

ON4X

Electrostatic Discharge Simulator



user manual



A Note to Begin

Thank you for choosing the Haefely ONYX to meet your ESD testing needs. Please take a little time to read through this user manual and familiarize yourself with the instrument controls and some potential dangers.

We hope you have many productive years of operation from the ONYX ESD Simulator.

HAEFELY TEST AG

| | |
|----------------|---|
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1 Safety


1.1 General Safety Information


-  This warning sign is visible on the equipment. **Meaning: This equipment should only be operated after carefully reading the user manual**
Throughout the user manual very important or helpful advice is presented in italics. Safety notices that must be heeded are printed in bold type.


-  **The earth connection of the ESD Simulator must be connected to a good earth. If trigger is pressed without connection to earth, electrical shock may occur!**


-  **Dangerous mains voltage or high voltages are present inside the ONYX.**


-  **Before removing any covers, remove all external connection cables.**


-  **Do not open any part of the ONYX as it contains no user replaceable parts. This does not apply to the cover used for replacement of RC module.**


-  **The ONYX should only be maintained by trained personnel.**

-  **People with heart pacemakers must not be in the vicinity of the system, when it is in operation.**

-  **Do not switch on or operate the ONYX System if an explosion hazard exists. The system should be operated in a dry room. If condensation is visible the unit should be dried before operating.**

-  **Never touch the Equipment Under Test (EUT), when the ONYX is operating. Establish a safety barrier around the test setup.**

-  **If any part of the ONYX is damaged or it is possible that damage has occurred, for example during transportation, do not switch on the unit.**

-  **This user manual is an integral part of the test system. Haefely Test AG and its sales partners refuse to accept any responsibility for consequential or direct damage to persons and/or goods due to none observance of instructions contained herein or due to incorrect use of the ONYX.**

1.2 Safety Standards

The ONYX fulfils the requirements of IEC 61010-1.

2 Description

2.1 Overview

Any electrical equipment can be subject to electrostatic discharges from human operators or from adjacent objects. The electrostatic discharge simulator ONYX, reproduces this phenomenon to evaluate the performance of electrical and electronic equipment.

There are specific test requirements that must be satisfied when conducting ESD testing. These are noted in some detail in IEC/EN 61000-4-2, ISO 10605 and other standards.

Because of its modular design, ONYX can be adapted quickly and easily to perform testing to any ESD standard.

All ESD testing should ideally be conducted in a Faraday cage or other suitable enclosure.

For small EUT's, a test table constructed only of wood must be used, This is covered with a metallic horizontal coupling plane which in turn is connected to a ground reference plane by 2 x 470 kOhm resistors. The EUT should be mounted above the horizontal coupling plane on an isolation plate of 0.5mm thickness.

Vertical coupling planes are to be used to inject an ESD field into all four faces of an EUT.

Larger floor standing equipment must be treated in a similar way but have an isolation plate of 0.1 m.

3 Technical Data

3.1 Electrical data

3.1.1 ONYX basic version

| | |
|------------------------------------|---|
| ONYX 16 output voltage range | 1kV to 16kV air discharge & contact discharge |
| ONYX 30 output voltage range | 1kV to 30kV air discharge & contact discharge |
| Voltage resolution | 100 V steps |
| Polarity | Positive / negative, automatic switching |
| Output voltage tolerance | ± 5% |
| Holding time | > 5s |
| Default Discharge electrodes | Round tip for air discharge / sharp tip for contact discharge according to IEC 61000-4-2 & ISO 10605 |
| Default RC module | 150pF / 330 Ohm according to IEC/EN 61000-4-2 edition 2, waveform specification see table 1 below |
| RC module recognition | Automatic, values shown in display & test report |
| Controls | Touch screen, Trigger key, Smart key |
| Repetition frequency | Single, 0.1, 0.2, 0.5, 1, 2, 5, 10 and 20 Hz (see table 3) |
| Operating modes | Manual / continuous |
| Discharge detection / Threshold | OFF (contact discharge mode only) HV -10% ... HV -90% (contact discharge & air discharge single) HV -20% (fixed for air discharge auto) |
| Impulse counter | 1 – 9999, pre-selectable |
| Temperature indicator | ° Celsius or ° Fahrenheit (selectable) |
| Humidity indicator | Relative humidity |
| Dew point indicator | ° Celsius or ° Fahrenheit (selectable) |
| Interface | Fibre-optic |
| Battery duration | Contact discharge 30kV, 1Hz, approx. 8h Contact discharge 16kV, 1Hz, approx. 12h Contact discharge 8kV, 1Hz, approx. 18h |
| Battery type | NiMH |
| Battery charger power requirements | 100V – 240V, 47-63Hz, 17VA |
| Battery charging time | Approx. 3.5h |

| Level | Indicated Voltage [kV] | First peak current (± 15%) [A] | Rise time tr (± 25%) [ns] | Current @ 30ns (± 30%) [A] | Current @ 60ns (± 30%) [A] |
|-------|---------------------------|--------------------------------------|---------------------------------|----------------------------------|----------------------------------|
| 1 | 2 | 7.5 | 0.8 | 4 | 2 |
| 2 | 4 | 15 | 0.8 | 8 | 4 |
| 3 | 6 | 22.5 | 0.8 | 12 | 6 |
| 4 | 8 | 30 | 0.8 | 16 | 8 |
| X | 16 | 60 | 0.8 | 32 | 16 |
| X | * 30 | 112.5 | 0.8 | 60 | 30 |

Table 1 contact discharge current waveform parameters ONYX 16 / ONYX 30 according to IEC 61000-4-2 edition 2

* ONYX 30 only

3.1.2 ONYX optional accessories

| | |
|------------------------|---|
| RC modules | 150pF / 2000 Ohm according to ISO 10605, see table 2 below 330pF / 2000 Ohm according to ISO 10605, see table 2 below 330pF / 330 Ohm according to ISO 10605, see table 2 below 100pF / 1500 Ohm various standards 150pF / 150 Ohm various standards 500pF / 500 Ohm various standards 500pF / 5000 Ohm various standards xxxx pF / xxxx Ohm customized values |
| Fast rise time tip | 0.3ns rise time 112.5A @ 30kV peak current |
| Mains adapter | 100V – 240V, 47-63Hz, 45VA |
| 30kV air discharge tip | 30mm diameter |

| RC module | First peak current [A/kV] | Rise time [ns] | Current @ t1 [A/kV] | Current @ t2 [A/kV] |
|------------------|------------------------------|-------------------|-----------------------------|----------------------------|
| 330pF / 330 Ohm | 3.75 (+10%/-10%) | 0.7 to 1.0 | 2 (± 30%) @ t1=65ns | 1 [± 30%] @ t2 = 130ns |
| 150pF / 2000 Ohm | 3.75 (+30%/-0%) | 0.7 to 1.0 | 0.275 (± 30%) @ t1=180ns | 0.15 (± 50%) @ t2=360ns |
| 330pF / 2000 Ohm | 3.75 (+30%/-0%) | 0.7 to 1.0 | 0.275 (± 30%) @ t1=400ns | 0.15 (± 50%) @ t2=800ns |

Table 2 contact discharge current waveform parameters ONYX 16 / ONYX 30 with ISO 10605 RC modules

For RC module capacitor value > 150pF, maximum voltage / maximum frequency is limited, depending on frequency or voltage settings. See table 3 below

| RC module capacitor value [pF] | maximum voltage < 10Hz repetition [kV] | maximum voltage at 10Hz repetition [kV] | maximum voltage at 20Hz repetition [kV] |
|-----------------------------------|--|---|---|
| 50 | 30 | 30 | 30 |
| 100 | 30 | 30 | 30 |
| 150 | 30 | 30 | 30 |
| 200 | 30 | 30 | 20 |
| 330 | 30 | 30 | 15 |
| 500 | 30 | 20 | 15 |
| 1000 | 30 | 20 | 10 |

Table 3 maximum voltage / repetition frequency

3.2 Operating Conditions

| | |
|-----------------------------|-------------------------------|
| Operating Temperature Range | +15...+35 °C |
| Storage Temperature Range | -10...+50 °C |
| Air humidity | 20...80 % r.h, non condensing |
| Air pressure | 86...106 kPa |

3.3 Mechanical Data

| | |
|---------------------|--|
| Dimensions: | approx. W 290mm x H 270mm x D 110mm |
| Weight: | approx. 1.7kg |
| Tripod screw thread | ¼ inch UNC (standard camera tripod screw thread) |

3.4 Standards

| | |
|---------------------------|---|
| Standards covered by ONYX | <ul style="list-style-type: none">• IEC/EN 61000-4-2 edition 1 + 2 (default)• ISO 10605• IEC/EN 61326• IEC/EN 61000-6-1 & -6-2• IEC 61340-3-1• GMW 3097• Ford AB/AC• ANSI C63.16• PSA B21 7110• ISO 14304• ITU-T K.20• MIL-STD-331/-464/-750/-883/-1512/-1514/-1541/-1542• RTCA/DO-160• JEDEC 22-A114• GR-78-CORE• GR-1089-CORE• and others |
|---------------------------|---|

3.5 General



The equipment must not be subjected to:

- direct solar radiation
- water ingress
- dirty or dusty atmospheres
- excessive vibration
- electromagnetic interference

4 Initial Operation



Persons with heart pacemakers must not be in the vicinity when the system is operating!

4.1 Visual Checks

During transport ONYX may be subjected to excessive shocks and vibrations, even though every care is taken by Haefely Test AG to provide suitable packaging. Before operating the unit, check for signs of mechanical damage. Damaged packing cases may be a sign of transport damage. Damage caused in transit must be reported to the shipping agent immediately.



If damage to ONYX or its charging unit can be seen or is suspected, do not apply any voltage!

4.2 Installation



This equipment should only be operated in a Faraday cage or other suitable environment!

4.2.1 Connecting the ONYX

Before powering, fully charge battery using the supplied battery charger.



Connect one side of the black ground cable to earth connection (3) on the ONYX, located in front of the trigger button, and the other to the ground system of your test setup. Failure to make secure earth connection may result in electrical shock.

Securely place correct discharge tip (air or contact discharge, depending on your test requirement).

Power on by keeping the trigger key pressed for approx. 3 seconds.

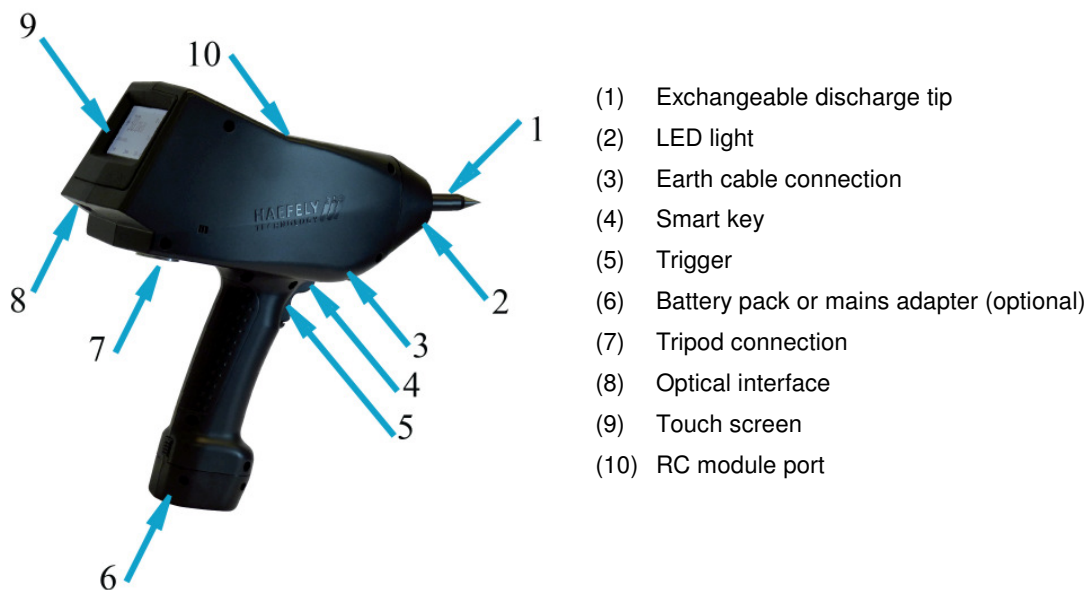


Fig. 1 connecting the ONYX

5 Local Operation

5.1 Power

5.1.1 Battery power & charger

The ONYX simulator comes together with two rechargeable NiMH batteries and a battery charger. The battery has to be either removed from the ONYX to be charged, or charged while the ONYX is not in operation. The battery charger cable has to be connected to the battery's charging connector, located at the base (bottom) of the battery, and has to be correctly and securely inserted to ensure correct charging.

The indicators on the charger provide all necessary information on the status of the battery and charging as described below:

- (1) LED red "Power": Steady light indicates that the charger is ready for use
- (2) LED red "Charge": Steady light indicates the fast charging process after connecting the battery pack
- (3) LED green "Ready": Steady light indicated that battery is fully charged. After approx 2 minutes it switches to flashing to indicate trickle charging.
Once the battery pack is connected, the testing cycle is initiated and the green LED flashes for approx 1 minute. If it carries on flashing and the red LED "Charge" does not light, it indicates that the battery pack is not connected properly and maybe has an incorrect polarity
- (4) LED yellow "Discharge": Steady light indicates the discharging process after pressing the yellow button. The LED "Ready" flashes for around 1 minute indicating the testing cycle
- (5) Discharge Button: Press this button for about two seconds to start the optional discharge process for the battery pack. Normally it is not necessary to discharge the batteries before charging

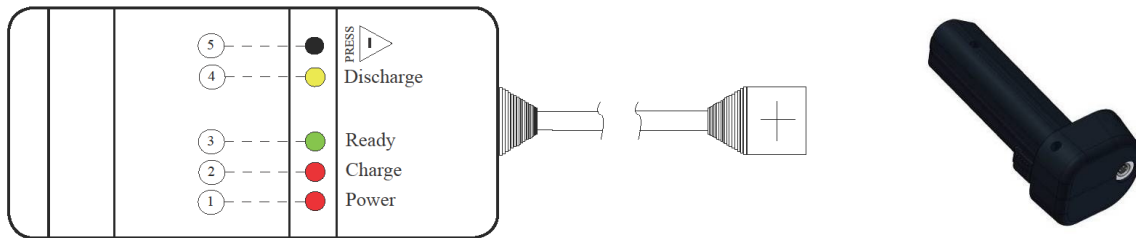


Fig. 2 charger and battery pack



To avoid deep discharge, remove battery pack from ONYX when not using it for more than one month



To avoid deep discharge due to self-discharge, battery pack should be fully charged at least once within a year, even if unit is not in use

5.1.2 AC mains adapter (optional)

The optional AC mains adapter set can be used for powering the ONYX from the power mains. To power the ONYX, replace the battery pack by the mains adapter and connect it to the power supply output cable.



Fig. 3 power supply

5.2 Parts

5.2.1 Trigger

The trigger position can be seen in figure 4.

When performing a sequence discharge event (see example section "Sub-menu 1"), the trigger needs to be kept pressed in order to run through the complete test sequence. By releasing the trigger during a sequence, the test will automatically stop, and will continue when the trigger is activated again.

You may also choose to select the "Trigger Lock" function from sub-menu 2, in order to lock the trigger position for long test events.



Fig. 4 trigger and smart key

5.2.2 Smart key

The smart key's position can be seen in figure 4 and is integrated in top part of the trigger button. Smart key functions are defined in the sub-menu 2.

5.2.3 Tripod

The ONYX connection position for the tripod is shown in figure 5. For continuous testing the use of a tripod is recommended. Screw thread 1/4 inch UNC.



Fig. 5 tripod position

5.2.4 Optical interface

The optional remote control package enables remote control operation of the unit, automatic generation of tests report and uploading/downloading test sequences to/from ONYX.

The package contains:

- Fibre-optic cable 10m having RS232 converter one end and optical plug on other end
- RS232 to USB converter
- User manual including instruction set
- ONYX application software for remote control & automatic reporting



Fig. 6 optical interface

5.2.5 Discharge tips



Before touching the discharge tips to change them, switch the ONYX tester off and wait for a few seconds so that the impulse capacitor can discharge internally. Do not touch the tips while the “HVon” is displayed on the touch screen, indicating that the capacitor is charged. Any contact with the test tips during this stage will result in electrostatic discharge.

The ONYX simulator is supplied with one contact and one air discharge tip. Additional tips such as 30mm air discharge and fast rise time tips are available as an option.

The 30mm air discharge tip ensures a more stable rise time of the pulse above 15kV.

The fast rise time tip reduces the rise time of the ESD pulse down to 0.3ns.

Please refer to section "Accessories and Options" for ordering details.



Because of the sharp edge of the contact discharge tip, we highly recommend that you handle this part with care to avoid unnecessary injuries.



Contact discharge tip



Air discharge tip



30mm air discharge tip (optional)

Fig. 7 discharge tips




- (1) The discharge tip can easily be placed or removed from the ONYX
- (2) Ensure correct tip type is used before each test
- (3) We recommend that you remove the tips for the ONYX when testing is complete and place within a safe area to avoid damaging

Fig. 8 discharge tip position

5.2.6 RC modules

The basic version of ONYX is supplied with the 150pF / 330 Ohm IEC / ISO RC module. Additional modules are available. Please refer to section "Accessories and Options".

To replace an RC module, remove the cover at the side of the ONYX as seen in figure 10. A small pull-out handle on the RC module is used for pulling out the RC module from the ONYX.

 **Never remove the RC module while the ONYX is in operation. Switch off unit and wait at least 10 seconds before removing. Failure to do this may result in electrical shock.**

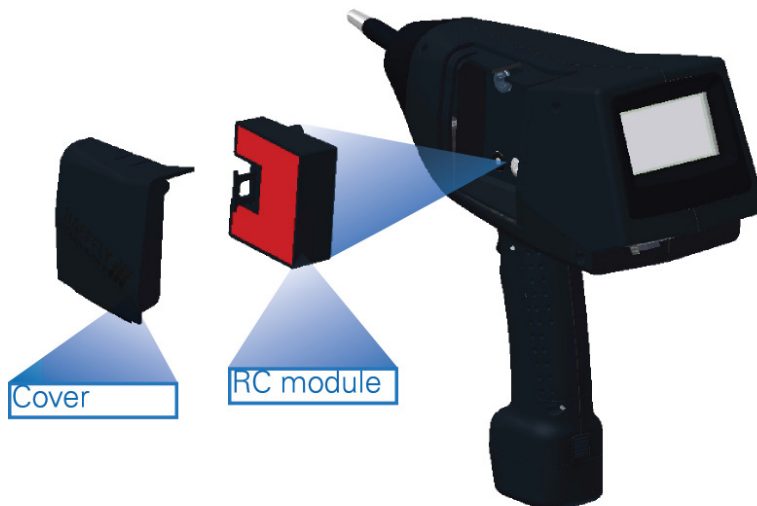


Fig. 9 RC module

5.3 Main menu

The ONYX simulator is operated via a touch screen which serves as an interface for defining, loading, and storing tests. The figure below resembles a screenshot of the main menu.

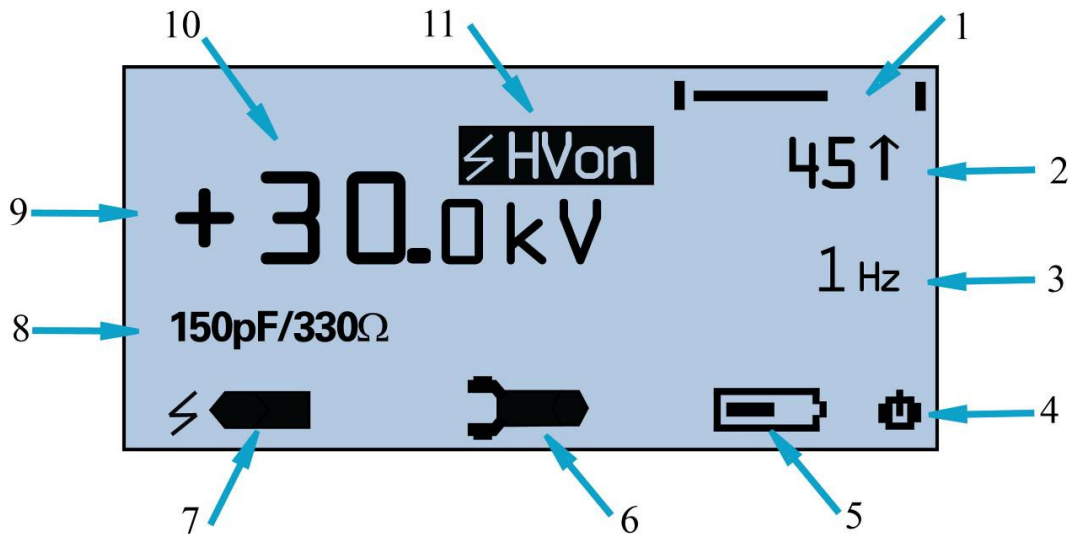




Fig. 10 ONYX main menu

| | | | |
|------|------------------------|--|--|
| (1) | Bar graph | Displays test progress if "Alt.Polarity" and/or "Sweep U" function has been selected | |
| (2) | Discharge counter | Select count up " ↑ " / down " ↓ " Set pre-selection counter 1-9999 (only if " ↓ " is selected) Reset the counter to 0 (counter up) or the preselected value (counter down) Set "Threshold" settings. For details see section "Discharge detection and Threshold setting" and section "Technical Data ONYX basic version" | |
| (3) | Repetition / frequency | Set frequency | single/auto for air discharge mode single/0.1/0.2/0.5/1/2/5/10/20Hz for contact discharge mode |
| (4) | Power Off | Keep pressed for 3 seconds to turn unit OFF | |
| (5) | Battery | Displays remaining battery life (display only) | |
| (6) | Sub-menu | Press to enter ONYX sub-menu 1-3 | |
| (7) | Discharge mode | Press to select discharge mode | <input type="checkbox"/>  contact discharge  air discharge |
| (8) | RC network | Displays current RC module (display only) | |
| (9) | Polarity | Set/display polarity to positive or negative | |
| (10) | Voltage | Set/display selected voltage | |
| (11) | HVon | Displays HV status. When this is displayed, then the high voltage capacitor is charged and any contact with the tip may cause a discharge (display only) | |

5.3.1 Using the sub-menus

Press shortcut 6 (figure 10) to enter sub-menu.

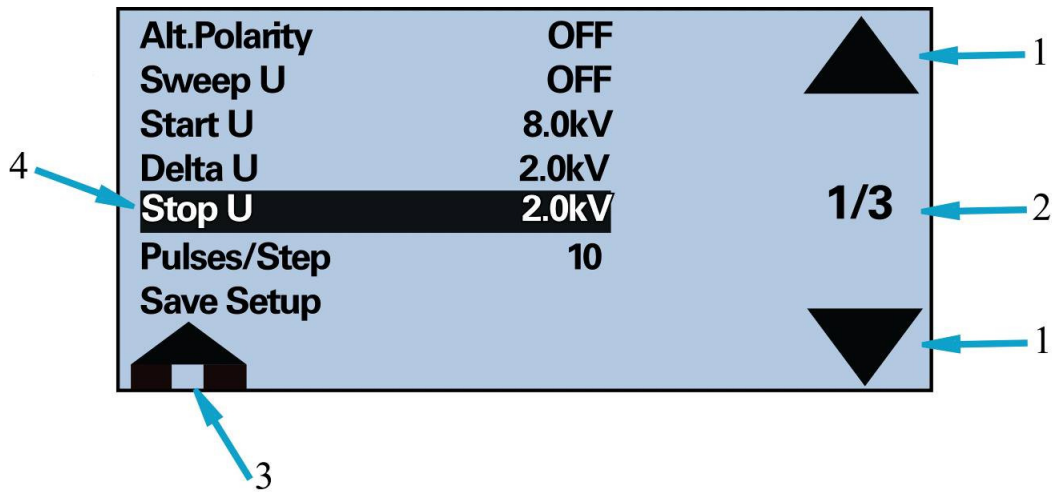
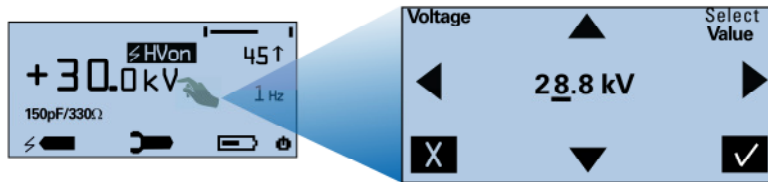


Fig. 11 sub-menu

| | | |
|-----|--------------------|--|
| (1) | Menu Up/Down key | Use the Up/Down key to toggle between menu pages and move the selection bar |
| (2) | Page | Displays the current menu page (display only) |
| (3) | Home | Press to return to main menu |
| (4) | Highlight function | This highlights the function you have moved to by using the menu up/down keys (1). Once you have highlighted the function you wish to select, press in the middle of the screen to enter |

5.4 Basic operation

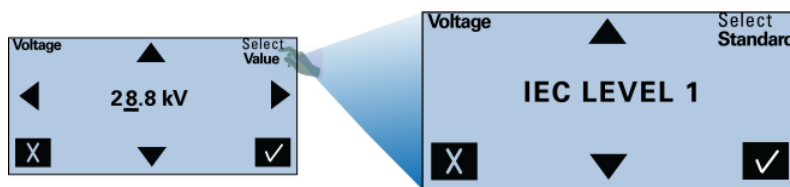
There are various ways of performing your ESD testing depending on your exact requirement. The ONYX has been designed in such a way to ensure flexibility and simplicity of operation. A fast test can be performed via the main menu, or you may load a test or define a test sequence via the sub-menu pages. The following examples will guide you through the types of tests you can perform with the ONYX, as well as the functions of each menu function.



Select contact/air discharge and repetition frequency as described in figure 10.

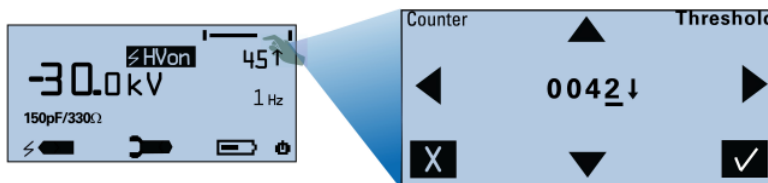
- (1) Press on "+" or "-" key to switch between positive and negative polarity
- (2) Touch on displayed value
- (3) Use Left/Right keys to scroll to the numerical value you wish to change
- (4) Use Up/Down key to change underlined value
- (5) Press "✓" key to save change, or "X" key to exit without saving

If you want to Select an "IEC level", press on the "Select Value" at the top right of the screen.



- (1) Press "Select Value" to switch to "Select Standard"
- (2) Scroll Up/Down to select desired level (1-4)
- (3) Press "✓" key to save change, or "X" key to exit without saving

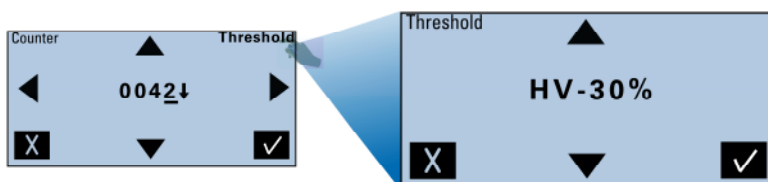
Press on the top right corner to enter and change "Counter" settings, and to access the "Threshold" settings menu.



By accessing the "Counter" menu and pressing "✓", without manually entering any counter values, the ONYX will automatically preset the counter to the last saved values.

- (1) Press on the top right corner to enter the "Counter" menu
- (2) Use the left/right/up/down arrow keys to enter the desired counter settings (1-9999), and select counter "up/down"
- (3) Press "✓" to save change, or "X" key to exit without saving

Note: Values 1-9999 only may be entered in "count down" mode



In "contact discharge" mode, Threshold settings are "10%...90%" or "OFF"
 In "single air discharge" mode, Threshold settings are "10%...90%"
 In "auto" air discharge mode, Threshold setting is fixed at "20%"

- (1) In the "Counter" menu, press on the top right corner to enter the "Threshold" menu
- (2) Use the Up/Down arrow keys to enter the desired Threshold level
- (3) Press "✓" to save change, or "X" key to exit without saving

For details please see section "Discharge Detection and Threshold setting"

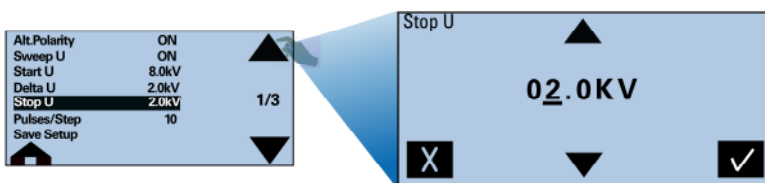
5.4.1 Sub-menu 1

The sub-menu section enables you to change ONYX settings, define, save and open pre-defined tests, as well as view environmental conditions, define smart key functions, display system info etc.

To enter the menu pages follow the instructions in figure 10. To scroll through menus and make selections, please use the instructions mentioned in figure 11.

| | |
|--------------|--|
| Alt.Polarity | Switch to "ON" position to activate automatic polarity switching. Polarity will toggle when "Pulses/Steps" impulses are finished Can be used in combination with "Sweep U" function |
| Sweep U | "ON" position activates the sweep voltage function Can be used in combination with "Alt.Polarity" function |
| Start U | Enter the starting voltage of your "Sweep U" sequence (1-16kV ONYX 16 / 1-30kV ONYX 30) |
| Delta U | Enter the voltage step of your "Sweep U" sequence (0,1kV ... 10kV / 0.1kV steps) |
| Stop U | Final test voltage level of your "Sweep U" sequence (1-16kV ONYX 16, 1-30kV ONYX 30) |
| Pulses/Step | Number of pulses per test step of your "Alt.Polarity" and/or "Sweep U" sequence (1 ... 999) |
| Save Setup | Save and/or rename current setup Note that to save a setup, you will need to overwrite one of the 8 factory-predefined setups. To change the name: (1) enter "Save Setup" page (2) touch the name displayed in the middle of the screen (3) use the Up/Down and Left/Right keys to make name changes (4) press "√" to save changes or "X" to exit without changing |

Example of a test sequence using "Alt.Polarity and "Sweep U" function



Enter the values as displayed on the menu page 1/3 on the left, and return to main menu.

By pressing the trigger button the ONYX will perform the following test sequence:

- (1) 10x impulses at +8kV
- (2) 10x impulses at -8kV
- (3) 10x impulses at +6kV
- (4) 10x impulses at -6kV
- (5) 10x impulses at +4kV
- (6) 10x impulses at -4kV
- (7) 10x impulses at +2kV
- (8) 10x impulses at -2kV



5.4.2 Sub-menu 2

| | |
|--------------|--|
| Open Setup | Open one of 8 stored setups. As factory default, 8 IEC tests are stored (L1 to L4 contact discharge and L1 to L4 air discharge). This predefined tests can be overwritten by customer specific setups |
| Trigger Lock | "ON" locks trigger position, "OFF" disables trigger lock position. When you select "ON" position, press the trigger once to begin a test sequence. If pressed again the test will stop |
| Smart key | Program the smart key function according to your testing requirements: Alternate Polarity, Reset Counter, Tip LED, Auxiliary trigger, Report, U-step "ALTERNATE POL" enables you to change the polarity via the smart key "RESET COUNTER" resets the counter to the pre-selected value "Tip LED" LED can be switched on/off by the smart key "AUX. TRIGGER" send a trigger signal to a PC via the optical link. Can be used for example for triggering an USB-Camera which is connected to the PC "REPORT" If ONYX application software is used (running on PC which is connect to ONYX via optical link), this function is used to jump automatically to the next test point on the generated test report "U-STEP" Use the smart key to increase/decrease test levels: U-2kV, U-1kV, U-0.5kV, U-0.1kV, U+0.1kV, U+0.5kV, U+1kV, U+2kV |
| Self test | Performs a self test on the ONYX simulator. Please refer to section "Error Messages and Selftest" |
| Tip LED | Switch tip LED ON and OFF |
| Temp & RH | Displays environmental temperature, relative humidity and dew point in degrees Fahrenheit or Celsius. Use up/down keys to toggle between degrees Fahrenheit and Celsius |
| System Info | Displays firmware version, serial number, model, RC module values |

5.4.3 Sub-menu 3

| | |
|----------------|--|
| Backlight | Adjust backlight settings OFF to 100% (10% steps) |
| Contrast | Adjust contrast 0-100% |
| Beeper | Set key-beep to ON/OFF. Beep sound due to a failure can not be deactivated |
| Set to default | ONYX settings are set to default. Saved tests will NOT be reset! |
| English | Change display language settings to English, French, German |
| Auto Off | Define switch off time: OFF, 120/60/30/15 minutes |
| Power Off | Switch unit off |

5.5 During the test

5.5.1 Display

During a test the main menu displays the selected test parameters and provides feedback on the test status.

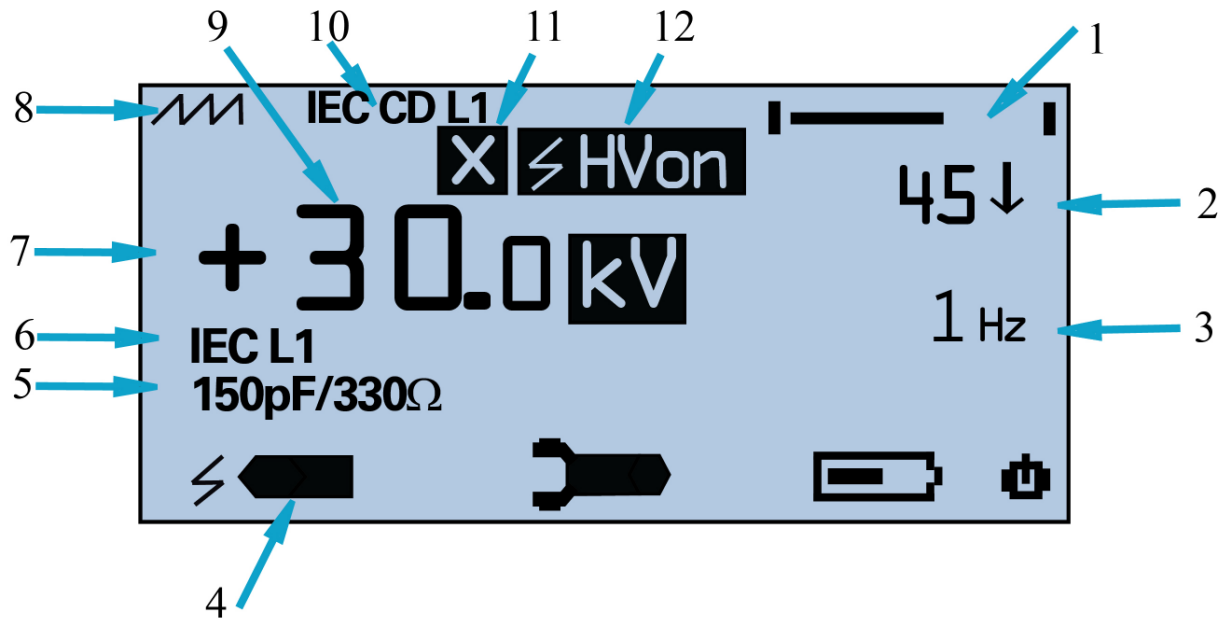


Fig. 12 during testing display

| | | |
|-----|------------------------|---|
| (1) | Bar graph | Displays sequence progress if "Alt.Polarity" and/or "Sweep U" function has been selected. If sequence is finished, beeper beeps thrice. Releasing and pressing again the Trigger will reset the bar graph and restart the sequence |
| (2) | Discharge counter | The display counter will count up or down depending on the settings " ↑ " will count up, indicating the current number of discharges. Once the trigger button is released, the test will stop. When the trigger is pressed again, the counter will continue to count up from the previous value. Resetting the counter is possible via the Counter menu or the smart key " ↓ " will count down from the user preselected value, indicating the value of the remaining discharges. When the Counter reaches "0", the test will stop and beeper beeps thrice. Resetting the Counter is possible via the Counter menu or the smart key |
| (3) | Repetition / frequency | Displays selected frequency |
| (4) | Discharge mode | Displays discharge mode |
| (5) | RC module | Displays current RC module |
| (6) | IEC level | If a certain test level (L1/L2/L3/L4) according to IEC 61000-4-2 is selected, this is indicated in the display. Please note that according to the standard, test levels are different for air discharge and contact discharge mode |
| (7) | Polarity | Displays current polarity |

| | | |
|------|--------------|--|
| (8) | Trigger Lock | If "Trigger Lock" is set to "ON" in the sub-menu 2, Trigger Lock sign is visible in the display. If trigger is pressed once, test will be started and the sign is highlighted. If trigger is pressed again, test will be stopped and sign is no longer highlighted |
| (9) | Voltage | Displays voltage When a valid discharge is detected, the "kV" sign is highlighted |
| (10) | Setup name | If a predefined setup is opened, the name is displayed. As soon as one of the test parameters is changed, setup name will disappear |
| (11) | HV timeout | In air discharge mode, if the trigger is pressed ONYX will start generating high voltage. During this time the "HVon" sign (12) is visible on the display. If no discharge occurs within a period of 10 seconds, high voltage is switched off automatically and the HV timeout " X " sign appears. This not only indicates that a discharge did not occur, but also prevents electrical shock and saves battery life |
| (12) | HVon | Displays HV status. When this is displayed, then high voltage is generated and any contact with the tip may cause a discharge (display only). Tip must not be touched by the user as long as this sign is displayed |

5.6 Discharge detection and Threshold setting

The ONYX provides appropriate feedback and warnings with regards to whether a discharge to EUT has occurred.

In contact discharge mode, whether a valid discharge occurred or not can normally only be detected by using the "Threshold" function.

For example, doing a contact discharge test on an EUT having coated metallic enclosure, it is required that the test tip penetrates the coating, so that a real discharge to EUT may occur. If there is no electrical contact between test tip and EUT enclosure, there will be no discharge to the EUT. Normally, the user may not detect by himself whether there was a discharge to EUT or not. No discharge means that EUT was in fact not tested correctly.

In air discharge mode, the user normally can detect if there was a flashover from the test tip to the EUT or not. However, even if a flashover occurred, the energy from HV-capacitor may be discharged only partly. Depending on the users requirements, also for air discharge mode the "Threshold" function may be useful.

Figure 13 below displays different "Threshold" levels. If for example a test is performed with a "Threshold" level of "HV -10%", then the ONYX will check the HV-capacitor voltage level before the trigger, and compare it to the voltage level following the release of the trigger. If the drop exceeds 10%, then the ONYX will automatically assume a valid discharge and Counter will be changed by 1 impulse.

If the 10% is not exceeded, indicating that the HV-capacitor did not discharge to the desired level, the ONYX will assume an invalid discharge and will issue the appropriate warnings and actions as described below.

If no valid discharge occurs then the beeper will beep once, the counter will not change value, and the test will stop. Release and press again the trigger to restart the test.

A valid air or contact discharge is confirmed by the "kV" indication next to the selected voltage display value. Once a valid discharge occurs, the "kV" indication is highlighted as shown in figure 12.

If "Threshold" is on "OFF" position (only possible with contact discharge mode), the ONYX will run through the test sequence but there will be no indication whether an actual discharge has occurred.

In "auto air discharge" mode, "Threshold" setting is fixed at "20%".

The individual users will need to judge which "Threshold" level is appropriate for their test depending on their requirements.

Please note: As conditions changes with specific EUT, test voltage, approach speed (for air discharge), polarity, test setup, temperature, humidity, etc, Threshold %-value (HV -XX%) may be only an approximation.

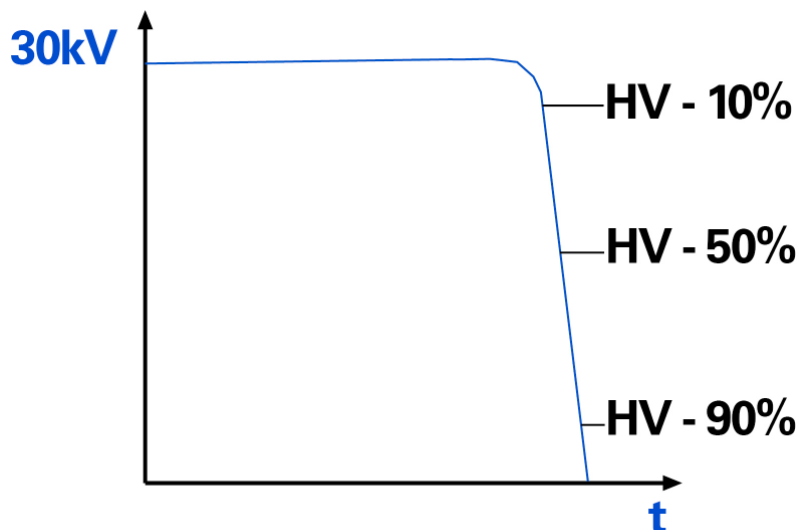


Fig. 13 Threshold

5.7 Test setup

To find out more about test levels and test setups, please refer to the relevant standards. Accessories such as VCP, HCP, test table, 2x470 kOhm resistor cable, etc. are available from Haefely. Please refer to section "Accessories and Options".

5.7.1 Test setup example according to IEC/EN 61000-4-2 edition 2

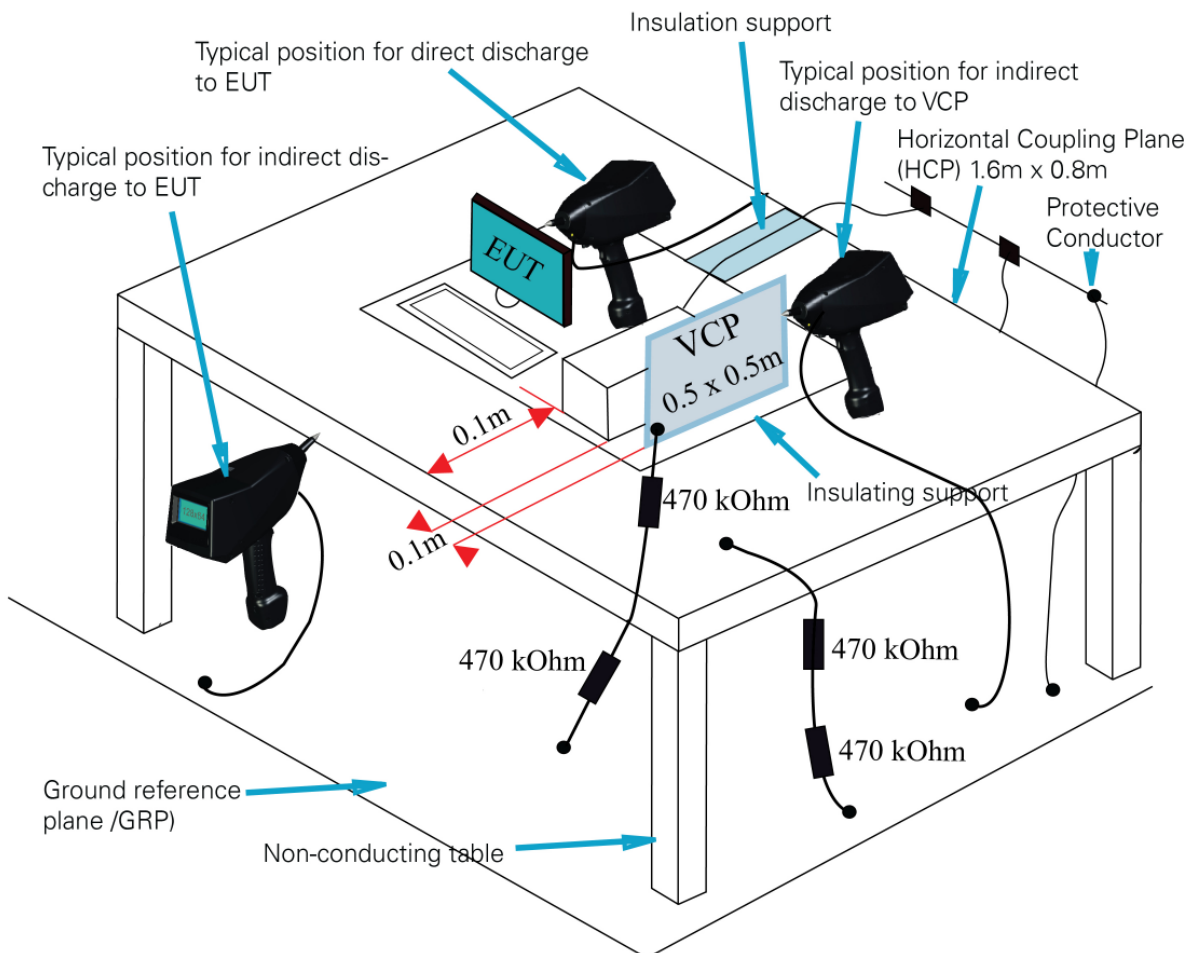


Fig. 14 test setup example for table-top equipment according to IEC 61000-4-2 edition 2

6 Error Messages and Selftest

6.1 Error messages



ONYX monitors constantly all important parameters. Almost any major failure within one of the low voltage or the high voltage circuits would be detected and reported immediately

When errors occur during operation of the ONYX, a warning message will appear.

If an error occurs, the ONYX will either request how to proceed, or following a warning, automatically switch off the unit to avoid possible damage.

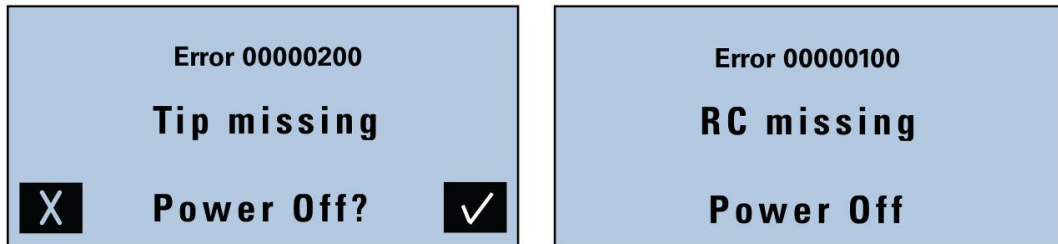


Fig. 15 error messages

| Error Code | Message | Possible cause | Action needed |
|------------|-----------------------|---|---|
| 0000 0001 | Battery voltage error | Battery voltage too high Battery voltage too low | Discharge battery via battery charger and re-charge or try other battery Charge battery or try other battery |
| 0000 0100 | RC missing | RC module missing or damaged RC module | Switch off unit and place RC module correctly or try another RC module (if available) |
| 0000 0200 | TIP missing | Tip missing or not placed correctly | Switch off unit and place tip correctly |
| 0000 0400 | Charger | The charger is connected to the battery while the ONYX is in operation | Switch off ONYX while charging battery, or remove battery from ONYX to charge |
| 0000 4000 | HV not reached | This error may occur only in air discharge mode, and indicates that either a short circuit from tip to earth has occurred, or that tip is too close to the target | Check test setup |
| 0000 8000 | Timeout HV low | The internal HV-capacitor discharge circuit does not work correctly | Switch ONYX off and on again. If error persists, unit need to be repaired |
| 0001 0000 | Flash memory error | Error occurred while ONYX was writing to memory. Setup will restore default settings | Turn unit off using the power off button on the display. Turn unit on and try again |

Table 4 error messages



If error codes appear without a displayed message, please take a note of the error code and contact our service department. Contact details see section "Corrections and Additions"

6.2 Selftest routine

Many ESD standards suggest determining whether the simulator is functioning correctly before testing takes place. Running the Selftest routine (see section "Sub-menu 2"), all relevant parts of the unit are checked quick and easy.

6.2.1 Performing Selftest routine



***Before performing the Selftest routine, ensure that the earth connection of the ESD Simulator is connected to a good earth.
If Selftest routine is started without connection to earth, electrical shock may occur!***



***The test tip of the ONYX need to be short-circuited to earth during entire Selftest routine!
Contact ONYX tip to the **ground reference plane** of your test setup, then start Selftest from the menu
Failure to do this, some "FAILED" will result from the Selftest***

The Selftest routine will check:

- Correct function of high voltage supply for both polarities
- Function of contact discharge relay
- Energy storage capacitor
- Discharge resistor
- Internal discharge circuit

A final report containing PASSED / FAILED information is displayed.

The Selftest duration time depends on the type of the RC module. For the default 150pF/330 Ohm RC module it requires about 30s. For large capacitor values, it may take up to 3 minutes.

6.2.2 Troubleshooting if Selftest FAILED

In case that one or more FAILED occurred, please check the following:

- Ensure that the ONYX tip is short-circuited to ground during entire Selftest
- Fully charge the battery or insert a fully charged battery, perform Selftest again
- Switch Off the unit, remove the battery for 1 minute, after that perform Selftest again
- Perform Selftest using another test tip
- Perform Selftest using another RC module (if available)

If the unit is still not working properly, please contact our customer support.
For contact information, please see section "Corrections and additions".

7 Accessories and Options

7.1 ONYX Accessories



The following accessories are included with the basic version of ONYX ESD simulator:

- Carrying case
- Quick start guide
- User manual
- Air discharge tip
- Contact discharge tip
- RC module IEC / ISO 150pF/330 Ohm
- Two rechargeable battery packs
- Battery charger including AC adapter for Europe, USA, China, UK
- Earth cable
- Factory calibration certificate

Following additional accessories or spare material can be ordered separately:

| Article | Article Number |
|---|----------------|
| RC Modules: | |
| 150pF / 2000 Ohm | 2490204 |
| 330pF / 2000 Ohm | 2490205 |
| 330pF / 330 Ohm | 2490206 |
| 100pF / 1500 Ohm | 2490207 |
| 150pF / 150 Ohm | 2490208 |
| 500pF / 500 Ohm | 2490209 |
| 500pF / 5000 Ohm | 2490210 |
| xxxxpF / xxxx Ohm (custom) | 2490211 |
| Air discharge tip 30kV / 30mm | 2490212 |
| Fast rise time tip 0.3ns | 2490213 |
| AC mains adapter | 2490214 |
| Remote control package (see Fig. 16 below) | 2490216 |
| Accredited calibration | 2499981 |
| ESD Verification set IEC/EN 61000-4-2 edition 2 | 2499971 |
| Vertical Coupling Plane with resistor cable | 2495581 |
| Horizontal Coupling Plane with resistor cable | 2496881 |
| ESD wooden test table | 2496871 |
| Resistor cable 2x470 kOhm | 2498101 |

7.1.1 ONYX remote control package

The optional remote control package enables remote control operation of the unit, automatic generation of tests report and uploading/downloading test sequences to/from ONYX.

The package contains:

- ONYX application software for remote control & automatic reporting
- Fibre-optic cable 10m having RS232 converter one end and optical plug on other end
- RS232 to USB converter
- User manual including instruction set

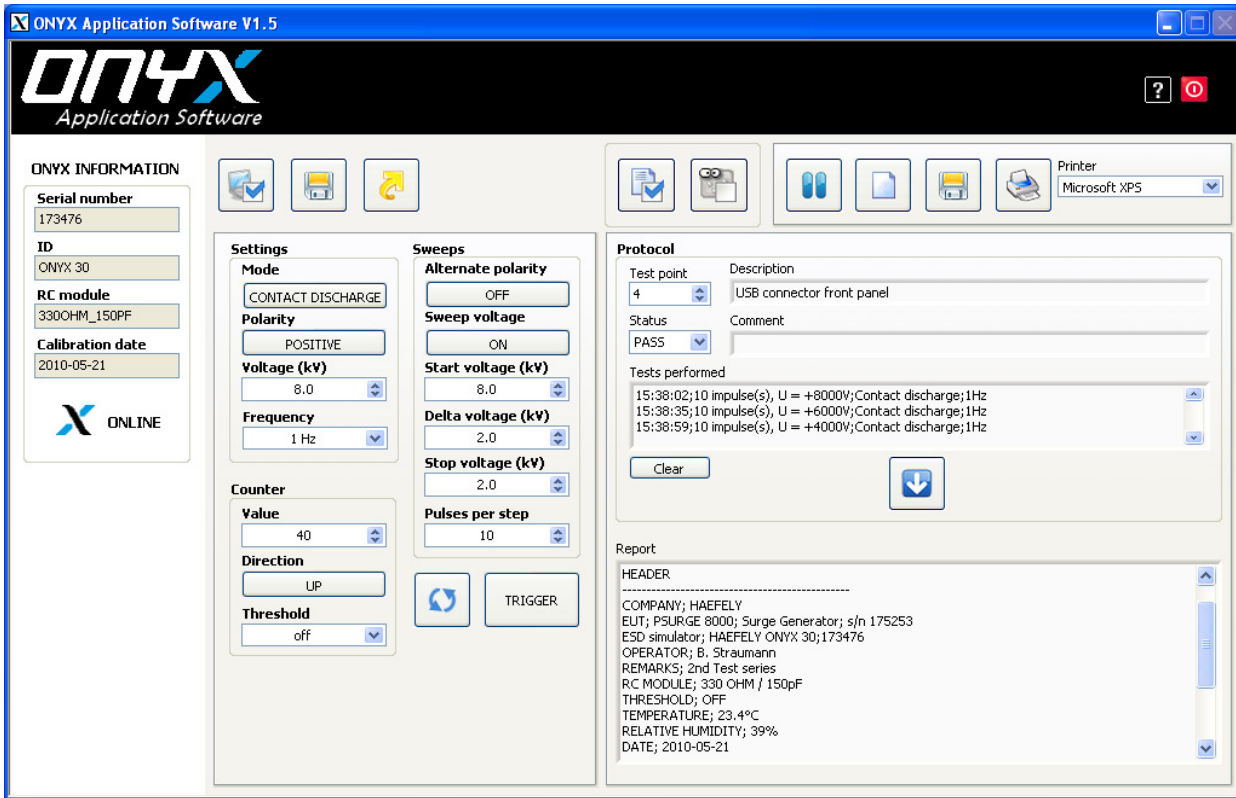


Fig. 16 ONYX application software

8 Service

8.1 Service

ONYX contains no user serviceable parts. Maintenance involves cleaning the outer surfaces of the equipment only.

8.1.1 Cleaning

1. Remove all mains cables and other connections from the unit.
2. The unit can be cleaned with a damp soapy cloth. Make sure that all equipment is dry before you reconnect and start up again.

8.1.2 Battery

To avoid deep discharge due to self-discharge, battery packs should be fully charged at least once within a year, even if unit is not in use.

8.2 Calibration

Calibration period of the ONYX has to be determined by the user, and depends on the intensity of use and end user requirements.

Typically, a calibration is recommended every 2 years.

The ONYX is factory calibrated before shipped and supplied with the calibration certificate.

9 Corrections and Additions

9.1 Addresses

9.1.1 International Customer Service

e-Mail: EMC-Support@haefely.com

Address: Haefely Test AG
Lehenmattstrasse 353
4052 Basel / Switzerland

Fax : + 41.61.373 45 99

Internet: www.haefelyEMC.com

9.1.2 USA Customer Service

e-Mail: EMC-Support@haefely.com

Address: Hipotronics Inc.
Department EMC
1650 Route 22
Brewster, NY 10509 / USA

Telephone : (845) 279 3644

Fax : (845) 279 2467

Internet: www.haefelyEMC.com

9.1.3 China Customer Service

e-Mail: EMC-Support@haefely.com

Address: Haefely Representative Office
8-1-602, Fortune Street
No.67, Chaoyang Road, Chaoyang District
Beijing, China 100025

Telephone : +86 10 8578 8099 / 8199 / 8299

Fax : +86 10 8578 9908

Internet: www.haefelyEMC.com

9.1.4 Manufacturer

e-Mail: EMC-Sales@haefely.com

Address: Haefely Test AG
Lehenmattstrasse 353
4052 Basel / Switzerland

Telephone : + 41.61.373 41 11

Fax : + 41.61.373 49 12

Internet: www.haefelyEMC.com

9.2 Glossary of terms and Abbreviations



meaning: Helpful hints, notes, tips or remarks



meaning: Attention!

| | |
|------|---|
| ESD | Electro Static Discharge |
| EUT | Equipment Under Test |
| HV | High Voltage |
| AD | Air Discharge |
| CD | Contact Discharge |
| HCP | Horizontal Coupling Plane |
| VCP | Vertical Coupling Plane |
| GRP | Ground Reference Plane |
| LCD | Liquid Crystal Display |
| LED | Light Emitting Diode |
| IEC | International Electro-technical Committee |
| EN | European Norm |
| ANSI | American National Standards Institute |
| EMC | Electro Magnetic Compatibility |
| EMV | German equivalent of EMC |

10 Appendix A

10.1 CE conformity

HAEFELY TEST AG

Declaration of Conformity

Haefely Test AG
Lehenmattstrasse 353
4052 Basel
Switzerland

declare, under his own responsibility, that the below mentioned product complies with the requirements of the listed standards or other normative documents.

So, the product complies with the requirements of the EMC directive 2004/108/EC and the low voltage directive 2006/95/EC.

Product: **ONYX 16 / ONYX 30**

Description: The product ONYX 16 / ONYX 30 generates electrostatic discharges according to IEC/EN 61000-4-2 and other standards. It is used to verify the conducted immunity of electrical products.

Standards: EN 61010-1: 2001
EN 61326-1: 2006

R. Mäder
Quality Department Manager
Haefely Test AG
4052 Basel
Switzerland

Basel, April 16, 2010



(Signature)

Notice:
The function of this equipment is to generate electrical interference. Because of this the limits defined for emission can be exceeded for short periods when the high voltage is switched on.