

INSTRUCTION MANUAL

ELECTRONIC LOAD LSA SERIES

LSA-165 LSA-165V1 LSA-330 LSA-1000

**GP-IB/USB/RS-232C
OPTIONAL CONTROL BOARD FOR LSA SERIES
IF-80GUR**



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USING THE PRODUCT SAFELY

■ Preface

To use the product safely, read instruction manual to the end.

Before using this product, understand how to correctly use it.

If you read the manuals but you do not understand how to use it, ask us or your local dealer.

After you read the manuals, save it so that you can read it anytime as required.

■ Pictorial indication

The manuals and product show the warning and caution items required to safely use the product.

The following pictorial indication and warning character indication are provided.

<Pictorial indication>	
	<p>Some part of this product or the manuals may show this pictorial indication. In this case, if the product is incorrectly used in that part, a serious danger may be brought about on the user's body or the product. To use the part with this pictorial indication, be sure to refer to the manuals.</p>
 	<p>If you use the product, ignoring this indication, you may get killed or seriously injured. This indication shows that the warning item to avoid the danger is provided.</p> <p>If you incorrectly use the product, ignoring this indication, you may get slightly injured or the product may be damaged. This indication shows that the caution item to avoid the danger is provided.</p>

Please be informed that we are not responsible for any damages to the user or to the third person, arising from malfunctions or other failures due to wrong use of the product or incorrect operation, except such responsibility for damages as required by law.

USING THE PRODUCT SAFELY



■ Do not remove the product's covers and panels

Never remove the product's covers and panels for any purpose. Otherwise, the user's electric shock or fire may be incurred.

■ Warning on using the product

Warning items given below are to avoid danger to user's body and life and avoid the damage or deterioration of the product. Use the product, observing the following warning and caution items.

■ Warning items on power supply

● Power supply voltage

The rated power supply voltages of the product are 100, 120, 220 and 240VAC. The rated power supply voltage for each product should be confirmed by reading the label attached on the back of the product or by the "rated" column shown in the instruction manual. The specification of power cord attached to the products is rated to 125VAC for all products which are designed to be used in the areas where commercial power supply voltage is not higher than 125VAC. Accordingly, you must change the power cord if you want to use the product at the power supply voltage higher than 125VAC. If you use the product without changing power cord to 250VAC rated one, electric shock or fire may be caused. When you used the product equipped with power supply voltage switching system, please refer to the corresponding chapter in the instruction manuals of each product.

● Power cord

(IMPORTANT) The attached power cord set can be used for this device only.

If the attached power cord is damaged, stop using the product and call us or your local dealer.

If the power cord is used without the damage being removed, an electric shock or fire may be caused.

● Protective fuse

If an input protective fuse is blown, the product does not operate. For a product with external fuse holder, the fuse may be replaced. As for how to replace the fuse, refer to the corresponding chapter in the instruction manual.

If no fuse replacement procedures are indicated, the user is not permitted to replace it. In such case, keep the case closed and consult us or your local dealer. If the fuse is incorrectly replaced, a fire may occur.

■ Warning item on Grounding

If the product has the GND terminal on the front or rear panel surface, be sure to ground the product to safely use it.

■ Warnings on Installation environment

● Operating temperature and humidity

Use the product within the operating temperature indicated in the "rating" temperature column.

If the product is used with the vents of the product blocked or in high ambient temperatures, a fire may occur.

Use the product within the operating humidity indicated in the "rating" humidity column.

Watch out for condensation by a sharp humidity change such as transfer to a room with a different humidity.

Also, do not operate the product with wet hands. Otherwise, an electric shock or fire may occur.

● Use in gas

Use in and around a place where an inflammable or explosive gas or steam is generated or stored may result in an explosion and fire. Do not operate the product in such an environment.

Also, use in and around a place where a corrosive gas is generated or spreading causes a serious damage to the product. Do not operate the product in such an environment.

● Installation place

Do not insert metal and inflammable materials into the product from its vent and spill water on it.

Otherwise, electric shock or fire may occur.

USING THE PRODUCT SAFELY

● POWER SWICHT

Do not do the setting that comes to have difficulty in ON/OFF of the power switch.

● POWER CABLE PLUG

Do not setting it in the place having difficulty in handling of the power supply cable plug.

■ Do not let foreign matter in

Do not insert metal and inflammable materials into the product from its vent and spill water on it. Otherwise, electric shock or fire may occur.

■ Warning item on abnormality while in use

If smoke or fire is generated from the product while in use, stop using the product, turn off the switch, and remove the power cord plug from the outlet. After confirming that no other devices catch fire, ask us or your local dealer.

■ Input / Output terminals

Maximum input to terminal is specified to prevent the product from being damaged.

Do not supply input, exceeding the specifications that are indicated in the "Rating" column in the instruction manual of the product. Also, do not supply power to the output terminals from the outside.

Otherwise, a product failure is caused.

■ Calibration

Although the performance and specifications of the product are checked under strict quality control during shipment from the factory, they may be deviated more or less by deterioration of parts due to their aging or others.

It is recommended to periodically calibrate the product so that it is used with its performance and specifications stable.

For consultation about the product calibration, ask us or your local dealer.

■ Daily Maintenance

When you clean off the dirt of the product covers, panels, and knobs, avoid solvents such as thinner and benzene. Otherwise, the paint may peel off or resin surface may be affected. To wipe off the covers, panels, and knobs, use a soft cloth with neutral detergent in it.

During cleaning, be careful that water, detergents, or other foreign matters do not get into the product.

If a liquid or metal gets into the product, an electric shock and fire are caused.

During cleaning, remove the power cord plug from the outlet.

Use the product correctly and safely, observing the above warning and caution items.

Because the instruction manual indicates caution items even in individual items, observe those caution items to correctly use the product.

If you have questions or comments about the manuals, ask us or E-Mail us.

1. LSA Series

1-1. Product Overview

The LSA series is a line of electronic loads that can operate in four different modes: CC, CR, CP, and CV (+CC/+CR). These electronic loads can be used to evaluate regulated DC power supply units, batteries, and other devices. In addition, current electric discharge control to 0V is enabled between remote sensing terminals and can use the V1 model for the hyperelectric discharge examinations of the battery.

Each model in the LSA series can be fitted with an IF-80GUR control board, which is mounted in the slot on the rear panel. This control board enables each model to be remotely controlled via communication.

1-2. Features

- The smallest movement voltage is rated load for standard type 1V. The LSA-165V1 model can work to 0V by power supply use for 0V.
- Switching at a minimum width of 10 μ s.
- Standalone sequence function with a maximum of 1018 steps.
- Support for GP-IB, USB, RS-232C, and other communication interfaces (when the separately sold IF-80GUR control board is installed).
- Ability to use an external voltage (0-10V) and external resistance (0-10k Ω) for analog control.
- Maximum of five units can be connected for master and slave parallel operation.
- Heat release via forced air cooling: Fan placed in the front reduces the work load and extends the product lifetime.
- Three protection functions: UVP, OCP, and OPP.
- Six alarm functions for reverse connection, overvoltage, overpower, overcurrent, front-terminal overcurrent, and overheating.
- Supply power voltage range of 100 to 240V AC (maximum of 250V AC) at 50Hz/60Hz can be used without needing to change the AC voltage. Make sure to use each model within the specified rated voltage of the supplied power cable.

Model	LSA-165/165V1	LSA-330	LSA-1000
Maximum applied voltage	150V		
Input power	165W	330W	1000W
Input current	33A	66A	200A

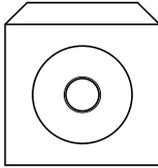
2. Preparation

2-1. Accessories

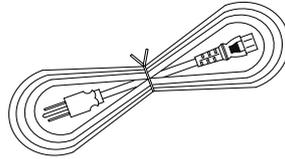
Make sure all the accessories are included with the product. If any of the accessories are missing or damaged, please contact one of our sales offices or your local dealer.

Accessories vary by model.

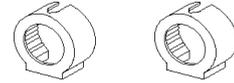
<Common accessories for all models>



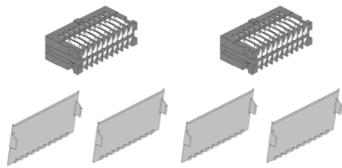
CD-ROM (Manual) 1 pc



Power cable: 1 pc



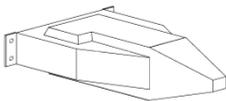
Front input terminal cover :
[F07-1590] 2 pcs



Rear control terminal connector

Connector : [E59-0613] 2 pcs
Connector cover : [F07-1594] 4 pcs

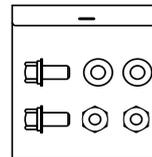
<Accessories for LSA-165/ LSA-165V1/LSA-330>



Rear input terminal cover :
[F07-1592] 1 pc



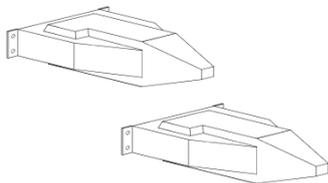
Screws for rear input terminal
cover : [N66-3005] 4 pcs



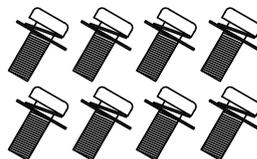
Screw set for rear input terminal :
[N99-0416] 1 set

Set Contents
Hexagon bolt (P3) : 2 pcs
Plain washer : 2 pcs
Hexagon nut : 2 pcs

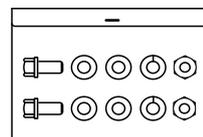
<Accessories for LSA-1000>



Rear input terminal cover :
[F07-1592] 2 pcs



Screws for rear input terminal
cover: [N66-3005] 8 pcs



Screw set for rear input terminal:
[N99-0418] 1 set

Set Contents
Hexagon bolt : 2 pcs
Plain washer : 4 pcs
Hexagon nut : 2 pcs
Spring washer : 2 pcs

2-2. Checking the Power Supply Voltage

When you use the unit, make sure to use it within the rated supply voltage that is specified. The rated supply voltage range of this unit is single-phase 100 to 240V AC (maximum of 250V AC) at 50Hz/60Hz.

This unit can be operated at power supply voltages of both 100 and 200V AC. However, 125V AC is the specified rated supply voltage of the power cable supplied with units sold in Japan and other countries where the commercial power supply voltage is 125V AC or lower.

If you need to operate the unit at a power supply voltage of 200V AC, please contact our company's service center or your local dealer.

2-3. Power Cable

Make sure to use the power cable that is supplied with the unit. The power cable supplied with the unit is a 3-P plug cable with a ground terminal.

Make sure to establish a ground connection. Failure to establish a ground connection can result in electric shock.



**The enclosed cable set is exclusively for this product.
It cannot be used with other products.**

2-4. Using LSA Series Models in Float Condition

When you use an LSA series model in float condition, high voltage might build up between the input terminal and the housing. Even after you are done using the unit, the high voltage remains between the input terminal and the housing. The presence of high voltage can result in electric shock.

If high voltage is still present between the input terminal and the housing when you finish using the unit, connect a resistor of approximately 500kΩ between the positive/negative input terminals and the housing to discharge the voltage. Make sure to discharge the voltage for at least 2 seconds.

2-5. Input Terminals

Each model in the LSA series is equipped with positive and negative input terminals on the front and rear panels. The terminals on both panels are electrically connected. Because the front terminal is a sub input terminal with a rated input current of 66A, a rated current cannot be input into the LSA-1000. For input currents of greater than 66A, use the rear input terminal. If you input a current greater than 66A into the front terminal, the front terminal overcurrent alarm is issued.



**The input terminals are polar. The positive input terminal must be connected to the positive output of the power supply source, and the negative input terminal must be connected to the negative output.
Failure to properly connect the power source to the unit (incorrect polarity) can lead to problems with the power supply source or result in damage to the unit.**



**Note that paid-repairs might be necessary to fix problems caused by an incorrect polarity connection, even if the problems occur during the warranty period.
In addition, please note that NIKKE TECHNO SYSTEM does not take any responsibility for problems with the power supply source caused by the incorrect polarity connection.**

2-6. Front/Rear Input Terminal Cover

The positive and negative input terminals on the front and rear panels are electrically connected. Make sure to place terminal covers on both the terminals that are being used and those that are not being used.

◆ For details about installing terminal covers on the front and rear panels, see [“4-2. Wiring Input Terminals”](#).

2-7. Checking the Rear Control Terminals and Other Precautions

Some of the external control terminals on LSA series models are connected to the negative input terminals. The power supply unit and the resistor for external control must be used when in float condition.

2-8. ±S Terminals

The rear panel of each LSA series models is equipped with +S terminal and -S terminal. The -S terminal is electrically connected to a negative input terminal.

2-9. "LOAD ON" of LSA Series Models

When you switch from LOAD OFF mode to LOAD ON mode, make sure that voltage has already been applied to the unit (except when performing operations such as "soft start"). If you switch to "LOAD ON" before applying voltage from the power source, the power supply unit might apply the maximum amount of current and break down.

2-10. Installation Environment

The specified operating temperature range for LSA series models is 0 to 40°C. If you use the unit in a location with a high ambient temperature, the internal temperature protection circuit is activated and the unit switches to LOAD OFF mode. Do not block or place any objects in front of the vents on the front and rear panels while the unit is in use. In addition, make sure to maintain a distance of at least 30cm between the unit and other objects. Install and use the unit in a location where the air that enters the front vent is no more than 40°C.

Do not use the unit in a location where there are a lot of dust particles and corrosive gases. Excessive exposure to dust particles or corrosive gases can damage the unit and cause it to malfunction.

Each LSA series model is equipped with a switching power supply unit. If highly sensitive measurement instruments are placed near an LSA series model or installed on the same power supply line, the instruments might be affected by the LSA series model.

2-11. Default Settings and Saving the Settings Data

The default settings are listed in the table below.

2-11-1. Using the DIRECT Keys to Specify Settings

To save the current settings (excluding the Preset function) specified by using the DIRECT keys to the internal memory, press the LOAD key while in LOAD ON mode and then switch to the LOAD OFF mode.

For the Preset function, you can save the Preset and Limit values to the internal memory by using the preset function keys while in "Save" mode.

Table 2-1

	Item	Default Setting
Main Setup function	Main Value	Minimum setting value
	Limit*	Maximum setting value: CV mode
	Mode	CC mode
	C Range	H Range
	V Range*	150V Range: CV mode
	Rspns*	3: CV mode
Preset function	Operation Selection	Recall
	Preset Values	Minimum setting value
	Preset Limit Values*	Maximum setting value: CV mode
Protect / Limit function	UVP	Off
	OCP*	Maximum setting value: All modes except CC mode
	OPP	Maximum setting value
	OCL*	Off: All modes except CC mode
	OPL	Off
Timer Soft Start function	On Timer	Off
	Off Timer	Off
	Soft Start Voltage	-0.50V: CC mode
	Soft Start Time	1ms: CC mode
SW function	Sub Value	Minimum setting value
	Slew Rate	Maximum setting value: All modes except CV mode
	Rspns*	3: CV mode
	Freq	1.0Hz
	Duty	50%
	Main Time*	500ms
	Sub Time*	Switching Type: Time
Seq function	Prgm / Wave	A
	Cycle	1

* Default settings for when the operation mode or switching type is changed.

2-11-2. Using the MENU Key to Specify Settings

To save the settings you specified with the MENU key to the internal memory, press "ENTER" when you are finished changing the values.

Table 2-2

Item		Default Setting	
System Setup	Contrast	5	
	Brightness	25	
	Screen Saver	Off	
	Buzzer	Off	
	Switching Type	Freq / Duty	
	Remote Sensing	Int	
	Load Response	Slow	
	Bias On-Voltage	0.25V	
Master / Slave	Master / Slave	Alone	
	Slave Qty.	1	
	Slave Type	Same	
	Terminal Unit	No	
External Setup	Select Type	External	
	Interface Setup*	Interface	GP-IB
		PC Address	1
	External Setup	Ext Control	Off
		Ext Load	Off
		Ext C Range	Off
Sequence Configuration	Program Select	A	
	Exec group order	N/A all	
	Group Setup	1	

* GP-IB, USB, and RS-232C communication interfaces (when the IF-80GUR control board is installed).

2-11-3. Initialization

The Initialize window allows you to initialize the settings of the unit.

◆ For details about how to initialize the settings, see "5-3-12-4. Data Initialization".

When you initialize the settings, all the values are returned to their default settings. You will need to set up the unit again the next time you use it.

2-12. Movement of the LSA-165V1 model

Because the input voltage enables an electric discharge to 0V, LSA-165V1 is equipped with switching power supply (power supply for 0V) inside. Therefore, a noise, power consumption become bigger than LSA-165.

When the "Bias On-Voltage" is set to "OFF", the smallest movement voltage will be 1.5V as rated load (1V for LSA-165)

It is controlled in the ON/OFF timing of the power supply for 0V by hardware. When the input voltage is approx. 1.5V or less, power supply for 0V will be turned on. When the input voltage is approx. 2V or more, the power supply for 0V will be turned off.

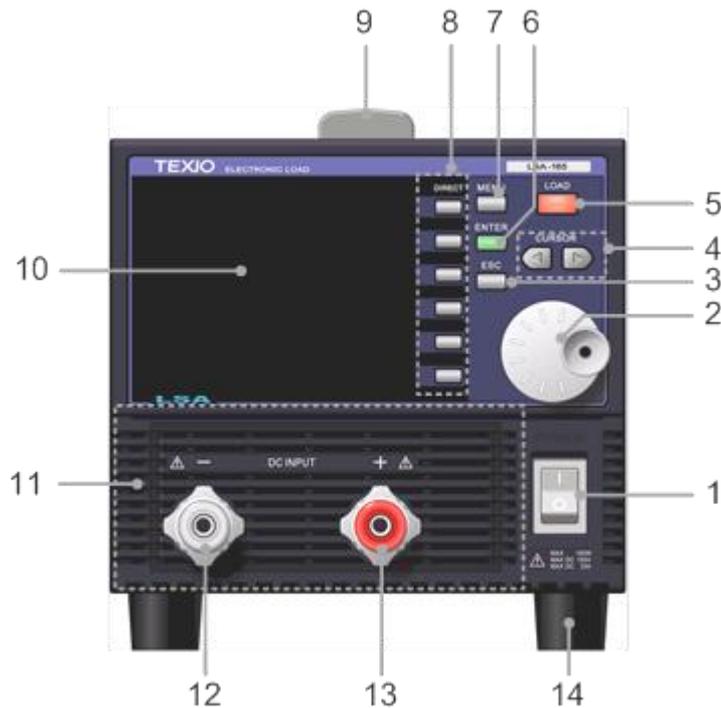
The ON voltage to set by "MENU" screen, becomes the beginning to use voltage of the power supply for 0V. ON/OFF control with the hardware is performed until I set LOAD OFF when it is in an ON state once.

(attention)

Because a power supply for 0V becomes in condition that the voltage was output on a load terminal as for the state of ON, the wiring of a load terminal and the remote sense might lead to trouble and the injury of the apparatus and is very in danger. Please work after confirming that the LOAD setting of this container becomes the OFF state by all means. Please refer to an item of "0V electric discharge function" for the details of the setting movement.

3. Panel Parts

3-1. Front Panel

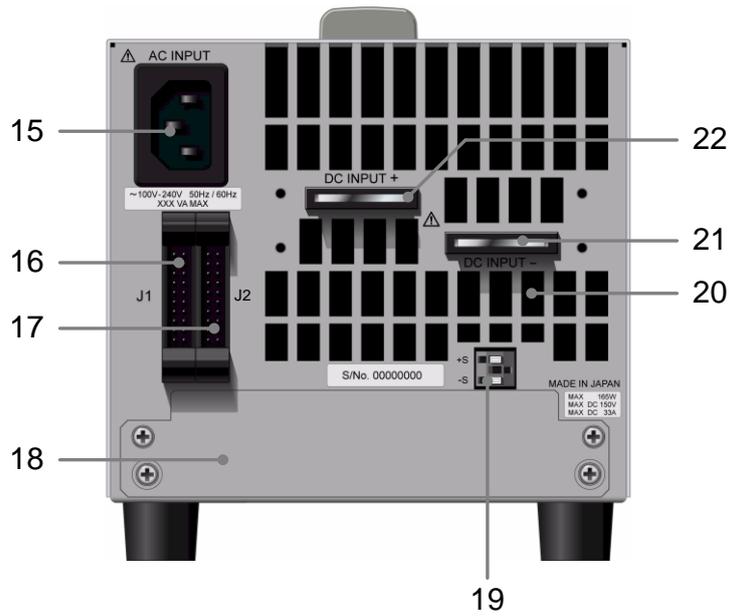


(Picture: LSA-165)

Fig. 3-1 Front Panel

- 1 Power switch : Turns the power on (|) and off (O).
- 2 Rotary encoder : Inputs a number, selects a value, and moves the cursor in the menu window.
- 3 ESC key : Cancels the currently entered operation. It is also used to return to the previous window.
Press and hold the ESC key to lock the keys.
Press and hold the ESC key again to unlock the keys.
If you press and hold the ESC key while in remote mode, the unit returns to local mode.
- 4 CURSOR key : Moves the cursor to input the individual digits of a number. It is also used to turn the page when there are multiple pages.
- 5 LOAD key : Switches between LOAD ON mode and LOAD OFF mode. The LOAD key lights up in red when in LOAD ON mode.
Press the LOAD key again to switch to LOAD OFF.
- 6 ENTER key : Fixes the settings values.
If you press and hold the ENTER key while the LCD display is off, the display will light up.
- 7 MENU key : Displays the menu window.
- 8 DIRECT keys : Perform the different selections that are assigned.
Select operation items in the main window.
A function is assigned to each selected key.
- 9 Handle : Make sure to remove the handle when you mount the unit on a rack or other elevated surface.
Note that once you remove the handle cover, you cannot use it again.
When you reattach the handle, use screws with a torque of 1N·m to secure the handle.
- 10 LCD : Color liquid crystal panel. Displays the monitored values, statuses, and settings of the unit.
- 11 Front grill : Allows air to enter and cool the unit.
- 12 Front negative input terminal : Negative input terminal. Make sure to connect this terminal to the negative output of the power supply source. The maximum input current is 66A.
- 13 Front positive input terminal : Positive input terminal. Make sure to connect this terminal to the positive output of the power supply source. The maximum input current is 66A.
- 14 Rubber feet : The four rubber pieces on the base plate of the unit.
Make sure to remove the feet when you mount the unit on a rack or other elevated surface.

3-2. Rear Panel



(Picture: LSA-165)

Fig. 3-2 Rear Panel

- 15 AC inlet : The power cable supplied with the unit is inserted here. The input voltage range is single-phase 100 to 240V AC, at a frequency of 50Hz/60Hz.
- 16 External control connector (J1) : External control connector.
- 17 External control connector (J2) : External control connector.

For the external control I/O connectors (J1 and J2), make sure to use the connector that is supplied with the unit (OMRON: XG5M) and attach a semi-cover. The AWG26, AWG27, and AWG28 cables can be used for the connector contact. Make sure to use the dedicated tool (OMRON: XY2B-7006) to crimp the cables.

For details about how to assemble the connectors, see [“5-3-11-1. Assembling the J1 and J2 Connectors”](#).

- 18 Control board slot : Slot into which the IF-80GUR control board (optional) is inserted.
- 19 ±S connector : Used to compensate the voltage drop caused by the direct-current resistance of the cable that connects the power supply source and the unit.
- 20 Air exhaust : Ventilates the entire unit by allowing air to enter through front panel and exit the rear panel.
- 21 Rear negative input terminal : Negative input terminal. Connect this terminal to the negative output of the power supply source.
- 22 Rear positive input terminal : Positive input terminal. Connect this terminal to the positive output of the power supply source.



The exhaust vent can become very hot during operation. Exercise care when handling the exhaust vent.

4. Getting Started

4-1. Connecting to a Power Supply Source

Make sure to observe the following points when connecting the power source:

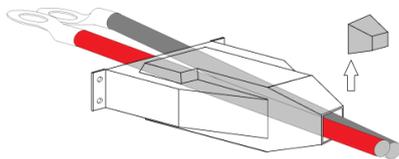
- To firmly secure the connection, use a crimp terminal to connect the power supply source to the input terminal of the unit (front input terminal: M8; rear input terminal of LSA-165/165V1/330: M6; rear input terminal of LSA-1000: M10).
- Always use a load line that is capable of handling the specified current capacity that passes between the unit and the power supply source. When inputting a current of 200A, use a cable that is at least 100mm².
- To prevent the risk of personal injury when installing or removing the load line, always turn off the power supply source and make sure the unit is in LOAD OFF mode.
- The LSA series is a line of electronic loads that can perform remote voltage sensing. Make sure to properly connect the positive and negative connectors.

Failure to properly connect the positive and negative connectors for voltage remote sensing can lead to malfunction and other problems with the unit, as well as problems with the power supply source.

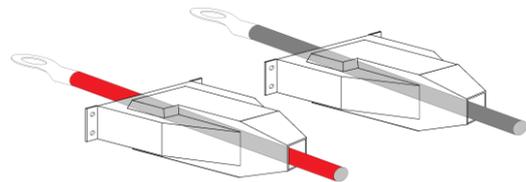
4-2. Wiring Input Terminals

4-2-1. Connecting to the Rear Input Terminals

1. Cut off the edge of the rear input terminal cover supplied with the unit, and then pass the cables (used to connect to the power supply source) through the cover.



For LSA-165/165V1/330, pass both cables (positive cable and negative cable) through the rear input terminal cover.



For LSA-1000, pass each cable (positive cable and negative cable) through a separate rear input terminal cover.

Do not cut a large section off the edge of the cover. Only a small section needs to be cut to allow the cables to pass through.

2. Use the supplied accessories (hexagon bolts, plain washers, hexagon nuts, and spring washers) to connect the cables (used to connect to the power supply source) to the terminals of the unit. Make sure the proper torque is applied when tightening the accessories.

Table 4-1 Recommended Torque

LSA-165 LSA-165V1 LSA-330	Approx. 2.6N·m
LSA-1000	Approx. 12.5N·m

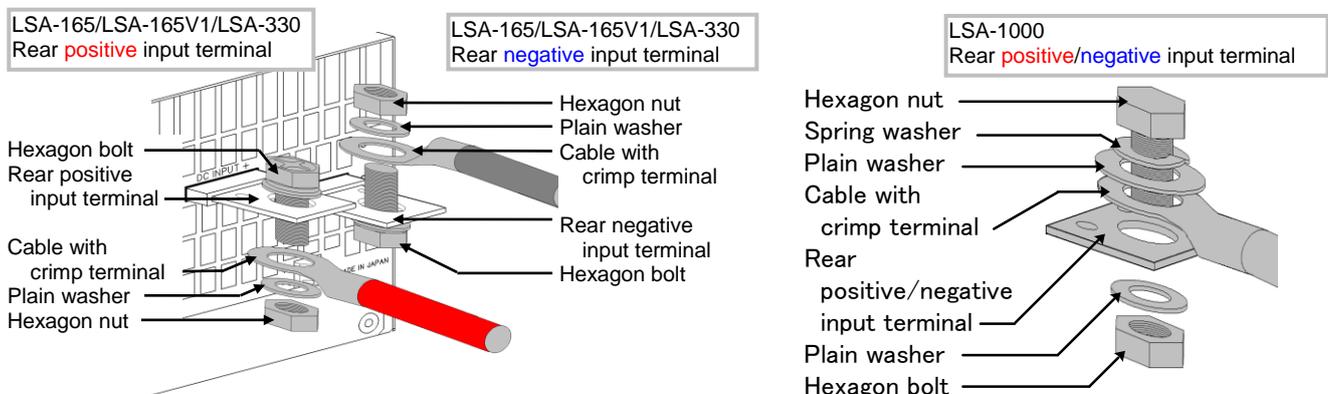
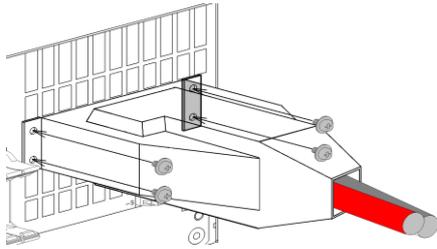


Fig. 4-1 Connecting to Rear Input Terminals

Use the supplied screw set to connect to the rear input terminals of the LSA-165, LSA-330, and LSA-1000, as shown in the Fig. 4-1. Make sure to attach the parts correctly. Failure to correctly attach the parts can prevent the rear inter-terminal cover from being properly attached.

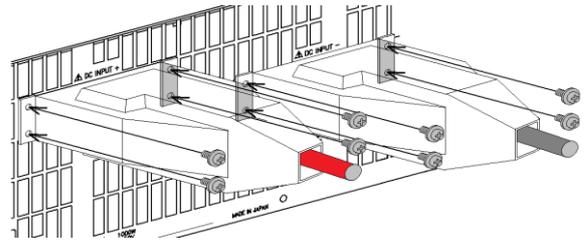
3. Use the supplied (M3) screws to attach the rear input terminal cover.

<LSA-165 /LSA-165V1/LSA-330>



There is only one rear input terminal cover for the LSA-165 and LSA-330.
Use four screws to attach the cover.

<LSA-1000>



The LSA-1000 has two rear input terminal covers.
Use four screws to attach each cover.



Always leave the rear input terminal covers attached to the rear terminals, even when the terminals are not being used.

4-2-2. Connecting to the Front Input Terminals

The maximum rated current for the front input terminals is 66A. If the input current is greater than 66A, use the rear input terminals.

<Using cables with crimp terminals>

Use a crimp terminal with an outer diameter of no more than 16.5mm and an inner diameter of at least M8. Make sure the crimp section of the crimp terminal and the cable are covered with insulation, and that the metal part is not exposed.

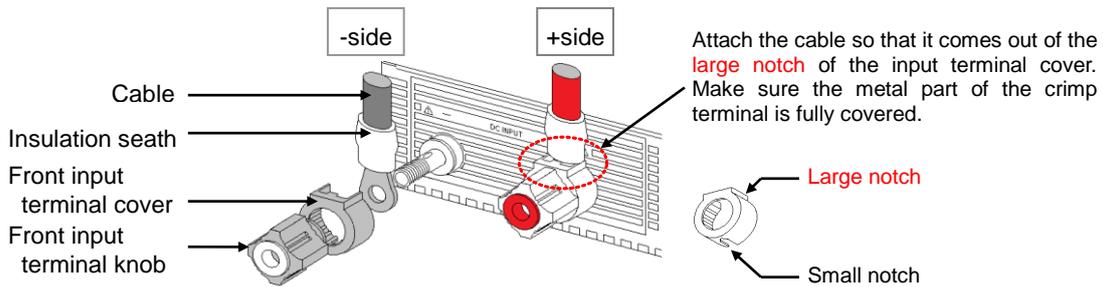


Fig. 4-2 Attaching a Cable with a Crimp Terminal

Firmly tighten the input terminal knob to prevent the cable from coming loose.

<Using cables without crimp terminals>

Strip the sheath off the cable and fully insert the wires into the hole on the front input terminal, as shown in the Fig. 4-3.

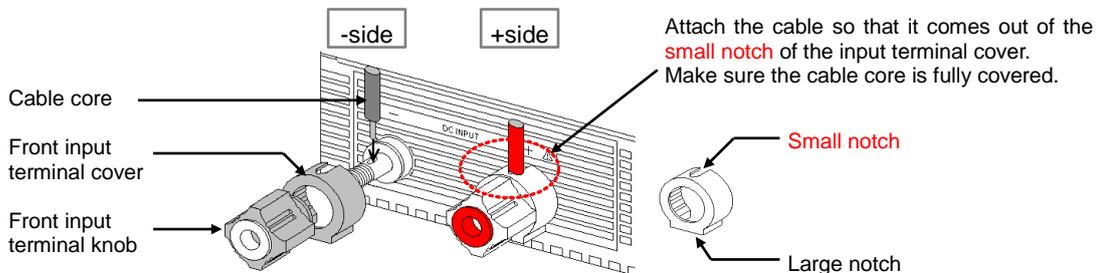


Fig. 4-3 Attaching a Cable without a Crimp Terminal

- When using cables without crimp terminals, operate the unit at a current of no more than 5A.
- Fasten the front input terminal knob as tight as possible.
- Always leave the front input terminal covers attached to the front terminals, even when the front input terminals are not being used. When the terminals are not being used, attach the covers so that the smaller notch is on top.

4-3. Effect of Inductance on the Load Line

If the load line is too long, or if there is a large loop in the positive and negative cables, the inductance on the load line will increase. If you operate the unit when there is a large inductance, the inductance on the wires generates a ringing effect when you change the current. As a result, the voltage will fluctuate greatly, making the unit unstable. In addition, the phase delay of the current might cause the unit to oscillate.

To prevent these problems from occurring, we recommend making the load line short and twisting it. You can reduce the ringing effect of the current by setting "Load Response" to "Slow".

When you use the switching function or sequence function, "Load Response" is fixed to "Fast". When you use these functions, you cannot set "Load Response" to "Slow" to reduce the current ringing effect. In this case, make the load line as short as possible.

* For details about how to set "Load Response", see "Load Response Setting" in "5-3-12-3. System Setup".

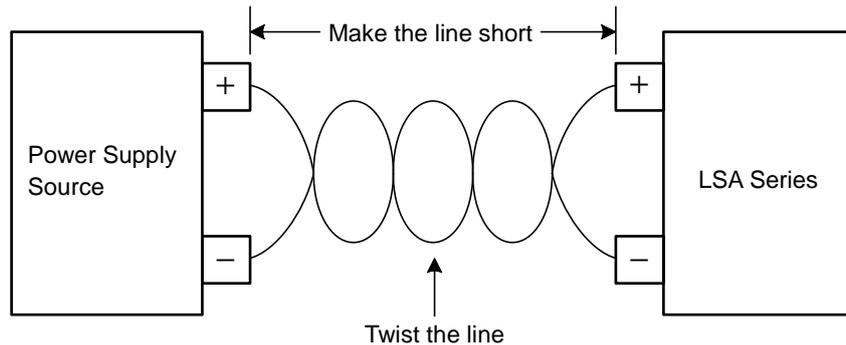


Fig. 4-4 Twisting the Wires of the Load Line

The unit might oscillate if the load line that connects the power supply source and the unit is long, or if a device with a large internal inductance, such as a motor, is connected. In this case, set "Load Response" to "Slow". If necessary, connect a capacitor parallel to the load terminal of the unit to cancel out the inductance component. When selecting the capacitor to be connected, make sure to carefully consider factors such as the withstand voltage and ripple current.

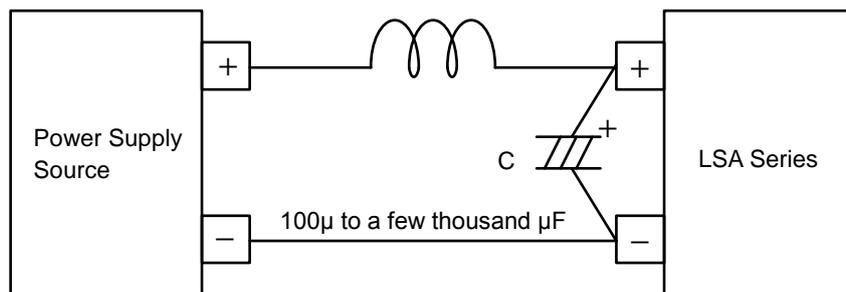


Fig. 4-5 Using a Capacitor to Cancel the Inductance Component

4-4. Cleaning the Front Grill

Each product in the LSA series cools the internal parts by taking in air from the front grill and the front of the housing. When the product is used continuously, dust and dirt will accumulate on the front grill and the front of the housing. Make sure to clean the front grill and the front of the housing on a regular basis, using a vacuum to suck up all the dust.

The LSA-1000 comes with a detachable front grill. For details about removing the front grill and vacuuming it on a regular basis, see the following section: "[4-4-1. Removing the Front Grill](#)".

The front grills of the LSA-165, LSA-165V1 and LSA-330 are not detachable.

4-4-1. Removing the Front Grill

1. Remove the screws from the front grill.
2. Slide the front grill up.

The front grill is divided into four pieces. Repeat the same procedure for each piece.

3. There is a filter inside each piece of the front grill. Use a vacuum to suck up the dust and dirt.

When you reinsert each piece of the front grill, position the screw hole over the notch of the filter and insert the screw.

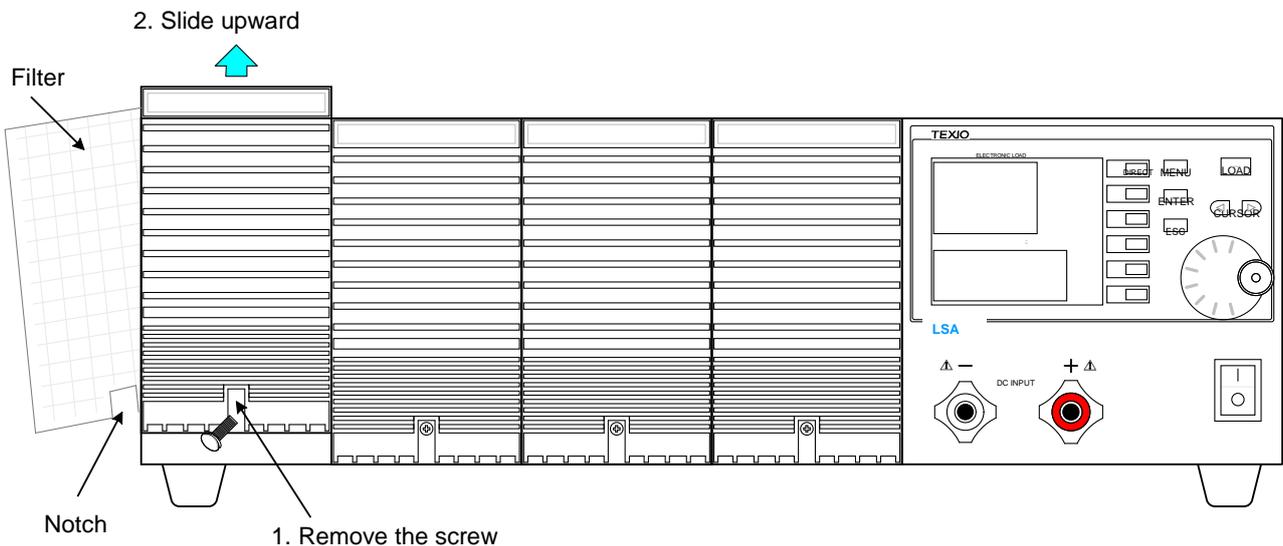


Fig. 4-6 Removing the Front Grill



The filter inside each piece of the front grill can be washed with water. After you finishing washing the filters, allow them to dry completely. Failure to do so can result in electric shock or unit malfunction.

4-5. Alarms

The following table describes the alarms that might be issued while the unit is running.

When an alarm is issued, turn off the power and fix the problem that caused the alarm to be issued. Do not turn on the power until you have fixed the problem.

If the alarm is issued again after you fix the problem and turn the power back on, please contact our company's service center.

Table 4-2 Alarms

Alarm Message	Cause
Over Voltage Alarm	Issued when the input voltage is approximately 160V or higher. Switches the unit to LOAD OFF mode.
Over Current Alarm	Issued when the input current exceeds the maximum rated current of the unit. Switches the unit to LOAD OFF mode.
Over Heat Alarm	Issued when internal temperature rises (when the temperature of the radiator rises to approximately 110°C) and causes the unit to overheat. Switches the unit to LOAD OFF mode.
Reverse-connection Alarm	Issued when voltage is applied while the positive and negative terminals are inverted. Switches the unit to LOAD OFF mode (if the unit is in LOAD ON mode).
External Alarm	Issued when an alarm is sent from an external unit.
EEPROM Error	Issued when an error occurs while writing the settings values to the internal ROM.
DSP Error	Issued when a communication error occurs in the internal DSP.
IF Error	Issued when a communication error occurs on the external interface.
Front Over Current Alarm	Issued when the current applied to the front input terminal exceeds 66A. Switches the unit to LOAD OFF mode. (This alarm is not issued by LSA-165 , LSA-165V1 and LSA-330.)

5. Basic Operations

This chapter describes the basic operations common to the products of the LSA series.

5-1. Power On

Before you use the unit, properly connect the power cable supplied with the unit and turn on the power switch located on the front panel.

When you turn on the power switch, the start window (left below) is displayed. Next, the main window appears, indicating that the unit is ready for operation.

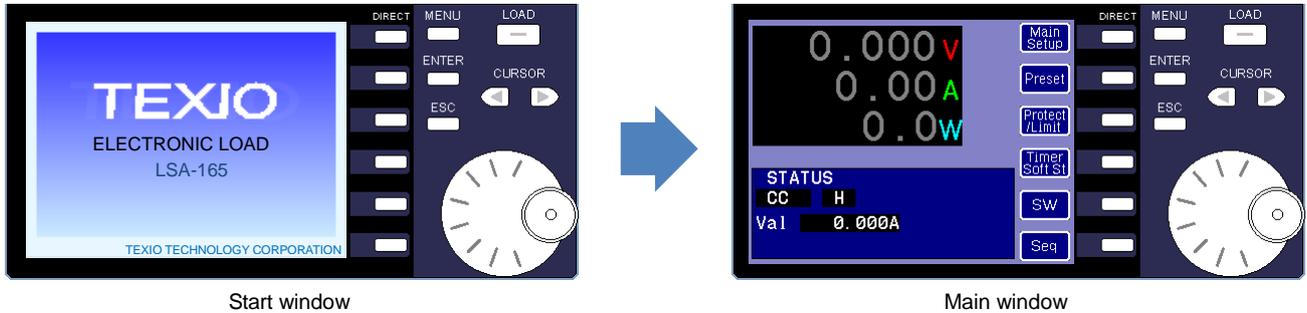


Fig. 5-1

5-2. Basic Operations on the Operation Panel

The functions displayed in the main window can be selected by pressing the DIRECT keys. The corresponding function icon (direct operation icon) is displayed to the left of each DIRECT key.

In addition to the functions displayed in the main window, you can specify other settings in the menu window. To display this window, press the MENU key. The settings icons (menu icons) are displayed in the menu window.

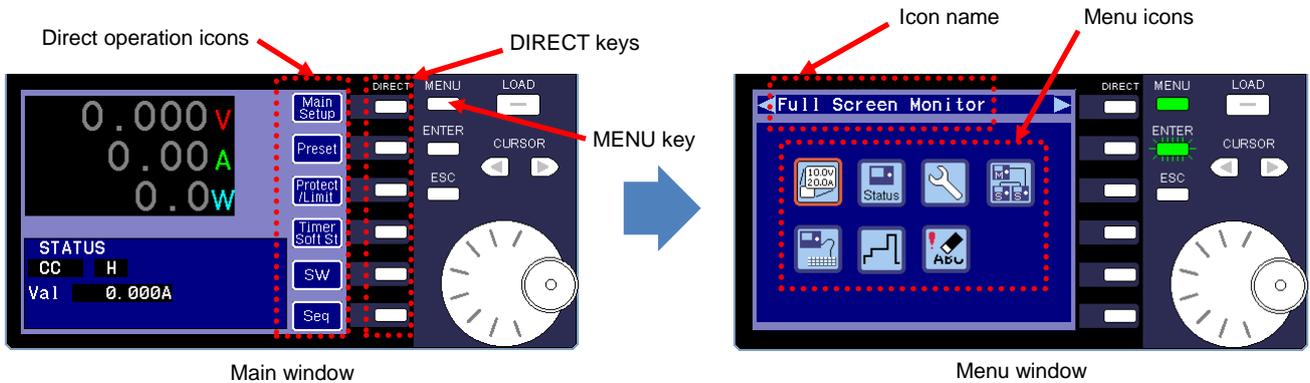


Fig. 5-2

5-2-1. Using the DIRECT Keys to Specify the Function Settings

In the main window, you can use the DIRECT keys displayed to the right of each direct operation icon to specify the settings of the following functions.

Direct Operation Icon	Selected Function	Direct Operation Icon	Selected Function
 Main Setup	Main Setup Function Specifies the operation mode, current range, and set values for the unit. For details, see "5-3-1. Main Setup Function".	 Timer Soft Start	LOAD ON/OFF Timer Setup Function Specifies the LOAD ON/OFF timer. For details, see "5-3-4. Load Timer Function". Soft Start Setup Function Specifies the soft start voltage and time. For details, see "5-3-5. Soft Start Function".
 Preset	Preset Function Allows you to use the preset function. For details, see "5-3-2. Preset Function".	 Switching	Switching Function Allows you to use the switching function. For details, see "5-3-6. Switching Function".
 Protect/Limit	Protect/Limit Value Setup Function Specifies the protect values and limit values. For details, see "5-3-3. Protective Functions".	 Sequence	Sequence Function Allows you to use the sequence function. For details, see "5-4-4. Executing Sequences".

5-2-2. Using the Menu Icons to Specify the Function Settings

In the menu window, you can specify or confirm settings of the following functions by selecting the corresponding menu icon.

Menu Icon	Selected Function	Menu Icon	Selected Function
 Full Screen Monitor	Full Screen Monitor Displays the values in full screen mode. In this mode, only the ESC key and the LOAD key (LOAD OFF) can be used. For details, see "5-3-12-1. Full Screen Monitor".	 External Setup	External Control Setup Specifies the external control. For details, see 5-3-11-3. Specifying External Control 5-3-11-4. Set Value Control Via an External Voltage or External Resistance 5-3-11-5. LOAD ON/OFF Control Via an External Contact Signal 5-3-11-6. C Range Control Via an External Contact Signal
 Status	Status Display Confirms the current setting status and operation status of the unit. For details, see "5-3-12-2. Status Display".		
 System Setup	System Setup Specifies the display window, buzzer, display units in CR mode, remote sensing, and current response. For details, see "5-3-12-3. System Setup".	 Sequence Configuration	Sequence Configuration Specifies the sequence programs. For details, see "5-4. Sequence Function".
 Master/Slave	Master/Slave Setup Specifies the settings for master/slave parallel operation. For details, see "5-3-10. Master/Slave Operation Function".	 Initialize	Data Initialization Initializes the setup data and restores the default settings. For details about how to initialize data, see "5-3-12-4. Data Initialization".

5-2-3. Using the Operation Panel

In the main window, you can use the DIRECT keys to select functions and specify their settings. In the menu window, you can use the menu icons to select parameters.

After you select a setup item or parameter, enter the value you wish to specify. You can also specify a value from the drop-down list.

5-2-3-1. Using the DIRECT Keys to Specify the Function Settings

This example describes how to specify the settings of the main setup function.

(Procedure)

- 1 Press the DIRECT key next to the "Main Setup" icon to display the MAIN SETUP window.



Main window

1



MAIN SETUP window

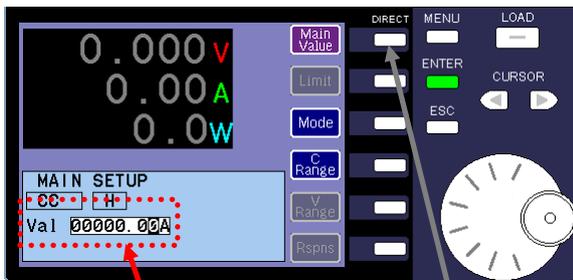
The MAIN SETUP window is displayed.

The icons displayed in this window are different from the icons in the main window.

This window displays the DIRECT icons for the main setup function.

You can only use the DIRECT keys of the DIRECT icons that are highlighted in blue. You cannot use the DIRECT keys of the icons that are highlighted in gray.

Input numbers



Value ready to be entered

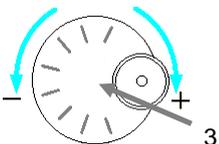
2

- 2 Press the "Main Value" DIRECT key in the MAIN SETUP window.

- The DIRECT operation icon changes from blue to purple. This indicates that the value (Val) for the corresponding DIRECT key can now be entered.

Val 00000.00A

Changeable digit



3

- 3 Turn the rotary encoder to change the number. The digit that can be changed is highlighted in black. Turn the rotary encoder clockwise to raise the number, and counter-clockwise to lower it.

Val 00000.00A



4

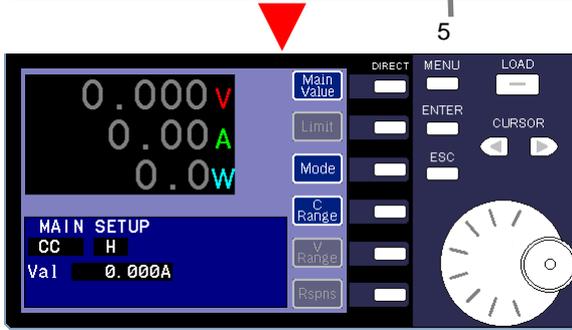
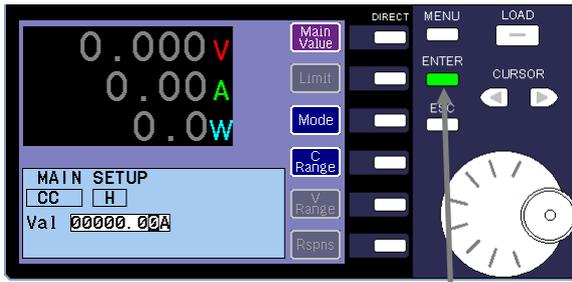
- 4 Press one of the CURSOR keys to select a different digit. Press the left key to move to the left, and the right key to move to the right.

Val 00000.00A

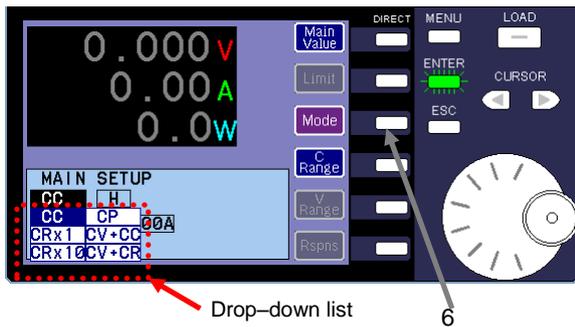


(Procedure)

- 5 Press the ENTER key (which is lit green) to confirm and enter the value for "Val".



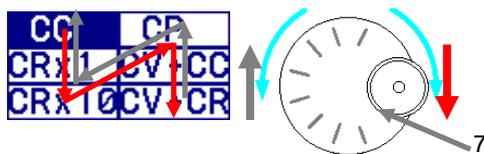
Selecting a value from the drop-down list



- 6 Press the "Mode" DIRECT key in the MAIN SETUP window.

The "Mode" icon changes from blue to purple and a drop-down list is displayed.

At this time, the ENTER key begins to flash green.



- 7 Use the rotary encoder to select an operation mode for the unit from the drop-down list.

Turn the rotary encoder clockwise to move the cursor in the direction of the red arrow, and counter-clockwise to move the cursor in the direction of the gray arrow.



8



Main window

9

(Procedure)

- After you select an operation mode (CP mode is selected in the figure on the left), press the green flashing ENTER key. The value selected in operation 7 is set and entered. The ENTER key stops flashing and turns off.

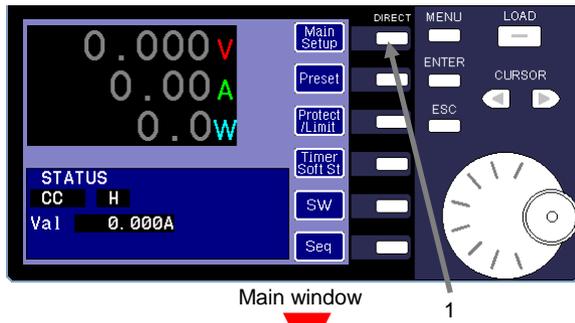
If you want to cancel the selected value and exit, press the ESC key.

To successfully cancel the value, you must press the ESC key before you press the ENTER key.

- Press the ESC key to end the main setup function. The main window is displayed.

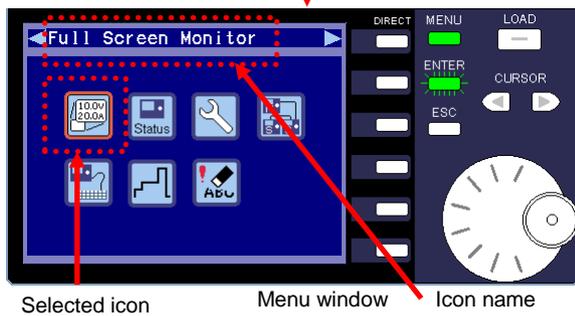
5-2-3-2. Selecting a Menu Icon

This section describes how to select a menu icon.



Main window

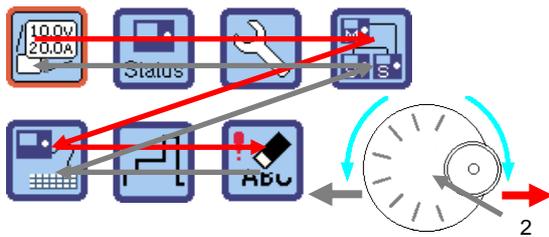
1



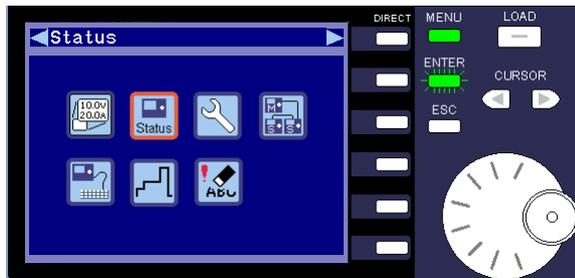
Selected icon

Menu window

Icon name



2



(Procedure)

- 1 Press the MENU key to display the menu window.

Note that the MENU key can be used in all windows.

The menu window is displayed and the ENTER key begins to flash green.

The selected menu icon is framed in orange and the icon name is displayed at the top of the window.

- 2 Use the rotary encoder to scroll through the icons.

Turn the rotary encoder clockwise to move the cursor in the direction of the red arrow, and counter-clockwise to move the cursor in the direction of the gray arrow.

The figure in the left is for when the "Status" icon is selected.

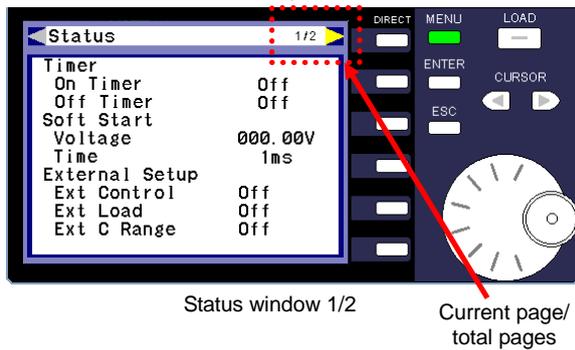
5-2-3-3. Changing the Pages in the Menu Window

If the menu window is composed of multiple pages, you can use the CURSOR keys to change the pages. The example provided in this section explains how to select the "Status" icon and display the Status window.

(Procedure)

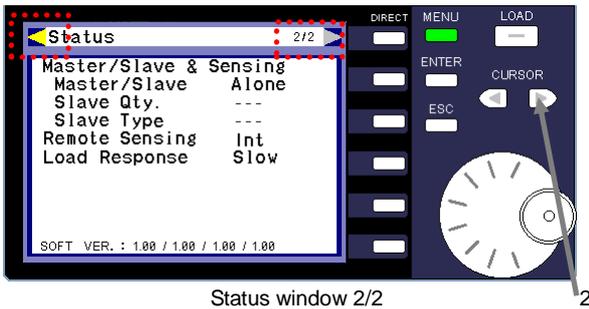
- 1 Select the "Status" icon in the menu window.

Press the green flashing ENTER key to display the Status window.



The Status window has 2 pages.

If the window is composed of multiple pages, "current page/total pages" is displayed in the upper right corner of the window. The arrow mark changes to yellow.



- 2 Press the right CURSOR key to go to next page.

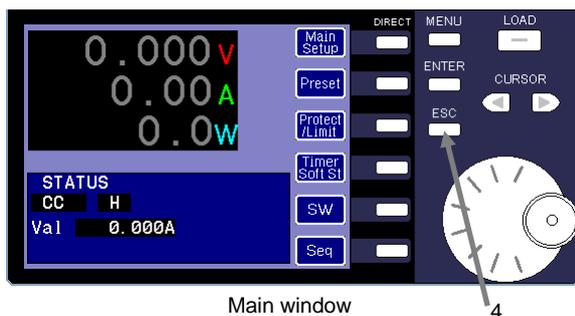
The next page is displayed on the Status window.

Press the left CURSOR key to go back to previous page.



- 3 Press the ESC key to close the Status window.

The menu window is displayed.



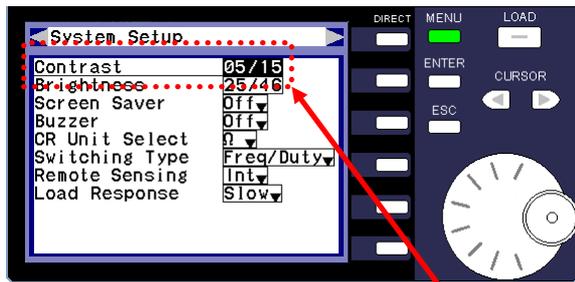
- 4 Press the ESC key again to close the menu window and display the main window.

5-2-3-4. Changing Parameters

The example in this section uses the System Setup window to describe how to select a menu icon and specify the corresponding settings.

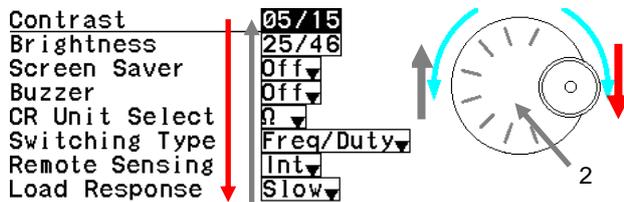


Menu window

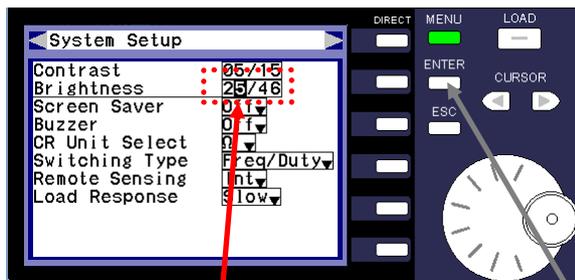
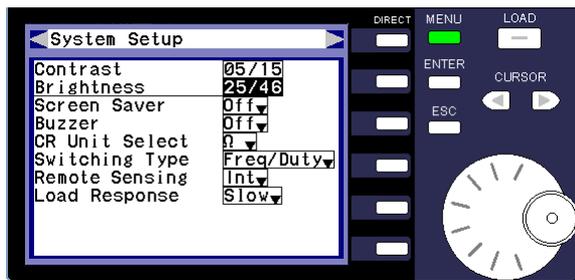


System Setup window Parameter selected to be changed

Selecting a parameter



Input numbers



New value ready to be entered

(Procedure)

- 1 Select the "System Setup" icon in the menu window.

Press the green flashing ENTER key to display the System Setup window.

The System Setup window allows you to change the parameters.

Framed numbers or words are displayed to the right of the parameters that can be changed.

The name of the selected parameter is underlined, and the numbers or words are highlighted in black.

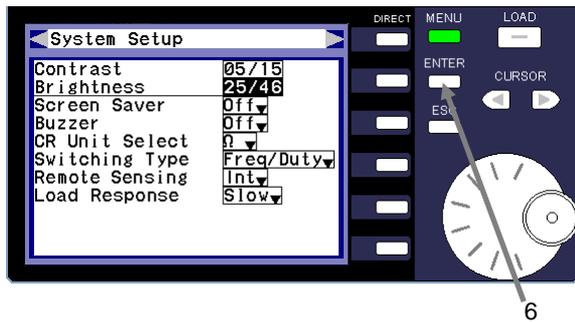
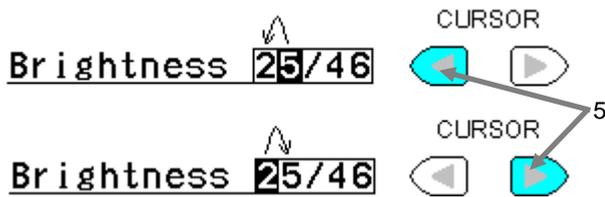
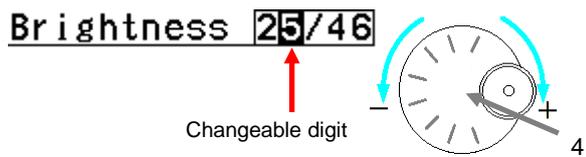
- 2 Use the rotary encoder to select the parameter you want to change.

Turn the rotary encoder clockwise to move the cursor in the direction of the red arrow, and counter-clockwise to move the cursor in the direction of the grey arrow.

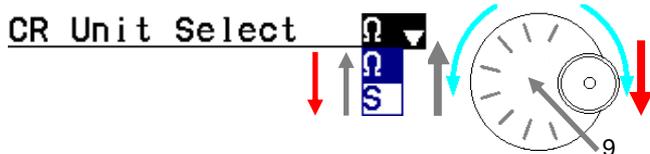
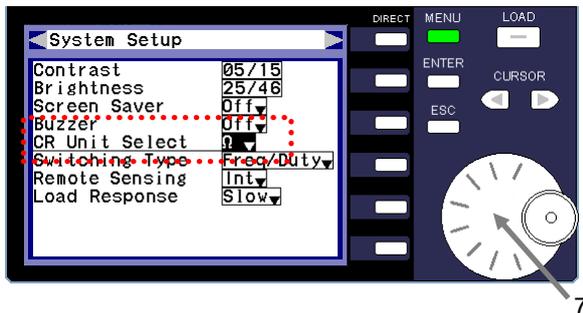
In the figure on the left, "Brightness" is selected as the parameter whose value will be changed.

- 3 Press the ENTER key.

You can now change the "Brightness" value.



Selecting a value from the drop-down list



(Procedure)

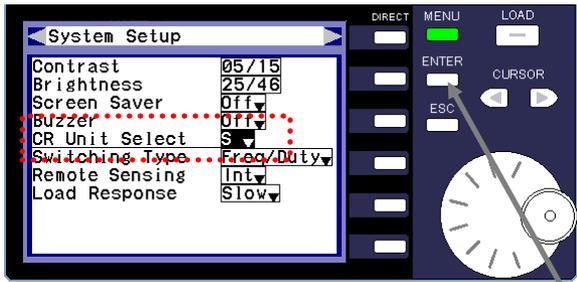
- 4 Turn the rotary encoder to change the number.
The digit that can be changed is highlighted in black.
Turn the rotary encoder clockwise to raise the number, and counter-clockwise to lower it.
- 5 Press one of the CURSOR keys to select a different digit.
Press the left key to move to the left, and the right key to move to the right.
- 6 Press the ENTER key.
The "Brightness" value is set and entered.

- 7 The following procedure describes how to specify the settings shown in the drop-list for CR Unit Select.

Use the rotary encoder to select CR Unit Select as the parameter whose value will be changed.
- 8 Press the ENTER key. The drop-down list for the CR Unit Select parameter is displayed.
At this time, the ENTER key begins to flash green.

- 9 Use the rotary encoder to select a parameter value (in this case unit).

Turn the rotary encoder clockwise to move the cursor in the direction of the red arrow, and counter-clockwise to move the cursor in the direction of the gray arrow.

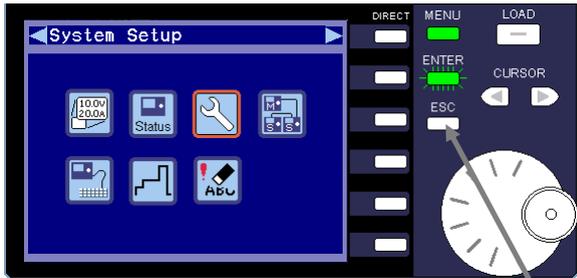


10

(Procedure)

- 10 Press the ENTER key to set the parameter (in this case unit).

"S (Siemens)" is selected for CR Unit Select in the figure on the left.



Menu window

11

- 11 Press the ESC key to close the System Setup window. The menu window is displayed.



Main window

12

- 12 Press the ESC key again to close the menu window and display the main window.

5-3. Using Functions

This section describes the functions in the main window that can be specified by using the DIRECT keys.

5-3-1. Main Setup Function

Each model in the LSA series has four operation modes. In CC mode, you can also select a current-based restriction (+CC) or a resistance-based restriction (+CR).

The four operation modes are as follows:

- CC mode (C onstant C urrent mode)
- CR mode (C onstant R esistance mode)
- CP mode (C onstant P ower mode)
- CV mode (C onstant V oltage mode)

5-3-1-1. Specifying the Constant Current (CC) Mode Settings

This section explains how to specify the settings for CC mode. The procedure consists of three main steps: Specifying the operation mode → Specifying the current range → Specifying the current.

(Procedure)



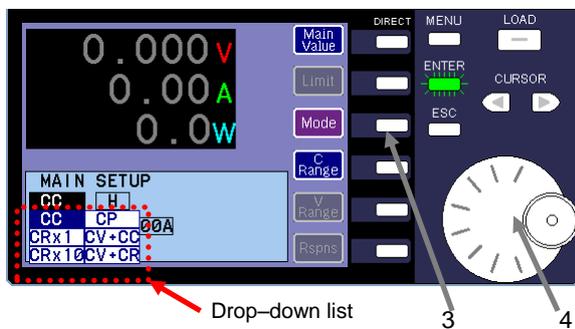
- 1 If the unit is in LOAD ON mode, press the LOAD key to switch the unit to LOAD OFF mode.
The LOAD key light turns off.

Connect the power source to the unit.

Make sure the unit is in LOAD OFF mode when you connect the power source.

- 2 Press the "Main Setup" DIRECT key in the main window to display the MAIN SETUP window.

Specifying the operation mode



- 3 Press the "Mode" DIRECT key in the MAIN SETUP window.
At this time, the ENTER key begins to flash green.

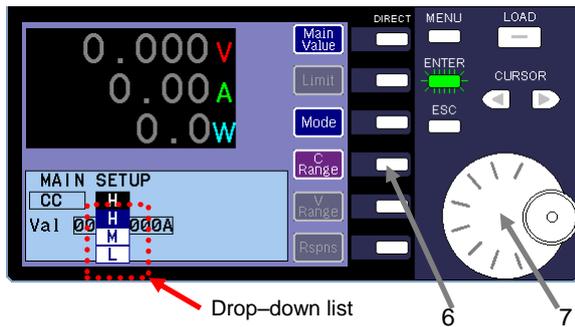
The items that can be selected are displayed in the drop-down list.

- 4 Turn the rotary encoder and select the operation mode you want to use.
"CC" mode (Constant Current mode) is selected in the figure on the left.

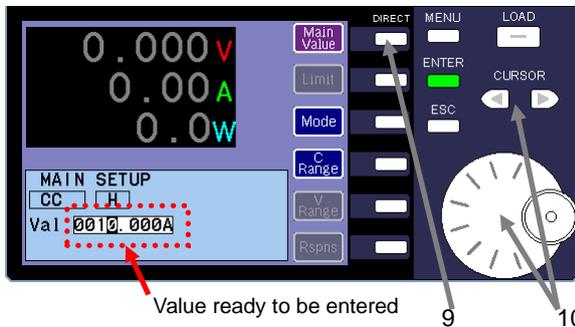


- 5 Press the ENTER key to set the operation mode.
The ENTER key light turns off.

Specifying the current range



Specifying the current



(Procedure)

- 6 Press the "C Range" DIRECT key. The ENTER key begins to flash green.
The current ranges that can be selected are displayed in the drop-down list in the window.

- 7 Turn the rotary encoder and select the current range you want to apply.
"H" is selected in the figure on the left.

The specifiable current ranges for each model are as follows:

	LSA-165 LSA-165V1	LSA-330	LSA-1000
H	0A to 33A	0A to 66A	0A to 200A
M	0A to 3.3A	0A to 6.6A	0A to 20A
L	0A to 330mA	0A to 660mA	0A to 2000mA

- 8 Press the ENTER key to set the current range.
The ENTER key light turns off.

- 9 Specify the current value. Press the "Main Value" DIRECT key.
The ENTER key flashes green. You can now enter the "Val" value.

- 10 Use the rotary encoder and CURSOR keys to specify the value.
The set value of the current is "10A" in the figure on the left.

- 11 Press the ENTER key to finish specifying the current.
The ENTER key light turns off.

5-3-1-2. Specifying the Constant Resistance Mode Settings (CRx1 / CRx10)

In CR mode, setting values are specified in step value, and the corresponding resistance value or conductance value for each step value is displayed.

Conductance is the inverse of resistance. It is calculated by using the following formula:

$$\text{Conductance} = 1/\text{Resistance}$$

Conductance is measured in Siemens (S), and resistance is measured in Ohms (Ω).

You can select to display the conductance value or resistance value as the corresponding value for the step value.

The relationship between the step value and resistance is as follows: Resistance = 1/(setup resolution (S) x step value)

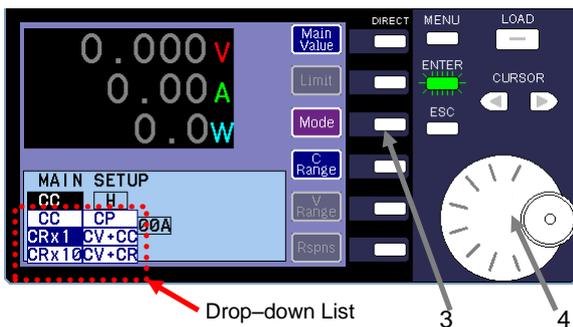
Step value: 1 to 61,500

There are two different CR modes: "CRx1" at 100% resistance, and "CRx10" at 1000% resistance.

The setup procedure consists of three main steps: Specifying the operation mode → Specifying the resistance range → Specifying the step value



Specifying the operation mode setup



(Procedure)

- 1 If the unit is in LOAD ON mode, press the LOAD key to switch the unit to LOAD OFF mode. The LOAD key light turns off.

Connect the power source to the unit.

Make sure the unit is in LOAD OFF mode when you connect the power source.

- 2 Press the "Main Setup" DIRECT key in the main window to display the MAIN SETUP window.

- 3 Press the "Mode" DIRECT key in the MAIN SETUP window. At this time, the ENTER key begins to flash green.

The items that can be selected are displayed in the drop-down list.

- 4 Turn the rotary encoder to select the operation mode you want to use. "CRx1" (CR mode at 100% resistance) is selected in the figure on the left.

"CRx1" and "CRx10"

When "CRx10" is selected, the specified resolution (conductance) is 1/10.

As a result, the resistance is shifted to a value that is 10 times greater than the specified resistance range. The number of steps also becomes 10 times, allowing for a more specific value to be specified. However, the rated current is also 1/10 when "CRx10" is selected.

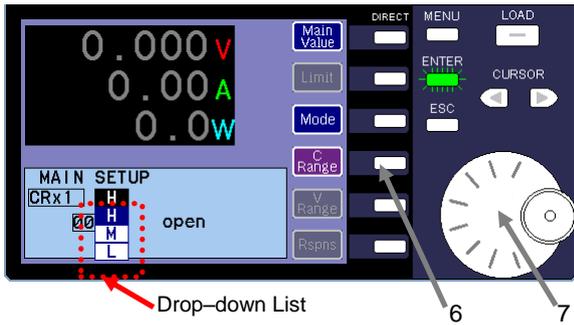
Ex) Number of steps from 1.81k Ω to 181 Ω in the H range (LSA-165)

CRx1: 1 to 10 steps

CRx10: 10 to 100 steps

- 5 Press the ENTER key to set the operation mode. The ENTER key light turns off.

Specifying the resistance range



(Procedure)

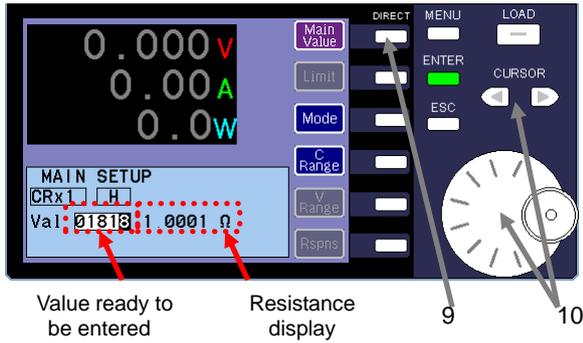
- 6 Press the "C Range" DIRECT key. The ENTER key begins to flash green.
The resistance ranges that can be selected are displayed in the drop-down list.
- 7 Turn the rotary encoder to select the resistance range you want to apply.
"H" is selected in the figure on the left.
- 8 Press the ENTER key to set the resistance range.
The ENTER key light turns off.

The set resistance ranges and set resolutions are as follows: The upper row indicates the set resistance range, and the lower row indicates the set resolution.

Table 5-1

		LSA-165/LSA-165V1	LSA-330	LSA-1000
H	CRx1	OPEN, 1.81kΩ to 30.3mΩ 0.55mS	OPEN, 909Ω to 15.1mΩ 1.1mS	OPEN, 303mΩ to 5.05mΩ 3.3mS
	CRx10	OPEN, 18.1kΩ to 303mΩ 55μS	OPEN, 9.09kΩ to 151mΩ 0.11mS	OPEN, 3.03kΩ to 50.5mΩ 0.33mS
M	CRx1	OPEN, 18.1kΩ to 303mΩ 55μS	OPEN, 9.09kΩ to 151mΩ 0.11mS	OPEN, 3.03kΩ to 50.5mΩ 0.33mS
	CRx10	OPEN, 181kΩ to 3.03Ω 5.5μS	OPEN, 90.9kΩ to 1.51Ω 11μS	OPEN, 30.3kΩ to 505mΩ 33μS
L	CRx1	OPEN, 181kΩ to 3.03Ω 5.5μS	OPEN, 90.9kΩ to 1.51Ω 11μS	OPEN, 30.3kΩ to 505mΩ 33μS
	CRx10	OPEN, 1810kΩ to 30.3Ω 0.55μS	OPEN, 909kΩ to 15.1Ω 1.1μS	OPEN, 303kΩ to 5.05Ω 3.3μS

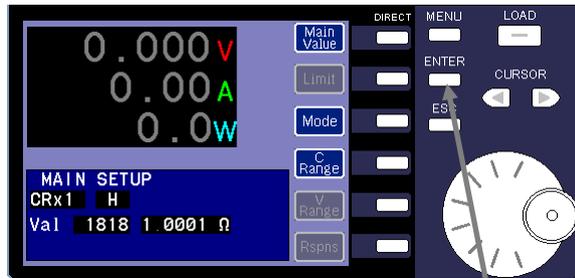
Specifying the step value



The relationship between the step value, conductance, and resistance is as follows:

$$\text{Conductance (S)} = \text{Step Value} \times \text{Setup Resolution (S)}$$

$$\text{Resistance } (\Omega) = 1/\text{Conductance (S)}$$



(Procedure)

- 9 Press the "Main Value" DIRECT key.
The ENTER key begins to flash green. You can now enter the "Val" value.
- 10 Use the rotary encoder and CURSOR keys to specify the step value.
The step value is "01818" and the resistance is "1.0001Ω" in the figure on the left.

To specify the CR mode setting values, you must specify the step value.

Specify the step value by referring to the corresponding conductance value or resistance value.

To switch between the resistance (Ω) display and conductance (S) display, press the MENU key, , CR Unit Select, and then the ENTER key

- 11 Press the ENTER key to finish specifying the resistance value.
The ENTER key light turns off.

5-3-1-3. Specifying the Constant Power (CP) Mode Settings

This section explains how to specify the Constant Power mode settings. The procedure consists of three main steps:
 Specifying the operation mode → Specifying the power range → Specifying the power.

(Procedure)

- 1 If the unit is in LOAD ON mode, press the LOAD key to switch the unit to LOAD OFF mode.
The LOAD key light turns off.

Connect the power source to the unit.

Make sure the unit is in LOAD OFF mode when you connect the power source.

- 2 Press the "Main Setup" DIRECT key in the main window to display the MAIN SETUP window.



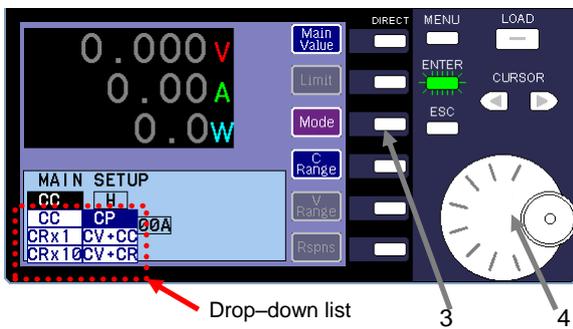
Specifying the operation mode

- 3 Press the "Mode" DIRECT key in the MAIN SETUP window. At this time, the ENTER key begins to flash green.

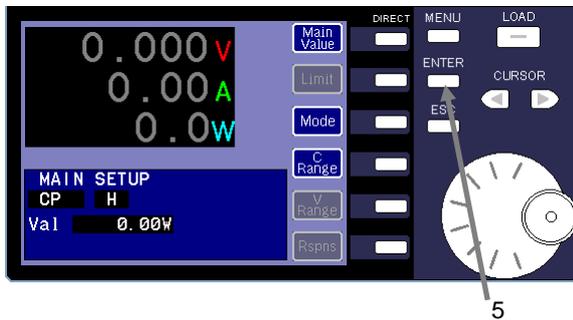
The items that can be selected are displayed in the drop-down list.

- 4 Turn the rotary encoder to select the operation mode you want to use.

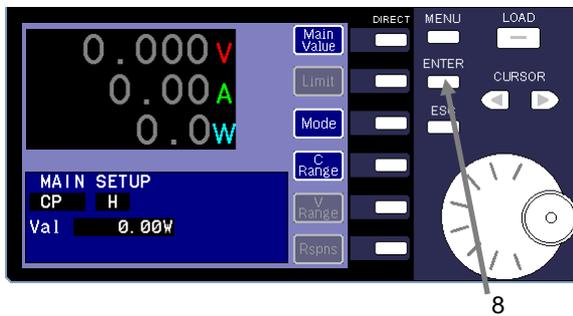
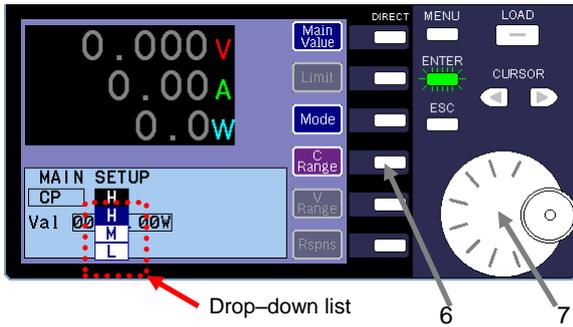
"CP" mode (Constant Power mode) is selected in the image on the left.



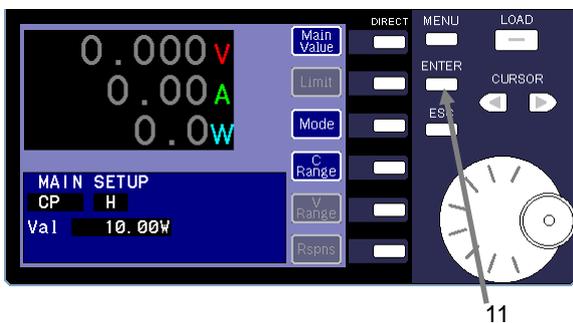
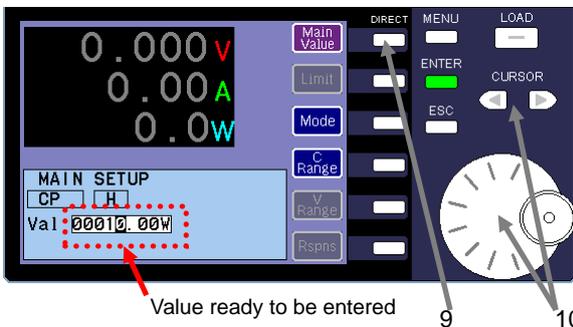
- 5 Press the ENTER key to set the operation mode. The ENTER key light turns off.



Specifying the power range



Specifying the power value



(Procedure)

- 6 Press the "C Range" DIRECT key. The ENTER key begins to flash green.
The resistance ranges that can be selected are displayed in the drop-down list.
- 7 Turn the rotary encoder to select the power range you want to apply.
"H" is selected in the figure on the left.
The specifiable power ranges for each model are as follows:

	LSA-165 LSA-165V1	LSA-330	LSA-1000
H	0W to 165W	0W to 330W	0W to 1000W
M	0W to 16.5W	0W to 33W	0W to 100W
L	0W to 1.65W	0W to 3.3W	0W to 10W
- 8 Press the ENTER key to set the power range.
The ENTER key light turns off.

- 9 Press the "Main Value" DIRECT key.
The ENTER key begins to flash green. You can now enter the "Val" value.
- 10 Use the rotary encoder and CURSOR keys to specify the value.
The set power value is "10W" in the figure on the left.
- 11 Press the ENTER key to finish the power setup.
The ENTER key light turns off.

5-3-1-4. Specifying the Constant Voltage Mode Settings (CV+CC/CV+CR)

Each model in the LSA series has two CV modes: CV+CC mode and CV+CR mode.

CV+CC mode: An upper limit for the current is set. This value is used to limit the input current.

CV+CR mode: A lower resistance (= set voltage / input current) limit is set. This value is used to prevent the input current from falling below the specified limit.

The procedure consists of the following steps: Specifying the operation mode → Specifying the voltage range → Specifying the response speed → Specifying the voltage → Specifying the limit range → Specifying the limit



(Procedure)

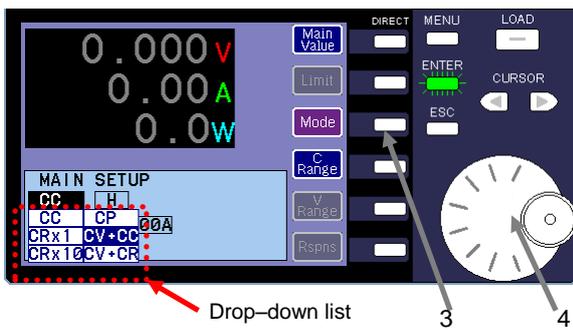
- 1 If the unit is in LOAD ON mode, press the LOAD key to switch the unit to LOAD OFF mode. The LOAD key light turns off.

Connect the power source to the unit.

Make sure the unit is in LOAD OFF mode when you connect the power source.

- 2 Press the "Main Setup" DIRECT key in the main window to display the MAIN SETUP window.

Specifying the operation mode



- 3 Press the "Mode" DIRECT key in the MAIN SETUP window. At this time, the ENTER key begins to flash green.

The items that can be selected are displayed in the drop-down list.

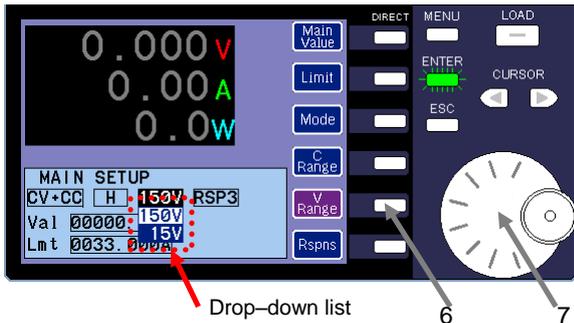
- 4 Turn the rotary encoder to select the operation mode you want to use.

In the image on the left, "CV+CC" mode is selected because the upper limit for the current is used in CV mode.

- 5 Press the ENTER key to set the operation mode. The ENTER key light turns off.



Specifying the voltage range



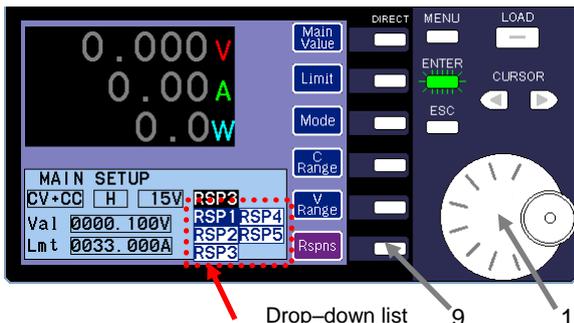
Drop-down list

6 7



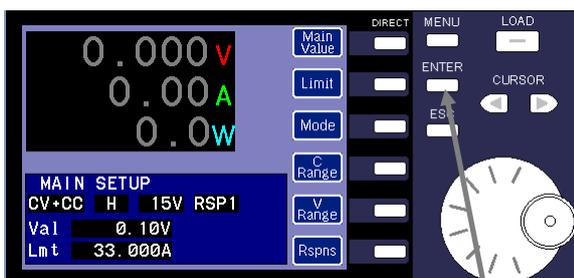
8

Specifying the response speed



Drop-down list

9 10



11

(Procedure)

6 Press the "V Range" DIRECT key. The ENTER key begins to flash green.
The voltage ranges that can be selected are displayed in the drop-down list

7 Turn the rotary encoder to select the voltage range you want to apply. "15V" is selected in the figure on the left.
The specifiable voltage ranges are as follows:

150V range	0.10V to 150.00V
15V range	0.100V to 15.000V

8 Press the ENTER key to set the voltage range.
The ENTER key light turns off.

9 Press the "Rspns" DIRECT key. The ENTER key begins to flash green.
The "Response Speed" ranges that can be selected are displayed in the drop-down list.

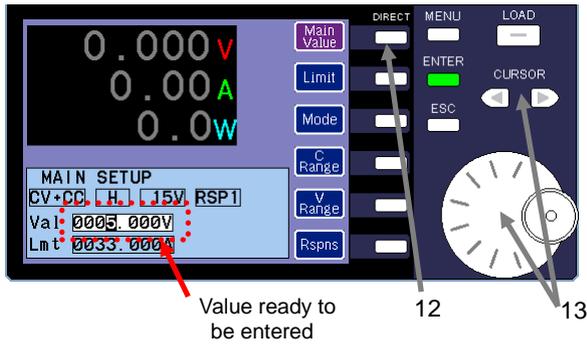
10 Turn the rotary encoder to select the response speed range you want to apply.
"RSP1" is selected in the figure on the left.

The relationship between each response speed range and the power supply source is described in the table below.
Select a response speed that fits the capacity of the power supply source.

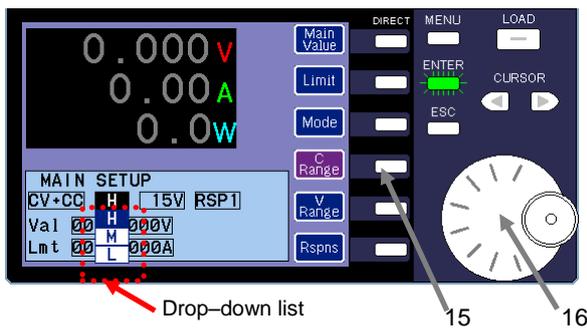
RSP1	Power source with a relatively large electric capacity (rated voltage that is at least 30% greater than that of the unit) and a rapid-response CV and CC.
RSP2	Power source with a relatively large electric capacity (rated voltage that is at least 30% greater than that of the unit) but a slow-response CV and CC.
RSP3	General power source.
RSP4	Power source with a relatively small electric capacity (rated voltage that is 30% or less than that of the unit) and a rapid-response CV and CC.
RSP5	Power source with a relatively small electric capacity (rated voltage that is 30% or less than that of the unit) but a slow-response CV and CC.

11 Press the ENTER key to set the response speed.
The ENTER key light turns off.

Specifying the voltage



Specifying the limit range

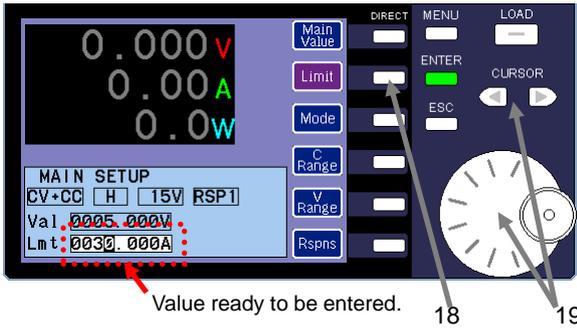


(Procedure)

- 12 Press the "Main Value" DIRECT key. The ENTER key begins to flash green.
You can now enter the "Val" value.
- 13 Use the rotary encoder and CURSOR keys to specify the value.
In the figure on the left, "5V" is specified as the voltage value.
- 14 Press the ENTER key to finish setting the voltage.
The ENTER key light turns off.
- 15 Press the "C Range" DIRECT key. The ENTER key begins to flash green.
The limit ranges that can be selected are displayed in the drop-down list.
- 16 Turn the rotary encoder to select the response speed range you want to apply.
"H" is selected in the figure on the left.

The specifiable limit range depends on the operation mode.
CV+CC: The specifiable limit ranges are the same as those for CC mode. For details about the specifiable current ranges, see ["5-3-1-1. Specifying the Constant Current \(CC\) Mode Settings"](#).
CV+CR: The specifiable limit ranges are the same as those for CR mode. For details about specifiable resistance ranges, see ["5-3-1-2. Specifying the Constant Resistance Mode Settings \(CRx1 / CRx10\)"](#).
Note that the specifiable ranges for CRx10 are not valid.
- 17 Press the ENTER key to finish setting the limit range.
The ENTER key light turns off.

Specifying the limit



Value ready to be entered.

18

19

18 Press the "Limit" DIRECT key.
The ENTER key begins to flash green. You can now enter the "Lmt" value.

19 Use the rotary encoder and CURSOR keys to specify the limit value.
In the figure on the left, "30A" is specified as the limit value.



20

20 Press the ENTER key to finish setting the current limit.
The ENTER key light turns off.



CV+CC mode
Current limit function is enabled



CV+CR mode
Resistance limit function is enabled

If the current/resistance limit function is enabled, the "Limit" icon is displayed.

5-3-1-5. LOAD ON/OFF Function

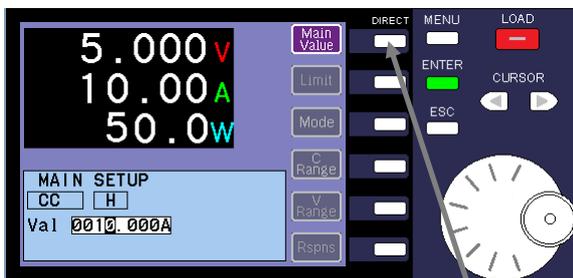
When in CC, CR, or CP mode, you cannot switch to LOAD ON or LOAD OFF mode while the "Mode" or "C Range" icon is selected. You can switch to LOAD ON or LOAD OFF while the "Main Value" icon is selected.

When in CV+CC or CR mode, you cannot switch to LOAD ON or LOAD OFF while the "Mode", "C Range", "V Range", or "Rspns" icon is selected. You can switch to LOAD ON or LOAD OFF while the "Main Value" or "Limit" icon is selected.

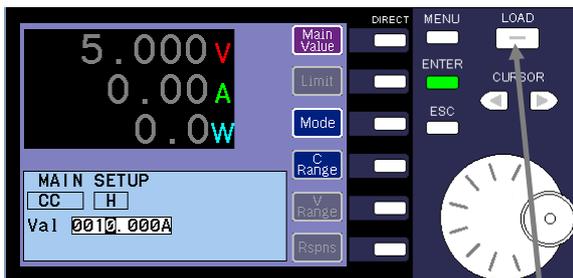
LOAD ON/OFF



1



2



3

(Procedure)

Turn on the output of the power supply source.

- 1 Press the LOAD key to switch the unit to LOAD ON mode. The LOAD key lights up in red.

You cannot specify the operation mode or current range while the unit is in LOAD ON mode.

The "Mode" and "C Range" icons turn gray.

- 2 Press the "Main Value" DIRECT key to specify the current while the unit is in LOAD ON mode.

The ENTER key begins to flash green. You can now enter the "Val" value.

- 3 Press the LOAD key to switch the unit to LOAD OFF mode. The unit switches to LOAD OFF mode and the LOAD key light turns off.

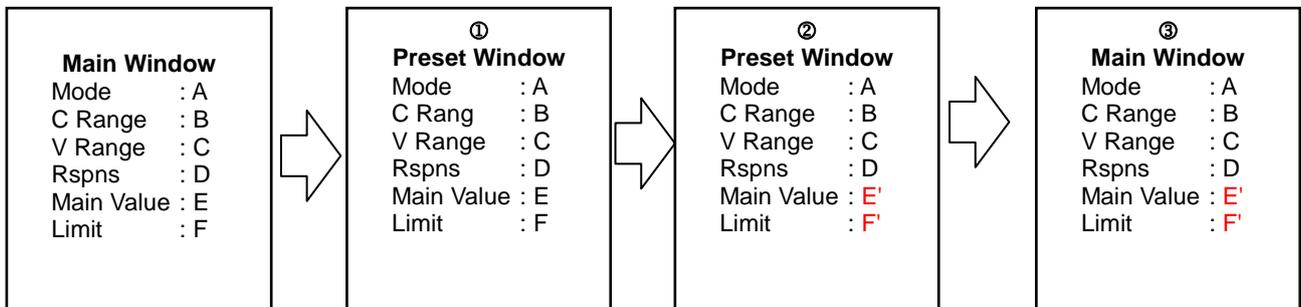
5-3-2. Preset Function

The preset function allows you to save specified values in the presets and recall them when needed.

You can save up to four items of preset data for each discharge mode and discharge range. These four items are labeled as "Preset 1", "Preset 2", "Preset 3", and "Preset 4". The values that are recalled from the presets are the values for the currently specified operation mode and range. Items of preset data can also be recalled when the unit is in LOAD ON mode. The following table describes the values that can be saved for each operation mode.

Operation Mode	Saved Data
CC	The specified values (current, resistance and power) for each current range.
CRx1	
CRx10	
CP	
CV+CC	The specified voltages and current limits (+CC) or resistance limits (+CR) for each voltage range and current range.
CV+CR	

The following flow chart describes how the values change between the main window and the preset window.



① When you switch from the main window to the preset window, the values displayed in the main window are specified as the values for the unit.

② Only the values for "Main Value" and "Limit Value" can be specified in the preset window.

The other values displayed in the flow chart above cannot be specified.

③ When you switch from the preset window to the main window, the values displayed in the preset window are specified as the values for the unit.

The values for "Main Value" and "Limit Value" are different from the original values displayed the main window.

Press the "Preset" DIRECT key in the main window to display the preset window.

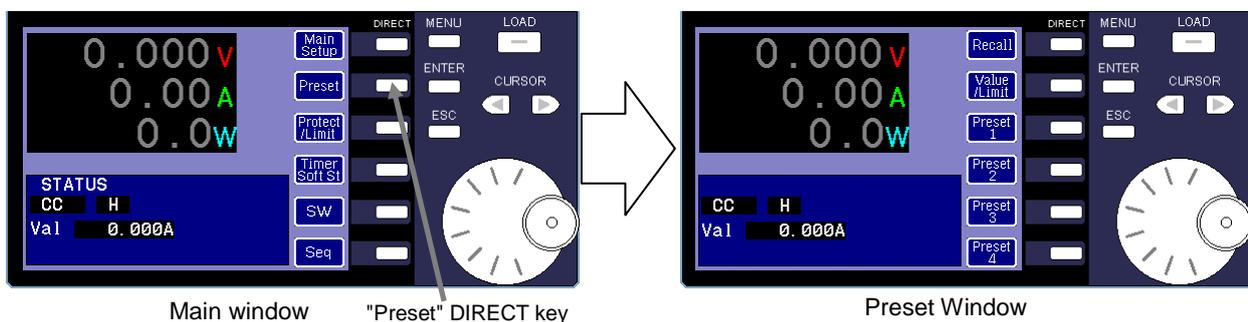
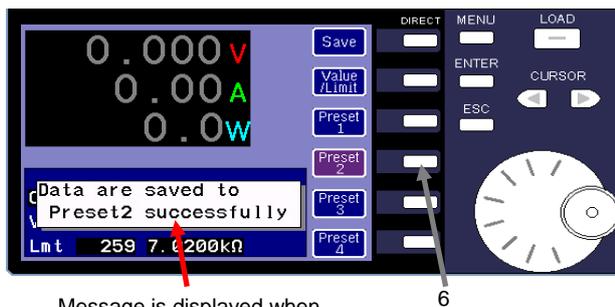
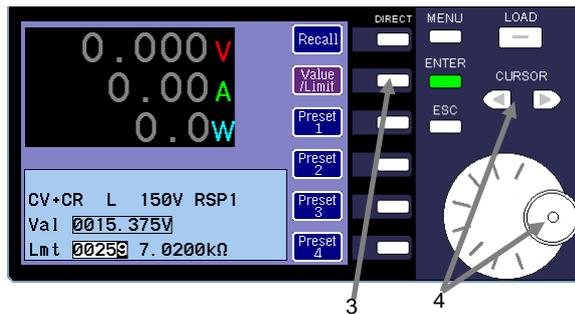
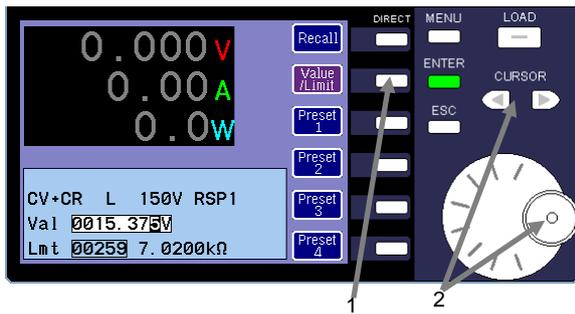


Fig. 5-3

5-3-2-1. Changing the Set Value and Saving the Preset Data



Message is displayed when data is finished saving.

(Procedure)

1 Press the "Value/Limit" DIRECT key in the preset window. The ENTER key begins to flash green. You can now enter the "Val" value.

2 Use the rotary encoder and CURSOR keys to change the setting value.

3 Press the "Value/Limit" DIRECT key. The ENTER key continues to flash green. You can now enter the "Lmt" value.

The "Lmt" value can only be entered while in CV+CC mode or CR mode. It cannot be entered while in other operation modes.

4 Use the rotary encoder and CURSOR keys to change the limit value.

5 Press the DIRECT 1 key (the top key) to display "Save".

Each time you press the DIRECT 1 key, the icon changes. The icons change in the following order: "Recall" → "Save" → "Check" → "Recall".

6 Press the DIRECT key of the preset number to which you want to save the data. "Preset 2" is selected in the figure on the left.

When the data is finished saving, a message is displayed. The saved preset data items are the value and limit that were specified in operations 1 through 4 above.

5-3-2-2. Recalling Preset Data

This section explains how to recall the data saved to the presets.



1



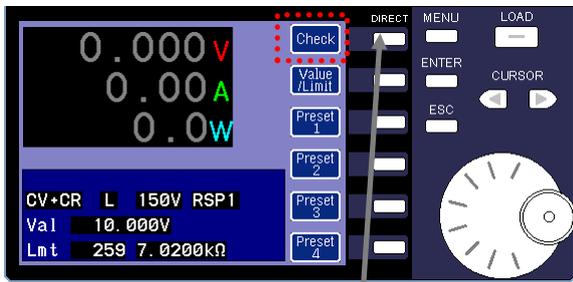
2

(Procedure)

- 1 Press the DIRECT 1 key (the top key) to display "Recall". Each time you press the DIRECT 1 key, the icon changes. The icons change in the following order: "Recall" → "Save" → "Check" → "Recall".
- 2 Press the DIRECT key of the preset number that contains the data you want to recall. In the figure on the left, "Preset 1" is selected and the data it contains is recalled. The recalled preset data is displayed in the window. The values of the recalled preset data are specified as the values of the unit.

5-3-2-3. Checking Preset Data

This section explains how to check the values of data saved to the presets.



1



2

(Procedure)

- 1 Press the DIRECT 1 key (the top key) to display "Check". Each time you press the DIRECT 1 key, the icon changes. The icons change in the following order: "Recall" → "Save" → "Check" → "Recall".
- 2 Press the DIRECT key of the preset number that contains the data you want to check. In the figure on the left, the data for "Preset 2" is displayed in the dialog box. The data values displayed in the dialog box are not the data values currently specified as the values of the unit.

5-3-3. Protective Functions

The protective functions are features designed to protect the power supply source and the unit. When a problem occurs that might affect the power supply source or disrupt the operation of the unit, the protective functions are used to switch the unit to LOAD OFF mode or limit the input. You can specify detection values that determine when these functions are enabled. There are two types of protective functions for overcurrent and overpower: one function that switches the unit to LOAD OFF mode (protect), and one function that restricts the input (limit). You can select one of these protective functions. The protective functions are as follows:

- UVP : Under Voltage Protection
- OCP/OCL : Over Current Protection / Over Current Limit
- OPP/OPL : Over Power Protection / Over Power Limit

Press the "Protect/Limit" DIRECT key in the main window to display the PROTECT/LIMIT window.

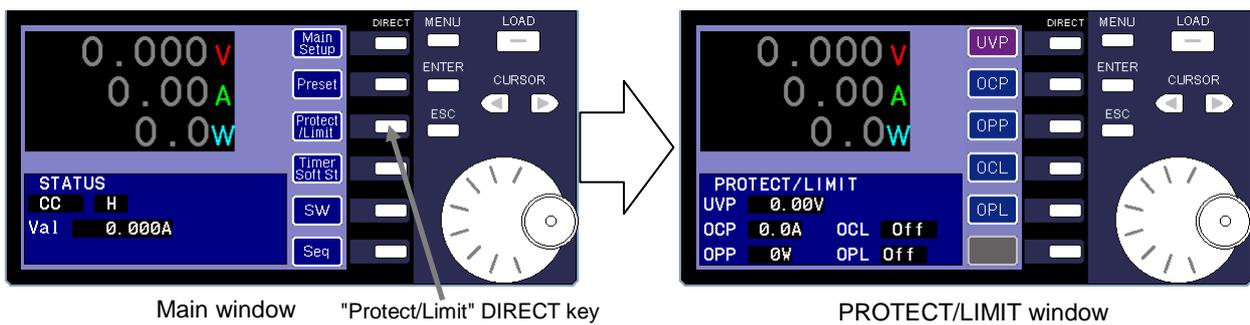


Fig. 5-4

5-3-3-2. OCP/OCL Functions

The OCP and OCL functions can be used in CR/CP/CV+CR operation modes.

Operation of the OCP and OCL functions

If a large discharge value is specified for the unit, or if the applied voltage from the power supply source is changed, the load current increases. However, if the load current is lower than the specified OCP or OCL value, the OCP and OCL functions are not enabled (T0-T1).

If the OCP function is set, the function switches the unit to LOAD OFF mode when the specified current is detected (T1).

If the OCL function is set, the running current will be limited to the specified value (T1-T2).

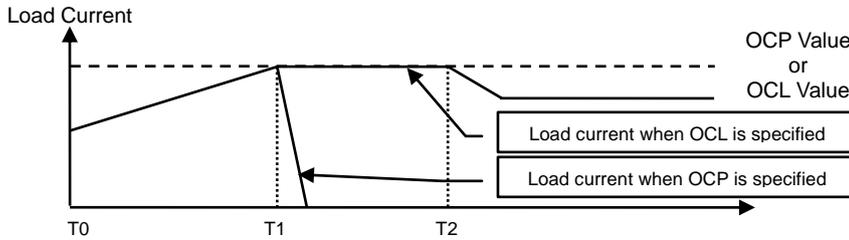
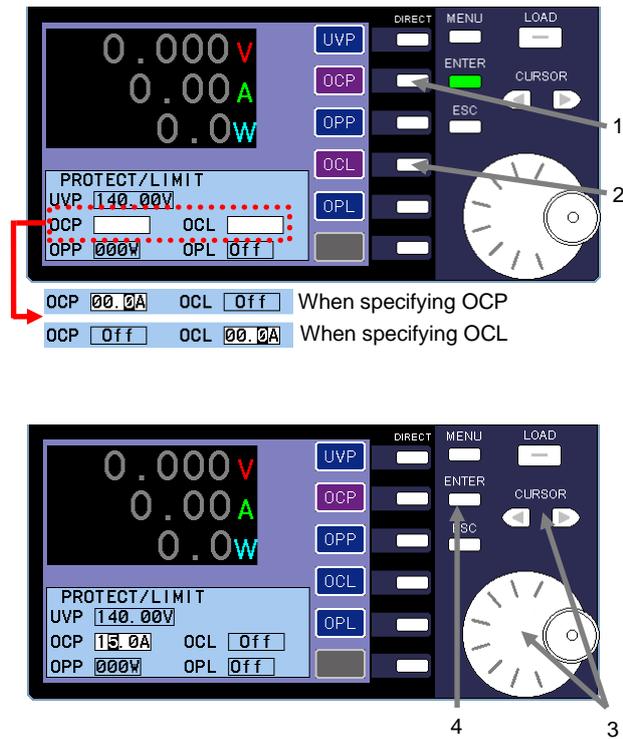


Fig. 5-6

Specifying the OCP and OCL functions



(Procedure)

- 1 Press the "OCP" DIRECT key to set the overcurrent protection.
The ENTER key begins to flash green. You can now enter the "OCP" value. "OCL" is displayed as "Off".
- 2 Press the "OCL" DIRECT key to set the overcurrent limit.
The ENTER key begins to flash green. You can now enter the "OCL" value. "OCP" is displayed as "Off".
The OCP and OCL functions cannot be used at the same time. You can only choose one of the functions.
- 3 Use the CURSOR keys to change the input digits. To change the OCP value or OCL value, use the rotary encoder.
- 4 Press the ENTER key to set the OCP or OCL value. The ENTER key light turns off.

5-3-3-3. OPP and OPL Functions

The OPP and OPL functions can be used in CC/CR/CV+CC/CV+CR operation modes.

Operation of the OPP and OPL functions

If a large discharge value is specified for the unit, or if the applied voltage from the power supply source is large, the load current increases. However, if the load current is lower than the specified OPP or OPL value, the OPP and OPL functions are not enabled (T0-T1).

If the OPP function is set, the function will switch the unit to LOAD OFF mode when the specified power is detected (T1).

If the OPL function is set, the running power will be limited to the specified value (T1-T2).

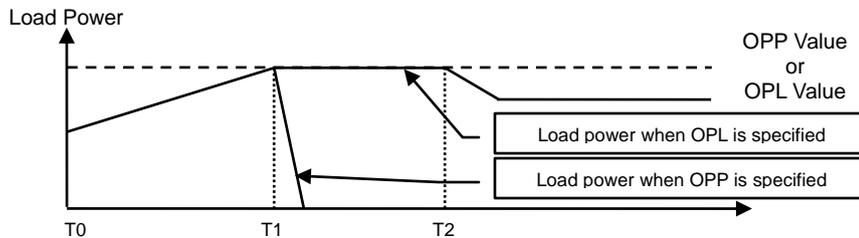
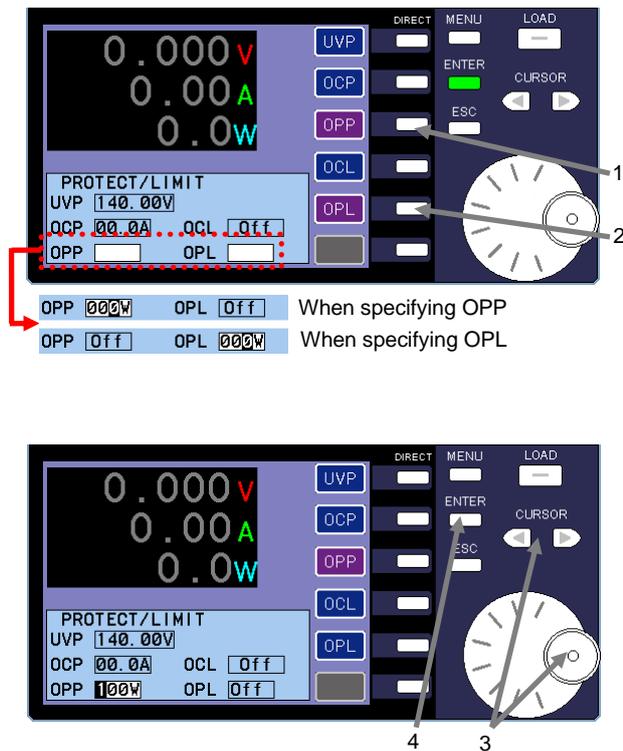


Fig. 5-7

Specifying the OPP and OPL functions

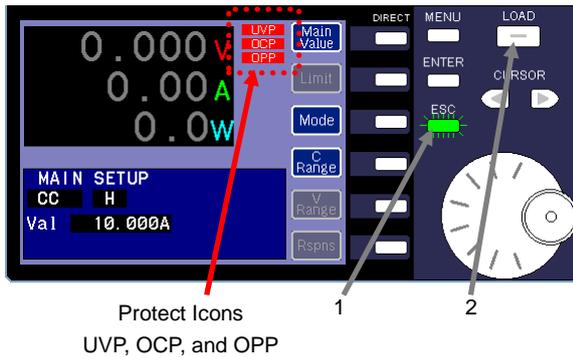


(Procedure)

- 1 Press the "OPP" DIRECT key to set the overpower protection.
The ENTER key begins to flash green. You can now enter the "OPP" value. "OPL" is displayed as "Off".
- 2 Press the "OPL" DIRECT key to set up the overcurrent limit.
The ENTER key begins to flash green. You can now enter the "OPL" value. "OPP" is displayed as "Off".
The OPP and OPL functions cannot be used at the same time. You can only choose one of the functions.
- 3 Use the CURSOR keys to change the input digits. To change the OPP value or OPL value, use the rotary encoder.
In the figure on the left, "100W" is specified for OPP and OPL is set to "Off".
- 4 Press the ENTER key to set the OPP or OPL value. The ENTER key light turns off.

5-3-3-4. Canceling the Protect and Limit Functions

Canceling the protect function



Protect Icons
UVP, OCP, and OPP

(Procedure)

When a protect function is enabled, the corresponding icon is displayed. The ESC key begins to flash green and the unit will be switched to LOAD OFF mode. (The LOAD key light turns off.)

You cannot switch the unit to LOAD ON mode while the "UVP" icon is displayed.

- 1 Press the green flashing ESC key. The protect icons disappear and the ESC key light turns off.
- 2 Confirm that the protect icons are no longer displayed, and then press the LOAD key again to switch the unit to LOAD ON mode.

Canceling the limit function



OCL icon



OPL icon

(Procedure)

When the limit function is enabled, the "Limit" icon is displayed and the current runs through the unit at the specified limit value. The unit remains in LOAD ON mode.

To cancel the OCL function, specify a lower discharge current limit value for the unit, or change the voltage applied from the power supply source.

When in CP mode, the higher the voltage applied to the unit is, the lower the current is.

When in CR mode, the lower the voltage applied to the unit is, the lower the current is.

To cancel the OPL function, specify a lower discharge current limit value for the unit, or lower the voltage applied from the power supply source.

5-3-4. Load Timer Function

Each model in the LSA series is equipped with two load timer functions: load-on timer and load-off timer.

The load-on timer is to specify the amount of time that elapses from when the LOAD key is pressed until the unit enters LOAD ON mode.

The specifiable time range is from 1 second to 9999 hours 59 minutes 59 seconds.

The load-off timer specifies the amount of time that elapses between when the LOAD key is pressed until the unit enters LOAD OFF mode.

The specifiable time range is from 1 second to 9999 hours 59 minutes 59 seconds.

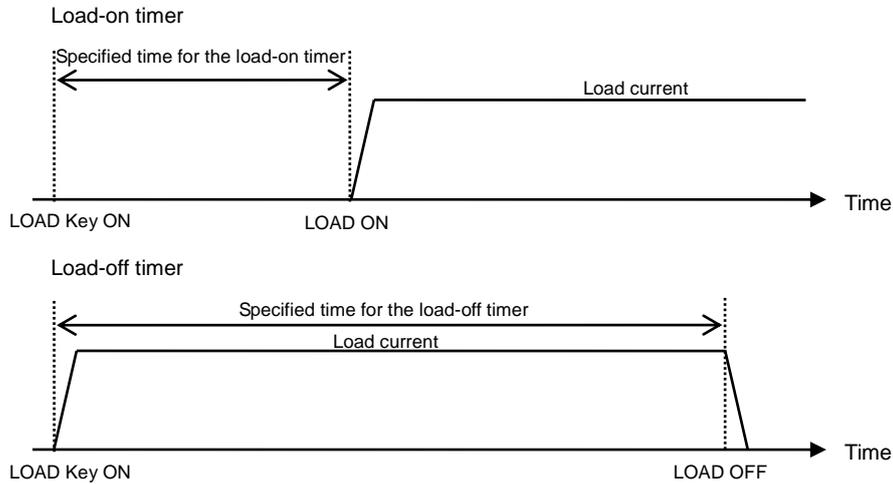


Fig. 5-8

To specify settings of the load timer function, press the "Timer/Soft St" DIRECT key in the main window to display the TIMER/SOFT START window.

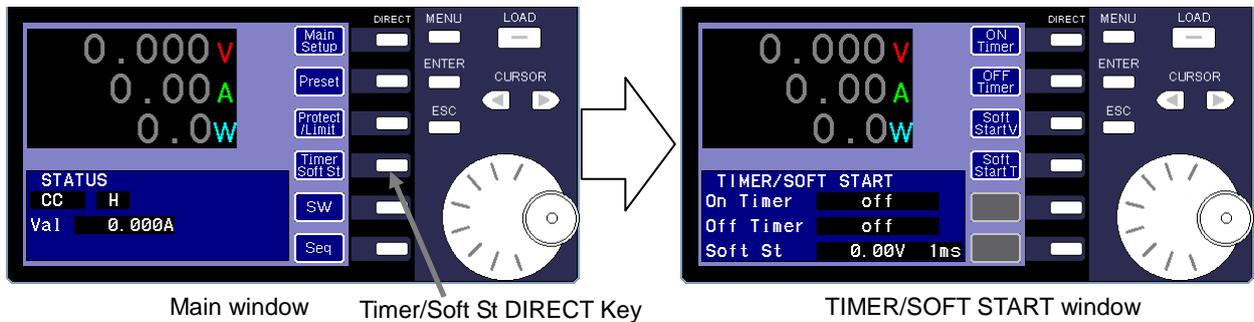
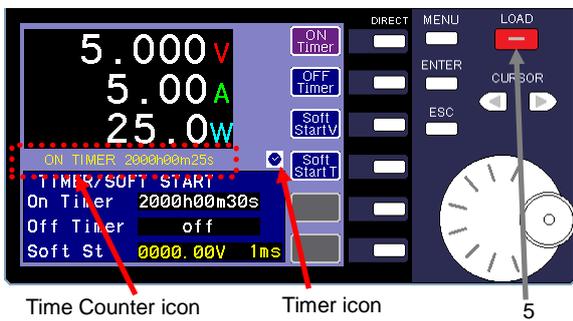
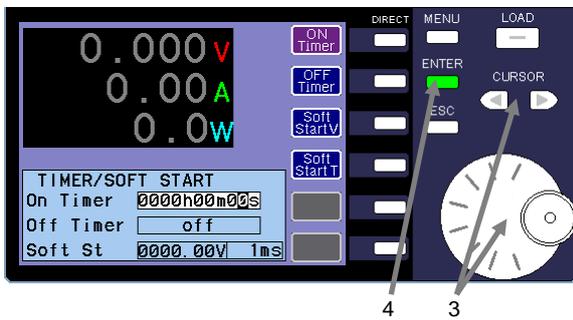
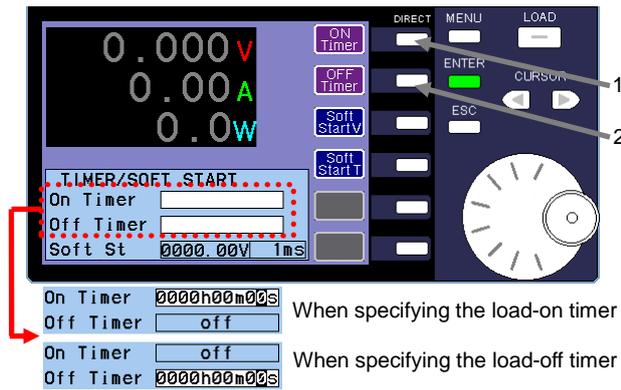


Fig. 5-9

5-3-4-1. Specifying the Load Timer Settings

Specifying the load timer settings



(Procedure)

- 1 To specify the load-on timer settings, press the "ON Timer" DIRECT key.
The ENTER key begins to flash green. You can now enter the "On Timer" value. "Off Timer" is displayed as "off".
- 2 To specify the load-off timer settings, press the "OFF Timer" DIRECT key.
The ENTER key begins to flash green. You can now enter the "Off Timer" value. "On Timer" is displayed as "Off".

The load-on timer and the load-off timer cannot be used at the same time.
If you specify 0 sec for the load-on time or load-off timer, the load timer function turns off.
- 3 Use the CURSOR keys to change the input digits. To change the set time, use the rotary encoder.
- 4 Press the ENTER key to finish setting the load timer values.
- 5 Press the LOAD key. The LOAD key begins to flash red and the time counter starts counting.
The timer icon and time counter are displayed while the load timer is enabled.

If you press the flashing red LOAD key (while the load timer is enabled), the timer stops. The LOAD key light turns off, and the unit switches to LOAD OFF mode.

5-3-5. Soft Start Function

The Soft Start function can only be specified while in CC discharge mode.

If you switch the power supply source to OUTPUT ON mode while the unit is in LOAD ON mode, an overcurrent that greatly exceeds the rated current will flow through the unit (T0-T1).

When an overcurrent occurs, the protection circuit might start running on certain power supply sources. As a result, it will be impossible to raise the voltage.

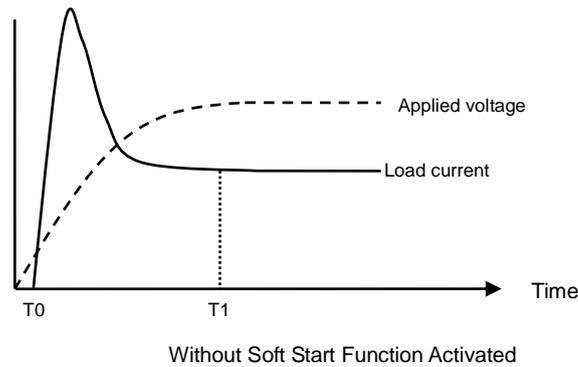


Fig. 5-10

When the Soft Start function is enabled, the unit does not apply current until the applied voltage from the power supply source reaches the soft start voltage (T0-T1). When the applied voltage from the power supply source reaches the Soft Start voltage, the unit begins to apply current. The unit takes the specified amount of time (Soft Start time) and applies current until the specified current value is reached (T1-T2). By using the Soft Start function, you can apply current without worrying about exceeding the specified current.

When the applied voltage from the power supply source falls below the Soft Start voltage (T3), the unit stops applying current.

When the applied voltage from the power supply source reaches the Soft Start voltage again (T4), the unit begins to apply current. The unit takes the specified amount of time and applies current until the specified current value is reached (T4-T5).

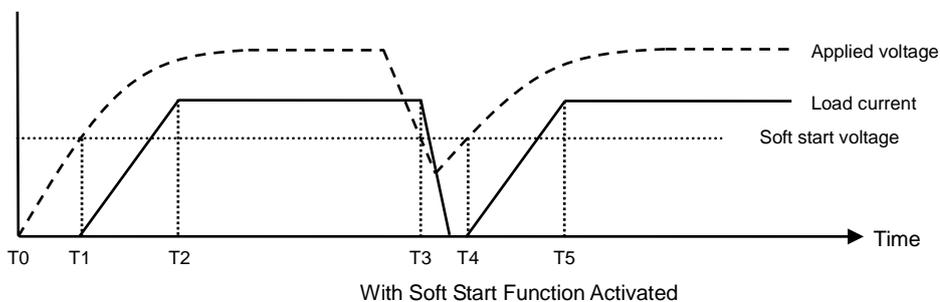


Fig. 5-11

The Soft Start function becomes off when the Soft Start start voltage set in "OFF".

Set it in "OFF", the getting started of the setting electric current rise become sharp, and a voltage descent depending on a setting electric current occurs by an inductance ingredient of the wiring, and big overshoot and ringing may occur. Please wire it so that you twist wiring length to electronic load briefly, and an inductance ingredient becomes small. The load reply is set in Slow with the factory default, but when overshoot and ringing become the problem, you set an appropriate soft start level, and please use it.

To specify the Soft Start function, press the "Timer/Soft St" DIRECT key in the main window to display the TIMER/SOFT START window.

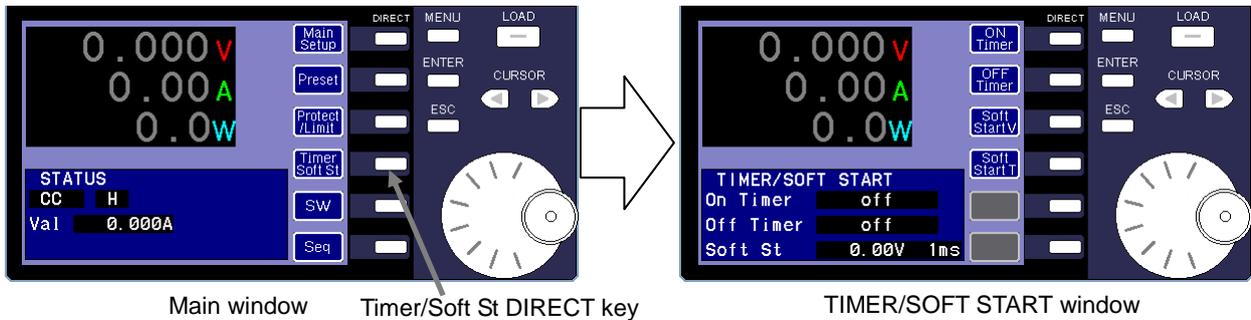
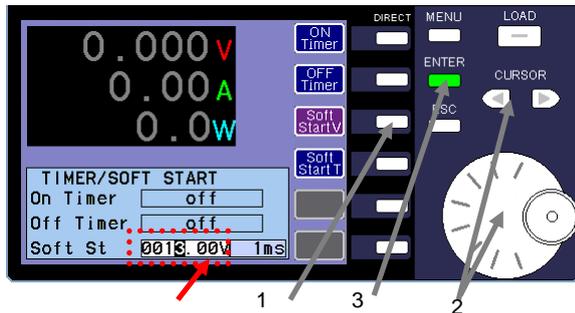


Fig. 5-12

5-3-5-1. Specifying the Soft Start Function Settings

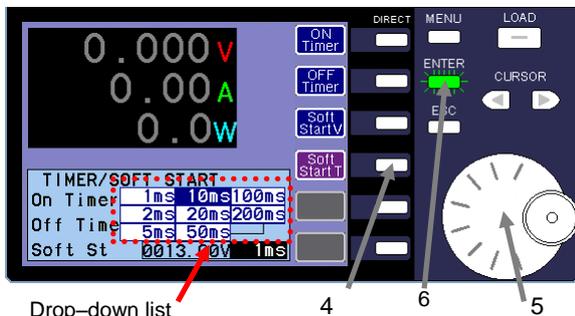
When you use the soft start function, you must specify the soft start voltage and the soft start time.

Specifying the soft start voltage



Value ready to be entered

Specifying the soft start time

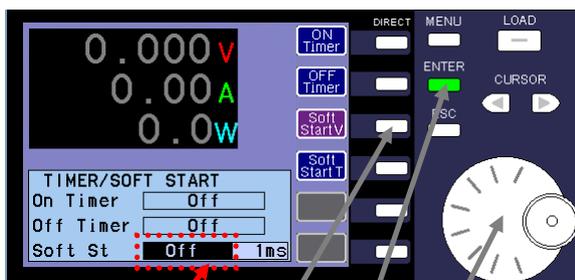


Drop-down list



7

Turn off a Soft Start function



Value ready to be entered

(Procedure)

- 1 Press the "Soft Start V" DIRECT key in the TIMER/SOFT START window.

The ENTER key begins to flash green. You can now enter the "Soft St" value.

- 2 Use the CURSOR keys to change the input digits. To change the soft start voltage, use the rotary encoder.

In the figure on the left, "13V" is specified for the soft start voltage.

- 3 Press the ENTER key to finish setting the soft start voltage. The ENTER key light turns off.

- 4 Press the "Soft Start T" DIRECT key in the TIMER/SOFT START window.

The ENTER key begins to flash green. The drop-down list for specifying the "Soft St" time is displayed.

- 5 Use the rotary encoder to change the soft start time.

In the figure on the left, "10ms" is specified for the soft start time.

- 6 Press the ENTER key to set the soft start time. The ENTER key light turns off.

- 7 Press the LOAD key to switch the unit to LOAD ON mode (the LOAD key lights up in red) to apply the voltage from the power supply source.

(操作手順)

- 1 Push the "Soft Start V" Direct key with "Timer software start setting window"

ENTER key turns on a green point and value ready to be entered.

- 2 Turn a rotary encoder to the left, and please change the Softstart start voltage setting to "off".

- 3 ENTER key turns off the light when push the ENTER key and finishes soft start start voltage setting operation.

5-3-6. Switching Function

The switching function (SW function) is used to execute two set values (main value and sub value) sequentially and repeatedly. This function can be used in all operation modes.

The switching types are described in the following diagram. There are three switching types: frequency and duty, dual time, and external signal.

The settings for the parameters described in the diagram can also be specified.

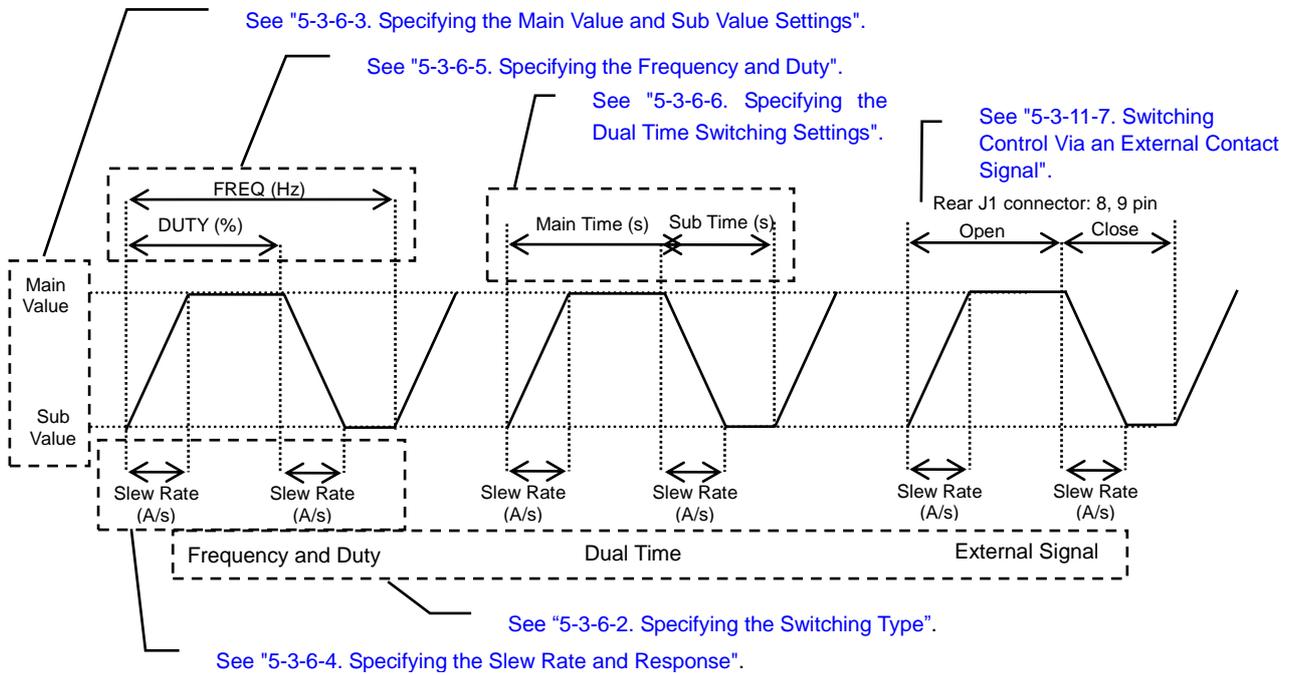
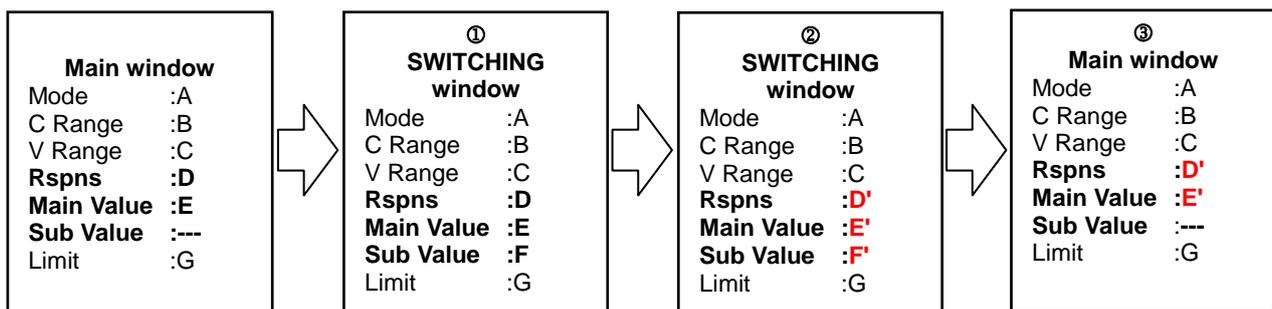


Fig. 5-13

In the figure above, the value of "Main Value" is specified to be greater than that of "Sub Value". However, you can also specify for the value of "Main Value" to be less than or equal to that of "Sub Value"

The value for "Slew Rate" cannot be specified in CV mode. Only the value for "Response" can be specified.

The following flow chart describes how the values change between the main window and the SWITCHING window.



- ① When you switch from the main window to the SWITCHING window, the values displayed in the main window are specified as the values for the unit.
- ② Only the values for "Rspns", "Main Value", and "Sub Value" can be specified in the SWITCHING window. The other values displayed in the flow chart above cannot be specified.
- ③ When changing from the SWITCHING window to the main window, values displayed on the SWITCHING window are set up on the unit. When you switch from the SWITCHING window to the main window, the values displayed in the SWITCHING window are specified as the values for the unit. The values for "Rspns" and "Main Value" are different from the original values displayed in the main window. The value for "Sub Value" is not displayed in the main window.

Press the "SW" DIRECT key in the main window to display the SWITCHING window and set up the switching function.

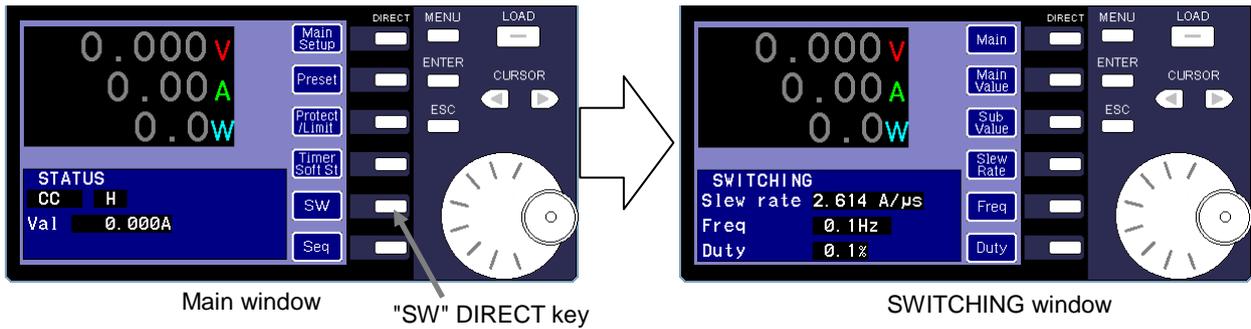
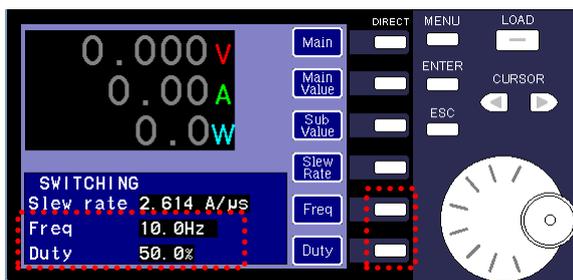
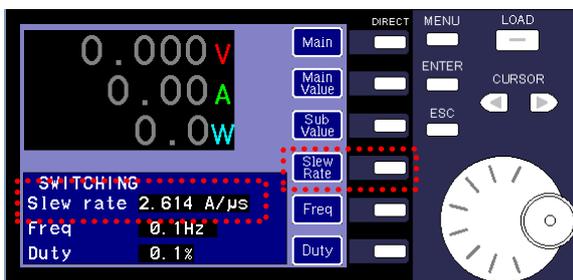
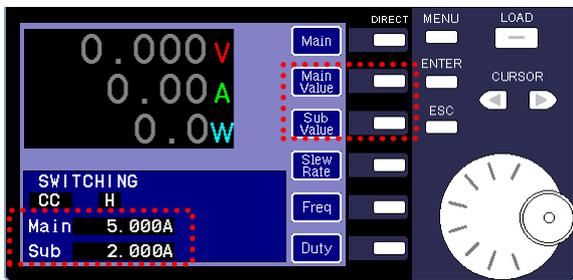
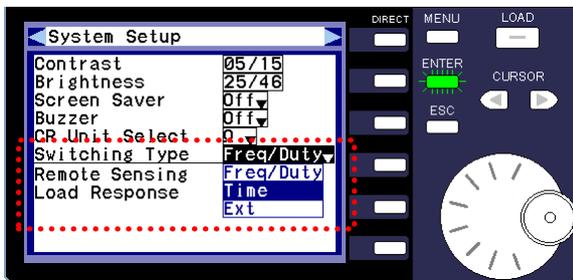


Fig. 5-14

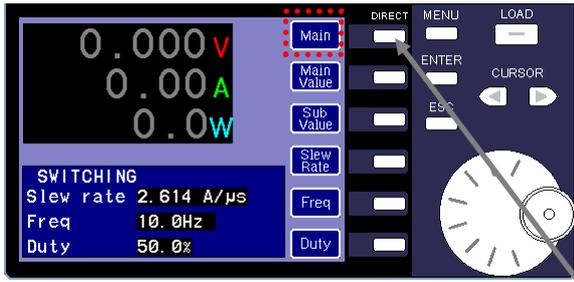
5-3-6-1. Using the Switching Function

This section provides an overview of the switching function. For details about the individual operations, see the corresponding explanations in the following sections.

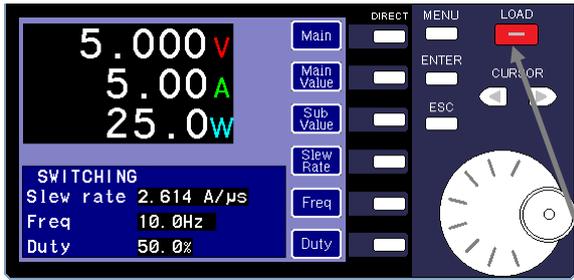


(Procedure)

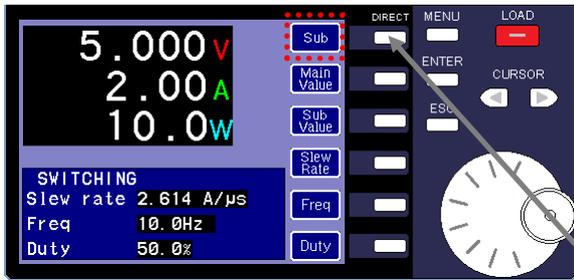
- 1 In the menu window, select "System Setup" and then "Switching Type". Next, select the switching type you want to use.
For details about how to select the switching type, see ["5-3-6-2. Specifying the Switching Type"](#).
- 2 In the SWITCHING window, specify the values for "Main Value" and "Sub Value" (switching function parameters).
For details about how to specify these values, see ["5-3-6-3. Specifying the Main Value and Sub Value Settings"](#).
- 3 Specify the switching response parameters.
When in CC, CR, or CP operation mode, specify the "Slew Rate" value.
When in CV+CC or CV+CR operation mode, specify the "Response" value.
For details about how to specify these values, see ["5-3-6-4. Specifying the Slew Rate and Response"](#).
- 4 Specify the switching time parameters.
If the switching type is "Frequency and Duty", specify the values for "Freq" and "Duty".
For details about how to specify these values, see ["5-3-6-5. Specifying the Frequency and Duty"](#).
If the switching type is "Dual Time", specify the values for "Main Time" and "Sub Time".
For details about how to specify these values, see ["5-3-6-6. Specifying the Dual Time Switching"](#).



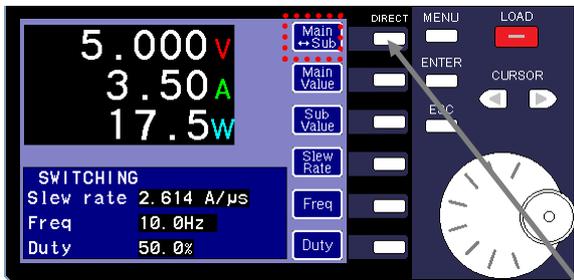
5



6



7



8

(Procedure)

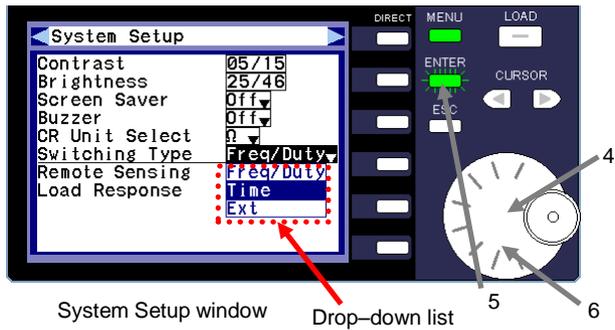
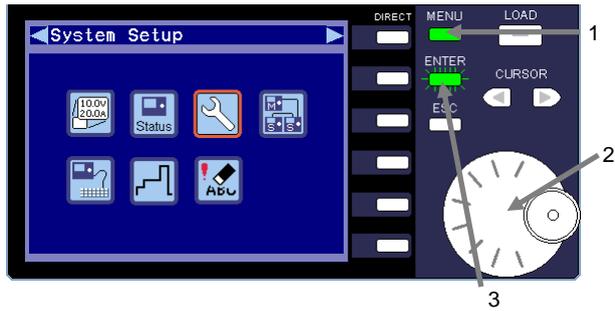
- 5 Each time you press the DIRECT 1 key (the top key), the icon changes. The icons change in the following order: "Main" → "Main↔Sub" → "Sub" → "Main". Display the "Main" icon. When this icon is displayed, the value set for "Main Value" is specified on the unit.
- 6 When you apply voltage to the unit and switch it to LOAD ON mode, the current specified for "Main Value" in operation 2 begins to flow through the unit.
- 7 Press the DIRECT 1 key and display the "Sub" icon. When this icon is displayed, the value set for "Sub Value" is specified on the unit. The current specified for "Sub Value" in operation 2 begins to flow through the unit.
- 8 Press the DIRECT 1 key to display the "Main↔Sub" icon. When this icon is displayed, the unit begins to perform switching.

If "Frequency and Duty" or "Dual Time" is selected as the switching type, the values for "Main Value" and "Sub Value" are switched based on the switching time parameter specified in operation 4.

If "External Signal" is selected, the values for "Main Value" and "Sub Value" are switched based on the status of the J1 connectors (8 and 9) located on the back of the unit.

The values you specified in operations 2 through 4 ("Main Value", "Sub Value", switching response parameter, and switching time parameter values) can all be changed in operation 8.

5-3-6-2. Specifying the Switching Type



(Procedure)

- 1 When the unit is in LOAD OFF mode, press the MENU key to display the menu window.
- 2 Turn the rotary encoder and select the "System Setup" icon in the menu window.
- 3 Press the ENTER key to display the System Setup window.
- 4 Turn the rotary encoder and select "Switching Type".
- 5 Press the ENTER key. A drop-down list is displayed.
- 6 Turn the rotary encoder to select the switching type you want to use (the currently selected type is highlighted in black).

If you use frequency and duty, select "Freq/Duty".

If you use dual time, select "Time".

If you use external signals, select "Ext".

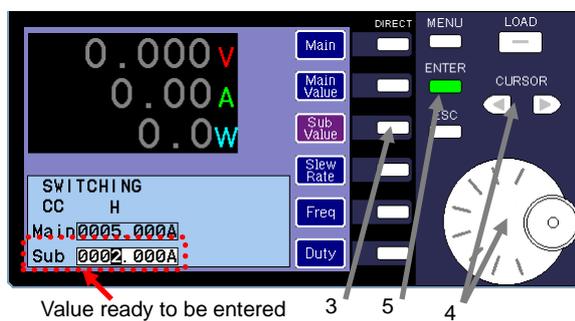
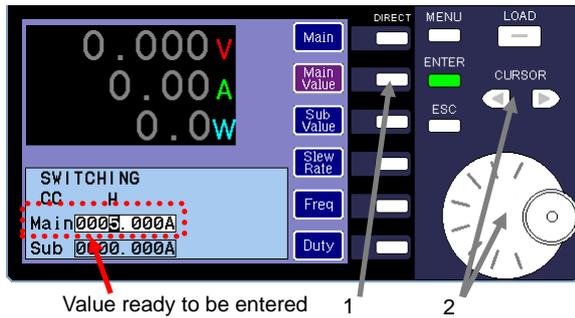
- 7 Press the ENTER key.
The green flashing ENTER key light turns off, and the switching type is specified.

In the figure on the left, "Time" (dual time) is specified as the switching type.

- 8 Press the ESC key twice to return to the main window.

5-3-6-3. Specifying the Main Value and Sub Value Settings

This section describes how to specify the values for "Main Value" and "Sub Value".



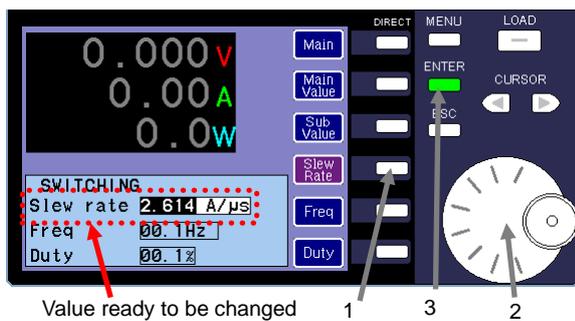
(Procedure)

- 1 Press the "Main Value" DIRECT key in the SWITCHING window.
The ENTER key lights up in green. You can now enter the "Main" value.
Before changing the value, make sure the value you specified in the main window is displayed as the "Main" value.
- 2 Use the CURSOR keys to change the input digits. To change the "Main" value, use the rotary encoder.
- 3 Press the "Sub Value" DIRECT key.
The ENTER key lights up in green. You can now enter the value for "Sub Value".
- 4 Use the CURSOR keys to change the input digits. To change the value of "Sub Value", use the rotary encoder.
- 5 Press the ENTER key to finish setting the values.

5-3-6-4. Specifying the Slew Rate and Response

The switching response parameter that can be specified depends on the operation mode.

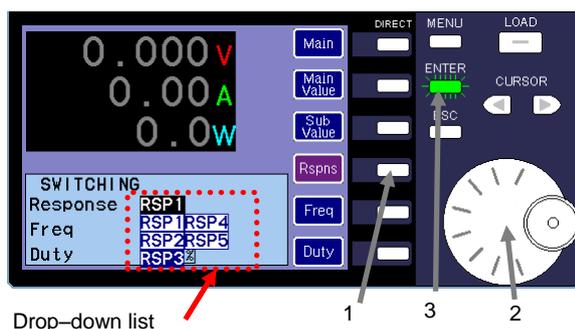
The slew rate can be specified in CC/CR/CP operation modes.



(Procedure)

- 1 Press the "Slew Rate" DIRECT key in the SWITCHING window.
The ENTER key lights up in green. You can now change the "Slew Rate" value.
- 2 Use the rotary encoder to select a value for "Slew Rate".
- 3 Press the ENTER key to finish setting the value.

The response can be specified in CV+CC/CV+CR operation modes.



(Procedure)

- 1 Press the "Rspns" DIRECT key in the SWITCHING window.
The ENTER key begins to flash green and a drop-down list is displayed.
- 2 Use the rotary encoder to select a value for "Response".
- 3 Press the ENTER key to finish setting the value.

5-3-6-5. Specifying the Frequency and Duty

The frequency and duty can only be specified when "Frequency and Duty" is selected as the switching type.

When you use the unit to perform switching, the values of "Main Value" and "Sub Value" are switched at a 10 μ s interval of integral multiplication. This interval is based on the circuit specifications of the unit.

For this reason, when you change the frequency or duty ratio, there are certain numbers that cannot be entered as the input digits.

While the frequency is being changed, an asterisk (*) is displayed to the right of the duty ratio. The asterisk indicates that the duty ratio might change after the frequency is changed.

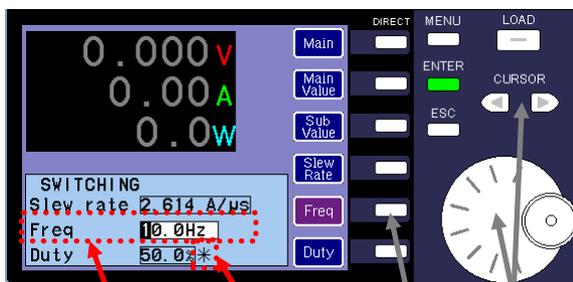
When you finish setting the frequency, the asterisk (*) disappears and the duty ratio closest to the value before the frequency was changed is specified.

Ex) A frequency of 200Hz and duty ratio of 50.0% are specified, and then the frequency is changed to 300Hz.

"50.0%" is displayed as the duty ratio before the frequency is changed.

The displayed duty ratio changes to "50.0%*" while the new frequency is being specified.

When you finish setting the frequency, the displayed duty ratio changes to "50.1%*".

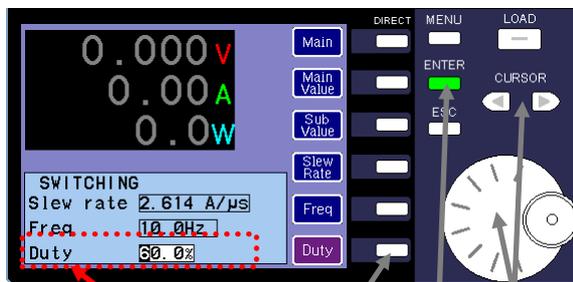


Value ready to be entered

"*" is displayed

1

2



Value ready to be entered

3

5

4

(Procedure)

- 1 Press the "Freq" DIRECT key in the SWITCHING window. The ENTER key lights up in green. You can now enter "Freq" value.

An asterisk (*) is displayed to the right of the "Duty" value.

- 2 Use the CURSOR keys to change the input digits. To change the frequency, use the rotary encoder.

In the figure on the left, "10Hz" is specified for the frequency.

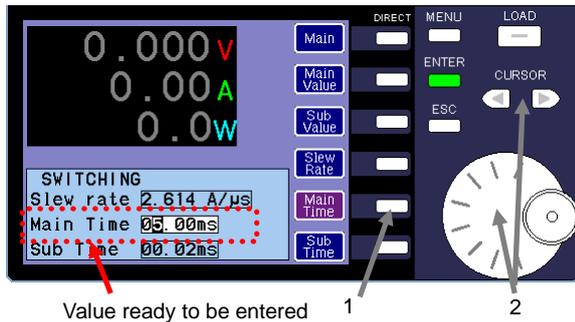
- 3 Press the "Duty" DIRECT key in the SWITCHING window. The ENTER key lights up in green. You can now enter the "Duty" value.
- 4 Use the CURSOR keys to change the input digits. To change the duty ratio, use the rotary encoder.

In the figure on the left, "60.0%" is specified for the "Duty" value.

- 5 Press the ENTER key to finish setting the frequency and duty ratio.

5-3-6-6. Specifying the Dual Time Switching

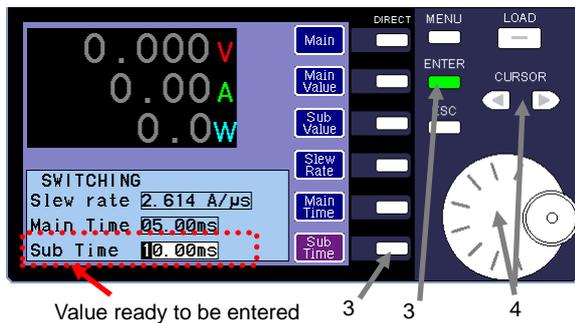
The dual time settings can only be specified when "Dual Time" is selected as the switching type.



Value ready to be entered

1

2



Value ready to be entered

3

3

4

(Procedure)

- 1 Press the "Main Time" DIRECT key on the SWITCHING window.

The ENTER key lights up in green and "Main Time" value.

- 2 Use the CURSOR keys to change the input digits. To change the "Main Time" value, use the rotary encoder.

In the figure on the left, "05.00ms" is specified for the "Main Time" value.

- 3 Press the "Sub Time" DIRECT key on the SWITCHING window.

The ENTER key lights up in green. You can now enter the "Sub Time" value.

- 4 Use the CURSOR keys to change the input digits. To change the "Sub Time" value, use the rotary encoder.

In the figure on the left, "10.00ms" is specified for the "Sub Time" value.

- 5 Press the ENTER key to finish setting the values.

5-3-7. Remote Voltage Sensing Function

In the products of the LSA series, an internal point or $\pm S$ connector can be specified as the voltage detection point.

The current runs through the load line that connects the power supply source to the unit. However, this current causes an electric potential difference to occur between the power supply source and the unit.

If an internal point of the unit is specified as the voltage detection point, the voltage detected by the unit is as low as the electric potential difference from the actual power supply output voltage.

When CR or CP is selected as the operation mode, the electric potential difference prevents the current from running at the specified value (the current runs at the wrong value). When CV+CC or CV+CR is selected as the operation mode, the voltage from the power supply source is larger than the specified voltage, thereby creating an electric potential difference.

To compensate for this difference, you can connect the power supply source to the $\pm S$ connector that serves as the voltage detection point. In addition to compensating for the difference, this also allows you to run the same level of current as that of the unit, as well as equalize the voltage of the power supply source and the set voltage of the unit.

5-3-7-1. Connecting the Sensing Cables

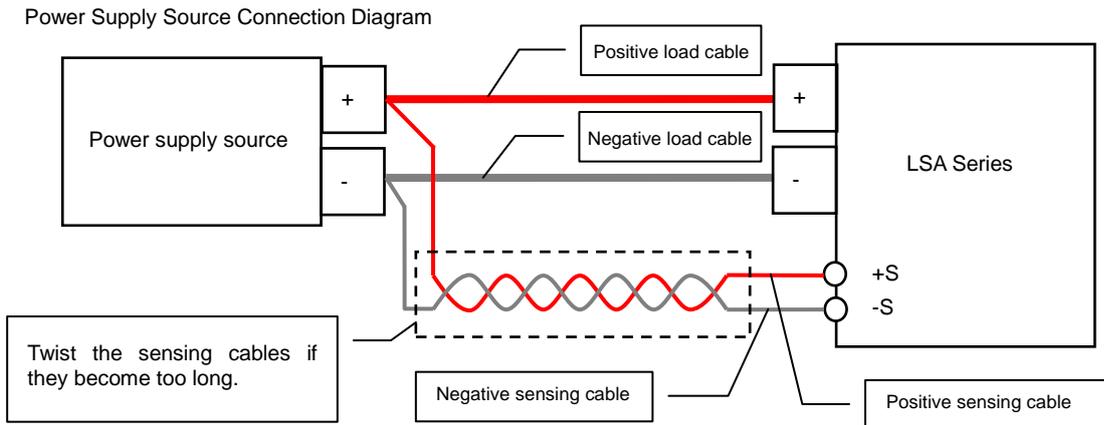
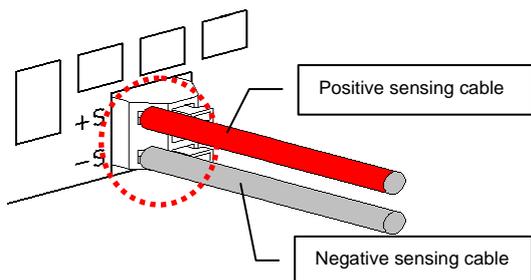
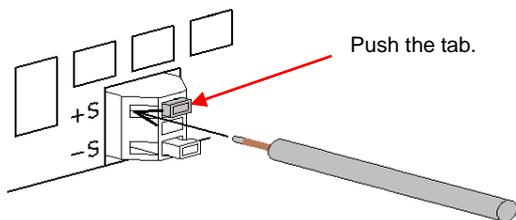


Fig. 5-15

Very little current is actually applied to the voltage remote sensing cables. However, it is important to use cables capable of withstanding the voltage that is output by the power supply voltage. We recommend using cables with twisted AWG24-28 wires.

Strip approximately 10mm off the sheath of each cable, and then solder the conductor to prevent the wires from unraveling.

Before you connect the sensing cables to the $\pm S$ connectors on the rear panel of the unit, make sure to switch the power supply source to OUTPUT OFF mode, and to switch the unit to LOAD OFF mode.



Push and hold the $\pm S$ connector tab, then insert the cable into the hole to the left of the tab.

Insert the positive sensing cable into the top hole, and the negative sensing cable into the bottom hole.

Make sure to correctly connect the positive and negative sensing cables, as well as the positive and negative load cables. If you inversely connect the cables, the unit or power supply source might become damaged.

Voltage is applied to the positive and negative sensing cables from the power supply source.

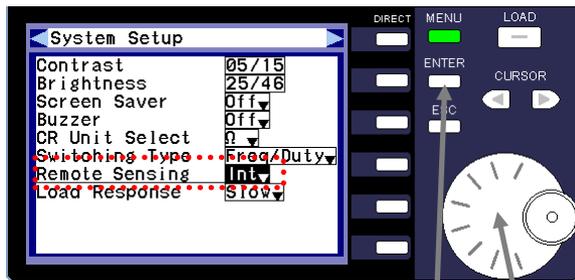
There is very little space between the $\pm S$ connectors (area circled in red in the figure on the left). Exercise care when handling the positive and negative cables, making sure the conductors do not make contact.

If the conductors of the positive and negative sensing cables make contact, the sensing cables might burn or the power supply source might become damaged.

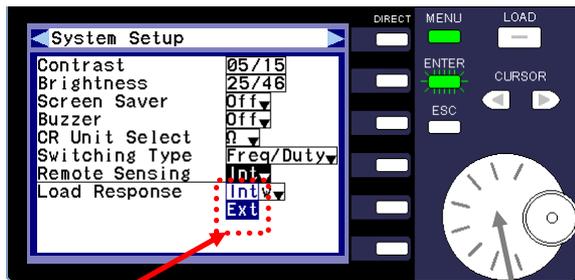
5-3-7-2. Specifying the Voltage Detection Point



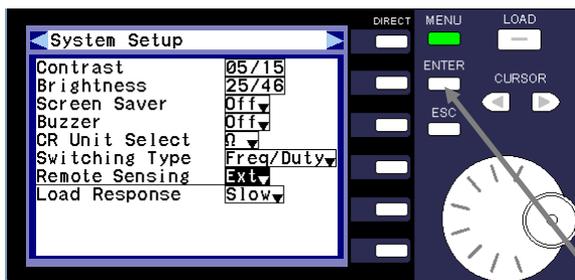
Menu window



System Setup window



Drop-down list



SENS icon

(Procedure)

- 1 Press the MENU key while the unit is in LOAD OFF mode. The ENTER key begins to flash, and the menu window is displayed.
- 2 Turn the rotary encoder and select the "System Setup" icon.
- 3 Press the ENTER key. The System Setup window is displayed.
- 4 Turn the rotary encoder and select "Remote Sensing" in the System Setup window.
- 5 Press the ENTER key. A drop-down list is displayed.

- 6 Use the rotary encoder to select "Int" or "Ext" from the drop-down list.

If you select "Int", a point inside the unit is specified as the voltage detection point.

If you select "Ext", the $\pm S$ connectors of the unit are specified as the voltage detection points.

- 7 Press the ENTER key.

The $\pm S$ connectors are specified as the voltage detection points in the figure on the left.

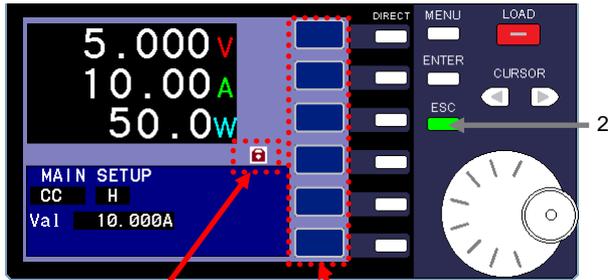
- 8 Press the ESC key twice. The main window is displayed.

If the $\pm S$ connectors are specified as the voltage detection points, the "SENS" icon is displayed.

However, if a point inside the unit is specified as the voltage detection unit, the "SENS" icon is not displayed.

5-3-8. Key Lock Function

This function is used to lock the keys in all operation modes other than LOAD OFF mode.



Key lock icon

Blank



(Procedure)

Turn off the output of the power supply source.

- 1 Press the LOAD key to switch the unit to LOAD ON mode. The LOAD key lights up in red.

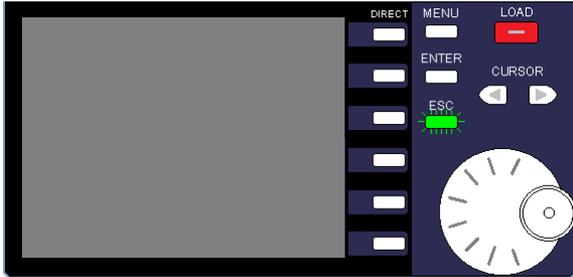
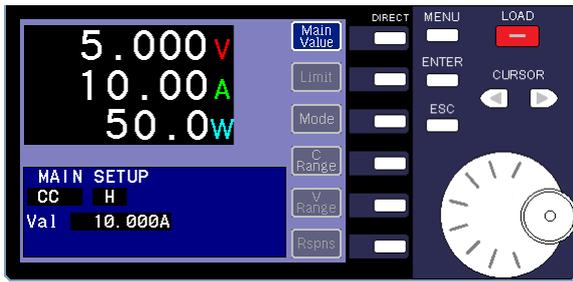
- 2 Press and hold the ESC key. The ESC key lights up in green and the keys are locked. The key lock icon is displayed, and all of the DIRECT operation icons become blank. In this state, the only operations that can be performed are switching the unit to LOAD OFF.

- 3 Press and hold the green flashing ESC key again to unlock keys. The ESC key light turns off and the keys are unlocked.

If you are using the IF-80GUR control board (optional) to remotely control the unit, press and hold the ESC key to switch the unit to local control.

5-3-9. Screen Saver Function

This function is used to turn off the display after none of the keys have been used for more than 10 minutes.



(Procedure)

- 1 Enable the screen saver function (set the function to "On"). For details on how to enable the screen saver function, see ["5-3-12-3. System Setup"](#).

Make sure the unit is in LOAD ON mode, as shown in the figure on the left.

- 2 The display turns off after none of the keys have been operated for more than 10 minutes. The ESC key begins to flash green. The other key lights turn off and can no longer be used. There is no change to LOAD key before and after the display turns off. In this state, the only operations that can be performed are switching the unit to LOAD OFF mode or turning the display back on.
- 3 Press the green flashing ESC key to turn on the display. The ESC key light turns off and the display lights up. You can now use all the keys.

5-3-10. Master/Slave Operation Function

Each model in the LSA series can perform parallel operation via master/slave connection.

The same model as the master unit can be used as the slave unit. In addition, a booster unit (scheduled for release) can also be used as a slave unit. Up to four slave units can be connected at one time.

A model that is different from the master unit cannot be used as a slave unit.

In addition, units that are of same model as the master unit cannot be used together with booster units as slave units.

5-3-10-1. Connecting the Units for Master/Slave Operation

Master/Slave Connection Diagram

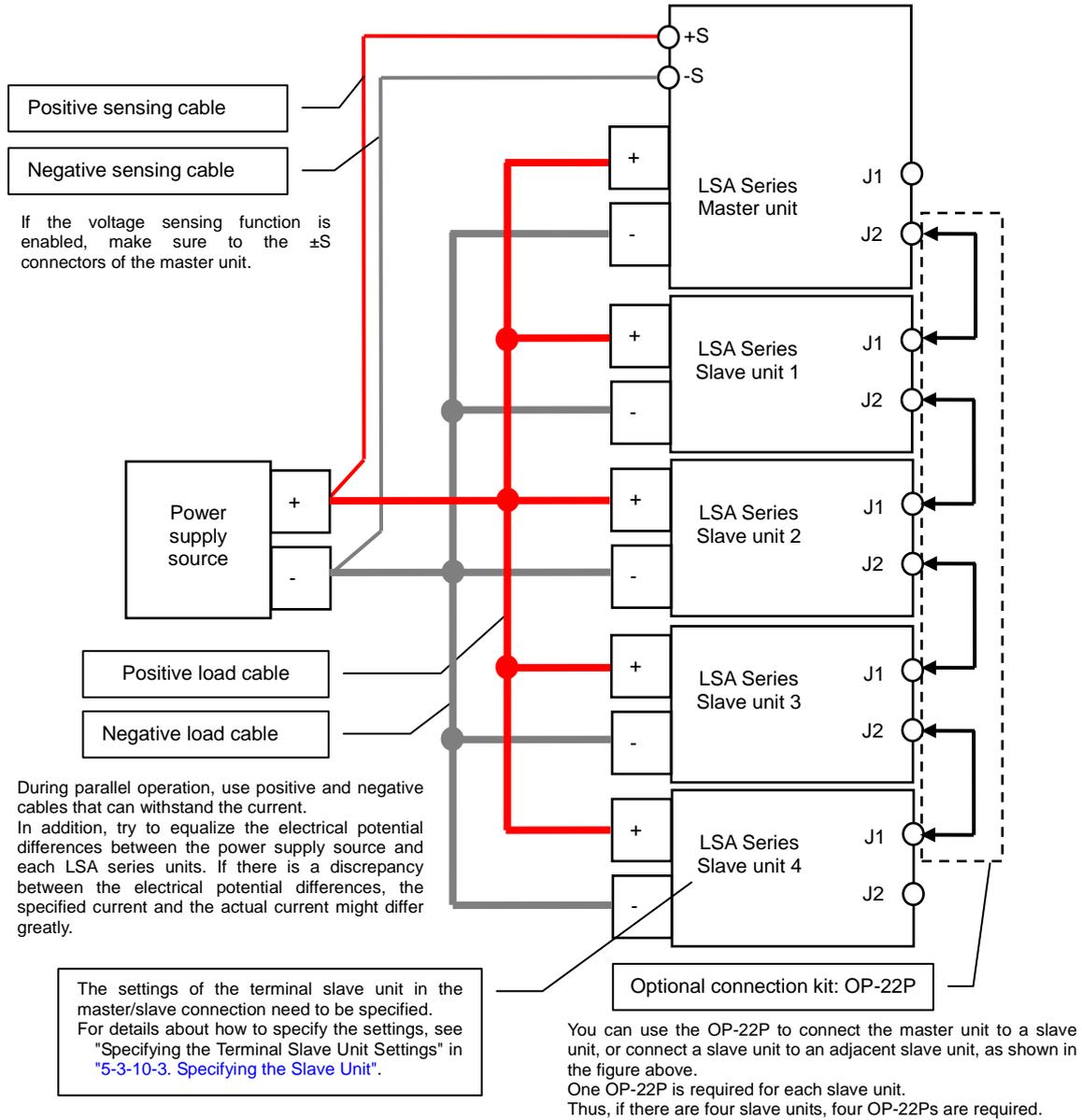


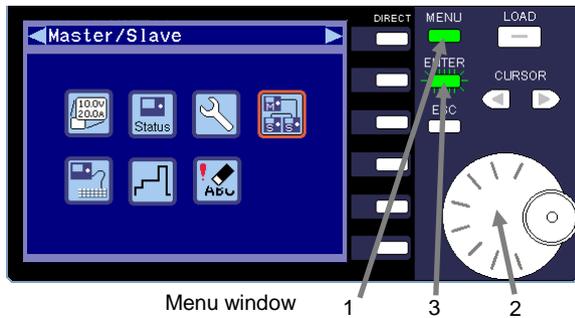
Fig. 5-16

5-3-10-2. Specifying the Master Unit

To specify the unit as the master unit, you must first switch the unit from "Alone" (independent operation) to "Master" (master unit for master/slave operation).

Next, specify the number of slave units that are connected to the master unit (parallel connection), as well as the slave unit types.

When you cancel independent operation and specify the unit as the master unit, you must power off the unit and then restart it. At this time, the settings data of the unit is initialized.

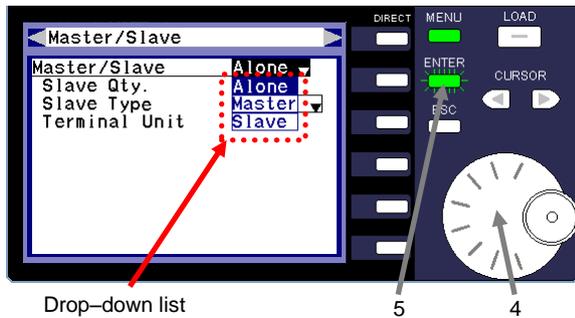


Menu window

(Procedure)

- 1 Press the MENU key while the unit is in LOAD OFF mode. The ENTER key begins to flash and the menu window is displayed.
- 2 Turn the rotary encoder and select the Master/Slave icon.
- 3 Press the ENTER key. The Master/Slave window is displayed.

Specifying the master unit



Drop-down list

- 4 Turn the rotary encoder and select "Master/Slave".
- 5 Press the ENTER key. A drop-down list is displayed.

"Alone": Independent operation.

"Master": Master unit in master/slave operation.

"Slave": Slave unit in master/slave operation.



- 6 Turn the rotary encoder and select "Master".
- 7 Press the ENTER key. The green flashing ENTER key light turns off and the unit is specified as the master unit for master/slave operation.

Specifying the number of slave units



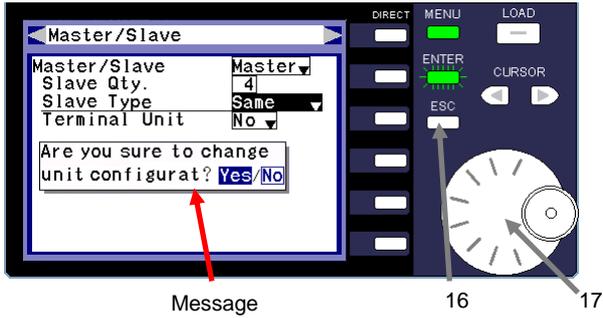
Specifying the slave unit type



(Procedure)

- 8 Turn the rotary encoder and select "Slave Qty."
This item allows you to specify the number of slave units for "Slave Qty."
- 9 Press the ENTER key.
- 10 Turn the rotary encoder and select the number of slave units.
- 11 Press the ENTER key.
The ENTER key light turns off and the number of slave units is set.
In the figure on the left, "4" is selected for the number of slave units in the master/slave connection.
- 12 Turn the rotary encoder and select "Slave Type".
- 13 Press the ENTER key.
The ENTER key begins to flash green and a drop-down list is displayed.
"Same": The same model as the master unit is used as a slave unit.
"Booster": A booster unit is used as a slave unit.
- 14 Turn the rotary encoder and select a slave type from the drop-down list.
- 15 Press the ENTER key.
The ENTER key light turns off and the slave type is set.
In the figure on the left, the same model as the master unit is selected for the slave units.

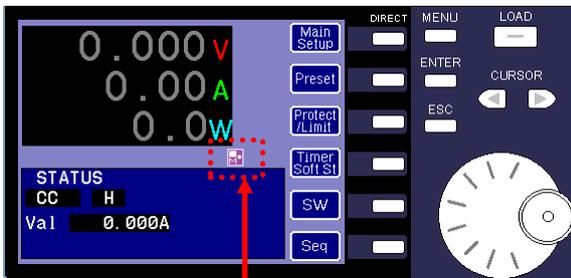
Initializing the settings



Message



Restart message



Master unit icon

(Procedure)

16 Press the ESC key.
A message asking whether you want to change the unit configuration is displayed.

17 Turn the rotary encoder and select "Yes".

If you select "No", the master unit settings you specified in operations 6 through 15 are canceled.

18 Press the ENTER key.

A message asking whether you want to restart the unit is displayed.

19 Press the power switch on the front panel to power off the unit, and then press the switch again to turn the unit back on.

The unit is specified as the master unit for master/slave operation.

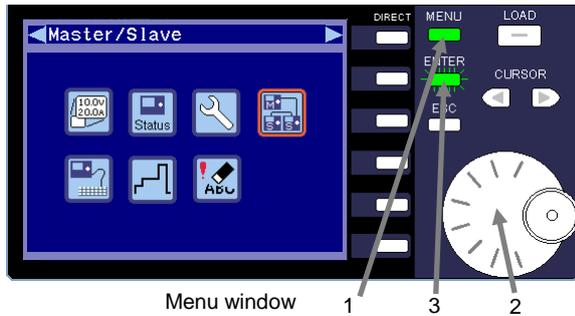
When the unit is specified as the master unit, the master unit icon is displayed.

5-3-10-3. Specifying the Slave Unit

To specify a unit as a slave unit, you must first switch the unit from "Alone" (independent operation) to "Slave" (slave unit in master/slave operation).

Next, you must specify the unit as the terminal slave unit. In Fig. 5-16 "Master/Slave Connection Diagram", slave unit 4 is specified as the terminal slave unit.

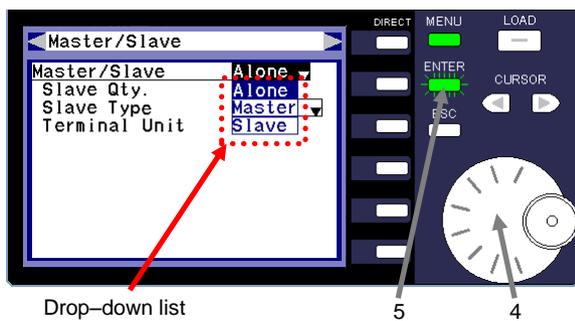
When you cancel independent operation and specify the unit as a slave unit, you must power off the unit and then restart it. At this time, the settings data of the unit is initialized.



(Procedure)

- 1 Press the MENU key while the unit is in LOAD OFF mode. The ENTER key begins to flash and the menu window is displayed.
- 2 Turn the rotary encoder and select the Master/Slave icon.
- 3 Press the ENTER key. The Master/Slave window is displayed.

Specifying a slave unit



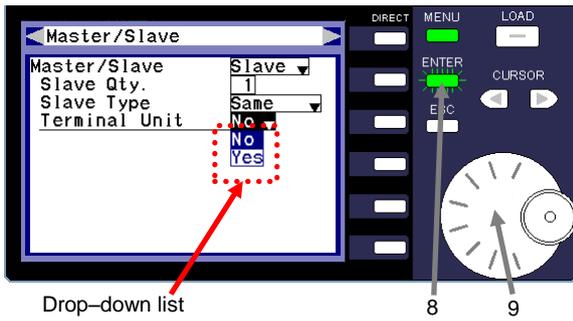
- 4 Turn the rotary encoder and select "Master/Slave".
- 5 Press the ENTER key. A drop-down list is displayed.

"Alone": Independent operation.
 "Master": Master unit in master/slave operation.
 "Slave": Slave unit in master/slave operation.

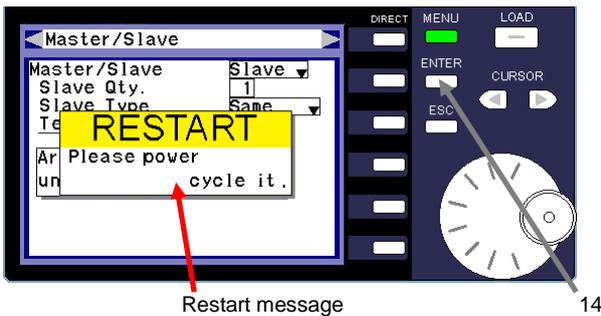
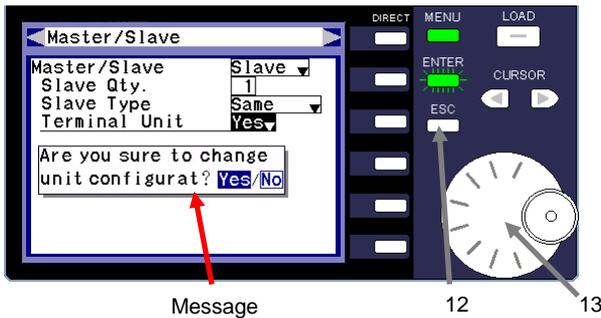


- 6 Turn the rotary encoder and select "Slave".
- 7 Press the ENTER key. The green flashing ENTER key light turns off and the unit is specified as a slave unit for master/slave operation.

Specifying the terminal slave unit



Initializing the settings



(Procedure)

- 8 Turn the rotary encoder and select "Terminal Unit".
- 9 Press the ENTER key.
The ENTER key begins to flash green and a drop-down list is displayed.

"No": Unit is not specified as the terminal slave unit.

"Yes": Unit is specified as the terminal slave unit.

- 10 Turn the rotary encoder and select "Yes" for "Terminal Unit".
- 11 Press the ENTER key.
The ENTER key light turns off and the unit is specified as the terminal slave unit.

- 12 Press the ESC key.
A message asking whether you want to change the unit configuration is displayed.

- 13 Turn the rotary encoder and select "Yes".

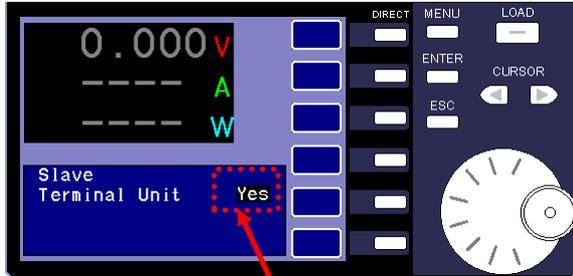
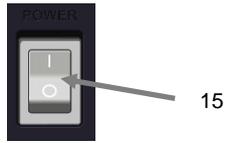
If you select "No", the slave unit settings you specified in operations 6 through 11 are canceled.

- 14 Press the ENTER key.

A message asking you to restart the unit is displayed.

(Procedure)

- 15 Press the power switch on the front panel to power off the unit, and then press the switch again to turn the unit back on.



State of the slave unit

The unit is specified as a slave unit for master/slave operation.

The display indicates the state of the unit.

In the figure on the left, the unit specified as the terminal slave unit ("Yes" is displayed for "Terminal Unit").

If the unit is not the terminal slave unit, "No" is displayed for "Terminal Unit".

Only the applied voltage is displayed in the monitor window.

The calculated totals for the current and total power are displayed on the master unit.

5-3-11. Using External Signals to Control the Unit

You can use an external analog signal or external contact signal to control the unit. The external signals are entered into the J1 rear control connector of the unit.

The unit can output analog signals or logic signals to indicate its operation status. These signals are output from the J2 rear control connector.

Make sure to power off the unit before connecting to the J1 or J2 connector.

5-3-11-1. Assembling the J1 and J2 Connectors

OMRON XG5 connectors are used as the J1 and J2 connectors.

The mounting of the wire to the contact, in order to improve the reliability, please use the (OMRON) special tool XY2B-7006. In addition, the application wire rod is twist line AWG26 - AWG28, external form $\Phi 1.1$ - $\Phi 1.3$.

Specifically, please review an instruction manual of XY2B-7006. For details, please confirm the operation manual of XY2B-7006.

In the case of faulty wiring or wiring change, please use the (OMRON) special tool XY2E-0001 that is withdrawn from the housing contact. For details, please confirm the operation manual of XY2E-0001.

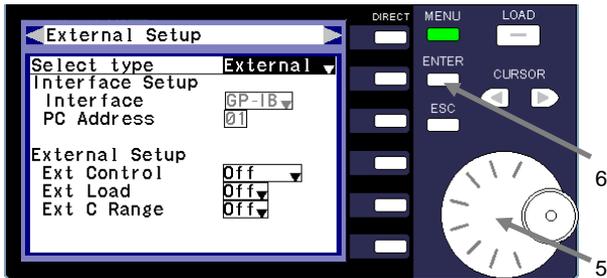
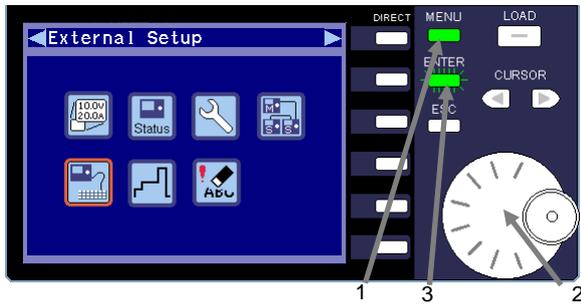
5-3-11-2. J1 and J2 Connector Specifications

The pin numbers of the J1 and J2 connectors are as follows: The pin in the upper left (when facing the back panel) is No. 1, and the pin directly to the right of it is No. 2. The pin in the lower right is No. 20, and the pin directly to the left of it is No. 19.

Pin Number	J1	J2
1. 2	Inputs the external trigger signal for the sequence function. For details about how to use these pins, see "5-3-11-9. External Trigger Signal Input" .	Output a pulse when the main value or sub value is switched during switching operation, and when executing the specified steps in sequence operation while the trigger output is set to ON. For details about how to use these pins, see "5-3-11-15. Trigger Signal Output" .
3. 4	An external alarm is sent to the unit by short-circuiting pins No. 3 and No. 4. Pin No. 4 is connected to pin No. 8 and is common for external input signals. For details about how to use these pins, see "5-3-11-8. External Alarm Signal Input" .	When an alarm is sent to the unit, the internal transistor turns on. Pin No. 3 acts as the collector of the transistor, and pin No. 4 acts as the emitter. For details about how to use these pins, see "5-3-11-14. Alarm Status Output"
5	NC	NC
6	NC	Control output for LSA series power expansion. This pin can only be connected to OP-22P.
7	NC	Outputs approx. +5V, using pin No. 8 as a reference. Do not apply a current of any greater than 100mA.
8	Connected to pin No. 4. Common to pins No. 9 to No. 12, which are the unit pins used for external input signals.	Common to pins No. 7 and No. 9 through No. 12, which are the unit pins used for external input signals.
9	Inputs the external switching signal for the switching function. For details about how to use this pin, see "5-3-11-6.C Range Control Via an External Contact Signal" .	Outputs the set value status while the switching function is being used. For details about how to use this pin, see "5-3-11-13. Switching Function Output Value Status Output" .
10	Uses an external signal to switch the unit to LOAD ON or LOAD OFF mode. For details about how to use this pin, see "5-3-11-5. LOAD ON/OFF Control Via an External Contact Signal" .	Outputs the LOAD ON and LOAD OFF status of the unit. For details about how to use this pin, "5-3-11-11. LOAD ON/OFF Status Output" .
11. 12	Use an external signal to change C Range. For details about how to use these pins, see "5-3-11-6. C Range Control Via an External Contact Signal" .	Outputs the C Range status of the unit. For details about how to use these pins, see "5-3-11-12. C Range Status Output" .
13 to 16	The input terminals used to control master/slave operation. These terminals can only be connected to OP-22P.	
17. 18	Control the set values on the unit via external voltage (17-18) and external resistance (19-20). For details about how to use these pins, see "5-3-11-4. Set Value Control Via an External Voltage or External Resistance" .	The output terminals for the current monitor of the unit. For details about how to use these pins, see "5-3-11-10. Current Monitor Output" .
19. 20	NC	

5-3-11-3. Specifying External Control

To control the specified values on the unit via external voltage or external resistance, or to use an external signal to control the C Range and LOAD ON/OFF modes, specify "External" under "Select type".



(Procedure)

- 1 Press the MENU key while the unit is in LOAD OFF mode. The menu window is displayed.
- 2 Turn the rotary encoder and select the external setup icon.
- 3 Press the ENTER key.

- 3 Turn the rotary encoder and select "Select type".

- 4 Press the ENTER key. A drop-down list is displayed.

"External": Control via external signal

"Interface": Control via IF-80GUR

- 5 Turn the rotary encoder and select "External".

Note that you cannot select "Interface" if the IF-80GUR is not mounted.

- 6 Press the ENTER key. External control is specified.

5-3-11-4. Set Value Control Via an External Voltage or External Resistance

An external voltage or external resistance can be used to control the set value for each operation mode of the unit.

When using an external voltage to control the set value in CC mode, the value specified by the external voltage is superposed by the value specified on the panel of the unit.

Connect the external voltage or resistance to the J1 connector on the back of the unit. The diagram below illustrates how to connect the voltage and resistance.

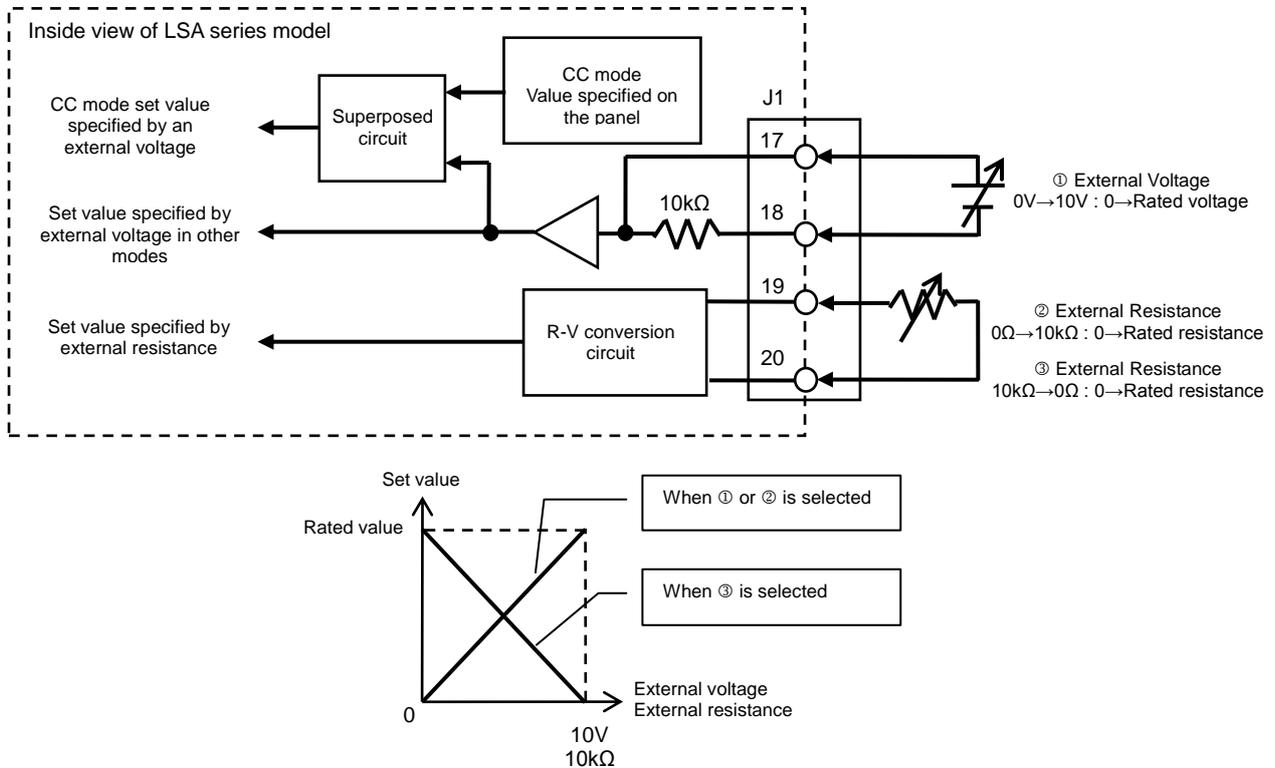
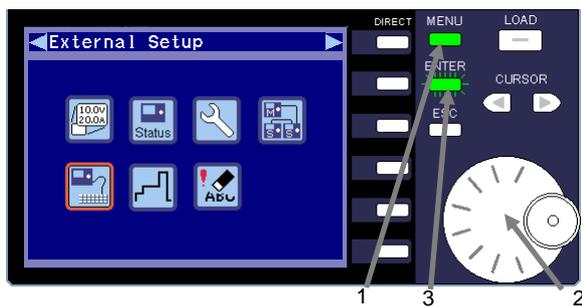


Fig. 5-17

Note: The set value for each operation mode that can be controlled by this function is the main value for the Main Setup function. The preset function and switching function cannot be used while this function is being used.

(Procedure)

- 1 Press the MENU key while the unit is in LOAD OFF mode. The menu window is displayed.
- 2 Turn the rotary encoder and select the external setup icon.
- 3 Press the ENTER key.



- 4 Turn the rotary encoder and select "Ext Control".

Select "External" for "Select type". For details about how to select, see "5-3-11-3. Specifying External Control".

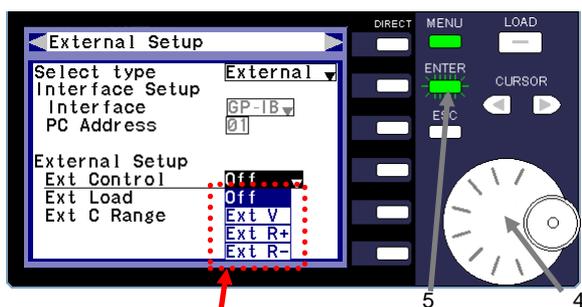
- 5 Press the ENTER key. A drop-down list is displayed.

"Off": Indicates that you can change the set value from the front panel.

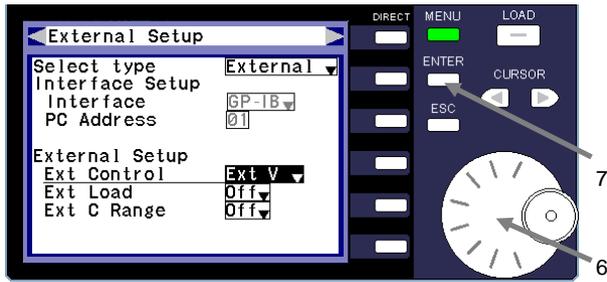
"Ext V": External voltage 0V→10V; set value 0→ rated

"Ext R+": External resistance 0Ω→10kΩ; set value 0→ rated

"Ext R-": External resistance 10kΩ→0Ω; set value 0→ rated



Drop-down list



(Procedure)

- 6 Turn the rotary encoder and select the external control type you want to use from the drop-down list.
- 7 Press the ENTER key. The green flashing ENTER key light turns off and the external control type is specified. External voltage is selected in the figure on the left.



External control type

- 8 Press the ESC key twice. The main window is displayed. The currently selected external control type is displayed in the main window.

"EX V" (external voltage) is displayed in the figure on the left.

EX V

"EX R+" (external resistance) is displayed when "Ext R+" is selected.

EX R+

"EX R-" (external resistance) is displayed when "Ext R-" is selected.

EX R-

The preset function and switching function cannot be used while this function is being used. Thus, the icons for these functions are displayed in gray.

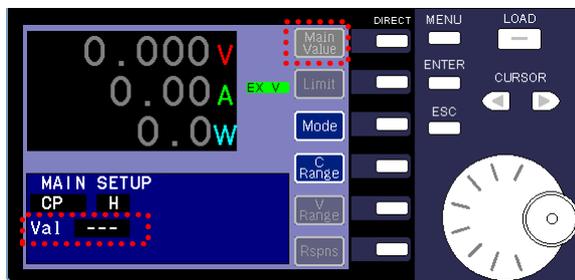
- 9 Press the "Main Setup" DIRECT key to display the MAIN SETUP window.



Value set on panel

In the figure on the left, CC mode external voltage control is selected. The value displayed for "Val" is the value that was specified on the panel.

The set value that was specified by using an external voltage or external resistance is not displayed.



Control mode other than CC mode external voltage control

If a control mode other than CC mode external voltage control is selected, no value is displayed for "Val" and the "Main Value" icon turns gray. In this state, you cannot change the set value from the panel.

The set value that was specified by using an external voltage or external resistance is not displayed.

5-3-11-5. LOAD ON/OFF Control Via an External Contact Signal

An external contact signal can be used to switch the unit to LOAD ON or LOAD OFF mode.

If you select to use an external contact signal for LOAD ON/OFF, you cannot use the front panel to switch the unit to LOAD ON or LOAD OFF mode.

Connect a contact or open collector circuit to the J1 connector on the back of the unit. The diagram below illustrates how to setup the connection.

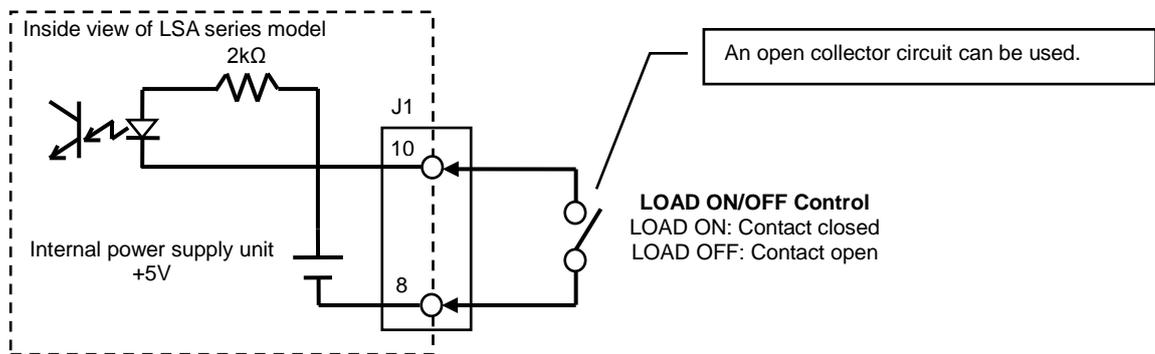
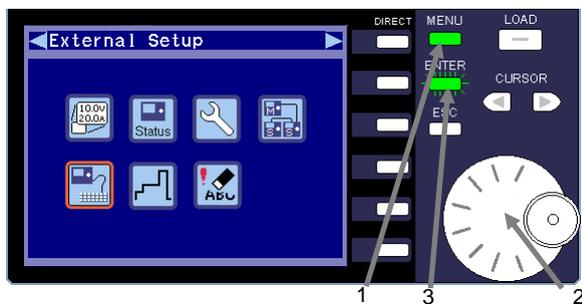


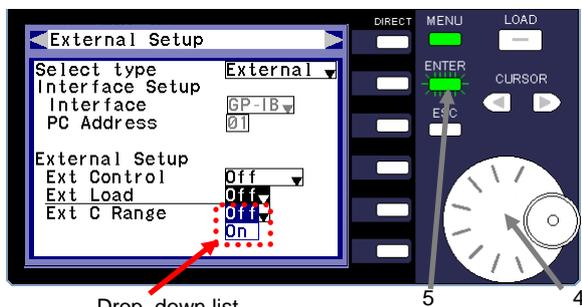
Fig. 5-18

(Procedure)

- 1 Press the MENU key while the unit is in LOAD OFF mode. The menu window is displayed.
- 2 Turn the rotary encoder and select the external setup icon.
- 3 Press the ENTER key.

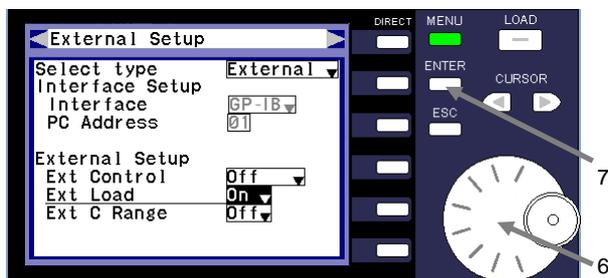


- 4 Turn the rotary encoder and select "Ext Load".
- 5 Press the ENTER key. A drop-down list is displayed.



Drop-down list

- 6 Turn the rotary encoder and select "On".
- 7 Press the ENTER key. The green flashing ENTER key light turns off and the external contact is specified.



- 8 Press the ESC key twice. The main window is displayed and indicates that the external contact LOAD ON/OFF has been specified.



External contact LOAD ON/OFF

5-3-11-6. C Range Control Via an External Contact Signal

An external contact signal can be used for C Range control.

However, when the unit is in LOAD ON mode, an external signal cannot be used for C Range control. An external contact signal can only be used for C Range control while the unit is in LOAD OFF mode.

Connect a contact or open collector circuit to the J1 connector on the back of the unit. The diagram below illustrates how to setup the connection.

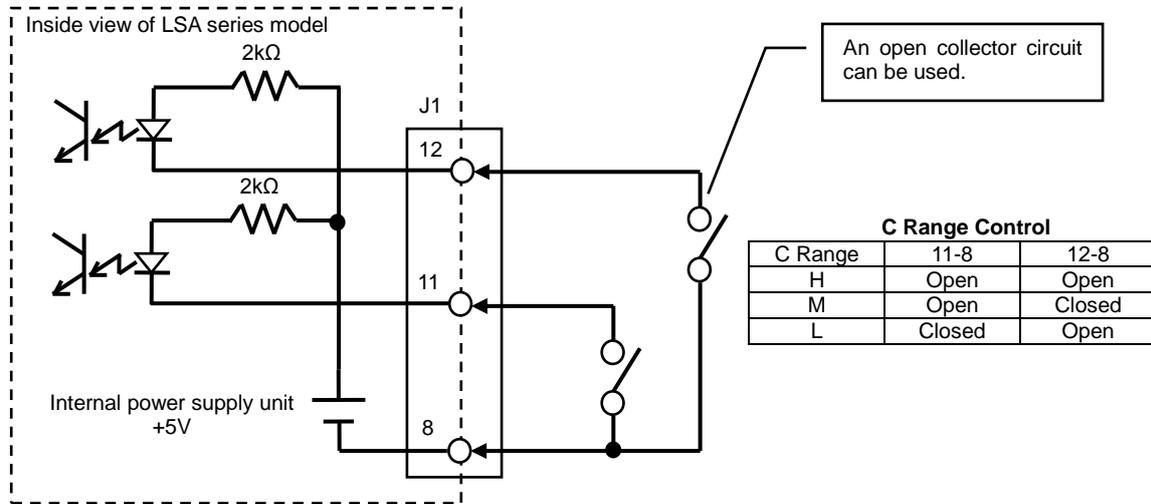
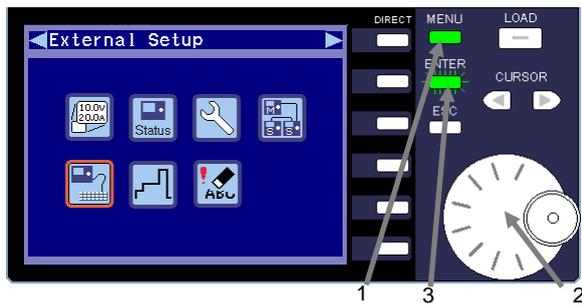


Fig. 5-19

(Procedure)

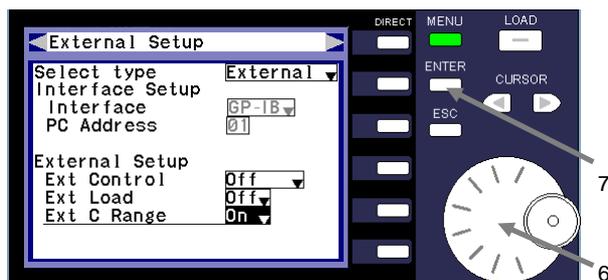


- 1 Press the MENU key while the unit is in LOAD OFF mode. The menu window is displayed.
- 2 Turn the rotary encoder and select the external setup icon.
- 3 Press the ENTER key.



- 4 Turn the rotary encoder and select "Ext C Range".
Select "External" for "Select type".
- 5 Press the ENTER key.
The ENTER key begins to flash green and a drop-down list is displayed.

"Off": C Range control via the front panel.
"On": C Range control via an external contact.



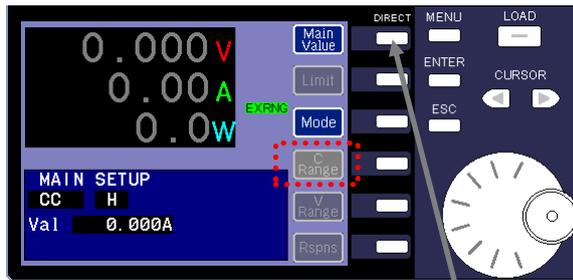
- 6 Turn the rotary encoder and select "On".
- 7 Press the ENTER key.
The green flashing ENTER key light turns off and C Range control via an external contact is specified.



External contact C Range 8

(Procedure)

- 8 Press the ESC key twice. The main window is displayed and indicates that C Range control via an external contact has been specified.



9

- 9 Press the "Main Setup" DIRECT key to display the MAIN SETUP window.

The "C Range" icon turns gray. In this state, you cannot use the panel to perform C Range control.

5-3-11-7. Switching Control Via an External Contact Signal

An external contact signal can also be used to switch the main value and sub value of the switching function.

If you select to use an external signal for switching control, the main value and sub value cannot be automatically switched from the front panel.

Connect a contact or open collector circuit to the J1 connector on the back of the unit. The diagram below illustrates how to setup the connection.

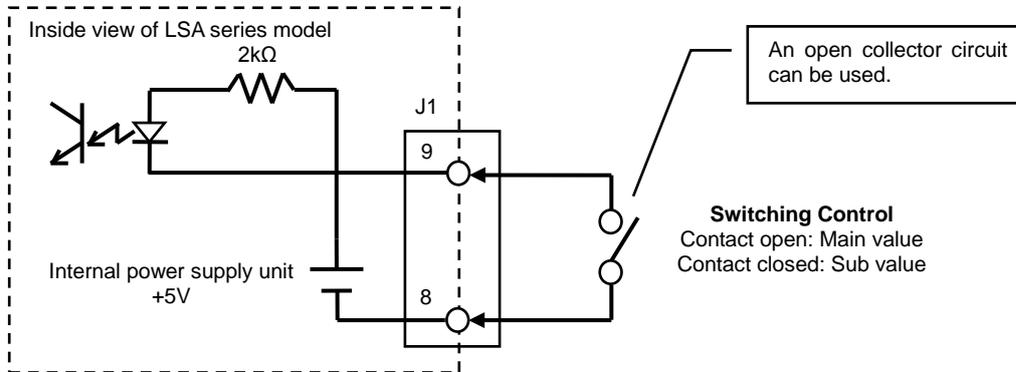
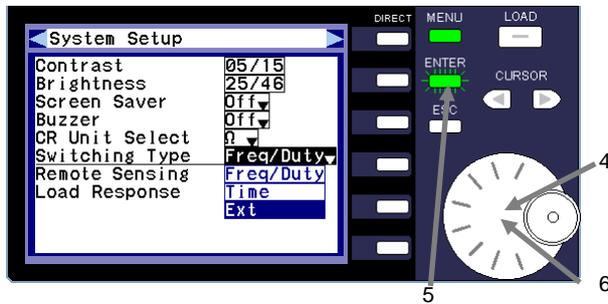
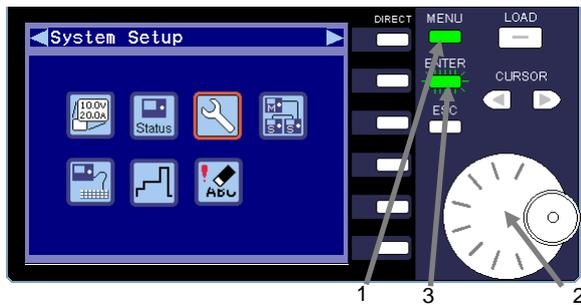


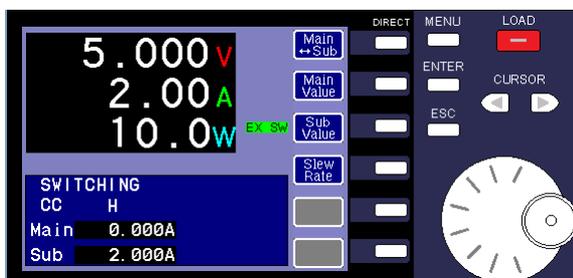
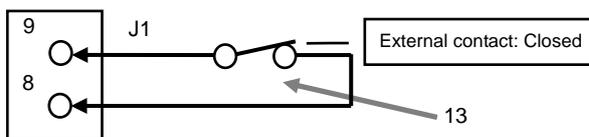
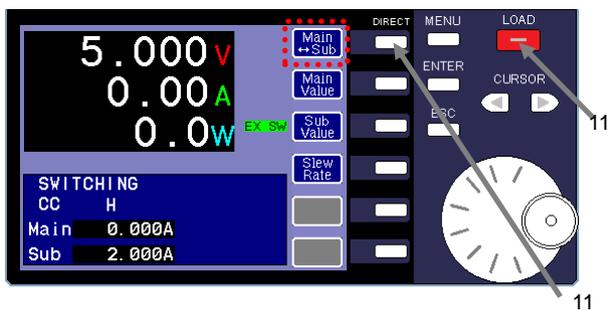
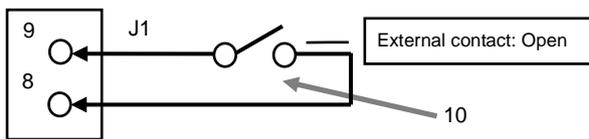
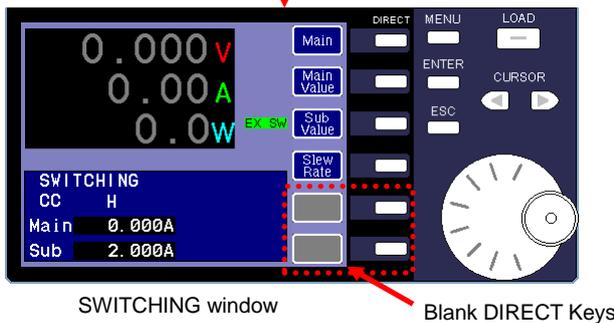
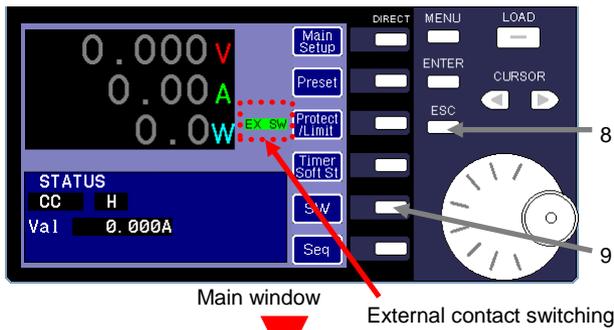
Fig. 5-20



(Procedure)

- 1 Press the MENU key while the unit is in LOAD OFF mode. The menu window is displayed.
- 2 Turn the rotary encoder and select the "System Setup" icon.
- 3 Press the ENTER key.
- 4 Turn the rotary encoder and select "Switching Type".
- 5 Press the ENTER key. A drop-down list is displayed.
- 6 Turn the rotary encoder and select "Ext".

Select "Freq/Duty" for the switching type "Frequency and Duty". For "Dual Time", select "Time", and for "External Signal", select "Ext".
- 7 Press the ENTER key.
The ENTER key light turns off and "Ext" is specified for "Switching Type".



(Procedure)

- 8 Press the ESC key twice to return to the main window.
The main window indicates that external contact switching has been specified.
- 9 Press the "SW" DIRECT key in the main window.
The SWITCHING window is displayed.

When switching via an external contact is specified for the unit, the switching types "Dual Time" and "Frequency and Duty" cannot be used.

In the figure on the left, the two DIRECT keys on the bottom are blank. "0.000A" is specified for the main value, and "2.000A" is specified for the sub value.

- 10 Open the external contact that is connected to the J1 connector between pins No. 9 and No. 8.
When performing switching, the value for "Main" value is specified as the value for the unit.

- 11 Press the DIRECT 1 key to display the "Main↔Sub" icon.
Each time you press the DIRECT 1 key, the icon changes. The icons change in the following order: "Main" → "Sub" → "Main↔Sub" → "Main".

- 12 Apply the voltage from the power supply source to the unit, and then press the LOAD key to switch the unit to LOAD ON mode.

The unit passes a level of current equal to the value specified for "Main" value" (0A).

- 13 Close the external contact that is connected to the J1 connector between pins No. 9 and No. 8.
When performing switching, the value for "Sub" value is specified as the value for the unit.

5-3-11-8. External Alarm Signal Input

An external contact signal can also be used to cause the unit to enter an alarm state, and to stop the unit after it is switched to LOAD OFF mode.

When the unit is in an alarm state, no operations can be performed. To operate the unit again, you must first cancel the alarm by powering off the unit and then turning it back on.

Connect a contact or open collector circuit to the J1 connector on the back of the unit. The diagram below illustrates how to setup the connection.

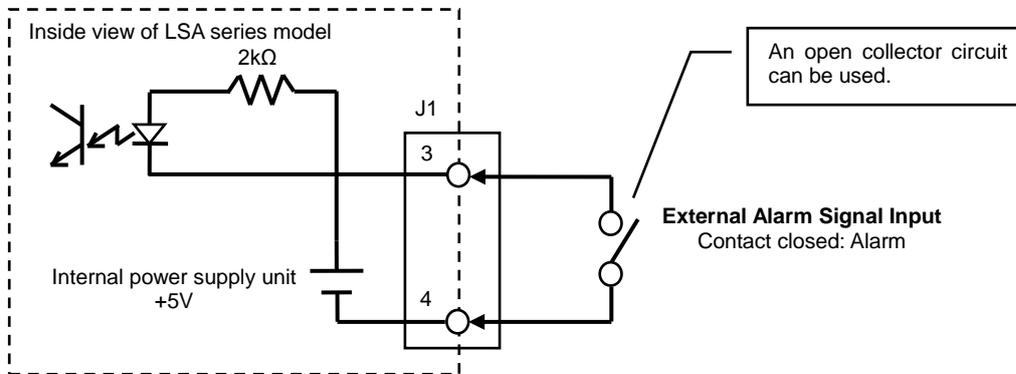
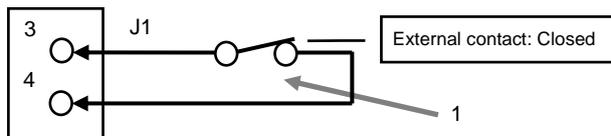


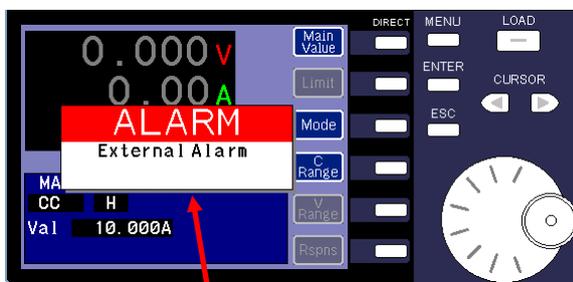
Fig. 5-21

(Procedure)

- 1 Close the external contact that is connected to the J1 connector between pins No. 3 and No. 4.

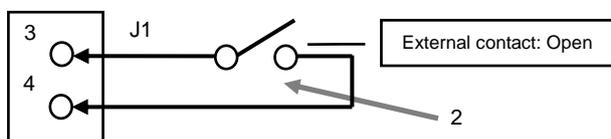


The unit switches to LOAD OFF mode and an alarm message is displayed.



Alarm message

- 2 Fix the problem that caused the alarm. After you fix the problem, open the external contact that is connected to the J1 connector between pins No. 3 and No. 4.



- 3 Press the power switch on the front panel to power off the unit, and then press the switch again to turn the unit back on.



5-3-11-9. External Trigger Signal Input

An external trigger signal can be used to cancel pause while the unit is in sequence operation.

Connect the signal transmitter to the J1 connector on the back of the unit. The diagram below illustrates how to setup the connection.

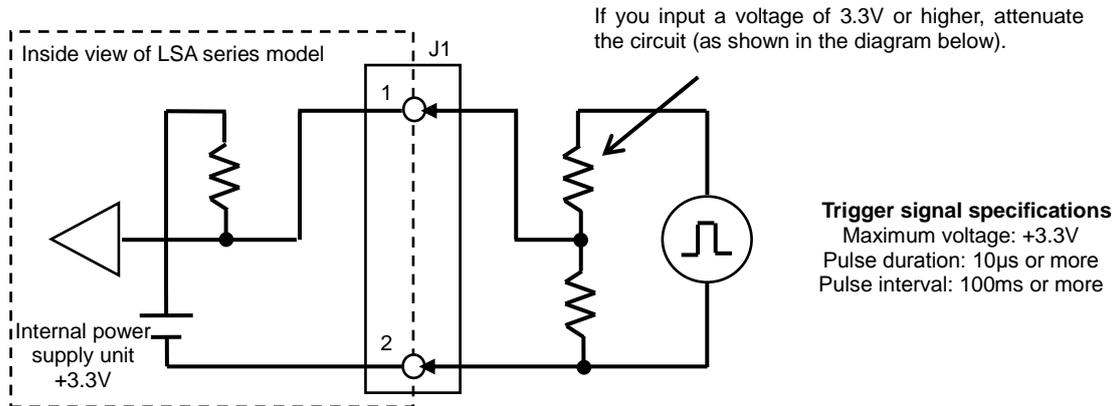


Fig. 5-22

5-3-11-10. Current Monitor Output

The value of the current running through the unit is output as voltage.

The output voltage is 0V for a rated current of 0%, and 10V for a rated current of 100% at each C range.

Connect a measuring instrument to the J2 connector on the back of the unit. The diagram below illustrates how to setup the connection.

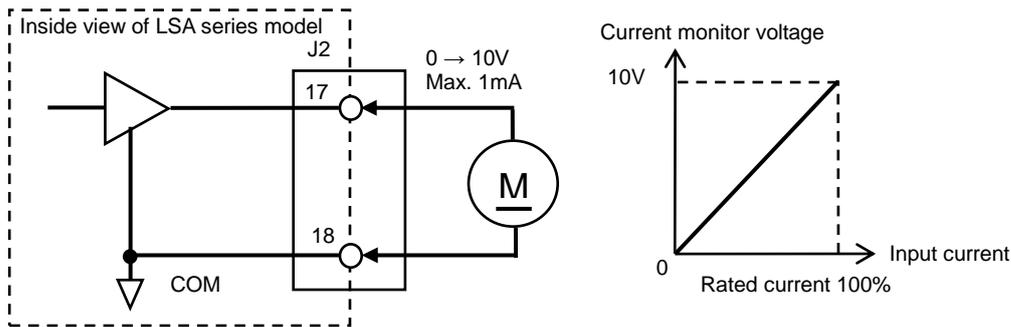


Fig. 5-23

* When you switch the unit on and off, the current monitor circuit becomes unstable. As a result, voltage might be generated by current monitor output.

5-3-11-11. LOAD ON/OFF Status Output

An open collector circuit can be used to output the LOAD ON/OFF status of the unit.

Connect a measuring instrument to the J2 connector on the back of the unit. The diagram below illustrates how to setup the connection.

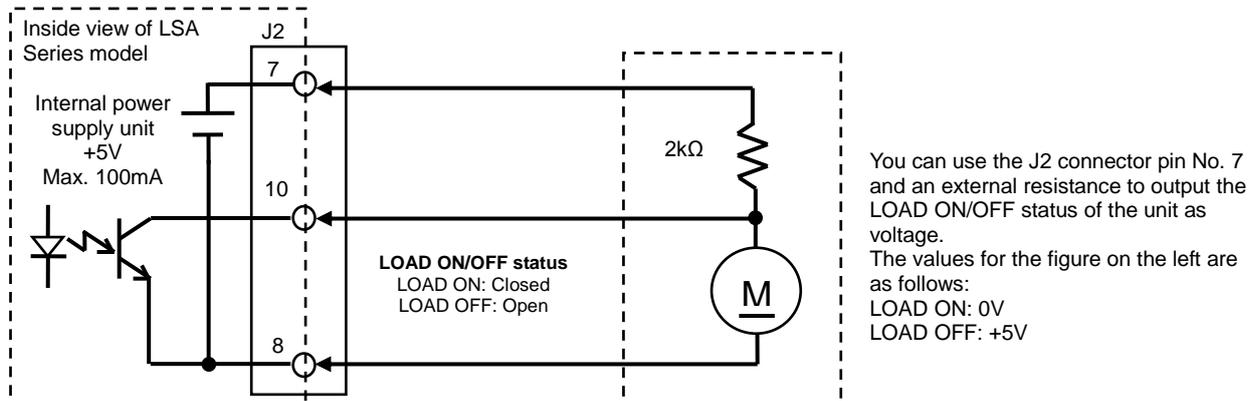
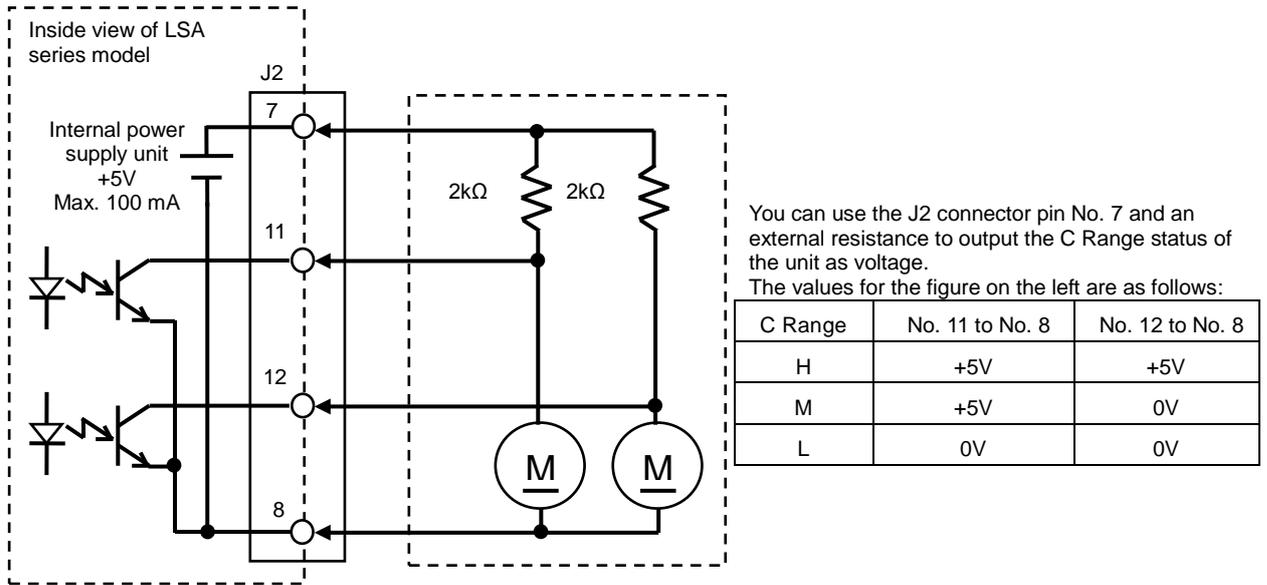


Fig. 5-24

5-3-11-12. C Range Status Output

An open collector circuit can also be used to output the C Range status.

Connect a measuring instrument to the J2 connector on the back of the unit. The diagram below illustrates how to setup the connection.



LOAD ON/OFF status output

C Range	No.11 to No.8	No.12 to No.8
H	Open	Open
M	Open	Closed
L	Closed	Closed

Fig. 5-25

5-3-11-13. Switching Function Output Value Status Output

A logic signal can be used to output the output value status of the switching function.

Connect a measuring instrument to the J2 connector on the back of the unit. The diagram below illustrates how to setup the connection.

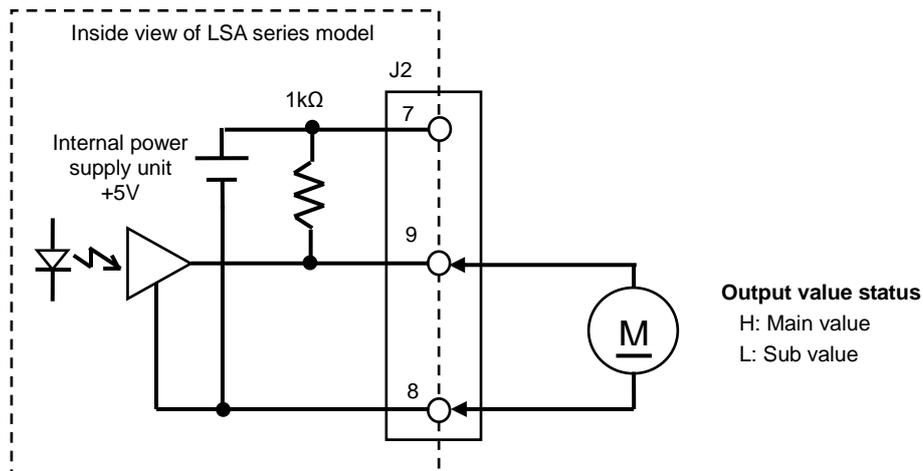


Fig. 5-26

5-3-11-14. Alarm Status Output

The alarm status can be output by the unit.

Connect a measuring instrument to the J2 connector on the back of the unit. The diagram below illustrates how to setup the connection.

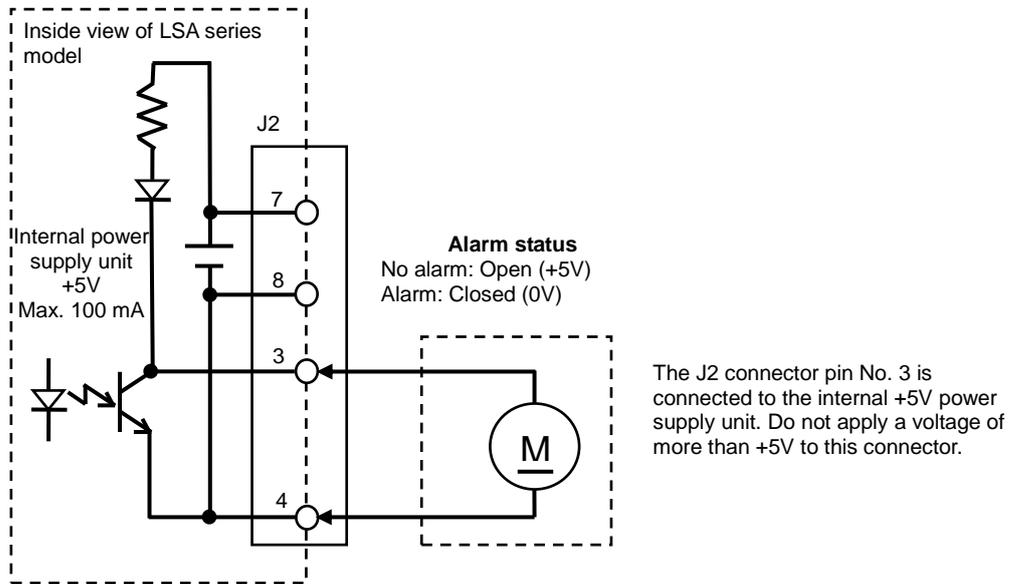


Fig. 5-27

5-3-11-15. Trigger Signal Output

Trigger signals are output by the unit during the following operations:

- Switching operation: When switching the main value and sub value.
- Sequence operation: When executing a step for which trigger signal output is set to ON.

Connect a measuring instrument to the J2 connector on the back of the unit. The diagram below illustrates how to setup the connection.

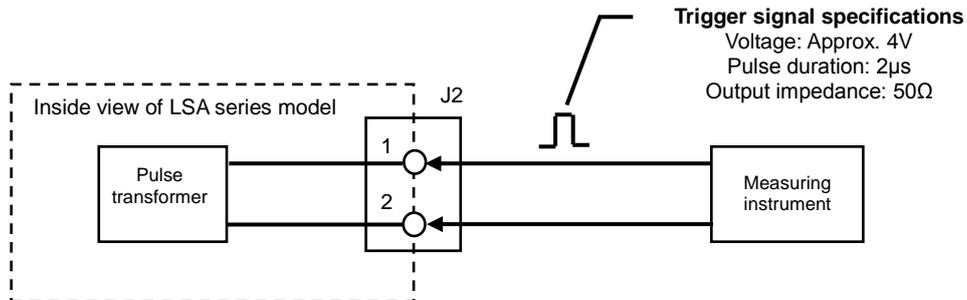


Fig. 5-28

5-3-12. Menu Window Operations

The settings for non-function related items can be specified in the menu window. To display this window, press the MENU key.

The following section describes the full screen monitor, status display, system settings, and data initialization.

For details about the master/slave settings, external control settings, and sequence configuration, see "5-2-2. Using the Menu Icons to Specify the Function Settings".

5-3-12-1. Full Screen Monitor

The voltage, current, and power values can be displayed in full screen mode. This makes it easier to confirm the values from a distance.

When the voltage, current, and power values are displayed in full screen mode, the only operation that can be performed is switching the unit to LOAD OFF mode. The unit cannot be switched to LOAD ON mode, and the set values cannot be modified.

(Procedure)

- 1 Press the LOAD key to switch the unit to LOAD ON mode.

In the figure on the left, a voltage of 5V is applied and a current of 10A runs through the unit.

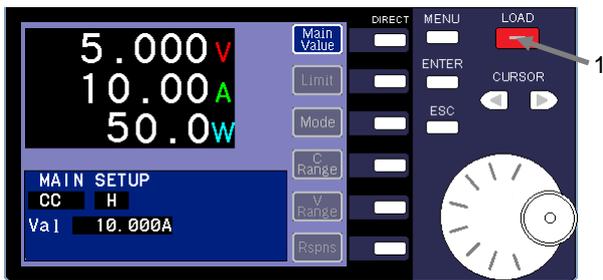
- 2 Press the MENU key to display the menu window.

- 3 Turn the rotary encoder and select "Full Screen Monitor".

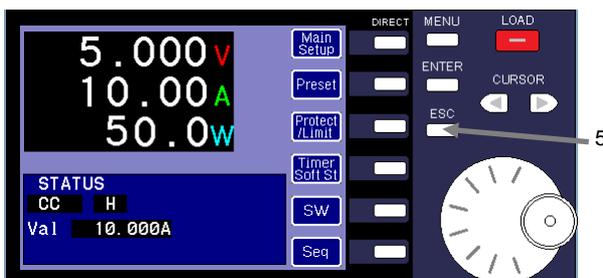
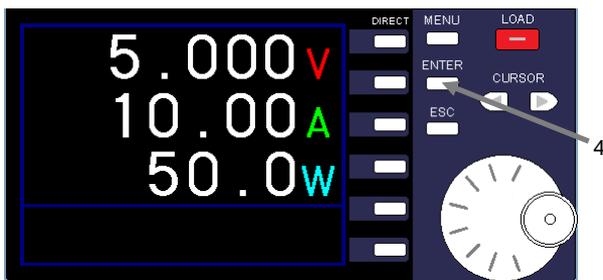
- 4 Press the ENTER key to display the voltage, current, and power values in full screen mode.

When the values are displayed in full screen mode, the only operation that can be performed is switching the unit to LOAD OFF mode.

- 5 Press the ESC key twice to display the main window for performing other operations.



Menu window



5-3-12-2. Status Display

The Status window allows you to confirm the current settings of the unit. The status can be displayed even in LOAD ON mode.

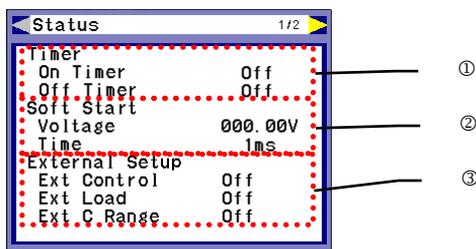


Menu window

(Procedure)

- 1 Select the "Status" icon in the menu window.
Press the green flashing ENTER key. The Status window is displayed.
- 2 The Status window has 2 pages. These pages display the current settings of the unit.
Press the CURSOR keys to change the page.

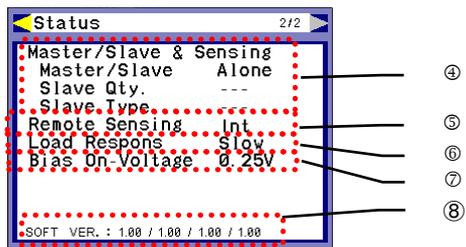
Status window 1/2



The following items are displayed:

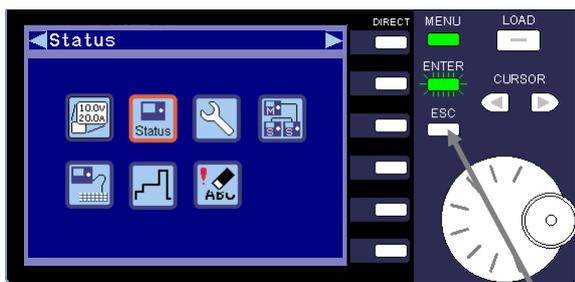
- ①: Load timer setting
- ②: Soft start setting
- ③: External control setting

Status window 2/2



The following items are displayed on the second page.

- ④ Master unit setting for master/slave operation
- ⑤ Sensing point setting for remote sensing function
- ⑥ Current response setting for the internal reference signal of the unit
- ⑦ Power supply movement voltage setting contents for 0V (LSA-165V1 only)
- ⑧ Software version of the unit



Menu window

- 3 Press the ESC key to close the Status window.
The menu window is displayed.

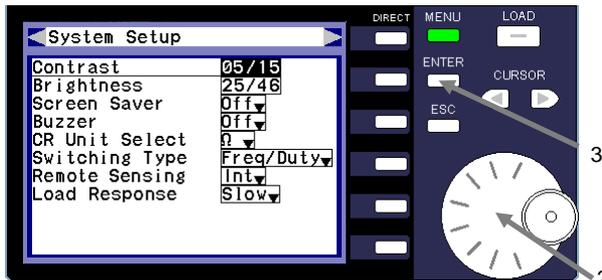
5-3-12-3. System Setup

The System Setup window allows you to specify the display window settings, buzzer setting, CR mode display unit, remote sensing setting, and current response setting.

(Procedure)

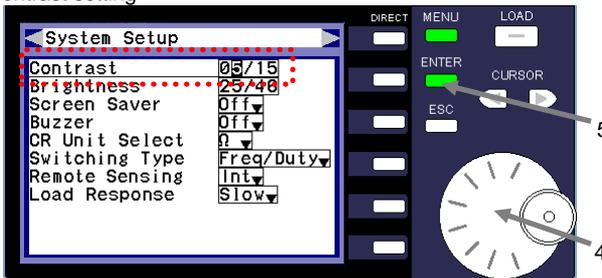


Menu window

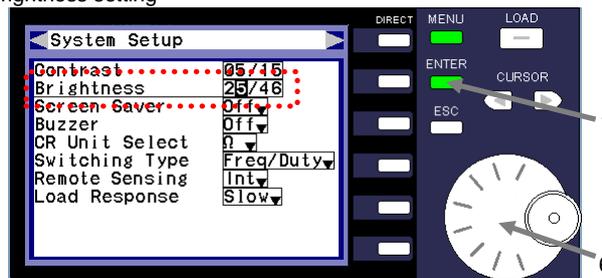


System Setup window

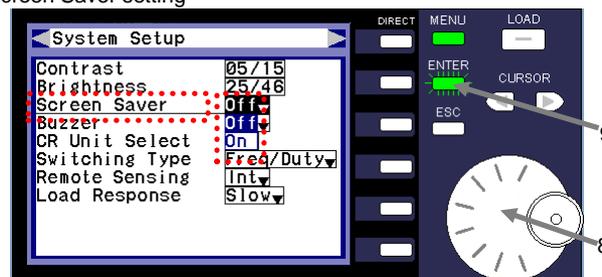
Contrast setting



Brightness setting



Screen Saver setting



- 1 Select the "System Setup" icon in the menu window.

Press the green flashing ENTER key. The System Setup window is displayed.

- 2 Use the rotary encoder to select the parameter in the System Setup window you want to change.

The name of the selected parameter is underlined, and the numbers or words are highlighted in black.

- 3 After you select a parameter, press the ENTER key. You can now enter the parameter value.

- 4 Specify the LCD contrast.

Turn the rotary encoder to change the value and specify the contrast.

- 5 Press the ENTER key to set the contrast you specified.

- 6 Specify the LCD brightness.

Turn the rotary encoder to change the value and specify the brightness.

- 7 Press the ENTER key to set the brightness you specified.

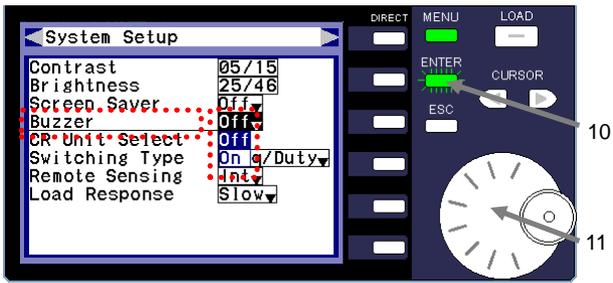
- 8 Specify the ON/OFF setting of the screen saver.

Turn the rotary encoder and select "Off" or "On" from the drop-down list.

- 9 Press the ENTER key to set the setting you specified.

(Procedure)

Buzzer setting



10 Specify the ON/OFF setting of the buzzer.
Turn the rotary encoder and select "Off" or "On" from the drop-down list.

11 Press the ENTER key to set the setting you specified.

CR Unit Select setting



12 Specify the display unit of the resistance in CR mode.
Turn the rotary encoder and select "Ω" or "S" from the drop-down list.

13 Press the ENTER key to set the display unit setting you specified.

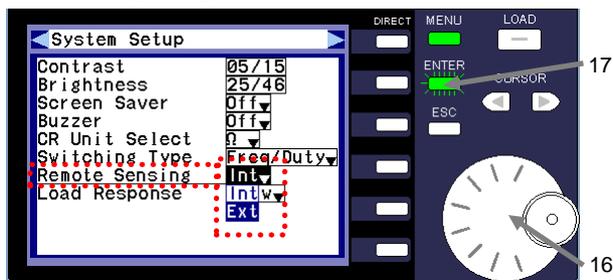
Switching Type setting



14 Specify the switching type used by the switching function.
Turn the rotary encoder and select "Freq/Duty", "Time", or "Ext" from the drop-down list.

15 Press the ENTER key to set the switching type you specified.

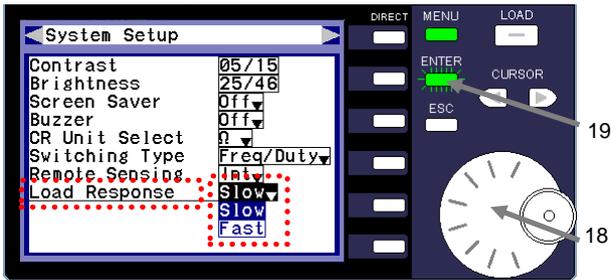
Remote Sensing setting



16 Specify the voltage sensing point used by the voltage remote sensing function.
Turn the rotary encoder and select "Int" or "Ext" from the drop-down list.

17 Press the ENTER key to set the sensing point you specified.

Load Response setting



(Procedure)

- 18 Specify the load response for the unit.
Turn the rotary encoder and select "Slow" or "Fast" from the drop-down list.

When you use the switching function, external voltage/resistance control, or sequence function, "Load Response" is fixed at "Fast". You cannot select "Slow" when you use these functions.
- 19 Press the ENTER key to set the load response you specified.
- 20 Press the ESC key to close the System Setup window.
The main window is displayed.

5-3-12-4. Data Initialization

The Initialize window is used to initialize the settings data (restore the default settings).

There are three types of initialization: all data (All data clear), all data other than sequence data (Set&Preset data clear), and sequence data (Sequence data clear).

(Procedure)

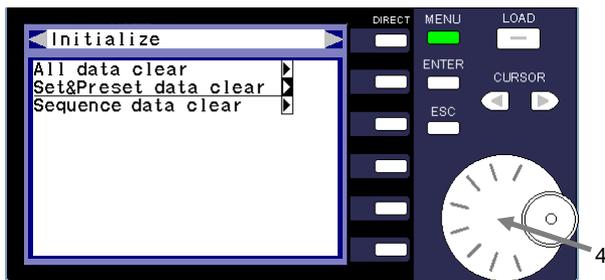


1 Press the MENU key while the unit is in LOAD OFF mode to display the menu window.



2 Turn the rotary encoder and select the "Initialize" icon.

3 Press the ENTER key to display the Initialize window.

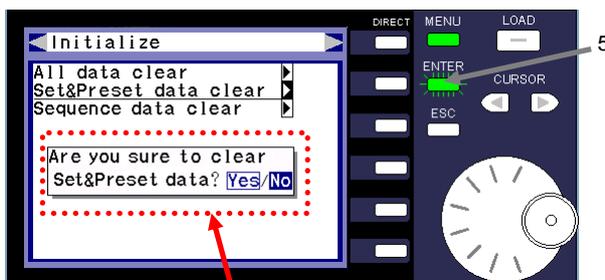


4 Turn the rotary encoder and select the type of initialization.

"All data clear": Delete all data.

"Set&Preset data clear": Delete all data other than sequence data.

"Sequence data clear": Delete sequence data.



5 After you select the type of initialization, press the ENTER key.

The ENTER key begins to flash green. A confirmation message asking whether you want to initialize the data is displayed.

"Set&Preset data clear" is selected in the figure on the left.

Confirmation message



6 Turn the rotary encoder and select "Yes" in the confirmation message.



(Procedure)

- 7 Press the ENTER key. The initialization you specified in operation 6 is performed.

The main window is displayed a few seconds after you clear the data.



5-3-13. Function of the 0V electric discharge (LSA-165V1 model)

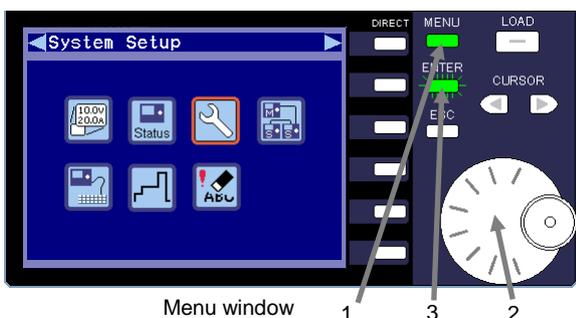
It is equipped with switching power supply (power supply for 0V) in the main body of LSA-165V1, and a rating electric current comes to be able to draw in a remote sensing terminal interval at 0V. At the time of factory shipment and after initialization, the power supply for 0V is set to on of the 0.25V movement setting.

When set 0.25V at "Bias On-voltage" setting of MENU, the power supply for 0V will work when input voltage is 0.25V or more even if you turn LOAD ON when the machine's discharge terminals are open.

It is an immediately power supply for 0V turns ON when you turn LOAD ON at 0V with the setting voltage of the power supply for 0V in an opening state with a load terminal. And a negative voltage should be measured under the influence of a power supply for 0V. Reverser connection alarm occurs.

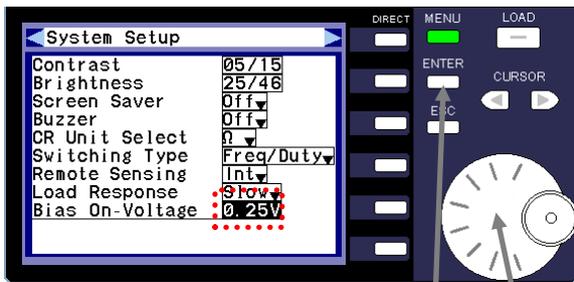
The setting of the power supply for 0V are in MENU → System Setup → Bias On-Voltage. You can set "OFF", "0.00V" for normaly LOAD ON. You can set from "0.05V" to "1.5V" for start voltage with 0.05V unit.

The set range of each electric discharge mode is the same as LSA-165.



(Procedure)

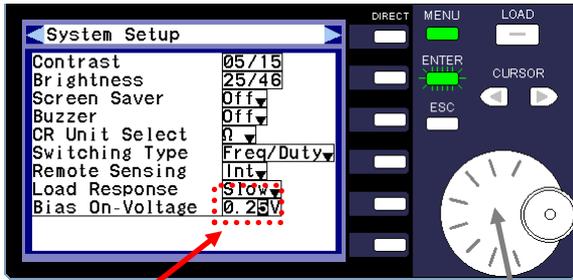
- 1 When the unit is in LOAD OFF mode, press the MENU key then the MENU key light turns on and the ENTER key becomes the blinking. The MENU screen appears.
- 2 Operate a rotary encoder and choose "System Setup" icon.
- 3 Press the Enter key. It becomes the System Setup screen.



SystemSetup window

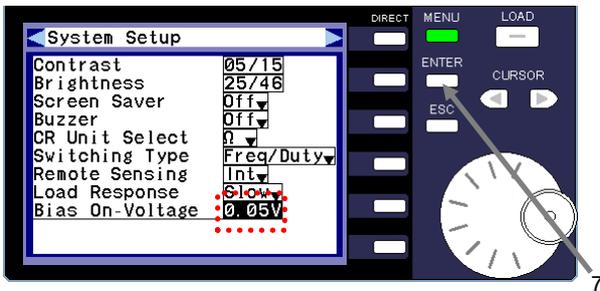
4 Operate a rotary encoder with System Setup screen, Please choose "Bias On-Voltage".System Setu

5 Press the Enter key
ENTER key turns on a green point and the "Bias On-Voltage" part is in a condition that input is possible.

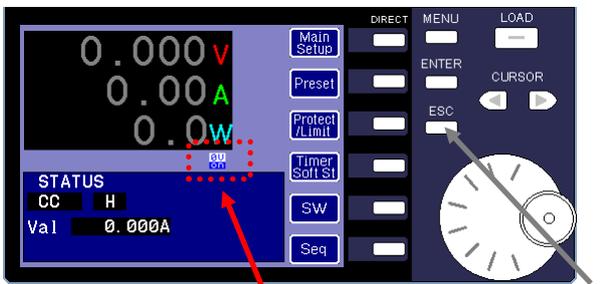


Value ready to be entered

6 Please make voltage reading desired while changing a value with a rotary encoder.



7 Press the Enter key
It becomes 0.05V in the left-hand figure.



0V icon

8 Press two times of ESC keys. This unit becomes "the main screen"

The icon of "0V on" is displayed when "Bias On-Voltage" is NOT set "OFF".

"0V on" icon refers to "power supply for 0V" is valid. This icon will be displayed at LOAD OFF.

5-4. Sequence Function

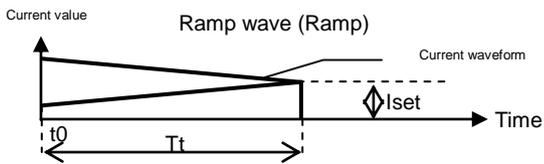
The sequence function allows you to automatically execute sequence waveforms and sequence programs that are registered in advance.

5-4-1. Overview of Sequence Waveforms

Sequence waveforms are registered and executed in CC mode. The sequence waveform settings cannot be specified in any other operation mode.

There are six types of waveforms, which are described below. A sequence waveform can be used as one of the steps of a sequence program.

Sequence waveforms

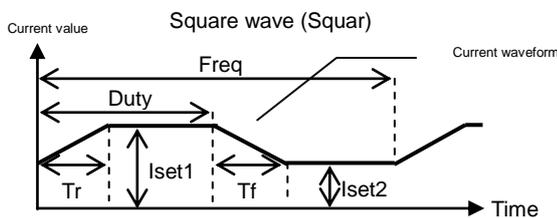


Description

A ramp wave is used to specify the set current (I_{set}) and the time at which the set current is reached (T_t).

A time of " t_0 " indicates that there is no previous step. Thus, "0A" is specified as the current.

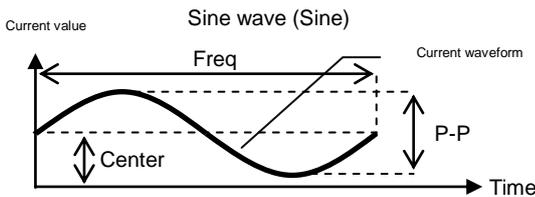
Ramp waves can only be executed one time. They cannot be executed continuously.



A square wave is used to specify the frequency ($Freq$), duty ratio ($Duty$), current 1 (I_{set1}), current 2 (I_{set2}), the time at which the current is changed from I_{set2} to I_{set1} (T_r), and time at which the current is changed from I_{set1} to I_{set2} (T_f).

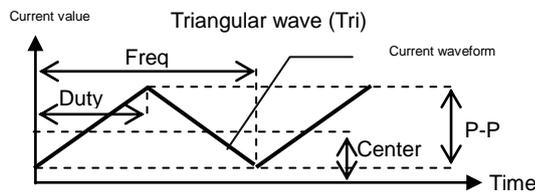
Square waves can be executed continuously. It can be executed infinitely or a specified number of times (1 to 9999 times).

The specified time for T_r and T_f is the same.



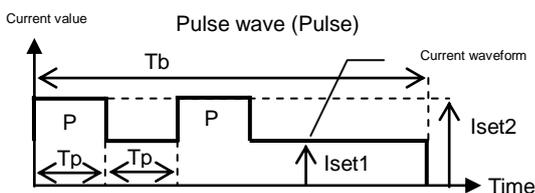
A sine wave is used to specify the frequency ($Freq$), center current ($Center$), and maximum/minimum current width ($P-P$).

Sine waves can be executed continuously. It can be executed infinitely or a specified number of times (1 to 9999 times).



A triangular wave is used to specify the frequency ($Freq$), duty ratio ($Duty$), center current ($Center$), and maximum/minimum current width ($P-P$).

Triangular waves can be executed continuously. It can be executed infinitely or a specified number of times (1 to 9999 times).

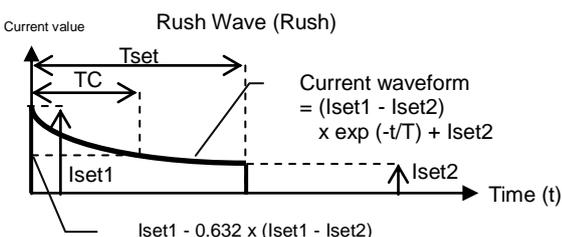


A pulse wave is used to specify the pulse wave time (T_p), pulse wave time (T_b), pulse current (I_{set1} and I_{set2}), and number of pulses (P).

A pulse wave can be executed continuously. It can be executed infinitely or a specified number of times (1 to 9999 times).

When T_p is short, the current waveform resembles a triangular wave and does not form a pulse waveform. This is due to characteristics of the unit at start up and the influence of the L factor (inductance) of the load cable.

When using pulse waveforms, make sure to take the T_p value and operation environment into consideration.



A rush wave is used to specify the current ripple (I_{set}), current convergence value (I_{set2}), current convergence time (T_{set}), and the time at which the current reaches $I_{set1} - 0.632 \times (I_{set1} - I_{set2})$ (TC).

Rush waves can only be executed one time. They cannot be executed continuously.

When TC is small, the current does not reach I_{set1} . This is due to characteristics of the unit at start up and the influence of the L factor (inductance) of the load cable.

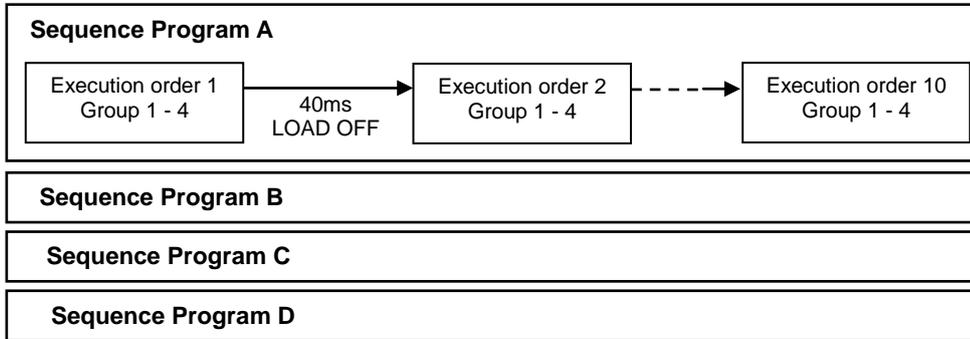
When you specify I_{set1} , make sure to measure the actual waveform.

5-4-2. Overview of Sequence Programs

A total of four sequence programs (A to D) can be specified on the unit. A sequence program is arranged in a series of 10 execution orders, each of which contains four sequence groups (1 to 4). When a sequence program is run, the sequence groups are executed in the specified order.

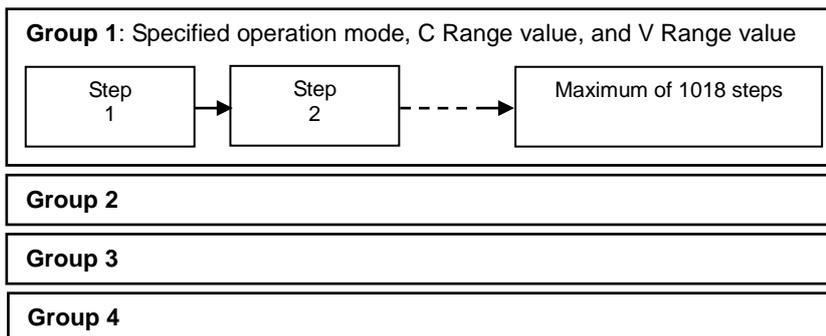
When a sequence group is finished executing, the unit enters LOAD OFF mode for approximately 40ms before it begins to execute the next sequence group.

The same four sequence groups can be used in each of the sequence programs specified on the unit. However, four unique groups cannot be specified for each sequence program.

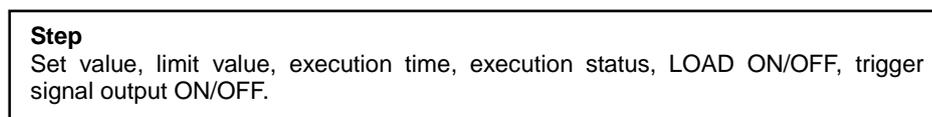


A total of four sequence groups (1 to 4) can be specified for an execution order. When you execute a group, you can freely specify the operation mode, C Range value, and V Range value.

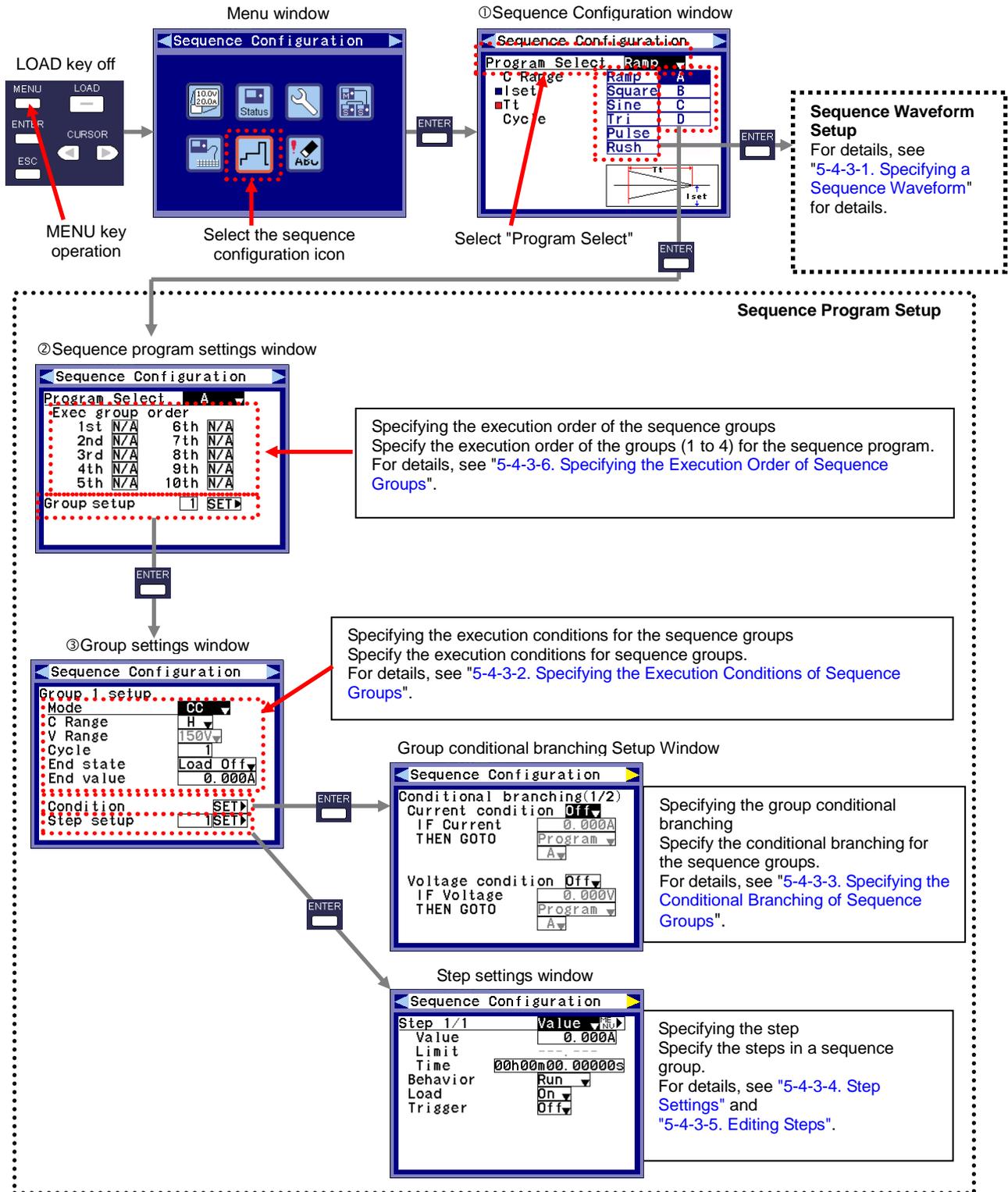
Each sequence group (1 to 4) can execute a maximum of 1018 steps in order.



The following items can be specified for a single step.



5-4-3. Overview of Specifying Sequence Waveforms and Sequence Programs



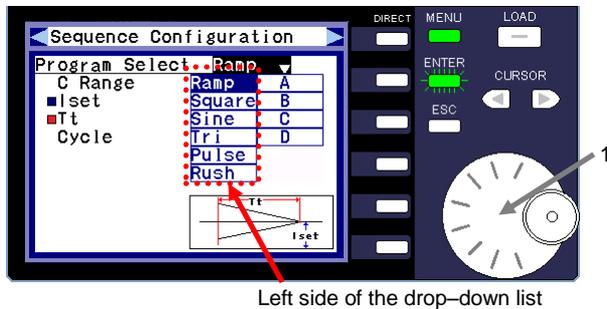
5-4-3-1. Specifying a Sequence Waveform

The explanation provided in this section begins with operation ① in "5-4-3. Overview of Specifying Sequence Waveforms and Sequence Programs".

For details about the preceding operations, see section "5-4-3. Overview of Specifying Sequence Waveforms and Sequence Programs".

(Procedure)

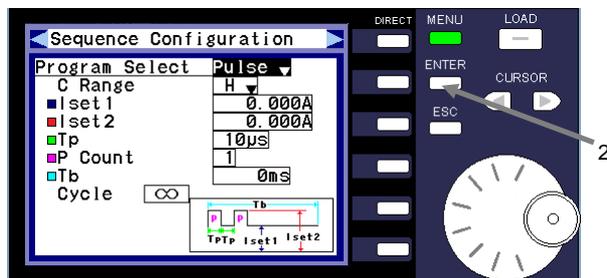
- 1 Turn the rotary encoder and select the sequence waveform you want to specify from the left column of the drop-down list.



- 2 After you select a sequence waveform, press the ENTER key.

The green flashing ENTER key light turns off and the sequence waveform is specified.

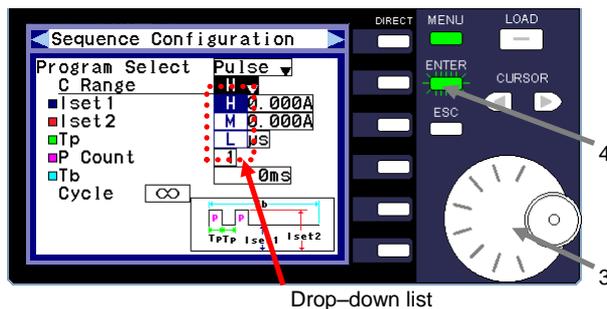
"Pulse" is selected and established in the figure on the left.



- 3 Turn the rotary encoder and move the cursor to "C Range".

- 4 Press the ENTER key.

A drop-down list of items is displayed. You can now specify the "C Range" value.

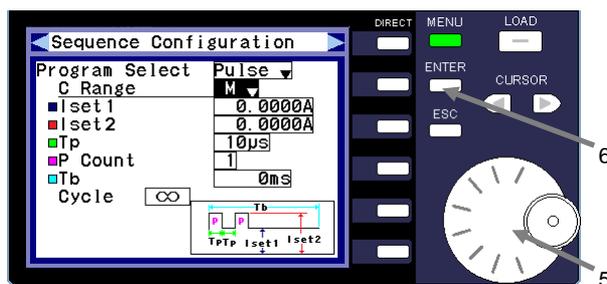


- 5 Turn the rotary encoder and specify the "C Range" value.

- 6 Press the ENTER key.

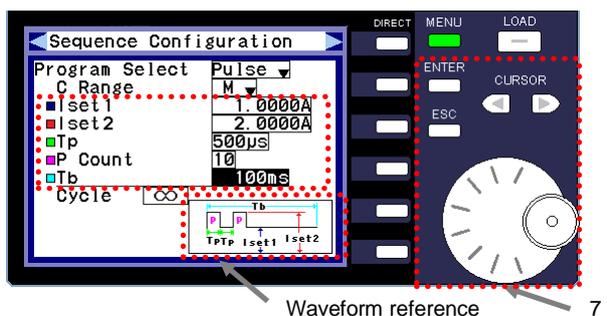
The green flashing ENTER key light turns off and the current is specified.

"M" is selected for the "C Range" value in the figure on the left.

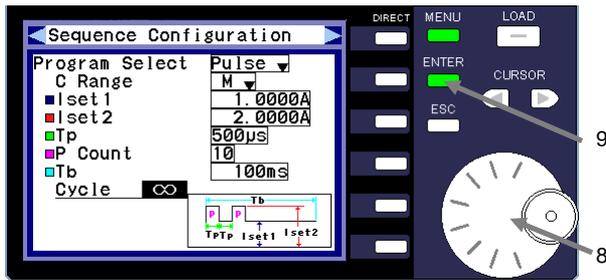


- 7 Check the diagram displayed in the lower-right corner of the screen. Next, specify the parameters that are listed between "C Range" and "Cycle".

Use the rotary encoder, ENTER key, and CURSOR keys to specify the parameters.

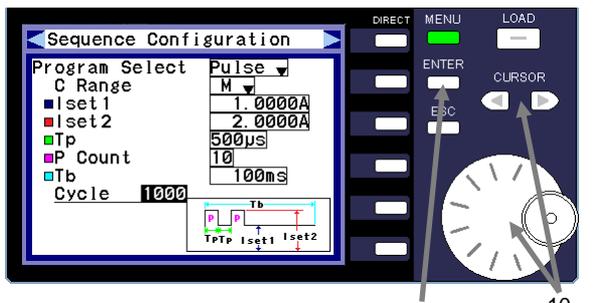


In the figure on the left, "1.0000A" is specified for "I set 1", "2.0000A" for "I set 2", "500µs" for "Tp", "10" for "P Count", and "100ms" for "Tb".



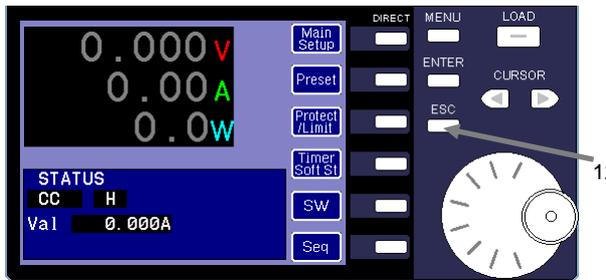
(Procedure)

- 8 Turn the rotary encoder and move the cursor to "Cycle".
- 9 Press the ENTER key.
The ENTER key lights up in green. You can now change the "Cycle" value.



- 10 Use the rotary encoder to change the "Cycle" value.
To change the input digits, use the CURSOR keys.
The "Cycle" value changes in the following order: "∞ (Infinite) ↔ 1 ↔ 2 ... 9998 ↔ 9999".

- 11 Press the ENTER key.
The ENTER key light turns off and the "Cycle" value is specified.
In the figure on the left, "1000" is specified as the "Cycle" value.



Main window

- 12 Press the ESC key twice.
The sequence settings are specified, and the main window is displayed.

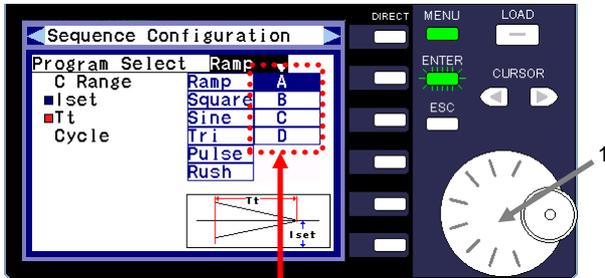
5-4-3-2. Specifying the Execution Conditions of Sequence Groups

The explanation provided in this section begins with operation ① in "5-4-3. Overview of Specifying Sequence Waveforms and Sequence Programs".

For details about the preceding operations, see section "5-4-3. Overview of Specifying Sequence Waveforms and Sequence Programs".

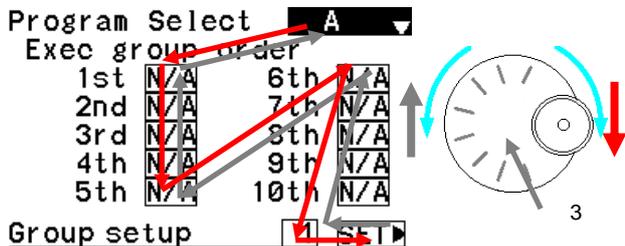
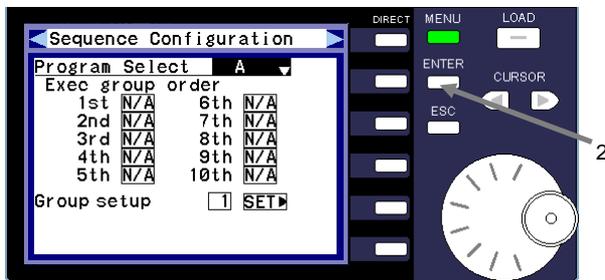
(Procedure)

- 1 Turn the rotary encoder and select the sequence program you want to specify from the right column of the drop-down list.



Right side of the drop-down list

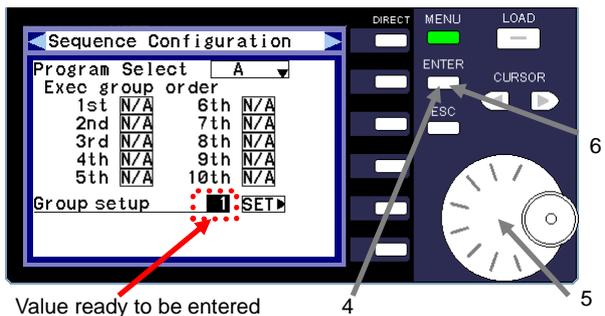
- 2 After you select a sequence program, press the ENTER key. The green flashing ENTER key light turns off and the sequence program is specified. "Sequence Program A" is selected and specified in the figure on the left. You can specify sequence groups and steps in any sequence program (A to D) you select.



- 3 Turn the rotary encoder and move the cursor to "Group setup".

Turn the rotary encoder clockwise to move the cursor in the red-arrow direction, and counter-clockwise to move the cursor in the gray-arrow direction.

- 4 Press the ENTER key. The ENTER key lights up in green. You can now enter the "Group setup" value.

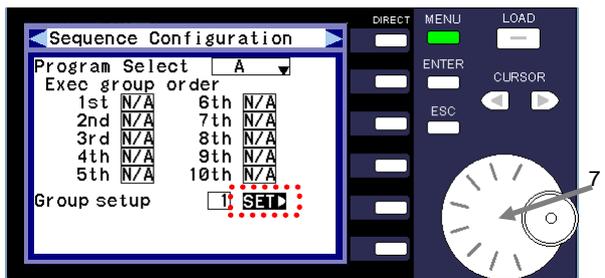


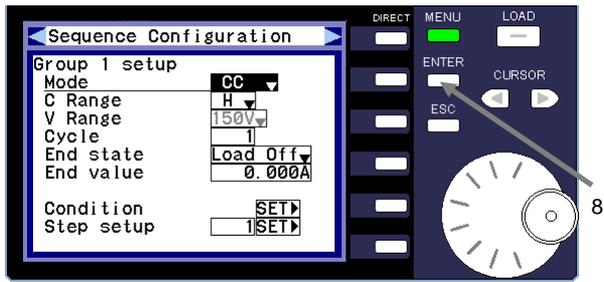
Value ready to be entered

- 5 Use the rotary encoder to select a group (1 to 4).

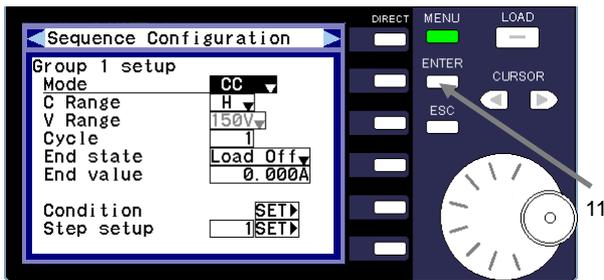
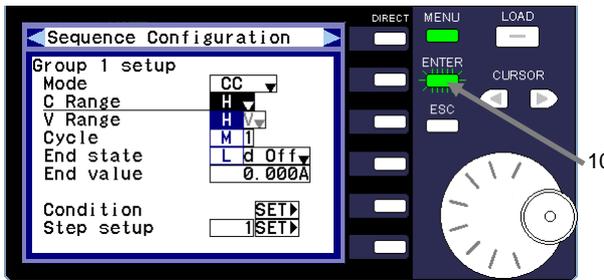
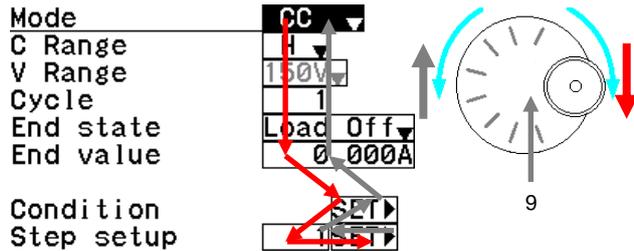
- 6 Press the ENTER key. The ENTER key light turns off and the group is specified. In the figure on the left "1" is selected for "Group setup".

- 7 Turn the rotary encoder and move the cursor to "SET" of "Group setup". "SET" is highlighted in black.





Group settings window



(Procedure)

- 8 Press the ENTER key.
The group settings window is displayed.

- 9 Turn the rotary encoder and move the cursor to the parameter you want to change.

Turn the rotary encoder clockwise to move the cursor in the red-arrow direction, and counter-clockwise to move the cursor in the gray-arrow direction.

- 10 After you select a parameter, press the ENTER key.
You can now enter the selected parameter value. Use the rotary encoder and CURSOR keys to specify the value.
Mode: Selects the operation mode.
C Range: Selects current range.
V Range: Voltage range can be specified in CV+CC mode and CV+CR mode.
Cycle: Specifies the number of execution cycles for the selected group.
End state: Specifies whether the unit enters LOAD ON or LOAD OFF mode when the selected group is finished executing.
End value: Specifies the value for when the selected group is finished executing.

- 11 Press the ENTER key.
The ENTER key light turns off and the parameters are specified.

5-4-3-3. Specifying the Conditional Branching of Sequence Groups

You can specify the current, voltage, or sequence group execution time as conditions for performing the following branching operations: switching and executing a different sequence program or sequence group, pausing sequence execution, or canceling sequence execution.

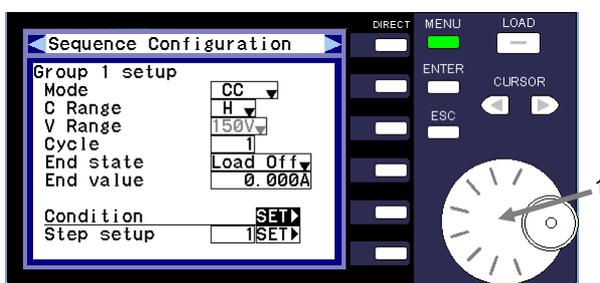
If current is specified as the condition, branching is performed when the current running through the unit crosses the specified value.

If voltage is specified as the condition, branching is performed when the voltage applied to the unit crosses the specified value.

If the execution time is specified as the condition, branching is performed when the execution time of sequence program exceeds the specified time.

The explanation provided in this section begins with operation ③ in "5-4-3. Overview of Specifying Sequence Waveforms and Sequence Programs".

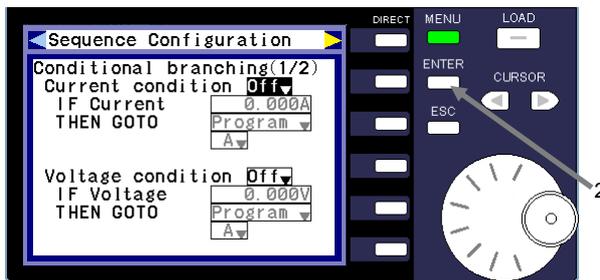
For details about the preceding operations, see section "5-4-3. Overview of Specifying Sequence Waveforms and Sequence Programs".



Sequence group settings window

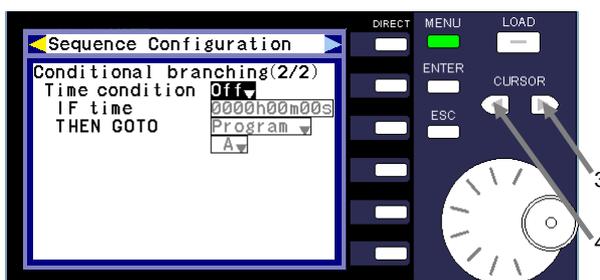
(Procedure)

- 1 Turn the rotary encoder and move the cursor to "Condition" in the sequence group settings window.



Conditional branching settings window (1/2)

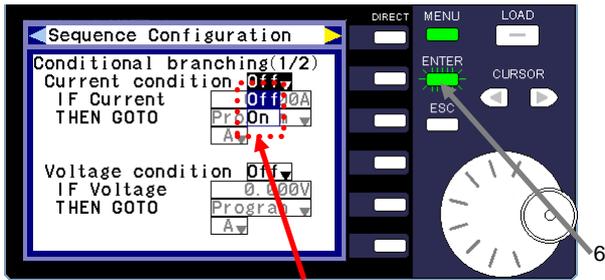
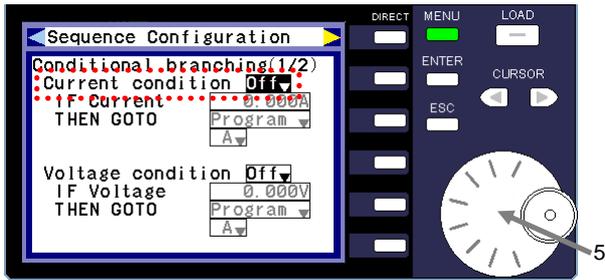
- 2 Press the ENTER key.
The first page of the conditional branching settings window (1/2) is displayed.
This page allows you to specify the current and voltage as conditions for branching.



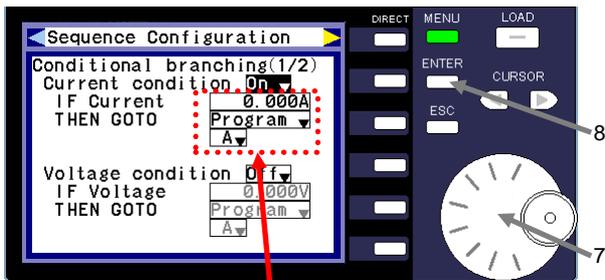
Conditional branching settings window (2/2)

- 3 Press the right CURSOR key to go to the second page of the conditional branching settings window (2/2).
This page allows you to specify the execution time as a condition for branching.
- 4 Press the left CURSOR key to go back to the first page of the conditional branching settings window (1/2).

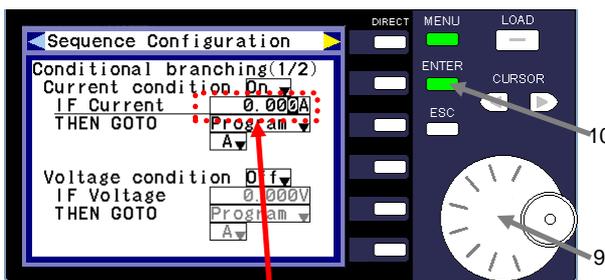
Specifying the branching condition



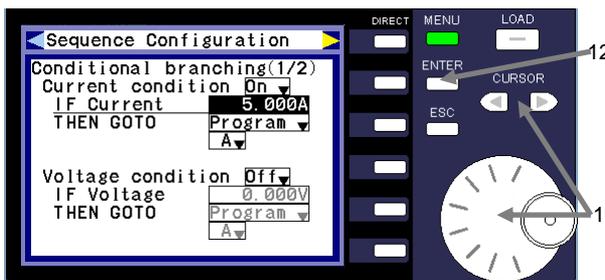
Drop-down list



Values that can be set



Value ready to be entered



(Procedure)

- Turn the rotary encoder and move the cursor to the parameter for which you want to enable conditional branching.
When you move the cursor to "Current condition", "Voltage condition", or "Time condition", the selected item is highlighted in black.
"Current condition" is selected in the figure on the left.

- Press the ENTER key.
The ENTER key begins to flash green, and a drop-down list containing the items "On" and "Off" is displayed.

- Turn the rotary encoder and select "On" to enable conditional branching.

- Press the ENTER key.
The ENTER key light turns off and "On" is specified conditional branching.
After conditional branching is enabled, the branching condition and "THEN GOTO" switch from gray to black. You can now specify the values for these items.

In the figure on the left, "On" is specified for "Current condition".

To specify the values for "Voltage condition" and "Time condition", perform the same procedure.

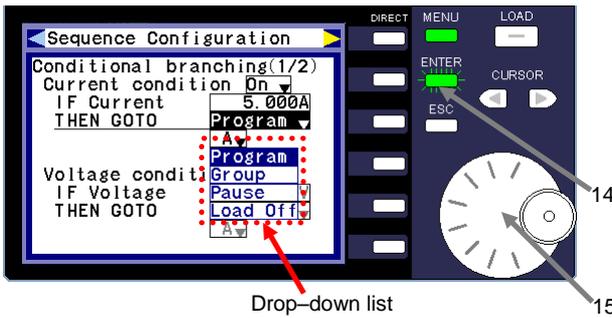
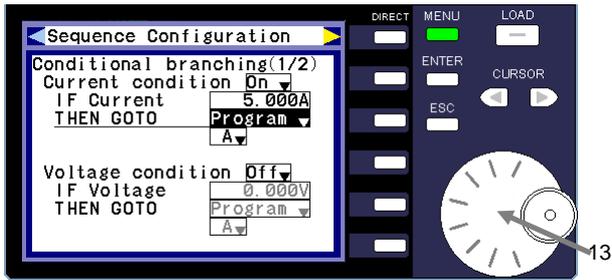
- Specifying the branching condition
Turn the rotary encoder and move the cursor to "IF Current".
- Press the ENTER key.
You can now enter the branching condition.

- Use the CURSOR keys to change the input digits. To change the value, use the rotary encoder.

- Press the ENTER key.
The ENTER key light turns off and the value is specified.
In the figure on the left, "5.000A" is specified for the branching condition.
To specify the values for "Voltage condition" and "Time condition", perform the same procedure.

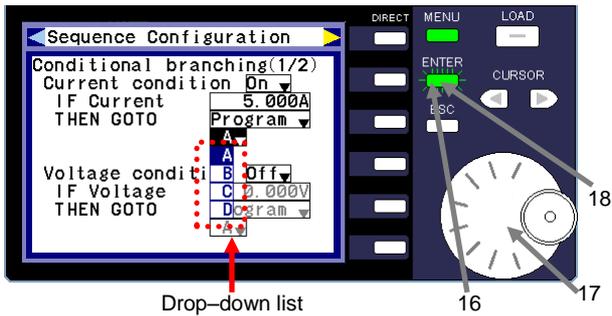
(Procedure)

Specifying the branching item

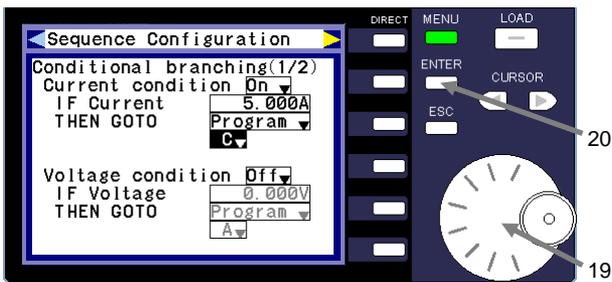


Drop-down list

Branching item: Sequence program



Drop-down list



13 Turn the rotary encoder and move the cursor to "THEN GOTO".

14 Press the ENTER key.
The ENTER key begins to flash green and a drop-down list is displayed. The branching points are displayed in the drop-down list.

The items displayed in the drop-down list are as follows:

Program: Displays sequence programs A, B, C, and D

Group: Displays groups 1, 2, 3, and 4

Pause: Pauses the sequence operation

Load Off: Switches the unit to LOAD OFF mode and stops the sequence operation

15 Turn the rotary encoder and select the branching item you want to specify.

16 Select "Program" (described in operation 14) and press the ENTER key.
"Program" is specified as the branching item.

17 Turn the rotary encoder and move the cursor to the box directly under "Program".

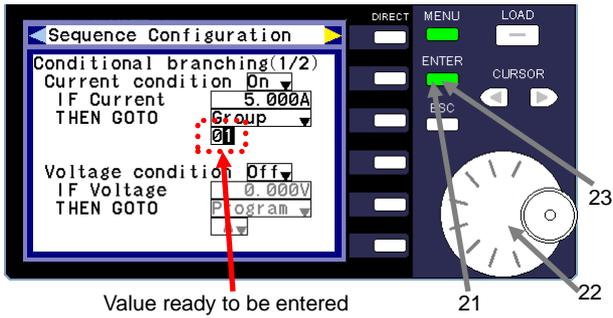
18 Press the ENTER key.
The ENTER key begins to flash green and a drop-down list appears. The sequence programs A, B, C, and D are displayed in the drop-down list.

19 Use the rotary encoder to select a sequence program (A, B, C, or D).

20 Press the ENTER key.
The green flashing ENTER key light turns off and the sequence program specified for branching is set.
In the figure on the left, "C" is set as the sequence program specified for branching.

(Procedure)

Branching item: Sequence group



Value ready to be entered

- 21 Select "Group" (described in operation 14) and press the ENTER key.
"Group" is specified as the branching item.
- 22 Turn the rotary encoder and move the cursor to the box directly under "Group".
- 23 Press the ENTER key.
The ENTER key lights up in green. You can now enter the group number (1, 2, 3, or 4).



- 24 Use the rotary encoder to select a group number (1, 2, 3, or 4).
- 25 Press the ENTER key.
The green flashing ENTER key light turns off and the group specified for branching is set.
In the figure on the left, "2" is the group specified for branching.

Branching item: Sequence pause



- 26 Select "Pause" (described in operation 14) and press the ENTER key.
"Pause" is specified as the branching item.

Branching item: LOAD OFF

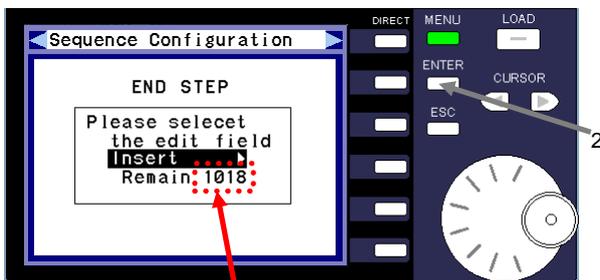
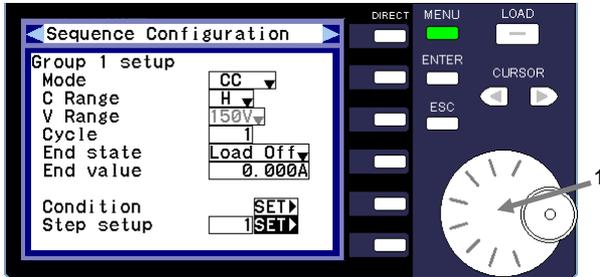


- 27 Select "Load Off" (described in operation 14) and press the ENTER key.
"Load Off" is specified as the branching item.

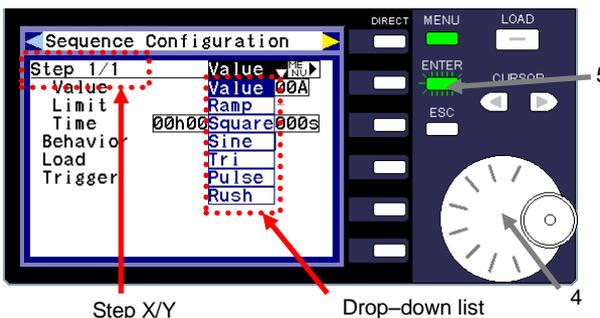
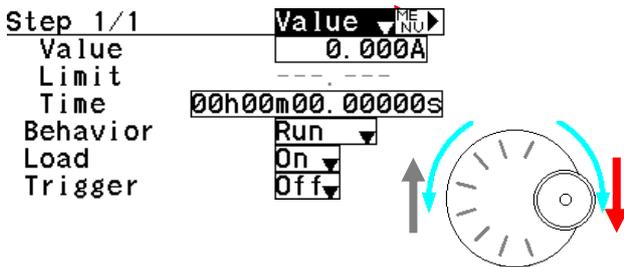
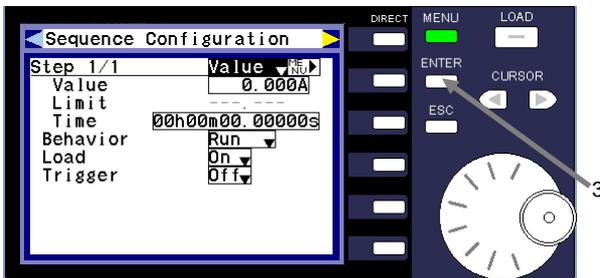
5-4-3-4. Step Settings

The explanation provided in this section begins with operation ③ in "5-4-3. Overview of Specifying Sequence Waveforms and Sequence Programs".

For details about the preceding operations, see section "5-4-3. Overview of Specifying Sequence Waveforms and Sequence Programs".



Total number of steps that can be specified



Step X/Y

Drop-down list

(Procedure)

- 1 Turn the rotary encoder and move the cursor to item "SET" on the same line as "Step setup".
After you select "SET", the item is highlighted in black.

- 2 Press the ENTER key.
"END STEP" is displayed if no step has been specified for the group, as shown in the figure on the left.
Nothing can be specified in END STEP.

The number of steps that can be specified is displayed at bottom.

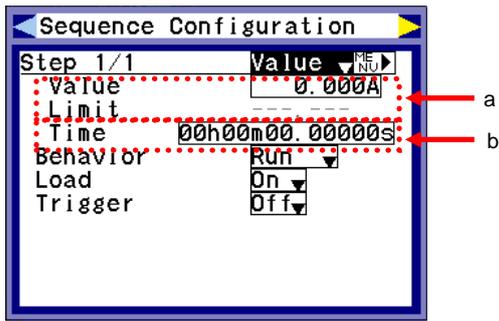
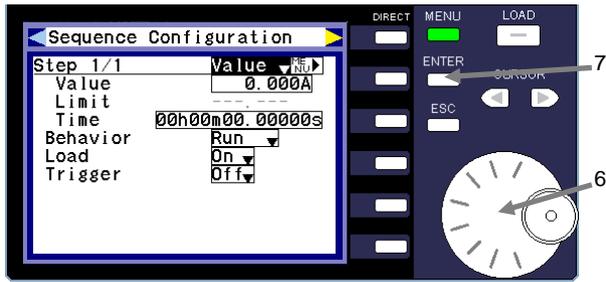
If you do not want to insert a step, press the ESC key to return to operation 1.

- 3 Press the ENTER key while the item "Insert" (displayed in the figure in operation 2) is highlighted in black.
A step is inserted before the END STEP, and the step settings window is displayed.

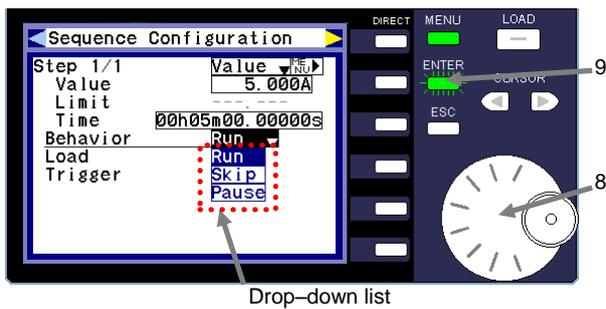
In the step settings window, turn the rotary encoder clockwise to move the cursor in the red-arrow direction, and counter-clockwise to move the cursor in the gray-arrow direction.

- 4 Turn the rotary encoder and move the cursor to "Step X/Y".
"X" represents the current step, and "Y" indicates the total number of steps in the group.
In the figure on the left, both the current step (X) and the total number of steps in the group (Y) are listed as "1".

- 5 Press the ENTER key.
The waveforms for the current step are displayed in the drop-down list.



Specifying the execution state



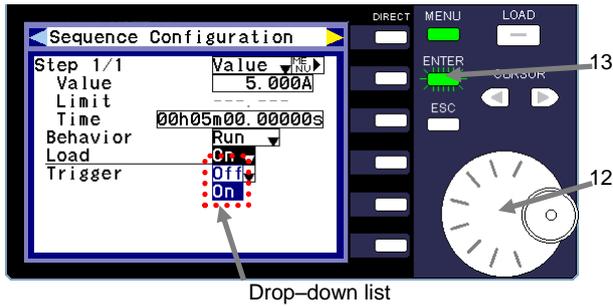
(Procedure)

- 6 Turn the rotary encoder and select a waveform. Waveforms can only be selected when CC mode is specified for the group. The only item that can be specified in other operation modes is "Value".
- 7 Press the ENTER key. The ENTER key light turns off and the waveform for the group is specified. "Value" is the item selected in the figure on the left.
 - a In the figure on the left, the parameters entered in section "a" vary by operation mode or waveform.
 - b If "Value" is selected for the waveform, the "Time" value is entered in section "b". If a waveform is selected, the "Cycle" value is displayed. In both sections "a" and "b", turn the encoder to move the cursor to a parameter. After you select a parameter, press the ENTER key. You can now enter the parameter value. Use the rotary encoder and CURSOR keys to enter the value. To specify the value, press the ENTER key.
- 8 Turn the rotary encoder and move the cursor to "Behavior".
- 9 Press the ENTER key. The ENTER key begins to flash green and a drop-down list is displayed. This list displays the different execution states of the step. The items displayed in the drop-down list are as follows:
 - Run: Executes the step with the specified settings.
 - Skip: Skips the step and executes the next step.
 - Pause: Temporarily pauses the execution of the step after a sequence is run.

※When it becomes a divergence condition when condition divergence is set, it becomes the set movement.
- 10 Turn the rotary encoder and select the execution state.
- 11 Press the ENTER key. The ENTER key light turns off and the execution state is specified. "Run" is selected in the figure on the left.

(Procedure)

Specifying the LOAD ON and LOAD OFF settings

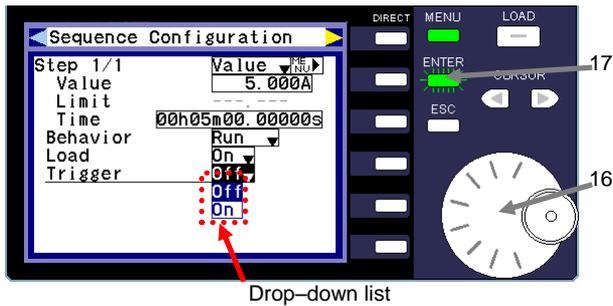


- 12 Turn the rotary encoder and move the cursor to "Load".
- 13 Press the ENTER key.
The ENTER key begins to flash green, and a drop-down list is displayed. This list indicates the LOAD ON and LOAD OFF settings of the step.
The items displayed in the drop-down list are as follows:
Off: Executes the step in LOAD OFF mode.
On: Executes the step in LOAD ON mode.



- 14 Turn the rotary encoder and select the execution state.
- 15 Press the ENTER key.
The ENTER key light turns off and the execution state is specified.
"On" is selected in the figure on the left.

Specifying the trigger signal setting: For details about how to use a trigger signal, see "5-3-11-15. Trigger Signal Output".



- 16 Turn the rotary encoder and move the cursor to "Trigger".
- 17 Press the ENTER key.
The ENTER key begins to flash green and a drop-down list is displayed. The list indicates whether a trigger signal is output when the step is executed.
The items displayed in the drop-down list are as follows:
Off: No trigger signal is output when the step is executed.
On: A trigger signal is output when the step is executed.



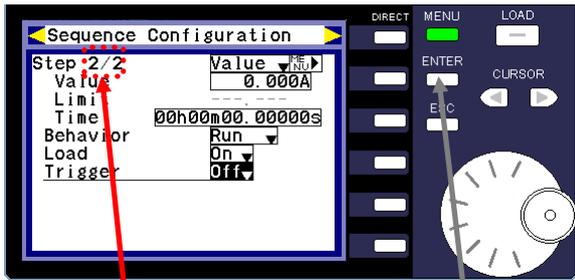
- 18 Turn the rotary encoder and select the trigger signal output state.
- 19 Press the ENTER key.
The ENTER key light turns off and the execution state is specified.
"Off" is selected in the figure on the left.

Adding a step

(Procedure)



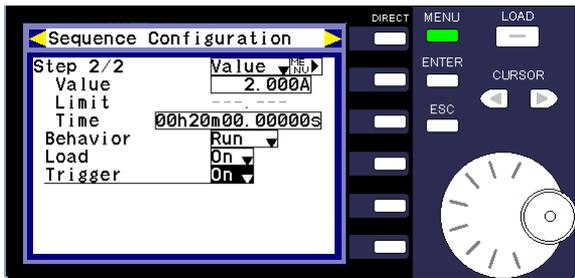
- 20 Press the right CURSOR key while the ENTER key light is off to specify the next step. The message shown in the figure on the left is displayed.



1/1 → 2/2

21

- 21 Press the ENTER key. The step settings window is displayed. The step and total number of steps change from "1/1" to "2/2".

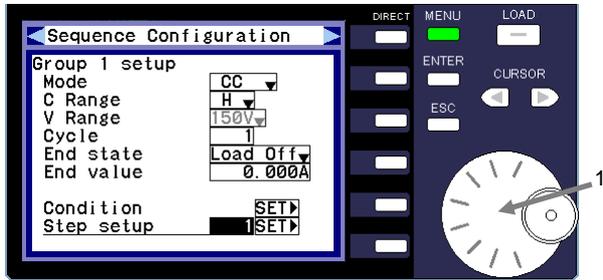


- 22 Perform operations 4 to 21 for Step 2/2.

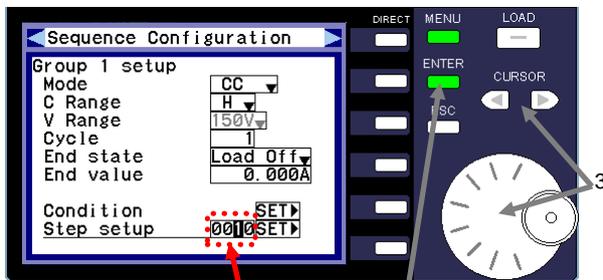
5-4-3-5. Editing Steps

The explanation provided in this section begins with operation ③ in "5-4-3. Overview of Specifying Sequence Waveforms and Sequence Programs".

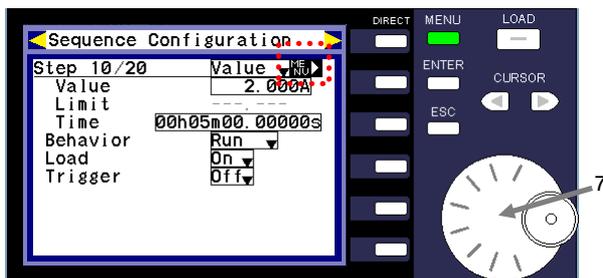
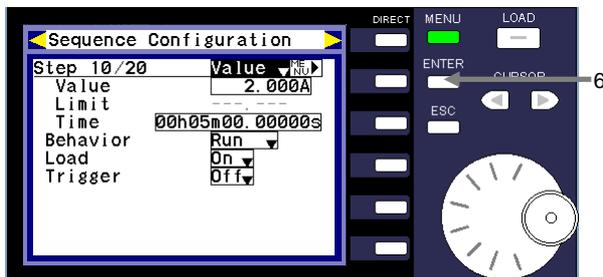
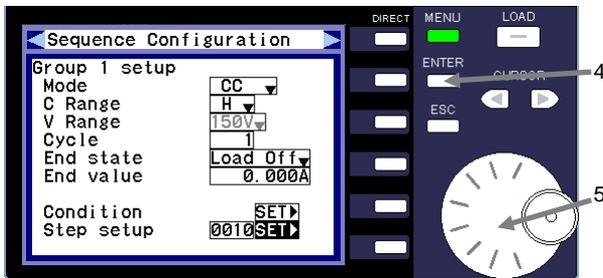
For details about the preceding operations, see section "5-4-3. Overview of Specifying Sequence Waveforms and Sequence Programs".



Group settings window



Value ready to be entered 2



(Procedure)

- 1 Turn the rotary encoder and move the cursor to "Step setup" in the sequence group setup window.

- 2 Press the ENTER key.
The ENTER key lights up in green. You can now enter the "Step setup" value.

- 3 Use the rotary encoder and CURSOR keys to enter the step you want to specify.

The step number entered here is one greater than the number of steps that have already been specified. For example, if nine steps have already been specified, the step number entered here is "10".

If no step has been specified, the only number you can enter is "1".

- 4 Press the ENTER key. The ENTER key light turns off and the step is specified.

In the figure on the left, "10" is specified as the sequence step.

- 5 Turn the rotary encoder and move the cursor to item "SET" on the same line as "Step setup".

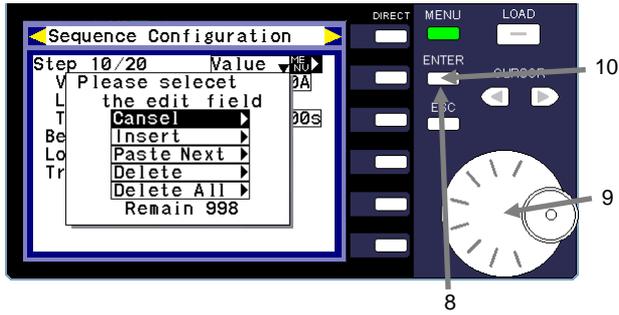
After you select "SET", the item is highlighted in black.

- 6 Press the ENTER key.
The step settings window is displayed.

The step displayed is the step that was specified in operation 4.

When you change the step settings, perform operations 4 to 19 described in "5-4-3-4. Step Settings".

- 7 Turn the rotary encoder and move the cursor to "MENU".
After you select "MENU", the item is highlighted in black.

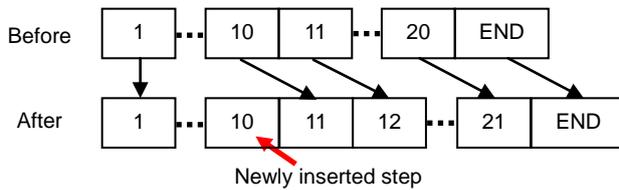


(Procedure)

- 8 Press the ENTER key.
The message shown on the left is displayed.
This window allows you to edit the sequence step number you selected (Insert, Paste Next, Delete, and Delete All).
- 9 Turn the rotary encoder to select the item you want to edit.
The item you select is highlighted in black.
- 10 Press the ENTER key.
Edit the item you selected in the previous operation (the item highlighted in black).

To cancel step editing, press the ENTER key while "Cancel" is highlighted in black.

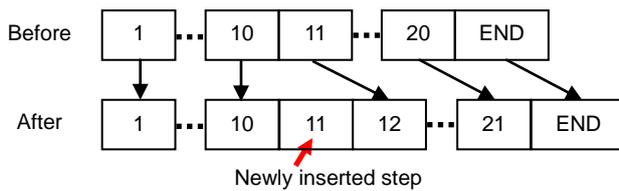
Insert



When you execute "Insert", a new step is inserted immediately before the step to be processed.

No parameters are specified for the new step. To specify the parameters for the new step, perform operations 4 to 19 described in "5-4-3-4. Step Settings".

Paste Next



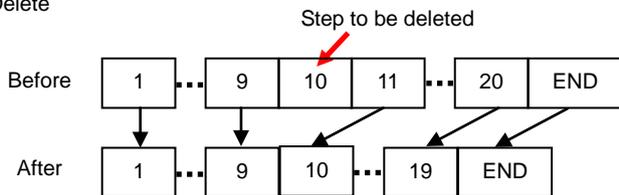
The figure on the left shows when "Insert" is executed for step 10/20.

When you execute "Paste Next", a new step is inserted immediately after the step to be processed.

The new step has the same parameters as the step for which "Paste Next" is executed.

The figure on the left shows when "Paste Next" is executed for step 10/20.

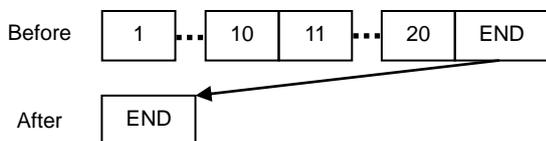
Delete



When you execute "Delete", the step to be processed is deleted.

The figure on the left shows when "Delete" is executed for step 10/20.

Delete All



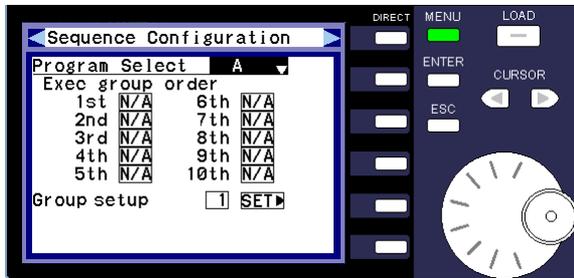
When you execute "Delete All", all the steps in the sequence group are deleted.

5-4-3-6. Specifying the Execution Order of Sequence Groups

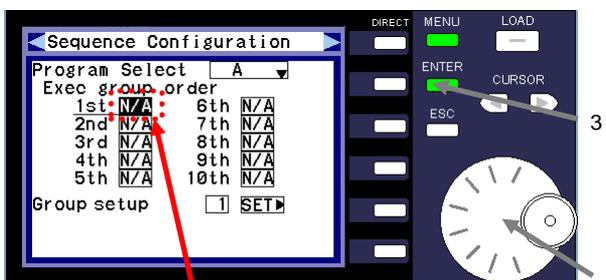
After you specify the required sequence groups and the steps for each respective group, you must specify the execution order of groups for the sequence program.

The explanation provided in this section begins with operation ② in "5-4-3. Overview of Specifying Sequence Waveforms and Sequence Programs".

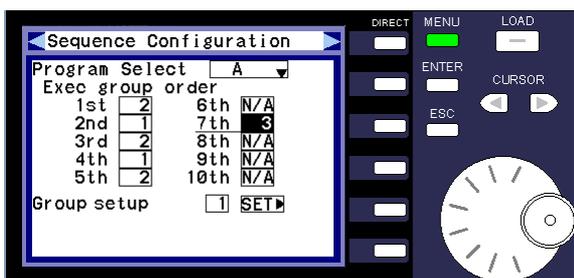
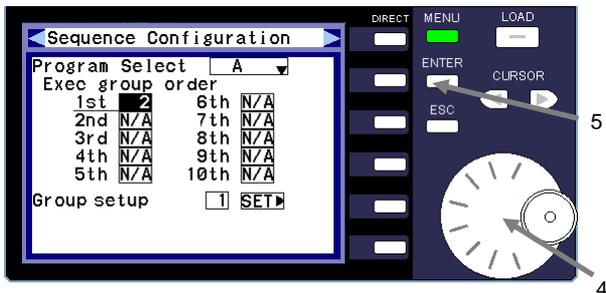
For details about the preceding operations, see section "5-4-3. Overview of Specifying Sequence Waveforms and Sequence Programs".



Sequence program settings window



Value ready to be entered



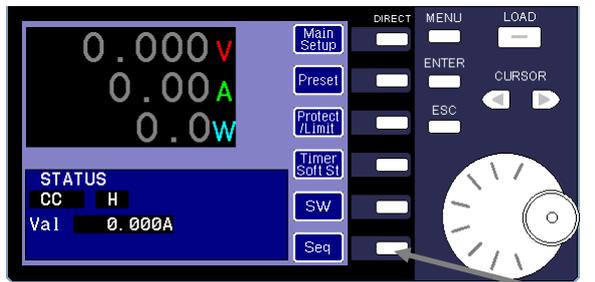
Main window

(Procedure)

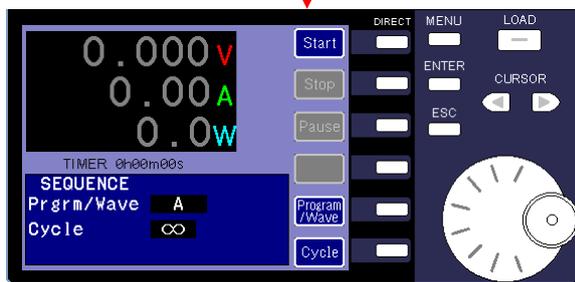
- In the sequence program settings window, select a program (A, B, C or D) for "Program Select".
Program "A" is selected and specified in the figure on the left.
- Turn the rotary encoder and move the cursor to "1st" under "Exec group order".
- Press the ENTER key.
The ENTER key lights up in green. You can now specify the value for "1st" (specify a group).
- Use the rotary encoder to select a sequence group (1, 2, 3, or 4) for "1st".
- Press the ENTER key.
The ENTER key light turns off and the program for "1st" is specified.
Group "2" is specified for "1st" in the figure on the left.
- Repeat operations 2 through 5 to specify the sequence groups for "2nd" through "10th" under "Exec group order".
If no number is entered in the window, the corresponding item is skipped.
In the figure on the left, sequence program A is executed in the following order: Group 2→1→2→1→2→3.
- Press the ESC key twice.
The sequence program settings are specified and the main window is displayed.

5-4-4. Executing Sequences

You can operate the specified waveforms and programs in the sequence execution window. To display this window, press the "Seq" DIRECT key in the main window.

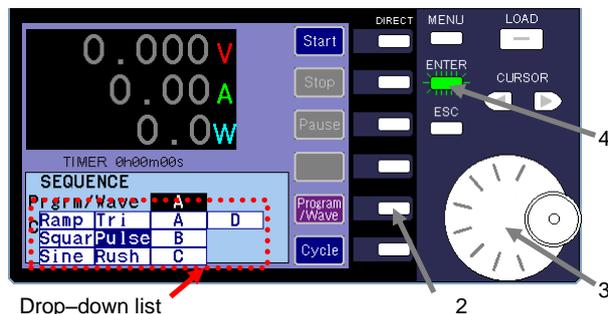


Main window

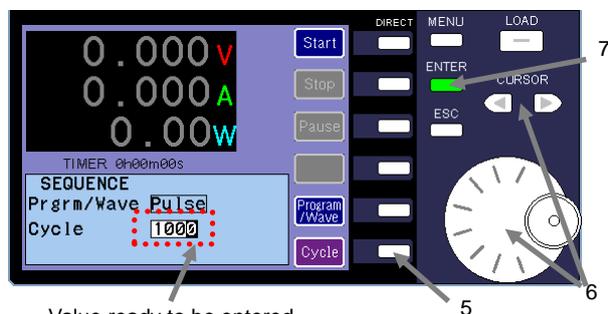


Sequence execution window

Specifying the waveform, program, and cycle value



Drop-down list



Value ready to be entered

(Procedure)

- 1 Press the "Seq" DIRECT key while the unit is in LOAD OFF mode.

The sequence execution window is displayed.

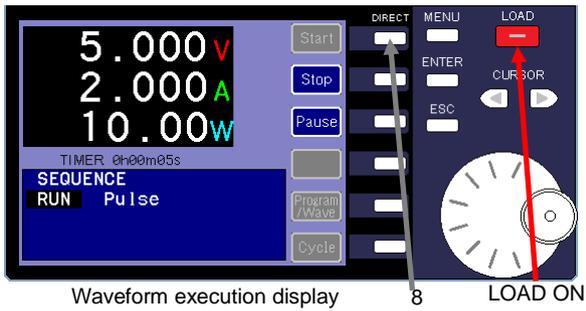
In the sequence execution window, you can specify the sequence waveform and the sequence program in the area where the operation mode and C Range are displayed in the main window.

- 2 Press the "Program/Wave" DIRECT key. A drop-down list is displayed.
- 3 Use the rotary encoder to select a waveform or program. "Pulse" is selected in the figure on the left.
- 4 Press the ENTER key. The green flashing ENTER key light turns off and the pulse waveform is established.
- 5 Press the "Cycle" DIRECT key. The ENTER key lights up in green. You can now enter the "Cycle" value. The "Cycle" value indicates the number of times the waveform and program are repeated.
- 6 If necessary, use the rotary encoder and CURSOR keys to change the "Cycle" value.
- 7 Press the ENTER key. The flashing green ENTER key light turns off and the "Cycle" value is specified.

* If there are multiple cycles, the unit will enter LOAD OFF mode for approximately 40ms between the time the current waveform and program end and before the next waveform and program start.

(Procedure)

Executing a sequence



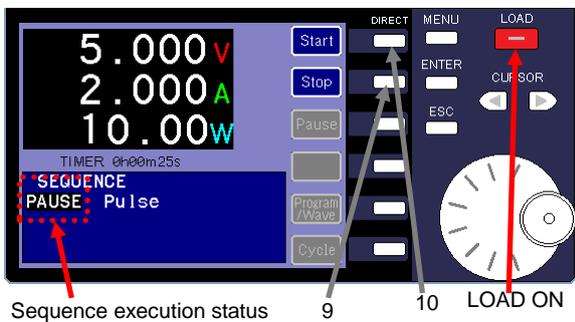
Waveform execution display



Program execution display

- 8 Apply the voltage from the power supply source to the unit, and then press the "Start" DIRECT key. The unit switches to LOAD ON mode and the sequence starts running. The sequence execution status (RUN) is displayed in the lower left corner of the window. The status displayed in the lower left depends on the type of sequence that is executed (waveform or program).
Waveform:
The execution status (RUN) and executed waveform (Pulse) are displayed.
Program:
The execution status (RUN), executed program (A), executed group (2), and executed step (15) are displayed.

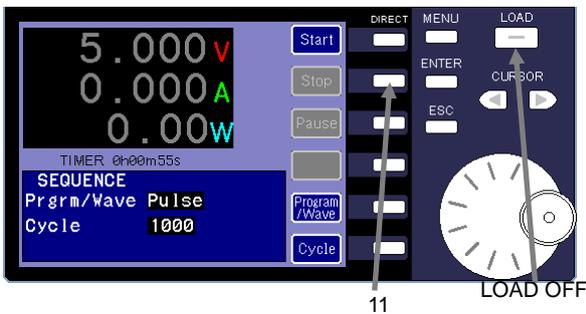
Pausing a sequence and resuming execution



Sequence execution status

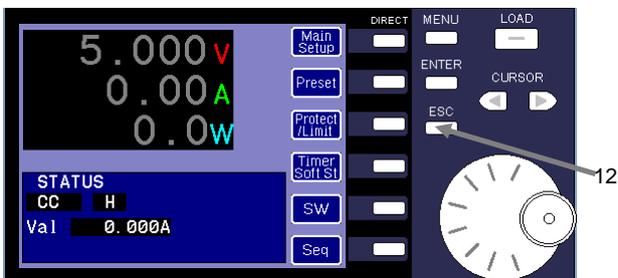
- 9 Press the "Pause" DIRECT key to pause the sequence that is being executed. The sequence is paused but the unit remains in LOAD ON mode. "PAUSE" is displayed as the sequence execution status.
* If you pause a waveform, the unit will execute the waveform again.
- 10 Press the "Start" DIRECT key to resume execution of the sequence.

Stopping a sequence



LOAD OFF

- 11 Press the "Stop" DIRECT key to stop the sequence that is being executed. The unit enters LOAD OFF mode and the sequence stops.



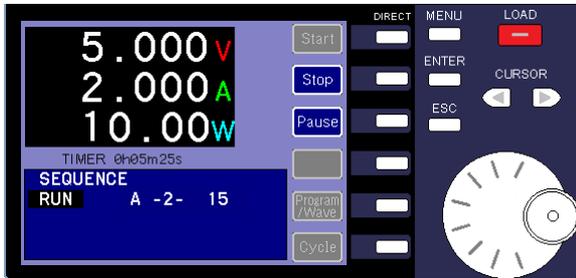
Main window

- 12 Press the ESC key to end the sequence waveform operation. The main window is displayed.

5-4-5. Elapsed time indication of the sequence program

Sets count the elapsed times when a sequence program is working. The count stops when you push the STOP key. But Sets count it during PAUSE.

Sets count it by a unit until up to 9,999 hours 59 minutes 59 seconds for one second unit. Even the case beyond the greatest elapsed time becomes the indication for 9,999 hours 59 minutes 59 seconds. Sets count it again from 0 seconds when Sets do working again after STOP. In addition, it is 0 seconds at the time of the initialization of the sequence program, the power supply injection.



Sequence execution window



Full screen window

6. Using the IF-80GUR Control Board

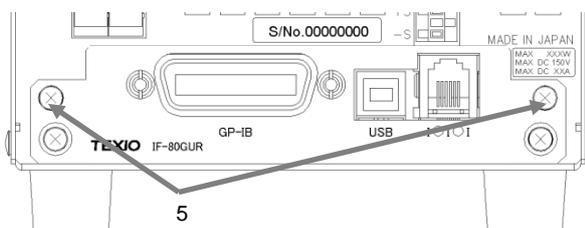
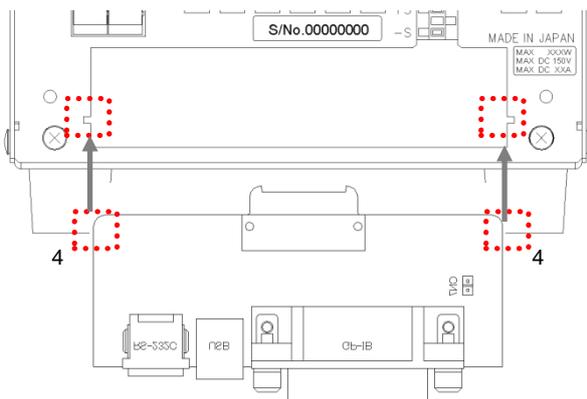
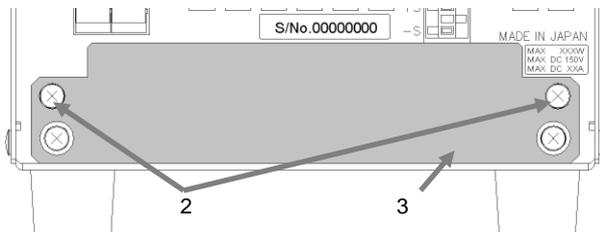
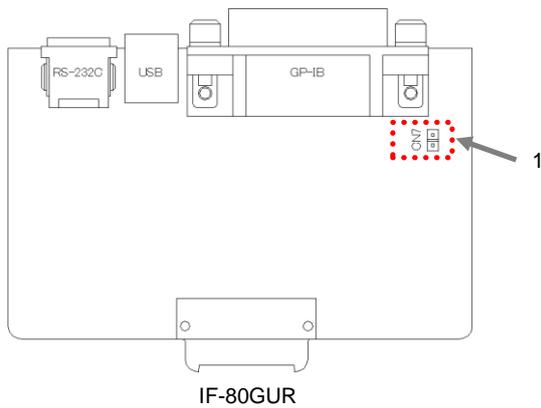
Each model in the LSA series can be fitted with the separately purchased IF-80GUR control board. Units with the IF-80GUR are controlled via a GP-IB, USB, or RS-232C acting as a communication interface.

6-1. Preparing to Use the IF-80GUR Control Board

To use the IF-80GUR control board to control the unit, you must first mount and configure the board. After you configure the board, you must then set up the communication interface on the unit.

6-1-1. Mounting the IF-80GUR Control Board

The following section describes how to mount the IF-80GUR control board. Make sure to exercise care when you mount the board.



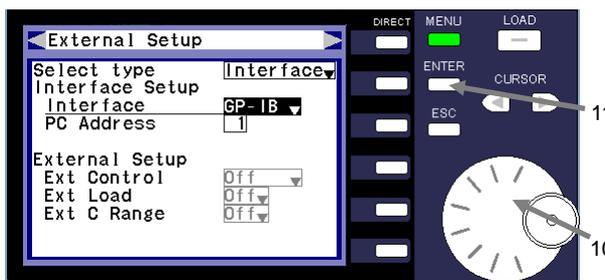
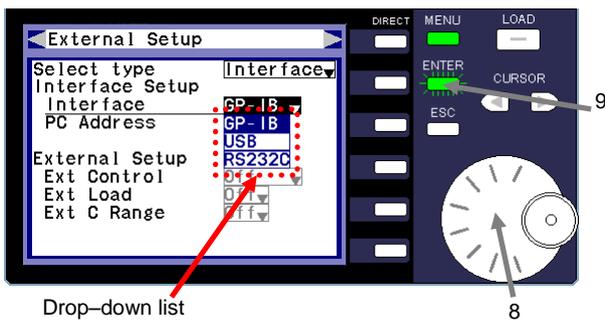
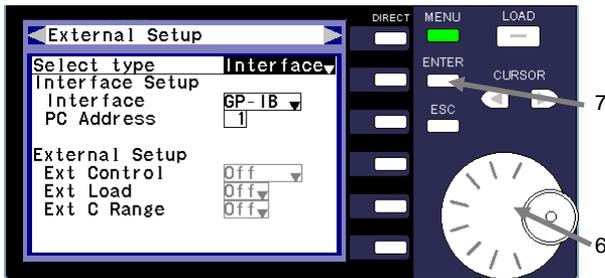
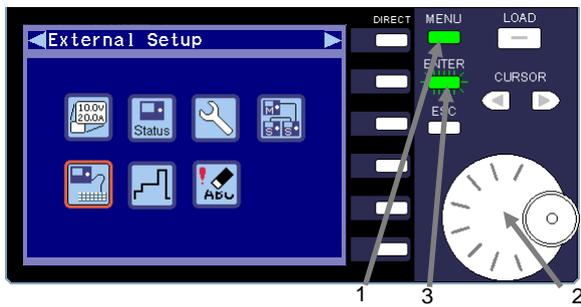
(Procedure)

- 1 If you plan to use the AC cable supplied with the product, you must ground the housing of the unit.
Before you mount the IF-80GUR control board, check the condition of the CN7 connector for the control board.
If a short connector is attached to the CN7 connector, you must connect the communication interface GND (GP-IB, USB, RS-232C) to the housing and then ground the housing.
If there is no short connector attached to the CN7 connector, the communication interface GND (GP-IB, USB, RS-232C) is used in a floating condition.
Determine whether a short connector needs to be attached to the CN7 connector, making sure to consider the grounding condition of the computer connected to the IF-80GUR control board.
To ensure safety, we strongly recommend that you attach a short connector to the CN7 connector and ground the computer you are using.
Remove the power cable of the power supply source. Confirm that the power switch is in the OFF position, and that nothing is displayed on the unit.
- 2 Remove the two screws that hold the rear blank panel in place.
- 3 Remove the blank panel.
The blank panel is the gray part in the figure on the left.
- 4 Insert the IF-80GUR control board from the back of the unit.
Set the IF-80GUR control board into the grooves of the unit and carefully insert it.
- 5 Use the two screws that were removed in operation 2 to secure the IF-80GUR control board on the unit and hold it in place.

6-1-2. Selecting a Communication Interface

Select the communication interface (GP-IB, USB or RS-232) you want to use.

If you select GP-IB or USB as the communication interface, you must specify the PC address.



(Procedure)

- 1 Press the MENU key while the unit is in LOAD OFF mode. The menu window is displayed.
- 2 Turn the rotary encoder and select the "External Setup" icon.
- 3 Press the ENTER key.

- 4 Turn the rotary encoder and select "Select type".

- 5 Press the ENTER key. A drop-down list is displayed.

"External": Control via external signal

"Interface": Control via IF-80GUR

- 6 Turn the rotary encoder and select "Interface".

- 7 Press the ENTER key. The ENTER key light turns off and "Interface" is specified as the external control of the unit.

- 8 Turn the rotary encoder and move the cursor to "Interface" under "Interface Setup".

- 9 Press the ENTER key. The ENTER key lights up in green and the drop-down list for "Interface" is displayed.

The items displayed in the drop-down list are as follows:

GP-IB = GP-IB

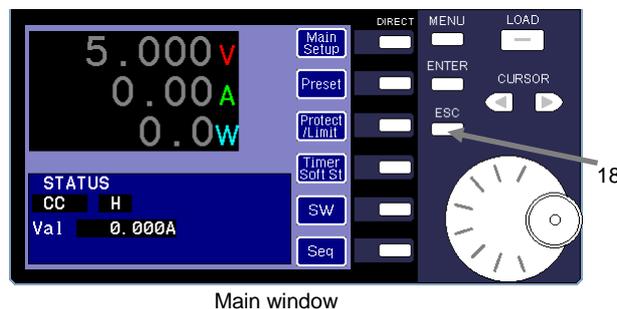
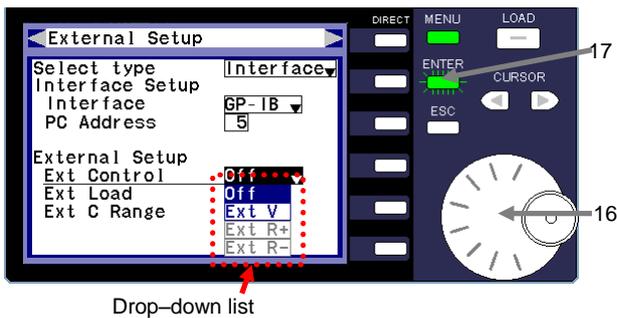
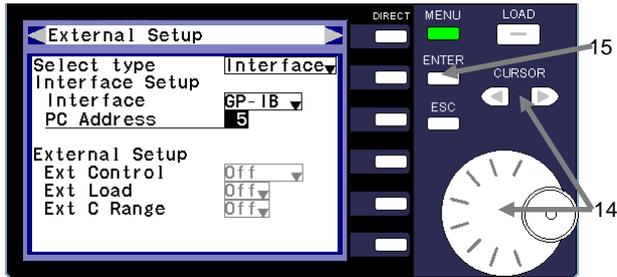
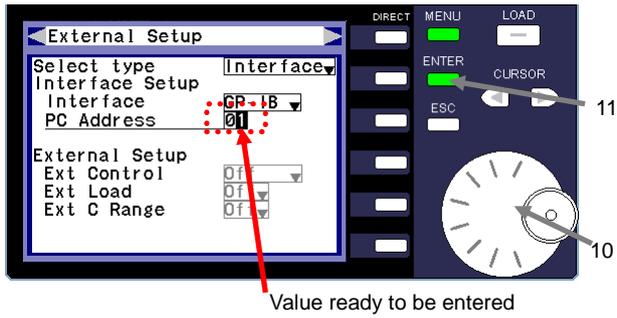
USB = USB

RS232C = RS-232C

- 10 Turn the rotary encoder and select the communication interface you want to use.

- 11 Press the ENTER key. The ENTER key light turns off and the communication interface is specified.

In the figure on the left, "GP-IB" is specified as the communication interface.



(Procedure)

- 12 If you select "GP-IB" or "USB" as the communication interface, you must specify the PC address.
Turn the rotary encoder and move the cursor to "PC Address" under "Interface Setup".
- 13 Press the ENTER key.
The ENTER key lights up in green. You can now enter the "PC Address" value.
In the figure on the left, "GP-IB" is specified as the communication interface.
- 14 Use the rotary encoder and CURSOR keys to enter the value for "PC Address".
A value of between "1" and "30" can be specified for "PC Address".
If you select GP-IB as the communication interface, the GP-IB address is specified as the PC address.
- 15 Press the ENTER key.
The ENTER key light turns off and the "PC Address" value is specified.
In the figure on the left, "5" is specified for "PC Address".
- 16 Turn the rotary encoder and move the cursor to "Ext Control" under "External Setup".
- 17 Press the ENTER key.
The ENTER key begins to flash green and a drop-down list is displayed.
"Off": Indicates set values that can be modified on the front panel.
"Ext V": External voltage 0V→10V; set value 0 → rated
If "Ext V" is selected, the set values are as follows:
CC mode: The values specified by the communication interface are superposed by the values specified by the external voltage.
Other modes: The set values are the values specified by the external voltage. The values specified by the communication interface are ignored.
- 18 Press the ESC key twice.
The interface setup menu closes, and the main window is displayed.

6-2. Communication Interfaces

6-2-1. Using GP-IB

The GP-IB interface system of the unit and IF-80GUR control board is compatible with the IEEE std 488.1-1987.

The table below describes the interface functions of the unit.

Table 6-1 Interface Functions

Function	Subset	Details
Source HANDSHAKE	SH1	All functions.
Acceptor Handshake	AH1	All functions.
Talker	T6	Basic talker function, talker disable function via designated listener, and serial port function.
Listener	L4	Basic listener function and listener disable function via MTA function.
Service Request	SR1	All functions.
Remote Local	RL1	All functions.
Parallel Poll	PP0	No function.
Device Clear	DC1	All functions.
Device Trigger	DT0	No function.
Controller	C0	No function.
	E1	Open collector bus driver is used. State driver is used for EOI and DAV.

GP-IB Address

Specify the GP-IB address in the LCD window. A value of between "1" and "30" can be specified for the address. If another device has the same GP-IB address as the unit, you must change the GP-IB address of either the unit or the other device.

The default GP-IB address is "1".

Clear and Reset Functions

You can issue commands or perform specific operations on the unit to reset or clear settings and other information.

The following section describes the responses to the clear and reset functions.

① IFC (Interface Clear)

The responses to the universal command IFC are as follows:

- The state of the designated talker or listener is disabled.
- The GP-IB buffer, output queue, and stand-by commands are held.
- The SRQ setting is held.
- The remote status and LLO settings are held.
- The panel settings are held.

② DCL, SDC (Device Clear)

The responses to the universal command DCL and address command SDC are as follows:

- The GP-IB buffer, output queue, and stand-by commands are disabled.
- The interface state (the state of designated talker and listener) is held.
- The SRQ setting is held.
- The remote status and LLO settings are held.
- The panel settings are held.

③ *RST (Reset Command)

The responses to the common command *RST are as follows:

- The state of the designated talker or listener is disabled.
- The GP-IB buffer, output queue, and stand-by commands are disabled.
- The SRQ, status byte, and mask settings are cleared.
- The remote status and LLO settings are held.
- The panel settings are held.

④ Power Cycling

The operations performed when the power is cycled are as follows:

- The state of the specified talker or listener is disabled.
- The GP-IB buffer, output queue, and stand-by commands are cleared.
- The SRQ, status byte, and mask settings are cleared.
- The unit switches to local operation. The LLO setting specified before power cycling is cleared.
- The panel settings specified before power cycling are held.

⑤ INIT (Initializing Command and Panel Initialization)

The operations performed by INIT are as follows:

- The state of the specified talker or listener is disabled.
- The GP-IB buffer, output queue, and stand-by commands are cleared.
- The SRQ, status byte, and mask settings are cleared.
- The unit switches to local operation. The LLO setting specified before power cycling is cleared.
- The panel settings are initialized (returned to the factory default settings).
- All the sequence data transferred from external devices is cleared.

Remote and Local Functions

The system controller and the remote key of the unit are used to control the remote and local functions. The operation mode of the unit should always be one of the following: local, remote, or remote with local lockout. The details of each respective operation mode are as follows:

① Local

The unit switches to local operation when:

- (a) The power switch is turned off and then turned back on.
- (b) The remote key is pressed and the LED light turns off.
- (c) A GTL command is received.
- (d) Remote control is canceled while the unit is being remotely controlled.

② Remote

When REN is True and the unit is designated by the listener, the unit switches to remote operation. At this time, the LCD switches to the remote display.

When the unit is in remote operation mode, only the power switch and remote key can be used. The panel and other keys cannot be used to perform operations. When the unit is in local lockout operation mode, only the power switch can be used.

Responses to Multi-line Message Commands

The following table describes the different multi-line message commands and their corresponding responses.

Type	Name	Description	Support
Universal Command	DCL	Clears the GP-IB buffer.	Yes
	SPE	Enables serial polling.	Yes
	SPD	Disables serial polling.	Yes
	PPU	Disables parallel polling.	No
	LLO	Switches all the devices to local lockout and prohibits manual operation.	Yes
Address Command	UNL	Disables the designated listener.	Yes
	UNT	Disables the designated talker.	Yes
	SDC	Clears the GP-IB buffer.	Yes
	PPC	Enables lines to be allocated to the designated listener during parallel polling.	No
	GTL	Switches the designated device to local.	Yes
	GET	Executes a trigger for the designated device.	No
	TCT	Enables the controller designated as the talker take control of a system in which there are two or more controllers.	No

Program Message and Program Codes

① Program Message Format

In order for the GP-IB interface to switch the unit to a specified state, a program message must be sent from the controller to the unit.

A program message consists of one or multiple program codes (commands). Program messages are received in ASCII code. Each program message received by the unit can contain a maximum of 128 bytes (including delimiters) of program codes.

If a message with multiple programs codes contains a non-designated header or outlying parameter, all of the codes that precede the header or parameter are executed.

② Program Message Terminator

A terminator serves as the delimiter of a single program message. The unit supports the following terminators but ignores CR.

- 1) LF
- 2) LF+EOI
- 3) EOI

Separator for response message: ";" (ASCII code 3Bh)

Terminator of response message: CR+LF+EOI

③ Program Code Separator

1) Program Message Unit Separator

A separator is used when transferring multiple messages at one time. In this case a semi colon ";" (ASCII code 3Bh) is used as the separator.

6-2-2. Using USB

The following USB and command delimiters are valid:

LF+null packet, CR, LF+null packet.

The USB standard is USB 2.0 full speed (USB 1.1 compatible) at 12 Mbps.

There is a total of four USB end points.

EP0: Control transfer

EP1: Bulk in transfer (device to PC), 64 bytes.

EP2: Bulk out transfer (PC to device), 64 bytes.

EP3: Interrupt in transfer (device to PC), 2 bytes.

Self power: Self-power operation only. Operation is unspecified when the PC is a suspended state.

Current bus usage: 0mA

Number of interfaces: 1, Number of configurations: 1

In addition to the USB address, there is also a PC address (488ID) that is used to designate a device. A value of between 0 to 127 can be specified (obtained by class request).

The vendor ID of TEXIO TECHNOLOGY CORPORATION is "0x098f", and the product ID is "1008".

There is a total of six built-in string descriptors. The header is full byte length and two 0x03 bytes, and the character code is Unicode. Thus, one 0x00 byte is added to each character after it is converted to ASCII.

0: Language code	0x09, 0x04
1: Vendor name	"TEXIO TECHNOLOGY"
2: Product name	"LSA"
3: Serial number	Not used. Always "0".
4: Version number	The ROM version of the communication unit is displayed in "1.00" format.
5: Interface name	"USB488"

The class requests are as follows:

IFC configuration:	Not configured.
SDC configuration:	Clear sent and received message buffer. Clear executions.
REN configuration:	Set to remote.
REN acquisition:	Read out remote state.
TRG configuration:	Set trigger execution.
TRG acquisition:	Acquire trigger state.
CLS configuration:	Clear status byte.
ID configuration:	Change the PC address setting.
ID acquisition:	Specify the PC address.
CAP acquisition:	Read out function enhancement data. --> Not required.

Data Transfer (Bulk Transfer)

When transferring data via a USB interface, data is transferred in packets. To support data transfer via a GP-IB interface, make sure to place CR(0x0d)+LF(0x0a) on the API side when you create a program. A null packet with a packet length of "0" is used on the unit side to indicate a state that is equal to EOI of the GP-IB interface.

Transferred Data

The differences between interfaces are not taken into consideration when data is received via bulk transfer. The data enters the ring buffer of either a GP-IB and RS-232C interface, where the commands and parameters are analyzed, commands are executed, and responses are issued in order.

6-2-3. RS-232C

The RS-232C connector of the IF-80GUR control board is RJ-11 (modular for telephone). Use optional modular cable (CB-0603S, CB-0615S, CB-0630S) and D-Sub modular conversion connector (TA-66) to connect the RS-232C connector.

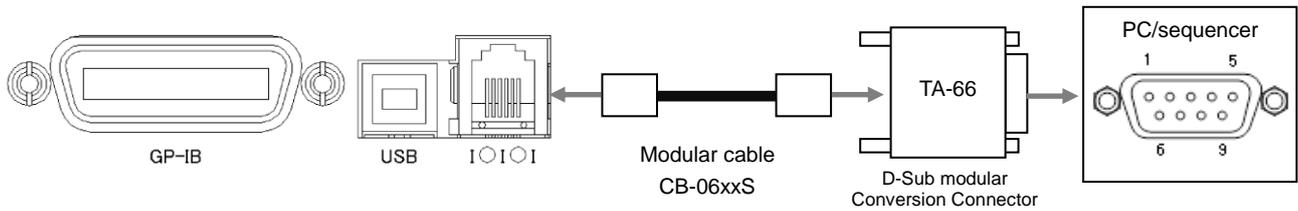


Fig. 6-1

The following table describes the wiring for the D-Sub modular conversion connector (TA-66).

The diagram shows the TA-66 connector with two arrows pointing to the table below, indicating the wiring connections for the RJ-11 side and the D-Sub side.

RJ-11 side		RJ-11 -D-Sub Wiring	D-Sub side			
Pin arrangement	Pin No.		Signal name on IF-80GUR	Signal name on PC/sequencer side Wiring	Pin No.	Pin arrangement
			DCD: Connected to 6, 7	1		
	2	TxD	⇔	RxD		2
	5	RxD	⇔	TxD		3
	4	S GND	⇔	DTR: Connected to 8		4
				S GND		5
				DSR: Connected to 1, 7		6
				RTS: Connected to 1, 6		7
				CB: Connected to 4		8
				RI		9
1	F GND	⇔	F GND	CASE		

The standard communication speed is 57600bps. The data length is 8 bits, with 1 stop bit and no parity. The communication format conforms to GP-IB. It does not conform to SRQ.

6-3. Interface Commands

6-3-1. Interface Command List

6-3-1-1. Unit Settings and Operation Commands

Command	Description	Query	Page
MODE {CC CR CREX CP CVCC CVCR}	Specifies the operation mode.	Valid	122
COND[:CR]	Specifies the conductance for CR mode.	Valid	122
RESI[:CR]	Specifies the resistance for CR mode.	Valid	122
CURR[:CC]	Specifies the current value.	Valid	122
POW[:CP]	Specifies the power.	Valid	122
VOLT:CVCC	Specifies the voltage for CV+CC mode.	Valid	123
VOLT:CVCR	Specifies the voltage for CV+CR mode.	Valid	123
COND:CVCR	Specifies the conductance for CV+CR mode.	Valid	123
RESI:CVCR	Specifies the resistance for CV+CR mode.	Valid	123
CURR:CVCC	Specifies the current limit for CV+CC mode.	Valid	123
CVP {P1 P2 P3 P4 P5}	Specifies the response for CV mode.	Valid	123
CURR:PROT	Specifies the level of overcurrent protection.	Valid	124
CURR:PROT:ACT {LIM TRIP}	Specifies the current limit and/or whether the unit enters LOAD OFF mode when overcurrent occurs.	Valid	124
POW:PROT	Specifies the level of overpower protection.	Valid	124
POW:PROT:ACT {LIM TRIP}	Specifies the power limit and/or whether the unit enters LOAD OFF mode when overpower occurs.	Valid	124
VOLT:PROT:UND	Specifies the level of undervoltage protection.	Valid	124
PULS:MAIN:COND	Specifies the main conductance for switching mode.	Valid	125
PULS:SUB:COND	Specifies the subconductance for switching mode.	Valid	125
PULS:MAIN:RESI	Specifies the main resistance for switching mode.	Valid	125
PULS:SUB:RESI	Specifies the subresistance for switching mode.	Valid	125
PULS:MAIN:CURR	Specifies the main current for switching mode.	Valid	125
PULS:SUB:CURR	Specifies the subcurrent for switching mode.	Valid	125
PULS:MAIN:POW	Specifies the main power for switching mode.	Valid	125
PULS:SUB:POW	Specifies the subpower for switching mode.	Valid	126
PULS:MAIN:VOLT	Specifies the main voltage for switching mode.	Valid	126
PULS:SUB:VOLT	Specifies the subvoltage for switching mode.	Valid	126
PULS:DCYC	Specifies the switching duty.	Valid	126
PULS:FREQ	Specifies the switching frequency.	Valid	126
PULS:SLEW	Specifies the current slew rate for switching mode.	Valid	126
PULS:TA	Specifies the switching main time.	Valid	126
PULS:TB	Specifies the switching subtime.	Valid	126
PULS {OFF ON MAIN SUB}	Specifies the ON/OFF and MAIN/SUB settings for switching mode.	Valid	126
PULS:DISP {0 1}	Specifies the display items for switching mode.	Valid	127
PULS:TYPE {F T E}	Changes the Freq, Duty (F), Time (T) and External (E) settings for switching mode.	Valid	127
CURR:RANG {L M H}	Specifies the current range.	Valid	127
VOLT:RANG {L H}	Specifies the voltage range.	Valid	127
PRES:REC {1 2 3 4}	Recalls settings from the preset memory.	Valid	127
PRES:STOR {1 2 3 4}	Stores settings in the preset memory.	N/A	127
SST:TIME {1m 2m 5m 10m 20m 50m 100m 200m}	Specifies the soft start time.	Valid	127
SST:VOLT	Specifies the soft start voltage.	Valid	127
EXT {OFF V}	Specifies the OFF/ON setting for the external voltage control and superposition.	Valid	128
INP {OFF ON}	Specifies whether the unit enters LOAD OFF or LOAD ON mode.	Valid	128
RESP {SLOW FAST}	Specifies and queries the response speed of the electric load.	Valid	128
SENS {INT EXT}	Changes the internal and external voltage sensing.	Valid	128
TIMER {NONE OFF ON}, ****.*.*	Specifies the LOAD NONE, LOAD ON and LOAD OFF time for the automatic LOAD function.	Valid	128
BIASV	Setting and the inquiry of the power supply for 0V.	Valid	128

6-3-1-2. Measurement Commands

Command	Description	Query	Page
MEAS:CURRE?	Reads out the measured current.	Query only	128
MEAS:POW?	Reads out the measured power.	Query only	128
MEAS:VOLT?	Reads out the measured voltage.	Query only	128

6-3-1-3. Other Commands

Command	Description	Query	Page
BUZZ {OFF ON}	Specifies the buzzer setting (OFF/ON).	Valid	135
CONFIG:SAVE	Saves the setting to the unit.	N/A	135
DISP {NOM ZOOM}	Displays in full screen.	Valid	135
ESC	Cancel the protection.	Invalid	135
INIT	Initializes the settings data (restores the factory defaults).	Invalid	135
SYST:SET {LOC REM LLO}	Switches between local and remote operation. Settings commands can only be entered via USB or RS-232C. Query commands can be entered via GP-IB, USB, or RS-232C.	Valid	135

6-3-1-4. IEEE 488.2 Common Commands

Command	Description	Query	Page
*CLS	Clears the status register.	N/A	133
*ESE	Specifies the standard event status enable register.	Valid	132
*ESR?	Queries the standard event status register.	Query only	132
*IDN?	Queries the unit ID.	Query only	135
*OPC	Specifies the operation completion bit for the standard event status register when all operations are completed.	Valid	132
*RST	Reset.	N/A	135
*SRE	Specifies the service request enable register.	Valid	133
*STB?	Reads out the status byte.	Query only	133
*TST?	Always replies "0".	Query only	132

6-3-1-5. SCPI Status Register Commands

Command	Description	Query	Page
STAT:OPER:COND?	Queries the condition of the OPERation status register.	Query only	130
STAT:OPER:ENAB	Enables the OPERation status register.	Valid	130
STAT:OPER:EVEN?	Queries events in the OPERation status register.	Query only	130
STAT:QUES:COND?	Queries the condition of the QUESTionable status register.	Query only	131
STAT:QUES:ENAB	Enables the QUESTionable status register.	Valid	131
STAT:QUES:EVEN?	Queries events in the QUESTionable status register.	Query only	131

6-3-1-6. Sequence Commands

Command	Description	Query	Page
PROG:GROUP	Designates a sequence group.	Valid	136
PROG:MODE {CC CR CP CVCC CVCR CREX}	Specifies the mode for the sequence group.	Valid	136
PROG:LINP {OFF ON}	Specifies whether the unit enters LOAD ON or LOAD OFF mode when the sequence is finished.	Valid	136
PROG:NCYC	Specifies the number of cycles of a sequence group.	Valid	136
PROG:LVAL	Specifies the reference value when the sequence is finished.	Valid	136
PROG:CRAN	Specifies the current range.	Valid	136
PROG:VRAN	Specifies the voltage range.	Valid	136
PROG:COND:CVCR	Specifies the conductance for CV+CR mode.	Valid	136
PROG:RESI:CVCR	Specifies the resistance for CV+CR mode.	Valid	136
PROG:CURR:CVCC	Specifies the current limit for CV+CC mode.	Valid	137
PROG:BRANI	Specifies the current for conditional branching.	Valid	137
PROG:BRANV	Specifies the voltage for conditional branching.	Valid	137
PROG:BRANT	Specifies the time for conditional branching.	Valid	137
PROG:ADD	Adds steps.	N/A	137
PROG:BEHAVE	Specifies the operation state of steps.	Valid	137
PROG:DEL	Deletes steps.	N/A	138
PROG:DEL:ALL	Deletes all the steps of the sequence group.	N/A	138
PROG:EDIT	Edits the step settings.	Valid	138
PROG:INS	Inserts a step (specifies the step number).	N/A	138
PROG:WAVE	Edits the waveform data of the step.	Valid	139
PROG:MS	Specifies the sequence program execution number.	Valid	140
PROG:MS:NCYC	Specifies the number of program execution cycles.	Valid	140
PROG:MS:ORDE	Specifies the execution order of the groups in the sequence program.	Valid	140
PROG:PG:WAVE	Edits the waveform data.	Valid	141
PROG {OFF ON}	Specifies OFF or ON for sequence mode.	Valid	142
PROG:CLE	Initializes the sequence group.	N/A	142
PROG:COUN?	Queries the number of steps.	Query only	142
PROG:COUN:ALL?	Queries the total number of steps (including 6 waveforms).	Query only	142
PROG:LOAD	Reads out sequence data.	N/A	142
PROG:SAVE	Saves sequence data.	N/A	142
PROG:STAT {RUN STOP PAUS CONT}	Executes the sequence group or modifies the operation state.	Valid	142
PROG:TIMER?	Reply of the elapsed time of the sequence program.	Query only	142

6-3-2. Interface Command Details

- No distinction is made between capital letters and lowercase letters.
- Items indicated with < > or { } are parameters (set values). <SP> indicates a half-width space.
- Insert at least one half-width space <SP> between a command and a parameter.
- Exponential notation can be used for the parameter of the floating point.
- Items with [] can be omitted. (Ex. CURR[:CC], COND[:CR], RESI[:CR], POW[:CP])
- The number of significant figures for the parameter of the floating point is the number of digits displayed on the LCD.

6-3-2-1. Operation Mode SET Commands

MODE

Description: Specifies and queries the operation mode.

SET command: MODE<SP>{CC|CR|CREX|CP|CVCC|CVCR}

QUERY command: MODE?

Example) MODE<SP>CC

* The parameter CR is for CRx1 mode. CREX is for CRx10 mode.

6-3-2-2. Parameter SET Commands

COND[:CR]

Description: Specifies and queries the conductance for CR mode.

SET command: COND<SP><conductance>

QUERY command: COND?

* When an intermediate value between the set value steps is sent, the value is rounded to the step value of the smaller conductance.

Unit: S (Siemens)

Example) COND<SP>2.5

RESI[:CR]

Description: Specifies and queries the resistance for CR mode.

SET command: RESI<SP><resistor>

QUERY command: RESI?

Unit: Ω

* When an intermediate value between the set value steps is sent, the value is rounded to the step value of the larger resistance.

Example) RESI<SP>2.5

CURR[:CC]

Description: Specifies and queries the current for CC mode.

SET command: CURR<SP><current>

QUERY command: CURR?

Unit: A

Example) CURR<SP>2.5

POW[:CP]

Description: Specifies and queries the power for CP mode.

SET command: POW<SP><power>

QUERY command: POW?

Unit: W

Example) POW<SP>2.5

VOLT:CVCC

Description: Specifies and queries the voltage for CV+CC mode.

SET command: VOLT:CVCC<SP><voltage>

QUERY command: VOLT:CVCC?

Unit: V

Example) VOLT:CVCC<SP>2.5

VOLT:CVCR

Description: Specifies and queries the voltage for CV+CR mode.

SET command: VOLT:CVCR<SP><voltage>

QUERY command: VOLT:CVCR?

Unit: V

Example) VOLT:CVCR<SP>2.5

COND:CVCR

Description: Specifies and queries the conductance for CV+CR mode.

SET command: COND:CVCR<SP><conductance>

QUERY command: COND:CVCR?

* When an intermediate value between the set value steps is sent, the value is rounded to the step value of the smaller conductance.

Unit: S (Siemens)

Example) COND:CVCR<SP>2.5

RESI:CVCR

Description: Specifies and queries the resistance for CV+CR mode.

SET command: RESI:CVCR<SP><resistor>

QUERY command: RESI:CVCR?

* When an intermediate value between the set value steps is sent, the value is rounded to the step value of the larger resistance.

Unit: Ω

Example) RESI:CVCR<SP>2.5

CURR:CVCC

Description: Specifies and queries the current for CV+CC mode.

SET command: CURR:CVCC<SP><current>

QUERY command: CURR:CVCC?

Unit: A

Example) CURR:CVCC<SP>2.5

CVP

Description: Specifies and queries the response parameter for CV mode.

SET command: CVP<SP>{P1|P2|P3|P4|P5}

QUERY command: CVP?

Example) CVP<SP>P3

6-3-2-3. Protect/Limit SET Commands

CURR:PROT

Description: Specifies and queries the set value of overcurrent protection.

SET command: CURR:PROT<SP><value>

QUERY command: CURR:PROT?

Unit: A

Example) CURR:PROT<SP>10.5

CURR:PROT:ACT

Description: Specifies and queries the operation to be executed when overcurrent occurs.

SET command: CURR:PROT:ACT<SP>{LIM|TRIP}

QUERY command: CURR:PROT:ACT?

Example) CURR:PROT:ACT<SP>LIM

POW:PROT

Description: Specifies and queries the set value of overpower protection.

SET command: POW:PROT<SP><value>

QUERY command: POW:PROT?

Unit: W

Example) POW:PROT<SP>20.5

POW:PROT:ACT

Description: Specifies and queries the operation to be executed when overpower occurs.

SET command: POW:PROT:ACT<SP>{LIM|TRIP}

QUERY command: POW:PROT:ACT?

Example) POW:PROT:ACT<SP>TRIP

VOLT:PROT:UND

Description: Specifies and queries the set value for undervoltage protection.

SET command: VOLT:PROT:UND<SP><voltage>

QUERY command: VOLT:PROT:UND?

<voltage>: OFF, -0.5V to 150V. The setup resolution is 0.01V.

Unit: V

Example) VOLT:PROT:UND <SP>7.50

6-3-2-4. Switching Function SET Commands

PULS:MAIN:COND

Description: Specifies and queries the main conductance for switching mode.

SET command: PULS:MAIN:COND<SP><conductance>

QUERY command: PULS:MAIN:COND?

* When an intermediate value between the set value steps is sent, the value is rounded to the step value of the smaller conductance.

Unit: S (Siemens)

Example) PULS:MAIN:COND <SP>2.5

PULS:SUB:COND

Description: Specifies and queries the subconductance for switching mode.

SET command: PULS:SUB:COND<SP><conductance>

QUERY command: PULS:SUB:COND?

* When an intermediate value between the set value steps is sent, the value is rounded to the step value of the smaller conductance.

Unit: S (Siemens)

Example) PULS:SUB:COND <SP>2.5

PULS:MAIN:RESI

Description: Specifies and queries the main resistance for switching mode.

SET command: PULS:MAIN:RESI <SP><resistor>

QUERY command: PULS:MAIN:RESI?

Unit: Ω

* When an intermediate value between the set value steps is sent, the value is rounded to the step value of the larger resistance.

Example) PULS:MAIN:RESI <SP>2.5

PULS:SUB:RESI

Description: Specifies and queries the subresistance for switching mode.

SET command: PULS:SUB:RESI <SP><resistor>

QUERY command: PULS:SUB:RESI?

Unit: Ω

* When an intermediate value between the set value steps is sent, the value is rounded to the step value of the larger resistance.

Example) PULS:SUB:RESI <SP>2.5

PULS:MAIN:CURR

Description: Specifies and queries the main current for switching mode.

SET command: PULS:MAIN:CURR<SP><current>

QUERY command: PULS:MAIN:CURR?

Unit: A

Example) PULS:MAIN:CURR<SP>2.5

PULS:SUB:CURR

Description: Specifies and queries the subcurrent for switching mode.

SET command: PULS:SUB:CURR<SP><current>

QUERY command: PULS:SUB:CURR?

Unit: A

Example) PULS:SUB:CURR<SP>2.5

PULS:MAIN:POW

Description: Specifies and queries the main power for switching mode.

SET command: PULS:MAIN:POW <SP><power>

QUERY command: PULS:MAIN:POW?

Unit: W

Example) PULS:MAIN:POW <SP>2.5

PULS:SUB:POW

Description: Specifies and queries the subpower for switching mode.
SET command: PULS:SUB:POW <SP><power>
QUERY command: PULS:SUB:POW?
Unit: W
Example) PULS:SUB:POW <SP>2.5

PULS:MAIN:VOLT

Description: Specifies and queries the main voltage for switching mode.
SET command: PULS:MAIN:VOLT <SP><voltage>
QUERY command: PULS:MAIN:VOLT?
Unit: V
Example) PULS:MAIN:VOLT <SP>2.5

PULS:SUB:VOLT

Description: Specifies and queries the subvoltage for switching mode.
SET command: PULS:SUB:VOLT <SP><voltage>
QUERY command: PULS:SUB:VOLT?
Unit: V
Example) PULS:SUB:VOLT <SP>2.5

PULS:DCYC

Description: Specifies and queries the duty in switching mode.
SET command: PULS:DCYC<SP><value>
QUERY command: PULS:DCYC?
Unit: %

PULS:FREQ

Description: Specifies and queries the frequency for switching mode.
SET command: PULS:FREQ<SP><value>
QUERY command: PULS:FREQ?
Unit: Hz
Example) PULS:FREQ<SP>5000

PULS:SLEW

Description: Specifies and queries the current slew rate for switching mode.
SET command: PULS:SLEW <SP><slew>
QUERY command: PULS:SLEW?
Unit: A/μs
Example) PULS:SLEW<SP>1.5

PULS:TA

Description: Specifies and queries the main time for switching mode.
SET command: PULS:TA<SP><value>
QUERY command: PULS:TA?
Unit: s (sec)
Example) PULS:TA<SP>0.0005

PULS:TB

Description: Specifies and queries the subtime for switching mode.
SET command: PULS:TB<SP><value>
QUERY command: PULS:TB?
Unit: s (sec)
Example) PULS:TB<SP>0.002

PULS

Description: Specifies and queries the ON/OFF and MAIN/SUB settings for switching mode.
SET command: PULS<SP>{OFF|ON|MAIN|SUB}
QUERY command: PULS?
Example) PULS<SP>ON

PULS:DISP

Description: Specifies and queries the display items in switching mode.

SET command: PULS:DISP<SP>{0|1}

QUERY command: PULS:DISP?

Example) PULS:DISP<SP>1

* 0: Slew rate, frequency and duty (or time) are displayed.

1: Set values of the operation mode are displayed.

PULS:TYPE

Description: Specifies and queries the Freq, Duty (F), Time (T), and External (E) settings for switching mode.

SET command: PULS:TYPE<SP>{F|T|E}

QUERY command: PULS:TYPE?

Example) PULS:TYPE<SP>T

6-3-2-5. Current Range SET Commands**CURR:RANG**

Description: Specifies and queries the current range.

SET command: CURR:RANG<SP>{L|H}

QUERY command: CURR:RANG?

Example) CURR:RANG<SP>H

VOLT:RANG

Description: Specifies and queries the voltage range.

SET command: VOLT:RANG<SP>{L|H}

QUERY command: VOLT:RANG?

Example) VOLT:RANG<SP>L

6-3-2-6. Preset Function SET Commands**PRES:REC**

Description: Recalls settings from the preset memory.

SET command: PRES:REC<SP>{1|2|3|4}

QUERY command: PRES:REC?

Example) PRES:REC<SP>1

PRES:STOR

Description: Stores setting in the preset memory.

SET command: PRES:STOR<SP>{1|2|3|4}

Example) PRES:STOR<SP>1

6-3-2-7. Soft Start Function SET Commands**SST:TIME**

Description: Specifies and queries the soft start time.

SET command: SST:TIME<SP>{1m|2m|5m|10m|20m|50m|100m|200m}

QUERY command: SST:TIME?

Unit: sec

Example) SST:TIME<SP>1m

SST:VOLT

Description: Specifies and queries the soft start voltage.

SET command: SST:VOLT<SP><voltage>

QUERY command: SST:VOLT?

<voltage>: OFF, -0.5V to 150V. The setup resolution is 0.01V.

Unit: V

Example) SST:VOLT<SP>10.0

6-3-2-8. Input Status SET Commands

EXT

Specifies the setting (ON/OFF) of the external voltage control and the superposing function.

SET command: EXT<SP>{OFF|V}

QUERY command: EXT?

Example) EXT<SP>V

INP

Description: Specifies and queries whether the unit enters LOAD ON or LOAD OFF mode.

SET command: INP<SP>{OFF|ON}

QUERY command: INP?

Example) INP<SP>ON

RESP

Description: Specifies and queries the response speed of the electronic load.

SET command: RESP<SP>{SLOW|FAST}

QUERY command: RESP?

Example) RESP<SP>SLOW

SENS

Description: Specifies and queries the settings for external/internal voltage sensing.

SET command: SENS<SP>{INT|EXT}

QUERY command: SENS?

Example) SENS<SP>EXT

TIMER

Description: Specifies and queries the LOAD ON/OFF time for the automatic LOAD function.

SET command: TIMER {NONE|OFF|ON},<time>

* The format of <time> is separated with "-"; hour-minute-second.

QUERY command: TIMER?

Example) TIMER<SP>ON,1-12-30

BIASV

Description: Setting and the inquiry of the power supply for 0V.

SET command: BIASV<SP><voltage>

QUERY command: BIASV?

<voltage>: OFF, 0V to 1.5V. The setup resolution is 0.05V.

Unit: V

6-3-2-9. Measuring Commands

MEAS:CURRE?

Description: Reads out the measured current.

QUERY command: MEAS:CURRE?

Unit: A

Example of response) 0.000

MEAS:POW?

Description: Reads out the measured power.

QUERY command: MEAS:POW?

Unit: W

Example of response) 0.000

MEAS:VOLT?

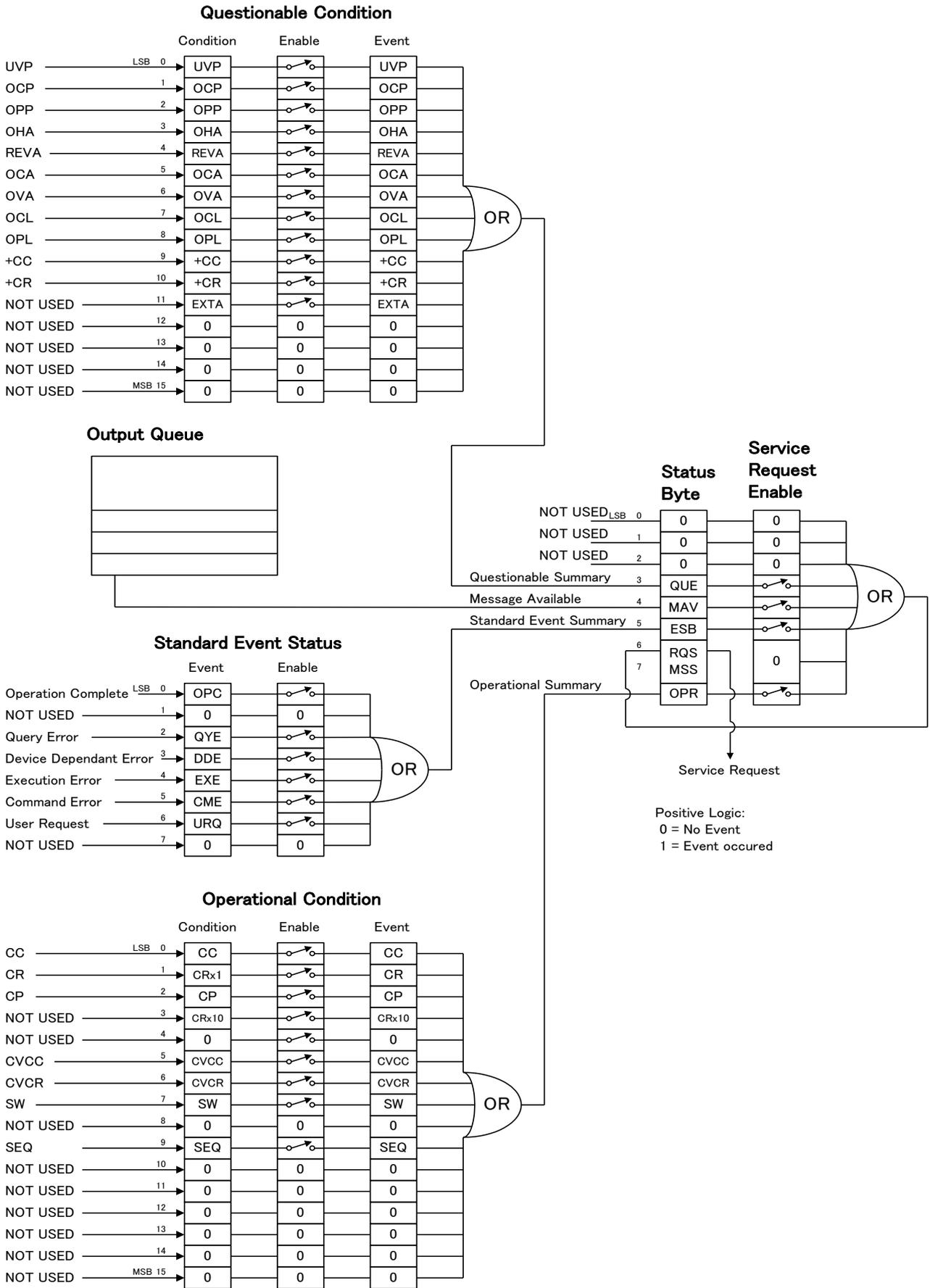
Description: Reads out the measured voltage.

QUERY command: MEAS:VOLT?

Unit: V

Example of response) 0.000

6-3-2-10. Status Report



6-3-2-11. OPERation Status Register

This register is primarily used to display the operation status.

Bit	Bit Weight	Bit Name	Description
0	1	CC	1 in CC mode
1	2	CRx1	1 in CRx1 mode
2	4	CP	1 in CP mode
3	8	CRx10	1 in CRx10 mode
4	16	NOT USED	Not used
5	32	CVCC	1 in CV+CC mode
6	64	CVCR	1 in CV+CR mode
7	128	SW	1 in switching mode
8	256	NOT USED	Not used
9	512	SEQ	1 in sequence mode
10	1024	NOT USED	Not used
11	2048	NOT USED	Not used
12	4096	NOT USED	Not used
13	8192	NOT USED	Not used
14	16384	NOT USED	Not used
15	32768	NOT USED	Always "0"

STAT:OPER:COND?

Description: Reads out the condition of the OPERation status register.

The return <value> is a decimal number that indicates the total of all the event bits.

STAT:OPER:ENAB

Description: Enables the OPERation status register.

The <value> is a decimal number that indicates the total of all the enable bits.

STAT:OPER:ENAB?

Description: Queries the enabled setting of the OPERation status register.

The <value> is a decimal number that indicates the total of all the enable bits.

STAT:OPER:EVEN?

Description: Reads out the values of the events in the OPERation status register.

The return <value> is a decimal number that indicates the total of all the event bits.

6-3-2-12. QUEStionable Status Register

This register is primarily used to display the error status.

Bit	Bit Weight	Bit Name	Description
0	1	UVP	Undervoltage protection
1	2	OCP	Overcurrent protection
2	4	OPP	Overpower protection
3	8	OHA	Overheat alarm
4	16	REVA	Reverse connection alarm
5	32	OCA	Overcurrent alarm
6	64	OVA	Overvoltage alarm
7	128	OCL	Overcurrent limit
8	256	OPL	Overpower limit
9	512	+CC(CVCC)	CC limit in CV+CC mode
10	1024	+CR(CVCR)	CR limit in CV+CR mode
11	2048	EXTA	External alarm
12	4096	NOT USED	Not used
13	8192	NOT USED	Not used
14	16384	NOT USED	Not used
15	32768	NOT USED	Always "0"

STAT:QUES:COND?

Description: Reads out the condition of the QUEStionable status register.

The return <value> is a decimal number that indicates the total of all the event bits.

STAT:QUES:ENAB

Description: Enables the QUEStionable status register.

The <value> is a decimal number that indicates the total of all the enable bits.

STAT:QUES:ENAB?

Description: Queries the enabled setting of the QUEStionable status register.

The return <value> is a decimal number that indicates the total of all the enable bits.

STAT:QUES:EVEN?

Description: Reads out the value of the events in the QUEStionable status register.

The return <value> is a decimal number that indicates the total of all the event bits.

6-3-2-13. Standard Event Status Register

This register is controlled by *ESE, *ESE?, and *ESR?.

Bit	Bit Weight	Bit Name	Description
0	1	OPC	Operation complete
1	2	-	Not used
2	4	QYE	Query error
3	8	DDE	Device dependent error
4	16	EXE	Execution error
5	32	CME	Command error
6	64	URQ	User request
7	128	-	Not used

*ESE

Description: Specifies and queries the setting of the standard event status enable register.

SET command: *ESE<SP><value>

* The <value> is a decimal number that indicates the total of all the enable bits.

QUERY command: *ESE?

Example: *ESE<SP>16

Example response: 16

*ESR?

Description: Queries the standard event status.

QUERY command: *ESR?

* The bit is cleared after the values of the events are read out.

Response example: 32

*OPC

Description: Specifies the OPC bit of the standard event status register.

* When "**OPC?" is sent, "1" is returned to the output queue.

*TST?

Description: Always returns "0" to the output queue.

6-3-2-14. Status Byte Register and Service Request

Status Byte

Bit	Bit Weight	Bit Name	Description
0	1	BSY	Operation status 1: Executing 0: Ready
1	2	0	Not used
2	4	SYS	System error. Message in the error queue is valid.
3	8	QUE	Error summary
4	16	MAV	Message in the output queue is valid
5	32	ESB	Standard event summary
6	64	SRQ/RQS/MSS	Service request
7	128	OPR	Operation summary

*SRE

Description: Specifies and queries the setting of the service request enable register.

SET command: *SRE<SP><value>

* The <value> is a decimal number that indicates the total of all the enable bits.

QUERY command: *SRE?

* The return <value> is a decimal number that indicates the total of all the event bits.

Example) *SRE<SP>48

*48 (decimal number) → 00110000 (binary number); MAV and ESB are enabled.

Response example: 48

* The mask setting specified by this command is valid until the setting is modified or the power is shut off.

When the unit is turned back on, all of the bits are masked, regardless of what their previous settings were.

MAV (message available): Indicates that there is a message in the output queue.

ESB (event summary bit): Indicates that an event has been logged in the standard event status register.

RQS (request service): Indicates that a service request has been logged. This bit cannot be masked. (Even when 0 is specified, it is assumed to be 1.)

*STB?

Description: Reads out the status byte and MSS.

* The return <value> is a decimal number that indicates the total of all the event bits.

QUERY command: *STB?

Response example: 32

* Only the bit specified by *SRE command is returned.

The status byte register cannot be cleared by performing a query with this command.

MAV (message available): Indicates that there is a message in the output queue.

ESB (event summary bit): Indicates that an event has been logged in the standard event status register.

RQS (request service) / MSS (master status summary)

: "1" is specified for MSS when the logical multiplication of all the status byte bits other than this bit (d6) and the service request enable register is "1". RQS is set to "1" when MSS is "1", and cleared when MSS is cleared or serial polling is enabled.

* The status byte register cannot be cleared by performing a query with the STB command.

*CLS

Description: Clears all the registered events and saved error messages.

SET command: *CLS

* Masking status byte and event register

If a status byte or event register contains a bit that you do not want to use to trigger SRQ, use the *SRE and *ESE commands to mask the status byte.

6-3-2-15. Supplementary Explanation about the Status Report

The unit is equipped with a function that issues a service request by conducting serial polling. After the request is issued, the unit outputs a status report. The status summary is described in the figure below. When a service request is detected, the controller side reads out the status byte and performs the necessary processing based on the byte that is read. All the statuses are masked when the unit is turned on.

* The SRQ function is only available when using a GP-IB.

Status Byte Operation

When an event occurs, if one of the status byte bits is "1", bit 6 is set to "1" and a service request (SRQ) is issued. The unit contains two status bits that can trigger SRQ.

ESB: Standard event register

MAV: Message available

Reading the Status Byte

There are two different methods that can be used to read out the status byte from the controller:

- 1) Performing a query with the *STB? command

When you use the *STB? command to perform a query, bit 6 reads out MSS. None of the status byte bits are cleared after MSS is read out.

- 2) Serial Polling

When serial polling is enabled, bit 6 reads out RQS. Only RQS is cleared after it is read out.

Clearing the Status Byte

The status byte cannot be cleared directly. To clear the status byte, the event register that triggered the status byte needs to be cleared.

When ESB occurs:

If ESB occurs, the *ESR? command is used to perform a query. All the bits are cleared after the standard event register is read out.

Receiving a *CLS command:

When the LSA series receives a *CLS command, the standard event register log is cleared.

→ Because the event register log is cleared in both cases 1) and 2), the corresponding bit of the status byte is also cleared.

When MAV occurs:

The MAV bit is cleared by reading out all the output queues. Although the *CLS command cannot be used to clear all the output queues, the queues are cleared when the unit receives the *CLS command immediately after the program message terminator.

When the event register and MAV are cleared, the MSS of bit 6 is also cleared.

6-3-2-16. Other Commands

BUZZ

Description: Specifies and queries the setting (ON/OFF) of the buzzer.

SET command: BUZZ<SP>{OFF|ON}

QUERY command: BUZZ?

Example) BUZZ<SP>ON

CONFIG:SAVE

Description: Saves configurations to the unit.

SET command: CONFIG:SAVE

Example) CONFIG:SAVE

DISP

Description: Displays in full screen.

SET command: DISP<SP>{NOM|ZOOM}

QUERY command: DISP?

Example) DISP<SP>ZOOM

ESC

Description: Cancels the protection.

SET command: ESC

Example) ESC

INIT

Description: Initializes the settings data (restores the factory defaults).

SET command: INIT

Example) INIT

SYST:SET

Description: Specifies and queries the settings of local operation, remote operation, and local lockout when a GP-IB is not used.

* The query command is only when using a GP-IB.

SET command: SYST:SET<SP>{LOC|REM|LLO}

QUERY command: SYST:SET?

Example) SYST:SET<SP>LLO

***IDN?**

Description: Queries the manufacturer name, model, serial number, and ROM version.

QUERY command: *IDN?

Response: co,obid,0,ver

co: Company name; TEXIO TECHNOLOGY

obid: Model; LSA-****

0: Always "0".

ver: ROM version; CPU1/CPU2/CPU3/CPU4

Response example: When the LSA-165 model is used and the ROM version of CPU1/CPU2/CPU3/CPU4 is 1.00.

TEXIO TECHNOLOGY, LSA-165,0,1.00/1.00/1.00/1.00

***RST**

Description: Clears the communication buffer, output queue, and standby commands.

SRQ, the status byte, and the mask settings are cleared.

SET command: *RST

6-3-2-17. Sequence Command Details

PROG:GROUP

Description: Designates the sequence group number. When a sequence group number is selected, the sequence-related commands are configured for the selected sequence group.

SET command: PROG:GROUP<SP><value>

Example) PROG:GROUP<SP>1

* The <value> is an integer number from 1 to 4.

PROG:MODE

Description: Specifies and queries the operation mode for the selected sequence group.

SET command: PROG:MODE<SP>{CC|CR|CP|CVCC|CVCR|CREX}

QUERY command: PROG:MODE?

Example) PROG:MODE<SP>CR

* The parameter CR is for CRx1 mode. CREX is for CRx10 mode.

PROG:LINP

Description: Specifies and queries the LOAD ON mode and LOAD OFF mode settings for when the sequence finishes.

SET command: PROG:LINP<SP>{OFF|ON}

QUERY command: PROG:LINP?

Example) PROG:LINP<SP>OFF

PROG:NCYC

Description: Specifies and queries the number of execution cycles for the selected sequence group.

SET command: PROG:NCYC<SP><value>

QUERY command: PROG:NCYC?

* When the <value> is "INF", the number of cycles is infinite. When a <value> is specified that does not fall between 1 and 9999, an execution error is issued.

Example) PROG:NCYC<SP>3

PROG:LVAL

Description: Specifies and queries the reference value for the moment when a sequence finishes.

SET command: PROG:LVAL<SP><value>

QUERY command: PROG:LVAL?

Example) PROG:LVAL<SP>5.00

PROG:CRAN

Description: Specifies and queries the current range of the selected sequence group.

SET command: PROG:CRAN<SP>{L|M|H}

QUERY command: PROG:CRAN?

Example) PROG:CRAN<SP>H

PROG:VRAN

Description: Specifies and queries the voltage range of the selected sequence group.

SET command: PROG:VRAN<SP>{L|H}

QUERY command: PROG:VRAN?

Example) PROG:VRAN<SP>L

PROG:COND:CVCR

Description: Specifies and queries the conductance of the sequence CV+CR mode.

SET command: PROG:COND:CVCR<SP><value>

QUERY command: PROG:COND:CVCR?

Example) PROG:COND:CVCR<SP>1.00

PROG:RESI:CVCR

Description: Specifies and queries the resistance of the sequence CV+CR mode.

SET command: PROG:RESI:CVCR<SP><value>

QUERY command: PROG:RESI:CVCR?

Example) PROG:RESI:CVCR<SP>1.00

PROG:CURR:CVCC

Description: Specifies and queries the current of the sequence CV+CC mode.

SET command: PROG:CURR:CVCC<SP><value>

QUERY command: PROG:CURR:CVCC?

Example) PROG:CURR:CVCC<SP>1.00

PROG:BRANI

Description: Specifies and queries the setting of the current for conditional sequence branching.

SET command: PROG:BRANI<SP>{OFF|ON},<condition_value>,<MS|GROUP|PAUSE|LOADOFF>,<no>

* <no> indicates a number that corresponds to the MS or GROUP selected for the <state>.

QUERY command: PROG:BRANI?

Example) PROG:BRANI<SP>ON,5.00,GROUP,1

* When "OFF" is selected in the SET command, the parameters that follow can be omitted.

When <MS|GROUP|PAUSE|LOADOFF> is set to "PAUSE" or "LOADOFF" in the SET command, the parameters that follow can be omitted.

If the setting is off, the query response is "OFF".

PROG:BRANV

Description: Specifies and queries the setting of the voltage for conditional sequence branching.

SET command: PROG:BRANV<SP>{ OFF|ON },<condition_value>,<MS|GROUP|PAUSE|LOADOFF>,<no>

* <no> indicates a number that corresponds to the MS or GROUP selected for the <state>.

QUERY command: PROG:BRANV?

Example) PROG:BRANV<SP>ON,5.00,MS,1

* When "OFF" is selected in the SET command, the parameters that follow can be omitted.

When <MS|GROUP|PAUSE|LOADOFF> is set to "PAUSE" or "LOADOFF" in the SET command, the parameters that follow can be omitted.

If the setting is off, the query response is "OFF".

PROG:BRANT

Description: Specifies and queries the time setting for conditional sequence branching.

SET command: PROG:BRANT<SP>{ OFF|ON },<condition_value>,<MS|GROUP|PAUSE|LOADOFF>,<no>

* <no> indicates a number that corresponds to the MS or GROUP selected for <state>.

The <condition_value> display is separated by "-" hyphens: hour-minute-second.

QUERY command: PROG:BRANT?

Example) PROG:BRANT<SP>ON,0-0-10,GROUP,1

* When "OFF" is selected in the SET command, the parameters that follow can be omitted.

When <MS|GROUP|PAUSE|LOADOFF> is PAUSE or LOADOFF in the SET command, the parameters that follow can be omitted.

If the setting is off, the query response is "OFF".

PROG:ADD

Description: Adds an additional step after the last step of the selected sequence group.

SET command: PROG:ADD<SP>{<current>|<conductance>|<power>|<voltage>},
<time>,

{wave OFF|ON},

{load OFF|ON},

{behave RUN|SKIP|PAUSE},

{trigger OFF|ON},

* The <time> display is separated by "-" hyphens: hour-minute-second.

Example) PROG:ADD<SP>3.35,0-0-0.005,OFF,OFF,RUN,OFF

PROG:BEHAVE

Description: Specifies and queries the operation of the selected step.

SET command: PROG:BEHAVE <SP><step>,{ RUN|SKIP|PAUSE }

QUERY command: PROG:BEHAVE <SP><step>?

Example) PROG:BEHAVE <SP>2,RUN

PROG:DEL

Description: Deletes a step from the selected sequence group.

SET command: PROG:DEL<SP><step>

Example) PROG:DEL<SP>1

PROG:DEL:ALL

Description: Deletes all the steps of the selected sequence group.

SET command: PROG:DEL:ALL

Example) PROG:DEL:ALL

PROG:EDIT

Description: Edits the selected step and queries the actual settings.

SET command: PROG:EDIT<SP><step>{<current>|<conductance>|<power>|<voltage>},
<time>,

{wave OFF|ON},

{load OFF|ON},

{behave RUN|SKIP|PAUSE},

{trigger OFF|ON},

QUERY command: PROG:EDIT<SP><step>?

* The <time> display is separated by "-" hyphens: hour-minute-second.

Example) PROG:EDIT<SP>10,5.25,0-0-1,ON,OFF,RUN,OFF

PROG:INS

Description: Inserts a step in the selected sequence group. Specifies the step number of the step to be inserted and the settings of the step.

SET command: PROG:INS<SP><step>,{<current>|<conductance>|<power>|<voltage>},
<time>,

{wave OFF|ON},{load OFF|ON},

{behave RUN|SKIP|PAUSE},

{trigger OFF|ON}

* The <time> display is separated by "-" hyphens: hour-minute-second.

Example) PROG:INS<SP>9,5.0,0-0-0.03,OFF,OFF,RUN,OFF

PROG:WAVE

Description: Edits a waveform step of the selected sequence group and queries the actual settings.

SET command: PROG:WAVE<SP><step>,{RAMP|SQU|SINE|TRI|PULSE|RUSH},
 <val1>,<val2>,<val3>,<val4>,<val5>,<val6>

QUERY command: PROG:WAVE<SP><step>?

Example) PROG:WAVE<SP>15,SQU,10000.0,50,0.01,5,1,2

Waveform	Val	Value	Unit
RAMP	val1	Iset	[A]
	val2	Tt	[s]
SQU	val1	Frequency	[Hz]
	val2	Duty	[%]
	val3	Tr/Tf	[ms]
	val4	Iset1	[A]
	val5	Iset2	[A]
	val6	Cycle	[cycles]
SINE	val1	Frequency	[Hz]
	val2	P-P	[A]
	val3	Center	[A]
	val4	Cycle	[cycles]
TRI	val1	Frequency	[Hz]
	val2	P-P	[A]
	val3	Center	[A]
	val4	Duty	[%]
	val5	Cycle	[cycles]
PULSE	val1	Iset1	[A]
	val2	Iset2	[A]
	val3	Tp	[µs]
	val4	P Count	[cycles]
	val5	Tb	[ms]
	val6	Cycle	[cycles]
RUSH	val1	Iset1	[A]
	val2	Iset2	[A]
	val3	TC	[s]
	val4	Tset	[s]

* When the <value> is "INF", the number of cycles is infinite. When a <value> is specified that does not fall between 1 and 9999, an execution error is issued.

PROG:MS

Description: Designates a sequence program number. When sequence program No. 1, 2, 3, or 4. is selected, the sequence-related commands are configured for the selected sequence program. The waveform is specified according to the selected waveform.

SET command: PROG:MS<SP>{1|2|3|4|RAMP|SQU|SINE|TRI|PULSE|RUSH}

Example) PROG:MS<SP>1

* The relationship between the settings of the parameters and programs/waveforms is as follows:

Parameter	Program/Waveform
1	Program A
2	Program B
3	Program C
4	Program D
RAMP	Ramp wave
SQU	Square wave
SINE	Sine wave
TRI	Triangular wave
PULSE	Pulse wave
RUSH	Rush wave

* A through D are used in place of 1 through 4.

PROG:MS:NCYC

Description: Specifies and queries the number of execution cycles of the selected sequence program.

SET command: PROG:MS:NCYC<SP><value>

QUERY command: PROG:MS:NCYC?

* When the <value> is "INF", the number of cycles is infinite. When a <value> is specified that does not fall between 1 and 9999, an execution error is issued.

Example) PROG:MS:NCYC<SP>3

PROG:MS:ORDE

Description: Specifies and queries the execution order of the registered sequence group.

SET command: PROG:MS:ORDE<SP><value>,<value>,,,,, <value>

QUERY command: PROG:MS:ORDE?

Example) PROG:MS:ORDE<SP>1,3,2,4

* When no data is registered and all are "NONE", the query response is "NONE". The <value> is an integer number from 1 to 4.

PROG:PG:WAVE

Description: Edits the selected waveform and queries the actual settings.

SET command: PROG:PG:WAVE<SP>{RAMP|SQU|SINE|TRI|PULSE|RUSH},
 {L|M|H},
 <val1>,<val2>,<val3>,<val4>,<val5>,<val6>

QUERY command: PROG:PG:WAVE<SP>RECT?

Example) PROG:WAVE<SP>RECT,H,10000.0,50,0.01,5,1,2

Waveform	Val	Value	Unit
RAMP	val1	Iset	[A]
	val2	Tt	[s]
SQU	val1	Frequency	[Hz]
	val2	Duty	[%]
	val3	Tr/Tf	[msec]
	val4	Iset1	[A]
	val5	Iset2	[A]
	val6	Cycle	[cycles]
SINE	val1	Frequency	[Hz]
	val2	P-P	[A]
	val3	Center	[A]
	val4	Cycle	[cycles]
TRI	val1	Frequency	[Hz]
	val2	P-P	[A]
	val3	Center	[A]
	val4	Duty	[%]
	val5	Cycle	[cycles]
PULSE	val1	Iset1	[A]
	val2	Iset2	[A]
	val3	Tp	[us]
	val4	P Count	[cycles]
	val5	Tb	[ms]
	val6	Cycle	[cycles]
RUSH	val1	Iset1	[A]
	val2	Iset2	[A]
	val3	TC	[s]
	val4	Tset	[s]

* {L|M|H} is the current range.

* When the <value> for the Cycle setting is "INF", the number of cycles is infinite. When a <value> other than "INF" or one that does not fall between 1 and 9999 is specified, an execution error is issued.

PROG

Description: Specifies and queries the LOAD ON mode and LOAD OFF mode settings for sequence operation.

SET command: PROG<SP>{OFF|ON}

QUERY command: PROG?

Example) PROG<SP>ON

PROG:CLE

Description: Clears the sequence group.

SET command: PROG:CLE

Example) PROG:CLE

PROG:COUN?

Description: Queries the number of steps for the selected sequence group.

QUERY command: PROG:COUN?

Example) PROG:COUN?

PROG:COUN:ALL?

Description: Queries the total number of registered steps.

QUERY command: PROG:COUN:ALL?

Example) PROG:COUN:ALL?

PROG:LOAD

Description: Reads out the data for all of the registered groups and steps from the backup memory.

SET command: PROG:LOAD

Example) PROG:LOAD

PROG:SAVE

Description: Saves the data for the all of the registered groups and steps to the backup memory.

SET command: PROG:SAVE

Example) PROG:SAVE

PROG:STAT

Description: Changes the execution or operation status of the selected sequence group.

SET command: PROG:STAT<SP>{RUN|STOP|PAUS|CONT}

* RUN: Executes the selected sequence.

STOP: Stops the selected sequence group.

PAUS: Pauses the selected sequence group.

CONT: Cancels the pause of the selected sequence group.

QUERY command: PROG:STAT?

Example) PROG:STAT<SP>RUN

PROG:TIMER?

Description: Inquiry of the elapsed time of the sequence program.

QUERY command: PROG:TIMER?

※ Return the format of the second, minutes and hours.

When it is over the greatest elapsed time with 9999-59-59 from 0-00-00, the reply range gives back 9999-59-59.

Example) 9876-54-32

Appendix A. Troubleshooting

The following table describes problems with the unit that might occur and how to fix them.

Problem	Possible Cause	Action
The POWER switch is thrown but the unit does not turn on. (The LCD on the front panel does not light up.)	The AC power cable is broken or not connected securely.	Check the connection of the AC power cable. Replace the cable if it is broken.
	The voltage supplied from the power source is too high, or a unit malfunction has caused the protection fuse to blow.	The fuse needs be replaced. Contact the TEXIO service center.
	The voltage supplied from the power source is too low.	Adjust the input voltage.
The unit is switched to LOAD ON mode but no current runs.	The input voltage is too low.	Increase the input voltage. (In order for the current to run, the input voltage must be at least 1V.)
	The specified current or current limit is too small.	Raise the specified current.
When 0V is input, a rating electric current does not flow. (In the case of V1 model)	When it loads on, operation voltage setting of "power supply for 0V" is higher than input voltage.	Set voltage within operation voltage setting of "power supply for 0V" or adjust operation voltage or input voltage and turns on.
	The operation setting voltage of the power supply for 0V is set "OFF".	Please set the movement setting voltage other than "OFF".
The unit cannot be switched to LOAD OFF mode.	The external LOAD ON/OFF function is ON in the external contact control.	Open pins No.10 and No.8 of the J1 connector on the back of the unit.
The input current is unstable or there is too much noise.	Commercial frequency noise is generated as a result of low supply voltage.	Adjust the input voltage.
	There is a source of strong magnetic or electrical field near the unit.	Move the unit away from equipment that might produce a magnetic or electrical field. In addition to relocating the unit, make sure to twist the wires.

If a problem occurs that is not described in this table, or if a problem continues to persist after the potential cause is eliminated, contact the TEXIO service center.



Do not remove the case.

The TEXIO service center will handle repair work that requires the case to be removed, as well as the work involved in replacing fuses.

Appendix B. Specifications

B-1. Input Specifications

Item		LSA-165	LSA-165V1	LSA-330	LSA-1000
Input power	H	0 W to 165 W		0 W to 330 W	0 W to 1000 W
	M	0 W to 16.5 W		0 W to 33 W	0 W to 100 W
	L	0 W to 1.65 W		0 W to 3.3 W	0 W to 10 W
Input voltage range: CR mode *1		0 V to 150 V			
Input voltage range: Other modes *2		1 V to 150 V			
Input current range: Rear input terminal		0 A to 33 A		0 A to 66 A	
Input current range: Front input terminal					
Input terminal type		Front		Screw terminal	
		Rear		Copper bus bar	

*1: The unit can run when only 0 V of voltage is input. However, at least 1 V of voltage must be input in order for the current to run at a value equal to the specified resistance.

*2: The unit can run when a voltage of 1 V or less is input. However, in this case the current that runs through the unit will be lower than the specified current or the current calculated from the input voltage and settings. In CV mode, the current will cause the actual voltage to be larger than the set voltage.

B-2. CC (Constant Current) Mode

Item		LSA-165	LSA-165V1		LSA-330	LSA-1000
Current setting range	H	0 A to 33 A			0 A to 66 A	0 A to 200 A
	M	0 A to 3.3 A			0 A to 6.6 A	0 A to 20 A
	L	0 mA to 330 mA			0 mA to 660 mA	0 mA to 2000 mA
Specified resolution	H	1 mA			2 mA	6 mA
	M	0.1 mA			0.2 mA	0.6 mA
	L	10 μ A			20 μ A	60 μ A
Maximum power	H	165 W			330 W	1000 W
	M	16.5 W			33 W	100 W
	L	1.65 W			3.3 W	10 W
Specified accuracy (23°C \pm 5°C)		$\pm(0.2\%$ of set+ 0.3% of fs)				
		—	Power supply on for 0V (0V/33A)	Power supply off for 0V (1.5V/33A)	—	—
Ripple noise (rms) Range of 10Hz to 1MHz	H	10 mA	25 mA	15 mA	15 mA	30 mA
	M	5 mA	10mA	5 mA	5 mA	10 mA
	L	1 mA	3mA	1 mA	1 mA	3 mA
Stability (long-time drifting)		$\pm 0.1\%$ of fs typ				
Temperature coefficient (for the specified value)		100 ppm/°C				

B-3. CR (Constant Resistance) Mode

Item		LSA-165	LSA-165V1	LSA-330	LSA-1000	
Resistance setting range	H	OPEN, 1.81 k Ω to 30.3 m Ω		OPEN, 909 Ω to 15.1 m Ω	OPEN, 303 Ω to 5.05 m Ω	
	M	OPEN, 18.1k Ω to 303 m Ω		OPEN, 9.09 k Ω to 151 m Ω	OPEN, 3.03 k Ω to 50.5 m Ω	
	L	OPEN, 181 k Ω to 3.03 Ω		OPEN, 90.9 k Ω to 1.51 Ω	OPEN, 30.3k Ω to 505 m Ω	
Specified resolution	H	0.55 mS		1.1 mS	3.3 mS	
	M	55 μ S		0.11 mS	0.33 mS	
	L	5.5 μ S		11 μ S	33 μ S	
Specified accuracy (conversion of current) 23°C \pm 5°C *3	H	$\pm(0.5\%$ of set+ 0.2) A		$\pm(0.5\%$ of set+ 0.4) A	$\pm(0.5\%$ of set+ 1.2) A	
	M	$\pm(0.5\%$ of set+ 20) mA + Vin/Rin		$\pm(0.5\%$ of set+ 40) mA + Vin/Rin	$\pm(0.5\%$ of set+ 120) mA + Vin/Rin	
	L	$\pm(0.5\%$ of set+ 2) mA + Vin/Rin		$\pm(0.5\%$ of set+ 4) mA + Vin/Rin	$\pm(0.5\%$ of set+ 12) mA + Vin/Rin	
Ripple noise (rms) Range of 10Hz to 1MHz	H	10 mA		15 mA	30 mA	
	M	5 mA		5 mA	10 mA	
	L	1 mA		1 mA	3 mA	
Stability (long-time drifting)		$\pm 0.1\%$ of fs typ				
Temperature coefficient (for the specified value)		1000 ppm/°C				

*3: Vin is the input voltage, and Rin is approximately 1 M Ω .

In CRx10 mode, the value is shifted 10 times toward to the larger resistance range. The rated current is 1/10 of the range.

B-4. CP (Constant Power) Mode

Item		LSA-165	LSA-165V1	LSA-330	LSA-1000
Power setting range	H	0 W to 165 W		0 W to 330 W	0 W to 1000 W
	M	0 W to 16.5 W		0 W to 33 W	0 W to 100 W
	L	0 W to 1.65 W		0 W to 3.3 W	0 W to 10 W
Specified resolution	H	10 mW		20 mW	60 mW
	M	1 mW		2 mW	6 mW
	L	0.1 mW		0.2 mW	0.6 mW
Specified accuracy *3	H	$\pm(0.4\% \text{ of set} + 1.6\% \text{ of fs})$			
	(23°C $\pm 5^\circ\text{C}$)	M	$\pm(0.4\% \text{ of set} + 1.6\% \text{ of fs}) + V_{in}^2/R_{in}$		
		L			
Ripple noise (rms) Within 10Hz - 1MHz	H	10 mA		15 mA	30 mA
	M	5 mA		5 mA	10 mA
	L	1 mA		1 mA	3 mA
Stability (long-time drifting)		$\pm 0.2\% \text{ of fs typ}$			
Temperature coefficient (for the specified value)		1000 ppm/°C			

*3: V_{in} is the input voltage, and R_{in} is approximately 1 M Ω .

B-5. CV+CC/CV+CR (Constant Voltage) Mode

Item		LSA-165	LSA-165V1	LSA-330	LSA-1000
Voltage setting range	H	0.1 V to 150 V			
	L	0.1 V to 15 V			
Specified resolution	H	10 mV			
	L	1 mV			
Minimum current for stable operation		1% of fs current			
Specified accuracy (23°C $\pm 5^\circ\text{C}$)		$\pm(0.2\% \text{ of set} + 0.1\% \text{ of fs})$			
Stability (long-time drifting)		$\pm 0.2\% \text{ of fs typ}$			
Input current variation		10 mV			
Temperature coefficient (for the specified value)		1000 ppm/°C			

The maximum power varies according to the current range.

The rated current of the corresponding current range can only be run when a voltage of at least 1V is specified.

Input current variation: Current variance range of 10% to 100% for a rated current at input voltage of 1V (in remote sensing).

The specified ranges for +CC and +CR are the same as the respective ranges for CC mode and CRx1 mode. (No CRx10)

There are three current ranges available. Each range can be paired with either +CC and +CR, creating a total of six different combinations.

B-6. Switching Mode

Item		LSA-165	LSA-165V1	LSA-330	LSA-1000
Operation Mode		CC, CR, CV, CP			
Frequency setting	Specified range	CC, CR, CP		1Hz to 20kHz	
		CV		1Hz to 1kHz	
	Specified resolution			1Hz to 99.9Hz: 0.1Hz	
				100Hz to 999Hz: 1Hz *4	
				1kHz to 9.99kHz: 10Hz *4	
				10kHz to 20kHz: 100Hz *4	
Specified accuracy		$\pm 1.5\% \text{ of set}$			
Duty setting (when specifying the frequency)*5	Specified range		1% to 99%		
	Specified resolution		0.1% step		
	Specified accuracy		$\pm 1.5\% \text{ of set}$		
Time setting	Specified resolution	CC, CR, CP		0.02 ms to 99.99 ms: 0.01 ms	
		CV		0.5 ms to 99.99 ms: 0.01 ms	
				100 ms to 500 ms: 0.1ms	
	Specified accuracy		$\pm 1.5\% \text{ of set}$		

*4: Segments smaller than 1/(integral multiple of 10 μs) cannot be specified.

*5: The specified range for DUTY varies according to the frequency (minimum width: 10 μs).

B-7. Slew Rate

Item		LSA-165	LSA-165V1	LSA-330	LSA-1000
Operation mode		CC, CR, CP			
Specified range	H	2.64 mA/μs to 2.64 A/μs		5.28 mA/μs to 5.28 A/μs	16 mA/μs to 16 A/μs
	M	0.264 mA/μs to 0.264 A/μs		0.528 mA/μs to 0.528 A/μs	1.6 mA/μs to 1.6 A/μs
	L	26.4 μA/μs to 26.4 mA/μs		52.8 μA/μs to 52.8 mA/μs	160 μA/μs to 160 mA/μs
Specified resolution	H	① 26.4 mA/μs (2.64A/μs to 0.29A/μs)		① 52.8 mA/μs (5.28 A/μs to 0.581 A/μs)	① 160 mA/μs (16 A/μs to 1.76 A/μs)
		② 2.64 mA/μs (0.264A/μs to 29 mA/μs)		② 5.28 mA/μs (0.528 A/μs to 58.1 mA/μs)	② 16 mA/μs (1.6 A/μs to 176 mA/μs)
		③ 0.264 mA/μs (26.4 mA/μs to 2.64 mA/μs)		③ 0.528 mA/μs (52.8 mA/μs to 5.28 mA/μs)	③ 1.6 mA/μs (160 mA/μs to 16 mA/μs)
	M	① 2.64 mA/μs (0.264 A/μs to 29.0 mA/μs)		① 5.28 mA/μs (0.528 A/μs to 58.1 mA/μs)	① 16 mA/μs (1.6 A/μs to 176 mA/μs)
		② 0.264 mA/μs (26.4 mA/μs to 2.90 mA/μs)		② 0.528 mA/μs (52.8 mA/μs to 5.81 mA/μs)	② 1.6 mA/μs (160 mA/μs to 17.6 mA/μs)
		③ 26.4 μA/μs (2.64 mA/μs to 0.264 mA/μs)		③ 52.8 μA/μs (5.28 mA/μs to 0.528 mA/μs)	③ 160 μA/μs (16 mA/μs to 1.6 mA/μs)
L	① 0.264 mA/μs (26.4 mA/μs to 2.9 mA/μs)		① 0.528 mA/μs (52.8 mA/μs to 5.81 mA/μs)	① 1.6 mA/μs (160 mA/μs to 17.6 mA/μs)	
	② 26.4 μA/μs (2.64 mA/μs to 0.29 mA/μs)		② 52.8 μA/μs (5.28 mA/μs to 0.581 mA/μs)	② 160 μA/μs (16 mA/μs to 1.76 mA/μs)	
	③ 2.64 μA/μs (0.264 mA/μs to 26.4 μA/μs)		③ 5.28 μA/μs (0.528 mA/μs to 52.8 μA/μs)	③ 16 μA/μs (1.6 mA/μs to 160 μA/μs)	
Specified accuracy		Representative values (when a voltage of 5V is input) ① ±(15% set +10 μs), ② ±(15% set +100 μs), ③ ±(15% set +1000 μs)			
Minimum reaction time		5 μs			

The specified accuracy is for the time it takes the rated current to rise from 10% to 70% and fall from 90% to 30% when there is a current variation of 1% to 100%.

The specified accuracy cannot be specified in CV mode.

B-8. Soft Start

Item		LSA-165	LSA-165V1	LSA-330	LSA-1000
Operation mode		CC			
Time setting		1 ms /2 ms /5 ms /10 ms /20 ms /50 ms /100 ms /200 ms			
Specified accuracy		±(30% of set+ 100 μs)			
Operation voltage	Specified range	OFF, -0.5 V to 150 V			
	Specified resolution	0.01 V			
	Setting accuracy (23°C ±5°C)	±(0.1% of set+ 30 mV)			

B-9. Remote Sensing

Item	LSA-165	LSA-165V1	LSA-330	LSA-1000
Compensation voltage external resistance control	One way 2 V			

The voltage range of the load input terminal is the minimum operation voltage to 150 V. A voltage of 2 V cannot be compensated if the voltage of the load input terminal is 3 V or higher. (V1 model is 2V or higher)

B-10. External Voltage Control

Item		LSA-165	LSA-165V1	LSA-330	LSA-1000
Controlled voltage		0% to 100% of the rated current (CC mode), rated voltage (CV mode), and rated power (CP mode) when a voltage of 0 V to 10 V is input. Maximum resistance to minimum resistance (CR mode) when a voltage of 0 V to 10 V is input.			
Linearity	CC, CV, CP	1% of fs			
	CR	2% of fs			
Input impedance		Approx. 10kΩ			

In all modes other than CC mode, it takes approximately 0.2 seconds from the time the settings are specified until the time the actual operation starts.

B-11. External Resistance Control

Item		LSA-165	LSA-165V1	LSA-330	LSA-1000
Controlled resistance	Proportion	0% to 100% of the rated current (CC mode), rated voltage (CV mode), and rated power (CP mode) when a resistance of 0 Ω to 10 kΩ is input. Maximum resistance to minimum resistance (CR mode) when a resistance of 0 Ω to 10 kΩ is input.			
	Reciprocal proportion	0% to 100% of the rated current (CC mode), rated voltage (CV mode), and rated power (CP mode) when a resistance of 10 Ω to 0 kΩ is input. Maximum resistance to minimum resistance (CR mode) when a resistance of 10 Ω to 0 kΩ is input.			
Linearity		2% of fs			

B-12. Master/Slave Parallel Operation

Item	LSA-165	LSA-165V1	LSA-330	LSA-1000
Number of connected units	Maximum of 5 units (including master unit)			

Master/slave operation can only be performed when using units that are of the same model.

B-13. External Control

Item	LSA-165	LSA-165V1	LSA-330	LSA-1000
Function	Switches between LOAD ON and LOAD OFF mode, Main and Sub, and the current range of H, M, and L.			

B-14. Current Monitor Output

Item	LSA-165	LSA-165V1	LSA-330	LSA-1000
Monitoring voltage	0 V to 10 V at 0 A to the rated current			
Monitoring accuracy	±1% of fs			

B-15. Direct Current Measurement (Current Display)

Item		LSA-165	LSA-165V1	LSA-330	LSA-1000
H Range	Measurement range	0.00 A to 33.00 A		0.00 A to 66.00 A	0.0 A to 200.0 A
	Measurement resolution	10 mA		10 mA	100 mA
V range	Measurement range	0.000 A to 3.300 A		0.000 A to 6.600 A	0.00 A to 20.00 A
	Measurement resolution	1 mA		1 mA	10 mA
L range	Measurement range	0.0 mA to 330.0 mA		0.0 mA to 660.0 mA	0 mA to 2000 mA
	Measurement resolution	0.1 mA		0.1 mA	1 mA
Measuring accuracy (23°C ±5°C)		±(0.2% of rdg + 0.3% of fs)			
Measurement frequency		2 cycles/sec.			

B-16. Summation Current Measurement

Item		LSA-165	LSA-165V1	LSA-330	LSA-1000
Measurement resolution	H Range	10×N mA *7			100×N mA*7
	M range	N mA *7			10×N mA*7
	L range	0.1×N mA *7			N mA*7
Measurement frequency		2 cycles/sec.			

*7: N represents the number of units connected for master/slave parallel operation.

B-17. DC Voltage Measurement (Voltage Display)

Item		LSA-165	LSA-165V1	LSA-330	LSA-1000
15 V range	Measurement range	0.000 V to 14.999 V			
	Measurement resolution	1 mV			
	Measuring accuracy (23°C ±5°C)	±(0.03% of rdg + 0.06% of fs)			
150 V range	Measurement range	15.00 V to 150.00 V			
	Measurement resolution	10 mV			
	Measuring accuracy (23°C ±5°C)	±(0.03% of rdg + 0.03% of fs)			
Hysteresis		14.98 V			
Temperature coefficient		±(0.003% of rdg + 0.003% of fs)/°C			
Measurement frequency		2 cycles/sec.			

B-18. DC Power Measurement (Power Display)

Item		LSA-165	LSA-165V1	LSA-330	LSA-1000
H Range	Measurement range	0.0 W to 165.0 W		0.0 W to 330.0 W	0 W to 1000 W
	Measurement resolution	100 mW			1 W
M range	Measurement range	0.00 W to 16.50 W	0.00 W to 33.00 W		0.0 W to 100.0 W
	Measurement resolution	10 mW			100 mW
L range	Measurement range	0.000 W to 1.650 W	0.000 W to 3.300 W		0.00 W to 10.00 W
	Measurement resolution	1 mW			10 mW
Measurement frequency		2 cycles/sec.			

The measured current and voltage are multiplied and displayed.

B-19. UVP (Under Voltage Protection)

Item		LSA-165	LSA-165V1	LSA-330	LSA-1000
150V range	Specified range	OFF, -0.5 V to 150 V			
	Specified resolution	0.01 V			
	Specified accuracy (23°C ±5°C)	±(0.1% of set + 30 mV)			

B-20. OPP (Over Power Protection), OPL (Over Power Limit)

Item		LSA-165	LSA-165V1	LSA-330	LSA-1000
H Range	Specified range	0 W to 173 W	0 W to 346 W		0 W to 1050 W
	Specified resolution	1 W			
	Specified accuracy (23°C ±5°C)	±(0.5% of set + 1% of fs)			
M range	Specified range	0 W to 17.3 W	0 W to 34.6 W		0 W to 105.0 W
	Specified resolution	0.1 W			
	Specified accuracy (23°C ±5°C)	±(0.5% of set + 1% of fs)			
L range	Specified range	0 W to 1.73 W	0 W to 3.46 W		0 W to 10.50 W
	Specified resolution	0.01 W			
	Specified accuracy (23°C ±5°C)	±(0.5% of set + 1% of fs)			

B-21. OCP (Over Current Protection), OCL (Over Current Limit)

Item		LSA-165	LSA-165V1	LSA-330	LSA-1000
H Range	Setting range	0.0 A to 34.6 A	0.0 A to 33.9 A	0.0 A to 69.2 A	0.0 A to 210.0 A
	Setting resolution	0.1 A			
M range	Setting range	0.00 A to 3.46 A		0.00 A to 6.92 A	0.00 A to 21.00 A
	Setting resolution	10 mA			
L range	Setting range	0.000 A to 0.346 A		0.000 A to 0.692 A	0.000 A to 2.100 A
	Setting resolution	1 mA			
Setting accuracy (23°C ±5°C)		±(0.2% of set + 0.3% of fs)			

B-22. TRIGGER

Item	LSA-165	LSA-165V1	LSA-330	LSA-1000
TRIGGER IN	Changes the sequence operation via pulse input (common to internal common terminal).			
TRIGGER OUT	Outputs a pulse when changing the dynamic operation or sequence operation. (Insulated from the internal common terminal)			

B-23. Sequence Function

Item		LSA-165	LSA-165V1	LSA-330	LSA-1000
Step	Maximum specified number of steps	1018			
	Time setting	10 μ s to 999 hours 59 minutes, PAUSE, PASS			
	Setting resolution	10 μ s			
Sequence wave	Ramp pulse	Setting current level(Iset) : same as CC current set range and the resolution Time before becoming the setting current level (Tt) : 0.1s to 10000s.the resolution is 0.001s.			
	Square pulse	Frequency: 1Hz to 3.03kHz, Resolution and the movement restrictions are the same as switching movement Duty: 1% to 99%. Resolution and the movement restrictions are the same as switching movement Tr/Tf: 0.01ms to 400ms, .the resolution is 0.01ms Current leve(Iset1,2) : same as CC current set range and the resolution The repetition number of times : 1 to 9999 cycles. ∞ (INF, Infinite time)			
	Sine wave	Frequency: 1Hz to 3.03kHz, Resolution and the movement restrictions are the same as switching movemen The very much smallest current value width (P-P) : same as CC current set range and the resolution Middle current value (Center) : same as CC current set range and the resolution			
	Chopping wave	Frequency: 1Hz to 3.03kHz, Resolution and the movement restrictions are the same as switching movemen Maximum minimam current value width (P-P) : same as CC current set range and the resolution Middle current value (Center) : same as CC current set range and the resolution Duty: 1% to 99%. Resolution and the movement restrictions are the same as switching movement The repetition number of times : 1 cycle~9999 cycles. ∞ (INF, Infinite time)			
	Pulse wave	Pulse current level (Iset1,2) : same as CC current set range and the resolution Pulse wave time (Tp) : 10 μ s to 500 μ s, .the resolution is 10 μ Pulse number of cycles (P Count) : 1 to 10 cycles, .the resolution is 1 cycle Pulse wave time (Tb) : 1ms to 10000ms, .the resolution is 1ms.			
	Rush wave	Current wave height level (Iset1) : same as CC current set range and the resolution Current convergence level (Iset2) : same as CC current set range and the resolution Current convergence time (Tset): 0.1s to 10000s, .the resolution is 0.001s A time constant (TC): 0.001s to 100s, .the resolution is 0.001			
Number of group cycles		1 to 9999 cycles, ∞ (INF: infinite)			
Specified item		Setting, time			
Procedure for specifying settings on the internal memory		Settings are specified by using the panel or by using an external interface (optional) to specify the settings from a computer.			

An application software can also be used to specify the item settings.

B-24. Hardware Alarm

Item	LSA-165	LSA-165V1	LSA-330	LSA-1000
Overvoltage	Switches to LOAD OFF mode when a voltage of approximately 160 V or more is input.			
Overcurrent	Switches to LOAD OFF mode when the rated current (for the specific model and current range) is exceeded.			
Overheat	Switches to LOAD OFF mode when the temperature of the internal radiator of the unit exceeds a temperature of approximately 110°C.			
Reverse connection	Switches to LOAD OFF mode when a reverse voltage is input by the body diode and the fuse of the internal MOSFET of the unit.			
External output	Switches to LOAD OFF mode when an alarm signal is input via the rear input terminal.			
Internal ROM	When a problem occurs in the internal ROM.			
Internal DSP	When a problem occurs in the internal DSP.			
Interface	When the optional control board causes a problem to occur on the external interface.			
Front-terminal overcurrent	Switches to LOAD OFF mode when the input current of the front input terminal exceeds 66A. (Excludes the LSA-165 and LSA-330)			

If a hardware alarm is issued, stop using the unit immediately. Turn off the power source and the unit and disconnect the wiring.

B-25. Use Environment and General Specifications

Item		LSA-165	LSA-165V1	LSA-330	LSA-1000
Service temperature		0°C to 40°C			
Service humidity		20% to 85%RH (No dew condensation)			
Storage temperature		-20°C to 60°C			
Storage humidity		20% to 85%RH (No dew condensation)			
AC Power Voltage		100V AC to 240V AC			
Power source frequency		50Hz / 60Hz			
Power consumption		70 VA	175VA	75 VA	130 VA
Withstand voltage	Primary Side - Case	1500V AC for 1 min.			
	Primary Side - Secondary Side	3200V DC for 1 min.			
Insulation resistance	Primary Side - Case	500V DC 10MΩ or higher			
	Primary Side - Secondary Side	500V DC 10MΩ or higher			
Cooling system		Forced air cooling by the front fan and the rear exhaust.			
Dimensions (mm)	H*W*D	124*140*383		124*140*383	124*421.5*383
	H*W*D (Maximum)	148.4*141.8*446.1		148.4*141.8*446.1	140.8*423.3*449
Weight		Approx. 4.6 kg	Approx. 5.2kg	Approx. 5.5 kg	Approx. 12.3 kg

B-26. External Communication Control (when the optional control board IF-80GUR is equipped)

Item		LSA-165	LSA-165V1	LSA-330	LSA-1000
Shared items					
Control functions		Able to specify the function settings of the electronic load and read out the measured values.			
Commands		Supports IEEE488.2-1992 universal commands. Also able to use commands specific to models in the LSA series.			
GP-IB					
Specifications		IEEE488.1-1987 compliant.			
Interface functions		SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E1			
USB					
Specifications		USB Revision 2.0, full speed (USB1.1 compliant), 12 Mbps, special device class.			
Connector type		USB series B			
Power supply		Self-power only			
RS-232C					
Specifications		RS-232C compliant, no flow control.			
Date transfer speed		57600 bps			
Data bit		Data: 8 [bit], stop bit: 1 [bit], parity: none.			
Connector type		RJ-11 (6-pin modular) Able to be converted to a D-sub 9-pin female connector by using the CB-06xxS modular cable (option) and D-sub-modular gender changer TA-66 (option).			

Appendix C. Outside Dimensions

<LSA-165 / LSA-165V1 / LSA-330>

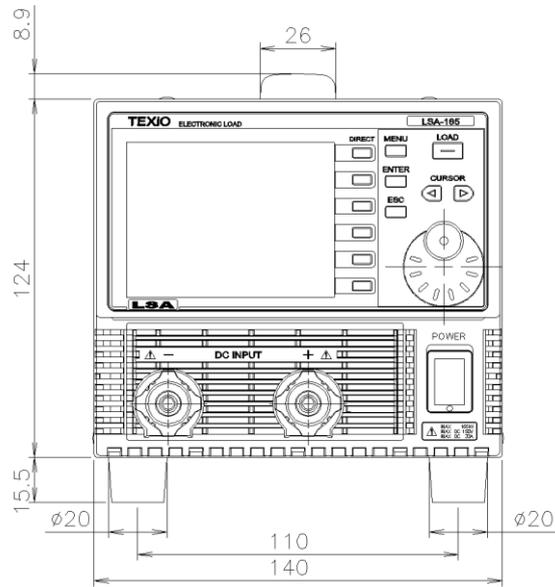


Fig. C-1

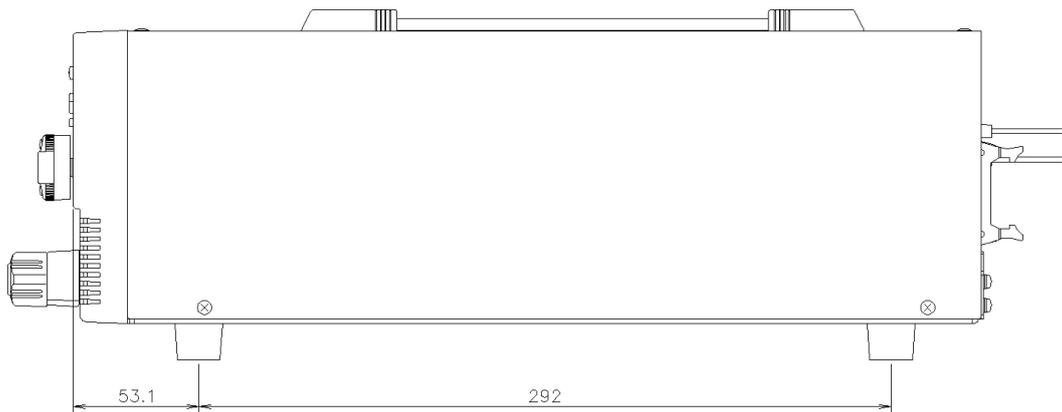


Fig. C-2

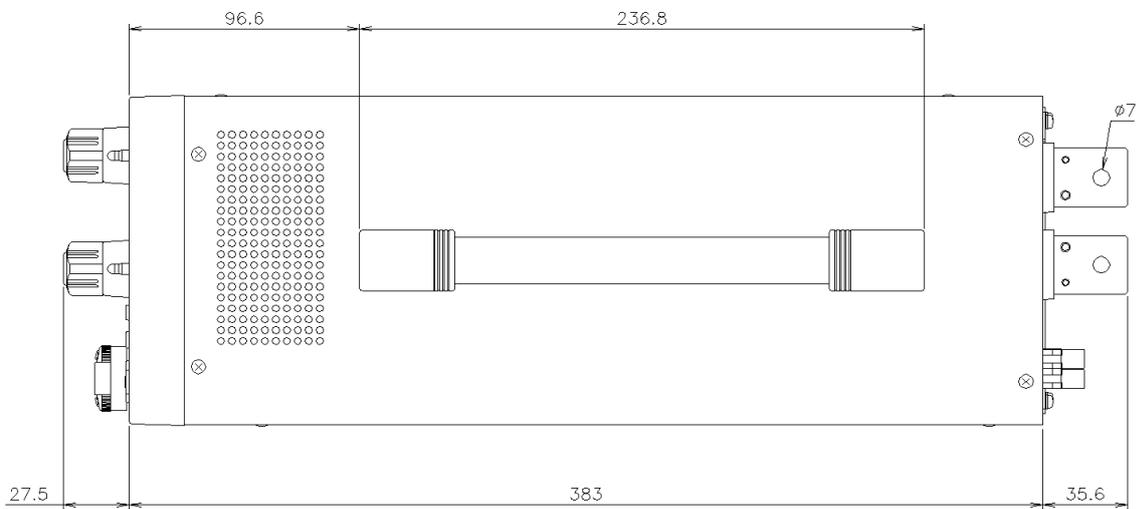


Fig. C-3

<LSA-1000>

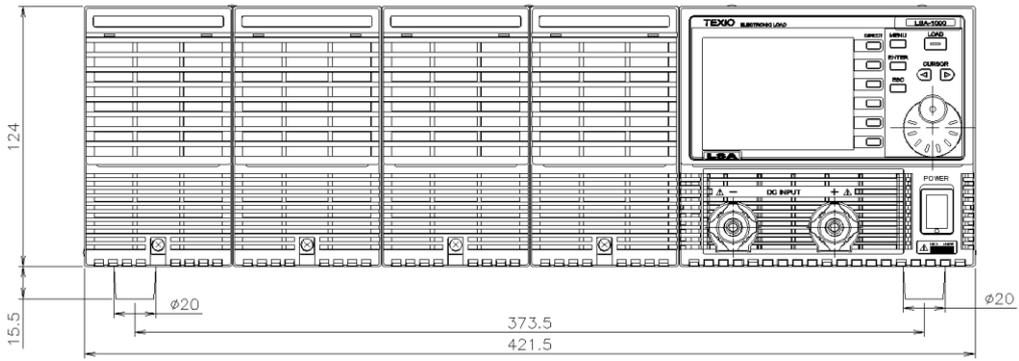


Fig. C-4

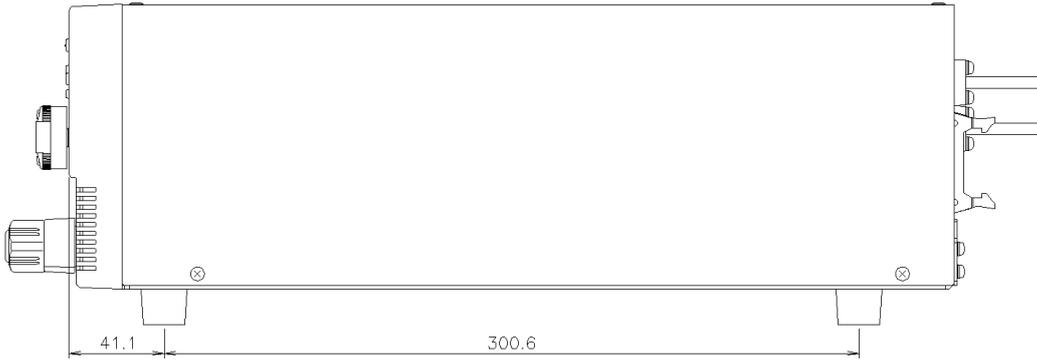


Fig. C-5

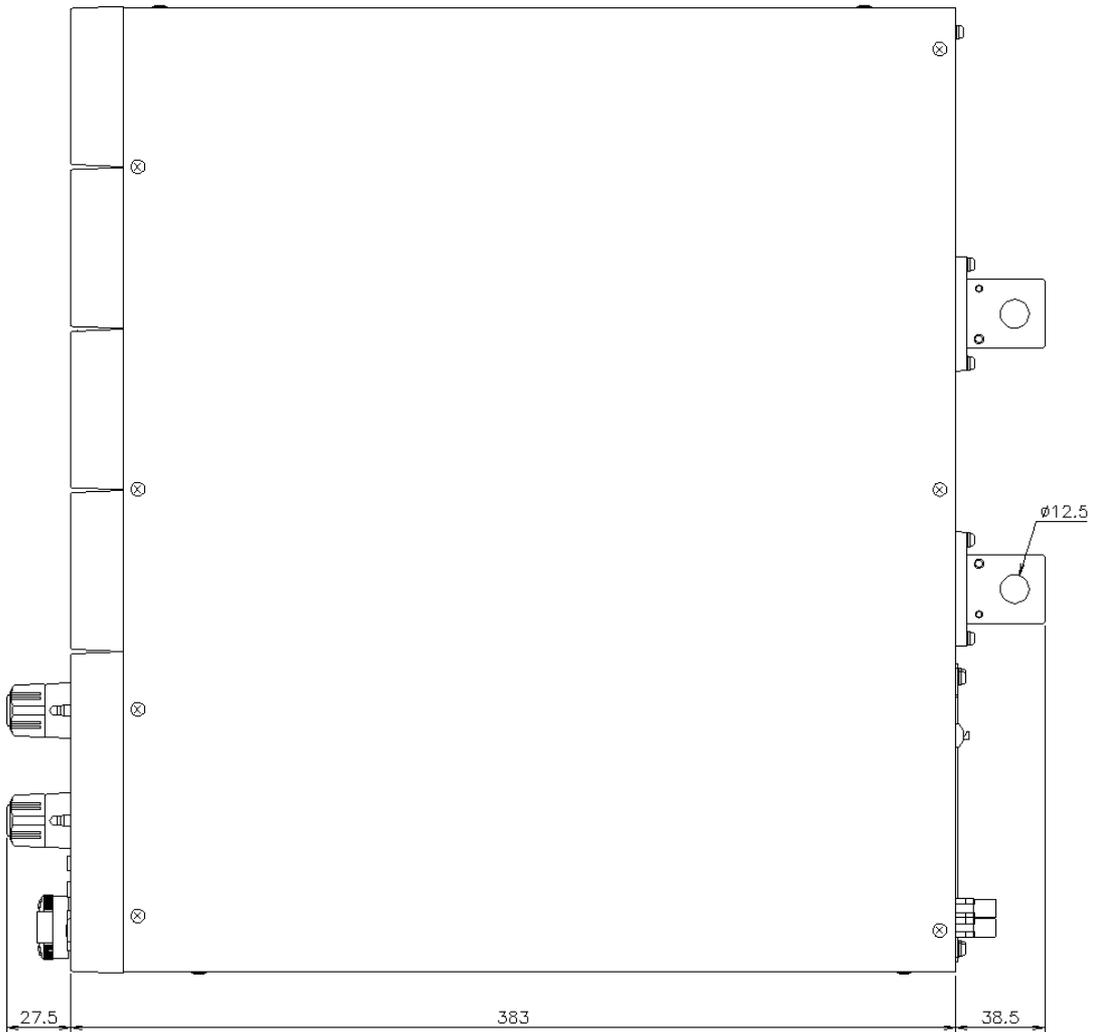


Fig. C-6



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