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**NoiseKen®**



*ESS-2000AX*

# **ELECTROSTATIC DISCHARGE SIMULATOR**



*ESS-2002EX*

**Noise Laboratory Co., Ltd.**  
**www.noiseken.com**

**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 sometime 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 relation 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.

- **Meet and far exceed the requirements in EN/IEC61000-4-2 and ISO10605**
- **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-2002EX and ESS-2000AX are available. The above-mentioned capabilities are common to them.

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

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

ESD Simulator

# ESS-2000AX & TC-815R

Conforming to IEC61000-4-2

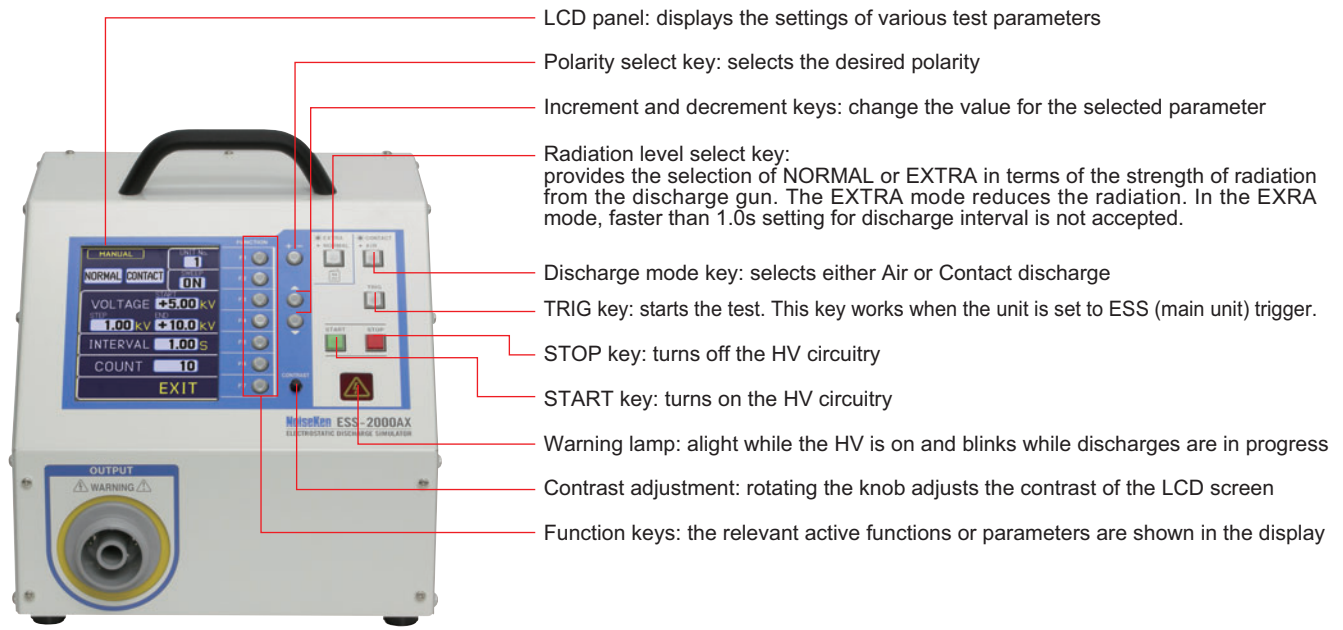
**FEATURES**

- Fully programmable menu-driven simulator providing three operation modes: IEC standard, Manual and Sequence
- A 5.7-inch color LCD for easy setting and good visibility
- Unique shape for the operator's easy access to the controls and displays even when the unit is put on the floor level (ground plane)
- Communications with PC through the optic serial interface
- A wide variety of the dedicated options

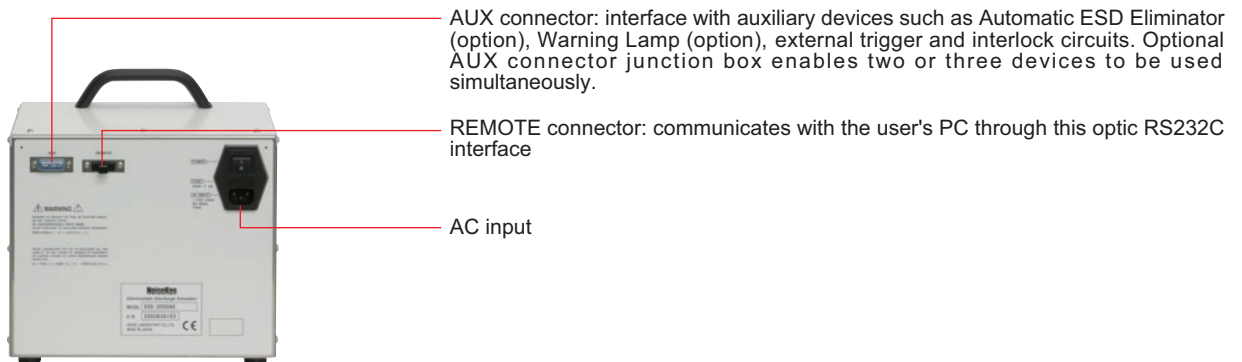


ESS-2000AX & TC-815R (with PS-806 gun stand)

**CONTROLS INDICATORS AND TERMINALS**



<Front Panel>



<Rear Panel>

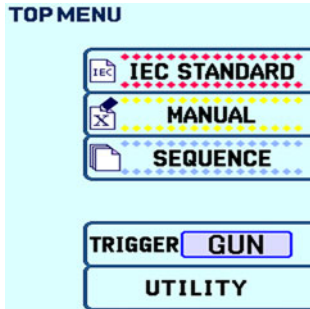
- LCD panel: displays the settings of various test parameters
- Polarity select key: selects the desired polarity
- Increment and decrement keys: change the value for the selected parameter
- Radiation level select key: provides the selection of NORMAL or EXTRA in terms of the strength of radiation from the discharge gun. The EXTRA mode reduces the radiation. In the EXTRA mode, faster than 1.0s setting for discharge interval is not accepted.
- Discharge mode key: selects either Air or Contact discharge
- TRIG key: starts the test. This key works when the unit is set to ESS (main unit) trigger.
- STOP key: turns off the HV circuitry
- START key: turns on the HV circuitry
- Warning lamp: alight while the HV is on and blinks while discharges are in progress
- Contrast adjustment: rotating the knob adjusts the contrast of the LCD screen
- Function keys: the relevant active functions or parameters are shown in the display

- AUX connector: interface with auxiliary devices such as Automatic ESD Eliminator (option), Warning Lamp (option), external trigger and interlock circuits. Optional AUX connector junction box enables two or three devices to be used simultaneously.
- REMOTE connector: communicates with the user's PC through this optic RS232C interface
- AC input

## ESS-2000AX

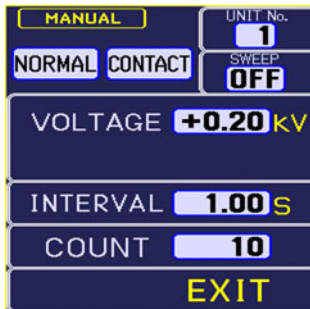
### ■ DISPLAY EXAMPLE

- Top Menu



After pressing the main switch, press the EXIT key. This places the simulator in the initial menu, which displays three operational modes, trigger selection and utility.

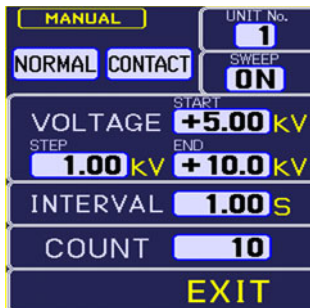
- Manual Mode



If you desire to operate the unit in the manual mode, press the corresponding function key. The parameters to be set by the operator will appear. Discharge method (contact/air discharge), discharge voltage, number of discharges and interval can be set. Select the parameter by pressing the corresponding function key then the value can be altered by the Increment or Decrement key.

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.

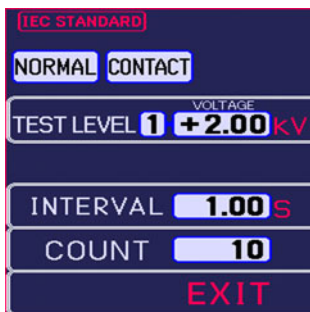
Air discharges: For air discharge testing, after completion of setting, press the START key. To carry out air discharges, pull and hold the trigger to maintain the HV relay in the on status and approach the discharge tip to the EUT.



When the SWEEP function is active, the simulator generates discharges in an automatic voltage ramp. The initial, final 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 the initial voltage, 10kV for final voltage and 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. A sign of "CONTINUE" is indicated on the screen and the simulator runs a complete step ramp test without further operator's trigger.

- IEC Standard Mode



The four test levels are preset. Select the desired level and run a test.

- Sequence Mode



The simulator can store up to 99 tests including Sweep settings. Each test is given a number (called Unit No). Any combination of units selected from 99 tests in the Manual Mode can consist of one test sequence having 30 units maximum. Twenty test sequences can be stored. For a unit setting, press EDIT button. Settings of voltage, etc. can be done in the same way as in the Manual mode.

## ESS-2000AX

## ■ ESS-2000AX Specifications

Item		Specifications
Output polarity		Positive or negative
Output voltage		0.20kV ~ 30.0kV± 5% (30.5kV max) 0.20kV ~ 10.0kV: 0.01kV step, 10.0kV ~ 30.0kV: 0.1kV step
Discharge interval		Normal mode: 0.05s ~ 600.0s± 10% Extra mode : 1.00s ~ 600.0s± 10% 0.05s ~ 9.99s: 0.01s step, 10s ~ 600.0s: 0.1s step
No. of times of discharge		1 ~ 60,000 times preset on the counter or continuous
Discharge mode		Air/contact discharge
Radiation level		Normal/Extra mode
Trigger mode		Gun trigger/main unit trigger/ external trigger
Operation mode	IEC standard	Contact discharge: 2.0kV, 4.0kV, 6.0kV, 8.0kV (4 voltages preset) Air discharge: 2.0kV, 4.0kV, 8.0kV, 15.0kV (4 voltages preset)
	Manual	Contact/Air discharge: 0.20kV ~ 30.0kV Sweep (automatic voltage ramping) available Up to 99 units (test settings) storable
	Sequence	Seamless run of the selected test sequence (made of any combination of 99 units in Manual mode) No. of units per one test sequence: up to 30 units No. of test sequences: up to 20
Warning lamp		Lights up while the HV circuitry is on.
		Blinks while discharges are in progress
Discharge gun		TC-815R
Charging resistance		10MΩ(53 MΩ for combination with TC-815R discharge gun)
AUX connector		D-SUB15 pin, female connector Warning lamp (optional) connection Automatic ESD Eliminator (optional) connection, External interlock input External trigger input
Optical communication connector		Optic RS-232C for PC communication
Power supply		100 ~ 240V AC 50/60 Hz ± 10%
Power consumption		75VA
Operating temperature and humidity		+15 ~ +35°C , 25 ~ 75% (no condensation)
Character display		English or Japanese
Dimensions and Weight		260 (W) X 230 (H) X 285 (D) mm (projection excluded) Approx. 5.3 kg

ESD Simulator Options

OPTIONAL ACCESSORIES FOR ESS-2000AX

- **Automatic ESD Eliminator**  
MODEL: 01-00013A



Connected to the ESS-2000AX simulator main unit, the Automatic ESD Eliminator automatically removes residual charges on the EUT. A control signal from the ESS-2000AX turns on the switch of the eliminator to drain away the residual charges to the ground. Two operation modes are provided: turn-on after each discharge and turn-on after preset number of discharges (Not compliant with the standard).

- **Gun Holder**  
Model 03-00056A



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

- **Warning Lamp**  
Model 11-00014A



- **AUX connector junction box**  
Model 05-00052A



Warning Lamp and Automatic ESD Eliminator options and external trigger circuit can be simultaneously connected.

- **Optical USB module**  
Model 07-00022A



Optical conversion adapter to be free from the EM interference when communicating with PC

- **Optical RS232 module**  
Model 07-00017A

Optical conversion adapter to be free from the EM interference when communicating with PC

## ESD Simulator

Conforming to IEC61000-4-2

## ESD Simulator ESS-2002EX &amp; TC-815R

A manual ESD simulator that is both lightweight and compact. A completely new design has made the product easier to use, safer and more reliable.

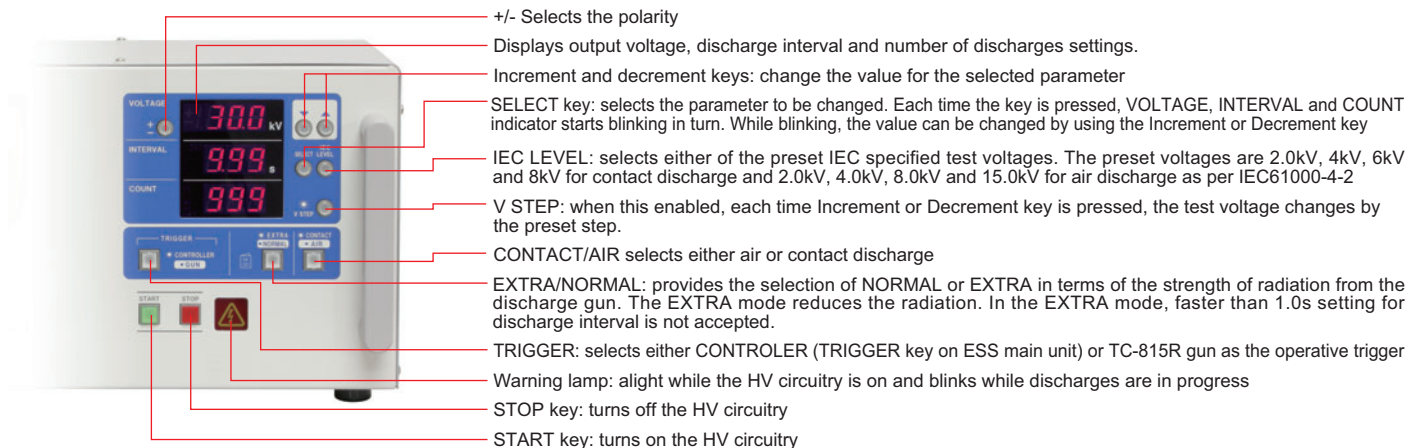
## FEATURES

- Easy to use self-explanatory control panel
- Preset discharge interval and count
- Preset IEC standard test levels
- "V STEP" function enables the voltage setting can be altered in steps of the desired preset increment (or decrement)



ESS-2002EX &amp; TC-815R (with PS-806 gun stand)

## CONTROLS INDICATORS AND DISPLAYS



## Specifications

Item	Specifications
Output polarity	Positive or negative
Output voltage	0.20kV ~ 30.0kV± 5% (30.5kV max) 0.20kV ~ 1.0kV: 0.05kV step, 1.0kV ~ 30.0kV:0.1kV step
Discharge interval (contact discharge)	Normal mode: 0.05s ~ 9.99s± 10% Extra mode : 1.00s ~ 9.99s± 10% 0.01s step
No. of times of discharge	1 ~ 999 times preset on the coutner or continuous
Discharge mode	Air/contact discharge
Radiation level	Normal/Extra mode
Trigger mode	Gun trigger or main unit trigger
Preset IEC levels	Contact discharge: 2.0kV, 4.0kV, 6.0kV, 8.0kV (4 test voltages preset) Air discharge: 2.0kV, 4.0kV, 8.0kV, 15.0kV (4 test vottages preset)
Preset step voltage mode ("V STEP" function)	Step setting: 0.00kV ~ 10kV 0.2kV ~ 1.0kV: 0.05kV step, 1.0kV ~ 30.0kV: 0.1kV step Each time Increment or Decrement key is pressed, the test voltage changes by the preset step
Warning lamp	Lights up while the HV circuitry is on. Blinks while discharges are in progress
Discharge gun	TC-815R
Charging resistance	10MΩ(53 MΩ for combination with TC-815R discharge gun)
Power supply	100 ~ 240V AC 50/60 Hz ± 10%
Power consumption	62VA
Operating temperature and humidity	+ 15 ~ +35°C 25 ~ 75% (no condensatoin)
Dimensions and Weight	340 (W) X 200 (H) X 170 (D) mm (projection excluded) Approx 4.6 kg

## Discharge Gun

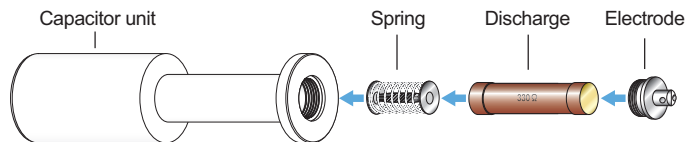
## TC-815R

Conforming to IEC61000-4-2

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 TC-815ISO including the relevant two CR networks is also available.



(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	2m
Dimensions	(W)75×(H)220×(D)210mm (Discharge tip excluded)
Discharge mode	Air discharge and contact discharge
Weight	Approx. 1.4kg

## 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×D70mm  
Weight: Approx. 5kg

- Gun Stand

Model: PS-806



Dimensions: H300mm  
Diameter: 160mm  
Weight: Approx. 1.6kg

- Fast Rise Time Adapter

Model: 12-00005A



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

- ISO Standard Discharge Adaptor

MODEL: 03-00050A



ISO Standard Discharge Adaptor 03-00050A is an additional gun head. The TC-815R gun with this option attached in place of the original gun head can obtain completely identical characteristics to the TC-815ISO to perform ESD immunity tests in compliance with ISO10605:2001. The relevant capacitor units and resistors are also required.

- 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.



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

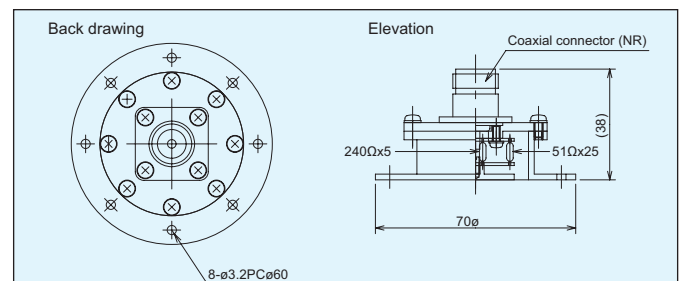
- Loading Resistor(Current Detector)

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

## ■ CONSTITUTION OF ESS-801GL(FLOOR TYPE)

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

### IEC 61000-4-2 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 1m<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 470k ohm 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.

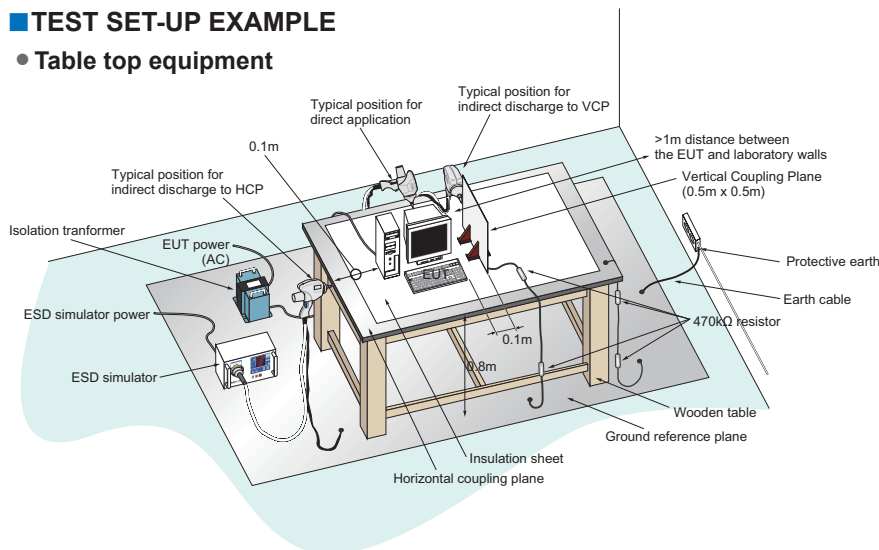
The EUT shall be connected to the grounding system and arranged and connected according to its installation specifications. A distance of 1 m minimum shall be provided between the EUT and any metallic structure.

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

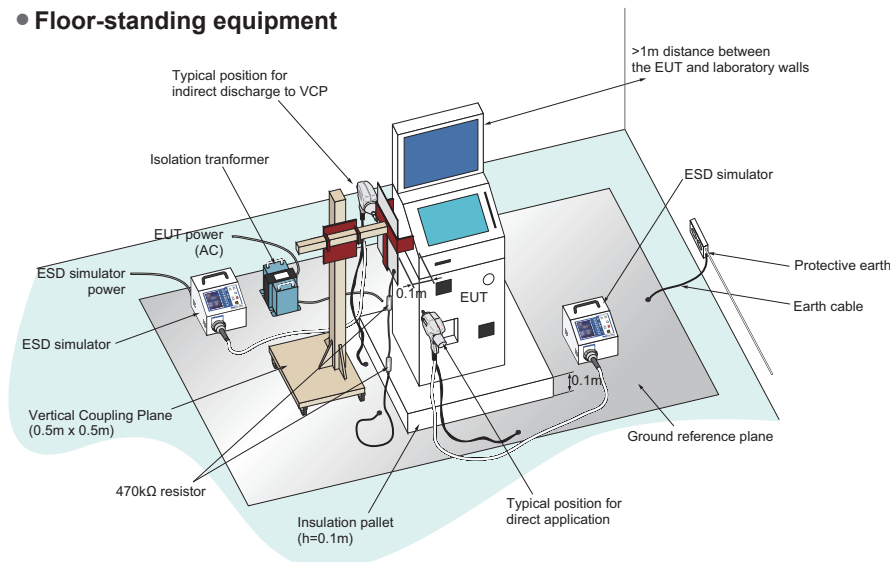


Test set-up for table-top equipment, laboratory tests

##### 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.

**IEC 61000-4-2 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:**

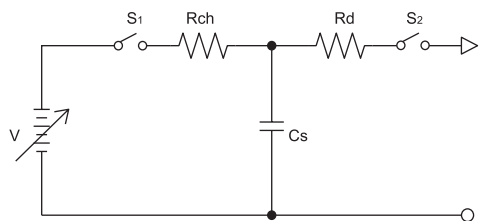
Discharges to objects placed or installed near the EUT shall be simulated by applying the discharges to a coupling plane in the contact discharge mode.

**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.

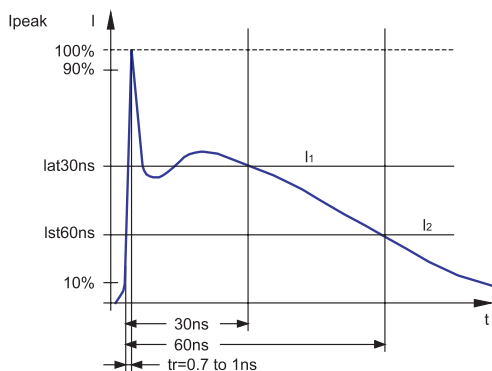
**ESD GENERATOR SCHEMATIC AND REQUIRED PERFORMANCE**

**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	2 kV	2 kV
2	4 kV	4 kV
3	6 kV	8 kV
4	8 kV	15 kV
X <sup>1)</sup>	Special	Special

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

**Waveform parameters**

Level	Voltage kV	First peak current (±10%) Ip	Rise time tr	Current at 30ns (±30%) I1	Current at 60ns (±30%) I2
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

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Authorized representative          	
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