

# Electrostatic Discharge Simulator

**ESS-S3011A**

**GT-30RA (Discharge Gun)**



ESD Simulator

# ESS-S3011A & GT-30RA

**Free you from the hassle of testing by the pre-check function and the weight reduction of the discharge gun**

EMC test equipment to evaluate the resistibility of electronic equipment when energy charged on a human body or object is discharged to the electronic equipment. This can be available for evaluating malfunctions or functions declines of electronic equipment against the ESD. Programmable simulator to ease some complicated tests. The output voltage is up to 30kV allowing to perform testing compliant to IEC61000-4-2 & ISO 10605 Standards.

- “3 pre-checking function” to ensure more reliable testing
- “CR constant indicator” to prevent incorrect unit attachment
- One-touch exchange of gun head and CR unit realized
- “Ten-key & Rotary knob” to ease the setting.
- “Infra-red Remote Controller” allowing setting remotely from the generator (Option)
- “Discharge Detecting Function” to realize the air-discharge confirmation
- “Lightest discharge gun in the market” to lighten the continuous operation (Excluding the cable and connector)
- “White LED Irradiator” to facilitate the visualization of the discharging areas
- “Control Software” to enable the test result reporting and control with PC



\*Probe stand for the discharge gun is an option.

\* The software is available for a free of charge download from our web-site. (The connection cable is necessary in addition).  
 \* C (Capacitor) and R (Resistor) for the discharge gun is one-body unit.  
 \* ISO 10605 compliant test can be realized with the optional parts in addition.

## Feature

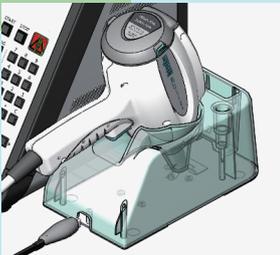
### Achieve more reliable test! Equipped with "3 Pre-check Functions"

The new ESD simulator is equipped with 3 pre-check functions; "high voltage power output check", "insulation failure check", and "discharge relay operation check" on the main body and discharge gun. You can prevent troubles such as failing to perform the test properly; if you did not notice the failure of the tester body or the relay inside the discharge gun has reached the end of its life.

**PRE CHECK**      **SET UP**

STEP 1

放電ガンをガンホルダーにセットし、  
(START)キーを押下してください。  
Please set the ESD GUN to the gunholder,  
and press (START) key.



- ① Set the discharge gun in the gun holder.
- ② Press the [START] key on the tester.

**PRE CHECK**      **SET UP**

STEP 2

接触放電チップを (PRE CHECK) 端子に接触させ、  
ガントリガを引いてください。  
Please set the contact discharge tip to  
the (PRE CHECK) terminal,  
and pull the GUN TRIGGER.



- ③ Bring the discharge gun into contact with the pre-check terminal [PRE CHECK] and pull the gun trigger.

**Pre-check completed!**

PRE CHECK	RESULT
[CHECK 1] ...	PASS
[CHECK 2] ...	PASS
[CHECK 3] ...	20

PRE CHECK	RESULT
[CHECK 1] ...	PASS
[CHECK 2] ...	PASS
[CHECK 3] ..	<b>FAILED</b>

Press any key to MAIN MENU.

**In case of failure, a "FAILED" message is displayed.**

[Check 1] High-voltage power output check: Check the error from the set value.

[Check 2] Insulation defect check: Checks for defective insulation withstand voltage.

When the discharge gun is placed in the attached gun holder, you can check the output of the high-voltage power supply and check for insulation defects.

[Check 3] Discharge relay operation check: Check the relay for wear.

Check the wear of the discharge relay by bringing the discharge gun into contact with the check terminal and discharging.

ESS-S3011A & GT-30RA

**“CR constant indicator” to make sure the correct unit attachment**

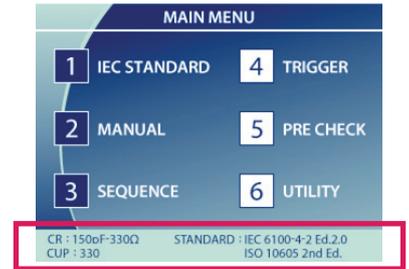
The constants of the discharge resistance and discharge capacitor, which were previously disassembled and checked, are now displayed on the main unit screen. When the CR unit or discharge cup of the discharge gun is replaced, it is automatically recognized and the type of CR unit is determined. The CR unit and the discharge cup are identified separately, and if the combination complies with the standard, the conforming standard is displayed at the bottom of the main menu.



Whether the gun head corresponds to IEC or ISO ?



What values are the charge capacitor and discharge resistor ?



Indicated on the display of the generator

\*There are restrictions on the display pattern.

CR unit [CR]	Discharge cup [CUP]	Compliant standard table
150pF-330Ω	330	IEC 61000-4-2 Ed.2, 10605 2nd Ed.
330pF-330Ω	330	ISO 10605 2nd Ed.
150pF-2kΩ	2k	ISO 10605 1st Ed. & 2nd Ed.
330pF-2kΩ	2k	ISO 10605 1st Ed. & 2nd Ed.

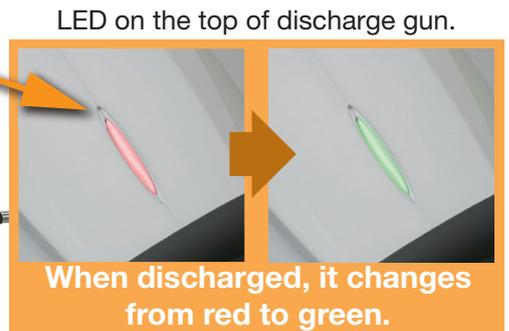
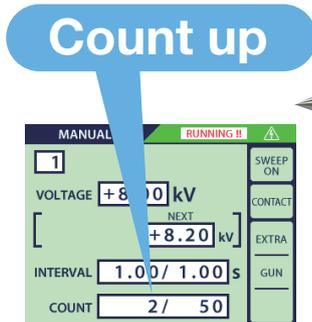
**Easy to Check for Discharge Equipped with discharge detection function**

It is possible to check the presence or absence of discharge during an air discharge test, which was difficult until now, by checking the buzzer sound from the tester and the LED display on the top of the discharge gun.

Buzzer sound of the tester

Count up the number of applications

Discharge gun LED color change



**“Infrared Remote Control” allows controlling the test from distance \*optional accessory\***

Since you can operate the tester with the remote control without returning to the tester during the test, the test can proceed smoothly.

Start/Stop

Polarity change

Voltage Up / Down

Air/Contact discharge change

Gun trigger function  
Count reset  
Sequence change  
F key assignment etc.

Most of the operations can be controlled by the remote controller.



## ESS-S3011A & GT-30RA

### The discharge gun became lighter and easier to use

The discharge gun itself has been reviewed from scratch to achieve weight reduction and the best balance of the center of gravity. The weight is lighter than previous one and the balance of the center of gravity has been improved, making it extremely easy to hold and reducing the burden on the arm during long-term tests. Please pick it up and try it.

In addition, it is now to easy to confirm the performing of air discharge by the LED indicator on the top of the discharge gun, which was possible only by visual check before, making it difficult to confirm at times. Also, it is a discharge gun with a full range of functions and operations, such as easy replacement of the CR units and discharge cup, which used to take time and effort, and the installation of an "LED light" that brightly illuminates the application.



**A light and easy-to-hold discharge gun!**  
**Improved balance of the center of gravity and weight reduction of over 20%**



Light and soft!  
High voltage cable and ground return cable.



One-touch replacement of CR unit.



Easy to replace the discharge cup.

### ISO 10605 standard compliant discharge gun package available

By adding the optional discharge cup and CR units, it performs tests that comply with the ISO 10605 standard. Since it is easily replaced the discharge cups and CR units, various CR constants can be tested with a single discharge gun.



#### Options for ISO 10605 Standard compliant test

Model	Name
12-00009A	Discharge tip (GT-30R series Spherical 30 mm)
03-00072A	Gun head to GT-30R series for constant 2 kΩ test
06-00074B	CR unit (150 pF - 2 kΩ) to GT-30R series
06-00076B	CR unit (330 pF - 2 kΩ) to GT-30R series
06-00075B	CR unit (330 pF - 330 Ω) to GT-30R series



Gun head for constant 2 kΩ test



CR unit

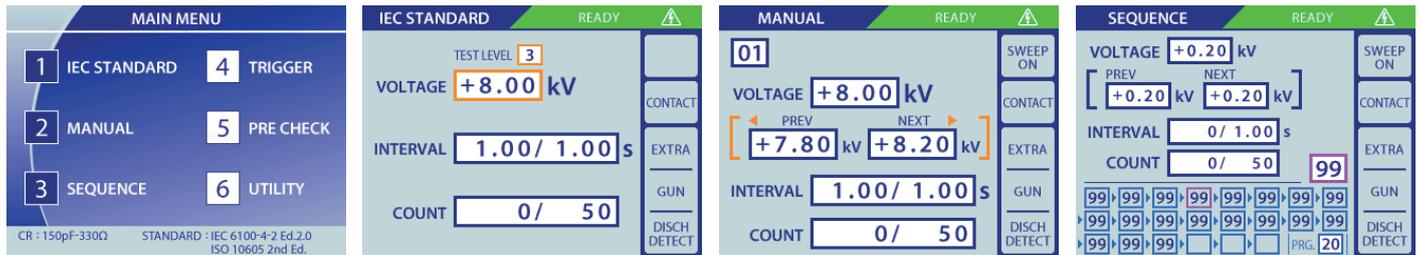


Discharge tip (Spherical 30 mm)

## ESS-S3011A &amp; GT-30RA

## High visibility LCD panel and operatability

Reviewed the past operatability, adding Ten-key and Rotary knob realizing an easier and more comfortable operation can be realized. In " 1 IEC STANDARD" in MAIN MENU, since the test levels are preset, the test parameters can be set easily only with selection of the test level. In " 2 MANUAL", voltage, number of times interval and sweep settings of the test can be selected and also the set conditions can be saved. In " 3 SEQUENCE", the set conditions in MANUAL can be recalled for combining them so as to realize the arbitrary sequential tests. In addition, varied functions like setting for gun trigger, automated ESD eliminator, etc. are equipped.



## Specifications

Parameter	Specification
Polarity	Positive / Negative
Output voltage	0.20 kV ~ 30.0 kV $\pm$ 5% (30.5 kV max) *0.20kV~1.99kV $\pm$ 10% 2.00kV~30.0kV $\pm$ 5% ~ 10.0 kV : 0.01 kV step ~ 30.0 kV : 0.1 kV step
Repetition cycle	0.05s ~ 600s $\pm$ 10% / Manual Set step : 0.01s (0.05 ~ 9.99s), 0.10s (10.0 ~ 600.0s)
Discharge number of times	1 ~ 60,000 times, Preset 1 time step or continuous preset
Discharge mode	Contact discharge / Air discharge
Radiation level mode	NORMAL mode / EXTRA mode
Trigger mode	Gun trigger / Main trigger / External trigger
Operation panel	Color LCD / Push-buttons (Partially lighting)
Gun holder	Standard attached (to hold the discharge gun Model GT-30RA)
Radiation mode select switch	Extra / Normal switching function built-in
Discharge detection	Discharge detection function in air-discharge equipped
Pre-checking function	Following 3 steps function equipped (by user operation. Not the calibration but just checking) STEP1 : High voltage output checking STEP2 : Withstanding voltage checking STEP3 : Discharge relay operation checking
CR & Gun head checking	CR constant and gun head recognizable (indication to prevent a wrong combination)
"IEC STANDARD" test mode	Contact discharge mode : 2.0 kV, 4.0 kV, 6.0 kV and 8.0 kV steps Air discharge mode : 2.0 kV, 4.0 kV, 8.0 kV and 15.0 kV steps
"MANUAL" test mode	Contact / Air discharge mode, Arbitrary setting 0.2 kV ~ 30.0 kV Sweeping function built-in, Recordable up to 99 units
"SEQUENCE" test mode	Enables to operate units set in MANUAL mode continuously. Max. 22 steps / 1 program and the programs recordable up to 20.
Warning lamp	Lighting at voltage output from the generator. Blinking at electro-static discharging
Charge capacitor / resistor	150 pF $\pm$ 10%, 330 $\Omega$ $\pm$ 10% (Built-in CR unit for discharge gun GT-30RA)
Charge resistor in generator	10 M $\Omega$ (Totally 53 $\Omega$ in combination with 43 M $\Omega$ in discharge gun)*
AUX connector	D-SUB 15 pins female connector (for connecting to patrolight, automated ESD eliminator, external interlock input, external trigger input terminal)
Optical communication	Optical connector (serial interface) for connecting to PC connector
Power supply / consumption	AC100 V ~ AC240 V 50 Hz / 60 Hz $\pm$ 10% 75VA
Dimensions	Generator : (W)392 mm $\times$ (H)312 mm $\times$ (D)295.3 mm (gun holder included) Discharge gun : (W)83.3 mm $\times$ (H)217.2 mm $\times$ (D)229.3 mm
Weight	Generator : approx. 7.5 kg (with Gun Holder) Discharge gun : approx. 800 g (cable and connector excluded)

\* The constant depends on combination with CR unit for the discharge gun

■ Details of GT-30RA discharge gun: Discharge gun (with discharge cup 330  $\Omega$  test), CR unit 06-00073B (150 pF - 330  $\Omega$ ), discharge tips (conical / round)

Test environment (Table-top type / Floor-standing type)

# ESS-801 / 801GL

## Feature

ESD test environment in conformance with EN/IEC61000-4-2 Standard.

Two types for EUT are available, table-top type and floor-standing type so that the environments can support the tests along EUT figures. Since the table is made of wood, influence to the test result should be small (quantifiable test result can be expected since the discharge can be realized in state high frequency electromagnetic field is less lost) and the high reproducibility can be expected and realized. Also, can be versatilely utilized for another tests like impulse noise immunity test, etc.

- ESD test environments in conformance with EN/IEC61000-4-2 standard
- Highly reproducible tests can be performed
- Can be versatilely utilized for other tests

## Specifications

### ESS-801 (Table-top type)

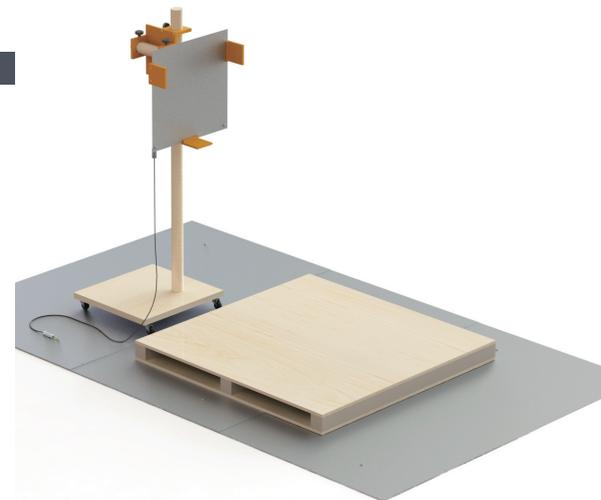
Item	Model	Dimensions	Q'ty
Test table	03-00039A	(W) 1600 × (H)800 × (D) 800 mm	1 set
Vertical coupling plane	03-00005A	(W) 500 × (H)500 × (t) 1.5 mm	1 set
Ground plane	03-00007A	(W) 1800 × (D)1000 × (t) 1.5 mm	3 pcs.
Insulating sheet	03-00004A	(W) 1450 × (D)650 × (t) 0.5 mm	1 pc.
Discharge resistance cable	05-00054B	2 m cable equipped with 470 kΩ × 2 pcs.	2 pcs.
Horizontal coupling plane	03-00020A	(W) 1600 × (D)800 × (t) 1.5 mm	1 pc.

### ESS-801GL (Floor-standing type)

Item	Model	Dimensions	Q'ty
Insulating support	03-00024A	(W) 1200 × (H)1200 × (t) 100mm	1 pc.
Floor-standing vertical coupling plane	03-00034A	(W) 540 × (H)1540 × (D) 500mm	1 pc.
Ground plane	03-00007A	(W) 1800 × (H)1000 × (t) 1.5mm	3 pcs.
Discharge resistance cable	05-00054B	2 m cable equipped with 470 kΩ × 2 pcs	1 pc.

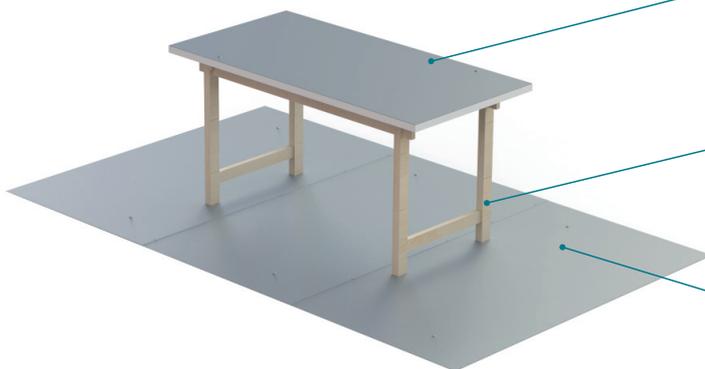


Test setup example with ESS-801  
\* Contents of the set are as per the specification



Test setup example with ESS-801GL  
\* Contents of the set are as per the specification

## Options



### Horizontal Coupling Plane (HCP) MODEL : 03-00020A

Metal plane to be placed onto the table in case of the testing to table top devices.  
W1600 × D800 × t1.5mm × 1 pc. (Made of aluminum)

### Test Table MODEL : 03-00039A

Wooden table to be used for the test to devices under test (DUT).  
W1600 × H800 × D800 mm

### Ground Reference Plane (GRP) MODEL : 03-00007A

Ground plane to be placed just under the wooden table.  
W1800 × D1000 × t1.5 mm × 3 pcs. in 1 set (Made of aluminum)

### Discharge resistance cable MODEL : 05-00054B



Cable to be used for eliminating the ESD on DUT and connect between HCP and GRP  
470 kΩ × 2 pcs./1 set.

### Insulating support MODEL : 03-00024A



When doing the electrostatic discharge test to floor-standing equipment, to be used for floating the equipment 10cm higher than the ground reference plane.  
Size : W 1200 × D 1200 × H 100 mm  
Material : Wooden  
Withstanding load : 500 kg

## Options

**Cubic Insulating Block100 MODEL : 03-00029A**

Used for floating EUT 10cm upper than the ground plane in case of testing to floor-standing EUT  
 Size : W100 × D100 × H100 mm  
 Material : Wood  
 Withstanding load: 500 kg

**ESD Elimination Brush MODEL : 05-00125A**

Brush to eliminate the electrification on EUT / DUT before starting the test.

**Automated ESD Eliminator MODEL : 01-00013B**

Enable to eliminate electric charge which has been charged to EUT automatically with connection to ESS-S3011A. (Not standardized in the IEC Standard)

- Compatible model : ESS-S3011A

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

Enables to move discharge gun vertically and horizontally to arbitrary desirable discharging point. (Not standardized in the IEC/ISO Standard)

- Compatible discharge gun : GT-30R series
- \* Conversion adaptor model 03-00074A is necessary in addition for the attachment to GT-30R series

**Probe Stand MODEL : 03-00108A**

A probe stand used to fix the discharge gun for ESD Simulator. (Not standardized in the IEC Standard) Because of the articulated type, the discharge gun fixes in any direction.

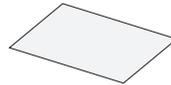
Parameter	Specification
Dimensions	(H)380 mm, Pedestal diameter 160 mm
Weight	approx. 4.1 kg
Range of movement	Vertical: 150 mm, Swing angle: 130°

- Compatible discharge gun : GT-30R series

**Conversion Adaptor for Free Arm Gun Stand MODEL : 03-00074A**

Adaptor for connecting between Free Arm Gun Stand 03-00022B and discharge gun GT-30R series.

- Compatible discharge gun : GT-30R series

**Insulating Support MODEL : 03-00066A**

Sheet to be laid out in between DUT and GRP for the test to automotive electronics devices.  
 W1450 × D650 × t2 mm  
 Material: PVC (vinyl chloride) transparent

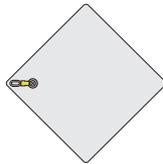
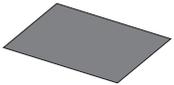
**Aluminum Plate for Test MODEL : 03-00053A**

Plate to be laid out under tires for the vehicle test  
 W500 × D500 × t1.5 mm

**Insulating Block MODEL : 03-00054A**

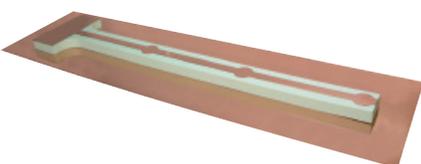
Blocks to float (isolate) wirings of DUT from GRP.  
 W300 × D300 × H50 mm, 5 pcs. in 1 set

**Conductive Mat (for ISO Standard) MODEL : 03-00055A**

Mat to be laid out in between DUT and GRP for the ESD susceptibility test in the packaging and handling.  
 Surface resistance  $10^7 \times 10^9 \Omega$   
 W1000 × D500 × t2 mm

**Ground Cable (for ISO Standard) MODEL : 05-00104A**

Cable to be used for grounding connection required in ISO 10605 (2001). L2000 × W50 mm  
 \* Not required in ISO 10605 Ed.2 (2008)

**Coupling Plane for ISO 10605 Annex F MODEL : 03-00065A**

Coupling plane used for the optional test in ISO 10605 Ed.2 (2008). It consists of a coupling plane (made of copper) and an insulation block.  
 \* Ground reference plane is not included.

## Options

### CR Units



CR units for GT-30R series ESD Guns

- Compatible discharge gun : GT-30R series
- \* Please contact us if you require a CR constant other than listed on this page.
- \* The unit size depends on the capacitor constant.

Model	CR constant
06-00077B	500pF-0Ω
06-00078B	150pF-500Ω
06-00079B	100pF-1.5kΩ
06-00080B	200pF-0Ω
06-00081B	150pF-150Ω
06-00082B	500pF-500Ω
06-00083B	500pF-5kΩ
06-00084B	250pF-100Ω
06-00085B	200pF-100Ω
06-00086B	250pF-0Ω
06-G896	330pF-0Ω
06-G897	150pF-0Ω
06-K1936	200pF-250Ω
06-K1964	330pF-100Ω
06-N2270	500pF-100Ω

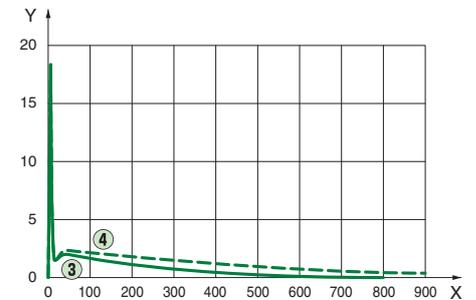
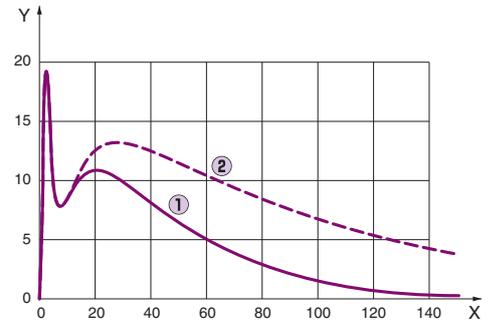
### ● For ISO 10605 compliant test

●GT-30R3302KA package contents

GT-30R series	gun body
03-00071A	gun head
03-00072A	gun head
06-00073B	150 pF - 330 Ω CR unit ①
06-00074B	150 pF - 2 kΩ CR unit ③
06-00075B	330 pF - 330 Ω CR unit ②
06-00076B	330 pF - 2 kΩ CR unit ④
12-00007A	conical tip
12-00008A	round tip
12-00009A	spherical tip



Energy storage capacitor / Discharge resistor values	1st discharge peak current	t <sub>1</sub> Current	t <sub>2</sub> Current
150 pF / 330 Ω ①	3.75 A / kV ± 10%	2A / kV ± 30% (t <sub>1</sub> = 30 ns)	1 A / kV ± 30% (t <sub>2</sub> = 60ns)
330 pF / 330 Ω ②	3.75 A / kV ± 10%	2 A / kV ± 30% (t <sub>1</sub> = 65 ns)	1A / kV ± 30% (t <sub>2</sub> = 130 ns)
150 pF / 2 kΩ ③	3.75 A / kV +30% -0%	0.275 A / kV ±30% (t <sub>1</sub> = 180 ns)	0.15 A / kV ± 50% (t <sub>2</sub> = 360 ns)
330 pF / 2 kΩ ④	3.75 A / kV + 30%-0%	0.275 A / kV ±30% (t <sub>1</sub> = 400 ns)	0.15 A / kV ± 50% (t <sub>2</sub> = 800 ns)



### Gun Head MODEL : 03-00071A / 03-00072A



Gun head to be changed according to Standard compliant test. 2 kinds for the test with 330 Ω (03-00071A) and 2 kΩ (03-00072) are available.

- Compatible discharge gun : GT-30R series

### Fast Rise Time Adaptor MODEL : 03-00073A



Realize a faster rise time of the discharge current than IEC 61000-4-2 standard value (0.6 ~ 1.0 ns) around 0.2 × 0.3 ns with attachment to the discharge gun. (Not standardized in the IEC Standard)

- Compatible discharge gun : GT-30R series

### Impulsive Electric Field Adaptor MODEL : 03-00068A



Adaptor for simulating static induction as one of noise inductive mode with attachment to the discharge gun (Not standardized in the IEC Standard)

- Compatible discharge gun :GT-30R series

### Discharge Tips MODELS : 12-00007A / 8A / 9A



Gun discharge tips  
The all 3 tips are standard equipped with GT-30R series.

- Compatible discharge gun : GT-30R series



## Options

**Impulsive Magnetic Field Adaptor MODEL : 03-00069A**

Adaptor for simulating electromagnetic induction as one of noise inductive mode with attachment to the discharge gun (Not standardized in the IEC Standard)

- Compatible discharge gun : GT-30R series

**Magnetic Field Adaptor MODEL : 03-00070A**

Magnetic field adaptor for Ford standard. Connected to GT-30R series discharge gun, it generates transient magnetic fields. (Not standardized in the IEC Standard)

- Compatible discharge gun : GT-30R series

Parameter	Specification
Loop coil diameter	155 mm
Dimensions	168 mm (loop outer diameter) 300 mm (length) 12.7 mm (thickness of the loop)

**Extension cable for GT-30R MODEL : 05-00047B**

Extension cable in connection between ESD simulator main unit and its discharge gun. The length is 3 m \* not compliant with the IEC standard

- Compatible discharge gun :GT-30R series

**Gun Holder MODEL : 03-00075A**

Holder for discharge gun during the test. Also, can be the pre-checking fixture in combination between ESS-S3011A and GT-30R series.

- Compatible discharge gun : GT-30R series

**Specialized Case for Discharge Gun MODEL : 09-00006A**

Specialized Case for storing and carrying the discharge gun, CR units and the other related fixtures.

- Compatible discharge gun : GT-30R series

**Warning Lamp MODEL : 11-00014B**

Warning light used for alerting and calling for attention during the test.

- Compatible model : ESS-S3011A

\* The connection is done with DSUB connector.

**AUX Connector Junction Box MODEL : 05-00052A**

Enable to connect warning lamp, automated ESD eliminator and external trigger simultaneously

- Compatible model : ESS-S3011A

**USB Optical Module Kit MODEL : 07-00022A**

Optical conversion adaptor Used for remote control with PC. 5 m of optical fiber cable with USB interface attached.

- Compatible model : ESS-S3011A

## Options

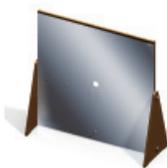
### Faraday cage MODEL : FC-200



Faraday cage which is defined in IIEC61000-4-2 Standard and ISO 10605 Ed.2 Standard to verify the discharge current waveform. Easy to move with casters equipped to the bottom.

Parameter	Specification
Power supply	AC100 V 50 Hz / 60 Hz 3 P inlet Equipped with over-current protective breaker
Opening Dimensions on door	(W) 410 mm × (H) 618 mm
Dimensions / Weight	(W)670 mm × (H)1612 mm × (D) 1509 mm Approx. 65 kg. 3p outlet × 2 15 A MAX

### Current Target Mounting Board MODEL : 03-00052B



The board to fix the load resistor (MODEL NO. 06-00094A ESD current target) for measuring the discharge current waveform defined in IEC61000-4-2 Standard and ISO 10605 Ed.2 Standard  
Dimensions : 1.2 m × 1.2 m

### Coaxial Cable MODEL : 02-00157A



High frequency responsible cable to connect ESD target and oscilloscope  
BNC-SMA connector (02-00133A) is also available as an option

### GND Cable Positioner MODEL : 03-00060A



Stand to pull and fix the ground cable of discharge gun 0.5 m backwards at the middle of the cable when calibrating the ESD current.

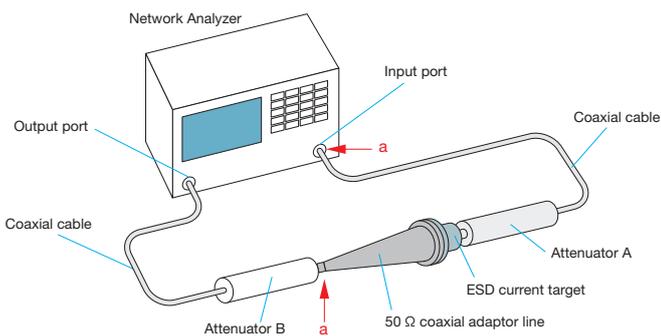
### ESD Current Target Calibration Set MODEL : 06-00068A

Set to calibrate the ESD target (06-00094A) in conformance with IEC61000-4-2 Ed.2.0 (2008).



Adaptor (06-00068A)

A photo of 06-00094A ESD target and 06-00068A adaptor connected faced to face



a : Calibration points with networks analyzer

### Current Target Mounting Board MODEL : 03-00027A



The board to fix the load resistor (MODEL NO. 06-00094A ESD current target) for simple measuring the discharge current waveform defined in IEC61000-4-2 Standard and ISO 10605 Ed.2 Standard. (not conforming to the standard)  
Dimensions : 0.6 m × 0.6 m

### ESD Current Target MODEL : 06-00094A



Load resistor to measure, verify and calibrate ESD current waveform defined in IEC61000-4-2 Standard and ISO 10605 Ed.2 Standard

Parameter	Specification
Injection voltage (pulse)	30 kV MAX
Input resistance	2.04 Ω
Output impedance	2.04Ω
Insertion loss (S21)	≤1GHz : Within ±0.5dB 1GHz~4GHz : Within ±1.2dB
Output connector	SMA type
Dimensions/Weight	70 φ × 35 mm / Approx. 480g

### Discharge Gun Mount MODEL : 03-00061B



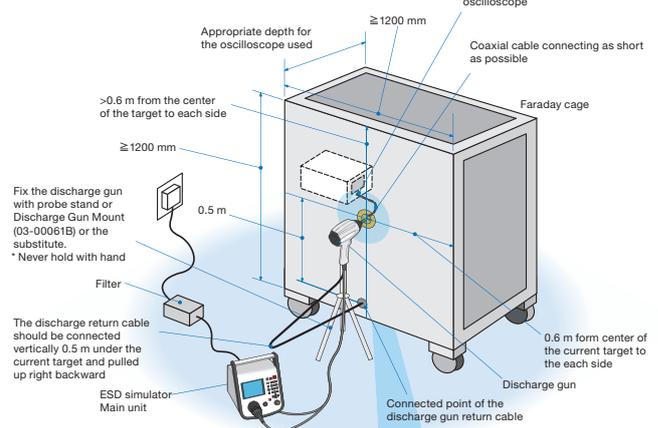
Fixture to load and fix the discharge gun to the Faraday cage (FC-200) or current target mounting board (03-00052B)

### Attenuator MODEL : 00-00022A

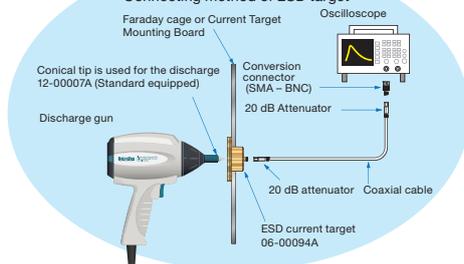
Attenuator to protect measurement equipment for ESD current waveform.  
Attenuation ratio 20 dB



Insertion of 20 dB attenuator is recommended for protecting the oscilloscope



### Connecting method of ESD target



## Options

Micro-gap Discharge Tip MODEL : 12-00010A

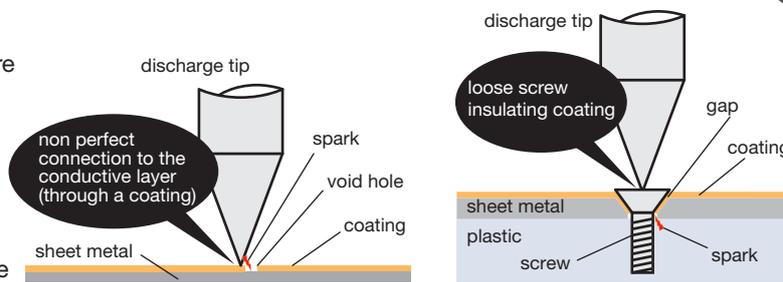
# Enabling a more stringent evaluation for the real world ESD immunity

Connected to the NoiseKen ESD gun, this tip allows for a waveform with higher peak amplitude and a faster rise time. It is a common view that ESD immunity testing is the most challenging and passing the standard test does not always assure real world immunity. This tip is helpful for more extensive testing against non-standardized field events



Gun Head Model : 03-00103A

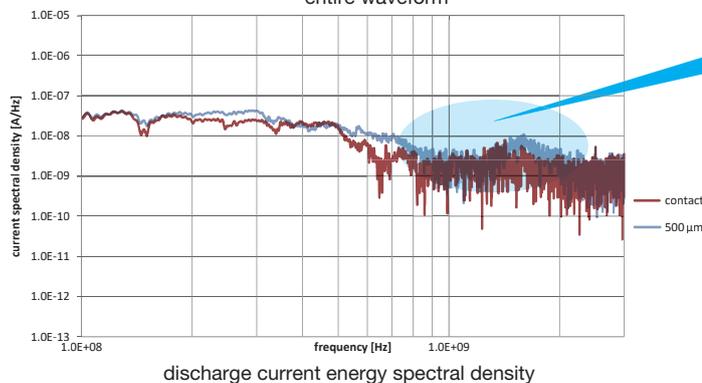
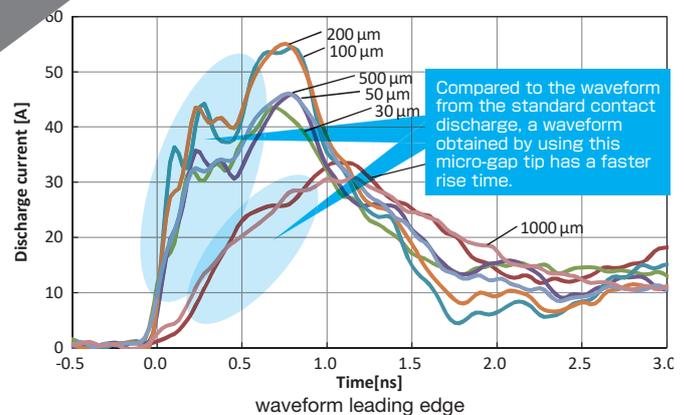
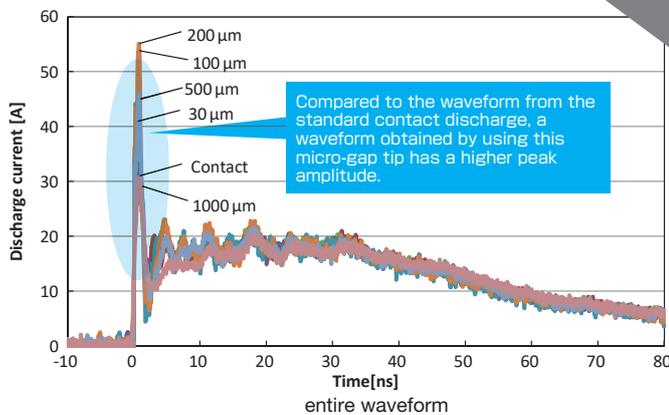
- Events you can simulate are
- Loose screws
- Poor insulation coating
- Poor electrical connection between components and others which cause secondary discharges within a very close distance



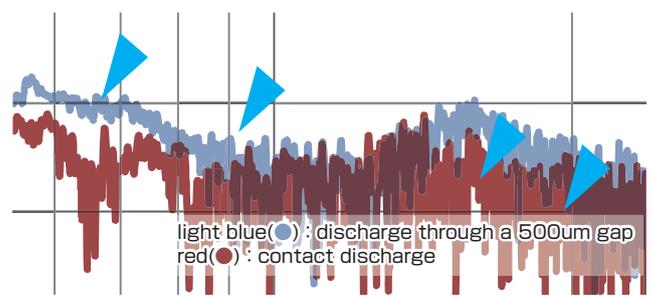
enlarged photo of the micro-gap

## Simulated field events

■ Output waveform (reference)



Compared to the contact discharge, discharge through a micro-gap contains a higher level of noises over the higher side of the spectrum



## Testing with energy rich pulses for the GHz band

■ Compatible discharge guns

TC-815S, 815R, 815ISO, 815-330, 815-2K, 815S-330, GT-30R series (the Gun Head 03-00103A required)

\*This product cannot be used for the air discharge testing

# IEC61000-4-2 Ed.2 Test Standard Overview

## 1. General

The international immunity test standard which applies to electronic equipment against ESD generated directly from a human body or near metal objects in condition chemical fibers carpets or clothings are used in low humidity relatively. This standard assumes cases when charged human body discharges to electronic equipment and testing with the circuit to simulate current waveform generated in such conditions.

## 2. Test Levels

### Test level range for the ESD

The levels as below.

Level	Test voltage (contact discharge)	Test voltage (air discharge)
1	2 kV	2 kV
2	4 kV	4 kV
3	6 kV	8 kV
4	8 kV	15 kV
X	Special	Special

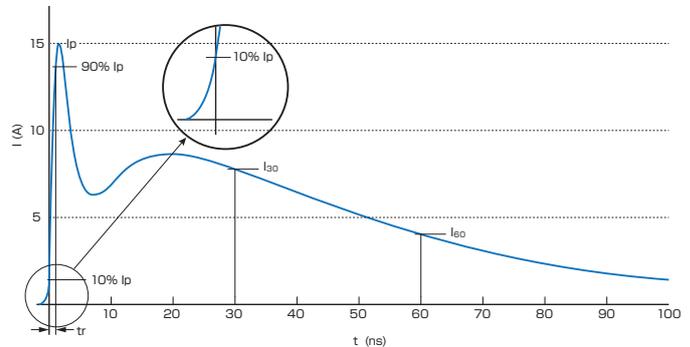
\* x can be any level determined by consent between the manufacturer and the user

## 3. Test Generator and Waveform Verification

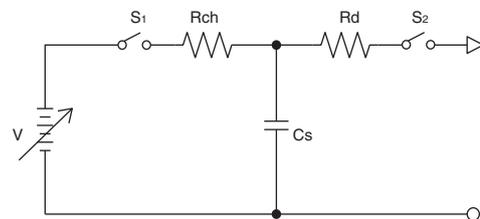
### Generator specification

The generator must satisfy following specification.

Energy accumulation capacity	150 pF (typical)
Discharge resistance	330 Ω (typical)
Output voltage	8 kV / Contact discharge, 15 kV / Air discharge
Tolerance of output voltage	± 5%
Polarity of output voltage	Positive and negative (Switching available)
Hold time	> = 5 sec.
Discharge mode of operation	Single discharges (Discharge interval > = 1 sec)
Waveform of discharge current	See right figure



Discharge current waveform and its characteristics



Capacitance  $C_s$  : 150 pF  
Discharge resistance  $R_d$  : 330 Ω

Simplified diagram of the ESD generator

### Generator characteristics

The characteristics in the following table must be verified in order to compare the tests results among different generators

Level	Indicated voltage	1 <sup>st</sup> peak current of discharge (± 15%) Ip	Rise time (± 25%)	Current (± 30%) at 30 ns	Current (± 30%) at 60 ns
1	2 kV	7.5 A	0.8 ns	4 A	2 A
2	4 kV	15 A	0.8 ns	8 A	4 A
3	6 kV	22.5 A	0.8 ns	12 A	6 A
4	8 kV	30 A	0.8 ns	16 A	8 A

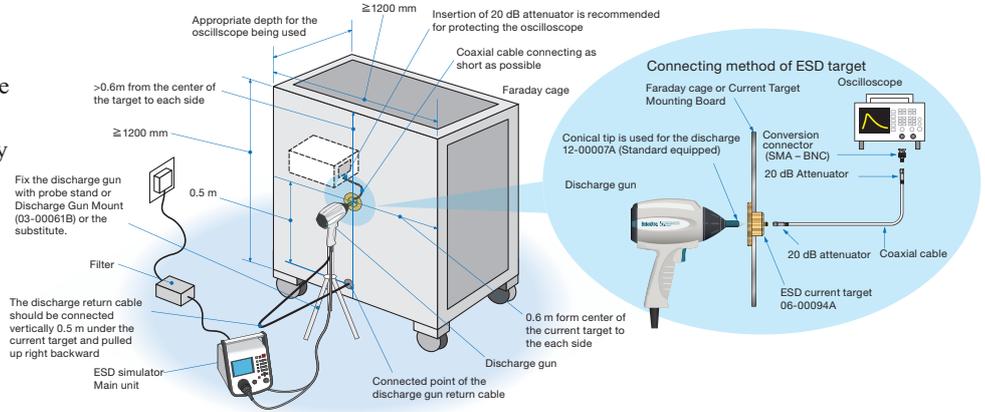
## IEC61000-4-2 Ed.2 Test Standard Overview

### Waveform verification of ESD Generator

Measure the waveform with an oscilloscope with bandwidth of 2 GHz or more upon use of Faraday cage and the current target.

Attach the discharge electrode directly to the current target and operate the generator with the contact discharge mode.

\* Insertion use of approx. 20 dB attenuator for protecting the measurement equipment is recommended, although it is not specified in the IEC Standard.



## 4. Test setup

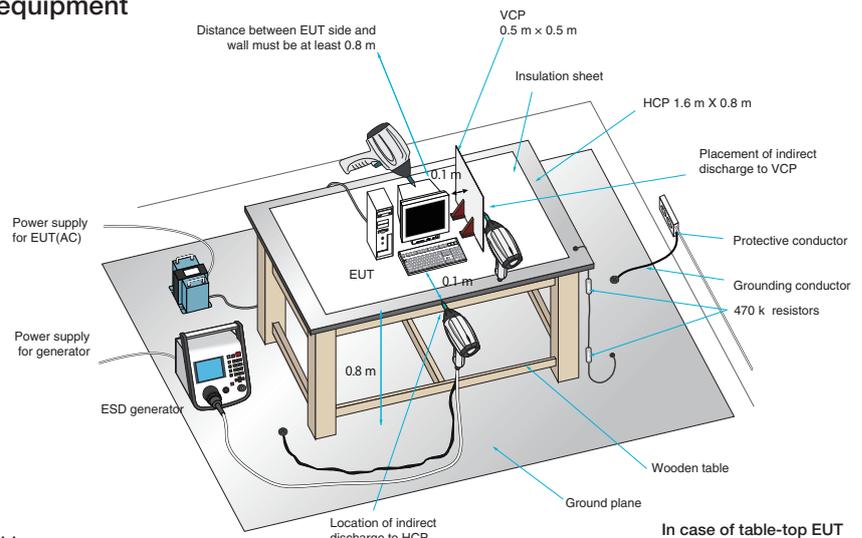
### Example of test set-up for table-top equipment

The direct discharge test is an electrostatic direct discharge to EUT for examining its influence to the EUT.

Put a wooden table which height is 0.8 m on the ground plane and place horizontal coupling plane (HCP 1.6 m × 0.8 m).

Connect the HCP with resistor 470 kΩ × 2 to the ground plane and lay an insulation sheet between the HCP and the EUT.

The indirect discharge test is an electrostatic discharge to the HCP and vertical coupling plane (VCP 0.5 m × 0.5 m) for examining its influence to the EUT. Connect the VCP with resistor 470 kΩ × 2 to the ground plane as well.

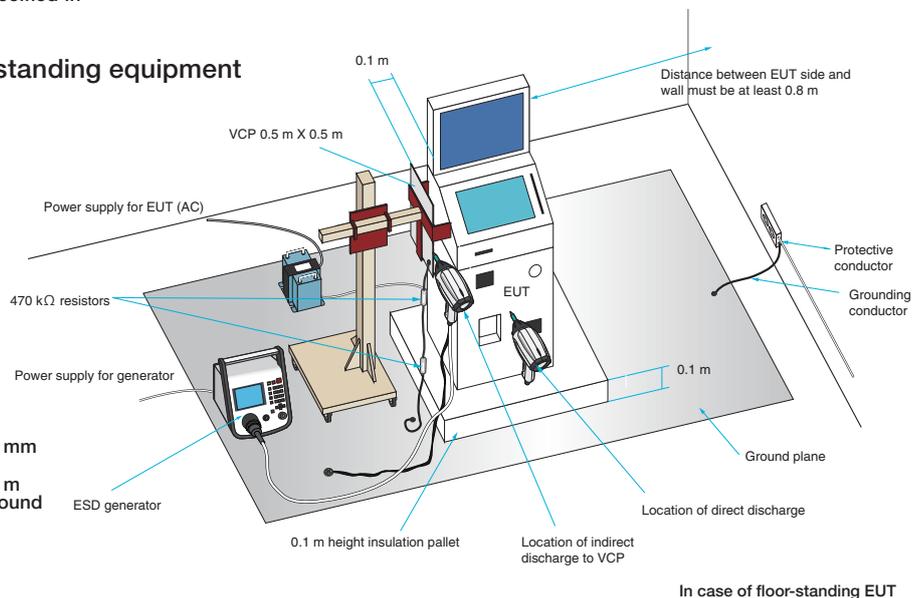


\* The isolation transformer for EUT is not specified in IEC Standard.

### Example of test set-up for floor-standing equipment

Put an insulation pallet which height is 0.1 m onto the ground plane and place EUT on the pallet for the direct discharge test.

The indirect discharge test is an electrostatic discharge to the VCP for examining its influence to the EUT. Connect the VCP with resistor 470 kΩ × 2 to the ground plane as well.



\* Float cables from the ground plane with 0.5 mm thickness insulation sheet.  
 \* Keep GND cable of the discharge gun  $\geq 0.2$  m from any conductive parts other than the ground plane  
 \* The isolation transformer for EUT is not specified in IEC Standard.

## IEC61000-4-2 Ed.2 Test Standard Overview

### 5. Test Procedure

#### ■ Climatic and Other Environmental Conditions

It is necessary to let the equipment brought in from different climatic conditions to fully adjust to testing environment before performing the test. Also, in order to stabilize the discharging condition certainly, it is necessary to fix the climatic conditions in the test room. Fulfillment of the conditions listed in following table must be required to perform testing in conformance with IEC61000-4-2.

Ambient temperature	15°C to 35°C
Relative humidity	30% to 60%
Atmospheric pressure	86 kPa (860 mbar) to 106 kPa (1060 mbar)
Electromagnetic conditions	Level not to affecting test result

#### ■ Test Procedure

Direct discharge test : Contact discharge (at 1 second interval) and air discharge (at max. 5 sec. cycle)

Indirect discharge test : Discharge to VCP and HCP

At least 10 single discharges shall be applied at 1 second or longer interval in both positive and negative polarities.

\* A preliminary test with discharges 20 times or more per second may be done in order to select the points to which single discharges should be applied.

### 6. Evaluation of Test Results and Test Report

The tests results are classified into following 4 patterns according to specifications of EUT and operating conditions.

- 1) Normal operation within the tolerance of the specification
- 2) Temporary degradation or loss in the operation or the function which is able to be recovered by a self-recovery function
- 3) Temporary degradation or loss in the operation or the function which needs to be recovered by user intervention or reset in the system.
- 4) Damage of the system (parts) or software, and unrecoverable degradation in the function due to loss of the data.

Generally, as far as the EUT is immune to the ESD during testing and it satisfies the functional requirements according to the product specification after testing, the test result can be perceived as "Pass"

The test report shall contain the test conditions and the result.

Notes: This test procedure and test set-up are extracted from IEC 61000-4-2 Ed.2 (2008) and JIS C 61000-4-2 ed.2.0 (2012) Standards for applying to our products. Please refer to the Standards for more details.

# ISO 10605 Ed.3 Test Standard Overview

## 1. General

Electrostatic discharges which are generated both in vehicles and while we get on and off there can be factors to cause malfunction of the electrical devices and components. Nowadays, more attention has been paid, as vehicles install more and more electronic devices and components. This Standard regulates that static electricity is discharged to the electronic devices or equipment from the charged human body and tests are simulated by electrical circuit to reproduce the electric current waveform at the discharge.

In addition to procedures for the immunity tests and evaluations in state that the electronic devices or equipment work while the vehicle is driving, the Standard also regulates tests procedures to evaluate the immunity of the each module against simulated human discharges during the assembly process or in servicing.

## 2. Test levels

The following tests levels are for reference. The categories are classified according to functional importance of the electronics devices/ components.

### Component test – Example severity levels for direct contact discharge and direct air discharge (Function performance status)

Test severity level	Direct contact discharge			Direct air discharge		
	Category 1	Category 2	Category 3	Category 1	Category 2	Category 3
Level 4	±8kV	±8kV	±15kV	±15kV	±15kV	±25kV
Level 3	±6kV	±8kV	±8kV	±8kV	±8kV	±15kV
Level 2	±4kV	±4kV	±6kV	±4kV	±6kV	±8kV
Level 1	±2kV	±2kV	±4kV	±2kV	±4kV	±6kV

### Component test – Example severity levels for indirect contact discharge (Function performance status)

Test severity level	Indirect contact discharge		
	Category 1	Category 2	Category 3
Level 4	±8kV	±15kV	±20kV
Level 3	±6kV	±8kV	±15kV
Level 2	±4kV	±4kV	±8kV
Level 1	±2kV	±2kV	±4kV

### Component test – Packaging and handling – Example severity levels –

Test severity level	Direct contact discharge			Direct air discharge		
	Category 1	Category 2	Category 3	Category 1	Category 2	Category 3
Full function after test	±1kV	±2kV	±4kV	±8kV	±15kV	±25kV

### Vehicle test – Example severity levels for contact discharge and air discharge (Test points accessible only from inside vehicle)

Test severity level	Contact discharge			Air discharge		
	Category 1	Category 2	Category 3	Category 1	Category 2	Category 3
Level 4	±6kV	±8kV	±8kV	±8kV	±15kV	±15kV
Level 3	±4kV	±4kV	±6kV	±6kV	±8kV	±8kV
Level 2	±2kV	±2kV	±2kV	±4kV	±4kV	±6kV
Level 1	–	–	–	±2kV	±2kV	±4kV

### Vehicle test – Example severity levels for contact discharge and air discharge (Test points accessible only from outside vehicle)

Test severity level	Contact discharge			Air discharge		
	Category 1	Category 2	Category 3	Category 1	Category 2	Category 3
Level 4	±6kV	±8kV	±8kV	±15kV	±15kV	±25kV
Level 3	±4kV	±6kV	±6kV	±8kV	±8kV	±15kV
Level 2	±2kV	±2kV	±4kV	±4kV	±6kV	±8kV
Level 1	–	–	±2kV	±2kV	±4kV	±6kV

## ISO 10605 Ed.3 Test Standard Overview

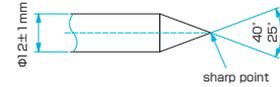
### 3. Specification of generator and verification of output waveform

#### ■ Specification of ESD simulator

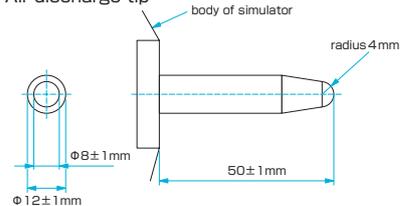
A simulator satisfying the following specifications must be used for the ESD Testing.

Parameter	Specification
Output voltage - Contact discharge- (kV)	2kV ~ 15kV
Output voltages - Air discharge- (kV)	2kV ~ 25kV
Output voltage accuracy (%)	≤ 5%
Polarity	Positive and negative
Rise time of short circuit current in contact discharge mode (10% to 90%)	0.7ns ~ 1ns
Holding time	≥ 5 s
Storage capacitances (pF)	150pF, 330pF
Discharge resistances (Ω)	2kΩ, 330Ω

Contact discharge tip



Air discharge tip

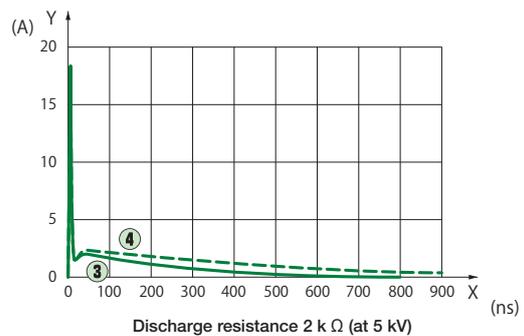
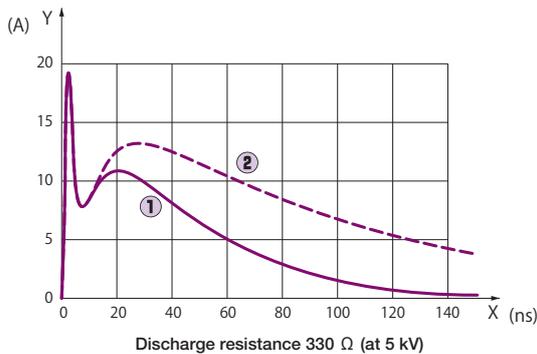


For air discharge at test voltages higher than 15 kV, a larger tip can be used to avoid pre-discharge.

#### ■ ESD Simulator Characteristics (Contact discharge mode current specifications)

The following discharge characteristics must be verified.

Capacitance / resistance	1st peak current	Current at $t_1$	Current at $t_2$	Below Figure indication
150pF/330Ω	3.75A/kV ±10%	2A/kV±30% ( $t_1=30$ ns)	1A/kV ±30% ( $t_2=60$ ns)	①
330pF/330Ω		2A/kV±30% ( $t_1=65$ ns)	1A/kV ±30% ( $t_2=130$ ns)	②
150pF/2kΩ	3.75A/kV +30% - 0%	0.275A/kV±30% ( $t_1=180$ ns)	0.15A/kV±50% ( $t_2=360$ ns)	③
330pF/2kΩ		0.275A/kV±30% ( $t_1=400$ ns)	0.15A/kV±50% ( $t_2=800$ ns)	④

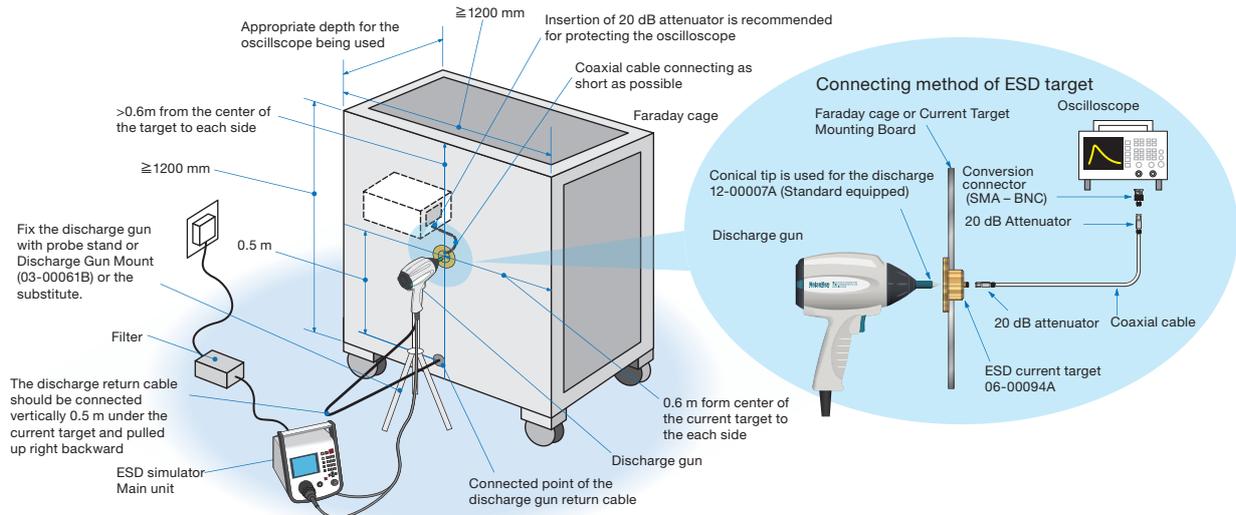


## ISO 10605 Ed.3 Test Standard Overview

### ■ Verification of output current waveform

The waveform shall be verified with an oscilloscope which bandwidth is 1 GHz or more in a Faraday cage or with a 1.2 m × 1.2 m metallic board mounting an ESD current target in the center of the cage or the board. The discharge electrode (Discharge tip of the gun) shall be touched onto the target and the discharge mode shall be set at the contact discharge mode.

The discharge return cable shall be turned up the center of the length and connected to vertically 0.5 m under the target on surface of the Faraday cage or board.



### ■ Current Target calibration

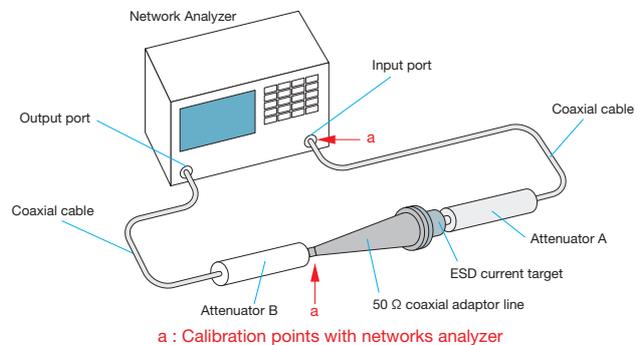
The frequency characteristics of current waveform observation targets must be verified using a dedicated measurement jig.



Adaptor for calibrating ESD current target (Model:06-00068A)



Figure of attaching ESD current target and the calibration adaptor (Left : Target Right : Adaptor)



## 4. Test setup and test procedure

### ■ Common Points:

- Ground plane: at least 1.6 x 0.8m in size, at least 0.2m larger than the DUT or peripherals during setup, and with a connection resistance of 2.5mΩ or less.
- Insulating block: height 50±5mm. Extend 20mm beyond the test configuration on all sides.
- The DUT shall be connected to all peripheral devices required for functional testing of the DUT with the wire harness length of 1.7m (+0.3m - 0).
- All components should be at least 0.2 m apart from each other.
- Bundle the wire harness 0.1m away from the edge of the ground plane and secure it to the insulating block.
- The supply battery shall be on the test table, with the negative terminal of the battery directly connected to the GP.
- The test stand should be at least 0.1m away from other dielectric structures.
- For direct discharge, connect the electrostatic simulator's discharge return cable to the ground plane.
- Use discharge network of 150pF or 330pF depending on the EUT device location, and use 330Ω or 2kΩ.
- The test should be conducted for two or more test levels.
- Isolating block should be used for electronic equipment that are not directly chassis-mounted.

## ISO 10605 Ed.3 Test Standard Overview

### ■ Component immunity test method (powered-up test) - Direct contact and air discharge -

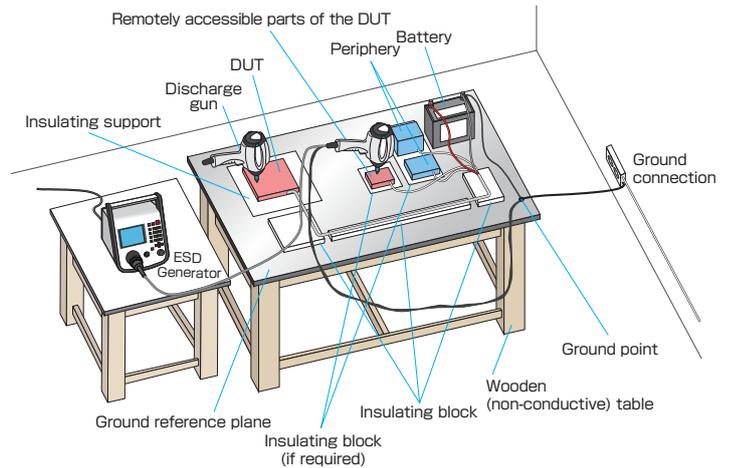
- Test at least 3 times with positive and negative polarity, separated by at least 1 second.
- Apply to every location available for human touch.
- Isolating block should be used for electronic equipment that are not directly chassis-mounted.

#### 【 Contact Discharge 】

- The discharge electrode is brought into contact with the discharge point of the DUT before activating the discharge switch.
- For painted surfaces, if the coating is not an insulating coating, the pointed tip of the generator should penetrate the coating so as to make contact with the conducting substrate.
- The ESD discharge tip is held perpendicular to the surface of the DUT.

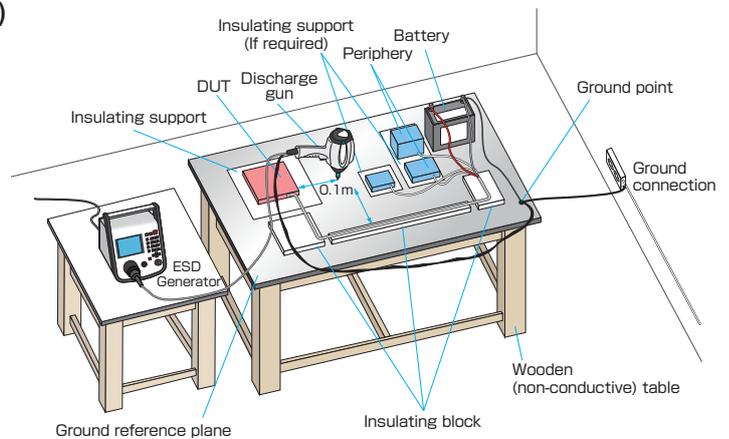
#### 【 Air Discharge 】

- After operating the discharge switch, move the discharge electrode tip to the DUT as quickly as possible (0.1m/s to 0.5m/s) until it contacts the discharge point and apply voltage.
- If the conductive material is declared to be an insulating coating, perform air discharge.



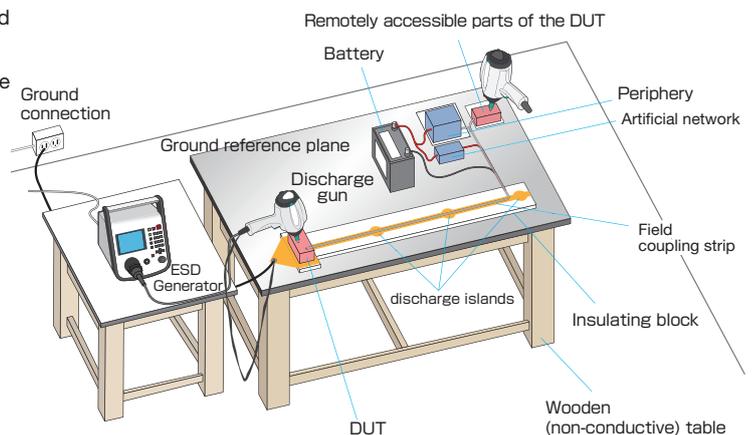
### ■ Component immunity test method (powered-up test) - Indirect Discharge -

- Apply discharge to the ground plane with contact discharge.
- Test 10 times or more at intervals of 1s or more.
- Apply to the ground plane at points on each side of the DUT.
- Position the DUT so that the nearest surface is 0.1 m away from the edge of the ground plane that receives the discharge.
- Apply at a position 0.1m from the DUT and harness.
- Select 330pF as the CR constant depending on the mounting position of the device, and use 330Ω.



### ■ Component immunity test method (powered-up test) - Direct Discharge using FCP -

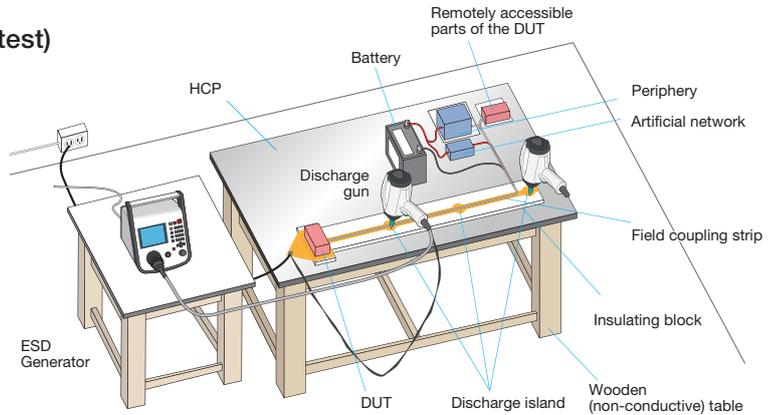
- At least 3 discharges shall be applied both to the positive and negative polarities with the interval not less than 1s.
- Select 150pF or 330pF as the CR constant depending on the mounting location of the device, and use 330Ω.



## ISO 10605 Ed.3 Test Standard Overview

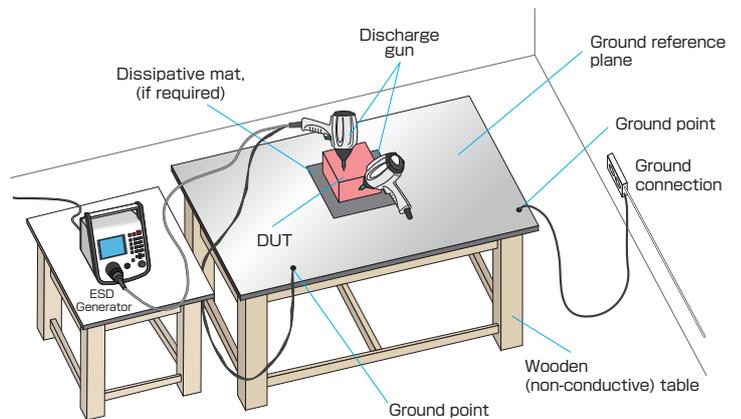
### ■ Component immunity test method (powered-up test) - Indirect Discharge using FCP -

- Apply at least 10 contact discharges for each polarity to each discharge island with the time interval 1 s or longer.
- The CR constant is selected to be 330pF depending on the mounting position of the device, and 330Ω is used.



### ■ Component immunity test method (unpowered) - Packaging and Handling - ESD Sensitivity Test

- Use 150pF capacitance and test with resistances that simulate direct contact with the human body (2kΩ) and touch with a metal object (330Ω).
- Conduct tests of two or more levels.
- At least 3 discharges shall be applied both to the positive and negative polarities with the interval not less than 1s.
- Contact discharge shall be applied to all locations human finger may touch.
- After applying the voltage, remove the static electricity from the DUT with a static elimination resistor of 1MΩ±20%, then energize it and confirm that it operates normally.

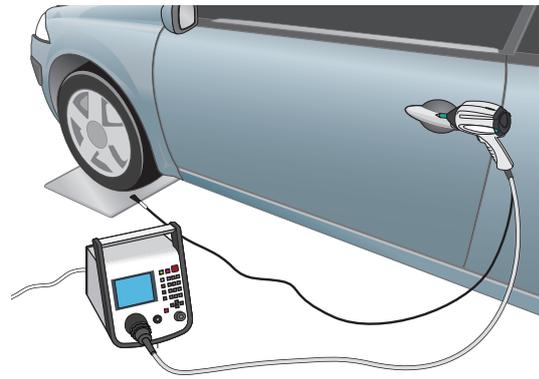


### ■ Vehicle test – Internal and external points –

- Areas that can be easily touched by people inside the vehicle are tested with 330pF/330Ω or 2kΩ.
- Areas that can be easily touched by people from outside the vehicle are tested with 150pF/330Ω or 2kΩ.
- The ground wire connects to the chassis, such as the seat rail. During external testing connect to a nearby chassis or metal plate under the tire.
- Both the contact discharge and air discharge tests shall be done both for the internal and external tests.



Internal test



External test

Note: This test outline is based on the ISO10605 Ed.3 2023 Standard. Please refer to the original text of the Standard for detailed test methods, etc.

\* Designs, appearances and specifications on the products are subject change without notice.