



# ESD Testers

ESD- and TRA-System



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# Brief Overview of Phenomena

What causes electrostatic discharges?

Humans become electrostatically charged by walking over an insulating floor surface. The body's capacitance can be charged to several kilovolts. A discharge occurs when contact is made to an electronic unit or system. These are visible as a spark and in many cases can be felt by the person, who receives a „shock“. These discharges are harmless to humans, but not to sensitive, modern electronic equipment. The resulting current can cause interference in electronic equipment or even cause an entire system „crash“.

ESD has been known to the electrical industry for over 30 years but only recently has increased in significance with the advent of sensitive micro electronic devices.

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

Most affected are:

- manufacturers of integrated circuits
- the chemical industry where explosions or fires can occur
- manufacturers where process controllers and electronic equipment can be disrupted
- automotive manufacturers
- military users

## Applicable Standards



### International Electrotechnical Committee (IEC)

IEC 61000-4-2 (A2:2000): Testing and measurement techniques - Electrostatic discharge immunity test.

IEC 61340-3-1: Electrostatics - Electrostatic discharge simulation - Human body model (HBM) - Component testing.

IEC 61340-3-2: Electrostatics - Electrostatic discharge simulation - Machine model (MM) - Component testing.



### International Telecommunications Union (ITU)

T- K.20 (February 2000): Resistibility of Telecommunications Equipment installed in a telecommunications centre to overvoltages and overcurrents.



### International Standards Organisation (ISO)

ISO10605: Road vehicle - Test methods for electrical disturbance from electrostatic discharges.

## Japanese Automobile Standards Organisation (JASO)

D001-94 (31 March 1994): General Rules of Environmental Testing Methods for Automotive Electronic Equipment.



## EUROCAE ED-14D /RTCA DO-160D

Environmental Conditions and Test Procedure for Airborne Equipment. Section 25: Electrostatic Discharge.



## Military Procurement Standards (MIL)

MIL-STD-883E (22 March 1999): ESD classification testing of devices.

MIL-STD-331B (01 December 1989): Fuse and Fuse components.

MIL-STD-750D (28 February 1995): Test method standard semiconductor devices.

MIL-STD-464 (18 March 1997): Electromagnetic Environmental Effects.

MIL-STD-1541 (30 December 1987): Electromagnetic Compatibility Requirements for space systems.



## European Standard (EN)

EN 61000-4-2 (A2:2000): Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test.



## American National Standards Institute (ANSI)

C63.16 : American National Standard for Electrostatic Discharge Test Methodologies and Criteria for Electronic Equipment.



## Telcordia

Bellcore GR-78-CORE (September 1997): Generic Requirements for the Physical Design and Manufacture of Telecommunications products and Equipment.

Bellcore-GR-1089-CORE (October 2002): Electromagnetic Compatibility and Electrical Safety-Generic Criteria for Network Telecommunications Equipment.



## Electronic Industry Association / JEDEC

EIA/JESD22-A114-B (June 2000): ESD Sensitivity Testing Human Body Model

EIA/JESD22-A115-A (October 1997): ESD Sensitivity Testing Machine Model



## Society of Automotive Engineers (SAE)

SAE J551-15 (July 2002): Vehicle Electromagnetic Immunity - Electrostatic Discharge (ESD).



# Test System Overview



ESD3000 – EMC PARTNER's battery operated, portable, 30 kV ESD generator

## ESD3000

ESD3000 is a light weight, hand-held battery operated tester. The modular construction enables many different test standards to be performed by simply changing the module. A broad range of accessories enable testing to many applications for contact discharge, air discharge and indirect discharge.

The easily interchangeable discharge modules (DM) quickly adapt ESD3000 to the specified circuits of a new application. Each new module fitted to the ESD3000 is automatically identified and the corresponding program displayed. Modules can be configured to meet requirements for special component values but also so that the waveshape is correct using the defined calibration method. The modules contain all the high voltage circuits making ESD3000 the ONLY ESD system capable of fully conforming to different calibration requirements.

Unique in it's class, ESD3000 is powered by a rechargeable battery pack up to 30kV for approximately 8 hours @ 1Hz discharge repetition. Regular AA batteries can also be used.

Electronic polarity reversal, including alternating polarity, is provided as standard in all ESD3000 models.

Available as a basic 16 kV unit ESD3000 is easily expandable to 30kV by simply adding a Relay Module (RM).

Remote control of ESD3000 test system is possible using the EMC PARTNER TEMA software package.

Long duration testing is made easier by fitting ESD3000 to a tripod mount fitted with standard „photo“ type mount. In combination with the TEMA software, test reports can be generated.

As standard accessories ESD3000 is equipped with one set of UM-3/AA size NiMH rechargeable batteries a power adapter for recharging, 2 m Earth cable, serial link cable to update the software via EMC PARTNER's website, user manual with verification protocol, conformity declaration and software package. All delivered in a smart case.



ESD2000 – 16 kV hand-held light weight ESD generator

## ESD2000

ESD2000 is a lightweight design used together with TRA2000 for control and power supply elements.

Discharge network is fixed at 150pF and 330ohm to meet the IEC/EN 61000-4-2 requirements.

Parameter input is via TRA2000 front panel allowing integration in a complete test process including EFT, surge and dips.

A tripod mount enables longer duration tests to be performed without operator fatigue.

As standard accessories, ESD2000 is equipped with 2m earth cable, *air* and *contact* test tips and a safety "crocodile" clip.

# ESD3000 System

## ESD3000 Features

ESD3000 has many unique and outstanding Features:

- 30kV contact discharge level
- Single impulse mode
- Simple operation
- Parameter change during operation using “+” and “-” keys
- Internal program memory
- Backlit LCD display
- Electronic polarity change
- Light weight
- Battery operation
- Compact design
- Fulfills ALL standard requirements
- Wide range of Discharge Modules (DM)
- Individually calibrated discharge modules (DM)
- Standard (0.7nS - 1nS) or Fast ESD (ca. 300pS) events
- Remote control and software upgrade through standard interface
- Wide range of accessories
- 2 year warranty



ESD3000 is powered by regular or rechargeable batteries.



As standard equipment, risetime switching on 30kV modules

## User Benefits

The technical excellence and many unique features of ESD3000 translate directly into benefits for the user:

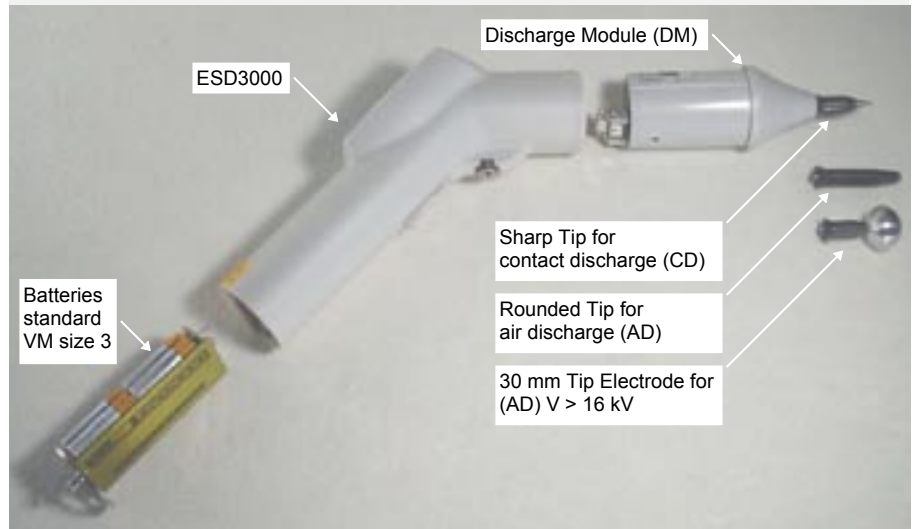
- Cost effective solution to meet many test requirements
- Low cost and rapid extension to 30kV
- Save unnecessary development time, no overtest
- ESD events realised exactly as in standard
- Increase quality of test object
- Always calibrated, ALL high voltage elements are in the module
- Real time parameter change, Ideal development tool
- Save operator time with the automated test routines and test report facility
- No operator fatigue due to ergonomic design and light weight
- Unparalleled reliability and system up-time
- Increase reliability of test object (EUT)



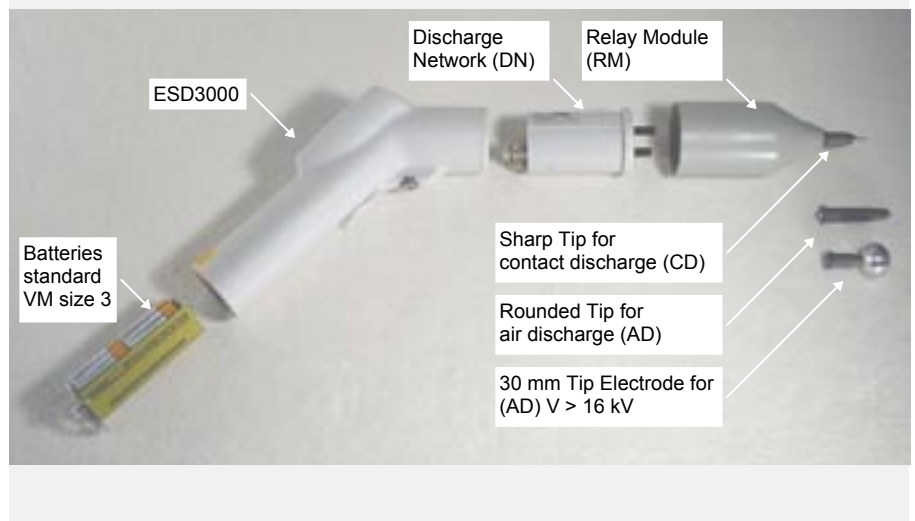
The ergonomic design allows easy parameter change during operation with one hand and without fatigue.

## Component Parts of the ESD3000

ESD3000 16kV version



ESD3000 30kV version



## ESD3000 Specifications

Discharge risetime	depending on module type
Air discharge	0.2 up to 30kV depending on module type
Contact discharge	0.08 up to 30kV depending on module type
Voltage increment resolution	1 volt steps
Contact discharge repetition interval	0.05 to 30s
Discharge detection	every pulse or real discharges only
Discharge counter	1 to 29999
Discharge polarity	positive, negative and alternating
Holding time	5s
Programmable parameter ramps	voltage, polarity
Discharge trigger	manual, automatic or remote
Test report data from TRA2000 or TEMA software	sequence, number of discharges, voltage, polarity
Power supply	10 x UM-3 / AA batteries
Weight including batteries	870g

## Modules

Modules	Standards	Cap. / Res.	Voltage range (CD) Contact Discharge	Voltage range (AD) Air Discharge
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### Standard Modules

DM1	IEC 61000-4-2 ITU-T K20	150pF / 330ohm	+/- 0.2kV up to 10kV	+/- 0.2kV up to 16kV
DM2	ISO TR10605 PSA Peugeot-Citroën B21 7110	330pF / 2000ohm	+/- 0.2kV up to 10kV	+/- 0.2kV up to 16kV
DM3	ISO TR10605	150pF / 2000ohm	no CD	+/-1kV up to 30kV
DM4	MIL-STD-464 MIL-STD-883 GR78-CORE	100pF / 1500ohm	+/- 0.2kV up to 10kV	+/- 0.2kV up to 16kV
DM5	RTCA/DO-160	150pF / 330ohm	no CD	+/-1kV up to 30kV
DM6	IEC 61340-3-1 JEDEC 22-A114 MIL-STD-750D	100pF / 1500ohm	+/- 0.2kV up to 10kV	no AD
DM7	IEC 61340-3-2 JEDEC 22-A115	200pF / 0ohm	+/- 0.08kV up to 2.5kV	no AD
DM8	IEC 60571 EN 50155	rise time < 0.05µs duration 0.1µs	+/- 0.2kV up to 10kV	+/- 0.2kV up to 16kV
RM32	0.7ns up to 1ns and < 400ps		+/- 1kV up to 30kV	+/- 1kV up to 30kV
DN1	IEC 61000-4-2 RTCA/DO-160 PSA Peugeot-Citroën B21 7110 GMW 3100	150pF / 330ohm	+/- 1kV up to 30kV	+/- 1kV up to 30kV
DN2	ISO TR10605 SAEJSSI-IS FORD AB/AC GMW 3100	330pF / 2000ohm	+/- 1kV up to 30kV	+/- 1kV up to 30kV
DN3	ISO TR10605 SAEJSSI-IS FORD AB/AC	150pF / 2000ohm	+/- 1kV up to 30kV	+/- 1kV up to 30kV
DN4	MIL-STD-331B STANAG 4239 ISO 14304	500pF / 5000ohm	+/- 1kV up to 30kV	+/- 1kV up to 30kV

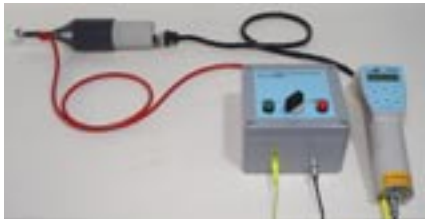
### Customer Specific Modules

DM16A	Custom	100pF up to 1300pF / 0ohm up to 2000ohm	no CD	+/- 0.5kV up to 16kV
DM16C	Custom	100pF up to 1500pF / 0ohm up to 2000ohm	+/- 0.2kV up to 10kV	+/- 0.2kV up to 16kV
DM32A	Custom	100pF up to 1000pF / 0ohm up to 2000ohm	no CD	+/- 1kV up to 30kV
DN32	Custom	100pF up to 1000pF / 0ohm up to 10000ohm	+/- 1kV up to 30kV	+/- 1kV up to 30kV

### Modules for Special Applications

CAR1	JASO D 001-94	150pF / 500ohm	+/- 2kV up to 30kV	+/- 2kV up to 30kV
CAR2	ISO TR10605	330pF / 330ohm	+/- 2kV up to 30kV	+/- 2kV up to 30kV
CAR3	ISO TR10605	330pF / 330ohm	+/- 0.2kV up to 10kV	+/- 0.2kV up to 16kV
CAR4	ISO TR10605	150pF / 2000ohm	+/- 0.2kV up to 10kV	+/- 0.2kV up to 16kV
MIL1	MIL-STD-331 MIL-DTL-23659D STANAG 4239	500pF / 500ohm	+/- 2kV up to 30kV	+/- 2kV up to 30kV
IND1	IEC801-2	150pF / 150ohm	+/- 2kV up to 30kV	+/- 2kV up to 30kV

# System Expansion Options



ESD3000 Safety Switch

## ESD3000 Safety Switch

Under certain circumstances it is desirable to remove all charge from the ESD generator discharge tip before connecting a test object. Particularly in applications involving explosive devices (airbags, foil initiators, etc.) where unexpected activation may endanger operating personnel. In addition, semiconductor devices can be damaged by a test finger holding residual charge.

ESD3000 Safety switch used in conjunction with ESD3000DM enables testing in a controlled environment that provides maximum safety for operating personnel and minimum risk of damage to Semiconductors.

ESD3000DM-EXT



## ESD3000DM-EXT

This extension allows the separation of control and discharge module. It can be used for DM and RM+DN.

CNH12



## CNH12

The CNH12 can be used for proximity magnetic field susceptibility tests.



TRA2000 controller with ESD2000

## ESD2000 with TRA2000

The combination of the TRA2000 and the ESD2000 via the ESD-TRA-LINK offers the possibilities of unlimited storage places and immediate protocol printing in the same protocol as surge, EFT, etc.

## ESD2000 Specifications

Discharge risetime:	0.7 - 1.0nS
Air discharge:	2.0 up to 16kV
Contact discharge:	2.0 up to 10kV
Voltage increment resolution:	1 volt steps
Contact discharge repetition interval:	0.05 to 30s
Discharge detection:	Every pulse or real discharges only
Discharge counter:	1 to 29999
Discharge polarity:	Positive, Negative and Alternating
Holding time:	5s
Programmable parameter ramps:	Voltage, Polarity
Discharge trigger:	Manual or Automatic

# Accessories

ESD-TARGET1



## ESD-TARGET1

2ohm target with N connector and N-BNC adapter, upper limit approximately 2 GHz.

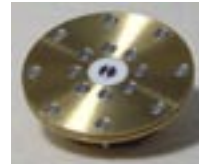
Application: ESD verification in accordance with IEC/EN 61000-4-2.



## ESD-TARGET2

2ohm target with SMA connector, upper limit > 4GHz, 20dB attenuator and 1m coaxial cable. Calibration: target-attenuator-cable chain..

Application: ESD calibration and comparison



ESD-TARGET2

## ESD-VERI-V

20GOhm divider for high voltage measurement on the ESD3000 up to 25kV.

Ratio is determined by the 1MOhm input of the oscilloscope. Ratio approx. 20'000.

Application: ESD voltage verification.



ESD-VERI-V

## ESD-VCP50 – Vertical Coupling Plate

- Mechanical dimension: 0.5m x 0.5m
- Application: indirect ESD discharge with contact tip
- Includes: 2m cable with 2 x 470kOhm resistors



ESD-VCP50 – Vertical Coupling Plate

## ESD-STAND3

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



ESD-STAND3

# Software

## ESD-OTPOLINK

For remote control of ESD3000, the ESD-OPTOLINK and one of the following software packages is needed:

- E3LOADER: downloaded free of charge from the EMC PARTNER Website. Using the serial link supplied, firmware can be updated.
- TEMA Software: Comfortable control of ESD3000 from a PC. Includes also control for TRA2000 and MIG2000 systems.



ESD-OPTOLINK

## USB-RS232 Adapter

ESD3000 can be controlled from TEMA software using computers with USB interfaces and the USB-RS232 adapter.



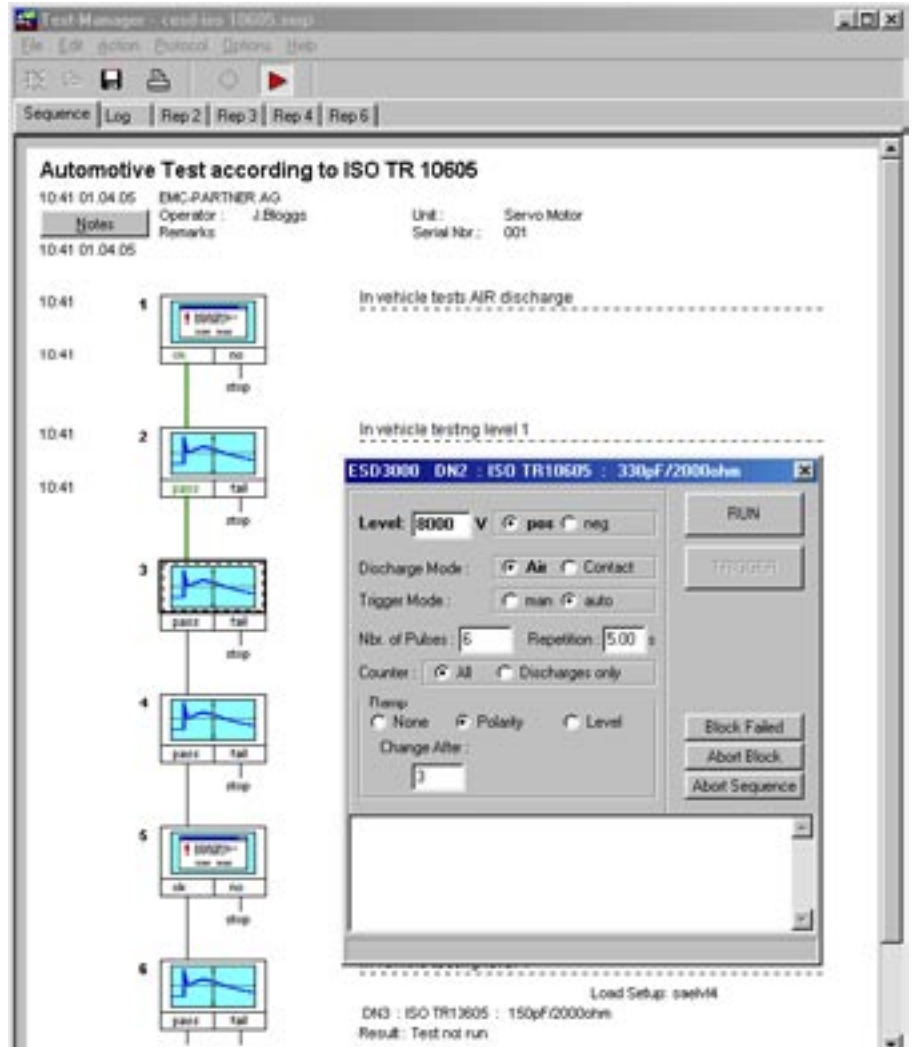
USB-RS232 Adapter

## TEMA Software

Start testing faster with pre-loaded standard routines. Supervise the test process using, Loop continue or stop functions linked into EUT responses. Customise the test report format and content automatically generating a document for export to Word® or Excel®.



TEMA Software



# Further Applications



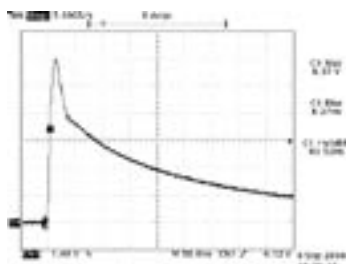
ESD3000 with remote DM for testing explosive devices

ESD3000 is so flexible it can be used in many applications other than for EMC.

## Explosive Device Testing

Testing of EUTs that could spontaneously explode or rapidly change state, such as airbags or munition fuses, can be accomplished with minimum risk to testing personnel by separating the ESD3000 control unit and the discharge module. ESD3000DM-EXT enables a separation of up to 1m.

Use of a test cabinet from EMC PARTNER further increases safety by containing flying debris.



Railway Surge Waveform B

## Railway Testing

Applicable standards are IEC 60571 Ed. 2.0b, EN 50155 and RIA12.

Module ESD3000DM8 generates the higher level waveform B impulse.

Waveform B: 0.05/0.1µs (8.4kV),  $Z_{out}$  100 ohm

In combination with the TRA2000 and option NW-TRA-RAIL, all the surge requirements from these standards can be met.

# EMC PARTNER's Product Range

The Largest Range of Impulse Test Equipment up to 100kA and 100kV.

## Immunity Tests

The TRA2000 performs all of the following transient tests on electronic equipment as required for the CE-mark up to full levels: ESD, EFT, surge, dips, a.c. magnetic field, surge magnetic field and common mode tests. A large range of accessories for different applications is available: MF antennas, three phase couplers, verification sets, coupling kits, etc. The TRA2000 complies with IEC 61000-4-2, -4, -5, -8, -9, -11, -12p, -16, -29p.

TRA2000, ESD3000 and CDN2000A-06-32 – a complete automatic three-phase test system



## Lightning Tests

EMC PARTNER offers a wide range of testers in accordance with national and international standards. These include FCC 68 part D, ITU K.44, ETS 300 046, Bellcore GR1089 for telecom, RTCA DO160D for aircraft and MIL-STD-461E for military electronic equipment testing.

MIG0600MS and MIG-OS-MB – a multiple stroke and multiple burst aircraft test system



## Component Tests

EMC PARTNER offers a wide range of modular impulse generators (MIG) for transient component testing on: varistors, arresters, surge protective devices (SPD), capacitors, circuit breakers, watt-hour meters, protection relays, insulation material, suppressor diodes, connectors, chokes, fuses, resistors, emc-gaskets, cables, etc.

MIG1212CAP – an automatic 8 bank capacitor test system



## Emission Measurements

One unit performs all measurements on the power supplies of electronic equipment and products for the CE-Mark.

The HAR1000 includes an amplifier for a clean power source, a line impedance network, the measurement systems Harmonics and Flicker. Accessories: three phase extension and HARCS Immunity software. Complies with IEC/EN 61000-3-2 and -3.

HAR1000-3P and HARCS Software – a complete three-phase harmonics and flicker test system



For further information please do not hesitate to contact EMC PARTNER's representative in your region. You will find a complete list of our representatives and a lot of other useful information on our website:

[www.emc-partner.com](http://www.emc-partner.com)

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