NoiseKen

Lightning Surge Simulator

LSS-6330 series

www.noiseken.com

NoiseKen NOISE LABORATORY

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

Lightning Surge Simulator

LSS-6330 series

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)
- Surge voltage up to 6.7 kV.
- CDN: Single phase up to 20A, AC240V/DC125V. Three phase up to 63A, AC600V/DC125V.
- Pre-checking function simplifies start-up inspection works.
- Voltage and current monitors enable status monitoring during noise applied to EUT.
- Large LCD operation panel improves visibility and operability.
- Easy out put current & voltage report.
- Interlocking function provides excellent safety.
- 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.
- Equipped withwaveform 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

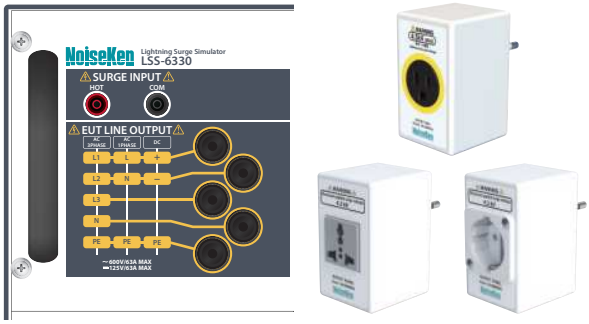
<Conventional>: It requires for two expensive high voltage probes and differential measurement available oscilloscope for start-up inspection works.
<LSS-6330>: Simplifies start-up inspection works only by connecting dedicated cables to the tester to confirm whether or not the output is present. (pre-checking).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

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)

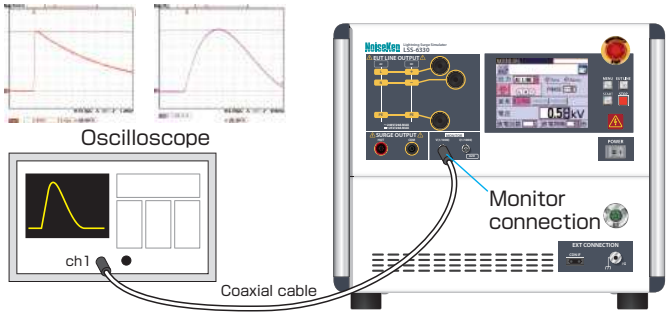
Visualize the testing connection status on monitor display for easy testing condition understanding

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



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.



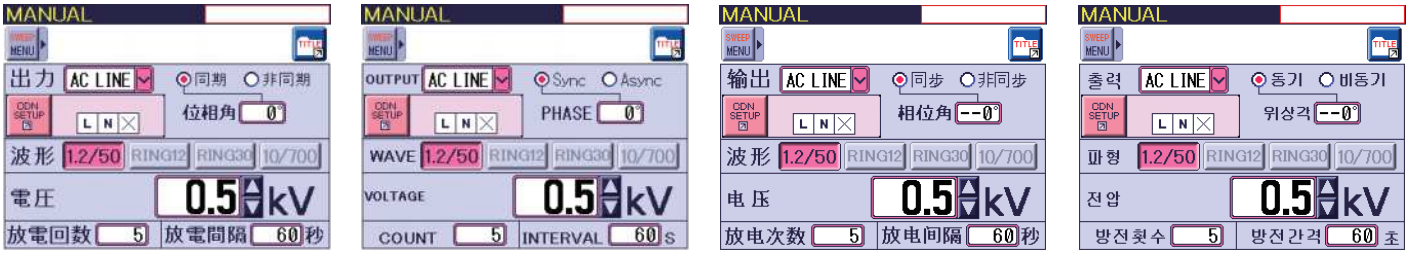
LSS-6330 series

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.



日本語　英語　中国語　韓国語

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	0.5kV ～ 6.7kV ±10%	Coupling circuit：18 μF Cable length：One side 0.5m Line input side open
	Front time	1.2 μs±30%	
	Time to half-value	50 μs±20%	
	Short-circuited current	250A ～ 3350A ±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 0.5m
	Front time	10 μs ±30%	
	Time to half-value	700 μs ±20%	
	Short-circuited current	12.5A ～ 167.5A ±10%	
	Front time	5 μs ±20%	
	Time to half-value	320 μs ±20%	
RING WAVE	Open voltage	0.25kV ～ 6.6kV ±10%	Cable length：One side 0.5m
	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 ～ 550A ±10%	
	Front time	0.2 ～ 1 μs	
Palarity	+/-		
Output impedance	2Ω ±10%		1.2/50 μs waveform
	40Ω ±10%		10/700 μs waveform
	12Ω ±20%、30Ω ±20%		RING （selectable）

LSS-6330 series

Item/Parameter	Specification	Note
Surge generation circuit	Floating	
Minimum charging time	0.0kV ～ 4.0kV：5 sec 4.1kV ～ 6.7kV：10 sec	1.2/50μs波形
	0.0kV ～ 4.0kV：10 sec 4.1kV ～ 6.7kV：15 sec	10/700μs 波形
	0.0kV ～ 6.6kV：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、2000V/V ±10% Accuracy：±10% vs. actual output	When output is open, no waveform prescription
Current monitor	BNC output、1000A/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. 50Hz/60Hz ±10%
Trigger input	asychronous , synchronized to AC line 0° ~360° / 1° step, external input	
Power supply	AC100V ～ AC240V ±10% 50Hz / 60Hz ±10%	
Operational environment	Humidity：15 ～ 35℃ Temperature：25 ～ 75%RH	
Dimentions / weight	(W)430 × (H)371 × (D)530 mm ／ approx 55kgs	

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

Item/Parameter	Specification		Note
Surge Waveform	1.2/50μs-8/20μs combination、RING WAVE		
1.2/50μs-8/20μs combination	Open voltage	0.5kV ～ 6.7kV ±10%	Coupling circuit：18μF Cable length：One side 0.5m Line input side open
	Front time	1.2μs ±30%	
	Time to half-value	50μs ±20%	
	Short-circuited current	250A ～ 3350A ±10%	
	Front time	8μs ±20%	
	Time to half-value	20μs ±20%	
	Open voltage	0.5kV ～ 6.7kV ±10%	Coupling circuit：：10Ω+9μF Cable length：One side 0.5m 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	0.25kV ～ 6.6kV ±10%	Coupling circuit：：4.5μF Cable length：One side 0.5m Line input side open
	Front time	0.5μs ±30%	
	Frequency	100kHz ±10%	
	Waveform envelop	Pk2 = 40% ＜ Pk1 < 110% Pk3 = 40% ＜ Pk2 < 80% Pk4 = 40% ＜ Pk3 < 80%	
	Short-circuited current	8.3 ～ 550A±10%	
	Front time	0.2 ～ 1μs	
Power Capacity for EUT line	AC240V/20A MAX 50/60Hz、DC125V/20A MAX		
Decoupling coil	1.5mH		
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	0.5kV ～ 6.7kV ±10%	Coupling circuit：18μF Cable length：One side 0.5m Line input side open
	Front time	1.2μs ±30%	
	Time to half-value	50μs ±20%	
	Short-circuited current	250A ～ 3350A ±10%	
	Front time	8μs ±20%	
	Time to half-value	20μs ±20%	
	Open voltage	0.5kV ～ 6.7kV ±10%	Coupling circuit：：10Ω+9μF Cable length：One side 0.5m 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	0.25kV ～ 6.6kV ±10%	Coupling circuit：：4.5μF Cable length：One side 0.5m Line input side open
	Front time	0.5μs ±30%	
	Frequency	100kHz ±10%	
	Waveform envelop	Pk2 = 40% ＜ Pk1 < 110% Pk3 = 40% ＜ Pk2 < 80% Pk4 = 40% ＜ Pk3 < 80%	
	Short-circuited current	8.3 ～ 550A±10%	
	Front time	0.2 ～ 1μs	
Power Capacity for EUT line	AC690V/63A MAX 50/60Hz、DC125V/63A MAX		
Decoupling coil	1.5mH		
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 AC90V min. & 50Hz / 60Hz ± 10%		
Power supply	AC100V ～ AC240V ±10%　50Hz / 60Hz ±10%		
Operational environment	Humidity：15 ～ 35℃ Temperature：25 ～ 75%RH		
Dimentions	(W)430 × (H)695 × (D)686 mm		

■ Standard accessries (LSS-6330-A20)

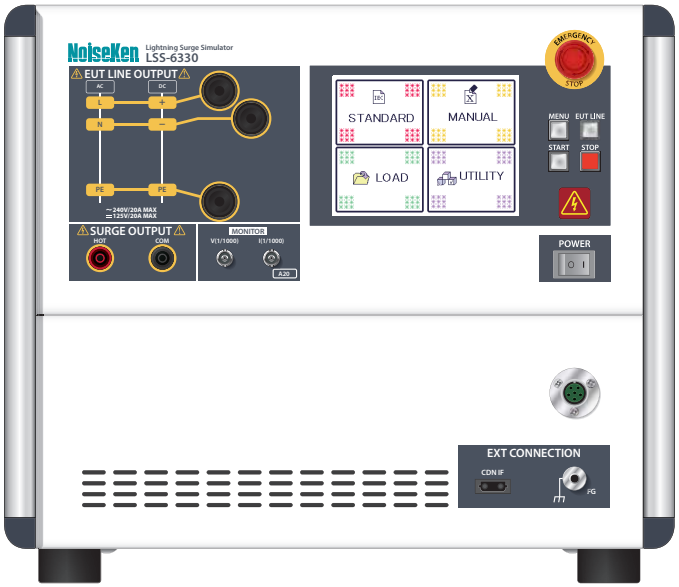
Items	Quantity	Note
AC cable	1 pc	
PE cable	1 pc	round solderless tip - round solderless terminal
Surge output cable(HOT･COM)	1 pc each (totally 2 pcs)	multi-contact: plug - round solderless terminal
Waveform verification cable (Surge output)	1 pc	multi-contact: plug - multi-contact: plug (for pre-check)
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	

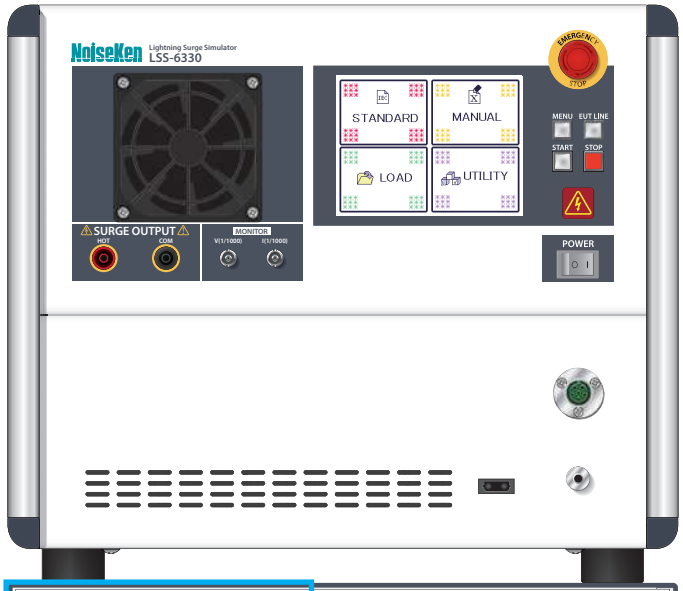
■ Standard accessries (LSS-6330-B63)

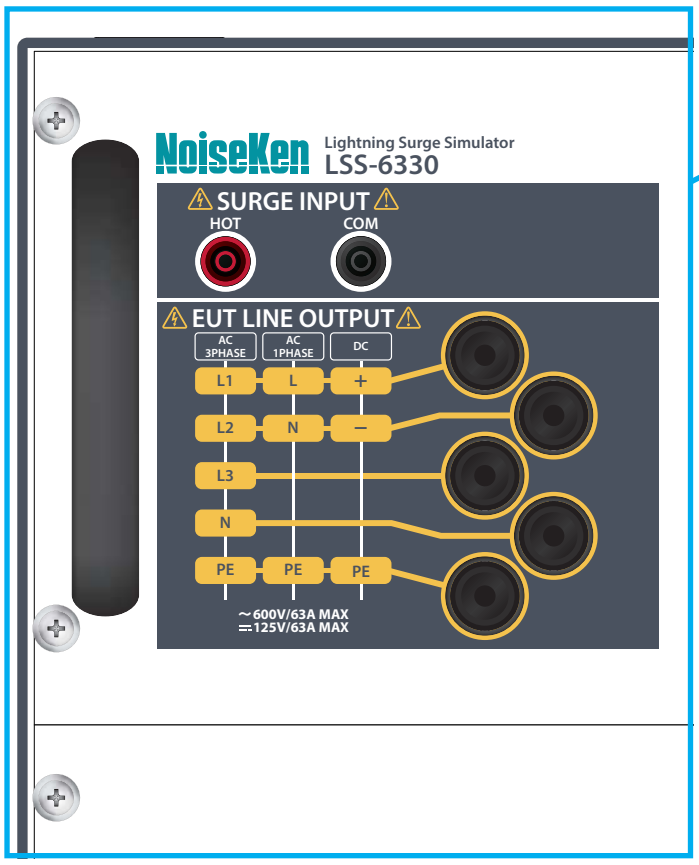
Items	Quantity	Note
AC cable	1 pc	
PE cable	1 pc	round solderless tip - round solderless terminal
Surge output cable(HOT･COM)	1 pc each (totally 2 pcs)	multi-contact: plug - round solderless terminal
Waveform verification cable (Surge output)	1 pc	multi-contact: plug - multi-contact: plug (for pre-check)
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

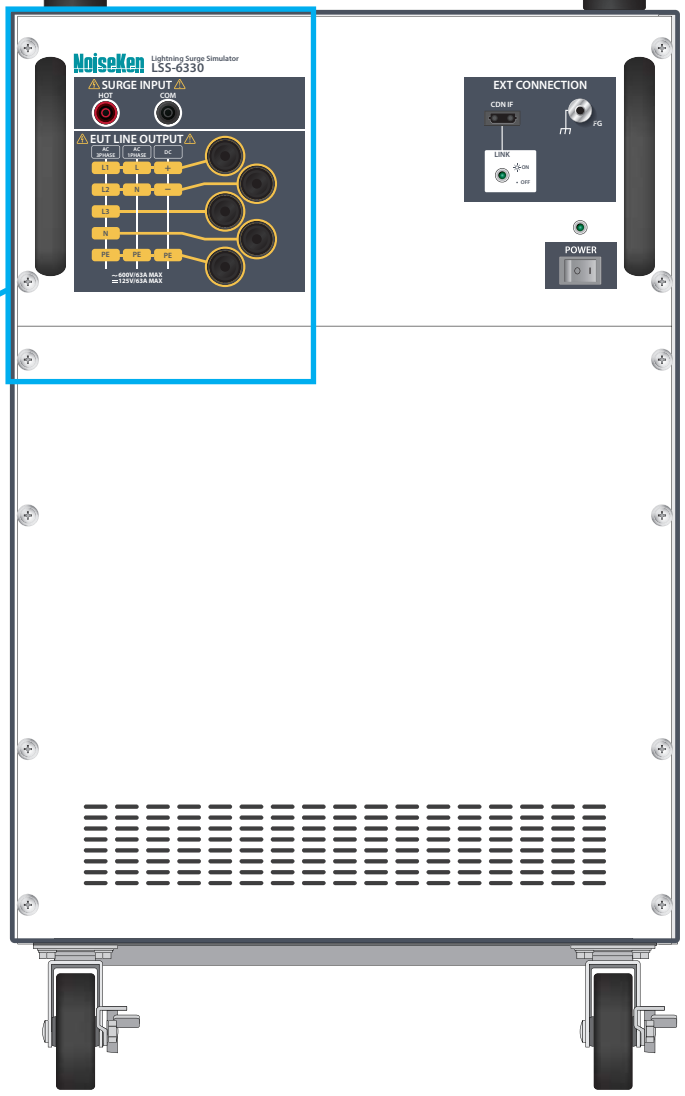
FNSront panel







SURGE IN ／ EUT LINE OUTの拡大

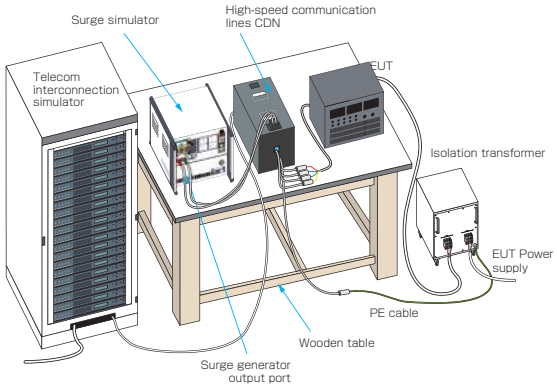


Option

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 1000Mbit/s. Conversion cables (05-00164A) are required for the CDN connection to the LSS-6330 simulator.

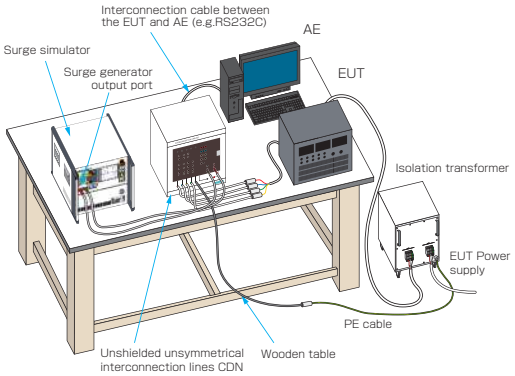
Parameter	F-130814-1004-2	F-130814-1004-4
Maximum input voltage	2kV	4kV
EUT power capacity	DC65V/1A	
Maximum line Number	8 lines	
EUT/AE connector	RJ-45	
Dimensions	(W)400×(H)230×(D)240mm	



CDN for Interconnection Lines 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 DC50V/1A and enable to inject the surge to interconnection lines up to 6,600V. Possible to bypass inductor (20mH) 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 (05-00165)cable is needed additionally.**

Parameter	Specification
Surge input voltage	500V~6.600V (Combination wave)
EUT power capacity	DC50V / 1A
Max. line number	4 lines
Decoupling coil	20mH each line
Matching resistor	40Ω±10%
Dimensions / Weight	(W) 488x(H)456x (D) 550mm Approx. 45kgs



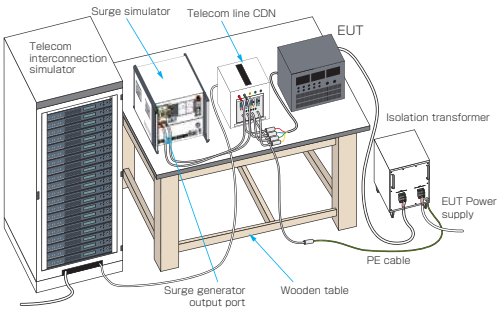
Telecom line CDN

* 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	6.6kV
EUT Power Supply Capacity	DC50V 100mA
Max. Line Number	4 Lines
Decoupling Coil	20mH each line
Matching Resistor	40Ω (1.2/50μs-8/20μs Combination wave)
	25Ω (10/700μs-5/320μs Combination wave)
Dimensions / Weight	(W)297×(H)262×(D)250mm Approx.10kgs



Option

OUTLET BOX

OUTLET BOX converts LINE output socket.

18-00081A	Outlet box 125V 15A 2P+PE	Btype (3Ptype、JP/USAtype) AC125V 15A MAX
18-00082A	multi-outlet box	Japan(JIS), America(UL), Canada(CSA), Australia(CSA), Swiss(SEV), Italy(CEI), Europe(CEE, DIN), England(BS)
18-00083A	Outlet box	Europe CEE DIN 250V 16A MAX

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 4.5kV)
***Conversion cable (model: 05-00166A) is required.**

Terminal Connection Board attached with Multi-Outlet(3P) 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 4.5kV)
***Multi-outlet is for single phase.**

Terminal Block for 3P MODEL：18-00047A

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

Terminal Block for 5P MODEL：18-00044A

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

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	Dimension
11-00005A	W400×D300×H300mm
11-00006A	W600×D400×H350mm

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

Tri-color pilot light MODEL：11-00015A

Usable together with LSS-5330-A20. The blinking makes the operators or neighbors pay attention to the test processig. Three colors indicate corresponing simulator's test status change.

Optical USB module MODEL：07-00022A

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

Option

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 AC240V Max (50/60Hz)
Maximum output current	30A 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	350(w) x 475(h) x 400(d)mm (Except for eye bolt and handle) Approx. 60kgs

Isolation Transformer MODEL : TF-6503P

Model TF-6503P is a three-phase isolation transformer rated AC600V/50A 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/Three phase AC600V Max (50/60Hz)
Transformer wiring method	Star wiring
Maximum output current	50A Max
Dielectric strength	Primary winding to core AC 4kV (1 minute) Secondary winding to core AC 4kV (1 minute) Primary to secondary windings AC 4kV (1 minute)
Insulation resistance	100MΩ or more at DC500V
Dimensions / Weight	500(w) x 640(h) x 700(d)mm (Except eye bolt and handle) Approx. 350kgs

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	120V	5A	50/60Hz
NCT-1120		10A	
NCT-1240		20A	
NCT-260	240V	2.5A	
NCT-2120		5A	
NCT-2240		10A	

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

Model TF-6503P is a three-phase isolation transformer rated AC600V/50A and dielectric strength of 4kV. For safety reason, an isolation transformer is indispensable for AC powered testing for equipment.

Item	Specification (18-00072A)	Specification (18-00073A)
Rated Voltage	AC250V 50/60Hz DC65V	AC240/415V, 3 phase 4 wire Y-connection, 50/60Hz Line-N (neutral): AC240V Line-Line: AC415V
Rated Current	20A	50A
Endurance	10,000 times or more open/close	
Neutral pole(N pole)	(Rated open/close 6,000 times,	No trip alone Neither open-circuit before pther poles nor closed-circuit after the other poles
Operating Temperature / Operating Humidity	No load open/close 4,000 times,	
Dimensions	6 times / minutes)	(W)180× (H)92× (D)120mm (projection excluded)
Weight	0.75 kg	1.2kg

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.

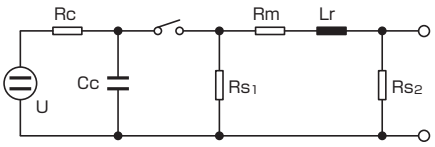
2. Test Level

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.

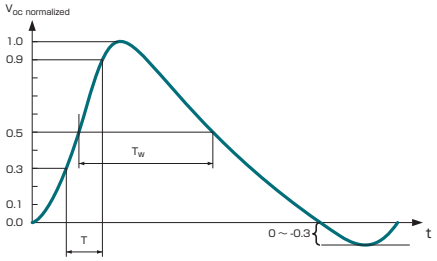
3. Waveforms Generator and Waveforms verification

■ Generation Circuit



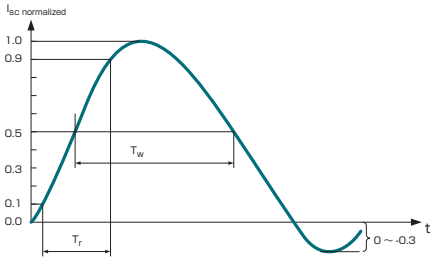
U High-voltage source
Rc Charging resistor
Cc Energy storage capacitor
Rs Pulse duration shaping resistors
Rm Impedance matching resistor
Lr Rise time shaping inductor

■ 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 Tf μs	Duration Td μs
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 μF (line to line)	9 μF + 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 μs ± 30 %	1,2 μs ± 30 %
Duration		
Current rating ≦ 16 A	50 μs + 10 μs/ -10 μs	50 μs + 10 μs/ -25 μs
16 A < current rating ≦ 32 A	50 μs + 10 μs/ -15 μs	50 μs + 10 μs/ -30 μs
32 A < current rating ≦ 63 A	50 μs + 10 μs/ -20 μs	50 μs + 10 μs/ -35 μs
63 A < current rating ≦ 125 A	50 μs + 10 μs/ -25 μs	50 μs + 10 μs/ -40 μs
125 A < current rating ≦ 200 A	50 μs + 10 μs/ -30 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.

IEC61000-4-5 Ed.3 Test Standard

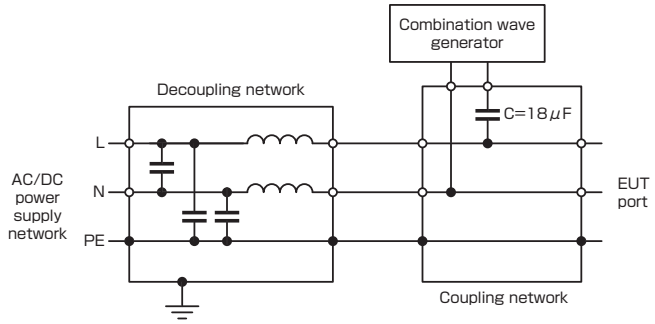
Current waveform specification at the EUT port of the power line CDN (short-circuit current)

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 = 2,5 µs ± 30 %
Duration	Td=1.18×Tw=20µs±20%	Td = 1,04 × Tw = 25 µs ± 30 %

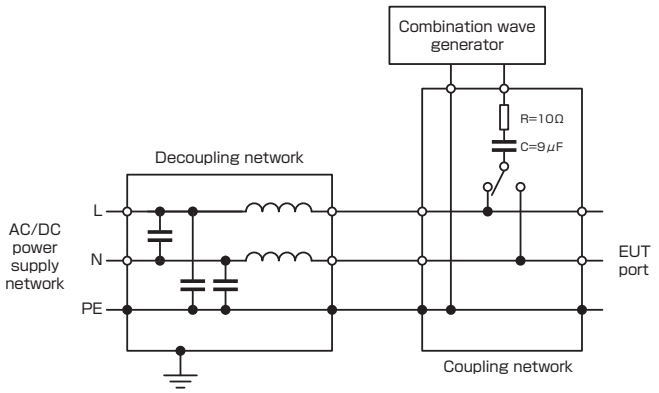
Relationship between peak open-circuit voltage and peak short-circuit current at the EUT port of the power line CDN

Open-circuit peak voltage +/-10% at EUT port of the CDN	Short-circuit peak current +/-10% at EUT port of the CDN (18µF)	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

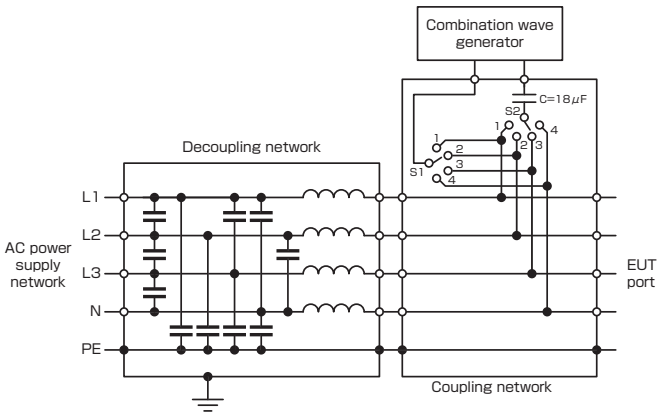
Single phase power line CDN (line to line mode)



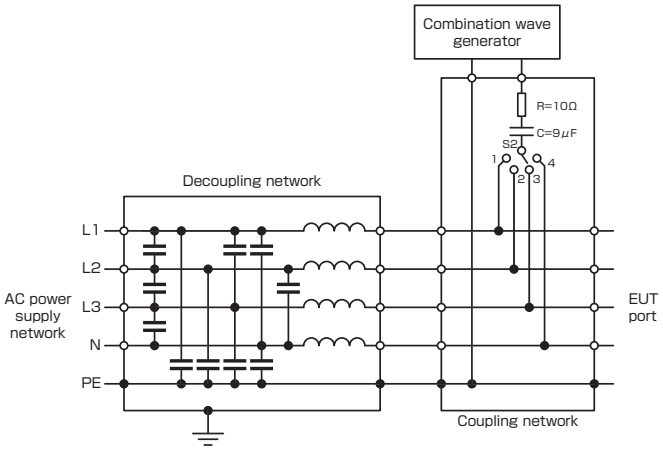
Single phase power line CDN (line to ground mode)



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

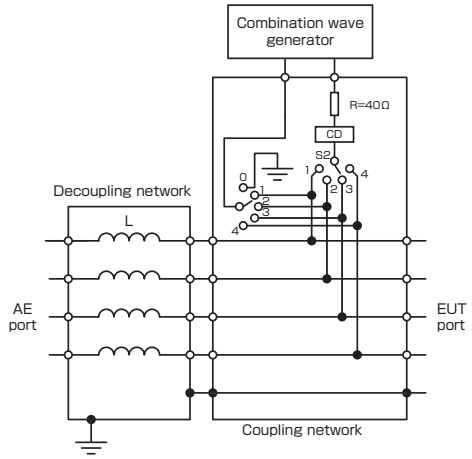


hree-phase power line CDN (line to ground mode)

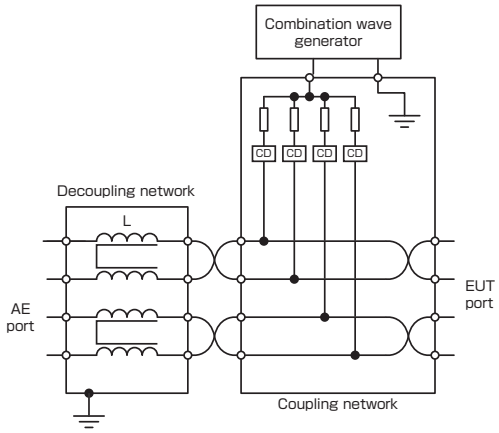


IEC61000-4-5 Ed.3 Test Standard

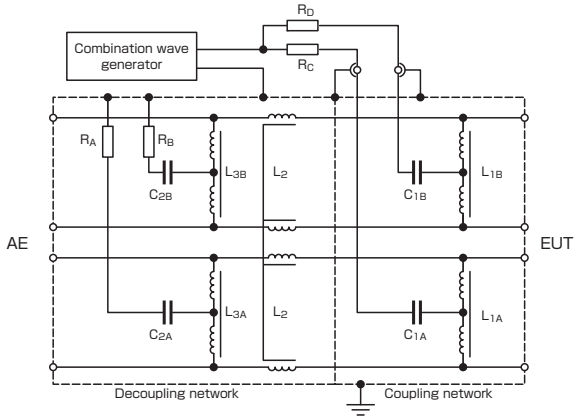
CDN for unshielded unsymmetrical interconnection lines



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=1,25xTr ±30 %	Current Duration Td=1,18xTw ±30 %
Line to PE R = 40Ω, CD = 0,5 µF	4 kV	4 kV	1,2 µs	38 µs	87 A	1,3 µs	13 µs
Line to PE R = 40Ω, CD = GDT	4 kV	4 kV	1,2 µs	42 µs	95 A	1,5 µs	48 µs
Line to line R = 40Ω, CD = 0,5 µF	4 kV	4 kV	1,2 µs	42 µs	87 A	1,3 µs	13 µs
Line to line R = 40 Ω, CD = GDT	4 kV	4 kV	1,2 µs	47 µs	95 A	1,5 µs	48 µs

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=1,25xTr ±30 %	Current Duration Td=1,18xTw ±30 %
Line to PE R = 40Ω Coupling devices*	2 kV	2 kV	1,2 µs	45 µs	48 A	1,5 µs	45 µs

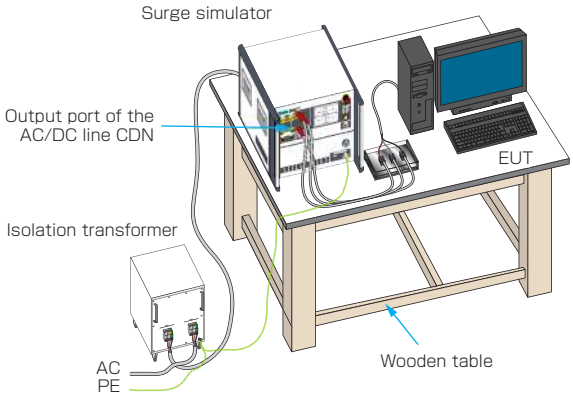
* GDT, Clamping device, Avalanche devices

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 6kV, 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



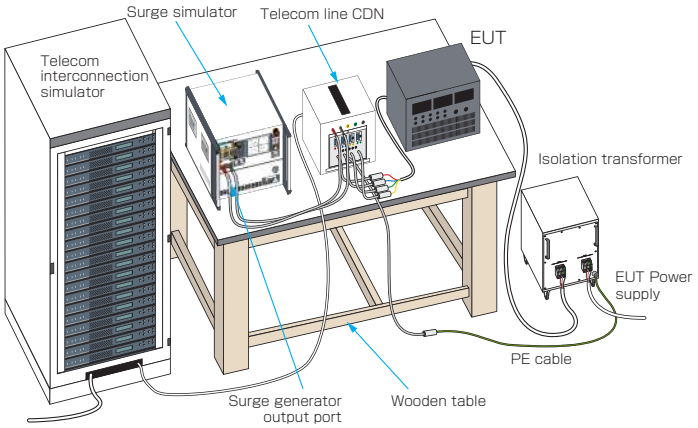
The 1.2/50 combination wave (C/W) specified in the IEC61000-4-5 standard is applied through the power lines CDN of the LSS-6330 simulator. Compliant with the standard requirements, the simulator is of floating output. The simulator can conduct a series of tests to preprogrammed settings.

Application of surges through unshielded unsymmetrical interconnection lines CDN

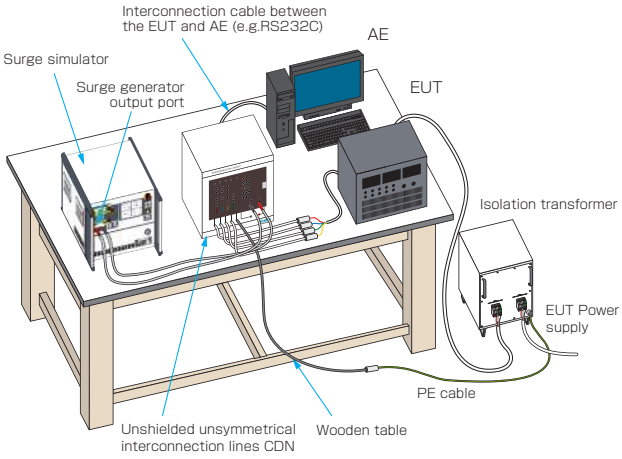
The 1.2/50 uS surge generator of the LSS-6330 simulator shall be used in combination with an optional external CDN. This CDN is connected between the EUT and AE (auxiliary equipment)

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.

Application of surges to telecom lines

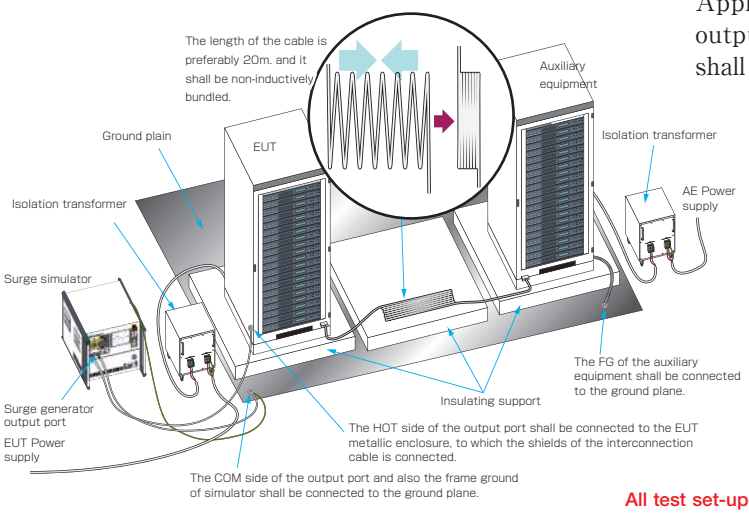


The 1.2/50 combination wave (C/W) specified in the IEC61000-4-5 standard is applied through the telecom lines CDN of the LSS-6330 simulator.

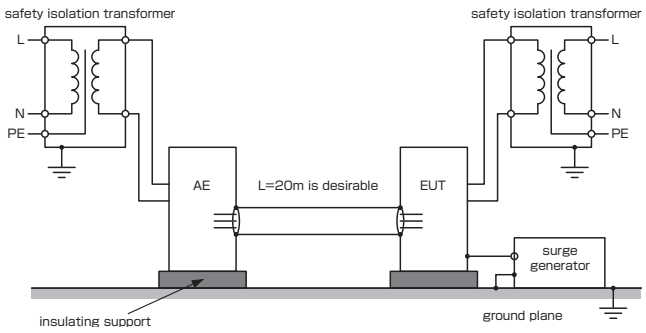


Test set-up for surges applied to shielded lines

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 μ F 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:

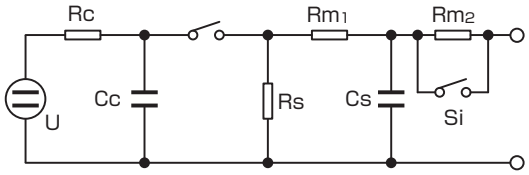
1) Normal performance within limits specified by the manufacturer, requestor or purchaser;
2) Temporary loss of function or degradation of performance which ceases after the disturbance ceases, and from which the equipment under test recovers its normal performance, without operator intervention;
3) 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

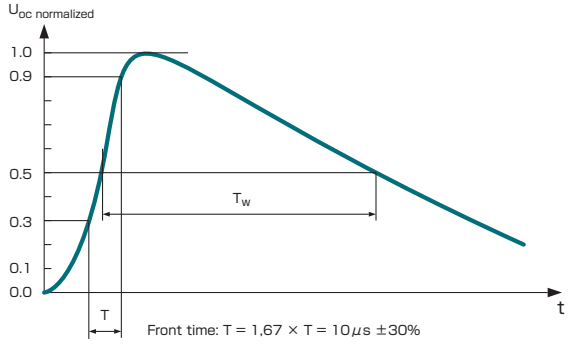
The 3rd edition of the standard requires the 10/700 us combination wave is applied to ports connected to outdoor telecommunication lines only and the Annex A (Normative) dedicatedly address this test. Outdoor telecommunication lines are typically greater than 300 in length, as the result of this length 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



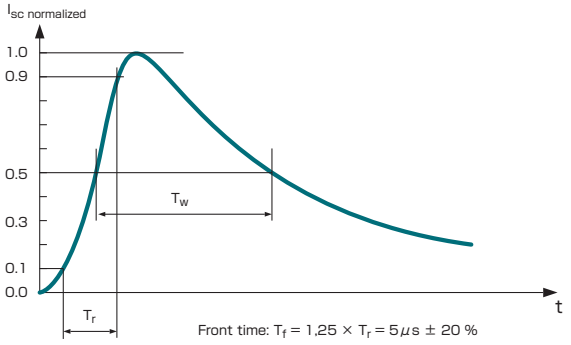
U	High-voltage source
Rc	Charging resistor
Cc	Energy storage capacitor
Rs	Pulse duration shaping resistor
Rm	Impedance matching resistors
Cs	Rise time shaping capacitor
S_1	Switch closed when using external matching resistors

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 × T_r = 5μs ± 20 %
Duration: $T_d = T_w$ = 320μs ± 20 %

IEC61000-4-5 Ed.3 Test Standard

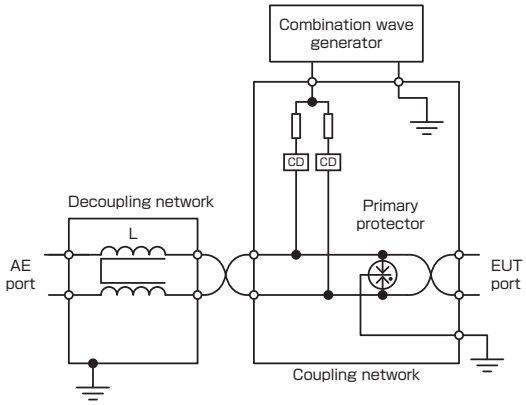
Definitions of the waveform parameters of 10/700 μs combination waveform

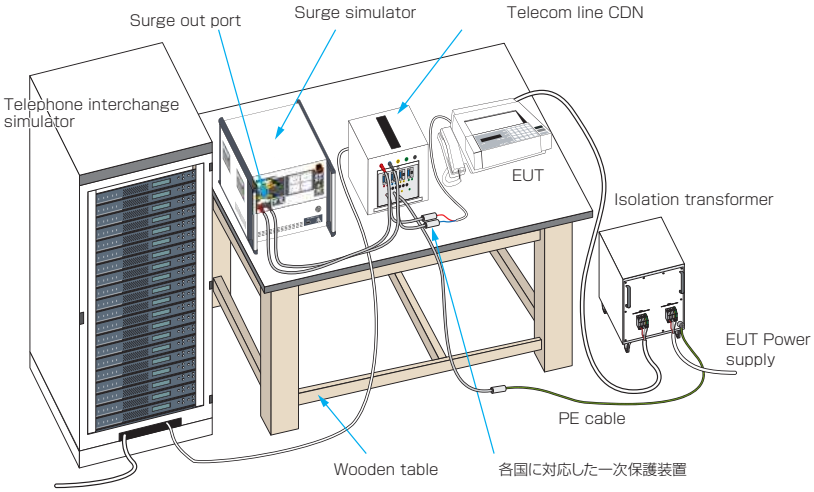
	Front time μs	Duration μs
Open-circuit voltage	10 ± 30 %	700 ± 20 %
Short-circuit current	5 ± 20 %	320 ± 20 %

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	25A
2.0 kV	50A
4.0 kV	100A

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 xTr ± 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 μs	250 μs	145 A	3.2 μs	250μs

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.

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