



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

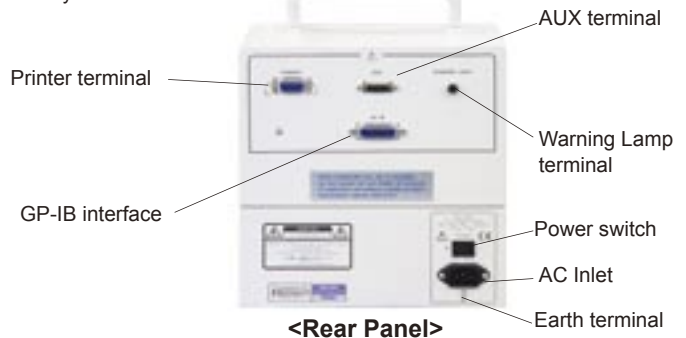
Cursor buttons

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.

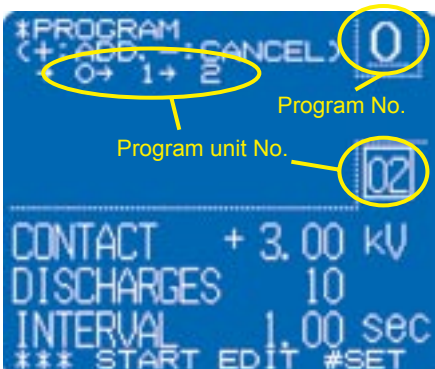
## ● SWEEP MODE



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

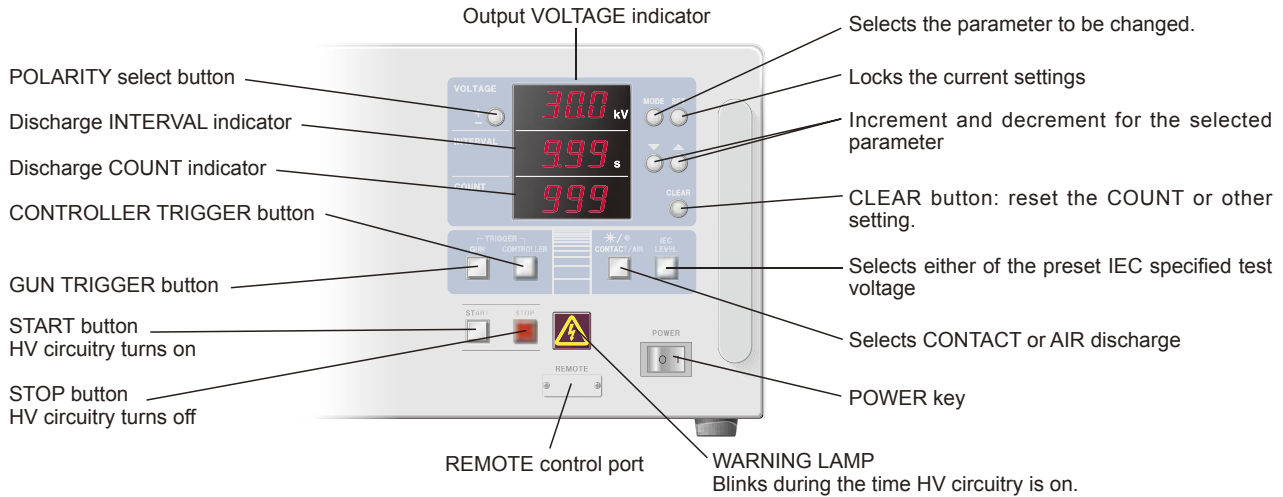
## FEATURES

- 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

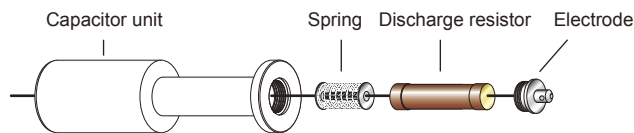
## Discharge Gun

## 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.

## ■ 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

## ■ 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

Conforming to IEC61000-4-2



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

## ■ STANDARD ACCESSORIES

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

## ● 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

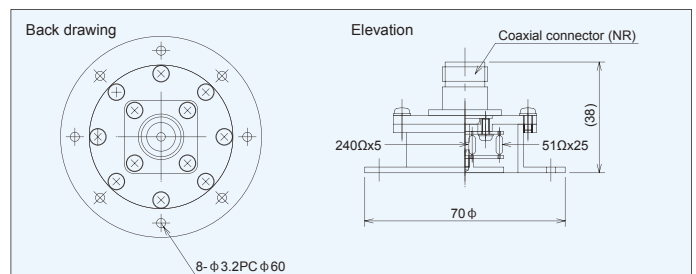
### OTHER OPTIONAL ACCESSORY

- **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

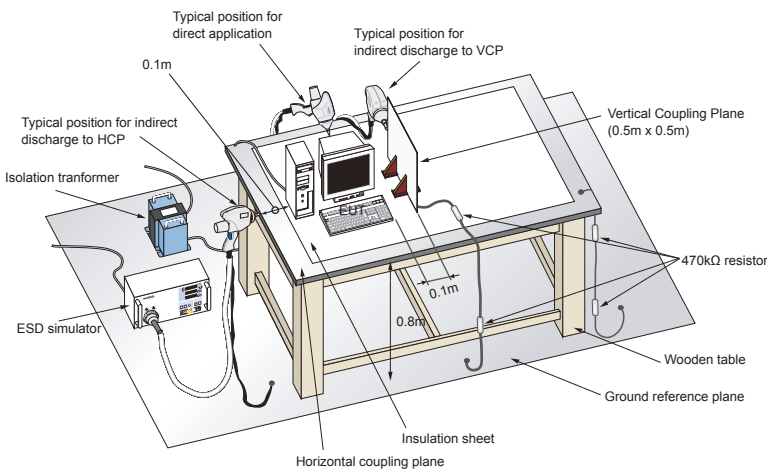
## IEC61000-4-2 Standard

### ■ 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 m<sup>2</sup>. 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

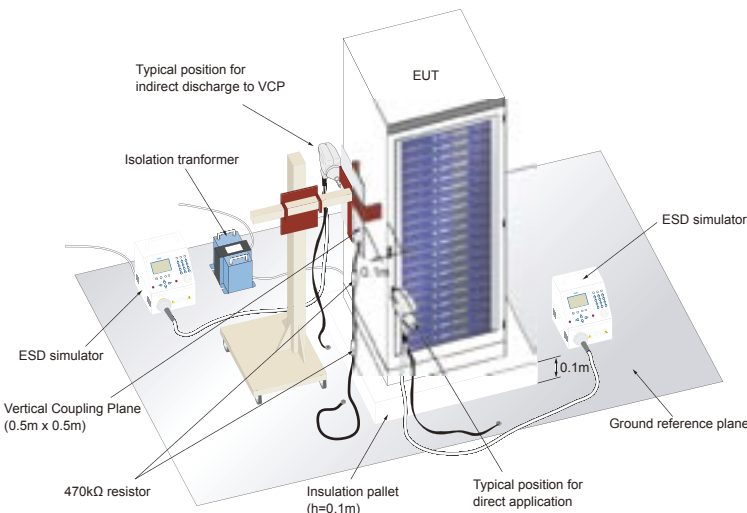
#### ● Table top equipment



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:

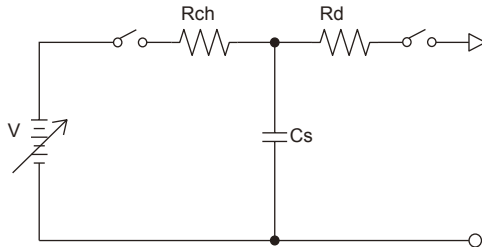
Discharges to objects placed or installed near the EUT shall be simulated by applying the discharges to a coupling plane in the contact discharge mode.

**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

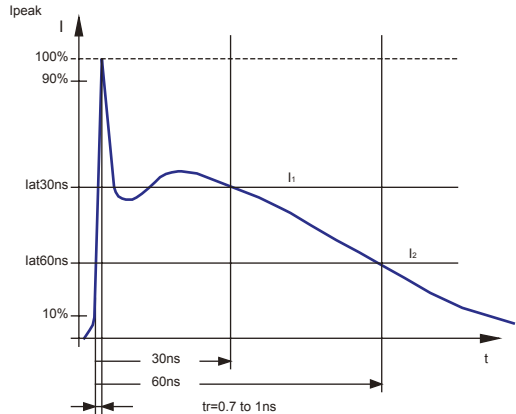
#### Circuit Diagram



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 <sup>1)</sup>	Special	Special

<sup>1)</sup> X is an open level.

#### Waveform parameters

Level	Voltage kV	First peak current (±10%) I <sub>p</sub>	Rise time t <sub>r</sub>	Current at 30ns (±30%) I <sub>1</sub>	Current at 60ns (±30%) I <sub>2</sub>
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.



## NOISE LABORATORY CO., LTD.

1-4-4, Chiyoda, Sagamihara City,  
 Kanagawa Pref., 229-0037 Japan  
 Tel: +81(0)42-712-2051 Fax: +81(0)42-712-2050  
<http://www.noiseken.co.jp/>  
 E-mail: sales@noiseken.com