CE MultiTesterXA
MI 3394
Instruction manual
Ver. 2.5.5, Code no.20 752 432

METREL®

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1   General description

1.1 Warnings and notes

 Read before use
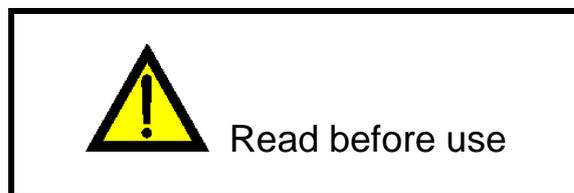
1.1.1   Safety warnings

In order to reach high level of operator safety while carrying out various measurements using the CE MultiTesterXA instrument, as well as to keep the test equipment undamaged, it is necessary to consider the following general warnings:

‣ **Read this Instruction manual carefully, otherwise use of the instrument may be dangerous for the operator, for the instrument or for the equipment under test!**

‣ **Consider warning markings on the instrument!**

‣ **If the test equipment is used in manner not specified in this Instruction manual the protection provided by the equipment may be impaired!**

‣ **Do not use the instrument and accessories if any damage is noticed!**

‣ **Consider all generally known precautions in order to avoid risk of electric shock while dealing with hazardous voltages!**

‣ **Use only standard or optional test accessories supplied by your distributor!**

‣ **Only test adapters provided or approved by Metrel should be connected to TC1 (test and communication) connectors.**

‣ **Use only earthed mains outlets to supply the instrument!**

‣ **In case a fuse has blown refer to chapter *8.2 Fuses* in this Instruction manual to replace it!**

‣ **Instrument servicing and calibration is allowed to be carried out only by a competent authorized person!**

1.1.2 Warnings related to safety of measurement functions

1.1.2.1   HV AC, HV DC, HV AC programmable, HV DC programmable

‣ **A dangerous voltage up to 5 kV$_{AC}$ or 6 kV$_{DC}$ is applied to the HV instrument outputs during the test. Therefore special safety consideration must be taken when performing this test!**

‣ **Only a skilled person familiar with hazardous voltages can perform this measurement!**

‣ **DO NOT perform this test if any damage or abnormality (test leads, instrument) is noted!**

‣ **Never touch exposed probe tip, connections equipment under test or any other energized part during the measurements. Make sure that NOBODY can contact them either!**

‣ **DO NOT touch any part of test probe in front of the barrier (keep your fingers behind the finger guards on the probe) – possible danger of electric shock!**

‣ **It is a good practice to use lowest possible trip-out current.**

1.1.2.2   Diff. Leakage, Ipe Leakage, Touch Leakage, Power, Leak's & Power

‣ **It is advisable not to run tested devices with load currents above 10 A for more than 15 minutes. Load currents higher than 10 A can result in high temperatures of On/Off switch and fuse holders!**

1.1.3   Markings on the instrument

‣ ⚠ **Read the Instruction manual with special care to safety operation«. The symbol requires an action!**

‣ ⚡ **Dangerous high voltage is present on terminals during the test. Consider all precautions in order to avoid risk of electric shock.**

‣ CE **Mark on your equipment certifies that it meets European Union requirements for EMC, LVD, and ROHS regulations.**

‣ 🗑 **This equipment should be recycled as electronic waste.**

1.2 Standards applied

The CE MultiTesterXA instrument is manufactured and tested according to the following regulations, listed below.

Electromagnetic compatibility (EMC)

EN 61326-1   Electrical equipment for measurement, control and laboratory use - EMC
                    requirements – Part 1: General requirements
                    Class B (Portable equipment used in controlled EM environments)

Safety (LVD)

EN 61010-1	Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements
EN 61010-2-030	Safety requirements for electrical equipment for measurement, control and laboratory use – Part 2-030: Particular requirements for testing and measuring circuits
EN 61010-031	Safety requirements for electrical equipment for measurement, control and laboratory use – Part 031: Safety requirements for hand-held probe assemblies for electrical measurement and test
EN 61557	Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures Instrument complies with all relevant parts of EN 61557 standards.

Functionality

EN 60335	Household and similar electrical appliances
EN 60950	Information technology equipment – Safety
EN 61439	Low-voltage switchgear and controlgear assemblies
EN 61010	Safety requirements for electrical equipment for measurement, control, and laboratory use
EN 60598	Safety of lighting equipment
VDE 0701-702	Inspection after repair, modification of electrical appliances – Periodic inspection on electrical appliances General requirements for electrical safety
EN 50191	Erection and operation of electrical test equipment

2   Instrument set and accessories

2.1 Standard set of the instrument

‣   Instrument MI 3394 CE MultitesterXA
‣   Bag for accessories
‣   HV test probes 2 m, 2 pcs
‣   Continuity test lead set 2.5 m, 2 pcs
‣   Continuity test lead red 1.5 m / 2.5 mm^2
‣   Test lead black 2.5 m
‣   Test lead red 2.5 m
‣   Alligator clips black 3 pcs
‣   Alligator clips red 2 pcs
‣   Mains cable
‣   RS232 cable
‣   USB cable
‣   Calibration Certificate
‣   Short form instruction manual
‣   CD with instruction manual (full version) and PC SW Metrel ES Manager

2.2 Optional accessories

See the attached sheet for a list of optional accessories that are available on request from your distributor.

3   Instrument description

3.1 Front panel
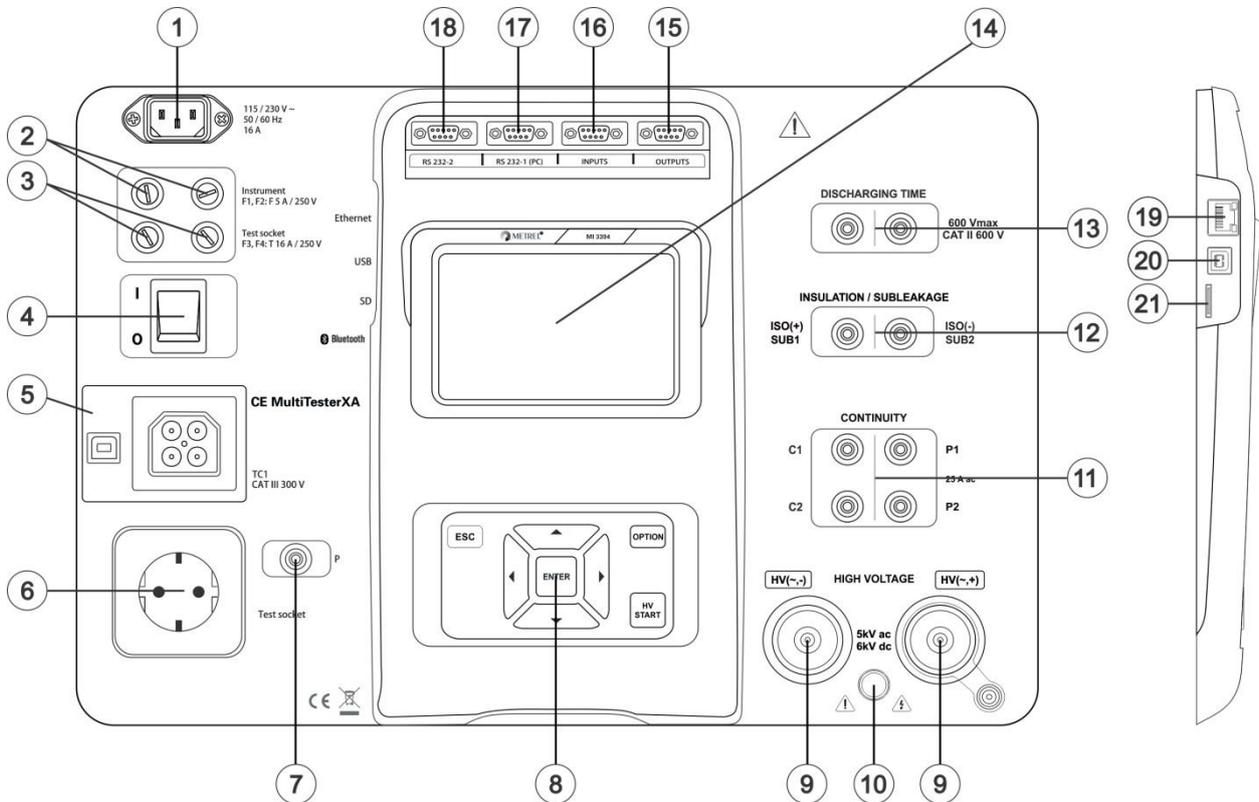
Figure 3.1: Front panel

1	**Mains supply connector**
2	**F1, F2 fuses (F 5 A / 250 V)**
3	**F3, F4 fuses (T 16 A / 250 V)**
4	**On / Off switch**
5	**Test connections TC1 for external test adapters**
6	**Mains test socket**
7	**P/S (probe) connector**
8	**Keypad**
9	**HV output connectors**
10	**HV output warning lamp**
11	**Continuity connectors**
12	**Insulation / Subleakage connectors**
13	**Discharging time connectors**
14	**Colour TFT display with touch screen**
15	**Control outputs**
16	**Control inputs**
17	**Multipurpose RS232-1 port**

18	**Multipurpose RS232-2 port**
19	**Ethernet connector**
20	**USB connector**
21	**MicroSD card slot**

4   Instrument operation

The CE MultiTesterXA can be manipulated via a keypad or touch screen.

4.1 General meaning of keys

(cursor keys)	Cursor keys are used to: - select appropriate option

ENTER	Enter key is used to:
	  - confirm selected option
	  - start and stop measurements

ESC	Escape key is used to:
	  - return to previous menu without changes
	  - abort measurements

OPTION	Option key is used to:
	  - expand column in control panel
	  - show detailed view of options

HV TEST	HV Test key is used to: - start and stop HV tests

4.2 General meaning of touch gestures:

(tap)	Tap (briefly touch surface with fingertip) is used to:
	  - select appropriate option
	  - confirm selected option
	  - start and stop measurements

(swipe)	Swipe (press, move, lift) up/ down is used to:
	  - scroll content in same level
	  - navigate between views in same level

(long press) **long**	Long press (touch surface with fingertip for at least 1 s) is used to:
	  - select additional keys (virtual keyboard)
	  - enter cross selector from single test screens

(tap escape icon)	Tap Escape icon is used to:
	  - return to previous menu without changes
	  - abort measurements

4.3 Safety checks

At start up and during operation the instrument performs various safety checks to ensure safety and to prevent any damage. These safety pre-tests are checking for:
‣ Correct input mains voltage
‣ Presence of input PE connection,
‣ Any external voltage against earth on mains test socket
‣ Excessive leakage currents through measuring I/Os,
‣ Too low resistance between L and N of tested device,
‣ Proper operation of safety relevant internal electronic circuits

If a safety check fails, an appropriate warning message will be displayed and safety measures will be taken. The warnings and safety measures are described in chapter 4.4 Symbols and messages.

4.4 Symbols and messages

Warning!

Instrument is connected to an IT earthing system or PE is not connected.
If IT system confirm to proceed.

| YES | NO |
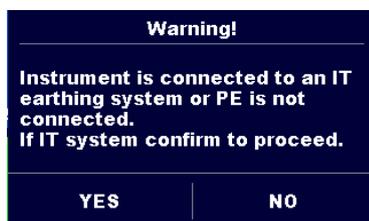
Supply voltage warning

Possible causes:

‣ No earth connection.

‣ Instrument is connected to an IT earthing system. Press YES to continue normally or NO to continue in a limited mode (measurements are disabled).

Warning:

The instrument must be earthed properly to work safely!

Warning!

Resistance L−N is too high(>30 kOhm). Check fuse / switch.
Would you like to proceed?

| YES | NO |
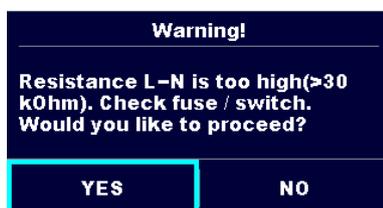
Resistance L-N > 30 kΩ

In pre-test a high input resistance was measured. Possible causes:

‣ Device under test is not connected or switched on

‣ Input fuse of device under test is blown.

Select **YES** to proceed with or **NO** to cancel measurement.

Warning!

Resistance L−N is very low (<10 Ohm).
Would you like to proceed?

| YES | NO |

Resistance L-N < 10 Ω

In pre-test a very low resistance of the device under test supply input was measured. This can result in a high current after applying power to the device under test. If the too high current is only of short duration (caused by a short inrush current) the test can be performed otherwise not.

Select **YES** to proceed with or **NO** to cancel measurement

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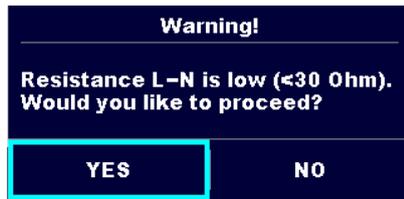
Warning! **Resistance L-N is low (<30 Ohm).** **Would you like to proceed?** **YES** **NO**	**Resistance L-N < 30 Ω** In pre-test a low input resistance of the device under test was measured. This can result in a high current after applying power to the device. If the high current is only of short duration (caused by a short inrush current) the test can be performed, otherwise not. Select **YES** to proceed with or **NO** to cancel measurement.
Improper input voltage **Check mains voltage and PE connection!** **OK**	Warning for improper supply voltage condition. If pressing OK instrument will continue to work in a limited mode (measurements are disabled).
Error **External voltage on C1P1 – C2P2 is too high!** **OK**	In pre-test an external voltage between C1/P1 and C2/P2 terminals was detected. The measurement was cancelled. Press OK to continue.
Error **External voltage on P – PE is too high!** **OK**	In pre-test a too high external voltage was detected between P and PE terminals. The measurement was cancelled. Press OK to continue.
Error **External voltage on Iso+ is too high!** **OK**	In pre-test a too high external voltage was detected between ISO/SUB and PE terminals. The measurement was cancelled. Press OK to continue.
Warning! **Leakage is high(>3.5 mA).** **Would you like to proceed?** **YES** **NO**	In pre-test a possible high leakage current was detected. It is likely that a dangerous leakage current (higher than 3.5 mA) will flow after applying power to the device under test. Select **YES** to proceed with or **NO** to cancel measurement.
Error **Measurment stopped because of too high leakage current.** **OK**	The measured leakage (Idiff, Ipe, Itouch) current was higher than 20 mA. Measurement was aborted. Press OK to continue.
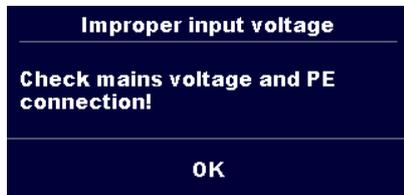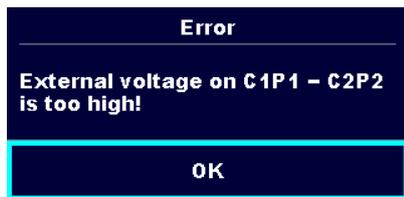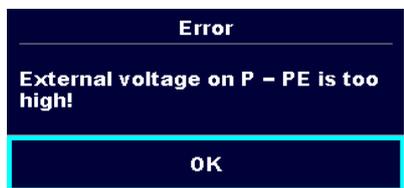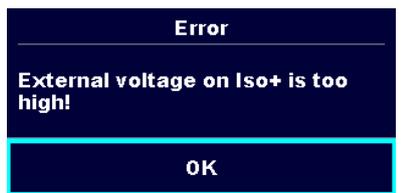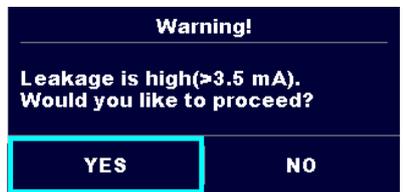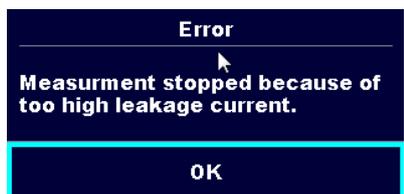
Error **I load is too high (>10 A)!** **OK**	The load current exceeded the highest upper limit of 10 A for the Discharging time test. Measurement was aborted. Press OK to continue. The load current continuously exceeded 10 A for more than 4 min (moving average) in Power and Leakage tests. Measurement was stopped for safety. Press OK to continue.
Error **I load is too high (>16 A)!** **OK**	The load current exceeded the highest upper limit of 16 A for the Power and Leakage tests. Measurement was aborted. Press OK to continue.
Warning! **Instrument will restart to apply new settings.** **OK**	Warning for restart of the instrument to set new Ethernet settings. This message appears on exit from Settings menu after changing Ethernet settings.
	The instrument is overheated. The measurement can't be carried out until the icon disappears. Press OK to continue.
	The device under test should be switched on (to ensure that the complete circuit is tested).
	Test voltage in Insulation resistance measurement is too low.
110	Measurement result is scaled to 110 V.
	Red dot indicates phase of measurement where higher leakage was measured. Applicable only if phase reversal is enabled during the measurement.
CAL	Test leads resistance in Continuity P/S - PE measurement is not compensated.
CAL	Test leads resistance in Continuity P/S - PE measurement is compensated.
⚠	**Warning**! A high voltage is / will be present on the instrument output! (Withstanding test voltage, Insulation test voltage, or mains voltage).
⚡	**Warning**! A very high and dangerous voltage is / will be present
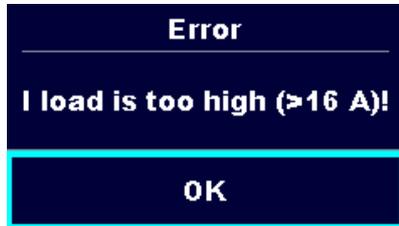
	on the instrument output! (Withstanding test voltage).
✔	Test passed.
✘	Test failed.
▶	Conditions on the input terminals allow starting the measurement; consider other displayed warnings and messages.
▶	Conditions on the input terminals do not allow starting the measurement, consider displayed warnings and messages.
▶▶	Proceeds to next measurement step
■	Stop the measurement.

4.5 Instrument main menu

From the instrument Main Menu different main operation menus can be selected.
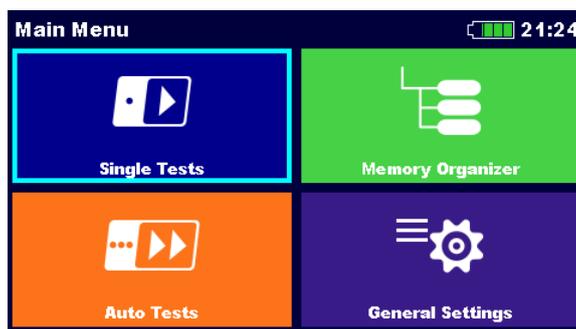
Figure 4.1: Main menu

Options

	Single Tests Menu with single tests, see chapter 6 *Single tests.*
	Auto Tests Menu with customized test sequences, see chapter 7 *Auto tests.*
	Memory Organizer Menu for working with and documentation of test data, see chapter 5 *Memory Organizer*.
	General Settings Menu for setup of the instrument, see chapter *4.6 General* settings.

4.6 General settings

In the General Settings menu general parameters and settings of the instrument can be viewed or set.

Figure 4.2: Setup menu

Options in General Settings menu

	Language Instrument language selection
	Date / Time Instruments Date and time.
	Workspace Manager Manipulation with project files. Refer to chapter *4.8 Workspace Manager* for more information.
	Auto test groups Manipulation with lists of Auto tests. Refer to chapter *4.9 Auto test groups* for more information.
	Profiles Selection of available instrument profiles.
	Settings Setting of different system parameters, including Ethernet settings.
	Change password Changing password for enabling HV tests.
	Initial Settings Factory settings.
	About Instrument info.

4.6.1 Language

In this menu the language of the instrument can be set.

Figure 4.3: Select language menu

4.6.2 Date and time

In this menu date and time of the instrument can be set.

Figure 4.4: Setting data and time menu

4.6.3 Profiles

Refer to *Chapter 4.7 Instrument profiles* for more information.

4.6.4 Workspace Manager

Refer to *Chapter 4.8 Workspace Manager* for more information.

4.6.5 Auto test groups

Refer to *Chapter 4.9 Auto test groups* for more information.

4.6.6 Change password for HV functions

In this menu the password to enable starting of HV functions can be set, changed or disabled.
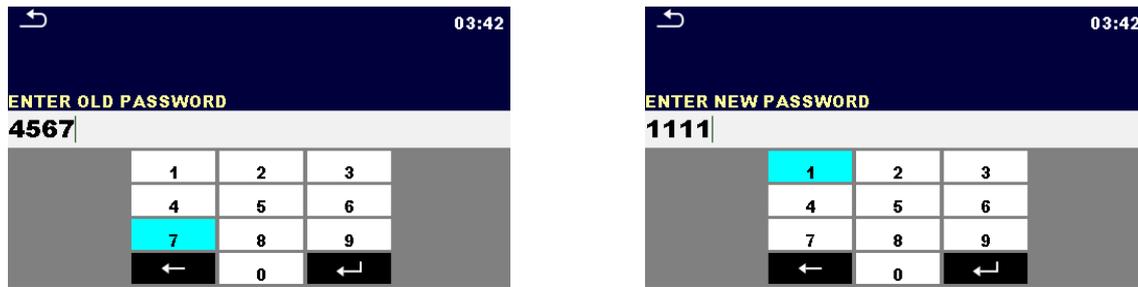
Figure 4.5: Initial settings menu

Notes:

› **Default password is 0000.**
› An empty entry disables the password.
› If password is lost, entry 4648 resets password to default.

4.6.7 Settings

In this menu different general parameters can be set.
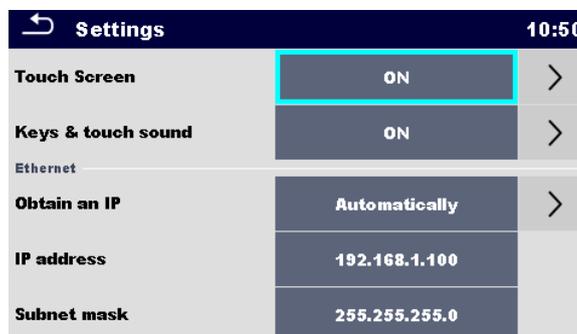
Figure 4.6: Settings menu

	Available selection	Description
Touch screen	[ON, OFF]	Enables / disables operation with touch screen.
Keys & touch sound	[ON, OFF]	Enables / disables sound on key press or touch.
Obtain an IP	[AUTOMATICALLY, MANUAL]	When the manual mode is chosen, the user must provide the correct network settings. Otherwise the instrument is automatically assigned an IP address from the local network using the DHCP protocol.
IP address	XXX.XXX.XXX.XXX	Displays the instrument's IP address. In manual mode, the user should enter the correct value.
Port number	0 – 65535	Selects the port number on which the instrument listens for incoming connections. The instrument communicates using UDP/IP protocol. Max. UDP packet length is 1024 bytes.
Subnet mask	XXX.XXX.XXX.XXX	In manual mode, the user should enter the correct value.

Default gateway	XXX.XXX.XXX.XXX	In manual mode, depending on the network topology, the use can enter the correct value or leave it as it is, if not needed.
Preferred DNS server	XXX.XXX.XXX.XXX	In manual mode, depending on the network topology, the use can enter the correct value or leave it as it is, if not needed.
Alternate DNS server	XXX.XXX.XXX.XXX	In manual mode, depending on the network topology, the use can enter the correct value or leave it as it is, if not needed.
Host name	MI3394_XXXXXXXX	Displays the instrument's unique name on the local network. The host name consists of the instrument's name and its serial number.
MAC address	XX:XX:XX:XX:XX:XX	Displays the instrument's MAC address. User can change the address in case of another device on the network using the same value.

Note:

‣ Instrument will reset to apply new Ethernet settings (if modified).

4.6.8 Initial Settings

In this menu internal Bluetooth module can be initialized and the instrument settings, measurement parameters and limits can be set to initial (factory) values.
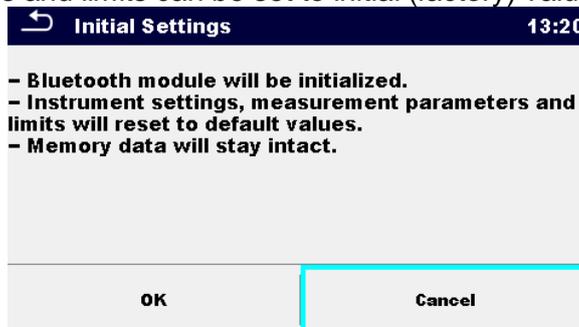
Figure 4.7: Initial settins menu

Warning!

Following customized settings will be lost when setting the instruments to initial settings:
  ‣ Measurement limits and parameters
  ‣ Global parameters and System settings in General settings menu

Note:

Following customized settings will stay:
  ‣ Profile settings
  ‣ Data in memory
  ‣ Password for HV functions

4.6.9 About

In this menu instrument data (name, serial number, version and date of calibration) can be viewed.

Figure 4.8: Instrument info screen

4.7 Instrument profiles

In this menu the instrument profile can be selected from the available ones.

Figure 4.9: Instrument profile menu

The instrument uses different specific system and measuring settings in regard to the scope of work or country it is used. These specific settings are stored in instrument profiles.
By default each instrument has at least one profile activated. Proper licence keys must be obtained to add more profiles to the instruments.
If different profiles are available they can be selected in this menu.
Refer to *Appendix B - Profile Notes* for more information about functions specified by profiles.

Options

	Loads the selected profile. The instrument will restart automatically with new profile loaded.
	Enters option for deleting a profile
	Before deleting the selected profile user is asked for confirmation.
	Loaded profiles can't be deleted.

4.8 Workspace Manager

The Workspace Manager is intended to manage with different Workspaces and Exports stored on the microSD card.

4.8.1 Workspaces and Exports

The works with CE MultiTesterXA MI 3394 can be organized with help of Workspaces and Exports. Exports and Workspaces contain all relevant data (measurements, parameters, limits, structure objects) of an individual work.
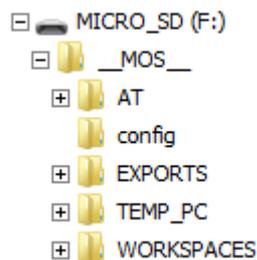
Figure 4.10: Organization of Workspaces and Exports on microSD card

Workspaces are stored on microSD card on directory WORKSPACES, while Exports are stored on directory EXPORTS. Export files can be read by Metrel applications that run on other devices. Exports are suitable for making backups of important works or can be used for storage of works if the removable microSD card is used as a mass storage device. To work on the instrument an Export should be imported first from the list of Exports and converted to a Workspace. To be stored as Export data a Workspace should be exported first from the list of Workspaces and converted to an Export.

4.8.2 Workspace Manager main menu

In Workspace manager Workspaces and Exports are displayed in two separated lists.

Figure 4.11: Workspace manager main menu

Options

WORKSPACES:	List of Workspaces.
■↔●	Displays a list of Exports.
✚	Adds a new Workspace. Refer to chapter *4.8.2.3 Adding a new Workspace* for more information.
EXPORTS:	List of Exports.
■↔●	Displays a list of Workspaces.

4.8.2.1　Operations with Workspaces

Only one Workspace can be opened in the instrument at the same time. The Workspace selected in the Workspace Manager will be opened in the Memory Organizer.

Figure 4.12: Workspaces menu

Options

●	Marks the opened Workspace in Memory Organizer. Opens the selected Workspace in Memory Organizer. Refer to chapters 5 *Memory Organizer* and *4.8.2.4 Opening a Workspace* for more information.
✖	Deletes the selected Workspace. Refer to chapter *4.8.2.5 Deleting a Workspace / Export* for more information.
✚	Adds a new Workspace. Refer to chapter *4.8.2.3 Adding a new Workspace* for more information.

	Exports a Workspace to an Export
	Refer to chapter *4.8.2.7 Exporting a Workspace* for more information.

	Opens options in control panel / expands column.

4.8.2.2   Operations with Exports

Figure 4.13: Workspace manager Exports menu

Options

	Deletes the selected Export.
	Refer to chapter *4.8.2.5 Deleting a Workspace / Export* for more information.

	Imports a new Workspace from Export.
	Refer to chapter *4.8.2.6 Importing a Workspace* for more information.

	Opens options in control panel / expands column.

4.8.2.3   Adding a new Workspace

①		New workspaces can be added from the Workspace manager screen.
②		Enters option for adding a new Workspace.

	Keypad for entering name of a new Workspace is displayed after selecting New.
③	After confirmation a new Workspace is added to the list of workspaces.

4.8.2.4   Opening a Workspace

①	Workspace can be selected from a list in Workspace manager screen.
②	Opens a Workspace in Workspace manager.
	The opened Workspace is marked with a blue dot. The previously opened Workspace will close automatically.

4.8.2.5   Deleting a Workspace / Export

| ① | | Workspace / Export to be deleted should be selected from the list of Workspaces / Exports. |

| ② | | Enters option for deleting a Workspace / Export. |
| | | Before deleting the selected Workspace / Export the user is asked for confirmation. |

| ③ | | Workspace / Export is deleted from the Workspace / Export list. |
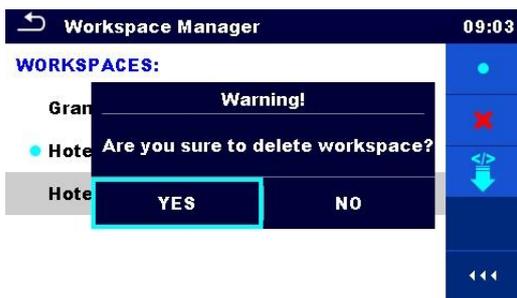
4.8.2.6   Importing a Workspace

| ① | | Select an Export file to be imported from Workspace manager Export list. |

| ② | | Enters option Import. |
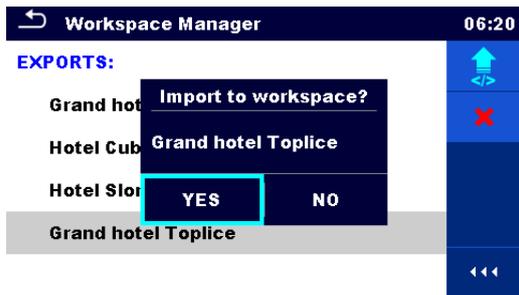
Before the import of the selected Export file the user is asked for confirmation.

The imported Export file is added to the list of Workspaces.

Note:
If a Workspace with the same name already exists the name of the imported Workspace will be changed (name_001, name_002, name_003, …).

4.8.2.7   Exporting a Workspace

Select a Workspace from Workspace manager list to be exported to an Export file.

Enters option for Export.
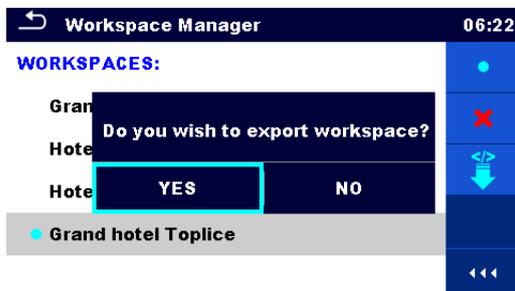
Before exporting the selected Workspace the user is asked for confirmation.

③
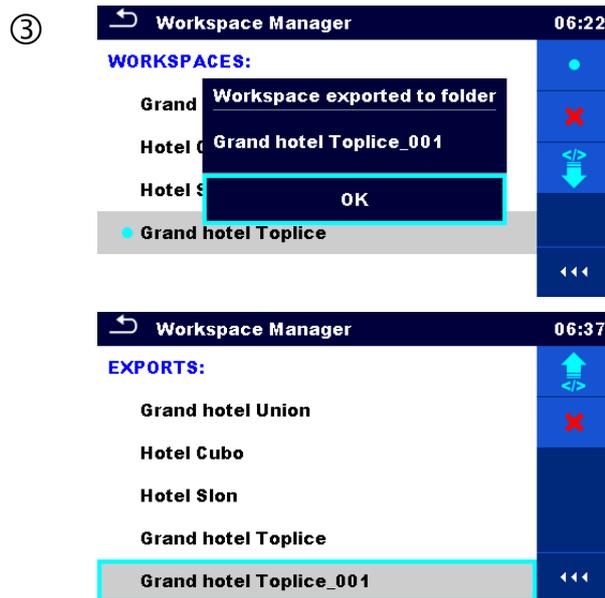
Workspace is exported to Export file and is added to the list of Exports.

Note:
If an Export file with the same name already exists the name of the an Export file will be changed (name_001, name_002, name_003, …).

4.9 Auto test groups

The Auto tests in CE MultiTesterXA MI 3394 can be organized in lists of Auto tests. In a list a group of similar Auto tests is stored. The Auto test groups menu is intended to manage with different lists of Auto tests that are stored on the microSD card.
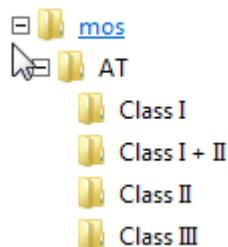
Figure 4.14: Organization of Auto tests on microSD card

Folders with lists of Auto tests are stored in *Root__MOS__\AT* on the microSD card.

4.9.1 Auto test groups menu

In Auto test groups menu lists of Auto tests are displayed. Only one list can be opened in the instrument at the same time. The list selected in the Auto test groups menu will be opened in the Auto Tests main menu.
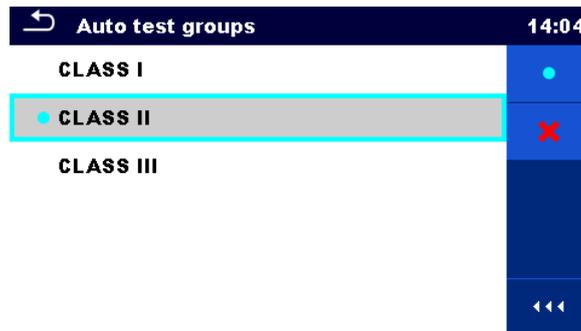
Figure 4.15: Auto test groups menu

4.9.1.1   Operations in Auto test groups menu:

Options

	Opens the selected list of Auto tests. Previously selected list of Auto tests will be closed automatically. Refer to chapter *4.9.1.2 Selecting a list of Auto tests* for more information.
	Deletes the selected list of Auto tests. Refer to chapter *4.9.1.3 Deleting a list of Auto tests* for more information.
	Opens options in control panel / expands column.

4.9.1.2   Selecting a list of Auto tests
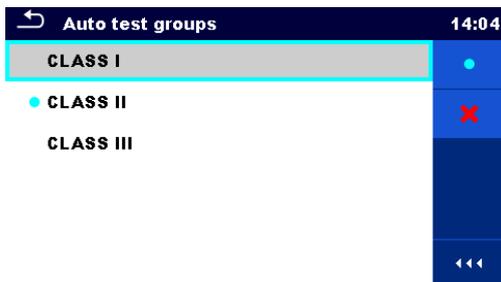
①		A list of Auto tests can be selected from the Auto test groups menu.
②		Enters option for selecting a list.

Auto test groups	14:05
● CLASS I	●
CLASS II	✖
CLASS III	◀◀◀
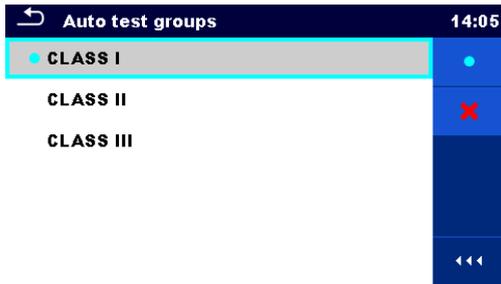
Selected list of Auto tests is marked with a blue dot.

Note:

Previously selected list of Auto tests is closed automatically.

4.9.1.3   Deleting a list of Auto tests

①

Auto test groups	14:05
CLASS I	●
CLASS II	✖
● CLASS III	◀◀◀
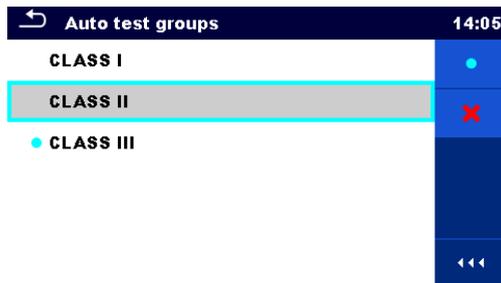
A list of Auto tests to be deleted can be selected from the Auto test groups menu.

② ✖

Enters option for deleting a list.

Auto test groups	14:06
CLASS I	●
Warning!	✖
Are you sure you want to remove this Auto test group?	
YES NO	◀◀◀
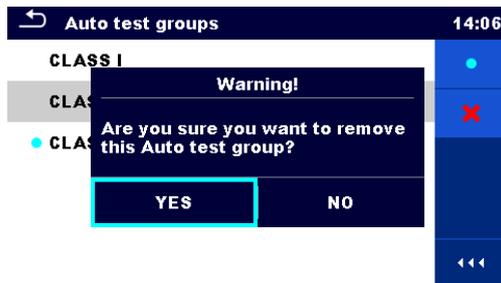
Before deleting the selected list of Auto tests the user is asked for confirmation.

③

Auto test groups	14:06
CLASS I	●
● CLASS III	✖
	◀◀◀
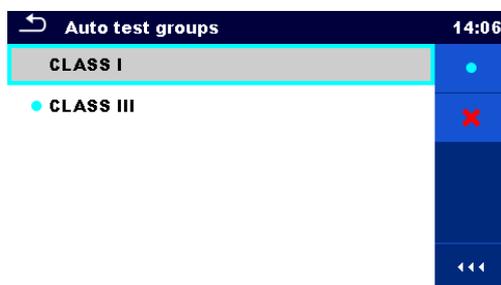
A list of Auto tests is deleted.

5　Memory Organizer

Memory Organizer is a tool for storing and working with test data.

5.1 Memory Organizer menu

The data is organized in a tree structure with Structure objects and Measurements. CE MultiTesterXA has a fixed three level structure. The hierarchy of Structure objects in the tree is shown on *Figure 5.1*.

0th level
　　　1st level
　　　　　　2nd level
　　　　　　　3rd level

NODE

APPLIANCE FD (full description)

　measurement

APPLIANCE (short description)

　measurement

PROJECT

　　APPLIANCE FD

measurement

　　APPLIANCE

measurement

LOCATION

　　APPLIANCE FD

measurement

　　APPLIANCE

measurement

Figure 5.1: Tree structure and its hierarchy

Figure 5.2: Example of a Tree menu

5.1.1   Measurement statuses

Each measurement has:
- a status (Pass or Fail or no status)
- a name
- results
- limits and parameters

A measurement can be a Single test or an Auto test. Statuses of single tests:

- passed finished single test with test results

- failed finished single test with test results

- finished single test with test results and no status

- empty single test without test results

Overall statuses of Auto tests:

- or   at least one single test in the Auto test passed and no single test failed

- or   at least one single test in the Auto test failed

- or   at least one single test in the Auto test was carried out and there were no other passed or failed single tests.

- or   empty Auto test with empty single tests

5.1.2   Structure Objects

Each Structure object has:
- an icon
- a name
- parameters

Optionally they can have:
  ‣ an indication of the status of the measurements under the Structure object
  ‣ a comment or a file attached
Structure objects supported in CE MultitesterXA are described in *Appendix A - Structure objects in CE MultiTesterXA*.

Figure 5.3: Structure object in tree menu

5.1.2.1   Measurement status indication under the Structure object

Overall status of measurements under each structure element / sub-element can be seen without spreading tree menu. This feature is useful for quick evaluation of test status and as guidance for measurements.

Options

	There are no measurement result(s) under selected structure object. Measurements should be made.	 **Figure 5.4: Example of status - No measurement result(s)**
	One or more measurement result(s) under selected structure object has failed. Not all measurements under selected structure object have been made yet.	 **Figure 5.5: Example of status - Measurements not completed with fail result(s)**
	All measurements under selected structure object are completed but one or more measurement result(s) has failed.	 **Figure 5.6: Status - Measurements completed with fail result(s)**

Note:
‣ There is no status indication if all measurement results under each structure element / sub-element have passed or if there is an empty structure element / sub-element (without measurements).

5.1.3   Selecting an active Workspace in Memory Organizer

Memory Organizer and Workspace Manager are interconnected so an active Workspace can be selected also in the Memory Organizer menu.

Procedure
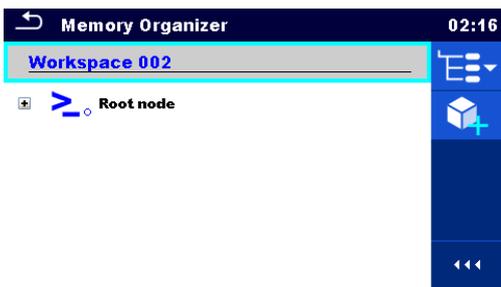
①		Press the active Workspace in Memory Organizer Menu.
②		Select List of Workspaces in Control panel.
③		Choose desired Workspace from the list of Workspaces.
③		Use Select button to confirm selection.
④		New Workspace is selected and displayed on the screen.
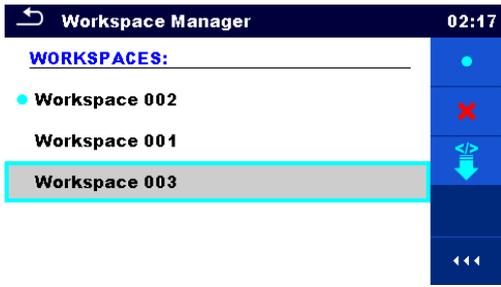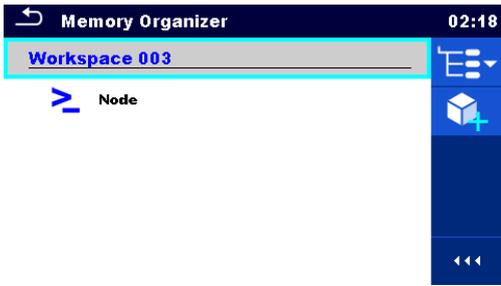
5.1.4   Adding Nodes in Memory Organizer

Structural Elements (Nodes) are used to ease organization of data in the Memory Organizer. One Node is a must; others are optional and can be created or deleted freely.

Procedure
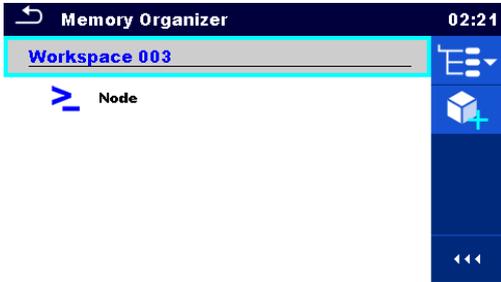
①		Press the active Workspace in Memory Organizer Menu.
②		Select Add New Structure Element in Control panel.
③		Change name of the Node if necessary and press Add to confirm.
④		New Structure Element (Node) will be added.
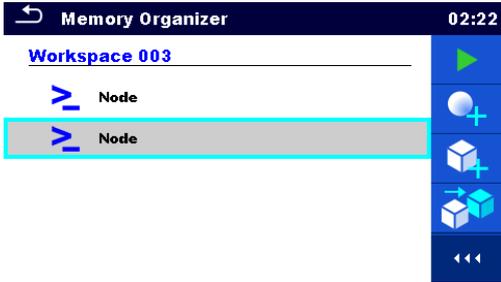
5.1.5   Operations in Tree menu

In the Memory organizer different actions can be taken with help of the control panel at the right side of the display. Possible actions depend on the selected element in the organizer.

5.1.5.1   Operations on measurements (finished or empty measurements)

The measurement must be selected first. Operation options can be selected from the menu on the right side of the screen. Menu options are adapted to measurement status, empty, finished, finished and saved, as presented on *Figure 5.7*.

Figure 5.7: A measurement is selected in the Tree menu

Options

	Views results of measurement. The instrument goes to the measurement memory screen. Refer to chapters *6.1.6 Single test memory* screen and *7.2.3 Auto test memory screen* for more information.
	Starts a new measurement. The instrument goes to the measurement start screen. Refer to chapters *6.1.3 Single test start screen* and *7.2.1 Auto test view menu* for more information.
	Saves a measurement. Saving of measurement on a position after the selected (empty or finished) measurement.
	Clones the measurement. The selected measurement can be copied as an empty measurement under the same Structure object. Refer to chapter *5.1.5.7 Clone a measurement* for more information.
	Copies & Paste a measurement. The selected measurement can be copied and pasted as an empty measurement to any location in structure tree. Multiple "Paste" is allowed. Refer to chapter *5.1.5.9 Copy & Paste a measurement* for more information.
	Adds a new measurement. The instrument goes to the Menu for adding measurements. Refer to chapter *5.1.5.5 Add a new measurement* for more information.
	deletes a measurement. Selected Measurement can be deleted. User is asked for confirmation before the deleting. Refer to chapter *5.1.5.11 Delete a measurement* for more information.

5.1.5.2   Operations on Structure objects

The structure object must be selected first.
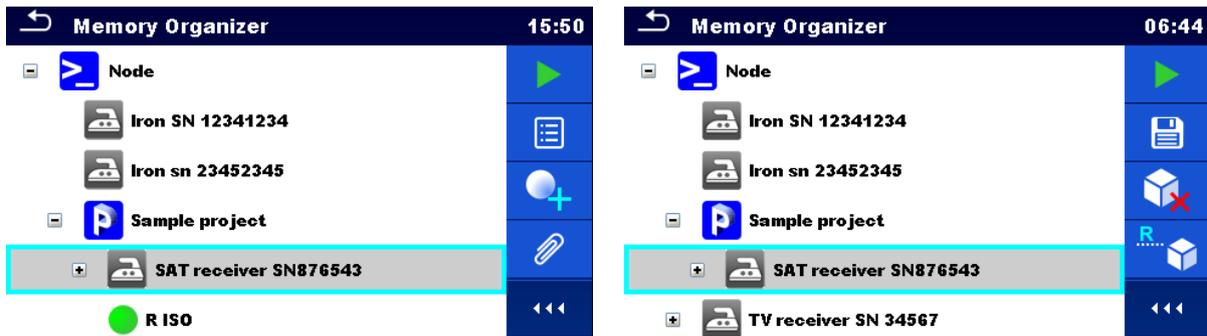
Figure 5.8: A structure object is selected in the tree menu

Options

	Starts a new measurement.
	First type of measurement (single test or Auto test) should be selected. After proper type is selected the instrument goes to single test or Auto test selection screen. Refer to chapters *6.1 Selection of single tests* and *7.1 Selection of Auto tests*.
	Saves a measurement.
	Saving of measurement under the selected Structure object.
	View / edit parameters and attachments.
	Parameters and attachments of the Structure object can be viewed or edited. Refer to chapter *5.1.5.3 View / Edit parameters and attachments of a Structure object* for more information.
	Adds a new measurement.
	The instrument goes to the Menu for adding measurement into structure. Refer to chapter *5.1.5.5 Add a new measurement* for more information.
	Adds a new Structure object.
	A new Structure object can be added. Refer to chapter *5.1.5.4 Add a new Structure Object* for more information.
	Attachments.
	Name and link of attachment is displayed.
	Clones a Structure object.
	Selected Structure object can be copied to same level in structure tree (clone). Refer to chapter *5.1.5.6 Clone a Structure object* for more information.
	Copies & Paste a Structure object.
	Selected Structure object can be copied and pasted to any allowed location in structure tree. Multiple "Paste" is allowed. Refer to chapter *5.1.5.8 Copy & Paste a Structure object* for more information.

	Deletes a Structure object.
	Selected Structure object and sub-elements can be deleted. User is asked for confirmation before the deleting. Refer to chapter *5.1.5.10 Delete a Structure object* for more information.
	Renames a Structure object.
	Selected Structure object can be renamed via keypad. Refer to chapter *5.1.5.12 Rename a Structure object* for more information.
	Expands column in control panel.

5.1.5.3   View / Edit parameters and attachments of a Structure object

The parameters and their content are displayed in this menu. To edit the selected parameter tap on it or press Enter key to enter menu for editing parameters.

Parameters

-

Figure 5.9: Example of View / Edit parameters menu
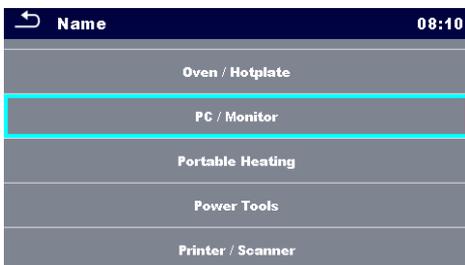
In menu for editing parameters the parameter's value can be selected from a dropdown list or entered via keypad. Refer to chapter 4 *Instrument operation* for more information about keypad operation.
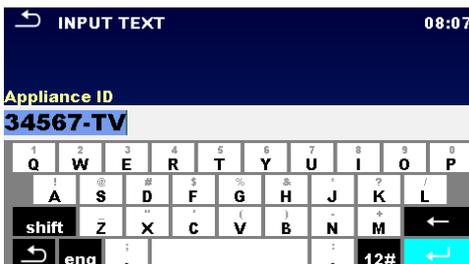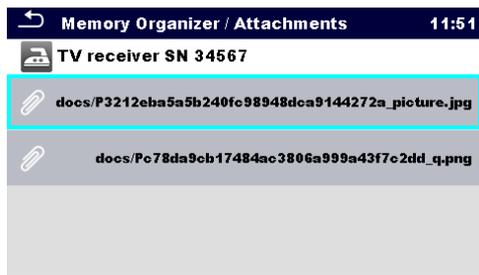
 Attachments

The name of attachment can be seen. Operation with attachments is not supported in the instrument.

5.1.5.4   Add a new Structure Object

This menu is intended to add new structure objects in the tree menu. A new structure object can be selected and then added in the tree menu.

 Add Structure
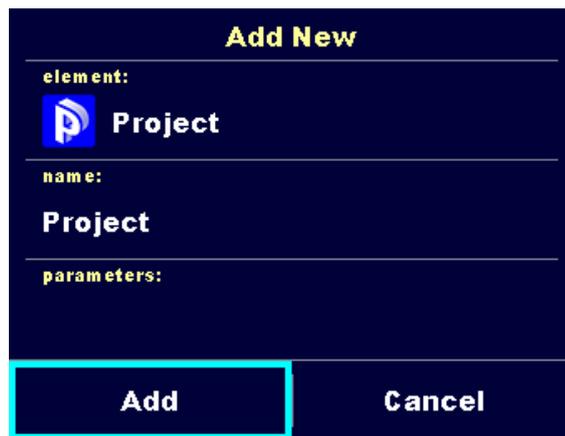
Figure 5.10: Add a new Structure Object menu

 The type of Structure object to be added can be selected from dropdown menu.

Only structure objects that can be used in the same level or next sublevel are offered.
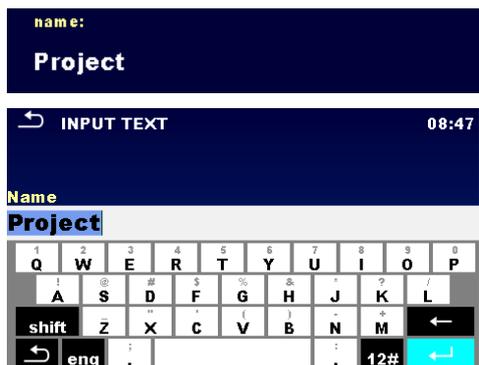
 The name of the Structure object can be edited.
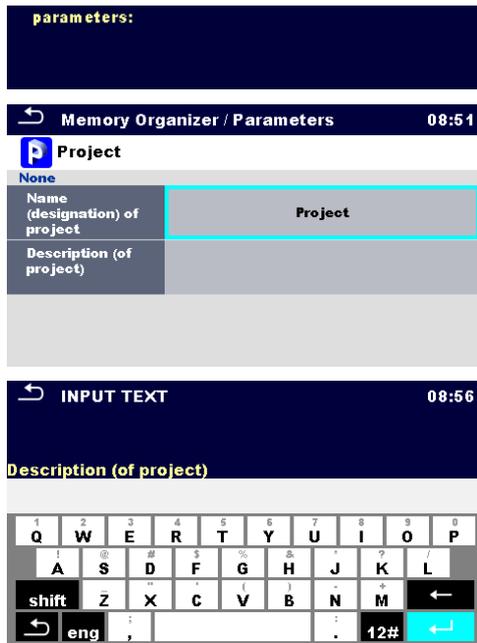
parameters:	Parameters of the Structure object can be edited.

Add	Adds the selected structure object and its parameters in the tree menu.

Cancel	Returns to the tree menu without changes.

5.1.5.5   Add a new measurement

In this menu new empty measurements can be set and then added in the structure tree. The type of measurement, measurement function and its parameters are first selected and then added under the selected Structure object.
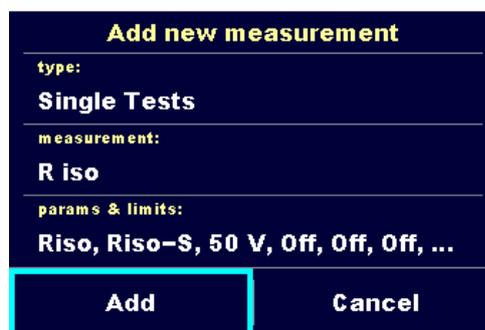
Add Measurement

Figure 5.11: Add a new measurement menu

type: **Single Tests**	Type of test can be selected from this field.
	Options: (Single tests, Auto tests)
	Tap on field or press ENTER key to modify.

measurement: **R iso**	Last added measurement is offered by default. To select another measurement press Enter to open menu for selecting measurements. Refer to chapters *6.1 Selection of single tests* and *7.1 Selection of Auto tests* for more information,
params & limits: **Riso, Riso-S, 50 V, Off, Off, Off, ...** Parameters & Limits 06:44 Type < Riso, Riso-S Uiso 50 V > Duration Off > L Limit(Riso) Off > H Limit(Riso) Off >	Tap on field or press ENTER key to open menu for editing parameters of the selected measurement. Select parameter and modify it as described earlier. Refer to chapter *6.1.2 Setting parameters and limits of single tests* for more information.
Add	**Add a new empty measurement**. Adds the measurement under the selected Structure object in the tree menu.
Cancel	Returns to the structure tree menu without changes.
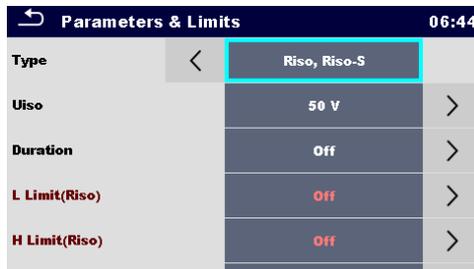
5.1.5.6   Clone a Structure object

In this menu selected structure object can be copied (cloned) to same level in the structure tree. Cloned structure object have same name as original.

Clone

☑ Include structure parameters
☑ Include structure attachments
☑ Include sub structures
☑ Include sub measurements

Clone | Cancel
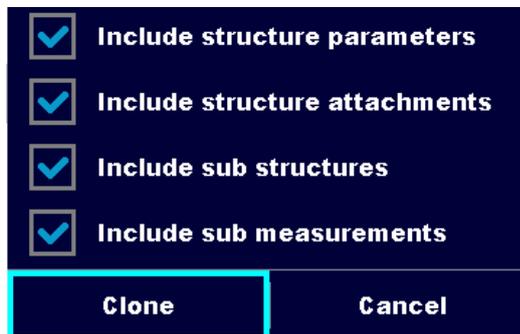
Figure 5.12: Clone Structure Object menu

Procedure and options
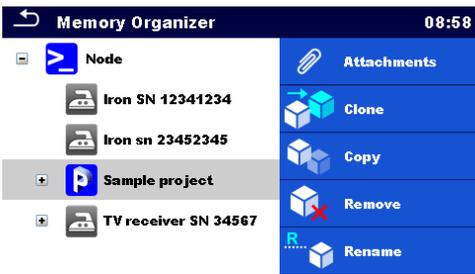
①		Select the structure object to be cloned.
②	**Clone**	Select Clone option from control panel.
③		The Clone Structure object menu is displayed. Sub-elements of the selected structure object can be marked or un-marked for cloning. Refer to chapter *5.1.5.8 Copy & Paste a Structure object* for more information.
④a		Selected structure object is copied (cloned) to same level in the structure tree.
④b		Cloning is cancelled. No changes in the Structure tree.
⑤		The new structure object is displayed.
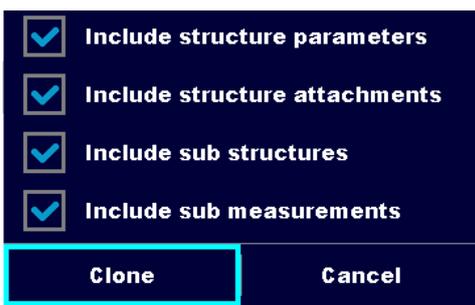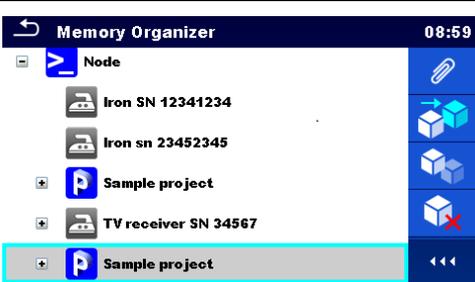
5.1.5.7   Clone a measurement

By using this function a selected empty or finished measurement can be copied (cloned) as an empty measurement to the same level in the structure tree.

Procedure and options
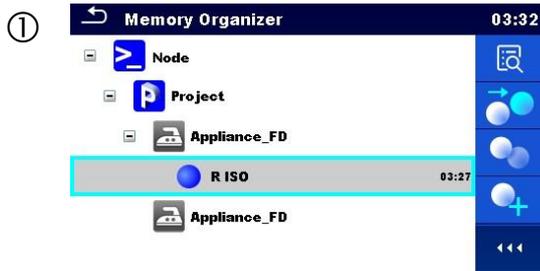
①		Select the measurement to be cloned.
②	**Clone**	Select Clone option from control panel.
③		The new empty measurement is displayed.
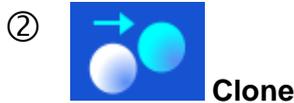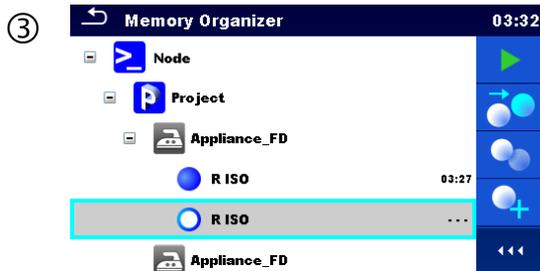
5.1.5.8   Copy & Paste a Structure object

In this menu selected Structure object can be copied and pasted to any allowed location in the structure tree.

Procedure and options

①		Select the structure object to be copied.
②	**Copy**	Select Copy option from control panel.
③		Select location where structure element should be copied.
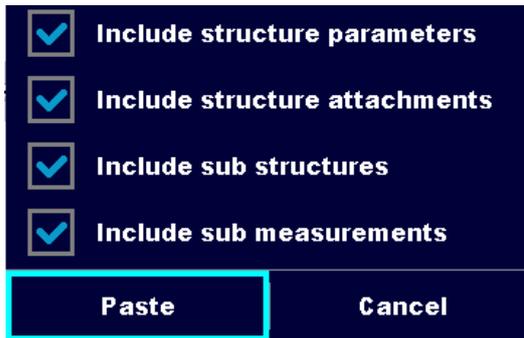
④	**Paste**	Select Paste option from control panel.
⑤	☑ Include structure parameters ☑ Include structure attachments ☑ Include sub structures ☑ Include sub measurements **Paste**　　**Cancel**	The Paste structure object menu is displayed. Before copying it can be set which sub-elements of the selected structure object will be copied too. For more details see options below.
⑥a	**Paste**	The selected structure object and elements are copied (pasted) to selected position in the tree structure.
⑥b	**Cancel**	Returns to the tree menu without changes.
⑦	↶ Memory Organizer　　09:19 ⊟ ≥ Node 　　🔲 Iron SN 12341234 　　🔲 Iron sn 23452345 ⊟ P Sample project 　　⊞ 🔲 SAT receiver SN876543 　　⊞ 🔲 TV receiver SN 34567 ▶ ▤ ●+ 𝒪 ◂◂◂	The new structure object is displayed. **Note:** The Paste command can be executed one or more times.

Options

☑ **Include structure parameters**	Parameters of selected structure object will be copied too.
☑ **Include structure attachments**	Attachments of selected structure object will be copied too.
☑ **Include sub structures**	Structure objects in sub-levels of selected structure object will be copied too.
☑ **Include sub measurements**	Measurements in selected structure object and sub-levels will be copied too.

5.1.5.9   Copy & Paste a measurement

In this menu selected measurement can be copied to any allowed location in the structure tree.
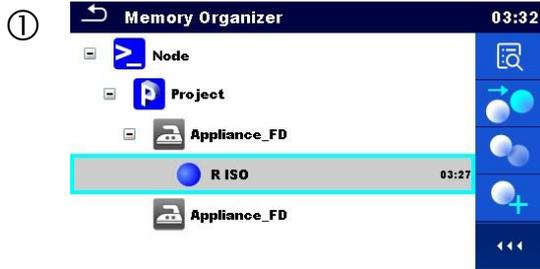
Procedure
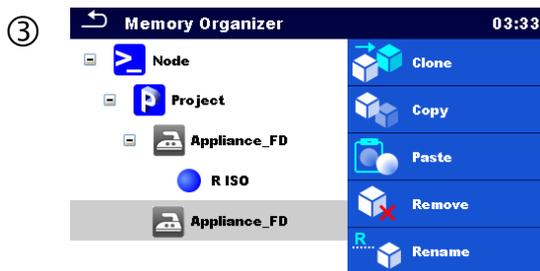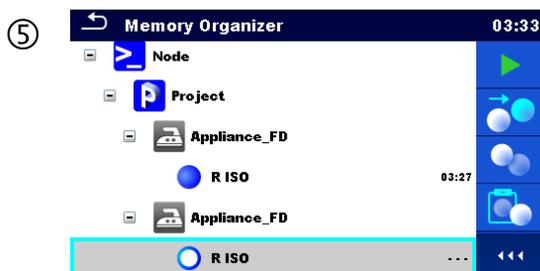
①		Select the structure object to be copied.
②	**Copy**	Select Copy option from control panel.
③		Select location where structure element should be copied.
④	**Paste**	Select Paste option from control panel.
⑤		The new (empty) measurement is displayed in selected Structure object.

5.1.5.10   Delete a Structure object

In this menu selected Structure object can be deleted.

Procedure

①		Select the structure object to be deleted.

②	**Delete**	Select Delete option from control panel.
③	Memory Organizer 11:12 / Are you sure you want to delete? / TV receiver SN 34567 / YES NO	A confirmation window will appear.
④a	**YES**	Selected structure object and its sub-elements are deleted.
④b	**NO**	Returns to the tree menu without changes.

5.1.5.11 Delete a measurement

In this menu selected measurement can be deleted.

Procedure
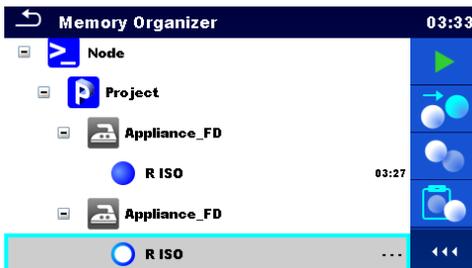
①	Memory Organizer 03:33 / Node / Project / Appliance_FD / R ISO 03:27 / Appliance_FD / R ISO ···	Select a measurement to be deleted.
②	**Delete**	Select Delete option from control panel.
③	Memory Organizer 11:27 / Project / Are you sure you want to delete? / R ISO / YES NO / R ISO ··· / Project	A confirmation window will appear.
④a	**YES**	Selected measurement is deleted.
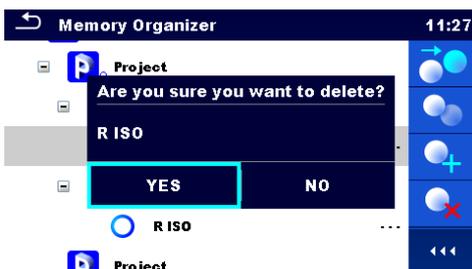
④b	**NO**	Returns to the tree menu without changes.

5.1.5.12   Rename a Structure object

In this menu selected Structure object can be renamed.

Procedure

①		Select the structure object to be renamed.
②	**Rename**	Select Rename option from control panel.
③		Virtual keypad will appear on screen. Enter new text and confirm.
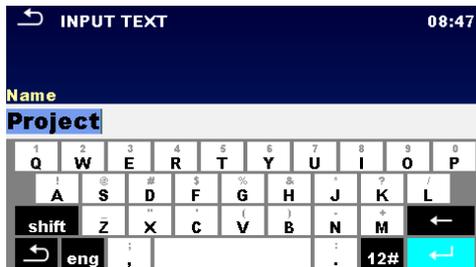
6   Single tests

6.1 Selection of single tests

Single tests can be selected in the Main single test menu or in Memory Organizer's main and submenus. In Single test main menu there are four modes for selecting single tests.

Options
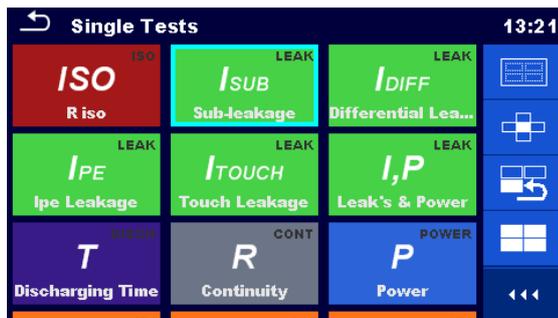
	All A single test can be selected from a list of all single tests. The single tests are always displayed in the same (default) order.
	Last used Last 9 made different single tests are displayed.
	Groups The single tests are divided into groups of similar tests.
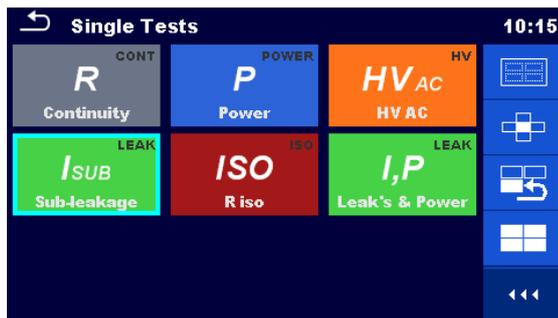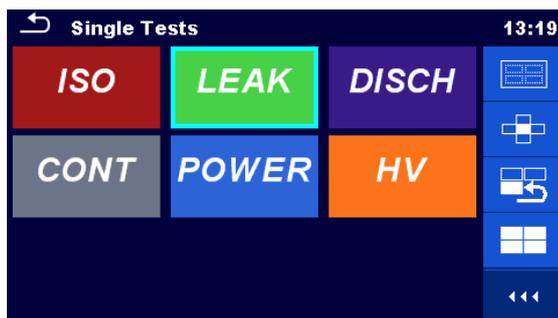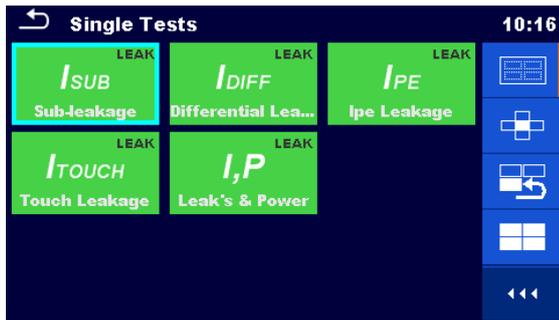
For the selected group a submenu with all single tests that belongs to the selected group is displayed.

Cross selector
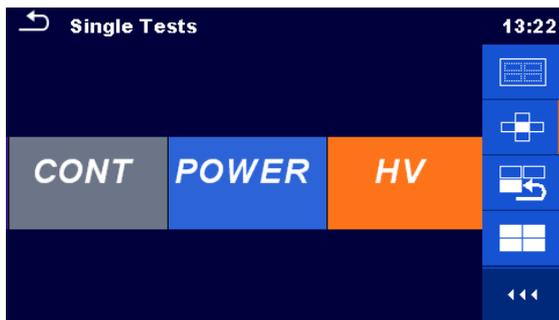
This selection mode is the fastest way for working with the keypad.
Groups of single tests are organized in a row.
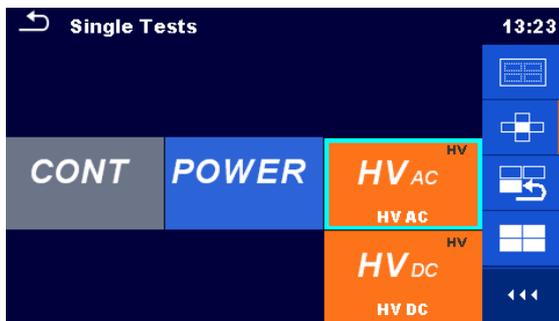
For the selected group all single tests are displayed and accessible with up/down keys.

Opens options in control panel / expands column.

6.1.1   Single test screens

In the Single test screens measuring results, sub-results, limits and parameters of the measurement are displayed. In addition on-line statuses, warnings and other information are displayed.

Name of function

Main result

Subresult

Options

Parameters (white) and limits (red)

Statuses, info, warnings
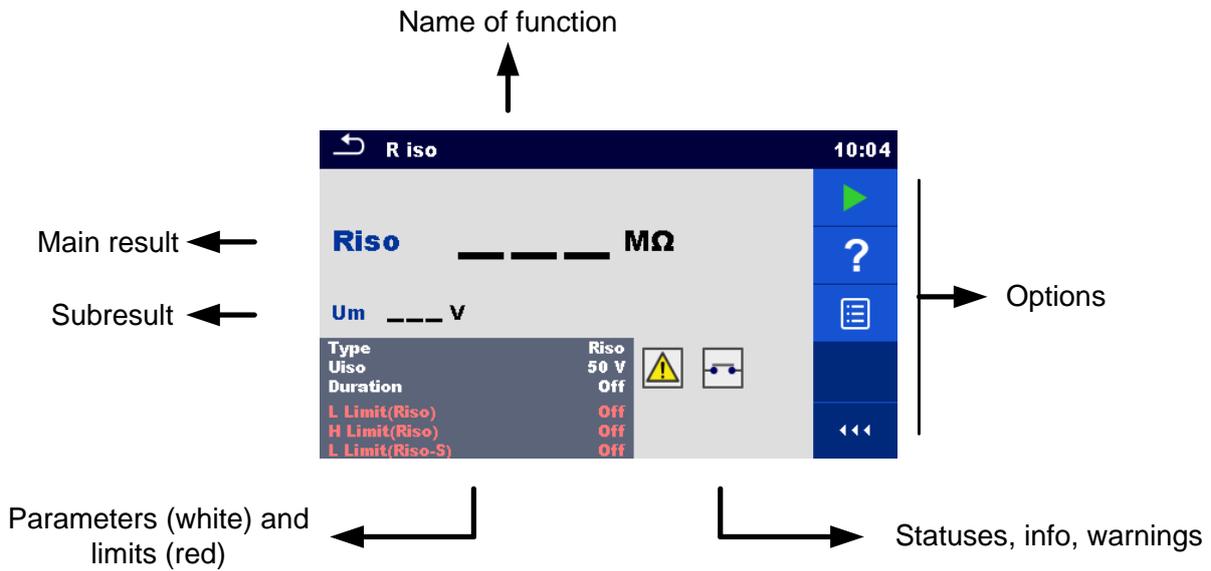
Figure 6.1: Single test screen organisation

6.1.2   Setting parameters and limits of single tests

Figure 6.2: Screens in menu for setting Single test parameters and limits
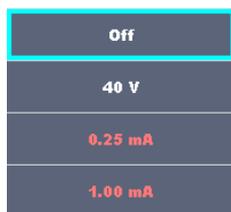
Selects parameter (white) or limit (red).
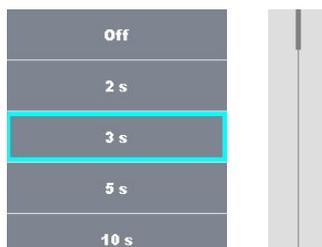
Selects value of parameter or limit.

In case of many (multiple pages of) parameters or limits:
- The scroll bar on the right side of screen can be used
- With right / left keys it can be jumped page up / page down

6.1.3   Single test start screen
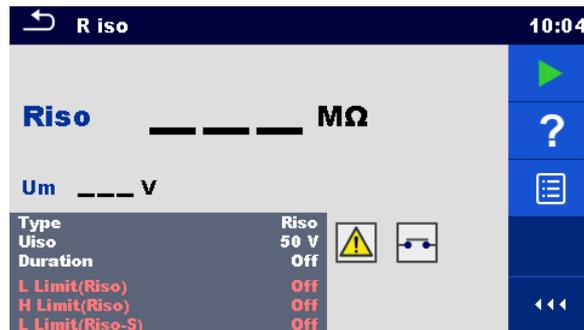
Figure 6.3: Single test start screen

Options (before test, screen was opened in Memory organizer or from Single test main menu)

	Starts the measurement.
	Opens help screens. Refer to chapter *6.1.7 Help screens* for more information.
	Opens menu for changing parameters and limits. Refer to chapter *6.1.2 Setting parameters and limits of single tests* for more information.
on	
	Enters cross selector. Refer to chapter *6.1 Selection of single tests* for more information.
long on	
	Opens options in control panel / expands column.

6.1.4   Single test screen during test
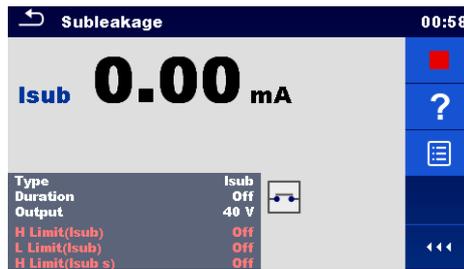
Figure 6.4: Single test screen (during measurement)

Options (during test)

	Stops the single test measurement.
	Proceeds to the next step of the measurement (if measurement consists of more steps).
	Aborts measurements.

6.1.5   Single test result screen
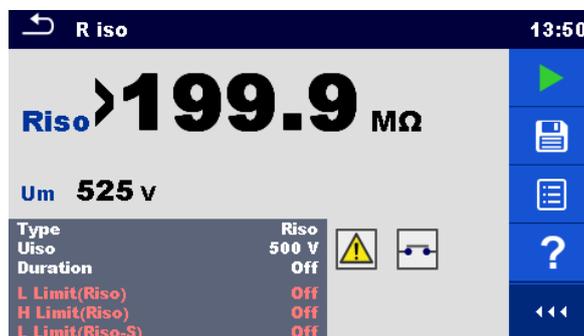
Figure 6.5: Single test result screen

Options (after measurement is finished)

	Starts a new measurement.

	Saves the result.
	
	A new measurement was selected and started from a Structure object in the structure tree:
	
	   - The measurement will be saved under the selected Structure object.
	
	A new measurement was started from the Single test main menu:
	
	   - Saving under the last selected Structure object will be offered by default. The user can select another Structure object or create a new Structure object. By pressing the ⊟ key in Memory organizer menu the measurement is saved under selected location.
	
	An empty measurement was selected in structure tree and started:
	
	   - The result(s) will be added to the measurement. The measurement will change its status from 'empty' to 'finished'.
	
	An already carried out measurement was selected in structure tree, viewed and then restarted:
	
	   - A new measurement will be saved under the selected Structure object.

?	Opens help screens. Refer to chapter *6.1.7 Help screens* for more information.
☰ 👆 on	Duration Off ¦ H Limit(Idiff) Off ¦ L Limit(Idiff) Off		Opens screen for changing parameters and limits. Refer to chapter *6.1.2 Setting parameters and limits of single tests* for more information.
◆ (cross selector) 👆 **long** on Riso >**199.9** MΩ Um 525 V	Enters cross selector. Refer to chapter *6.1 Selection of single tests* for more information.
◀◀◀	Opens options in control panel / expands column.

6.1.6 Single test memory screen
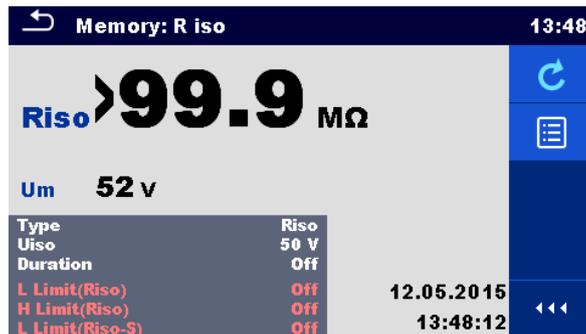
Figure 6.6: Single test memory screen

Options

		Retest Enters screen with "empty" measurement.
		Opens menu for viewing parameters and limits. Refer to chapter *6.1.2 Setting parameters and limits of single tests* for more information.
on		

6.1.7 Help screens

Help screens contain diagrams for proper connection of the instrument.
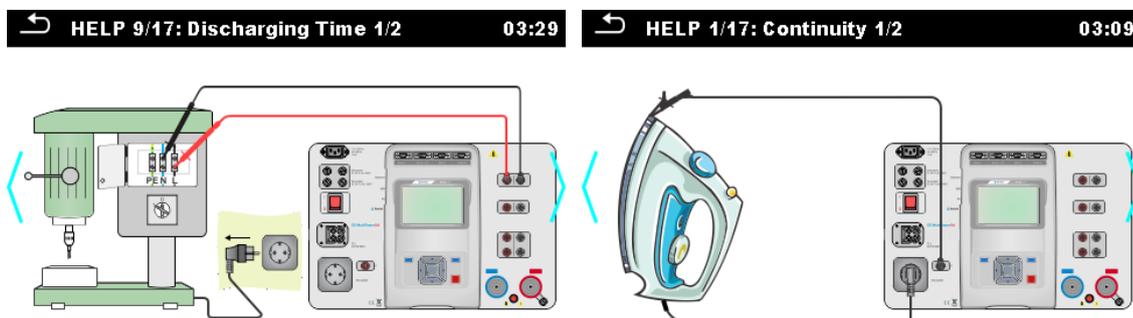
Figure 6.7: Examples of help screens

Options

on		Goes to previous / next help screen.

6.2 Single test measurements

6.2.1 Continuity
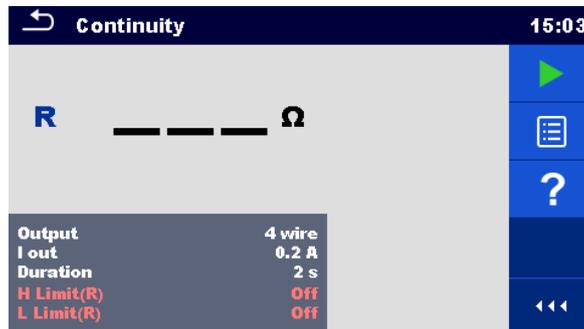
Figure 6.8: Continuity test menu

Test results / sub-results

R................Resistance
ΔU………..Voltage drop scaled to 10 A

Test parameters

Output connections	Output [4-wire, P-PE]
Test current	I out [0.2 A, 4 A, 10 A, 25 A]
Duration	Duration [Off, 2 s ... 180 s]
ΔU test*	Enables ΔU test [On, Off]
Wire section*	Wire section for ΔU test [0.5 mm^2…$\geq$ 6mm^2]

Test limits

H Limit (R)	H limit [Off, 0.01 Ω ... 9 Ω]
L Limit (R)	L limit [Off, 0.01 Ω ... 9 Ω]
H Limit (ΔU)*	H limit (1.0 V … 5.0 V)

* Applicable only at test current 10 A.

Test circuit
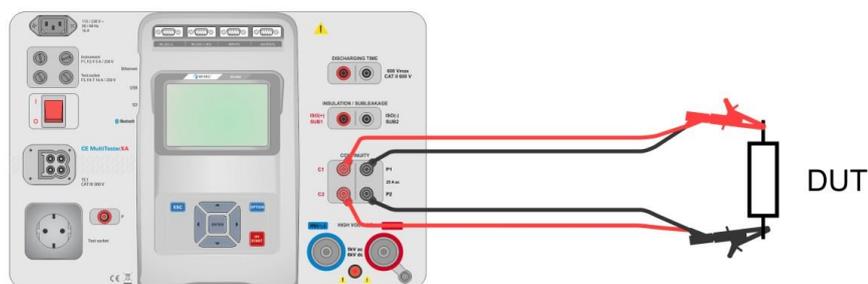
Figure 6.9: Measurement of continuity 4-wire
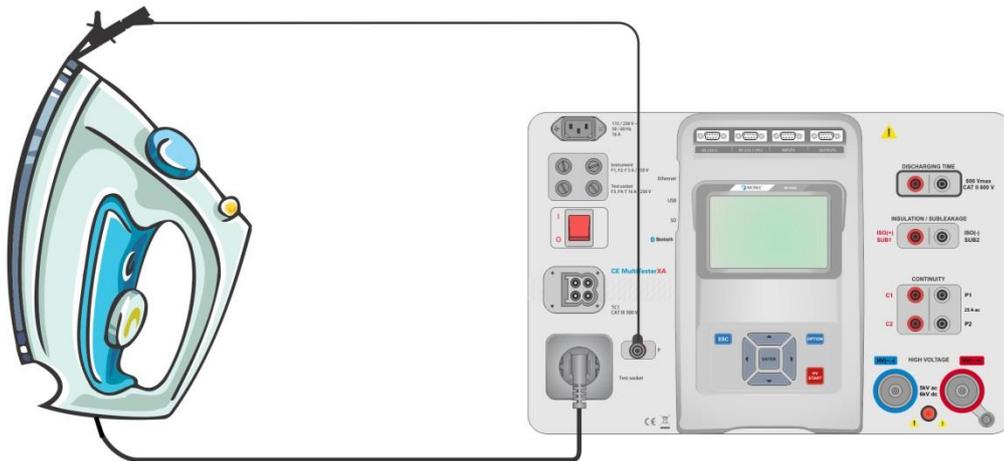
Figure 6.10: Measurement of Continuity P/S - PE

Continuity measurement procedure

‣   Select the **Continuity** function.
‣   Set test parameters / limits.
‣   Connect test leads to C1, P1, P2 and C2 terminals on the instrument (4 wire), or connect test lead to P/S terminal (2 wire measurement P/S – PE).
‣   Compensate test leads resistance (optional).
‣   Connect test leads to device under test.
‣   Start measurement.
‣   Measurement can be stopped manually or by timer.
‣   Save results (optional).

Figure 6.11: Examples of Continuity measurement results

6.2.1.1   Compensation of test leads resistance

This chapter describes how to compensate the test leads resistance in **Continuity (Output = P/S** – **PE)** function. Compensation can be carried out to eliminate the influence of test leads resistance and the internal resistances of the instrument on the measured resistance.

Connection for compensating the resistance of test leads
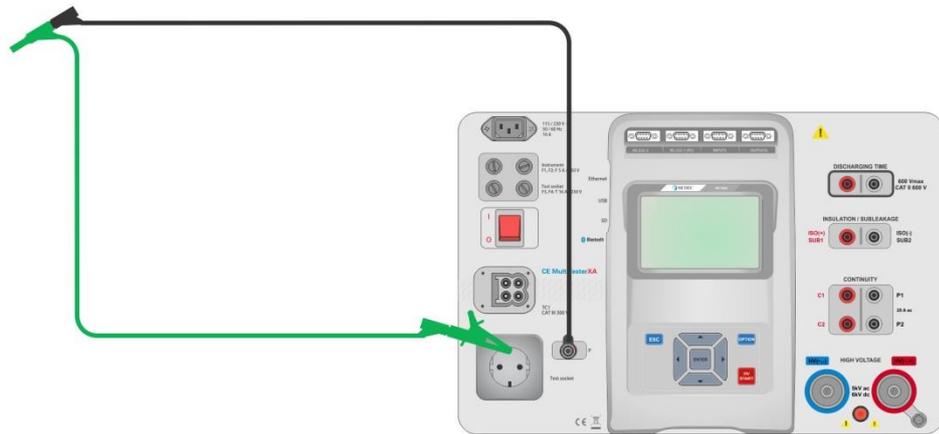
Figure 6.12**: Shorted test leads**

Compensation of test leads resistance procedure

‣ Select the **Continuity** function. Parameter Output must be set to P/S - PE.
‣ Connect test leads to the instrument and short the test leads together, see *Figure 6.12*.
‣ Touch the [⊙] key to compensate leads resistance.
‣ Symbol [CAL✓] is displayed if the compensation was carried out successfully.
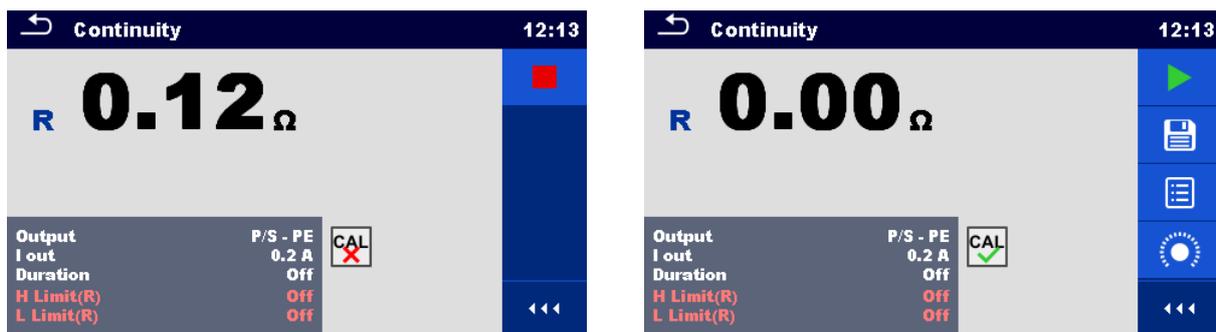
Figure 6.13: Uncompensated and compensated result

Note:
The compensation of test leads is carried out with set test current (I out).

6.2.2   HV AC

⚠ **IMPORTANT SAFETY NOTE**

Refer to chapter *1.1 Warnings and notes* for more information regarding safe use of the instrument.
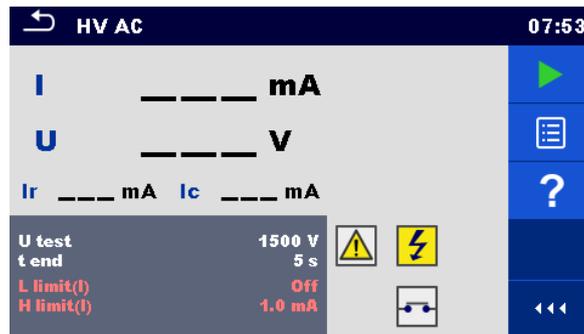
Figure 6.14: HV AC test menu

Test results / sub-results

I ....test current
U................measured a.c. test voltage
Ir ....resistive portion of test current
Ic ....capacitive portion of test current

Test parameters

AC test voltage	U test [100 V ... 5000 V in steps of 10 V]
Duration	t end [Off, 1 s ... 120 s]

Test limits

High limit (I)	H limit [0.5 mA ... 100 mA]
Low limit (I)	L limit [Off, 0.5 mA ... 100 mA]

Test circuit
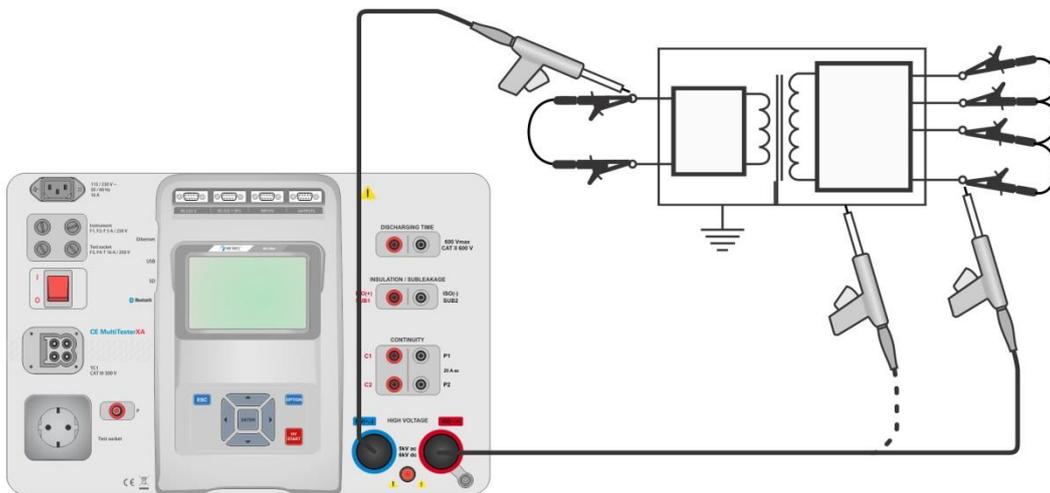
Figure 6.15: HV AC measurement

HV AC measurement procedure

‣ Select the **HV AC** function.
‣ Set test parameters / limits.
‣ Connect HV test leads to HV(~,+) and HV(~,-) terminals on the instrument.
‣ Connect HV test leads to device under test.

‣ Start measurement.
‣ Measurement can be stopped manually or by timer.
‣ Save results (optional).

Figure 6.16: Examples of HV AC meaasurement results

Note:

    ‣ First HV measurement after power on the instrument (if password protection is enabled) or first HV measurement after enabling or changing password require entering password for enabling HV test. Refer to chapter *4.6.6 Change password for HV functions* for more information.

6.2.3   HV DC

⚠ **IMPORTANT SAFETY NOTE**

Refer to chapter *1.1 Warnings and notes* for more information regarding safe use of the instrument.
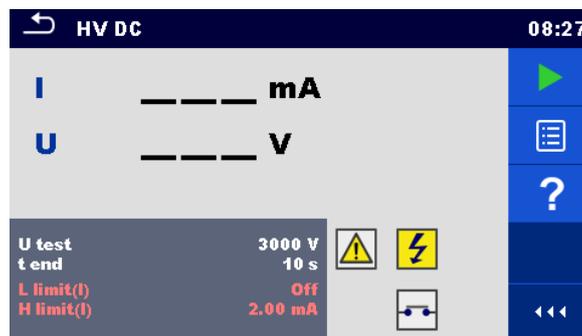
Figure 6.17: HV DC test menu

Test results / sub-results

U................measured test voltage
I ....test current

Test parameters

DC test voltage	U test [500 V ... 6000 V in steps of 50 V]
Duration	t end [Off, 1 s ... 120 s]

Test limits

High limit (I)	H limit [0.05 mA ... 10.0 mA]
Low limit (I)	L limit [Off, 0.05 mA ... 10.0 mA]

Test circuit
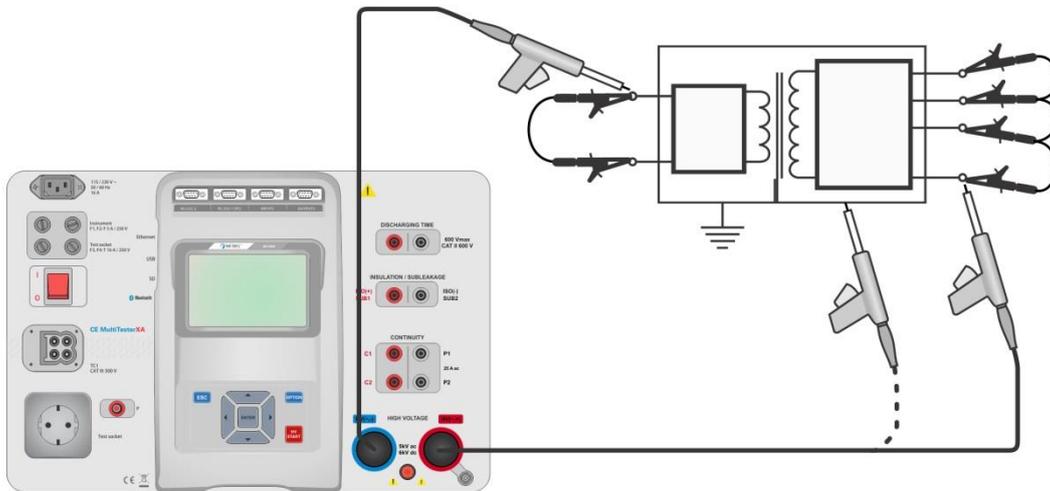
Figure 6.18: HV DC measurement

HV DC measurement procedure

‣   Select the **HV DC** function.
‣   Set test parameters / limits.
‣   Connect HV test leads to HV(~,+) and HV(~,-) terminals on the instrument.
‣   Connect HV test leads to device under test.
‣   Start measurement.
‣   Measurement can be stopped manually or by timer.
‣   Save results (optional).

Figure 6.19: Examples of HV DC measurement results

Note:

‣   First HV measurement after power on the instrument (if password protection is enabled) or first HV measurement after enabling or changing password require entering password for enabling HV test. Refer to chapter *4.6.6 Change password for HV functions* for more information.

6.2.4   HV AC programmable

⚠ **IMPORTANT SAFETY NOTE**

Refer to chapter *1.1 Warnings and notes* for more information regarding safe use of the instrument.

In the HV AC programmable test the time dependency of high voltage can be set according to diagram on *Figure 6.20.*
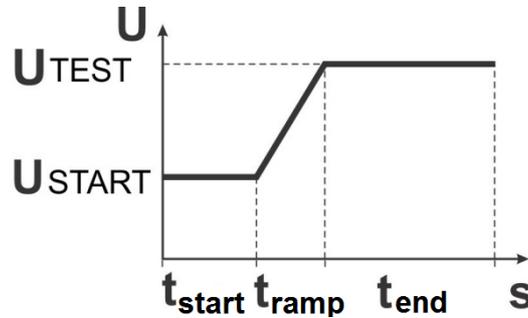
Figure 6.20: Voltage / time diagram of the HV AC programmable test
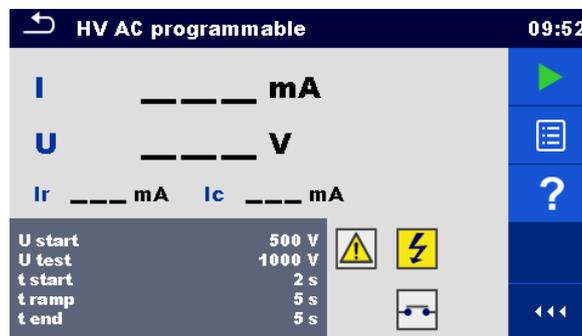
Figure 6.21: HV AC programmable test menu

Test results / sub-results

I ....test current
U................measured test voltage
Ir ....resistive portion of test current
Ic ....capacitive portion of test current

Test parameters

Starting AC test voltage	U start [100 V ... 5000 V in steps of 10 V]
AC test voltage	U test [100 V ... 5000 V in steps of 10 V]
Duration of starting voltage	t start [1 s ... 120 s]
Duration of ramp	t ramp [2 s ... 60 s]
Duration of test voltage	t end [Off, 1 s ... 120 s]

Test limits

High limit (I)	H limit [0.5 mA ... 100 mA]
Low limit (I)	L limit [Off, 0.5 mA ... 100 mA]

Test circuit
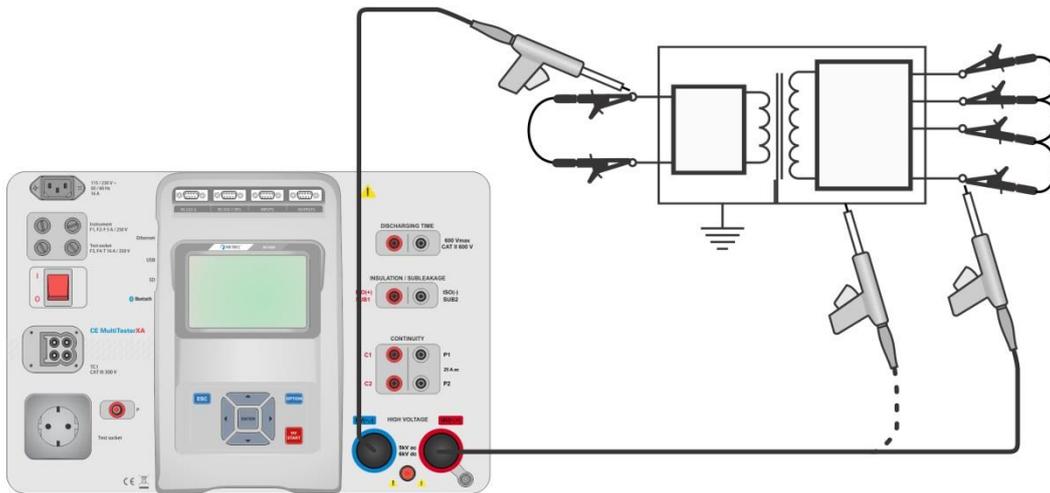
Figure 6.22: HV AC programmable test

HV AC programmable test procedure

‣ Select the **HV AC programmable** function.
‣ Set test parameters / limits.
‣ Connect HV test leads to HV(~,+) and HV(~,-) terminals on the instrument.
‣ Connect HV test leads to device under test.
‣ Start measurement.
‣ Measurement can be stopped manually or by timer.
‣ Save results (optional).
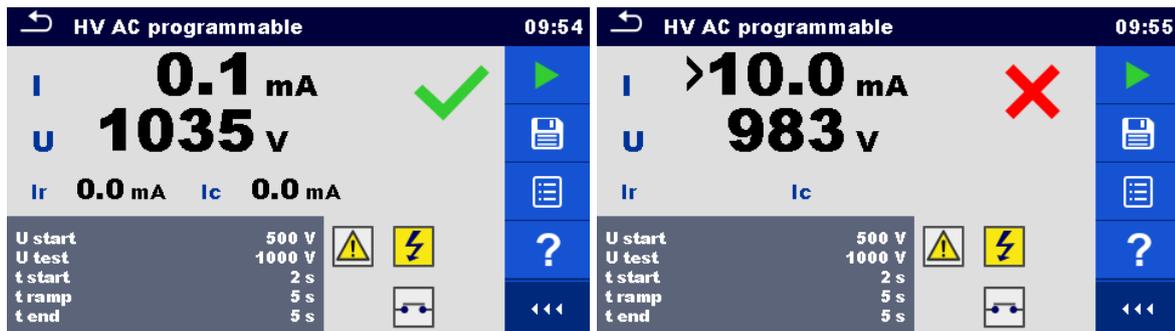
Figure 6.23: Examples of HV AC programmable test results

Note:

‣ First HV measurement after power on the instrument (if password protection is enabled) or first HV measurement after enabling or changing password require entering password for enabling HV test. Refer to chapter *4.6.6 Change password for HV functions* for more information.

6.2.5   HV DC programmable

⚠️ **IMPORTANT SAFETY NOTE**

Refer to chapter *1.1 Warnings and notes* for more information regarding safe use of the instrument.

In the HV DC programmable test the time dependency of high voltage can be set according to diagram on *Figure 6.24*.
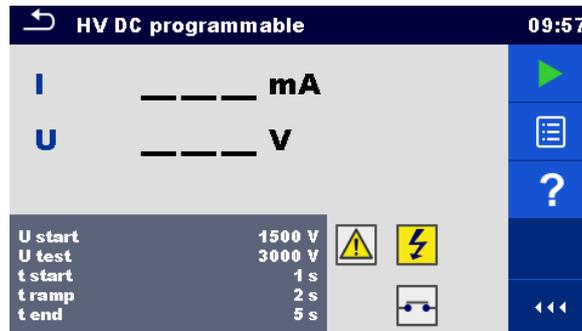
Figure 6.24: HV DC programmable test menu

Test results / sub-results

U................measured test voltage
I ....test current
Ic ....capacitive portion of test current
Ir ....resistive portion of test current

Test parameters

Starting DC test voltage	U start [500 V ... 6000 V in steps of 50 V]
DC test voltage	U test [500 V ... 6000 V in steps of 50 V]
Duration of starting voltage	t start [1 s ... 120 s]
Duration of ramp	t ramp [2 s ... 60 s]
Duration of test voltage	t end [Off, 1 s ... 120 s]

Test limits

High limit (I)	H limit [0.05 mA ... 10.0 mA]
Low limit (I)	L limit [Off, 0.05 mA ... 10.0 mA]

Test circuit
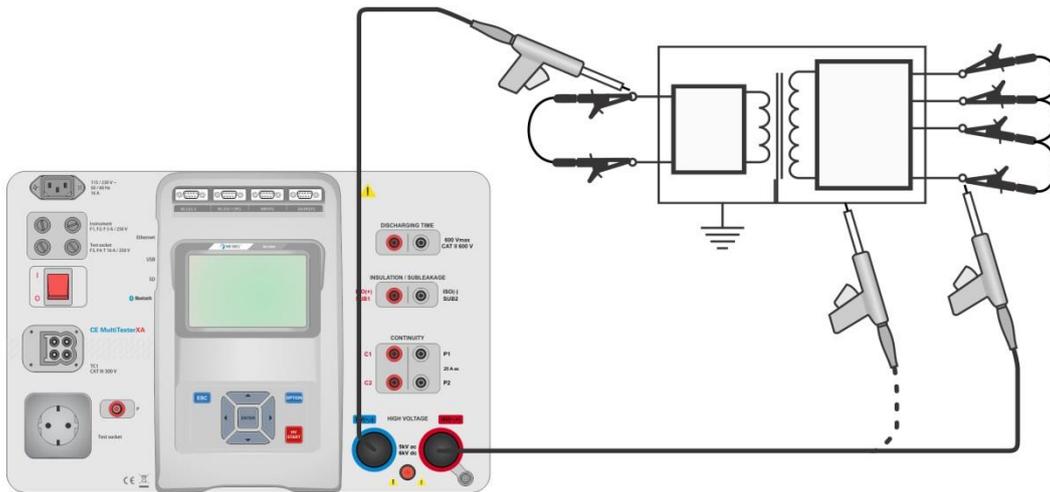
Figure 6.25: HV DC programmable test

HV DC programmable test procedure

‣ Select the **HV DC programmable** function.
‣ Set test parameters / limits.
‣ Connect HV test leads to HV(~,+) and HV(~,-) terminals on the instrument.
‣ Connect HV test leads to device under test.
‣ Start measurement.
‣ Measurement can be stopped manually or by timer.
‣ Save results (optional).

Figure 6.26: Examples of HV DC programmable test results

Note:

‣ First HV measurement after power on the instrument (if password protection is enabled) or first HV measurement after enabling or changing password require entering password for enabling HV test. Refer to chapter *4.6.6 Change password for HV functions* for more information.

6.2.6   Insulation resistance (Riso, Riso-S)

Figure 6.27: Insulation resistance test menus

Test results / sub-results

Riso ....Insulation resistance
Riso-S ....Insulation resistance-S
Um.............Test voltage

Test parameters

Nominal test voltage	Uiso [50 V, 100 V, 250 V, 500 V, 1000 V]
Duration	Duration [Off, 2 s ... 180 s]
Type of test	Type [Riso, Riso-S, (Riso, Riso-S)]
Output connections (Riso)	[ISO(+), ISO(-), Socket LN-PE, Socket LN-P/S]
Output connections (Riso-S)	[Socket LN-P/S]

Test limits

H Limit (Riso)	H limit [Off, 0.10 MΩ ... 10.0 MΩ]
L Limit (Riso)	L limit [Off, 0.10 MΩ ... 10.0 MΩ]
H Limit (Riso-S)	H limit [Off, 0.10 MΩ ... 10.0 MΩ]
L Limit (Riso-S)	L limit [Off, 0.10 MΩ ... 10.0 MΩ]

Test circuits
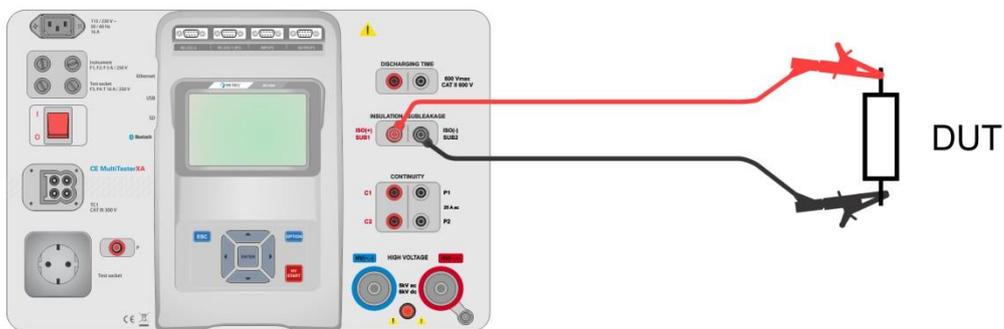
Figure 6.28: Measurement of insulation resistance (ISO(+), ISO(-))
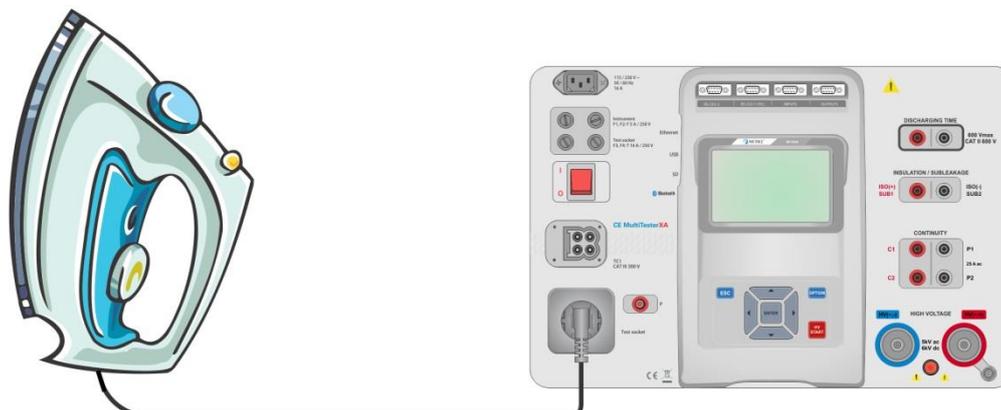
Figure 6.29: Measurement of insulation resistance (Socket LN - PE)
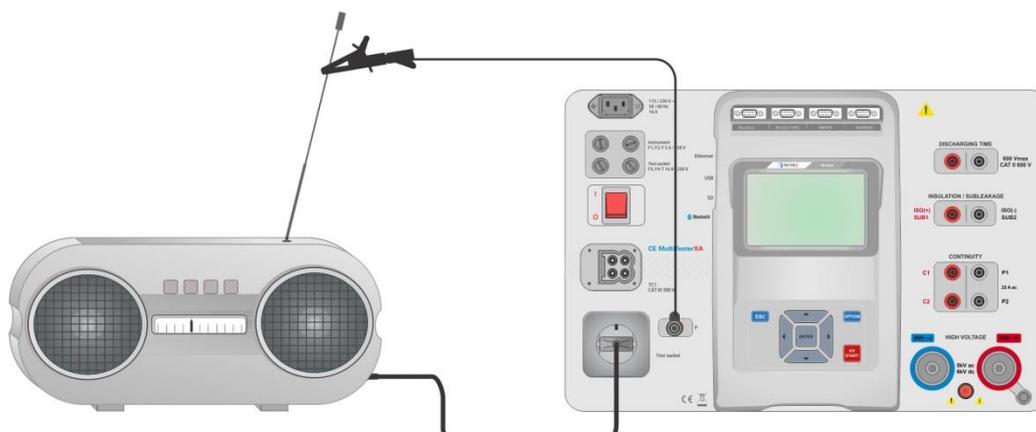
Figure 6.30: Measurement of Riso, Riso-S (socket)

RISO measurement procedure

‣ Select the **Riso** function.
‣ Set test parameters / limits.
‣ Connect test leads to ISO(+), ISO(-) terminals on the instrument, then connect test leads to device under test, or
‣ Connect device to mains test socket. For Riso-S test, additionally connect test lead to P/S terminal on instrument, and then connect test lead to device.
‣ Start measurement.
‣ Measurement can be stopped manually or by timer.
‣ Save results (optional).

Figure 6.31: Examples of Insulation resistance measurement results

Note:

‣   When P/S probe is connected during the Riso measurement, then the current through it
    is also considered.

6.2.7   Sub-leakage (Isub, Isub-S)
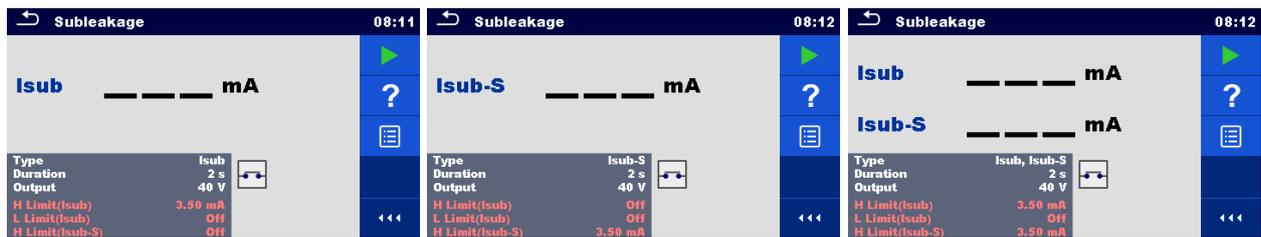
Figure 6.32: Sub Leakage test menus

Test results / sub-results

Isub ....Sub-leakage current
Isub-S........Sub-leakage current-S

Test parameters

Type of test	Type [Isub, Isub-S, (Isub, Isub-S)]
Output voltage	Output [40 Vac]
Duration	Duration [Off, 2 s ... 180 s]
Output connections (Isub)	[SUB1, SUB2, Socket LN-PE, Socket LN-P/S]
Output connections (Isub-S)	[Socket LN-P/S]

Test limits

H Limit (Isub)	H limit [Off, 0.25 mA ... 15.0 mA]
L Limit (Isub)	L limit [Off, 0.25 mA ... 15.0 mA]
H Limit (Isub-S)	H limit [Off, 0.25 mA ... 15.0 mA]
L Limit (Isub-S)	L limit [Off, 0.25 mA ... 15.0 mA]

Test circuits
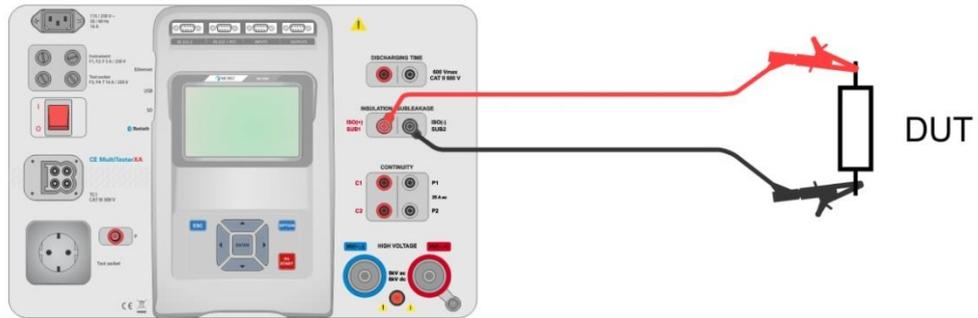
Figure 6.33: Measurement of Sub-leakage (SUB1, SUB2)
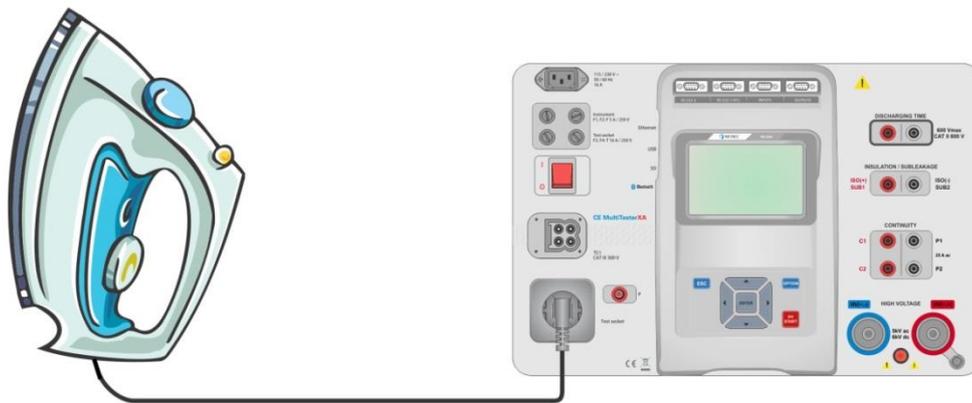
Figure 6.34: Measurement of Sub-leakage (socket LN-PE)
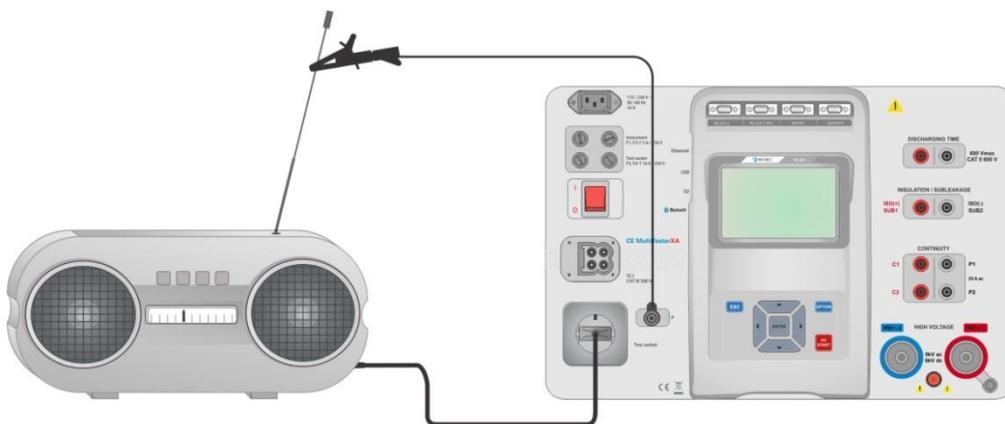
Figure 6.35: Measurement of Sub-leakage, Sub-leakage-S (socket)

Sub-leakage measurement procedure

‣   Select the **Sub-leakage** function.
‣   Set test parameters / limits.
‣   Connect test leads to SUB1,SUB2 terminals on the instrument, then connect test leads to device under test, or
‣   Connect device under test to mains test socket. For Isub-S test, additionally connect test lead to P/S terminal on the instrument, and then connect test lead to a device.
‣   Start measurement.
‣   Measurement can be stopped manually or by timer.
‣   Save results (optional).

Figure 6.36: Examples of Sub-leakage measurement results

Note:

‣   When P/S probe is connected during the Sub-leakage measurement, then the current through it is also considered.

6.2.8   Differential Leakage
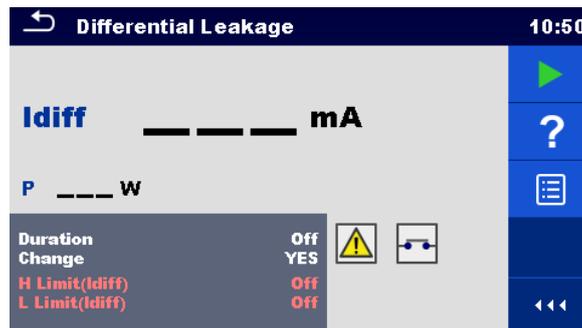
Figure 6.37: Differential Leakage test menu

Test results / sub-results

Idiff ....Differential Leakage current
P................Power

Test parameters

Duration	Duration [Off, 2 s ... 180 s]
Change status	Change [YES, NO] YES: The instrument measures leakage current in two sequential steps with 5 s delay in between. The phase voltage is firstly applied to the right live output of the mains test socket and

| | secondly to the left live output of the mains test socket.
NO: The phase voltage is applied only to the right live output of the mains test socket. |

Test limits

H Limit (Idiff)	H limit [Off, 0.25 mA ... 15.0 mA]
L Limit (Idiff)	L limit [Off, 0.25 mA ... 15.0 mA]
Output connections	[Socket L,N – PE,P/S]

Test circuit
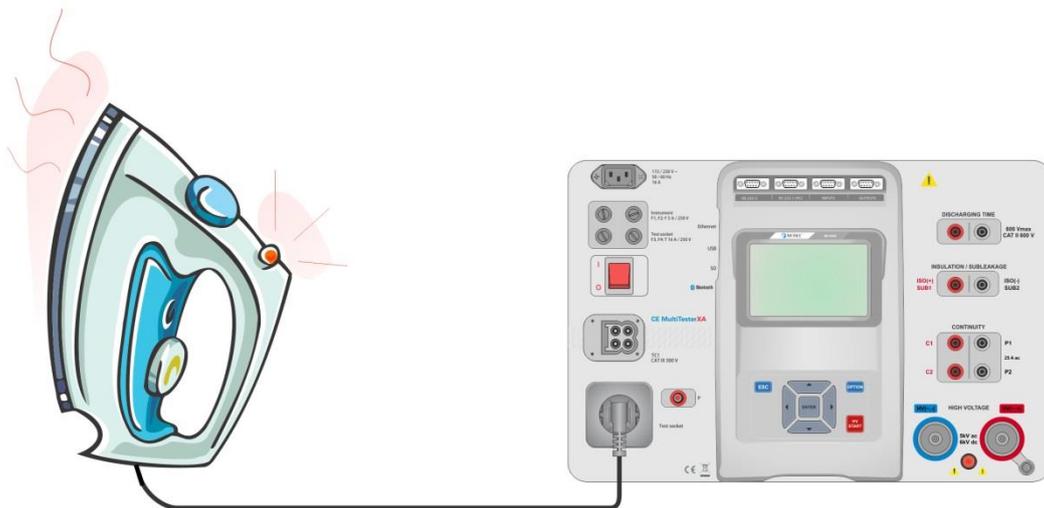
Figure 6.38: Measurement of Differential Leakage current

Differential Leakage measurement procedure

‣   Select the **Differential Leakage** function.
‣   Set test parameters / limits.
‣   Connect device under test to mains test socket and optionally to P/S terminal.
‣   Start measurement.
‣   Measurement can be stopped manually or by timer.
‣   Save results (optional).

Figure 6.39: Examples of Differential Leakage measurement results

6.2.9   Ipe Leakage
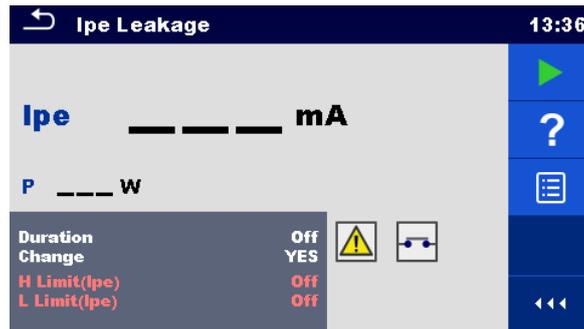
Figure 6.40: Ipe Leakage test menu

Test results / sub-results

Ipe ....PE current
P ....Power

Test parameters

Duration	Duration [Off, 2 s ... 180 s]
Change status	Change [YES, NO] YES: The instrument measures leakage current in two sequential steps with 5 s delay in between. The phase voltage is firstly applied to the right live output of the mains test socket and secondly to the left live output of the mains test socket. NO: The phase voltage is applied only to the right live output of the mains test socket.
Output connections	[Socket L,N – PE]

Test limits

H Limit (Ipe)	H limit [Off, 0.25 mA ... 15.0 mA]
L Limit (Ipe)	L limit [Off, 0.25 mA ... 15.0 mA]

Test circuit
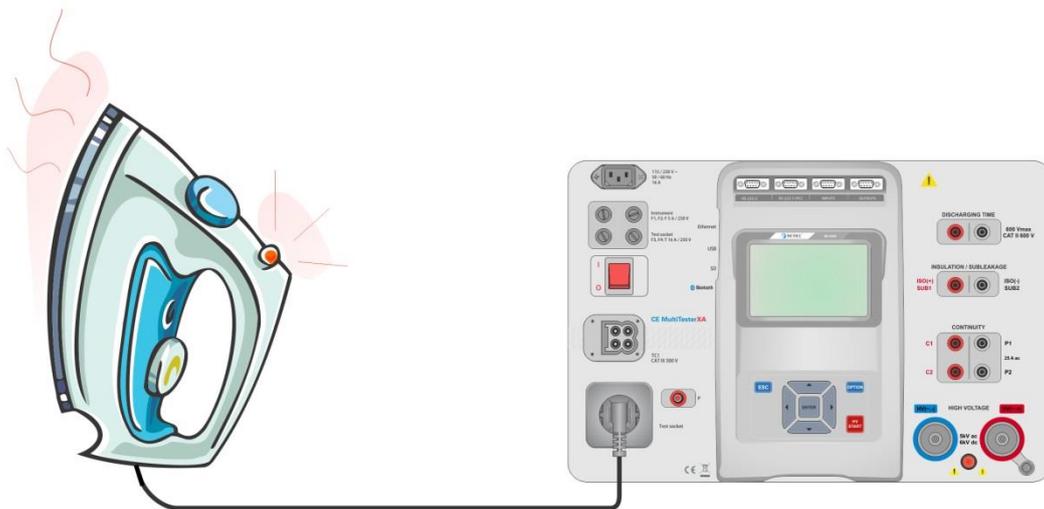
Figure 6.41: Measurement of Ipe Leakage current

Ipe Leakage measurement procedure

‣ Select the **Ipe Leakage** function.
‣ Set test parameters / limits.
‣ Connect device under test to mains test socket.
‣ Start measurement.
‣ Measurement can be stopped manually or by timer.
‣ Save results (optional).

Figure 6.42: Examples of Ipe Leakage measurement results

6.2.10 Touch Leakage
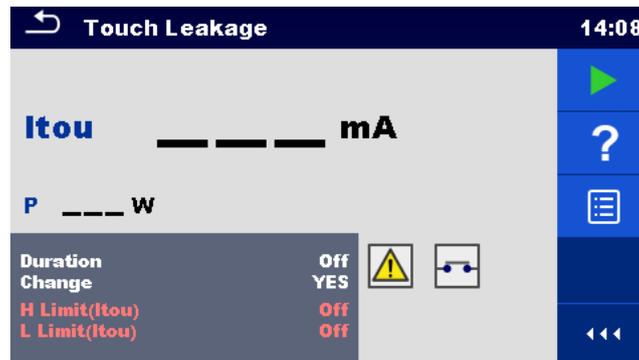
Figure 6.43: Touch Leakage test menu

Test results / sub-results

Itou ....Touch Leakage current
P................Power

Test parameters

Duration	Duration [Off, 2 s ... 180 s]
Change status	Change [YES, NO] YES: The instrument measures leakage current in two sequential steps with 5 s delay in between. The phase voltage is firstly applied to the right live output of the mains test socket and secondly to the left live output of the mains test socket. NO: The phase voltage is applied only to the right live output of the mains test socket.
Output connections	[Socket L,N – PE,P/S]

Test limits

H Limit (Itou)	H limit [Off, 0.25 mA ... 15.0 mA]
L Limit (Itou)	L limit [Off, 0.25 mA ... 15.0 mA]

Test circuit
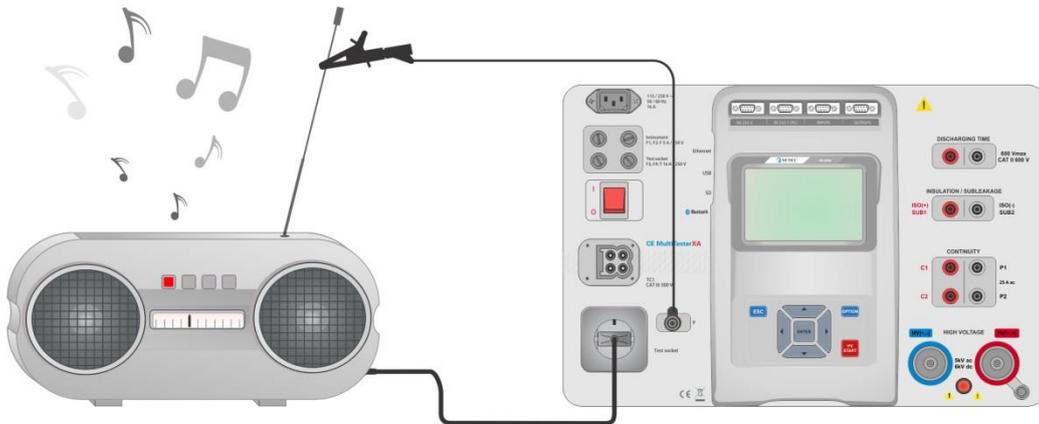
Figure 6.44: Measurement of Touch Leakage current

Touch Leakage measurement procedure

‣ Select the **Touch Leakage** function.
‣ Set test parameters / limits.
‣ Connect device under test to mains test socket. Connect test lead to P/S terminal on the instrument and on device under test.
‣ Start measurement.
‣ Measurement can be stopped manually or by timer.
‣ Save results (optional).

Figure 6.45: Examples of Touch Leakage measurement results

6.2.11   Power
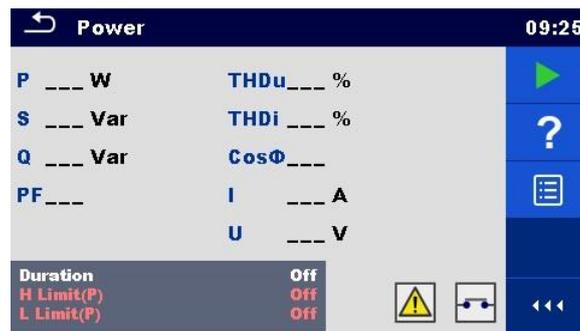
Figure 6.46: Power measurement menu

Test results / sub-results

P................Active power
S................Apparent power
Q ....Reactive power
PF.............Power factor
THDu.........Total harmonic distortion – voltage
THDi..........Total harmonic distortion – current
Cos Φ........cosinus Φ
I ....Load current
U................Voltage

Test parameters

Duration	Duration [Off, 2 s ... 180 s]
Output connections	[Socket L–N]

Test limits

H Limit (P)	H limit [Off, 10 W ... 3.50 kW]
L Limit (P)	L limit [Off, 10 W ... 3.50 kW]

Test circuit
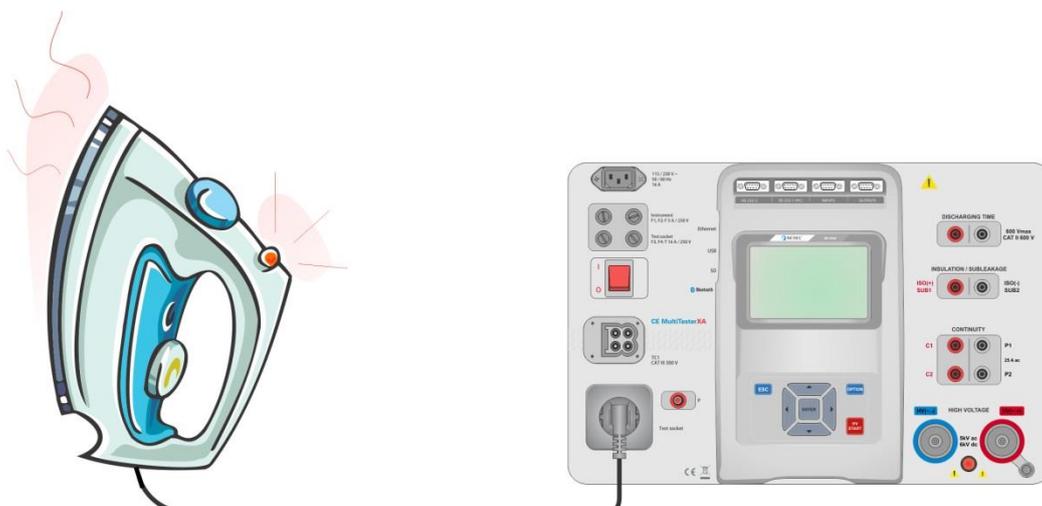
Figure 6.47: Measurement of Power

Power measurement procedure

‣ Select the **Power** function.
‣ Set test parameters / limits.
‣ Connect device under test to mains test socket.
‣ Start measurement.
‣ Measurement can be stopped manually or by timer.
‣ Save results (optional).

Figure 6.48: Examples of Power measurement results

6.2.12   Leak's & Power
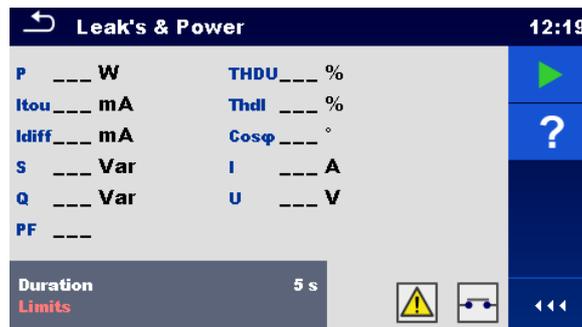
Figure 6.49: Leak's & Power measurement menu

Test results / sub-results

P................Active power
Itou ....Touch Leakage current
Idiff ....Differential Leakage current
S................Apparent power
Q ....Reactive power
PF..............Power factor
THDu.........Total harmonic distortion – voltage
THDi..........Total harmonic distortion – current
Cos Φ........cosinus Φ
I ....Load current
U...............Voltage

Test parameters

Duration	Duration [Off, 2 s ... 180 s]
Change status	Change [YES, NO]

	YES: The instrument measures leakage current in two sequential steps with 5 s delay in between. The phase voltage is firstly applied to the right live output of the mains test socket and secondly to the left live output of the mains test socket. NO: The phase voltage is applied only to the right live output of the mains test socket.
Output connections	[Socket L–N, Socket L,N – PE,P]

Test limits

H Limit (P)	H limit [Off, 10 W ... 3.50 kW]
L Limit (P)	L limit [Off, 10 W ... 3.50 kW]
H Limit (Idiff)	H limit [Off, 0.25 mA ... 15.0 mA]
L Limit (Idiff)	L limit [Off, 0.25 mA ... 15.0 mA]
H Limit (Itou)	H limit [Off, 0.25 mA ... 15.0 mA]
L Limit (Itou)	L limit [Off, 0.25 mA ... 15.0 mA]

Test circuit
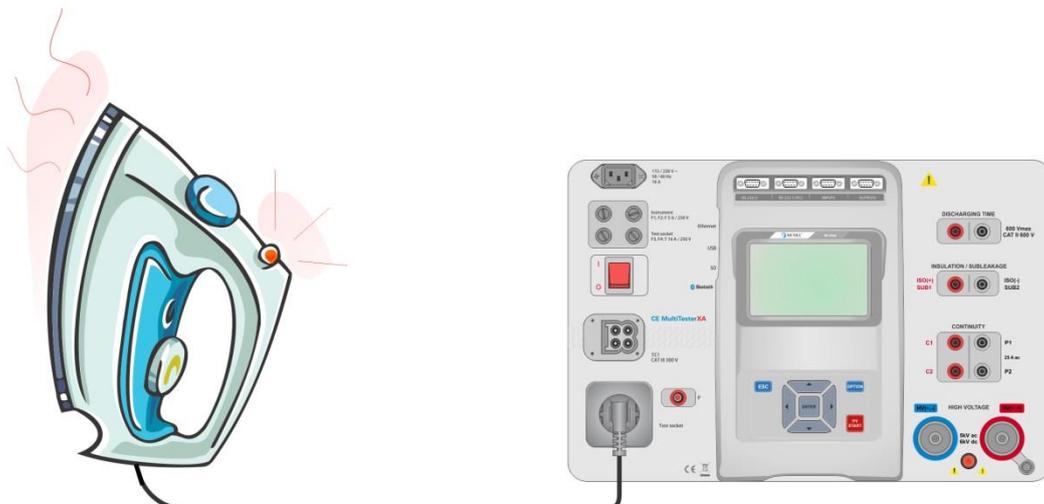
Figure 6.50: Measurement of Leak's and Power

Leak's & Power measurement procedure

‣   Select the **Leak's & Power** function.
‣   Set test parameters / limits.
‣   Connect device under test to mains test socket and optionally to P/S terminal.
‣   Start measurement.
‣   Measurement can be stopped manually or by timer.
‣   Save results (optional).
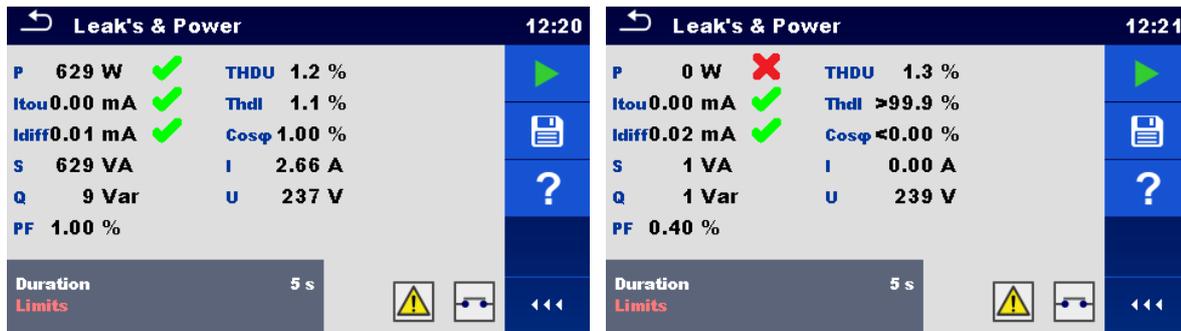
Figure 6.51: Examples of Leak's & Power measurement results

6.2.13   Discharging Time
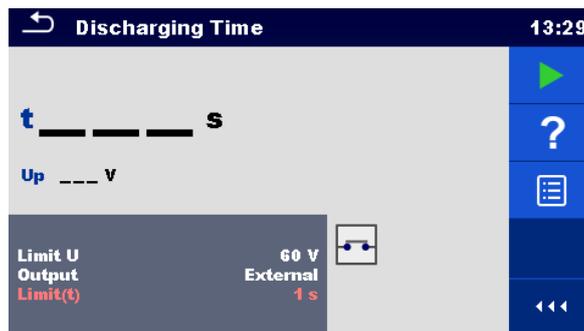
Figure 6.52: Discharging Time test menu

Test results / sub-results

t ....Discharging time
Up..............Peak voltage of supply during the test

Test parameters

Limit voltage	Limit U [34 V, 60 V, 120 V]
Output connections	Output [External, Socket]
Test mode	Mode [Manual, Auto]
Delay time for AUTO mode	Delay [2 s ... 30 s]

Test limits

Discharging time limit	Limit(t) [1 s, 5 s]

Measuring principle (Output = External)

The measuring principle of the Discharging time function is as following:

Phase ①   The device under test is connected to supply voltage via an external socket. The instrument monitors the voltage (on supply or internal connections) and internally stores the peak voltage value.

***Phase* ②**   The device under test is disconnected from the supply and the voltage at the test terminals starts to fall. Once the rms voltage falls for 10V the instrument starts the timer.

***Phase* ③**   After the voltage drops below an internally calculated voltage value the timer is stopped. The instrument re-calculates the measured time to a value as it would be if the disconnection occurred at the maximum voltage value.
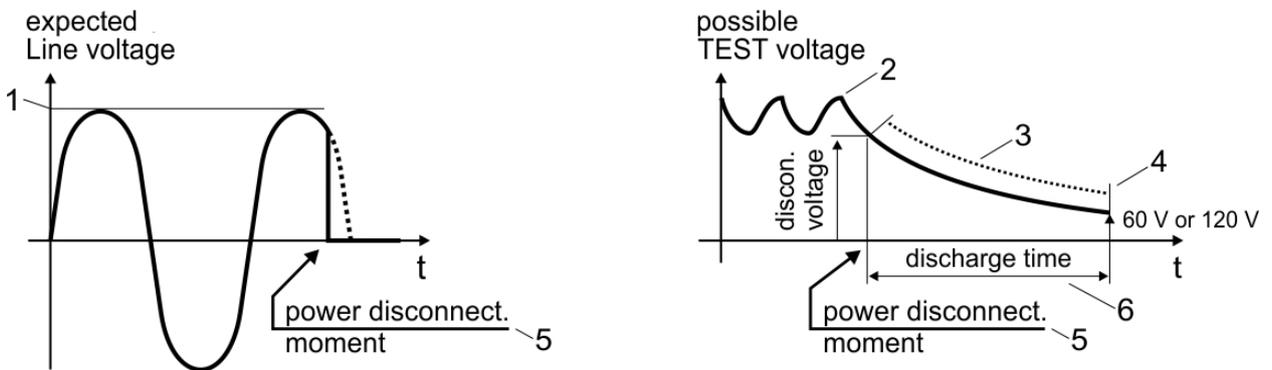
(1) peak voltage
(2) voltage at disconnection time
(3) calculated voltage value

(4) Ulim
(5) moment of disconnection
(6) discharging time

Figure 6.53: Measuring principle (external)

Test circuit (Output = External)
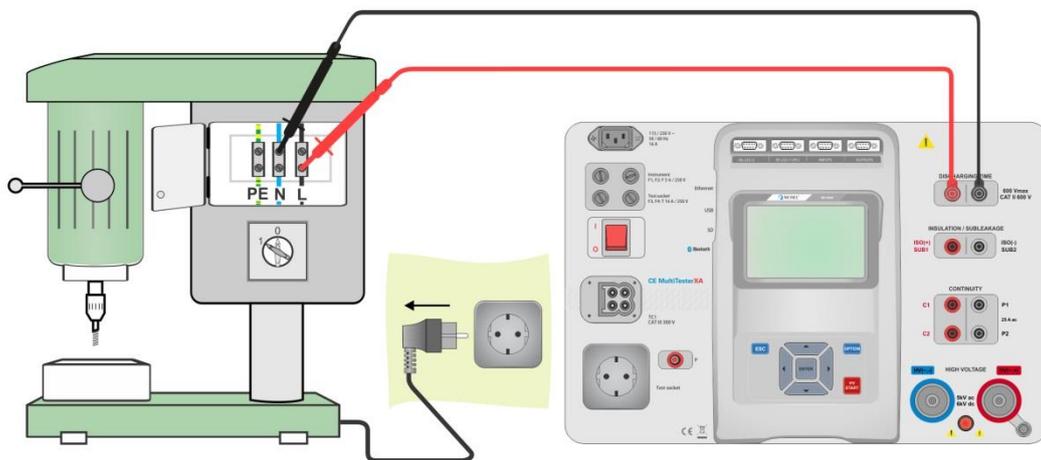
Figure 6.54: Discharging Time test (Output = External)

Discharging Time test procedure (Output = External)

‣ Select the **Discharging Time** function.
‣ Set test parameters / limits.
‣ Connect test leads to the DISCHARGING TIME terminals on the instrument and on the device under test.
‣ Connect device under test to the mains supply and Switch it ON.
‣ Start measurement.
‣ Measurement is stopped manually by disconnecting device under test mains supply.
‣ Save results (optional).
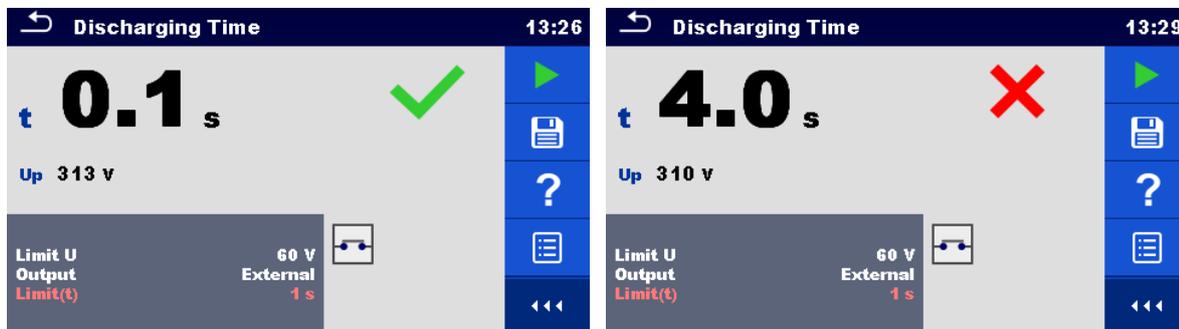
Figure 6.55: Examples of Discharging Time measurement results (Output = External)

Measuring principle (Output = Socket)

The measuring principle of the Discharging time function is as following:

Phase ① 　　The DEVICE UNDER TEST is connected to the mains test socket.The instrument monitors the mains voltage and internally stores the peak voltage value.

Phase ② 　　The instrument disconnects the DEVICE UNDER TEST from the supply and the voltage at the supply connections starts to fall. Disconnection moment is always at peak voltage.

Phase ③ 　　After the voltage drops below the limit value the timer is stopped.

Test circuit (Output = Socket)
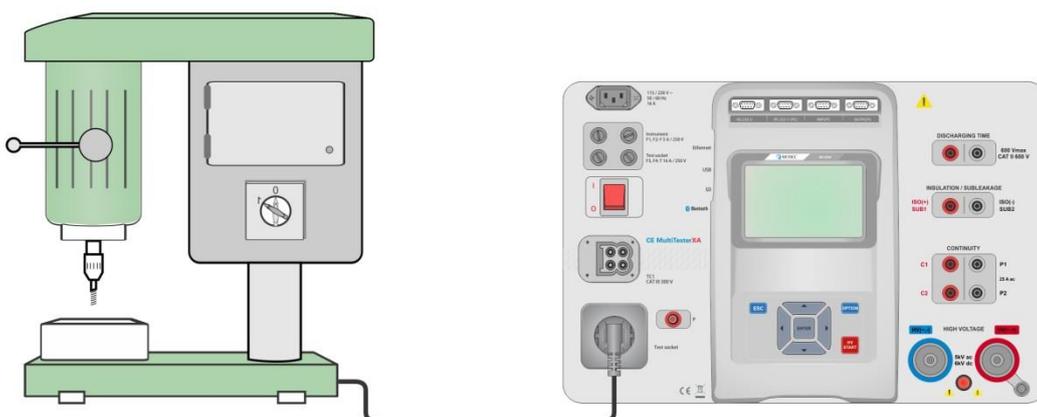
Figure 6.56: Discharging Time test (Output = Socket)

Discharging Time test procedure (Output = Socket)

‣ Select the **Discharging Time** function.
‣ Set test parameters / limits.
‣ Connect the device under test to the mains test socket on the instrument.
‣ Start measurement.
‣ Measurement can be stopped manually or automatically.
‣ Save results (optional).

Figure 6.57: Examples of Discharging Time measurement results (Output = Socket)

7   Auto tests

Preprogrammed sequences of measurements can be carried out in Auto test menu. The sequence of measurements, their parameters and flow of the sequence can be programmed. The results of an Auto test can be stored in the memory together with all related information.
Auto tests can be pre-programmed on PC with the Metrel ES Manager software and uploaded to the instrument. On the instrument parameters and limits of individual single test in the Auto test can be changed / set.

7.1 Selection of Auto tests

The Auto test list from Auto test groups menu should be selected first. Refer to chapter *4.6.5 Auto test groups* for more details.
The Auto test to be carried out can then be selected from the Main Auto tests menu. This menu can be organized in structural manner with folders, sub-folders and Auto tests.
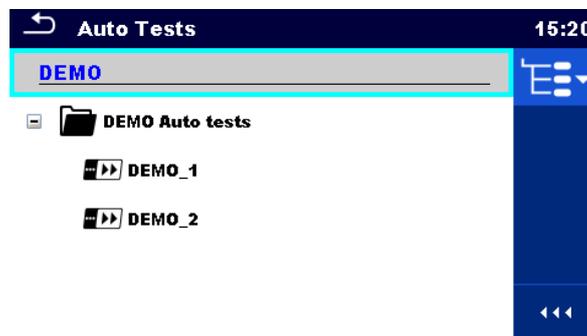
Figure 7.1: Example of organized Auto tests in Main Auto tests menu

Options

	Enters menu for more detail view of selected Auto test. This option should also be used if the parameters / limits of the selected Auto test have to be changed. Refer to chapter *7.2.1 Auto test view menu* for more information.
	Starts the selected Auto test. The instrument immediately starts the Auto test.
	Opens options in control panel / expands column.

7.2 Organization of Auto tests

An Auto test is divided into three phases:

‣ Before starting the first test the Auto test view menu is shown (unless it was started directly from the Main Auto tests menu). Parameters and limits of individual measurements can be set in this menu.
‣ During the execution phase of an Auto test, pre-programmed single tests are carried out. The sequence of single tests is controlled by pre-programmed flow commands.
‣ After the test sequence is finished the Auto test result menu is shown. Details of individual tests can be viewed and the results can be saved to Memory organizer.

7.2.1 Auto test view menu

In the Auto test view menu the header and the single tests of selected Auto test are displayed. The header contains the name and description of the Auto test. Before starting the Auto test, test parameters / limits of individual measurements can be changed.

7.2.1.1 Auto test view menu (header is selected)
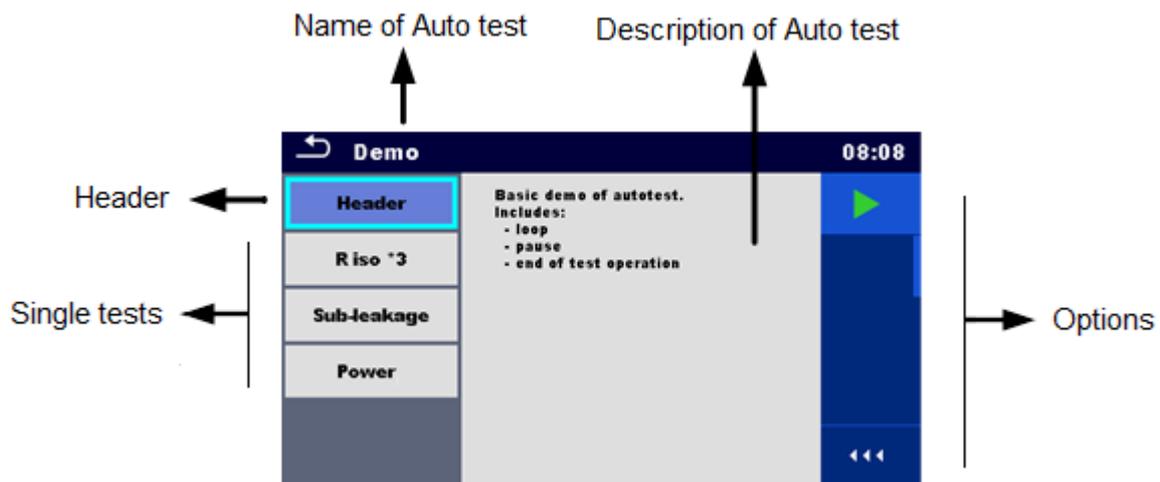
Figure 7.2: Auto test view menu – header selected

Options

▶	Starts the Auto test.
◀◀◀	Opens options in control panel / expands column.

7.2.1.2   Auto test view menu (measurement is selected)
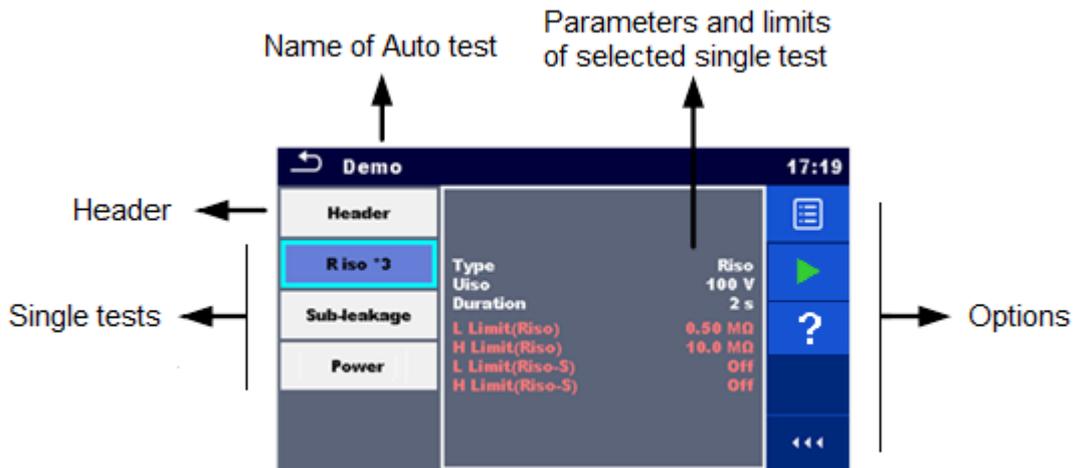
Figure 7.3: Auto test view menu – measurement selected

Options

	Selects single test.
on	Opens menu for changing parameters and limits of selected measurements. Refer to chapter *6.1.2 Setting parameters and limits of single tests* for more information how to change measurement parameters and limits.
	Starts the selected Auto test.
	Opens the Help menu of selected test.
	Opens options in control panel / expands column.
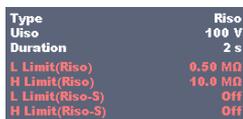
7.2.1.3   Indication of Loops

R iso x3

The attached 'x3' at the end of single test name indicates that a loop of single tests is programmed. This means that the marked single test will be carried out as many times as the number behind the 'x' indicates. It is possible to exit the loop before, at the end of each individual measurement.

7.2.1   Step by step excecution of Auto tests

While the Auto test is running it is controlled by pre-programmed flow commands. Examples of actions controlled by flow commands are:
- pauses during the test sequence
- monitoring of input pins
- control of lamps, test adapters and other external devices
- proceeding of test sequence in regard to measured results
- etc.

The actual list of flow commands is available on chapter *D.5 Description of flow commands.*
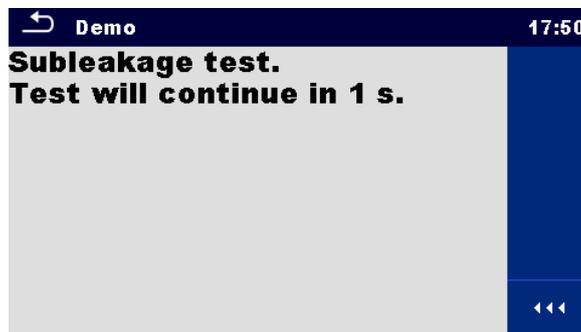
Figure 7.4: Auto test – example of a pause with message
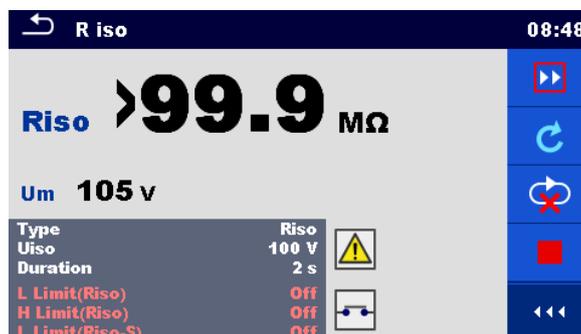
Figure 7.5: Auto test – example of a finished measurement with options for proceeding

Options (during execution of an auto test)

▶▶	Proceeds to next step in the test sequence.
↻	Repeats the measurement. Displayed result of a single test will not be stored.
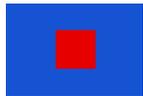
■	Ends the Auto test and goes to Auto test result screen. Refer to chapter *7.2.2 Auto test result screen* for more information.
⟳✗	Exits the loop of single tests and proceeds to the next step in the test sequence.
◄◄◄	Opens options in control panel / expands column.

The offered options in the control panel depend on the selected single test, its result and the programmed test flow.

Note:

‣   During Auto tests the popup Warning messages (see chapter *4.4 Symbols and messages*) are displayed only before the single test inside one Auto test. This default setting can be changed with appropriate flow command. For more information about programming Auto tests refer to chapter *Appendix D - Programming of Auto tests on Metrel ES Manager*.

7.2.2   Auto test result screen

After the Auto test sequence is finished the Auto test result screen is displayed as presented on *Figure 7.6*. At the left side of the display the single tests and their statuses are shown.In the middle of the display the header of the Auto test is displayed and at the top the overall Auto test status is displayed. Refer to chapter *5.1.1 Measurement statuses* for more information*.
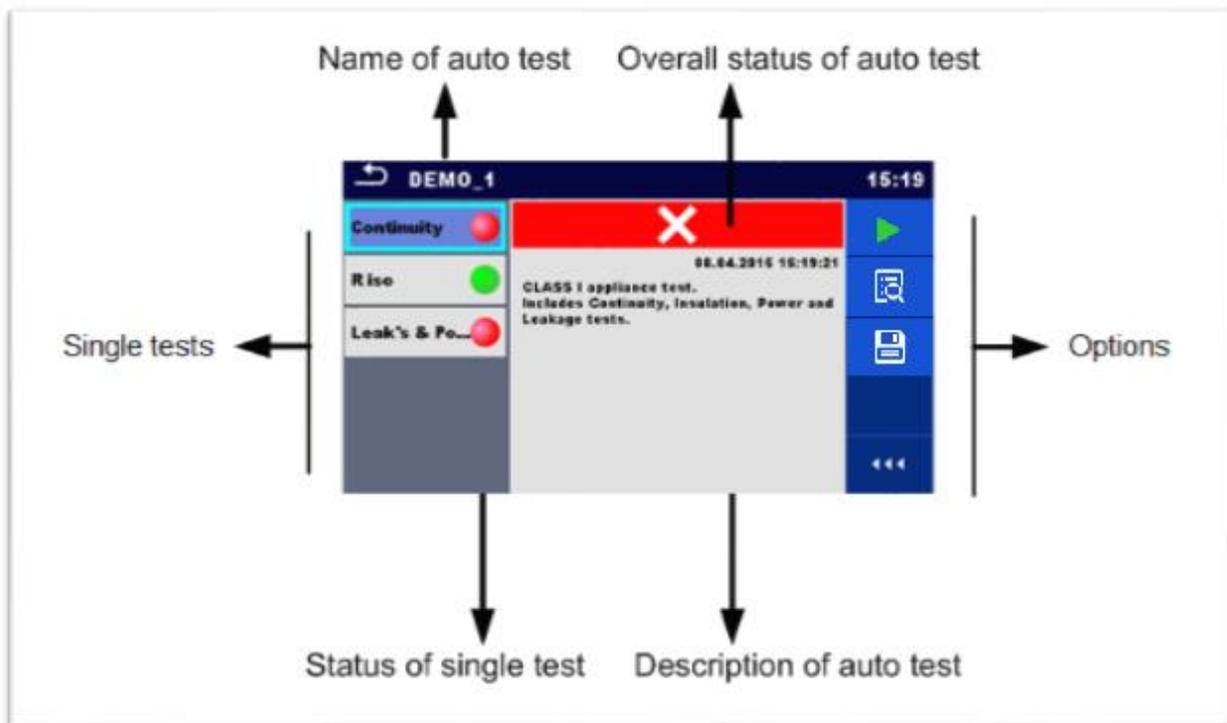
Figure 7.6: Auto test result screen

Options

	Start Test Starts a new Auto test.
	View results of individual measurements. The instrument goes to menu for viewing details of the Auto test, see Figure 7.8.
	Saves the Auto test results. A new Auto test was selected and started from a Structure object in the structure tree: ‣ The Auto test will be saved under the selected Structure object. A new Auto test was started from the Auto test main menu: ‣ Saving under the last selected Structure object will be offered by default. The user can select another Structure object or create a new Structure object. By pressing in Memory organizer menu the Auto test is saved under selected location. An empty measurement was selected in structure tree and started: ‣ The result(s) will be added to the Auto test. The Auto test will change its overall status from 'empty' to 'finished'. An already carried out Auto test was selected in structure tree, viewed and then restarted: ‣ A new Auto test will be saved under the selected Structure object.
	Opens options in control panel / expands column.

Options in menu for viewing details of Auto test results

	Details of selected single test in Auto test are displayed, see Figure 7.7.
   on	Opens menu for viewing parameters and limits. Refer to chapter *6.1.2 Setting parameters and limits of single tests* for more information.
	Opens options in control panel / expands column.
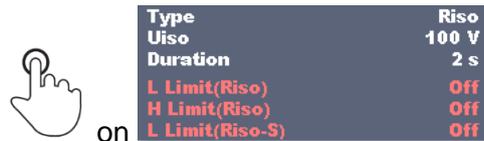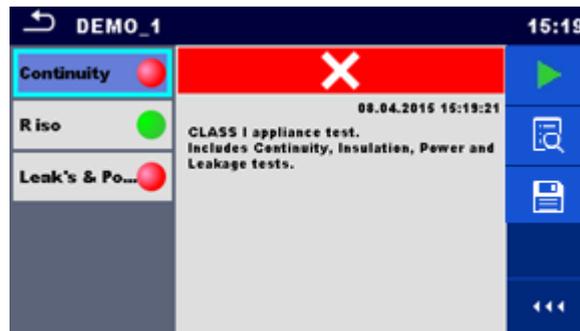
Figure 7.7: Details of menu for viewing details of Auto test results
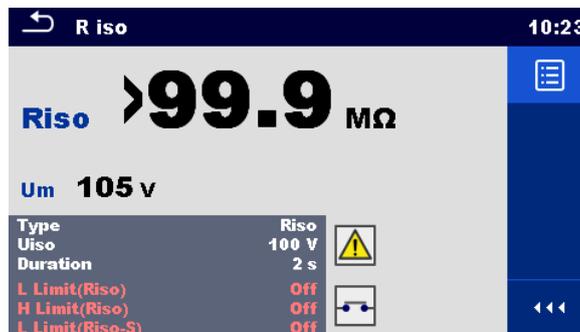
Figure 7.8: Details of single test in Auto test result menu

7.2.3   Auto test memory screen

In Auto test memory screen details of the auto test can be viewed and a new Auto test can be restarted.
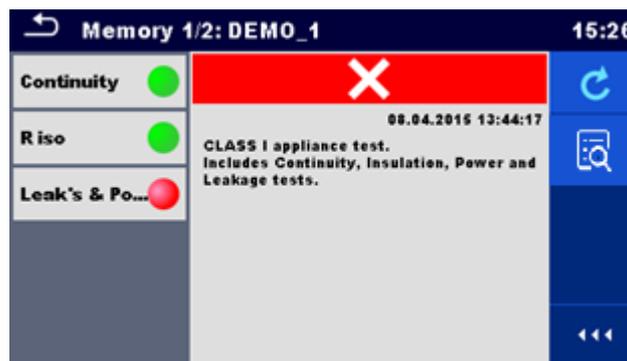
Figure 7.9: Auto test memory screen

Options

	Retest the Auto test. Enters menu for a new Auto test.
	Enters menu for viewing details of the Auto test. Refer to chapter *7.2.2 Auto test result screen* for more information.
	Opens options in control panel / expands column.

8   Maintenance

8.1 Periodic calibration

It is essential that all measuring instruments are regularly calibrated in order for the technical specification listed in this manual to be guaranteed. We recommend an annual calibration.

8.2 Fuses

There are four fuses on the front panel:

F1, F2: F 5 A / 250 V / (20 $\times$ 5) mm / 1500 A: intended for instrument protection.
For position of fuses refer to chapter *3.1 Front panel*.

F3, F4: T 16 A / 250 V / (32 $\times$ 6,3) mm / 1500 A: protection against over-currents through mains test socket.
For position of fuses refer to chapter *3.1 Front panel*.

Warnings!

‣   **Switch off the instrument and disconnect all test accessories and mains cord before replacing the fuses or opening the instrument.**
‣   **Replace blown fuses only with the same types defined in this document.**

8.3 Service

For repairs under or out of warranty please contact your distributor for further information.

Unauthorized person is not allowed to open the CE MultiTesterXA instrument. There are no user replaceable parts inside the instrument.

8.4 Cleaning

Use a soft, slightly moistened cloth with soap water or alcohol to clean the surface of CE MultiTesterXA MI 3394 instrument. Leave the instrument to dry totally before using it.

Notes:
‣   Do not use liquids based on petrol or hydrocarbons!
‣   Do not spill cleaning liquid over the instrument!

9   Communications

9.1 USB and RS232 communication with PC

The instrument automatically selects the communication mode according to detected interface. USB interface has priority.

How to establish an USB or RS-232 link:

› RS-232 communication: connect a PC COM port to the instrument RS232-2 connector using the RS232 serial communication cable;
› USB communication: connect a PC USB port to the instrument USB connector using the USB interface cable.
› Switch on the PC and the instrument.
› Run the *Metrel ES Manager* software.
› Select communication port.
› The PC and the instrument will automatically recognize each other.
› The instrument is prepared to communicate with the PC.

Metrel ES Manager is a PC software running on Windows 7, Windows 8, Windows 8.1 and Windows 10.

9.2 Bluetooth communication

The internal Bluetooth module enables easy communication via Bluetooth with PC and Android devices.

How to configure a Bluetooth link between instrument and PC

› Switch On the instrument.
› On PC configure a Standard Serial Port to enable communication over Bluetooth link between instrument and PC. Usually no code for pairing the devices is needed.
› Run the *Metrel ES Manager* software*.*
› Select configured communication port.
› The PC and the instrument will automatically recognize each other.
› The instrument is prepared to communicate with the PC.

How to configure a Bluetooth link between instrument and Android device

› Switch On the instrument.
› Some Android applications automatically carry out the setup of a Bluetooth connection. It is preferred to use this option if it exists. This option is supported by Metrel's Android applications.
› If this option is not supported by the selected Android application then configure a Bluetooth link via Android device's Bluetooth configuration tool. Usually no code for pairing the devices is needed.
› The instrument and Android device are ready to communicate.

Notes
- ‣ Sometimes there will be a demand from the PC or Android device to enter the code. Enter code 'NNNN' to correctly configure the Bluetooth link.
- ‣ The name of correctly configured Bluetooth device must consist of the instrument type plus serial number, eg. *MI 3394-12240429I*. If the Bluetooth module got another name, the configuration must be repeated.
- ‣ In case of serious troubles with the Bluetooth communication it is possible to reinitialize the internal Bluetooth module. The initialization is carried out during the Initial settings procedure. In case of a successful initialization "INITIALIZING… OK!" is displayed at the end of the procedure. See chapter *4.6.8* Initial Settings.
- ‣ Check if there are available Metrel Android applications for this instrument.

9.3 Ethernet communication

The instrument is also capable of communicating through an Ethernet port. The Ethernet communication must be fully configured in the setting menu before first use. See chapter *4.6.7 Settings* for details.

Metrel ES Manager is currently **not** supporting Ethernet communication. Contact Metrel or your distributor regarding options for using the Ethernet communication.

9.4 RS232 communication with other external devices

It is possible to communicate with scanners and printers via the RS232-1 serial port. Contact Metrel or your distributor which external devices and functionalities are supported.

9.5 Connections to test adapters

9.5.1 Test connector TC1

The 8 pin test connector TC1 is intended for connection of external test adapters. TC1 consists of Measuring signal connector and Communication signal connector.
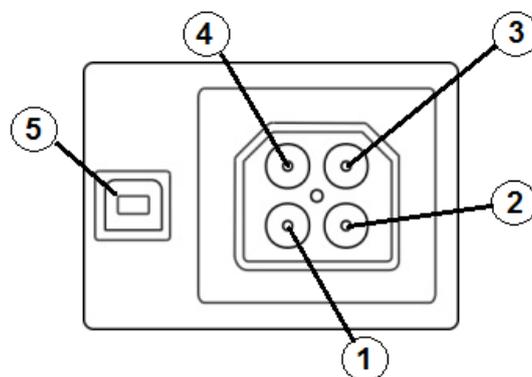
Figure 9.1: Test connector TC1 layout

Legend:

4 pin measuring signal connection (Safety connector)

1	In parallel to terminal N on mains test socket
2	In parallel to terminal L on mains test socket
3	In parallel to terminal PE on mains test socket
4	In parallel to terminal P/S

4 pin communication signal connection[1] (USB type connector)

5	Rx, Tx, +5V, GND

Note
- [1]Do not connect USB communication cable to 4 pin communication signal connector. It is intended only for connection to test adapters.

9.6 INPUTs

The DB9 connector INPUTs is intended for connection of external control signals.
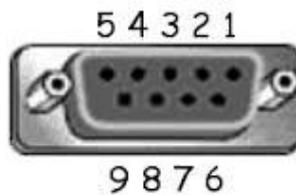
Figure 9.2: INPUT connector - pin layout

Legend:

Pin		Description	Type
5	EXTERNAL OK KEY mode	Input for Remote control pedal	Input low: < 1 V d.c. against earth Input high: > 4.5 V d.c. against earth Umax: 24 V a.c, d.c against earth
6	IN_2	External input 2	
7	IN_3	External input 3	
8	IN_4	External input 4	
4	IN_5	External input 5	
9		GND	
3		Instrument reset pin	
1,2		Not supported	

9.7 OUTPUTs

Via the DB9 connector OUTPUT four control signals for external devices are provided.
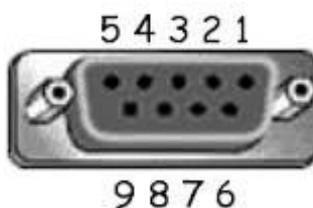
Figure 9.3: OUTPUT connector - pin layout

Legend:

Pins			Description	Type
4,9		OUT_1	Control output 1	NO relay, Umax: 24V, Imax: 1.5 A Output low: open contact Output high: closed contact
3,8		OUT_2	Control output 2	
2,7		OUT_3	Control output 3	
1,6		OUT_4	Control output 4	
5		+5 V	Supply for inputs	
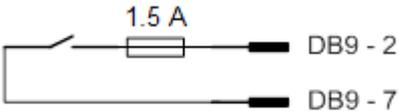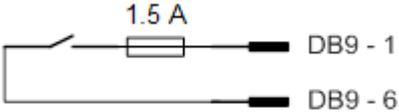
10 Technical specifications

10.1 HV AC, HV AC programmable

Voltage a.c.

	Range	Resolution	Accuracy
U	0 V ... 1999 V	1 V	±(3 % of reading)
	2.00 kV ... 5.99 kV	10 V	±(3 % of reading)

Current a.c. (apparent)

	Range	Resolution	Accuracy
I	0.0 mA ... 99.9 mA	0.1 mA	±(3 % of reading + 3 D)

Current a.c.(capacitive, resistive)

	Range	Resolution	Accuracy
Ir	0.0 mA ... 99.9 mA	0.1 mA	Indicative
Ic	-99.9 mA ... 99.9 mA	0.1 mA	Indicative

Output voltage .... 100 V … 1000 V (-0/+10%),
.... 1010 V … 5000 V (-0/+5%) floating to earth
Trip out time (if apparent current exceeds high limit).......... < 30 ms
Short circuit current ……………………………………….> 200 mA
Output power……………………………………………….500 VAmax

Test terminals

Function	Connections
Withstanding voltage (HVAC, HVAC-P)	HV(~,+) ↔ HV(~,-)

10.2 HV DC, HV DC programmable

Voltage d.c.

	Range	Resolution	Accuracy
U	0 V ... 1999 V	1 V	±(3 % of reading)
	2.00 kV ... 6.99 kV	10 V	±(3 % of reading)

Current d.c.

	Range	Resolution	Accuracy
I	0.01 mA ... 9.99 mA	0.01 mA	±(5 % of reading + 3 D)

Output voltage .... 100 V … 1000 V (-0/+10%),
.... 1050 V … 6000 V (-0/+5%) floating to earth
Ripple voltage .... ±3 %
Trip out time (if current exceeds high limit) ...... < 30 ms
Max. capacitive load .... 2 µF

Test terminals

Function	Connections
Withstanding voltage (HV~DC~, HV~DC-P~)	HV(~,+) ↔ HV(~,-)

10.3 Continuity

Continuity

	Range	Resolution	Accuracy
R	0.00 Ω ... 19.99 Ω	0.01 Ω	±(2 % of reading + 2 D)
	20.0 Ω ... 99.9 Ω	0.1 Ω	± 3 % of reading
	100.0 Ω ... 199.9 Ω	0.1 Ω	± 5 % of reading
	200 Ω ... 999 Ω	1 Ω	indicative

Voltage drop (Iout = 10 A)

	Range	Resolution	Accuracy
ΔU	0.00 V ... 19.99 V	0.01 V	±(2 % of reading + 5 D)
	20.0 V ... 99.9 V	0.1 V	± 3 % of reading

Limit value of voltage drop versus wire cross-section:

Wire cross-section (mm²)	Limit voltage drop (V)
0.5	5.0
0.75	5.0
1	3.3
1.5	2.6
2.5	1.9
4	1.4
≥6	1.0

Operating range (acc. to EN 61557-4)............. 0.08 Ω ... 199.9 Ω
Test currents... 0.2A, 4A, 10A, 25A
Current source (at nominal mains voltage, use of standard accessories)
.... 0.2 A at R < 8 Ω
.... 4 A at R < 1 Ω
.... 10 A at R < 0.5 Ω
.... 25 A at R < 0.2 Ω
Open circuit voltage... < 6 V a.c.
Max current lead resistance .... 40 Ω
Test lead compensation (P/S – PE) .... up to 5 Ω
Test method: Continuity 4 wire .... Kelvin method, floating to earth
Test method: Continuity P/S – PE.................... 2 wire test, floating to earth

Test terminals

Function	Connections
Continuity P/S – PE	P/S ↔ Mains test socket (PE), TC1
Continuity 4 wire	P1/C1 ↔ P2/C2

10.4 Insulation Resistance, Insulation Resistance-S

Insulation resistance, Insulation resistance –S (250 V, 500 V, 1000 V)

	Range	Resolution	Accuracy
Riso	0.00 MΩ … 19.99 MΩ	0.01 MΩ	±(3 % of reading + 2 D)
Riso-S	20.0 MΩ ... 199.9 MΩ	0.1 MΩ	± 5 % of reading

Insulation resistance, Insulation resistance –S (50 V, 100 V)

	Range	Resolution	Accuracy
Riso	0.00 MΩ ... 19.99 MΩ	0.01 MΩ	±(5 % of reading + 2 D)
Riso-S	20.0 MΩ ... 99.9 MΩ	0.1 MΩ	± 20 % of reading

Output voltage

	Range	Resolution	Accuracy
Um	0 V ... 1200 V	1 V	±(3 % of reading + 2 D)

Operating range (acc. to EN 61557-2).........0.08 MΩ ... 199.9 MΩ
Nominal voltages Un (d.c.) ....50 V, 100 V, 250 V, 500 V, 1000V (- 0 %, + 10 %)
Short circuit current ....max. 2.0 mA

Test terminals

Function	Connections
Insulation	Mains test socket (LN), ISO(+) ↔ Mains test socket (PE), ISO(-), TC1
Insulation – S	Mains test socket (LN), ISO(+) ↔ P/S, TC1

10.5 Substitute Leakage Current, Substitute Leakage Current - S

Substitute leakage current, Substitute leakage current - S

	Range	Resolution	Accuracy
Isub Isub-S	0.00 mA ... 19.99 mA	10 µA	±(5 % of reading + 3 D)

Operating range (acc. to EN 61557-16)........... 0.12 mA ... 19.99 mA
Open circuit voltage... < 50 V a.c.
Current calculated to mains supply voltage (110 V or 230 V) is displayed.

Test terminals:

Function	Connections
Subleakage	Mains test socket (LN), SUB1 ↔ Mains test socket (PE), SUB2, TC1
Subleakage – S	Mains test socket (LN), SUB1 ↔ P/S, TC1

10.6 Differential Leakage current

Differential leakage current

	Range	Resolution	Accuracy
Idiff	0.00 mA ... 19.99 mA	0.01 mA	±(3 % of reading + 5 D)

Power (active)

	Range	Resolution	Accuracy
P	0 W ... 999 W	1 W	±(5 % of reading + 5 D)
	1.00 kW ... 3.70 kW	10 W	± 5 % of reading

Operating range (acc. to EN 61557-16)........... 0.19 mA ... 19.99 mA
Frequency response of measuring circuit .... complies with EN 61010 - Figure A1
Influence of load current.................................. < 0.02 mA/A

Test terminals:

Function	Connections
Differential leakage	Mains test socket (LN), TC1

10.7 PE leakage current

PE leakage current

	Range	Resolution	Accuracy
Ipe	0.00 mA ... 19.99 mA	0.01 mA	±(3 % of reading + 3 D)

Power (active)

	Range	Resolution	Accuracy
P	0 W ... 999 W	1 W	±(5 % of reading + 5 D)
	1.00 kW ... 3.70 kW	10 W	± 5 % of reading

Operating range (acc. to EN 61557-16)........... 0.12 mA ... 19.99 mA
Frequency response of measuring circuit .... complies with EN 61010 - Figure A1

Test terminals:

Function	Connections
PE leakage	Mains test socket, TC1

10.8 Touch leakage current

Touch leakage current

	Range	Resolution	Accuracy
Itou	0.00 mA ... 19.99 mA	0.01 mA	±(3 % of reading + 3 D)

Power (active)

	Range	Resolution	Accuracy
P	0 W ... 999 W	1 W	±(5 % of reading + 5 D)
	1.00 kW ... 3.70 kW	10 W	± 5 % of reading

Operating range (acc. to EN 61557-16)........... 0.12 mA ... 19.99 mA
Frequency response of measuring circuit .... complies with EN 61010 - Figure A1

Output:

Function	Connections
Touch leakage	Mains test socket ↔ P/S, TC1

10.9   Power

Power (active)

	Range	Resolution	Accuracy
P	0 W ... 999 W	1 W	±(5 % of reading + 5 D)
	1.00 kW ... 3.70 kW	10 W	± 5 % of reading

Power (apparent)

	Range	Resolution	Accuracy
S	0 VA ... 999 VA	1 VA	±(5 % of reading + 5 D)
	1.00 kVA ... 3.70 kVA	10 VA	± 5 % of reading

Power (reactive)

	Range	Resolution	Accuracy
Q	±(0 VAr ... 999) VAr	1 VAr	±(5 % of reading + 5 D)
	±(1.00 kVAr ... 3.70) kVAr	10 VAr	± 5 % of reading

Power factor

	Range	Resolution	Accuracy
PF	0.00i ... 1.00i 0.00c ... 1.00c	0.01	±(5 % of reading + 5 D)

Total Harmonic Distortion (voltage)

	Range	Resolution	Accuracy
THDU	0.0 % ... 99.9 %	0.1 %	±(5 % of reading + 5 D)

Total Harmonic Distortion (current)

	Range	Resolution	Accuracy
THDI	0.0 % ... 99.9 %	0.1 %	±(5 % of reading + 5 D)

Cosinus Φ

	Range	Resolution	Accuracy
Cos Phi	0.00i ... 1.00i 0.00c ... 1.00c	0.01	±(5 % of reading + 5 D)

Voltage

	Range	Resolution	Accuracy
U	0.0 V ... 199.9 V	0.1 V	±(3 % of reading + 10 D)
	200 V ... 264 V	1 V	±3 % of reading

Current

	Range	Resolution	Accuracy
I	0.00 A ... 16.00 A	0.01 A	±(3 % of reading + 5 D)

Test terminals:

Function	Connections
Power	Mains test socket, TC1

10.10 Leak's & Power

Power (active)

	Range	Resolution	Accuracy
P	0 W ... 999 W	1 W	±(5 % of reading + 5 D)
	1.00 kW ... 3.70 kW	10 W	± 5 % of reading

Power (apparent)

	Range	Resolution	Accuracy
S	0 VA ... 999 VA	1 VA	±(5 % of reading + 5 D)
	1.00 kVA ... 3.70 kVA	10 VA	± 5 % of reading

Power (reactive)

	Range	Resolution	Accuracy
Q	0 VAr ... 999 VAr	1 VAr	±(5 % of reading + 5 D)
	1.00 kVAr ... 3.70 kVAr	10 VAr	± 5 % of reading

Power factor

	Range	Resolution	Accuracy
PF	0.00i ... 1.00i 0.00c ... 1.00c	0.01	±(5 % of reading + 5 D)

Total Harmonic Distortion (voltage)

	Range	Resolution	Accuracy
THDU	0.0 % ... 99.9 %	0.1 %	±(5 % of reading + 5 D)

Total Harmonic Distortion (current)

	Range	Resolution	Accuracy
THDI	0.0 % ... 99.9 %	0.1 %	±(5 % of reading + 5 D)

Cosinus Φ

	Range	Resolution	Accuracy
Cos Phi	0.00i ... 1.00i 0.00c ... 1.00c	0.01	±(5 % of reading + 5 D)

Voltage

	Range	Resolution	Accuracy
U	0.0 V ... 199.9 V	0.1 V	±(3 % of reading + 10 D)
	200 V ... 264 V	1 V	±3 % of reading

Current

	Range	Resolution	Accuracy
I	0.00 A ... 16.00 A	0.01 A	$\pm$(3 % of reading + 5 D)

Differential leakage current

	Range	Resolution	Accuracy
Idiff	0.00 mA ... 19.99 mA	0.01 mA	$\pm$(3 % of reading + 5 D)

Operating range (acc. to EN 61557-16)........... 0.19 mA ... 19.99 mA
Frequency response of measuring circuit .... complies with EN 61010 - Figure A1
Influence of load current................................... < 0.02 mA/A

Touch leakage current

	Range	Resolution	Accuracy
Itou	0.00 mA ... 19.99 mA	0.01 mA	$\pm$(3 % of reading + 3 D)

Operating range (acc. to EN 61557-16)........... 0.12 mA ... 19.99 mA
Frequency response of measuring circuit .... complies with EN 61010 - Figure A1

Test terminals:

Function	Connections
Power	Mains test socket, TC1
Differential leakage	Mains test socket (LN), TC1
Touch leakage	Mains test socket $\leftrightarrow$ P/S, TC1

10.11 Discharging time

Discharging time

	Range	Resolution	Accuracy
t	0.0 s ... 9.9 s	0.1 s	$\pm$(5 % of reading + 2 D)

Peak voltage

	Range	Resolution	Accuracy
Up	0 V ... 550 V	1 V	$\pm$(5 % of reading + 3 D)

Operating range (acc. to EN 61557-14)........... 0.8 s ... 9.9 s
High limits .... 1 s, 5 s
Threshold voltage .... 34 V, 60 V, 120 V
Input resistance .... 48 MΩ
Max. load current (Output = Socket)….. .... 10 A
Automatic disconnection at ULN$_{peak}$ if DUT (Device Under Test) is connected to mains test socket.

Test terminals

Function	Connections
Discharging time External	DISCH1 $\leftrightarrow$ DISCH2
Discharging time Socket	Mains test socket (L,N), TC1

10.12 General data

Power supply
Supply voltage, frequency .... 110 V / 230 V AC, 50 Hz / 60 Hz
Supply voltage tolerance .... ±10 %
Max. power consumption................................... 600 W (without load on mains test socket)
Max. power consumption................................... 4.5 kW (with load on mains test socket)
Mains supply overvoltage category.................. CAT II / 300V
Altitude .... ≤ 2000 m

Measuring categories
DISCH1 / DISCH2 .... CAT II / 600 V
ISO(+) SUB1 / ISO(-) SUB2 .... CAT II / 300 V
P1, C1 / P2, C2... CAT II / 300 V
P/S .... CAT II / 300 V
TC1 .... CAT II / 300 V
Mains test socket.. CAT II / 300 V
Altitude .... ≤ 2000 m

Protection classifications
Power supply .... Class I
HV output... 5 kV a.c. / 6 kV d.c., double insulation
Pollution degree... 2
Degree of protection .... IP 50 (closed case)
………………………………….................... IP 40 (open case)
.... IP 20 (mains test socket)
Case.. Shock proof plastic / portable
INPUTs .... 24 Vmax, earthed
OUTPUTs .... 24 Vmax, earthed

Display .... Colour TFT display, 4.3 inch, 480 x 272 pixels
Touch screen .... Capacitive

Communication
Memory .... depends on microSD card size
RS232 interfaces .... two DB9 ports
USB 2.0... Standard USB Type B
Bluetooth... Class 2
Ethernet .... Dynamic IP (DHCP)
                                                                              Static IP (manual)

I/Os
Inputs .... DB9 connector (24 V max)
Outputs .... DB9 connector (NO relays, 24 V max, 1.5 A max)

Dimensions (w×h×d):....................................... 43.5 cm × 29.2 cm × 15.5 cm
Weight... 8.4 kg

Reference conditions
Reference temperature range: .... 15 °C ... 35 °C
Reference humidity range: .... 35 % ... 65 % RH

Operation conditions
Working temperature range:............................ 0 °C ... +40 °C
Maximum relative humidity:............................. 85 % RH (0 °C ... 40 °C), non-condensing

Storage conditions
Temperature range:.. -10 °C ... +60 °C
Maximum relative humidity:............................. 90 % RH (-10 °C ... +40 °C)
.... 80 % RH (40 °C ... 60 °C)

Accuracies apply for 1 year in reference conditions. Temperature coefficient outside these limits is 0.2 % of measured value per °C plus 1 digit, otherwise noted.

Fuses
2 x T 16 A / 250 V, 32 mm × 6.3 mm / 1500 A (protection of mains test socket)
2 x T 5 A / 250 V, 20 mm × 5 mm / 1500 A (instrument protection)

Appendix A - Structure objects in CE MultiTesterXA

Icon	Default name	Description
	NODE	Node
	PROJECT	Project
	LOCATION	Location
	APPLIANCE	Appliance (short description)
	APPLIANCE FD	Appliance (full description)

Appendix B - Profile Notes

There are no specific profile notes for CE MultiTesterXA MI 3394.

Appendix C - Default list of Auto tests

Pre-programmed Auto test sequences

No.	Name	Description
1	**DEMO_1**	This Auto test is just for demonstration of manipulation of Auto test operation.
2	**DEMO_2**	This Auto test is just for demonstration of manipulation of Auto test operation.

Appendix D - Programming of Auto tests on Metrel ES Manager

The Auto test editor is a part of the Metrel ES Manager software. In Auto test editor Auto tests can be pre-programmed and organized in groups, before uploaded to the instrument.

D.1 Auto test editor workspace

To enter Auto test editor's workspace, select **Autotest Editor** in Home Tab of Metrel ES Manager PC SW. Auto test editor workspace is devided in four main areas. On the left side **❶**,structure of selected group of Auto tests is displayed. In the middle part of the workspace**❷**, the elements of the selected Auto test are shown. On the right side, list of available single tests **❸** and list of flow commands **❹** are shown.
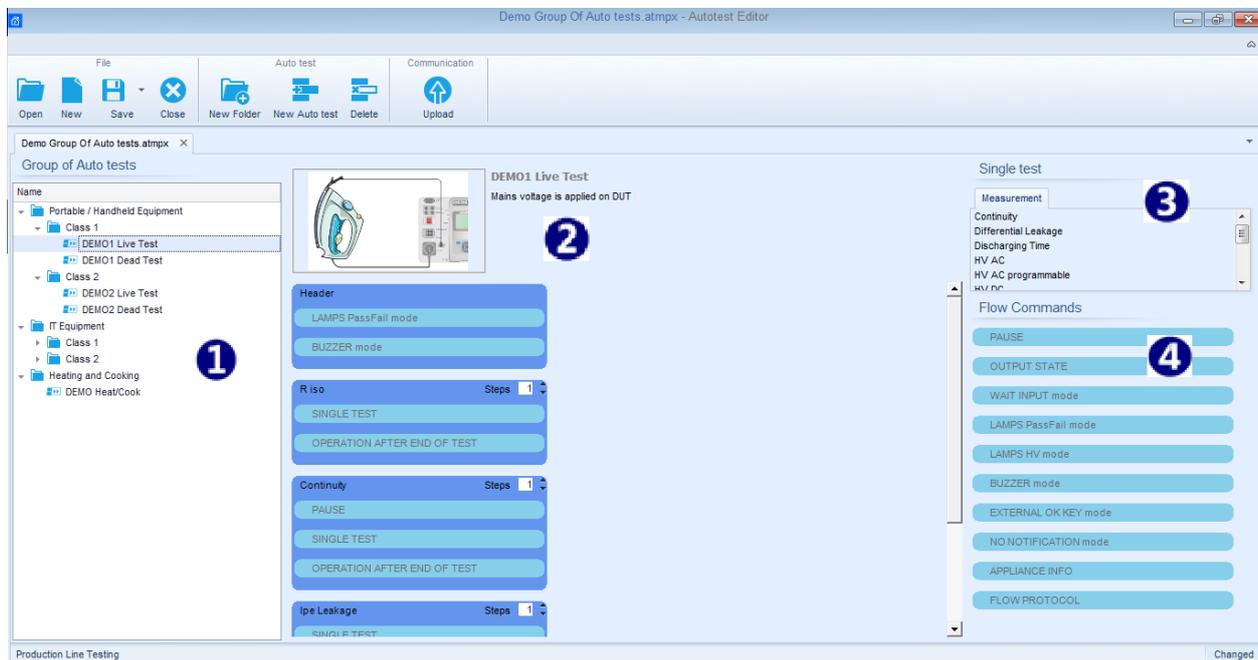

Figure D.1: Auto tests editor workspace

An Auto test sequence**❷** begins with Name, Description and Image, followed by the first step (Header), one or more measuring steps and ends with the last step (Result). By inserting appropriate Single tests **❸** and Flow commands **❹** and setting their parameters, arbitrary Auto test sequences can be created.
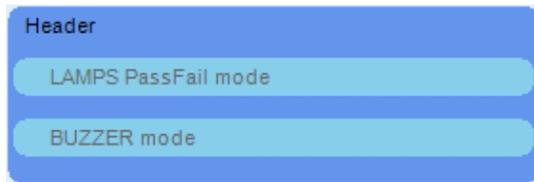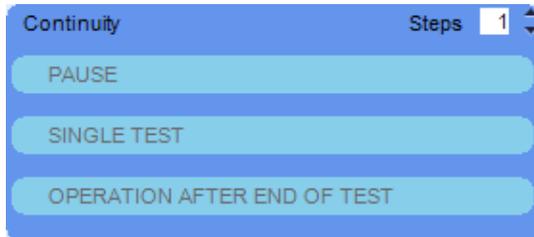
Figure D.2: Example of an Auto test header

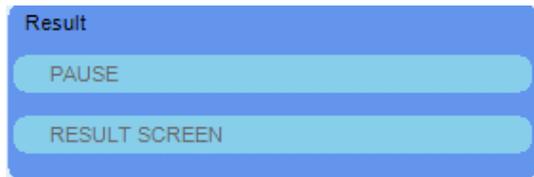**Figure D.3: Example of a measurement step**

Figure D.4: Example of an Auto test result

D.2 Managing groups of Auto tests

The Auto tests can be divided into different user defined groups of Auto tests. Each group of Auto tests is stored in a file. More files can be opened simultaneously in Auto test editor.

Within Group of Auto tests, tree structure can be organized, with folders / subfolders containing Auto tests. The three structure of currently active Group of Auto tests is displayed on the left side of the Auto test editor workspace, see *Figure D.5.*
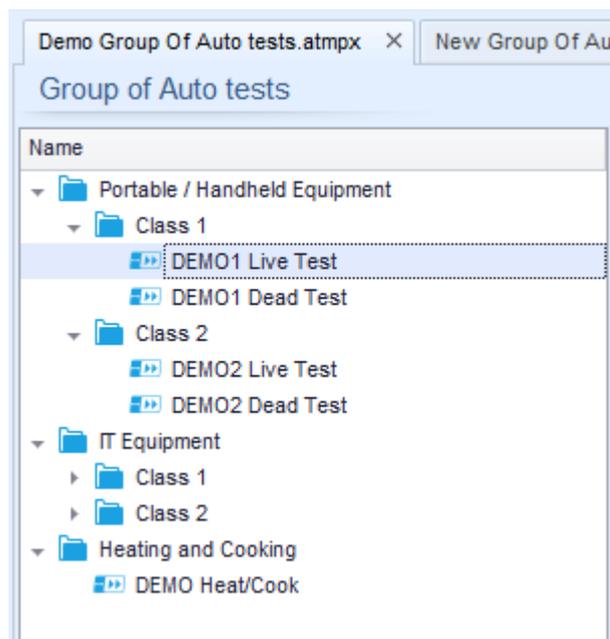

Figure D.5: Group of Auto tests tree organization

Operation options on Group of Auto tests are available from menu bar at the top of Auto test editor workspace.

File operation options:

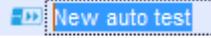|	
📁	Opens a file (Group of Auto tests).
💾 ▾	Saves / Saves as the opened Group of Auto tests to a file.
📄	Creates a new file (Group of Auto tests).
✖	Closes the file (Group of Auto tests).

Group of Auto tests operation options (also available by right clicking on Folder or Auto test):

📁+	Adds a new folder / subfolder to the group
⊞	Adds a new Auto test to the group.
⊟	Deletes: - the selected Auto test - the selected folder with all subfolders and Auto tests

Right click on the selected Auto test or Folder opens menu with additional possibilities:

✏	**Auto test:** Edit Name, Description and Image (see *Figure D.6).* **Folder:** Edit folder name
📄	**Auto test:** Copy to clipboard **Folder:** Copy to clipboard including subfolders and Auto tests
✂	**Auto test:** Cut it to clipboard **Folder:** Cut it to clipboard together with all subfolders and Auto tests
📋	**Auto test:** Paste it to selected location **Folder:** Paste it to selected location

Double click on the object name allows it name edit:

DOUBLE CLICK	**Auto test name:** Edit Auto test name ▪D▪ New auto test **Folder name:** Edit folder name ▾ 📁 Portable / Handheld Equipment

Drag and drop of the selected Auto test or Folder / Subfolder moves it to a new location:

DRAG & DROP	"Drag and drop" functionality is equivalent to "cut" and "paste" in a single move. ➡ move to folder ↪ insert

D.2.1   **Auto test Name, Description and Image editing**

When EDIT function is selected on Auto test, menu for editing presented on Figure *D.6* appear on the screen. Editing options are:

Name: Edit or change the name of Auto test

Description: Any test for additional description of Auto test can be entered

Image: Image presenting Auto test measureing arrangement can be entered or delited;

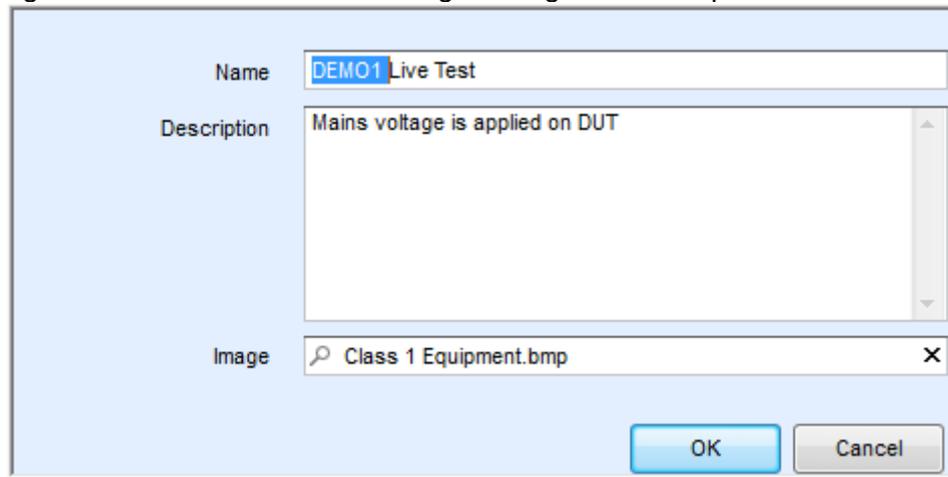by clicking on 🔍 icon menu for browsing to Image location apear on the screen.

Figure D.6: Editing the Auto test Name, Description and Image

D.3 Elements of an Auto test

D.3.1   **Auto test steps**

There are three kinds of Auto test steps.

Header

The Header step is empty by default.

Flow commands can be added to the Header step.

Measurement step

The Measurement step contains a Single test and the Operation after end of test flow command by default. Other Flow commands can also be added to the Measurement step.

Result

The Result step contains the Result screen flow command by default. Other Flow commands can also be added to the Result step.

D.3.2   **Single tests**

Single tests are the same as in Metrel ES Manager Measurement menu.

Limits and parameters of the measurements can be set. Results and sub-results can't be set.

D.3.3　**Flow commands**

Flow commands are used to control the flow of measurements. Refer to chapter *D.5 Description of flow commands* for more information.
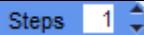
D.3.4　**Number of measurement steps**

Often the same measurement step has to be performed on multiple points on the device under test. It is possible to set how many times a Measurement step will be repeated. All carried out individual Single test results are stored in the Auto test result as if they were programmed as independent measuring steps.
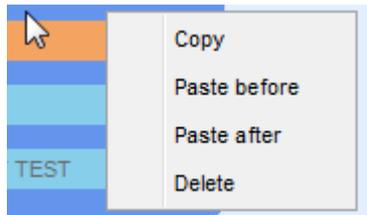
D.4 Creating / modifying an Auto test

If creating a new Auto test from scratch, the first step (Header) and the last step (Result) are offered by default. Measurement steps are inserted by the user.

Options:

Adding a measurement step	By double clicking on a Single test a new measurement step will appear as the last of measurement steps. It can also be dragged and dropped on the appropriate position in the Auto test.
Adding flow commands	Selected flow command can be dragged from the list of Flow commands and dropped on the appropriate place in any Auto test step.
Changing position of flow command within measurement step	By a click on an element and use of 🔺 , 🔻 keys.
Viewing / changing parameters of flow commands or single tests.	By a double click on the element.
Setting number of measurement step repetitions	By setting a number from 1 to 20 in the Steps 1 ⬍ field.

Right click on the selected measurement step / flow command:

	Copy – Paste before A measurement step / flow command can be copied and pasted above selected location on the same or on another Auto test. Copy – Paste after A measurement step / flow command can be copied and pasted under selected location on the same or on another Auto test. Delete Deletes the selected measurement step / flow command.

D.5 Description of flow commands

Double click on inserted Flow Command opens menu window, where text or picture can be entered, external signalling and external commands can be activated and parameters can be set.

Flow commands Operation after end of test and Results screen are entered by default, others are user selectable from Flow Commands menu.

Pause

A Pause command with text message or picture can be inserted anywhere in the measuring steps. Warning icon can be set alone or added to text message. Arbitrary text message can be entered in prepared field Text of menu window.

Parameters:

Pause type	Show text and/or warning (☑ check to show warning icon)
	Show picture (🔎 browse for image path)
Duration	Number in seconds, infinite (no entry)

Output state

Sets outputs OUT_1, OUT_2, OUT_3, and OUT_4 on OUTPUT port.

Following settings of this command are ignored:
- ‣ OUT_1 and OUT_2 while Lamps HV mode is enabled.
- ‣ OUT_3 and OUT_4 while Lamps Pass / Fail mode is enabled.

All outputs are single normally opened relay contacts if not checked in Menu Output pins window.

Parameters:

☑ OUT_1	Set closed relay contact between OUTPUT pins 4 and 9
☑ OUT_2	Set closed relay contact between OUTPUT pins 3 and 8
☑ OUT_3	Set closed relay contact between OUTPUT pins 2 and 7
☑ OUT_4	Set closed relay contact between OUTPUT pins 1 and 6

Wait input mode

Reads input condition on pins IN_2, IN_3, IN_4 and IN_5 on INPUT port. Input must be high to proceed with the Auto test.

Parameters

State	On – enables Wait input mode; set active INPUT from Input pins menu
	Off – disables Wait input mode
☑ IN_2	IN_2 reading condition on INPUT pin 6 is active
☑ IN_3	IN_3 reading condition on INPUT pin 7 is active
☑ IN_4	IN_4 reading condition on INPUT pin 8 is active
☑ IN_5	IN_5 reading condition on INPUT pin 4 is active

Lamps HV mode
Drives external lamps through OUT_1 and OUT_2 outputs. Works only in HV & HV programmable functions.
‣ Red lamp (OUT_1) ON means that the instrument is ready for HV test. Red lamp turns on before first flow command in step that contains HV test. Red lamp turns off after end of the HV test.
‣ Green lamp (OUT_2) blinking means that high voltage will be applied to WITHSTANDING (HV(~+) and HV(~-)) test terminals as soon as all input conditions will be fulfilled.
‣ Green lamp (OUT_2) ON means that dangerous voltage is present at WITHSTANDING (HV(~+) and HV(~-)) test terminals. Green lamp turns on before the measurement and turns off after the measurement.
While Lamps HV mode command is enabled the settings of Drive output command for OUT_1 and OUT_2 is ignored.

Parameters

State	On – enables Lamps HV mode
	Off – disables Lamps HV mode

Lamps Pass / Fail mode
Drives external lamps through OUT_3 and OUT_4 outputs.
During measurement the lights reflect status icon in single test.
After measurement
‣ Blue lamp (OUT_3) lights ON when test has passed. Lamp is lit until next step is started.
‣ Yellow lamp (OUT_4) lights ON when test has failed. Lamp is lit until next step is started.
‣ Lights turn off at the beginning of next step.
While Lamps Pass / Fail mode command is enabled the settings of Drive output command for OUT_3 and OUT_4 is ignored.

Parameters

State	On – enables Lamps Pass / Fail mode
	Off – disables Lamps Pass / Fail mode

Buzzer mode
Passed or failed measurement is indicated with beeps.
‣ Pass – double beep after the test
‣ Fail – long beep after the test
Beep happens right after single test measurement.

Parameters

State	On – enables Buzzer mode
	Off – disables Buzzer mode

External TEST / OK key mode
Instrument enables external TEST / OK key (OK / ENTER / TEST / HV TEST) by activating INPUT pin 5 reading condition. Functionality of the EXTERNAL OK KEY mode is the same as of the OK / ENTER / TEST / HV TEST key.

Parameters

State	On – enables External TEST / OK key mode (INPUT pin 5 is active)
	Off – disables External TEST / OK key mode

No notifications mode
Instrument skips pre-test warnings (see CE MultiTesterXA User Manual, chapter *4.4 Symbols and messages* for more information).

Parameters

State	On – enables No notifications mode Off – disables No notifications mode

Appliance info
Instrument enables to automatically add the appliance name to the Auto test.

Parameters

Repeat Setting	Repeat:	The same Appliance ID will be offered each time if the same Auto test is carried out successively in a loop.
	Increment:	A four digit number will be added to the Appliance ID and incremented each time if the same Auto test is carried out successively in a loop.
Appliance type	Selects the type of the appliance (Appliance, Appliance_FD)	
Default Appliance ID	Enter default Appliance ID	

Note
   ‣   This flow command is active only if Auto test is started from the Auto test Main menu.

Flow Protocol

This flow command controls commands for communication with external device for the control of the flow of Auto tests.

Parameters

Communication settings	Selects the port for communication with the external device.
	   - RS232(PC)
	   - USB		

Flow settings	Commands for communication with external device (industrial PC for example)		
	☑ Proceed	Send string: **Proceed** Description: If Proceed Flow setting is enabled, implementation of Auto tests on instrument can be automatically controlled by external device by using **Proceed** string command. Command works in parallel with OK / ENTER / TEST / HV TEST keys and the EXTERNAL TEST / OK key mode. Proceed Flow setting is disabled by default.	

	☑ End + Status	Recived strings: **End - pass**
		                    End - fail
		                    End - none
		                    End - empty
		
		Description: Instrument sends string to external device at the end of each Measurement step. End + Status Flow setting is disabled by default.	

	☑ Alarm	Recived string: **Alarm** Description: Instrument sends "Alarm" string to external device if "empty" status is detected and if both conditions - "Fail" status at the end of measurement step and flow command OPERATION AFTER END OF TEST – fail is set to "manual". Alarm Flow setting is disabled by default.

Operation after end of test
This flow command controls the proceeding of the Auto test in regard to the measurement results.

Parameters

Operation after end of test – pass – fail – no status	The operation can be individually set for the case the measurement passed, failed or ended without a status.	
	Manual:	The test sequence stops and waits for apropriate command (TEST key, external command...) to proceed.
	Auto:	The test sequence automatically proceeds.

Result screen
This flow command controls the proceeding after the Auto test has ended.

Parameters

☑ Local Save	Auto test is stored in the momentary workspace. A new Node with the date and time will be created. Under the Node results of the auto test or (if Appliance info flow command is set) a new appliance and the results of the auto test will be stored. Up to 100 results of auto test or appliances can be automatically stored under the same node. If more results / appliances are available, they are split to multiple nodes. Local Save Flow setting is disabled by default. **Notes** ‣ This flow command is active only if Auto test is started from the Auto test Main menu (not from Memory organizer).