

# ON4X

*Electrostatic Discharge Simulator*

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**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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Authors	B. Straumann
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# 1 Safety

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## 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.**

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## 1.2 Safety Standards

The ONYX fulfils the requirements of IEC 61010-1.

# 2 Description

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## 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



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## 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

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## 3.3 Mechanical Data

Dimensions:	approx. W 290mm x H 270mm x D 110mm
Weight:	approx. 1.7kg
Tripod screw thread	1/4 inch UNC (standard camera tripod screw thread)

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## 3.4 Standards

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

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## 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!**

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## 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.

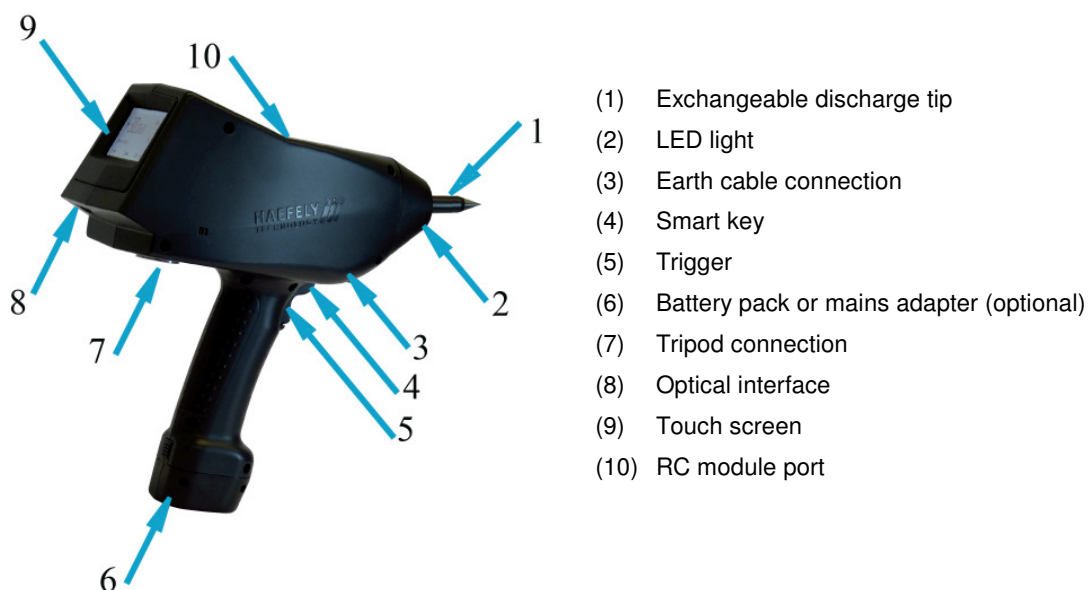


Fig. 1 connecting the ONYX

## 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 pack has to be removed from the ONYX to be charged. It can not be charged during ONYX is 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

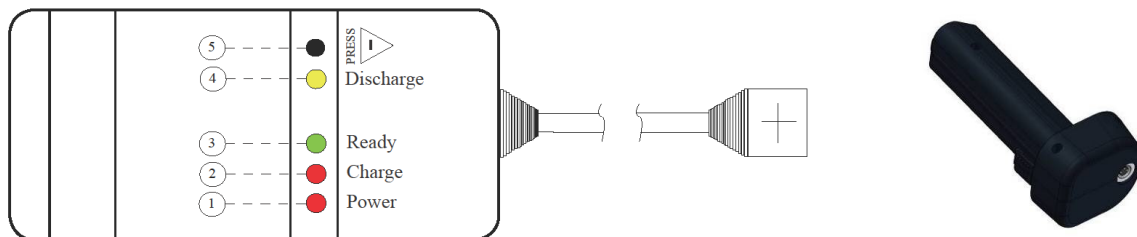


Fig. 2 charger and battery pack



*Battery pack should only be recharged after it has been used for at least 1 hour*



*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

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## 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.**

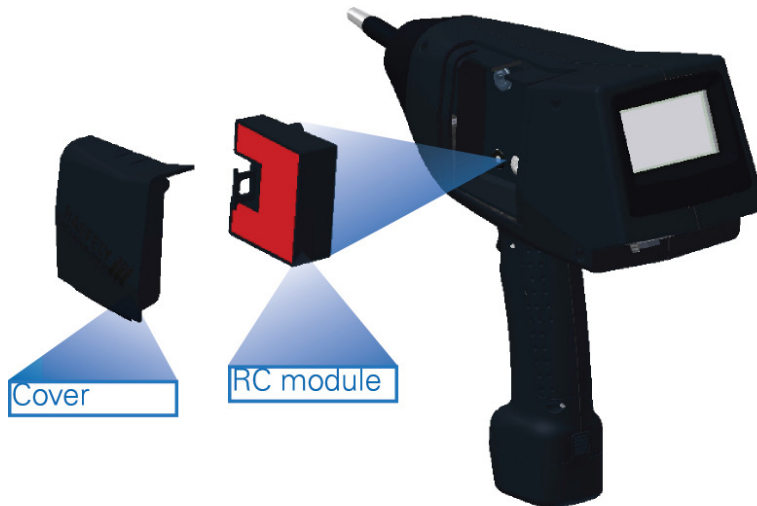


Fig. 9 RC module

## 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.

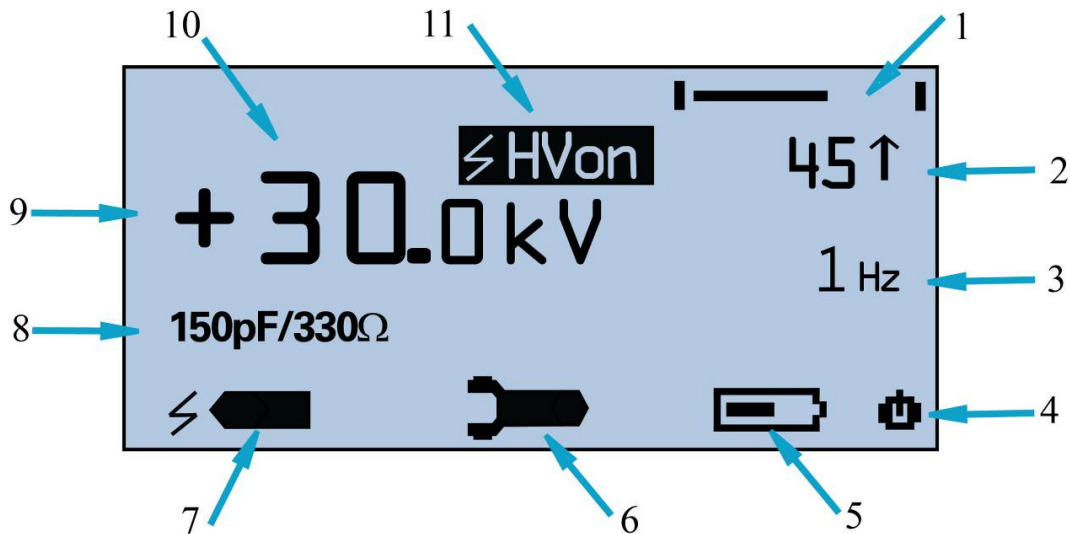




Fig. 10 ONYX main menu

(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.

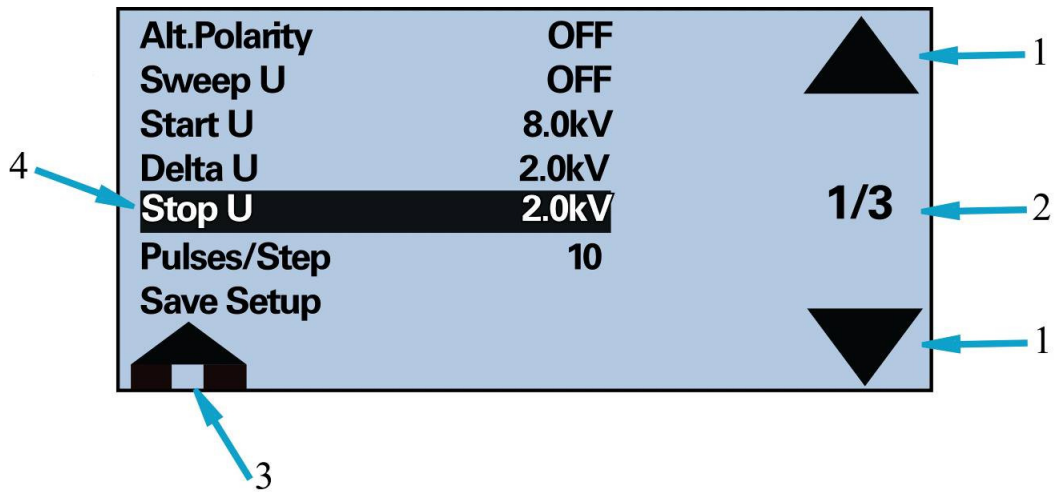


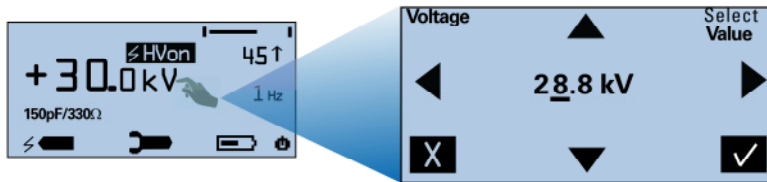
Fig. 11 sub-menu

(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

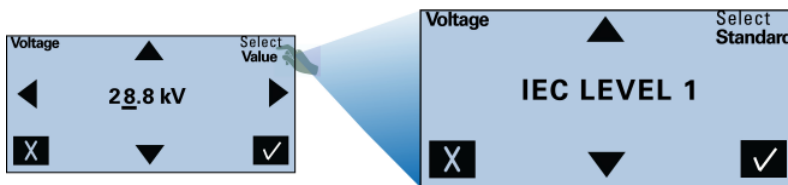
There are various ways of performing your ESD testing depending on your exact requirement. The ONYX has been designed in such a way to ensure flexibility and simplicity of operation. A fast test can be performed via the main menu, or you may load a test or define a test sequence via the sub-menu pages. 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.

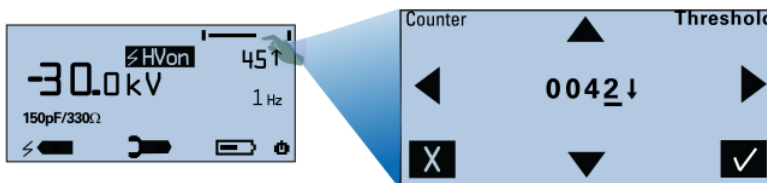
- (1) Press on "+" or "-" key to switch between positive and negative polarity
- (2) Touch on displayed value
- (3) Use Left/Right keys to scroll to the numerical value you wish to change
- (4) Use Up/Down key to change underlined value
- (5) Press "✓" key to save change, or "X" key to exit without saving

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

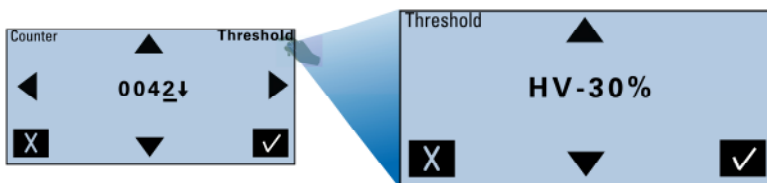
Press on the top right corner to enter and change "Counter" settings, and to access the "Threshold" settings menu.



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



- (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

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%"

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

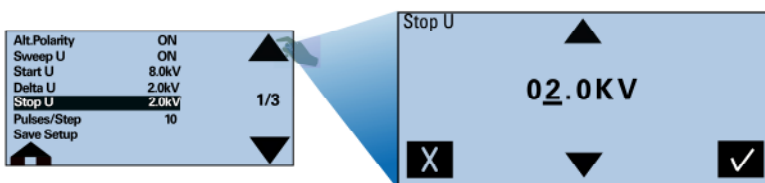
### 5.4.1 Sub-menu 1

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

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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

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## 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.

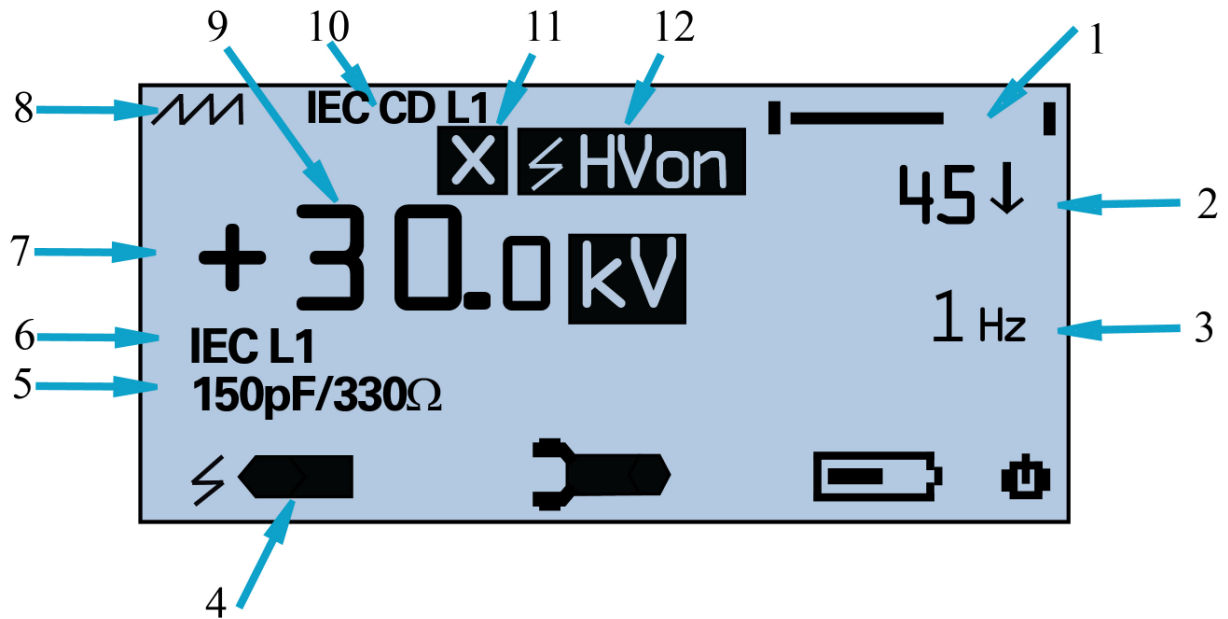


Fig. 12 during testing display

(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.

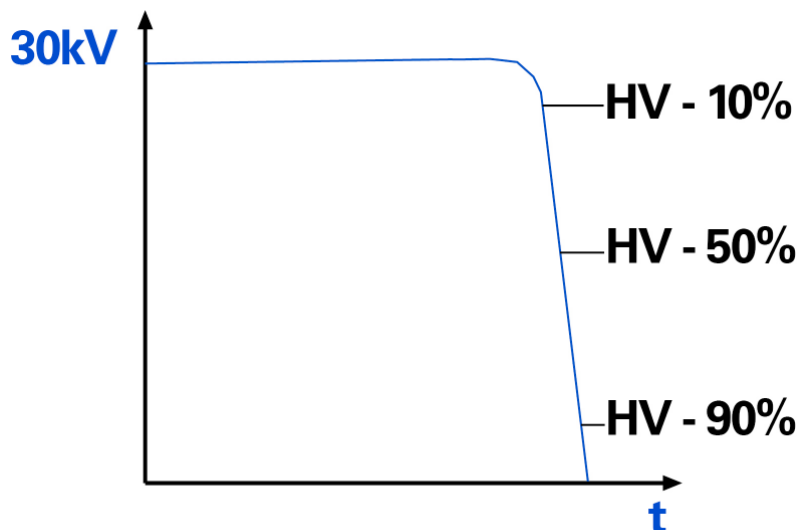


Fig. 13 Threshold

## 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

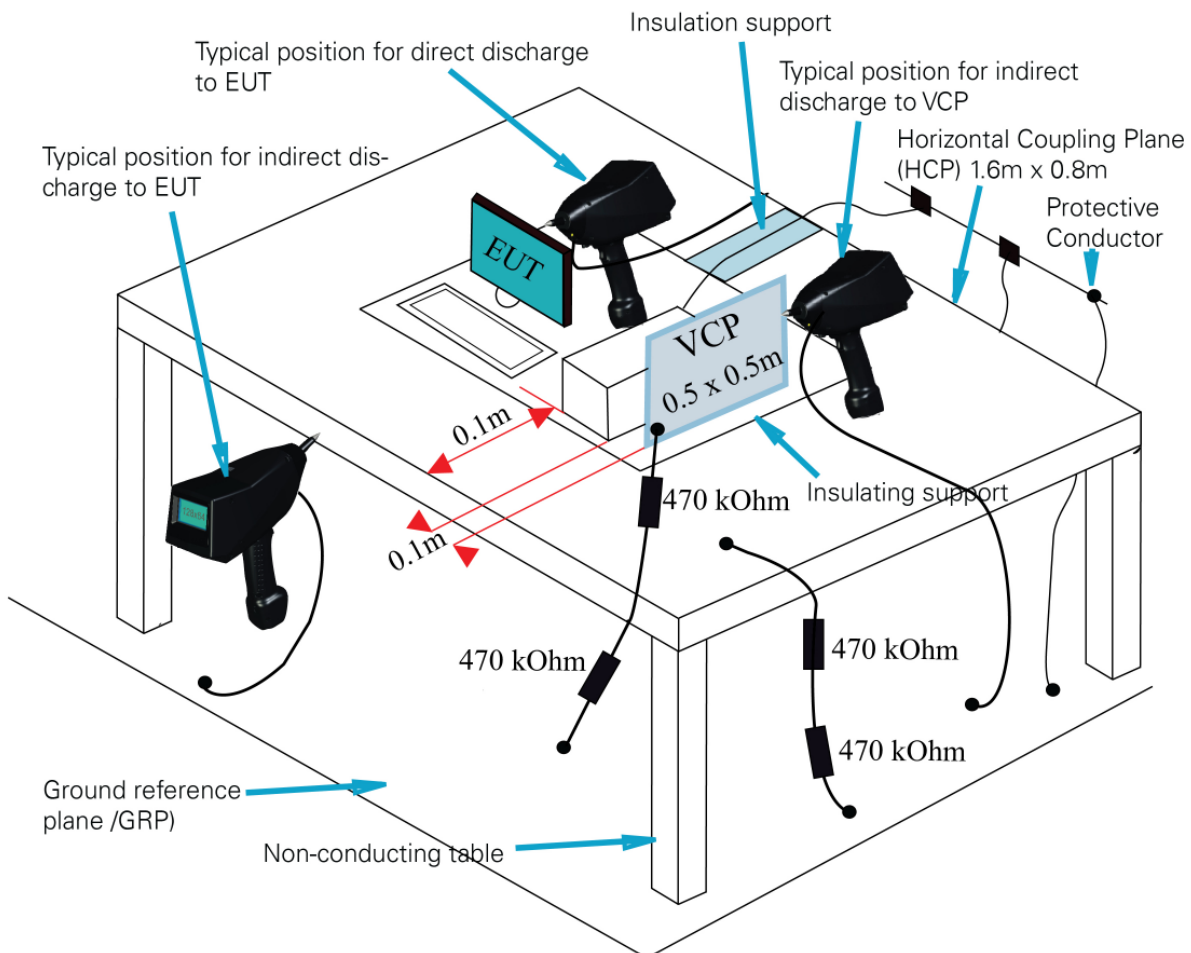


Fig. 14 test setup example for table-top equipment according to IEC 61000-4-2 edition 2



## 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.

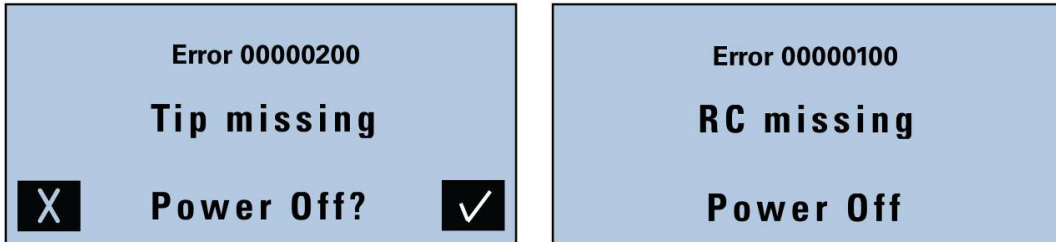


Fig. 15 error messages

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 a 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	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
0000 8000	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
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"

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## 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	4700531
330pF / 2000 Ohm	4700532
330pF / 330 Ohm	4700618
100pF / 1500 Ohm	4700622
150pF / 150 Ohm	4700620
500pF / 500 Ohm	4700619
500pF / 5000 Ohm	4700621
xxxxpF / xxxx Ohm (custom)	4700633
Air discharge tip 30kV / 30mm	4700526
Fast rise time tip 0.3ns	4700527
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	4700480
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

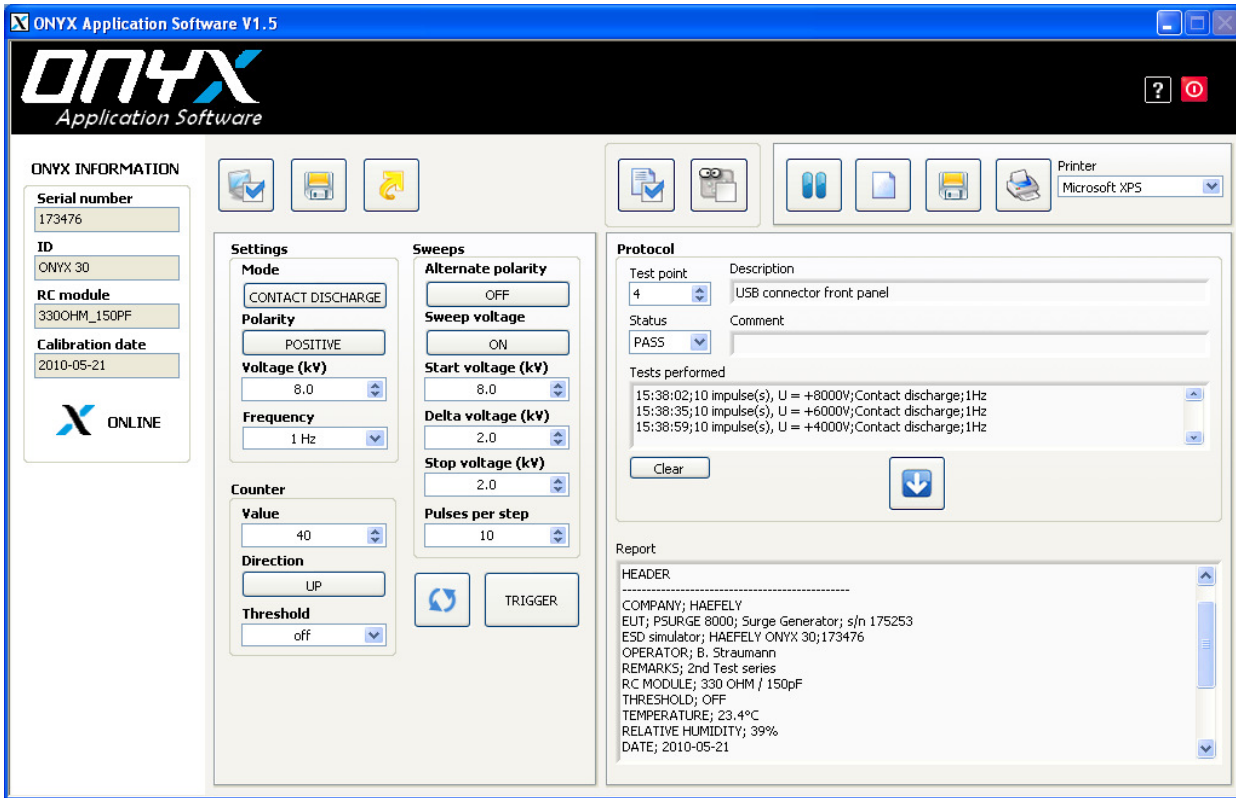


Fig. 16 ONYX application software

## 8 Service

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### 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.

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### 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

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## 9.1 Addresses

### 9.1.1 International Customer Service

e-Mail: [EMC-Support@haefely.com](mailto:EMC-Support@haefely.com)

Address: Haefely Test AG  
Birsstrasse 300  
4052 Basel / Switzerland

Fax : + 41.61.373 45 99

Internet: [www.haefelyEMC.com](http://www.haefelyEMC.com)

### 9.1.2 USA Customer Service

e-Mail: [EMC-Support@haefely.com](mailto: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](http://www.haefelyEMC.com)

### 9.1.3 China Customer Service

e-Mail: [EMC-Support@haefely.com](mailto: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](http://www.haefelyEMC.com)

### 9.1.4 Manufacturer

e-Mail: [EMC-Sales@haefely.com](mailto:EMC-Sales@haefely.com)

Address: Haefely Test AG  
Birsstrasse 300  
4052 Basel / Switzerland

Telephone : + 41.61.373 41 11

Fax : + 41.61.373 49 12

Internet: [www.haefelyEMC.com](http://www.haefelyEMC.com)

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## 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



### Declaration of Conformity

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Haefely Test AG  
Birsstrasse 300  
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.

Haefely brands



Haefely is a subsidiary of Hubbell Incorporated.



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