NoiseKen

INSTRUCTION MANUAL

LIGHTNING SURGE SIMULATOR
MODEL LSS-15SC (FL)

(AC 220V)

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LSS-15SC(FL) 1995.2.
AEE00234-00E

PREFACE

We thank you very much for your buying this Lightning Surge Simulator Model LSS-15SC.

In order to obtain the highest performance from your simulator, it is recommended that the contents of this manual be thoroughly understood and used as ready reference for operation.

CONTENTS

1. FEATURES : THINGS THAT LSS-15SC CAN DO.

The LSS-15SC is the lightning surge simulator conforming to "Surge Immunity Test Requirements" of IEC Pub. 801-5. This simulator is provided with a combination wave generator and is also provided with an AC/DC line injecting unit as a surge injecting unit.

■ Waveform generator

The LSS-15SC is provided with a surge generator, namely a combination wave generator prescribed by "Surge Immunity Test Requirements" of IEC Pub. 801-5. The combination wave means a voltage waveform of 1.2/50 μ s when the circuit is open and a current waveform of 8/20 μ s when the circuit is closed.

■ Injecting unit

Surge Immunity Test Requirements of IEC Pub. 801-5 prescribe several kinds of coupling/decoupling networks. The LSS-15SC is provided with an AC/DC line injecting unit.

(1) The AC/DC line injecting unit has a power capacity of AC240V 20A single phase and DC60V 20A for equipment under test. This unit is used to inject a combination wave to an AC/DC power line.

(Note) It is necessary to receive power from an external AC power supply or DC power supply.

2. NAME AND FUNCTION OF EACH PART

The LSS-15SC consists of Control Unit, Surge Generator and AC/DC Line Injecting Unit, which are set in the rack (1800 mm in height x 555 mm in width) with casters.

■ Components of LSS-15SC

The LSS-15SC consists of Control Unit, Surge Generator and AC/DC Line Injecting Unit, which are set in the rack (1800 mm in height x 555 mm in width) with casters.

① Control Unit..... Used to control a surge output in accordance with settings of surge output conditions. Surge output conditions can be set on the front operating panel. It incorporates a high-voltage power supply for surge generation.

② Surge Generator..... Used to generate combination waves.

③ AC/DC Line Injecting Unit:.....Used to inject a combination wave to an AC or DC power line. Injection mode can be set on the right side of the AC/DC line injecting unit panel.

■ Fig. 2.1 shows the appearance of LSS-15SC.

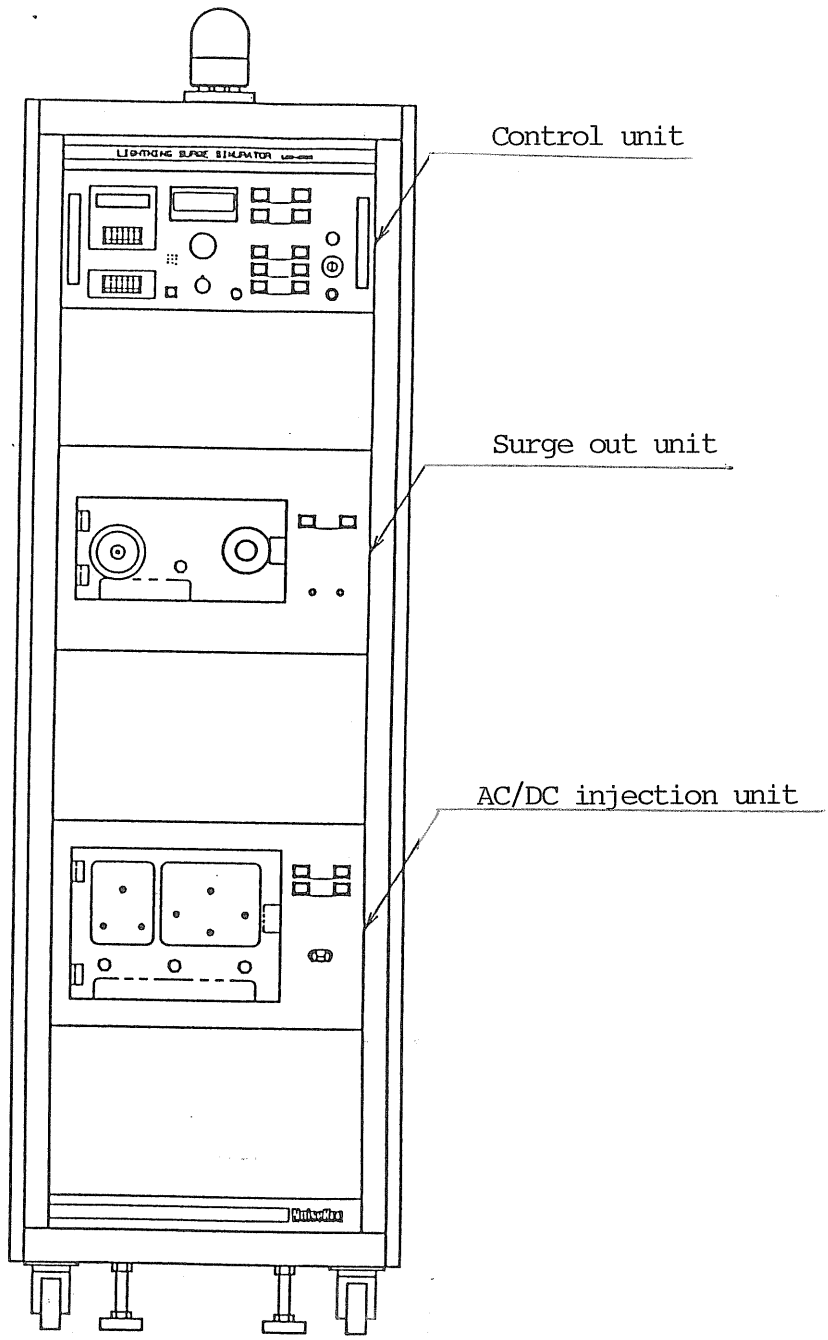


Fig. 2. 1 Appearance of LSS-15SC

2.1 CONTROL UNIT

The control unit incorporates a high-voltage power supply for surge generation to control the operation of LSS-15SC. Operating keys, counters, timers and digital voltmeters for operating LSS-15SC are arranged on the front operating panel.

■ Name and function of each part on the operating panel

① POWER SWITCH: Used to turn on and off the driving power to the main unit.

② POWER LAMP: Lights up when the driving power to the main unit is on.

③ VOLTAGE SETTING KNOB: Used to set surge output voltage.

④ LINE PHASE ANGLE SETTING KNOB:
Used to set a synchronous phase angle when injecting a surge to AC line.

⑤ FINE ADJUST KNOB:
Used to interpolate the phase angle set with LINE PHASE ANGLE SETTING KNOB. Adjustable by 80° maximum. When this knob is set to OFF, set value by LINE PHASE ANGLE SETTING KNOB is applied.

(Application Example)
When LINE PHASE ANGLE SETTING KNOB is set to 90° , the synchronous phase angle can be varied between 90° and approx. 170° by rotating FINE ADJUST KNOB.

⑥ DIGITAL VOLTMETER: Indicates voltage setting for surge output.

⑦ COUNTER: Used to set surge output times in case of auto mode test.

⑧ TIMER: Used to set a surge output cycle in case of auto mode test.

(NOTICE)
- When setting a surge output cycle, set it longer than the time shown below:
  Combination wave..... 20 seconds
  When START SWITCH is pressed with time setting below the above-mentioned time, test cannot be started. (An alarming sound is given to indicate that the output cycle is less than the prescribed time.)

⑨ BUZZER STOP SWITCH:
Used to sound or stop sounding the buzzer when surge is output. When the lamp is on, the buzzer does not sound at surge output. When the lamp is off, the buzzer sounds at surge output.

⑩ HIGH VOLTAGE CIRCUIT ON SWITCH:
Used to turn on the high-voltage circuit. When the high-voltage circuit is on, the lamp of the switch is on, sounding the buzzer.

(Notice)
The buzzer which sounds interlockingly with HIGH VOLTAGE CIRCUIT ON SWITCH is not restricted by BUZZER STOP SWITCH. When outputting a surge in the manual mode test, use HIGH VOLTAGE CIRCUIT ON SWITCH in such a manner that HIGH VOLTAGE CIRCUIT ON SWITCH sounds the buzzer and outputs a surge to the periphery.

⑪ HIGH VOLTAGE CIRCUIT OFF SWITCH: Used to turn off the high-voltage circuit. When the high-voltage circuit is off, the lamp of the switch is on.

⑫ START SWITCH:
Used to start charging the condenser for surge generation and start surge output. When this switch is pressed, the inside lamp of the switch flickers to start charging the condenser. When charging is finished, the lamp is continuously on. When this switch is pressed during manual mode test while the lamp is on, a surge is output. After a surge is output, charging of the condenser is restarted.

⑬ STOP SWITCH
Used to stop the surge output or stop charging the condenser for surge generation.

(NOTICE)
When "high voltage circuit off switch" or "stop switch" is pressed, the condenser discharge circuit is automatically operated. While the discharge circuit is operated (about 5 seconds), "high voltage circuit on switch", "start switch", "polarity select switch" and "output range select switch" are inoperative.

⑭ POLARITY SELECT SWITCH:
Used to select the polarity of surge output voltage. The lamp of the switch which is selected at the time is on.

⑮ AUTO MODE SWITCH (AUTO): Used to select the auto mode. The lamp of this switch is on while this switch is set to the auto mode.

⑯ MANUAL MODE SWITCH (MANUAL): Used to select the manual mode. The lamp of this switch is on while this switch is set to the manual mode.

⑰ OUTPUT RANGE SELECT SWITCH:
Used to select the surge output range. The lamp of the switch which is selected at the time is on. [High range....15KV Max., Low range.....7.5KV Max.]

⑱ REMOTE CONTROLLER CONNECTING TERMINAL:
Used to connect the remote controller.

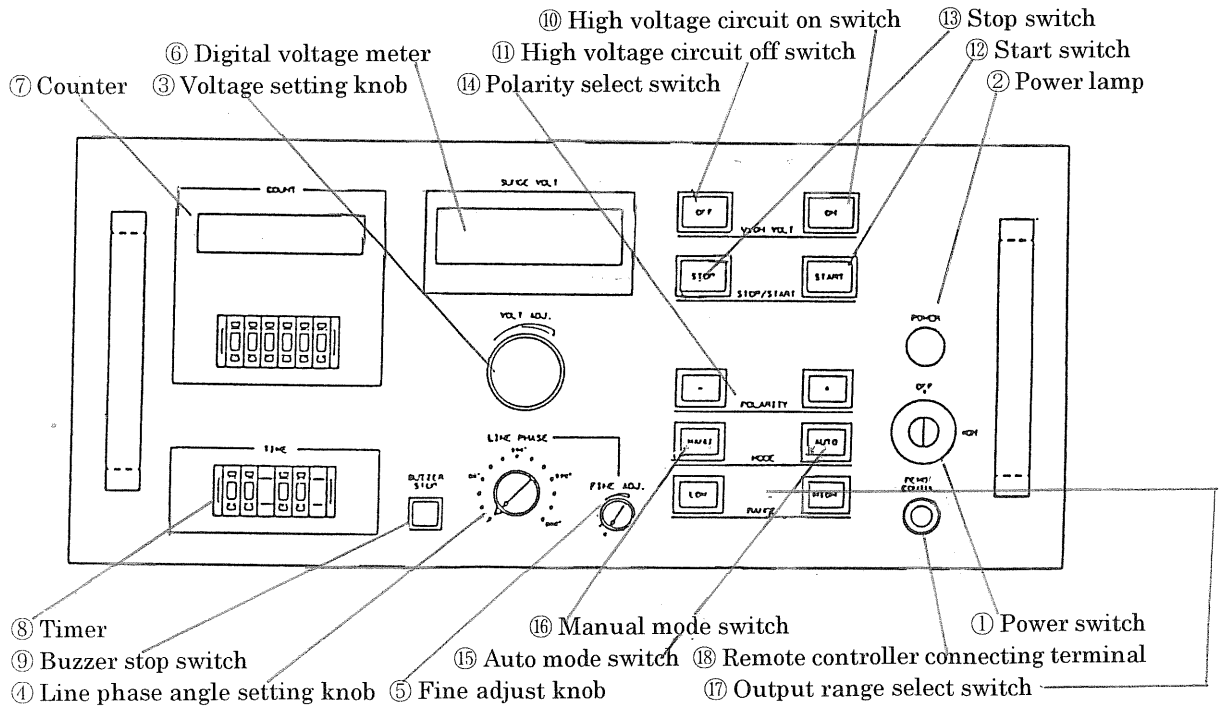


Fig. 2.2 Name of each part on the operating panel of control unit

2.2. SURGE GENERATOR

The Surge Generator is provided to generate a combination wave and consists of the surge output terminal and ground terminal.

■ Name and function of each part of surge generator

Fig. 2.3 shows the name and function of each part of the surge generator. The function of each part of the surge generator is described below.

① SURGE OUT SWITCH (SURGE OUT MODE):
Used to supply surge output between Surge output terminal and Ground terminal. When surge out mode is selected, the switch lamp is on.

② INJECTION SWITCH (INJECTION MODE):
Used to supply surge output to surge injecting unit. When injection mode is selected, the switch lamp is on.

③ VOLTAGE CHECK CONNECTOR (V. CHECK):
Used to supply surge output voltage at 1/100.

④ CURRENT CHECK CONNECTOR (A. CHECK):
Used to convert surge output current into 1V per 100A and output it.

⑤ SURGE OUTPUT TERMINAL (SURGE OUT):
When surge out mode is selected, a surge is output between this terminal and GROUND TERMINAL.

⑥ GROUND TERMINAL (SG):
When surge out mode is selected,, a surge is output between this terminal and SURGE OUTPUT TERMINAL.

⑦ FLOATING CONNECTOR (FLOATING/UN FLOATING):
Used to choose between floating and frame-grounding of the surge generating circuit. When the frame-grounding plug (black plug) is inserted, the surge ground of the surge generating unit is grounded to the frame. By inserting frame-grounding plug, voltage check (V. CHECK) and current check (A. CHECK) can be performed.

NOTICE
Choose between floating the surge generating circuit and frame-grounding according to the connection of equipment under test.

■ Figure 2.4. shows the circuit diagram of surge generating unit.

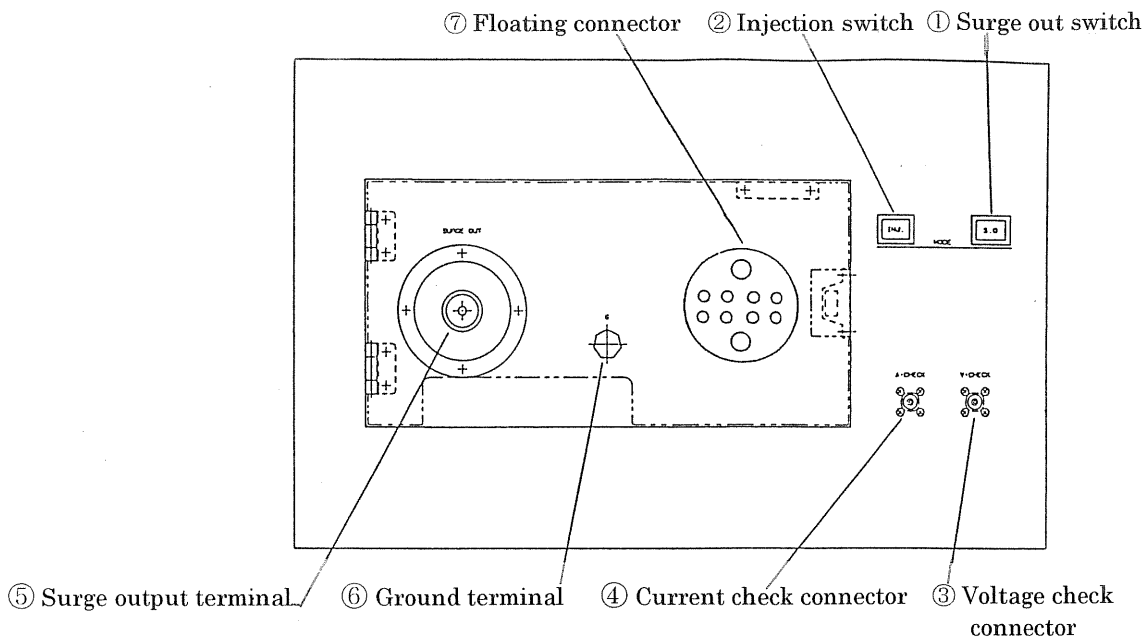


Fig. 2. 3 Surge generator

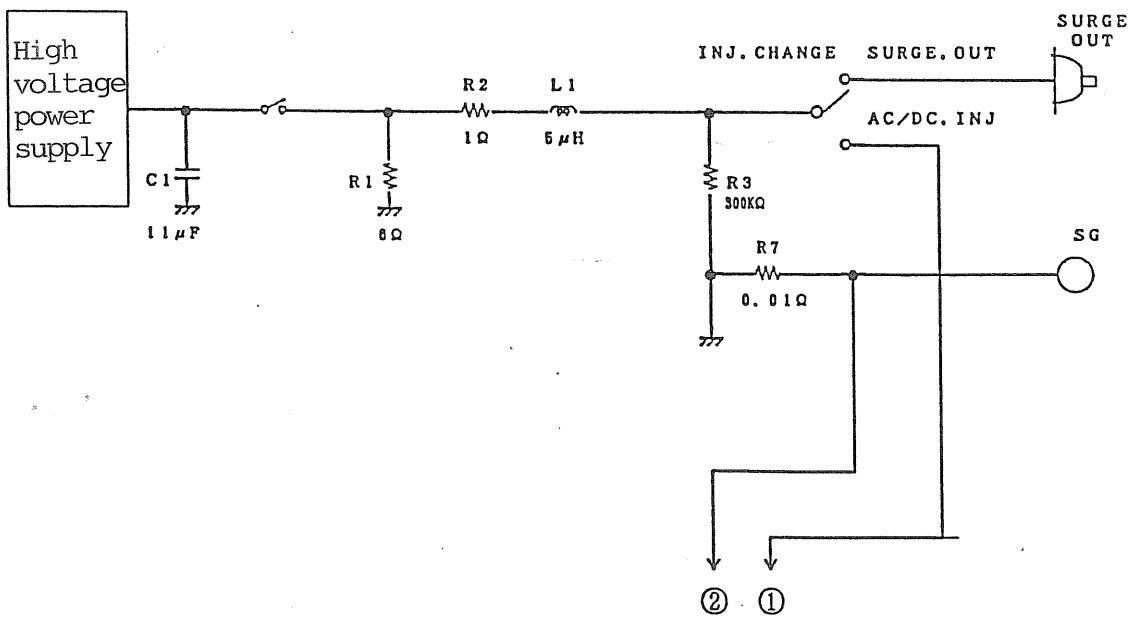


Fig. 2. 4 Surge generator circuit diagram

2.3 AC/DC LINE INJECTING UNIT

AC/DC LINE INJECTING UNIT is provided to inject a combination wave to AC or DC power line. The injection mode can be set by means of the injection mode setting unit on the right side of the panel.

■ Name and function of each part of AC/DC LINE INJECTING UNIT

The name of each part of AC/DC LINE INJECTING UNIT are shown in Fig. 2.5. The function of each part of AC/DC LINE INJECTING UNIT is described below.

① LINE ON SWITCH: Used to turn on and off the input line.

② AC MODE SWITCH (AC MODE):
Used to select the AC line injecting test mode. The lamp of this switch is on while this switch is selected.

③ DC MODE SWITCH(DC MODE):
Used to select the DC line injecting test mode. The lamp of this switch is on while this switch is selected.

④ C COUPLING SWITCH(C COUPLING MODE):
A surge is injected into the line through a 18 μ F condenser. The lamp of this switch is on while this switch is selected.

⑤ CR COUPLING SWITCH(CR COUPLING MODE):
A surge is injected into the line through a 10 Ω resistance and a 18 μ F condenser. The lamp of this switch is on while this switch is selected.

⑥ INJECTION MODE SETTING UNIT:
Used to select an injection mode to the line. The function of each part of the injection mode setting unit is described below:

(a) SURGE COM:
Used to select one line (L or N) to which a surge is injected. Another line or ground is selected by S.G.

(b) SURGE GND.
Used to choose between the common mode and normal mode. When injecting a surge between the line and ground (common mode), select G (ground). When injecting between the line and line (normal mode), select another line (L or N).

(c) L,N: Line output terminals

(d) PE: PE terminal(Protective earth)

■ Fig. 2.6 shows the circuit diagram of AC/DC line injecting unit.

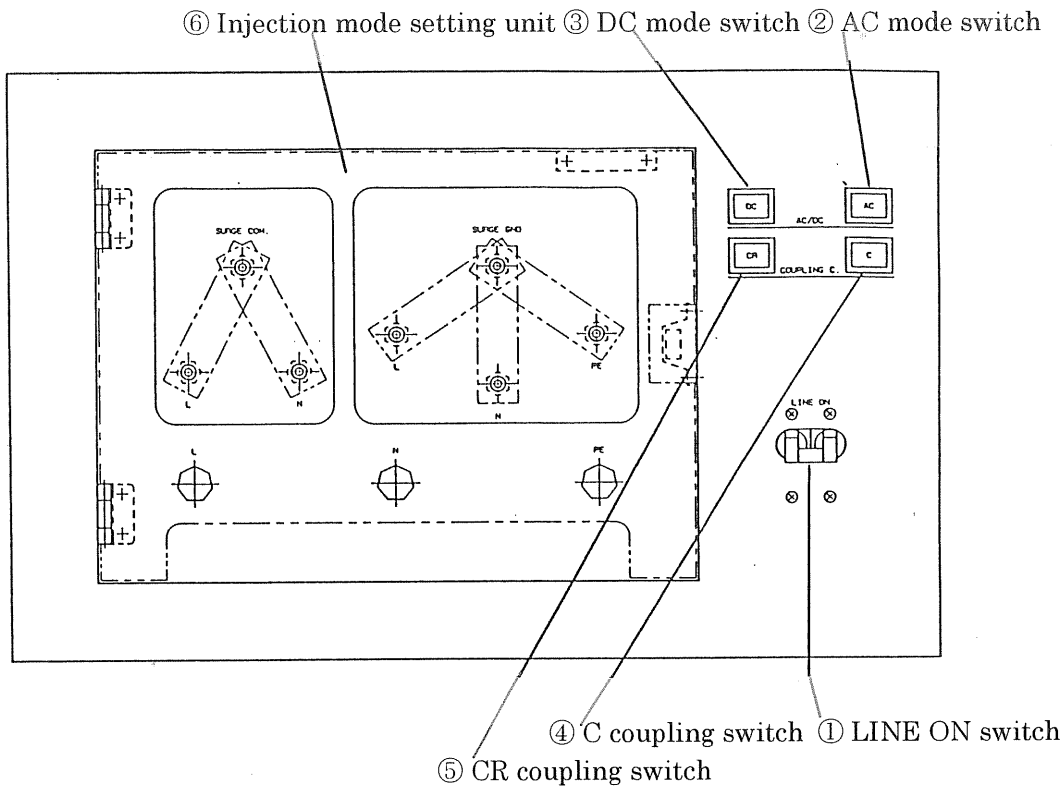


Fig. 2.5 AC/DC line injecting unit

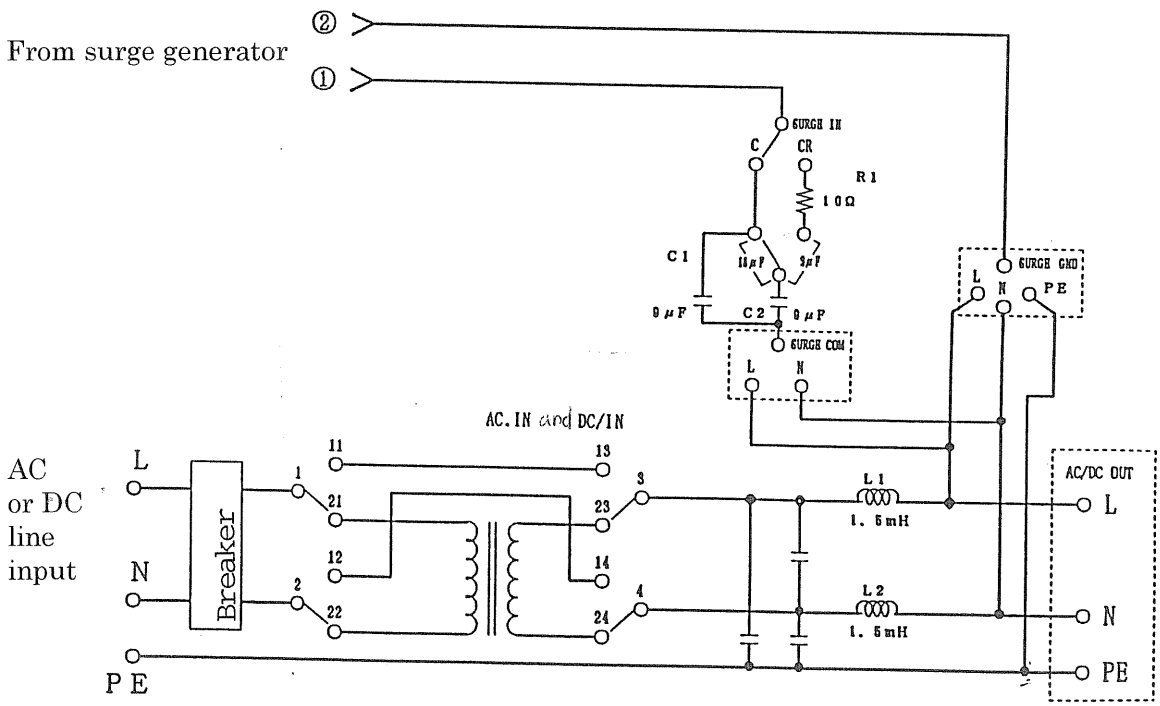


Fig. 2.6 Circuit diagram of AC/DC line injecting unit

2.4. DRIVE PANEL

The rear panel of LSS-15SC is provided with driving power input connector, fuse, alarm lamp connector, ground terminal, interlock signal input connector, line frequency select switch and line input connector.

■ Name and function of each part of drive panel

The drive panel of LSS-15SC is located under the main unit. The name of each part is shown in Fig. 2.7. The function of each part is described below.

① DRIVE POWER INPUT CONNECTOR:
Driving power connector. Connect the power cord to it and supply AC220V, 50/60Hz.

② FUSE: 10A fuses (2 pcs.)

③ ALARM LAMP CONNECTOR: Used to connect the alarm lamp supplied.

④ GROUND TERMINAL: Used for chassis ground of main unit.

⑤ INTERLOCK SIGNAL INPUT CONNECTOR:
Unless the supplied INTERLOCK CONNECTOR is connected, HIGH VOLTAGE CIRCUIT ON SWITCH (red) cannot be turned on. When connection between pin ①. and pin ③ of INTERLOCK CONNECTOR is opened with a relay contact (DC24V 2A) on the user side, HIGH VOLTAGE CIRCUIT OFF SWITCH (green) is on and can be used as a control for forced stopping etc.

⑥ LINE FREQUENCY SELECT SWITCH:
When LINE INPUT CONNECTOR ⑦ is connected to AC power supply, set the switch according to the frequency of the AC line.

⑦ LINE INPUT CONNECTOR:
AC/DC line input connector to be connected with the line input of AC/DC line injecting unit. Connect it to AC power supply or DC power supply using the supplied line input cable.

(Notice)
When conducting a test with AC power supplied to the AC/DC line injecting unit, phase angle control cannot be performed provided that voltage is below 70V. In this case, a surge is injected independently of the line phase angle.

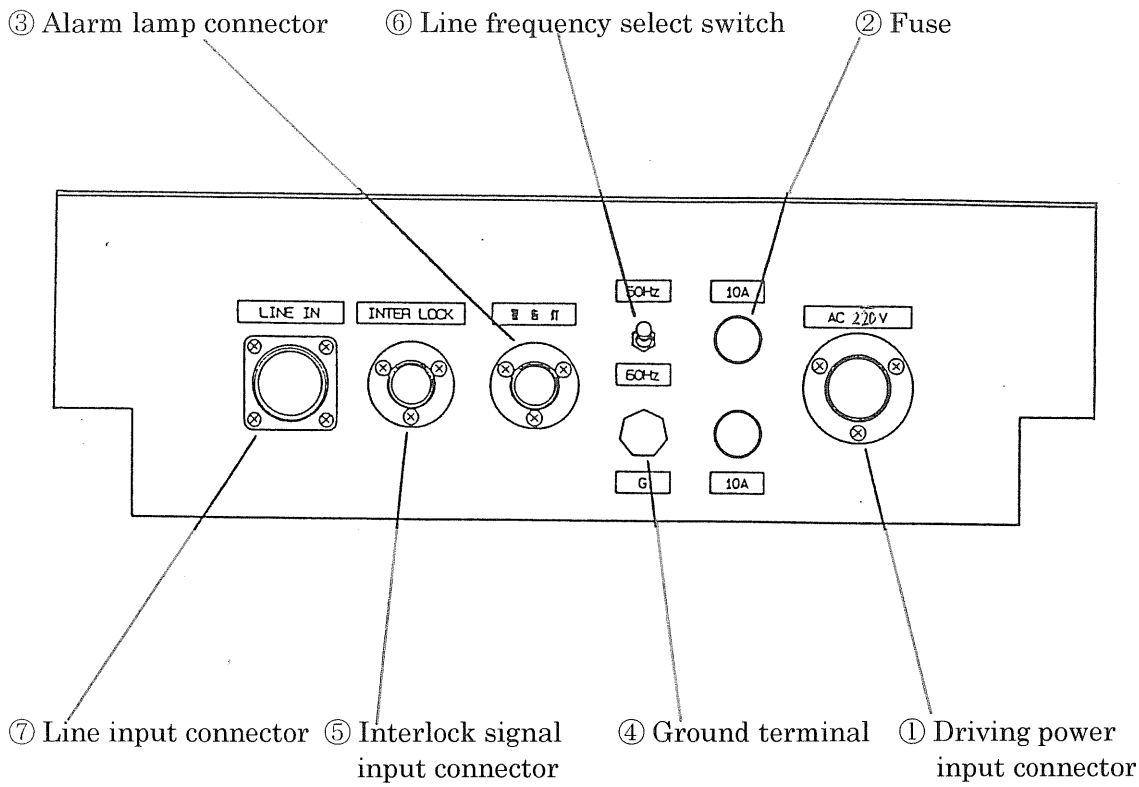


Fig. 2. 7 Drive panel of main unit

3. STANDARD ACCESSORIES

The LSS-15SC is supplied with the following accessories, a list of which is shown in Fig. 3.1.

① Instruction manual (This manual).....1 volume

② Connecting plug..... 2 pcs.
Used to set the injection mode of AC/DC line injecting unit.

③ Line input cable.....1 pc.
AC/DC line input cable.

④ Alarm lamp.....1 pc.
Connects to the alarm lamp connector on the rear panel of the main unit and it is placed on the main unit.

⑤ Waveform check terminal.....1 pc.
Used to connect it to the voltage check connector or current check connector of the surge generator for checking waveforms.

⑥ Surge output cable.....2 pcs.
Connects to the surge output terminal of the surge generator and the line output terminal of the injection mode setting unit of AC/DC line injecting unit.

⑦ Ground cable.....1 pc.
Connects to the ground terminal of the surge generator and the PE terminal of AC/DC line injecting unit.

⑧ Key switch .....2 pcs.
Key for power ON/OFF of the main unit.

⑨ Interlock connector.....1 pc.
Connects to INTERLOCK SIGNAL INPUT CONNECTOR.
(Refer to Pages 10 and 11.)

⑩ Remote controller.....1 pc.

⑪ 10A spare fuse..... .....2 pcs.

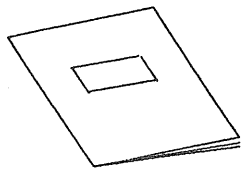
⑫ Power cord .....1 pc.
Power cord for driving main unit.

⑬ Flame-grounding plug .....1 pc.
When setting the surge generating circuit to the frame-grounding state, connect this plug to the floating connector of the surge generating unit.

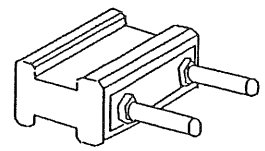
⑭ DANGER seal.....2 pcs.

⑮ Accessory carrying bag.....1 pc.

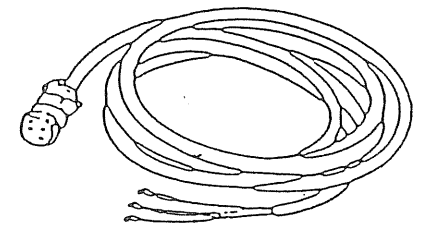
①Instruction manual
(1 volume)



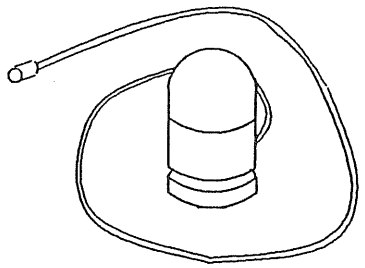
② Connecting plug
(2 pcs.)



③Line input cable
(1 pc)



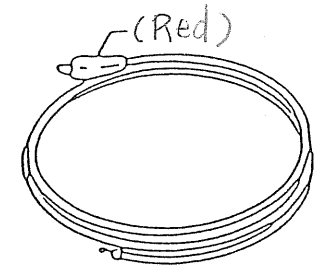
④ Alarm lamp (1 pc)



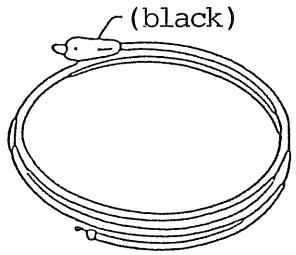
⑤ Waveform check
terminal (1 pc)

⑧ Key switch (2 pcs.)

⑥ Surge output calbe
(2 pcs.)



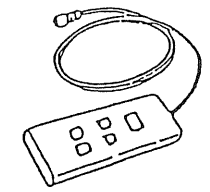
⑦ Ground cable (1 pc.)



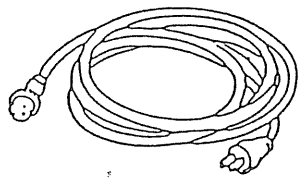
⑨ Interlock connector
(1 pc)

⑪ 10A spare fuse (2 pcs.)

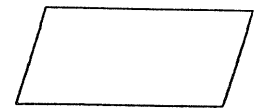
⑩ Remote controller
(1 pc)



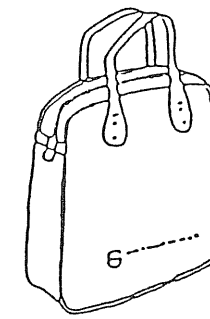
⑫ Power cord (1 pc)



⑭ DANGER seal (2 pcs.)



⑮ Accessory carrying bag
(1 pc)



⑬ Frame grounding plug
(1 pc)

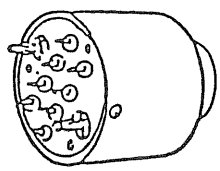


Fig. 3-1. Standard accessories

LSS-15SC(FL)1995.2.

4. OPERATING CONDITIONS OF LSS-15SC: HOW LSS-15SC WORKS

The operating conditions after power on are classified into the following 4 modes.

(1)Stop mode..... Stop mode with high-voltage off and stop mode with high-voltage on.
(2)Execution in auto mode.....Repeating surge output in auto mode.
(3)Execution in manual mode.....Surge output in manual mode.
(4)Surge out mode/Injection mode.....Surge output to surge out terminal (surge out mode) or surge injection to injecting unit (injection mode)

After power is turned on, LSS-15SC stops with high-voltage off and its operating condition changes as shown in Fig. 4.1. The receiving condition of the respective operating switches in each operating condition is as shown in Table 4.1.

(1) Stop mode (Stopping state)

① Stopping with high-voltage power off

After power is turned on, the lamp of HIGH VOLTAGE POWER OFF SWITCH is on so that LSS-15SC stops with high-voltage power turned off. The initial state of each switch at this time is as follows:

●Control unit

High voltage circuit ON switch: Off
High voltage circuit OFF switch: On
Start switch: Off
Stop switch: On
Buzzer stop switch: Former set position
Auto mode switch: On
Manual mode switch: Off
Output range select switch: HI switch On
Polarity select switch: Positive polarity

●Surge generator

Surge out switch: On
Injection switch: Off

●AC/DC line injecting unit

Line on switch: Former set position
AC mode switch: Off
DC mode switch: Off
C coupling switch: Off
CR coupling switch: Off

② Stopping with high voltage power on

If VOLTAGE SETTING KNOB is fully rotated counterclockwise when LSS-15SC stops with high-voltage power off, the stopping state can be shifted to the state of high-voltage power on by pressing HIGH VOLTAGE ON SWITCH.

(NOTICE)
When the front panel cover of the surge generator or AC/DC line injecting unit of LSS-15SC is opened, the current mode will forcefully shift to the state of high-voltage off.

(2) Execution in auto mode

When HIGH VOLTAGE POWER is turned on and START SWITCH is pressed while AUTO MODE SWITCH is on, START SWITCH starts flickering to charge the discharge condenser and the lamp of STOP SWITCH is off. The buzzer starts sounding 3 seconds before a surge is output.

A surge is automatically output at the preset time, thus subtracting "1" from the count. When a surge is output, charging of the condenser is restarted. When the count becomes "0", the test is finished and the lamp of STOP SWITCH is on.

(Notice)

- Be sure to set the timer at 20 seconds or more (combination wave). If START SWITCH is pressed with the timer set at below the prescribed time, the test will not be started, (sounding an alarm.)

- When stopping the test halfway, press STOP SWITCH. (When STOP SWITCH is pressed, the counter set value is reset.)

(3) Execution in manual mode

When HIGH VOLTAGE POWER is turned on and START SWITCH is pressed while MANUAL MODE SWITCH is on, START SWITCH starts flickering to charge the discharge condenser and the lamp of STOP SWITCH is off.

The flickering lamp of START SWITCH is continuously on after 20 seconds, finishing to charge the condenser. Surge output can be performed by pressing START SWITCH again in this state.

When a surge is output, the buzzer is sounded simultaneously and the lamp of START SWITCH flickers again, starting charge of the condenser.

(NOTICE)

Surge output cannot be performed while the lamp of START SWITCH is flickering.

(4) Surge out mode/ Injection mode

The choice between surge output to surge out terminal and surge injection to surge injecting unit is operative only when high voltage power is turned off. Each switch of the injecting unit is effective only when injection mode is selected.

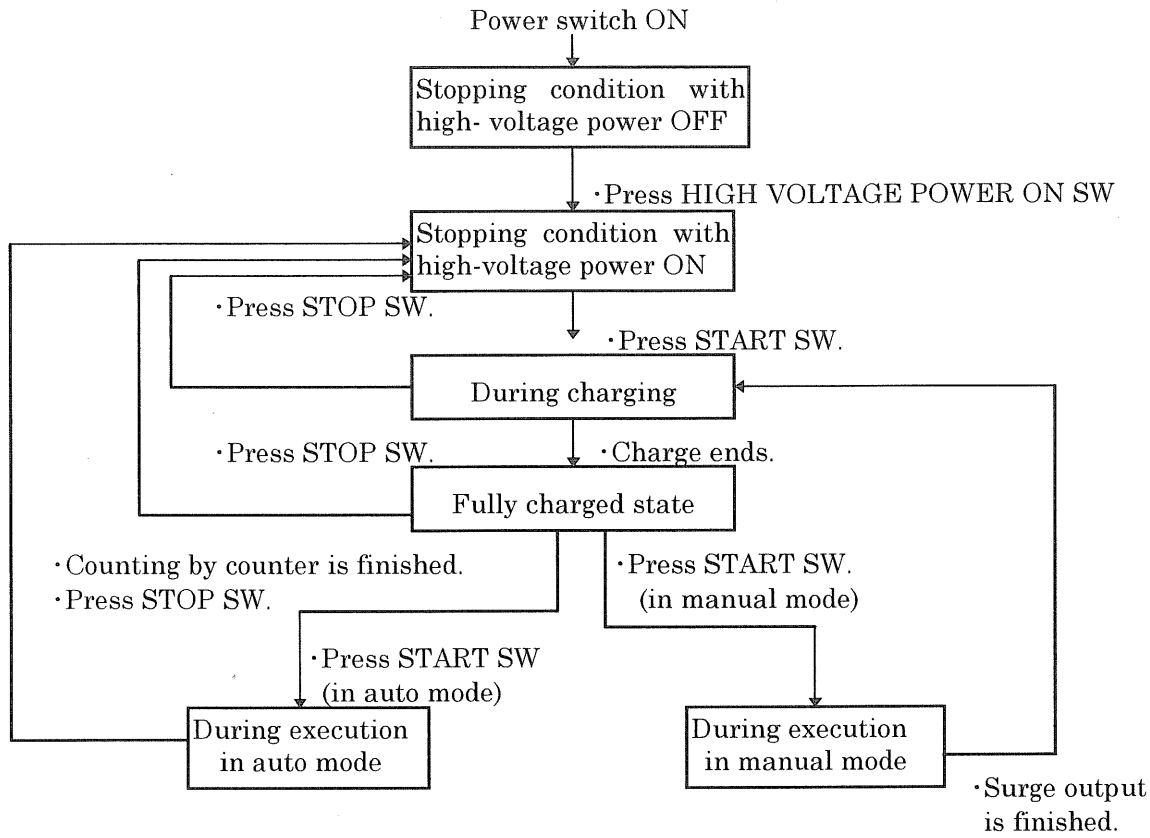


Fig. 4.1 Flow of operations of LSS-15SC

Table 4.1 Receiving condition of each operating switch

Switch / Conditions of LSS-15SC	High-voltage power ON	High-voltage power OFF	Start	Stop	Polarity change	Auto mode	Manual mode	Output range select	Surge mode	Buzzer stop	AC mode	DC mode	C coupling	CR coupling
High-voltage power off	○				○	○	○	○	○	○				
High-voltage power on		○	○			○	○			○				
Execution in auto mode		○		○						○				
Execution in manual mode		○	○	○						○				
At setting of injection mode (combination)	○		○		○	○	○	○	○	○	○	○	○	○
During execution of injecting mode (combination)		○		○						○				

① Circle ○ means that the switch is operative.

② HIGH VOLTAGE ON SWITCH is not operative unless VOLTAGE SETTING KNOB is fully rotated counterclockwise.

③ The above-mentioned "At setting of injection mode" means the state of high-voltage power off.

5. OPERATING PROCEDURE AND OPERATING PRECAUTIONS

When conducting a test using LSS-15SC, be sure to follow the operating precautions. This section describes the operating procedure required for conducting a test properly.

5-1 Connecting the drive panel
5-2 Setting for the control unit and surge generator
5-3 Setting for the AC/DC line injecting unit
5-4 Conducting a test
5-5 How to use the check terminal and remote controller
5-6 How to observe the actual voltage waveform
5-7 Difference between frame-grounding and floating

■ Operating precautions

- Set position..... Place the unit on a level place.
- Operating power supply..... Use AC220V (50Hz/60Hz). Never use power supply of other rating.
- Environment..... Operate at a temperature of 0～40℃.
- Avoid connecting surge output terminal (SURGE OUT) to a commercial AC power supply or DC or AC power supply over 30V. Otherwise, a current will flow into the unit, causing a damage to the internal component parts.
- Avoid pressing AC mode switch of the AC/DC line injecting unit when DC power supply is supplied to line input connector of main unit drive panel. If AC mode switch is pressed, supplied DC power is connected to the internal insulating transformer and the DC power line is short-circuited, causing to flow a large current and thus damaging the transformer.
- When AC power supply is supplied to line input connector of the main unit drive panel and DC mode switch of AC/DC line injecting unit is pressed, the supplied AC power supply is output to line output terminal by passing the internal insulating transformer of the main unit. In the line-to-line injection mode, the chassis of the unit is connected to one side of the AC supply power line/ When the grounding PE conductor of the line input cable is grounded, one side of the AC supply power line may be short-circuited to the ground through the PE conductor, so that a large current may flow, sometimes turning off the breaker (LINE ON). Also, the chassis of the unit may have the same voltage as that of one side of the AC supply power line, causing an electric shock. To avoid such a danger, be sure to select the same power supply mode as input power supply.

5-1. CONNECTING THE DRIVE PANEL

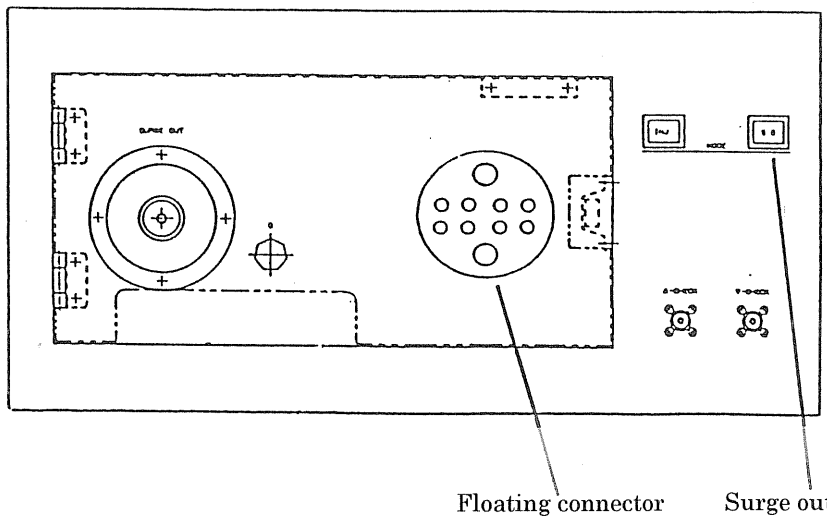
Before turning on the power switch, check that the drive panel is connected.

① Connecting the power cord····Connect the supplied power cable to AC 220V input connector and insert the plug to the supply side socket.
② Connecting the alarm lamp····Connect the alarm lamp to the alarm lamp connector and place the alarm lamp on the upside of the unit.
③ Interlock signal input connector····Connect the supplied interlock connector.
④ Connecting power supply to equipment under test (for AC/DC line injecting unit)····Connect the supplied line input cable to the line input connector and connect the other side to AC power supply or DC power supply.
(Note) Mis-connection will result in a damage to EUT.

5-2 SETTING FOR THE CONTROL UNIT AND SURGE GENERATOR

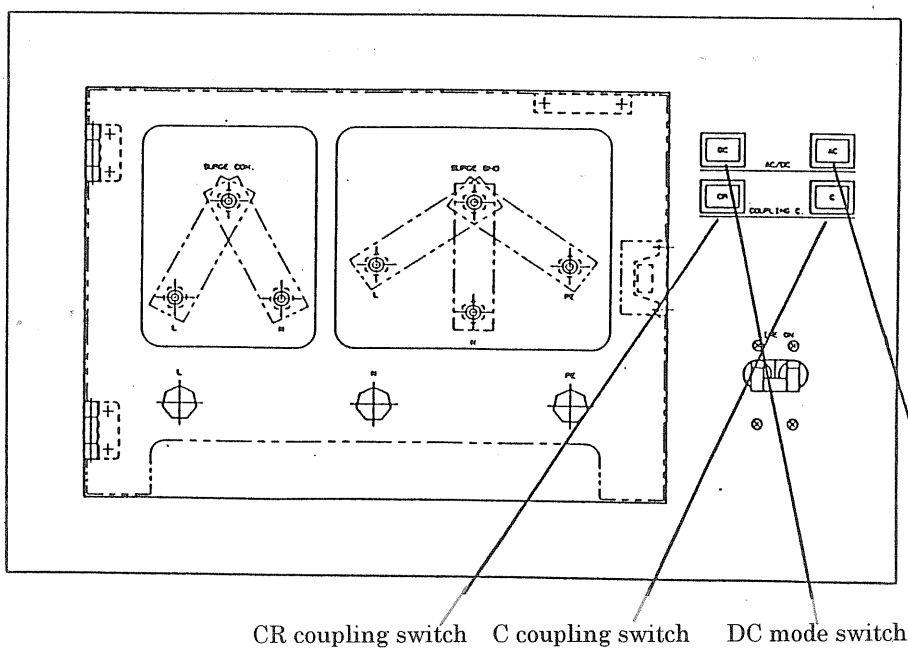
(1) When outputting a surge waveform to surge out terminal (SURGE OUT)

Press the surge out switch of surge generator and set the surge output mode to surge out mode.
Choose between floating condition and frame-grounding condition. For frame-grounding condition, insert the frame ground plug into the floating connector. For floating condition, do not insert the frame ground plug into the floating connector.



(2) When injecting a surge waveform to AC/DC line injecting unit

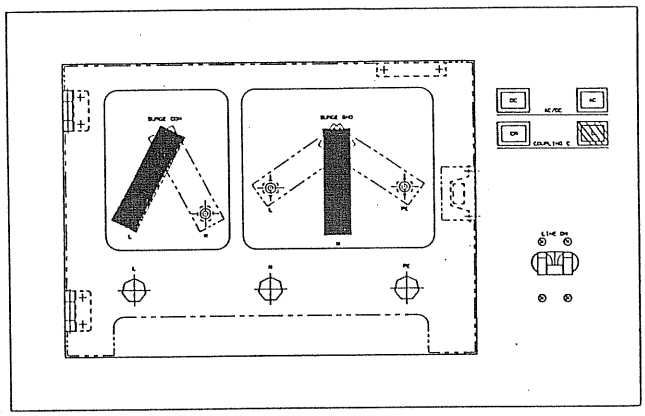
① Press the injection switch of surge generator and each lamp of AC mode switch and C coupling switch of AC/DC line injecting unit is automatically on.
② Press AC mode switch or DC mode switch, and C coupling switch or CR coupling switch according to the test conditions.



5-3. SETTING FOR AD/DC LINE INJECTING UNIT

(1) When injecting surge in normal mode (between line and line)

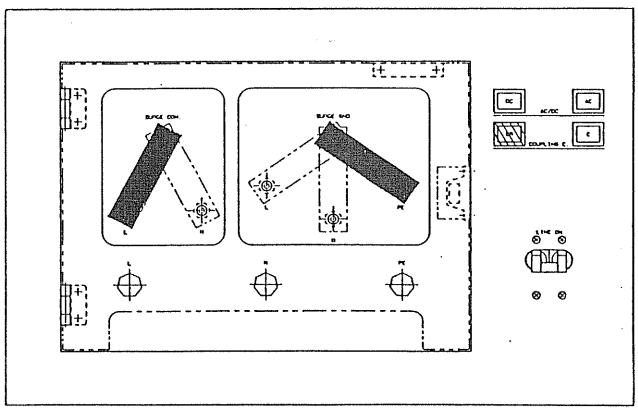
① Connect SURGE COM. to line L of the injecting mode setting unit using the connecting plug. (When the surge is injected to line N , connect SURGE COM to N side.)
② Connect SURGE GND to line N of the injecting mode setting unit using the connecting plug. (When the surge is injected to line L, connect SURGE GND to L side using the connecting plug.)
③ Press C coupling switch to set the condenser (18 μ F) coupling.



※The above example shows the case the surge is injected to line L.

(2) When injecting surge in common mode (between line and PE)

① Connect SURGE COM. to line L of the injecting mode setting unit using the connecting plug. (When the surge is injected to line N, connect SURGE COM to N side.)
② Connect SURGE GND to PE of the injecting mode setting unit using the connecting plug.
③ Press CR coupling switch to set the resistance (10 Ω) + condenser (9 μ F) coupling.



※The above example shows the case the surge is injected to line L.

5-4 CONDUCTING A TEST

This section describes how to connect LSS-15SC to equipment under test and how to use check terminals.

(NOTICE)

Before connecting equipment under test, be sure to check the following matters:

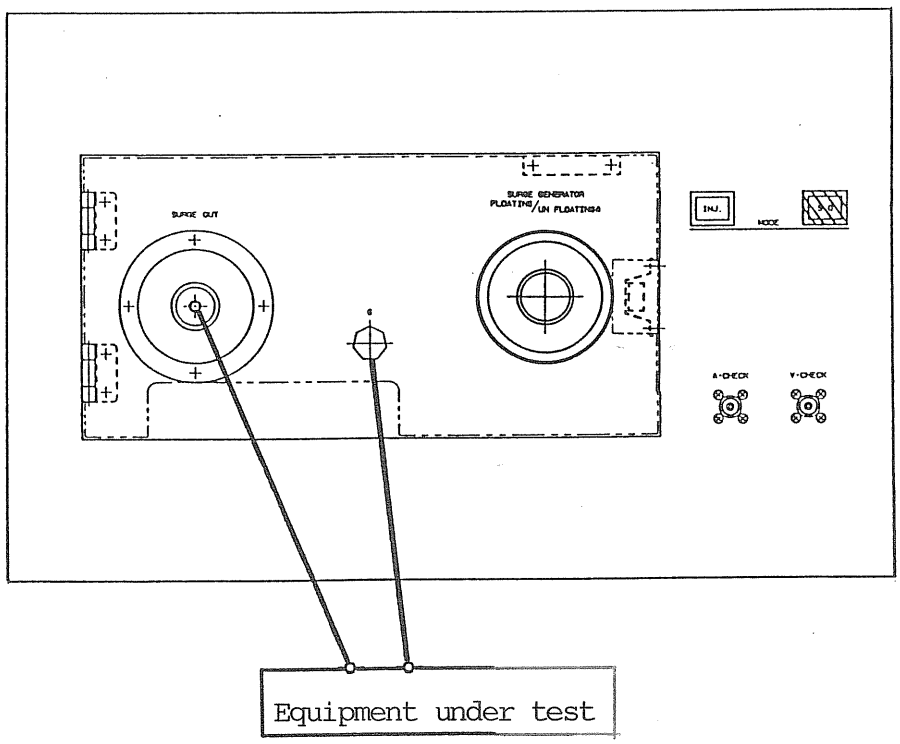
① Check that HIGH VOLTAGE OFF SWITCH is on.
② Check that the breaker of AC/DC line injecting unit is turned off.

(1) When connecting EUT to SURGE OUT terminal:

1. Connect EUT to SURGE OUT terminal using the supplied surge output cable and ground cable as shown below.

2. After completion of connection, set for the control unit according to test conditions and press HIGH VOLTAGE CIRCUIT ON SWITCH to turn it on.

3. Press START SWITCH, and the surge generating condenser is charged to start the test.



(NOTICE)

When connecting EUT to SURGE OUT terminal for conducting a test, remove the connecting bar of the AC/DC line injecting unit.

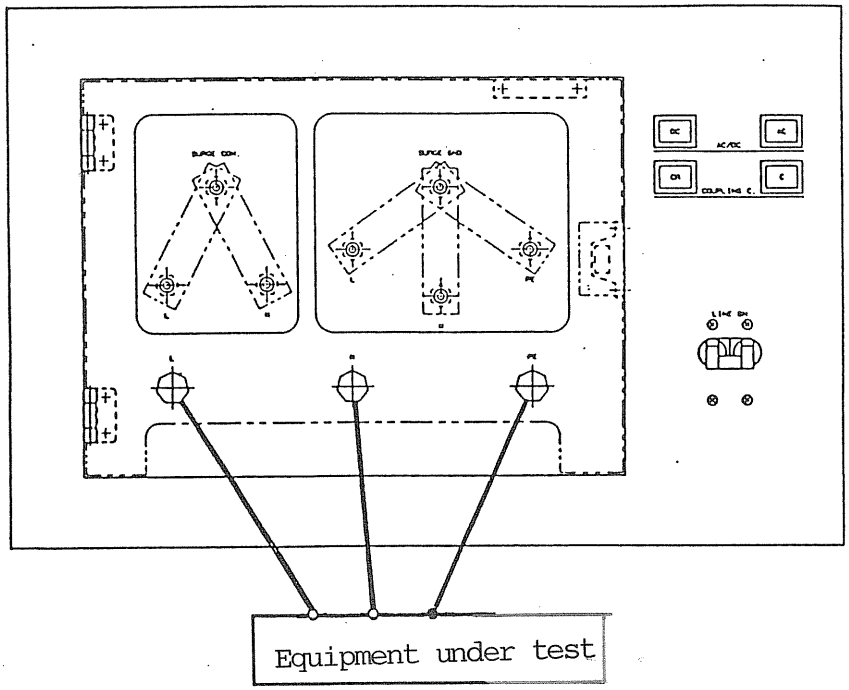
(2) When connecting EUT to AC/DC line injecting unit:

① Connect EUT to AC/DC line injecting unit using the supplied surge output cable and ground cable.

② Connect the line power supply to the line input connector of the drive unit using the supplied line input cable. (When connecting DC power supply, use phase L - N of the line input cable.)

③ After completion of connection, turn on the line breaker.

④ Set for the control unit in the same manner as (1) and start the test.



5-5 How to use the check terminal and remote controller

(1) How to use the check terminal

The surge generator is provided with a voltage check terminal and current check terminal. Since the following voltage is output from the check terminal, the output waveform can be easily monitored with an oscilloscope.

V.CHECK TERMINAL: Voltage equivalent to 1/100 of output voltage surge is output.
A.CHECK TERMINAL: Voltage equivalent to 100A/V of output current surge is output.

(NOTICE)
The check terminal has been adjusted for only peak values of surge voltage and current. When measuring surge waveforms accurately, use a high-voltage probe and a current probe.

(NOTICE)
When a frame-grounding plug (black plug) is not fitted to the floating connector (the surge generating circuit is floating), the check terminal cannot be used. If an oscilloscope is connected in this state, it will not be damaged.

(2) How to use the remote controller

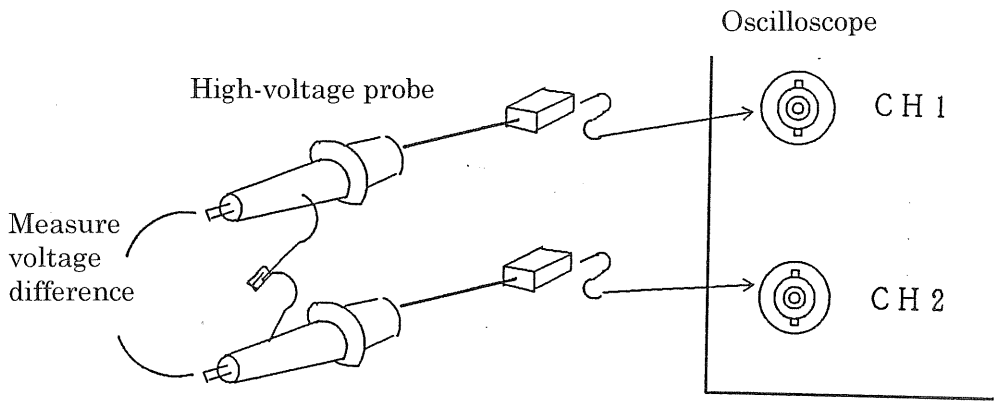
This simulator is supplied with a remote controller. When using the remote controller, pay attention to the following points:

- When connecting the remote controller, turn off the high-voltage circuit in advance.
- When the remote controller is already connected, START SWITCH of the control unit is not operative for safety's sake.
- Keep the remote controller cable away from the surge generator, AC/DC line injecting unit and EUT as much as practicable.

5-6 HOW TO OBSERVE THE SURGE OUTPUT WAVEFORM

When observing the voltage waveform under the actual test condition with the surge generating circuit set to the floating status, the oscilloscope may be damaged even if the high-voltage probe is connected to the oscilloscope. Therefore, be sure to use 2 high-voltage probes and observe the waveform by a differential connection.

Set the oscilloscope as shown below and observe the input waveforms at SURGE OUT terminal and EUT.



Set CH2 to INVERT mode, and use CH1 and CH2 in ADD mode (CH1+CH2).

Connect the ground and lead wires of the high-voltage probe, and do not connect to others.
(High-voltage probe: TECHTRONIX p6015 or p6015A)

NOTICE
In this differential connection method, hams and noise are injected to the observing system including the oscilloscope, making observation difficult. In this case, change the surge generating circuit to the frame-grounding state and observe the waveform in the ordinary method using one high-voltage probe.

5-7. DIFFERENCE BETWEEN FRAME-GROUNDING AND FLOATING

(1) Voltage check terminal and current check terminal cannot be used under the floating condition.

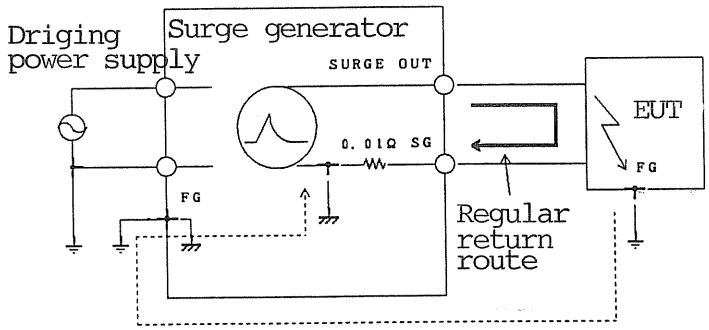
When an oscilloscope is connected to the voltage check terminal and current check terminal with the surge generating circuit set to the floating state, surge voltage may be applied into the oscilloscope. Therefore, the voltage check terminal and current check terminal are separated from the surge generating circuit under the floating condition.

(2) Deference between frame grounding and floating of surge generating unit:

- When EUT is not grounded, the surge return route are common in the frame-grounding condition and floating condition, so the same test results are obtained. Using the unit under the frame-grounding condition where the voltage check terminal and current check terminal are available is recommended.
  (Frame-grounding means the state where the frame-grounding plug (black plug) is inserted into the floating connector.)

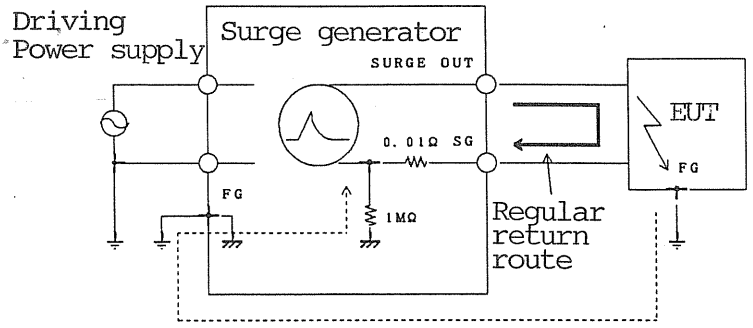
- When EUT is grounded, the surge may be discharged to FG of EUT. In this case, a surge may not pass the regular return route, so that a surge test to the input terminal can not be conducted. To avoid such a state, use the unit under the floating condition.
  (Floating condition means the state where the frame-grounding plug is not inserted into the floating connector.)

When surge generating circuit is set to frame-grounding condition



When a surge is discharged to FG of EUT, all surge is applied between FG of EUT and a surge may not be sometimes applied to the input terminal.

When surge generating circuit is set to floating condition



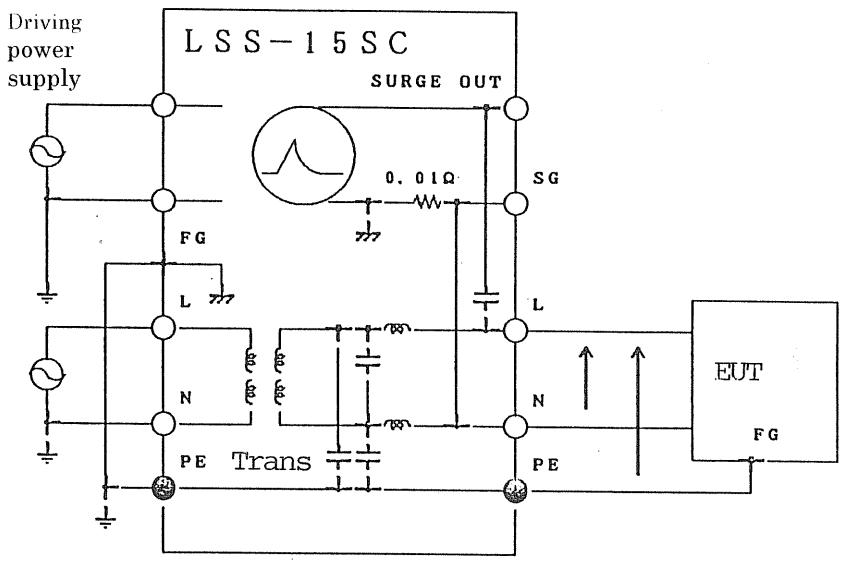
When a surge is discharged to FG of EUT, the impedance of the return circuit via FG is large and thus surge is always applied to the input terminal of EUT.

(3) When a surge is applied between AC power lines (L - N), injected and output:

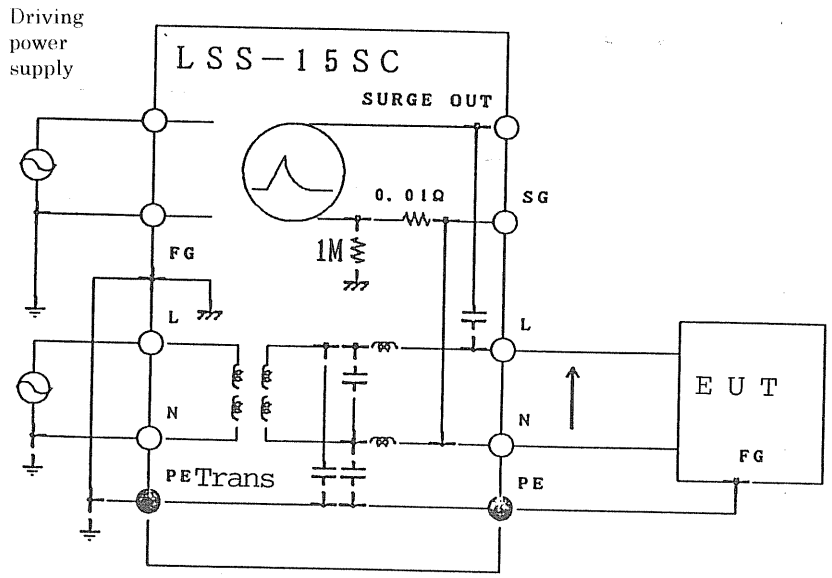
- PE, FG and SG have the same electric potential under the frame-grounding condition. So, a surge is applied between input lines (between L and N) and between input line and FG simultaneously.

- SG is separated from PE (FG) by a 1 M Ω resistor and thus the same electric potential is not attained. So, a surge is applied between input lines (between L and N) alone.

When surge generating circuit is set to frame-grounding condition



When surge generating circuit is set to floating condition



6. SPECIFICATIONS AND PERFORMANCE

Specifications and performance of LSS-15SC are as follows:

■Specifications and performance of LSS-15SC

Items	Specifications		Remarks
Generated surge waveforms	Combination wave ・Voltage surge 1.2/50 μ s (When output terminal is open.) Duration of wave front ±30% Duration of wave tail ±20% ・Current surge 8/20 μ s (When output terminal is short-circuited.) Duration of wave front ±20%, Duration of wave tail ±20%		
Generated surge voltage and current	Combination waves HI: 500 ~15000V (1.2 / 50 μ s) 250 ~7500A (8 / 20 μ s) LOW: 500 ~7500V (1.2 / 50 μ s) 250 ~3750A (8 / 20 μ s)		(Note)
Output impedance	Combination wave 2.0 Ω ±10%		
Polarity	Positive or negative (Change-over type)		
AD/DC line injection	Power capacity of EUT	Single phase AC240V 20A MAX DC 60V 20A MAX	
	Phase angle control of AC line	0° ~360° Accuracy: ±5° for phase setting (At AC 70V or over)	Infinitely variable 30° steps
Repeating cycle of surge generation	Minimum repeating cycle	Combination wave Approx. 20 seconds	
	Timer setting range	20 seconds~59 minutes and 59 seconds	Auto mode only
Counter setting range	1~ 999999 (6-digit figure, subtraction type)		
Remote controller	Manual mode switch, Auto mode switch, Start switch, Stop switch, High voltage OFF Switch		
Main unit driving power supply	AC220V 50-60 Hz Approx. 600VA		
Dimensions	(W) 555 X (H) 1800 x (H) 790 mm		

(Note) When surge output voltage is below 500V, the surge waveform will not come within the tolerance prescribed by "Surge Immunity Test Requirements" of IEC Pub. 801-5.