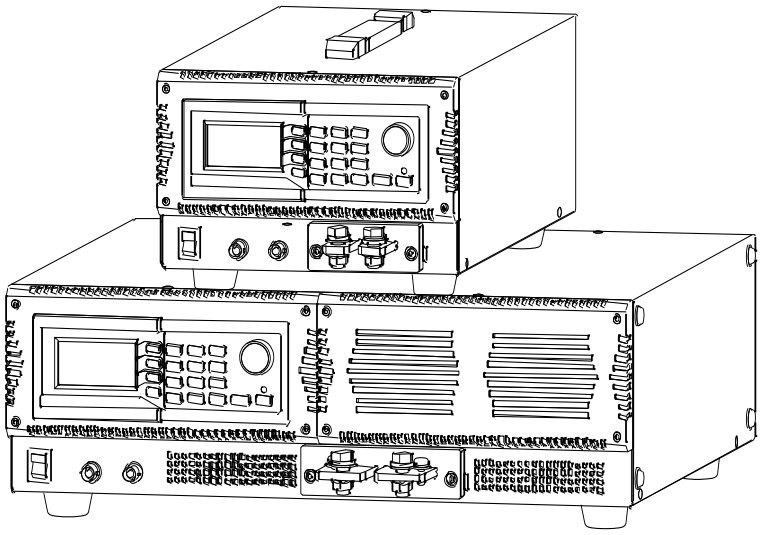
OPERATION MANUAL

High Performance Electronic Load

LOAD EDGE SERIES



ELL-355/1005

Engineering Company

KEISOKU GIKEN

Warranty Information

KG (KEISOKU GIKEN CO. LTD.) certifies that this product met its published specifications in this manual at time of shipment from factory with rigorous product inspection.
KG hardware product is warranted against defects in material and workmanship for a period of one year from date of delivery.
During the warranty period KG will, at its option, either repair or replace products without charge which prove to be defective. Please contact a dealer you purchased from or KG directly for any request or questions of the warranty service
Regarding measurement accuracy, warranty period is six months from date of delivery.

The foregoing warranty shall not apply to any failure(s) or defect(s) resulting from improper or inadequate maintenance/handling by the Customer as listed below.
The repair will be charged in those situations.

1. Usage not in accordance to instruction for operations in manual.
2. Unauthorized repair, alteration, modification, or physical damage.
3. The damage caused by improper packaging or handling during transportation.
4. Acts of God such as temblor, floods, riot, and war.
5. The abnormal input or power surge voltage.
   The repair with dispatching engineer from KG is also charged.

*This warranty is valid only in Japan.

Copyrights

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.

Exempt products of limits for harmonic current emissions

This product is exempted from the regulation of limits for harmonic current emissions due to industial application.product.
The regulation of limits for harmonic current emissions is not considered in the specifications.

Trademarks

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

For safety operation

This is an instruction for safety operation.

Please read the manual and follow all safety notes.

Please understand that we are not responsible for any accidents caused by wrong operation or usage not following the safety note or cautions.

Prohibition of breakup

Never remove the cover or a panel since high voltage portion exists inside that might cause injury to the body of operator.

Setting environment

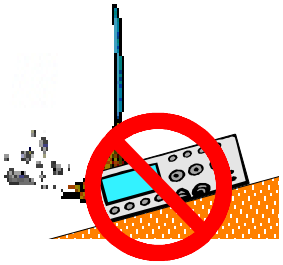
For security reasons, do not use this product in the environment where explosive and corrosive gasses exist.

Never use this product in where strong electric - magnetic field because the heavy electric-magnetic field influences to the unit.

Place this product on a flat surface and under no direct sunshine. Also avoid to place where high humidity is expected.

The operating environment condition of this product is (Temperature : 23℃±5℃ / The humidity : Less than 70%RH).

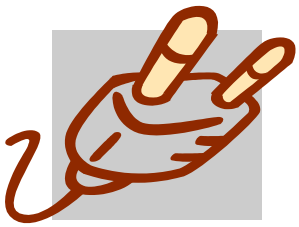
Do not use this product when condensed dew. Don't use this unit until it becomes completely dry.



Do not use this unit at dusty place or on a slope or place where has much vibration.

Keep good distance from this unit to a wall.
Do not block air outlet of this product to have good air circulation for cooling.

input power

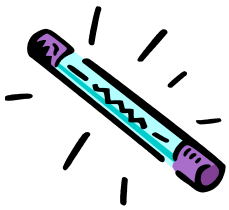


Use at rated voltage only. (Input rating : AC 100 V～240 V 50/60 Hz)

In addition, use the power supply cable attached to this product. (attached cable rating : AC 125 V)

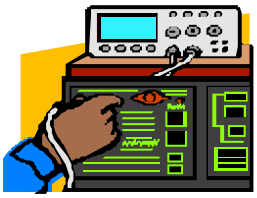
When used abroad, use a power cable suitable for the shape and rating for the power supply.

fuse



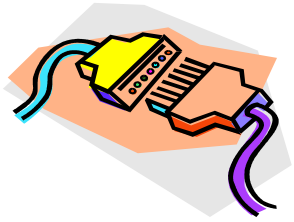
A replacement fuse is contained in the AC inlet.
Use the same shape and rating fuse only when necessary (250V/3.15A)

operator



This product can be operated by only someone who is enogh capable to understand this manual and after understanding all contents of this manual.
An operator does not have enough knowledge must be supervised by capable person.

Connections



In the case of connection or disconnection of GPIB unit, cut off the power supplies of each product first.

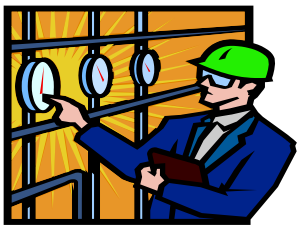
Transportation

Turn off all power switches and remove all wirings before moving.
Always move the product with the instruction manual.

Use original packing materials when moving or for transportation.

Use equivalent packing materials if original packing materials are not available.

Maintenance and Inspection

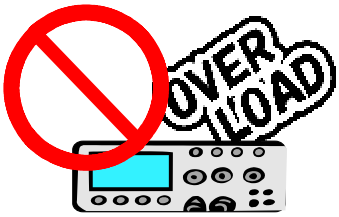


Unplug the AC cable to prevent electrical shock before any maintenance or inspection work.

It is suggested to periodical maintenance and inspection for safety operation.

It is also suggested to calibrate periodically.

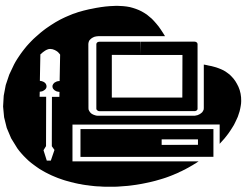
Over loading



Never use connectors or input terminals of this product other than specified use.

Never apply voltage out of specification.

Repair and Adjustment



Please contact with us or your dealer for repair or adjustment.

Safety symbols

For safety operation, the following symbols are used in this manual.
Read and understand the meanings of each symbol for safety operation.

This symbol means Warning, Danger or Notice.

Refer to this manual of appropriate page when such symbol was found on the product.

This symbol means severe human damage if not operated this product properly.
Strictly follow the instruction in this manual.

This symbol means slight human damage when this product is not used properly.
Follow the instruction of this manual properly.

This label means prohibited action.

NOTE

This symbol shows the footnotes such as operational procedure.

REMARK

This symbol means that it is related to the performance of the unit.

Preface

General

Applicable models.

ELL-355	30V-135A-350W
ELL-1005	30V-400A-1000W

Framework of this manual

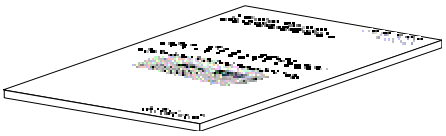
This manual consists of the following chapters.

Check when you unpack

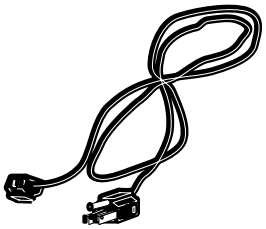
After you unpack, please check if the product suffers any damages and all the accessories are duly provided.

Should you find any damages and missing accessories, please contact dealer you purchased from or KG directly.

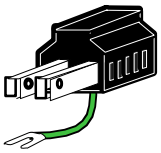
In the package of this product includes the following accessories.



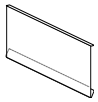
☐Operation manual（M-2161）



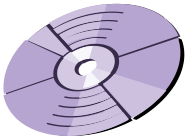
☐Input power cord（3P / 2 m）



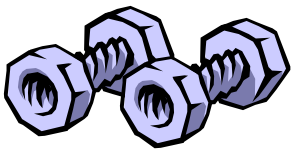
☐3P-2Pplug



☐Remote sensing cover
(Attached to this product)



☐CD-ROM
(USB Driver, etc.)



☐Screws for load input terminal
(Two (2) pairs)
(Attached to this product)

☐Booster connection cable

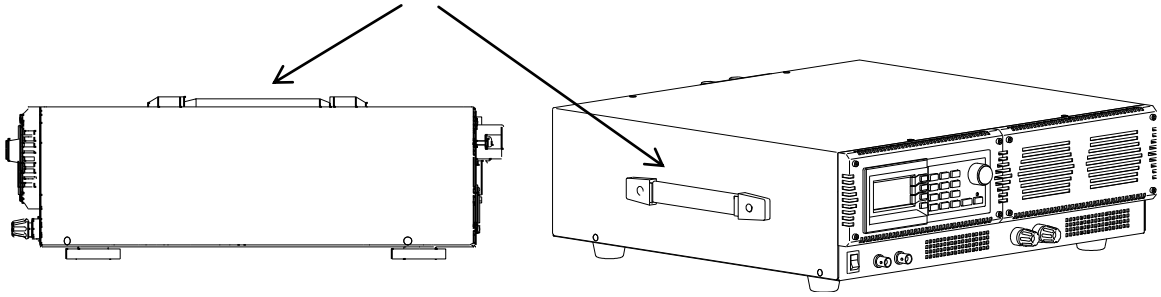
Cautions when you transfer

When you carry this product, grasp the handle on the top surface shown below.

CAUTION

- Powers OFF this product before you carry this product.

You must hold this handle when carrying it.



CAUTION

- When you ship this product, use the original packaging materials that you received from KG.
- If the package is not available, use an package that must have the same protection capability of protecting this product against damages during transportation

TABLE OF CONTENTS

Chapter 1 Product Outline

1.1 Outline

Leading Edge Series (ELL-355/1005) is a high-performance electronic load that can work in lower voltage range and with fast load response due to internal new load circuits that KEISOKU GIKEN developed. In addition, KEISOKU GIKEN's new "Extreme Power" technique employed in this electronic load expands its applications because the "Extreme Power "technology allows peak load power operations that exceeds power rating in short-term (*1) and consecutive load power operations larger than rated power in middle-term (*1).

(*1: there are some limits upon such operations)

New various applications of this electronic load include testing fuel cells, solar batteries in addition to testing conventional switching power supplies.

1.2 Features

- Easily connectable design because load terminal is located on the front panel.
- Very fast load response up to 50A/μs. (when terminal voltage ≥5V)
- Larger power than rating can be set for a short-term operation by "Extreme Power" technique. (up to 4000W)
- Stable frequency response within 3dB up to 300 kHz. (External Control: AC+ offset voltage)
- No minimum voltage requirement or concept. It can operate from virtually 0V. Any voltage difference will drive the operation of this product.
- Support power input for world-wide mains electricity. (100V-240V 50/60Hz)
- Various load modes like CC, CR, CV, CP, Dynamic, ext. control and SHORT mode
- In the dynamic load mode, single and auto modes are supported.
- As the interface, both USB and GPIB are supported as the standard.
  By simply connecting to your PC via a USB cable, you can control this product to measure automatically.
  Via GP-IB, you can easily integrate this product to your existent system.
- Abundant alarm functions including over voltage over power, reverse connection, overheat.
- By internal function for current limitation, " CV+Climit(current limitation)" operation is supported.
- By internal memory function, you can up to six (6) measurements and setting conditions can be memorized.
- Ripple Noise digital measurement function (factory option)
  Ripple noise can be measured by way of our unique method capable of measuring in digital eradicating human reading error in using an analog.

NOTE

To realize fast load response, there are several considerations for the connection method, load voltage, and load current.
For more information, Refer to "2.3 To achieve fast load response"

1.3 Applications

The following shows examples of the applications with this product.

- Test low voltage power supplies for a micro processor.
- Large current fast pulse load test.
- Evaluate solar batteries
- Replace a load switch
- Evaluate battery's charge/discharge characteristics and life test
- Evaluate a capacitor
- Evaluate a current sensor
- Evaluate a relay
- Evaluate electric double-layer capacitor.
- Evaluate the I-V characteristics of a fuel cell
- Measure AC impedance of a fuel cell
- Evaluate power semiconductor

1.4 Options

The following options are provided.

Low inductance cable

Model	Length	Withstand Voltage	Ampacity	DC resistance	Inductance
LL-050	50cm	500V	100A	1mΩ	80nH
LL-100	100cm	500V	60A	2mΩ	100nH
LL-200	200cm	500V	40A	4mΩ	130nH

** Values shown here are typical values

Ripple Noise convertor

RC-02A (Factory option)

NOTE

The LL-05, LL-100 and LL-200 are built to order.
The ripple noise convertor is a factory option only.with electronic load.purchase.
Just a single ripple noise convertor alone can not be purchased.
With this option, measurement of the ripple noise can be controlled via GPIB and USB.

Please contact a dealer you purchased from or KG directly for any questions of those options.

1.5 Extreme Power Technique（Patent pending）

Principal of "Extreme Power"

In conventional electronic loads, any instaneous power [(applied voltage)x(load current)] exceeding the rated power is not allowed even in a short period. This limitation results in that it is necessary to secure an additional electronic load unit that can work in higher power capacity. KEISOKU GIKEN's "Extreme Power" technique will remove the strict limit and provide wider operating range by making the best of improved the latest device protection technology.

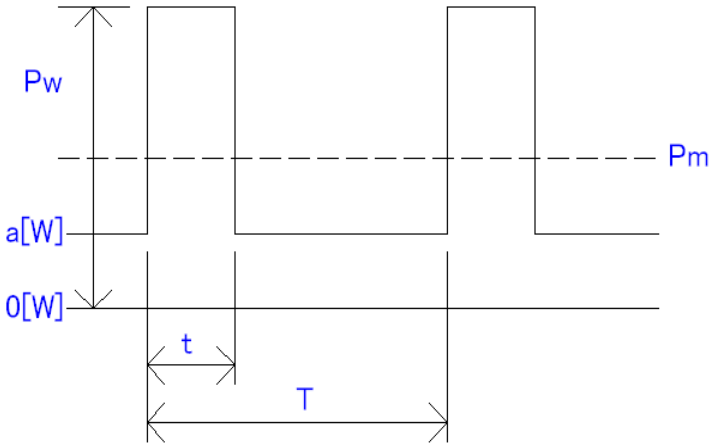
In most cases, it may be only about 2 to 20 seconds that needs for maximum load current in general tests including the load regulation test and over current test of a switching power supply.

Even in those cases, when an average power is calculated by integrated for all the period of the whole tests, the average power is substantially lower than rated power because in the whole tests, there are several load conditions including max load, light load and even no load conditions.

KEISOKU GIKEN paid attention to this actual procedure of testing and developed the "Extreme Power" technique which allows a consecutive operation with much larger load current than rated as long as the averaged power does not predetermined limit. In addition, even when high power operation exceeding the allowance time, the electronic load unit has robust protection circuits to protect the unit. The operations of the protection circuits can be monitored to check if the load operation exceeds the limit or not.

Relationship between Maximum load and Load ON time

The averaged power should be calculated according to the following formula.



$$Pav \geqq Pm = \frac{(Pw - a) \times t}{T} + a$$

Pav: Rated power
Pm: Averaged power
Pw: Peak power
a[W]: Base power
T: whole period
t: Period of Peak power

The limits of applied peak power are as follows:

Model	<20uS	<20sec	Rated power
ELL-355	4000W	430W	350W
ELL-1005	12000W	1290W	1000W

Examples

When a pulse load of 2KW and 100 μ s width repeats in period of 500 μ s, the averaged power will be

2KW × (100 μ s ÷ 500 μ s) = 400W

So it is possible to apply this load conditions for up to 20 seconds.

When a pulse load of 400W and 20s width followed by 3s or longer pause, the averaged power will be

400W × (20s ÷ (20s + 3s)) ≒ 348W

The calculated average power will be less than 350W.
So it is possible to operate consecutively.

Chapter 2 Connections

Necessary cautions for connections

2.1 Power cable

In domestic shipment, we attach a 3-pin AC100V AC cable.
Please be careful when you connect power cable because you may get electric shock.

- The rating of above 3-pin AC cable and 3P-2P plug is AC 125V.
- Please replace it with an appropriate AC cable when over AC 125V input voltage will be used.
- Do not use the attached power code to other equipments because it is dedicated
- cord for this product.

- Power OFF this product first, before you connect / disconnect an AC cable.
- Use an AC cable that has 3pin type having a GND terminal.
- When you used a 3P-2P plug, connect the guard line to a GND line.

2.2 Cable Connections

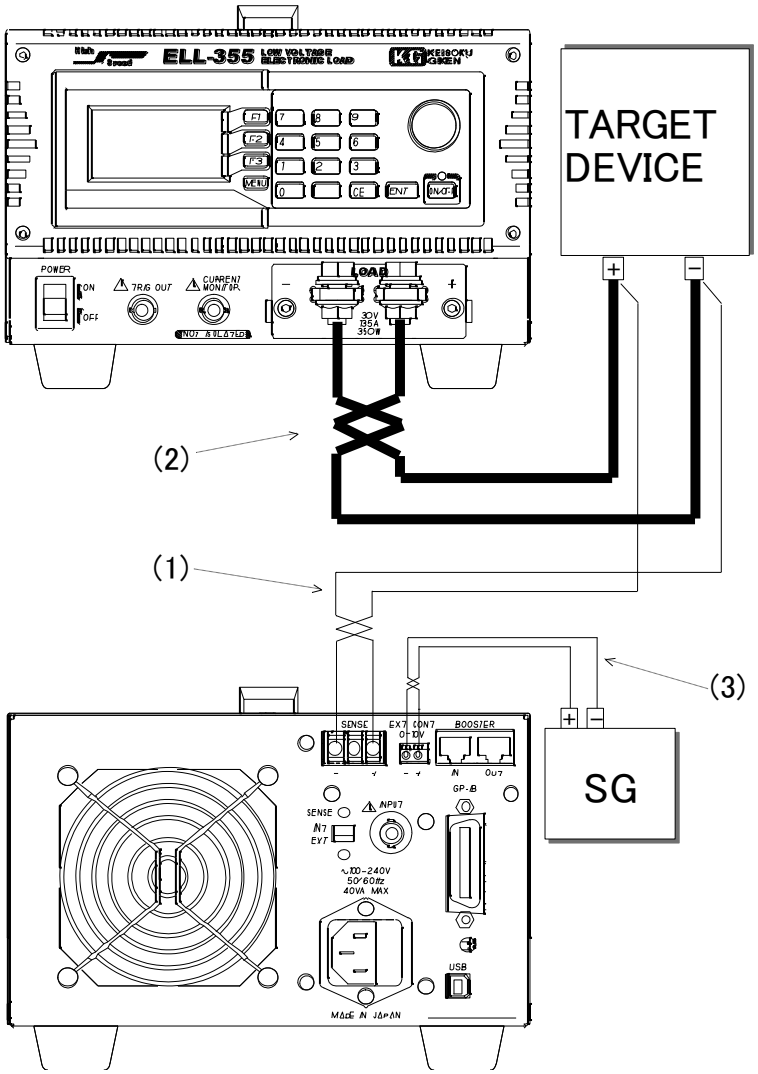


Fig. 2-2-1: How to connect cables

REMARK

TARGET DEVICE: e.g. Power supply to be tested, Device under test.
SG: Signal Generator (e.g. standard voltage source, oscillator)

1. Remote sense cable

Be sure to connect remote sensing cables

It is necessary to connect remote sensing cables properly in EXT sensing mode (you can select EXTernal sensing or INTernal sensing by switching a button in rear panel of main unit). Use such as shielded cable or twisted cables. Pay great attention on its polarity.

If a remote sense cable is not used (opened), it would cause an error in voltage measurement at load terminal and measurement in CR, CV, CP modes requiring reference voltage.

- Powers OFF a TARGET DEVICE first before you connect cable to the TARGET DEVICE. In a case of using remote-sensing cable, you must switch a selecting button (it's in rear panel in main unit) to EXTernal sensing. When you don't use remote-sensing cable, you have better to select INTernal sensing. If you don't have a properly setting, you can't measure a correct value and you are also trouble in load setting and power protection.

REMARK

This product has a protection resister against a reverse connection between remote sense and load terminals. So as for the voltage, measurement at the load terminal, measured value may be lower than actual value due to the protection resister. There is no protection resister at the remote sense terminals.

2. Load cable

As shown in the Fig. 2-2-1, please use hexagon nuts and hexagon head bolts when you connect load cables. Also please use load cables adapted for necessary current capacity and wire the load cables as short as possible. In addition, twist the load cables if the cable length is long and/or if possible.

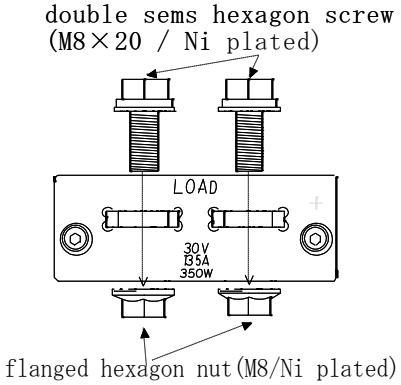


Fig. 2-2-3 How to fix load cables to the load terminals of this product.

Load current Io (A)	Suggested cable size
Io≦10A	16AWG or more
10≦Io≦30A	12AWGor more
30≦Io≦60A	8AWG or more
60≦Io≦100A	7AWGor more
100≦Io≦135A	6AWG or more

Table 2-2-1 Suggested size for load cables

WARNING

Never touch the Load terminals on front panel or rear panel while in operation. Since front panel load terminals and rear panel terminals are connected internally, the same voltage level will appear at other side of terminal when the voltage is supplied to one side of terminal (rear or front).

CAUTION

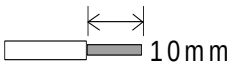
Never connect DUT at the same time to both on front panel terminals and rear panel terminals.
Contrary will cause serious damage.

- When reverse voltage is applied, the loading circuit of this unit will behave as shorted and alarmed. But it will cause damage of internal circuit when applied higher current than rating.
- Never apply higher voltage than rating. When applied higher voltage, it will alarm but may cause damage inside.

3. External control cable
   As an external control cable, use a twisted cable when connecting.
   The wire lines should be selected according to the following requirement.
   The input signal would be DC signal. But in case AC signal is applied, it is necessary to have offset voltage for superposing to keep the voltage above 0V any time.
   Input voltage range is 0 to 10V and DC to 100 kHz (3dB).

   Suggested wire line

   Single wire line
   Diameter: 0.4mm-1.2mm (AWG26-AWG16)
   Twisted wire line
   Cross section: 0.3mm^2-1.25mm^2 (AWG22-AWG16), Diameter 0.18mm or more.



Strip gauge

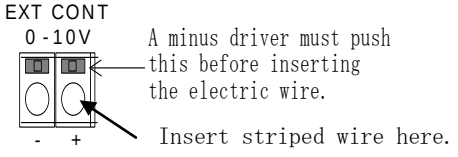


Fig. 2-2-4 Strip gauge of the wire and connecting method

- Do NOT apply any Voltage other than the range (0-10V). Any voltage outside this range would damage this product.
-

2.3 To achieve fast load response

To achieve fast load response as described in the specification of this product, pay attention to the following:

1. Negative effect by inductance

   Back electromotive force caused by both inductance of load cable and internal inductance of this product would influence rising time by voltage drop. Needless to say, current could not be sunk if the voltage drop caused by the back electromotive force exceeds voltage between load terminals, because there is no voltage potential difference left.

   This product is designed to minimize the internal inductance but is not zero, so it is necessary that some level of voltage potential difference need to be presented between the load terminals. For example, 2V needs to be presented between the load terminals to set and realize 20A/usec slew rate. Because voltage drop is caused by the inductance of load cables, it is suggested that the inductance caused by load cables should be minimize as much as possible. Voltage difference between inputs terminals is necessary even internal inductance is very low. Use lowest possible cable to minimize cable inductance.

Voltage between load terminals Vin (V)	Setting slew rate: α
5V≦Vin	50A/μs = α (Typ)
4V≦Vin	40A/μs = α (Typ)
3V≦Vin	30A/μs = α (Typ)
2V≦Vin	20A/μs = α (Typ)
1V≦Vin	10A/μs = α (Typ)

Table 2-3-1 Maximum slew rate settable in accordance with the voltage presented at between load terminals.

REMARK

- With optional low inductance cable LL-050, the inductance can be reduced by typically 80% comparing with normal cable (equivalent to 7AWG). The inductance value of the LL-050 is 80nH (Typ)
- Please refer to p.15 "1.4 Options" for low inductance cable option.

2. Affect by Load current setting

As the nature of this product, slew rate may be decreased depending on the slew rate and load current settings. Specifically, if the setting of load current is less than a certain current, the slew rate won't exceed the min load response time which is 500ns.

Some examples are explained below with reference to the following figure.

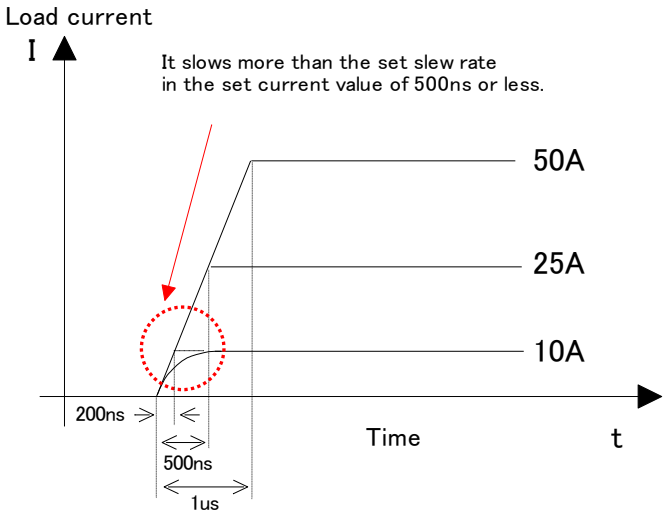


Fig. 2-3-1 Relation between slew rate and load current (ELL-355)

When slew rate: 50A/μs and load current: 50A are set:
The Load response changes on the 50A line above. This slew rate is 50A per 1μs.
However, when slew rate: 50A/μs and load current: 10A are set:
The load response changes on the 10A line above. Theoretically, the load current should have reached 10A in about 200ns, but it takes 500ns whose slew rate is about 25A/μs. This slew rate is slower than 50A/μs.

This 500ns is called minimum load response time which is in the specification sheet of this product. In other words, when a load current and slew rate are set so as to reach the load current less than 500ns (min. load response time), the load response time to reach the load current is automatically set for 500ns (min. load response time), and accordingly slower slew rate than setup slew rate is automatically setup.

For example, when slew rate and load current are set for 50A/μs and 25A respectively, the rise time is set 500ns which is equal to the min. load response time. But when the load current is set for 10A, the theoretical rise time is 200ns but the actual rise time is set 500ns which is slower than theoretical value.

Table below shows the relation between setup slew rate you set and min load current that can support the slew rate.

Note

Min. load current X (A) = slew rate Y (A)/2

Setting slew rate(α)	Minimum load current (I)
α = 50A/μs (Typ)	I = 25A (Typ)
α = 40A/μs (Typ)	I = 20A (Typ)
α = 30A/μs (Typ)	I = 15A (Typ)
α = 20A/μs (Typ)	I = 10A (Typ)
α = 10A/μs (Typ)	I = 5A (Typ)

Table 2-3-2 Minimum Setting of Load Current about slew rate (ELL-355)

2.4 CURRENT MONITOR

This CURRENT MONITOR can be used when you observe a current waveform by an oscilloscope.

REMARK

- The CURRENT MONITOR output is not isolated. Pay great attention on its connection. Improper connections would cause damage.
- Monitor output voltage range is between 0V and 1V depending on current measurement value between 0 A and FS(*Full Scale of load current of its range), Output impedance : 50Ω (typ.)

Model	Output Voltage(High,Mid)
ELL-355	1V/135A
ELL-1005	1V/405A

Table 2-4-1 Difference of Monitor Output Voltage with full scale

REMARK

- An equivalent circuit in terms of the current monitor with grounding points.

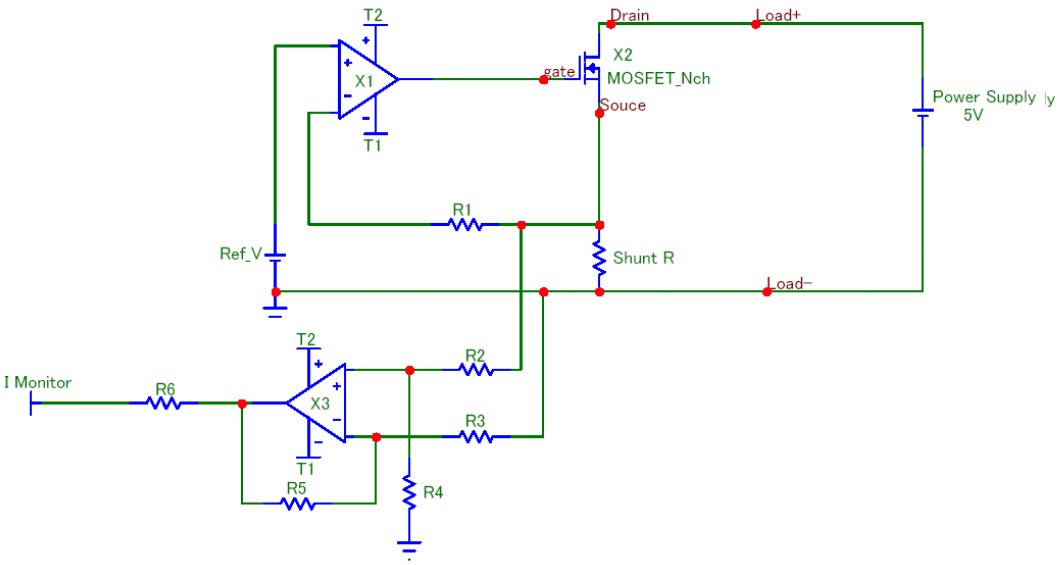


Fig. 2-4-1 Equivalent circuit of a current monitor

・Connection to an oscilloscope.
When you connect this product to an oscilloscope, please be careful about the polarities of the probes of the oscilloscope to connect as shown in the Fig. 2-4-2.

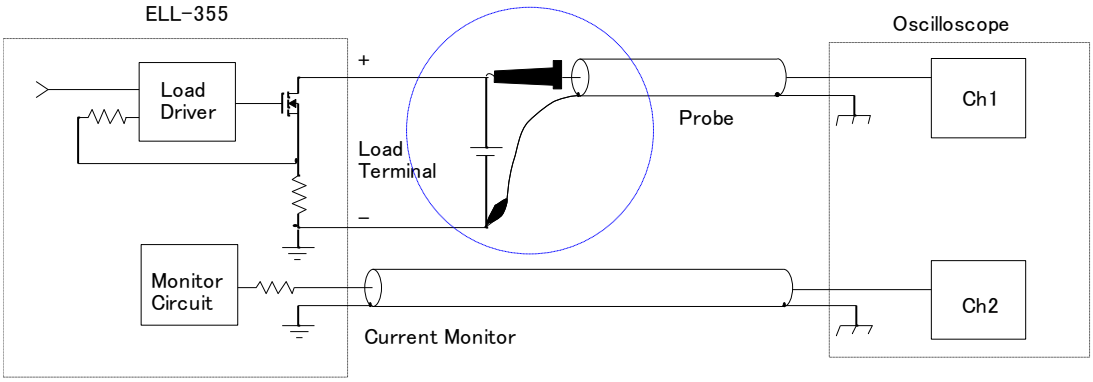


Fig. 2-4-2　(Correct) Connections to an oscilloscope

・If you should connect in reverse connection as shown below, large current would flow through the probe and the internal of the oscilloscope causing damage.

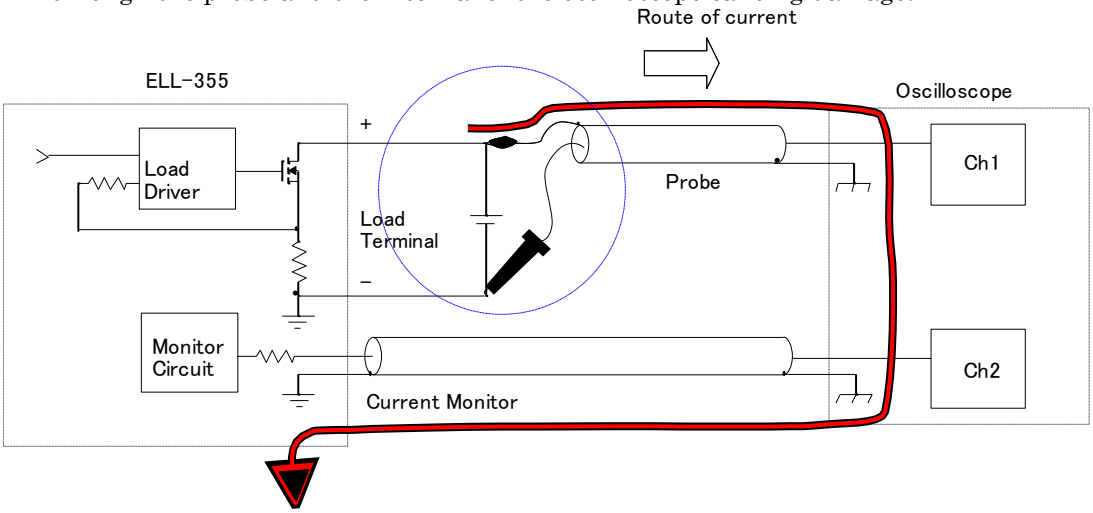


Fig. 2-4-3　(Wrong) Connections to an oscilloscope

2.5 TRIG OUT

TRIG OUT signal can be used for oscilloscope trigger signal when you observe a waveform in dynamic mode operation.

REMARK

- The TRIG output is isolated.
- This output is only valid in dynamic mode.
- The TRIG output is used photo-coupler, CC1 is +5V (Typ), pulse width is same as the setting time of dynamic/sequence time being set.

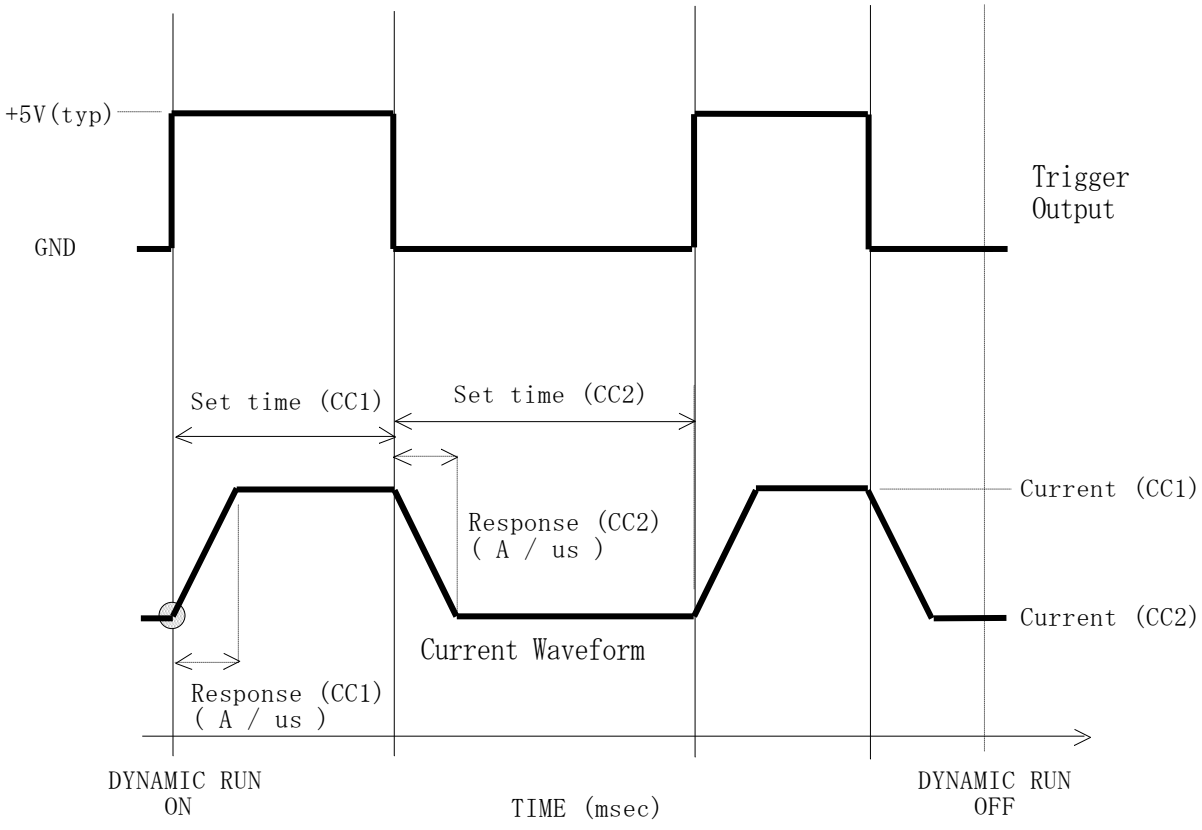


Fig. 2-5-1 Relationship between Trig Out and Current waveform

Chapter 3 Names and Functions

Names and functions of parts on the panels and terminal of this product are provided.

3.1 Front panel

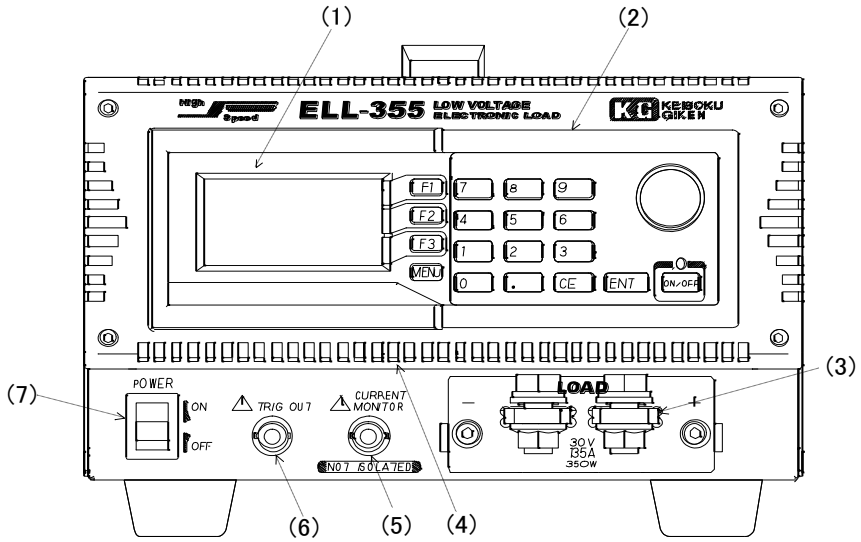


Fig. 3-1-1 Front Panel

(1) Display

A 128x64 dots monochrome LCD panel displays setting and measurement values etc.

(2) Operation Panel

This panel consists of function keys, a rotary knob to change values, and numeric keypad to input values. For specific operations, refer to "Ch.4" and "Ch.5" and "Ch.6".

(3) Front panel load terminals

Load terminals block. Note that accurate voltage is not measured at load terminals. Please use remote sensing terminals for accurate voltage measurement.
Refer to → "**2.2. Connections**" for cable connections.

(4) Air inlet

Air for cooling can be taken in through this air inlet.
Note: Please do NOT block the air inlet.

(5) Current monitor output

Voltage output terminal to monitor load current.
Refer to → "**2.4 CURRENT MONITOR**" for load current monitoring.

(6) TRIGger OUTput

In dynamic (load) mode, sync, signals in accordance with the edges of the load current will be outputted. This signal is isolated.

(7) Power switch

Switch for powering ON/OFF of this product.

3.1.1 Display

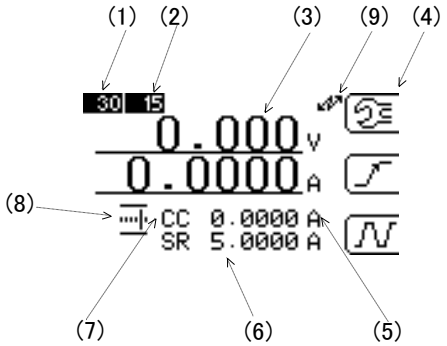


Fig. 3-1-2 Display on LCD

(1) Voltage ranges
The status of the selected voltage range is displayed: either Low range or High range.

(2) Current ranges
The status of the selected current range is displayed: either Low range or High range.

Model	Voltage range Low/High	Current range Low/High
ELL-355	4V/30V	15A/135A
ELL-1005	4V/30V	45A/405A

Table. 3-1-1 Difference of Load range

(3) Measurement values
Two measurement values are simultaneously displayed. You can select what should be displayed. Voltage and current are displayed in upper and lower columns respectively in Fig. 3-1-2.

(4) Function buttons
Characters or icons currently allocated to F1-F3 are displayed.
Items displayed therein depend upon the function you selected.

(5) Load setting
Selected load setting value is displayed. In dynamic mode,"DYNAMIC" is displayed instead.

(6) Response speed (slew rate) setting value
Setting response speed (slew rate) is displayed. In a mode that you cannot set response speed,"----"is displayed instead.

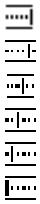
(7) Load modes

Abbreviation of currently selected load mode is displayed. Abbreviation represent as follows.

CC	constant current mode
CR	constant resister mode
CV	constant voltage mode
CP	constant power mode
EX	external control mode
ST	short mode (shortened)

(8) Icon indicating the scale of increase/decrease load setting by the rotary knob

Unless you operate in some specific items, you can use the rotary knob to change load setting. The step value of load change can be selected. This icon shows minimum increment as shown below.



00.0001
00.0010
00.0100
00.1000
01.0000
10.0000

The minimum increment values are common for all load modes.

(9) Control signal accepting signal

This shows that this unit has been externally controlled.

While showing this mark, front panel controls are disabled.
Press [CE] key to put out this mark and return manual control,

3.2 Rear Panel

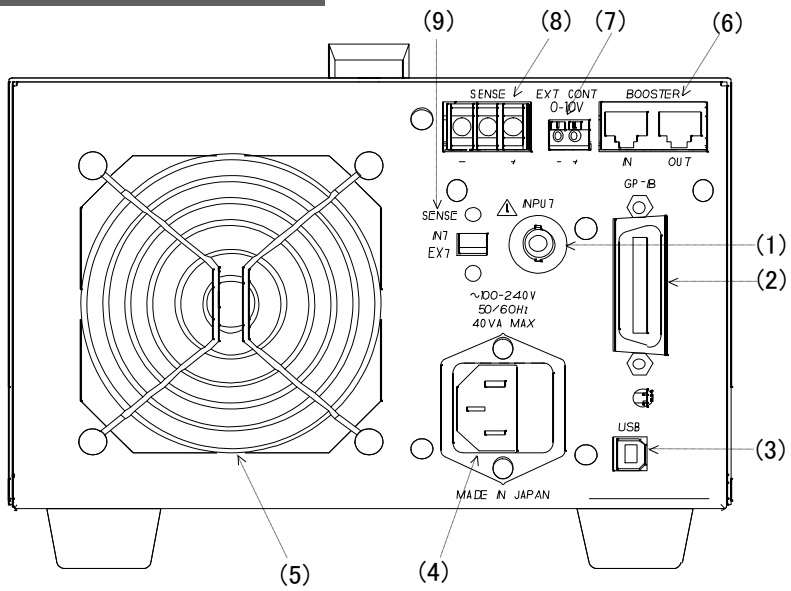


Fig. 3-2-1 Rear panel.

(1) INPUT connector
When option RC-02A (Ripple Noise converter) is built- in, a BNC connector is added there. Otherwise, the hole is occluded with a cover.

(2) GP-IB Connector
I/F with IEEE488.1 compliant. You can control this product from a general GP-IB controller.

(3) USB Connector
A USB connector with USB1.1 compliant for connecting a PC. With attached device driver and control library, you can control from your PC.
Refer to → "**Ch.8 Remote control**" for more infromation.

(4) AC Inlet
For connecting AC power cord. The input voltage range of this product is 100V-240V.

(5) Air outlet
A drawing air through the front and the sides is exhausted it out through air outlet.
Note: Please do NOT block the air outlet and allow sufficient space at the front , the sides and the back of the unit for adequate air circulation to keep unit cool properly.

(6) Booster
Used for parallel operations.
Refer to → "**Ch.9 Parallel Operation**" for more infromation.

(7) External Control Input BNC Connector
For inputting external Voltage for controlling load level.
The input range is 0-10V.
For more information, refer to → "**5.9 External Control (EXT) mode**".

(8) Remote Sensing Terminals
The voltage sensing terminals is used for voltage measurement in CR, CV and CP mode. The remote sensing has to be used when set at EXTernal Sensing mode. Contrary to this will cause damage.

(9) Remote sensing selector switch

In remote sensing mode, this selector switch has to be set at EXT.

EXT	Fig. 3-2-1	Select the voltage being applied at rear panel (8)
INT	Fig. 3-1-1	Select the voltage being applied to front panel (3)

Set the remote sensing selector switch at “EXT” position in remote sensing mode.
Set at “INT” position when not in use.
Contrary may cause malfunction on measurement, setting and /or power limiting.

3.3 Side panel

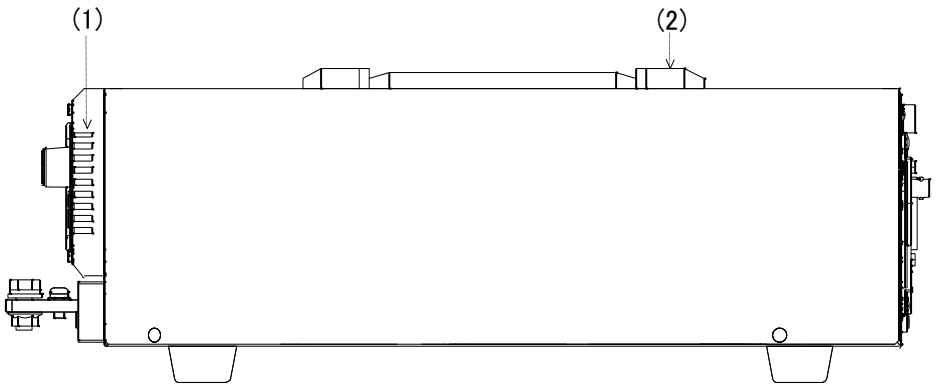


Fig. 3-3-1 Side panel

(1) Air inlet
Air for cooling can be taken in through this air inlet.
Note: Please do NOT block the air inlet.

(2) handle
When carrying a main unit, please carry it to grasp here.

Chapter 4 Operations

Names and functions of the operation panel, menu selection, memory function, and configuration setting are presented.

4.1 Operation panel

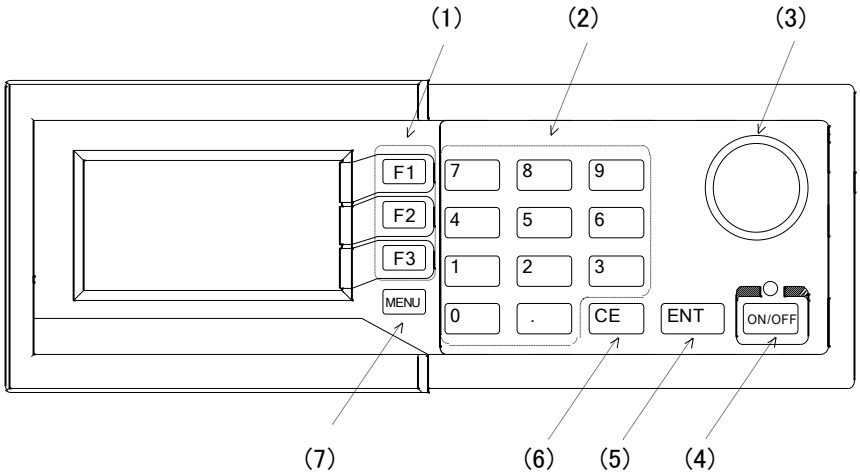


Fig. 4-1-1 Operation Panel

(1) Function keys
These function key are used to recall function allocated for each menu selected.

(2) Numeric keypad
These keys are for setting values like load current.

(3) Rotary knob
With this convenient knob, you can increase/decrease a setting value or change item to be selected. And this knob can be used as a button to confirm the selected value.

(4) ON/OFF switch
This switch is for setting Load ON/OFF. When Load ON, the LED above this switch is turned ON.

(5) ENT key
This key is for confirming inputted value(s) and selected conditions.

(6) CE key
This key can be used to cancel data input and a commend you selected.
It can be also used for switching from remote control to panel(local) operation and cancelling alarm.

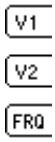
(7) Menu key
This key is used to select menu.

4.2 Menu selection

There are three (3) menus available in this product.

・LOAD CONTROL you can setup about load.

・MEASURE SETUP you can setup about measurement.



・I/O – MEMORY you can setup GP-IB address and I/O.

First of all, it is necessary to select proper menu mode.
To select proper menu, press MENU key to display menu select window.

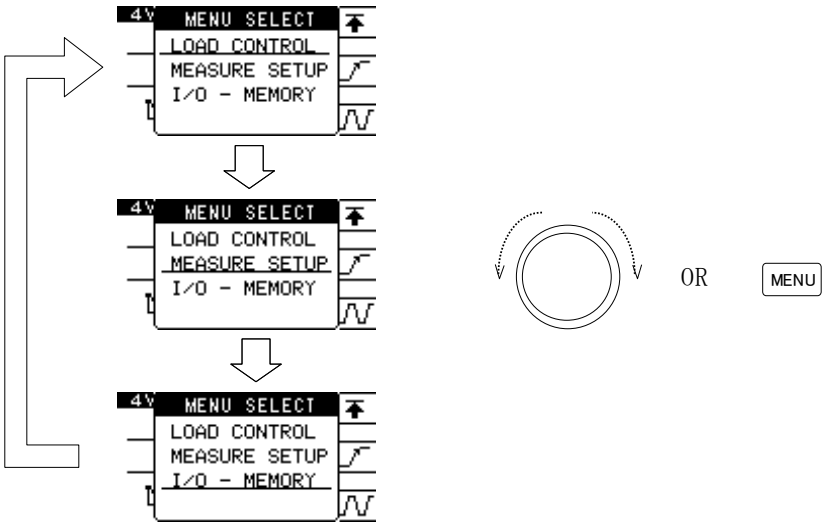


Fig. 4-2-1 Menu select window

Press MENU key or the rotary knob to select initial menu window.
(Underlined item represents a selected item)
Underline will move to select next menu by pressing MENU key
or rotate the rotary knob.
Press ENT key or the rotary knob to enter the selected menu item.
(You can abort by pressing CE key.)

4.3 LOAD CONTROL

The LOADS CONTROL consists of the following functions.

・Select maintenance function
・Set slew rate(SR)
・Select Dynamic mode (DYNAMIC)

(1)Maintenance function
Select LOAD CONTROL menu with referring "4.2 menu selection"
When F1 key is pressed, next level of menu selection screen is desplyed.
Press F1 again to display menu page.

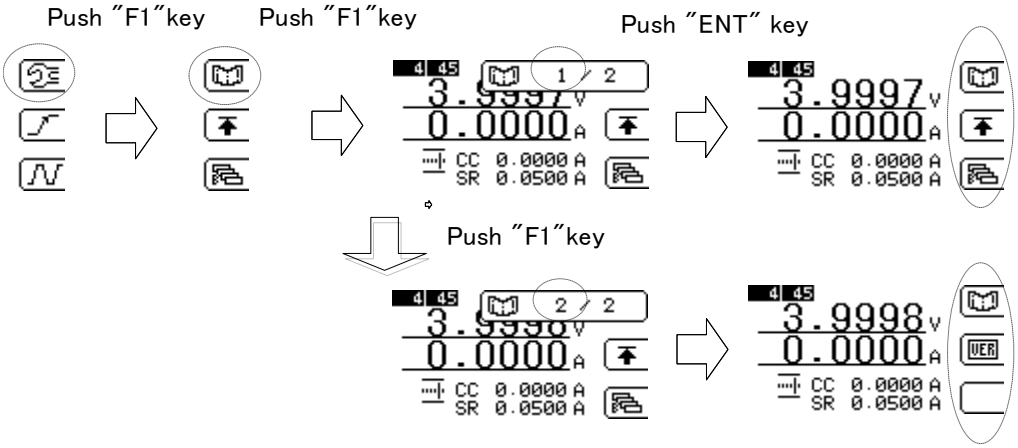


Fig. 4-3-1 Menu selection on LOAD CONTROL

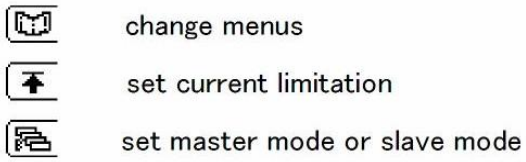


Fig. 4-3-2 Menu page 1

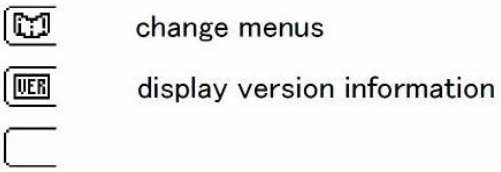


Fig. 4-3-3 Menu page 2

(2)Current limit setting

Press F2 key at menu page 1 for current limit setting.
Refer to the "5.4 Current limit"

(3)Master –Slave setting

Press F3 key for Master-Slave selection mode at menu page-1.
Press ENT key after selection.

NORMAL	Basic operation with single unit.
MASTER	This unit is selected as MASTER unit incorporated with several Slave units of the same model in Load Edge Series and has boost control function for Slave units.
MULTI	This unit is selected as MASTER unit incorporated with several Slave units of the differnt models in Load Edge Series and has synchronizing control function for Slave units.

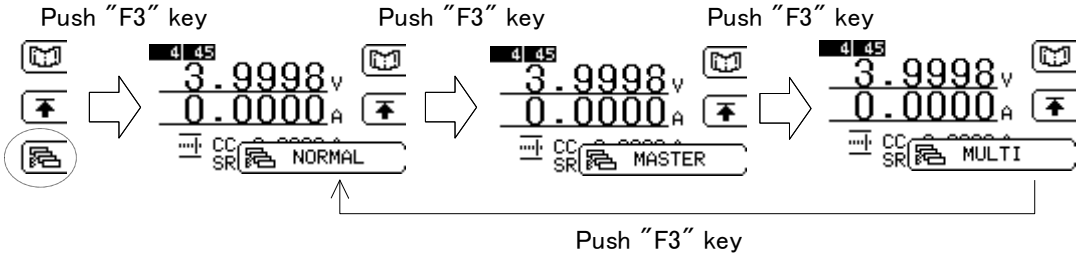


Fig. 4-3-4a Menu page -1a

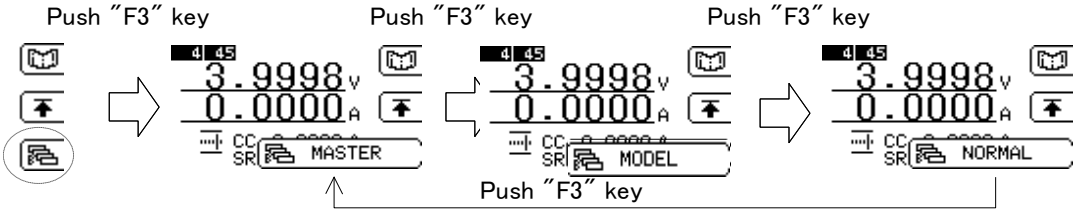


Fig. 4-3-4b Menu page-1b

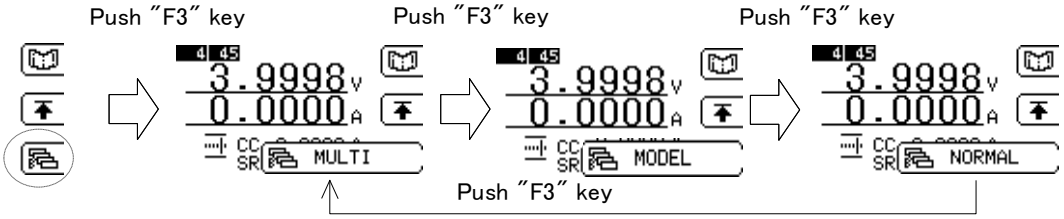


Fig. 4-3-4c Menu page -1c

(4) Version information

Press F2 key at menu page 2 for checking current version of this unit.

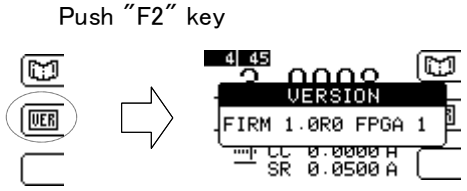


Fig. 4-3-5 Menu page 2

4.4 I/O setting

I/O setting consists of the following settings.

- GP-IB address
- Contrast of the display (LCD)
- Brightness of back light of the display (LCD)

(1) GP-IB address

First, call the "I/O – MEMORY" by the method as described above "4.2 Menu Selection".

Press F1 key to display menu for setting the I/O.

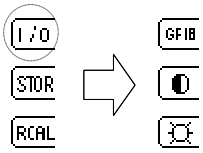


Fig. 4-4-1 Selecting of I/O menu

Press F1 key again to display a window for GPIB setting.
Press F1 or turn the rotary knob to display the address you want to select.
Press ENT key or the rotary knob to enter the selected address.

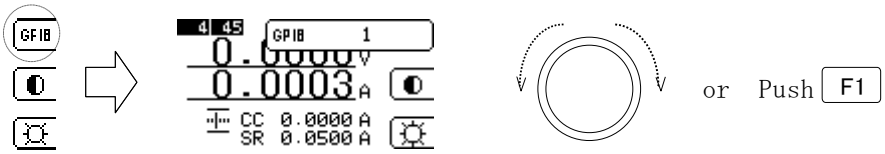


Fig. 4-4-2 Setting of GPIB address

(2) Contrast of Display (LCD)

Press F2 key of the I/O menu to display a window for contrast setting.
Press F2 key or the rotary knob to adjust the contrast.
Press ENT key to the rotary knob to enter the adjusted level.

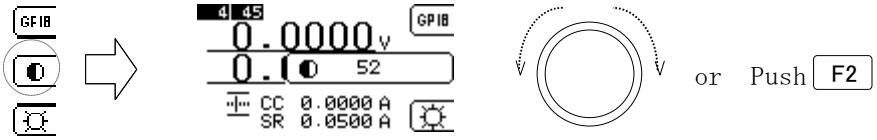


Fig. 4-4-3 Setting of Contrast of LCD

(3) Brightness of back light of the display (LCD)

Press F3 key of the I/O menu to display a window for back light setting.
Press F3 key or the rotary knob to adjust the contrast.
Press ENT key to the rotary knob to enter the adjusted level.

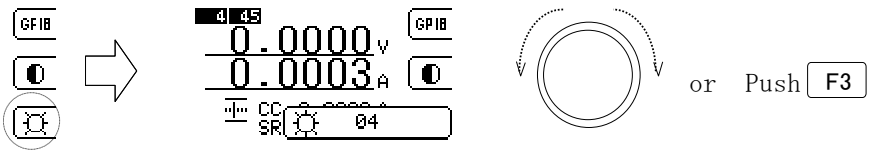


Fig. 4-4-4 brightness setting of back light of LCD

4.5 Memory function

You can save up to six (6) group of setting conditions, and recall any of those conditions freely.
Parameters that you can save in this memory function are as follows:

- currently selected load mode
- Load setting value(s) in each load mode
- Load response speed (slew rate) in each load mode
- Current limit value
- Parameters for dynamic load operation

(1) STORE
In I/O – MEMORY menu,
Press F2 to display a window of the storing location number for setting condition to be stored.
Press F2 key or turn the rotary knob to display the number you want to select.
Press ENT key or the rotary knob to enter the number you selected.

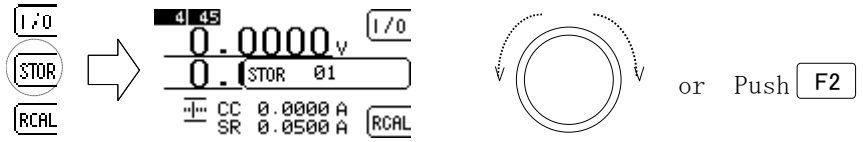


Fig. 4-5-1 How to set "STORE"

NOTE

Data with the same number will be overwritten with new data

(2) RECALL
In I/O – MEMORY menu,
Press F3 to display a window of the storing location number for setting condition to be recalled.
Press F3 key or turn the rotary knob to display the number you want to select.
Press ENT key or the rotary knob to enter the number you selected.

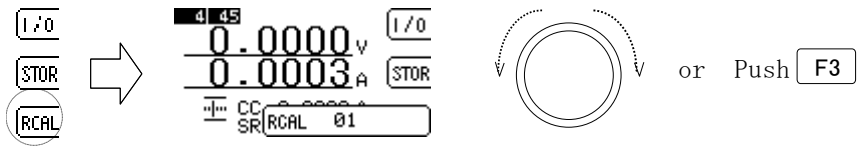


Fig. 4-5-2 How to set "RECALL"

Chapter 5 Operations for Load modes

This product has seven (7) load modes; constant current (CC), constant resistor (CR), constant voltage (CV), constant power (CP), external control (EXT), dynamic (DYNAMIC), and short (SHORT) modes. Please check first which mode you will use, and setup it properly.

CAUTION

- Set Load OFF by using Load ON/OFF switch on the front panel, before you select a load mode.
- Some load condition you setup may cause substantially short condition and then would damage TARGET DEVICE connected.

REMARK

- In some cases, you may be forced to change load range without cutting off the load you set. But please note that about 15msec of no load condition would occur when the range is switched.

Load mode can be selected from any basic menu shown in "4.2 Menu selection"
But when I/O is being selected during the I/O menu is displayed, Load mode cannot be changed. So display the basic menu to change the load mode.

5.1 Select Load mode

To select a load mode, press the rotary knob once to display "MODE" as shown below. While the "MODE" is displayed, you can select a load mode.

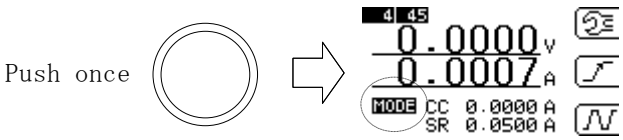


Fig. 5-1-1 Mode selection

Then you turn the knob, load modes that can be selected are displayed sequentially and repeatedly.

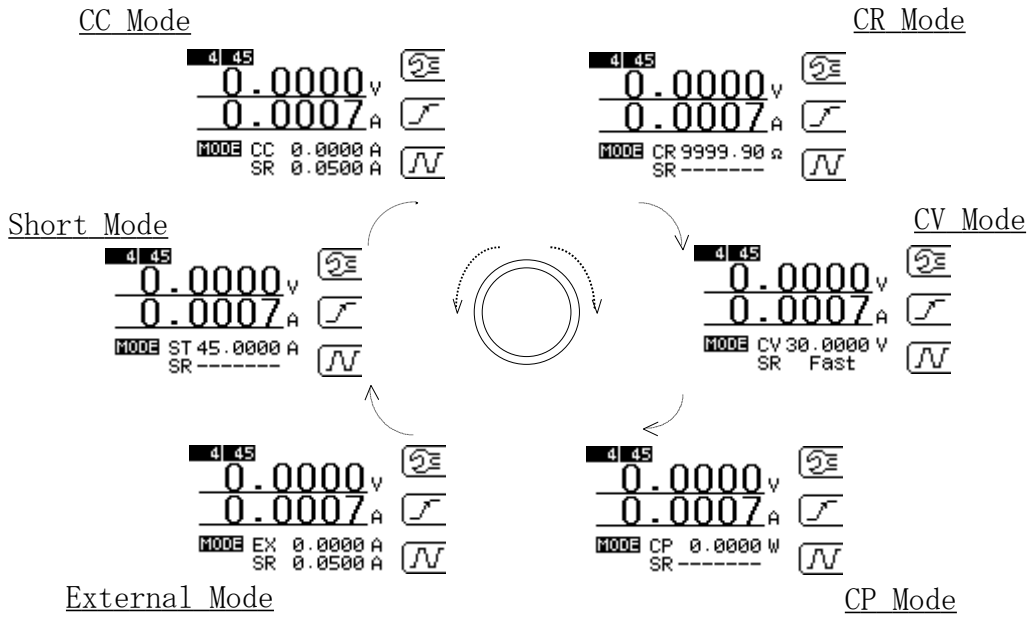
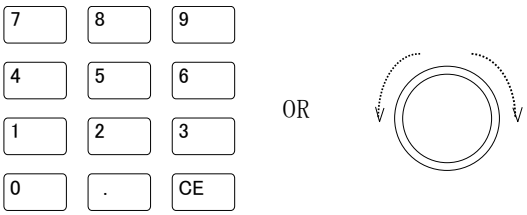


Fig. 5-1-2 Procedure to change load mode

Turn the knob until the load mode you want to select.
Press ENT key or the knob to switch to the load mode.
Or before you switch to the load mode, you can setup values of the load mode.
While the load mode is selected, use numeric keypad to input values and then press ENT key or the knob to enter the values.

5.2 Load setting

You can change values of a load condition by using numeric keypad and the knob.



(1) Numeric keypad
You can input values directly by using the numeric keypad.
The values you can input are those in the load mode currently displayed.
You can input/change values regardless of Load ON/OFF.
Use numeric keypad to input values and press ENT key to enter it.

Example: setup 28.50A in CC mode

Note: you need to select CC mode before you input the value.

Use numeric keypad to input [2] [8] [.] [5]. Then you can find underlined "28.5" is displayed as shown below. While underlined, the values are under setting up.
In this case, you didn't change load mode, (CC mode is still selected.)
Please note that Load won't be activated unless you operate the following step.

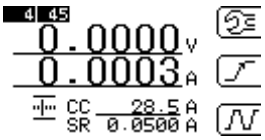
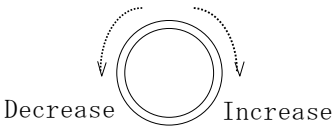


Fig. 5-2-1 Picture of current setting in CC mode

Press ENT key to enter activated setting value.

(2) Rotary knob

If you turn the rotary knob in a clockwise/counterclockwise direction, setting values increases / decreases respectively.
You can change values regardless of Load ON/OFF.



NOTE

If you turn the knob too fast, setting value may not always matches the steps you turned the knob.

(3) Increase/decrease value per step of the knob

The minimum resolution when you turn the knob is one step. You can change the resolution of this one step. The resolution of one step is displayed in icons as shown below.

00.0001
00.0010
00.0100
00.1000
01.0000
10.0000

These resolution values are common to all load modes.
To change the resolution, press CE key. When you press the CE key, resolution increases. But after 10.0, it goes to 0.0001 again.

5.3 Response Rate

You can change the response speed (slew rate) of both rising and falling time that is effective when load is ON/OFF and load condition changes. The response speed depends on the current range selected then. Load response speed of both rising and falling time is identically setup.

The load modes in which you can change the response speed are as follows:

1. CC mode

Settable load response range is as follows:

Model	High range	Low range
ELL-355	0.5A～50A/μs	0.05A～5A/μs
ELL-1005	0.5A～50A/μs	0.05A～5A/μs

Table 5-3-1 Slew rate at CC mode

2. EXT mode

Settable load response range is as follows:

Model	High range	Low range
ELL-355	0.5A～50A/μs	0.05A～5A/μs
ELL-1005	0.5A～50A/μs	0.05A～5A/μs

Table 5-3-2 Slew rate at EXT mode

3. CV mode

Settable load response are Fast (300μs)/ Slow(10ms) (loop gain setting)

Notes: CV mode
In CV mode, setting value is any of Fast or Slow only.
This value can be fixed regardless of voltage range selected.

Oscillation.
If oscillation happened due to the combined condition of response speed between this product and the target device connected, please set response speed Slow to decrease the loop gain value and to avoid the oscillation. .

How to change response speed

(1) In Constant Current and External Control modes

Make sure if it is in CC mode or External Control mode.
In the LOAD CONTROL menu, press F2 key to display a window where you can change the value.
Use numeric keypad to input value.
Press ENT key to enter the value and the value becomes effective

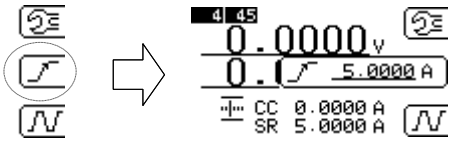


Fig. 5-3-1 Load response setting for CC and External Control modes

(2) In Constant Voltage mode

Make sure if it is CV mode.
In the LOAD CONTROL menu, press F2 key.
Turn the rotary knob to select fast or slow. .
Press ENT key to enter the value and the value becomes effective

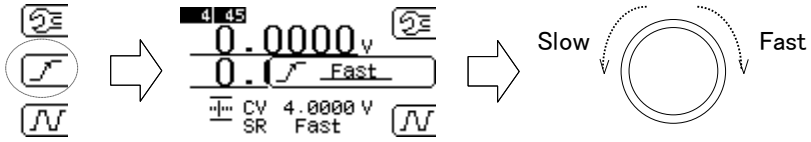


Fig. 5-3-2 Load response setting for CV mode

5.4 Current limit setting

You can limit the load current. The current limit is effective regardless of the load mode selected.
This function allows you to prevent unnecessary current flow in CV mode etc. to protect devices from possible damage.

How to change current limit

In the LOAD CONTROL menu, press F1 key. Then press F2 key to have display window where you can change the limit value in setting frame using numeric keypad. Press ENT key to enter the value and press ENT again to be the value effective with setting frame disappeared.

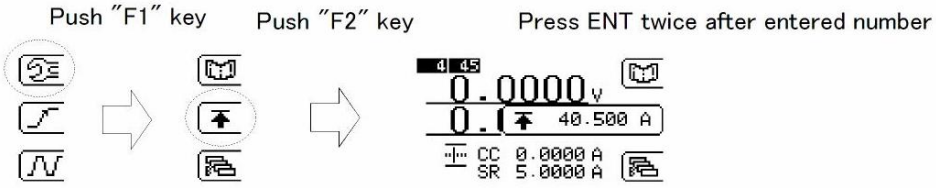
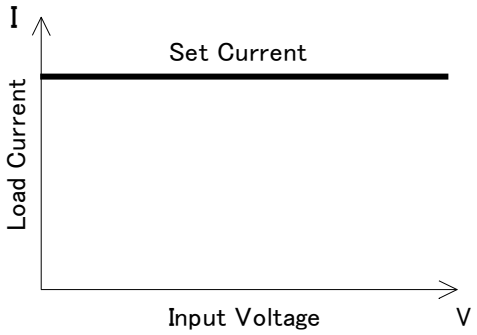


Fig. 5-4-1 Current limit setting

For more detailed about current limit refer to " 7.1 Over current limit ".

5.5 CC mode

In CC mode, a constant current flow can be set regardless of the load voltage



(1) Press the rotary knob to set mode select condition. And then turn the knob until “CC” is displayed as shown below.

(2) Input setting value by numeric keypad, and then press ENT key to enter the setting value.
No need this operation, if the previous setting value is not necessary to change because it is still memorized in the device.

(3) Press ON/OFF key to select ON to start the load current flow with setting value.

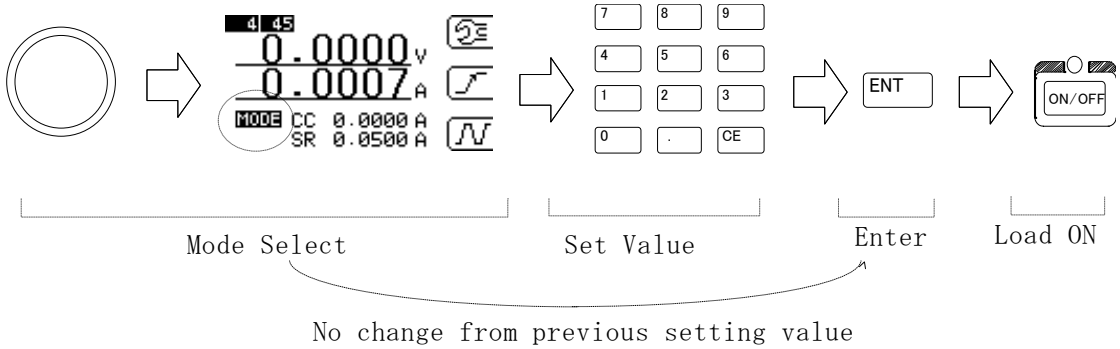
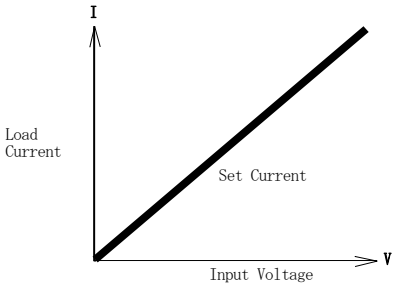


Fig. 5-5-1 Operation in CC mode

NOTE

・When CC mode is already set, CC setting value can be changed by inputting the value with numeric keypad and the ENTER key.
・When load mode is changed from CC mode, the CC setting value is stored for future use.
・When CC setting value exceeds the settable maximum value, the settable maximum (current) value is automatically set as CC value.

5.6 CR mode



In CR mode, load resistance is simulated by sink current with linearly proportional to the load voltage. This mode is suitable for a general load simulation.

(1) Press the rotary knob to set mode select condition. And then turn the knob until "CR" is displayed as shown below.

(2) Input setting value by numeric keypad, and then press ENT key to enter the setting value.
No need this operation, if the previous setting value is not necessary to change because it is still memorized in the device.

(3) Press ON/OFF key to select ON, the load current with linearly proportional to input voltage start flow to simulate setting resistance value.

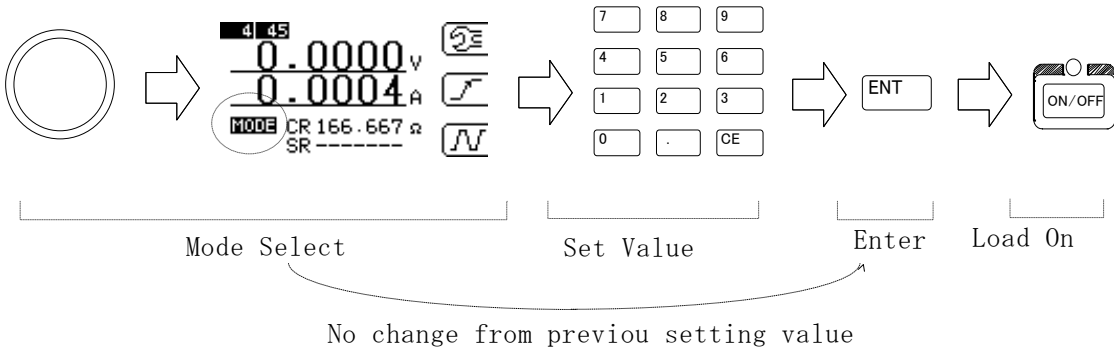


Fig. 5-6-1 Operation in CR mode

.

WARNING

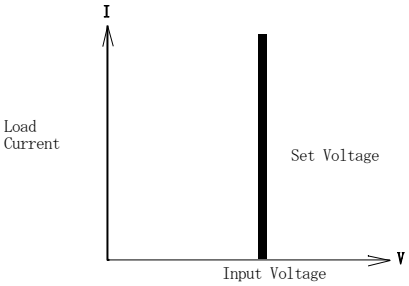
Set the remote sensing selector switch at "EXT" position in remote sensing mode.
Set at "INT" position when not in use.
Contrary may cause malfunction on measurement, setting and /or power limiting.

For detailed about the connection refer to → "2.2 Cable Connection" .

NOTE

·When CR mode is already set, CR setting value can be changed by inputting the value with numeric keypad and the ENTER key.
·When load mode is changed from CR mode, the CR setting value is stored for future use.
·When CR setting value is less than minimum value, the minimum (resistance) value is automatically set.

5.7 CV mode



In CV mode, the load current changes to keep the load voltage constant considering internal resistance of power supplies. This mode is adapted to test rechargeable batteries.

(1) Press the rotary knob to set mode select condition. And then turn the knob until "CV" is displayed as shown below.

(2) Input setting value by numeric keypad, and then press ENT key to enter the setting value. No need this operation, if the previous setting value is not necessary to change because it is still memorized in the device.

(3) Press ON/OFF key to select ON, the load current start flow to keep the setting voltage.

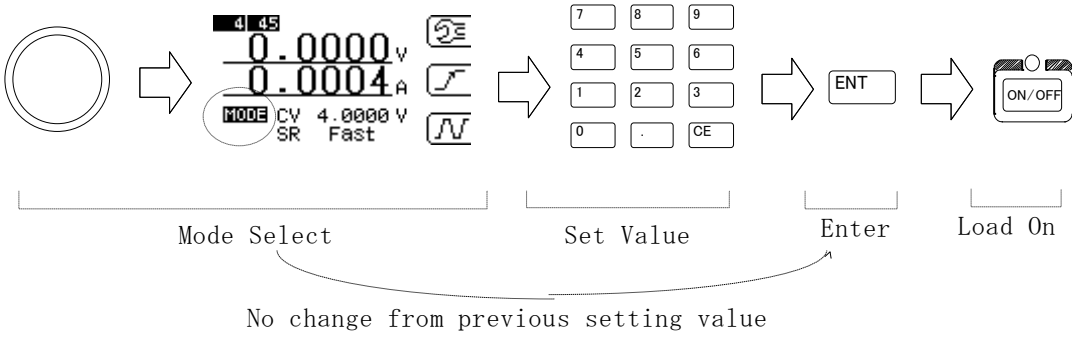


Fig. 5-7-1 Operation in CV mode

REMARK

・When CV mode is selected , connect remote sense cables to the sense terminals. Otherwise this product cannot work properly.

・

WARNING

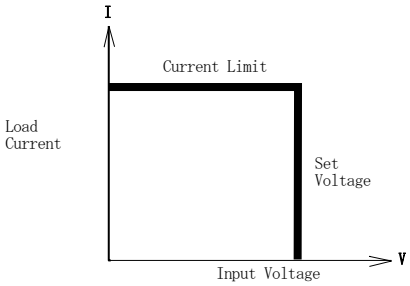
Set the remote sensing selector switch at "EXT" position in remote sensing mode.
Set at "INT" position when not in use.
Contrary may cause malfunction on measurement, setting and /or power limiting.

For detailed about the connection refer to → " 2.2 Cable Connections" .

NOTE

- Due to the principle of CV mode Operation, you may find oscillation and unstable load control because of wiring conditions or DUT. In such cases, you may stabilize the load control by changing the loop gain value to stabilize the measurement. For changing the loop gain, refer to →"5.3 Response time".
- In CV mode, there is no AUTO range for the load setting. Please note that the max load current should be the max value of the selected range: Low range: 15A, High range: 135A.

5.7.1 CV+Climit



In this CV +Climit mode, by using the current limit function in the configuration setting, you can limit the load current in CV mode. This is adapted for simulating the charge characteristics of batteries. You can set the current in about 110% of the value you set in current limit.

Constant current operation with current limit up to setting voltage can be executed.

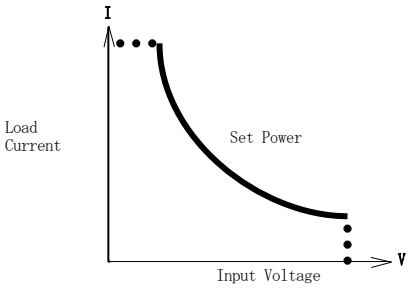
As an example, in case of batteries, load voltage value is the value you setup in CV mode, and at the same time load current value is determined by the battery voltage and the internal resistance of the battery.

To set current limit, refer to →"5.4 Current limit setting".

NOTE

・When CV mode is already set, CV setting value can be changed by inputting the value with numeric keypad and the ENTER key.
・When load mode is changed from CV mode, the CV setting value is stored for future use.
When CV setting value exceeds the settable maximum value, the settable maximum (voltage) value is automatically set as CV value.

5.8 CP mode



In this mode, load current is determined so that the load power becomes constant. This mode is adapted for simulating switching power supplies that tend to increase the load current as the voltage decreases.

(1) Press the rotary knob to set mode select condition. And then turn the knob until "CP" is displayed as shown below.

(2) Input setting value by numeric keypad, and then press ENT key to enter the setting value. No need this operation, if the previous setting value is not necessary to change because it is still memorized in the device.

(3) Press ON/OFF key to select ON to start flowing the load current which is inversely proportional to the setup power value and input voltage

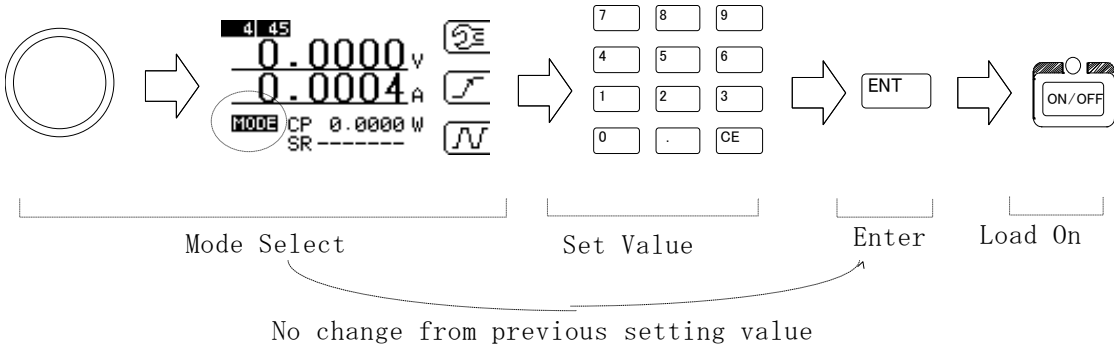


Fig. 5-8-1 Operation in CP mode

WARNING

Set the remote sensing selector switch at "EXT" position in remote sensing mode.
Set at "INT" position when not in use.
Contrary may cause malfunction on measurement, setting and /or power limiting.

For detailed about the connection refer to → " 2.2 Cable Connection" .

NOTE

・When CP mode is already set, CP setting value can be changed by inputting the value with numeric keypad and the ENTER key.
・When CP setting value exceeds the settable maximum value, the settable maximum (power) value is automatically set as CP value.

5.9 Load modes switch by threshold voltage settings

You can switch load mode by setting threshold voltage.

Mode	Description
OFF:	Disable this function
CR(H):	Switched to CR mode when measured voltage is over threshold voltage
CV(H):	Switched to CV mode when measured voltage is over threshold voltage
CP(H):	Switched to CP mode when measured voltage is over threshold voltage
LOADOFF(H):	Switched to Load Off when measured voltage is over threshold voltage
CR(L):	Switched to CR mode when measured voltage is under threshold voltage
CV(L):	Switched to CV mode when measured voltage is under threshold voltage
CP(L):	Switched to CP mode when measured voltage is under threshold voltage
LOADOFF(L):	Switched to Load Off when measured voltage is under threshold voltage

Table 5-9-1 Load mode swiched by threshold voltage

(1) Load Mode Setting

Press F1 key three times in the LOAD CONTROL menu. The menu will be changed for load mode setting after pressing ENT key as shown in Fig 5-9-1.

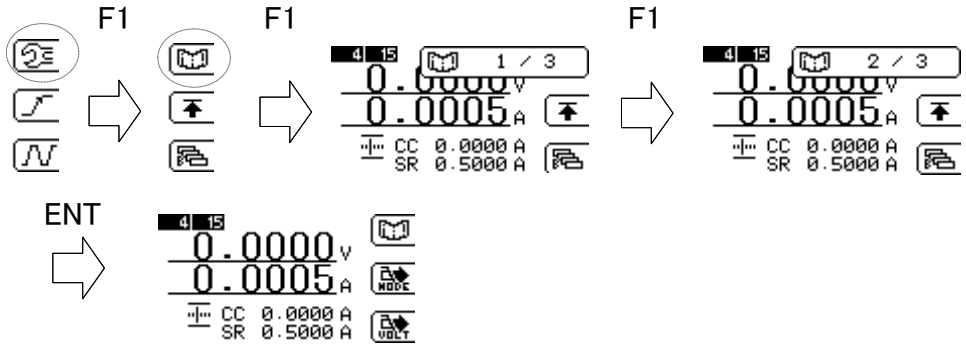


Fig 5-9-1 Procedure to select load mode setting menu

The load modes will be changed sequentially by pressing F2 key.and the required mode can be selected by pressing ENT key as shown in Fig 5-9-2.

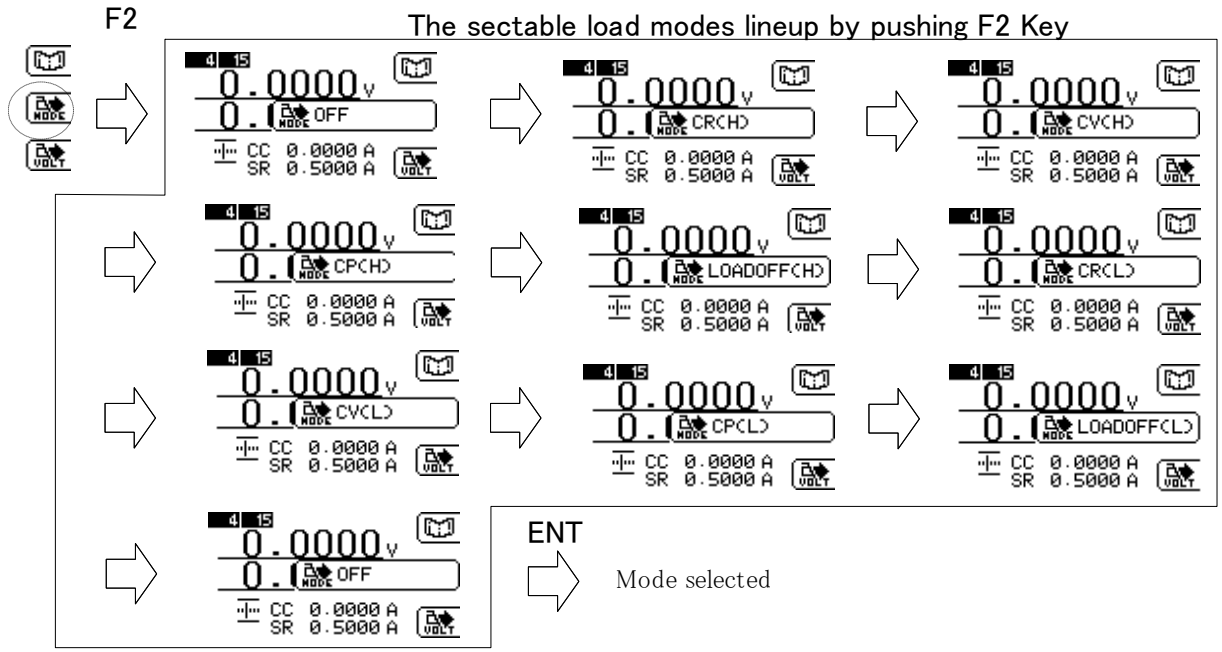


Fig 5-9-2 The load Mode selecting and setting operation

(2) Setting threshold voltage

Press F3 key to display threshold voltage entry screen and set the value by numeric keypad. Press ENT key for entering the value.

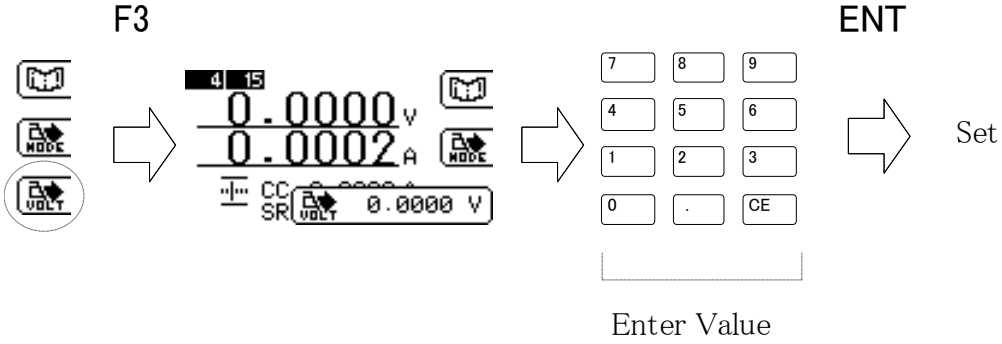


Fig 5-9-3 Operation for setting threshold voltage

(3) When load mode is set besides OFF, the load mode indicator in initial display become highlighted in reverse video.which shows load mode switching valid.

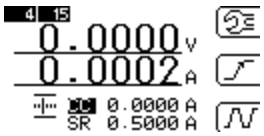


Fig 5-9-4 Load mode setting indication

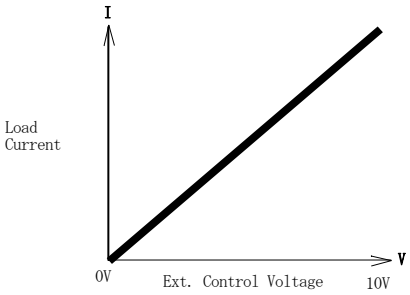
NOTE

Mode switch from CC mode to other modes is available but the reverse switching directions (To CC mode from other modes) are not available because of inconsistency range generation.

The maximum mode switching time is 240ms.

EXT mode and SHORT mode are not supported in this command.

5.10 EXT mode



In this mode, load current becomes proportional to the voltage inputted to the EXT terminal on the rear panel.

(1) Press the rotary knob to set mode select condition. And then turn the knob until "EX" is displayed as shown below.

(2) Input setting value by numeric keypad, and then press ENT key to enter the setting value. No need this operation, if the previous setting value is not necessary to change because it is still memorized in the device.

(3) Press ON/OFF key to select ON to start flowing the load current which is proportional to the setup current and ext. control voltage

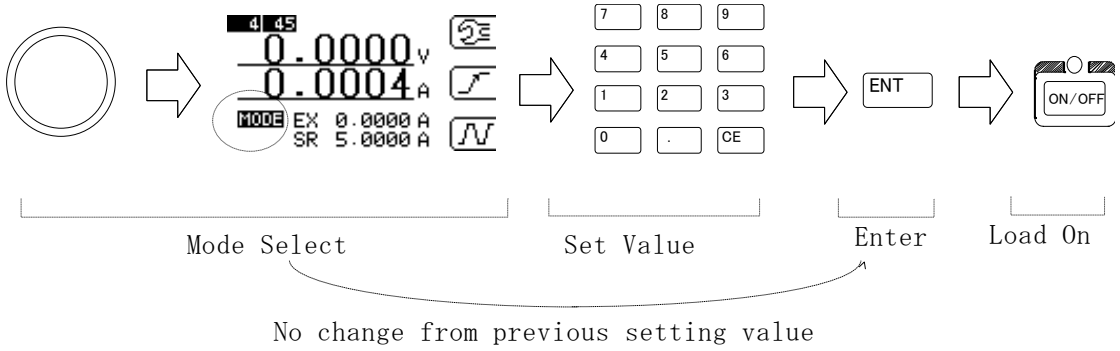


Fig. 5-9-1 Operation in EXT. Mode

NOTE

・When EXT mode is already set, EXT setting value can be changed by inputting the value with numeric keypad and the ENTER key.
・When load mode is changed from EXT mode, the EXT setting value is stored for future use.
・When EXT setting value exceeds the settable maximum value, the settable maximum (current) value is automatically set as CC value.
Load current can flow up to the maximum rated current or setup current limit whichever smaller, but the current range is fixed to High range.

5.11 SHORT mode

In this mode, load terminals are shortened
Load current can flow up to the maximum rated current or setup current limit whichever smaller, but the current range is fixed to High range.

(1) Press the rotary knob to set mode select condition. And then turn the knob until "ST" is displayed as shown below.

(2) Press ENT key or rotary knob to set the SHORT mode.

(3) Press ON/OFF key to select ON to start flowing the load current up to the rated current or setup current limit whichever smaller.

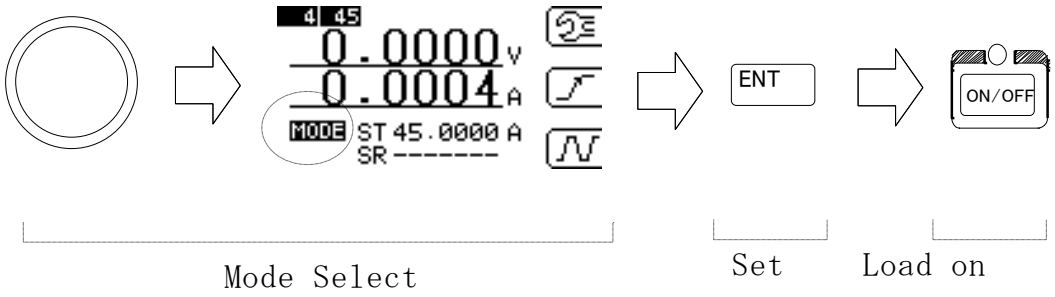
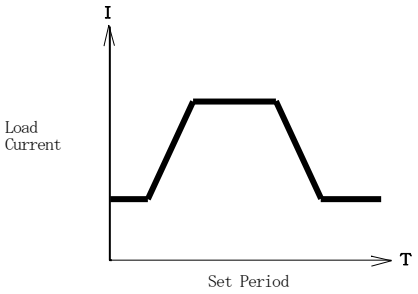


Fig. 5-11-1 Operation in SHORT mode

Model	Rated current (High range)
ELL-355	135A
ELL-1005	405A

Table 5-11-1 rated current

5.12 Dynamic Load mode (DYNAMIC)



This mode repeats multiple loading conditions.
All loading conditions of CC, CV, CP, EXT and SHORT modes can be set. However each loading condition has to be in a same loading mode.

Max.16 patterns can be set.

(1) Multiple load condition setting

The DYNAMIC loading can be achieved by multiple loading conditions.

CC1 and CC2 have the following parameters which can be setup independently each other.

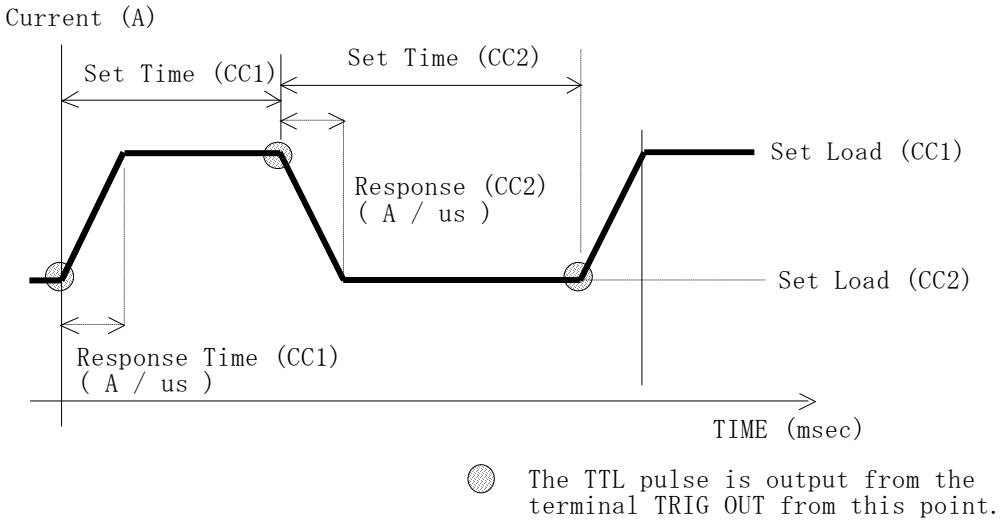


Fig. 5-12-1 DYNAMIC loading

- Load value
  Setting range is depend on present setting mode and current range which is the same as normal settings
- Effective time
  from 1 μ s to 60s (1 μ s resolution)
- Response speed (slew rate)
  Setting range is depend on present setting mode and current range which is the same as normal settings

  Above parameters can be setup independently from each other.

NOTE

- The accuracy of the effective time becomes worse as the effective time becomes longer, even though the resolution is not changed.
- In the dynamic mode operation, trigger signals are outputted from the TRIG OUT output on the front panel in the timing of circled edges in the Fig. 5-11-1.
  For more information, refer to →"2.5 TRIG OUT ".

(2) Load mode

Load mode selected is kept effective when you setup dynamic mode. For example, if CC mode is selected, then you select dynamic mode, the CC mode is still effective.

But if you change the load mode while dynamic mode is select, the dynamic mode is stopped and the selected mode is selected. For example, if both CC mode and dynamic mode is selected, and then you select CV mode, the dynamic mode is stopped and CV mode is selected.

(3) How to select dynamic mode

In the LOAD CONTROL menu, press F3 button.

Load mode selected is kept effective when you setup dynamic mode.

If CC mode has been selected when you select dynamic mode, parameters of CC mode are displayed.

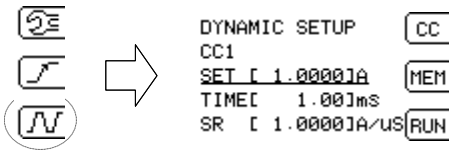


Fig. 5-12-2 Recall procedure for Dynamic loading mode

(4) How to switch between CC1 and CC2.

First, setting menu for CC1 is displayed.

Present CC_No is shown in (1) and showing parameters are under editing.

Press F1 key to switch CC_No to (3) CC_No input screen as shown in (2) menu.

Enter numeric value by F1 key or Dial or Numeric key then press ENT key.

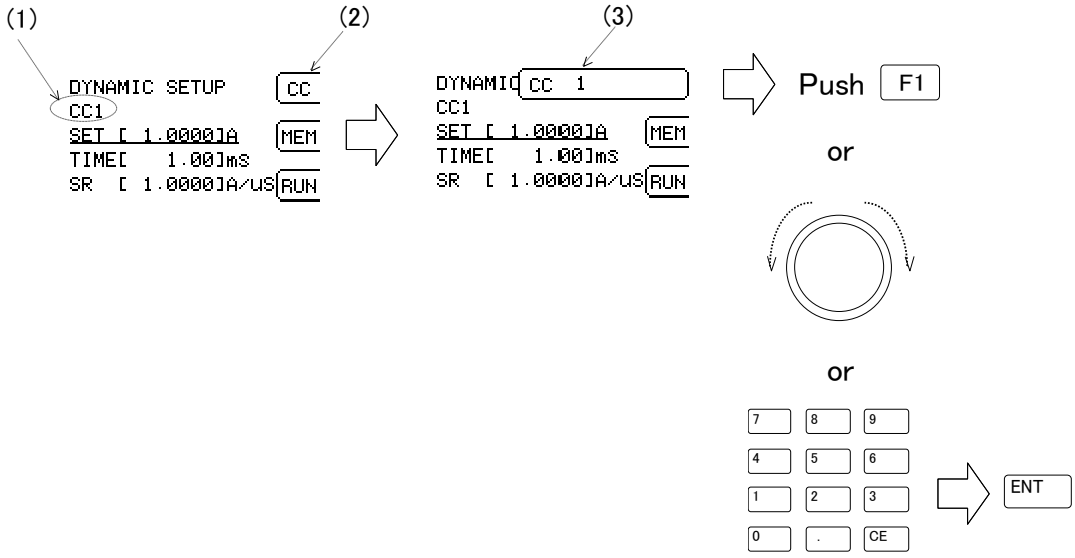
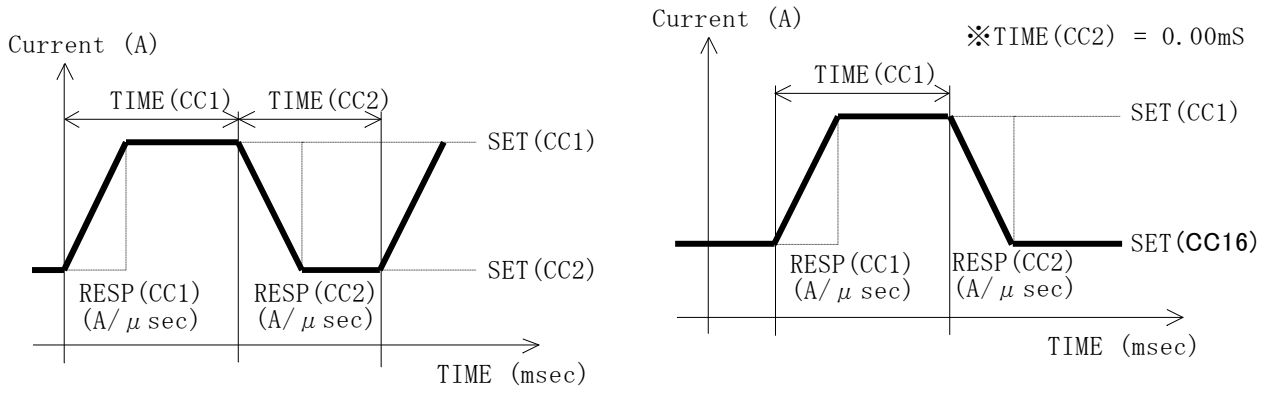


Fig. 5-12-3 How to change each CC values

(5) Setting parameters.

The following figures show each parameter and operation.

*Set CC1 and CC2 only and skipped other settings.



[Auto]

[Continuous operation] RUN-LOOP

[Single]

[Single operation] RUN-SINGLE

Fig. 5-12-4 Parameters and operation

Setting screen shown as follow.

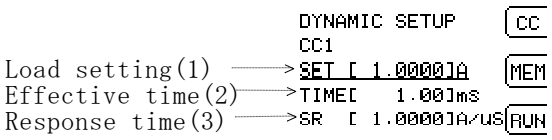


Fig. 5-12-5 Setting screen

When turned rotary knob, underline will shift accordingly.

The parameters can be entered by numeric keypad directly.
The entry value by rotary knob become effective when “ENT” is pressed at underlined item for parameters change and white/black reverse display indicates the selected item.
Pressing “ENT” again disables the input by the rotary knob.

The resolution of increase/decrease value per step for the rotary knob input is kept the same value with the load setting.
The resolution increment can be changed by pressing rotary knob while pressing “ENT”.

The CC_No can be set from 1 to 16.

The CC_No is skipped when effective time (2) is set as 0.

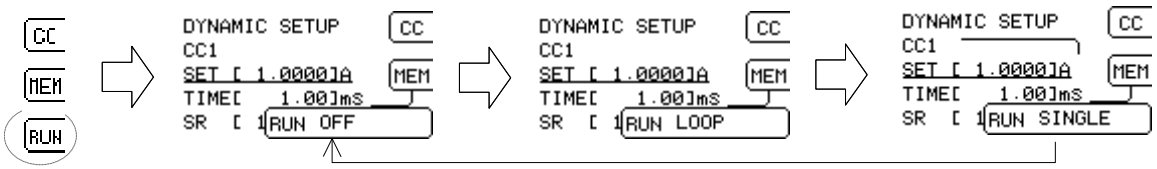
NOTE

- During the dynamic mode operation, if you change parameters, the setting becomes effective immediately.

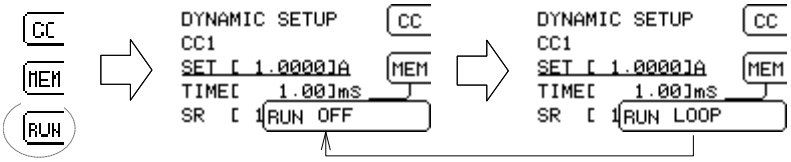
(6) Execute

Start executing after completion of CC1 and CC2 setting.
As to start, press F3 at dynamic load change mode and select OFF, LOOP or SINGLE.
Press “ENT” key or “Rotary” knob to enter.

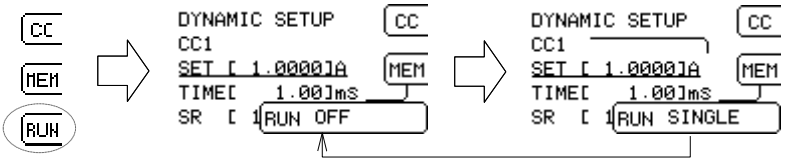
(6-1) In OFF mode



(6-2) In LOOP mode



(6-3) In SINGLE mode



(6-4) The display in Execution

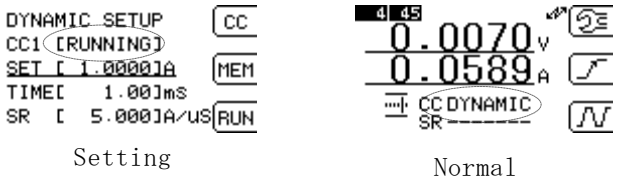


Fig. 5-12-6 Display in Execute

It will show “RUNNING” in setting display while executing or
“DYNAMIC” at setting value display area in normal mode.

(7) Example of setting

Ex-1 Continuous operation

Condition: 1A for 1ms at CC mode then 2ms for rest (no load).

1) Set CC mode at the normal setting screen
2) Set CC1 at dynamic load setting screen
3) Set CC2 at dynamic load setting screen
4) Set Load output "ON".
5) Press F3 key to select "LOOP" mode then press "ENT" to ON.

This will loop from CC1 to CC16 as so programmed in each CC setting.
*It will skip if the TIME is set as "0".

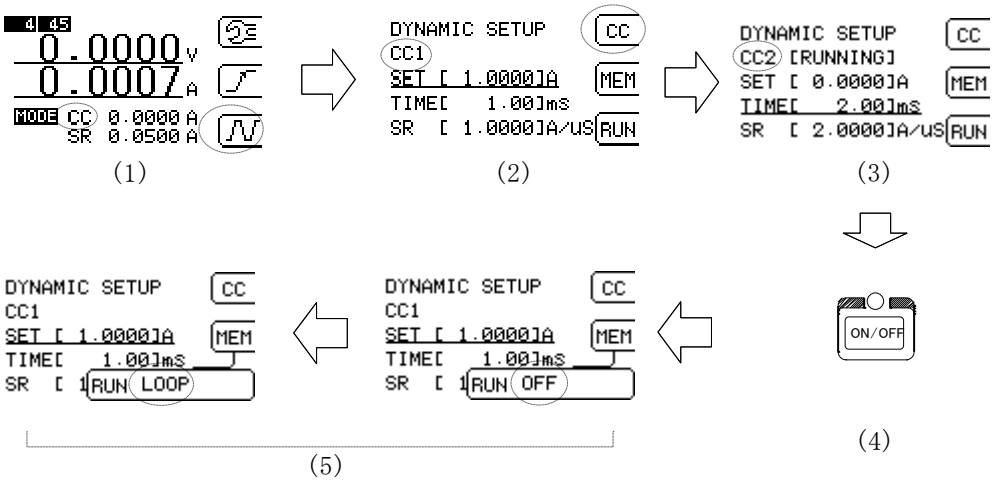


Fig. 5-11-7 Continuous operation

Ex.-2 Single operation

Condition: Draw current of 10A for 10ms at CC mode once.

1) In normal menu, select CC mode.
2) In dynamic load setting menu, setup parameters of CC1
3) Setup parameters of CC2 where parameter of the effective time should be zero (0).
4) Load ON
5) Press F3 to set the dynamic load mode to “SINGLE” then press “ENT” to ON.

This will loop from CC1 to CC16 as so programmed in each CC setting.
*It will skip if the TIME is set as “0”.

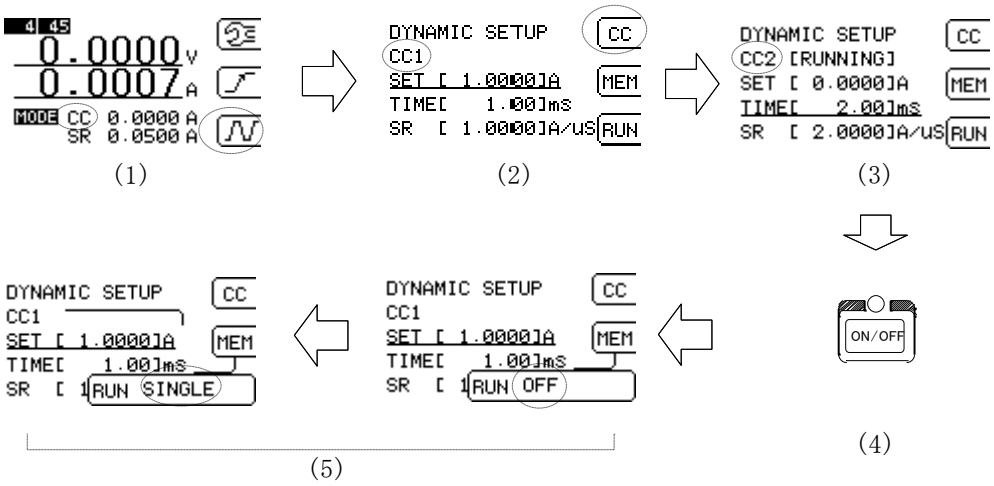


Fig. 5-12-8 Single operation

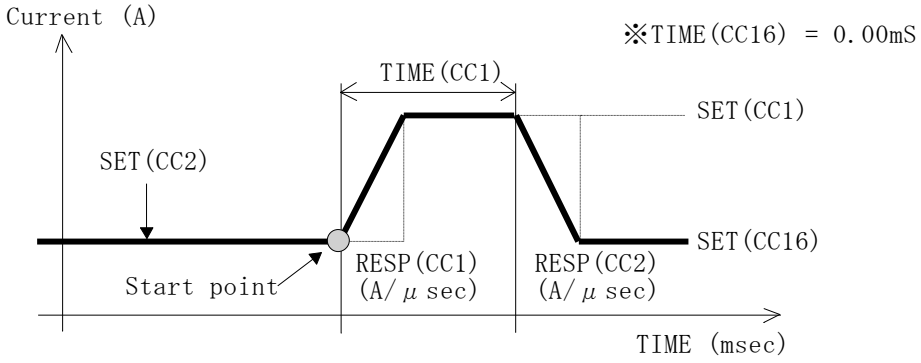


Fig. 5-12-9 Single operation in detail

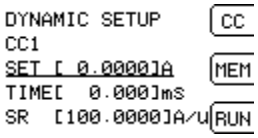
(8) How to repeat Single operation.
Press ENT key without Load ON/OFF operation.

NOTE

- This single operation is become effective only when dynamic load mode is effective. Load ON first, and then start this Single Operation.

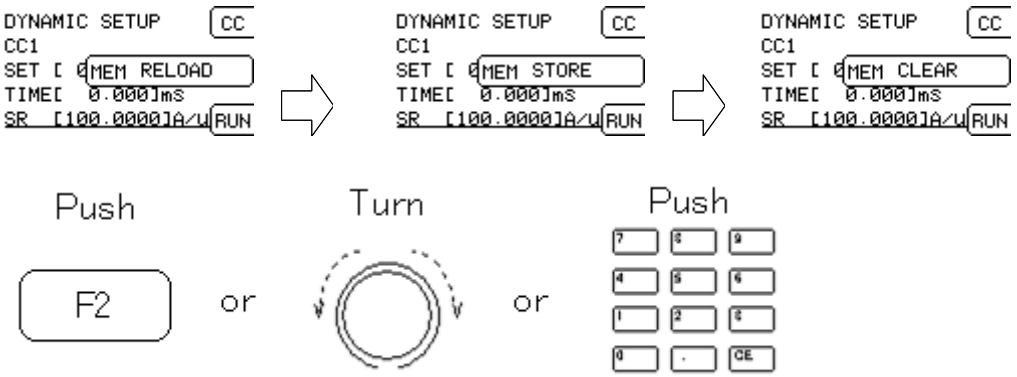
(9) Store setting, read data, clear [MEM]
Change to MEM and setting

Press [F2] at dynamic load mode.



The [MEM] mode is selected by [UP], [Down] key of rotary knob or numeric keys.

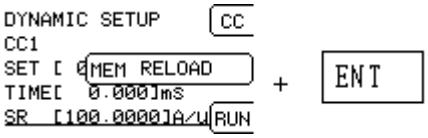
Pressing [F2] or [UP] is same in function wise.



(9-1) Reading the set value
Select [RELOAD] at MEM mode.

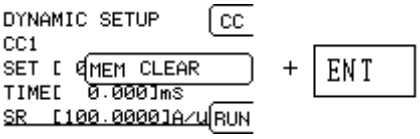
Read stored data from storage. (Initial data when booted)

The condition of the hardware is renewed in accordance to the data being read.
The stored data consists of following dynamic loading modes in four loading modes as CC, CR, CV and CP.

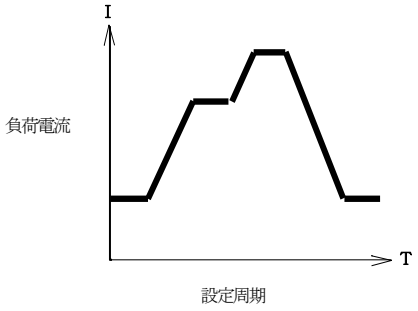


(9-2) Store the setting
Set as [STORE] at MEM mode.
Store the dynamic loading mode setting of present loading mode to storage.
The other loading mode data are not renewed by this.
By this, present dynamic loading mode setting is valid as initial setting when booted.

(9-3) Clear the setting
Select [CLEAR] at MEM mode.
Clear the setting of dynamic loading mode to the default value.
Set the following to all steps: SET=0.0/TIME=0.0/SR=MAX
The hardware will be renewed its setting in accordance to the data being read.
The stored data is not renewed.



5.13 Dynamic (Sequence) mode operation



・ The sequence mode is to test in different loading condition continuously but in fixed time period per step.

・

・ Maximum 1024 steps loading condition can be set as arbitrary loading patterns in minimum 1msec time period per step.

・

・ A complicated loading pattern can be realized without using external control signals.

(1) Specification for sequence mode

Interval	1 msec – 10min. The same time period applied to all steps.
Loading steps	1 – 1024 steps
Repeat	1 – 65535, Continuous
Loading mode	CC, CR, CV, CP
Control	Remote control by GPIB/USB
Reset	Remote control by GPIB/USB or “CE” key on the panel

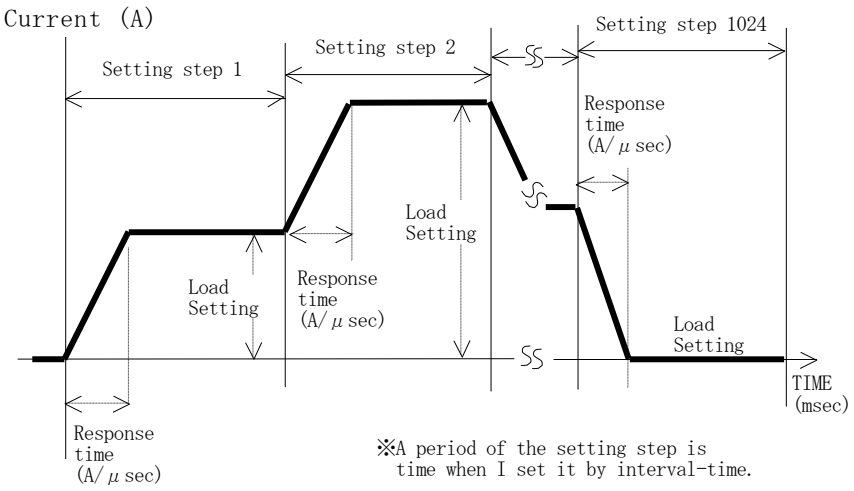


Fig. 5-13-1 Sequence load (CC mode)

(2) Setting by sequence control software .xls

The sequence mode is supported by GPIB or USB.
The attached Excel can be used in USB interface.

It is necessary to install device driver to the PC.
As for the installation, refer to "8.8 USB interface"

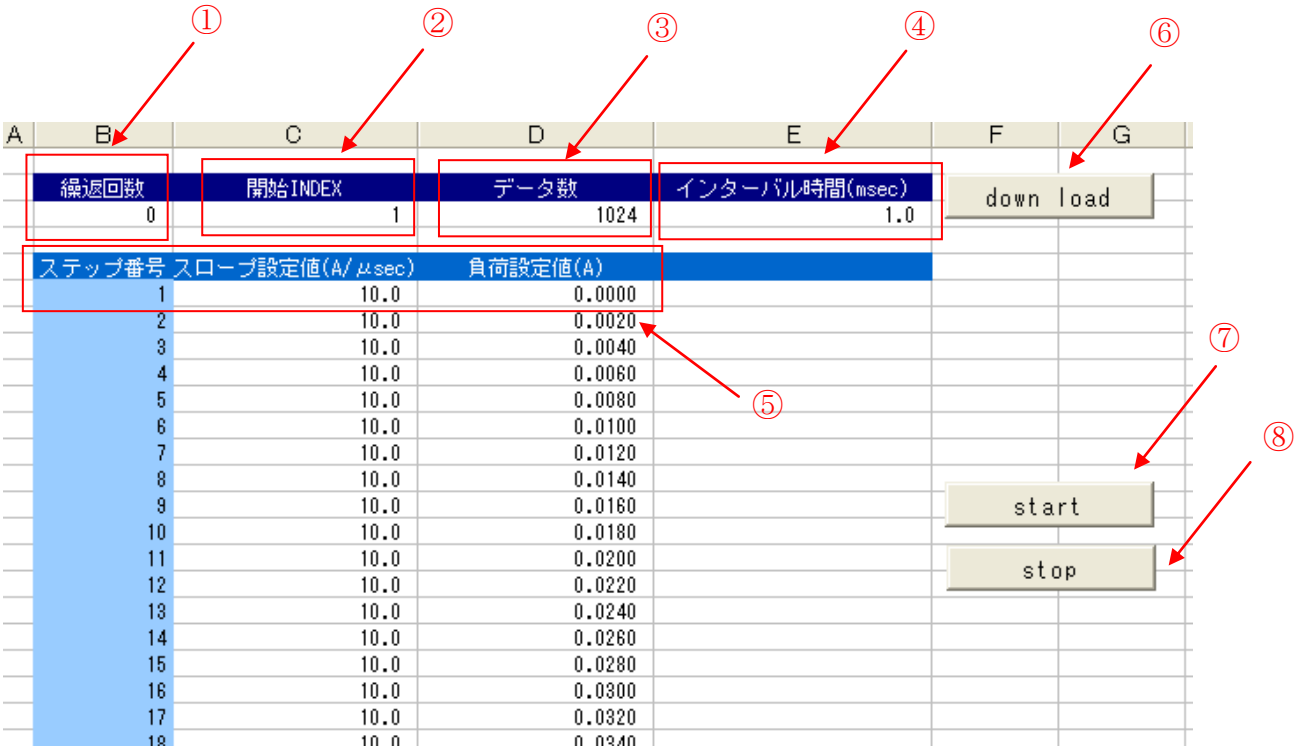


Fig. 5-13-2 Sequence control software .xls

① Repetition — Set the number to repeat as shown in start INDEX and to DATA NO. For continuous loop operation, set as "0".

② Start INDEX — Starting step. Range: 1 – 1023.

③ Data number — Ending step. Range: 2 – 1024.

④ Interval — Set the time period of each step. Range: 1msec – 10min.

⑤ Step No. — Slope and load condition can be set in each step differently. Range: 1 – 1024.

Slope setting — Set slew rate of the step. Unit: A/u sec

Load condition — Set the current value of the step. Unit: A

The slew rate setting is effective at CC mode only. The slew rate setting is ignored at the other loading mode and set at maximum slew rate.

The setting value should be followed present setting load mode. (Example: Resistance for CR mode, Voltage for CV mode. Power for CP mode)

⑥ Down load　　Transfer the data to the electronic load. The electronic load shows [SEQLOAD] after completion.

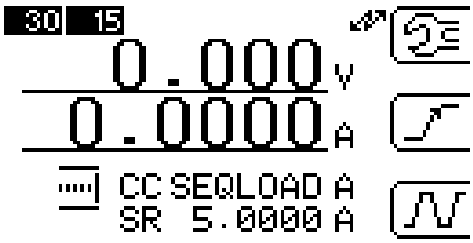


Fig. 5-13-3 Display at sequence mode

⑦ start　　Start the sequence operation
⑧ stop　　Stop the sequence operation

The attached sequence control software .xls is developed by VBA of Excel.
Refer to the Appendix. A.) for the commands.

Three sequence programs are contained as sample in SINE wave form, Triangular waveform and circular ark waveform. Use them as you like.

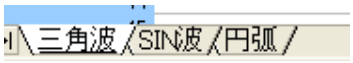


Fig. 5-13-4　Excel sheet for the sequence program

(3) Notice on sequence mode

(a) Setting

The operation of sequence mode is depending on the present loading mode and current range. Current range cannot be set from the sequence mode.
The sequence load setting is set as the condition of the present loading mode.

NOTE

If the present loading mode is CR mode, the setting is interpreted as resistance value.

(b) The down loaded sequence mode data is not stored.
(Down load it when it is necessary)

(c) Dynamic loading mode cannot be used in sequence mode.

(d) Manual operation on front panel is prohibited in sequence mode.

(e) Current auto ranging can not be used in sequence mode. (Use fixed range only)

(Others)

- Stop operation on the front panel.
  Press “CE” key on the front panel to stop the operation.
- Measurement in sequence mode
  The measurement is as same as in remote operation mode.
  The front panel measurement values can be renewed in real time when free run condition is set by remote command.

Appendix 1 Setting command

1) Initialize command

SQI no argument

Function: Clear all data to “0”

2) Load setting data

SQD [Data index No. (1-1024)],[Slew rate],[Load setting]

Function: Set each loading condition

3) Execute condition

SQU[No. of loops, 1 – 65535, 0 for continue],[data index no.(1 – 1024)],[No. of output data (1 – 1024)]

Function: Set execute conditions in sequence mode

4) Start / Stop

SQC [start (1) / stop (0)]

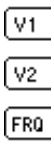
Function: Control of start or stop operation in sequence mode

Chapter 6 Operations for measurement mode

This product has three (3) measurement modes: Current, Voltage, and Power.
There are 2 ranges for voltage measurement and 3 ranges for current measurement for accurate measurement.
For ripple noise measurement, there is an optional RC-02 measurement module (Factory option).

6.1 Measurement value display

In this product, you can select two (2) items to be displayed.
To select display item, you can do the same way as explained in 4.2 Menu Selection to call a MEASURE SETUP menu.



(1) Change item of upper display
To change item of upper display,
Press F1 key to display select item window.
Press F1 key or turn the rotary knob to select item.
Press ENT key or the knob to enter the item.

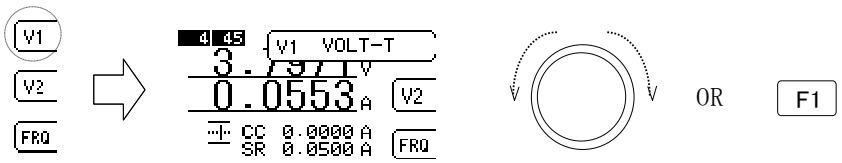


Fig. 6-1-1 Setting for Upper display

(2) Change item of lower display
To change item of lower display,
Press F2 key to display select item window.
Press F2 key or turn the rotary knob to select item.
Press ENT key or the knob to enter the item.

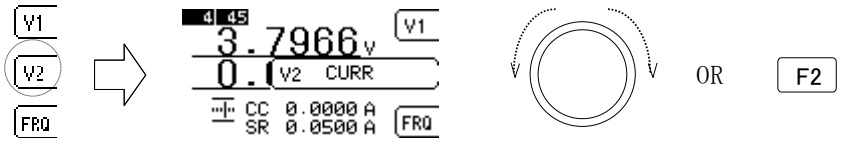


Fig. 6-1-2 Setting for lower display

The characters shown in the frame on the screen are interpreted as follow:

*CURR and POWER with –BS shows total current or power in parallel operation.

VOLT-T	Voltage at terminals (Voltage between loading terminals)
CURR	Load current
CURR-BS	Load current (Total current in parallel operation)
POWER	Power (Load current x Voltage at terminal)
POWER-BS	Power (Total power in parallel operation)

VOLT-I	Voltage by RC-02A module
NOISE	Noise by RC-02A
RIPPLE	Ripple by RC-02A

Note: RC-02A module can be provided by a factory option of this product.

REMARK

- For voltage measurement, connect remote sense cables to the sense terminals. Otherwise this product cannot work properly.
- For detailed about the connection refer to → "2.2 Cable Connection".

6.2 Sampling rate

To cancel the influence of humming noise, you can select sampling rate of A/D converter in this product. In general, the same frequency with commercial line is selected.

- Select frequency

To select sampling rate, display MEASURE SETUP menu.
Press F3 key to display sampling rate window as shown below.
Press F3 key or turn the knob to select 50Hz or 60Hz.
Press ENT key or the knob to enter the frequency you selected.

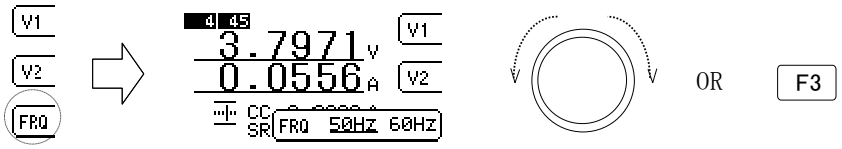


Fig. 6-2-1 setting for sampling rate

6.3 Voltage / Current ranges

Note; Switching the ranges of this product affect not only to measurement but also to load setting. Please pay attention to the specifications of each range before you use this product.
No dedicated menu for changing range but it can be done from any menu except I/O menu which is under I/O setting.

(1) Voltage range setting
Press the rotary knob twice quickly.

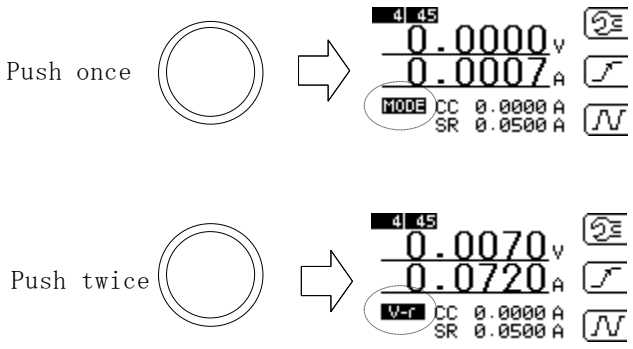


Fig. 6-3-1 Voltage range setting - 1

After the knob is pressed first, MODE is displayed in the dot circle in the upper figure. When the knob was pressed second, "Vr" is displayed. Turn the knob to select "4V" or "30V" as shown below. Press ENT key or the knob to enter the selected setting.

Fig. 6-3-2 Voltage range setting – 2

Voltage range

Model	Range HIGH	Range LOW
ELL-355	30V	4V
ELL-1005	30V	4V

Table. 6-3-1 Voltage range by models

The voltage range can be set only HIGH or LOW as fixed range.

(2) Current range setting
Press the rotary knob three times quickly.

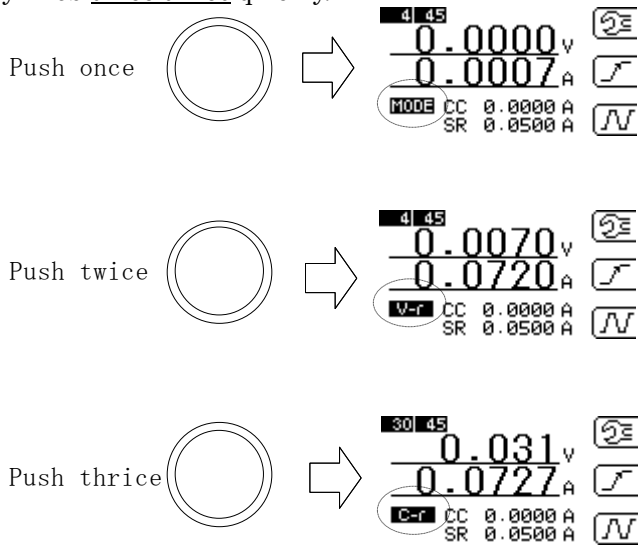


Fig. 6-3-3 Operation to change current range - 1

When you press the knob once, MODE is displayed in the dot circle as shown in the upper figure. When you press the knob three times quickly, “Cr” is displayed.
Turn the knob to select “45A”, “405A”, or “AT” as shown below.

“45”	45A fixed range
“405”	405A fixed range
“AT”	Auto range

Press ENT key or the knob to enter the selected setting.

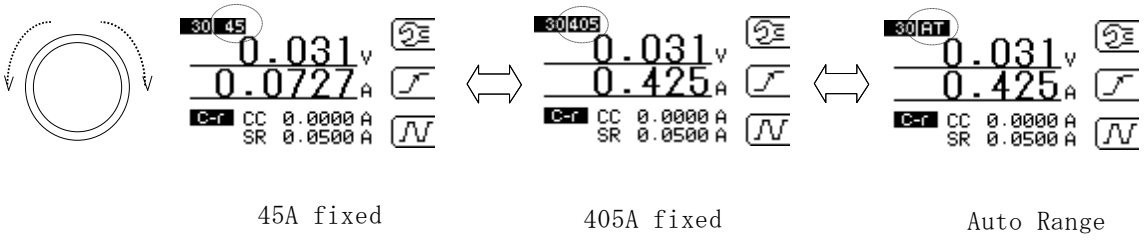


Fig. 6-3-4 Operation to change current range –2

Current range

Model	Range HIGH	Range LOW
ELL-355	135A	15A
ELL-1005	405A	45A

Table. 6-3-2 Current range by models

Chapter 7 Alarms

Protection features and alarms of this product are described.

In this product, when an alarm occurs, load is automatically forced to LOAD OFF, with beep sound and error message on display.

7.1 Over current limit

To protect load section, load current of this product can be limited. When you setup the current limit, current will be limited with the 110% (typ.) of setting value. The default value is 135A (for ELL-355)

Model	Default current limit
ELL-355	135A
ELL-1005	405A

Table. 7-1-1 Default current limit setting

For the operation of setting current limit, refer to → "5.4 Current limit setting".

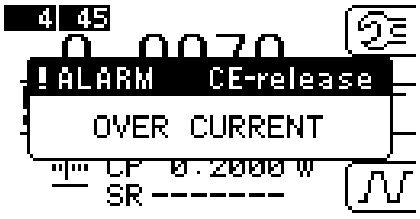


Fig. 7-1-1 Display of over current alarm

REMARK

- When the limit value is set less than 15 % (Typical) of range (about 20A in High range 135A, about 2.2A in Low range 15A) the accuracy of the limit current will be deteriorated.
- Transient peak current over current limit may be drawn in CV mode.
- Never set current value more than 100 times than its limit value.

7.2 Over voltage alarm

When the load voltage exceeds the tolerance value, this alarm operates. This protection will be activated when applied 104% (typ) of rated voltage.

Model	Range HIGH	Range LOW
ELL-355	31.2V	4.16V
ELL-1005	31.2V	4.16V

Table 7-2-1 Threshold voltage for OVP.

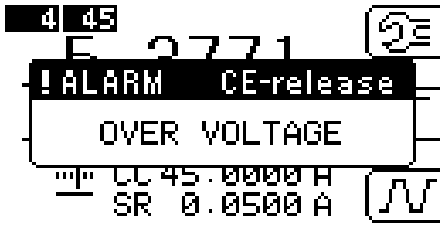


Fig. 7-2-1 Display of over voltage alarm

- This is alarm only and the load section won't be protected by this alarm.
- When an alarm is issued, if you find a phenomenon of a trouble like abnormal smell, sound, please stop using immediately, and ask us for repair.

7.3 Over temperature alarm

This alarm is raised when the temperature exceeds 90℃(Typ) at temperature detection point on heatsink of the load.

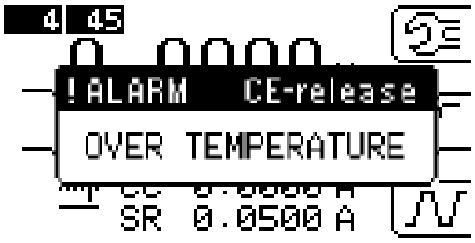


Fig. 7-3-1 Display of overheat alarm

CAUTION

- Please note that the cause of alarm lies in blocked air inlet / air outlet of this product, stopped cooling fan due to dust, or higher ambient temperature than that of in specification sheet.

7.4 Reverse connection alarm

This will be activated when reverse current is detected.

Model	Threshold current
ELL-355	-1.5A(typ)
ELL-1005	-1.5A(typ)

Table 7-4-1 Threshold current for Reverse connection protector

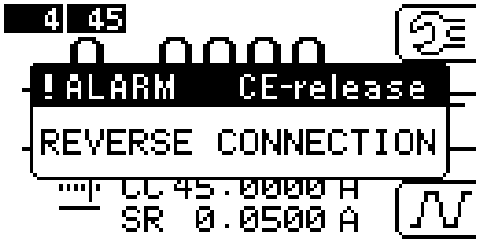


FIG. 7-4-1 Display of reverse connection alarm

- This is alarm only; the load section won't be protected. Please remove cause of alarm immediately.
- When you detect any trouble indicaton like unusual smell, noise and so on after alarm is raised, please stop use of the load immediately and ask us for repair.

REMARK

- The reverse connection voltage of -0.6V (Typ) or more is required for the detection of this alarm,

7.5 Stop an alarm

Alarm can be stopped by pressing CE key.
Note: Make sure to remove the cause of the alarm before stopping the alarm.

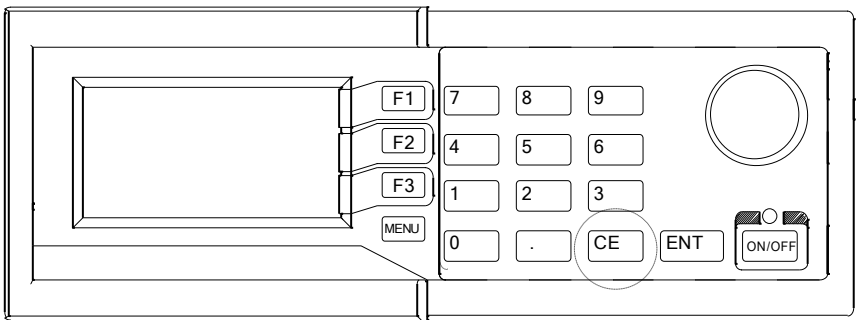


Fig. 7-5-1 CE key

7.6 Instaneous power limited status

Instaneous power limited status become active when maximum power exceeds 350W (Typ) < Pin or the Peak Power Limit condition is violated.
For the Peak Power Limit Condition, refer to → " 10.6 Operation Area "

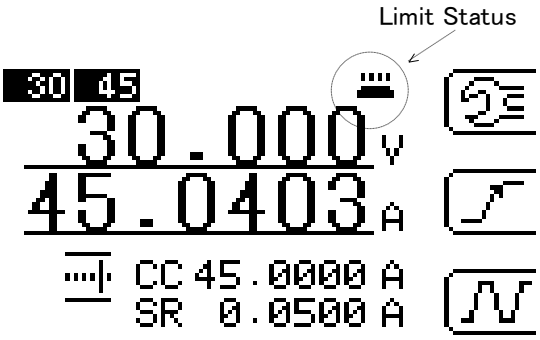


Fig. 7-6-1 Display status when the power limited

WARNING

Set the remote sensing selector switch at "EXT" position when remote sensing is used.
Set it at "INT" position otherwise.

Contrary to this may cause measurement error or malfunction of setting and power limit.

For detailed about the connection refer to → " 2.2 Cable Connections"

7.7 Release the power limited status

Power limit will be released only automatically.
It is not possible to release the power limit status by manual operation.

Chapter 8 Remote control

This product has the GP-IB (IEEE488.1 compliant) and USB (USB1.1 compliant) interfaces as standard installation. The automatic measurement system can be easily configured owing to the features of parameter setting on panel display and readback feature for current and voltage measured value on this product.

8.1 GP-IB interface

(1) Address
Address number can be used from 1 to 30.

(2) Delimiter
Delimiters that you can select in this product are" CR, LF, CR + LF or None". Regardless of this setting, "EOI" (End of Strings) will be outputted without fail.
For the operations of the setting , refer to →" 4.4 I/O setting".

(3) Multiple statement
The separators for multiple commands in a single line are space, comma, colon, semi-colon, or tab. Without any separators, the commands won't recognized properly.

(4) Switch from Remote to Local
To switch from Remote mode to Local mode, press CE key, then you can operate from the front panel of this product.

REMARK

- Max. No. of instrument connected : 15 (including a controller)
- Total length of cables should be less than 20m and any cable between two devices should be 2m or shorter.
- More than two GPIB connectors can Not be connected at one position.
- Power OFF first, before you connect /disconnect connectors.
- All instruments via GP-IB should be turned ON when used.

8.2 Measurement commands

Function	Command	Operating/setting range	Memo
Load current measurement	MC{NR1}	range: 0-2 0:AUTO range 1:current High range 2:current Low range	*1 readback value:real number(##.###)
Voltage at the load terminal measurement	MV{NR1}	range: 1-2 1:voltage High range 2:voltage Low range	*1 readback value:real number(##.###)
Simplified current measurement in booster operation	BMC{NR1}	Range 0 - 2 0:Auto range 1:Current range HIGH 2: Current range LOW	*1 readback value: real number (##.###)
Simplified power measurement in booster operation	BMW	Voltage at terminals x Simplified load current	Calculated value is returned. readback value: real number (##.###)
power measurement	MW	Load terminal volt.×load curr.	calsulated power result is back readback value:real number(##.###)
select display	DS{NR1}	range 0-1 0: select upper display 1: select lower display	*2 select display to be displayed while measuring
Fixed measurement mode	MF{NR1}	range 0～1 0:free run meas. 1:single meas.	meas. command selected last will be executed repeatedly.
meas. frequency setting	HZ{NR1}	range 0～1 0:50Hz 1:60Hz	sampling rate of the AD for measurement can be setup.
Load mode switching by Thresold volttage	LM{NR1}	range 0～8 0:OFF: Disable this function 1:CR(H):Switched to CR mode 2:CV(H):Switched to CV mode 3:CP(H):Switched to CP mode 4:LOADOFF(H) Load Off 5:CR(L):Switched to CR mode 6:CV(L):Switched to CV mode 7:CP(L):Switched to CP mode 8:LOADOFF(L): Load Off	When measured voltage is over(H) or under(L) thresold voltage setting, load mode will be switched to specified function mode.
Threshold voltage setting for load mode switching	LV{NR2}	range 0.0000[V]～Max Value[V]	

Notes
{} : you can NOT omit in this paren NR1・・・・・・ integral value
*1: Setting range and the measurement range of load section can not be setup independently but should be set as iden
*2: when power is ON, lower display is selected as the default
*3 Refer to the instruction manual of RC-02A for ripple noise measurement module commnd.

8.3 Load setting commands

Function	Command	Operating/setting range	Memo
Load setting	CC{NR2}	Constant current〔A〕	When setting load consditions, mode and setting values are setup at the same command.
	CR{NR2}	Constant registor〔Ω〕	
	CV{NR2}	Constant voltage〔V〕	
	CP{NR2}	Constant power〔W〕	
	CX{NR2}	Current value[A] when external control voltage is 10V.	
	CS	Short Current range becomes High range	
	CD{NR1}	range: 0～2 0:stop/shift dynamic operation 1: start dynamic loop operation 2: start dynamic single operation *2	When CD command is issued, dynamic seettings become activate. Setting of switch 1 to 2 or 2 to 1 is not available.
Dynamic	DP{NR1}	range: 0～16 1:define "TIME A" and section "CC-1". 2:define "TIME B" and section "CC-2" n:define "TIME X" and section "CC-n"	Section where DC and DTcommands are are efficitve is defined
	DC{NR2}	current value(A) in section.	efficitve for the section defined by DP command
	DT{NR2}	time period (msec) of section.	
	DR{NR2}	set load response (slew rate) (A/μsec)	settable regardless of DP setting
Current setting range	RC{NR1}	range : 0～2 0: auto range 1:High range 2:Low raneg	*1 load current range
Voltage setting range	RV{NR1}	range: 1～2 1:High range 2:Low raneg	*1 load voltage range This setting influences CR and CV settings.
Output control	SW{NR1}	range: 0～1 0:load OFF 1:load ON	Load OFF becomes no load condition inactivating load settings.
Load response (slew rate)	GC{NR2}	response time [A/μs] in CC and EXT setting	Valid for CC, EXT,and CV setting only. or max default value in other modes.
	GV{NR2}	response time [%] in CV setting The following two rqnges 0.1～less than 50: Slow setting 50～100: Fast Setting	
Current limit setting	LS{NR2}	Current value[A] up to max. rated value.	No limit for load current setting range.
Booster setting	BS{NR1}	Range: 0-2 0:Normal 1: Master 2: Multi	To set Master/Multi, present setting has to be in Normal.

Notes:
{}: you can NOT mot in this par NR1・・・・・・ integral value
NR2・・・・・・ real value

*1: Setting range and the measurement range of load section can not be setup independently but should be set identically..
*2: Single operation with CD2 command is activated by changing from LOAD OFF to LOAD ON.
*3 Refer to the instruction manual of RC-02A for ripple noise measurement module commnd.

8.4 System command

Function	Command	Operating/setting range	Memo
return Version no.	V	return ROM version	
release alarm	AC	release alarm	
initialize	INI	initialize	Remote condition is retained.
clear	CL	clear	set power ON condition
response data	T0	comma, space	bound symbol of response data
	T1	comma	
	T2	space	
SRQ setting	S0	N/A	setting SRQ issuing conditions
	S1	command error	
	S2	alarm issues	
	S3	command error and alarm issues	

8.5 Multi line message

The multi line message is effective when the ATT signal is “Low”.
In this product, the following functions are supported.

Function	Code	description	memo
device clear	20	DCL (Device Clear)	set the same condition as power ON
	4	SDC (Selected Device Clear)	
trigger	8	GET (Group Execute Trigger)	repeat last command
panel operations	1	GTL (Go To Local)	release remote condition
	17	LLO (Local Lock Out)	inhibit frrom relreasing remote condition

Notes:
Codes of multi line command is sent as binary data
So it is not accessed from normal sending command usually used.

8.6 Status registers

By these status resisters, you can read the status (alarms and errors) of this product by way of serial pole. Each bit represents as follows.

Bit (HEX)	abbrev	description	memo
80	ALM	alarm is issued	set when bits of ST0～ST2 is high.
40	SRQ	service request	when service request is setup.
20	ERR	commad error	back status of operating command
10	BUSY	command in operated	back status of operating command
08	LIMIT	status of current limit	set when laod control has a trouble
04	ST2	back alarm status by number	
02	ST1	0:normal, 1:over volt., 2:overheat	
01	ST0	3:reverse connection,	

8.7 GPIB sample program

There are sample programs provided herein based on Microsoft Visual Basic for a GPIB card of National Instruments. Refer to the suppliers' relevant document for the Visual Basic and the GPIB card thereof.

Sample - 1)·····section in Command1_Click()
This is a basic program to display the measurement result by CC mode setting (Initial value 50A and decrease it by 5A step), using default conditions of load setting range. The measured voltage between the load terminals and current measurement results are displayed.

Sample – 2) ·····section in Command2_Click()
Using dynamic mode of constant current, this program continuously changes the current as shown below. The numbers shown in Fig 8-7-1 are corresponding to the number of the comments in the sample program.

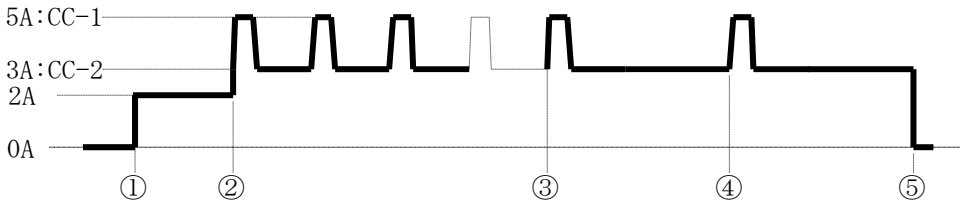


Fig. 8-7-1 Load current transition change based on this program

Sample- 3) ·····section in Command3_Click()
This is a program to read and display the status information by serial pole.

```
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 sample-1

    Call InitIF                                        ' initialize the GPIB I/F
    ilwrt IFid, "SW1", 3                               ' LOAD ON

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

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

    For i = 0 To 10                                    ' set No of loops for 11 times
        cmd = "CC" & CStr(curr)                        ' create cc setting command
        ilwrt IFid, cmd, Len(cmd)

        ilwrt IFid, "MV1", 3                           ' Volt meas in HIGH range
                                                       ' send a command
        rcv = "                    "                   ' fill in receive characters domain
                                                         with blank
        ilrd IFid, rcv, 16                             ' receive meas. value
        MsgBox rcv & "[V]", vbInformation, "Voltage"   ' receive meas. voltage

        ilwrt IFid, "MC0", 3                           ' send current meas, command
        rcv = "                    "
        ilrd IFid, rcv, 16
        MsgBox rcv & "[A]", vbInformation, "Current"

        curr = curr - 5#                               ' decrease next setting by 5A
    Next i

    MsgBox "End CC set & Measure loop Sample Program"

    ilwrt IFid, "SW0", 3                               ' LOAD OFF
    ilwrt IFid, "CC0", 3                               ' Set value for 0A
End Sub                                                ' End of sample -1)
```

```
Private Sub Command2_Click()                    ' start sample-2)

    Call InitIF                                 ' initialize GPIB I/F

    ilwrt IFid, "SW1", 3                        ' LOAD ON
    ilwrt IFid, "CC2", 3                        ' set constant cur. for 2A
                                                ' ①


    ilwrt IFid, "DP1 DC5 DT10", 12              ' CC-1=5A TIME-A=10msec
    ilwrt IFid, "DP2 DC3 DT40", 12              ' CC-2=3A TIME-B=40msec
    ilwrt IFid, "DR5", 4                        ' RESPONS=5A/usec

    MsgBox "Dynamic Load Start"                 ' ②

    ilwrt IFid, "CD1", 3

    MsgBox "Dynamic Load Stop"                  ' ③

    ilwrt IFid, "CD0", 3
    ilwrt IFid, "DP2 DT0", 7                    ' TIME-B=0msec

    MsgBox "Single shot Dynamic Load Start"

    ilwrt IFid, "CD1", 3                        ' ④

    MsgBox "End Dynamic Sample Program"

    ilwrt IFid, "SW0", 3                        ' LOAD OFF
                                                ' ⑤


    ilwrt IFid, "CC0", 3                        ' set value for 0A
End Sub                                         ' End of sample-2)


Private Sub Command3_Click()                    ' start sample-3)

    Call InitIF                                  ' initialize GPIB I/F

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

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

8.8 USB interface

If you have a PC having a USB interface (OS should be Microsoft Windows 2000/XP), you can control this product by connecting a USB cable between the PC and this product from VBA such as Visual Basic and Excel. The command structure of the USB is similar to that of GPIB, and the control capability is also equivalent to that of GPIB.

Operating environment

OS
Microsoft Windows2000 Professional　Japanese Version
Microsoft WindowsXP Home/Professional　Japanese version

ＰＣ
Equivalent to IBMPC/AC where above OS can work on having a USB port.

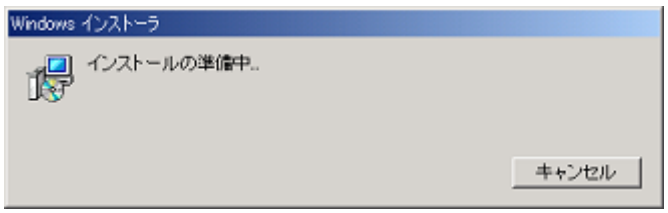
(1) Software installation

It is necessary to check if the software such as device drive of the USB and Active X control install USB is properly installed.
If you need to install such software, please note that the previous version of the software need to be uninstalled before you install the proper version of such software.

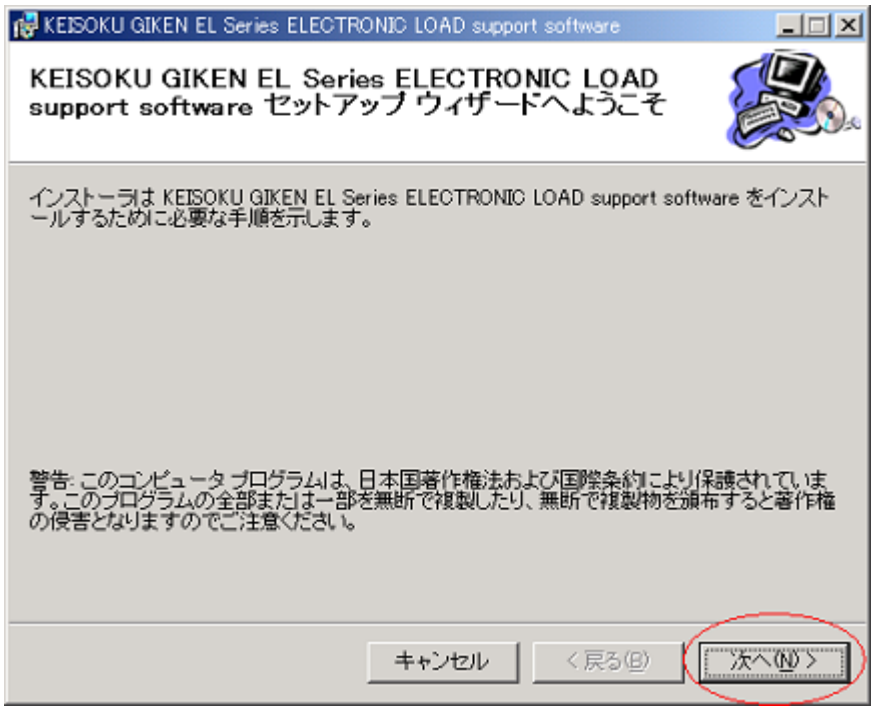
(a) Put the SUPPORT CD for EL Series Electronic Load CD-ROM in the CD-ROM drive of the PC.

(b) Use the computer etc. to double click the “Setup.exe” file of the CD-ROM as shown below.

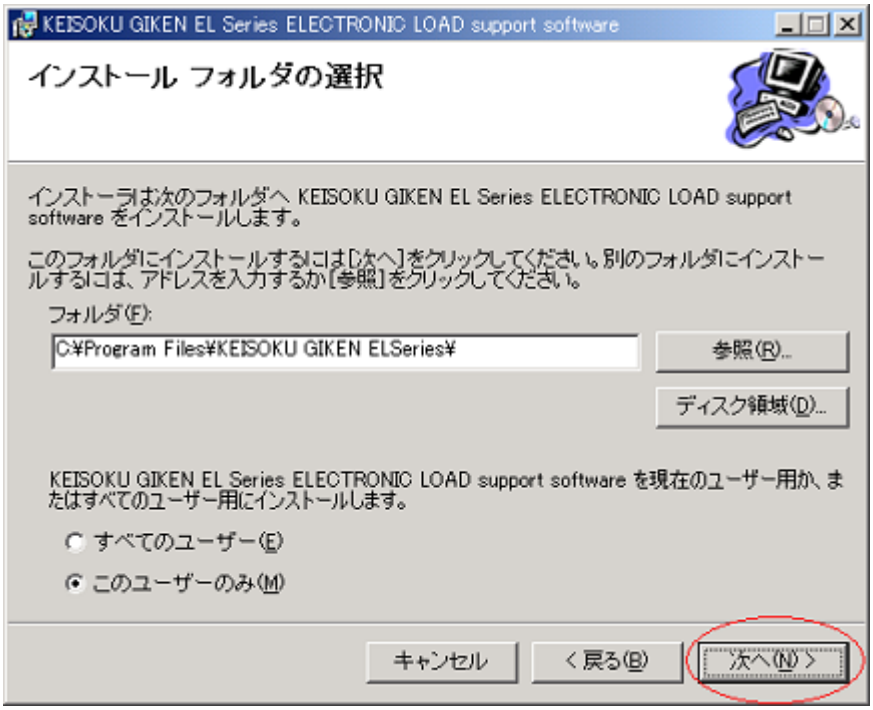
(c) The installer program starts up.



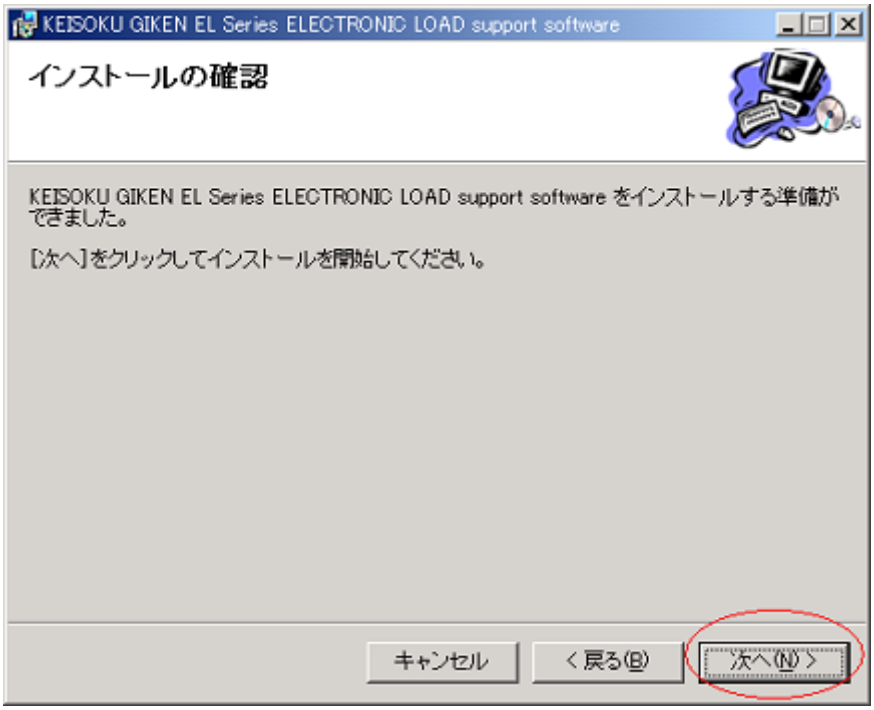
(d) Click “Next（N）”.



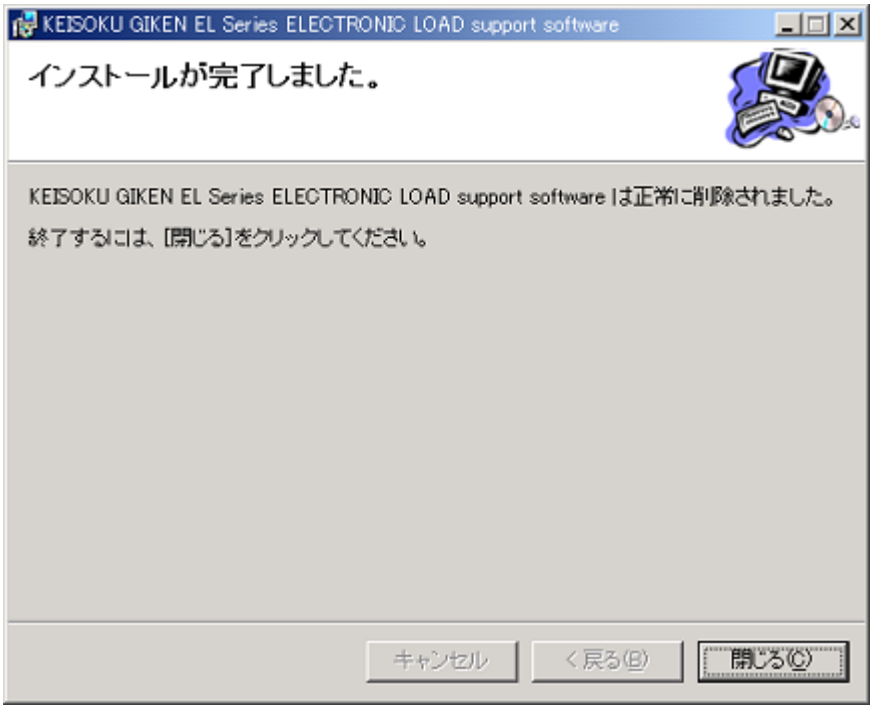
(e) Select a folder where the software is installed.
Default folder is “C:¥Program Files¥KEISOKU GIKEN ELSeries”
Confirm the folder, and click “Next（N）”.



(f) Check the install.
This is the final check. If the setting are OK, click ”Next（N）”.



(g) End of install
The following menu is displayed without any problem.



Note
To uninstall this software, use Windows' “Addition and Deletion of Applications” or “deletion by setup wizard (in JAPANESE)” of the SUPPORT CD for EL Series Electronic Load CD-ROM.

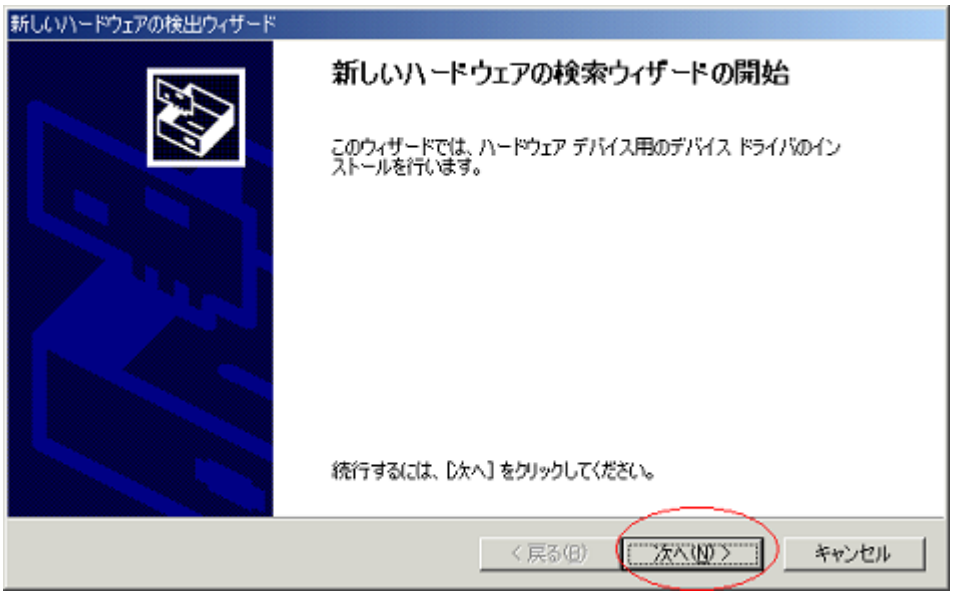
(2) Install the USB device driver

This shows how to install the USB device driver.
Please install by using the "SUPPORT CD for EL Series Electronic Load CD-ROM"

(a) Connect between the Leading Edge Series and a PC
Please use a USB cable to connect between the PC and the Leading Edge Series.

(b) A message "New hardware is found" is displayed.

(c) Click "Next (N) " to start the Found New Hardware wizard.
It is not necessary to connect with WindowsUpdate, and select "No and not this time".

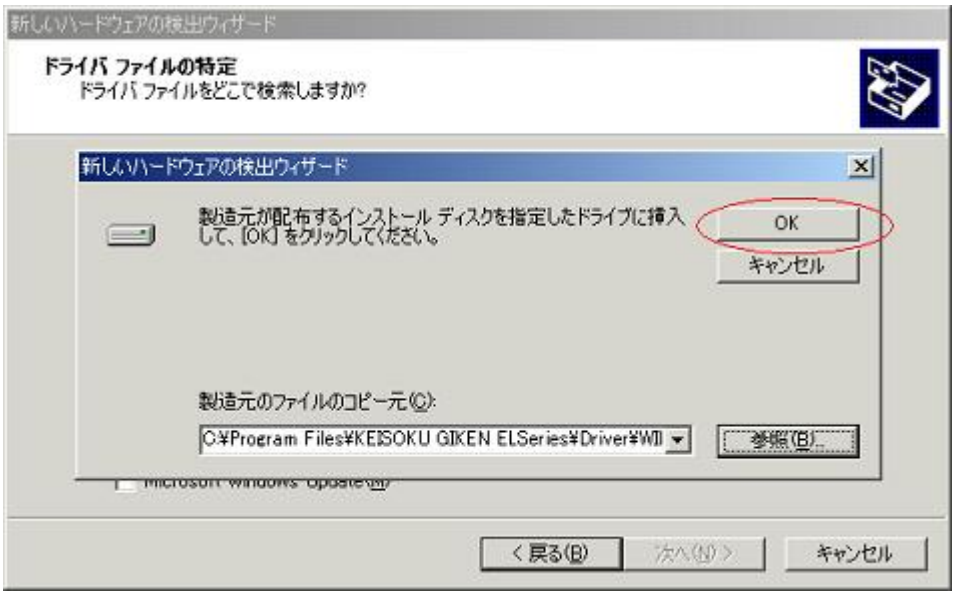


(d) Menu for searching the driver file is displayed.
Select "Install from a list of specific location" and click"Next (N) ".

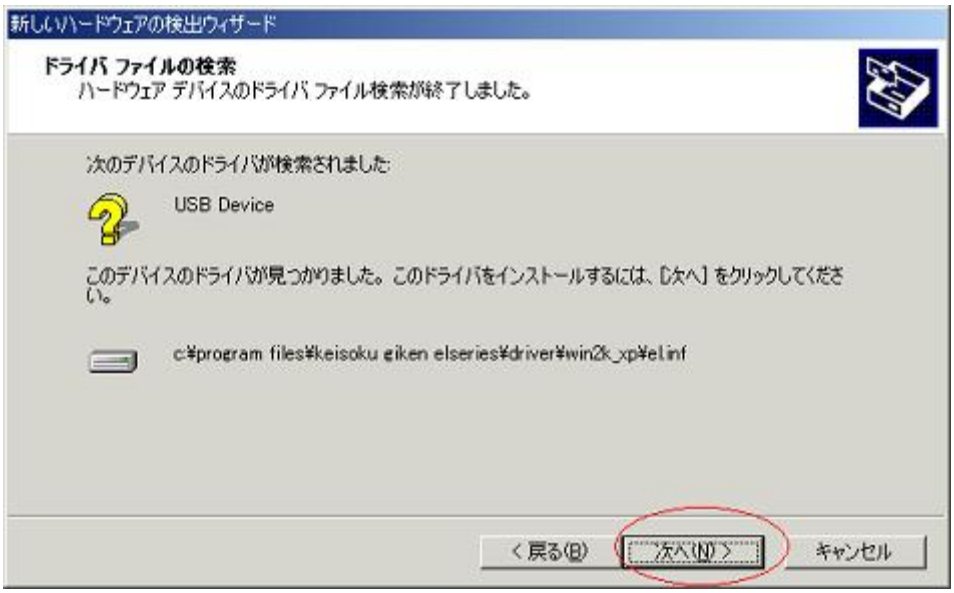
(e) Select [appoint a place] and Click [NEXT]

(f) Designate the folder where " el.Inf" file is located.
The " el.Inf" file should be located in the folder where the software is installed from the SUPPORT CD for EL Series Electronic Load CD-ROM.
In case of default folder is selected, the folder is :

C:¥Program Files¥KEISOKU GIKEN ELSeries¥Driver¥WIN2K_XP
Designate the folder and click "OK".



(g) After the searching ends, click “Next（N）” to start the installation.



(h) End of the installation.
The following menu will be displayed and end of the installation without any problem.

8.9 ActiveX controller function references

REMARK

- Please do NOT use any command other than listed below. Because some commands are KG internal use purpose only. Usage of such command would change the specifications of this product so that this product could not meet the specifications thereof.

Commands that can be used by a user.
(Usage of any other command would change the specifications of this product.)

Cmdsend（*str As string*） As long
CmdRcv（*string*） As long
LoadSet（*mode As Integer,val As Double*） As long
Measure（*mode As Integer,val*） long
MeasureSample（*times As Integer*） As long
LoadON,
LoadOFF
ResetAlm
Version

・CmdSend(*str As string*) As long
The same contents of the commands can be executed.
Ex. CmdSend “CC10” ‘Set CC mode 10A

・CmdRcv(*string*) As long
received the readback value
Ex. CmdRcv ret ‘ret = readback value

・LoadSet(*mode As Integer,val As Double*) As long
Load setting command corresponding an integer value can be used.
0:CC mode, 1:CR mode, 2:CV mode,
3:CP mode, 4:External control mode, 5:Short mode

Ex. LoadSet 0,10 ‘Set CC mode 10A

・Measure(*mode As Integer,value*) long
Measurement command corresponding an integer value can be used.
0: Current measurement AUTO range,
1: Current measurement High range,
2: Current measurement Low range
3: Voltage measurement AUTO range (RippleConverter),
4: Voltage measurement High range (RippleConverter),
5: Voltage measurement Low range (RippleConverter),
6: Load terminal voltage measurement,
7: Power measurement (RippleConverter),8:power measurement,
*RippleConverter is a factory option.

Ex. Measure 0,ret ‘ret = readback value of current measurement.

・MeasureSample(times As Integer) As long

You can select the no of averaging the measurement.
0:one (1) time, 1: three (3) times, 2:five (5) times.

・LoadON

Set load ON

・LoadOFF

Set load OFF

・ResetAlm

Release alarm

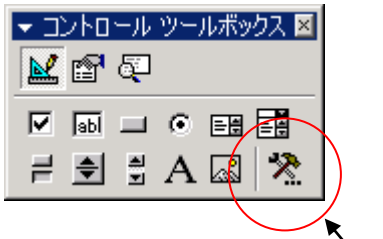
・Version

readback the ROM version.

8.10 ActiveX control from Excel

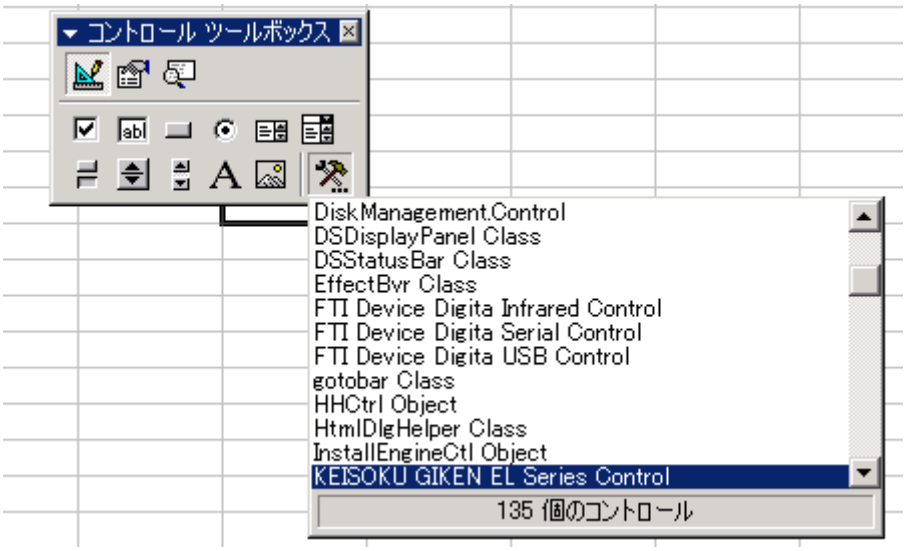
Selection method of Active X using the Excel Visual Basic is explained.

(1) Start up the Excel and select “Display “ -> Tool bar (T) -> Control toll box” and select the icon of red circled as shown below.

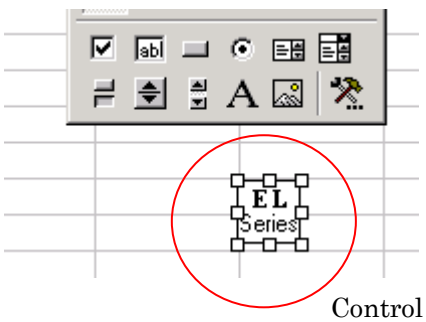


Select

(2) Select “KEISOKU GIKEN EL Series Control”



(3) Then , when you drug on the worksheet, following mark (red circled) will be displayed This is the end of selection of control of this product.



Control of this product.

8.11 USB sample program

A sample program using Excel Visual Basic is explained. Refer to relevant document for detailed about the Visual Basic.

Sample program
Read the firmware version of this product and display it on a worksheet.

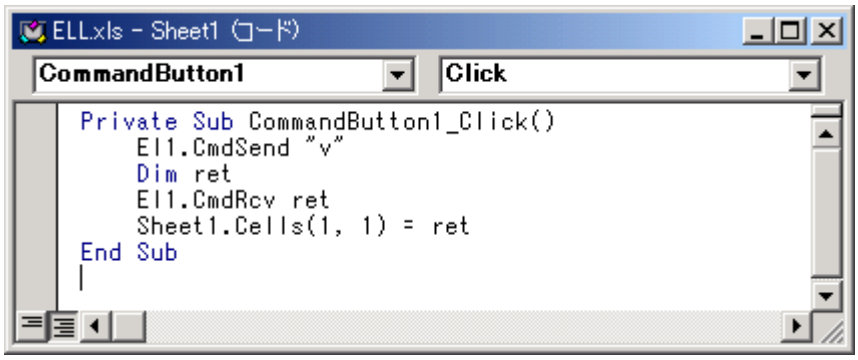


Fig. 8-11-1 Design window of Excel Visual Basic

```
Private Sub CommandButton1_Click( ) 'An event created when you click Command
                                    Button1

El1.CmdSend "V"                     'send GPIB command to read version
Dim ret
El1.CmdRcv ret                      'Receive data from this product
Sheet1.Cells(1, 1) = ret            'write the version information in cell A1

End Sub
```

The firmware version of this product is displayed on the excel worksheet as shown below.

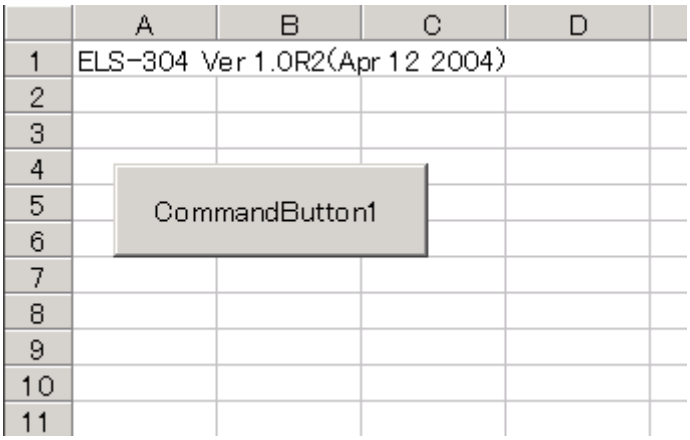


Fig. 8-11-2 Worksheet prepared after the sample program is executed.

Chapter 9 Parallel operation

9.1 Parallel operation

This series can be operated in parallel to increase the handling current and power. One unit act as master and controls other units being connected in parallel.

The master unit also displays total current and power.
The units that can be connected in parallel are of same voltage rating.(ELL/ELA/ELB/ELC)

Model ELA-305 and ELA-1005 can be paralleled but ELA-305 and ELL-355 are not since voltage ratings are different.

One master unit can control up to 4 slave units hence total 5 units can be used in parallel operation.

*Some restriction may apply to the parallel operation.

- Setting resolution may vary to the number of unit.
- Setting accuracy in parallel operation is +/-3% of FS at Current H range and +/-7% of FS at current L range.
- The current ripple is defined as approximately “Ripple voltage” x “Number of unit”.
- Power distribution in parallel operation is relevant to the current rating ratio at the specified current range.
  Ex.) When ELA-305 and ELA-1005 are paralleled in CP mode:
  When set ELA-305 as master then ELA-1005 can handle 900W max.
  When set ELA-1005 as master then ELA-305 can handle 333W max.
  As shown above (2), ELA-305 will be over powered depends on the setting then Over Heat Alarm may be generated. Set ELA-305 as Master when paralleled with ELA-1005 in CP mode.
- The slew rate shown on the display is for the Master unit but total slew rate will be slower than slowest model in paralleled.

9.1.1 Connection for Parallel operation

It is necessary to connect both signal cables between electronic load and load cables between Electronic loads DUT.
As for signal cable, use attached BOOSTER connection cable.
As many as 4 sets of slaves can be connected but it shows 2 sets in Fig. 9-1-1

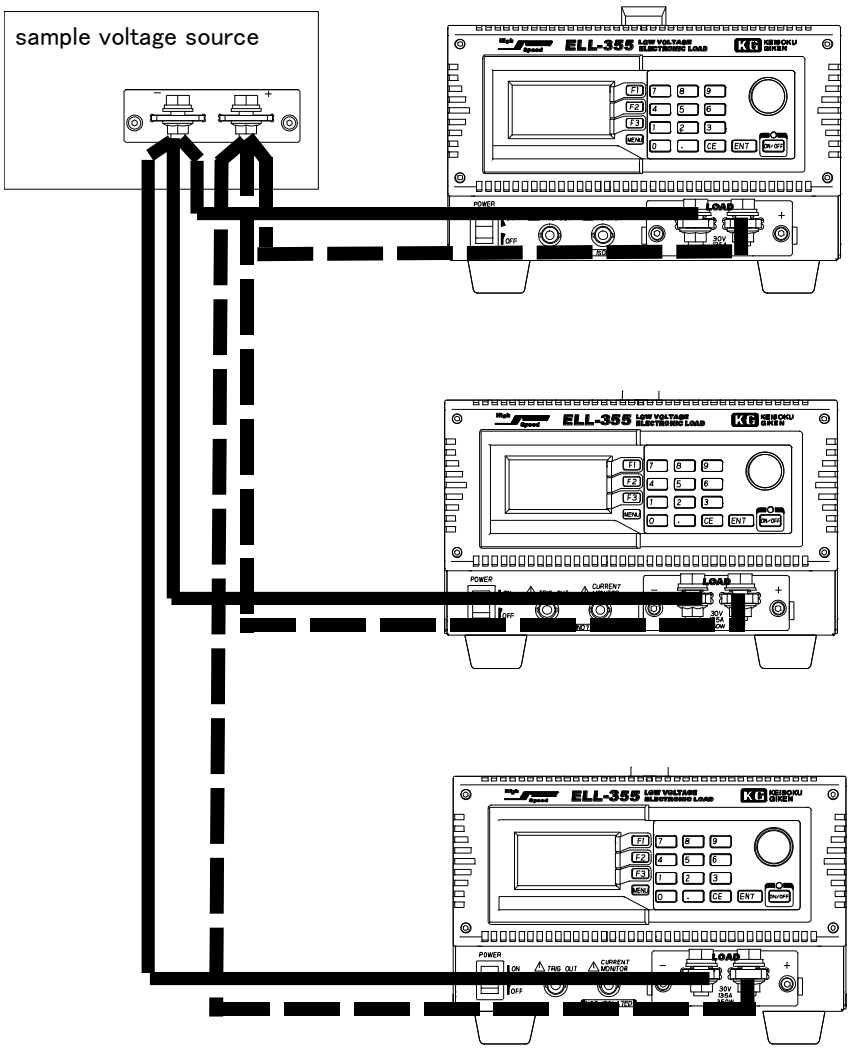


Fig. 9-1-1 Parallel operation with 2 slave units. (Loading cables)

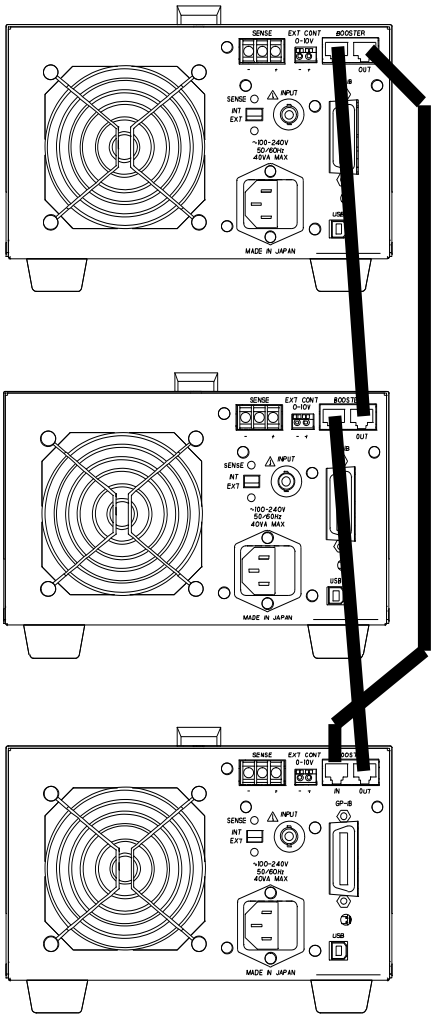


Fig. 9-1-2　Connection between slaves (BOOSTER connection cables)

CAUTION

Use rear input terminals in parallel operation. Never connect any devices to the front panel terminals.
Use load cable as short as possible and appropriate size for the current.
To minimize influence, place the load cable and BOOSTER connection cable as far as possible.

9.1.2 Connection procedure in parallel operation

Connect Master and Slave unit with attached BOOSTER connection cable and connect input terminals by loading cables.

Refer to the "2.2 Cable connection" in detail.

Use appropriate size cable for the current and flame retardant or fire resistive cable.

1. Turn the power off

   Make sure all the units are set OFF position.

   Press POWER switch to set OFF position if any unit is set ON.

2. With referring to the connection drawing, connect the load input terminals in parallel securely.

3. Connect BOOSTER cable
   Connect BOOSTER _IN and BOOSTER_OUT with the attached cables.
   Great care should be taken since wrong connection will result to damage.

9.1.3 Master / Slave setting procedure

1. Turn ON the power for all units.
   Press POWER switch to set ON.

2. Select LOAD CONTROL at menu screen.
   It is necessary to select right menu mode for proper selection.
   Press menu key to call menu selection screen.

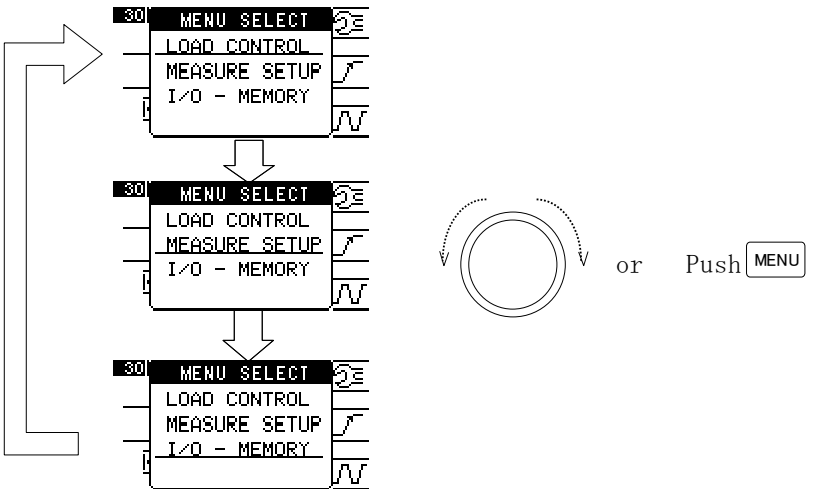


Fig. 9-1-2 Menu selection

At the initial screen, underline is shown as being selected. The underline shift as pressing menu key or turned the rotary knob.
The menu is called when pressed “ENT” or “Rotary” knob where underline is seen.

3. Select maintenance function from LOAD CONTROL

Call LOAD CONTROL menu from “4.2 Menu selection”.
Press F1 for other selection menu display.
Press F1 for menu page display.

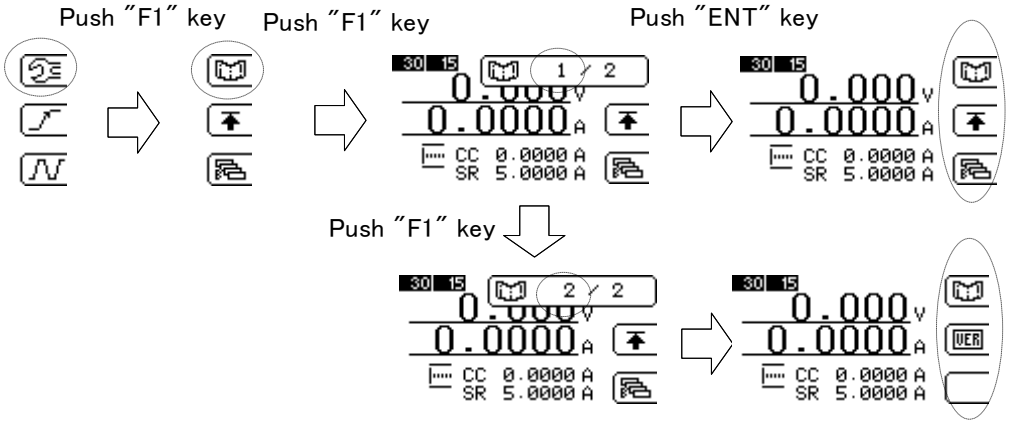


Fig. 9-1-3 Menu screen selection

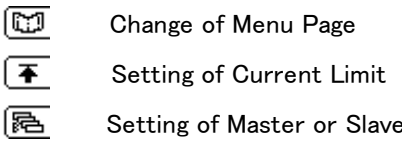


Fig. 9-1-4 Menu page 1

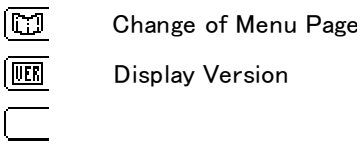
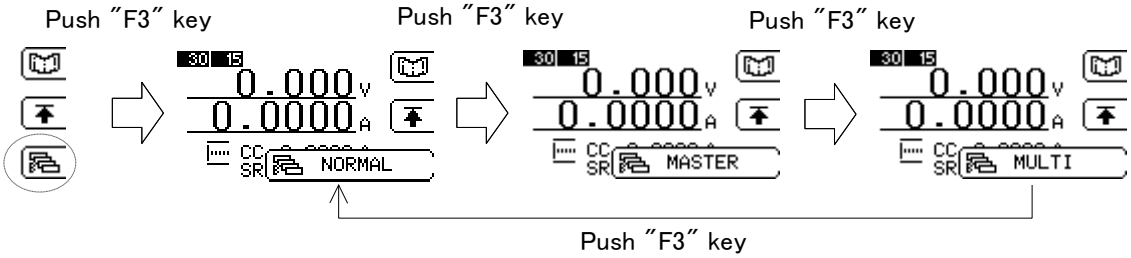


Fig. 9-1-5 Menu page 2

4. Master / Slave selection

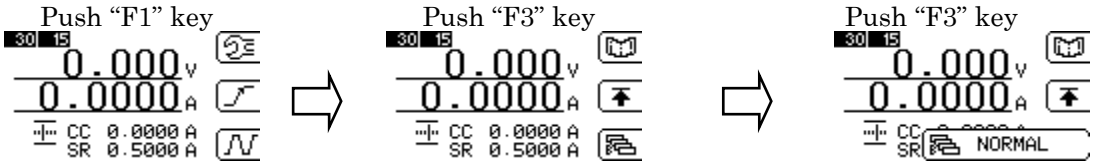
At the menu page, press F3 to select MASTER/SLAVE selection.
Press ENT after selection.

NORMAL	Single unit operation
MASTER	This unit is selected as MASTER unit incorporated with several Slave units of the same model in Load Edge Series and has boost control function for Slave units.
MULTI	This unit is selected as MASTER unit incorporated with several Slave units of the different models in Load Edge Series and has synchronizing control function for Slave units.



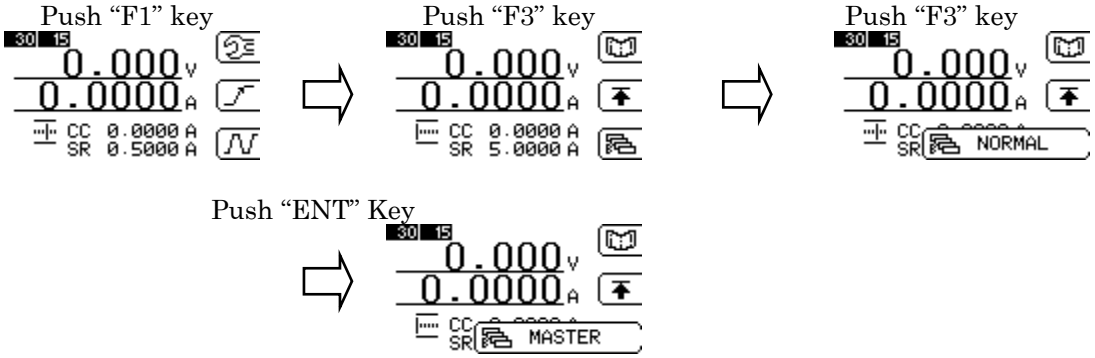
5. Set as SLAVE unit

Slave

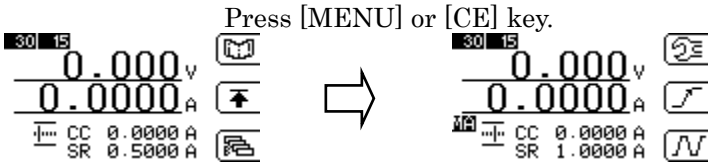


6. Set as MASTER

Master

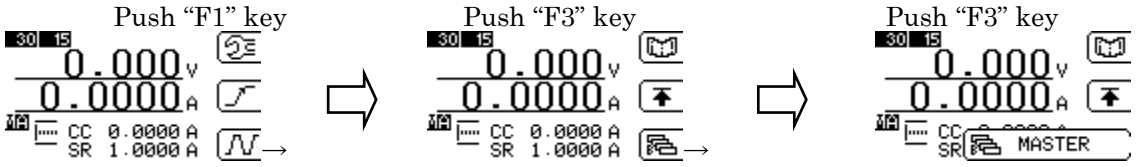


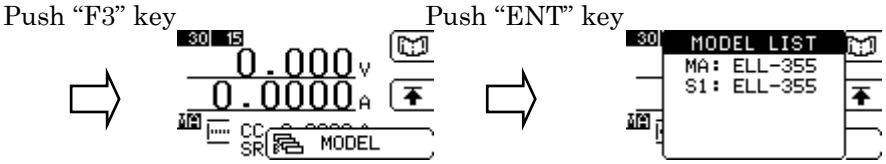
5. Escape from Menu page 1



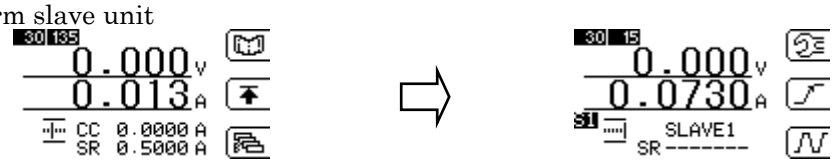
9.1.4 Confirmation of connected units

Confirm the slave units being connected.





Confirm slave unit



9.1.5 ALARM in parallel operation

An error message is displayed when generated ALARM in parallel operation then set all the units to be OFF. (Load OFF)

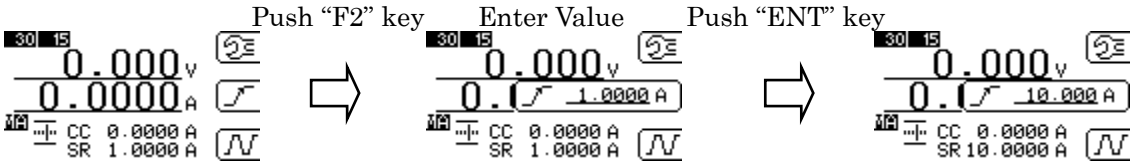
When an ALARM is generated in slave units, error message will be shown in Master unit.

Reset the ALARM either at MASTER unit or SALVE unit accordingly.

9.1.6 Slew rate at parallel operation

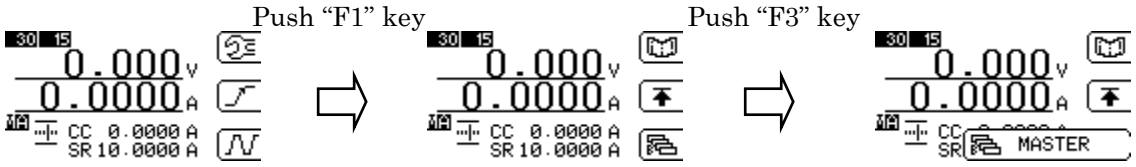
The slew rate can be set in CC mode and EXT mode.
It is suggested to set slower slew rate for stable operaton when oscillation is occurred with unstable control caused by current phase delay or higher voltage drop with the wire inductance.

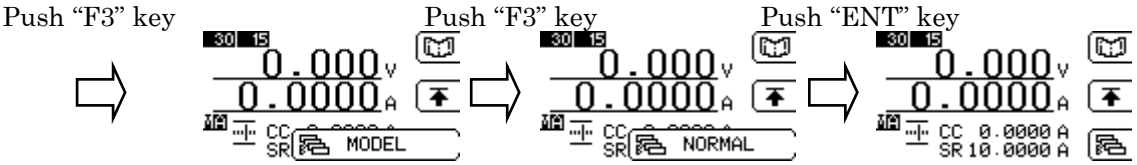
The slew rate in parallel operation is of Master unit.



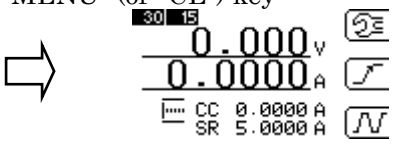
9.1.7 Reset Parallel operation

When reset the parallel operation, select [NORMAL] at the menu.

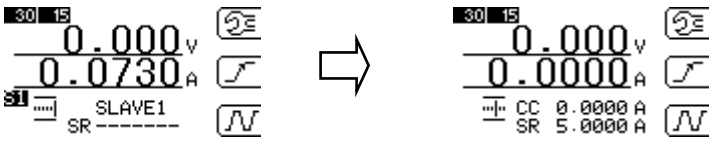




Push “MENU” (or “CE”) key



Slave



When returning from parallel operation to single operation, turn all the power switches OFF then disconnect BOOSTER cables.

Turn off the power from the higher slave numbered unit.
In case of turning off all units, or setting the MASTER unit as single operation, you set all units as single operation (set [NORMAL] mode on the menu page 1).

9.2 Multi-Channel Synchronized operation

The Multi-channel Synchronized operation can test or evaluate multiple outputs DC power supply simultaneously. (Synchronized)

This mode provide synchronized load ON or OFF operation.

In this operation, ELA, ELB or ELC series electronic load can be connected regardless to the input voltage rating.

In dynamic mode, reference clock signal is distributed from the master unit to slave units for synchronization.

In dynamic operation, Single mode is possible independently.

There is no BOOSTER function selection on slave unit.

In [MULTI] setting, [MASTER] selection cannot be seen and in [MASTER] setting, [MULTI] is not seen.

When DYNAMIC ON/OFF of each unit is switched, the phase will shift.

When the phase and start timing need to be synchronized, set LOAD OFF → ON of the MASTER unit.

The ALARM is not synchronized. Hence the unit being generated ALARM will turn off the LOAD but LOAD LED is in ON.

In DYNAMIC mode, the time setting of the SLAVE units are in accordance to the timing range of MASTER unit. If it is out of timing range, setting value will be changed.

--- Timing range ---

0.001ms =< Time 1 =< 20ms
0.010ms =< Time 2 =< 200ms
0.1ms =< Time 3 =< 2S
1ms =< Time 4 =< 20S
10ms =< Time 5 =< 200S
100ms =< Time 6 =< 2000S

9.2.1 Connection for Multi-channel Synchronized operation

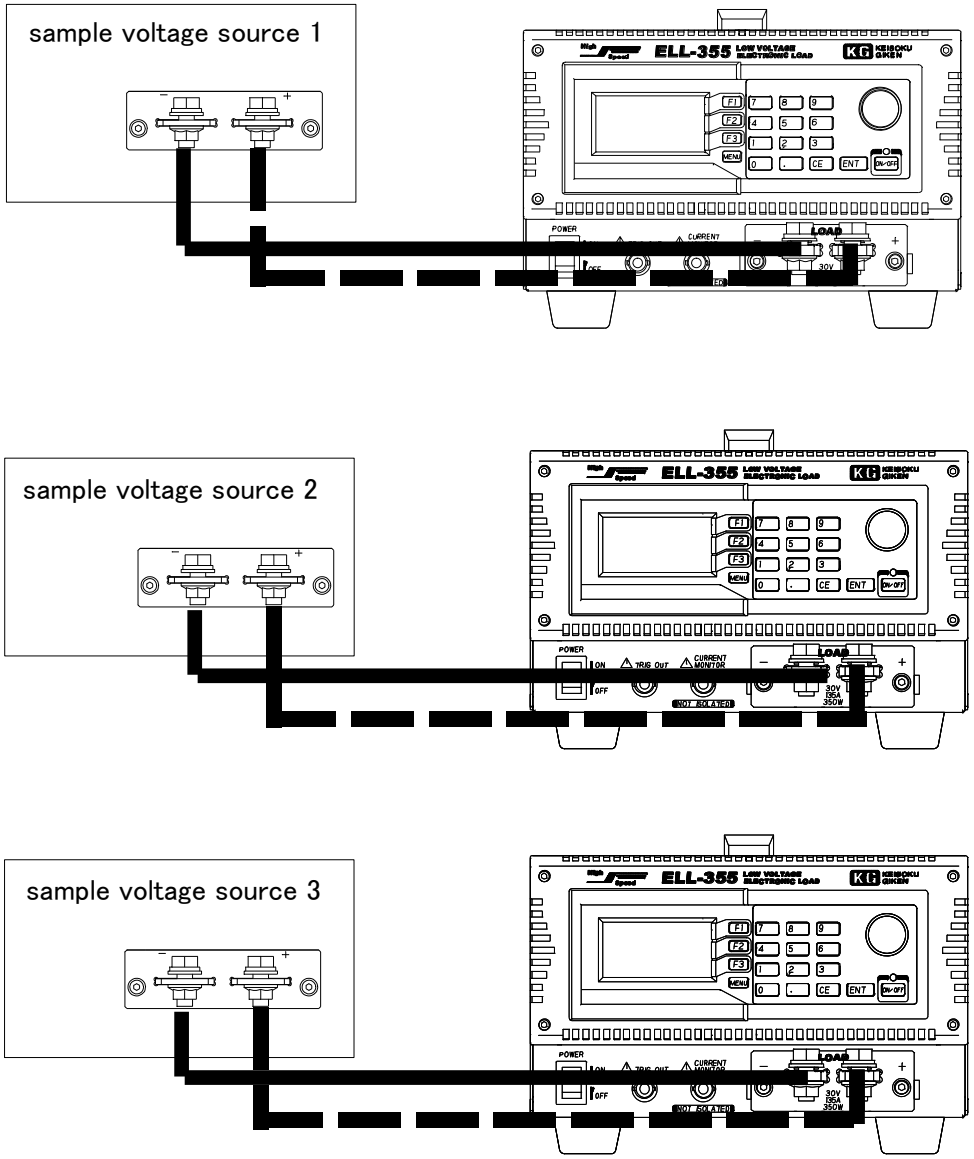


Fig. 9-2-1 Connection for synchronized operation

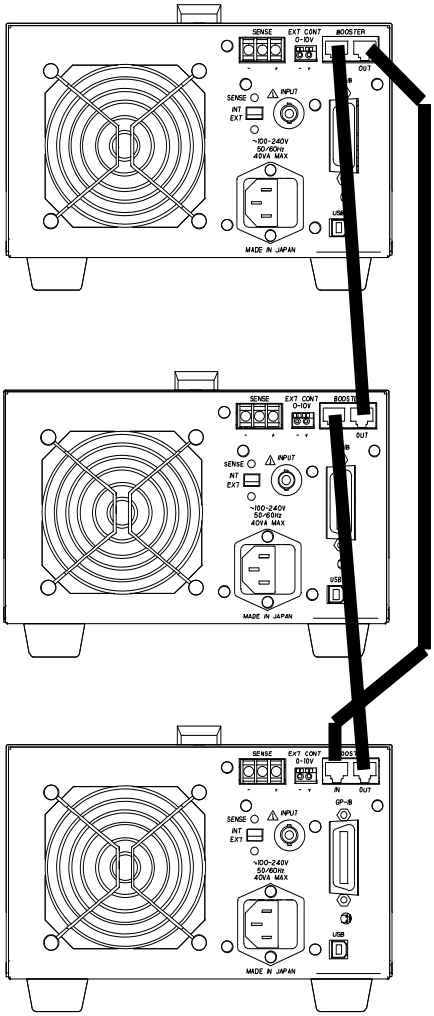


Fig. 9-2-2 Connection in synchronized operation

9.2.2 Connection procedure for multi-channel synchronized operation

Connect Master unit and Slave unit by attached BOOSTER cable. Connect with DUT with load cables.

Refer to the "2.2 Cable connection" for wiring method and cable size of load cable.

Use load cable with appropriate cable size with flame retardant or fire resistive sheath.

1. Confirm OFF
   Make sure all units are set at power OFF.
   Press power switch to set it OFF position.

2. Connect loading terminals
   With referring the drawing, connect all the loading terminals with DUTs.

3. Connect BOOSTER connector of each unit.
   Connect BOOSTER_IN and BOOSTER_OUT by attached BOOSTER cable.
   Pay great care to the connection since wrong wiring may result in serious damage to the unit.

9.2.3 Multi-Channel Synchronization setting

1. Power On all units.
   Press power switch to power ON.

2. Select LOAD CONTROL at the menu.
   It is necessary to select proper menu first.
   Press menu key to call menu screen.

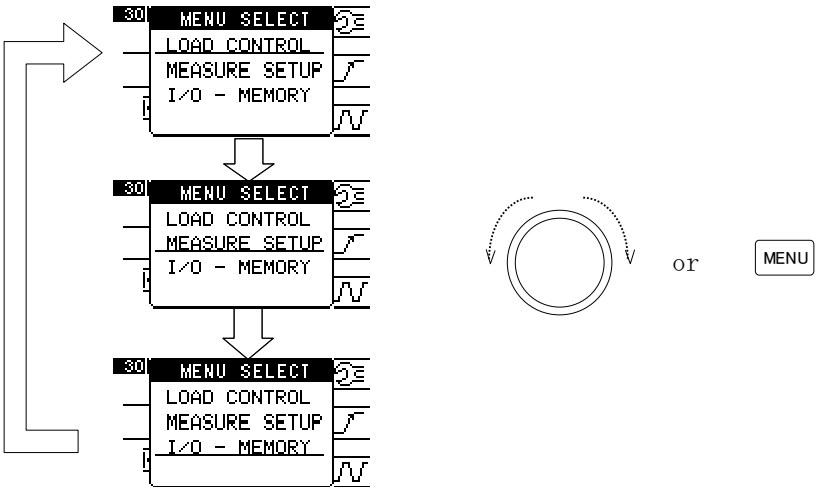


Fig. 9-2-3 Menu selection screen

At the initial screen, underline shows parameter is being selected. The underline can shift when pressed menu key or turn the rotary knob.
To select the parameter, press ENT key or rotary knob.

3 Select Maintenance function at LOAD CONTROL
Call the LOAD CONTROL with referring “4.2 Menu selection”.
Further menu screen will be seen when pressed F1 key.
Menu page will be seen when press F1 again.

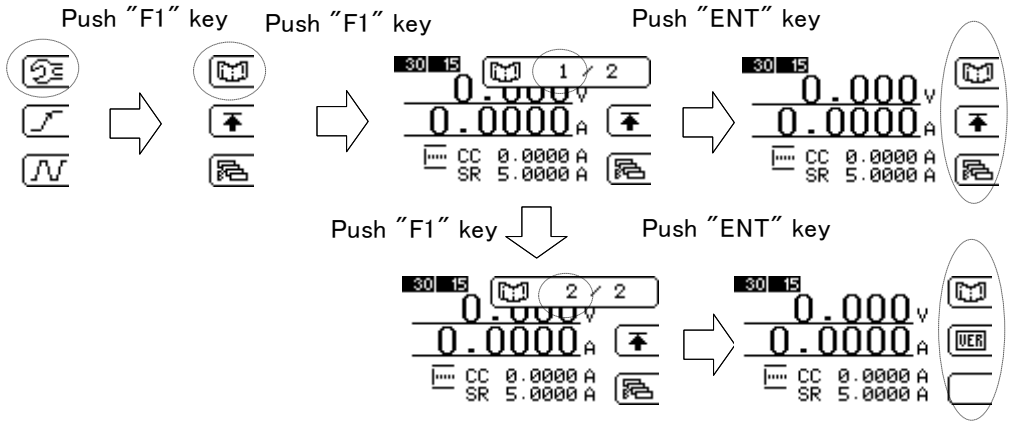


Fig. 9-2-4 Menu screen selection

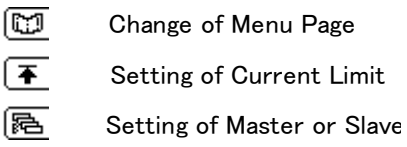


Fig. 9-2-5 Menu page 1

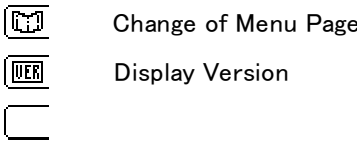
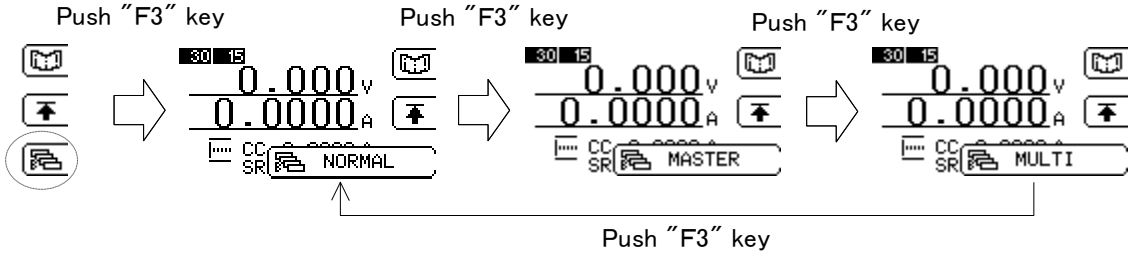


Fig. 9-2-6 Menu page 2

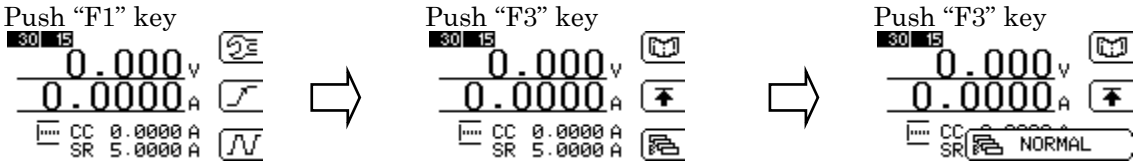
4. Master/ Slave selection

Press F3 at menu page 1 to call Master/Slave mode.
Press ENT key after selection.

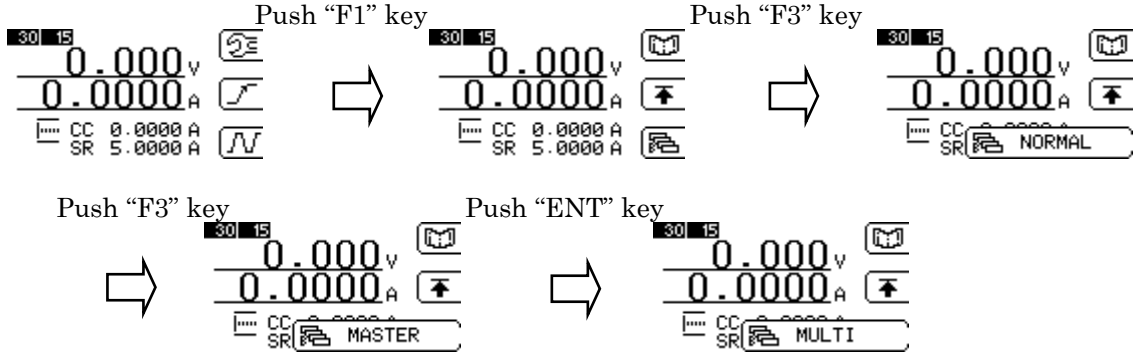
NORMAL	Basic operation by this unit alone.
MASTER	This unit is selected as MASTER unit incorporated with several Slave units of the same model in Load Edge Series and has boost control function for Slave units.
MULTI	This unit is selected as MASTER unit incorporated with several Slave units of the different models in Load Edge Series and has synchronizing control function for Slave units.



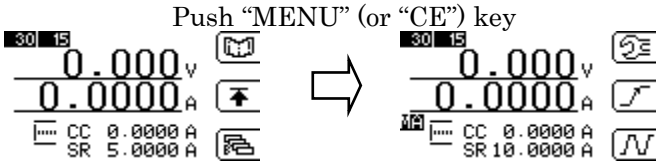
5. Set as SLAVE
   Slave



6. Set as MASTER
   Master

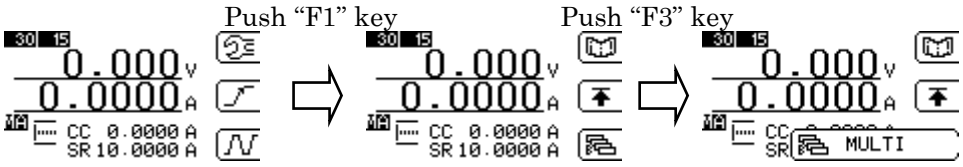


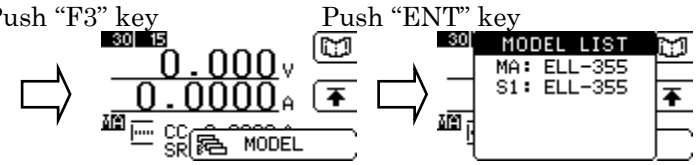
7. Escape from menu page 1
   Press [MENU] or [CE] key.



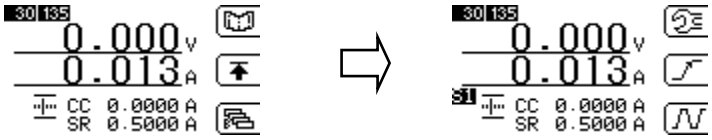
9.2.4 Confirm connection

Check the slave unit being connected





Confirm Slave unit



9.2.5 Alarm in Multi-channel Synchronized operation

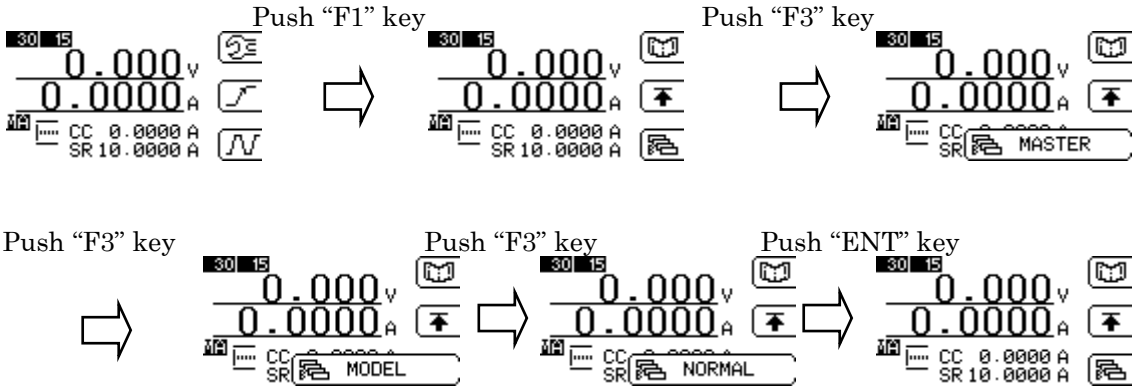
An error message will be seen on the screen when an ALARM is generated in Multi-channel operation then turn the load OFF of the unit generating ALARM.
Remove as soon as possible the cause of ALARM.
When you detect any trouble indicaton like unusual smell, noise and so on after alarm is raised, please stop use of the load immediately and ask us for repair.

An error message will be seen on a Slave unit when ALARM is generated in the slave unit then turn the LOAD OFF.
However if the MASTER unit is LOAD ON condition, Slave unit will be back to LOAD ON after removing the cause of ALARM.

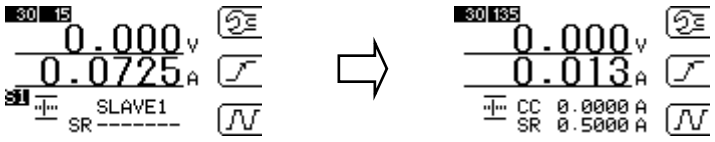
To reset the ALARM, set LOAD OFF (*the Load ON/OFF button of Master unit is only active) then reset the ALARM.

9.2.6 Reset Multi-channel Synchronized operation

Set the Master unit to [NORMAL] as follow.



Slave unit



When the Multi-channel Synchronized operation is reconfigured to the normal operation, remove BOOSTER cables after turning all the power OFF.

Turn off the power from the higher slave numbered unit.
In case of turning off all units, or setting the MASTER unit as single operation, please set all units as single operation in advance (set [NORMAL] mode on the menu page 1).

Chapter 10 Specifications

The specifications of this product are as follows unless otherwise specified.

- Warm up time 30 min. or more
- Temperature: 23℃±5℃, Humidity 70% or less.

10.1 General

General	ELL-355
Load terminal	Front panel input
Power	AC100～240V±10% 50/60Hz
Consumption power	less than 45VA (at AC100V)
Operating temprature	5℃～40℃
Cooling method	forced air cooling by a fan
Sizes	215(W)×128.6(H)×420(D) excluding protruding parts
Weight	about 10Kg

General	ELL-1005
Load Terminal	Front panel input
Power	AC100～240V±10% 50/60Hz
consumption power	less than 70VA (at AC100V)
operating temperature	5℃～40℃
cooling method	forced air cooling by a fan
size	430(W)×128.6(H)×420(D) excluding protruding parts
weight	about 16 kg

Interfaces	ELL-355
GPIB	IEEE488.1 compliant
USB	USB1.1 compliant
EXTernal control voltage	Input voltage: 0V～10V

Interfaces	ELL-1005
GPIB	IEEE488.1 compliant
USB	USB1.1 compliant
EXTernal control voltage	Input voltage: 0V～10V

Protection alarm functions	ELL-355
Over current	protect the load section by limiting the current
Over power	protect the load section by limiting the power
Over voltage	alarm only, the load section is NOT protected
Over heat	protect the load section by setting no load condition
Reverse connection	alarm only, the load section is NOT protected

Protection alarm functions	ELL-1005
Over current	protect the load section by limiting the current
Over power	protect the load section by limiting the power
Over voltage	alarm only, the load section is NOT protected
Over heat	protect the load section by setting no load condition
Reverse connection	alarm only, the load section is NOT protected

*)Remove the cause of alarm as soon as possible for over voltage or reverse connection because those alarm functions do not protect the load section.

10.2 Measurement section

DC voltage mesurement		ELL-355	
	Range	4.0000V	30.000V
	Resolution	0.1mV	1.0mV
	Accuracy (※1)	±0.05% of rdg. ±0.05% of fs.	
	Meas. time (※2)	about 100ms	

DC voltage measurement		ELL-1005	
	Range	4.0000V	30.000V
	Resolution	0.1mV	1.0mV
	Accuracy (※1)	±0.05% of rdg. ±0.05% of fs.	
	Meas. time (※2)	about 100ms	

DC current mesurement		ELL-355	
	Range (※3)	15.0000A	135.000A
	Resolution	0.1mA	1mA
	Accuracy (※1)	±0.2% of rdg. ±0.2% of fs.	

DC current measurement		ELL-1005	
	Range (※3)	45.0000A	405.000A
	Resolution	0.3mA	3mA
	Accuracy (※1)	±0.2% of rdg. ±0.2% of fs.	
	Measurement time (※2)	about 100ms	

Power mesurement		ELL-355
	Mesurement method (※4)	Calculation method [Volt. measured × Curr. measured]
	Mesurement time (※2)	about 200ms

Power measurement		ELL-1005
	Measurement method (※4)	Calculation method [Volt. measured × Curr. measured]
	Measurement time (※2)	about 200ms

*1 Warranted for six months under the condition of ambient temperature 23℃±5℃, humidity 70% or less.
*2 Measurement time in the same measurement mode and the same range.
*3 There are two ranges for current measurement. Specification is depending on the selected load range.
*4 Readback data is in the absolute value.

10.3 Load section

Maximum ratings	ELL-355
Curr.	135A
Volt.	30V
int. Min. resit.	3mΩ
int. inductance(Typ)	80nH
min. ope. Volt (※6)	0.4V(135A)/0.2V(67.5A)/0.1V(33.75A)
Peak power (※5)	4000W(20μs or less)
	430W(20sec or less)
Power	350W

Maximum ratings	ELL-1005
Curr.	405A
Volt.	30V
int. Min. resist.	1.5mΩ
int. inductance(Typ)	80nH
min. ope. Volt (※6)	0.6V(405A)/0.3V(202.5A)/0.1V(67.5A)
Peak power (※5)	12000W(20μs or less)
	1290W(20sec or less)
Power	1000W

Constant current setting	ELL-355	
Curr. range	15A	135A
Setting Value	0～15A	0～135A
Nominal resolution (※1)	1mA	10mA
Accuracy	±0.2% of stg. ±15mA	±0.2% of stg. ±60mA

Constant current setting	ELL-1005	
Curr. range	45A	405A
Setting value	0～45A	0～405A
Nominal resolution (※1)	3mA	30mA
Accuracy	±0.2% of stg. ±60mA	±0.2% of stg. ±500mA

Constant resistor setting	ELL-355	
Volt. range	4V	
Curr. range	15A	135A
Setting value	0.05Ω～500Ω	5mΩ～50Ω
Nominal resolution (※1)	2mS	20mS
Accuracy (※2)	±0.5% of Conv.Curr. ±0.2% of fs.	

Volt. range	30V	
Curr. range	15A	135A
Setting value	0.15Ω～1500Ω	0.015Ω～150Ω
Nominal resolution (※1)	666μS	6.66mS
Accuracy (※2)	±0.5% of Conv.Curr. ±0.2% of fs.	

Constant resistor setting	ELL-1005	
Volt. range	4V	
Curr. range	45A	405A
Setting value	0.0167Ω～166.667Ω	1.7mΩ～16.667Ω
Nominal resolution (※1)	6mS	60mS
Accuracy (※2)	±0.5% of Conv.Curr. ±0.2% of fs.	

Volt. Range	30V	
Curr. Range	45A	405A
Setting value	0.05Ω～500Ω	0.005Ω～50Ω
Nominal resolution (※1)	1998μS	19.98mS
Accuracy (※2)	±0.5% of Conv.Curr. ±0.2% of fs.	

Constant voltage setting	ELL-355	
Volt. range	4V	30V
Setting value	0～4V	0～30V
Nominal resolution (※1)	0.5mV	5mV
Accuracy	±0.2% of stg. ±0.2% of fs.	
Response time	Fast / Slow (300μs/10ms)	

Constant voltage setting	ELL-1005	
Volt. range	4V	30V
Setting value	0～4V	0～30V
Nominal resolution (※1)	0.5mV	5mV
Accuracy	±0.2% of stg. ±0.2% of fs.	
Response time	Fast / Slow (300μs/10ms)	

Constant power setting	ELL-355	
Curr. range	15A	135A
Setting value	0～40W	0～350W
Nominal resolution (※1)	5mW	25mW
Accuracy	±2.5% of stg.±1% of fs.	

Constant power setting	ELL-1005	
Curr. range	45A	405A
Setting value	0～120W	0～1000W
Nominal resolution (※1)	15mW	75mW
Accuracy	±2.5% of stg.±1% of fs.	

External control setting		ELL-355	
	Curr. range	15A	135A
	Setting value	0～15A	0～135A
	Nominal resolution (※1)	2mA	20mA
	Accuracy (※4)	± 0.2% of stg. ± 0.5% of fs.	
	Control voltage	0V ～ 10V	

External control setting		ELL-1005	
	Curr. range	45A	405A
	Setting value	0～45A	0～405A
	Nominal resolution (※1)	6mA	60mA
	Accuracy (※4)	± 0.2% of stg. ± 0.5% of fs.	
	Control voltage	0V ～ 10V	

Dynamic load setting		ELL-355	
	Dynamic mode		
	Curr. range	15A	135A
	Controlling method	Switching operation	
	Applied lode mode	CC/CR/CV/CP mode	
	Setting period	20ms/～ 200ms/～ 2s/～ 20s/～ 60s	
	Resolution of period	1μs/10μs/100μs/1ms/10ms	
	Operationg mode	Auto,Single	
	Slew rate (※11)	0.05A/μs～5A/μs	0.5A/μs～50A/μs
	Min. load resp. time (※3,12)	500ns	
	Sequence mode		
	Load operation mode	CC / CR / CV / CP	
	Max. step	1024	
	Step time	1ms ～ 10min	
	Step time resolution	1ms(1ms～100ms) / 100ms(100ms ～ 10min)	

Dynamic load setting		ELL-1005	
	Dynamic mode		
	Curr. range	45A	405A
	Controlling method	Switching operation	
	Applied load mode	CC /CR/CV/CP mode	
	Setting Period	～20ms/～200ms/～2s/～20s/～60s	
	Resolution of Period	1μs/10μs/100μs/1ms/10ms	
	Operationg mode	Auto,Single	
	Slew rate (※11)	0.05A/μs～5A/μs	0.5A/μs～50A/μs
	Min. load resp. time (※3,12)	500ns	
	Sequence mode		
	Load operation mode	CC / CR / CV / CP	
	Max. step	1024 steps	
	Step time	1ms ～ 10min	
	Step time resolution	1ms(1ms～100ms) / 100ms(100ms ～ 10min)	

Short mode		ELL-355
	Max. load curr.	135A

Short mode		ELL-1005
	Max. load curr.	405A

Current limit setting		ELL-355	
	Curr. range	15A	135A
	Setting range	0.1A～15A	1A～135A
	Nominal resolution (※1)	100mA	1A

Current limit setting		ELL-1005	
	Curr. range	45A	405A
	Setting range	0.3A～45A	3A～405A
	Nominal resolution (※1)	300mA	3A

Parallel operation	
	Master-Slave operation. One master unit can control up to 4 units of slaves of same voltage rating. For example: If the master unit is ELA-305 then ELA-155, ELA-305 or ELA-1005 may be connected as slave unit.

*1 : Nominal resolution: Approximated resolution of the range.
*2 : Conv.Curr: Ideal current value being calculated by [input voltage / setting resistance value]
*3 : Min load response time: Minimum time required by the load when setting slew rate
*4 : External control setting accuracy: Setting accuracy is defined when external control voltage of 10V is supplied.
*5 :It is the target value at ambient temperature of 20 ℃. It will vary with the internal temperature and operating time.
*6 :Minimum operating voltage varies with the current value.
*11:settable only in CC mode. Maximum or minimum setting value can be selected in CV mode.
*12:In CC mode

10.4 Output section

TRIG OUT			ELL-355
	Output circuit (※1)		Photocoupler output
	Output voltage	CC1	+5V(Typ)
		CC2 or later	0V(Typ)

TRIG OUT			ELL-1005
	Output circuit (※1)		Photocoupler output)
	Output voltage	CC1	+5V(Typ)
		CC2	0V(Typ)

CURRENT MONITER		ELL-355
	Output (※2)	1V/135A f.s.
	Output impedeance	50Ω
	Accuracy (※3)	±1% of Conv.Volt. ±1% of fs.

CURRENT MONITER		ELL-1005
	Output (※2)	1V/405A f.s.
	Output impedeance	50Ω
	Accuracy (※3)	±1% of Conv.Volt. ±1% of fs.

*1 : An output of “TRIG OUT” is isolated
*2 : An output of “CURRENT MONITOR” is NOT isolated

*3：Conv. Volt means [measurement current × （F.S. of current monitor / rating current ）].

10.5 Outline view

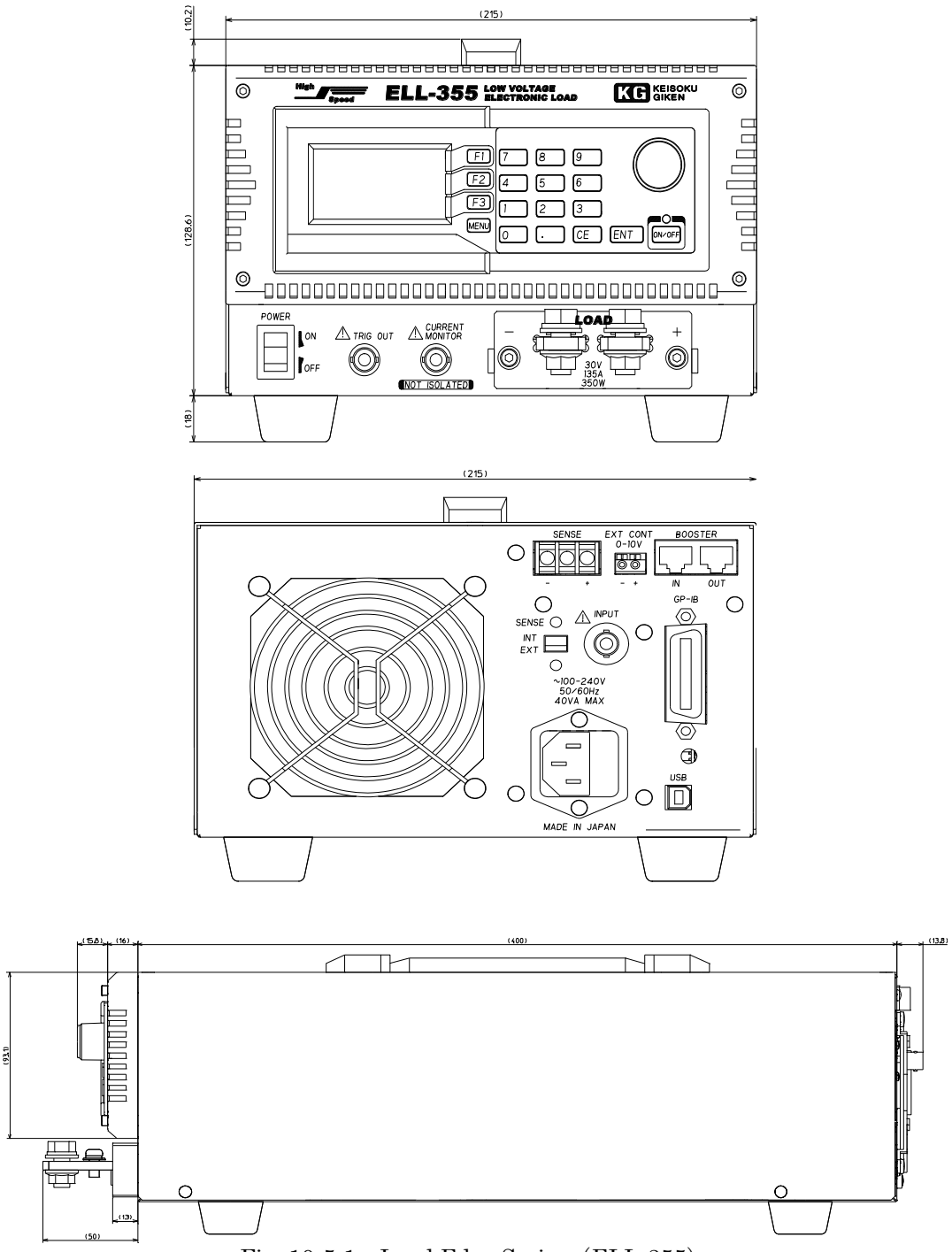


Fig. 10-5-1 Load Edge Series（ELL-355）

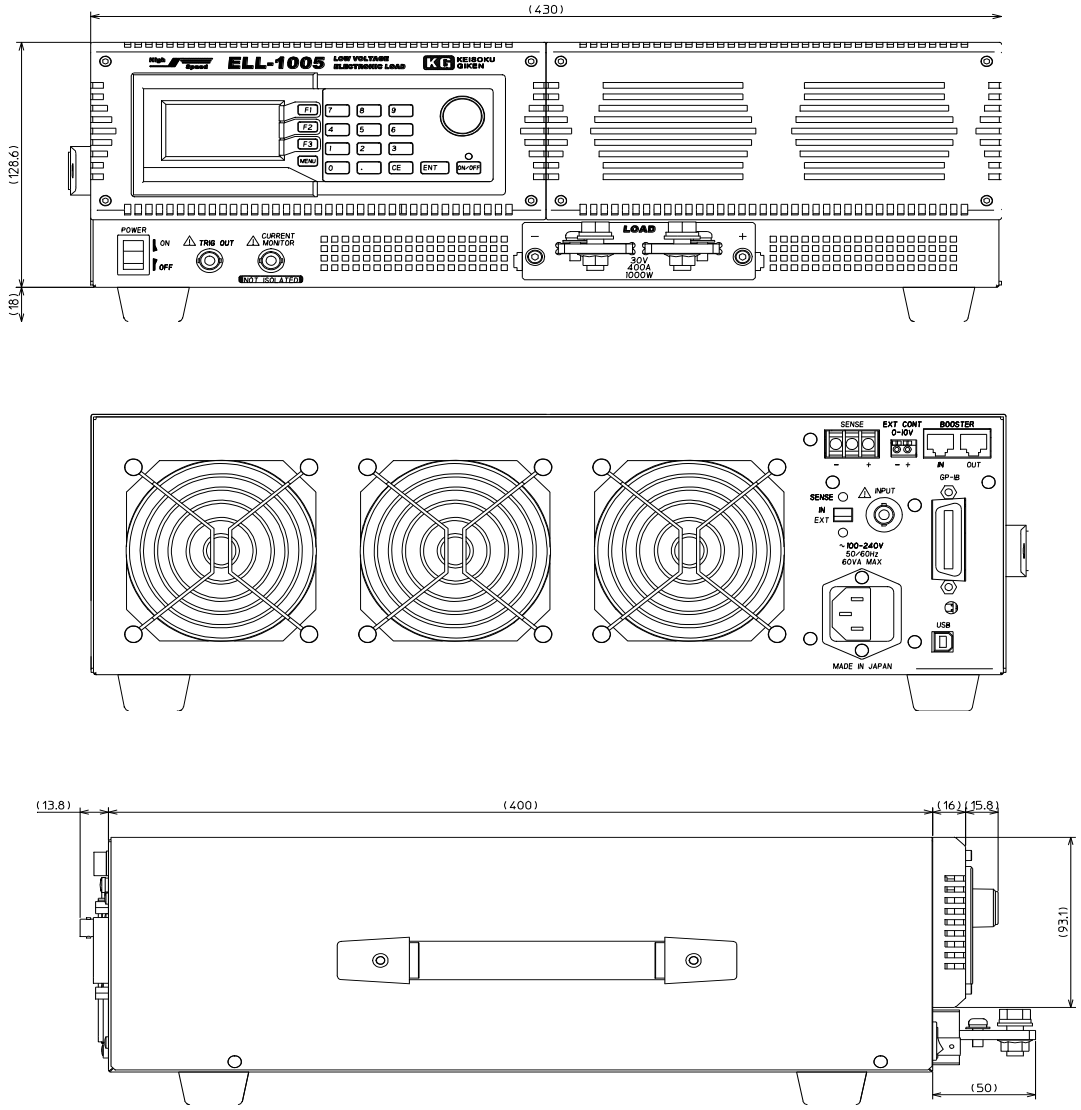


Fig. 10-5-2　Load Edge Series（ELL-1005）

10.6 Operating area

Low voltage operating area and peak power operating area of this product are shown in below graph.

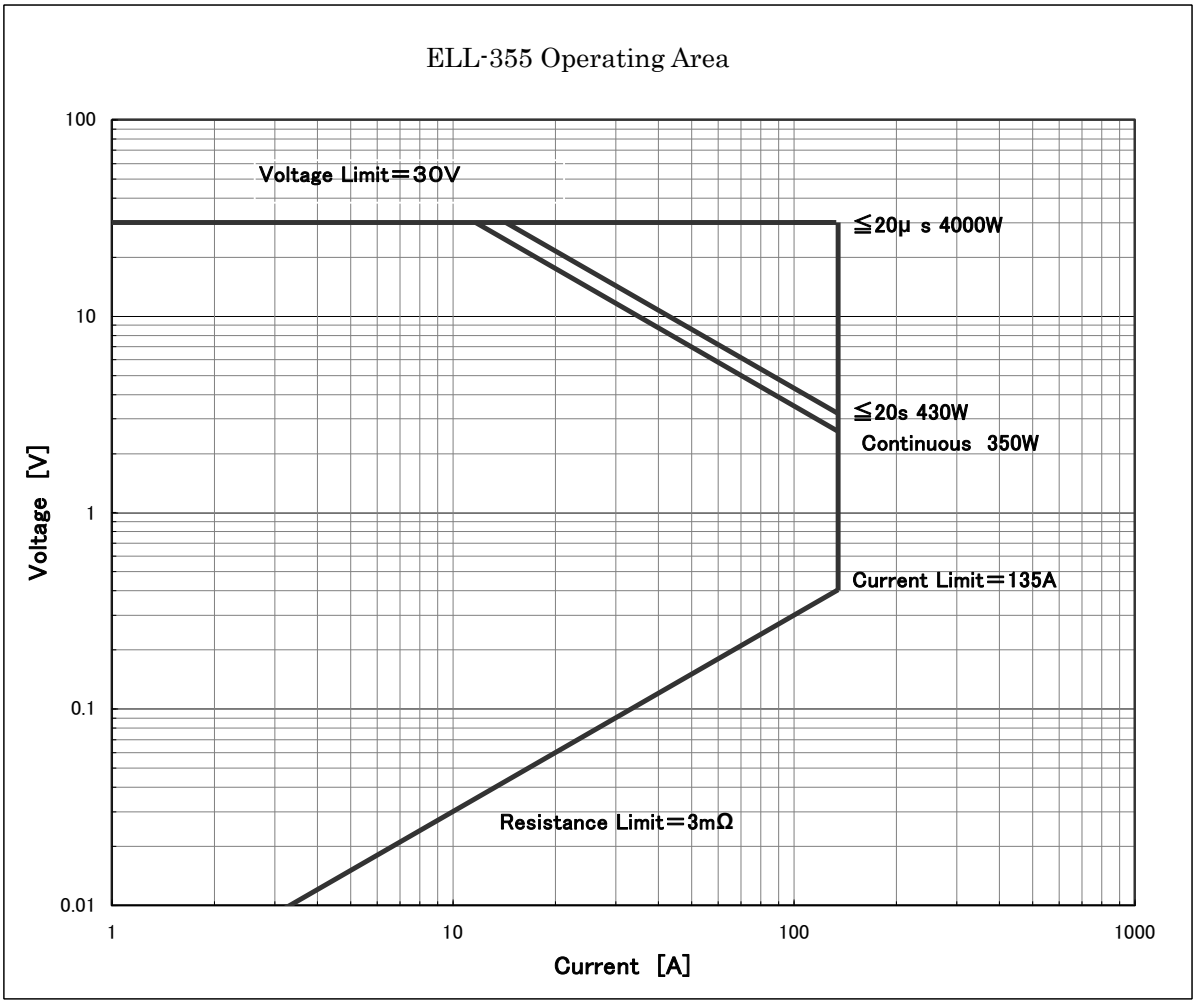


FIG. 10-6-1 ELL-355 Operating Area

The operation Area may change depending on the ambient temperature (or internal temperature) and accumulated operating time.

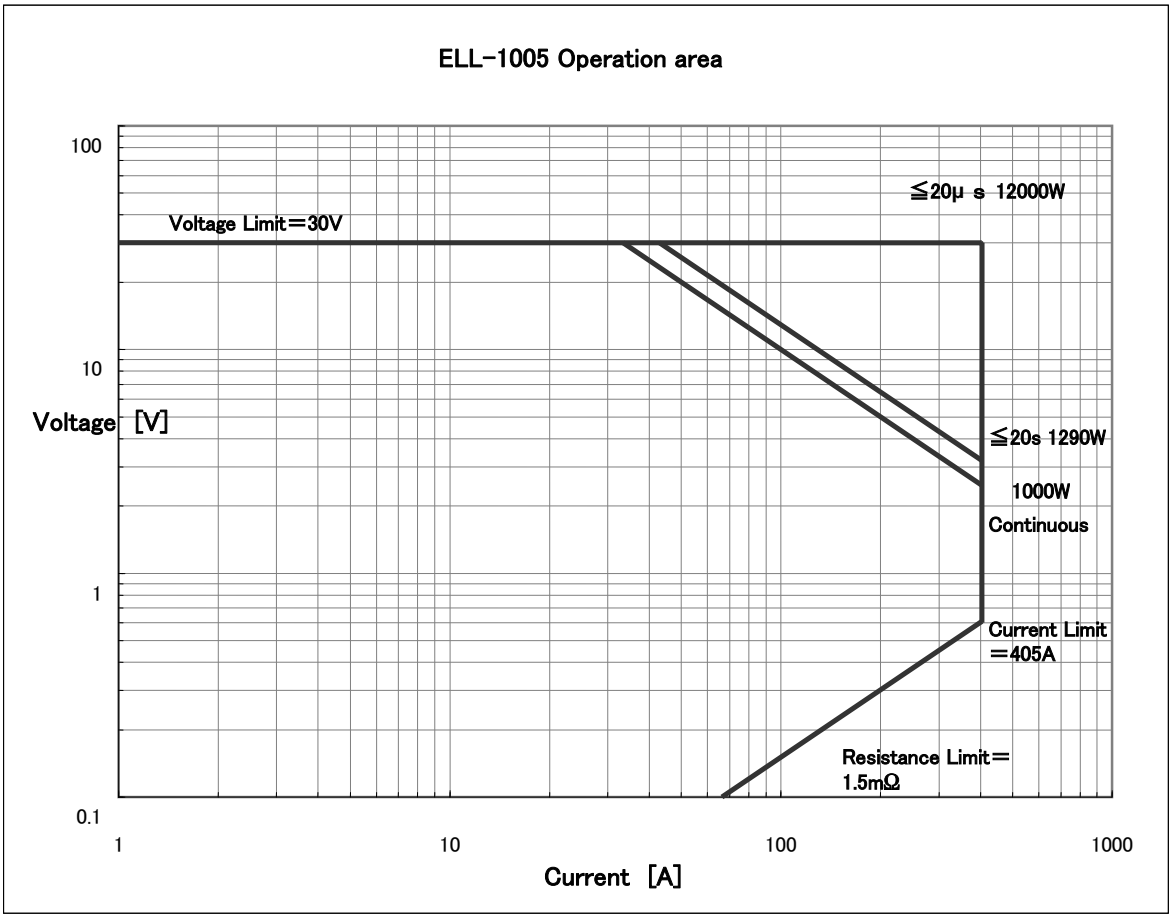


Fig. 10-6-2 ELL-1005 Operating Area

The operation Area may change depending on the ambient temperature (or internal temperature) and accumulated operating time.

Chapter 11 Maintenance

For your longer use of this product, please maintain and check periodically.

11.1 Cleaning

To remove dust and dirt, wipe them away with a soft or slightly wet close.

- Power this product OFF first and pull the plug of the AC cable of its socket before you clean this product.
- Please do not use any organic solvent, for example, benzene, acetone, or the like, that would damage the plastic materials. And pay attention to prevent any fluid like such solvent from penetrating into the inside of the chassis of this product.

11.2 Fuse

To replace a fuse in this product, please follow the instructions below.

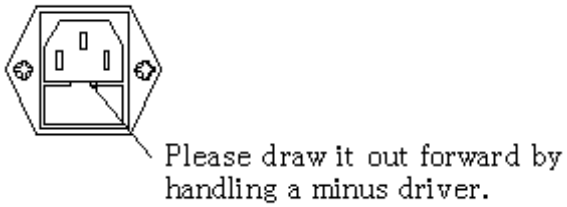
- Power this product OFF first and pull the plug of the AC cable of its socket before you replace the fuse therein.

- Do not use any other fuse then is specified in this manual. And if you used a fuse other than originally equipped with this product, the fuse with which you replace should have a certificate of safety standard in your country.
- Do not shorten in the fuse holder.
- If you find a phenomenon of abnormal smell or sound that seem to be defective, contact us or dealer that you purchased this product from without further usage.

There are two types of fuse holders depending on the lot of this product.
Make sure which type of the fuse holder is placed on the rear panel and follow the instruction of corresponding type blow:

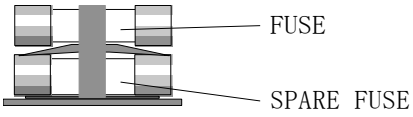
Single type

1．Remove the power fuse.



Use a minus screw driver

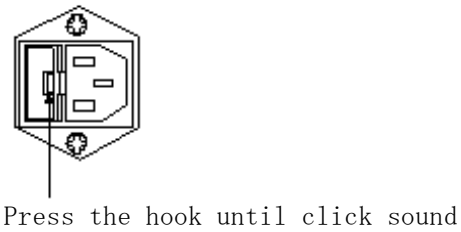
2．Replace the power fuse



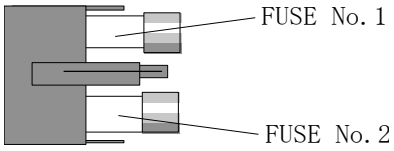
Replace by a preliminary fuse.
If the preliminary is empty, use a fuse with the same specifications and certificate of safety standard in your country.

Dual type

1. Open the cover by pressing the hook until click sounds



2. Replace burnt fuse



No preliminary fuse is prepared in this type.
Replace the burnt fuse by the same type or equivalent fuse.

11.3 Input power cable

Check if the input power cable for this product has no damage of the outer rubber, plugs, or a crack.

- Any damage of the outer rubber of the cable, or the like, would cause electric shock to an operator. Stop using such a cable immediately.

To purchase an accessory including the power cable for this product, contact us or our dealer you purchased from.

11.4 Calibration

To calibrate this product, contact us or our dealer you purchased from.

11.5 Storage

In case you don't need to use this product for a long term, keep this product away from direct sunshine and in dry space.
Storage temperature range is 0 ~ 50℃.

Load Edge
High Performance Electronic Load Series
ELL-355/1005
OPERATION MANUAL

M-2161-02
Rev2.3

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