



ESS-2000

ELECTROSTATIC DISCHARGE SIMULATOR



ESS-2002

Your products may have passed the test standards, but can they survive in the real world?

There are many ESD standards for your equipment.

Do those standards really represent the real world phenomenon?

Reconsider your testing program to assure that your products are really ESD-immune.

Consider NoiseKen's ESS series ESD simulators to ensure your products survival in the real world.

The issue of product-level ESD (electrostatic discharge) immunity has been attracting continued interest because it is an important quality factor in equipment reliability, durability and sometimes safety.

Generally, among the causes of equipment malfunction, problems caused by ESD are the most difficult events against which to incorporate protective measures, since the causal relationship generally cannot be found easily. This often makes ESD test programs extensive, complex, burdensome and time-consuming. Thanks to the following benefits, NoiseKen's ESS series ESD simulators are your best choice whatever your requirements are, for design, qualification, production or diagnostic tests.

- **Meets and far exceeds the requirements in EN/IEC61000-4-2**
- **Up to 30kV output in both contact and air discharges**
- **A light weight discharge gun**
- **Easily changeable capacitor and resistor units**
- **A wide range of options**
- **CE marked**

Two models ESS-2000 and ESS-2002 are available.

The above-mentioned capabilities are common to them.

The ESS-2002 is the basic model with a built-in discharge counter and time controller.

The ESS-2000 is the fully programmable menu-driven simulator enabling users to carry out tests in a more automated manner.

Computer-Controlled ESD Simulator

ESS-2000 & TC-815R

Conforming to IEC61000-4-2

FEATURES

- Fully programmable menu-driven simulator providing four operation modes: IEC severity, Manual, Sweep, and Program
- A new level of ease of use and safety with the user interface consisting of a 5-inch LCD, ten-key buttons, rotary knob and others
- Unique shape for operator's easy access to the control and displays even when the unit is put on the floor level (ground plane)
- GP-IB interface
- A wide variety of the dedicated options



TC-815R

ESS-2000

(Gun stand in the photo is an optional accessory.)

CONTROLS, INDICATORS AND TERMINALS

Large LCD: Makes testing faster, easier and more reliable

Controls: Intuitive set-up can be done

Start/Stop buttons

Infra-red reception for Remote Controller and Tem./Humidity Sensor

Rotary Control

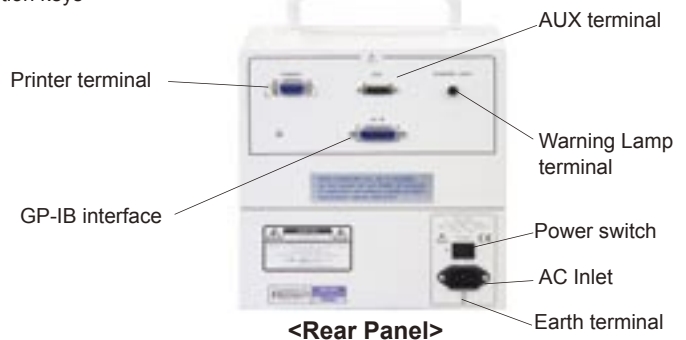
Cursor buttons

Warning Lamp: Blinks when the HV circuitry is on.

High Voltage Connector: Used to connect discharge gun

<Front Panel>

Function keys



<Rear Panel>

AUX terminal

Printer terminal

Warning Lamp terminal

GP-IB interface

Power switch

AC Inlet

Earth terminal

ESS-2000

■ DISPLAY EXAMPLES

● MENU DISPLAY



After pressing the main switch, press the mode button. This places the simulator in the initial menu, which displays the four operational modes and utility mode.

 The optional temperature/humidity sensor shows the current measured values.

● MANUAL MODE



If you desire to operate the unit in the manual mode, press the corresponding ten-key, 2. Items to be set by the operator will appear. Discharge method (contact/air discharge), discharge voltage, number of discharges and interval can be set. The item in the cursor can be varied by using the ten-key or rotary knob.

Contact discharges: For contact discharge testing, after completion of required settings, press the START button and pull the trigger. The simulator will then generate the required number of pulses at the required interval. Pulling the trigger again will pause the unit. Pulling again will restart the unit.

Air discharges: For air discharge testing, after completion of setting, press the START key. To carry out air discharges, keep pulling the trigger and approach the discharge tip to the EUT. Keep pulling the trigger to maintain the HV relay in the on status.

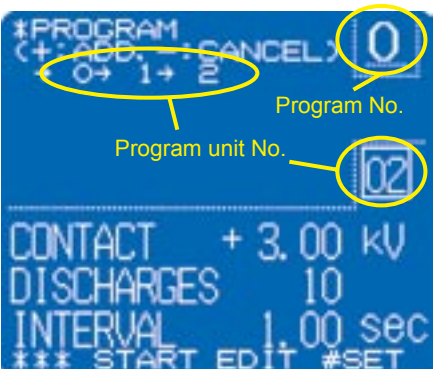
● SWEEP MODE



In this mode, the simulator generates discharges in an automatic ramp. Starting, ending and step voltages can be freely set. In this mode, the number of discharges set is that in each step. For example, when the simulator is set to 5kV for start voltage, 10kV for end voltage, 1kV for step voltage, in a way of 10 discharges at an interval of 1 second, it produces 10 pulses at 5kV at an interval of 1 second and proceeds to 6kV pulses, also 10 discharges. These steps continue until the simulator has completed 10 pulses of 10kV.

Two different ways of pulling the trigger: When the trigger is pulled and then released quickly, the simulator operates in a way that it pauses before it proceeds to next step voltage. For continuous operation, pull the trigger for more than 2 seconds. The message of "CONTINUOUS" is indicated on the upper right side of the screen.

● PROGRAM MODE



Test settings can be stored for 100 program units. Any combination of units selected from those 100 units can consist of one test sequence, the longest is up to 30 units. Here we call one test sequence a program. 50 programs can be stored.

For program unit setting, press EDIT button. Settings of voltage, etc. can be done in the same way as the other operation modes. The trigger functions in the same ways as in the sweep mode. When pulled once and released instantly, the simulator operation pauses before it goes to the next program unit. If pulled for more than 2 seconds, the simulator operates continuously.

ESS-2000

■ SPECIFICATIONS

| Parameters | | | ESS-2000 specifications |
|------------------------------------|--------------------|---------------------------|--|
| Output voltage | | | 0.20 ~ 30.0kV ±5% |
| Polarity | | | Positive or negative |
| Charging resistance | | | 10MΩ(53MΩ for combination with TC-815R discharge gun) |
| Discharge mode | | | Air discharge and contact discharge |
| Operation mode | IEC severity level | Level setting | 1, 2, 3, 4 |
| | | Discharge interval | 0.05 ~ 600.0 s |
| | | No. of times of discharge | 1 ~ 60000 times |
| | Manual | Discharge interval | 0.05 ~ 600.0 s |
| | | No. of times of discharge | 1 ~ 60000 times |
| | | Setting storage function | Up to 10 conditions storable |
| | Sweep | Starting voltage | ±0.20 ~ 30.0 kV |
| | | Ending voltage | ±0.20 ~ 30.0 kV |
| | | Step voltage | 0.00 ~ 30.0 kV |
| | | Discharge interval | 0.05 ~ 600.0 s |
| | | No.of times of discharge | 1 ~ 60000 times |
| | | Setting storage function | Up to 10 conditions storable |
| | Program | Voltage setting | ±0.20 ~ 30.0 kV |
| | | Discharge interval | 0.05 ~ 600.0 s |
| | | No. of times of discharge | 1 ~ 60000 times |
| | | No. of steps | 30 steps maximum |
| | | No. of programs | Up to 50 conditions storable |
| | | No. of program units | Up to 100 conditions can be set. |
| Display element | | | LCD with back light |
| Character display | | | English or Japanese |
| Setting method | | | Ten-key pad, Rotary control, Function keys |
| Auxiliary function | | | Upper limit voltage setting function / Trigger switch select function Auto stop function / Inversion on the screen function |
| Memory function | | | Contents of each setting and last operation display are backed up for more than 3 months with battery full charged. |
| External interface functions | | | GP-IP connecting I/F / Warning light connecting I/F External trigger input I/F / Elimination probe connecting I/F |
| Printer interface | | | Conforming to simple CENTRONIX I/F |
| Contents of print | | | Currently applied voltage/ Contents of various settings / Current temperature and humidity(option) |
| Power supply | | | 100 ~ 240 VAC 50/60 Hz |
| Operating temperature and humidity | | | 15 ~ 35°C 25 ~ 75% (No dewing shall occur.) |
| Dimensions and weight | | | (W)250 × (H)324 × (D)320 mm Approx. 8.0 kg |

ESD Simulator

ESS-2002 & TC-815R

Conforming to IEC61000-4-2

The NoiseKen's ESS-2002 is a further development from an award winning* ESD simulator ESS-2001. A completely new design has made the product easier to use, more reliable and affordable. The major benefits provided by our best selling high performance ESD simulator ESS-2000 are not sacrificed. The most significant addition is RS232 interface. Remote control Windows software package is optionally available.

* Evaluation Engineering 2001 Readers' Choice Award

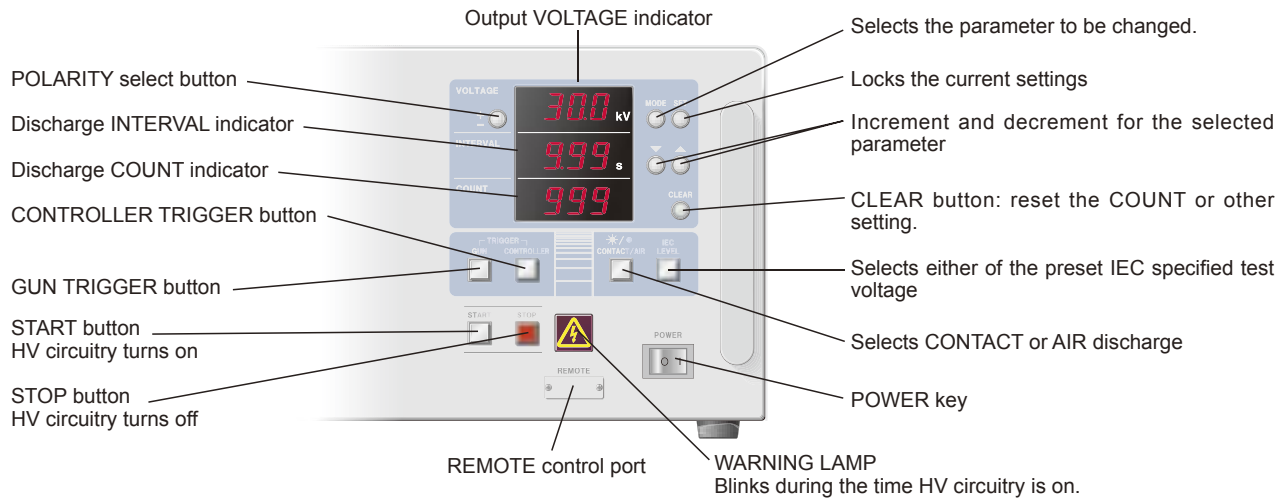
FEATURES

- Meets and far exceeds the requirements in EN/IEC61000-4-2
- Up to 30kV output in both contact and air discharges
- A lightweight discharge gun
- Easily changeable capacitor and resistor units
- A wide range of options
- CE marked
- Self-explanatory control panel
- Optional remote control Windows software ESS-2002-PC offers more comprehensive control than local operation.



(Gun stand in the photo is an optional accessory.)

CONTROL PANEL



SPECIFICATIONS

| Parameters | ESS-2002 specifications |
|------------------------------------|---|
| Output voltage | 0.20~30.0kV |
| Polarity | Positive or negative |
| Charging resistance | 10MΩ (53M ohm for combination with TC-815R Discharge Gun) |
| Discharge mode | Air discharge and Contact discharge |
| Discharge interval | 0.05~9.99s |
| Counter | 1~999 discharges |
| Trigger | Gun and main unit (controller) |
| External interface | Optic RS232 |
| Power supply | 100~240VAC 50/60Hz, <50VA |
| Operating temperature and humidity | 15~35°C, 25~75% (No dewing shall occur) |
| Dimensions | (W)340×(H)200×(D)300mm (Projection excluded) |
| Weight | Approx. 7.0kgs. |

ESD Simulator Options

OPTIONAL ACCESSORIES for ESS-2000

● **Tem./Humidity Sensor**

Model: 07-00016A



● **Automatic ESD Eliminator**

Model: 01-00013A



Dimensions: (W)85 × (H)60 × (D)150 mm

● **Wireless Remote Controller**

Model: 08-00006B



● **Gun Holder**

Model: 03-00040A



A gun holder can be screwed to the left-side panel of ESS-2000.

● **Warning Lamp**

Model: 11-00008A



OPTIONAL ACCESSORIES for ESS-2002

● **Fiber optic RS232 interface Model 07-00017A**

● **Remote control Windows software ESS-2002-PC Model 14-00030A**

Complete, comprehensive ready-made Windows software package to control the ESS-2002 simulator remotely from your PC.

All test parameters in ESD test can be controlled including discharge mode of either air or contact.

Manual mode offers operability as if the operator directly controls the ESS-2002 simulator but with automatic preset voltage ramp.

IEC severity mode offers preprogrammed test setting as per IEC 61000-4-2 standard for instant use.

Program mode offers sequencing of user edited parameter settings.



Manual mode



IEC severity mode



Program mode

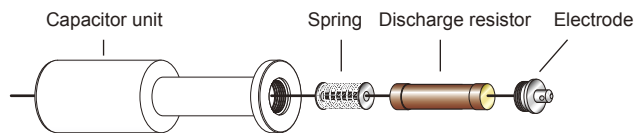
Discharge Gun

TC-815R

A lightweight and versatile discharge gun standard-supplied with the both ESS series models.

■ FEATURES

- 200ps Fast Rise Time Adapter optionally available.
- Easily changeable Capacitor and Resistor units: A discharge resistor is placed in the capacitor unit and the resulting CR network can be fitted into the gun. This method ensures any desired combination of a capacitor and resistor.



For the waveform integrity, the standard 150pF capacitor unit has a fixed combination with 330 ohm resistor only.

For automotive electronics ESD test to ISO 10605, a dedicated discharge gun package including the relevant two CR networks is also available.

Conforming to IEC61000-4-2



(Gun stand in the photo is an optional accessory.)

■ SPECIFICATIONS

| Parameters | TC-815R specifications |
|-----------------------------------|--|
| Output voltage | 0.20 ~ 30.0kV |
| Discharge waveform parameters | Compliant with EN/IEC61000-4-2 |
| Standard energy storage capacitor | 150pF ±10% |
| Standard discharge resistor | 330Ω±10% |
| Charging resistor | 43MΩ (53MΩ for combination with ESS main unit) |
| Cable length | 2 m |
| Dimensions | (W)75 × (H)220 × (D)210 mm (Discharge tip excluded) |
| Discharge mode | Air discharge and contact discharge |
| Weight | Approx. 1.4 kg |

■ STANDARD ACCESSORIES

- 150pF Capacitor unit
(with a 330 ohm resistor built-in)
- Discharge tip
Model: 12-00001A (Conical)
Model: 12-00002A (Round)
- Instruction manual

■ OPTIONAL ACCESSORIES

*) Standard accessories for TC-815R

● Discharge tip

Model: 12-00001A (Conical)*
Model: 12-00002A (Round)*



● Discharge resistor

(100, 150, 200, 250, 300, 330, 400,
500, 1k, 1.5k, 2k, 5k, 10kΩ)
Model: H-100, 150, 200, 250, 300, 330,
400, 500, 1K, 1.5K, 2K, 5K, 10K



● Capacitor unit

(100, 150, 200, 250, 300pF)
(330, 400, 500pF)
Model: 06-00013A ~ 00017A
06-00032A/00018A/00019A

● Extension cable

Model: 05-00047A



2m length of TC-815R gun cable can be extended to 5m.

TC-815R

OPTIONAL ACCESSORIES

- **Free Arm Gun Stand**
Model: 03-00022B



Dimensions: W180 × H760 × D70 mm
Weight: Approx. 5kg

- **Gun Stand**
Model: PS-806



Dimensions: H300 mm
Diameter: 160mm
Weight: Approx. 1.6kg

- **Fast Rise Time Adapter**
Model: 12-00003A



Enables a fast rise time.
Approx. 200ps (150ps~300ps)

- **Impulsive Magnetic Field Adapter** Model: 03-00030B

- **Impulsive Electric Field Adapter** Model: 03-00031B

Simulations of the electric and magnetic fields produced by an electrostatic discharge can be separately performed by the Impulsive Magnetic Field Adaptor and Impulsive Electric Field Adaptor. These adaptors are designed to connect to the Discharge Gun TC-815R.



03-00030B



03-00031B

| Parameters | Specifications |
|---------------------------|----------------|
| Current limiting resistor | 15Ω |

| Parameters | Specifications |
|---|-------------------|
| Discharge resistance | 1.5kΩ |
| Electrode for generating electric field | 80 mm in diameter |
| Maximum voltage applied | 30kV |

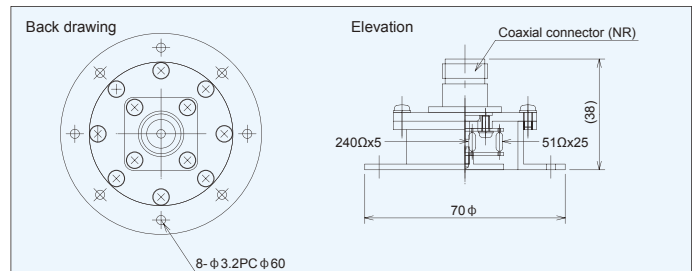
OTHER OPTIONAL ACCESSORY

- **Loading Resistor (Current Detector)**
Model: 06-00001A

The Loading Resistor (Model: 06-00001A) is used to check, verify and calibrate the output waveforms of an electrostatic simulator for conducting an electrostatic discharge immunity test conforming to IEC61000-4-2.



| Parameters | Specifications |
|------------------|-------------------------|
| Applied voltage | 15kV max |
| Output impedance | 50Ω |
| Conversion ratio | 1V/1A (50Ω termination) |
| | 2V/1A (Open) |
| Output connector | N-R type |
| Dimensions | 70 φ x 39mm |



ESD Test Environment

ESS-801/801GL

Conforming to IEC61000-4-2

A complete package to easily build up the ESD test (laboratory test) set-up called for in the IEC standard.



Test set-up example with ESS-801

ESS-801GL
(Vertical coupling plane & Cable with resistors)

■ CONSTITUTION OF ESS-801 (TABLE TYPE)

| Description | Model | Dimensions | Quantity |
|--------------------------------|-----------|-------------------------------|----------|
| Testing table | 03-00039A | (W)1600 × (H)800 × (D)800 mm | 1 |
| Vertical coupling plane | 03-00005A | (W)500 × (H)500 × (t)1.5 mm | 1 |
| Ground plane | 03-00007A | (W)1800 × (H)1000 × (t)1.5 mm | 3 |
| Insulating sheet | 03-00004A | (W)1450 × (H)650 × (t)0.5 mm | 1 |
| Cable with discharge resistors | 05-00054B | 470kΩ × 2 | 2 |
| Horizontal coupling plane | 03-00020A | (W)1600 × (H)800 × (t)1.5 mm | 1 |

■ CONSTITUTION OF ESS-801GL (FLOOR TYPE)

| Description | Model | Dimensions | Quantity |
|--------------------------------|-----------|-------------------------------|----------|
| Insulation pallet | 03-00024A | (W)1200 × (H)1200 × (t)100 mm | 1 |
| Vertical coupling plane base | 03-00034A | (W)540 × (H)1540 × (D)500 mm | 1 |
| Ground plane | 03-00007A | (W)1800 × (H)1000 × (t)1.5 mm | 3 |
| Cable with discharge resistors | 05-00054B | 470kΩ × 2 | 1 |

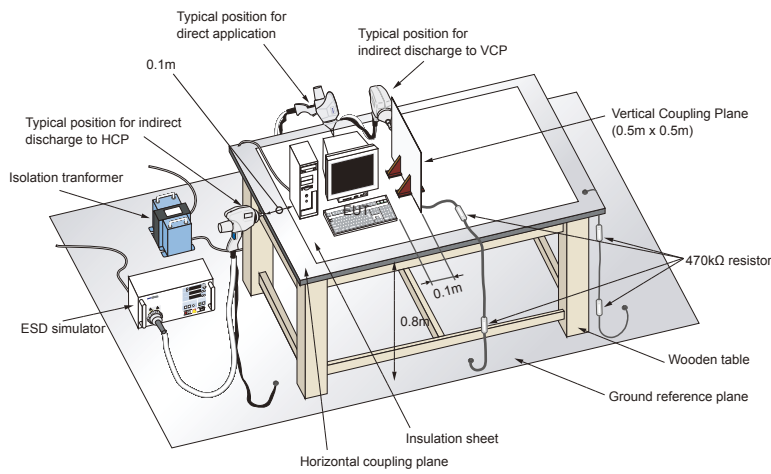
IEC61000-4-2 Standard

■ TEST SET-UP

- **Ground reference plane:** A copper or aluminum sheet of 0.25 mm minimum thickness; other materials may be used but they shall have at least 0.65 mm minimum thickness. The minimum size is 1 m². The exact size depends on the EUT. It shall project beyond the EUT or coupling plane by at least 0.5 m on all sides. It shall be connected to the protective earth.
- **Coupling planes:** These planes shall be constructed from the same material and thickness as that of the ground reference plane and shall be connected to the ground reference plane via a cable with a 470kΩ resistor located at each end.
- **Test set-up for test performed in laboratories:** A ground reference plane shall be provided on the floor of the laboratory. The EUT shall be connected to the grounding system and arranged and connected according to its installation specifications. A distance of 1 m minimum shall be provided between the EUT and any metallic structure. The discharge return cable of the test generator shall be connected to the ground reference plane, and this connection shall be of low impedance. In cases where the length of the cable exceeds the length necessary to apply the discharges to the selected points, the excess length shall be placed non-inductively off the ground reference plane and shall not come closer than 0.2 m to other conductive parts in the test set-up.

■ TEST SET-UP EXAMPLE

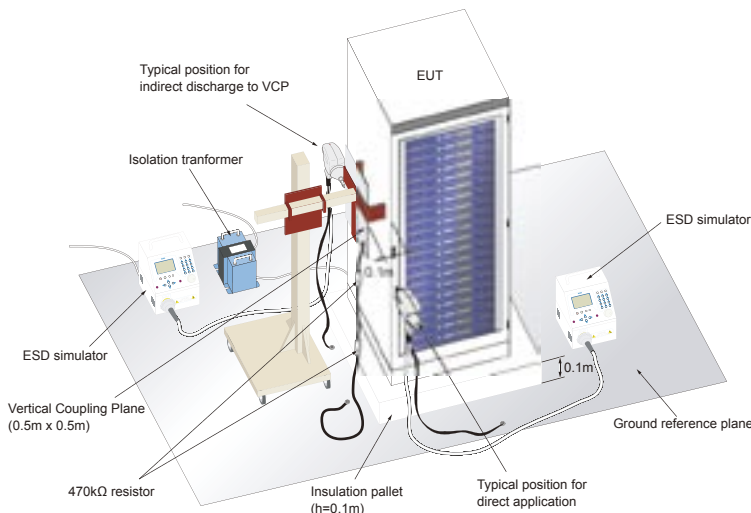
● Table top equipment



Test set-up for table-top equipment, laboratory tests

A wooden table of 0.8m height shall be set on the ground plane. 1.6m x 0.8 m horizontal and 0.5m x 0.5 m vertical coupling planes shall be put on the table. An insulating support of 0.5 mm thickness shall be inserted between the EUT/cables and the horizontal coupling plane.

● Floor-standing equipment



An insulation support of 0.1m thickness shall be used. 0.5m x 0.5m vertical coupling plane shall be used for indirect application of discharges.

IEC61000-4-2 Standard

EXECUTION OF THE TEST

Direct application of discharges to the EUT

The test voltage shall be increased from the minimum to the selected test level. The test shall be performed with single discharges. On selected points at least ten discharges in the most sensitive polarity shall be applied.

It may be necessary to carry out some investigatory or preliminary testing to select the points at which discharges are to be applied. This pretest may be done at a repetition rate of 20 discharges per second or more.

The ESD gun shall be held perpendicular to the surface to which the discharge is applied.

In the case of contact discharge, the tip of the discharge electrode shall touch the EUT before the discharge switch is operated.

In the case of air discharges, the round tip of the discharge electrode shall be approached as fast as possible to touch the EUT. While the discharge electrode approaching, the discharge switch shall be maintained closed until a discharge occurs.

Indirect application of the discharge:

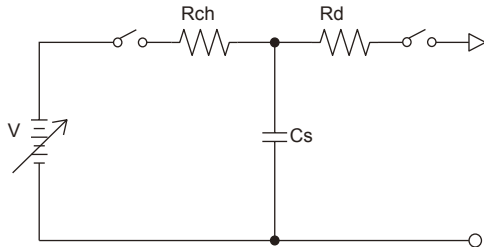
Discharges to objects placed or installed near the EUT shall be simulated by applying the discharges to a coupling plane in the contact discharge mode.

Horizontal coupling plane: At least 10 single discharges in the most sensitive polarity shall be applied to the edge of the plane opposite the center point of the EUT and 0.1m from the front of the EUT. The ESD gun shall be kept horizontal and perpendicular to the front edge line of the plane.

Vertical coupling plane: At least 10 single discharges in the most sensitive polarity shall be applied to the center of one vertical edge of the coupling plane. The coupling plane shall be placed parallel to, and positioned at a distance of 0.1 m from, the EUT. Discharges shall be applied with sufficient different positions such that the four faces of the EUT are completely illuminated.

ESD GENERATOR SCHEMATIC AND REQUIRED PERFORMANCE

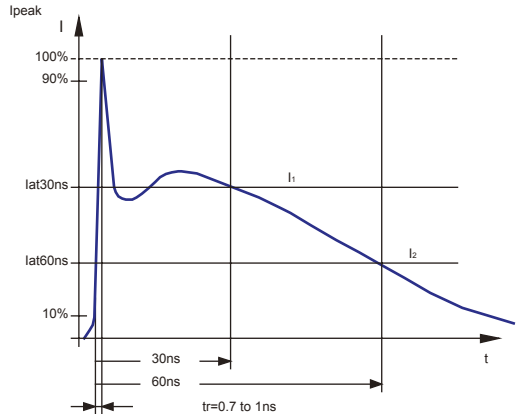
Circuit Diagram



Capacitance Cs: 150pF
 Discharge resistance Rd: 330Ω
 Charging resistance Rch: 50-100MΩ
 Output voltage V: Contact 8kV max.
 Air 15kV max.

Holding time: at least 5 s
 Discharge, mode of operation: Single discharge
 (time between successive discharges at least 1 s)

ESD typical output waveform



Severity Level

| Level | Contact Discharge | Air discharge |
|-----------------|-------------------|---------------|
| 1 | 2kV | 2kV |
| 2 | 4kV | 4kV |
| 3 | 6kV | 8kV |
| 4 | 8kV | 15kV |
| X ¹⁾ | Special | Special |

¹⁾ X is an open level.

Waveform parameters

| Level | Voltage kV | First peak current (±10%) I _p | Rise time t _r | Current at 30ns (±30%) I ₁ | Current at 60ns (±30%) I ₂ |
|-------|------------|--|--------------------------|---------------------------------------|---------------------------------------|
| 1 | 2 | 7.5A | 0.7 ~ 1ns | 4A | 2A |
| 2 | 4 | 15A | 0.7 ~ 1ns | 8A | 4A |
| 3 | 6 | 22.5A | 0.7 ~ 1ns | 12A | 6A |
| 4 | 8 | 30A | 0.7 ~ 1ns | 16A | 8A |

● Designs and specifications are subject to change without notice.



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