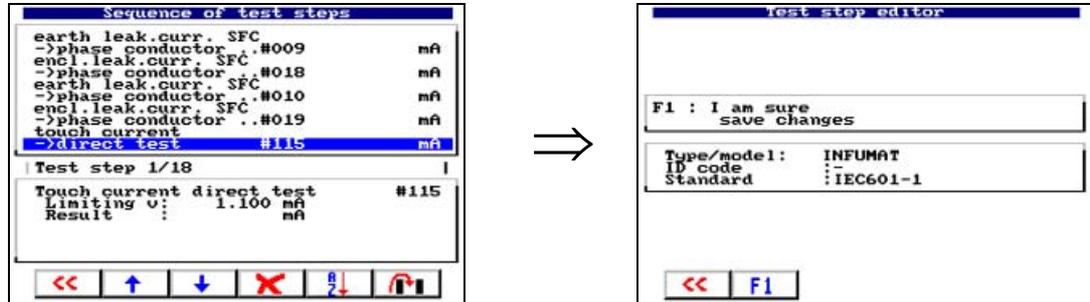
2. Press F1 to confirm that you wish to sort the test steps.

UNIMET® 1100ST has now sorted the test steps into groups (all visual inspections, all test steps during which the DUT is not switched on, all test steps during which the DUT is operated in one phase, all test steps during which the DUT is operated in the other phase, all function tests, etc.).



How to save a test sequence following modification

1. Press to exit the test step editor.



2. Press F1 to save the modified test sequence.
Press to exit the test step editor without making any changes. The old unmodified test sequence is restored.



If a test sequence has been changed, this will be evident in the device master data or in the test protocol. "Modified" will appear after the name of the test standard.

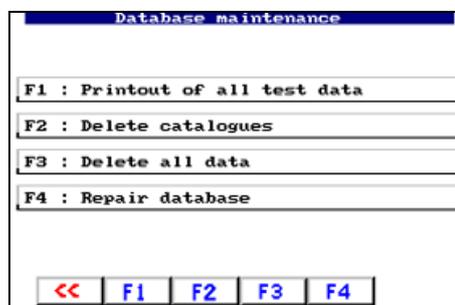
4.5.4.4 Delete and repair catalogues, print all data

[-> Main menu -> F5: System administration -> F3: Database maintenance... -> F3: Catalogues]



Older versions of UNIMET® 1000ST feature a PCMCIA card for catalogue storage. This card must remain connected during all operations affecting the device catalogue or type catalogue. The Unimet mains power supply must remain connected at all times, regardless of version. Otherwise you risk data loss.

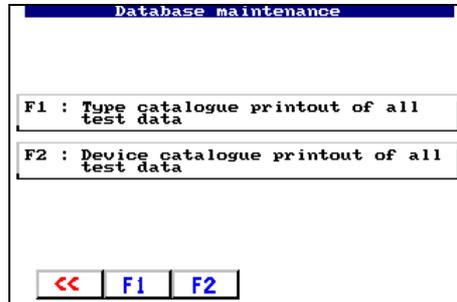
This menu features various edit functions for the database.



Print all

[-> Main menu -> F5: System administration -> F3: Database maintenance... -> F3: Catalogues
-> F1: Print all]

Prints a separate protocol for each device.



F1	Prints a separate protocol for each type.
F2	Prints a separate protocol for each device.
	Exit print all.

Deleting catalogues

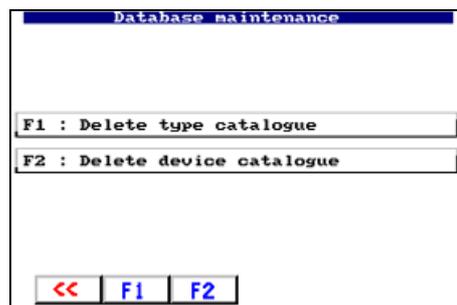
[-> Main menu -> F5: System administration -> F3: Database maintenance... -> F3: Catalogues
-> F2: Delete catalogues]

Select whether you wish to delete the device catalogue or the type catalogue.



Only links to data are deleted. This action will not free up any memory space!

It may take several minutes to delete a catalogue.



F1	Deletes the type catalogue. An additional prompt will prevent unintentional deletion of a catalogue.
F2	Deletes the device catalogue. An additional prompt will prevent unintentional deletion of a catalogue.
	Exit the "Delete" function.

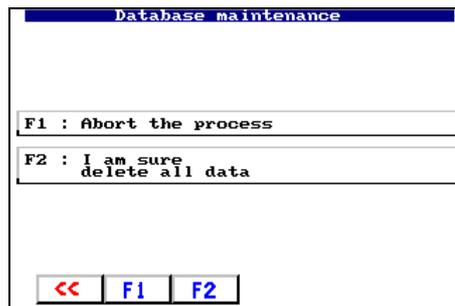
Delete all data

[-> Main menu -> F5: System administration -> F3: Database maintenance... -> F3: Catalogues -> F3: Delete all data]

This function is used for example if the UNIMET® 1100ST is used by different departments and each department transfers its data for periodic testing from PC to the UNIMET® 1100ST.



As a new empty database is created, this action frees up memory. Existing database problems may be deleted along with the data. An additional prompt will prevent unintentional deletion of the database.



Repair database

[-> Main menu -> F5: System administration -> F3: Database maintenance... -> F3: Catalogues -> F4: Repair database]

If individual data records have become unusable (e.g. due to a power failure during the test sequence), the situation can be rectified using function "F4: Repair database".



*The process takes several minutes and must not be interrupted.
The UNIMET® 1000ST PCMCIA card must not be removed whilst repairs are in progress. Removing the card may render the Unimet database unusable.
Tip: You can also use the UNIData1100 PC software to repair the database.*

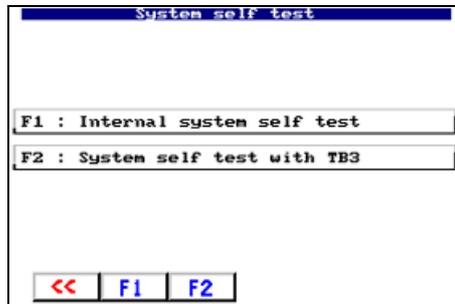
4.5.5 System info

[-> Main menu -> F5: System administration -> F4: System info]

The menu branches to the system self test screen. The screen contains information about the software, firmware and hardware versions as well as the type of test probe selected. Keep this information to hand should you need to contact BENTRON® Service for assistance.



Once you have pressed "F1: System self test" you can choose between an internal self test and a more extensive test with the TB3 test box.



4.5.5.1 Internal system self test

[-> Main menu -> F5: System administration -> F4: System info -> F1: System self test -> F1: Internal system self test]

The internal system self test checks the essential functions of the UNIMET® 1100ST. Please note the following conditions to be met in order for the test to be carried out:

- Connect the UNIMET® 1100ST to an earthed mains supply (not an IT system).
- Do not connect any DUTs or adapters.
- Do not connect any earthed printers.

The test takes approximately 30 seconds to complete. The result of the test is displayed once the test is complete. Test steps during which the limiting value was not observed are indicated by *. If the UNIMET® 1100ST fails the internal test, contact BENTRON® Service.



	Print test protocol.
 , 	Show detailed information about the individual test steps.
	Exit internal self test.

4.5.5.2 System self test with TB3

[-> Main menu -> F5: System administration -> F4: System info -> F1: System self test -> F2: System self test with TB3]

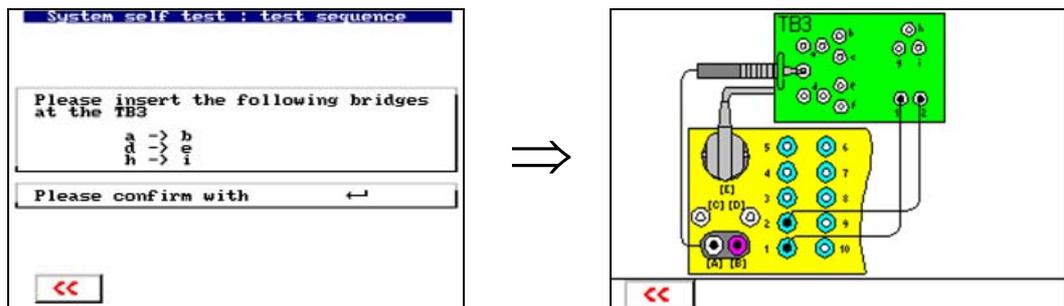
The system self test with TB3 checks the calibration values of the UNIMET® 1100ST. Please note the following conditions to be met in order for the test to be carried out:

- Connect the UNIMET® 1100ST to an earthed mains supply (not an IT system).
- You need the optional TB3 test box. When connecting and using the TB3 test box, please note the information on the instruction leaflet!
- Do not connect any earthed printers.



	Select master data for display or modification.
	Show detailed information about the limiting values.
	Modify selected master data.
	Exit self test.

1. Press Enter to start the self test.
2. Check the assignment of the jumpers on the TB3 and then connect the TB3 to the UNIMET® 1100ST as indicated:



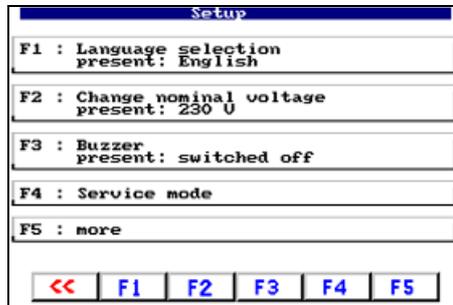
3. Press Enter to continue the self test. Follow the instructions that appear on the UNIMET® 1100ST display.

The test takes approximately one minute to complete. The result of the test is displayed once the test is complete. You can print out and save the test results for certification purposes. Test steps during which the limiting value was not observed are indicated by *. If the UNIMET® 1100ST fails the internal test, contact BENTRON® Service.

4.5.6 Setup

[-> Main menu -> F5: System administration -> F5: Setup]

The following settings can be made in the “Setup” menu:



4.5.6.1 Language

[-> Main menu -> F5: System administration -> F5: Setup -> F1: Language]

All menus will appear in the selected language. “Austrian” is used to adapt menu and protocol texts to reflect standards applicable in Austria (e.g. ÖVE-E 8751-1).



 , 	Select language. Press Enter to confirm your selection.
	Exit function without making changes.

4.5.6.2 Select nominal voltage

[-> Main menu -> F5: System administration -> F5: Setup -> F2: Select nominal voltage]

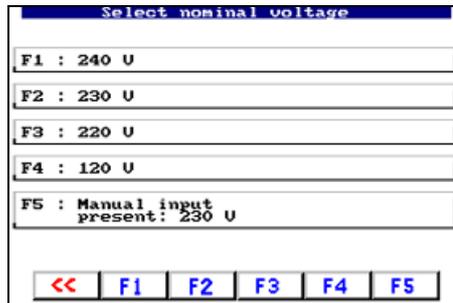
The UNIMET® 1100ST supports a voltage range between AC 90 and 264 V . In order to always obtain comparable measured values even if the system voltage is fluctuating, various standards require measured values to be converted to nominal system voltage or even to 106% or 110% of the nominal system voltage.

For this reason, you should set the nominal system voltage. The factory setting is 230 V. UNIMET® 1100ST automatically performs the required conversion of the measured values.



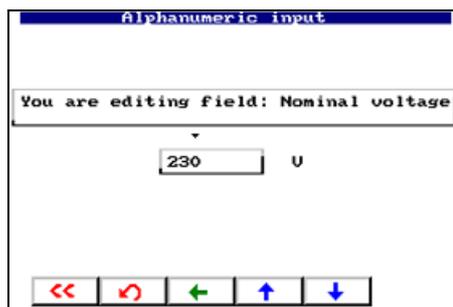
This setting does not affect the internal power supply of the test device or the voltage applied at the test socket. UNIMET® 1100ST provides the DUT with the same voltage it is supplied with itself.

Selecting the nominal voltage:



F1 ... F4	Select nominal voltage.
F5	Manual input of nominal voltage.
<<	Exit function without making changes.

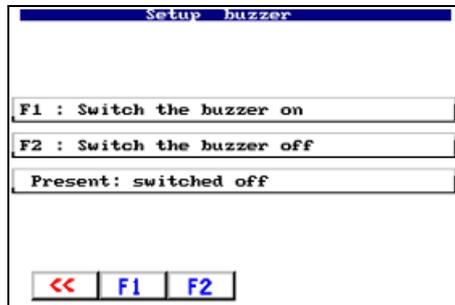
Manual input of nominal voltage



 ,  , 	Select nominal voltage. UNIMET® 1100ST only accepts values from 100 to 264 V.
	Undo previous action.
<<	Exit function without making changes.

4.5.6.3 Buzzer

[-> Main menu -> F5: System administration -> F5: Setup -> F3: Buzzer]

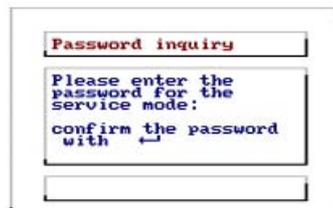


F1	Switch the buzzer on. A beep sounds every time a key is pressed.
F2	Switch the buzzer off. The beep only sounds when specific events occur (e.g. error messages, end of electrical testing, etc.)
<<	Exit function without making changes.

4.5.6.4 Service mode

[-> Main menu -> F5: System administration -> F5: Setup -> F4: Service mode]

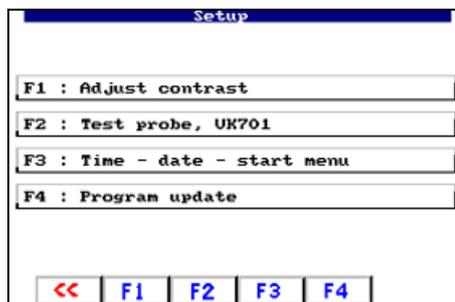
Service mode is intended exclusively for use by BENTRON[®] Service. Access to this mode is therefore password-protected.



4.5.6.5 More settings

[-> Main menu -> F5: System administration -> F5: Setup -> F5: More]

This menu offers more options for configuring the UNIMET[®] 1100ST:



Contrast

[-> Main menu -> F5: System administration -> F5: Setup -> F5: More -> F1: Contrast]

Adapt the contrast of the UNIMET® 1100ST to the brightness of the environment in which it is being used.



 , 	Contrast
	Exit function

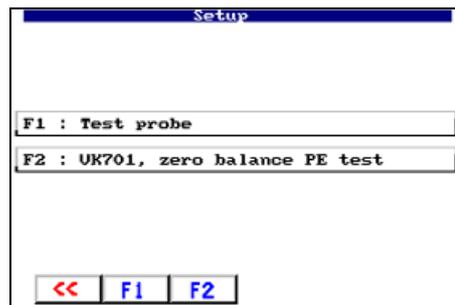
Test probe, VK701

[-> Main menu -> F5: System administration -> F5: Setup -> F5: More -> F2: Test probe, VK701]

The Unimet test probe or connected test adapter (e.g. VK701 for testing extension cables) must be zero-balanced. As with an ohmmeter, this ensures that the ohmic resistance of the test adapter and test probe will not affect the PE conductor test result. The test adapter cables need to be as short as possible.

UNIMET® 1100ST saves the calibration values. You should repeat this calibration procedure every time you connect a different test probe or a different test adapter to the test system.

Note: For information about general device calibration, see “Calibration” on page 81.

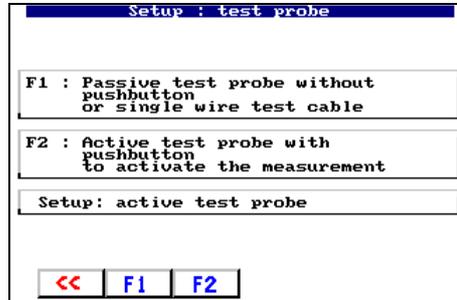


F1	Perform zero balancing for test probe.
F2	Perform zero balancing for VK701-x adapter.
	Exit function without making changes.

Calibrating the test probe

[-> Main menu -> F5: System administration -> F5: Setup -> F5: More -> F2: Test probe, VK701 -> F1 Test probe]

1. Select the test probe to be used:



F1	Perform zero balancing for a test probe or pushbutton or any measuring cable.
F2	Perform zero balancing for a TP2/TP3 test probe.
<<	Exit function without making changes.

2. Select the measuring path for which zero balancing is to be carried out (e.g. F3 to test a device with a power supply cord). If all three measuring paths (F1 ... F3) are used, a zero balancing process can be saved for each measuring path. Designations A, B, C, E within the menu items indicate between which connections zero balancing is being performed. Connect the contacts for which you wish to perform zero balancing. Then select the associated function.

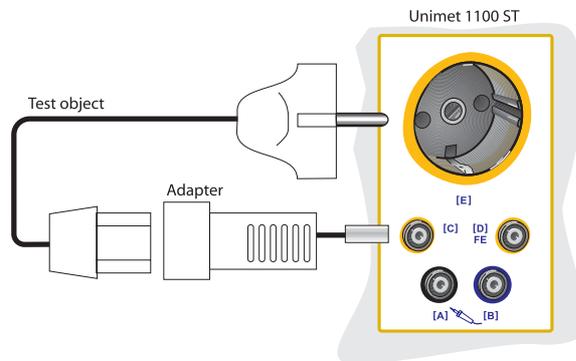


F1	Zero balancing to test the extension cables via an adapter.
F2	Zero balancing to test permanently installed equipment via a measuring cable in [C] or to test devices without connecting cables.
F3	Zero balancing to test devices with power connectors.
ⓘ	Detailed information about the test probe connected. The function of the active test probe's pushbutton can also be tested.
<<	Exit function without making changes.

Zero balancing takes approximately 5 seconds to complete. Perform zero balancing for all measuring paths required. Each calibration value is saved and is retained until a new zero balancing procedure is performed for this measuring path.

Connecting the test probe during zero balancing

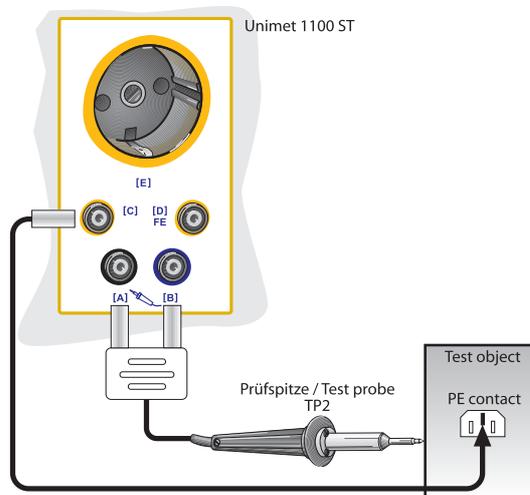
1. A DUT has a detachable power supply cord. If only the resistance of the PE conductor is to be measured, make the connection as follows:



How to perform zero balancing for measurement # 2:

- Insert the adapter into bush "C".
- Contact the adapter's PE contact with the PE contact on test socket "E".
- Start zero balancing by pressing "F1".

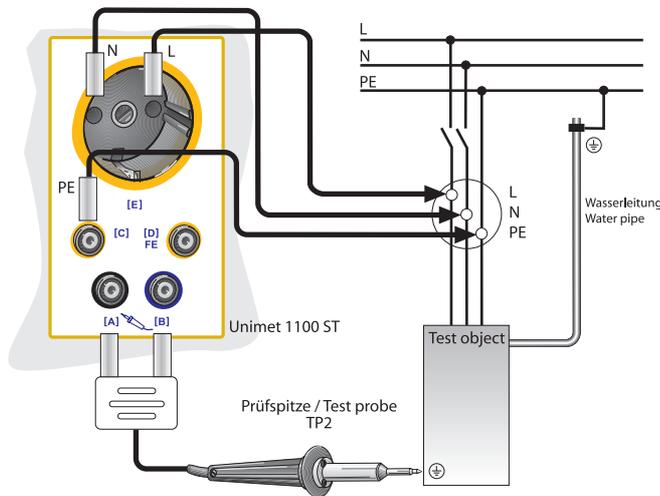
2. A DUT has a detachable power supply cord. If only the resistance of the DUT is to be measured, make the connection as follows:



How to perform zero balancing for measurement # 1:

- Insert the measuring cable (with test terminal if applicable) into bush "C".
- Insert the passive test probe into bush "B" or active test probe into the colour-coded bushes "B" and "A".
- Contact the test probe with the end of the measuring cable (with test terminal if applicable).
- Start zero balancing by pressing "F2".

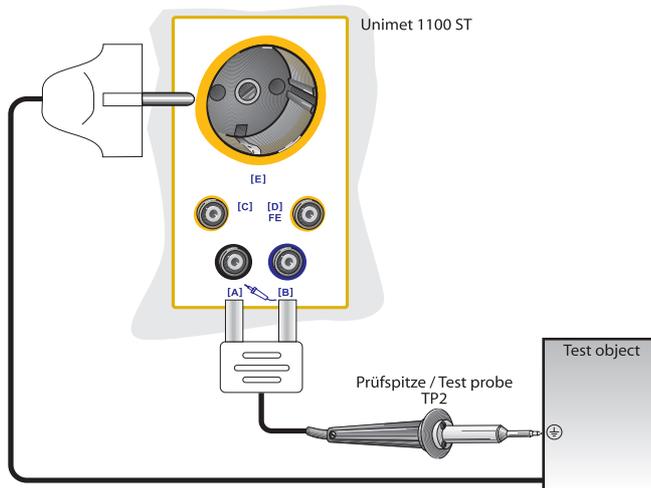
3. If at a permanently connected DUT the resistance of the PE conductor is to be measured, make the connection as follows:



How to perform zero balancing for measurement # 4:

- Insert the measuring cable (with test terminal if applicable) into bush "C".
- Insert the passive test probe into bush "B" or active test probe into the colour-coded bushes "B" and "A".
- Contact the test probe with the end of the measuring cable (with test terminal if applicable).
- Start zero balancing by pressing "F2".

4. A DUT has a permanently connected power supply cord. The connection is made in the same way if a DUT with a detachable power supply cord is to be tested together with this cable.



How to perform zero balancing for measurement # 3:

- Insert the passive test probe into bush "B" or active test probe into the colour-coded bushes "B" and "A".
- Contact the test probe with the PE contact on test socket "E".
- Start zero balancing by pressing "F3".

Zero balancing of the VK701 adapter

[-> Main menu -> F5: System administration -> F5: Setup -> F5: More -> F2: Test probe, VK701 -> F2: VK701...]

This function can be used to perform zero balancing for the VK701 adapter for the purpose of testing extension cables. Please follow the instructions in the VK701 data sheet in respect of connecting and using the VK701.

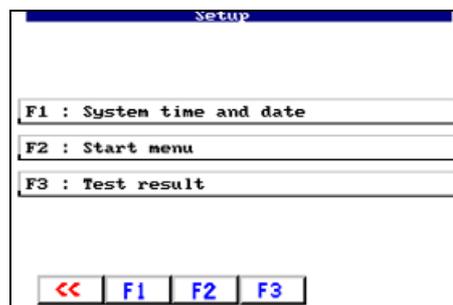
1. Connect the VK701 adapter to the UNIMET® 1100ST.
2. Connect the adapter's plug and coupling.
3. Press F1 to perform zero balancing.



Zero balancing takes approximately 5 seconds to complete. The calibration value is saved and is retained until a new zero balancing procedure is performed for this measuring path.

System time, Start menu, Test result

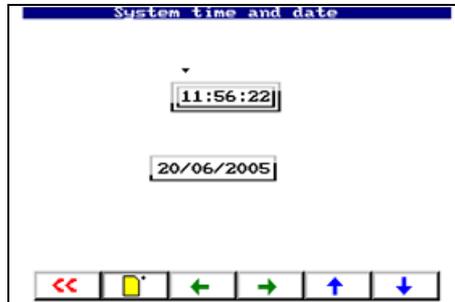
[-> Main menu -> F5: System administration -> F5: Setup -> F5: More -> F3: System time, Start menu, Test result]



Setting the system time and date

[-> Main menu -> F5: System administration -> F5: Setup -> F5: More -> F3: System time, Start menu, Test result -> F1: System time and date]

The date is saved with each test result. It also appears on the printed test protocol.



 /   / 	Set the system time and date. Press Enter to confirm changes.
	Reject changes and show current UNIMET® 1100ST system time.
	Exit function without making changes.

Modifying the start menu

[-> Main menu -> F5: System administration -> F5: Setup -> F5: More -> F3: System time, Start menu, Test result -> F2: Start menu]

Every time the system is switched on, the UNIMET® 1100ST start menu appears. This text is also used for the header on printed test protocols (lines 1 and 2 for short-format printout; lines 1 to 4 for long-format printout). You can change the setting.

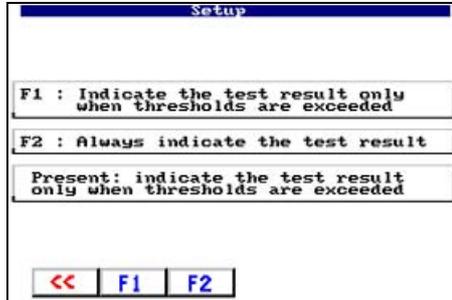


F1, F2, F3, F4	Modify the associated line in the start menu.
F5	Reset start menu factory settings (Bender GmbH...).
	Exit function without making changes.

Test result

[-> Main menu -> F5: System administration -> F5: Setup -> F5: More -> F3: System time, Start menu, Test result -> F3: Test result]

Specify how UNIMET® 1100ST should respond following an automatic test:



F1	Only if the test is failed will the test result appear immediately. For tests which have been passed, a menu will appear in which you must select how to proceed with the test result. This can be useful if the test results simply need to be saved and not processed further until a later date.
F2	Always show test result after test.
<<	Exit function without making changes.

Program update

[-> Main menu -> F5: System administration -> F5: Setup -> F5: More -> F4: Program update]

Starting an update of the operating software. A detailed description of the updated procedure appears in "Updating the Unimet operating software (firmware update)" on page 77.



F1	Exit function without making changes.
F2	Start update.

5. Testing and measuring

5.1 Test concept

The integrated type and device catalogue provides the basis for time-efficient and cost-effective testing with UNIMET® 1100ST.

Classification

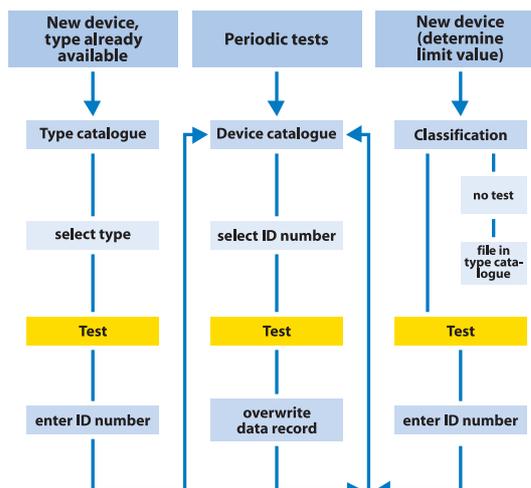
The UNIMET® 1100ST can be used to carry out tests in accordance with the standards indicated in “System description” on page 11. For new devices, which have not yet been created in the type catalogue, the test steps required and the associated limiting values are determined in dialogue between the test engineer and UNIMET® 1100ST. This classification is then saved as a test procedure for a specific device in the type catalogue, from where it can be called up for all other devices of this type.

Type catalogue

The test procedures for devices already classified are saved in this catalogue under type designations (e.g. AFX infusion pump). The first time a new device is tested whose type already exists in the type catalogue, only the type designation needs to be called. Once the test has been completed successfully, the DUT is saved in the device catalogue under the ID number. This saves an enormous amount of time where new acquisitions are concerned. A further advantage is that all devices of the same type are tested under identical conditions.

Device catalogue

Measurement data for individual devices is saved in the device catalogue under the ID number. In the event of periodic testing, only the ID no. needs to be selected. Connect DUT – Test – Done. This saves an enormous amount of time where periodic tests are concerned. In the event of periodic testing, this means that a device will always be tested in accordance with the same test procedure.



Single test

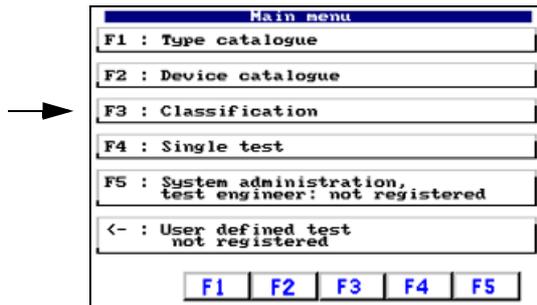
Test steps can be called up in the form of single tests and repeated as often as required. If, for example, a limiting value is not observed during a classified test sequence, the test step concerned can be examined in more detail using a single test.

5.2 Classification

Select the applicable test standard from the main menu. Answer the questions that appear on the screen. The test system will identify the required tests and limiting values to be observed. Save the classification under the device's type name in the UNIMET® 1100ST type catalogue.

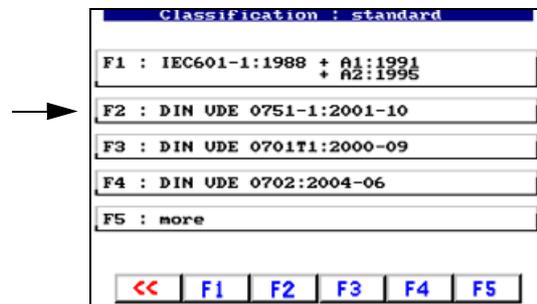
Example 1:

Classification of a medical electrical device (e.g. combined ultrasound/stimulation current unit) to DIN VDE 0751-1:2001-10. This is a Class I equipment with two patient connections. In the main menu, select "F3: Classification".



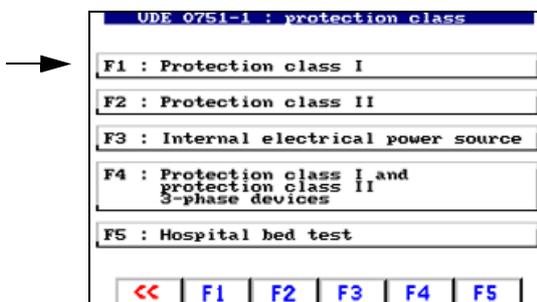
5.2.1 Test standard

Select the test standard in accordance with which the device is to be tested. Example: "F2: DIN VDE 0751-1:2001-10".



5.2.2 Protection class

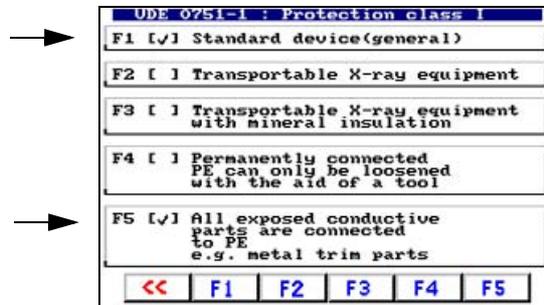
Select the DUT protection class in accordance with which the device is to be tested. Example: "F1: Protection class I (Class I equipment)"



(Note: F5: Hospital bed test = Abbreviated classification for hospital beds)

5.2.3 Device type

Select the type of device. You can activate several relevant menu items by pressing the associated function key. Activated menu items are identified by “√”. Example: “F1 and F5 selected”.



F1 ... F4	The DUT can only have one of these features.
F5	This function can be used if you know that all accessible metal parts of the enclosure are connected to PE. During device testing, the test probe then only has to be brought into contact with one metal point on the enclosure. If not all metal parts of the enclosure are connected to PE, deactivate this function. During device testing, an additional device leakage current test (Class II) is carried out. However, this will only work if a manual or semi-automatic test sequence has been classified. During testing, proceed as follows: During PE conductor testing, use the test probe to scan all parts of the enclosure connected to PE. Then, during device leakage current testing (Class II), scan all parts not connected to PE.

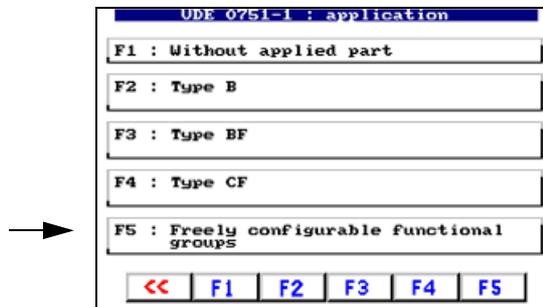
Press the associated function key to activate [√] or deactivate [] this function. Press Enter to confirm your entries.

5.2.4 Applied part

If there is only one applied part, during testing to DIN VDE 0751-1:2001-10, all patient electrodes are interconnected. Select the type of applied part (B, BF, CF; see nameplate on medical device).

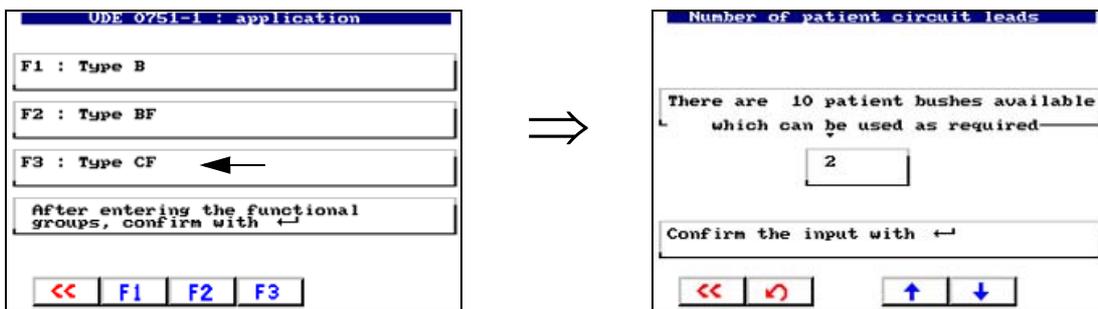
Medical devices often have more than one function. The different types B, BF and CF are assigned to the various patient connections. UNIMET® 1100ST can be used to test these medical devices as part of a test sequence.

Example: The combined ultrasound/stimulation current device has two CF type patient connections for stimulation current and two BF type patient connections for ultrasound. The two CF patient connections should be connected to bushes 1 and 2 on the UNIMET® 1100ST. The two BF patient connections should be connected to bushes 3 and 4 on the UNIMET® 1100ST.



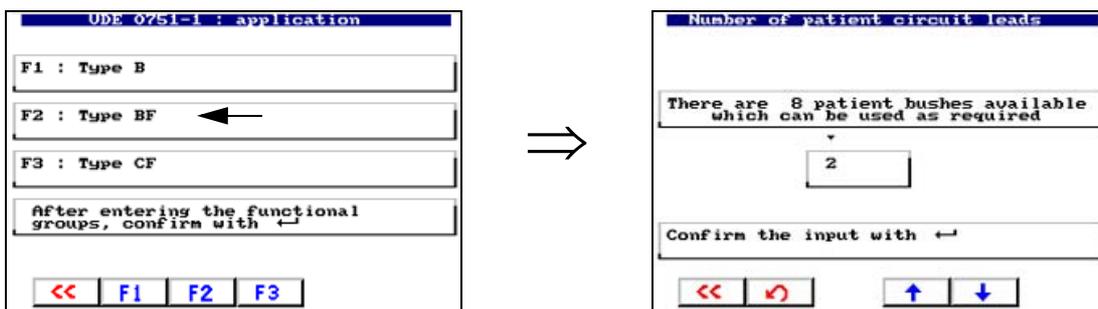
For this example, select “F5: Freely configurable function groups”.

Now classify the sequence of patient bushes as B, BF or CF.



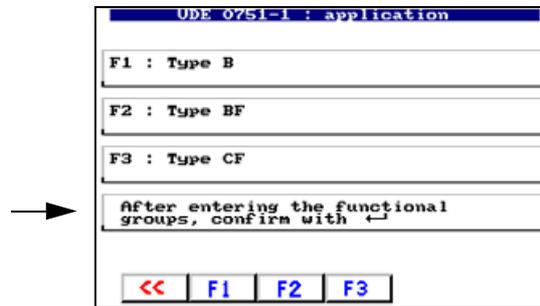
- Select “F3: Type CF” for the first two patient bushes.
- Use the arrow keys to select the number of patient bushes of this type (in this case 2) and confirm by pressing Enter.

Now classify the remaining patient bushes.



- Select “F2: Type BF” for the next two patient bushes.
- Use the arrow keys to select the number of patient bushes of this type (in this case 2) and confirm by pressing Enter.

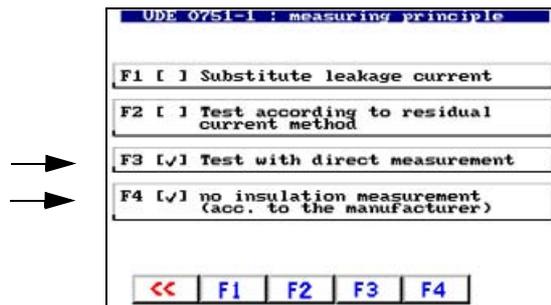
Once all patient bushes used have been classified, exit function groups entry by pressing Enter.



5.2.5 Measuring principle

The test standards enable you to choose between various measuring principles to ascertain the leakage currents. If you have selected one of methods F1 ... F3, a note about the measuring principle will appear on the screen. The current measuring principle is identified by “√”.

Example: “F3: Direct measurement” and “F4: No insulation measurement”.

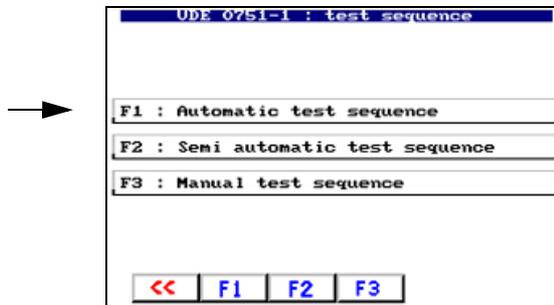


F1 ... F3	The DUT can only have one of these features. It is for this reason that only one of these three menu items can be selected.
F4	During insulation measurement, a voltage of 500 V is applied between the active conductors and earth. Insulation testing may damage sensitive devices. Only activate insulation measurement if permitted by the manufacturer's instructions provided with the DUT.

5.2.6 Test sequence

The test can be carried out automatically, semi-automatically or manually for each DUT.

Example: “F1: Automatic test sequence”.



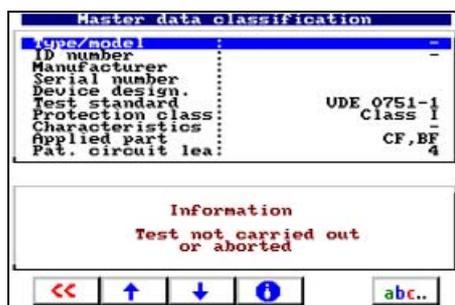
Automatic test sequence	During automatic testing, the test probe or test terminal comes into contact with one point of the DUT. The test sequence then runs through all test steps automatically.
Semi-automatic test sequence	During semi-automatic testing, there is a break after certain measurements have been taken. This break can be used to repeat measurements or to take measurements at different “points” on the DUT. Start the test step within 15 seconds by pressing Enter or by bringing the test probe into contact with the DUT. If the test step is not started in this way, the current test step is measured once after 15 seconds and the test then continues as during automatic testing.
Manual test sequence	During manual testing, it is possible to repeat each test step as often as required, thereby bringing the test probe into contact with a number of accessible parts on the DUT consecutively.

During manual and semi-automatic testing, UNIMET® 1100ST saves the “worst” measured value in each case. When measuring leakage currents and the PE conductor resistance, this is the highest measured value; when measuring insulation resistance, this is the lowest measured value.

5.2.7 Master data

Once the classification of the test sequence is complete, UNIMET® 1100ST will display the master data screen containing the master data already defined. You have several options from this screen:

- Edit/complete master data
- Start measurement
- Save classification in type or device catalogue.



ENTER key	Starts test
 , 	To scroll entries in master data screen.
	Provides information about the sequence of test steps and about limiting values.
	Edits the selected entry. The test sequence (automatic, semi-automatic, manual), the warning notice (suppress/automatic) and the start-up (automatic or manual start) can be edited. The remainder of the classification and the date cannot be modified.
	Exit master data

5.2.7.1 Time-efficient testing and documentation

If there are a number of DUTs of this type, we recommend that you proceed as follows once you have completed the classification process:

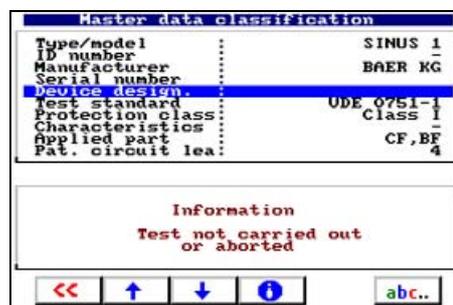
1. Enter type/model.
2. Edit other master data valid for this type (e.g. manufacturer, device designation, start-up).
3. Exit master data and save type in type catalogue.
4. Start and carry out the test from the type catalogue.
5. Save the test result in the device catalogue.

5.2.7.2 Editing master data

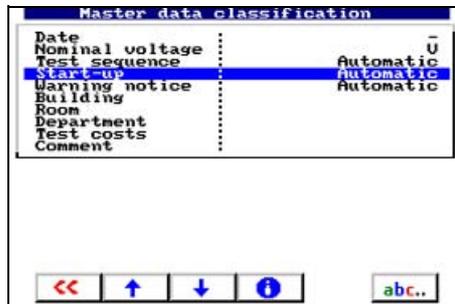
Select the required entry using the arrow keys and press the “abc” key to start the edit process. Chapter “Entering text and numbers” on page 18 describes how to enter text. For our example, we will complete the master data.

You must always enter a type name. If you do not, you will not be able to save the classification.

The manufacturer and device designation provide more detailed information about the device. You must decide whether you want to enter this information immediately or edit the type at a later date.



The test sequence (automatic, semi-automatic, manual) can be modified subsequently. You must also complete the remaining settings, which are valid for all devices of this type (start-up, warning notice, test costs).



5.2.7.3 Configuring the warm-up and cooling-down phases

Once they have been switched on, an increasing number of DUTs need to complete a self test and warm-up phase or a cooling-down phase prior to shutting down. Examples include computers, processor-controlled devices and laser equipment.

For these devices, the UNIMET® 1100ST may only commence measurements once the DUT has warmed up or “booted”. Otherwise, there is a risk that the parts of the device to be tested will only have switched on partially or not at all, and therefore will not be tested.

Once measurements are complete, the UNIMET® 1100ST may only shut down the DUT once it has booted down or cooled down. Otherwise, on laser equipment, there is the risk of overheating or, on a computer, of sectors of the hard disk becoming unusable.

The features of the “warm-up and cooling-down phase” on the UNIMET® 1100ST are as follows:
This function is available for the following tests:

- IEC 60601-1:1988+A1:1991 + A2:1995
- DIN VDE 0751-1:2001-10
- DIN VDE 0701-1:2000-09
- DIN VDE 0702:2004-06

It can only be configured for complete test sequences from the:

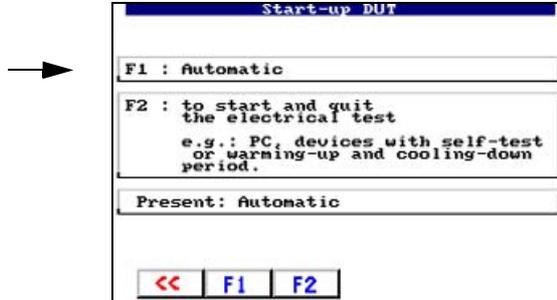
- classification
- type catalogue and
- device catalogue

The warm-up and cooling-down phase is not active:

- during single testing,
- during test sequences compiled in the UNIMET® 1100ST test step editor,
- during test sequences compiled from single tests in a computer program.

Make the settings for devices with warm-up and cooling-down phases under “Start-up DUT”.

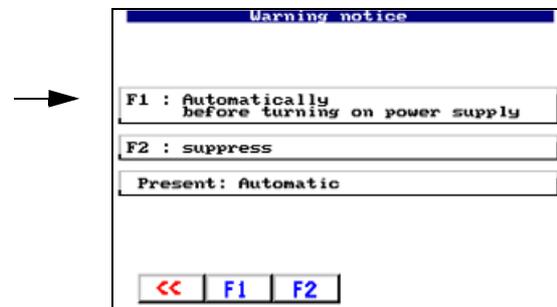
Example: The device does not need a warm-up and cooling-down phase. You should therefore select “Automatic”.



F1	Automatic (no warm-up and cooling-down phase)
F2	Manual starting and ending of electrical testing.

5.2.7.4 Activate warning notice

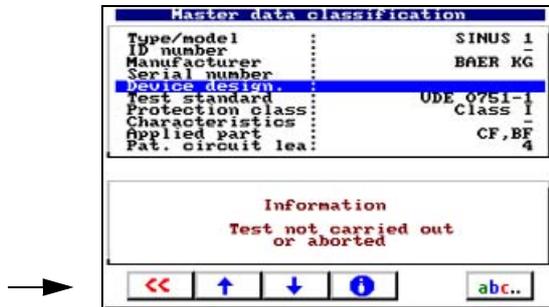
If this function is activated, a warning notice will appear prior to the DUT being connected to the system voltage. Only once the message has been confirmed will the system voltage be connected. This prevents hazardous devices such as grinders starting up unexpectedly.
Example: Automatic.



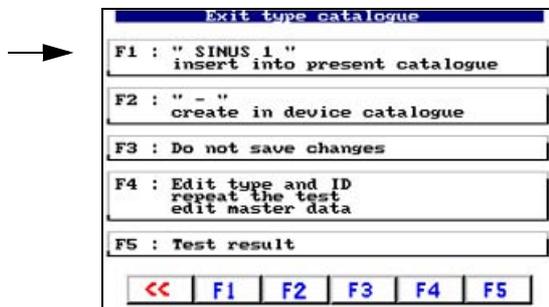
F1	Warning notice appears automatically before the DUT is connected to system voltage.
F2	Warning notice is suppressed.

5.2.8 Exit classification

Once all settings have been made, exit the master data screen by pressing  .



For our example, we are selecting “F1: ...create in type catalogue” in the “Save classification” menu.



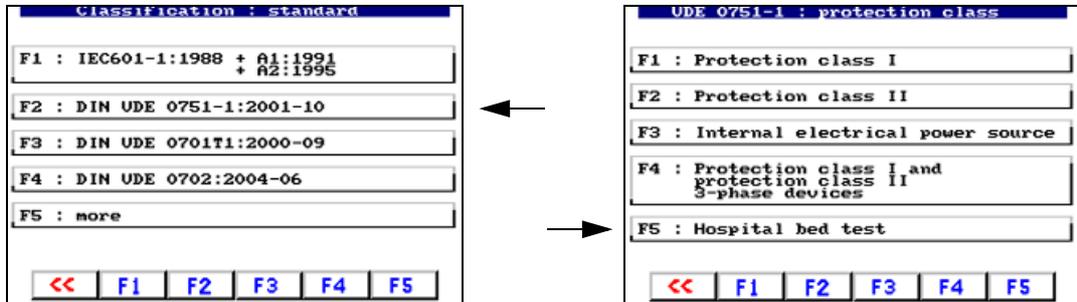
F1	The classification is saved in the type catalogue under the type name.
F2	If an ID number has been assigned with “F4”, you can use this key to subsequently save the test under this ID number in the device catalogue. The ID number will then appear instead of “-”.
F3	Do not save changes. The entries and changes are rejected following the appearance of a safety prompt.
F4	Back to master data screen. The master data can be edited and the test can be started.
F5	The test result and ID number (if available) are displayed, along with the sequence of test steps.
	Exit menu. The entries and changes are rejected following the appearance of a safety prompt.

This completes the classification of this device type. UNIMET® 1100ST now returns to the classification screen in order to classify another device.

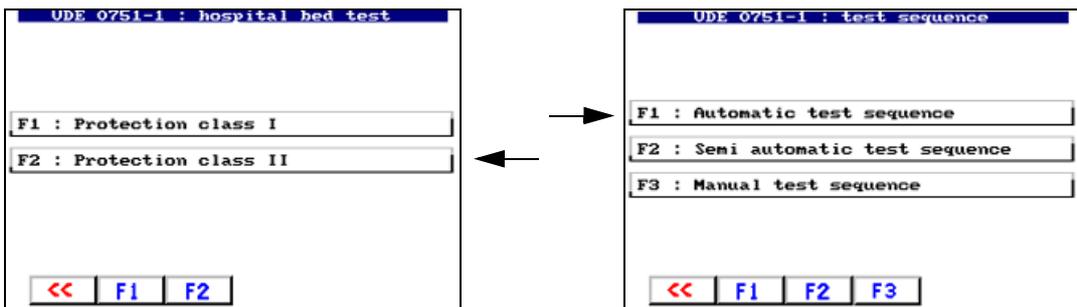
Example 2:

Classification of a care bed or hospital bed, Class II.

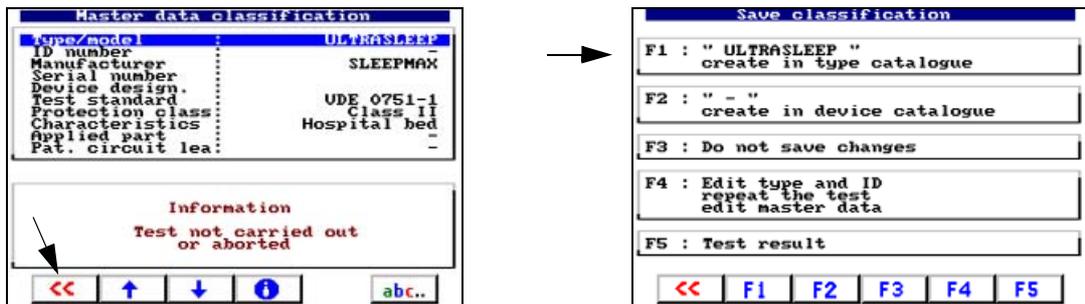
Select “DIN VDE 0751-1:2001-10” in the main menu and “Hospital bed test” in the next sub-menu.



The UNIMET® 1100ST default settings for care beds or hospital beds mean that only a few settings need to be made. Even visual inspections have been customised for these DUTs. For our example, select “F2: Protection class II” and “F1: Automatic test sequence”.



You must always enter a type name. If you do not, you will not be able to save the classification. Example: Ultrasleep. Modify the settings for all master data to match the device to be tested. Once all settings have been made, exit the master data screen by pressing .



For our example, we are selecting “F1: ...create in type catalogue”. This completes the classification of this device type. UNIMET® 1100ST now returns to the classification screen in order to classify another device.

5.3 Test

A test can be started in a number of ways. Start a test:

- following classification by pressing Enter;
- by selecting an existing type from the type catalogue;
- by selecting an existing device from the device catalogue;
- as a user-defined test from the main menu;
- from the main menu by calling up a serial number using the barcode scanner.

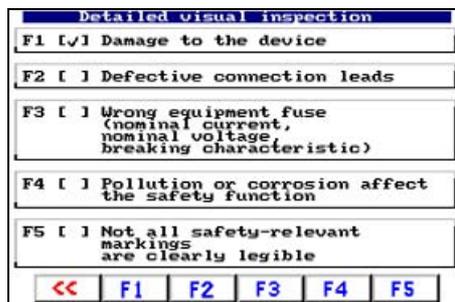
The test is carried out in accordance with the following sequence:

1. Visual inspection (not when testing in accordance with IEC 60601-1)
2. Electrical tests
3. Functional test (not when testing in accordance with IEC 60601-1)

The test can be aborted at any point by pressing  .

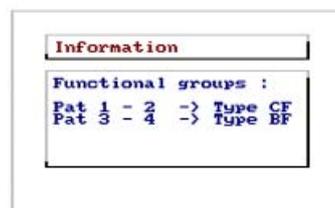
5.3.1 Carrying out the visual inspection

Carry out the visual inspection using the test steps listed. All visual inspections are set as passed [] by default. If a DUT should fail a test step, press the relevant function key. This will mark the test step concerned as failed [✓]. The entire test is assessed as failed. Press Enter to apply the entries and continue the test. If the visual inspection contains a large number of test steps, it will be displayed on more than one page.



5.3.2 Connecting the DUT

If there are patient connections which have been assigned to function groups, UNIMET® 1100ST will indicate which patient bushes these patient connections need to be plugged into.



Plug the patient connections into the bushes on the UNIMET® 1100ST.

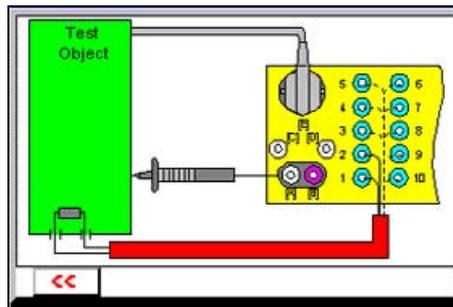
Example: Type CF patient connections in bushes 1 - 2,

Type BF patient connections in bushes 3 - 4.

UNIMET® 1100ST will now display the connection diagram matching the classification. This diagram will show you where to make the connection for the test probe and all other connections to the DUT.



In the connection diagram, the test probe is connected to the colour-coded bushes [A] and [B]. This test probe is the one with a switch which is included in the UNIMET® 1100ST scope of supply. If a single-pole test probe is used instead, this is connected to the bush [B].



Proceed as follows:

1. Connect the DUT to the UNIMET® 1100ST as shown in the connection diagram.
2. Press Enter to continue with the test.

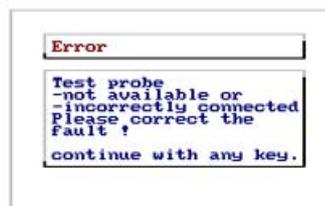
5.3.3 Carrying out electrical tests

UNIMET® 1100ST now starts the electrical part of the test. The electrical tests are carried out in accordance with the following sequence:

1. All tests during which the DUT is not in operation (e.g. PE conductor test, insulation test, substitute leakage current)
2. Tests with the DUT in operation with a given phasing (e.g. touch current test, residual current test, patient leakage current)
3. Tests as 2, but with phase reversed. This ensures that the DUT is not switched on and off too often.

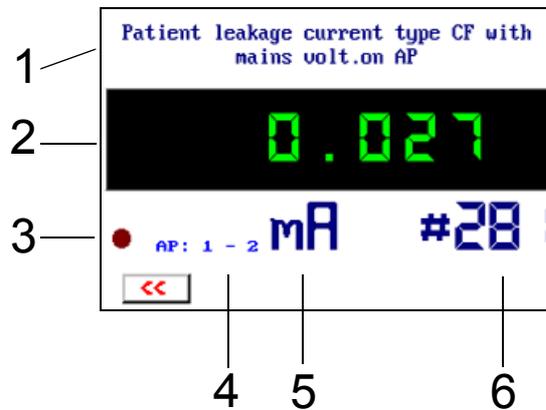
5.3.3.1 Has the test probe been connected correctly?

When starting the electrical tests, UNIMET® 1100ST checks whether the test probe has been connected correctly and whether the test probe connected is in accordance with the system administration settings. Any errors will be indicated:



Correct the test probe connection and continue the test.

5.3.3.2 Test steps display



1	Name of current test (example: patient leakage current test)
2	Measured value. The background colour is: - red if the limiting value is not observed; - green if the limiting value is observed or if no limiting value applies.
3	Activity display, flashes slowly during testing.
4	Indicates the patient components currently being tested.
5	Measured value unit
6	Measurement number. BENDER device measurements are numbered consecutively. See also "Chapter 9.2 Test steps".
	Abort test

5.3.3.3 PE conductor test

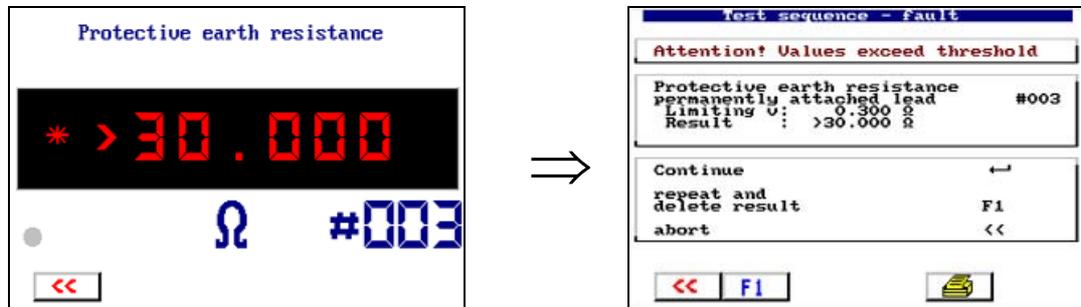
On Class I equipment, the resistance of the PE conductor is tested.



During the PE conductor test, the low-resistive continuity of the PE conductor is tested with a high current (> 10 A). This produces heat energy. If the PE conductor test is repeated frequently and without breaks during manual testing or single tests, UNIMET® 1100ST will prevent overheating by aborting testing. A message will appear. PE conductor testing can continue once a short cool-down period has elapsed.

5.3.3.4 Monitoring limiting values

A warning signal will sound if the limiting value is not observed during PE conductor testing. The measured value is displayed followed by a warning notice.



UNIMET® 1100ST offers several options to respond when this limiting value has been exceeded:

ENTER key	Continue test. The error will be recorded. Ensure sufficient safety clearance during the remaining tests. Please note that potentially dangerous touch voltages can be present on the DUT enclosure. The results of the test are displayed immediately at the end of the test sequence.
F1	Deletes the measured value and repeats the test step. This can be very helpful for example, in the event of an erroneous measurement due to test probe not being connected.
<<	Exit menu. The test is aborted.

Indication of exceeded limiting values in all other cases

UNIMET® 1100ST monitors observance of the limiting value throughout the test sequence. A warning signal will sound if the limiting value is not observed during a test step. * appears next to the measured value; the colour of the display changes to red. With the exception of PE conductor testing, the test sequence continues. The results of the test are displayed immediately at the end of the test sequence.



The test system does not, however, permit any hazardous currents.



Faulty DUTs can exhibit dangerous leakage currents. During all leakage current tests, testing is aborted immediately if a measured value > 20 mA is reached.

5.3.3.5 Tests on de-energized DUTs

In accordance with classification, all tests during which the DUT is not in operation (e.g. PE conductor test, insulation test, substitute leakage current) are carried out at this point.



Vorsicht

During testing of the insulation resistance, a direct touch current of up to 1.8 mA may be conducted on faulty test objects or in the event of direct contact with the test probe. IEC 61010 permits a direct touch current of up to 2 mA.

5.3.3.6 Tests on connected DUTs

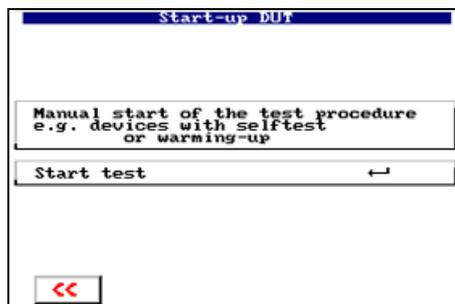
If the “Warning notice” message has been activated in the master data screen, the following warning notice will appear before the DUT is connected to the system voltage.



	Aborts the test.
ENTER key	Continues the test. The DUT is connected to the power supply.

Warm-up phase

If the “Start-up” function is set to “Manual start” in the master data screen, UNIMET® 1100ST will wait until the DUT has booted up or is ready for operation. Once the test object has been connected to the mains supply, the following message appears. Switch the DUT on and wait until it is ready for operation.



	Aborts the test.
ENTER key	Continues the test.

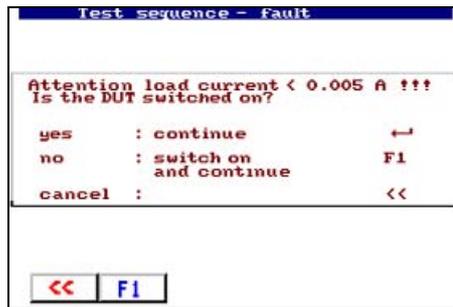
Power consumption

UNIMET® 1100ST measures the power consumed by the DUT.



Please note that only DUTs with a power consumption of up to 3700 VA may be supplied with power via the UNIMET® 1100ST test socket. If DUTs with higher power consumption levels are connected, the thermomagnetic circuit-breaker integrated into the UNIMET® 1100ST power switch will trip. Once the DUT has been removed, the test system can be switched again on after a few seconds.

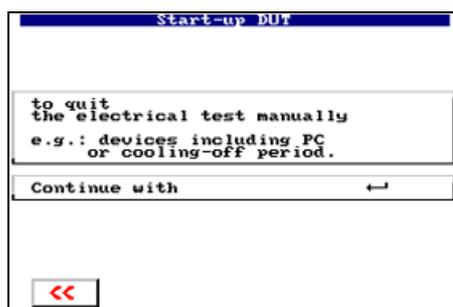
At a load current less than 0.005 A, UNIMET® 1100ST will prompt you to confirm that the DUT is actually switched on.



	Aborts the test.
F1	Allows the DUT to be switched on. Load current testing is repeated.
ENTER key	Confirms the lower value as correct. Continues the test.

cooling-down phase

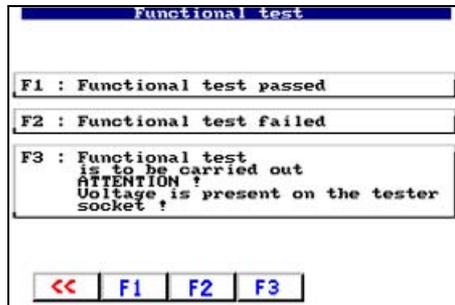
If the “Start-up” function is set to “Manual start” in the master data screen, after the last test step carried out with this phase relation, UNIMET® 1100ST will wait until the DUT has been shut down.



	Aborts the test.
ENTER key	Continues the test e.g. with the phase reversed.

5.3.4 Carrying out the functional test

The functional test follows the electrical part of the test.



F1	The functional test is assessed as "passed".
F2	The functional test is assessed as "failed". The entire test is saved as "failed".
F3	Power up the DUT by connecting it to the UNIMET® 1100ST test socket. Please note the manufacturer's instructions when doing this. Three-phase DUTs and DUTs with power consumption levels higher than 3700 VA cannot be supplied with power via the test socket. Connect these DUTs directly to the designated system voltage.

5.3.5 Recording the test result

5.3.5.1 Displaying the test result

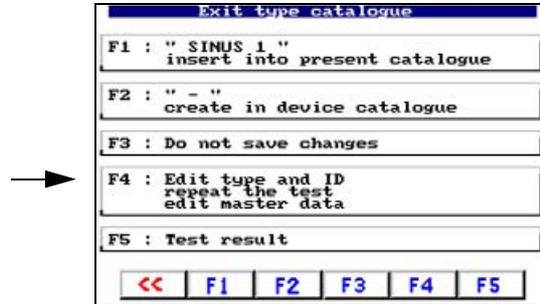
Once the functional test has been completed, the result of the test is displayed in accordance with the system administration setting (see "Test result" on page 49). If the test result is not displayed immediately, it can be called up as described in the following menu.



1	Name of test
2	If the DUT has failed the test, this message will appear.
3	Sequence of test steps See also "Chapter 9.2 Test steps".
4	Test steps which the DUT has failed are marked with *.
5	Measured value and unit
	Exit test results. Go to the "Classification" menu.
 , 	Scroll test results
	Detailed display of all test steps (long-format printout possible)
	Prints the test result (short-format printout)

5.3.5.2 Editing and saving

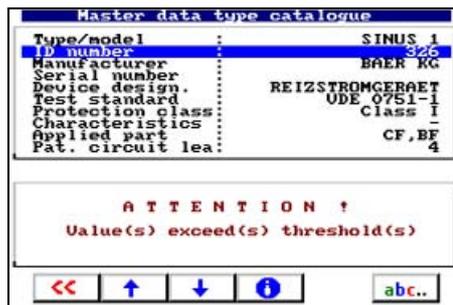
For our example, we are selecting “F4: Edit type and ID”. You can also access the following functions via this menu:



F1	Save in type catalogue. We do not need this function for our example, as the type has already been saved.
F2	Save in device catalogue. Enter the ID number as previously with “F4: Edit type and ID”.
F3	Do not save changes. The entries and changes are rejected following the appearance of a safety prompt.
F4	Back to master data screen. The master data can be edited and the test can be started.
F5	The test result (if there is one) and sequence of test steps are displayed.
<<	Exit menu. The entries and changes are rejected following the appearance of a safety prompt.

5.3.5.3 Entering the ID number

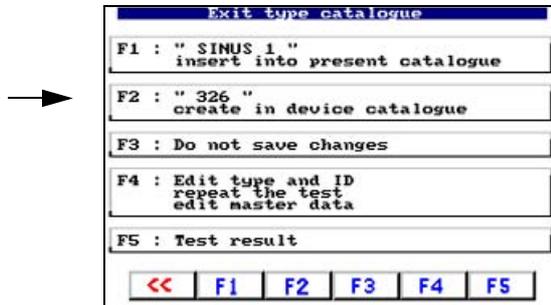
The device ID is required for saving to the device catalogue.



- Using the arrow keys, scroll to the "ID number" entry and enter an ID number. Other data such as serial number, building, room, department, test costs and a comment can also be entered.
- Exit the master data screen by pressing  .

5.3.5.4 Saving in the device catalogue

In the next menu, you can save the test in the device catalogue.



This completes the test.

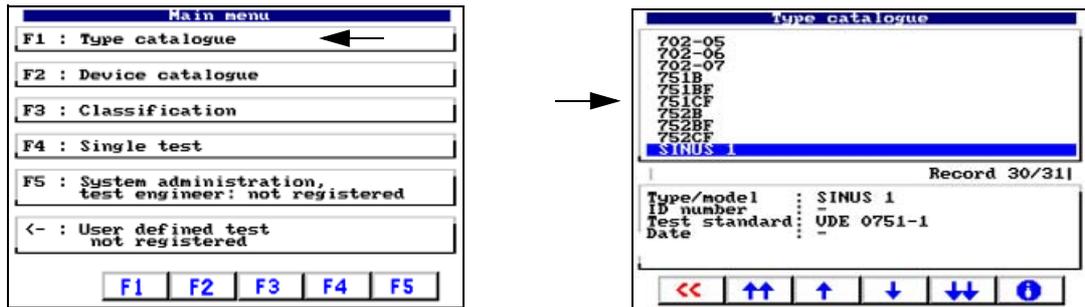
5.4 Type catalogue

All type names and the test steps and limiting values defined during classification are saved in the type catalogue. If there are a number of devices of the same type, the type catalogue offers the following advantages:

- Saves time: Classification only has to be carried out once.
- Assures quality: Every test of the same type is carried out with exactly the same test steps.

5.4.1 How to access the “type catalogue”

In the main menu, select “F1: Type catalogue”. In the type catalogue, select the type of DUT.



There are several ways to select the type of DUT:

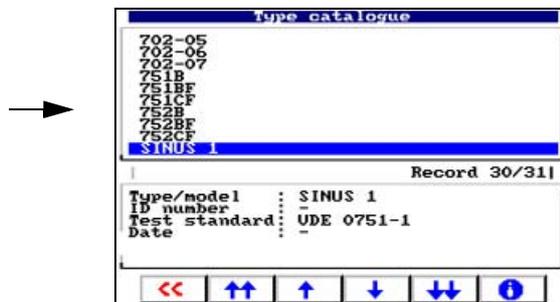
Arrow keys	Use the , keys to scroll page by page, use the , keys to scroll to the required entry.
Keypad	Enter the letters at the beginning of the type name. If necessary, use the , keys to scroll to the required entry.
Barcode scanner	If there is a barcode with the type name, the type can be selected directly.



If a type entry is used very frequently, it is recommended to include it in user-defined testing (See “Modify type catalogue” on page 28).

5.4.2 Type catalogue: Start test and edit type

The required type entry is already selected.



	Modify master data (master data can also be modified once the test has been completed).
ENTER key	Starts the test

Start the test and follow the instructions on the UNIMET® 1100ST display (see also “Test” on page 62ff). Once the test is complete, save the result to the device catalogue.

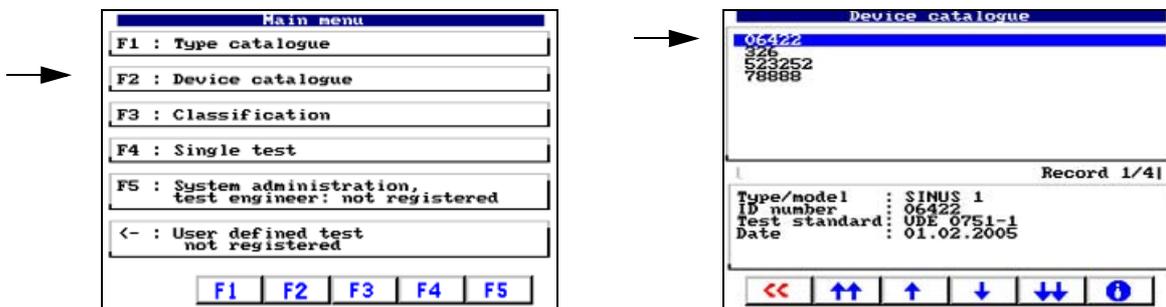
5.5 Device catalogue

All tested devices are saved in the device catalogue with their device ID and the test results obtained. In the event of periodic testing, the devices are simply called up in the device catalogue and tested again.

The content of the device catalogue can be transferred to a PC program. Similarly, data records selected in the PC program can be transferred to the device catalogue. These functions are described in the PC software guide.

5.5.1 How to access the “device catalogue”

In the main menu, select “F2: Device catalogue”. In the device catalogue, select the ID number of the DUT.

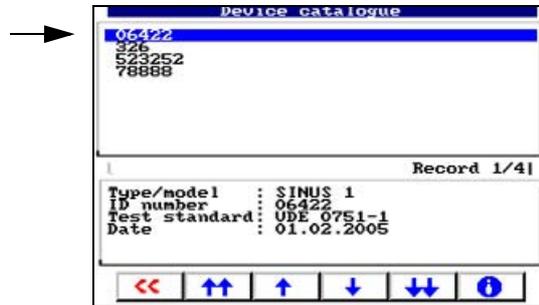


There are several ways to select the DUT's ID number:

Arrow keys	Use the  ,  keys to scroll page by page, use the  ,  keys to scroll to the required entry.
Keypad	Type in the characters at the beginning of the ID number. If necessary, use the  ,  keys to scroll to the required entry.
Barcode scanner	If there is a barcode with the DUT's ID number, the ID number can be selected directly.

5.5.2 How to start a test from the device catalogue

The required ID number is already selected.



	Modify master data (master data can also be modified once the test has been completed).
ENTER key	Starts the test

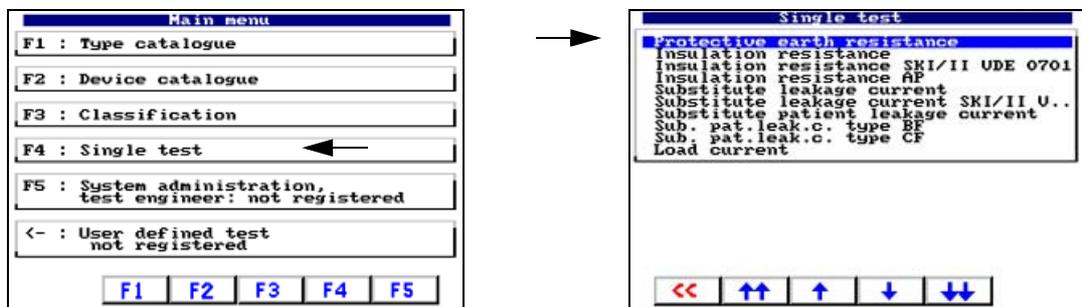
Start the test and follow the instructions on the UNIMET® 1100ST display (see also “Test” on page 62ff). Once the test is complete, save the result to the device catalogue again. The old test results will be replaced by the new ones.

5.6 Single test

Test steps can be called up in the form of single tests and repeated as often as required. If, for example, a limiting value is not met during a classified test sequence, the test step concerned can be examined in more detail using a single test.

5.6.1 How to access the “single test”

In the main menu, select “F1: Single test”. Use the arrow keys to select the type of test required. Double arrows can be used to scroll page by page. Once you have made your selection, activate the entry by pressing the Enter key.



5.6.2 How to start a single test

Select the required test and then start it by pressing Enter.

Chapter “Connecting the test probe during zero balancing” on page 45 describes the various options for PE conductor testing.



	Sets the single test up as a user-defined test in the main menu.
ENTER key	Starts the single test.



During the PE conductor test, the low-resistive continuity of the PE conductor is tested with a high current (> 10 A). This produces heat energy. If the PE conductor test is repeated frequently and without breaks during manual testing or single tests, UNIMET® 1100ST will prevent overheating by aborting testing. A message will appear. PE conductor testing can continue once a short cool-down period has elapsed.

Example: Measuring the PE conductor resistance of a device with permanently attached lead



	Stops the test. The last measured value remains on the display. Press  to continue the test.
	Prints the test result to a connected printer.
	Exit single test.

6. PC-compatible functions of the UNIMET® 1100ST

6.1 Overview of functions

The UNIMET® 1100ST can be connected to a PC using the null modem cable included in the scope of supply. A number of different device administration programs (e.g. programs manufactured by HSD, Loy & Hutz, Mebedo) support communication with UNIMET® 1100ST or even allow the test device to be controlled remotely.

If you wish to create a software program yourself, you will find information about commands and measurement numbers in the “UNIMET® ...ST Schnittstellenbeschreibung” manual, a German version of which can be downloaded from <http://www.bentron.de> (Download).

The following BENTRON® software products can assist you in working with UNIMET® 1100ST:

Software	Features
UniBackup (freeware, download: http://www.bentron.de)	<ul style="list-style-type: none"> – Transfer of firmware updates from PC to UNIMET® 1100ST. – Saves a backup copy of Unimet’s database files (type and device catalogues) on PC. The backup copy can be transferred back to the Unimet. UniBackup cannot be used as a substitute for device administration software. – The following operating languages are supported: English, German, French and Italian.
UNIData1100 (option)	<ul style="list-style-type: none"> – Import and export of type and device catalogue data. – Administration of type and device catalogue data; update of schedules for periodic testing. – Printout of all or individual test protocols; customisation of printout (company name and logo). – Extensive selection options (e.g. on the basis of test date) for export or printout. – Export of files in pdf, html, Excel, Word, rtf format. – Service utilities can be used to compress, repair and back up the UNIData1100 database. – Automatic detection of RS-232 interface settings.

6.2 Setting up UNIMET® 1100ST for data exchange

1. Install the software (e.g. “UniBackup or UNIData1100”) on your PC.
2. Use a null modem cable to connect UNIMET® 1100ST to the RS-232 interface on the PC.
3. Switch the Unimet® 1100ST on.
4. System settings:
 - Make sure that **no** barcode scanners are logged on.
 - Set the same baud rate as in the software (e.g. 9600 baud).
5. Return to Unimet® 1100ST main menu.
6. Start up the PC software.

6.3 UniBackup software

6.3.1 System requirements

- UNIMET® 1000ST/1100ST firmware version 4.20 or higher
- UniBackup will run on IBM-compatible PCs with a Windows® 95/98, Windows® 2000 or Windows® XP operating system.

6.3.2 Installing UniBackup

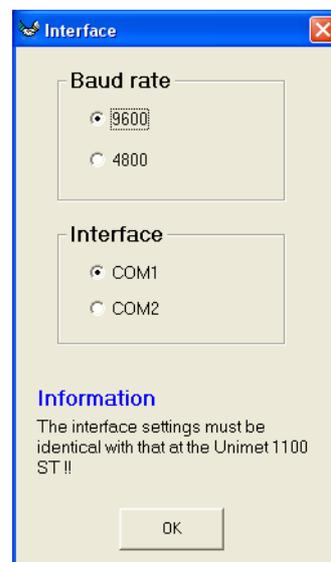
1. Download the software from <http://www.bentron.de>.
2. Unzip file UniBackupV1.1.zip.
3. Start the installation file UniBackupV1.1.exe and follow the installation instructions. You must agree to the licence conditions in order to be able to install the software.

6.3.3 Starting UniBackup

1. Start the program (-> Start -> Programs -> UniBackup V1.1).
2. Select a language.



3. Set the baud rate and interface.



6.3.4 Updating the Unimet operating software (firmware update)

UNIMET® 1100ST is continuously developed. New update files received from BENTRON® are transferred from PC to UNIMET® 1100ST using UniBackup.

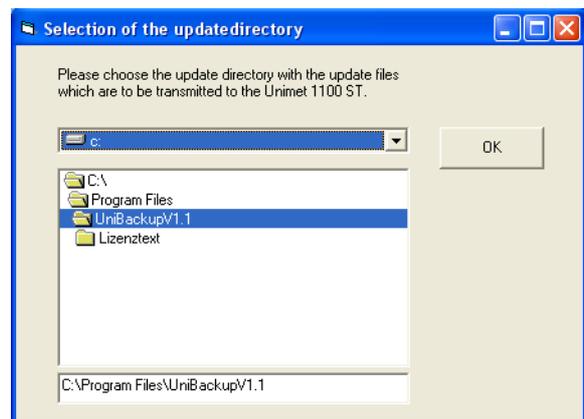


Before performing an update, we strongly recommend that you back up all type and device catalogue data to a PC.

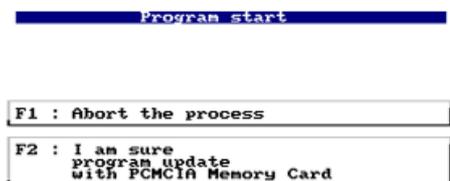
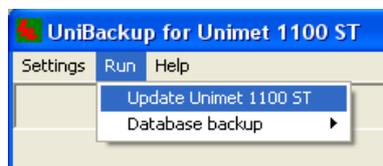
The update process takes several minutes and must not be interrupted. If the update process on the UNIMET® 1100ST is interrupted, there is a risk that the UNIMET® 1100ST operating software will no longer function correctly. Try to start the update process again from scratch. If you do not succeed, only BENTRON® will be able to carry out the update.

Following an update, you should check your settings in the UNIMET® 1100ST system administration (e.g. contrast, test engineer's name, nominal voltage, etc.). Correct any settings changed during the update (see "Basic settings" on page 22).

1. Specify where the update directory is located.
 - For UNIMET® 1100ST, you need directory "disk_ETX".
 - For UNIMET® 1000ST with PCMCIA drive, you need directory "disk_104".



2. Start the update first in UniBackup and then in Unimet.



Following an update, UNIMET® 1100ST will restart and the main menu will reappear.

6.3.5 Backing up the Unimet database to PC

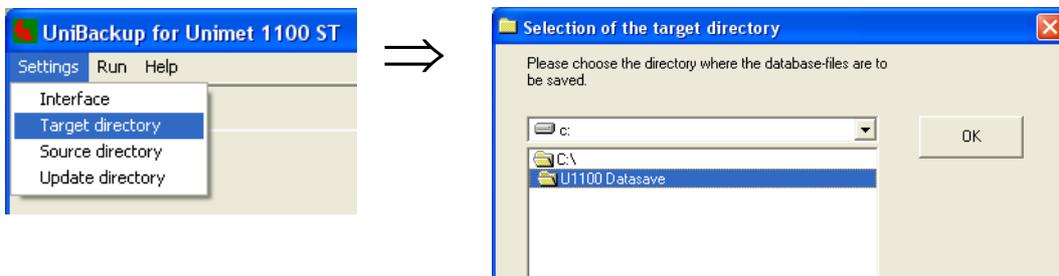
You should make regular back-up copies of the UNIMET® 1100ST database in order to avoid loss of data.

If the UNIMET® 1100ST is used by a number of different people in various departments, various versions of the Unimet database can be backed up.

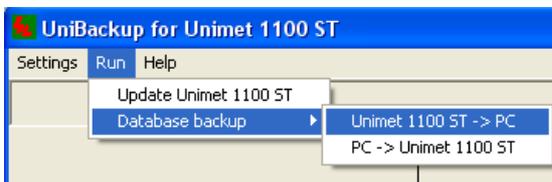


It is always the entire UNIMET® 1100ST database that is transferred. This enables a reliable back-up copy of the relevant version of the UNIMET® 1100ST database to be made. This function cannot be used as a substitute for device administration software.

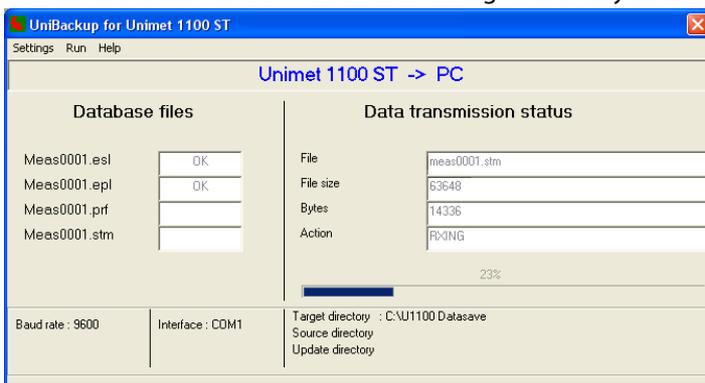
1. Enter the target directory where the four UNIMET® 1100ST database files are to be saved.



2. Start database transfer.



3. The database files are transferred to the target directory indicated.



Database files are transferred from PC to UNIMET® 1100ST as follows:

1. Select the source directory.
2. Start database backup "PC -> Unimet 1100ST".

The "Help" menu in the UniBackup software contains more information about how this function works.

6.4 UNIData1100 software

6.4.1 System requirements

- UNIMET® 1000ST/1100ST firmware version 4.20 or higher
- IBM-compatible PC, minimum 600 MHz Pentium II processor, with RS-232 interface or USB/RS-232 adapter
- Minimum 128 MB RAM, 256 MB recommended
- Minimum OS Windows® 2000 running SP3 or Windows® XP
- Minimum screen resolution 800 x 600, 256 colours

The UNIData1100 software instruction manual is included on the software CD.

7. Maintenance and calibration

7.1 Calibration

Like any other test instrument, UNIMET® 1100ST requires a regular measured values check. The calibration interval is 24 months. The test system can only be calibrated and adjusted by BENTRON® or persons who has been authorized by BENTRON®.

7.2 Changing the battery

The UNIMET® 1100ST is powered by a battery with a service life of approx. three years. The test system battery can only be changed by BENTRON® or persons who has been authorized by BENTRON®.

The battery is always replaced by BENTRON® as part of the calibration procedure.

7.3 Maintenance

Other than the work carried out as part of periodic calibration, the device requires no further maintenance.

7.4 Device errors

UNIMET® 1100ST monitors its device functions continuously. In the unlikely event that an error does occur, a message will appear on the display in plain text.

Proceed as follows:

1. Make a note of the error message.
2. Switch the UNIMET® 1100ST off and remove the mains connector.
3. Make a note of what happened prior to the error: operator inputs, type of DUT, ambient conditions, etc.
4. Keep the device serial number to hand.
5. Call BENTRON® technical support and describe the type of error.

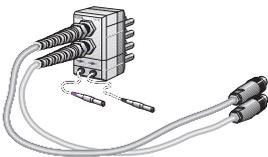
8. Options and accessories

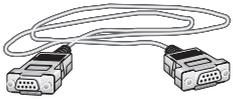
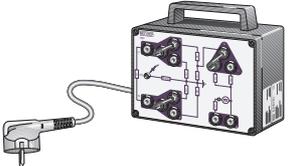
8.1 Standard version, options and accessories

The following table provides an overview of the available options and documentation, along with ordering data. The latest documentation can be accessed in the Download area of our homepage at <http://www.bentron.de>.

Description	Image	More information	Order number
UNIMET® 1100ST standard Test system for medical electrical devices and electrical equipment; Tests to IEC 60601-1, DIN VDE 0751, DIN VDE 0701 and DIN VDE 0702; Us: AC 100...240 V, max. load 3500 VA, PE conductor test current approx. 8 A Plug/socket: Schuko (German), Color Edition		UNIMET® 1100ST brochure	B96021100C *1)
UNIMET® 1100ST, 25 A version Test system for medical electrical devices and electrical equipment; Tests to IEC 60601-1, DIN VDE 0751, DIN VDE 0701 and DIN VDE 0702; Us: AC 100...240 V, max. load 3500 VA, PE conductor test current 25 A Plug/socket: Schuko (German), Color Edition		UNIMET® 1100ST brochure	B96021112C *1)
Printer Ink jet printer HP450CBI, A4		UNIMET® 1100ST brochure	B 9602 0056
ST6180 Barcode reading wand for fast identification of the DUT (only available for a limited period).		This manual, chapter "Barcode reading" on page 25, "ST6180 barcode reading wand, DLC7070 barcode scanner" on page 88	B9602 0003
DLC7070 Barcode scanner, for fast identification of the DUT		This manual, chapter "Barcode reading" on page 25, UNIMET® 1100ST brochure	B9602 0073

Description	Image	More information	Order number
T1000 Carrying bag well designed, to store the UNIMET® 1100ST, printer, barcode scanner, etc.		UNIMET® 1100ST brochure	B 9602 0001
TW1000 Unimet trolley with built-in bag for easy transportation of the UNIMET® 1100ST		UNIMET® 1100ST brochure	B 9602 0059
PK3 Test kit, various adapters for connecting devices to the UNIMET® 1100ST		UNIMET® 1100ST brochure, PK3 instruction leaflet	B 9602 0009
DS601 Three-phase adapter for testing medical electrical 3-phase devices during operation to IEC 60601		UNIMET® 1100ST brochure, DS601 instruction leaflet	B 928 729
VK701-1 Schuko/Schuko/non-heating device adapter for testing extension cables and device power supply cables		UNIMET® 1100ST brochure, VK701 data sheet	B 9602 0048
VK701-2 CEE 16 A plug/socket adapter for testing extension cables and device power supply cables		UNIMET® 1100ST brochure, VK701 data sheet	B 9602 0049

Description	Image	More information	Order number
VK701-3 Screw/plug-in connector adapter for testing extension cables and device power supply cables with PK701 adapter case		UNIMET® 1100ST brochure, VK701 data sheet	B 9602 0050
VK701-4 CEE 32 A 5-pole adapter for testing extension cables and device power supply cables		UNIMET® 1100ST brochure, VK701 data sheet	B 9602 0051
VK701-5 CEE 64 A 5-pole adapter for testing extension cables and device power supply cables		UNIMET® 1100ST brochure, VK701 data sheet	B 9602 0052
VK701-6 Adapter with protective earthing contacts		UNIMET® 1100ST brochure	B 9602 0067
VK701-7 Adapter for non-heating devices		UNIMET® 1100ST brochure	B 9602 0066
TP2, active test probe with switch, cable length approx. 1.70 m		UNIMET® 1100ST brochure	B 9602 0019
TP3, active test probe with switch, cable length approx. 4.0 m, for testing larger devices such as dentist's chairs.			B 9602 0015
TP16 cable drum with measuring cables, 16 m long, for PE conductor testing on larger devices. Also includes 4 m test cable with test terminal.		TP16 instruction leaflet	B 9602 0054

Description	Image	More information	Order number
Test probe, passive 3 m measuring cable with black test probe			B 928 748
TP1010, test probe for testing lab equipment in accordance with IEC 61010-1, EN61010-1		TP1010 instruction leaflet	B 9602 0060
Measuring cable, 150 cm, 4 mm connector			B 928 703
Test clip Test terminal black			B 928 741
Null modem cable Cable for connecting the test system with a PC, 9-pole, female-female			BNR 264 044
TM1000, external keypad module for UNIMET® 1000/1100ST		UNIMET® 1100ST brochure	B 9602 0017
TB3, test box for inspecting safety testers		TB3 instruction leaflet	B 9602 0025

*1) UNIMET® 1100ST can also be supplied with plugs and sockets in a number of country-specific versions (B, CH, USA, GB, CDN).

8.2 25 A PE conductor test option

Chapter 18 of European standard EN 60601-1:1996 requires that a PE conductor test be carried out at 25 A or 1.5 times' the rated current of the device, whichever is larger ($\pm 10\%$). A current source with a frequency of 50 or 60 Hz is to be used and a test period between 5 and 10 seconds is required. Therefore, manufacturers of medical devices in particular test the PE conductor on their devices as part of type testing using the method specified.

The optional version of the UNIMET® 1100ST with 25 A PE conductor current has the following features:

- A regulated AC source supplies a sinusoidal current of 25 A ($\pm 10\%$) at a resistance to be measured of 0 Ω to 0.3 Ω . If the electrical resistance of the DUT's PE conductor connection exceeds 0.3 Ω , the current will drop as the resistance increases.
- The 25 A test is carried out in the following menu for complete test sequences in accordance with IEC 60601-1 and UL 60601-1:
 - classification,
 - type catalogue and
 - device catalogue.
- 25 A testing is **not** active:
 - during single testing;
 - during test sequences compiled in the UNIMET® 1100ST test step editor;
 - during test sequences compiled from single test steps in a computer program
- During testing, the test current is applied to the connected DUT for 5 seconds.
- The heat generated by the PE conductor current in the UNIMET® 1100ST is dissipated via the ventilation apertures in the base and on the right-hand side wall of the UNIMET® 1100ST. Suitable apertures are also located in the UNIMET® 1100ST carrying bag. You must ensure that these apertures remain unobstructed at all times.
- Temperature monitoring prevents the UNIMET® 1100ST from overheating. If PE conductor testing is repeated several times without a break, the UNIMET® 1100ST will switch to a cooling-down phase lasting approx. 1 minute after the fourth test at the earliest. Test practice is such that when leakage currents are being tested and the results of these tests recorded, the cooling-down breaks are long enough to ensure that the temperature monitoring function on the UNIMET® 1100ST is activated only occasionally.

The 25 A option does not affect the operation of the UNIMET® 1100ST. If test results are printed out via the UNIMET® 1100ST menu, the value of the test current will appear in the protocol.

8.3 Printer

A portable ink jet printer for immediate printout of test protocols can be supplied as an option. The printer is an integral feature of the optional carrying bag for the UNIMET® 1100ST. The printer is supplied set up for use with UNIMET® 1100ST.

Please see the printer manual for more information.

If you are using a printer not supplied by BENTRON®, please note:



*Printers not supplied by BENTRON® must be disconnected from the UNIMET® 1100ST during testing!
These printers can distort measurements and create earth loops that can damage the UNIMET® 1100ST and the DUT.*

- Only connect printers that are not earthed. If you are using an earthed printer, the Centronics

interface must be isolated using an appropriate device.

- Only connect printers which use an IBM 8-bit character set. Set the printer up so that it runs in IBM emulation.

8.4 ST6180 barcode reading wand, DLC7070 barcode scanner

The ST6180 barcode reading wand or DLC7070 scanner can be used to read master data, such as the device ID, type name or test engineer's name.

Devices and types can be selected in the relevant catalogue with the barcode scanner. When a barcode is read in the main menu, UNIMET® 1100ST will attempt to find a device with this serial number in its device catalogue. If it finds such a device, the test can be started directly. If there are a number of different devices in the device catalogue with the same serial number, the device found first is displayed.

How to activate the barcode scanner

- Connect the barcode reading wand or barcode scanner to the RS-232 serial interface on the Unimet.
- Select the appropriate barcode scanner in the system settings (see "Barcode reading" on page 25). The barcode reader is supplied set up for use with UNIMET® 1100ST.
- Please observe the information in the manual supplied with the barcode scanner.
- Test the function of the barcode scanner. Barcodes on merchandise can be used for this purpose.
- If you create your own barcodes:
 - Use one of the barcode types indicated in the barcode scanner manual.
 - Use test printouts to check whether the print quality is sufficient to ensure reliable reading.

Important information about the ST6180 barcode reading wand

- Following logon and every time the Unimet is started up, the ST6180 barcode reading wand will need about 20 seconds before it is ready for operation. It may need longer the first time it is used.
- The red LED in the tip of the reading wand will flash to indicate readiness for operation.
- A short beep will indicate that the barcode has been read successfully.
- When the ST6180 barcode reading wand is not in use, no objects should be positioned in front of the tip of the wand. Otherwise the reading wand will attempt to read without success; a beep will sound as long as the object remains in front of the tip of the reading wand.

8.5 VK701 adapter

The VK701 adapter enables UNIMET® 1100ST to check extension cables and device power supply cables. This automated test includes checking that the wiring is correct and verifying the connection between the individual pins on the plug and socket. The insulation resistance of the wires in relation to the PE conductor is also tested.

Commissioning

Prior to first use, the VK701 adapter must be zero balanced. Connect the VK701 measuring cables to bushes [B] and [C] and plug the VK701 into the UNIMET® 1100ST socket connector. Bushes 1 and 10 are not used. Then connect the VK701 plug and coupler. Start zero balancing (See “Test probe, VK701” on page 43).

Please see the VK701 data sheet for more information.

8.6 TP1010 for tests to IEC 61010-1:2001-02

For tests in accordance with standard IEC 61010-1:2001-02, UNIMET® 1100ST always needs to use the TP1010 test probe. International standard IEC 61010-1:2001-02 sets out general safety requirements for electrical equipment for measurement, control and laboratory use.

Please see the TP1010 instruction leaflet for more information.

9. Data

9.1 Standards

9.1.1 Application standards

The UNIMET® 1100ST carries out measurements and tests based on the following standards:

- DIN EN 60601-1 (VDE 750 Part 1):1996-03
Medical electrical equipment - Part 1: General requirements for safety (IEC 601-1:1988+A1:1991+A2:1995); German version EN 60601-1:1990+A1:1993+A2:1995
- DIN VDE 0751-1 (VDE 0751 Part 1):2001-10
Repair, modification and testing of medical electrical devices
- DIN VDE 0701-1 (VDE 0701 Part 1):2000-09
Repair, modification and testing of electrical appliances – General requirements
- DIN VDE 0702:2004-06
Periodic testing of electrical devices
- ÖVE/ÖNORM E 8751-1+A1/Publication date 2003-05-01
Recurrent test and test after repair of medical electrical devices - Part 1: General requirements
- ANSI/AAMI ES1
- UL 60601-1
Medical Electrical Equipment, Part 1: General Requirements for Safety
- IEC 61010-1, Publication date: 2002-08
Safety regulations for electrical equipment for measuring, control, regulating and laboratory use - Part 1: General requirements (IEC 61010-1:2001); German version EN 61010-1:2001

9.1.2 Design standards

The requirements of the following standards were taken into account in the design of UNIMET® 1100ST:

- DIN VDE 0404-1 (VDE 0404 Part 1): 2002-05
“Devices for technical safety inspection of electrical equipment - Part 1: General requirements”
- DIN VDE 0404-2 (VDE 0404 Part 2): 2002-05
“Devices for technical safety inspection of electrical equipment - Part 2: Testing equipment for tests after repair, modification or periodic testing”
- DIN VDE 0404-3 (VDE 0404 Part 3): 2005-04
“Devices for technical safety inspection of electrical equipment - Part 3: Equipment for periodic testing and tests prior to commissioning medical electrical devices or systems”

9.1.3 Terms used

The terms used have been taken primarily from standard DIN EN 60601-1 (VDE 750 Part 1):1996-03.

Term	Explanation
Detachable power supply cord	Flexible cord intended to be connected to electrical equipment by means of a suitable appliance coupler for mains supply purpose.
Applied part (AP)	A part of ME equipment that in normal use, necessarily comes into physical contact with the patient for ME equipment or an ME system to perform its function.
F-type isolated (floating) applied part	Applied part in which the patient connections are isolated from other parts of the ME equipment to such a degree that no current higher than the allowable patient leakage current flows if an unintended voltage originating from an external source is connected to the patient, and thereby applied between the patient connection and earth.
Type B applied part 	F-type applied part complying with the specified requirements of IEC 60601-1 to provide protection against electric shock, particularly regarding allowable leakage current and patient auxiliary current. It is marked with the symbol to the left.
Type BF applied part 	An applied part complying with the requirements of IEC 60601-1 to provide a higher degree of protection against electric shock than that provided by Type B applied parts. It is marked with the symbol to the left.
Type CF applied part 	F-type applied part complying with the specified requirements of IEC 60601-1 to provide a higher degree of protection against electric shock than that provided by Type BF applied parts. It is marked with the symbol to the left.
Accessible part	Part of ME equipment other than an applied part, that can be touched by means of the standard test finger (in accordance with DIN EN 60601-1) .
Functional earth terminal (FE)	Terminal, directly connected to a circuit or to a screening part, that is intended to be earthed for functional purposes.
Direct cardiac application	Use of applied part that can come in direct contact with the patient's heart.
Electrically skilled personnel	Person with relevant education and experience to enable him or her to perceive risks and to avoid hazards which electricity can create.
Single fault condition	Condition in which a single means for reducing the risk resulting from a hazard is defective or a single abnormal condition is present.
Permanently installed	Meaning electrically connected to the supply mains by means of a permanent connection that can only be detached by the use of a tool.
Class I ME equipment	ME equipment in which protection against electric shock does not rely on basic insulation only, but which includes an additional safety precaution in that means are provided for accessible parts of metal or internal parts of metal to be protectively earthed.

Term	Explanation
Class II ME equipment 	ME equipment in which protection against electric shock does not rely on basic insulation only, but in which additional safety precautions such as double insulation or reinforced insulation are provided, there being no provision for protective earth or reliance upon installation conditions.
Internal electrical power source	Electrical power for operating ME equipment that is a part of the ME equipment and which produces electrical current from some other form of energy.
Measuring device (MD)	Measuring device. The measuring device must load the source of the leakage current with a specific impedance. In the case of alternating current, the measuring device must have a specific frequency curve. Detailed information is provided in the standard relating to the DUT.
Mains part (MP)	Electrical circuit that is intended to be connected to the supply mains

9.1.4 Abbreviations used

The following abbreviations appear in this manual or on the Unimet screens. We have used the abbreviations from applicable standards where possible.

Abbreviation	Meaning
AC	Alternating Current
AG2	Application Group 2: Medical locations, in which medical electrical devices connected to mains systems are used for the purpose of operative intervention.
AP	Applied Part
DC	Direct Current
DIN	German standardization institut
DUT	Device under test
EABL	Eearth leakage current
EGA	Ssubstitute device leakage current
EPA	Substitute patient leakage current
GABL	Enclosure leakage current
MD	Measuring Device (IEC 60601-1)
MDD	Medical Device Directive - European guideline for medical devices
MP	Mains Part
MPG	German medical device law
PA	Equipotential bonding

Abbreviation	Meaning
PABL	Patient leakage current
PABN	Patient leakage current with system voltage on applied part
IGER	Device leakage current
IPE	PE current
IBER	Touch current
UBER	Touch voltage
UAP	with system voltage on applied part
ph. rev.	Reversed phase
E -> E	Patient electrode to patient electrode test
PE	Protective earth conductor
PHS	Patientenhilfsstrom (patient auxiliary current)
R-ISO	Insulation resistance
R-PE	PE resistance
TRMS	Root-mean-square value
UL	Underwriters Laboratories
Unimet	UNIMET® 1000ST or UNIMET® 1100ST BENDER test system
BGV-A2, VBG4	Accident prevention regulation for electrical installation and equipment in Germany
VDE	Association of German electrical engineers

9.2 Test steps

A classified test sequence with UNIMET® 1100ST comprises a number of individual test steps. The test steps are sorted on the basis of measurement numbers. A comprehensive list of test steps appears in the “Unimet Interface” manual.

9.3 Technical data

Supply voltage.....	90 ... 264 V AC ¹⁾
Frequency range	45 ... 65 Hz
Power consumption	max. 40 VA
Maximum load current	16 A
Maximum connectable load at 230 V	3800 VA
Protection class	I
Ambient temperature	0°C ... +50°C
Storage temperature.....	-10°C ... +70°C
Degree of protection	IP20

Testing of PE conductor resistance

Test voltage	max. 14 V, mains frequency
Short-circuit current (standard version)	approx. 10 A
Short-circuit current (25 A version)	25 A \pm 10% in the range 0.001 Ω to 0.3 Ω
Measuring range	0.001 Ω to 29.999 Ω
Measuring accuracy.....	0.001 Ω to 0.2 Ω \pm 0.02 Ω 0.2 Ω to 29.999 Ω \pm 10% of measured value

Leakage and substitute leakage currents (direct measurement)

Measuring range	0.001 mA to 19.999 mA
Measuring accuracy.....	0.001 mA to 9.999 mA < \pm 5% of MV \pm 2 digits 10 mA to 19.999 mA < \pm 7% of MV \pm 2 digits
Test voltage (substitute leakage currents)	approx. system voltage, mains frequency
Max. test current	3.5 mA

Leakage current by residual current measurement

Measuring range	0.02 mA ... 19.99 mA
Measuring accuracy.....	\pm 5% of MV \pm 5 digits

Patient auxiliary currents

Measuring range	0.001 mA - 19.99 mA
Measuring accuracy.....	\pm 5% of MV \pm 2 digits

Insulation resistance

Test voltage	approx. 500 V DC
Max. test current	2.5 mA
Measuring range	0.01 M Ω to 299.99 M Ω
Measuring accuracy.....	\pm 5% of MV \pm 2 digits

Voltage measurement

Measuring range	90 ... 264 V
Frequency range	50 ... 60 Hz
Measuring accuracy.....	\pm 2.5% of MV \pm 2 digits

Load current measurement

Measuring range	0.005 A to 16 A
Frequency range	50 ... 60 Hz
Measuring accuracy.....	\pm 2.5% of MV \pm 3 digits

Apparent power

Measuring range	0.005 ... 3.8 kVA
Frequency range	50 ... 60 Hz
Measuring accuracy.....	\pm 5% of MV \pm 5 digits

General data

Bumping IEC 6068-2-29 (transport)	40 g / 6 ms
Vibration resistance IEC 6068-2-6 (during operation)	1 g / 10 ... 150 Hz
Vibration resistance IEC 6068-2-6 out of operation)	2 g / 10 ... 150 Hz
Dimensions	approx. 380x400x135 mm
Weight (without accessories or bag)	approx. 10 kg
Calibration interval	24 months

of MV = of measured value

¹⁾ With printer option : See printer mains part for supply voltage

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