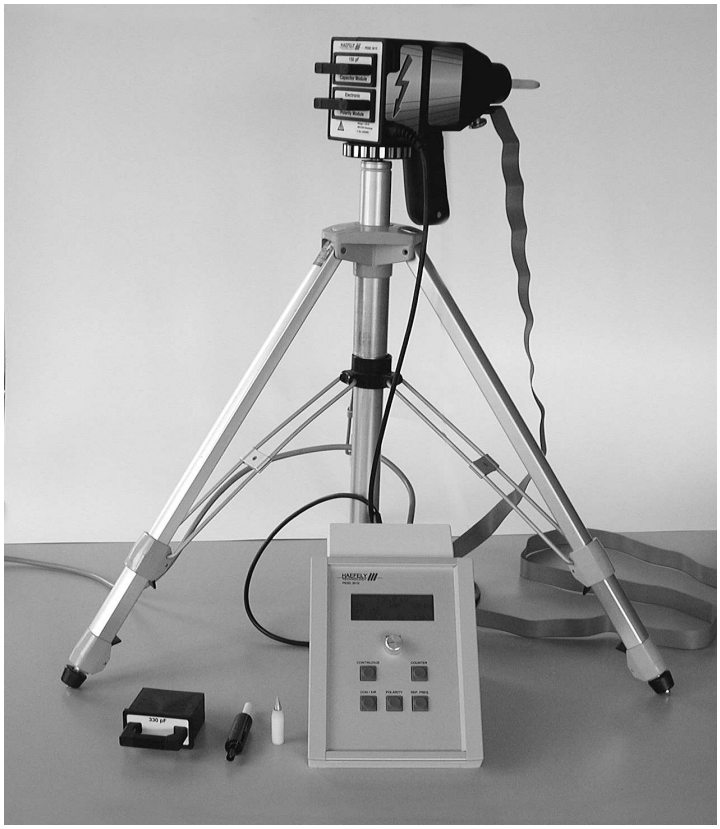
HAEFELY EMC
TECHNOLOGY

user manual



ElectroStatic Discharge Generator

PESD 3010
30 kV

A Note to Begin

Thank you for choosing the Haefely PESD 3010 to meet your ESD testing needs. Do take a little time to read through this users manual and familiarize yourself with the instrument controls and some potential dangers.

We hope you have many productive years of operation from the PESD 3010.

HAEFELY TEST AG

Document Title	User Manual: Electrostatic Discharge Simulator **PESD 3010**
Release date	December 2002
Authors	N. Wright / B. Straumann
Reference No.	251856-41-01.4

Contents

1 Safety

1.1 General Safety Information

This warning sign is visible on the module. ***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.

Dangerous mains voltage or high voltages are present inside the PESD 3010 and the control unit attached to it.

The protective Earth must be connected to a good Earth.

Before removing any covers, remove all external connection cables.

Do not open any part of the PESD 3010 or it's control unit, they contains no user replaceable parts.

The PESD 3010 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 PESD 3010 System if an explosion hazard exists.
The system should be operated in a dry room. If condensation is visible, the affected unit(s) should be dried before operating.

Never touch the Equipment under Test (EUT), when the PESD 3010 is operating. Establish a safety barrier around the EUT. Cables under high voltage must not be touched during Testing.

If any part of the PESD 3010 is damaged or it is possible that damage has occurred, for example during transportation, do not apply any voltage.

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 PESD 3010.

Before opening any units remove the mains power cord.

Before changing the mains fuse, remove the mains power cord.

Fuses should only be replaced with the same type and value.

1.2 Safety Standards

The PESD 3010 fulfills the requirements of IEC 61010.

2 Overview

Any electrical equipment can be subject to electrostatic discharges from human operators or from adjacent objects. The electrostatic discharge simulator PESD 3010, 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 the basic standard IEC/EN 61000-4-2.

Because of it's modular design, PESD 3010 can be adapted quickly and easily to perform testing to any ESD standard.

The most important points are noted here for reference.

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

For small EUTs, 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 470KΩ resistors. The EUT should be mounted above the horizontal coupling plane on an isolation plate of 0.5mm thickness.

Larger floor standing equipment must be treated in a similar way but have an isolation plate of 0.1 m.
Vertical coupling planes are to be used to inject an ESD field into all four faces of an EUT.

Verification of the ESD impulse is very critical and requires special test equipment. In particular a 2 Ω co-axial target and measuring device of 1 GHz bandwidth. Both should be built into a Faraday cage.

3 Technical Data

3.1 Discharge Pistol

Polarity	positive and negative
Discharge electrodes	Contact and Air according to IEC/EN 61000-4-2
Standard Energy storage capacitance	150 pF +/- 10 %
Standard Discharge resistance	330 Ω +/- 10 %
Energy storage capacitance (options)	50 pF to 1000 pF
Discharge resistance (options)	50 Ω to 5000 Ω
Waveform of the discharge current	according to IEC/EN 61000-4-2 and ISO/TR 10605 (option)
Rise time at Contact discharge	0,7 - 1,0 ns

3.2 Control unit

Output voltage air discharge Mode	1 kV to 30 kV
Output voltage contact discharge Mode	1 kV to 30 kV
Voltage increment	100 V steps
Discharge modes	Air and Contact discharge
Operating modes	single and continuous
Repetition frequencies	Single, 0.1, 0.2, 1, 2, 5, 10 and 20 Hz
Counter pre-selectable	1 - 9999
Polarity	Electronic positive and negative (option)
R, C & Polarity Module recognition	Automatic using transponder technology
User Configurable connection	BNC connector can be used to trigger contact discharges
Supply voltage:	85 to 264V
Supply frequency	47 to 63 Hz
Power	30VA

3.3 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

3.4 Mechanical Data Pistol

Dimensions:	approx. B 100mm x H 210mm x D 200mm
Weight:	approx. 1550g

3.5 Mechanical Data Controller unit

Dimensions:	approx. B 170mm x H 100mm x D 280mm
Weight:	approx. 1450g

3.6 Standards

Standards which feature impulses of the type generated by PESD 3010:	IEC/EN 61000-4-2, ISO/TR 10605 (option) and others

3.7 General

The System must not be subjected to:

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

4 Initial Operation

Mains voltages are always a potential danger. This applies equally to all personnel. Persons with heart pacemakers must not be in the vicinity when the system is operating!

4.1 Visual Checks

During transport PESD 3010 may be subjected to excessive shocks and vibrations, even though every care is taken by Haefely Test AG to provide suitable packaging. Before operating a system, check for signs of mechanical damage. Damaged packing cases may by a sign of transport damage. Damage caused in transit must be reported to the shipping agent immediately.

If damage to PESD 3010 or it's 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 PESD 3010

Select discharge modules (resistor and capacitor), insert into PESD 3010 using the procedure in section 5.5.13 and 5.5.14.
Connect the flat cable with one end on the grounding screw of the PESD 3010 (located near the discharge tip on the underside) and the other end to the ground reference plane.
Insert one of the two test tips dependant on whether air or contact discharge tests are being conducted.
Connect the test pistol to the base unit using the multi-pole supply/control cable.
Connect the base unit to a correct mains supply.
Switch on the base unit using the mains switch located on the rear panel.
It is now possible to program test parameters and start testing.

4.2.2 Powering PESD 3010

The PESD 3010 is powered from the control unit by switching mains power on controller rear panel. The mains switch is located next to the power cord connection.

4.3 System Service Menu

The SYSTEM SERVICE MENU is entered as follows:

Switch PESD 3010 OFF using the mains switch
Press and hold down the following keys CONTINUOUS + COUNTER + POLARITY.
While holding down the 3 keys, switch PESD 3010 ON using the mains switch

The display now shows the instrument status. Below is an example of the display.

VERS: 020	software version (020)
FN: 204501	Serial Number of PESD 3010 (204501)
ESCAPE	function of the CONTINUOUS key (in this case exit the edit menu)
BNC=TrBoth	change the BNC connection function using the COUNTER key

BNC = NONE	the BNC connector is not activ
BNC = TrOnly	discharges can ONLY be released by making a short circuit between BNC inner and outer
BNC = TrBoth	discharges can be released by either making a short circuit on the BNC connector or using the normal trigger switch

CM=OF	In contact mode the PESD 3010 detects if the test finger is really in contact with a metal surface. Use the CON/AIR key to disable and re-enable the contact detection function.
XX=OF	this is for future expansion and use of the REP.FREQ key.

When all changes have been made, exit this menu using the CONTINUOUS key.

The display now shows the current configuration. It is not possible to edit any parameters at this stage.

The following is an example of the information that could be displayed:

C = 150pF	FN: 204501	Capacitor module value and serial number
R = 330 O	FN: 204501	Resistor module value and serial number
P = AUTO	FN: 204501	Polarity module type and serial number
M = IEC/ISO	FN: 204501	Discharge tip type and serial number

Exit this menu using the CONTINUOUS key.

4.4 Example of ESD Test Set-up

The following example shows correct connection of an ESD Test setup

Fig. 1 ESD test set-up as described in IEC/EN 61000-4-2. Note Ground Reference Plane (GRP) connected to earth (ground)

Fig. 2 ESD testing using the Vertical Coupling Plane (VCP). Note resistor cable connecting VCP to GRP

5 Operational Functions

5.1 Base Unit Front Panel Controls

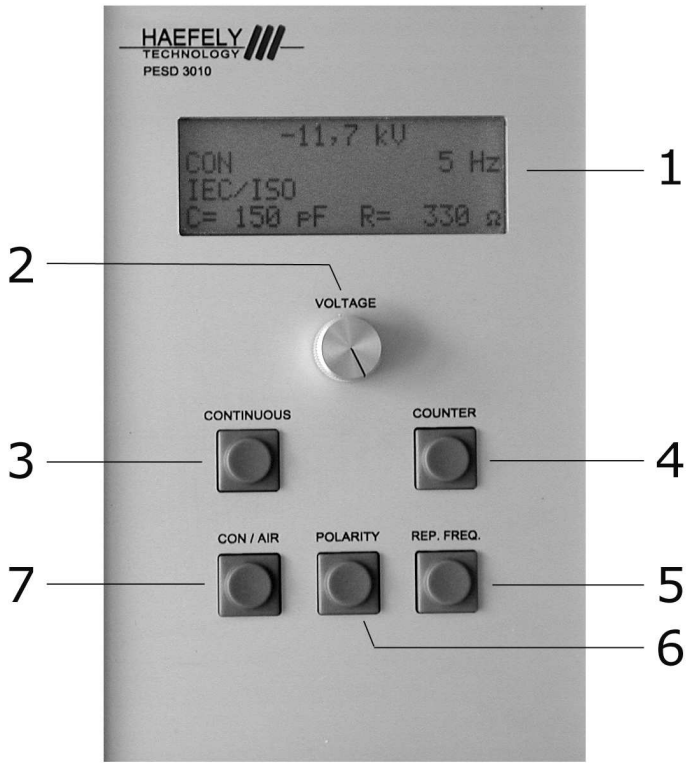


Fig. 3

(1)	LCD display	Four line display of programmed parameters with backlight.
(2)	Multifunction rotary switch	Used to set the number of pulses in counter mode and the test voltage level
(3)	Continuous discharge selector	PESD 3010 generates a continuous stream of discharges
(4)	Impulse counter / pre-selector	Set the number of discharges to be released
(5)	Impulse Repetition frequency selection switch	In CONTACT mode selects between Single, Continuous, 0.1, 0.2, 1, 2, 5, 10 & 20Hz. In AIR mode selects between Single and Continuous
(6)	Polarity selection switch	Toggles between Positive and Negative polarity discharges (option)
(7)	Discharge mode selection switch	Toggles between AIR and CONTACT discharge modes

5.2 PESD 3010 Overview

Fig. 4

(8)	Trigger	Discharge release
(9)	Ground return cable	Ground cable fitted between this point and the Ground Reference Plane
(10)	Discharge tips	Push fit easy to change when switching between CONTACT and AIR modes
(11)	Tripod mounting	Long duration testing can be better accommodated by fixing the PESD 3010

5.3 Discharge Modules Overview

Fig. 5

(12)	Polarity module	Turn this module to reverse polarity of the discharge. Electronic module switches polarity from Base Unit Controller (Option)
(13)	Capacitor module	Push fit into the PESD 3010. Capacitances in the range 50 to 1000pF .
(14)	Resistor module	Fits inside the capacitor module. Resistors in the range 50 to 5000 Ω
(15)	Power supply connection	Connection to the Base Unit Controller.

5.4 Base Unit Rear Panel Connections

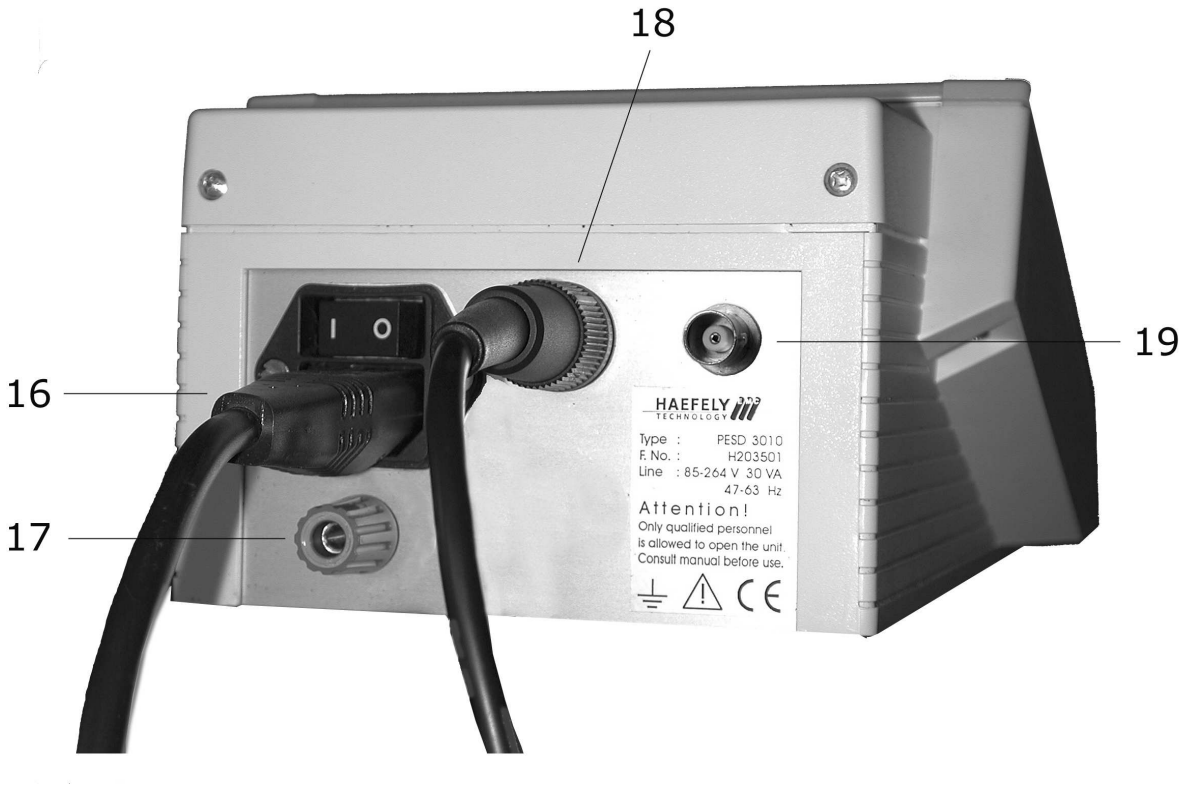


Fig. 6

(16)	Mains Power	Mains cable connection and power ON/OFF switch
(17)	Earth Stud	Earth stud for connection to the Ground Reference Plane
(18)	Connector to Test Pistol	Supply Voltage and control cable from Test Pistol
(19)	BNC connector	Programmable connection can be used to trigger contact discharges

5.5 Operating Principles

5.5.1 LCD display (1)

The upper line of the display shows the selected test voltage amplitude in kV and the polarity. On the left of the middle line contact or air discharge method is indicated (CON or AIR) and on the right of the middle line the repetition frequency is displayed. The lower line displays the value of capacitor and resistor fitted in the discharge circuit. This information is read automatically from the components.

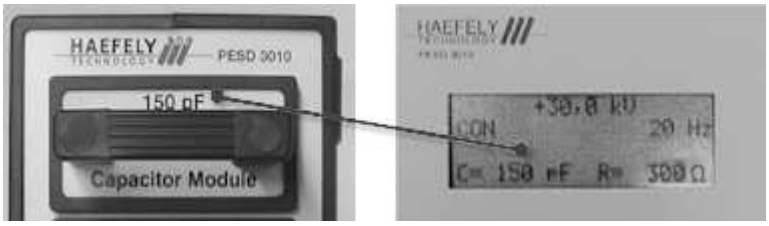


Fig. 6

Other messages indicating the condition of the PESD 3010 are displayed on the upper line.
The asterisk sign " * " indicates that high voltage is available at the discharge tip. This is usually displayed as long as the discharge trigger is pressed or in continuous mode (see 5.5.10).
After releasing the trigger or ending continuous mode, a "-" is displayed for two or three seconds. During this time the unit discharges the high voltage internally. As long as the "-" sign is displayed changing some of the parameters is not possible.

The LCD contrast can be adjusted as described in 5.5.2.2

5.5.2 Multifunction rotary switch (2)

This switch can be used to change several parameters such as the voltage level and discharge counter.

5.5.2.1 Test voltage adjustment

The test voltage of the PESD 3010 is adjusted by turning this switch until the required value is shown in the top line of the display.
Turning the switch slowly, adjusts the voltage in increments of 100 V. To make the voltage increments bigger, turn the switch faster.

5.5.2.2 LCD contrast adjustment

The display contrast is adjusted by pressing and holding down the REP FREQ switch before switching the simulator on with the ON / OFF switch. Continue to hold down the REP FREQ switch until " ADJUSTMENT OF CONTRAST" is displayed. The knob can then be turned in either direction to adjust the display contrast.

5.5.3 Continuous discharge selector (3)

To activate continuous mode, press and hold switch, then simultaneously press the
trigger. Impulses will now be released until the trigger is pressed one more time.
For continuous tests of extended duration the PESD 3010 tester can be mounted on a tripod.

5.5.4 Impulse counter / pre-selector (4)

Press this switch and "COUNTER SET CXXXX" appears in the LCD.
Rotating the multifunction switch (2) in either direction, increases or decreases the number of pre-selected impulses.
Adjustment is possible between 0 and 9999.
Press the counter switch a second time to enter the value in the memory.
Each impulse is then deducted from the pre-selected number until zero is reached at which time the impulses will stop.
The pre-selection counter can be deactivated by pressing the counter switch and holding for a few seconds

5.5.5 Impulse repetition frequency selection switch (5)

The impulse repetition frequencies can be changed by pushing this button. The selection is then displayed on the lower line of the LCD.
In air discharge mode SINGLE or REP (repetitive) impulse modes are available.
Contact discharge mode allows selection between 0.1 Hz, 0.2 Hz, 1 Hz, 2 Hz, 5 Hz 10 HZ and 20 Hz repetition rates.

5.5.6 Polarity selection switch (6) (Option)

This function requires the optional Electronic Polarity module to be fitted in the PESD 3010 test pistol.
The polarity can be changed once the PESD is powered on, by pressing this switch.
Pressing the switch again will toggle between the polarity options.
The LCD display indicates the polarity selected with a + or - sign in front of the test voltage indication. e.g. + 8 kV .

5.5.7 Discharge mode selection switch (7)

This switch is used to change from air discharge to contact discharge. The selected mode is displayed in the lower line of the LCD as "AIR" for air discharge mode or "CON" for contact discharge mode. Maximum 30 kV for contact and air discharge. If one of the IEC 61000-4-2 standard specified test levels L1 to L4 coincides with the voltage selected, this test level is shown on the display screen.
i.e.: CON mode test level L3 = 6 kV
AIR mode test level L3 = 8 kV.

Always take care to attach the appropriate test tips for the respective test method.
Pointed tip for contact discharge, round tip for air discharge.

In contact discharge mode, ESD impulses can only be release by the PESD 3010 trigger if the series resistance in the test circuit is below 4 Mega Ohms. If this is not the case, the message
"NO CONTACT TO EUT PLEASE CHECK" is shown on the LCD display.

5.5.8 Trigger for impulse release (8)

This trigger serves to release the impulses of the PESD 3010 in accordance with the preselected mode. Impulse release modes are selected by activating/deactivating respective push buttons on the control unit panel. For further details please refer to the applicable paragraphs of these instructions (5.5.3, 5.5.4 & 5.5.5).

5.5.9 Connector for the ground return cable (9)

The ground return cable must be connected between the grounding screw of the PESD 3010 and the ground reference plane or the EUT.

5.5.10 Tips for contact or air discharge (10)

***Before touching the discharge tips to change them, switch the PESD 3010 tester off and wait for a few seconds so that the impulse capacitor can discharge internally*.**

Change the discharge tip by pulling it off the front of the PESD 3010 and pushing the other one in its place.
Always check that the correct discharge tip for the type of test being made is fitted.
The rounded tip should be fitted for air discharge and the pointed one for contact discharge.

5.5.11 Adapter for tripod mounting (11)

For continuous testing the use of a tripod is recommended. The continuous testing method is explained in section 5.5.3.

5.5.12 Polarity Module (12)

When changing the polarity module, DO NOT press the red trigger button. Dangerous voltages can be present on the polarity module mating connectors in the PESD 3010.

Polarity of ESD impulses is changed by turning the polarity module through 180°.

- pull the polarity module from the back of the test pistol using the black handle.
- push the polarity module back into place with the correct polarity.

The selected polarity is shown on the LCD as "+" or "-" next to the test voltage.
The following example shows positive polarity has been selected. ("+ positive" is uppermost,
"- negative" is upside down)

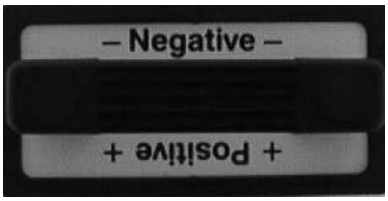


Fig. 7

When changing the polarity with the PESD 3010 switched on do NOT touch the mating connectors inside the PESD 3010 as dangerous voltages may be present.

The black handle on the polarity module is for removing and inserting the polarity module. PESD 3010 must NEVER be lifted or carried by this handle.

An Electronic Polarity Module is available as an option. If this option is purchased,

- switch PESD 3010 off using the mains switch on rear of the base unit.
- touch the test finger to an earth potential to ensure the impulse capacitors have discharged.
- fit the module
- switch on the PESD 3010

Select test polarity using the switch on the Base Unit Controller (6)

5.5.13 Capacitor Module (13)

When changing the capacitor module with the PESD 3010 switched on do NOT touch the mating connectors inside the PESD 3010 as dangerous voltages may be present.

The black handle on the capacitor module is for removing and inserting the module ONLY. PESD 3010 must NEVER be lifted or carried by this handle.

The Capacitor module is inserted into the PESD 3010 in a slot above the Polarity module. Each Capacitor module has it's value clearly written on the outside. In addition, each module is fitted with automatic detection circuits so that the capacitor value is displayed in the lower line of the LCD display.

5.5.14 Resistor Module (14)

When changing the resistor module with the PESD 3010 switched on do NOT touch the mating connectors inside the PESD 3010 as dangerous voltages may be present.

The Resistor module is inserted into the Capacitor module. Each Resistor module has it's value clearly written on the outside. In addition, each module is fitted with automatic detection circuits so that the resistor value is displayed on the lower line of the LCD display.

5.5.15 Cable to the base unit controller and power supply (15)

The tester is connected with the base unit controller and power supply via this cable.

5.5.16 Mains Power Connection (16)

The 10A mains power cable is connected here. PESD 3010 is powered ON and OFF by operation of the mains switch located above the power cable.

BEFORE applying power to the PESD 3010, ensure all cables between the base unit controller and test pistol are correctly connected.

5.5.17 Earth Stud (17)

Earth connection to ensure correct bonding with the Ground Reference Plane (GRP) and PE.

5.5.18 Connection to Test Pistol (18)

The PESD 3010 Test Pistol is attached to the Base Unit by a 2m long cable which carries the supply voltage DC and control signals. The cable can be disconnected, at the Base Unit end for storage and transport.

5.5.19 User Definable Connection (19)

PESD 3010 has a BNC connection on the Base Unit, which can be programmed by the user to release discharges in contact mode. The options are:

- BNC = NONE the BNC connector is not active
- BNC = Tronly discharges can ONLY be released by making a short circuit between BNC inner and outer
- BNC = TrBoth discharges can be released by either making a short circuit on the BNC connector or using the normal trigger switch

Programming the BNC connector is performed from the SYSTEM SERVICE MENU see section 4.3 System Service Menu.

6 Accessories and Options

6.1 PESD 3010 Accessories

The following accessories are delivered as standard with the PESD 3010

Pcs	Article	Article Number
1	PESD 3010 ESD generator	249963
1	Carrying case	included
1	User manual	included
1	Mains cable 10A country specific, 2m	included
1	Base unit controller and power supply	included
1	Ground cable PESD 3010	included
1	Test finger for Air discharge	included
1	Test finger for Contact discharge	included
1	Capacitor module 150pF	included
1	Resistor module 330Ω	included
1	Manual Polarity Module	included

Following additional accessories or spare material can be ordered:

Article	Article Number
Electronic Polarity Module	249968
Capacitor Module (330pF) ISO/TR 10605	249987
Resistor Module (2000Ω) ISO/TR 10605	249986
Capacitor Module (50pF to 1000pF)	On Request
Resistor Module (50Ω to 5000Ω)	On Request
2 Ohm target	249563
ESD Table, H 750mm x W 1600mm x D 800mm	249687
HCP Horizontal Coupling Plane, H 2,0mm x W 1580mm x D 780mm	249688
Vertical Coupling plane, H 1,5mm x W 500mm x D 500mm	249558
Calibration of PESD 3010, including Calibration certificate	249988
Calibration of PESD 3010 in an accredited test laboratory	249989

7 Service

7.1 Service

PESD 3010 contains no user serviceable parts. Maintenance involves cleaning the outer surfaces of the equipment only.

7.1.1 Cleaning

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

7.2 Customer Service

When:
- Accessories or replacement parts are needed
- Questions arise that are not covered in the user manual
- The equipment must be re-calibrated
- The equipment needs repairing

contact your local Haefely Test service center. If you do not know where this is, check on our Internet site **www.haefelyemc.com** and select representatives. If you do not find one in your area, contact Haefely in Switzerland. The addresses are given in the next chapter.

7.2.1 Serial Number

Each PESD 3010 tester has a serial number. This is saved in the unit software. It can be accessed as follows:

Hold down the keys CONTINUOUS + COUNTER + POLARITY
Switch mains power onto the PESD 3010

The serial number will appear on the LCD in the upper right hand corner next to the “FN” annotation.

7.3 Failure diagnostics

7.3.1 NO Contact

If the PESD 3010 displays the message "NO CONTACT", this is an indication that in contact mode, a bad connection has been made to the EUT.

1. Check that the correct operating mode is selected.
2. Ensure that the point of the contact discharge tip is penetrating any paint or other covering on the EUT.

7.3.2 Multiple Discharges in Air Discharge / Single Shot Mode

During air discharge, approach of the test finger to the EUT must be from at least 8-10 cm, otherwise multiple discharges can occur in single shot mode.

8 Corrections and Additions

8.1 Addresses

8.1.1 International Customer Service

e-Mail: EMCsupport@haefely.com

Address: Haefely Test AG
Department EMC
Lehenmattstrasse 353
P.O. BOX
4028 Basel / Switzerland

Telephone : + 41.61.373 41 11
Fax : + 41.61.373 49 12

Internet: www.haefelyemc.com

8.1.2 USA Customer Service

e-Mail: EMCsupport@haefely.com

Address: Haefely Test Inc.
Department EMC
1650 Route 22
Brewster, NY 10509 USA

Telephone : (845) 279 3644
Fax : (845) 279 2467

Internet: www.haefelyemc.com

8.1.3 China Customer Service

e-Mail: EMCsupport@haefely.com

Address: Haefely Test AG.
Grand Pacific Building
North Tower Room 209A
8A, Guanghua Road, Chaoyang District
Beijing 100026
Peoples Republic of China

Telephone : (010) 6581.5428
Fax : (010) 6581.5400

Internet: www.haefelyemc.com

8.1.4 Manufacturer

e-Mail: EMCsales@haefely.com

Address: Haefely Test AG
Haefely EMC Division
Lehenmattstrasse 353
P.O. BOX
4028 Basel / Switzerland

Telephone : + 41.61.373 41 11
Fax : + 41.61.373 49 12

Internet: www.haefelyemc.com

8.2 Glossary of terms and Abbreviations

meaning: Helpful hints, notes, tips or remarks

meaning: Attention!

ESD	ElectroStatic Discharge
EUT	Equipment Under Test
LCD	Liquid Crystal Display
LED	Light Emitting Diode
IEC	International Electro-technical Committee
ANSI	American National Standards Institute
EMC	Electro Magnetic Compatibility
EMV	German equivalent of EMC
HV	High voltage

9 Appendix A

9.1 CE conformity

HAEFELY EMC TECHNOLOGY

DECLARATION OF CONFORMITY

Haefely Test AG
Lehenmattstrasse 353
4028 Basel
Switzerland

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

So, the product complies with the requirements of the EMC directive 89/336/EEC, 92/31/EEC and 93/68/EEC and the low voltage directive 73/23/EEC and 93/68/EEC.

Product:	**PESD 3010**	
Description:	The product PESD 3010 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 61326-1	1997
	EN 61010-1	1993

L. Walder
Business Unit Manager EMC
Haefely Test AG
Basel / Switzerland

(Signature)

Basel, April 12, 2002

Important 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 Test AG, Lehenmattstrasse 353, PO Box, CH-4028 Basel / Switzerland
Phone +41.61.373 41 11, Fax +41.61.373 49 12, www.haefely.com, e-Mail: EMCsales@haefely.com

10 Appendix B

10.1 Test and Calibration Certificates