NoiseKen

INSTRUCTION MANUAL

AUTOMOTIVE TRANSIENT SURGE SIMULATOR

MODEL ISS-7650

Noise Laboratory Co., Ltd.

Edition 2.00
AEJ00339-00E-1-E

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1. IMPORTANT SAFETY PRECAUTIONS

The following instructions are very important for safe handling of ISS-7650 (the “Unit”). Read them carefully before use.

1. **Do not use the Unit near flammable materials or fire sources. When used, there is a risk of fire due to pulses, etc.**
2. **Any person with medical electronics such as a heart pacemaker is not to operate the Unit. And, do not enter the test area while the Unit is operating.**
3. **To avoid electric shock, be sure that the power of the Unit, the power source, and the device under test ("DUT") are all turned OFF, and make sure there is no residual voltage before making any connections.**
4. **A number of safety recommendations are listed in the later chapter "BASIC SAFETY PRECAUTIONS". Be sure to read them before test environment settings, connecting and testing.**
5. **A powerful magnetic field is generated by the Unit at the time of pulse output. Give careful consideration to your testing environment to use the Unit.**
6. **Do not touch AC power voltage switch terminals or external output terminals. There is a risk of electric shock.**

2. APPLICATION FORM FOR INSTRUCTION MANUAL

We place an order for an instruction manual.

Model: ISS-7650

Serial No.: _____

Applicant:

Company name: _____

Address: _____

_____

Department: _____

Person in charge: _____

Tel No.: _____

Fax No. _____

Cut off this page "APPLICATION FORM FOR INSTRUCTION MANUAL" from this volume and keep it for future use with care.

When an INSTRUCTION MANUAL is required, fill in the above Application Form and mail or fax it to the following sales department of our company.

To: Noise Laboratory Co., Ltd.
1-4-4 Chiyoda Chuo-ku Sagamihara City,
Kanagawa Pref., 252-0237 Japan
Tel: +81-(0)42-712-2051 Fax: +81-(0)42-712-2050

Cut line

3. CONTENTS

4. PREFACE

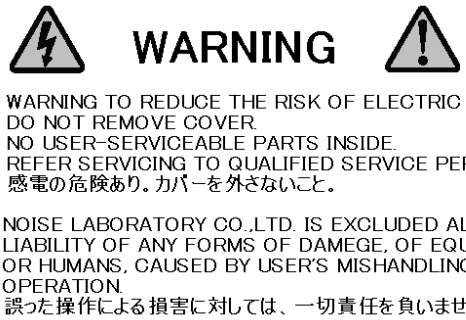
Thank you very much for purchasing ISS-7650 (the "Unit"). Please read this instruction manual (the "Manual") thoroughly prior to use of the Unit in order to attain the maximum and safe use of the Unit.

Remote Control Software to control the Unit by a PC is also attached. When you control the Unit through the software, please read the instruction manual of Remote Control Software thoroughly in addition to the Manual to ensure safety and correct procedures

- The Manual will let you operate ISS-7650 safely and make the most use of it if you strictly follow the operational procedures and the safety instructions.
- Keep the Manual handy whenever you operate ISS-7650.

5. BASIC SAFETY PRECAUTIONS

5-1. Symbols of Hazard



Indication of Warning

The following warning indication is placed on the upper left of the rear-panel of the Unit, and alerts a risk of electric shock.

This sign indicates the presence of "dangerous voltage/current" that may endanger persons.

This sign indicates "handle with care".

Refer to the Manual to protect human bodies and devices.

This sign indicates a protective ground terminal.

This sign indicates a connection to FG (steel case).

5-2. Basic Safety Instructions

1. **The Unit is grounded by the three line AC cord with a grounding conductor. To avoid electric shock, be sure to insert it to an outlet with a ground terminal.**
   【Precautions regarding connection and use】
2. **Use the AC cord which matches the source voltage, as the shape of the AC cord differs depending on the source voltage.**
   【Precautions regarding connection and use】
3. **When changing fuses, choose the same melt off type and rating. Also, be sure to unplug the AC chord before changing fuses.**
   【Precautions regarding use and safety】
4. **Do not supply the Unit with voltage or overload beyond the specification range. The Unit may be damaged if this is not obeyed.**
   【Precautions regarding connection and use】
5. **Use the input and output cables which meet the current and power capacity requirements.**
   【Precautions regarding connection and use】

6. **Before connecting the Unit, turn OFF the DC power source and the Unit, and make sure that there is no residual voltage. Connect each cable securely. Nonobservance may cause electric shock or damage to the internal parts of the Unit and connected devices.**
【Precautions regarding bodily injury and connection】

7. **When a protective cover, etc. of the Unit is removed for connection to the Unit, be sure to place the protective cover before supplying electricity. There is a risk of short circuiting or electric shock.**
【Precautions regarding connection and use】

8. **Use accessories and optional items supplied by the Company to ensure safe operation.**
【Precautions regarding connection and use】

9. **Do not open the Unit's cover, as voltages are generated within the Unit's enclosure,**
【Precautions regarding bodily injury】

10. **Do not block any ventilation openings of the Unit.**
【Precautions regarding environment】

11. **Do not utilize or store the Unit under extremely high or low temperature environment. (Operating environment：23℃±5℃ / Operating Humidity Range：25 - 75 %)**
【Precautions regarding environment】

12. **Do not use the Unit under high humidity or dusty conditions.**
【Precautions regarding environment】

13. **Should condensation form, fully dry the Unit before usage.**
【Precautions regarding environment】

14. **Do not wipe the body of the Unit with solvents such as lacquer thinner or alcohol. When the Unit gets dirty, wipe it with a detergent moistened fabric etc.**
【Precautions regarding use】

15. **Do not use the Unit near flammable materials or fire sources. When used, there is a risk of fire due to electric discharge, etc.**
【Precautions regarding bodily injury and environment】

16. **The Company and its sales agent assume no responsibility for any bodily injury, loss, damage or resultant damage arising from derelict misuse of the Unit on the part of the user.**
【Precautions regarding bodily injury, use, environment, and connection】

17. **Should the necessity of services such as repair, maintenance, or internal calibration arise, leave them to qualified service personnel only.**
【Precautions regarding use and safety】

18. **The Unit has a heavy load. Install it in the place possessing adequate strength. When moving the Unit, confirm the safety of the surrounding area, and more than one person should move it. Use casters etc. to fix the Unit after moving. Moving or falling down of the Unit may cause injuries.**
【Precautions regarding use and safety】

5-3. Loss of Warning Label

1. If the warning label is peeled off and missing or it gets dirty, replace it with a new one for safety.

2. If the warning label is lost, order a new one from our sales agent or the Technical Service Center of the Company.

6. MAIN FEATURES

6-1. Distinctive Features

- Capable of performing tests of Test Pulse 5a/5b in accordance with ISO/DIS 7637-2.2(2002-07-16), ISO/DIS 7637-2.3 (2003-05-20), and ISO7637-2 (Second edition 2004-06-15).
- Capable of detailed configuration of output wave voltage, pulse width, and device resistance.
  - Pulse 5a output voltage is variable from 20V to 200V in steps of 0.5V.
  - Pulse 5b output voltage is variable from 10.0V to 40.0V in steps of 0.1V.
  - Pulse widths of 40ms, 100ms, 200ms, 350ms, 400ms.
  - Output resistance Ri is variable from 0.5Ω to 8.0Ω in steps of 0.5Ω.
- Capable of producing Pulse 5b clipped waveform without externally attaching a zener diode.
- Pulse 5b clipped waveform is pre-eminent in evenness.
- The maximum DUT (Device Under Test) capacity is 60V 30A.
- Capable of selecting DC injection methods (See Figure 2).
- Capable of performing tests under harsher conditions than the Standards (to max 999 repetitions in sequence).
- A buzzer begins to ring 5 seconds before pulse output.
- The waveform at the time of 2Ω connection with output terminals(ISO Standard Annex D)is ensured.
- Allows oscilloscope observation of the current waveform flowing into DUT. Current and voltage waveforms can be examined at the same time with an oscilloscope because the current monitor output circuit is floating off from SG and FG. Voltage waveform is measurable from DC.
- Output terminals are the electric shock free safety plugs which protect against electric shock.
- Compatible with AC Input driving voltage of 100V, 110V, 120V, 200V, 220V, and 240V by a jumper switch on the rear panel.
- Capable of creating test conditions not limited to the Standards by utilizing optional Remote Control Software. Also capable of running user defined sequential tests (sequence) combining various test settings.
- Capable of noise unsusceptible stable transmissions by using an optional Optical Interface Unit and Remote Control Software for the purpose of communication between ISS-7650 and the PC (when used standalone without mounting to a rack),
- An optional ISS-7690 is capable of integrated pulse output when the Unit is installed onto System Rack ISS-7602 (Optional). The optional 50A type ISS-7690 can expand DUT capacity to 60V max, 50A max.

6-2. Schematic Circuit Diagram of the Unit

The schematic circuit diagram of the Unit is shown in Figure 1. The basic action is that the charge collected in capacitor C flows through internal resistance Ri and DUT connected between Output Terminals HOT-GND, and return to C when SW is turned ON.

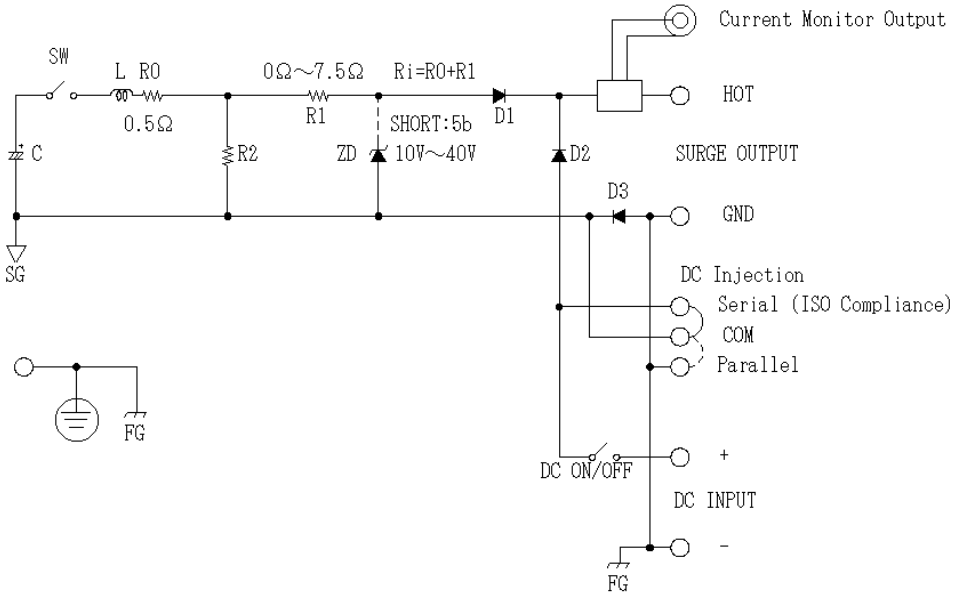
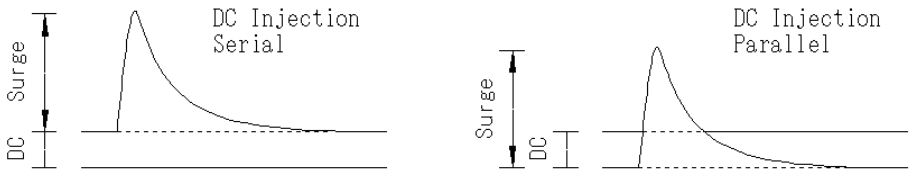


Figure 1 Schematic Circuit Diagram

- Output resistance Ri is the sum of R1 and direct current resistance R0 of L.
- When Pulse 5b is selected, ZD is connected and the waveform clipped at configured voltage will be output. ZD mounts the circuitry that has functions equivalent to a zener diode.
- Current Monitor Output lets you measure the current flowing to DUT. Current and voltage waveforms can be examined at the same time with an oscilloscope because the current monitor output circuit is floating off from SG and FG.
- You can select either serial or parallel DC Injection. An example of waveform output is shown in Figure 2. By short-circuiting D3, SG and FG electric potential becomes the same, and allows more stable waveform output.
- DC input is controlled by DC ON/OFF Switch. Take caution, as **the input DC voltage is output to the Output Terminals when the switch is ON.**



（In compliance with ISO Standards）

Figure 2　DC Injection Method

6-3. Regarding DC Injection Circuit

For the purpose of ISO complied serial injection, short circuit Serial and COM of DC Injection in Figure 1. To input DC, DC source is connected to DC INPUT. The following explains the pulse current flow in this state referring to the figure below.

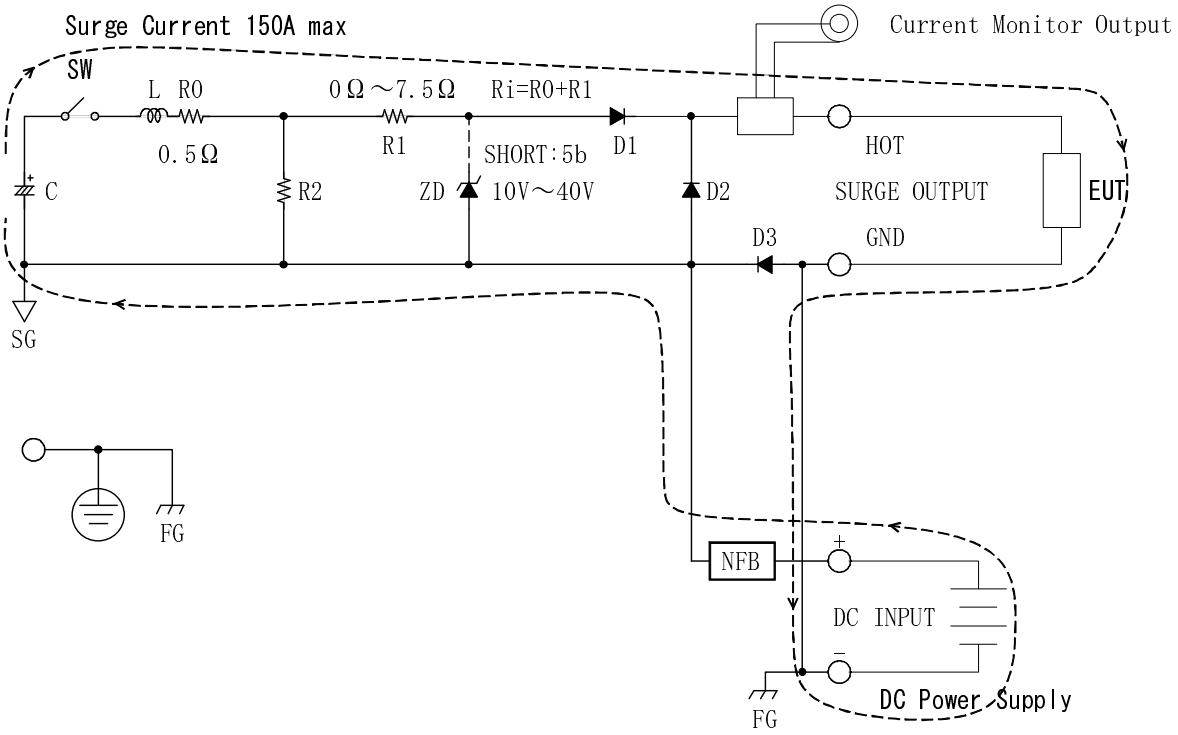


Figure 3 DC Input Serial Injection

1. When SW contactor is connected, the charge stored in capacitor flows through the circuit as pulse current.
2. Pulse current going out of HOT Terminal flows through DUT to GND Terminal.
3. As SG electric potential is the same as DC input, **pulse current is not able to flow through D3** and flows to the bottom of the schematic circuit and reaches Negative Terminal of DC INPUT.
4. Pulse current is output from the positive Terminal of DC Power Supply.
5. Pulse current will eventually return to the capacitor.

At this point, pay attention to DC Power Supply current-carrying capacity. Pulse current fluctuates depending on DUT impedance and the Unit settings, and it can reach up to 150A. Because of this, it is recommended that tests be performed with DC Power Supply which can manage this much current flow. Note that DC Power Supply may be destroyed if tests are performed by low capacity DC Power Supply.

When DC Power Supply contains an over current protection circuit, the circuit might work. But it may result in reduction of DC Power Supply output voltage, and may cause deviation of injected pulse waveform voltage + DC voltage from the Standards. An example follows.

The Unit setting (Pulse 5b) is as follows;

Uss	:	40.0V	Us	:	200V
Ri	:	1Ω	td	:	400ms

The injection method is serial.

Connecting the external DC Supply (with the maximum 60A over current protection circuit) to DC Input Terminal with the voltage of 27V, the two figures below gives the waveform difference between the open Output Terminal and 0.9Ω load.

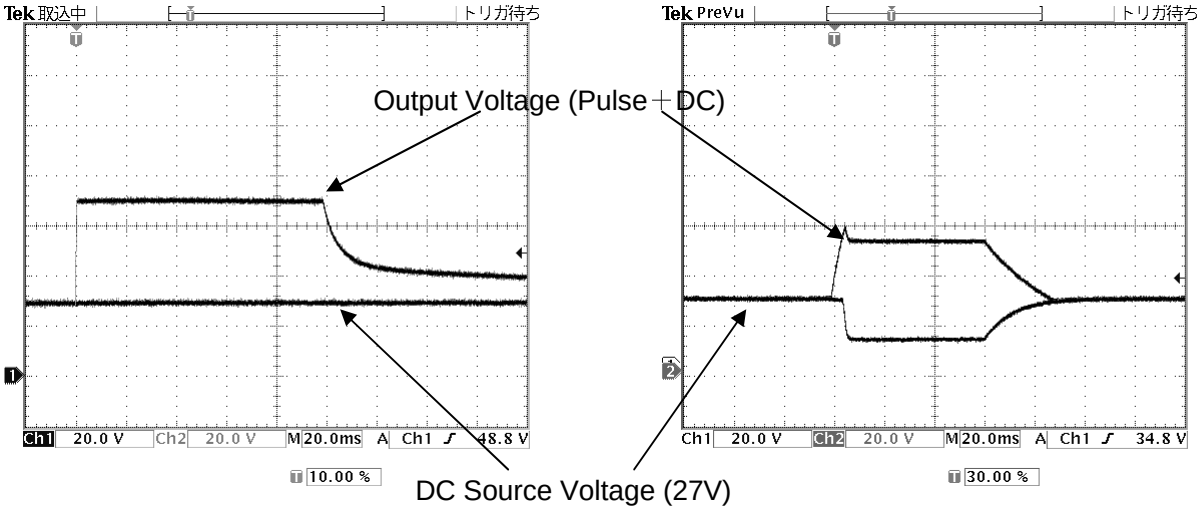


Figure 4 DC Serial Injection Waveforms (left: Output Open, right: Output 0.9Ω Load)

When the output is open (Figure 4 left), no current flows through output HOT-GND and DC Power Supply, DC Supply outputs +40V.

When output is 0.9Ω (Figure 4 right) with the pulse voltage 40V and DC Supply voltage 27V, the current flowing into DC Power Supply makes (40 + 27) / 0.9 ≒ 74.4(A), which exceeds the current capacity 60A of DC Supply. The waveform shows that the DC Source over current protection circuitry is working and dropping the voltage. As 40V is injected onto the decreased voltage, the output voltage is lowered.

To correct this problem, change DC Power Supply to a battery or change injection method to parallel injection.

6-4. Regarding ISO 7637-2 (Second edition 2004-06-15)

ISO7637-2 (Second Edition 2004-06-15) specifies the standard relevant to the transient pulse simulator for in-vehicle devices. This standard specifies the configurations of the test, the pulse voltage waveforms, the testing voltage level and the testing environment, etc. The Unit is capable of performing tests in accordance with this standard. The schematic test setup is excerpted from the standard and shown below. For details, be sure to refer to the ISO Standards.

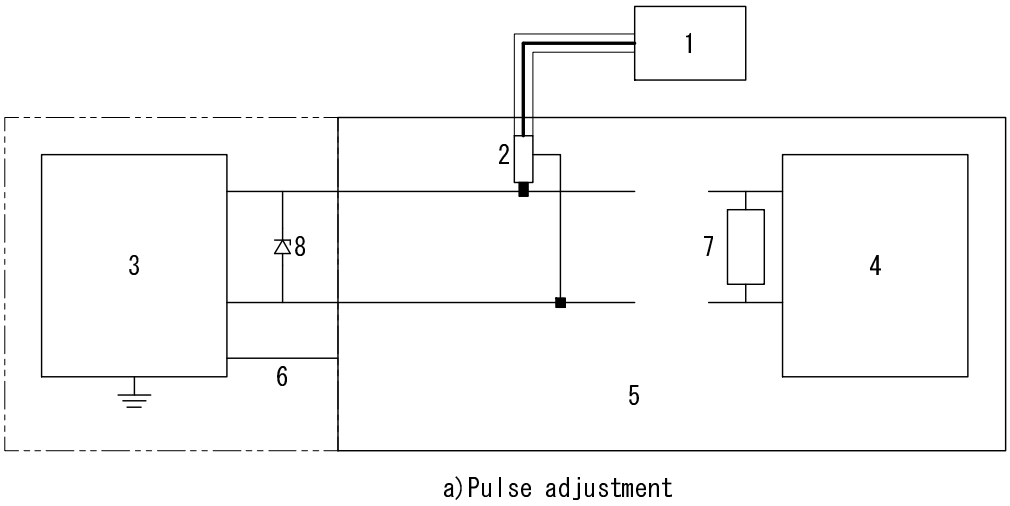


Figure 5 Test Configuration (For Pulse Veification)

When verifying the Unit waveform, do not connect DUT to output and leave the output open. Turn DC LINE ON (Circuit Breaker is also ON), short circuit DC INPUT ＋ and － terminals with the accessory Short Lead Cable (for Waveform Verification), and set the injection to serial injection. The standards for the output waveform under this condition is shown below. The standards for Pulse 5a with 2Ω connected to Output Terminals is specified in Annex D. The parameters are also given.

The standard provides the following;

(1) Pulse 5a Output Open (Top of Table 1）

(2) Pulse 5a Output with 2Ω （Annex D）(Bottom of Table 1)

(3) Pulse 5b Output Open (Table 2, td is the same as td of Pulse 5a Output Open)

The current flow changes dramatically compared with Pulse 5a Output Open, and td always changes when zener diode is connected to the Unit output as shown in Figure 5, **This standard contains inconsistency,** and it is not possible to realize the waveform (3) specified in the standard under the Figure 5 configuration. A test set-up other than a zener diode connection to the output must be used to output waveform satisfying (3).

The Unit is designed according to Figure 5 configuration, which models the conditions of real vehicles. Please note **td shown in Table 2 cannot be realized for this reason.**

Pulse 5a Waveform Standard (ISO 7637-2 (Second edition 2004-06-15))

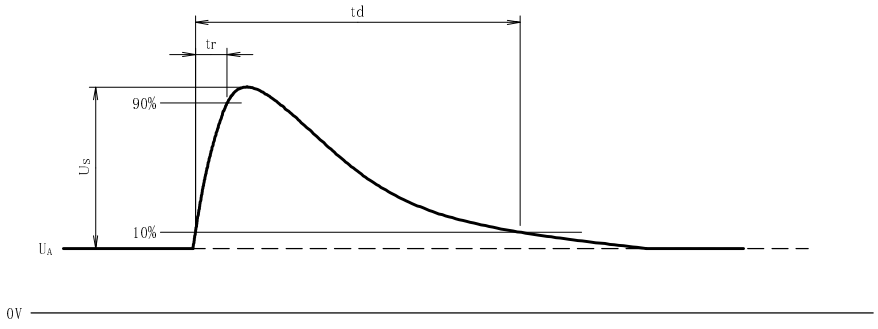


Figure 6 Pulse 5a Waveform

Table 1 Pulse 5a Parameters

	Parameters	12V System	24V System
Output Open	Us	65V~87V	123V~174V
	Ri	0.5Ω~4Ω	1Ω~8Ω
	td	40ms~400ms	100ms~350ms
	tr	10ms –5ms/+0ms	10ms –5ms/+0ms
Annex D	Us	50V±10V	100V±20V
	td	200ms±40ms	175ms±35ms
	tr	Not Specified	Not specified

Annex D Requirements

- 12V System (U_A=0V, td=400ms, Ri=2Ω, Us=100V, Output=2Ω Load)
- 24V System (U_A=0V, td=350ms, Ri=2Ω, Us=200V, Output=2Ω Load)

Pulse 5b Waveform Standard (ISO7 637-2 (Second edition 2004-06-15))

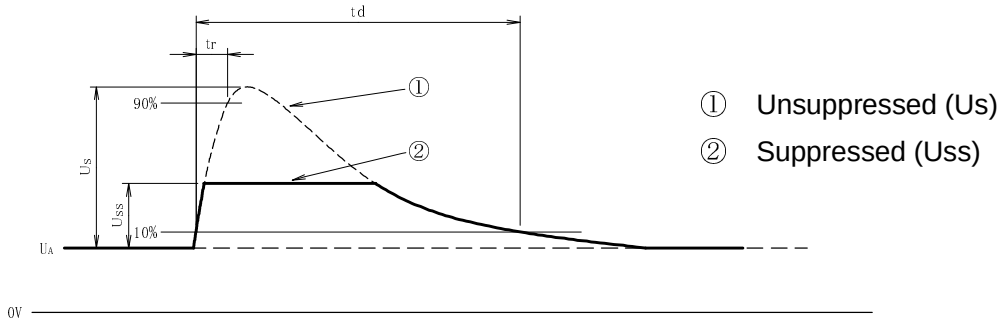


Figure 7 Pulse 5b Waveform

Table 2 Pulse 5b Parameters

Parameter	12V System	24V System
Us	65V~87V	123V~174V
Uss	As specified by customer	
Td	Same as unsuppressed value	

7. PART NAMES AND FUNCTIONS

Unit (ISS-7650)

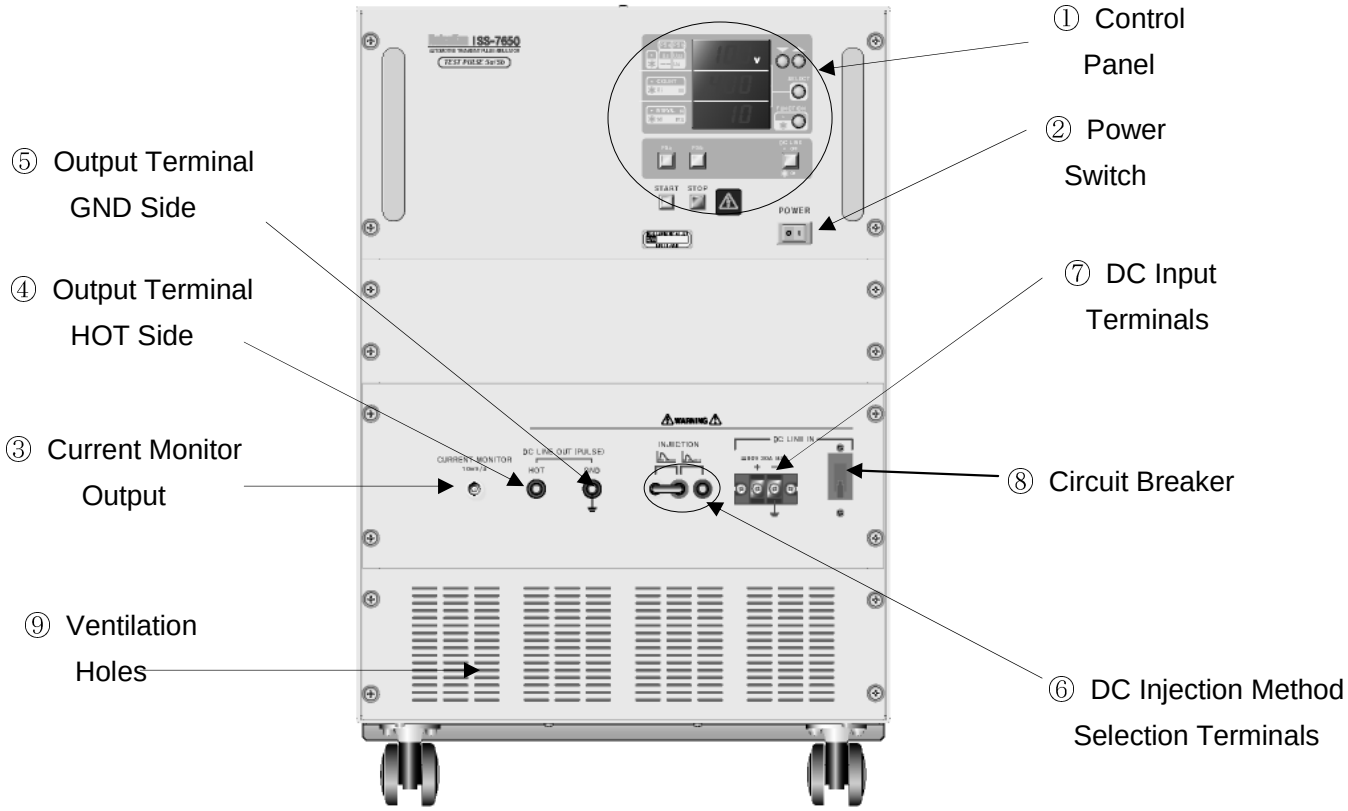


Figure 8 Front View

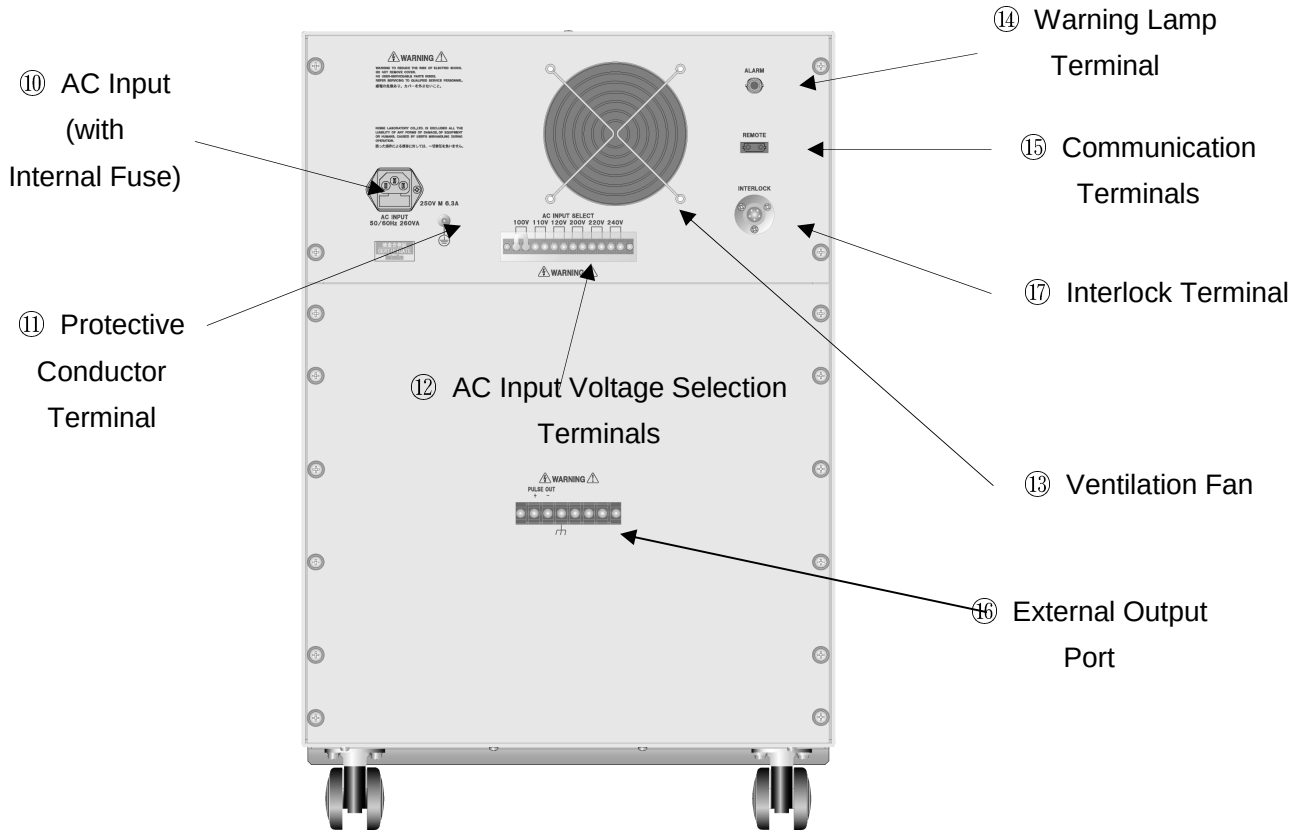


Figure 9 Rear View

① Control Panel

The “Control Panel” lets you set local settings.

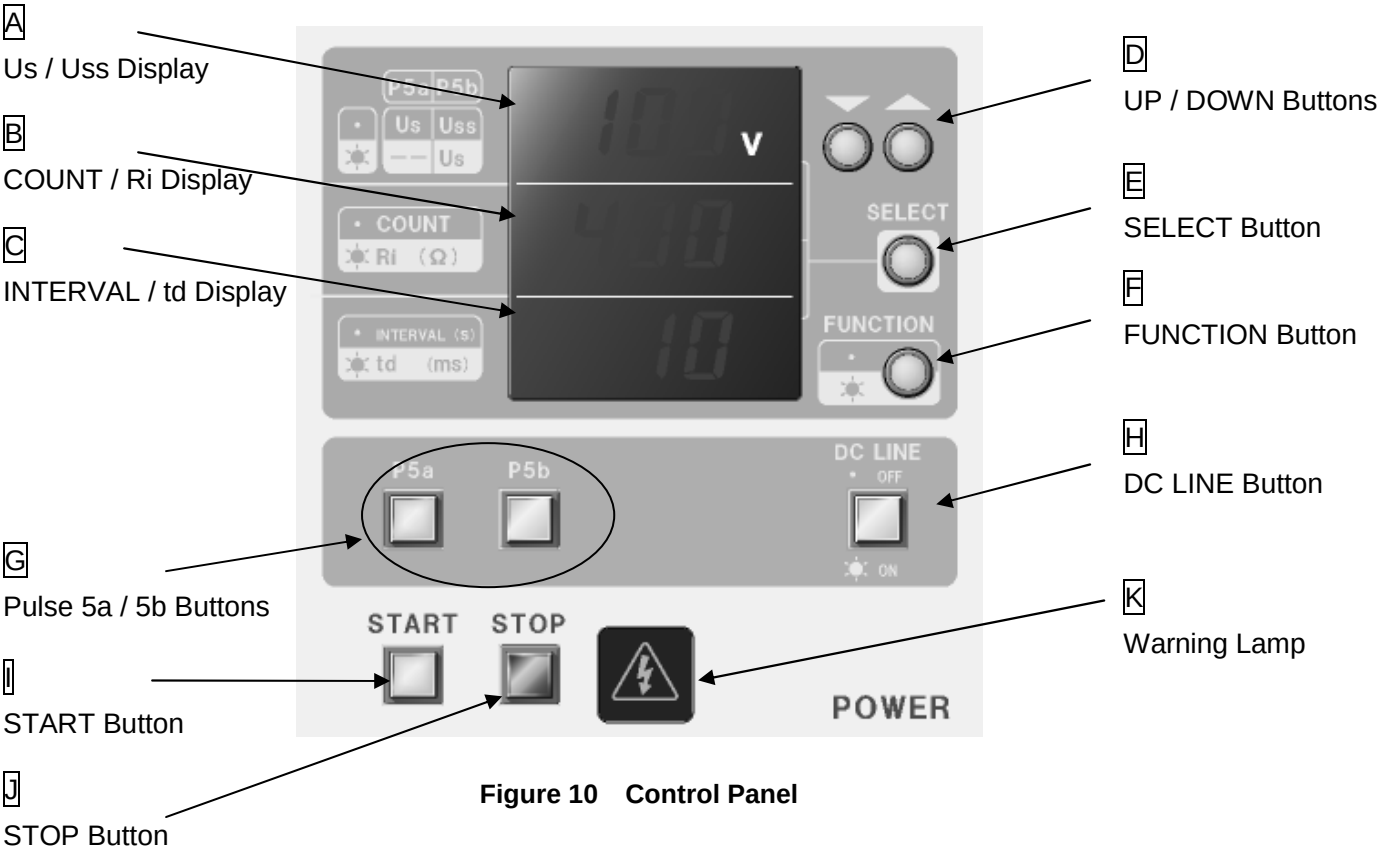


Figure 10 Control Panel

A Us / Uss Display

The “Us / Uss Display” displays either Us or Uss value. It shows Us value when P5a is chosen. It shows Uss value when P5b is chosen and “FUNCTION F” is not lit, and it shows Us when P5b is chosen and “FUNCTION F” is lit. When START Button is pressed, the monitor forcefully displays Us (P5a) or Uss (P5b). (FUNCTION light is unlit). As shown in Figure 6 and Figure 7, Us for Pulse 5a is the actual output voltage, and Uss for Pulse 5b is the actual clipping voltage. Also, Us value for Pulse 5b is the virtual open voltage. Therefore, Us for both Pulse 5a and Pulse 5b gives the same waveform, and the Unit shows the value in conjunction with the waveform. When Ri is 0.5Ω or td is 40ms, the maximum voltage of Us is 100V. To set it above 101V, set Ri larger than 1Ω and td larger than 100ms.

B COUNT / Ri Display

The “COUNT / Ri Display” displays either COUNT or Ri value. It shows COUNT when FUNCTION is not lit and Ri when lit. When START Button is pressed, (FUNCTION light goes off and) the monitor forcefully displays COUNT. COUNT is the number of sequential output under the same setting. It can be set from the minimum 1 to the maximum 999. Every time a pulse is output during testing, this value will decrease by 1 indicating the remaining number of pulse out put. When the remaining count becomes “0,” the test is complete, and the Unit enters STOP mode. Ri is the Unit’s output resistance. It can be set from 0.5Ω to 8.0Ω in steps of 0.5Ω, but Us of Pulse 5a or Pulse 5b must be below 100V to set it to 0.5Ω.

C INTERVAL / td Display

The “INTERVAL / td Display” displays either INTERVAL or td value. It shows INTERVAL when FUNCTION is not lit and td when lit. When START Button is pressed, (FUNCTION light goes out and) the monitor forcefully displays INTERVAL, and it counts down the time remaining for pulse output every second.

INTERVAL is the time from START to actual pulse output. It can be set between the minimum 30s to the maximum 999s. In repetition tests, it is the interval between successive pulse output. For example, if INTERVAL is set to 30s and COUNT is set to 3, the outputs will be timed as shown in Figure 11.

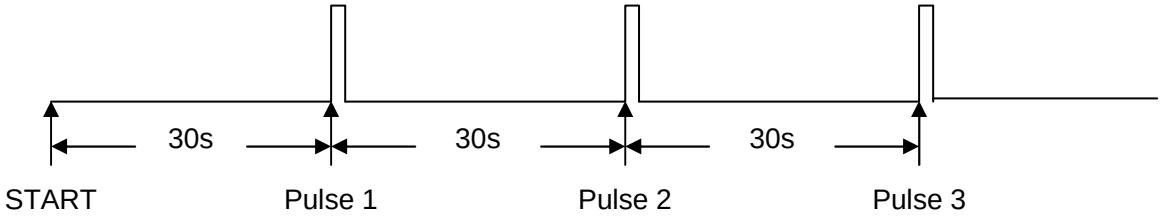


Figure 11 Pulse Output Timing

D UP / DOWN Buttons

The “UP / DOWN Buttons” raise or lower the value displayed in the currently selected display. Keeping holding the button down will accelerate the value increment/decrement. Even if you try to set the value beyond the allowable range, it stops at the moment it reaches the limit.

E SELECT Button

The “SELECT Button” lets you select one of the three row displays. The selected display repeats blinking. Every time the button is pressed, the selected row will change from row1 →row 2→row 3→row 1.

F FUNCTION Button

The “FUNCTION Button” lets you change the displays as follows:

When this button is not lit, the values displayed for P5a are from the top Us, COUNT, and INTERVAL. When it is lit, the display will be no display, Ri, and td.

When this button is not lit, the values displayed for P5b are from the top Uss, COUNT, and INTERVAL. When it is lit, the displays are Us, Ri, and td.

When START Button is pressed, FUNCTION Button lamp goes off, and the displays are forcefully changed to Us (Uss for P5b), COUNT, and INTERVAL. During START mode, holding down this button will light the lamp and “no display (Us for P5b), Ri, td” values can be confirmed.

G P5a Button, P5b Button

The “P5a Button, P5b Button” let you switch the output waveform between Pulse 5a and Pulse 5b. The waveform of the lit button will be output. ZD in Figure 1 is connected when START Button is pressed while P5b Button is lit. ZD is not connected in STOP mode even if P5b button is blinking.

H DC LINE Button

The “DC LINE Button” serves as the switch to control DC output, and moves the DC ON/OFF electromagnetic contactor in Figure 1. It is OFF immediately after the Power Switch is turned ON. When the button is turned ON, externally input DC is output from the HOT output terminal. It works independently of the START Button. You can also turn the button off in START mode (ON → OFF). In this case, the Unit will go into STOP mode, which is identical to “STOP Button I” pressing.

I START Button

By pressing the “START Button” for 1 second, the Unit will go into START mode keeping the current settings. When the test is finished or stopped by the STOP button, 5 seconds of electricity purge time is pre-set, and all the displays are kept lit. When you keep pressing this button for 1 second during the electricity purge, the Unit will go into standby mode, and will return to START mode after the purge is complete. Other buttons are functional during the purge time (except standby mode), and you can modify the settings.

J STOP Button

The “STOP Button” lets you stop START mode (incl. standby mode). At this time, the Unit will return to STOP mode without outputting pulses from the Output Terminals. **As STOP Button does not work with DC output , DC output is not turned OFF.** Turn DC Output OFF with DC LINE Button.

K Warning Lamp

The “Warning Lamp” turns ON when DC LINE is ON during STOP mode. Be aware that DC is output from the Output Terminals while the Warning Lamp is ON. Also, it blinks while the capacitor is charging, and will return to the pre-START mode when charge/discharge is complete (See the table below).

Table 3 Warning Lamp status

START／STOP	DC LINE ON/OFF	Display
STOP Mode	DC LINE OFF	Unlit
	DC LINE ON	Lit
START Mode	DC LINE OFF	Blink
	DC LINE ON	Blink

② Power Switch

The “Power Switch” powers the Unit. When flipped to the right, the power turns ON, and settings will be displayed on the control panel. The power turns OFF when flipped to the left.

③ Current Monitor Output

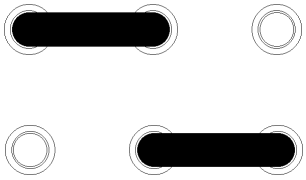
The “Current Monitor Output” lets you monitor current flowing to DUT. The current waveform at 10mV/A can be observed by connecting BNC cable to the oscilloscope and setting input resistance to 1MΩ. An offset current exists in the output. With compensating the offset current to the 0A as the reference, measure the difference.

④, ⑤ Output Terminals (HOT, GND)

The “Output Terminals (HOT, GND)” output the pulse. The red terminal is HOT, and black is GND. The black GND Terminal is connected to FG (see Figure 1).

⑥ DC Injection Method Selection Terminals

Select the DC injection method using the accessory DC Injection Selection Plug. Refer to Figure 2 for the difference in Serial and Parallel.
The connection layouts are shown in Figure 12.



Serial Method: In compliance with ISO

Parallel Method

Figure 12 DC Injection Selection Procedure

⑦ DC Input Terminals

The “DC Input Terminals” is capable of receiving input up to 60V 30A. Connect the accessory DC Input Cable or an equivalent one that match the DUT current. Make sure that “＋” and “－” are connected as directed by the signs.

⑧ Circuit Breaker

The “Circuit Breaker” serves as protection against DUT short circuits. It is inserted between the “+” of DC Input Terminal ③ and the Output Terminal (HOT) ⑤ (See Figure 3 NFB). Raise the lever for electrical continuity. It goes down (or trips) when an over current is detected. It trips when the current exceeds 40A (excluding transitional currents flow).

⑨ Vent Intakes

The “vent intakes” are for drawing in air to cool the internal devices in the steel case. Do not block them.

⑩ AC Input (Fuse)

The “AC Input (Fuse)” is the driving power connector for the Unit. Input the voltage set by the “AC Source Voltage Selection Terminals ⑫.” If you can not ground the Unit with the power supply cable, be sure to ground it with the “Protective Conductor Terminal ⑪.” Also the Fuse for the power source is built in here. It will melt off in emergencies such as extreme current flow. Should the melting off occur, turn the Unit and connected device powers OFF, check out the symptoms, the model name, and the serial number and contact our sales agent or the Technical Service Center. In the event of the Fuse check-up or replacement, disconnect the power cable from the Unit and other connected devices and “DC Input Terminals ⑦” connection cable before proceeding.

Do not use fuse other than the specified φ5mm×20mm 250V M 6.3A (M: Medium Slow).

⑪ Protective Conductor Terminal

The “Protective Conductor Terminal” grounds the Unit. It is connected to FG (Frame Ground).

⑫ AC Input Voltage Selection Terminals

The “AC Input Voltage Selection Terminals" let you select AC Input Voltage. The Unit is capable of running at 6 different voltages 100V, 110V, 120V, 200V, 220V, and 240V. “AC Input ⑩” voltage can be chosen by short-circuiting a pair of the terminals shown on Figure 13.

The factory default voltage is set to the voltage used in the exported country. Be sure to adjust the setting when you use the Unit under different voltage. Never fail to unplug the AC plug from the outlet when changing configurations.

Also, be sure to input electricity after placing the terminal covers since there is danger of electric shock if you touch the terminals.

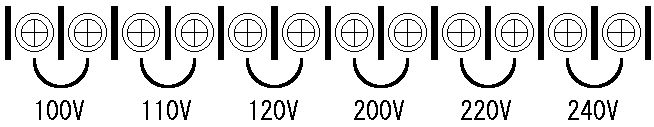


Figure 13 AC Input Selection Terminals

⑬ Ventilation Fan

The “Ventilation Fan” is for cooling the internal devices. Do not block the vents.

⑭ Warning Lamp Terminal

The “Warning Lamp Terminal” lets you connect Warning Lamp (Option Model: 11-00008A). The lamp is alight during START mode.

⑮ Communication Terminal

By connecting the Unit to a PC using the optional parts Optical Interface Unit (Option Model #: 07-00022A) and Remote Control Software (Option Model #: ISS-7601) through this “Communication Terminal”, parameter settings, START, and STOP can be controlled from the PC.

⑯ External Output Terminals

The “External Output Terminals” let you output pulses to ISS-7690. Do not connect anything to these ports when using standalone.

There is a risk of electric shock. Do not touch these terminals.

⑰ Interlock Terminal

The “Interlock Terminal” is for inserting the accessory Interlock Plug. Either removal of the Interlock Plug or opening connection between the Pins 1 – 3 on the Interlock Plug will result in disconnection of Interlock, and the screen shown in Figure 14 appears. Once this occurs, it cannot be recovered unless the power is turned OFF and turned ON again.

When the Interlock is disconnected, the system will go into the following status:

・STOP mode

・DC LINE OFF

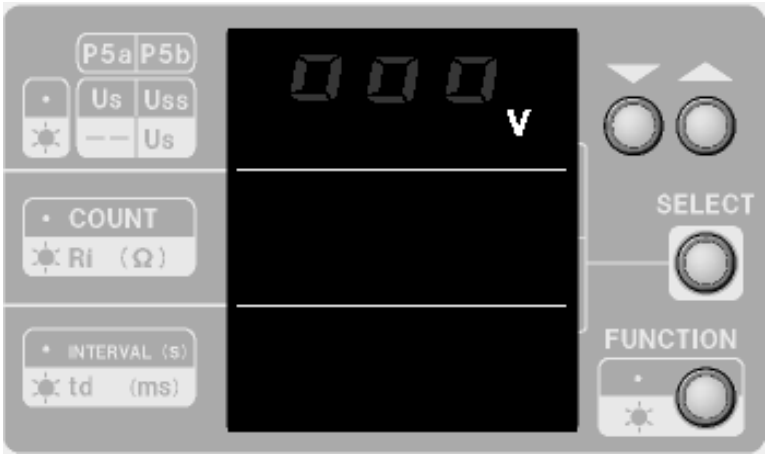


Figure 14 Display during Interlock Disconnection

Remote Controlling Interlock

1. The 1 and 3 pins on the accessory Interlock Plug on the rear panel are short circuited. Open this connection. This will result in Interlock disconnection.
2. Control the number 1 and 3 pins by shorting or opening them at the contact point or with the Open Collector. Input 100ms or longer sequential signals (to open). Opening these pins will result in Interlock disconnection.
3. The control procedure is shown in Figure 15
   Pin 1 voltage: approximately 4V (when open, the reference is Pin3)
   Pin 3 voltage: 0V (the same electric potential as FG)
   Pin 1 –Pin 3 short circuit current : less than 10mA
   Voltage identified as error: 2V to 4V
   Voltage identified as normal: 0V to0.4V (0.4V to 2V is in the indefinite range)

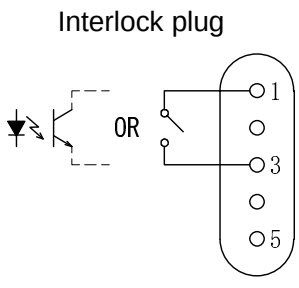


Figure 15 Interlock Control Procedure

8. TEST PROCEDURES

8-1. Pre-Operation Check

Check the installation environment, various wiring, and terminal connections.

- Confirming the Installation Location

  The waveform output may deviate from the specifications when any magnetic material is placed near the Unit (within 1m radius). And install the Unit after reading “the Important Safety Instructions” carefully.

- Inserting Interlock Plug

  Connect the accessory Interlock Plug to the “Interlock Terminal ⑫” on the rear panel. Confirm that either the Interlock Plug 1 - 3 Pins are short circuited or that interlock remote control signals (refer to Figure 15 Interlock Control Procedure) are input.

- Connecting DC Input Cable

  First, be sure to turn off (lower) the “Circuit Breaker ⑧.”

  Connect the accessory DC Input Cable to “DC Input Terminals ⑦” of the Unit, making sure ＋ and － polarities are connected correctly. The Unit may be damaged if they are connected reversely.

  Connect an appropriate cable for DC Input to the DUT, as large current may flow depending on the load.

- Selecting DC Injection Method

  Select either Serial or Parallel Injection. Refer to Figure 2 for the difference of waveforms, and refer to Figure 12 for connection.

- Connecting Output Cable

  Insert the plug of the accessory Output Cable into the “Output Terminals (HOT, GND) ④, ⑤.” The Unit has the ability to output high voltage and large current. Make sure that the connector is completely inserted. If the metal part of the connector is exposed, there is a risk of electric shock.

  Connect the other end of the Output Cable to DUT. To ensure compatible and replicable tests, it is important to keep the same cable-to-cable distance, the same cable length to DUT, and the same height from the ground plane every time.

- Confirming AC Source Voltage

  Never fail to confirm that the currently used AC source voltage is the same as the setting of “AC Source Voltage Selection Terminals” on the rear panel. When you make a mistake, the Unit will be damaged.

- Connecting AC Cable

  Insert the AC Cable into the “AC Input” on the rear panel of the Unit. If you cannot ground the Unit with the power supply cable, be sure to ground it with the "Protective Conductor Terminal".

- Turning the Unit Power ON

  After confirming all the items listed above, turn the Unit power ON with the “Power Switch ②.”

・ Turning on and setting up DUT

Turn the “Circuit Breaker ⑧” ON (raise the lever up). No current will flow to DUT at this time because the “DC LINE Button H” of the Unit is OFF. Next, set up DUT, peripheral devices, and testing environment according to the test plan.

8-2. Various Settings

The previous settings except DC LINE ON/OFF are preserved immediately after the Power Switch is turned ON. The displays are also the same as the settings immediately before turning OFF.

・ Selecting Pulse 5a / 5b

Select the pulse to be used for the test.

・ Setting Output Voltage (and Virtual Open Voltage)

Set the Output Voltage. Set Us only for Pulse 5a, and Us and Uss for Pulse 5b.

P5a Us setting procedure is as follows. **Set** “Pulse 5a / 5b Buttons G” **to P5a**. Turn “FUNCTION Button F.” lamp OFF. Then, press “SELECT Button E” several times until “Us/Uss Display A” **blinks**.

Finally, **set** the value shown on “Us/Uss Display A” with “UP/DOWN Buttons D” according to the test plan.

P5b Uss setting procedure is as follows. **Set** “Pulse 5a / 5b Buttons G” **to P5b.** Turn “FUNCTION Button F” lamp OFF. Then, press “SELECT Button E” several times until “Us/Uss Display A” **blinks.**

Finally, **set** the value shown on “Us/Uss Display A” with “UP/DOWN Buttons D” according to the test plan.

P5b Us setting procedure is as follows. **Set** “Pulse 5a / 5b Buttons G” **to P5b.** Turn “FUNCTION Button F” lamp OFF. Then press “SELECT Button E” several times until “Us/Uss Display A” **blinks**.

Finally, **set** the value shown on “Us/Uss Display A” with “UP/DOWN Buttons D” according to the test plan.

・ Setting Output Resistance

Set the output resistance Ri according to the Standards and the test plan.

Confirm that the “FUNCTION Button F” is **lit.** Then, press “SELECT Button E” until “COUNT / Ri Display B” **blinks**.

Finally, **set** the value shown on “COUNT / Ri Display B” with “UP/DOWN Buttons D”.

・ Setting td

Set td(Refer to “0 6-4. Regarding ISO 7637-2 (Second edition 2004-06-15)”.

Confirm that the “FUNCTION Button F” is **lit.** Then, press “SELECT Button E” until “INTERVAL / td Display C” **blinks**.

Finally, **set** the value shown on “INTERVAL / td Display C” with “UP/DOWN Buttons D”.

- Setting Number of Repetitions

  Set the number of pulse input repetitions. The standard is 1, but the maximum 999 repetitions can be designated. The Unit is capable of performing tests under harsher conditions than ISO Standards.

  Press the "FUNCTION Button F" to **turn the lamp OFF**. Then, press "SELECT Button E" until "COUNT / Ri Display B" **blinks**.

  Finally, **set** the value shown on "COUNT / Ri Display B" with "UP/DOWN Buttons D".

- Setting Interval Between Repetitions

  Set the interval between pulse outputs. The minimum setting is 30s.

  Confirm that the "FUNCTION Button F" is **lit.** Next, press "SELECT Button E" until "INTERVAL / td Display C" **blinks**.

  Finally, **set** the value shown on "INTERVAL / td Display C" with "UP/DOWN Buttons D".

- Turning DC LINE ON/OFF

  While the DC source is outputting, turn the "DC LINE Button H" ON (the **button lights**) to output DC voltage from the "Output Terminals (HOT, GND) ④, ⑤" of the Unit.

  Voltage will drop in the injection circuitry (D2 in Figure 1) when the current flows to DUT. Adjust the DC source voltage if the voltage across the DUT does not fall within the range specified in the test plan.

8-3. Starting and Finishing Test

Be sure to carry out "11 Pre-Start Checkup" prior to proceeding with a test.

Start the test after completing the checkups and various settings.

- Start

  Keep pressing the START Button for 1 second or more. A beep sounds, "Warning Lamp M" begins to **blink** and the Unit will enter START (run) mode.

- Pulse Output

- The pulse is output after elapsing the time set in the "Setting Intervals between Repetitions". The buzzer begins to ring 5 seconds before the pulse output. Keeping the switch (SW in Figure 1) ON for longer than 1 second triggers pulse output. Every time a pulse is output, value displayed in "Repetition COUNT" decreases by 1. The pulse output is repeated until this number becomes 0 or STOP Button is pressed.

- Finish

  The test finishes when the value shown in "Repetition COUNT" changes from 1 to 0. The Unit will discharge electricity internally and return to the STOP mode. The discharge takes 5 seconds, and the test cannot be resumed while discharging.

- Stop

  Pressing STOP Button during START mode is defined as "Stop". When a test is stopped, the Unit will discharge its electricity internally just like "Finish" and the Unit goes back to STOP mode. The energy stored up by charging is all discharged internally in the Unit. As the internal circuit must bear the loading, repeating "Stop" and "Start" more than necessary may shorten the life of the Unit. Do not repeat START/STOP intentionally.

Turn the Unit power OFF after the test has been finished (or stopped) and the displays become ready to enter (one of the displays will blink).

The recommended procedure for turning the Unit power OFF is as follows;

1. Put the Unit into STOP mode
2. Turn DUT power OFF, or make ready to turn it OFF.
3. Reduce output of DC power source to 0V.
4. Turn DC LINE OFF.
5. Turn the Unit power OFF.

9. REMOTE CONTROLLING BY PC

9-1. Preparation

The Remote Control Software on a PC (Personal Computer) lets you control the Unit externally. FG, SG, and PE of the Unit and the FG of the PC can be isolated.
Once communication with the Remote Control Software is established, you cannot control the Unit locally any more. To enable local control, the Unit must be turned off once.
The following items are necessary:

- Remote Control Software (Option ISS-7601)
- Optical Interface Unit (Option 07-00022A)
- PC (Personal Computer) (To be procured separately by the user)

9-2. Hardware Setup

- Confirm that the power of the Unit and the PC are both OFF.
- Remove the protective cap on the “Communication Terminal ⑮” on the rear panel of the Unit.
- Remove the protective rubber caps on the optical cable plugs.
  Insert the plug of the optical cable that comes with the optional Optical Interface Unit 07-00022A, into the Communication Terminal ⑮. Insert the other plug into the Optical Interface Unit. See Figure 16.
- Turn the Unit power ON.
- Turn the PC power ON, and start up the OS.
- Log in as a user with Administrator’s ID.
- Hot-plug the USB plug of the Optical Interface Unit into the PC.

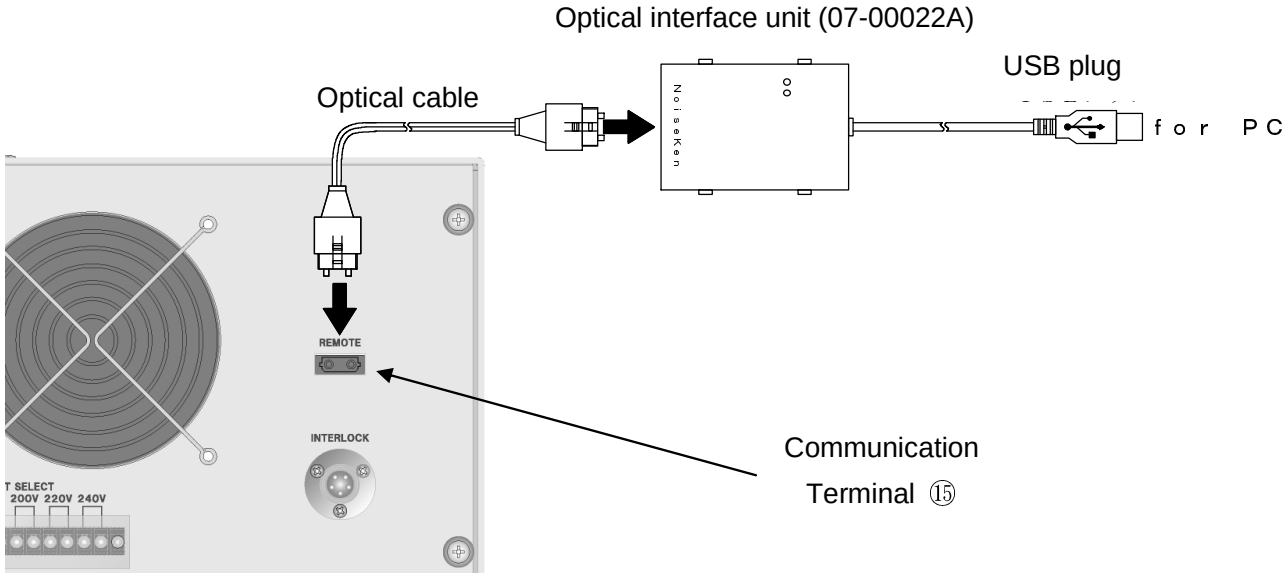
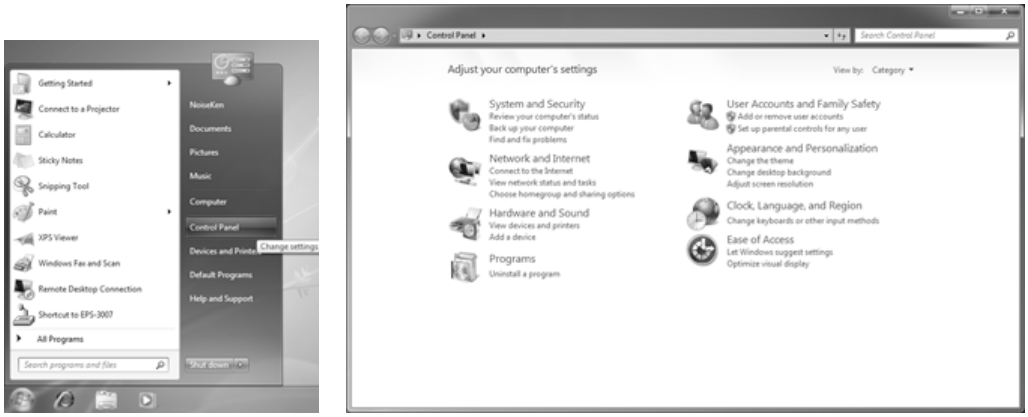


Figure 16 Hardware Setup

9-3. Installing the Software

Install the “Remote Control Software”ISS-7601 onto PC using the DISK of the Remote Control Software. Refer to the instruction manual of Remote Control Software for installation procedure.



Installing Software

9-4. Installing Remote Control Software

Refer to the instruction manual of Remote Control Software for installation procedure.

9-5. Installing Serial Port Drivers(At the time of Stand-alone Use)

Refer to the instruction manual of Remote Control Software for installation procedure.

9-6. Using Remote Control Software

Run the Remote Control Software and remote control the Unit. Refer to the instruction manual of the Remote Control Software for operation procedures.

9-7. Turning Off the Remote Control Software and the Unit

- **Be sure to** do the following steps;
- Set the Unit to “STOP” and “LINE OFF” with the Remote Control Software.
- Shutdown PC after closing Remote Control Software.
- Turn the Unit power switch OFF.
- Remove USB Cable.

10. SPECIFICATIONS

10-1. Specifications Common to Pulse 5a / 5b

Table 4　Product Specifications - Common Parameters

Parameter		Specifications
Compatible Standards		ISO 7637-2(Second edition 2004-06-15) Test pulse 5a/5b ISO/DIS 7637-2.3(2003-05-20) Test pulse 5a/5b ISO/DIS 7637-2.2(2002-07-16) Test pulse 5a/5b
Counter		1～999 Count　7 Segment LED
Cycle Timer		30s～999s　1s Step　7 Segment LED
Interlock		Control by External Input, Contact Point, or Open Collector L Level: 0V～0.4V　H Level: 2V～4V
Warning Lamp		Option　Model : 11-00008A
Energy Capacitor Can Store	12V System	Approx 233[J]　(Us=100V, td=400ms)
	24V System	Approx 806[J]　(Us=200V, td=350ms)
Energy Used By Output Terminal 2Ω	12V System	Approx 63.6[J] / Pulse　(Us=100V, Ri=2Ω, td=400ms)
	24V System	Approx 217[J] / Pulse　(Us=200V, Ri=2Ω, td=350ms)
Current Monitor	Output Unit	10mV/A
	Characteristic Freq	DC ～ 150kHz　Approx -3dB
	Error Tolerance	±5% (DC Measure Value)±0.8Amax (Offset) at 25℃
	Withstanding Voltage	DC60V (BNC Terminal Exterior：FG)
	Form	BNC Terminal (Oscilloscope Wave Verification 1MΩ　Input)
Circuit Breaker		Rated Current 40A
Remote Control from PC	Interface	Option: Optical Interface Unit Model:07-00022A
	Software	Option: Remote Control Software Model:ISS-7601
	Compatible OS	Windows 7/10 (ISS-7601 requires version 2.1.0.0 or later)
DUT Capacity		DC60Vmax, 30Amax
Pulse Injection Method		Serial (Accord with ISO)／Parallel　2 Choices Manually select with DC Injection Selection Plugs
Device Input Voltage		AC100V, AC110V, AC120V, AC200V, AC220V, AC240V (50Hz/60Hz) Tolerance：±10% for all　Select on terminals on FG Rear
Operational Temperature Range		23℃±5℃
Operational Humidity Range		25%～75%R.H. (No Condensation)
Perimeter Measurements		(W) 430mm×(H) 670mm×(D) 600mm (Excluding abutments)
Mass		Approx 100kg
Electricity Usage		Charging: Approx 600VA Standby: Approx 150VA

10-2. Pulse 5a

Pulse 5a Specifications (Refer to “6-4. Regarding ISO 7637-2 (Second edition 2004-06-15) “ regarding waveform measurement)

Table 5　Pulse 5a Parameters Output Port Open U_A=0V）

Parameter	12V System	24V System
Us	20V～100V　0.5V Steps ±10% (Set Value)	20V～200V　0.5V Steps ±10% (Set Value)
Ri	0.5Ω～8Ω　0.5Ω Steps ±20%(Static DC Resistance)	1Ω～8Ω　0.5Ω Steps ±20%(Static DC Resistance)
Td	40ms, 100ms, 200ms, 350ms, 400ms ±20%	100ms, 200ms, 350ms, 400ms ±20%
Tr	10ms -5ms/+0ms	10ms -5ms/+0ms

Annex D Specifications for the following 2 conditions:

- 12V System（U_A=0V, td=400ms, Ri=2Ω, Us=100V, Output Port=2Ω）
- 24V System（U_A=0V, td=350ms, Ri=2Ω, Us=200V, Output Port =2Ω）

Table 6　Tolerance Specified in Annex D

Parameter	12V System	24V System
Us	50V±10V	100V±20V
Td	200ms±20%	175ms±20%
Tr	Not Specified	Not Specified

10-3. Pulse 5b

Pulse 5b Specifications (Refer to “6-4. Regarding ISO 7637-2 (Second edition 2004-06-15) “ regarding waveform measurement.

Table 7　Pulse 5b Parameters (Output Port Open U_A=0V)

Parameter	12V System	24V System
Uss (Clipping Voltage)	10.0V～40.0V　0.1V Steps ±10% (Set Value)	10.0V～40.0V　0.1V Steps ±10% (Set Value)
Us (Open Voltage)	100V≧Us＞Uss	200V≧Us＞Uss
Td	Not Specified（※）	Not Specified（※）

※　Since ZD is placed in between Output Resistance and DUT as shown in Fig.2, td varies as Us, Uss, td, and Ri are changed.

11. WAVEFORM VERIFICATION

Before proceeding to tests, verify that the Unit is outputting the pulse normally.
Do the following steps to set up the Unit as shown in Figure 5:

1 For verifying the waveform, make the circuit between "HOT ④ and GND ⑤" output terminals open status, or connect the optional 2Ω Load for Waveform Verification: 06-00061A (recommended) in accordance with Annex D.

2 Observe the pulse waveform between HOT and GND directly with an oscilloscope.

3 Connect the accessory "DC Injection Selection Plug" into "DC Injection Method Selection Terminals ⑥."
Choose the terminal for "Serial Method".

4 Never fail to short circuit the + and – of the "DC Input Terminals ⑦" using the accessory Short Lead Cable (for Waveform Verification).
This is because Annex D of ISO Standards specifies U_A=0V for waveform verifications.

5 Be sure to turn the "Circuit Breaker ⑧" lever ON (up).

Set parameters to values shown on Table 8 using the "Control Panel ①." Confirm that the output pulse readings fall within the specifications in Table 9. All the COUNT settings are at the discretion of the user, and set INTERVAL to 30.

Table 8 Waveform Verification Settings

	Setting 1	Setting 2	Setting 3	Setting 4	Setting 5
Pulse	5a	5a	5a	5a	5b
Us	100V	100V	200V	200V	100V
Uss	—	—	—	—	10.0V
Ri	2Ω	2Ω	2Ω	2Ω	2Ω
Td	400ms	400ms	350ms	350ms	400ms
Output	Open	2Ω	Open	2Ω	Open

Table 9 Waveform Specifications in Each Setting

	Setting 1	Setting 2	Setting 3	Setting 4	Setting 5
Us	100V±10V	50V±10V	200V±20V	100V±20V	—
Uss	—	—	—	—	10.0V±1.0V
Tr	5ms~10ms	None	5ms~10ms	None	None
Td	400ms±80ms	200ms±40ms	350ms±70ms	175ms±35ms	None

If the measurement does not fall within the range, check the Unit installation environment. The values may fall out of the specified range when any magnetic material is closely placed. If there is no problem with the environment, the Unit may need repair. Contact our Technical Service Center.

Be sure to verify that the required waveform is output prior to performing the tests in accordance with the ISO Standards.

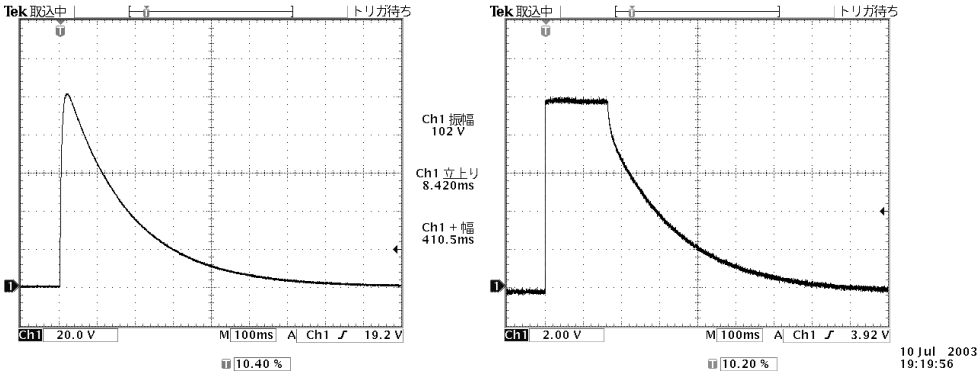
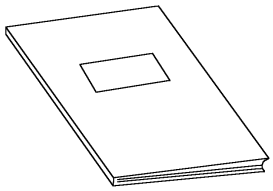


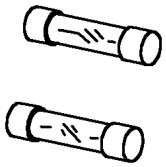
Figure 17 Setting 1 (left) and Setting 5 (right) Sample Waveforms

12. ACCESSORIES

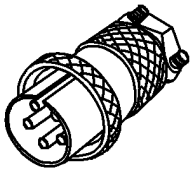
Instruction Manual



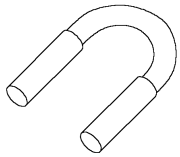
Spare Fuse 6.3A



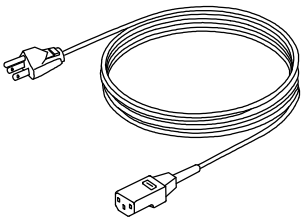
Interlock Plug



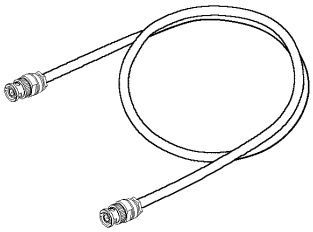
DC Injection Selection Plug



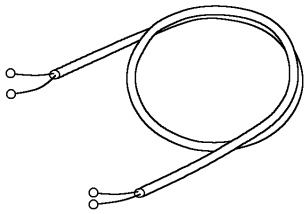
AC Cable



Current Monitor Coaxial Cable

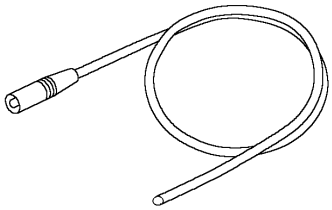


DC Input Cable 2m



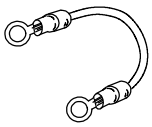
Output Cables 2m

（Red・Black　1 Each）

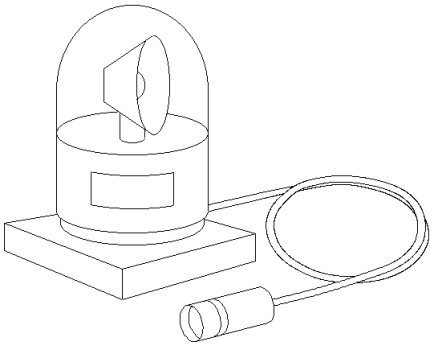


Short Lead Cable

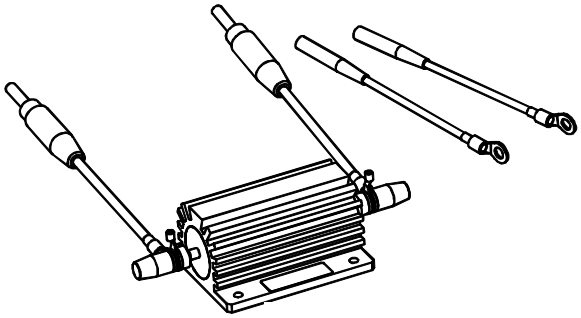
(for Waveform verification)



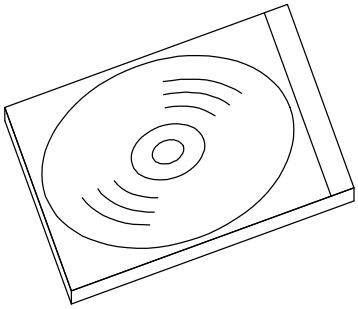
13. OPTIONS



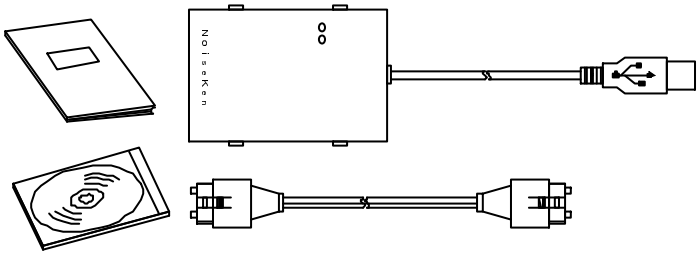
Warning Lamp 11-00008A



Waveform Verification
2Ω Load
06-00061A



Remote Control Software
ISS-7601



Optical Interface Unit
07-00022A

14. WARRANTY

Services

The following terms are applicable to the services provided by the Company to maintain and repair the Unit.

1. Scope

   The Unit and accessories and options provided by the Company are covered under this section.

2. Technical Service Fee

   Any repairs provided by the Company during the warranty period will be free of charge in accordance with the Limited Warranty. After expiration of the warranty period, actual cost for the repair will be charged to the user.

3. Ownership of Defective Parts

   All the defective parts replaced during the warranty period become the property of the Company. For paid repairs, they also become the property of the Company unless otherwise directed by the user.

4. Maximum Compensation

   In the event the user incurs damage due to malfunction of the Unit arising solely from the negligence and/or improper repair on the part of the Company, the Company will compensate for the damage. The maximum compensation amount shall be limited to the amount paid by the user at the time of purchase of the Unit. In no event, shall the company be liable or in any way responsible for incidental or consequential damages such as loss of profit or third party's claims to the user.

5. Wrong Parts, Missing Parts and Damage

   The company shall not be liable for loss of profit, business interruption, other incidental damage, special loss, punitive damage or third party's claims to the user directly or indirectly arising from suspension of testing activities due to wrong parts, missing parts, or damage of the Unit.

6. Service Refusal

   The company may not accept a repair order in the following cases:
   - More than 5 years have passed since the product discontinued
   - More than 8 years have passed after delivery
   - Required component for servicing already discontinued and no alternative is available.
   - Product changed, repaired or remodeled without obtaining a prior permission from the Company.
   - Product severely damaged to the extent it has lost its original form

Limited Warranty

In the event of failure during the warranty period, the Unit will be repaired or replaced free of charge. Decision of the repair method shall be left at the discretion of the Company. This limited warranty is applicable in Japan only.

1. Scope

   This warranty is applicable only to the Unit and its accessories.

2. Warranty Period

   One year from the date of delivery.

   For a location once repaired, the warranty period for same parts / same problems is 6 months from the time of repair completion.

3. Exceptions

   Regardless of the above, following will be excluded from the warranty.

   - ✧ Consumable parts replacement, including High Voltage Relay (if used)
   - ✧ Failure caused by negligence, or damage to the Unit.
   - ✧ Failure due to modifications made without the Company's authorization.
   - ✧ Failure due to repairs made by personnel not authorized by the Company.
   - ✧ Failure directly or indirectly arising from force majeure including but not limited to, acts of god, fire, war, rebellion and others
   - ✧ Failure due to shipping, vibration, falling, or impact shock after delivery
   - ✧ Failures due to use of the Unit under the improper environment.
   - ✧ When the Unit is taken out of the country

15. MAINTENANCE

1. Should the necessity of services such as repair, maintenance, or internal calibration arise, leave them to qualified service personnel only.

2. Limit your own maintenance works to exterior surface cleaning and functional tests.

3. When checking or changing replaceable fuses, turn OFF the power switches of the Unit and connected devices (if any).

4. Before cleaning the Unit, turn OFF the power switches of the Unit and connected devices (if any).

5. When face panels get dirty, wipe them lightly with a cloth moistened with water or mild detergent.

6. Do not open the Unit's covers unless such an action is expressly specified in the Manual.

16. NOISE LABORATORY SUPPORT NETWORK

- If a symptom which seems a trouble is found, inform the model name and serial number of the product together with the symptom to Noise Laboratory or your nearest sales agent of Noise Laboratory.
- When the product is returned to Noise Laboratory, write the state of the trouble, contents of your request, model name and serial number in a repair order, and pack the product and repair order sheet in the former package of equivalent suitable for transit and send them back.

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