

**INSTRUCTION MANUAL
LIGHTNING SURGE SIMULATOR
MODEL LSS-720B2 (240V)**

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- In addition, please note that the Company cannot be held responsible for any consequences arising from the use of this product.

1. IMPORTANT SAFETY PRECAUTIONS

The following instructions are very important for safe handling of the Lightning surge simulator LSS-720B2 (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 instrument 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 instrument in conjunction with appropriate measures for dealing with electromagnetic noise such as a Faraday cage or shielded room.

- **Do not use the instrument for any purposes other than the EMC testing purposes described in this instruction manual**

Failure to follow this rule risks death or serious injury.

- **The instrument 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. 心臓用ペースメーカー等の電子医療器具を付けた人は、本試験器を操作しないようにし、且つ本試験器が動作中に試験区域へ立ち入る事もしないでください。

- **The instrument may not be used in a location where fire is**

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.

2. APPLICATION FORM FOR INSTRUCTION MANUAL

We place an order for an instruction manual.

Model: LSS-720B2 (240V)

Serial No.: _____

Applicant:

Company name: _____

Address: _____

Department: _____

Person in charge: _____

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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 your nearest sales agent or Noise Laboratory Co., Ltd. directly.

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4. PREFACE

This instruction manual provides all necessary information for fully utilizing the Lighting Surge Simulator Model: LSS-720B2 (hereinafter “the Unit”) including the procedures of operation and testing.

Before operating the simulator, please read the manual carefully and master how to handle it for enjoying 100% of the performance.

- This Instruction Manual was prepared so that any person who can observe the prescribed instruction method and operating precautions may safely handle and fully utilize this lightening surge simulator (Model LSS-720B2).
- Keep this Instruction Manual by your side or other proper location so that it may be readily available when using the LSS-720B2.

Features

- Can perform voltage surge test (1.2/50 μ s) specified under JEC-210 · 212 standard. (JEC: JAPANESE ELECTRO-TECHNICAL COMMITTEE)
- Can perform current surge test (8/20 μ s) specified under JEC-210 · 212 standard.
- High voltage/current tests up to 20kV and 4000A.
- Surges can be readily superimposed on an active AC line and can be output from the surge out terminal to conduct non-electrified test.
- Output voltage / current can be checked during test at the check terminals.
- Setup status can be observed through a transparent acrylic door.
- Housed in movable caster cabinet to allow free mobility to a location near the equipment under test.

5. BASIC SAFETY PRECAUTIONS

5-1. Sign of Danger and its Meaning



It expresses a DANGER.

WARNING indicates an urgent hazardous situation which, if not avoided, could result in death or serious injury



It expresses a WARNING.

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



It expresses a CAUTION.

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

5-2. Fundamental Safety Precautions



1. This simulator generates high voltage and large current (20kV, 4000A max). Mishandling or careless operation may cause a deadly injury.
【Warning against human body, environments, operation and connection】
2. This simulator is 20kV/4000A MAX specification. Never place the unit for a long time with the voltage/current meter reading an exceeding value (red zone). Never set the output voltage/current exceeding the mentioned value.
【Warning against human body and connection】
3. This simulator cannot be used in an explosive area, fire prohibited area, etc. Use of this simulator in such an area is liable to cause ignition by discharge.
【Warning against human body and environments】
4. A person who has a pacemaker on should not operate this simulator and also should not enter the area where this simulator is operating.
【Warning against human body and operation】
5. Test facilities using this simulator should be insulated and protected against a minimum of 20kV. EUT tests using this simulator should be performed within a protective enclosure proof, such as a safety box or a safety fence, against scattering broken pieces, fire and electric shock.
【Warning against human body, operation and environments】
6. When connecting accessories and optional units for setting test waveforms and test conditions or when connecting to other equipment, turn off the high voltage circuit of this simulator (by pressing the HIGH VOLTAGE OFF switch) beforehand. Otherwise, you may receive an electric shock.
【Warning against human body and connection】

⚠ DANGER 危険

7. Take care of surge and electric shock which may occur by power supply to EUT while the simulator is operating.
【Warning against human body and operation】
8. Be sure to ground FG (Frame Ground) terminal of this simulator.
~~(A ground plane can be used.)~~ 【Warning against human body and connection】
9. Do not connect a connecting bar, cable, etc. to any terminal which is unnecessary for setting test conditions. Do not mistake the setting and connection of connecting bars, cables, etc. Otherwise, you may receive an electric shock from high voltage or the internal equipment and connected equipment may be damaged.
【Warning against human body, operation and connection】
10. When lowering the set voltage of this simulator by means of SURGE ADJ Knob, discharge extra energy beforehand; otherwise causing danger. (High voltage accumulated in the internal condensers etc. will not lower even if you rotate the knob, unless high voltage is discharged.) There are 2 ways of discharging extra energy in this case: one is rotating SURGE ADJ knob counterclockwise fully to '0V (0A)' and turning off the high voltage circuit (by pressing HIGH VOLTAGE OFF switch). The other is with rotating SURGE ADJ knob counterclockwise gradually pressing the Trigger switch or External trigger switch several times while seeing the meter until it reads the intended set value. In this method, pay fully attention to surge output coming from HOT (SURGE OUT) terminal or LINE OUT terminal which is being output as the surge indicator indicates.
【Warning against human body and operation】
11. (Discharge will be finished by opening the acrylic door by means of the safety device.) However, when changing the connecting bar set position to change the waveform, changing the surge polarity and/or ending the test, be sure to short-circuit between each terminal and **GND** terminal (for about 5 seconds) using the supplied Discharge probe beforehand. If this discharging process is insufficient, you may receive an electric shock from residual high voltage.
【Warning against human body, operation and connection】
12. The AC line for EUT is free from the devices for safety such as HIGH VOLTAGE OFF switch or the acrylic door. It can be operated independently with using the LINE ON breaker. When you set the surge injection part, be sure to turn off the LINE ON breaker to cut off AC power supply and discharge residual electricity with the attached Discharge probe, and then set that part. Failure to follow this instruction risks an electric shock by the power supply to EUT (AC100V~240V).
【Warning against human body, operation and connection】
13. When operating this simulator, never neglect to watch the equipment. When leaving this simulator, be sure to check that the meter reads '0V (0A)' and the high voltage circuit is turned off (by pressing the HIGH VOLTAGE OFF Switch). Otherwise, any other person or facilities related to test equipment may be exposed to danger.
【Warning against human body, operation and environment】

DANGER 危険

14. As high voltage is generated inside the unit, do not open the cover of this unit.

【Warning against human body】

WARNING 警告

15. When conducting an AC line injection test using this simulator, turn off power supply to EUT and the LINE ON breaker located on the viewing window frame of this simulator before connecting this simulator to EUT and to line input cable.

【Warning against human body and connection】

16. The GND line of the attached Single-phase LINE IN cable is for protective earth. When EUT needs to be grounded, it is grounded via the injection part of this simulator with connecting the GND line.

【Warning against human body and connection】

17. Securely connect the connectors and cables. Otherwise, you may receive an electric shock from high voltage or the internal components and equipment connected to this simulator may be damaged.

【Warning against human body and connection】

18. For assuring safety operation, use the standard and optional accessories supplied by our company.

【Warning against human body and connection】

19. When this simulator is not used, remove the supplied Switch key and keep it in a safe place.

20. Our company and sales agent shall have no responsibility for any accident resulting in injury or death, any breakage or resultant damages due to irresponsible handling.

【Warning against human body, environment and connection】

CAUTION 注意

21. Avoid using or storing this simulator in a high temperature or low temperature environment. (Operating temperature: 15~35°C)

【Cautions regarding environment】

22. Use the simulator in the places with high humidity and free from dust and vibration. (Operating humidity: 25~75%)

【Cautions regarding environment】

23. If dewing or condensation occurs, thoroughly dry it before operating the unit.

【Cautions regarding environment】

24. When installing the unit, do not block the ventilating hole.

【Cautions regarding environment】

CAUTION 注意

25. When connecting accessories and optional units for setting test waveforms and test conditions or when connecting to other equipment, turn off operating power supply to this simulator beforehand. Otherwise, the simulator or optional unit may be damaged.
【Cautions regarding connection】
26. The voltage value of the power supply which drives this simulator is AC240V. A caution label indicating operating power supply voltage is affixed to the AC input connector section on the rear panel of this simulator. Use within a range of $\pm 5\%$. Avoid applying voltage exceeding this range.
【Cautions regarding connection】
27. **GND** terminal on the front side of this simulator is the GND terminal for surge tests. FG terminal provided on the rear side is the ground terminal for the control system of this simulator. Be sure not to use **GND** terminal and FG terminal.
【Cautions regarding connection】
28. Do not connect AC line directly to **HOT (SURGE OUT)** terminal. Otherwise, the internal component of this simulator may be damaged.
【Cautions regarding connection】
29. When an EUT test is performed using this simulator, much electromagnetic waves are emitted, adversely affecting the neighboring electronic equipment and radio communication. The user should take a proper measure such as a shield room, shielding cable, etc. to prevent such harmful phenomena.
【Cautions regarding environment】
30. Avoid dropping the unit or do not give excessive shock to it.
【Cautions regarding environment】
31. When repair, maintenance or internal adjustment is required, it should be performed by a qualified service engineer.
32. Do not wipe this unit with thinner or similar solvent. When the body is dirty, soak a cloth in detergent, squeeze the cloth and wipe the body with it.

5-3. Necessary steps to be taken when caution or warning label is missing

1. When the caution or warning label is peeled off, missing or dirty, attach a new one for securing safety.
2. When the caution or warning label is missing, ask the sales department or maintenance section of our company to send a new label.

6. OUTLINE OF TESTING

Problems of damages and malfunctions of digital equipment have been closed up in recent years as control systems have become diversified. Primary causes of damages and malfunction are largely classified into the degradation of power supply environments and discharge of static electricity.

Induced lightening on power line transmission/distribution lines is the most representative phenomenon, causing damages or malfunctions of electronic equipment. As the energy of lightening is very big, even though electro equipment is not lightened directly, the equipment can be damaged or malfunctioned with degradation of power supply environments caused indirectly by induced lightening induced to power lines.

It is very difficult to reproduce this phenomenon by a test. Test method differs according to where the equipment is placed. The test method meeting the installation conditions must be decided upon after taking into account the dimensions and grounding conditions of equipment.

The test methods are largely divided into two—voltage surge test and current surge test.

For deciding the test method, the value of grounding impedance of the place where the EUT is installed can be a basis of decision-making. Generally, in case the grounding impedance is high, conducting voltage surge test only is sufficient, but in case it is low, current surge test is also necessary.

Configuration and test method of both tests are prescribed in the standard JEC-210 and JEC-212. For details, refer to those standards.

7. MAIN UNIT AND ACCESSORIES

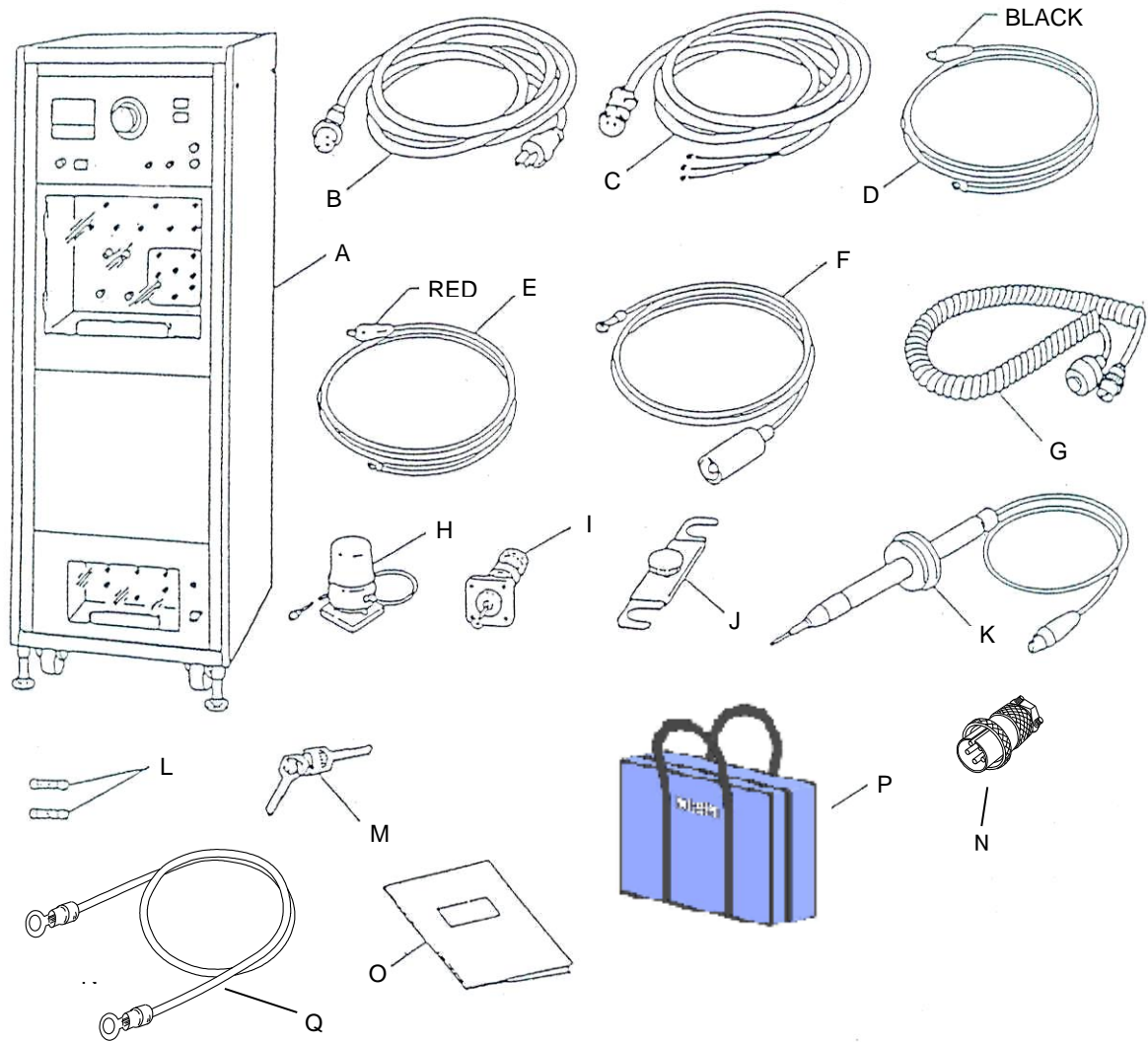


Fig.1

Quantity

A : Main unit	1
B : AC cable	1
C : Single-phase LINE IN cable.....	1
D : Ground cable.....	1
E : LINE OUT cable.....	2
F : Surge output cable	1
G : External trigger switch.....	1
H : Warning lamp	1
I : CHECK connector plug	1
J : Connection bar	6
K : Discharge probe.....	1
L : Fuse (20A).....	2
M : Switch key	2
N : Interlock connector	1
O : Instruction manual.....	1
P : Accessory bag.....	1
Q : FG cable	1

8. FUNCTION OF EACH PART

8-1. Name OF Each Part

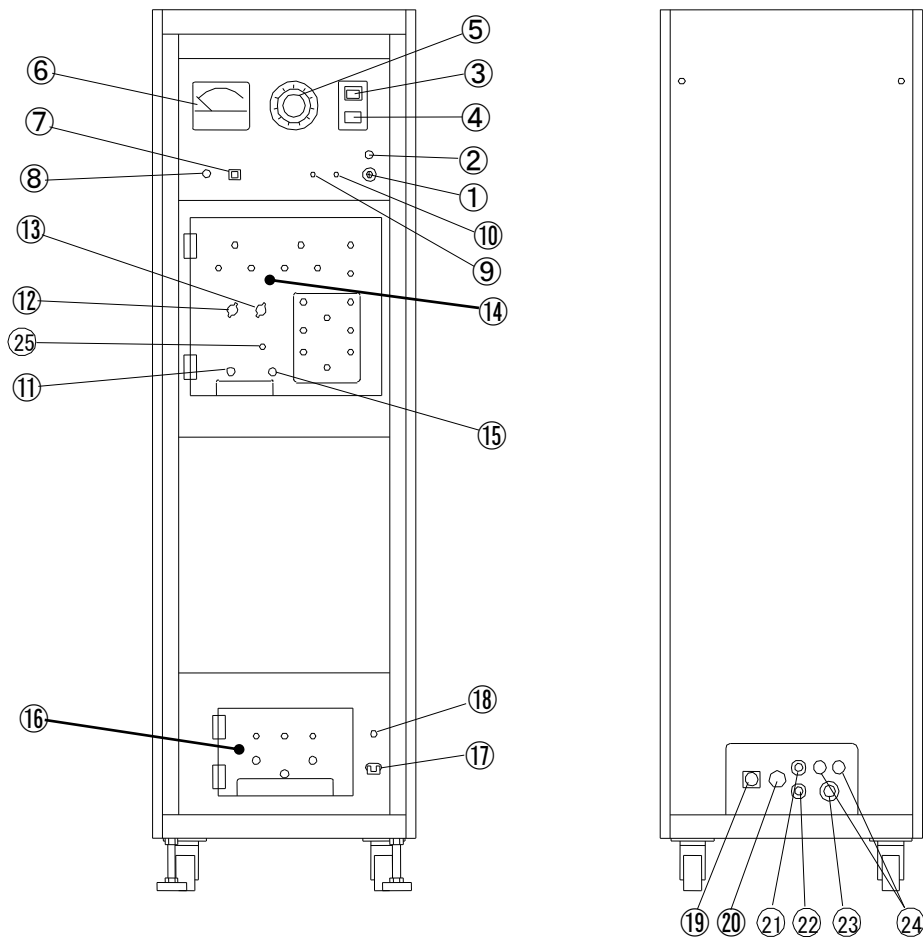


Fig. 2

- | | |
|--|--|
| <ul style="list-style-type: none"> ① POWER switch ② POWER on indicator ③ HIGH VOLTAGE ON switch
(Alarm buzzer switch) ④ HIGH VOLTAGE OFF switch ⑤ SURGE ADJ knob ⑥ SURGE Voltage/Current indicator ⑦ MANUAL trigger switch ⑧ External trigger switch connector ⑨ Voltage check connector (V-CHECK) ⑩ Current check connector (A-CHECK) ⑪ HOT SURGE OUT terminal- ⑫ POLARITY selector ⑬ METER selector ⑭ Output waveform selector ⑮ GND SG Terminal- | <ul style="list-style-type: none"> ⑯ SURGE INJECTION PHASE SELECTOR <ul style="list-style-type: none"> • Surge injection phase selector common terminal(R-S CHANGE) • Surge injection phase selector PHASE R terminal • Surge injection phase selector PHASE S terminal • SG terminal • LINE OUT PHASE R terminal • LINE OUT PHASE S terminal ⑰ LINE ON breaker ⑱ LINE ON lamp ⑲ LINE IN connector ⑳ FG terminal ㉑ Warning lamp connector ㉒ Safety interlock connector ㉓ 240V AC input connector ㉔ AC fuse holders ㉕ SURGE lamp |
|--|--|

8-2. Function of Each Part

- ① POWER switch
This switch controls the AC power input to the simulator.
- ② POWER indicator
A lamp to light up when the POWER switch ① is turned on.
- ③ HIGH VOLTAGE ON switch (Warning buzzer switch)
This switch controls the high voltage output of the simulator. Press it and the high voltage circuitry will be activated, an alarm sound is given simultaneously, and the built-in lamp of this switch, SURGE lamp ②⑤ and a warning lamp of the accessory illuminates.
- ④ HIGH VOLTAGE OFF switch
Switch to turn off the high voltage circuit of the simulator.
- ⑤ SURGE ADJ knob
This control adjusts the level of output voltage/current. It is operative only when the HIGH VOLTAGE ON switch ③ is on. Only when the knob is on '0' position, which means the knob is rotated counterclockwise fully, the high voltage circuit can be turned ON.
- ⑥ SURGE Voltage/Current indicator
This voltage/current meter indicates the output voltage or current. The lower black figure shows voltage value, the upper red figure shows current value.
- ⑦ MANUAL trigger switch (MANUAL SW)
This is the trigger switch to output surge. Trig SW operate for approx 2seconds. Single press triggers single output.
- ⑧ External trigger switch connector (EXT SW)
Connecting the External trigger switch to this connector enables external control of the simulator. Single press causes the simulator to produce one surge (one discharge pulse from the energy storage capacitors) each time it is pressed. To connect / disconnect the external trigger switch, please turn off the high voltage circuit firstly.
- ⑨ Voltage check connector (V-CHECK)
Connecting the attached waveform check terminal to this connector enables verification of the peak voltage with an oscilloscope. This connector provide an attenuated signal (1/100). As only the peak voltage is calibrated, a waveform observed at this connector is different from an actual output waveform.
- ⑩ Current check connector (A-CHECK)
Connecting the attached waveform check connector to this connector enables verification of the peak current with an oscilloscope. This connector provide an attenuated signal (0.01V/A). As only the peak current is calibrated, a waveform observed at this connector is different from an actual output waveform.
- ⑪ ~~HOT SURGE OUT~~ terminal (SURGE OUT)
Output terminal of voltage/current surge waveform. This terminal is used only when applying surges to the sample directly but not by using the built-in power line injection circuit._
- ⑫ POLARITY selector
This switch selects the polarity of the output surge.

- ⑬ METER selector
This switch selects the mode(voltage or current) of the SURGE Voltage/Current indicator ⑥.
Select the mode corresponding to the selected output waveform
- ⑭ Output waveform selector
Terminals to select the right components (inductors and resistors) and whether current limiter (100 Ω) is used or not to produce the desired waveform. Also terminals are provided to select the output of the surges between the HOT terminal (SURGEOUT) ⑪ and the LINE OUT PHASE R or LINE OUT PHASE S terminals ⑯. Connect the attached short bars for setup.
- ⑮ ~~SG~~-GND terminal
Surge ground terminal used when applying surges directly to the sample without the use of the built-in power line injection circuit.
- ⑯ Surge injection phase selector (Surge injection part)
Equipped with switching terminals for selecting injection phase (R or S) and LINE OUT terminal for supplying AC to EUT. The voltage / current surge is the LINE OUT terminal of the desired phase which is set with injection switching terminals.
- ⑰ LINE ON breaker
Turns ON/OFF power supply to EUT which is output from the LINE OUT terminal on the above ⑯.
This breaker works independently with safety function of high voltage circuit. It is never turned of linking with HIGH VOLTAGE OFF switch ④. Be sure to turn OFF this breaker (lower the lever) before setting the surge injection part.
- ⑱ LINE ON lamp
This lamp indicates the ON state of the LINE ON breaker ⑰.
- ⑲ LINE IN connector
Feed the AC power (240V AC maximum) for the equipment under test to this connector.
- ⑳ FG terminal
Terminal used to ground the simulator. Be sure to ground the terminal to prevent from getting electric shock.
- ㉑ Warning lamp connector
Connects the attached Warning lamp. When the high voltage circuit is turned ON, AC power (100V) is provided to illuminate the Warning lamp.
- ㉒ Safety interlock connector
This is provided as a safety measure. Open condition (disconnection of No.1 Pin form No.3 Pin) causes the high voltage circuitry off. Connect the attached Interlock connector. If it is connected to the safety box and the safety fence, you can utilize them as the safety apparatus. For controlling it, use a contactor.
*The safety box and the safety fence are optional.
- ㉓ 240V AC input connector
Connect the attached AC cable to supply AC power driving the surge generator.
- ㉔ AC fuse holders
A fuse rated at 250V 20A is in each holder.
- ㉕ SURGE lamp

Lights up when HIGH VOLTAGE ON switch ③ is pressed.

9. SPECIFICATIONS

Voltage surge generating part

- Surge waveform..... 1.2/50 μ s*1, 30% allowance for Front time, 20% allowance for Time to half-value.
- Surge voltage.....4kV~20kV \pm 1kV *2
- Surge output polarity.....positive/negative
- Surge output impedance.....6 Ω \pm 10%
- Current limiter.....100 Ω \pm 10%
- Check connector..... 1/100V (V-CHECK)

*1 : Waveform measurements are done with no EUT connected by using a high voltage probe with 100M Ω input impedance.

*2 : A discontinuity may be generated on the tail of the waveform.

Current surge generating part

- Surge waveform 8/20 μ s *3, 10% allowance for both Front time, and Time to half-value.
- Surge current 800A~4000A \pm 400A *4
- Surge output polarity..... positive/negative
- Surge output impedance.....5 Ω \pm 10%
- Check connector..... 0.01V/A (A-CHECK)

*3 : Waveform measurements are done with the output terminals short-circuited.

*4 : A discontinuity may be generated on the tail of the waveform.

Surge generating part

- Surge polarity.....+(positive) or -(negative)
- Surge repetition cycleApprox. 30s or longer by hand
- Prescription of waveform Conforming to the JEC-212 standard

AC power supply injection part

- Power supply capacity of equipment under test240V AC, Single-phase 20A MAX
- Surge voltage for superimposing on power line20kV MAX.
- Surge current for superimposing on power line4000A MAX

Others

- Power consumption 240V AC \pm 5%, 50/60Hz, 300VA MAX
- Safety interlock.....Open condition inhibits the high voltage circuitry from turning on.
Short-circuit current : 100mA or less
Open-circuit voltage : approx 24V
- Dimensions555(W) \times 1860(H) \times 840(D)mm
- Weight450 kg

Notice

This product employs a contact switch, which is deemed consumable component. It shall be replaced when it comes to affect the output waveforms.

10. PRECAUTIONS ON OPERATION

1. The surge voltage and current generated by this simulator is of high amplitude. Misuse or ignoring the instructions given in this manual endangers life, be careful in handling this simulator.
2. The high voltage charge may be retained. To avoid any danger of shock, before touching the connection bars to change waveform, be sure to discharge the remaining charges at each terminal of the Output waveform selector ⑭ by using the discharge probe (marked 'K' in the accessories list) as shown in Fig. 3. Connect the connector end of the probe to the SG terminal ⑮ and touch the probe tip to each terminal for short-circuiting for approx 5 seconds.
3. Never connect the connection bars or cables to the terminals other than those corresponding to the required waveform.
4. Avoid operating in humid or dusty places.
5. Make sure each connector and cable are securely connected.
6. When you go away from the simulator, never fail to turn off the high voltage circuit and reset the SURGE ADJ knob ⑤ to the OV position.
7. While the high voltage circuit is ON status, do not open any acrylic door. When you switch POLARITY and METER select or change the waveform setup, be sure to lower the indicated value to 0V(0A) by SURGE ADJ knob ⑤ and press HIGH VOLTAGE OFF switch ④ and then start setting.
8. Do not connect AC line directly to HOT terminal ⑪. Otherwise, the internal component of this simulator may be damaged.

11. TEST AND OPERATION PROCEDURES

Install this simulator on proper position of the test room and ground FG terminal ⑳ to the earth with a proper cable. Connect the attached Safety interlock connector ㉒. After ensuring the POWER switch ① is turned OFF, connect the attached AC cable to supply AC240V. Connect the attached Warning lamp to the Warning lamp connector ㉑ and put it on the ceiling board of the simulator or on a remarkable place suitable for the lamp.

11-1. Applying 1.2/50μs voltage surge directly to EUT

1. For safety, discharge the residual charges remaining on the Output waveform selector terminals ⑭ with the attached Discharge probe. Connect the clip of the Discharge probe to the GND terminal ⑮ (Refer to Fig. 3) and short-circuit for 5 seconds between each terminal and GND terminal.

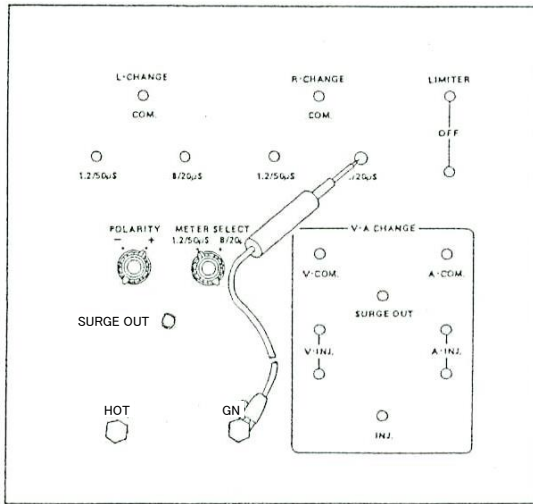


Fig. 3

⚠ DANGER 危険

When the acrylic door is open, a safety device of the unit functions to eliminate electric charges stored thus far in the HV circuitry, but there is some possibility that the electric charge is remaining on the unit.

Preparing for the worst case that the safety device malfunctions, never fail to discharge the electric discharge with short-circuiting between each terminal and GND terminal for about 5 seconds by the attached Discharge probe before relocating connection bars to change waveform or changing surge polarity. Before using the Discharge probe, ensure the value of resistance between the pin and clip of is $180k\Omega \pm 5\%$.

2. Make connections on the Output waveform selector ⑭ as shown in Fig. 4.

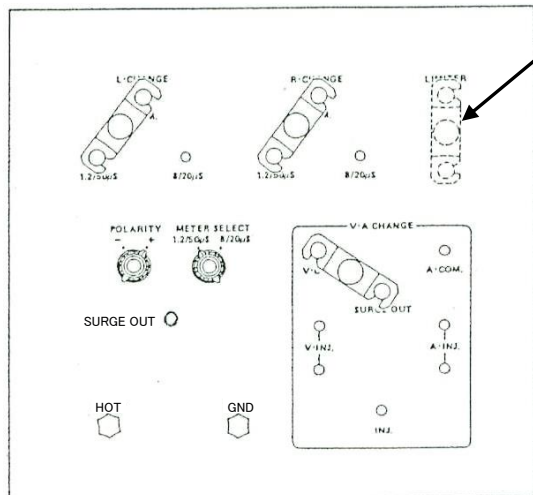


Fig. 4

[CURRENT LIMITER] terminals

Notice

When the attached connection bar is installed on [CURRENT LIMITER] terminals to short-circuit the terminals, the value of the output impedance of surge generating part is $6\Omega \pm 10\%$ because the limiter is by-passed.

In case the connection bar is not installed there, the value is $106\Omega \pm 10\%$ because the resistance value of the limiter (100Ω) is added.

Select whether inserting the limiter or not with taking conditions like test method, surge absorbing device of EUT, or so on into consideration.

3. Connect the sample to simulator via the H^{OT} terminal ⑪ and via the GND terminal ⑮ through the supplied Surge output cable and Ground cable, respectively, as shown in Fig. 5.

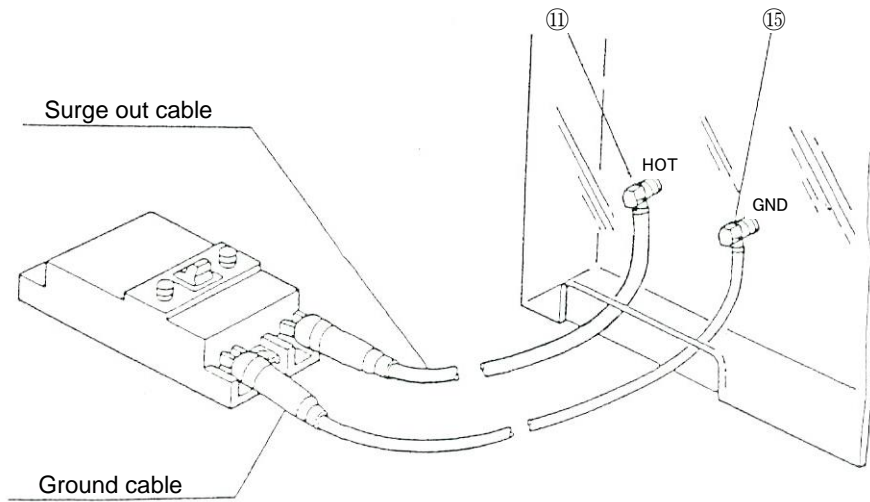


Fig. 5

4. Set the POLARITY selector ⑫ to the desired surge polarity (e.g. "+").

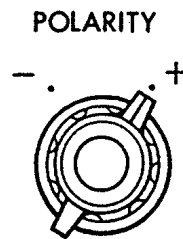


Fig. 6

5. Set the METER selector ⑬ to the 1.2/50 μ s position.

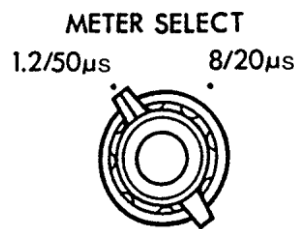


Fig. 7

6. Turn the SURGE ADJ knob ⑤ fully counterclockwise, or check to see that the knob has been fully turned counterclockwise. At the same time, make sure the safety cover (acrylic door) is closed and that the attached Interlock connector is attached on to the Safety interlock connector.

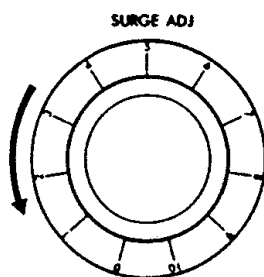


Fig. 8

Since the SURGE ADJ knob ⑤ and the acrylic door are equipped with safety devices, the high voltage ON switch does not work when the knob is not on '0' position or when the acrylic door is open.

7. Turn on the simulator power by inserting the switch key into the POWER switch ① slot and turn it clockwise by 90°. The POWER on indicator ② will be illuminated and the built-in fan will work.

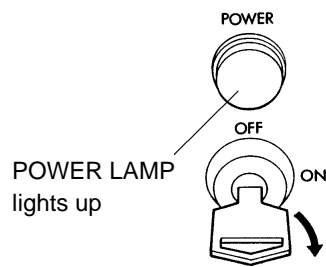


Fig. 9

8. Depress the HIGH VOLTAGE ON switch ③. The corresponding switch lamp ③ or SURGE lamp ②⑤ will be illuminated and an alarm sound will be generated by the buzzer warning the operator of the existence of high voltage.

CAUTION

If the HIGH VOLTAGE ON switch lamp ③ does not light up, check to insure the safety cover and SURGE ADJ knob ⑤ is set and check to see the safety interlock is not functioning. This is a safety feature to prevent dangerous accidents from occurring. If the lamp still does not light up even after the setting in step 6 have been done, please contact our authorized agent.

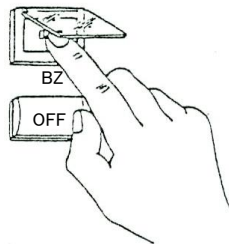


Fig. 10

9. Turn the SURGE ADJ knob ⑤ slowly clockwise and set the desired voltage by monitoring the SURGE Voltage/Current indicator ⑥. After the indicator's needle becomes stable, apply the surge voltage to the sample by depressing the MANUAL trigger switch ⑦ or the External trigger switch connected to the External trigger connector ⑧. When the trigger switch is released (a finger is detached), the unit starts charging for the next discharge. While the trigger switch is being pressed, the unit cannot change to charging stage.

CAUTION

To stop surge application, be sure to turn the SURGE ADJ knob ⑤ fully counterclockwise and press the HIGH VOLTAGE OFF switch ④ to return the SURGE Voltage/Current indicator ⑥ to 0V.

This procedure is also required before changing the setting of the POLARITY selector ⑫ METER selector ⑬ or the connection bars.

Once the safety cover is opened, return to the step 6 to resume the surge generation. The simulator is designed not to operate in any other way.

After completion of testing, be sure to reset the SURGE Voltage/Current indicator ⑥ to 0V (0A) by the SURGE ADJ knob ⑤ and the HIGH VOLTAGE OFF switch, and discharge residual charges at each terminal of the Output waveform selector ⑭ (in case of the injection test, Surge injection phase selector ⑯ also) with the Discharge probe.

11-2. Applying 8/20 μ s current surge directly to EUT

1. See Fig. 3 for safety, discharge the remaining charges with the attached Discharge probe.
2. Make connections on the Output waveform selector ⑭ as shown in Fig. 11. Do not connect anything on Surge injection phase selector ⑯.

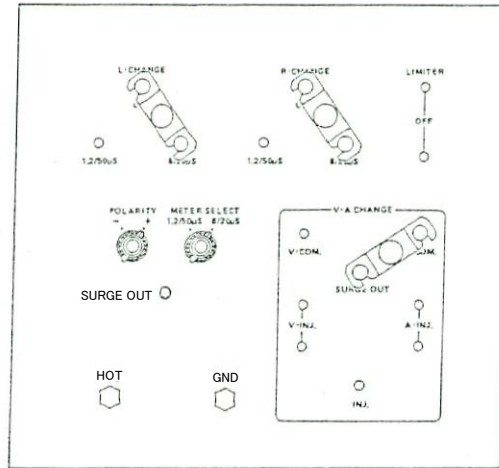


Fig. 11

3. Connect the sample to the simulator via the HOT terminal ⑪ and via the GND terminal ⑮ through the supplied Surge output cable and Ground cable, respectively, as shown in Fig. 12.

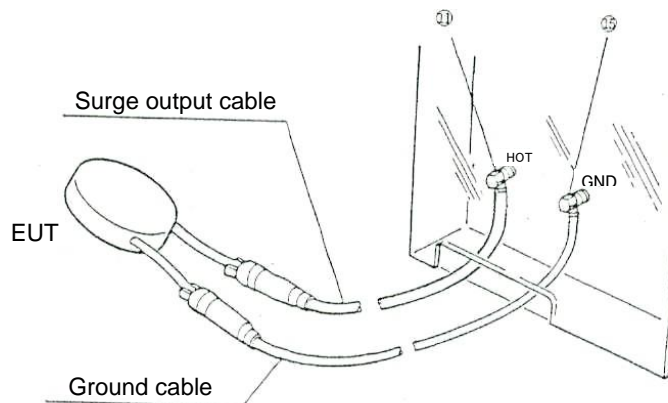


Fig. 12

4. Set the METER selector ⑬ to the 8/20 μ s position and select the desired surge polarity.
5. After the steps through 1-4 as the above, follow the procedures through 6-9 of section 11-1.

11-3. Applying voltage surge by using the built-in power line injection circuit

1. For safety, discharge remaining charges on Output waveform selector ⑭ and SURGE INJECTION PHASE SELECTOR ⑯ with the attached Discharge probe.
2. Make connections on the Output waveform selector ⑭ as shown in Fig.13. Set the METER selector ⑬ to the 1.2/50 μ s position and select the desired surge polarity.

- Output waveform selector

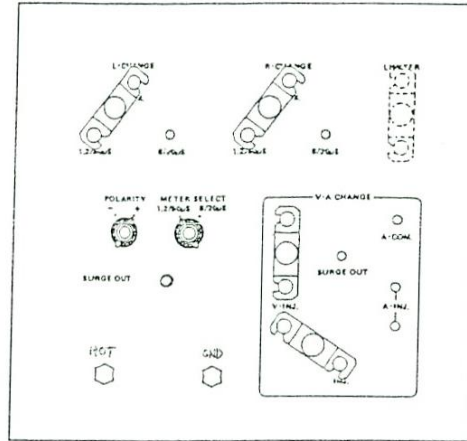


Fig. 13

3. Set the Surge injection phase selector ⑯ as Fig. 14.

- Surge injection phase selector [Connection for R phase injection]

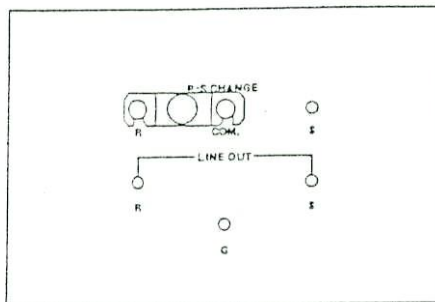


Fig. 14

⚠ DANGER 危険

The AC line for EUT is free from the devices for safety such as HIGH VOLTAGE OFF switch or the acrylic door. It can be operated independently with using the LINE ON breaker. When you set the Surge injection part, be sure to turn off the LINE ON breaker to cut off AC power supply and discharge residual electricity with the attached Discharge probe, and then set that part.

4. Connect the single phase LINE cable (marked C in the accessory list) to the LINE IN connector ⑰. Connect the other end of the cable to the power supply.
5. For the common mode test, connect LINE OUT terminal of the Surge injection selector to EUT with the attached LINE OUT cable as shown in Fig. 15. Connect G terminal to G terminal or FG of EUT with the attached Ground cable.

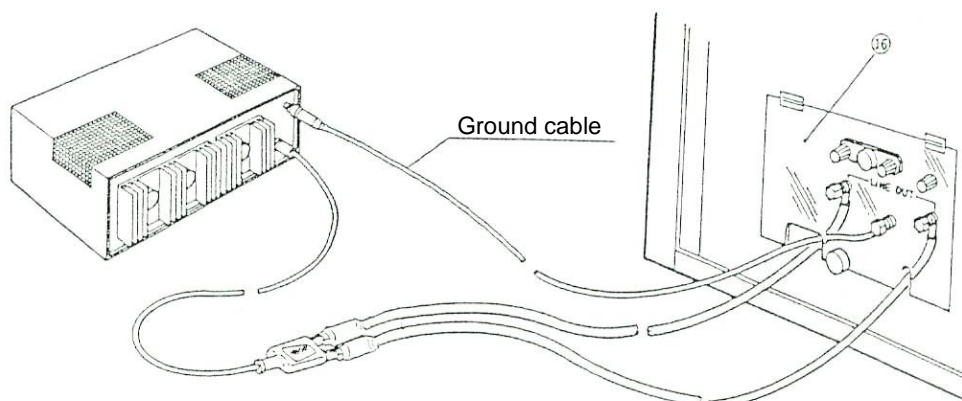


Fig. 15

6. For the normal mode testing, connect LINE OUT terminal of the Surge injection phase selector to EUT with the attached LINE OUT cable as shown in Fig. 16. Connect G terminal to the reversed phase of EUT (e.g. If the surge is injected to R-phase, it is S-phase) with the attached Ground cable.

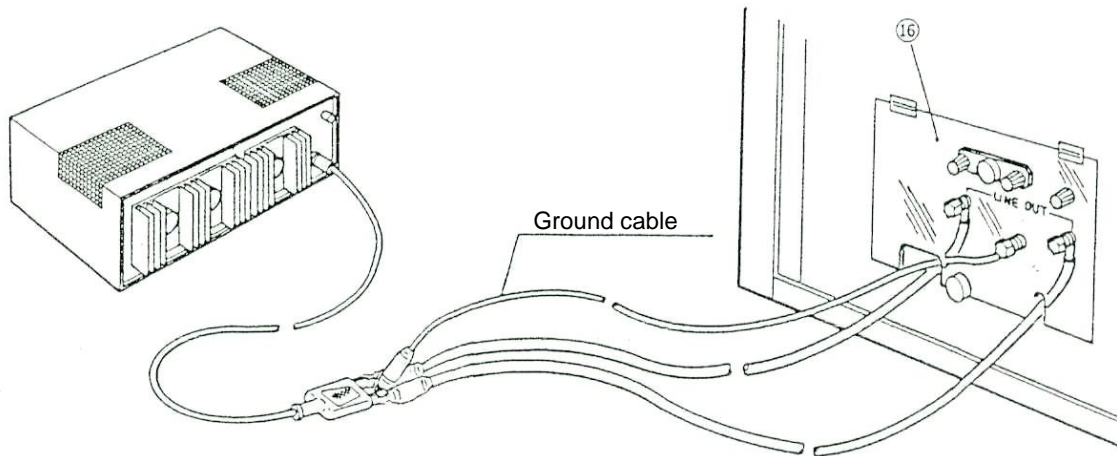


Fig. 16

7. Turn on the LINE ON breaker ⑰. (LINE ON lamp ⑱ will turn on.)
8. Follow the procedures through 6-9 of section 11-1.

CAUTION

After completion of testing, be sure to reset the SURGE Voltage/Current indicator ⑥ to 0V by the SURGE ADJ. knob ⑤ and the HIGH VOLTAGE OFF switch, and discharge remaining charges at each terminal of the Output waveform selector ⑭ and SURGE INJECTION PHASE SELECTOR ⑰ with the attached Discharge probe.

11-4. Applying current surge by using the built-in power line injection circuit

1. For safety, discharge the remaining charges on Output waveform selector ⑭ and SURGE INJECTION PHASE SELECTOR ⑯ with the attached Discharge probe.
2. Make connections on the Output waveform selector ⑭ as shown in Fig. 17. Set the METER selector ⑬ to the 8/20 μ s position and select the desired surge polarity.

- Output waveform selector

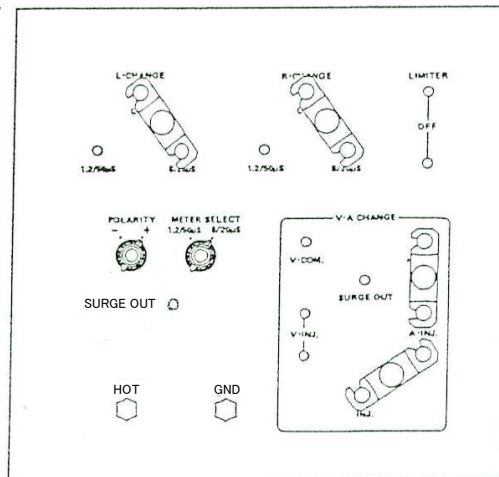


Fig. 17

3. Set the Surge injection phase selector ⑯ as Fig. 18.

- Surge injection phase selector [Connection for R phase injection]

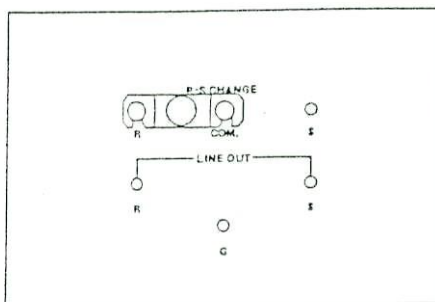


Fig.18

⚠ DANGER 危険

The AC line for EUT is free from the devices for safety such as HIGH VOLTAGE OFF switch or the acrylic door. It can be operated independently with using the LINE ON breaker. When you set the surge injection part, be sure to turn off the LINE ON breaker to cut off AC power supply and discharge residual electricity with the attached Discharge probe, and then set that part.

4. Connect the Single phase LINE IN cable (marked C in the accessory list) to the LINE IN connector ⑰. Connect the other end of the cable to the power supply.
5. Make connections between each terminal and EUT with the attached LINE OUT cable and Ground cable as shown in Fig. 15 and 16 for the common and normal modes testing, respectively.
6. Turn on the LINE ON breaker ⑰. (LINE ON lamp ⑱ will turn on.)
7. Follow the procedures through 6-9 of section 11-1.

CAUTION

After completion of testing, be sure to reset the SURGE Voltage/Current indicator ⑥ to 0V by the SURGE ADJ. knob ⑤ and the HIGH VOLTAGE OFF switch, and discharge the remaining charges at each terminal of the Output waveform selector ⑭ and SURGE INJECTION PHASE SELECTOR ⑯ with the attached Discharge probe.

12. VERIFICATION OF SURGE WAVEFORMS

12-1. Voltage surge at the voltage check connector (1.2/50 μ s)

1. Necessary instrument Oscilloscope (With 50MHz or wider bandwidth)
2. Connect the supplied check connector plug to the Voltage check connector (V-CHECK) ⑨ and connect the 10:1 probe to it.

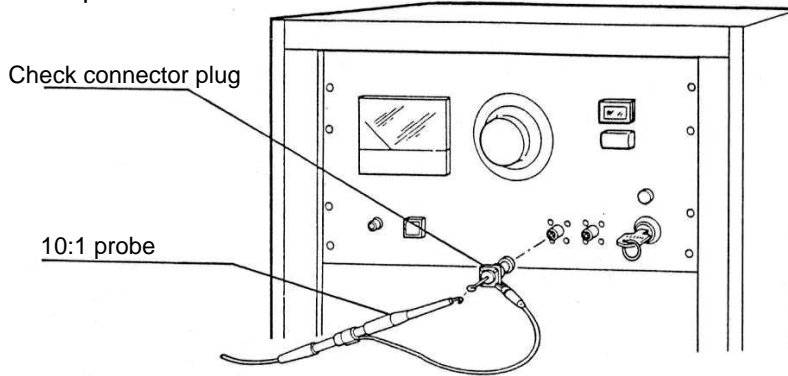


Fig. 19

3. Make connections on the Output waveform selector ⑭ as shown in Fig. 4. Set the METER selector ⑬ to the 1.2/50 μ s position and select the desired pulse polarity.
4. Oscilloscope setting Vertical : 20V/DIV, Horizontal : 10 μ s/DIV
5. Set the output voltage to 100V with the SURGE ADJ knob ⑤, press the MANUAL trigger switch ⑦ and check the waveform displayed on the oscilloscope screen. The waveform is seen as shown in Fig. 20. (Polarity: +)

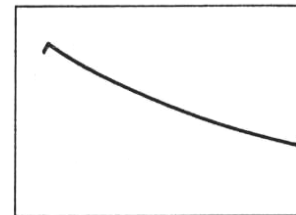


Fig. 20

This check connector is just for monitoring and only the peak value is calibrated. For observing actual waveforms at HOT terminal ⑪ and GND terminal ⑮, follow the procedure described in 12-3.

12-2. Current surge at the current check connector (8/20 μ s)

1. Necessary instrument Oscilloscope (With 50MHz or wider bandwidth)
2. Connect the supplied check connector plug to the Current check connector (A-CHECK) ⑩ and connect the 10:1 probe to it.
3. Make connections on the Output waveform selector ⑭ as shown in Fig. 11. Set the METER selector ⑬ to the 8/20 μ s position and select the desired surge polarity. Connect HOT terminal ⑪ to GND terminal ⑮ with a 5.5sq cable or an equivalent to make these terminals short-circuited and close the acrylic door.

4. Oscilloscope setting Vertical : 5V/DIV, Horizontal : 5 μ s/DIV
5. Set the output current to 2000A with the SURGE ADJ knob ⑤, press the MANUAL trigger switch ⑦ and check the waveform displayed on the oscilloscope screen. The waveform is seen as in Fig. 21. (Polarity: +)

This check connector is just for monitoring and only the peak value is calibrated. For observing actual waveforms at HOT terminal ⑪ and GND terminal ⑮, follow the procedure described in 12-4.

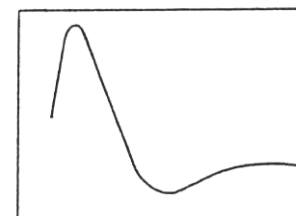


Fig. 21

12-3. Voltage surge at the HOT terminal

1. Necessary instruments Oscilloscope (With 50MHz or wider bandwidth)
High voltage probe with an attenuation factor of 1000
2. Make connections on the Output waveform selector ⑭ as shown in Fig. 4. Set the METER selector ⑬ to the 1.2/50 μ s position and select the desired pulse polarity.
3. Make connections as shown in Fig. 22 and close the acrylic door.

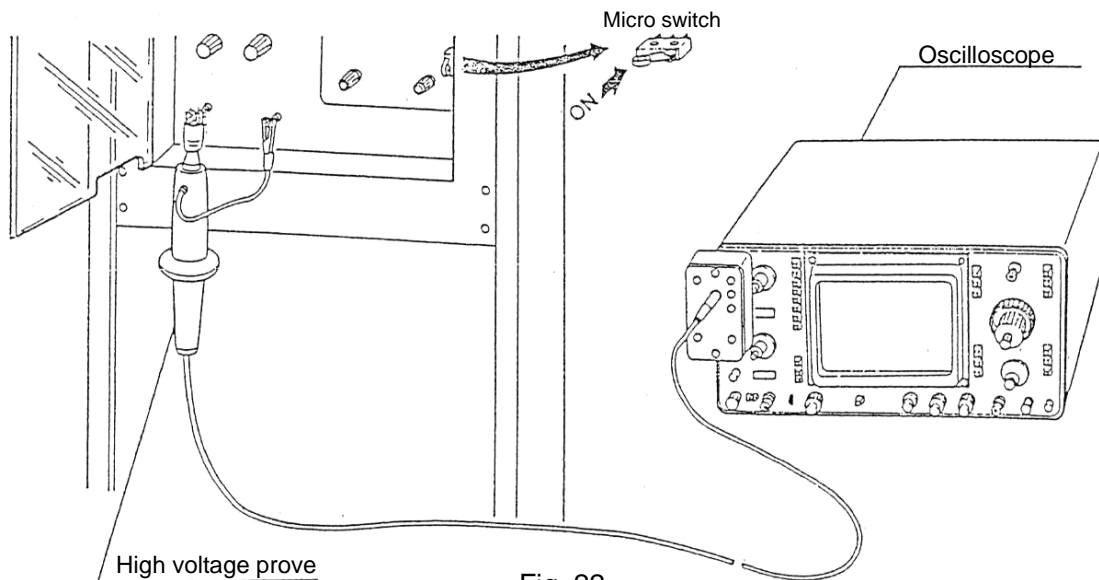


Fig. 22

! DANGER 危険

In case of observing waveforms while the door is open when any other way is impossible, hold the actuator of the micro switch down with adhesive tape or something to keep it ON status.

4. Oscilloscope setting Vertical : 2kV/DIV, Horizontal : 10 μ s/DIV
5. Increase the output voltage to 10kv, press the MANUAL trigger switch ⑦ and check the waveform displayed on the oscilloscope screen.
6. The waveform is seen as shown in Fig. 24. For details of the waveform, refer to the JEC-212 standard.

NOTE

Measured waveforms may vary depending on the manner of measurements and connections.

Standard JEC-212 defines the voltage surge waveform as follows:

Front time : time Interval between the 30% of peak and 90% of peak points on the leading edge divided by 0.6.

Time to half-value : time interval between the virtual origin and the 50% of peak point on the trailing edge.

12-4. Current surge at the HOT terminal

1. Necessary instruments Oscilloscope (With 50MHz or wider bandwidth)
Current probe of with an attenuation factor of 1000
2. Set the Output waveform selector ⑭ as shown in Fig. 11. Connect the HOT terminal ⑪ to the GND terminal ⑮ by a 5.5sq cable or an equivalent.
3. Make connections as shown in Fig. 23 and close the acrylic door.

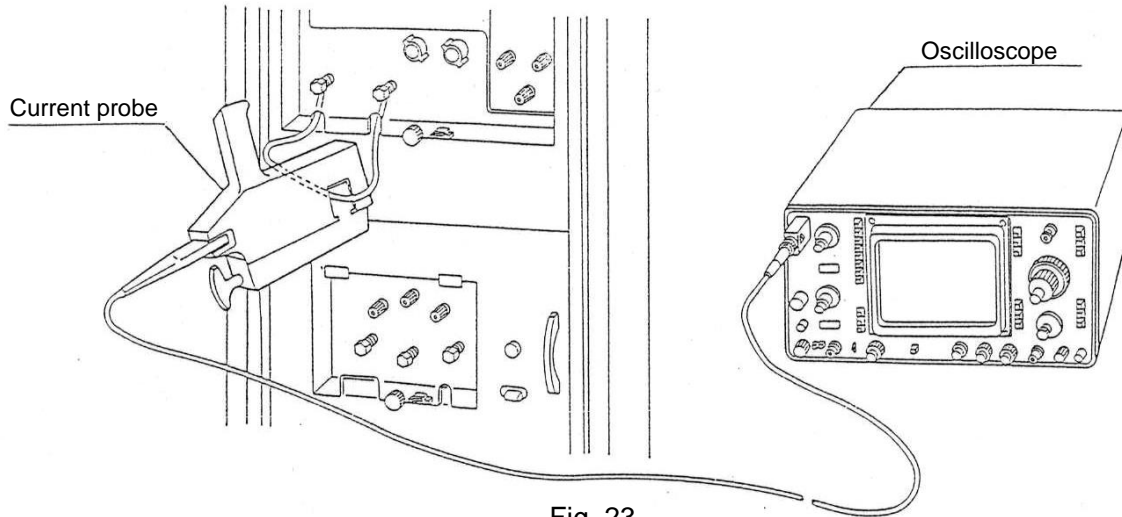


Fig. 23

! DANGER 危険

In case of observing waveforms while the door is open when any other way is impossible, hold the actuator of the micro switch down with adhesive tape or something to keep it ON status.

4. Oscilloscope setting Vertical : 500A/DIV, Horizontal : 10 μ s/DIV
5. Set the output current to 2000A, turn on the MANUAL trigger switch ⑦ and check the waveform displayed on the oscilloscope screen.
6. The waveform is usually seen as shown in Fig. 21 but, waveforms which are different from actual ones are sometimes observed caused by the frequency characteristics of the current probe. For details of the waveform, refer to the JEC-212 standard.

NOTE

Measured waveforms may vary depending on the manner of measurements and connections. Standard JEC-212 defines the current surge waveform as follows:

*Front time: time interval between the 10% of peak and 90% of peak points on the leading edge divided by 0.8.

*Time to half-value: time interval between the virtual origin and the 50% of peak point on the trailing edge.

INFORMATIVE : The definition of surge waveforms

Voltage surge waveform

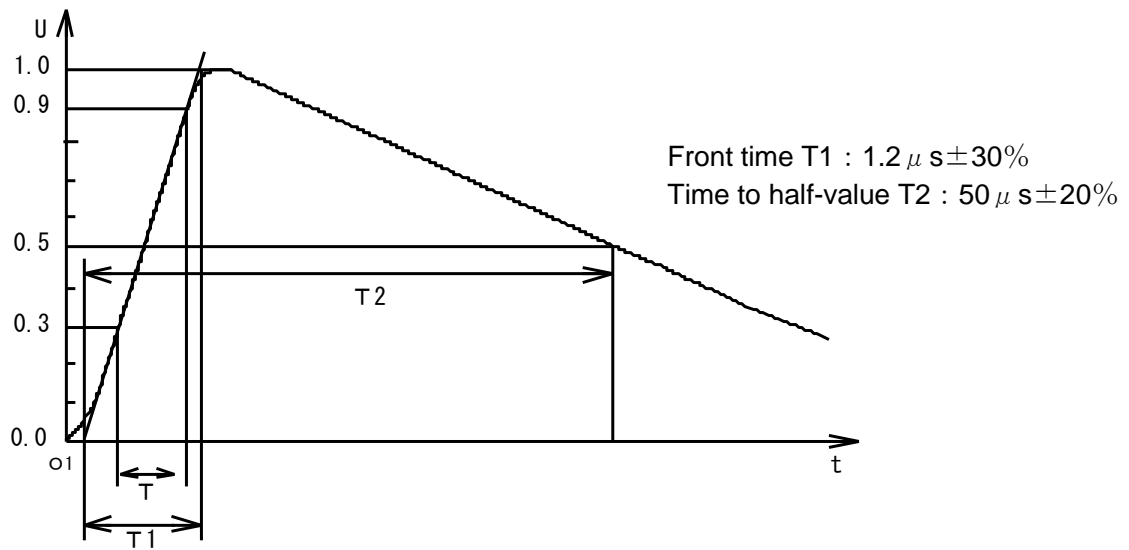


Fig. 24

Current surge waveform

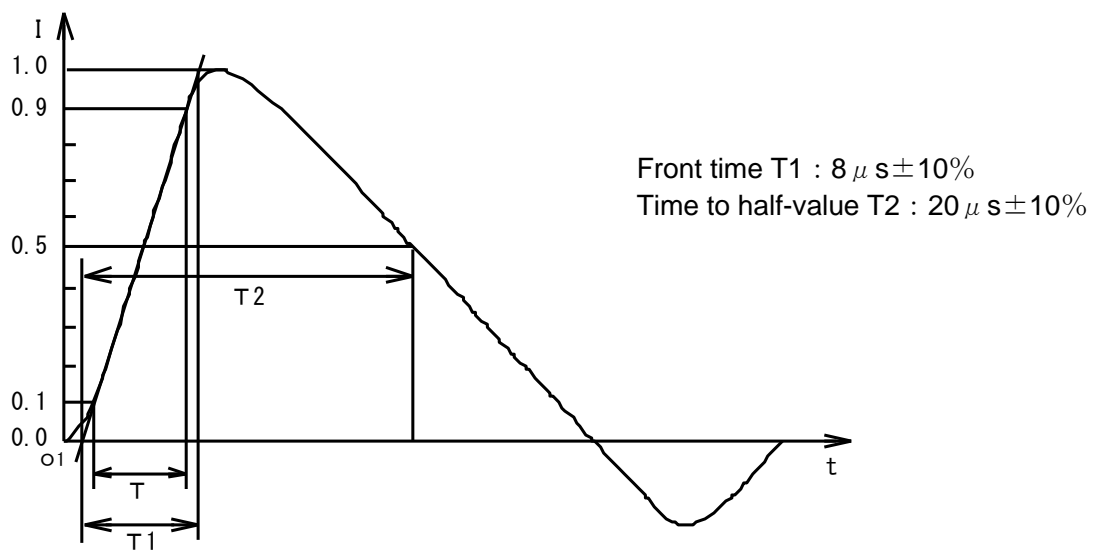


Fig. 25

13. PRINCIPLE OF PULSE GENERATION

1. The electrical schematic of the simulated pulse generator is shown in Fig. 26.

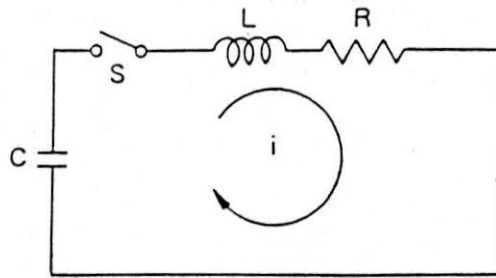


Fig. 26

2. Taking time as the horizontal axis and considering the vertical axis as current in the diagram of Fig. 26, the waveform obtained as a result of transient phenomena is as shown in Fig. 27.

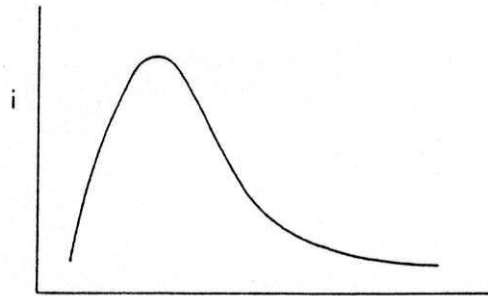


Fig. 27

3. For details of the pulse generation circuit and the prescription of waveform, refer to JEC-210 and JEC-212 standards.

14. BLOCK DIAGRAM

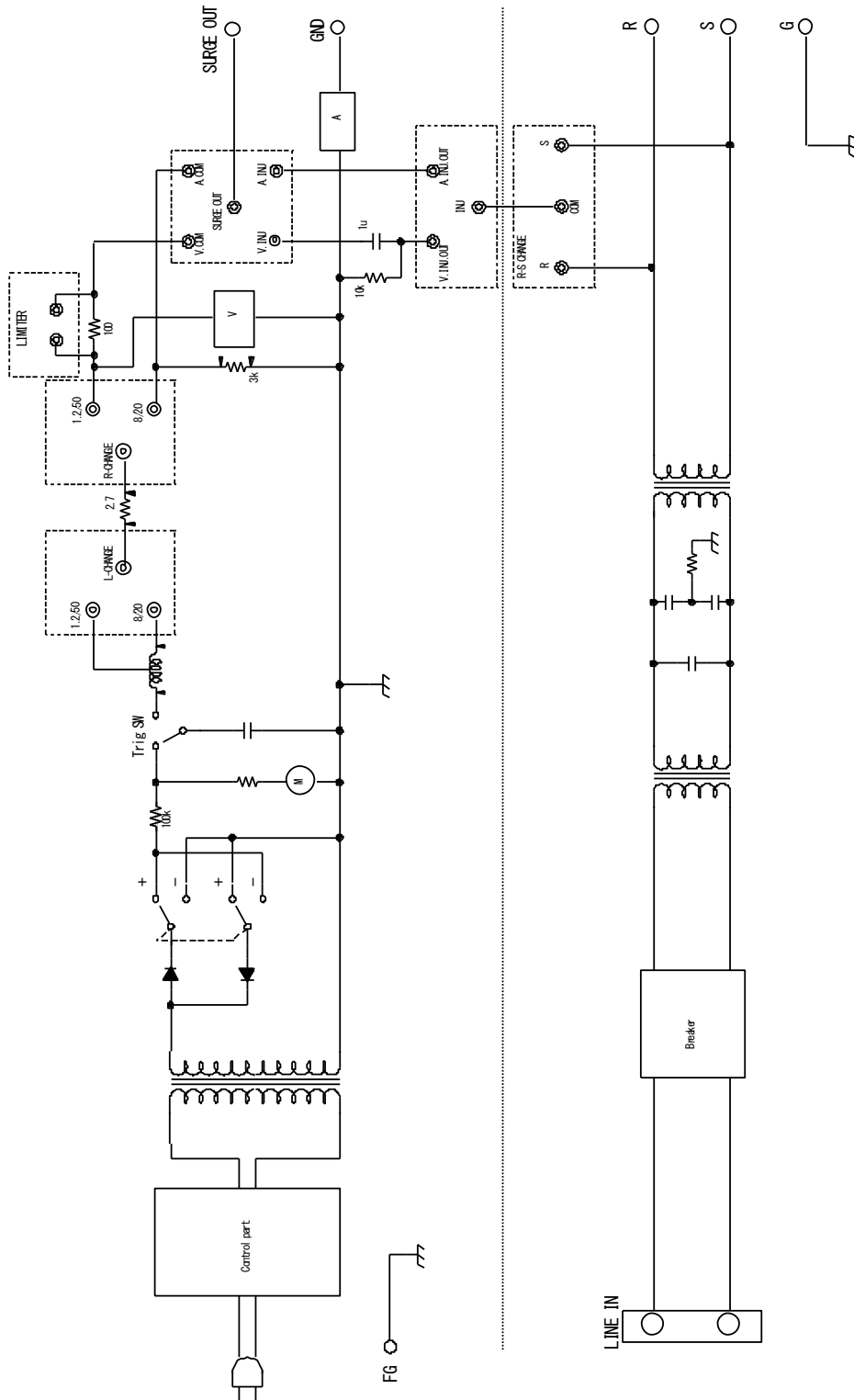


Fig. 28

15. 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. 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. 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 force 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

16. 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 checking or replacing the fuse, turn off the switch of the unit 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 open the cover of this unit.

17. NOISE LABORATORY SUPPORT NETWORK

- If a symptom that 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 our nearest sales agent in your area.
- 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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