Compliance to a standard or to the real world?

No one could have doubt as to the importance of the pulsed EMI test.

In fact, in the scheme of international compliance, the Elctrical Fast Transient/ Burst test is a must for almost all products.

As logic circuits get faster, they tend to be more susceptible to higher frequency disturbances.

Does your test program represent this scenario?

Noise-related malfunctions of electronic equipment containing electronic control devices, such as information technology equipment, are now becoming a serious problem in today's society. One of the best-known sources of interference is the inductive component through which a current is interrupted. It is represented by the switching on and off of a relay. This type of noise has a broadband interference spectrum; thus it is coupled to wires and printed circuits in equipment, reflecting and resonating and being amplified by an IC to cause equipment malfunction.

A market proven conducted immunity test method

The Impulse Noise Simulator (abbreviated to INS) design comes from test equipment invented by an American computer manufacturer in early 1970's when events of malfunctions of digital equipment had just begun to emerge in society. Now the INS method is the established test method in Japan and other Asian countries. In fact, the number of INS units shipped exceeds 5,000.

The first priority is to reproduce the upset of digital equipment

If you are facing an immunity problem, the first priority should not be just testing, but rather built-in solutions in your equipment. The simulator you are about to use must reproduce the identical phenomena happening in the field.

Complementary to the IEC61000-4-4 EFT/Burst test

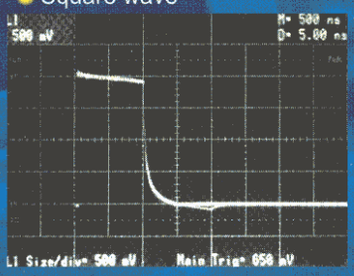
The NoiseKen INS-4001 Impulse Noise Simulator with unique valuable features and capabilities, most of which are not met by Electrical Fast Transient/Burst generators, greatly helps to enhance your test program to ensure your products are really immune from real world phenomena.

FEATURES

- **1ns rise time square pulse containing a frequency component of up to 2 GHz regions**
- **Variable pulse widths from 50ns to 1 μs in 50ns steps for compensation for the lack of a specific interference frequency band**
- **Line to line and line to ground coupling modes**
- **Synchronous and asynchronous pulse placement with AC phase angle**
- **Dedicated capacitive and inductive coupling clamps are optionally available**
- **A market proven test method with a 30-year history**

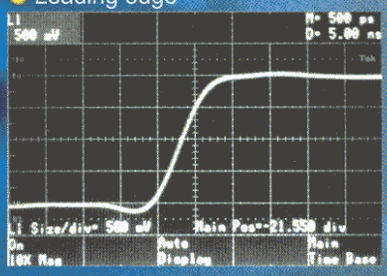
WAVEFORMS

- Square wave



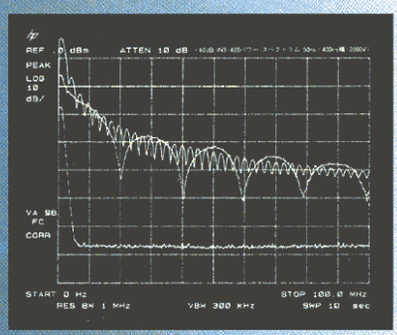
V:500V/Div H:500ns/Div
50Ω termination

- Leading edge



V:500V/Div H:0.5ns/Div

FREQUENCY SPECTRUM



+60dB INS series pulse power spectrum,
50ns and 400ns width (2000V)

INS-4001 (2kV/4kV type)

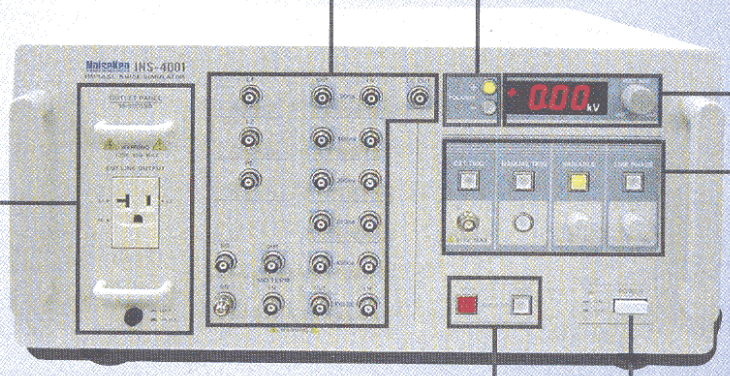
INS-4001 series is our latest development based on our versatile INS series transient simulators for greater ease of use, safety, durability and reliability with new technology specifically applied to the new product.

FEATURES

- Floating output
- Coupling mode selection by connecting the supplied coaxial connector to the selected port
- Easily changeable mercury relay
- Built-in 50Ω terminator
- Easily changeable outlet panel (EUT interface)

CONTROL PANEL

Pulse width and coupling mode can be set by connecting the supplied coaxial cables and SG short plug to these coaxial ports.



Polarity Select Buttons

Output voltage control and display

Trigger mode Select Buttons
4 trigger modes (Line phase mode/Variable mode/ Manual Trigger mode/ External Trigger mode) available.

Outlet panel (Model 18-00059B)
For instant connection of the EUT to the simulator, an easily exchangeable outlet panel is provided. UL plug type Model 18-00059B is equipped as a standard accessory. Other types are optionally available.

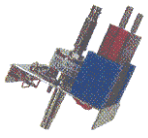
Start/Stop Buttons

Power switch

STANDARD ACCESSORIES

- **Relay unit** (Selected when ordering) (1 pc.)

Model:INS-RL2K

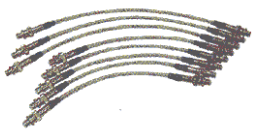


Model: INS-RL4K

- **SG short plug**
  Model: 02-00106A (1 pc.)

- **Line input cable**
  Model: 05-00088A (1 pc.)

- **Pulse width select cable** / 26cm
  Model: 02-00012A (3 pcs.)
- **Pulse width select cable** / 18cm
  Model: 02-00104A (5 pcs.)



- **Outlet panel** Model:18-00059B (1 pc.)
- **Instruction manual** (1 pc.)
- **Accessory bag** (1 pc.)

INS-4001

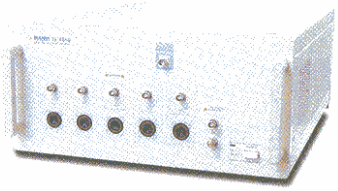
SPECIFICATIONS

Parameters		INS-4001 (2kV)	INS-4001 (4kV)
Output voltage		0.02~2.00kV ±10% with 50Ω Load (±0.04kV for <0.1kV)	0.02~4.00kV ±10% with 50Ω Load (±0.04kV for <0.1kV)
Polarity		Positive or negative	
Square wave	Pulse width	50ns, 100ns, 200ns, 250ns, 400ns and any combination thereof, maximum width 1 s , or 10ns±3ns (the shortest connection)	
	Rise time	<1ns	
	Output impetance	50Ω	
Pulse repetition mode	Line phase	50 or 60Hz, Injection phase angle 0~359° (Synchronized with L1, L2 of power supply to be injected, or external terminal.)	
	Variable	10ms±10% ~ 100ms - 0/+80ms	16ms±10% ~ 100ms - 0/+80ms
	External	>10ms TTL/Open collector negative logic	>16ms TTL/Open collector negative logic
	Manual	By trigger switch, a single pulse injection to any phase angle of the power line	
Power capacity of EUT		AC240V Single phase, DC60V, 16A	
Injectjion power supply protection circuit		Circuit breaker	
Power supply		100 ~ 240 VAC 50/60 Hz	
Power consumption		150VA/AC100V 230VA/AC240V (at 4kV output) 50/60 Hz	
Operating temperature and humidity		15 ~ 35℃ 25 ~ 75% (No dewing shall occur.)	
Dimensions and weight		(W)430 × (H)200 × (D)535 mm (Projections exluded) / Approx. 25.0 kg	

OPTIONS

Injection Unit Model: IJ-4050

This optional unit can extend the EUT supply voltage and current ratings up to 3-phase AC 415V/50A. In conjunction with INS-4001, this unit can operate in the EUT Line Synchronization mode.



Parameters	IJ-4050
Impulse input	8kV max when the INS-4001 output is not terminated
EUT power capacity	3-phase, 5-wire (L1, L2, L3, N, PE) AC 415V, 50A
Coupling mode selection	By short plug connection
Zero cross detection	Detects L1 - L2 voltage and outputs synchronization signal from the SYNC OUT connector
Dimensions and weight	(W)430 × (H)200 × (D)535 mm (Projections exluded) / Approx. 25.0 kg

Outlet Panel Model: 18-00060A

CEE7 type/Schuko plug

Outlet Panel Model: 18-00061A

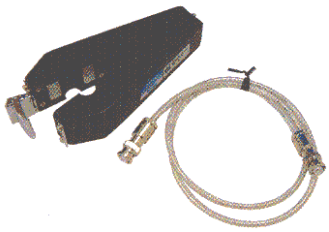
Terminal block type

Triangular Wave Unit Model: 02-00099A

OPTIONAL ACCESSORIES

Coupling Adaptor Model: CA-803A

Input voltage: 2000V max.
Input pulse width: 50ns~1 μ s
Dimensions: (W)160 x (H)60 x (D)35mm
Weight: Approx. 400g

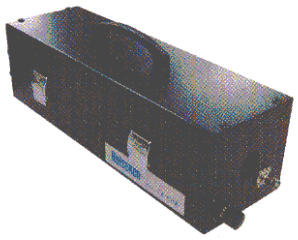


Radiation Probe Model: 01-00006A~00010A

Input voltage: 4000V max.
Input pulse width: 50ns~1 μ s
Radiation part diameter: 50, 75, 100, 150, 200 mm
Cable length: Approx.2m
Weight: Approx. 180g~220g

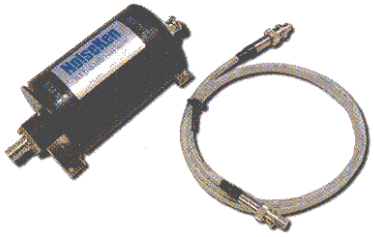
Coupling Adaptor Model: CA-805B

Input voltage: 4000V max.
Input pulse width: 50ns~1 μ s
Dimensions: (W)350x(H)120x(D)130mm
Weight: Approx. 3kg



Attenuator Model: AT-810

Input voltage: 4000V max.
Input pulse width: 50ns~1 μ s
Attenuation ratio: 1:100(40dB)
Input impedance: 50 Ω
Output impedance: 50 Ω
Frequency characteristics: DC to 500MHz (-4dB)
Weight: Approx. 550g



Mercury Relay Unit

Model: INS-RL2K (2kV relay unit for INS-4001)
Model: INS-RL4K (4kV relay unit for INS-4001)

EMS Probe Kit Model: H2-B

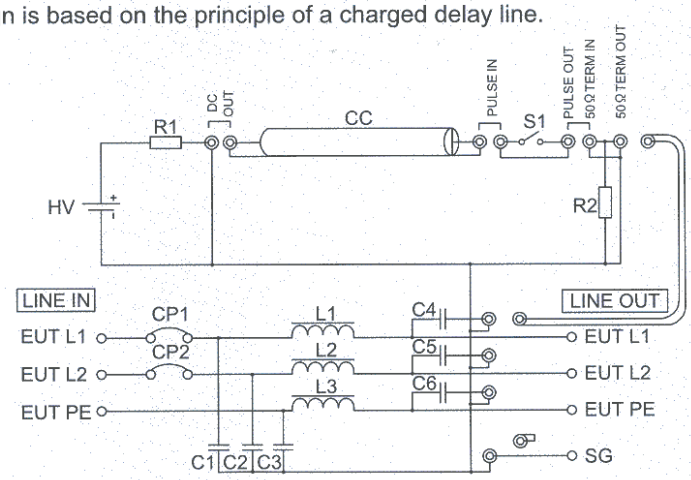
A diagnostic tool for locating sensitive spots on the circuits under test to the electric or magnetic transient field. This kit consists of 3 electric and 3 magnetic field probes, all in a different probe head size for a variety of applications. Connected to the INS or FNS (Electrical Fast Transient Burst) simulator, each probe works as a transient field source.

Features

- ▷Detects possible noise immunity problem spots
- ▷Generates transient electrical and magnetic fields separately
- ▷Application for modules, components, conductors and ICs
- ▷Convenient handling by pencil shape, light plug-type cable with snap-action coupling

INS SERIES ELECTRICAL SCHEMATIC

The simulator design is based on the principle of a charged delay line.



HV: HV power supply
S1: Mercury relay
C4,5,6: Coupling capacitor
L1/C1,L2/C2,L3/C3: Filter
R1: Charging resistor
R2: Termination resistor
CP1,2: Circuit breaker
CC: Coaxial cable

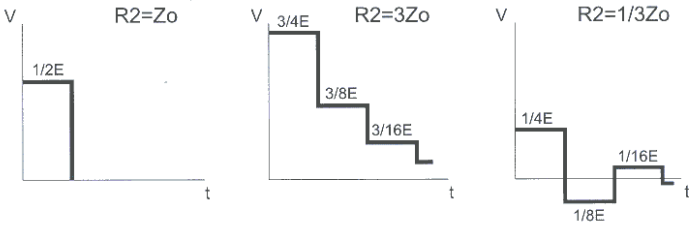
PULSE GENERATION PRINCIPLE

The main components of the pulse generator circuitry of this unit are coaxial cables, HV power supply, charging resistor, mercury relay, and terminating resistor. The coaxial cables form a distributed constant circuit consisting of the inductance of the inner conductor and capacitance between the inner and outer conductors. When this line is terminated by a 50Ω resistance, it works as a square wave pulse generator. Pulse widths vary depending on the delay time of the coaxial line (length of the cable). The proportion of pulse widths to the length is approximately 10 ns per meter. Pulse waveforms and amplitudes depend on the relation between terminator resistance and coaxial cable characteristic impedance.

The HV power supply charges up the capacitance component of the coaxial line through the charging resistor when the mercury relay is in off status. The stored energy is discharged when the mercury relay contacts turn on, generating a HV square wave pulse across the 50Ω terminating resistor. The injection unit couples this pulse through a capacitor to an EUT LINE. Also provided is a decoupling circuit consisting of an inductor and a capacitor, working as a high impedance circuit when seen from the injection point. This enables the unit to effectively couple the interference signals to the EUT and to reduce their leakage into the power supply side (LINE IN).

FOR PERFECT MATCHING

Pulse waveforms and amplitudes are dependent on the value of a termination resistor being connected to the PULSE OUT terminal. The figures and equation shown at the right show their relations. To generate square wave pulses, this unit adopts a 50Ω (strictly, 53.5Ω resistance), an equal value to the characteristic impedance of the coaxial cables.



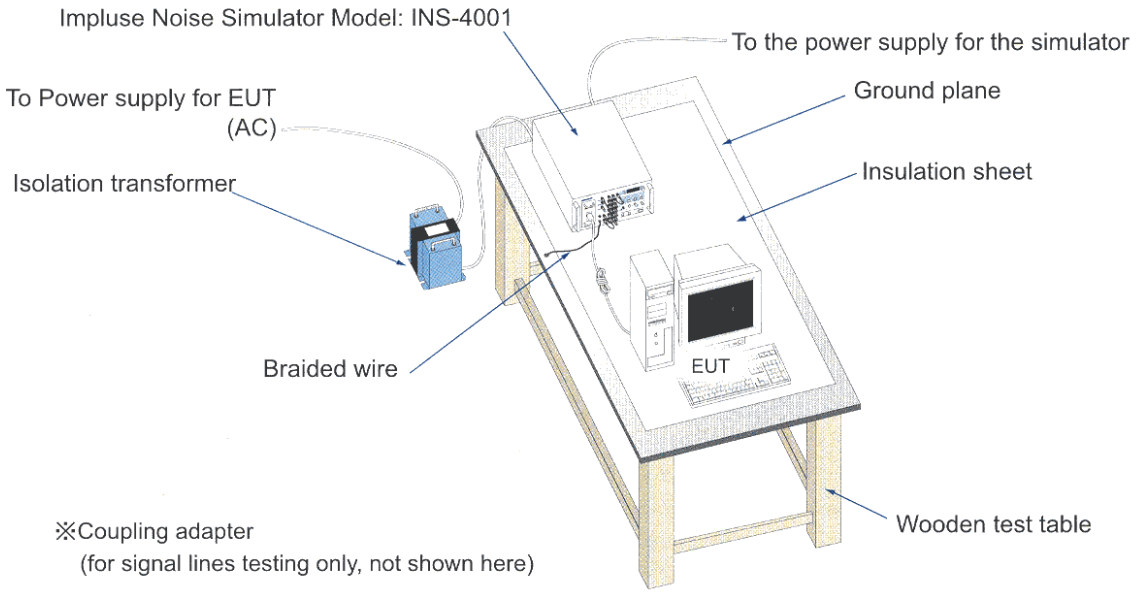
$Vp=R2/(Z_0+R2) \times E$

Vp: Peak voltage being measured across the terminating resistor
R2: Value of terminating resistor
Z_0: Characteristics impedance of the cable cables
E: Output voltage from the HV power supply

OUTLINES OF TEST SET-UP (EXAMPLE: INS-4001)

Test environments

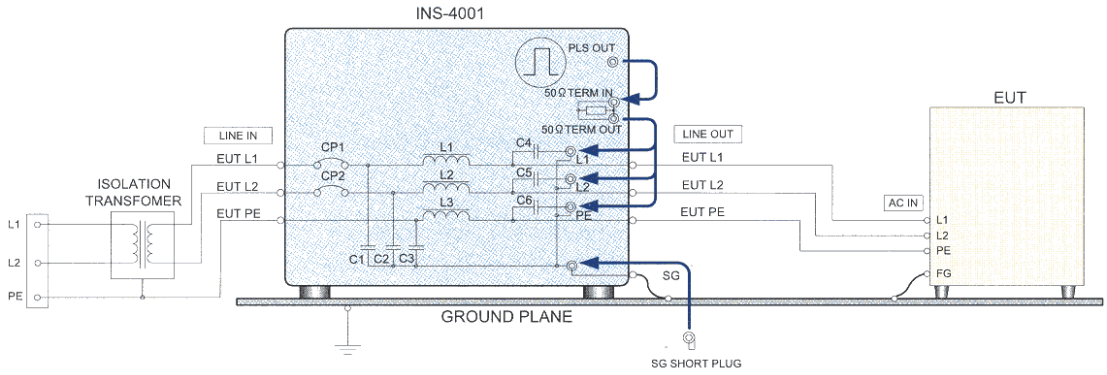
A recommended test set-up example is shown here.



(Notice) EUT LINE INPUT for AC powered testing shall be power-fed from an isolation transformer.
Place a ground plane beneath the simulator and EUT. The plane shall be grounded for safety.

TEST SET-UP

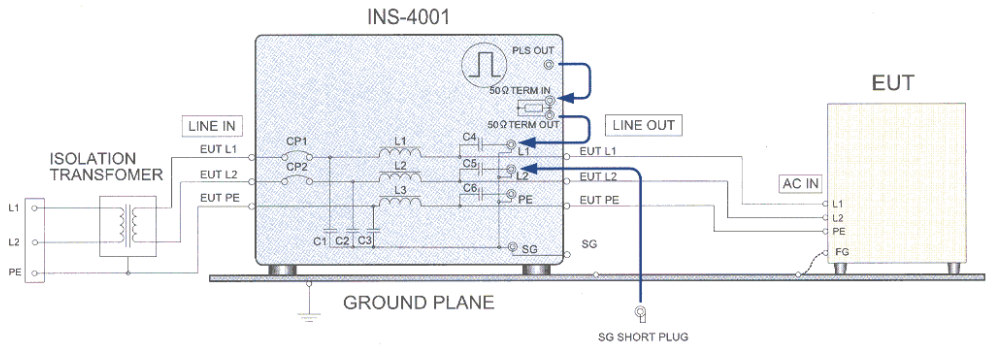
Line to ground mode (common mode) for AC operated equipment



(1) Mount the OUTLET PANEL matching the EUT and then plug the EUT AC cord to the panel receptacle. In case the AC cord is too long, fold it so that it might not cross with signal or other cables.
(2) Plug the SG (=signal ground) connector with the SG short plug.
(3) Connect the SG terminal of this unit and FG (=frame ground) terminal of the EUT to the ground plane by using low impedance wires, for example, braided wire of 3.5mm2 of the shortest possible length.
(4) In case the EUT consists of plural units, each unit shall be connected to the ground plane.
(5) When the EUT does not have FG terminal, testing shall be done with the EUT ungrounded to the ground plane.
(6) Select the line to which the pulses are to be injected by making a connection from 50Ω TERM OUT terminal to the EUT LINE L1 (L2 or PE) by using a supplied coaxial cable.

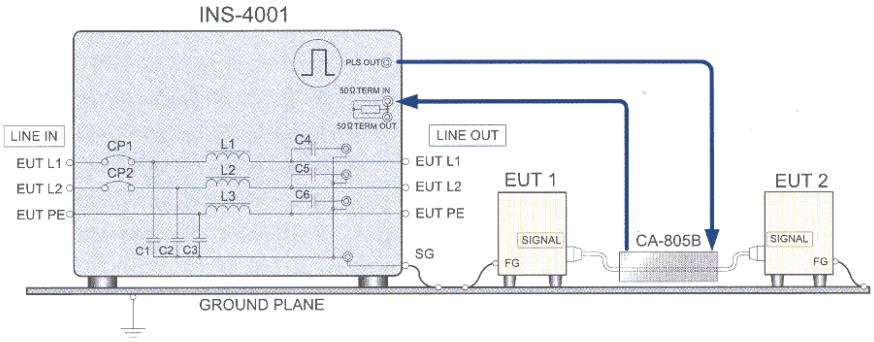
TEST SET UP

Line to line (normal mode) for AC operated equipment



(1) Mount the OUTLET PANEL matching the EUT and then plug the EUT AC cord to the panel receptacle. In case the AC cord is too long, fold it so that it might not cross with signal or other cables.
(2) Testing shall be done with the SG terminal not being connected to the ground plane. In case the EUT have an FG terminal, test it both with the FG connected to the ground plane and with the FG disconnected form the plane.
(3) Select the line to which the pulses are to be injected by making a connection from 50Ω TERM OUT terminal to the EUT LINE L1 (or L2) by using a supplied coaxial cable.
(4) Plug the L2 (or L1) connector with the SG short plug, while the SG connector shall remain open circuit.

Capacitive coupling test for signal lines (by using CA-805B coupling adapter)



(1) Open the coupling adapter (option) and clamp the interface cable under test. The PULSE OUT terminal shall be connected to one side of the adapter and the 50Ω TERM IN terminal shall be connected to the other side. (Changing the injection and termination sides is also recommended as test results may vary.)
(2) EUT power can be supplied from the service outlet directly, as the HV pulses are not injected to these lines.
(3) Connect the SG terminal of this unit and FG terminal of each unit of the EUT to the ground plane)

Designs and specifications are subject to change without notice.

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