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Switching Type Programmable DC Power Supply **MX Series**

User Manual

Manual Part NO. 018MX-1.0



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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

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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 Symbol

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. Return the product to an ODA Sales and Service Office for service and repair to ensure that safety features are maintained.

When returning, be sure to use the box that was originally packaged.

If there's any damage occurred from using other packaging, warranty may not be assured.

In Case of Damage

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

Ventilation precautions

Keep the vents unobstructed.

CAUTION

A **CAUTION** 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 damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.





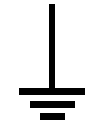

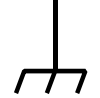











WARNING

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.

Location of parts

Do not place power cord, equipment inlet, main switch, etc. to make it difficult to operate the equipment.

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.
	Neutral conductor on permanently installed equipment		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

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1. General Information

1-1. Features

MX Series Single Output products are high-performance, high-efficiency programmable DC power supply with 5KW~15KW capacity. It supports RS-232C and RS-485 interfaces based on SCPI (Standard Commands for Programmable Instruments) or Modbus protocols. Refer to the Modbus Manual when using the Modbus protocol.

General Features

- Easy settings by using encoders.
- Output Voltage/Current Breaking and Restoration of Function (Output ON/OFF)
- Front Panel Key Lock Function
- Alarms for Various Events
- Excellent Precision and High Resolution
- Built-in Remote Sensing for Load Voltage (V-Sensing)
- Over Voltage Protection (O.V.P.) / Over Current Protection (O.C.P.) / Over Temperature Protection Fan RPM Trip / Power Module Trip / Voltage-Current Trip / V-Sensing Error / AC Input Trip / Pfc C.
- Under Voltage Limit (U.V.L.)/Over Voltage Limit (O.V.L.), Under Current Limit (U.C.L.)/Over Current Level Settings
- Excellent Load Regulation and Line Regulation
- Storing and Recalling up to 10 Operating Settings (Voltage, Current, OVP, OCP)
- Save and Confirm up to 10 Error Messages
- Highly Efficient Output of 80%~90%

Remote Interface

- Supports Various Interfaces such as RS232C, RS485, and TCP/IP
- Compatible with SCPI (Standard Commands for Programmable Instruments)
- High-Speed Setting & Measurement
- Many Built-In Commands
- Easy Interface Settings by Using the Front Control Panel's I/O config
- Technical Realization of Products Insulation & Floating Logic
- Built-In Error Checking Function for SCPI Programming Grammar

Calibration

- Software Calibration by manual with PC (no need to open cover of instrument for calibration)
- Easy calibration by using independent or PC interface

Factory Functions

- Initialization Function of 10 User Memories
- Save and Recall Last State of the Instrument Before Turning Off
- "Auto Key Lock & Auto Cursor Move" Function to Prevent Operator Mistakes
- OVP & OCP Disable Settings Available
- Fast or Precise Value Reading by Using "Adc" (Analog to Digital Conversion)
- Calibration Recall Function
- Calibration Back-up Function

Self-Testing

- Front Panel Test
- Remote Interface Test
- Memory Data Verification Test
- ADC H/W Error Test
- Unregulated State Test
- ADC/DAC Calibration Verification Test

1-2. Accessories and Options

Accessories

- 1 User's Manual
- Demo Software (Windows Application Manual Included) Available for Download at the Home Page
<http://www.odacore.com>

Options

- RS232C Cable 1M, 2M, 4M
- RS485 Cable 2/4/8-Channel 1M, 2M, 4M, 10M
- TCP/IP
- Analog Input 0~10V or 0~5V
- Analog Output 0~10V or 0~5V
- AC Input Cable (special order type)
- Output Cable (special order type)

1-3. Inspecting the Unit

After opening the delivered power supply, please check for issues described below. If any problems occur, you can request A/S from a nearby service center or the head office. You must send the unit in its original package box for smooth service. You can also contact ODA Technologies regarding questions or get technical advice by referring to the Q&A in the company homepage or calling.

Mechanical Checklist

- Check the key, encoder switch, and power switch for damages.
- Check the panel surfaces for dents or scratches.
- Check the rear output terminals for damages.
- Check the unit's body for dents or scratches.
- Check the LCD for cracks and scratches.

Electrical Checklist

- Check for an alarm sound after connecting power to the unit.
An alarm sounding at this step is probably indication of an error during self-testing.
You can read the error code by pressing the error key.
For more details regarding errors, refer to "7.Error Messages."
For the self-testing, refer to 「1-6. Check after Power On」
- The LCD displays the company logo and model name during the initial self-testing phase.
- If the "****OUTPUT OFF****" message is displayed without any problems, refer to the specific while checking the unit.

Note

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

1-4. Operating Conditions

This instrument is designed to be used under the following environmental conditions:

- Environmental Temperature: 0 ~ 50°C
- Relative Humidity: ≤80%
- Operating Altitude: ≤2,000m
- Zero vibrations
- Away from electromagnetic fields

1-5. Checking Before Connecting Power

Checking the AC Input Cable

- The AC input cable provided in the package is a 4-Wire (R,S,T,G) cable.
For custom cables, use cable appropriate for power supply's capacity.
Likewise, connect power line's earth and the unit's GND before use.

Checking the Input Power

- This product is designed for 3Phase 342Vac ~ 440Vac / 50-60Hz.
- To protect the unit from severe damage caused by overloading, it has built-in fast fuses. If the unit does not turn on even after turning on power switch, you can request A/S from a nearby service center or the head office.

1-6. Checking After Connecting Power

When the unit's power switch is turned on, the unit starts operating with the initial settings and self-testing. In addition, the unit maintains the remote interface settings while setting the output voltage for 0V and the output current for the maximum value (This is the initial factory settings when the last state is disabled). The OVP & OCP are set to the maximum output value of the unit's capacity, and monitoring begins (initial factory settings).

Procedure Checklist

- The logo of the manufacturer, "ODA Technologies," is displayed.
- The model name, "MX-Series," is displayed.
- The frontal ERR, LMT, RMT, and LOCK lamps are all turned on and off, starting from the left
Does not apply for CV and CC annunciators.
- During the display, the unit is initialized by receiving various data from the internal non-volatile memory.
- The unit starts self-testing as well. The criteria for self-testing are shown below.

Front Panel Test	Connection status with the front panel
Remote Interface Test	Remote interface board for PC connection
Memory Data Verification Test	Unit profile and settings data
ADC H/W Error Test	ADC control condition status
Unregulated State Test	Output voltage floating status
ADC/DAC Calibration Verification Test	ADC and DAC calibration data status

If an error occurs, the alarm rings, and the error code is saved to the volatile memory. You can read the error code by pressing the error key.
For more details regarding errors, refer to "7.Error Messages"

Default Setting Values (If the Last State Mode is Disabled)

- OVP: OVP is set for the maximum value, ■ Remote Interface: Set to maintain the previous settings
OVP is set to ON
- OCP: OCP is set for the maximum value ■ State after self-testing: "**OUTPUT OFF**"
OCP is set to ON
- UVL: 0V ■ Cursor location: Default voltage select
- OVL: Maximum value Voltage: 1V
- UCL: 0A Current: 100mA if current is below 5A
- OCL: Maximum value In case of under 50A: 1A
- Output Voltage: 0V In case of under 100A: 10A
- Output Current: Maximum value ■ KEY LOCK: OFF

Note1

The default remote interface is RS232C with baud-rate setting of 9,600bps.

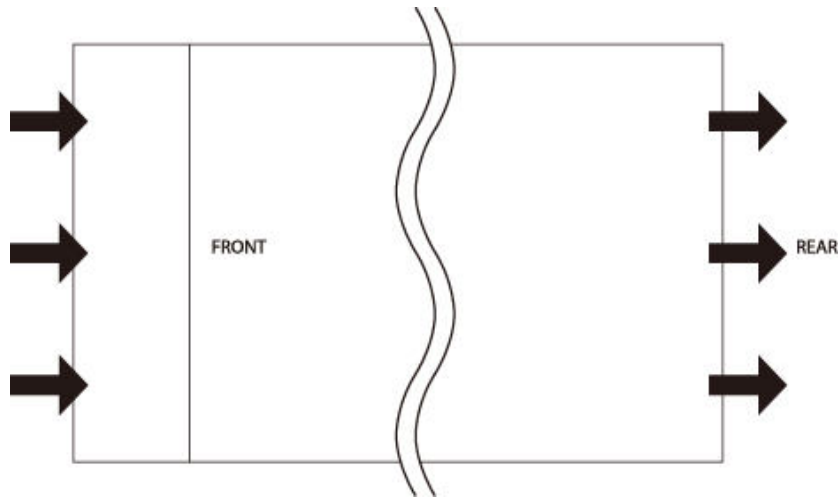
Note2

The last state is disabled at the time of shipping from the factory. To reset various settings such as voltage/current to the state before you turn off the unit, you can change the settings

1-7. Installation

Cooling

- This unit can operate without performance loss within the temperature range of 0°C ~ 50°C so this must be taken into consideration when installing the unit.
If the temperature is between 50°C ~ 55°C, decrease the output current to 0~70%.
When installing the unit on a rack, take care about the airflow. Using a rack

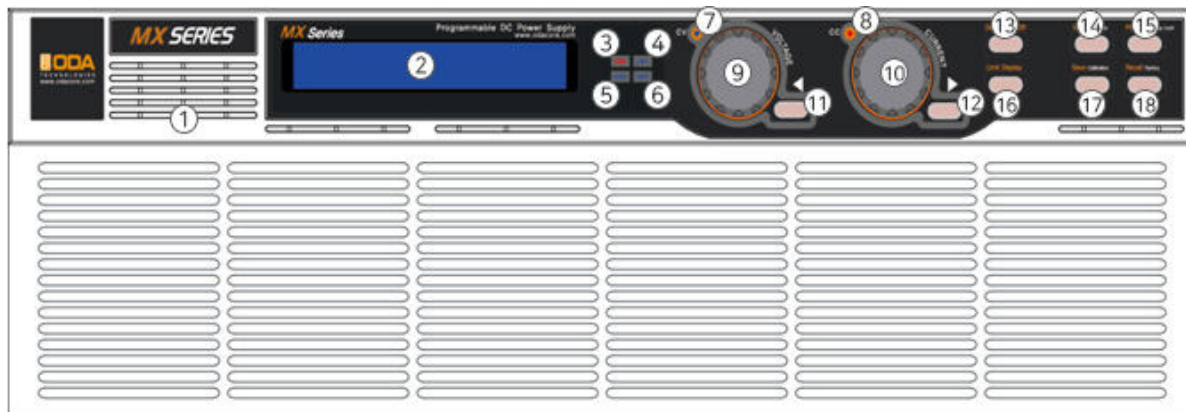


<Figure 1-4 Bottom view>

Bench Operation

- There must be enough space for airflow in the front and rear of this unit.
The bottom has no air vent, so you can operate the unit without taking this into consideration.

2. Front/Rear Panel Composition & Function



1	Ventilation Slit	12	Curr Cursor or Menu Change Key
2	16char-Type LCD Display	13	Output Voltage/Current ON/OFF Key
3	Error Lamp	14	IO/Local Settings and Error Display Key
4	Limit Display Lamp	15	Protection Settings and Front-panel Lock Key
5	Key Lock Lamp	16	Voltage/Current Settings Value Display Key
6	Remote Interface Lamp	17	Save Current State or Calibration Key
7	CV Mode Lamp	18	Memory Saving State Reset or Factory Key
8	CC Mode Lamp		
9	Voltage Settings Encoder		
10	Current Settings Encoder		
11	Voltage Cursor or Menu Change Key		

1. Ventilation Slit

The air from the front and sides of the unit are taken in and exhausted from the rear.

2. 16char-Type LCD Display

Voltage/Current value, settings, and various menus are displayed here.

3. CV Mode Lamp

Turned on when the unit is currently in CV (Constant Voltage) Mode.

4. CC Mode Lamp

Turned on when the unit is currently in CC (Constant Current) Mode.

5. Limit Display Lamp

LED is lit when the voltage/current is being set.

LED is turned off if the current voltage/current output is displayed.

6. Remote Interface Lamp

LED is turned on when the remote interface is active.

In this case, the front panel cannot be used.

7. Key Lock Lamp

The front panel is locked and cannot be used if this lamp is on.

8. Error Lamp

LED is lit when various errors occur and turned off when all errors have been confirmed.

9. Voltage Settings Encoder

Used for adjusting the voltage limit settings or values in the menu.

10. Current Settings Encoder

Used for adjusting the current limit settings or values in the menu.

11. Voltage Cursor or Menu Change Key

Cursor key exclusive for voltage. The cursor moves left for each press of the button, and it is used to move the menu.

12. Current Cursor or Menu Change Key

Cursor key exclusive for current. The cursor moves right for each press of the button, and it is used to move the menu.

13. Output Voltage/Current ON/OFF

Used for disabling the output voltage/current.

14. Voltage/Current Settings Value Display Key

Used for checking the voltage/current settings. May be different from the actual output value.
Pressing the key turns on the LMT Lamp and displays the set voltage/current value.
Pressing the key once more displays the actual output voltage/current value.
If the previous state was Output OFF, the "****OUTPUT OFF****" message is displayed.

15. IO/Local Settings and Remote Key

Default remote interface setting key available to choose between RS232C and RS485.
Acts as the local mode changing key in remote interface control mode.
Acts as an error display confirming key when errors occur.
Set to act automatically as IO/Local key after checking all errors.

16. Protection Settings and Front-panel Lock Key

Can set various protection functions such as OVP/OCP/UVL/OVL/UCL/OCL.
Pressing the key for 1 second turns on the LOCK Lamp
and locks the front panel. Pressing the key once more disables the lock.

17. Save Current State or Calibration Key

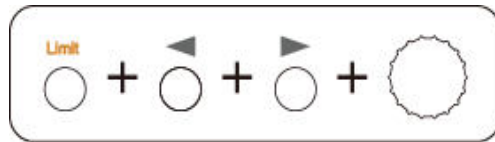
Saves the current voltage, current, protection, and output ON/OFF state.
Turning on power of the unit while holding this key enables switching to calibration mode,
which lets you calibrate the voltage/current.

18. Memory Saving State Reset or Factory Key

You can apply the saved voltage, current, protection, and output ON/OFF settings.
Turning on power of the unit while holding this key enables switching to factory mode.
This initializes the memory, Last State, Auto Cursor Move, Auto Key Lock, OVP Disable, OCP
Disable, ADC Sampling, and Calibration, Various menus such as calibration backup or
initializing calibration factory default values are available.

2-1. Front-Panel Setting of Voltage and Current

You can set the voltage and current limit values using the following method:



1. After connecting power to power supply, check if “**OUTPUT OFF**” is displayed on the LCD
2. Press the Limit Display Key to switch to Limit Mode.
3. The left cursor key increases the voltage settings value, and the right cursor key decreases the current settings value.
4. The left encoder changes the voltage settings, and the right encoder changes the current settings.
5. Rotate the voltage or current encoder clockwise to increase the limit value. To decrease the limit value, rotate the encoders counter-clockwise.
6. Check if the set values have changed on the LCD display.
7. Press the Output On/Off Key to begin the output of your set voltage and current.

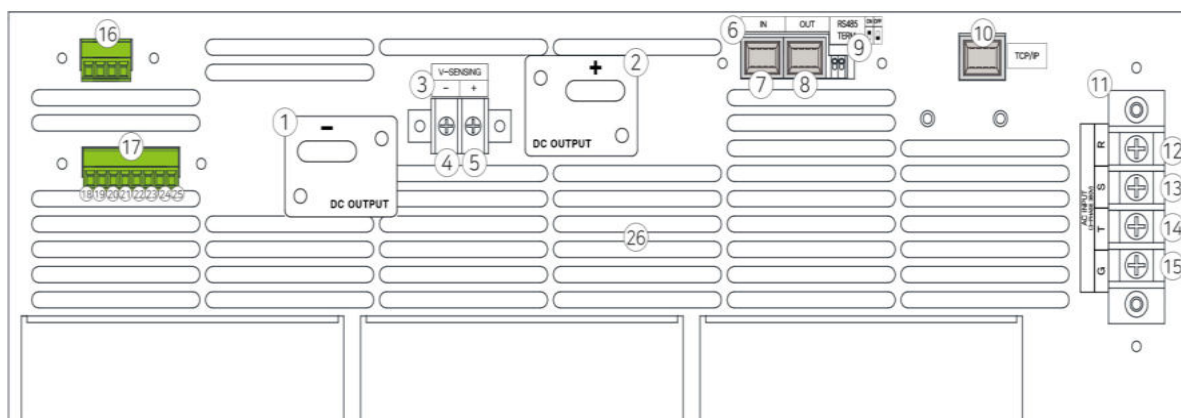
Note1

If an error occurs during the 『Self-test』, you can check the error by pressing the Error Key.
To check the error codes, refer to “7.Error Messages”

Note3

If you are using the remote interface, the front panel's key and encoder switch do not work.
After stopping the remote interface, press the front IO/Local Key to switch to Local mode.

2-2. Rear Panel Composition



1	「-」 Negative Output	Negative Output Port
2	「+」 Positive Output	Positive Output Port
3	Voltage Sensing Terminal Block	Output Voltage Sensing Terminal Block
4	「-」 Negative Sensing	Negative Sensing Port
5	「+」 Positive Sensing	Positive Sensing Port
6	Connection Ports	RS232C, RS485 Connection IN/OUT Socket
7	RS232C/RS485 In Connection Port	Built-In RS232C, RS485 Connection
8	RS485 Out Connection Port	RS485 Parallel Connection Out Port
9	RS485 Termination Switch	RS485 Terminating Resistor Connection Switch
10	TCP/IP Connection Port (Option)	TCP/IP Connection
11	AC Input Terminal Block	3Phase 342Vac~440Vac Power Input Terminal
12	AC 「R」 Phase Input	Inputs R Phase
13	AC 「S」 Phase Input	Inputs S Phase
14	AC 「T」 Phase Input	Inputs T Phase
15	AC Ground Input	Inputs Distributor's Ground (Earth)
16	Parallel Control Terminal Block	Control Port for Operating 2 or More MX-Series Units
17	Signal I/O Terminal Socket (Option)	Optional Port
18	Analog Input Voltage Control Terminal Block	Terminal Block for Controlling the Voltage in Proportion to Input of 0~5V or 0~10V
19	Gnd	Option Port's Gnd
20	Analog Input Current Control Terminal Block	Terminal Block for Controlling the Current in Proportion to Input of 0~5V or 0~10V
21	Analog Output Voltage Terminal Block	Outputs 0~5v or 0~10v Voltage in Proportion to the Output Voltage
22	Analog Output Current Terminal Block	Outputs 0~5v or 0~10v Voltage in Proportion to the Output Current
23	Gnd	Option Port's Gnd
24	External Output On/Off Port	Controls power Supply Output's On/Off Through the 0 to 5v Method or Contact Method.
25		
26	Ventilation Slit	Ventilation Slit for Exhausting Air Inlet from the Front

Details for Each Component

1. Positive, Negative Output Bus Bar

Bus Bar for Output Voltage and Current

2. Voltage Sensing Terminal Block

Voltage sensing terminal block. Rewards up to +5% of power supply's maximum output voltage. A warning message is displayed on the LCD if the reward value exceeds 5%. If the value exceeds 10%, power supply's output is disabled.

3. RS232C/RS485 Connection Port

The IN connection port has a built-in RS232C, RS485 connection, and the OUT port is for parallel RS485 connection.

4. RS485 Termination Switch

On/Off switch for using terminating resistors when using RS485 connection. Turns on the 120 Ohm resistor for the RS485 data connection line when turned on.

5. AC Input Terminal Block

Terminal block for connecting the AC input. The 3Phase + Ground input is the default setting. Input voltage: 3Phase 342Vac ~ 440Vac 60Hz

6. Signal I/O Terminal Socket

Refer to the MX-Series Option Manual.

7. Parallel Control Terminal Block

Terminal block for parallel current in case of using over 30kW.

It's safe to connect DUTs after a pre-check of the voltage and current output. The procedures below explain how to proceed with the pre-check.

Voltage Output Check

- To check the output voltage, follow the procedures below.
 1. Connect power to the unit.
 2. After the self-checking mode, switch the unit to “**OUTPUT OFF**” mode and leave power supply on standby.
 3. Connect the output port to a DVM appropriate for measuring the voltage.
 4. Press the Output On/Off Key so that the voltage is outputted from the output port.
 5. Press the Limit Display Key to display the set voltage.
 6. Press the left cursor key to move the cursor to your desired voltage.
 7. Turn the voltage encoder switch clockwise or counter-clockwise to control the voltage.
 8. Compare the voltage displayed on the LCD and the voltage measured with the DVM.

Current Output Check

- To check the output current, follow the procedures below.
 1. Connect power to the unit.
 2. After the self-checking mode, switch the unit to “**OUTPUT OFF**” mode and leave power supply on standby.
 3. Press the Output On/Off Key so that the voltage is outputted from the output port.
 4. Press the Limit Display Key to display the set voltage.
 5. Press the left cursor key to move the cursor to your desired voltage.
 6. Turn the voltage encoder switch clockwise for 5V.
 7. Press the right cursor key to move the cursor to your desired current.
 8. Turn the current encoder switch clockwise or counter-clockwise to control the current.
 9. Press the Output On/Off Key to switch the output to “**OUTPUT OFF**” mode.
 10. Connect the output port to a DAM appropriate for measuring the voltage.
 11. Press the Output On/Off Key so that the current is outputted from the output port.
 12. Compare the current displayed on the LCD and the current measured with the DVM.

3. Front Panel Operation

To cancel the menu for each feature, press the IO/Local, Protection, Store, or Recall key. Otherwise, if no other events occur, the unit will automatically switch to local mode after about 5 seconds.

The key used to enter the menu is the “confirm” key for easy and convenient control.

Overview



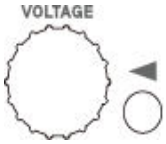
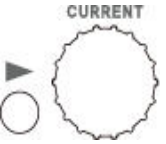
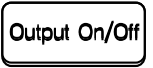

- 1. Activating Constant Voltage (CV)**
Description for the activation of constant voltage output mode.
- 2. Activating Constant Current (CC)**
Description for the activation of constant current output mode.
- 3. Remote Voltage Sensing**
Description for the DUT's remote voltage sensing.
- 4. Programming Over Voltage Protection (OVP)**
Description for over voltage protection.
- 5. Programming Over Current Protection (OCP)**
Description for over current protection.
- 6. Programming Under Voltage Limit (UVL)**
Description for the under voltage limit.
- 7. Programming Over Voltage Limit (OVL)**
Description for the over voltage limit.
- 8. Programming Under Current Limit (UCL)**
Description for the under current limit.
- 9. Programming Over Current Limit (OCL)**
Description for the over current limit.
- 10. Key Lock**
Description on how to enable and disable the front panel lock.
- 11. IO/Local**
Description on how to set the remote interface and switch to local mode, including related
- 12. Limit Display**
Description on viewing the set voltage/current value and the actual output value.
- 13. Store**
Description on saving power supply information on the 『User Memory』 .
- 14. Recall**
Description on applying the data saved on the 『User Memory』 on power supply.
- 15. Output ON/OFF**
Description on the approved output status and disabling of output voltage.
- 16. Error Message Display**
Description on checking power supply's errors.

Note1

You can set the remote interface method by pressing the front panel's I/O Local key.

3-1. Activating Constant Voltage (CV)

The procedure for activating constant voltage output mode is described below.
(The last state mode is disabled in this example.)

	<ul style="list-style-type: none"> Turn on the power switch. After turning on power, check if the unit is in "**OUTPUT OFF**" mode. Connect the DUT to the output terminals.
	<ul style="list-style-type: none"> Press the LMT DISPLAY Key to set the limit.
	<ul style="list-style-type: none"> When setting the voltage, use the left cursor key to move the cursor to the range, and then use the encoder switch to select your desired voltage. <i>The voltage cannot exceed the protection level if the Protection (OVP/UVL/OVL) settings are active. If you try to exceed the limit in this case, the "PROTECTION LIMIT" message will be displayed, and the voltage will be set to the protection</i>
	<ul style="list-style-type: none"> You can protect the DUT from damage by setting the current value a bit higher than the current value a bit higher than the amount of current required by DUT. Change the current settings below as well.
	<ul style="list-style-type: none"> To set the current value, use the right cursor key and encoder. <i>The current cannot exceed the protection level if the Protection (OCP/UCL/OCL) settings are active. If you try to exceed the limit in this case, the "PROTECTION LIMIT" message will be displayed, and the current will be set to the protection level's value.</i>
	<ul style="list-style-type: none"> If all settings are complete, press the OUTPUT ON/OFF Key to approve the output. The unit will then switch to Readback Display mode.
	<ul style="list-style-type: none"> Check if the CV lamp is on while the CC lamp is off. If the CC lamp is on and the CV lamp is off, check if the current provided for the DUT is enough and increase the current limit value.

» Related remote interface commands

```
APPLY{<voltage>,<current>}
VOLT{<voltage>|UP|DOWN}
CURR{<current>|UP|DOWN}
OUTP{OFF|ON}
```



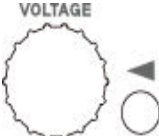
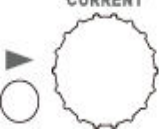


<i>Application 1:</i>	<i>OUTP OFF Disable Output</i>	<i>Application 2:</i>	<i>OUTP OFF Disable Output</i>
	<i>VOLT 10 Set Voltage to 10V</i>		<i>APPLY 10,5 Set for 10V/5A</i>
	<i>CURR 5 Set Current to 5A</i>		<i>OUTP ON Output Voltage and Current</i>
	<i>OUTP ON Output Voltage and Current</i>		

Note

- The left cursor key increases the voltage range, and the right cursor key decreases the current range.
- What is ReadBack Display?
This means that the LCD is displaying the currently outputted voltage and current.

3-2. Activating Constant Current (CC)

Follow the procedures below to activate constant current mode.

	<ul style="list-style-type: none"> Turn on the power switch. After turning on power, check if the unit is in "***OUTPUT OFF**" mode. Connect the DUT to the output terminals.
	<ul style="list-style-type: none"> Press the LMT DISPLAY Key to set the limit.
	<ul style="list-style-type: none"> When setting the voltage, use the left cursor key to move the cursor to the desired voltage range, and use the encoder switch to select your desired voltage. <i>The voltage cannot exceed the protection level if the Protection (OVP/UVL/OVL) settings are active. If you try to exceed the limit in this case, the "PROTECTION LIMIT" message will be displayed, and the voltage will be set to the protection level's value.</i>
	<ul style="list-style-type: none"> To set the current value, use the right cursor key and encoder. <i>The current cannot exceed the protection level if the Protection (OCP/UCL/OCL) settings are active. If you try to exceed the limit in this case, the "PROTECTION LIMIT" message will be displayed, and the current will be set to the protection level's value.</i>
	<ul style="list-style-type: none"> If all settings are complete, press the OUTPUT ON/OFF Key to approve the output. The unit will then switch to Readback Display mode.
	<ul style="list-style-type: none"> Check if the CC lamp is on while the CV lamp is off. If the CV lamp is on and the CC lamp is off, check if the voltage provided for the DUT is enough and increase the voltage limit value.

» Related remote interface commands

APPLY{<voltage>,<current>}

VOLT{<voltage>|UP|DOWN}

CURR{<current>|UP|DOWN}

OUTP{OFF|ON}

Application1:

<i>OUTP OFF</i>	<i>Disable Output</i>
<i>VOLT 10</i>	<i>Set Voltage to 10V</i>
<i>CURR 5</i>	<i>Set Current to 5A</i>
<i>OUTP ON</i>	<i>Output Voltage and Current</i>

Application2:

<i>OUTP OFF</i>	<i>Disable Output</i>
<i>APPLY 10,5</i>	<i>Set for 10V/5A</i>
<i>OUTP ON</i>	<i>Output Voltage and Current</i>

3-3. Remote Voltage Sensing

When the DUT is connected to the power supply's output terminal, voltage regulation occurs in the DUT's connection cable. Therefore, remote voltage sensing (V-sensing) can be used to provide the correct amount of power to the DUT. Familiarize yourself with the contents below before using V-sensing.

CV Regulation

See below for the specification of the voltage load regulation's characteristics. Due to the current change in the DUT during V-sensing, you must add 5mV each to the 1V drop between the +S point and + output terminal. Since the sensing cable is part of the power supply's feedback system, the sensing cable's own resistance value must be set as 0.5Ω or below to maintain your desired output value.

Output Rating

See below for the specification of the voltage and current output rate. During V-sensing, the sum of the load cable's voltage drop value and the voltage provided to the DUT becomes the supply's total output value. Thus, if this exceeds the power supply's maximum output voltage, V-sensing's performance cannot be guaranteed, and power supply goes into an unregulated state. Likewise, keep in mind that power supply may go into an unregulated state regardless of the output voltage if each DUT's cable exceeds 1V.

Note

What is an unregulated state? This is a state wherein the power supply's source supplying limit has been exceeded to the point where the activation of CV and CC is unavailable.

Output Noise

Noise in the sensing cable from the power supply's output can cause serious problems in the voltage load regulation. Therefore, follow the procedure below. Refer to Figure <3-1>.

- Decrease the external noise by twisting the sensing cables together.
- Connect the sensing cables parallel to each other near the DUT's cable.
- You must mask the sensing cables in an environment exposed to noise.
- The noise masking device must be connected to the GND nearest to the power supply.
- Connect the DUT's cable and sensing cable in the shortest route possible.

Stability

Since V-sensing under the circumstances wherein the DUT's cable is long and the DUT requires a large amount of power acts like a filter itself just like a part of the voltage feedback loop, this can cause problems in V-sensing. This leads to power supply itself or the output terminal's output value becoming unstable due to the power supply's very fast responding speed. This unstable loop creates a feedback and acts as another unstable factor, which leads to the possibility of the power supply's oscillation. To avoid this, follow the procedure below.

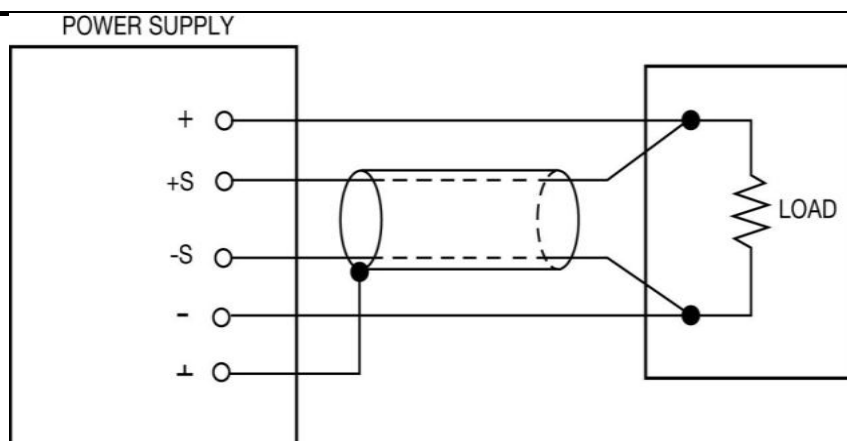
- Keep the DUT's cable and sensing cable as short as possible.
- Twist the DUT's cable.
- The sensing cable must be safely connected to the DUT.
Since the power supply's programming feedback is part of the loop, unmasking the sensing cable during V-sensing can give rise to many unexpected issues.
- You should never connect the DUT cable to the sensing terminal.

Connecting Remote Voltage Sensing

V-sensing must be carefully connected from the output terminal and sensing terminal to the DUT. Connecting the DUT to the sensing terminal may lead to the unit falling into an unregulated state. Since the displayed voltage and current values are significantly different from the output terminal's voltage and current, this is very dangerous.

Note





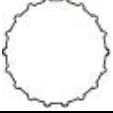

To connect V-sensing, the metal short bar must be removed from the output and sensing terminals. If V-sensing is no longer used, the metal short bar must be connected the output and sensing terminals again.



< Figure 3-1 >

3-4. Programming Over Voltage Protection (OVP)

This function protects the DUT from power supply if the output voltage is higher than the OVP level. The procedure for setting OVP levels is described below. *You can disable the OVP function in factory mode. The OVP level values shown below may be different from the actual values.*

	<ul style="list-style-type: none"> Turn on the power switch. After turning on power, check if the unit is in "**OUTPUT OFF**" mode.
	<ul style="list-style-type: none"> Press the protection key to set the levels. Displayed LCD Message PROTECT> 1.OVP
	<ul style="list-style-type: none"> Press the protection key once more in "1.OVP" mode. Displayed LCD Message OVP SET> 32.00V
	<ul style="list-style-type: none"> Use the cursor keys to place the cursor on the desired value.
	<ul style="list-style-type: none"> Control the encoder switch to change the level value. <i>The OVP level cannot be set lower than the currently outputted voltage to prevent operator mistakes.</i>
	<ul style="list-style-type: none"> Press the protection key when the change is complete. Displayed LCD Message CHANGED Return to the previous stat after the message above is displayed.
<p>Canceling Wait for 5 Seconds</p>	<ul style="list-style-type: none"> If you want to cancel the setting, wait for 5 seconds. Displayed LCD Message CANCEL...

» Related remote interface commands

VOLT:OVP {<voltage>}

VOLT:OVP?

VOLT:TRIP?

VOLT:CLE

Application: VOLT:OVP 25

VOLT:OVP?

VOLT:OVP:TRIP?

VOLT:OVP:CLE

Set OVP Level

View OVP Level

Check OVP Trip Occurrence

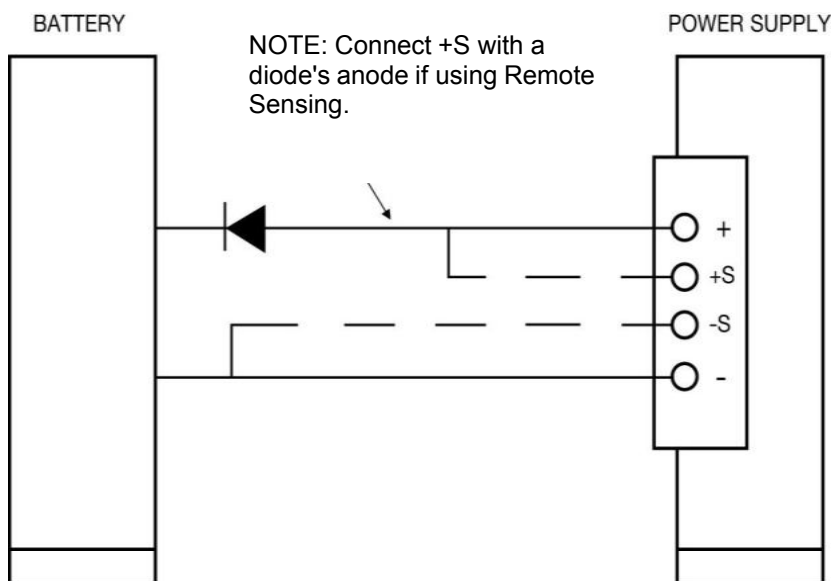
OVP Trip Clear

Note




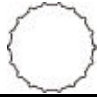

Refer to "Initial Setting Value" in "1-6 Check after Power On" for the initial OVP settings

The “OVP TRIPPED” message will be displayed if the actual output voltage is higher than the OVP level value, and this stops the source from being displayed based on the output voltage and current. You can disconnect the DUT and follow the procedure below to clear the trip and allow the unit to output the desired voltage and current once more. A trip may

1. Errors in the set OVP level value. Thus, increasing the level value may solve this problem.
2. Using DUTs with coils or motors that create counter–electromotive force.
Inserting a UF–diode appropriate for the current capacity as in the figure below
Can prevent this problem.
3. Using the power source as the DUT's power source. If the battery is charging or discharg
A value higher than the set level value can cause a trip.
Inserting a diode appropriate for the current capacity as in the figure below
can prevent this problem.



4. If it is difficult to resolve the trip, you can turn off the OVP feature.
To turn off this feature, switch to factory mode and select “Disable” in “5.OVP USE.”

	<ul style="list-style-type: none"> The LCD will display "OVP TRIPPED" if an OVP trip occurs.
	<ul style="list-style-type: none"> To clear the OVP trip, start with increasing the OVP level. Press the protection key to set the level. <p>Displayed LCD Message protect> 1.ovp</p>
	<ul style="list-style-type: none"> Press the protection key once more in "protect> 1.ovp." <p>Displayed LCD Message ovp set> 15.00v</p>
	<ul style="list-style-type: none"> Use the cursor keys to place the cursor on the desired value.
	<ul style="list-style-type: none"> Use the encoder switch to increase the level value.
	<ul style="list-style-type: none"> Press the protection key when the change is complete. <p>Displayed LCD Message CHANGED</p> <p>After the message above is displayed, you will be returned to the state before the trip occurred.</p>

» Related remote interface commands

VOLT:OVP {<voltage>}

VOLT:OVP?

VOLT:OVP:TRIP?

VOLT:OVP:CLE





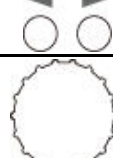

Application1: Checking if a trip occurred and increasing the OVP level if it did
VOLT:OVP:TRIP? Return value "1" Checking if there is an OVP trip
VOLT:OVP 32 Set OVP Level
VOLT:OVP:CLE OVP Trip Clear

Application2: Checking if a trip occurred and decreasing the OVP level if it did
VOLT:OVP:TRIP? Return value "1" Checking if there is an OVP trip
VOLT 0 Setting the voltage to 0V
VOLT:OVP:CLE OVP Trip Clear

3-5. Programming Over Current Protection(OCP)

This function protects the DUT from power supply if the output voltage is higher than the OCP level. The procedure below describes how to set the OCP level and turning it on and off.

The OCP level values shown below may be different from the actual values.

	<p>■ Turn on the power switch. After turning on power, check if the unit is in "**OUTPUT OFF**" mode.</p>
<p>Protection</p> 	<p>■ Press the protection key to set the levels. Displayed LCD Message PROTECT> 1.OVP</p>
	<p>■ Use the right cursor key to go to the OCP menu. Displayed LCD Message PROTECT> 2.OCP</p>
<p>Protection</p> 	<p>■ Press the protection key once more in "protect> 2.ocp." Displayed LCD Message OcP SET> 88.00a</p>
	<p>■ Use the cursor keys to place the cursor on the desired value. ■ Control the encoder switch to change the level value. The OCP level cannot be set lower than the currently outputted current to prevent operator mistakes.</p>
<p>Protection</p> 	<p>■ Press the protection key when the change is complete. Displayed LCD Message CHANGED Return to the previous stat after the message above is displayed.</p>
<p>Canceling</p> <p>Wait for 5 Seconds</p>	<p>■ If you want to cancel the setting, wait for 5 seconds. Displayed LCD Message CANCEL...</p>

» Related remote interface commands

CURR:OCP {<current>}

CURR:OCP?

CURR:OCP:TRIP?

CURR:OCP:CLE

Application: CURR:OCP 50

Set OCP Level







Note

Refer to "Initial Setting Value" in "1-6 Check after Power On" for the initial OVP settings

The “OCP TRIPPED” message will be displayed if the actual output current is higher than the OCP level value, and this stops the source from being displayed based on the output voltage and current. You can disconnect the DUT and follow the procedure below to clear the trip and allow the unit to output the desired voltage and current once more. A trip may be caused by...

1. Errors in the set OCP level value. Thus, increasing the level value can prevent this problem.
2. Using DUTs with coils or motors that create counter-electromotive force. As shown in Figure < 3-2 > you can prevent this problem by inserting a UF-diode appropriate for the current capacity.
3. Using the power source as the DUT's power source. If the battery is charging or discharging, a value higher than the set level value can cause a trip. Inserting a diode appropriate for the current capacity as in the figure below can prevent this problem.
4. If it is difficult to resolve the trip, you can turn off the OVP feature.

To turn off this feature, switch to factory mode and select “Disable” in “5.OVP USE.”

	<p>■ The LCD will display "OCP TRIPPED" if an OCP trip occurs.</p>
	<p>■ To clear the OCP trip, start with increasing the OCP level. Press the protection key to set the level.</p> <p>Displayed LCD Message Protect> 1.ovp</p>
	<p>■ Use the right cursor key to go to the OCP menu.</p> <p>Displayed LCD Message PROTECT> 2.OCP</p>
	<p>■ Press the protection key once more in “protect> 2.ocp.”</p> <p>Displayed LCD Message OCP SET> 50.00a</p>
	<p>■ Use the cursor keys to place the cursor on the desired value.</p>
	<p>■ Use the encoder switch to increase the level value.</p>
	<p>■ Press the protection key when the change is complete.</p> <p>Displayed LCD Message CHANGED</p> <p>After the message above is displayed, you will be returned to the state before the trip occurred.</p>

» Related remote interface commands

CURR:OCP {<current>}

CURR:OCP?

CURR:OCP:TRIP?

CURR:OCP:CLE



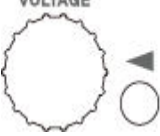






Application1: Checking if a trip occurred and increasing the OCP level if it did
CURR:OCP:TRIP? Return value "1" Checking if there is an OCP trip
CURR:OCP 80 Set OCP Level
CURR:OCP:CLE OCP Trip Clear

Application2: Checking if a trip occurred and lowering the current level if it did
CURR:OCP:TRIP? Return value "1" Checking if there is an OCP trip
CURR 0 Setting the current to 0A

3-6. Programming Under Voltage Limit (UVL)

The encoder switch can change the voltage from 0V up to the maximum value. If the UVL is active however, the encoder can change the voltage only from the UVL up to the maximum voltage.

The UVL level values shown below may be different from the actual values.

	<p>Turn on the power switch. After turning on power, check if the unit is in "**OUTPUT OFF**" mode.</p>
	<p>Since the voltage limit must be set higher than the set UVL value before setting the UVL, the voltage limit must be set first.</p>
	<p>When setting the voltage, use the left cursor key to move the cursor to the desired voltage range, and use the encoder switch to select your desired voltage. <i>The voltage cannot exceed the protection level if the Protection(OVP/UVL/OVL) settings are active. If you try to exceed the limit in this case, the "PROTECTION LIMIT" message will be displayed, and the voltage will be set to the protection level.</i></p>
	<p>Press the protection key to set the UVL level. Displayed LCD Message PROTECT> 1.OVP</p>
	<p>Use the right cursor key to go to the OVL menu. Displayed LCD Message PROTECT> 3.uvl</p>
	<p>Press the protection key once more in "protect> 3.UVL." Displayed LCD Message UVL SET> 00.00v</p>
	<p>Use the cursor keys to place the cursor on the desired value.</p>
	<p>Control the encoder switch to change the level value. The UVL level cannot be set lower than the currently outputted voltage to prevent operator mistakes.</p>
	<p>Press the protection key when the change is complete. Displayed LCD Message CHANGED Return to the previous stat after the message above is displayed.</p>
<p>Canceling Wait for 5 Seconds</p>	<p>If you want to cancel the setting, wait for 5 seconds. Displayed LCD Message CANCEL...</p>

» Related remote interface commands

VOLT:UVL {<voltage>}
VOLT:UVL ?

Application: VOLT:UVL 5

Set UVL Level








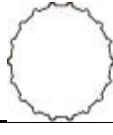

Note

Refer to "Initial Setting Value" in "1-6 Check after Power On" for the initial OVP settings

3-7. Programming Over Voltage Limit (OVL)

The encoder switch can change the voltage from 0V up to the maximum value. If the OVL is active the encoder can change the voltage only from 0V up to the OVL.

The OVL level values shown below may be different from the actual values.

	<p>Turn on the power switch. After turning on power, check if the unit is in "**OUTPUT OFF**" mode.</p>
	<p>Since the voltage limit must be set lower than the set OVL value before setting the UVL, the voltage limit must be set first.</p>
	<p>When setting the voltage, use the left cursor key to move the cursor to the desired voltage range, and use the encoder switch to select your desired voltage. <i>The voltage cannot exceed the protection level if the Protection(OVP/UVL/OVL) settings are active. If you try to exceed the limit in this case, the "PROTECTION LIMIT" message will be displayed, and the voltage will be set to the protection level.</i></p>
	<p>Press the protection key to set the OVL level. Displayed LCD Message PROTECT> 1.OVP</p>
	<p>Use the right cursor key to go to the OVL menu. Displayed LCD Message PROTECT> 4.Ovl</p>
	<p>Press the protection key once more in "protect> 4.OVL." Displayed LCD Message OVL SET> 31.50v</p>
	<p>Use the cursor keys to place the cursor on the desired value.</p>
	<p>Control the encoder switch to change the level value. The OVL level cannot be set lower than the currently outputted voltage to prevent operator mistakes.</p>
	<p>Press the protection key when the change is complete. Displayed LCD Message CHANGED Return to the previous stat after the message above is displayed.</p>
<p>Canceling Wait for 5 Seconds</p>	<p>If you want to cancel the setting, wait for 5 seconds. Displayed LCD Message CANCEL...</p>

» Related remote interface commands

VOLT:OVL {<voltage>}

VOLT:OVL?

Application: VOLT:OVL 20

Set OVL Level



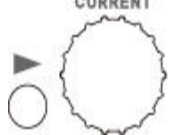






Note

Refer to "Initial Setting Value" in "1-6 Check after Power On" for the initial OVP settings

3-8. Programming Under Current Limit (UCL)

The encoder switch can change the current from 0A up to the maximum value. If the UCL is active however, the encoder can change the current only from the UCL up to the maximum voltage.

The UCL level values shown below may be different from the actual values.

	<p>Turn on the power switch. After turning on power, check if the unit is in "**OUTPUT OFF**" mode.</p>
	<p>Since the current limit must be set higher than the set UCL value before setting the UCL, the current limit must be set first.</p>
	<p>When setting the current, use the left cursor key to move the cursor to the desired current range and use the encoder switch to select your desired current. <i>The current cannot exceed the protection level if the Protection(OCP/UCL/OCL) settings are active. If you try to exceed the limit in this case, the "PROTECTION LIMIT" message will be displayed, and the current will be set to the protection level.</i></p>
	<p>Press the protection key to set the UCL level. Displayed LCD Message PROTECT> 1.OVP</p>
	<p>Use the right cursor key to go to the UCL menu. Displayed LCD Message PROTECT> 5.uCl</p>
	<p>Press the protection key once more in "protect> 5.UCL." Displayed LCD Message UCL SET> 00.00A</p>
	<p>Use the cursor keys to place the cursor on the desired value.</p>
	<p>Control the encoder switch to change the level value. The UCL level cannot be set higher than the currently outputted voltage to prevent operator mistakes.</p>
	<p>Press the protection key when the change is complete. Displayed LCD Message CHANGED Return to the previous stat after the message above is displayed.</p>
<p>Canceling Wait for 5 Seconds</p>	<p>If you want to cancel the setting, wait for 5 seconds. Displayed LCD Message CANCEL...</p>

» Related remote interface commands

CURR:UCL {<current>}

CURR:UCL?

Application: CURR:UCL 5

Set UCL Level



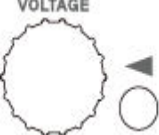






Note

Refer to "Initial Setting Value" in "1-6 Check after Power On" for the initial OVP settings

3-9. Programming Over Current Limit (OCL)

The encoder switch can change the current from 0A up to the maximum value. If the OCL is active however, the encoder can change the current only from 0A up to the OCL.

The OCL level values shown below may be different from the actual values.

	<ul style="list-style-type: none"> Turn on the power switch. After turning on power, check if the unit is in "**OUTPUT OFF**" mode.
	<ul style="list-style-type: none"> Since the current limit must be set lower than the set OCL value before setting the OCL, the current limit must be set first.
	<ul style="list-style-type: none"> When setting the current, use the left cursor key to move the cursor to the desired current range and use the encoder switch to select your desired current. <i>The current cannot exceed the protection level if the Protection(OCP/UCL/OCL) settings are active. If you try to exceed the limit in this case, the "PROTECTION LIMIT" message will be displayed, and the current will be set to the protection level.</i>
	<ul style="list-style-type: none"> Press the protection key to set the OCL level. Displayed LCD Message PROTECT> 1.OVP
	<ul style="list-style-type: none"> Use the right cursor key to go to the OCL menu. Displayed LCD Message PROTECT> 6.Ocl
	<ul style="list-style-type: none"> Press the protection key once more in "protect> 6.OCL." Displayed LCD Message OCL SET> 88.00A
	<ul style="list-style-type: none"> Use the cursor keys to place the cursor on the desired value.
	<ul style="list-style-type: none"> Control the encoder switch to change the level value. The OCL level cannot be set lower than the currently outputted current to prevent operator mistakes.
	<ul style="list-style-type: none"> Press the protection key when the change is complete. Displayed LCD Message CHANGED Return to the previous stat after the message above is displayed.
<p>Canceling</p> <p>Wait for 5 Seconds</p>	<ul style="list-style-type: none"> If you want to cancel the setting, wait for 5 seconds. Displayed LCD Message CANCEL...

» Related remote interface commands

CURR:OCL {<current>}

CURR:OCL?

Application: CURR:OCL 44




Set OCL Level

Note

Refer to "Initial Setting Value" in "1-6 Check after Power On" for the initial OVP settings

3-10. Key Lock

This feature locks and unlocks the front panel.
It is designed to prevent the operator from changing the set values by accident.

	<ul style="list-style-type: none"> Turn on the power switch. After turning on power, check if the unit is in "**OUTPUT OFF**" mode.
	<ul style="list-style-type: none"> Press and hold the protection/key lock key to lock the front panel. The lock lamp lights up when the front panel is locked.
	<ul style="list-style-type: none"> Press and hold the protection/key lock key to unlock the front panel. The lock lamp turns off when the front panel is unlocked.

» Related remote interface commands

`KEYL {OFF|ON}`
`KEYL?`

Application: Checking the key lock and locking it if it is unlocked

`KEYL?` Return value "0" *Checking lock status*
`KEYL ON` *Lock settings*

Note1

Enabling the auto key lock feature in factory mode automatically locks the front panel 1 minute after the last operated moment.

Note2

The front panel is always locked regardless of the key lock feature In remote interface mode.

3-11. IO/Local

This key activates the unit's remote interface. You can choose between the RS232C and RS485 protocols. The unit must be set first before activating the remote interface. The RS232C protocol is selected as default, and the Baud rate is set for 9,600bps when at the ti shipment from the factory.

Connection settings are available only from the front panel.

- The IO/Local settings are permanently saved on the non-volatile memory before being cha so it does not change even when power is turned off.
- When the remote interface is activated, the front panel's RMT lamp lights up, and the unit can be controlled only through the remote device.
- Press the IO/Local key and switch to local mode to return the control to the unit.



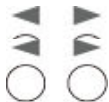



This turns off the RMP lamp.

If the RMT lamp is off, but you cannot control the unit, there is a high possibility that the unit is in Press the protection key and turn off the lock lamp.

- You can switch to remote mode by pressing the IO/Local key for 3 seconds.

RS232C Settings

The procedure for setting RS232C is described below.

	<ul style="list-style-type: none"> ■ Turn on the power switch. After turning on power, check if the unit is in "**OUTPUT OFF**" mode.
	<ul style="list-style-type: none"> ■ Press the IO/Local key for RS232C settings. Displayed LCD Message I/O> 1.RS232C This can be different depending on the previous state.
	<ul style="list-style-type: none"> ■ Depending on the previous settings, RS232C or RS485, USB, TCP/IP is displayed while the unit is booting up. If "1.RS232C" is not displayed, press the cursor key to set "I/O> 1.RS232C" displayed on the LCD. Displayed LCD Message I/O> 1.RS232C
	<ul style="list-style-type: none"> ■ Press the IO/Local Key for the Baud rate settings. Displayed LCD Message >br 1: 9600 bps This can be different depending on the previous state.
	<ul style="list-style-type: none"> ■ The Baud rate is composed of 9,600, 19,200, 38,400, 57,600, 115,200, and 230,400bps. This must be identical to the remote interface's Baud rate. For example, press the right cursor key four times to select 115,200bps. Displayed LCD Message >br 5: 115200 bps
	<ul style="list-style-type: none"> ■ Press the IO/Local Key to complete the settings. Displayed LCD Message SAVED Now, the interface is RS232C, and the Baud rate is 115,200bps.

Note

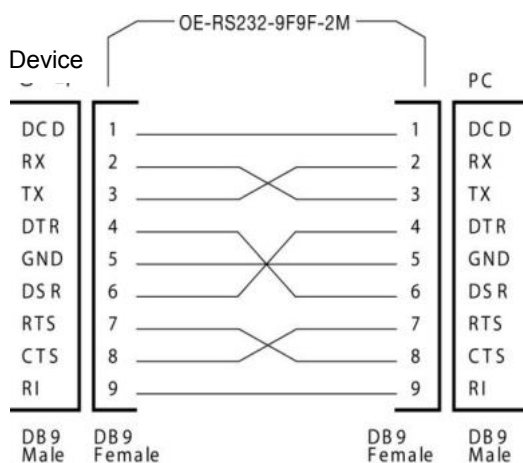
What is bps? This stands for bit/sec, which means how many bits of data can be transferred per second. The higher the number is, the faster the speed.

RS232C Installation Settings

- The RS232C is fixed as shown below.

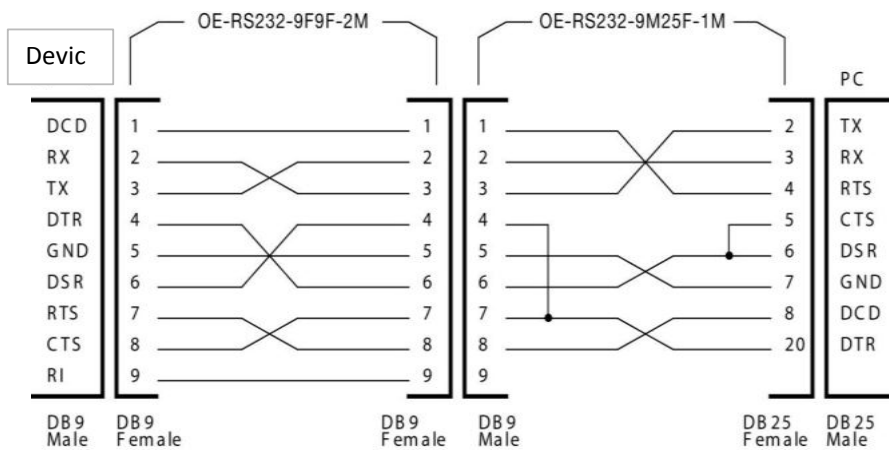
Data Bit: 8
 Stop Bit: 1
 Parity Bit: None

- RS232C data frame method







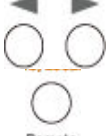


- It is convenient to use an additional adapter cable if the remote device supports only the D platform or if you want to use that platform.

"Refer to 1-2. Accessories and Options" to choose your desired use and length.



RS485 Settings

You can connect and control up to 255 units in parallel including the remote device. The procedure for this setting is described below.

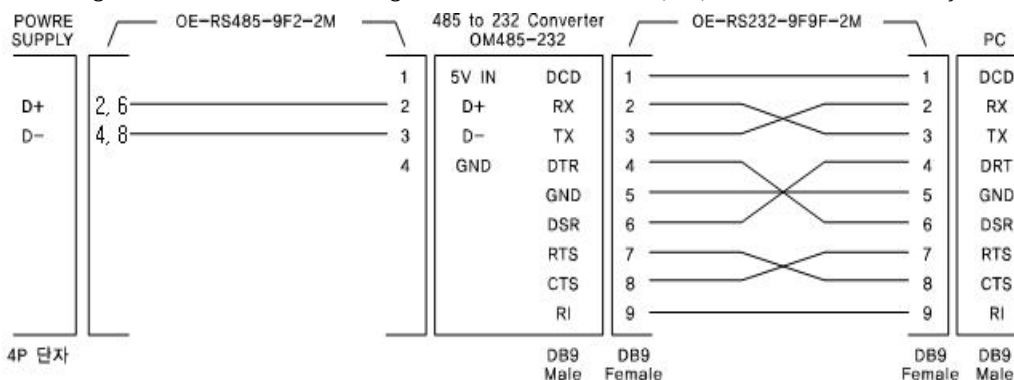
	<ul style="list-style-type: none"> Turn on the power switch. After turning on power, check if the unit is in "**OUTPUT OFF**" mode.
	<ul style="list-style-type: none"> Press the IO/Local key for the RS485 settings. Displayed LCD Message: <code>I/O> 1.RS232C</code> <i>This can be different depending on the previous state.</i>
	<ul style="list-style-type: none"> Depending on the previous settings, RS485, RS232C, USB, or TCP/IP is displayed while the unit is booting up. If "1.RS485" is not displayed, press the cursor key to set "I/O> 2.RS485" displayed on the LCD. Displayed LCD Message: <code>I/O> 2.RS485</code>
	<ul style="list-style-type: none"> Press the IO/Local Key for the Baud rate settings. Displayed LCD Message: <code>>br 1: 9600 bps</code> <i>This can be different depending on the previous state</i>
	<ul style="list-style-type: none"> The Baud rate is composed of 9,600, 19,200, 38,400, 57,600, 115,200, and 230,400bps. This must be identical to the remote interface's Baud rate. Press the IO/Local Key after selecting the Baud rate. Displayed LCD Message: <code>>address no. 05</code>
	<ul style="list-style-type: none"> The address can be changed through the encoder switch. The unit's address must be unique in case of parallel connection.
	<ul style="list-style-type: none"> Press the IO/Local Key to complete the settings. Displayed LCD Message: <code>SAVED</code> This changed the unit's interface into RS485 connection.

Note

A built-in RS485 to RS232C converter module is sold as an option by ODA. An additional 5V power is required for external modules.

RS485 Installation Settings

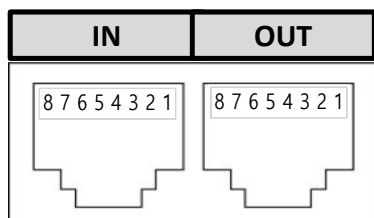
- Wiring is required as an additional harness to connect the RS485 line and the remote device
- The figure below shows the diagram of ODA's remote (PC) device connected by the 485 to 232 co



485 to 232 Converter

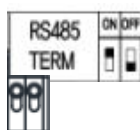
< Figure 3-5 >

RS232C, RS485 Wiring Specifications and Terminating Resistors



< Figure 3-6 >

IN Port			Out Port		
No	Name	Description	No	Name	Description
1	N.C.		1	N.C.	
2	B-	Data -	2	N.C.	
3	RX	RX(RS232)	3	B-	Data -
4	A+	Data +	4	A+	Data +
5	GND	Ground	5	GND	Ground
6	B-	Data -	6	B-	Data -
7	TX	TX(RS232)	7	N.C.	
8	A+	Data +	8	A+	Data +

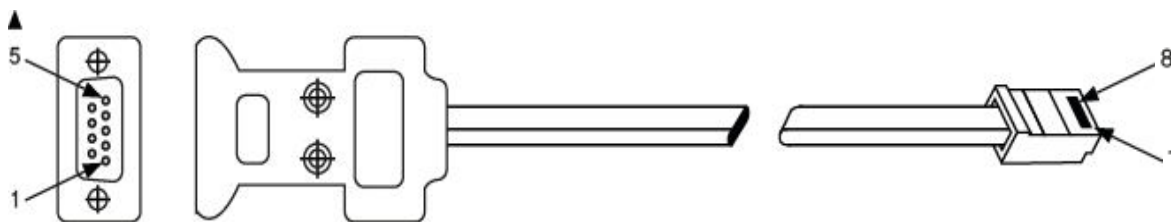


< Figure 3-7 >

	Switch Status	Switch Location
Final Device on the Line	ON	All Up
Not Final Device on the Line	OFF	All Down

- The IN Port socket has a built-in RS232C / RS485 connection.
- The Out Port socket is a port for parallel RS485 wiring.
- Resistance value when using terminating resistors
 - Data+, Data- line: 120Ω 1/4W
 - Data+ Full Up resistance: 2KΩ 1/4W
 - Data- Full Down resistance: 2KΩ 1/4W

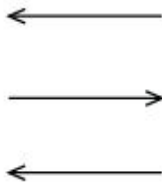
RS232C,RS485 Wiring Cable Specifications



< Figure 2 >

RS232C Pin Diagram Specifications

PC Port : DB-9 Connector (Female)	
Pin Number	Name
2	RX
3	TX
5	SG



EX Port : RJ-45 Jack (8pin)	
Pin Number	Name
7	TX
3	RX
5	SG

RS485 Pin Diagram Specifications

PC, Converter Port: RS-485 Connector	
Pin Number	Name
?	D-
?	D+
?	SG
?	D-
?	D+








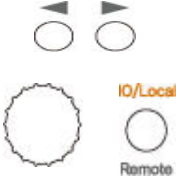
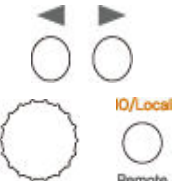
EX Port: RJ-45 Jack (8pin)	
Pin Number	Name
2	D-
4	D+
5	SG
6	D-
8	D+

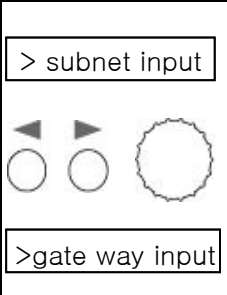
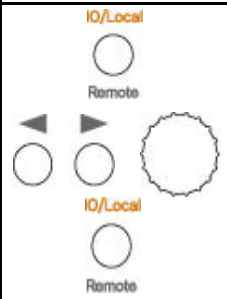

TCP/IP Settings (Option)

The TCP/IP connection module is sold as an option, and it must be built into the unit when purchased since it is not an external module.

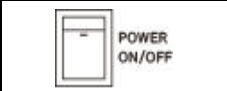
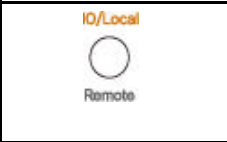
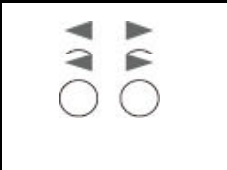
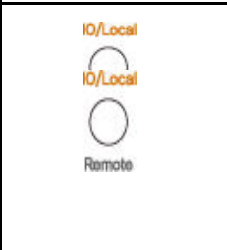
The module supports 10/100Mbps. Giving the unit a fixed IP allows the module to be controlled not only within the office network PCs but anywhere across the world.


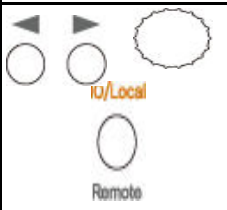
*Direct IP Input Settings

	<ul style="list-style-type: none"> Turn on the power switch. After turning on power, check if the unit is in "**OUTPUT OFF**" mode.
	<ul style="list-style-type: none"> Press the IO/Local Key for the TCP/IP settings. Displayed LCD Message: I/O> 1.RS232C This can be different depending on the previous state.
	<ul style="list-style-type: none"> Depending on the previous settings, TCP/IP, RS232C, RS232C, or USB is displayed while the unit is booting up. If "4.tcp/ip" is not displayed, press the cursor key to set "I/O> 4.tcp/ip" displayed on the LCD. Displayed LCD Message: I/O> 4.tcp/ip
	<ul style="list-style-type: none"> Press the IO/Local Key for the TCP/IP settings. Displayed LCD Message: >1. Static This can be different depending on the previous state. There are two methods for setting a fixed IP. You can directly input a fixed IP or use the DHCP method by receiving an IP from the server. The procedure below directly entered a fixed IP.
	<ul style="list-style-type: none"> Use the cursor key to select "1.static" and press the IO/Local key. The TCP/IP Port settings must be identical to the PC. Displayed LCD Message: >port 5000 This can be different depending on the previous state.
	<ul style="list-style-type: none"> The device number can be changed through the encoder switch. After setting up the port by using the cursor key and encoder switch, press the IO/Local key.
<div style="border: 1px solid black; padding: 2px; display: inline-block;">> local ip input</div> 	<ul style="list-style-type: none"> After briefly displaying the "Local IP Input" message, the LCD will be switched to the IP input screen. Displayed LCD Message: >192.168.123.100 Use the cursor key and encoders to enter the fixed IP. Press the IO/Local key after completing input.




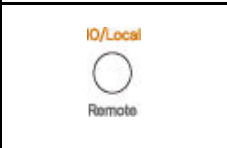

	<ul style="list-style-type: none"> After briefly displaying the "Subnet Input" message, the LCD will be switched to the subnet mask input screen. Displayed LCD Message >255.255.255.0 Use the cursor key and encoders to enter the subnet mask. Press the IO/Local key after completing input.
	<ul style="list-style-type: none"> After briefly displaying the "gate way Input" message, the LCD will be switched to the gateway input screen. Displayed LCD Message >192.168.123.254 Use the cursor key and encoders to enter the subnet mask. Press the IO/Local key after completing input.
	<ul style="list-style-type: none"> Press the IO/Local Key to complete the settings. Displayed LCD Message SAVED This changed the unit's interface into TCP/IP connection.

*DHCP Method Setting Procedure

	<ul style="list-style-type: none"> Turn on the power switch. After turning on power, check if the unit is in "**OUTPUT OFF**" mode.
	<ul style="list-style-type: none"> Press the IO/Local Key for the TCP/IP settings. Displayed LCD Message I/O> 1.RS232C This can be different depending on the previous state.
	<ul style="list-style-type: none"> Depending on the previous settings, TCP/IP, RS232C, RS232C, or USB is displayed while the unit is booting up. If "4.tcp/ip" is not displayed, press the cursor key to set "I/O> 4.tcp/ip" displayed on the LCD. Displayed LCD Message I/O> 4.tcp/ip
	<ul style="list-style-type: none"> Press the IO/Local Key for the TCP/IP settings. Displayed LCD Message >1. Static This can be different depending on the previous state. There are two methods for setting a fixed IP. You can directly input a fixed IP or use the DHCP method by receiving an IP from the server. The procedure below is for the DHCP method settings.

	<ul style="list-style-type: none"> Use the cursor key to select "2.dhcp" and press the IO/Local key. The TCP/IP Port settings must be identical to the PC. Displayed LCD Message >port 5000 <i>This can be different depending on the previous state.</i>
	<ul style="list-style-type: none"> Set the port by using the cursor key and encoder switch. Press the IO/Local Key after completing the settings.
	<ul style="list-style-type: none"> The "wait..." message will be displayed. Displayed LCD Message wait... Standby while the unit is receiving an IP from the server. After normally receiving an IP, the unit will display the received IP and exit the menu. Displayed LCD Message Local ip is → 192.168.123.32 If an IP is not received within a certain time, the unit will display the "Time Out Error" message and exit the menu.

*Viewing IP






	<ul style="list-style-type: none"> Turn on the power switch. After turning on power, check if the unit is in "**OUTPUT OFF**" mode.
	<ul style="list-style-type: none"> Press the IO/Local Key for the TCP/IP settings. Displayed LCD Message I/O> 1.RS232C <i>This can be different depending on the previous state.</i>
	<ul style="list-style-type: none"> Depending on the previous settings, TCP/IP, RS232C, RS485, or USB is displayed while the unit is booting up. If "4.tcp/ip" is not displayed, press the cursor key to set "I/O> 4.tcp/ip" displayed on the LCD. Displayed LCD Message I/O> 4.tcp/ip
	<ul style="list-style-type: none"> Press the IO/Local Key to view your IP. Displayed LCD Message >1. Static <i>This can be different depending on the previous state.</i>
	<ul style="list-style-type: none"> Use the cursor key to show "3.IP CHECK." Displayed LCD Message >3. ip check
	<ul style="list-style-type: none"> Pressing the IO/Local key shows the IP set for the unit. After a certain time, the unit will exit the menu. Otherwise, you can press the IO/Local key to exit the menu manually. Displayed LCD Message >192.168.123.32

Note

Standard UTP (LAN) cables have been used.






Delimiter

You can choose the transferred data's terminal code as LF, CR, or CRLF. The default setting at the time of shipment from the factory is LF. The procedure for this setting is described below.

	<ul style="list-style-type: none"> Turn on the power switch. After turning on power, check if the unit is in "**OUTPUT OFF**" mode.
	<ul style="list-style-type: none"> Press the IO/Local Key to change the delimiter. Displayed LCD Message <input type="text" value="I/O>"/> <i>This can be different depending on the previous state.</i>
	<ul style="list-style-type: none"> Press the cursor key to show "5.delimiter." Displayed LCD Message <input type="text" value=">delimiter lf"/>
	<ul style="list-style-type: none"> Press the IO/Local key to change the settings to CR. Displayed LCD Message <input type="text" value="delimiter"/> <i>This can be different depending on the previous state.</i>
	<ul style="list-style-type: none"> Press the cursor key to select CR. After pressing the cursor key to show "delimiter cr," press the IO/Local key to save your settings. Displayed LCD Message <input type="text" value="delimiter"/> → <input type="text" value=""/>

Response

You may receive a response from the device when transmitting setting orders. This is unlocked at the time of shipment from the factory. The procedure for this setting is described below.




	<ul style="list-style-type: none"> Turn on the power switch. After turning on power, check if the unit is in "**OUTPUT OFF**" mode.
	<ul style="list-style-type: none"> Press the IO/Local Key to change the response. Displayed LCD Message <input type="text" value="I/O>"/> <i>This can be different depending on the previous state.</i>
	<ul style="list-style-type: none"> Press the cursor key to show "6.response." Displayed LCD Message <input type="text" value="I/O>"/>
	<ul style="list-style-type: none"> Press the IO/Local Key to receive a response. Displayed LCD Message <input type="text" value=">response"/> <i>This can be different depending on the previous state.</i>
	<ul style="list-style-type: none"> Press the cursor key to show "YES." After pressing the cursor key to show "response yes," press the IO/Local key to save your settings. <input type="text" value="response yes"/> → <input type="text" value="SAVED"/>

3-12. Limit Display





This key is for viewing the currently set voltage and current.

The LMT lamp lights up to show that the unit is currently in limit display state. When the lamp is off, the unit is in ReadBack Display (actual output voltage/current) mode. The procedure below is for setting the limit display.

***Limit Display in Output OFF mode**

	<ul style="list-style-type: none"> Turn on the power switch. After turning on power, check if the unit is in **OUTPUT OFF** mode.
<p>Limit</p> 	<ul style="list-style-type: none"> Press the Limit Display key to view the voltage and current limitations.
	<ul style="list-style-type: none"> The LMT lamp lights up, and the LCD shows the currently set voltage and current values. Displayed LCD Message 00.00V 88.00A By using the cursor keys and encoders in this state, the voltage and current settings can be changed.
<p>Limit</p> 	<ul style="list-style-type: none"> Press the IO/Local key once more to disable the voltage and current settings mode. Displayed LCD Message **output off**

***Limit Display in Output ON mode**

	<ul style="list-style-type: none"> Turn on the power switch. After turning on power, check if the unit is in **OUTPUT OFF** mode.
<p>Output</p> 	<ul style="list-style-type: none"> Press the Output ON/OFF key for voltage and current output. Displayed LCD Message 00.00V 00.00A
<p>Limit</p> 	<ul style="list-style-type: none"> Press the Limit Display key to view the voltage and current limitations.
	<ul style="list-style-type: none"> The LMT lamp lights up, and the LCD shows the currently set voltage and current values. Displayed LCD Message 00.00V 88.00A By using the cursor keys and encoders in this state, the voltage and current settings can be changed.
<p>Limit</p> 	<ul style="list-style-type: none"> Press the IO/Local key once more to disable the voltage and current settings mode. Displayed LCD Message 10.00v 00.00a <i>This example set the voltage to 10V</i>





3-13. Store

You can save the current power supply's state in the 『User Memory』. The 『User Memory』 is composed of 10 slots, and the set Output ON/OFF state, voltage, current, OVP, OCP, UVL, OVL, UCL, and OCL level values are saved.

The procedure for saving the settings on the 『User Memory』 is shown below.

The Store key also provides a software calibration feature that is required for calibrating the unit.

Refer to "4. CALIBRATION" for the calibration feature

	<ul style="list-style-type: none"> Turn on the power switch. After turning on power, check if the unit is in "**OUTPUT OFF**" mode.
	<ul style="list-style-type: none"> Press the STORE key to save the current power supply's state in the 『User Memory』. <p>Displayed LCD Message STORE NO, 01</p>
	<ul style="list-style-type: none"> Use the encoder switch to select the slot you want to use among 01 ~ 10. For example, turn the encoder switch once clockwise to save the state in slot 02. <p>Displayed LCD Message STORE NO, 02</p>
	<ul style="list-style-type: none"> Press the STORE key once more to save in the selected slot. <p>Displayed LCD Message Saved</p>
	<ul style="list-style-type: none"> The LCD returns to the previous screen after displaying the "Saved" message.

» Related remote interface commands

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

Application. *SAV 4 This saves the current state in the 4th 『User Memory』 slot

Note

Saving in Output ON state can be dangerous since the output can be activated immediately during recall, so save in OFF state for safety.

Note

The 『User Memory』 can be reset. "Refer to 5-3. USER-MEM CLEAR"





3-14. Recall

This feature applies the settings saved in the 『User Memory』 by the STORE feature to the current power supply. There are 10 memory slots, with the set Output ON/OFF state, voltage, current, OVP, OCP, UVL, OVL, UCL, and OCL values applied.

The procedure for activating recall is shown below.

The unit supports a FACTORY feature as well as the RECALL feature.

Refer to "5.FACTORY " for the factory feature

	<ul style="list-style-type: none"> Turn on the power switch. After turning on power, check if the unit is in "**OUTPUT OFF**" mode.
	<ul style="list-style-type: none"> Press the RECALL key to apply the data saved in the 『User Memory』 to the current power supply. Displayed LCD Message RECALL NO, 01
	<ul style="list-style-type: none"> Use the encoder switch to select the slot you want to use among 01 ~ 10. For example, turn the encoder switch once clockwise to save the state in slot 02. Displayed LCD Message RECALL NO, 02
	<ul style="list-style-type: none"> Press the RECALL key once more to apply the settings saved in the selected slot. Displayed LCD Message saved
	<ul style="list-style-type: none"> The LCD returns to the previous screen after displaying the "saved" message.

» Related remote interface commands

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




Application. *RCL 4 This applies the settings saved in the 4th 『User Memory』 slot to the current state

Note

Storing in Output ON state can be dangerous since the output can be activated immediately during recall, For safety, store in OFF state even if it is inconvenient.

3-15. Output ON/OFF

This feature turns the power source from the output terminal on and off. It allows you to shut down power from the DUT without removing it. The procedure for activating this is shown below.

	<ul style="list-style-type: none"> Turn on the power switch. After turning on power, check if the unit is in "**OUTPUT OFF**" mode.
<p>Output</p> 	<ul style="list-style-type: none"> This is the default Output OFF state. To approve output, press the OUTPUT ON/OFF key once.
<p>Output</p> 	<ul style="list-style-type: none"> To turn off the output again, press the OUTPUT ON/OFF key once more.

» Related remote interface commands

OUTP {OFF/ON}

OUTP?

Application. How to check the output state and turning it on if it is off

OUTP? Return value "0" Check Output State

OUTP ON Approve Output

Note

If the unit is not in Output OFF mode when it is first turned on, disabling the last state in Factory mode the power supply always shift to default initialization mode, enabling use of Output OFF mode at all times. The Last State mode is a feature that lets you save the last set state to recall the settings when you turn on the unit again.





3-16. Error Message Display

Up to 10 errors such as self-testing errors, calibration errors, and SCPI program decoding errors can be saved in the volatile memory when they occur.

For more details regarding errors, refer to "7.Error Messages"

- The memory stacks the errors, with the first error accessed last.
- Up to 10 errors are saved, and the oldest errors are deleted in order starting from the 11th
- Viewing the errors by pressing the ERROR key deletes the errors from the stack starting with the latest error.
- The ERR lamp lights up, and an alarm sounds whenever errors occur.

Viewing Errors

	<ul style="list-style-type: none"> ■ Turn on the power switch. After turning on power, check if the unit is in "**OUTPUT OFF**" mode.
	<ul style="list-style-type: none"> ■ Press and hold the ERROR key to view errors. The following message is displayed if there are no errors, and the LCD returns to the previous state after a moment: Displayed LCD Message NO ERROR The ERR lamp is turned off. If there is an error, the corresponding error code is displayed. Displayed LCD Message ERROR NO, -200
	<ul style="list-style-type: none"> ■ Press the ERROR key to view the next error. If there is an error, the corresponding error code is displayed. Displayed LCD Message ERROR NO, -10
	<ul style="list-style-type: none"> ■ You can continue to check the next error by continuing to press the ERROR key.

» Related remote interface commands

SYST:ERR?

Application: View Error

SYST:ERR? Return value :-222, "Out of data"

You can view the error code and description.

Note

1. Only the error code can be viewed from the front panel. The description can be viewed along with error code in the remote interface.

2. What is a STACK MEMORY? This structure follows the FILO (First In Last Out) rule, which deletes the data added later first to access the oldest data.

What is a QUEUE MEMORY? This structure follows the FIFO (First In First Out) rule, which deletes the oldest data when new data is added.

4. CALIBRATION

Warning

Only personnel or institutes with prior knowledge should use the calibration feature.
Calibration must be done regul > For Precision Use: Every 180 Days
> For Normal Use: Every 365 Days

Various environmental factors such as aging of the device, temperature, or humidity can cause a small error in the performance. Therefore, this feature calibrates the device to the best condition according to the environment.

4-1. Characteristics

- No need to open the power supply cover for calibration
- Calibration can be done through the front panel key
- Calibration can be done through the PC-based remote interface
- Storing on the non-volatile permanent memory
- Calibration data restoration and backup support
- Easy to control by entering the calibration equipment's meter values 1:1

4-2. Preparing for Calibration

- Use measuring instruments that are more precise than the power supply.
- Warm up the power supply and measuring instrument for calibration for more than 1 hour between 20°C ~ 30°C
- Maintain the humidity below 80%.
- Connect power supply's output terminal and measuring instrument so that there is no contact resistance.
- The power supply's GND and the measuring instrument's Earth terminals must be connect To the AC input power's GND.
- Turn off all electromagnetic equipment unnecessary for the calibration.

4-3. Equipment Required for Calibration

Using measuring instruments with higher performance than the following is recommended for calibrating power supply.

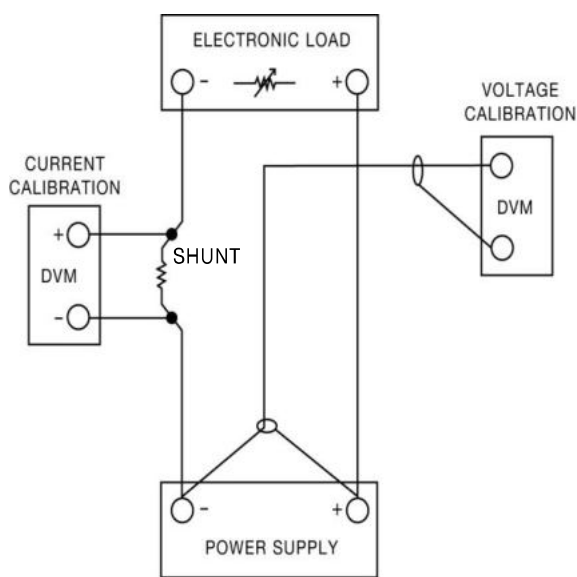
M/I	Required Performance	Recommended Equipment	Use
Digital Voltmeter	Resolution: 0.1 mV Accuracy: 0.01%	Agilent 34401A	For Voltage Calibration
Electronic Load	Voltage Range: 500 Vdc Current Range: 120 Adc Open and Short Switches Transient On/Off		For Power Supply Protection During Current Calibration (General-purpose resistors can be used)
Current monitoring Resistor (Shunt)	0.001Ω, 0.01%		For Voltage Monitoring During Current Calibration
Oscilloscope	100 MHz with 20MHz bandwidth	Tektronix TDS3014	For Ripple & Noise Measuring

4-4. Calibration Techniques

Technical contents regarding calibration are shown below.

Instrument Connection Diagram

- Connect power supply's output terminal to the measuring instrument as shown in the diagram.
- Turn off or disconnect the electronic load prior to voltage calibration.
- You can use a general-purpose resistor with identical capacity to the electronic load instead.



Electronic Load

- An electronic load is used as a variable resistor required for the power supply's current calibration.
- The electronic load must be able to turn ON/OFF the load required for the test and short-circuit its
- During current calibration, connect the power supply's (+) output terminal with the electronic load's (+) terminal and connect the electronic load's (-) output terminal to one side of the current monitoring shunt's lead while connecting the opposite lead to the power supply's (-) output terminal.
- Connection for remote control through PC must be available.

Current-Monitoring Resistor (shunt)

- Since common current measuring instruments are not suitable for high current capacities, current monitoring resistors must be used.
- Select the TCR for 10ppm or below.
- Use a 0.01% high-precision standard resistor.

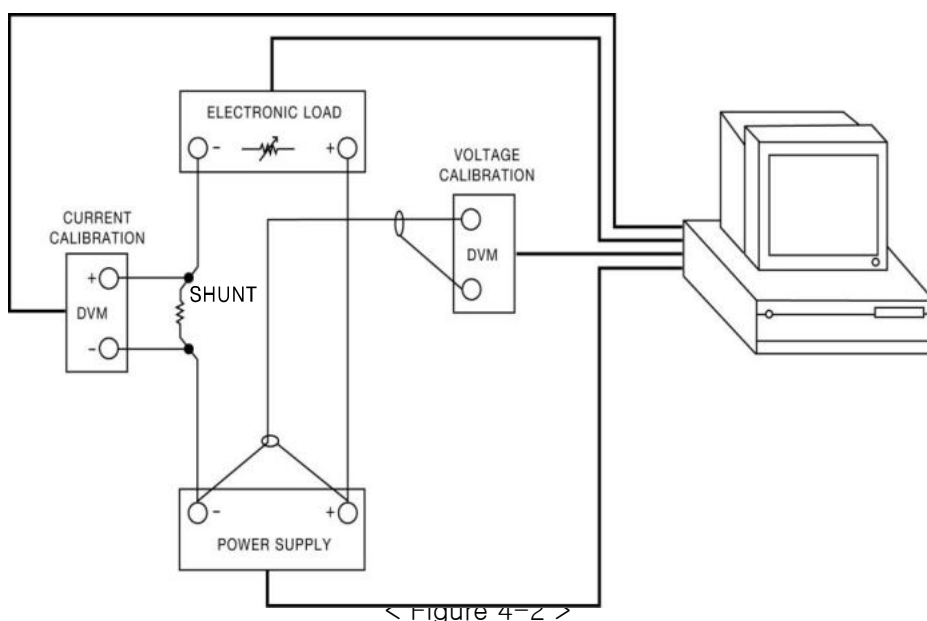
DVM (Digital Volt Meter)

- Used for voltage calibration and current monitoring sensing voltage measuring.
- Resolution: 0.1 mV, Accuracy: A DVM that guarantees more than 0.01% performance must be used
- Connection for remote calibration through PC must be available.

Programming

This product supports PC interface-based calibration.

Measuring errors do not occur when the calibration is done by connecting the power supply, DVM, ammeter, and electronic load. This allows the user to measure precise calibration data. The PC connection diagram is shown below.

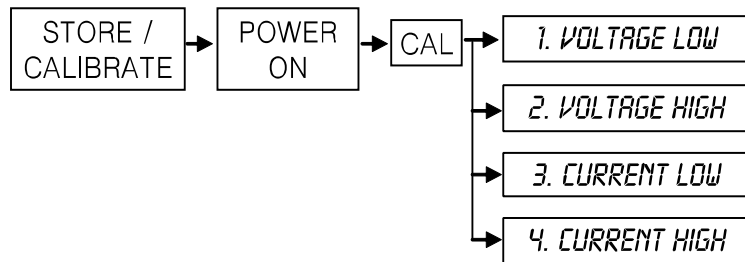


< Figure 4-2 >















4-5. Using Front Panel Calibration

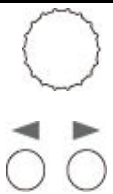

Below structure is the procedure of using front panel "CALIBRATE Key"

CALIBRATION KEY Structure



Voltage Calibraton

	<ul style="list-style-type: none"> Turn off all device and connect all device before calibration >Connect the power supply (+) output bus bar at the DVM (+) and connect the power supply (-) output bus bar at the DVM (-)
 Press hold 	<ul style="list-style-type: none"> Turn on Power switch in a pressing calibration key .
	<ul style="list-style-type: none"> Power switch on.
 Release 	<ul style="list-style-type: none"> After self test is finished, and when appearing "1.cal-volt low" message, release calibration key.
 	<ul style="list-style-type: none"> Press the calibration key in "1.cal-volt low" mode. <p>LCD Display V-LOW 00.14V <i>Display value can be different</i></p>
Wait for 5 minutes	<ul style="list-style-type: none"> Wait until DVM display voltage becomes stable
	<ul style="list-style-type: none"> Enters a voltage value that you obtained by reading an external DVM meter. If the value is 151.9mV, enters as following below.
	<p>LCD Display V-LOW 00.15V <i>This is an examples for 30V.</i></p>
 	<ul style="list-style-type: none"> After finished to enter the value, press the "Calibration" key. <p>LCD Display ADC datA 026ch <i>About 500ms, display HEX value instead of readback value.</i></p> <p>LCD Display 1.cal-volt low <i>Return to the previous state of calibration</i></p>
  	<ul style="list-style-type: none"> Move to "2.cal-volt high" mode by using cursor key and press the "Calibration" key. <p>LCD Display V-high 31.60V <i>Display voltage value can be different</i></p>
Wait for 5 minutes	<ul style="list-style-type: none"> Wait until DVM display voltage becomes stable







	<p>■ Enters a voltage value that you obtained by reading an external DVM meter If the value is 31.607V, enters as following below.</p> <p>LCD Display V-high 31.61v <i>This is an examples for 30V</i></p>
	<p>■ After finishing to enter the value, press the "Calibration" key.</p> <p>LCD Display ADC datA f100h <i>About 500ms, display HEX value instead of readback value.</i></p> <p>LCD Display 2.cal-volt high <i>Return to the previous state of calibration</i></p>
	<p>■ Volatage calibration is finished. It can be applied next operation of power supply.</p>






Current Calibration

■ Turn off all device and connect all device before calibration

>When current calibration, connect the power supply (+) output terminal and electronic load and connect the power supply (-) output terminal and shunt lead for current monitoring and then connect shunt's the other lead to electronic load (-) terminal

>Connect the DVM (+) test lead at the electronic load connction of current monitoring resistor connect the DVM (-) test lead at the other side of current monitoring resistor

	<p>■ Press hold  Power switch on while pressing Calibration key.</p>
	<p>■ Power switch ON</p>
	<p>■ Release  After self diagnose mode, release the Calibration key when seeing "1.cal-volt low" Message</p>
	<p>■ Using cursor key, pressing Calibration key while "3.cal-curr low" mode. LCD Display a-LOW 00.14a <i>Current Display value can be different.</i></p>
<p>Wait for 5 minute</p>	<p>■ Wait until the voltage displayed in DVM meter be stable.</p>

	<p>■ Calculate the current when DVM display voltage became stable. If resistor is 0.01Ω and DVM display voltage value is 1.23mV, the current value is 0.123A.</p>
	<p>■ Enters a current value that you calculated by using cursor key and encoder knob. LCD Display a-LOW 00.12a <i>This is a example of 60V</i></p>
	<p>■ After finishing to enter the value, press the "Calibration" key. LCD Display ADC datA 026ch <i>About 500ms, display HEX value instead of readback value.</i> LCD Display 3.cal-curr low <i>Return to the previous state of calibration</i></p>
	<p>■ Move to "4.cal-curr High" mode by using cursor key and press the "Calibration" key LCD Display a-high 61.00a <i>Display current can be different</i></p>
Wait for 5 minute	■ Wait until DVM display voltage becomes stable
	<p>■ Calculate the current when DVM display voltage became stable If resistor is 0.01Ω and DVM display voltage value is 615mV, the current value is 61.50A.</p>
	<p>■ Enters a current value calculated by using cursor key and encoder knob. LCD Display a-high 61.50a <i>This is a example of 60V</i></p>
	<p>■ After finished to enter the value, press the "Calibration" key. LCD Display ADC datA f500h <i>About 500ms, display HEX value instead of readback value.</i> LCD Display 4.cal-curr high <i>Return to the previous state of calibration</i></p>
	■ Current calibration is finished. It can be applied next operation of power supply.

4-6. Calibration by Remote Interface

This chapter is for remoting calibration method by using remote interface.

When you calibrate the power supply under remote interface state, you should not set other command

Instruments Connection

- Before calibrating, connect the all devices like <Figure. 4-2>
- Set communication state of each measuring instruments .
- Warming up the power supply and measuring instruments while 1 hour or more at room temperature 20°C ~ 30°C.

Command Procedure for f Remote Calibration

- Refer to SCPI commands of "6-6. Calibration command"
- You must send the commands as next order, if occurs the errors, remote calibration is cancelled.
- If error is occurred, you must restart remote calibration.

Voltage Calibraton

- Send the "OFF" command to electronic load
- Send minimum calibration command of the power supply voltage
Sending command `CAL:VOLT MIN`
- After waiting for minimum 5 minutes more, measure DVM's voltage.
- Send measured voltage value.
For examples, if measured voltage value is 0.1234, sends as following
Sending command `CAL:VOLT 0.1234`
- Send maximum calibration command of the power supply voltage
Sending c `CAL:VOLT MAX`
- After waiting for minimum 5 minutes more, measure DVM's voltage
- Send measured voltage value.
For examples, if measured voltage value is 30.123, sends as following.
Sending command `CAL:VOLT 30.123`

Current Calibration

- Send the "ON" command to electronic load.
- Send the power supply current minimum calibration command.
Sending command `CAL:CURREN MIN`
- The mode of electronic load is CC mode, so set the current value is higher than the power supply's maximum output ampere value. If you send the current calibration value is lower than the power supply's maximum ampere value, this is CV mode and wrong calibration value is measured and saved at the power supply. So remind to set the sending value is higher than power supply's maximum output ampere.
- After waiting for minimum 5 minutes more, measures DVM's voltage that is connected with current monitoring resistor.
- Send calculated current value that calculated by current value calculating program prepared.
For examples, if calculated current value is 0.1234, sends as following.
Sending command `CAL:CURREN 0.1234`
- Send current maximum calibration command of the power supply.
Sending command `CAL:CURREN MAX`
- After waiting for minimum 5 minutes more, measures DVM's voltage that is connected with current monitoring resistor.
- Send calculated current value that calculated current value calculating program prepared.
For examples, if calculated current value is 60.553, sends as following.
Sending command `CAL:CURREN 60.553`

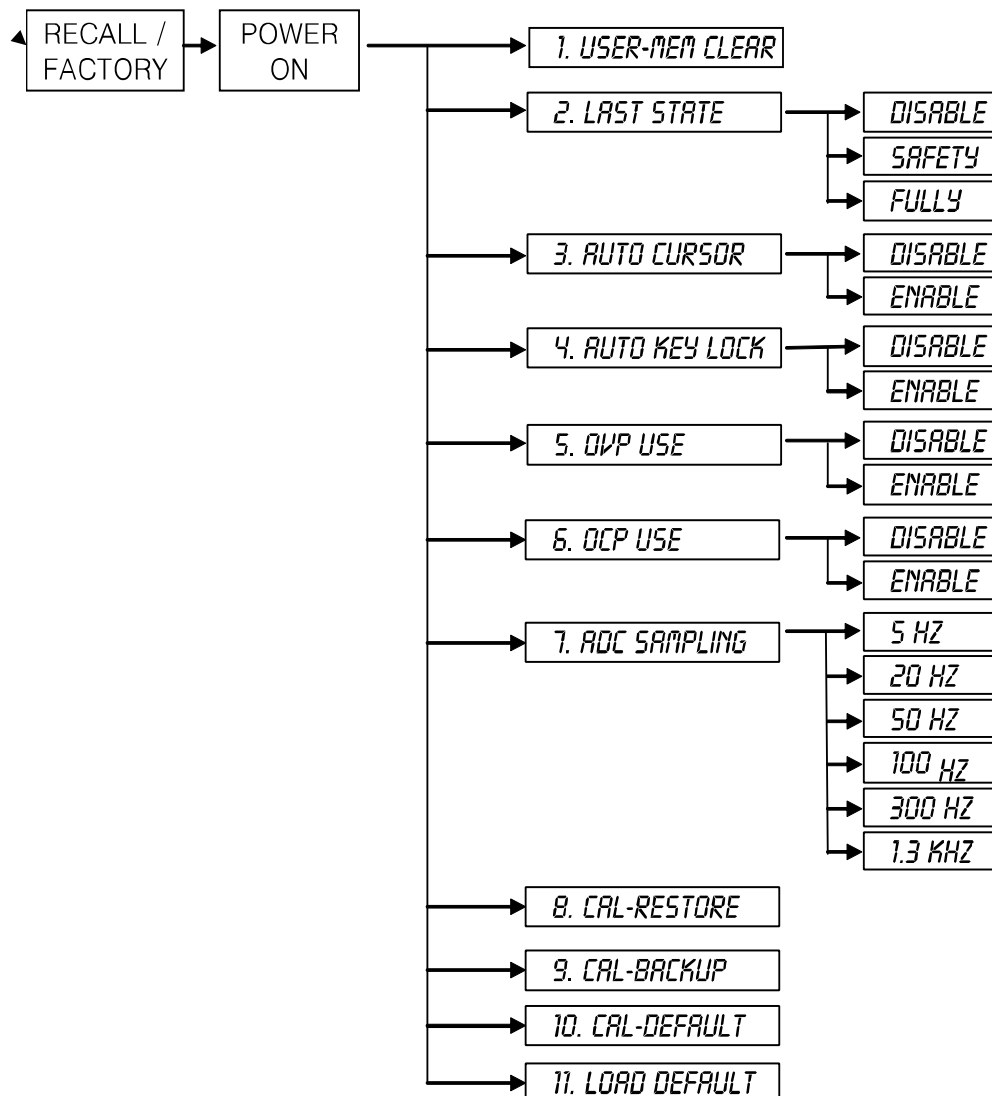
5. FACTORY

You can set the various convenient function as following calibration restore, backup and etc. by using "FACTORY" mode.

5-1. Characteristic

- Be able to initialize the 10 non-volatile memory datas as like OVP, OCP and etc.
- Be able to recall the previous state of the power supply power-off
- Be able to change to minimum value of voltage/current value automatically if you are not use the power supply for long time.
- Be able to lock the power supply's front-panel if you are not set the power supply after set and just outputs the DC source.
- Be able to disable the OVP, OCP protection function.
- Be able to set the average value of voltage/current.
- Be able to backup and restore calibration and be back to factory setting value.

5-2. FACTORY KEY Structure







5-3. USER-MEM CLEAR

- This mode is to initialize the 10 datas of OVP, OCP, UVL and etc in the non-volatile memory at once.
- After initialized the datas of non-volatile, initialized data never be recovered.
- Initialized contents

>Voltage	0V
>Current	Limit maximum value
>OVP-Level	OVP setting maximum value
>OCP-Level	OCP setting maximum value
>UVL-Level	0V
>OVL-Level	Limit maximum value
>UCL-Level	0A
>OCL-Level	Limit maximum value
>Output Mode	OFF

USER-MEM CLEAR Operating

 <p style="text-align: center;">Recall Factory</p>	<p>Press hold</p> <ul style="list-style-type: none"> ■ Power switch on in a pressing "FACTORY" key
 <p style="text-align: center;">POWER ON/OFF</p>	<ul style="list-style-type: none"> ■ Power switch ON
 <p style="text-align: center;">Recall Factory</p>	<p>Release</p> <ul style="list-style-type: none"> ■ When appearing "1. user-mem clear" message, release "FACTORY" key.
 <p style="text-align: center;">Recall Factory</p>	<ul style="list-style-type: none"> ■ In order to initialize non-volatile memory datas, press the "FACTORY" key one more time <p style="text-align: center;">LCD Display done</p>

» Related Remote Interface Command

FACT:USER-CLE








Apply: *FACT:USER-CLE*

Initialize non-volatile memory data

5-4. LAST STATE

- When you turn on the power supply, you can select the default state or last state of power off.
- Function
 - > DISABLE When selected this mode, boot the power supply to original default value
For the safety, recommend this mode.
 - > SAFETY Recall last state before you turn off but boot the default state of output to Output C
Therefore, the setting value is restored but it is safe as it boots with Output OFF.
 - > FULLY Recall last state before you turn off fully.
Since the output state is also restored, voltage/current can be output.
In this case, caution is required because it is dangerous.

LAST STATE 실행

 Press hold Factory	■ Power switch on in a pressing "FACTORY" key.
	■ Power switch ON
 Release Factory	■ When appearing "1. user-mem clear" message, release "FACTORY" key
	■ Enter to "2. last state" mode by using cursor key.
	■ In order to set, press the "FACTORY" key one more time. LCD Display <input type="text" value="disable"/>
	■ Set the "SAEFTY" mode by using cursor key. LCD Display <input type="text" value="safety"/>
	■ To finish the last state mode, press the "FACTORY" key one more time. LCD Display <input type="text" value="done"/>

» Related Remote Interface Command

FACT:LAST-STA {DIS/SAF/FUL}

FACT:LAST-STA? Return Value(DISABLE, SAFETY, FULLY)








Apply: FACT:LAST-STA? Return value : FULLY Last state mode is "FULLY"

FACT:LAST-STA DIS Last state mode bacame to "DISABLE" mode

5-5. AUTO CURSOR MV

- If the power supply doesn't receive any operation by using front-panel within a certain period of time, the power supply's cursor location go down to minimum changing unit automatically when you set the "AUTO CURSOR MV" mode is enable.
- After passed long time, if a operator turns encoder knob by mistake, cursor location of voltage and current is at minimum unit position, so it can reduce the DUT damage.
- Function
 - > DISABLE Disable "AUTO CURSOR MV" mode.
 - > ENABLE Enable "AUTO CURSOR MV" mode.

AUTO CURSOR MV Operating

 Factory	<ul style="list-style-type: none"> ■ Power switch on in a pressing "FACTORY" key.
 POWER ON/OFF	<ul style="list-style-type: none"> ■ Power switch ON
 Release	<ul style="list-style-type: none"> ■ When appearing "1. user-mem clear" message, release "FACTORY" key.
	<ul style="list-style-type: none"> ■ Enter to "3. AUTO CURSOR MV" mode by using cursor key.
 Factory	<ul style="list-style-type: none"> ■ In order to set, press the "FACTORY" key one more time. LCD Display <input type="text" value="disable"/>
	<ul style="list-style-type: none"> ■ Set the "enable" mode by using cursor key. LCD Display <input type="text" value="enable"/>
 Factory	<ul style="list-style-type: none"> ■ To finish the "AUTO CURSOR" mode, press the "FACTORY" key one more time. LCD Display <input type="text" value="done"/>

» Related Remote Interface Command

FACT:AUTO-CUR {DIS|ENA}

FACT:AUTO-CUR?

Return Value(0,1)

Apply: FACT:AUTO-CUR?

Return value : 1

"AUTO CURSOR" mode is enable state








FACT:AUTO-CUR DIS

"AUTO CURSOR" mode changed to disable state

5-6. AUTO KEY LOCK

- If the power supply doesn't receive any operation by using front-panel within a certain period of time, the power supply becomes the key lock state automatically when you set the "AUTO KEY LOCK" mode is enable.
- It is safe from another person's mistake touch of the power supply front-panel.
- If the power supply entered under the "AUTO KEY LOCK" mode, the power supply can be controlled by front panel when after pressed the "Key Lock" button and turned off "LOCK" lamp.
- Function.
 - > DISABLE Disable "AUTO KEY LOCK" mode.
 - > ENABLE Enable "AUTO KEY LOCK" mode.

AUTO KEY LOCK Operating

 Recall Press hold Factory	<ul style="list-style-type: none"> ■ Power switch on in a pressing "FACTORY" key.
 POWER ON/OFF	<ul style="list-style-type: none"> ■ Power switch ON
 Recall Release Factory	<ul style="list-style-type: none"> ■ When appearing "1. user-mem clear" message, release "FACTORY" key.
	<ul style="list-style-type: none"> ■ Enter to "3. AUTO KEY LOCK" mode by using cursor key.
 Recall Factory	<ul style="list-style-type: none"> ■ In order to set, press the "FACTORY" key one more time. LCD Display <input type="text" value="disable"/>
	<ul style="list-style-type: none"> ■ Set the "enable" mode by using cursor key. LCD Display <input type="text" value="enable"/>
 Recall Factory	<ul style="list-style-type: none"> ■ To finish the "AUTO KEY LOCK" mode, press the "FACTORY" key one more time LCD Display <input type="text" value="done"/>

» Related Remote Interface Command

FACT:AUTO-LOC {DIS|ENA}

FACT:AUTO-LOC?

Return Value(0, 1)

Apply: FACT:AUTO-LOC?

Return value : 1

"AUTO KEY LOCK" mode is enable state








FACT:AUTO-LOC DIS

*"AUTO KEY LOCK" mode is changed to
disable state*

5-7. OVP USE

- Enable or disable the "Over Voltage Protection" function.
- In case of a like inductivity DUT, motor, big capacity DUT and etc, occurs "OVP trip" frequently so if it is not convenient to use the power supply, you can set disable of "OVP USE" mode.
- If disable the "OVP USE", the power supply doesn't cut the DC source when voltage level is over OVP setting level.
- Function
 - > DISABLE Disable "OVP USE" mode.
 - > ENABLE Enable "OVP USE" mode.

OVP USE Operating

 Recall Press hold Factory	<ul style="list-style-type: none"> ■ Power switch on in a pressing "FACTORY" key
	<ul style="list-style-type: none"> ■ Power switch ON
 Recall Release Factory	<ul style="list-style-type: none"> ■ When appearing "1. user-mem clear" message, release "FACTORY" key.
	<ul style="list-style-type: none"> ■ Enter to "5. OVP USE" mode by using cursor key
 Recall Factory	<ul style="list-style-type: none"> ■ In order to set, press the "FACTORY" key one more time LCD Display <input type="text" value="enable"/>
	<ul style="list-style-type: none"> ■ Set the "enable" mode by using cursor key. LCD Display <input type="text" value="disable"/>
 Recall Factory	<ul style="list-style-type: none"> ■ To finish the "OVP USE" mode, press the "FACTORY" key one more time. LCD Display <input type="text" value="done"/>

» Related Remote Interface Command

FACT:OVP {DIS|ENA}

FACT:OVP?

Return Value(1, 0)

Apply: FACT:OVP?

Return value : 0

FACT:OVP ENA








"OVP USE" mode is disable state

"OVP USE" mode is changed to enable state

5-8. OCP USE

- Enable or disable the "Over Current Protection" function.
- In case of a like inductivity DUT, motor, big capacity DUT and etc, occurs "OCP trip" frequently so if it is not convenient to use the power supply, you can set disable of "OCP USE" mode.
- If disable the "OCP USE", the power supply doesn't cut the DC source when current level is over OCP setting level.
- Function
 - > DISABLE Disable "OCP USE" mode.
 - > ENABLE enable "OCP USE" mode.

OCP USE Operating

 Press hold Factory	■ Power switch on in a pressing "FACTORY" key
 POWER ON/OFF	■ Power switch ON
 Release Factory	■ When appearing "1. user-mem clear" message, release "FACTORY" key.
	■ Enter to "6. OCP USE" mode by using cursor key.
 Factory	■ In order to set, press the "FACTORY" key one more time. LCD Display <input type="text" value="enable"/>
	■ Set the "enable" mode by using cursor key. LCD Display <input type="text" value="disable"/>
 Factory	■ To finish the "OCP USE" mode, press the "FACTORY" key one more time. LCD Display <input type="text" value="done"/>

» Related Remote Interface Command

FACT:OCP {DIS|ENA}

FACT:OCP?

Return Value(1, 0)

Apply: FACT:OCP?

Return value : 0

"OCP USE" mode is disable state

FACT:OCP ENA










"OCP USE" mode is changed to

enable state

5-9. ADC SAMPLING

- Be able to set the output voltage/current measuring speed and displaying speed
- If the frequency is lower, data acquisition is reduced. But you can get the more accurate value.
- If the frequency is higher, data acquisition is increased. But voltage/current measuring value can be changeable frequently in the display.
- In case of PC interface control, recommends ADC sampling speed is 20~50Hz
- In case of Front-panel control, recommends ADC sampling speed is 5~20Hz.
- CAUTION : If you have to acquire the voltage/current in high speed 100Hz, 300Hz, use 1.3KHz speed!!
- Function
 - > 5Hz 200ms 마다 전' Measures voltage/current at every 200ms
 - > 20Hz 50ms 마다 전입 Measures voltage/current at every 50ms.(Instrument default value)
 - > 50Hz 20ms 마다 전입 Measures voltage/current at every 20ms.
 - > 100Hz 10ms 마다 전입 Measures voltage/current at every 10ms.
 - > 300Hz 3.3ms 마다 전' Measures voltage/current at every 3.3ms.
 - > 1.3KHz 770us 마다 전' Measures voltage/current at every 770us.

ADC SAMPLING Operating

 Recall Factory	Hold press  <ul style="list-style-type: none"> ■ Power switch on in a pressing "FACTORY" key.
	<ul style="list-style-type: none"> ■ Power switch ON
 Recall Factory	Release  <ul style="list-style-type: none"> ■ When appearing "1. user-mem clear" message, release "FACTORY" key.
	<ul style="list-style-type: none"> ■ Enter to "7. adc sampling" mode by using cursor key
 Recall Factory	<ul style="list-style-type: none"> ■ In order to set, press the "FACTORY" key one more time. LCD Display <input type="text" value="20hz"/>
	<ul style="list-style-type: none"> ■ Set the "50Hz" mode by using cursor key. LCD Display <input type="text" value="50hz"/>
 Recall Factory	<ul style="list-style-type: none"> ■ To finish the "ADC SAMPLING" mode, press the "FACTORY" key one more time LCD Display <input type="text" value="done"/>

» Related Remote Interface Command

FACT:ADC {5/20/50/100/300/1300}

FACT:ADC?

Return Value(5Hz, 20Hz, 50Hz, 100Hz, 300Hz, 1.3KHz)

Apply: FACT:ADC 100

Set 100Hz speed in other to acquire the data.

FACT:ADC?






Return value : 100Hz

Confirm the ADC sampling speed : 100Hz.

5-10. CAL-RESTORE

- This function is restoring saved calibration data at present system by backup function.
- You can use this function when the person who have no previous knowledge of calibration operates calibration of the power supply or have an error about calibrtn, and you can return to previous calibration data.

CAL-RESTORE Operating






 Hold Press Factory	<ul style="list-style-type: none"> ■ Power switch on in a pressing "FACTORY" key.
 POWER ON/OFF	<ul style="list-style-type: none"> ■ Power switch ON
 Releasing Factory	<ul style="list-style-type: none"> ■ When appearing "1. user-mem clear" message, release "FACTORY" key.
	<ul style="list-style-type: none"> ■ Enter to "8. CAL-RESTORE" mode by using cursor key
 Factory	<ul style="list-style-type: none"> ■ In order to restore, press the "FACTORY" key one more time. LCD Display done

» There's no related Remote Interface Command

5-11. CAL-BACKUP

- Recommended calibration interval is 6 months and in order to precision of the power supply you must calibrate this unit at the certificated calibration center. Annual calibration is recommended in order to use this unit without problem about calibration.
- If back-up is operated, you can not recover to previous back-up data.

CAL-BACKUP 실행






 Hold Press Factory	<ul style="list-style-type: none"> ■ Power switch on in a pressing "FACTORY" key
 POWER ON/OFF	<ul style="list-style-type: none"> ■ Power switch ON
 Release Factory	<ul style="list-style-type: none"> ■ When appearing "1. user-mem clear" message, release "FACTORY" key.
	<ul style="list-style-type: none"> ■ Enter to "8. CAL-BACKUP" mode by using cursor key.
 Factory	<ul style="list-style-type: none"> ■ In order to back-up, press the "FACTORY" key one more time. LCD Display done

» There's no related Remote Interface Command

5-12. CAL-DEFAULT

- This function is to restore to the state of calibration data that shipped from factory.
- If you calibrate the unit in the condition that you have no previous knowledge of calibration or you can not restore by using "5-10. CAL-RESTORE" function, you can return to factory default calibration (If you use this function, you must calibrate this unit at the official calibration center.

CAL-DEFAULT Operating






 Hold press	■ Power switch on in a pressing "FACTORY" key.
	■ Power switch ON
 Release	■ When appearing "1. user-mem clear" message, release "FACTORY" key
	■ Enter to "10. CAL-DEFAULT" mode by using cursor key.
	■ In order to restore, press the "FACTORY" key one more time. LCD Display done

» There's no related Remote Interface Command

5-13. LOAD DEFAULT

- This function is to return to default value that shipped the unit from factory. You can erase setting and changing all value at the "Factory Mode"
- Initializing contents
 - > User Memory Clear > Last State : Disable > Auto Cursor Move : Disable
 - > Auto Key Lock : Disable > OVP Use : Enable > OCP Use : Enable > ADC Sampling : 20Hz

LOAD DEFAULT Operating

 Hold Press	■ Power switch on in a pressing "FACTORY" key
	■ Power switch ON
 Releasing	■ When appearing "1. user-mem clear" message, release "FACTORY" key.
	■ Enter to "11. LOAD DEFAULT" mode by using cursor key.
	■ In order to return to default value, press the "FACTORY" key one more time LCD Display done

» Related Remote Interface Command

FACT:LOAD-DEF

Apply: FACT:LOAD-DEF

Initialize all the Factory setting value

6. SCPI Command

This section summarizes the SCPI (Standard Commands for Programmable Instruments) commands available to program the power supply over the remote interface. By using interface as following RS232C, RS485 and TCP/IP(Optional) you can control the devices so it is fit to FA system and research center.

6-1. Commands Syntax

- Be able to skip small English letter.
- Be able to use the command of capital/small letter.
- It is no limit about quantity of blank (20H) or tap(09H) and set minimum 1 more.
- Command sending is one step at a time
- A square brackets([]) is option or parameters and you can skip it.
- You can not skip the parameter in braces({ }).
- Triangle brackets (< >) indicate that you must substitute a value or a code(examples, MIN, MAX) for the enclosed parameter.
- A vertical bar (|) separates one of two or more alternative parameters.
- Command finish suffix is LF(0AH) and you can change to CR, CRLF.
- Maximum character of one time are 40 Byte.
- In case of RS485 communication, it consists of "ODA" + 1byte address (01H ~ FFH) + SCPI P
- In the query of RS485 communication, the return string is the same as the RS232C method (address not included).

6-2. Commands

Output Setting Commands

APPLy {<voltage>}[,<current>]	VOLT:UVL {<numeric value>}
APPLy?	VOLT:UVL?
VOLT {<voltage> UP DOWN}	VOLT:OVL {<numeric value>}
VOLT?	VOLT:OVL?
VOLT:STEP {<numeric value>}	
VOLT:STEP?	
VOLT:OVP {<numeric value>}	
VOLT:OVP?	
VOLT:OVP:TRIP?	
VOLT:OVP:CLE?	
CURR {<current> UP DOWN}	CURR:UCL{<numeric value>}
VOLT?	CURR:UCL?
CURR:STEP {<numeric value>}	CURR:OCL{<numeric value>}
CURR:STEP?	CURR:OCL?
CURR:OCP {<numeric value>}	
CURR:OCP?	
CURR:OCP:TRIP?	
CURR:OCP:CLE?	
FLOW?	
POL {P N}	
POL?	

Measurement Commands

MEAS:CURRE?
MEAS:VOLT?
MEAS:ALL?

Calibration Commands

CAL:VOLT {voltage|MIN|MAX}
CAL:CURRE {current|MIN|MAX}

Factory Commands

FACT:USER-M {CLR}
FACT:LAST-STA {DIS|SAF|FUL}
FACT:LAST-STA?
FACT:AUTO-CUR {DIS|ENA}
FACT:AUTO-CUR?
FACT:AUTO-LOC {DIS|ENA}
FACT:AUTO-LOC?
FACT:OVP {DIS|ENA}
FACT:OVP?
FACT:OCP {DIS|ENA}
FACT:OCP?
FACT:ADC {5|20|50|100|300|1300}
FACT:ADC?
FACT:LOAD-DEF

System Commands

SYST:BEEP
SYST:ERR?
SYST:VERS?
SYST:TEMP?
SYST:REM {232 | 485}

OUTP {OFF|ON}
OUTP?

KEYL {OFF|ON}
KEYL?

*IDN?
*SN?
*RST
*SAV {1|2|3|4|5|6|7|8|10}
*RCL {1|2|3|4|5|6|7|8|10}
*CLS

6-3. Apply Command

The APPLy command provides to control the output voltage and current by remote interface.

APPLy {<voltage>}[,<current>]

- > voltage Input voltage value
- > current Input current value

- ex1) APPL 30,5 Voltage is 30V, current is 5A.
- ex2) APPL 5 Just set voltage to 5V excepted current set.

APPLy?

Only the APPLy? will instruct the power supply to send a response message about voltage and current value. Between return value, the former is voltage value, the latter is current.

Return value "voltage,current"

- ex) APPL? *return value "30.0000,5.0000"*

6-4. Output V/I Setting & Operating Commands

This command is for controlling output voltage and current using PC remote interface.

VOLT {<voltage>|UP|DOWN}

This command programs the immediate voltage level of the power supply. The immediate level is the voltage value of the output terminals.

This command also increases or decreases the immediate voltage level using the "UP" or "DOWN" parameter by a predetermined amount. The command VOLTage:STEP sets the amount of increase or decrease.

- > Voltage Input voltage value.
- > UP Increase voltage setting value as step value.
- > DOWN Decrease voltage setting value as step value.

- ex1) volt 10 *set the voltage 10V*
- ex2) volt up *Increase voltage setting value as step value*

Note

If you operated "*RST" command, voltage step value returned to the unit's default value.
*About "*RST" command, refer to "*RST" command chapter.*

VOLT ?

This query returns the presently programmed voltage level of the power supply.

Return value "voltage" "voltage"

- ex) volt? *return value "30.0000"*

VOLT:STEP {<numeric value>}

This command sets the step size for voltage programming with the VOLTage UP and VOLTage DOWN commands.

- > numeric value Program the power supply to the allowed setting value resolution.

- ex) volt:step 0.5 *set the voltage to 0.5V*

VOLT:STEP?

This query returns the value of the step size currently specified. The returned parameter is a numeric value.
Return value "numeric value"

ex) volt:step? *return value "0.5000"*

VOLT:OVP {<numeric value>}

This command sets the voltage level at which the overvoltage protection circuit will trip.

> numeric value Input voltage within OVP setting range.

ex) volt:ovp 32 *Set the OVP Level to 32V*

VOLT:OVP?

This query returns the overvoltage protection trip level presently programmed.

Return value "numeric value"

ex) *return value "32.0000"*

VOLT:OVP:TRIP?

This query returns a "1" if the overvoltage protection circuit is tripped and not cleared or a "0"

Return value "0" – not tripped state.

"1" – OVP Trip state and cut the output.

ex) volt:ovp:trip? *return value "1"*

VOLT:OVP:CLE

This command is for releasing OVP(Over voltage protection) Trip.

Before release trip, refer to "3-4. Programming Over Voltage Protection(OVP)" in order to check the reason of trip occurring and remove this reason.

ex) volt:ovp:cle *Clear the OVP Trip*

Note

When appears OVP Trip, cut the voltage/current output. At that time, if you set the voltage/current, it can be set. But DC output is still cut unless release the trip mode.

VOLT:UVL {<numeric value>}

This command sets the under voltage limit level.

> numeric value 0V ~ currently setting value.(up to voltage setting value).

ex) volt 10 *At first set the voltage value*
 volt:uvl 5 *Set lower value than above setting value*
 From the time set UVL, you can not set the voltage to below 5V.

VOLT:UVL?

This query returns the under voltage limit value presently programmed.

Return value "numeric value"

ex) volt:uvl? *return value "5.0000"*

VOLT:OVL?

This command sets the over voltage limit level.

> numeric value Currently setting value~mixture of limit value.

ex) volt 10 *At first set the voltage value*
 volt:ovl 15 *Set the higher value than above setting value*
 From the time set OVL, you can not set the voltage to above 15V.

VOLT:OVL?

This query returns the under voltage limit value presently programmed.

Return value "numeric value"

ex) volt:ovl? *return value "15.0000"*

CURR {<current>|UP|DOWN}

This command programs the immediate current level of the power supply. The immediate level is the current value of the output terminals.

This command also increases or decreases the immediate current level using the "UP" or "DOWN" parameter by a predetermined amount. The command CURRent:STEP sets the amount of increase or decrease.

> current Input current value
> UP Increase current setting value as step value.
> DOWN Decrease current setting value as step value.

ex1) curr 4.5 *Set the current 4.5A*
ex2) curr up *Increase current setting value as step value*

Note

If you operated "*RST" command, current step value returned to the unit's default value. About Default Value, refer to "*RST" command chapter.

CURR?

This query returns the presently programmed current level of the power supply.

Return value "current"

ex) curr? *return value "4.5000"*

CURR:STEP {<numeric value>}

This command sets the step size for current programming with the CURRENT UP and CURRENT DOWN commands.

> numeric value Program the power supply to the allowed setting value resolution.

ex) curr:step 0.5 *Set the voltage to 0.5A*

CURR:STEP?

This is for checking set step value.

Return value "numeric value"

ex) curr:step? *return value "0.5000"*

CURR:OCP {<numeric value>}

This command sets the current level at which the overcurrent protection circuit will trip.

> numeric value Input current within OVP setting range.

ex) curr:ocp 5.2 *Set the OVP Level to 5.2A*

CURR:OCP?

This query returns the overcurrent protection trip level presently programmed.

Return value "numeric value"

ex) curr:ocp? *return value "5.2000"*

CURR:OCP:TRIP?

This query returns a "1" if the overcurrent protection circuit is tripped and not cleared or a "0" if not tripped.

Return value "0" – not tripped state.

"1" – OCP Trip state and cut the output.

ex) curr:ocp:trip? *return value "1"*

CURR:OCP:CLE

This command causes the overcurrent protection circuit to be cleared.

Before release trip, refer to "3-4. Programming Over Current Protection(OVP)" in other to check the reason of trip occurring and remove this reason.

ex) curr:ocp:cle *Clear the OCP Trip*

Note

When appears OCP Trip, cut the voltage/current output. At that time, if you set the voltage/current, it can be set. But DC output is still cut unless release the trip mode.

CURR:UCL {<numeric value>}

This command sets the under current limit level.

> numeric value 0V ~ currently setting value.(up to current setting value).

ex) curr 10 *At first set the current value*

 curr:ucl 5 *Set the lower value than above setting value*

From the time set UCL, you can not set the current to below 5A.

CURR:UCL?

This query returns the under current limit value presently programmed.

Return value "numeric value"

ex) curr:ucl? *return value "5.0000"*

CURR:OCL {<numeric value>}

This command sets the over current limit level.

> numeric value Currently setting value~mixture of limit value.

ex) curr 10 *At first set the current value*

 curr:ocl 15 *Set the higher value than above setting value*

From the time set OCL, you can not set the current to above 15A.

CURR:OCL?

This query returns the over current limit value presently programmed.

Return value "numeric value"

ex) curr:ocl? *return value "15.0000"*

FLOW?

This command is to confirm the power supply's CV(Constant Voltage), CC(Constant Current) sta

Return value "CV" – Constant Voltage state.
"CC" – Constant Current state.

ex) FLOW? *return value "CV"*

POL {P|N}

This command serves for specialized polarity power supply and changing polarity of output.

> P Convert to positive output state.
> N Convert to negative output state.

ex) POL P Convert to positive output state

POL?

This command serves for confirming the power supply's output polarity state.

Return value "P" – positive output state.
"N" – negative output state.

ex) POL? *return value "P"*

6-5. Measure 명령

Measure commands measure the output voltage or current. MEASure commands acquire new data before returning the reading. Also you don't need DVM(Digital Volt Meter) and ammeter and you can measure voltage and current independently.

MEAS:VOLT?

These queries perform a measurement and return the DC output voltage in volts.

Return value "voltage"

ex) meas:volt? *return value "11.0000"*

MEAS:CURR?

These queries perform a measurement and return the DC output current in amperes.

Return value "current"

ex) meas:curr? *return value "1.0000"*

MEAS:ALL?

These queries perform a measurement and return the DC output current in amperes and

DC output voltage i "voltage,current"

Return value "voltage,current"

ex) meas:all? *return value "10.00,1.00" // measured value 10V, 1A*

6-6. Calibration Command

This command is for Remote Calibration.

CAL:VOLT {voltage|MIN|MAX}

This command is for voltage calibration.

Be careful calibration procedure.

Refer to "4-6. Remote Interface Calibration"

> voltage This command save the calibration measuring voltage value in MIN band and MAX

> MIN Calibrate low band voltage calibration.

> MAX Calibrate low band voltage calibration.

ex) Following procedure is for voltage calibration order sample.

CAL:VOLT MIN *Calibrate low value of voltage*

CAL:VOLT voltage *Sending measured voltage value by DVM*

CAL:VOLT MAX *After calibrated low value, so calibrate high value of voltage*

CAL:VOLT voltage *Sending measured voltage value by DVM*

After sended Min or Max and then send voltage value, automatically saved the calibration data in the non-volatile memory.

CAL:CURR {current|MIN|MAX}

This command is for current calibration.

Be careful calibration procedure.

Refer to "4-6. Remote Interface Calibration" .

> current This command save the calibration measuring current value in MIN band and MAX band.

> MIN Calibrate low band current calibration.

> MAX Calibrate low band current calibration.

ex) Following procedure is for current calibration order sample.

CAL:CURR MIN *Calibrate low value of current*

CAL:CURR current *Sending measured current value by DVM*

CAL:CURR MAX *After calibrated low value, so calibrate high value of current*

CAL:CURR current *Sending measured current value by DVM*

After sended Min or Max and then send current value, automatic saved the calibration data in the non-volatile memory.

6-7. Factory Commands

Outside of calibration recovery, you can set various convenient 10 functions.

FACT:USER-M {CLR}

After initializing the datas of non-volatile, initialized data never be recovered.

About more information of "User memory clear", refer to "5-3. USER-MEM CLEAR".

> CLR Initialize the non-volatile memory.

ex) fact:user-m clr

FACT:LAST-STA {DIS|SAF|FUL}

When you turn on the power supply, you can select the default state of output DC power.

- > DIS When this mode is selected , boot the power supply to original default value.
- > SAF Recall last state before you turn off but boot the Ouput to OFF.

- > FUL Recall the state before you turn off fully.

ex) fact:last-sta saf *Set the safety mode*

FACT:LAST-STA?

Confirm the Last-state value.

Return value "DISABLE"
 "SAFETY"
 "FULLY"

ex)fact:last-sta? *return value "SAFETY"*

FACT:AUTO-CUR {DIS|ENA}

If the power supply doesn't receive any operation by using front-panel within a certain period of time, the power supply's cursor location go down to minimum changing unit automatically when you set the "AUTO CURSOR MV" mode is enable.

- > DIS Disable "AUTO CURSOR MV" mode.
- > ENA Enable "AUTO CURSOR MV" mode.

ex) fact:auto-cur ena *Disable "AUTO CURSOR MV" mode.*

FACT:AUTO-CUR?

Confirm the auto cursor value.

Return value "0" Disable state
 "1" Enable state

ex)fact:auto-cur? *return value "1"*

FACT:AUTO-LOC {DIS|ENA}

If the power supply doesn't receive any operation by using front-panel within a certain period of time, the power supply becomes the key lock state automatically when you set the "AUTO KEY LOCK" mode is enable.

- > DIS Disable "AUTO KEY LOCK" mode.
- > ENA Enable "AUTO KEY LOCK" mode.

ex) fact:auto-loc ena *Set the auto lock function.*

FACT:AUTO-LOC?

Confirm auto key lock value.

Return value "0" Disable state
 "1" Enable state

ex)fact:auto-loc? *return value "1"*

FACT:OVP {DIS|ENA}

Enable or disable the "Over Current Protection" function.

- > DIS Disable "OCP USE" mode.
- > ENA Enable "OCP USE" mode.

ex) fact:ovp dis *Set the disable "OCP" function.*

FACT:OVP?

Confirm OVP function value.

Return value	"0"	Disable state
	"1"	Enable state

ex)fact:ovp? *return value "0"*

FACT:OCP {DIS|ENA}

Enable or disable the "Over Current Protection" function.

> DIS	Disable "OCP USE" mode.
> ENA	Enable "OCP USE" mode.

ex) fact:ocp dis Set the disable "OCP" function.

FACT:OCP?

Confirm OCP function value.

Return value	"0"	Disable state
	"1"	Enable state

ex)fact:ocp? *return value "0"*

FACT:ADC {5|20|50|100|300|1300}

Be able to set the output voltage/current measuring speed and displaying speed.

> 5	Measures voltage/current at every 5 times/1sec, measure very precise value.
> 20	Measures voltage/current at every 20 times/1sec, measure very precise value.
> 50	Measures voltage/current at every 50 times/1sec, measure precise value.
> 100	Measures voltage/current at every 100 times/1sec, measure precise value.
> 300	Measures voltage/current at every 300 times/1sec, measure value in fast.
> 1300	Measures voltage/current at every 1300 times/1sec, measure value in fast.

ex) fact:ADC 5 Sampling speed is slow but you can read precise value.

FACT:ADC?

Confirm ADC Sampling speed.

Return value	"5Hz"	<i>5 times/1sec sampling time</i>
	"20Hz"	<i>20 times/1sec sampling time</i>
	"50Hz"	<i>50 times/1sec sampling time</i>
	"100Hz"	<i>100 times/1sec sampling time</i>
	"300Hz"	<i>300 times/1sec sampling time</i>
	"1.3KHz"	<i>1300 times/1sec sampling time</i>

ex)fact:ADC? *return value "5Hz"*

FACT:LOAD-DEF

This function is to initialize to the factory mode's setting value.

You can clear in User memory field excepted calibration data.

ex)fact:load-def Initialize to the factory mode's setting value

6–8. System Commands

This is the command that is various control command of the power supply.

SYST:BEEP

The event to beep sound of power supply

ex) syst:beep Make beep sound.

SYST:ERR?

Confirm the power supply's error that occurred.

Error recording, save in volatile memory up to 10 event. If the error occurs more than 10, erase the first occurred error at first. If check the error, automatically erase the confirmed error and there are no error, you can receive +0 value, "No error" Message.

Return value - : - error number , "message"

ex) syst:err? return value -222, "Out of data"

Note

1. About error, refer to "7. Error Messages".
2. If you send "CLS" command, every error is cleared. But in case of "*RST" command, not cleared.

SYST:VERS?

You can confirm the power supply's version.

Return "YYYY.Ver"

YYYY - developed year.

Ver - Product version of development year.

ex) syst:vers? return value "2008.3"

SYST:TEMP?

You can confirm the power supply's version.

Return : Receiving temperature Decimel value in units of 99.99

ex) syst:temp? return value "40.00"

SYST:REM {232 | 485}

Command that select the communication between RS232C and RS485.

However, the communication speed is fixed at 9600bps.

OUTP {OFF|ON}

You can control the power supply's DC output state of ON or OFF.

- > ON Output on.
- > OFF Output off.

ex1) outp on *DC power output on*
ex2) outp off *DC power output off*

OUTP?

Confirm the power supply's DC output ON or OFF state.

Return value " 0 " Output off state
 " 1 " Output on state.

ex) outp? *return value "1"*

KEYL {OFF|ON}

This command is controlling the front panel's key/encoder knob locking or unlocking.

- > ON Key locking.
- > OFF Key unlocking

ex1) keyl on *Key locking.*
ex2) keyl off *Key unlocking.*

KEYL?

Confirm controlling the front panel's key/encoder knob locking or unlocking state.

Return value " 0 " *Output off state.*
 " 1 " *Output on state.*

ex) keyl? *return value "1"*

*IDN?

This command is confirming the power supply's properties. You will receive 3 kinds properties.

Return value "ODA Technologies, MX-Series, 1.3-1.3-1.2"
 First, Manufacturer.
 Second Products model.
 Third, Products detailed version.

ex) *idn? *return value "ODA Technologies,PT-Series,1.3-1.3-1.2"*

*SN?

Confirm the power supply serial number. This can be applied as a serial number for distribution when developing a Window application.

Return value "oda-00-0000-00000"

ex) *SN? *return value "oda-01-0923-00185"*

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

This command is saving the power supply's voltage, current, OVP, OCP Level value in the non-volatile memory of 1~10.

- > 1 ~ 10 Memory saving sector number.

ex) *sav 2 *Save to number 2 memory sector.*

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

This command is recalling the power supply's saved data in the non-volatile memory

You can select among 1 ~ 10 number.

- > 1 ~ 10 Memory sector.

ex) *rcl 2 *Recall and apply the number 2 memory data to the power supply.*

***CLS**

Clear the all error event.

ex) *CLS

***RST**

This command is initializing of the power supply. Following is initializing contents.

> Output	OFF
> Voltage Limit	0V
> Current Limit	Maximum current value of the power supply.
> OVP	Maximum OVP value of the power supply.
> OCP	Maximum OCP value of the power supply.
> UVL	0V
> OVL	Voltage Limit MAX value
> UCL	0A
> OCL	Current Limit MAX value
> Volt:Step	Minumum value of setting
> Curr:Step	Minumum value of setting
> Key Lock	OFF
> Factory Mode	Keep the value of before reset
> Trip state	Clear if the OVP or OCP Tripped occurred automatically.

ex) *RST *Initialize the power supply*

7. Error Messages

About error explanation. You can confirm the error by using front panel's "ERROR I/O Local" key or PC remote interface.(Refer to "SYST:ERR?" command.)

+0,"No error"

No error state.

7-1. Operating Error

-1 OVP Trip error

Occurs when output overvoltage.

-2 OCP Trip error

Occurs when output overcurrent.

-3 OTP Trip error

Occurs when the internal temperature rises more than 70°C.

-4 FAN Trip error

Occurs when the FAN has stopped.

-5 AC Input Trip error

Occurs when the error of the monitored AC input voltage value is more than $\pm 15\%$.

-6 PFC CAP Voltge Trip error

Occur when the error of the monitored PFC output value is more than $\pm 15\%$.

-7 PA Imon Trip error

Occurs when the measured primary current of the power module is overcurrent.

-8 Power Down Trip error

Occurs when the main MCU power is unstable.

-10 V-Sensing Trip error

Occurs when V-sensing voltage output more than 5%.

7-2. Hardware Error

-200, "System interface error"

It appears when SCPI Module is out of order.

-201, "ADC operating failed"

It appears when circuit of ADC part is out of order.

-202, "Front panel operating failed"

It appears when front panel does not response.

-255, "Error not define"

It appears when unknown error occurs.

7-3. Remote Calibration Error

Refer to "4-6. Remote Interface Calibration(for GPIB)."

-20, "Ignored min run under volt"

If you set the "max" command or value input of calibration without voltage "Min" calibration operating at first.

Procedure : Min → VALUE → MAX → VALUE

-21, "Ignored min save under volt"

If you set the "max" command without "Value" of voltage "Min" calibration operating.

Procedure : Min → VALUE → MAX → VALUE

-22, "Invalid min value use under volt"

After sent the command of voltage "Min" value and then you sent the value command without Max command calibration operating.

Procedure : Min → VALUE → MAX → VALUE

-23, "En route to cal the curr"

It appears when sended calibration command about voltage during current calibration.

-24, "Over volt min parameter"

It appears voltage Min value is over the power supply's voltage limit.

Refer to "4-5. Using Front Panel Calibration."

-25, "Under volt max parameter"

It appears voltage Max value is gotton out the power supply's voltage lowest limit value.

Refer to "4-5. Using Front Panel Calibration."

-26, "Over volt max parameter"

It appears voltage Max value is gotton out the power supply's voltage highest limit value.

Refer to "4-5. Using Front Panel Calibration."

-27, "Ignored min run under curr"

If you set the "max" command or value input of calibration without current "Min".

Procedure : Min → VALUE → MAX → VALUE

-28, "Ignored min save under curr"

If you set the "max" command without "Value" of current "Min" calibration operating.

Procedure : Min → VALUE → MAX → VALUE

-29, "Invalid min value use under curr"

After sent the command of current "Min" value and then you sent the value command without Max command calibration operating.

-30, "En route to cal the curr"

It appears when sended calibration command about currrent during voltage calibration.

-31, "Over curr min parameter"

It appears current Min value is over the power supply's current limit.

Refer to "4-5. Using Front Panel Calibration."

-32, "Under curr max parameter"

It appears currenr Max value is gotton out the power supply's current lowest limit value.

Refer to "4-5. Using Front Panel Calibration."

-33, "Over curr max parameter"

It appears current Max value is gotton out the power supply's current highest limit value.

Refer to "4-5. Using Front Panel Calibration."

-34, "Not allowed command under cal"

Under the remote calibration mode, you can not use another command.

7-4. Calibration Error

If you do calibration, the power supply also do calibration of readback.
The following errors indicate failures that may occur during a calibration.

-74, "ADC-V low limit over"

It apprars when calibration of voltage ADC low section is out of range

-75, "ADC-V high limit over"

It apprars when calibration of voltage ADC high section is out of range.

-76, "ADC-A low limit over"

It apprars when calibration of current ADC low section is out of range.

-77, "ADC-A high limit over"

It apprars when calibration of current ADC high section is out of range.

7-5. Nonvolatile Memory Check Error

Before shipping the power supply, register the properties in the non-volatile memory.
If check the properties and occur the error, it appears the error.

-80, "Memory limit volt error"

It means the error of setting available voltage value.

-81, "Memory limit curr error"

It means the error of setting available current value.

-82, "Memory max volt error"

It means the error of the power supply's maximum voltage value.

-83, "Memory max curr error"

It means the error of the power supply's maximum current value.

-84, "Memory volt decimal error"

It means the error of the power supply's point expression of voltage.

-85, "Memory curr decimal error"

It means the error of the power supply's point expression of current.

-86, "Memory volt length error"

It means the error of the power supply's digit length of voltage.

-87, "Memory curr length error"

It means the error of the power supply's digit lengt of current.

-88, "Not match volt length and limit"

It means the error of no match between the power supply's setting available voltage value

-89, "Not match curr length and limit"

It means the error of no match between the power supply's setting available current value and digit length.

7-6. Interface Commands Error

This chapter is for PC interface communication error.

-120, "Suffix too long"

A suffix for a numeric parameter contained too long characters. Maximum memory buffer that you are able to send is 50 byte at only once.

-121, "Invalid data"

An invalid character was found in the command.

*ex) volt 10V Don't need character 'V'
You must revise to "volt 10".*

-122, "Syntax error"

Invalid syntax was found in the command string. You may have inserted a blank space

*ex)volt You skipped numeric value
You must revise to "volt 10".*

-123, "Invalid suffix"

A suffix was incorrectly specified for a numeric parameter. You may have misspelled the suffix

ex)volt 10 You added "*" after command.
You must revise to "volt 10".*

-124, "Undefined header"

A command was received that is not valid for this power supply. You may have misspelled the command or it may not be a valid command. If you are using the short form of the command,

*ex)volta 10 The power supply just receive "Volt" or "Voltage"
You must revise to "volt 10".*

-220, "No execution"

The power supply does not accept to execute.

*ex)Volt 20 Set the voltage to 20V.
Volt:OVP 15 The error occurred when you set the OVP level lower
than setting voltage value.*

-221, "Setting conflict"

SCPI command exist, but could no be executed in current device.

ex)POL N This is polarity change command, but could not be executed in Single Chan

-222, "Out of data"

A numeric parameter value is outside the valid range for the command.

*ex)volt 1000 Voltage setting value is too much big.
You must revise to "volt 10".*

-223, "Incorret error"

It appears when you send new query command again without receiving former query command execution from buffer.

*ex)*idn? You sent query command to the power supply and
volt? immediatly send again another new command.*

8. Cautions

Non compliance with the warnings and/or the instructions for use may damage the instrument and/or its components or injure the operator. Keep following articles.

- Avoid the installation in severe cold or hot area.
- Do not use immediately after moved from cold area
As liquefaction phenomenon, it gives damage to the power supply
After 20~30min later, use the power supply.
- Do not place the liquor thing on the power supply
The use of this instrument in a wet state could result in electrical shock or fire.
- Avoid vibration or severe impact.
- Make sufficient space at the sides and rear of the power supply for adequate air circulation.
- Do not place the heavy things on the power supply.
- Avoid the electric-magnetic field as motor and etc.
- Do not put the wire or any itmes in ventilation slots.
- Avoid hot instrument such as iron nearby the power supply.
- Do not place the front panel to downside.
It will occur to break encoder knob and etc.
- Do not connect other kinds power sources to this power supply output bus bar.
- Do not connect the DUT to output bus bar when power on.

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