



# ESD Test 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 (Ed2:2008): 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-14 /RTCA DO-160

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

## Military Procurement Standards (MIL)

MIL-STD-883 (18 June 2004): ESD classification testing of devices.

MIL-STD-331 (5 January 2005): Fuse and Fuse components.

MIL-STD-750 (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 (A2:2009 Ed.2): 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 (4 June 2006): 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.



TRA2006 with ESD2000

## TRA2004, TRA2006

ESD2000 is an accessory to EMC PARTNER's Transient Test System. Power supplies and control of ESD2000 are incorporated into Transient Test System generators.

Connecting ESD2000 to TRA2004 or TRA2006 offers the possibilities of unlimited storage places and immediate protocol printing in the same protocol as surge, EFT, etc.

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



TRA3000 with EXT-TRA3000 E

## TRA3000

EXT-TRA3000 E is an accessory to EMC PARTNER's TRA3000 test system.

Power and High Voltage are fully contained in EXT-TRA3000 E. Programming and control is via the TRA3000 front panel menu.

A test report is available from the TRA3000 Web Server.



# 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) and discharge networks (DN)
- Individually calibrated discharge modules and networks
- 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

## 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)



ESD3000 is powered by regular or rechargeable batteries.



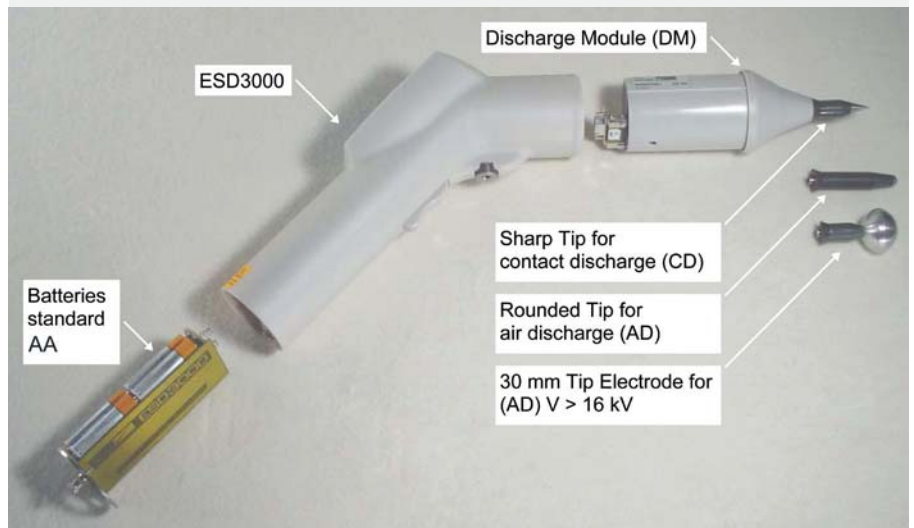
As standard equipment, risetime switching on 30kV modules



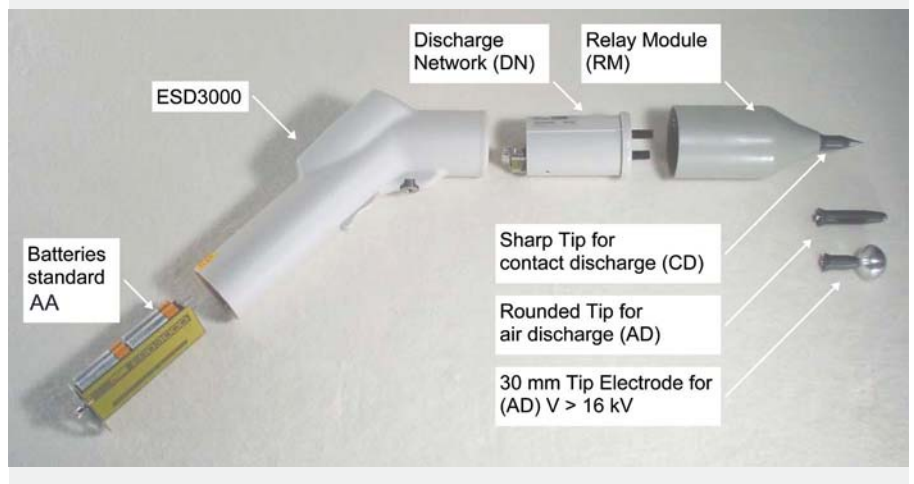
The ergonomic design allows easy parameter change during operation with one hand and without fatigue.

ESD3000 16kV version

## Component Parts of the ESD3000



ESD3000 30kV version



# Generator Specifications

## ESD3000

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	100 volt steps
Contact discharge repetition interval <sup>1)</sup>	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 software	sequence, number of discharges, voltage, polarity
Power supply	10 x UM-3 / AA batteries
Weight including batteries	870g

<sup>1)</sup> Note: The repetition rates are applicable to IEC61000-4-2 only. For all other modules or applications consult the relevant DM (Discharge Module) or DN (Discharge Network) specific instruction sheets.

## Modules

### Standard Modules

Modules	Standards	Cap. / Res.	Voltage range (CD) Contact Discharge	Voltage range (AD) Air Discharge
ESD3000DM1	IEC 61000-4-2 ITU-T K20	150pF / 330ohm	+/- 0.2kV up to 10kV	+/- 0.2kV up to 16kV
ESD3000DM2	ISO TR10605 PSA Peugeot-Citroën B21 7110	330pF / 2000ohm	+/- 0.2kV up to 10kV	+/- 0.2kV up to 16kV
ESD3000DM4	MIL-STD-883 GR78-CORE	100pF / 1500ohm	+/- 0.2kV up to 10kV	+/- 0.2kV up to 16kV
ESD3000DM5	RTCA/DO-160	150pF / 330ohm	no CD	+/-1kV up to 30kV
ESD3000DM6	IEC 61340-3-1 JEDEC 22-A114 MIL-STD-750D	100pF / 1500ohm	+/- 0.2kV up to 8kV	no AD
ESD3000DM7	IEC 61340-3-2 JEDEC 22-A115	200pF / 0ohm	+/- 0.1kV up to 2kV	no AD
ESD3000DM8 <sup>1)</sup>	IEC 60571 EN 50155	rise time < 0.05µs duration 0.1µs	+/- 0.2kV up to 10kV	+/- 0.2kV up to 16kV
ESD3000RM32	0.7ns up to 1ns and < 400ps		+/- 1kV up to 30kV	+/- 1kV up to 30kV
ESD3000DN1	IEC 61000-4-2 RTCA/DO-160 PSA Peugeot-Citroën B21 7110 GMW 3100	150pF / 330ohm	+/- 1kV up to 30kV	+/- 1kV up to 30kV
ESD3000DN2	ISO TR10605 SAEJSSI-IS FORD AB/AC GMW 3097	330pF / 2000ohm	+/- 1kV up to 30kV	+/- 1kV up to 30kV
ESD3000DN3	ISO TR10605 SAEJSSI-IS FORD AB/AC GMW 3097	150pF / 2000ohm	+/- 1kV up to 30kV	+/- 1kV up to 30kV
ESD3000DN4	STANAG 4239 ISO 14304 MIL-STD-1512	500pF / 5000ohm	+/- 1kV up to 30kV	+/- 1kV up to 30kV
ESD3000DN5	MIL-STD-331C MIL-DTL-23659D STANAG 4239	500pF / 500ohm	+/- 2kV up to 30kV	+/- 2kV up to 30kV
ESD3000DN6	ISO TR10605	330pF / 330ohm	+/- 2kV up to 30kV	+/- 2kV up to 30kV

1) Generates Waveform B. Can be used together with TRA3000, TRA2004 or TRA2006 and NW-TRA-RAIL to complete Waveform A requirements.

### Modules for Special Applications

Modules	Standards	Cap. / Res.	Voltage range (CD) Contact Discharge	Voltage range (AD) Air Discharge
ESD3000DN32-CAR1	JASO D 001-94	150pF / 500ohm	+/- 2kV up to 30kV	+/- 2kV up to 30kV
ESD3000DN32-CAR5 <sup>1)</sup>	Renault 32-10-001/D	330pF / 0ohm	+/- 2kV up to 30kV	+/- 2kV up to 30kV
ESD3000DN32-IND1	IEC801-2	150pF / 150ohm	+/- 2kV up to 30kV	+/- 2kV up to 30kV
ESD3000DN32-MIL2	Special Military	400pF / 150ohm	+/- 2kV up to 30kV	+/- 2kV up to 30kV
ESD3000DN32-MIL3	MIL-STD-1576	500pF / 0ohm	+/- 2kV up to 30kV	+/- 2kV up to 30kV

1) module integrated into ESD3000RM32 relay module

Further information for all modules is available on the individual instruction sheets. Refer to EMC PARTNER or your local representative.

### DM1 module for IEC 61000-4-2

IEC 61000-4-2 Ed.2: New test method and tolerances for impulse evaluation. ESD3000 with DM1 fulfills BOTH Ed.1 and Ed.2



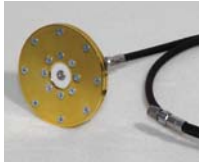
## TRA3000, TRA2004, TRA2006

ESD specifications of TRA3000, TRA2000IN4 and TRA2000IN6:

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 and Options

ESD-TARGET2



### 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-VERI-V



### 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.

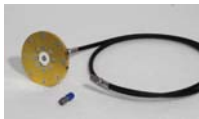
ESD-VCP50 – Vertical Coupling Plate



### 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.-TARGET2-DN



### ESD-TARGET2-DN

2ohm target with SMA connector, upper limit > 4GHz. Calibrated target attenuator cable chain for up to 30kV.

Application: ESD calibration and comparison

ESD.-TARGET2-50



### ESD-TARGET2-50

50 Ohm target with SMA connector. Calibrated target attenuator cable chain according to IEC61340-3-1 and -2.

ESD.-TARGET2-500



### ESD-TARGET2-500

500 Ohm target with SMA connector. Calibrated target attenuator cable chain according to IEC61340-3-1 and -2.



## ESD3000 only

### ESD3000 SAFETY-S

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 and ESD3000DN enables testing in a controlled environment that provides maximum safety for operating personnel and minimum risk of damage to Semiconductors.

### ESD3000DM-EXT

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

### CNH12

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

### ESD-STAND Ed2

- Non metallic stand for ESD2000 / 3000 in accordance with IEC 61000-4-2 Ed.2.
- Height adjustable from 0.4m up to 1.75m.
- Application: long term tests in contact and air discharge mode

### TC-MIG24 ED (for explosive devices)

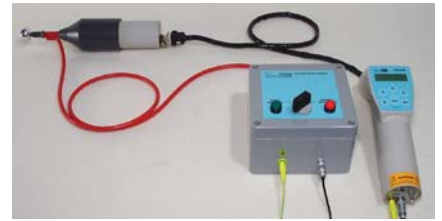
Testing of EUTs that could spontaneously explode or rapidly change state, such as airbags or munition fuses, can be accomplished with minimum risk to testing personnel by separating the ESD3000 control unit and the discharge module. ESD3000DM-EXT enables a separation of up to 1m.

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

## TRA2000, TRA2004, TRA2006 only

### ESD2000

ESD2000 is a lightweight design with fixed discharge network to meet the IEC/EN 61000-4-2 requirement (150pF/330ohm).



ESD3000 SAFETY-S



ESD3000DM-EXT



CNH12



ESD-STAND Ed2



ESD3000 with remote DM for testing explosive devices



ESD2000

# Software

ESD3000-OPTOLINK



## ESD3000-OTPOLINK

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

- E3LOADER: downloaded free of charge from the EMC PARTNER Website. Using the serial interface, firmware can be updated.
- TEMA Software: Comfortable control of ESD3000 from a PC. Includes also control for EMC PARTNER Transient Test System and MIG2000 generators.

USB-RS232 Adapter



## USB-RS232 Adapter

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

TEMA Software



## 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®.

Example of sequence for automotive tests

**Test-Manager - <esd-iso 10605.seq>**

File Edit Action Protocol Options Help

Sequence Log Rep 2 Rep 3 Rep 4 Rep 6

**Automotive Test according to ISO TR 10605**

10:41 01.04.05 EMC-PARTNER AG Unit: Servo Motor  
 Operator: J.Bloggs Serial Nbr.: 001  
 Remarks

10:41 01.04.05

10:41 1 In vehicle tests AIR discharge

10:41 2 In vehicle testing level 1

10:41 3

4

5

6

ESD3000 DN2 : ISO TR10605 : 330pF/2000ohm

Level: 8000 V  pos  neg RUN

Discharge Mode:  Air  Contact TRIGGER

Trigger Mode:  man  auto

Nbr. of Pulses: 6 Repetition: 5.00 s

Counter:  All  Discharges only

Ramp:  None  Polarity  Level

Change After: 3

Block Failed

Abort Block

Abort Sequence

Load Setup: saelv4

DN3 : ISO TR10605 : 150pF/2000ohm  
 Result: Test not run

Active Block : 3 / 6 Elapsed Time: 12sec Status: Sequence running LOG: 3 10:37 10:37 pass ...

# EMC PARTNER's Product Range

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

## Immunity Tests

Transient Test System can be used to perform all EMC tests on electronic equipment. ESD, EFT, surge, AC dips, AC magnetic field, surge magnetic field, common mode, damped oscillatory and DC dips tests are available as stand-alone or combined test instruments. A large range of accessories for different applications is available: three phase couplers up to 690V/100A, telecom and data line couplers, verification sets, magnetic field coils. Immunity test systems fulfill IEC and EN 61000-4-2, -4, -5, -8, -9, -11, -12, -16, -18, -29.

TRA3000 and ESD3000 ideal for CE testing  
Easily extended to meet other applications



## Lightning Tests

A range of test equipment and accessories for aircraft, military and telecom applications. Complete solutions including all hardware and software to meet the requirements of RTCA / EUROCAE DO160 / ED14 for indirect lightning on aircraft systems, MIL-STD-461 tests CS106, CS115, CS116, for military vehicles, ITU-T .K44 basic and enhanced tests for impulse, power contact and power induction, FCC part 68 for telecom equipment testing.

MIG2000-6 – a flexible solution for military and avionic applications



## Component Tests

Modular impulse generators (MIG) for transient component testing on: varistors, gas discharge tubes (GDT), surge protective devices (SPD), XY capacitors, circuit breakers, watt-hour meters, protection relays, insulation material, suppressor diodes, connectors, chokes, fuses, resistors, emc-gaskets, cables, etc. Manual or fully automated solutions are available up to 100kA (8/20us) and 144kV (1.2/50us).

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. HAR1000 uses a novel technique to deliver clean power source for the EUT in a compact and lightweight form. The system includes all hardware and software including line impedance networks, control and evaluation software. A basic 1-phase system can be easily extended to 3-phase by adding 2 further phases. HARCS Immunity software further expands the system by adding interharmonic tests, voltage variation and ripple on DC tests. Complies with IEC / EN 61000-3-2, -3 IEC / EN 61000-4-13, -14,

HAR1000-3P and HARCS software  
a complete test system



## System Automation

As addition to the basic generators, a range of accessories are available to enhance capability. Test cabinets, test pistols, adapters and software, simplify interfacing with the EUT.

PS3 programmable source is an EMC hardened supply for frequencies from 16.7Hz to 400Hz. Frequency variation tests can be made using the PS3-SOFT-EXT. Complies with IEC / EN 61000-4-28

PS3 - programmable source  
ideal for EMC applications



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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