

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 Electrical 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

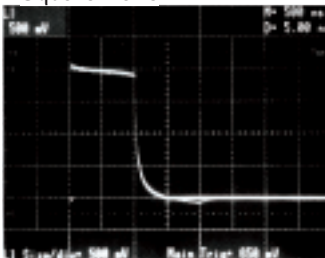
The NoiseKen INS-series Impulse Noise Simulators with unique valuable features and capabilities, most of which are not met by Electrical Fast Transient/Burst generators, greatly helps to enhance your test program to ensure your products are really immune from real world phenomena.

■ FEATURES

- 1ns rise time square pulse containing a frequency component of up to 2 GHz regions
- Variable pulse widths from 50ns to 1 μ s 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

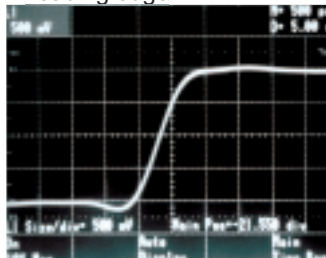
■ WAVEFORMS

- Square wave



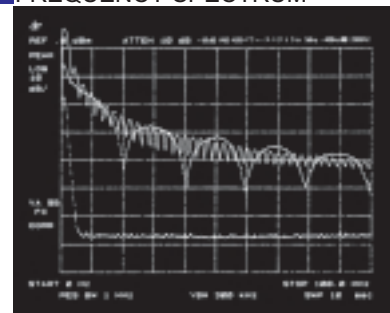
V:500V/Div H:500ns/Div
50 Ω termination

- Leading edge



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

■ FREQUENCY SPECTRUM



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

INS-4020 and INS-4040

The NoiseKen's INS-4020/4040 is a further development from our versatile INS series simulators for greater ease of use, durability and reliability with new technology specifically applied to this new product. The most significant addition is automatic ramp operation in output voltage, pulse repetition period and phase angle placement.

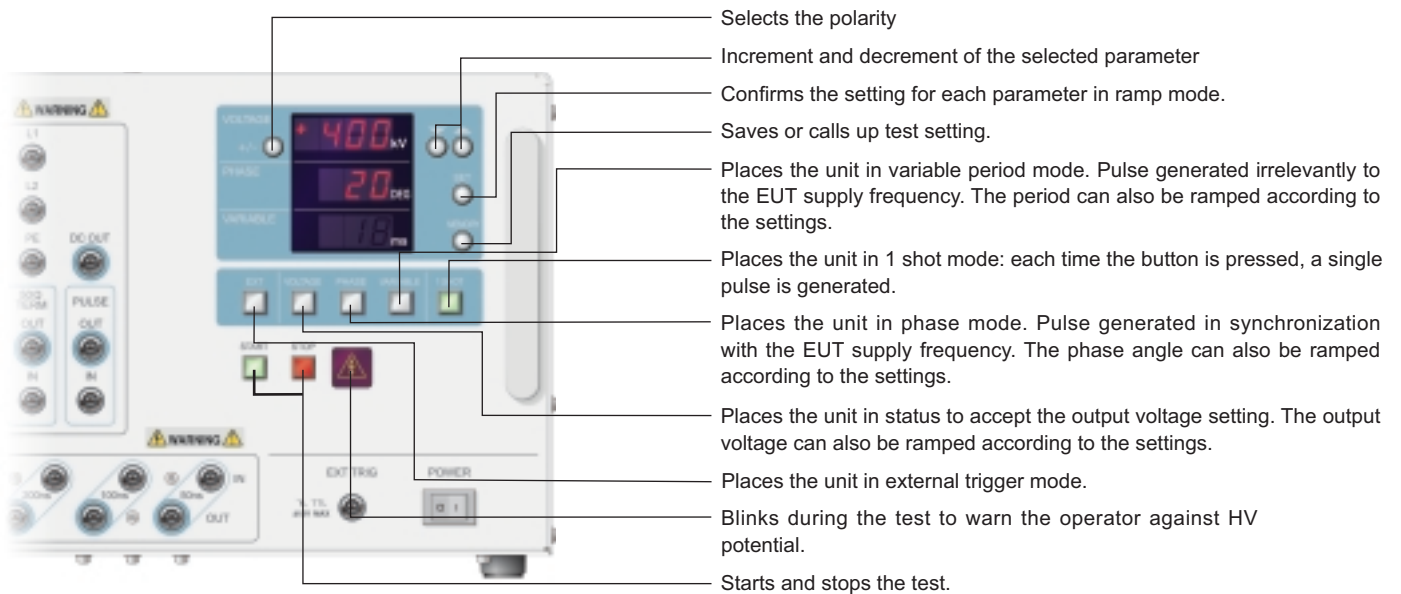


INS-4020

FEATURES

- Automatic ramp operation for output voltage, phase angle and repetition period
- Floating output
- Coupling mode selection by plugging the supplied coaxial connector to the selected port
- Easily changeable mercury relay
- Built-in 50-ohm terminator
- Up to 5 test settings can be stored in the memory
- Easily changeable outlet panel

CONTROL PANEL



STANDARD ACCESSORIES

Description		Quantity	Note
Coaxial cable	02-00013A	8	30cm length
SG short plug	02-00106A	1	
Outlet panel (Terminal block type)	18-00061B	1	AC240V/16A DC60V/16A maximum Leaves the factory with this panel attached to the main unit.
Instruction manual		1	

INS 4020 and 4040

INS-4020/4040 SPECIFICATIONS

Parameters		INS-4020	INS-4040
Output voltage		0.01~2.00kV $\pm 10\%$ with 50 Ω Load (± 0.04 kV for <0.1kV)	0.01~4.00kV $\pm 10\%$ with 50 Ω Load (± 0.04 kV for <0.1kV)
Polarity		Positive or negative	
Square wave	Pulse width	50ns, 100ns, 200ns, 250ns, 400ns and any combination thereof, maximum width 1 μ s , or 10ns \pm 3ns (the shortest connection)	
	Rise time	<1ns	
	Output impedance	50 Ω system (53.5 Ω)	
Pulse repetition mode	PHASE	50 or 60Hz, Injection phase angle 0~359°(Synchronized with L1, L2 of power supply to be injected, or external terminal.)	
	VARIABLE	10ms ~ 999ms $\pm 10\%$	16ms ~ 999ms $\pm 10\%$
	EXT	>10ms TTL/Open collector negative logic	>16ms TTL/Open collector negative logic
	1 SHOT	By trigger switch, a single pulse injection to any phase angle of the power line	
Power capacity of EUT		AC240V Single phase, DC60V, 16A	
Power supply		100 ~ 240 VAC 50/60 Hz	
Power consumption		140VA	
Operating temperature and humidity		15 ~ 35°C 25 ~ 75% (No dewing shall occur.)	
Dimensions and weight		(W)430 x (H)249 x (D)420 mm (Projections excluded) / Approx. 19 kg	

OPTIONAL ACCESSORIES FOR INS-4020/4040

Injection Unit MODEL:IJ-4050



Input voltage: 8,000V (without 50 Ω terminated)
 EUT power capacity: 3-phase/5-wire AC415V/50A
 Coupling selection: By connecting cable
 Coupling mode: Normal or Common mode by SG short plug
 Line synchronization: Detects L1-L2 voltage and outputs the synchronization signal from SYNC OUT terminal
 Coupling attenuation characteristic: <-10dB ~ 1GHz
 Power supply: AC100~240V 50/60Hz 20VA max

Triangular wave unit MODEL:02-00099A



Pulse shape: Triangular wave
 Pulse voltage: 4,000V (with 50 Ω terminated)
 Pulse width: 1 μ s $\pm 30\%$
 Rise time: <40ns
 Polarity: Positive or negative

Outlet Panel MODEL:18-00059C



JP/USA type
 AC125V/20A max

Outlet Panel MODEL:18-00060B



CEE7 Schuko type
 AC240V/16A max

Outlet Panel MODEL:18-00061B



Terminal block type
 AC240V/16A, DC60V/16A

Circuit breaker box MODEL:18-00072A



Single phase AC240V/20A 50/60Hz, DC65V/20A

Mercury relay unit for replacement MODEL:INS-RL2K for INS-4020

Mercury relay unit for replacement MODEL:INS-RL4KB for INS-4040

INS series

OPTIONAL ACCESSORIES FOR INS

■ Coupling Adapter Model:CA-805B



Input voltage: 4,000V max
 Input pulse width: 50n~1 μs
 Diameter for clamping cable: 26mm max

■ Coupling Adapter MODEL:CA-803A



Input voltage: 2,000V max
 Input pulse width: 50n~1 μs
 Coupling ratio: 20:1
 Terminator: 50Ω terminator built-in
 Diameter for clamping cable: 15mm max

■ EMS Probe Kit MODEL: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 or magnetic fields
 Application for modules, components, conductors and ICs
 Convenient handling by pencil shape, light plug-type cable with snap-action coupling

■ Radiation Probe Model:01-00006A ~ 10A



Input voltage: 4,000V max
 Input pulse width: 50n~1 μs
 Loop diameter: 50, 75, 100, 150, 200mm
 Cable length: Approx. 2m

■ Coupling Adapter CA-806 Model:15-00007A



Input voltage: 2,000V max
 Input pulse width: 50n~1 μs
 Coupling ratio: 10:1
 Terminator: 50Ω terminator built-in
 Diameter for clamping cable: 27mm max

■ Attenuator for waveform observation MODEL:AT-810

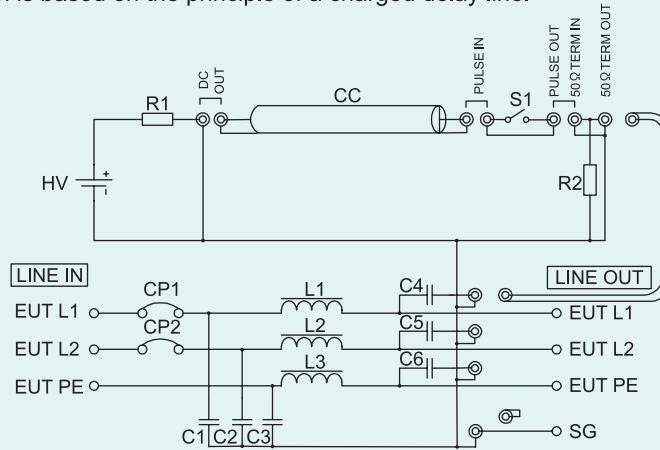


Input voltage: 4,000V max
 Input pulse width: 50n~1 μs
 Attenuation: 1:100 (40dB)
 Input impedance: 50Ω
 Output impedance: 50Ω
 Frequency characteristics: DC to 500MHz (-4dB)

INS 4020 and 4040

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

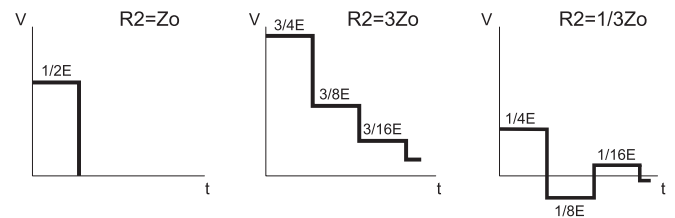
PULSE GENERATION PRINCIPLE

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.



$$V_p = R_2 / (Z_o + R_2) \times E$$

V_p: Peak voltage being measured across the terminating resistor

R₂: Value of terminating resistor

Z_o: Characteristics impedance of the cable

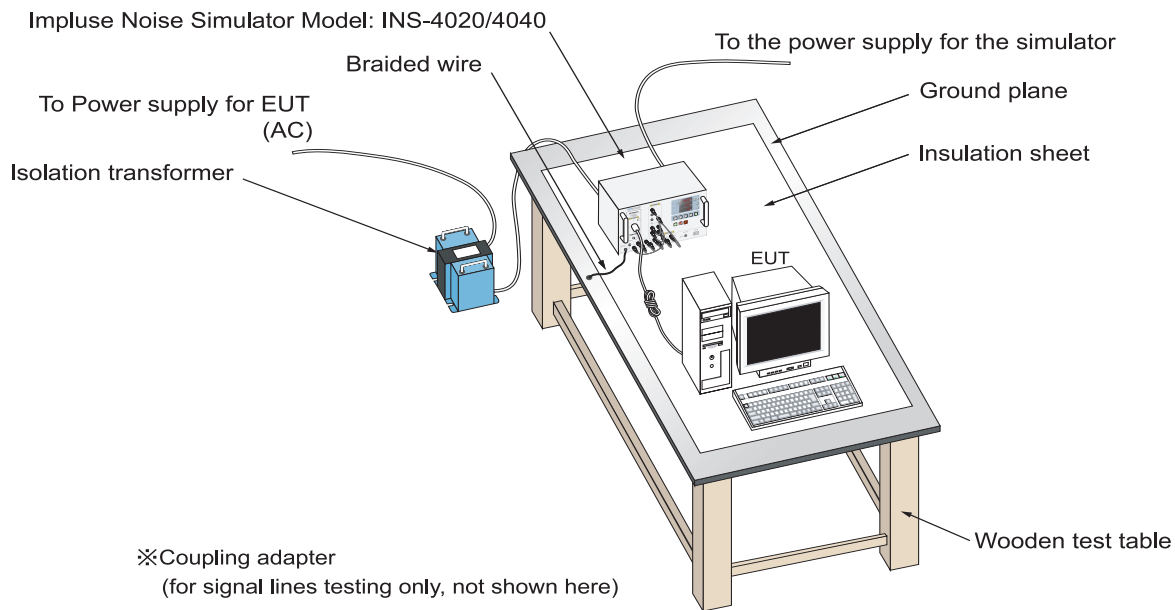
E: Output voltage from the HV power supply

INS 4020 and 4040

OUTLINES OF TEST SET-UP (EXAMPLE: INS-4020/4040)

Test environments

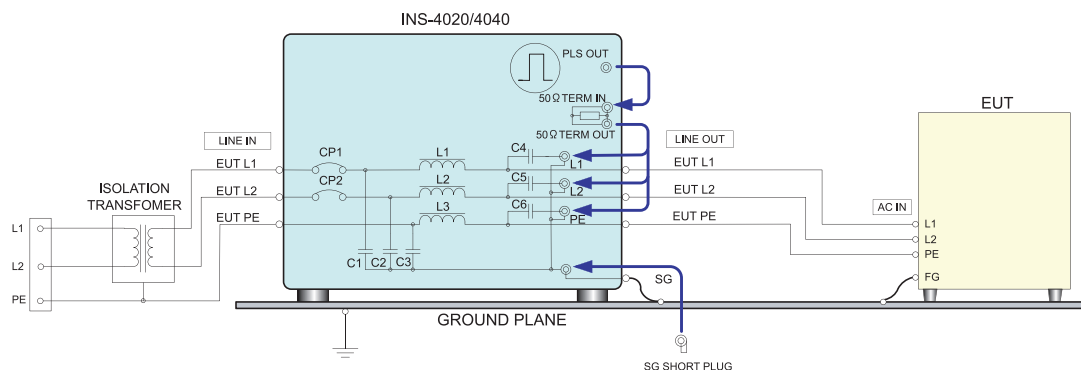
A recommended test set-up example is shown here.



(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

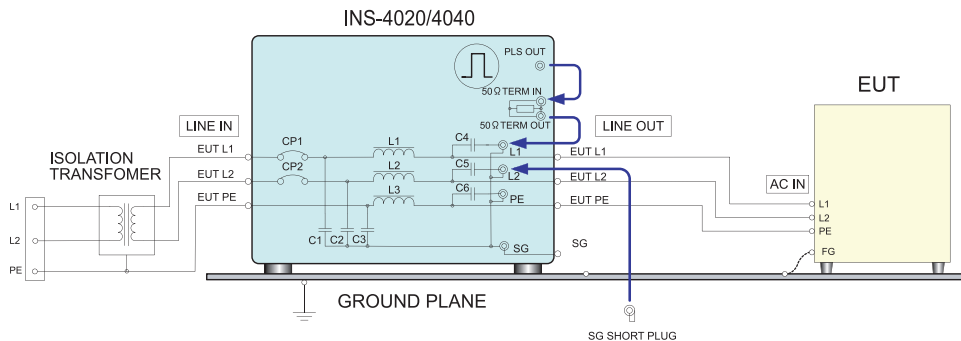


- (1) Mount the OUTLET PANEL matching the EUT and then plug the EUT AC cord to the panel receptacle. In case the AC cord is too long, fold it so that it might not cross with signal or other cables.
- (2) Plug the SG (=signal ground) connector with the SG short plug.
- (3) Connect the SG terminal of this 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.

INS 4020 and 4040

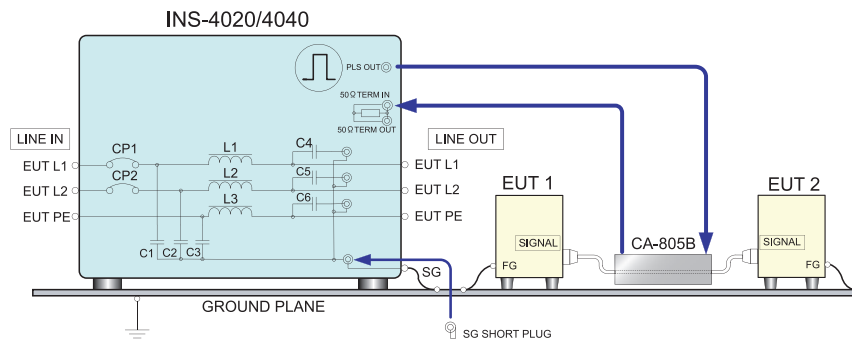
TEST SET UP

● 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 from the plane.
- (3) Select the line to which the pulses are to be injected by making a connection from 50ΩTERM 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 50ΩTERM 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.