NoiseKen

EMC Test Equipment Catalog

- Electrostatic Discharge Simulator
- Impulse Noise Simulator
- Fast Transient / Burst Simulator
- Lightning Surge Simulator
- Voltage Dip & Swell Simulator
- Damped Oscillatory Wave Simulator
- Emission Measurement System
- Broadband Sleeve Antenna
- TEM Horn Antenna
- EMC Test Systems for Automotive Electronics

2020-2021

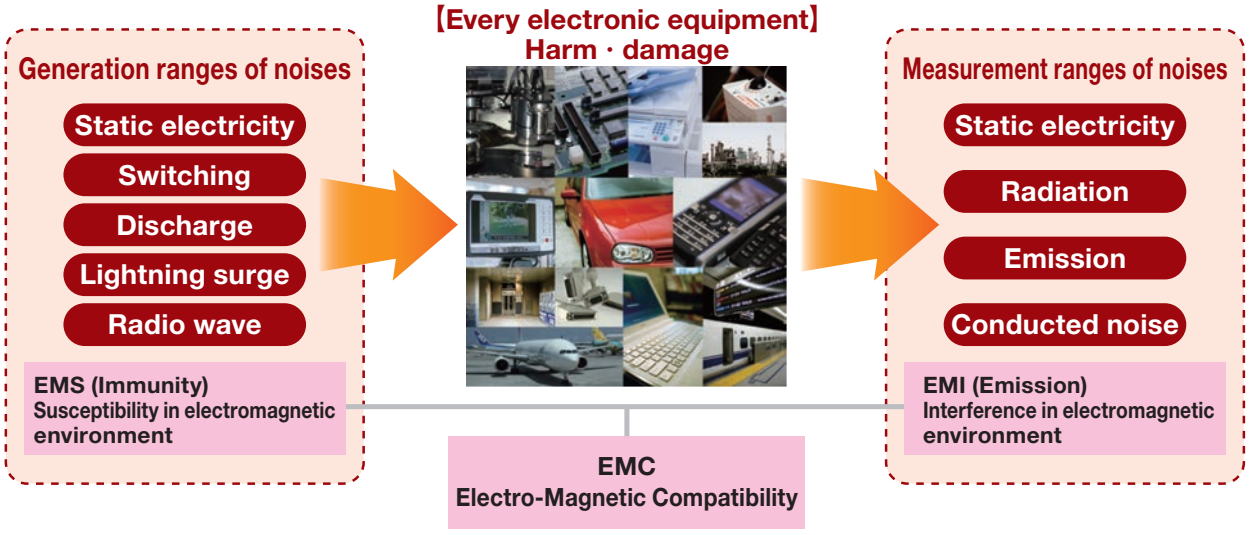
www.noiseken.com

Mission statement from NoiseKen

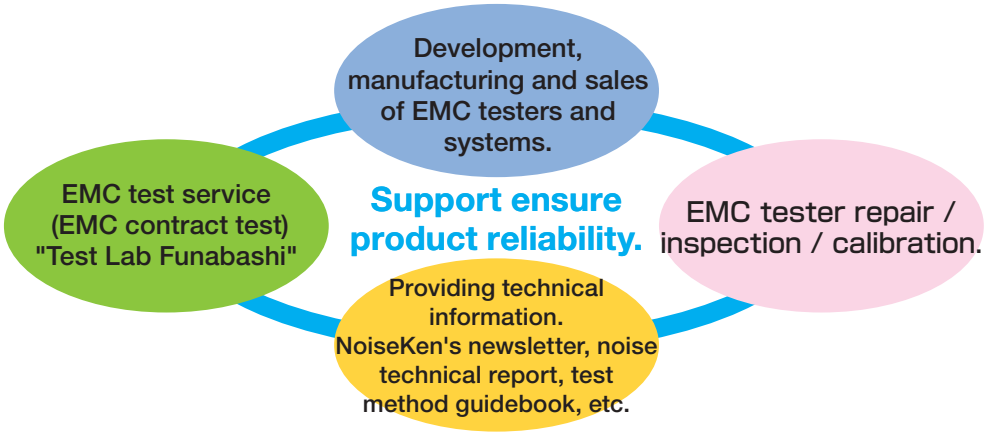
"To challenge the reproduction of electrical noise continuously and aim to be a company that makes customer EMC tests easier."

In 1975, when the term "EMC" began to be used as the phenomenon of malfunctions became a social problem with the spread of computers, we were "a company that manufactures noise testers for reproducing malfunctions of electronic devices." It was founded as.
Since then, in order to contribute to the quality of products that customers make, we have provided EMC testers reproduce (output / measure) electrical noise such as electrostatic discharge phenomenon, high current phenomenon at the time of lightning strike, transient phenomenon in car, contracted EMC test services (contracted test site "Test Lab Funabashi"), and other technical materials such as NoiseKen News (former technical report), test method guidebook. Our brand "NoiseKen" has been adopted by more than 5,000 customers in Japan.
Based on the history and achievements so far, in addition to "continuing to challenge the reproduction of electrical noise" which is the starting point of our founding, we will not only quality, cost and delivery, but also autonomation and simulation testers / measuring instruments. "NoiseKen" contributes to EMC and noise countermeasures by aiming to be a "company that makes customer's EMC tests easier" while responding to changes in the way of life, and everyone recognizes its permanent existence.

Variety of Electrical Noises and EMC



Products & Services of "NoiseKen"

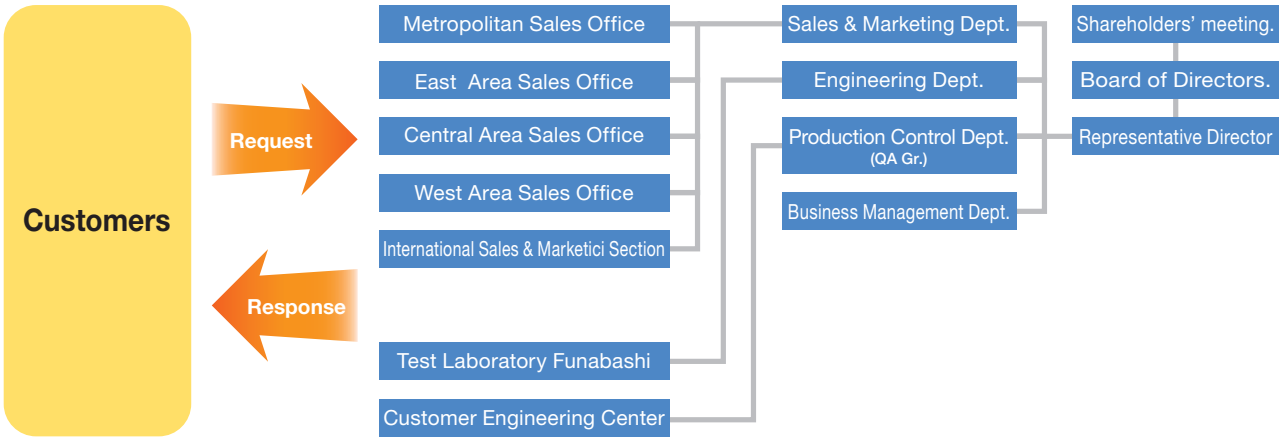


Historical Highlights of Noise Laboratory Co., Ltd.

1975 Adachi Noise Laboratory Co., Ltd. establishment / Location of the Head Office : Iguchi,Mitaka-shi, Tokyo
1976 Company name was changed into Noise Laboratory Co., Ltd.
1984 Head Office was relocated to Noborito, Tama-ku, Kawasaki-shi.
1990 Head Office was relocated to Kami-asao, Asao-ku, Kawasaki-shi.
1995 Start contract testing and measurement services in Funabashi, Chiba Pref.
Selected as "New business model company" by Kanto Trade & Industry Bureau.
1996 Head Office was relocated to Mampukuji, Asao-ku, Kawasaki City,
Commercialization of "electromagnetic wave interference source exploration device (ESV system)" through industry-academia collaboration with Industrial Technology Center of Tochigi prefecture.
1997 Equipped an anechoic chamber in Test Laboratory Funabashi
2000 Head Office and Kakio Work were relocated to Chiyoda, Sagamihara City.
2004 Acquired IEC17025 accredition.
2009 Acquired test site certification in ISO/IEC17025 to Test Laboratory Funabashi by VLAC.
2011 China after-sales service office was established.
2012 Launched Space-electric/magnetic visualization systems (EPS-02 series) in collaboration with Kanazawa University
2015 Launched thin-plate broad band antenna in partnership with Toyota Motor Corp
2016 The 32rd Kanagawa Industrial Technology Development Grand Prize incentive-awarded to NKU07M32G Broadband Sleeve Antenna
2018 Received "IEC 1906 Award" from IEC (International Electrotechnical Commission)
2019 Received the "Excellent paper award" from Environmental Electromagnetic Engineering Study Group, the Institute of Electronics, Information and Communication Engineers.
2020 Commercialization of "TEM horn antenna" through industry-academia collaboration with the National Institute of Information and Communications Technology (NICT)
Completion of new building (office building) due to business expansion.

Outline of Noise Laboratory Co., Ltd.

【Company name】	NOISE LABORATORY CO., LTD.
【Location】	Head offices: 1-4-4 Chiyoda, Chuo-ku, Sagamihara City, Kanagawa Pref. 252-0237 Japan TEL : +81-42-712-2051 FAX: +81-042-712-2050
【Establishment】	28th March, 1975
【Board of Directors】	Junichi Fujigaki / Representatives director
【Accounting period】	May
【Dealings banks】	Mizuho bank Machida Branch Bank of Yokohama Sagamihara Ekimae Branch Bank of Mitsubishi UFJ Sagamihara Branch Sumitomo Mitsui Banking Corporation Machida Branch



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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 equipments 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 and performable IEC61000-4-2 & ISO 10605 Standards compliant tests.

*Probe stand for the discharge gun is option.

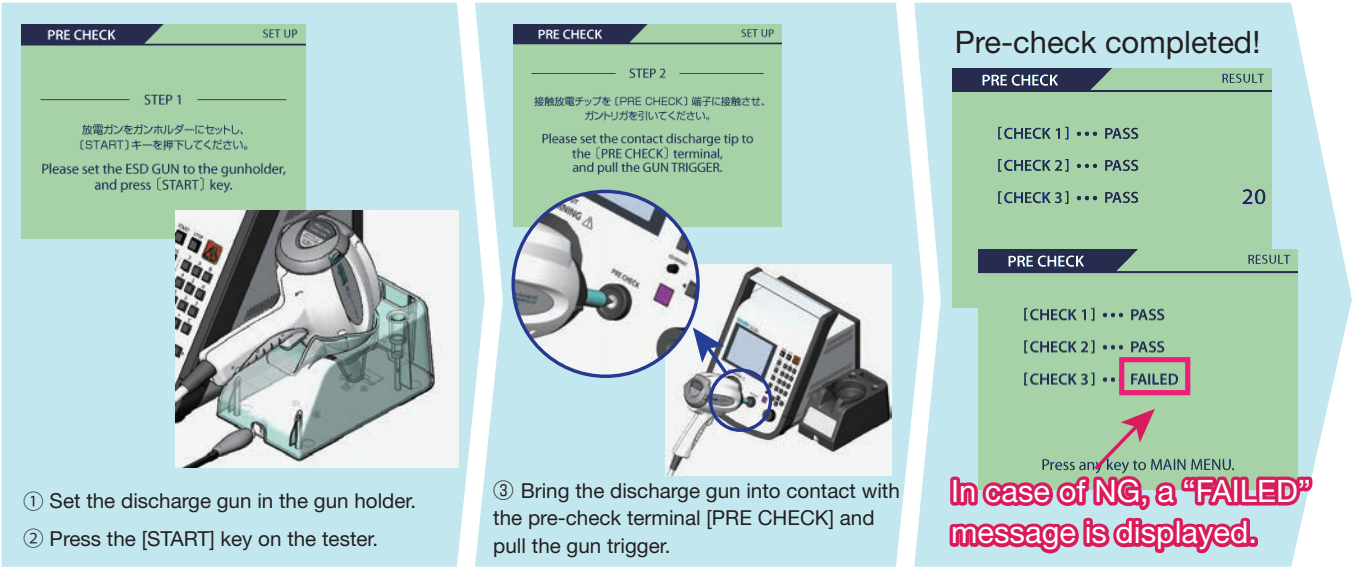
- **“3 pre-checking function” to make sure the more confirmable test**
- **“CR constant indicator” to make sure the correct unit attachment**
- **One-touch exchange of gun head and CR unit realized**
- **“Ten-key & Rotary knob” to ease the setting.**
- **“Infra-red Remote Controller” to realize the setting remotely from the generator (Standard attached).**
- **“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.**

* The software is scheduled to be downloaded freely 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 not 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.



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

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

[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.

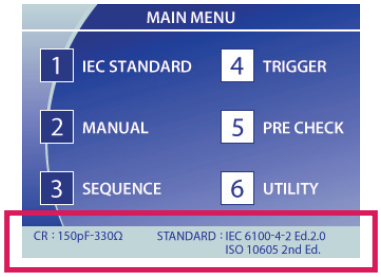
ESS-S3011A & GT-30RA

"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

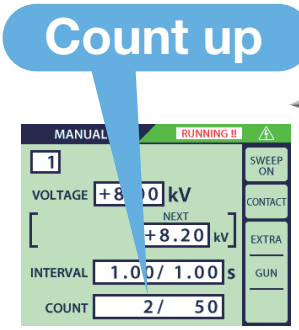
*There are restrictions on the display pattern.

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

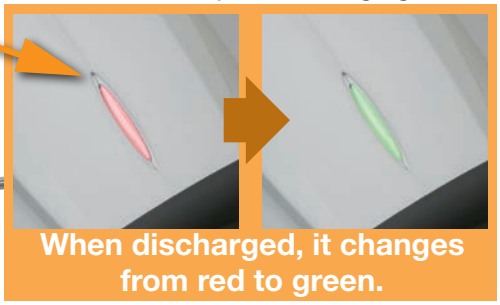
Easy to Check for Discharge Equipped with discharge detection function.

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**



LED on the top of discharge gun.



When discharged, it changes from red to green.

"Infra-red Remote Controller" standard attached to realize the setting remotely from the generator

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 operation can be controlled by the remote controller.

ESS-S3011A & GT-30RA

The discharge gun becomes 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, since it has checked only visually, it is now to check the presence or absence of discharge during aerial discharge, which was difficult to check, with the LED on the top of the discharge gun, making it easy to check. Also, it is a discharge gun with a full range of functions and operations, such as easy replacement of the CR units and discharge cups, which used to take time and effort, and the installation of an "LED light" that brightly illuminates the application.

Equipped with an LED light that illuminates the application location.

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 availabler

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

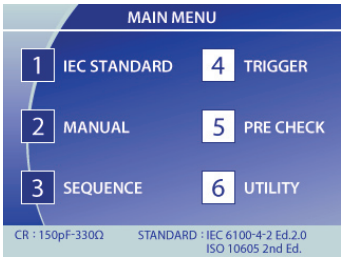
CR unit

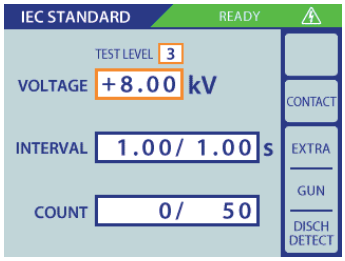
Discharge tip
(Spherical 30 mm)

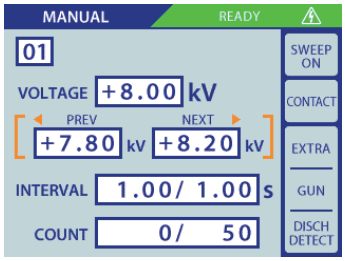
ESS-S3011A & GT-30RA

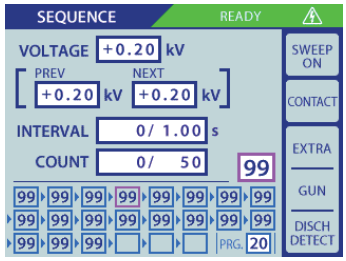
High visibility LCD panel and operatability

Reviewed the past operatability so that more easy and optimal 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 and number of times of the test can be selected and also the set conditions can be recorded. Sweeping discharges can be set as well. 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.









Specification

Parameter	Specification
Polarity	Positive / Negative
Output voltage	0.20 kV ～ 30.0 kV ± 5% (30.5 kV max) ～ 10.0 kV : 0.01 kV step ～ 30.0 kV : 0.1 kV step
Repetition cycle	0.05s ～ 600s ±10% / Manual Set step : 0.01s (0.05 ～ 9.99s), 0.10s (10.0 ～ 600.0s)
No. of time of discharge	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) SETP1 : High voltage output checking STEP2 : Withstanding voltage checking STEP3 : Discharge relay operation checking
CR & Gun head checking	CR constant and gun head recognizable (with an indicator to prevent the wrong combination)
"IEC STANDARD" test mode	Contact discharge mode : 2.0 kV, 4.0 kV, 6.0 kV and 8.0 kV step Air discharge mode : 2.0 kV, 4.0 kV, 8.0 kV and 15.0 kV step
"MANUAL" test mode	Contact / Air discharge mode, Arbitrary setting during 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 ± 10%, 330 Ω ± 10%(Built-in CR unit for discharge gun GT-30RA)
Charge resistor in generator	10 M Ω (Totally 53 Ω in combination with 43 M Ω in discharge gun)*
AUX connector	D-SUB 15 pins female connector (for connecting to patolight, 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 ± 10% 75VA
Dimensions	Generator : (W)392 mm × (H)312 mm × (D)295.3 mm (gun holder included) Discharge gun : (W)83.3 mm × (H)217.2 mm × (D)229.3 mm
Weight	Generator : approx. 7.5 kg Discharge gun : approx. 800 g (cable and connector excluded)

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

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

ESD Simulator

ESS-B3011A & GT-30RA

Cost-oriented Basic models

Cost-oriented basic model ESD Simulator the light Weight discharge gun attachable.
The output voltage can be selected max. 30 kV.
And compliant to both EN / IEC 61000-4-2 Standard and ISO 10605 Standard.

- **"Pre-checking function" taking the confirmable test into the account**
- **"CR constant checking function" (No indicator) to make the correct unit attachment sure"**
- **"Discharge Detecting Function" to realize the air-discharge confirmation.**
- **"Lightest Discharge Gun in the market" to lighten the continual operation"**
- **"White LED Irradiator" to facilitate the visualization of the discharging area.**
- **One-touch exchange of gun head and CR unit realized**

*** ISO 10605 compliant test performable with addition of the gun head and CR units (only with ESS-B3011A)**

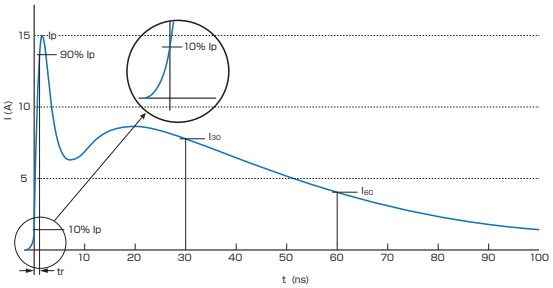
*Probe stand for the discharge gun is option.

Specification

Parameter	Specification
Modell	ESS-B3011A
Output voltage	0.20 kV ~ 30.0 kV ± 5% (30.5 kV max)
Polarity	Positive / Negative
Repetition cycle	0.05s ~ 9.99s ± 10%, 0.01s step / Manual
No. of time of discharge	1 ~ 999 times, Preset 1 time step or continuous preset
Discharge mode	Contact discharge / Air discharge
Trigger mode	Gun trigger / Main trigger
Operation panel	Indicator : 5 × 7 Dot matrix LED / Operation : Push buttons (Partially lighting)
Radiation mode select switch	Extra / Normal switching function built-in
Discharge detection	Discharge detection function in air-discharge equipped.
Pre-checking function	High voltage output checking function (by user operation. Not the calibration but just checking)
CR & Gun head checking	CR constant and gun head recognizable (to prevent the wrong combination without indicator)
IEC LEVEL Switching function	Contact discharge mode : 2.0 kV, 4.0 kV, 6.0 kV and 8.0 kV step Air discharge mode : 2.0 kV, 4.0 kV, 8.0 kV and 15.0 kV step
Warning lamp	Lighting at voltage output from the generator. Blinking at electro-static discharging
Charge capacitor / resistor	150 pF ±10%, 330 Ω ± 10% (Built-in CR unit for discharge gun GT-30RA)
Charge resistor in generator	10 MΩ (Totally 53 Ω in combination with 43 MΩ in discharge gun)*
Power supply / consumption	AC 100 V ~ AC 240 V ± 10% 50 Hz / 60 Hz 62 VA
Dimensions	Generator : (W)270 mm × (H)263 mm × (D)200 mm Discharge gun : (W)83.3 mm × (H)217.2 mm × (D)229.3 mm
Weight	Generator : Approx. 4.8 kg Discharge gun : Approx. 800 g (excluding cable and connector)

* Remote control function not built-in.
* The constant depends on combination with CR unit for the discharge gun

Discharge output waveform (IEC Standard)



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 (quantitable 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, versatilely utilized for another tests like impulse noise immunity test, etc.

- ESD test environments in conformance with EN/IEC61000-4-2 standard
- High reproducible tests can be performed
- Can be verstatilely utilized for another tests

Test setup example with ESS-801
* Contents in the set referred to following specification

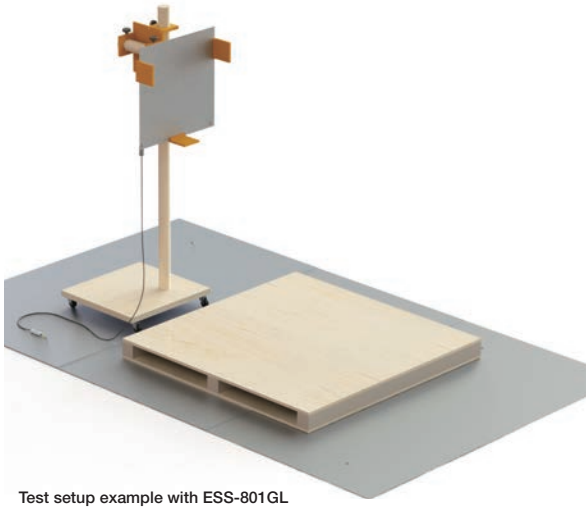
Specification

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 plate	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 plate	03-00020A	(W) 1600 × (D)800 × (t) 1.5 mm	1 pc.

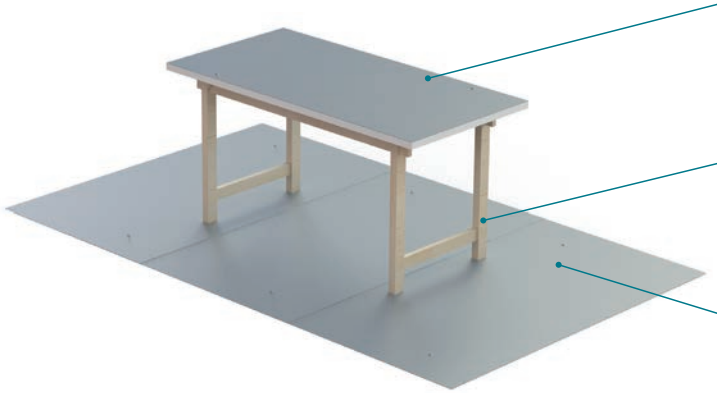
ESS-801GL (Floor-standing type)

Item	Model	Dimensions	Q'ty
Insulating support	03-00024A	(W) 1200 × (H)1200 × (t) 100mm	1 pc.
Floor-standing vertical coupling plate	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-801GL
* Contents in the set referred to following specification

■Option



Horizontal Coupling Plate (HCP) MODEL : 03-00020A

Metal plate 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

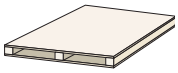
Ground Reference Plane (GRP) MODEL : 03-00007A

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.

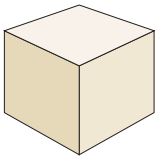
Insulating support MODEL : 03-00024A



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 loads : 500 kg

Option

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 loads: 500 kg

Automated ESD Eliminator MODEL : 01-00013B

Enable to eliminate electric charge which has been charged to EUT automatically with connection to ESS-S3011A

●Available model : ESS-S3011A

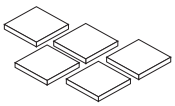
Probe Stand MODEL : 03-00108A

A probe stand used to fix the discharge gun for ESD Simulator. (Excluded from IEC standard) Because of the articulated type, the discharge gun fixes in any direction.

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

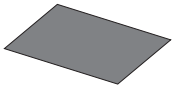
●Available discharge gun : GT-30R series

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 × 10^9 Ω
W1000 × D500 × t2 mm

ESD Elimination Brush MODEL : 05-00125A

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

Conversion Adaptor for Probe Stand MODEL : 03-00074A

Adaptor for connecting between probe stand PS-806 or 03-00022B and discharge gun GT-30R series.

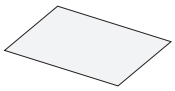
●Available discharge gun : GT-30R series

Free Arm Gun Stand MODEL : 03-00022B

Enable to move discharge gun vertically and horizontally to arbitrary desirable discharging point.
(Out of ISO Standard)

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

Aluminum Plate for Test MODEL : 03-00053A

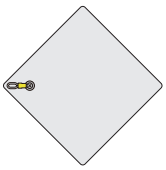
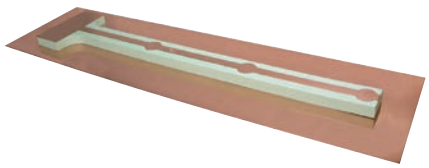


Plate to be laid out under tires for the vehicle test
W500 × D500 × t1.5 mm

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 Plate for ISO 10605 Annex F MODEL : 03-00065A



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

Option

CR Unit M

CR unit for ESD gun GT-30R series

●Available discharge gun : GT-30R series

*** Please contact us when the other CR constant is required than the right description.**
*** The unit size depends on the capacitor constant.**

Model	CR constant	Model	CR constant
06-00073B	150 pF - 330 Ω	06-00081B	150 pF - 150 Ω
06-00074B	150 pF - 2 kΩ	06-00082B	500 pF - 500 Ω
06-00075B	330 pF - 330 Ω	06-00083B	500 pF - 5 kΩ
06-00076B	330 pF - 2 kΩ	06-00084B	250 pF - 100 Ω
06-00077B	500 pF - 0 Ω	06-00085B	200 pF - 100 Ω
06-00078B	150 pF - 500 Ω	06-00086B	250 pF - 0 Ω
06-00079B	100 pF - 1.5 kΩ		
06-00080B	200 pF - 0 Ω		

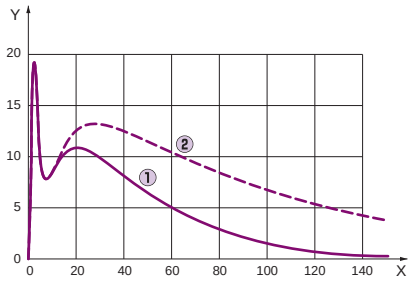
● For ISO 10605 compliant test

●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
06-00074B	150 pF - 2 kΩ CR unit
06-00075B	330 pF - 330 Ω CR unit
06-00076B	330 pF - 2 kΩ CR unit
12-00007A	conical tip
12-00008A	round tip
12-00009A	spherical tip

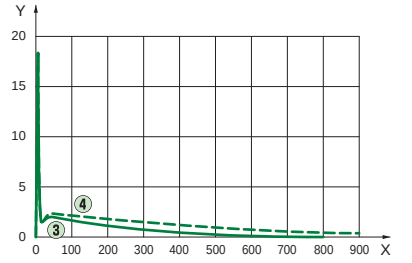
2 kΩ gun head

Spherical (φ30 mm) discharge tip



Energy storage capacitor / Discharge resistor values	1st discharge peak current	t_1 Current	t_2 Current
150 pF / 330 Ω ①	3.75 A / kV ±10%	2A / kV ± 30% (t_1 = 30 ns)	1 A / kV ± 30% (t_2 = 60ns)
330 pF / 330 Ω ②	3.75 A / kV ±10%	2 A / kV ± 30% (t_1 = 65 ns)	1A / kV ± 30% (t_2 = 130 ns)

Energy storage capacitor / Discharge resistor values	1st discharge peak current	t_1 Current	t_2 Current
150 pF / 2 kΩ ③	3.75 A / kV +30% -0%	0.275 A / kV ±30% (t_1 = 180 ns)	0.15 A / kV ± 50% (t_2 = 360 ns)
330 pF / 2 kΩ ④	3.75 A / kV + 30%-0%	0.275 A / kV ±30% (t_1 = 400 ns)	0.15 A / kV ± 50% (t_2 = 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 lined up.

●Available discharge gun : GT-30R series

Fast Rise Time Adaptor MODEL : 03-00073A

Fast Rise Time Adaptor MODEL : 03-00073A
Realize 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.

●Available discharge gun : GT-30R series

Discharge Tip MODEL : 12-00007A / 8A / 9A

Discharge tips on the gun.
Conical (12-00007A) and Round (12-00008A) are standard equipped with GT-30R series.
The all 3 tips are standard equipped with GT-30R series.

●Available discharge gun : GT-30R series

Impulsive Electric Field Adoptor MODEL : 03-00068A

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

●Available discharge gun : GT-30R series

Option

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 IEC)

- Available discharge gun : GT-30R series

Magnetic Field Adapter MODEL : 03-00070A

Magnetic field adapter for Ford standard. Connected to GT-30R series discharge gun, it generates transient magnetic fields.

- Available discharge gun : GT-30R series

Item	Specification
Loop coil diameter	155 m
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

- Available 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.

- Available discharge gun : GT-30R series

Specialized Case for Discharge Gun MODEL : 09-00006A

Specialized Case for putting the discharge gun, CR units and the other related fixtures and carrying them out.

- Available discharge gun : GT-30R series

Warning Lamp MODEL : 11-00014B

Caution is alerted with its blinking while the HV circuit is on.

- Available 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

- Available model : ESS-S3011A

Optical USB Module MODEL : 07-00022A

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

- Available model : ESS-S3011A

Optical RS232 Module MODEL : 07-00017A

Optical conversion adaptor used for remote control with PC.
5 m of optical fiber cable with RS232 interface attached.

- Available model : ESS-S3011A

Option

Faraday cage MODEL : FC-200

Farady 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.

Item	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

Load Resistor Mounting Board MODEL : 03-00052B

The board to fix the load resistor (MODEL NO. 06-00067A 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 : 02-00132A

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

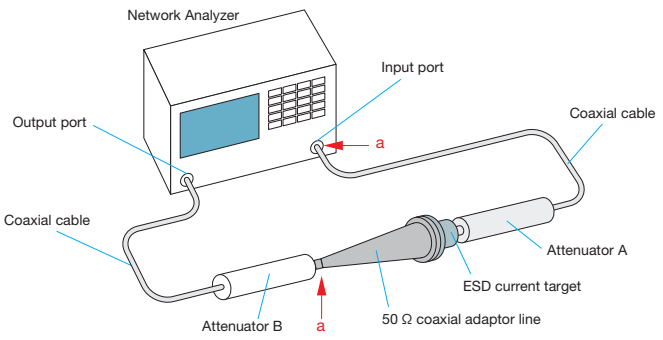
Stand to pull and fix the ground cable of discharge gun 0.5 m backward at the middle of the cable when calibrating the ESD current.

ESD Current Target Calibration Set MODEL : 06-00068A

Set to calibrate the ESD target (06-00067A) in conformance with IEC61000-4-2 Ed.2.0 (2008).

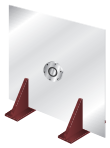
Adaptor (06-00068A)

A photo of 06-00067A ESD target and 06-00068A adaptor connected faced to face



a : Calibration points with networks analyzer

Load Resistor Mounting Board MODEL : 03-00027A



The board to fix the load resistor (MODEL NO. 06-00067A ESD current target) for measuring the discharge current waveform defined in IEC61000-4-2 Standard and ISO 10605 Ed.2 Standard. (not conforming to the standard strictly but simply)
Dimensions : 0.6 m × 0.6 m

ESD Current Target MODEL : 06-00067A

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

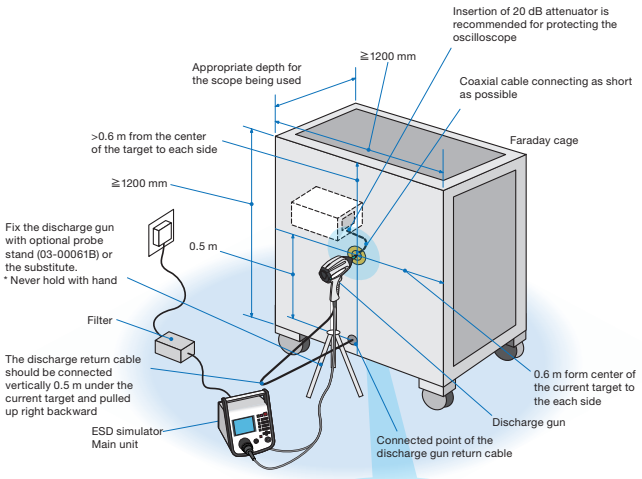
Parameter	Specification
300 kHz ~ 1 GHz	±0.5 dB
1G Hz ~ 4 GHz	±1.2 dB
Maximum applied voltage	15 kV
Conversion ratio	2 V / 1 A (50 Ω termination)
Weight	Approx. 400 g

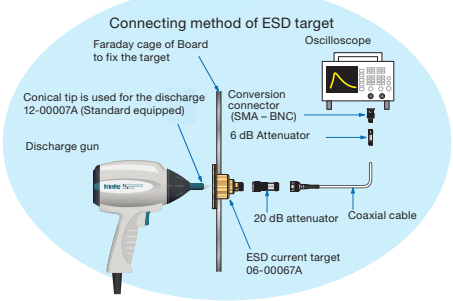
Discharge Gun Mount MODEL : 03-00061B

Fixture to load and fix the discharge gun to be Farady cage (FC-200) or load resistor mounting board (03-00052B)

Attenuator MODEL : 00-00010A / 00-00011A

Attenuator to protect measurement equipment for ESD current waveform.
00-00010A : Attenuation ratio 6 dB / SMA connector
00-00011A : Attenuation ratio 20 dB / N connector





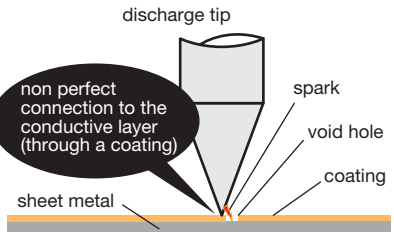
Micro-gap Discharge Tip **MODEL : 12-00010A**

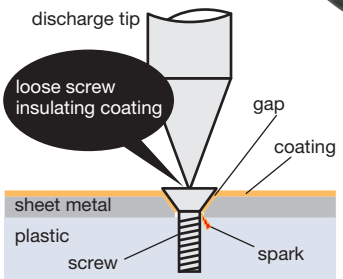
Enabling a more stringent evaluation for the real world ESD immunity

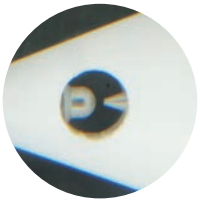
Connected to the NoiseKen ESD gun, this tip allows for a waveform with higher peak amplitude and a faster rise time. It is a common view that ESD immunity testing is the most challenging and passing the standard test does not always assure real world immunity. This tip is helpful for more extensive testing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

dedicated cup
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



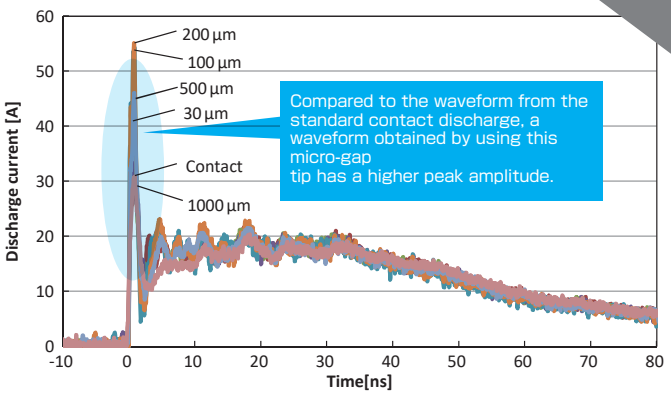




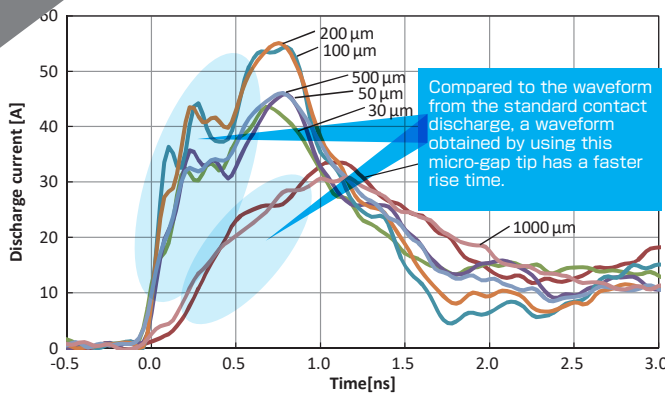
enlarged photo of the micro-gap

Simulated field events

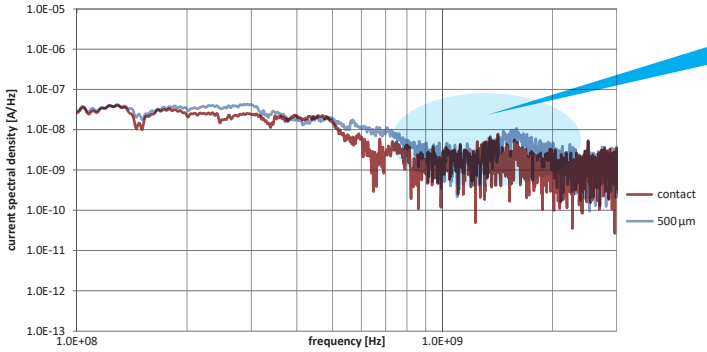
■ Output waveform (reference)



entire waveform

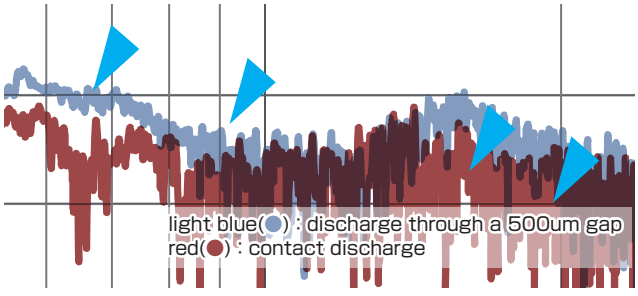


waveform leading edge



discharge current energy spectral density

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 region

■ Compatible discharge gun

TC-815S, 815R, 815ISO, 815-330, 815-2K, 815S-330, GT-30Rseries (the dedicated cup 03-00103A required)

*This product cannot be used for the air discharge testing

IEC61000-4-2 Ed.2 Test Standard

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 an charged human body discharges to electronic equipment and testing with the circuit to simulate current waveform generated in such conditions

2. Test Level

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

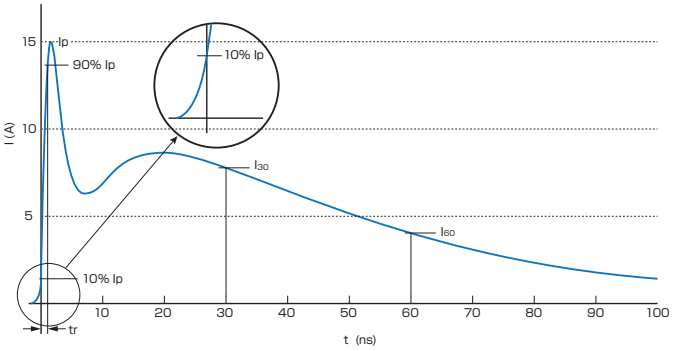
*** × can be any level determined by consent between the EUT manuracturer and the simulator supplier**

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

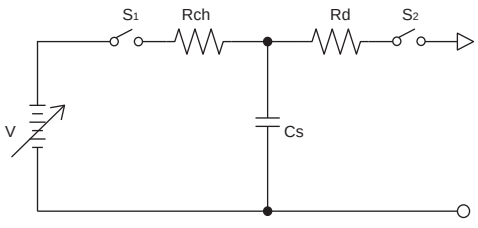


Discharge current waveform and its characteristics

Generator characteristics

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

Level	Indicated voltage	1st 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

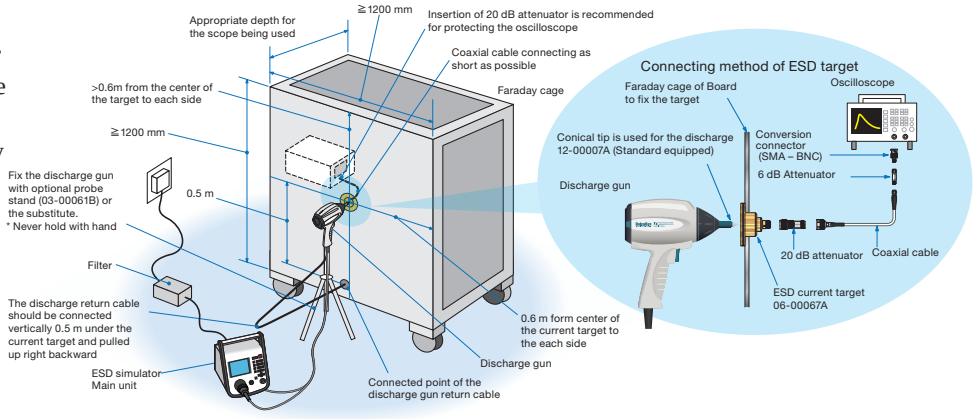


Capacitance Cs : 150 pF
Discharge resistance Rd : 330 Ω

Simplified diagram of the ESD generator

Waveform verification of ESD Generator

Measure the waveform with an oscilloscope whose band width is 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.

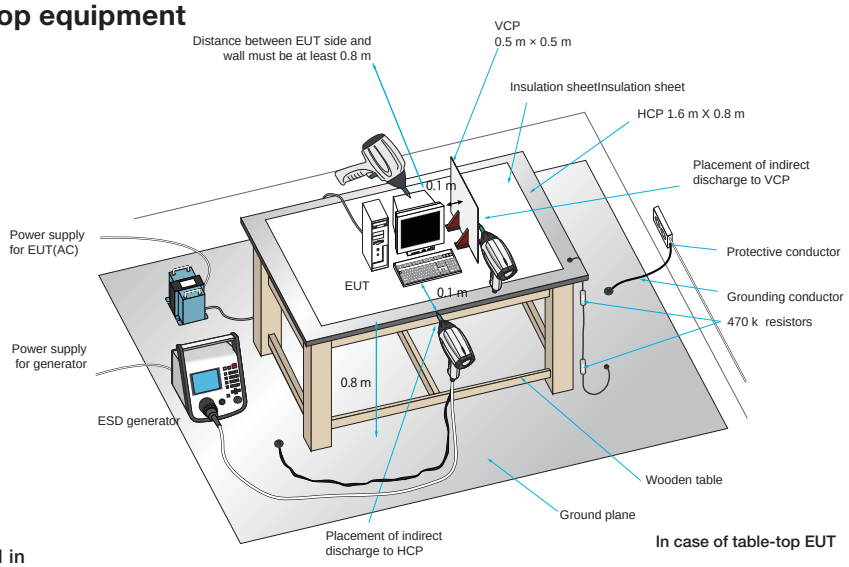


* It is recommended that insertion of approx. 20 dB attenuator for protecting the measurement equipment although it is not specified in IEC Standard.

4. Test setup

Example of test set-up for table-top equipment

The direct discharge test is electrostatic direct discharge to EUT and examine the influence.
Put a wooden table whose height is 0.8 m on the ground plane and place horizontal coupling plate (HCP 1.6 m × 0.8 m).
Connect the HCP with resistor 470 kΩ × 2 to the ground plane and lay a insulation sheet between the HCP and the EUT.
The indirect discharge test is electrostatic discharge to the HCP and vertical coupling plate (VCP 0.5 m × 0.5 m) and examine the influence of EUT. Connect the VCP with resistor 470 kΩ × 2 to the ground plane as well.

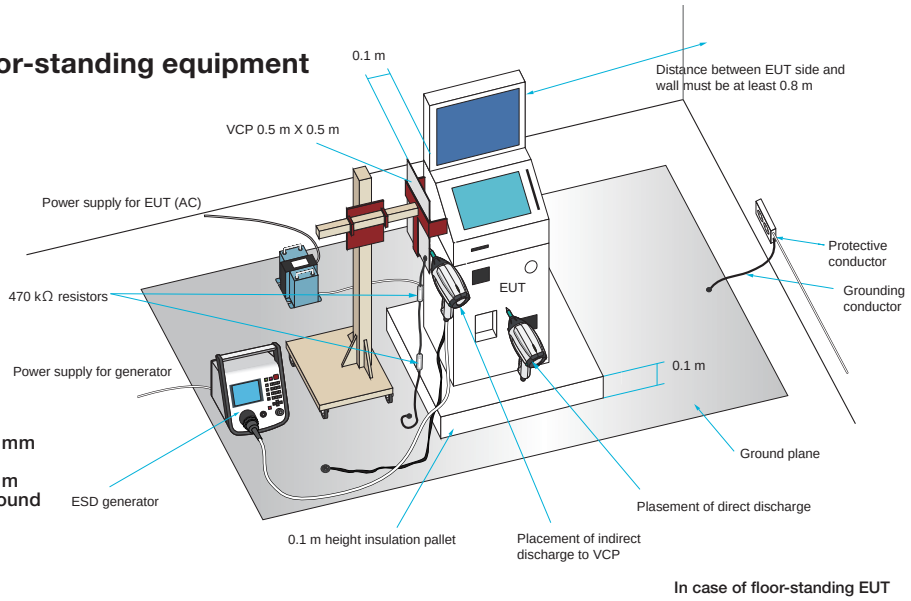


In case of table-top EUT

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

Example of test set-up for floor-standing equipment

Put an insulation pallet whose 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 electrostatic discharge to the VCP and examine the influence of EUT.
Connect the VCP with resistor 470 kΩ × 2 to the ground plane as well.



In case of floor-standing EUT

* Float cables from the ground plane with 0.5 mm thickness insulation sheet.
* Keep GND cable of the discharge gun ≧ 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 Test Standard

5. Test Procedure

Climatic and Other Environmental Conditions

It is necessary to leave equipment which are brought in from different climatic conditions fully 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	15ºC to 35ºC
Relative humidity	30% to 60%
Atmospheric pressure	86 kPa (860 mbar) to 106 kPa (1060 mbar)
Electromagnetic conditions	Level not to affect the test result

Test Procedure

Direct discharge test : Contact discharge (at 1 second interval) and air discharge
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 which 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 (2009) and JIS C 61000-4-2 standardsed.2.0 (2005) Standard for applying to our products.
Please go through the Standards if the more details are required.

ISO 10605 Ed. Test Standard

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 provides 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, also, the Standard provides tests procedures to evaluate the immunity of the each module against simulated human discharges during the assembly process or in servicing.

2. Test level

The following tests levels are 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)

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

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

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

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

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

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

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

3. Specification of generator and verification of output waveform

Specification of ESD simulator

Following specification must be satisfied with the simulator for the test.

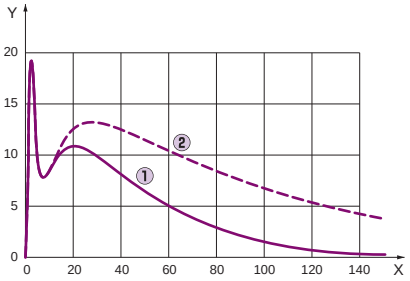
Parameter	Specification
Output voltage . Contact discharge-(kV)	2 kV ~ 15 kV
Output voltages - Air discharge-(kV)	2 kV ~ 25 kV
Output voltages accuracy (%)	≦ 5%
Polarity	Positive and negative
Rise time of short circuit current in contact discharge mode(10% to 90%)	0.7 ns ~ 1 ns
Holding time	≧ 5 s
Storage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

Testing Summary according to ISO 10605 Ed.2 Standard

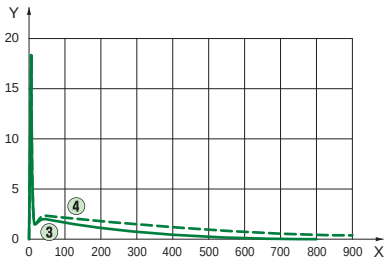
Contact discharge mode current specifications

Following discharges characteristics should be verified.

Typical capacitance / resistance values	Peak current / charge voltage	Current at T1 / Charge voltage	Current at T2 / Charge voltage
① 150 pF / 330 Ω	3.75 A / kV ± 10%	2 A / kV ± 30% (t1 = 30 ns)	1 A / kV ± 30 % (t2 = 60 ns)
② 330 pF / 330 Ω		2A / kV ± 30% (t1 = 65 ns)	1 A / kV ± 30 % (t2 = 130 ns)
③ 150 pF / 2 kΩ	3.75 A / kV + 30% -0%	0.275 A / kV ± 30% (t1 = 180 ns)	0.15 A / kV ± 50 % (t2 = 360 ns)
④ 330 pF / 2 kΩ		0.275 A / kV ± 30% (t1 = 400 ns)	0.15 A / kV ± 50 % (t2 = 800 ns)



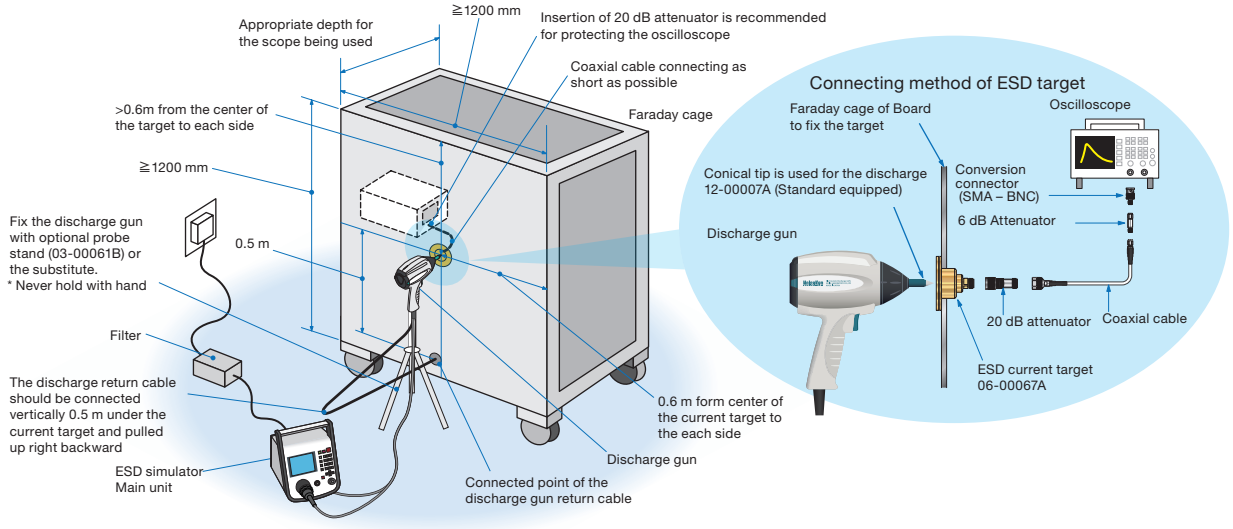
Discharge resistance 330 Ω (at 5 kV)



Discharge resistance 330 Ω (at 5 kV)

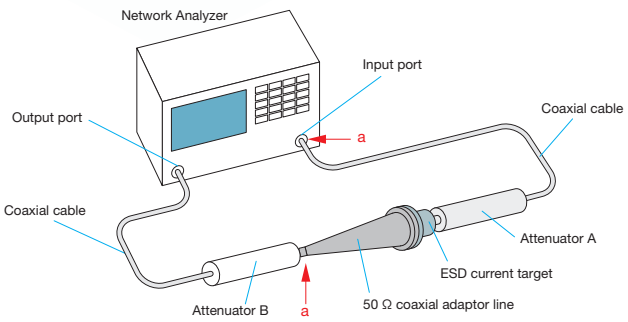
Verification of output current waveform

The waveform shall be verified with an oscilloscope whose 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.



Calibration of target


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



a : Calibration points with networks analyzer

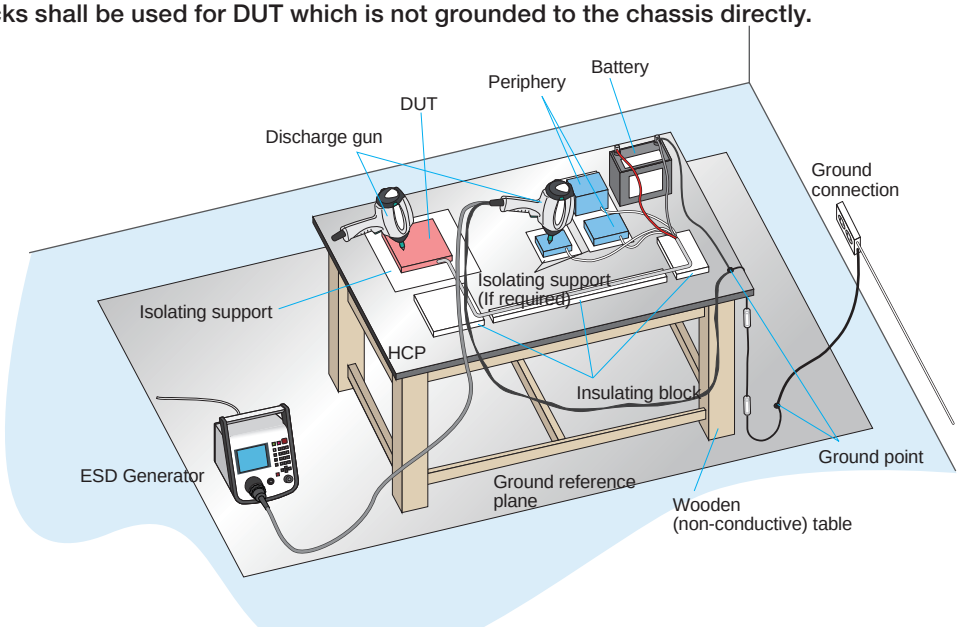

Figure of attaching ESD current target and the calibration adaptor (Left : Target Right : Adaptor)

Testing Summary according to ISO 10605 Ed.2 Standard

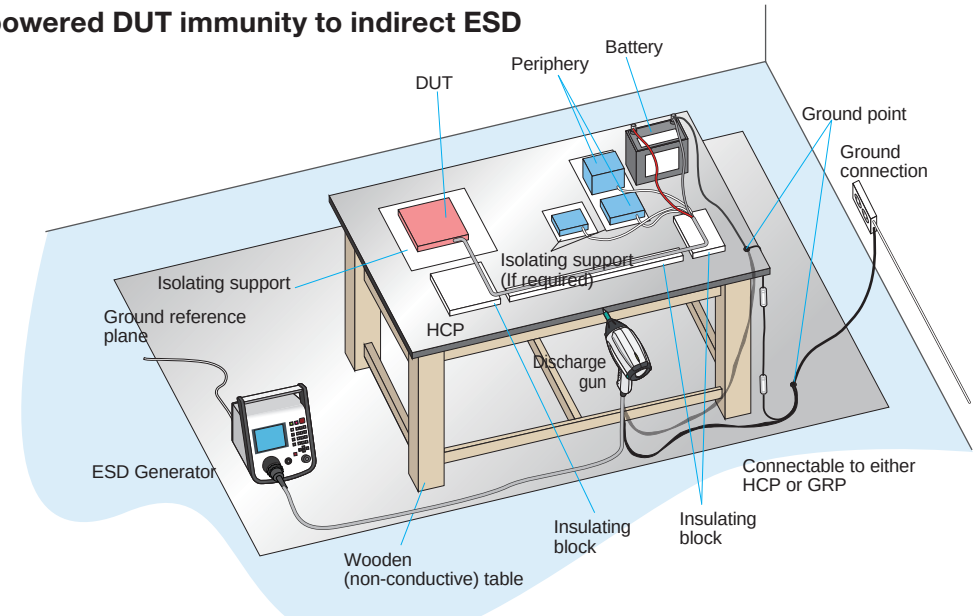
4. Test setup and test procedure

For testing powered DUT immunity to direct ESD - Contact discharge and air discharge

- Capacitance shall be selected to 150 pF (In case for components accessible from outside vehicle) or 330 pF (In case for components accessible from inside vehicle) and resistance shall be 330 Ω.
- The test level shall be two or more.
- At least 3 discharges shall be applied both to the positive and negative polarities with the interval not less than 1s. The time intervals between successive single discharges in the indirect discharge shall be longer than 50 ms and the number of the test shall be > 50 times.
- In the contact discharge, it shall be done to wherever human finger may touch.
- In the air discharge, the speed of approach should be between 0.1 m / s and 0.5 m / s and the discharge tip is held perpendicular to the surface of the DUT when possible; if not possible, an angle of at least 45° to the surface of the DUT is preferred.
- Insulating blocks shall be used for DUT which is not grounded to the chassis directly.



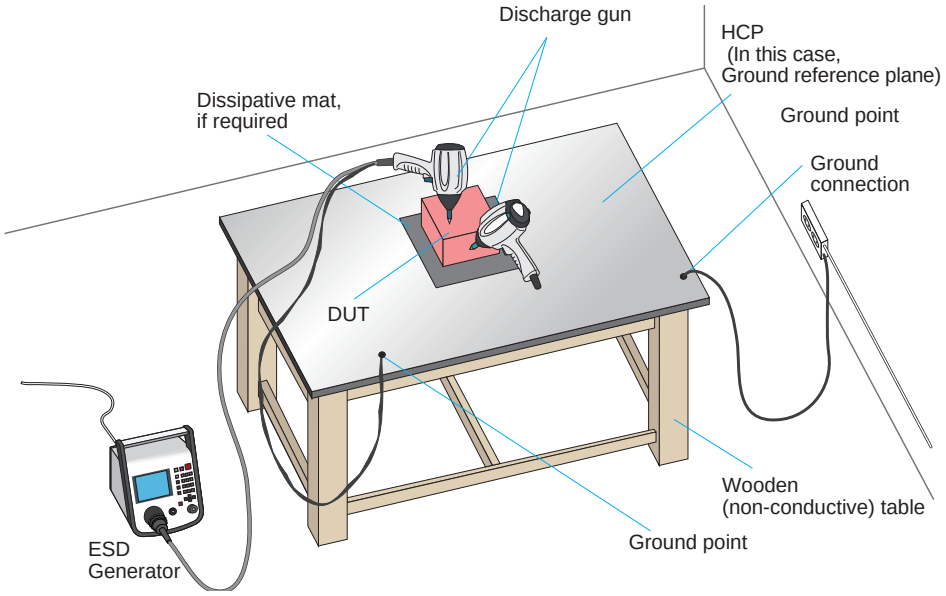
For testing powered DUT immunity to indirect ESD



Testing Summary according to ISO 10605 Ed.2 Standard

For testing (unpowered) packaging and handling ESD sensitivity

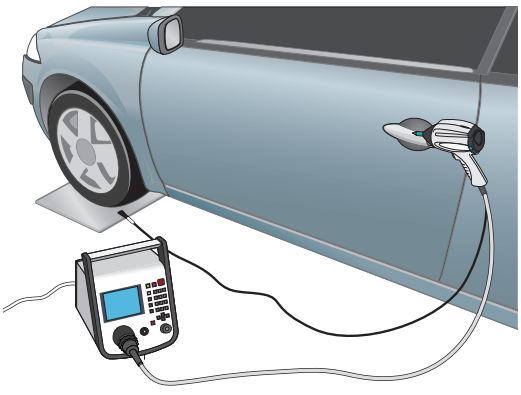
- Capacitance shall be selected to 150 pF (Although the resistance value is not provided, it is recommended to perform the tests supposing both resistance when the DUT may be directly accessible by human body (2 kΩ) and it may be accessible by a metal object a human hold (330 Ω))
- The test level shall be two or more.
- At least 3 discharges shall be applied both to the positive and negative polarities with the interval not less than 1s.
- In the contact discharge, it shall be done to wherever human finger may touch.
- Charge build-up should be eliminated by briefly connecting a bleeder wire with high resistance (> 1 MΩ) after the discharge and the DUT shall be turned on. Afterwards, normal operation of it shall be confirmed.



Vehicle test – Internal and external points

- Choose a generator capacitance of 330 pF for areas that can easily be accessed only from the inside of the vehicle and resistance of 330 Ω or 2 kΩ
- Choose a capacitance of 150 pF for points that can easily be touched only from the outside of the vehicle and resistance of 330 Ω or 2 kΩ.
- The ESD generator ground shall be connected to chassis like the seat-rail in case of the interior test or connected to a metallic plate under the wheel closest to the application point in case of the exterior test.
- Both the contact discharge and air discharge shall be done both for the internal and external.

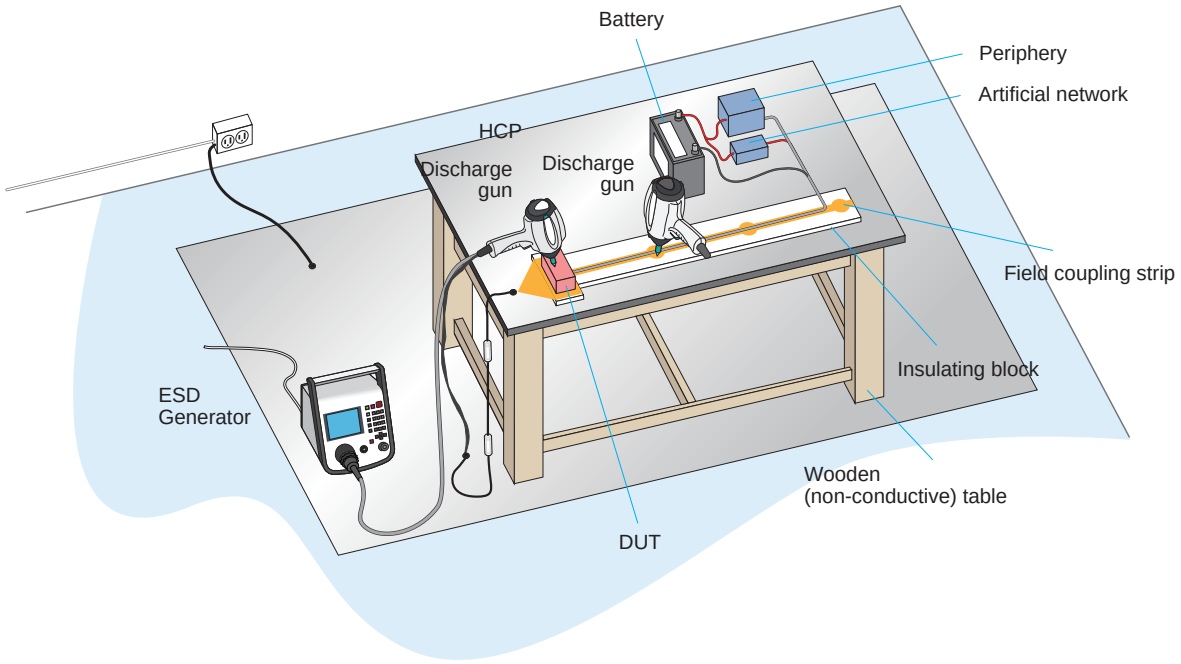
Internal test



External test

Testing Summary according to ISO 10605 Ed.2 Standard

Optional test set-up and procedure for electronic modules (powered-up test) – Direct and indirect discharge



Notes: This test set-up is quoted from ISO10605 ed2.0 (2008) Standard.
Please go through the Standard if the more details are required.

Impulse Noise Simulator (semi-conductor type)

INS-S220

To solve the real trouble in the market

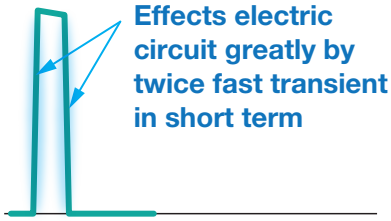
Noise simulator can simulate high frequency noise generated ON/OFF at contact point of switch or relay, arc caused by electric motor. It can evaluate the resistibility of electric devices.
Pulse contains high frequency and by energy volume is changable by adjusting pulse width. The high reproduction noise test of noise trouble in the market can be conducted.

- Repetition cycle becomes faster. Due to high repetition, mal-function occurrence rate is up and test time is to be shortened.
- Pulse width setting becomes easier.
  Just by pushing button, pulse width setting is available by 50 ns step. Setting time and connection mistake can be reuced.
- Pulse waveform stability is improved, so high reproduction test is available.
- Cost is cut down because consuamable parts are reduced.
- Common mode/normal mode test is easily to switch by short plug.
- Wiring becomes easier because 50 Ω resisitor is built in simulator.
- AC plug of EUT can be inserted directly by outlet panel.(option)
- Various tests are available by using different probes and coupling clamp.(option)
- EUT test with 3 phase 5 lines is available by external CDN.(option)

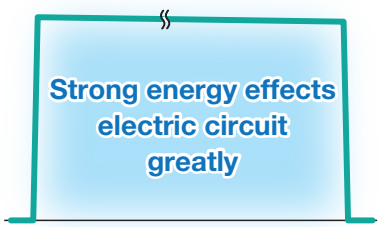
Feature

To solve the trouble in the markethigh frequency, energy volum of test pulse can be ajustable

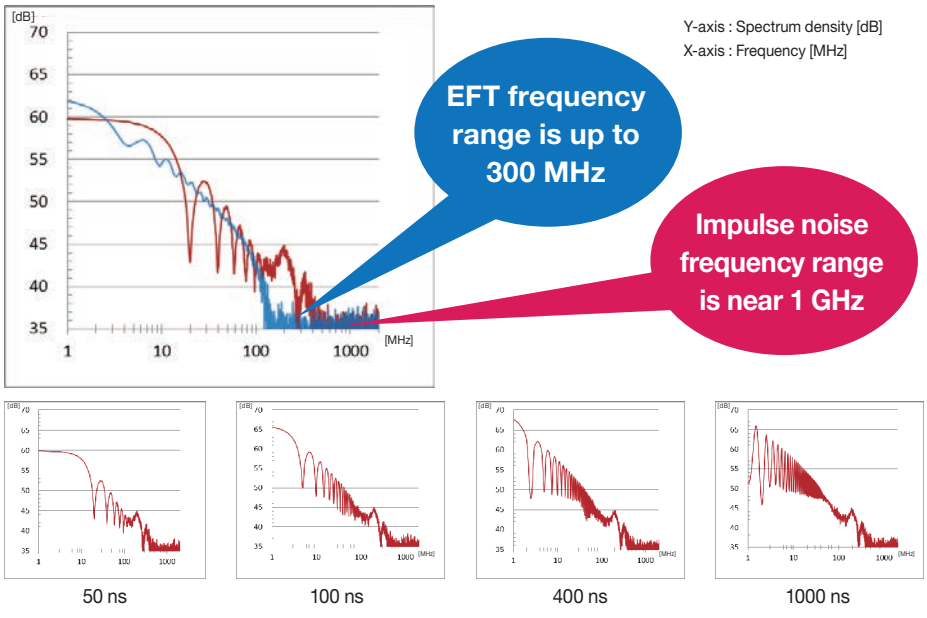
Even narrow pulse with 50 ns ～ 100 ns width contains less energy, twice fast transient due to rise and fall and inducted coupling occurred by sharp electromagnetic field effect electric circuit greatly.
Wide pulse with 800 ns ～ 1000 ns contains more energy, so voltage fluctuation is easily to effect circuit.
The rise time of impulse simulator is faster than IEC61000-4-4 fast transient/burst test, so spectrum is high. When it injects noise to EUT, noise is easier to invade electric circuit internally.
Spectrum and amplitude is different due to Impulse width, so it is recommended to test with different pulse width.



【 50 ns pulse image 】



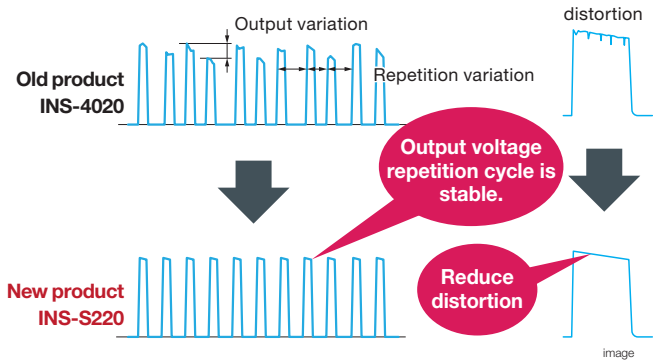
【 1000 ns pulse image 】



INS-S220

Test reproduction is improved. More quantitative test is available.

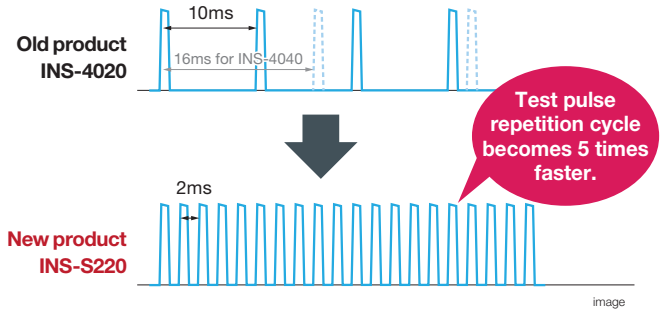
The usual mercury relay changes into semiconductor relay, so test pulse stabability is improved. More quantitative and high reproduction test is available. Also, waveform distortion due to mercury relay's deterioration.



Mal-function rate is up. Test time is to be shortened.

The repetition of pulse in test is faster than the old product. Mal-function rate is up and test time is expected to be shortened.

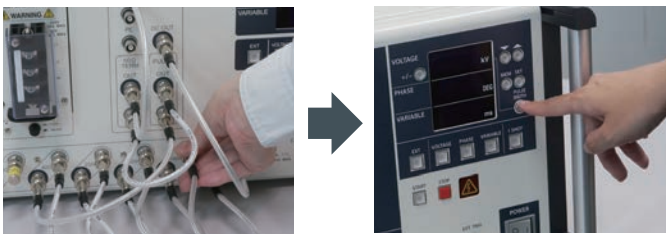
Example) In case that the repetitive cycle is 2 ms



* There are restrictions on the pulse repetition period.

Setting is simplified. Setting time is shortened.

It is troubesome to change the special coxial cables manually in old way. Setting time and connection mistake can be reduced because setting can be operated by button.



Settings for complex cable connections.

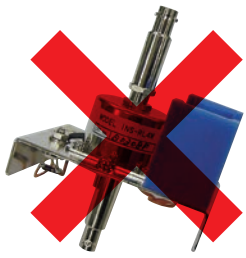
Easy with button operation !!

Connection is simplified. Connection time is shortened.

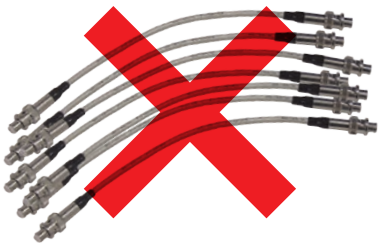
Outlet panel to which EUT is easyily to be connected is adopted.
EUT is easy to connect by using outlet panel (option) complying to each country's socket shape.

Cost is cut down. Consumable parts are reduced.

We adopt semiconductor type relay instead of the mercuray relay in old type.
Also, cost on consumable exchange is reduced because pulse width setting cable (consumable) is no longer needed.



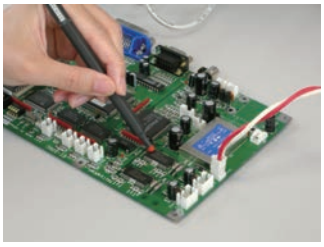
Mercury realy image



Coaxial cable image

Noise countermeasurement is easy. The malfunction generating position can be identified.

From power supply line, signal line, harness, enclosure to PCB, various noise injection options are ready. The malfunction generating position is easy to identify.



INS-S220

Specification

Parameter		Specification
Pulse setting-1	Pulse output voltage	0.50 kV ～ 0.99 kV ± 10%　0.01 kV step
	Pulse width	100 ns ～ 1000 ns ± 10%　50 ns step
	Pulse repetition	1 ms ～ 999 ms ±10%　1ms step
Pulse setting-2	Pulse output voltage	1.00 kV ～ 2.00 kV ± 10%　0.01 kV step
	Pulse width	50 ns ～ 1000 ns ± 10%　50 ns step
	Pulse repetition	10 ms ～ 999 ms ± 10%　1 ms step
Output voltage		0.5 ～ 2.00 kV ± 10%　(10 V step)
Polarity		+ / -
Rise time		< 3 ns
Output impedance		50 Ω
Terminal resistor		50 Ω
Pulse repetition mode	LINE PHASE	50 Hz / 60 Hz　coupling phase angle 0 ～ 360°　± 10° synchronized with L-N of EUT supply or external CDN
	VARIABLE	1 ms ～ 999 ms ± 10 %(～ 1 kV) 10 ms ～ 999 ms ± 10 %(1 kV ～ 2 kV)
	EXT TRIG	Period：> 10 ms Input signal level：TTL/open collector negative logic Pulse width：> 1 ms Also functions for timing reference signals input from an external injection unit.
	1 SHOT	Single pulse generation, each time the 1 SHOT button is pressed. Synchronized (phase angle set on the PHASE control) or asynchronized pulse period.
Memory storage		5 tests
Test time		1s ～ 999s ±10%　1s step
Coulping switch		L(+), N(−), PE ／ PULSE OUT　※manual switch by coxial cable
Coupling mode		common-mode / normal-mode　※manual switch by short plug
EUT power capacity		Single phase AC 240 V / DC 125 V 16 A　(L(+), N(−), PE)
Power supply		AC 100 ～ 240 V 50 Hz / 60 Hz
Operatig temperature / operatig humidity		15 ～ 35℃　25 ～ 75%
Dimensions / Weight		(W)430 × (H)249 × (D)540 mm (projection excluded) / approx. 20 kg
HV coxial cable		NMHV our customized type
Accessory		coxial cable 30 m (02-00013A): 2 pcs, SG short plug (02-00106A): 1 pc, SG cable (05-00103A): 1 pc, outlet panel: 1 pc, AC cable: 1 pc, manual instruction: 1 volum, accessory bag: 1 pc

Option

Attenuator for waveform check MODEL：00-00017A

Attenuator for measuring high voltage pulse.

Parameter	Specification
Attenuation rate	DC ～ 2 GHz：40 dB (100：1)
Input pulse peak voltage	4000V MAX
Tolerable continuous pulse examples	Pulse peak voltage : Max. 4000 V Pulse width : 50 ns ～ 1000 ns Pulse width repetitive frequency : Max. 60 Hz at 4000 V output Max. 100 Hz at 2000 V
Input impedance	50 Ω (50 Ω ± 1 % at DC)
Output impedance	50 Ω (50 Ω ± 1 % at DC)
Interface connectors	INPUT：HN(F) OUTPUT：N(F)
Dimensions/ Weight	(W)154.5 mm × (D)105mm × (H)37 mm / approx. 1350 g

Attenuator MODEL：00-00011A

It is attenuator protecting measuring instrument.
It is recommend to use waveform checking attenuator (00-00017A) to protect measuring instrument.

Attenuating rate 20 dB・N type connector

Outlet Panel MODEL：18-00059C/60B/84A

Outlet panel to be available for different types of connectors in line output of INS-S220.

Model	Specification
18-00059C	JP / USA Type AC 125 V 20 A MAX
18-00060B	CEEType AC 240 V 16 A MAX
18-00084A	multi outlet type

Coupling Clamp MODEL：15-00014A

Enable for testing characteristics against the noise only with clamping interconnection cable of electronic equipment in combination with INS series. The calibration fixture (15-00015A) for this clamp is also available.

- ○**Enable to inject the noise without cutting signal, DC, AC, GND, etc.**
- ○**It can test noise tolerance of electric device separatly.**
- ○**Realize to test the noise resistibility effectively since the injection can be directly to lines.**
- ○**Enable to clamp bundle of lines whose maximum diameter is 20mm**

Parameter	Specification
Input voltage	4000 V Max
Input pulse width	50 ～ 1000 ns
Coupling method	Capacitive coupling
Dimensions / Weight	(W) 350 × (H) 145 × (D) 140 mm / Approx 3 kg
Adequate cable Dimensions	maxium diameter 20 mm
Terminal resistor	none
Coaxial connectors	NMHV(J) NoiseKen custom for the both of input and termination sides

Coupling Adaptor MODEL : CA-805B (Capacitive coupling)

Enable for testing characteristics against the noise only with clamping interconnection cable of electronic equipment in combination with INS series.

- ○**Enable to inject the noise without cutting signal, DC, AC, GND, etc.**
- ○**It can test noise tolerance of electric device separatly.**
- ○**Realize to test the noise resistibility effectively since the injection can be directly to lines.**
- ○**Enable to clamp bundle of lines whose maximum diameter is 26mm**

Option

Coupling Adaptor MODEL : 15-00007A (CA-806 / Magnetic field coupling)

Enable for testing characteristics against the noise only with clamping interconnection cable of electronic equipment in combination with INS series.

- ○**Enable to inject the noise without cutting signal, DC, AC, GND, etc.**
- ○**It can test noise tolerance of electric device separatly.**
- ○**Termination resistance built-in.**

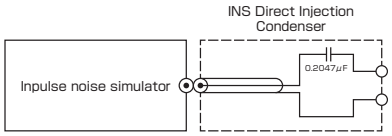
Parameter	Specification
Structure	Magnetic field coupling noise injection clamp
Input voltage	2000 V Max.
Input pulse width	50 ～ 1000 ns
Coupling ratio	1/10±10% of input voltage
Termination resistance	54 Ω system built-in
Max. diameter of ground cable	27 mm
Dimensions/ Weight	(W) 89 × (H) 64 × (D) 120 mm / approx. 1000 g
Coaxial connector	NMHV(J) NoiseKen custom

Pulse Injection Cable

It is noise injection cable combed with noise impulse simulator.
***It can't be used to injected onto where current flows like power supply line.**

INS Direct Injection Condenser MODEL : 01-00047A

CDN and the same condenser for coupling are built in the box.
It is supposed to be used in the case that EUT capacity is 5 V. Thepower doesn't turn on through CDN.

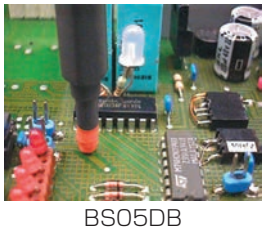


Item	Specification
Coxial connector	NMHV
Connector	Crimp terminal for 6mm
Dimensions / Weight	80 × 80 × 150 mm (projection excluded) ／ 0.4 kg

EMS Probe Kit MODEL : H2-B

Probes set to enable the noise injection onto PCB patterns, flat cables, etc. in the connection with the generator.
The probes can be selected per electric fields or magnetic fields and the irradiation in the near field can be performed.

- ○**Arbitrary noise injection to where it is desired on PCB or harness.**
- ○**Enable to detect point which the noise resistibility is weak per electric field and magnetic field with the probes differentiation.**
- ○**Each 3 pieces of different figure and size are contained for electric field and magnetic field.**
- ○**Enable to pinpoint where the noise resistibility is weak since the injection can be done in such small range several mm.**
- ○**Enable to detect point where the noise resistibility is weak in particular frequency in combination with a signal generator**
- ○**Suited for locating noise sensitive spots by using with the INS or FNS equipment**

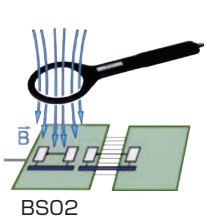

BS05DB


ES02

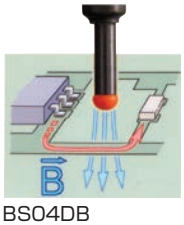

ES00


ES05D

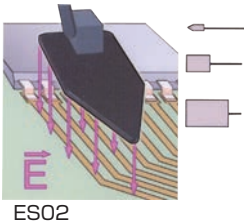

BS02



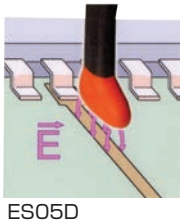
BS02



BS04DB
BS05DB



ES02
ES00



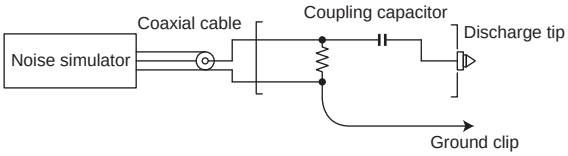
ES05D

Option

Noise Injection Probe MODEL : 01-00034A

- ○Enable to test the noise resistibility in a board level since the direct injection to LSI pin by pin is possible
- ○Possible for the noise injection up to 500 V utilizing the INS or FNS simulator on hand.
- ○Possible to exchange the coupling capacitor (Option)
- ○50 ohm termination resistor built-in

[Option]
Coupling capacitors: 06-00039A : 220 pF, 06-00040A : 330 pF, 06-00041A : 3 pF, 06-00042A : 500 pF,
* 01-00034A. does not contain the coupling capacitors

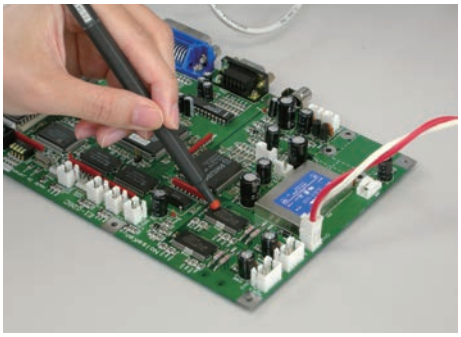


Radiation Probes MODEL : 01-00006A / 7A / 8A / 9A / 10A

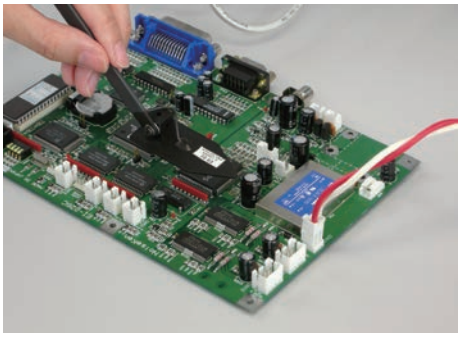
Probes to irradiate the radiation noise to wiring on PCB of electronic equipment so that point where the radiation noise resistibility is weak can be detected.

Parameter	Specification
Input voltage	4000 V Max
Input pulse width	50 ns ~ 1μs
Loop diameter	01-00006A : φ50 mm, 01-00007A : φ75 mm, 01-00008A : φ100 mm 01-00009A : φ150 mm, 01-00010A : φ200 mm, 01-00031A: 250 mm, 01-00050A: 30 mm
Cable length	Approx. 2 m
Approx. Weight	180 g = 220 g
Applicable connector	NMHV type

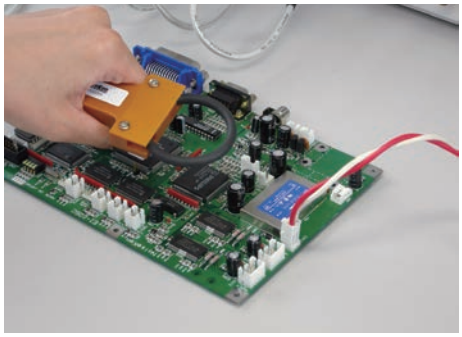
Application Example of Probes



H2-B

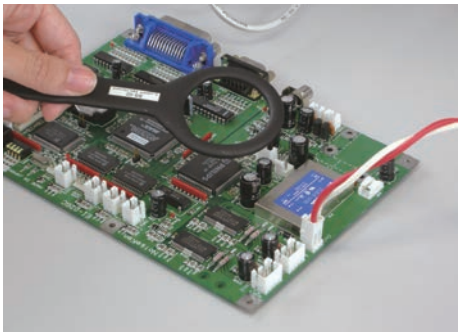


H2-B

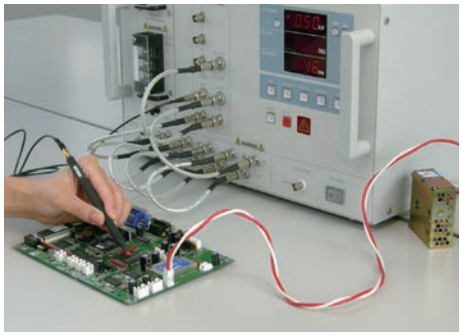


Radiation probe

Noise injection probe



H2-B



H2-B

Option

Injection Unit MODEL : IJ-4050

Unit to enable the noise injection for power supply lines of EUT up to 3-phase 5 lines (L1, L2, L3, N. PE) in combination with main units of INS series. Setting for Normal mode and Common mode is simple and easy only with change of the connectors configurations
In case of the combination with INS-4020 / 4040 / S220, test synchronized with EUT lines can be conducted.

Parameter	Specification
Input impulse voltage	Max. 8 kV without 50 Ω termination Max. 4 kV with 50 Ω termination
EUT power capacity	3-phase 5 lines (L1, L2, L3, N, PE) AC 415 V 50 A (Unavailable for DC) AC 415 V between L1 – L2, L2 – L3, L3 – L1 AC 240 V between L1, L2, L3 – N
Change of injection line	With connectors configurations L1, L2, L3, N, PE
Coupling mode	Normal / Common (Setting with short plug connection)
Line synchronization detection	Detects between L1 – L2 add put out the synchronizatoin signal from SYNC OUT terminal
EUT line protection circuit	Detects current in L1, L2 and L3 lines and breakes L1, L2, L3 and N lines
EUT line input terminal	Terminal block, screw connection
EUT line output terminal	Exclusive contact for φ6
Attenuation characteristics on coupling	≦ -10 dB 10 kHz ～ 1 GHz without load
Residual voltage at input	≦450V Residual voltage without load when 4000V impulse is injected with 50Ω termination
Termination resistance	Nothing (Termination resistance in the main unit is applied)
Power supply	AC 100 V ～ 240 V ± 10% 50 / 60Hz 20 VA Max
Operating temperature / humidity range	15 ～ 35℃ 25 ～ 75%
Dimensions / Weight	(W) 430 × (H)199 × (D) 535 mm (protrusion excluded) / approx. 25 kg

Injection Unit MODEL : IJ-5100Z

Unit to enable the noise injection to power supply lines of EUT up to AC480V / 100A 3 pjase 5 lines (L1, L2, L3, N, PE) in combination with main units of INS series. In case of the combination with INS-4020 / 4040 / S220, test synchronized with EUT lines can be conducte.

Parameter	Specification
Input impulse voltage	Max. 8 kV without 50 Ω termination Max. 4 kV with 50Ω termination
EUT Line	3-phase 5 lines (L1, L2, L3, N, PE) AC 415 V 50 A (Unavailable for DC) AC 415 V between L1-L2, L2-L3, L3-L1 AC 240 V between L1, L2, L3 – N
Maxium voltage of EUT line	AC 480 V
Maxium current of EUT line	100 A
Line synchronization output	1/2 of EUT line input voltage
Through characteristic	within -10 dB under 10 kHz ～ 1G Hz
CDN power supply	AC 100 ～ 240 V ± 10% 50/60 Hz
Dimensions / Weight	(W)488 ×(H)520 × (D)825 mm (protrusion excluded) / approx. 115 kg

Option

Circuit Breaker Box MODEL : 18-000072A (20A) / 18-00073A (50A)

Parameter (18-00072A)	Specification
Rated operating voltage	AC 250 V 50 / 60Hz DC 65 V
Standard Arated current	20 A
Switching life	≧ 10000 times (Test conditions: rated switching 6000 times, switching without load 4000 times, switching frequency 6 times/min
Operating temperature / humidity range	15 ～ 35℃ 25 ～ 75% (without dew)
Dimensions / Weight	(W) 180 × (H)92 × (D) 100mm (protrusion excluded) / 0.75 kg

Isolation Transformer MODEL : TF-2302P

Model TF-2302P is a single-phase isolation transformer rated AC240V/30A and dielectric strength of 4kV. For safety reason, an isolation transformer is indispensable for AC powered testing for equipment.

Parameter	Specification
Maximum input voltage	Single phase AC 240 V Max (50/60 Hz)
Maximum output current	30 A Max
Dielectric strength	Primary winding to core AC 4 kV (1 minute) Secondary winding to core AC 4 kV (1 minute) Primary to secondary windings AC 4 kV (1 minute)
Insulation resistance	100MΩ or more at DC 500 V
Dimensions	(w)350 × (h)475 × (d)400 mm (Eye bolts and handles excluded) / approx. 60 kg

Noise Canceller Transformer NCT series

It has superb attenuation characteristics against impulse noises. It can be used for insulate in the impulse noise test.
***Connection cable is needed to be modified when it is connected with the transformer. Please inquire us for details.**

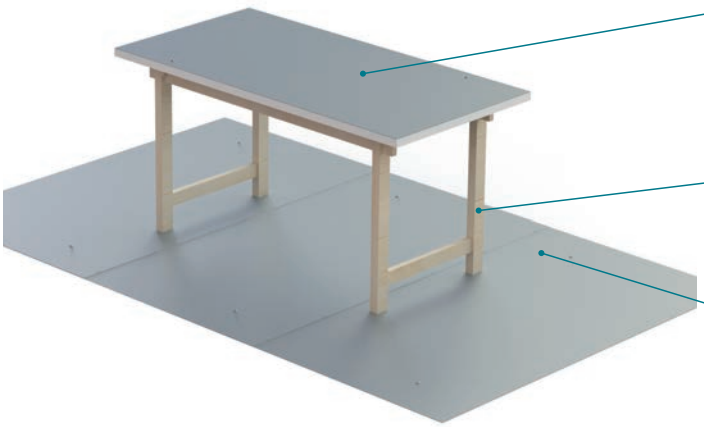
MODEL	Primary Voltage / Secondary Voltage	Rated current	Frequency
NCT-160	120 V	5 A	50/60 Hz
NCT-1120		10 A	
NCT-1240		20 A	
NCT-260	240 V	2.5 A	
NCT-2120		5 A	
NCT-2240		10 A	

Line input cable MODEL：05-00160A Line output cable MODEL：05-00161A

The connection cable between noise impulse simulator and noise canceller transformer on primary winding. Pleas inquiry us for details.

Description	MODEL	Description
Line input cable	05-00160A	Single phase 20 A 3 m Cabtyre cable. "Ring terminal end" - "Stripped end" (termination at customers)
Line output cable	05-00161A	Single phase 20 A 2 m Cabtyre cable. "Ring terminal end" - "Ring terminal end"

Option



Horizontal Coupling Plate (HCP) MODEL : 03-00020A

Metal plate placed on the table for the testing of tabletop EUT.
W1600 × D800 × t1.5 mm × 1 sheet (Made of Aluminum)
* Used as a horizontal coupling plate in ESD testing and also can be used as a ground plane

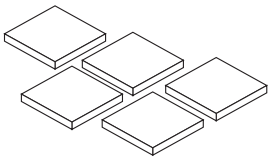
Test Table MODEL : 03-00039A

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

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

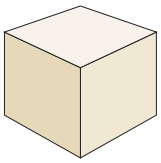
Ground plane to be placed just under the wooden table.
W1800 × D1000 × t1.5 mm × 3 pcs. in 1 set (Made of aluminum)

Insulating Block MODEL : 03-00054A



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

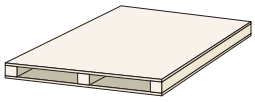
Cubic Insulating Block100 MODEL : 03-00029A



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 loads: 500 kg

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 loads : 500 kg

SG cable MODEL : 05-00103A

Braided wire cable to connect between SG terminal of the main unit and the ground reference plane.
Length : 0.1 m

SG Connection Plate **MODEL : 03-00112A**

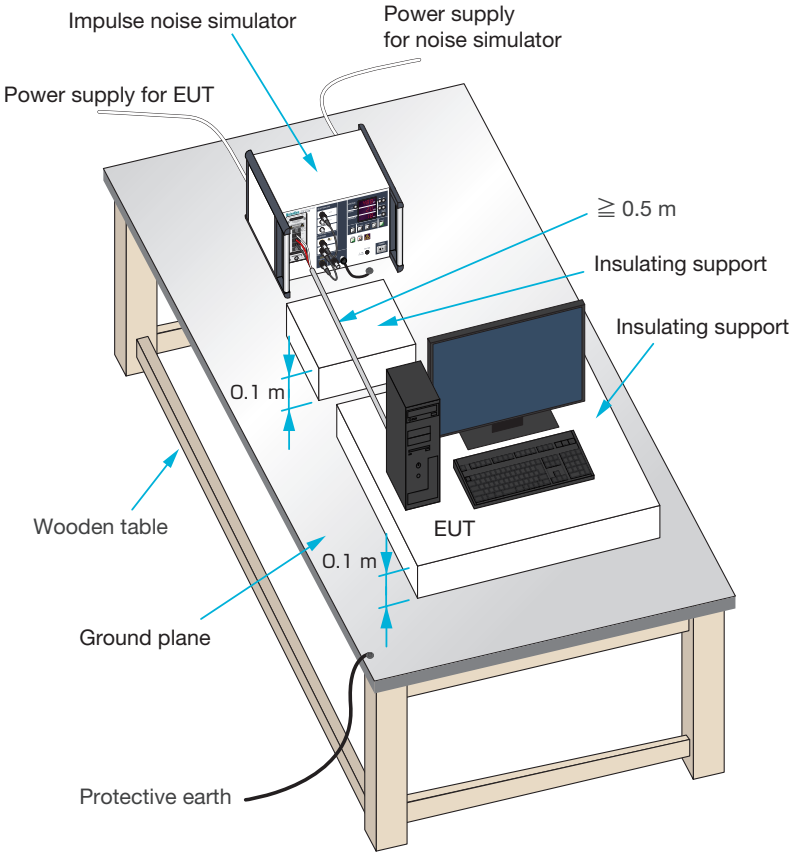
It is metal plate connecting simulator's SG and ground plane.
There is no need to screw on ground plane, so the simulator becomes easy to move.

INS Test Setup Summary

INS Test Method

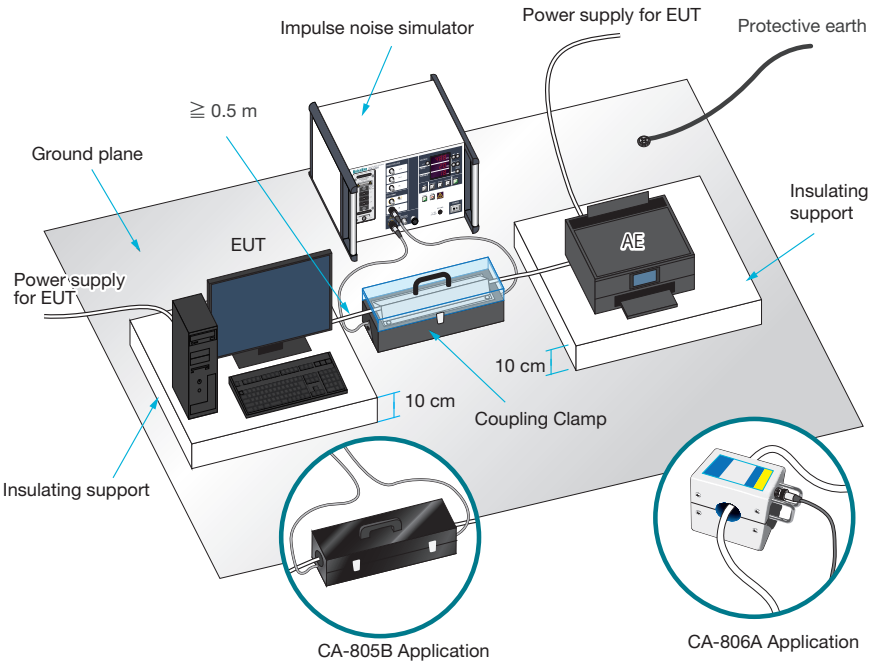
Method or test to power supply lines

①Connect power supply line for EUT to EUT LINE INPUT on the simulator main unit (hereafter called as main unit) through an isolation transformer
②Lay a ground plane and insulation sheet under main unit and EUT, and ground the ground plane for safety
③Connect power supply cable of EUT to main unit (Fold and bind the cable so it can be short in case the length is long)
④Connect SG short plug to SG terminal. Connect SG terminal of main unit and FG terminal (In case it is there) of EUT to ground plane with low impedance braided wire shortly and securely
⑤Connect 50 Ω TERM OUT connector to connector of phase (L1 or L2, PE if necessary) the noise is intended to be injected with coaxial cable



Method or test to interconnection lines

①Lay a ground plane and insulation sheet under main unit and EUT, and ground the ground plane for safety
②Open coupling adaptor 15-N1636 (Option) and clamp interface cable with the adaptor. Connect connector of the adaptor to PULSE OUT of main unit. Connect the one another connector of the adaptor to 50 Ω TERM IN of main unit.
③Connect power supply cable of EUT to any power source since no high voltage pulse is injected in this test
④Connect SG terminal and FG terminal of EUT to ground plane



Fast transient / burst simulator

FNS-AX4-A20/B63

It is compact! it is equipped with new functions to make EMC testing easier.

It is a tester that evaluates the resistance of electronic devices by simulating high-frequency noise that rises quickly due to discharge between contacts of switching devices and arc discharge generated from electronic motors.

- IEC 61000-4-4 Ed.3 standard compliance.
- Pre-check function is installed. Inspection before testing is now easy.
- Normal mode test support. Taking account of field troubles is possible. (option)
- Utilize an outlet box that simplifies EUT connection. (option)
- Compared with conventional products, the size has become compact. (Approximately 67% by volume)
- Easy to understand Panel display reduces mistakes in connecting power cables.
- Software control with Android ™ and Windows. (option)
- Next calibration date can be notified. (Android / Windows software only)
- Employ LCD screen with multi-language support and enhanced operability.
- Maximum output voltage of 5 kV and maximum pulse frequency of 2 MHz allow you to test above the standard test level.
- CDN capacity is increased to single phase type AC 240 V 20 A, single and three phase type to AC 600 V 63 A, supporting wider range of EUT.
- Large capacity CDN (100 A or 150 A) option available for Injection test on various EUT
- Using coupling clamps, EMS probe kits, you can test the signal lines and evaluate the noise immunity on the PCB. (option)

Specification

■ Generator specification

Item	Specification / Function
Output voltage	200 to 5000 V 10 V Step
Polarity	Positive or negative, polarity alternation possible per burst
Repetition frequency	0.1 kHz to 2000 kHz 0.1 kHz to 1 kHz / 0.01 kHz step Tolerance ± 5%, 1.0 kHz to 10 kHz / 0.1 kHz step Tolerance ± 5% 10 kHz to 100 kHz / 1 kHz step Tolerance ± 5%, 100 kHz to 1000 kHz / 10 kHz step Tolerance ± 5% 1000 kHz to 2000 kHz / 100 kHz step Tolerance ± 10%, (Limitation per voltage levels when continuous output)
Number of pulses	1 to 1000 at a step of 1 pulse , Setting limit: 1 pulse per ms in a burst (repetition frequency 1 kHz or more)
Burst duration	Formula for Burst duration = Pulse number / Repetition Frequency Scope of manually setting value for burst duration: 0.01 to 999 ms
Burst period	10 to 1000ms ± 10% 10ms steps (500ms or more for polarity alternate mode)
Polarity alternate function	Output polarity alternated between positive and negative at each burst period Setting condition: the burst period is 500ms or more and the burst pause period [(burst period) - (burst duration)] is 100ms or more Maximum test time: 10 minutes
Continuous Pulse output	Up to 1000 V -10 kHz or less, to 2000 V -4 kHz or less, to 5000 V -1 kHz or less. Maximum test time for each case: 10 min
Frequency modulation	Frequency is shifted continuously between set frequency and approximately -10% from the set frequency. The modulating wave is triangular wave of approximately 20Hz
External trigger	External trigger input invokes 1 burst output in synchronization with the trigger input. Trigger specification: Hi (+ 5V) → Lo (0 V) triggers one burst period.
Pulse waveform (at 50 Ω load)	Pulse peak voltage: (set voltage / 2) ± 10% Rise time: 5 ns ± 30% Pulse width: 50 ns ± 30%
Pulse waveform (at 1 kΩ load)	Pulse peak voltage: (set voltage × 0.95) ± 20% Rise time: 5 ns ± 30% Pulse width: 35 to 150 ns
DC blocking capacitor	10nF ± 20%

■ CDN specification

Item	Specification / Function
Power capacity	A 20 model: Single phase AC 240 V / 20 A, DC 125 V / 20 A (10 A for PE) B 63 model: three-phase AC 600 V / 63 A, DC 125 V / 63 A (10 A for N / PE)
Applied phase	A20 model: L / N / PE B63 model: L1 / L2 / L3 / N / PE Single line or all lines can be specified individually for each phase
Injection mode	Common mode (Normal mode available using option)
EUT Line input/output	φ6 mm safety socket
Coupling capacitor	33 nF
Output waveform specification	Pulse peak voltage: (set voltage) / 2 ± 10% Rise time: 5.5 ns ± 1.5 ns Pulse width: 45 ns ± 15 ns Set voltage ± 4000 V, frequency specified from 5 kHz to 100 kHz
Input residual voltage	10% or less of setting pulse voltage EUT line input is 50 Ω termination, line output is defined as open
AC Line Sync	Synchronous and asynchronous setting available. Setting phase angle: 0 to 360 ° ± 10 ° 1 ° Step Synchronizable voltage: AC 85 V to rated voltage Reference phase: between L-N (A20 model), L1-L2 (B63 model)

■ Other specifications

Item	Specification / Function
emergency stop	Push lock type switch (Test stop, EUT line OFF)
EUT FAIL function	FAIL signal from external (Hi → Lo) detected during test FAIL signal specifications VLO: 0 V, VHI: + 5 V Choose operation from test stop / pause when triggered 3 channels available for the FAIL input
External interface	REMOTE (For external PC control), CDN I/F (For external CDN), INDICATOR (For Warning Lamp or indicator lamp) EUT FAIL INPUT (For temporary pause at EUT failure event)
Accessary	Power Cable, SG Cable, Line Input Cable, Output Cable, Waveform Check Connector, Coaxial Cable, Operation Manual, Accessary bag
Operating environment	Temperature 15 to 35 °C Relative humidity 25 to 75%
External Dimensions / Weight	(W)430 × (H)199 × (D)370 mm (excluding protrusions) / Approximately 14 kg (A20 model) and 22 kg (B63 model)
Power supply	AC 100 to 240 V ± 10% 50/60 Hz approx. 120 VA

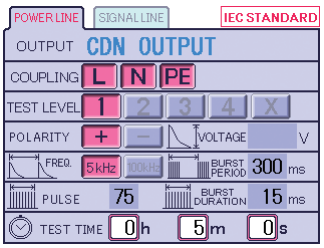
FNS-AX4-A20/B63

Operation Screen

Operation Screen

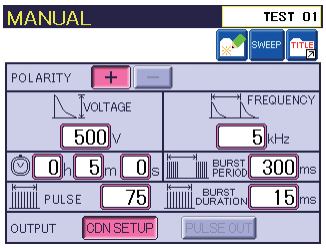
In each test mode screen, you can simply push button on/off and simply enter numerical parameters with the numeric keypad. In addition, all test conditions can be set within 1 to 2 screens deep.

STANDARD mode



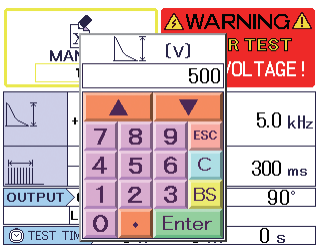
The test conditions defined in IEC 61000-4-4 are pre-set. When injected on the power supply, test pulse frequencies are 5 kHz or 100 kHz and voltage selections are 0.5 kV, 1.0 kV, 2.0 kV, 4.0 kV.

MANUAL mode



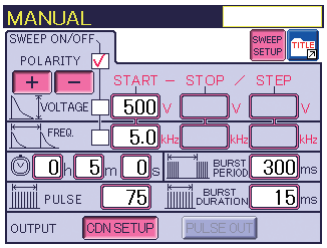
In the MANUAL mode, detailed test conditions can be set. The pictograms are shown to intuitively understand the setting of the test conditions. From this screen you can switch to the setting screen for conducting the sweep test.

MANUAL mode (Test condition setting)



Polarity and injection phase setting can be easily set by turning the button on/off. Numerical parameters, such as test voltage, etc. can be entered with numeric keypad which appears when necessary for easy number entering.

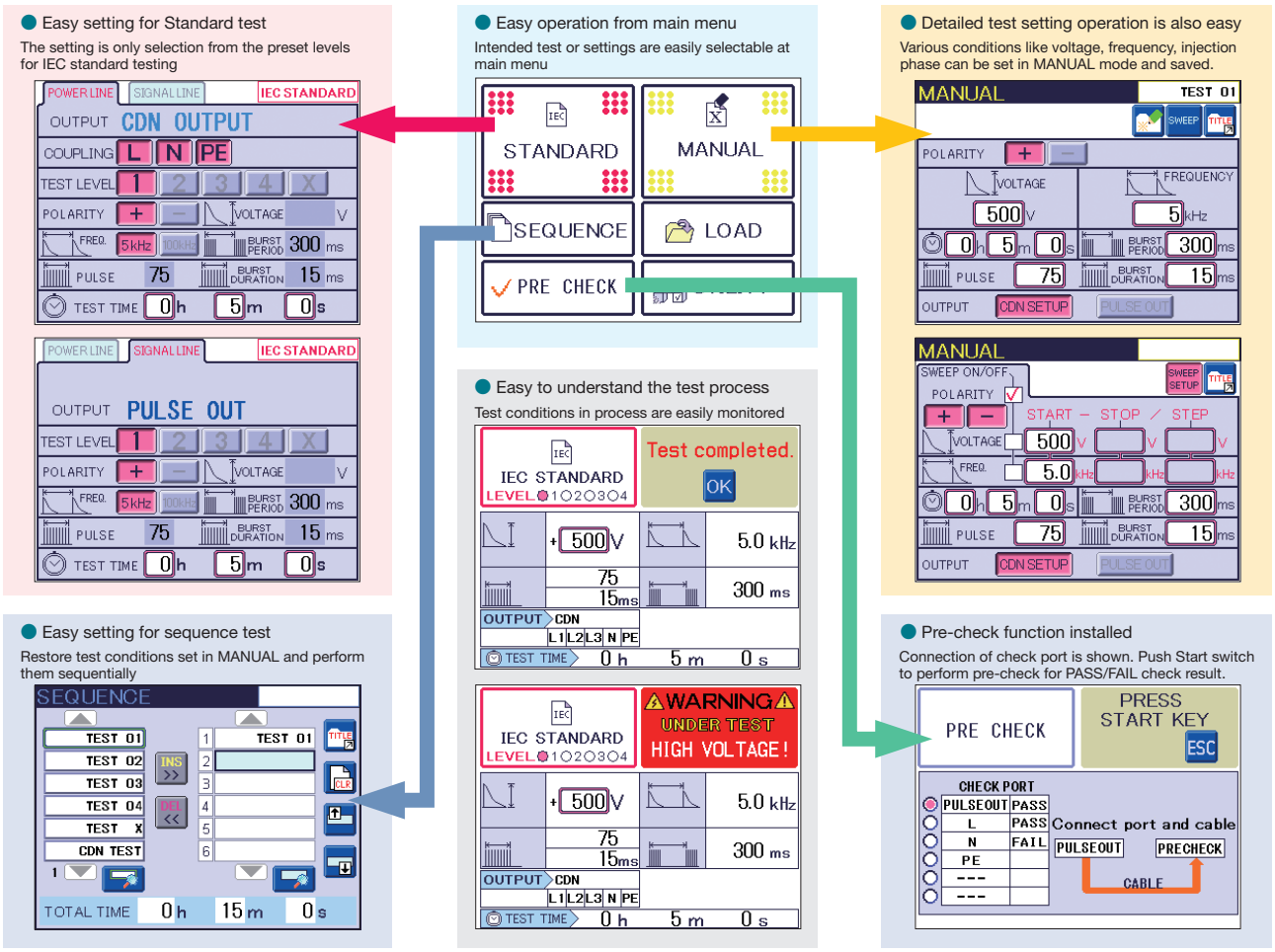
MANUAL mode (sweep test setting)



It is a test mode in which the condition of output voltage and repetition frequency change can be set to be executed automatically. In the setting example, shows burst voltage change in 100V step from 500V to 1000V. A convenient function for judging the malfunction point of EUT by setting the condition change of output voltage, repetition frequency, polarity, power injection phase, injection phase angle.

Screen Configuration

Set either "STANDARD" or "MANUAL" from the menu screen, and make various settings such as test voltage, polarity, frequency, injection phase and so on. "MANUAL" also allows you to set the sweep mode injection. You can store up to 30 test conditions. In "SEQUENCE", you can call up the test conditions set in "MANUAL" and combine the test conditions of maximum 18 steps, and create up to 15 programs. You can also pre-check before starting test.



FNS-AX4-A20/B63

Feature

Easy to perform pre-test inspection with pre-check function

Built-in monitor circuit for pre-check in the tester body. By simply connecting the waveform observation connector and the attached coaxial cable to the CDN OUT or PULSE OUT of the tester, you can easily check whether the pulse is output normally. You can easily perform pre-start inspection without using a dedicated attenuator or oscilloscope.

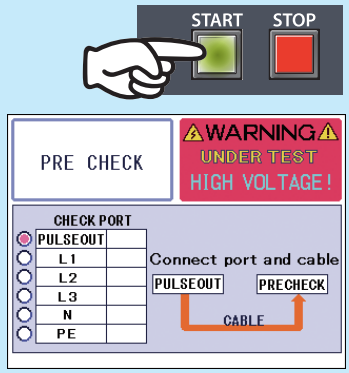
* Note: this is not a calibration of the tester.

Connect a cable etc. to the port for pre-check.

Check CDN line out.

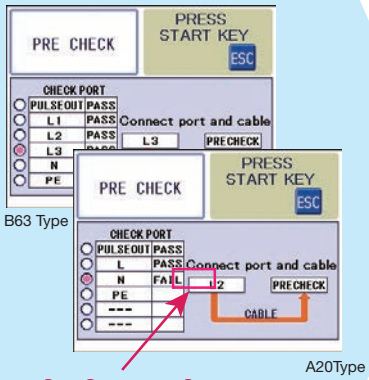
Confirmation of pulse out.

Pre-check is executed when the START switch is pressed.



Pre-check execution screen (B63 type).

Pre-check completed!



Pre-check execution screen (B63 type).

Simple and Easy EUT power line connection Injection phase indicator on front panel

In order to prevent mistakes in the connection of the power cable during the test, Front panel shows the connection destination at a glance. Also an outlet box (option) is available for the simple power connection.

Coupling Balun ready for normal mode test

IEC 61000-4-4 standard has the provision of the common mode test only, but noise may enter the equipment in the normal mode in the field and malfunction may occur. ANSI C37.90.1 standard specifies for corresponding normal mode noise testing. FNS-AX4 can now perform the normal mode test complying with ANSI C 37.90.1 standard with an optional dedicated normal mode coupling balun.

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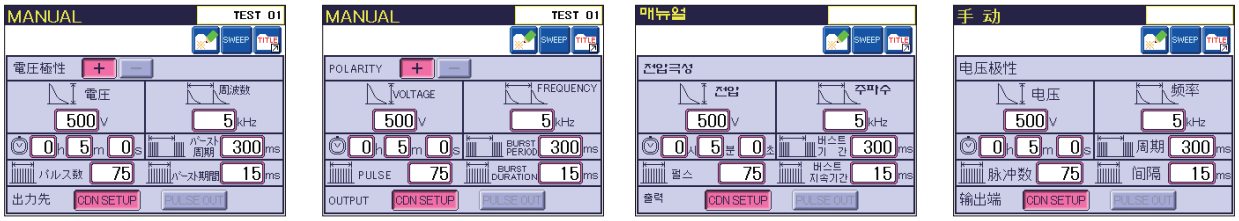
Easy to understand test settings in "multi-language"

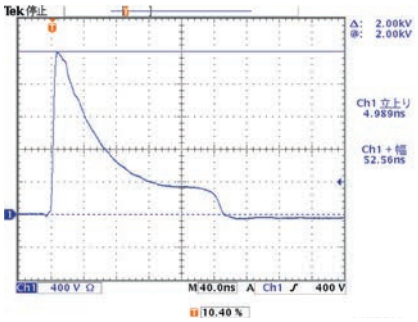
In addition to Japanese, operation in English, Korean, and Chinese are provided for easy understanding of the test setting and operation.



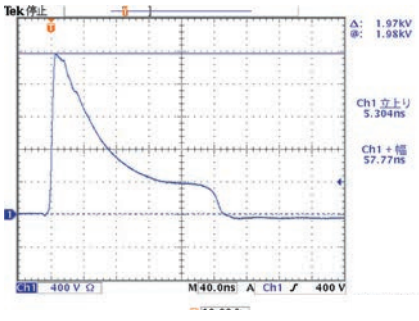
FNS-AX4-A20/B63

OUTPUT Waveform

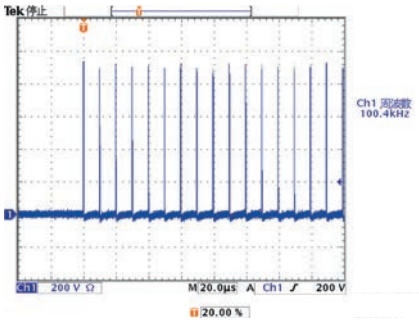
PULSE OUT connector waveform: 50 Ω



EUT LINE OUTPUT waveform：50 Ω

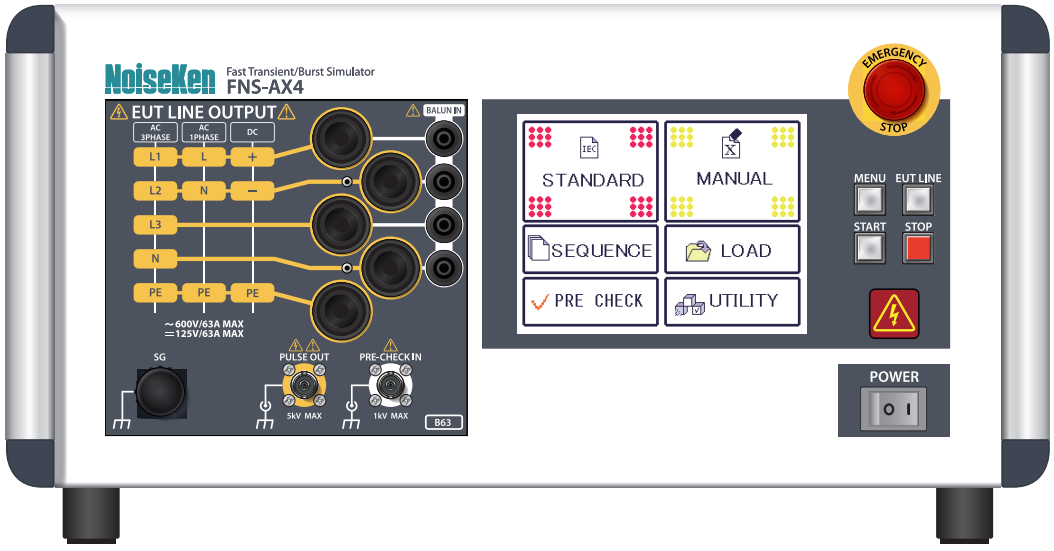


Repetitive pulses output as burst

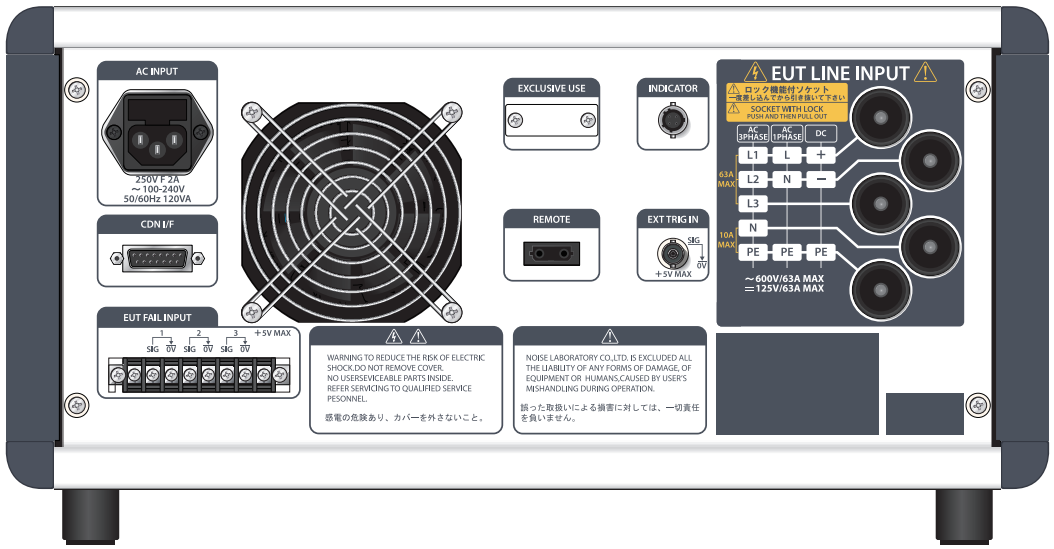


Front Panel / Rear Panel

Front Panel



Rear Panel



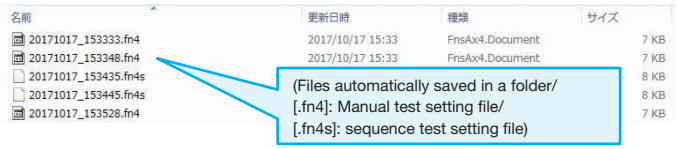
FNS-AX4-A20/B63

Windows software

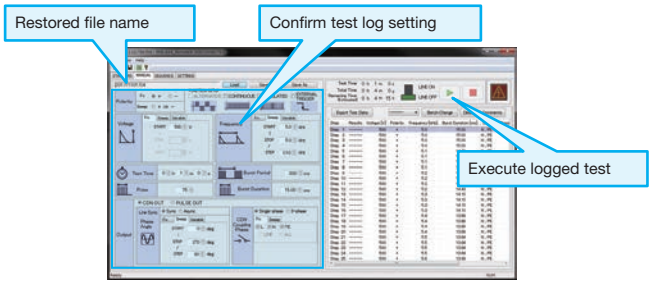
Remote control from Windows PC is possible using optional Optical USB module(MODEL：07-00022A). Windows software is available for customer environment for setting test conditions, saving test results, recording test logs, report generation, etc. .

■ Test Log

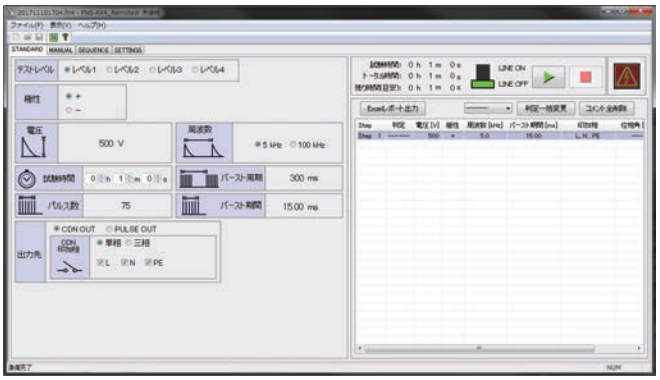
Manual Test/ Sequential test will create test log and setting file and saved automatically Setting file is named automatically from the tested year/month/date/time.



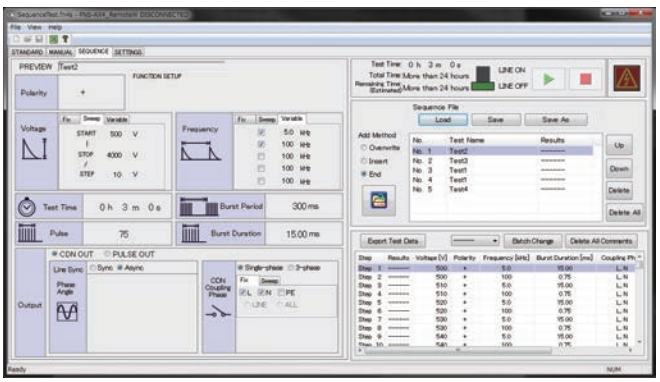
With software setting, you can enable or disable test log saving and also set folder location of the setting files saved. You can restore the testing condition saved in the test log to re-test with the previously saved condition.



■ Standard mode test screen (For IEC standard testing)

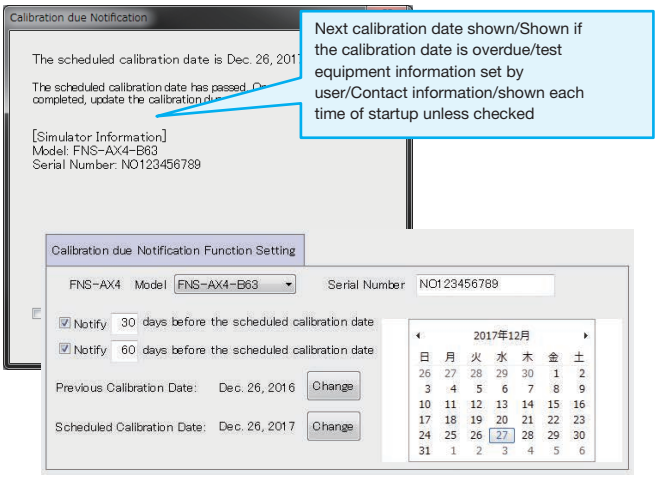


■ Sequence mode test screen (For sequence test)

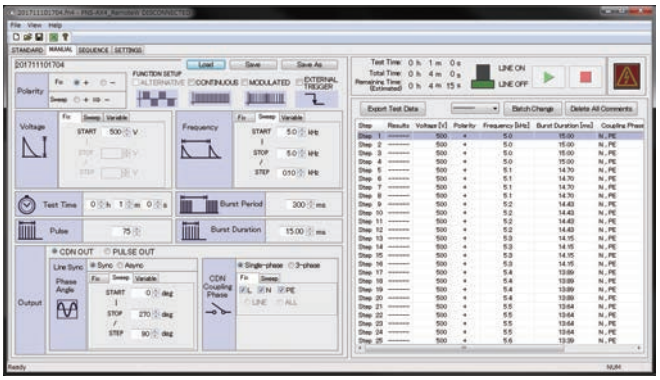


■ Next calibration date notification

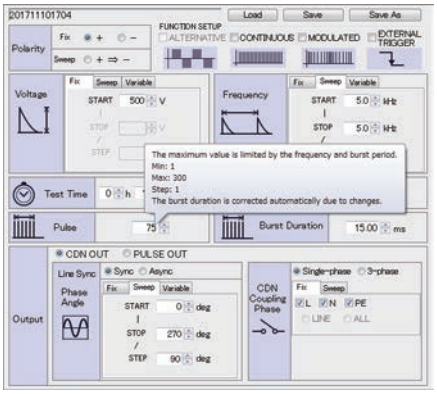
Following notification will be shown when it is the date set as notified date. It is simply set by the pop-up calendar



■ Manual mode test screen (For Manual setting)



In Manual mode, A balloon show up to indicate setting limitation by just placing mouse pointer. Balloon display can be enabled or disabled.



Option

Coupling Clamp MODEL: 15-00012A

Clamp calibration fixture (15-00010A)

Coupling clamp for capacitive coupling test on interconnection lines complying IEC61000-4-4 Ed.3. In addition, calibration fixture for coupling clamp is available.

- ○ Size: W1110 × D210 × H189 mm (protrusion excluded)
- ○ Visibility of the tested cable is improved by the transparent plastic upper lid
- ○ Clamp bar allows you to easily fix coupling plate to the signal line or control lines

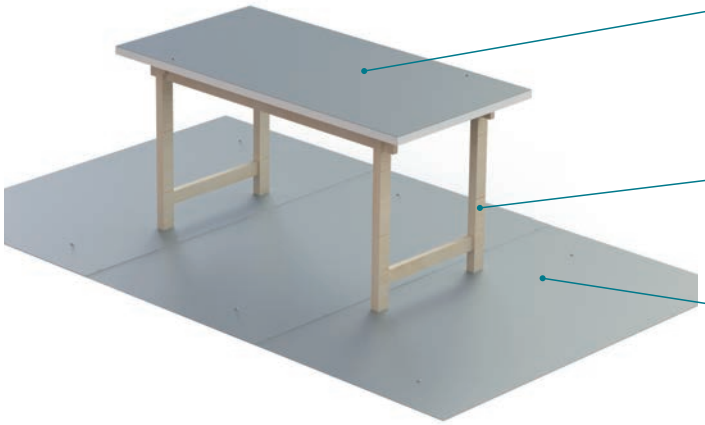
OUTLET BOX

OUTLET BOX converts LINE output socket.

18-00081A	Outlet box 125 V 15 A 2P+PE	Btype(3Ptype、JP/USAtype) AC 125 V 15 A MAX
18-00082A	multi-outlet box	Japan(JIS), America(UL), Canada(CSA), Australia(CSA), Swiss(SEV), Italy(CEI), Europe(CEE, DIN), England(BS) Input up to 4.55 kV
18-00083A	Outlet box	Europe CEE DIN 250 V 16 A MAX
18-T2300	3P terminal block conversion box	3P terminal block M6 with protective cover & Input up to 5 kV. * This is a custom product. Please contact us for details.
18-N2494	5P terminal block conversion box	5P terminal block M6 with protective cover & Input up to 5 kV. * This is a custom product. Please contact us for details.

Normal mode coupling balun Model: 15-00013A

The product allows injection of test voltage on EUT with Normal mode. 5 kV Max.



Horizontal Coupling Plate (HCP) MODEL : 03-00020A

Metal plate placed on the table for the testing of tabletop EUT.
W1600 × D800 × t1.5 mm × 1 sheet (Made of Aluminum)
* Used as a horizontal coupling plate in ESD testing and also can be used as a ground plane

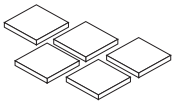
Test Table MODEL : 03-00039A

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

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

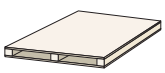
Ground plane to be placed just under the wooden table.
W1800 × D1000 × t1.5 mm × 3 pcs. in 1 set (Made of aluminum)

Insulating block MODEL：03-00054A



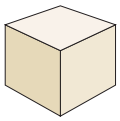
Keep the EUT and its wirings afloat above the ground plane
Size: W300 × D300 × H50 mm
Material: foamed polyethylene
5 pcs per set

Insulating support MODEL：03-00024A



Keep the EUT and its wirings 10cm afloat above the ground plane
Size: W1200 × D1200 × H100 mm
Material: Wood
Weight withstand: 500 kg

Cubic insulator block MODEL：03-00029A



Keep the EUT and its wirings 10cm afloat above the ground plane
Size: W100 × D100 × H100 mm
Material: Wood
4 pcs per set

SG cable MODEL：05-00103A

Braided wire cable to connect between SG terminal of the main unit and the ground reference plane.
Length: 0.1 m

Option

Warning Lamp MODEL：11-00008B

Alarm lamp for FNS-AX4 series. Alarm lamp illuminated when high voltage is generated at the time of test

Tri-color pilot light MODEL：11-00015A

The light is for FNS-AX4 series. Three colors indicate corresponding simulator' s test status change.

Attenuator for waveform check MODEL：00-00017A

Attenuator for measuring high voltage pulse.

Parameter	Specification
Attenuation rate	DC ～ 2 GHz：40 dB (100：1)
Input pulse peak voltage	4000 V MAX
Tolerable continuous pulse examples	Repetition Frequency：≦ 5 kHz Burst duration：≦ 15ms Burst period：≧ 300ms, (Assuming IEC 61000-4-4 pulse waves)
Input impedance	50 Ω (50 Ω ± 1% at DC)
Output impedance	50 Ω (50Ω ± 1% at DC)
Interface connectors	INPUT：HN(F) OUTPUT：N(F)
Dimensions/ Weight	(W)154.5 mm × (D)105 mm × (H)37 mm approx. 1350 g

Attenuator for waveform check MODEL：00-00018A

Attenuator for measuring high voltage pulse.

Parameter	Specification
Attenuation ratio	DC ～ 400 MHz：60 dB (1000：1)
Input pulse peak voltage	5000 V MAX
Tolerable continuous pulse examples	Repetition frequency：≦ 5 kHz Burst duration：≦ 15ms Burst period：≧ 300ms, (Assuming IEC 61000-4-4 pulse waves)
Input impedance	1000 Ω ± 2%
Output impedance	50 Ω (± 2% at DC ～ 400 MHz)
Interface connectors	INPUT：NMHV(F) OUTPUT：N(F)
Dimensions / Weight	(W)133 mm × (D)25.4 mm × (H)25.4 mm approx. 150 g

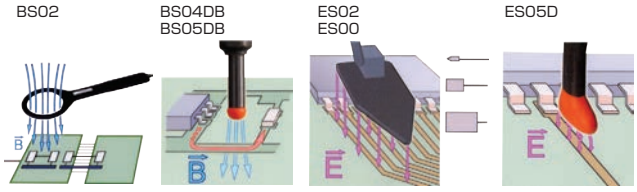
Optical USB module MODEL：07-00022A

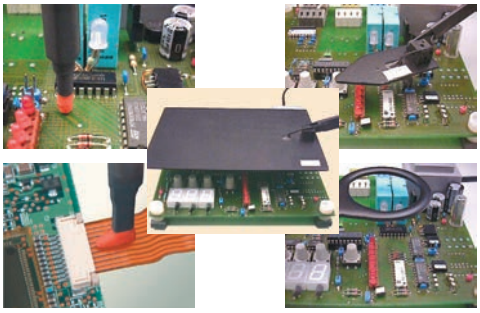
Conversion adapter to interface with PC for the remote control of FNS
USB to optical interface. Fiber cable 5m included.

EMS Probes Kit MODEL: H2-B

Probes kit to enable the noise injection onto PCB patterns, flat cables, etc. The probes can be selectable for either electric fields or magnetic fields in order to irradiate in the near field.

- ○ Choose noise radiation points at will on PCB or harness.
- ○ Inject noise either electrically or magnetically by choosing probes.
- ○ Provides 3 each pieces of electric field probe or magnetic field probe in different form and size.
- ○ Weak noise tolerance points can be found with granularity of mm of injection scope.

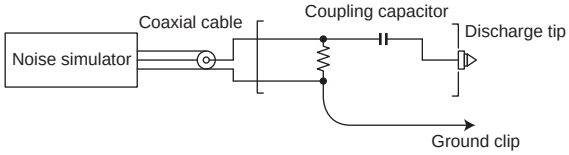




Noise Injection Probe MODEL: 01-00034A

- ○ Direct noise injection on a LSI pin makes the board level noise tolerance testing possible.
- ○ Maximum injection voltage up to 500 V.
- ○ Optional coupling capacitor available (Option)

[Option]
Coupling capacitors : 06-00039A : 220 pF, 06-00040A : 330 pF, 06-00041A : 3 pF, 06-00042A : 500 pF

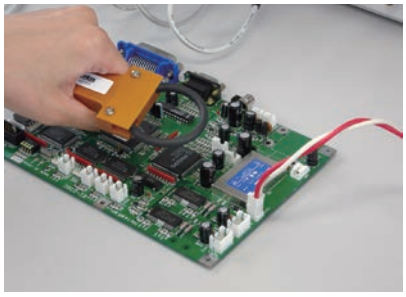


Option

Radiation Probes MODEL: 01-00006A / 7A / 8A / 9A / 10A / 31A / 50A

Probes with which irradiate the noise at wiring on PCB of electronic equipment. Weak noise tolerance points can be detected using the probe.

Parameter	Specification
Input voltage	4000 V Max
Input pulse width	50 ns ～ 1 μs
Loop diameter	06A : φ50 mm, 07A : φ75 mm, 08A : φ100 mm, 09A : φ150 mm, 10A : φ200 mm, 31A: φ250 mm, 50A: φ30 mm
Cable length	approx. 2 m
Weight	approx. 180 ～ 220 g
Termination resister	Not contained



Coupling Adapter MODEL: CA 805B

CA-805B makes testing for noise tolerance possible by just clamping interconnection cable of electrical equipment in combination with FNS series.

- ○ Inject noise without cutting cables
- ○ Able to test individual noise tolerance of electrical equipment
- ○ Able to clamp bundle lines up to 26 mm max diameter

Parameter	Specification
Input voltage	4000 V Max
Dimensions	(W) 350 × (H) 120 × (D) 130 mm
Clamp interim	26mm
Weight	approx. 3 kg

Coupling Adaptor MODEL: 15-00007A (CA 806)

15-00007A (CA-806) makes testing for noise tolerance possible by just clamping interconnection cable of electrical equipment in combination with FNS series.

- ○ Inject noise without cutting cables
- ○ Able to test individual noise tolerance of electrical equipment
- ○ Able to clamp bundle lines up to 27 mm max diameter

Parameter Structure	Specification
Input voltage	2000 V Max.
Coupling ratio	1/10 of input voltage ± 10%
Termination resistance	50 Ω system built-in
Max. diameter of cable clamped	27 mm
Dimensions	(W) 89 × (H) 64 × (D) 120 mm (protrusion excluded)
Weight	approx. 1000 g

<Quick comparison of Clamps>

Clamp Model	Coupling method	Maximum Input voltage	Coupling ratio	Interim diameter of clamp
CA-805B	Capacitive (Electrostatic)	±4000 V	1:1	26 mm
CA-806	Inductive (Magnetic)	±2000 V	10:1	27 mm

High power Coupling Decoupling Network

High powered Coupling Decoupling Network (CDN) can be provided for customers' requirements. Please consult with us for details.

Coupling Fixture for High Frequency Surge Test

Coupling fixture provided to inject noise to harness in combination with Fast Transient Burst simulator.
The varieties of coupling capacity are lined up. Please contact us for details.

IEC61000-4-4 Ed.3 Test Standard

1. General

The Test Standard for evaluating immunity of electric / electronic equipment when they are interfered by fast transient repetitive bursts which are generated by break of inductive load equipment or bounds of relay contact point.

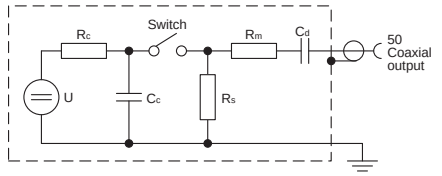
2. Test Level

Open circuit output test voltage and repetition rate of the impulses

	On power port, PE		On I/O (input/output) signal, data and control ports	
Level	Voltage peak (kV)	Repetition rate (kHz)	Voltage peak (kV)	Repetition rate (kHz)
1	0.5	5 or 100	0.25	5 or 100
2	1	5 or 100	0.5	5 or 100
3	2	5 or 100	1	5 or 100
4	4	5 or 100	2	5 or 100
X	Special	Special	Special	Special

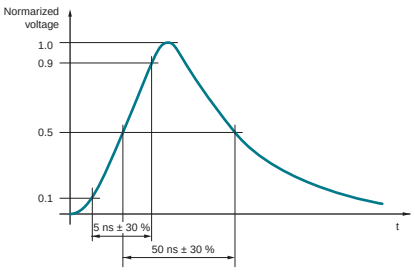
3. Burst Generator and Waveform Verification

Circuit diagram of a fast transient/burst generator

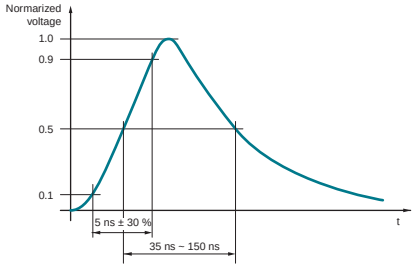


U High-voltage source
Rc Charging resistor
Cc Energy storage capacitor
Rs Impulse duration shaping resistor
Rm Impedance matching resistor
Cd DC. blocking capacitor

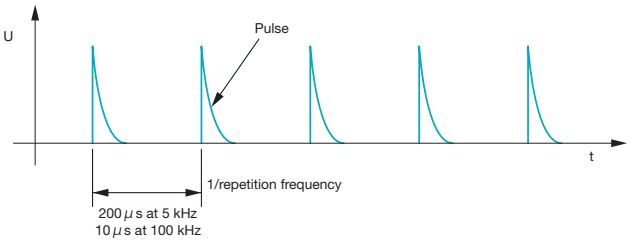
Waveshape of a single pulse into a 50 Ω load

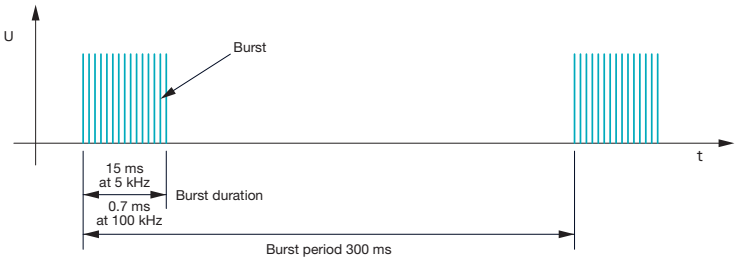


Waveshape of a single pulse into a 1 kΩ load

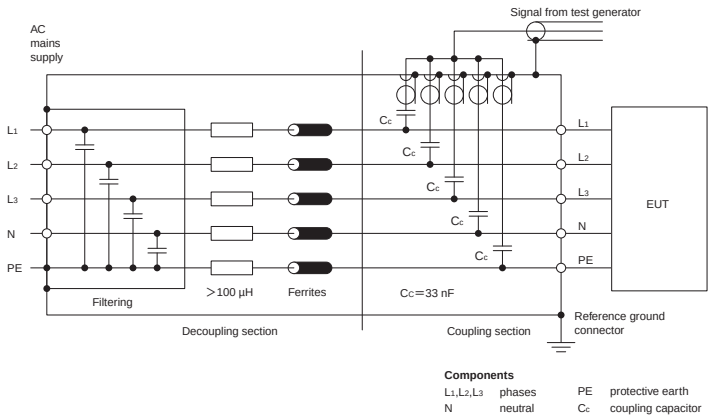


Pulse wave shape into a 50Ω load and general graph of a fast transient/burst





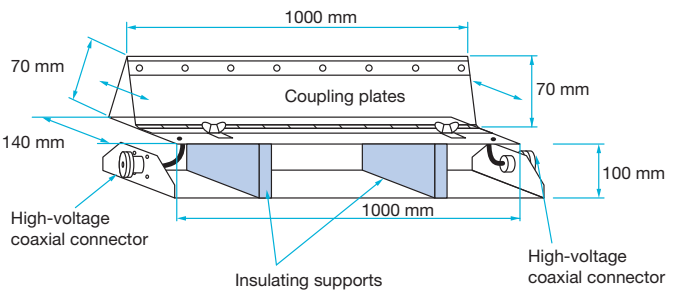
■ CDN for AC/DC power mains supply ports/terminals



Components

L1,L2,L3	phases	PE	protective earth
N	neutral	Cc	coupling capacitor

■ Capacitive couplin clamp



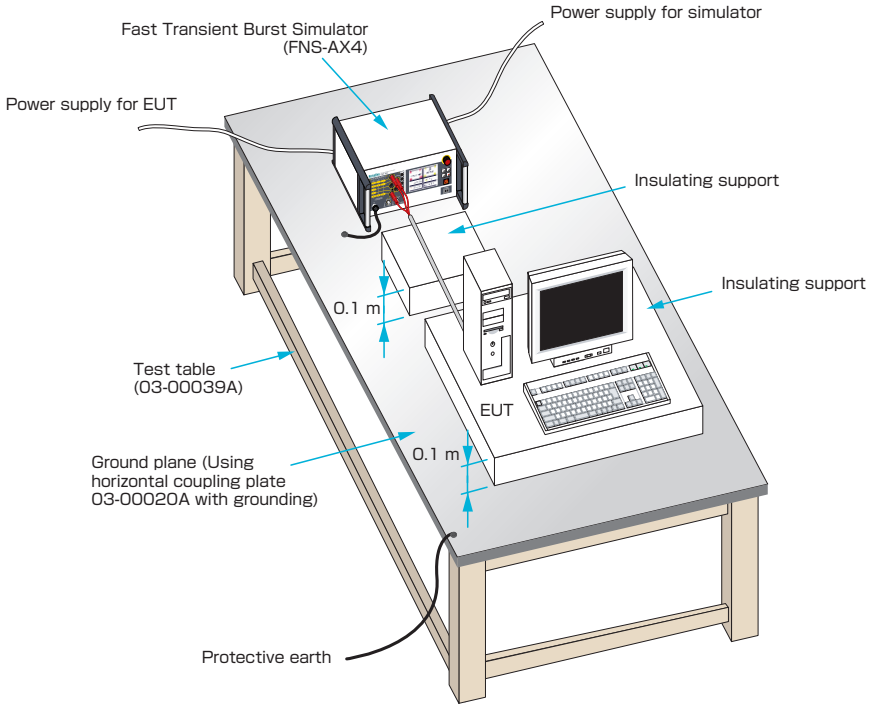
IEC61000-4-4 Ed.3 Test Standard

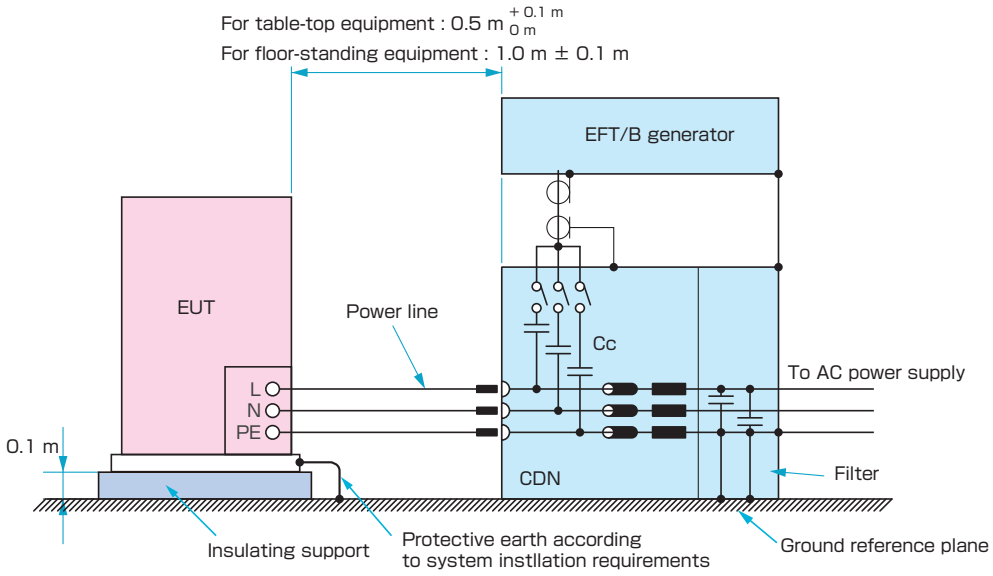
4. Test Setup

Test Method to Power Supply Lines

① Put the simulator onto ground reference plane which is connected to the protective ground and connect SG terminal on the front panel to the ground reference plane.
② Place an insulating support (whose thickness is 10cm) onto the ground reference plane and put EUT on the support (so that the EUT can be isolated from the ground reference plane).
③ Connect LINE OUT on the front panel of the simulator to EUT with a cable (whose length is 50cm) and start operation of EUT.
④ Set the required test conditions (like the burst voltage, etc.) and start the test.

In case of table top EUT

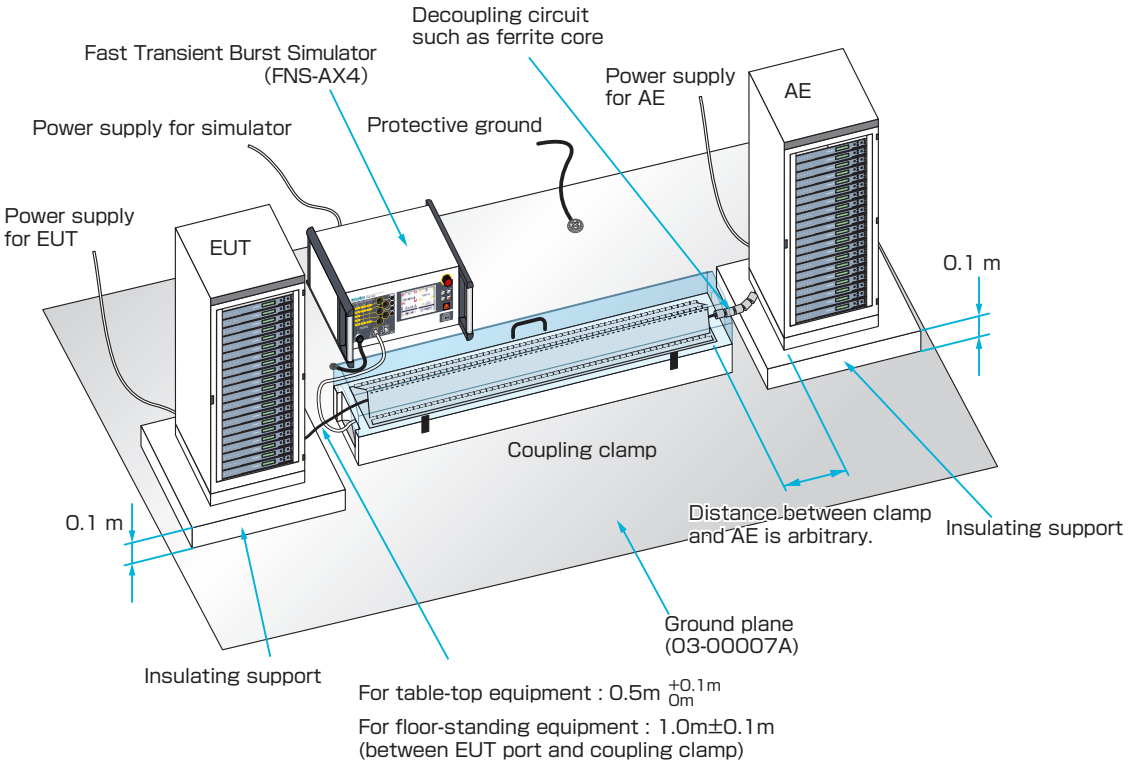


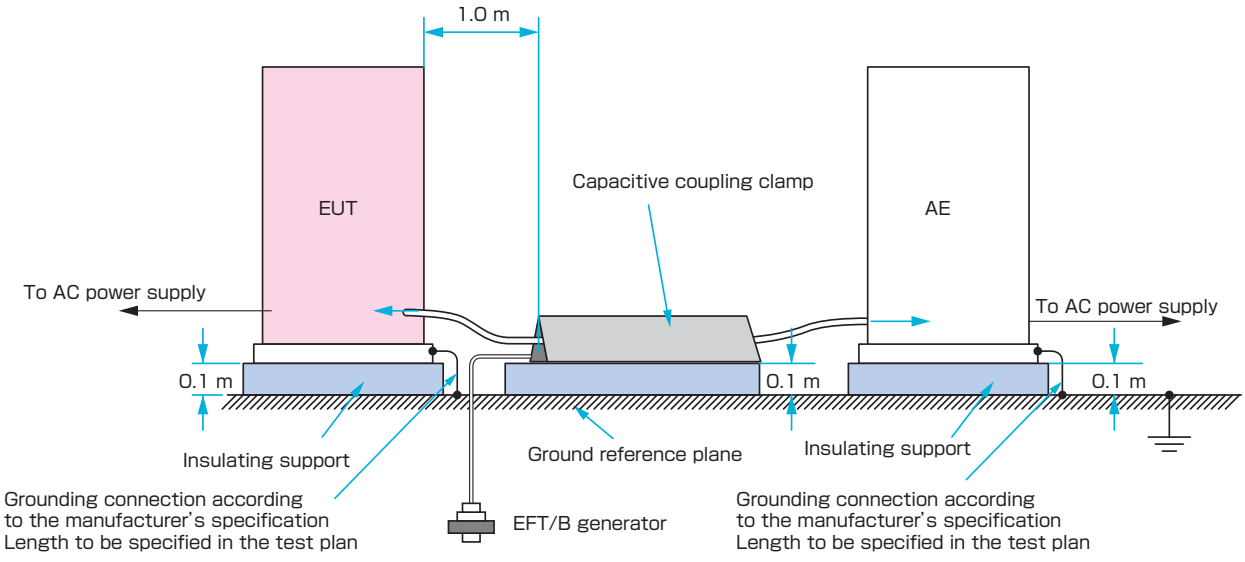


IEC61000-4-4 Ed.3 Test Standard

Test Method to Interconnection Lines

① Put the simulator onto ground reference plane which is connected to the protective ground and connect SG terminal on the front panel to the ground reference plane.
② Place the coupling clamp (Option) onto the ground reference plane.
③ Connect PULSE OUT port to connector of the coupling clamp.
④ Pass the line cable through the coupling clamp. Adjust the clamping part so that the coupling capacity can be largest (space between the cable and clamp can be minimum).
⑤ Cover the coupling clamp for preventing the electrical shock, Set the required test conditions (like the burst voltage, etc.)





IEC61000-4-4 Ed.3 Test Standard

5. Test Procedure

The test shall be carried out on the basis of a test plan that shall include the verification of the performances of the EUT as defined in the technical specification.

- Type of test that will be carried out;
- Test level;
- Polarity of the test voltage (both polarities are mandatory);
- Internal or external generator;
- Duration of the test not less than 1 min
- Number of applications of the test voltage;
- EUT's ports to be tested;
- Representative operating conditions of the EUT;
- Sequence of application of the test voltage to the EUT's ports.
- Auxiliary equipment.

6. Evaluation of Test Results and Test Report

Classify tests results as below in terms of specifications and operating conditions of EUT.

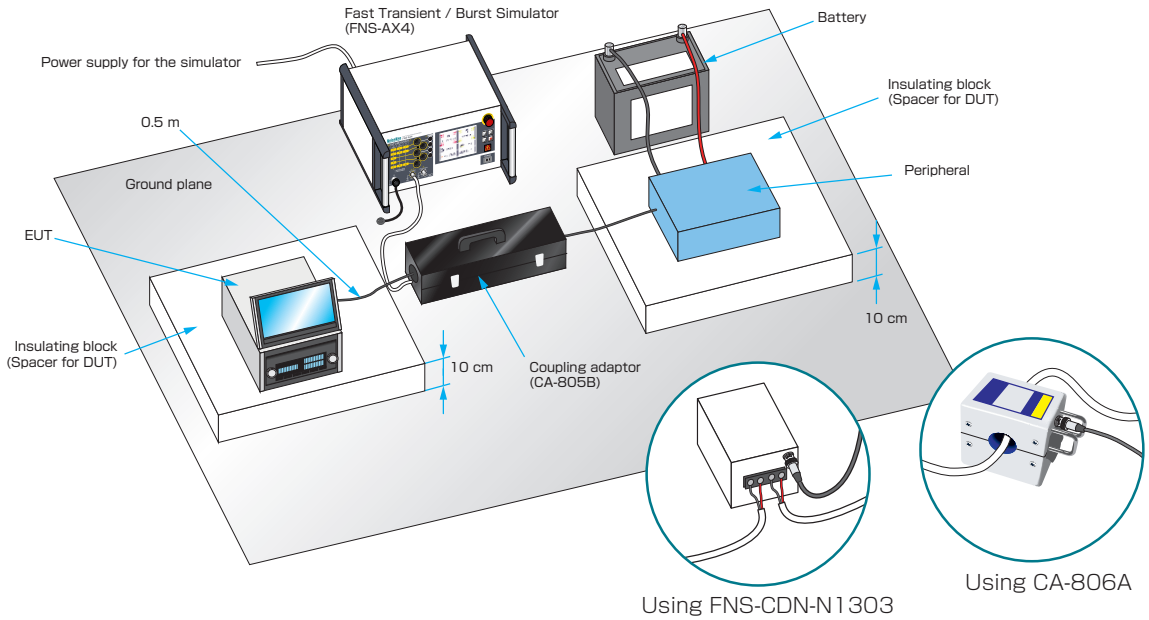
1) Normal performance within limits specified by the manufacturer, requestor or purchaser;
2) Temporary loss of function or degradation of performance which ceases after the disturbance ceases, and from which the equipment under test recovers its normal performance, without operator intervention;
3) Temporary loss of function or degradation of performance, the correction of which requires operator intervention;
4) Loss of function or degradation of performance which is not recoverable, owing to damage to hardware or software, or loss of data.

Notes: This test procedure and test set-up are extracted from IEC61000-4-4 Ed.3 (2012) and JIS C 61000-4-4 standards for applying to our products.
Please go through the Standards if the more details are required.

■ Test Method using various clamps (outside of IEC 61000-4-4 compliance testing)

Test Method using Fast Transient / Burst Simulator

① Place the simulator onto the ground plane which is connected to the protective earth and connect SG terminal on the front panel to the ground plane.
② Connect power cable (Standard accessory) to AC IN on the back of the simulator.
③ Place coupling adaptor CA-805B (Option) onto the ground plane and connect G terminal on side connector part of the clamp to the ground plane.
④ Connect PULSE OUT connector on the front of the simulator to connector of the adaptor.
(Fully pay attention to that any high voltage must not be put out during the connection)
⑤ Clamp the interconnection lines to be tested with the adaptor.
⑥ Set the test conditions like the coupling voltage, etc. , by the touch-panel on the simulator and start the test.



model	specification
LSS-6330-A20	left picture : single phase 20 A type lightning surge simulator
LSS-6330-B63	right picture : three phases 63 A type lightning surge simulator

Lightning Surge Simulator

LSS-6330 series

The compact & low-priced 6kV type - It is frequently requested.

A tester simulatively generates "High energy induced lightning noise" which induced to distribution lines or communication lines by ground potential fluctuation caused by lightning strikes.

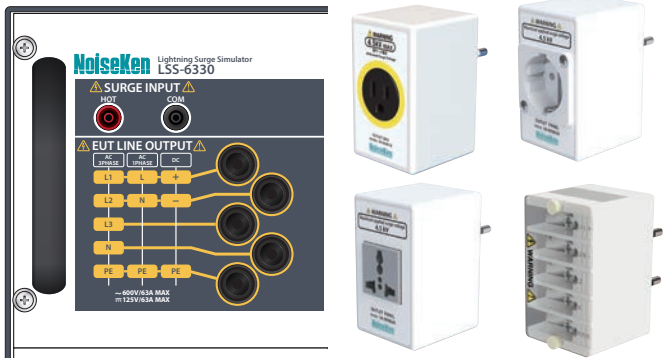
- Conforming to IEC 61000-4-5 Ed.3, IEC61000-4-12 Ed.3 (RINGWAVE 100kHz) and ANSI IEEE62-45 (2002)
- Pre-checking function simplifies start-up inspection works.
- Voltage and current monitors enable status monitoring during noise applied to EUT.
- Large LCD operation panel improve visibility and operability.
- MPU control function simplifies continuous testing, enables automatic surge-out, waveform-switching and polarity switching.
- Equipped with both manual and program mode to simplify test condition setting. Manual mode: for standard and single-shot testing. Program mode: for different testing in succession.
- Interlocking function provides excellent safety.
- Standardly equipped waveform checking terminals provide easy output waveform checking with existing oscilloscope and BNC cables.
- Isolation transformer available for safety protection for superimposing circuit current leakage and back surge to power source.(Option)

Pre-checking function simplifies start-up inspection works

<Conventional>: It requires for two expensive high voltage probes and differential measurement available oscilloscope for start-up inspection works.
<LSS-6330>: Simplifies start-up inspection works only by connecting dedicated cables to the tester to confirm whether or not the output is present. (pre-checking). (Available for SURGE OUTPUT/EUT LINE OUTPUT)

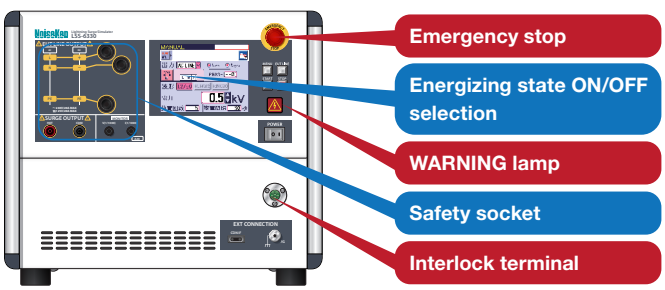
Visualize the testing connection status on monitor display for easy testing condition understanding

Monitor screen displays connection status in order to avoid incorrect power line connection. In addition, an outlet box (option) simplifies testing connection.



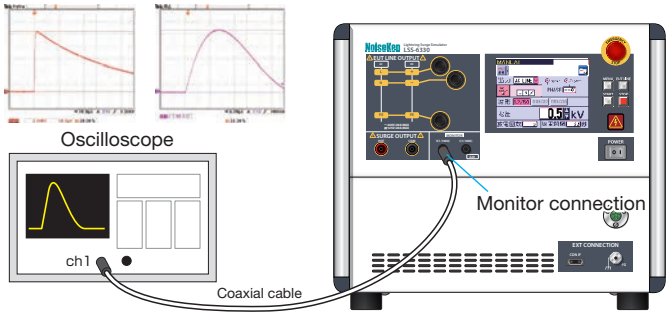
Incorporated “Emergency stop” and “Interlock function” to improve operation safety.

Equipped with operation safety functions in both hardware and software. Safety sockets as well as emergency stop switches and interlock terminals secure operation safety when connecting EUT. In addition, further safety is available by using “protection fences” and “protection boxes” . (option)



Waveform checking terminal enables output waveform monitoring

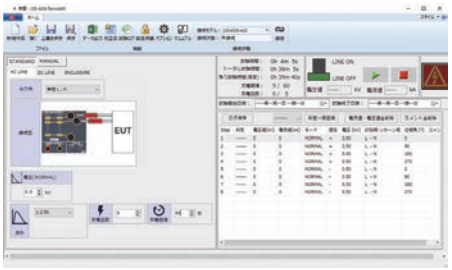
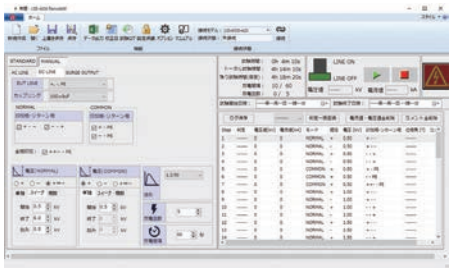
We received many market feedbacks say “I want to check the output waveform during the test” , the answer is “Yes we can” . We incorporated the checking terminal, and it enables monitoring of applied waveforms to EUT via oscilloscopes during tests. Furthermore, even without oscilloscopes, you could check the voltage & current value on the upgraded monitor screen as well.



LSS-6330 series

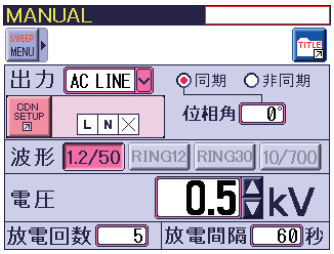
PC control software simplifies overall test processes

It is so easy to set complicate test sequences of various test types, save test results & records and generate test reports.

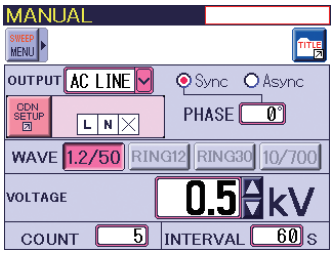




Multilingual localization provides easy test condition setting

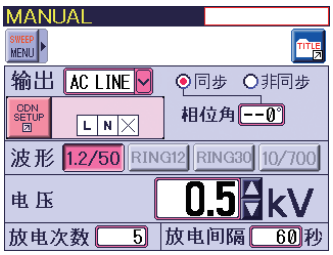
Multilingual touch panel display supports easy and sure test setting. Languages in English, Chinese, Korean and Japanese.



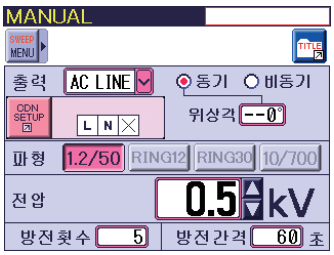
Japanese



English



Chinese



Korean

Specification

■ Surge generator unit　LSS-6330-A20 / -B63 both applicable

Item/Parameter	Specification		Note
Surge Waveform	1.2/50 μs - 8/20 μs combination 10/700 μs - 5/320 μs combination RING WAVE		
1.2/50 μs - 8/20 μs combination	Open voltage	0.5 kV ～ 6.7 kV ± 10%	Coupling circuit：18 μF Cable length：One side 0.5 m Line input side open
	Front time	1.2 μs ± 30%	
	Time to half-value	50 μs±20%	
	Short-circuited current	250 A ～ 3350 A ± 10%	
	Front time	8 μs ±20%	
	Time to half-value	20 μs ±20%	
10/700 μs - 5/320 μs combination	Open voltage	0.5kV ～ 6.7kV ± 10%	Cable length：One side 0.5 m
	Front time	10 μs ± 30%	
	Time to half-value	700 μs ± 20%	
	Short-circuited current	12.5 A ～ 167.5 A ± 10%	
	Front time	5 μs ±20%	
	Time to half-value	320 μs ±20%	
RING WAVE	Open voltage	0.25 kV ～ 6.6 kV ± 10%	Cable length：One side 0.5 m
	Front time	0.5 μs ±30%	
	Frequency	100kHz ±10%	
	Waveform envelop	Pk2 = 40% ＜ Pk1 < 110% Pk3 = 40% ＜ Pk2 < 80% Pk4 = 40% ＜ Pk3 < 80%	
	Short-circuited current	8.3 ～ 550 A ±10%	
	Front time	0.2 ～ 1 μs	
Palarity	+ / -		
Output impedance	2 Ω ± 10%		1.2/50 μs waveform
	40 Ω ± 10%		10/700 μs waveform
	12 Ω ± 20%、30 Ω ± 20%		RING (selectable)

LSS-6330 series

Item/Parameter	Specification	Note
Surge generation circuit	Floating	
Minimum charging time	0.0 kV ～ 4.0 kV：5 sec 4.1 kV ～ 6.7 kV：10 sec	1.2/50 μs Surge Waveform
	0.0 kV ～ 4.0 kV：10 sec 4.1 kV ～ 6.7 kV：15 sec	10/700 μs Surge Waveform
	0.0 kV ～ 6.6 kV：1 sec	RING WAVE
Communication fuction	RS-232C (Optical connector), Bluetooth	Option
	External CDN control	
Emergency stop	Push-lock(Test STOP, High voltage OFF, EUT switch SHUT OFF)	
Interlock function	External connection status detection	
Emergency lamp	Red LED blinking after start the tests	
Emergency lamp connector	Equiped with emergency lamp connectors. Lamp blinking after start the tests.	3 ports
EUT Fail	3 ports	
Voltage monitor	BNC output, 2000 V/V ± 10% Accuracy：± 10% vs. actual output	When output is open, no waveform prescription
Current monitor	BNC output, 1000 A/V ± 10% Accuracy：± 10% vs. actual output	When output is short-circuited, no waveform prescription
Phase angle control	0° ～ 360° ±10°	EUT power AC90V Min. 50/60 Hz ± 10%
Trigger input	asychronous , synchronized to AC line 0° ～ 360° / 1° step, external input	
Power supply	AC 100 V ～ AC 240 V ± 10% 50 Hz / 60 Hz ± 10%	
Operational environment	Humidity：15 ～ 35℃ Temperature：25 ～ 75 % RH	
Dimensions / Weight	(W)430 × (H)371 × (D)530 mm ／ approx. 55 kg	

■ AC / DC Line Injection Part LSS-6330-A20

Item/Parameter	Specification		Note
Surge Waveform	1.2/50 μs - 8/20 μs combination, RING WAVE		
1.2/50 μs - 8/20 μs combination	Open voltage	0.5 kV ～ 6.7 kV ± 10%	Coupling circuit：18 μF Cable length：One side 0.5 m Line input side open
	Front time	1.2 μs ± 30%	
	Time to half-value	50 μs ± 20%	
	Short-circuited current	250 A ～ 3350 A ± 10%	
	Front time	8 μs ± 20%	
	Time to half-value	20 μs ± 20%	
	Open voltage	0.5 kV ～ 6.7 kV ± 10%	Coupling circuit：10 Ω + 9 μF Cable length：One side 0.5 m Line input side open
	Front time	1.2 μs ±30%	
	Time to half-value	50 μs +10 μs /-25 μs	
	Short-circuited current	41.6 A ～ 558 A ± 10%	
	Front time	2.5 μs ± 30%	
	Time to half-value	25 μs ± 30%	
RING WAVE	Open voltage	0.25 kV ～ 6.6 kV ± 10%	Coupling circuit：4.5 μF Cable length：One side 0.5 m Line input side open
	Front time	0.5 μs ± 30%	
	Frequency	100 kHz ±10%	
	Waveform envelop	Pk2 = 40% ＜ Pk1 < 110% Pk3 = 40% ＜ Pk2 < 80% Pk4 = 40% ＜ Pk3 < 80%	
	Short-circuited current	8.3 ～ 550 A ± 10%	
	Front time	0.2 ～ 1 μs	
Power Capacity for EUT line	AC 240 V / 20 A MAX 50/60 Hz、DC 125 V / 20 A MAX		
Decoupling coil	1.5 mH		
Voltage dip	Less than 10% of the rated voltage when the rated current is energized		Trough AC line injection part terminal
Residual voltage	Less than 15% of the injected voltage or less than double of the rated voltage (peak value)		

LSS-6330 series

■ AC / DC Line Injection Part　LSS-6330-B63

Item/Parameter	Specification		Note
Surge Waveform	1.2/50μs-8/20μs combination、RING WAVE		
1.2/50μs - 8/20μs combination	Open voltage	0.5 kV ～ 6.7 kV ± 10%	Coupling circuit：18 μF Cable length：One side 0.5 m Line input side open
	Front time	1.2μs ±30%	
	Time to half-value	50μs ±20%	
	Short-circuited current	250 A ～ 3350 A ± 10%	
	Front time	8μs ± 20%	
	Time to half-value	20μs ±20%	
	Open voltage	0.5 kV ～ 6.7 kV ±10%	Coupling circuit：：10Ω + 9 μF Cable length：One side 0.5 m Line input side open
	Front time	1.2μs ± 30%	
	Time to half-value	50μs + 10μs / -25μs	
	Short-circuited current	41.6A ～ 558A ± 10%	
	Front time	2.5μs ± 30%	
	Time to half-value	25μs ± 30%	
RING WAVE	Open voltage	0.25 kV ～ 6.6 kV ± 10%	Coupling circuit：：4.5 μF Cable length：One side 0.5 m Line input side open
	Front time	0.5μs ± 30%	
	Frequency	100 kHz ± 10%	
	Waveform envelop	Pk2 = 40% ＜ Pk1 < 110% Pk3 = 40% ＜ Pk2 < 80% Pk4 = 40% ＜ Pk3 < 80%	
	Short-circuited current	8.3 ～ 550 A ± 10%	
	Front time	0.2 ～ 1μs	
Power Capacity for EUT line	AC 690 V / 63 A MAX 50/60Hz、DC 125 V / 63 A MAX		
Decoupling coil	1.5 mH		
Voltage dip	Less than 10% of the rated voltage when the rated current is energized		At the output terminal of the AC superposition section
Residual voltage	Less than 15% of the injected voltage or less than double of the rated voltage (peak value)		
Phase angle control	0° ～ 360° ± 10° Operates at EUT power supply AC 90 V min. & 50/60 Hz ± 10%		
Power supply	AC 100 V ～ AC 240 V ± 10%　50/60 Hz ± 10%		
Operational environment	Humidity：15 ～ 35℃ Temperature：25 ～ 75% RH		
Dimensions	(W)430 × (H)695 × (D)686 mm		

■ Standard accessries(LSS-6330-A20)

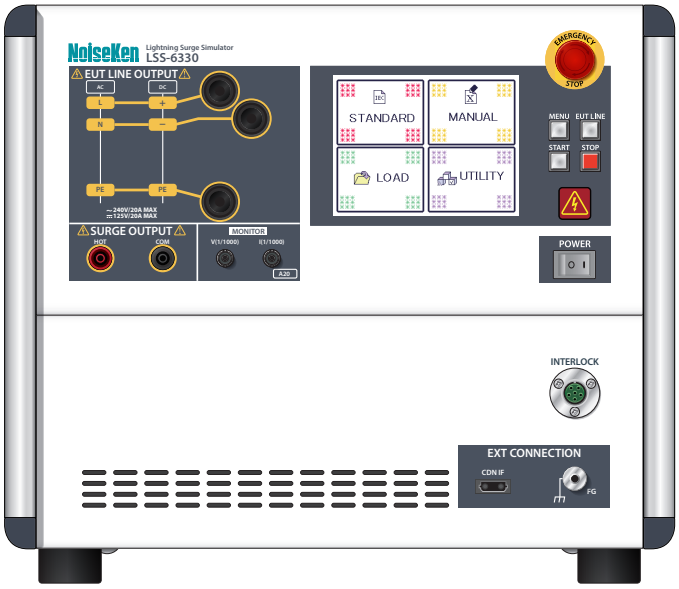
Items	Quantity	Note
AC cable	1 pc	
PE cable	1 pc	round solderless tip - round solderless terminal
Surge output cable (HOT・COM)	1 pc each (totally 2 pcs)	multi-contact: plug - round solderless terminal
Waveform verification cable (Surge output)	1 pc	multi-contact: plug - multi-contact: plug (for pre-check)
Waveform verification cable (CDN output)	1 pc	multi-contact: plug - multi-contact: plug (for pre-check)
Line input cable (05-00162A)	3 pcs	multi-contact: plug - bar solderless terminal、Single wire
Line outupt cable	3 pcs	multi-contact: plug - round solderless terminal
Interlock connector	1 pc	
BNC cable for monitor	1 pc	
Accessory bag	1 pc	
Instruction manual	1 volume	

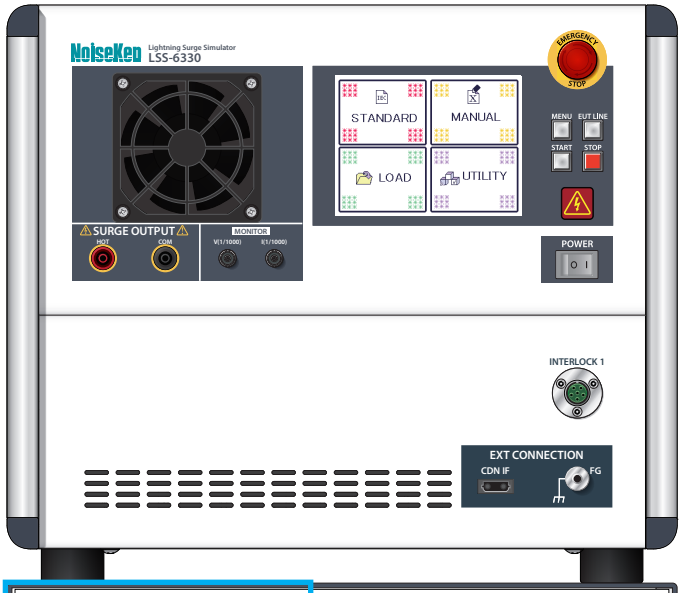
■ Standard accessries(LSS-6330-B63)

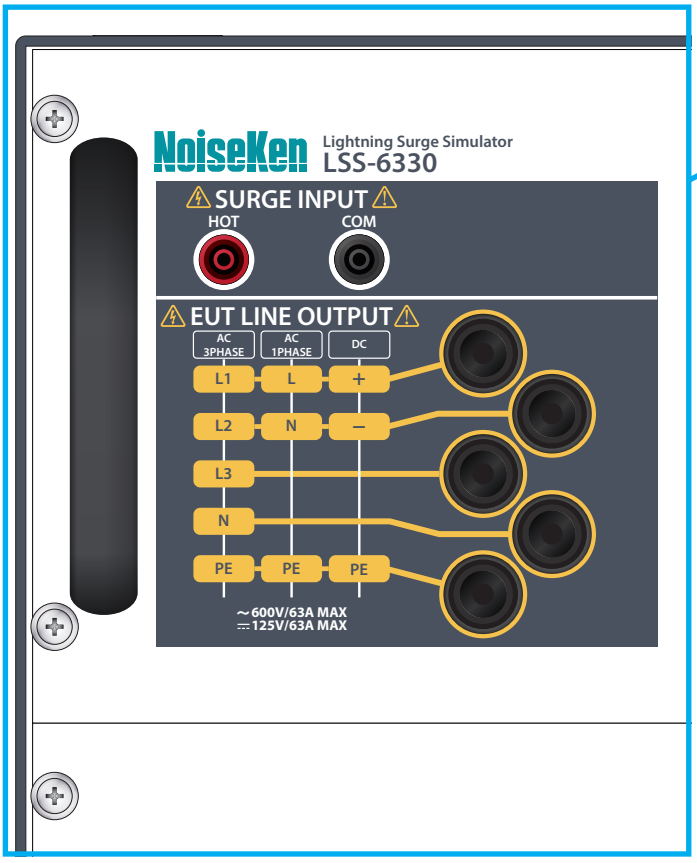
Items	Quantity	Note
AC cable	1 pc	
PE cable	1 pc	round solderless tip - round solderless terminal
Surge output cable (HOT・COM)	1 pc each (totally 2 pcs)	multi-contact: plug - round solderless terminal
Waveform verification cable (Surge output)	1 pc	multi-contact: plug - multi-contact: plug (for pre-check)
Waveform verification cable (CDN output)	1 pc	multi-contact: plug - multi-contact: plug (for pre-check)
Line input cable (05-00163A)	5 pcs	multi-contact: plug - bar solderless terminal、Single wire
Line outupt cable	5 pcs	multi-contact: plug - round solderless terminal
CDN connection cable (HOT・COM)	1 pc each (totally 2 pcs)	
Connection cable between CDN and PE on main unit	1 pc	
CDN control cable	1 pc	
Interlock connector	1 pc	
BNC cable for monitor	1 pc	
Accessory bag	1 pc	
Instruction manual	1 volume	

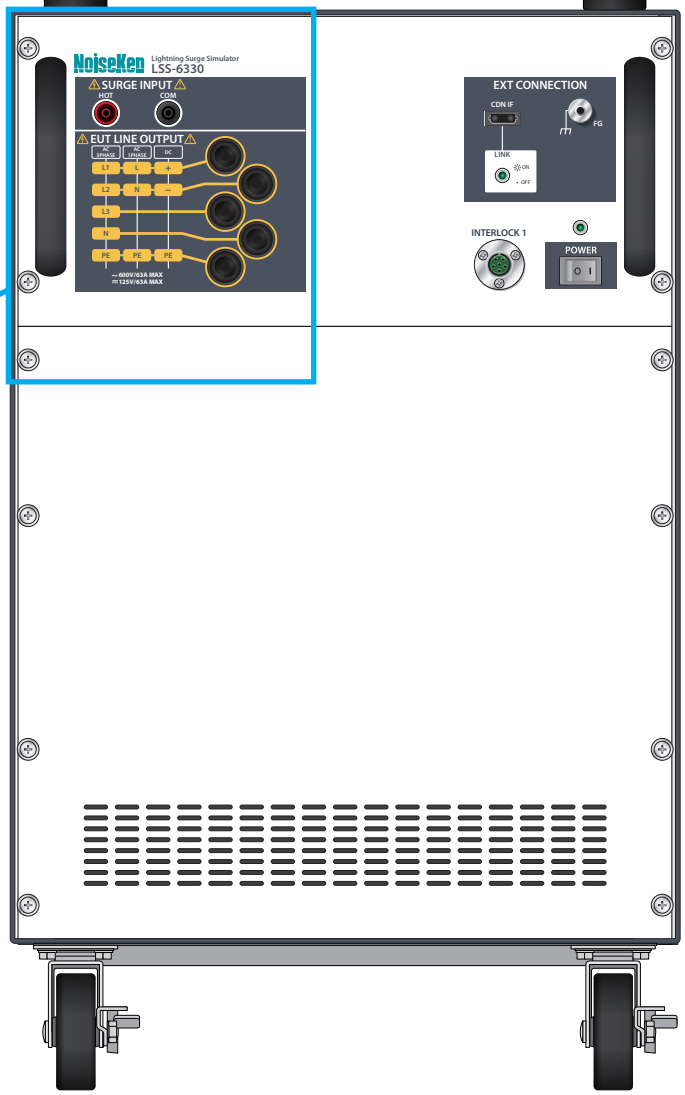
LSS-6330 series

Front panel









Lightning Surge Simulator

LSS-F03 series

For a stricter test with a maximum voltage of 15 kV.

A tester simulatively generates "High energy induced lightning noise" which induced to distribution lines or communication lines by ground potential fluctuation caused by lightning strikes.

- Lightning surge simulator compliant with the IEC61000-4-5 Edition 3 requirements
- Maximum output voltage 15 kV (maximum coupling of 15 kV to AC / DC CDN and 6 kV to Telecom CDN)
  Enable to conduct the more extended reliability test including the destructive test
- Large size LCD for the operation is adopted for realizing better visibility and operatability
- Easy operation for the sequential tests with adoption of MPU control Surge output / Waveform switching / Polarity switching / Sequence can be automated sequentially
- Selectable either MANUAL or PROGRAM mode MANUAL mode is used for the test according to the Standard or performing single conditioned test and PROGRAM mode can perform different conditioned tests sequentially so that the tests can be performed easily along purposes.
- Excellent safety with equipment of interlock
- Standard equipment of terminal for checking the waveforms : Enable to check the waveforms in connection to an oscilloscope on hand with BNC cable
- Isolation transformers in line-up (Option)
- In order to avoid resonance with the power supply, possible to vary the constant of the decoupling network (1.5, 1.3, 1.0, 0.8 mH)(Customized production). When some products like a power conditioner for photovoltaic application are connected to a lightning surge simulator, the resonant phenomena may be happened and the products may not work well. In LSS-F03 series (with customization), possible to change constants of the inductances so as to avoid such trouble.

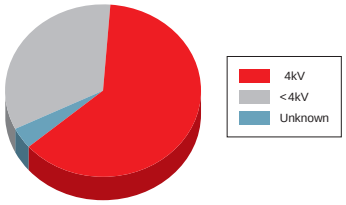
Unit to switch constant of the inductance

"Output voltage 15 kV, current 7500 A" which can conduct breakdown resistibility test.

Approx. 60% of the users are carrying on the test with voltage more than IEC Standard.

Requirement in IEC Standard < To keep up with quality in the market

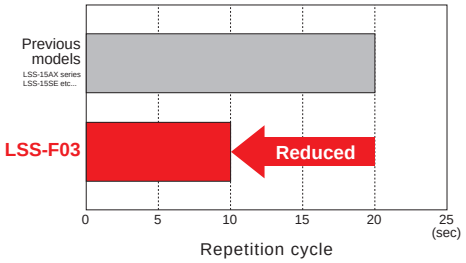
Test voltage of lightning surge immunity test



Quoted from the market investigation by NoiseKen on 2010

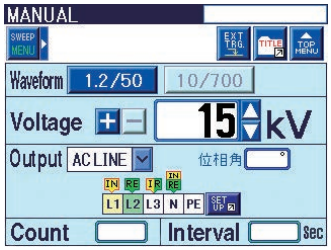
"50% reduction of the output interval" which can drastically reduce the test time.

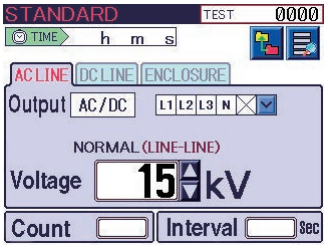
Realize 1/2 of the interval time comparing to our previous models so as to contribute to reduction of the man-hour for the test.
(* in case of the test less than 6 kV output)



"Touch-panel" adopted for the easy test setting.

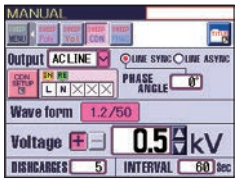
Adopt LCD touch panel for pursuing high visibility and realizing user-friendly operation with affluent icons.
Also, easy operation is realized not only for the test according to IEC Standard but also for the sequential tests with the parameter sweep function.





"Multi-languages" for the easy operation processing available.

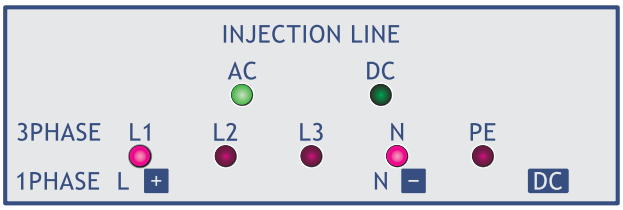
Not only Japanese and English but also Chinese and Korean available for the easy operation processing.

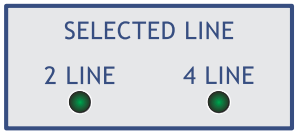


LSS-F03 series

"Indicator" which is linked with the test setting equipped.

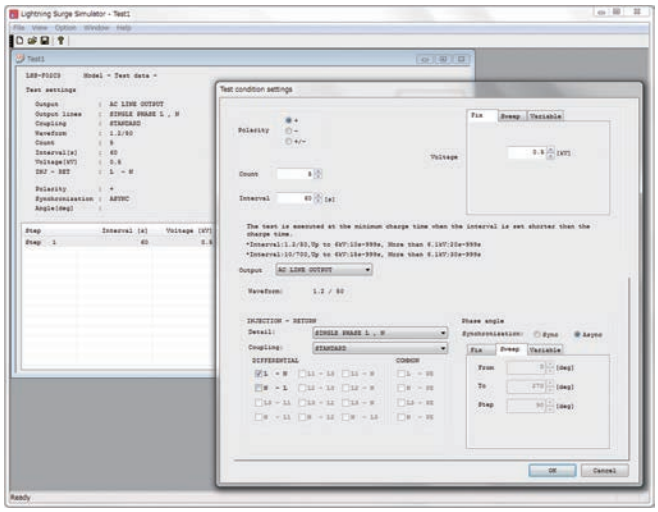
Indicators which visualize the cables connections in the test equipped.





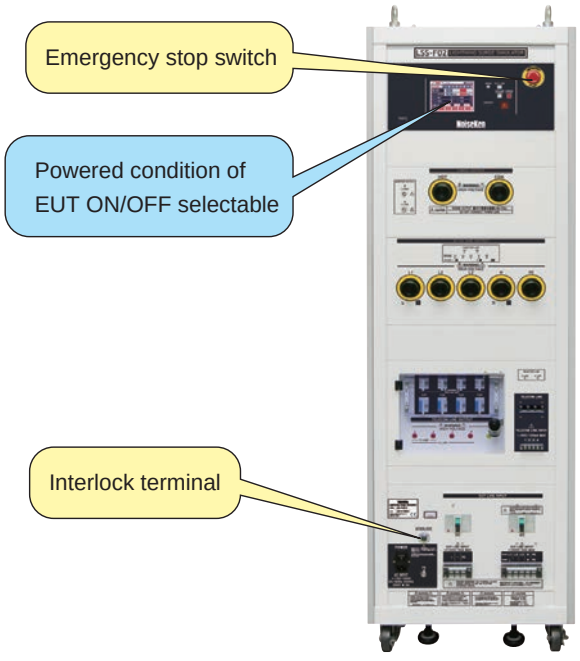
PC control available with the optional software.

Enable to control from external Windows® PC. Also, enable to put the report of the test result in record out.



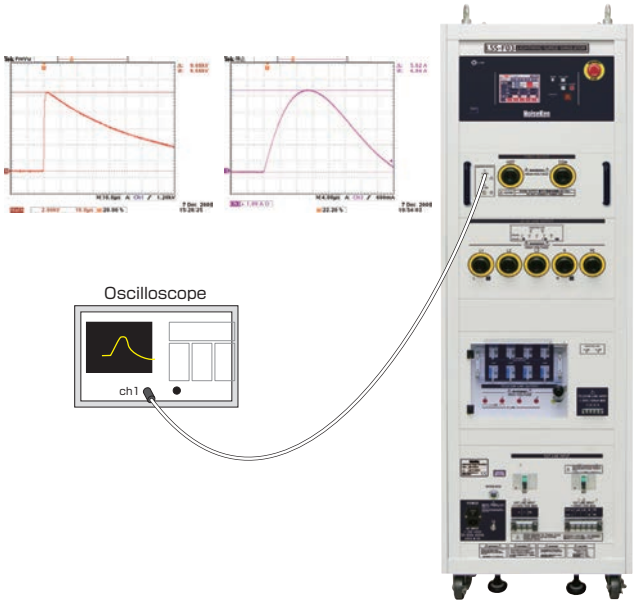
"Emergency stop" & "Interlock terminal" which secure the test operator equipped.

Emergency stop function which takes safety of the test operator into the account equipped both in the main body and the software. Also, the interlock setting and output voltage control function equipped.
If the protective safety fence and protective safety box are adopted as the options, more safety test can be realized.



"Output waveform monitor terminal" which can ease pre-checking of the waveforms prior to the actual test.

In order to respond to the request "The simple waveform checking is desired before the test", equip the monitor terminal.
*The terminal is just for the simple checking.
If the accurate measurement is required, the specialized equipments are necessary.
Please contact us for the more details.



How to understand the model numbers

LSS-F03-□□
- 1 : Model for single phase EUT L/N/PE
- 3 : Model for 3-phase EUT L1/L2/L3/N/PE(Available both for single phase & 3-phase)
- A : 1.2/50μs-8/20μs (Totally 1 kind surge generates)
- C : 1.2/50μs-8/20μs、10/700μs-5/320μs (Totally 2 kinds)

Specification

■Parameter	Specification		Note
Surge generating unit			
1.2/50μs - 8/20μs Combination waveforms	Output voltage	0.5 kV ～ 15 kV ± 10%	Common for the all models Voltage step : 0.1 kV step The setting can be from 0 kV
	Front time	1.2μs ± 30%	
	Duration	50μs ± 20%	
	Output current	250 A ～ 7500 A ± 10%	
	Front time	8μs ± 20%	
	Duration	20μs ± 20%	
10/700μs-5/320μs Combination waveforms	Output voltage	0.5 kV ～ 15kV ± 10%	Models : C1A / C3A Voltage step : 0.1 kV step The setting can be from 0 kV
	Front time	10μs ± 30%	
	Duration	700μs ± 20%	
	Output current	12.5 A ～ 375 A ± 10%	
	Front time	5μs ± 20%	
	Duration	320μs ± 20%	
Output polarity	Positive / Negative		
Interval	10 sec. ～ 989 sec., depending on the set voltage 10 sec. (< 6 kV)		15 sec. ～ in 10/700μs waveform
Output impedance	2 Ω ± 10%		1.2/50μs waveform
	40 Ω ± 10%		10/700μs waveform

■AC/DC CDN			
Coupling surge waveform	1.2/50μs - 8/20μs combination waveforms		
Max. coupling surge voltage / current	Up to the values which can be set		
Coupling network	18 μF	Between LINE - LINE (10 Ω + 9 μF selectable)	
Correspondent to IEC61000-4-5	10 Ω ± 9 μF	Between LINE - PE (18 μF selectable)	
Injection mode	Between LINE - LINE, Between LINE - PE		
Power supply lines structure for EUT	Single phase AC	: L / N / PE	Model : A1A / C1A
	DC	: + / - / PE	
	3-phase AC	: L1 / L2 / L3 / N / PE (Common for single phase and 3-phase)	Model : A3A / C3A
	DC	: + / - / PE	
EUT power capacity	AC 240 V / 20 A MAX 50/60 Hz DC 125 V / 20 A MAX		Model : A1A / C1A
	AC 500 V / 50 A MAX 50/60 Hz DC 125 V / 50 A MAX		Model : A3A / C3A
Decoupling coil	1.5 mH		
Phase angle control	0 ～ 360° ± 10°		

■CDN for Telecom lines (Only in model C1 and C3)			
Coupling surge waveform	1.2/50μs - 8/20μs combination waveforms		
	10/700μs - 5/320μs combination waveforms		
Max. coupling surge voltage / current	6 kV (waveform specifications can be met at 2 kV for 1.2/50μs waveform and 4 kV for 10/700 waveform)		
Impedance matching resistors	40 Ω	80 Ω per 1 line at 2 lines	1.2/50μs waveform
		160 Ω per 1 line at 4 lines	
	25 Ω per line		10/700μs waveform
Coupling mode	Common mode		
Coupling network	Gas arrestor : 90 V		
Line for EUT	2 lines / 4 lines DC 50 V / 100 mA MAX		Selectable
Decoupling coil	20 mH		

■Others		
Voltage monitor	BNC output, 1 / 2000 ± 10%	In open-circuit for SURGE OUT
Current monitor	BNC output, 1 mV / A ± 10%	In short-circuit for SURGE OUT
External communication	RS-232C optical communication	
Power supply	AC 100 V ～ AC 240V ± 10% 50/60Hz	
Dimensions	(W)555 × (H)1450 × (D)790 mm (A1A / A3A), (W)555 × (H)1800 × (D)790 mm (C1A / C3A)	Projection excluded (in all models)
Weight	A1A : approx. 290 kg A3A : approx. 300 kg C1A : approx. 325 kg C3A : approx. 340 kg	

Standard accessory

Item	Specification / Function	Q'ty	Correspondent model
Surge output cable	HOT / COM	2 pcs.	Common
Output cable to power supply lines	For single phase : L / N / PE	3 pcs.	A1A / C1A
	For 3-phase : L1 / L2 / L3 / N / PE	5 pcs.	A3A / C3A
Output cable to telecom lines	For 1 ～ 4 lines and GND	5 pcs.	C1A / C3A
Arrestor unit	For coupling : Equipped to main unit panel	4 pcs.	C1A / C3A
	For input protection : Equipped to main unit panel	4 pcs.	
Cable for monitor	BNC - BNC cable	1 pc.	Common
External interlock connector	5P plug (Short between #1 - #3)	1 pc.	Common
Power supply cable	For AC 100 V, 3P equipped with G connector cable	1 pc.	Common
High voltage connector cap	Equipped to main unit panel	5 pcs.	A1A / C1A
		7 pcs.	A3A / C3A
FG cable	For grounding the body	1 pc.	Common
Instruction manual	-	1 volume	Common

● These products use parts containing mercury. Please comply with lows or regulation in countries or states the products are used for the disposal.
● Certain periodical inspection shall be recommended since consumable parts are contained in the products.
In the test to 3-phase 5 lines (with PE) power supply lines, a message which alert the inspection per around 200 sets (in the test to single phase (with PE) power supply lines, it is done per around 800 sets).
(1 set in this case means that the test shall be done with 2 levels (eg. 0.5 kV and 1 kV) for the test series according to IEC 61000-4-5)
* Exchange timing of the parts may differed depending on the operative conditions and environment. Please contact us for the more details.

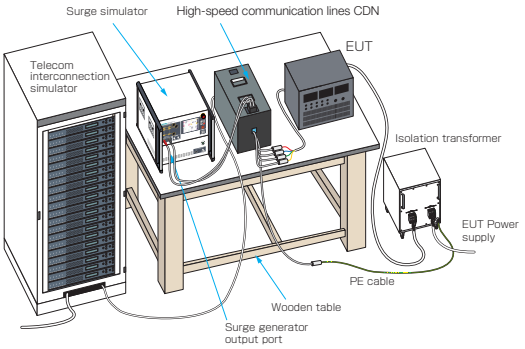
Option

High-speed communication lines CDN for LSS-F03 series

Defined in the IEC 61000-4-5 , this CDN product is used to apply surges to unshielded symmetrical interconnection lines with speed up to 1000 Mbit/s.
Conversion cables (05-00147A) are required for the CDN connection to the LSS-F03 simulator.
Conversion cables (05-00164A) are required for the CDN connection to the LSS-6330 simulator.

Parameter	F-130814-1004-2	F-130814-1004-4
Maximum input voltage	2 kV	4 kV
EUT power capacity	DC 65V / 1 A	
Maximum line Number	8 lines	
EUT/AE connector	RJ-45	
Dimensions	(W)400 × (H)230 × (D)240 mm	

● **Available model : LSS-F03 series, LSS-6330 series**

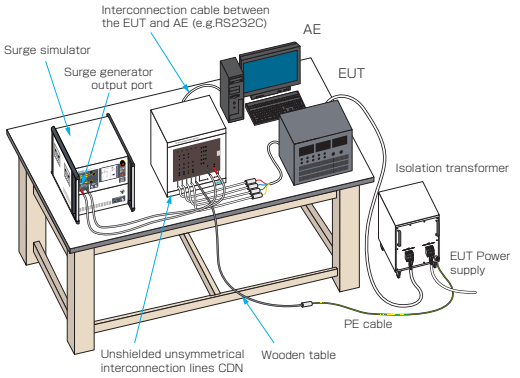


CDN for Interconnection Lines for LSS-F03 series MODEL : LSS-INJ6401SIG

Used for the surge test to interconnection lines defined in IEC61000-4-5 Standard. The EUT power capacity is DC 50 V / 1 A and enable to inject the surge to interconnection lines up to 6,600 V. Possible to bypass inductor (20 mH) with connecting the attached connection plug to inductor bypass terminal in DC output. Possible to equip the attached surge protective arrestor between each line and ground.
*** The conversion (05-T1578)cable is needed additionally.**
*** The conversion (05-00165)cable is needed additionally.**

Parameter	Specification
Surge input voltage	500 V ～ 6.600 V (Combination wave)
EUT power capacity	DC 50 V / 1 A
Max. line number	4 lines
Decoupling coil	20 mH each line
Matching resistor	40Ω ± 10%
Dimensions / Weight	(W) 488 × (H)456 × (D) 550 mm approx. 45 kg

● **Available model : LSS-F03 series, LSS-6330 series**



Telecom line CDN

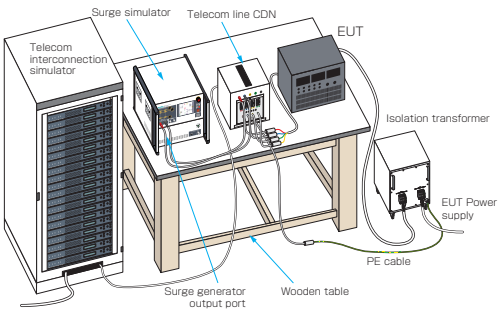
* The product in the photo is under development.

Defined in IEC61000-4-5 , this CDN product is used to apply surges to interconnection lines for unshielded subject or telecom lines.

***Please inquire to us for details.**

Item	Specificaion / Performance
Surge Input Volatage	6.6 kV
EUT Power Supply Capacity	DC 50 V 100 mA
Max. Line Number	4 Lines
Decoupling Coil	20 mH each line
Matching Resistor	40 Ω (1.2/50μs - 8/20μs Combination wave)
	25Ω (10/700μs - 5/320μs Combination wave)
Dimensions / Weight	(W)297 × (H)262 × (D) 250 mm / approx. 10 kg

● **Available model : LSS-6330 series**



AC Line Input Cable (Single phase) MODEL : 05-00134A

AC line input cable (3-phase) MODEL : 15-00135A

DC line input cable MODEL : 05-00136A

Option

OUTLET BOX

OUTLET BOX converts LINE output socket.

18-00081A	Outlet box 125V 15A 2P+PE	Btype(3Ptype、JP/USAtype) AC 125 V 15 A MAX
18-00082A	multi-outlet box	Japan(JIS), America(UL), Canada(CSA), Australia(CSA), Swiss(SEV), Italy(CEI), Europe(CEE, DIN), England(BS) Input up to 4.55 kV
18-00083A	Outlet box	Europe CEE DIN 250 V 16 A MAX
18-T2300	3P terminal block conversion box	3P terminal block M6 with protective cover & Input up to 5 kV. * This is a custom product. Please contact us for details.
18-N2494	5P terminal block conversion box	5P terminal block M6 with protective cover & Input up to 5 kV. * This is a custom product. Please contact us for details.

● Available model : LSS-6330 series

Terminal Connection Board attached with Multi-Outlet(3P) MODEL : 18-00048B

Terminal connection board for the output of LSS-6230-A20 to connect EUT. By wiring with multi-outlet, plug compliant to each country's standard can be inserted directly.

single phase 3 lines (withstand vlotage 4.5 kV)
*Conversion cable (model: 05-00166A) is required.

● Available model : LSS-F03 series, LSS-6330 series

Terminal Connection Board attached with Multi-Outlet(5P) MODEL : 18-00058B

Terminal connection board for the output of LSS-6230-A20 to connect EUT. By wiring with multi-outlet, plug compliant to each country's standard can be inserted directly.

three phases 5 lines (withstand vlotage 4.5 kV)
*Multi-outlet is for single phase.

● Available model : LSS-F03 series, LSS-6330 series

Terminal Block for 3P MODEL：18-00047A

Terminal block board for CDN to connect EUT. 3 pins
*Conversion cable (model: 05-00166A) is required.

● Available model : LSS-F03 series, LSS-6330 series

Terminal Block for 5P MODEL：18-00044A

Terminal block board for CDN to connect EUT. 5 pins
*Conversion cable (model: 05-00167A) is required.

● Available model : LSS-F03 series, LSS-6330 series

EUT Protective Safety Box MODEL : 11-00005A/11-00006A

Protection box to prevent access to EUT during the test.
Further safety is secured together with the safety protective fence

MODEL	Dimensions
11-00005A	(W)400 × (D)300 × (H)300 mm
11-00006A	(W)600 × (D)400 × (H)350 mm

Protective Safety Fence MODEL : 11-00010A

Enable to materialize the safe test environment with connection to interlock function equipped in LSS-F03 series. The safety measure can be sure together with the EUT protective safety box.

Warning Lamp MODEL：11-00008A

Alarm lamp for LSS series. Alarm lamp illuminated when high voltage is generated at the time of test

● Available model : LSS-F03 series, LSS-6330 series

Tri-color pilot light MODEL：11-00015A

Usable together with LSS-6330-A20. The blinking makes the operators or neighbors pay attention to the test processig. Three colors indicate corresponing simulator's test status change.

● Available model : LSS-F03 series, LSS-6330 series

Optical USB module MODEL：07-00022A

Conversion adapter to interface with PC for the remote control of LSS
USB to optical interface. Fiber cable 5 m included.

● Available model : LSS-F03 series, LSS-6330 series

Option

Isolation Transformer MODEL : TF-2302P

Model TF-2302P is a single-phase isolation transformer rated AC 240 V / 30 A and dielectric strength of 4 kV. For safety reason, an isolation transformer is indispensable for AC powered testing for equipment.

Parameter	Specification
Maximum input voltage	Single phase AC 240 V Max (50/60 Hz)
Maximum output current	30 A Max
Dielectric strength	Primary winding to core AC 4 kV (1 minute) Secondary winding to core AC 4 kV (1 minute) Primary to secondary windings AC 4 k V (1 minute)
Insulation resistance	100 MΩ or more at DC 500 V
Dimensions / Weight	(W)350 × (H)475 × (D)400 mm (Eye bolts and handles excluded) / approx. 60 kg

Isolation Transformer MODEL : TF-6503P, TF-6633P

Model TF-6503P is a three-phase isolation transformer rated AC 600 V / 50 A and dielectric strength of 4 kV. For safety reason, an isolation transformer is indispensable for AC powered testing for equipment.

Parameter	TF-6503P Specification	TF-6633P Specification
Maximum input voltage	Single / Three phase AC 600 V Max (50/60 Hz)	
Transformer wiring method	Star wiring	
Maximum output current	50 A Max	63 A Max
Dielectric strength	Primary winding to core AC 4 kV (1 minute) Secondary winding to core AC 4 kV (1 minute) Primary to secondary windings AC 4 kV (1 minute)	
Insulation resistance	100 MΩ or more at DC 500 V	
Dimensions / Weight	(W)500 × (H)640 × (D)700 mm (Eye bolts and handles excluded) / approx. 300 kg	

Noise Canceller Transformer NCT series

It has superb attenuation characteristics against impulse noises. It can be used for insulate in the impulse noise test.
***Connection cable is needed to be modified when it is connected with the transformer. Please inquire us for details.**

MODEL	Primary Voltage / Secondary Voltage	Rated current	Frequency
NCT-160	120 V	5 A	50/60Hz
NCT-1120		10 A	
NCT-1240		20 A	
NCT-260	240 V	2.5 A	
NCT-2120		5 A	
NCT-2240		10 A	

Circuit Breaker Box MODEL : 18-00072A/73A

Model TF-6503P is a three-phase isolation transformer rated AC600 V / 50A and dielectric strength of 4 kV. For safety reason, an isolation transformer is indispensable for AC powered testing for equipment.

Item	Specification (18-00072A)	Specification(18-00073A)
Rated Voltage	AC 250 V 50/60 Hz DC 65 V	AC 240 / 415 V 3-phase 4-line Y-connection 50/60 Hz AC 240 V: Line - Neutral pole (N pole) AC 415 V: Line - Line
Rated Current	20 A	50 A
Switching life	≧10000 times (test conditions: rated switching 6000 times、swiching without load 4000 times、switching frequency 6 times/min.)	
Neutral pole(N pole)	-	No trip alone Neither open-circuit before pther poles nor closed-circuit after the other poles
Operating Temperature / Operating Humidity	15 - 35℃ / 25-75% (without dew)	
Dimensions	(W)180 × (H)92 × (D)100 mm (protrusion excluded)	(W)180 × (H)92 × (D)120 mm (protrusion excluded)
Weight	0.75 kg	1.2 kg

● **Available model : LSS-6330 series**

Option

Arrester capacitor unit MODEL : 08-00012A

Arrester unit for surge decoupling.

● **Available model : LSS-F03 series**

Arrester capacitor unit MODEL : 08-00016A

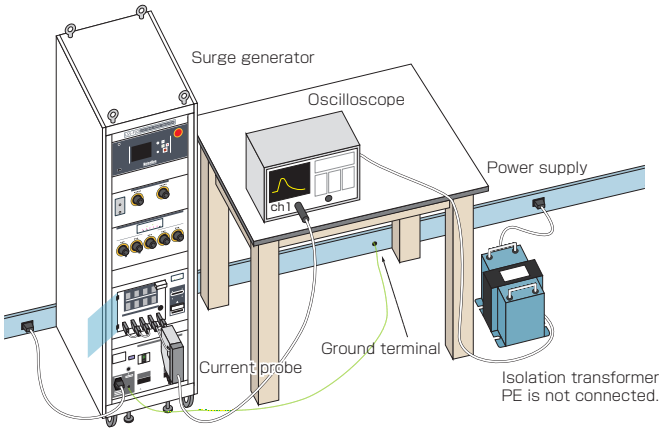
Arrester unit for surge coupling

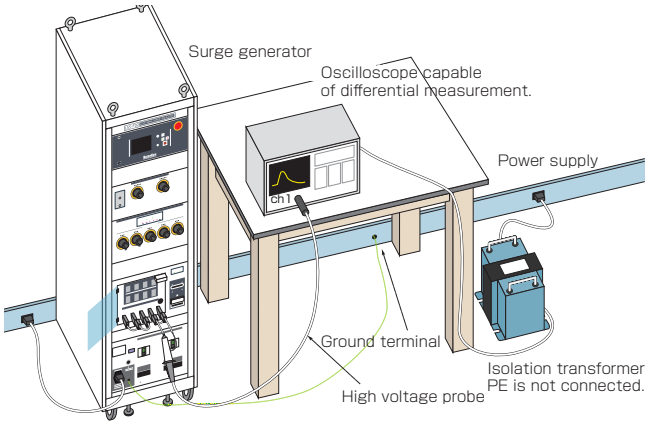
● **Available model : LSS-F03 series**

Telecom waveform check cable set MODEL：05-00150A

The Jig used when measure the output waveform from the CDN for telecom line.
The following equipment is required additionally.
- Oscilloscope (with differential operation function)
- High voltage probe (when measuring surge voltage / withstand voltage required)
- Current probe (when measuring surge short-circuit current)
- Insulation transformer (for oscilloscope)

■Surge waveform measurement (measurement example at the telecom line CDN terminal at 05-00150A)

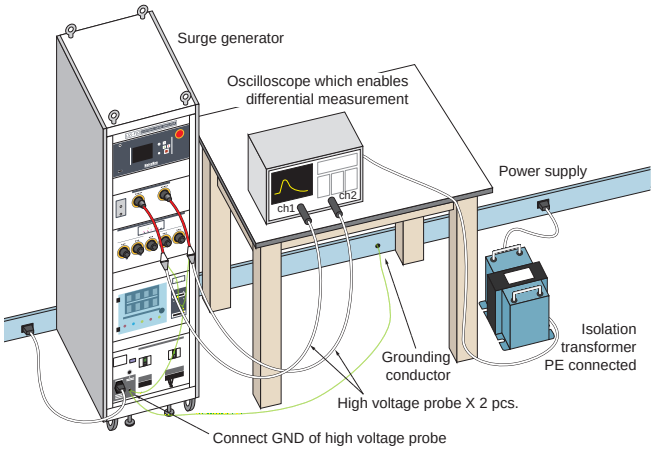


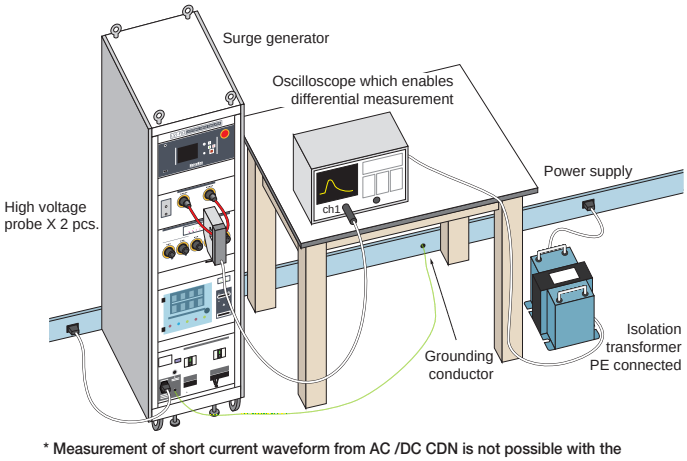


Waveform Pre-Checking Cables Set MODEL : 05-00099A

Fixtures for checking voltage waveforms and current waveforms of LSS-F03 series.
Followings are necessary for the checking additionally.
- **Oscilloscope (Differential operation function built-in)**
- **High voltage probes (for surge voltage measurement / Voltage resistibility necessary)**
- **Current probe (For surge short current measurement)**
- **Isolation transformer (for oscilloscope)**
- **Earth cable (for PE connection)**

■ Surge Waveform Measurement (Setup of measurement from SURGE OUT with 05-00099A)





* Measurement of short current waveform from AC /DC CDN is not possible with the waveform pre-checking cables set (05-00099A)

IEC61000-4-5 Ed.3 Test Standard

1. General

The task of the described laboratory test is to find the reaction of the EUT under specified operational conditions, to surge voltages caused by switching and lightning effects at certain threat levels. This standard specifies 2 kinds of the combination waveforms. One is simulating the injection to power supply lines and interconnections lines (The voltage waveform as 1.2/50μs and current waveform as 8/20μs) and the other is doing the injection to telecommunications lines (The voltage waveform as 10/700μs and current waveform as 5/320μs).
It is not intended to test the capability of the EUT's insulation to withstand high-voltage stress, direct injections of lightning currents, i.e., direct lightning strikes, are not considered in this standard.

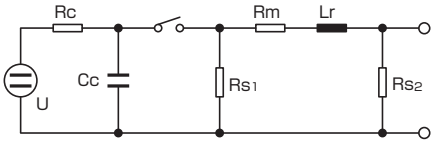
2. Test Level

Level	Open-circuit test voltage kV	
	Normal model	Common mode
1	-	0.5
2	0.5	1.0
3	1.0	2.0
4	2.0	4.0
x	special	special

x: Can be any level, above, below or in between the others. The level shall be agreed upon between the manufacturers and users.

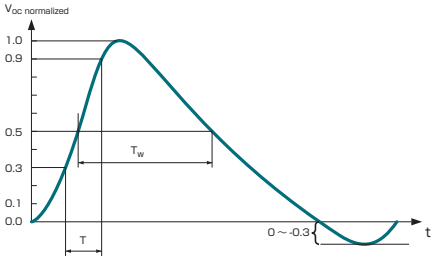
3. Waveforms Generator and Waveforms verification

■ Generation Circuit



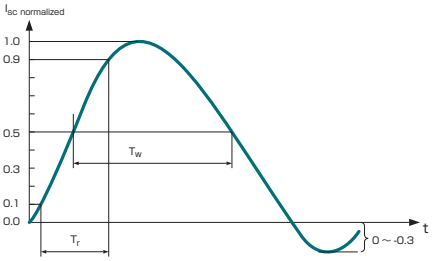
U High-voltage source
Rc Charging resistor
Cc Energy storage capacitor
Rs Pulse duration shaping resistors
Rm Impedance matching resistor
Lr Rise time shaping inductor

■ Voltage Surge (1.2/50μs)



Front time: $T_f = 1{,}67 \times T = 1{,}2\mu s \pm 30\%$
Duration: $T_d = T_w = 50\mu s \pm 20\%$

■ Current Surge (8 / 20μs)



Front time: $T_f = 1{,}25 \times T_r = 8\mu s \pm 20\%$
Duration: $T_d = 1{,}18 \times T_w = 20\mu s \pm 20\%$

■ 1.2/50μs Combination Waveform specification

	Front time Tfμs	Duration Tdμs
Open-circuit voltage	Tf = 1,67 × T = 1,2 ± 30 %	Td = Tw = 50 ± 20 %
Short-circuit current	Tf = 1,25 × Tr = 8 ± 20 %	Td = 1,18 × Tw = 20 ± 20 %

4. Voltage waveform specification at the EUT port of power line CDN

■ 1.2/50μs Voltage waveform specification at the EUT port of the power line CDN (open-circuit voltage)

Open circuit votlage *	Coupling impedance	
	18 μ F (line to line)	9 μ F + 10 Ω (line to ground)
Peak voltage		
Current rating ≦ 16 A	Set voltage +10 %/-10 %	Set voltage +10 %/-10 %
16 A < current rating ≦ 32 A	Set voltage +10 %/-10 %	Set voltage +10 %/-10 %
32 A < current rating ≦ 63 A	Set voltage +10 %/-10 %	Set voltage +10 %/-15 %
63 A < current rating ≦ 125 A	Set voltage +10 %/-10 %	Set voltage +10 %/-20 %
125 A < current rating ≦ 200 A	Set voltage +10 %/-10 %	Set voltage +10 %/-25 %
Front time	1,2 μ s ± 30 %	1,2 μ s ± 30 %
Duration		
Current rating ≦ 16 A	50 μ s + 10 μ s/ -10 μ s	50 μ s + 10 μ s/ -25 μ s
16 A < current rating ≦ 32 A	50 μ s + 10 μ s/ -15 μ s	50 μ s + 10 μ s/ -30 μ s
32 A < current rating ≦ 63 A	50 μ s + 10 μ s/ -20 μ s	50 μ s + 10 μ s/ -35 μ s
63 A < current rating ≦ 125 A	50 μ s + 10 μ s/ -25 μ s	50 μ s + 10 μ s/ -40 μ s
125 A < current rating ≦ 200 A	50 μ s + 10 μ s/ -30 μ s	50 μ s + 10 μ s/ -45 μ s

* A CDN meeting the current rating of the EUT and its relevant waveform specification from this table shall be used.

IEC61000-4-5 Ed.3 Test Standard

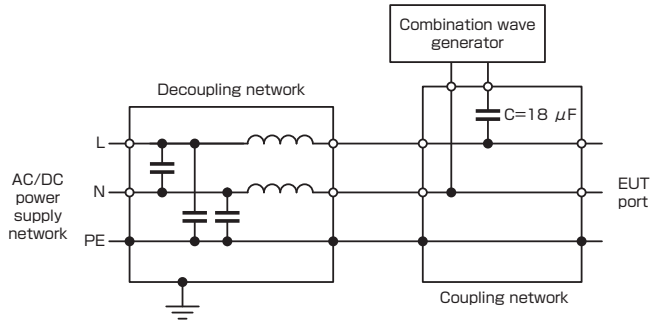
Current waveform specification at the EUT port of the power line CDN (short-circuit current)

Surge current parameters under short-circuit conditions	Coupling impedance	
	18 µF (line to line)	9 µF + 10 Ω (line to ground)
Front time	Tf = 1,25 × Tr = 8µs ± 20%	Tf = 1,25 × Tr = 2,5µs ± 30%
Duration	Td = 1.18 × Tw = 20µs±20%	Td = 1,04 × Tw = 25µs ± 30%

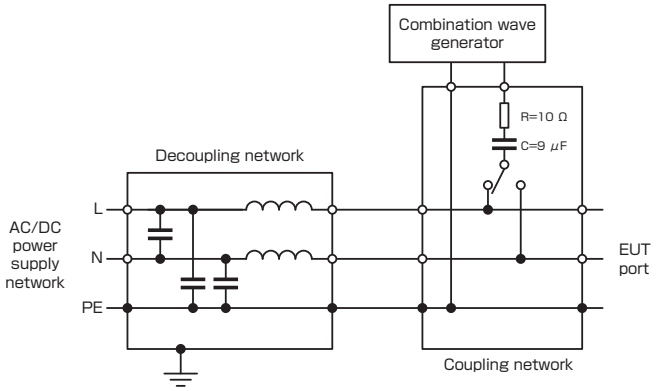
Relationship between peak open-circuit voltage and peak short-circuit current at the EUT port of the power line CDN

Open-circuit peak voltage +/-10% at EUT port of the CDN	Short-circuit peak current +/-10% at EUT port of the CDN (18 µF)	Short-circuit peak current +/-10% at EUT port of the CDN (9 µF + 10 Ω)
0,5 kV	0,25 kA	41,7 A
1,0 kV	0,5 kA	83,3 A
2,0 kV	1,0 kA	166,7 A
4,0 kV	2,0 kA	333,3 A

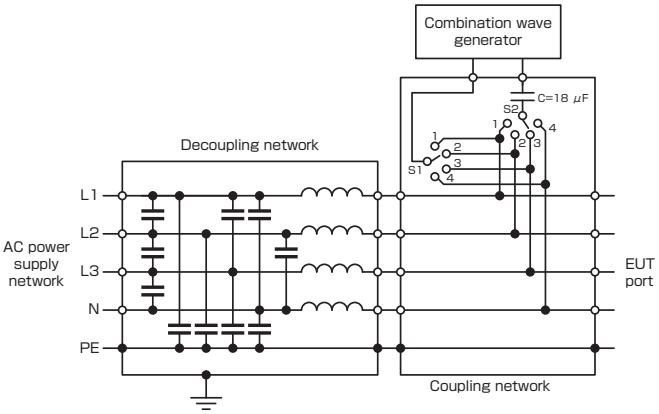
Single phase power line CDN (line to line mode)



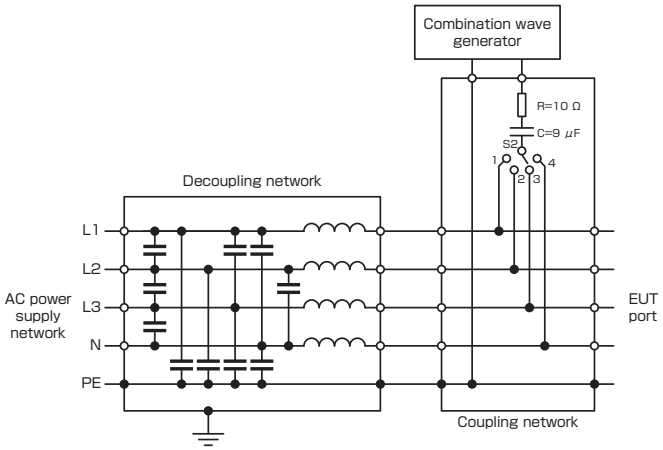
Single phase power line CDN (line to ground mode)



hree-phase power line CDN (line to line mode)

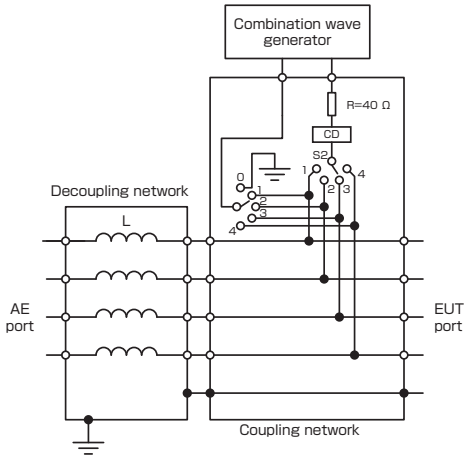


hree-phase power line CDN (line to ground mode)

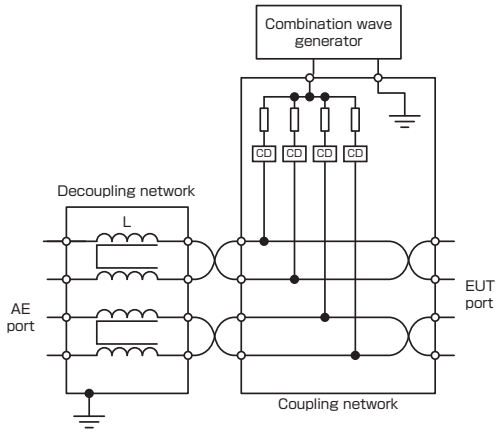


IEC61000-4-5 Ed.3 Test Standard

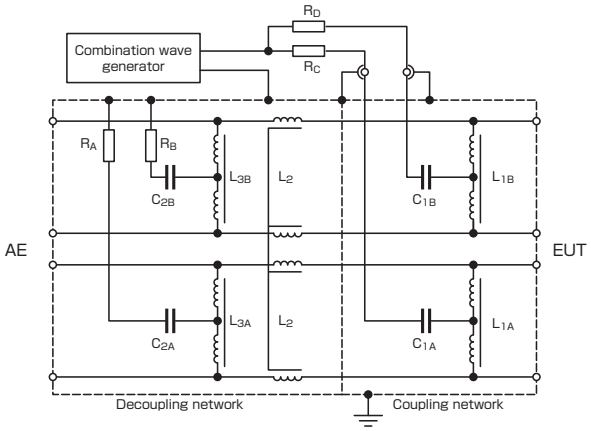
CDN for unshielded unsymmetrical interconnection lines



CDN for unshielded symmetrical interconnection lines



CDN for unshielded symmetrical high speed communication lines up to 1000Mbit/s



Surge waveform specifications at the EUT port of the CDN for unshielded unsymmetrical interconnection lines

Coupling method	Output voltage from the generator	Voltage at the EUT port of the CDN Voc ± 10 %	Voltage front time Tf = 1,67 ×Tr ± 30 %	Voltage duration Td = Tw ± 30 %	Short-circuit current at the EUT port of the CDN Isc ± 20 %	Current front time Tf = 1,25 x Tr ± 30 %	Current Duration Td = 1,18 x Tw ± 30 %
Line to PE R = 40 Ω, CD = 0,5 µF	4 kV	4 kV	1,2µs	38µs	87 A	1,3µs	13µs
Line to PE R = 40 Ω, CD = GDT	4 kV	4 kV	1,2µs	42µs	95 A	1,5µs	48µs
Line to line R = 40 Ω, CD = 0,5 µF	4 kV	4 kV	1,2µs	42µs	87 A	1,3µs	13µs
Line to line R = 40 Ω, CD = GDT	4 kV	4 kV	1,2µs	47µs	95 A	1,5µs	48µs

Surge waveform specifications at the EUT port of the CDN for unshielded symmetrical interconnection lines

Coupling method	Output voltage from the generator	Voltage at the EUT port of the CDN Voc ± 10 %	Voltage front time Tf = 1,67 xTr ± 30 %	Voltage duration Td = Tw ± 30 %	Short-circuit current at the EUT port of the CDN Isc ± 20 %	Current front time Tf = 1,25 x Tr ± 30 %	Current Duration Td = 1,18 x Tw ± 30 %
Line to PE R = 40 Ω Coupling devices*	2 kV	2 kV	1,2µs	45µs	48 A	1,5µs	45µs

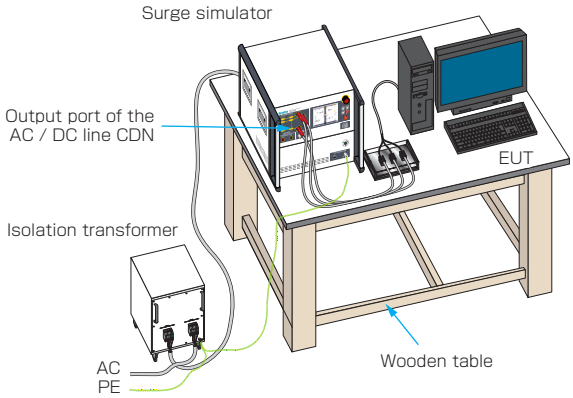
* GDT, Clamping device, Avalanche devices

It is recommended that the CDN calibrated at the highest rated voltage. The values shown in the table are for a set value of 4 kV. If the CDN is rated for another maximum voltage, calibration shall perform at that maximum voltage. (In the case of the maximum voltage is 6 kV, multiply the short circuit current value shown in this table by 1.5.)

IEC61000-4-5 Ed.3 Test Standard

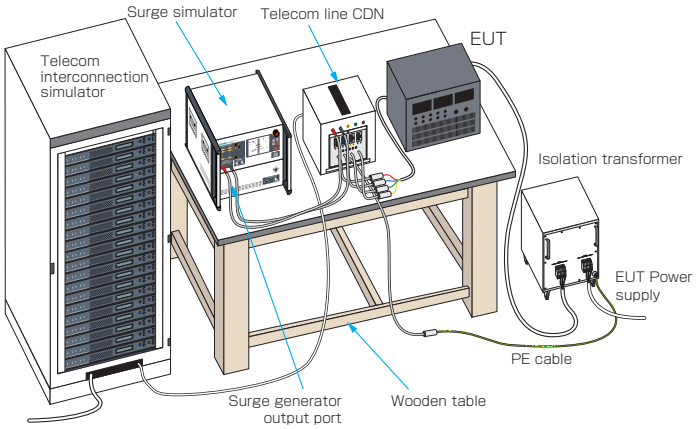
5. Test Set-ups

Application of surges to power supply lines



The 1.2/50 combination wave (C/W) specified in the IEC 61000-4-5 standard is applied through the power lines CDN of the LSS-6330 simulator. Compliant with the standard requirements, the simulator is of floating output. The simulator can conduct a series of tests to preprogrammed settings.

Application of surges to telecom lines

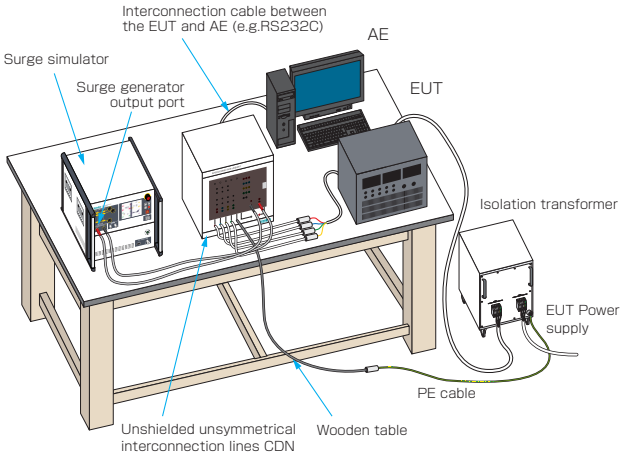


The 1.2/50 combination wave (C/W) specified in the IEC 61000-4-5 standard is applied through the telecom lines CDN of the LSS-6330 simulator.

Application of surges through unshielded unsymmetrical interconnection lines CDN

The 1.2/50 μ s surge generator of the LSS-6330 simulator shall be used in combination with an optional external CDN. This CDN is connected between the EUT and AE (auxiliary equipment)

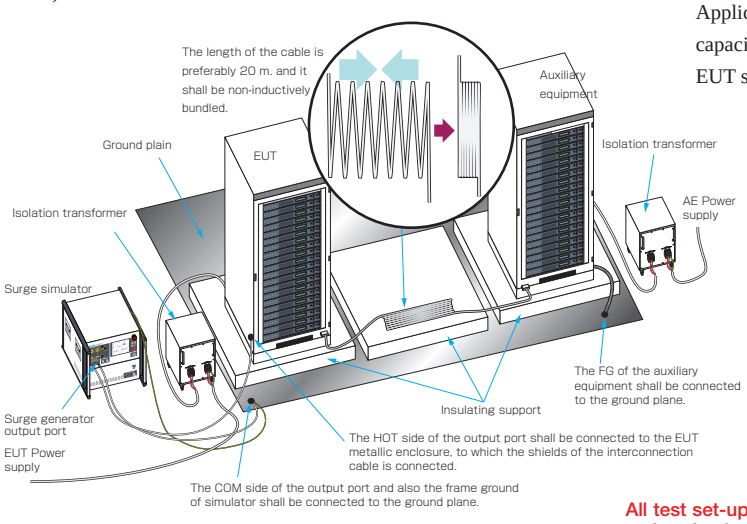
For all tests shown here, if it is not otherwise specified, the length of cable between the EUT and CDN should be 2m or shorter.

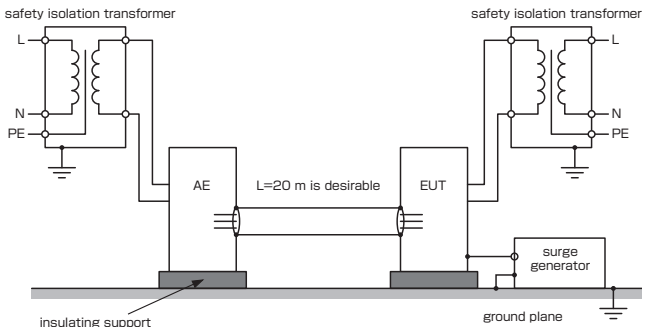


Test set-up for surges applied to shielded lines

In case of shield lines, surge shall be applied to the metal enclosure of the EUT (for the EUT without a metallic enclosure, surges shall be applied to the shields of the cable)

Application of the surges shall be done from the generator output port via a 18 μF capacitor. The auxiliary equipment shall be connected to the ground plane while the EUT shall not.





All test set-ups shown here are examples for performing tests by using the LSS-6330 series simulators. Some parts are not requirements of the relevant IEC standard.

IEC61000-4-5 Ed.3 Test Standard

6. Test procedure

■ Execution of the test

・Number of surges
For DC power ports and interconnection lines five positive and five negative surge pulses.
For AC power ports five positive and five negative pulses each at 0º, 90º, 180º and at 270º;
・Time between successive pulses: 1 min or less

7. Evaluation of Test Results and Test Report

The test results shall be classified in terms of the loss of function or degradation of performance of the equipment under test, relative to a performance level defined by its manufacturer or the requestor of the test, or agreed between the manufacturer and the purchaser of the product. The recommended classification is as follows:

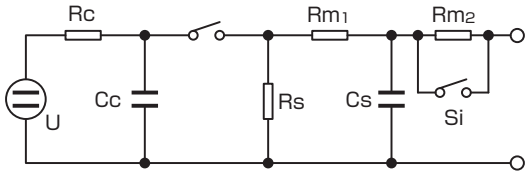
1) Normal performance within limits specified by the manufacturer, requestor or purchaser;
2) Temporary loss of function or degradation of performance which ceases after the disturbance ceases, and from which the equipment under test recovers its normal performance, without operator intervention;
3) Temporary loss of function or degradation of performance, the correction of which requires operator intervention;
4) Loss of function or degradation of performance which is not recoverable, owing to damage to hardware or software, or loss of data.

Generally speaking, as far as the EUT can be immune to the surges which is injected in the all specified period and it satisfy the functional requirements according to the product specification, the test result can be judged as “Good”.
The test report shall contain the test conditions and the result.

8. Surge testing for unshielded outdoor symmetrical communication lines

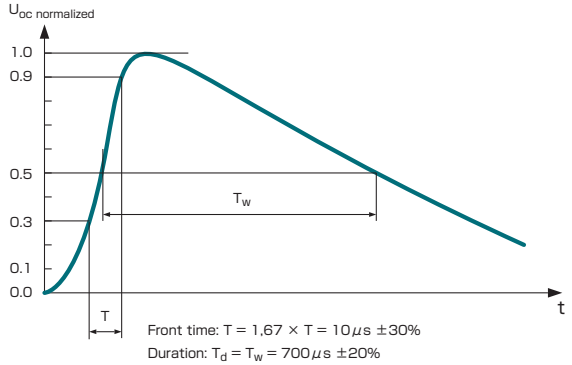
The 3rd edition of the standard requires the 10 / 700 us combination wave is applied to ports connected to outdoor telecommunication lines only and the Annex A (Normative) dedicatedly address this test. Outdoor telecommunication lines are typically greater than 300 in length, as the result of this length 10 / 700 uS wave is more representative. Telecommunication lines are usually protected by a primary protector installed at the cable entry to building. Testing shall be performed with the intended primary protector.

■ 10 / 700 combination waveform (10 / 700・5 / 320μs) generation circuit



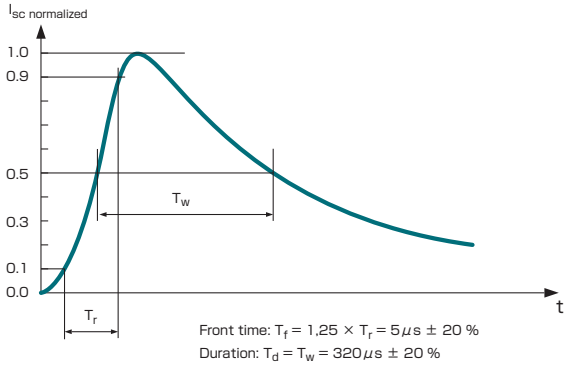
U	High-voltage source
Rc	Charging resistor
Cc	Energy storage capacitor
Rs	Pulse duration shaping resistor
Rm	Impedance matching resistors
Cs	Rise time shaping capacitor
S_1	Switch closed when using external matching resistors

■ Open circuit voltage waveform



Front time: T = 1.67 × T = 10μs ±30%
Duration: $T_d = T_w$ = 700μs ±20%

■ Short circuit current waveform



Front time: $T_f = 1.25 \times T_r$ = 5μs ± 20 %
Duration: $T_d = T_w$ = 320μs ± 20 %

IEC61000-4-5 Ed.3 Test Standard

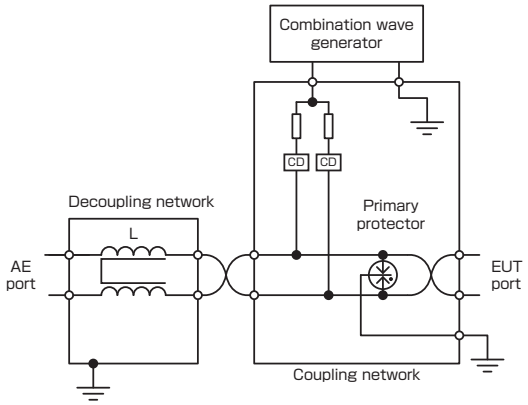
Definitions of the waveform parameters of 10/700μs combination waveform

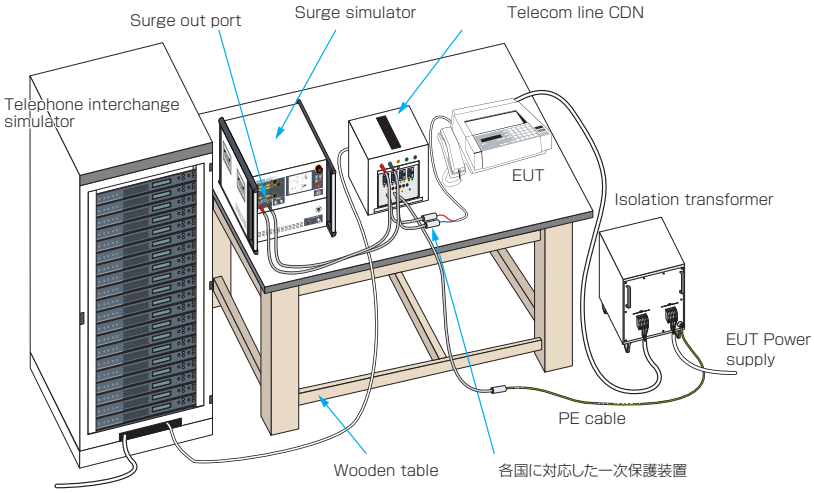
	Front time μ s	Duration μ s
Open-circuit voltage	10 ± 30 %	700 ± 20 %
Short-circuit current	5 ± 20 %	320 ± 20 %

Relationship between peak open-circuit voltage and peak short-circuit current of the 10/700μs combination waveform

Peak open-circuit voltage at generator output ± 10 %	Peak short-circuit current at generator output ± 10 %
0,5 kV	12,5 A
1,0 kV	25 A
2,0 kV	50 A
4,0 kV	100 A

Test set-up example by using the 10/700 us generator and CDN for outdoor unshielded symmetrical communications lines





Surge waveform specifications at the EUT port of the CDN for unshielded outdoor symmetrical communication lines

Coupling method	Output voltage from the generator	Open-circuit voltage at the EUT port of the CDN Voc ± 10 %	Voltage front time Tf = 1,67 x Tr ± 30 %	Voltage duration Td = Tw ± 30 %	Short-circuit current at the EUT port of the CDN Isc ± 20 %	Current front time Tf ± 30 %	Current duration Td ± 30 %
Common mode Coupling devices 1 pair 27,5 Ω	4 kV	4 kV	8 μ s	250 μ s	145 A	3,2 μ s	250 μ s

Note: These test set-ups and procedures are quoted from IEC61000-4-5 Ed.3 (2014) Standard. Please go through the standard if the more details are required.

Lightning Surge Simulator

LSS-720B2

Feature

- Lightning surge simulator (Generator) conforming to JEC 210 / 212 Standard
- 20 kV as the maximum output voltage
  Enable to verify dielectric strength against induced lightning surge whose level cannot be available with the combination surge simulators
- 4000 A as the maximum output current
  Enable to conduct testing for surge absorbers for their current handling capability
- Enable to observe the output waveform only with an oscilloscope on hand and 1 / 10 voltage probes since 1 / 100 waveform check terminal is standard equipped
- Isolation transformer built-in so that the primary power input and EUT can be easily connected

Specification

Parameter		LSS-720B
Voltage surge	Output waveform	1.2/50μs
	Max. output voltage	20 kV
	Polarity	Positve or negative
	Output impedance	6 Ω ± 10 %
	Built-in load resistance	50 Ω ± 10% (Current limite resistance 100 Ω)
	Short current at max. output	3300 A
Current surge	Output waveform	8 / 20μs
	Max. output current	4000 A
	Polarity	Positive or negative
	Output impedance	5 Ω ± 10%
	Built-in load resistance	3 kΩ ± 10%
Surge repetitive cycle single output		Single output
EUT power capacity		Single phase 240 V / 20 A
Dimensions		(W) 555 × (H) 1860 × (D) 840 mm
Weight		Approx. 450 kg

Accessory

Item	Model number	Q'ty
Bag for accessories		1 pc.
Power cable		1 pc.
Surge ground cable		1 pc.
Switch for external trigger	04-00003A	1 pc.
Surge output cable		1 pc.
Single phase input cable	05-00003A	1 pc.
Check terminal	02-00023A	1 pc.
Residual voltage discharge probe		1 pc.
Warning lamp		1 pc.
Fuse		2 pcs.
Output cable	05-00015A	2 pcs.
Interlock connector		1 pc.
Instruction manual		1 volume
Switch key		2 pcs.
Waveform switching connection bar		6 pcs.

JEC Standard Summary

Standard

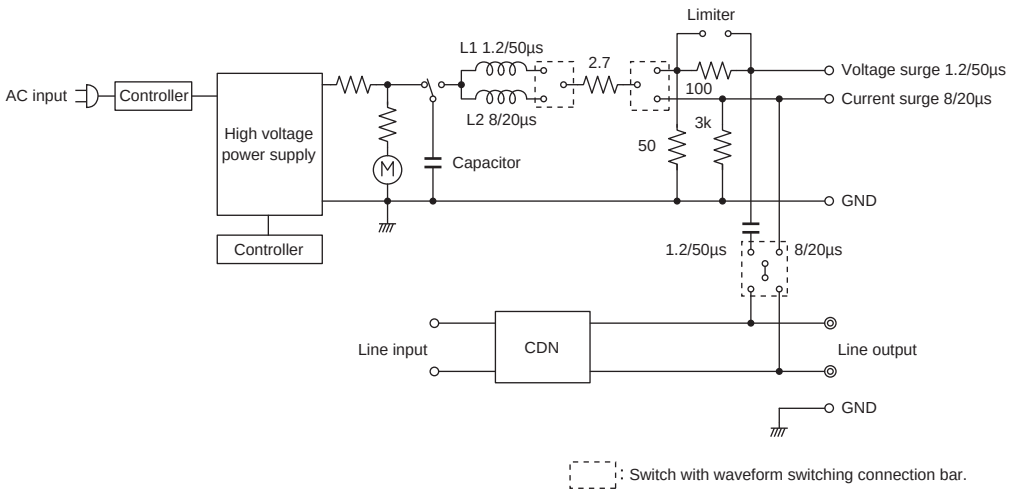
Provides dielectric strength test for electronic equipment connected to electric power systems, and specifies test voltage and object circuits for purpose of protection of electric facilities.

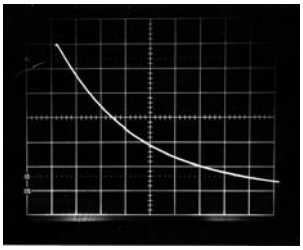
Examples of Surge Injection to Power Lines

In low voltage control dielectric test method, test voltage induction and voltage resistibility test against lightning surge impulse specified in JEC-210 (The Institute of Electrical Engineers of Japan / Japanese Electrotechnical Committee), verify whether EUT can be resistible against the lightning impulses (Standardized 1.2/50μs) whose test conditions are specified in the Standard and which are injected both to the positive and negative each 3 times.

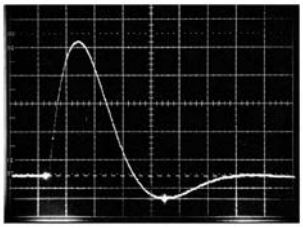
Circuit clss NO.	Lightning impulse test voltage (V)				Object circuit
	To gound	Between inter electric cicuit	Between contact points and between coil terminals: Instrument transformer	Between contact points and between coil terminals: DC/AC circuits	
1	7	4.5	4.5		Secondary and third circuits in instrument transformer which is used for main circuit (main unit side)
2A	7	3		3	Operation / Control circuits in breaker of disconnector used for main circuit
2B	5	3		3	
3	3	3		3	DC100-200V/AC100-400V circuits auxiliary equipements in main unit attached
4	4	4.5	3		Secondary and third circuits in instrument transformer of observation / protective relay / remote observation control board, etc.
5	4	3		3	DC100-200V/AC100-400V circuits in direct / protective realy / observation control board, etc.

Block Diagram and Waveforms





Voltage surge waveform 1.2/50μs
Voltage : 3 kV
V : 500 V / Div.
H : 20μs / Div.



Current surge waveform 8 / 20μs
Current : 2400 A
I : 500 A / Div.
H : 10μs / Div.

Voltage Dip & Swell Simulator

VDS-2002

Feature

- Voltage dip & swell simulator conforming to EN/IEC61000-4-11 Ed.3 (2020) Standard
- Multiple types AC plug receptacle on the front panel for easy connection of the EUT
- Easy setting for the test parameters on the front panel
- Realize flexible test conditions setting beyond the Standard with a PC remote control
- Enable to conduct the interruption test in DC (DC 125 V / 16 A max)

Specification

Parameter				Specification	Note
Input voltage range				AC 90 ～ 240 V ± 10% 50/60 Hz ± 10% DC 0 ～ 125 V	
Output voltage range				AC 0 ～ Input voltage + 20% DC 0 or Input voltage	AC 290 V Max
Output current capability	AC	100% of input voltage		16 A rms	Continuous
		80% of input voltage	20 A rms	for a duration of < 5s	
		70% of input voltage	23 A rms	for a duration of < 5s	
		40% of input voltage	40 A rms	for a duration of < 5s	
	DC			16 A	Continuous
Peak inrush current drive capability		AC 100 ～ 120 V		250 A peak (< 10ms)	
		AC 220 ～ 240 V		500 A peak (< 10ms)	
Load regulation		100% of input voltage at 0 ～ 16 A rms		<5%	
		80% of input voltage at 0 ～ 20 A rms		< 5%	
		70% of input voltage at 0 ～ 23 A rms		< 5%	
		40% of input voltage at 0 ～ 40 A rms		< 5%	
Over shoot / Under shoot				<5%	At 100 Ω load
Rise and fall time				1 ～ 5μs	At 100 Ω load
Dip / Swell level		Percent setting		0 ～ 120%	
		Voltage setting		0 ～ 290 V	5 V step
Number of repetition		Number setting		1 ～ 1000 times or unlimited repetition	1 time step
Interval cycle		Cycle setting	Synchronous	0.5 ～ 5000 cycles	0.5 cycle step
		Time setting	Synchronous	1s ～ 100s	1s step
			Asynchronous	10ms ～ 10h	0.1ms step
Dip cycle		Cycle setting	Synchronous	0.01 ～ 5000 cycyles	0.01 cycle step
		Time setting	Synchronous	0.1ms ～ 100s	0.1ms step
			Asynchronous	0.1ms ～ 10h	1s step at setting > 100s
Dip phase		Phse angle setting	Synchronous	0 ～ 360°	1° step
		Time setting	Synchronous / Asynchronous	0 ～ 19.9 ms (50Hz) 0 ～ 16.6 ms (60Hz)	0.1ms step
Voltage variation test		Time setting	Synchronous	0.3 ～ 10 s for time for increasing voltage	
Memory capacity				5 tests	
Input voltage from EUT				AC100 ～ 115V / AC200 ～ 240 V ± 10% 50/60 Hz ± 5%	
Interface				Optical interface (RS232C or USB)	
Operating temperature range			15 ～ 35℃		
Operating humidity range				25 ～ 75%RH (without dew)	
Dimensions				(W) 430 x (H)650 x (D) 600 mm	
Weight				Approx. 130 kg	

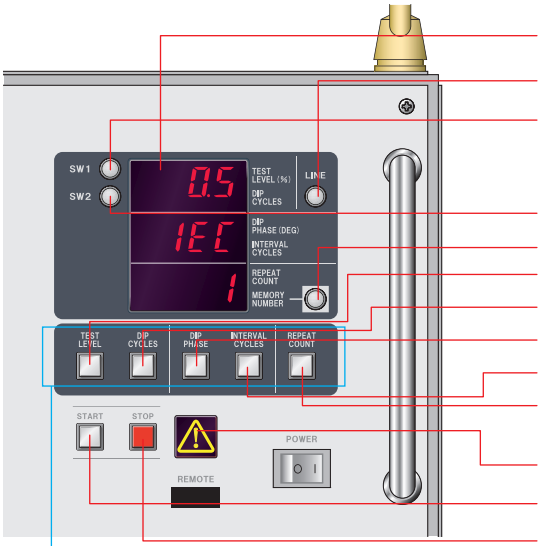
* The above specifications are based on the use of the optional Windows remote control software.

Accessory

Item	Q'ty
Power cable	1 pc.
Instruction manual	1 volume

VDS-2000

Front Panel



Digital indicator : Indicates test level / Dip cycle / Dip phase / Interval / Number of test

LINE switch : ON / OFF of power supply to EUT

SW1 monitor switch : Put out input voltage (base voltage) in LINE ON state. Switching between Sensing mode (Correction of voltage fall due to load variation) and Direct Mode (Outputs the input voltage constantly) by press-and-hold operation

SW2 monitor switch : Indicates test level (Set % value for input voltage) in LINE ON state

Memory number switch : Memorizes test patterns up to 5

Test level switch : Sets test level

Dip cycle switch : Sets time from start of dip or swell and its finish

Dip phase switch : Sets phase angle from start of dip or swell and its finish

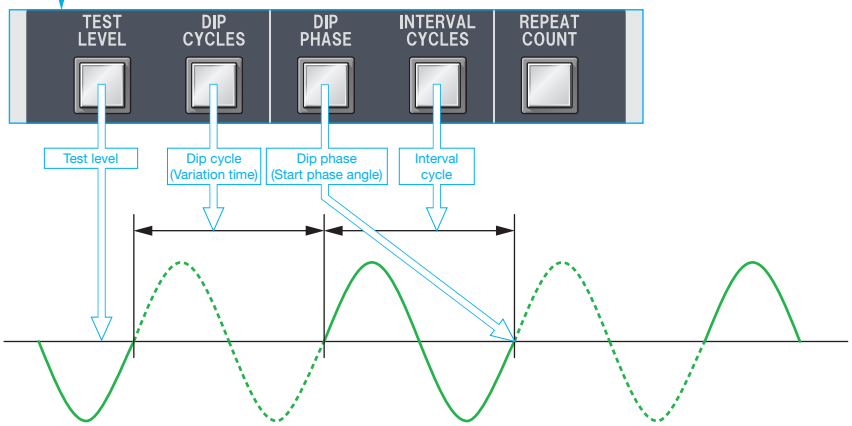
Interval cycle switch : Sets repletion cycle

Repeat switch : Sets number of time of test

Warning lamp : Turns on in LINE on state. Blinking in START of test

START switch : Starts test. Impossible to do without LINE ON

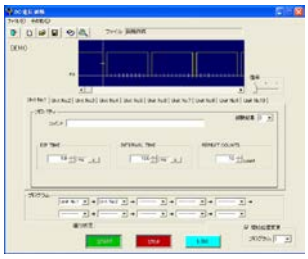
STOP switch : Stops test Does not LINE OFF

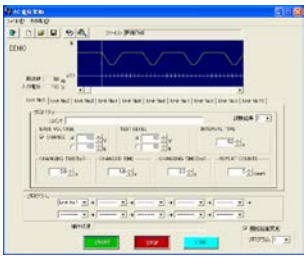


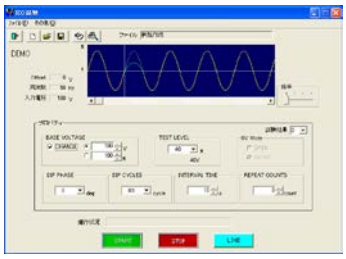
Option

Software (VDS-2002-PC) MODEL : 14-00036A

Enables to set the test parameters along users' preference or determination in addition to the Standard.
The set available parameters are dip & swell cycle, repetition cycle, interval cycle, etc. as well as IEC test levels. Very efficient tools for the operation.







Optical USB Module MODEL : 07-00022A

Connection adaptor used for PC remote control of the simulator.
USB optical conversion, equipped with 5m optical fiber cable

Optical RS232 Module MODEL : 07-00017A

Connection adaptor used for PC remote control of the simulator.
RS232C optical conversion, equipped with 5m optical fiber cable

IEC61000-4-11 Ed.3 Test Standard

1. General

Immunity test standard for electrical / electronic equipment which are connected to low voltage power supplies networks whether they are malfunctioned or resistible against voltage dips, short interruptions or voltage variations.
Power capacity of equipments under the test (EUT) shall be 16A per phase. This standard applies to equipment connected to 50/60 Hz AC supply network and does not apply to equipment operating on 400Hz AC.

2. Test Level

- A basis for the voltage test level use the rated voltage for the equipment (U_T).
- if the voltage range does not exceed 20 % of the lower voltage specified for the rated voltage range, a single voltage within that range may be specified as a basis for the test level specification (U_T).

1. Voltage dips and short interruption

Table 1 – Preferred test level and durations for voltage dips

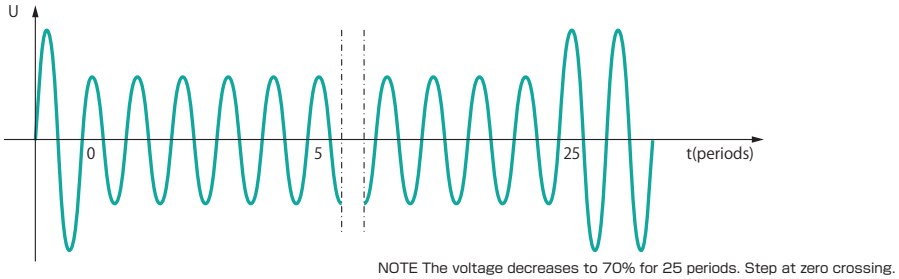
Calss[a]	test level and durations for voltage dips (ts) (50 Hz / 60 Hz)				
Class 1	Case-by-case according to the equipments requirements				
Class 2	0% during 1 / 2 cycle	0% during 1 cycle	70% during 25 / 30[c] cycles		
Class 3	0% during 1 / 2 cycle	0% during 1 cycle	40% during 10 / 12[c] cycle	70% during 25 / 30[c] cycle	80% during 250 / 300[c] cycle
Class X[b]	Special	Special	Special	Special	Special

a. Classes as per IEC 61000-2-4 ; see Annex B
b. Class x can be any level determined by consent between the EUT manufacturer and the simulator supplier
c. “25 / 30 cycle” means “25 cycles for 50 Hz test” and “30 cycles for 60 Hz test”
* Each dip% shall be voltages against the rated voltages

Table 2 – Preferred test level and durations for short interruptions

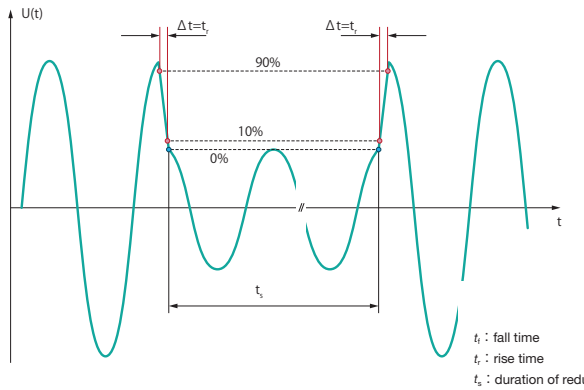
Calss	Test level and durations for short interruptions (ts) (50 Hz / 60 Hz)
Class 1	Case-by-case according to the equipments requirements
Class 2	0% during 250 / 300* cycle
Class 3	0% during 250 / 300* cycle
Class X	Special

a. Classes as per IEC61000-2-4 ; see Annex B
b. Class x can be any level determined by consent between the EUT manufacturer and the simulator supplier
c. “250/300 cycle” means “250 cycles for 50 Hz test” and “300 cycles for 60Hz test”

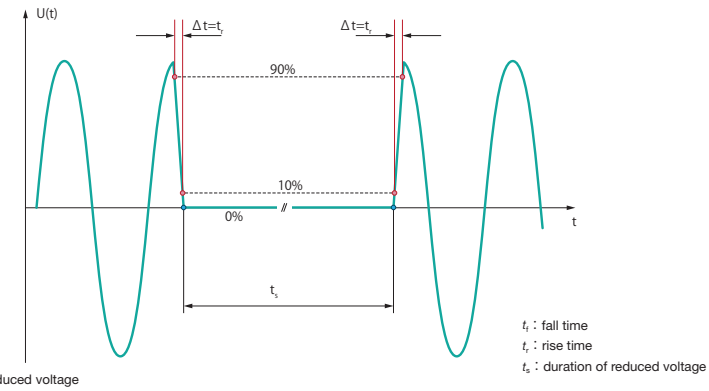


NOTE The voltage decreases to 70% for 25 periods. Step at zero crossing.

Voltage dip - Example: 70% voltage dip sine wave graph at 0°



Voltage dip - Example: 40% voltage dip sine wave graph at 90°



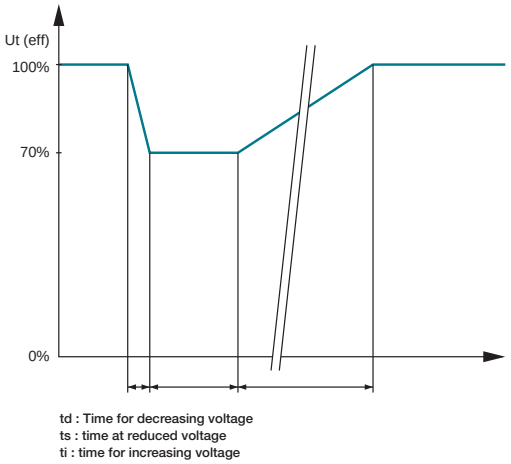
Short interruption

2. Voltage variations (Optional)

Table 3 – Timing of short-term voltage variations

Voltage test level	Time for decreasing voltage (td)	Time at reduced voltage (ts)	Time for increasing voltage (ti)
70%	Abrupt	1 cycle	25/30 cycles
X*	Special	Special	Special

* Class x can be any level determined by consent between the EUT manufacturer and the simulator supplier
* "25/30 cycle" means "25 cycles for 50Hz test" and "30 cycles for 60Hz test"

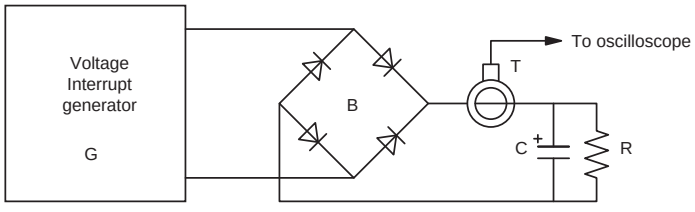


td : Time for decreasing voltage
ts : time at reduced voltage
ti : time for increasing voltage

3. Characteristics and performance of the generator

Output voltage at no load	As required in Table 1, ±5% of residual voltage value
Voltage change with load at the output of the generator	
100% output, 0 A to 16 A	Less than 5 of U_T
80% output, 0 A to 20 A	Less than 5 of U_T
70% output, 0 A to 23 A	Less than 5 of U_T
40% output, 0 A to 40 A	Less than 5 of U_T
Output current capability	16A r.m.s per phase at rated voltage. The generator shall be capable of carrying 20A at 80% of rated value for a duration of 5s. It shall be capable for carrying 23A at 70% of raged voltage and 40A at 40% rated voltage for a duration of 3s. (This requirement may be reduced according to the EUT rated steady-state supply current. See Clause A. 3).
Peak inrush current capability (no requrement for voltage variation tests)	Not be limited by the generator. However, the maximum peak capability of the generator need not exceed 1000 A for 250 V to 600 V mains, 500 A for 200 V to 240 V mains, or 250 A for 100 V to 120 V mains.
Instantaneous peak overshoot / undershoot of the actual voltage, generator loaded with 100 Ω resistive load	Less than 5% of U_T
Voltage rise (and fall) time tr (and tf) see Figures 1b) and 2, during abrupt change, generator loaded with 100 Ω resistive load	Between 1µs and 5µs
Phase shifting (if necessary)	0° to 360°
Phase relationship of voltage dips and interruptions with the power frequency	Less than ± 10°
Zero crossing control of the generators	± 10°

EUT Peak Inrush Current requirement



Components

G voltage interrupt generator, switched on at 90° and 270°
T current probe, with monitoring output to oscilloscope
B rectifier bridge
R bleeder resistor, not over 10000 Ω or less than 100 Ω
C 1700 µF ± 20% electrolytic capacitor

Circuit for determining the inrush current drive capability of the short interruptions generator

In order to be able to use a low-inrush drive current capability generator to test a particular EUT, that EUT's measured inrush current shall be less than 70% of the measured inrush current drive capability of the generator.

IEC61000-4-11 Ed.3 Test Standard

4. Test Setup

The test shall be performed with the EUT connected to the test generator with the shortest power supply cable as specified by the EUT manufacturer. If no cable length is specified, it shall be the shortest possible length suitable to the application of theEUT.

5. Test Procedure

Climatic and Electromagnetic Conditions

Ambient temperature	15℃ ～ 35℃
Relative humidity	25% ～ 75%
Atmosopherical pressure	86 kPa ～ 106 kPa (860 hPa (mbr) ～ 1060 hPa (mbr))
Electromagnetic environment	Level which does not affect the test result

Execution of the test

- The EUT shall be tested for each selected combination of test level and duration with a sequence of three dips / interruptions with intervals of 10s minimum (between each test event).
- Each representative mode of operation shall be tested.
- For voltage dips, changes in supply voltage shall occur at zero crossings of the voltage, and at additional angles considered critical by product committees or individual product specifications preferably selected from 45°, 90°, 135°, 180°, 225°, 270° and 315°on each phase. For short interruptions, the angle shall be defined by the product committee as the worst case. In the absence of definition, it is recommended to use 0°for one of the phases.
- For voltage variations (Optional), the EUT is tested to each of the specified voltage variations, three times at 10s interval for the most representative modes of operations.

6. Evaluation of Test Results and Test Report

The test results shall be classified in terms of the loss of function or degradation of performance of the equipment under test, relative to a performance level defined by its manufacturer or the requestor of the test, or agreed between the manufacturer and the purchaser of the product. The recommended classification is as follows.

1) Normal performance within limits specified by the manufacturer, requestor or purchaser;
2) Temporary loss of function or degradation of performance which ceases after the disturbance ceases, and from which the equipment under test recovers its normal performance, without operator intervention;
3) Temporary loss of function or degradation of performance, the correction of which requires operator intervention;
4) Loss of function or degradation of performance which is not recoverable, owing to damage to hardware or software, or loss of data.

Generally speaking, as far as the EUT can be immune to the surges which is injected in the all specified period and it satisfy the functional requirements according to the product specification, the test result can be judged as “Good”.
The test report shall contain the test conditions and the result.

Notes: This test set-up is quoted from IEC61000-4-11 Ed.3.0 (2020) Standard.
Please go through the Standard if the more details are required.

High Frequency Surge Test (Burst Waveform)

SWCS-931SD

Simulator to reproduce damped oscillatory wave which is gradual damping noise and evaluate the immune resistibility of DUT against the noise.
More high reliability and high accuracy have been realized comparing to the previous model with adaption of the semiconductor switch.

- **High accuracy realized with adaption of the semiconductor switch.**
- **Variable from 0.4 Hz to 400 Hz as the repetition frequency**
- **Easy to switch the coupling capacitor.**

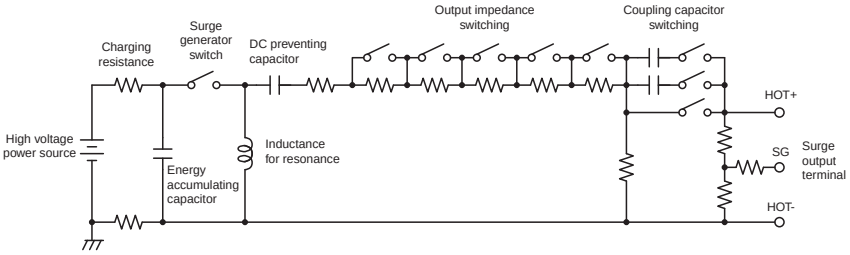
Specification

Parameter	Specification
Output waveform	Damped oscillatory wave
Output voltage	100 V ～ 1500 V
Polarity	Positive (1st wave) or negative (short bar switching)
Oscillatory frequency	1.5 MHz ± 0.2 MHz
Time to half-value peak	10μs ± 20 % (0.1 kV ～ 1.0 kV) 10μs ± 40 % (1.0 kV ～ 1.5 kV)
Output impedance	50 ～ 200 Ω (10 Ω pitch set possible)
Repetition cycle	0.4 ～ 400 Hz (3-stage switching, continuously variable)
Injection time	1s ～ 10min. or continuous
Coupling capacitor	100 pF / 470 pF
EUT power capacity	–
Power supply	AC 100 ～ 240 V 50 / 60Hz
Dimensions	(W) 430 x (H)200 x (D)400 mm
Weight	Approx. 7 kg

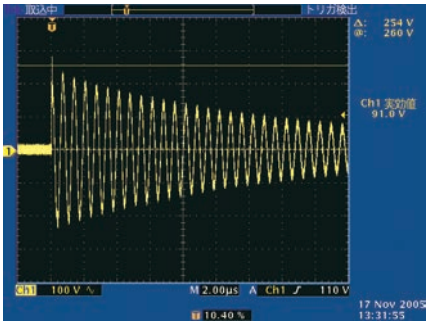
Accessory

Item	Q'ty
Bag for accessories	1 pc.
Instruction manual	1 volume
Power cable	1 pc.
Short bar	1 pc.

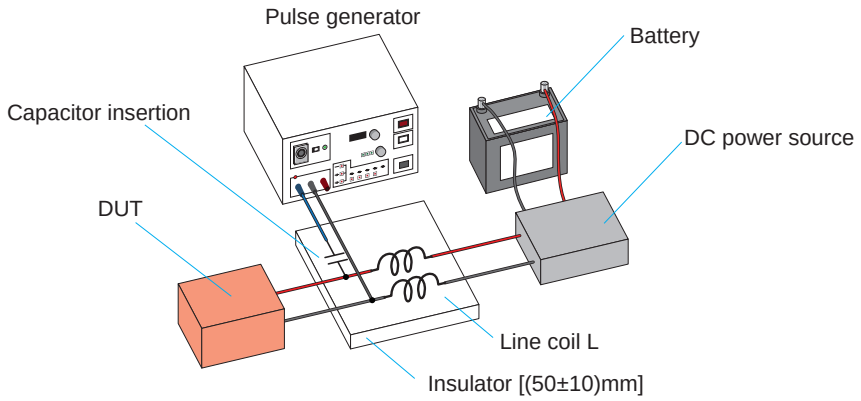
Inside Circuit



Output Waveform



Test Setup



Test procedure example used the damped oscillatory wave simulator

① Place the main simulator unit (hereinafter referred to as Main unit) onto the outside of the ground reference plane.
② Connect the standard attached power supply cable to AC in on the backside of Main unit.
③ Connect the connection cables for DUT to HOT terminal and ground terminal on Main unit (insert a capacitor to HOT side), and do the other side of the cables to the testing harnesses. * The connection cables to be prepared by the users.
④ Set the parameters on the controller on the front panel of Main unit and start the test.

EPS-02Ev3

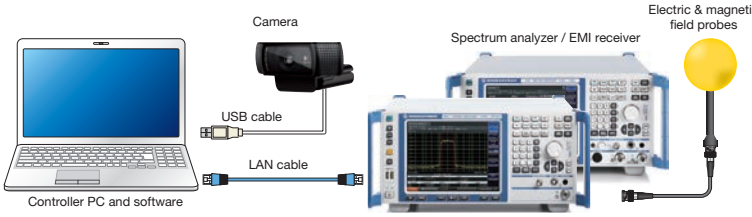
Electromagnetic Field Visualization System

Three-Dimensional Indication (Time, Frequency, Amplitude) Simplifies EMC/EMI Debugging

EPS is a EMC/EMI debugging tool enabling designers to rapidly perform pre-measurement, failure point identification, and improvement efficiency confirmation in EMC/EMI countermeasure process of product design.
How does it work? The software detects locations of probes by color discrimination through camera's image sensors*, real time analysis measured signal frequency, shows a heat map by overlapping electromagnetic field strength and real images of measured objects.

Image recognition (recognized the yellow color at the tip of the probe)

- A real-time diagnostic tool supports EMC/EMI debugging.
- Fast visualize EMC/EMI problems.
- Enables easy comparison of countermeasures before and after.
- Capable of measurement from entire products to single components.
- Factor-editor function provides correction of antenna characteristics, cable loss and pre-amplifier.
- User friendly compact design.
- Customer supplied spectrum and probes acceptable (Please consult)

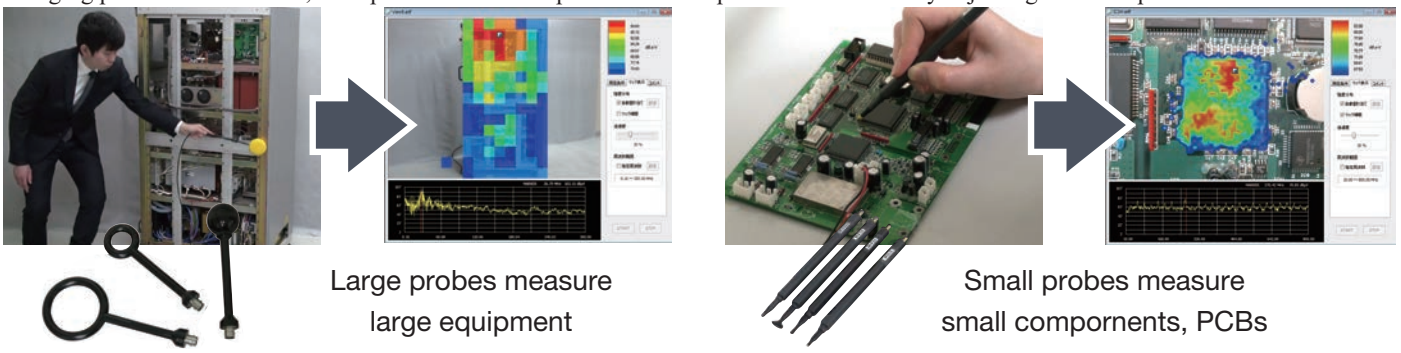


Easy to carry at a lower price!

The RSA306B spectrum analyzer makes it easy to carry on-site measurements. Also, you can build a system at a lower price.

Capable of Measurement of Various product sizes
arious probes applicable

Various probes are applicable regardless of manufactures. Not only small components, but also big equipment are available to measure by changing probes. Furthermore, even products with complex surface shape are measureable by adjusting camera's positi



Large probes measure large equipment

Small probes measure small compornents, PCBs

A wide variety of standard-compliant spectrum analyzer drivers

Type of standard spectrum analyzer has included, for that alreadyyou using spectrum analyze use to build became easier.

Rode Schwartz	Spectrum analyzer	FSV series, FSV3000 series, FPL series
	EMI receiver	ESR series, ESRP series
Key sight Technology	Signal analyzer	N9010A, N9010B
Tektronix	Oscilloscope	MDO4000 series
	Spectrum analyzer	RSA306B

Please inquire about other spectrum analyzers.

Tektronix MDO4000 series

Tektronix RSA360B

Key sight Technology N9010A

Key sight Technology N9010B

Rode Schwartz FSV

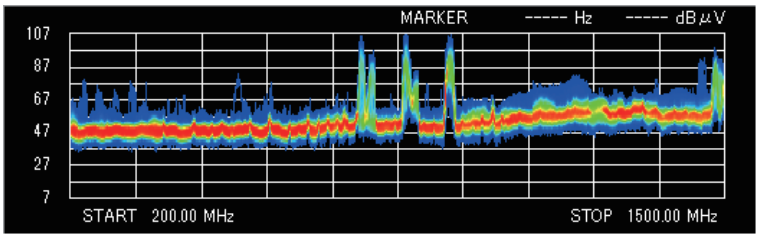
Rode Schwartz FPL

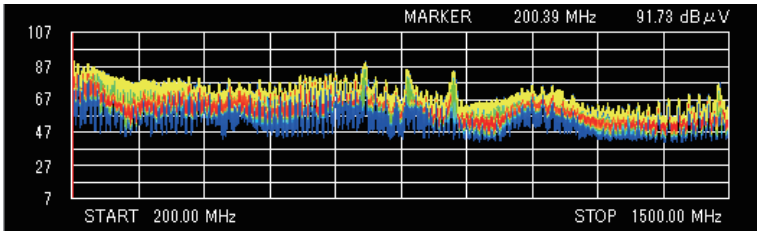
Rode Schwartz ESR

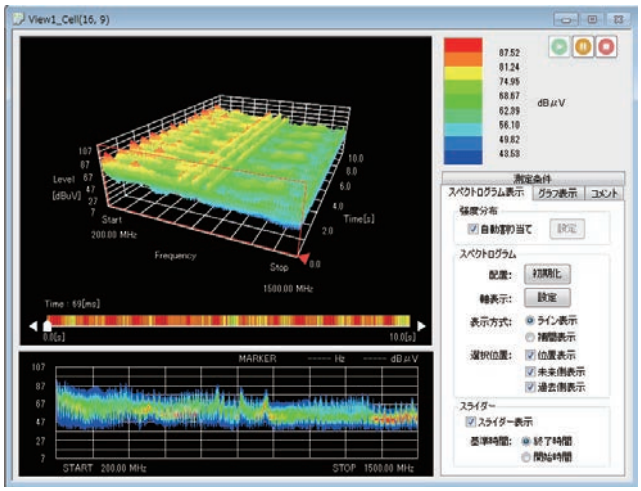
EPS-02Ev3

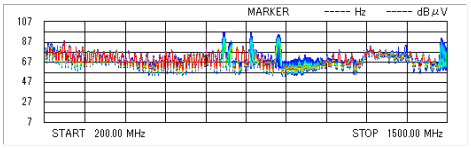
Easily Check the Noise Occurrence Frequency.
Add density display function.

Added a function to display colors according to the frequency of occurrence (density display function) to the conventional spectrum display function.This makes it possible to easily check the noise occurrence frequency and the amplitude at the measurement frequency.

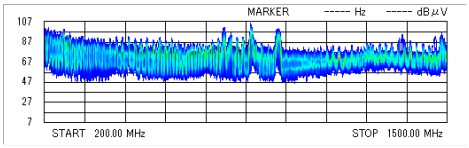




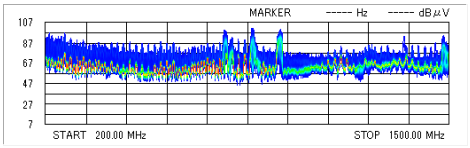




Example of noise with little change



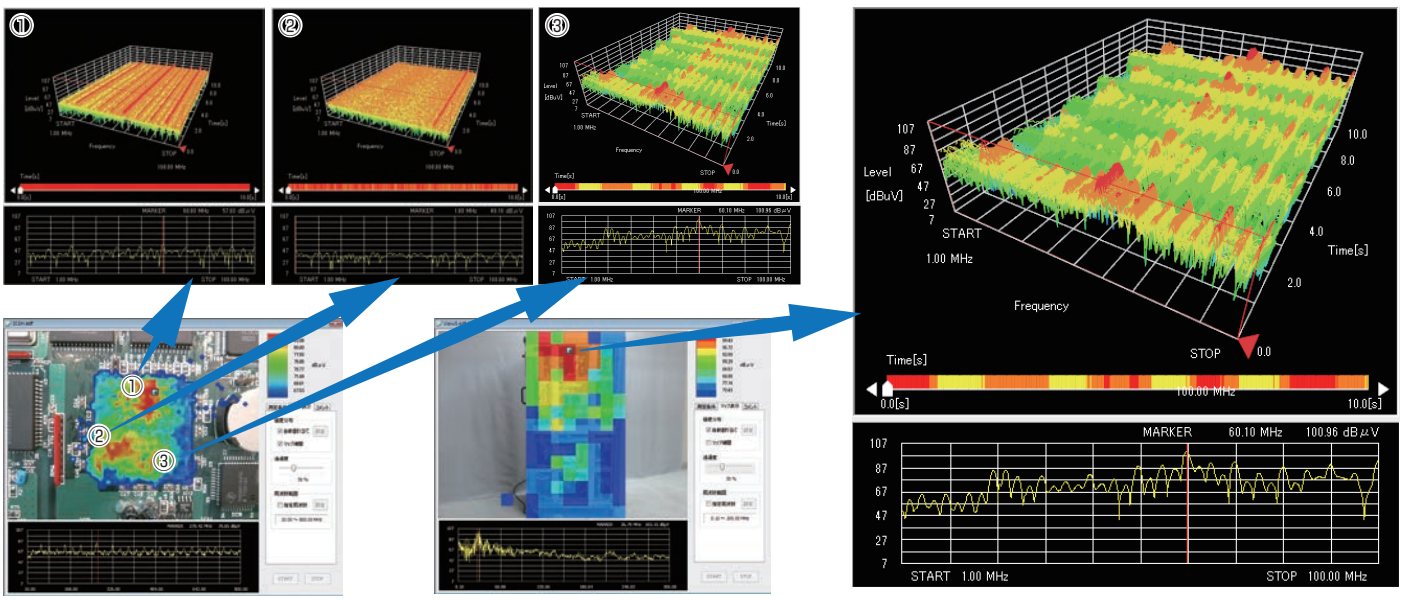
Example of noise with large fluctuation



Example of intermittent noise

Simplifies EMC/EMI Debugging
Three-Dimensional Indication (Time, Frequency, Amplitude)

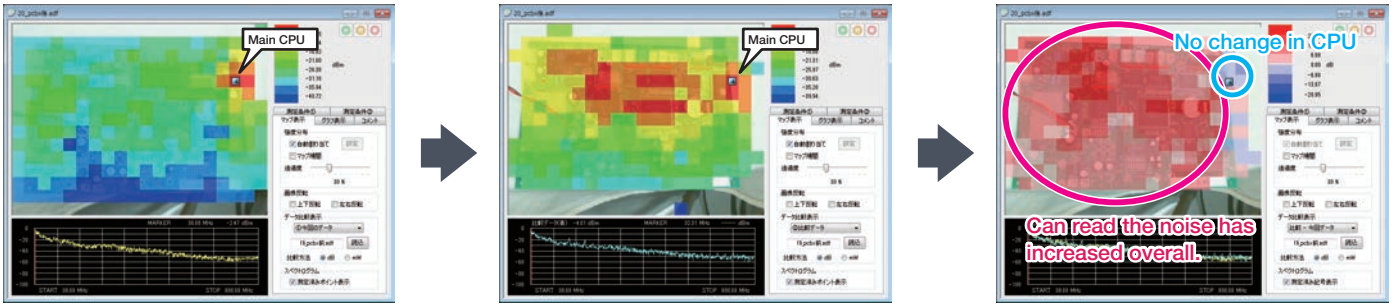
Three-Dimensional Indication (Time, Frequency, Amplitude) pinpoint design failure even when the noise is intermittent.



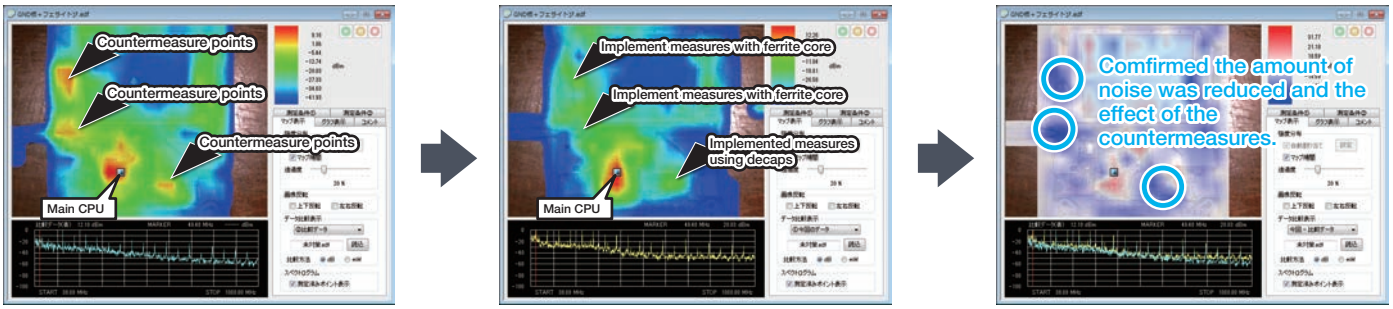
EPS-02Ev3

Easy comparison before and after countermeasures.

Three-Dimensional Indication (Time, Frequency, Amplitude) pinpoint design failure even when the noise is intermittent.



Operation Mode (1) (During standby) | **Operation Mode (2) (During operated)** | Differences display



Before Measurement | After Measurement | Differences display

Easy measurement under the same conditions as past data

Newly measurement time, before measured option can also use in this new version. Before measured data if you save, then from Spectrum analyzer's setting menu the range of frequency or RBW select and use.

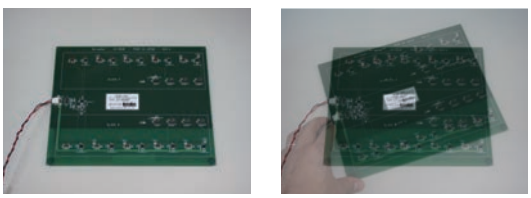
Measured Window | Same Measurement Condition | New Measurement Window

Camera image ghost function

Overlaid the previous image for position adjustment.

Example of use ①: To match the camera position with the previous image before the test

Example of use②: When re-adjusting when the camera position shifts during the test

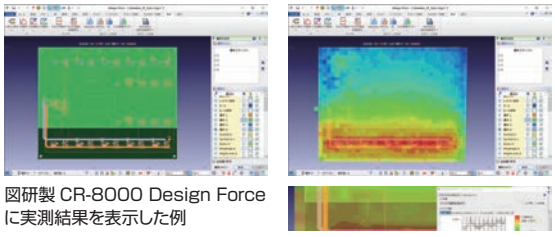


Simplify image recognition settings

By clicking on the part of the screen where you want to recognize the color (tip of the probe), automatically adjusts the hue, saturation, and brightness optimal for color recognition.

Designated coordinate output function

Measurement results can be imported to external CAD software and CAD drawings and actual measurement data can be superimposed and displayed.



図研製 CR-8000 Design Force に実測結果を表示した例

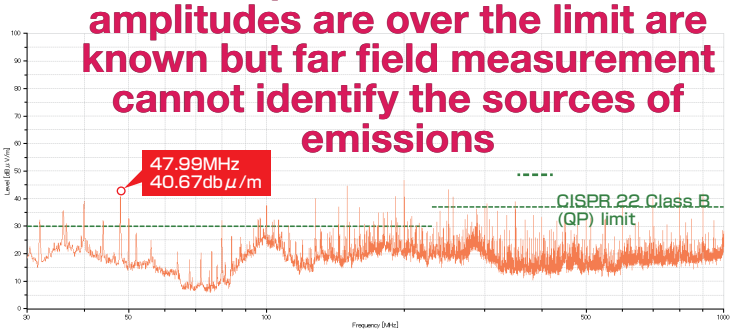
Others

- Highlighting unmeasured points: Unmeasured area highlights by flashing black and white. During measurement, it prevents unmeasured.
- Excess limit detection function: A function to display a message or stop measurement to protect the measuring instrument due to excessive input when the set limit value is exceeded.

EPS-02Ev3

Locates possible interference sources for pre- and post-compliance measurements

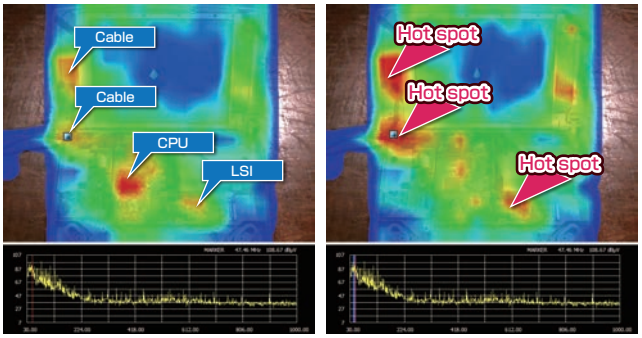
A product failed in a compliance measurement at some frequencies. The frequency of 47.99 MHz is one of the target frequencies to which a solution is looked for.



② Near-field measurement by EPS-02

A intensity distribution map shows "hot spots", which are the target areas. Furthermore, narrowing down to the desired range of frequencies lets you know the relevant spots of the frequencies in interest.

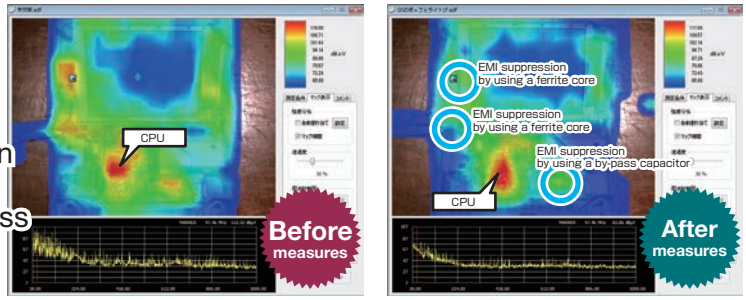
- Incorporating suppression measures and verifying their effectiveness
- An amplitude versus frequency plot for each probe position gives the users the power to evaluate the EMI properties in depth.



③ Incorporating suppression measures and verifying their effectiveness

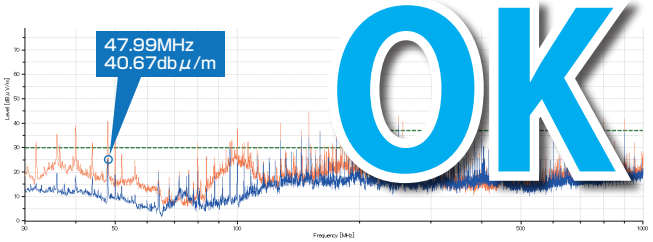
Measurement after modification indicated that the emission level lowered. This makes it easier to establish the countermeasure strategy for problem areas such as circuit traces, components, cables and housing

- Enables the users to evaluate suppression methodologies
- Enables the users to verify the effectiveness of the selected methodology



④ Far-field measurement

A compliance measurement after debugging verified the product emission was within the limit. Data can be saved, accumulated and shared for future occasions.



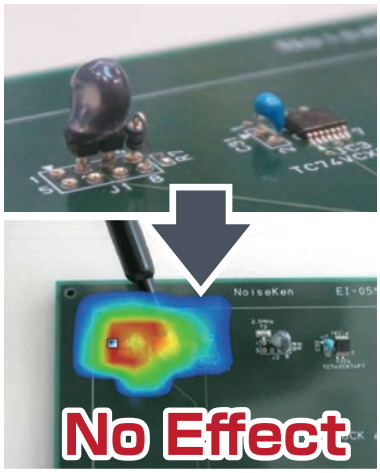
Accumulated measurement data can be the basis of optimized design and debugging method rules, and improving and sharing how-hows, which contributes to engineering time and cost reduction, and reliability and safety improvements.

EPS-02Ev3

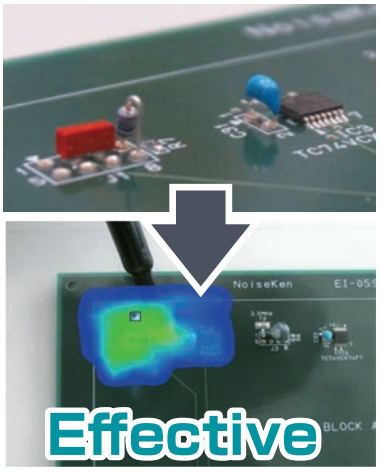
Helpful for the users to design good EMI performance circuit boards and to choose the best suited EMI suppression components

Since all spectrum charts can be saved, the users can evaluate and compare the effectiveness of EMI suppression measures referring to the stored and accumulated data.

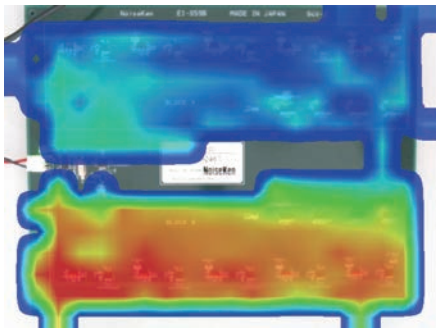
Measures as ferrite core



Measures such as resistance



When designing a board, a comparison between the case where the ground routing is made into a pattern and the case where it is made a solid ground (Design of ground wiring)

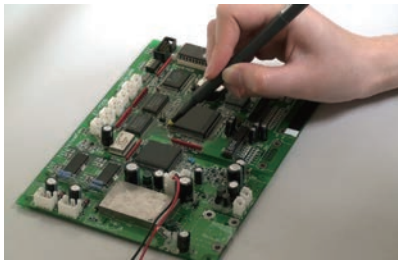


Customer Credentials

The frequency of failures at measurements in a chamber has been reduced

"Our company chamber is used only for a complete finished product testing stressing there is no meaning for PCB or internal unit testing. PCB and unit basis measurements were R&D department's objective. As a valuable pre-compliance tool, this system helps us to visualize quickly and locate problems areas, thus dramatically improve debugging works. Before the introduction of this system, one prototype sample failed 4 to 5 times at chamber measurements. Now the number has dropped to 2."

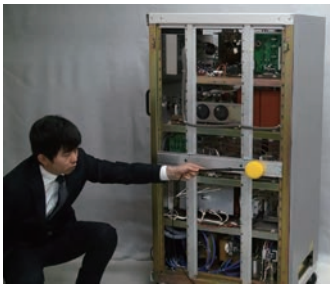
Design Engineer, R&D Department, "T" company



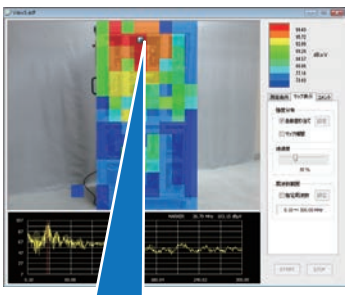
Now EMI debugging is my job

"The situation was like that before: when a product failed at a test house,
the person in charge of the product asked for help from a trained and skillful engineer. Now the situation has dramatically changed like that: Even untrained or inexperienced engineers intensively tackle EMI debugging by using the EPS-02 system providing the visualization of the EMI properties of the test object. This can-do attitude is the greatest result of the introduction of the system."

Quality Assurance Engineer, Quality Assurance Dept, "A" company



On-site measurement

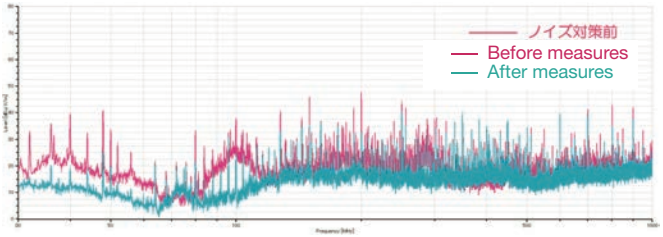


Locating hot spots

EPS-02Ev3

An amplitude versus frequency plot for each probe position is helpful for effective EMI debugging

"The objective is pre-compliance measurement. Only a combination of near-field probes and a spectrum analyzer was available before, which I thought was a time consuming debugging tool, if I can do it anyway. With the EPS-02, the way the data is stored and reviewed is much more convenient, as an amplitude versus frequency plot for each probe position can be seen. The benefits we are enjoying now are smoother EMI debugging, and the resultant reduced failures at a compliance measurement.



Design Engineer, Electrical Engineering Dept. "S" company

Quick results are very helpful.

"Our department is a user of the NoiseKen EPS-3000 EMI Board Scanner System. Compared to EPS-3000, this newly introduced EPS-02E provides a faster result. Portability is also a point. I'm very satisfied with measurement data, which I think, are more accurate than I expected."

Design Engineer, Electrical Engineering Dept. "N" company

Drawings are for image only. (Not for actual use)

Specifications

Frequency range	100 kHz ～ 3 GHz　*Depends on the electromagnetic field probe specifications (The above is for ETS probes)
Measurement unit	dB μV、dBm
Sensor/probe	φ 60 / 30 / 10 mm loop coil (magnetic field), φ 36 mm ball (electric field), φ 6 mm tip (electric field) Total 5 types *Depends on electromagnetic probe specifications (Probe by ETS-Lindgren)
Probe cable length	2m (N(P)-BNC(P) (Coaxial connector cable)
Data recording method	Single ／ Free Run ／ Max Hold ／ Max Peak Data*
Auxiliary function	Save / load / export / comment input / factor re-read / camera image retake / Save / load / export / comment input / factor re-read / camera image retake / up-down & right-left inversion of camera image / ghost display of camera image / Screen enlargement-reduction
Compatible operating system	Windows 7 ／ 10
System configuration	Electromagnetic field probe (PN 7405) , BNC (P) -N (P) connector coaxial cable (02-000150A), Three Color Probe Head Cover (03-00111A), RF preamplifier (00-00019A), Spectrum analyzer, Control PC
accessories	LAN cable, NI-GPIB-USB-HS GPIB Controller, Camera, USB cable extension 2 m for camera, Tripod for camera, Software, USB protect key, Instruction manual

*Peak Hold: Displays the trace data with the largest peak value from the trace data measured at each measurement point.

Electromagnetic Field Probe (PN 7405) Frequency Specialization

Model	Type	Electric field / Magnetic field	Construction	Recommended Frequency Band
901	6 cm Loop	Magnetic field	Sealed loop	3 MHz ～ 500 MHz
902	3 cm Loop		Sealed loop	5 MHz ～ 1 GHz
903	1 cm Loop		Sealed loop	10 MHz ～ 3 GHz
904	3.6 cm Ball	Electric field	Spherical dipole	10 MHz ～ 3 GHz
905	6 mm Stub Tip		Short monopole	50 MHz ～ 3 GHz

■ Magnetic field probe

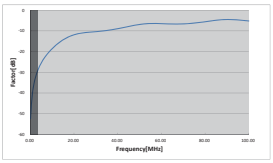
901（6cm Loop）　902（3cm Loop）　903（1cm Loop）

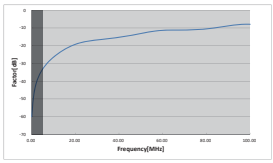
■ Electric field probe

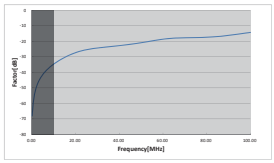
904（3.6cm Ball）　905（6mm Stub Tip）

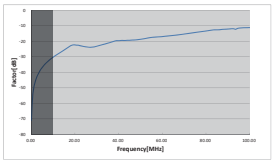
EPS-02Ev3

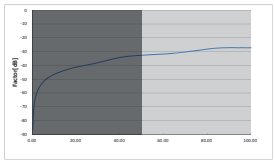
■100 kHz ～ 100 MHz


901（6cm Loop）

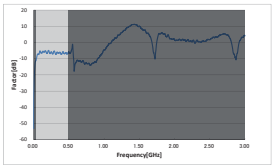

902（3cm Loop）

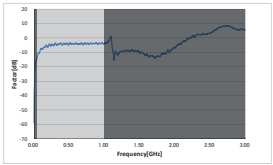

903（1cm Loop）

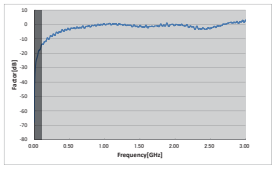

904（3.6cm Ball）

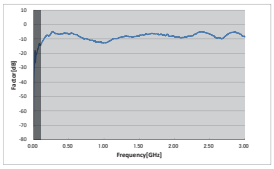

905（6mm Stub Tip）

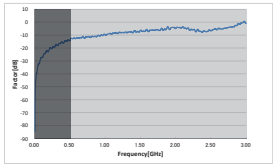
■100 kHz ～ 3 GHz


901（6cm Loop）


902（3cm Loop）


903（1cm Loop）


904（3.6cm Ball）


905（6mm Stub Tip）

*The frequency characteristics of the above probes are data using strip lines.
*The gray area is outside the recommended frequency band.

Recommended PC specifications

Item	Specification
OS	Microsoft® Windows® 7　32 bit / 64 bit (Eng/Jap) Microsoft® Windows® 10　32 bit / 64 bit (Eng/Jap)
CPU	Intel Core™ i5 or higher（i7 or higher recommended）
Memory	8 GB or more recommended
Hard Disc	min. 20 GB of free space
Display	over 1366 × 768 pixels

● A pointing device such as a mouse must be available.
● Existed DVD Drive.
● There is a free USB port. (Use 2 or 3 ports by using dongle, web camera, mouse etc.) *
＊The operation guarantee for using of an external USB-HUB is not covered.

Standard spectrum analyzer

Rode Schwartz	Spectrum analyzer	FSV series、FSV3000 series FPL series、
	EMI receiver	ESR series、ESRP series
Key sight Technology	Signal analyzer	N9010A、N9010B
Tektronix	Oscilloscope	MDO4000 series
	Spectrum analyzer	RSA306B

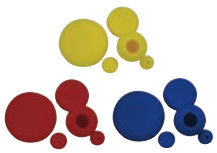
Please inquire about other spectrum analyzers.

Options

Three Color Probe Head Cover　MODEL：03-00110A

Various type of probe head cover set. Camera image recognition is better in EPS-02 series by using probe head cover.
The case accommodates an electromagnetic field probe (Model: PN7415) with the probe cover head attached. Also stored unused probe cover heads.

Replacement Three Color Probe Head Cover　MODEL：03-00111A



Replacement probe head cover for "3-color probe cover head Model: 03-00110A."

Pre-amplifier　MODEL：00-00012A/14A/16A/19A

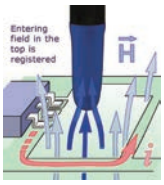
It is a high performance pre-amplifier that can be used for various applications such as the EPS-02 series.

Item	Specifications/Performance	
Operating Frequency Range	00-00012A：9 kHz ～ 1 GHz 00-00016A：9 kHz ～ 1 GHz	00-00014A：500 MHz ～ 8 GHz 00-00019A：10 kHz ～ 3 GHz
GAIN	00-00012A：36 dB (typ) 00-00016A：46 dB (typ)	00-00014A：47 dB (typ) 00-00013A：43 dB (typ)
Input/Output Connector	N-Female	
Size/Weight	W160 × D230 × H94 mm ／約 3 kg	
Accessories	N(P)-N(P) connector coaxial cable 1 m (00-00013A only)	

Introduction of LANGER's Near Field Probe

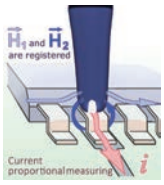
The electromagnetic field probe guiding as standard in the EPS-02Ev3 system is a near-field electromagnetic field probe manufactured by ETS-LINDGREN (MODEL: PN7405), but in this system, various other types of electromagnetic field probes can be used in combination.The electromagnetic field probe introduced below is a near-field probe manufactured by LANGER, Germany. A variety of probes; measurement of large components, single pin level, and assemblies. And also probes for low frequency and higher frequency both can measurements. Combination with EPS-02Ev3 very easy to use.
Please contact our sales office for detailed specifications of various near-field probes and combinations with EPS-02Ev3.

Near Field Probe Model: LF1 set — 100 kHz ～ 50 MHz Magnetic Field

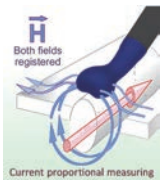


LF-B3

LF-R400



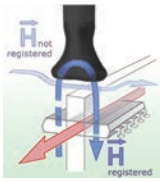
LF-U2.5



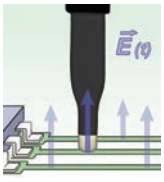
LF-U5

The LF1 set is a set of 4 types of shielded probes for measuring magnetic fields from 100 kHz to 50 MHz on electronic assemblies.
The probe head is designed for detection of single pins, larger components, and electromagnetic interference sources on the assembly. First, identify the large-scale sources with the LF-R 400 probe, and then use high-resolution probes such as LF-B 3, LF-U 5 and LF-U 2. 5 The magnetic field probe has a structure that suppresses the electric field component.
*EPS-02Ev3 to be connect need conversion connector (MODEL: 02-00050A).

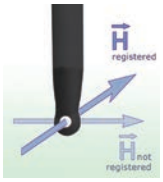
Near Field Probe Model : RF1 set — 30 MHz ～ 3 GHz Electric Field/ Magnetic Field



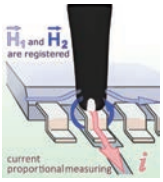
RF-K 7-4



RF-E10



RF-R 3-2

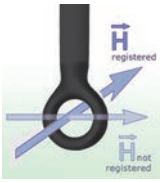


RF-U 2.5-2

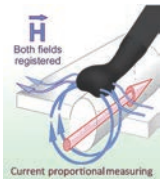
RF1 set is a set of 4 probes for measuring electric and magnetic fields from 30 MHz to 3 GHz on electronic assemblies. Each probe is suitable for measurements very close to the electronic assembly. Single IC pins, conductive paths, components to identify electromagnetic interference sources connect the connector and measure. By using these probes can check the direction of the magnetic field and the electric field distribution. The magnetic field probe has a structure that suppresses the electric field component.
※EPS-02Ev3 to be connect need conversion connector (MODEL:02-00050A).

Near Field Probe Model : RF2 set — 30 MHz ～ 3 GHz Electric Field/ Magnetic Field

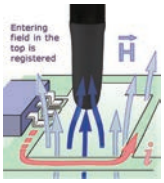
RF-R 400-1



RF-R 50-1



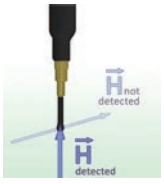
RF-U 5-2



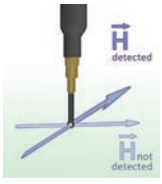
RF-B 3-2

RF2 set is a set of 4 probes for measuring electric and magnetic fields from 30 MHz to 3 GHz on electronic assemblies.
The probe head can step through the sources of interference from the RF magnetic field on the assembly. Initially, RF-R 400-1 and RF-R 50-1 probes can be used to detect far-field electromagnetic interference. Next, the higher resolution RF-B 3-2 and RF-U 5-2 probes allow for more accurate detection of interferers. By using these probes, can check the direction of the magnetic field and the electric field distribution. The magnetic field probe has a structure that suppresses the electric field component.
*EPS-02Ev3 to be connect need conversion connector (MODEL:02-00050

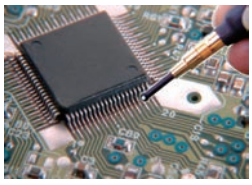
Near Field Probe Model : RF3 mini set — 30 MHz ～ 3 GHz Magnetic Field



RF-B 0.3-3



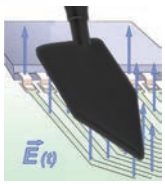
RF-R 0.3-3



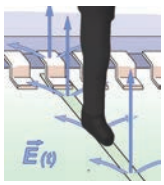
The RF3 mini set are two probes with a resolution of 1 mm or less to measure the magnetic field of 30 MHz to 3 GHz on the electronic assembly at the development stage. The probe head is designed for measurements. These probes can be used to detect the directivity and distribution of the magnetic field on the electronic assembly. The probe has a sheath structure and shields the electric field component. And also recommend using a 20 dB or 30 dB pre-amplifier when measuring this probe.

*EPS-02Ev3 to be connect need conversion connector.
(MODEL:02-00050A)

Near Field Probe Model : RF4-E set — 30 MHz ～ 3 GHz Electric Field



RF-E 02

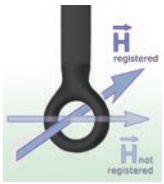


RF-E 05

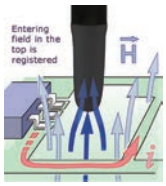
The RF4-E set is a set of two probes for measuring electric fields in the frequency range 30 MHz to 3 GHz. This probe detects the electric field by capacitive coupling and the steep rise and falls of the digital pulse of the signal pin (foot and lead) of the IC, and detects a sharp switching (voltage) component generated on the power supply pin of the IC. This probe has a function to suppress detection of current components (magnetic field components).
*EPS-02Ev3 to be connect need conversion connector.
(MODEL:02-00050A)

Introduction of LANGER's Near Field Probe

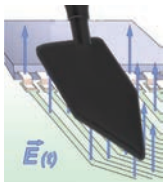
Near Field Probe Model : RF6 set — 30 MHz ～ 3 GHz Electric Field/ Magnetic Field



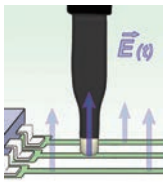
RF-R 50-1



RF-B 3-2



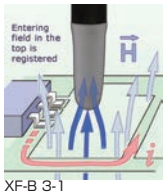
RF-E 02



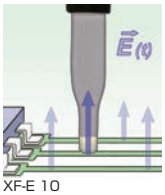
RF-E 10

The RF6 set is for the generation of electric and magnetic fields in the range 30 MHz to 3 GHz of the electronic assembly set of 4 probes for measurement. The probe head enables step-by-step localization of RF magnetic and RF-E magnetic interference sources on the assembly. From larger distances, use RF-R50-1 for magnetic fields and RF-E02 for electric fields to detect electromagnetic interference. The higher resolution RF-B 3-2 and RF-E 10 probes can better detect magnetic field and E-field interferers. By using these probes, it is possible to detect the direction of the magnetic field and the electric field distribution on the electronic assembly. The magnetic field probe has a structure that suppresses the electric field component.
*EPS-02Ev3 to be connect need conversion connector.
(MODEL:02-00050A)

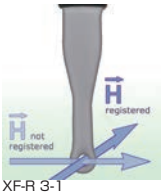
Near Field Probe Model : XF1 set — 30 MHz ～ 6 GHz Magnetic Field



XF-B 3-1

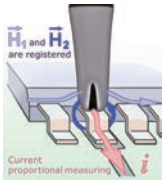


XF-E 10



XF-R 3-1

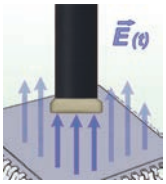
XF-R 400-1



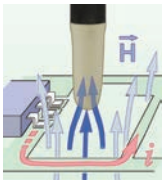
XF-U 2.5-2

The XF1set consists of four magnetic field probes and one E field probe, can measure within magnetic fields from 30 MHz to 6 GHz. The probe head enables step-by-step localization of magnetic field interference sources on the assembly. First, use the XF-R 400-1 probe to detect electromagnetic interference from a distance. Second, you can use a high-resolution probe to detect interference sources more accurately. E-field probes are used to detect electrical interference fields near the assembly. By using these probes, it is possible to detect the direction of the magnetic field and the electric field distribution on the electronic assembly. The magnetic field probe has a structure that suppresses the electric field component.
*EPS-02Ev3 to be connect need conversion connector.
(MODEL:02-00137A)

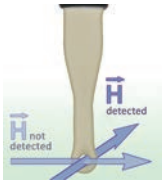
Near Field Probe Model : SX1 set — 1 GHz ～ 10 GHz Electric Field/ Magnetic Field



SX-E 03



SX-B 3-1



SX-R 3-1

The SX1 set consists of three passive type near-field probes for measuring magnetic fields and also magnetic fields with high clock frequencies of 1 GHz to 10 GHz on electronic components and ICs at development stage. The probe head allows measurements at distances very close to the electronic assembly. They can be placed on single IC pins, conductive paths, components and connectors to identify sources of interference. By using these probes, the direction of the magnetic field and the electric field distribution of the electronic assembly can be detected.
*EPS-02Ev3 to be connect need conversion connector.
(MODEL:02-00137A)

LANGER near-field probes are not using probe cover. At the time of use probe, wrapped with vinyl tape or other on the tip of the probe that can make color recognition. In addition, a coaxial conversion connector is required to connect to EPS-02Ev3. (See below)
Please contact our sales in charge for details.

Conversion Connector Model : 02-00050A/137A

It is a conversion connector for connecting LANGER near field probe to EPS-02Ev3.

Model	Connector	Support Model
02-00050A	N(P)-BNC(J)	LF1 set, RF1 set, RF2 set, RF3 mini set, RF4-E set, RF6 set
02-00137A	N(P)-SMA(J)	XF1 set, SX1 set

Model : NKU07M32G / NKU07M60G

Broadband Sleeve Antenna

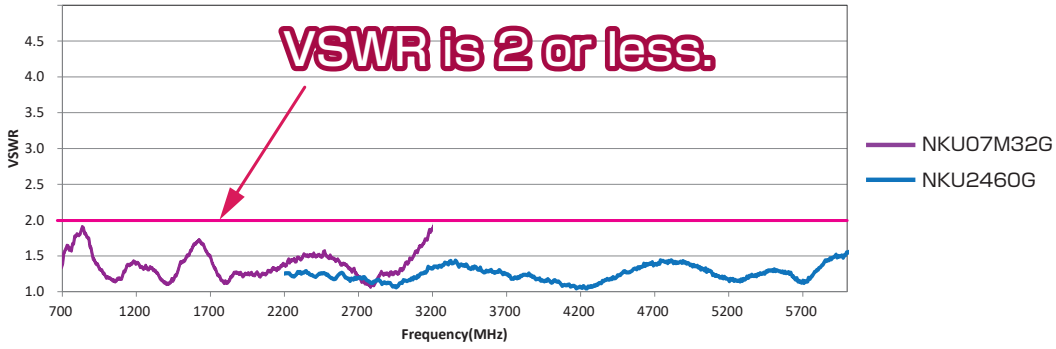
Broadband sleeve antenna has been developed for efficient immunity testing against hand-held transmitters and cellular phones. Many pieces of spot frequency antennas had to be used in turn thus fur. This new Broadband s leeve antenna is a single antenna solution eliminating the need for antenna changes and dramatically reducing the test time. Furthermore, this antenna with its small-size and lightWeight properties and a flexible handle is suitable for testing in narrow spaces.

- A wide frequency range eliminating the need for antenna changes
- 30 W maximum power input allows high filed strengths
- High efficiency due to a low VSWR and high gain
- Suitable for broadband digital modulation thanks to a good VSWR flatness
- Small, light-Weight and flat antenna easy to use in narrow spaces
- Easy handling with a flexible arm
- A wide radiation pattern makes directivity of the fields no longer an issue

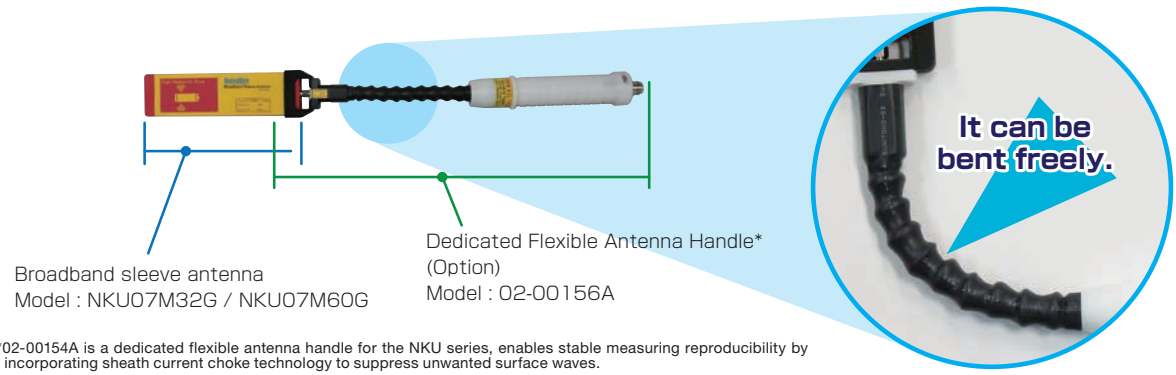
Specification

Model	NKU07M32G	NKU2460G
Frequency range	700 MHz ～ 3.2 GHz	2.4 GHz ～ 6 GHz
VSWR	≦ 2	
Maximum power input	20 W (continuous) 30 W (continuous 10 minutes)	10 W (CW)
Input impedance	50 Ω	
Connector	SMA(J)	
Dimensions	W50 × D8 × H186 mm (projection excluded)	W35 × D10 × H108 mm (projection excluded)
Weight	73.5g	20 g

■ VSWR



■ Antenna and Dedicated Flexible Antenna Handle

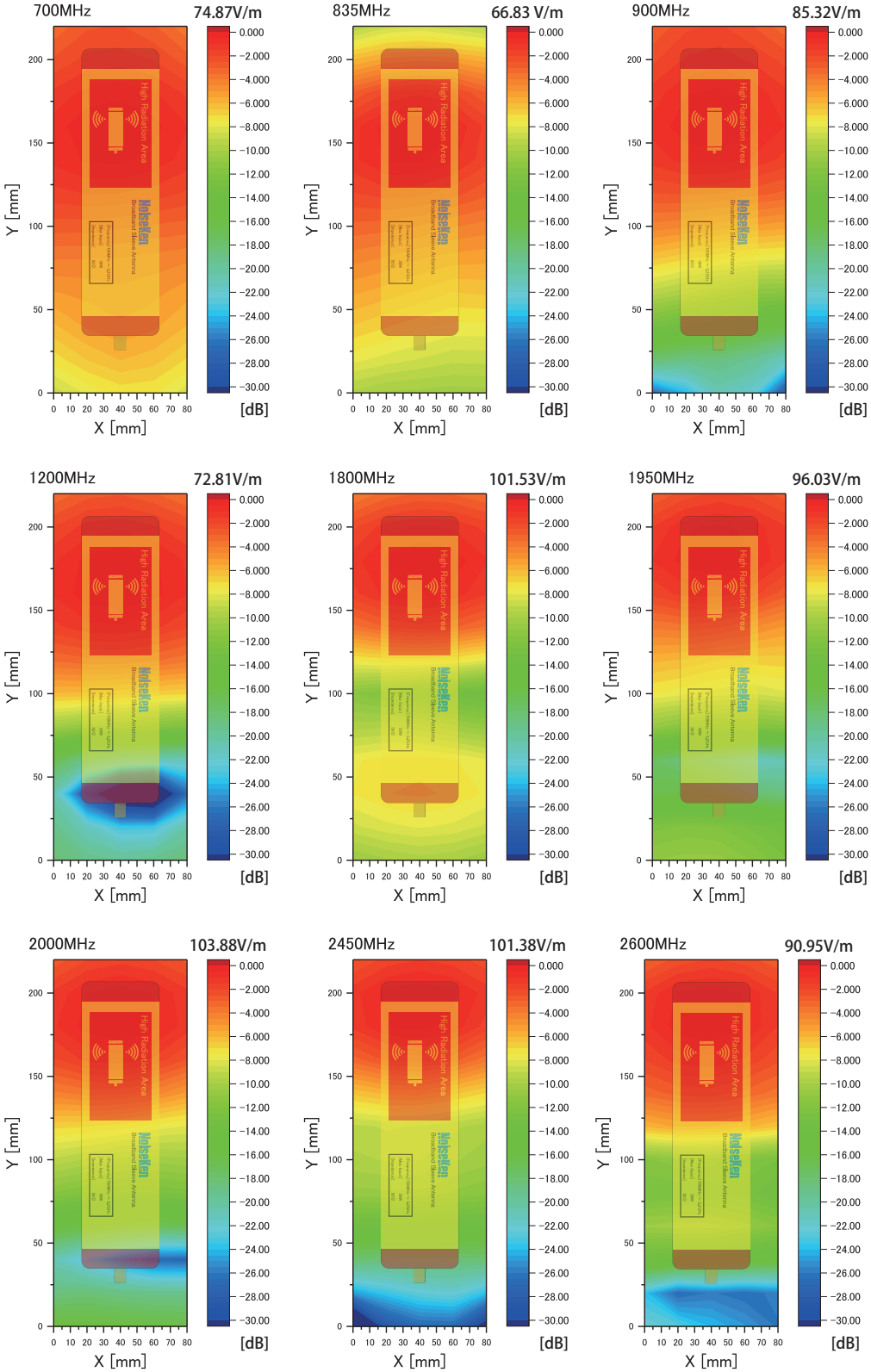


*02-00154A is a dedicated flexible antenna handle for the NKU series, enables stable measuring reproducibility by incorporating sheath current choke technology to suppress unwanted surface waves.

NKU07M32G / NKU07M60G

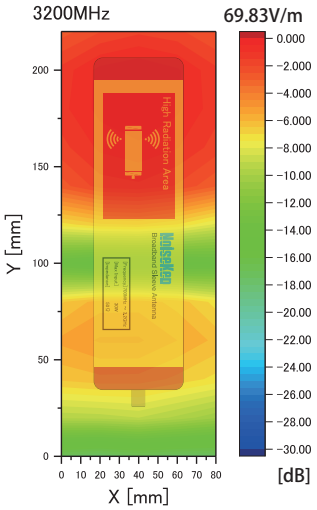
Specifications

■ Near field distribution characteristics(NKU07M32G)



NKU07M32G / NKU07M60G

Specifications

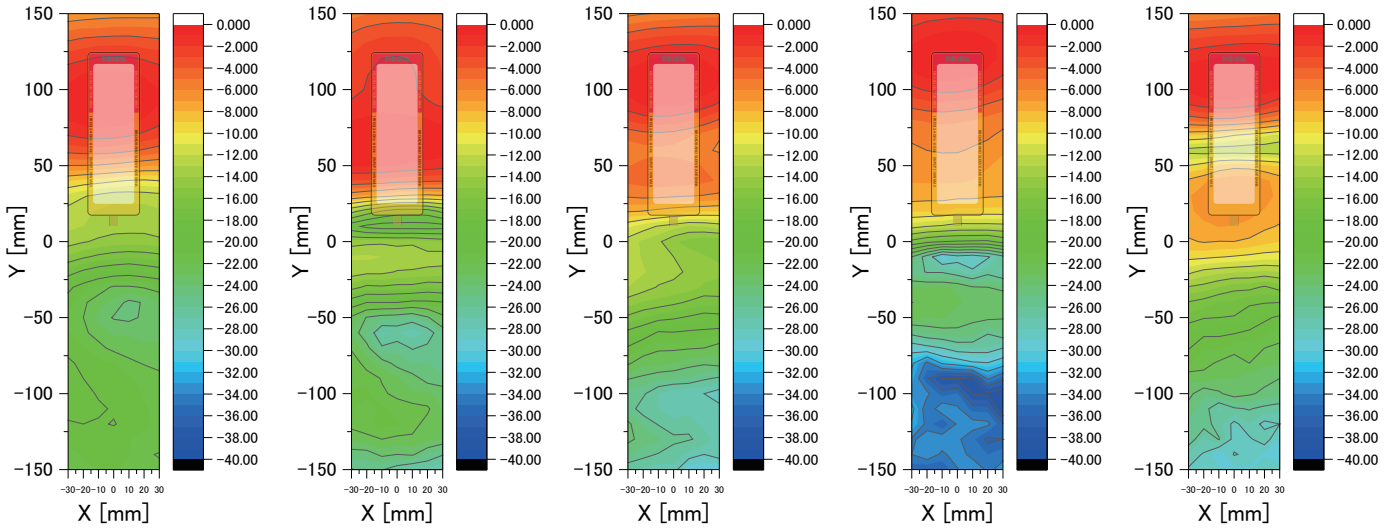


Electric field direction : y-axis (Single axis)

Input power ／ distance : 1W/50mm

The electric field strength is a reference value.

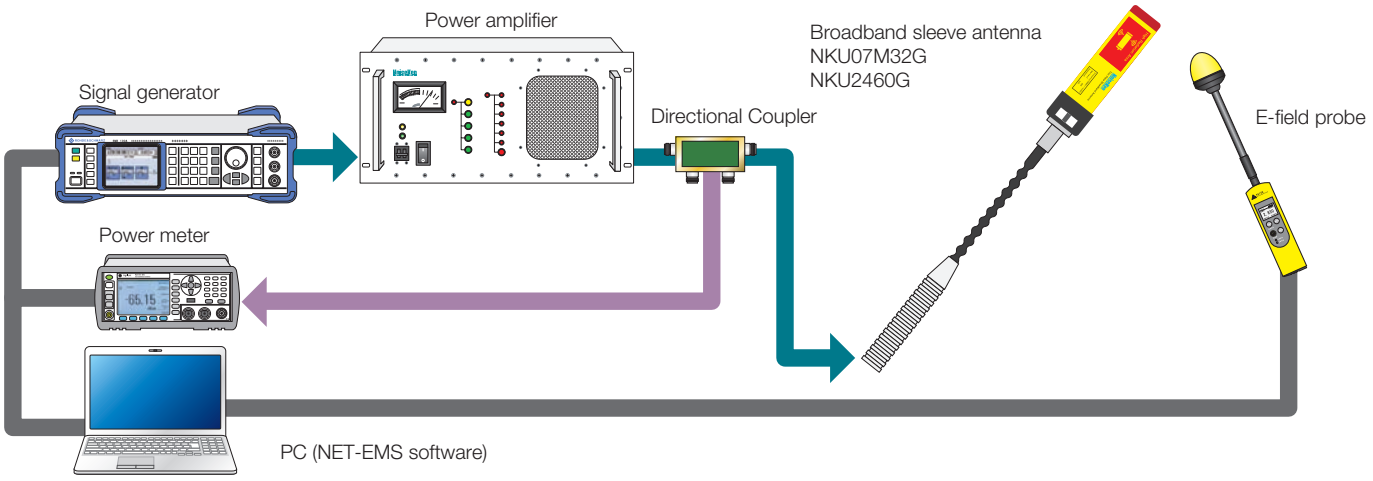
■ Near field distribution characteristics(NKU2460G)



2450MHz　3200MHz　3800MHz　4500MHz　6000MHz

NKU07M32G / NKU07M60G

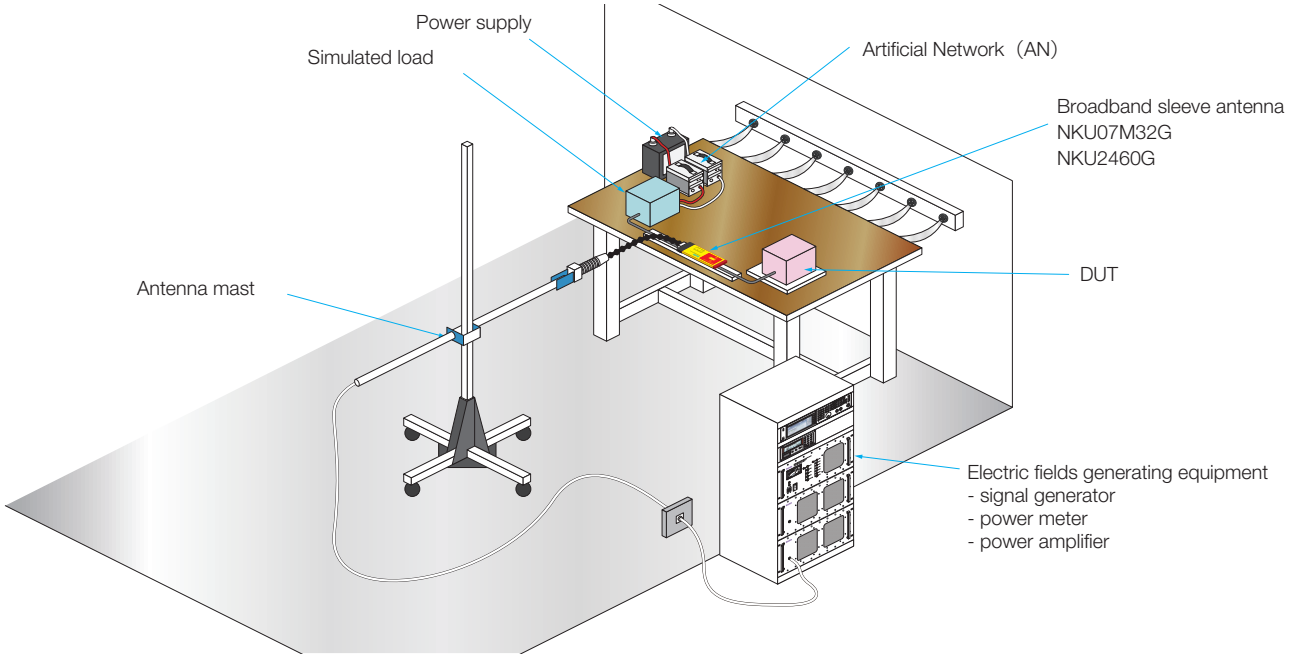
System configuration example



Application

■ In-vehicle testing

■ Testing for automotive electronics

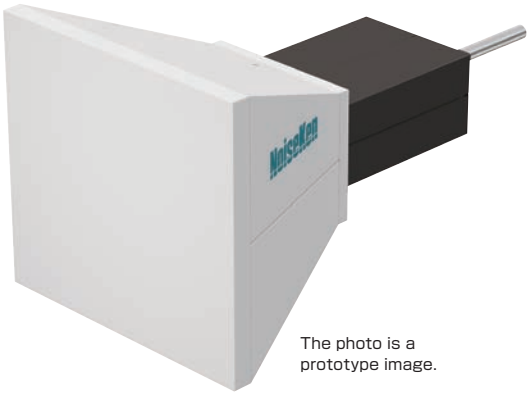


THA-380M60G

TEM Horn Antenna

EMC Testing in the 5G/IoT Era!

The TEM horn antenna is an antenna for conducting a close proximity radiation immunity evaluation test (near electromagnetic field immunity test) of electromagnetic waves radiated from various wireless transmitters such as mobile phones.
In the future, the close proximity radiation immunity evaluation test using the TEM horn antenna is expected to expand to various product standards such as medical equipment (IEC 60601-1-2) and multimedia equipment (CISPR 35).
NoiseKen's TEM horn antenna has a wide band, low VSWR, and wide electric field uniformity offers an ideal solution for an efficient close proximity radiation immunity test.



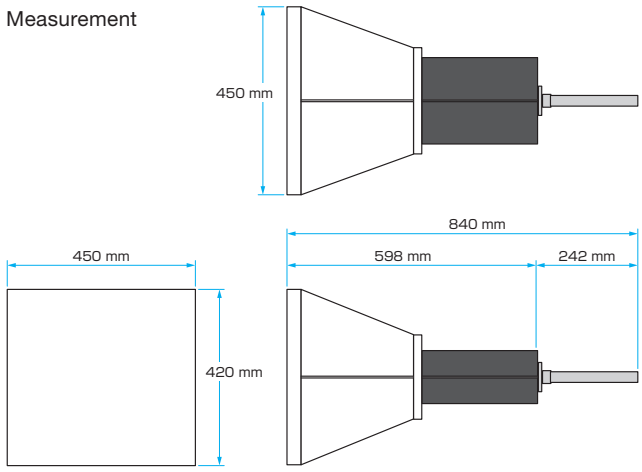
The photo is a prototype image.

- A TEM horn antenna compliant with IEC 61000-4-39 Ed.1.
- Test without changing the antenna in the frequency range of 380 MHz to 6 GHz.
- Low VSWR and high GAIN enable efficient electromagnetic wave radiation.
- Wide field uniformity reduces the number of times of movement of the antenna when radiating the EUT.
- Since the maximum point of the near electric field distribution for each frequency is at the center, enables radiation on the EUT based on the axis of the antenna. Hence, significantly simplifies test point alignment.

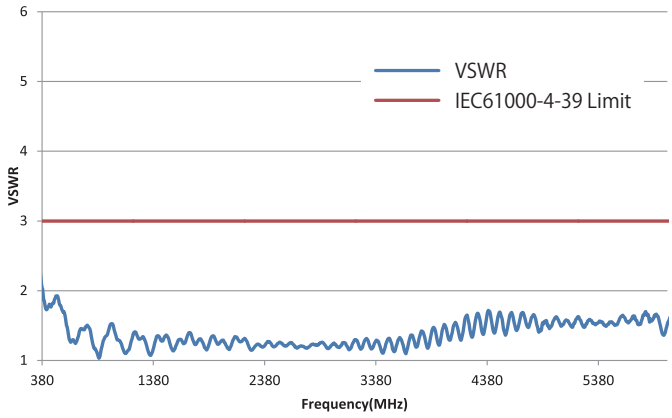
Specification

Item	Specification
Compliant standard	IEC 61000-4-39
Frequency range	380 MHz ～ 6 GHz
VSWR	3 and below *Refer to figure (VSWR)
Undetermined power	380 MHz ～ 750 MHz：180 W MAX 750 MHz ～ 1.7 GHz：100 W MAX 1.7 GHz ～ 6 GHz：65 W MAX
Electric field uniform area	See figure (electric field distribution characteristics)
Gain	Refer to the figure {Power required to generate 300V/m (typ) (at 0.1m)}
Impedance (typ)	50 Ω
Connector	N (J)
Dimensions	W450 mm × H420 mm × D598 mm *Refer to diagram (measurement) for details.
Weight	approx. 3.2 kgs

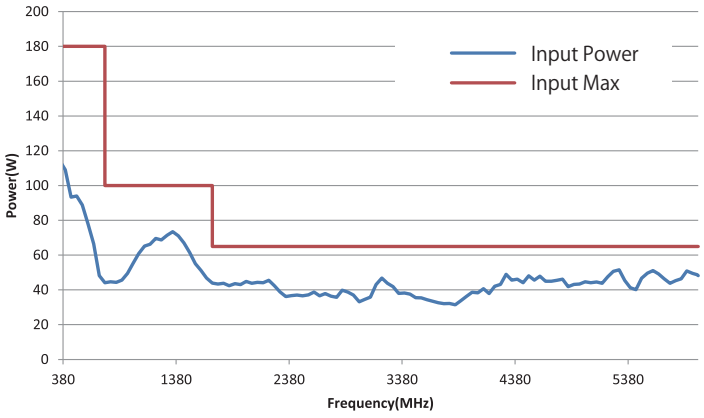
■ Measurement



■ VSWR

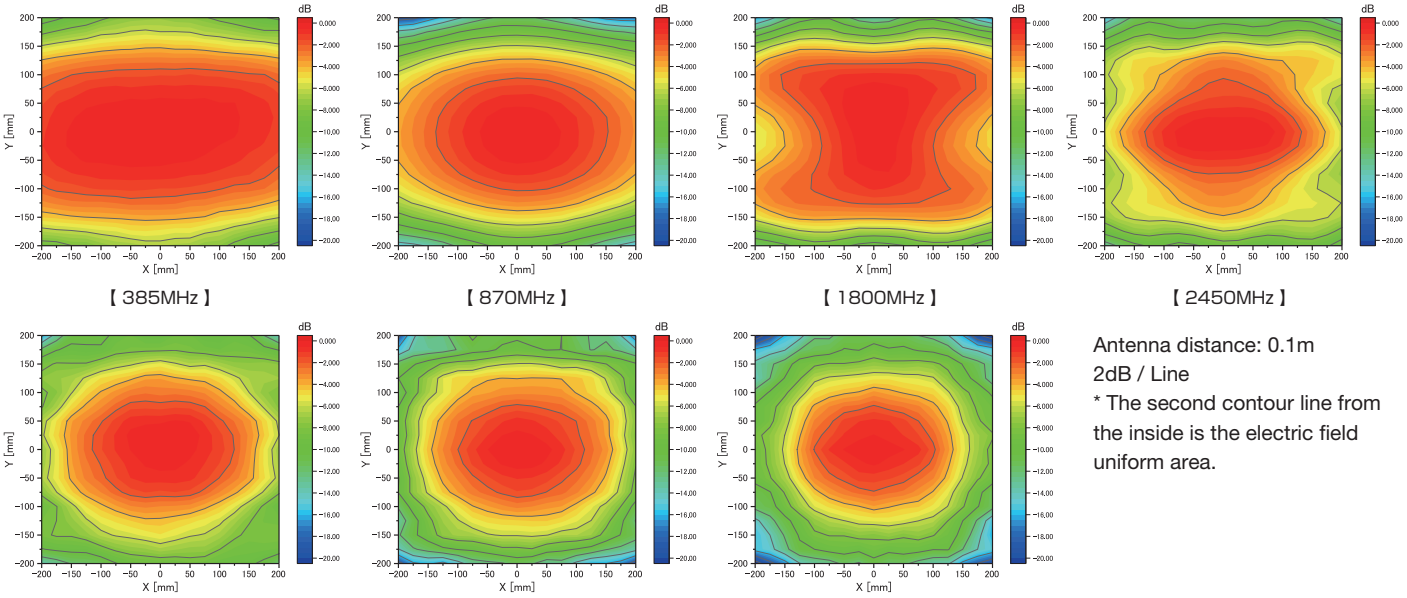


■ Power required for generating 300 V/m (typ) (at 0.1m)



TEM horn antenna

■ Electric field distribution characteristics



【 385MHz 】 【 870MHz 】 【 1800MHz 】 【 2450MHz 】

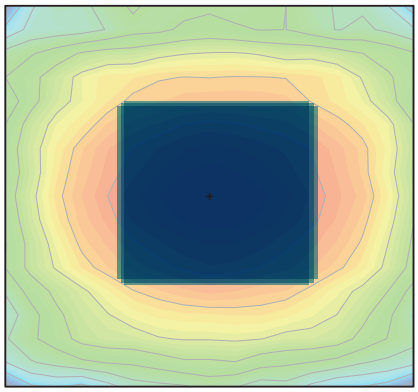
【 3700MHz 】 【 4500MHz 】 【 5800MHz 】

Antenna distance: 0.1m
2dB / Line
* The second contour line from the inside is the electric field uniform area.

The electric field distribution characteristics are ymmetrical vertically and horizontally.

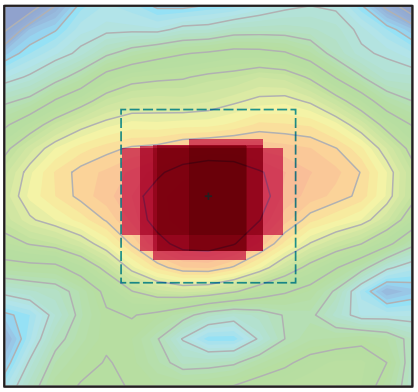
About securing an uniform electric field

In the actual test, the radiation position is controlled by creating a quadrangle inscribed on the uniform electric field surface. Therefore, there is a symmetric electric field distribution characteristic that has a maximum point in the center and can create a large quadrangle.



When the uniform electric field is symmetrical

Since the electric field uniform surface is symmetrical vertically and horizontally, a wide electric field uniform surface can be obtained based on the antenna center axis.



When there is distortion on the uniform electric field surface

If the electric field uniform surface is distorted, it is difficult to secure a wide electric field uniform surface with respect to the center axis of the antenna. (It becomes a narrow electric field uniform surface.)

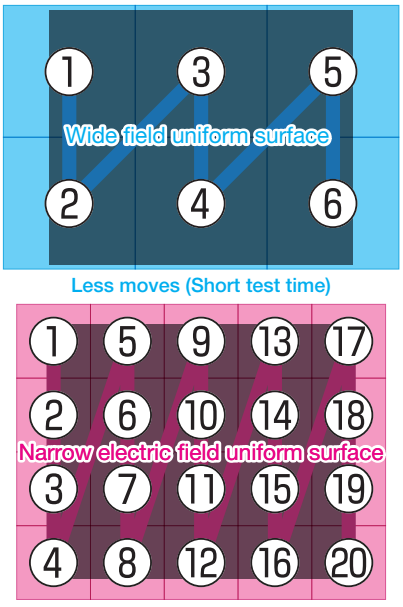


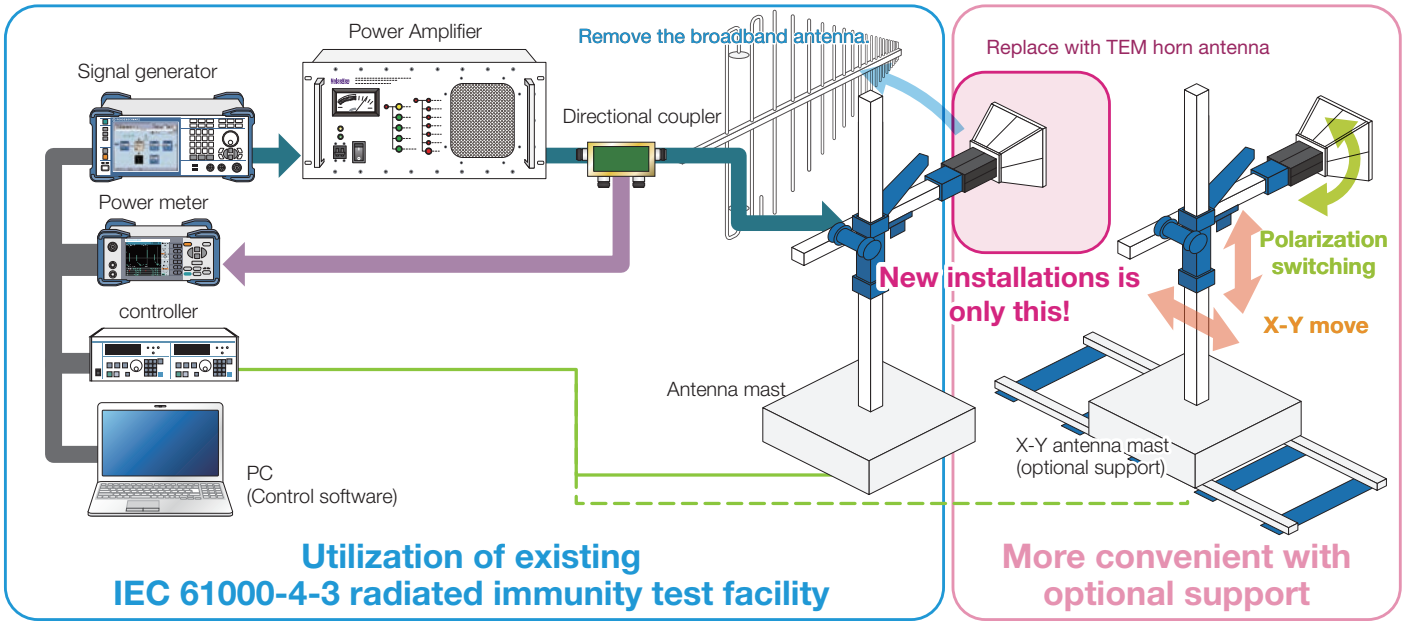
Image of the difference in the number of antenna movements

Widely symmetrical electric field distribution characteristics can be expected to shorten the test time.

TEM horn antenna

System configuration image

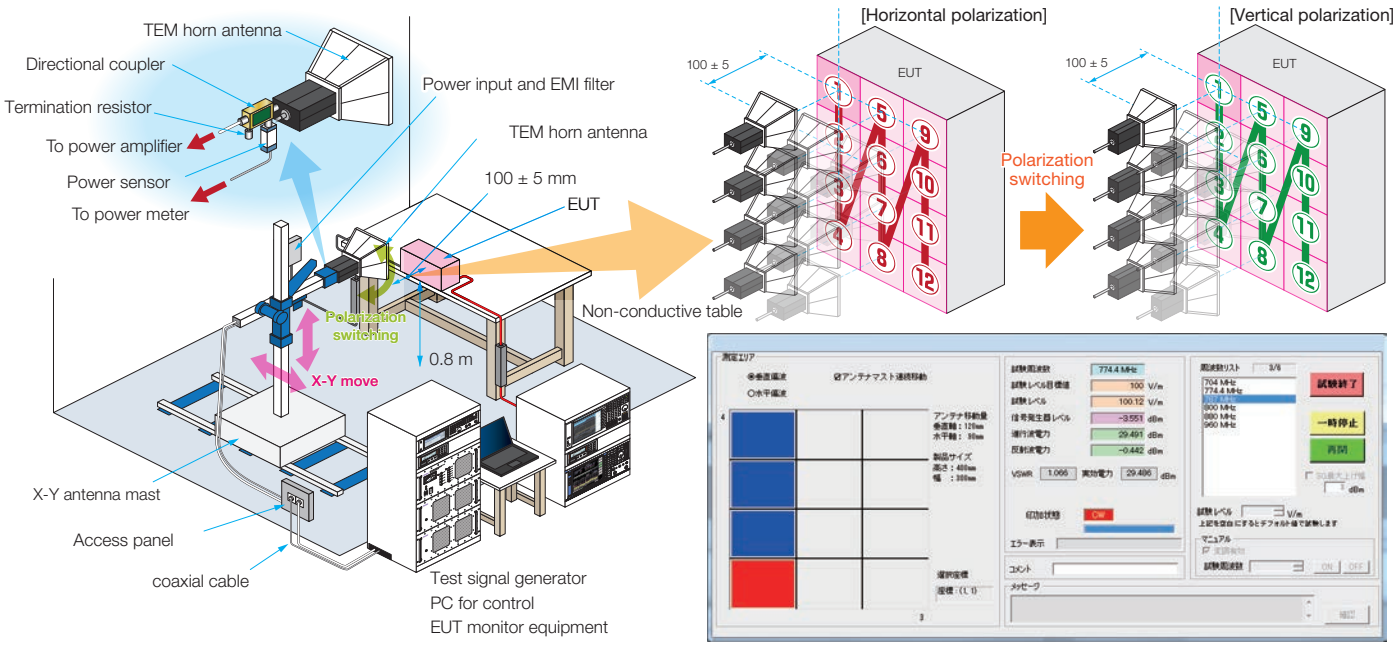
The system configuration is a signal generator that is a signal source of noise, a power amplifier that amplifies the signal, a TEM horn antenna that radiates radio waves, a power meter that confirms the power supplied to the TEM horn antenna, and software to control these series of devices.
The basic system configuration is almost the same as the IEC 61000-4-3 radiated immunity test, and in order to perform the proximity radiation test, the system can construct simply by changing the antenna from the conventional wideband antenna to the TEM horn antenna. (Antenna position control (X-Y control) is available as an option.)



A system with dedicated software can build.

Test image using dedicated software (X-Y position movement and polarization switching control)

In the test, the distance between the DUT and the antenna is set to 100 mm, and all surfaces of the DUT are radiated with vertically polarized waves and horizontally polarized waves. By using dedicated software to automate antenna movement and radio wave radiation, you can further reduce test time and labor.

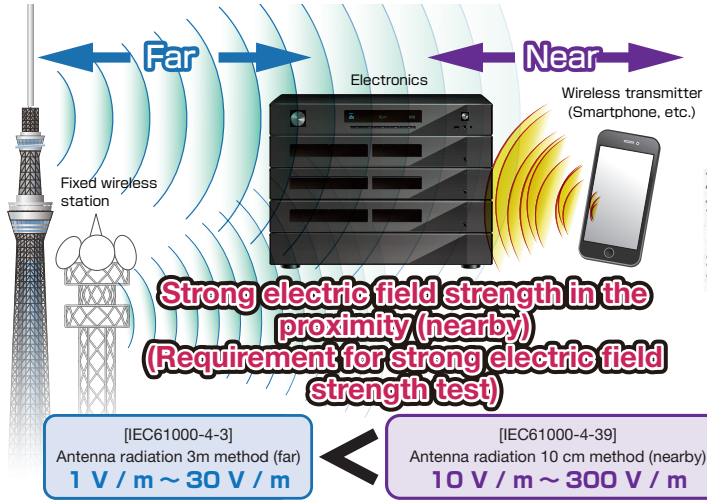


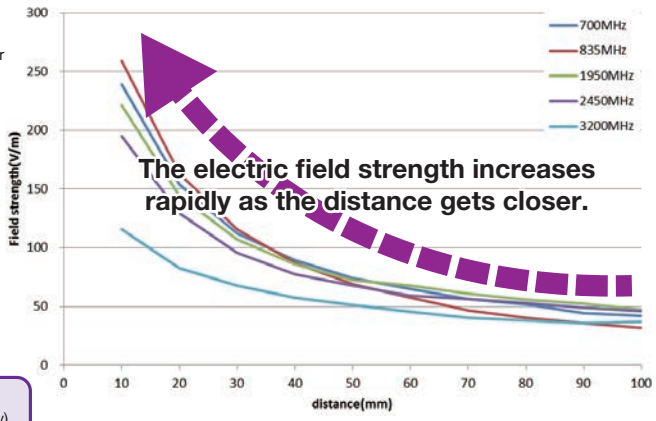
*Dedicated software is currently under development. Please contact us for details.

TEM horn antenna

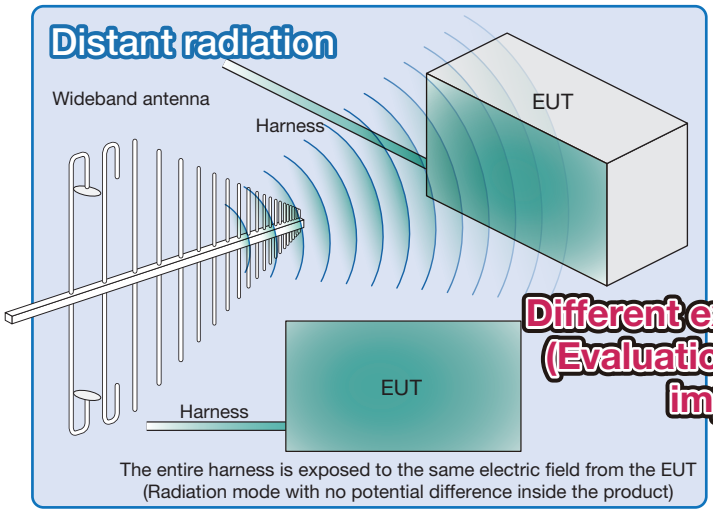
The need for The need for proximity radiation testing

With the advent of new communication technologies and infrastructures such as IoT and 5 G, in addition to smartphones and wireless LANs, which have become extremely popular in recent years, a world is emerging in which many electronic devices are connected by wireless communication. On the other hand, from the perspective of EMC, the number of cases where these wireless transmitters are in close proximity to other electronic devices is increasing, and there is concern about the risk of electromagnetic interference. Against this background, IEC 61000-4-39, an electromagnetic immunity test method for nearby transmitters, was issued. Since the electromagnetic field generated by a nearby transmitter is extremely strong and has the characteristics of the near field, it is necessary to perform it in addition to the conventional radiated immunity test that radiates from a distance. The basic standard, IEC 61000-4-39, defines the antenna to be used, and it is necessary to use a TEM horn antenna in the frequency band of smartphones, mobile phones, and 5G(sub6).

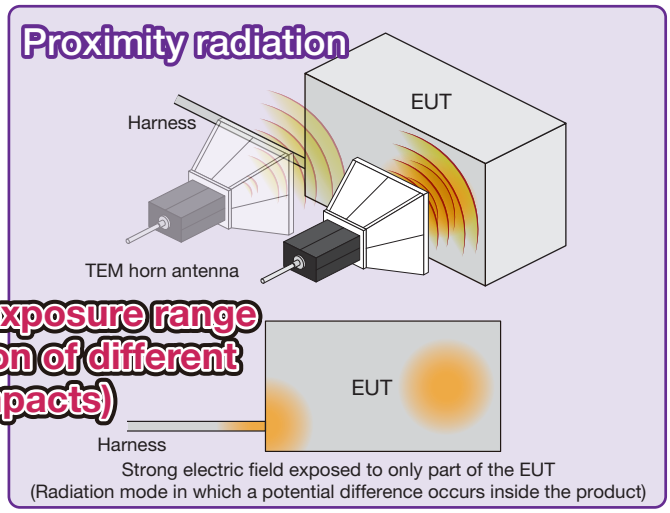




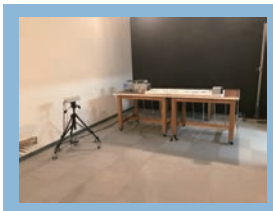
Electric field near the transmitter-Image of distance characteristics



The entire harness is exposed to the same electric field from the EUT
(Radiation mode with no potential difference inside the product)

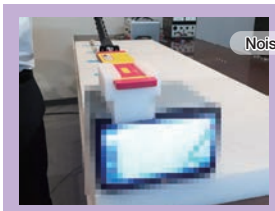


Strong electric field exposed to only part of the EUT
(Radiation mode in which a potential difference occurs inside the product)



No problem in distance radiation test

[Test conditions]
Product: Car navigation
Frequency: 900MHz
Modulation: PM
Rating: 1kHz audio signal



Malfunction occurs in the proximity radiation test

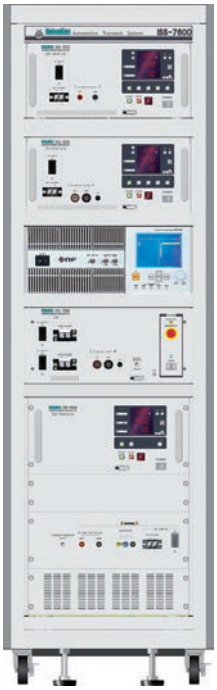
【Note】
This test is the result of the test conducted in accordance with the proximity radiation immunity test standard (ISO 11452-9) for automobile equipment. Vehicles and in-vehicle devices have already been tested for distance radiation and proximity radiation.

Because the test conditions are different, the results are different.

ISO Standard Compliant Automotive Transient Surge Simulator

ISS-7600 Series

Designed to meet and exceed the testing needs to ISO7637-2 (2011), NoiseKen ISS-7600 series Automotive Transient Surge Simulator System offers flexible and productive testing facilities.



- Highly accurate output waveforms
- Waveforms guaranteed not only at the output terminal of each generator but also at the output terminal of the Coupling Network.
- Capable of running either as a system or as individual generators.
- PC Remote Control Software can control ISS-7600 through USB interface connection.
- Supports 12 V / 24 V / 42 V systems
- 60 V / 50 A Coupling Network
- Up to 200 A Power supply available.
- Electric shock-free safety plugs are used for every output terminal.
- Load resistors meeting the loading conditions (specified in Annex D of the standard) for the verification of the output characteristics optionally available.
- Equipped with a high accuracy current monitor. An oscilloscope allows measurement of the current waveform flowing into the DUT. Current and voltage waveforms can be examined at the same time with an oscilloscope because the current monitor output circuit is floating with respect to the SG and FG. The monitor's frequency response characteristic is from DC to 150 kHz.
- Japanese software is also available.

* Private standards or specifications by manufactures can be responded upon request.

Pulse 1 / 2a Generator

ISS-7610

Pulse 1 : Simulation of transients due to supply disconnection from inductive loads. It is applicable to DUTs which, as used in the vehicle, remain connected directly in parallel with an inductive load.

Pulse 2a : Simulates transients due to sudden interruption of currents in a device connected in parallel with the DUT due to the inductance of the wiring harness

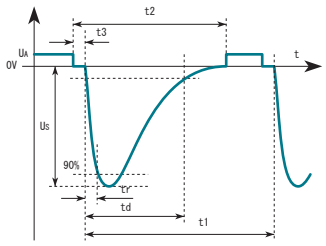
- Compliant tests to ISO 7637-2 (2011) Standard (Pulse1/Pulse2a generator)
- Stand-alone usage possible with 60V 30A CDN built-in.

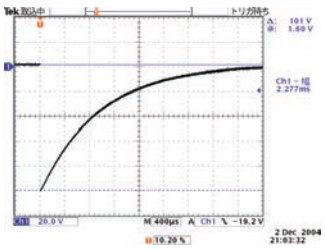
Parameter	Specification (Pulse 1)	Specification (Pulse 2a)
Output voltage(Us)	-5 V ～ -720 V (-1 V step)	5 V ～ 300 V (1V step)
Output impedance(Ri)	10 Ω, 30 Ω, 50 Ω	2 Ω, 4 Ω, 10 Ω, 30 Ω, 50 Ω
Pulse width(td)	50μs, 200μs, 300μs, 500μs, 1ms, 2ms	50μs, 200μs, 300μs, 500μs
Rise time(tr)	1μs : -0.5μs /+0μs 3μs : -1.5μs /+0μs	1μs : -0.5μs /+0μs
Pulse repetition period(t1)	0.5s ～ 99.9s (0.1s step), P2a : 0.1s ～ 99.9s (0.1s step)	
DUT power capacity	DC 60 V / 30A	
Dimensions	(W)430 × (H)200 × (D)522 mm	
Weight	Approx. 20 kg	Power consumption 260 VA

Item	Q'ty
Output cable(2 m)	Each 1 pc. of red & black color one
DC input cable(2 m)	1 pc.
Short lead for waveform verification	1 pc.
Interlock plug	1 pc.
Fuse(3.15 A)	2 pcs.
AC cable	1 pc.
Instruction manual	1 volume

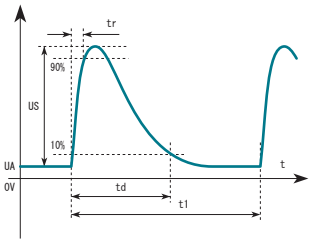
Output waveform

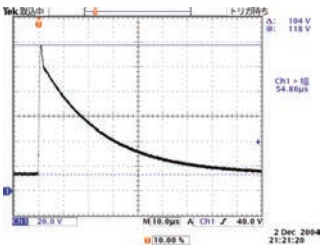
pulse1





pulse2a





ISS-7600 Series

Pulse 3a / 3b Generator
ISS-7630

Simulation of transients which occur as a result of the switching processes. The characteristics of these transients are influenced by distributed capacitance and inductance of the wiring harness.

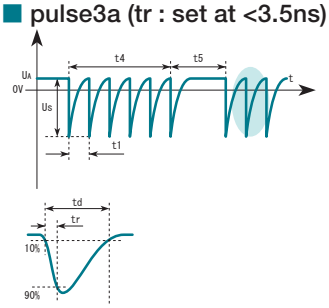
- **Compliant tests to ISO 7637-2 (2011) Standard (Pulse 3a/Pulse 3b generator)**
- **Stand-alone usage possible with 60V 30A CDN built-in.**
- **Frequency sweep (10 kHz - 100 kHz - 10 kHz) test possible (Option)**
- **Faster than 3.5ns rise time realized so as to conduct more severe test than the Standard.**

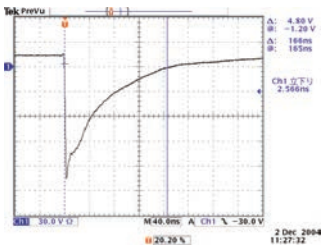
Parameter	Specification
Output voltage(Us)	-20 V ～ -350 V (-1 Vstep) 20 V ～ 350 V (1 Vstep)
Output impedance(Ri)	50 Ω
Pulse width(td)	150ns ± 45ns
Rise time(tr)	5ns ± 1.5ns, <3.5ns
Pulse repetition period(t1)	10μs ～ 999μs(1μs step) *1 kHz ～ 100 kHz Frequency sweep possible (option necessary)
DUT power capacity	DC60V/30A
Dimensions	(W)430 × (H)200 × (D)522 mm
Weight	Approx. 17 kg　Power consumption 110 VA

Item	Q'ty
Output cable(0.5m)	Each 1 pc. of red & black color one
DC input cable(2m)	1 pc.
BNC conversion adaptor	1 pc.
50Ω coaxial cable (BNC equipped)	1 pc.
G cable	1 pc.
Waveform verification lead	1 pc.
Interlock plug	1 pc.
Fuse(3.15A)	2 pcs.
AC cable	1 pc.
Instruction manual	1 volume

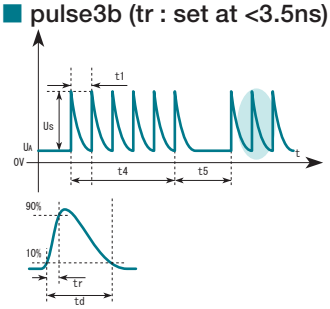
Output waveform

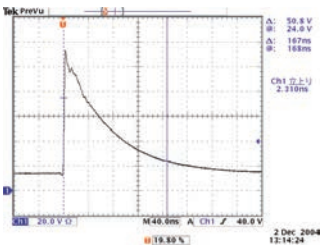
pulse3a (tr : set at <3.5ns)





pulse3b (tr : set at <3.5ns)



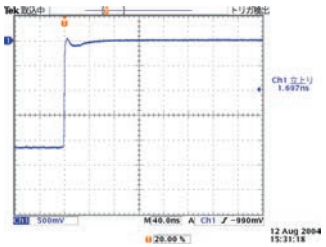


Difference of the impulse response among measurement probes

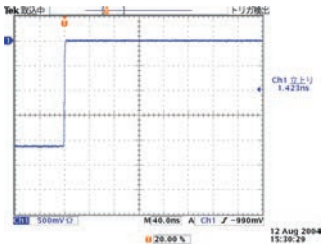
Since Pulse 3a / 3b contain high frequency components, the waveform measurement should be paid attention.
It can be done easily with the optional attenuator.

BNC conversion adaptor for the measurement

Attenuator in No-load (Option)



Measurement with a 100:1



Measurement with the NoiseKen no-load attenuator

ISS-7600 Series

Pulse 2b / 4 Generator

BP4610

Pulse 2b : Simulates transients from d.c. motors acting as generators after the ignition is switched off.
Pulse 4 : Simulates supply voltage reduction caused by energizing the starter-motor circuits of internal combustion e spikes associated with starting.

- **Compliant tests to ISO 7637-2 (2011) Standard (Pulse 2b generator)**
- **Compliant to ISO 7637-2 (2004) pulse 4**
- **± 60 V 10 A DC - 150 kHz bipolar amplifier built-in.**
- **Works as a power source replacing an external battery for testing with the other pulses.**
- **Expandable to be 15 A or 30 A upon addition of an optional external power supply.**

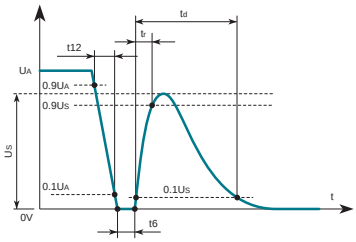
*** Requirement of 100 A / 200 A can be responded upon request and discussion.**
*** Optional software shall be necessary for putting Pulse 2b / 4 out.**

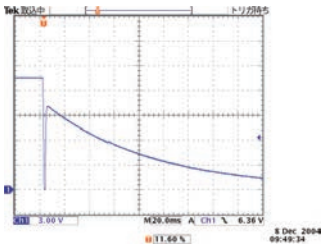
Parameter		Specification
Pulse 2b	UA, Us*	0 V ~ 60.0V ± 10% ± 0.5 V 0.1 V step
	Ri	0 Ω ~ 0.05 Ω
	Td	0.1s, 0.2s ,0.5s ,1s ,2s ,4s ±20%
	t12, tr, t6*	1ms ,2ms ,5ms ±50%
Pulse 4	UB	0 V ~ 60.0 V ± 10% ± 0.5 V 0.1 V step
	Us, Ua	0 V ~ -UB ± 10% ± 0.5 V -0.1 V step
	Ri	0Ω ~ 0.02 Ω(at shipment)
	t7, t8 ,t10 ,t11*	1ms ~ 999ms ± 10% 1ms step
	t9	0.1s ~ 99.9s ±1 0% 0.1s step
Dimensions		(W)430 × (H) 177 × (D)550 mm
Weight		Approx. 26 kg Power consumption 1200 VA

***Each parameter can be set individually.**

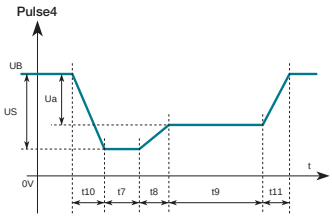
Output Waveform

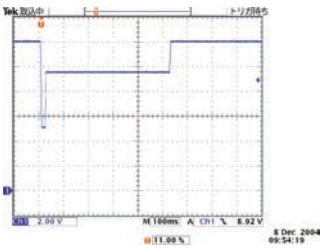
pulse2b





pulse4





Pulse 5a / 5b Generator

ISS-7650

Pulse 5a : Simulation of load dump transient, occurring in the event of a discharged battery being disconnected while the alternator is generating charging current and with other loads remaining on the alternator circuit at this moment.
Pulse 5b : Simulation of the above load dump transient when a Zener diode is inserted to the battery route.

- **ISO 7637-2 (2004) compliant pulse 5a**
- **Pulse 5a and Pulse 5b generating unit**
- **A built-in 60 V / 30 A Coupling Network allows independent operation.**
- **Equipped with a programmable clip circuit that can produce Pulse 5b clipped waveform in steps of 0.1 V without externally attaching a zener diode.**

***The ISO standard requires pulse 5a and 5b have the same value for their td. Due to the effects of the integrated clip circuit, pulse 5b width is different from that of pulse 5a. Pulse 5b non-compliant to ISO 16750 (2012) Test B**

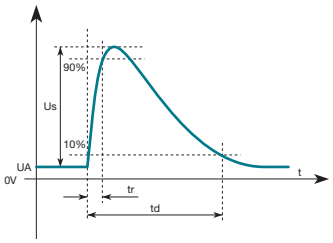
ISS-7600 Series

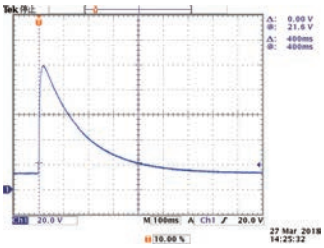
Parameter	Specification	
Pulse5a	12 V system	24 V system
Output voltage(Us)	20 V ～ 100 V (0.5 V step)	20 V ～ 200 V (0.5 V step)
Output impedance(Ri)	0.5 Ω ～ 8 Ω (0.5 Ω step)	1 Ω ～ 8 Ω (0.5 Ω step)
Pulse width(td)	40ms, 100ms ,200ms, 350ms ,400ms	100ms ,200ms ,350ms ,400ms
Rise time(tr)	10ms (+0, -5ms)	10ms (+0, -5ms)
Pulse5b	12 V system	24V system
Output voltage(Uss)	10 V ～ 40 V (0.1 V step)	
Pulse width(td)	Td of pulse 5b is dependent on Us, Uss and Ri settings, the same value as pulse 5a td not available	
DUT power capacity	DC 60 V / 30 A	
Dimensions	(W)488 × (H)670 × (D)660 mm	
Weight	Approx. 100 kg	Power consumption150 VA(in stand-by) / 600 VA(in charging)

Item	Q'ty
Output cable (2 m)	Each 1 pc. of red & black color one
DC input cable (2 m)	1 pc.
Coaxial cable for current monitoring	1 pc.
DC coupling switching plug	1 pc.
Short lead for waveform verification	1 pc.
Interlock plug	1 pc.
Fuse (6.3 A)	2 pcs.
AC cable	1 pc.
Instruction manual	1 volume

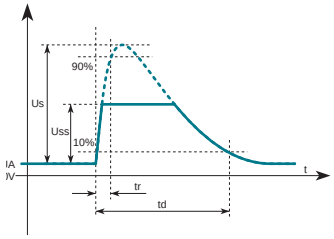
Output Waveform

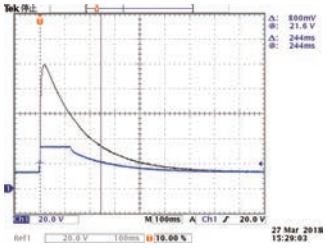
pulse5a





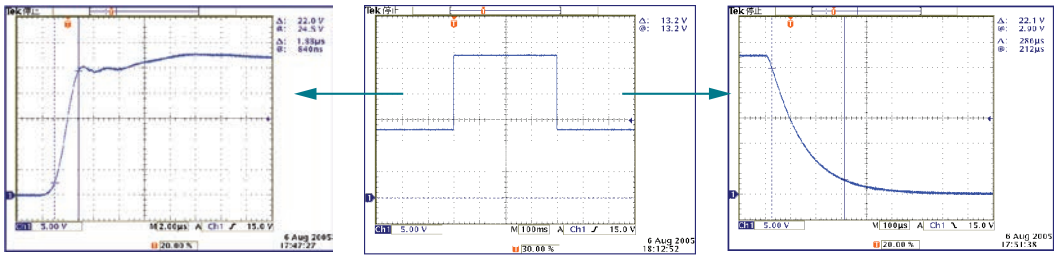
pulse5b





pulse5c (Customized waveform)

* Responded upon the particular request. If required, please contact us.



*1ms - 500ms (1ms)

Coupling Network & System Rack

ISS-7690 / ISS-7602

System rack that all pulse generating units can be mounted on (ISS-7602).
ISS-7690 Coupling Network unit centralizes all pulse outputs of the system-configured generators in the single output port.

- **Software selectable pulse generators and DC supplies**
- **In addition to the built-in DC power supply (BP4610), two external power supplies (battery) connections are available**
- **Switches three independent power supplies (BP4610 (LINE 1), LINE 2, LINE 3)**
- **A high speed DC interruption switch with < 1μs fall time capability is standard built-in**
- **Equipped with a high accuracy current monitor.**
- **The pulse 3a and 3b waveforms meet the ISO standard specifications at the output ports of the Coupling Network Unit.**

Insure high frequency Pulse 3a / 3b waveforms which may be dulled due to the wiring length with the centralized CDN output port.

Parameter	Specification
DUT power capacity	60 V / 50 A
DC input	2 channels (Amplifier power supply & battery) *Including Pulse 2b, Pulse 4 and arbitrary waveform.
Pulse input	Pulse1, Pulse2a/2b ,Pulse3a/3b ,Pulse4, Pulse5a, Pulse5b
Interruption test	≦ 1μs (in DC interruption), Not switched in fluctuation of the interruption
Current monitor	Monitoring terminal (BNC)output 10m V/A (DC)150 kHz
System rack	(W)555 × (H)1800 × (D)790 mm

Control software

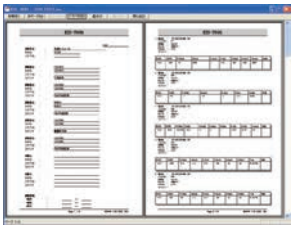
ISS -7601

Comprehensive control software for the all pulse generators.

- Comprehensive control software for the all pulse generators.
- Enables to control the each pulse generator comprehensively.
- One touch output possible even in Pulse 2b and Pulse 4 whose waveforms assembly may be troublesome.
- Easy setting of the test conditions with its programming function.
- Reporting function available to realize the test conditions, comments as well as the result (Preview and print-out also possible).

Sequence setting screen

Preview screen for printing the test result out



Fest Pulse /Slow Pulse Generators

ISS-7630 / ISS-7610-N1229

The ISO 7637-3 2007 standard provides evaluation of the immunity of devices under test (DUTs) to transient transmission by coupling via lines other than supply lines. The test transient pulses simulate both fast and slow transient disturbances, such as those caused by the switching of inductive loads and relay contact bounce. Also it provides 3 kinds of the coupling methods.

ISS-7630(Fast Pulse)

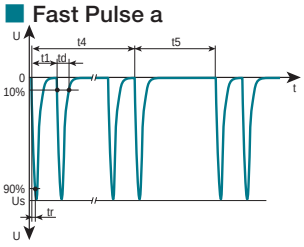
Parameter	Specification
Output voltage(Us)	-20 V ～ -350 V (-1 V step) 20 V ～ 350 V (1 V step)
Output impedance(Ri)	50 Ω
Pulse width(td)	150ns ± 45ns
Rise time(tr)	5ns ± 1.5ns, < 3.5ns
Pulse repetition period(t1)	10μs ～ 999μs(1μs step)
DUT power capacity	DC 60V / 30 A
Dimensions	(W)430 × (H)200 × (D)522 mm
Weight	Approx. 17 kg　Power consumption 110VA

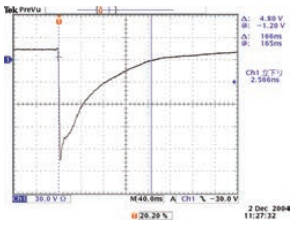
ISS-7610-N1229(SLOW Pulse)

Parameter	Specification
Output voltage(Us)	5 ～ 50 V (0.1 V step) -5 ～ -50 V (-0.1 V step)
Output impedance(Ri)	2 Ω
Pulse width(td)	50μs ± 10μs
Rise time(tr)	1μs
Pulse repetition period(t1)	0.1 ～ 99.9s (0.1s step)
DUT power capacity	–
Dimensions	(W)430 × (H)200 × (D)522 mm
Weight	Approx. 20 kg　Power consumption 50VA

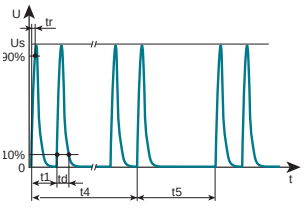
Output Waveform

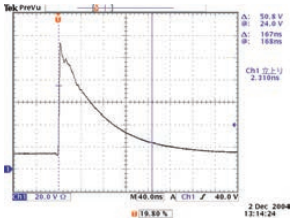
Fast Pulse a



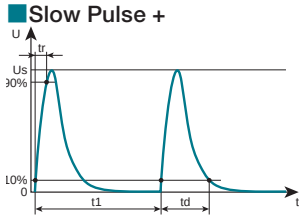


Fast Pulse b

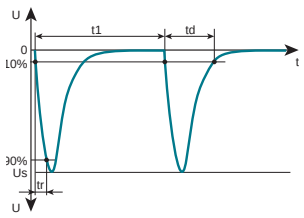




Slow Pulse +



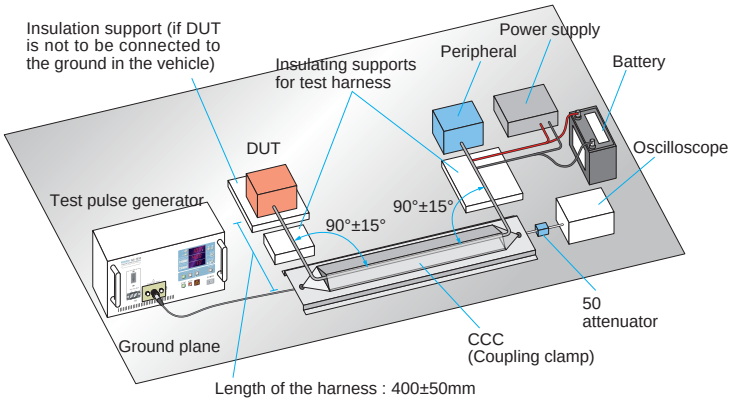
Slow Pulse –



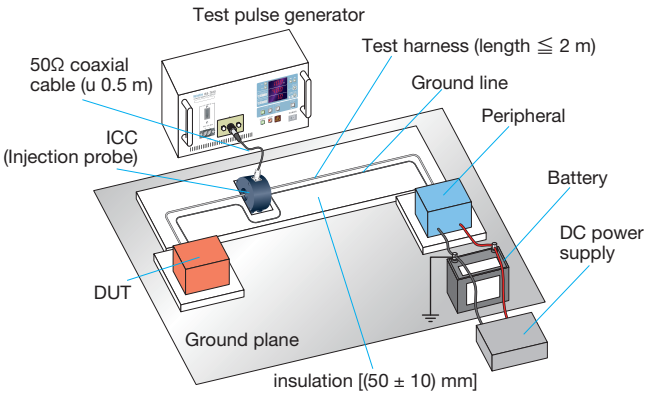
ISS-7600 Series

Test Setup(ISO 7637-3)

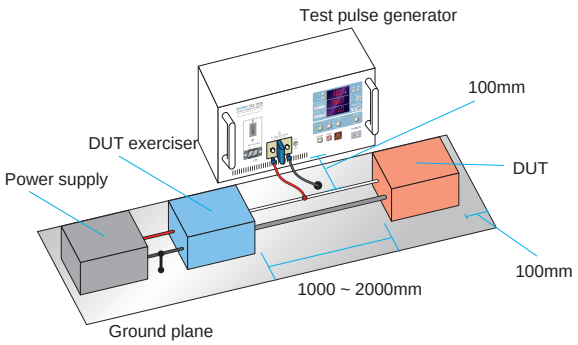
· Capacitive coupling clamp (CCC) method (Only for Fast Pulse)

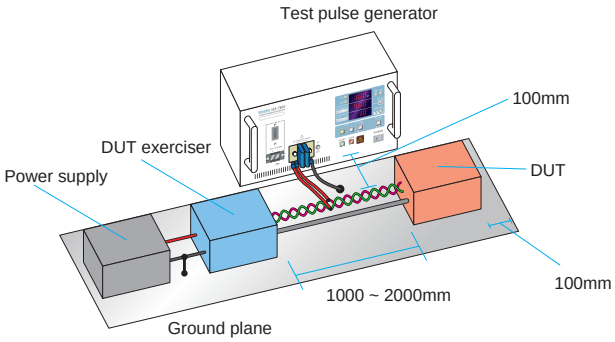


· Inductive coupling clamp (ICC) method (Only for Slow Pulse)



Direct capacitor coupling (DCC) method (For Fast Pulse and Slow Pulse)





* DCC test setup for CANBAS.

Option

Coupling Clamp MODEL : ISS-7630-Cup

Coupling clamp for testing for lines other than supply lines. Capacitively couples 3a and 3b pulses into the lines under test.
Contents: Coupling clamp, BNC Coaxial cable 0.5m, BNC coaxial cable 0.1 m, 50Ω 5W terminator, Metal fasteners

● Correspondent model : ISS-7630

Injection Probe MODEL : F-120-2

Clamp used for the Inductive coupling clamp (ICC) test method provided in ISO 7637-3 Standard. Calibration fixture (FCC-BCICF-1) is also available.
* The left photo is the figure including the calibration fixture.

DCCBOX

• Inject pulse noise into the I / O signal line through a 100pF coupling capacitor regulated by ISO 7637-3.
• With a check terminal to check the pulse
• The pulse decoupling inductor can be attached to and detached from the sample (hereinafter referred to as EUT1 and EUT2).
• Since the pulse generator to the DCC BOX is a balanced transmission line and the DCC BOX to EUT 1 and EUT 2 is an unbalanced transmission line, a balanced / unbalanced balun is built in to suppress disturbance of the pulse waveform.

Waveform Verification Set Model: 06-00059B

A set of resistor and attenuator for observing the pulse of Test Pulse 1 / Test Pulse 2a / Test Pulse 2b / Test Pulse 3a / Test Pulse 3b / Test Pulse 5a of ISS-7610, BP4610, ISS-7630, & ISS-7650.

1 Ω resistor, 2 Ω resistor, 10 Ω resistor, 50 Ω resistor, 2.5 k Ω 40 dB ATT, 50 Ω 20 dB ATT × 2

● Compatible models: ISS-7610, ISS-7630, ISS-7650

* Resistors can also be purchased individually.

Waveform Verification Attenuator under No Load Conditions Model: 00-00007A

The attenuator for observing high frequency and high voltage pulses of Test Pulse 3a / Test Pulse3b of ISS-7630.
2.5 k Ω 40 dB ATT (Pulse 3a / Pulse 3b)

● Compatible model: ISS-7630

50Ω Load Waveform Verification Attenuator Model: 00-00006B

The attenuator for observing high frequency and high voltage pulses of Test Pulse 3a / Test Pulse 3b of ISS-7630.
50 Ω 20 dB ATT × 2 (Pulse 3a / Pulse 3b)

● Compatible model: ISS-7630

JASO Standard Compliant Automotive Transient Surge Simulator

JSS Series

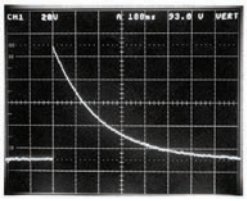
Simulator to reproduce various transient surge phenomena which are generated in a vehicle and required in JASO D 001-94 General Rules of Environmental Testing Methods for Automotive Electronic Equipment established by The Society of Automotive Engineers of Japan Standard, and evaluate the immune resistibility of the equipped electronics devices against the surge.

- **JASO D001-94 Rule compliant simulator**
- **Respond both for 12 V and 24 V systems.**
- **One touch selection possible for the output surge waveform.**

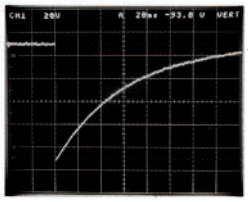
JSS-001
JSS-002

JSS-003

Output Waveform



A-1 Waveform
τ :200ms
V:20V/Div
H:100ms/Div



B-1 Waveform
τ :60ms
V:20V/Div
H:20ms/Div

Specification

Parameter		Specification (JSS-001)	Specification (JSS-002)	Specification (JSS-003)
Output voltage / RC Time constant / Output impedance / DC cut time				
	Type A-1	100 V / 200ms / 0.8 Ω / —		100 V / 200ms / 0.8Ω /—
	Type A-2	150 V / 2.5μs / 0.4 Ω / —		150 V / 2.5μs / 0.4 Ω /—
	Type B-1	-100 V / 60ms / 8 Ω / 300ms		-100 V / 60ms / 8 Ω / 300ms
	Type B-2	-320 V / 2ms / 80 Ω / 10ms		-320 V / 2ms / 80 Ω / 10ms
	Type D-1		150 V / 400ms / 1.5Ω / —	150 V / 400ms / 1.5 Ω / —
	Type D-2		200 V / 2.5μs / 0.9Ω / —	200 V / 2.5μs / 0.9 Ω / —
	Type E		-400 V / 26ms / 210Ω / 120ms	-400 V / 26ms / 210 Ω / 120ms
Repetition frequency /number of pulse		30s / 1 ～ 999999	30s/1 ～ 999999	30s/1 ～ 999999
DUT power capacity		Max. DC 50 V / 10 A	Max. DC 50 V / 10 A	Max. DC 50 V / 10 A
Dimensions		(W)555 × (H)1500 × (D)790 mm	(W)555 × (H)1500 × (D)790 mm	(W)555 × (H)1800× (D)790 mm
Weight		Approx. 160 kg	Approx. 200 kg	Approx. 200 kg

JASO D001-94

1.Conditions of Transient Voltage Test

Class	Type of test		Test conditions Vp(V)	τ(μs)	f(Hz)	R3(Ω)	Number of pulses	Location of transient voltage impression
12V system	Type A	A-1	70	200000	–	0.8	1	Power supply terminal
		A-2	110	2.5	1/30	0.4	10	
	Type B	B-1	-80	60000		8	100	
		B-2	-260	2000		80		
	Type C		As agreed between the parties concerned				via agreement	Related Terminal
24V system	Type D	D-1	110	400000	–	1.5	1	Power supply terminal
		D-2	170	2.5	1/30	0.9	10	
	Type E		-320	26000		210	100	
	Type F		As agreed between the parties concerned				via agreement	Related Terminal

2.Constants in the Generating Circuits for Type A and Type D Transient Voltage Tests

Type of test		Capacitor voltage(V)	ResistorR1	ResistorR2(Ω)	ResistorR3(Ω)	ResistorR4(Ω)	Capacitor C(μF)	Remarks
Type A	A-1	88	To be determined along power supply capacity for the charging	5(100)	1(100)	4(100)	80000	Select the either combination
		70		2(100)	0.8(100)	∞	110000	
	A-2	110		0.6(200)	0.4(150)	∞	4.7	–
Type D	D-1	130		22(100)	2(100)	11(100)	50000	Select the either combination
		110		5.5(100)	1.5(100)	∞	73000	
	D-2	170		1.2(100)	0.9(100)	∞	2.2	–

Remarks
1. Numbers in parenthesis are reference figures for resistor power rating. Unit: W
2 The specified values for resistors and capacitors shall be true values not designated values.

3.Constants in the Generating Circuits for Type B and Type E Transient Voltage Tests

Type of test		Capacitor voltage(V)	ResistorR1	ResistorR2(Ω)	ResistorR3(Ω)	ResistorR4(Ω)	Capacitor C(μF)	Remarks
Type B	B-1	-100	To be determined along power supply capacity for the charging	50(10)	10(10)	40(10)	2400	Select the either combination
		-80		20(10)	8(10)	∞	3000	
	B-2	-260		60(5)	80(5)	∞	33	–
Type E		-457		27(100)	300(10)	700(10)	1000	Select the either combination
		-320		13(100)	210(10)	∞	2000	

Remarks
1. Numbers in parenthesis are reference figures for resistor power rating. Unit: W
2 The specified values for resistors and capacitors shall be true values not designated values.
* See the original document for the Figures.

FORD Standard Transient Pulse Generator

ISS-T1321

Simulator to generate Transient Pulse as required in FORD's EMC standard (EMC-CS-2009) for surge test onto automotive electronic devices. The generation waveforms are Pulse A1 / A2-1 / A2-2 / C1 / C2 surges standardized as RI130 & CI220, and Waveform F fluctuation standardized as CI260.

Basic specification

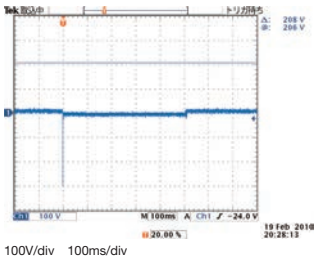
Parameter	Specification
DC Max Input Voltage	DC 13.5 V
DC Max Output Current	10 A・50 A (depends on waveform selection)
DC Input Breaker	50 A
Test Timer	1 ～ 999S(Enable to memorize the last setting at most 3 months)
Switching Relay	KUP-1415-12(Produced by Potter & Brumfield) Display the relaying accumulation * Recommend the replacement after 100 hours usage.
Emergency Stop	Red colored mushroom shape type. (push-lock-turn-reset type) Pulse output stop / DC output stop.
Power supply	AC 100 V–AC 240 V ± 10 %　50 VA
Dimensions	Approx. W430 mm × D322 mm × H 200 mm (protrusion excluded)
Weight	Approx. 12 kg

Output waveform and Current value

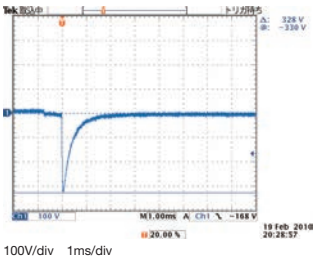
Test item	Output waveform	Mode	Required injection time *1	Max output current	Output terminal
RI130	A2-1	2	60s		C, D*2 terminals(BNC terminals)
		3			
	A2-2	2			
		3			
CI220	A1	1	120s	10A	DC LINE OUT (C, D terminals are short circuited)
		2	20s		
	A2-1	1	120s		
		2	**20s**		
		3			
	A2-2	2			
		3			
	C-1	2		50A	
		3			
	C-2	2			
		3			
CI260	Waveform F	-	60s	10A	DC LINE OUT (C, D terminals are open)

*1 : Injection times are variable.　*2: Direct connection to 15-N1583 coupling test fixture.

■ CI220 A1 MODE1

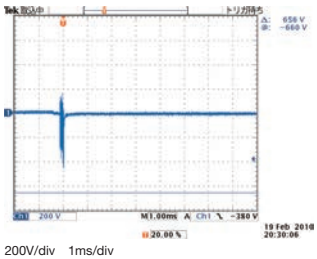


100V/div　100ms/div

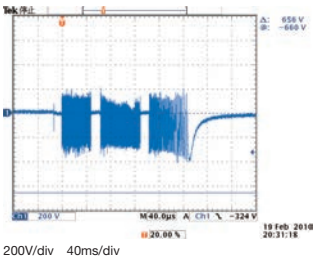


100V/div　1ms/div

■ CI220 A2-1 MODE1

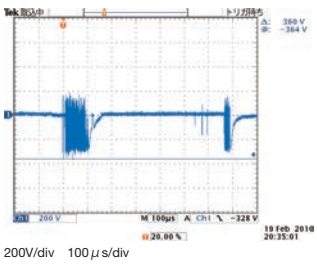


200V/div　1ms/div

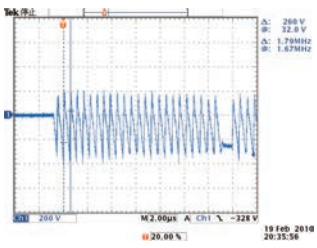


200V/div　40ms/div

■ CI220 A2-1 MODE2

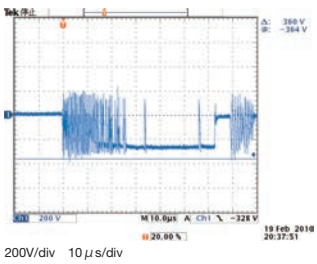


200V/div　100 μs/div

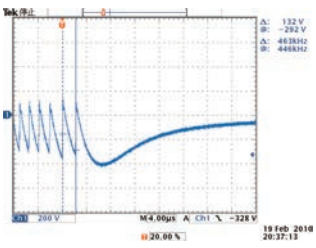


200V/div　2 μs/div

■ CI220 A2-1 MODE3



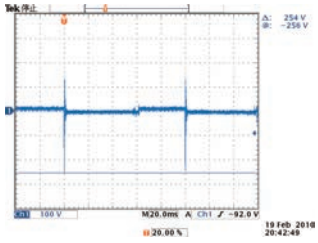
200V/div　10 μs/div



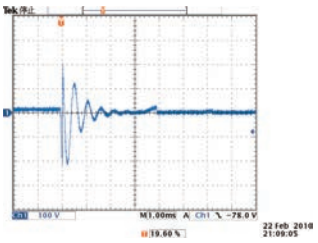
200V/div　4 μs/div

ISS-T1321

CI220 A2-2 MODE2

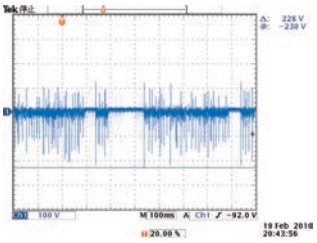


100V/div 20ms/div

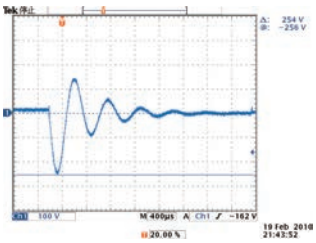


100V/div 1ms/div

CI220 A2-2 MODE3

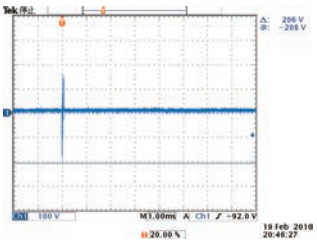


100V/div 20ms/div

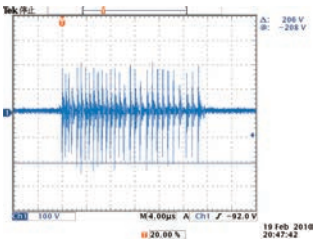


100V/div 1ms/div

CI220 C1 MODE2

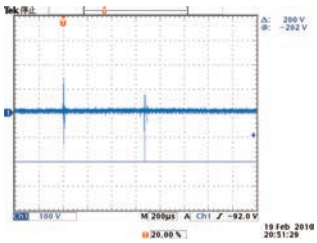


100V/div 1ms/div

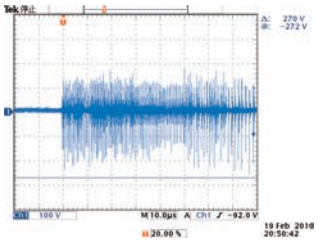


100V/div 4 μs/div

CI220 C1 MODE3

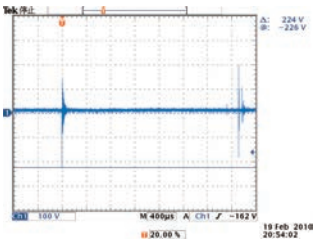


100V/div 200 μs/div

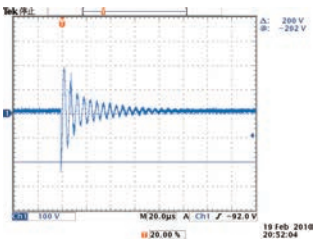


100V/div 10 μs/div

CI220 C2 MODE2

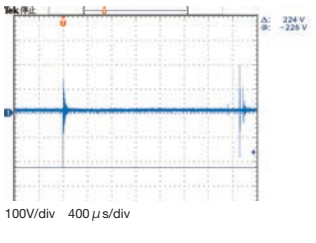


100V/div 400 μs/div

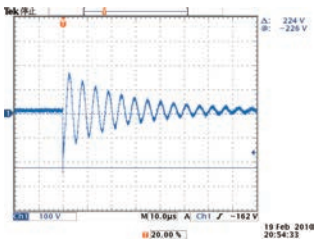


100V/div 20 μs/div

CI220 C2 MODE3

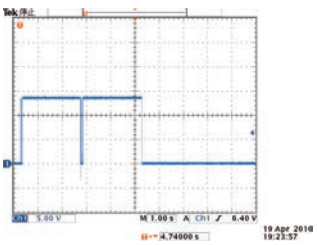


100V/div 400 μs/div

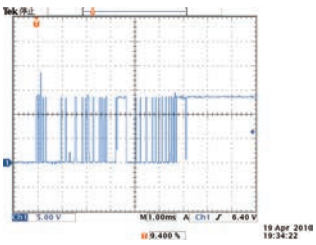


100V/div 10 μs/div

CI260 Waveform F



5V/div 1s/div



5V/div 1ms/div

ISS-T1321

Test Fixture for FORD standard RI130/RI150
15-N1583

Harness injection fixture to perform RI130 / RI150 test required in FORD Standard EMC-CS-2009
(Enable to perform RI130 test in combination with ISS-T1321).

Test fixture outside appearance

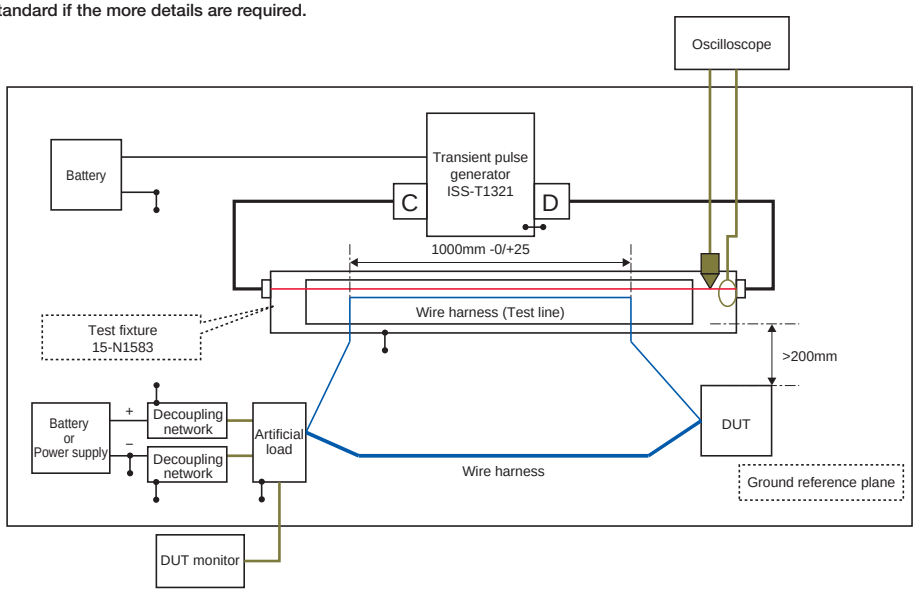
Basic specification

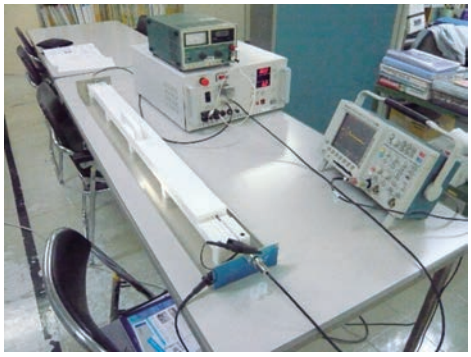
Connector	N Type (Female contact)
Source wire	AWG 14 copper sire (with cover)
Dimensions	(W)1306 × (H)72 × (D)152 mm (protrusion excluded)
Weight	Approx. 7.5 kg
Equipped cable	Connection cable to ISS-T1321 × 2 pcs.

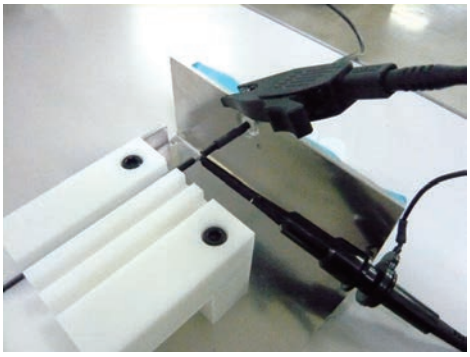
Connection setup

【Test setup】RI130

* Please go through the Standard if the more details are required.



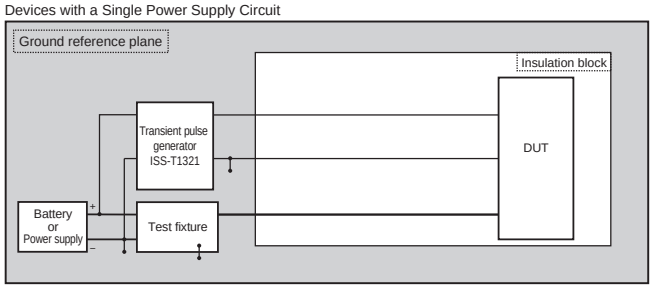




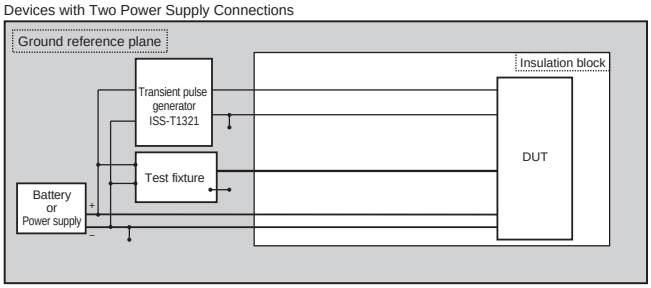
ISS-T1321

【Test setup】CI220

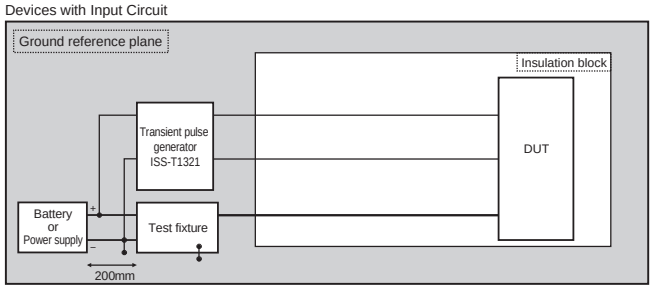
・Devices with a Single Power Supply Circuit



・Devices with Two Power Supply Connections



・Devices with Input Circuit



*** Please go through the Standard if the more details are required.**

FORD Standard CI250 Transformer Unit

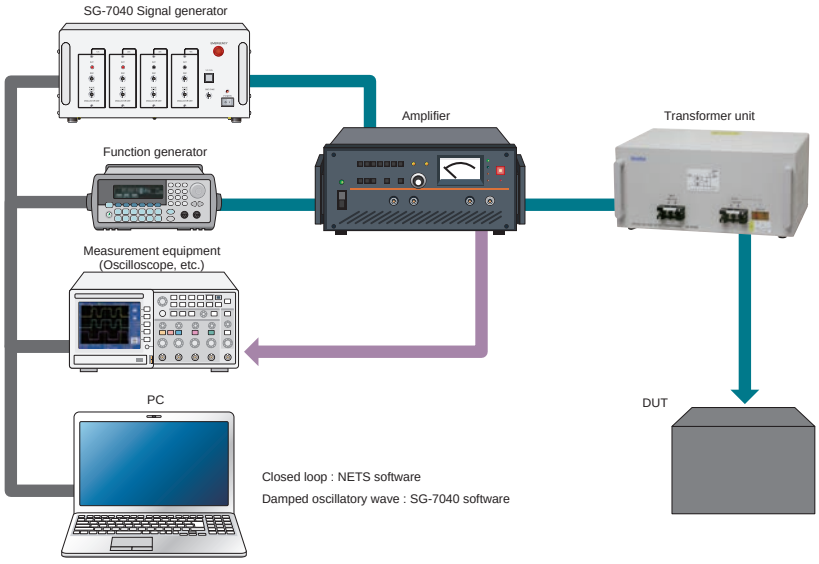
06-N1588

Ground offset transformer to perform CI250 test as required in FORD Standard (EMC-CS-2009)

Outside appearance

Basic specification

Frequency Characteristics	30 Hz ～ 250 kHz
Input Signal	200 W max
Output Current	DC 50 A max
Coupling Ratio	4 : 1 (Input : Output)
Dimensions	Approx.(W)430 × (D)322 × (H)200 mm (protrusion excluded)



Generators or measurement systems correspondent to the other standards shall be responded upon request.

DC Power Supply Voltage Fluctuation Simulators

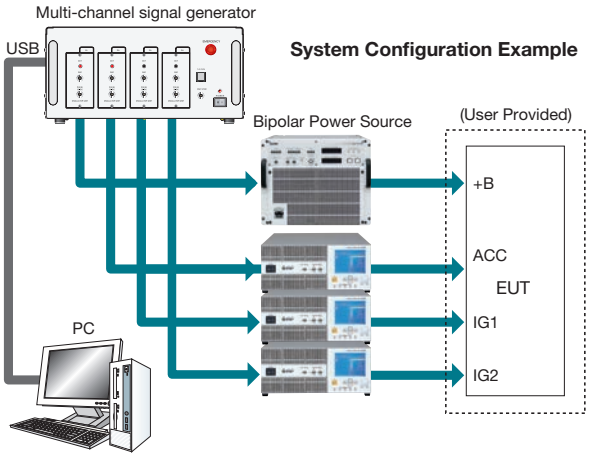
SG-7040A System

Simulator to reproduce power supply voltage fluctuation to electronics devices in a vehicle and evaluate the immune resistibility against the fluctuation.
Max. 4 channels not only +B connection but also ACC, IG (and IG2), etc. can be synchronized for the reproduction.

- ISO 16750 Standard compliant test (Possible to respond to private standards of the manufacturers).
- High resolution and high accuracy for the waveforms output realized with waveforms operation circuits built in the each channel.
- Easy and precise reproduction of the fluctuation phenomena not only in the Standard but also arbitrarily enabled with the software control (USB).
- Insures less than 1μs for the synchronizing variation among the channels.
- Enable to reproduce waveforms by using CSV data collected from real vehicle oscilloscope measurements.
- Automated testing operation can be customized for reducing the man-hour.

*Please contact us for the specification details.
*Load dump test A and B pulses not available

Specification



The system is primarily comprised of the following three elements: multi-channel signal generator, bipolar power source(s), and arbitrary waveform creation software.
Appropriate bipolar power sources shall be selected and the multi-channel signal generator shall be configured according to test requirements.

1. Multi-channel signal generator

・Modular construction for a maximum of four channels
・Arbitrary waveform creation (DC, ramp wave, sine wave, exponential wave, frequency modulation, amplitude modulation)
・Waveform sequence creation

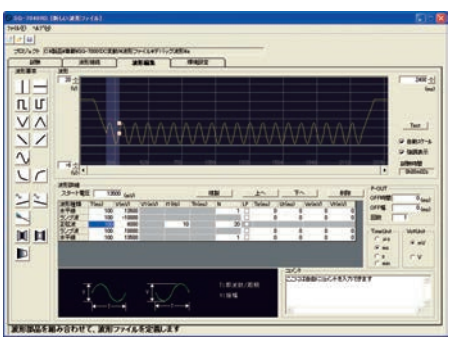
2. Arbitrary Waveform Creation Software

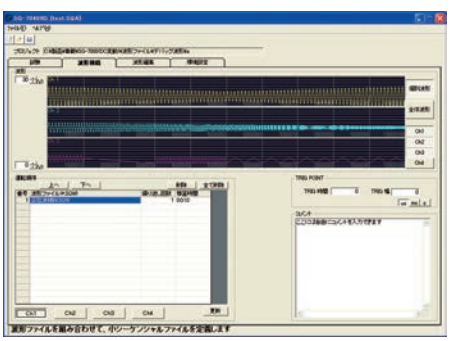
The arbitrary waveform creation software easily creates complicated waveforms with repeated voltage and time ramping with its superb GUI.

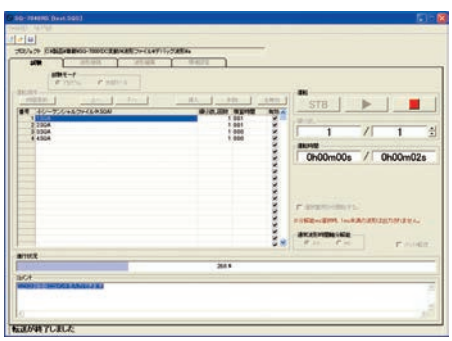
3. Bipolar Power Source

High-speed bipolar power source is selected according to the DUT power rating.

Software

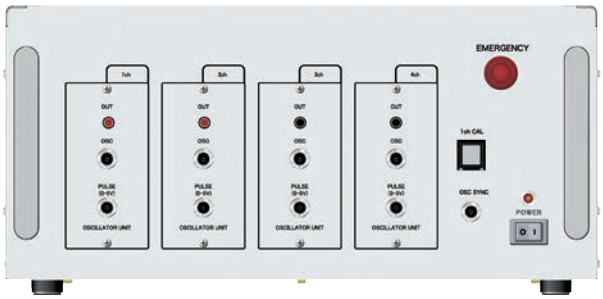






SG-7040A System

Multi-channel signal generator SG-7040A



Specifications

Parameter	Specifications / Functions
Channel Number	1 ch ～ 4 ch
Oscilloscope Trigger Output	BNC Connector 0 ～ 5 V Set the desired point as the trigger point with the waveform creation software and monitor waveform generation with the external trigger function of the oscilloscope.
Waveform Generator Method	Sampling waveform output based on partial waveform memory and DSP circuit output CSV data
Output Voltage	0.00 ～ ± 6.00 V
Output Current	5 mA Max.
Output Impedance	50 Ω
Setting Resolution	0.01 V
Output Resolution	1.221 mV
Offset Voltage	± 6.0 V
Frequency Response	150 kHz Max. (± 6.00 V Amplitude Sine Wave)
Characteristics	150 kHz Max. (± 6.00 V Square Sine Wave)
Frequency Precision	± 20ns + 50 ppm (over the entire frequency rang)
Waveform Rise / Fall Time	Less than 100ns (0±1.00V Swing)
Slew Rate	20 V /μs
Synchronization accuracy	Adjustable at a step of 1.0uS up to 10uS, to compensate differences in response time of the amplifiers connected. Synchronization with <1.0uS accuracy at the outputs of the bipolar power amplifiers connected.
Calibration Output	1 kHz 1V (Test Use)
PC Interface	USB 1.1
Operating Temperature	25℃ ±10℃
Operating Humidity	20 ～ 90% RH
Drive Power Source	Local AC supply voltage ±10% 50 / 60Hz 15 VA
External Dimensions	approx. (W)430 × (D)400 × (H)200 mm
Weight	approx. 10 kg

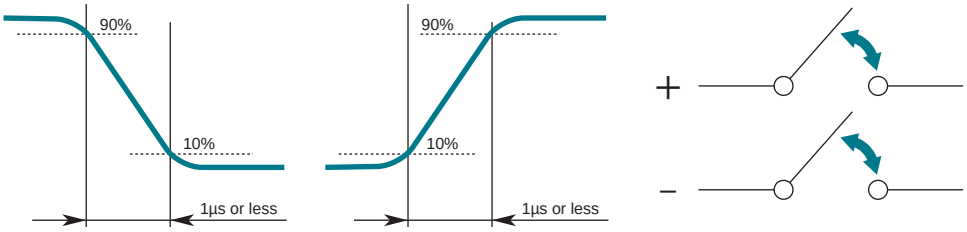
Accessory

Item	Q'ty
Coaxial cable (BNC-BNC/2m)	For number of channel
Output cable (1m)	For number of channel
Crimping terminal (M4)	For number of channel × 2 pcs.
Crimping terminal (M6)	For number of channel × 2 pcs.
Crimping terminal (M8)	For number of channel × 2 pcs.
Fuse (3.15A)	1 pc.
Application software	1 pc.
AC cable	1 pc.
USB cable	1 pc.
Instruction manuals (for main unit and software operation)	Each 1 volume
Bag for accessories	1 pc.

DC Cut Module **MODEL : SG-7044**

- **Disconnects DC supply circuits**
- **Open and Sink Modes**
- **Rise and fall time < 1μs**
- **Caontrollable from SG-7040A**
- **Sink currents up to -30 V**
- **DC 50 A**

Optional equipment for the SG-7040A Series to carry out supply interruption test with <1uS rise/fall time requirement.



Specification

Parameter	Specification
Output voltage	0 ～ DC 60 V
Steady-state current	Max. 50 A
Short mode	Open / Short (Current intake)
Cut off mode	Only + / Only - / Both polarities
Cut time	Open : Input terminal or trigger switch
	Short : Set at short duration or set at 2 - 9999μs
Rise / Fall time	≦ 1μs (10 % - 90 % short mode output open at DC 12V)
Dimensions / Weight	(W)430 × (D)400 × (H)200 mm / approx. 10 kg

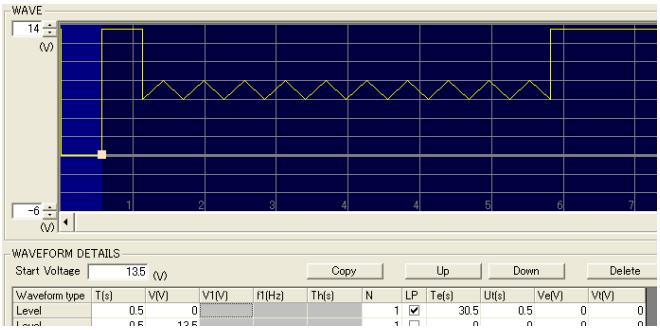
Accessory

Item	Q'ty
Coaxial cable (BNC-BNC / 2 m)	1 pc.
Output cable (1m)	1 pc.
Crimping terminal (M4)	4 pcs.
Crimping terminal (M8)	4 pcs.
Fuse (2 A)	2 pcs.
AC cable	1 pc.
Instruction manuals	1 volume
Bag for accessories	1 pc.

* In case the units are cabined in the rack, AC cable shall be connected inside of the rack.

SG-7040A System

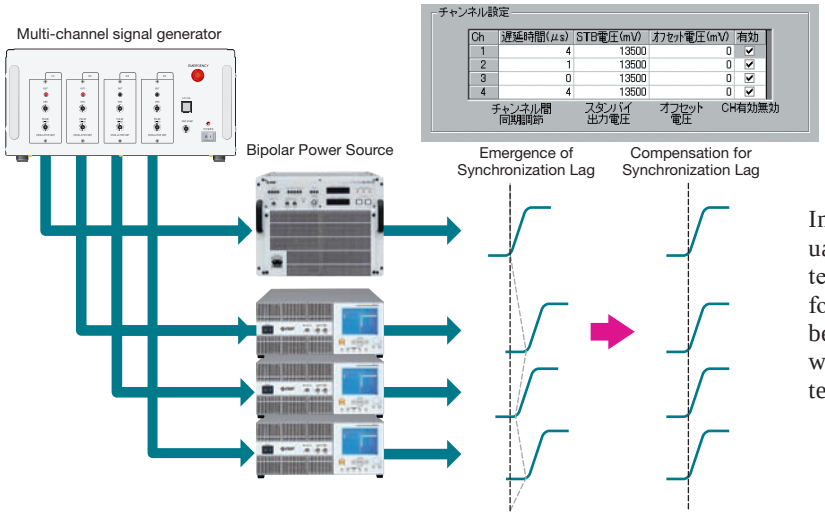
Sweep Setting Function



Easily and reliably creates a loop waveform using the sweep function detailed at left for a long test duration requiring varying T (times) and V (voltages).

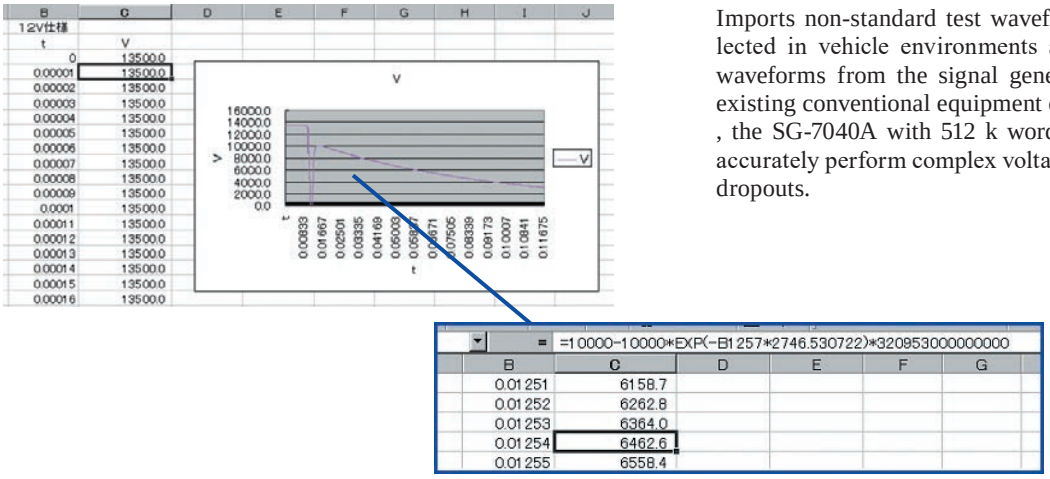
T(ε) = Start
Te(ε) = Stop
Ut(ε) = Step
N = Loop Number
LP = Loop Setting

Delay Set Function



In multichannel tests it is important to ensure each individual channel is precisely synchronized. This system guarantees a synchronization delay of 1μs or less by compensating for output timing differences from the power amplifiers being connected, whereas other systems are not equipped with similar capability, which often leads to a erroneous test.

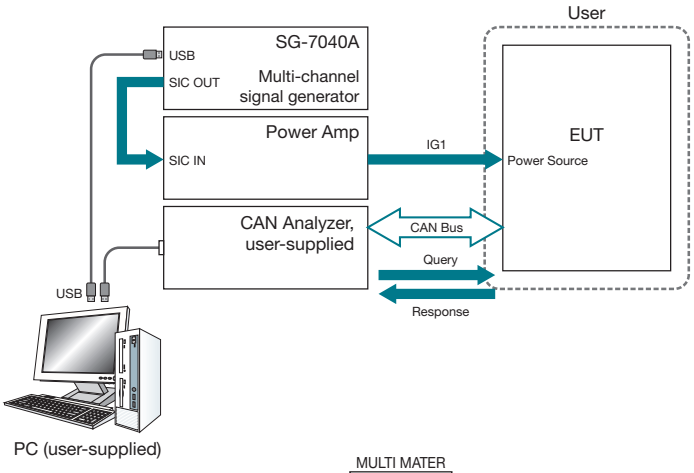
CSV Waveform EXCEL Operation Example



Imports non-standard test waveforms such as waveforms data collected in vehicle environments as CSV files, and generates these waveforms from the signal generator. Not available thus far with existing conventional equipment due to the limited memory capacity , the SG-7040A with 512 k words memory is a perfect solution to accurately perform complex voltage variations, fluctuations, dips and dropouts.

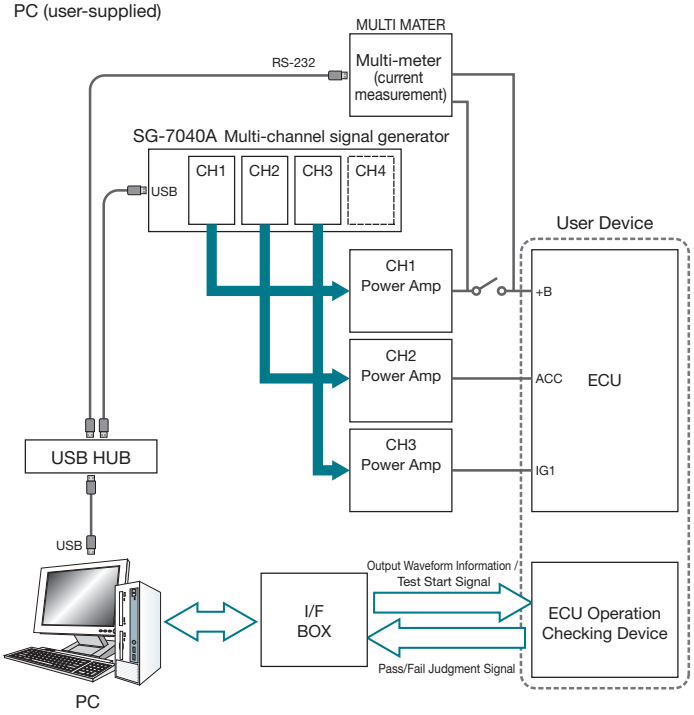
SG-7040A System

Automated Simulations



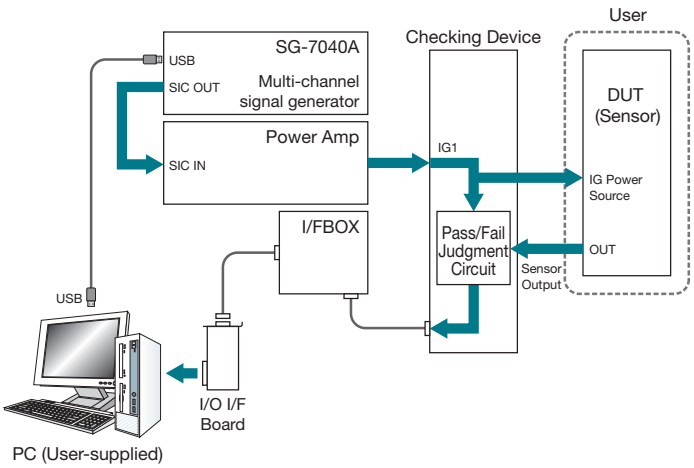
Example 1: CAN Communication Control

CAN is one of the most widely adopted system bus in automotive technology. Automated testing can be done by reading CAN communication protocols into the software and defining malfunction of the DUT.



Example 2: “Dark Current” Measurement

Some automobile manufacturers implement “Dark Current” measurements. This system allows dark current measurements in conjunction with voltage fluctuation simulations.



Example 3: Check Device

Automated testing by incorporating Pass/Fail judgment circuit with received signals from the DUT such as voltage, current, and frequency.

SG-7040A System

Regarding the Bipolar Power Source

Points to be considered for bipolar power source for automotive test applications

1. Amplifier gain linearity	A stable output voltage required over a wide range in response to the input signal
2. Capacitive loading capability with electrolytic capacitor resembling actual loads	Minimum distorted waveforms for various loads
3. Existence of oscillations with a capacitor connected	Large oscillation may damage the DUT
4. Low output impedance	Needs to resemble an extremely low impedance of actual automotive battery

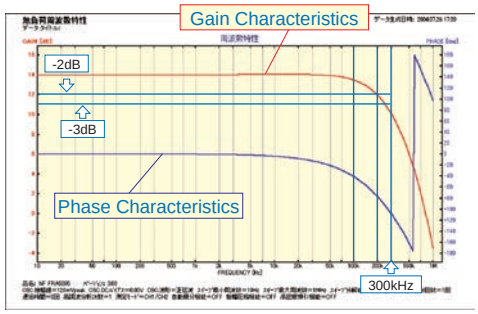
In order to meet the above requirements, NoiseKen recommends NF Corporation' s bipolar power sources

AS-161 Series line-up

Model	Output voltage	Output Current peak current	Output Current DC	Frequency Characteristics
As-161-30 / 60	-15 V ～ +60 V	±30 A	15 A	DC ～ 150 kHz
As-161-60 / 60		±60 A	30 A	
As-161-120 / 60		±120 A	60 A	DC ～ 100 kHz
As-161-60 / 30	-10 V ～ +30 V	±60 A	30 A	DC ～ 150 kHz
As-161-120 / 30		±120 A	60 A	
As-161-240 /30		±240 A	120 A	DC ～ 100 kHz

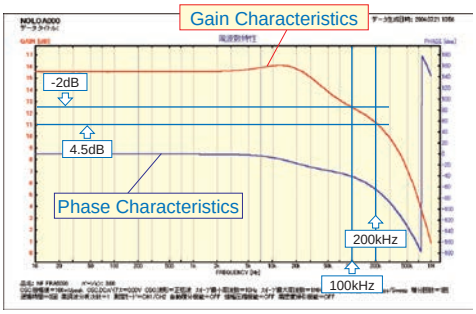
Competitive Comparison 1: Broadband Gain Characteristics

NF Corporation Model: As-161 Broadband Gain Characteristics (under no load conditions)



Gain characteristics stable to 100 kHz
A slight deviation of 1 - 2dB up to 200kHz only

Company A: Broadband Band Gain Characteristics (under no load conditions)



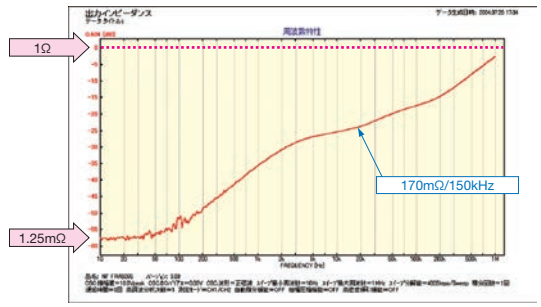
There is variation in 10kHz - 20k Hz range
Gain variation of 2.5 dB is evident up to 100 kHz and variation of 3.5 dB up to 200 kHz.

Obtaining gain linearity within the guaranteed frequencies prevents possible malfunctions other than from the intended simulations

Competitive Comparison 2: Impedance Characteristics

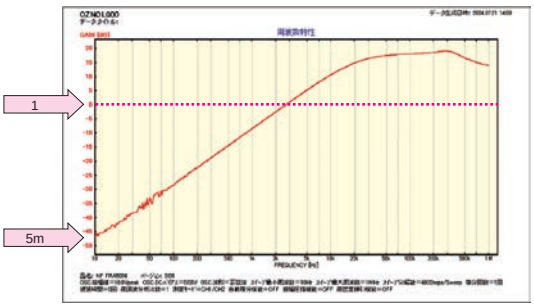
NF Corporation Model: As-161 Impedance Characteristics

Under 1 Ω value over a range beyond the 150 kHz specifications



Company A: Impedance Characteristics

Characteristics of 1 Ω or less are only achievable at 3 kHz or less.



A bipolar power amplifier with value close to the battery's impedance characteristics (≒0 Ω) performs testing to best resemble vehicles.

NoiseKen
NOISE LABORATORY

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