NoiseKen

INSTRUCTION MANUAL

DAMPED-OSCILLATORY WAVE SIMULATOR

SWCS-931SD

NOISE LABORATORY CO., LTD.

1.11 edition
AEH00005-00E-0L

NOTICE

- The contents of this instruction manual are subject to change without prior notice.

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- The contents of this instruction manual have been thoroughly examined. However, if you find any problems, misprints, or missing information, please feel free to contact our sales agent who you purchased our product from.

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1. IMPORTANT SAFETY PRECAUTIONS

The following instructions are very important for safe handling of the **Damped-oscillatory wave simulator SWCS-931SD** (hereinafter “the Unit”).
They must be kept strictly to prevent users of the Unit from receiving harm or damage through using the Unit.
Read them carefully before use.

- The Unit may not be used by people fitted with electronic medical devices such as pacemakers and such people may not enter the testing site while the instrument is operating.
  Failure to follow this rule risks death or serious injury.
- The Unit may not be used in a location where fire is prohibited or there is a risk of explosion.
  Failure to follow this rule risks igniting a fire due to an electrical discharge.
- The Unit may only be used by trained EMC technicians (electrical technicians).
  There is a risk of death or serious injury, and of the emission of electromagnetic noise that exceeds the stipulated limits. Use the Unit in conjunction with appropriate measures for dealing with electromagnetic noise such as a Faraday cage or shielded room.
- Do not use the Unit for any purposes other than the EMC testing purposes described in this instruction manual.
  Failure to follow this rule risks death or serious injury.
- Use an AC power cable that is certified for use under the safety rules of the country in which the Unit is being used.
  Failure to follow this rule risks fire or electric shock. The supplied AC power cable is intended for Japan and North America. If the Unit is used in a country other than these, use a cable that is certified for use under the safety rules of that country.

Before setting up the test site, connecting the equipment, or starting testing, please read the Chapter entitled "Basic Safety Precautions" which contains additional safety advice.

Cut Line

2. APPLICATION FORM FOR INSTRUCTION MANUAL

To**:** Noise Laboratory Co., Ltd.

We place an order for an instruction manual.

Model: **SWCS-931SD**

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. TABLE OF CONTENTS

4. PREFACE

We thank you very much for buying SWCS-931SD. This Instruction Manual contains important information on the function, operating procedure and operating precautions of your SWCS-931SD unit.
In order to obtain the maximum performance of your unit, thoroughly read this Instruction Manual and use it as ready reference for operation.

- This manual is designed to help intended users who can comply with the given safety precautions and operating procedures to operate and utilize this product safely.
- Keep this Instruction Manual in a readily accessible place.

Features

- This unit generates a defined damped oscillatory waveform over a range of 100V to 1500V and applies it to the equipment and device under test to check for its surge withstand capability.
- A semiconductor switch is employed, offering more reliability and energy-saving feature than conventional unit with a mechanical switch.
- A wide range of repetition over 0.4Hz to 400Hz.
- Push button selection for output impedance and coupling capacitance from 50Ω to 200Ω a step of 10Ω and 0 (short), 470pF and 100pF, respectively. This feature eliminates the need for the operator to touch "HOT" line, offering easy and safe operation.

5. BASIC SAFETY PRECAUTIONS

5-1. Warning signs and their meanings

Means a warning.

If such a danger is not avoided, a potential danger which may result in a death or serious injury will be caused.

Means a caution.

If such a danger is not avoided, a potential danger which may result in a minor or medium degree of injury will be caused.

5-2. Basic safety precautions

1. **Any person who has an implanted pacemaker in the body should not operate this unit. Furthermore, such a person should not enter the test area while this unit is operating. Non-compliance may present a harmful effect due to malfunction of the medical device caused by interference.**
   【Precautions for human body and operation】

2. **Use of this unit in an explosive area such as "No fire" area etc. is prohibited. If used in such an area, it is liable to cause combustion or ignition due to discharge.**
   【Precautions for human body and environments】

3. **This unit generates high voltages (1500V maximum). So be extremely careful in handling it. Mishandling and careless operation of this unit will result in a deadly injury.**
   【Precautions for human body, operation, environment and connection】

4. **Test rig used in conjunction with this unit should be insulated against a minimum voltage of 1500V. Insufficient withstand voltage may lead to shock hazards, ground leak current or fire.**
   【Precautions for human body, operation and environments】

5. **When connecting to and setting for accessories, options and other equipment for tests, press STOP button of this unit beforehand and check to see that SURGE OUT lamp is off and the output VOLT meter reads 0V. Otherwise an electric shock due to high voltage may be caused.**
   【Precautions for connection】

⚠ WARNING 警告

6. Be extremely careful of an electric shock due to the generated surges.
【Precautions for human body and operation】

7. As high voltages are generated in the unit, do not open the cover of this unit. Touching inside the unit may cause an electric shock hazard.
【Precautions for human body】

8. NOISE LABORATORY and its sales agents shall have no liability against any accident resulting in injury or death, any damage to equipment or any resultant damage thereof which is caused by abuse or careless handling of this unit.
【Precautions for human body, operation, environments and connection】

9. While the unit is operating, never keep your eyes off the unit. When leaving the unit, be sure to press the STOP button beforehand and check to see that SURGE OUT lamp is off. Otherwise, a third person or equipment related to the test may be put in danger.
【Precautions for human body, operation and environments】

10. Do not connect a cable etc. to any terminal that is not required for test set-up. Be careful not to make a misconnection. Otherwise, you may receive an electric shock due to high voltage or the inside of the unit and connected equipment may be damaged.
【Precautions for human body, operation and connection】

11. For AC supply connection, be sure to use the supplied AC input cable in order to connect the PE terminal of the AC inlet of this unit to the safety ground. In case of not using the PE terminal, be sure to use the earth terminal beneath the AC inlet.
【Precautions for human body and connection】

12. Connect each connector and cable without fail. Otherwise, you may receive an electric shock due to high voltage or the inside of the unit and connected equipment may be damaged.
【Precautions for human body and connection】

13. Never use damaged connector or cable. Otherwise, you may receive an electric shock due to high voltage or the inside of the unit and connected equipment may be damaged.
【Precautions for human body and connection】

14. To ensure safety in operation, use the accessories and optional equipment supplied by our company. Use of others may degrade the safety and performance of this unit.
【Precautions for human body and connection】

⚠ WARNING 警告

15. The AC INPUT (AC inlet) terminals on the rear panel has a terminal for safety grounding connection. The GND terminal on the front panel is the signal ground terminal for the surge generator circuitry. For connection details, refer to "7. Operation".
【Precautions for connection】

16. Place the unit in a stable place, otherwise, it may fall and result in injury to operators and others.
【Precaution for humans and environments】

17. Never use this unit for other purpose than surge testing. NOISE LABORATORY and its sales agents shall have no liability against any accident resulting in injury or death, any damage to equipment or any resultant damage thereof that is caused by abuse or careless handling of this unit.
【Precautions for human body, operation, environments and connection】

⚠ CAUTION 注意

18. During test, high level of electromagnetic radiation may be generated depending on the type or nature of the EUT/DUT and thus causing interference with nearby electronic equipment and radio communication equipment. In such case, the user may have to take measures such as a faraday cage, shielded room, shielded cable and so on.
【Precaution for environments】

19. When connecting to and setting for accessories, options and other equipment for tests, turn off the unit power beforehand. Otherwise an electric shock due to high voltage may be caused.
【Precautions for connection】

20. Do not drop the unit or do not give strong shock to the unit. Do not put heavy object or sit down on this unit. When installing the unit, do not block the vent. Care should be taken not to put a foreign body or water into inside the unit through the vent, otherwise, the unit may be damaged.
【Precaution for environments】

21. The voltage rating for AC supply for this unit is shown on the inlet on the rear panel. Use this unit within the range of ±10% of the rating. Do not apply voltage exceeding this rated voltage, otherwise, the unit may be damaged.
【Precautions for connection】

22. Do not use nor keep the unit in a hot or cold environment, otherwise, the unit may be damaged or only exhibit limited performance.
(Operating temperature range: 15℃～35℃)
【 Precaution for environments】

⚠CAUTION 注意

23. If condensation is found, fully dry the unit before operating it, otherwise, the unit may be damaged or only exhibit limited performance.
【Precautions for environments】

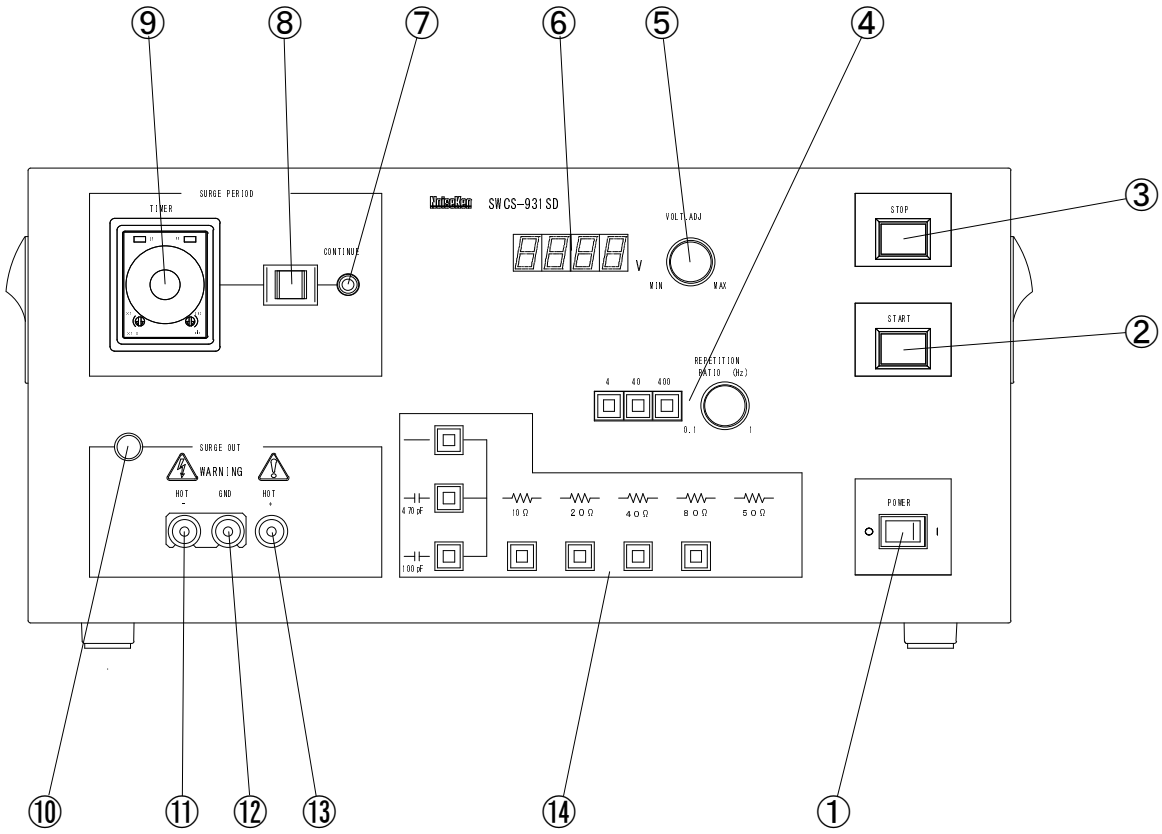
24. Avoid using this unit in a humid or dusty place, otherwise, the unit may be damaged or only exhibit limited performance.
(Operating humidity range: 25 ～75%)
【Precautions for environments】

25. Only authorities personnel can carry out repair or adjustment work on the internal circuit. Non-authorized personally servicing may lead to a degraded performance of this unit.

26. Do not wipe this unit with thinner, alcohol or similar solvent. When the body is dirty, soak a cloth in detergent, squeeze the cloth and wipe the body with it.

6. NAME AND FUNCTION OF EACH PART OF THIS UNIT

【 Front panel 】



① POWER switch : Controls the mains power input to the unit. This switch pressed to the vertical bar position places this unit in the ON status.

② START switch : Press this button to start surge generation. "⑩ SURGE OUT lamp" is on when the unit generates surges.

③ STOP switch : Press this button to stop the test. When this button is pressed, "⑩ SURGE OUT lamp" turns off.

④ REPETITION RATIO controls : Push buttons and rotary knob to control the repetition frequency of the surges. The push-buttons select 4, 40 or 400Hz and the knob provides a multiplication from 0.1 to 1. In combination, repetition frequency from 0.4Hz to 400Hz is available.

⑤ VOLT ADJ knob : Controls the peak amplitude of the surge. Adjustment from 0V to 1500V is available. (the waveform specifications are assured only over a range of 100V to 1500V)

⑥ Surge Voltmeter : Indicates the peak amplitude of the surge.

⑦ CONTINUE lamp : Alight while selecting CONTINUE mode. In this mode, pressing "② START switch" makes the surge output start, and pressing "③ STOP switch" makes the surge output stop.

⑧ TIMER/CONTINUE mode select switch : Switches the mode for how to output the surge, TIMER mode or CONTINUE mode. If it is turned to "TIMER" side, "⑨ TIMER" becomes effective. If it is turned to "CONTINUE" side, this unit works continuously.

⑨ TIMER : Sets the surge output period. It is effective when "⑧ TIMER/CONTINUE mode select switch" is turned to "TIMER" side. In this mode, the surge output starts when "② START switch" is pressed and the surge output stops when output time reaches to the time set by this timer. Pressing "③ STOP switch" while outputting surge also makes the surge output stop.

⑩ SURGE OUT lamp : Illuminates while the unit is generating surges.

⑪ HOT − (negative) terminal : Generates the negative polarity output reference to GND. For this purpose, HOT + (positive) terminal and "⑫ GND terminal" shall be short-circuited by the supplied short-bar.

⑫ GND terminal : The signal ground of the generator circuitry, providing a potential reference.

⑬ HOT + (positive) terminal : Generates the positive polarity output with reference to GND. For this purpose, HOT − (negative) terminal and "⑫ GND terminal" shall be short-circuited by the supplied short-bar.

⑭ Output impedance and coupling capacitance selectors : Push-buttons select the desired output impedance and coupling capacitance.

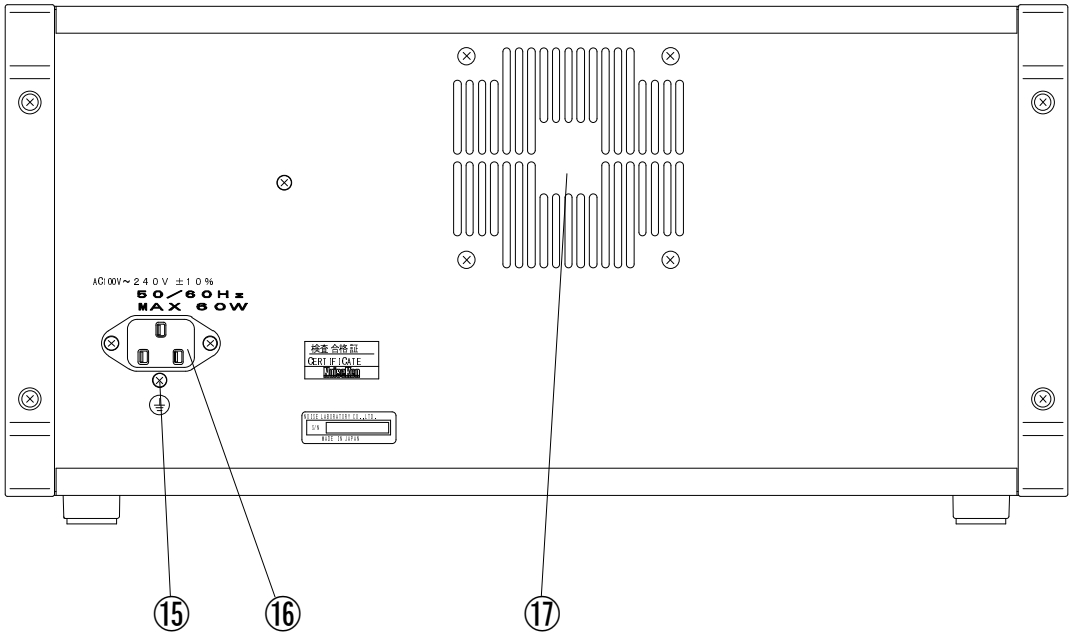
Output impedance selection

The push-buttons to control output impedance toggles between on and off. The lamp indicates the relevant resistor has been inserted into the test circuit. Only 50Ω resistor is fixedly inserted. The others are all selectable between in and out. This feature provides selection of 50Ω to 200Ω at a step of 10Ω.

Coupling capacitance selection

the three push-buttons operate exclusively. Only one of them is operative.
The button with no capacitor sign is provided to select short-circuit.

【 Rear panel 】



⑮ PE screw : Screw for safety grounding connection. When the unit cannot be grounded through the AC cable. Use this screw.

⑯ AC inlet : AC input for this unit. Supply 100V to 240V AC 50/60Hz.

⑰ Ventilation fan (aspiration) : Do not block this ventilation intake the unit is operating.

7. ACCESSORIES

Before using the instrument, please check that none of the associated items are missing.

- AC input cable ……1 pcs.
- Short bar ……1 pcs.
- Accessory bag ……1 pcs.
- Instruction manual (This booklet) ……1 pcs.

8. OPERATION

⚠ WARNING 警告

Be extremely careful of an electric shock due to the generated surges. Before connecting the EUT/DUT to this unit, be sure to turn off power supply to EUT/DUT. Otherwise an electric shock due to the generated surge or power supply may be caused.

8-1. Preparation

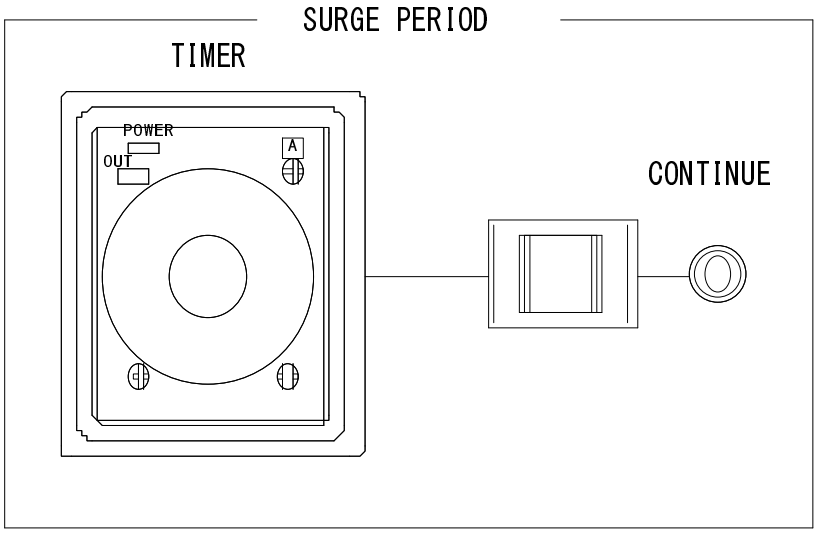
For operation of this unit, appropriately grounded AC mains (50/60 Hz) is necessary. Connect this unit to power supply with 50/60 Hz.

8-2. Connections and settings

8-2-1. Connections and surge polarity setting

1. Connect this unit to AC mains.
2. Select the desired surge polarity by short-circuiting either HOT terminal to GND terminal with the supplied short-bar. Connection of HOT – (negative) to GND terminal lets the unit generate positive surges. Connection of HOT + (positive) to GND terminal lets the unit generate negative surges.
3. Connect the equipment or device under test to SURGE OUT. Use cables with 1.5kV or higher withstand capability.

8-2-2. Test duration setting



1. Check to see that the connection is correct.
2. Turn on the unit. Check to see Surge Voltmeter illuminates.

3. Select the desired operation mode by TIMER/CONTINUE mode select switch.

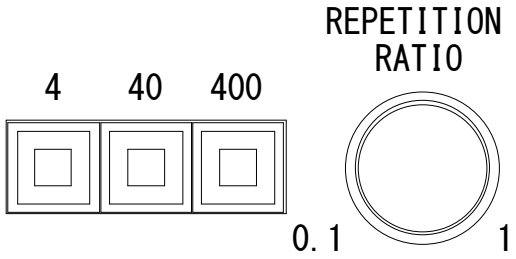
Operation in TIMER mode: (Press the left side of the button.)

The TIMER setting knob provides setting for test duration time. The time range selector switch at the lower left provides selection among 1.2/3/12/30 and the time unit selector at the lower right provides selection among sec/10s/min/10min/hour/10hrs. All these three combined provide the time range from 1.2 seconds to 300 hours. The upper right operating mode selector shall always be set to A and never change this setting. In TIMER mode, the unit starts generating surges when the START button is pressed and automatically stops surge generation after a lapse of the preset duration. The operator can also forcibly stop the surge generation by pressing STOP button

Operation in CONTINUE mode: (Press the right side of the button.)

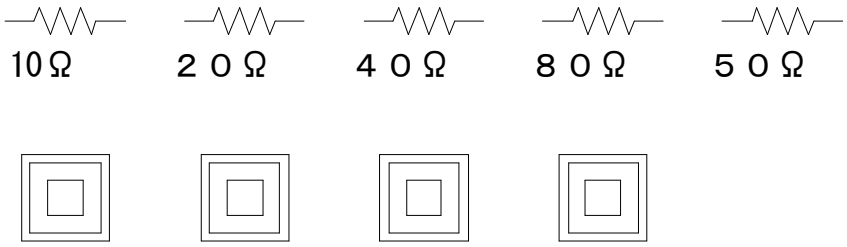
In CONTINUE mode, the unit starts generating surges when the START button is pressed and continues it until STOP button is pressed.

8-2-3. Surge repetition frequency setting



✧ Select the maximum frequency by pressing either 4Hz, 40Hz or 400Hz button. The adjacent knob controls supplementary adjustment by offering a multiplication from 0.1 to 1.

8-2-4. Output impedance setting



✧ In the output stage of the surge generator, resistors can be selectively inserted. The block diagram shown in a later page will help you to understand the concept.

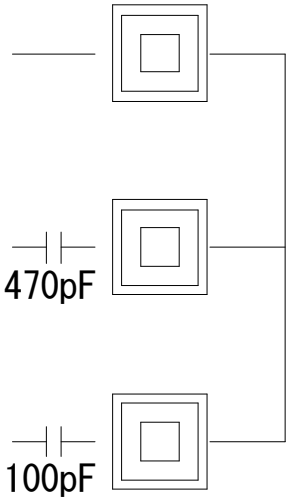
✧ Press bush buttons. Illuminated buttons are operative; the relevant resistors have been inserted. The 50Ω resistor has been fixedly inserted into the circuit. Add, therefore, 50Ω to the total values of illuminating buttons.

✧ The push buttons toggle between on and off. If a luminous button is pressed, the light is turned off and the connected resistor is disconnected.

✧ When any of the push buttons is pressed, the unit suspends surge generation and resume

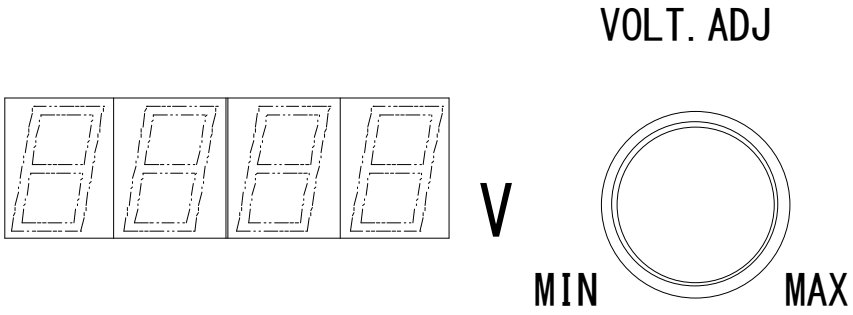
operation with a newer impedance setting.

8-2-5. Coupling capacitance setting



- ✧ In the output stage of the surge generator circuit, a capacitor can be inserted. Refer to the block diagram.
- ✧ Three selections are available: none (short), 100pF and 470pF. Two or more selection at the same time cannot be done.
- ✧ When any of the push buttons is pressed during surge generation, the unit suspends surge generation and resumes operation with a new capacitance setting.

8-2-6. Surge voltage setting



- ✧ Adjust to the desired voltage by rotating the VOLT ADJ knob. Rotate it clockwise to higher the voltage and counterclockwise to lower the level.

8-3. Execution of test

1. Press START button. SURG OUT lamp will turn on.
2. In TIMER mode, the unit automatically stops surge generation. To terminate surge generation, press STOP button.
3. In CONINUE mode, the unit continues to generate surges until the STOP button is pressed.

8-4. Surge waveform verification

Before starting test, pre-operation check for verifying that this unit outputs waveform as prescribed on the specification is recommendable. The procedure is as follows.

8-4-1. Equipment preparation

- Oscilloscope with a frequency bandwidth: DC to 100MHz
- HV probe with a frequency bandwidth: DC to 10MHz and 10kV withstand voltage
- 10:1 probe (500V withstand voltage)

8-4-2. Connection

① For safety, check the following conditions:

- This unit is in STOP status.
- No equipment or device under test has been connected to this unit.
- No test cable or test lead has not been connected to this unit.

② Measurement equipment connection

Connect the ground lead of the HV probe to the GND terminal of this unit and hot tip to the HOT terminal, respectively.

8-4-3. Measurements

① Turn on the unit. Rotate VOLT ADJ knob fully counterclockwise and then press START button.

② Rotate VOLT ADJ knob clockwise until the Surge Voter reads 500V.

③ Observe the waveform on the scope screen and reads the peak amplitude.

④ Measure at the 100V to 1500V setting. (Refer to "9-1. Specifications ".)

NOTICE The purpose of this verification is to observe waveform easily.

For more precise verification, prepare two high voltage probes, connect them to HOT(+) and HOT(−)terminals, and observe waveform with differential mode. Connect GND of the probes to PE screw on the rear panel of this unit at this time.

9. TECHNICAL SPECIFICATIONS

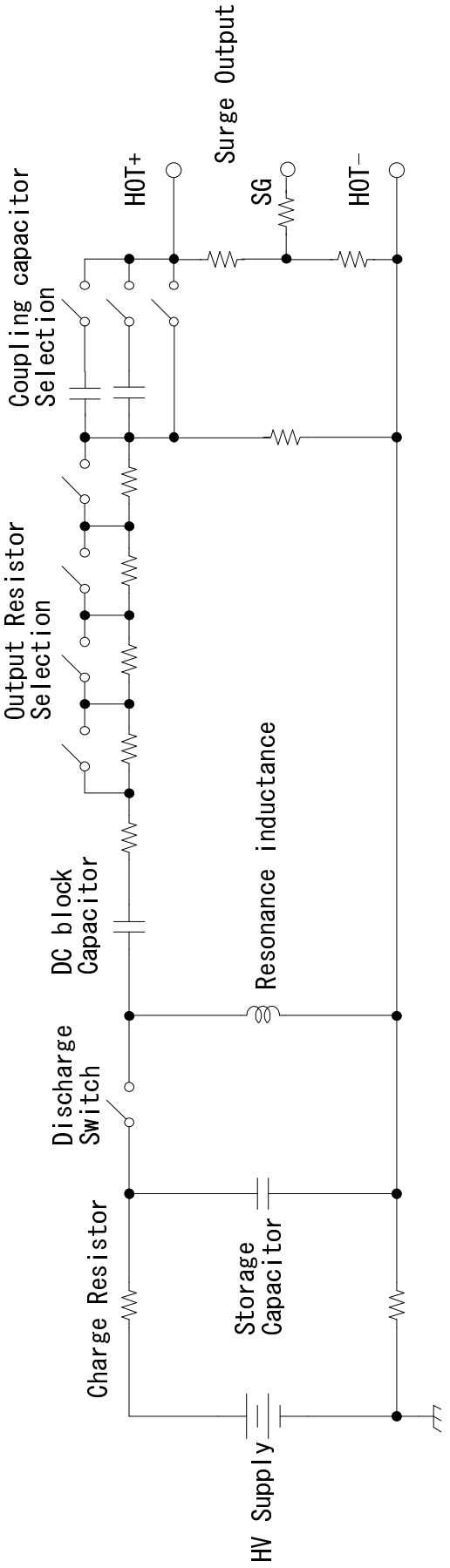
9-1. Specifications

Parameter	Specifications
Surge waveform	Damped oscillatory waveform
Oscillation frequency	1.5MHz ±0.2MHz
Repetition	0.4Hz to 400Hz (3 stage selection, continuously variable)
Output voltage	Output: 0.1kV～1.5 kV, continuously variable Accuracy:±10% of the reading (*1)
Polarity of the first peak	Positive and negative, short-bar selection
Rise time	Rise time of the first peak <100ns
Envelop decay time to 50% of the first peak	10μs ±20% (0.1kV – less than 1.0kV) 10μs ±40% (1.0kV – 1.5k) Measured at SURGE OUT with no load (*2)
Output impedance	50Ω to 200Ω (10Ω step)
Test duration	TIMER mode: 1.2sec to 300hours (by TIMER setting) CONTINUE mode: the operator STARTs and STOPs
DC blocking capacitor	0.047μF
Coupling capacitor	Short, 470pF, 100pF
Operating power supply	AC100～240V ±10%, 50/60Hz
Power consumption	Approx. < 60 W
Operating temperature range	15℃～35℃
Operating humidity range	25～75%
Dimensions	Approx. (W)430×(H)200×(D)400 mm (Projection excluded)
Weight	Approx. 7 kg

(*1) The first peak amplitude shall be projected from the 2nd and 3rd peaks.

(*2) The 2nd or 3rd peak shall be used as the reference to measure a decay time to 50%.

9-2. Block diagram



11. WARRANTY

Servicing terms

The following terms are applicable to servicing by Noise Laboratory Co., Ltd., (hereafter referred to as the Company) provided to maintain the intended performance of its products.

1. Scope
   The following terms shall apply only to products made by the Company.
2. Technical servicing fee
   In the event of a failure of a product within the warranty period (see warranty section), the Company will repair a product without charge. After the warranty expires, repairs will be billed at a nominal cost.
3. Ownership of defective parts
   Any defective part exchanged under the Company's servicing belongs to it.
4. Limited liability
   In the event that damages resulting from servicing by the Company are intentional or caused by negligence, the Company will pay the cost but at the purchase value of the relevant product maximum. But, notwithstanding the foregoing, the Company shall not be responsible for any incidental or consequential damages of any nature, including without limitation thereof loss of would-be profit or compensation demanded from a third party
5. Refusal to offer servicing
   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

Noise Laboratory Co., Ltd. (hereafter referred to as the Company) warrants its products to be free from defects in materials and workmanship under normal use and service for a period of one year from date of delivery. In the event of failure of a product covered by this warranty, the Company will repair the product or may, at its option, replace it in lieu of repair without charge.

Not withstanding the foregoing, the Company shall not be responsible for any incidental or consequential damages of any nature, including without limitation thereof loss of would-be profit or compensation demanded from a third party. This warranty is valid only in Japan.

1. Scope

   This warranty shall only apply to products made by the Company.

2. Period

   One year from date of delivery. The warranty may be valid in 6 months after servicing if the same failure on the same component has repeated.

3. Exclusions

   The followings are exclusions from this warranty:

   - Consumable parts (including HV relay)
   - Failure caused by misuse, neglect, accident or abnormal conditions of operation
   - Failure caused by remodeling on the user side without prior permission from the Company
   - Failure caused by servicing by unauthorized personnel by the Company
   - Failure due to fore majeure including but not limited to, acts of God, fire, war, riot, rebellion and others
   - Failure due to shock or drop in or after transit
   - Failure due to operation in environment being out of ambient specifications.
   - A unit shipped to overseas.

12. MAINTENANCE

1. When repair, maintenance or internal adjustment of the unit is required, a qualified service engineer takes charge of such work.
2. Maintenance on the user side is restricted to the outside cleaning and functional check of the unit.
3. When replacing the fuses, turn off the switch of this unit and the connected equipment and disconnect the plug socket beforehand.
4. When cleaning the unit, turn off the switch of this unit and the connected equipment and disconnect the plug socket beforehand.
5. Avoid using chemicals for cleaning. Otherwise, the coating of the unit may peel off or the sight glass may be broken.
6. Do not over the cover of this unit.

13. NOISE LABORATORY SUPPORT NETWORK

- If a symptom which seems a trouble is found, check the symptom against the following check sheet and 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, pack the product and repair order sheet in the former package or equivalent suitable for transit and send them back.

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