



**INSTRUCTION MANUAL**  
**LIGHTNING SURGE SIMULATOR**  
**MODEL LSS-F03 SERIES**

**NOISE LABORATORY CO., LTD.**

The 1.04 edition  
AEE00567-00E-0E

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## 1. IMPORTANT SAFETY PRECAUTIONS

The following instructions are very important for safe handling of the lightning surge simulator LSS-F03 series (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.

- **Only well-trained EMC technicians (electric technicians) are allowed to use the Unit.**

The Unit may cause a fatal wound. Carefully handle it. And it may radiate electromagnetic noise which exceeds the regulation value. Take applicable countermeasures such as faraday cage, shield room, etc. as the need arises.

- **The Unit should be used only for EMC testing described in this manual.**

Using it for other purposes may result in a fatal or serious accident.

- **A person who has a pacemaker on should not operate the Unit and also should not enter the area where it is operating.**

It may result in a fatal or serious accident.

- **The Unit cannot be used in an explosive area, fire prohibited area, etc.**

Use of the Unit in such an area is liable to cause combustion or ignition.

**A number of safety recommendations are listed in the later chapter "BASIC SAFETY PRECAUTIONS". Be sure to read them before test environment settings, connecting relating equipment and testing.**

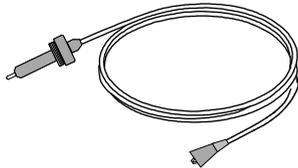
## 2. CHECK PACKAGE CONTENTS

Before using the instrument, check whether the included accessories are complete according to the following list.

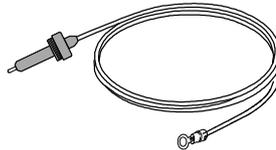
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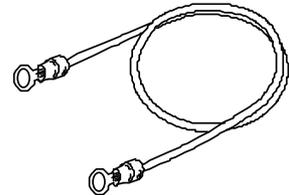
B



C



D



E



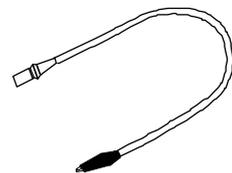
F



G



H



I



J



K



L



A : AC cable-----	1
B : Surge output cable (1.8m) (MODEL : 05-00137A alligator clip) -----	2
C : Line output cable (1.8m) (MODEL : 05-00138A M6) -----	3(A1/C1) 5(A3/C3)
D : FG cable (2m) (MODEL : 05-00070A M6—M6) -----	1
E : Coaxial cable for monitoring (1m) (MODEL : 02-00128A BNC—BNC) -----	1
F : Interlock connector-----	1
G : High voltage connector cap (MODEL : 05-00060A) -----	5(A1/C1) 7(A3/C3)
H : Telecom line output cable (1m) (MODEL : 05-00061A/05-00065A) -----	5(C1/C3)
I : Coupling arrestor unit (for coupling) (MODEL : 08-00016A) -----	4(C1/C3)
J : Arrestor unit (For input protection) (MODEL : 08-00012A) -----	4(C1/C3)
K : Accessory bag-----	1
L : Instruction manual-----	1

### 3. APPLICATION FORM FOR INSTRUCTION MANUAL

We place an order for an instruction manual.

**Model: LSS-F03** \_\_\_\_\_

**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**

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line



## 4. PREFACE

### 4-1. Preface

We thank you very much for your purchase of our Lightning Surge Simulator LSS-F03 series (hereinafter “the Unit”). This instruction manual (“the Manual”) contains how to use the Unit and other important information. In order to obtain the highest performance from the Unit, thoroughly understand the contents of the Manual and use as ready reference for operation.

- The Manual was prepared so that any person who can observe the prescribed instruction method and operating precautions may safely handle and fully utilize the Unit.
- Keep the Manual by your side or other proper location so that it may be readily available when using the Unit.

### 4-2. Feature

#### Conforming to IEC61000-4-5 (Edition 3.0 / 2014)

- Generating combination wave surge of 1.2/50 $\mu$ s and 10/700 $\mu$ s prescribed by IEC 61000-4-5 (Edition 3 / 2014).  
Combination waves mean output of 1.2/50 $\mu$ s or 10/700 $\mu$ s voltage surge waveform with the surge output unit opened (load: more than 10k $\Omega$ ) and output of 8/20 $\mu$ s or 5/320 $\mu$ s current surge waveform with the output unit short-circuited.
- Testing high voltage and great electric current (voltage surge: 15kV, current surge: 7500A). The surge generating circuit adopts a floating output system recommended by IEC 61000-4-5 (Edition 3 / 2014).
- Capable to conduct surge injection test to power supply lines with the CDN (Coupling and Decoupling Network) for EUT which is equipped as standard equipment. The AC/DC line injection part adopts a circuit system conforming to IEC 61000-4-5 (Edition 3 / 2014).
- Capable to conduct surge injection test to TELECOM lines with the incorporated CDN for the symmetrical interconnection lines (C1 / C3 model).

#### User-friendly LCD Control Panel

- The operation panel adopts a color LCD touch panel for pursuing high visibility.
- Capable of various kinds of setup with simple touch panel.
- Employs push buttons for handling safety-related operation such as START/STOP.

#### Various Functions Broaden Horizons of Test

- Preset test conditions which are prescribed on the standard in the “standard test” mode.
- Capable to set test conditions as you like in the “manual test” mode.
- “Sweep” function enable automatic step-by-step change of test parameters.
- Capable to save your test conditions.
- Remote control is available with optical communication (optional).
- Capable to set upper limit of voltage setup (6kV).

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## 6. BASIC SAFETY PRECAUTIONS

- The following items are very important instructions which users must follow to take precautions against possible injury and harm.
- The indications are provided as an explanation of potential danger involved if the safety precautions are not observed correctly.

### 6-1. Symbols of Hazard

- ◆ The following display classifications describe degree, to which injury or harm might occur when the contents of the display are not followed or the Unit or related equipment is operated incorrectly.



## DANGER

The contents of this display indicate “the assumption that imminent danger might occur resulting in death or serious injury” if the Unit or related equipment is handled incorrectly.



## WARNING

The contents of this display indicate “the assumption that there is a possibility of death or serious injury” if the Unit or related equipment is handled incorrectly.



## CAUTION

The contents of this display indicate “the assumption that there is a possibility of harm and the assumption that there is a possibility of physical damage” if the Unit or related equipment is handled incorrectly.

### 6-2. Symbols of Instruction, Warning and Caution

- ◆ The following display classifications describe details that should be followed.

	Indicates attention (a matter that must be paid attention fully)		
	Indicates prohibition (an action that must not be taken)	 Prohibited	 Do not disassemble
	Indicates a compulsory action (an action that must be taken)	 Compulsory	

◆ The contents of following signs indicate warnings and cautions when using the Unit.

	<p><b>Noticing possibility of an electric shock</b> It indicates that there is possibility of an electric shock.</p>
	<p><b>Noticing caution, warning and danger</b> It indicates that there is a possibility of harm or physical damage if the Unit is or related equipment is handled incorrectly and that the Manual should be referred.</p>
 <p><b>WARNING</b> <b>HIGH-VOLTAGE</b></p>	<p>It indicates warnings for electric shock etc. and the Manual should be referred.</p>
 <p>CAUTION</p> <p>SURGE OUTPUT 端子に電源を接続しないこと。 DO NOT CONNECT POWER LINE</p>	<p>It indicates warnings for electric shock etc. and the Manual should be referred.</p> <p><u>Caution on handling</u> Do not connect power lines to the terminal. Failure to follow this instruction may result in damage of the Unit.</p>
 <p>USE INSULATION TRANSFORMER BETWEEN AC POWER INPUT TERMINAL AND AC POWER SUPPLY FOR AC INJECTION TO PREVENT LEAKAGE TO GROUND. AC入力時、LINEに絶縁トランスを挿入すること。</p>	<p>It indicates warnings for electric shock etc. and the Manual should be referred.</p> <p><u>Caution on handling</u> Insert an isolation transformer between the AC power input terminal of the Unit and the power supply.</p>
 <p>感電防止のため、本器の駆動用 AC インレットの接地端子は AC ケーブルを通じて確実に大地アースに接続して下さい。 TO PREVRNT ELECTRIC SHCOK, GROUND THIS UNIT VIA THE GROUND CONDUCTOR OF THE AC CORD.</p>	<p>It indicates warnings for electric shock etc. and the Manual should be referred.</p> <p><u>Caution on handling</u> To prevent an electric shock, ground the Unit securely with the ground conductor of the AC cable.</p>
 <p>BEFORE REMOVING THE TERMINAL BLOCK COVER, CHECK TO SEE NO ELECTRIC POTENTIAL EXISTS. 端子台のカバーを外す前に、EUT 供給電源が遮断されていることを確認して下さい。</p>	<p>It indicates warnings for electric shock etc. and the Manual should be referred.</p> <p><u>Caution on handling</u> Before uncovering the terminal block cover, check to see no electric potential exists.</p>

<div data-bbox="290 226 764 479" style="border: 1px solid black; padding: 5px;"> <div style="text-align: center;">  <b>WARNING</b> </div> <p>WARNING TO REDUCE THE RISK OF ELECTRIC SHOCK, DO NOT REMOVE COVER. NO USER-SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.</p> <p>感電の危険あり。カバーを外さないこと。</p> </div>	<p>It indicates warnings for electric shock etc. and the Manual should be referred.</p> <p><u>Caution on handling</u> Do not uncover to reduce the risk of an electric shock.</p>
<div data-bbox="290 512 764 766" style="border: 1px solid black; padding: 5px;"> <div style="text-align: center;">  <b>WARNING</b> </div> <p>NOISE LABORATORY CO.,LTD. IS EXCLUDED ALL THE LIABILITY OF ANY FORMS OF DAMAGE, OF EQUIPMENT OR HUMANS, CAUSED BY USER'S MISHANDLING DURING OPERATION.</p> <p>誤った操作による損害に対しては、一切責任を負いません。</p> </div>	<p>It indicates warnings for electric shock etc. and the Manual should be referred.</p> <p><u>Caution on handling</u> Noise Laboratory Co., Ltd. is excluded all the liability of any forms of damage, of equipment or humans, caused by user's mishandling during operation.</p>
<div data-bbox="290 889 764 1142" style="border: 1px solid black; padding: 5px;"> <div style="text-align: center;">  <b>WARNING</b> </div> <p>THIS UNIT EMPLOYS A MERCURY SWITCH. THE COMPONENT SHALL BE DISPOSED OF IN CONFORMITY TO THE LOCAL REGULATIONS.</p> <p>水銀を使用した部品を内蔵しているため、廃棄の際は法に従うこと。</p> </div>	<p>It indicates warnings for electric shock etc. and the Manual should be referred.</p> <p><u>Caution on handling</u> The Unit employs a mercury switch. The component shall be disposed of in conformity to the local regulation.</p>
<div data-bbox="290 1202 764 1447" style="border: 1px solid black; padding: 5px;"> <div style="text-align: center;">  <b>CAUTION</b> </div> <p>OPERATIONAL ENVIRONMENT TEMPERATURE : 15~35°C HUMIDITY : 25~75%RH</p> <p>下記の項目を確認して下さい。 使用温度範囲 : 15 ~ 35°C 使用湿度範囲 : 25 ~ 75%RH</p> </div>	<p>It indicates warnings for electric shock etc. and the Manual should be referred.</p> <p><u>Caution on handling</u> Operational temperature : 15~35°C Operational humidity : 25~75%RH</p>

# DANGER

 Do not disassemble	<p><b>Do not take the Unit apart or do not remodel. Do not open the cover.</b></p> <p>Imminent danger might occur resulting in death or serious injury. Repair, internal adjustment, and inspection of the Unit should be performed by a qualified service engineer. Ask the Company or its sales agent.</p>
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 Prohibited	<p><b>Do not use the Unit in an explosive are or fire-prohibited area etc.</b></p> <p>Use of the Unit in such an area is liable to cause combustion or ignition.</p>
	<p><b>A person who has a pacemaker on should not operate the Unit and also should not enter the area where it is operating.</b></p> <p>It may result in a fatal or serious accident.</p>

# WARNING

 Compulsory	<p><b>Stop operation if following unusual phenomena should occur.</b></p> <ul style="list-style-type: none"> <li>○ Emitting fumes, or smelling.</li> <li>○ Water or an unusual substance being stuck</li> <li>○ Being dropped or being damaged</li> <li>○ AC cable being damaged (e.g. core lines being exposed etc.)</li> </ul> <p>Continuing to operate in the above status may result in a fire, electric shock, or injury. If an unusual phenomenon occurs, turn off power supply immediately, pull AC plug out of an outlet, and ask the Company or sales agent repair. As there is potential danger, any user must not repair the product.</p>
	<p><b>Insulate and protect the test facility against maximum output voltage of the Unit.</b></p> <p>If the test facility is not so insulated and protected, there is the dangerous possibility of an electric shock, leak or fire.</p>
	<p><b>Turn off power supply of the Unit when setting or changing connection of related equipment.</b></p> <p>Failure to follow this notice may cause electric shock, injury, or malfunction.</p>
	<p><b>Fully pay attention to insulation of surge return route also.</b></p> <p>The surge generating circuit of the Unit adopts floating system. Since the return route is not connected to the chassis, high voltage may generate on the return route.</p>

 Compulsory	<p><b>Use the Unit after understanding instructions in the Manual fully.</b></p> <p>There may be danger causing a fatal or serious wound or emitting over-ristricted-value electromagnetic noise in using the Unit. 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.</p>
	<p><b>Watch equipment while the Unit is operating.</b></p> <p>If this instruction should not be followed, a third person or equipment related to the test may be exposed to a danger.</p>
	<p><b>Supply power within the indicated range.</b></p> <p>Failure to follow this instruction may cause an electric shock or a fire. The attached AC cord in the accessory is for AC100~120V.</p>
	<p><b>Use proper connectors and cables and connect them securely.</b></p> <p>Avoid using a damaged connector or cable. The misuse may cause an electric shock or damage of equipment.</p>
	<p><b>Insert AC plug securely to the end.</b></p> <p>Insecure inserting generates heat and gathers dust. It may result in a fire or an electric shock. Avoid using a multiple outlet extension plug for the same reason.</p>
	<p><b>Install the Unit on a stable place.</b></p> <p>If the Unit is installed on an unstable place, human body may be in danger due to drop or overturn of the Unit.</p>
	<p><b>Connect the protective earth of the Unit.</b></p> <p>Prepare a proper 3-line AC cable with a protective earth pin conforming to the local safety standard and connect it to the protective earth of the test room securely. Unless grounding from the power supply is available, utilize the FG terminal on the rear panel for grounding.</p>
	<p><b>Be sure to insert an isolation transformer between LINE IN of the Unit and AC LINE power supply for AC LINE Injection test.</b></p> <p>If AC LINE power is supplied to the Unit directly, a circuit breaker installed on the power supply may function due to leak current from the Unit.</p>
	<p><b>Do not turn on the circuit protector on the input panel while the emergency button is pressed.</b></p> <p>Failure to follow this instruction may cause destruction of the Unit.</p>
	<p><b>In the telecom line surge injection test, be sure to avoid connecting the telephone switchboard to the telecom line input terminal block.</b></p> <p>Failure to follow this instruction may cause destruction of the telephone switchboard due to surge back from the Unit.</p>

## WARNING

 Prohibited	<p><b>Do not use the Unit for any other purpose than Lightning Surge test.</b>                      The misuse may result in an electric shock, an injury, or damage of equipment.</p>
	<p><b>Do not put any substance into the Unit or its connectors.</b>                      If some metal or flammable things are put into the Unit through a connector or a vent, it may result in a fire or an electric shock.</p>
	<p><b>Do not install the Unit on the spot where quick operation of power key or STOP key is difficult.</b>                      If the simulator is set up on such a spot, difficulty in taking action in emergency may result in a fire or an electric shock.</p>
	<p><b>Do not use the attached AC cable for any other purpose.</b>                      The misuse may result in a fire or an electric shock.</p>
	<p><b>Do not damage AC cable.</b>                      A damaged AC cable may cause a fire or an electric shock.                      For HV cable, be sure to take notice following points.</p> <ul style="list-style-type: none"> <li><input type="radio"/> Do not work it.</li> <li><input type="radio"/> Do not bend it forcibly.</li> <li><input type="radio"/> Do not twist it.</li> <li><input type="radio"/> Do not pull it.</li> <li><input type="radio"/> Do not move it close to heat.</li> <li><input type="radio"/> Do not put heavy things on it.</li> </ul>
	<p><b>Do not use the Unit with tilting it more than 10°.</b>                      Use the Unit with making it even. Failure to follow this instruction may cause trouble of the Unit.</p>

## CAUTION

 Compulsory	<p><b>Take actions against emission of electromagnetic waves.</b>                      When a test is performed using the Unit, a great amount of electromagnetic waves are emitted depending on the type of EUT, sometimes adversely affecting the neighboring electronic equipment and radio communication apparatus. The user is required to provide a Faraday gage, shield room, shielding cable, etc. as necessary.</p>
	<p><b>Do not connect any power supply to EXT CDN terminal.</b>                      The EXT CDN terminal is the terminal exclusively used for outputting surge to the external CDN and outputting 10/700µs surge. If an AC or a DC power supply is directly connected to it, the internal of the Unit may be damaged.</p>
	<p><b>If dewing occurs, fully dry up the Unit before using it.</b>                      Dews may cause an electric shock, a trouble, or a fire.</p>

 <p>Compulsory</p>	<p><b>Use the Unit in proper environment.</b></p> <p>Operating temperature range is 15~35°C. Operating humidity range is 25~75%. If these precautions are not followed, the unit may be broken or the prescribed performance may not be warranted.</p>
	<p><b>Clean up the AC plug periodically.</b></p> <p>If dust gets damp between the AC plug and outlet, insulation capability deteriorates. It may result in a fire. Pull the AC plug out from an outlet periodically and wipe it with a dry cloth.</p>
	<p><b>When the body is dirty, wipe the body with a dry cloth.</b></p> <p>Do not wipe the Unit and Probe with thinner, alcohol or other solvent. When the body is very dirty, soak a cloth into neutral detergent, squeeze out the detergent from the cloth and wipe the body with the cloth.</p>
	<p><b>Make hazardous labels always noticeable.</b></p> <p>When the caution or warning label is peeled off, missing or dirty, attach a new one for securing safety. When the caution or warning label is missing, ask the sales department or maintenance section of our company to send a new label.</p>
	<p><b>Carry the Unit by more than two persons for moving it.</b></p> <p>The Unit is a heavy stuff. When it is moved, work by more than two persons with taking sufficient safety measures.</p>
	<p><b>Do not install the Unit on following places.</b></p> <p>Setting up the Unit on wrong places as follows may result in a fire, an electric shock, or an injury.</p> <ul style="list-style-type: none"> <li>○ A very humid or dusty place</li> <li>○ A hot place, e.g. a place exposed to direct rays of the sun, a place close to a heater.</li> </ul> <p>A place easy to bedew, e.g. a place close to a window.</p>
 <p>Prohibited</p>	<p><b>Do not block a vent or do not use the Unit in a place poorly ventilated.</b></p> <p>If a vent is blocked, the internal heat is close. It may cause a fire. For ventilation, be sure to take notice following points.</p> <ul style="list-style-type: none"> <li>○ Do not lay the Unit on its back, sideways, or upside down.</li> <li>○ Do not turn on the Unit with putting something like paper, cloth, or so on, on it.</li> <li>○ Do not put the Unit into a small, poorly ventilated place.</li> </ul> <p>Keep the Unit at least 10cm away from a wall or some substance.</p>
	<p><b>Do not handle the AC plug with your hand wet.</b></p> <p>The misuse may result in an electric shock or trouble.</p>
	<p><b>Do not put any container containing water on the Unit.</b></p> <p>If water is spilled or gets into the Unit, it may result in a fire or an electric shock.</p>
	<p><b>Do not drop or shock the Unit excessively.</b></p> <p>The misuse may cause trouble or damage.</p>
	<p><b>Do not bump or rub the Unit against something hard.</b></p> <p>The misuse may damage a surface of the Unit.</p>
	<p><b>Do not put any heavy stuff or sit on the Unit.</b></p> <p>The misuse may result in a dent on the body or damage of internal components.</p>

## 7. CAUTION ABOUT EXPENDABLE SUPPLIES

- **About switches, storage capacitors, high voltage relays, discharge switches, contactors, circuit breakers, fuses, fans, and varistors inside**
  - The above components used in the Unit are expendable.
  - The lifetime of them is dependent on using conditions and environment.
  - If a symptom which seems to be caused by exhausted components e.g. unstable current waveform or so on, is found, contact Noise Laboratory or your closest sales agent. Repair by a user is not allowable due to safety reason.
  
- **Rechargeable battery for backing up memory**
  - A battery for backing up memory is expendable.
  - Without being turned on for more than 2 months, a rechargeable battery will discharge and memory backup function will not work.
  - If a rechargeable battery discharges, previously memorized contents (Refer to P.71) will return to the default values.
  - For maintaining memory backup function, turn on the Unit for approximate 24 hours once every 2 months. (Recharging time is dependent on using condition and environment.)
  - If memory backup function does not work even after charging the battery, the battery seems to be exhausted. Contact Noise Laboratory or your closest sales agent of Noise Laboratory. As repair by a user is very dangerous, do not repair unconditionally.
    - ※ Noise Laboratory and its sales agent are not liable to loss of backup data caused by an exhausted battery, malfunction, malfunction, or so on.  
As for important information, write down beforehand.

※ **In the event of failure in normal usage, repair shall be performed under the condition of the warranty rule. However, NOISE LABORATORY and its sales agents shall not be liable for any accident resulting in damage of DUT or peripheral equipment caused by deterioration of performance of expendable parts or any other external factors.**

## 8. INTRODUCTORY NOTES

### 8-1. Introductory Notes

The meaning of following symbols is as follows.

	Operate the touch panel.
	Additional explanation.
	Indicating other parts to be referred in the Manual.
	Indicating restriction of setting up.
	Indicating items to be confirmed before usage.
<b>【 】</b>	Indicating text on the panel of the Unit.
<b>『 』</b>	Indicating text on the LCD of the Unit.

### 8-2. Terms and Definitions

The terms and their definitions are shown as follows.

Term	Definition
<b>Surge</b>	Transient wave of electrical voltage, current, or power, propagating along a line or a circuit. It is a single waveform characterized by a rapid increase followed by a slower decrease. The phenomenon occurs sometimes by lightening, sometimes by transient response of switching of a circuit.
<b>Voltage surge</b>	Surge which waveform is formed in as voltage. With this simulator, this waveform is defined as a voltage waveform which is observed when some load (EUT or DUT) is connected to the output including when the output is open.
<b>Current surge</b>	Surge which waveform is formed in as voltage. With this simulator, this waveform is defined as a current waveform which is observed when some load (EUT or DUT) is connected to the output including when the output is short-circuited.
<b>Front time</b>	Parameter defining rise time of surge waveform. Each of voltage surge and current surge has its own definition of front time.
<b>Time to half-value</b>	Interval of time between the virtual origin and the point when the value decreases to 50% with supposing peak of waveform 100%.
<b>Output impedance</b>	Effective output impedance of the surge generating circuit. The following formula is used to acquire it. (Peak voltage value in open) / (Peak current value in short-circuited)
<b>DUT</b>	Device Under Test. A device to be tested by test equipment.
<b>EUT</b>	Equipment Under Test. Equipment to be tested by test equipment.

### 8-3. How to Understand Model Number

This instruction manual is common for all of LSS-F02 series models. The outline of each model of this series is shown as the following table.

Model No.	Output waveform	CDN
LSS-F03A1	1.2/50μs-8/20μs combination waveform	AC single phase / DC
LSS-F03A3		AC single and three phase/DC
LSS-F03C1	1.2/50μs-8/20μs combination waveform	AC single phase/DC/TEL
LSS-F03C3	10/700μs -5/320μs combination waveform	AC single and three phase/DC/TEL

### 8-4. Definition of Surge Waveform

#### Voltage Surge Waveform

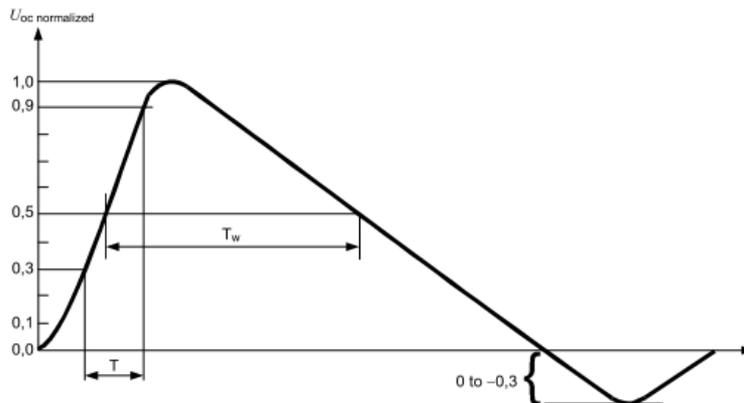


Fig. 8-1. Voltage surge waveform

Front time ( $T_1$ ): 1.67 times of the interval of time between the instants when the voltage value increases to 30% and 90% of the peak value.

Time to half-value ( $T_2$ ): time interval between the instant at which the surge voltage rises to 0.5 of its peak value, and then falls to 0.5 of its peak value

#### Current Surge Waveform

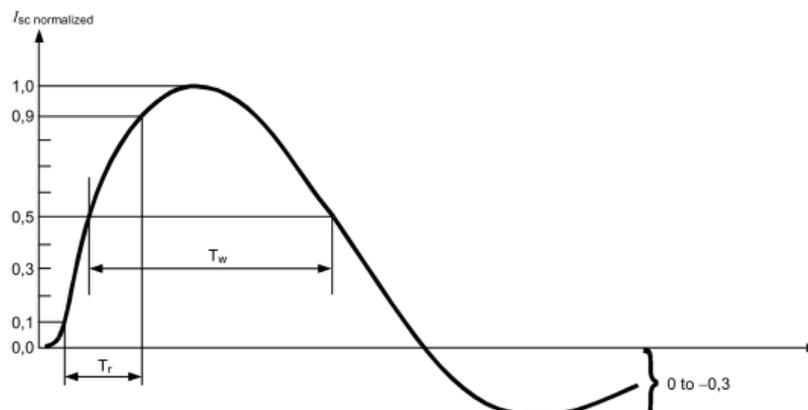
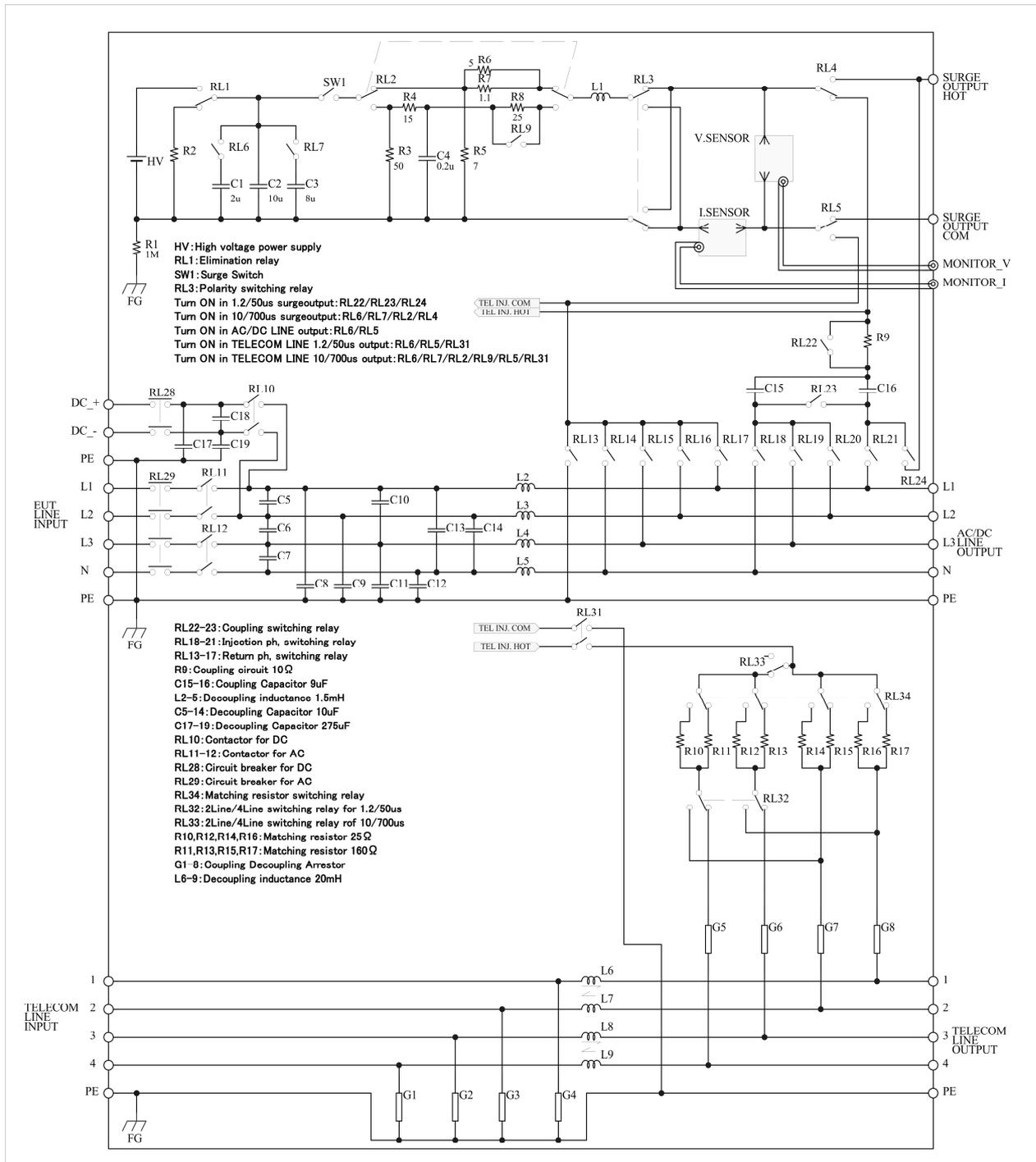


Fig. 8-2. Current surge waveform

Front time ( $T_1$ ): 1.25 times of the interval of time between the instants when the current value increases to 10% and 90% of the peak value.

Time to half-value ( $T_2$ ): virtual parameter defined as the time interval between the instant at which the surge current rises to 0.5 of its peak value, and then falls to 0.5 of its peak value ( $T_w$ ) for 5/320uS waveform, and multiplied by 1.18 for 8/20uS waveform

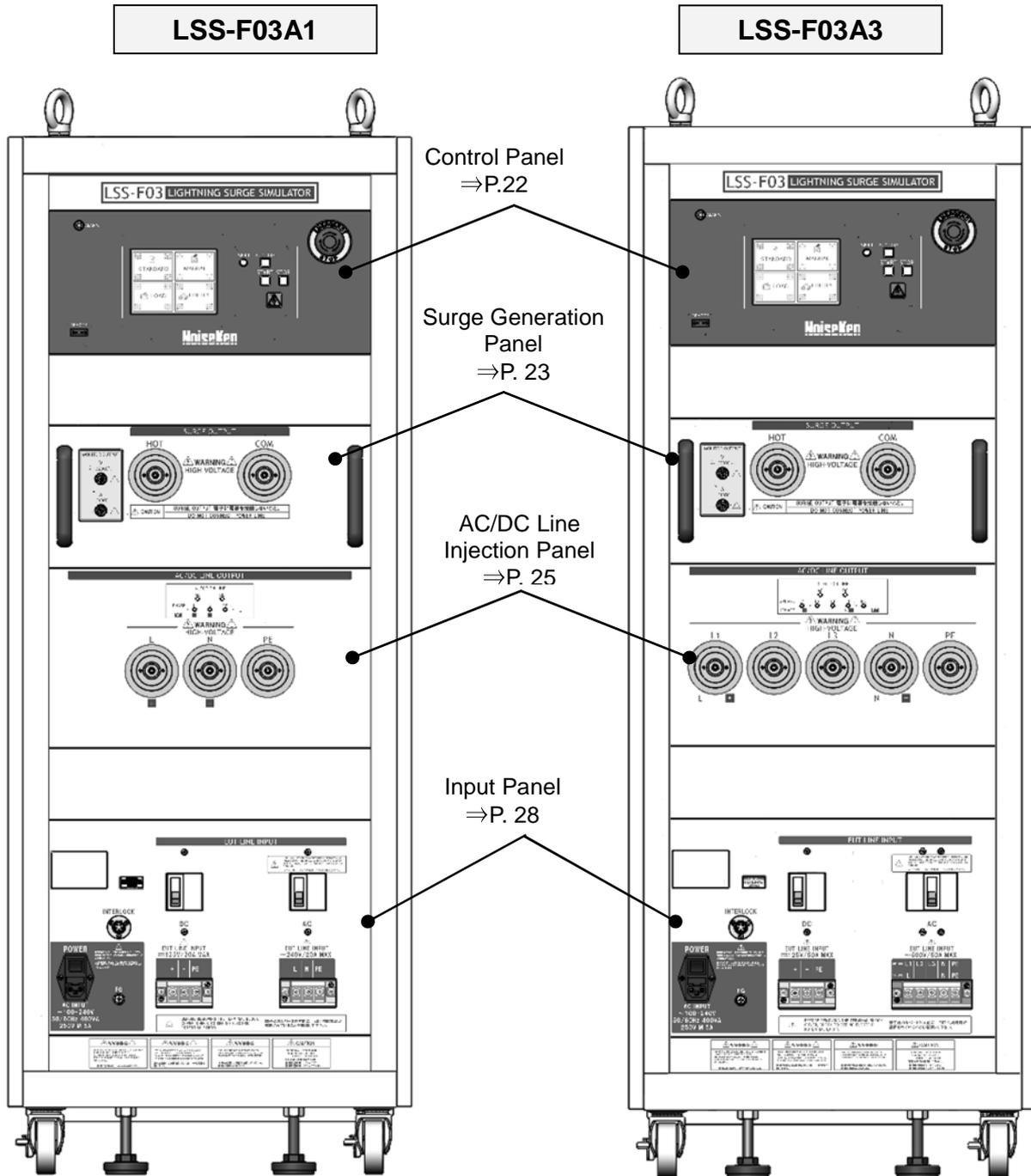
### 8-5. Block Diagram



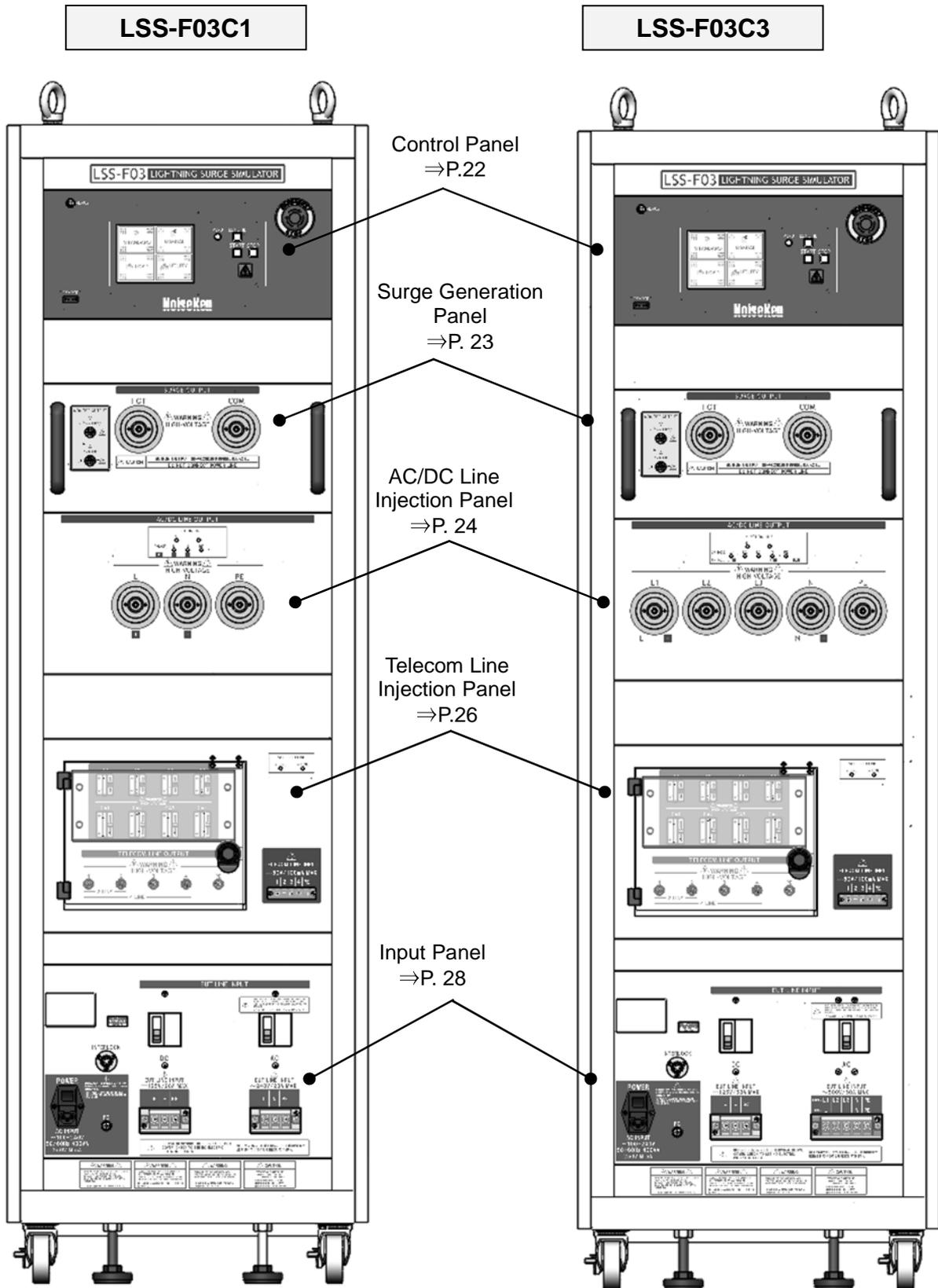
LSS-F03C3

# 9. APPEARANCE AND FUNCTION OF EACH PART

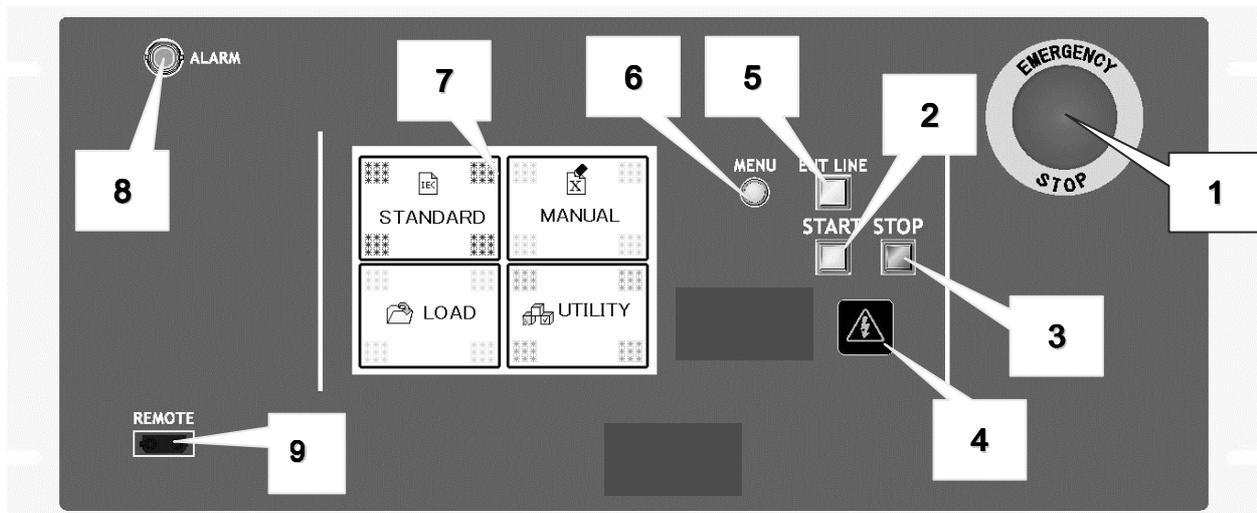
## 9-1. Appearance of The Main Unit



※Refer to 8-3. How to Understand Model Number.



## 9-2. Control Panel



1. Emergency stop button **【EMERGENCY】**  
Stop button for emergency. Avoid using this button for ordinary stop.
2. START key **【START】**  
Uses to start a test. Starting is available when a lamp of switch is blinking.
3. STOP key **【STOP】**  
Uses to stop a test.
4. Warning lamp  
Blinking while a test is being performed.



Since high voltage surges are generated while this lamp is blinking, carefully handle the Unit.

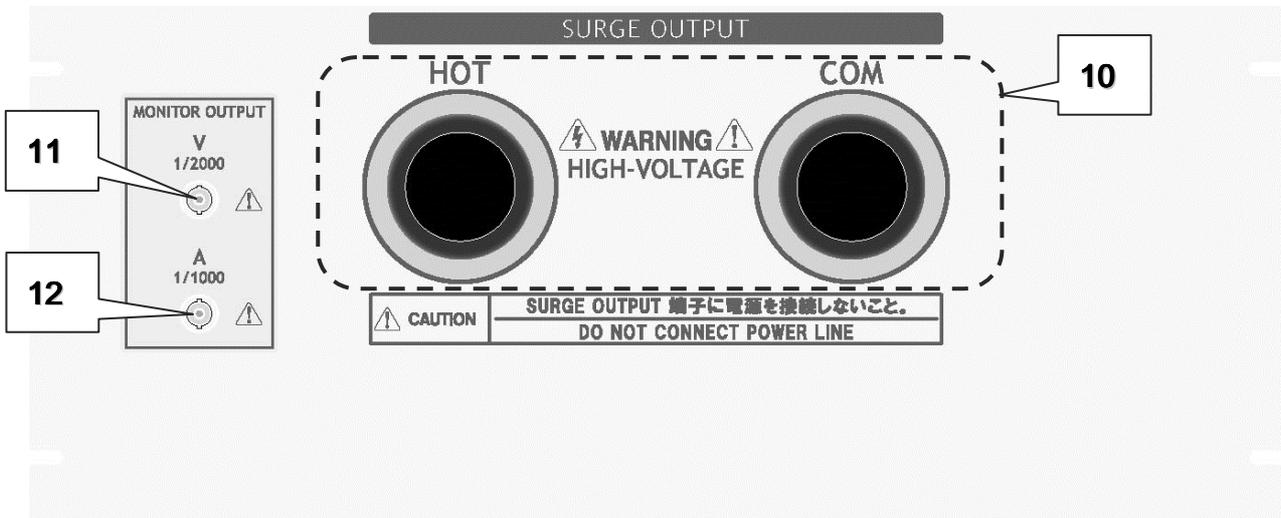
5. EUT LINE key **【EUT LINE】**  
Turns ON/OFF power line of AC or DC. If it is in ON status, change of output line is unavailable.



The EUT LINE key is designed to turn ON/OFF a usual EUT, but if the EUT is an extremely inductive load, use the power switch of the EUT instead of the EUT LINE key.

6. MENU key **【MENU】**  
Makes the LCD touch panel display 'MENU' screen. This operation is unavailable when testing.
7. LCD touch panel  
Selects operation mode and sets test conditions.
8. Alarm connector **【ALARM】**  
For connecting the optional warning lamp.
9. Optical communication connector **【REMOTE】**  
Connects the PC on which the remote software is operated via an optical cable.

### 9-3. Surge Generation Panel



#### 10. Surge output terminal 【SURGE OUTPUT HOT - COM】

Outputs surge.



High voltage surge is output from this terminal. Mishandling or careless operation may result in fatal wound. Fully be careful to handle it.

#### 11. Voltage surge monitor terminal 【MONITOR OUTPUT V 1/2000】

Voltage waveform monitor output terminal. A monitor output ratio is 2000V/V. The surge voltage can be monitored with connecting the supplied BNC cable to an oscilloscope.

#### 12. Current surge monitor terminal 【MONITOR OUTPUT A 1/1000】

Current waveform monitor output terminal. A monitor output ratio is 1000A/V. The surge current can be monitored with connecting the supplied BNC cable to an oscilloscope.

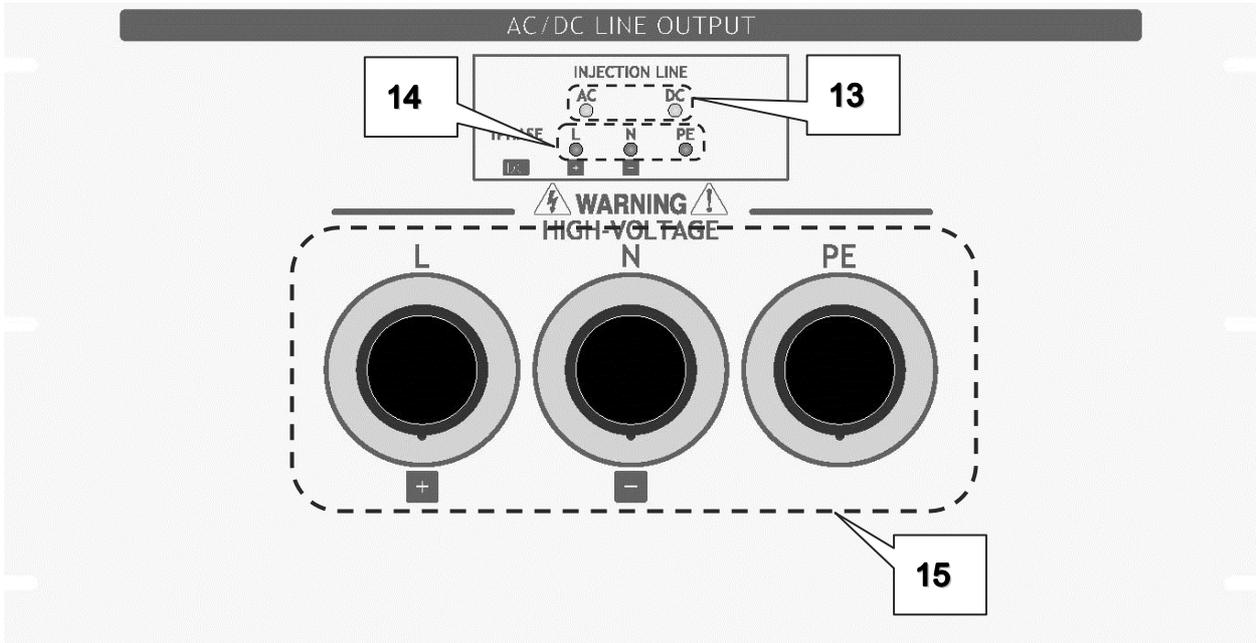


[Voltage surge monitor terminal / Current surge monitor terminal]  
(Refer to 19. WAVEFORM VERIFICATION)

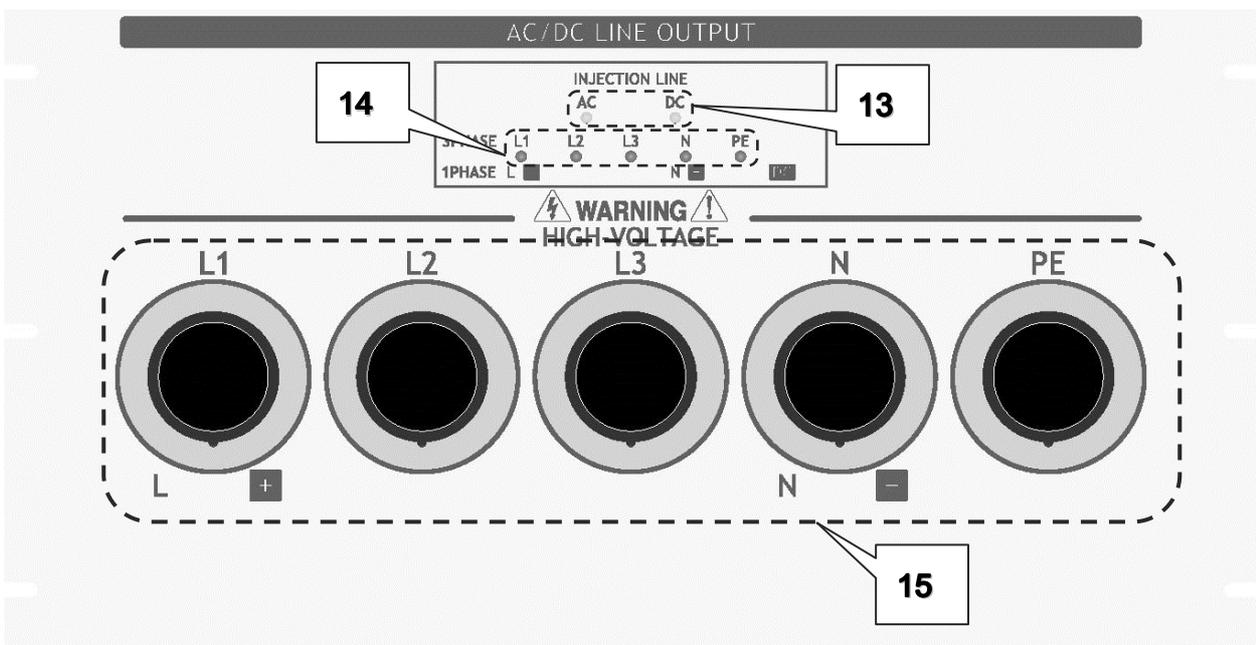
Since waveform at the output terminal of the Unit is monitored by monitor terminal, the monitored waveform is different from waveform which is injected to EUT actually. The monitor terminal is isolated from the high voltage surge generating circuit. Only voltage peak amplitude under open circuit conditions and current peak amplitude under short circuit conditions are guaranteed while no specifications are given with the EUT connected.

### 9-4. AC/DC Line Injection Panel

#### Single Phase Model (A1/C1 type)



#### Three Phase Model (A3/C3 type)



**13. Power line indication LED 【INJECTION LINE AC/DC】**

illuminates when the EUT LINE key 【EUT LINE】 is turned ON in the line injection test.

**14. Injection line indication LED 【INJECTION LINE】**

The LED of the connector which should be connected illuminates when no test is conducted. The LED of the lined related with the test (injection phase / return phase) illuminates during the line injection test.

**15. AC/DC line output terminal 【AC/DC LINE OUTPUT】**

Line injection output terminals of AC and DC power line.



High voltage surge is output from this terminal. Mishandling or careless operation may result in fatal wound. Fully be careful to handle it.

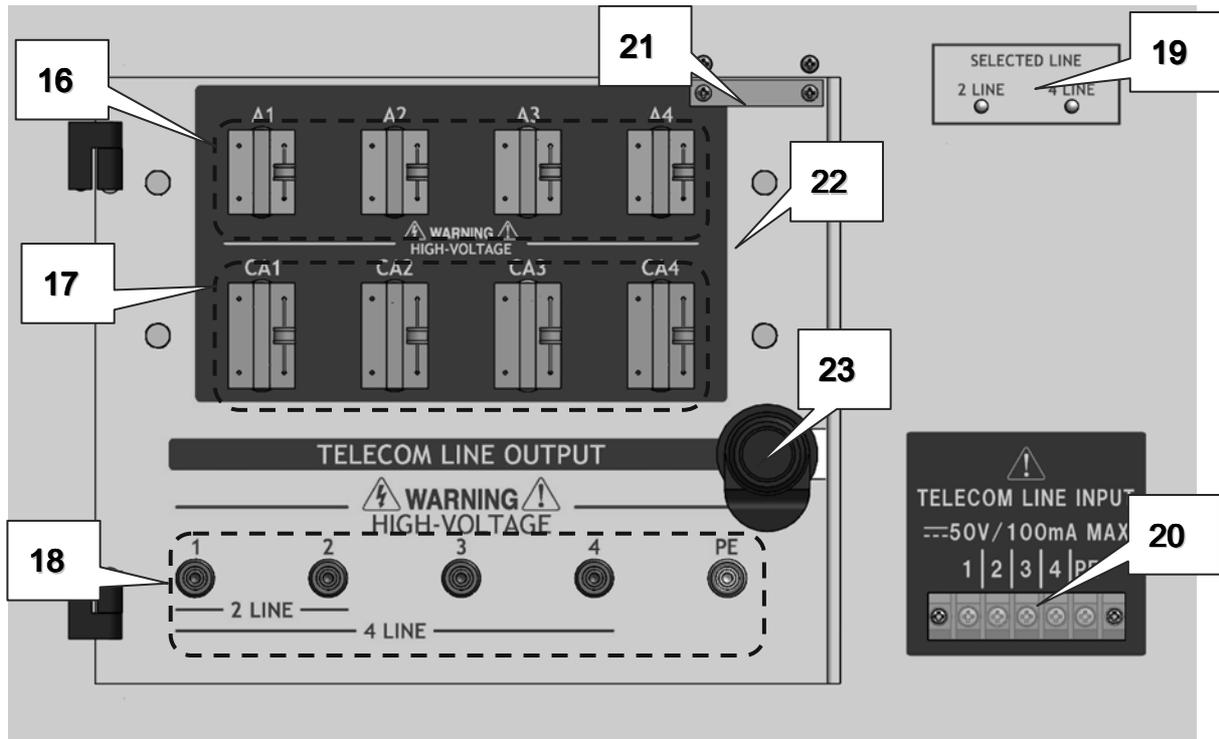
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AC line input part of the Unit incorporates varistors for absorbing surge back voltage. Since the varistors are expendable components, they might be exchanged in calibration or repairing opportunities. Lifetime of them depends on output voltage and load condition. If the maximum surge output (15kV) is conducted without connecting EUT –surge output part open--, lifetime might extremely be shortened.

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### 9-5. Telecom Line Injection Panel (C1/C3)



**16. Arrester unit [A1/A2/A3/A4]**

For surge decoupling. All of four units should be installed for safety when testing.

**17. Coupling arrester unit [CA1/CA2/CA3/CA4]**

For surge coupling. Install at least CA1 and CA2 for 2-line type, all of CA1~CA4 for 4-line type. Installing all of CA1~CA4 is recommendable.

- Arrester unit: Discharge voltage 90V
- !
 Lifetime of an arrester is approximately 300 times of surge under the condition that 6kV surge continues to inject, but the lifetime gets longer exponentially if the surge current gets smaller since the lifetime depends on the surge output current. And besides, the load condition varies the lifetime substantially.
- !
 If arrestors of the arrester unit and the coupling arrester unit deteriorate, surge is not injected to EUT properly. Especially, the arrestors of the arrester unit is installed for surge decoupling (to restrain surge back), therefore if they deteriorate, surge may return to EUT side. Fully be careful to avoid such phenomenon.

**18. Telecom line output terminal 【TELECOM LINE OUTPUT 1/2/3/4/PE】**

Line injection output terminal for telecom line. Use the terminal 1 and 2 for 2-line type, the terminal 1~4 for 4-line type. In case EUT has an FG terminal, connect it to the PE terminal.



High voltage surge is output from this terminal. Mishandling or careless operation may result in fatal wound. Fully be careful to handle it.

---

**19. Selected line indication LED 【SELECTED LINE】**

The LED of the selected type illuminates, the 2 LINE or 4 LINE.

**20. Telecom line input terminal block 【TELECOM LINE INPUT】**

Input terminals for inputting signals from auxiliary equipment to EUT. Connect the signal lines which are connected to communication equipment such as a switchboard emulator. Use the terminal 1 and 2 for 2-line type test. Note that the rated input is DC50V/100mA MAX.

**21. Injection part door interlock**

A magnetic sensor for detecting open and shut of the door of the injection part.

**22. Arrestors cover**

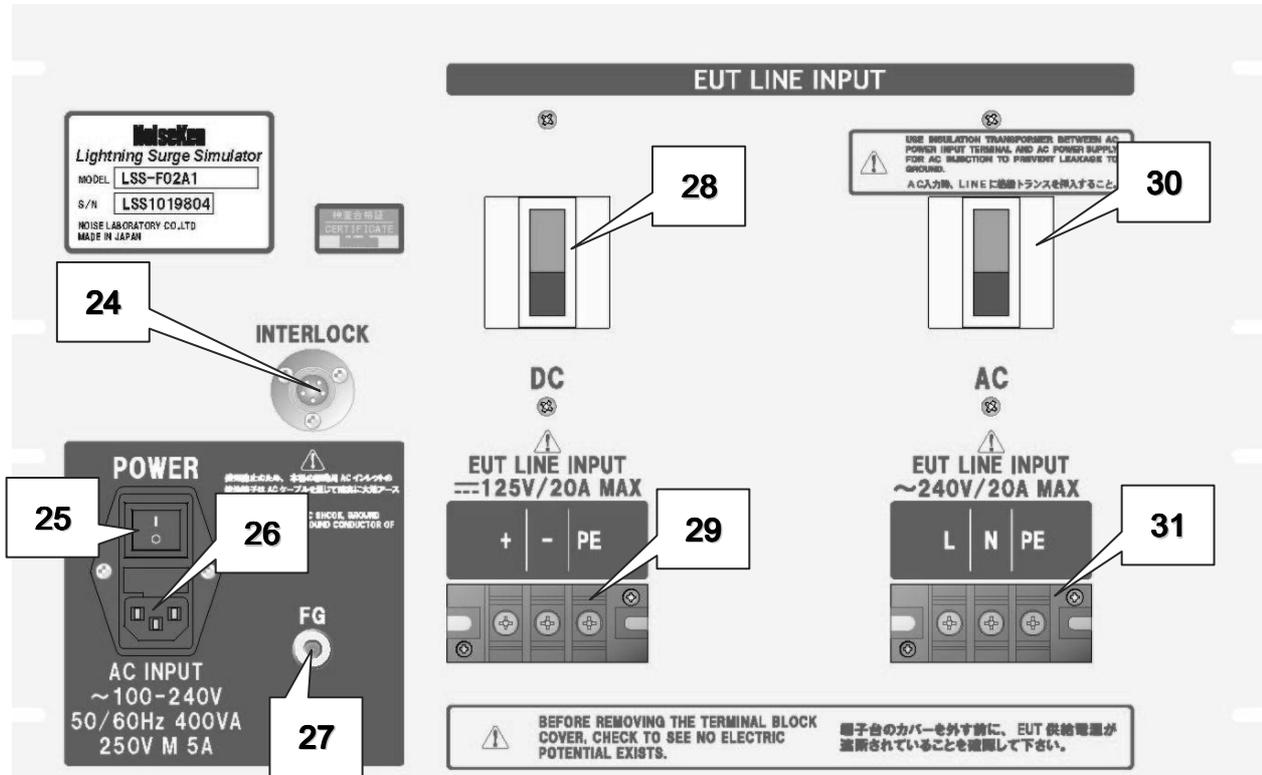
A protection cover for coupling and decoupling arrestor units.

**23. Injection part door**

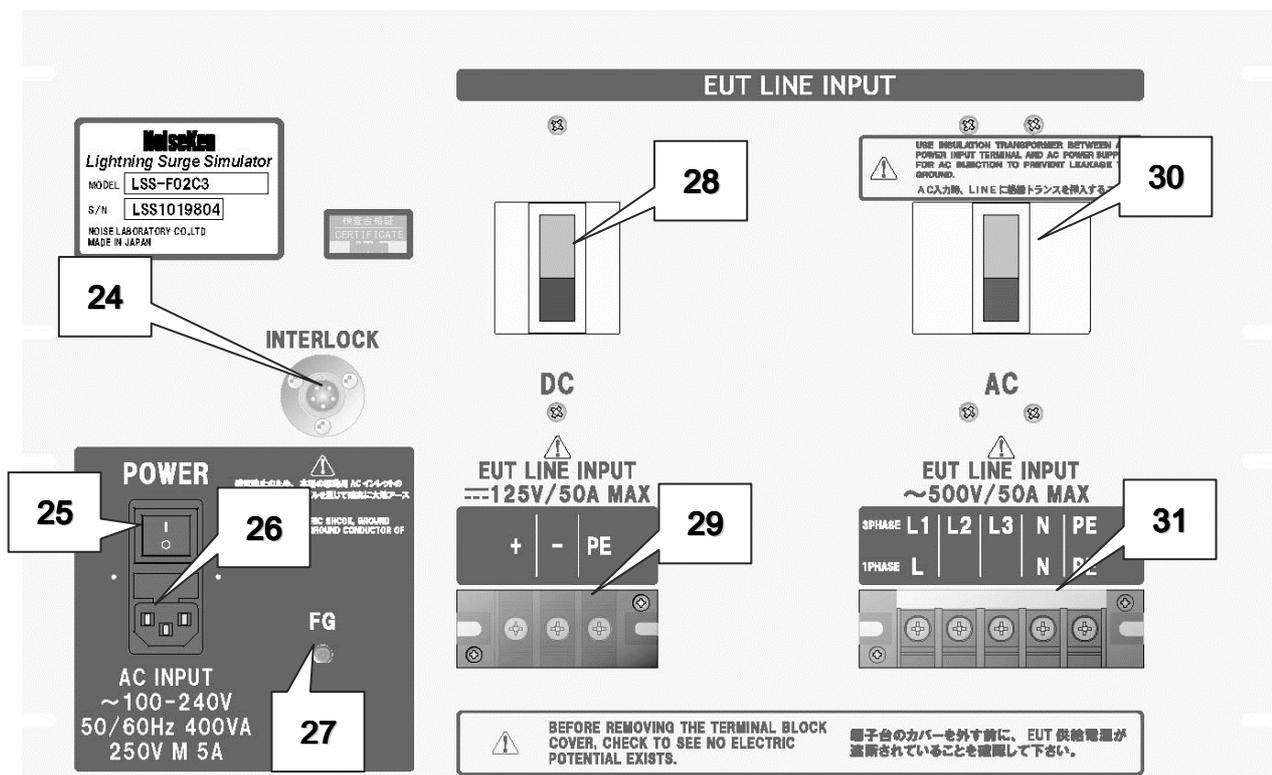
Since this door is interlock-detected, no test is performed unless the door is closed.

9-6. Input Panel

Single Phase Model (A1/C1 type)



Three Phase Model (A3/C3 type)



**24. Interlock terminal 【INTERLOCK】**

Turns ON when 1pin - 3pin is short-circuited so that test is ready. Connect the supplied interlock connector to this terminal.

**25. POWER switch 【POWER】**

Used to turn on and off power to the Unit. Turn it to [I] side to turn ON and to [O] side to turn OFF.

**26. AC inlet (with a fuse incorporated) 【AC INPUT】**

Connects AC cable to drive the Unit. A fuse is incorporated. Be sure to use the 250V M 5A fuse for exchange.

**27. FG terminal 【FG】**

FG (Frame Ground) terminal of the Unit. Since the Unit is usually grounded via the AC power supply cable with PE terminal, grounding of this terminal is unnecessary. Unless the Unit is grounded via an AC cable, connect it to the ground via the supplied FG cable.

**28. DC line breaker 【EUT LINE INPUT】**

For DC power supply to EUT. This breaker is turned OFF forcibly when the emergency stop button is pressed. Refer to 11-1. Emergency Stop Button.

**29. DC line input terminal block 【EUT LINE INPUT】**

Input terminals for DC power supply for driving EUT. Supply the plus side of DC to +, the minus side to -. Use this terminal with following the rated input.



Prepare the power supply cable which is conforming to the local standard with considering the power capacity of EUT and install a  $\Phi 5$  soldering terminal to it. Be sure to ground the PE via a cable which diameter is the same as the + and - line. Never fail to install the protective cover.

**30. AC line breaker 【EUT LINE INPUT】**

A circuit breaker for AC power supply for driving EUT. This breaker is turned OFF forcibly when the emergency stop button is pressed. Refer to 11-1. Emergency Stop Button.

**31. AC line input terminal block 【EUT LINE INPUT】**

Input terminals for AC power supply for driving EUT. Use this terminal with following the rated input.



Be sure to confirm that the power supply is turned OFF before connecting it.



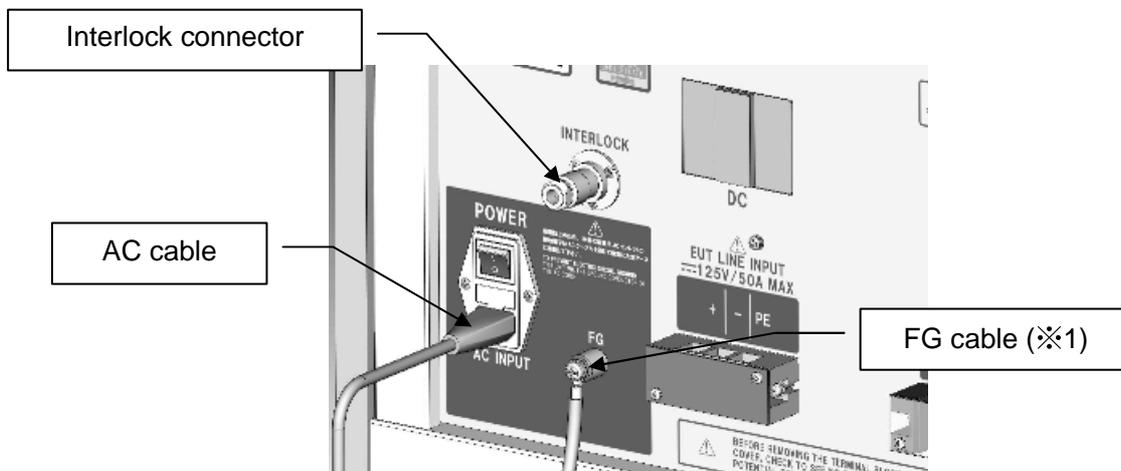
When supplying AC power to the EUT line input terminal, be sure to put an isolation transformer between AC power supply and the EUT line input terminal. If AC power is directly supplied to the Unit, a leakage current from the Unit will activate the ground fault circuit interrupter installed on the AC power supply.



As for the EUT line input cables, use the AC cable which is conforming to the local standard and suited to the EUT power handling capacity and connect it to the terminal after installing a  $\phi 5$  type soldering terminal to the cable. Be sure to ground PE terminal via a cable which has the same diameter as line in cables. After connection, never fail to put the protective cover on the terminals.

## 10. CONNECTION

### 10-1. Connection of AC Cables and Interlock Connector



- ① Insert the AC cable into the AC inlet **【AC INPUT】** .
- ② Connect the interlock connector to the interlock terminal.



The supplied AC cable is for AC100~120V. When the Unit is used with AC220~240V, prepare a three line AC cable which has a protective earth terminal conforming to the local safety standard.

- ※1 Unless the Unit is grounded via the 3 pin AC cable, ground the FG terminal **【FG】** via the supplied FG cable. Be sure to tighten a screw securely.

## **10-2. Connection of Optical Communication Cable (Optional)**

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To control the Unit externally (optional), connect a communication cable to the optical communication connector **【REMOTE】** . The communication cable is connected to PC via the optical fiber cable and adaptor.

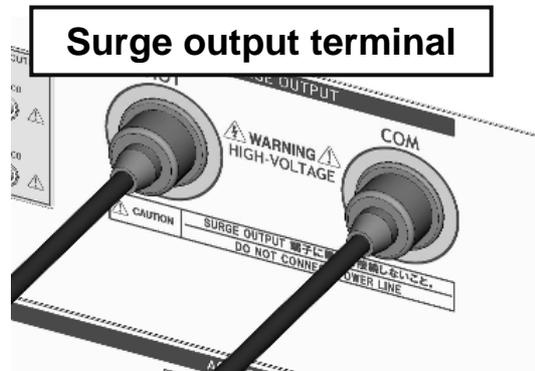
For details, refer to the instruction manual of the remote software. When communication is started, the display changes as the remote software content changes, but operation on the Unit is unavailable in this status except the following operation.

- Emergency stop button **【EMERGENCY】**
- LINE ON/OFF key **【LINE ON/OFF】** : Only turning OFF is effective.
- STOP key **【STOP】**

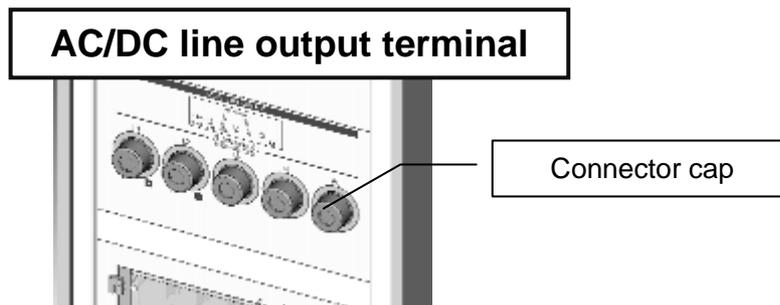
### 10-3. Connection for Applying Surge Waveform to EUT Directly

#### Connection of Surge Output

- ① Connect the supplied surge output cable to the surge output terminal **[HOT]**, **[COM]** on the surge generation panel.



- ② Put the protective cover on every AC/DC line output terminal **[AC/DC LINE OUTPUT]** which is not used for the test.



- ③ Be sure to close the door of the telecom line injection panel (in case of C1/C3 type).
- ④ Connect EUT to the tip of the surge output cable. If the surge output cable and the connecting part are worked for the test with insulation tubes, the surge test can be performed more safely. However, it is necessary to use an insulated tube with dielectric strength of 15kV or more. Moreover, as creeping discharge sometimes occurs on the surface of parts, it is also necessary to take into consideration the dielectric strength to creeping discharge.



Do not connect any power supply to the surge output terminal **[SURGE OUTPUT HOT · COM]** directly. If an AC power supply or a DC power supply is connected there directly, the Unit may be damaged.



Since all of the surge output terminals and doors of the Unit are detected by the interlock system, the test cannot be started unless all of the terminals are covered by caps and doors are closed. If the conditions are not satisfied, the screen indicates the caution.



An alligator clip is provided at the end of the surge output cable so that the cable can be easily handled. However, the alligator clip does not satisfy safety and electric specifications. Cut the alligator clip and connect it to the terminal base or work it according to operating conditions on the user to perform a test. In such cases, use a proper connector to meet dielectric strength of 15kV and short circuit current of 7500A.



When performing a test, maximum care for safety should be taken. When there is possibility that the EUT could explode, fit a cover to the EUT to assure the safety of the users.

## 10-4. Connection for Applying Surge Waveform to AC/DC Line

### Connection of AC/DC Line Input

#### Connection of Isolation Transformer

The power line injection unit of the Unit incorporates filters to prevent the surge from returning to the power supply upstream (Those filter are referred to as "Decoupling Network" in the relevant IEC standard.). It consists of LC filter and this simulator adopts  $L=1.5\text{mH}$ ,  $C=10\mu\text{F}$ . Since the capacitor of this filter is provided between line and line, and between line and PE, electric current flows to the capacitor when AC power is supplied to the AC line input part of this Unit. To eliminate the influence of leak current inside the Unit, an isolation transformer should be provided between AC power supply and the EUT line input.



The AC/DC line input cables should be prepared in the user side.



Be sure to use an isolation transformer between to supply to the EUT line in terminal of the Unit. If AC power is directly supplied without using an isolation transformer, the ground fault circuit interrupter installed in the test site acts to OPEN the circuit. When wiring, be sure to turn off power supply input to the insulation transformer beforehand.

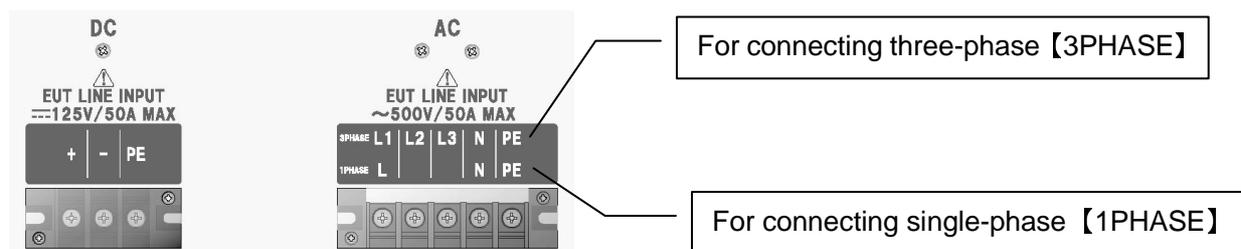


Since residual voltage (maximum 1.5kV) occurs at the output terminal of the isolation transformer, be sure to use the isolation transformer which is able to withstand this voltage.

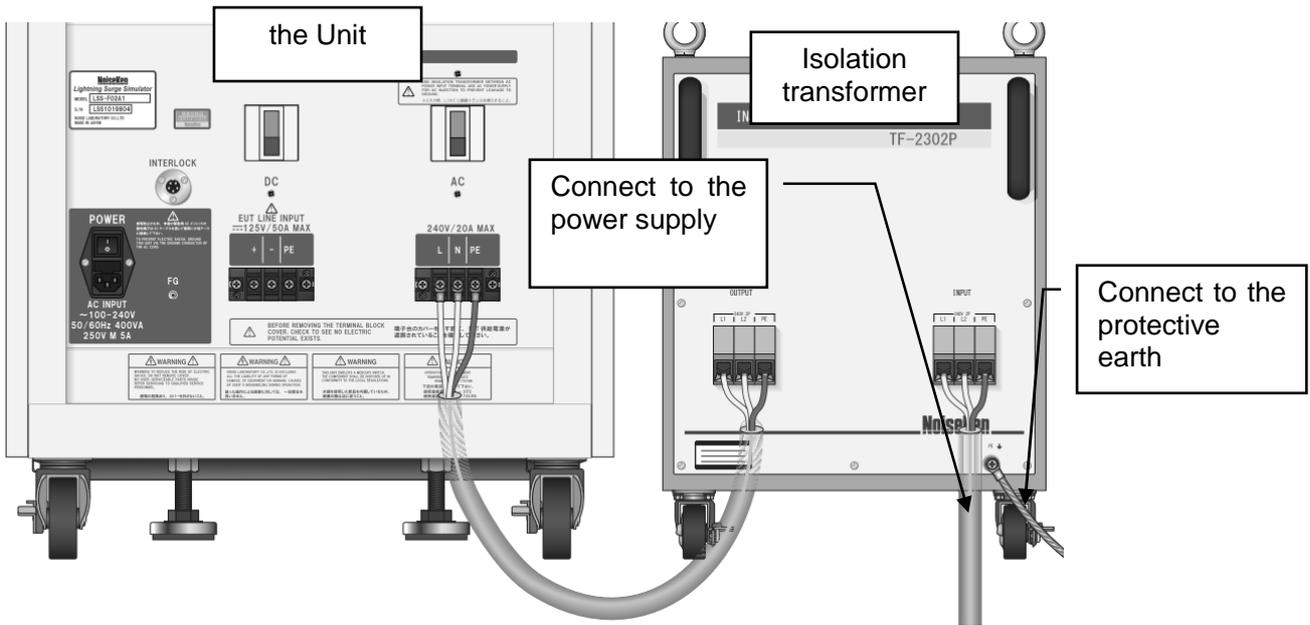


Since residual voltage (maximum 1.5kV) occurs at the input terminal of the isolation transformer, be sure to use the isolation transformer which is able to withstand this voltage.

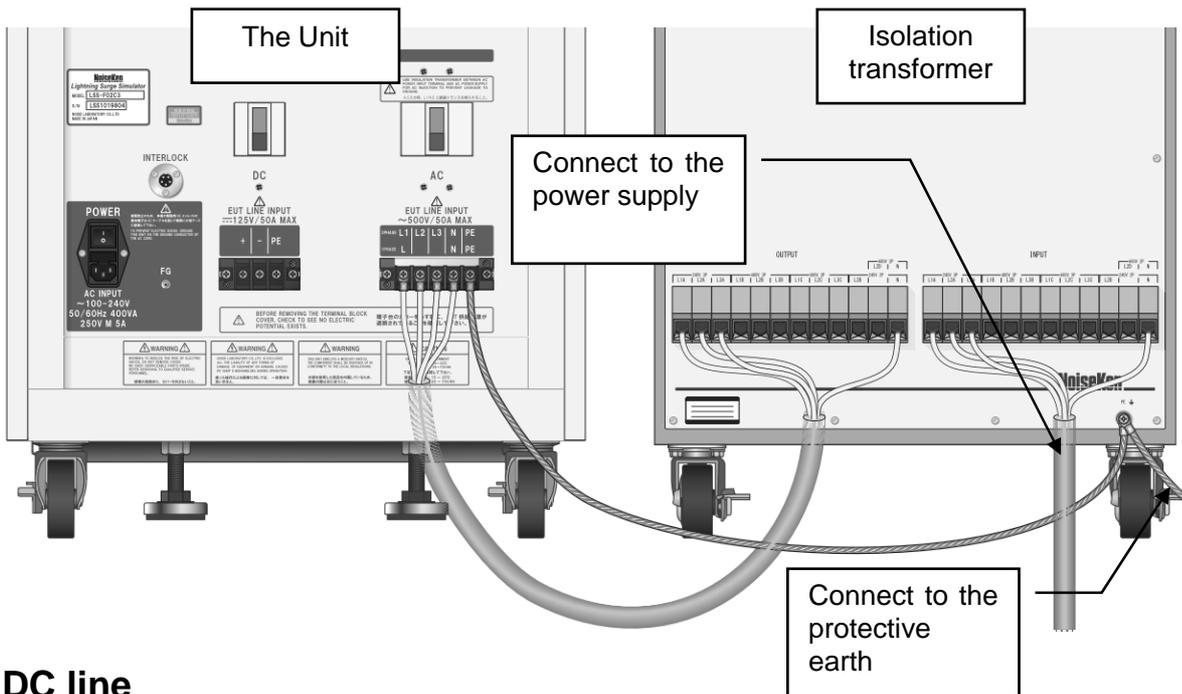
- ① Before connecting, ensure that power supply to the EUT is turned off and that the Unit is in OFF status.
- ② In case of connecting a DC power supply, connect it to the DC line input terminal block, in case of connecting an AC single-phase or three-phase power supply, connect it to the AC terminal block. Use the power supply cable which is conforming to the local standard and suited to the EUT power handling capacity and connect it to the terminal after installing a  $\phi 5$  type soldering terminal to the cable. Refer to the figures on the next page.
- ③ The connecting points depend on the model number of the simulator and the power supply for the EUT.
- ④ Put the protective cover on the terminals after connection.



### Single-phase (A1/C1 type)



### Three-phase (A3/C3 type)



### DC line



## Connection of AC/DC Line Output

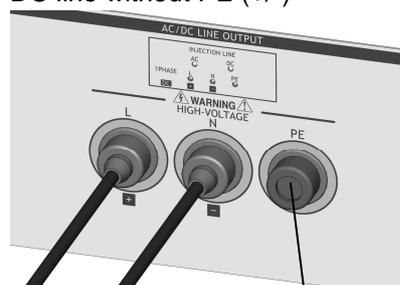
- ① Connect the supplied line output cable to the AC/DC line output terminal [AC/DC LINE OUTPUT]. Refer to the figures as below. Put the connector cap on the AC/DC line output terminal which is not used for the test.

### Single-phase (A1/C1 type)

#### AC line (single-phase) / DC line

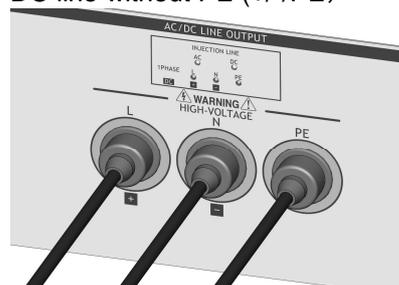
AC line (single-phase) without PE (L/N)

DC line without PE (+/-)



AC line (single-phase) with PE (L/N/PE)

DC line without PE (+/-/PE)



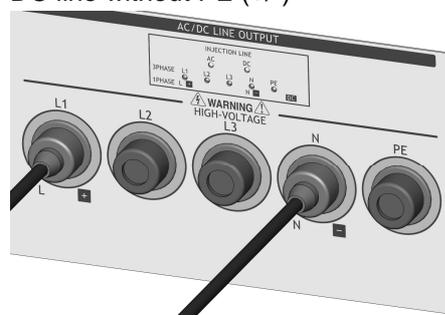
Connector cap

### Three-phase (A3/C3 type)

#### AC line (single-phase) / DC line

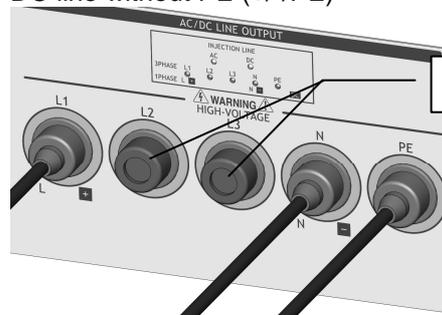
AC line (single-phase) without PE (L/N)

DC line without PE (+/-)



AC line (single-phase) with PE (L/N/PE)

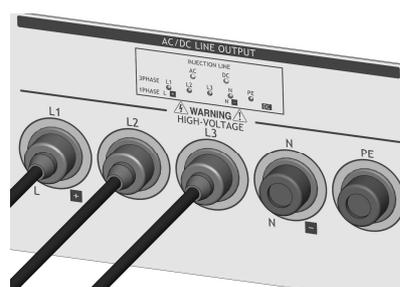
DC line without PE (+/-/PE)



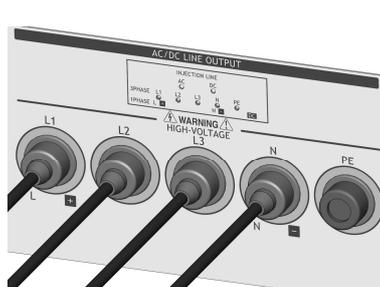
Connector cap

#### AC line (three-phase)

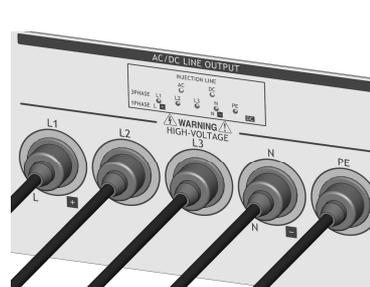
AC three-phase 3-line  
(L1/L2/L3)



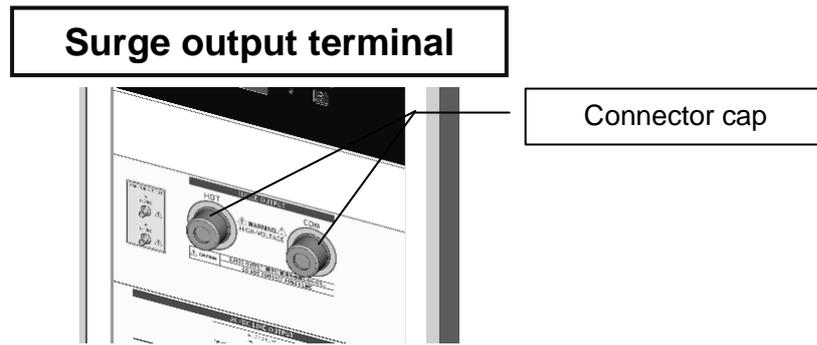
AC three-phase 4-line  
(L1/L2/L3/N)



AC three-phase 5-line  
(L1/L2/L3/N/PE)



- ② Put the connector cap on the surge output terminal [HOT] [COM] .



- ③ Be sure to close the door of the telecom injection panel (in case of C1/C3 type).
- ④ Connect EUT to the tip of the surge output cable. If the surge output cable and the connecting part are worked for the test with insulation tubes, the surge test can be performed more safely. However, it is necessary to use an insulated tube with dielectric strength of 15kV or more. Moreover, as creeping discharge sometimes occurs on the surface of parts, it is also necessary to take into consideration the dielectric strength to creeping discharge.



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Since all of the surge output terminals and doors of the Unit are detected by the interlock system, the test cannot be started unless all of the terminals are covered by caps and doors are closed. If the conditions are not satisfied, the screen indicates the caution.

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When performing a test, maximum care for safety should be taken. When there is possibility that the EUT could explode, fit a cover to the EUT to assure the safety of the users.

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## 10-5. Connection for Applying Surge Waveform to Telecom Line (C1/C3)

### Connection of Telecom Line Input

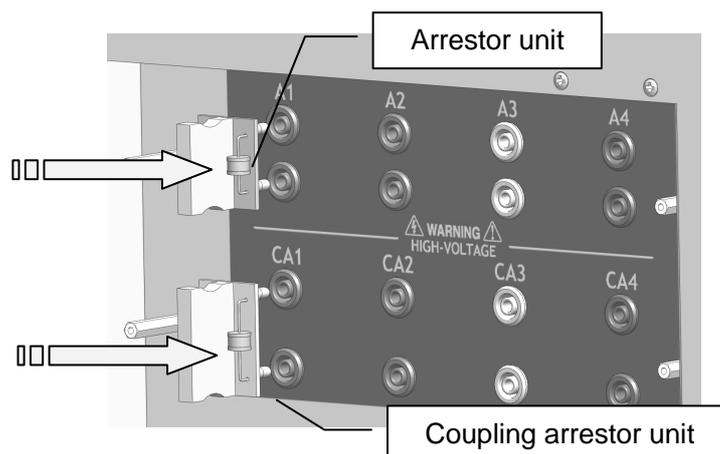
- ① Before connecting, ensure that power supply to the EUT is turned off and that the Unit is in OFF status.
- ② In case of 2-line, **【TELECOM LINE OUTPUT 1】** and **【TELECOM LINE OUTPUT 2】** are automatically selected in the Unit. Connect the lines to 1 and 2 terminal of **【TELECOM LINE INPUT】** . For connecting, install a  $\Phi 4$  soldering terminal to the line.
- ③ Put the protective cover on the terminals after connection.



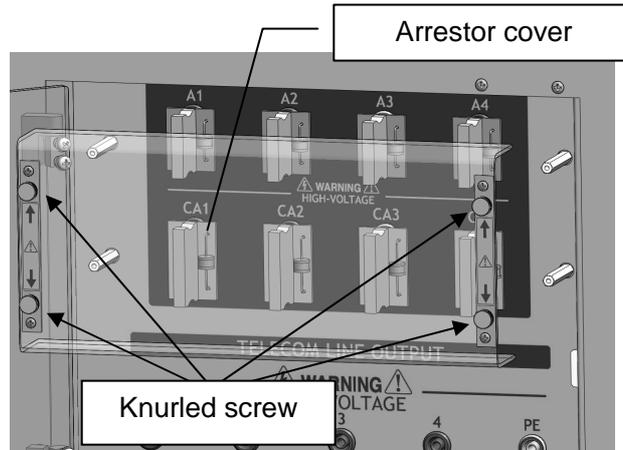
The telecom line input cables should be prepared in the user side.

### Connection of Telecom Line Output

- ① For safety, be sure to put all of the arrestor unit **【A1/A2/A3/A4】** and the coupling arrestor unit **【CA1/CA2/CA3/CA4】** .

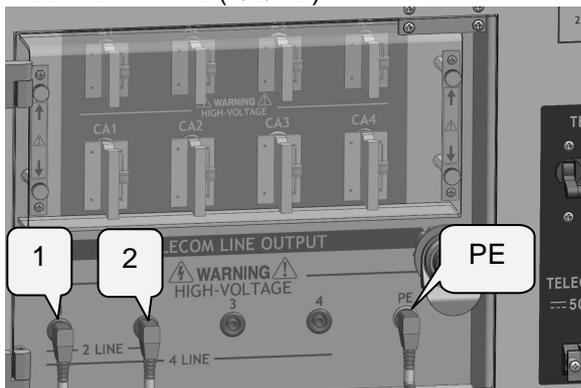


- ② Put the arrestor cover on these arrestor units. Tighten 4 pieces of knurled screws securely.

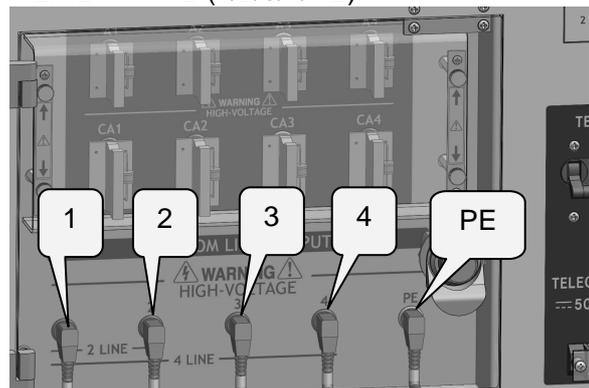


- ③ Connect the supplied telecom line output cable to the telecom line output terminal **【TELECOM LINE OUTPUT】** on the telecom line injection panel.

2LINE with PE (1/2/PE)



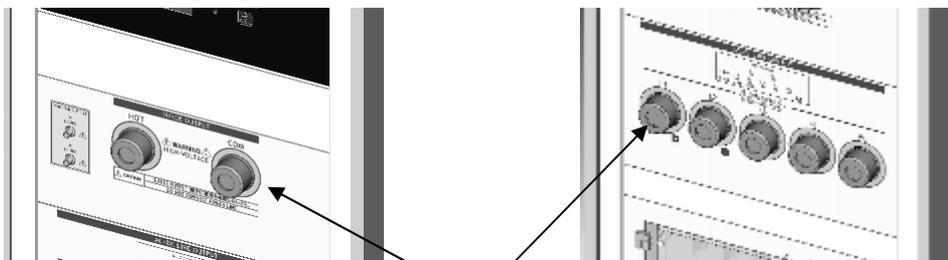
4LINE with PE (1/2/3/4/PE)



- ④ Put the connector cap on the surge output terminal **【HOT】 【COM】** and on the AC/DC line output terminal **【AC/DC LINE OUTPUT】** .

**Surge output terminal**

**AC/DC line output terminal**



**Connector cap**

- 
- ⑤ Be sure to close the door of the telecom line injection panel.
  - ⑥ Connect EUT to the tip of the supplied telecom line output cable. If the telecom line output cable and the connecting part are worked for the test with insulation tubes, the surge test can be performed more safely. However, it is necessary to use an insulated tube with dielectric strength of 15kV or more. Moreover, as creeping discharge sometimes occurs on the surface of parts, it is also necessary to take into consideration the dielectric strength to creeping discharge.



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Since all of the surge output terminals and doors of the Unit are detected by the interlock system, the test cannot be started unless all of the terminals are covered by caps and doors are closed. If the conditions are not satisfied, the screen indicates the caution.

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When performing a test, maximum care for safety should be taken. When there is possibility that the EUT could explode, fit a cover to the EUT to assure the safety of the users.

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Since the coupling arrestor units and the arrestor unit installed on the telecom line injection panel are expendable components, exchange them when they deteriorate. When change of the quality starts, e.g. the arrestor has difficulty to illuminate, the arrestor tube has discolored, etc, exchange the arrestor is recommendable.

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When exchanging the arrestor, turn OFF power supply for driving the Unit and also that for EUT. Since the arrestor cover is interlock-detected, be sure to install it securely after exchanging the arrestor.

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# 11. OPERATION

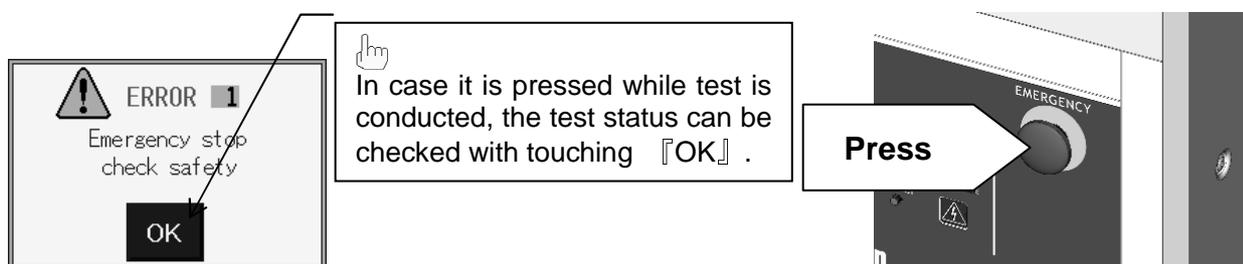
## 11-1. Emergency Stop Button

**When emergency stop button is pressed, the Unit shifts to the following status forcibly.**

- The test is immediately stopped and high voltage generating circuit of the Unit is turned off.
- EUT power supply (EUT LINE switch ) is turned OFF by force.
- The circuit breakers (the AC line breaker / the DC line breaker) are turned OFF by force.

**Emergency stop button is just for emergency. Do not use it to stop usual operation.**

The following error message is displayed on the operation screen. The operation is prohibited until the Unit is turned on again.



### How to release emergency stop

To release emergency stop status, follow the instruction as below.

- ① Turn off the power switch of the Unit.
- ② Rotate emergency stop button clockwise to release the status.
- ③ After removing the cause of pressing emergency stop button and ensuring safety fully, turn on the Unit again with the power switch.
- ④ Pull up the circuit protector to restart.



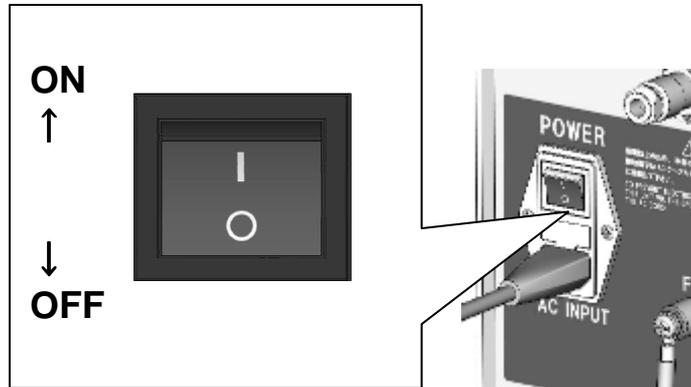
If you try to turn on the circuit protector while the emergency stop button is pressed, the circuit protector will be turned off forcibly. Avoid this procedure because it may cause damage of the Unit.



In releasing emergency stop status and turning on the Unit again, remove the cause of pressing emergency stop button and ensure safety fully.

## 11-2. Turn ON the Unit

- ① Turn on the Unit with the POWER switch on the input panel.
- ② When the Unit is turned on and starts normally, an electronic sound goes off, the main menu is displayed on the LCD touch panel.

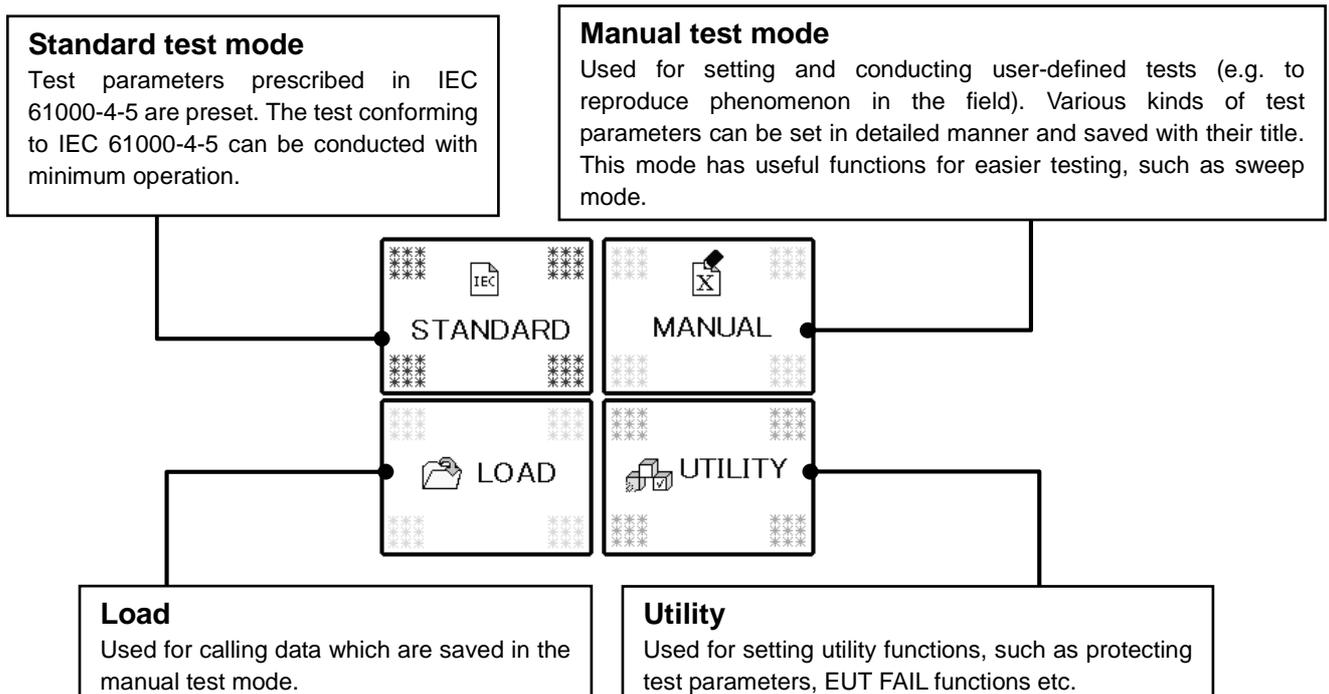


To make the Unit its default status, turn on the power switch [POWER] with pressing the menu key [MENU], the EUT line key [EUT LINE], the start key [START], and the stop key [STOP] so that all of the saved data can be deleted.  
The above way is only used for returning the Unit to the default status forcibly. Do not use it for ordinary turning ON/OFF.

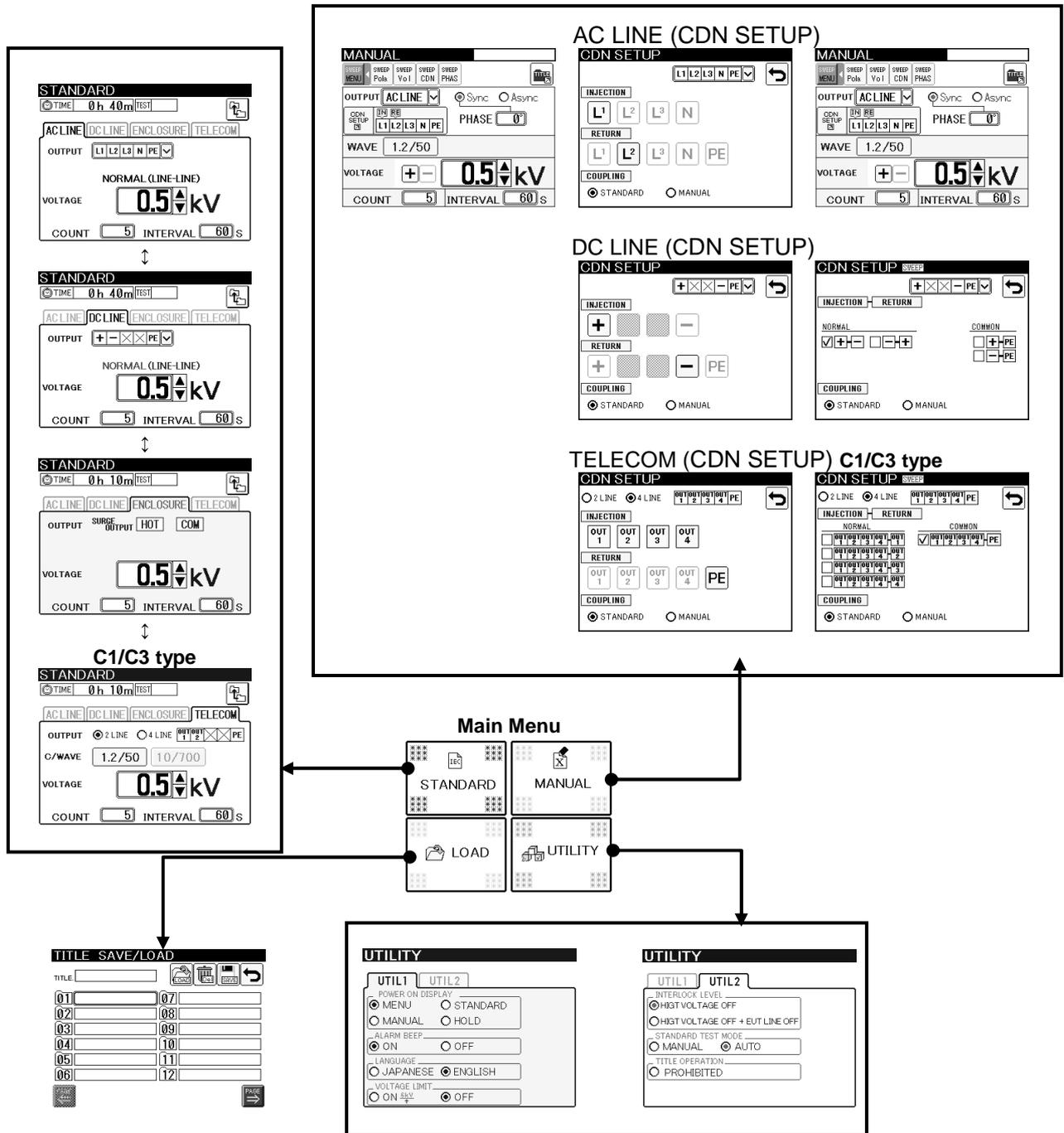
## 11-3. Main Menu

The Unit adopts a touch-panel-type LCD which enables image-oriented operation with graphic display. When the main menu is displayed, touch the panel to select a function to be used.

As the main menu is always displayed when the menu switch is pressed, easy moving to another screen is available. (This function is unavailable while conducting test.)

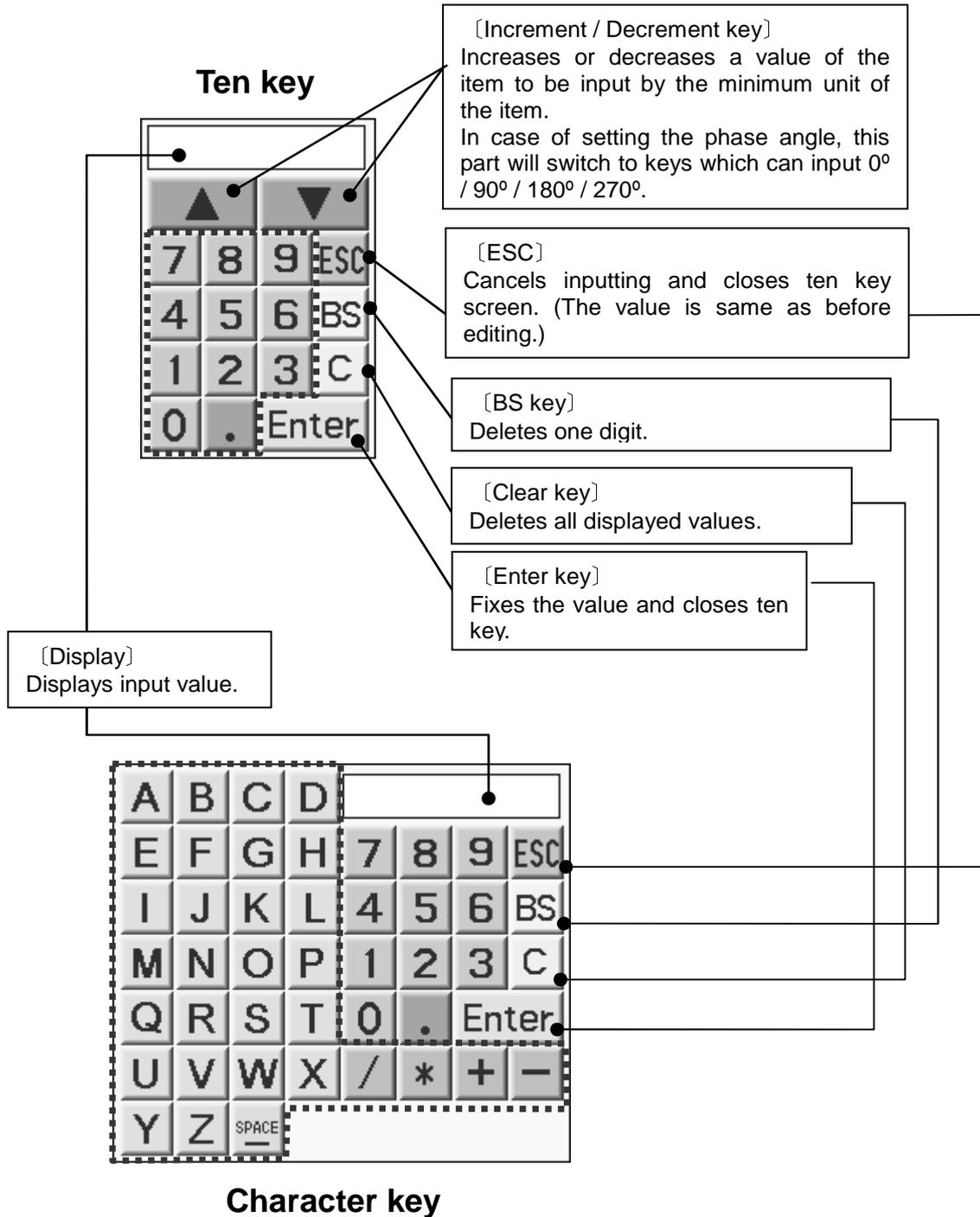


11-4. Screen Flowchart



### 11-5. Inputting Numbers and Letters (About Ten Key and Character Key)

The ten key is displayed for inputting numbers, the character key is displayed for operation for title. Basic operations of them are as follows. Touch the item which is necessary to be input and the ten key is displayed with the value as in the last usage.



## 12. STANDARD TEST

### 12-1. Setting Standard Test

 Touch 『STANDARD』 on the main menu.

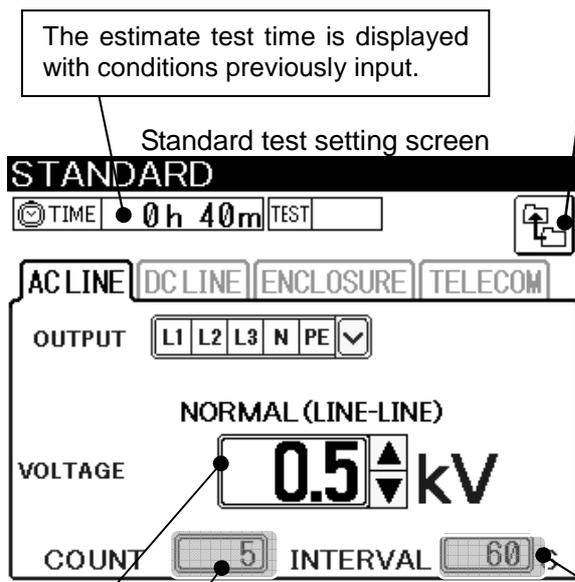
In the standard test mode, the test conditions prescribed on the IEC61000-4-5 are preset. The test list is made automatically only with inputting the output way and voltage according to the user's EUT line. If any other test condition than the standard test is needed, set with the manual test mode (Refer to 13.MANUAL TEST –P.54).

**Example) The test list in case of;**

**Output: AC LINE, Output line: L/N/PE, Normal mode voltage: 0.5kV, Common mode voltage: 1.0kV**

**Table 12-1. Test list**  
1.2/50 $\mu$ s surge waveform

Output: AC/DC line output terminal 【AC/DC LINE OUTPUT】						
Test No.	Mode	Polarity	Voltage	Injection phase	Return phase	Phase angle
1	Normal mode	+	0.5kV	L	N	0°
2						90°
3						180°
4						270°
5		-	0.5kV	L	N	0°
6						90°
7						180°
8						270°
9	Common mode	+	1.0kV	L	PE	0°
10						90°
11						180°
12						270°
13		-	1.0kV	L	PE	0°
14						90°
15						180°
16						270°
17		+	1.0kV	N	PE	0°
18						90°
19						180°
20						270°
21		-	1.0kV	N	PE	0°
22						90°
23						180°
24						270°



The estimate test time is displayed with conditions previously input.

Standard test setting screen

If this button is pressed, a message box asking whether moving to the manual test mode or not will appear. If 『yes』 is selected, the screen will move to the manual test setting screen with holding all of set data. As for voltage, the set value is moved (The normal mode value is prioritized). This function is useful for making a new test format based on IEC test with changing some conditions of it.

Set the interval time.

Press  and the ten key is displayed.

▲	▼		
7	8	9	ESC
4	5	6	BS
1	2	3	C
0	.	Enter	

Input the interval time (second) and press Enter to fix the value.

1.2/50 waveform selected: 10~999s 1s step  
 Minimum value  
6.0kV or less: 10 seconds  
6.1kV or more: 20seconds

10/700 waveform selected: 15~999s 1s step  
 Minimum value  
6.0kV or less: 15 seconds  
6.1kV or more: 30seconds

Set the discharge times.

Press  and the ten key is displayed.

▲	▼		
7	8	9	ESC
4	5	6	BS
1	2	3	C
0	.	Enter	

Input the times and press Enter to fix the value.

1~999 times 1 time step

Set the surge voltage.

If AC LINE or DC LINE is selected, setting normal mode voltage and common mode voltage is available depending on the selected EUT line.

Normal mode (without PE) NORMAL (LINE-LINE) <input type="text"/> kV	Normal / Common mode (with PE) NORMAL (LINE-LINE) <input type="text"/> kV COMMON (LINE-PE) <input type="text"/> kV
---	--

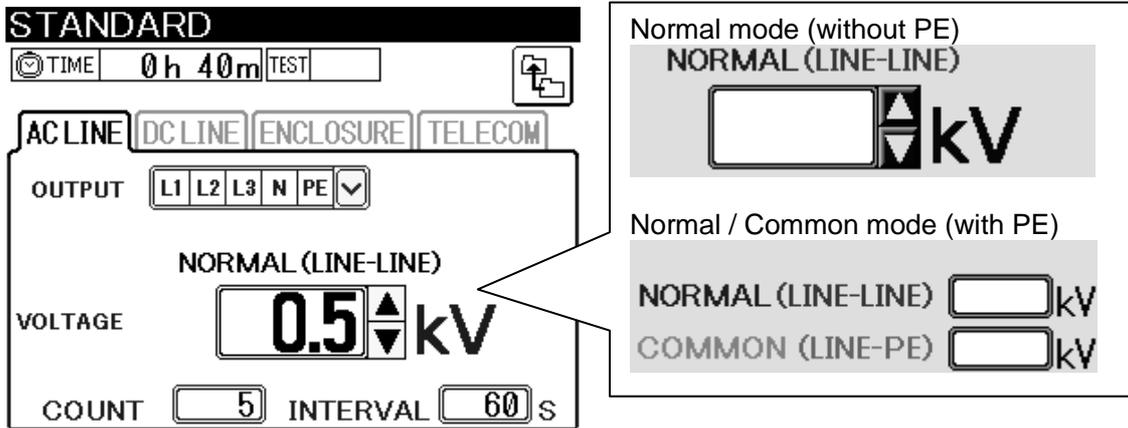
Press  and the ten key is displayed. 0.0~15.0kV 0.1kV step  
 Setting 0.1kV step with ▲/▼ is available only in the normal mode.  
 (The voltage range as the guaranteed waveform on the specification is 0.5~15.0kV.)

▲	▼		
7	8	9	ESC
4	5	6	BS
1	2	3	C
0	.	Enter	

## Discharge Interval

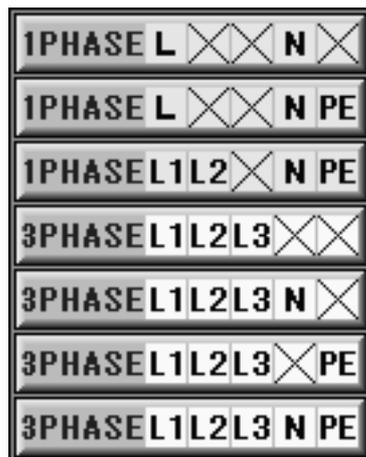
The first surge after the test start is output when the minimum charging time (Refer to the previous page) has passed without any relationship with the set interval.

### 12-2. AC LINE Standard



① For injecting surge to the AC line, touch 『AC LINE』 on the above tab.  
The surge is output from the AC/DC line output terminal 【AC/DC LINE OUTPUT】 .

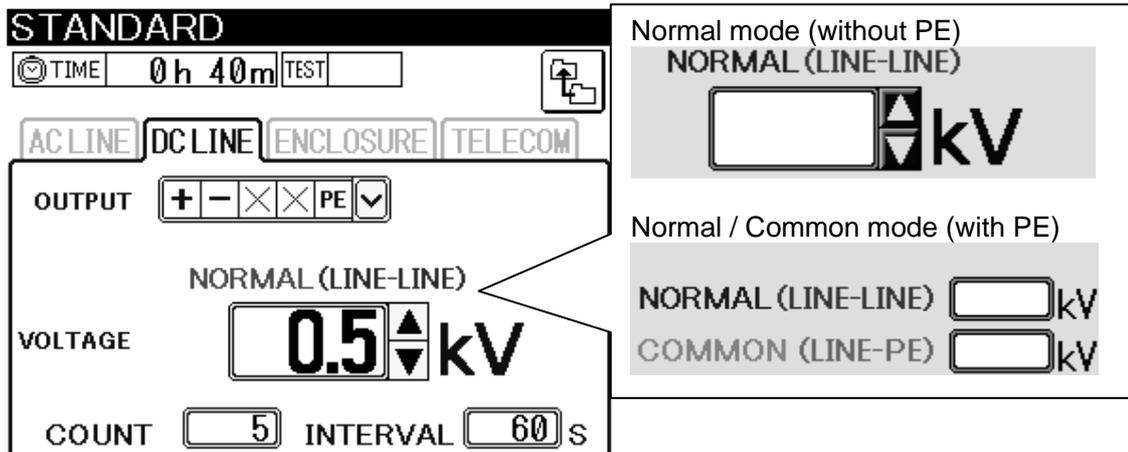
② Select EUT line.  
In case of the single-phase models (A1, C1 type), touch [ ] [ ] [ ] [ ] to indicate single-phase without PE (L/N) / Single-phase with PE (L/N/PE). In case of the three-phase models (A3, C3 type), touch [ ] [ ] [ ] [ ] [ ] [ ] to indicate the following pop-up menu. Select the EUT line depending on the EUT.



 Fully pay attention to connection of the line input and the line output.  
 There should be no discrepancy between the actual connection and setting on the screen. Refer to 10. CONNECTION.

③ Set voltage, count, and interval.

### 12-3. DC LINE Standard



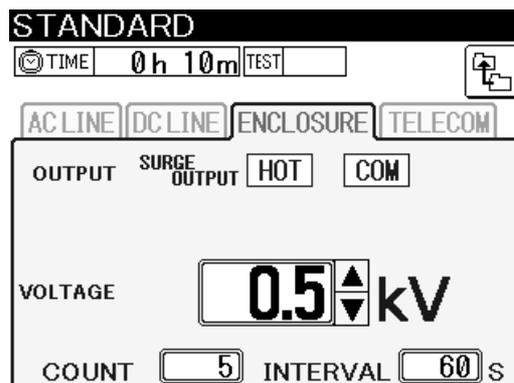
- ① For injecting surge to the DC line, touch 『DC LINE』 on the above tub.  
The surge is output from the AC/DC line output terminal 【AC/DC LINE OUTPUT】 .
- ② Select EUT line.  
Touch    to indicate single-phase without PE (L/N) / Single-phase with PE (L/N/PE).  
Select the EUT line depending on the EUT.



Fully pay attention to connection of the line input and the line output.  
There should be no discrepancy between the actual connection and setting on the screen. Refer to 10. CONNECTION.

- ③ Set voltage, count, and interval.

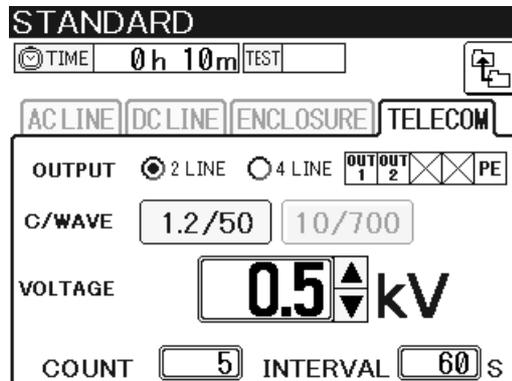
### 12-4. ENCLOSURE Standard



- ① For injecting surge to the EUT directly, touch 『ENCLOSURE』 on the above tub.  
The surge is output from the surge output terminal 【SURGE OUTPUT】 .
- ② Set voltage, count, and interval.

## 12-5. TELECOM Standard (C1/C3 type)

This function is just for the LSS-F02C1 or the LSS-F02C3.



- ① For injecting surge to the telecom line, touch 『TELECOM』 on the above tab.  
The surge is output from the telecom line output terminal 【TELECOM LINE OUTPUT】 .
- ② Select lines.  
Touch 『2LINE』 or 『4LINE』 . Select the EUT line depending on the EUT.

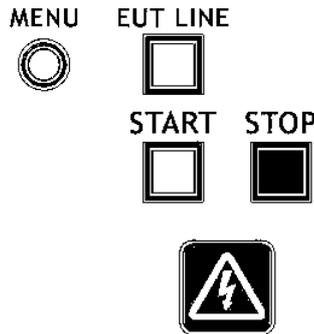


Fully pay attention to connection of the line input and the line output.

There should be no discrepancy between the actual connection and setting on the screen. Refer to 10. CONNECTION.

- ③ Select waveform.  
Touch  or  .
- ④ Set voltage, count, and interval.

## 12-6. Executing Standard Test



- ① In case of the injection test to power lines, turn ON the line breaker of lines to be tested.
- ② Power supply to the EUT  
 In case of the injection test to power lines, press the EUT LINE key [EUT LINE] to connect the line. The LED of the EUT LINE key illuminates when power is supplied.



Since the line power supply is output to the AC/DC line output terminal [AC/DC LINE OUTPUT] when the EUT LINE key is turned ON, fully be careful to the terminals for safety.

- ③ Check screen  
 Press START key to complete all conditions for test and to indicate the following check screen. Confirm the whole condition and press the START key again to start the test. (Changing the test order is not available.) If there is any dissatisfied condition, an error message will appear. if touched on the check screen, the screen will return to the standard test setting screen.

**CHECK TEST SETTINGS**

C/W 1.2 50    COUNT 5    PAGE

TEST 24    INTERVAL 60s   

No.	MODE	Pola	VOLTAGE	OUTPUT
1	NOR	+	0.5kV	IN L RE N  0°
2	NOR	+	0.5kV	IN L RE N  90°
3	NOR	+	0.5kV	IN L RE N  180°
4	NOR	+	0.5kV	IN L RE N  270°
5	NOR	-	0.5kV	IN L RE N  0°
6	NOR	-	0.5kV	IN L RE N  90°
7	NOR	-	0.5kV	IN L RE N  180°
8	NOR	-	0.5kV	IN L RE N  270°

Output to ~

**For selecting the opening test**

If the specific test number is touched and the START key is pressed again on the check screen, the test starts with the specific test number.

Example) If you like to start with the No. 5 test, touch the No. 5 to move the executing test frame to the No.5.

①

CHECK TEST SETTINGS						
C/W	1.2 / 5.0	COUNT	5	[PAGE] [←] [→]		
TEST	24	INTERVAL	60s			
No.	MODE	Pola	VOLTAGE	OUTPUT		
1	NOR	+	0.5kV	IN	L	RE N 0°
2	NOR	+	0.5kV	IN	L	RE N 90°
3	NOR	+	0.5kV	IN	L	RE N 180°
4	NOR	+	0.5kV	IN	L	RE N 270°
5	NOR	-	0.5kV	IN	L	RE N 0°
6	NOR	-	0.5kV	IN	L	RE N 90°
7	NOR	-	0.5kV	IN	L	RE N 180°
8	NOR	-	0.5kV	IN	L	RE N 270°

②

CHECK TEST SETTINGS						
C/W	1.2 / 5.0	COUNT	5	[PAGE] [←] [→]		
TEST	24	INTERVAL	60s			
No.	MODE	Pola	VOLTAGE	OUTPUT		
1	NOR	+	0.5kV	IN	L	RE N 0°
2	NOR	+	0.5kV	IN	L	RE N 90°
3	NOR	+	0.5kV	IN	L	RE N 180°
4	NOR	+	0.5kV	IN	L	RE N 270°
5	NOR	-	0.5kV	IN	L	RE N 0°
6	NOR	-	0.5kV	IN	L	RE N 90°
7	NOR	-	0.5kV	IN	L	RE N 180°
8	NOR	-	0.5kV	IN	L	RE N 270°

Example) If you like to start with the No. 13 test, touch 'PAGE' to move to the next page, and touch the No. 13 to move the executing test frame to the No.13.

①

CHECK TEST SETTINGS						
C/W	1.2 / 5.0	COUNT	5	[PAGE] [←] [→]		
TEST	24	INTERVAL	60s			
No.	MODE	Pola	VOLTAGE	OUTPUT		
1	NOR	+	0.5kV	IN	L	RE N 0°
2	NOR	+	0.5kV	IN	L	RE N 90°
3	NOR	+	0.5kV	IN	L	RE N 180°
4	NOR	+	0.5kV	IN	L	RE N 270°
5	NOR	-	0.5kV	IN	L	RE N 0°
6	NOR	-	0.5kV	IN	L	RE N 90°
7	NOR	-	0.5kV	IN	L	RE N 180°
8	NOR	-	0.5kV	IN	L	RE N 270°

②

CHECK TEST SETTINGS						
C/W	1.2 / 5.0	COUNT	5	[PAGE] [←] [→]		
TEST	24	INTERVAL	60s			
No.	MODE	Pola	VOLTAGE	OUTPUT		
9	COM	+	1.0kV	IN	L	RE PE 0°
10	COM	+	1.0kV	IN	L	RE PE 90°
11	COM	+	1.0kV	IN	L	RE PE 180°
12	COM	+	1.0kV	IN	L	RE PE 270°
13	COM	-	1.0kV	IN	L	RE PE 0°
14	COM	-	1.0kV	IN	L	RE PE 90°
15	COM	-	1.0kV	IN	L	RE PE 180°
16	COM	-	1.0kV	IN	L	RE PE 270°

③

CHECK TEST SETTINGS						
C/W	1.2 / 5.0	COUNT	5	[PAGE] [←] [→]		
TEST	24	INTERVAL	60s			
No.	MODE	Pola	VOLTAGE	OUTPUT		
9	COM	+	1.0kV	IN	L	RE PE 0°
10	COM	+	1.0kV	IN	L	RE PE 90°
11	COM	+	1.0kV	IN	L	RE PE 180°
12	COM	+	1.0kV	IN	L	RE PE 270°
13	COM	-	1.0kV	IN	L	RE PE 0°
14	COM	-	1.0kV	IN	L	RE PE 90°
15	COM	-	1.0kV	IN	L	RE PE 180°
16	COM	-	1.0kV	IN	L	RE PE 270°

④

CHECK TEST SETTINGS						
C/W	1.2 / 5.0	COUNT	5	[PAGE] [←] [→]		
TEST	24	INTERVAL	60s			
No.	MODE	Pola	VOLTAGE	OUTPUT		
9	COM	+	1.0kV	IN	L	RE PE 0°
10	COM	+	1.0kV	IN	L	RE PE 90°
11	COM	+	1.0kV	IN	L	RE PE 180°
12	COM	+	1.0kV	IN	L	RE PE 270°
13	COM	-	1.0kV	IN	L	RE PE 0°
14	COM	-	1.0kV	IN	L	RE PE 90°
15	COM	-	1.0kV	IN	L	RE PE 180°
16	COM	-	1.0kV	IN	L	RE PE 270°

④ Conducting test

First, 『Test is being prepared』 is indicated. When switching the internal circuit is complete, 『UNDER TEST』 appears on the screen. The warning lamp is blinking while the test is conducted. The discharge times counts up and the interval counts down.

⚠ UNDER TEST ⚠ WARNING ⚠						
C/W	1.2 / 5.0	COUNT	5			
TEST	24	INTERVAL	60s			
No.	MODE	Pola	VOLTAGE	OUTPUT		
1	NOR	+	0.5kV	IN	L	RE N 0°
2	NOR	+	0.5kV	IN	L	RE N 90°
3	NOR	+	0.5kV	IN	L	RE N 180°
4	NOR	+	0.5kV	IN	L	RE N 270°
5	NOR	-	0.5kV	IN	L	RE N 0°
6	NOR	-	0.5kV	IN	L	RE N 90°
7	NOR	-	0.5kV	IN	L	RE N 180°
8	NOR	-	0.5kV	IN	L	RE N 270°



High voltage surges are output. Mishandling or careless operation may result in a fatal wound. Carefully handle it.

⑤ Moving to the next test

When one test stage is complete, the completion check is indicated in the column.

If the sequence method on the “Utility” is “AUTO”, the test stage moves to the next automatically.

If “MANUAL”, 『Press START key to prepare next test』 is indicated, press the START key to start the next test. The executing test frame moves to the next test.

Conducting one by one

⚠ UNDER TEST ⚠ WARNING ⚠						
C/W	1.2 / 5.0	COUNT	5			
TEST	24	INTERVAL	60s			
No.	MODE	Pola	VOLTAGE	OUTPUT		
1	NOR	+	0.5kV	IN	L	RE N 0° ✓
2	NOR	+	0.5kV	IN	L	RE N 90° ✓
3	NOR	+	0.5kV	IN	L	RE N 180°
4	NOR	+	0.5kV	IN	L	RE N 270°
5	NOR	-	0.5kV	IN	L	RE N 0°
6	NOR	-	0.5kV	IN	L	RE N 90°
7	NOR	-	0.5kV	IN	L	RE N 180°
8	NOR	-	0.5kV	IN	L	RE N 270°

Completion check



As for the sequence method, set it on the utility. Refer to 15. UTILITY.



In moving to the next test stage, 'Pause' is not available.

**Pause**

Pressing the START key while conducting test makes the output pausing. The START key is blinking and 『PAUSE』 is indicated on the screen. For restarting the test, press the START key again. While pausing, the restarting test can be changed. Since the operation is same as selecting the opening test, refer to P. 50.

PAUSE						
C/W	1.2 / 5.0	COUNT	5			
TEST	24	INTERVAL	60s			
No.	MODE	Pola	VOLTAGE	OUTPUT		
1	NOR	+	0.5kV	IN	L RE N	0° ✓
2	NOR	+	0.5kV	IN	L RE N	90° ✓
3	NOR	+	0.5kV	IN	L RE N	180°
4	NOR	+	0.5kV	IN	L RE N	270°
5	NOR	-	0.5kV	IN	L RE N	0°
6	NOR	-	0.5kV	IN	L RE N	90°
7	NOR	-	0.5kV	IN	L RE N	180°
8	NOR	-	0.5kV	IN	L RE N	270°

If 『PAUSE』 status is left as is for 10 minutes, the test will be stopped automatically for safety.

**Suspension**

Pressing the STOP key while conducting test makes the test stop at the moment. The START key lights off and 『Test suspended』 is indicated on the screen.

Confirming suspension, touch to return to the standard test setting screen.

Test suspended	
----------------	--

Starting the test again on this screen is not available. For restarting, touch to return to the standard test setting screen and start again on that screen. Even if the test is suspended, the EUT line key is not turned OFF. For turning it OFF, manual operation is necessary.

## ⑥ Completion of test

The test is ended automatically when the entire set test is complete. The START key lights off and 『Test Completed.』 Is indicated on the screen.

 Confirming completion, touch **OK** to return to the standard test setting screen.

Test Completed						
C/W	1.2 / 5.0	COUNT	5	<b>OK</b>		
TEST	24	INTERVAL	60s			
No.	MODE	Pola	VOLTAGE	OUTPUT		
17	COM	+	10.0kV	IN N RE PE	0°	✓
18	COM	+	10.0kV	IN N RE PE	90°	✓
19	COM	+	10.0kV	IN N RE PE	180°	✓
21	COM	+	10.0kV	IN N RE PE	270°	✓
20	COM	-	10.0kV	IN N RE PE	0°	✓
22	COM	-	10.0kV	IN N RE PE	90°	✓
23	COM	-	10.0kV	IN N RE PE	180°	✓
24	COM	-	10.0kV	IN N RE PE	270°	✓

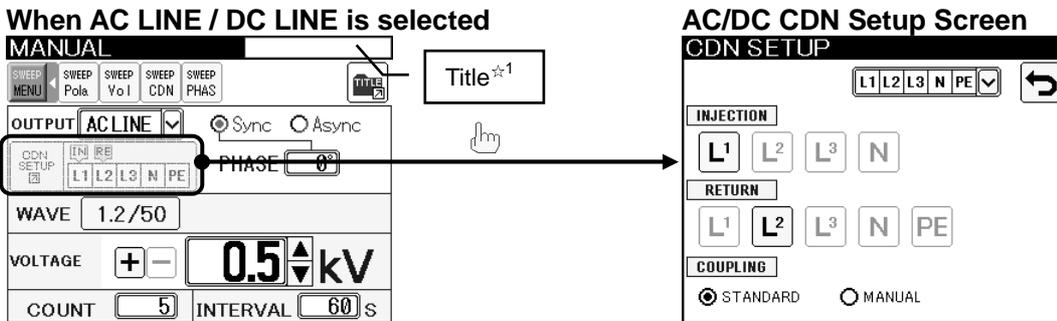


- Starting test again on this screen is not available. For restarting, touch **OK** to return to the standard test setting screen and start again on that screen. When test is complete, the Unit provides a lag for eliminating electricity of the internal circuit. Elimination needs about 4 seconds. For safety, restarting is not available during that period.
- In case of conducting test with the EUT LINE key ON, when the LINE key is turned OFF, not only power supply is shut down, but also surge generation is stopped.
- When test is suspended or completed, the LINE key is not turned off automatically. Turn it off manually.

# 13. MANUAL TEST

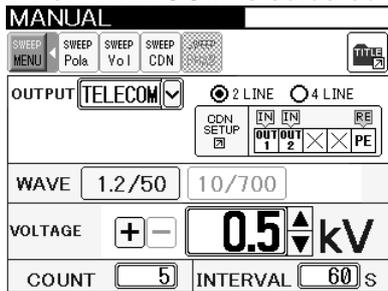
## 13-1. Setting Manual Test

Touch 『MANUAL』 on the main menu.



C1/C3 type

When TELECOM is selected



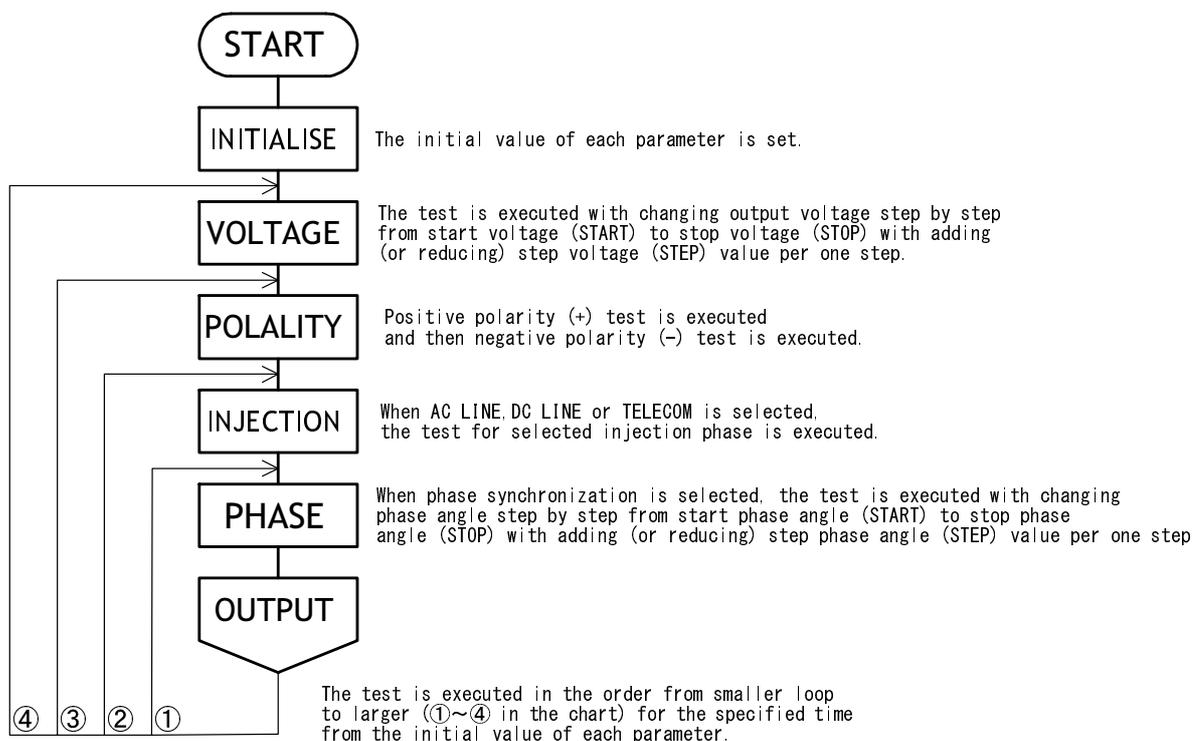
☆1 Title is indicated when the setup content is saved.

List of icons for operation

Icon of key	Remarks
	Used for saving a set content under a title and for calling it again. → For details, refer to “14. TITLE SAVE / LOAD” (P.72)
	Used for moving to the AC/DC CDN setup screen or the TELECOM CDN setup screen. The settings set up on the CDN setup screen indicates on this icon. IN indicates the injection phase, RE indicates the return phase. IN RE indicates both of the injection and return phase set on this line in the injection phase sweep mode.
	Used for turning ON/OFF the sweep function. When SWEEP MENU key is pressed, the menu bar appears (or disappears). In case the sweep function is set, the menu bar is fixed (indicated). Sweep function of polarity 『POLA』, surge voltage 『VOL』, output line 『CDN』, and/or phase angle 『PHASE』 can be selected. When TELECOM is selected, output from AC/DC CDN and PHASE control is not available.

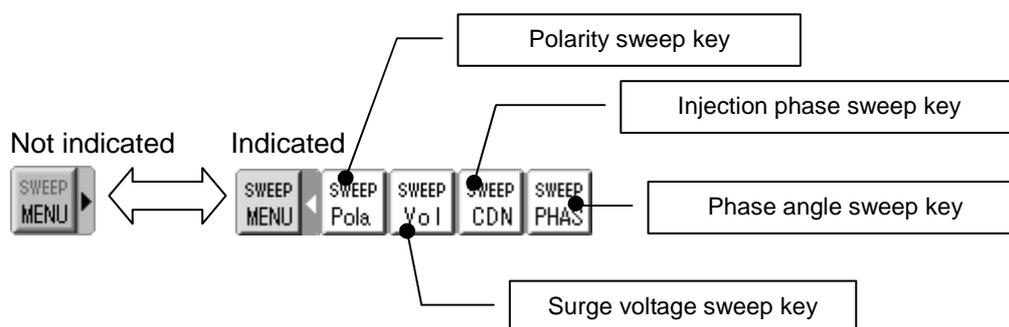
## Sweep function

The sweep function of polarity 『Pola』, surge voltage 『Vol』, output line 『CDN』, and/or phase angle 『PHASE』 can be selected. As for the surge voltage and the phase angle (Only when the surge is output to the AC line and phase angle synchronization is selected), the start value (START), the stop value (STOP), and step value can be input to utilize this function. The order of executing each sweep is fixed as the following flow chart. The value of the item which is not set the sweep mode is fixed.



When  key is pressed, the menu bar appears (or disappears).

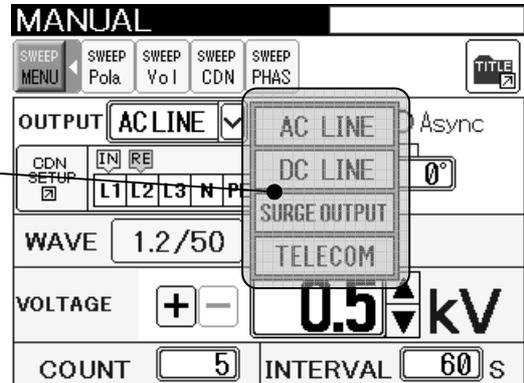
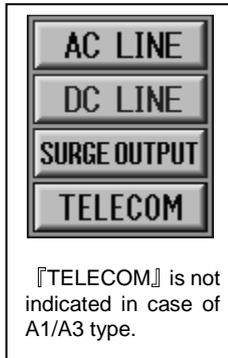
For setting the sweep function, indicate the menu bar and touch the item to be swept. In case that the sweep function is not used, the menu bar can be hidden. Once the sweep function is set, the menu bar is fixed (indicated).



## Selecting Output

Select which terminal the surge is output to.

Touch



- For injecting surge to the AC line, select 『AC LINE』 .  
The surge is output from the AC/DC line output terminal 【AC/DC LINE OUTPUT】 .
- For injecting surge to the DC line, select 『DC LINE』 .  
The surge is output from the AC/DC line output terminal 【AC/DC LINE OUTPUT】 .
- For injecting surge to the EUT directly, select 『SURGE OUTPUT』 .  
The surge is output from the surge output terminal 【SURGE OUTPUT】 .
- For injecting surge to the telecom line, select 『TELECOM』 .  
The surge is output from the telecom line output terminal 【TELECOM LINE OUTPUT】 .  
(C1/C3 type)



Fully pay attention to connection of the line input and the line output.

There should be no discrepancy between the actual connection and setting on the screen. Refer to 10. CONNECTION.

## Selecting Synchronization (Phase Angle) / Synchronization

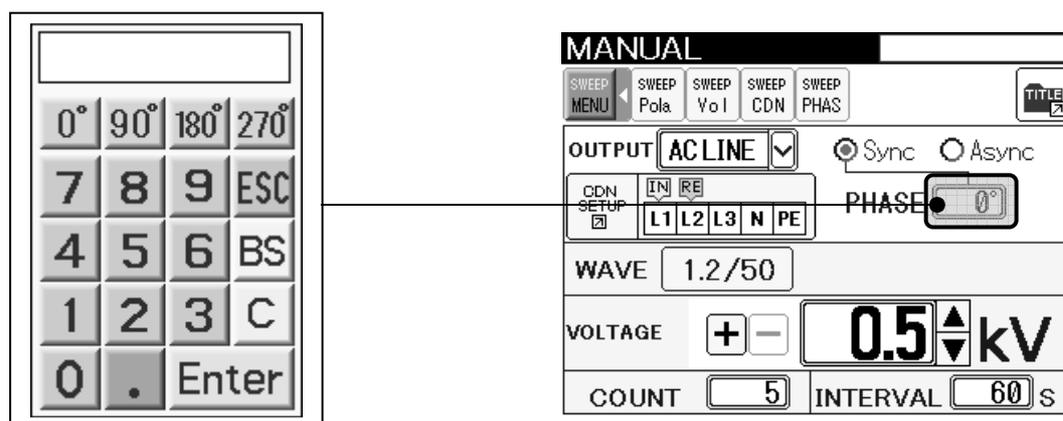
When 『AC LINE』 is selected as the output, surge injection synchronized with AC line of the EUT power supply is available.

Touch the check box of **Sync** or **Async** (☉).

When **Sync** is selected, the phase angle can be set.

Touch  of PHASE and input the value. 0~360° 1° step

There are 0° / 90° / 180° / 270° keys on the ten key for setting the phase angle.

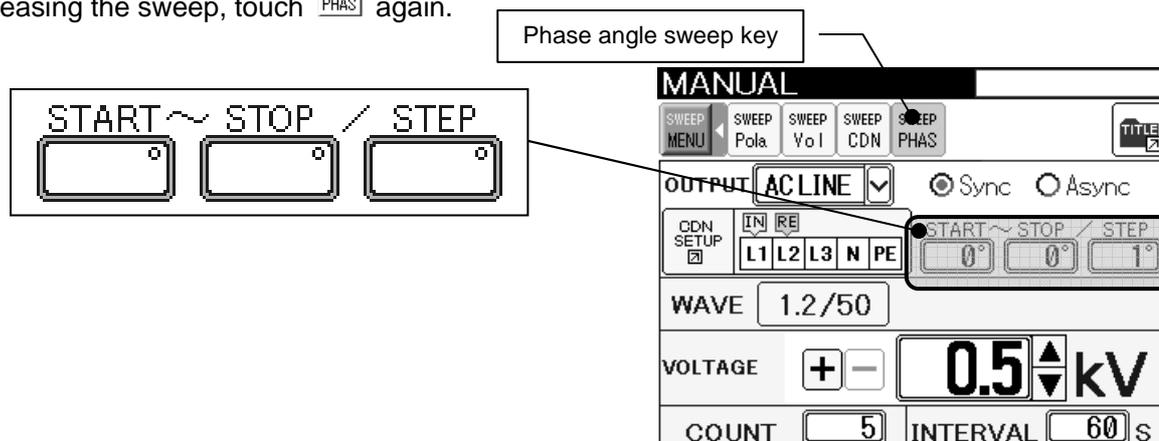


## Phase angle sweep

Touching on the sweep menu bar enables setting the phase angle sweep.

(frame) of the starting angle (START), stopping angle (STOP), and step angle (STEP) are indicated. Touch  of each column to indicate the ten key. Enter the value of the phase angle and press Enter.

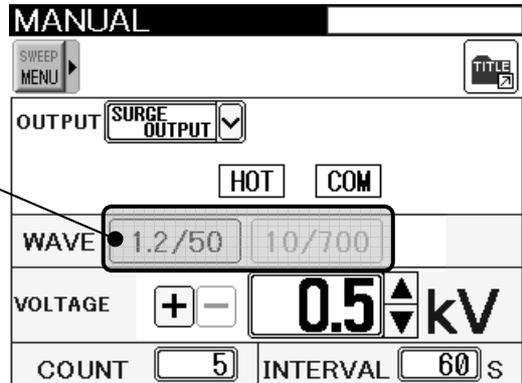
For releasing the sweep, touch again.



- The values are restricted as Starting value (START) ≤ Stopping value (STOP), Step value (STEP) ≥ 1.

### Selecting Waveform

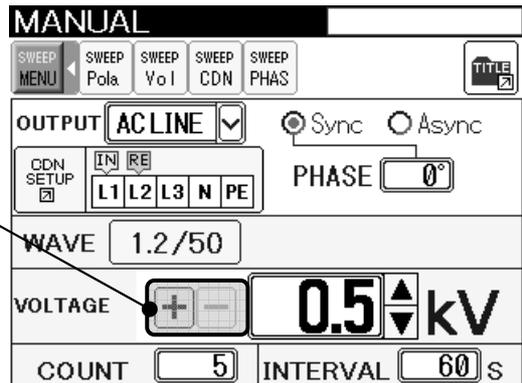
Touch  or .



- In case OUTPUT is set as AC LINE or DC LINE, only 『1.2/50』 is available.
- In case OUTPUT is set as SURGE OUT, both 『1.2/50』 and 『10/700』 is selectable.
- In case OUTPUT is set as TELECOM, both 『1.2/50』 and 『10/700』 is selectable.

### Selecting Polarity

Touch  or .

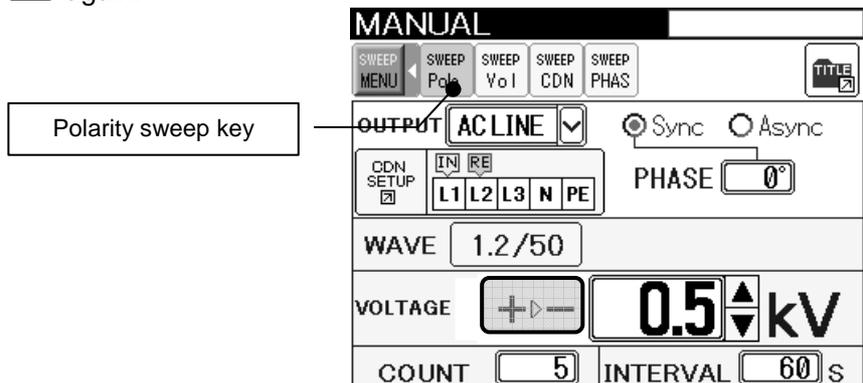


### Polarity sweep

Touching  on the sweep menu bar enables setting the polarity sweep.

The indication is fixed as , which means the test is conducted as positive (+)→negative (-) order in the polarity sweep.

For releasing the sweep, touch  again.



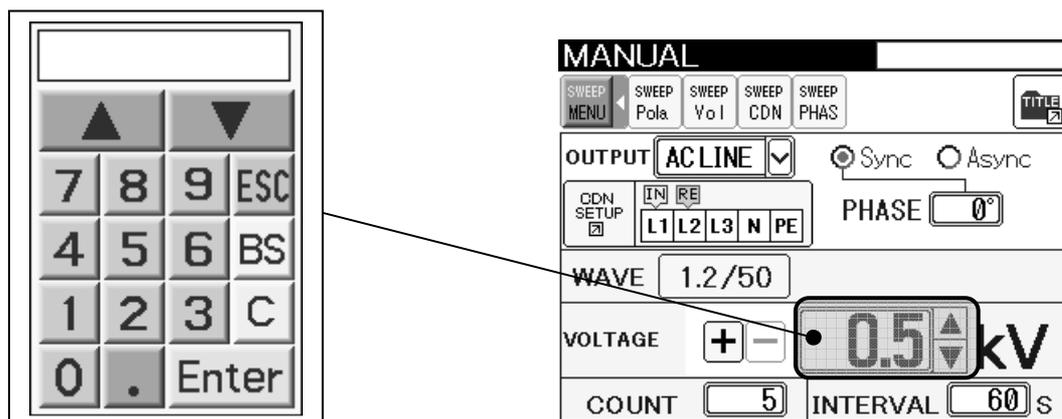
## Setting Voltage

Touch  of VOLTAGE to indicate the ten key.

 0.0~15.0kV 0.1kV step

Setting voltage with ▲/▼ key on the right side of the column is also available instead of indicating the ten key (Also as 0.1kV step).

(The voltage range as the guaranteed waveform on the specification is 0.5~15.0kV.)

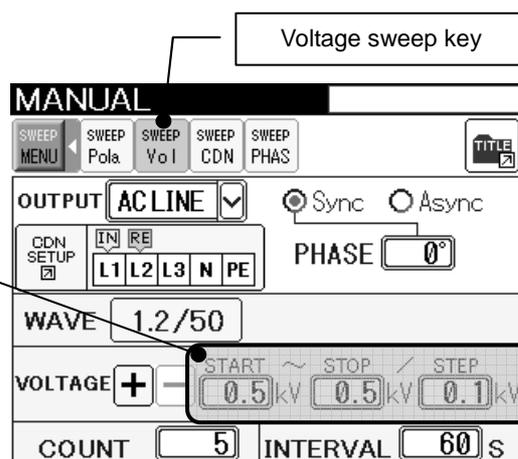
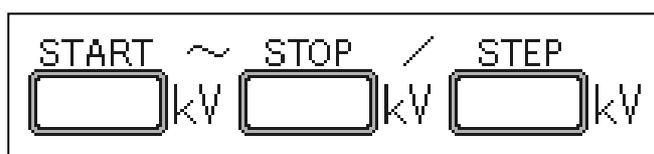


## Voltage sweep

Touching  on the sweep menu bar enables setting the voltage sweep.

(frame) of the starting voltage (START), stopping voltage (STOP), and step voltage (STEP) are indicated. Touch  of each column to indicate the ten key. Enter the value of the voltage and press Enter.

For releasing the sweep, touch  again.

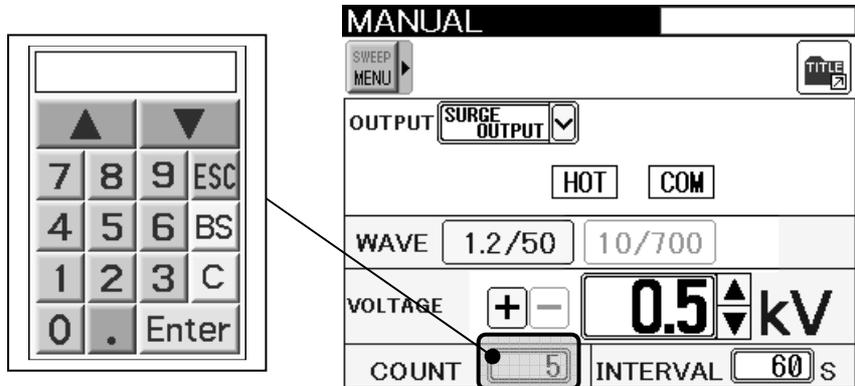


- The values are restricted as Starting value (START)  $\leq$  Stopping value (STOP), Step value (STEP)  $\geq$  0.1.
- The settable voltage can be restricted up to 6kV on the utility screen. Refer to 15. UTILITY (P.75).

### Setting Discharge Times

Touch  of COUNT to indicate the ten key. Input the discharge times and press Enter to fix the number of discharge times.

 1~999 times 1 time step



### Setting Interval

Touch  of INTERVAL to indicate the ten key. Input the value (unit: second) and press Enter to fix the value.

 1.2/50 waveform selected: 10~999s 1s step

Minimum value

6.0kV or less: 10 seconds

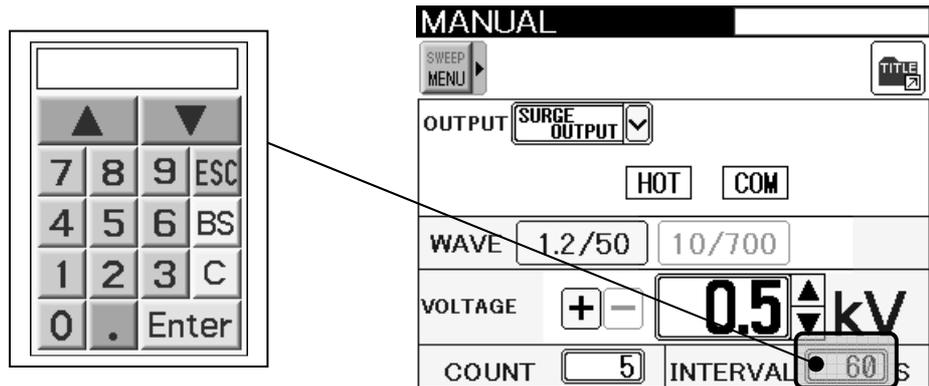
6.1kV or more: 20seconds

 10/700 waveform selected: 15~999s 1s step

Minimum value

6.0kV or less: 15 seconds

6.1kV or more: 30seconds

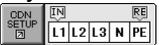


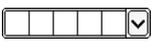
 The interval time depends on the set voltage value.  
The settable voltage can be restricted up to 6kV on the utility screen. Refer to 15. UTILITY (P.75).

 The first surge discharge after the test start is output when the minimum charging time (Refer to the above) has passed without any relationship with the set interval. After that, the Unit discharges surges with the set interval time.

## 13-2. Setting AC/DC Injection

In case of injecting surge to power lines, setting the injection phase and the return phase is necessary.

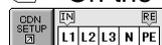
Touch  to move to the AC/DC CDN setup screen when AC LINE or DC LINE is selected on the manual setting screen.

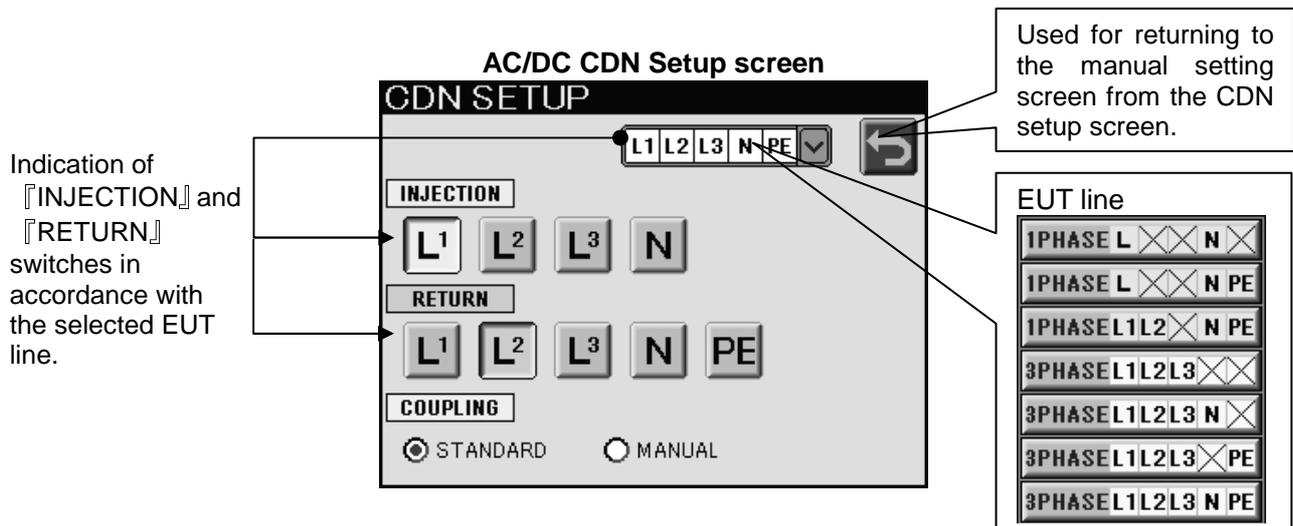
 Touch  to indicate the popup menu.

Select the EUT line for the EUT. The indication of the injection phase and the return phase switches in accordance with the selected EUT line.

 Select the injection phase of the surge and touch the phase.

 Select the return phase of the surge and touch the phase.

 On the manual setting screen after returning there with pressing  on the CDN setup screen,  (the CDN setup display) indicates the CDN settings.

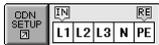


 Selecting the same line as both of the injection and return phase is not available.



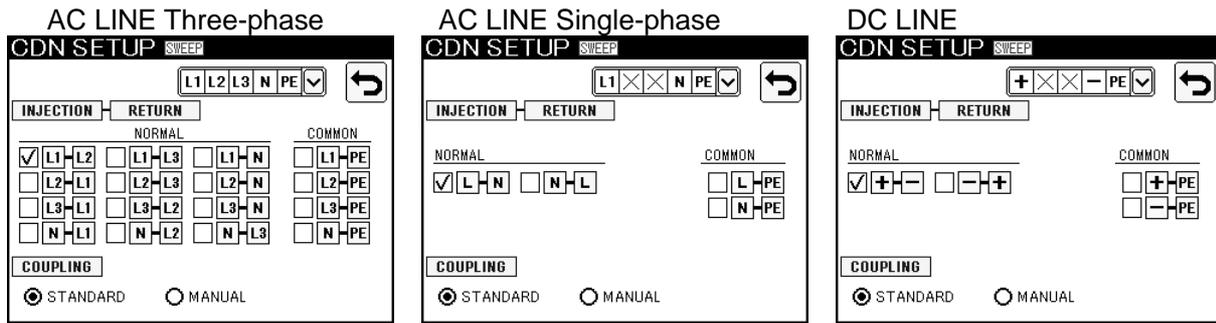
- The test cannot start from this screen.
- Fully pay attention to connection of the line input and the line output.
  -  There should be no discrepancy between the actual connection and setting on the screen. Refer to 10. CONNECTION.

## Injection phase sweep (AC/DC sweep)

If the CDN sweep key  is touched on the manual setting screen and  is touched, the screen moves to the CDN setup 'sweep' screen.

Touch  to indicate the popup menu.

Select the EUT line for the EUT. All of the combinations of the injection phase and the return phase in accordance with the selected EUT line are displayed on the screen.



Touch the combination of INJECTION-RETURN () to select the injection and return phase for the test.

If more than two combinations are selected, the sweep function works.

The order of sweeping is unchangeable.

 As for the order of sweeping, the normal mode is prioritized (NORMAL⇒COMMON). The injection phase takes the next priority. The order is L1⇒L2⇒L3⇒N, L⇒N, +⇒-.

On the manual setting screen after returning there with pressing  on the CDN setup screen,  (the CDN setup display) indicates the CDN settings.

For releasing the sweep, touch  again.

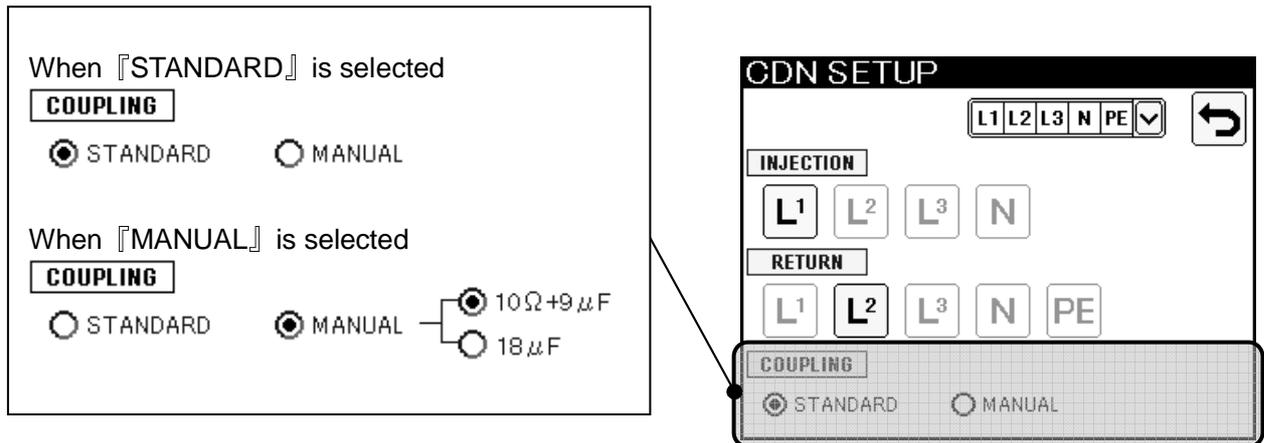
-  The test cannot start from this screen.
-  Fully pay attention to connection of the line input and the line output.
  - Touch  There should be no discrepancy between the actual connection and setting on the screen. Refer to 10. CONNECTION.

## Setting coupling

In the AC / DC injection setting, selecting the coupling circuit is available.

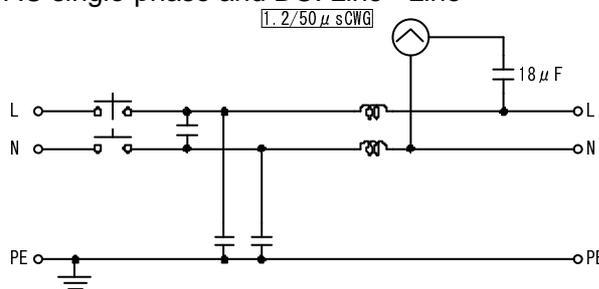
In the STANDARD mode, the coupling circuit which is prescribed on the IEC61000-4-5 is composed automatically. For the normal mode (line – line), it is fixed as  $18\mu\text{F}$ , for the common mode (line – PE), fixed as  $10\Omega + 9\mu\text{F}$ . Refer to the following schematics.

In the MANUAL test mode, the coupling circuit can be selected as  $10\Omega + 9\mu\text{F}$  or  $18\mu\text{F}$  with no relevance to the selected injection or return phase. Touch the item to be selected (⊙).

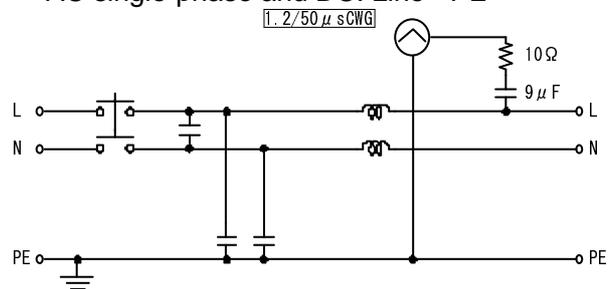


### Schematics on the STANDARD mode

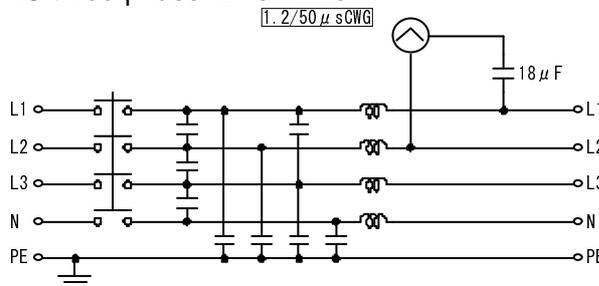
AC single-phase and DC: Line - Line



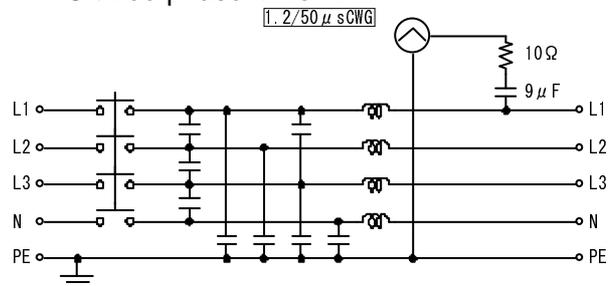
AC single-phase and DC: Line - PE



AC three-phase: Line - Line



AC three-phase: Line - PE

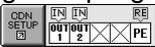


The default setting on shipment is as STANDARD.

### 13-3. Setting TELECOM Injection (C1/C3 type)

This function is provided for the LSS-F03C1 and LSS-F03C3 only.

For surge coupling to the telecom lines, coupling and return lines can be selected.

Touch  to move to the TELECOM CDN setup screen when TELECOM is selected on the manual setting screen.

 Touch the check box of 2LINE or 4LINE (☑).

Select the number of lines matching with the EUT. Coupling and return lines are shown accordingly.

 The unit automatically selects the following lines:

2LINE: OUT1 · OUT2

4LINE: OUT1 · OUT2 · OUT3 · OUT4

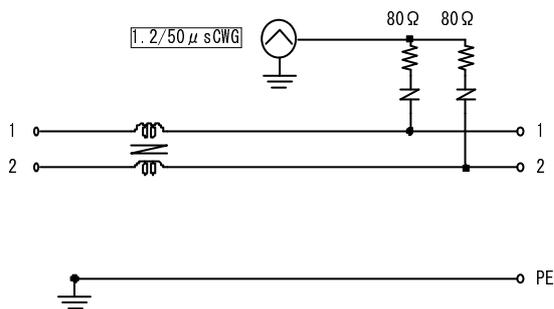
 Setting is shown by 

## Setting matching resistor

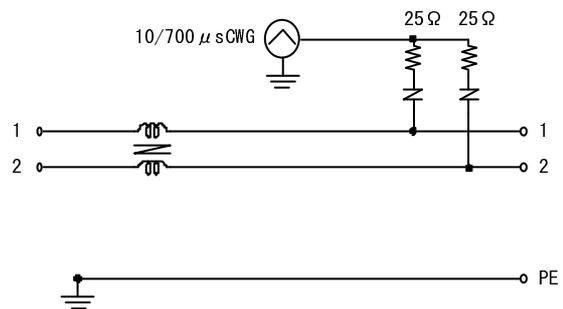
In the TELECOM coupling setting, the unit automatically selected the matching resistors specified in the IEC61000-4-5 standard. When the 1.2/50 and 10/700 wave are used, the matching resistor is always set to a combined 40 ohm resistance and 25 ohm for each line, respectively. Refer to the schematics shown below:

### Coupling schematics

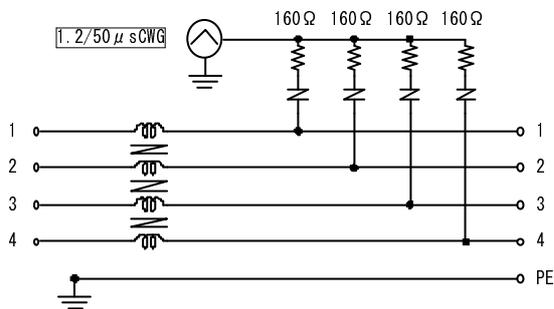
TELECOM : 2 LINE (40  $\Omega$ )



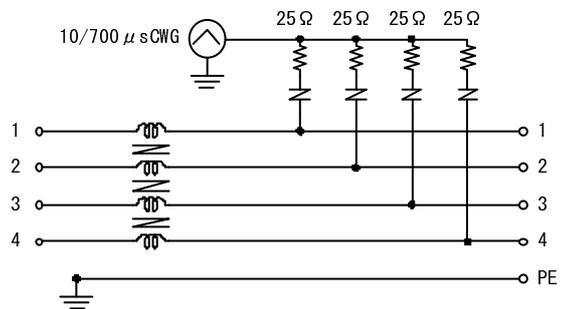
TELECOM : 2 LINE (25  $\Omega$ )



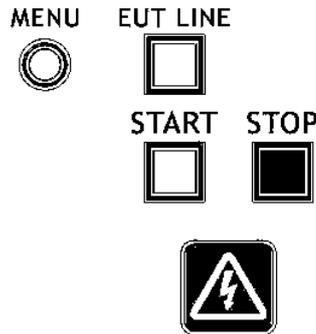
TELECOM : 4 LINE (40  $\Omega$ )



TELECOM : 4 LINE (25  $\Omega$ )



### 13-4. Executing Manual Test

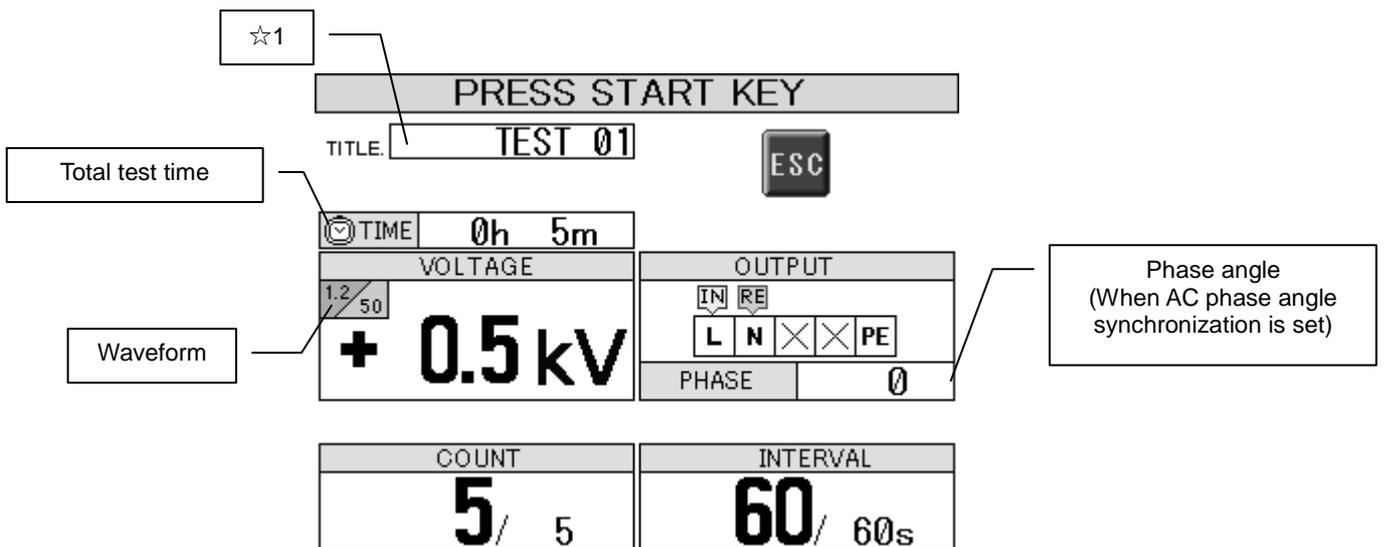


- ① In case of the injection test to power lines, turn ON the line breaker of lines to be tested.
- ② Power supply to the EUT  
 In case of the injection test to power lines, press the EUT LINE key [EUT LINE] to connect the line. The LED of the EUT LINE key illuminates when power is supplied.

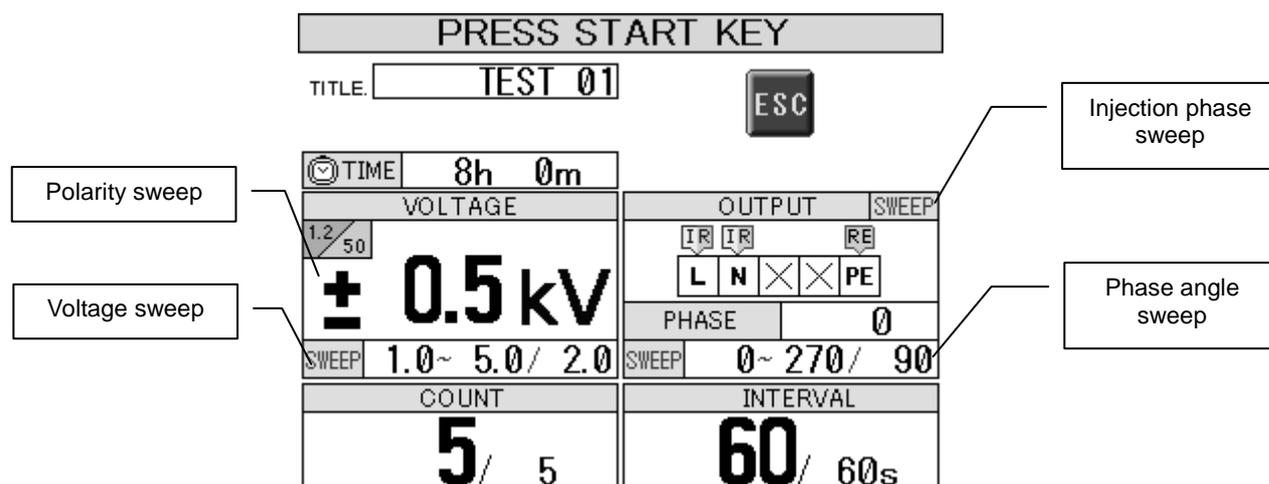


Since the line power supply is output to the AC/DC line output terminal [AC/DC LINE OUTPUT] when the EUT LINE key is turned ON, fully be careful to the terminals for safety.

- ③ Check screen  
 When the START key is pressed and settings of test conditions are complete, the following check screen is indicated. If there is any dissatisfied condition, an error message will appear. Confirm the whole condition and press the START key again to start the test. If [ESC] is pressed again on the check screen, the screen will return to the manual test setting screen.



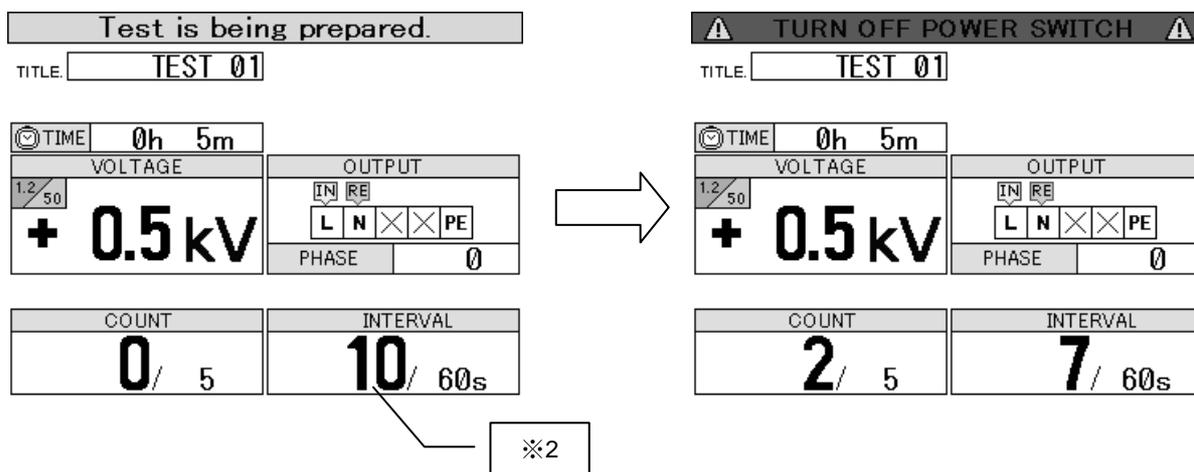
☆1 The title is indicated here when the test contents is saved.  
 If the test contents are edited after saving, the title is not indicated.

**Check screen when the sweep mode is set**

 When SWEEP of voltage and/or phase angle is set, start value, stop value, and step value are indicated in the bottom column. When the injection phase sweep is set, 『SWEEP』 is indicated in the upper right column.

## ④ Conducting test

First, 『Test is being prepared』 is indicated. When switching the internal circuit is complete, 『UNDER TEST』 appears on the screen. The warning lamp is blinking while the test is conducted. The discharge times counts up and the interval counts down. Note that the minimum charging time<sup>※2</sup> is counted down to the first surge output.

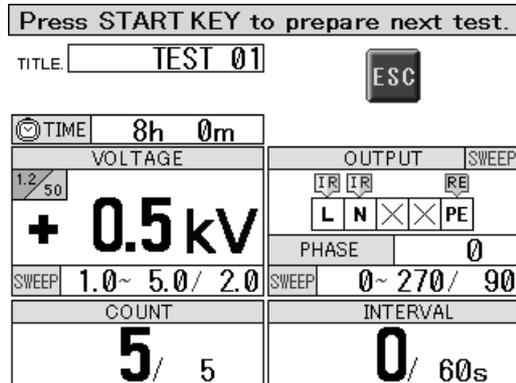


 High voltage surges are output. Mishandling or careless operation may result in a fatal wound. Carefully handle it.

※2 The minimum charging time depends on the waveform and the output voltage. Refer to P74.

⑤ Moving to the next test

If the sweep function is set and the sequence method on the “Utility” is “AUTO”, the test stage moves to the next automatically. If the sweep function is set and the sequence method on the “Utility” is “MANUAL”, 『Press START key to prepare next test』 is indicated, press the START key to start the next test.



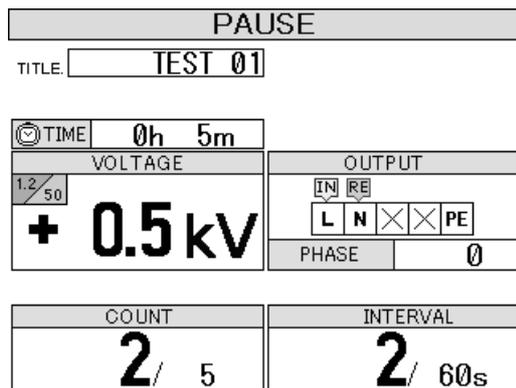
As for the sequence method, set it on the utility. Refer to 15. UTILITY.



In moving to the next test stage, 'Pause' is not available.

**Pause**

Pressing the START key while conducting test makes the output pausing. 『PAUSE』 is indicated on the screen. For restarting the test, press the START key again.



If 『PAUSE』 status is left as is for 10 minutes, the test will be stopped automatically for safety.

## Suspension

Pressing the STOP key while conducting test makes the test stop at the moment. The START key lights off and 『Test suspended』 is indicated on the screen.

☞ Confirming suspension, touch **OK** to return to the manual test setting screen.

Test suspended	
TITLE:	TEST 01 <b>OK</b>
TIME	0h 5m
VOLTAGE	OUTPUT
1.2/50 <b>+ 0.5 kV</b>	IN RE L N X X PE PHASE 0
COUNT	INTERVAL
<b>4</b> / 5	<b>10</b> / 60s



Starting the test again on this screen is not available. For restarting, touch **OK** to return to the manual test setting screen and start again on that screen. Even if the test is suspended, the EUT line key is not turned OFF. For turning it OFF, manual operation is necessary.

## ⑥ Completion of test

The test is ended automatically when all of the set test is complete. The START key lights off and 『Test Completed.』 Is indicated on the screen.

☞ Confirming completion, touch **OK** to return to the manual test setting screen.

Test Completed	
TITLE:	TEST 01 <b>OK</b>
TIME	0h 5m
VOLTAGE	OUTPUT
1.2/50 <b>+ 0.5 kV</b>	IN RE L N X X PE PHASE 0
COUNT	INTERVAL
<b>5</b> / 5	<b>0</b> / 60s



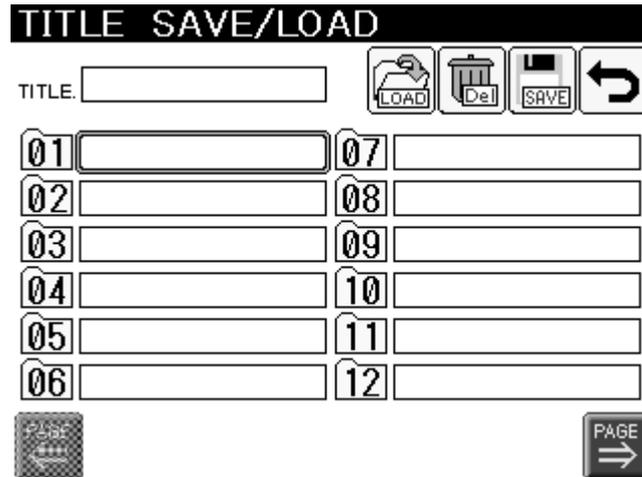
- Starting test again on this screen is not available. For restarting, touch **OK** to return to the manual test setting screen and start again on that screen. When test is complete, the Unit provides a lag for eliminating electricity of the internal circuit. Elimination needs about 4 seconds. For safety, restarting is not available during that period.
- In case of conducting test with the EUT LINE key ON, when the LINE key is turned OFF, not only power supply is shut down, but also surge generation is stopped.
- When test is suspended or completed, the LINE key is not turned off automatically. Turn it off manually.

## 14. TITLE SAVE / LOAD

The test conditions set on the manual test setting screen can be saved with naming a title. Saving 36 kinds of sets is available and each title can include 12 or less roman letters, digits. Select a title box and select 『LOAD/DEL/ SAVE』 .

Touch , upper right on the manual test setting screen or the sweep setting screen, or touch 『LOAD』 on the main menu to open the title operation screen.

### Title operation screen



### List of icons for operation

Icon of key	Remarks
	Title box to save a title. There are 36 pieces (12 pieces x 3 pages) of title boxes.
 	Used for turning the page.
	Used for loading the saved titled file.
	Used for deleting the saved titled file.
	Used for saving / overwriting.
	Used for returning to the manual test setting screen and the sweep setting screen.

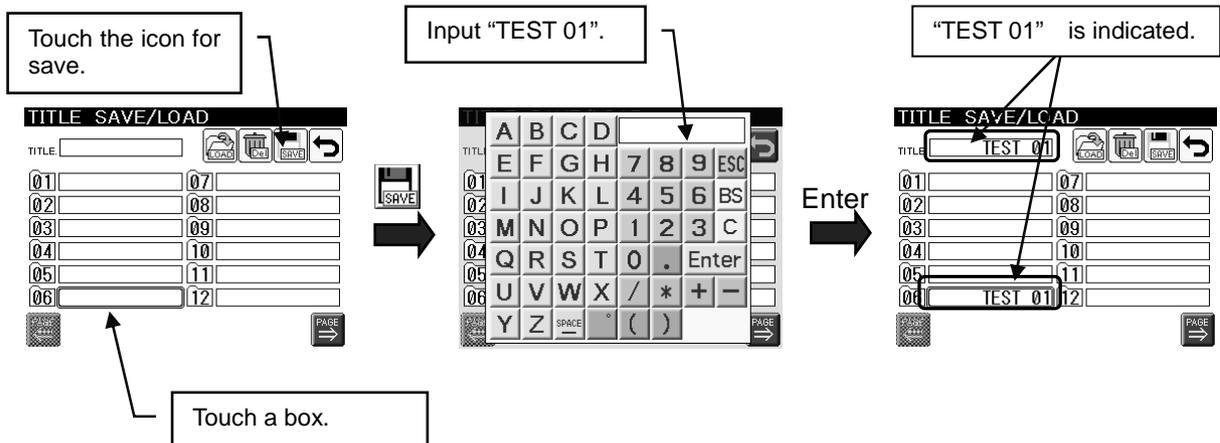


A test cannot start from this screen.

## Save

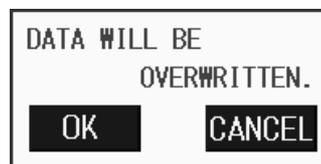
Touch a title box for saving and touch  to indicate character key. Input a title and fix it with Enter.

Ex.) Save a new file as TEST 01.



## Overwriting

If you are trying to overwrite the already-saved file and save it, a check box appears. If 『OK』 is touched, the file is overwritten. In case overwriting is not necessary, touch 『CANCEL』.



## Changing Title

The title of the saved file can be changed.

Touch a title box to be changed. → Touch the same box again to indicate character key. → Input a new title and fix it with Enter.



If Enter is pressed without inputting any letter, the title is saved as 『NO NAME』.



- For details of character key, refer to P.43.
- Title operation (save / delete) can be prohibited. For details, Refer to 15.UTILITY "Title Operation" (P.75).

## Load

Load means calling the saved titled file to use it for the manual test setting.

 Touch the title box to be called.

 Touch  to call the saved test contents.

If there is another set up in editing on the manual test setting screen, a check box as below appears before start loading. In case loading is not necessary, touch 『CANCEL』 .



Check box to confirm LOAD

## Delete

 Touch the title box to be deleted.

 Touch  and a check box as below appears. Touch 『OK』 to delete, 『CANCEL』 not to delete.



Check box to confirm DELETE



Title operation (save / delete) can be prohibited.  
For details, Refer to 15.UTILITY "Title Operation" (P.75).

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## 15. UTILITY

### Power ON Display

Selects the first screen indicated when the Unit is turned ON.

Touch 『UTIL 1』 → 『POWER ON DISPLAY』 . Touch the check box (☉) depending on your need.

The diagram shows the 'POWER ON DISPLAY' menu with four radio button options: MENU, STANDARD, MANUAL, and HOLD. Each option is linked to a text box explaining its function:

- MENU**: The main menu screen is indicated when starting.
- STANDARD**: The standard test setting screen is indicated when starting.
- MANUAL**: The manual test setting screen is indicated when starting.
- HOLD**: The last indicated screen is indicated when starting.

☐ 『HOLD』 is selected as a default value on shipment.

### Alarm Beep

Selects whether an alarm sound beeps or not when handling the Unit.

Touch 『UTIL 1』 → 『ALARM BEEP』 . Touch the check box (☉) depending on your need.

The diagram shows the 'ALARM BEEP' menu with two radio button options: ON and OFF. Each option is linked to a text box:

- ON**: Beeps
- OFF**: No beep

☐ 『ON』 is selected as a default value on shipment.

### Language

Selects language (English or Japanese) on the screen.

Touch 『UTIL 1』 → 『LANGUAGE』 . Touch the check box (☉) depending on your need.

The diagram shows the 'LANGUAGE' menu with two radio button options: JAPANESE and ENGLISH. Each option is linked to a text box:

- JAPANESE**: Japanese
- ENGLISH**: English

☐ 『ENGLISH』 is selected as a default value on shipment.

### Voltage Limit

Selects whether setting upper limit value of voltage value as 6kV or not.

Touch 『UTIL 1』 → 『VOLTAGE LIMIT』 . Touch the check box (☉) depending on your need.

When ON is selected,  $\frac{6kV}{\uparrow}$  is indicated on the standard and manual test setting screen.

The diagram shows the 'VOLTAGE LIMIT' menu with two radio button options: ON and OFF. Each option is linked to a text box:

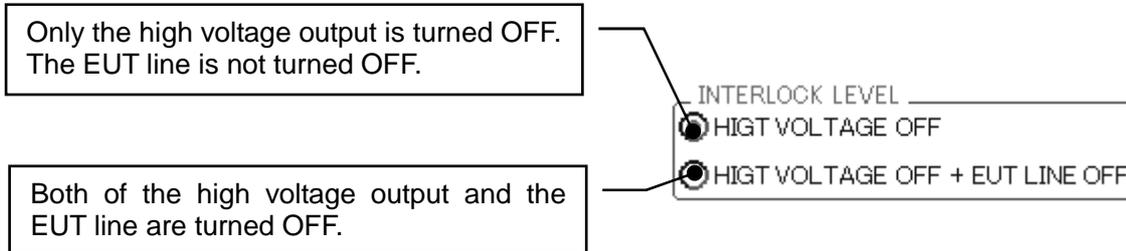
- ON**: Upper limit: 6kV
- OFF**: No voltage limit

☐ 『OFF』 is selected as a default value on shipment.

## Interlock Level

Selects the way of turning OFF when the interlock is unlocked.

Touch 『UTIL 2』 → 『INTERLOCK LEVEL』 . Touch the check box (☑) depending on your need.

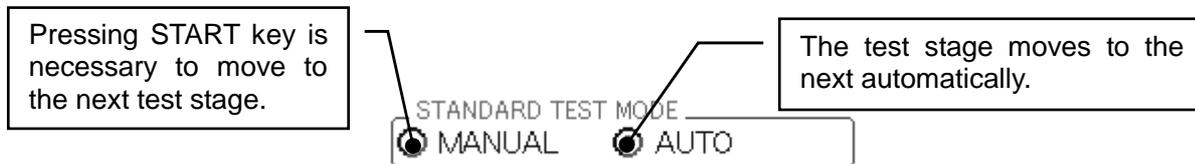


『HIGT VOLTAGE OFF + EUT LINE OFF』 is selected as a default value on shipment.

## Sequence Method

Selects how to move to the next test stage. This function works when conducting the standard test and when the sweep function is set.

Touch 『UTIL 2』 → 『STANDARD TEST MODE』 . Touch the check box (☑) depending on your need.



『MANUAL』 is selected as a default value on shipment.

## Title Operation

On the title operation, operation of saving and deleting can be prohibited.

Touch 『UTIL 2』 → 『TITLE OPERATION』 . Touch the check box of 『PROHIBITED』 (☑) if prohibition is necessary.



OFF (No ☑ on 『PROHIBITED』 ) is selected as a default value on shipment.

## 16. ERROR MESSAGE

Errors indicated on the Unit are shown as below table.

Error message		Meanings
ERROR 1	Emergency stop check safety	Emergency stop button was pressed. The Unit cannot be operated. After confirming safety, turn on again.
ERROR 2	Fan error Repair is necessary	The fan does not work. Repair is necessary. Enquire of your sales agent or Noise Laboratory.
ERROR 3	An HV connection of SURGE OUTPUT is inserted mistakenly	In spite of "TELECOM LINE OUTPUT" setting, an HV connector is connected to SURGE OUTPUT.
ERROR 4	An HV connection of SURGE OUTPUT is connected wrongly	There is discrepancy between the operation on screen and the actual settings. <ul style="list-style-type: none"> <li>• A connector is undone.</li> <li>• A connector cap is undone.</li> </ul>
ERROR 5	An HV connection of AC/DC LINE OUTPUT is connected wrongly	There is discrepancy between the operation on screen and the actual settings. <ul style="list-style-type: none"> <li>• A connector is undone.</li> <li>• A connector cap is undone.</li> </ul>
ERROR 6	Line input error A line cannot be detected	-The EUT LINE key was pressed without any line input. Check the line input. -The line input was not connected or the EUT LINE key was not turned ON in spite that line synchronization was set. Check the line input and the EUT LINE key. (Line input voltage: More than 10V is necessary)
ERROR 7	Line input error Test execution was suspended	The line was not able to be detected in conducting the test. Check the line input and the EUT LINE key. (Line input voltage: More than 10V is necessary)
ERROR 8	Interlock of TELECOM LINE OUTPUT was released	The door of TELECOM LINE OUTPUT is open.
ERROR 9	Interlock was released	Any of the following interlock is unlocked. <ul style="list-style-type: none"> <li>-The interlock on the input panel</li> <li>-The arrester cover on the telecom line injection panel</li> </ul>
ERROR 10	Title name is Protected	Title operation was tried in spite that the operation is prohibited. Check setting of 『TITLE OPERATION』 on the utility screen.

ERROR 11	System error Refer to instruction manual	A system error happens as the following part. Repair is necessary. Enquire of your sales agent or Noise Laboratory.	
		No.01	Unused
		No.02	Generating part unit error
		No.03	Injection part unit error
		No.04	Telecom unit error
		No.05	Hot switching error
		No.06	HVPS error
		No.07	Unused
		No.08	Unused
		No.09	Switching unit exchanging time
		No.10	Unused
		No.11	Unused
		No.12	Unused
		No.13	Unused
		No.14	Drive unit 1 communication error
		No.15	Drive unit 2 communication error
		No.16	Drive unit 3 communication error
		No.17	Drive unit 1 reset detection
		No.18	Drive unit 2 reset detection
		No.19	Drive unit 3 reset detection
		No.20	Drive unit 1 memory error
		No.21	Drive unit 2 memory error
		No.22	Drive unit 3 memory error
		No.23	Main board memory error
		No.24	Inoperative on maintenance mode
		No.25	EEP-ROM error
		No.26	PC communication error

## 17. SPECIFICATIONS

### 17-1. Controlling Part

ITEM	SPECIFICATIONS	REMARKS
Voltage limiter	Upper limit: 6kV	Settable by user on the utility screen (Default: OFF)
Discharge interval	10~999sec, Depending on set voltage	1.2/50 $\mu$ s waveform
	15~999sec, Depending on set voltage	10/700 $\mu$ s waveform
Discharge times	1~999 times / 1 time step	
Trigger input	Asynchronized	Depending on repetition time
	AC line synchronized 0° ~360° / 1° step	For AC injection
Saving settings	Savable in the internal memory with its title	Maximum number of titles: 36
STANDARD mode	Capable to conduct tests prescribed on IEC61000-4-5 with preset parameters	Normal mode/Common mode Automatic shift
Communication	RS-232 optical communication	

### 17-2. Surge Generating Part

ITEM	SPECIFICATIONS		REMARKS
1.2/50 $\mu$ s -8/20 $\mu$ s Combination waveforms	Open voltage	0.5kV~15kV $\pm$ 10%	Cable length : One side 0.5m Voltage step: 0.1kV Setting available from 0kV
	Front time	1.2 $\mu$ s $\pm$ 30%	
	Time to half-value	50 $\mu$ s $\pm$ 20%	
	Short-circuited current	250A~7500A $\pm$ 10%	
	Front time	8 $\mu$ s $\pm$ 20%	
	Time to half-value	20 $\mu$ s $\pm$ 20%	
10/700 $\mu$ s-5/320 $\mu$ s Combination waveforms (C1/C3 type only)	Open voltage	0.5kV~15kV $\pm$ 10%	Cable length : One side 0.5m Voltage step: 0.1kV Setting available from 0kV
	Front time	10 $\mu$ s $\pm$ 30%	
	Time to half-value	700 $\mu$ s $\pm$ 20%	
	Short-circuited current	12.5A~375A $\pm$ 10%	
	Front time	5 $\mu$ s $\pm$ 20%	
	Time to half-value	320 $\mu$ s $\pm$ 20%	
Output polarity	Positive / Negative		
Output impedance	2 $\Omega$ $\pm$ 10%		1.2/50 $\mu$ s waveform
	40 $\Omega$ $\pm$ 10%		10/700 $\mu$ s waveform (C1/C3 type only)
Generating circuit	Floating		
Minimum charging period	0.0kV ~6.0kV : 10sec 6.1kV ~15.0kV : 20sec		1.2/50 $\mu$ s waveform
	0.0kV ~6.0kV : 15sec 6.1kV ~15.0kV : 30sec		10/700 $\mu$ s waveform (C1/C3 type only)

### 17-3. AC / DC Line Injection Part

ITEM	SPECIFICATIONS		REMARKS		
Injection surge waveform	1.2/50 $\mu$ s -8/20 $\mu$ s Combination waveforms				
Maximum injectable surge voltage / current	Up to the settable maximum value				
Coupling circuit IEC 61000-4-5	18 $\mu$ F $\pm$ 10%		Line - Line		
	10 $\Omega$ +9 $\mu$ F $\pm$ 10%		Line - PE		
AC/DC Input part Output waveform	Open voltage	0.5kV ~ 15kV $\pm$ 10%	Coupling circuit : 18 $\mu$ F Decoupling coil : 1.5mH Cable length : One side 0.5m Setting available from 0kV Line input side open		
	Front time	1.2 $\mu$ s $\pm$ 30%			
	Time to half-value	50 $\mu$ s+10 $\mu$ s /-10 $\mu$ s			
	Short-circuited current	250A ~ 7500A $\pm$ 10%			
	Front time	8 $\mu$ s $\pm$ 20%			
	Time to half-value	20 $\mu$ s $\pm$ 20%			
	Open voltage	0.5kV ~ 15kV $\pm$ 10%	Coupling circuit : 10 $\Omega$ +9 $\mu$ F Decoupling coil : 1.5mH Cable length : One side 0.5m Setting available from 0kV Line input side open		
	Front time	1.2 $\mu$ s $\pm$ 30%			
	Time to half-value	50 $\mu$ s+10 $\mu$ s /-25 $\mu$ s			
	Short-circuited current	41.7A ~ 1250A $\pm$ 10%			
	Front time	2.5 $\mu$ s $\pm$ 30%			
	Time to half-value	25 $\mu$ s $\pm$ 30%			
	Injection mode	Line – line		Coupling circuit : 18 $\mu$ F (10 $\Omega$ +9 $\mu$ F selectable)	
		Line - PE		Coupling circuit : 10 $\Omega$ +9 $\mu$ F (18 $\mu$ F selectable)	
EUT line	Single-phase AC: L/N/PE DC: +/-/PE		Model : A1/C1		
	Three-phase AC: L1/L2/L3/N/PE (For both single- and three-phase) DC: +/-/PE		Model : A3/C3		
Power capacity for EUT line	AC240V/20A MAX 50/60Hz DC125V/20A MAX		Model : A1/C1		
	AC500V/50A MAX 50/60Hz DC125V/50A MAX		Model : A3/C3		
Decoupling coil	1.5mH				
Voltage fall	Less than 10% of the rated voltage with the rated current flowing		At the output terminal of the AC injection part *1		
Residual voltage	Less than 15% of the injected voltage or less than double of the rated voltage (peak value)				
Phase angle control	0° ~ 360° $\pm$ 10°		EUT power supply: More than AC90V Working at 50Hz/60Hz $\pm$ 10%		

\*1): verified with loading of 10 ohm resistive load and 4 ohm resistive load, with input of AC 200V

**17-4. Telecom Line Injection Part (C1/C3 Type)**

ITEM	SPECIFICATIONS		REMARKS
Injection surge waveform	1.2/50 $\mu$ s-8/20 $\mu$ s Combination waveforms 10/700 $\mu$ s-5/320 $\mu$ s Combination waveforms		
Maximum injectable surge voltage / current	Up to 6kV/300A		
Matching resistor	40 $\Omega$ $\pm$ 10%	1 line 80 $\Omega$ : at 2 line 1 line 160 $\Omega$ : at 4 line	1.2/50 $\mu$ s waveform
	25 $\Omega$ for each line		10/700 $\mu$ s waveform
Coupling mode	Common mode		
1.2/50 – 8/20 combination waveform coupled to the TELECOM CDN	Open circuit voltage	2kV $\pm$ 10%	*2 *3
	Rise time	1.2 $\mu$ S $\pm$ 30%	
	Duration	45 $\mu$ S $\pm$ 30%	
	Short circuit current	48A $\pm$ 20%	
	Rise time	1.5 $\mu$ S $\pm$ 30%	
	Duration	45 $\mu$ S $\pm$ 30%	
10/700 $\mu$ S – 5/320 $\mu$ S combination waveform coupled to the TELECOM CDN	Open circuit voltage	4kV $\pm$ 10%	*2 *3 *4
	Rise time	8 $\mu$ S $\pm$ 30%	
	Duration	250 $\mu$ S $\pm$ 30%	
	Short circuit current	145A $\pm$ 20%	
	Rise time	3.2 $\mu$ S $\pm$ 30%	
	Duration	250 $\mu$ S $\pm$ 30%	
EUT line	2 line / 4 line		Selectable
	DC50V/100mA MAX		
Decoupling coil	20mH		

\*2) open circuit measurement with all lines connected together with reference to PE on the EUT side and with all lines shorted to PE on the AE (auxiliary equipment) side

\*3) Short-circuit measurement with all lines shorted to PE on the EUT side and with all lines shorted to PE on the AE (auxiliary equipment) side

\*4) in case of 2-line (1 pair)

### 17-5. General Specifications

GENERAL SPECIFICATIONS		
Driving power supply	AC100V~AC240V $\pm 10\%$ 50Hz / 60Hz	
Consumption power	400VA	
Operational environment	Temperature : 15~35°C Humidity : 25~75%RH	
Dimensions	A1/A3 : W555xH1450xD790 mm C1/C3 : W555xH1800xD790 mm	Projection excluded
Mass	A1 : Approx. 290kg    A3 : Approx. 300kg C1 : Approx. 310kg    C3 : Approx. 340kg	
SAFETY FUNCTIONS		
Emergency stop	Push-lock type switch: Stops the test, turns OFF the high voltage generating part, and cuts OFF EUT line.	EUT line ON / OFF: selectable
Interlock function	Detects the surge output connector status, the protective door status, and the status of connectors for connecting external equipment.	
Warning lamp	LED start blinking when a test starts    Color: Red	
Alarm connector	Available to connect the external warning lamp. The warning lamp starts illuminating when a test starts.	
OUTPUT MONITOR		
Voltage monitor	BNC output: 000V/V Accuracy : $\pm 10\%$ vs. actual ratio	Surge out setting ※5 When output is open No waveform prescription
Current monitor	BNC output: 1000A/V Accuracy : $\pm 10\%$ vs. actual ratio	Surge out setting ※5 When output is short-circuited No waveform prescription

※5 : Only voltage peak amplitude under open circuit conditions and current peak amplitude under short circuit conditions are guaranteed while no specifications are given with the EUT connected.

## 18. OPTIONAL PRODUCT

Major optional products are as follows.

For details, enquire Noise Laboratory or your nearest sales agent of Noise Laboratory.

Items	MODEL No.	Remarks
Warning Lamp	11-00008A	The blinking makes the operators or neighbors pay attention to the test processing.
Isolation transformer	TF-2302P TF-6503P	For isolation of line input. Single-phase AC240V/30A (TF-2302P) Three-phase AC600V/50A (TF-6503P)
Protective Safety Fence	11-00010A	Enable to materialize the safe test environment with connection to interlock function equipped in the simulator. The safety measure can be sure together with the EUT protective safety box.
EUT Protective Safety Box	11-00005A/6A	Protection box to prevent access to EUT during the test. Further safety is secured together with the protective safety fence.
Remote Software	14-00037A	Application software for remote-controlling the Unit from PC.
Optical USB Module	07-00022A	Connection adaptor for PC remote control of the simulator. USB optical conversion, equipped with 5m optical fiber cable.

## 19. WAVEFORM VERIFICATION

This chapter describes how to verify the output waveform of this simulator.

### 19-1. Preparation

- Oscilloscope (Frequency range: DC~100MHz or more)
- Isolation transformer

### 19-2. Connection

Connect voltage surge monitor terminal **【MONITOR OUTPUT V 1/2000】** or current surge monitor terminal **【MONITOR OUTPUT A 1/1000】** to the oscilloscope with the supplied coaxial cable. Input impedance of oscilloscope is set in advance for accurate observation at  $1M\Omega$ . Both of the voltage monitor circuit and the current monitor circuit are isolated from the surge generating circuit. As the electric potential of GND of the monitor terminal is common with the chassis of this unit, safety is secured.

### 19-3. Notice for Observing at Monitor Terminal



For AC power supply for the oscilloscope, insert an isolation transformer. Do not connect PE terminal of the oscilloscope.



Keep away a coaxial monitor cable from the surge output cable as far as possible. As shown in the figure as below, the distance should be more than 5cm.

### How to observe at Monitor Terminal

Ground the Unit securely with using 3pin AC cable with earth terminal. When the protective earth cannot be secured through AC cable, connect PE terminal of the Unit to the earth terminal of the test room with the supplied PE cable.

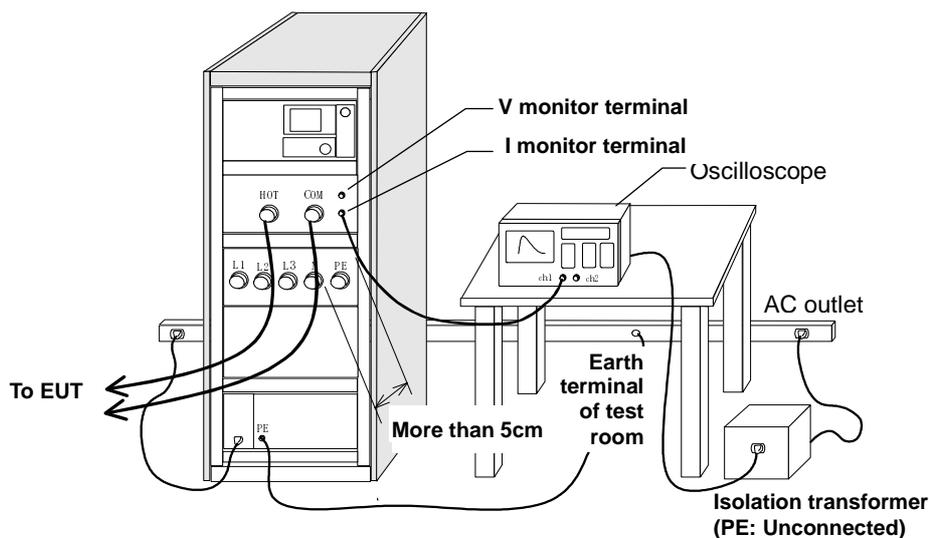


Fig. 19-1 How to observe waveform

\*\*The above figure shows the way to observe waveform of the surge output part. In case of the injection output part, the basic concept is same as the above figure.

## 15-4. Measurement

Set the probe input  $1M\Omega$  on the oscilloscope and the ratio at 1:1. Set the voltage axis and time axis of the oscilloscope according to surge voltage (current) output. As monitor output ratio is VOLTAGE: 1/2000, CURRENT: 1000A/V, when surge voltage is 15kV, voltage monitor output is 7.5V, and when surge current is 7500A, voltage monitor output is 3.3V. As for time axis, set at  $20\mu\text{s}/\text{DIV}$  to observe the entire waveform.

As the purpose of the monitor terminal is to observe waveform easily without any special probe, it cannot provide observation of great precision. And, besides, as both voltage and current are detected at the surge output terminal, in case of injection out especially, actual waveform to EUT via the injection part and cables is sometimes different from observed ones.



As the surge generating circuit of this unit is floated, if you try to observe output waveform directly via a high voltage probe, you may receive an electric shock, or measurement instruments may be damaged. Never do so. If you need to observe waveform directly, contact Noise laboratory.

## 19-5. Why PE of Oscilloscope Should Not be Common with Earth of the Unit

A strong magnetic field generates on an output route by the surge current. If a closed circuit is made via common GND between the monitor terminal and the oscilloscope, an induced electromotive force will generate as the figure as the below shows. As a result, since the difference of electric potential between the monitor terminal GND and the oscilloscope GND occurs, measurement error will be bigger. To prevent this phenomenon, a closed circuit between this unit and the oscilloscope should be avoided.

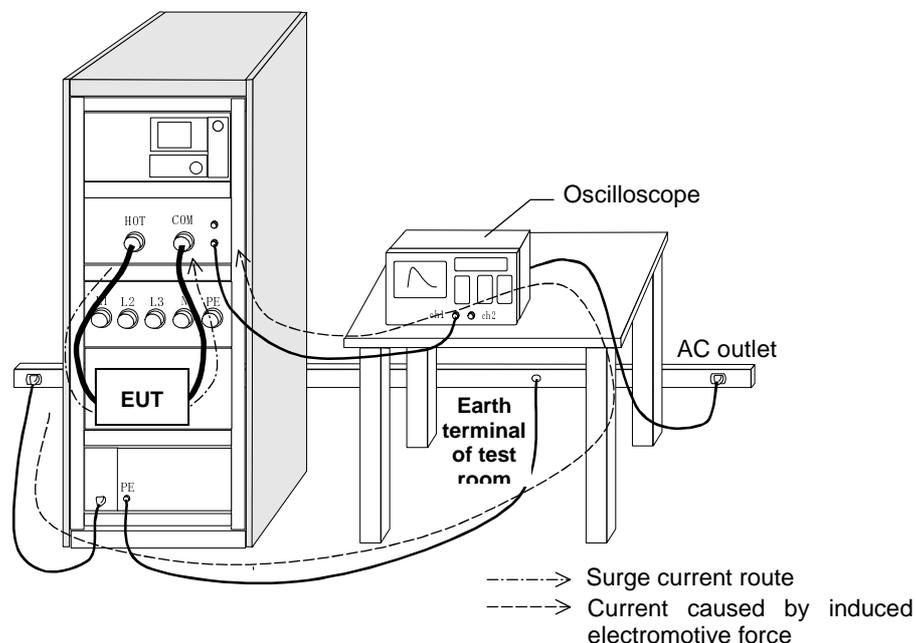


Fig.19-2 Bad Example: Without the isolation transformer--Measurement error might be bigger.

## 20. 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.

## 21. 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 the 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 the Unit.

## **22. 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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