ODA TECHNOLOGIES

www.odacore.com

Programmable DC Electronic Load

LF Series

User Manual

Manual Part NO. 018LF-1.0.1

Legal Notices

Warranty Certification

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Assistance

This product comes with the standard product warranty. Warranty options, extended support contacts, product maintenance agreements and customer assistance agreements are also available.
Contact your nearest ODA Technologies Sales and Service office for further information on ODA Technologies' full line of Support Programs. Refer to below information.

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+82-2-1800-8644

Waste Electrical and Electronic Equipment

The affixed product label (see right) indicates that you must not discard this electrical/electronic product in domestic household waste. Do not dispose in domestic household waste. To return unwanted products, contact our local ODA distributors, or call us for more information.

Manual Editions

Manual Part Number: 018LF-1.0.1 Edition 13, July, 2018 Printed in ROK
Reprints of this manual containing minor corrections and updates may have the same printing date. Revised editions are identified by a new printing date.

Safety Notices

The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings or instructions elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. ODA Technologies assumes no liability for the customer's failure to comply with these requirements.

General

Do not use this product in any manner not specified by the manufacturer. The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.

Ground the Instrument

This product is a Safety Class 1 instrument (provided with a protective earth terminal). To minimize shock hazard, the instrument chassis and cover must be connected to an electrical ground. The instrument must be connected to the ac power mains through a grounded power cable, with the ground wire firmly connected to an electrical ground (safety ground) at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

Before Applying Power

Verify that all safety precautions are taken. Make all connections to the unit before applying power. Note the instrument's external markings described under "Safety Symbols"

Fuses

The instrument contains an internal fuse, which is not customer accessible.

Do Not Operate in an Explosive Atmosphere

Do not operate the instrument in the presence of flammable gases or fumes.

Do Not Remove the Instrument Cover

Only qualified, service-trained personnel who are aware of the hazards involved should remove instrument covers. Always disconnect the power cable and any external circuits before removing the instrument cover.

Do Not Modify the Instrument

Do not install substitute parts or perform any unauthorized modification to the product. Retur the product to an ODA Sales and Service Office for service and repair to ensure that safety features are maintained.

In Case of Damage

Instruments that appear damaged or defective should be made inoperative and secured agains unintended operation until they can be repaired qualified service personnel.

CAUTION

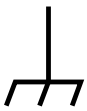
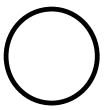
A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, o the like that, if not correctly performed or adher to, could result in damage to the product or of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

ODA

Safety Symbol

	Direct current		Alternating current
	Both direct and alternating current		Three phase alternating current
	Earth (ground) terminal		Protective earth ground terminal.
	Frame or chassis terminal		Terminal is at earth potential.
N	Neutral conductor on permanently installed equipment	L	Line conductor on permanently installed equipment.
	On supply		Off supply
	Standby supply. Unit is not completely disconnected from ac mains when switch is off		In position of a bi-stable push switch
	Out position of a bi-stable push switch		Caution, risk of electric shock
	Caution, hot surface		Caution, refer to accompanying documents

CONTENTS

3. Operating Front-Panel

4. CALIBRATION

5. FACTORY

6. SCPI Command

7. Error Messages

1. General Information

1-1. Feature

LF Series is a high performance, high efficiency programmable electronic load which has RS-232C, RS-485, TCP/IP(Option) interface that is equivalent to SCPI(Standard Commands for Programmable Instruments) Protocol.

General Features

- Easy-to-use knob control settings
- Big size 2Line 16Char LCD Display
- Input ON/OFF
- Front panel Key Lock function
- Alram beep when events occur
- Excellent precise and high resolution
- Built-in Remote Sensing for Load Voltage(V-Sensing)
- O.V.P / O.P.P / O.T.P / O.C.P
- Excellent load and line regulation
- Memory save and recall function(up to 10 operation states)
- Save and confirm up to 10 error messages
- 2U * 19inch half Rack Compact Size(300W, 600W)

Remote Interface

- RS232C, RS485, TCP/IP(Option)
- SCPI(Standard Commands for Programmable Instruments) adopted
- High speed setting & measument
- A large number of commands are programmed in product.
- Easy interface setting using I/O config on front panel
- Technical realization of products insulation & Floating Logic.
- Built-in checking SCPI programming grammar error system

Calibration

- Adopting Software Calibration (No need to internal calibrate)
- Easy calibration operating by itself or PC Interface

Factory Function

- Initializing 10 user memories
- Last state memory store and recall function (output on/off, voltage & current value and etc.).
- Auto Key Lock to prevent operator error
- Calibration Restoration
- Calibration Backup

1-2. Accessories and Option

Accessories

- 1.5M Output cable 1 pc
- Rack mount
- User's Manual 1 pc.

Options

- RS232C Cable 1M, 2M, 4M
- RS485 Cable 2/4/8-Channel 1M, 2M, 4M, 10M
- AC Input Cable (Special order type)
- Output Cable (Special order type)

1-3. Inspecting the Unit

When you receive your electric load, inspect it for any obvious damage that may have occurred during shipment. If any damage is found, notify the carrier and the nearest ODA Sales Office immediately. Warranty information is shown in the front of the manual.
Keep the original packing materials in case the electric load has to be returned to ODA Technologies in the future. If you return the electric load for service, attach a tag identifying the owner and model number. Also include a brief description of the problem.

Mechanical Check

- Check the broken key, encoder switch, power switch.
- Check the panel surfaces are free of dents and scratches.
- Check the broken rear output terminals.
- Check the cabinet is free of scratches.
- Check the LCD display is not scratched or cracked.

Electrical Check

- Initial Display message is ODA Technologies and Model Name.
- If "**OFF-ISET**" Message is displayed, Please check other specifications.

Note

Service Center : 82-32-623-5454
Home page : www.odacore.com

1-4. Operating Conditions

This instrument is designed for following environmental condition for using optimized condition.

- Environmental Temperature : 0 ~ 40℃
- Relative humidity : ≤80%
- Operating Altitude : ≤2000m
- No vibration
- Avoid the electric magnetic field.

1-5. Check Before Power on

Power Cord Check

▌Provided power cord is 3-wire ground type.
If you use power cord from other brand, use Ground type.
And connect the power supply earth to load's GND.

AC Input Power Check

▌The product is designed for single phase AC110/220V (Changing switch) ±10% / 50~60Hz.
You can choose 3 phase AC Input or other options additionally.
※ Before power on, check the switch on the bottom of the product (Default: AC220V)

1-6. Check After Power On

Turn on the power and load will be set in the previous setting value.

Displayed procedure on LCD

▌All icons on LCD and segments will light up

▌"ODA Technologies" is displayed on line 1

▌"The model name of LF-Series" is displayed on line 2.

▌During displaying above procedure, the instrument is initialized by stored in non-volatile memory.

Default Setting Values

▌Remote Interface RS-232C 9600bps
▌CC,CV,CP MODE VALUE: 0
▌CR MODE Value: LF300-A 10Ω
▌CC,CV Range: HI Range
▌KEY LOCK : OFF
▌BAT MODE CC
▌BAT END VOLT 1V, END CAP 6550AH
▌DYN DUTY: 50%
▌DYN-CYCLING TIME: 0.0001s
▌DYN A,B VALUE 0
▌CYC STEP VALEU 0
▌CYC Finish STEP100
▌TIME: 100mS (ON/OFF TIME, CYC STEP TIME, FUSE TIME)
▌REPEAT: 1(CYC REPEAT, ON/OFF REPEAT)

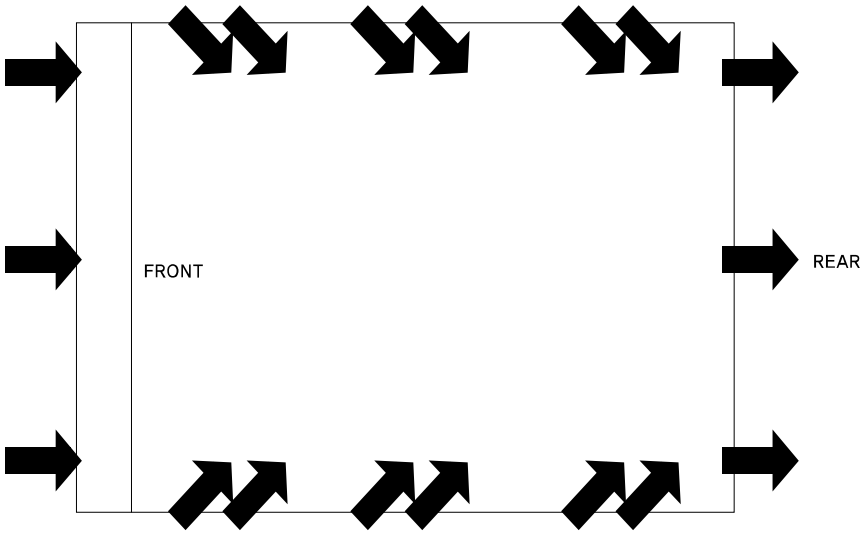
Note1

When rebooting, it reboots with setting value.

1-7. Installation

Cooling

▌Load's quality is guaranteed in the circumstances of 0℃ ~ 40℃.
If you use this instrument in 40℃ ~ 55℃, please lower the output current to 0~70%.
When you use your electronic load on a rack, please be careful air-circulation.
You can use Rack Mounting Support as optional product.



<Figure 1-1 Bottom view>

Bench Operation

▌Load must be installed in a location that allows sufficient space at the sides, front and rear of the unit for adequate air circulation. There is no ventilation silt on the underside.

Rack Mounting

▌This product is designed to support 2U * 19inch-Half.
You can fix product on a rack mounting provided

▌Tightly fasten Rack Mounting and Rack with bolts.

▌It would be easier If you use built-in cabinet and slider(optional product).

Note

300W, 600W: 2U *19inch-Half
900W, 1200W: 2U *19inch

2. Configuration of Front Panel & Real Panel

2-1. Front Panel

< Figure 2-1 >

1	16Char *2Line Type LCD Display	18	INPUT ON/OFF KEY
2	CC/CV LOW RANG LCD ICON	19	MODE KEY
3	CC/CV HI RANG LCD ICON	20	DISPLAY KEY
4	INPUT ON LCD ICON	21	CC/CV RANG KEY
5	Remote Interface LCD ICON	22	IO/LOCAL KEY
6	KEY LOCK LCD ICON	23	ESC, ERROR, PROTECTION KEY
7	ERROR LCD ICON	24	SAVE/RECALL, V_SENSING KEY
8	V_SENSING ON LCD ICON	25	SHORT ON/OFF, KEY LOCK KEY
9	CYCLING MODE LCD ICON	26	CYCLING RUN/STOP KEY
10	DYNAMIC MODE LCD ICON	27	CYCLING SETING KEY
11	CP MODE LCD ICON	28	DYNAMIC RUN/STOP, Calibration KEY
12	CR MODE LCD ICON	29	DYNAMIC SETING, Factory KEY
13	CC MODE LCD ICON	30	INPUT + Terminal
14	CV MODE LCD ICON	31	INPUT - Terminal
15	Setting Encoder	32	POWER S/W
16	Right Cursor or Menu Change Key	33	
17	Left Cursor or Menu Change Key	34	

1. 16Char * 2Line type LCD Display
   Voltage/current and all kinds menu/message are displayed

2. CC/CV LOW RANG LCD ICON
   lights up when CC/CV MODE RANG is low

3. CC/CV HI RANG LCD ICON
   lights up when CC/CV MODE RANG is high

4. INPUT ON LCD ICON
   lights up when INPUT is on

5. Remote Interface LCD ICON
   When received request for remote control, this lamp lights automatically.
   In this mode, you can't use other keys excpet IO/LOCAL KEY

6. KEY LOCK LCD ICON
   lights up when KEY LOCK mode. In this mode you can't use any other keys

7. ERROR LCD ICON
   If errors occur, the lamp lights up. When all errors are checked, the lamp goes out

8. V_SENSING ON LCD ICON
   lights up when V_SENSING mode

9. CYCLING MODE LCD ICON
   lights up when CYCLING MODE setting or CYCLING MODE on

10. DYNAMIC MODE LCD ICON
    lights up when DYNAMIC MODE setting or DYNAMIC MODE on

11. CP MODE LCD ICON
    lights up when CP MODE setting or CP MODE on

12. CR MODE LCD ICON
    lights up when CR MODE setting or CR MODE on

13. CC MODE LCD ICON
    lights up CC MODE setting or CC MODE on

14. CV MODE LCD ICON
    lights up when CV MODE setting or CV MODE on

15. Setting Encoder
Set all values or change numerical value in functional menu

16. Right Cursor or Menu Change Key
Move to the right direction. After entering Menu, this is the move key

17. Left Cursor or Menu Change Key
Move to the left direction. After entering Menu, this is the move key

18. INPUT ON/OFFKEY
Enable and disable CC,CV,CR,CP,ON/OFF,FUSE,BAT MODE

19. MODE KEY
Change CC,CV,CR,CP,ON/OFF,FUSE,BAT MODE
※ CC→CV→CR→CP→ON/OFF→FUSE→BAT→CC

20. SETTING & DISPLAY KEY
When input is off, you can change SETTING PAGE in ON/OFF, FUSE, BAT mode
When all mode is on, you can change DISPLAY PAGE

21. CC/CV RANG KEY
When CC/CV MODE is off, you can change RANG of CC/CV

22. IO/LOCAL KEY
As Remote Interface setting key, you can select RS232C, RS485 and TCP/IP
In Remote Interface mode, you can change to Local Mode using this key

23. ESC, ERROR, PROTECTION KEY
Can be used as Cancellation key when press the key shortly
Can be used as Checking Error Display key when an error is occurred
When Protection Mode is on, to press and hold this key will clear protection
※ In PROTECTION mode, "PROTECTION CLEAR" will be displayed after Protection is cleared

24. SAVE/RECALL, V_SENSING KEY
Press this key shortly to enter SAVE/RECALL menu or for setting in functional menu
Press and hold this key to enable or disable V_SENSING

25. SHORT ON/OFF, KEY LOCK KEY
Press this key shortly to set MAX current when CC HI RANG MODE is ON
Press and hold this key to disable KEY LOCK Mode

26. CYCLING RUN/STOP KEY
Start or Stop CYCLING MODE

27. CYCLING SETTING KEY

When entering setting menu of CYCLING MODE, this is the setting key.

28. DYNAMIC RUN/STOP, Calibration KEY

After booting, this key is used to start and end DYNAMIC Mode

During booting, this key is for setting in Calibration menu and functional menu

29. DYNAMIC SETTING, Factory KEY

After booting the product, this key is used to enter DYNAMIC MODE SETING menu.

During booting, this key is for setting in Factory menu and functional menu

30. INPUT + Terminal

(+) Input terminal

31. INPUT + Terminal

(−) Input terminal.

32. POWER S/W

This switch can cut off or supply power

2-2. Rear Panel Interface

1	AC Input	5	RS232C Interface Port
2	External Input/Output Terminal	6	Ventilation Slit
3	TCP/IP Interface Port(Option)		
4	RS485 Interface Port		

1. AC Input

Input AC voltage here.

110/220V(changeable) / 50-60Hz is default and change the value is optional.

※ Before power on, be sure to check AC switch on the bottom (Default is AC220V)

2. External Input/Output Option Terminal

1) V_Sensing + Input
2) V_Sensing - Input
3) Current Analog Output(0~10V)
4) Analog Ground
5) Firmware Upgrade Mode Set Terminal
6) Firmware Upgrade Mode Set Terminal

3. TCP/IP Interface Port(Option)

Interface Port that can control the electronic load using TCP/IP communication.

4. RS485 Interface Port

It is a Communication method that can connect multiple devices(power supplier, DMM, Scope, etc.,) in parallel to one external controller.

※ Pin Description

1) +5V (Communication Power Source)
2) D+ (Data+)
3) D- (Data-)
4) 0 (Communication Ground)

5. RS232C Interface Port

This is a Serial Port that equipped in PC.

This use 1:1 communication with external controller (PC,PLC,ETC.,)

6. Ventilation Slit

Suck the air from the side of unit forcibly and drain it from the rear

3. Front-Panel Operating

Select and confirm key is the same key that you press when enter that menu,
so it is easy to operate.

Overview

3-1.CC MODE
Description about the operation of constant current mode.

3-2. CV MODE
Description about the operation of constant voltage mode.

3-3. CR MODE
Description about the operation of constant resistance mode.

3-4. CP MODE
Description about the operation of constant power mode.

3-5. ON/OFF MODE
Description about ON/OFF Mode of constant current

3-6. FUSE MODE
Description about FUSE Mode of constant current.

3-7. BAT MODE(BATTERY)
Description about BATTERY TEST Mode.

3-8. CYC MODE(Cycling)
Description about actions of various steps of pattern input Mode.

3-9. DYN MODE(Dynamic)
Description about actions of high speed input Mode

3-10. CC,CV RANG
Description about changing CC/CV RANG

3-11. IO/LOCAL
Description about Remote Interface setting and returning to Local Mode

3-12. ESC/ERR/PROT

Description about cancel, checking errors and disabling Protection

3-13. SAVE/RECALL, KEY LOCK

Description about saving and loading the data from 『User Memory』 and disabling KEY LOCK mode.

3-14. REMOTR Voltage

Description about Remote Voltage Sensing

3-15. SHORT

Description about SHORT function

3-1.CC MODE (Constant Currunt)

To set up CC mode, proceed as follow.

MODE SET

POWER	▌Power ON
MODE	▌Move to MODE menu Press MODE Key to enter MODE menu When entering MODE menu, ">MODE SET" is displayed on 1st line of LCD
◀ ▶	▌MODE setting Set CC MODE by using left/right key When CC MODE is on, "1. CC MODE" is displayed on 2nd line of LCD ※MODE change order: CC ↔ CV ↔ CR ↔ CP ↔ ON/OFF ↔ FUSE ↔ BAT
MODE	▌Saving MODE & Exit MODE menu Press MODE key to save MODE and exit MODE menu. After "SAVE…" is displayed on the 2nd line of LCD present voltage and current will displayed on the 1st line and "I-SET" will displayed on the 2nd line of LCD.

≫ Related Remote Interface Command
MODE:{CC | CV | CR |CP |ONOFF | FUSE | BAT }
MODE? 0:CC, 1:CV, 2:CR, 3:CP, 4:ON/OFF, 5:FUSE, 6:BAT

When CC mode is off, how to change current

	▌Check CC MODE When I-SET is displayed on 2nd line of LCD, CC icon lights up.
◀ ▶	▌To set current, move cursor to the value you want to change by using left/right key. Control encorder switch to change your current value

≫ Related Remote Interface Command
CURR {VALUE}
CURR?

CC MODE INPUT ON

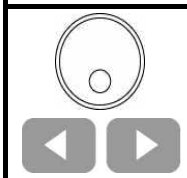
INPUT ON/OFF	▌To enable CC MODE ON, press INPUT ON/OFF Key When INPUT is on, ON icon will light up.

≫ *Related Remote Interface Command*
INPUT {OFF|ON}
INPUT?

When CC MODE is ON, how to change LCD display

	▌Check if CC MODE is on CC icon and ON icon light up.
DISPLAY	▌Press DISPLAY KEY and you can check various information, when CC MODE is on ※DISPLAY change I-SET → WATT → MODE TIME → I-SET

When CC mode is on, how to change current

	▌Check I-SET setting When CC & ON icon are on and "I-SET" is displayed on the 2nd line LCD.
	▌To set current, move cursor to the value you want to change by using left/right cursor key. Control encorder switch to change your current value

≫ *Related Remote Interface Command*
CURR {VALUE}
CURR?

CC MODE INPUT OFF

INPUT ON/OFF	▌To disable CC MODE, press INPUT ON/OFF KEY. If INPUT is off, ON icon will light off.

≫ Related Remote Interface Command
INPUT {OFF|ON}
INPUT?

Note

MD.T Unit	000.	00.	00.	00
	Day	Hour	Minute	Second

3-2. CV MODE

To set up CV mode, proceed as follows.

MODE SET

POWER	▌Power ON
MODE	▌Move to MODE menu Press MODE Key to enter MODE menu When entering MODE menu, ">MODE SET" is displayed on 1st line of LCD
◀ ▶	▌MODE setting Set CV MODE by using left/right key When CV MODE is on, "2. CV MODE" is displayed on 2nd line of LCD ※MODE change order: CC ↔ CV ↔ CR ↔ CP ↔ ON/OFF ↔ FUSE ↔ BAT
MODE	▌Saving MODE & Exit MODE menu Press MODE key to save MODE and exit MODE menu. After "SAVE…" is displayed on the 2nd line of LCD present voltage and current shows on the 1st line of LCD "V-SET" will show on the 2nd line of LCD.

≫ *Related Remote Interface Command*
MODE:{CC | CV | CR |CP |ONOFF | FUSE | BAT }
MODE? 0:CC, 1:CV, 2:CR, 3:CP, 4:ON/OFF, 5:FUSE, 6:BAT

When CV mode is OFF, how to change voltage

	▌Check CV mode setting When CV icon lights on and "V-SET" is displayed on the 2nd line LCD
◀ ▶	▌To set voltage, move cursor to the value you want to change by using left/right cursor key. Control encorder switch to change your current value

≫ *Related Remote Interface Command*
VOLT {VALUE}
VOLT?

CV MODE INPUT ON

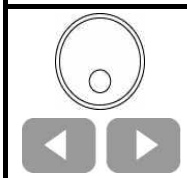
INPUT ON/OFF	▌To able CV MODE, press INPUT ON/OFF KEY. If INPUT is on, ON icon will light up.

≫ Related Remote Interface Command
INPUT {OFF|ON}
INPUT?

When CV MODE is ON, how to change LCD display

	▌Check if CV MODE is on CV icon and ON icon light on.
DISPLAY	▌Press DISPLAY KEY and you can check various information, when CV MODE is on ※DISPLAY change V-SET → WATT → MODE TIME → V-SET

When CV mode is on, how to change voltage

	▌Check V-SET setting When CV and ON icon are on and "V-SET" is displayed on the 2nd line LCD
	▌To set voltage, move cursor to the value you want to change by using left/right cursor key. Control encorder switch to change your voltage value

≫ Related Remote Interface Command
VOLT {VALUE}
VOLT?

CV MODE INPUT OFF

INPUT ON/OFF	▌To disable CV MODE, press INPUT ON/OFF KEY. If INPUT is off, ON icon will light off.

≫ Related Remote Interface Command
INPUT {OFF|ON}
INPUT?

Note

MD.T unit	000.	00.	00.	00
	Day	Hour	Minute	Second

3-3. CR MODE

To set up CR mode, proceed as follows.

MODE SET

POWER	▌Power ON
MODE	▌Move to MODE menu Press MODE Key to enter MODE menu When entering MODE menu, ">MODE SET" is displayed on 1st line of LCD
◀ ▶	▌MODE setting Set CR MODE by using left/right key When CR MODE is on, "3. CR MODE" is displayed on 2nd line of LCD ※MODE change order: CC ↔ CV ↔ CR ↔ CP ↔ ON/OFF ↔ FUSE ↔ BAT
MODE	▌Saving MODE & Exit MODE menu Press MODE key to save MODE and exit MODE menu. After "SAVE…" is displayed on the 2nd line of LCD present voltage and current shows on the 1st line "R-SET" will show on the 2nd line of LCD.

≫ Related Remote Interface Command
MODE:{CC | CV | CR |CP |ONOFF | FUSE | BAT }
MODE? 0:CC, 1:CV, 2:CR, 3:CP, 4:ON/OFF, 5:FUSE, 6:BAT

When CR mode is OFF, how to change resistance

	▌Check CR mode setting When CR icon is on and "R-SET" is displayed on the 2nd line LCD
◯ ◀ ▶	▌To set resistance, move cursor to the value you want to change by using left/right cursor key. Control encorder switch to change your resistance value

≫ Related Remote Interface Command
RES {VALUE}
RES?

CR MODE INPUT ON

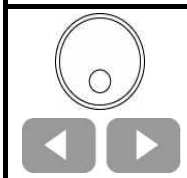
INPUT ON/OFF	▌To enable CR MODE ON, press INPUT ON/OFF Key If INPUT is on, ON icon will light up.

≫ Related Remote Interface Command
INPUT {OFF|ON}
INPUT?

When CR MODE is ON, how to change LCD display

	▌Check if CR MODE is on CR icon and ON icon light on.
DISPLAY	▌Press DISPLAY KEY and you can check various information, when CR MODE is on ※DISPLAY change R-SET → WATT → MODE TIME → R-SET

When CR mode is on, how to change resistance

	▌Check R-SET setting When CR & ON icon light on and "R-SET" is displayed on the 2nd line LCD
	▌To set resistance, move cursor to the value you want to change by using left/right cursor key. Control encorder switch to change your resistance value ※ If "R-SET SET-ERR" is displayed on LCD, you can't set the resistance value with your present source on your DC electronic load.

≫ Related Remote Interface Command
RES {VALUE}
RES?

CR MODE INPUT OFF

INPUT ON/OFF	▌To disable CR MODE, press INPUT ON/OFF KEY. If INPUT is off, ON icon will light off.

≫ Related Remote Interface Command
INPUT {OFF|ON}
INPUT?

Note

MD.TIME Unit	000.	00.	00.	00
	Day	Hour	Minute	Second

3-4. CP MODE

To set up CP mode, proceed as follows.

MODE SET

POWER	▌Power ON
MODE	▌Move to MODE menu Press MODE Key to enter MODE menu When entering MODE menu, ">MODE SET" is displayed on 1st line of LCD
◀ ▶	▌MODE setting Set CP MODE by using left/right key When CP MODE is on, "4. CP MODE" is displayed on 2nd line of LCD ※MODE change order: CC ↔ CV ↔ CR ↔ CP ↔ ON/OFF ↔ FUSE ↔ BAT
MODE	▌Saving MODE & Exit MODE menu Press MODE key to save MODE and exit MODE menu. After "SAVE…" is displayed on the 2nd line of LCD present voltage and current shows on the 1st line "P-SET" will show on the 2nd line of LCD.

≫ *Related Remote Interface Command*
MODE:{CC | CV | CR |CP |ONOFF | FUSE | BAT }
MODE? 0:CC, 1:CV, 2:CR, 3:CP, 4:ON/OFF, 5:FUSE, 6:BAT

When CP mode is OFF, how to change watt

	▌Check CP mode setting When CP icon lights on and "P-SET" is displayed on the 2nd line LCD
◯ ◀ ▶	▌To set resistance, move cursor to the value you want to change by using left/right cursor key. Control encorder switch to change your watt value

≫ *Related Remote Interface Command*
WATT {VALUE}
WATT?

CP MODE INPUT ON

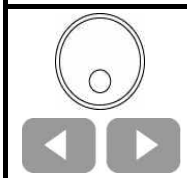
INPUT ON/OFF	▌To enable CP MODE ON, press INPUT ON/OFF Key If INPUT is on, ON icon will light up.

≫ *Related Remote Interface Command*
INPUT {OFF|ON}
INPUT?

When CP MODE is ON, how to change LCD display

	▌Check if CP MODE is on CP icon is on and ON icon is on.
DISPLAY	▌Press DISPLAY KEY and you can check various information, when CP MODE is on. ※DISPLAY change P-SET → MODE TIME → P-SET

When CP mode is on, how to change watt

	▌Check P-SET setting When CP and ON icon are on and "P-SET" is displayed on the 2nd line LCD
	▌To set resistance, move cursor to the value you want to change by using left/right cursor key. Control encorder switch to change your watt value. ※ If "P-SET SET-ERR" is displayed on LCD, you can't set the watt value with your present source on your DC electronic load.

≫ *Related Remote Interface Command*
WATT {VALUE}
WATT?

CP MODE INPUT OFF

INPUT ON/OFF	▌To disable CP MODE, press INPUT ON/OFF KEY. If INPUT is off, ON icon will light off.

≫ Related Remote Interface Command
INPUT {OFF|ON}
INPUT?

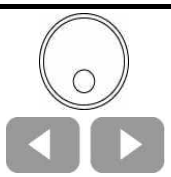
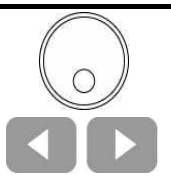
Note

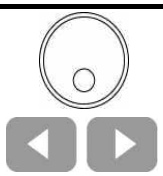
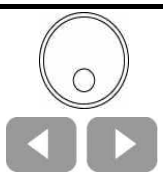
MD.TIME Unit	000.	00.	00.	00
	Day	Hour	Minute	Second

3-5. ON/OFF MODE(Constant current ON / OFF mode)

To set up ON/OFF mode, proceed as follows.

MODE SET

POWER	▌Power ON
MODE	▌Move to MODE SETTING menu Press MODE Key to enter MODE menu When entering MODE menu, ">MODE SET" is displayed on 1st line of LCD
	▌MODE setting Set CP MODE by using left/right key When ON/OFF MODE is on, "5. ON.OFF MODE" is displayed on 2nd line of LCD ※MODE change order: CC ↔ CV ↔ CR ↔ CP ↔ ON/OFF ↔ FUSE ↔ BAT
MODE	▌Move to ON.VALUE menu. Press MODE key to enter ON.VALUE menu. ">MODE >ON.OFF" is displayed on 1st line of LCD, and "ON.VALUE" is displayed on 2nd line of LCD.
	▌To set ON_VALUE, move cursor using right/left key to the value you want to change. And adjust the encorder switch to change value.
MODE	▌Entering ON.TIME menu Press MODE Key to enter ON.TIME menu. ">MODE >ON.OFF" is displayed on 1st line of LCD, and "ON.T" is displayed on 2nd line of LCD.
	▌To set ON_TIME, move cursor using right/left key to the value you want to change. And adjust the encorder switch to change value. ※10mS unit (minimum 100mS)

MODE	▌Entering OFF.TIME menu Press MODE Key to enter OFF.TIME menu. ">MODE >ON.OFF" is displayed on 1st line of LCD, and "OFF.T" is displayed on 2nd line of LCD.
	▌To set OFF_TIME, move cursor using right/left key to the value you want to change. And adjust the encorder switch to change value. ※10mS unit (minimum 100mS)
MODE	▌Entering OFF.REPEAT menu Press MODE key to enter OFF.TIME SETING menu. ">MODE >ON.OFF" is displayed on 1st line of LCD, "REPEAT" is displayed on 2nd line of LCD.
	▌To set ON/OFF_REP, move cursor using right/left key to the value you want to change. And adjust the encorder switch to change value.
MODE	▌Saving MODE & Exit MODE menu Press MODE key to save MODE and exit MODE menu. After "SAVE…" is displayed on the 2nd line of LCD, present voltage and current shows on the 1st line of LCD "ON.OFF MODE OFF" will show on the 2nd line of LCD.

≫ Related Remote Interface Command
MODE:{CC | CV | CR |CP |ONOFF | FUSE | BAT }
MODE? 0:CC, 1:CV, 2:CR, 3:CP, 4:ON/OFF, 5:FUSE, 6:BAT

ONOFF:CURR{VALUE}
ONOFF:CURR?

ONOFF:ON:TIME{VALUE}
ONOFF:ON:TIME?

ONOFF:OFF:TIME{VALUE}
ONOFF:OFF:TIME?

ONOFF:REP{VALUE}
ONOFF:REP?

ON/OFF MODE INPUT ON

INPUT ON/OFF	▌To enable ON/OFF MODE on, press INPUT ON/OFF KEY. If INPUT is on, ON icon will light up.

≫ Related Remote Interface Command
INPUT {OFF|ON}
INPUT?

When ON/OFF MODE is ON, how to change LCD display

	▌Check if ON/OFF MODE is on On icon lights up.
DISPLAY	▌Press DISPLAY KEY and you can check various information, when ON/OFF MODE is on ※DISPLAY change ON_VALUE → WATT → ON/OFF.TIME → MODE TIME → REPEAT → ON_VALUE

ON/OFF MODE INPUT OFF

INPUT ON/OFF	▌To disable ON/OFF MODE OFF, press INPUT ON/OFF KEY if INPUT is off, ON icon will light off.

≫ Related Remote Interface Command
INPUT {OFF|ON}
INPUT?

Note

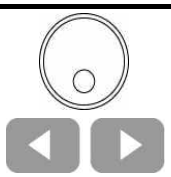
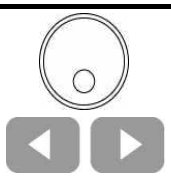
When turn off REPEAT of ON/OFF mode, ON_OFF_MODE_END will be displayed on ON_VALUE display and ON/OFF.TIME&MODE.TIME REPEAT will be stop and current value will be set as 0.
※ All the setting value of ON/OFF mode has been saved even after rebooting.

MD.T Unit	000.	00.	00.	00
	Day	Hour	Minute	Second

3-6. FUSE MODE(Constant current FUSE mode)

To set up FUSE mode, proceed as follows.

MODE SET

POWER	▌Power ON
MODE	▌Move to MODE menu Press MODE key to enter MODE menu When entering MODE menu, ">MODE SET" is displayed on 1st line of LCD
	▌MODE setting Set FUSE MODE by using left/right key When FUSE MODE is on, "6. FUSE MODE" is displayed on 2nd line of LCD ※MODE change order: CC ↔ CV ↔ CR ↔ CP ↔ ON/OFF ↔ FUSE ↔ BAT
MODE	▌Move to FUSE VALUE menu. Press MODE Key once to enter FUSE VALUE menu. ">MODE >FUSE" is displayed on 1st line of LCD, "VALUE" is displayed on 2nd line of LCD.
	▌To set FUSE value, move cursor using right/left key to the value you want to change. And adjust the encorder switch to change value.
MODE	▌Entering FUSE.TIME menu Press MODE Key once to enter FUSE TIME SETTING menu. ">MODE >FUSE" is displayed on 1st line of LCD, and "FU.T" is displayed on 2nd line of LCD.
	▌To set FUSE TIME value, move cursor using right/left key to the value you want to change. And adjust the encorder switch to change value. ※10mS unit (minimum 100mS)

MODE	▌Saving MODE & Exit MODE menu Press MODE key to save MODE and exit MODE menu. After "SAVE…" is displayed on the 2nd line of LCD, present voltage and current shows on the 1st line of LCD "FUSE MODE OFF" will show on the 2nd line of LCD.

≫ Related Remote Interface Command
MODE:{CC | CV | CR |CP |ONOFF | FUSE | BAT }
MODE? 0:CC, 1:CV, 2:CR, 3:CP, 4:ON/OFF, 5:FUSE, 6:BAT

FUSE:CURR{VALUE}
FUSE:CURR?

FUSE:TIME{VALUE}
FUSE:TIME?

FUSE MODE INPUT ON

INPUT ON/OFF	▌To enable ON/OFF MODE on, press INPUT ON/OFF KEY. If INPUT is on, ON icon will light up.

≫ Related Remote Interface Command
INPUT {OFF|ON}
INPUT?

When FUSE MODE is ON, how to change LCD display

	▌Check if FUSE MODE is on On icon is light on.
DISPLAY	▌Press DISPLAY KEY and you can check various information, when FUSE MODE is on ※DISPLAY change FUSE_VALUE → WATT → FUSE.TIME → FUSE_VALUE

FUSE MODE INPUT OFF

INPUT ON/OFF	▌To disable ON/OFF MODE off, press INPUT ON/OFF KEY. If INPUT is off, ON icon will light off.

≫ Related Remote Interface Command
INPUT {OFF|ON}
INPUT?

Note

When time of FUSE mode is finished, FUSE_MODE_END will be displayed on FUSE VALUE display and FUSE TIME will be stop and current value will be set as 0.

When stop FUSE, FUSE_CUT_OFF will be displayed on FUSE VALUE display and FUSE TIME will be stop and current value will be set as 0.
※ All the setting value of FUSE mode are saved also after rebooting.

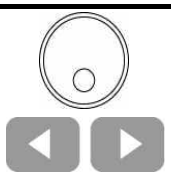
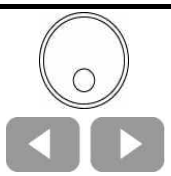
FU.T Unit	000.	00.	00.	00
	Hour	Minute	Second	10mS

3-7. BAT MODE(BATTERY TEST MODE)

To set up BATTERY TEST mode, proceed as follows.

MODE SET

POWER	▌Power ON
MODE	▌Move to MODE menu Press MODE key to enter MODE menu When entering MODE menu, ">MODE SET" is displayed on 1st line of LCD
◀ ▶	▌MODE setting Set BAT MODE by using left/right key When BAT MODE is on, "7. BAT MODE" is displayed on 2nd line of LCD ※MODE change order: CC ↔ CV ↔ CR ↔ CP ↔ ON/OFF ↔ FUSE ↔ BAT
MODE	▌Move to BAT MODE menu. Press MODE Key to enter BAT MODE menu. ">MODE >BAT" is displayed on 1st line of LCD, and "BAT_MODE" is displayed on 2nd line of LCD.
◀ ▶	▌To set BAT_MODE(CC, CR, CCP), move cursor using right/left key to the value you want to change. ※BAT_MODE change order: 1. CC ↔ 2. CR ↔ 3. CP
MODE	▌Entering BATTERY VALUE menu Press MODE Key once to enter BATTERY VALUE menu. ">MODE >BAT" is displayed on 1st line of LCD, "BT_VAL" or "B.VAL" is displayed on 2nd line of LCD.
◯ ◀ ▶	▌To set BATTERY value, move cursor using right/left key to the value you want to change. And adjust the encorder switch to change value.

MODE	▌Entering BATTERY END VOLT menu Press MODE Key to enter BATTERY END VOLT menu. ">MODE >BAT" is displayed on 1st line of LCD, and "END.VOLT" is displayed on 2nd line of LCD.
	▌To set END VOLT value, move cursor using right/left key to the value you want to change. And adjust the encorder switch to change value.
MODE	▌Entering BATTERY END CAPACITOR menu Press MODE Key once to enter BATTERY END CAPACITOR menu. ">MODE >BAT" is displayed on 1st line of LCD, and "EN.CAP" is displayed on 2nd line of LCD.
	▌To set END CAPACITOR value, move cursor using right/left key to the value you want to change. And adjust the encorder switch to change value.
MODE	▌Saving MODE & Exit MODE menu Press MODE key to save MODE and exit MODE menu. After "SAVE…" is displayed on the 2nd line of LCD, present voltage and current shows on the 1st line of LCD "BAT MODE OFF" will show on the 2nd line of LCD.

≫ Related Remote Interface Command
MODE:{CC | CV | CR |CP |ONOFF | FUSE | BAT }
MODE? 0:CC, 1:CV, 2:CR, 3:CP, 4:ON/OFF, 5:FUSE, 6:BAT

BAT:MODE:{CC,CR,CP}
BAT:MODE? 0:CC, 1:CR, 2:CP

BAT:CURR{VALUE}
BAT:CURR?
BAT:RES{VALUE}
BAT:RES?
BAT:WATT{VALUE}
BAT:WATT?

BAT:END:VOLT{VALUE}
BAT:END:VOLT?

BAT:END:CAP{VALUE}
BAT:END:CAP?

BATTERY MODE INPUT ON

INPUT ON/OFF	▌To enable ON/OFF MODE on, press INPUT ON/OFF KEY. If INPUT is on, ON icon will light up.

≫ *Related Remote Interface Command*
INPUT {OFF|ON}
INPUT?

When BATTERY MODE is ON, how to change LCD display

	▌Check if BATTERY MODE is on On icon lights up.
DISPLAY	▌Press DISPLAY KEY and you can check various information, when BATTERY MODE is on ※DISPLAY change BAT_VALUE → WATT → BT_CAP → BAT_VALUE

BATTERY MODE INPUT OFF

INPUT ON/OFF	▌To disable ON/OFF MODE off, press INPUT ON/OFF KEY. If INPUT is off, ON icon will light off.

≫ *Related Remote Interface Command*
INPUT {OFF|ON}
INPUT?

Note

All values in BATTERY MODE can be set only when INPUT is off.

When BATTERY mode is END_VOLT or END_CAP, BAT_MODE_END will be displayed on BAT_VALUE display and FUSE TIME will be stop and current value will be set as 0.
※ All the setting value of BATTERY mode are saved also after rebooting.

MD.T Unit	000.	00.	00.	00
	Day	Hour	Minute	Second

3-8.CYC MODE

To set up CYCLING mode, proceed as follows.

MODE SET

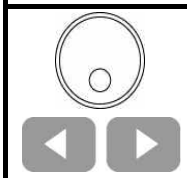
POWER	▌Power ON
CYCLING SETTING	▌Move to Cycling mode menu Press Cycling setting key. When entering setting menu of Cycling mode, ">CYC SET" is displayed on 1st line of LCD. CYC icon will light up.

Cycling FINISH STEP SET

	▌When in Cycling mode setting menu, CYC icon lights up and On icon lights off
◀ ▶	▌Setting Cycling Finish Step menu Move to Finish Step menu by using left/right key When in Finish Step, "1. FINISH_STEP" is displayed on 2nd line of LCD ※Cycling setting munu order: 1.FINISH_STEP ↔ 2.REPEAT_NUM ↔ 3.MODE ↔ 4.VALUE STEP: ↔ 5.DELAY STEP:
CYCLING SETTING	▌Entering Finish Step menu Press Cycling setting key to enter Finish Step menu.
◀ ▶	▌To set Finish Step value, move cursor using right/left key to the value you want to change. And adjust the encorder switch to change value.
CYCLING SETTING	▌Saving Finish Step value Press Cycling setting key. After saving Finish Step value, exit Finish Step menu and return to Cycling setting menu.

≫ Related Remote Interface Command
CYC:SEQ{VALUE}
CYC:SEQ?

Cycling REPEAT SET

	▌When in Cycling mode setting menu, CYC icon is on and On icon is off
◀ ▶	▌Setting Cycling Finish Step menu Move to Cycling REPEAT menu by using left/right key When in Finish Step, "2.REPEAT_NUM" is displayed on 2nd line of LCD ※Cycling setting munu order: 1.FINISH_STEP ↔ 2.REPEAT_NUM ↔ 3.MODE ↔ 4.VALUE STEP: ↔ 5.DELAY STEP:
CYCLING SETTING	▌Entering REPEAT menu Press Cycling setting key to enter REPEAT menu.
	▌To set REPEAT value move to REPEAT value which you want to set by using left/right cursor key And adjust the encorder switch.
CYCLING SETTING	▌Saving REPEAT value Press Cycling setting key. After saving Finish Step value, exit Finish Step menu and return to Cycling setting menu.

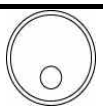
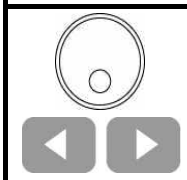
≫ *Related Remote Interface Command*
CYC:REP {VALUE}
CYC:REP?

Cycling MODE SET

	▌When in Cycling mode setting menu, CYC icon is on and On icon is off
◀ ▶	▌Cycling Mode menu setting Move to Cycling mode menu by using left/right key When Finish Step menu, "2.MODE" is displayed on 2nd line of LCD ※Cycling setting munu order: 1.FINISH_STEP ↔ 2.REPEAT_NUM ↔ 3.MODE ↔ 4.VALUE STEP: ↔ 5.DELAY STEP:
CYCLING SETTING	▌Entering Cycling mode menu Press Cycling setting mode once to enter Cycling mode menu.
◀ ▶	▌To set Cycling mode, move to Cycling mode which you want to set ※Cycling MODE order : 1.CC ↔ 2.CV
CYCLING SETTING	▌Saving Cycling mode Press Cycling setting key. After saving CYC_MODE, exit Cycling MODE menu and return to Cycling setting menu.

≫ *Related Remote Interface Command*
CYC:MODE:{CC | CV }
CYC:MODE?

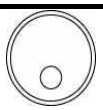
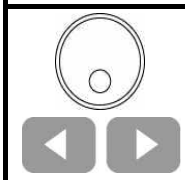
Cycling STEP VALUE SET

	▌When in Cycling mode setting menu, CYC icon lights up and On icon lights off
	▌Cycling STEP value menu setting Move to Cycling STEP value menu by using left/right key When Cycling menu, "4.VALUE STEP:" is displayed on 2nd line of LCD ※Cycling setting munu order: 1.FINISH_STEP ↔ 2.REPEAT_NUM ↔ 3.MODE ↔ 4.VALUE STEP: ↔ 5.DELAY STEP:
	▌Set STEP value by using encorder switch
CYCLING SETTING	▌Entering Cycling STEP value menu Press Cycling setting key once to enter Cycling STEP VALUE menu.
	▌To set Cycling STEP value, move cursor using right/left key to the value you want to change. And adjust the encorder switch to change value.
CYCLING SETTING	▌Saving Cycling STEP value Press Cycling setting key. After saving Cycling STEP value, exit Cycling STEP VALUE and return to Cycling setting menu.

※ Repeat until each Step value is saved.

≫ *Related Remote Interface Command*
CYC:VAL:{STEP_NUM} {VALUE}
CYC:VAL:{STEP_NUM}?

Cycling STEP DELAY SET

	▌When in Cycling mode setting menu, CYC icon lights up and On icon lights off
	▌Setting Cycling STEP DELAY menu Move to Cycling STEP DELAY value menu by using left/right key When in Cycling menu, "5.CYC_DELAY:" is displayed on 2nd line of LCD ※Cycling setting munu order: 1.FINISH_STEP ↔ 2.REPEAT_NUM ↔ 3.MODE ↔ 4.VALUE STEP: ↔ 5.DELAY STEP:
	▌Set DELAY value by using encorder switch
CYCLING SETTING	▌Entering Cycling STEP DELAY menu Press Cycling setting key once to enter Cycling STEP DELAY menu.
	▌To set Cycling STEP DELAY value, move cursor using right/left key to the value you want to change. And adjust the encorder switch to change value. ※10mS unit(Minimum 100mS)
CYCLING SETTING	▌Saving Cycling STEP DELAY value Press Cycling setting key. After saving Cycling STEP DELAY value, exit Cycling STEP DELAY and return to Cycling setting menu.

※ Repeat until each Step value is saved.

≫ Related Remote Interface Command
CYC:DELAY:{STEP_NUM} {VALUE}
CYC:DELAY:{STEP_NUM}?

Exit Cycling mode setting menu

ESC ERR/PROT	▌Exit Cycling mode setting menu Press ESC & ERR, PROT key. Exit Cycling mode setting menu and return to manual mode.

※ Exit after Cycling setting.

Cycling Mode RUN

	▌When INPUT is OFF ON icon lights off.
CYC RUN/STPO	▌Cycling Mode RUN Press Cycling RUN/STOP key. After starting Cycling mode, CYC icon and ON icon light up.

≫ Related Remote Interface Command
CYC:INPUT:{ON | OFF}
CYC:INPUT?

When Cycling is ON, how to change LCD display.

	▌Check if Cycling is on CYC icon and On icon are on.
DISPLAY	▌Press DISPLAY KEY and you can check various information, when Cycling mode is on ※DISPLAY change STEP_VALUE → WATT → STEP.TIME → MD.TIME → REPEAT → STEP_VALUE

Cycling mode STOP

	▌Check if Cycling is on CYC icon and On icon are light up.
CYC RUN/STPO	▌To disable Cycling mode off, press Cycling RUN/STOP KEY. CYC icon and On icon will light off and return to manual mode.

≫ Related Remote Interface Command
CYC:INPUT:{ON | OFF}
CYC:INPUT?

Note

Entering Cycling mode setting menu is only available when INPUT is off

When turn off REPEAT of Cycling mode, CYCLING_END will be displayed on STEP_VALUE display and STE.TIME&MODE will be stop and current value will be set as 0.
※ All the setting value of Cycling mode are saved also after rebooting.

MD.TE Unit	000.	00.	00.	00
	Day	Hour	Minute	Second

3-9.DYN MODE

To set up Dynamic mode, proceed as follows.

MODE SET

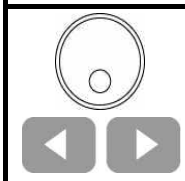
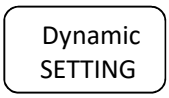
POWER	▌Power ON
Dynamic SETTING	▌Move to Dynamic mode menu Press Dynamic setting key once. When entering Dynamic mode setting menu, ">DYN SET" is displayed on 1st line of LCD. DYN icon will light up.

Dynamic MODE SET

	▌When in Dynamic mode setting menu, DYN icon is on and On icon is off
◀ ▶	▌Dynamic mode menu setting Move to Dynamic mode menu by using left/right key When in Dynamic menu, "1. MODE" is displayed on 2nd line of LCD ※Dynamic setting menu order: 1.MODE ↔ 2.A VALUE ↔ 3.B VALUE ↔ CYC TIME ↔ 5.A DUTY
Dynamic SETTING	▌Entering Dynamic mode menu Press Dynamic setting key once to enter Dynamic setting menu.
◀ ▶	▌To set Dynamic mode, set the mode you want by using left/right cursor ※Dynamic MODE order 1.CC ↔ 2.CV
CYCLING SETTING	▌Saving DYN mode Press Dynamic setting key. After saving DYN-MODE, escape Dynamic mode menu. Return to Dynamic mode menu.

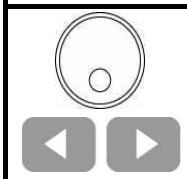
≫ Related Remote Interface Command
DYN::MODE {CC | CV}
DYN:MODE?

DYN A VALUE SET

	▌When in Dynamic mode setting menu, CYC icon is on and On icon is off
	▌Dynamic A_VALUE menu setting Move to Dynamic A_VALUE menu by using left/right key When in Finish Step menu, "2.A VALUE" is displayed on 2nd line of LCD ※Dynamic setting munu order: 1.MODE ↔ 2.A VALUE ↔ 3.B VALUE ↔ CYC TIME ↔ 5.A DUTY
	▌Dynamic A_VALUE menu Press Dynamic setting key once to enter Dynamic A_VALUE menu.
	▌To set A VALUE move to REPEAT value which you want to set by using left/right cursor key And adjust the encorder switch.
	▌Saving A VALUE Press Dynamic setting key. After saving A_VALUE, exit A_VALUE menu and return to Dynamic setting menu.

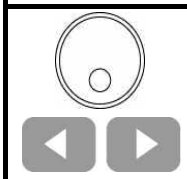
≫ Related Remote Interface Command
DYN:MEM:A {VALUE}
DYN:MEM:A?

DYN B VALUE SET

	▌When in Dynamic mode setting menu, DYN icon is on and On icon is off
	▌Dynamic B VALUE menu setting Move to Dynamic B VALUE menu by using left/right key When in Dynamic menu, "3.B VALUE:" is displayed on 2nd line of LCD ※Dynamic setting menu order : 1.MODE ↔ 2.A VALUE ↔ 3.B VALUE ↔ CYC TIME ↔ 5.A DUTY
Dynamic SETTING	▌Entering Dynamic B Value menu Press Dynamic setting key once to enter Dynamic B Value menu.
	▌To set B VALUE, move cursor using right/left key to the value you want to change. And adjust the encorder switch to change value. ※B VALUE must be set more than A VALUE
Dynamic SETTING	▌Saving B VALUE Press Dynamic setting key. After saving B VALUE, exit B VALUE and return to Dynamic setting menu.

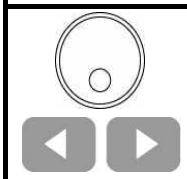
≫ *Related Remote Interface Command*
DYN:MEM:B {VALUE}
DYN:MEM:B?

DYN CYC TIME SET

	▌When in Dynamic mode setting menu, DYN icon is on and On icon is off
	▌Dynamic CYC_TIME menu setting Move to Dynamic CYC_TIME menu by using left/right key When in Dynamic menu, "4.CYC_TIME:" is displayed on 2nd line of LCD ※Dynamic setting menu order: 1.MODE ↔ 2.A VALUE ↔ 3.B VALUE ↔ CYC TIME ↔ 5.A DUTY
Dynamic SETTING	▌Entering Dynamic CYC_TIME menu Press Dynamic setting key once to enter Dynamic CYC_TIME menu.
	▌To set CYC TIME value, move cursor using right/left key to the value you want to change. And adjust the encorder switch to change value. ※Minimum 0.1mS unit
Dynamic SETTING	▌Saving CYC TIME value Press Dynamic setting key. After saving CYC TIME value, exit CYC TIME and return to Dynamic setting menu.

≫ Related Remote Interface Command
DYN:FREQ {VALUE}
DYN:FREQ?

DYN A DUTY SET

	▌When in Dynamic mode setting menu, DYN icon is on and On icon is off
	▌Dynamic A DUTY menu setting Move toDynamic A DUTY menu by using left/right key When in Dynamic menu, "5.A_DUTY:" is displayed on 2nd line of LCD ※Dynamic setting menu order: 1.MODE ↔ 2.A VALUE ↔ 3.B VALUE ↔ CYC TIME ↔ 5.A DUTY
Dynamic SETTING	▌Entering Dynamic A DUTY menu Press Dynamic setting key once to enter Dynamic A DUTY menu.
	▌To set A DUTY value, move cursor using right/left key to the value you want to change. And adjust the encorder switch to change value. ※B DUTY is 100 - A DUTY %
Dynamic SETTING	▌Saving A DUTY value Press Cycling setting key. After saving A DUTY value, exit A DUTY and return to Dynamic setting menu.

≫ *Related Remote Interface Command*
DYN:DUTY {VALUE}
DYN:DUTY?

Exit Dynamic mode setting menu

ESC ERR/PROT	▌Exit Dynamic mode setting menu Press ESC & ERR, PROT KEY once. Exit Dynamic mode setting menu and return to manual mode.

※Escape after Dynamic Setting

Dynamic Mode RUN

	▌INPUT OFF ON icon is off.
Dynamic RUN/STPO	▌Dynamic Mode RUN Press Dynamic RUN/STOP KEY. After Dynamic mode starts, DYN icon and ON light up.

≫ *Related Remote Interface Command*
DYN:INPUT:{ON | OFF}
DYN:INPUT?

When Dynamic is ON, how to change LCD display.

	▌Check if Dynamic is on Dynamic icon and On icon are on.
DISPLAY	▌Press DISPLAY KEY and you can check various information, when Dynamic mode is on ※DISPLAY change: DYN.A.VALUE → DYN.B.VALUE → DYN.CYC.TIME → A.DUTY → MD.TIME → DYN.A.VALUE

Dynamic Mode STOP

	▌Check if Dynamic is on Dynamic icon and On icon are light up.
Dynamic RUN/STPO	▌Dynamic mode STOP Press Dynamic RUN/STOP KEY After Dynamic mode stops CYC icon and On icon will light off and return to manual mode.

≫ *Related Remote Interface Command*
DYN:INPUT:{ON | OFF}
DYN:INPUT?

Note

Entering Dynamic mode setting menu is only available when INPUT is off

※ All the setting value of Cycling mode are saved also after rebooting.

MD.T Unit	000.	00.	00.	00
	Day	Hour	Minute	Second

3-10.CC,CV RANG

To set the RANG in Constant Current and Constant Voltage, proceed as follows.

CC,CV RANG SET

POWER	▌Power On ▌When INPUT is OFF
CC/CV RANG	▌Enter CC/CV RANG menu Press CC/CV RANG KEY.
◀ ▶	▌CC/CV RANG setting Move to CC/CV RANG menu by using left/right key ※CC/CV RANG menu order: 1:CC.H_CV.H ↔ 2:CC.L_CV.H ↔ 3:CC.H_CV.L ↔ 4:CC.L_CV.L
CC/CV RANG	▌Saving CC/CV RANG Press CC/CV RANG KEY. After saving CC/CV RANG, exit CC/CV RANG menu and return to manual mode.

Note

CC/CV RANG KEY is only available when INPUT of CC/CV mode is OFF

Setting of CC/CV RANG is only available in CC/CV mode
on the other hand, it always operate as HI RANG state

※When change the VOLT RANG, Please eliminate the Source.
(OVER RANG or OVER VOLT can be occure when change RANG because of Instantaneous voltage)

3-11. IO/LOCAL

This is the setting key to configure your electronic load for RS-232C, RS-485, TCP/IP(option).
You have to set your electronic load before remote interface.
The default setting is RS-232C protocol and baud rate is 9600bps.
communication setting is only able to be set by front panel key.

▌IO/LOCAL setting is stored permanentely until you change it in non-volatile memory, even if you turn off your power supply.
▌Once remote interface works, the RMT lamp on the front panel lights up and remote device will be controlled preferentially.
▌To control the electronic load on local mode, finish remote interface and press "IO/LOCAL Key". Then RMT lamp will lights off and you can control your E-Load on the front panel.
(If you can't control the load though RMP lights off, please check if the load is under KEY LOCK state.

RS-232C SET

To set up RS-232C, proceed as follows.

POWER	▌Power ON ▌INPUT is off (ON icon lights off)
IO/LOCAL	▌Enter IO/LOCAL menu ▌Press IO/Local Key to set RS-232C
◀ ▶	▌RS-232C menu setting Move to RS-232C menu by using left/right key When in RS-232C menu, "1. RS-232C" is displayed on 2nd line of LCD ※IO/LOCAL menu order: 1.RS-232C ↔ 2.RS-485 ↔ 3.TCP/IP
IO/LOCAL	▌Entering RS-232C Baud Rate ▌Press IO/Local Key to set Baud Rate.
◀ ▶	▌To set RS-232C Baud Rate, press left/right key to Baud Rate you want to change. ※RS-232C Baud Rate order: BR_1: 9600BPS ↔ BR_2: 19200BPS ↔ BR_3: 38400BPS ↔ BR_4: 57600BPS ↔ BR_5: 115200BPS
IO/LOCAL	▌Saving RS-232C communication setting Press IO/Local key. After saving RS-232C setting, exit Remote interface setting menu and return to Manual mode.

Note

What is the 'BPS'? BPS is the short word for Bit per Second.
It is the unit that means it can transfer 1bit/sec and higher unit means higher transfer speed.

RS-232C Configuration

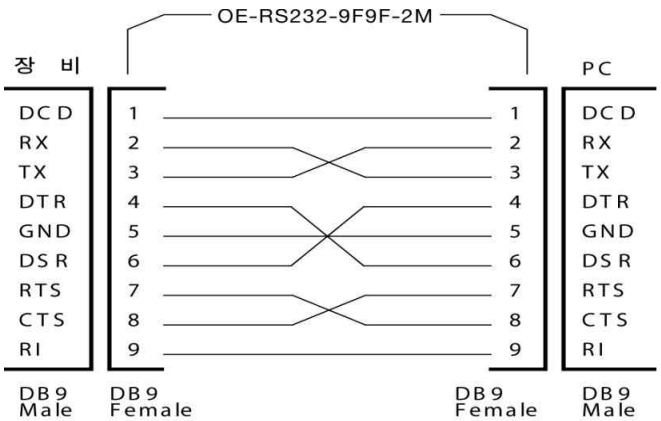
▌RS-232C is fixed as following.

Data Bit : 8
Stop Bit : 1
Parity Bit : None

▌RS-232C data frame

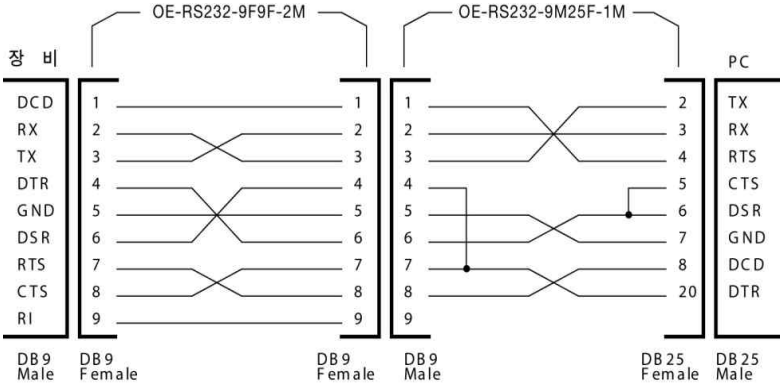
< Figure 3-1 >

▌To connect your electronic load to remote device, you need standard Cross cable.
Below figure is a wiring drawing in case both cables are Female type of standard Cross cable.
Refer "1-2. Accessories and Options" to select properly by length and use.



< Figure 3-2 >

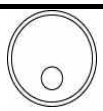
▌If the remote device equipped DB25PIN only or you want to use DB25PIN alone,
using additable adaptor cable can help you use conviniently.
Refer "1-2. Accessories and Options" for you to select properly by length and use.



< Figure 3-3 >

RS-485 SET

You can control up to 255 units connected in parallel, including your remote device.
To set up RS-485, proceed as follows.

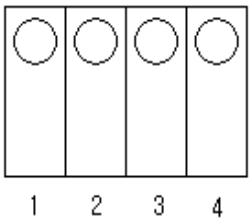
POWER	▌Power ON ▌INPUT is off (ON icon is on)
IO/LOCAL	▌Enter IO/LOCAL menu ▌Press IO/Local Key to set RS-485
◀ ▶	▌RS-485 menu setting Move to RS-232C menu by using left/right key When in RS-232C menu, "2. RS-485" is displayed on 2nd line of LCD ※IO/LOCAL menu order: 1.RS-232C ↔ 2.RS-485 ↔ 3.TCP/IP
IO/LOCAL	▌Enter RS-485 Baud Rate ▌Press IO/Local Key to set Baud Rate.
◀ ▶	▌To set RS-485 Baud Rate, press left/right key to Baud Rate you want to change. ※RS-485 Baud Rate order: BR_1: 9600BPS ↔ BR_2: 19200BPS ↔ BR_3: 38400BPS ↔ BR_4: 57600BPS ↔ BR_5: 115200BPS
IO/LOCAL	▌Enter RS-485 ADDRESS menu ▌Press IO/Local key to set RS-485 ADDRESS.
	▌Set RS-485 ADDRESS by using the encorder switch. ※RS-485 is a parallel communication, so a unique addess is required.
IO/LOCAL	▌Saving RS-485 communication setting Press IO/Local key. After saving RS-485 setting, exit Remote interface setting menu and return to Manual mode.

Note

In case use RS485 to RS232C converter module that can buy optional product in our company, it can be built-in type or if you want to use as external type, you don't need any additional device since you can use the power that offered by our electronic load.

RS485 Connection Drawing

▌RS485 connector consists of 4 pin one-touch terminal.
The below figure 3-4 is view of rear side.

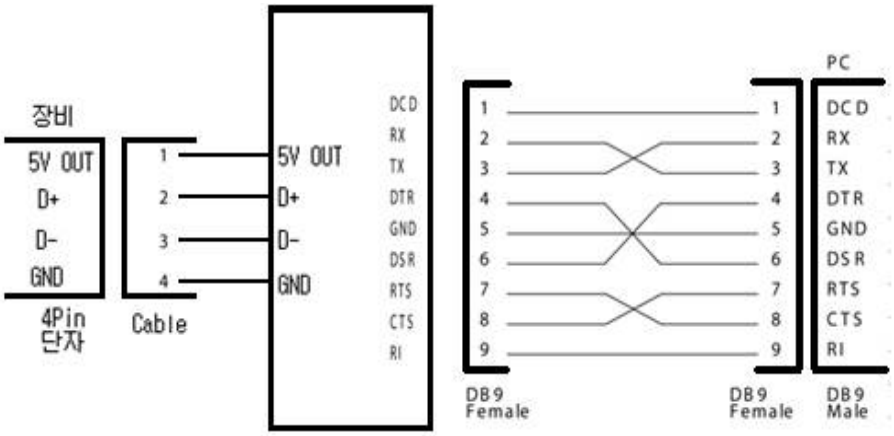


< Figure 3-4 >

Pin Description	
No	Description
1	DC +5V/0.2A Output
2	Data +
3	Data -
4	GND(Earth Ground)

RS485 Configuration

▌To connect RS485 line to remote device, you need to use extra harness for wiring.
The blow figure is a wire diagram of Remote device(PC) by ODA's 485 to 232 converter.



< Figure 3-5 >

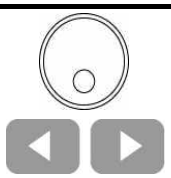
▌RS485 PC Interface Drawing

RS485 of LF-Series outputs DC5V/0.2A. It doesn't need any extra power supply because this model is designed to support OM485-232 modules.
To minimize the loss of power source, place your device and OM485-232(RS485 to RS-232C converter) closely and use short wires as possible as you can.

TCP/IP SETTING (Option)

TCP/IP communication module is optional.
You have to request this option when you place order since this module is not external type.
This module supports 10/100Mbps and can be controlled with company network PC of course, and also can be controlled from anywhere if you assign static IP to the instrument.

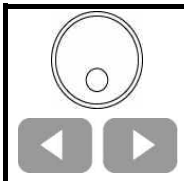
*Static IP SET

POWER	▌Power ON ▌INPUT is off (ON icon is off)
IO/LOCAL	▌Enter IO/LOCAL menu ▌Press IO/Local Key to set TCP/IP
	▌TCP/IP menu setting Move to TCP/IP menu by using left/right key When in TCP/IP menu, "3. TCP/IP" is displayed on 2nd line of LCD ※IO/LOCAL menu order: 1.RS-232C ↔ 2.RS-485 ↔ 3.TCP/IP
IO/LOCAL	▌Enter TCP/IP menu ▌Press IO/Local Key to enter TCP/IP menu
	▌Static IP setting Move to Static IP mode by using left/right cursor. When in Static IP mode, "TCP.MODE_1: ST" is displayed on 2nd line of LCD TCP/IP mode order: TCP.MODE_1: ST ↔ TCP.MODE_2: DHCP
IO/LOCAL	▌Enter TCP/IP Port setting menu ▌Press IO/Local key to enter TCP/IP Port setting menu
	▌TCP/IP Port setting ▌Set Port by using left/right cusrsor and encorder switch. ※ set the same as PC setting value.
IO/LOCAL	▌Enter TCP/IP Port setting menu ▌Press IO/Local key to set TCP/IP Port
	▌TCP/IP IP setting ▌Set IP by using left/right cusrsor and encorder switch. ※ set the same as PC setting value.
IO/LOCAL	▌Enter TCP/IP SUBNET setting menu ▌Press IO/Local key to set TCP/IP SUBNET

	▌TCP/IP SUBNET setting ▌Set SUBNET by using left/right cusrsor and encorder switch. ※ Set the same as PC setting value.
IO/LOCAL	▌Enter TCP/IP GATE WAY setting menu ▌Press IO/Local key to enter GATE WAY setting.
	▌TCP/IP GATE WAY setting ▌Set GATE WAY by using left/right cusrsor and encorder switch. ※ Set the same as PC setting value.
IO/LOCAL	▌Save TCP/IP setting ▌Press IO/Local Key. After Saving TCP/IP setting, exit Remote Interface setting menu and return to manual mode.

*DHCP SET

POWER	▌Power ON ▌INPUT is off (ON icon is off)
IO/LOCAL	▌Enter IO/LOCAL menu ▌Press IO/Local Key to set TCP/IP
	▌TCP/IP setting Move to TCP/IP menu by using left/right key When in TCP/IP menu, "3. TCP/IP" is displayed on 2nd line of LCD ※IO/LOCAL menu order: 1.RS-232C ↔ 2.RS-485 ↔ 3.TCP/IP
IO/LOCAL	▌Enter TCP/IP menu ▌Press IO/Local Key to enter TCP/IP menu
	▌DHCP setting Move to DHCP mode by using left/right key. When in Static IP mode, "TCP.MODE_2: DHCP" is displayed on 2nd line of LCD TCP/IP mode order: TCP.MODE_1: ST ↔ TCP.MODE_2: DHCP
IO/LOCAL	▌Enter TCP/IP Port setting menu ▌Press IO/Local key to enter TCP/IP setting menu

	▌TCP/IP IP setting ▌Set Port by using left/right cusrsor and encorder switch. ※ set the same as PC setting value.
IO/LOCAL	▌TCP/IP IP Assignment ▌Press IO/Local Key to have TCP/IP IP.
	▌"wait..." is displayed on the LCD ▌"Wait" will be displayed while IP is being assigned. After IP was assigned, assigned IP will be displayed and Menu will be exited. ▌If IP wasn't assigned for some time, Menu will be exited after "Time Out Error" is displayed.

Note

Use a standard UTP cable.

3-12. ESC/ERR/PROT

This chapter is about cancellation, checking errors and clearing protection in the menu.

ESC (Cancellation)

ESC ERR/PROT	▌Cancellation in the menu When entering CYC SETING, DYN SETING, IO/LOCAL, SAVE/RECALL, CALIBRATION and FACTORY menu, press ESC & ERR/PROT KEY to cancle or exit from menu.

ERR (Error)

Error Message Display

When error is occured, up to 10 errors are stored in the nonvolatile memory.
(Like errors founded in self-diagnostic mode, errors about Calibration or SCPI program)
Please refer to "7. Error Messages" about error information.

- ▌First error will be accessed at the last since ERROR memory is Stack structure type.
- ▌From 11th error, errors will be discarded in the order they occured.
- ▌After check the message pressing ERROR Key, it will be deleted in the order errors occurred.
- ▌When ERROR occurs, alarm and err lamp will be on.

ERROR Check

	▌INPUT is OFF - Manual mode (when not in menu mode) ON icon is off, Manual mode is displayed on the 2cn line of LCD.
ESC ERR/PROT	▌Press ESC & ERR/PROT KEY to check errors. If there's no error, "NO ERROR" will be displayed and return to previous state. If there is an error, error number will be displayed. LCD will display "ERROR NO, -125".
ESC ERR/PROT	▌Press ESC & ERR/PROT KEY to check errors. If there's an error, error number and message will be displayed. LCD will display "ERROR NO, -124"
ESC ERR/PROT	▌Press ESC & ERR/PROT KEY to check another error.

Protection

LF Series has various protection modes. (OVP, OCP, OPP, OTP)
Below are explanation about each pretection mode.

OVP ESC ERR/PROT	OVP means "Over Voltage Protection". If load outputs more voltage than its capacity, protection will be on and "OVER VOLT PORT" will be displayed. To disable OVP, set the voltage of power supply according to load's spec and press ESC & ERR/PROT KEY for 2~3 seconds.
OCP ESC ERR/PROT	OCP means "Over Current Protection". If load outputs more current than its capacity, protection will be on and "OVER CURR PORT" will be displayed. To disable OCP, press ESC & ERR/PROT KEY for 2~3 seconds.
OPP ESC ERR/PROT	OPP means "OVER WATT PROTECTION". If load outputs more power than its capacity, Protection will be on and "OVER WATT PORT" will be displayed. To disable OPP, set the power of load according to load's spec and press ESC & ERR/PROT KEY for 2~3 seconds.
OTP ESC ERR/PROT	OTP means "Over Temperature Protection". If heatsink's temperature is more than 100℃, Protection will be on and "OVER TEMP PORT" will be displayed. To disable OTP, stop operating load and cool down the load. To disable OTP, press ESC & ERR/PROT KEY for 2~3 seconds when the temperature is less than 100℃.
OVR ESC ERR/PROT	OVR is "Over Voltage Range". It is indicated as "VOLT RNG OVER" on the LCD as range over when exceeding the allowable voltage value of "CV LOW Range" of DC electronic load. To release OVR, get the voltage of the power supply to meet the 'voltage low range'specficiation of DC electronic load. or, set the voltage range of DC electronicl load as "HI" and then press ESC & ERR / PROT KEY for 2 ~ 3 seconds to release
OCR ESC ERR/PROT	OCR is "Over Current Range". It is indicated as "CURR RNG OVER" on the LCD as range over when exceeding the allowable current value of "CC LOW Range" of DC electronic load. To release OCR, set the current range of DC electronicl load as "HI" and then press ESC & ERR / PROT KEY for 2 ~ 3 seconds to release

≫ Related Remote Interface Command
PROT?
PROT:CLE
Application: *Check Protection*
PROT? *Return value: "Over Voltage"*
PROT:CLE *Clear Protection*

3-13.SAVE/RECALL

SAVE

You can save present status of load in 『User Memory』. 『User Memory』 is divided into 10 and Mode status, Range, Voltage, Current, Resistance and Watt value will be saved in 『User Memory』 Below is the process of saving data in 『User Memory』.

SAVE

POWER	▌Power On ▌INPUT is OFF (ON icon is off)
SAVE/RECALL V_SENSING	▌To save present status in 『User Memory』, press SAVE/RECALL & V_SENSING KEY at the same time.
◀ ▶	▌SAVE menu setting Move to SAVE menu by using left/right key. When in SAVE menu, "1.SAVE MODE" is displayed on 2nd line. ※SAVE/RECALL menu order: 1.SAVE MODE ↔ 2.RECAL MODE
SAVE/RECALL V_SENSING	▌Enter SAVE mode menu Press SAVE/RECALL, V_SENSING KEY to enter SAVE Mode Menu
○	▌Set SAVE address number ▌Select address number between 1~10 by using encorder switch.
SAVE/RECALL V_SENSING	▌Press SAVE/RECALL, V_SENSING KEY to save to the selected address. ▌After "SAVE. . ." is displayed, will be returned to the previous state.

≫ Related Remote Interface Command

**SAV {1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10}*
*Application 1: *SAV 4 Save present status in address number 4 of 『User Memory』*

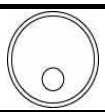
Note

You can initialize 『User Memory』. Please refer to "5-3. USER-MEM CLEAR".

RECALL

You can recall the saved status in 『User Memory』 and apply to the load.
There are 0 ~ 10 address number and Mode Status, Range, Voltage, Current, Resistance, Power in the memory will be applied to current load.

RECALL

POWER	▌Power On ▌INPUT is OFF (ON icon is off)
SAVE/RECALL V_SENSING	▌Press SAVE/RECALL, V_SENSING KEY to recall the data saved to 『User Memory 』
	▌SAVE menu setting Move to SAVE menu by using left/right key. When in RECALL menu, "2.RECALL MODE" is displayed on 2nd line. ※SAVE/RECALL menu order: 1.SAVE MODE ↔ 2.RECAL MODE
SAVE/RECALL V_SENSING	▌Enter RECALL mode menu Press SAVE/RECALL, V_SENSING KEY to enter RECALL Mode Menu
	▌Setting RECALL address number ▌Select address number between 0~10 by using encorder switch.
SAVE/RECALL V_SENSING	▌Press SAVE/RECALL, V_SENSING KEY to recall the data. ▌After "RECALL. . ." is displayed, return to the previous state.

≫ Related Remote Interface Command

**RCL {1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10}*
*Application 1: *RCL 4*

Note

You can set SAVE/RECALL, only when INPUT is OFF.

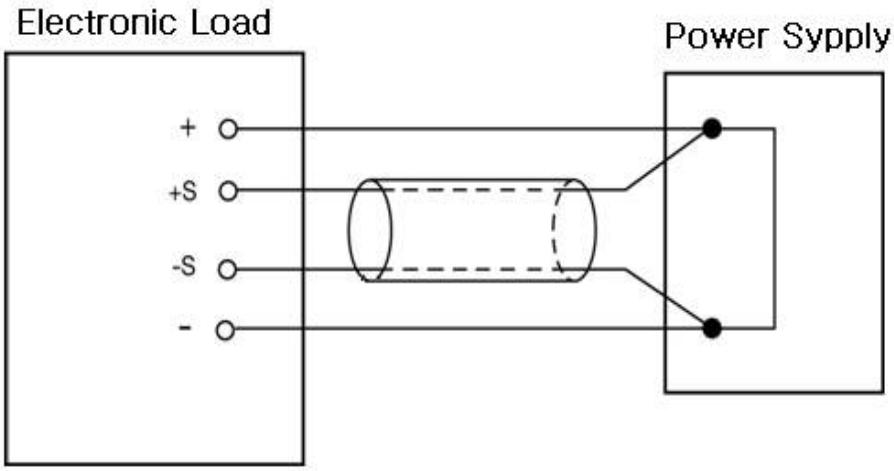
SAVE/RECALL can be applied for CC, CV, CR and CP mode.

3-14. Remote Voltage

When the power supply is connected from the input terminal of the electronic load, voltage Regulation will occur in load connection lead wire.
To use more correct voltage, you can use Remote Voltage Sensing (V-Sensing).
Please refer following information when using V-Sensing

Connecting Remote Voltage Sensing

Set Remote Voltage Sensing mode. Connect sensing terminal to power supply terminal and source output terminal to the load. Please be careful of +, - polarity.



< Figure 3-6 >

Remote Voltage Mode Setting

POWER	▌Power on, V_SENSING OFF ▌When INPUT is off(ON & SYN icons are off)
SAVE/RECALL V_SENSING	▌To enable V_SENSING ON, press SAVE/RECALL, V_SENSING key for 2~3 seconds. *SYN icon is on.*
SAVE/RECALL V_SENSING	▌To disable V_SENSING, press SAVE/RECALL, V_SENSING key for 2~3 seconds. *SYN icon is off.*

Note

V_SENSING setting can be saved when POWER is ON/OFF.

Even input comes to load's DC input terminal, voltage display will be displayed as 0 if there's no sensing wiring when V_SENSING is on.

3-15.SHORT, KEY LOCK

Use full current in electronic load like short the power supply.
To set SHORT mode, proceed as follows.

POWER	▌Power ON
MODE	▌MODE Change Move to CC MODE. "I-SET" is displayed on 2nd line and CC icon lights up. ※MODE change order: CC→CV→CR→CP→ON/OFF→FUSE→BAT→CC MODE KEY can be used only when INPUT is OFF.
INPUT ON/OFF	▌Press INPUT ON/OFF KEY to enable CC Mode. When INPUT is ON, ON icon lights up.
SHORT KEY LOCK	▌Press INPUT SHORT, KEY LOCK KEY to enable SHORT MODE When SHORT ON, "***SHORT ON***" is displayed on 2nd line.
SHORT KEY LOCK	▌Press INPUT SHORT, KEY LOCK KEY to disable SHORT MODE off. Then it return to CC MODE ON.

KEY LOCK(Disable KEY LOCK)

	▌When KEY LOCK (Refer to AUTO KEY LOCK 5-8) ▌When LOCK icon is on
SHORT KEY LOCK	▌Press LOCK KEY for 2~3 seconds to disable KEY LOCK ▌LOCK icon lights off and FRONT KEY will be activated.

Note

This mode can be used when CC MODE INPUT is on,

4. CALIBRATION

Warning

Calibration processes are recommended to someone specialized in calibration only.
Calibration period > For test : per 180 days
> For normal use : per 365 days

You may experience some performance errors in a variety of environments,
such as aging, temperatures and humidity. To keep your electronic load in the best condition,
you need to calibrate your electronic load according to the environment.

4-1. Characteristic

- Calibration without opening product's cases
- Calibration using front panel key
- Data can be stored to non-volatile permanent memory
- Back up & Restore calibration data
- Easy process by inputting meter value from calibration instruments one by one

4-2. Preparation for calibration

- Use measuring instrument and power supply which can measure higher specification than your electronic load.
- Electronic load and measuring instrument should be warmed up more than 1 hour at 20°C ~ 30°C.
- Humidity should be lower than 80%.
- Connect each measuring instruments without any contact resistance.
- The electronic load's GND and measuring instrument's earth terminal should be connected to GND terminal of AC input.
- Turn off the electronic instruments that can generate magnetic field.

4-3. Measuring instrument specifications

Use higher measuring instrument than below spec to make load's performace properly.

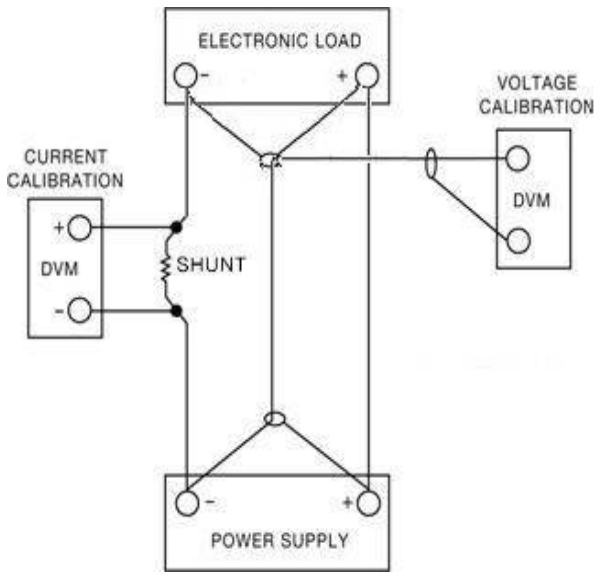
Measuring Instrument	Required Specifications	Recommended Instrument	Use
Digital Voltmeter	Resolution: 0.1 mV Accuracy: 0.01%	Agilent 34401A	Voltage Calibration
Power supply	Voltage Range: 200 Vdc Current Range: 60 Adc (Based on LF-300A)	ODA Technologies Ex-Series	Power supply for E-load
Current monitoring Resistor (Shunt)	0.001Ω , 0.01%		When current calibration, voltage monitoring
Oscilloscope	100 MHz with 20MHz bandwidth	Tektronix TDS3014	Measure ripple & noise

4-4. Measruing Technic

Below is a technical description of the calibration.

Device wiring diagram

▌Connect each measuring instruments as the below wiring diagram.



< Figure 4-1 >

Power Supply

- Power supply can be used for source for calibration.
- When you do current calibration, power supply's + terminal should be connected to load's + terminal and load's - terminal should be connected to current monitoring shunt's one lead line. Other side lead line should be connected to power supply's - terminal.

Current-Monitoring Resistor(shunt)

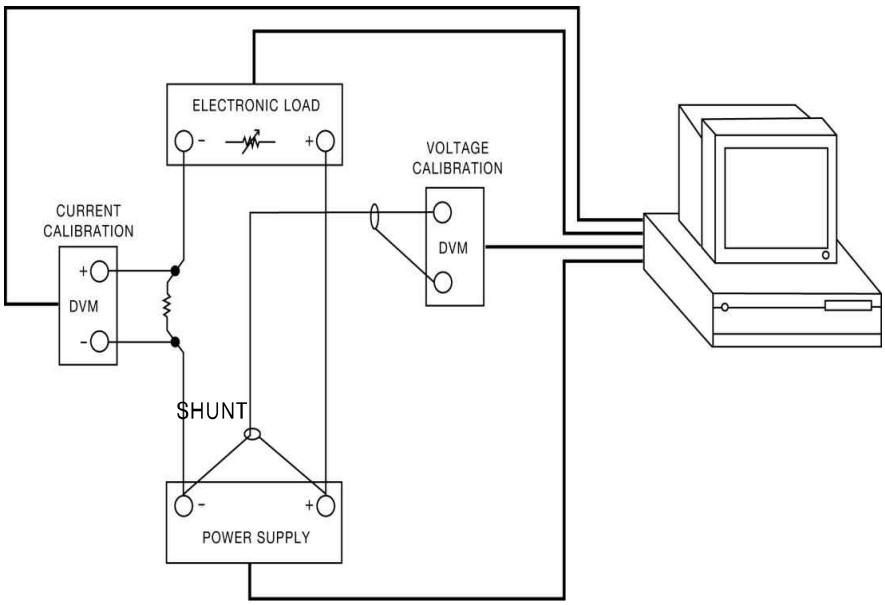
- Use current monitoring resistor. Normal current measuring instrument is not suitable for high current capacity.
- Select less than TCR 10ppm
- Use 0.01% high precise standard resistor

DVM(Digital Volt Meter)

- Used for voltage calibration and measuring current monitoring sensing voltage.
- Resolution: 0.1 mV , Accuracy: more than 0.01%

Programming

This product supports calibration based on PC interface.
Calibration using communication doesn't cause measurement errors and
you can get accurate calibration data.
Below is the PC communication connection diagram.

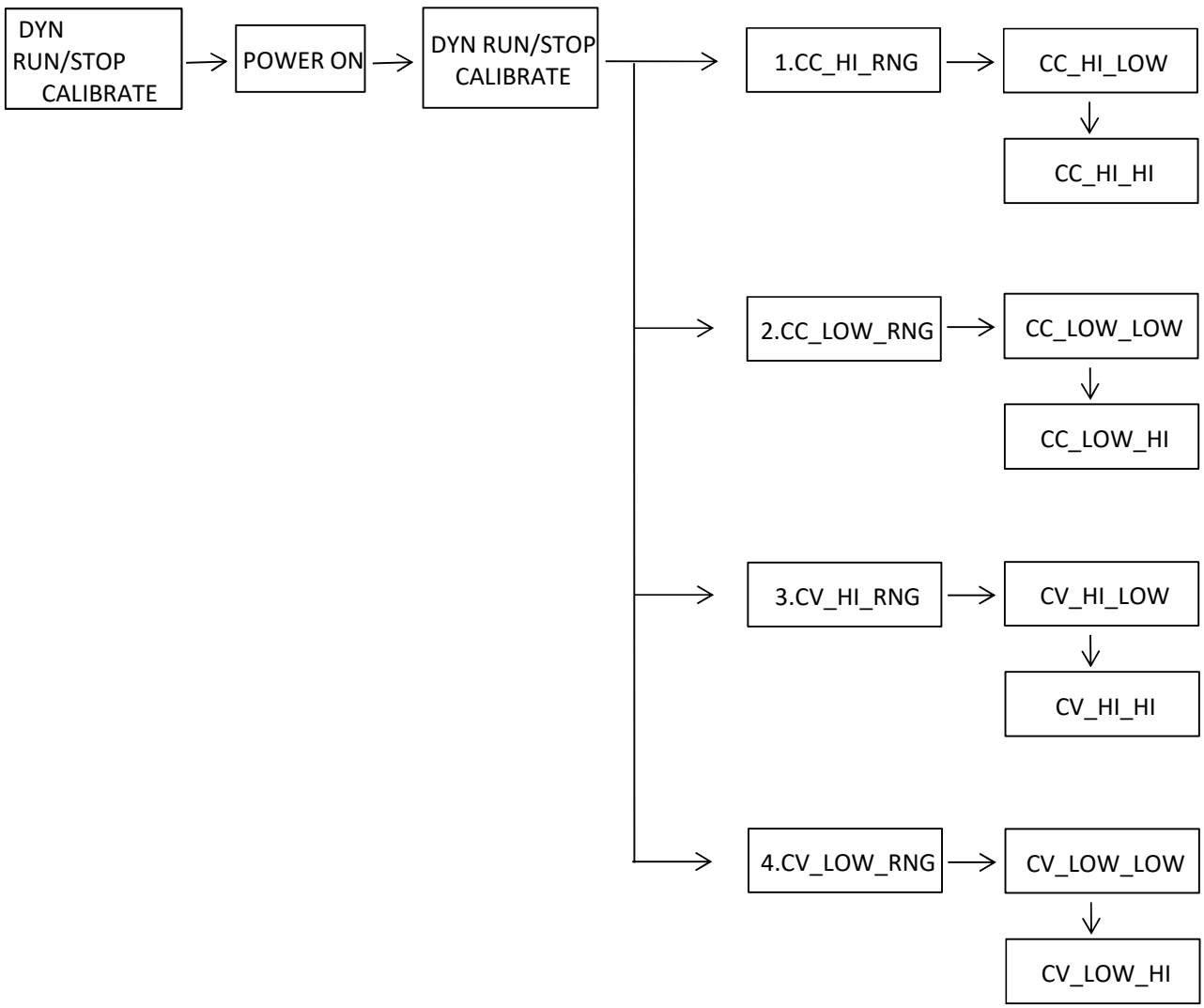


< Figure 4-2 >

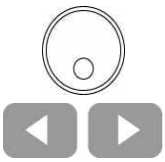
4-5. Calibration using front panel

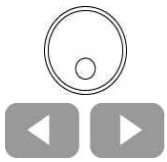
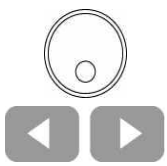
The following description is the procedure for calibration using Calibration Key on the front pane

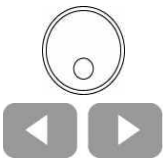
CALIBRATION KEY STRUCTURE



Current Calibration

	▌Before calibration, connect the product to a power supply. > Connect power supply's (+) output terminal to load's (+) input terminal. load (−) input terminal is connected to Current Monitoring resistance. Connect Current monitoring resistance's other side of lead line to power supply's (−) output terminal. >DVM (+) input terminal is connected to Current Monitoring resistance's lead line which is already connected to the load. DVM (−) terminal is connected to other side of the Current monitoring resistance's lead line.
Press and hold DYN RUN/STOP Calibration	▌While pressing DYN RUN/STOP, Calibration Key, turn on your electronic load
POWER	▌Power on
Release DYN RUN/STOP Calibration	▌Release the key after model name is displayed and entered "− CALIBRATION −*" mode.
	▌Move to "1.CC_HI_RNG" and press DYNRUN/STOP, Calibration Key then "CC_HI.LOW" will be displayed. CALIBRATION menu order 1.CC_HI_RNG ↔ 2.CC_LOW_RNG ↔ 3.CV_HI_RNG ↔ 4.CV_LOW_RNG
Wait at least 3 mins	▌Wait until DVM's voltage becomes stable.
	▌Calculate the current value after the voltage becomes stable. If the used resistance value is 0.001Ω and the measured voltage is 0.6mV, the current value is 0.6.
	▌Input the calculated current value to the load using cursor key and encoder switch.

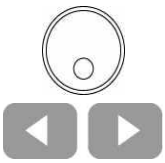
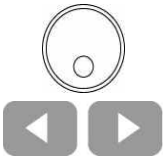
DYN RUN/STOP Calibration	▌After setting, press DYNRUN/STOP,Calibration key to save the setting value. After "HAX DAT: " is displayed, it will be changed to CC_HI_HI_CAL mode. "CC_HI.HI" will be displayed.
◀ Wait at least 3 mins	▌Wait until DVM's voltage becomes stable.
	▌After the voltage becomes stable, calculate the current value. If the used resistance value is 0.001Ω and the measured voltage is 63.2mV, the current value is 63.2A.
	▌Input the calculated current value to the load using cursor key and encoder switch.
DYN RUN/STOP Calibration	▌After setting, press DYNRUN/STOP,Calibration key to save the setting value. After "HAX DAT: " is displayed, go back to Calibration menu
	▌Move to "2.CC_LO_RNG" and press DYNRUN/STOP, Calibration Key then, "CC_HI.LOW" will be displayed. CALIBRATION menu order 1.CC_HI_RNG ↔ 2.CC_LOW_RNG ↔ 3.CV_HI_RNG ↔ 4.CV_LOW_RNG
◀ Wait at least 3 mins	▌Wait until DVM's voltage becomes stable.
	▌After the voltage becomes stable, calculate the current value. If the used resistance value is 0.001Ω and the measured voltage is 0.06mV, the current value is 0.06A.
	▌Input the calculated current value to the load using cursor key and encoder switch.

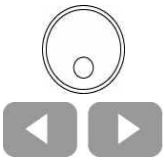
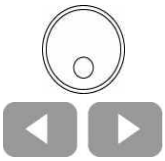
DYN RUN/STOP Calibration	▌After setting, press DYNRUN/STOP,Calibration key to save the setting value. After "HAX DAT: " is displayed, it will be changed to CC_LOW_HI_CAL mode. "CC_LOW.HI" will be displayed.
Wait at least 3 mins	▌Wait until DVM's voltage becomes stable.
	▌After the voltage becomes stable, calculate the current value. If the used resistance value is 0.001Ω and the measured voltage is 6.12mV, the current value is 6.12A.
	▌Input the calculated current value to the load using cursor key and encoder switch.
DYN RUN/STOP Calibration	▌After setting, press DYNRUN/STOP,Calibration key to save the setting value. After "HAX DAT: " is displayed, go back to Calibration menu
POWER	▌Power OFF

Note

When calibrating the current, lower the voltage of source by about 5V.
(Must use the power supply that can controll CV.)

Voltage Calibration

	▌Before calibration, connect the product to a power supply. > Connect (+) output terminal of the power supply and the load to DVM's (+) input terminal. And connect the load's (+) output terminal and the power supply's (−) output terminal to DVM's (−) input terminal.
Press and hold DYN RUN/STOP Calibration	▌While pressing DYN RUN/STOP, Calibration Key, turn on your electronic load
POWER	▌Power On
Release DYN RUN/STOP Calibration	▌Release the key after model name is displayed and entered "− CALIBRATION −⋆" mode.
	▌Move to "3.CV_HI_RNG" and press DYNRUN/STOP, Calibration Key then "CV_HI.LOW" will be displayed. CALIBRATION menu order 1.CC_HI_RNG ↔ 2.CC_LOW_RNG ↔ 3.CV_HI_RNG ↔ 4.CV_LOW_RNG
Wait at least 3 mins	▌Wait until DVM's voltage becomes stable.
	▌Input the calculated voltage value to the load using cursor key and encoder switch.
DYN RUN/STOP Calibration	▌After setting, press DYNRUN/STOP,Calibration key to save the setting value. After "HAX DAT: " is displayed, it will be changed to CC_HI_HI_CAL mode. "CV_HI.HI" will be displayed.
Wait at least 3 mins	▌Wait until DVM's voltage becomes stable.
	▌Input the calculated voltage value to the load using cursor key and encoder switch.

DYN RUN/STOP Calibration	▌After setting, press DYNRUN/STOP,Calibration key to save the setting value. After "HAX DAT: " is displayed, go back to Calibration menu
	▌Move to "4.CV_LOW_RNG" and press DYNRUN/STOP, Calibration Key "CV_LOW.LOW" is displayed. CALIBRATION menu order 1.CC_HI_RNG ↔ 2.CC_LOW_RNG ↔ 3.CV_HI_RNG ↔ 4.CV_LOW_RNG
Wait at least 3 mins	▌Wait until DVM's voltage becomes stable.
	▌Input the calculated voltage value to the load using cursor key and encoder switch.
	▌After setting, press DYNRUN/STOP,Calibration key to save the setting value. After "HAX DAT: " is displayed, it will be changed to CV_LOW_HI_CAL mode. "CV_LOW.HI" will be displayed.
Wait at least 3 mins	▌Wait until DVM's voltage becomes stable.
	▌Input the calculated voltage value to the load using cursor key and encoder switch.
DYN RUN/STOP Calibration	▌After setting, press DYNRUN/STOP,Calibration key to save the setting value. After "HAX DAT: " is displayed, go back to Calibration menu
POWER	▌Power OFF

Note

Lower the current of voltage CALIBRATION source by several tens of mA.
(Must use the power supply that can controll CC.)

4-6. REMOTE INTERFACE Calibration

You can do calibration by using Remote Interface.
During remote calibration process, load can't proceed other command.

Connecting Measurement Device

- Before calibration, connect measurement device as <Figure 4-2>.
- Set communication setting in each devices.
- Warming-up is required for all measuring devices before calibration.

Remote Calibration Command process

- Refer to SCPI Commands in "6-6. Calibration Command".
- Commands should be sent in the order provided.
  If the order is wrong, remote calibration will be canceled.
- If an error occurs, restart remote calibration.

Current Calibration

- After sending switch on command to the power supply, set the correct voltage and current.

CC_HI_RANG CALIBRATE

- Send 'CC_HI_RANG Calibration' command to the load.
  Command "CAL:CURR:H"

- Power supply's current value should be higher than load's max current value
  and set voltage as 5V. If the power suppliy's current value is lower than
  load's calibration range, incorrect value can be measured.

- After several minutes, measure DVM voltage connected to Current Monitoring resistance.

- Send current value resulted from current calcuration program to the load's value.
  For example, If measured value is 0.623, send command as below.
  Command "CAL:CURR:MIN 0.623" *More Digit will be okay.*
  MIN value is stored and go to HI CAL. (Communication delay is more than 500mS)

- After several minutes, measure DVM voltage connected to Current Monitoring resistance.

- Send measured value to the load's voltage value.
  For example, if measured value is 62.325, send command as below.
  Command "CAL:CURR:MAX 62.325"
  MAX value will be saved. (Communication delay is more than 500mS)

CC_LOW_RANG CALIBRATE

▌Send 'CC_LOW Calibration' command to the load.
Command "CAL:CURR:L"

▌Power supply's current value should be higher than load's max current value and set voltage as 5V. If the power suppliy's current value is lower than load's calibration range, incorrect value can be measured.

▌After several minutes. Measure DVM voltage connected to Current Monitoring resistance.

▌Send current value resulted from current calcuration program to the load's value.
For example, If measured value is 0.0623, send command as below.
Command "CAL:VOLT:MIN 0.0632" *More Digit will be okay.*
MIN value is stored and go to HI CAL. (Communication delay is more than 500mS)

▌After several minutes, measure DVM voltage connected to Current Monitoring resistance.

▌Send measured value to the power supply's voltage value.
For example, if measured value is 6.3213, send command as below.
Command "CAL:CURR:MAX 6.3213"
MAX value will be saved. (Communication delay is more than 500mS)

▌Rest the load.
Command "*RST"
(Communication delay is more than 3S)

Voltage CALIBRATION

▌Send 'Switch on command' and set the current and voltage suitably for the load.

CC_HI_RANG CALIBRATE

▌Send Load's CV_HI_RANG Calibration Command.
Command "CAL:VOLT:H"

▌Set your power supply's voltage to 3V like maximum voltage of load and set current to several tens of mA. If the voltage is less than or far greater than calibration range of the load, CV can be measured incorrectly.
E.g) LF300-A CALIBRATION: 155~160V, 20~100mA

▌After several minutes, send the measured voltage from DVM to the load's value.
For example, if the measured value is 1.35, send command as below.
Command "CAL:VOLT:MIN 1.35"
MIN value is stored and go to HI CAL. (Communication delay is more than 500mS)

▌After several minutes, send the measured voltage from DVM to the load's value.
For example, if the measured value is 157.23, send command as below.
Command "CAL:VOLT:MAX 157.23"
MIN value is stored and go to HI CAL. (Communication delay is more than 500mS)

CV_LOW_RANG CALIBRATE

▌Send 'CV_LOW Calibration' command to the load
Command "CAL:VOLT:L"

▌Set your power supply's voltage to 3V like maximum voltage of load and set current several tens of mA. If the voltage is less than or far greater than calibration range of the load, CV can be measured incorrectly.
E.g) LF300-A CALIBRATION: 155~160V, 20~100mA

▌After several minutes, send the measured voltage from DVM to the load's value.
For example, if the measured value is 0.231, send command as below.
Command "CAL:VOLT:MIN 0.231"
MIN value is stored and go to HI CAL. (Communication delay is more than 500mS)

▌After several minutes, send the measured voltage from DVM to the load's value.
For example, if the measured value is 20.753, send command as below.
Command "CAL:VOLT:MAX 20.753"
MAX value will be saved. (Communication delay is more than 500mS)

▌Rest the load.
Command "*RST"
(Communication delay is more than 3S)

Note

Must use a power supply that can control CC and CV mode.

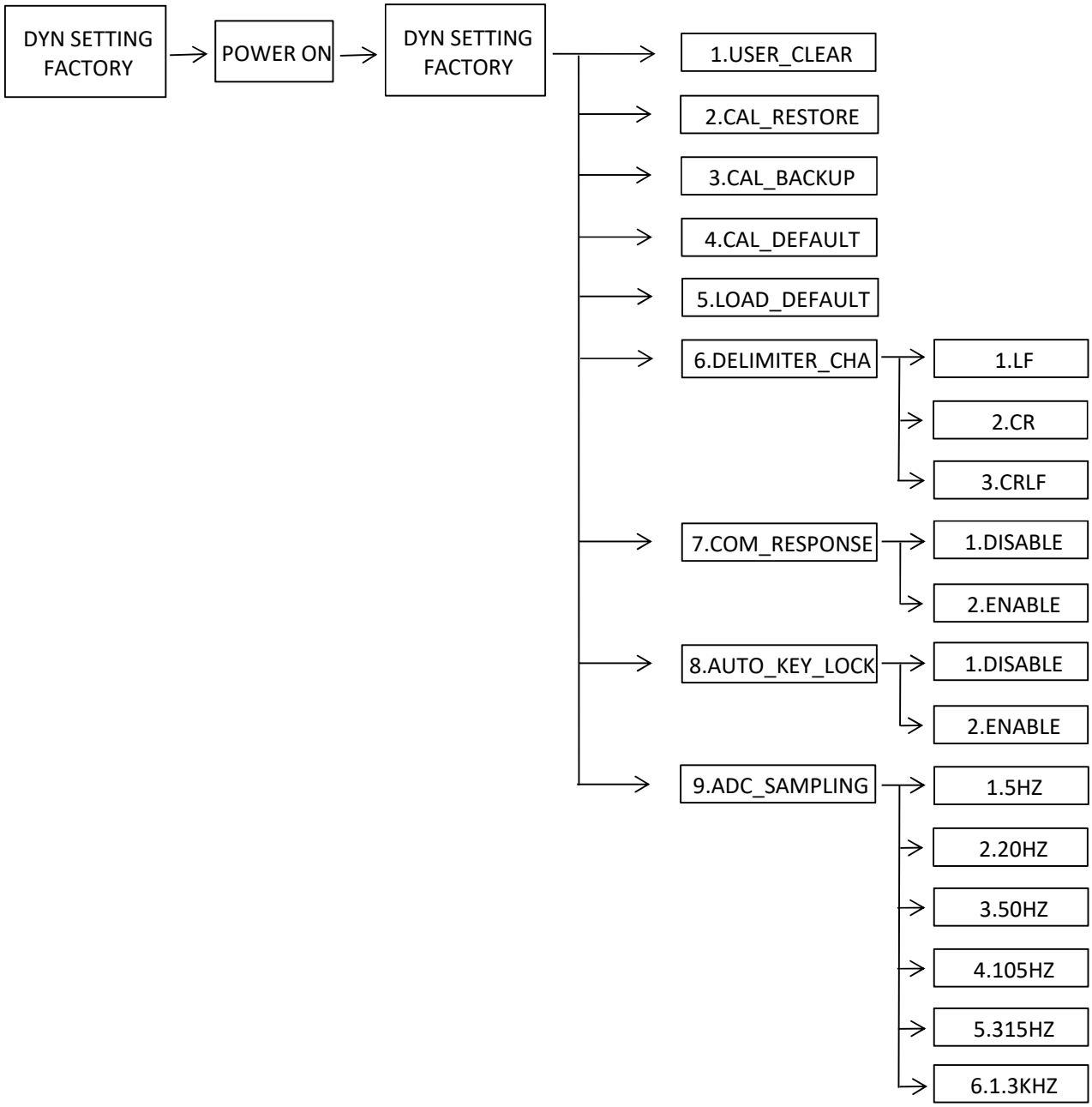
Before calibration, be sure to check the load's specifications.

5. FACTORY

5-1. Features

- Can initialize 10 memories in 『non-volatile memory』.
- Can use Auto Lock function while you don't use product for a long time.
- Can back up and restore Calibration data and set to default value.

5-2. FACTORY KEY Strecture



5-3. USER_CLEAR

▌Data 1 ~ 10 address in 『User Memory』 can be initialized at once.
▌Once initialized, the old data can't be recovered.
▌Iniialize 『User Memory』 to factory default.

USER_CLEAR

Press and hold DYN SETTING FACTORY	▌Power on while pressing DYN SETTING,FACTORY key.
POWER	▌Power on
Release DYN SETTING FACTORY	▌Release the key after model name is displayed and entered "--- FACTORY ---" mode.
◀ ▶	▌Move to USER_CLEAR menu using cursor key. "1.USER_CLEAR" will be displayed. FACTORY menu order: 1.USER_CLEAR ↔ 2.CAL_RESTORE ↔ 3.CAL_BACKUP ↔ 4.CAL_DEFAULT ↔ 5.LOAD_DEFAULT ↔ 6.DELIMITER_CHAR ↔ 7.COM_RESPONSE ↔ 8.AUTO_KEY_LOCK ↔ 9.ADC_SAMPLING
DYN SETTING FACTORY	▌Press DYN SETTING,FACTORY key. After "USER_CLEAR. . ." is displayed, 『User Memory』 will be initialized.
POWER	▌Power OFF

5-4. CAL_RESTORE

▌Restore the data saved for calibration backup.
▌If calibration done without knowledge or by user's mistake, you can retore previous data.

CAL_RESTORE

Press and hold DYN SETTING FACTORY	▌Power on while pressing DYN SETTING,FACTORY key.
POWER	▌Power on
Release DYN SETTING FACTORY	▌Release the key after model name is displayed and entered "--- FACTORY ---" mode.
◀ ▶	▌Move to CAL_RESTORE menu. "2.CAL_RESTORE" will be displayed. FACTORY menu order: 1.USER_CLEAR ↔ 2.CAL_RESTORE ↔ 3.CAL_BACKUP ↔ 4.CAL_DEFAULT ↔ 5.LOAD_DEFAULT ↔ 6.DELIMITER_CHAR ↔ 7.COM_RESPONSE ↔ 8.AUTO_KEY_LOCK ↔ 9.ADC_SAMPLING
DYN SETTING FACTORY	▌Press DYN SETTING,FACTORY key. After "CAL.RESTORE_DONE" is displayed, saved Calibration data will be loaded.
POWER	▌Power OFF

5-5. CAL_BACKUP

▌To guarantee precision, calibration should be done by a certificated organization every 6 months and calibration once a year is necessary to use without problem. To avoid the worst case, you can back-up calibration data of certificated organization.

▌Once back-up is done, the previous data can't be recovered.

CAL_BACKUP

Press and hold DYN SETTING FACTORY	▌Power on while pressing DYN SETTING,FACTORY key.
POWER	▌Power ON
Release DYN SETTING FACTORY	▌Release the key after model name is displayed and entered "--- FACTORY ---" mode.
◀ ▶	▌Move to CAL_RESTORE menu. "3.CAL_BACKUP" will be displayed. FACTORY menu order: 1.USER_CLEAR ↔ 2.CAL_RESTORE ↔ 3.CAL_BACKUP ↔ 4.CAL_DEFAULT ↔ 5.LOAD_DEFAULT ↔ 6.DELIMITER_CHAR ↔ 7.COM_RESPONSE ↔ 8.AUTO_KEY_LOCK ↔ 9.ADC_SAMPLING
DYN SETTING FACTORY	▌Press DYN SETTING,FACTORY key. After "CAL.BACKUP_DONE" is displayed, the calibration value will be stored.
POWER	▌Power OFF

5-6. CAL_DEFAULT

▌Set the Calibration value as factory dafault.
▌If calibration done without knowledge or doesn't restore with 『5-4. CAL-RESTORE』, you can restore the factory default. In this case, calibration should be done in a a certificated organization to guarantee precision of output voltage and current.

CAL_DEFAULT

Press and hold DYN SETTING FACTORY	▌Power on while pressing DYN SETTING,FACTORY key.
POWER	▌Power ON
Release DYN SETTING FACTORY	▌Release the key after model name is displayed and entered "--- FACTORY ---" mode.
◀ ▶	▌Move to CAL_DEFAULT menu using cursor key. "4.CAL_DEFAULT" will be displayed. FACTORY menu order: 1.USER_CLEAR ↔ 2.CAL_RESTORE ↔ 3.CAL_BACKUP ↔ 4.CAL_DEFAULT ↔ 5.LOAD_DEFAULT ↔ 6.DELIMITER_CHAR ↔ 7.COM_RESPONSE ↔ 8.AUTO_KEY_LOCK ↔ 9.ADC_SAMPLING
DYN SETTING FACTORY	▌Press DYN SETTING,FACTORY key. After "CAL.RESTORE_DONE" is displayed, saved Calibration data will be loaded.
POWER	▌Power OFF

5-7. LOAD_DEFAULT

▌The changed data from Factory Mode can be returned to the basic setting.

LOAD_DEFAULT

Press and hold DYN SETTING FACTORY	▌Power on while pressing DYN SETTING,FACTORY key.
POWER	▌Power ON
Release DYN SETTING FACTORY	▌Release the key after model name is displayed and entered "--- FACTORY ---" mode.
◀ ▶	▌Move to LOAD_DEFAULT menu. "5.LOAD_DEFAULT" will be displayed. FACTORY menu order: 1.USER_CLEAR ↔ 2.CAL_RESTORE ↔ 3.CAL_BACKUP ↔ 4.CAL_DEFAULT ↔ 5.LOAD_DEFAULT ↔ 6.DELIMITER_CHAR ↔ 7.COM_RESPONSE ↔ 8.AUTO_KEY_LOCK ↔ 9.ADC_SAMPLING
DYN SETTING FACTORY	▌Press DYN SETTING,FACTORY key. After "CAL.RESTORE_DONE" is displayed, saved Calibration data will be loaded.
POWER	▌Power OFF

5-8. DELIMITER_CHAR

▌LF Series support varous delimeter. (LF,CR,CRLF)

DELIMITER_CHAR

Press and hold DYN SETTING FACTORY	▌Power on while pressing DYN SETTING,FACTORY key.
POWER	▌Power ON
Release DYN SETTING FACTORY	▌Release the key after model name is displayed and entered "--- FACTORY ---" mode.
◀ ▶	▌Move to DELIMITER_CHAR menu using cursor key. "6.DELIMITER_CHAR" will be displayed. FACTORY menu order: 1.USER_CLEAR ↔ 2.CAL_RESTORE ↔ 3.CAL_BACKUP ↔ 4.CAL_DEFAULT ↔ 5.LOAD_DEFAULT ↔ 6.DELIMITER_CHAR ↔ 7.COM_RESPONSE ↔ 8.AUTO_KEY_LOCK ↔ 9.ADC_SAMPLING
DYN SETTING FACTORY	▌Press DYN SETTING,FACTORY key. Enter DELIMITER_CHAR menu. "D.CHAR" will be displayed.
◀ ▶	▌Move to DELIMITER_CHAR using cursor key. DELIMITER_CHAR menu order. 1.LF ↔ 2.CR ↔ 3.CRLF
DYN SETTING FACTORY	▌Press DYN SETTING,FACTORY key. After saving DELIMITER_CHAR setting, return to FACTORY menu.
POWER	▌Power OFF

5-9. COM_RESPONSE

▌This is the response when LF Series send setting commands.

COM_RESPONSE

Press and hold DYN SETTING FACTORY	▌Power on while pressing DYN SETTING,FACTORY key.
POWER	▌Power ON
Release DYN SETTING FACTORY	▌Release the key after model name is displayed and entered "--- FACTORY ---" mode.
◀ ▶	▌Move to COM_RESPONSE menu. "7.COM_RESPONSE" will be displayed. FACTORY menu order: 1.USER_CLEAR ↔ 2.CAL_RESTORE ↔ 3.CAL_BACKUP ↔ 4.CAL_DEFAULT ↔ 5.LOAD_DEFAULT ↔ 6.DELIMITER_CHAR ↔ 7.COM_RESPONSE ↔ 8.AUTO_KEY_LOCK ↔ 9.ADC_SAMPLING
DYN SETTING FACTORY	▌Press DYN SETTING,FACTORY key. Enter COM_RESPONSE menu. "RESP" will be displayed.
◀ ▶	▌Move to COM_RESPONSE using cursor key. COM_RESPONSE menu order: 1.DISABLE ↔ 2.ENABLE ※ 1.DISABLE(No response) 2.ENABLE(Response "OK")
DYN SETTING FACTORY	▌Press DYN SETTING,FACTORY key. After saving COM_RESPONS setting, return to FACTORY menu.
POWER	▌Power OFF

5-10. AUTO_KEY_LOCK

▌Auto Key Lock can be used if a user doesn't use the key for a long time.

AUTO_KEY_LOCK

Press and hold DYN SETTING FACTORY	▌Power on while pressing DYN SETTING,FACTORY key.
POWER	▌Power ON
Release DYN SETTING FACTORY	▌Release the key after model name is displayed and entered "--- FACTORY ---" mode.
◀ ▶	▌Move to AUTO_KEY_LOCK menu using cursor key. "8.AUTO_KEY_LOCK" will be displayed. FACTORY menu order: 1.USER_CLEAR ↔ 2.CAL_RESTORE ↔ 3.CAL_BACKUP ↔ 4.CAL_DEFAULT ↔ 5.LOAD_DEFAULT ↔ 6.DELIMITER_CHAR ↔ 7.COM_RESPONSE ↔ 8.AUTO_KEY_LOCK ↔ 9.ADC_SAMPLING
DYN SETTING FACTORY	▌Press DYN SETTING,FACTORY key. Enter COM_RESPONSE menu. "A.LOCK" will be displayed on 2nd line.
◀ ▶	▌Set AUTO_KEY_LOCK using cursor key. AUTO_KEY_LOCK menu order: 1.DISABLE ↔ 2.ENABLE ※ 1.DISABLE 2.ENABLE
DYN SETTING FACTORY	▌Press DYN SETTING,FACTORY key. After saving COM_RESPONS setting, return to FACTORY menu.
POWER	▌Power OFF

Note

When AUTO KEY LOCK is on, key will be locked if there's no key operation for tens of seconds.

5-11. ADC_SAMPLING

▌You can change the voltage, current and feedback speed according to the user's purpose.

ADC_SAMPLING

Press and hold DYN SETTING FACTORY	▌Power on while pressing DYN SETTING,FACTORY key.
POWER	▌Power ON
Release DYN SETTING FACTORY	▌Release the key after model name is displayed and entered "--- FACTORY ---" mode.
◀ ▶	▌Move to ADC_SAMPLING menu. "9.ADC_SAMPLING" will be displayed. FACTORY menu order: 1.USER_CLEAR ↔ 2.CAL_RESTORE ↔ 3.CAL_BACKUP ↔ 4.CAL_DEFAULT ↔ 5.LOAD_DEFAULT ↔ 6.DELIMITER_CHAR ↔ 7.COM_RESPONSE ↔ 8.AUTO_KEY_LOCK ↔ 9.ADC_SAMPLING
DYN SETTING FACTORY	▌Press DYN SETTING,FACTORY key. Enter COM_RESPONSE menu. "ADC_SAM" will be displayed.
◀ ▶	▌Set ADC_SAMPLING using cursor key. ADC_SAMPLING menu order: 1.5HZ ↔ 2.20HZ ↔ 3.50HZ ↔ 4.105HZ ↔ 5.315HZ ↔ 6.1.3KHZ
DYN SETTING FACTORY	▌Press DYN SETTING,FACTORY key. After saving ADC_SAMPLING setting, return to FACTORY menu.
POWER	▌Power OFF

Note

If ADC_SAMPLING is fast, the current on display may be unstable.

6. SCPI Commands

The load can be controlled remotely by SCPI(Standard Command for Programmable Instruments) commands. Multiple electronic loads and power supplies can be used at once using RS-485. You can apply your instruments to F.A(factory automation) or data collection of product in lab in the best condition.

6-1. Commands Syntax

- You can use both upper case and lower case when input the command.
- No limit with space(20H) or tab(09H). Just give more than one.
- One command in one time.
- Square bracket([ ]) means 'option' or 'parameters' and it can be omitted.
- Do not omit the parameter in bracket ({ }).
- The value in Triangular bracket (< >) can be changed by CODE(ex:MIN,MAX).
- Bar (|) means you can choose one between 2 or more parameters.
- LF,CR,CRLF are available for Delimiter (Refer to 5-8)
- You can send up to 30 Byte in one time.
- RS485 consists of "ODA" + 1byte address(01H ~ FFH) + SCPI Protocol
- Return doesn't include address same as RS232C in Query of RS485.

6-2. Commands

INPUT Setting Commands

INPUT { ON | OFF}
INPUT ON?

MODE:{CC | CV | CR |CP |ONOFF | FUSE | BAT }
MODE?

RANG{0~3}
RANG?

CURR {VALUE}
CURR?

VOLT {VALUE}
VOLT?

RES {VALUE}
RES?

WATT {VALUE}
WATT?

ONOFF:CURR {VALUE}
ONOFF:CURR?
ONOFF:ON:TIME {VALUE}
ONOFF:ON:TIME?
ONOFF:OFF:TIME {VALUE}
ONOFF:OFF:TIME?
ONOFF:REP {VALUE}
ONOFF:REP?
ONOFF:END?

FUSE:CURR {VALUE}
FUSE:CURR?
FUSE:TIME {VALUE}
FUSE:TIME?
FUSE:END?
FUSE:CUT?

BAT:MODE:{CC,CR,CP}
BAT:MODE?
BAT:CURR {VALUE}
BAT:CURR?
BAT:RES {VALUE}
BAT:RES?
BAT:WATT {VALUE}
BAT:WATT?
BAT:END:VOLT {VALUE}
BAT:END:VOLT?
BAT:END:CAP {VALUE}
BAT:END:CAP?
BAT:END?

Measurement Commands

MEAS:CURR?
MEAS:VOLT?
MEAS:WATT?

Dynamic Commands

DYN:INPUT {ON | OFF}
DYN:INPUT ON?

DYN::MODE {CC | CV}
DYN:MODE?

DYN:MEM:A {VALUE}
DYN:MEM:A?

DYN:MEM:B {VALUE}
DYN:MEM:B?

DYN:FREQ {VALUE}
DYN:FREQ?

DYN:DUTY {VALUE}
DYN:DUTY?

Cycling Commands

CYC:INPUT { ON | OFF }
CYC:INPUT ON?

CYC:MODE:{CC | CV }
CYC:MODE?

CYC:VAL:{STEP_NUM} {VALUE}
CYC:VAL:{STEP_NUM}?

CYC:DELAY:{STEP_NUM} {VALUE}
CYC:DELAY:{STEP_NUM}?

CYC:REP {VALUE}
CYC:REP?

CYC:SEQ{VALUE}
CYC:SEQ?

CYC:FIN?

Calibration Commands

CAL:CURR:{H|L}
CAL:CURR:MIN {VALUE}
CAL:CURR:MAX {VALUE}

CAL:VOLT:{H|L}
CAL:VOLT:MIN {VALUE}
CAL:VOLT:MAX {VALUE}

System Commands

PROT?
PROT:CLE

SYST:ERR?

*IDN?
*RST
*RCL {VALUE}
*SAV {VALUE}
*SN?

INPUT Setting Commands

Command for using basic function of load with PC Remote Interface.

INPUT {ON | OFF}

Command for controlling INPUT ON / OFF of load.

>ON	Able Input
>OFF	Disable Input

ex1) input on *Able Input*
ex2) input off *Disable Input*

INPUT ON?

Command for checking load's input status.

Return value	"0"	Disable the input status.
	"1"	Able the input status.

MODE:{CC | CV | CR |CP |ONOFF | FUSE | BAT }

Command for setting load's mode.

>MODE:CC	CC Mode(Constant Current)
>MODE:CV	CV Mode(Constant Voltage)
>MODE:CR	CR Mode(Constant Resitstance)
>MODE:CP	CP Mode(Constant Power)
>MODE:ON/OFF	ON/OFF Mode(Constant Current ON/OFF test)
>MODE:FUSE	FUSE Mode(Constant Voltage test)
>MODE:BAT	BAT Mode(Battery test)

MODE?

Command for checking load's mode status.

Return value	"CC"	CC Mode	Return value	"CP"	CP Mode
	"CV"	CV Mode		"ON/OFF"	ON/OFF Mode
	"CR"	CR Mode		"FUSE"	FUSE Mode
				"BAT"	BAT Mode

RANG{0~3}

Command for changing load's CC/CV range.
0:CC.H_CV.H 1:CC.L_CV.H 2:CC.H_CV.L 3:CC.L_CV.L

RANG?

Command for changing confirmation of load's CC/CV range.

CURR {value}

Command for setting input value of CC Mode. (Only available on CC Mode)

>value	Input current value.

ex) curr 10 *Set current as 10A*

CURR?
Command for checking CC Mode setting current.
Return value "current"

ex) curr? *Return value "60.0"*

VOLT {value}
Command for setting input value of CV Mode. (Only available on CV Mode)
>value Input voltage value.

ex) VOLT 10 *Set voltage as10V*

VOLT?
Command for checking setting voltage of CV Mode.
Return value "voltage"

ex) VOLT? *Return value "10.000"*

RES {value}
Command for setting input value of CR Mode. (Only available on CR Mode)
>value Input resistance value.

ex) RES 10 *Set resistance as 10 ohms*

RES?
Command for checking CR Mode setting resistance.
Return value "res"

ex) RES? *Return value "10.000"*

WATT {value}
Command for setting input value of CP Mode. (Only available on CP Mode)
>value Input watt value.

ex) WATT 10 *Set power as 10W*

WATT?
Command for checking CP Mode setting watt.
Return value "watt"

ex) WATT? *Return value "10.000"*

ONOFF:CURR {VALUE}

Command for setting ON current value of ON/OFF Mode. (Only available on ON/OFF Mode)

>value Input current value.

ex) ONOFF:CURR 10 Set current 10A

ONOFF:CURR?

Command for checking current of ON/OFF Mode.

Return value "current"

ex) ONOFF:CURR? Return value "10.000"

ONOFF:ON:TIME {VALUE}

Command for setting On Time of ON/OFF Mode. (Only available on ON/OFF Mode)

>value Input ON TIME

ex) ONOFF:ON:TIME 000000100 Set ON TIME as 1S

TIME Unit	000	00	00	00
	Hour	Minute	Second	10mS

Make a space after ONOFF:ON:TIME,

It is Hour, Minute, Second, Millisecond from the beginning in order without a space.

ONOFF:ON:TIME?

Command for checking ON Time of ON/OFF Mode.

Return value "time"

ex) ONOFF:ON:TIME? Return value "000:00:01:00"

ONOFF:OFF:TIME {VALUE}

Command for setting OFF Time of ON/OFF Mode. (Only available on ON/OFF Mode)

>value Input OFF TIME

ex) ONOFF:OFF:TIME 000000100 Set OFF TIME 1S

TIME Unit	000	00	00	00
	Hour	Minute	Second	10mS

Make a space after ONOFF:ON:TIME,

Input Hour(3digit), Minute(2digit), Second(2digit), 10mS(2digit) in order without any space.

ONOFF:OFF:TIME?

Command for checking OFF Time of ON/OFF Mode.
Return value "time"

ex) ONOFF:ON:TIME? Return value "000:00:01:00"

ONOFF:REP {VALUE}

Command for setting REPEAT value of ON/OFF Mode. (Only available on ON/OFF Mode)
>value Input REPEAT value

ex) ONOFF:REP 00100 Set ON/OFF as 100 times

ONOFF:REP?

Command for checking REPEAT value of ON/OFF Mode.
Return value "repeat"

ex) ONOFF:REP? Return value "00100"

ONOFF:END?

Command for checking REPEAT END of ON/OFF Mode.
Return value "0" Before END (Working)
"1" END (Not working)

FUSE:CURR {VALUE}

Command for setting current value of FUSE Mode. (Only available on FUSE Mode)
>value Input current value

ex) FUSE:CURR 10 Set current as 10A

FUSE:CURR?

Command for checking current value of FUSE Mode.
Return value "current"

ex) FUSE:CURR? Return value "10.000"

FUSE:TIME {VALUE}

Command for setting OFF Time of FUSE Mode. (Only available on FUSE Mode)
>value Input FUSE TIME

ex) FUSE:TIME 000000100 SET FUSE TIME as 1S

TIME Unit	000	00	00	00
	Hour	Minute	Second	10mS

Make a space after FUSE:TIME,
Input Hour(3digit), Minute(2digit), Second(2digit), 10mS(2digit) in order without any space.

FUSE:TIME?
Command for checking OFF Time of FUSE Mode.
Return value "time"

ex) FUSE:TIME?? Return value "000:00:01:00"

FUSE:END?
Command for checking TIME END of FUSE Mode.
Return value "0" Before END (Working)
"1" END (Not working)

FUSE:CUT?
Command for checking Fuse status of FUSE Mode.
Return value "0" FUSE current application (Working)
"1" FUSE disconnected (Not working)

BAT:MODE:{CC,CR,CP}
Command for setting mode of BAT Mode. (Only available on BAT Mode)
>BAT:MODE:CC CC Mode
>BAT:MODE:CR CR Mode
>BAT:MODE:CP CP Mode

BAT:MODE?
Command for checking mode of BAT Mode.
Return value "0" CC Mode
"1" CR Mode
"2" CP Mode

BAT:CURR {VALUE}
Command for setting current value of BAT CC Mode. (Only available on BAT CC Mode)
>value Input currnet value

ex) BAT:CURR 10 SET current as 10A

BAT:CURR?
Command for checking current value of BAT CC Mode.
Return value "current"

ex) BAT:CURR? Return value "10.000"

BAT:RES {VALUE}
Command for setting resistance value of BAT CR Mode. (Only available on BAT CR Mode)
>value Input resistance value

ex) BAT:RES 10 SET resistance as 10ohms

BAT:RES?

Command for checking resistance value of BAT CR Mode.
Return value "res"

ex) BAT:RES? Return value "10.000"

BAT:WATT {VALUE}

Command for setting current value of BAT CP Mode. (Only available on BAT CP Mode)
>value Input watt value

ex) BAT:WATT 10 SET watt value as 10W

BAT:WATT?

Command for checking resistance value of BAT CR Mode.
Return value "watt"

ex) BAT:WATT? Return value "10.000"

BAT:END:VOLT {VALUE}

Command for setting end voltage value of BAT Mode. (Only available on BAT Mode)
>value Input voltage

ex) BAT:END:VOLT 10 SET 10V

BAT:END:VOLT?

Command for checking end voltage value of BAT Mode.
Return value "voltage"

ex) BAT:END:VOLT? Return value "10.000"

BAT:END:CAP {VALUE}

Command for setting end capacity value of BAT Mode. (Only available on BAT Mode)
>value input capacity

ex) BAT:END:CAP 10 Set end capacity value as10mA

BAT:END:CAP?

Command for checking end capacity value of BAT Mode.
Return value "capacity"

ex) BAT:END:CAP? Return value "10.000"

BAT:END?

Command for checking "Pause State" by end condition of BAT Mode.
Return value "0" Before END (Working)
"1" END (Not working)

Measurement Commands

Command for measuring the Read Back voltage, current and watt.
The load can be measured alone without DVM(Digital Volt Meter) or ammeter.

MEAS:VOLT?

Command for measuring the output voltage of load.
Return value "voltage"

ex) MEAS:VOLT? return value "11.0000"

MEAS:CURR?

Command for measuring the output current of load.
Return value "current"

ex) MEAS:CURR? return value "1.0000"

MEAS:WATT?

Command for measuring the output watt of load.
Return value "watt"

ex) MEAS:WATT? return value "1.0000"

Dynamic Commands

Command for Dynamic Mode

DYN:INPUT {ON | OFF}

Command to enable or disable Dynamic Mode

> ON	Enable Dynamic Mode
> OFF	Disable Dynamic Mode Off

ex1) DYN:INPUT ON
ex2) DYN:INPUT OFF

DYN:INPUT?

Command for checking if Dynamic Mode is on or off.

Return value	"1"	Enable Dynamic Mode
	"0"	Disable Dynamic Mode

DYN:MODE {CC | CV}

Command for setting Dynamic Mode.

> CC	Set CC Mode
> CV	Set CV Mode

ex1) DYN:MODE CC	*Set CC Mode*
ex2) DYN:MODE CV	*Set CV Mode*

DYN:MODE?

Command for checking mode of Dynamic Mode.

Return value "0" CC Mode

"1" CV Mode

DYN:MEM:A {VALUE}

Command for setting Ach(LOW) value.

>value Input Ach value

ex) DYN:MEM:A 10 Set Dynamic as 10A or 10V

Depending on selected Dynamic Mode(CC,CV), voltage or current will be set automatically.

DYN:MEM:A?

Command for checking Ach(LOW) value.

Return value "VALUE"

ex) DYN:MEM:A? return value "10.000"

DYN:MEM:B {VALUE}

Command for setting Bch(HI) value.

>value Input Dynamic Bch value

ex) DYN:MEM:B 10 Set Dynamic as 10A or 10V

Depending on selected Dynamic Mode(CC,CV), voltage or current will be set automatically.

DYN:MEM:B?

Command for checking Bch(HI) value.

Return value "VALUE"

ex) DYN:MEM:B? return value "10.000"

DYN:FREQ {VALUE}

Command for setting the speed of Dynamic Mode.

> VALUE Set the speed of Dynamic Mode

ex)DYN:FREQ 0.05 Set speed of Dynamic as 0.05s

DYN:FREQ?

Command for checking the speed of Dynamic Mode.

Return value "freq"

ex) DYN:FREQ? return value "0.05"

DYN:DUTY {VALUE}

Command for setting duty ratio(Based on Ach) of Dynamic Mode.

> VALUE Set duty ratio

ex)DYN:DUTY 90 Set duty ratio as 90%

DYN:DUTY?

Command for checking duty ratio(Based on Ach) of Dynamic Mode.

Return value "duty"

ex) DYN:DUTY? return value "90"

Cycling Commands

Commnad for Cycle Mode

CYC:INPUT:{ON | OFF}

Command to enable or disable Cycling Mode

> ON Enable Cycling Mode

> OFF Disable Cycling Mode

ex1) CYC:INPUT ON

ex2) CYC:INPUT OFF

CYC:INPUT?

Command for checking if Cycling Mode is on or off.

Return value "1" Enable Cycling Mode

"0" Disable Cycling Mode

CYC:MODE:{CC | CV }

Command for setting Cycling Mode.

> CC Set CC Mode

> CV Set CV Mode

ex1) CYC:MODE:CC

ex2) CYC:MODE:CV

CYC:MODE?

Command for checking mode of Cycling Mode.

Return value "0" CC Mode

Return value "1" CV Mode

ex) CYC:MODE? return value "0"

CYC:VAL:{STEP_NUM} {VALUE}

Command for setting input value and steps to save information of Cycling Mode.

> VALUE Cycling input value

ex) CYC:VAL:001 10 Save input value 10 to Step 1

Depending on selected Cycling Mode(CC,CV), voltage or current will be set automatically.

CYC:VAL:{STEP_NUM}?

Command for checking input value saved in step

Return value "VALUE"

ex) CYC:STEP:VAL:001? return value "10.0"

CYC:DELAY:{STEP_NUM} {VALUE}

Command for setting DELAY TIME and steps to save information of Cycling Mode.

> VALUE Cycling DELAY TIME

ex) CYC:STEP:DELAY:001 000000100 Save DELAY TIME(1S) to Step 1

TIME Unit	000	00	00	00
	Hour	Minute	Second	10mS

Set step(001~100) and make a space after CYC:DELAY:

Input Hour(3digit), Minute(2digit), Second(2digit), 10mS(2digit) in order without any space.

CYC:DELAY:{STEP_NUM}?

Command for checking DELAY TIME saved in step

Return value "delay"

ex) CYC:DELAY:001? return value "000:00:01:00"

CYC:REP {VALUE}

Command for setting repeat time of Cycling Mode

> VALUE Cycling REPEAT

ex) CYC:REP 00100 Set cycling repeat as 100 times

CYC:REP?

Command for checking repeat time of Cycling Mode

Return value "repeat"

ex) CYC:REP? return value "00100"

CYC:SEQ {VALUE}

Command for setting last step of Cycling Mode
> VALUE

ex) CYC:SEQ 10 Set step between 1~10

CYC:SEQ?

Command for checking last step of Cycling Mode
Return value "final step"
ex) CYC:SEQ? *return value "10"*

CYC:FIN?

Command for checking if repeat time of Cycling Mode is finished.
Return value "0" Cycling remained (Working)
"1" Cycling finished (Not working)

Calibration Commands

Be sure to follow the calibration procedure.
Refer to "4-6 Remote Interface Calibration"

CAL:CURR:{H | L}

Command for entering current calibration

> H	HIGH RANGE current calibration
> L	LOW RANGE current calibration

CAL:CURR:MIN {VALUE}

After entering current High,LOW Range Calibration, set LOW(MIN) current value.
> VALUE

ex) CAL:CURR:MIN 0.523

CAL:CURR:MAX {VALUE}

After entering current High,LOW Range Calibration, set HI(MAX) current value.
> VALUE

ex) CAL:CURR:MAX 60.123

CAL:VOLT:{H | L}

Command for entering voltage calibration

> H	Command for HIGH RANGE voltage calibration
> L	Command for LOW RANGE voltage calibration

CAL:VOLT:MIN {VALUE}

After entering current High,LOW Range Calibration, set LOW(MIN) current value.
> VALUE

ex) CAL:VOLT:MIN 1.52

CAL:VOLT:MAX {VALUE}

After entering current High,LOW Range Calibration, set HI(MAX) current value.
> VALUE

ex) CAL:VOLT:MAX 153.23

Note

Be sure to follow the calibration procedure.
Wrong calibration can cause data loss.

System Commands

PROT?

Command for checking whether or not it is PROTECTION Mode.

Return value "1" PROTECTION Mode On
"0" PROTECTION Mode Off

PROT:CLE

Command for escaping PROTECTION Mode

SYST:ERR?

Command for checking if there is an error.

Return value "1" error occurred
"0" No error occurred

*SN?

Command for checking the serial number. This can be applied to serial number for distrubution when develop Windows application.

Return value "LF-00-0000-00000"

*ex) *SN? return value "LF-03-0923-00185"*

*IDN?

Command for checking load's information.
Three versions of the information are sent separated by comma.

Return value "ODA Technologies,OPC-3010,1.0-1.0-1.0"
First Manufacturer
Second Model
Third Details of the product (3 version)
First System controller Version
Second Front panel Version
Third SCPI protocol Version

*ex) *idn? return value "ODA Technologies,LP-Series,1.0-1.0-1.0"*

***SAV {1|2|3|4|5|6|7|8|10}**

Command for saving value of Range, Voltage, Current, Slew Level, Dynamic A and B, DUTY, FREQ of load in 1~10 nonvolatile 『User Memory』.

> 1 ~ 10 Memory save address

*ex) *sav 2 Save to address # 2*

***RCL {1|2|3|4|5|6|7|8|10}**

Command for applying the data saved in non-vilatile 『User Memory』 to your power supply Select one among 1 ~ 10

> 1 ~ 10 Memory save address

*ex) *rcl 2 Apply the data saved in address # 2 to your power supply*

***RST**

Command for initializing your load.

7. Error Messages

You can check errors by pressing error key on front panel.

+0,"No error"

There is no error.

7-1. Operating Error

-10, "Invalid the DAC parameter"

If setting value is out of range that can be represented by DAC, represented value will be different with actual setting value. In that case, remove load immediately.
This problem may occur if your electronic load isn't calibrated well.
Refer to "4. CALIBRATION"

7-2. Hardware Error

-200, "System interface error"

SCPI Module is not operating.

-201, "ADC operating failed"

ADC Part's circuit is not operating.

-202, "Front panel operating failed"

Front panel is not operating.

-255, "Error not define"

Error occured but not defined.

7-3. Remote Calibration Error

Refer to "4-6. REMOTE INTERFACE Calibration(for GPIB)" for further information.

-20, "Ignored min run under volt"

When operate MAX or VALUE before operating volatge MiN value.
Procedure : Min → VALUE → MAX → VALUE

-21, "Ignored min save under volt"

When operate MAX before operating voltage MIN value.
Procedure : Min → VALUE → MAX → VALUE

-22, "Invalid min value use under volt"

When operate Min value again instead of MAX after operating voltage MIN value.
Procedure : Min → VALUE → MAX → VALUE

-23, "En route to cal the curr"

Occurs if you send calibration commands related to voltage during current calibration.

-24, "Over volt min parameter"

Occurs when over range of Voltage Min value.

Refer to "4-5. CALIBRATE '

-25, "Under volt max parameter"

Occurs when over lower limit value of Voltage Max.

Refer to "4-5. CALIBRATE '

-26, "Over volt max parameter"

Occurs when over upper limit value of Voltage Max.

Refer to "4-5. CALIBRATE '

-27, "Ignored min run under curr"

Occurs when operate MAX or VALUE before operating MiN value.

Procedure : Min → VALUE → MAX → VALUE

-28, "Ignored min save under curr"

Occurs when operate MAX before operating Value of current MIN.

Procedure : Min → VALUE → MAX → VALUE

-29, "Invalid min value use under curr"

Occurs when operate Min value again instead of MAX after operating current MIN value.

Procedure : Min → VALUE → MAX → VALUE

-30, "En route to cal the curr"

Occurs if you send calibration commands related to current during voltage calibration.

-31, "Over curr min parameter"

Occurs when over range of Current Min value.

Refer to "4-5. CALIBRATE"

-32, "Under curr max parameter"

Occurs when over lower limit value of Current Max.

Refer to "4-5. CALIBRATE"

-33, "Over curr max parameter"

Occurs when over upper limit value of Current Max.

Refer to "4-5. CALIBRATE"

-34, "Not allowed command under cal"

You can't use any othe commands under Remote Calibration

7-4. Calibration Error

If you do calibration, Read back calibration will be proceeded inside the product .
After checking the calibration proceeded properly, occurred error will be displayed.

-60, "DAC-V high Rang high limit over"

Occurs when over high range of Voltage DAC high Rang.

-61, "DAC-V high Rang low limit over"

Occurs when over low range of Voltage DAC high Rang.

-62, "ADC-V high Rang high limit over"

Occurs when over high range of Voltage ADC high Rang.

-63, "ADC-V high Rang low limit over"

Occurs when over low range of Voltage ADC high Rang.

-64, "DAC-V low Rang high limit over"

Occurs when over high range of Voltage DAC low Rang.

-65, "DAC-V low Rang low limit over"

Occurs when over low range of Voltage DAC low Rang.

-66, "ADC-V low Rang high limit over"

Occurs when over high range of Voltage ADC low Rang.

-67, "ADC-V low Rang low limit over"

Occurs when over low range of Voltage ADC low Rang.

-68, "DAC-A high Rang high limit over"

Occurs when over high range of Current DAC high Rang.

-69, "DAC-A high Rang low limit over"

Occurs when over low range of Current DAC high Rang.

-70, "ADC-A high Rang high limit over"

Occurs when over high range of Current ADC high Rang.

-71, "ADC-A high Rang low limit over"

Occurs when over low range of Current ADC high Rang.

-72, "DAC-A low Rang high limit over"
Occurs when over high range of Current DAC low Rang.

-73, "DAC-A low Rang low limit over"
Occurs when over low range of Current DAC low Rang.

-74, "ADC-A low Rang high limit over"
Occurs when over high range of Current ADC low Rang.

-75, "ADC-A low Rang low limit over"
Occurs when over low range of Current ADC low Rang.

7-5. Non-volatile Memory Check Error

Before factory shipment, each product records unique value in non-volatile memory.
Check data and notify if an error occurred.

-80, "Memory limit volt error"
There's an error in voltage limit value.

-81, "Memory limit curr error"
There's an error in current limit value.

-82, "Memory max volt error"
There's an error in max voltage value.

-83, "Memory max curr error"
There's an error in max current value.

-84, "Memory volt decimal error"
There's an error in the decimal point of voltage.

-85, "Memory curr decimal error"
There's an error in the decimal point of current.

-86, "Memory volt length error"
There's an error in digit length of the voltage.

-87, "Memory curr length error"
There's an error in digit length of the current.

-88, "Not match volt length and limit"

Digit length of voltage does not matched with limit value.

-89, "Not match curr length and limit"

Digit length of current does not matched with limit value.

7-6. Interface Commands Error

Notify the errors about command and description when controll with PC communication.

-120, "Suffix too long"

The limit of memory buffer that can be transferred at one time is 50byte.
If over that limit, this will be displayed.

-121, "Invalid data"

Occurs when input incorrect data or the character in digit.

ex) volt 10V 'V' should be removed
Revised) volt 10

-122, "Syntax error"

There's a syntax error.

ex)volt Value' should be added after 'volt'
Revised) volt 10

-123, "Invalid suffix"

There's an error in suffix of received data.

ex)volt 10 '*' should be removed*
Revised) volt 10

-124, "Undefined header"

Occurs when send undefined command.

ex)volta 10 Recognize only one of 'volt' or 'voltage'
Revised) voltage 10 or volt 10

-125, "In the mode not work"

Occurs when send the command that can't use in current mode.

ex) When send MODE:RES in INPUT ON mode.
Revised) Send MODE:RES after INPUT OFF.

-221, "Setting conflict"

Existent SCPI command but doesn't be used in this instrument.

ex)POL N Command for changing polarity but can't use in Single Channel power supply.

-222, "Out of data"

Occurs when value is out of setting value range.

ex)volt 1000 The value is too much

Revised) volt 10

-223, "Incorret error"

Occurs when try a new operation without processing the buffer.

*ex)*idn? After send query command send a new command without acquiring data.*

volt?

b = data

*Revised)*idn?*

a = data Save idn data in string array variable 'a'

volt?

b = data Save voltage value in voltage variable.

8. Cautions

Please refer to followings to use product safely for long time.

- Don't place product to extremely hot or cold space.

- Don't use product immediately after bringing it from cold space.
  Liquefaction can cause damage to operation.
  In this case, operate instrument after waiting for 20~30 minutes.

- Do not place liquid containers on top of product.
  liquid can cause serious damage to the product.

- Don't apply strong vibration or pressure to product.

- Acquire enough space near the ventilation slit.

- Don't put heavy things on product.

- Don't use product near any device that can makes strong magnetic field.

- Don't put wires or any product into the ventilation slit.

- Don't place hot iron near product.

- Don't place front-panel at the bottom.
  It may cause broken of Knob or Output terminal.

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