

Make EMC Test Easier!

**NoiseKen**  
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**Lightning Surge Test**  
High visibility, simple operation

***Safer  
than  
Ever!***



LSS-FE01 Series  
**Lightning Surge Simulator**

# High visibility, simple operation Safer than ever

## Lightning Surge Simulator **LSS-FE01 Series**

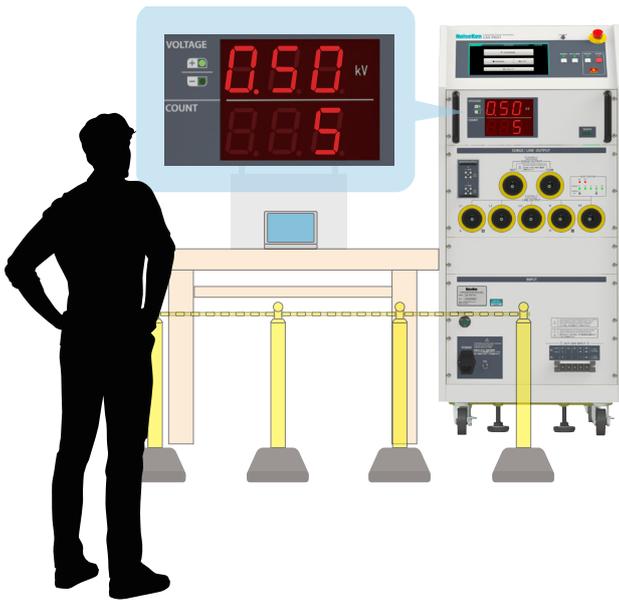
LSS-FE01 Series evaluate the immunity of electronic equipment by simulating "high energy induced lightning noise" induced in power distribution lines and communication lines due to fluctuations in the earth's potential caused by lightning strikes.

This is an entry model of the LSS-F03 series (15kV model). (Maximum output voltage 6.6kV)

### Highly Visible !

#### See It Fast. See It Clearly.

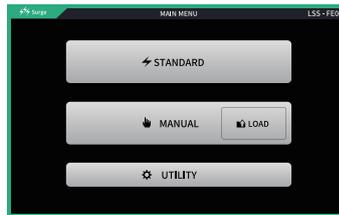
The front panel features a highly visible display that allows users to instantly check the testing status even from a distance, delivering a design that prioritizes true user convenience. Even during high-risk tests, the system allows operators to safely monitor test conditions from a distance.



### Easy to operate !

#### Large touch panel for easy operation

Large-screen operation panel with 10.1" LCD module. Featuring our largest control panel to date, this model delivers exceptional visibility and an intuitive user experience. The UI has been specially optimized for this product, ensuring precise operation and significantly improving the efficiency of test setup. The operating height is ergonomically designed for comfortable use for both standing and seated positions.

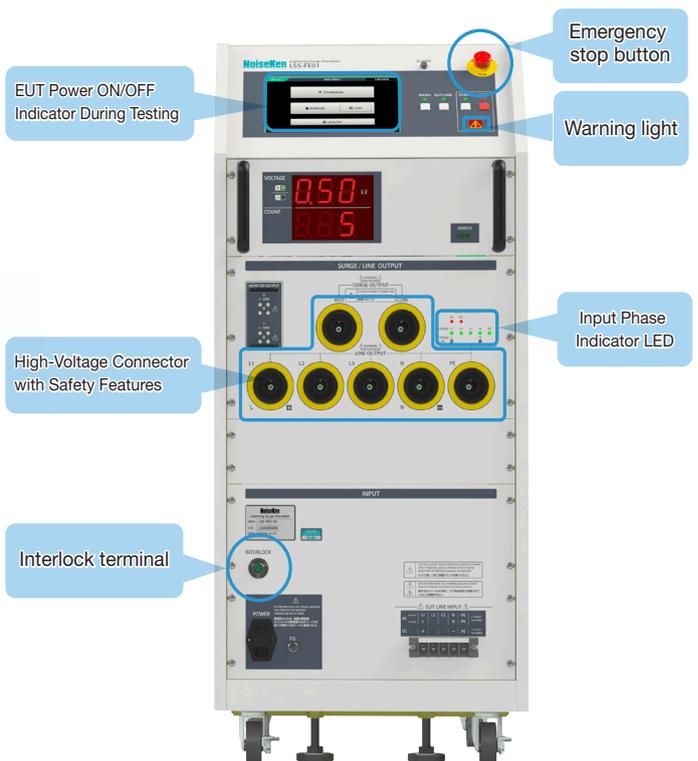


### Even safer !

#### Outstanding stability and reliability

Although it is an entry-level model, it inherits the superior safety features of our long-established LSS-F03 Series (15 kV type). This product is designed with safety as the top priority for high-output testing. It is equipped with safety-enhanced high-voltage connectors, interlock terminals, and a connection-leak detection function, greatly reducing the risk to operators from high-output discharges during lightning surge testing.

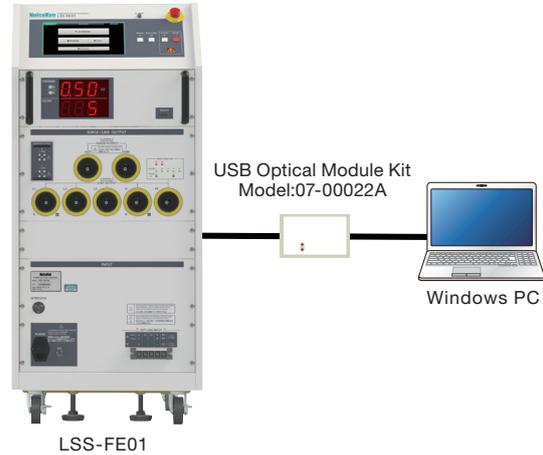
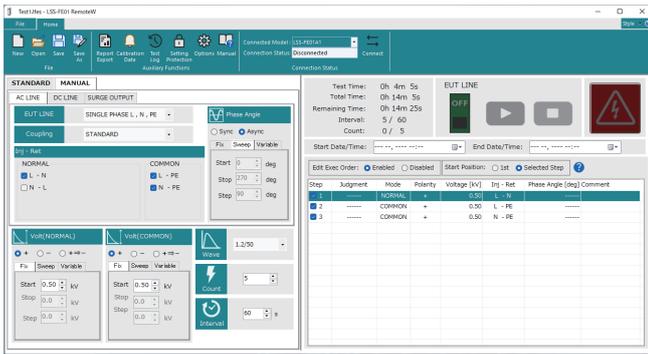
It ensures high reliability and confidence during on-site use.



# Easy test setup and operation

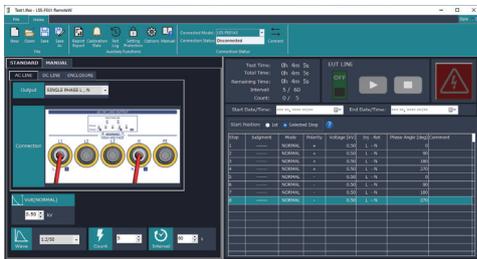
## PC Software control

The system can be used to set test conditions, save test results, record test history, and generate reports. This is an optional accessory - LSS-FE01 PC Software "RemoteW" MODEL:14-00075A.



Automatically organizes complex test conditions, pass/fail judgement, product specifications, and easily outputs them as test report in a standard format.

This eliminates rules and checks for each person in charge, and greatly reduces the time required to generate reports. It frees you from the cumbersome data management of various individually created formats, and dramatically improves operational efficiency and data reliability.



Test environment

Temperature : 25°C  
Humidity : 40%

Test Result

Step	Result	Mode	Polarity	Volt[kV]	INJ - RET	Angle[deg.]	Comm
Step 1	PASS	NORMAL	+	0.50	L - N	0	
Step 2	PASS	NORMAL	+	0.50	L - N	90	
Step 3	PASS	NORMAL	+	0.50	L - N	180	
Step 4	PASS	NORMAL	+	0.50	L - N	270	
Step 5	PASS	NORMAL	-	0.50	L - N	0	
Step 6	FAIL	NORMAL	-	0.50	L - N	90	
Step 7	PASS	NORMAL	-	0.50	L - N	180	

Test reports can be generated in Excel or PDF formats.

### LSS-FE01 PC Software "RemoteW" MODEL:14-00075A



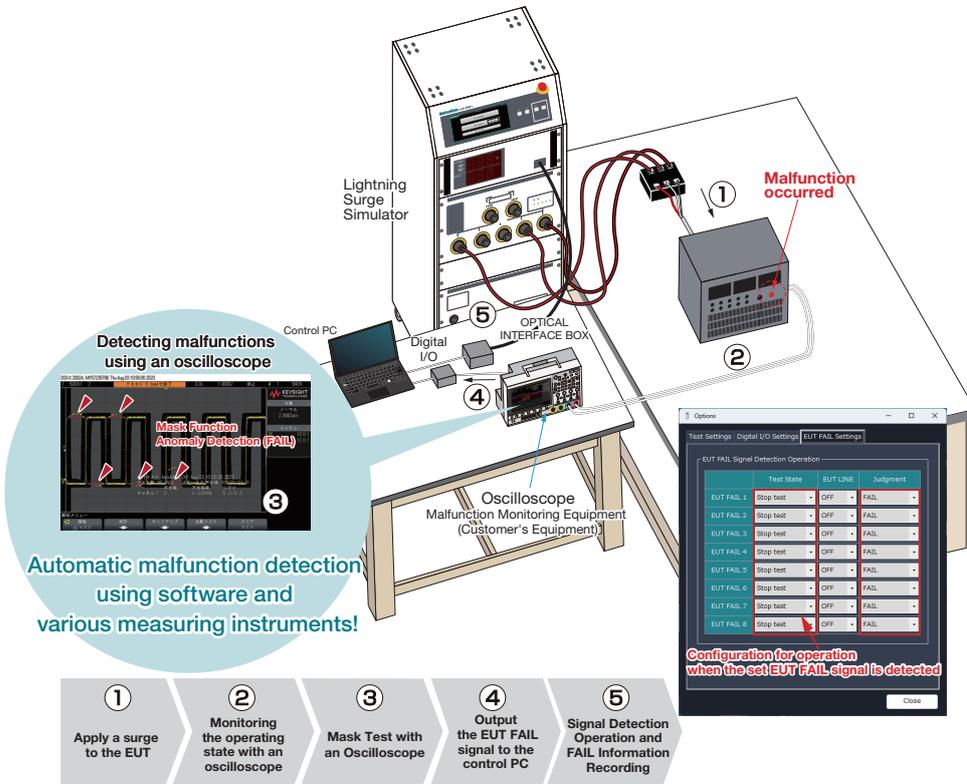
Dedicated software for PC remote control of the LSS-FE01 equipment. Total control of test conditions settings, program control, malfunction judgment and report generation is possible.

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



Connection adapter used for remotely controlling the simulator from a PC. Equipped with USB-Optical conversion fiber optic cable (5m).

# Automated malfunction judgment. Easy testing



## Malfunction judgment Through PC software

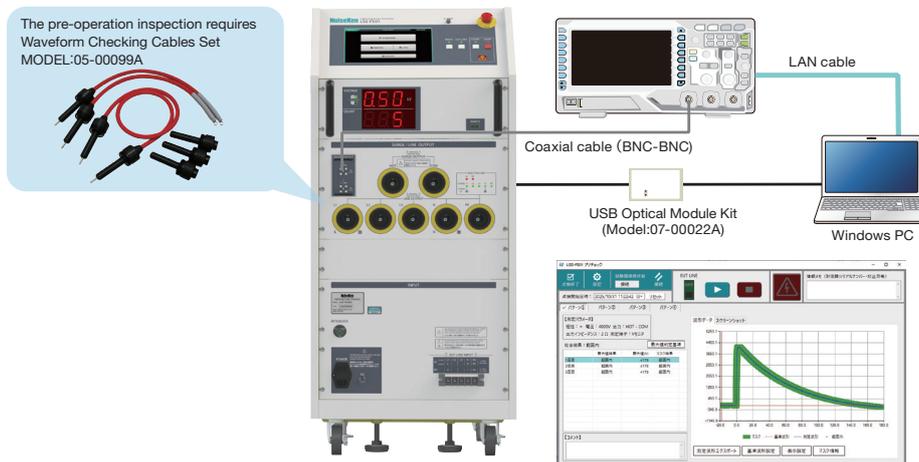
In the past, operators had to visually check for malfunctions, but now it is possible to automatically record them in the software via FAIL signals in conjunction with oscilloscopes and image judging devices. This enables accurate recording of judgment results in each test condition, which not only reduces the burden on the operator, but also greatly improves the reliability and efficiency of the test.

Up to 8 EUT FAIL signals can be detected by using an optional digital I/O from National Instruments.

# Easy pre-start inspection

## Reliable Pre-check Software Kit

In waveform observation for IEC 61000-4-5 Standard, dedicated probes are required for each current surge and voltage surge. Because each observation involved complicated wiring and adjustments, measurements required a great deal of time and effort. The Pre-Check Kit greatly reduces these complicated tasks. Enables easier daily inspections and supports smooth test operations. \*This is an optional accessory (LSS-FE01 Pre-check Kit MODEL: 14-00076A).



\*A separately sold oscilloscope (RIGOL MODEL:DS1202Z-E) is required.

## Lightning Surge Simulator

# LSS-FE01 Series



- Test equipment compliant with IEC 61000-4-5 Ed.3, IEC 61000-4-12 RingWave standards.
- Maximum output voltage 6kV
- Large-screen operation panel with 10.1" LCD module for improved visibility and operability.
- Designed for smooth operation whether sitting or standing.
- Equipped with a display panel that allows the user to instantly grasp the test status (voltage and number of times applied) even from a distance.
- Uses a reliable output connector inherited from the LSS-F series.
- Connection cable settings are indicated by LED lamps.
- Can be combined with high-capacity external CDN (custom).
- PC software support allows for operation from a PC.
- Daily inspections can be easily performed using the pre-check software (optional).

## LSS-FE01 Series Specifications

### ■ Surge generator

Parameter	Functions & Performance		Remarks
1.2/50μs-8/20μs Combination waveform	Open circuit voltage	0.5kV ~ 6.6kV ±10%	Cable length: 0.5 m (one side) Voltage step: 0.00kV-2.00kV: 0.01kV step 2.1kV-6.6kV: 0.1kV step Settings can be made from 0kV
	Front time	1.2μs±30%	
	Duration	50μs±20%	
	Short-circuit current	250A ~ 3300A ±10%	
	Front time	8μs ±20%	
	Duration	20μs ±20%	
0.5μs-100kHz Ring waveform	Open circuit voltage	0.25kV ~ 6.6kV ±10%	Cable length: 0.5 m (one side) Voltage step: 0.00kV-2.00kV: 0.01kV step 2.1kV-6.6kV: 0.1kV step Settings can be made from 0kV
	Front time	0.5μs±30%	
	Frequency	100kHz±10%	
	Attenuation value	2ndpeak : 40%<1st<110% 3rdpeak : 40%<2nd<80% 4thpeak : 40% <3rd<80%	
	Short-circuit current	(Set voltage/12Ω) ±10 (Set voltage/30Ω) ±10	
	Front time	0.2μs ~ 1μs	
Output polarity	Positive/Negative		
Surge generation circuit type	Floating		
Minimum charge time	0.0kV-4.0kV: 5 sec. 4.1kV-6.6kV: 10 sec.		1.2μs/50μs-8/20μs Combination waveform
	0.0kV-6.6kV: 5 sec.		Ring waveform (LSS-FE01B1 model only)

## LSS-FE01 Series Specification

### ■ AC/DC CDN

Parameter	Functions & Performance		Remarks
Superimposed surge waveform	1.2/50μs-8/20μs combination waveform Ring waveform		Ring waveform (LSS-FE01B1 model only)
1.2/50μs-8/20μs Combination waveform	Open circuit voltage	0.5kV~6.6kV ±10%	Coupling circuit: 18μF Decoupling coil: 1.5mH Cable length: 0.5m on each side Setting is possible from 0kV Line input side open
	Front time	1.2μs±30%	
	Duration	50μs+10μs /-10μs	
	Short-circuit current	250A~3300A ±10%	
	Front time	8μs±20%	
	Duration	20μs±20%	
	Open circuit voltage	0.5kV~6.6kV ±10%	Coupling circuit: 10Ω + 9μF Decoupling coil: 1.5mH Cable length: 0.5m on each side Setting is possible from 0kV Line input side open
	Front time	1.2μs±30%	
	Duration	50μs+10μs /-25μs	
	Short-circuit current	41.7A~550A ±10%	
	Front time	2.5μs±30%	
	Duration	25μs±30%	
Injection mode	Line-to-Line		Coupling circuit: 18 μF (10 Ω + 9 μF selectable)
	Between Line and PE		Coupling circuit: 10Ω + 9μF (18μF selectable)
0.5μs-100kHz Ring waveform	Open circuit voltage	0.25kV~6.6kV ±10%	Coupling circuit: 4.5 μF Decoupling coil: 1.5mH Cable length: 0.5m on each side Setting is possible from 0kV Line input side open (excluding simultaneous injection settings)
	Front time	0.5μs±30%	
	Frequency	100kHz±10%	
	Attenuation value	2ndpeak : 40% < 1st < 110%	
		3rdpeak : 40% < 2nd < 80%	
		4thpeak : 40% < 3rd < 80%	
	Short-circuit current	(Set voltage / 12Ω) ±10	
	Front time	0.2μs~1μs	
Injection mode	Line-to-Line Between Line and PE		Coupling circuit: 4.5 μF (10Ω used in CW cannot be inserted)
	Simultaneous injection		Coupling circuit: 4.5 μF for each line
EUT power supply Line configuration	Single phase AC : L/N/PE DC : +/-/PE		Single-phase (A1/B1) type
	Three-phase AC : L1/L2/L3/N/PE (for both single and three phases) DC : +/-/PE		Three-phase (A3) type
EUT power supply Line power capacity	AC240V/20A MAX 50/60Hz DC125V/20A MAX		Single-phase (A1/B1) type
	AC500V/50A MAX 50/60Hz DC125V/50A MAX		Three-phase (A3) type
Decoupling coil	1.5mH		
Voltage drop	Less than 10% of rated voltage when rated current is applied		At the output terminal of the AC superimposed part*1
Residual voltage	15% or less of injected surge voltage or power supply Less than twice the rated voltage (peak value) of the line		
Phase angle control	0°~ 360°±10°		EUT power supply 90V AC or more Operate at 50Hz / 60Hz ±10

\*1: Check with input voltage AC200V, resistive load 10Ω, and resistive load 4Ω.

## LSS-FE01 Series Specification

### ■ Control Specifications

Parameter	Functions & Performance	Remarks
Discharge interval	5 sec - 999 sec (depending on the set voltage)	1.2/50 $\mu$ s waveform
	5 sec - 999 sec (depending on the set voltage)	Ring waveform (LSS-FE01B1 model only)
Discharge count	1 to 999 times / 1 time step	
Trigger Input	Asynchronous	Depending on the repetition time
	AC line sync 0° - 360° / 1° step	When AC superimposed
Save Settings	Test settings can be named (title name) and saved in internal memory	
STANDARD mode	Preset settings regulated by the IEC61000-4-5 standard	Normal mode - common mode automatic transfer
Communication Function	RS-232 compliant optical communication	

### ■ Other specifications

General Specifications		
Power supply	AC100V~AC240V $\pm$ 10% 50Hz / 60Hz	
Operating environment	Temperature: 15~35°C Relative humidity: 25~75%	
Dimensions	W500 x H1140 x D600 mm	(excluding protrusions)
Weight	135kg (A1), 155kg (A3), 135kg (B1)	
Safety Specifications		
Emergency Stop	Push-lock push button switch Test stop, High voltage OFF, EUT Line OFF	EUT Line OFF is selectable
Interlock function	Surge output connector status detection, connector status detection for externally connected devices	
Warning lamp display	LED blinks red when the test starts.	
Warning lamp connector	Equipped with a connector to connect a warning lamp. Warning lamp lights on at test start.	
Output monitor function		
Voltage Monitor	BNC output, 2000V/V Output accuracy: $\pm$ 10% of the actual output ratio ( $\pm$ 15% of the ratio of actual output in ring waveform)	Surge out settings *2 When output is open No waveform guarantee
Current Monitor	BNC output, 1000A/V Output accuracy: $\pm$ 10% of the actual output ratio ( $\pm$ 15% of the ratio of actual output in ring waveform)	Surge out settings *2 When output is open No waveform guarantee

\*2: Only the peak values of open/shorted outputs are guaranteed. Performance is not guaranteed with the EUT connected.

### ■ Models

Model	Output waveform	CDN
LSS-FE01A1	1.2/50 $\mu$ s-8/20 $\mu$ s Combination waveform	AC Single phase / DC
LSS-FE01A3		AC single-phase and three-phase/DC
LSS-FE01B1	1.2/50 $\mu$ s-8/20 $\mu$ s Combination waveform 0.5 $\mu$ s - 100kHz Ring waveform	AC Single phase / DC

### ■ Standard accessories

Name	Q-ty	Remarks
AC cable	1 pc.	
Surge output cable	2 pcs.	crocodile clip
Line output cable	3 pcs.	Single phase (A1/B1) type
	5 pcs.	Three-phase (A3) type
FG cable (2m) MODEL: 05-00070A	1 pc.	M6 Round - M6 Round
Coaxial monitor cable (1m) MODEL: 02-00128A	1 pc.	BNC-BNC
Interlock connector	1 pc.	
Hi-voltage connector cap (MODEL: 05-00060A)	5 pcs.	Single phase (A1/B1) type
	7 pcs.	Three-phase (A3) type
Accessories bag	1 pc.	
User's Manual	1 copy	

# LSS-FE01 Series Optional accessories

CDN unit	Main supported communication methods
High-speed Telecom CDN F-130814-1002 · 1004	RS-485, PoE Gigabit Ethernet (1000Base-T), etc.
Interconnection lines CDN LSS-INJ6401SIG	RS-232C, etc.
Telecom CDN	Analog telephone lines

Options

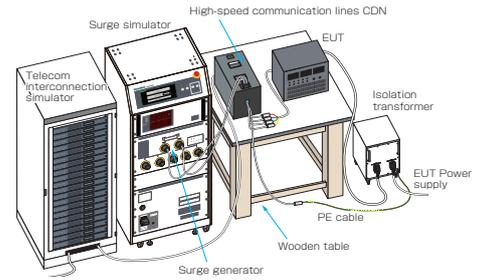
## Communication lines testing optional items

### High-speed communication lines CDN MODEL : F-130814-1002 / F-130814-1004

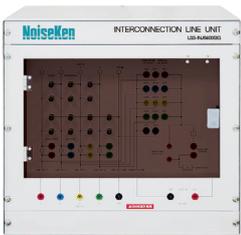


This CDN product is used to apply surges to unshielded symmetrical high-speed communication lines with speed up to 1000Mbit/s, as defined in the IEC 61000-4-5 Standard. Conversion cables (05-00147A) are required for the CDN connection to the LSS-FE01 simulator.

Parameter	F-130814-1004-2	F-130814-1004-4
Maximum input voltage	2kV	4kV
EUT power capacity	DC65V 1A	
Maximum line Number	8 lines	
EUT/AE connector	RJ-45	
Dimensions	(W)400 × (H)230 × (D)240mm	



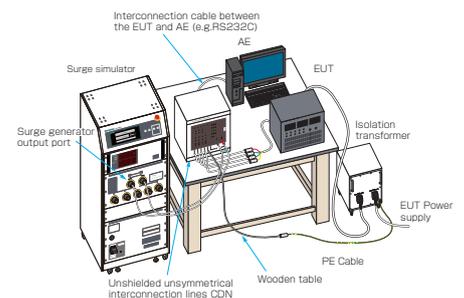
### CDN for Interconnection Lines MODEL : LSS-INJ6401SIG



This CDN product is used to apply surges to interconnection lines as defined in the IEC61000-4-5 Standard. With The EUT power capacity of DC50V / 1A it is possible to inject surges to interconnection lines up to 6,600V. 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 arresstor between each line and ground.

Conversion cables (05-T1578) are required for the CDN connection to the LSS-FE01 simulator.

Parameter	Specifications
Surge input voltage	500V-6,600V (1.2/50µs-8/20µs Combination wave)
EUT power capacity	DC50V / 1A
Max. line number	4 lines
Decoupling coil	20mH each line
Matching resistor	40Ω±10%
Dimensions / Weight	(W) 488 x (H) 456 x (D) 550mm Approx. 45kgs



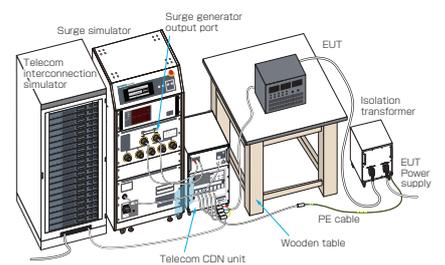
### Telecom CDN unit (under development)



Perform surge testing applicable to unshielded symmetrical interconnection lines/communication lines as specified in the IEC61000-4-5 standard.

\*A separate conversion cable is required to connect this device to the LSS-FE01.

Parameter	Specifications	
Max superimposed surge voltage/current	6kV/300A max	
Matching resistor	40Ω±10% (1.2/50µs waveform)	80Ω per line: at 2 lines 160Ω per line: at 4 lines
	1 line 25Ω (10/700µs waveform)	
Line for EUT	2 lines/4 lines DC50V/100mA MAX	
Number of lines	2 lines/4 lines	
Decoupling Coil	20mH	



Images and specifications are for reference only.

### Arresstor unit MODEL : 08-00012A

Arresstor unit for surge decoupling.



### Coupling arresstor unit MODEL : 08-00016A

Arresstor unit for surge coupling.



# Power lines testing optional accessories

## Isolation Transformer MODEL : TF-2302P,TF-6503P



Model TF-2302P is a single-phase isolation transformer rated AC240V/30A with dielectric strength of 4kV. Model TF-6503P is three-phase isolation transformers rated AC 600 V / 50 A and dielectric strength of 4 kV. For safety reasons, an isolation transformer is indispensable for AC powered testing for equipment.

MODEL	TF-2302P	TF-6503P
Maximum input voltage	Single phase AC240V Max (50/60Hz)	Single / Three phase AC 600 V Max (50/60 Hz)
Transformer wiring method	—	Star wiring
Maximum output current	30A Max	50 A Max
Dielectric strength	Primary winding to core AC4kV (1 minute) Secondary winding to core AC4kV (1 minute) Primary to secondary windings AC4kV (1 minute)	
Insulation resistance	100MΩ or more at DC500V	
Dimensions / Weight	(W)350×(H)475×(D)400mm (Except for eye bolt and handle) / approx. 60kg	(W)500×(H)640×(D)700mm (Eye bolts and handles excluded) / approx. 350kg
Accessories	<ul style="list-style-type: none"> <li>• AC single-phase input cable (5.5sq-3C 3m:Bar/None): 1pc.</li> <li>• PE/FG cable (3.5sq 3m:R-terminals:φ6/φ6): 1pc.</li> <li>• Instruction Manual: 1pc.</li> <li>• AC single-phase output cable Model:05-00134A (3.5sq-3C 2m:Bar to R-terminal:φ5): 1pc.</li> </ul>	<ul style="list-style-type: none"> <li>• AC 3-phase input cable (14sq-4C 3m:Bar/None): 1pc.</li> <li>• PE cable (8sq 3m:R-terminal:φ6/None): 1pc.</li> <li>• PE/FG cable (8sq 3m:R-terminals:φ6/φ6): 1pc.</li> <li>• Instruction Manual: 1 pc.</li> <li>• AC 3-phase output cable Model:05-00134A (14sq-4C 2m:Bar to R-terminal:φ5): 1pc.</li> <li>• PE cable (8sq 2m:R-terminals:φ6/φ5):1 pc.</li> </ul>

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



A relay terminal board for connecting the output of the LSS-F03 series to the EUT. By wiring to the included multi-outlet, you can directly connect a power plug that supports the standards of each country.

single phase 2 lines with PE  
(outlet withstand voltage 4.5kV)

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



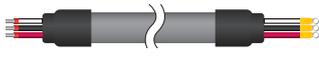
A relay terminal board for connecting the output of the LSS-F03 series to the EUT. By wiring to the included multi-outlet, you can directly connect a power plug that supports the standards of each country.

three phase 4 lines (outlet withstand voltage 4.5kV)  
\*The outlet is for single phase only.

### Terminal Block for 3P MODEL : 18-00047B

Terminal block board for CDN to connect EUT. 3 pins

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



Cable for connecting LSS-FE01 and isolation transformer(TF-2302P).\*1  
Bar terminal - Round terminal (Φ5)  
3-wire 2m

### Terminal Block for 5P MODEL : 18-00044A

Terminal block board for CDN to connect EUT. 5 pins

### AC line input cable (3-phase) MODEL : 05-00135A



Cable for connecting LSS-FE01 and isolation transformer (TF-6503P)  
Bar terminal - Round terminal (Φ5)  
3-wire 2m

### DC line input cable MODEL : 05-00136A



This cable connects the LSS-FE01 to a DC power supply and other devices.  
Terminal Unprocessed - Round Terminal (Φ5) 3-wire 2m

# Safety optional accessories

### EUT Protective Safety Box MODEL : 11-00006A



Protection box to prevent access to EUT during the test. Further safety can be achieved by combining with the protective safety is fence

(W) 600 × (D) 400 × (H) 350mm \*protrusions excluded

### Protective Safety Fence MODEL : 11-00010A

Allows construction of a safe test environment by connecting with the lightning surge simulator's interlock function. Combined use with the EUT protection box ensures a completely safe test environment.

### Tri-Color Polot Loght MODEL : 11-00015A



This indicator light is compatible with the LSS-FE01 series. During testing, the indicator light flashes to alert the user, and its three-color display changes according to the test status.

### Warning Lamp MODEL : 11-00017A



Alarm lamp for LSS series. Allows to alert and call for attention by blinking during the test.

## Calibration and inspection optional accessories

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

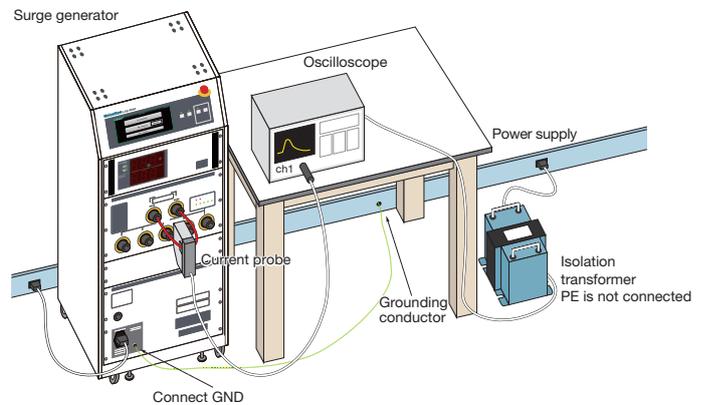
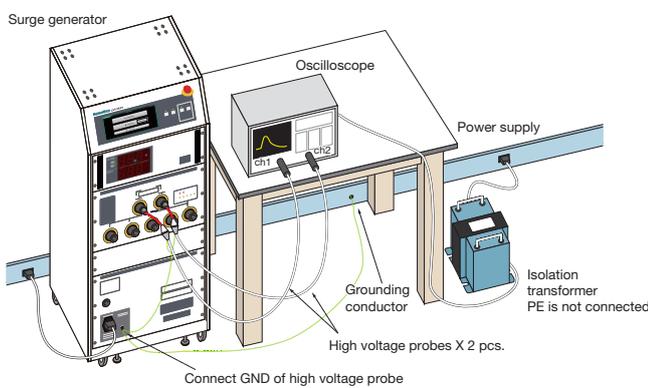


Jig for checking voltage waveforms and current waveforms of LSS-FE01 series.

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)



### Telecom waveform check cable set MODEL:05-00150A

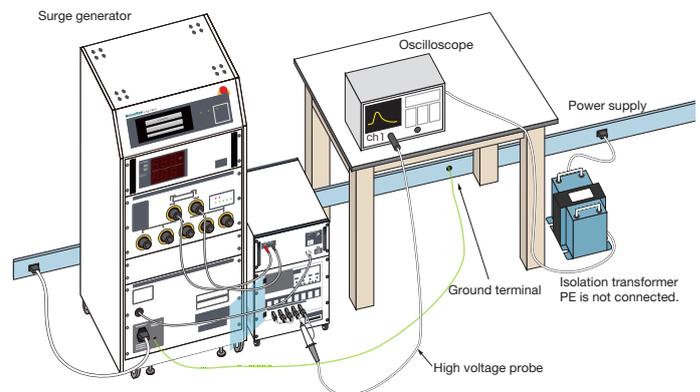
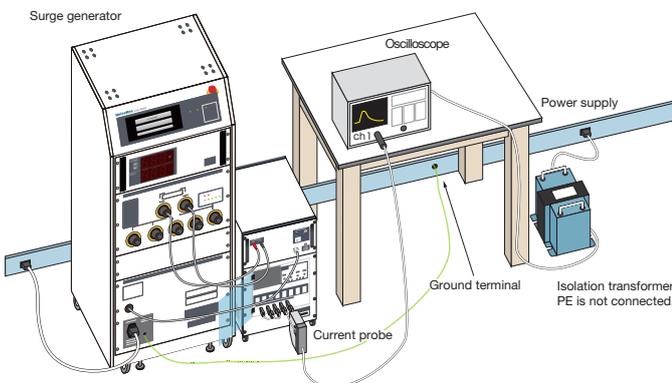


Jig used for measuring the output waveform from the CDN for telecom line.

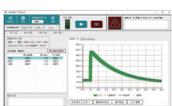
The following equipment is required additionally.

- Oscilloscope (with differential operation function)
- High voltage probe (when measuring surge voltage / withstand voltage required)
- Current probe (when measuring surge short-circuit current)
- Isolation transformer (for oscilloscope)

#### Measurement of surge waveform (example of measurement at telecom line CDN terminal with 05-00150A)



### LSS-FE01 Pre-check Kit MODEL:14-00076A



Pre-check kit (PC Software) for easy daily inspections of the LSS-FE01 Series. Software, USB license key and a LAN cable are included.

This is not the measurement of compliance to the IEC 61000-4-5 standard.

\*A separately sold oscilloscope (RIGOL MODEL:DS1202Z-E) is required.

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



Connection adapter used for remotely controlling the simulator from a PC.

Equipped with USB-Optical conversion fiber optic cable (5m).

# IEC 61000-4-5 Ed.3 Test Standard Overview

## 01 General

The task of the described laboratory test is to evaluate malfunctions of EUT under specified operational conditions to unipolar one-way surges caused by switching and lightning induction effects at certain threat levels. This standard specifies 2 kinds of the combination waveforms. One is simulating injection to power supply lines and interconnections lines (1.2/50µs voltage waveform and 8/20µs current waveform) and the other simulates injection to telecommunication equipment connect to outdoor telephone lines (10/700µs voltage waveform and 5/320µs current waveform). It is not intended to test the capability of EUT's insulation to withstand high-voltage stress or direct injections of lightning currents, i.e., direct lightning strikes.

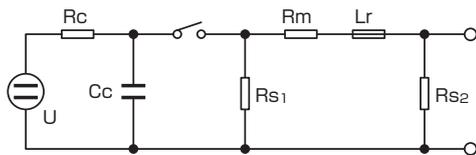
## 02 Test Levels

Level	Open-circuit test voltage kV	
	Normal mode	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.

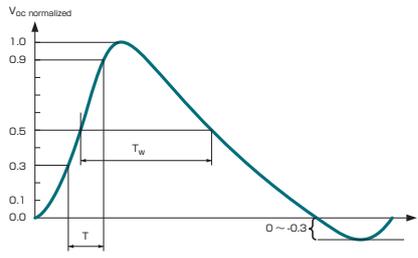
## 03 Waveforms Generator and Waveforms specifications

### Generation Circuit

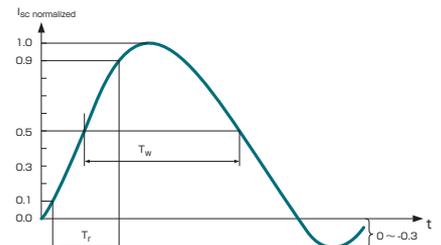


- U High-voltage source
- Rc Charging resistor
- Cc Energy storage capacitor
- Rs Pulse duration shaping resistors
- Rm Impedance matching resistor
- Lr Rise time shaping inductor

### 1.2/50µs Combination Waveform (1.2/50µs • 8/20µs)



Voltage Surge



Current Surge

### 1.2/50µs Combination Waveform specification

	Front time Tf µs	Duration Td µs
Open-circuit voltage	$T_f = 1.67 \times T = 1.2 \pm 30\%$	$T_d = T_w = 50 \pm 20\%$
Short-circuit current	$T_f = 1.25 \times T_r = 8 \pm 20\%$	$T_d = 1.18 \times T_w = 20 \pm 20\%$

## 04 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 voltage *	Coupling impedance	
	18 µF (line to line)	9 µF + 10 Ω (line to ground)
Peak voltage Current rating ≤ 16 A 16 A < current rating ≤ 32 A 32 A < current rating ≤ 63 A 63 A < current rating ≤ 125 A 125 A < current rating ≤ 200 A	Set voltage +10 %/-10 % Set voltage +10 %/-10 % Set voltage +10 %/-10 % Set voltage +10 %/-10 % Set voltage +10 %/-10 %	Set voltage +10 %/-10 % Set voltage +10 %/-10 % Set voltage +10 %/-15 % Set voltage +10 %/-20 % Set voltage +10 %/-25 %
Front time	1,2 µs ± 30 %	1,2 µs ± 30 %
Duration Current rating ≤ 16 A 16 A < current rating ≤ 32 A 32 A < current rating ≤ 63 A 63 A < current rating ≤ 125 A 125 A < current rating ≤ 200 A	50 µs + 10 µs/ -10 µs 50 µs + 10 µs/ -15 µs 50 µs + 10 µs/ -20 µs 50 µs + 10 µs/ -25 µs 50 µs + 10 µs/ -30 µs	50 µs + 10 µs/ -25 µs 50 µs + 10 µs/ -30 µs 50 µs + 10 µs/ -35 µs 50 µs + 10 µs/ -40 µs 50 µs + 10 µs/ -45 µs

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

## IEC 61000-4-5 Ed.3 Test Standard Overview

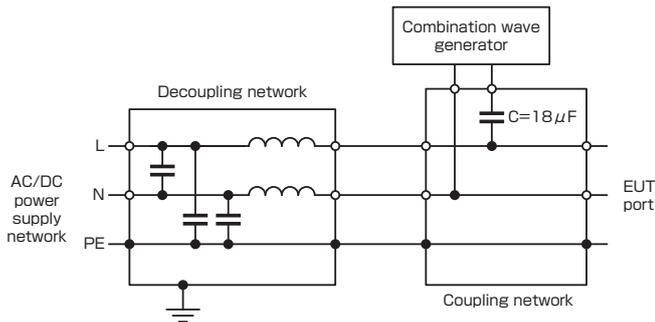
### Current waveform specification at the EUT port of the power line CDN (short-circuit current)

Surge current parameters under short-circuit conditions	Coupling impedance	
	18 $\mu\text{F}$ (line to line)	9 $\mu\text{F}$ + 10 $\Omega$ (line to ground)
Front time	$T_f = 1,25 \times T_r = 8\mu\text{s} \pm 20\%$	$T_f = 1,25 \times T_r = 2,5 \mu\text{s} \pm 30\%$
Duration	$T_d = 1,18 \times T_w = 20\mu\text{s} \pm 20\%$	$T_d = 1,04 \times T_w = 25 \mu\text{s} \pm 30\%$

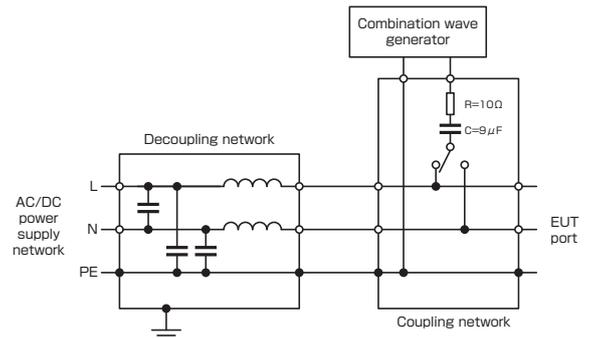
### Relationship between peak open-circuit voltage and peak short-circuit current at the EUT port of the power line CDN

Open-circuit peak voltage +/-10% at EUT port of the CDN	Short-circuit peak current +/-10% at EUT port of the CDN (18 $\mu\text{F}$ )	Short-circuit peak current +/-10% at EUT port of the CDN (9 $\mu\text{F}$ + 10 $\Omega$ )
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

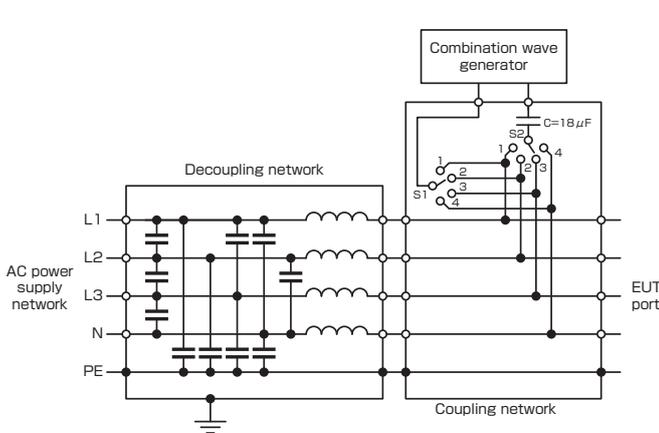
### Single phase power line CDN (line-to-line mode)



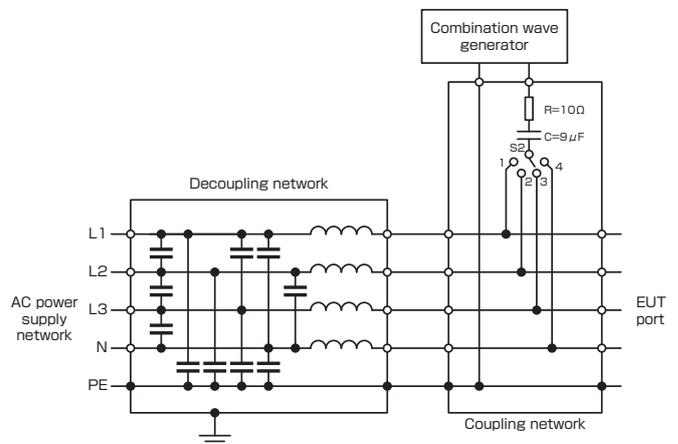
### Single phase power line CDN (line-to-ground mode)



### Three-phase power line CDN (line-to-line mode)

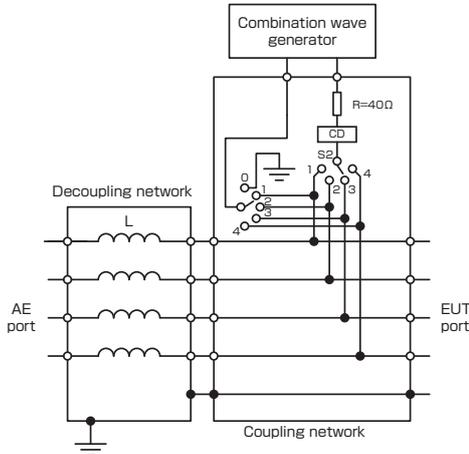


### Three-phase power line CDN (line-to-ground mode)

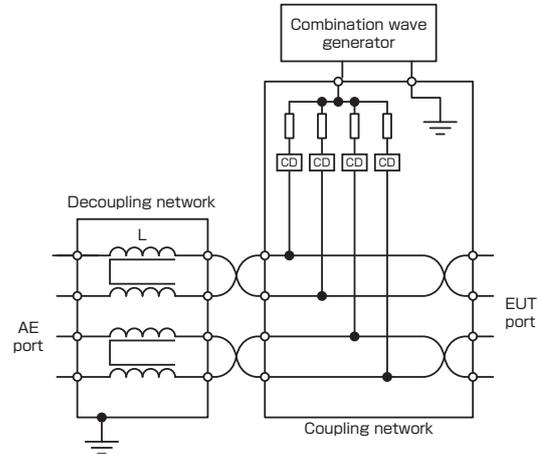


## IEC 61000-4-5 Ed.3 Test Standard Overview

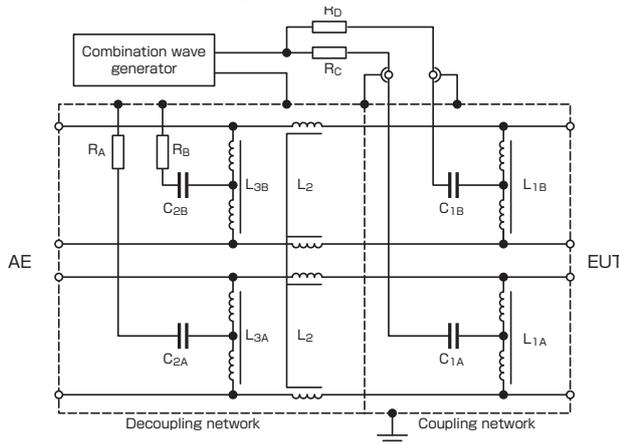
### CDN for unshielded unsymmetrical interconnection lines



### 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	Open-circuit Voltage at the EUT port of the CDN $V_{oc} \pm 10\%$	Voltage front time $T_f = 1,67 \times T_r \pm 30\%$	Voltage duration $T_d = T_w \pm 30\%$	Short-circuit current at the EUT port of the CDN $I_{sc} \pm 20\%$	Current front time $T_f = 1,25 \times T_r \pm 30\%$	Current Duration $T_d = 1,18 \times T_w \pm 30\%$
Line to PE $R = 40\Omega, CD = 0,5 \mu F$	4 kV	4 kV	1,2 $\mu s$	38 $\mu s$	87 A	1,3 $\mu s$	13 $\mu s$
Line to PE $R = 40\Omega, CD = GDT$	4 kV	4 kV	1,2 $\mu s$	42 $\mu s$	95 A	1,5 $\mu s$	48 $\mu s$
Line-to-line $R = 40\Omega, CD = 0,5 \mu F$	4 kV	4 kV	1,2 $\mu s$	42 $\mu s$	87 A	1,3 $\mu s$	13 $\mu s$
Line-to-line $R = 40\Omega, CD = GDT$	4 kV	4 kV	1,2 $\mu s$	47 $\mu s$	95 A	1,5 $\mu s$	48 $\mu s$

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

Coupling method	Output voltage	Open-circuit Voltage at the EUT port of the CDN $V_{oc} \pm 10\%$	Voltage front time $T_f = 1,67 \times T_r \pm 30\%$	Voltage duration $T_d = T_w \pm 30\%$	Short-circuit current at the EUT port of the CDN $I_{sc} \pm 20\%$	Current front time $T_f = 1,25 \times T_r \pm 30\%$	Current Duration $T_d = 1,18 \times T_w \pm 30\%$
Line to PE $R = 40\Omega$ Coupling devices*	2 kV	2 kV	1,2 $\mu s$	45 $\mu s$	48 A	1,5 $\mu s$	45 $\mu s$

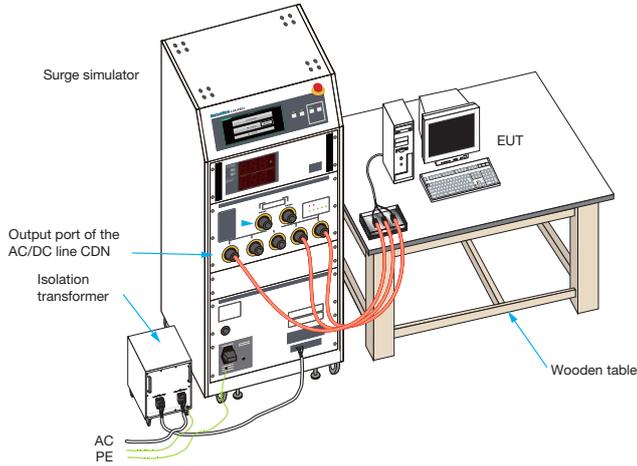
\* GDT, Clamping device, Avalanche devices

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, the calibration shall be performed at that maximum voltage. (In case the maximum voltage is 6kV, multiply the short circuit current value shown in this table by 1.5.)

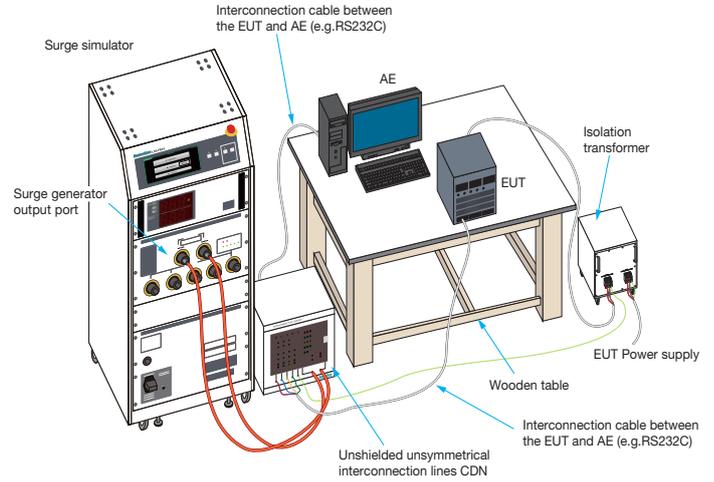
IEC 61000-4-5 Ed.3 Test Standard Overview

**05** Test Setup

■ Application of surges to power supply lines



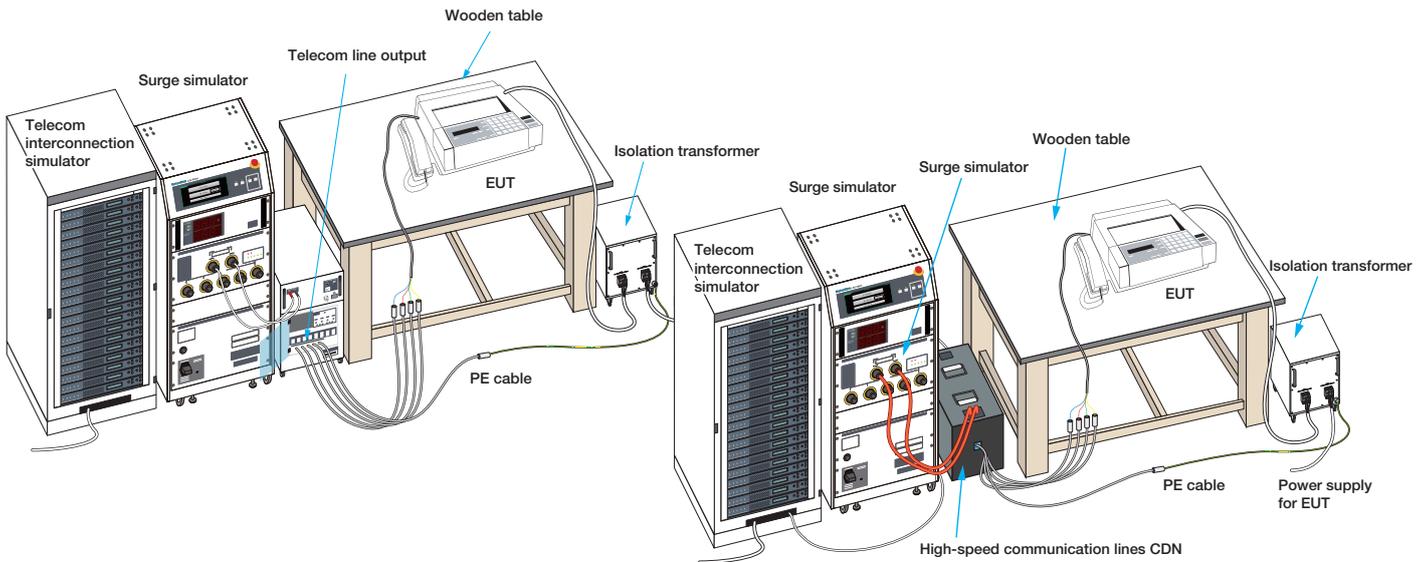
■ Application of surges to telecom lines



The 1.2/50 combination wave specified in the IEC61000-4-5 standard is applied from Lightning Surge simulator's CDN to power supply of the EUT. Compliant with the standard requirements, the simulator is equipped with a floating output. The simulator can conduct a series of automated tests based on preprogrammed settings.

The 1.2/50 combination wave surge specified in IEC 61000-4-5 Standard is applied to the telephone line of an EUT (such as a facsimile machine) through a high-speed telecom CDN connected to Lightning Surge simulator.

■ Application of surges through unshielded unsymmetrical interconnection lines CDN



The 1.2/50 $\mu$ s surge generator of the LSS-6330A 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 not exceed 2m.

Test Standard Overview



## IEC 61000-4-5 Ed.3 Test Standard Overview

### 06 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 0°, 90°, 180° and at 270°;
- Time between successive pulses: 1 min or less

### 07 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, as far as the EUT can be immune to the surges injected during all injection period and it satisfies 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.

Note: These test setups and procedures are quoted from IEC61000-4-5 Ed.3 (2014) Standard. Please refer to the standard if more details are required.

### 08 Surge testing for unshielded outdoor symmetrical communication lines

Not supported by the LSS-FE01 series and is therefore omitted from this document.

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