Manual

Hipot Safety Analyser KT 6780H, KT 6680U

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1 General Information

1.1 Information on this operating manual

This operating manual is part of the technical documentation for the hipot safety analysers KT 6680 / KT 6780 of SPS electronic GmbH.
This operating manual contains all the information on how to operate this device properly, safely and economically, how to prevent dangerous situations, how to reduce repair costs and downtimes and how to prolong the service life of these devices.

Should you, while perusing this operating manual, find any misprints, any information you do not understand or which are incorrect please do not hesitate to inform SPS electronic GmbH about same.

Pictographs and Symbols

- **Warnings** are characterized by warning triangles with danger symbol and warn of dangers which can lead to personal injury and/or material damage:

General Warning

Danger caused by electric current or voltage

- **Information** on same are characterized by the Information Pictograph and give advice or additional information:

You can order accessories directly from *SPS electronic GmbH*.

- **Continuations** of contextual paragraphs on the next page are characterized by the symbol on the right-hand margin.

1.2 Requirements for the operation of this device

1.2.1 Regulations for application

The tester must be in an operational and reliable condition.

Only personnel having completely read and understood this operating manual and who are authorized skilled electricians or who have been instructed in electrical engineering are allowed to perform any operations with and at the testers.

The tester is not to be operated if or for:

- operations are performed which are not specified in this operating manual or which have not been recommended by SPS electronic GmbH concerning installation, operation, maintenance and service.
- unauthorized alterations and/or repairs
- dismantling and/or avoiding of safety devices
- use of components, tools, additional installations, supplements and working material which have not been approved or recommended by SPS electronic GmbH
- building in of spare parts which are not original SPS electronic GmbH spare parts or of spare parts from suppliers not recommended by SPS electronic GmbH

1.2.2 Product liability

The testers have been produced, adjusted and tested according to the state of the art and the approved safety requirements.
The devices comply with the conditions agreed upon by contract of the confirmation of order concerning execution, single parts and accessories selection.

SPS electronic GmbH will be liable for errors or omissions to the extent of the guarantee liabilities of the confirmation of order.
Applicable are the general conditions of delivery of the Central Association of Electrical Engineering and the Electronics Industry, registered association (ZVEI).

The contents of this operating manual is in compliance with the condition of the tester on the date when same was drawn up.
Subject to change are technical alterations because of further developments and improvements of these products by SPS electronic GmbH.
Liability claims can therefore not be derived from the contents of this operating manual (data, descriptions, graphs, misprints, etc.).

Errors and omissions excepted!

SPS electronic GmbH will only be liable in case of application of the testers according to regulations (pl. see 1.2.1).
If those regulations have not been applied the operator is solely responsible for risks of hazard to body and life of the user or a third party and impairments of the tester and other material assets!

1.3 General safety regulations

The safety tester KT 6680 / KT 6780 has been manufactured according to the state of the art at the time of delivery.

Nevertheless the tester is not without hazards if it is applied by untrained personnel, applied improperly or not applied according to regulations.

In addition to this operating manual the generally applicable legal regulations and other binding instructions concerning safety regulations, regulations for preventing accidents and regulations for the protection of the environment must be adhered to.

Beware of high electronic voltage and electromagnetic fields

In case of defective test objects, like e.g. arc-overs, there can occur electromagnetic fields. This is of particular concern to persons with active or passive medical devices, like e.g. cardiac pacemaker.

1.3.1 Obligations of the operator

- The tester is only to be operated according to regulations and in operational condition (see chap. 1.2.1)
- Protective and safety devices, locking devices and couplings, etc. have to be inspected by an expert at least once a year.
- A protocol on the test results has to be drawn up in form of a **test report** same has to be retained.
- Instructions on operations with or at a machine or installation as to hazards to health and/or life of persons are obligatory.
- Persons who operate with or at an KT 6680 / KT 6780 have to confirm by their signature to have read and comprehended this operating manual especially in regard to the operating instructions.
- Dangerous zones resulting from the integration of the tester into a system or a device have to be located by the operator and safeguarded against.
  When assembling or installing devices, systems or items of equipment of different manufacturers or suppliers and after modifications by company or service personnel where changes within the electric equipement were made the operator has, before putting into operation, to perform a precise inspection according to the accident prevention regulations DGUV 4 in compliance with the individually applicable rules of electrical engineering.

1.3.2 Operating instructions for personnel

- Operating instructions, general instructions and regulations are part of the tester and have to be accessible, readable and complete for all those who operate with or at the KT 6680 / KT 6780.
- Before operating with or at the KT 6680 / KT 6780 questions have to be answered or uncertainties have to be explained by the personnel in charge.
- Any operations with or at the KT 6680 / KT 6780 may only be performed by workers skilled in electrical engineering or trained in electronic engineering and who have been given instructions for such operations and thus been authorized by the operator.
- Testing personnel may only operate the KT 6680 / KT 6780 when a skilled electrician is in charge.
- Adjustments, service and inspections have to be performed according to the instructions specified and according to schedule.

1.3.3 Safety installations

The KT 6680 / KT 6780 testers are, for the safety of the operating personnel, equipped with below safety equipment:

- Differential current safety cutoff (similar to an RCD) for Insulation and Hipot test (tripping threshold at > 3 mA rms, switch-off speed 6000 V → 50 V < 100 µs)
- protective low voltage for protective wire test
- 16 A fuse for current path of function test
- connection for external safety circuit signal

Capacitive DUTs and DC high voltage

When testing with DC high voltage, capacitive DUTs are getting charged. At the end of an insulation test or HV-DC test, the test object is discharged, the PASS / FAIL signal is output only after the end of the discharge. That's why tests with DC high voltage always have to go through to the end in a controlled manner. If the contact is prematurely disconnected (or if the tester is switched off, mains voltage failure, etc.), the test object is not discharged and may still be charged with dangerously high energy!

If such conditions are met by appropriate DUT types, the personal safety measures according to EN 50191 must be observed!

1.3.4 Note on possible disorder of USB devices

When testing with high-voltage, it is possible that failing testpieces may cause disorder of USB devices in close surrounding of the test field.

Please see annex C for a problem description, and measures to avoid.

1.3.5 Information on further publications

For the protection of persons the trade associations and unions have published below literature:

• DIN EN 50191	Installation and Operation of Electrical Installations
• DIN EN 50274	Protection against Electric Shock – Protection against unintended direct contact of dangerous active parts
• DIN 40 008 part 3	Safety Signs for Electrical Engineering; Warning Signs and Additional Signs
• DIN 40 050	IP-Protective System, Protection against Contact, Foreign Matter and Water for Production Equipment
• DIN 57100	Specifications for the Installation of Power Plants with Nominal Voltages of up to 1000 V
• DGUV 203-034	Establishing and operation of electrical test plants

2 Description

2.1 Device functions

You can perform safety tests at electric devices according to standard test regulations (EN, IEC, VDE etc.) with the safety tester KT 6680 / KT 6780.

Below tests can be performed:

	KT 6680U	KT 6780H
GB: Ground bond test	1 – 32 A AC	1 – 32 A AC
RES: Resistance test	1 Ω – 100 kΩ	1 Ω – 1 MΩ
IR: Insulation resistance test	100–6000 V DC / 20 mA	100–6000 V DC / 20 mA
HPAC: Highpot test AC	100–5500 V AC / 20 mA	100–5500 V AC / 20 mA
HPDC: Highpot test DC	100–6000 V DC / 20 mA	100–6000 V DC / 20 mA
FP: Function power test	–––	Via external supply, 120/230 V / 16 A
LC: Leakage current test	–––	100 – 270 VAC / 10 mA

The test device works with a fully electronic high-voltage generator. The high voltage is readjusted fully automatically during the test operation, depending on the load, once the test voltage has been correctly adjusted.

If the voltage change is too fast (> 2% per full wave), the voltage drop will be recognized as an error.

2.2 Technical Data

Measurements and weights	
Width / depth / height	ca. 482 / 439 / 133 mm (19" / 3 HU)
weight	ca. 20.4 kg

Ambient	
temperature	operation: 15 °C – 40 °C (allowed for general operation) storage: 5 °C – 60 °C
Air humidity	max. 70 % (non-condensing) (allowed for general operation)
ambient conditions to comply with the stated technical specifications	24 °C (± 3 °C) and max. 50% relative air humidity (not condensing) Start-up time after switching on: 15 minutes until limit values are fully reached.

Connection data	
Power supply	wide range 110-230 V / 50-60 Hz
Power input	ca. 240 VA typical / 2 A fuse

RES Test (Resistance Test)			
Test voltage / current	8 V DC / 10 mA		
Thresholds	1 Ω – 1 MΩ		
Measuring range KT 6780H: KT 6680U:	**range** 1.0 Ω – 1.00 MΩ 1.0 Ω – 100 kΩ / 1 kΩ*)	**Resolution (2/3 digits)** 0.1 / 1 / 0.01	**accuracy** 5% of meas.value ±1 digit
Continuity test	Fix 14 Ω – 100 kΩ = PASS (<14 Ω ⇒ short circuit / >100 kΩ ⇒ not connected)		

*) only 1 kΩ if PE probe is connected to the device

GB Test (Ground Bond Test)						
Test current	Programmable from 1 to 32 A AC, stepsize 1 A, output +1% +0.1 A, accuracy display ± 1.5%					
No-load voltage	6 V AC					
Thresholds	programmable, current- dependent up to max 6 Ω					
Measuring range current	**range** 32 A	**resolution** 0.01 A	**accuracy** 1% of meas.range ±1 digit			
Measuring range resistance	**range** 1 mΩ – 600 mΩ 600 mΩ – 6.00 Ω	**resolution (3 digits)** 1 mΩ 1 mΩ / 10 mΩ	**accuracy** 2% of meas.value ±1 digit 5% of meas.value ±1 digit			
Max. thresholds, current dependent	Current:	1 A	10 A	20 A	25 A	30 A
	Resistance:	6 Ω	600 mΩ	300 mΩ	240 mΩ	200 mΩ

LC Test (Leakage Current test) acc. EN60990 / fig. 3			
Test voltage	programmable from 100 up to 270 V AC, 50/60 Hz		
Short circuit current	≤ 100 mA AC		
Measuring range current	**range** 0 to 10 mA AC	**resolution** 0.01 mA	**accuracy display** 1% of meas.range ±1 digit
Measuring range voltage	**range** 0 to 270 V	**resolution** 1 V	**accuracy display** 1.5% of meas.range ±1 digit

IR Test (Insulation Resistance Test)			
Test voltage	programmable from 100 up to 6000* V DC residual ripple DC: < 3% acc. VDE 0432 / EN 61180		
Short circuit current	20 mA DC		
Limit value	Voltage dependent, max. 10 GΩ / kV		
Measuring range resistance	**range (automatic)** 100 kΩ - 50.0 GΩ **accuracy (of value)** ***(for pure ohmic load)*** 5% ±1 digit 10% ±1 digit	**resolution** 3 digits **in range** 1 GΩ/kV 10 GΩ/kV	
Measuring range voltage	**range** 600 V 6000 V	**resolution** 1 V 1 V	**accuracy** 1% of meas.range ±1 digit 0.5% of meas.range ±1 digit

** with capacitive load there is a chance for overshoot or that correct discharge cannot be guaranteed.*

HV Test (High Voltage Test)			
Test voltage	programmable from 100 up to 5500* V AC programmable from 100 up to 6000* V DC residual ripple DC: < 3% acc. VDE 0432 / EN 61180		
Short circuit current	20 mA AC / 20 mA DC		
Measuring range current	**range** 0 – 400 µA DC 20 mA DC 5 – 400 µA AC 20 mA AC	**resolution** 0.01 µA 0.01 mA 0.01 µA 0.01 mA	**accuracy** 0.5% of meas.range ±1 digit 0.25% of meas.range ±1 digit 1.5% of meas.range ±1 digit 2.5% of meas.range ±1 digit
Measuring range voltage	**range** 550 VAC / 600 VDC 5500 VAC / 6000 VDC	**resolution** 1 V 1 V	**accuracy** 1% of meas.range ±1 digit 0.5% of meas.range ±1 digit

** with capacitive load there is a chance for overshoot or that correct discharge cannot be guaranteed.*

FP Test (Functional Power Test)			
Test voltage	External supply: up to 250 V AC 50/60 Hz (1 phase) / up to 200 V DC		
Maximum current	max. 16 A AC max. 10 A DC		
Measuring range: Current	**range** 0 – 3 A 0 – 16 A	**resolution** 0.01 A 0.1 A	**accuracy** 1.5% of meas.range ±1 digit 1.5% of meas.range ±1 digit
Measuring range: Voltage	**range** 0 – 400 V	**resolution** 1 V	**accuracy** 1.5% of meas.range ±1 digit
Measuring range: Power factor (Cos Phi)	**range** 0 – 1	**resolution** 0.01	**accuracy** 2% of range ±1 digit

** The other values are calculated from these measured values.*

I/O Test		
Inputs 1 – 4	input voltage: supply V+ : input resistance:	24 V DC ± 10% to PIN 7 – 10 +24 V at PIN 11+12 6.6 kΩ
Outputs 1 - 4	output voltage: supply GND: output current: *potential free to test voltage and internal supply, short-circuit protected*	+24V ± 10% on PIN 1 - 4, GND on PIN 5+6 max. 2.4 A per output / max. 2.4 A total

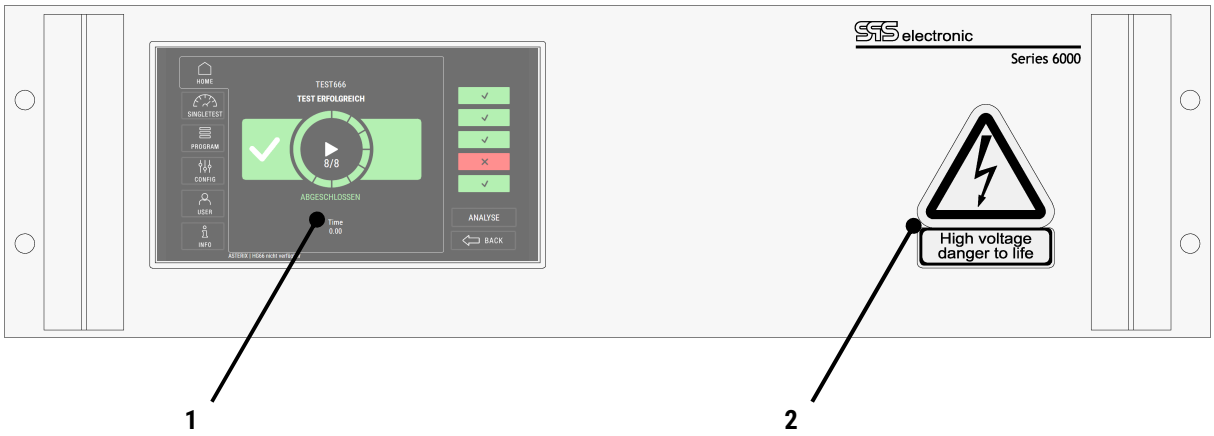
** Inputs / Outputs are typically supplied by V+ / GND.*

Features

- A multi-functional safety analyzer for safety testing in accordance with common national and international standards (IEC, EN, UL, VDE, etc.)
- 19" plug-in unit, with integrated LC touch display
- 7" TFT colour display 1024x600 pixels
- Operation with capacitive touch
- USB 2.0 interface
- Ethernet 10/100/1000 MBit
- 1GHz 32bit Dual-Core CPU + GPU with 512 MByte RAM
- 1GB internal storage

2.3 Set-up of device

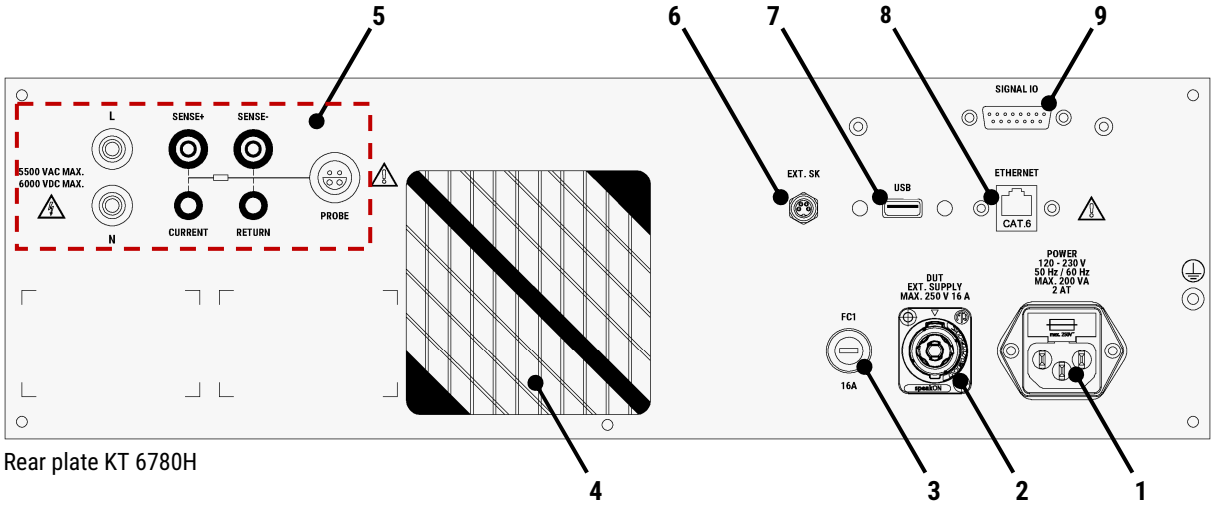
2.3.1 Front panel



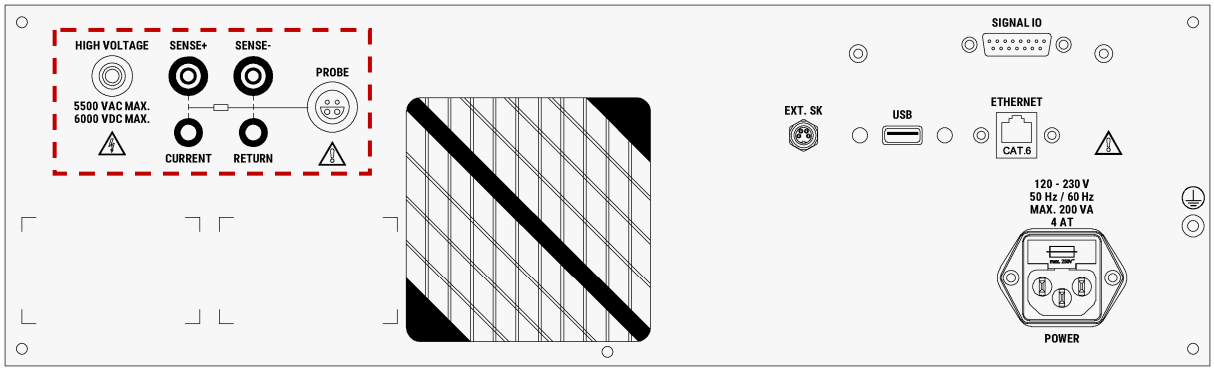
1 LC touch display – *the touch display provides easy & comfortable user interaction.*

2 warning sign – *mandatory warning note: beware of high voltage*

2.3.2 Rear panel



Rear plate KT 6780H



Rear plate KT6680U

1 Default appliance plug IEC-60320 C13 for device supply (POWER)

2 Neutrik powerCon® connector for power input for Functional Power Test (DUT EXT SUPPLY)

3 16 A fuse 6,3 x 32 for DUT supply, safeguarding the external DUT supply (FC1)

4 ventilation grid – keep free of obstruction!

5 Connection field for DUT connection:

PROBE	–	conn. socket for PE probe HIGH current lead (pe b)
RETURN	–	4mm connector for HIGH current lead (pe b)
CURRENT	–	4mm connector for LOW current lead or high voltage low potential (pe a / HV−)
SENSE+	–	4mm connector for current sense+ (pe b')
SENSE-	–	4mm connector for current sense− (pe a')
L, N	–	4mm safety connector for functional power and leakage current tests *– only KT 6780H*
HIGH VOLTAGE	–	4mm safety connector for high voltage tests (HV+) *– only KT 6680U*

6 M8 connector 4-pin female, for external safety input (EXT. SK)

7 USB 2.0 A connector for keyboard/mouse or USB storage (USB)

8 RJ45 connector for remote control and access via ethernet/LAN (ETHERNET)

9 D-SUB connector 15-pin female, for digital IO's (SIGNAL IO)

3 Putting into operation

3.1 Requirements

The testers KT 6680 / KT 6780 as well as all of the electric connections and lines must be in operational and reliable condition.
The General Safety Regulations (pl. see chapter 1.3) and the generally applicable legal rules as well as other binding directives for industrial safety, for accident prevention and for the protection of the environment have to be adhered to and persons staying in the area of operation must be informed respectively.

There is danger to life caused by electric current or voltage in case of handling electric installations inappropriately!

If a function test is performed with the KT 6680 / KT 6780 the supply function voltage has to be protected by an external fault-current circuit breaker!

3.2 Connection of device

1. plug power cable of tester into cold equipment socket (POWER) at back of device
2. connect power cable to power supply
3. If provided for, connect external devices to interfaces
4. In case that hardware safety circuit (socket EXT-SK) is not actually getting used, the respective jumper plug must be plugged here.

As long as EXT.SK is not wired, testing is not possible with the KT 6680 / KT 6780!
(Because the safety circuit is not closed.)

3.3 Switching the device on / off

The testers KT 6680 / KT 6780 are designed for system operation and do not have a power switch. The devices are starting up when they are supplied with mains voltage (booting of internal operating system takes approx. 10 sec), after that the devices are ready to operate.

Switching off of the testers is simply done by removing mains supply/voltage.

In case of tests with high voltage (IS- and HV-test) the DUT has to remain connected until a test result is displayed. At the end of the test time the DUT is discharged.
If the KT 6680 / KT 6780 is switched off prematurely, the DUT cannot be discharged!

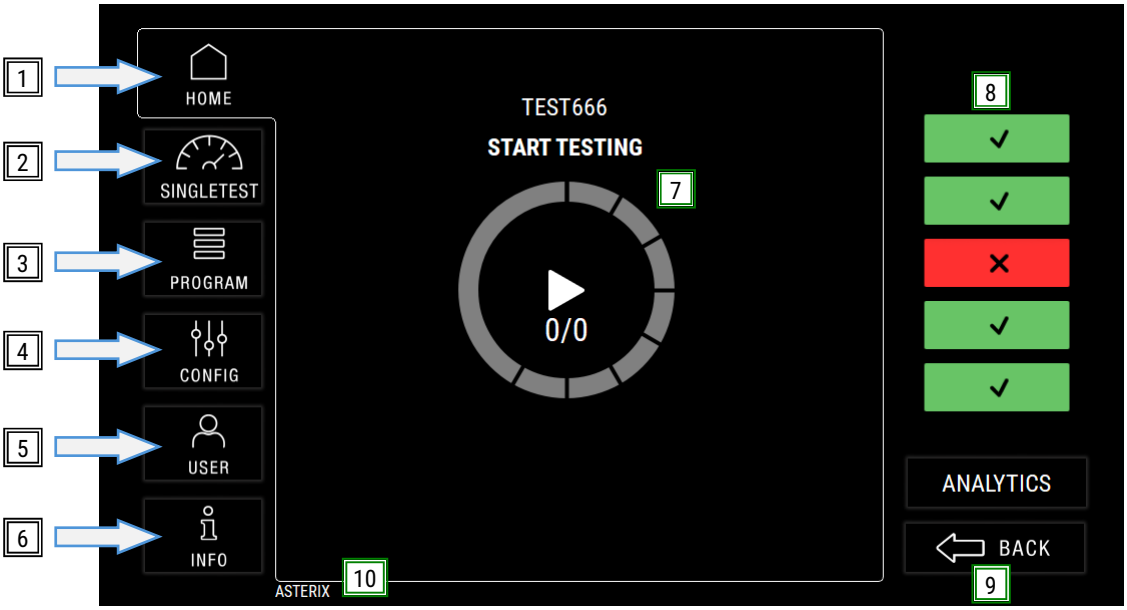
4 General Operation

4.1 Operating elements

All operations are carried out via the device's touch screen. If you want to push a function-button, switch between registers, chose an element out of a list – just touch the wanted element with your finger.

When entering parameter values or text, a virtual QWERTY or numerical keyboard is shown on the display, where you can enter numbers and characters as required.

4.2 Start Screen / Main Menu



After the user-login, the device is showing the start screen with the latest used program active. You can immediately start testing by pushing the START triangle ▶ in the middle of the screen.
To choose another test program, touch the symbol "PROGRAM" on the left. It will show a list of all test programs saved in the device, and you simply touch the program you want to use next.

(1) HOME – the start screen where testing operation takes place.

(2) SINGLE TEST – Execution of single test steps without the need to create a test program.

(3) PROGRAM – opens the program editor where test programs can be created or modified. Also, switching to another test program is done from here.

(4) CONFIG – opens the options dialog where general system settings can be made.

(5) USER – opens the user administration where users and passwords can be administrated.

(6) INFO – shows the info screen with basic information about the device.

(7) (Test wheel) – shows the actual status and progress of a running test.

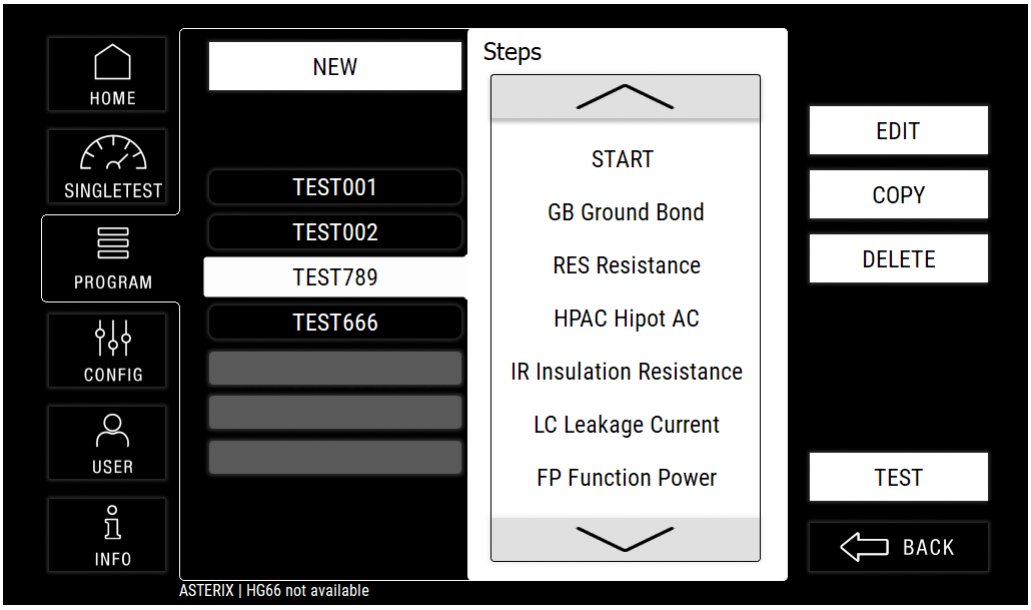
(8) (result bars) – they show the status/results of the past tests that have been done.

(9) BACK – Goes back from the current sub-menu to the previous menu, or back to the HOME screen.

(10) – name of the logged-in user, if user management is enabled.

4.3 Changing the Test Program

To switch to another test program, tap on the item "PROGRAM" at the left. This will bring up the test program list:



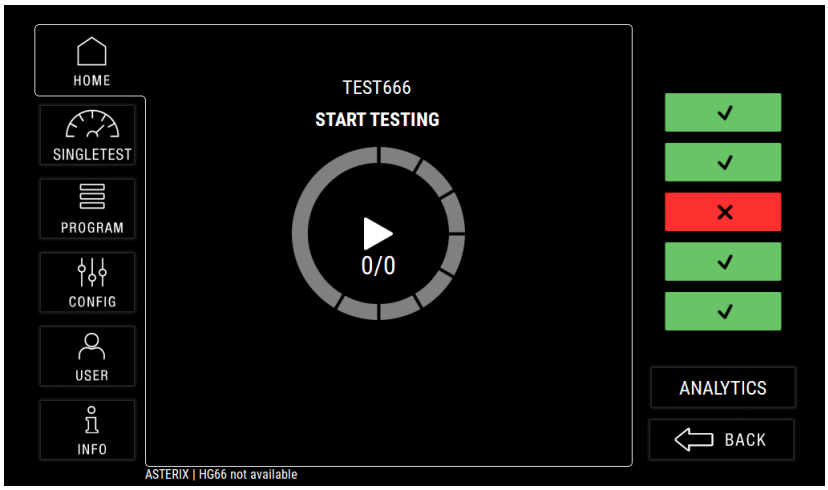
From the program list, select the test program you want to use next, then tap on the button "SELECT". The test program is loaded active, and you'll be automatically back at the "HOME" screen to start with testing.

5 Testing Operation

5.1 Outline

- **Connecting the DUT**
  When using a connection box (e.g. "A3"), just put the DUT's mains plug into the power socket of the box. All electrical tests will now be executed via the DUT's mains supply.
  If required by the actual test norm, and/or if you need to test device parts that are not reachable via the mains connection, the DUT can also be contacted manually. At the rear of the KT 6680 / KT 6780, there are connectors with all electrical outputs for custom test connections.

- **Loading of test program**
  After loading a test program (see previous page), the program is shown in the start screen:



- **Start of test**
  To run the test program, touch the START triangle ▶ in the middle of the test wheel.

- **Test step process**
  The test steps are consecutively carried out with their programd parameters.
  Depending on test step and set start control the single steps will start automatically or when contacting DUT or after activating start control.
  While one test step is in process the current measuring values are displayed. (See figures on next page.)

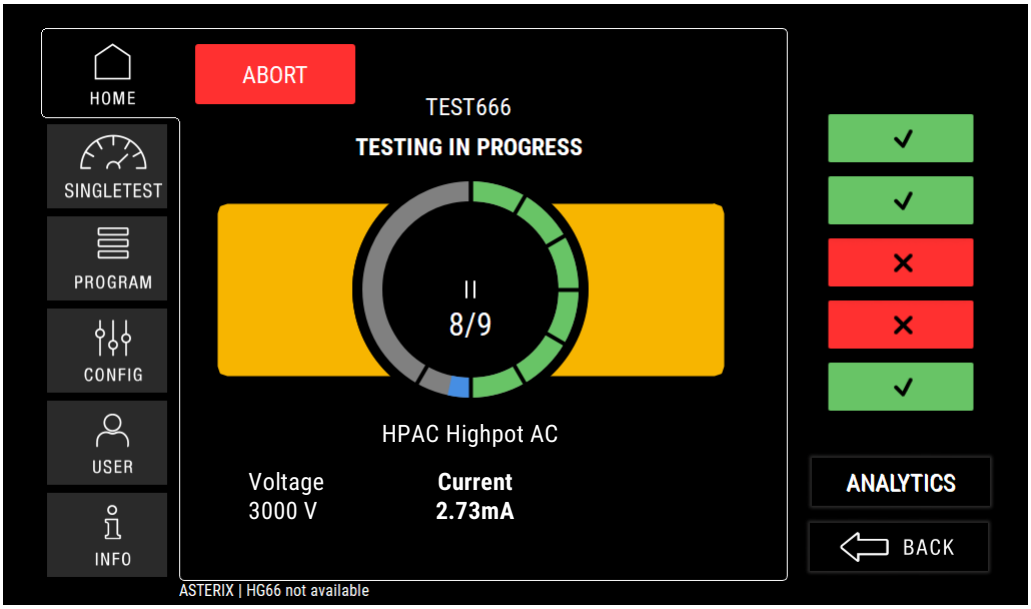
- **Test step result**
  If a test step ends with PASS, the next step will start immediately.
  If a test step ends with FAIL, then:
  - the test process is stopped.
  - the test's status bar is colored red and marked with an [X].

- **Test result**
  If all test steps resulted in PASS, the complete test result is PASS.
  The device will show the start screen again, with the last test's status bar colored in green, to indicate that the last test run was good.
  If the result of any one test step was FAIL, the complete test result is FAIL.
  The device will show the start screen again, with the last test's status bar colored in red.
  In the manual test mode you can now either
  - immediately start the next test with START key, or
  - examine the measuring values of the test process (pl. see chpt.5.4, p.21)

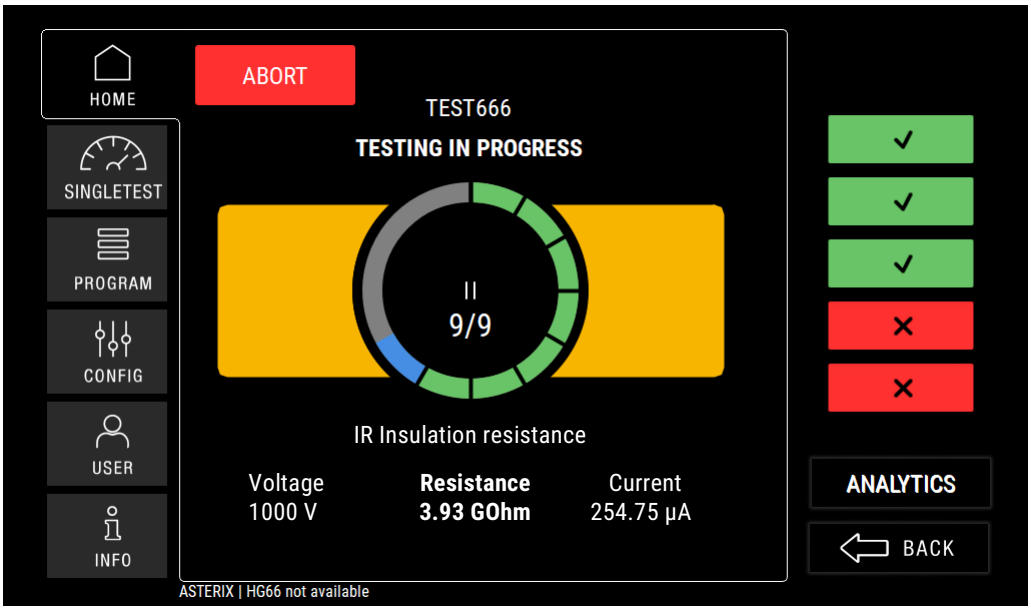
5.2 Screen display during a test step

When a test step is running, all important data is shown on the screen:
- successfully ended test steps are marked in GREEN in the test wheel
- the progress of the actually running test step is shown in BLUE
- below the test wheel, the actual test values and measurements are displayed.

E.g. Hipot test AC:



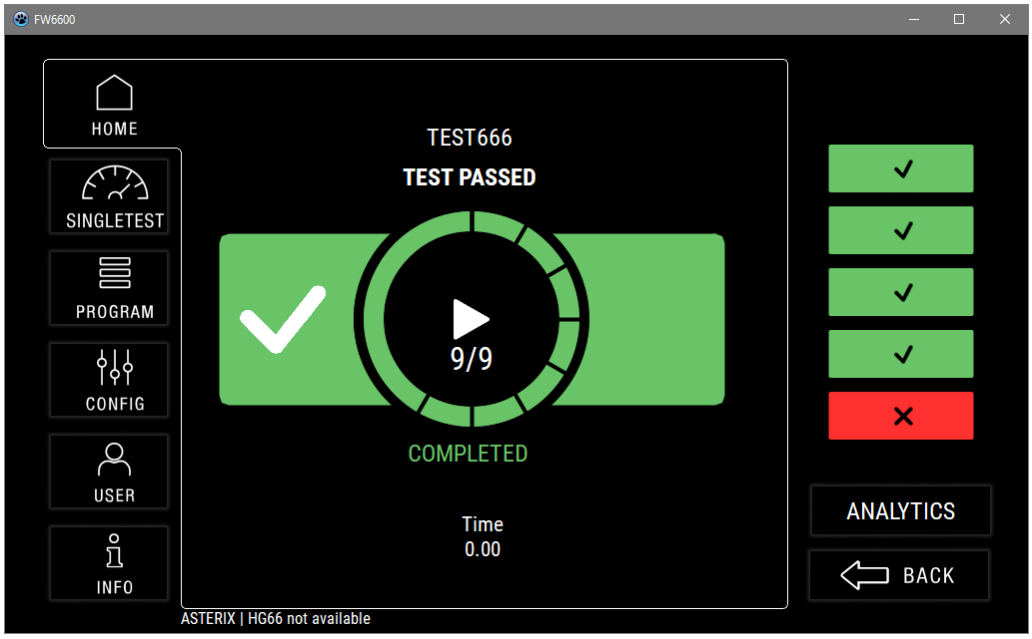
E.g. Insulation resistance test:



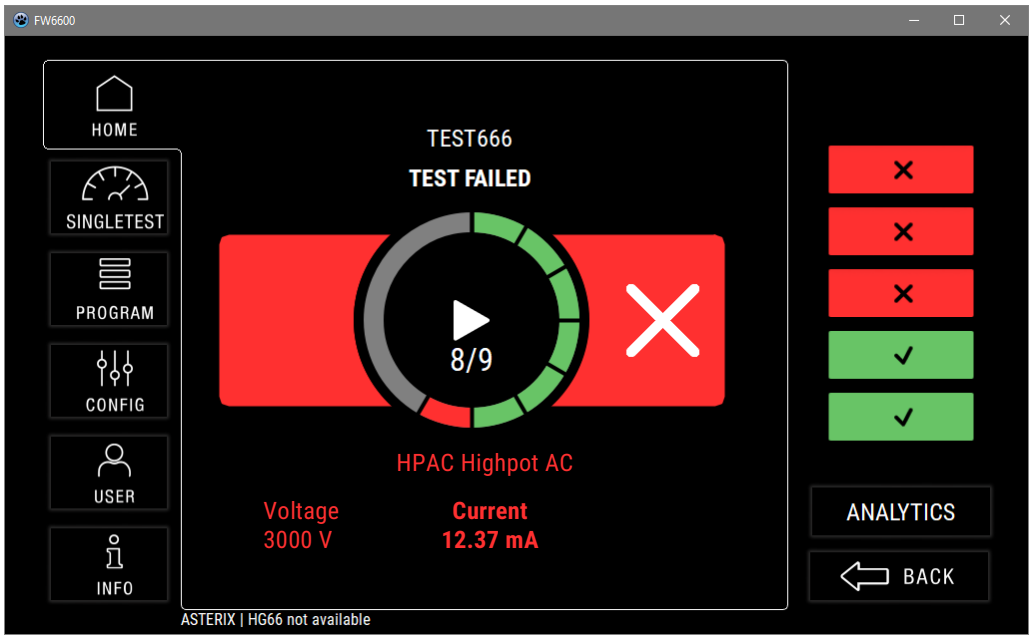
5.3 Display of PASS/FAIL Test Runs

When a test run has finished with result PASS, or if any test step did FAIL, this result is immediately shown with a green resp. red background sign.

E.g. test result PASS:

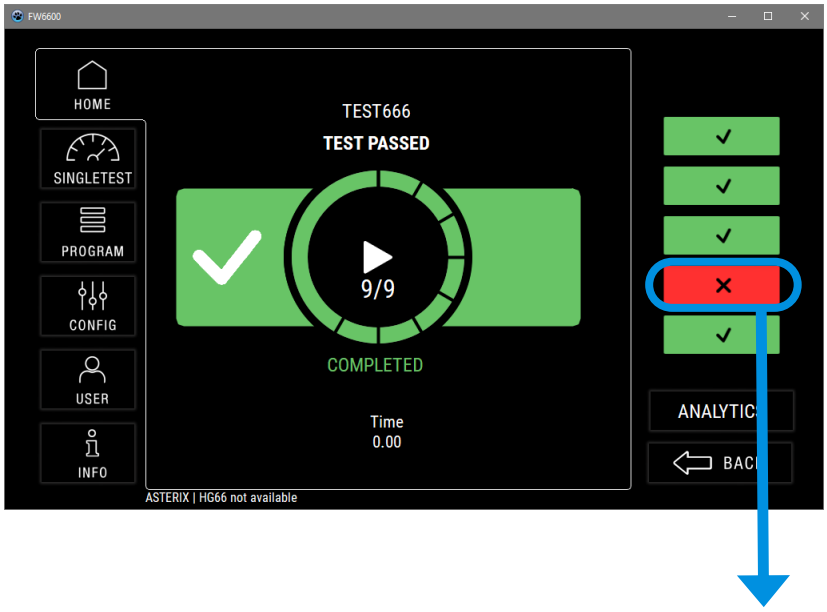


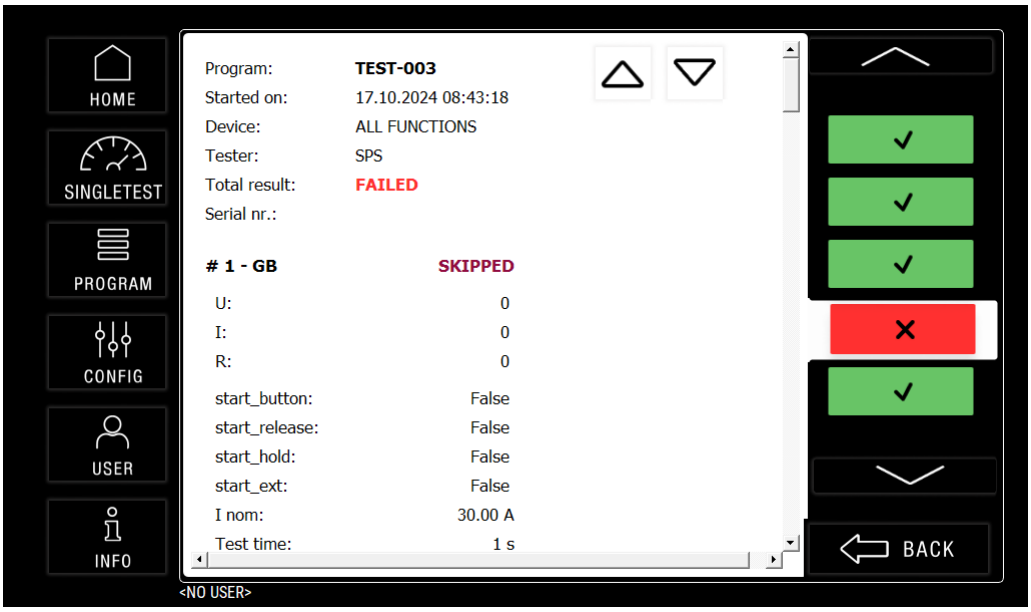
E.g. test result FAIL:



5.4 Reviewing Test results

When a test run has finished and the device is showing the start screen again, the status/result bars on the right side can be used to review the results of the latest test run(s):





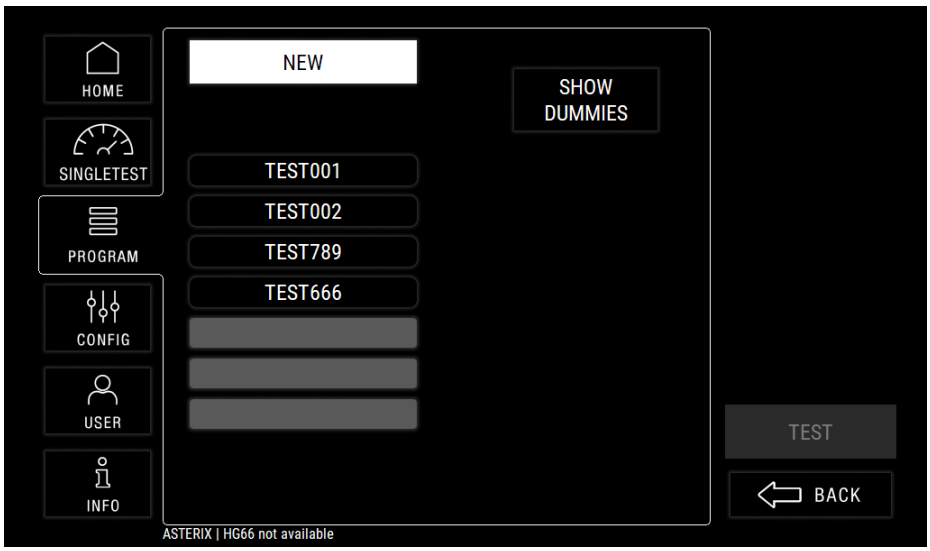
6 Creation of test programs

6.1 General information

Due to the functionality of the test programs of the KT 6680 / KT 6780 complex test processes can be realized comfortably. Administration and organisation of various programs for different DUT types can be carried out without problems.
The created test programs are filed internally in a non-volatile memory and remain filed even if the device is completely cut off from power supply.

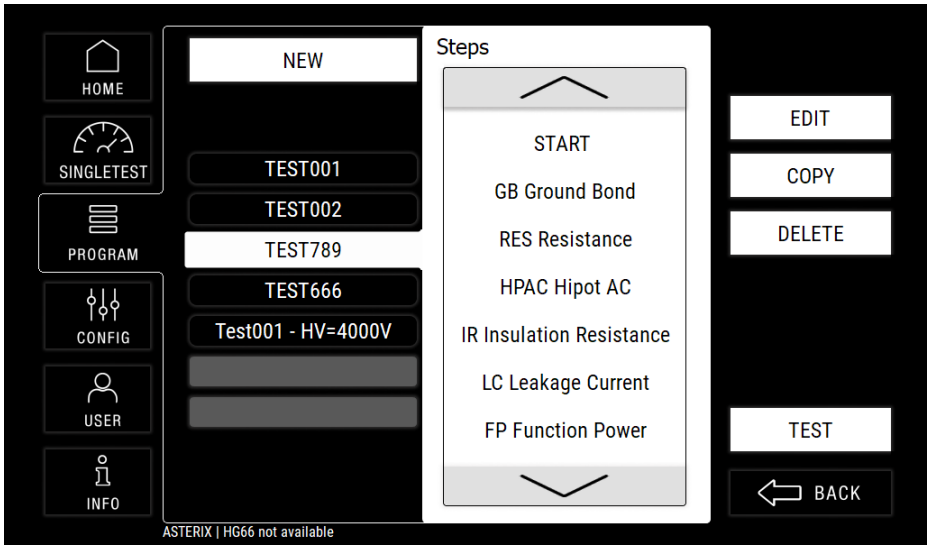
6.2 Managing of test programs

To create a new test program or to edit existing test programs, the "PROGRAM" module is used. When calling the module, you see the list of all test programs, and a "NEW" button to create a new test program:



"Show Dummies" switches between the "normal" program list and the list of dummy test programs.

When selecting one of the test programs, there appear the additional options to EDIT that program, or to DELETE the program, or to make a COPY (clone) of the program:



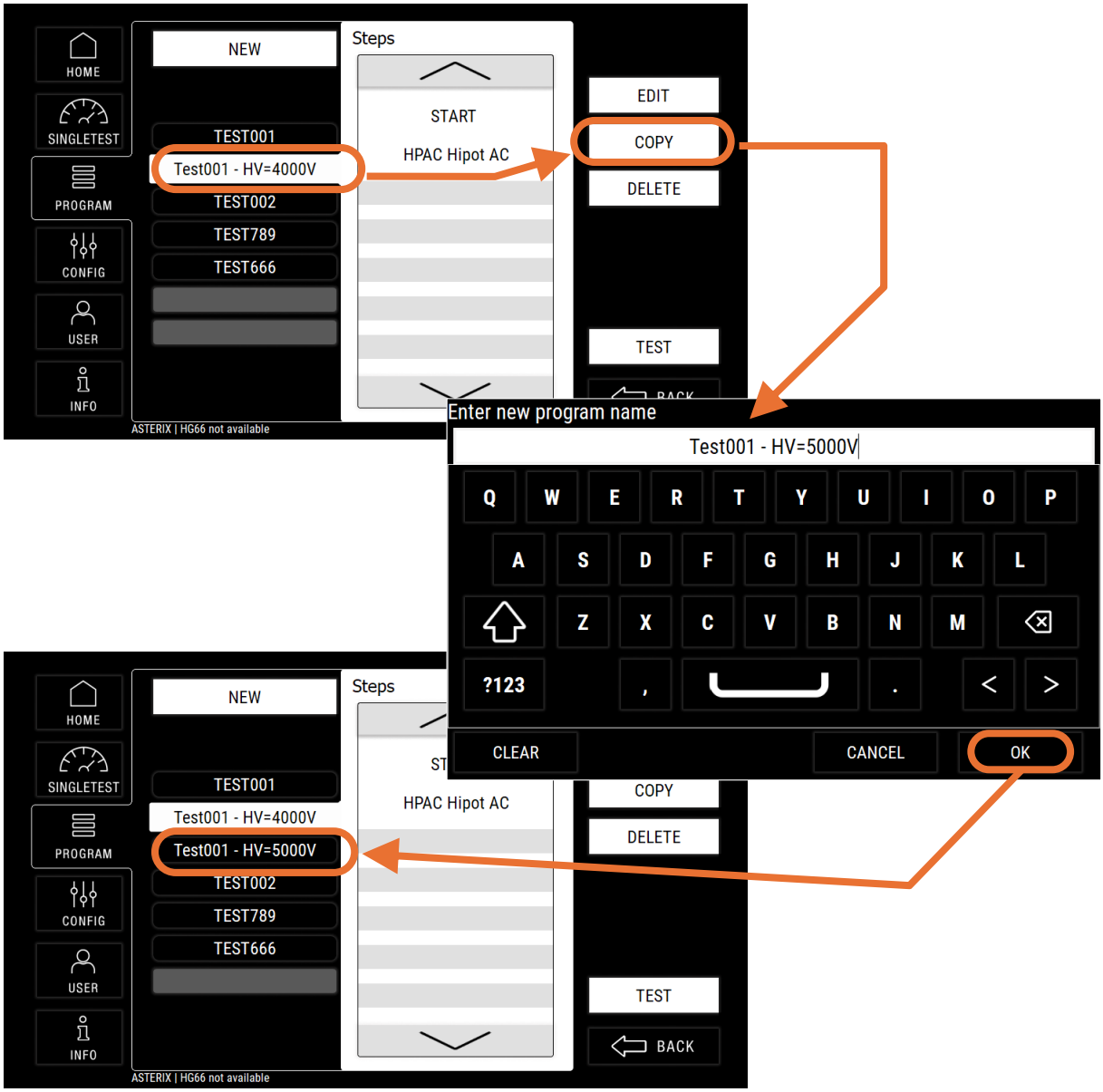
New – This option will create a new test program. First a dialogue is displayed into which a name for the new test program must be entered. After input and acknowledgement of name, test steps can be added to the program.

Note: The position of programs in the list can not be chosen. All programs are stored in that order in which they were created.

Edit – If you select the action "Edit" then the selected test program will be opened for operation. You can then insert or delete test steps, or alter test parameters of existing test steps.

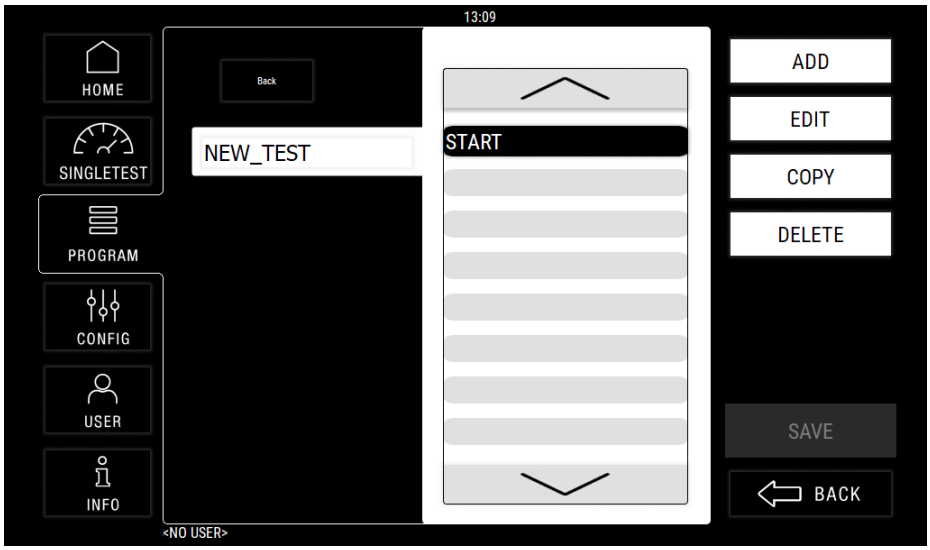
Delete – This will delete the selected program from the list.

Copy – With this option, a new program is created by duplicating the selected program. After choosing "Copy", you are prompted to enter a new name for the duplicated program:



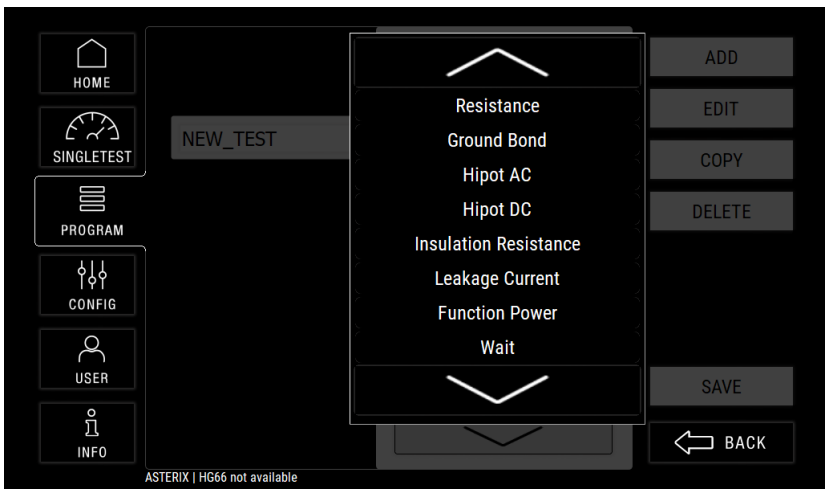
6.3 Editing of a test program

When a new program has been created, or an existing program was chosen with "Edit", the program is shown in detail view for further editing:



After creating a new program

ADD – This option will insert a new test step into the program. When "ADD" is actuated, a list with all available test steps will be shown.
The desired test step is selected simply by tapping on it.
The new test step will be inserted after the step that is currently selected/highlighted in the program.



Selection when inserting a new test step

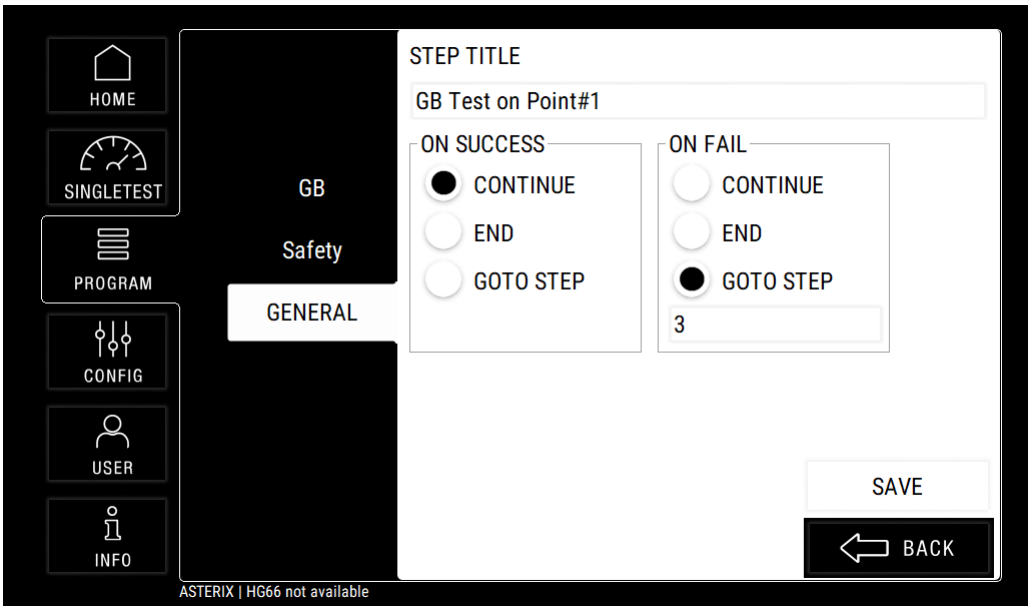
EDIT – If you select the action "Edit" then the selected test step will be opened for operation.

COPY – The selected test step is duplicated. It can then be moved up or down using the ∧ ∨ symbols.

DELETE – The highlighted test step is deleted from the program.

6.3.1 General Options of Test Steps

Each test step contains several options in the GENERAL tab that function identically for each type of test step.



Step Title:

When inserting a test step, each step initially receives a "default" name. A custom name can then be assigned to each test step in this field.

On Success / On Fail

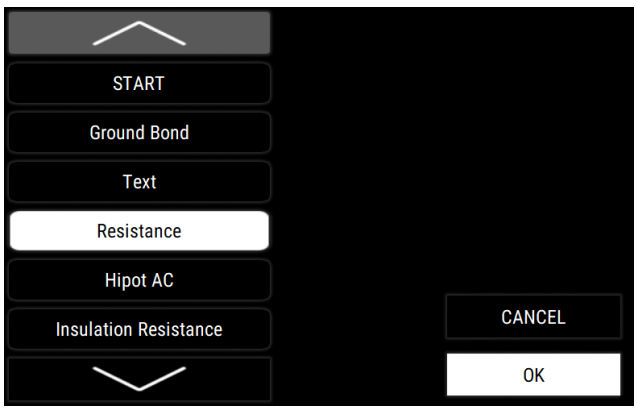
This specifies how to proceed after the test step in the case of a PASS or FAIL result:

Continue – the process continues with the next test step in the program. (typical/standard for PASS tests)

End – the program will terminate after this test step. (typical/standard for FAIL tests)

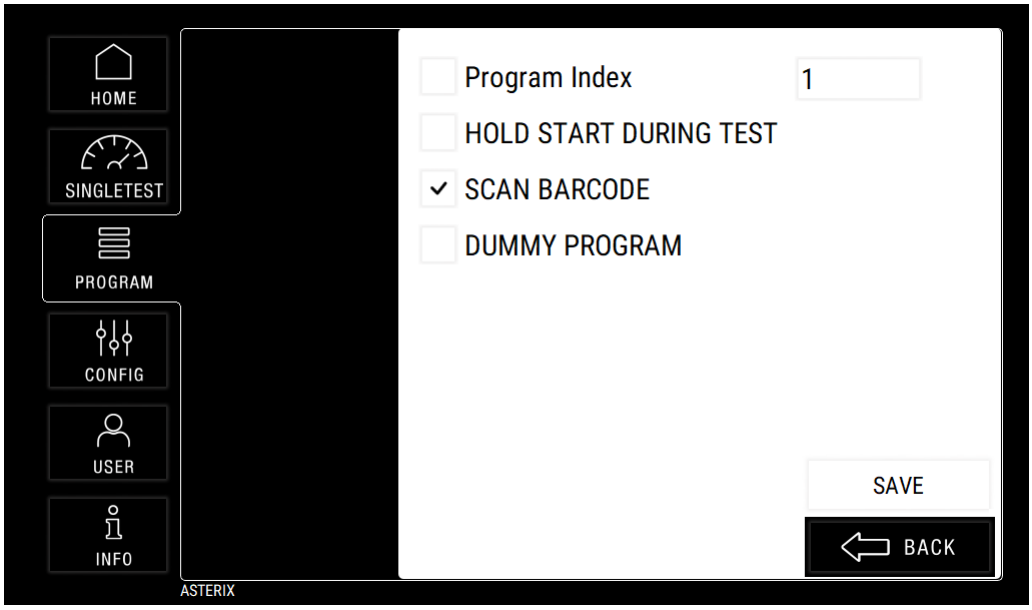
Goto Step – after this test step, the program jumps to another point in the test. This allows for the creation of structures, e.g., depending on the response to a text step, program part A or program part B is executed, or after an error step, a text step should first be displayed for the tester, etc.

The goto statement is internally managed as a number (test step number). However, when selecting the jump target, the current program's list appears, from which the desired check step can be selected as the jump target:



6.3.2 Test Step "START"

Every test program begins with the test step "START". Various settings can be configured here, which then apply to the entire test program.



Program Index
Each test program can be assigned an index number. When the device is controlled remotely, internal test programs can then be selected using this index number.

Hold Start during Test
When this option is activated, the test sequence only starts when the protective circuit signal is triggered, and this signal must be present continuously until the end of the test. This is suitable, for example, for operation with a test hood:
Close the hood → protective circuit signal is and remains valid → ... → Test complete → Hood can be opened.

Note: If this option is enabled in the "START" step, then the individual "SAFETY" options of the individual test steps will be ignored!

Scan Barcode
With this option, at the beginning of each test, you will be prompted to scan a barcode – for the serial number of the DUT, order number, etc. The scanned barcode will later be listed in the header of the results report.

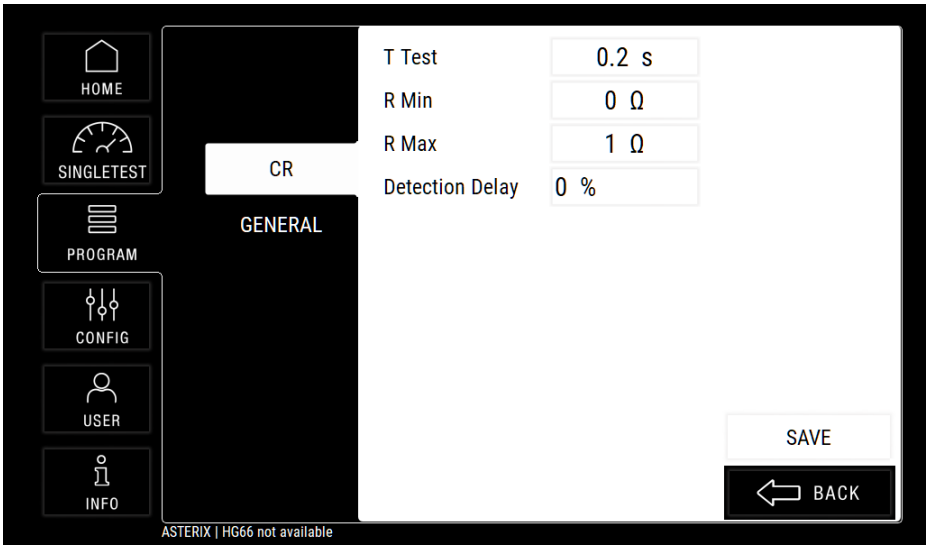
Dummy Program
The device maintains two different program lists: the "normal" test programs, and the dummy test programs for regular testing of the device or system. This option saves or moves the current program to the dummy program list.

6.3.3 RES: Resistance Test

With the resistance test a voltage of 8 VDC is applied between connections **L** and **N** of the DUT, and from the flowing current the resistance is measured.

Herewith one can test:

- Has the DUT been switched on? *(resistance is sufficently low)*
- Is the DUT still switched off? *(resistance is very high)*
- Is there an internal short-circuit at the DUT? *(resistance is close to zero)*



Explanation of test parameters for RES resistance test:

• **t Test**	The duration of the test in seconds	(0.0 – 100 s)
• **R min**	Required minimum resistance for test result PASS	(0 mΩ – 1 MΩ)
• **R max**	Tolerable maximum resistance for test result PASS	(0 mΩ – 1 MΩ)
• **Detection Delay**	The parameter "Detection delay" specifies the time span at the start of a resistance test that is <u>not</u> checked for the Rmin threshold. <u>Example</u>: If "Detection Delay time" is set to e.g. 40% and a resistance test with a test duration of 10s is carried out, then the evaluation of the Rmin threshold takes place only after 4 seconds. This function is helpful if test items require a certain amount of time due to their design (e.g. capacitive behavior) before stable measurements are obtained. Reckognition of general hardware faults (e.g. short-circuit detection) remains unaffected and still leads to immediate test break.	

<u>Note for KT6680U</u>:

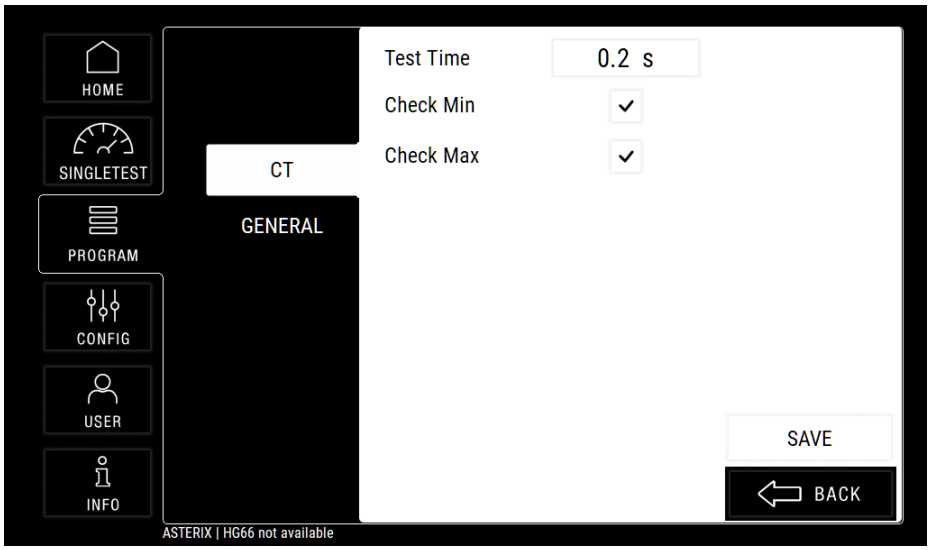
The KT6680U does not have L+N DUT connectors, just the HV⁺ connector.

With this device, the RES measurement is done between SENSE⁺ ↔ SENSE⁻!

6.3.4 CT: Continuity Test

The continuity test is a simplified form of the resistance test (see previous page). This step has no parameters; it operates with fixed thresholds. It is primarily used to quickly and easily check, prior to a functional test, whether:

a) a test object is connected at all
b) the test object may have a short circuit (in this case, it is better not to carry out a functional test)

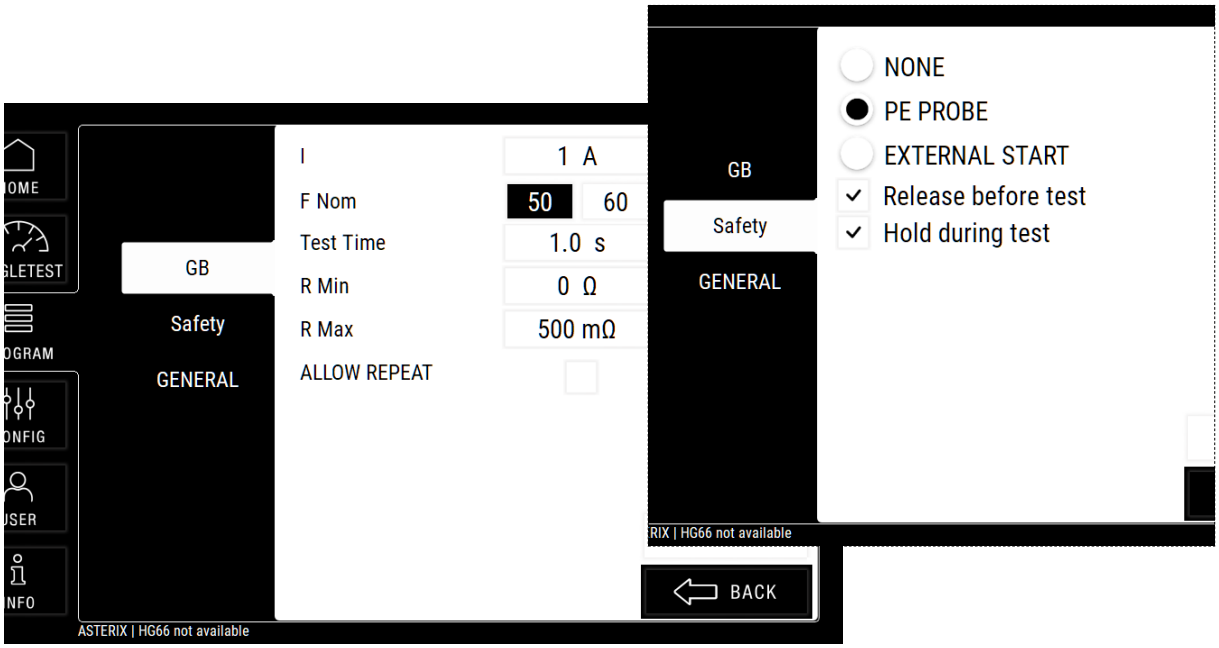


6.3.5 GB: Ground Bond Test

The ground bond test measures the resistance between PE (earthing) and housing of DUT. The resistance should be as low as possible.

If resistance values between R_{min} and R_{max} are measured, DUT has passed the test.

If resistance values lower than R_{min} or higher than R_{max} are measured, the test result will be "FAILED".



Explanation of test parameters for GB Ground Bond test:

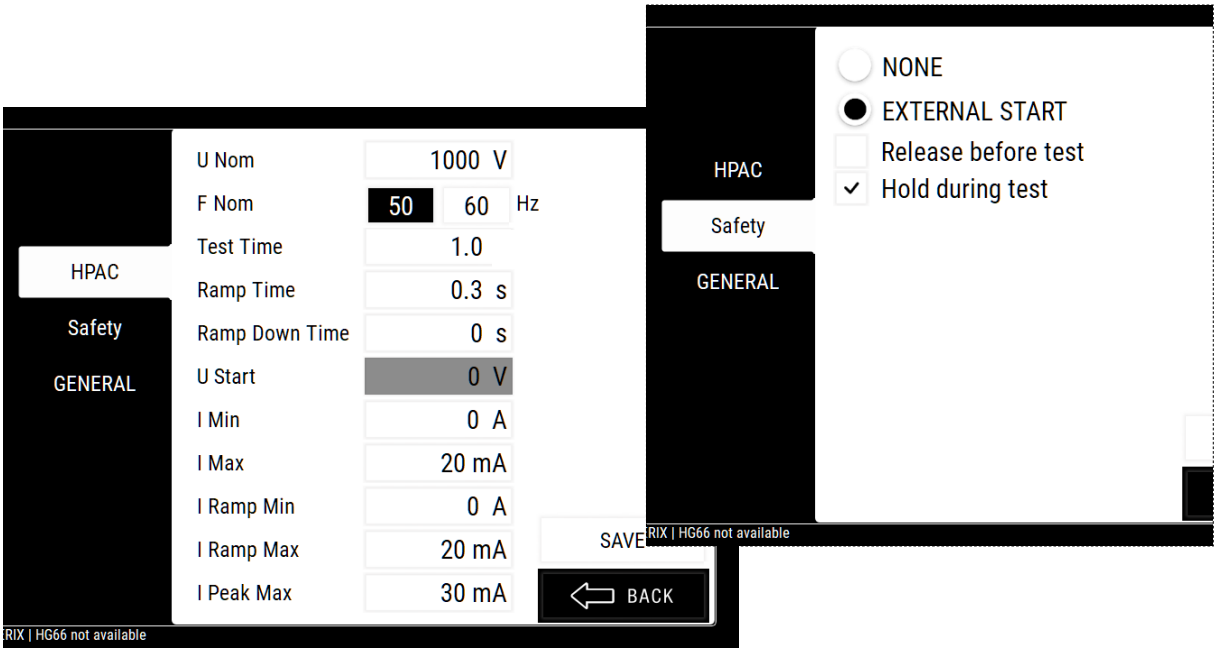
• **I**	(Minimum) of test current required	(1-32 A AC)
• **f nom**	Sets the frequency of the AC test voltage	(50 Hz / 60 Hz)
• **Test time**	Preset value for complete duration of test	(0.1-999 s)
• **R min**	Minimum resistance required	(0 - 6000 mΩ)
• **R max**	Maximum tolerable resistance	(0 - 6000 mΩ)
• **Allow Repeat**	If the test fails, you will be asked whether you want to repeat it (e.g. after the probe has slipped off, etc.).	

Safety:

• **None**	Test starts immediately without query of any safety signal
• **PE Probe**	Test starts with the button on the PE test probe
• **External Start**	Test starts with signal on the ext.IO (Input#1 or Input#2)
• **Release Before Test**	The start signal must not already be activated at the beginning of the test
• **Hold during Test**	The start signal must be present continuously during the test

6.3.6 HPAC: Hipot Test AC

With the high voltage test, the electrical strength between the contacted potentials is evaluated.
In case of insufficient or damaged electric strength of the DUT, an arc-over will occur.

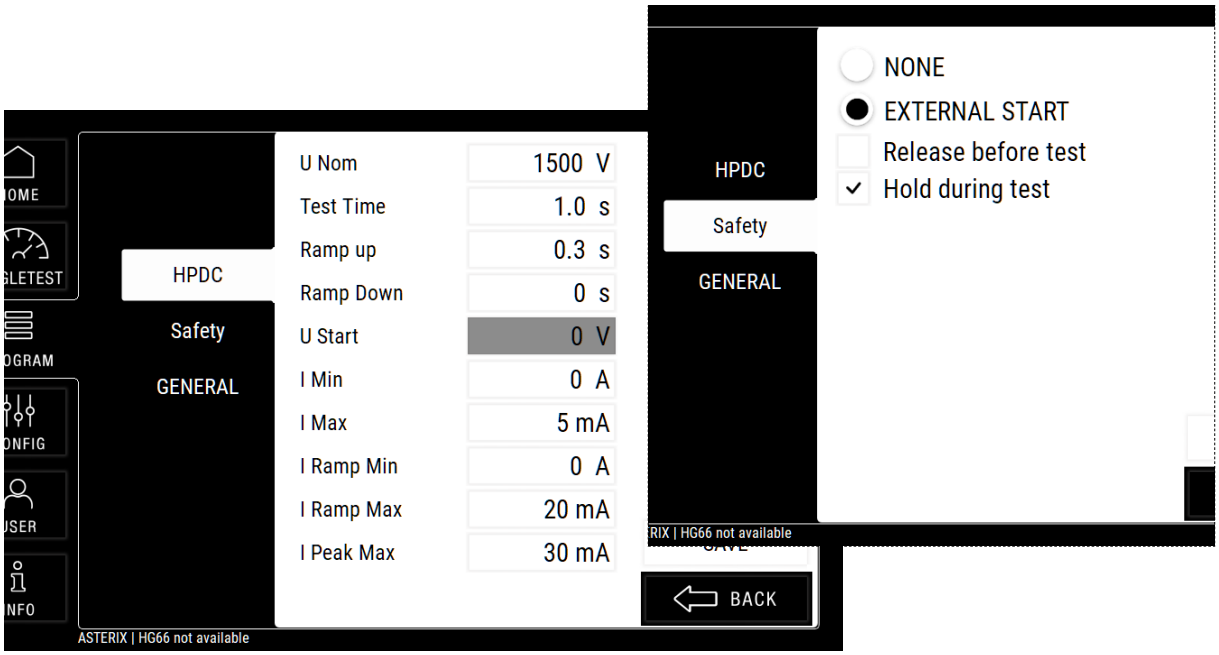


Explanation of test parameters for HPAC Hipot test:

• **U nom**	Preset value for test voltage	(100 – 5500 V [AC])
• **f nom**	Sets the frequency of the AC tests voltage	(50 Hz / 60 Hz)
• **Test time**	Preset value for duration of test (without ramp time)	(0.1 – 999.9 s)
• **Ramp time**	Duration of time for voltage ramp when starting test	(0.0 – 999.9 s)
• **Ramp down time**	Duration of time for dropping voltage ramp at test's end	(0.0 – 999.9 s)
• **U start**	Initial voltage value at start of voltage ramp	(0V – [Unom])
• **I min**	Required minimum current for PASS result	(0.000 – 20.000 mA [AC])
• **I max**	Allowed maximum current for PASS result	(0.000 – 20.000 mA [AC])
• **I Ramp min**	Minimum allowed current during voltage ramp	(0.000 – 20.000 mA [AC])
• **I Ramp max**	Maximum allowed current during voltage ramp	(0.000 – 20.000 mA [AC])
• **I peak max**	Short current peaks up to this value are allowed	(0.000 – 30.000 mA [AC])
• **None**	Test starts immediately without query of any safety signal	
• **External Start**	Test starts with signal on the ext.IO (Input#1 or Input#3)	
• **Release Before Test**	The start signal must not already be activated at the beginning of the test	
• **Hold during Test**	The start signal must be present continuously during the test	

6.3.7 HPDC: Hipot Test DC

With the high voltage test, the electrical strength between the contacted potentials is evaluated.
In case of insufficient or damaged electric strength of the DUT, an arc-over will occur.



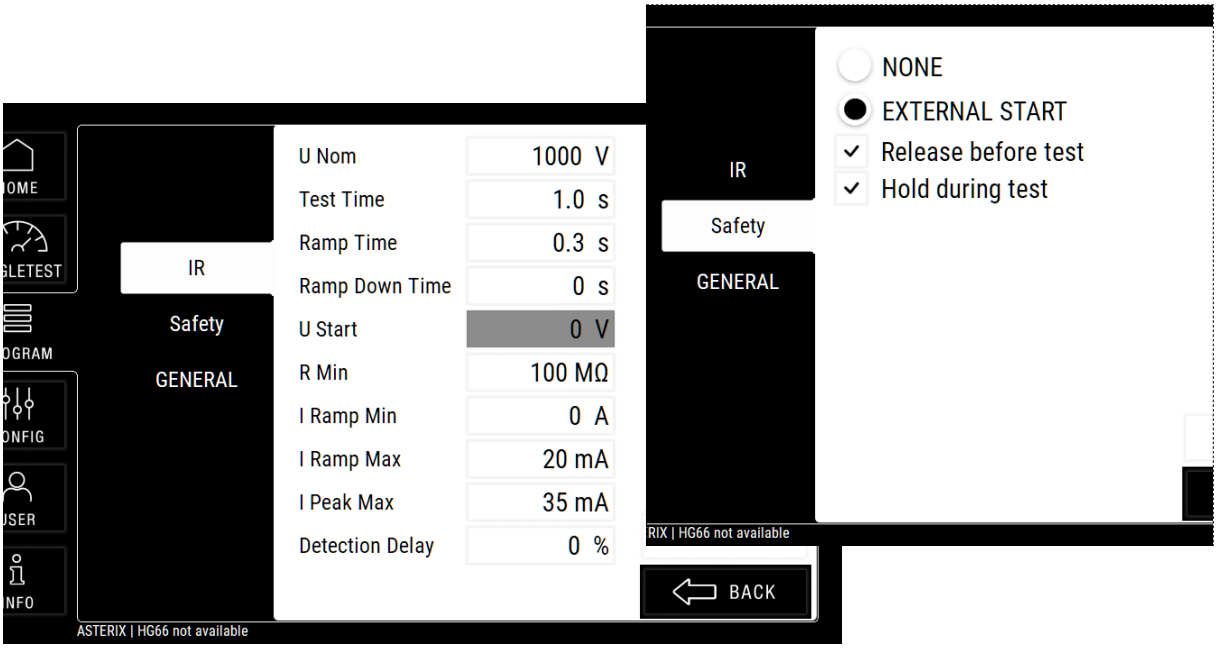
Explanation of test parameters for HPDC Hipot test:

• **U nom**	Preset value for test voltage	(100 – 6000 V [DC])
• **Test time**	Preset value for duration of test (without ramp time)	(0.1 – 999.9 s)
• **Ramp time**	Duration of time for voltage ramp when starting test	(0.0 – 999.9 s)
• **Ramp down time**	Duration of time for dropping voltage ramp at test's end	(0.0 – 999.9 s)
• **U start**	Initial voltage value at start of voltage ramp	(0V – [Unom])
• **I min**	Required minimum current for PASS result	(0.000 – 20.000 mA [AC])
• **I max**	Allowed maximum current for PASS result	(0.000 – 20.000 mA [AC])
• **I Ramp min**	Minimum allowed current during voltage ramp	(0.000 – 20.000 mA [AC])
• **I Ramp max**	Maximum allowed current during voltage ramp	(0.000 – 20.000 mA [AC])
• **I peak max**	Short current peaks up to this value are allowed	(0.000 – 30.000 mA [AC])
• **None**	Test starts immediately without query of any safety signal	
• **External Start**	Test starts with signal on the ext.IO (Input#1 or Input#3)	
• **Release Before Test**	The start signal must not already be activated at the beginning of the test	
• **Hold during Test**	The start signal must be present continuously during the test	

6.3.8 IR: Insulation Resistance Test

With the insulation test IR, the insulation resistance between the contacted potentials is evaluated.
In case of insufficient or damaged electric strength of the DUT, an arc-over will occur.

For measurement accuracy, especially at ***very high*** resistance values, refer to chpt. 7.3.8 "Calibration".

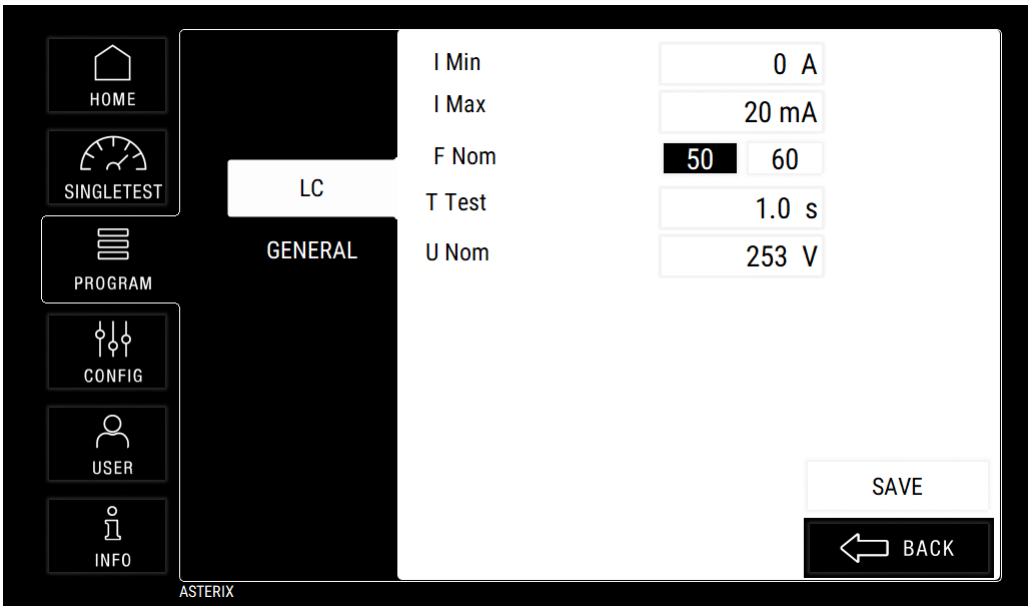


Explanation of test parameters for IR insulation test:

• **U nom**	Preset value for test voltage	(100 – 6000 V)
• **t Test**	Preset value for duration of test (without ramp time)	(0.1 – 999.9 s)
• **R min**	Required minimum resistance for PASS-result	(100 kΩ – 10 GΩ)
• **t Ramp up**	Duration of time for voltage ramp when starting test	(0.0 – 999.9 s)
• **t Ramp down**	Duration of time for dropping voltage ramp at test's end	(0.0 – 999.9 s)
• **U start**	Initial voltage value at start of voltage ramp	(0V – [Unom])
• **IR min**	Minimum allowed current during voltage ramp	(0.000 – 20.000 mA [AC])
• **IR max**	Maximum allowed current during voltage ramp	(0.000 – 20.000 mA [AC])
• **I Peak Max**	Short current peaks up to this value are allowed	(0.000 – 30.000 mA [AC])
• **Detection Delay**	The parameter "Detection delay" specifies the time span at the start of an insulation test that is not checked for the R_{min} threshold. Example: If "Detection Delay time" is set to e.g. 40% and a resistance test with a test duration of 10s is carried out, then the evaluation of the R_{min} threshold takes place only after 4 seconds. This function is helpful if test items require a certain amount of time due to their design (e.g. capacitive behavior) before stable measurements are obtained. Reckognition of general hardware faults (e.g. short-circuit detection) remains unaffected and still leads to immediate test break.	

6.3.9 LC: Leakage Current Test

The leakage current test determines the current that, in case of protective wire missing or being defective, can flow through the DUT's housing to earth.



Explanation of test parameters for LC leakage current test:

• **I min**	Minimum allowed current for test result PASS	(0.0 – 10.0 mA)
• **I max**	Maximum allowed current for test result PASS	(0.0 – 10.0 mA)
• **f nom**	Sets the frequency of the AC tests voltage	(50 Hz / 60 Hz)
• **t Test**	Preset value for duration of test	(0.1 – 999.9 s)
• **U nom**	Preset value for test voltage	(100 – 270 V)

6.3.10 FP: Function Power Test

The function test is a current consumption measurement with preset nominal voltage. An alternating voltage of 120 or 230 VAC is applied between phase and N-conductor of the DUT and various electrical values can be measured. The current measuring range lies between 0 and 16 A.

The required AC test voltage has to be supplied externally, via the EXT.SUPPLY socket at the rear panel.

Explanation of test parameters for FP function power test:

• **Test time**	Maximum duration for function test.	(0.1 – 999.9 s)
• **Good time**	If all measuring values are continuously within the limit values for the duration of [Good time], the test will already be ended before the end of the process of [Test time].	(0.0 – 999.9 s)
• **Run full test time**	[Good time] is sufficient for result "pass", but the test runs for full [Test time].	
• **Keep Power on**	When activated, the test voltage is not switched off after the FP step. This applies until the next FP step, or for subsequent text- or wait-steps. When performing an "electrical" test, the functional voltage is forcibly switched off.	

Tab "Limits":

In this tab it is defined which electrical values are actually measured. By activating the checkbox of an element, this value will be measured and the measured values are included in the test result protocol.

During the test, up to three values can be displayed on the device screen. The values to be displayed are chosen with the radiobuttons on the right side.

6.3.11 TXT: Text Step

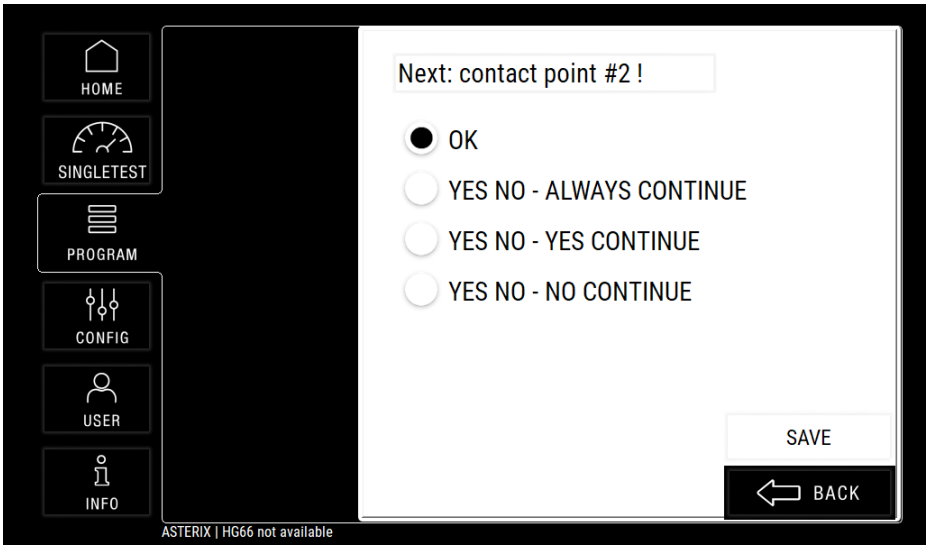
This step can be used to show the examiner hints (acknowledged with "Okay"), or questions that can be answered with yes/no.

In the case of yes/no questions, you can decide how the answer should be evaluated:

Always continue: the test procedure continues (but the question and answer appear in the test report)

Yes continue: If the answer is YES, the test procedure continues, if NO it is aborted with an error

No continue: If the answer is NO, the test procedure continues, if YES it is aborted with an error

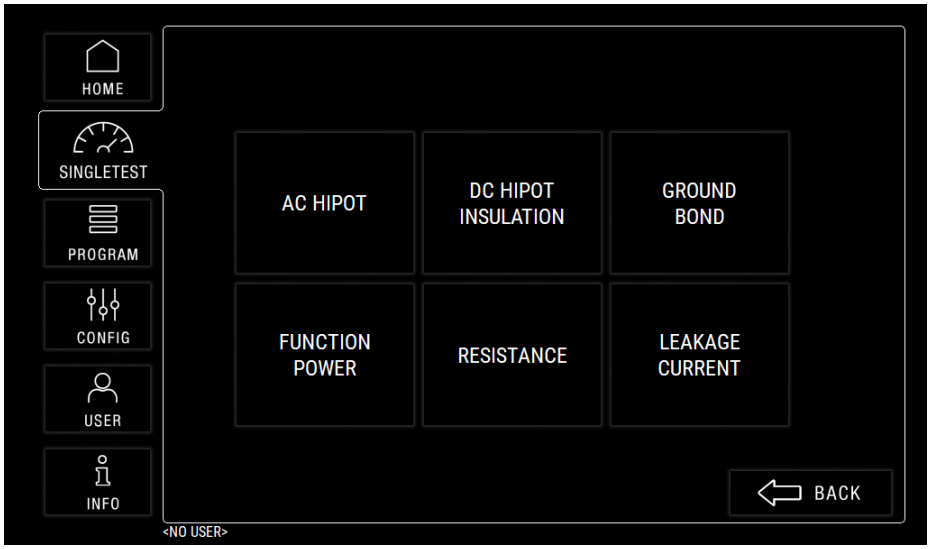


7 Additional Functions and Settings

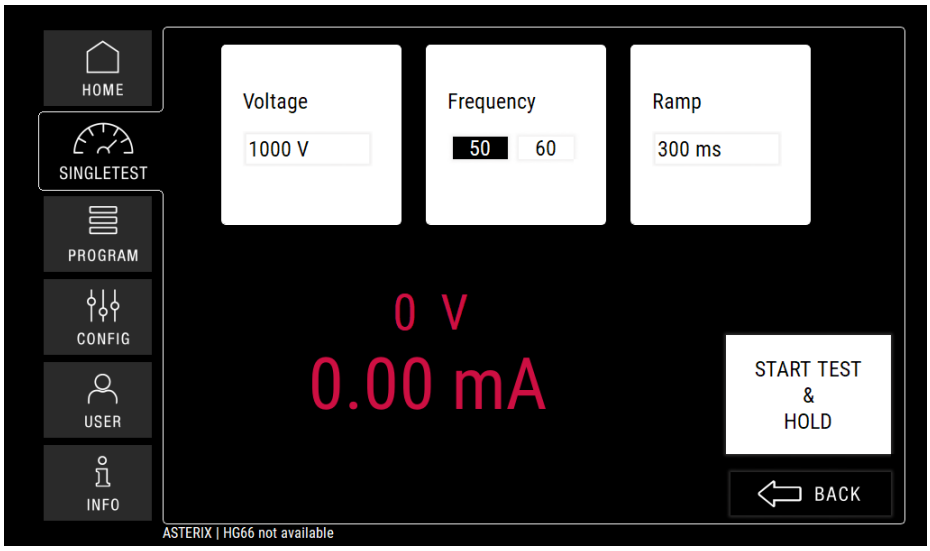
7.1 Single Test

The single test operation is suitable for performing single tests with changing test parameters quickly and easily in sequence. To be able to find the appropriate test parameter for a new type of DUT, in order to create a new test program, the single step operation can be recommended.
Further possibilities for single DUTs could e.g. be special tests or tests for error finding – to create a program for this purpose alone would be too time-consuming.

When changing to the "Single Test" tab, you can directly choose which test to perform:



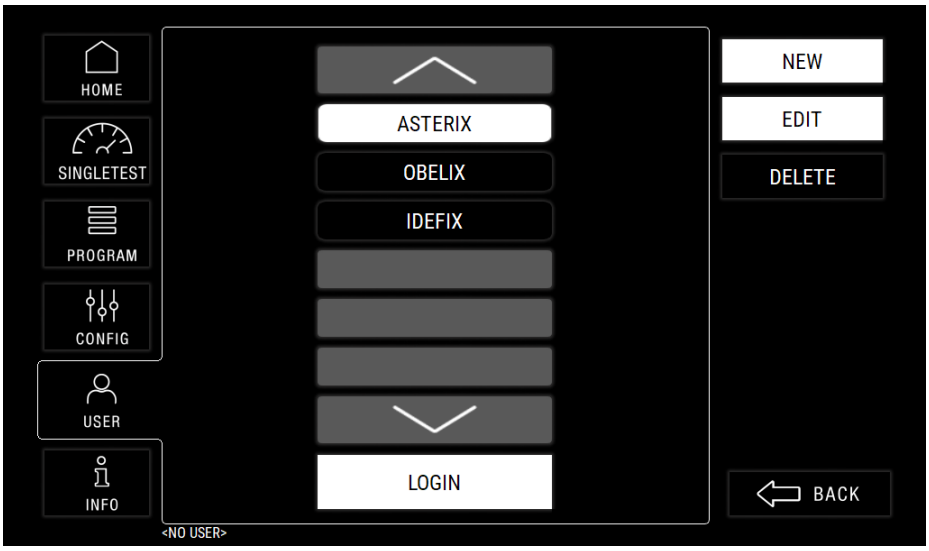
In the test tab, you can set the most important parameters, and then start the test with the "Run Test" button:



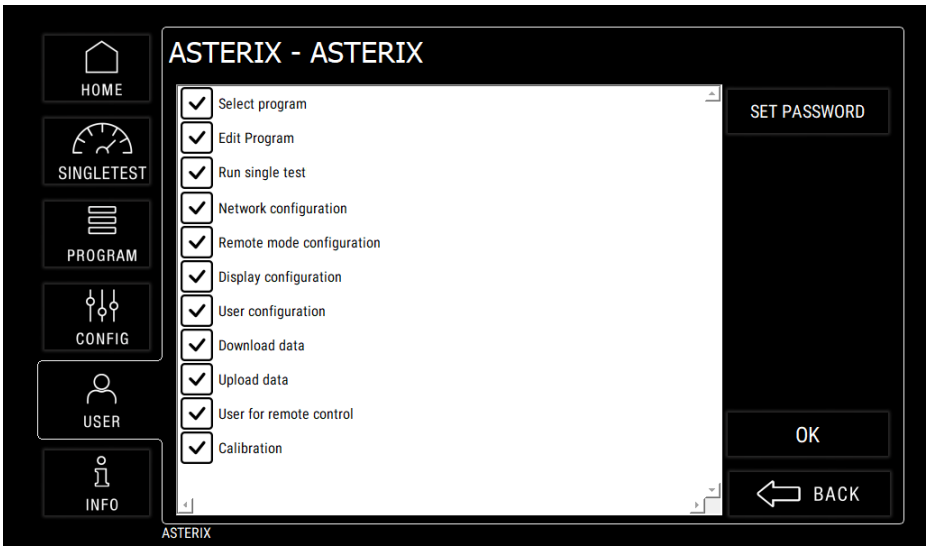
Note that the Single Test operation performs just measuring of values and displays them on the screen.
There is no test result "Pass" or "Fail", and the measured values are not recorded in any way.

7.2 User Administration

In the "User" tab, there can be created individual user accounts. Individual "rights" can be assigned for each user, which determine which functions of the device are available to this user.



List of registered users



List of rights given to a user

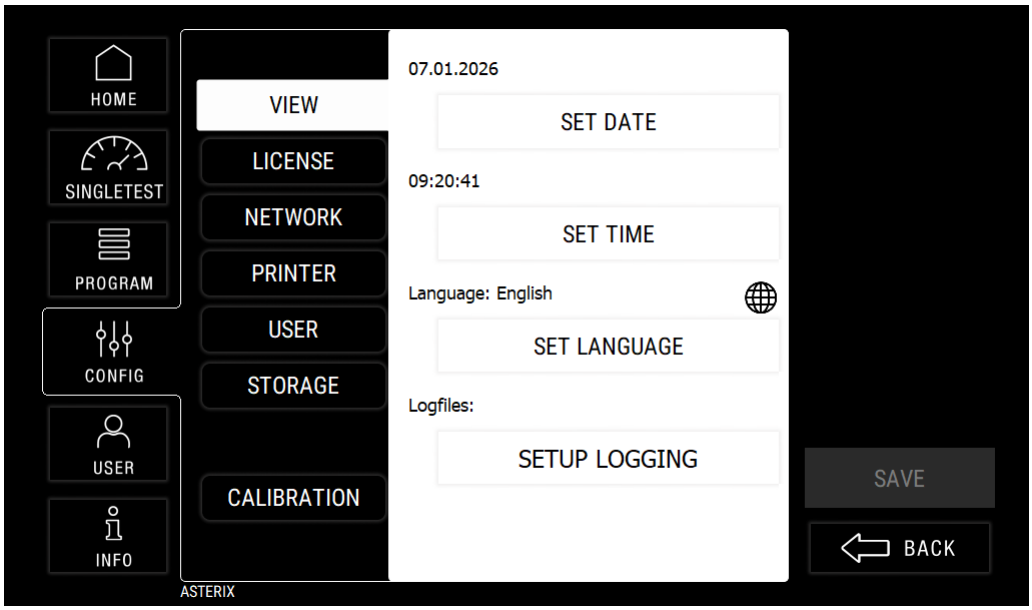
Notes:

- each user can set an individual password to protect his account, but it's also allowed to leave the password empty.
- when the user management system is used, there must be at least one user with the right "User administration"
- when not needed (laboratory use, etc.), the user management system can be completely switched off in the tab CONIG→USERS. In this case all device functions are open to everyone.

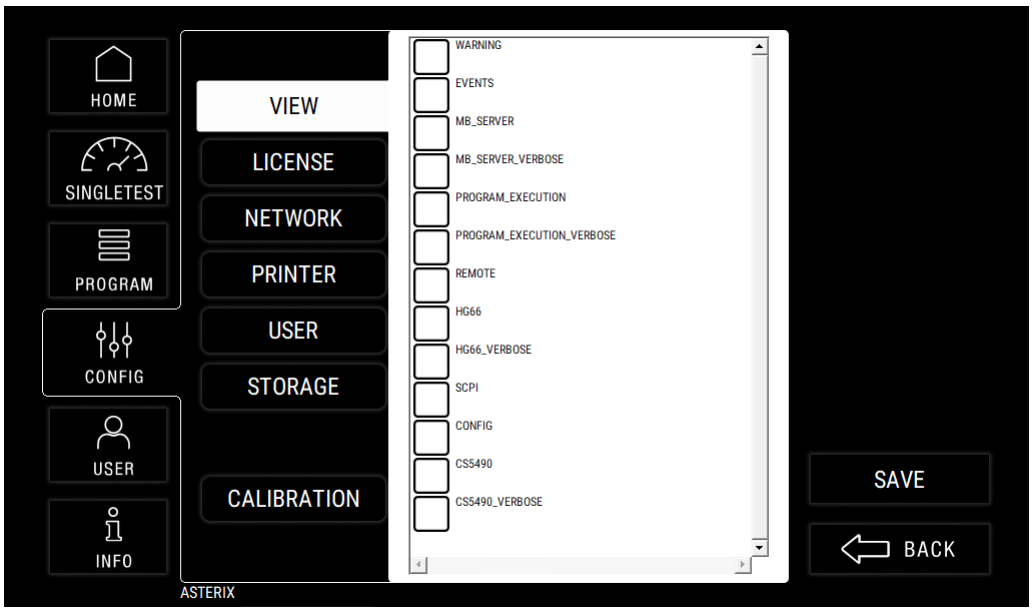
7.3 "CONFIG" – general device settings

7.3.1 Register "VIEW"

In this register, general settings can be configured: the current date, the current time, and the user interface can be switched to a different language.



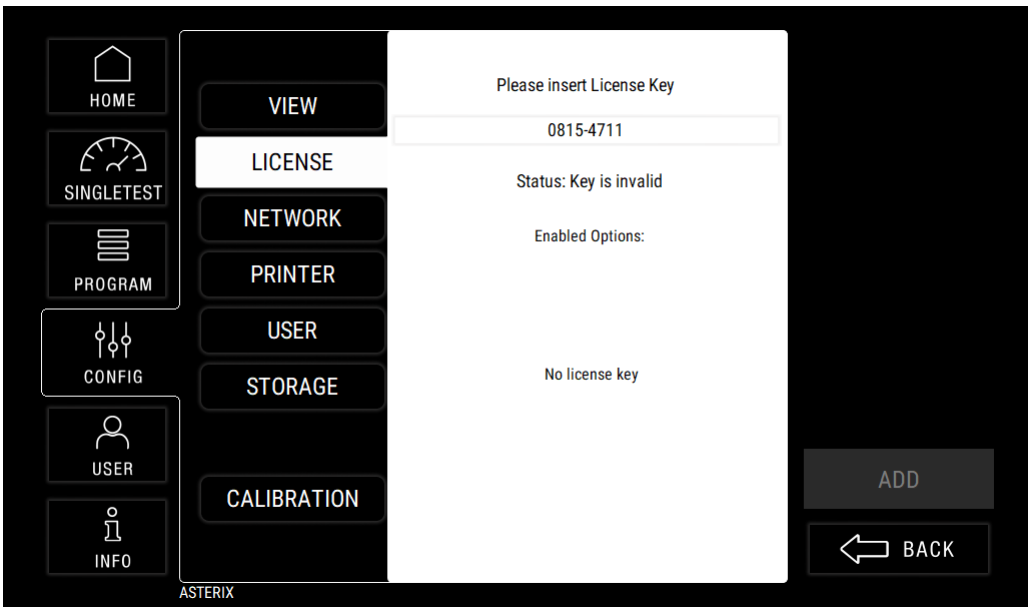
The "Logfiles" setup should not be used for normal testing operations, all options usually should be left "empty":



These options are only needed for service purposes or for troubleshooting technical problems.

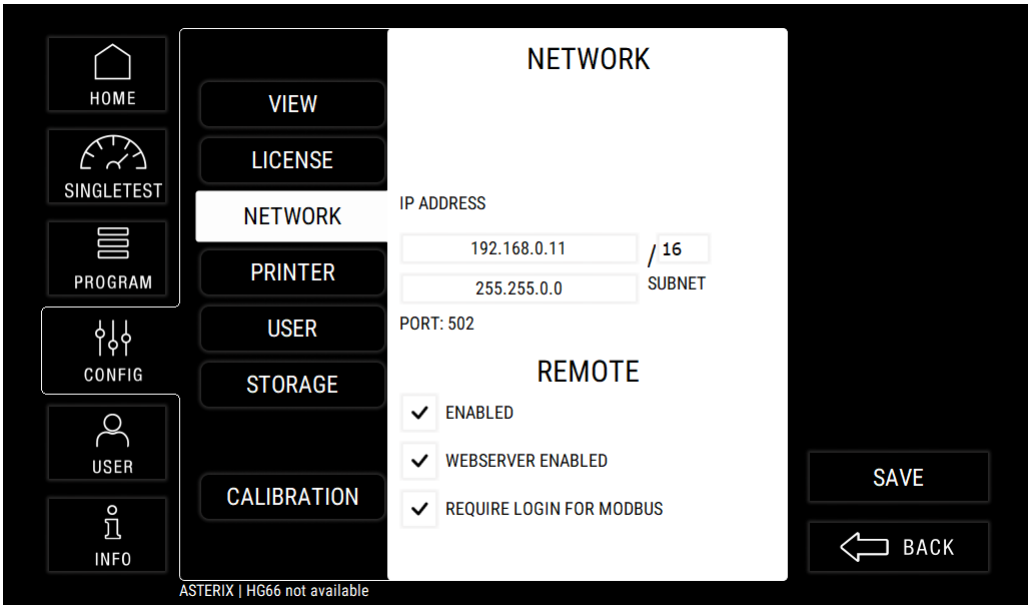
7.3.2 Register "LICENSE"

If additional device options have been purchased, e.g., remote operation with the DAT3810 software, the purchased license key can be entered in this register:



7.3.3 Register "NETWORK"

Here you configure the IP address under which the device is accessed on a LAN network. A fixed address with IP/port and subnet mask is specified..



Remote:

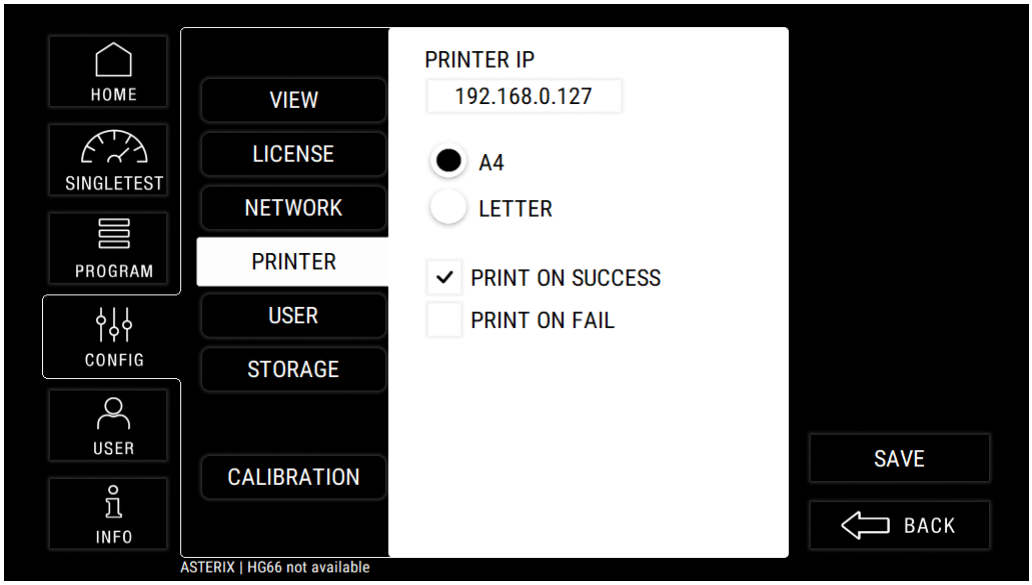
– "enabled" must be selected so that the device can be controlled remotely (via SCPI commands, or when using the DAT3810 software).

– "Webserver enabled" can be selected to configure the device externally via the webserver interface (accessed by connecting via web browser to the device's IP address).

7.3.4 Register "PRINTER"

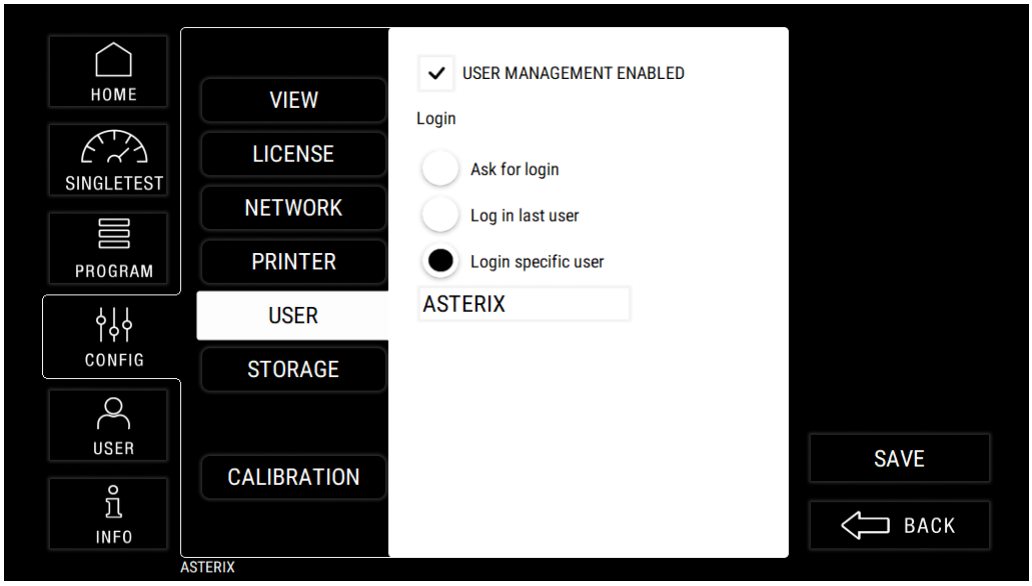
Test reports are printed via Ethernet to a network printer. You can choose whether a report should be printed for pass tests, for fail tests, or for both (i.e., always).

Only PostScript-compatible printers can be used as network printers!



7.3.5 Register "USER"

In this tab, the user management can be enabled or disabled. When user management is disabled, all device functions are fully accessible. When user management is enabled, each user is subject to the rights defined for them in the main "USER" section.



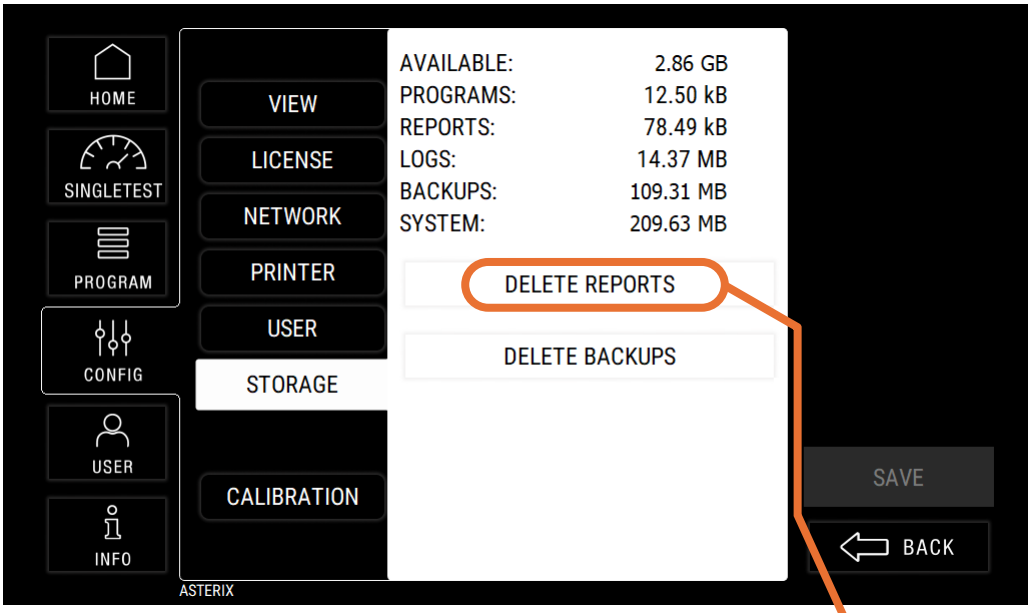
Ask for login: When the device starts up, a list of all users appears, one of whom can log in with their password.

Log in last user: The last active user is automatically logged in when the device starts.

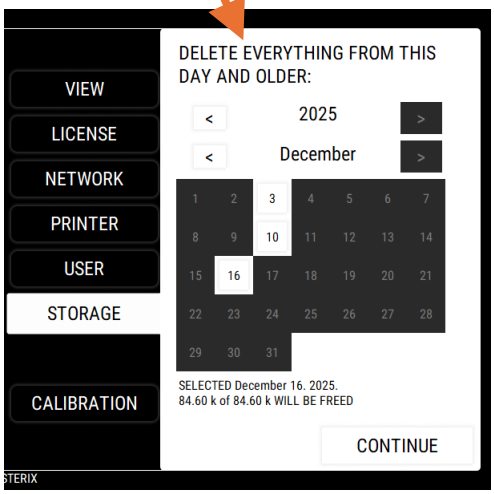
Login specific user: The user specified here will be automatically logged in when the device starts.

7.3.6 Register "STORAGE"

This register shows an overview of the current usage of the device's internal memory.



If results are to be deleted, a selection is made to delete all results older than a specific date..
Data can only be deleted month by month. The dates highlighted in white indicate the days for which result logs are currently available. In the example on the right, the latest result files are from December 16th. This selection will delete the results from December 16th and all results with an earlier date (including November, October, etc.).

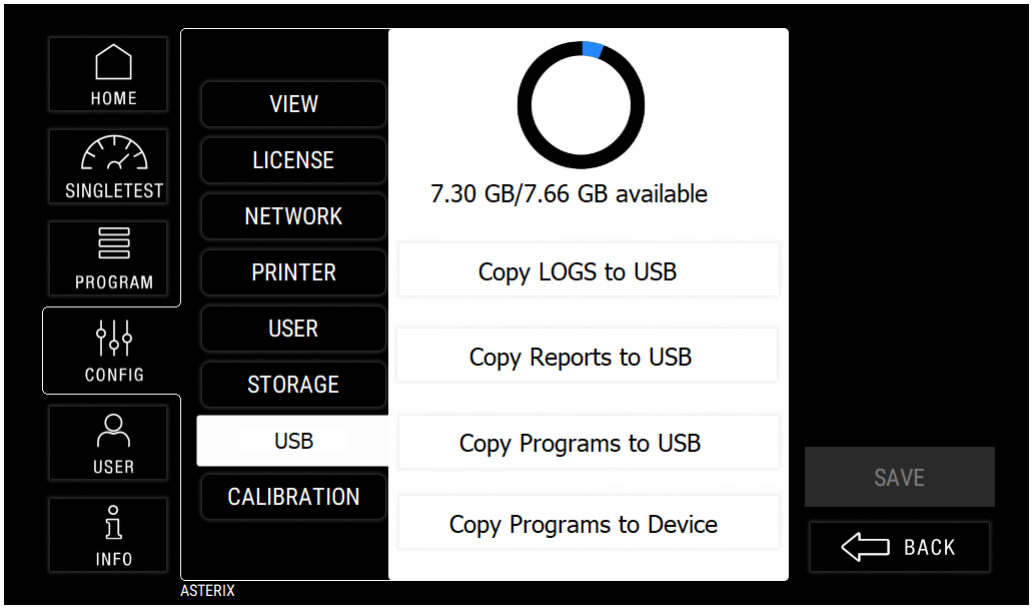


➢ Please ensure that only results that are no longer needed are deleted, or that the results have been backed up beforehand via USB or web server!

Backups, if present, can also be deleted.
Backups are archives that are automatically created when the device undergoes a firmware update.

7.3.7 Register "USB"

This register is only visible if a USB mass storage device is currently connected to the test device.



This register allows programs, results, and log files to be exported to a connected USB storage device.

The data will be exported to the following directories: (if already existing, new data will be added; if not existing, the corresponding directories will be created)

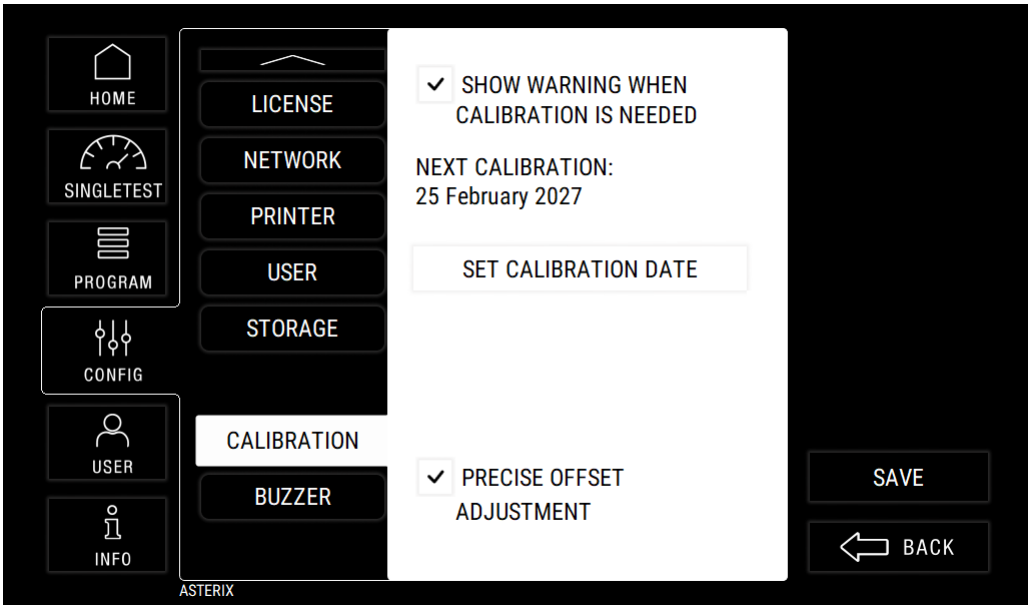
X:\SPSelectronic\programs	(test programs)
X:\SPSelectronic\reports	(result reports)
X:\SPSelectronic\log	(logging files)

7.3.8 Register "CALIBRATION"

This tab in the upper section displays information and settings regarding device calibration.

It is generally recommended that the test device is calibrated annually by SPS electronic. A "factory calibration" can be performed at your site or at SPS electronic's facilities, while the more stringent "DAkkS" calibration (ISO/IEC 17025) can only be carried out in our calibration laboratory. When the test equipment is calibrated, the technician will also enter the date of the next due calibration (usually one year later) using the "Set Calibration Date" function.

The "Show Warning…" option can also be activated. In this case, the test instrument will display a warning message after being switched on, once the recalibration date has been reached. Testing can continue without restriction, however, calibration should be performed as soon as possible to ensure the accuracy of the measured values.



"Precise Offset Adjustment": Measurement accuracy of the insulation resistance test (IR)

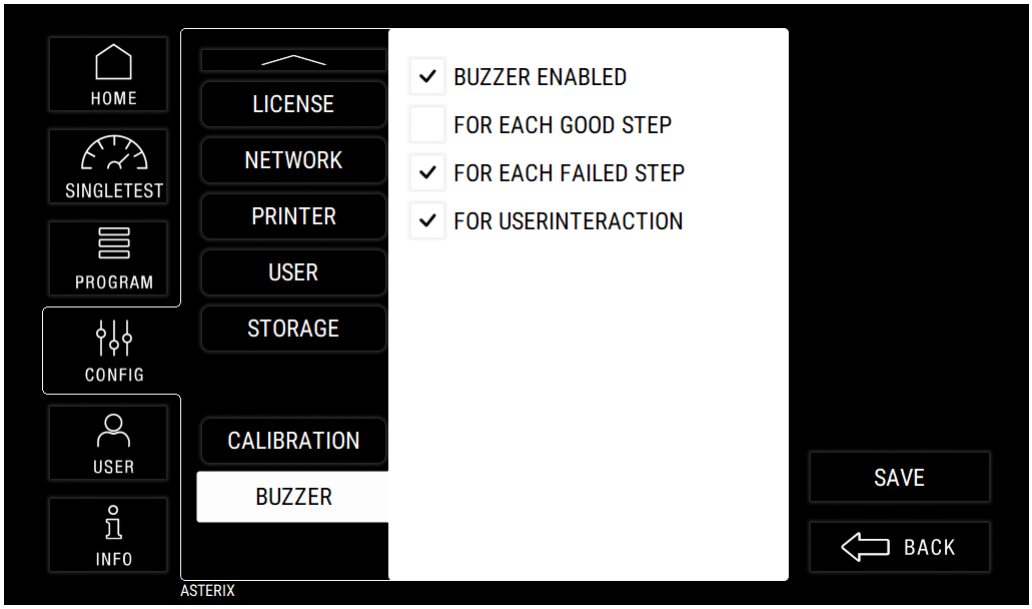
In the lower section, there is the option "Precise Offset Adjustment", which relates to the insulation resistance test:

When an insulation resistance test (IR) is performed, the test instrument ***always*** carries out a zero-point adjustment at the beginning of a test step in order to improve measurement accuracy (this cannot be deactivated); this normally takes 200 ms.

By activating "Precise Offset Adjustment," the zero-point adjustment can be extended to 1000 ms to achieve even higher precision through more measurements during this adjustment. This increases the run time of each IR step by 800 ms.

7.3.9 Register "BUZZER"

This tab is used to configure settings for the device's internal buzzer.



Buzzer enabled: This turns the general use of the buzzer either on or off.

For each good step: The buzzer sounds when a test step has been completed with "Pass". (1 x long)

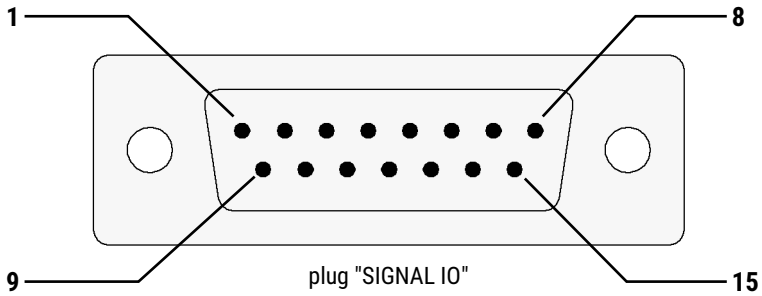
For each failed step: The buzzer sounds when a test step has been completed with "Fail". (2 x short)

For user interaction: The buzzer sounds when the user needs to perform an action (answer a text step with yes/no, activate an external device to close the protective circuit, etc.).

Annex

A Interface Configuration

A-1 External I/O Interface "SIGNAL IO"



plug "SIGNAL IO"
(Dsub15, male, on rear panel)

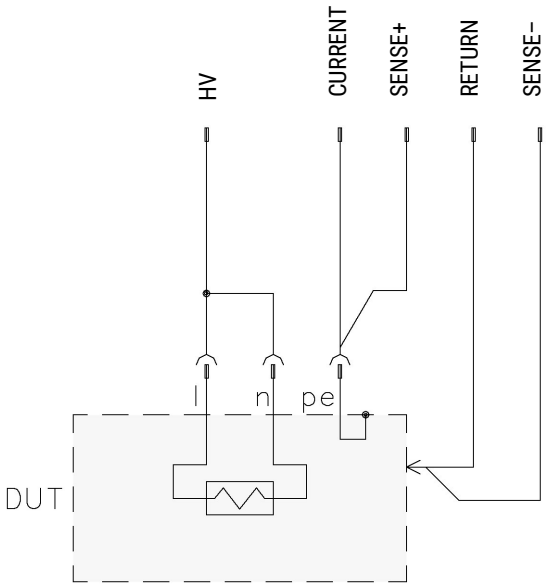
PIN	description	configuration
1	output 1	Passed
2	output 2	Failed
3	output 3	Testing
4	output 4	Discharge
5	GND	grounding
6	GND	grounding
7	input 1	Ext_Start
8	input 2	Ext_Start_PE
9	input 3	Ext_Start_HV
10	input 4	*not used*
11	+24 V DC *)	int. voltage against ground *)
12	+24 V DC *)	int. voltage against ground *)
13	*n.a.*	*not used*
14	*n.a.*	*not used*
15	*n.a.*	*not used*

*) internal 24V supply, do **NOT** feed in from external!

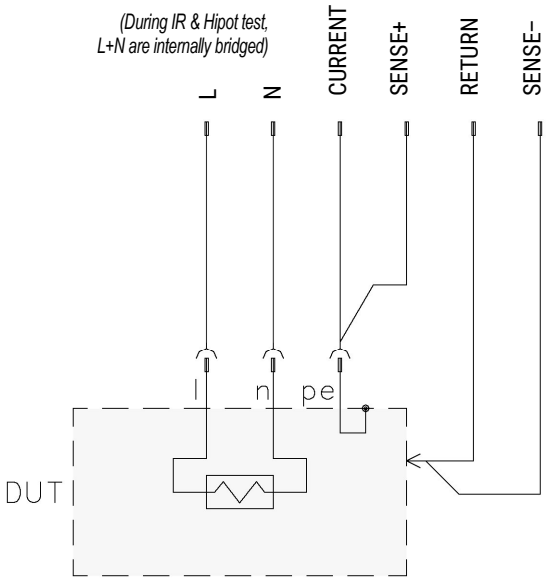
Note:
In standalone operation, the input and output signals are fixed and cannot be changed or reconfigured.
When remotely controlled with the DAT3810 software, the inputs/outputs can be used freely as desired.

A-2 Rear connectors for test voltages

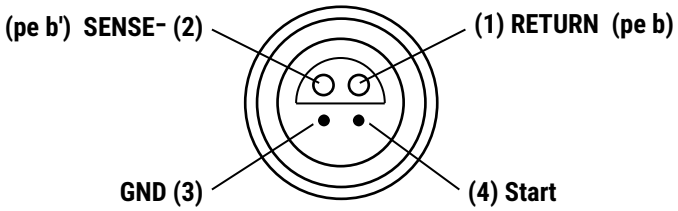
For KT 6680U:



For KT 6780H:



A-3 Probe Connector PROBE



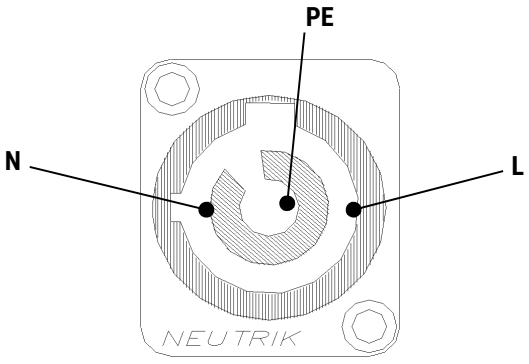
This connector is used for connection of a PE test probe.
The contacts pe b and pe b' are internally connected parallel to the contacts RETURN/SENSE⁻ in the connection field.

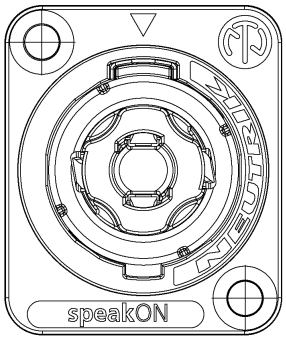
Note: With the 4-wire measuring technique, the lines pe b and pe b' are merging at the DUT. When using a PE test probe, the lines are merging **in** the probe (in the tip). Therefore it is important that the points pe b and pe b' are not used multiply due to a connected probe:

– If the points pe b / pe b' are used manually (via the laboratory jacks in the connection field), then no test probe may be connected to the KT device or to the connection panel!

– There must not be two probes connected to the connection panel and to the KT device at the same time!

A-4 Connector for external voltage EXT.SUPPLY



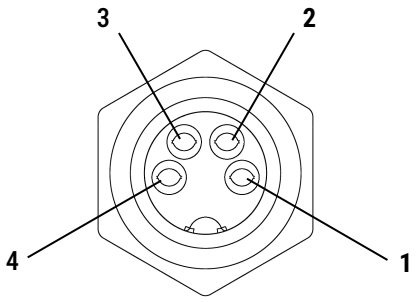


This interface is used to feed-in the external function voltage to supply the DUT with during the function power test (FP) and leakage current test (LC).

The function voltage is safeguarded by a 16A melting fuse. ("FC1" on the rear panel)

A-5 Connector for external protective circuit EXT.SK

4-pole M8 socket with female thread



View of the socket from outside (back panel)

To close the protective circuit, PINs 1 and 2 have to be short-circuited. PIN 3 and 4 are not assigned.

If no external safety loop application is provided, the supplied jumper plug must be connected. As long as this interface is open, no test operation is possible.

B On the topic of "dummy testing"

Motivation

We generally recommend subjecting the test device to regular checks (usually at least once or twice a day) using a suitable test dummy. This ensures that the test device correctly detects all GOOD states of a test object, and, even more importantly, that all FAULT states of a test object are reliably and correctly detected. Worst-case scenario: The testing device has an unexpected or undetected error and fails to recognize certain fault conditions. You test 1000 items, all marked as "Good," but in reality, some of them could have been faulty. Consequently, you could not say with certainty whether all 1000 delivered items were truly "Good."

The test device comes pre-loaded with one or more dummy test programs (matching the test device and its corresponding test dummy). These programs are permanently stored in memory and cannot be deleted. However, you can create your own additional dummy programs based on these pre-installed programs if your requirements necessitate fewer or additional test steps.

The testing logic behind the execution of a dummy test

Since this topic occasionally causes confusion, the following clarification is provided:

- In normal testing operations, we test a test item to determine whether the test item is GOOD or FAULTY.
- In a dummy test, the device under test is simulated by the dummy. However, we are not testing the dummy itself. The dummy simulates PASS and FAIL states in a controlled manner, and we are testing the testing device instead, to see if it correctly detects these PASS and FAIL states.

This necessitates a slightly different logic in the process of a dummy test than in normal testing operations:

If the dummy simulates FAIL, and the testing device detects that the corresponding test step was FAIL, then that FAIL-step in fact is PASS in the sense of a dummy test! Conversely, if the dummy simulates PASS but the testing device detects FAIL, then something is also wrong.

A simple example of a dummy test: (only HV test as an example)

#0	START		
#1	TXT	"Set HV to PASS on the dummy!"	OK / continue
#2	HV-Test	[standard parameters, HV = 1500 V]	on PASS: continue / on FAIL: goto #6
#3	TXT	"Set HV to FAIL on the dummy!"	OK / continue
#4	HV-Test	[standard parameters, HV = 1500 V]	on PASS: goto #6 / on FAIL: continue
#5	TXT	"Dummy Test was successful!"	"No continue" & on FAIL: "End"
#6	TXT	"Dummy Test has failed!"	"OK" & "End"

The small peculiarity here lies in the HV test at step #4: if the dummy's FAIL simulation is incorrectly recognized as PASS, then the program branches to the overall result ERROR (#6).
Similar the HV test in step #2: this **must** be recognized as PASS – if this step is recognized as FAIL, then the error is 99.9% not with the dummy, but with the test device.

C USB devices, and "Testing with High Voltage"

- When testing with high voltage, a failing testpiece can be the cause for electromagnetic radiation (because of voltage arc-over at the weak point in the testpiece), and the resulting sparkling can cause EM radiation of high frequencies. This radiation gets emitted by the test lines – antenna principle – , and may get recepted again by USB lines in the closer surrounding.
- USB controllers are generally vulnerable to stray fields of high frequencies, and thus the communication with USB can get interrupted. In particular, it is possible that short occurances of stray fields put the USB-controller into a persistent inoperable state, so that USB communication keeps being interrupted.
- If such an USB malfunction occurs, often it is already sufficient to just unplug the USB cable, and plug it in again after a few seconds. If the malfunction still persists, it is needed to switch the affected devices off, and on again.

Concerned Situations and devices:

- generally every kind of PC or similar device that is using a USB connection, and is located in very close neighborhood to a test with high voltage.
- in particular such PCs that are using DAT3800 or DAT3805 software to control a testing device, and are using an USB connection to the test device.
- also test devices of series 3800 or 1800, when they are themselves using external USB devices, like e.g. USB keyboard, USB sticks for data exchange, etc.

Measures to avoid failures

- as far as possible, it is recommended to keep a sufficiently large distance between USB cables/devices, and testpiece / testing lines. (Recommended are at least 30cm, the practical rule is "the more, the better".)
- it is recommended to use well-shielded USB cables with ferrite-core coil.
  (On its own this is won't eliminate the possibility of errors, but it generally reduces sensitivity against stray fields, and makes occurance of errors less likely.)

EU-Konformitätserklärung
EU Declaration of Conformity
EU Déclaration de Conformité

Wir / We / Nous:

SPS electronic GmbH
True German Quality
Eugen-Bolz-Str. 8
74523 Schwäbisch Hall - Germany

erklären hiermit, dass das nachfolgende genannte Gerät den einschlägigen grundlegenden Sicherheitsforderungen der EU-Richtlinien entspricht.

declare, that the following unit complies with all essential safety requirements of the EU Directives.

Déclarons que le produit désigné ci-dessous est conforme aux exigences de sécurité des Directives EU.

Geräteart:	**Multifunktions-Sicherheitsprüfgerät**
Description of device:	**Hipot Safety Analyser**
Typ / Type:	**KT 6780 H, KT 6680 U**

EU Richtlinien / EU Directives / Directives EU:

☐ EG Maschinenrichtlinie 2006/42/EG mit Änderungen
EC Directive for machinery 2006/42/EC with amendments
Normes CE machines 2006/42/EC avec amendements

☒ EU Niederspannungsrichtlinie 2014/35/EU
EU Directive for low voltage 2014/35/EU
Normes CE basse tension 2014/35/EU

☒ EU Richtlinie Elektromagnetische Verträglichkeit 2014/30/EU mit Änderungen
EU Directive electromagnetic compatibility 2014/30/EU with amendments
Normes électromagnétiques CE compatibles 2014/30/EU avec amendements

☒ RoHS-Richtlinie 2015/863/EU (RoHS III)
RoHS directive 2015/863/EU (RoHS III)
Directive RoHS 2015/863/UE (RoHS III)

Angewandte harmonisierte Normen / Applicable harmonized standards / Normes Européennes harmonisées:

- EN 61 000-3-2:2019-12; EN 61 000-3-3: 2020-7 ; EN 61326:2013-07; EN 50 191:2011-10
- DIN EN ISO 12100:2011-03

Angewandte nationale Normen und technische Spezifikationen / Applicable national standards and technical specifications: Normes nationales et spécifications techniques particuliéres:

- – – –

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23.06.2025
Datum / date / date

Dipl. Ing. Johannes Geyer

Dieser Konformitätserklärung unterliegt grundsätzlich nur das von uns gelieferte oder in Betrieb genommene Gerät. Für Änderungen und Erweiterungen ist der Betreiber verantwortlich und damit für die Sicherstellung der Übereinstimmung der veränderten Anlage mit den betreffenden EU-Richtlinien.

This declaration of conformity is only subject to the device as it was delivered or commissioned by us. Any subsequent alterations and extensions are in the responsibility of the operator, and he therefore has to ensure the altered unit complies with the corresponding EU directives.

Cette déclaration de conformité se réfère uniquement à l'appareil que nous avons livré ou mis en service. L´utilisateur est responsable des changements ultérieurs et des extensions et doit donc s´assurer que l´unité change respecte les directives CE correspondantes.