

User Manual ESD3000



Uch: **+10.0kV**
Discharge : **CONTACT**
Trigger : Man

ESD3000 - 001
SW-Version - 1.09
DN1: EN61000-4-2
16kV 150pF/330ohm

Uch: **+30.0kV**
Discharge : **AIR**
Trigger : Man

Title:
Date:
Division Manager:
Quality Manager:
Revised:

EMC Test System ESD3000
22.03.2002
M. Saachi
R. Henz
08. February 2018

EMC TESTER
Electrostatic Discharge ESD3000



ATTENTION

This user manual provides information necessary for operation of the test equipment.

Throughout the users manual, standard references are used as an aid to understanding only.

The relevant standard(s) **must** be obtained and used in conjunction with this users manual

The Small Print



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1 Description

1.1.1 Electrostatic discharge ESD

Electro Static Discharge

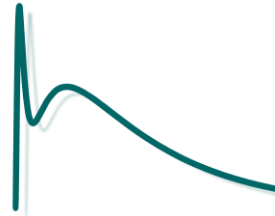


Figure: 1.0.2

What causes electrostatic discharges?

A person becomes electrostatically charged by walking over an insulating floor surface. The capacity of the body can be charged to several kilovolts (1000 V). This capacity is discharged when contact is made with an electronic unit or system. The discharge is visible as a spark in many cases and can be felt by person concerned, who gets a „shock“. The discharges are harmless to humans, but not to sensitive, modern electronic equipment. The resulting current causes interference in the units or makes entire systems „crash“.

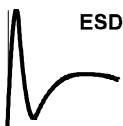
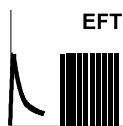
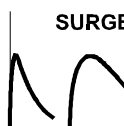
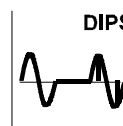
For over 25 years it has been known to the electrical industry that electrostatic discharges as encountered every day can have a disastrous effect on electronic equipment.

The cost of damage caused by ESD is difficult to assess, but amounts to billions of dollars world-wide.

The areas most affected are:

- manufacturing of integrated circuits (chips).
- the chemical industry, e.g. by explosion, fires caused by the sparks from electrostatic discharges.
- malfunctioning of process control with the secondary damage costs. characteristics

1.1.2 How ESD, EFT, SURGE, DIPS differ

Characteristics	Static discharges	Switched inductance	Lightning. switching actions	Mains Interruptions
Phenomenon	"ESD"	"EFT Burst"	"Surge"	"DIPS"
Voltage U	up to 15 kV	up to 4 kV	up to 4 kV	supply source voltage
Energy at maximum voltage	approx. 10 mJ	300 mJ	300 J	-
Repetition rate	Single event	Multiple event 5 kHz	Maximum 6 Impulse / minutes	supply source frequency
Application to the different ports	Touchable metallic part (enclosure ports)	AC/DC ports, Signal and data lines	AC/DC ports, Signal and data lines	AC/DC ports
upper limit frequency	approx.. 1 GHz	approx. 200 MHz	approx. 350 kHz	approx. 100 kHz
impulse waveform	 IEC 61000-4-2	 IEC 61000-4-4	 IEC 61000-4-5	 IEC 61000-4-11

The overview of „How ESD,EFT, SURGE, DIPS differ“ shows that all four test have to be carried out because the frequency content and energy of the four transient tests are different.

1.2 Technical data of the ESD3000 and Discharge Modules

ESD3000 Mainframe

Polarity	positive negative alternating
Trigger Mode	automatic manual
Repetition Counter	0.05 s - 30 s 1 - 30000
Count Mode	every pulse only discharges
Battery Supply	10 AA rechargeable batteries
Mains Supply	
Voltage	100 V - 240 V ± 10 %
Frequency	50 Hz - 60 Hz
Serial Interface	
Speed	9600 bit/s
Data bits	8
Parity	no
Data bits	1
Flow Control	no
Dimensions	
only Mainframe	27 cm x 9 cm x 7 cm
Mainframe with Module	34 cm x 13 cm x 7 cm
Weight	
only Mainframe	0.73 kg
with Module and Batteries	1.05 kg
Environmental Conditions	
Temperature	10 °C - 35 °C
Humidity	30 % - 60 % non condensing
Pressure	86 kPa - 106 kPa

ESD3000DM1

Standards ¹	IEC 61000-4-2:2008 ISO 10605 ITU-T K.20 MIL-STD-461G CS118 DO-160 Section 25
Storage Capacitance	150 pF
Discharge Resistance	330 Ω
Voltage Holding Time	≥ 5 s
Contact Discharge into 2 Ω	
Level / Output Voltage ²	
selectable	0.2 V - 16 kV
guaranteed	2 kV - 10 kV ± 5 %
Current Peak	7.5 A @ 2kV - 37.5 A @ 10kV ± 15 %
Current @30ns	4 A @ 2kV - 20 A @ 10kV ± 30 %
Current @60ns	2 A @ 2kV - 10 A @ 10kV ± 30 %
Rise time	0.8 ns ± 25 %
Air Discharge	
Level / Output Voltage ³	
selectable	0.2 kV - 16 kV
guaranteed	2 kV - 15 kV ± 5 %

ESD3000DM4

Standards	MIL-STD-883 GR78-CORE
Storage Capacitance	100 pF
Discharge Resistance	1500 Ω
Voltage Holding Time	≥ 5 s
Contact Discharge into 2 Ω	
Level / Output Voltage ⁴	
selectable	0.2 kV - 10 kV
guaranteed	0.5 kV - 8 kV ± 5 %
Current Peak	0.333 A @ 0.5 kV - 5.33 A @ 8 kV ± 10 %
Rise time	<10 ns
RC Time Constant	150 ns ± 20 ns
Air Discharge	
Level / Output Voltage ⁵	
selectable	0.2 kV - 16 kV
guaranteed	0.5 kV - 15 kV ± 5 %

¹Standard Calibration according IEC 61000-4-2. Calibration according ISO 10605 is available upon request.

²For exploratory purposes, a wider voltage range can be selected. The extended range itself and all other parameter within this range are not guaranteed.

³For exploratory purposes, a wider voltage range can be selected. The extended range itself and all other parameter within this range are not guaranteed.

⁴For exploratory purposes, a wider voltage range can be selected. The extended range itself and all other parameter within this range are not guaranteed.

⁵For exploratory purposes, a wider voltage range can be selected. The extended range itself and all other parameter within this range are not guaranteed.

ESD3000DM6

Standards	IEC 61340-3-1 JEDEC 22-A114 MIL-STD-750D
Storage Capacitance	100 pF
Discharge Resistance	1500 Ω
Voltage Holding Time	≥ 5 s
Contact Discharge into 2 Ω	
Level / Output Voltage ⁶	
selectable	0.2 kV - 8.5 kV
guaranteed	0.25 kV - 8 kV ± 5 %
Current Peak	0.17 A @ 0.25 kV - 5.33 A @ 8 kV ± 10 %
Rise time	2 ns - 10 ns
RC Time Constant	150 ns ± 20 ns
Contact Discharge into 500 Ω	
Current Peak	0.375 A - 0.55 A @ 1kV

ESD3000DN1

Standards ⁷	IEC 61000-4-2:2008 ISO 10605 ITU-T K.20 MIL-STD-461G CS118 DO-160 Section 25
Storage Capacitance	150 pF
Discharge Resistance	330 Ω
Voltage Holding Time	≥ 5 s
Contact Discharge into 2 Ω	
Level / Output Voltage ⁸	
selectable	1 kV - 30 kV
guaranteed	2 kV - 30 kV ± 5 %
Current Peak	7.5 A @ 2kV - 112.5 A @ 30kV ± 15 %
Current @30ns	4 A @ 2kV - 60 A @ 30kV ± 30 %
Current @60ns	2 A @ 2kV - 30 A @ 30kV ± 30 %
Rise time	0.8 ns ± 25 %
Air Discharge	
Level / Output Voltage ⁹	
selectable	1 kV - 32 kV
guaranteed	2 kV - 30 kV ± 5 %

⁶For exploratory purposes, a wider voltage range can be selected. The extended range itself and all other parameter within this range are not guaranteed.

⁷Standard Calibration according IEC 61000-4-2. Calibration according ISO 10605 is available upon request.

⁸For exploratory purposes, a wider voltage range can be selected. The extended range itself and all other parameter within this range are not guaranteed.

⁹For exploratory purposes, a wider voltage range can be selected. The extended range itself and all other parameter within this range are not guaranteed.

ESD3000DN2

Standards	ISO 10605 PSA B32 7110 GMW3097 GMW3097
Storage Capacitance	330 pF
Discharge Resistance	2000 Ω
Voltage Holding Time	≥ 5 s
Contact Discharge into 2 Ω	
Level / Output Voltage ¹⁰	
selectable	1 kV - 30 kV
guaranteed	2 kV - 30 kV ± 5 %
Current Peak	7.5 A @ 2kV - 112.5 A @ 30kV +30 % / -0 %
Current @400ns	0.55 A @ 2kV - 8.25 A @ 30kV ± 30 %
Current @800ns	0.3 A @ 2kV - 4.5 A @ 30kV ± 50 %
Rise time	
Standard	0.7 ns - 1 ns
Fast Edge	0.5 ns ± 0.2 ns
Air Discharge	
Level / Output Voltage ¹¹	
selectable	1 kV - 32 kV
guaranteed	2 kV - 30 kV ± 5 %

¹⁰For exploratory purposes, a wider voltage range can be selected. The extended range itself and all other parameter within this range are not guaranteed.

¹¹For exploratory purposes, a wider voltage range can be selected. The extended range itself and all other parameter within this range are not guaranteed.

ESD3000DN3

Standards	ISO 10605 PSA B32 7110 GMW3097 GMW3097
Storage Capacitance	150 pF
Discharge Resistance	2000 Ω
Voltage Holding Time	≥ 5 s
Contact Discharge into 2 Ω	
Level / Output Voltage ¹²	
selectable	1 kV - 30 kV
guaranteed	2 kV - 30 kV ± 5 %
Current Peak	7.5 A @ 2kV - 112.5 A @ 30kV +30 % / -0 %
Current @180ns	0.55 A @ 2kV - 8.25 A @ 30kV ± 30 %
Current @360ns	0.3 A @ 2kV - 4.5 A @ 30kV ± 50 %
Rise time	
Standard	0.7 ns - 1 ns
Fast Edge	0.5 ns ± 0.2 ns
Air Discharge	
Level / Output Voltage ¹³	
selectable	1 kV - 32 kV
guaranteed	2 kV - 30 kV ± 5 %

ESD3000DN4

Standards	STANAG4239 MIL-STD-330
Storage Capacitance	500 pF
Discharge Resistance	5000 Ω
Voltage Holding Time	≥ 5 s
Contact Discharge into 2 Ω	
Level / Output Voltage ¹⁴	
selectable	1 kV - 30 kV
guaranteed	2 kV - 30 kV ± 5 %
Current Peak	7.5 A @ 2kV - 112.5 A @ 30kV +30 % / -0 %
Rise time	0.7 ns - 1 ns
RC Time Constant	2.5 μ s ± 10 %
Air Discharge	
Level / Output Voltage ¹⁵	
selectable	1 kV - 32 kV
guaranteed	2 kV - 30 kV ± 5 %

¹²For exploratory purposes, a wider voltage range can be selected. The extended range itself and all other parameter within this range are not guaranteed.

¹³For exploratory purposes, a wider voltage range can be selected. The extended range itself and all other parameter within this range are not guaranteed.

¹⁴For exploratory purposes, a wider voltage range can be selected. The extended range itself and all other parameter within this range are not guaranteed.

¹⁵For exploratory purposes, a wider voltage range can be selected. The extended range itself and all other parameter within this range are not guaranteed.

ESD3000DN5

Standards	STANAG4239 MIL-STD-330
Storage Capacitance	500 pF
Discharge Resistance	500 Ω
Voltage Holding Time	≥ 5 s
Contact Discharge into 2 Ω	
Level / Output Voltage ¹⁶	
selectable	1 kV - 30 kV
guaranteed	2 kV - 30 kV ± 5 %
Current Peak	7.5 A @ 2kV - 112.5 A @ 30kV +30 % / -0 %
Rise time	0.7 ns - 1 ns
RC Time Constant	250 ns ± 10 %
Air Discharge	
Level / Output Voltage ¹⁷	
selectable	1 kV - 32 kV
guaranteed	2 kV - 30 kV ± 5 %

ESD3000DN6

Standards	ISO 10605 PSA B32 7110 GMW3097 GMW3097
Storage Capacitance	330 pF
Discharge Resistance	330 Ω
Voltage Holding Time	≥ 5 s
Contact Discharge into 2 Ω	
Level / Output Voltage ¹⁸	
selectable	1 kV - 30 kV
guaranteed	2 kV - 30 kV ± 5 %
Current Peak	7.5 A @ 2kV - 112.5 A @ 30kV ± 10 %
Current @65ns	4 A @ 2kV - 60 A @ 30kV ± 30 %
Current @130ns	2 A @ 2kV - 30 A @ 30kV ± 30 %
Rise time	
Standard	0.7 ns - 1 ns
Fast Edge	0.5 ns ± 0.2 ns
Air Discharge	
Level / Output Voltage ¹⁹	
selectable	1 kV - 32 kV
guaranteed	2 kV - 30 kV ± 5 %

¹⁶For exploratory purposes, a wider voltage range can be selected. The extended range itself and all other parameter within this range are not guaranteed.

¹⁷For exploratory purposes, a wider voltage range can be selected. The extended range itself and all other parameter within this range are not guaranteed.

¹⁸For exploratory purposes, a wider voltage range can be selected. The extended range itself and all other parameter within this range are not guaranteed.

¹⁹For exploratory purposes, a wider voltage range can be selected. The extended range itself and all other parameter within this range are not guaranteed.

ESD3000DN32-MIL3

Standards	MIL-STD-1576
Storage Capacitance	500 pF
Discharge Resistance	0 Ω
Voltage Holding Time	≥ 5 s
Contact Discharge into 2 Ω	
Level / Output Voltage ²⁰	
selectable	1 kV - 30 kV
guaranteed	2 kV - 30 kV ± 5 %
Air Discharge	
Level / Output Voltage ²¹	
selectable	1 kV - 32 kV
guaranteed	2 kV - 30 kV ± 5 %

EARTH CABLE

Length	2m
Impedance	2 x 470 Ω
Connector	4 mm banana plugs

ESD-VCP50

Standard	IEC 61000-4-2
Dimensions	
Coupling Plane	50 cm x 50 cm x 0.1 cm
Insulation	10 cm
Material	Stainless Steel
Weight	8 kg

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²¹For exploratory purposes, a wider voltage range can be selected. The extended range itself and all other parameter within this range are not guaranteed.

ESD-TARGET2 / ESD-TARGET2 DN

Standard	IEC 61000-4-2
Input Impedance	2 Ω
Attenuator	
ESD-TARGET2	1 x 20 dB
ESD-TARGET2 DN	1 x 20 dB
	2 x 20 dB
Max. Input Voltage (ESD Impulse)	
with 1 x 20 dB	10 kV
with 2 x 20 dB	30 kV
Input / Output Ratio	
with 1 x 20 dB	0.2 V / 1 A
with 2 x 20 dB	0.02 V / 1 A
Tolerance of Insertion Loss	
up to 1 GHz	± 0.5 dB
up to 4 GHz	± 1.2 dB
Cable	1 m Coax Cable with SMA-Connector
Dimension	Diameter 7 cm x 4 cm
Weight	0.4 kg

ESD-VERI-V

Input Impedance	20 G Ω
Max. Input Voltage	32 kV
Input / Output Ratio ²²	1 : 20'000
Output Connector	BNC
Dimension	Diameter 5.5 cm x 17 cm
Weight	0.43 kg

²²with an 1 M Ω external divider resistor. If a voltage measurement equipment with 10 M Ω is used, a 1.111 M Ω resistor in parallel is needed to get a total resistance of 1 M Ω .

ESD-STAND Ed2

Height	50 cm - 180 cm
Weight	4 kg

ESD-HCP-AUTO

Standard	ISO 10605 Annex F
Dimensions	
Coupling Plane	20 cm x 40 cm
Field Coupling Strip	4 cm x 155 cm
Insulation	5 cm
Material	Copper
Weight	2.2 kg

ESD3000DM-EXT

Compatibility	All DM and DN Modules
Cable length	1 m
Weight	0.5 kg

ESD3000 SAFETY-S

Max. Voltage	30 kV
Mains Supply	
Voltage	100 V - 240 V \pm 10 %
Frequency	50 Hz - 60 Hz
Dimension	20 cm x 16 cm x 12 cm
Weight	2 kg

TC-MIG24ED

Material	acrylic glass
Insulation Voltage	max. 36 kV
EUT Dimension	20 cm x 30 cm x 20 cm
Dimension	47 cm x 43.5 cm x 25.4 cm
Weight	8 kg

ESD3000 CNH12

Loop Diameter	12 cm
Loop Current (with DN1)	
15 kV	around 50 A
30 kV	around 100 A
Dimension	33 cm x 13 cm 1 cm
Weight	0.2 kg

ESD3000-OPTOLINK

Cable length	10 m
Connector	D-Sub DE-9 female
Weigth	0.2 kg

USB-RS232 ADAPTETR

Cable length	0.45 m
Connector	USB 1.1 Type A D-Sub DE-9 male
Transfer Rate	max. 115 kbps
Operating System	Windows 98 / XP / Vista / 7 / 8.1 / 10
Weigth	0.2 kg

1.3 Accessories, dimensions

1.3.1 Included articles, dimensions

ESD3000 (Article No. 103605)

Mechanical Dimensions

Unit Height:

Length: 46 cm

Width: 41 cm

Height: 17 cm

Net Weight: 0.7 kg

Included Articles

According to STL-Variante 20, STL-Version 1

Qty	PN	Description
1	103194	CD-UM-IN-ALL includes all User Manuals and Instruction sheets of all EMC PARTNER AG sales products.
1	104802	Standard calibration report
1	103191	Standard accessories pack
1	104836	Broschure ESD Test System
1	104817	Power Cord 2 pole

1.3.2 Standard accessories

Accessories to ESD3000 (Article No. 103605)

According to OP-Variante 1, OP-Version 1

Qty	PN	Description	Weight (kg)	Length (cm)	Width (cm)	Height (cm)
1	103104	Cable 9 pole f / LEMO plug 4pin	0	100	0	0
1	104065	MC Crocodile Clip yellow	0.02	0	0	0
10	104067	AA-Batteries 1.2V	0	0	0	0
1	104402	Battery Charger with LEMO plug 4pin to ESD3000	0	0	0	0
1	104404	Flat earth cable 20mm with 2 banana plugs 4mm to ESD3000, EXT-TRA3000 E	0.1	200	0	0

2 Safety

The ESD3000 belongs to Safety class 1

2.1 Safety standard

The ESD3000 fulfils the requirements of the safety standards IEC 61010 for laboratory measurements equipment „Safety requirements for electrical measuring, control and laboratory equipment“. Based on EN 61010 (IEC61010) the declaration of conformity to low voltage directive (LVD 73/23/EEC O.J.N° L77, 1973-03-26) is given.



This manual is a integral part of the ESD3000 tester. The instructions contained in the manual regarding operation and the test set up are to be strictly observed



It is strictly forbidden to operate the ESD3000 in rooms with of gas explosion risk. The high voltage of the ESD3000 generate sparks, which can ignite the gas.

People with heart pacemakers should not be in the vicinity of the test set up during operation.

2.2 Precautionary measure during use



The **ESD3000** generates high voltages. The energy content of the 30 kV modules is high and can be dangerous with improper use. It is wise to observe the following rules

- | |
|---|
| • Never touch the EUT when a test is in operation. |
| • Touch no connectors of connection cable or tips when a EMC test is in operation. |
| • The high voltage of the ESD3000 and the power on the EUT must turned off before a manipulation on the EUT is carried out. |
| • For all tests the 2 m ground cable must be connected to ground. |

2.3 Electromagnetic Compatibility



The outputs of the ESD3000 and the discharge to the EUT will emit disturbances. Please consider the national emission rules. The Test System ESD3000 should not be operated near sensitive measuring and control systems.

The ESD3000 fulfils the following immunity requirements

• Electrostatic discharge	Level 4 (8 kV)	(IEC 61000-4-2)
---------------------------	----------------	-----------------

2.4 The manual is an integral part of the equipment. Refer to the manual.

<p>This manual is an integral part of the ESD3000. The safety rules and precautions in the manual must be observed. EMC PARTNER and their representatives are not responsible for damage to persons and equipment by not observance the safety rules and precautions in the manual.</p>

2.5 No operation of ESD3000 without ground wire



The ESD3000 must be operated with a ground wire attached to the battery case

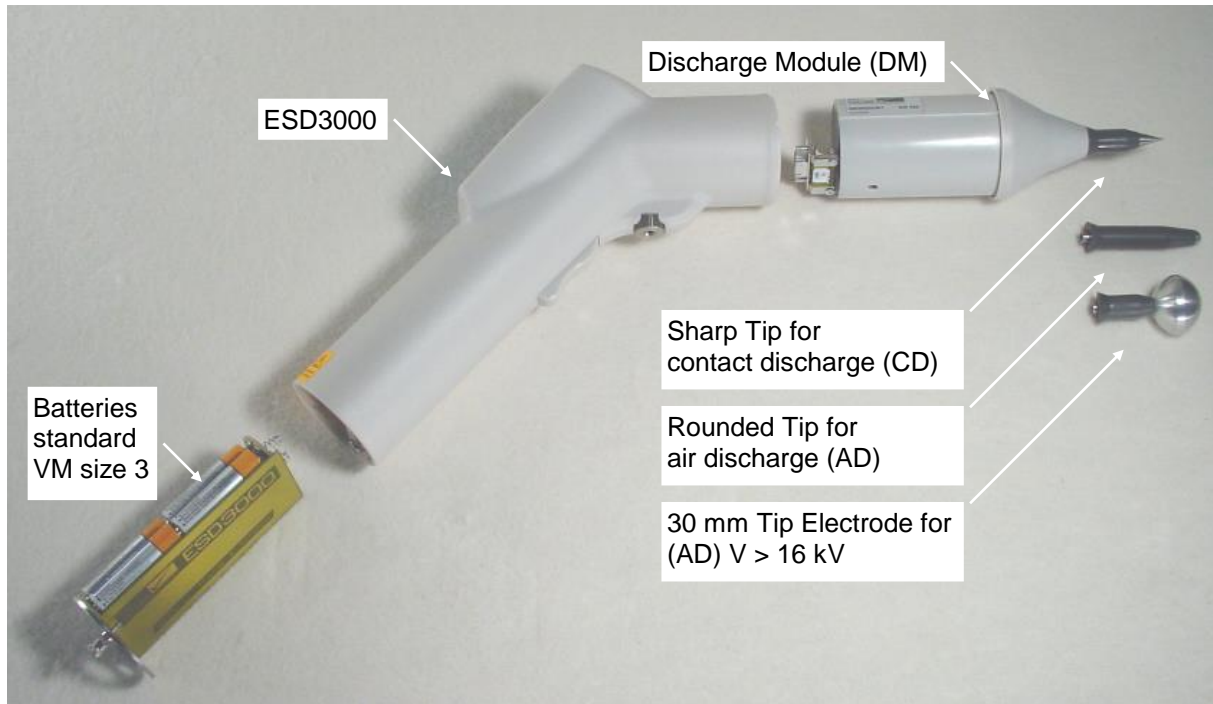
3 Mechanical structure

3.1 General

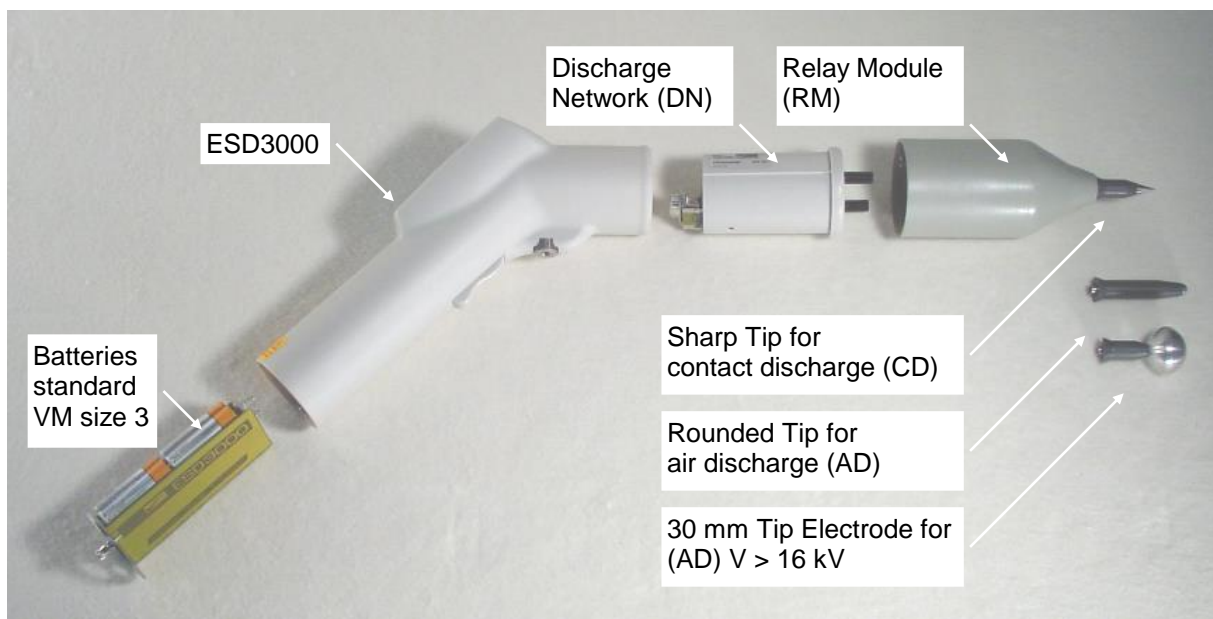
The battery operated ESD3000 is ideal for running tests in development/test laboratory environments and for outdoor service on larger systems.

3.2 Overview ESD3000 system

3.2.1 ESD3000 Contact Discharge (CD) up to max. 10kV with Discharge Module (DM)



3.2.2 ESD3000 Contact Discharge (CD) up to max. 30kV with (RM and (DM)



ESD3000 Contact Discharge (CD) up to 30 kV) with Relay Module (RM), Discharge Network (DN)

The ESD test System consist of ESD3000, the discharge modules (DM/DN) and, where applicable a relay module.

The batteries, the charger and control are part of ESD3000. The discharge modules or networks include the high voltage generation and the wave-shaping network.



ESD3000 with one discharge module



Mechanical register on the discharge modules

Discharge Module

The screw on the bottom side of the ESD3000 must be unscrewed, before the DM/DN can be pull out and changed with another one. A mechanical register ensures the modules can only be inserted in one position.

3.2.3 Avoiding Mechanical Damage to Discharge Modules

ESD3000 discharge modules contain components sensitive to mechanical shock. When modules suffer mechanical shock they can be damaged beyond repair.

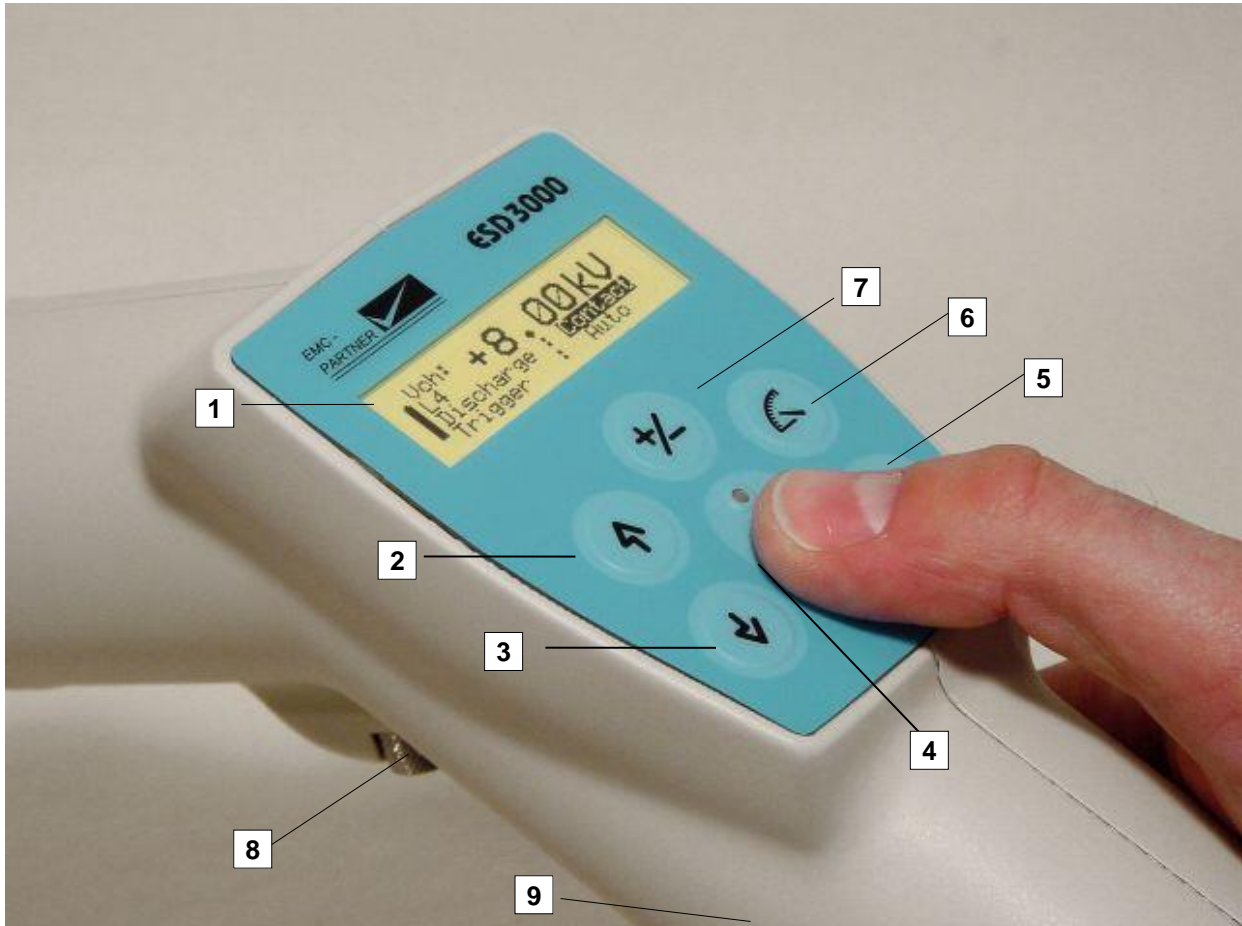


When ESD3000 modules are not in use, place them in the transport case. Do not allow them to roll around on the test bench or fall onto the floor.

4 Control Panel

4.1 Front panel of the ESD3000

The operator should study the manual in detail. Only instructed personal is allowed to operate the ESD3000.



The most important elements of the front panel are:

1. **Display**
2. Voltage up or menu command line up
3. Voltage down or menu command line down
4. Run button: With the „Run“ button, a test can be started or interrupted. With the run button the unit is turned „ON“
5. **Enter**
6. Selection of the programmed test levels. The programmed test levels changes with discharge module interchange
7. **Polarity selection**
8. **Screw for looking the discharge modules.** The same screw can be used for fix the ESD3000 on a tripod stand.
9. **Trigger button:** When manual trigger is programmed and the tester is ready for manual trigger, this will be signalled by the LED. As soon as the signal occurs the pulse can be released.

4.2 Interchange of discharge modules

Loose the screw 8 and pull the discharge module out.

4.3 Interchange of the finger and tips



Pull out the finger and insert the tip

CD = sharp tip
AD = finger electrode

4.4 Inputs and Outputs



The control of the ESD3000 is carried out by a microprocessor. The microprocessor controls the EMC tests, stores the inputs of the numeric input terminal, updates the display, checks whether the inputs of the operators are allowed values or not. The operator communicates with the ESD3000 via the input terminal and the display.

This plate is reserved for the CE mark. The CE -mark is needed for the free movement of the goods into and within European community.

Via this interface port, the ESD3000 can be also controlled by an external PC. To configure the interface, see Chapter 13 „Remote Control“.



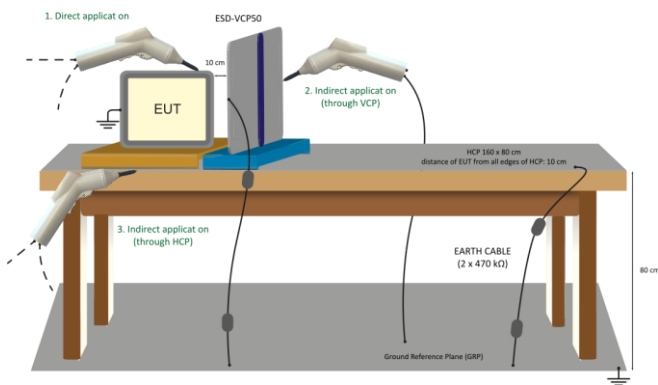
Safety:

ESD3000 is a professional tool and belongs only in the hand of specialists and appropriately trained personnel.
The ESD3000 must only be operated when an earth or ground cable is in place.

5.1.2 ESD Test set-up fwith HCP and VCP

Test set up

Single Phase EUT



Test sequence

I. EFT

1. Connect the earth bar of the TRANSIENT-2000 with the flat multiwire cable (1) to the reference ground plate
2. Put 10 cm insulation between EUT and the reference ground plate
3. Carry out the tests!

II. ESD

1. Remove the flat multiwire cable (1) between the earth bar of the TRANSIENT-2000 and the reference ground plate
2. Put 0,5 mm insulation between EUT and the reference ground plate
3. Carry out the tests!

III. SURGE, DIPS, VARIATION

1. Reinstall the flat multiwire cable 1
2. Carry out the tests!

6 Testing with the ESD3000

6.1 Contact discharge

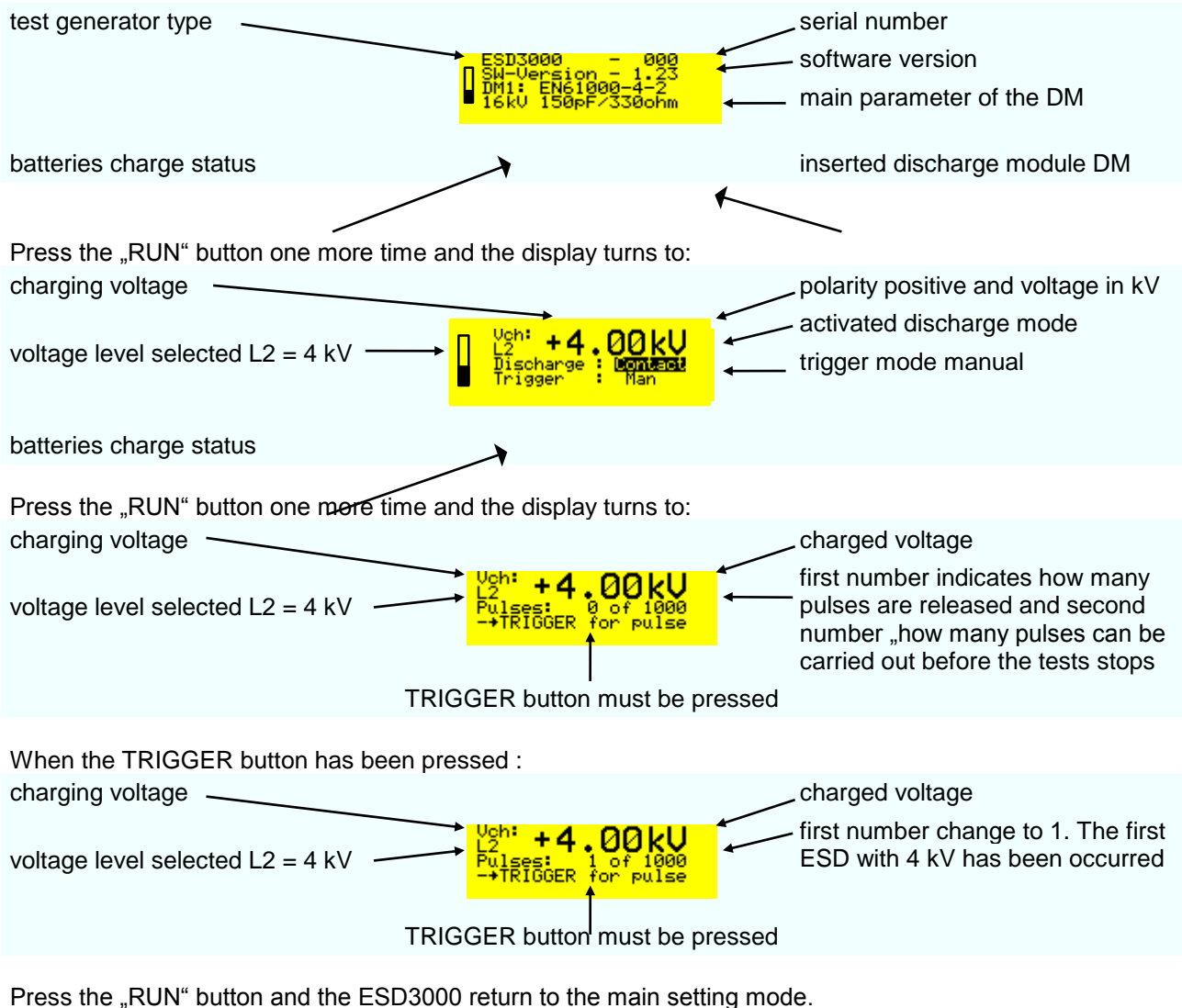
After studying Chapter 2 „Safety“ and Chapter 5 „Preparation for operation“ and all instructions have been followed you can proceed with a quick start.

EMC PARTNER store the needed tests specified in the basic standard in the ESD3000 before shipping.



To carry out a contact discharge, the following steps must be carried out:

- Connect correctly the earth or ground cable to a laboratory supply earth point or to a earth point of the EUT.
- The discharge module must be equipped with the sharp tip
- Operate the „RUN“ button on the front panel the display turns to the EMC PARTNER logo and after a second to:

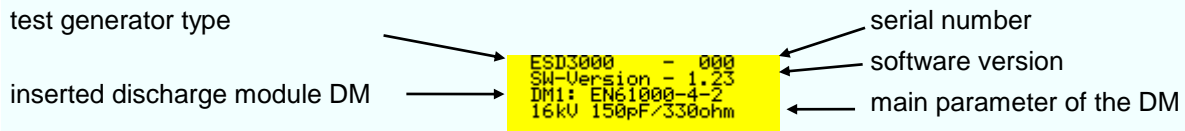


6.2 Air discharge

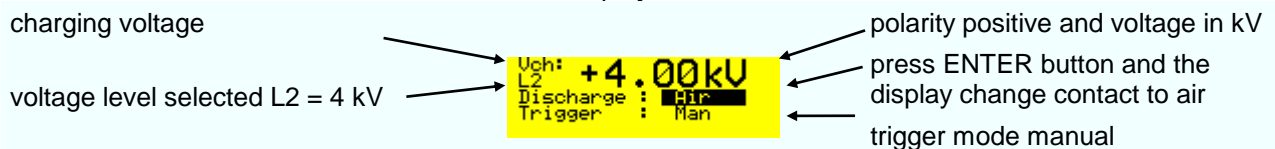


To carry out an air discharge, the following steps must be carried out:

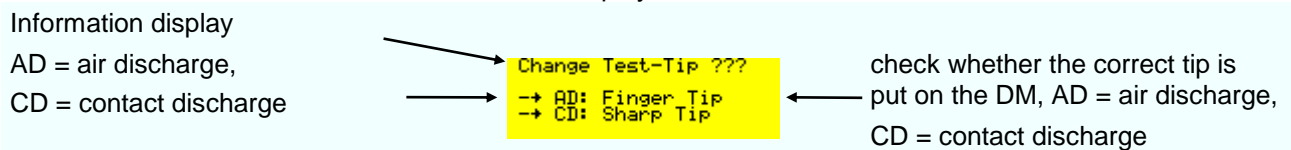
- Connect correctly the earth or ground cable to a laboratory supply earth point or to a earth point of the EUT.
- The discharge module must be equipped with the finger tip
- Press the „RUN“ button on the front panel and the display turns to the EMC PARTNER logo and after a second to:



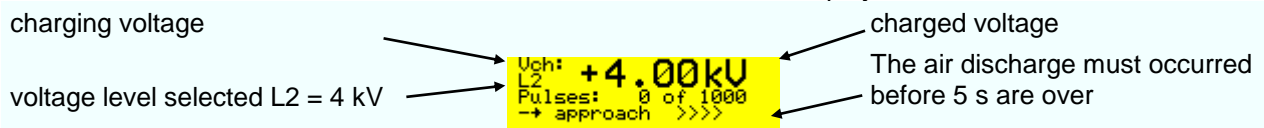
Press the „RUN“ button one more time and the display turns to:



Press the „RUN“ button one more time and the display turns to:

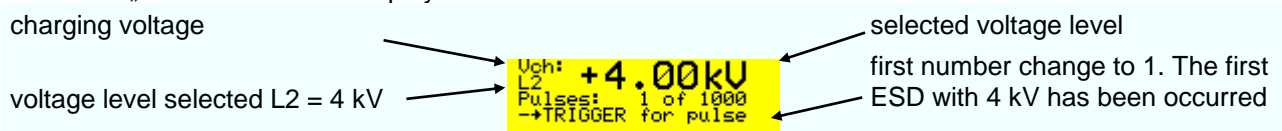


Press the „RUN“ button twice and the TRIGGER button once - the display turns to:



As soon as „approach >>>>“ is indicated on the display, the finger can be moved against the EUT. For the movement against the EUT a maximum of 5 Seconds are reserved, corresponding to the holding time in the IEC standard. For ISO 10605 test on insulated equipment press the Trigger button a second time when the 15 mm position is reached. This will avoid second air discharges.

Press the „RUN“ button - the display turns to:



Press the „RUN“ button and the ESD3000 will be in the main setting mode.

6.3 Main parameter setting with the buttons on the front plate



RUN

this button has different functions:

- Turn „ON“ and „OFF“ the supply of the ESD3000
- Turn „ON“ and „OFF“ the high voltage in the discharge modules DM
- The blinking light above the „RUN“ button indicates „High Voltage ON“



ENTER

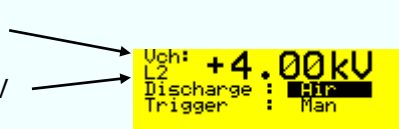
this button has different functions:

- Change the mode of the black cursor location
- Activate parameter in one line to vary the parameter with up and down
- Quit the selected parameter

Examples with ENTER button

charging voltage

voltage level selected L2 = 4 kV

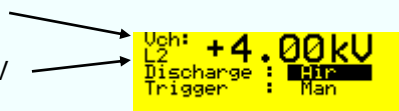


selected voltage level

When the black cursor is positioned as showed and the ENTER button is pressed, the discharge change to „contact“

charging voltage

voltage level selected L2 = 4 kV



selected voltage level

When the black cursor is positioned as showed and the ENTER button is pressed, the trigger change to „Auto“



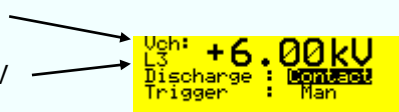
LEVEL

- With the button „level“ very quickly the test levels of different standards can be selected.
- The test levels change in function of the DM discharge module inserted into the ESD3000.

Examples with LEVEL button

charging voltage

voltage level selected L3 = 6 kV



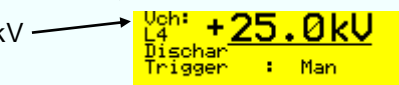
polarity and Voltage value

With discharge module DM1“

Examples with LEVEL button

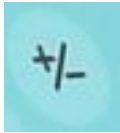
charging voltage

voltage level selected L4 = 25 kV



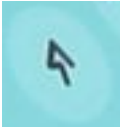
charged voltage

With discharge module DM3



POLARITY

- Change the polarity of the charging voltage from positive to negative or from negative to positive.



UP

this button has different functions:

- Change the charging voltage between the levels
- Moves the cursor in the menu up
- In the operation mode the charging voltage can be increased



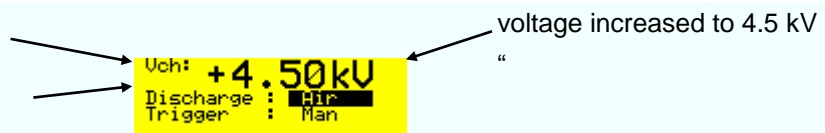
DOWN

this button has different functions:

- Change the charging voltage between the levels
- Moves the cursor in the menu down
- In the operation mode the charging voltage can be decreased

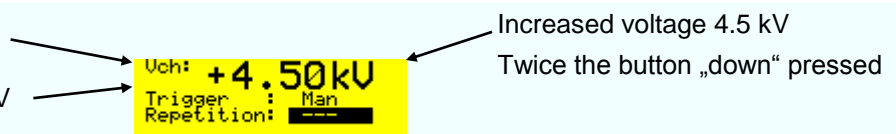
Examples with charging voltage
charging voltage

No level is indicated



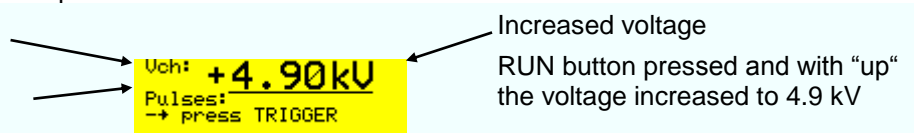
Examples with menu
charging voltage

voltage level selected L2 = 4 kV



Examples with voltage changes in operation mode
charging voltage

No voltage level selected kV



Well that's easy isn't it ?

Most of the ESD tests can be done only using the hardware button on the front plate. In the next two sections, the additional possibilities of the ESD3000 will be explained in detail.

6.4 The different software menus of the ESD3000

6.4.1 Repetition, number of pulses, count mode

Number of pulses

charging voltage

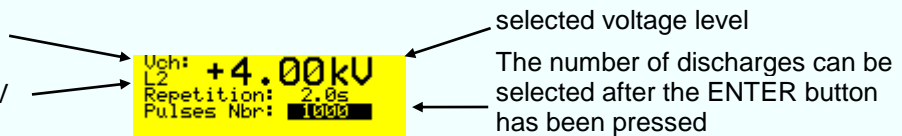
voltage level selected L2 = 4 kV



When the „down button „ has been pressed twice - the display looks like:

charging voltage

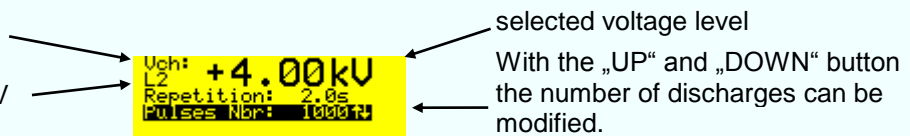
voltage level selected L2 = 4 kV



When the „ENTER „ button has been pressed the displays turns to:

charging voltage

voltage level selected L2 = 4 kV

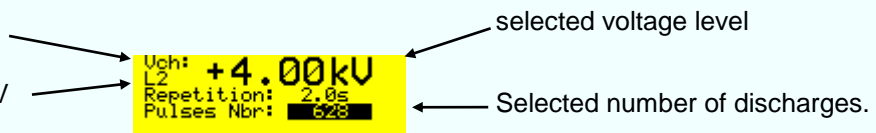


Remark: up to 1000 discharges steps are 1, over 1000 steps change to 1000. Holding the „UP“ or „DOWN“ button pressed, the steps changes from 1 to 10 or from slow to fast.

The „ENTER „ button must be pressed to quit the selected pulse number:

charging voltage

voltage level selected L2 = 4 kV



Repetition of the discharge pulses can be changed on same way as the pulse number. The repetition can only for AUTO mode be selected. The repetition time can be selected from 0.05 (20 Hz) up to 30 seconds



EMCP recommends to use the air discharge mode for weak points exploration. The 20Hz repetition reduce the life span of the high voltage relay. See chapter 6.5.1.2.

Count mode

After pressing „down „ with the „ENTER“ button the count mode can be selected

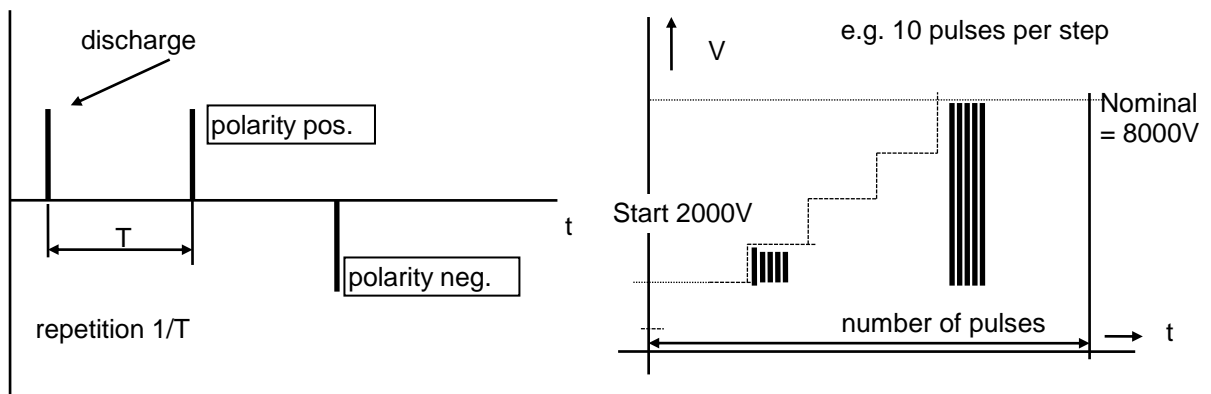
charging voltage

voltage level selected L2 = 4 kV



Remark: two count mode can be differed: „Disch.“ or „ALL“. In „All“ mode all released impulses will be counted. In „Disch.“ mode only the real discharges are counted (current sensing).

6.4.2 Menu „Ramps“



Polarity

charging voltage

voltage level selected L2 = 4 kV

```
Uch: +4.00kV
L2
Count mode: Disch.
Ramps      : menu
```

selected voltage level

Press the ENTER button to open the „Ramps“ menu.

When the „ENTER“ button has been pressed twice the displays indicate:

Polarity change after the selected number of pulses

```
RAMPS      : Pol.
+/- after  : 1
```

Ramp polarity

Press the ENTER button to change the number of pulses with up or down

Polarity changes after 5 pulses

```
RAMPS      : Pol.
+/- after  : 5
```

Ramp polarity

Voltage

When the „ENTER“ button has been pressed an additional once:

Level changes after the selected number of pulses

```
RAMPS      : Level
+/- after  : 5
U-start    : 2.0kV
U-step     : .50kV
```

Ramp Level

The ramp starts at this level

After 5 pulses the voltage will be increased with 500 V

Remark: The maximum voltage is equal the nominal voltage or selected level 4 kV.

The following message will occur when after three releases no discharges was happen

```
No discharge: ???
-> is the ground-
    cable connected ?
```

6.4.3 Menu „Setup“

charging voltage

voltage level selected L2 = 4 kV

```
Uch: +4.00kV
L2:
Setup : menu
Settings : menu
```

selected voltage level

Up to 9 customised parameter set-up can be stored

When „ENTER „ has been pressed
SETUP indicates that in storage
place 1 set-1 is stored

Setup Nbr. 1 to 9

```
SETUP set-1
Setup Nbr.: 1
Setup 1 : Store
Setup 1 : Load
```

selected voltage level

All setted parameter of the
ESD3000 will be stored into the
set-1

With „Load“ and „ENTER“ button the set-1 can be activated.

Setup number

Setup Nbr.1 will loaded in to the
ESD3000 control

```
SETUP set-1
Setup Nbr.: 1
Setup 1 : Store
Setup 1 : Load
```

Up to 9 customised parameter set-up
can be stored

When the „ENTER“ button has been pressed twice.

Instead of Uch, set-1 indicates that
customer set-1 is loaded

L2 with the up and down arrow
indicates that a voltage ramp is
activated in the set-1

```
set-1 +2.00kV
L2: ↑↓
Pulses: 0 of 628
→ press TRIGGER
```

selected voltage level to start the
ramp

The set-up number 2 is empty

With up and down it can be
checked whether the storage
places are empty

```
SETUP
Setup Nbr.: 2 ↑↓
Setup 2 : Store
Setup 2 : Load
```

6.4.4 Menu „Settings“

charging voltage

voltage level selected L2 = 4 kV

```
set-1 +4.00kV
L2
Setup : menu
Settings : menu
```

selected voltage level

When the black cursor is positioned as showed and the ENTER button is pressed, the trigger change to „Auto“

menu page

Beeper „ON“ or „OFF“ with „ENTER“ button

```
SETTINGS
Beeper : On
Backlight : Auto
Assistant : On
```

selected voltage level

Backlight „Auto“, „OFF“ or „ON“

Assistant: „ON“ or „OFF“. The message displays occur only when the assistance is in the „ON“ mode

6.4.5 Menu „Service“

Last menu which can be found with the down arrows is the service menu

charging voltage

voltage level selected L2 = 4 kV

```
Uch: +4.00kV
L2
Settings : menu
Service : menu
```

selected voltage level

When the black cursor is positioned as showed and the ENTER button is pressed, the display below will be showed

menu page

calibration of the charging voltage at 4 kV or 16 kV

```
SERVICE DM1
Calib. 4kV: -0.00%
Calib.16kV: -0.00%
Language : engl.
```

ESD3000 equipped with Discharge module DM1

For the time being only the English version exists

Remark: With the voltage calibration divider ESD-VERI-V all customers can calibrate the voltages at 4 or 16 kV with an oscilloscope. The calibration factor include two values: the value from ESD3000 and the values of the different discharge modules. As soon as the discharge module is interchanged the calibration factor will be adapted to the new discharge module.

menu page

calibration of the charging voltage at 4 kV or 16 kV

```
SERVICE DM2
Calib. 4kV: -0.00%
Calib.16kV: -0.00%
Language : engl.
```

ESD3000 equipped with Discharge module DM2

For the time being only the English version exists

Remark: This solution offers different advantages :

advantage 1: The accredited calibration Lab can calibrate the ESD3000 directly

advantage 2: Additional DM can extend the application of the ESD3000 system after the first sale. The factor delivered with the DM must be set in the service menu.

menu page

calibration of the charging voltage at 4 kV or 16 kV

```
SERVICE      DM2
Calib. 4kV:  -1.00%
Calib.16kV: -1.00%
Language :   engl.
```

ESD3000 equipped with Discharge module DM2

For the time being only the English version exists

Remark: When two discharge module exist for equal application e.g. two polarity for each discharge module the factors are specified.

menu page

calibration of the charging voltage at 4 kV or 16 kV

```
SERVICE      DM3+
Calib. 4kV:  -1.00%
Calib.16kV: -1.00%
Language :   engl.
```

ESD3000 equipped with Discharge module DM3+

For the time being only the English version exists

6.4.6 Reset of the ESD3000 to default values

When the ESD3000 is turned "OFF" hold the +/- button and press the „RUN“ button. Release the +/- button when the message „reset to default“ is displayed. If no message occur repete the reset.

6.5 Parameter change during operation „RUN Mode“

6.5.1.1 Changing values during operation

In RUN-mode, several parameters can be continuously varied using the „up“ and „down “ buttons. This is very helpful for exactly determining of the immunity level of the EUT. The manual change of the nominal voltage will be noted in the report with a warning.

Charging voltage

Increased voltage with „up“ during operation

```
Vch:  +4.70kV
Pulses:
-> press TRIGGER
```

For very fast investigation the polarity can also be changed during operation by pressing the +/- button.

6.5.1.2 Point exploration with air discharge

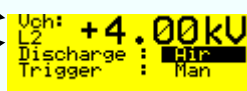
The points on an EUT to which the discharges should be applied can be discovered by first doing an exploratory test by running at a repetition rate of approximately 20 discharges per second or more.

With the ESD3000 and the ESD3000DM1 it can be arranged as following:

Select the desired discharge voltage in air discharge mode.

charging voltage

voltage level selected L2 = 4 kV



Uchg: +4.00kV
L2
Discharge: Air
Trigger: Man

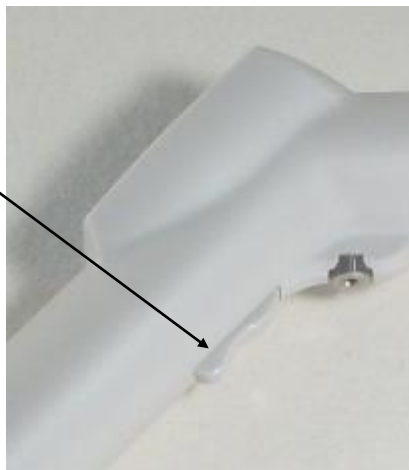
polarity positive and voltage in kV

press ENTER button and the display change contact to air

trigger mode manual

Press the „RUN“ button and hold the trigger button pressed on the main body

Press and hold trigger



When the trigger is held down the discharge tip is supplied with d.c. The discharges will occur with a repetition of approximately 20 Hz.

6.5.1.3 Putting out of operation



Press and hold the „RUN“ button until the message „power down“ is displayed.

7 Maintenance and Servicing

7.1 Maintenance

No maintenance is necessary on the ESD3000.

7.2 Verification of the ESD3000 by the user

A full verification in accordance with the IEC standards can only be carried out with very expensive measuring equipment. A simple verification is watching the spark at the finger or sharp tip to ground.



Ground cable must be connected. See warning advice on the ESD3000.
„ **Make sure, the grounding cable is connected before you start using the ESD3000 high voltage**“

7.3 System Reset

A system reset can be made as follow:

1. Remove the batteries and wait about 5 to 10 seconds before inserting the batteries back.
2. With +/- hold, press button the power ON/OFF (RUN button).

The software will be reset to the default values.

7.4 Caution with calibration labels



It is strictly forbidden to use metallic labels for calibration information. No metallic labels are allowed on neither on ESD3000 or modules and networks. Metallic labels could influence the current waveform or the voltage withstand capability.
Only plastic foils are allowed.

7.5 What must be done when the serial number is not indicated during the start up



If the serial number is not indicated in the display as showed below the stored information about the DN are lost. The calibration data “calib” and serial number must be entered manually. Only with the correct % values the output current and voltages are correct.

test generator type	→	ESD3000 - 000	←	serial number
inserted discharge module DM	→	SW-Version - 1.23	←	software version
		DM1: EN61000-4-2	←	main parameter of the DM
		16kV 150pF/330ohm		

8 What must be done following failed operation

- The ESD3000 has different messages to assist the operator to solve possible problems, give information regarding incorrect operation of the ESD3000, or to correct an incorrect system configuration.

8.1 Display messages

8.1.1 Examples of messages

The following message will occur when after three releases no discharges was happen

```
No discharge: ???
-> is the ground-
cable connected ?
```

Information display

AD = air discharge,
CD = contact discharge

```
Change Test-Tip ???
-> AD: Finger Tip
-> CD: Sharp Tip
```

check whether the correct tip is
put on the DM, AD = air discharge,
CD = contact discharge

Message display

```
No discharge: ???
-> search for dis-
charges in IC-mode.
( hold TRIGGER )
```

advice for changing mode

8.2 Service; Repairs

The ESD3000 is a compact equipment and servicing or repairing the generator can only be carried out by EMC PARTNER authorised service companies.

Do not continue to use the instrument should any mechanical damage occur. The instrument housing has both an insulating and a screening function which can only be assured when the housing is intact. Return a damaged generator to EMC PARTNER service centre immediately for repair.

8.3 Spare parts list

No spare parts are necessary for the ESD3000.

8.4 Service department of EMC PARTNER AG

EMC PARTNER AG
Baselstrasse 160
CH - 4242 Laufen
Switzerland
Tel. ++41 61 775 20 50
Fax ++41 61 775 20 59
Email service@emc-partner.ch
Web www.emc-partner.com

9 Charging the batteries or replacing batteries

The ESD3000 is a laboratory test equipment. Whenever the tester is not used, store it in the ESD3000 box.



The time the ESD3000 is not in use the batteries can be charged as follow.



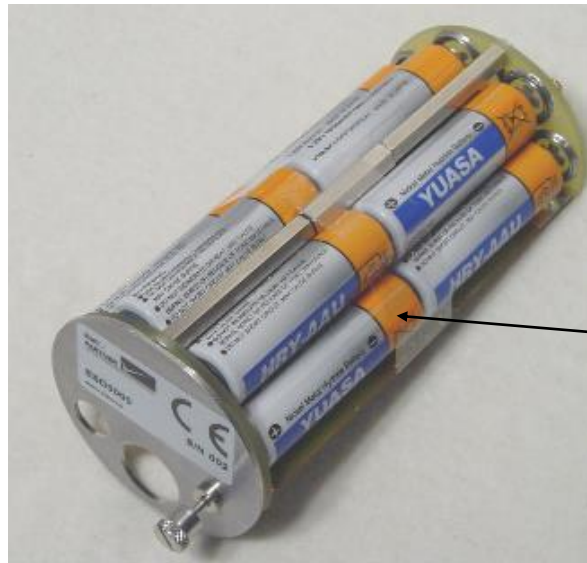
Connect the special Lemo connector to the ESD3000 on the bottom side. The power supply cord must be connected to a public outlet with voltage 110 V up to 240 V 50/60 Hz

The standard batteries can be changed as follow:



Unscrew the little screw on the bottom of the ESD3000 and pull the battery back out of the ESD3000

Charging time is approximately 5 hours (completely empty to completely full).



replace the batteries by pull it out piece by piece

10 Packaging and Transport

10.1 Packaging

If you transport the ESD3000, pack it in the original shipping box.

10.2 Transport

If you are transporting the ESD3000 to an EMC PARTNER field office for repair, attach a tag to the equipment showing the instrument owner and address, the name of the person to contact about the instrument, the instrument type and the serial number.

11 Recycling / Disposal

11.1 RoHS directive 2002/95/EG

The ESD3000 complies with the directive 2002/95/EG (RoHS - Restriction of certain Hazardous Substances). From July 2006 onwards.

From December 2005, all EMC Partner products either hand soldered or by machine are produced using lead-free solder.

11.2 WEEE directive 2002/96/EG

The EMC Partner ESD3000, is exempted from the directive 2002/96/EG (WEEE) under category 9.

The product should be recycled through a professional organisation with appropriate experience for the disposal and recycling of electronic products. EMC Partner are also available to help with questions relating to the recycling of this product.

11.3 Information for dismantling



Remove always power cord fist.

There is no special danger involved in dismantling the ESD3000.

11.4 Parts which can be recycled

The ESD3000 contains parts made from steel, aluminium, PVC, two-component sealing compound. The impulse capacitors are filled with non-poisonous mineral oil. The various parts can be separated and recycled.

11.5 Parts which can not be recycled

All parts in the ESD3000 can be recycled.

11.6 ESD accessories

ESD-STAND Ed2:



Height adjustable from 0.4 m up to 1.75 m
Application:
long term tests in contact and air discharge mode

ESD-VERI-V:



20 G divider for high voltage measurement on the ESD3000 up to 25 kV.
Ratio is determined by 1 M Ohm input of the oscilloscope.
Ration approximate 20'000

ESD-TARGET2:



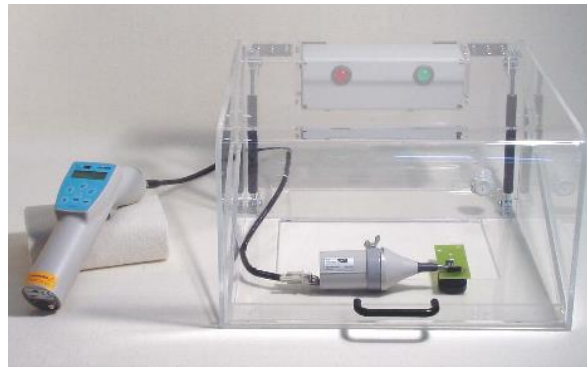
2 Ohm Target with SMA connector, upper limit >4GHz

VCP50



Vertical coupling plate.
Mechanical dimension: 0.5 x 0.5 m
Application indirect ESD discharge with contact tip.

ESD3000DM-EXT



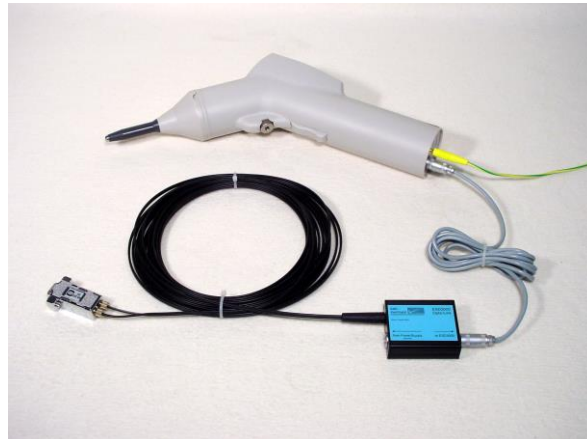
Testing of EUTs that could spontaneously explode or rapidly change state, such as airbags or munitions fuses

CNH12



Accessory to ESD3000 with RM32 and DN1 to simulate rapidly changing H-field as generated at real ESD discharge.

ESD-OPTOLINK



Accessory to ESD3000 to remote control the ESD3000 without any galvanic connection

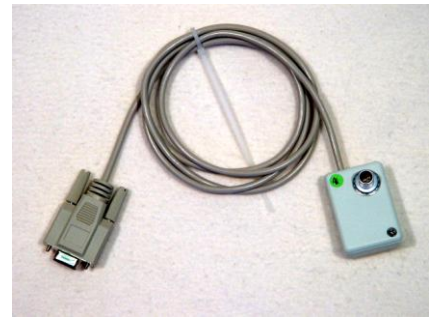
12 E3Loader and Serial Communication

12.1 Remote control with „E3Loader“

The E3Loader program, delivered with ESD3000, is a basic software package primarily used for updating firmware and, with the optional ESD-VERI-V, adjusting the HV-DC level. E3Loader can also be used as a simple remote control tool.



The Download-Module (picture right) connects ESD3000 to a 9-pin serial port on the PC.

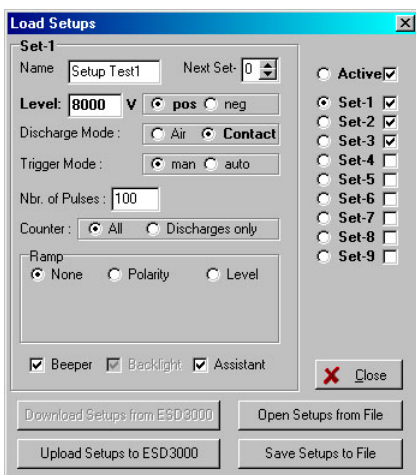


This is an easy way to upload new settings or firmware but as there is **no** galvanic insulation high-voltage testing is not possible.

For remote controlled testing, an optional optical RS232 interface is required.

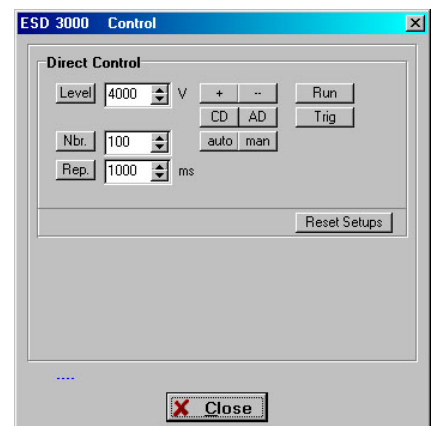
The serial port uses just the data lines TxD and RxD for information transfer (9600Baud, 8 N 1).

12.2 Controlling ESD3000

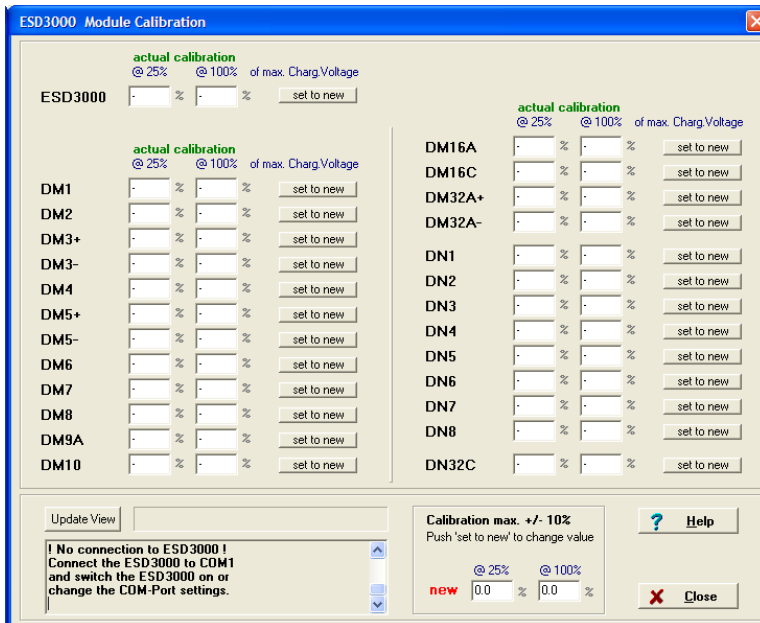


Click 'Load Setup' to enter the parameter input menu (picture left). Parameters can be changed and saved in one of 9 memory locations on the computer hard disk. These setup files can be transferred to the ESD3000 using the download module.

Click 'Control' to enter the real-time test menu (picture right). Parameter values can be changed, even when ESD3000 is operating (optical interface required).



12.3 Module Calibration



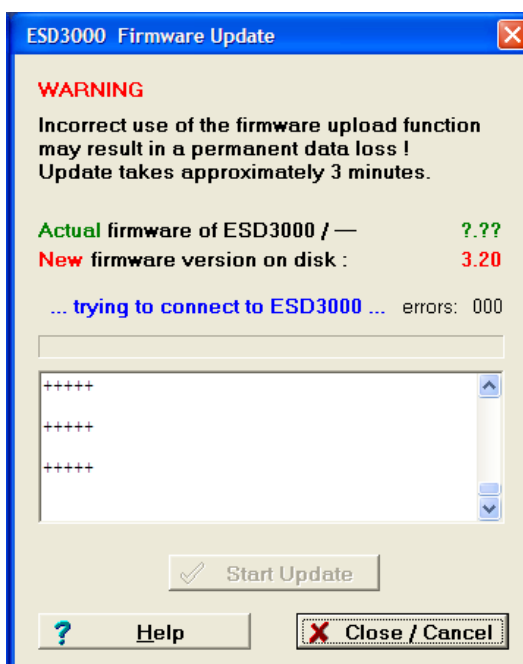
Together with an optional high-impedance high-voltage divider (ESD-VERI-V), a recalibration and adjustment of the discharge-modules (DMx) can be performed and stored in the ESD3000 memory.

12.4 Firmware Upload



ATTENTION

Incorrect use of the firmware upload may result in permanent data loss ! See Warning windows before the upload starts.



How to update the ESD3000 Firmware:

1. Using The download module, connect ESD3000 to the serial port of a computer
2. Switch on ESD3000. Make sure system power is maintained during the upload process (Batteries fully charged before start of update). This takes approximately 10 minutes.
3. The window indicates the firmware version on the ESD3000 and the version on the hard disk.
4. If communication with the upload monitor inside the ESD3000 is established (message...connected to ESD3000...), click on 'Start Update' and wait until the message '...Upload successful...' appears.
5. Restart the ESD3000 and check if the new version is shown in the display.

13 ESD3000 Control with Test-Manager (Tema)

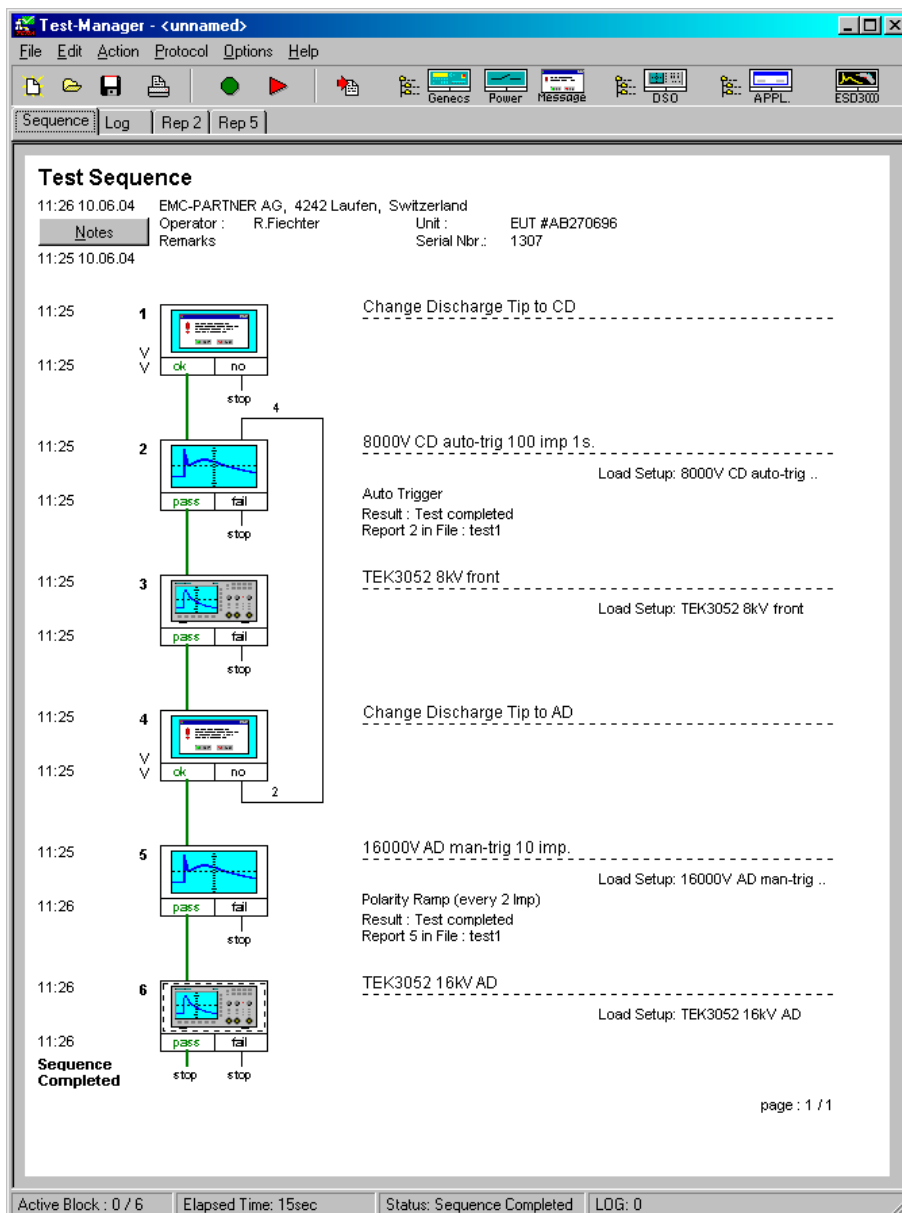
13.1 Remote Control from PC

Direct control of the ESD3000 with a PC requires the following items:

- ESD-OPTOLINK (RS232-interface with 10m optical wire)
- ESD-TRA-CABLE (cable with LEMO plugs to connect interface and ESD3000)
- TEMA ('Test-Manager' software)

Test-Manager software is available for all EMC Partner generators and enables complex test sequences to be programmed using standard windows methods. Test reports can be generated which include results from different generator sources and pictures from a DSO (Digital Storage Oscilloscopes). ESD3000 can be connected directly to a PC and benefits from all these features.

When TEMA software is started, the following window appears:



The screenshot shows the Test-Manager software window with a menu bar (File, Edit, Action, Protocol, Options, Help) and a toolbar. The main window displays a 'Test Sequence' log for a test performed on 11:26 10.06.04. The log includes the following steps:

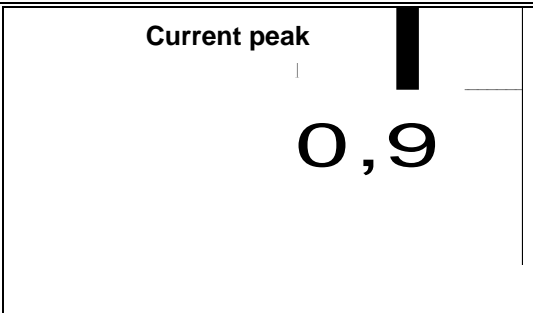
- Step 1:** Change Discharge Tip to CD. Includes a 'Notes' section with operator R.Fiechter, unit EUT #AB270696, and serial number 1307.
- Step 2:** 8000V CD auto-trig 100 imp 1s. Includes an oscilloscope screenshot and a 'pass' status.
- Step 3:** TEK3052 8kV front. Includes an oscilloscope screenshot and a 'pass' status.
- Step 4:** Change Discharge Tip to AD.
- Step 5:** 16000V AD man-trig 10 imp. Includes an oscilloscope screenshot and a 'pass' status.
- Step 6:** TEK3052 16kV AD. Includes an oscilloscope screenshot and a 'pass' status.

The sequence concludes with 'Sequence Completed' at 11:26. The status bar at the bottom indicates 'Active Block : 0 / 6', 'Elapsed Time: 15sec', 'Status: Sequence Completed', and 'LOG: 0'.

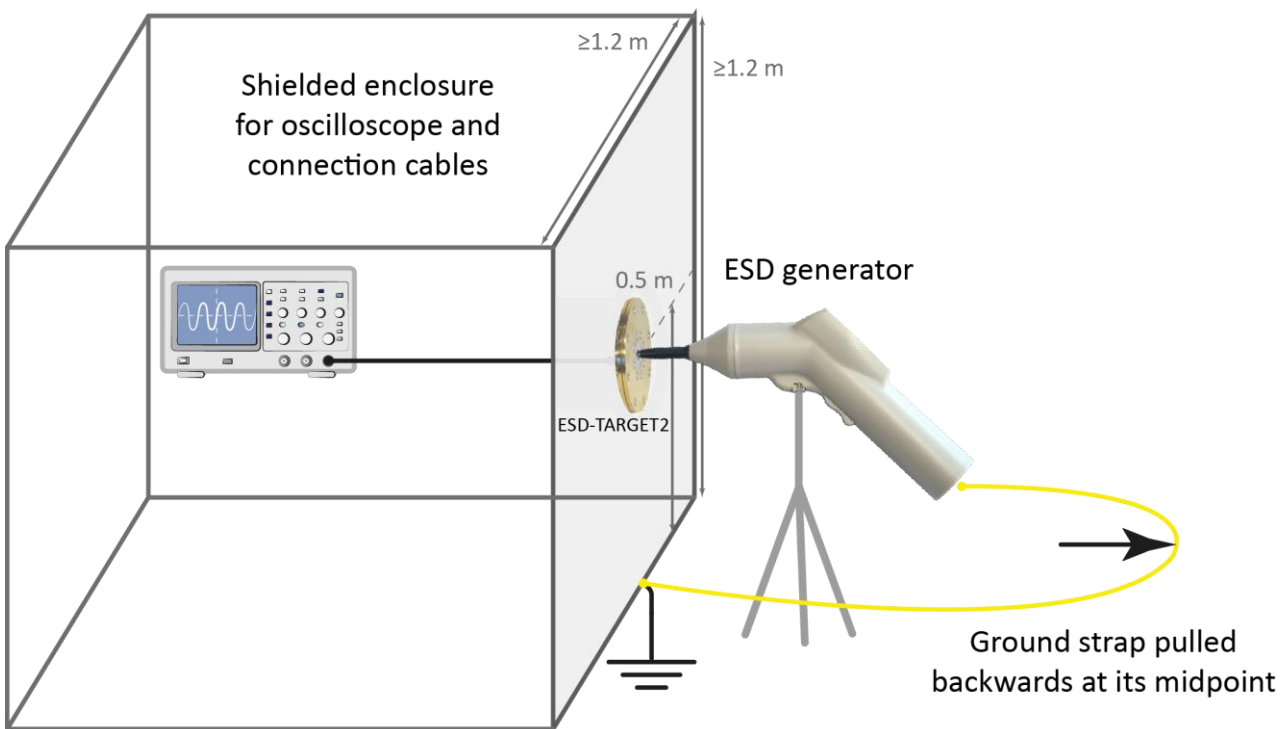
14 Appendix and Corrections

14.1 Appendix

14.1.1 Definition of the ESD Waveform

Level	Test voltage kV+30%	Peak current A+30%	Amplitude at 30ns A+30%	Amplitude at 60 ns A+30%	
1	2	7,5	4	2	
2	4	15	8	4	
3	6	22,5	12	6	
4	8	30	16	8	

It is only possible to check the impulse current by using very expensive pieces of measuring equipment. The price of such an instrument today lies at approx. 50 k\$. In addition, persons who carry out such tests must have some experience with high voltage and high frequency test work, so that they can interpret the measured values. The calibration and verification of the generators must be carried out by the manufacturer or the official calibration authorities.



The ESD-current produces on 2 Ohm Shunt a voltage drop u_1 . The 2 Ohm target is terminated with 50 Ohm to avoid reflection. With the 20 dB attenuator the 60V drop on the 2 Ohm will be reduced to the allowed input voltage of the oscilloscope. The memory oscilloscope must have a minimum bandwidth of 1 GHz. For all four levels (2,4,6,8 kV) the current wave-form must be within the tolerances as specified in the IEC standard 61000-4-2.




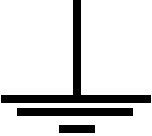
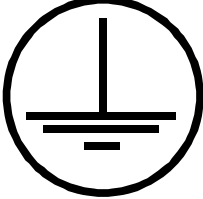
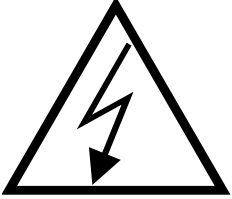

The calibration of the ESD generator should be made at manufacturer side or at an accredited test house.

15 Glossary

Wherever possible, definitions in accordance with IEC 50 (IEV 161) are used.

EUT	Equipment under Test
EST	French abbreviation of EUT
EMV = EMC = CEM	Electro Magnetic Compatibility German:Elektromagnetische Verträglichkeit French: compatibilité elctromagnetique
Hybrid pulse	Voltage at no load 1.2 / 50 µs and current at short circuit 8 / 20µs.
CWG	Definition in IEC 1000-4-5 used for Surge Tester Combination wave generator.
Coupling network	Electric circuit for transferring energy with low losses from one circuit into another circuit.
Decoupling network	Electric circuit to prevent transmitting energy from one circuit into another circuit.
CDN coupling decoupling network (single or three phase unit)	Consist of a coupling and a de-coupling network.
EFT	Electric Fast Transient (switched inductance)
ESD	Electric Static Discharge
SURGE	Transients with high energy content with relatively low frequency content as produced by lightning and switching of power lines.
DIP	Short voltage interruption or short voltage drop
IEC	International standardisation organisation for electronic technology
VARIAC	Voltage variable transformer
SPIKE	One pulse of the burst
CRO	oscilloscope
HV	High Voltage
rms.	root mean square; effective value

Used symbols:

	Direct current
	Alternating current
	Three phase alternating current
	Earth (ground) terminal
	Protective conductor terminal IEC 417, No. 5019
	Caution, risk of electric shock ISO 3864, No. B.3.6
	Caution (refer to accompanying documents) ISO 3864, No. B.3.1

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