KEISOKU GIKEN

Instruction Manual

Electronic Load

Load Station

LN-300A

LN-300C

LN-1000A

LN-1000C

- Quality Assurance Provision -

This product passed our close product inspection. When it did not satisfy an early purpose, specifications by trouble after the delivery in a year, we repair it gratis in the case of the responsibility in our production. Please report to agency or us. We repair it in our factory. About measurement accuracy, I guarantee it for six months after the delivery. But I will repair it undermentioned for payment.

1. In the case of trouble / the damage that occurred by the handling against usage mentioned in the manual of this product and instructions.
2. When you remodeled it without our approval
3. In the case of trouble / the damage that occurred because the handling was not reasonable such as the bad transportation by the visitor, a fall at the time of the movement, a shock.
4. In the case of trouble / the damage by the natural accidents such as a fire / an earthquake / the flood.
5. In the case of trouble / the damage that occurred by the abnormal input voltage.
6. When we dispatched an engineer.

This warranty is valid only in Japan.

READ THIS MANUAL BEFORE START USING THIS PRODUCT

Please read this manual carefully before using this product.
This manual should be kept in a place accessible easily.
Please attach this manual to this product when you relocate them.

This manual is written based on the functions of this product when shipped from KG.
The specifications are subject to change without any notice.

TRADEMARKS

Microsoft Windows, Microsoft Excel, ActiveX, Visual Basic, and Visual C++ are trademarks of its respective suppliers.

——— Preface ———

Thank you very much for purchasing our **“ELECTRONIC DC LOAD” Load Station Series**.
For safe and correct use of the electrical product, please first read **“Safety Precautions”** on the next page.

● This manual consists of the following chapters.
If it is the first time for you to use this product, start with "1. Overview".

1.	Overview	Explains the Overview and feature of this product.
2.	Installation and Preparing for Use	Explains the Installation, power supply connection and wiring.
3.	Basic Operations	Explains the Basic Operations.
4.	Normal Mode	Explains the Normal Mode that executes a constant load.
5.	Dynamic Mode	Explains the Dynamic Mode that executes multiple loads by switching load in sequence.
6.	Sequence Operation	Explains the method of creating and controlling sequence using USB or GPIB.
7.	Sweep Mode	Explains the Sweep R, Sweep C and Sweep P.
8.	Menu, System	Explains the Menu screen and System screen.
9.	Memory	Explains the Memory screen.
10.	Protection, Alarm Function	Explains the Protection function and Alarm function.
11.	Parallel Operation	Explains the Parallel Operation for increasing the capacity by connecting multiple Load Station Series.
12.	Multichannel Synchronous Operation	Explains the Multichannel Synchronous Operation for synchronous operation of multiple Load Station series.
13.	Remote Control	Explains the Remote Control using the communication interface.
14.	Maintenance	Explains the method of inspection, cleaning, calibration and storage.
15.	Specifications	This is a list of functions and performance specifications.
16.	Appendix A	Explains the factory default settings.
17.	Appendix B	Explains the method of using the ripple noise measurement option.
18.	Appendix C	Explains the external control (DIDO).

● Scope of contents
The description of this manual applies to products with firmware version 3.1.1 and above.
For details on checking the firmware version, see "Displaying Firmware Version" in Chapter 8.

Safety Symbols

The following symbols are used in this manual and this product for safely and correctly using the product. Please understand the meaning of symbols and keep safety precautions in mind while using the product.

Indicates areas or details involving warning, hazard or caution. Wherever these symbols are displayed on this product, please refer to the corresponding page in the manual for details.

WARNING

Indicates that incorrect operation of the product may cause severe damage to user (death, heavy injury etc). Fully understand the instructions mentioned and operate the product according to these instructions.

CAUTION

If not operated correctly, it may cause damage to the product and other connected devices, as well as may cause light physical damage to user. Fully understand the instructions mentioned and operate the product according to these instructions.

Prohibited acts.

CE

Indicates that this product conforms to the requirement of the applica-ble EU directive.

NOTE

Indicates things that you should know regarding product operation and performance.

For Safely Using the Product

Precautions for safely using this product are described here. Please understand and follow the instructions. KEISOKU GIKEN Co.,Ltd shall not be responsible for accidents resulting from inappropriate use of the product or non-compliance with the instructions.

■Users

This product shall be used by personnel with adequate knowledge of electrical concepts.
Users without adequate knowledge of electrical concepts should use the product under the supervision of a knowledgeable person.

■Input power supply

Ensure that input power supply voltage is within the rated range.
(Rated input values are AC100 V – 240 V　50 Hz/60 Hz)
Use the power cord set provided in accessories for power supply under AC125 V.

■Dismantling

Some of the parts inside the product uses high voltage that may be hazardous for human body. Do not remove cover or panel.

■Gas

Do not use in inflammable and corrosive gas environment.

■Noise

Do not use in strong electromagnetic environment. Due to device characteristics, in strong electromagnetic environment, noise induced in the input cable is measured as input signal, affecting the measurement values.

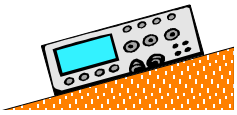
■High temperature, High humidity

Avoid high temperature places or places with direct exposure to sunlight.
Use where surrounding temperature is 0°C - 40°C.
Avoid highly humid places. When the product is exposed to such places, do not use it until it is completely dry.

■ Dust, Grit

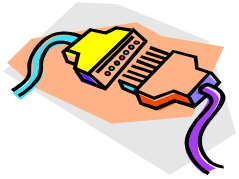
Do not use the product where there is too much dust or grit.
Do not use the product with poor air circulation.
The product uses forced cooling. Ensure that adequate space is available around the product so that its intake port and exhaust outlet are not blocked.

■Setting, Inclination, Vibration



Ensure to use the product after placing it in horizontal position.
Do not use on an inclined or vibrating place.

■Connecting / Removing

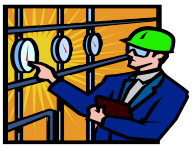


When connecting or removing load cable, current monitor, GPIB devices etc, turn OFF the power switch of each device beforehand.

■Transportation

Move the product only after turning OFF the power supply and removing all wiring cables.
Attach the instruction manual when moving the product.
When transporting the product, use the special packing material supplied with the product. If you do not have the special packing material, adequately protect the product with shock-absorbing material.

■Maintenance, Inspection



In order to prevent electric shock when performing maintenance or inspection, ensure to remove the plug of power cord set.
Periodic maintenance, inspection and cleaning of the product is recommended for maintaining its safety.
Periodic calibration is recommended for maintaining the performance of the product.

■Overload

Do not apply voltage outside the specified range in connectors and input terminals of the product.
Do not use connectors and input terminals of the product except for applications described in this manual.

■Calibration, Repair

Calibration and repair of the product is handled by KEISOKU GIKEN Co.,Ltd.
In the event calibration or repair is required, please contact us or our agent.

Contents

Chapter 1 Overview

This chapter describes the features and options of the product.

Overview and Features

Overview

DC electronic load Load Station series is a DC electronic load of load power 300 W/1 kW with high speed response and operational improvement at low voltage. It can be used as load of Regulated DC power supplies, fuel cells, solar cells, etc. By using the optional MASTER/SLAVE connection cables, you can configure a system up to 10 kW.

Features

- Low voltage operation similar to actual resistance
  This product works like actual resistance from 0 V without delayed operation due to soft start function for avoiding current discontinuity below the minimum operating voltage found in ordinary electronic loads.

- Equipped with high-speed current feedback control
  Overshoot or vibration that most likely occurs near set value of current is eliminated using high-speed current feedback control, resulting in current waveform of smooth rising while maintaining high slew rate (30 A/μ s maximum, at CC mode of LN-1000A).

- Equipped with 6 load modes
  Equipped with 6 load modes, viz. Constant Current (CC), Constant Resistance (CR), Constant Voltage (CV), Constant Power (CP), External Control (EXT), and Short (SHORT) modes. By using current limit in CV mode, CV/CC mode can be realized which is useful for battery discharge, etc. Moreover, it is also equipped with a function named VMode that automatically changes the load mode or turns off the load input when load voltage reaches the specified value.

- Equipped with dynamic mode
  In dynamic mode, up to 16 steps (execution time of each step can be set by 1μ s at minimum) can be run in series in either single-shot or repeating manner.
  Also, sequence operations up to 1024 steps (repeatable) can be achieved with USB or GPIB control.

- Equipped with 3 sweep modes for realizing characteristic test such as V-I characteristic test
  Three tests, viz. V-I characteristic test in Sweep R mode, overcurrent protection characteristic test for power supply device in Sweep C mode (with decision function) and overvoltage protection characteristic test for power supply device in Sweep P mode (with decision function) can be conducted only by panel operation of the main unit.

- Can be used to create automatic measurement system
  USB interface is available as a standard feature, while GPIB and external output control can be added as additional options.

- Supports parallel operation, multichannel synchronized operation (optional)
  By using the optical MASTER/SLAVE connection cable, multichannel synchronized operation can be performed that synchronizes LOAD ON/OFF or load fluctuation of multiple Load Station series and maximum 10 kW system (parallel operation) can be built.

- Equipped with ripple noise measurement function (optional)
  You can add the measurement function equivalent to ripple noise measurement using 100 MHz oscilloscope recommended by Japan Electronics and Information Technology Industries Association (JEITA) standard. Spiked switching noise and line frequency can be separated and measured. Variation found in measurement using oscilloscope can be avoided and measurement time can be reduced.

Options

The following options are available. Please order the options as per your use.

LX-OP01 GPIB/DIDO option

GPIB communication and external control (DIDO) functions are added.

RC-02A Ripple noise measurement option

This will add the measurement function equivalent to ripple noise measurement using 100 MHz oscilloscope recommended by Japan Electronics and Information Technology Industries Association (JEITA) standard. If you would like this option to be added, please indicate your requirement at the time of buying the product. This option is not sold individually.

LX-OP03 MASTER/SLAVE connection cable

Cable used in parallel operation and multichannel synchronized operation.

BPK1W-58 Current monitor connection cable

This cable is connected to the current monitor output.

DP-100 Differential probe

This probe reduces common mode noise from the signal which causes measurement error.

Low inductance cable

This can minimize the inductance of the loading cables. Ex. LL-050 has inductance of 80nH which is about 1/5 of regular gauge cable (7AWG)

Model	Length	Voltage rating	Current capacity	Resistance	Inductance
LL-050	50 cm	500 V	100 A	1 mΩ	80 nH
LL-100	100 cm	500 V	60 A	2 mΩ	100 nH
LL-200	200 cm	500 V	40 A	4 mΩ	130 nH

※The resistance and inductance above are typical values.

Chapter 2 Installation and Preparing for Use

This chapter explains the process from installation of the product to turn on the power supply and connecting the cables.

Checking Before Use

Check that this product and its accessories were not damaged during transportation and accessories are correctly supplied. If this product is damaged, or if the accessories are not correct, please contact us or our agent.

Accessories

Accessories	Quantity
CD-ROM (Instruction Manual, USB Device driver, Control software etc.)	1
Power cord set (Approx. 2m long)	1
Terminal block covers (for front panel load terminal and rear panel load terminal)	2
Signal Cable (1.5 m) (BM-58U-150KO) (*with RC-02A Op.)	1

Installation

Checking the place of installation

Please check the following for the best performance of the product.

- Use indoor at altitude under 2000 m.
- Use the product where temperature is 0°C to +40°C and humidity is 5 - 85%RH (however, absolute humidity 1 - 25 g/m^3, no condensation). Also, for some of the specifications, temperature range is restricted.
- Use at a place with good air circulation.
  Ensure adequate space around the product so that there is good air circulation around the product.
- Do not install at the following places.
  - Places with inflammable gases
    → Danger of explosion. Never install or use at such place.
  - Outdoors or place with direct exposure to sunlight or place near fire or heat source
    → Performance may decline and product may trouble.
  - Places with corrosive gases or moisture, highly humid places
    → May result in corrosion or trouble.
  - Near electromagnetic source or high voltage device or power lines
    → May result in malfunction of the product.
  - Places with lot of vibration
    → May result in malfunction or trouble of the product.
  - Places with lot of dust
    → May result in trouble. Especially, do not install at a place with conductive dust.

Precautions on Movement and Transportation

- Remove all wiring.
- Turn off the power switch.
- Hold the handle while lifting.
- When transporting, use special packing material (packing material provided when delivering the product). If you do not have the special packing material, pack after adequately securing the product with shock-absorbing material.
- Ensure to attach the instruction manual (this document) to this product.

Power Supply

Connecting power cord set

Rating of the power cord set with 3-pole plug provided as accessory is single phase AC125 V. Use appropriate power cord set if the input voltage is more than AC125 V. Power cord set provided as accessory is only for this product. Do not use it for other devices.
Power cord set with 3- pole plug can be used for disconnecting the product from AC power supply in case of emergency. Use a power socket located at convenient place with adequate space around so that the plug can be removed from socket.

WARNING **There is a danger of electric shock.**

- **Connect the power cord set after turn OFF the main POWER switch of rear panel.**
- **Connect the power supply plug to a 3- pole power socket with protective ground terminal.**

1. **Turn OFF the main POWER switch of rear panel.**
   "I" is ON position, while "O" is OFF position.
2. **Turn OFF the STANDBY switch of front panel.**
3. **Connect power cord set to AC inlet of rear panel.**
4. **Insert the plug of power cord set in a power socket with ground.**

Checking the operation

After checking the place of installation, check standalone operation of the product. Remove load cable, remote sense cable and external control cable.

Turn ON the power switch

Power switch is located at two places, front panel and rear panel. Functions of both these switches are described below.

Rear panel POWER switch (main power switch)

Rear panel POWER switch turns ON/OFF the main power supply.

Front panel STANDBY switch

Front panel STANDBY switch can be used to change between standby and startup states. Since standby state consumes standby electricity, turn off the rear panel POWER switch when not using the product for long time.

1. **Check that the power cord set is connected correctly.**
2. **Check that nothing is connected to load terminals of front panel and rear panel.**
3. **Turn ON the rear panel POWER switch.**
   "I" is ON position, while "O" is OFF position.
4. **Turn ON the front panel STANDBY switch.**
   Main screen will appear after startup screen and version display screen.

This product will start with default factory settings when turning ON both the power switch and STANDBY switch for the first time after buying the product.

When nothing is displayed

- Check the connection of power cord set.
- Check power supply voltage.
  Input voltage range is AC85 V - 264 V and frequency is 50 Hz ±2 Hz/60 Hz ±2 Hz.

Alarm occurs

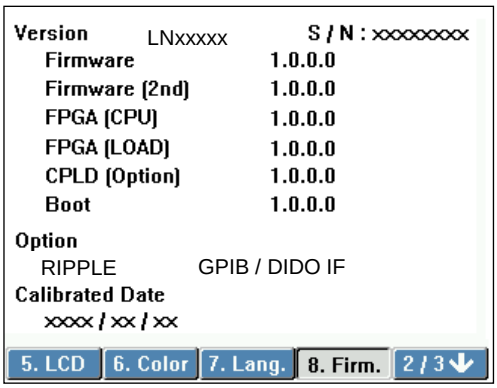
- Protective function has been activated. Remove the root cause of alarm. Refer to "Protection, Alarm Function" in Chapter 10.

Cooling fan is built-in

Internal cooling fan controls the rotation speed according to cooling requirement. Rotation sound may change, but it is not a trouble.

Checking the version

Check the system screen. Refer to “Displaying Firmware Version” in Chapter 8 Menu, System.



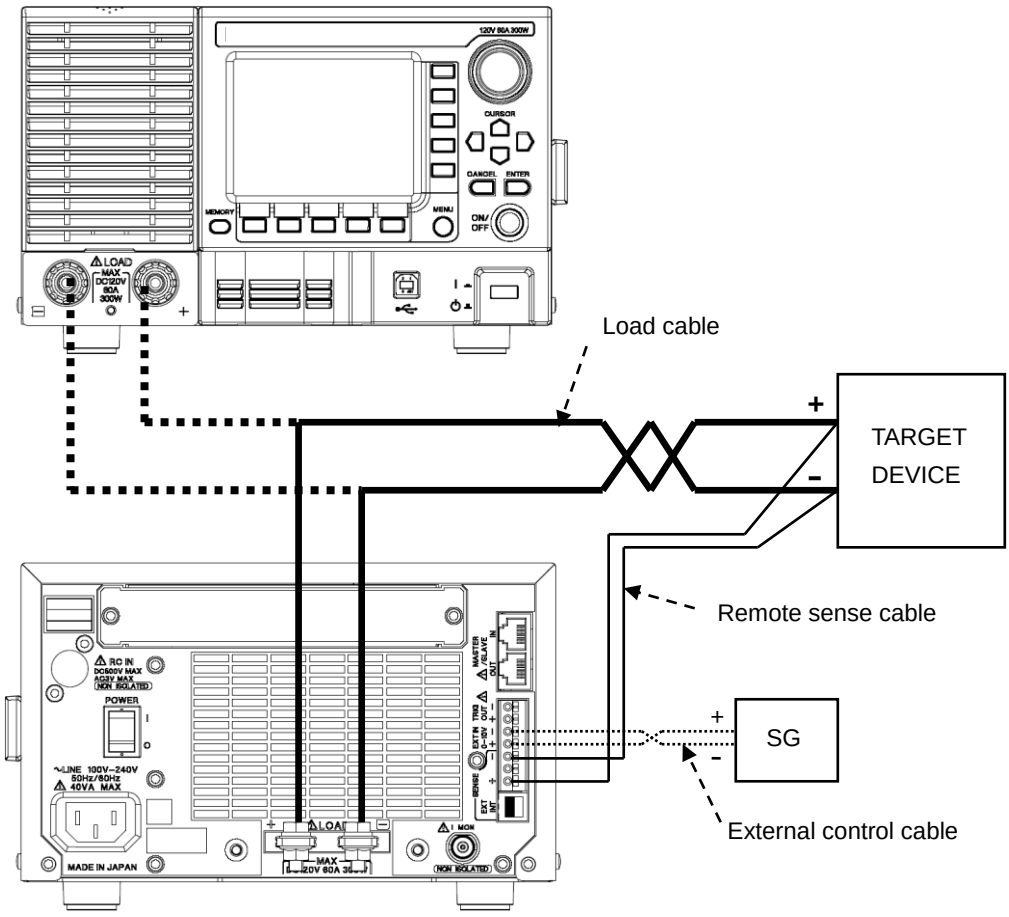
Wiring

Connecting the cable

Connect load cable, remote sense cable and external control cable.

CAUTION Device may be damaged.

- Ensure to turn OFF the main POWER switch of rear panel.



TARGET DEVICE: Test power supply, test specimen, etc. (test device)
SG: Signal generator (Standard voltage source, oscillator, etc.)
▪▪▪▪▪▪▪▪▪▪▪▪▪▪ : Connect to the front panel load terminal
▬▬▬▬▬▬▬▬▬▬▬▬▬ : Connect to the rear panel load terminal
* Simultaneous connection is not allowed.
* Load terminal screw size is M6 for 300 W and M8 for 1000 W.

Load cable

Load cable connects rear panel load terminal or front panel load terminal and test device. It can be connected to either rear panel load terminal or front panel load terminal. Product cannot be used by connecting it to both the terminals.

WARNING **There is a danger of electric shock.**

- **Do not touch the load terminal when power switch is on.**
- **Ensure to use terminal block cover.**
- **Since voltage may be remaining in the load terminal, remove the load cable as per the following steps.**
  - **(1) Turn OFF the output of test device.**
  - **(2) Turn ON the load and check that voltage has reduced. Turn OFF the load.**
  - **(3) Turn OFF the main POWER switch.**
  - **(4) Remove the load cable.**
- **In this product, front panel load terminal and rear panel load terminal are internally connected. Voltage input in one of them will be output in the other.**

- Connect the load cable keeping the distance between the product and test device at minimum. For stable operation, connect at a distance of 3 m or less.
- For load cable, use the cable having appropriate conductor size responding to the amount of the current for use.
- Use crimp-type terminal with sleeve and firmly secure the load cable with the screws of load terminal.
- Twist the cable in case load cable is long.

Recommended conductor size of cable

Load current Io	Conductor size of cable
Io ≤ 10 A	AWG16 or more
10 A < Io ≤ 30 A	AWG12 or more
30 A < Io ≤ 60 A	AWG8 or more

CAUTION This product may be damaged.

- Ensure that maximum rated value of load terminal does not exceed.

Maximum rated value of rear panel load terminal

Model	Maximum rated voltage	Maximum rated current
LN-300A	120 V	60 A
LN-300C	500 V	12 A
LN-1000A	120 V	180 A
LN-1000C	500 V	36 A

CAUTION Connection part of binding post type load terminal may emit heat.

- Keep the load current under 20 A when connecting with banana plug etc.
- When connecting with horizontal hollows of binding post type load terminal, keep the load current under 20 A.

CAUTION This product may be damaged.

- The following limit values apply to voltage and frequency input into load terminal. Ensure not to exceed these limit values.

To ensure this product's stable operation under the influence of load cable inductance, a capacitor and a resistor are connected inside in series between load terminals. Permissible loss of this resistance is expressed with the following equations. Ensure that input between load terminals does not exceed this limit value.

Letting

Input voltage to load terminal: V [Vrms] and

Input frequency: f [Hz],

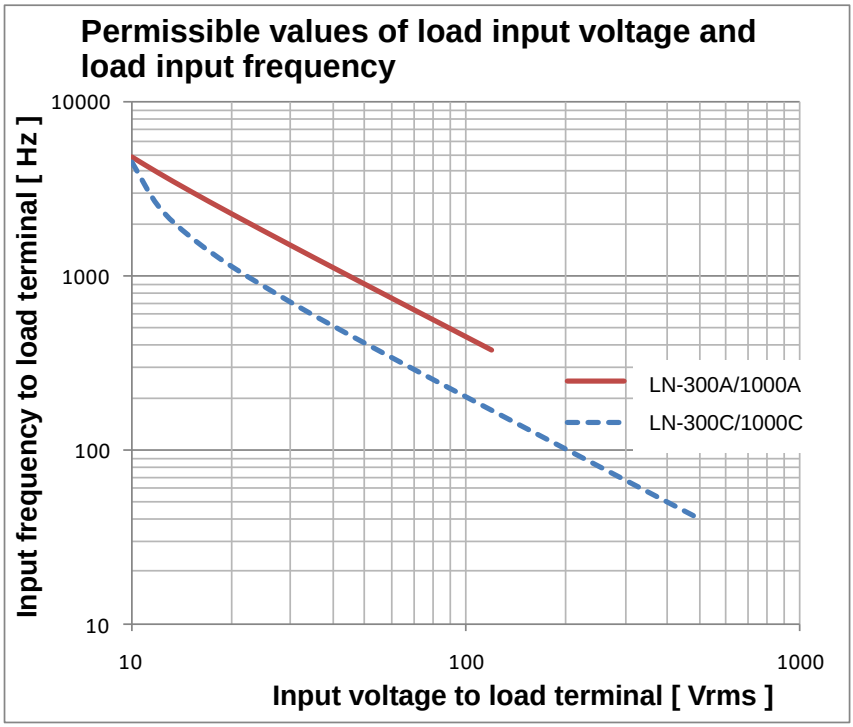
Limit value for LN-300A, LN-1000A is,

$$\frac{V^2}{66 \times \left(1 + \frac{1.20E8}{f^2}\right)} \leq 0.25$$

Limit value for LN-300C, LN-1000C is,

$$\frac{V^2}{320 \times \left(1 + \frac{5.11E6}{f^2}\right)} \leq 0.25$$

The aforementioned equations can be expressed as graph in the following manner.



Remote sense cable

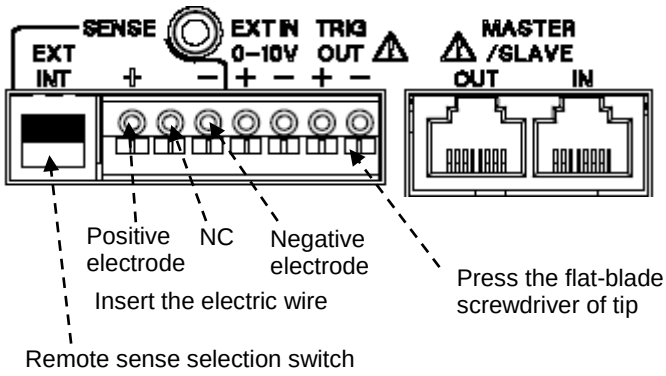
Remote sense cable is used for measuring the voltage of test device terminal. Connect SENSE terminal and test device terminal. Connect according to your requirement, such as using long load cable. Use cables described below. Use shielded or twisted cables. Ensure polarities of cables.

WARNING **Danger of electric shock as SENSE terminal and load terminal have same potential.**

- **Ensure to turn OFF the output of test device when connecting remote sense cable.**

When using SENSE terminal, set the remote sense selection switch located on rear panel to EXT (External Sense). Set it to INT when not using SENSE terminal. If settings are not correct, measurement may not be correct and settings and over power protection may not become effective. Ensure to turn OFF the output of test device when setting remote sense selection switch.

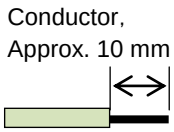
SENSE Terminal



Cables used

Single wire: ø0.4 mm - ø1.2 mm (AWG26 - AWG16)

Twisted wire: 0.3 mm^2 - 1.25 mm^2 (AWG22 - AWG16), Strand diameter ø0.18 mm or more



External control cable

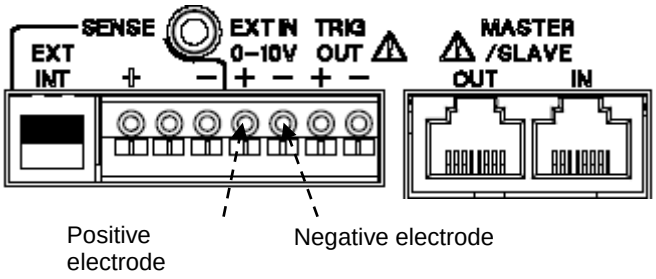
External control cable is used when setting the load mode to External Control Mode. Using external control cable, EXT IN terminal is connected to the signal of external standard device or signal source. For cable, use similar cable as remote sense cable. Use twisted cable for connection.

EXT IN terminal is for DC signal input only. For inputting AC signal, superimpose the offset voltage to input AC signal and ensure that voltage does not fall below 0V (i.e. it does not become negative). Use input voltage in the range of 0 V - 10 V, DC - 100 kHz.

WARNING **There is a danger of electric shock as electric potentials of EXT IN terminal and load terminal are same.**

- **When connecting external control cable, ensure to turn OFF the output of test device.**

External connection terminal



For safe operation

Effect of inductance

Back electromotive force

Changing the load current generates back electromotive force due to internal inductance of the product and load cable. Voltage drop generated due to this back electromotive force significantly effects the start up time of load current. Voltage between load terminals decline due to voltage drop and product may not be able to pull the current.

Reducing voltage drop

Although the internal inductance of the product is very small, since it is not zero, voltage is required between load terminals. Since voltage drop occurs depending on inductance of connected cable, in order to reduce voltage drop, reduce the inductance of load cables to the extent possible.

Rear panel load terminal is recommended (for LN-300A, LN-300C)

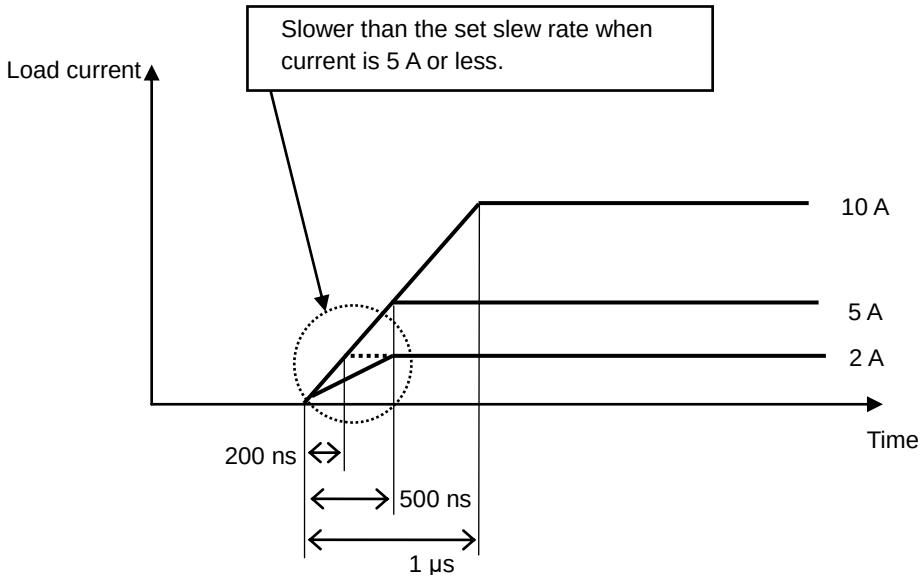
For LN-300A and LN-300C, load terminal of front panel has higher internal inductance than the rear panel load terminal. To hasten SlewRate at low voltage, please use rear panel load terminal. For LN-1000A and LN-1000C, there is no difference between internal inductance for front panel and real panel. Both can be used with same conditions.

Maximum set SlewRate for real panel load terminal voltage

Model	Rear panel load terminal voltage Vin	Maximum set SlewRate
LN-300A	6 V ≤ Vin	20 A/μs
	5 V ≤ Vin	15 A/μs
	4 V ≤ Vin	10 A/μs
	3 V ≤ Vin	5 A/μs
LN-300C	3 V ≤ Vin	1 A/μs

Effect of load current value

In addition to the effect of load terminal voltage and inductance of cable, if load current value is small against maximum current range, slew rate may become slow. This is explained using the following example.



In the above figure, when SlewRate is set to 10 A/µs and load current is set to 10 A, it will be 10 A line shown in the figure. This is a waveform indicating the variation of 10 A for 1 µs.
Similarly, when SlewRate is set to 10 A/µs and load current is set to 5 A, it will be 5 A line shown in the figure. This is a waveform indicating the variation of 5 A for 500 ns.

On the other hand, when SlewRate is set to 10 A/µs and load current is set to 2 A, it will be 2 A line shown in the figure.
In this case, it will be ideal if waveform is indicating the variation of 2 A for 200 ns, however, actually it is slower than the set 10 A/µs. (500 ns in this example shown in the figure is an illustrative value. This value of time varies according to load terminal voltage, cable inductance, and so on.)

Connecting to current monitor output

Current monitor output signal is used when monitoring current waveform with oscilloscope. Output voltage is 5 V/full scale and output impedance is 50 Ω. When the current range is L range, output voltage will be 0.2 V/full scale.

Model	Output voltage (full scale value)	
	Current range is H, M range	Current range is L range
LN-300A	5 V/60 A	0.2 V/0.6 A
LN-300C	5 V/12 A	0.2 V/0.12 A
LN-1000A	5 V/180 A	0.2 V/1.8 A
LN-1000C	5 V/36 A	0.2 V/0.36 A

WARNING **There are some risks of electronic shock as the voltage of the current monitor terminal is same as the load terminals.**

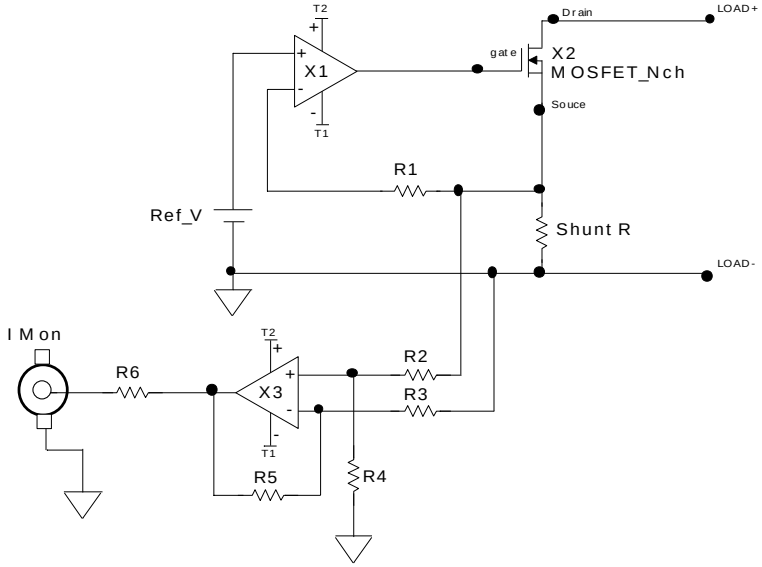
- **Never touch the current monitor terminals while in operation.**
- **There may be some residual voltage on the current monitor terminals, remove the connection cable by the following procedure:**
  - **(1) Turn OFF the output of the DUT.**
  - **(2) Turn ON the load once by the ON/OFF key to reduce the residual voltage on the current terminals.**
  - **(3) Turn OFF the power switch.**
  - **(4) Remove the connected cable.**

CAUTION Device may be damaged.

- Current monitor output of the product has same potential as load terminal. Common side of current monitor terminal (metal part on the outside of BNC terminal) and negative electrode (–) of the load terminal are internally connected.
- Overcurrent may circulate through the product, test device and external devices.
- When test device is connected to load terminal and some external device is connected to current monitor terminal, do not connect the common side of external device to positive electrode (+) of the load terminal.

GND connection of current monitor output (internal equivalent circuit)

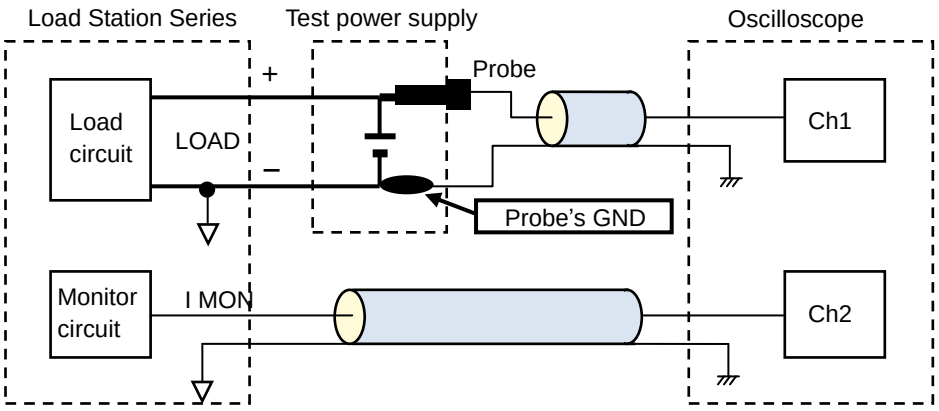
Common side of current monitor terminal (metal part on the outside of BNC terminal) and negative electrode (–) of the load terminal are internally connected.



Connecting to oscilloscope

When using oscilloscope, as shown in the figure below, ensure to connect right polarities of the probe. Terminate the probe with 1 MΩ. Do not terminate with 50 Ω.

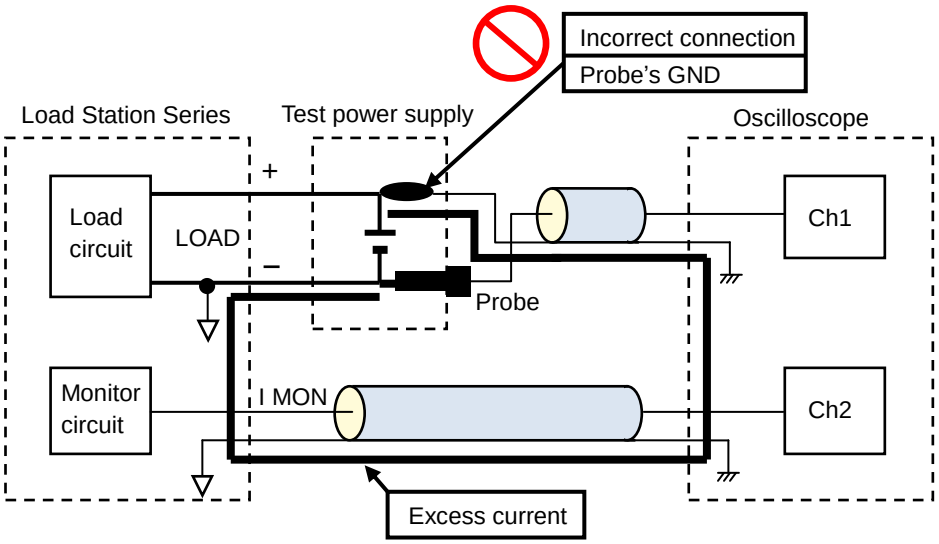
Correct probe connection



CAUTION Device may be damaged.

- As shown in the figure below, when GND side of the probe is connected to the positive electrode (+) of load terminal, overcurrent may pass through probe and oscilloscope.
- When test device is connected to load terminal and some external device is connected to current monitor terminal, do not connect the common side of external device to positive electrode (+) of the load terminal.
- Do not terminate probe with 50 Ω.

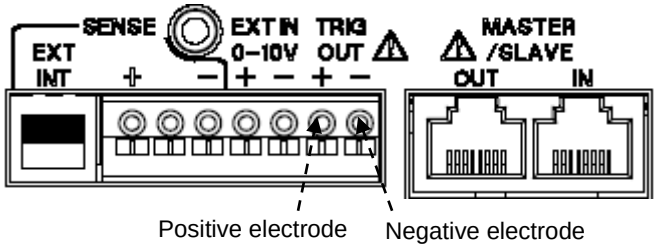
Incorrect probe connection (excess current may flow)



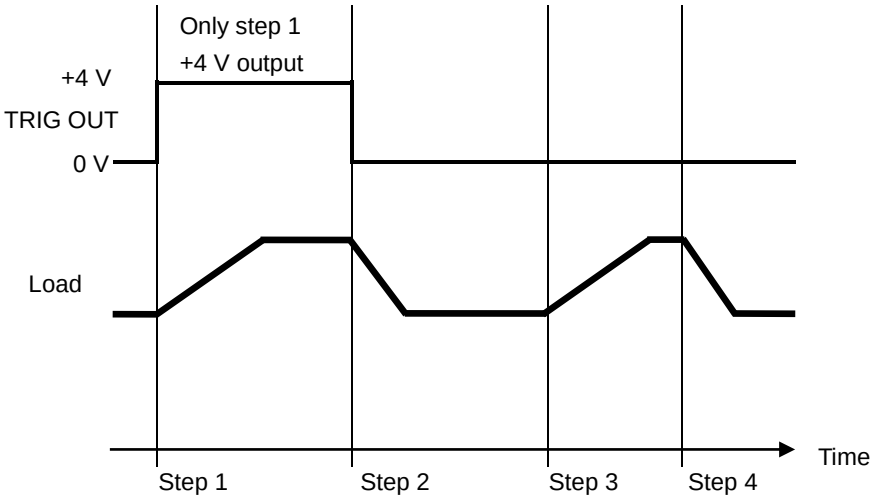
Connecting trigger signal output

Trigger signal output is used as trigger signal when observing the waveform of dynamic mode operation with oscilloscope. Output is insulated from the load terminal potential by the photo coupler, so that it becomes the case potential. Output voltage is set to +4 V, while pulse width is set to execution time of Step 1. Use similar types of cables as remote sense cable.

Trigger signal output terminal



Trigger signal output waveform

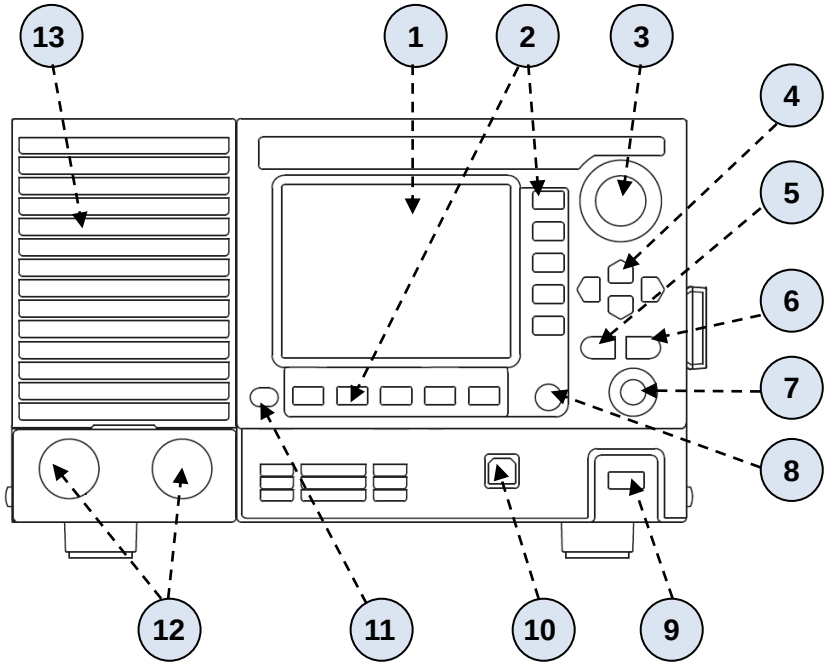


Chapter 3 Basic Operations

This chapter describes the structure of menu, basic of panel operation and other basic operations.

Name of Each Part

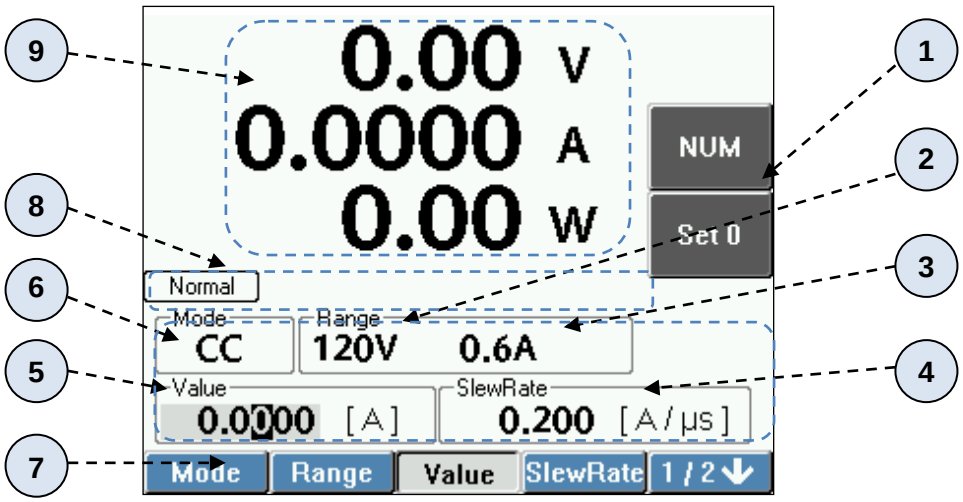
Front panel



No.	Name	Function	Reference Chapter
1	Display	Color LCD. Displays set value, measurement value etc.	-
2	Function keys	Select items from horizontal menu and vertical menu	3
3	Modify knob	Numeric value input	3
4	CURSOR keys	Up and down keys: For increasing and decreasing the numeric value Left and right keys: For specifying decimal places	3
5	CANCEL key	Returns to previous operation. Canceling remote control. clears the alarm.	3
6	ENTER key	Fix set items.	3
7	ON/OFF key	Load ON and OFF	3
8	MENU key	Enters into Menu screen/Returns to Main screen	3
9	STANDBY switch	Switching between standby and startup states	2
10	USB connector	USB2.0 compliant interface	2
11	MEMORY key	Enters into Memory screen/Returns to Main screen	9
12	LOAD terminals *	Front panel load terminal. Terminal for connecting test device Connected with load terminal of rear panel internally	2
13	Intake port	Inlet for cooling air.	-

* LOAD terminals in the figure above are available for LN-300A and LN-300C. In case of LN-1000A and LN-1000C, bus bar is provided. Refer to external view.

Display



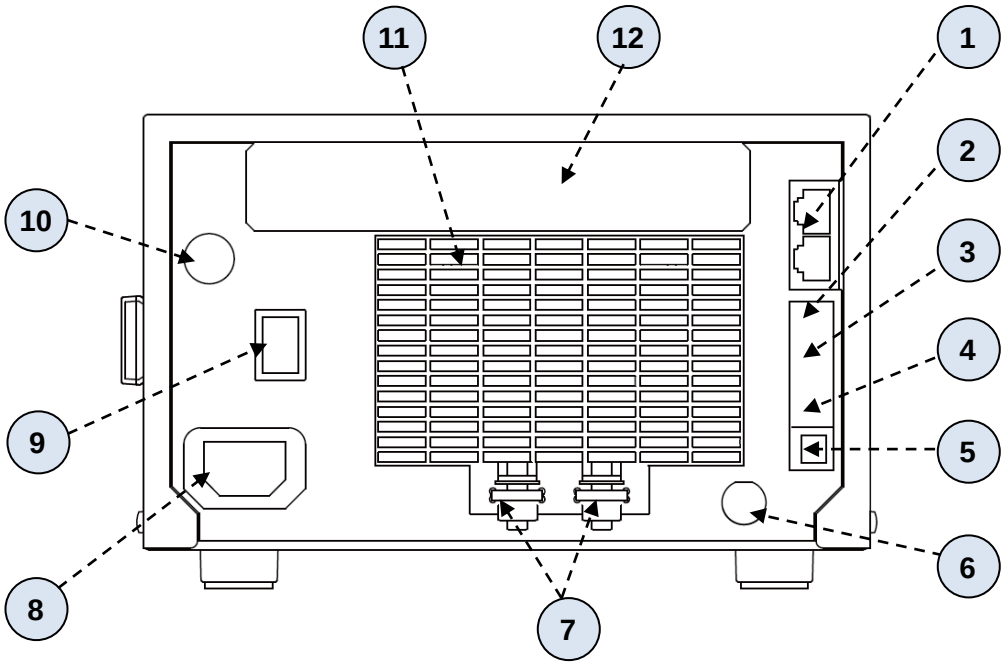
No.	Name	Function	Reference Chapter
1	Vertical menu *	Displays detailed settings for a menu item selected on the horizontal menu. Fix by selecting the item.	3
2	Set value *	Range: Voltage range H/L. See the table below.	4
3		Range: Current range H/M/L. See the table below.	4
4		SlewRate: Displays the set value of SlewRate.	4
5		Value: Set value of the load. Digits to be set are displayed in reverse contrasting colors.	3
6		Mode: Load mode CC: Constant current mode CR: Constant resistance mode CV: Constant voltage mode CP: Constant power mode EX: External control mode ST: Short mode	4
7	Horizontal menu *	Basic setting menu of items displayed on the screen	3
8	Status display	Operation mode, VMode, Master, OCP, OPP	4, 5 6, 7, 8
9	Measured value	Measured values of voltage, current and power. Display order can be changed.	8

* Vertical menu, horizontal menu and set values displayed on the screen vary according to mode or other settings. (The figure above is an illustrative example of Normal mode).

Voltage Range, Current Range

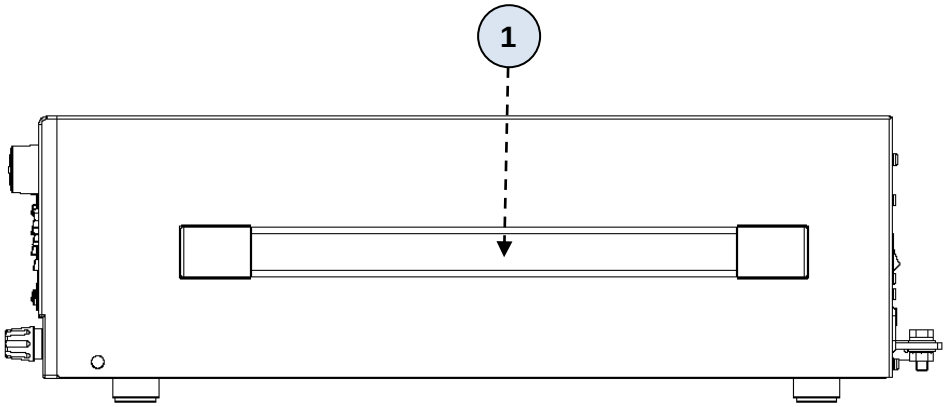
Model	Voltage Range L/H	Current Range L/M/H
LN-300A	20 V / 120 V	0.6 A / 6 A / 60 A
LN-300C	85 V / 500 V	0.12 A / 1.2 A / 12 A
LN-1000A	20 V / 120 V	1.8 A / 18 A / 180 A
LN-1000C	85 V / 500 V	0.36 A / 3.6 A / 36 A

Rear panel



No.	Name	Function	Reference Chapter
1	MASTER/SLAVE connector	Connects the optional MASTER/SLAVE connection cable. Used during parallel run.	2
2	TRIG OUT terminal	Trigger signal output. Outputs the signal in accordance with the timing of load change at dynamic mode. (case potential)	2
3	EXT IN terminal	External control input. Input voltage range is 0 V to 10 V (load potential).	2
4	SENSE terminal	For connecting remote sense cable. SENSE terminal is enabled when remote sense selection switch is set to EXT. SENSE terminal has a same potential as load potential.	2
5	Remote Sense selection switch	Switch for selecting voltage sense signal. Set to EXT when using remote sense cable.	2
6	I MON terminal	Current monitor output. Voltage in proportion to load current is output. (load potential)	2
7	LOAD terminals	Rear panel load terminal. Terminal for connecting test device. Connected to the load terminal of the front panel internally.	2
8	AC Inlet	For connecting power cord set provided as accessory. Input voltage range is AC 85 V to 264 V, 50 Hz / 60 Hz.	2
9	POWER switch	Main power switch.	2
10	RC IN terminal	For connecting measurement signal of ripple noise voltage. BNC connector is mounted when ripple noise measurement option is built-in.	Appendix B
11	Exhaust outlet	For venting the air which is coming from front.	-
12	Option board mounting port	Used for GPIB interface or external control (DIDO)	13 Appendix C

Side panel



No.	Name	Function	Reference Chapter
1	Handle	For holding the product with hands	-

Power ON/OFF procedure

CAUTION There are some risks to damage this unit.

- Please follow the power ON/OFF instruction below strictly.
- Do not power ON/OFF this unit while applying voltages to the load terminals otherwise this unit will be damaged.

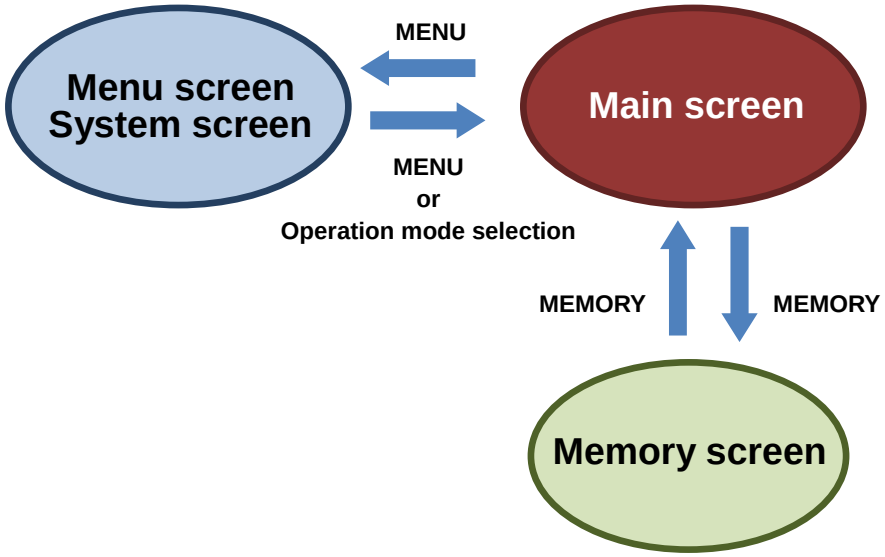
Power ON procedure:

1. **Turn ON the power switch on the rear panel.**
2. **Turn ON the standby switch on the front panel.**
3. **Turn ON the output switch of the DUT.**
4. **Turn the load ON with the load ON / OFF key.**

Power OFF procedure:

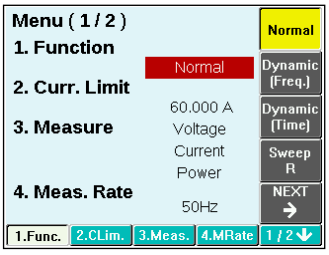
1. **Turn the load OFF with the load ON / OFF key.**
2. **Turn OFF the output of the DUT.**
3. **Confirm if the voltage on the load terminals are low enough.**
4. **Turn OFF the standby switch on the front panel.**
5. **Turn OFF the power switch on the rear panel.**

Structure of Menu



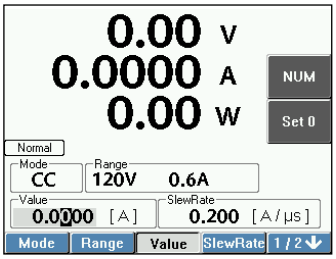
Menu screen

Used for setting the basic items of the product. You can access main screen and system screen from here.



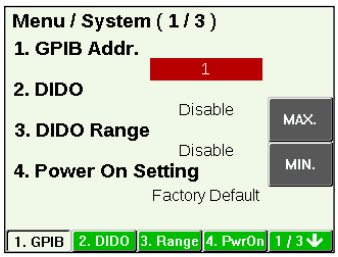
Main screen

Sets the operation mode of the product. You can access memory screen and menu screen from here.



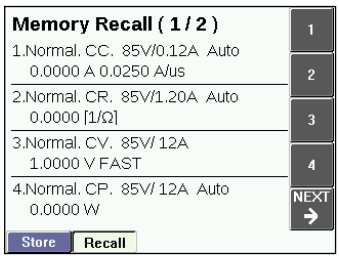
System screen

Hardware setting, screen brightness setting and version check are done. You can go to main screen from here.



Memory screen

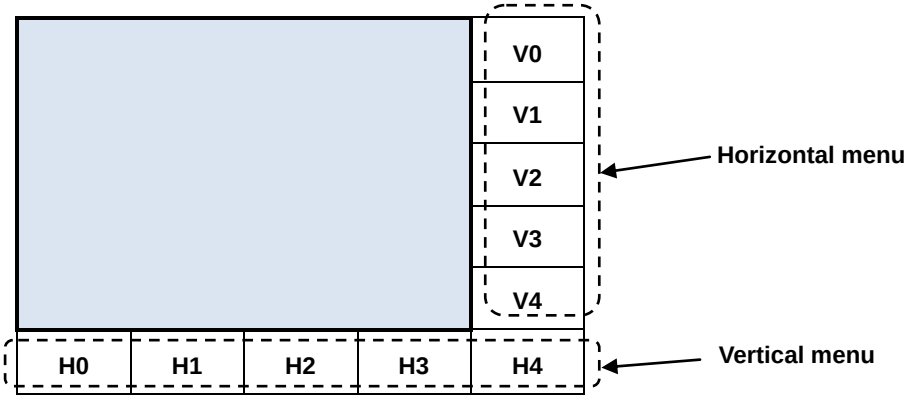
Load settings can be saved. Total 8 memory slots are available. You can go to main screen from here.



Menu

Horizontal menu, Vertical menu

Screen has horizontal menu as well as vertical menu. Panel contains function keys corresponding to H0 - H4 of horizontal menu. Similarly, it also has function keys corresponding to V0 - V4 of vertical menu.
Select menu items by pressing corresponding function keys. Menu names displayed at H0 - H4 and V0 - V4 vary according to the menu selection.



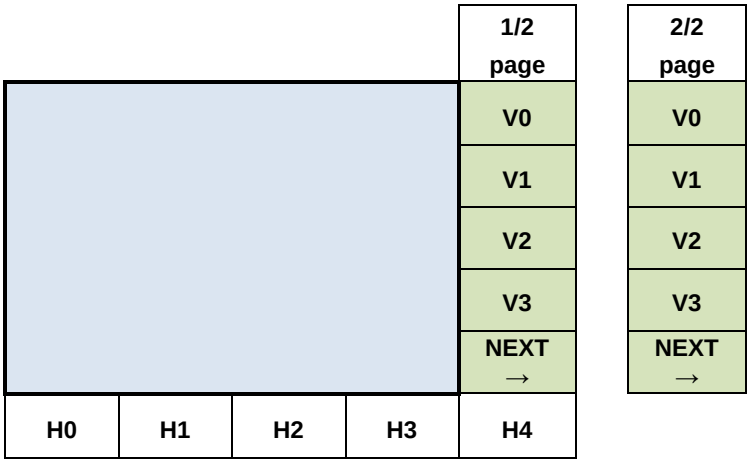
Horizontal menu

Horizontal menu is displayed for each screen. When “1/2 ↓”appears in H4 as below for example, it indicates that there are multiple pages (total 2 pages in this case).

H0	H1	H2	H3	1/2 ↓

Vertical menu

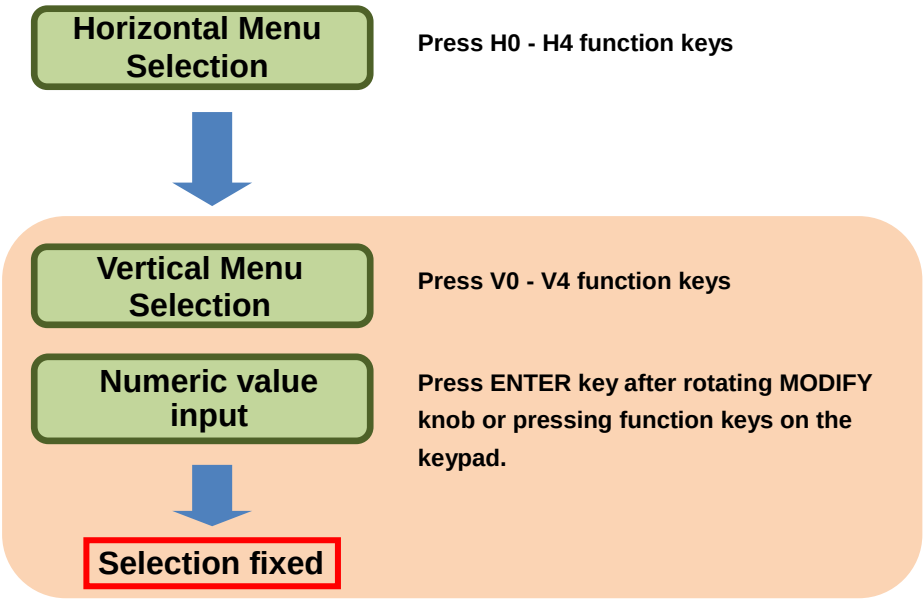
Vertical menu is displayed for the item selected (H0, H1, H2, H3, or H4) on the horizontal menu. When “NEXT→” appears in V4, it indicates that there are multiple pages (example of 2 pages in the following figure).
Selecting an item on the vertical menu fixes the item. Namely, vertical menu items are associated with selection and decision.



Operation

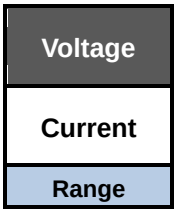
Selecting menu items with function keys

On the panel, there are function keys corresponding to H0 - H4 of the horizontal menu. Similarly, there are function keys corresponding to V0 - V4 of the vertical menu. Select menu item by pressing the corresponding function key. Selecting vertical menu will fix the selected item.



Selecting in the pop-up menu

Some of horizontal menu items are displayed in pop-up menu. After selecting a menu item with function key, press the function key and select. Selected menu item will appear in reverse contrasting color.



1. **Press the function key of the horizontal menu to be selected.**
   Pop-up menu will appear.

2. **Press the function key pressed in Step 1 once again.**
   Selected menu item will appear in reverse contrasting color. Selection of pop-up menu will move when a function key is pressed.

Modify knob

Used for entering a numeric value. You can increase the numeric value by rotating the knob in clockwise direction and decrease the numeric value by rotating the knob in counterclockwise direction. Value when you stop the knob becomes set value.
Set value is displayed in set value section of the screen.

CURSOR key (Left and Right keys, Up and Down keys)

Left and Right keys

Specifies the digit to be set. Pressing the right key moves the cursor to right and pressing the left key moves it to left. If either key is pressed repetitively, the cursor wraps around. The cursor does not move to the digit that does not appear on the display area (the hidden digit), nor the digit that is smaller than the setting resolution.

Up and Down Keys

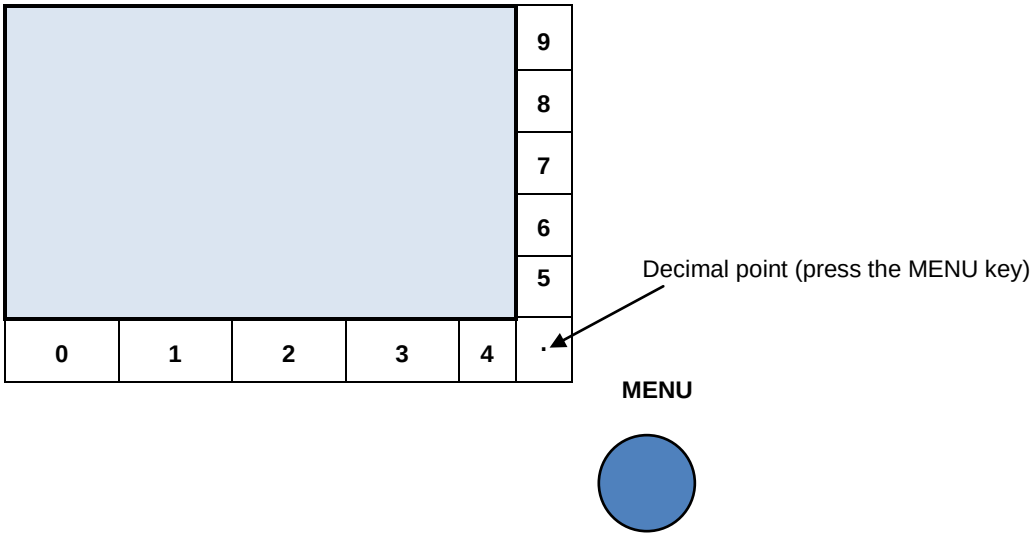
Used for entering a numeric value. Pressing the Up key increases the numeric value, while pressing the Down key decreases the numeric value. Modified value is set immediately after pressing the key. Set value appears in the set value display on the screen.

Keypad

Used for entering a numeric value. When an item for setting a numeric value is selected on the horizontal menu, NUM will appear in the vertical menu. Pressing the function key of NUM will display a key pad in the vertical and the horizontal menu.
Press the MENU key for decimal points.
Fix the numeric value by pressing ENTER key after entering a value. Set value appears in the set value display on the screen.

When an incorrect numeric value is entered by mistake

Use the left key for returning by 1 character. Press the CANCEL key for entering a value again. Press the function key of NUM again and enter a value with keypad.



Main Screen, Operation Mode

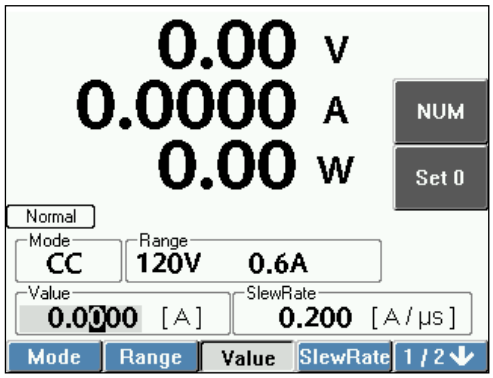
This Main Screen is most commonly used in the product. Details of respective operation mode can be set here.

Types of main screens

Main screens corresponding to the following 6 operation modes are available (refer to Chapter 4, Chapter 5 and Chapter 7 for details of operation modes).

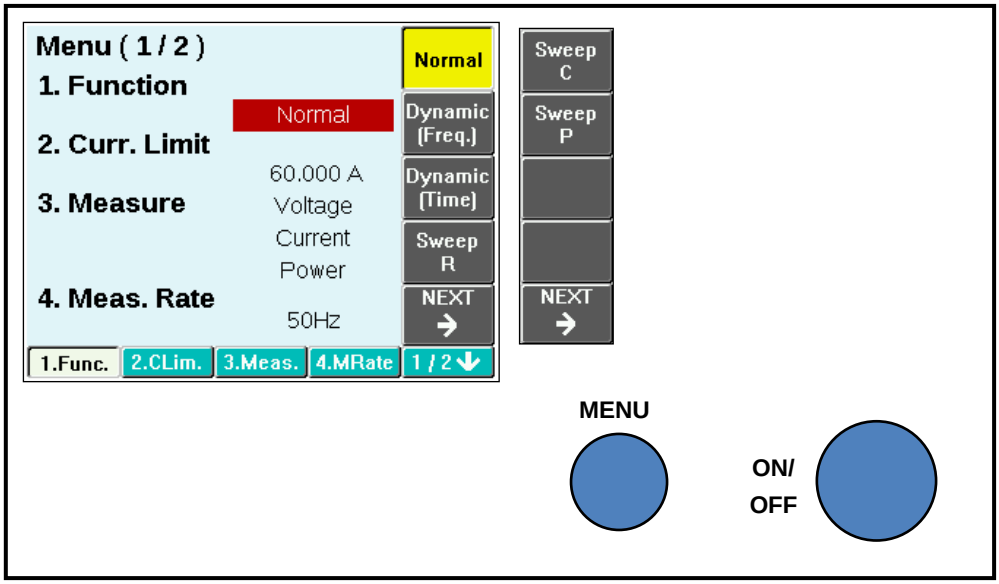
- Normal: Constant Load. 6 load modes are available (Constant Current (CC), Constant Resistance (CR), Constant Voltage (CV), Constant Power (CP), External Control (EXT), Short Circuit (SHORT)).
- Dynamic (Time): Fluctuation Load. Maximum 16 types of load can be sequentially switched with a designated period.
- Dynamic (Freq.): Frequency and duty ratio are set. 2 types of load can be switched.
- Sweep R (V-I characteristic test): Voltage and current are measured with varying the load in CR mode.
- Sweep C (overcurrent characteristic test): Current and voltage are measured with varying the load in CC mode.
- Sweep P (overpower characteristic test): Power, voltage and current are measured with varying the load in CP mode.

The following figure is an example of Normal.



Selecting operation mode

1. **Press the MENU key.**
   Menu screen will appear (right page).
2. **Select 1.Func. on the horizontal menu.**
   Vertical menu corresponding to 1.Func. will appear.
3. **Select Operation Mode on the vertical menu.**
   Main screen of the selected operation mode will appear.



Moving alternatively between main screen and menu screen

You can move alternatively between Main screen and Menu screen with the MENU key. Contents of the respective screen are saved even if the screen is changed.

1. **Press the MENU key on the Main screen.**
   Display will change to menu screen.

2. **Press the MENU key on the Menu screen.**
   Display will change to main screen of the present operation mode.

When you do not know the present operation mode

1. **Press the MENU key on main screen.**
   Menu screen will appear.

2. **Select 1. Func. on the horizontal menu.**
   Present operation mode will appear in reverse contrasting color in the vertical menu.

LOAD ON/OFF

ON

Pressing the ON/OFF key will turn the load ON (the key will light up) and make the load current flow.

OFF

Pressing the ON/OFF key will turn the load OFF (the key will light out) and interrupt the load current.

In this manual “LOAD ON” and “LOAD OFF” are used for indicating that the load is turned on or off.

Combination of Operation Mode and Load Mode

Available load modes in each operation mode

The following table shows load modes available for use for each of the 6 operation modes.

	Load mode					
Operation mode	CC	CR	CV	CP	EXT	SHORT
Normal	○	○	○	○	○	○
Dynamic (Freq.)	○	○	○	○		
Dynamic (Time)	○	○	○	○		
Sweep R		○				
Sweep C	○					
Sweep P				○		

○: Available

Types of load modes

- CC Mode: Constant current will flow even if load terminal voltage changes.
- CR Mode: Current proportional to load terminal voltage will flow.
- CV Mode: Current will flow such that load terminal voltage remains constant.
- CP Mode: Current will flow such that load power remains constant.
- EXT Mode: Current proportional to voltage of external control input terminal will flow.
- SHORT Mode: Shorted load operation and the maximum current will flow.

In this manual, “Load Mode” is mentioned as follows.
Constant current mode: “CC Mode” or “Constant Current Mode”
Constant resistance mode: “CR Mode” or “Constant Resistance Mode”
Constant voltage mode: “CV Mode” or “Constant Voltage Mode”
Constant power mode: “CP Mode” or “Constant Power Mode”
External control mode: “EXT Mode” or “External Control Mode”
Short mode: “SHORT Mode” or “Short Mode”

Chapter 4 Normal Mode (Constant Load)

This chapter describes the Normal mode.

Overview of Normal Mode

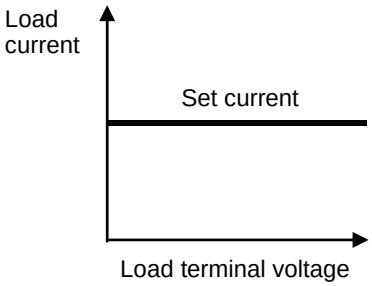
Load mode

The following 6 load modes are available.

- Constant current mode
- Constant resistance mode
- Constant voltage mode
- Constant power mode
- External control mode
- Short mode

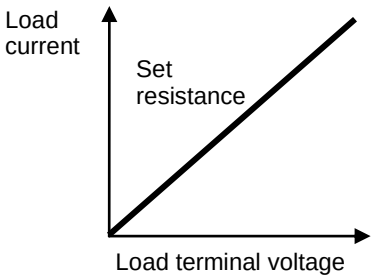
Constant current mode

Constant current will flow even if load terminal voltage changes.



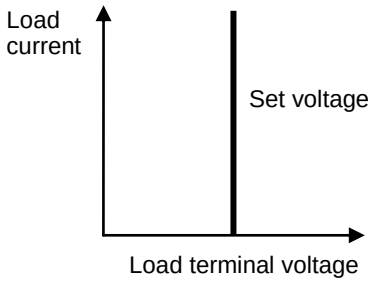
Constant resistance mode

Current proportional to load terminal voltage will flow. Device will operate similar to resistance load.



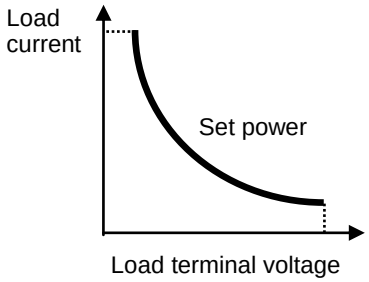
Constant voltage mode

Load current will flow such that load terminal voltage remains constant. Rechargeable battery etc. can be simulated.



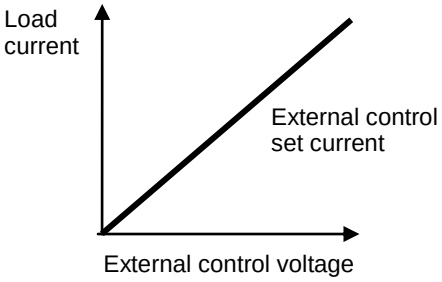
Constant power mode

Load current will flow such that load power remains constant. Device such as switching power supply that current will increase if voltage reduces can be simulated.



External control mode

Load current proportional to voltage supplied to EXT IN terminal of rear panel will flow.



Short mode

Short circuit will be created between load terminals. Current below the maximum rated current or the current limit setting value can be let flow. Current range will be fixed to H range.

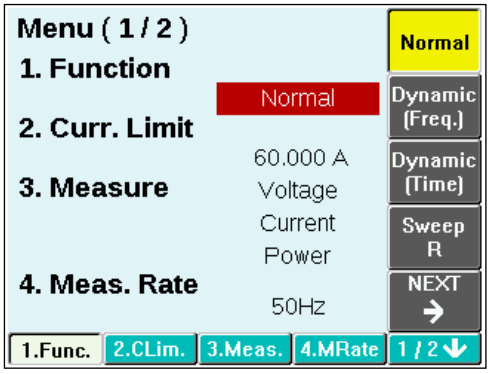
For setting current limit, refer to “Protection Current Value Setting” (p.115) and “Setting of OCP Load Off” (p.134) .

Menu

Selecting normal (Constant Load) mode setting menu

First of all, enter the menu screen. Then go to the main screen.

1. Press the MENU key.
The following menu screen will appear.



2. Select 1. Func. on the horizontal menu.
Vertical menu corresponding to 1.Func. will appear. Go to Step 3 when selecting 1. Func.

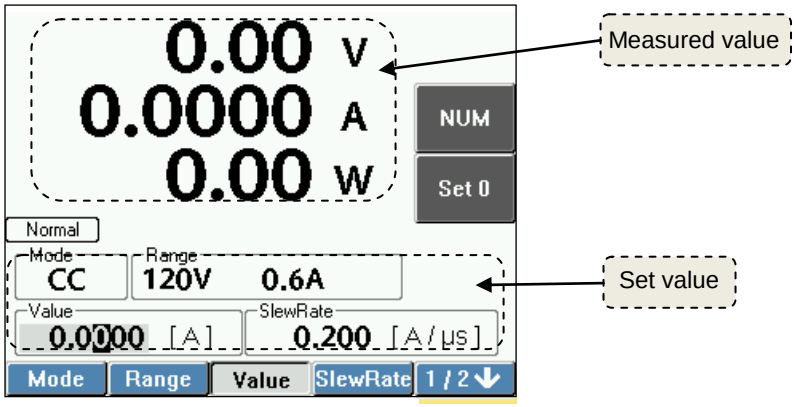
3. Select Normal on the vertical menu.
Normal (constant load) setting screen will appear.

Moving out of Normal (Constant Load) setting screen

You can move out of the Normal (Constant Load) screen using the following 2 methods.

- Press the MENU key to display the Menu screen.
- Press the MEMORY key to displays the Memory screen.

Normal (Constant Load) mode setting menu



Normal			
Mode			Load mode setting
	1/2 page		
	CC		CC mode
	CR		CR mode
	CV		CV mode
	CP		CP mode
	NEXT→		Go to 2/2 page
	2/2 page		
	EX		EXT mode
	ST		SHORT mode
	NEXT→		Go to 1/2 page
Range			Sets voltage range, current range.
	Voltage		Sets voltage range. 2 ranges of H and L are available. Value of range differs according to model.
		H range	H range value
		L range	L range value
	Current		Sets current range. 3 ranges of H, M and L are available. Value of range differs according to model and load mode.
		H range	H range value
		M range	M range value
		L range	L range value
		Auto	Auto range
Value			Load setting (except CR)
	NUM		Setting numeric value with keypad
	SET 0		Changes set value to 0

		Load setting (CR)
	NUM	Setting conductance value with keypad
	MIN.	Minimum value of conductance
SlewRate		SlewRate setting (CC, EXT)
	NUM	Setting numeric value with keypad
	MAX.	Maximum value
	MIN.	Minimum value
		SlewRate setting (CV)
	Fast	Response time with high speed
	Slow	Response time with low speed

Before Setting the Load

ON/OFF key

CAUTION Test power supply may be damaged.

- Turn the LOAD OFF with ON/OFF key when setting the load mode.
- Depending on load setting conditions, it may become close to the state of short circuit.

Changing the range

When changing the range, turn the LOAD OFF using ON/OFF key. Changing the range with LOAD ON will turn off the load once.

Remote sense

Voltage detection circuit will activate when the load mode is CR mode, CV mode or CP mode. Therefore, when using SENSE terminal, it is necessary to correctly set the remote sense selection switch. For setting method, refer to “Wiring” in Chapter 2 Preparation for Installation and Use for correctly setting remote sense switch.

CAUTION Settings, measurement and overpower protection may not work correctly.

- Ensure to set remote sense selection switch to INT when SENSE terminal is not used.
- For using SENSE terminal, set remote sense selection switch to EXT.

External communication

Remote control is activated when Remote appears in the horizontal menu. Load value cannot be set.

Set items of normal mode

Set items		Details
Mode	**Load mode**	CC, CR, CV, CP, EXT, SHORT
Range	**Voltage range**	H range, L range
	Current range	H range, M range, L range, Auto range
Value	**Load value**	Current, Conductance (Resistance), Voltage, Power
SlewRate	**Slew Rate**	Common to rising and falling
CLim.	**Current limit**	Current limited to 110% of set value. Factory default settings is the maximum value of H range. For setting current limit, refer to “Protection Current Value Setting” (p.115) and “Setting of OCP Load Off” (p.134) .
VMode	**Auto load mode switching**	Operation mode, specified voltage Refer to p.122

Setting the Load

Setting the load mode (Mode)

1. **Select Mode on the horizontal menu.**
   Vertical menu of Mode will appear.

2. **Select the Mode to be set from the vertical menu.**
   You can select either CC, CR, CV, CP, EXT (external control) or SHORT mode.

Setting the range (Range)

Sets the voltage range and current range. When ripple noise measurement option is installed, ripple noise measurement menu will appear.

Voltage range

Sets the voltage range. You can set H or L. Value of range differs depending on the model.

1. **Select Range on the horizontal menu.**

2. **Select Voltage by pressing the function key.**
   Selected menu item will appear in reverse contrasting color. Range will appear in the vertical menu. Range value differs according to model.

Voltage range	L range	H range
LN-300A, LN-1000A	20 V	120 V
LN-300C, LN-1000C	85 V	500 V

3. **Select Range on the vertical menu.**
   Voltage range is set.

Current range

1. **Select Range on the horizontal menu.**

2. **Select Current by pressing the function key.**
   Selected menu item will appear in reverse contrasting color. Range will appear in the vertical menu. Range value differs according to model.

Current range	L range (*1)	M range	H range	Auto Range (*2)
LN-300A	0.6 A	6 A	60 A	0.6 A (at 0 A setting)
LN-300C	0.12 A	1.2 A	12 A	0.12 A (at 0 A setting)
LN-1000A	1.8 A	18 A	180 A	1.8 A (at 0 A setting)
LN-1000C	0.36 A	3.6 A	36 A	0.36 A (at 0 A setting)

*1 : CC mode only in L range.

*2 : CC/CR/CP/EXT modes only in Auto range. Ranges automatically switch so that setting resolution becomes the highest at the set value.

3. **Select Range on the vertical menu.**
   Current range is set.

Setting the load (Value)

For entering the set value of load, you can use either modify knob, CURSOR key or keypad. Set value will be stored even after changing to other mode.
Load can be set irrespective of LOAD ON/OFF state.

Using modify knob

Set value will change according to the direction in which the modify knob is rotated. Rotating in clockwise direction increases the value, while counterclockwise direction reduces the value.

1. **Select Value on the horizontal menu.**
   Vertical menu will appear.

2. **Specify the digit to be set using left and right key.**
   The specified digit will appear in reverse contrasting color.

3. **Set the value by rotating modify knob.**
   Stopping the modify knob will set the value as it is.

Using keypad

Set value can be directly entered using keypad. After entering numeric value, press ENTER key to fix it.

1. **Select Value on the horizontal menu.**
   Vertical menu will appear.

2. **Select NUM on the vertical menu.**
   Keypad will appear.

3. **Enter set value using key pad.**

4. **Press the ENTER key.**
   The numeric value entered will be fixed.

NOTE Value on the horizontal menu forms basic menu in the screen.

- Value of the horizontal menu is enabled unless other item except value is selected in the horizontal menu. Load value can be immediately set or changed on the vertical menu.

Setting range

CC mode

Model	Current range		
	L range	M range	H range
LN-300A	0.0000 A ~ 0.6000 A	0.0000 A~ 6.0000 A	0.000 A ~ 60.000 A
LN-300C	0.0000 A ~ 0.1200 A	0.0000 A ~ 1.2000 A	0.000 A ~ 12.000 A
LN-1000A	0.0000 A ~ 1.8000 A	0.000 A ~ 18.000 A	0.00 A ~ 180.00 A
LN-1000C	0.00000 A ~ 0.36000 A	0.0000 A ~ 3.6000 A	0.000 A ~ 36.000 A

If an entered set value exceeds the upper or lower limit of the setting range the maximum or minimum current value in the range will be set.

CR Mode (conductance set, resistance display)

Model	Voltage range	Current range	
		M range	H range
LN-300A	L range 20 V	0.0005 S ~ 4.0000 S (2000.0 Ω ~ 0.2500 Ω)	0.005 S ~ 40.000 S (200.00 Ω ~ 0.0250 Ω)
	H range 120 V	0.00016 S ~ 1.3333 S (6000.2 Ω ~ 0.7500 Ω)	0.0016 S ~ 13.333 S (600.00 Ω ~ 0.0750 Ω)
LN-300C	L range 85 V	0.00004 S ~ 0.33333 S (25000 Ω ~ 3.0000 Ω)	0.0004 S ~ 3.3333 S (2500.0 Ω ~ 0.3000 Ω)
	H range 500 V	0.00001 S ~ 0.11111 S (69999 Ω ~ 9.0000 Ω)	0.0001 S ~ 1.1111 S (6999.9 Ω ~ 0.9000 Ω)
LN-1000A	L range 20 V	0.001 S ~ 12.000 S (666.67 Ω ~ 0.0833 Ω)	0.01 S ~ 120.00 S (66.667 Ω ~ 0.0083 Ω)
	H range 120 V	0.0005 S ~ 4.0000 S (2000.0 Ω ~ 0.2500 Ω)	0.005 S ~ 40.000 S (200.00 Ω ~ 0.0250 Ω)
LN-1000C	L range 85 V	0.0001 S ~ 1.0000 S (8333.3 Ω ~ 1.0000 Ω)	0.001 S ~ 10.000 S (833.33 Ω ~ 0.1000 Ω)
	H range 500 V	0.00004 S ~ 0.33330 S (23333 Ω ~ 3.0003 Ω)	0.0004 S ~ 3.3333 S (2333.3 Ω ~ 0.3000 Ω)

If an entered set value exceeds the upper or lower limit of the setting range the maximum or minimum conductance value in the range will be set.

CV mode

Model	Voltage range	
LN-300A LN-1000A	L range 20 V	0.000 V ~ 20.000 V
	H range 120 V	0.00 V ~ 120.00 V
LN-300C LN-1000C	L range 85 V	0.000 V ~ 85.000 V
	H range 500 V	0.00 V ~ 500.00 V

If an entered set value exceeds the upper or lower limit of the setting range the maximum or minimum voltage value in the range will be set.

CP mode

Model	Current range	
	M range	H range
LN-300A	0.000 W ~ 40.000 W	0.00 W ~ 300.00 W
LN-300C		
LN-1000A	0.00 W ~ 120.00 W	0.0 W ~ 1000.0 W
LN-1000C		

If an entered set value exceeds the upper or lower limit of the setting range the maximum or minimum power value in the range will be set.

EXT mode

The setting full scale corresponds to the external control input voltage full scale (10 V)

Model	External control input voltage	Current range	
		M range	H range
LN-300A	0 V ~ 10 V	0.0000 A ~ 6.0000 A	0.000 A ~ 60.000 A
LN-300C		0.0000 A ~ 1.2000 A	0.000 A ~ 12.000 A
LN-1000A		0.000 A ~ 18.000 A	0.00 A ~ 180.00 A
LN-1000C		0.0000 A ~ 3.6000 A	0.000 A ~ 36.000 A

If an entered set value exceeds the upper or lower limit of the setting range, the maximum or minimum current value in the range will be set.

SHORT mode

Model	H range (Max. rating)
LN-300A	60 A
LN-300C	12 A
LN-1000A	180 A
LN-1000C	36 A

Short circuit will be created between load terminals. Current range will be fixed to H range.
Setting value of current will be maximum rated current. When current limit is set, setting value will become 110% of current limit value.

Setting the SlewRate (SlewRate)

Slew rate can be changed. SlewRate will be same for rise as well as fall. Only CC mode and EXT mode can be set the slew rate. Slew rate of CV mode is set as selecting two type of response, "fast" or "slow".

1. **Select SlewRate on the horizontal menu.**
   Type of settings will appear in the vertical menu.

2. **Select items on the vertical menu.**
   Select NUM for keypad input.
   MAX will select the maximum value.
   MIN will select the minimum value.

Setting range

SlewRate of CC mode

Model	Current range		
	L range	M range	H range
LN-300A	0.005 A/μs ~ 0.500 A/μs	0.02 A/μs ~ 2.00 A/μs	0.2 A/μs ~ 20.0 A/μs
LN-300C	0.00025 A/μs ~ 0.0250 A/μs	0.001 A/μs ~ 0.100 A/μs	0.01 A/μs ~ 1.00 A/μs
LN-1000A	0.0075 A/μs ~ 0.7500 A/μs	0.03 A/μs ~ 3.00 A/μs	0.3 A/μs ~ 30.0 A/μs
LN-1000C	0.00075 A/μs ~ 0.07500 A/μs	0.003 A/μs ~ 0.300 A/μs	0.03 A/μs ~ 3.00 A/μs

If an entered set value exceeds the upper or lower limit of the setting range, the maximum or minimum current value in the range will be set.

Response Time of CV Mode

Response time can be set as Fast or Slow. This value is not dependent on voltage range. In case of Fast, oscillations may occur due to relation with response time of test power supply. In such cases, select Slow.

Setting range of EXT mode

Model	Current range	
	M range	H range
LN-300A	0.02 A/μs ~ 2.00 A/μs	0.2 A/μs ~ 20.0 A/μs
LN-300C	0.001 A/μs ~ 0.100 A/μs	0.01 A/μs ~ 1.00 A/μs
LN-1000A	0.03 A/μs ~ 3.00 A/μs	0.3 A/μs ~ 30.0 A/μs
LN-1000C	0.003 A/μs ~ 0.300 A/μs	0.03 A/μs ~ 3.00 A/μs

If an entered set value exceeds the upper or lower limit of the setting range the maximum or minimum current value in the range will be set.

Using current limit function

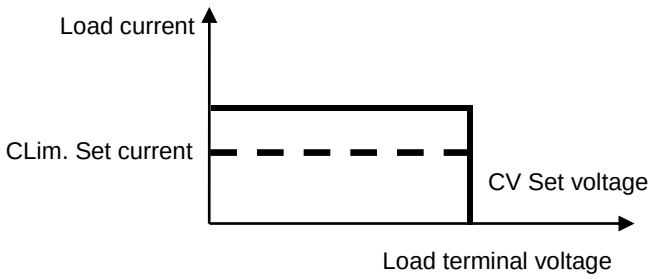
Current limit function is a type of overcurrent protection function. When the set current is detected, without switching to LOAD OFF, current is restricted to 110% of the set value with LOAD ON. Factory default setting is the maximum value of H range. Refer to “Overcurrent protection” in Chapter 10 Protection, Alarm Function for overcurrent protection function.

Current limit setting value is common to each mode.

In the each operation mode of normal load, dynamic load and sweep, current limit setting value is common. When the current limit set value is smaller than load set value (Value), overcurrent protection works after switching to LOAD ON. In this case, set the current limit again after changing to LOAD OFF with the ON/OFF key. Current limit value is stored. Refer to “Protection Current Value Setting” on p.115.

Using Current Limit Function in CV Mode (CV+CLim.)

CV+CLim. function is formed by adding current limit function to CV mode. Constant current operation is performed up to the set voltage. CV+CLim. Function is suitable for discharge test of battery.



Method of setting the voltage is same as CV mode settings.

As for current limiter setting, refer to “Protection Current Value Setting” (p.115) and “Setting of OCP Load Off” (p.134) .

Using automatic load mode switching (VMode function)

This function automatically changes the load mode in “Voltage Rising” or “Voltage Declining” during operation. In addition, device can be switched to LOAD OFF in such cases. It takes about 700 ms on the switching. (It depends on the measurement settings.)

It can also be used as low voltage limiter, low voltage protection or overvoltage protection function. For example, in low voltage protection function, battery can be protected such that voltage of battery does not fall below the specified voltage during discharge test.

- CC Mode can be accessed from any other mode except CC Mode as it will cause inconsistency of range.
- Load mode cannot be set to EXT Mode or SHORT Mode.
- This is valid only for Normal (constant load) operation mode.

Changing the load mode by specifying voltage

Set VMode voltage in advance. VMode voltage is a voltage that becomes condition for switching load mode. VMode setting can be done from the Menu screen. Refer to “VMode Voltage Setting” in Chapter 8 Menu, System for further details.

Execution

Execution

LOAD ON, OFF

Load current will flow if the switch is turned ON (key will light up) with the ON/OFF key.
Load current will disconnect if the switch is turned OFF (key will light out) with the ON/OFF key.

When it does not work properly

Oscillation might have occurred

In CV mode, due to operating principles, load control may not stabilize because of test power supply and connector, resulting in oscillation. In such cases, load control can be stabilized by changing the response time.

Remote sense

Voltage detection circuit will activate when the load mode is CR mode, CV mode or CP mode. Therefore, when using SENSE terminal, it is necessary to correctly set the remote sense selection switch. For setting method, refer to “Wiring” in Chapter 2 Preparation for Installation and Use for correctly setting remote sense switch.

CAUTION Settings, measurement and overpower protection may not work correctly.

- Ensure to set remote sense selection switch to INT when SENSE terminal is not used.
- For using SENSE terminal, set remote sense selection switch to EXT.

Set current does not flow

Current limit might be set. Check the current limit set value (p.115).

Protection and Alarm occurs

When protection and alarm occurs, message will appear with beep sound, resulting in LOAD OFF. For details, refer to “Protection, Alarm Function” of Chapter 10.

Type of alarm	Operation
Overcurrent protection	When overcurrent is detected, the load turns off and interrupts the current. When the current limit function is set, load current is restricted to 110% of the limiter setting value with LOAD ON. Refer to “Protection Current Value Setting” (p.115) and “Setting of OCP Load Off” (p.134) .
Overpower protection	When the rated power is exceeded, the load turns off and interrupts the current. If LOAD ON is selected, load power is restricted to 110% of the rated power with LOAD ON. Refer to OPP Load Off Setting (p. 135) for the Setting.
Overheat protection	Temperature anomaly in load section will result in LOAD OFF and current cutoff.
Overvoltage alarm (*1)	If overvoltage detection value of each voltage range (p. 150) is exceeded, the load turns off and interrupts the current, and an alarm occurs.
Reverse connection alarm (*1)	If reverse connection to the load terminals is detected, an alarm occurs.

*1: Remove the root cause of alarm as the load section may breakdown.

NOTE Pay attention to the overcurrent protection especially in Constant Power mode.

- During constant power mode, drop in load terminal voltage will increase the current pulled in. Overcurrent protection will be activated once the load current reaches the protection current setting value.

Chapter 5 Dynamic Mode (Fluctuation Load)

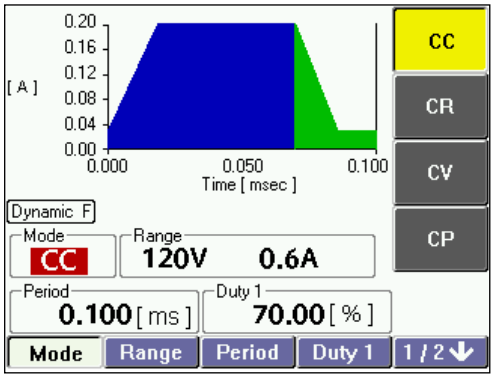
This chapter describes the Dynamic mode.

Overview of Dynamic Mode

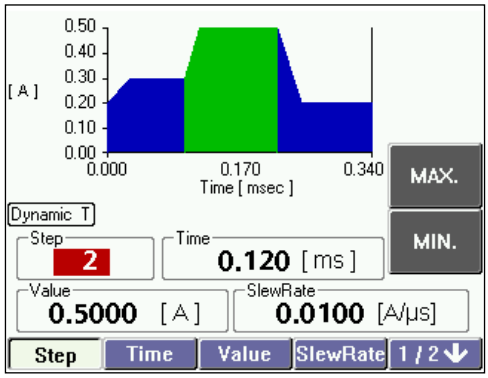
Operation method

In Dynamic mode, multiple loads can be switched in sequence.
There are 2 types of mode, Dynamic (Freq.) Mode and Dynamic (Time) mode.
Dynamic (Freq.) mode allows setting Period and duty ratio (Duty1) of Step1 and sequential switching of 2 types of loads.
Dynamic (Time) mode allows setting Time by Step and sequential switching of maximum 16 types of loads.

Dynamic (Freq.) mode



Dynamic (Time) mode



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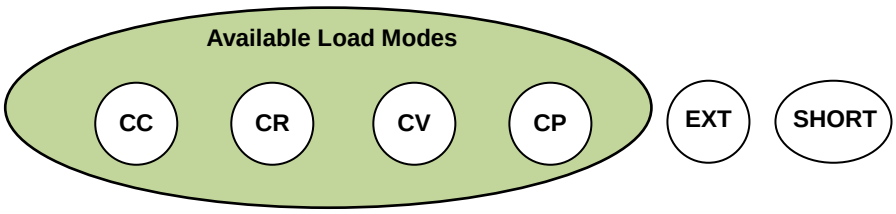
Single operation

Single operation is allowed in Dynamic (Time) modes.

Available load modes

CC Mode, CR Mode, CV Mode and CP Mode can be used. Load Mode cannot be changed during operation.

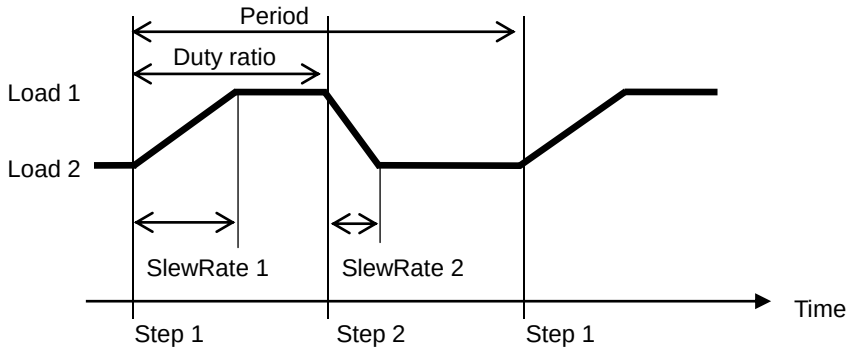


Trigger Signal Output

Trigger signal is output from TRIG OUT terminal of rear panel. It is used as the trigger signal when observing the waveform of the dynamic mode with the oscilloscope or when synchronizing with other devices.

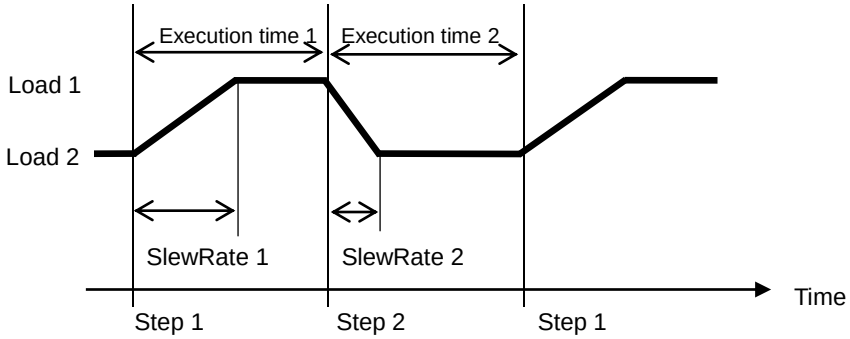
Representative example of Dynamic (Freq.) Mode

2 types of load are switched alternately. Load 1 and Load 2 are set with Period and Duty ratio (Duty1) and switched alternately. SlewRate is set for each step individually.



Representative example of Dynamic (Time) Mode

The following is displayed when 2 types of load are switched alternately. Load (Value) 1 of Step 1 and Load (Value) 2 of Step 2 are switched alternately. Execution time (Time) and SlewRate are set for each step individually.



Menu

Selecting dynamic mode setting menu

First of all, enter the menu screen. Then go to the main screen.

1. **Press the MENU key.**
   Menu screen will appear.

2. **Select 1. Func. on the horizontal menu.**
   Vertical menu corresponding to 1.Func. will appear. Go to Step 3 when selecting 1. Func.

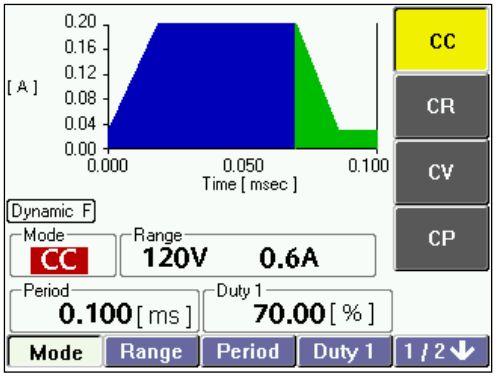
3. **Select Dynamic (Freq.) or Dynamic (Time) on the vertical menu.**
   Select the Dynamic (Freq.) or Dynamic (Time).
   After operation, fluctuation load (Dynamic) setting menu of main screen will appear.

Moving out of the fluctuation load (Dynamic) settings menu screen

You can move out of the fluctuation load (Dynamic) settings screen using the following 2 methods.

- Press the MENU key to display the Menu screen.
- Press the MEMORY key to displays the Memory screen.

Dynamic Mode Setting Menu Dynamic (Freq.)



Horizontal menu 1/2 page

Dynamic (Freq.)			
	Mode		Load mode setting
		CC	CC mode
		CR	CR mode
		CV	CV mode
		CP	CP mode
	Range		Sets voltage range, current range.
		Voltage	Sets voltage range. 2 ranges of H and L are available. Value of range differs according to model.
		H range	H range value
		L range	L range value
		Current	Sets current range. 3 ranges of H, M and L are available. Value of range differs according to model and load mode.
		H range	H range value
		M range	M range value
		L range	L range value
	Period		Sets time for 1 period
		NUM	Set numeric value with keypad
		MAX.	Maximum value
		MIN.	Minimum value
	Duty1		Sets Duty ratio of step 1 in 1 period
		NUM	Set numeric value with keypad
		MAX.	Maximum value
		MIN.	Minimum value

1/2 ↓		Current 1/2 page. Go to next↓

Horizontal menu 2/2 page

Dynamic (Freq.)			
	Value1		Load setting
		NUM	Set numeric value with keypad
		MAX.	Maximum value
		MIN.	Minimum value
	Value2		Load setting
		NUM	Set numeric value with keypad
		MAX.	Maximum value
		MIN.	Minimum value
	SR1		SlewRate setting (CC)
		NUM	Set numeric value with keypad
		MAX.	Maximum value
		MIN.	Minimum value
			Response time setting (CV)
		Fast	Response time with High speed *1
		Slow	Response time with Low speed *1
	SR2		SlewRate setting (CC)
		NUM	Set numeric value with keypad
		MAX.	Maximum value
		MIN.	Minimum value
			Response time setting (CV)
		Fast	Response time with High speed *1
		Slow	Response time with Low speed *1
	2/2 ↓		Current 2/2 page. Return to↓1/2.

*1: Setting of SlewRate in CV Mode is common for all steps.

Before Setting the Load

CAUTION Test power supply may be damaged.

- Turn the LOAD OFF with ON/OFF key when setting the load mode.
- Depending on load setting conditions, it may become close to the state of short circuit.

Changing the range

When changing the range, turn the LOAD OFF using ON/OFF key. Changing the range with LOAD ON will turn off the load once.

Remote sense

Voltage detection circuit will activate when the load mode is CR mode, CV mode or CP mode. Therefore, when using SENSE terminal, it is necessary to correctly set the remote sense selection switch. For setting method, refer to “Wiring” in Chapter 2 Preparation for Installation and Use for correctly setting remote sense switch.

CAUTION Settings, measurement and overpower protection may not work correctly.

- Ensure to set remote sense selection switch to INT when SENSE terminal is not used.
- For using SENSE terminal, set remote sense selection switch to EXT.

External communication

Remote control is activated when Remote appears in the horizontal menu. Load value cannot be set.

Setting items of Dynamic (Freq.)

Dynamic (Freq.)

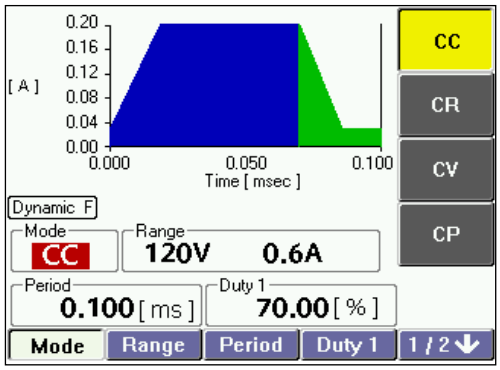
Set items		Content
Mode	Load mode	CC, CR, CV, CP
Range	Voltage range	H range, L range
	Current range	H range, M range, Lange
Period	Period	Sets time for 1 period
Duty1	Duty ratio	Sets duty ratio of step 1 in 1 period
Value1	Load 1 value	Load of step 1. Current, Conductance (Resistance), Voltage, Power
Slew Rate1	Slew rate1	Step 1 rising or trailing
Value2	Load 2 value	Load of step 2. Current, Conductance (Resistance), Voltage, Power
Slew Rate 2	Slew rate 2	Step 2 rising or trailing

Flow of setting steps

For each step, four parameters shown in the following example are set.

Step	1	2
Period	Period	
Duty	Duty1	
Load (Value)	Val1	Val 2
SlewRate	SR1	SR2

The figure below is an example. Vertical axis shows current and horizontal axis shows time. Current and Time of each step is shown. Displayed values on the time axis are accumulated values from the beginning of the first step.



Execution time of each step is automatically determined from Period and Duty ratio (Duty1).

- Overall step execution time = Period
- Execution time of Step 1 =
  Period ×(Duty ratio (Duty1)) / 100%
- Execution time of Step 2 =
  Period – (Execution time of Step 1)

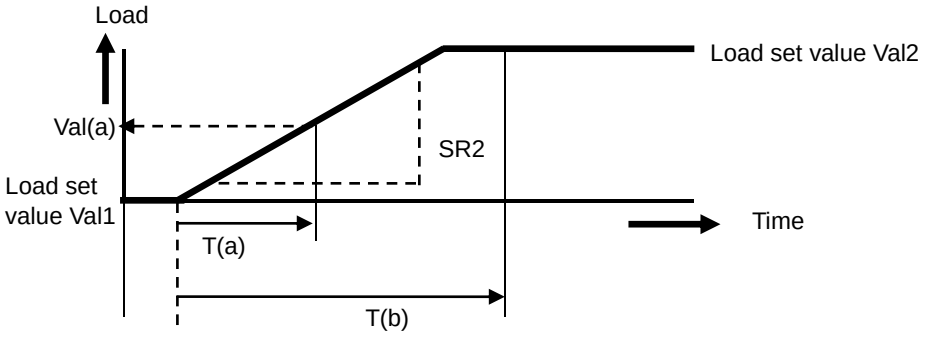
Check the parameters set for each step

Changing to 2/2 of horizontal menu, displays the parameters set for that step in display.

Precautions for set value

Execution time is automatically determined from Period and Duty ratio (Duty1) as mentioned above, Load (Value) and SlewRate are interrelated. Let us consider the case where SlewRate (SR2) is set as shown in the figure below.

If execution time is T(b) and above, load value will become val2 and will be equivalent to set value. However, if execution time is T(a), load value has increased to Val(a), but does not reach the set value of load. In this way, depending on SlewRate, load value may not rise up to set value with the execution time. Period, Duty ratio (Duty 1), Value and SlewRate are independent from each other. It is important to set the load considering relation of these 4 parameters.



Setting the load

Set the Step 1, 2 loads, SlewRate, Period and Duty ratio. Parameters set are shown as graph on the screen.

Mode, Range

Setting the load mode (Mode)

CC Mode, CR Mode, CV Mode and CP Mode can be used. Setting method is same as mode setting of normal mode. Refer to “Setting the Load” in Chapter 4 Normal Mode (Constant Load).

Setting the load (Range)

Setting method of voltage range and current range is same as range setting of normal mode. Refer to “Setting the Load” in Chapter 4 Normal Mode (Constant Load).

Period, Duty ratio (Duty1)

Setting the period (Period)

Sets time of 1 period. Setting range is 2μs-10 s. When the execution time becomes longer, the set resolution becomes coarser (table below).

Setting range	Resolution
1 μs ≤ Period ≤ 20 ms	1 μs
20 ms < Period ≤ 200 ms	10 μs
200 ms < Period ≤ 2 s	100 μs
2 s < Period ≤ 10 s	1 ms

Setting the duty ratio (Duty1)

Sets the duty ratio of Step 1. Setting range is 0% - 100%.

Load (Value)

Set the load for each step separately. Setting method is same as Value setting for normal mode. Refer to “Setting the Load” in Chapter 4 Normal Mode (Constant Load).

SlewRate (SlewRate)

Set the SlewRate for each step separately. Setting method is same as SlewRate setting for normal mode. Refer to “Setting the Load” in Chapter 4 Normal Mode (Constant Load).

Using current limit function (CLim.)

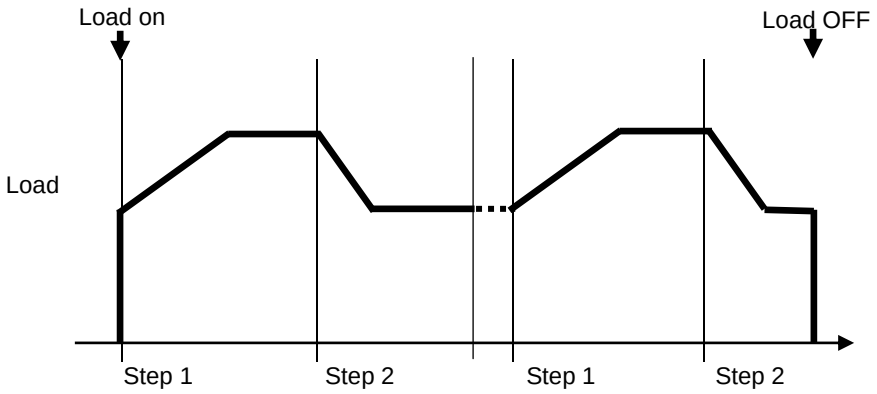
Setting method of current limit, refer to “Protection Current Value Setting” (p.115) and “Setting of OCP Load Off” (p.134) .

Execution

Execution

Load mode cannot be changed during operation.
Changing the load mode during operation will interrupt the operation and switch the device to LOAD OFF.

LOAD ON, OFF



Selecting ON by pressing the ON/OFF key (key will light up) will start operation. Switching the ON/OFF key to OFF during execution, operation ends and LOAD turns to OFF (key will light out).

When it does not work properly

Oscillation might have occurred

In principle, load control in CV mode might become unstable and cause oscillation because of the tested power supply and its connection. In such cases, load control can be stabilized by changing the response time.

Remote sense

Voltage detection circuit will activate when the load mode is CR mode, CV mode or CP mode. Therefore, when using SENSE terminal, it is necessary to correctly set the remote sense selection switch. For setting method, refer to “Wiring” in Chapter 2 Preparation for Installation and Use for correctly setting remote sense switch.

CAUTION Settings, measurement and overpower protection may not work correctly.

- Ensure to set remote sense selection switch to INT when SENSE terminal is not used.
- For using SENSE terminal, set remote sense selection switch to EXT.

Set current does not flow

Current limit might be set. Check the current limit set value (p.115).

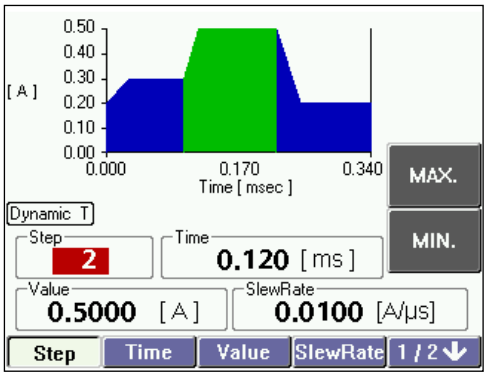
Protection and Alarm occurs

When protection and alarm occurs, message will appear with beep sound, resulting in LOAD OFF. For details, refer to “Protection, Alarm Function” of Chapter 10.

Type of alarm	Operation
Overcurrent protection	When overcurrent is detected, the load turns off and interrupts the current. When the current limit function is set, load current is restricted to 110% of the limiter setting value with LOAD ON. Refer to “Protection Current Value Setting” (p.115) and “Setting of OCP Load Off” (p.134) .
Overpower protection	When the rated power is exceeded, the load turns off and interrupts the current. If LOAD ON is selected, load power is restricted to 110% of the rated power with LOAD ON. Refer to OPP Load Off Setting (p. 135) for the Setting.
Overheat protection	Temperature anomaly in load section will result in LOAD OFF and current cutoff.
Overvoltage alarm (*1)	If overvoltage detection value of each voltage range (p. 150) is exceeded, the load turns off and interrupts the current, and an alarm occurs.
Reverse connection alarm (*1)	If reverse connection to the load terminals is detected, an alarm occurs.

*1: Remove the root cause of alarm as the load section may breakdown.

Dynamic Mode Setting Menu Dynamic (Time)



Horizontal menu 1/2 page

Dynamic (Time)			
Step			Step number (1 to 16)
	MAX.		Maximum value
	MIN.		Minimum value
Time			Sets execution time of each step
	NUM		Set numeric value with keypad
	MAX.		Maximum value
	MIN.		Minimum value
Value			Setting load
	NUM		Set numeric value with keypad
	MAX.		Maximum value
	MIN.		Minimum value
SlewRate			SlewRate setting (CC)
	NUM		Set numeric value with keypad
	MAX.		Maximum value
	MIN.		Minimum value
			Response time with High speed (CV)
	Fast		High speed *1
	Slow		Low speed *1
1/2 ↓			Current 1/2 page. Go to next ↓

*1: Setting of SlewRate in CV Mode is common for all steps.

Horizontal menu 2/2 page

Dynamic (Time)			
Mode			Load mode setting
	CC		CC mode
	CR		CR mode
	CV		CV mode
	CP		CP mode
Range			Sets voltage range, current range.
	Voltage		Sets voltage range. 2 ranges of H and L are available. Value of range differs according to model.
		H range	H range value
		L range	L range value
	Current		Sets current range. 3 ranges of H, M and L are available. Value of range differs according to model and load mode.
		H range	H range value
		M range	M range value
		L range	L range value
Repeat			Sets repeat operation
	ON		Repeat operation (Repeat)
	OFF		Single operation (Single)
Graph			
	Disp. [Cursor]		Graph enlargement, cursor display
	Auto Y axis		Optimization of Y axis
2/2 ↓			Current 2/2 page. Return to ↓ 1/2.

Before Setting the Load

ON/OFF key

CAUTION Test device may be damaged.

- Turn the LOAD OFF with ON/OFF key when setting the load mode.
- Depending on load setting conditions, it may become close to the state of short circuit.

Changing the range

When changing the range, turn the LOAD OFF using ON/OFF key. Changing the range with LOAD ON will turn off the load once.

Remote sense

Voltage detection circuit will activate when the load mode is CR mode, CV mode or CP mode. Therefore, when using SENSE terminal, it is necessary to correctly set the remote sense selection switch. For setting method, refer to “Wiring” in Chapter 2 Preparation for Installation and Use for correctly setting remote sense switch.

CAUTION Settings, measurement and overpower protection may not work correctly.

- Ensure to set remote sense selection switch to INT when SENSE terminal is not used.
- For using SENSE terminal, set remote sense selection switch to EXT.

External communication

Remote control is activated when Remote appears in the horizontal menu. Load value cannot be set.

Set items of Dynamic (Time)

Dynamic (Time)

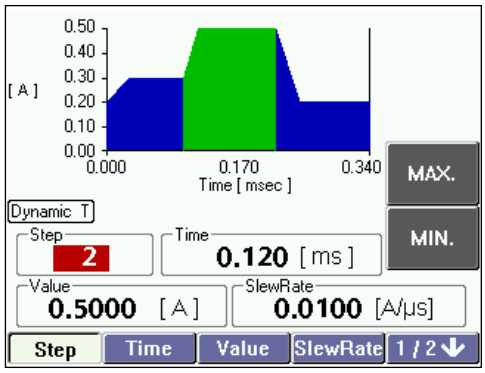
Set items		Content
Step	Step	Step to be execute. Maximum 16 steps including Step 1.
Time	Execution time	Execution time of each step. Setting 0 will skip that step.
Value	Load value	Load of each step executed in sequence. Current, Conductance (Resistance), Voltage, Power
SlewRate	SlewRate	Rising of each step. Same value for trailing.
Mode	Load mode	CC, CR, CV, CP
Range	Voltage range	H range, L range
	Current range	H range, M range, L range
Repeat	Repeat operation	Starting from step 1, after executing load up to steps defined, return to step 1 and repeat the execution.

Flow of setting steps

For each step, 4 parameters shown in the following example are set.
Set Step>Time>Value>SlewRate in this order in each step. For setting a particular step, set Time>Value>SlewRate after specifying the Step number.

Step	1	2	3	·····	16
Execution time (Time)	T1	T2	T3	·····	T16
Load (Value)	Val1	Val2	Val3	·····	Val16
SlewRate	SR1	SR2	SR3	·····	SR16

The figure below is an example up to step 3. Vertical axis shows current and horizontal axis shows time. Current and Execution time of each step is shown. Displayed values on the time axis are accumulated values from the beginning of the first step.

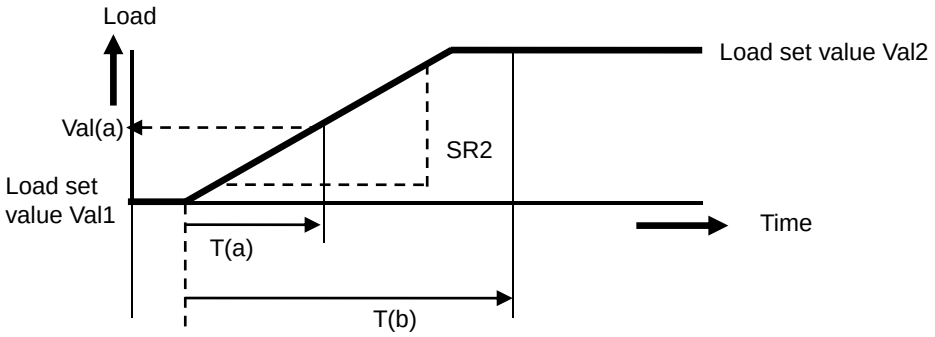


Checking the parameters set for each step

Specifying the step number displays the parameters set for that step in display.

Precautions for set value

Execution time (Time), Load (Value) and SlewRate (SlewRate) are interrelated. Let us take an example where we have set SlewRate (SR2) as shown in the figure below.
If execution time is T(b) and above, load value will become val2 and will be equivalent to set value. However, if execution time is T(a), load value has increased to Val(a), but did not reach the set value of load. In this way, depending on SlewRate, load value may not rise up to set value with the execution time. Execution time, Value and SlewRate are set independent of each other. It is important to set the load considering relation between these 3 parameters.



Setting the Load

Set the load and execution time for maximum 16 steps including step 1. Parameters set are shown as graph on the screen.

Step

Total 16 types of load from step 1 to maximum step 16 can be set.

1. **Select Step on the horizontal menu.**
   Vertical menu will appear. Start from Step 1.

2. **Set the value by rotating modify knob.**
   Stopping the modify knob will set the value as it is.
   Selecting NUM on the vertical menu allows entering a value with keypad.

Execution time (Time)

Execution time is set for each step. Setting range is 1 µs to 60 s. Longer the execution time, coarser is the set resolution (table below).

Setting range	Resolution
1 µs ≤ Time ≤ 20 ms	1 µs
20 ms < Time ≤ 200 ms	10 µs
200 ms < Time ≤ 2 s	100 µs
2 s < Time ≤ 20 s	1 ms
20 s < Time ≤ 60 s	10 ms

1. **Select Time in horizontal menu.**
   Vertical menu will appear. Setup method is same as the setup of Step.

Load (Value)

Set the load for each step separately. Setting method is same as Value setting for normal mode. Refer to “Setting the Load” in Chapter 4 Normal Mode (Constant Load).

SlewRate (SlewRate)

Set the SlewRate for each step separately. Setting method is same as SlewRate setting for normal mode. Refer to “Setting the Load” in Chapter 4 Normal Mode (Constant Load).

Mode, Range

Setting the load mode (Mode)

CC Mode, CR Mode, CV Mode and CP Mode can be used. Setting method is same as Mode setting of Normal mode. Refer to “Setting the Load” in Chapter 4 Normal Mode (Constant Load).

Setting the Range (Range)

Setting method of voltage range and current range is same as Range setting of normal mode. Refer to “Setting the Load” in Chapter 4 Normal Mode (Constant Load).

Repeat operation (Repeat)

Repeat operation is set. Repeat On execute repeat operation, while Repeat Off execute single operation.
Repeat operation starts from Step 1, returns to Step 1 after execute the load up to the steps set and then repeats the execution.

1. **Select Repeat on the horizontal menu.**
   Vertical menu will appear.

2. **Select ON or OFF from the vertical menu.**
   ON is for repeat operation and OFF is for single operation.

Using current limit function (CLim.)

Setting method of current limit, refer to “Protection Current Value Setting” (p.115) and “Setting of OCP Load Off” (p.134) .

Execution

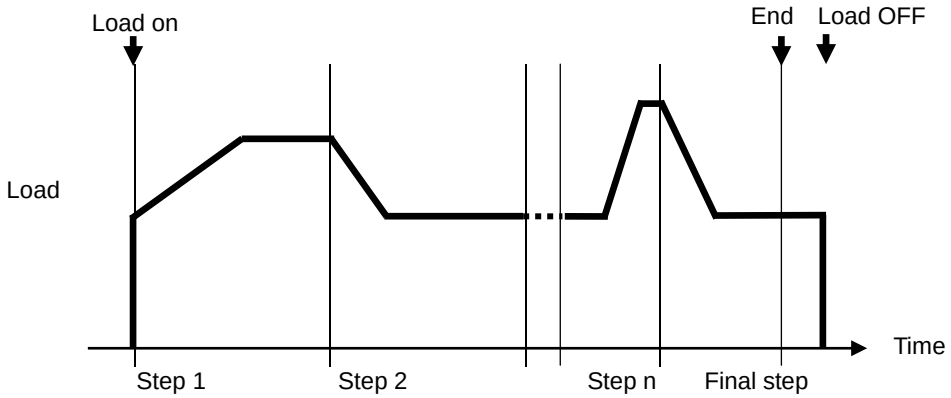
Execution

Load mode cannot be changed during operation.
Changing the load mode during operation will interrupt the operation and switch the device to LOAD OFF.

LOAD ON, OFF

Single operation

Selecting ON by pressing the ON/OFF key (key will light up) will start the single operation.
After all the steps are completed, load is still drawn at the setting value of the last step. Selecting OFF by pressing the ON/OFF key (key will light down) will stop the operation and turn the LOAD OFF.



Repeat operation

Selecting ON by pressing the ON/OFF key (key will light up) will start repeat operation. Switching the ON/OFF key to OFF during execution, operation ends and change to LOAD OFF. (key will light out)

When it does not work properly

Oscillation might have occurred

In CV mode, due to operating principles, load control may not stabilize because of test power supply and connector, resulting in oscillation. In such cases, load control can be stabilized by changing the response time.

Remote sense

Voltage detection circuit will activate when the load mode is CR mode, CV mode or CP mode. Therefore, when using SENSE terminal, it is necessary to correctly set the remote sense selection switch. For setting method, refer to “Wiring” in Chapter 2 Preparation for Installation and Use for correctly setting remote sense switch.

CAUTION Settings, measurement and overpower protection may not work correctly.

- Ensure to set remote sense selection switch to INT when SENSE terminal is not used.
- For using SENSE terminal, set remote sense selection switch to EXT..

Set current does not flow

Current limit might be set. Check the current limit set value (p.115).

Protection and Alarm occurs

When protection and alarm occurs, message will appear with beep sound, resulting in LOAD OFF. For details, refer to “Protection, Alarm Function” of Chapter 10.

Type of alarm	Operation
Overcurrent protection	When overcurrent is detected, the load turns off and interrupts the current. When the current limit function is set, load current is restricted to 110% of the limiter setting value with LOAD ON. Refer to “Protection Current Value Setting” (p.115) and “Setting of OCP Load Off” (p.134) .
Overpower protection	When the rated power is exceeded, the load turns off and interrupts the current. If LOAD ON is selected, load power is restricted to 110% of the rated power with LOAD ON. Refer to OPP Load Off Setting (p. 135) for the Setting.
Overheat protection	Temperature anomaly in load section will result in LOAD OFF and current cutoff.
Overvoltage alarm (*1)	If overvoltage detection value of each voltage range (p. 150) is exceeded, the load turns off and interrupts the current, and an alarm occurs.
Reverse connection alarm (*1)	If reverse connection to the load terminals is detected, an alarm occurs.

*1: Remove the root cause of alarm as the load section may breakdown.

Chapter 6 Sequence Operation

This chapter describes method of creating and controlling sequence using USB or GPIB.

Sequence Operation

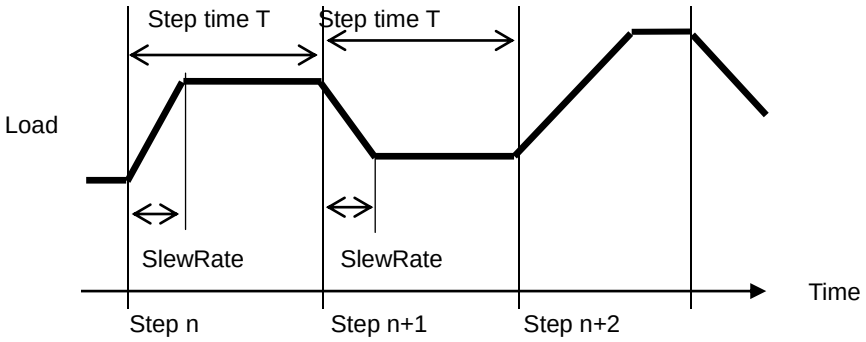
Sequence operation is a function where load is switched in a certain time interval. Maximum 1024 load settings can be switched in minimum 1 ms interval. As a result an arbitrary load pattern is realized. Start and end can be handled with remote control of GPIB, or USB.

Main functions of sequence operation

Set items	Content
Step time	1 ms - 10 min
Number of steps	1 - 1024
Repetitions	Finite (1 - 65535 repetitions) or infinite
Load mode	CC, CR, CV, CP
Control method	Remote control using GPIB or USB
Termination	Remote control using GPIB or USB, or pressing the CANCEL key on the front panel

* Step time is common to all the steps.

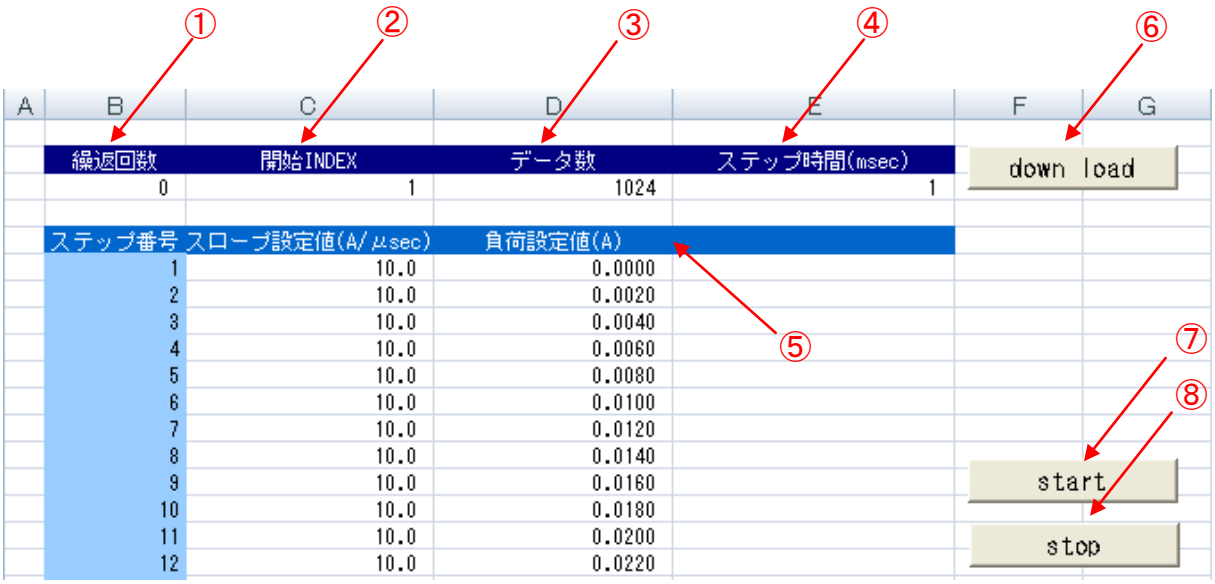
Wave form during sequence operation



Control software.xls

- The sequence operation is supported only by GPIB or USB.
- Remote control by USB is possible by the attached Excel Microsoft.
- Installation of disk driver to PC is necessary when using.
- Also refer to "[USB Driver and OCX Installation]" in Chapter 13 Remote Control and USB Interface.

Control software.xls



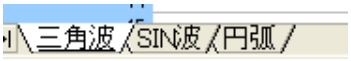
No.	Item	Operation
①	No. of repeat	For the period from starting INDEX to the number of data. It will continue the loop when set the number of repeat as 0.
②	Starting INDEX	Specify by the step number for the starting point. Range: 1 ～ 1023 (Start INDEX < No. of Data)
③	No. of data	Specify the STOP point of the sequence by step number. Range: 2 ～ 1024 (Starting INDEX < No. of data)
④	Step time	Hold time as specified at the step. (Width) Range: 1 ms～10 min
⑤	Step No.	Step. Range 1～1024
	Slew rate	Unit: A/μs. Ignored except CC mode and set at maximum value.
	Load	Load current. Unit: A Setting value of the present load mode. (Ex. Resistance value when in CR mode, Voltage value when in CV mode and power value when in CP mode.)
⑥	download	Transfer the data to this unit. No data stored. Down load as necessary.
⑦	start	Start sequence mode
⑧	stop	Stop sequence mode

Load setting

Sequence mode operation is heavily relying to the present load mode and current range. It cannot exceed the current value of the present current range. The current range cannot be set in sequence operation.

The load setting is understood as the setting for the present load mode. For example, when current value is set in CR mode, it will be considered as resistance value.

It cannot be used together with dynamic mode.



Sequence program of Triangular waveform, Sin waveform and Arc waveform are provided as standard accessories in the Excel sheet. They can be used freely and modified as necessary.

Setting command

The attached sequence control software.xls was created by VBA of Excel.

Function	Command	Operation and setting range		Remarks
Initialization command	SQI			All data is set to 0
Load data setting	SQD{SP}{NR1}{C}{NR2}{C}{NR2}	Argument 1 Argument 2 Argument 3	Data index number (1 - 1024) SlewRate Load set value	Sets various load data
Execution condition setting	SQU{SP}{NR1}{C}{NR1}{C}{NR1}{C}{NR2}	Argument 1 Argument 2 Argument 3 Argument 4	Repetitions 1 - 65535 (Infinite if 0) Starting data index number (1 - 1024) No. of data (1 - 1024) Step time [ms]	Sets execution conditions
Execution Start/Stop	SQC{SP}{NR1}	Range 0 - 1 0: Stop 1: Start		Controls Start /Stop

Executing the sequence

Front panel cannot be used when executing.

Measurement is taken in the same way as normal remote control.

Execute stop

Pressing the CANCEL key in the middle of executing stops Sequence Operation.

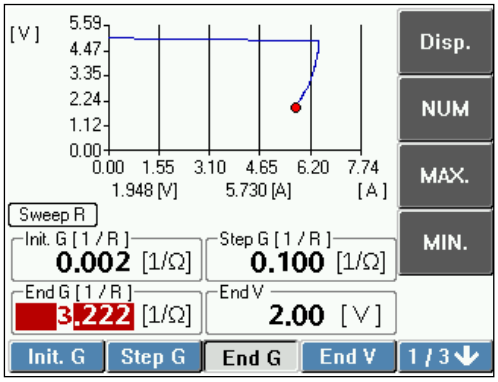
Chapter 7 Sweep Mode

This chapter describes Sweep R (V-I characteristics), Sweep C (overcurrent protection characteristics) and Sweep P (overpower protection characteristics).

Sweep Mode Overview

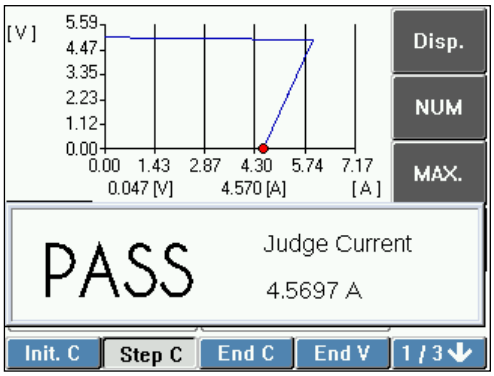
Sweep R, Sweep-C, Sweep-P

Sweep R (V-I characteristic test)



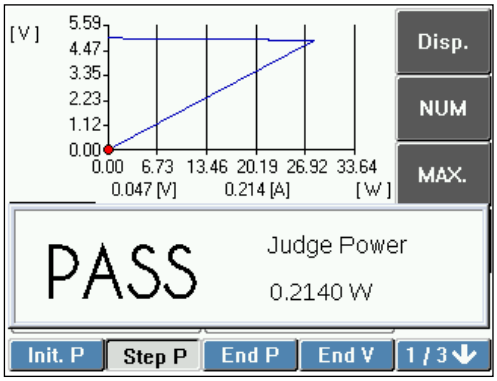
Current and voltage value are measured while changing the load in a step-wise manner in CR mode. It is used for constant current characteristic, current interruption characteristic and battery characteristic test of a test device. Resistance value can be finely changed between sweeps. Test can be conducted according to the characteristic of test device. Measurement values are shown as graph. Display of the graph can be enlarged and reduced for easy viewing.

Sweep-C (Overcurrent protection characteristic test)



Current and voltage value are measured while changing the load in a step-wise manner in CC mode. It is used for overcurrent protection characteristic test of a test device. Characteristic can be evaluated by setting upper and lower limits of current value. Measurement values are shown as graph. Display of graph can be enlarged and reduced for easy viewing.

Sweep-P (Overpower protection characteristic test)



Power and voltage value are measured while changing the load in a step-wise manner in CP mode. It is used for overpower protection characteristic test of a test device. Characteristic can be evaluated by setting upper and lower limits of power value. Measurement values are shown as graph. Display of graph can be enlarged and reduced for easy viewing.

Menu

Selecting the sweep menu

First of all, enter the menu screen. Next, enter the main screen.

1. **Press the MENU key.**
   Menu screen will appear.

2. **Select 1. Func. on the horizontal menu.**
   Vertical menu corresponding to 1.Func. will appear. Go to Step 3 when selecting 1. Func.

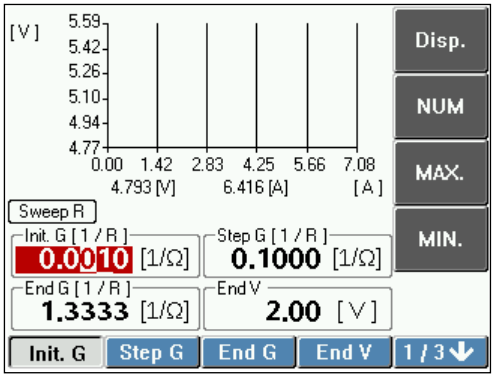
3. **Select the vertical menu.**
   Select Sweep R, Sweep C or Sweep P. For selecting Sweep C, Sweep P, select NEXT→ and go the next page of vertical menu.
   Sweep menu of the main screen will appear after operation is over.

Moving out of sweep setting screen

You can move out of the Sweep setting screen using the following 2 methods..

- Pressing the MENU key, displays the Menu screen.
- Pressing the MEMORY key, displays the Memory screen.

Sweep R (V-I Characteristic Test) Menu



Horizontal menu 1/3 page

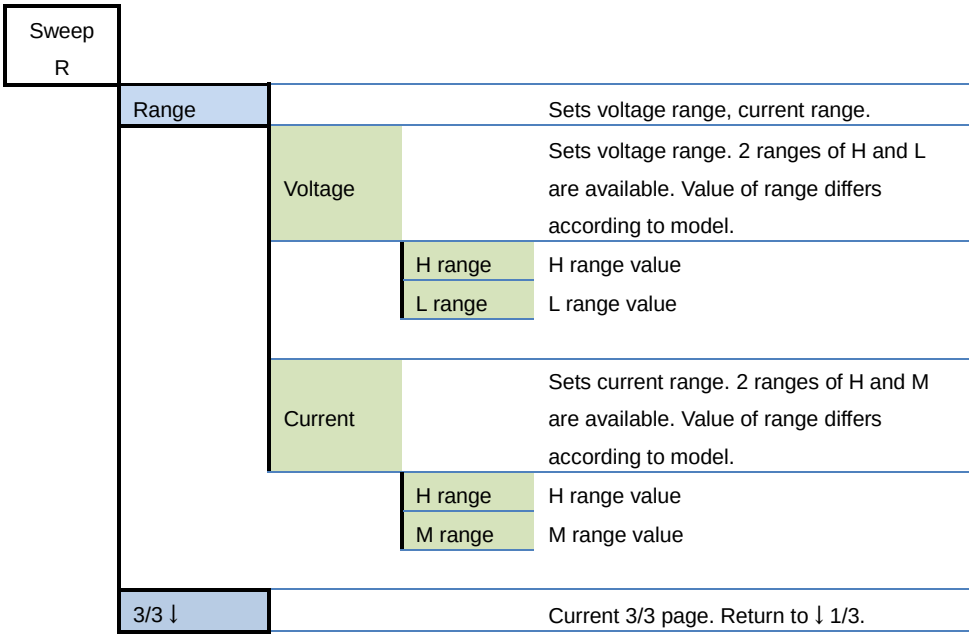
Sweep R			
Init. G			Initial conductance value
	Disp. [Cursor]		Graph enlarge, cursor display
	NUM		Set numeric value with keypad
	MAX.		Maximum
	MIN.		Minimum
Step G			Step conductance value
	Disp. [Cursor]		Graph enlarge, cursor display
	NUM		Set numeric value with keypad
	MAX.		Maximum
	MIN.		Minimum
End G			End conductance value
	Disp. [Cursor]		Graph enlarge, cursor display
	NUM		Set numeric value with keypad
	MAX.		Maximum
	MIN.		Minimum
End V			End voltage
	Disp. [Cursor]		Graph enlarge, cursor display
	NUM		Set numeric value with keypad
	MAX.		Maximum
	MIN.		Minimum

1/3 ↓		Current 1/3 page. Go to next ↓

Horizontal menu 2/3 page

Sweep R			
	Fine V		Fine sweep start voltage
		Disp. [Cursor]	Graph enlarge, cursor display
		NUM	Set numeric value with keypad
		MAX.	Maximum
		MIN.	Minimum
	FineStep		Fine sweep, step conductance value
		Disp. [Cursor]	Graph enlarge, cursor display
		NUM	Set numeric value with keypad
		MAX.	Maximum
		MIN.	Minimum
	Time		Step execution time
		Disp. [Cursor]	Graph enlarge, cursor display
		200 ms	Set by every 200 ms
		1000 ms.	Set by every 1000 ms
	Graph		Graph display setting
		Disp. [Cursor]	Graph enlarge, cursor display
		Data Clear	Delete graph data
		Auto X Axis	Optimizes X axis
		Auto Y Axis	Optimizes Y axis
	2/3 ↓		Current 2/3 page. Go to next ↓

Horizontal menu 3/3 page

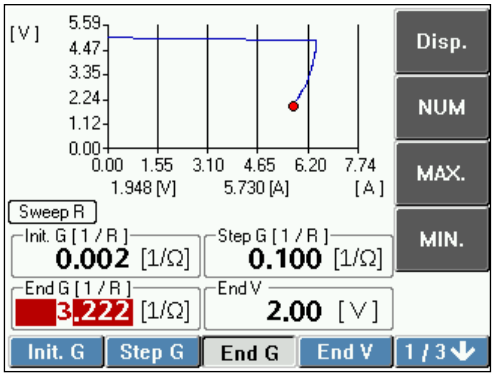


Settings of Sweep R

Sweep R operation

1. Turning the LOAD ON will change the state of the product to resistance load of initial conductance value, starting the sweep operation.
2. Step execution time is executed.
3. Voltage and current of load terminals are measured.
4. Load resistance is reduced by the amount of change in step conductance value.
5. Step execution time is executed. Similarly, each step is executed sequentially.
6. Sweep operation executed up to load resistance value of end conductance.
7. Fine sweep is started from fine sweep start voltage.
8. Load resistance is reduced by the amount of change in fine step, conductance value.
9. Sweep is executed until end voltage.
10. Sweep ends when voltage measurement at load terminals is less than end voltage (automatically LOAD OFF).

Sample graph of measured values



Set items of Sweep R

Before setting various parameters of load, check the following items. Since maximum step number of sweep mode is 1024, input step value below that.

Set Items		Content
Init. G	Initial conductance	Conductance at the start of sweep
Step G	Step conductance	Amount of change in conductance per step
End G	End conductance	Conductance at completion of step
End V	End voltage	Voltage for completing the step
Fine V	Fine Sweep start voltage	Fine sweep start voltage
FineStep	Fine Sweep, Conductance	Amount of change in conductance per step of fine sweep
Time	Step execution time	Execution time per step
Graph	Graph display	Setting graph display of screen
Range	Voltage range	H range, L range
	Current range	H range, M range

Setting load variation range

Initial conductance value (Init. G)

Set the conductance value at the start of sweep. In accordance with the characteristic of test device, set the conductance value such that minimum current value to be measured is achieved.

1. Select Init. G on the horizontal menu.
Vertical menu will appear.

2. Specify the digit to be set using left and right key.
The specified digit will appear in reverse contrasting color.

3. Set the value by rotating modify knob.
Stopping the modify knob will set the value as it is.
Value can be entered using keypad if NUM is selected on the vertical menu.
MAX will select the maximum value.
MIN will select the minimum value.

Setting range (conductance set, resistance displayed)

Model	Voltage range	Current range	
		M range	H range
LN-300A	L range 20 V	0.0005 S ~ 4.0000 S (2000.0 Ω ~ 0.2500 Ω)	0.005 S ~ 40.000 S (200.00 Ω ~ 0.0250 Ω)
	H range 120 V	0.00016 S ~ 1.3333 S (6000.0 Ω ~ 0.7500 Ω)	0.0016 S ~ 13.333 S (600.00 Ω ~ 0.0750 Ω)
LN-300C	L range 85 V	0.00004 S ~ 0.33333 S (25000 Ω ~ 3.0000 Ω)	0.0004 S ~ 3.3333 S (2500.0 Ω ~ 0.3000 Ω)
	H range 500 V	0.00001 S ~ 0.11111 S (70000 Ω ~ 9.0000 Ω)	0.0001 S ~ 1.1111 S (7000.0 Ω ~ 0.9000 Ω)
LN-1000A	L range 20 V	0.001 S ~ 12.000 S (666.67 Ω ~ 0.0833 Ω)	0.01 S ~ 120.00 S (66.667 Ω ~ 0.0083 Ω)
	H range 120 V	0.0005 S ~ 4.0000 S (2000.0 Ω ~ 0.2500 Ω)	0.005 S ~ 40.000 S (200.00 Ω ~ 0.0250 Ω)
LN-1000C	L range 85 V	0.0001 S ~ 1.0000 S (8333.3 Ω ~ 1.0000 Ω)	0.001 S ~ 10.000 S (833.33 Ω ~ 0.1000 Ω)
	H range 500 V	0.00004 S ~ 0.33330 S (23333 Ω ~ 3.0000 Ω)	0.0004 S ~ 3.3333 S (2333.3 Ω ~ 0.3000 Ω)

If an entered set value exceeds the upper or lower limit of the setting range the maximum or minimum conductance value in the range will be set.

Step conductance value (Step G)

Amount of change in conductance value per step is set. Set the measurement point in accordance with characteristic of test device. Setting method is same as that for initial conductance value. Starting from initial conductance value, conductance value increases in the unit of step conductance value.

End conductance value (End G)

Set the conductance value at the end of sweep. Conductance value to be set must be larger than initial conductance value. Setting method is same as that for initial conductance value.

End voltage (End V)

Set the voltage that ends the sweep. Upon detection of the set end voltage, operation will end. Setting method is same as CV mode setting for normal mode. Refer to “Setting the Load” in Chapter 4 Normal Mode (Constant Load).

Setting range

Model	Voltage range	
LN-300A LN-1000A	L range 20 V	0.000 V ~ 20.000 V
	H range 120 V	0.00 V ~ 120.00 V
LN-300C LN-1000C	L range 85 V	0.000 V ~ 85.000 V
	H range 500 V	0.00 V ~ 500.00 V

If an entered set value exceeds the upper or lower limit of the setting range the maximum or minimum conductance value in the range will be set.

Fine sweep

Fine sweep start voltage value (Fine V)

Set the voltage that starts the fine sweep. Set in accordance with characteristic of test device. Setting method is same as that for end voltage. If you do not want to start fine sweep, set 0 V.

Fine sweep, step conductance value (FineStep)

Set the amount of change in conductance per step of fine step. Setting method is same as that for initial conductance value. With the set value, step sweep is executed until end voltage.

Step execution time (Time)

Set the execution time per step. Setting range is of two types, 200 ms or 1000 ms.

1. **Select Time in the horizontal menu.**
   Vertical menu will appear.

2. **Select 200 ms or 1000 ms in the vertical menu.**
   Set value will appear in the set value display section of Time.

Graph display (Graph)

Values measured during operation are displayed in a graphical manner. X axis and Y axis can be optimized for easy viewing. Data specified with cursor on the graph can also be displayed.
Graph data can be deleted.

Enlarging the graph

1. **Select 1/3 page on the horizontal menu.**

2. **Select Disp. on the vertical menu.**
   Graph on the screen will be enlarged. Selecting Disp. again returns to the original display.

Setting the graph display

3. **Select Graph on 2/3 page of the horizontal menu.**

4. **Select the vertical menu and display so that it can be easily viewed.**

Graph display operations

Disp. [Cursor]	Graph enlarge, cursor display. Move the cursor by rotating the modify knob. Read voltage and current values.
Data Clear	Deletes graph data.
Auto X Axis	Optimizes of X axis
Auto Y Axis	Optimizes of Y axis

Range

Setting method of voltage range and current range is same as Range setting of normal mode. Refer to “Setting the Load” in Chapter 4 Normal Mode (Constant Load).

Executing Sweep R

Execution

LOAD ON, OFF

Turning ON (key will light up) by pressing the ON/OFF key will start the flow of load current. Upon detection of the set end voltage, operation will end even if all the steps are not completed (key will light off) and load current will get disconnected.

Operation stop with end voltage (End V)

Upon detection of the set end voltage, operation will stop. Status will automatically change to LOAD OFF.

When it does not work properly

Set current does not flow

Current limit might be set. Check the current limit set value (p.115).

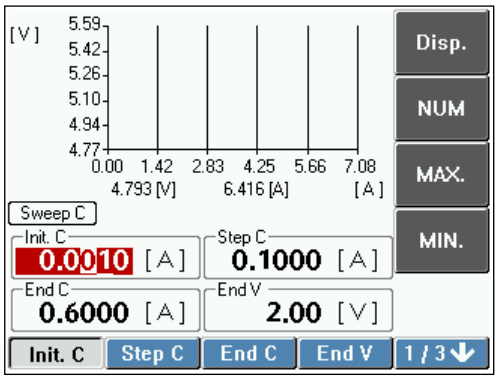
Protection and Alarm occur

When protection and alarm occurs, message will appear with beep sound, resulting in LOAD OFF. For details, refer to “Protection, Alarm Function” of Chapter 10.

Type of alarm	Operation
Overcurrent protection	When overcurrent is detected, the load turns off and interrupts the current. When the current limit function is set, load current is restricted to 110% of the limiter setting value with LOAD ON. Refer to “Protection Current Value Setting” (p.115) and “Setting of OCP Load Off” (p.134) .
Overpower protection	When the rated power is exceeded, the load turns off and interrupts the current. If LOAD ON is selected, load power is restricted to 110% of the rated power with LOAD ON. Refer to OPP Load Off Setting (p. 135) for the Setting.
Overheat protection	Temperature anomaly in load section will result in LOAD OFF and current cutoff.
Overvoltage alarm (*1)	If overvoltage detection value of each voltage range (p. 150) is exceeded, the load turns off and interrupts the current, and an alarm occurs.
Reverse connection alarm (*1)	If reverse connection to the load terminals is detected, an alarm occurs.

*1: Remove the root cause of alarm as the load section may break down.

Sweep C (Overcurrent Protection Characteristic Test) Menu



Horizontal menu 1/3 Page

Sweep C			
Init. C			Initial current value
	Disp. [Cursor]		Graph enlarge, cursor display
	NUM		Set numeric value with keypad
	MAX.		Maximum
	MIN.		Minimum
Step C			Step current value
	Disp. [Cursor]		Graph enlarge, cursor display
	NUM		Set numeric value with keypad
	MAX.		Maximum
	MIN.		Minimum
End C			End current value
	Disp. [Cursor]		Graph enlarge, cursor display
	NUM		Set numeric value with keypad
	MAX.		Maximum
	MIN.		Minimum
End V			End voltage value
	Disp. [Cursor]		Graph enlarge, cursor display
	NUM		Set numeric value with keypad
	MAX.		Maximum
	MIN.		Minimum

1/3 ↓		Current 1/3page. Go to next ↓

Horizontal menu 2/3 page

Sweep C			
	C High		Upper limit of current for decision
		Disp. [Cursor]	Graph enlarge, cursor display
		NUM	Set numeric value with keypad
		MAX.	Maximum
		MIN.	Minimum
	C Low		Lower limit of voltage for decision
		Disp. [Cursor]	Graph enlarge, cursor display
		NUM	Set numeric value with keypad
		MAX.	Maximum
		MIN.	Minimum
	Time		Step execution time
		Disp. [Cursor]	Graph enlarge, cursor display
		200 ms	Set by every 200 ms
		1000 ms	Set by every 1000 ms
	Graph		Graph display setting
		Disp. [Cursor]	Graph enlarge, cursor display
		Data Clear	Delete graph data
		Auto X Axis	Optimizes X axis
		Auto Y Axis	Optimizes Y axis
	2/3 ↓		Current 2/3 page. Go to next ↓

Horizontal menu 3/3 page

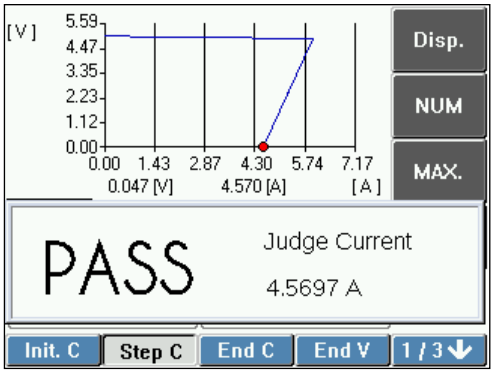
Sweep C			
	Range		Sets voltage range, current range.
		Voltage	Sets voltage range. 2 ranges of H and L are available. Value of range differs according to model.
			H range: H range value
			L range: L range value
		Current	Sets current range. 2 ranges of H and M are available. Value of range differs according to model.
			H range: H range value
			M range: M range value
			L range: L range value
	3/3 ↓		Current 3/3 page. Return to ↓ 1/3.

Settings of Sweep C

Sweep C Operation

1. With LOAD ON, current set as initial current value will flow and sweep execution will start.
2. Step execution time is executed.
3. Voltage and current of load terminals are measured.
4. Current is increased by current change amount of step current value.
5. Step execution time is executed. Similarly, each step is executed sequentially.
6. Sweep is executed until end current value.
7. PASS/FAIL decision with Decision Upper Limit Current Value and Decision Lower Limit Current Value.
8. Sweep ends when voltage measurement at load terminals is less than end voltage (automatically LOAD OFF).
9. PASS/FAIL decision is displayed.

Sample graph of measured values



Set items of Sweep C

Before setting various parameters of load, check the following items. Since maximum step number of sweep mode is 1024, input step value below that.

Set Items		Content
Init. C	Initial current value	Current value at the start of sweep
Step C	Step current value	Change in current value per step
End C	End current value	Current value at completion of sweep
End V	End voltage value	Voltage value for completing the sweep
C High	PASS/FAIL decision upper limit	Upper limit of current for decision
C Low	PASS/FAIL decision lower limit	Lower limit of current for decision
Time	Step execution time	Execution time per step
Graph	Graph display	Setting graph display of screen
Range	Voltage range	H range, L range
	Current range	H range, M range

Setting variable range of load

Initial current value (Init. C)

Set the load current value at the start of sweep. In accordance with the characteristic of test device, set the minimum current value to be measured.

1. Select Init. C on the horizontal menu.
Vertical menu will appear.

2. Specify the digit to be set using left and right key.
The specified digit will appear in reverse contrasting color.

3. Set the value by rotating modify knob.
Stopping the modify knob will set the value as it is.
Value can be entered using keypad if NUM is selected on the vertical menu.
MAX will select the maximum value. MIN will select the minimum value.

Setting range

Model	Current range		
	L range	M range	H range
LN-300A	0.0000 A ~ 0.6000 A	0.0000 A ~ 6.0000 A	0.000 A ~ 60.000 A
LN-300C	0.00000 A ~ 0.12000 A	0.0000 A ~ 1.2000 A	0.000 A ~ 12.000 A
LN-1000A	0.0000 A ~ 1.8000 A	0.000 A ~ 18.000 A	0.00 A ~ 180.00 A
LN-1000C	0.00000 A ~ 0.36000 A	0.0000 A ~ 3.6000 A	0.000 A ~ 36.000 A

Step current value (Step C)

Amount of change in current value per step is set. Set the measurement point in accordance with characteristic of test device. Setting method is same as that for initial current value.
Starting from initial current value, load current value increases in the unit of step current value.

End current value (End C)

Set the load current value at the end of sweep. Current value to be set must be larger than initial current value. Setting method is same as that for initial current value.

End voltage (End V)

Set the voltage that ends the sweep. Upon detection of the set end voltage, operation will end. Setting method is same as CV mode setting for normal mode. Refer to “Setting the Load” in Chapter 4 Normal Mode (Constant Load).

Setting range

Mode;	Voltage range	
LN-300A LN-1000A	L range 20 V	0.000 V ~ 20.000 V
	H range 120 V	0.00 V ~ 120.00 V
LN-300C LN-1000C	L range 85 V	0.000 V ~ 85.000 V
	H range 500 V	0.00 V ~ 500.00 V

Setting PASS/FAIL decision conditions

Upper value of current and lower value of current is set. If the value is within the range, PASS is displayed and if the value exceeds the range, FAIL is displayed.

Current upper limit (C High)

It can be set between the range of initial current value and end current value. It should be large value than current lower limit value (C Low).

Current lower limit (C Low)

It can be set between the range of initial current value and end current value. It should be small value than current upper limit value (C High).

Step execution time (Time)

Set the execution time per step. Setting range is of two types, 200 ms or 1000 ms.

1. **Select Time in the horizontal menu.**
   Vertical menu will appear.

2. **Select 200 ms or 1000 ms in the vertical menu.**
   Set value will appear in the set value display section of Time.

Graph display (Graph) operation

Values measured during operation are displayed in a graphical manner. You can set the graph display screen viewing.

Data specified with cursor on the graph can also be displayed.

Graph data can be deleted. Setting method is same as sweep R. Refer to “Graph display (Graph)” in Sweep R.

Range

Setting method of voltage range and current range is same as Range setting of normal mode. Refer to “Setting the Load” in Chapter 4 Normal Mode (Constant Load).

Executing Sweep C

Execution

LOAD ON, OFF

Turning ON (key will light up) by pressing the ON/OFF key will start the flow of load current. Upon detection of the set end voltage, operation will end even if all the steps are not completed (key will light off) and load current will get disconnected.

Operation stop with end voltage (End V)

Upon detection of the set end voltage, operation will stop. Status will automatically change to LOAD OFF.

PASS/FAIL decision

Upper value (C High) of current and lower value (C Low) of current is set. If the value is within the range, PASS is displayed and if the value exceeds the range, FAIL is displayed.
End voltage (End V) operation will continue until detection.

When it does not work properly

Set current does not flow

Current limit might be set. Check the current limit set value (p.115)

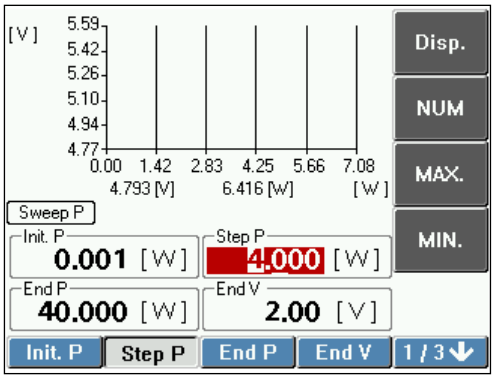
Protection and Alarm occurs

When protection and alarm occurs, message will appear with beep sound, resulting in LOAD OFF. For details, refer to “Protection, Alarm Function” of Chapter 10.

Type of alarm	Operation
Overcurrent protection	When overcurrent is detected, the load turns off and interrupts the current. When the current limit function is set, load current is restricted to 110% of the limiter setting value with LOAD ON. Refer to “Protection Current Value Setting” (p.115) and “Setting of OCP Load Off” (p.134) .
Overpower protection	When the rated power is exceeded, the load turns off and interrupts the current. If LOAD ON is selected, load power is restricted to 110% of the rated power with LOAD ON. Refer to OPP Load Off Setting (p. 135) for the Setting.
Overheat protection	Temperature anomaly in load section will result in LOAD OFF and current cutoff.
Overvoltage alarm (*1)	If overvoltage detection value of each voltage range (p. 150) is exceeded, the load turns off and interrupts the current, and an alarm occurs.
Reverse connection alarm (*1)	If reverse connection to the load terminals is detected, an alarm occurs.

*1: Remove the root cause of alarm as the load section may breakdown.

Sweep P (Overpower Protection Characteristic Test) Menu



Horizontal menu 1/3 page

Sweep P			
Init. P			Initial power value
	Disp. [Cursor]		Graph enlarge, cursor display
	NUM		Set numeric value with keypad
	MAX.		Maximum
	MIN.		Minimum
Step P			Step power value
	Disp. [Cursor]		Graph enlarge, cursor display
	NUM		Set numeric value with keypad
	MAX.		Maximum
	MIN.		Minimum
End P			End power value
	Disp. [Cursor]		Graph enlarge, cursor display
	NUM		Set numeric value with keypad
	MAX.		Maximum
	MIN.		Minimum
End V			End voltage value
	Disp. [Cursor]		Graph enlarge, cursor display
	NUM		Set numeric value with keypad
	MAX.		Maximum
	MIN.		Minimum

1/3 ↓		Current 1/3 page. Go to next ↓

Horizontal menu 2/3 page

Sweep P			
P High			Upper limit of power value for decision
	Disp. [Cursor]		Graph enlarge, cursor display
	NUM		Set numeric value with keypad
	MAX.		Maximum
	MIN.		Minimum
P Low			Upper lower of power value for decision
	Disp. [Cursor]		Graph enlarge, cursor display
	NUM		Set numeric value with keypad
	MAX.		Maximum
	MIN.		Minimum
Time			Step execution time
	Disp. [Cursor]		Graph enlarge, cursor display
	200 ms		Set by every 200 ms
	1000 ms		Set by every 1000 ms
Graph			Graph display setting
	Disp. [Cursor]		Graph enlarge, cursor display
	Data Clear		Deletes graph data
	Auto X Axis		Optimizes X axis
	Auto Y Axis		Optimizes Y axis
2/3 ↓			Current 3/2 page. Go to next ↓

Horizontal menu 3/3 page

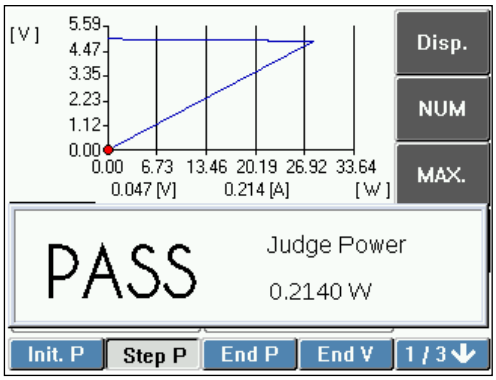
Sweep P			
	Range		Sets voltage range, current range.
		Voltage	Sets voltage range. 2 ranges of H and L are available. Value of range differs according to model.
			H range: H range value
			L range: L range value
		Current	Sets current range. 2 ranges of H and M are available. Value of range differs according to model.
			H range: H range value
			M range: M range value
	3/3 ↓		Current 3/3 page. Return to ↓ 1/3.

Settings of Sweep P

Sweep P operation

1. With LOAD ON, current set as initial current value will flow and sweep run will start.
2. Step execution time is executed.
3. Voltage and current of load terminals are measured.
4. Power is increased by power change amount of step power.
5. Step execution time is executed. Similarly, each step is executed sequentially.
6. Sweep is executed until end power value.
7. PASS/FAIL decision with Decision Upper Limit Power Value and Decision Lower Limit Power Value.
8. Sweep ends when voltage measurement at load terminals is less than end voltage (automatically LOAD OFF).
9. PASS/FAIL decision is displayed.

Sample graph of measured values



Set items of Sweep P

Before setting various parameters of load, check the following items. Since maximum step number of sweep mode is 1024, input step value below that.

Set Items		Content
Init. P	Initial power value	Power value at the start of sweep
Step P	Step power value	Amount of change in power value per step
End P	End power value	Power value at completion of sweep
End V	End voltage value	Voltage value for completing the sweep
P High	PASS/FAIL decision upper limit	Upper limit of power value for decision
P Low	PASS/FAIL decision lower limit	Lower limit of power value for decision
Time	Step execution time	Execution time per step
Graph	Graph display	Setting graph display of screen
Range	Voltage range	H range, L range
	Current range	H range, M range

Setting variable range of load

Initial power value (Init. P)

Set the load power value at the start of sweep. In accordance with the characteristic of test device, set the minimum power value to be measured.

1. **Select Init. P on the horizontal menu.**
   Vertical menu will appear.

2. **Specify the digit to be set using left and right key.**
   The specified digit will appear in reverse contrasting color.

3. **Set the value by rotating modify knob.**
   Stopping the modify knob will set the value as it is.
   Value can be entered using keypad if NUM is selected on the vertical menu.
   MAX will select the maximum value. MIN will select the minimum value.

Setting range

Model	Current range	
	M range	H range
LN-300A	0.000 W ~ 40.000 W	0.00 W ~ 300.00 W
LN-300C		
LN-1000A	0.00 W ~ 120.00 W	0.0 W ~ 1000.0 W
LN-1000C		

Step power value (Step P)

Amount of change in power value per step is set. Set the measurement point in accordance with characteristic of test device. Setting method is same as that for initial power value.
Starting from initial power value, load current value increases in the unit of step power value.

End power value (End P)

Set the load power value at the end of sweep. Power value to be set must be larger than initial power value. Setting method is same as that for initial power value.

End Voltage (End V)

Set the voltage that ends the sweep. Upon detection of the set end voltage, operation will end. Setting method is same as CV mode setting for normal mode. Refer to “Setting the Load” in Chapter 4 Normal Mode (Constant Load).

Setting range

Model	Voltage range	
LN-300A LN-1000A	L range 20 V	0.000 V ~ 20.000 V
	H range 120 V	0.00 V ~ 120.00 V
LN-300C LN-1000C	L range 85 V	0.000 V ~ 85.000 V
	H range 500 V	0.00 V ~ 500.00 V

Setting PASS/FAIL decision conditions

Upper value of power and lower value of current is set. If the value is within the range, PASS is displayed and if the value exceeds the range, FAIL is displayed.

Power upper limit (P High)

It can be set between the range of initial power value and end power value. It should be larger value than power lower limit value (P Low).

Power lower limit (P Low)

It can be set between the range of initial power value and end power value. It should be smaller value than power upper limit value (P High).

Step execution time (Time)

Set the execution time per step. Setting range is of two types, 200 ms or 1000 ms.

1. **Select Time in the horizontal menu.**
   Vertical menu will appear.

2. **Select 200 ms or 1000 ms in the vertical menu.**
   Set value will appear in the set value display section of Time.

Graph display (Graph) operation

Values measured during operation are displayed in a graphical manner. Graph on the screen can be set such that it is easily viewable.
Data specified with cursor on the graph can also be displayed.
Graph data can be deleted. Setting method is same as sweep. Refer to “Graph display (Graph)” of Sweep R.

Range

Setting method of voltage range and current range is same as Range setting of normal mode. Refer to “Setting the Load” in Chapter 4 Normal Mode (Constant Load).

Executing Sweep P

Execution

LOAD ON, OFF

Turning ON (key will light up) by pressing the ON/OFF key will start the flow of load current. Upon detection of the set end voltage, operation will end even if all the steps are not completed (key will light off) and load current will get disconnected.

Operation stop with end voltage (End V)

Upon detection of the set end voltage, operation will stop. Status will automatically change to LOAD OFF.

PASS/FAIL decision

Upper limit value (P High) of power and lower limit value(C Low) of power is set. If the value is within the range, PASS is displayed and if the value exceeds the range, FAIL is displayed.
End voltage (End V) operation will continue until detection.

When it does not work properly

Set current does not flow

Current limit might be set. Check the current limit set value (p.115).

Protection and Alarm occur

When protection and alarm occurs, message will appear with beep sound, resulting in LOAD OFF. For details, refer to “Protection, Alarm Function” of Chapter 10.

Type of alarm	Operation
Overcurrent protection	When overcurrent is detected, the load turns off and interrupts the current. When the current limit function is set, load current is restricted to 110% of the limiter setting value with LOAD ON. Refer to “Protection Current Value Setting” (p.115) and “Setting of OCP Load Off” (p.134) .
Overpower protection	When the rated power is exceeded, the load turns off and interrupts the current. If LOAD ON is selected, load power is restricted to 110% of the rated power with LOAD ON. Refer to OPP Load Off Setting (p. 135) for the Setting.
Overheat protection	Temperature anomaly in load section will result in LOAD OFF and current cutoff.
Overvoltage alarm (*1)	If overvoltage detection value of each voltage range (p. 150) is exceeded, the load turns off and interrupts the current, and an alarm occurs.
Reverse connection alarm (*1)	If reverse connection to the load terminals is detected, an alarm occurs.

*1: Remove the root cause of alarm as the load section may breakdown.

NOTE When constant power mode is operating, overcurrent protection may activate.

- During constant power mode, drop in load terminal voltage will increase the current pulled in. Overcurrent protection will activate once the load current reaches the set protection current value of the product.

Chapter 8 Menu, System

This chapter describes menu screen and system screen.

Overview

Overview

You can set basic item using menu screen and system screen of the product. Parameters set on the menu screen are commonly used for each operation mode. Parameters set on the system screen are commonly used by each function of the product.

Menu configuration of the Menu screen

Menu of the Menu screen comprises of the following.

Horizontal menu	
1.Func.	Operation mode setting
2.CLim.	Current limit set value
3.Meas.	Measurement value display setting
4.MRate	Measurement sample frequency setting
5.M/S	Master device, slave device setting
6.VMode	Automatic load mode switching setting
7.VLev.	VMode specified voltage set value

Menu configuration of the System screen

Menu of the System screen comprises of the following.

Horizontal Menu	Setting content	Setting Range
1.GPIB	Sets GPIB address	1 ~ 30
2.DIDO	Enables external control	Enable, Disable
3.Range	Enables external control of voltage and current range	Enable, Disable
4. PwrOn	Saves the setting for next startup session	User Defined (Settings for next startup session will be set to present status)
5.LCD	Sets brightness of LCD backlight	1 ~ 8
6.Color	Sets color of screen	Normal (Fixed)
7.Lang.	Selects the screen language	English (Fixed)
8.Firm.	Checks the firmware version	–
9.OCP	LOAD OFF when overcurrent limit	Enable (Load OFF), Disable (current limit function)
10.OPP	LOAD OFF when overpower limit	Enable (Load OFF), Disable (power limit function)
11.I/F	Selection of external interface	USB and GPIB (Fixed)
12.Reset	Settings to factory default values	Factory Default (resets to factory default values)

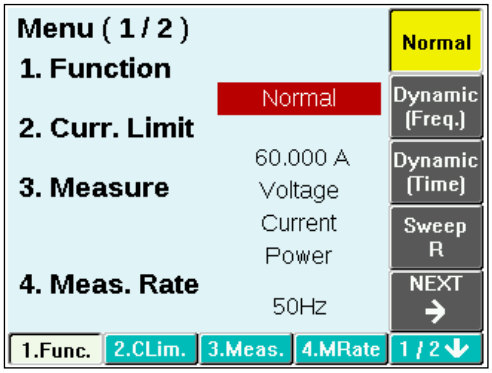
Menu Screen

Entering the menu screen

Press the MENU key and enter the menu of MENU screen.

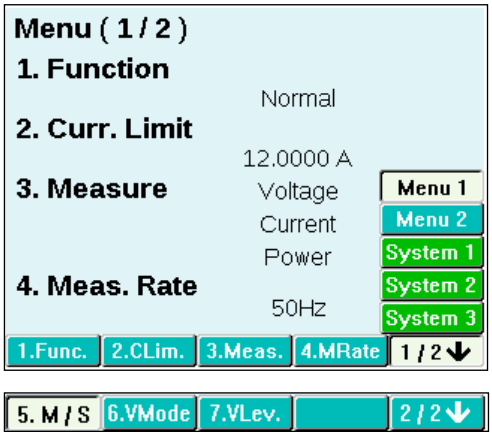
1. Press the MENU key.

Menu screen shown in the following figure appears. Horizontal menu has 2 pages. (1/2, 2/2).



2. For selecting the 2nd page, select 1/2 on the horizontal menu.

Menu selection window will appear.



3. For selecting the 2nd page, press 1/2 on the horizontal menu once again.

MENU2 will appear.

Moving out of the menu screen

You can move out of the menu screen using the following method.

- Pressing the MENU key or the CANCEL key returns the display to the Main screen.

Menu of the menu screen

Horizontal menu 1/2 page

Menu				
1.Func.				Operation mode setting (go to main screen)
	1/2 page			
	Normal			Normal mode
	Dynamic (Freq.)			Dynamic Mode (Sequentially switching two types of load after setting Period and Duty1)
	Dynamic (Time)			Dynamic Mode (Up to 16 types of load are changed sequentially)
	Sweep R			V-I Characteristic test
	NEXT→			Go to 2/2 page
	2/2 page			
	Sweep C			Overcurrent protective characteristic test
	Sweep P			Overpower protective characteristic test
	NEXT→			Go to 1/2 page
2.CLim.				Current limit setting
	NUM			Set numeric value with keypad
	MAX.			Maximum
	MIN.			Minimum
3.Meas.				Measured value display setting
	Top			Display position（Top）
	Middle			Display position（Middle）
	Bottom			Display position（Bottom）
		1/2 page		
		Voltage		Voltage value
		Current		Current value
		Power		Power value
		M / S Current		Current value (total current during parallel operation) Displayed during booster connection
		NEXT→		Go to 2/2 page
		2/2 page		
		M / S Power		Power value (total power during parallel operation) Displayed during booster connection
		NEXT→		Go to 1/2 page
4.MRate				Measurement sample frequency setting
	50 Hz			Commercial frequency 50 Hz
	60 Hz			Commercial frequency 60 Hz

1/2 ↓		Current 1/2 page. Go to MENU2 ↓

Horizontal menu 2/2 page

Menu			
	5.M/S		Master device, slave device setting
		OFF	Standalone operation or slave device
		Master	Master device for parallel operation
		Multi	Master device of multichannel synchronized operation
		List	Display the list of loads connected as Master/Slave
	6.VMode		Setting of auto load mode switching function (VMode)
		1/3 page	
		OFF	VMode function not used.
		Load Off (H)	Load Off when “Voltage Rising”
		Load Off (L)	Load Off when “Voltage Declining”
		CR (H)	Change to CR Mode when “Voltage Rising”
		NEXT→	Go to 3/2 page
		2/3 page	
		CR (L)	Change to CR Mode when “Voltage Declining”
		CV(H)	Change to CV Mode when “Voltage Rising”
		CV (L)	Change to CV Mode when “Voltage Declining”
		CP (H)	Change to CR Mode when “Voltage Rising”
		NEXT→	Go to 3/3 page
		3/3 page	
		CP (L)	Change to CP Mode when “Voltage Declining”
		NEXT→	Go to 1/3 page
	7.VLev.		Sets specified voltage of VMode function
		NUM	Set numeric value with keypad
		MAX.	Maximum
		MIN.	Minimum
	2/2 ↓		Current 2/2 page. Go to SYSTEM1 ↓

“Voltage Rising”: When measured voltage is above specified voltage

“Voltage Declining”: When measured voltage is below specified voltage

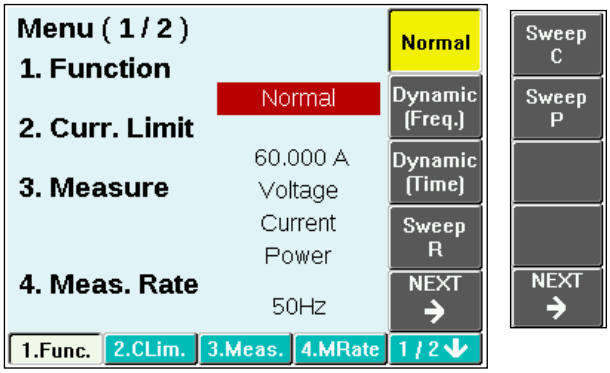
Operation Mode Setting

Setting operation mode (1.Func.)

Sets the Operation Mode of the Main screen.

1. Select 1. Func. on the horizontal menu.

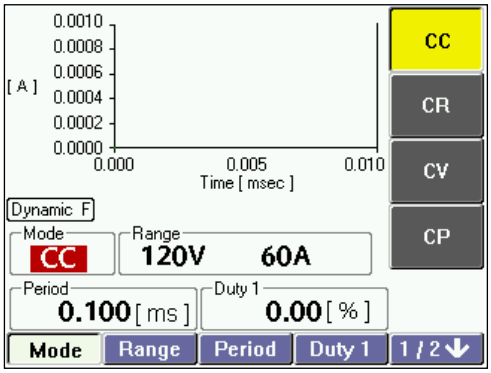
Vertical menu of 1. Func. will appear.



2. Select the item to be set in the vertical menu.

Select normal mode, dynamic mode or sweep. After selection, main screen of the selected operation mode will appear.

Example. When Dynamic (Freq.) is selected.



Items on vertical menu

Constant Load: Normal
Variable Mode: Dynamic (Freq.), Dynamic (Time)
Sweep: Sweep R, Sweep C or Sweep P

Refer to Chapter 4 Normal Mode (Constant Load), Chapter 5 Dynamic Mode (Fluctuation Load) or Chapter 7 Sweep for Operation Mode settings.

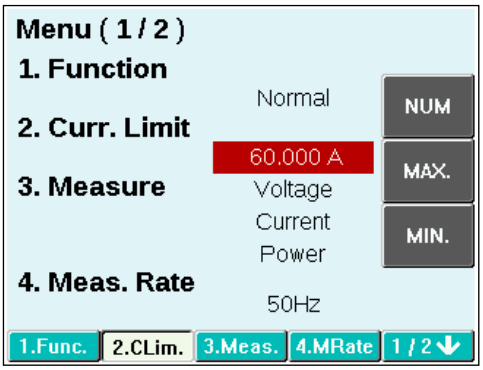
Protection Current Value Setting

Sets the current value of the overcurrent protection function. Load current is limited within the protection current value that is 110% of the setting value.

Setting the current limit value (2.CLim.)

1. Select 2.CLim. on the horizontal menu.

Vertical menu of 2.CLim. will appear.



2. Select the item to be set in the vertical menu.

Selecting NUM displays the keypad. Enter a value using the keypad.
MAX will select the maximum value. MIN will select the minimum value.

Setting range

Model	Current range		
	L range	M range	H range
LN-300A	0.000 A ~ 60.000 A	0.00 A ~ 60.00 A	0.0 A ~ 60.0 A
LN-300C	0.000 A ~ 12.000 A	0.00 A ~ 12.00 A	0.0 A ~ 12.0 A
LN-1000A	0.000 A ~ 180.000 A	0.00 A ~ 180.00 A	0.0 A ~ 180.0 A
LN-1000C	0.000 A ~ 36.000 A	0.00 A ~ 36.00 A	0.0 A ~ 36.0 A

Factory default setting is the maximum value of H range. Operating current value is 110% of set value.

NOTE Setting conditions of the current limit set value.

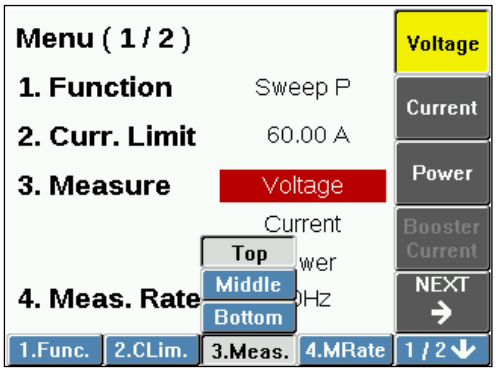
- When the current limit value is set below 15% of current range, accuracy of protection current value will deteriorate.
- Current limit set value can be set irrespective of load value.
- In CV mode, current transiently higher than the protection limit value may flow.
- Do not set such load that will flow current over 100 times of current limit setting value.

Measurement Value Display Setting

Setting measurement items, display position (3.Meas.)

Set the measurement value display of the Main screen. Measurement items to be displayed at top, middle and bottom are specified.

Example: In case of no booster connection and no RC-02A ripple noise measurement option



1. Select 3.Meas. on the horizontal menu.
Vertical menu will appear. Select either Top, Middle or Bottom from the pop-up menu for the horizontal menu.

2. Press 3.Meas. on the horizontal menu to select the display position.
Select Top, Middle or Bottom. Selected items will appear in reverse contrasting color.

3. Select the item to be displayed from the vertical menu.
Display item is set.

Return to the Main screen and check the display.

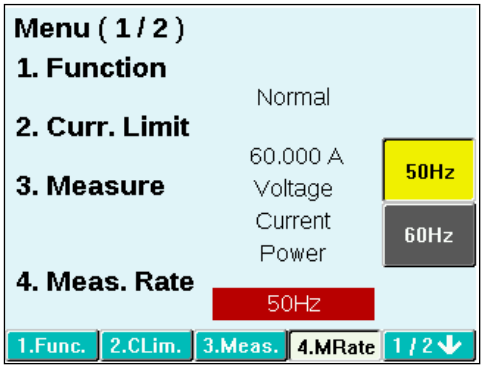
4. Press the MENU key.
Check the measurement display item on the Main screen used (Operation mode settings).

Measurement Frequency Setting

Setting measurement period (4.MRate)

Sets the measurement period. Because of hum cancelling, align the sample frequency of A/D converter for measurement with power supply frequency.

1. **Select. 4.MRate on the horizontal menu.**
   Vertical menu will appear.



2. **Select 50 Hz or 60 Hz.**
   Usually align with the power supply frequency used.

Specifying Master Device and Slave Device

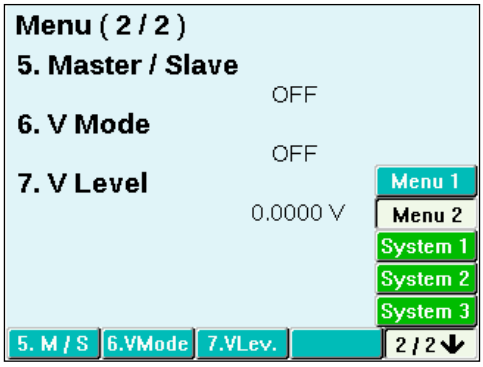
Setting master device and slave device (5.M/S)

Used in case of parallel operation and multichannel synchronized operation.

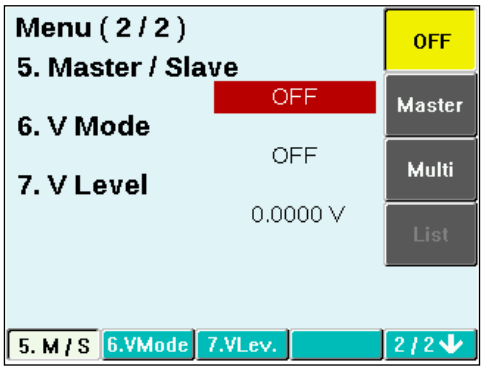
Specifying slave device

1. Press the MENU key of the product to be set as slave device.
Menu screen will appear.

2. Press the right most button on the horizontal menu and select Menu 2.
Vertical menu of Menu 2 will appear.



3. Select 5.M/S of the horizontal menu.
Vertical menu of 5.M/S will appear.

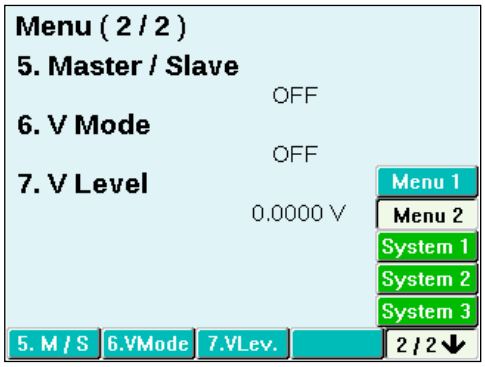


4. Select OFF on the vertical menu.
Screen will change to the screen of standalone operation.
Similarly, set the screens of all slave devices to standalone operation screen.

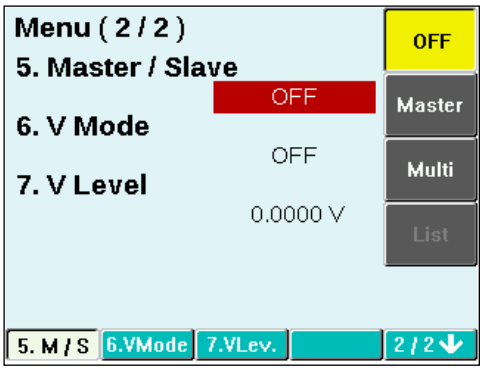
Specifying master device

1. Press the MENU key of the product to be set as master device.
Menu screen will appear.

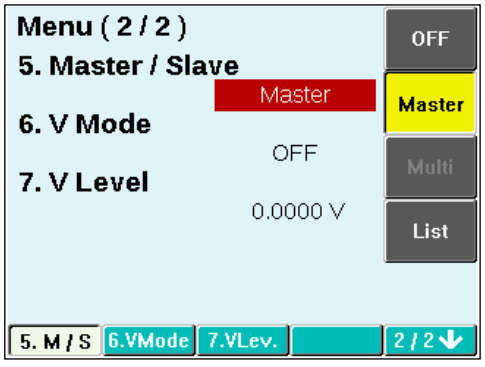
2. Press the right most button on the horizontal menu and select Menu 2.
Vertical menu of Menu 2 will appear.



3. Select 5.M/S of the horizontal menu.
Vertical menu of 5.M/S will appear.



4. Select Master on the vertical menu.
Select Multi in case of multichannel synchronized operation.
After selecting, it will be set to master device.



Automatic Load Mode Switching

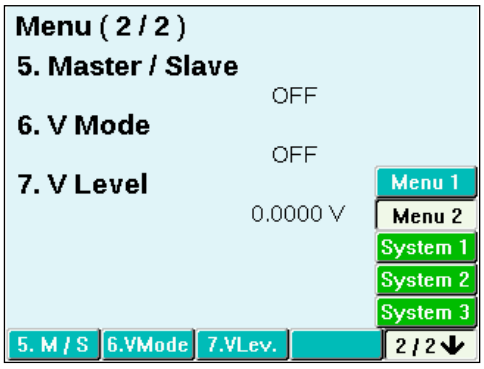
Using automatic load mode switching(VMode function)(6.VMode)

This function automatically changes the load mode for “Voltage Rising” or “Voltage Declining” during operation. You can set LOAD OFF even without changing the load mode. Switching time is maximum 700 ms (by setting measurement conditions).

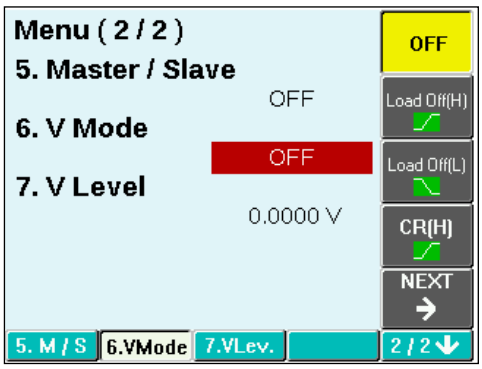
It can be used as low voltage limiter, low voltage protection or overvoltage protection function. For example, in low voltage protection function, batteries can be protected by ensuring that voltage does not fall below the specified voltage during discharge test of batteries.

- You cannot switch to CC mode from any other mode except CC mode, as it will result in inconsistency of range.
- EXT Mode and SHORT Mode cannot be used for load mode.
- This is valid only for Normal (constant load) operation mode.

1. Press the right most button on the horizontal menu and select Menu 2.



2. Select 6.VMode of the horizontal menu.
Vertical menu will appear.



3. Select operation mode from the vertical menu.

Operation Mode	Operation
OFF	Turns off the function
Load Off (H)	Load Off during “Voltage Rising”
Load Off (L)	Load Off during “Voltage Declining”
CR(H)	Change to CR Mode when “Voltage Rising”
CR(L)	Change to CR Mode when “Voltage Declining”
CV(H)	Change to CV Mode when “Voltage Rising”
CV(L)	Change to CV Mode when “Voltage Declining”
CP(H)	Change to CP Mode when “Voltage Rising”
CP(L)	Change to CP Mode when “Voltage Declining”

(H) : “Voltage Rising”: When measured voltage is above specified voltage

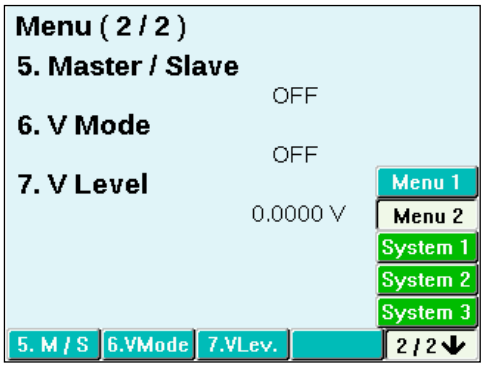
(L) : “Voltage Declining”: When measured voltage is below specified voltage

VMode Voltage Setting

Setting VMode voltage (7.VLev.)

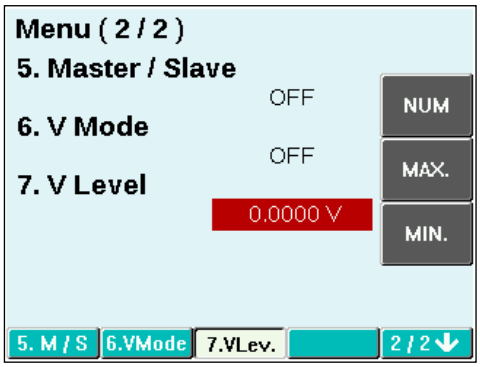
VMode voltage is a specified voltage that becomes the threshold of the load mode switching.

1. Press the right most button on the horizontal menu and select Menu 2.



2. Select 7.VLev.of the horizontal menu.

Vertical menu will appear.



3. Select the item to be set in the vertical menu.

Selecting NUM displays the keypad. Enter a value using the keypad.
MAX will select the maximum value. MIN will select the minimum value.
A value can also be entered with the modify knob without selecting NUM.

Setting range

Model	Voltage value
LN-300A	0.0000 V ~ 120.000 V
LN-1000A	
LN-300C	0.0000 V ~ 500.000 V
LN-1000C	

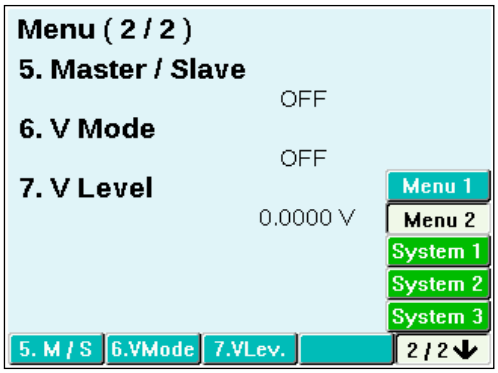
System Screen

Entering System screen

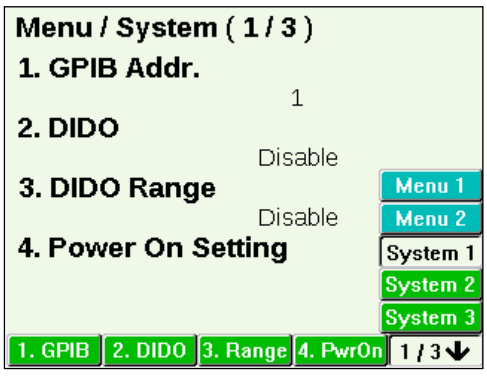
Press the MENU key and enter the menu of Menu screen. Go to Step 2 if you are already in the Menu screen.

1. **Press the MENU key.**
   Menu screen will appear.

2. **Select 2/2 on the horizontal menu.**
   Window for selecting the menu will appear. Menu has two pages.



3. **Once again select 2/2 on the horizontal menu.**



Moving out of the system screen

You can move out of the system screen using the following method.

- Pressing the CANCEL key or the MENU key returns the display to the Menu screen.

Menu of System screen

Horizontal menu 1/3 page

Menu/System(1/3)		
1.GPIB		GPIB address setting
	MAX.	Maximum value 30
	MIN.	Minimum vale1
2.DIDO		External control
	Enable	Enables
	Disable	Disables
3.Range		External control of voltage, current range
	Enable	Enables
	Disable	Disables
4. PwrOn		Settings to factory default settings
	User Defined	Settings for the next startup session are set to the present state
1/3 ↓		Current 1/3 page. Go to SYSTEM2 ↓

Horizontal menu 2/3 page

Menu/System(2/3)		
5.LCD		Sets the brightness of LCD backlight 1-8
	MAX.	8
	MIN.	1
6.Color		Sets color of the screen
	Normal	Normal (fixed)
7.Lang.		Selects the language
	English	English (fixed)
8.Firm.		Check the firmware version
2/3 ↓		Current 2/3 page. Go to SYSTEM3 ↓

Horizontal menu 3/3 page

Menu/System(3/3)			
	9.OCP		LOAD OFF during overcurrent protection
		Enable	Enables
		Disable	Disables
	10.OPP		LOAD OFF during overpower protection
		Enable	Enables
		Disable	Disables
	11.I/F		Selects external interface
		USB / GPIB	Enables USB and GPIB (fixed)
	12.Reset		Resets the settings to factory default settings
		Factory Default	Resets to factory default settings
	3/3 ↓		Current 3/3 page. Go to MENU1 ↓

Setting GPIB Address

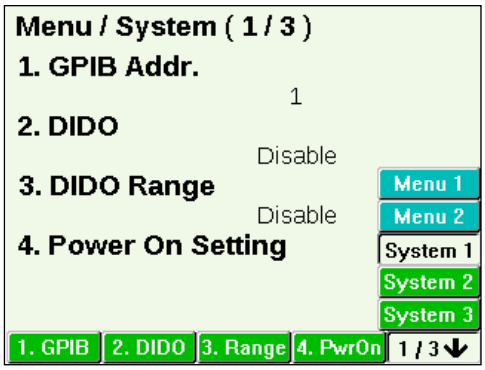
You can set GPIB address.
GPIB address should be different from other devices connected with GPIB cable. Set value is stored even if the power supply is switched off.
Factory default setting is “1”.

Entering the System screen

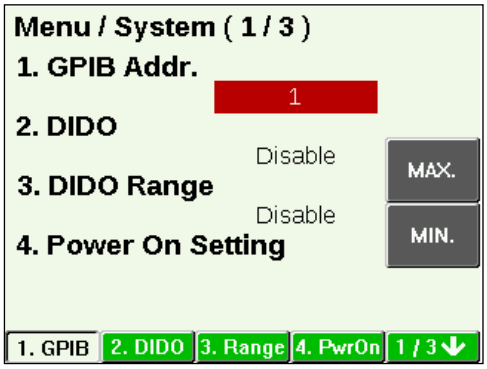
Press the MENU key and enter the menu of Menu screen.

Setting GPIB address (1.GPIB)

1. Press the right most button on the horizontal menu and select System 1.
Menu display will renew.



2. Select 1. GPIB from horizontal menu.
GPIB Addr. vertical menu will appear.



3. Set the value by rotating the modify knob.
Stopping the modify knob will set the value as it is.
MAX will select the maximum value, while MIN will select the minimum value.

Setting of DIDO

DI input can be enabled or disabled.

Enabling DI Input will enable settings from DI.

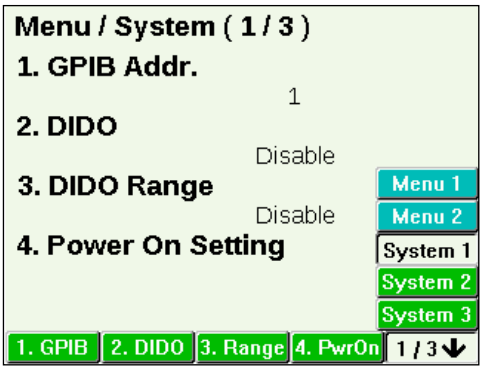
Entering the System screen

Press the MENU key and enter the menu of Menu screen.

Setting DIDO (2.DIDO)

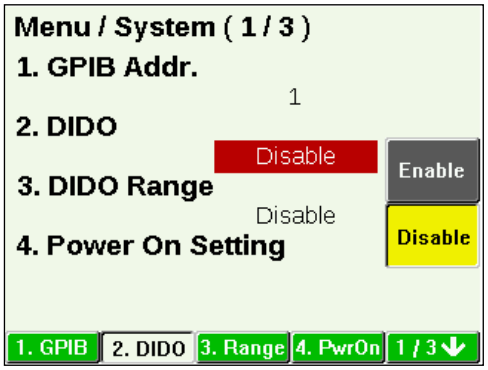
1. Press the right most button on the horizontal menu and select System 1.

Menu display will renew.



2. Select 2. DIDO from horizontal menu.

DIDO vertical menu will appear.



3. Select the item to be set on the vertical menu.

Selecting Enable will enable the DI input.

Selecting Disable will disable the DI input.

Setting of DIDO Range

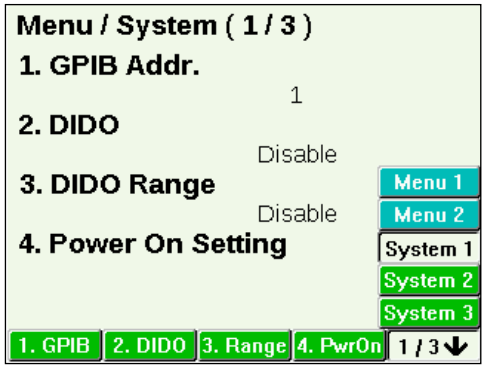
Current and voltage range setting from DI Input can be enabled or disabled.

Entering the System screen

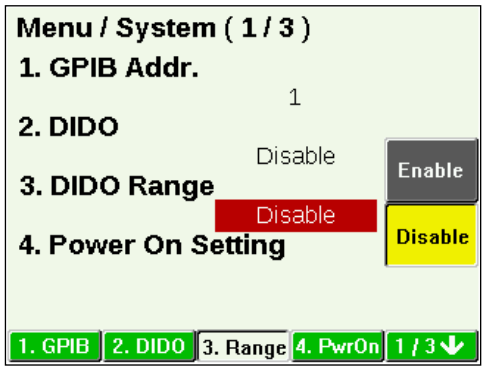
Press the MENU key and enter the menu of Menu screen.

Setting DIDO Range (3.Range)

1. Press the right most button on the horizontal menu and select System 1.
Menu display will renew.



2. Select 3. Range from horizontal menu.
DIDO Range vertical menu will appear.



3. Select the item to be set on the vertical menu.
Selecting Enable will enable current and voltage range setting from DI input.
Selecting Disable will disable current and voltage range setting from DI input.

Setting of Power On Setting

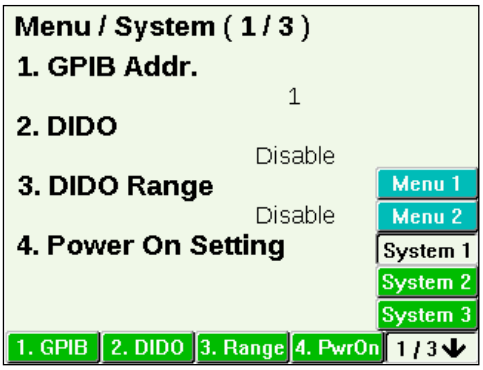
Present setting can be saved as the initial setting on the next startup.

Entering the System screen

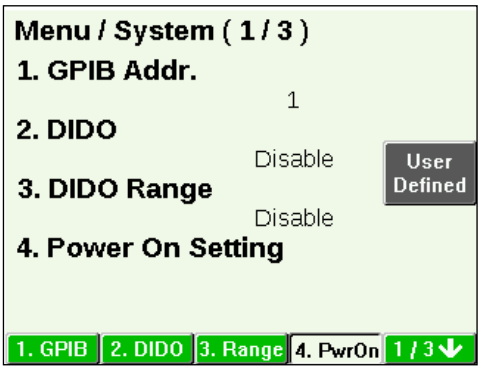
Press the MENU key and enter the menu of Menu screen.

Setting power on setting (4.PwrOn)

1. **Press the right most button on the horizontal menu and select System 1.**
   Menu display will renew.



2. **Select 4. PwrOn from horizontal menu.**
   Power On Setting vertical menu will appear.



3. **Press User Defined on the vertical menu.**
   Progress bar will appear and next session will start with the present settings.

LCD Backlight Setting

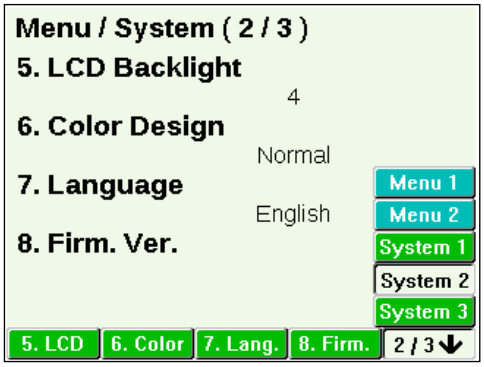
You can adjust the brightness of LCD.

Entering the System screen

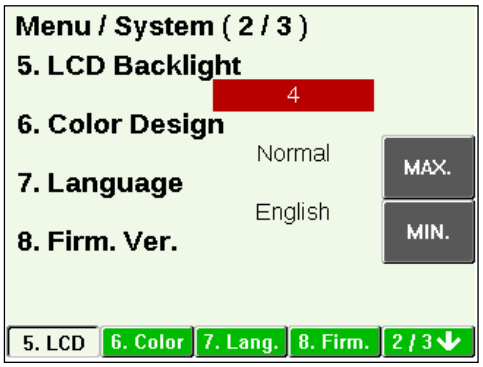
Press the MENU key and enter the menu of Menu screen.

Setting LCD Backlight (5.LCD)

1. Press the right most button on the horizontal menu and select System 2.
Menu display will renew.



2. Select 5. LCD from horizontal menu.
LCD Backlight vertical menu will appear.



3. Set the value by rotating the modify knob.
Stopping the modify knob will set the value as it is.
MAX will select the maximum value, while MIN will select the minimum value.

Color Design Setting

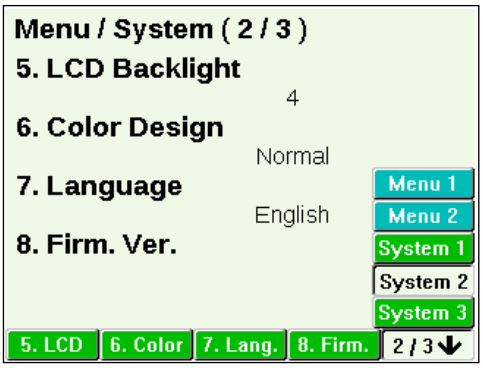
You can change the color design of LCD.
(*Only Normal is selectable for now.)

Entering the System screen

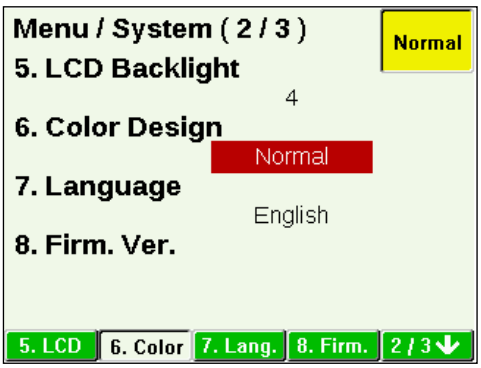
Press the MENU key and enter the menu of Menu screen.

Setting Color Design (Color)

1. Press the right most button on the horizontal menu and select System 2.
Menu display will renew.



2. Select 6. Color from horizontal menu.
Color Design vertical menu will appear.



3. Select the item to be set in the vertical menu.
(*Only Normal is selectable for now.)

Language Settings

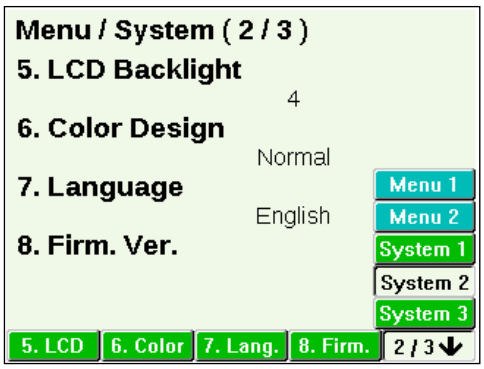
You can change the display language.
(*Only English is selectable for now.)

Entering the System screen

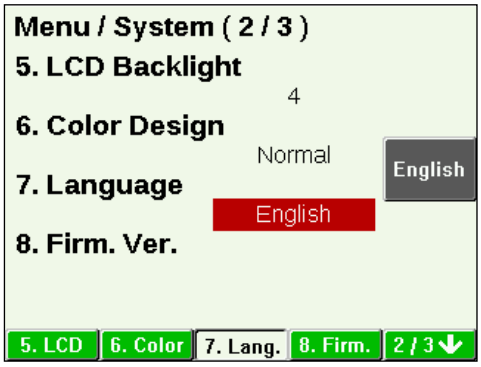
Press the MENU key and enter the menu of Menu screen.

Setting Language (Lang.)

1. Press the right most button on the horizontal menu and select System 2.
Menu display will renew.



2. Select 7. Lang from horizontal menu.
Language vertical menu will appear.



3. Select the item to be set in the vertical menu.
(*Only English is selectable for now.)

Displaying Firmware Version

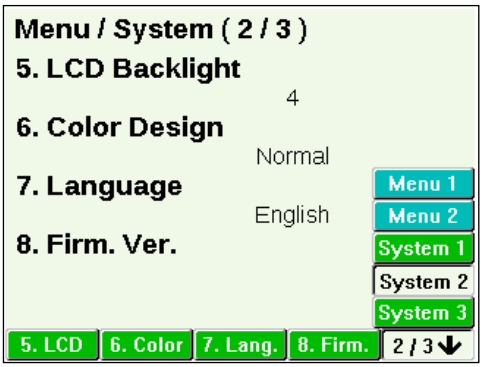
Displays the firmware version.

Entering the System screen

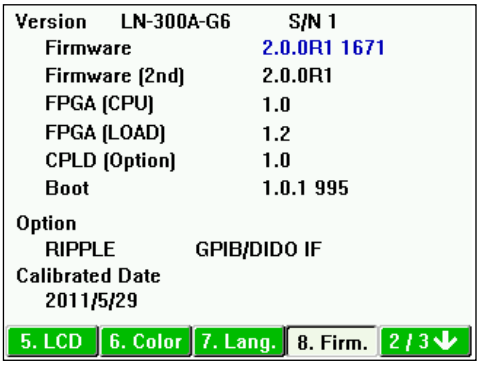
Press the MENU key and enter the menu of Menu screen.

Displaying Firmware version (8.Firm.)

1. **Press the right most button on the horizontal menu and select System 2.**
   Menu display will renew.



2. **Select 8. Firm. from horizontal menu.**
   Firmware version will appear.



Setting of OCP Load Off

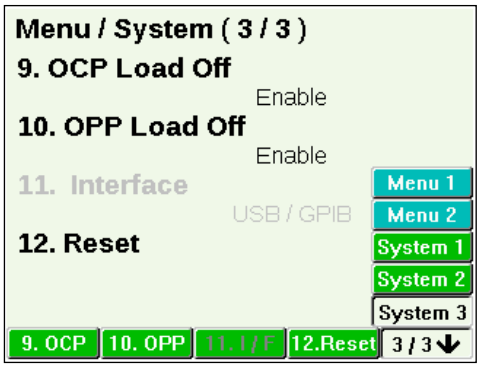
You can select how the overcurrent protection works; to limit the current to 110% of the limiter setting value or to turn LOAD OFF.

Entering the System screen

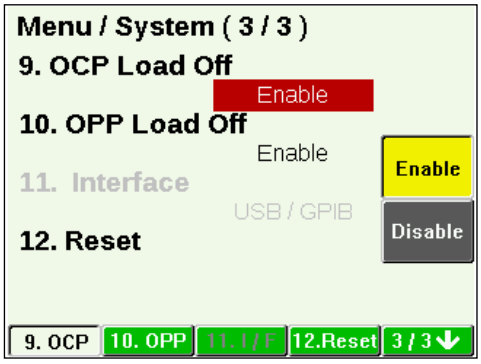
Press the MENU key and enter the menu of Menu screen.

Setting OCP Load Off (9.OCP)

1. Press the right most button on the horizontal menu and select System 3.
Menu display will renew.



2. Select 9. OCP from horizontal menu.
OCP Load Off vertical menu will appear.



3. Select the item to be set in the vertical menu.
Selecting Enable will turn LOAD OFF in the event of current limit.
Selecting Disable will continue the load at 110% of current limit value with LOAD ON in the event of current limit.

Setting of OPP Load Off

You can select how the overpower protection works; to limit the load power to 110% of the rated power or to turn LOAD OFF.

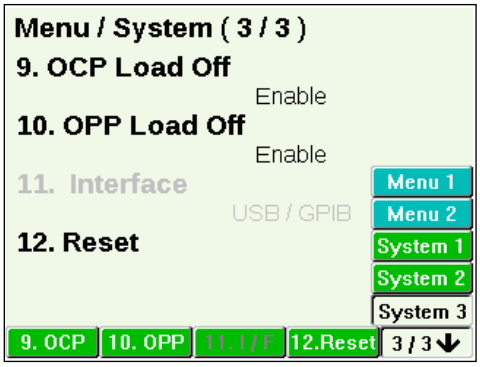
Entering the System screen

Press the MENU key and enter the menu of Menu screen.

Setting OPP Load Off (10.OPP)

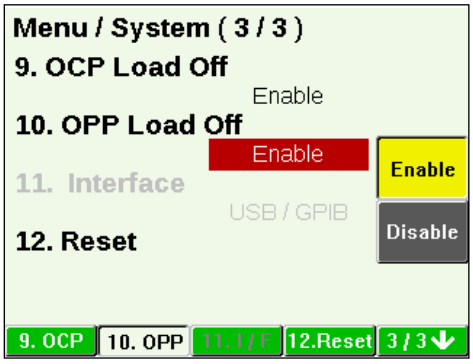
1. Press the right most button on the horizontal menu and select System 3.

Menu display will renew.



2. Select 10. OPP from horizontal menu.

OPP Load Off vertical menu will appear.



3. Select the item to be set in the vertical menu.

Selecting Enable will turn LOAD OFF in the event of power limit.
Selecting Disable will continue the load at 110% of rated power with LOAD ON in the event of power limit.

Selecting External Interface

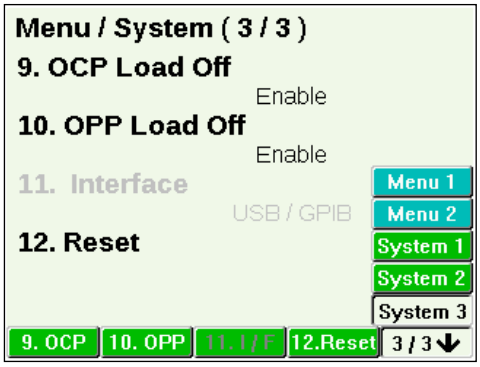
You can change the external interface.
(*Only USB and GPIB is selectable for now.)

Entering the System Screen

Press the MENU key and enter the menu of Menu screen.

Selecting external interface (11.I/F)

1. **Press the right most button on the horizontal menu and select System 3.**
   Menu display will renew. (*Only USB and GPIB is selectable for now.)



System Reset

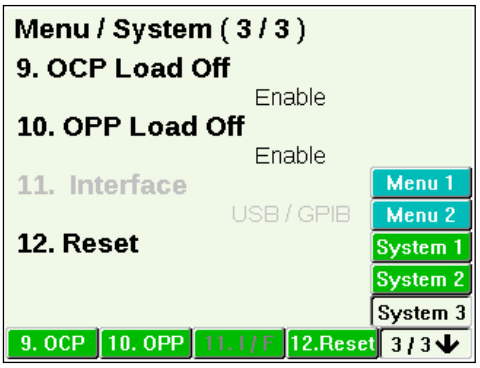
System Reset will return the settings of this product to factory default settings.

Entering the System screen

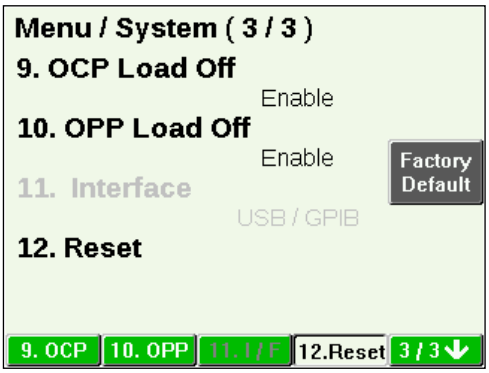
Press the MENU key and enter the menu of Menu screen.

Resetting the system (12.Reset)

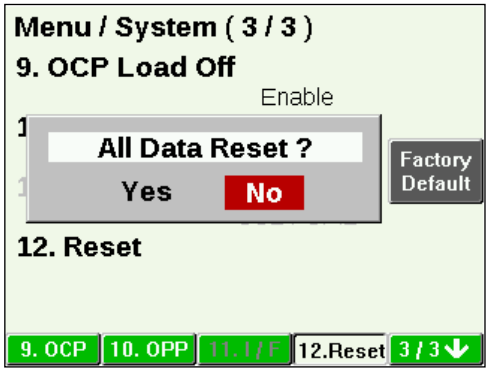
1. **Press the right most button on the horizontal menu and select System 3.**
   Menu display will renew.



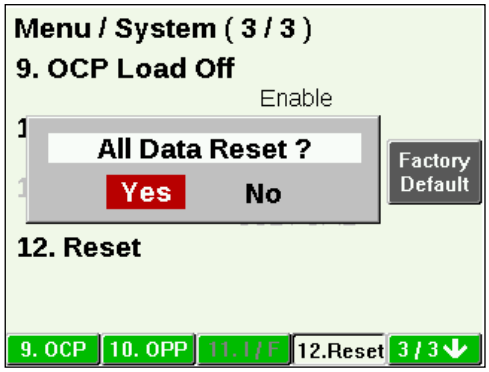
2. **Select 12. Reset from horizontal menu.**
   Interface vertical menu will appear.



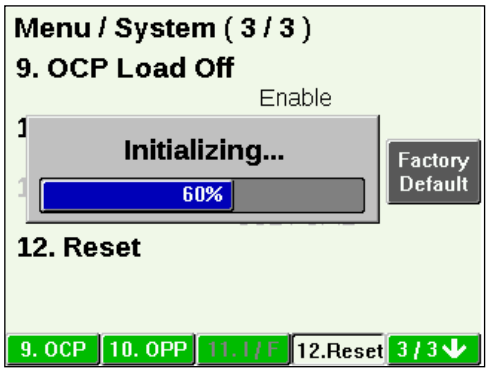
3. **Select Factory Default in the vertical menu.**
Confirmation screen will appear.
For aborting Reset,
Select No with the cursor key and press Enter.



4. **Select Yes by pressing the left side of the cursor key.**

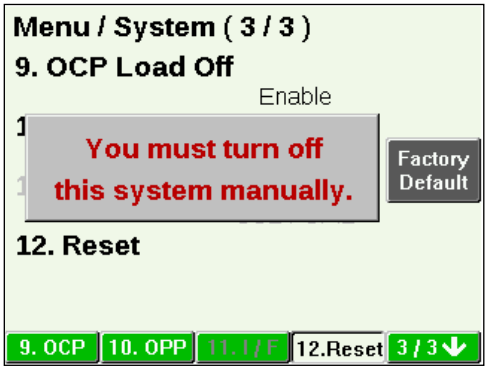


5. **Press the Enter key.**
Initialization will start.



6. Restart this product manually.

When the following screen appears, turn OFF the power supply and then restart the product.



Chapter 9 Memory

This chapter describes the memory screen.

Memory Screen

Overview of memory function

Using the Memory screen, you can save up to 8 present settings. Parameters stored in memory can be recalled by specifying the number. Following are the main parameters that can be stored.

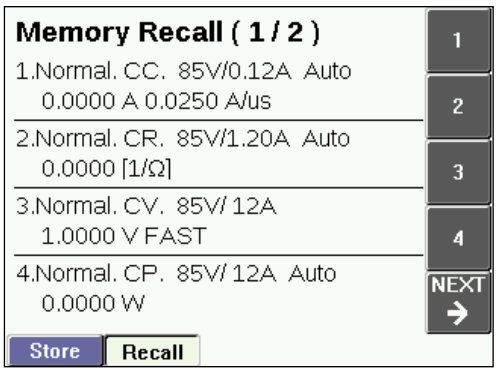
- Operation mode
- Load Mode
- Load Set Value

Entering menu of the Memory screen

Press the MEMORY key and enter the menu of Memory screen.

1. Press the MEMORY key.

As shown in the figure below, menu of the Memory Screen will appear. Memory numbers and values stored in the memory will appear on the screen.



2. Press the NEXT→ key on the vertical menu.

Menu of the Memory screen will appear. Vertical menu has 2 pages.

Moving out of the Memory screen

You can move out of the Memory screen with either of the following methods.

- Pressing the CANCEL key returns the display to the Main screen.
- Recalling memory will switch the display to the Main Screen in the operation mode stored in the memory.

Menu of Memory screen

MEMORY			
Recall			Recall
	1/2 page		
	1		Memory number 1
	2		Memory number 2
	3		Memory number 3
	4		Memory number 4
	NEXT→		Go to 2/2 page
	2/2 page		
	5		Memory number 5
	6		Memory number 6
	7		Memory number 7
	8		Memory number 8
	NEXT→		Go to 1/2 page
Store			Store
	1/2 page		
	1		Memory number 1
	2		Memory number 2
	3		Memory number 3
	4		Memory number 4
	NEXT→		Go to 2/2 page
	2/2 page		
	5		Memory number 5
	6		Memory number 6
	7		Memory number 7
	8		Memory number 8
	NEXT→		Go to 1/2 page

Store, Recall

Store operation can be performed irrespective of LOAD ON, LOAD OFF. Recall operation will change the mode to LOAD OFF, if the mode is LOAD ON. After changing to LOAD OFF, it will be set to the recalled item. In case of LOAD OFF, it will be set to the recalled item with LOAD OFF.
If the parameters are set to recall contents with LOAD ON, test device may breakdown if operating conditions are very different before and after the recall. To avoid this, Recall operation is performed only after changing the mode to LOAD OFF.

Store

1. **Press the Store key on the horizontal menu.**
2. **Select memory number to be stored (vertical menu).**
   Present settings will be stored. If the number is already in use, contents will be overwritten.

Recall

1. **Turn OFF the load by pressing the ON/OFF key.**
2. **Check the memory number and details stored on the screen.**
3. **Select the Recall key on the horizontal menu.**
4. **Select the memory number (vertical menu) to be recalled.**
   Menu of the Main screen will appear. Recalled contents will be set.

Stored items

Pressing the Store button displays the stored item in each memory number.

Item	Save / Don't save
Menu screen items	Don't save
System screen items	Don't save
Load settings	Save

Load settings: Operation Mode, Load Mode, Voltage Range, Current Range, Load Set Value, and Slew Rate

Menu screen items and system screen items are stored at other places and they become valid after restarting.
Moreover, they are stored at the timings mentioned below.

Item	Storage timing	Next session, When Power is On
Menu screen items	Immediately after changing the value (auto store)	Valid
System screen items	Immediately after changing the value (auto store)	Valid
Load settings	When the Store button is pressed	Invalid (Starts with Factory Default or User Defined values)

The following table shows the comparison of User Defined of 4. PWRON and Factory Default of 12.Reset, set on the System screen.

Item	User Defined	Factory Default	Store Operation
Menu screen items	Present settings are applied to the next startup settings	Factory default settings are applied to the next startup settings	
System screen items	Present settings are applied to the next startup settings	Factory default settings are applied to the next startup settings	
Load settings	Present settings are applied to the next startup settings	Factory default settings are applied to the next startup settings	Present value is stored

Chapter 10 Protection, Alarm Function

This chapter describes protection function and alarm function.

Protection, Alarm Function

The product has protection function and alarm function described below. Alarm will occur upon activation of protection function. Beep sound will occur along with alarm and alarm message corresponding to respective protection function will appear, turning the device to LOAD OFF.

- Overcurrent protection
- Overpower protection
- Overheat protection
- Overvoltage alarm (*1)
- Reverse connection alarm (*1)

*1: Remove the root cause of alarm as the load section may breakdown.

Select LOAD OFF or keep limit state

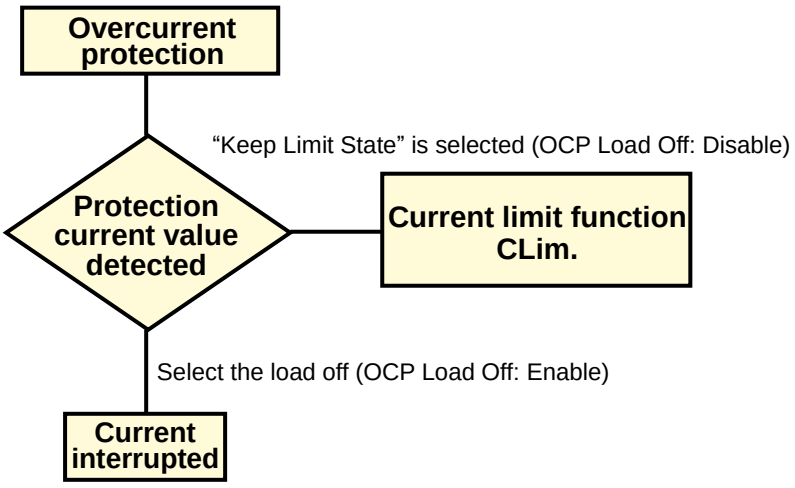
“LOAD OFF” or “Keep Limit State” can be selected when overcurrent protection and overpower protection has activated. Refer to OCP Load Off or OPP Load Off of “System Screen” in Chapter 8 Menu, System for selection method.

Overcurrent protection

The product can be protected against overcurrent with respect to load current set value.
The following 2 types of operations are available for overcurrent protection.

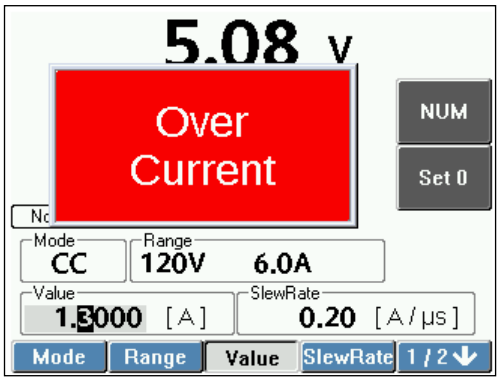
- With 110% of current limit set value, it will change to LOAD OFF and current will stop.
- Current will be restricted to 110% of current limit set value with LOAD ON. (Current limit function)

In case of current limit function, once load current set value falls below protection current value, it will return to the original state.



Set current value of current limit function is called “Current limit set value”.
Load current set value that actually interrupts the current is called,
“Protection current value” (= Current limit set value X 110%).

Alarm message



Set of Current Limit Value

Setting method is same as 2.CLim setting of the Menu screen. Refer to “Protection Current Value Setting” in Chapter 8 Menu, System.

Following shows the current limit set value at the time of shipping from a factory.

Model	Current range, H range
LN-300A	60 A
LN-300C	12 A
LN-1000A	180 A
LN-1000C	36 A

NOTE Setting conditions of the set current limit value.

- When the current limit value is set below 15% of current range, accuracy of protection current value will deteriorate.
- Current limit set value can be set irrespective of load value.
- In CV mode, current transiently higher than the protection limit value may flow.
- Do not set such load that will flow current over 100 times of current limit setting value.

Overpower protection

Overpower protection has the following 2 types of operation. Operation method is same as that for overcurrent protection.

- If the voltage exceeds 110% of rated power, it will lead to LOAD OFF and current cutoff.
- If the voltage exceeds 110% of rated power, with LOAD ON, power will be restricted to 110% of rated power.

The following tables shows rated power.

Model	Rated Power
LN-300A	300.00 W
LN-300C	
LN-1000A	1000.0 W
LN-1000C	

In case of power restriction, if power falls below rated power of power range, it will return to original state.

Refer to “System Screen” in Chapter 8 Menu, System selecting LOAD OFF / DO NOT LOAD OFF.

Alarm message

Over power will appear. Screen format is same as alarm message for overcurrent.

Overheat protection

If temperature error is detected in load section, it will result in LOAD OFF and current cutoff.

CAUTION Overheat protection will activate.

- Do not block inlet port and exhaust outlet with objects.
- Do not use the product if the cooling fan has stopped because of dust etc.
- Do not use at temperatures outside specification range.

Alarm message

Over Temperature will appear. Screen format is same as alarm message for overcurrent.

Overvoltage alarm

If overvoltage detection value of each voltage range is exceeded, the load turns off and interrupts the current, and an alarm occurs.

Model	Detection voltage	
	H range	L range
LN-300A	130 V	22 V
LN-300C	520 V	88.4 V
LN-1000A	130 V	22 V
LN-1000C	520 V	88.4 V

CAUTION The product may be damaged.

- Activation of protection function will result in LOAD OFF, however, load section is still connected. Once overvoltage alarm or reverse connection alarm is triggered, promptly remove the root cause of the alarm.

Alarm message

Over voltage will appear. Screen format is same as alarm message for overcurrent.

Reverse connection alarm

Alarm will occur if detected load current exceeds the permissible value (detected current).

Model	Detection current
LN-300A	–0.6 A
LN-300C	–0.15 A
LN-1000A	–0.6 A
LN-1000C	–0.15 A

CAUTION The product may be damaged.

- Activation of protection function will result in LOAD OFF, however, load section is still connected. Once reverse connection alarm is triggered, promptly remove the root cause of the alarm.

NOTE Reverse connection voltage

- Reverse connection voltage of -0.6V is required for alarm detection.

Alarm message

Reverse connection will appear. Screen format is same as alarm message for overcurrent.

Clearing the alarm

Upon activation of protection function, alarm corresponding to the respective protection function will occur. Press the CANCEL key for clearing the alarm. Clear the alarm after remove the root cause of the alarm.

Chapter 11 Parallel Operation

This chapter describes the parallel operation.

Overview and Connection

Overview

Current capacity or power capacity may be increased by connecting multiple units in parallel. In parallel operation, 1 unit will be master device, while other units will be slave devices. Maximum of 9 slave devices can be connected. Total number of connected units including the master device is 10. The entire control can be handled from the master device. Master device can also display total current and total power value of all devices connected in parallel.

Combination of master device and slave device

Only slave devices having same maximum voltage as the master device can be used for parallel connection. For example, LN-300A and LN-1000A can be connected, however, LN-300A and LN-300C cannot be connected. LN-xxxx-G6 model can be connected in parallel to only with LN-xxxx-G6 model.

Master device	Connectable slave devices	
LN-300A	LN-300A	LN-1000A
LN-300C	LN-300C	LN-1000C
LN-1000A	LN-1000A	LN-300A
LN-1000C	LN-1000C	LN-300C

* When using CP mode, the overheat protection function may be activated, therefore LN-300C or LN-300A needs to be used as the master device.

Master device	Connectable slave devices	
LN-xxxxA-G6	LN-xxxxA-G6	YES
	LN-xxxxA-G7	NO
	LN-xxxxA	NO
LN-xxxxA-G7	LN-xxxxA-G6	NO
	LN-xxxxA-G7	YES
	LN-xxxxA	YES
LN-xxxxA	LN-xxxxA-G6	NO
	LN-xxxxA-G7	YES
	LN-xxxxA	YES
LN-xxxxC-G6	LN-xxxxC-G6	YES
	LN-xxxxC-G7	NO
	LN-xxxxC	NO
LN-xxxxC-G7	LN-xxxxC-G6	NO
	LN-xxxxC-G7	YES
	LN-xxxxC	YES
LN-xxxxC	LN-xxxxC-G6	NO
	LN-xxxxC-G7	YES
	LN-xxxxC	YES

Distribution of Load and Maximum Power

In parallel operation where the load mode is set to CP mode, load of each device is distributed in proportion to the rated current of specified range. The following table shows an example where LN-300A and LN-1000A are connected in parallel.

Master Device	Slave Device	Maximum power of slave device	Total maximum power
LN-300A	LN-1000A	900 W	1200 W
LN-1000A	LN-300A	333 W *	1333 W

* Overheat protection function may activate in LN-300A.

Connection of parallel operation

For parallel operation connection, optional MASTER/SLAVE connection cable used for connecting the units, and load cable for connecting the unit and test device, are required. Ensure to use the rear panel load terminal. Do not connect any other device to the front panel load terminal.

WARNING **There is a danger of electric shock.**

- **Do not touch MASTER/SLAVE connector when power supply is on.**
- **When connecting or removing the optional MASTER/SLAVE connection cable, ensure to turn OFF the main POWER switch. Moreover, use with either both MASTER/SLAVE_IN connector and MASTER/SLAVE_OUT connector connected or removed.**

CAUTION Device may be damaged.

- Ensure that load cable has adequate wire thickness corresponding to current and it is coated with strong nonflammable material.
- Ensure to appropriately connect MASTER/SLAVE_IN connector and MASTER/SLAVE_OUT connect using MASTER/SLAVE connection cable.

1. **Turn OFF the power supply of each device.**

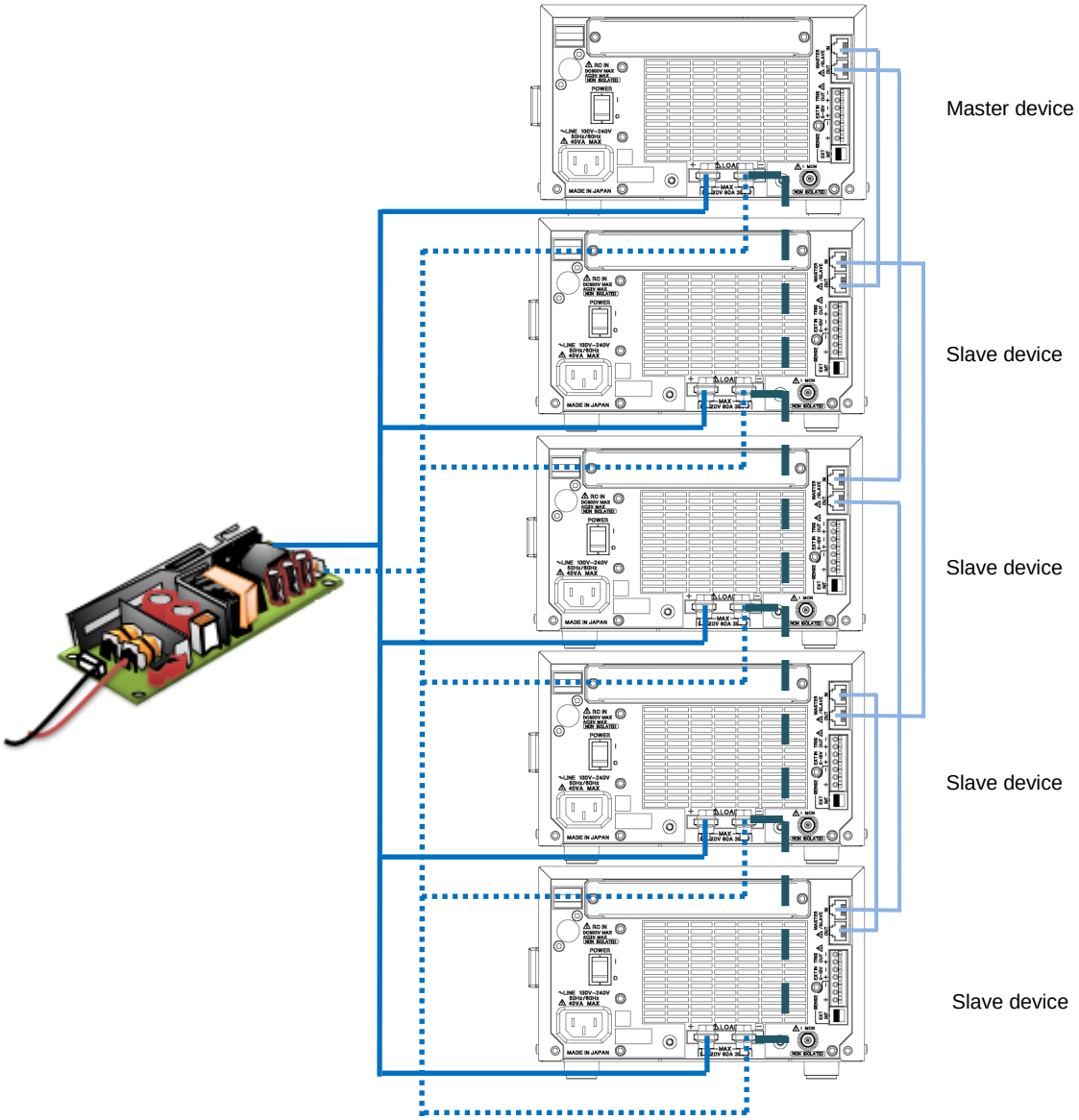
2. **Connect the load terminal of each device.**
   Refer to the connection diagram and firmly connect the load terminals in parallel.

3. **Connect MASTER/SLAVE connector of each device.**
   Using the optional MASTER/SLAVE connection cable, connect MASTER/SLAVE_IN connector and MASTER/SLAVE_OUT connector between each device. Keep load cable and MASTER/SLAVE connection cable as far as possible, as it may cause unstable operation.

Parallel operation connection diagram

In the following figure, 2 slave devices are connected. Refer to “Wiring” in Chapter 2 Preparing for Installation and Use for wiring and wire diameter of load cable.

Cable to connect the EUT and load terminal should be twisted as short as possible.
We recommend the use of a low-inductance cable options.
For a long cable, as shown in the figure below the dotted line, please connect between minus terminals as short as possible. And cable length to connect the each load terminal and equipment for test should be same as much as possible also.



Settings of Parallel Operation

Specifying master device and slave device

First specify the slave device.

Specifying slave device

1. **Turn ON both the power switch and STANDBY switch of each device.**
2. **Press the MENU key of the unit to be set as slave device.**
   Menu screen will appear.
3. **Select 5.M/S of the horizontal menu.**
   Vertical menu of 5.M/S will appear.
4. **Select OFF on the vertical menu.**
   Screen will change to the screen of standalone operation.
   Similarly, set the screens of all slave devices to standalone operation screen.

Specifying master device

5. **Press the MENU key of the unit to be set as master device.**
   Menu screen will appear
6. **Select 5.M/S of the horizontal menu.**
   Vertical menu of 5.M/S will appear.
7. **Select Master on the vertical menu.**
   Master device is set.

Deactivating parallel operation

For returning the master device to standalone operation, select OFF in Step 7 above.
It is not necessary to set slave device.

WARNING There is a danger of electric shock.

- **Do not touch MASTER/SLAVE connector when power supply is on.**
- **When connecting or removing the optional MASTER/SLAVE connection cable, ensure to turn OFF the main POWER switch. Moreover, use with either both MASTER/SLAVE_IN connector and MASTER/SLAVE_OUT connector connected or removed.**

CAUTION Device may be damaged.

- When turning off the power switch of devices, simultaneously turn them OFF.
- For returning the device from parallel operation to standalone operation, remove the MASTER/SLAVE connection cable after turning OFF the power switch of each device.

CAUTION Alarm may occur.

- Alarm will occur if the power switch or STANDBY switch is turned OFF with parallel operation settings.

Setting the load

Set the load with master device. Refer to “Setting the Load” in respective operation mode for setting method.

- Set resolution power changes depending on the number of units in parallel operation.
- Set accuracy is ±3% of full scale in current H range and ±7% of full scale in current M range. (Reference value)
- Current ripple is standalone operation multiplied by the number of units in parallel operation.
- SlewRate setting value depends on the value of the master device.

Increase in wiring inductance will lead to voltage drop that is higher than the change in current. In addition, due to phase lag of current, control of the product may become unstable leading to oscillation phenomenon. In such cases, SlewRate can be set slower and stable operation can be achieved.

Measuring the load

Measured values of total load current and total load power for all units in parallel connection are displayed in the master unit.
Measurement values displayed in master device are calculated using the values measured by the master device, coefficient depending on the rated current of the connected slave devices and number of slave devices connected.

Example 1. With LN-300C as master device connected to 3 LN-1000C slave devices

Total load current =

Current measurement value of LN-300C ×

(1 (= 12 A / 12 A) × 1 [Unit] + 3 (= 36 A / 12 A) × 3 [Unit])

Master device (LN-300C) Slave device (LN-1000C)

= Current measurement value of LN-300C × 10

Example 2. With LN-1000A as master device, connected to 2 LN-300A slave devices and 2 LN-1000A slave devices

Total load current =

Current measurement value of LN-300A ×

(1 (= 180 A / 180 A) × 1 [Unit] + 1/3 (= 60 A / 180 A) × 2 [Unit]

Master device (LN-1000A) Slave device (LN-300A)

+ 1 (= 180 A / 180 A) × 2 [Unit])

Slave device (LN-1000A)

= Current measurement value of LN-1000A × 11 / 3

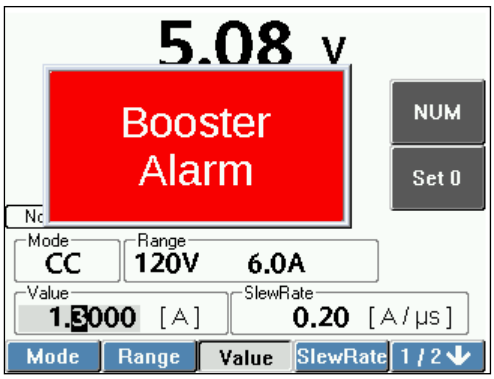
Execution

LOAD ON, OFF

Load current will flow to all the devices, if the master device is turned to LOAD ON with ON/OFF key (key will light up). Load current will disconnect, if the master device is turned to LOAD OFF (key will light out).

Alarm during parallel operation

If the alarm is occurred during parallel operation, error message will appear and all units will be switched to LOAD OFF. If the alarm is triggered in a slave device, the alarm message will appear in the master device.
Clear the alarm in the master device as well as the slave device.



Chapter 12 Multichannel Synchronous Operation

This chapter describes the multichannel synchronous operation.

Overview and Connection

Overview

In multichannel synchronous operation, you can synchronize the execution of steps in Dynamic Mode and ON/OFF control of multiple Load Station Series. It is useful for output test of multi-channel power supply.
Unlike parallel operation, combination of slave device and master device can be used even if the slave device does not have the same maximum voltage as master device.
Up to 9 slave devices can be connected.

Connection of multichannel synchronous operation

For connection of multichannel synchronous operation, optional MASTER/SLAVE connection cables and load cables for connecting the unit and test device are required. Do not connect any other device to the front panel load terminal.

⚠ WARNING **There is a danger of electric shock.**

- **Do not touch MASTER/SLAVE connector when power supply is on.**
- **When connecting or removing the optional MASTER/SLAVE connection cable, ensure to turn OFF the main POWER switch. Moreover, use with either both MASTER/SLAVE_IN connector and MASTER/SLAVE_OUT connector connected or removed.**

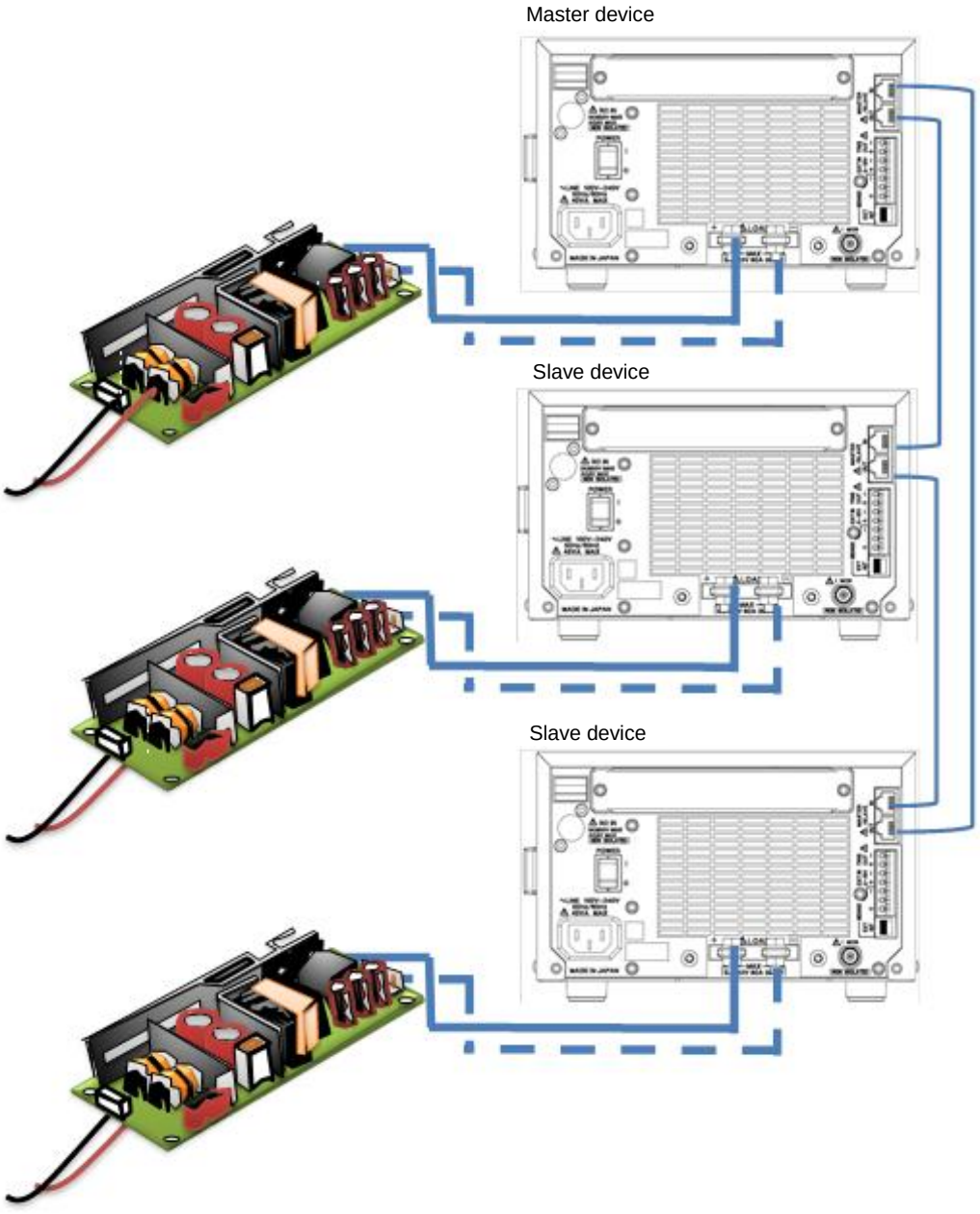
⚠ CAUTION Device may be damaged.

- Ensure that load cable has adequate wire thickness corresponding to current and it is coated with strong nonflammable material.
- Ensure to appropriately connect MASTER/SLAVE_IN connector and MASTER/SLAVE_OUT connector using MASTER/SLAVE connection cable.
- The minus load terminal and terminals of MASTER / SLAVE connector have the same potential. In the case of connecting electronic load by optional MASTER/SLAVE connection cables, load terminals of each product become the same potential. Do not connect the minus terminal of ± EUT and GND terminal of ± EUT to the load terminals which have the same potential.

1. **Turn OFF the power supply of each device.**
2. **Connect the load terminal of each device.**
   Refer to the connection diagram and firmly connect the load terminals in parallel.
3. **Connect MASTER/SLAVE connector of each device.**
   Using the optional MASTER/SLAVE connection cable, connect MASTER/SLAVE_IN connector and MASTER/SLAVE_OUT connector between each device. Keep load cable and MASTER/SLAVE connection cable as far as possible, as it may cause unstable operation.

Multichannel synchronous operation connection diagram

Use load cables of master device and slave device respective for connecting to the test device. Refer to “Wiring” in Chapter 2 Preparing for Installation and Use for wiring and wire diameter of load cable.



Settings of Multichannel Synchronous Operation

Specifying master device and slave device

First specify the slave device.

Specifying slave device

1. **Turn ON both the power switch and STANDBY switch of each device.**

2. **Press the MENU key of the unit to be set as slave device.**
   Menu screen will appear.

3. **Select 5.M/S of the horizontal menu.**
   Vertical menu of 5.M/S will appear.

4. **Select OFF on the vertical menu.**
   Screen will change to the screen of standalone operation.
   Similarly, set the screens of all slave devices to standalone operation screen.

Specifying master device

5. **Press the MENU key of the unit to be set as master device.**
   Menu screen will appear.

6. **Select 5.M/S of the horizontal menu.**
   Vertical menu of 5.M/S will appear.

7. **Select Multi. on the vertical menu.**
   Master device is set.

Deactivating multichannel synchronous operation

For returning the master device to standalone operation, select OFF in Step 7 above.
It is not necessary to set slave device.

WARNING There is a danger of electric shock.

- **Do not touch MASTER/SLAVE connector when power supply is on.**
- **When connecting or removing the optional MASTER/SLAVE connection cable, ensure to turn OFF the main POWER switch. Moreover, use with either both MASTER/SLAVE_IN connector and MASTER/SLAVE_OUT connector connected or removed.**

CAUTION Device may be damaged.

- When turning off the power switch of devices, simultaneously turn them off.
- For returning the device from multichannel synchronous operation to standalone operation, remove the MASTER/SLAVE connection cable after turning OFF the power switch of each device.

CAUTION Alarm may occur.

- Alarm will occur if the power switch or STANDBY switch is turned OFF with multichannel synchronous operation settings.

Setting the load

Load is set for master device as well as slave device. For setting method, refer to “Setting the Load” for respective Operation Mode.

Setting Conditions for Dynamic Mode

- In dynamic mode operation, master device and slave device are synchronized by distributing standard clock from master device to slave device.
- Standalone operation is only possible for respective devices independently. Interlocked operation is not possible.
- For aligning the starting time, set the master device to LOAD OFF before starting the operation. Turning it to LOAD ON aligns the starting time of each device.
- It is necessary to ensure that execution time of slave device is within execution time range of master device. If value is set outside the range, time will be different from set value.

Execution

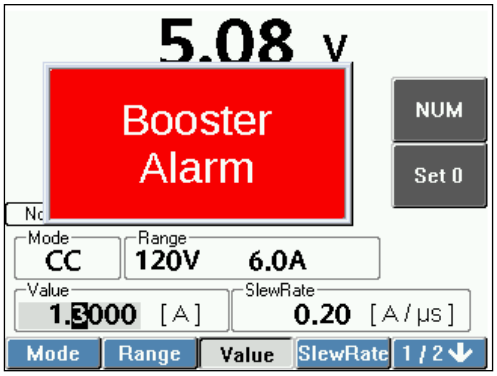
LOAD ON, OFF

Load current will flow to all the devices, if the master device is turned to LOAD ON with ON/OFF key (key will light up). Load current will disconnect, if the master device is turned to LOAD OFF (key will light out).

Alarm during multichannel synchronized operation

If the alarm is occurred during multichannel synchronized operation, error message will appear and unit in which the alarm is occurred will be switched to LOAD OFF. Alarm is not linked between devices.

If the master device is in LOAD ON state and the alarm has occurred in the slave device, only slave device will be switched to LOAD OFF. Clearing the alarm in slave device will immediately change the state to LOAD ON.
To clear the alarm, firstly turn load off on the master device and then clear.



Chapter 13 Remote Control

This chapter describes USB/GPIB (IEEE488.1 compliant) interfaces.

USB/GPIB Interface

USB interface is available on the front panel. GPIB interface is included in the option LX-OP01.

GPIB Address

Address between 1-30 can be used. Refer to “Setting GPIB Address” in Chapter 8 Menu, System for setting method.

Delimiter

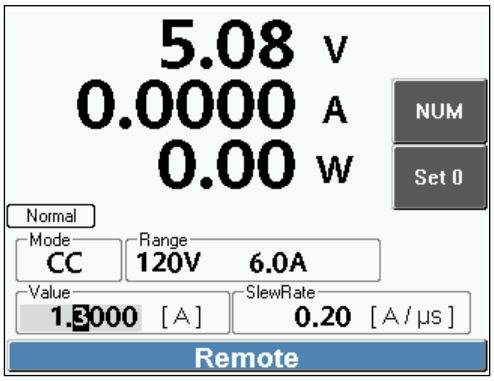
Only LF can be set as delimiter in this product. EOI (End of Identify) will certainly be transmitted.

Delimiter symbol in multi statement

Semicolon is used as separator when sending multiple commands together. System will not operate normally without delimiter symbol.

Changing to local operation

The following screen will appear when the product is operated with remote control. Press the CANCEL key for changing to panel operation (local operation).



Connecting GPIB cable

GPIB is an interface designed assuming that it will be used in a relatively better environment. To the extent possible, avoid using it where there is too much power supply fluctuation or noise.
Ensure to connect / remove GPIB connector only after turning OFF the rear panel POWER switch.
Maximum of 15 devices (including controller) can be connected. Cable length should be under 20 m (total length of all cables) and distance between devices should be under 2 m. Length of a single cable should be under 4 m. Do not overlap more than 3 GPIB connectors for bus cable.
Turn ON both the power switch and STANDBY switch of all devices connected with GPIB.

Connecting USB cable

USB is an interface designed assuming that it will be used in a relatively better environment. To the extent possible, avoid using it where there is too much power supply fluctuation or noise.
Length of a single cable should be under 4 m.

Measurement commands

Function	Command	Operation and setting range	Remarks
Load current measurement	MC{SP}{NR1}	Range 0 - 3 0: Auto range 1: H range 2: M range 3: L range	(*1) Return value: real value (##.###) Measurement value of the measurement display upgrade position specified with DS command will be updated to current measurement value.
	MCFR	Returns the measured value of present current range	Return value: real value (##.###) Measurement value of the measurement display upgrade position specified with DS command will be updated to current measurement value.
Load terminal voltage measurement	MV	Returns the measured value of present current range	Return value: real value(##.###) Measurement value of the measurement display upgrade position specified with DS command will be updated to voltage measurement value.
Power measurement	MW	Load terminal voltage x Load current	Returns the calculation result of power Return value: real value (##.###) Measurement value of the measurement display upgrade position specified with DS command will be updated to power measurement value.
Simplified load current measurement during M/S connection	BMC{SP}{NR1}	Range 0 - 3 0: Auto range 1: H range 2: M range 3: L range	(*1) Return value: real value (##.###) Measurement value of the measurement display upgrade position specified with DS command will be updated to simplified load current measurement value.
Simplified power measurement during M/S connection	BMW	Load terminal voltage x Simplified load current	Returns the calculation result of power Return value: real value (##.###) Measurement value of the measurement display upgrade position specified with DS command will be updated to simplified power measurement value.
Specifying measurement value display upgrade position	DS{SP}{NR1}	Range 0 - 2 0: Top 1: Middle 2: Bottom	Bottom when starting up.
Measurement Fixed Mode	MF{SP}{NR1}	Range 0 - 1 0: Free run measurement 1: Single measurement	Specifies repetition of the measurement command specified at last

Measurement frequency setting	HZ{SP}{NR1}	Range 0 - 1 0: 50 Hz 1: 60 Hz	Sets the sample rate of A/D used for measurement

Details inside the { } of command cannot be omitted. NR1: Integer value, SP: Space (Blank), C: Comma

*1: Setting range of load and setting of measurement system cannot be changed independently. Same range will be selected.

Load setting commands

Function	Command	Operation and setting range	Remarks
Load setting	CC{SP}{NR2}	Constant current [A]	Specify simultaneously with load mode and set value in load setting commands
	CR{SP}{NR2}	Constant resistance [Ω]	
	CV{SP}{NR2}	Constant voltage [V]	
	CP{SP}{NR2}	Constant power [W]	
	CX{SP}{NR2}	Current value [A] when external control voltage is 10V	
	CS	Short circuit Current range will be H range	
	CD{SP}{NR1}	Range 0 - 3 0: Abort dynamic mode 1: Start repeating dynamic mode 2: Start single operation of dynamic mode (*2) 3: Operation start of the Dynamic(Freq.) mode	CD command enables dynamic mode setting and operating conditions are set with dynamic mode setting commands. 1 -> 2, 1 -> 3, 2 -> 1, 2 -> 3, 3 -> 1, 3 -> 2 cannot be specified
Dynamic mode setting (Dynamic(Freq.)) mode setting	FDT{SP}{NR2}	Range 0.01 - 10000 [ms]	Period setting
	FDD{SP}{NR2}	Range 0.00 - 100.00 [%]	Duty 1 setting
	FDC{SP}{NR1}{C}{NR2}	Argument 1 Step number Range 1 - 2 Argument 2 Load set value	Load setting of each step
	FDR{SP}{NR1}{C}{NR2}	Argument 1 Step number Range 1 - 2 Argument 2 SlewRate [A/μs]	SlewRate setting of each step
Dynamic mode setting (Dynamic(Time)) mode setting	DP{SP}{NR1}	Range 1 - 16 1: Setting zone of Step-1 is specified 2: Setting zone of Step-2 is specified n: Setting zone of Step-n is specified	Specifies zones set with DC, DT, DR commands
	DC{SP}{NR2}	Set value of load in zone	Sets the value of zone specified with DP command
	DT{SP}{NR2}	Step time [ms]	
	DR{SP}{NR2}	SlewRate setting [A/μs]	

Current setting range	RC{SP}{NR1}	Range 0 - 3 0: Auto range 1: H range 2: M range 3: L range	(*1) Load current range
Voltage setting range	RV{SP}{NR1}	Range 1 - 2 1: H range 2: L range	(*1) Voltage range Affects the settings of CR, CV
Load control	SW{SP}{NR1}	Range 0 - 1 0: Load off 1: Load on	LOAD OFF results in no load, disabling load settings
Load response setting	GC{SP}{NR2}	SlewRate [A/μs] in constant current, external control mode	Only constant current, external control and constant voltage settings are enabled. Other values are maximum default values. In case of Fast, oscillation may occur due to relation to response speed of test power supply. Select Slow in such cases.
	GV{SP}{NR2}	Response time in CV mode 2 Values from the ranges 0 to 50 (≤ 50) and 50 (50 <) to 100, respectively 0 to 50 (≤ 50): Slow setting 50 (50 <) to 100: Fast setting	
Current limit setting	LS{SP}{NR2}	Can be specified up to constant current [A]	No restriction on load current setting range.
M/S function setting	BS{SP}{NR1}	Range 0 - 2 0: OFF 1: Master 2: Multi	Master/Multi setting is not allowed when present state is other state than OFF.
DIDO	UDO {SP}0{C}{NR1}	Range 0 - 1 0: OFF 1: ON	Changes the status of user defined output in external control (DIDO).
Automatic load mode switching settings	LM{SP}{NR1}	Range 0 - 8 0: Turn off this function 1: Change to CR mode during “Voltage Rising” 2: Change to CV mode during “Voltage Rising” 3: Change to CP mode during “Voltage Rising” 4: Load OFF during “Voltage Rising 5: Change to CR mode during “Voltage Declining” 6: Change to CV mode during “Voltage Declining” 7: Change to CP mode	Sets the function of automatically switching load mode during “Voltage Rising” or “Voltage Declining” in operation.

		during “Voltage Declining” 8: Load OFF during “Voltage Declining”	
Setting conditional voltage for automatic load mode switching	LV{SP}{NR2}	Range 0.0000 [V] - Voltage rated value [V]	Sets the voltage that becomes precondition for switching the load mode in automatic load mode switching.
Operational settings in case of overcurrent protection	ALMCOFF{SP}{NR1}	Range 0 - 1 0: Disable 1: Enable	LOAD OFF with current limit
Operational settings in case of overpower protection	ALMPOFF{SP}{NR1}	Range 0 - 1 0: Disable 1: Enable	LOAD OFF with power limit

Details inside the { } of command cannot be omitted.

NR1: Integer value, NR2: Real value (##.###), SP: Space (Blank), C: Comma

Sweep command

Function	Command	Operation and setting range	Remarks
Sweep R basic setting	SWRSET{SP} {NR2}{C} {NR2}{C} {NR2}{C} {NR2}{C} {NR1}	Argument 1 Initial conductance value Argument 2 End conductance value Argument 3 End voltage value Argument 4 Step conductance value Argument 5 Step time［ms］	Argument 5 is more than 100ms, minimum time interval. Step interval may be more than set interval. Maximum number of steps is 1024. Enter a step value less than this range.
Sweet R Fine Setting	SWRFSET{SP} {NR2}{C} {NR2}	Argument 1 Fine sweep start voltage value Argument 2 Fine sweep step conductance value	
Sweep R Start	SWRSTART		Start of Sweep Mode During measurement, string “VI TEST Error Already start” is returned Once the measurement is complete, string “TEST END” is returned. If the number of sweep steps is too much, string “VI TEST Error step overflow” is returned In the event of error in sweep parameters, string “VI TEST Error parameter invalid” is returned

Sweep R Result	SWRRES{SP} {NR1}	Gets measurement results by step number Argument 1 Step Number Range 0 to 1023	Return Value: Current value real value (##.###) Return Value: Current value real value (##.###)
Sweep R End No. of Steps	SWRRESSTP		Return Value: Step number when measurement is complete integer If measurement is not complete, string “NOW Measuring” is returned. If measurement is not executed, string “Measure Not starting” is returned
Sweep C basic setting	SWCSET{SP} {NR2}{C} {NR2}{C} {NR2}{C} {NR2}{C} {NR1}	Argument 1 Initial current value Argument 2 End current value Argument 3 End voltage value Argument 4 Step current value Argument 5 Step time[ms]	Maximum no. of steps is 1024. Set the step value within this range.
Sweep C test setting	SWCTSET{SP} {NR2}{C} {NR2}	Sets PASS Range Argument 1 Max. current value Argument 2 Mini. current value	
Sweep C start	SWCSTART		Start of Sweep Mode During measurement, string “OCP TEST Error Already start” is returned Once the measurement is complete, string “TEST END” is returned. If the number of sweep steps is too much, string “OCP TEST Error step overflow” is returned In the event of error in sweep parameters, string “OCP TEST Error parameter invalid” is returned
Sweep C result	SWCRES{SP} {NR1}	Gets measurement results by step number Argument 1 Step Number Range 0 to 1023	Return Value: Current value real value (##.###) Return Value: Current value real value (##.###)
Sweep C End No. of Steps	SWCRESSTP	Gets step number at completion of measurement	Return Value: Step number when measurement is complete integer If measurement is not complete, string “NOW Meas” is returned. If measurement is not executed, string “Measure Not starting” is returned
Sweep C PASS/FAIL Decision Results	SWCTRES	Gets PASS/FAIL decision results and current value used for decision	Return Value: PASS Real Value (##.####) Or FAIL Real Value (##.####) If the measurement is not complete, string “Now Measuring” is returned If measurement is not executed, string “NO OCP TEST” is returned

Sweep P basic setting	SWPSET{SP} {NR2}{C} {NR2}{C} {NR2}{C} {NR2}{C} {NR1}	 Argument 1 Initial power value Argument 2 End power value Argument 3 End voltage value Argument 4 Step power value Argument 5 Step time[ms]	Maximum no. of steps is 1024. Set the step value within this range.
Sweep P test setting	SWPTSET{SP} {NR2}{C} {NR2}	Sets PASS Range Argument 1 Max. power value Argument 2 Mini. power value	
Sweep P start	SWPSTART		Start of Sweep Mode During measurement, string “OPP TEST Error Already start” is returned Once the measurement is complete, string “TEST END” is returned. If the number of sweep steps is too much, string “OPP TEST Error step overflow” is returned In the event of error in sweep parameters, string “OPP TEST Error parameter invalid” is returned
Sweep P result	SWPRES{SP} {NR1}	Gets measurement results by step number Argument 1 Step Number Range 0 to 1023	Return Value: Current real value (##.###) Return Value: Voltage real value (##.###) Return Value: Real Power Value (##.###)
Sweep P End No. of Steps	SWPRESSTP	Gets step number at completion of measurement	Return Value: Step number when measurement is complete integer If measurement is not complete, string “NOW Meas” is returned. If measurement is not executed, string “Measure Not starting” is returned
Sweep P PASS/FAIL Decision Results	SWPTRES	Gets PASS/FAIL decision results and power value used for decision	Return Value: PASS Real Value (##.####) Or FAIL Real Value (##.####) If the measurement is not complete, string “Now Measuring” is returned If measurement is not executed, string “NO OPP TEST” is returned

Details inside the {} of command cannot be omitted.

NR1: Integer value, NR2: Real value (##.###), SP: Space (Blank), C: Comma

*1) Setting range of load and setting of measurement system cannot be changed independently. Same range will be selected.

*2) During single operation of dynamic mode of CD2, single operation is conducted with LOAD OFF → ON.

Sequence command

Function	Command	Operation and setting range	Remarks
Initialization command	SQI		All data is set to 0
Load data setting	SQD{SP}{NR1}{C}{NR2}{C}{NR2}	Argument 1 Data index No. (1 - 1024) Argument 2 SlewRate Argument 3 Load set value	Sets each load data
Execution conditions setting	SQU{SP}{NR1}{C}{NR1}{C}{NR1}{C}{NR2}	Argument 1 No. of repetitions 1 - 65535 (0 is unlimited) Argument 2 Start data index No. (1 - 1024) Argument 3 No. of data (1 - 1024) Argument 4 Step time[ms]	Sets execution conditions
Execution Start/Stop	SQC{SP}{NR1}	Range 0 - 1 0: Stop 1: Start	Controls Start/Stop

Details inside the {} of command cannot be omitted.

NR1: Integer value, NR2: Real value (##.###), SP: Space (Blank), C: Comma

*1) Depends on the load mode and current range presently setting. Value exceeding the maximum current of the current range set at present cannot be selected.

Current range cannot be changed in sequence operation.

System command

Function	Command	Operation and Setting range	Note
Return version	V	Return ROM version	
Return GPIB address	ADDR	Return GPIB address	
Reset alarm	AC	Reset alarm	
Initialize	INI	Initialized	Remote condition remains.
Clear	CL	Clear	Return back to power on condition.
Response data	T0	Comma, space	Separator for response data.
	T1	Comma	
	T2	Space	
SRQ setting	S0	None	Set the SRQ generation condition.
	S1	Command error	
	S2	Alarm generated	
	S3	Command error & alarm generated	

Multiline message

Multiline message is enabled when ATN signal is Low. Code of multiline command is sent as binary data. Therefore, it cannot be accessed with transmission command normally used.

Function	Command	Operation and setting range	Remarks
Device Clear	20	DCL(Device Clear)	Sets to the same state as when switching on the power supply.
	4	SDC(Selected Device Clear)	
Panel Operation	1	GTL(Go To Local)	Clears the remote status.

Status Register

Status Register can read the function (alarm and error) of the product with serial polling. The following table shows the details of each bit data.

Bit (HEX)	Abbreviation	Content	Note
80	ALM	Alarm generated	Set by ST0～ST2 bits
40	SRQ	Service request	When requesting interrupt
20	ERR	Command error	Return command status being executed.
10	BUSY	Command executing	Return command status being executed.
08	CLIMIT	Under current limit	Set when load control is malfunctioning. Other alarm conditions are read by QUES command.
04	PLIMIT	Under power limit	
02	ST1	Under other alarm	
01	ST0	Under over voltage alarm	

Return value of QUES command.

Return value (Decimal)	Abbreviation	Content	Note
1	ALARM_OVER_VOLT	Over voltage	No argument
2	ALARM_LIMIT_CURR	Over current	
8	ALARM_LIMIT_POWER	Over power	
16	ALARM_OVER_TEMP	Over heat	
1024	ALARM_EXT	Ext. alarm input	
2048	ALARM_REV_VOLT	Reverse connection	
4096	ALARM_BOOSCON	BOOSTER connection	
8192	ALARM_BOOSMODEL	BOOSTER connection. Model error.	

Example

Example of use of commands is given below.

• When measuring current (M range) and voltage by pulling the load with 0.1A setting of CC mode

<Command>	<Description>
RC 2	Sets the current range to M
CC 0.1	Set the load mode to CC and load current value to 0.1A
SW 1	Load ON
MC 2	Measures current in M range
MV	Measures voltage

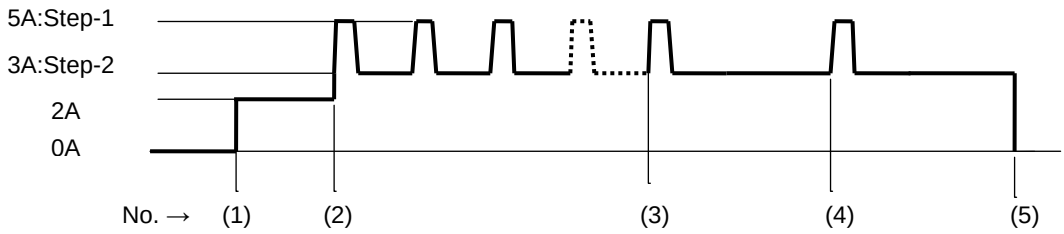
GPIB Sample Program

This is a sample program used in Microsoft's Visual Basic 6.0 using GPIB card/board of National Instruments. Refer to the instruction manuals and other literature supplied by Microsoft and National Instruments for the details of driver of GPIB card/board and Visual Basic 6.0.

Private Sub InitIF() of sample program is a function for initializing GPIB bus.
This is used commonly by all sample programs.

Sample-1): Command1_Click()
Basic program that display measurement results using the constant current mode.
Shows the results of measurement of voltage and current between terminals when the current is reduced from 50 A to 5 A in the constant current mode using default automatic settings of set load range. However, since the range of setting value in the constant current mode differs depending on product, align the set value with specifications of the product.

Sample-2): Command2_Click()
This program consecutively changes the load current as shown in the figure below using the dynamic constant current mode.
Number shown in the figure corresponds to the comment number inside sample program.



Sample-3): Command3_Click()
Program that reads status information via serial pole and then displays it.

```
Option Explicit
Dim IFid As Integer                                    ' NI I/F Device ID
Private Sub InitIF()

    If 0 <= ilfind("GPIB0") Then
        ' Init I/F
        IFid = ildev(0, 1, 0, T3s, 1, &HC0A)

        ilsic 0                                        ' Interface Clear
        ilsre 0, 1                                     ' Remote Enable

        ilwrt IFid, "INI", 3
        Sleep 3000
    Else
        MsgBox "GPIB I/F(GPIB0) can't find"
    End If
```

```
End Sub


Private Sub Command1_Click()                          ' Start of Sample-1)

    Call InitIF                                       ' GPIB I/F Initialization
    ilwrt IFid, "SW 1", 4                             ' LOAD ON

    Dim i As Integer
    Dim curr As Double
    Dim cmd As String
    Dim rcv As String

     curr = 50#                                       ‘ 50 A is set as initial value

    For i = 0 To 10                                   ' No. of loops is set to 11
        cmd = "CC " & CStr(curr)                       ' Constant current setting
                                                       command is created
        ilwrt IFid, cmd, Len(cmd)

        ilwrt IFid, "MV", 2                           ' Voltage measurement
                                                      ' Command is sent
        rcv = "                    "                   ' Area of strings received is filled
                                                       with blank
        ilrd IFid, rcv, 16                            ' Measurement value is received
        MsgBox rcv & "[V]", vbInformation, "Voltage"  ' Measured voltage is received

        ilwrt IFid, "MC 0", 4                          ' Current measurement command
                                                       is sent
        rcv = "                    "
        ilrd IFid, rcv, 16
        MsgBox rcv & "[A]", vbInformation, "Current"

        curr = curr - 5#                              ' Next set value is reduced by 5A
    Next i

    MsgBox "End CC set & Measure loop Sample Program"

    ilwrt IFid, "SW 0", 4                             ' LOAD OFF
    ilwrt IFid, "CC 0", 4                             ' Set value is 0A
End Sub                                               ' End of Sample-1)



Private Sub Command2_Click()                          ' Start of Sample-2)

    Call InitIF                                       ' GPIB I/F Initialization
```

```
    ilwrt IFid, "SW 1", 4                    ' LOAD ON
    ilwrt IFid, "CC 2", 4                    ' Constant current 2A is set
                                             ' (1)

    ilwrt IFid, "DP 1;DC 5;DT 10", 15        ' Step-1=5 A TIME-A=10 ms
    ilwrt IFid, "DP 2;DC 3;DT 40", 15        ' Step-2=3 A TIME-B=40 ms
    ilwrt IFid, "DR 5", 4                    ' RESPONSE=5 A/us

    MsgBox "Dynamic Load Start"              ' (2)

    ilwrt IFid, "CD 1", 4

    MsgBox "Dynamic Load Stop"               ' (3)

    ilwrt IFid, "CD 0", 4
    ilwrt IFid, "DP 2;DT 0", 9               ' TIME-B=0 ms

    MsgBox "Single shot Dynamic Load Start"

    ilwrt IFid, "CD 2", 4                    ' (4)

    MsgBox "End Dynamic Sample Program"

    ilwrt IFid, "SW 0", 4                    ' LOAD OFF
                                             ' (5)

    ilwrt IFid, "CC 0", 4                    ' Set value is 0A
End Sub                                      ' End of Sample-2)


Private Sub Command3_Click()                 ' Start of Sample-3)

    Call InitIF                              ' GPIB I/F Initialization

    Dim stb As Integer
    ilrsp IFid, stb                          ' Reading status information

    MsgBox CStr(stb)
End Sub                                      ' End of Sample-3)
```

USB Interface

A PC (OS: Windows XP(SP3)(32bit)/7/8/8.1/10(32bit/64bit)) with USB interface can control this instrument by Visual basic or VBA of Excel by connecting USB cable.
The commands are same as GPIB commands therefore same control is obtained.

Operational environment

OS	Microsoft Windows XP(SP3)(32bit)/7/8/8.1/10(32bit/64bit), Japanese edition
PC	IBM PC/AT equivalent model with USB interface

USB driver, OCX installation

The device driver to be installed to PC from the enclosed CD when USB is used.
The CD contains USB driver for Load Station series, control OCX and Control sample programs.
(*it is not a driver for LabVIEW. You need to install another one if you use LabVIEW. Please contact me.)

**LabVIEW are trademarks of National Instruments Corporation.

If the installation is not successful, download the latest driver software published on our website and try it.

■Installation and un-installation of USB driver

The ¥KG folder contains both ¥32bit and ¥64bit versions, so please use the appropriate one for each OS.
Installation of USB driver begins when “dpinst.exe” has been clicked in each folder.

※Use “Add and Delete of applications” in the Windows when uninstalling “Windows driver package-KEISOKU GIKEN (LN series) USB”.

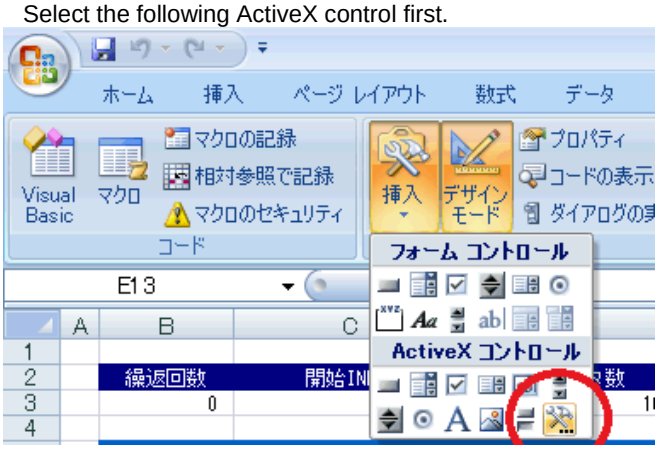
■Installation and un-installation of OCX

The installation will begin when “LN Series Setup.msi” in ¥Libs or “SETUP.EXE” has been clicked.

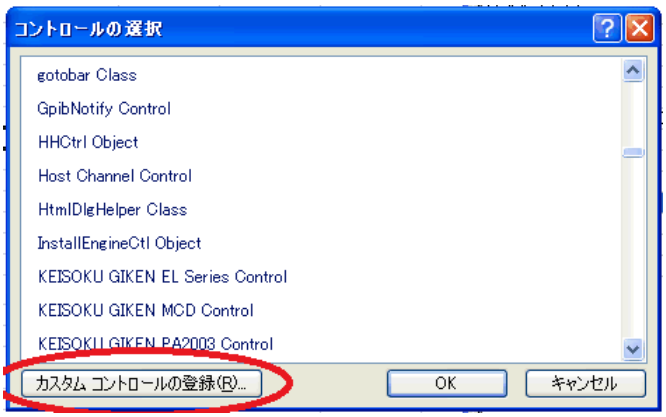
※Use “Add and Delete of applications” in the Windows when uninstalling “LN Series Library”

■Registration to Excel

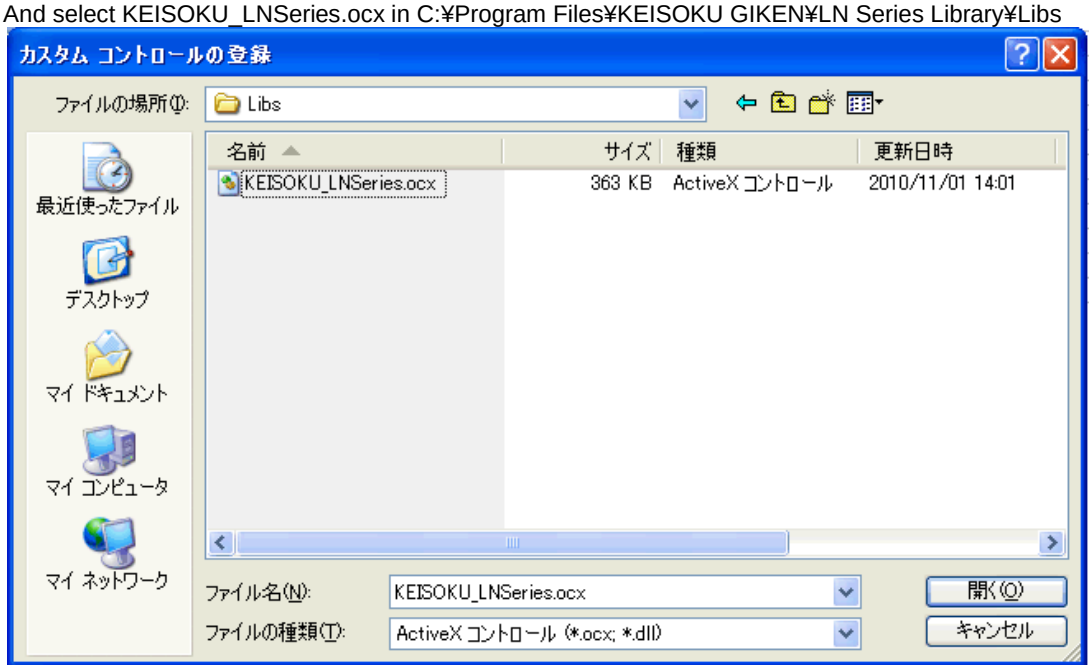
Select the following ActiveX control first.



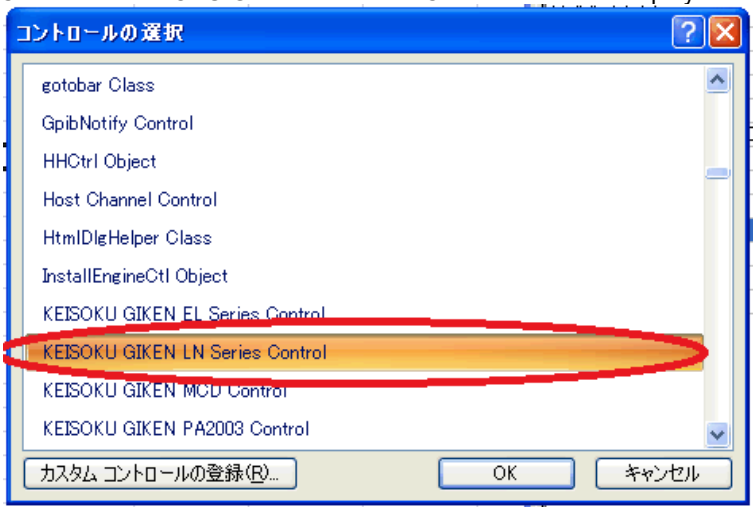
Then select Custom Control registration.



And select KEISOKU_LNSeries.ocx in C:¥Program Files¥KEISOKU GIKEN¥LN Series Library¥Libs



Confirm if “KEISOKU GIKEN LN Series Control” has been displayed on the Control Selection.



Control function reference

Note

There are commands in the library beside those listed herein but they are intended for factory use only.
Never use those commands as they might affect to the specifications.

Usable commands

CmdSend（dn As integer,str As string） As long
CmdRcv（dn As integer, str As Variant） As long

・CmdSend(dn As integer,str As string) As long
Executable as same as GPIB command.

ex) CmdSend 1, “CC 10” ‘Set at 10A at Constant current mode

・CmdRcv(dn As integer,str As Variant) As long
Receive the return value.

ex) CmdRcv 1, ret ‘ret = Return value

USB sample program

Sample program which are using Excel Visual basic. Refer to the technical book for Excel Visual basic.

Sample program
Import the version number of the firmware and show on the work sheet.

```
Private Sub CommandButton1_Click()      ‘This event will be generated when "CommandButton1" has been
                                          clicked.
    Dim ret As Variant
    Sheet1.KEISOKU_LNSeries1.CmdSend 1, "V"   ‘Export the GPIB version number which has been imported.
    Sheet1.KEISOKU_LNSeries1.CmdRcv 1, ret    ‘Receipt of data from this instrument
    Sheet1.Cells(1, 1) = ret                  ‘Input the Version number in the cell A1
End Sub
```

The firmware version information of this instrument will be shown on the work sheet after execution.

Control sample programs are included in the enclosed CD. Refer to the Chapter 6 Sequence mode accordingly.

Chapter 14 Maintenance

This chapter describes maintenance including inspection and cleaning.

Inspection and cleaning

Inspect and clean the product periodically for using it over a long period of time. For the replacement of accessories such as power cord set, please contact us or our agent.

Power cord set

Inspect it for breakage of coating, dirt in plug, breakage etc.

WARNING **There is a danger of electric shock.**

- **Do not use power cord set if there is any breakage in coating.**

Cleaning

Wipe off any dust on the product with soft cotton or wet cotton.

CAUTION Device may be damaged.

- Ensure to turn OFF the rear panel main POWER switch and remove the plug of power cord set from the power socket.
- Do not use organic solvents (benzene, acetone, etc.) that may deform plastic. Take necessary precaution so that liquids such as solvent do not get into the device.

Calibration

Please contact us or our agent for calibrating the product.

Storage

When not using the product for long time, store it in a dry place, free of dust and direct sunlight. It is recommended to cover it and store in a carton box.
Store in temperature range of –20 °C to 60 °C.

Chapter 15 Specifications

This chapter describes specifications and external dimensions of the product.

LN-300A / LN-300C

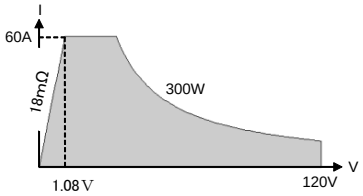
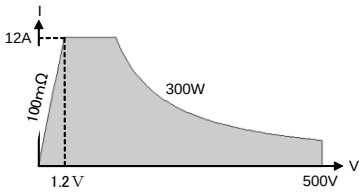
LN-1000A / LN-1000C

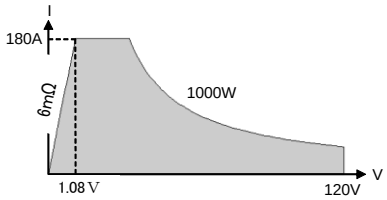
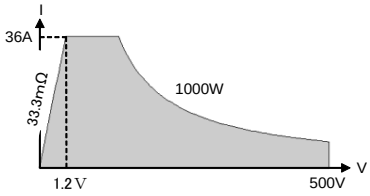
[set] refers to set value, [rdg] refers to reading and [F.S.] indicates maximum value in each range. Specifications indicate values after warm-up time of 30 minutes. Vin is load input voltage.

Values indicated with accuracy in specifications are guaranteed values (guaranteed for 6 months after delivery). Values without accuracy are nominal values or representative values (indicated as typ.).

Load Section

Rating

	LN-300A	LN-300C
Voltage	120 V	500 V
Current	60 A	12 A
Power *1	300 W	
Internal minimum resistance *2	18 mΩ or less	100 mΩ or less
Load range *2, 3		
	1.08 V(60 A) / 0.54 V(30 A) / 0.22 V(12 A)	1.2 V(12 A) / 0.6 V(6 A) / 0.28 V(2.8 A)

	LN-1000A	LN-1000C
Voltage	120 V	500 V
Current	180 A	36 A
Power *1	1000 W	
Internal minimum resistance *2	6 mΩ or less	33.3 mΩ or less
Load range *2, 3		
	1.08 V(180 A) / 0.54 V(90 A) / 0.22V(36 A)	1.2 V(36 A) / 0.6 V(18 A) / 0.28 V(8.4 A)

*1: Changes depending on temperature inside the case and operation time when using the product.
*2: At rear panel load terminal. This is not a set value of CR mode.
*3: Minimum operating voltage changes depending on current value.

Operation mode

Normal Mode (Constant Load)

	Common for Load Station Series
Constant current (CC) mode	Constant current will flow even if the load terminal voltage is changed.
Constant resistance (CR) mode	Current proportional to load terminal voltage will flow.
Constant voltage (CV) mode	Current will flow such that load terminal voltage remains constant.
Constant power (CP) mode	Current will flow such that load power remains constant.
External control (EXT) mode	Current proportional to voltage of external control input terminal will flow.
Short (SHORT) mode	Creates short circuit between load terminals (maximum current)

Dynamic mode (fluctuation load)

	Common for Load Station Series
Control method	Switching operation (2 types or maximum 16 types of load conditions can be changed in sequence and executed)
Usable load modes	CC / CR / CV / CP mode
Set cycle	~ 20 ms / ~ 200 ms / ~ 2 s / ~ 20 s / ~ 60 s
Cycle resolution capability	1 μs / 10 μs / 100 μs / 1 ms / 10 ms
Operation selection	Single(Time only), repeat

Sweep mode

	Common for Load Station Series
Sweep R (V-I characteristic test)	Current and voltage value are measured while changing the load in CR mode
Sweep C (overcurrent characteristic test)	Current and voltage value are measured while changing the load in CC mode
Sweep P (overpower characteristic test)	Power and voltage value are measured while changing the load in CP mode

Sequence operation (remote control only)

	Common for Load Station Series
Usable modes	CC / CR / CV / CP mode
Maximum steps	1024
Step time	1 ms ~ 10 min (common for each step)
Step time resolution	1 ms (1 ms ~ 100 ms) / 100 ms (100 ms ~ 10 min)
Repetitions	1～65535 or ∞

Load mode

Constant current (CC) mode

		LN-300A	LN-300C	LN-1000A	LN-1000C
Current setting range	H	0 A ~ 60 A	0 A ~ 12 A	0 A ~ 180 A	0 A ~ 36 A
	M	0 A ~ 6 A	0 A ~ 1.2 A	0 A ~ 18 A	0 A ~ 3.6 A
	L	0 A ~ 0.6 A	0 A ~ 0.12 A	0 A ~ 1.8 A	0 A ~ 0.36 A
Resolution	H	5 mA	1 mA	15 mA	3 mA
	M	0.5 mA	0.1 mA	1.5 mA	0.3 mA
	L	0.1 mA	0.02 mA	0.3 mA	0.06 mA
Setting accuracy *4	H	±{0.2% of set. +25 mA +Vin/50 kΩ}	±{0.2% of set. +10 mA +Vin/750 kΩ}	±{0.2% of set. +75mA +Vin/16.67 kΩ}	±{0.2% of set. +30mA +Vin/250 kΩ}
	M	±{0.2% of set. +12 mA +Vin/50 kΩ}	±{0.2% of set. +3 mA +Vin/750 kΩ}	±{0.2% of set. +36mA +Vin/16.67 kΩ}	±{0.2% of set. +9 mA +Vin/250 kΩ}
	L	±{0.2% of set. +6 mA +Vin/50 kΩ}	±{0.2% of set. +2 mA +Vin/750 kΩ}	±{0.2% of set. +18mA +Vin/16.67 kΩ}	±{0.2% of set. +6 mA +Vin/250 kΩ}
SlewRate *5 (Current range)	H	0.2 A / µs ~ 20 A / µs	0.01 A / µs ~ 1 A / µs	0.3 A / µs ~ 30 A / µs	0.03 A / µs ~ 3 A / µs
	M	0.02 A / µs ~ 2 A / µs	0.001 A / µs ~ 0.1 A / µs	0.03 A / µs ~ 3 A / µs	0.003 A / µs ~ 0.3 A / µs
	L	0.005 A / µs ~ 0.5 A / µs	0.00025 A / µs ~ 0.025 A / µs	0.0075 A / µs ~ 0.75 A / µs	0.00075 A / µs ~ 0.075 A / µs

*4: At ambient temperature 23°C ±5°C.

*5: At rear panel load terminal.
Can be set only in CC mode and EXT mode.
In CV mode, it will be response time setting.
Cannot be set in CR, CP and SHORT modes.

Constant resistance (CR) mode

		LN-300A	LN-300C	LN-1000A	LN-1000C
Voltage range		20 V	85 V	20 V	85 V
Resistance setting range	Current range : H	40.000 S ~ 0.005 S (0.025 Ω ~ 200 Ω)	3.3333 S ~ 0.0004 S (0.3 Ω ~ 2.5 kΩ)	120.00 S ~ 0.01 S (0.0083 Ω ~ 66.667 Ω)	10.000 S ~ 0.001 S (0.1 Ω ~ 833.33 Ω)
	Current range : M	4.000 S ~ 0.0005 S (0.25 Ω ~ 2 kΩ)	0.33333 S ~ 0.00004 S (3 Ω ~ 25 kΩ)	12.000 S ~ 0.001 S (0.0833 Ω ~ 666.67 Ω)	1.0000 S ~ 0.0001 S (1 Ω ~ 8333.3 Ω)
Resolution	Current range : H	4 mS	333 µS	12 mS	1 mS
	Current range : M	400 µS	33 µS	1.2 mS	0.1 mS

		LN-300A	LN-300C	LN-1000A	LN-1000C
Voltage range		120 V	500 V	120 V	500 V
Resistance setting range	Current range : H	13.333 S ~ 0.0016 S (0.075 Ω ~ 600 Ω)	1.1111 S ~ 0.0001 S (0.9 Ω ~ 7 kΩ)	40.000 S ~ 0.005 S (0.025 Ω ~ 200 Ω)	3.3333 S ~ 0.0004 S (0.3 Ω ~ 2.3333 kΩ)
	Current range : M	1.3333 S ~ 0.00016 S (0.75 Ω ~ 6 kΩ)	0.11111 S ~ 0.00001 S (9 Ω ~ 70 kΩ)	4.0000 S ~ 0.0005 S (0.25 Ω ~ 2 kΩ)	0.33330 S ~ 0.00004 S (3 Ω ~ 23.333 kΩ)
Resolution	Current range : H	1.33 mS	111 µS	3.99 mS	333 µS
	Current range : M	133 µS	11 µS	399 µS	33 µS
Setting accuracy *6		±{0.5% of Conv.Curr. +0.2% of F.S. +Vin/50 kΩ}	±{0.5% of Conv.Curr. +0.2% of F.S. +Vin/750 kΩ}	±{0.5% of Conv.Curr. +0.2% of F.S. +Vin/16.67 kΩ}	±{0.5% of Conv.Curr. +0.2% of F.S. +Vin/250 kΩ}

*6: Conv.Curr. indicates the ideal current value of “Vin / Set Resistance”.
Vin is valid starting from voltage of 1/10V and more for the selected voltage range.
F.S. is the full scale current of current H range.
At ambient temperature 23°C ±5°C.

Constant voltage (CV) mode

		LN-300A	LN-300C	LN-1000A	LN-1000C
Voltage setting range	H	0 V ~ 120 V	0 V ~ 500 V	0 V ~ 120 V	0 V ~ 500 V
	L	0 V ~ 20 V	0 V ~ 85 V	0 V ~ 20 V	0 V ~ 85 V
Resolution	H	10 mV	50 mV	10 mV	50 mV
	L	2 mV	10 mV	2 mV	10 mV
Setting accuracy *7		±{0.1% of set. +0.1% of F.S.}			
Response time		Fast / Slow			

*7: At ambient temperature 23°C ±5°C.

Constant power (CP) mode

		LN-300A	LN-300C	LN-1000A	LN-1000C
Power setting range	Current range : H	0 W ~ 300 W		0 W ~ 1000 W	
	Current range : M	0 W ~ 40 W		0 W ~ 120 W	
Resolution	Current range : H	50 mW		167 mW	
	Current range : M	5 mW		16.7 mW	
Setting accuracy *8		±{0.6% of set. +1.4% of F.S. +(Vin×Vin) /50 kΩ}	±{0.6% of set. +1.4% of F.S. +(Vin×Vin) /750 kΩ}	±{0.6% of set. +1.4% of F.S. +(Vin×Vin) /16.67 kΩ}	±{0.6% of set. +1.4% of F.S. +(Vin×Vin) /250 kΩ}

*8: F.S. is the full scale power of current H range.
At ambient temperature 23°C ±5°C.

External control (EXT) mode

		LN-300A	LN-300C	LN-1000A	LN-1000C
Current setting range	H	0 A ~ 60 A	0 A ~ 12 A	0 A ~ 180 A	0 A ~ 36 A
	M	0 A ~ 6 A	0 A ~ 1.2 A	0 A ~ 18 A	0 A ~ 3.6 A
Resolution	H	10 mA	2 mA	30 mA	6 mA
	M	1 mA	0.2 mA	3 mA	0.6 mA
Setting accuracy *9		±{0.2% of set. +0.5% of F.S. +Vin/50 kΩ}	±{0.2% of set. +0.5% of F.S. +Vin/750 kΩ}	±{0.2% of set. +0.5% of F.S. +Vin/16.67 kΩ}	±{0.2% of set. +0.5% of F.S. +Vin/250 kΩ}
Control voltage		0 V ~ 10 V			

*9: Accuracy of external control mode is only when control voltage input is 10V.
At ambient temperature 23°C ±5°C.

Short (SHORT) mode

	LN-300A	LN-300C	LN-1000A	LN-1000C
Short current (max. value)	60 A	12 A	180 A	36 A

Measurement Section

DC voltage measurement

		LN-300A	LN-300C	LN-1000A	LN-1000C
Voltage measurement range *10	Voltage range : H	0 V ~ 120 V	0 V ~ 500 V	0 V ~ 120 V	0 V ~ 500 V
	Voltage range : L	0 V ~ 20 V	0 V ~ 85 V	0 V ~ 20 V	0 V ~ 85 V
Resolution	Voltage range : H	10 mV			
	Voltage range : L	1 mV			
Measurement accuracy *11		±{0.05% of rdg. +0.05% of F.S.}			
Measurement time *12		Approx. 100 ms			

*10: Voltage measurement range changes in accordance with the voltage set range selected.

*11: At ambient temperature 23°C ±5°C.

*12: This specification does not apply immediately after the voltage range has changed.

DC current measurement

		LN-300A	LN-300C	LN-1000A	LN-1000C
Current measurement range *13	Current range : H	0 A ~ 60 A	0 A ~ 12 A	0 A ~ 180 A	0 A ~ 36 A
	Current range : M	0 A ~ 6 A	0 A ~ 1.2 A	0 A ~ 18 A	0 A ~ 3.6 A
	Current range : L	0 A ~ 0.6A	0 A ~ 0.12 A	0 A ~ 1.8 A	0 A ~ 0.36 A
Resolution	Current range : H	0.5 mA		1.5 mA	
	Current range : M	0.1 mA		0.3 mA	
	Current range : L	0.1 mA		0.3 mA	
Measurement accuracy *14	Current range :H, M	±{0.2% of rdg. +0.2% of F.S.}			
	Current range : L	±{0.2% of rdg. +0.5% of F.S.}			
Measurement time *15		Approx. 100 ms			

*13: Current measurement range changes in accordance with the current set range selected.

*14: At ambient temperature 23°C ±5°C.

*15: This specification does not apply immediately after the voltage range has changed.

Power measurement

	Common for Load Station Series
Measurement method *16	Calculation method [measured voltage × measured current]
Measurement time *17	Approx. 200 ms

*16: Measurement results are shown as absolute values.

*17: This specification does not apply immediately after the voltage range has changed.

Ripple noise measurement (Optional)

DC voltage measurement

	Common for Load Station Series		
Measurement range	±6 V	±60 V	±500 V
Resolution	0.1 mV	1.0 mV	10.0 mV
Measurement auto range	–6.0000 V ~ 6.0000 V	–60.000 V ~ –5.600 V 5.600 V ~ 60.000 V	–500.00 V ~ –56.00 V 56.00 V ~ 500.00 V
Measurement accuracy *18	±{0.025% of rdg. +0.025% of F.S.}		
Maximum applied voltage	±500 V		
Measurement time *19	Approx. 100 ms		

*18: At ambient temperature 23°C ±5°C.

*19: This specification does not apply immediately after the voltage range has changed.

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Ripple / noise voltage measurement

		Common for Load Station Series	
Maximum Input voltage		±3 V	
Measurement range		300 mV	3000 mV
Resolution		0.1 mV	1.0 mV
Measurement accuracy *20		±{2% of rdg. +1% of F.S.}	
Filter	THRU	50 Hz ~ 100 MHz	
	LPF *21	50 Hz ~ 2 kHz	
	HPF *22	5 kHz ~ 100 MHz	
20 MHz bandwidth limit		50 Hz ~ 20 MHz	
Ripple ratio *23, 24		0.0% ~ 50.0% (Per 0.5%)	
Measurement time *23, 25		Approx. 350 ms	

*20: In ripple ratio of 0% to 10%
In the range of 10 kHz to 10 MHz
At ambient temperature 23°C ±5°C.

*21: LPF=Low Pass Filter

*22: HPF=High Pass Filter

*23: In the range of 10 kHz to 10 MHz

*24: Ripple ratio is the ratio of switching ripple period originating from switching period and time with ripple noise.
Measured values of ripple voltage and noise voltage becomes equal at 0.0% setting.

*25: This specification does not apply immediately after the voltage range has changed.

Power measurement

	Common for Load Station Series
Measurement method *26	Input voltage × Load current
Measurement time *27	Approx. 200 ms

*26: Measurement results are shown as absolute values.
*27: This specification does not apply immediately after the voltage range has changed.

Input terminal

	Common for Load Station Series
Terminal (rear panel), impedance	BNC connector, DC 1 MΩ, high frequency 50 Ω

Limit function

Current

		LN-300A	LN-300C	LN-1000A	LN-1000C
Current setting range	Current range : H, M, L	0 A ~ 60 A	0 A ~ 12 A	0 A ~ 180 A	0 A ~ 36 A
Resolution	Current range : H	0.1 A			
	Current range : M	10 mA			
	Current range : L	1 mA			
Limit operation		Load off or current is restricted at 110% of set value (select)			

Power

	LN-300A	LN-300C	LN-1000A	LN-1000C
Rated Power	300 W		1000 W	
Limit operation	Load off or power is restricted at 110% of rated power (select)			

Sensing

	Common for Load Station Series
Function	Voltage detection can be selected either INT (load terminal) or EXT (EXT IN terminal), selectable by switch.
EXT IN Terminal (rear panel)	One touch terminal block, load terminal potential

Parallel operation, multichannel synchronized operation

	Common for Load Station Series
Parallel operation	Method of connecting slave device in parallel with specifying 1 unit as a master device. Up to 9 units having same rated voltage as master unit can be used as slave devices in parallel connection (LN-300A, or LN-1000A if the master device LN-300A). In parallel operation, only H range and M range can be used as current range.
Multi channel synchronized operation	ON/OFF control and load change for multiple Load Station Series can be conducted in synchronized manner. Unlike parallel operation, slave device need not have the same rated voltage as master device. Maximum of 9 slave devices can be connected to the master device.

Interface

	Common for Load Station Series
USB	USB2.0 compliant, USBTMC

Note: Communication error may occur when using USB hub. It is recommended to use properly shielded short cable.

	Common for Load Station Series
GPIB (option)	IEEE488.1 compliant (Address 1-30, factory default setting is 1)

DIDO (option simultaneously supplied with GPIB)

Control Input (Edge detection)

	Common for Load Station Series		
Load ON/OFF	Photo coupler LED input	*28	L: Load off, H: Load on
Current range specified	Photo coupler LED input 2 bit	*28	LL: Maintain same status, LH:L range, HL:M range, HH:H range
Voltage range specified	Photo coupler LED input	*28	L:L range, HH:H range
External alarm	Photo coupler LED input	*28	Occurred with H
Protection / alarm clear	Photo coupler LED input	*28	Cleared with H

Note: H indicates that photo coupler LED is ON, while L indicates that photo coupler LED is off.

*28: In series with LED, resistance of 2.4 kΩ is supplied. Applying 5V-12V voltage results in H. Ensure that input current is below 4.5 mA.

Status Output

	Common for Load Station Series	
LOAD ON/OFF	Photo coupler open collector output *29	Open: LOAD OFF, Close: LOAD ON
Current range	Photo coupler open collector output *29 2 bit	STATUS1 L range: close, M range: open, H range: close STATUS2 L range: open, M range: close, H range: close
Voltage range	Photo coupler open collector output *29	Open:L range, Close:H range
Protection / alarm status	Photo coupler open collector output *29	Open: None, Close: In operation
User defined output	Photo coupler open collector output *29	Open or Close
Sweep decision	Photo coupler open collector output *29	Open:Pass, Close:Fail

*29: Open collector output. Maximum applied voltage 30V, collector current 10 mA.

Power supply output

	Common for Load Station Series
Power supply output	12V, Max. 100 mA, case potential

Protection and alarm function

	Common for Load Station Series
Overcurrent protection	By current limit function (Load Off or current limit)
Overpower protection	By power limit function (Load Off or power limit)
Overheat protection	LOAD OFF
Overvoltage alarm *30	LOAD OFF
Reverse connection alarm *30	LOAD OFF

*30: Device will turn to LOAD OFF due to overvoltage, reverse connection alarm function, however, voltage that caused this will continue to be applied. Promptly remove the root cause.

Trigger output (only for Dynamic mode)

		Common for Load Station Series
Output		Photo coupler output
Output voltage	Step 1	+4 V(typ.)
	After step 2 ahead	0 V(typ.)
Terminal (rear panel)		One touch terminal block, case potential

Current monitor

		LN-300A	LN-300C	LN-1000A	LN-1000C
Monitor output	Current range : H, M	5 V / 60 A	5V / 12 A	5 V / 180 A	5 V / 36 A
	Current range : L	0.2 V / 0.6 A	0.2 V / 0.12 A	0.2 V / 1.8 A	0.2 V / 0.36 A
Output Impedance *31		50 Ω			
Measurement accuracy *32	Current range : H, M	±{1% of Conv.Volt. +1% of F.S.}			
	Current range : L	±{5% of Conv.Volt. +3% of F.S.}			
Terminal (rear panel)		BNC connector, Load terminal potential			

*31: When terminated at 1 MΩ.

*32: Conv.Volt. indicates converted voltage of “Measurement current value X (current monitor F.S. / Rated current)”.

Power supply input

	LN-300A	LN-300C	LN-1000A	LN-1000C
Voltage	85 V ~ 264 V Overvoltage Category Ⅱ			
Frequency	50 Hz ±2 Hz or 60 Hz ±2 Hz			
Power consumption	60 VA or less		65 VA or less	

Withstand voltage and insulation resistance

Power input vs. bundle of load terminal and case

	Common for Load Station Series
Withstand voltage	AC1500 V / 1 minute
Insulation resistance	30 MΩ or more (DC500 V)

Safety and EMC (Electro-Magnetic Compatibility)

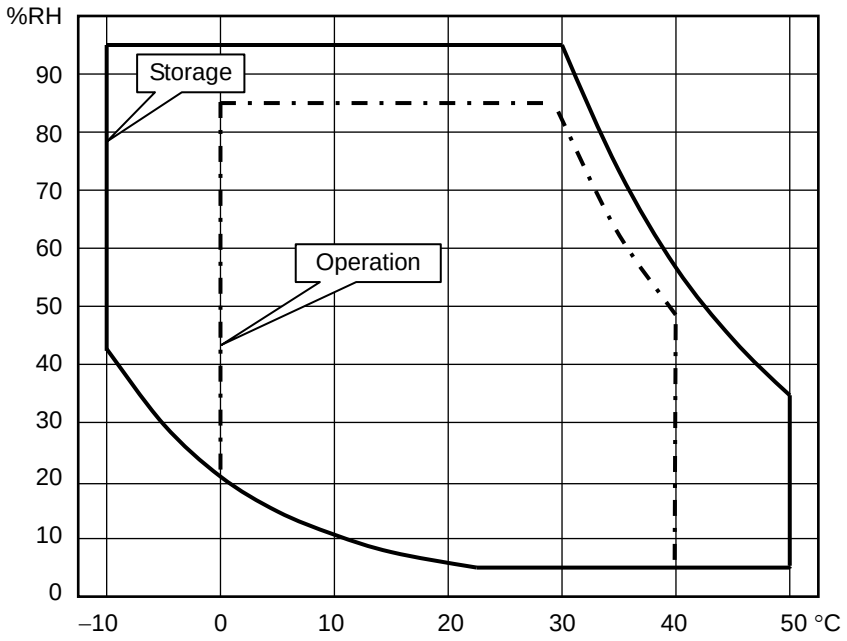
	Only models with CE marking on the rear panel
Safety	EN61010-1 : 2010 3rd Pollution degree : 2
EMC *33	EN61326-1 : 2013(Class A)

*33: When it receives a strong electro-magnetic field, the measured value and load setting may be changed.

Operating Environment

	Common for Load Station Series
Operating Environment	Indoor use
Altitude	Under 2000 m
Cooling method	Forced cooling
Operating temperature, humidity	0 ˚C ~ 40 ˚C, 20 ~ 85 %RH Absolute humidity 1 to 25 g/m^3, no condensation Temperature range is restricted for some of the specifications. In case of condensation, do not use the product before it is fully dry.
Storage temperature, humidity	–20 °C ~ 60 °C, 20 ~ 85 %RH Absolute humidity 1 to 29 g/m^3, no condensation

Ambient temperature and humidity range is shown below.



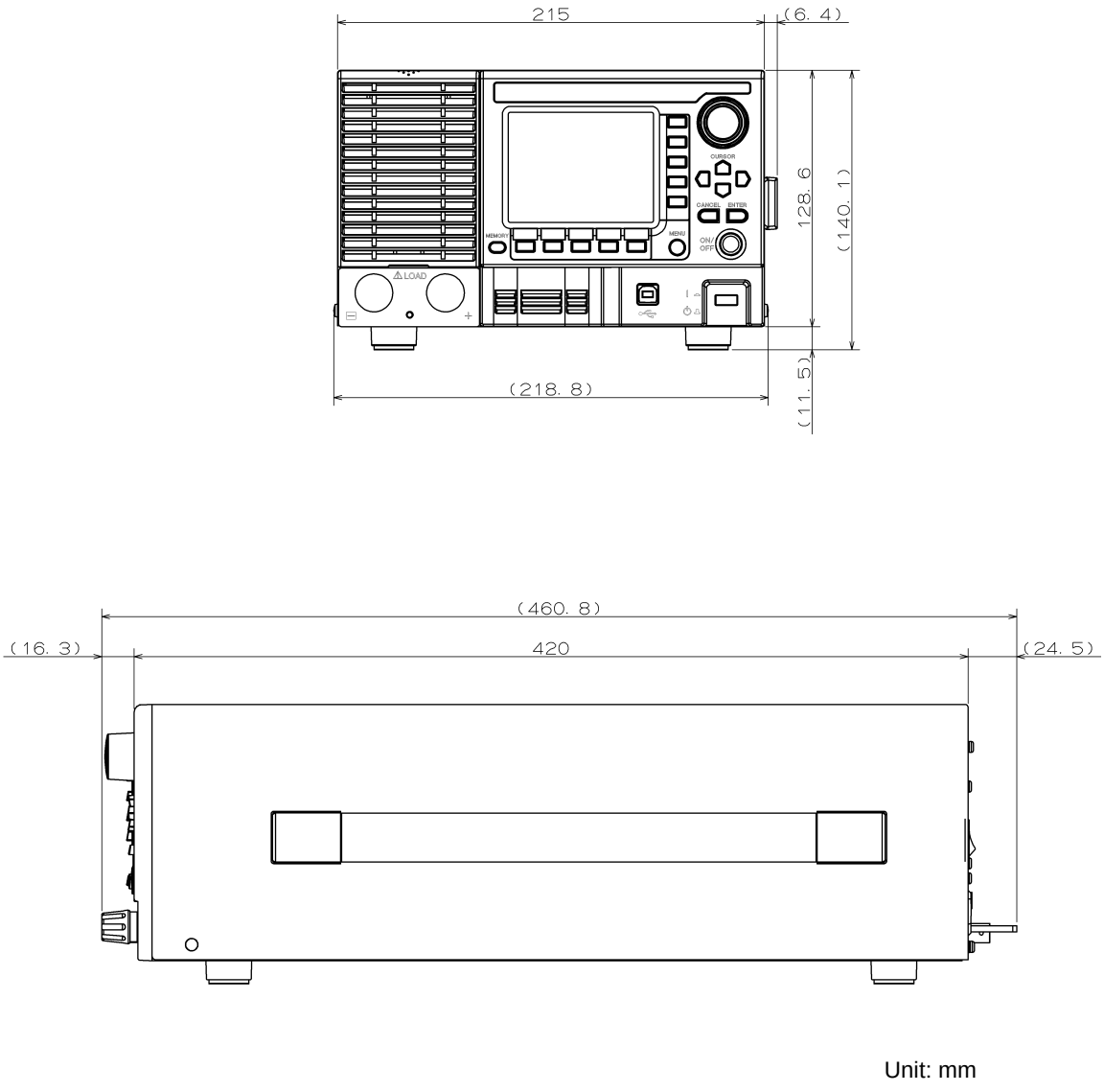
External dimension, Weight, and Load Terminal Shape

		LN-300A	LN-300C	LN-1000A	LN-1000C
Load terminal shape	Front	Binding post		M8 terminal	
	Rear	M6 terminal		M8 terminal	
Dimensions (W × H × D) (not including protrusions)		215 × 128.6 × 420 mm		430 × 128.6 × 450 mm	
Weight		Approx. 6.5 kg		Approx.13 kg	

Optional

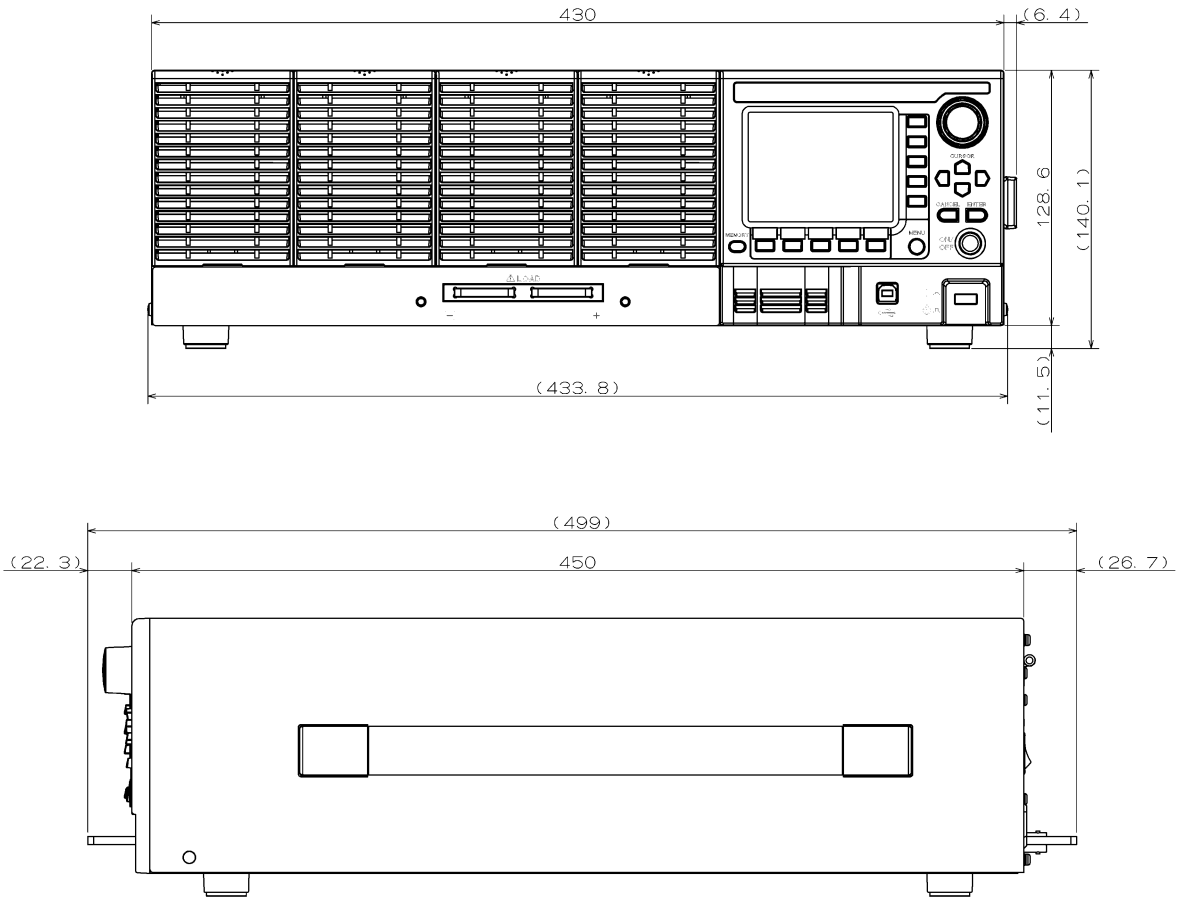
Option name	Description	Remarks
GPIB/DIDO LX-OP01	GPIB communication and external control (DIDO) functions are added.	When ordering or after buying
Ripple noise measurement RC-02A	This will add the measurement function equivalent to ripple noise measurement using 100 MHz oscilloscope recommended by Japan Electronics and Information Technology Industries Association (JEITA) standard.	When ordering
MASTER/SLAVE connection cable LX-OP03	Cable used in parallel operation and multichannel synchronized operation.	When ordering or after buying
Current monitor connection cable BPK1W-58	This cable is connected to the current monitor output.	When ordering or after buying
Differential probe DP-100	This probe reduces common mode noise from the signal which causes measurement error.	When ordering or after buying
Low inductance cable LL-050 LL-100 LL-200	This can minimize the inductance of the loading cables. Ex. LL-050 has inductance of 80nH which is about 1/5 of regular gauge cable (7AWG)	When ordering or after buying

External Dimensions



Unit: mm

Figure 14-1 LN-300A, LN-300C



Unit: mm

Figure 14-2 LN-1000A, LN-1000C

Appendix A

Appendix A describes factory default settings.

Factory Default Setting

Set to factory default setting

Enter the system screen

Press the MENU key and enter the menu of Menu screen. If you are already in the Menu screen, go to Step 2.

1. **Press the MENU key.**
   Menu screen will appear.
2. **Select the right most button of the horizontal menu.**
   System screen will appear. System Menu has 3 pages. Select 3/3.
3. **Select 12. Reset on the horizontal menu 3/3.**
4. **Select Factory Default on the vertical menu.**
5. **Follow the instructions on screen and restart.**

Contents of factory default setting

Normal Mode

Items	Description	Factory default value
Mode	Load mode	CC
Voltage.	Voltage range	H range
Current.	Current range	Auto range
Value	CC mode	MIN.
	CR mode	MIN.
	CV mode	MAX.
	CP mode	MIN.
	EXT mode	MIN.
	SHORT mode	-
SlewRate	CC mode	MAX.
	CV mode	Fast
	EXT mode	MAX.

Normal Mode

RC-02A Ripple Noise Measurement Option

Items	Description	Factory default value
Ratio	Ripple ratio	0.0%
DC	DC voltage range	Auto
Noise & Ripple	Ripple noise voltage range	Auto
Filter	Filter	50 Hz
Band	Band width limit	FULL

Dynamic mode (Freq.)

Items	Description	Factory default value
Mode	Load mode	CC
Period	Period	0.100 ms
Duty1	Duty ratio	0.00%

Dynamic mode (Time)

Items	Description	Factory default value
Step	Step number	1
Time	Each step execution time	0.000 ms
Mode	Load mode	CC
Repeat	Repeat operation	ON

Sweep R (V-I Characteristic test)

Items	Description	Factory default value
Init. G	Initial conductance value	MIN.
Step G	Step conductance value	MIN.
End G	End conductance value	MIN.
End V	End voltage	0.000 V
Fine V	Fine sweep start voltage	0.000 V
FineStep	Fine step, conductance value	0.000 S
Time	Step execution time	200 ms

Sweep C (Overcurrent protection characteristic test)

Items	Description	Factory default value
Init. C	Initial current value	MIN.
Step C	Step current value	MIN.
End C	End current value	MIN.
End V	End voltage	0.000 V
C High	PASS/FAIL decision upper limit	0.000 A
C Low	PASS/FAIL decision lower limit	0.000 A
Time	Step execution time	200 ms

Sweep P (Overpower protection characteristic test)

Items	Description	Factory default value
Init. P	Initial power value	MIN.
Step P	Step power value	MIN.
End P	End power value	MIN.
End V	End voltage	0.000 V
P High	PASS/FAIL decision upper limit	0.000 W
P Low	PASS/FAIL decision lower limit	0.000 W
Time	Step execution time	200 ms

Menu

Items	Description	Factory default value
1.Func.	Operation mode	Normal
2.CLim.	Current limit set value	H range, MAX.
3.Meas.	Top	Voltage
	Middle	Current
	Bottom	Power
4.MRate	Measurement sample frequency	50 Hz
5.M/S	Master device, slave device	OFF（Slave device）
6.VMode	Auto load mode switching	OFF
7.VLev.	VMode specify voltage	0.0000 V

System setting

Items	Description	Factory default value
1.GPIB	GPIB address	1
2.DIDO	Enables external control	Disable
3.Range	Enables external control of voltage and current range	Disable
4.PwrOn	Saves the setting for next startup session	Settings to factory default values
5.LCD	Sets brightness of LCD backlight	6
6.Color	LCD color	Normal
7.Lang.	Selects the screen language	English
8.Firm.	Firmware information	-
9.OCP	LOAD OFF when overcurrent protection is enabled	Enable
10.OPP	LOAD OFF when overpower protection is enabled	Enable
11.I/F	Selection of external interface	USB / GPIB
12.Reset	Settings to factory default values	-

Initializing（INI Command）setting

Contents of initializing setting

Normal Mode

Items	Description	Factory default value
Mode	Load mode	CC
Voltage.	Voltage range	H range
Current.	Current range	Auto range
Value	CC mode	MIN.
	CR mode	MIN.
	CV mode	MAX.
	CP mode	MIN.
	EXT mode	MIN.
	SHORT mode	-
SlewRate	CC mode	MAX.
	CV mode	Fast
	EXT mode	MAX.

RC-02A Ripple Noise Measurement Option

Items	Description	Factory default value
Ratio	Ripple ratio	0.0%
DC	DC voltage range	Auto
Noise & Ripple	Ripple noise voltage range	Auto
Filter	Filter	50 Hz
Band	Band width limit	FULL

Dynamic Mode(Freq.)

Items	Description	Factory default value
Mode	Load mode	CC
Period	Period	0.100 ms
Duty1	Duty ratio	0.00%

Dynamic Mode(Time)

Items	Description	Factory default value
Step	Step number	1
Time	Each step execution time	0.000 ms
Mode	Load mode	CC
Repeat	Repeat operation	ON

Sweep R (V-I Characteristic test)

Items	Description	Factory default value
Init. G	Initial conductance value	MIN.
Step G	Step conductance value	MIN.
End G	End conductance value	MIN.
End V	End voltage	0.000 V
Fine V	Fine sweep start voltage	0.000 V

FineStep	Fine step, conductance value	0.000 S
Time	Step execution time	200 ms

Sweep C(Overcurrent protection characteristic test)

Items	Description	Factory default value
Init. C	Init. C	Initial current value
Step C	Step C	Step current value
End C	End C	End current value
End V	End V	End voltage
C High	C High	PASS/FAIL decision upper limit
C Low	C Low	PASS/FAIL decision lower limit
Time	Time	Step execution time

Sweep P(Overpower protection characteristic test)

Items	Description	Factory default value
Init. P	Initial power value	MIN.
Step P	Step power value	MIN.
End P	End power value	MIN.
End V	End voltage	0.000 V
P High	PASS/FAIL decision upper limit	0.000 W
P Low	PASS/FAIL decision lower limit	0.000 W
Time	Step execution time	200 ms

Menu

Items	Description	Factory default value
1.Func.	Operation mode	Normal

Appendix B

Appendix B describes the method of using RC-02A ripple noise measurement option. RC-02A ripple noise measurement option can be added at the time of shipping from the factory.

RC-02A Ripple Noise Measurement Option

Overview

This will add the measurement function equivalent to ripple noise measurement using 100 MHz oscilloscope recommended by Japan Electronics and Information Technology Industries Association (JEITA) standard.

Features

- Creates frequency band up to 100 MHz.
- Band limitation (~20 MHz) can be selected.
- AC ripple and switching ripple can be individually measured.
- Measurement values of DC voltage and ripple noise voltage can be added.
- For separating ripple noise, without using low-pass filter, spike noise pulse width ratio based separation method is used. With this, results very similar to conventional oscilloscope observation can be obtained.
- Ripple ratio can be set between 0.0% to 50.0% (0.5% step).

Definition of Terms, Separating Ripple Noise

Definition of terms

Figure B.1 shows a representative example of output voltage waveform of switching power supply.

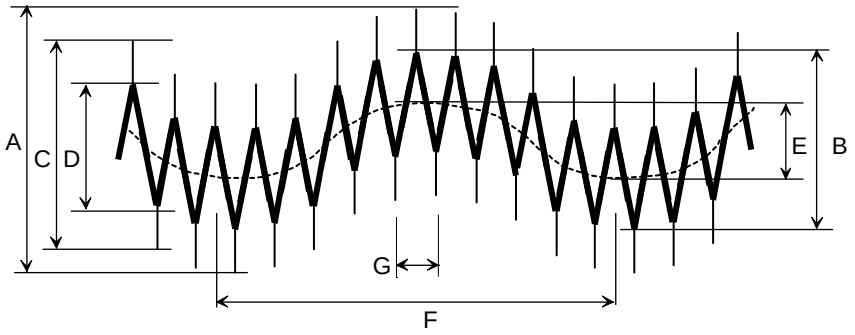


Figure B.1 Example of output voltage of switching power supply

A: Ripple noise voltage
B: Ripple voltage
C: Noise voltage
D: Switching ripple voltage
E: AC ripple voltage
F: AC input voltage period
G: Switching period

Ripple Ratio: t/T X 100(%), where T is switching period and t is pulse width of spike noise.
It is pulse width of spike noise against switching period (Refer to Figure B.3).

Separating ordinary ripple noise

Spike noise of switching power output usually takes the waveform shown in Figure B.2. Spike noise that occurs for every switching cycle gets integrated by smoothing condenser or filter and generates triangular wave shape ripple voltage. Switching phase of transition is followed by a large spike shape noise and gets superimposed near peak and trough of ripple voltage.

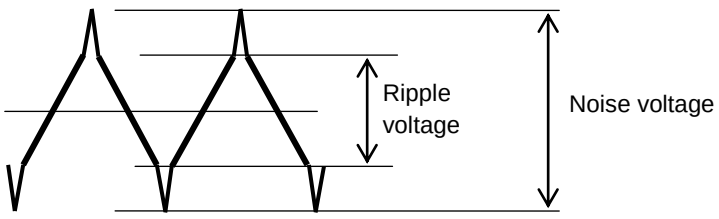


Figure B.2 Example of Switching Ripple Waveform

Method using low-pass filter

There are various methods of separating ripple voltage from this waveform. An easy method is to remove high-frequency component of spike noise with low-pass filter and then measuring it as ripple voltage. However, in this method, measurement is not accurate due to the effect of ripple voltage wave form as only spike component can be removed.

In case of method using low-pass filter, separation with filter becomes difficult when spike frequency changes drastically (20 kHz or 500 kHz) or when pulse width of spike is large.

Separation using pulse width duty ratio (ripple ratio)

In RC-02A, as a method of separating ripple voltage, separation method using pulse width duty ratio (ripple ratio) is used.

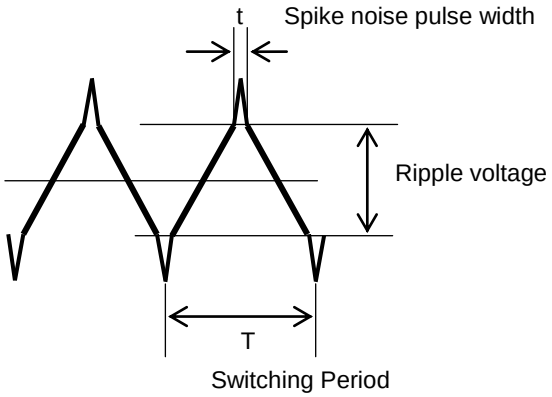


Figure B.3 Spike Noise Separation Method using Pulse Width Duty Ratio

For 1 period of switching, voltage level is calculated so that pulse width duty ratio of spike noise becomes equal to the specific ripple ratio. This value is then taken as ripple voltage. Ripple ratio can be specified between the range of 0.0% to 50.0%. Since this method can separate the spike noise without affecting the original waveform in the entire bandwidth, results obtained are quite similar to measurement results of conventional oscilloscope.

Setting ripple ratio which matches the measurement results of oscilloscope

Ripple voltage is a function of ripple ratio

Measurement results for ripple voltage differs from the set value of ripple ratio. Since ripple ratio is the ripple voltage obtained after separating spike noise, it can be said that ripple voltage is related to ripple ratio.

To focus on oscillation component of ripple or spike noise and express it in a quantitative manner, it is ideal to measure ripple voltage for each ripple ratio (0.0% to 10.0% etc). However, existence of multiple ripple measurement values is generally confusing and also takes lot of measurement effort. The following paragraph describes the method of setting ripple ratio that matches with measurement results of oscilloscope.

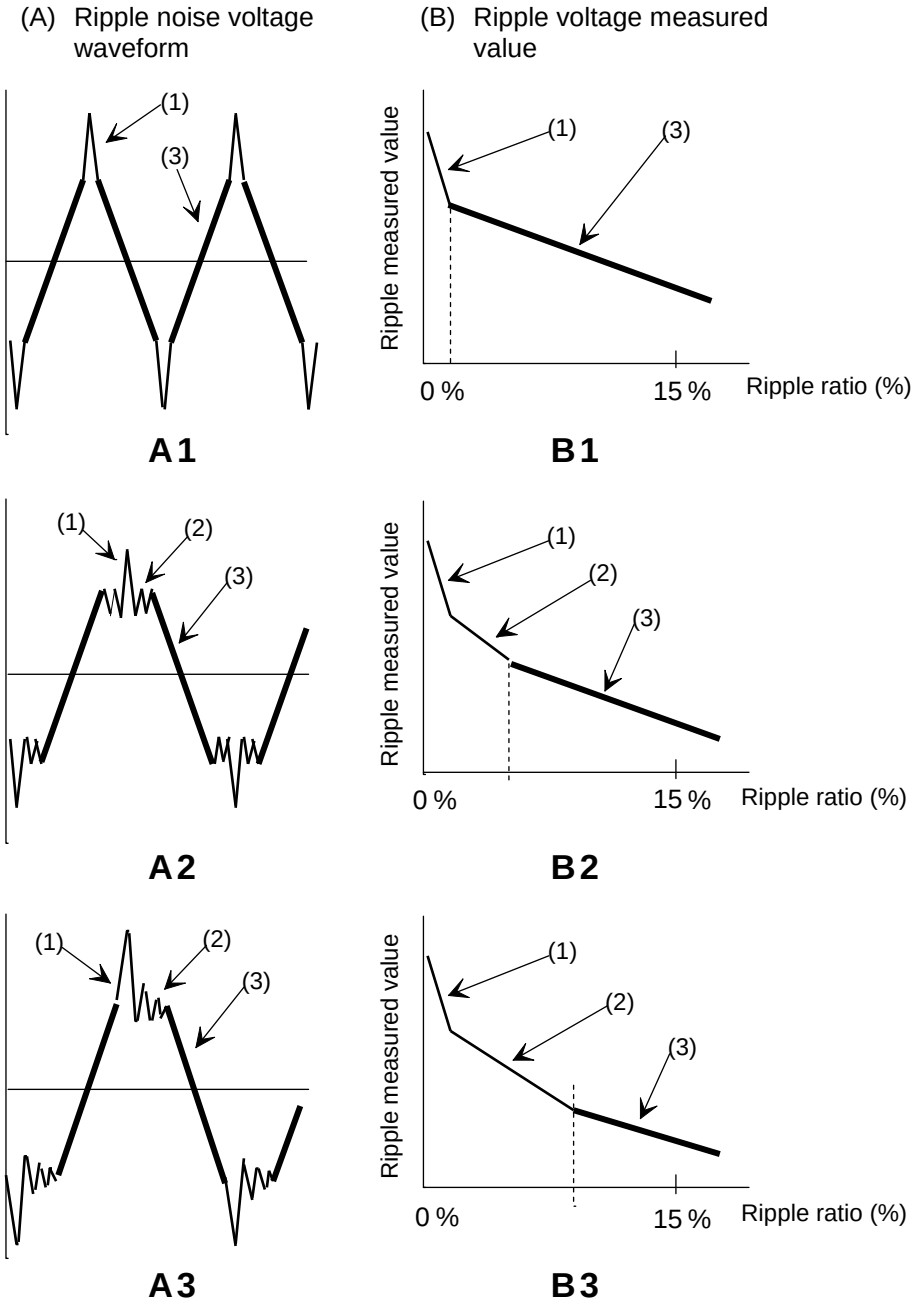


Figure B.4 Explanation of Ripple Ratio

Ripple measurement value with respect to ripple ratio

Figure B.4 shows ripple voltage measurement value (B) against representative ripple noise voltage waveform (A), for each ripple ratio.

When ripple ratio is 0%, ripple measurement value shows huge value due to spike noise edge. If ripple ratio is increased, in area (1) ripple measurement value declines along steep slope. Further increasing the ripple ratio will finally make ripple measurement value move across the most gentle slope shown as area (3). If vibration follows spike noise such as waveform of A2 and A3, there is a region (2), with intermediate slope between (1) and (3) mentioned above.

Reading the amplitude of thick line portion in visual measurement with oscilloscope

During visual measurement using oscilloscope, in the waveform shown with A1-A3, portions highlighted with thick line appears as the brightest line, while spikes appear dark as they change in a steep manner. Therefore, amplitude of thick line is read as ripple voltage value.

Optimum ripple ratio

For setting optimum ripple ratio such that results match with measurement results of oscilloscope, it is recommended to set ripple ratio in the left most part of (3) having the most gentle slope in aforementioned B1-B3 graphs. There is no need to change the ripple ratio decided once for the same type of test power supply.

Method of setting filter when AC ripple is superimposed

In ripple separation method based on pulse with duty ratio (ripple ratio), ripple measurement value will be on lower side if filter separation is not used for signal having fundamental wave of dual frequency. In this method, without taking switching fundamental wave as 1 period, the largest period (AC component etc) is taken as 1 period and gross average duty ratio of spike voltage in this 1 period measures the voltage level that becomes set value of ripple ratio. Therefore, in order to correct the spike component interrupted in the valley of AC component, level decreases so that it cuts into switching basic wave component of crest. In this manner, setting filter within 2 kHz to 5 kHz for measuring fundamental wave of dual frequency yields correct results. (However, measurement time will be more than double.)

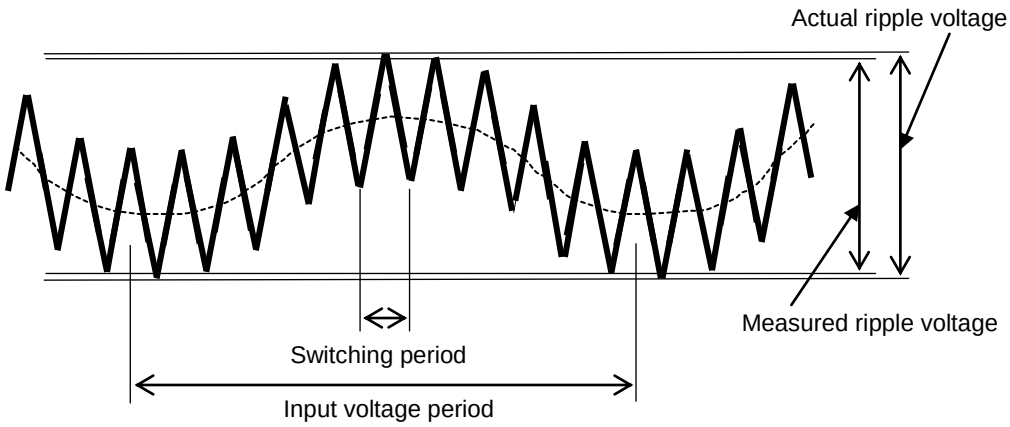


Figure B.5 Superimposed waveform of AC ripple and switching ripple

Measurement

Connecting RC IN connector

Measurement signal of ripple noise voltage is input to RC IN (BNC connector) of rear panel. For measurement cable, please use coaxial cable with 50 Ω impedance. There may be some measurement error in switching power supply depending on the method of connecting measurement cable and measurement conditions.

WARNING **There is a danger of electric shock.**

- **Ensure to connect measurement cable to test device only after connecting it to RC IN connector.**
- **Do not remove the connector with measurement cable connected to the object to be measured.**

CAUTION Device may be damaged.

- Ensure that voltage applied to RC IN connector does not exceed the maximum rated input (±500 V).

Menu of ripple noise measurement option

By installing RC-02A ripple noise measurement option, menu for ripple noise measurement option will be added to main screen and menu screen.

Main screen (Normal: 2/2 page)

Normal			
	Ratio		Ripple ratio settings
		MAX.	Maximum value
		MIN.	Minimum value
	Range R		DC voltage, ripple voltage range settings
		DC	DC voltage range
		500 V	
		60 V	
		6 V	
		Auto	Auto range
		Noise & Ripple	Ripple, Noise voltage range
		3 V	
		0.3 V	
		Auto	Auto range
	Filter		Filter setting
		THRU	No filter. Low bandwidth of 50 Hz.
		5 kHz [HPF]	High pass filter with cutoff frequency of 5 kHz

2 kHz [LPF]		Low-pass filter of cutoff frequency 2 kHz. Low bandwidth of 50 Hz.
~2 kHz +5 kHz		Combination of low-pass filter of cutoff frequency 2 kHz and high pass filter of cutoff frequency 5 kHz. Low bandwidth of 50 Hz.
Band		Bandwidth limit
FULL		Entire bandwidth
20 MHz		20 MHz band limitation

Menu screen

MENU			
3.Meas.			Measurement value display setting
Top			Display position (Top)
Middle			Display position (Middle)
Bottom			Display position (Bottom)
	1/3 page		
	Voltage		Voltage value
	Current		Current value
	Power		Power value
	M / S Current		Current value (total currents during parallel operation) Displayed during M/S connection
	NEXT→		Go to 2/3 page
	2/3 page		
	M / S Power		Power value (total power during parallel operation) Displayed during M/S connection
RC-02A Ripple noise measurement option	R-Opt. Voltage		Voltage measurement value
	R-Opt. NOISE		Noise voltage measurement value
	R-Opt. RIPPLE		Ripple voltage measurement value
	NEXT→		Go to 3/3 page
	3/3 page		
	R-Opt. Power		Power measured value(voltage measured value x current value)
	R-Opt. DC+ NOISE		± (voltage + half of noise voltage)
	R-Opt. DC+ RIPPLE		± (voltage + half of ripple voltage)
	NEXT→		Go to 1/3 page

Setting measurement conditions (Main Screen: Constant Load)

Ratio

Set the ripple ratio. Setting range is 0.0%-50.0% and setting resolution performance is 0.5%.
It is valid when R-Opt. RIPPLE (ripple voltage measurement value) is selected at 3.Meas in the menu screen on p.218.

DC

Set the DC voltage range. 6 V, 60 V, 500 V and auto range are available. Set the range corresponding to the rating of test device.

Noise & Ripple

Set noise and ripple voltage range. 0.3V, 3V and auto range are available. Set the range corresponding to ripple noise voltage to test device.

Filter

Select the measurement filter. The following table shows recommended filter for various measurement items.

Measurement items	Filter menu selection	Selection of the measurement function
Ripple noise voltage	2 kHz [LPF] + 5 kHz [HPF]	NOISE
Ripple voltage	2 kHz [LPF] + 5 kHz [HPF]	RIPPLE
Noise voltage	5 kHz [HPF]	NOISE
Switching ripple voltage	5 kHz [HPF]	RIPPLE
AC ripple voltage	2 kHz [LPF]	NOISE

About the measurement function

DC measurement : overage values are measured.

Ripple measurement : peak-to-peak values are measured using the ripple separation ratio (AC coupling). Any filter setting can be combined, but the recommend combinations are as the following.

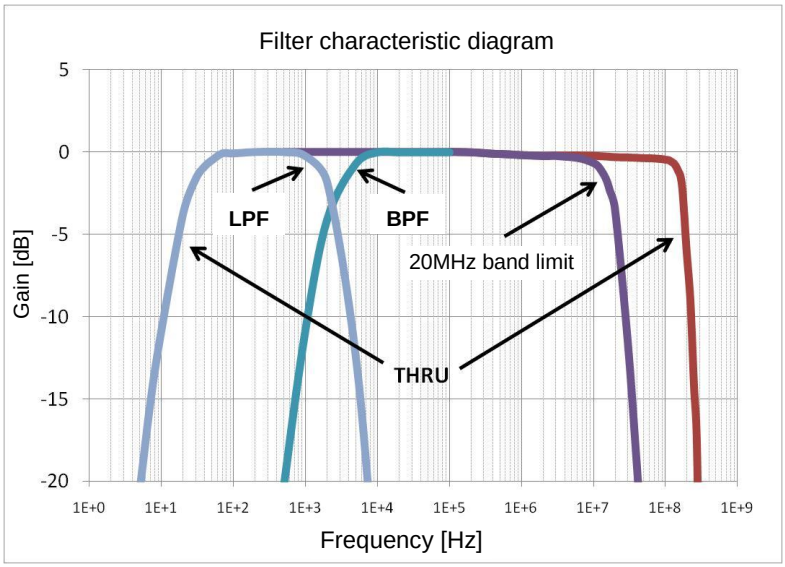
Noise measurement : peak-to-peak values are measured (AC coupling). Any filter setting can be combined, but the recommend combinations are as the

Band

Sets measurement band limitation.

FULL: Entire bandwidth of 100 MHz

20 MHz: Band limitation of 20 MHz



Measurement display item set (Menu Screen)

3.Meas.

Set the display items of measurement value and display position. Top, middle and bottom display positions are available. After selecting the display position, select the item to be displayed in the position.

Remote Control

USB/GPIB Interface

Refer to “USB/GPIB Interface” in Chapter 13 Remote Control for delimited symbol used in address, delimiter and multi-statement.

Ripple noise measurement commands

Function	Command	Operation and setting range	Remarks
DC voltage measurement	MD{SP}{NR1}	Range 0 - 3 0: Auto range 1: 6 V range 2: 60 V range 3: 500 V range	
Noise voltage measurement	MN{SP}{NR1}	Range 0 - 2 0: Auto range 1: 300 mV range 2: 3.00 V range	
Ripple voltage measurement	MR{SP}{NR1}	Range 0 - 2 0: Auto range 1: 300 mV range 2: 3.00 V range	
Power measurement	MP	INPUT DC voltage x load current	Returns the calculation result of power Return value: real value (##.###)
Filter setting	FL{SP}{NR1}	Range 1 - 4 1: THRU 50 Hz ~ 2: HPF 5 kHz ~ 3: LPF 50 Hz~2 kHz (*1) 4: HPF+LPF 50~2 KHz + 5 KHz ~	Returns addition of FL2+FL3
Band limit setting	FH{SP}{NR1}	Range 1 - 2 1: ~ FULL 2: ~20 MHz	
Measurement averaging process	MS{SP}{NR1}	Range 0 - 1 0: 1 time sample 1: 3 times sample	Valid for only DC voltage measurement
Measurement fix mode	MF{SP}{NR1}	Range 0 - 1 0: Free-run measurement 1: Single measurement	Specifies repetition of the measurement command specified at last
Measurement frequency setting	HZ{SP}{NR1}	Range 0 - 1 0: 50 Hz 1: 60 Hz	Sets the sample rate of A/D used for measurement
Ratio setting	RF{SP}{NR2}	Setting range: 0.0% to 50% (in increments of 0.5%)	

Details inside the { } of command cannot be omitted.

NR1: Integer value, NR2: Real value, SP: Space (Blank), C: Comma

*1 Bandwidth limiting is disabled.

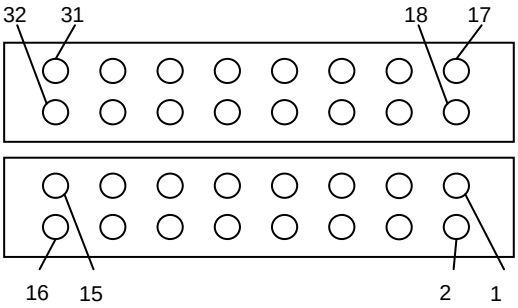
Appendix C

Appendix C describes external control (DIDO). External control (DIDO) is included in LX-OP01 option.

External Control (DIDO)

Overview

External control (DIDO) is used for external control of the product and for monitoring the status.
External control (DIDO) uses the DIDO connector (option board mounting slot) in rear panel.
Arrangement of DIDO connector terminals is shown in the following figure.
For enabling external control (DIDO), Enable DIDO in the system setting of the product. Refer to ”System Screen” of Chapter 8 Menu, Memory for the method of system setting.



Supported connectors

Maker	Product
Omron	for XG5M-1632-N Loose cable
Omron	for XG5M-1635-N Loose cable
Omron	for XG5M-1630-N Flat cable

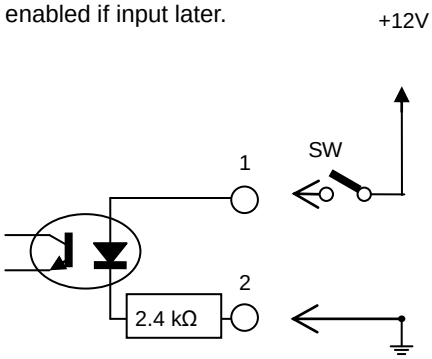
Terminal Number	Signal	Function
1	LOAD-ON/OFF INPUT+	Load ON/OFF Input +
2	LOAD-ON/OFF INPUT–	Load ON/OFF Input –
3	CUR-RANGE1+	Current Range Input 1+
4	CUR-RANGE1–	Current Range Input 1–
5	CUR-RANGE2+	Current Range Input 2+
6	CUR-RANGE2–	Current Range Input 2-
7	VOL-RANGE+	Voltage Range Input+
8	VOL-RANGE–	Voltage Range Input –
9	ALM INPUT+	External Alarm Input+
10	ALM INPUT–	External Alarm Input –
11	ALARM CLR+	Protection/Alarm clear input+
12	ALARM CLR–	Protection/Alarm clear input –
13	Reserved	Reserved (do not connect anything)
14	Reserved	Reserved (do not connect anything)
15	PWR +12V	Power output+12V (*1)
16	PWR GND	Power supply GND
17	LOAD-ON/OFF STATUS+	Load ON/OFF Output+
18	LOAD-ON/OFF STATUS –	Load ON/OFF Output –
19	CUR-RANGE STATUS1+	Current Range Output 1+
20	CUR-RANGE STATUS1–	Current Range Output 1–
21	CUR-RANGE STATUS2+	Current Range Output 2+
22	CUR-RANGE STATUS2–	Current Range Output 2–
23	VOL-RANGE STATUS+	Voltage Range Output +
24	VOL-RANGE STATUS–	Voltage Range Output –
25	ALM STATUS+	Protection/Alarm Output +
26	ALM STATUS–	Protection/Alarm Output –

27	USER DEFINED+	User defined output+
28	USER DEFINED–	User defined output –
29	SWEEP C/P Pass/Fail+	Sweep C/P decision output+
30	SWEEP C/P Pass/Fail–	Sweep C/P decision output –
31	PWR +12V	Power output+12V (*1)
32	PWR GND	Power supply GND

*1 Total 100 mA or less.

LOAD ON/OFF

LOAD ON/OFF is controlled according to external contacts. Input the external signal to No. 1-2 of DIDO connector. In external control also, the ON/OFF key of front panel is always enabled. In will be enabled if input later.

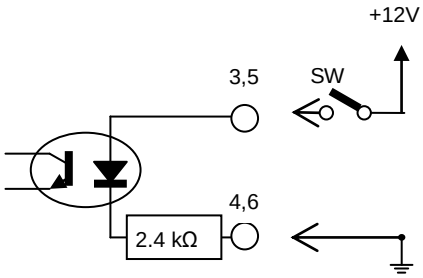


Load	LOAD-ON/OFF STATUS(edge detection)
	1-2
OFF	Open
ON	Close

Open: Photo coupler LED off, Close: Photo coupler LED on

Specified current range

Current range is controlled by external contacts. Input external signal to 3-4, 5-6 of DIDO connector. Control of the current range is disabled when shipping from factory. For cancelling it, Enable 3. Range during System Setting. Refer to “System Screen” of Chapter 8 Menu, System for system setting method.

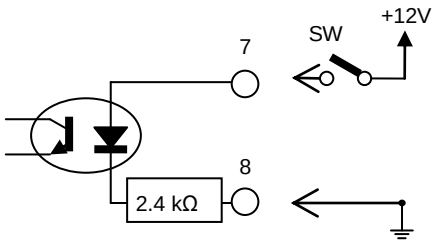


Current range	CUR-RANGE1	CUR-RANGE2 (Edge detection)
	3-4	5-6
L	Close	Open
M	Open	Close
H	Close	Close

Open: Photo coupler LED off, Close: Photo coupler LED on

Specified voltage range

Voltage range is controlled by external contacts. Input external signal into 7-8 of DIDO connector. Control of voltage range is disabled when shipping from factory. For cancelling it, Enable 3. Range during System Setting. Refer to “System Screen” of Chapter 8 Menu, System for system setting method.

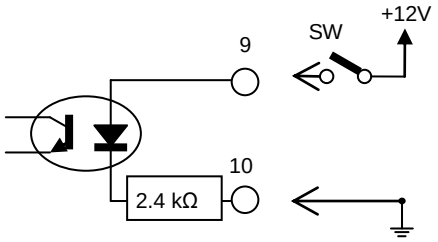


Voltage range	VOL-RANGE (Edge detection)
	7-8
L	Open
H	Close

Open: Photo coupler LED off, Close: Photo coupler LED on

External alarm

Alarm is controlled by external contacts. Input external signal into 9-10 of DIDO connector. Once the alarm is input, display indicating the occurrence of alarm will appear, resulting in LOAD OFF.



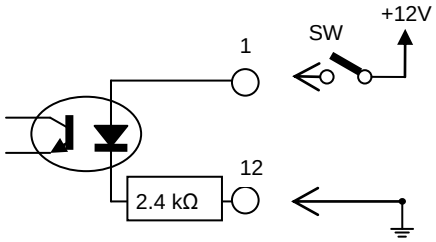
Alarm	ALM INPUT (Edge detection)
	9-10
OFF	Open
ON	Close

Open: Photo coupler LED off, Close: Photo coupler LED on

Clearing protection and alarm

Protection and alarm clear is controlled by external contacts. External signal is input into 11-12 of DIDO connector. If protection and alarm are stopped, the display and buzzer noticing occurrence of protection and alarm are turned off.

Root cause of protection and alarm is removed when protection and alarm is enabled. With protection and alarm occurred, enabling protection and alarm clear input will not cleared protection and alarm.

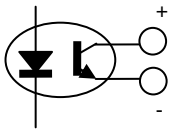


Clearing alarm	ALARM CLR (Edge detection)
	11-12
OFF (disable)	Open
ON (enable)	Close

Open: Photo coupler LED off, Close: Photo coupler LED on

Status output

Outputs the status of LOAD ON/OFF, status of range and status of alarm. Output signal pins are no. 17-18, 19-20, 21-22, 23-24, 25-26 of the DIDO connector, respectively.
Maximum applied voltage of respective photo coupler output is 30 V, maximum collector current is 10 mA.



Load	LOAD-ON/OFF STATUS
	17-18
OFF	Open
ON	Close

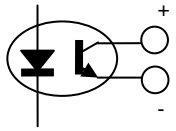
Current range	CUR-RANGE STATUS1	CUR-RANGE STATUS2
	19-20	21-22
L	Close	Open
M	Open	Close
H	Close	Close

Voltage range	VOL-RANGE STATUS
	23-24
L	Open
H	Close

Alarm	ALM STATUS
	25-26
OFF (disable)	Open
ON (enable)	Close

User defined output

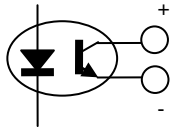
Output signal can be defined. You can control from USB or GPIB. Output signal pins are no. 27-28 of the DIDO connector. Maximum applied voltage of respective photo coupler output is 30 V, maximum collector current is10 mA.



User-defined	USER DEFINED
	27-28
1	Close
0	Open

Sweep C/P decision output

Outputs Pass/Fail decision result of Sweep C and Sweep P. Output signal pins are no. 29-30 of the DIDO connector. Maximum applied voltage of respective photo coupler output is 30 V, maximum collector current is10 mA.



Sweep C/P decision output	SWEEP C/P Pass/Fail
	29-30
Fail	Close
Pass	Open

Power supply output

Used with input and output of the external signals. It is case potential.

Using it at signal input section

It is used for operating LED of photo coupler in input circuit. It can also be used for relay of input circuit connection. Refer to input terminal diagram of control for circuit constants.

Using it at signal output section

It is used for outputting voltage signal from open collector transistor of photo coupler in output circuit. In this case, resistor designed for external circuit is required. Use external power supply when power supply voltage of 5 V is required.

Power supply	PWR +12V	PWR GND
	15,31	16,32
Power supply	12 V Max.100 mA	Power supply GND

Mounting method of GPIB/DIDO option

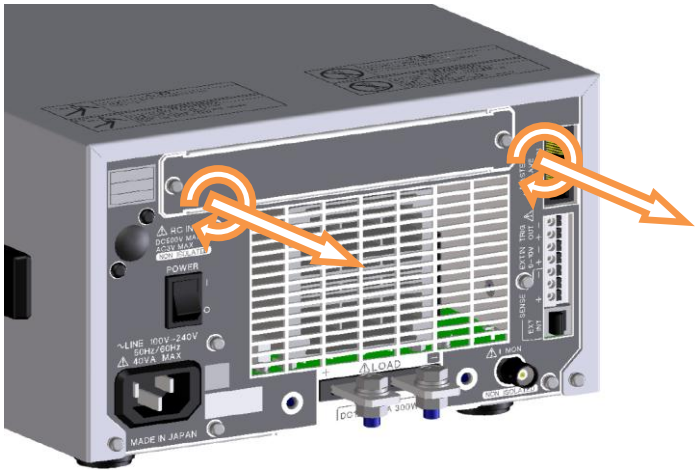
CAUTION Option and the unit may be damaged.

- Before starting the work, ensure to turn off the main power switch and remove the power cord set from this product.
- Perform the work in environment where ESD protection have been taken.

1. Removing blank panel

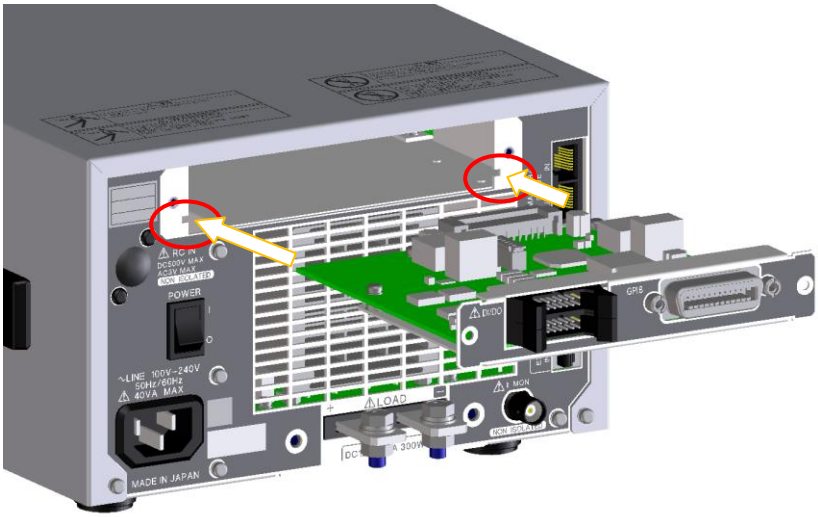
Remove the blank panel covering optional board mounting slot. Use Phillips head screw driver to remove 2 screws of blank panel.

Do not lose the removed screws as they will be used for mounting the optional item.



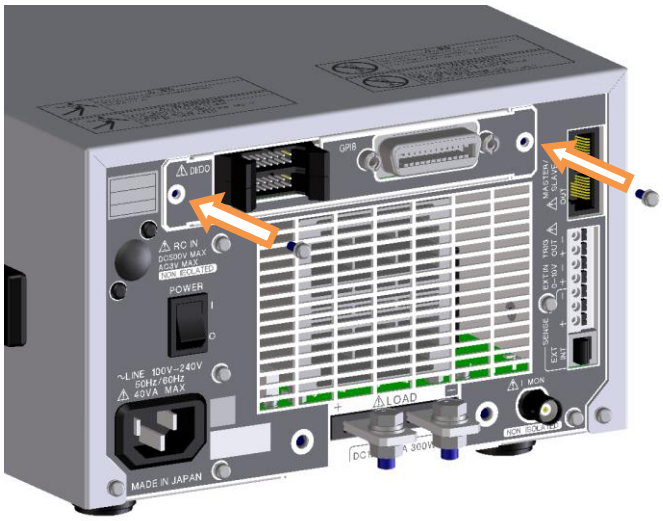
2. Mounting GPIB/DIDO Option

Insert GPIB/DIDO option in option board mounting slot. Align the board with the slot and insert it straight.



3. Fastening GPIB/DIDO option

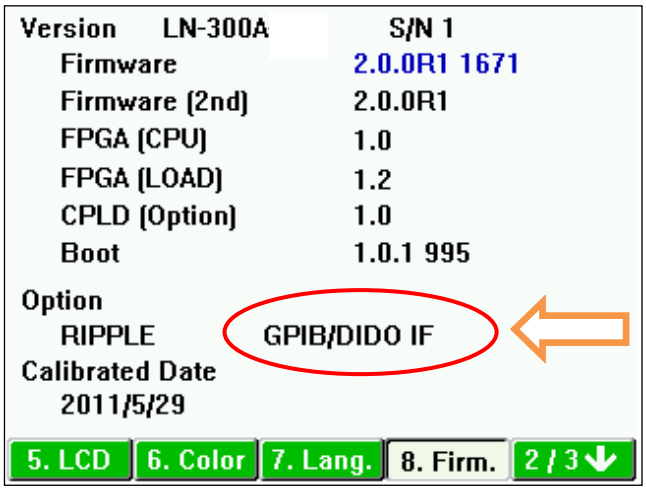
Fasten GPIB/DIDO option using the screws removed earlier.



4. Starting Check

Turn on the power supply of this product. Mounting status of Option is displayed at a particular place on the version checking screen at the time of startup. Check that GPIB/DIDO IF is displayed there. This can also be checked on version display of Menu/system. Installation is complete if this is displayed.

If it is not displayed, turn off the power supply of this product and check that the option is mounted correctly. If it is not displayed even after checking, please contact us or our agent.



A

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V

W

Load Station
Wide Voltage / Multifunction
Electronic Load

LN-300A
LN-300C
LN-1000A
LN-1000C

Instruction MANUAL

M-2323
Rev 1.4

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Electronic Load Instruction Manual
Load Station
LN-300A
LN-300C
LN-1000A
LN-1000C
M-2323 Rev 1.4

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