

# User's Manual

## Regulated DC Power Supply

PWR-01 Series

400W model

**PWR401L      PWR401ML**

**PWR401MH      PWR401H**

800W model

**PWR801L      PWR801ML**

**PWR801MH      PWR801H**

1200W model

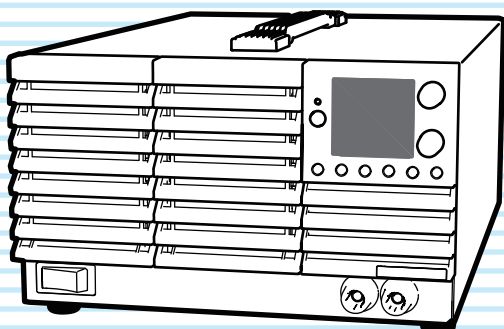
**PWR1201L      PWR1201ML**

**PWR1201MH      PWR1201H**

2000W model

**PWR2001L      PWR2001ML**

**PWR2001MH      PWR2001H**



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## About the PWR-01 Manuals

These manuals are intended for users of the Regulated DC Power Supply and their instructors. Explanations are given under the presumption that the reader has knowledge of the electrical aspects of regulated DC power supplies.

### PWR-01 manual construction

#### ■ User's manual (this manual, PDF)

This manual is intended for first-time users of this product. It provides an overview of the product, notes on usage, and specifications. It also explains how to configure the product, operate the product, perform maintenance on the product, and so on.

Please read this manual before you operate the product.

#### ■ Communication interface manual (PDF)

This manual describes remote control and multichannel (Virtual Multi Channel Bus).

The interface manual is written for readers with sufficient basic knowledge of how to control power supplies using a PC.

#### ■ Quick Reference

This document briefly explains the PWR-01 panel and the basic operation of it.

#### ■ Safety Information

This document contains general safety precautions. Keep them in mind and make sure to observe them.

PDF files are included in the accompanying CD-ROM.

The newest version of the manual can be downloaded from Download service of Kikusui website.

### Firmware versions that this manual covers

This manual applies to products with firmware versions 1.2X.

When contacting us about the product, please provide us with the following information.

Model (marked in the top section of the front panel)

Firmware version (see page 32)

Serial number (displayed on the top panel).

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## Disposal

Dispose of the product in accordance with your local regulations.

## Accessories

- Chassis connection short bar (1 pc.) [E3-300-064]
- Output terminal M4x10 screws (2 pcs.) [M3-120-010]
- Output terminal bolt set (2 sets)
  - <400W/ 800W/ 1200W model>
    - M8x18 bolt set
    - \* Only L type and ML type included.
  - <2000W model>
    - M10x25 bolt set
    - \* Only L type and ML type included.
- Output terminal cover (1 set)
- Packing list (1 copy)
- Quick Reference (Japanese: 1 pc, English: 1 pc.)
- Safety Information (1 pc.)
- CD-ROM (1 disk)

### Included only with the 400W/800W model

- The attached power cord varies depending on the shipment destination.
- Power cord (1 pc.)
    - Rating: 125 Vac  
Plug: NEMA5-15
    - 400W model:  
Length: Approx. 2.5 m [85-AA-0004]
    - 800W model:  
Length: Approx. 3.0 m [85-10-1030]
  - Power cord (1 pc.)
    - Rating: 250 Vac  
Plug: CEE7/7  
Length: Approx. 2.5 m [85-10-1070]
  - Power cord (1 pc.)
    - Rating: 250 Vac  
Plug: GB1002  
Length: Approx. 2.5 m [85-10-0791]

### Included only with the 1200W model

- Input terminal cover (1 set)
  - M3x18 [M3-112-018]
  - M3x12 [M3-112-015]
  - [P1-000-410]
  - [D6-750-001]
- Ferrite core set (1 set)
  - [96-01-0370]
  - [P4-000-551]

## Product Overview

The PWR-01 series is a constant voltage (CV)/constant current (CC) automatic crossover power supply that can output a wide range of voltage and current within rated output power.

The products in this series are divided into the following four models depending on the output capacity. They are divided into four types depending on the output voltage.

	400W model	800W model
L type(40 V)	PWR401L	PWR801L
ML type(80 V)	PWR401ML	PWR801ML
MH type(240 V)	PWR401MH	PWR801MH
H type(650 V)	PWR401H	PWR801H

	1200W model	2000W model
L type(40 V)	PWR1201L	PWR2001L
ML type(80 V)	PWR1201ML	PWR2001ML
MH type(240 V)	PWR1201MH	PWR2001MH
H type(650 V)	PWR1201H	PWR2001H

## Features

### Communication function

RS232C, USB, and LAN interfaces are all installed as standard. The remote interfaces comply with IEEE Std 488.2 1992 and SCPI Specification 1999.0.

The LAN interface complies with the LXI standard. Multi-channel (VMCB), which controls up to 31 PWR-01s from a single PC, can be used to construct a multichannel power supply system.

### Master-slave parallel operation

You can increase the output current by connecting up to three PWR-01s (two units for the 1200W model and 2000W model) in parallel. You can set one unit as the master unit, and control the remaining units as slave units.

If an error occurs in a slave unit, the master unit detects the alarm and shuts down the output of the entire system.

### Setting preset memory function

You can save up to three sets of output settings (the combination of the voltage, current, OVP, OCP, and UVL). You can simply select a set of output settings that you want to use rather than having to specify each setting every time.

### Automatic output-on setting

You can set the PWR-01 so that when a low AC input protection function (AC-FAIL) is activated and the output is turned off, the output is automatically turned back on when the problem that caused the output to turn off is fixed.

### Output-on/off delay function

You can set the delay (DELAY TIME) from when the OUTPUT key is turned on or off to when the output actually turns on or off. This is useful when you want to turn the output on or off by setting a delay according to the load characteristics.

### Set voltage/current limitation function

You can apply limits to the voltage and current settings. This prevents you from setting an appropriate value by mistake, which would cause the output to turn off.

### Overcurrent protection (OCP) detection time setting

You can set the amount of time that an overcurrent must persist after the first detection of the overcurrent before the overcurrent protection (OCP) is activated. If inrush current from the load causes an excessive current to flow temporarily, you can adjust the delay to prevent the overcurrent protection (OCP) from being activated.

### Bleeder circuit function

You can turn the bleeder circuit on and off. Turn the bleeder circuit off when you do not want the internal bleeder circuit to sink output current. When you connect a battery, you can prevent excessive electrical discharges by turning the bleeder circuit off.

### Soft start/ stop function

This function can be used to control the rise time or fall time when the load voltage or current cannot follow the sudden rise or fall in the output current or when you want to avoid the overvoltage or overcurrent protection from being activated.

### Variable internal resistance function

You can easily simulate rechargeable batteries, solar batteries, fuel cells, and other power supplies that have internal resistance. By setting the internal resistance value in constant voltage (CV) mode, you can decrease the output voltage according to the output current.

### Sequence function

The sequence function recalls conditions set in a program and runs automatically. If you write a program created on a PC into the PWR-01, you can execute the program from the panel.

When a program is written in the PWR-01, you can execute the program without a PC.

### CONFIG setting shortcut function and display

You can register CONFIG setting parameters to the front panel's SC keys. Because you do not have to go into the CONFIG menu to set the parameters, you can perform tests efficiently by registering CONFIG parameters that you use frequently. Up to three parameters can be registered.

## Notations Used in This Manual

- In this guide, the suite of products shown on the front cover is also referred to as the "PWR-01."
- The term "PC" is used to refer generally to both personal computers and workstations.
- The illustrations of displays used in this manual may differ from the actual displays. The illustrations are merely examples.
- The following markings are used in the explanations of this text.



Indicates a potentially hazardous situation which, if ignored, could result in death or serious injury.



Indicates a potentially hazardous situation which, if ignored, may result in slight injury or damage to the product and other property.



Indicates information that you should know.



Indicates a reference to detailed information.



Indicates a reference to a manual containing detailed information.

### CFxx: x

"CF" indicates that this is a CONFIG parameter. The two digits after CF indicate the CONFIG parameter number. The value after the colon indicates the selected setting.

### SHIFT+key name

Indicates an operation that requires you to press a key while holding down SHIFT.



Indicates useful information.



## Safety Precautions

When using this product, be sure to observe the “Safety Precautions” in the Safety Information manual. The following precautions pertain only to this product.

- You cannot use this product by standing it up.  
The legs on the side panel of the 2000 W model is designed to temporarily stand the product up for the purpose of carrying it by the handle.  
Because there is a risk of the product falling over, do not use or store the product in the standing position.

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### CAUTION

This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

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## Precautions Concerning Installation Location

When installing this product, be sure to observe the “Precautions Concerning Installation Location” in the Safety information manual. The following precautions pertain only to this product.

- When installing this product, be sure to observe the temperature and humidity ranges indicated below.  
Operating temperature range: 0 °C to +50 °C  
(32 °F to 122 °F)  
Operating humidity range: 20 %rh to 85 %rh  
(no condensation)
- When storing this product, be sure to observe the temperature and humidity ranges indicated below.  
Storage temperature range: -25 °C to +60 °C  
(-13 °F to 140 °F)  
Storage humidity range: 90 %rh or less (no condensation)

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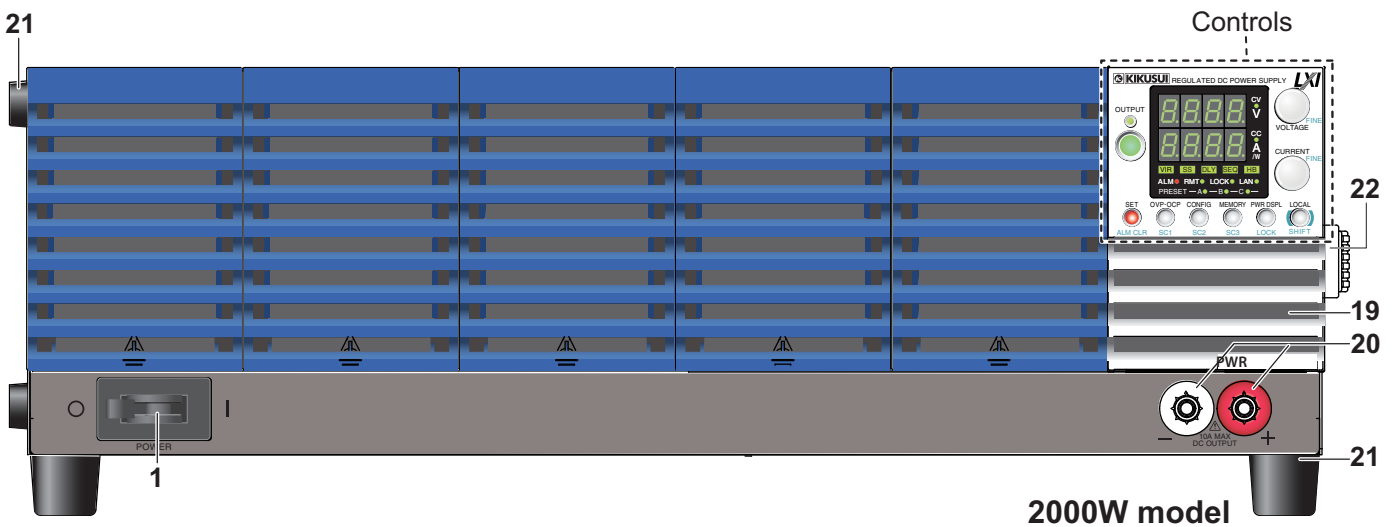
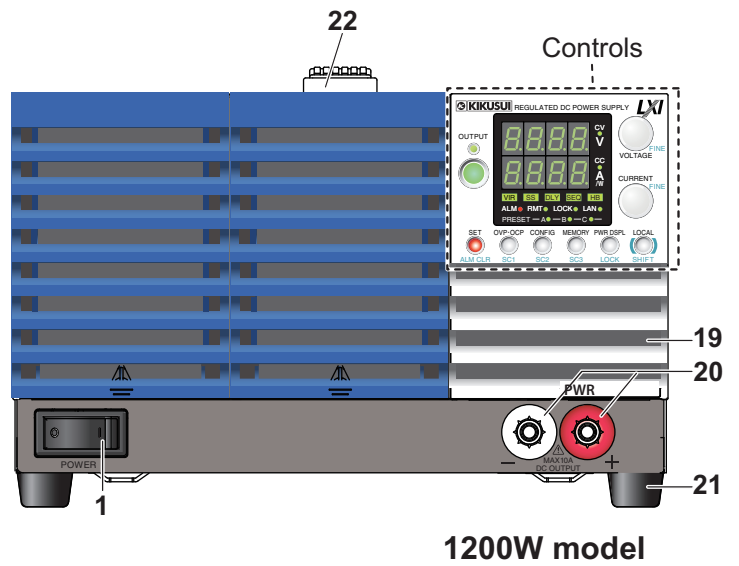
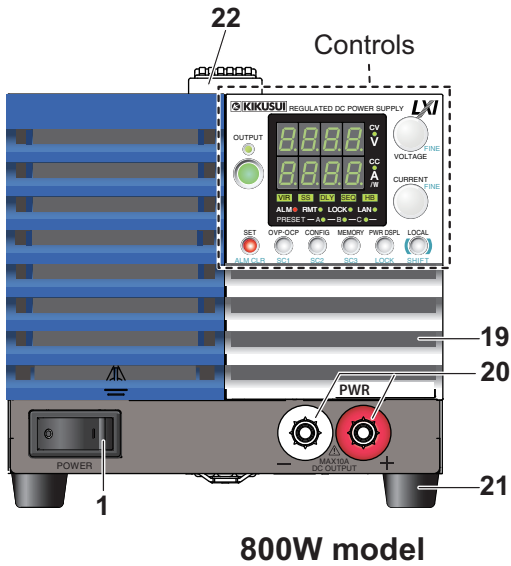
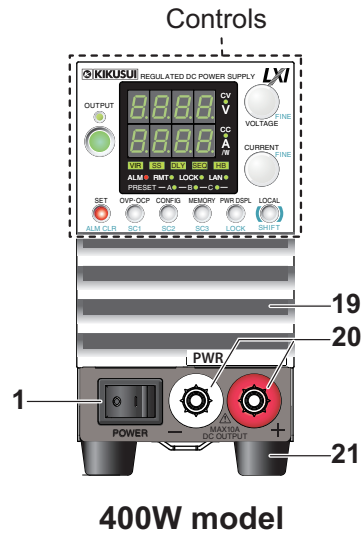
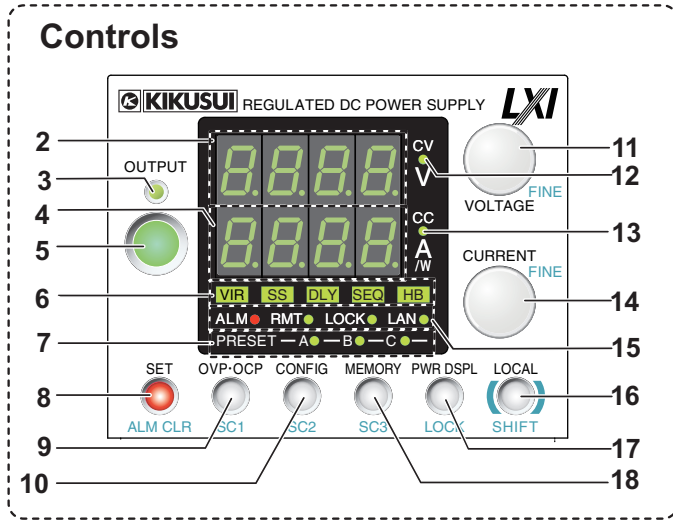
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# Component Names

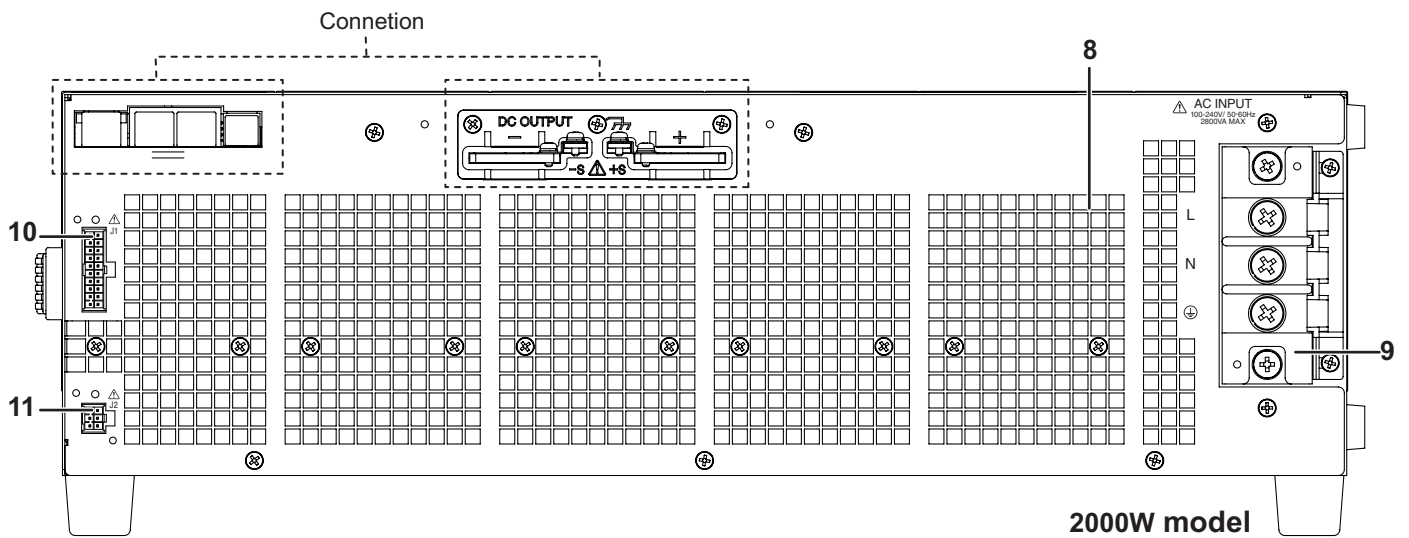
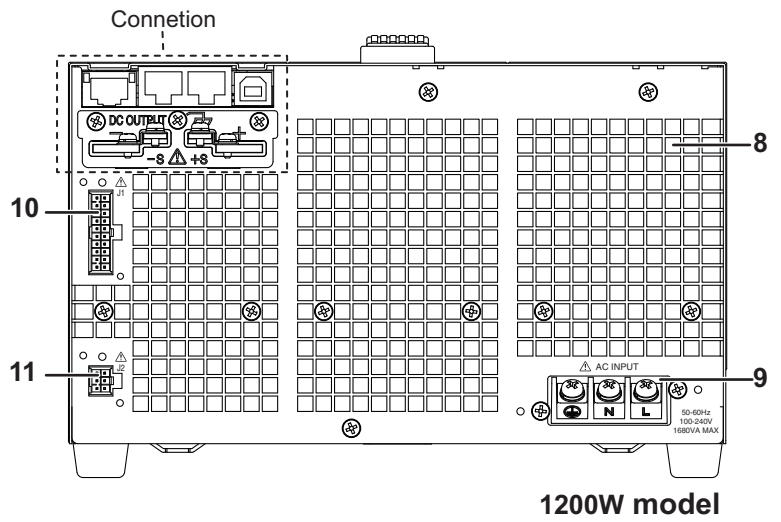
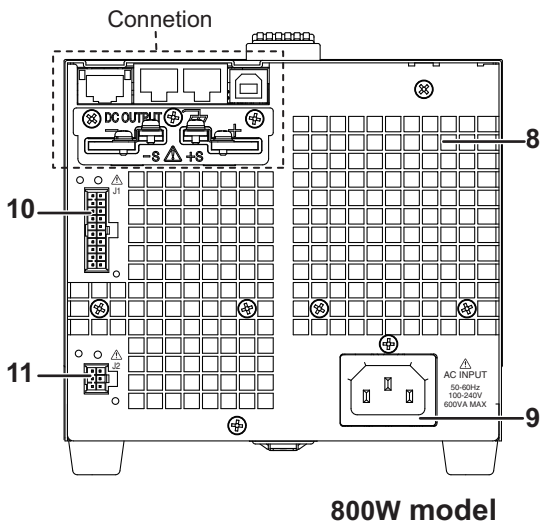
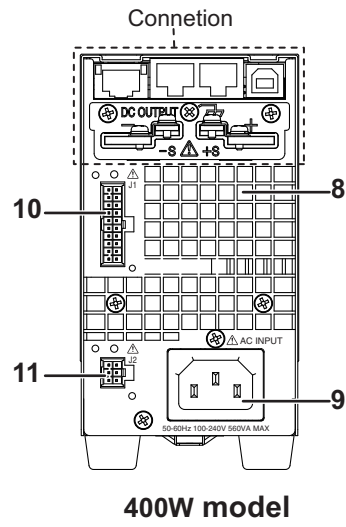
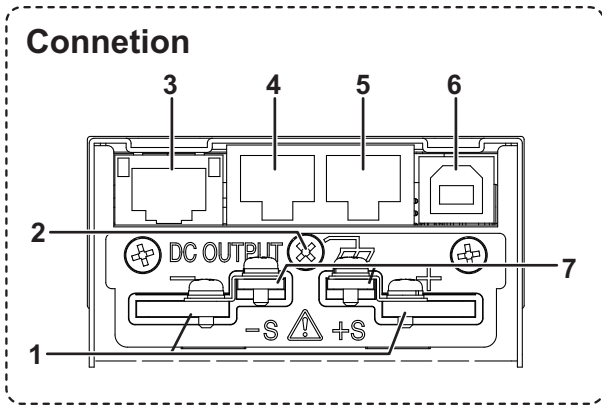
## Front panel





No.	Name	Function	See
1	POWER switch	400W model/ 800W model/ 1200W model: Power on/ off switch. Press the (I) side to turn the power on and the (O) side to turn the power off. 2000W model: Power on/ off breaker. (Rated current: 50 A, L line single-pole) Flip the lever to the (I) side to turn on and the (O) side to turn off.	p.32, p.33
2	Voltmeter	Displays the voltage, alarm, or CONFIG parameter number.	p.38, p.60
3	OUTPUT LED	Lights green when output is turned on. Blinks orange during output-on delay. Blinks green during output-off delay.	p.41
		Blinks orange when output is on and a protection function is activated.	p.50
		Lights green during soft start. Blinks green during soft stop.	p.43
4	Ammeter	Displays the current, power, or the cause of an alarm, or the value of a CONFIG parameter.	p.38, p.50, p.60
5	OUTPUT key	Used to turn output on and off.	p.41
6	VIR/ SS/ DLY/ SEQ/ HB	VIR: Lights when the variable internal resistance function is enabled.	p.84
		SS: Lights when the soft start/ stop function is enabled and blinks when it is in progress.	p.43
		DLY: Lights when the output-on/ off delay is enabled and blinks when it is in progress.	p.42
		SEQ: Lights when a sequence is being executed and blinks the PWR-01 is waiting for a trigger.	p.85
		HB: Lights when the hyper bleeder of the bleeder circuit is enabled.	p.82
7	PRESET A/ B/ C LED	A: Lights green when the memory A values are being recalled or saved.	p.77
		B: Lights green when the memory B values are being recalled or saved.	
		C: Lights green when the memory C values are being recalled or saved.	
8	SET key	Used to set and confirm the output voltage and output current (the key has an LED).	p.38
	ALM CLR key	Used to release the activated state (alarm) of protection functions (the key has an LED).	p.51
9	OVP•OCP key	Used to set and display the overcurrent protection (OCP), overvoltage protection (OVP), undervoltage limit (UVL) trip points (the key has an LED).	p.52, p.59
	SC1	Used to call the CONFIG parameter shortcut (the key has an LED)	p.79
10	CONFIG key	Used to configure the various operating conditions (CONFIG) (the key has an LED).	p.60
	SC2	Used to call the CONFIG parameter shortcut (the key has an LED)	p.79
11	VOLTAGE knob	Used to set the voltage value or select the value of a CONFIG parameter.	p.40, p.60
	FINE	Used to make fine voltage value adjustments.	p.40
12	CV LED	Lights green during constant voltage mode.	p.49
13	CC LED	Lights red during constant current mode.	p.49
14	CURRENT knob	Used to set the current, change the value of a CONFIG parameter, or set the internal resistance value.	p.40, p.60, p.65
	FINE	Used to make fine current or internal resistance value adjustments.	p.40, p.65
15	ALM LED	Lights red when a protection function is activated. However, when the undervoltage limit (UVL) is activated, the LED does not light. When the power limit (POWER LIMIT) is activated, the LED blinks.	p.78
	RMT LED	Lights green when the PWR-01 is being remotely controlled	p.80
	LOCK LED	Lights green when the keys are locked.	p.78
	LAN LED	Lights and blinks when the LAN interface is running. • No fault status (green) • Fault status (red) • Standby status (orange) • Identify status (blinking green)	MANUAL Communication Interface Manual
16	LOCAL key	Used to switch between local mode and remote mode (the key has an LED) and switch the CONFIG parameter display.	p.80
	SHIFT key	Used to enable the functions that are written in blue characters below the key.	–
17	PWR DSPL key	Used to display the output power on the ammeter (the key has an LED).	p.38
	LOCK key	Used to lock the operation of all keys other than the OUTPUT key (key lock) (the key has an LED).	p.78
18	MEMORY key	Used to load and save the value of preset memory A, B, or C (the key has an LED).	p.77
	SC3	Used to call the CONFIG parameter shortcut (the key has an LED).	p.79
19	Air inlet (louver)	Air inlet for cooling.	p.122
20	DC OUTPUT connector	Front-panel output terminal.	p.31
21	Rubber feet	400W model/ 800W model/ 1200W model: Four locations on the bottom. 2000W model: Four locations on the bottom, four locations on the side.	p.147
22	Handle	Handle for carrying.	p.147

# Rear Panel



No.	Name	Function	See
1	DC OUTPUT terminal	Rear-panel output terminal.	p.25
2	Chassis terminal	A connector for grounding the output.	p.25
3	LAN port <sup>1</sup>	Ethernet port for controlling the PWR-01 remotely.	
4	RS232C/ TRG IN connector <sup>1</sup>	RS232C port for controlling the PWR-01 remotely. Trigger signal input connector. The common terminal is connected to the chassis.	
5	TRG OUT connector <sup>1</sup>	Trigger signal output terminal. The common terminal is connected to the chassis.	
6	USB port <sup>1</sup>	USB port for controlling the PWR-01 remotely.	
7	Sensing terminal	Terminals to connect the sensing cables to.	p.34
8	Air outlet	Air outlet for internal cooling.	–
9	AC INPUT	400W model/ 800W model: AC inlet. 1200W model/ 2000W model <sup>2</sup> : AC INPUT terminal block.	p.14 p.15
10	J1 connector <sup>1</sup>	For external control and master-slave parallel operation.	p.91, p.110
11	J2 connector <sup>1</sup>	External control	p.91



1. A connector cover or terminal cover is attached when the product is shipped from the factory.
2. A terminal block cover is attached when the product is shipped from the factory (2000W model only).

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# 1

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## Preparation

This chapter describes how to turn on the PWR-01, what kind of load cables to use, and how to connect cables to the output terminals.

For information about installing and moving this product, see “Precautions Concerning Installation Location” and “Precautions to Be Taken When Moving the Product” in the Safety information manual.

When using or storing this product, be sure to observe the temperature and humidity ranges. For environmental conditions, see General Specifications ([p.142](#)).

If you want to mount the product on a rack, see “Rack mount option” ([p.146](#)).

# Connecting the Power Cord

This product conforms to IEC Overvoltage Category II (energy-consuming equipment that is supplied from a fixed installation).



**WARNING**

**Risk of electric shock.**

**This product conforms to IEC Safety Class I (equipment that has a protective conductor terminal). Be sure to earth ground the product to prevent electric shock.**

## 400W model/ 800W mode



**WARNING**

**Risk of electric shock.**

**The product is grounded through the power cord ground wire. Connect the protective conductor terminal to earth ground.**



**NOTE**

- Use the included power cord to connect to the AC line. If the supplied power cord cannot be used because the rated voltage or the plug shape is incompatible, have a qualified engineer select an appropriate power cord that is 3 m or less in length.
- The power cord with a plug can be used to disconnect the product from the AC power line in an emergency. Connect the plug to an easily accessible power outlet so that the plug can be removed from the outlet at any time. Be sure to provide adequate clearance around the power outlet.
- Do not use the dedicated power cord with other instruments.

### **1 Check that the AC power line meets the nominal input rating of the product.**

The product can receive a nominal line voltage in the range of 100 Vac to 240 Vac at 50 Hz or 60 Hz.

### **2 Check that the POWER switch is turned off.**

### **3 Connect the power cord to the AC inlet on the rear panel.**

### **4 Insert the power plug into a grounded outlet.**

## 1200W model/ 2000W model



**Risk of electric shock.**

- Before you connect the power cable, turn off the switchboard breaker (a switch that cuts off the power supply from the switchboard).
- Attach the INPUT terminal block cover regardless of whether you are using the AC INPUT terminal block before turning the POWER switch on.

**Risk of fire.**

- Be sure to have a qualified engineer make the connection to the switchboard.
- The switchboard breaker must meet the requirements shown below.

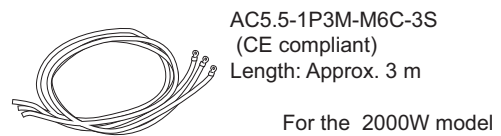
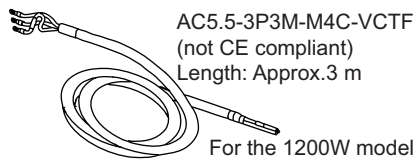


Inside the product, protection circuits are connected to match the polarity of the input terminal. Be sure to connect the L, N, and ⚡ (GND) terminals correctly between the switchboard and the product.



- We recommend that you use the optional dedicated power cord to connect to the AC power line. If you will not use the dedicated power cord, use an appropriate power cord with a length of 3 m or less that has been selected by a qualified technician.
- Do not connect to a power outlet.
- In an emergency, turn off the switchboard breaker to separate the product from the AC power line.

A power cord is not included with the 1200W model and 2000W model. Use a power cord that conforms to the rated AC input voltage and current of this product. The following dedicated power cord is available as an option.

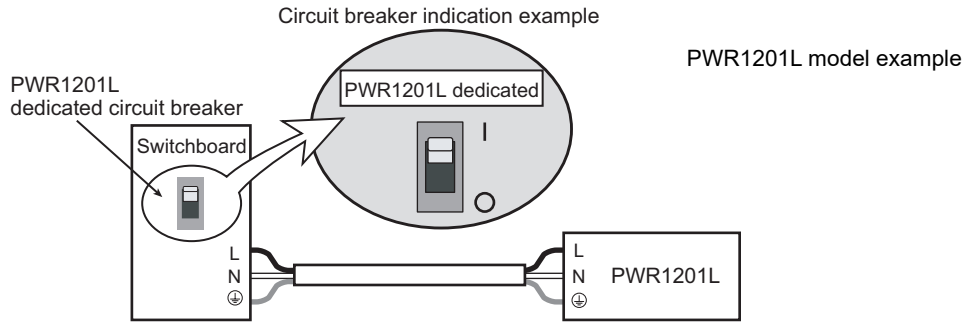


If you will not use one of the optional power cords, prepare a wire that meets the following specifications.

1200W model	Finished diameter: 12.1 mm or less
	Rated voltage: 250 V or higher
	Vinyl cabtire cable (VCTF) Nominal cross-sectional area 5.5 mm <sup>2</sup> 3 core Input terminal end: Ring terminal 5.5-4 (5.5 mm <sup>2</sup> M4)
2000W model	Nominal cross-sectional area 5.5 mm <sup>2</sup> Single core, 3pcs. Input terminal end: Ring terminal 5.5-6 (5.5 mm <sup>2</sup> M6)

■ **Switchboard breaker requirements**

- **Rated current**  
For safety reasons, circuit breakers exceeding the specified current cannot be used.  
1200W model: 30 A (100 V system), 15 A (200 V system)  
2000W model: 50 A (100 V system), 30 A (200 V system)
- Only use the breaker with this product.
- Keep the breaker readily accessible at all times.
- Indicate that the circuit breaker is dedicated for use with this product and that it is used to disconnect the product from the AC power line.

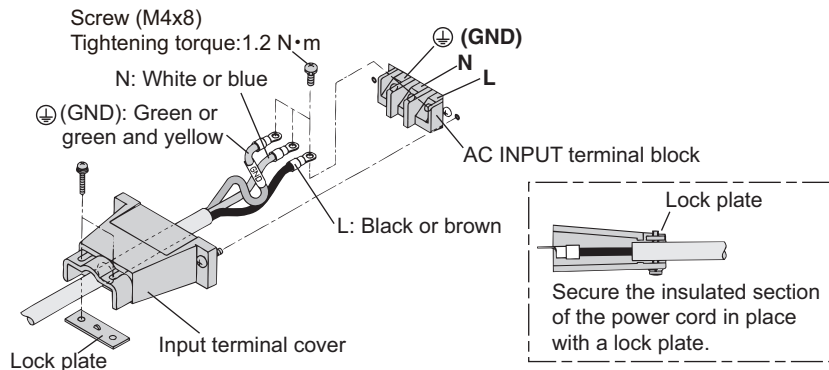


	400W model	800W model	1200W model	2000W model
Protective conductor current (at 265 Vac, 60 Hz)	1.5 mA	2.5 mA	4.0 mA	4.7 mA
Inrush current	25 Amax	50 Amax	75 Amax	125 Amax

**Connection procedure of 1200W model**

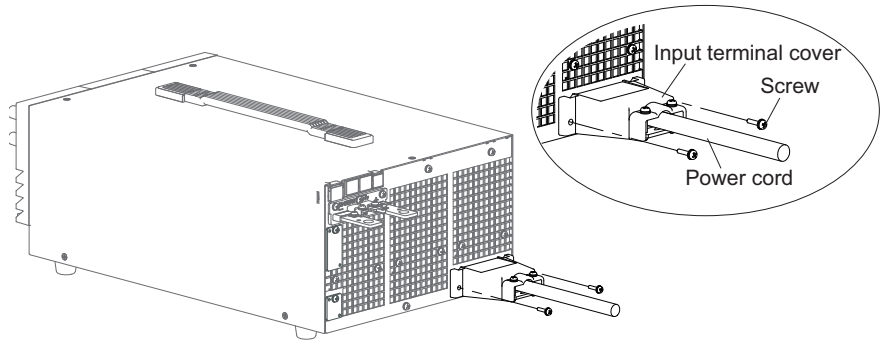
- 1 Check that the AC power line meets the nominal input rating of the product.**  
The product can receive a nominal line voltage in the range of 100 Vac to 240 Vac at 50 Hz or 60 Hz.
- 2 Check that the POWER switch is turned off.**
- 3 Connect the power cord to the AC INPUT terminal on the rear panel. Pass the power cord through the included INPUT terminal cover, and fix the cord in place using the lock plate and screws.**

Be sure to connect the L, N, and ⊕(GND) of the AC input terminal correctly.



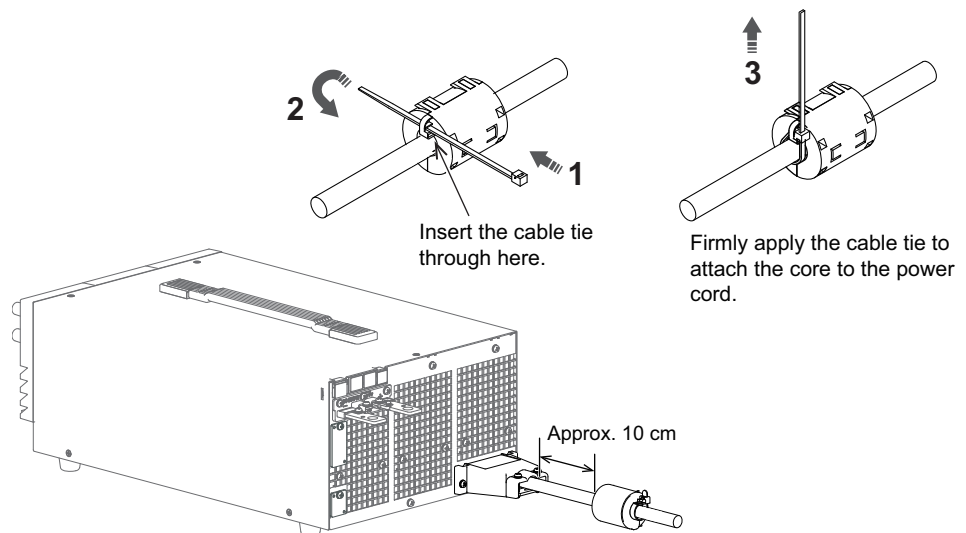


#### 4 Attach the INPUT terminal cover using the screws on the PWR-01.



#### 5 Attach the included ferrite core to the power cord.

Attach the core as close to the input terminal as possible but not too close as to get in the way of attaching and removing the INPUT terminal cover. Use the cable tie to fix the core on to the power cord. Check that the core is locked and does not move. Cut the cable tie at an appropriate length.

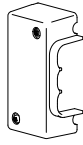


#### 6 Attach a appropriate solderless terminal to the switchboard end of the power cord.

#### 7 Turn off the switchboard's circuit breaker.

#### 8 Connect the L, N, and $\ominus$ (GND) wires of the power cord to the matching terminals on the switchboard.

## Connection procedure of 2000W model



When the PWR-01 is shipped from the factory, terminal block covers are attached to the AC INPUT terminal block.

If the cover is damaged or lost, contact your Kikusui agent or distributor

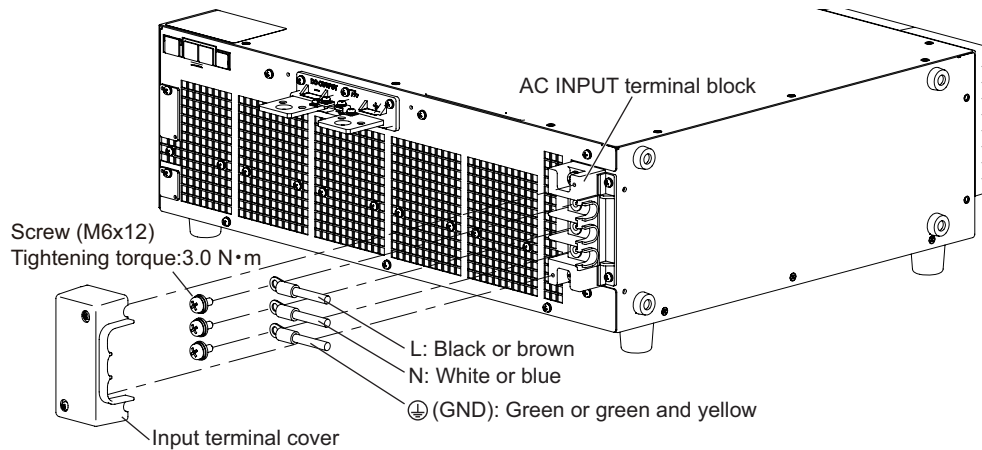
- 1 Check that the AC power line meets the nominal input rating of the product.**

The product can receive a nominal line voltage in the range of 100 Vac to 240 Vac at 50 Hz or 60 Hz.

- 2 Check that the POWER switch is turned off.**

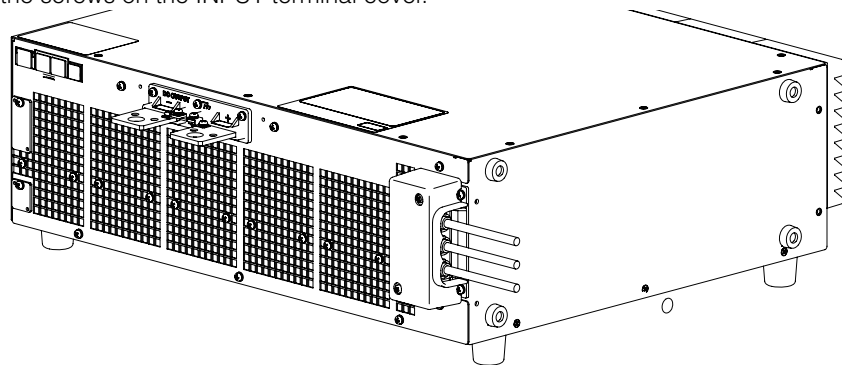
- 3 Connect the power cord to the AC INPUT terminal on the rear panel.**

Be sure to connect the L, N, and ⊕ (GND) of the AC input terminal correctly.



- 4 Attach the INPUT terminal cover to the AC INPUT terminal on the rear panel.**

Use the screws on the INPUT terminal cover.



- 5 Attach a appropriate solderless terminal to the switchboard end of the power cord.**

- 6 Turn off the switchboard's circuit breaker.**

- 7 Connect the L, N, and ⊕ (GND) wires of the power cord to the matching terminals on the switchboard.**

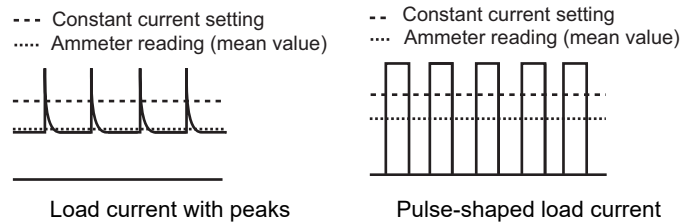
# Load Considerations

Note that the output will become unstable if the following types of loads are connected.

## Loads with peak current or pulse-shaped current

The PWR-01 only indicates mean values. Even when the indicated value is less than or equal to the set constant current, the peak values may exceed the set constant current. If this happens, the PWR-01 is instantaneously put into constant-current mode, and the output voltage drops.

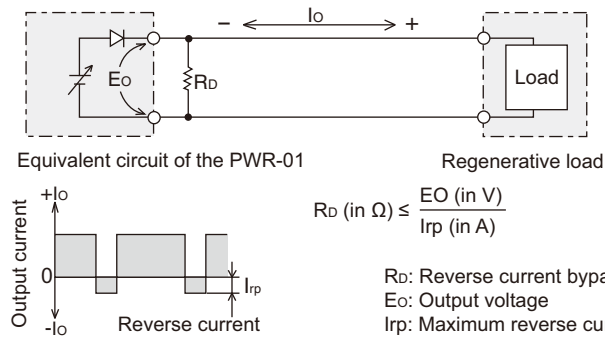
For these types of loads, you must increase the set constant current or increase the current capacity.



## Loads that generate reverse current to the power supply

The PWR-01 cannot absorb reverse current from the load. Therefore, if a regenerative load (such as an inverter, converter, or transformer) is connected, the output voltage increases and becomes unstable. This can cause a malfunction.

For these types of loads, connect a resistor ( $R_D$ ) as shown in the following figure to bypass the reverse current. However, the amount of current to the load decreases by  $I_{rp}$ .



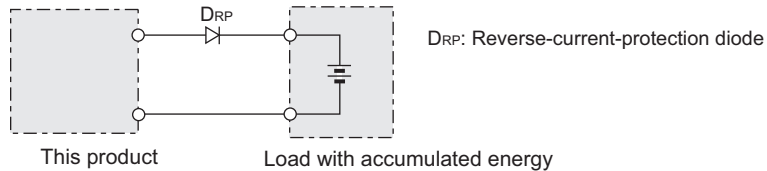
**CAUTION** Use a resistor with sufficient rated power for  $R_D$ . If a resistor with insufficient rated power for the circuit is used, resistor  $R_D$  will burn out.

## Loads with accumulated energy

Connecting a load with accumulated energy, such as a battery, to the PWR-01 may cause current to flow from the load to the internal circuit of the PWR-01. This current may damage the PWR-01 or reduce the life of the load.

For this type of load, connect a reverse-current-prevention diode (DRP) between the PWR-01 and the load in series as shown in the following figure.

This cannot be used in conjunction with remote sensing.



- 
- ⚠ CAUTION**
- To protect the load and the PWR-01, use a DRP that conforms to the following specifications.
    - Reverse voltage withstand capacity: At least twice the rated output voltage of the PWR-01.
    - Forward current capacity: 3 to 10 times the rated output current of the PWR-01.
    - A diode with small loss.
  - Be sure to take into account the heat generated by DRP. DRP will burn out with inadequate heat dissipation.
-

# Selecting the Load Cables



## **WARNING** Risk of fire.

- Use load cables whose capacity is adequate for the PWR-01's rated output current.
- The output terminal and its surrounding area become very hot. Use cables whose covers have an allowable temperature of 85 °C or higher.

## Risk of electric shock.

- Use load cables with a voltage rating that meets or exceeds the product's isolation voltage. For details on the PWR-01's isolation voltage, see Chap.7 "Specifications"(p.123).



- Use load cables with a core diameter that is appropriate for the amount of current being used and with sturdy, flame-resistant insulation.

## ■ Current capacity of load cables

A cable's temperature is determined by the resistive loss based on the current, the ambient temperature, and the cable's external thermal resistance. The following table shows the current capacity of heat-resistant vinyl cables that have a maximum allowable temperature of 60 °C when one of the cables is separated and stretched out horizontally in air in an ambient temperature of 30 °C. The current must be reduced under certain conditions, such as when vinyl cables that have a low heat resistance are used, when the ambient temperature is 30 °C or greater, or when cables are bundled together and little heat is radiated.

Nominal cross-sectional area (mm <sup>2</sup> )	AWG (reference cross-sectional area; mm <sup>2</sup> )	Allowable current <sup>1</sup> (A) (Ta = 30 °C)	Kikusui-recommended current (A)
2	14 (2.08)	27	10
3.5	12 (3.31)	37	-
5.5	10 (5.26)	49	20
8	8 (8.37)	61	30
14	6 (13.3)	88	50
22	4 (21.15)	115	80
30	2 (33.62)	139	-
38	1 (42.41)	162	100
50	1/0 (53.49)	190	-
60	2/0 (67.43)	217	-
80	3/0 (85.01)	257	200
100	4/0 (107.2)	298	-

1 Excerpt from Japanese laws related to electrical equipment.

## ■ Taking measures against noise

When connecting cables that have the same heat resistance, separating the cables as much as possible to increase heat radiation enables a greater amount of current to flow. However, wiring the + (positive) and - (negative) output wires of the load cable side by side or bundling them together is more effective against unwanted noise. The Kikusui-recommended currents shown in the above table are allowable currents that have been reduced in consideration of the potential bundling of load cables. Use these values as a guideline when connecting cables.

### ■ Limitations of the remote sensing function

All wires have resistance. As the wire becomes longer or the current becomes larger, the voltage drop in the wire becomes greater. This results in a smaller voltage being applied at the load end. The PWR-01 has a sensing function that compensates for this voltage drop up to the following values (p.34). If the voltage drop exceeds this level, use cables that have a greater cross-sectional area.

	L type	ML type	MH type	H type
Compensation voltage	Approx. 1.5 V one way	Approx. 4 V one way	Approx. 5 V one way	Approx. 5 V one way

# Output Terminal Insulation



**Risk of electric shock. For safety reasons, even if the output terminal is grounded, make sure that the insulation capacity of the output terminal (including the sensing terminal) is greater than or equal to the isolation voltage of this product. For details on the isolation voltage of each model, see "Specifications" (p.123). If you cannot obtain a cable with sufficient rated voltage, secure adequate withstand voltage by passing the cable through an insulation tube with a withstand voltage greater than the isolation voltage of the PWR-01.**



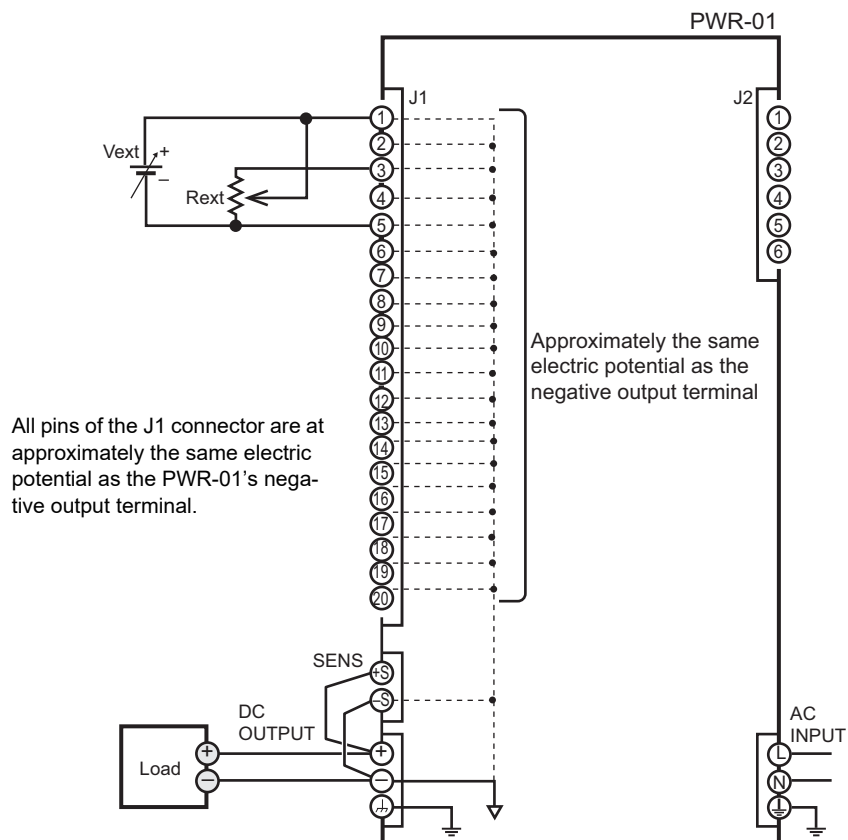
The signal cable may burn out. If the PWR-01 is to be controlled through an external voltage ( $V_{ext}$ ), do not ground the external voltage (leave it floating).

The cable and load that are connected to the output terminal (including the sensing terminal) must have an insulation capacity that is greater than or equal to the isolation voltage of the PWR-01 with respect to the chassis. Isolation voltage indicates the maximum allowed voltage that appears across the output terminal of the power supply unit and the protective conductor terminal (chassis terminal).

## When the output terminal is not grounded (floating)

The output terminal of the PWR-01 is isolated from the protective conductor terminal. If you connect the GND wire of the power cord to the ground terminal of the switchboard, the chassis of the PWR-01 is set to ground potential.

The J1 connector on the rear panel are at approximately the same electric potential as the PWR-01's negative output terminal. Cables and devices that are connected to these pins must have an insulation capacity greater than or equal to the isolation voltage of the PWR-01.

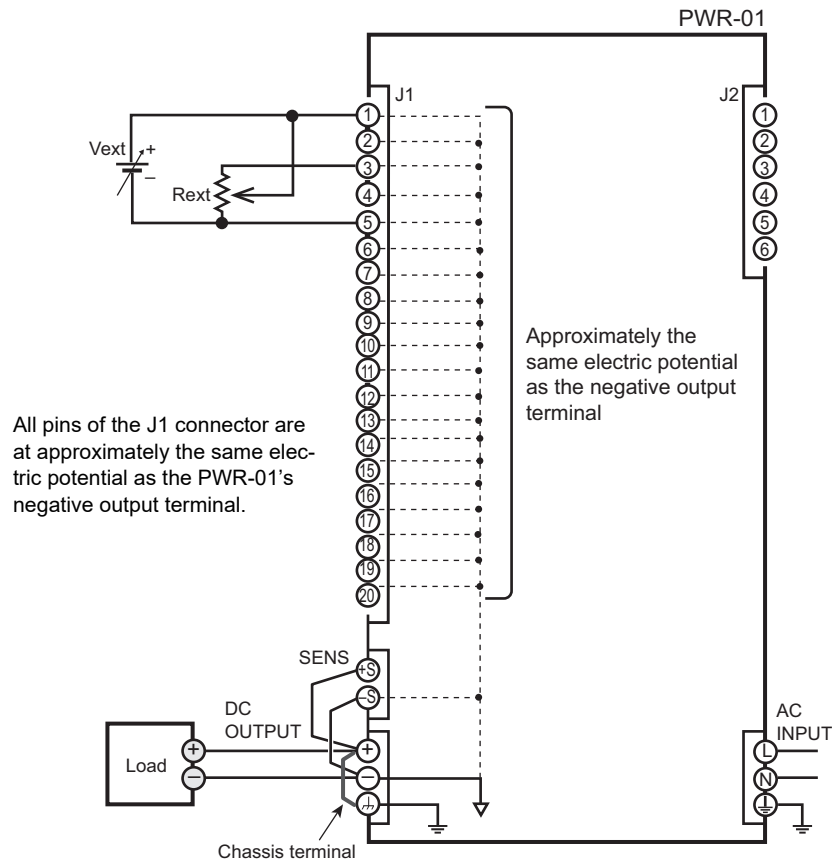


## When the output terminal is grounded

If the positive output terminal is connected to the chassis terminal, the positive output terminal is at ground potential. The cable and load that are connected to the output terminal (including the sensing terminal) will only require an insulation capacity that is greater than or equal to the maximum output voltage of the PWR-01 with respect to the chassis.

The same holds true when the negative terminal is connected to the chassis terminal. The cable and load require an insulation capacity that is greater than or equal to the maximum output voltage of the PWR-01.

For safety reasons, connect one of the output terminals to the chassis terminal unless your application requires the output terminals to be floating.





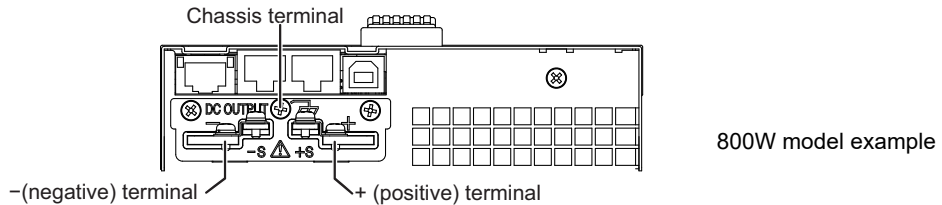
# Connecting to the Output Terminals



## Risk of electric shock.

- Turn the **POWER** switch off before you touch the rear-panel output terminals.
- Even if you turn the output off or turn the **POWER** switch off, if the bleeder circuit is set to off (CF01: 0 15), the voltage that was present when the output was on will remain at the output terminals. Set the bleeder circuit to on (CF01: 0 0 0 / 1 5 P) before you touch the output terminals.
- Regardless of whether load cables are connected to the output terminals, be sure to attach the **OUTPUT** terminal cover before turning the **POWER** switch on.

## Connecting to the rear-panel output terminals



### 1 Turn the **POWER** switch off.

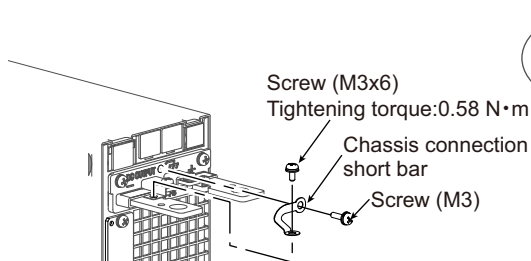
Check that there is no residual voltage at the rear-panel output terminals.

### 2 Connect one end of the included chassis connection short bar to the chassis terminal and the other end to the negative or positive output terminal.

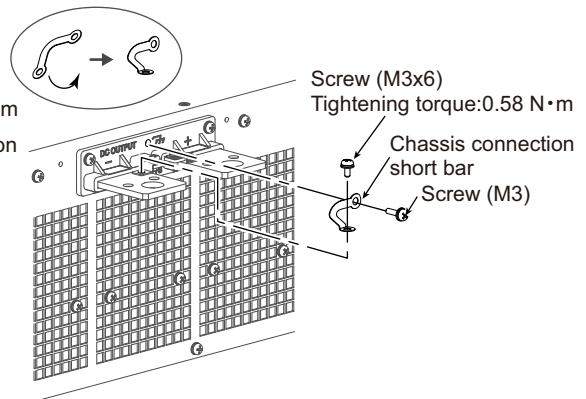
Bend the short bar to match the positions of the terminals.

Use the screw on the PWR-01 to connect the short bar to the chassis terminal. Use the screw on the rear-panel output terminal to connect the short bar to the output terminal.

If you are not grounding the output terminal (leaving it floating), refer to "Output Terminal Insulation" (p.23) before use.



400W model  
Example of connecting to the negative terminal



2000W model  
Example of connecting to the negative terminal

### 3 Attach solderless terminals to the load cables.

The rear-panel output terminals have holes for connecting the load cables. Use solderless terminals that are appropriate for the bolts that you are using.

### 4 Connect the load cables to the rear-panel output terminals.

To reduce the influence of noise on the output, keep the cables as short as possible. If possible, twist the positive and negative load cables.

**★ Memo**

If you do not connect load cables in the correct orientation, you will not be able to attach the OUTPUT terminal cover.

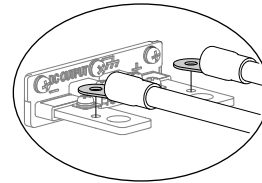
- **Cable diameter Up to  $\phi 7$  (including the insulation)**

Applicable models  
 400W model  
 800W model  
 1200W model

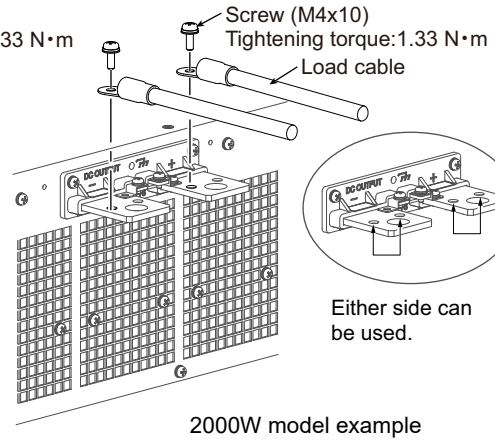
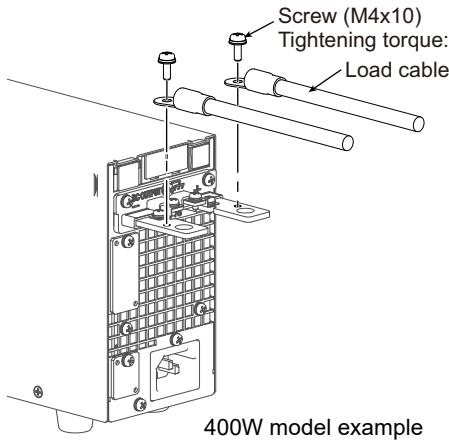
- **Cable diameter Up to  $\phi 10$  (including the insulation)**

Applicable models  
 2000W model

Bring the ring to the bottom side, and align to the top side of the output terminal.



[ Connection using the M4 screw set ]



Either side can be used.

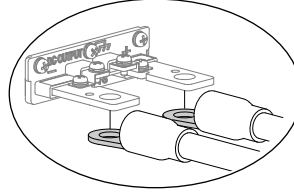
- **Cable diameter  $\varnothing 8$  to  $\varnothing 17$  (including the insulation)**

Applicable models: L type/ ML type  
 400W model  
 800W model  
 1200W model

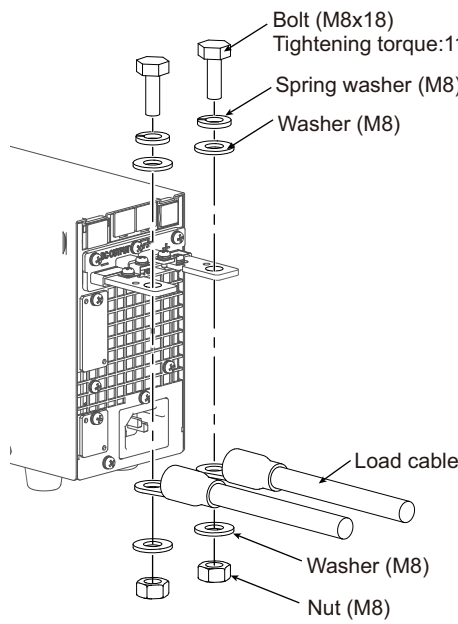
- **Cable diameter  $\varnothing 11$  to  $\varnothing 20$  (including the insulation)**

Applicable models: L type/ ML type  
 2000W model

Bring the ring to the bottom side, and align to the bottom side of the output terminal.

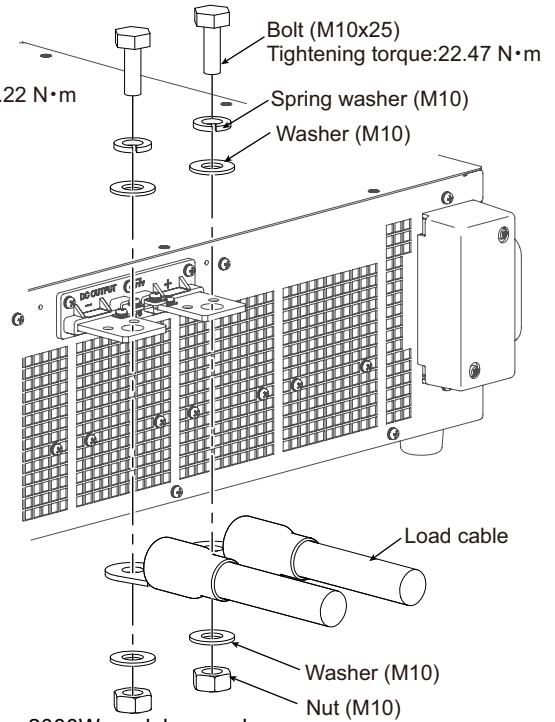


[ Connection using the M8 screw set ]



400W model example

[ Connection using the M10 screw set ]



2000W model example

## Attaching the OUTPUT terminal cover

You can adjust the diameter of the holes that the load cables pass through by changing the orientation of the adapter attached to the OUTPUT terminal cover. There are two available orientations. Use the appropriate orientation for the load cables (including the insulation) that you are using.

### Attaching the 400W model/ 800W model/ 1200W model

- Cable diameter (including the insulation) up to  $\varnothing 7$ : Attach the adapter of the OUTPUT terminal cover so that the hole diameter is small.
- Cable diameter (including the insulation) from  $\varnothing 8$  to  $\varnothing 17$ : Attach the adapter of the OUTPUT terminal cover so that the hole diameter is large.

**Memo**

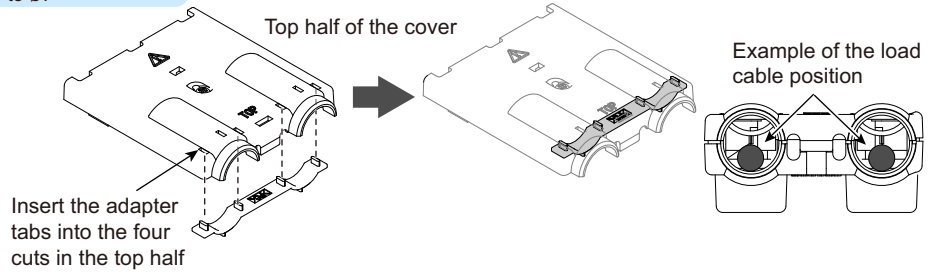
The top and bottom halves of the OUTPUT terminal cover have different shapes.

**1 Attach the adapter to the top half of the OUTPUT terminal cover.**

Insert the adapter tabs into the cuts in the OUTPUT terminal cover.

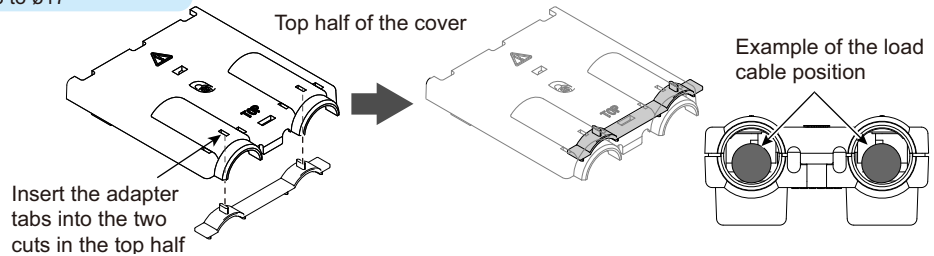
For thin load cables

Cable diameter (including the insulation)  
Up to  $\varnothing 7$

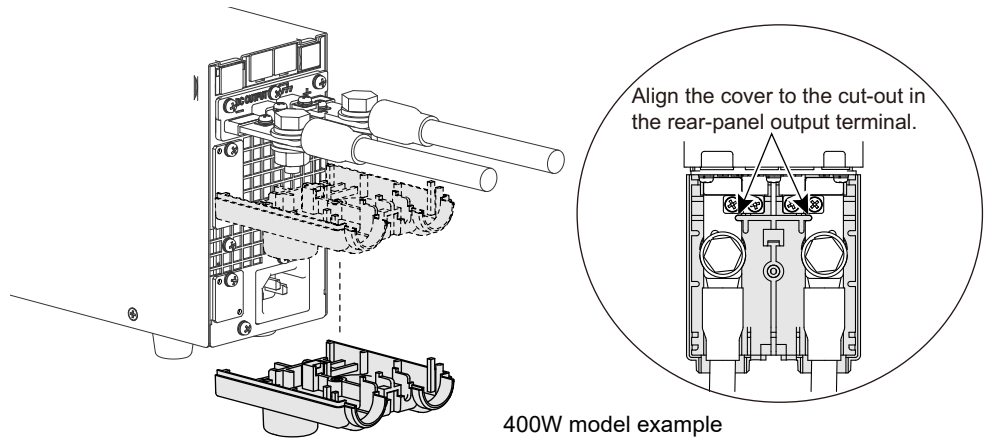


For thick load cables

Cable diameter (including the insulation)  
 $\varnothing 8$  to  $\varnothing 17$

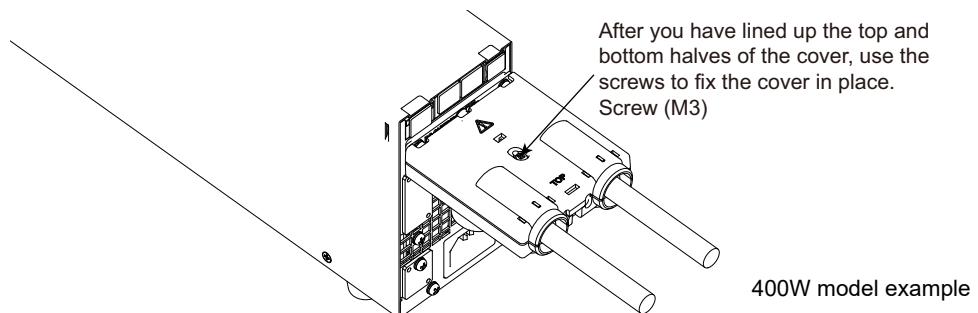


**2 Align the bottom half of the OUTPUT terminal cover to the rear-panel output terminals.**



**3 Place the top half of the OUTPUT terminal cover over the bottom half, and attach them together with the included screws.**

Make sure that the screws are securely fastened.



## Attaching the 2000W model

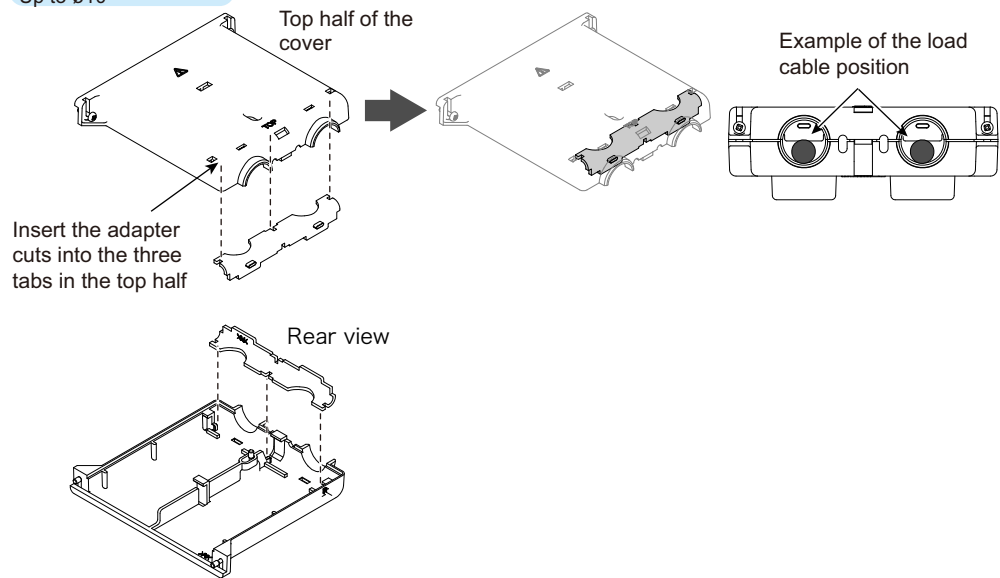
- Cable diameter (including the insulation) up to  $\varnothing 10$ : Attach the adapter of the OUTPUT terminal cover so that the hole diameter is small.
- Cable diameter (including the insulation) from  $\varnothing 11$  to  $\varnothing 20$ : Attach the adapter of the OUTPUT terminal cover so that the hole diameter is large.

### 1 Attach the adapter to the top half of the OUTPUT terminal cover.

Insert the adapter in alignment with the tabs or cuts in the OUTPUT terminal cover.

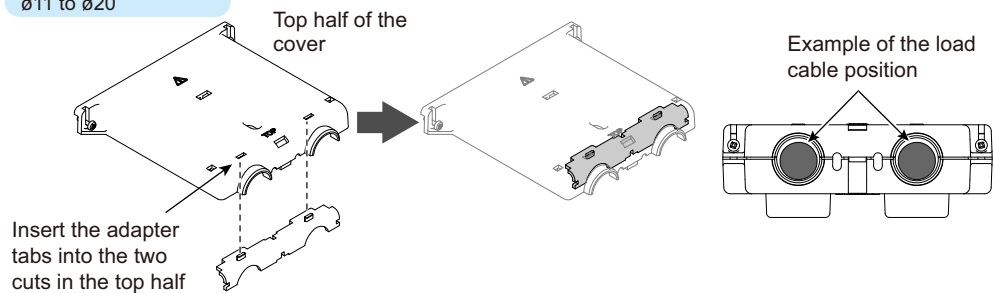
For thin load cables

Cable diameter  
(including the insulation)  
Up to  $\varnothing 10$

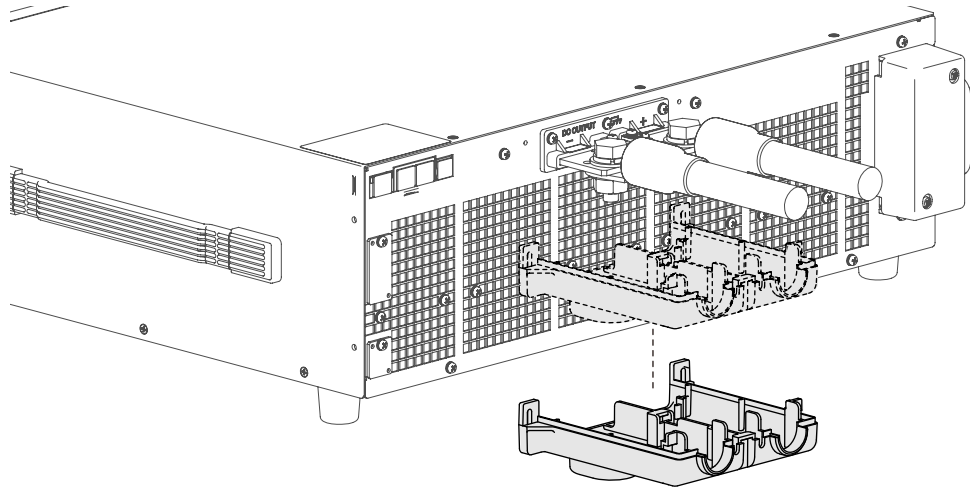


For thick load cables

Cable diameter  
(including the insulation)  
 $\varnothing 11$  to  $\varnothing 20$

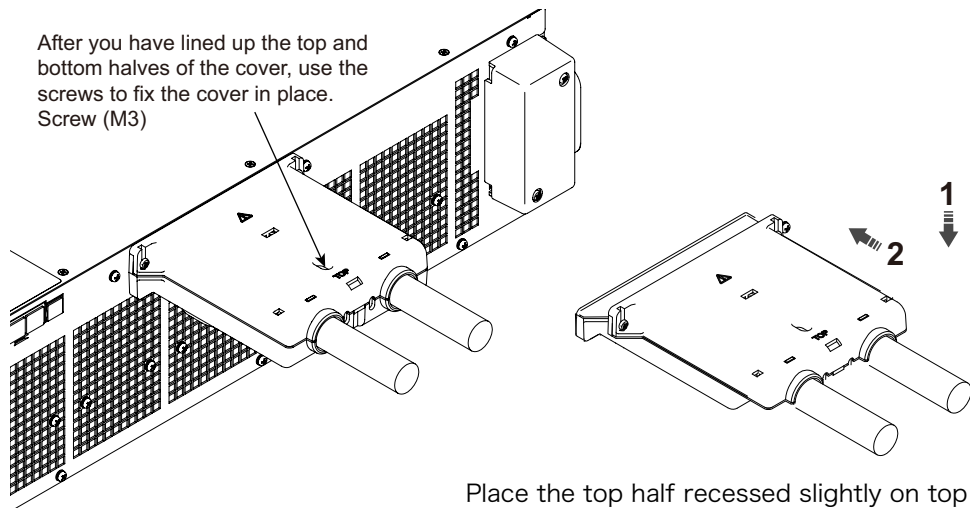


- 2** Align the bottom half of the OUTPUT terminal cover to the rear-panel output terminals.



- 3** Place the top half of the OUTPUT terminal cover recessed slightly on top of the bottom half, and then slide it forward. Attach them together with the included screws.

Make sure that the screws are securely fastened.



Place the top half recessed slightly on top of the bottom half (1) and then slide (2).

## Connecting to the front-panel output terminals

The specifications of the PWR-01 apply to the rear-panel output terminals. The front-panel output terminals may not meet the specifications.

There is no grounding terminal on the front-panel output terminals. To ground one side of the output, connect the rear-panel chassis terminal to either the negative output terminal or the positive output terminal.

If you are not grounding the output terminal (leaving it floating), refer to “Output Terminal Insulation” (p.23) before use.

If the output current of the front-panel output terminals exceeds 10 A (typical value), the front-panel output terminal overcurrent protection (FOCP) will be activated (p.55).



- **Risk of electric shock. The front-panel output terminals are designed to be used with safety plugs. Do not use connectors that have bare conductive parts (such as banana plugs) to connect to the front-panel output terminals.**
- **Risk of heat buildup or fire. Do not run current higher than 10 A through the front-panel output terminals.**

### ■ Necessary cables and plugs (recommended)

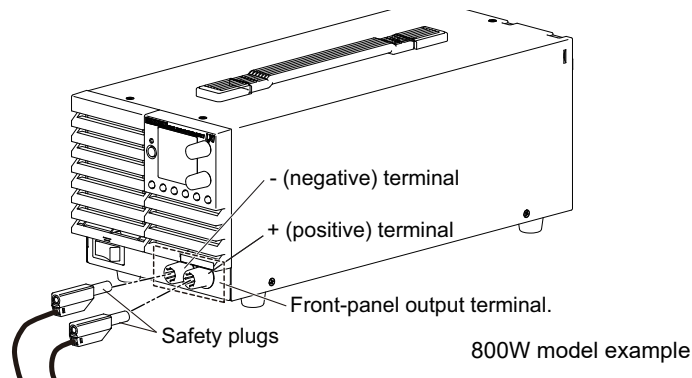
Polyvinyl chloride insulation cable: Nominal cross-sectional area of 0.33 mm<sup>2</sup> (AWG22) to 0.82 mm<sup>2</sup> (AWG18)

Rated voltage: 1000 V or higher

Length: Less than 3 m

Output terminal plugs: Safety plugs

Safety plugs TL41 and TL42 are available as options (p.148).



- 1 Attach safety plugs to the load cables.**
- 2 Connect the load cables with safety plugs to the front-panel output terminals.**

To reduce the influence of noise on the output, keep the cables as short as possible. Twist the positive and negative load cables.

# Turning the Power On

## Turning on the POWER switch



**WARNING**

**Risk of electric shock. Regardless of whether load cables are connected to the output terminals, be sure to attach the OUTPUT terminal cover before turning the POWER switch on.**



**CAUTION**

Risk of damage to load.

If the PWR-01 is configured to turn on the output when the POWER switch is turned on in CONFIG settings, set an appropriate OVP or OCP value before connecting a different load.

If the POWER switch is turned on for the first time after purchase, the PWR-01 starts in the factory default condition (p.144). Subsequent times that you turn the PWR-01 on, it starts with the panel settings (excluding the output on/off setting) that were in use immediately before the POWER switch was turned off.

You can use the CONFIG settings (CF45) to select the output state of the PWR-01 when the POWER switch is turned on (p.71).

**1 Check that the power cord is connected correctly.**

**2 Check that the OUTPUT terminal cover is attached (p.27).**

When the product is shipped from the factory, the OUTPUT terminal cover is not attached.

**3 Turn the POWER switch on (I).**

All the indicators light, and then the voltmeter and the ammeter display the following sequence of information: the rated voltage and rated current, the firmware version number, and then the build number. Each item is displayed for approximately 1 second.

After a few seconds, the PWR-01 enters the operation standby state (the measured value is displayed).



Rated voltage and rated current display  
(PWR401ML example)



Firmware version display  
(Version 1.00 in this example)



Build number display  
(Build number BLD 0125 in this example)



## Turning the POWER switch off

Turn the POWER switch off (O).

Because the AC input is shut off, AC-FAIL will be indicated, and then the PWR-01 will shut down.



Power-off indication

The PWR-01 saves the panel settings (except the output on/off setting) that were in use immediately before the POWER switch was turned off.

You can use the CONFIG settings (CF45) to select the output state of the PWR-01 when the POWER switch is turned on ([p.71](#)).

If the POWER switch is turned off immediately after the settings have been changed, the last settings may not be stored.

---

**CAUTION**

After you turn the POWER switch off, wait at least 10 seconds after the panel display turns off before you turn the POWER switch back on. Repeatedly turning the POWER switch on and off at short intervals can cause damage to the inrush current limiter. Furthermore, this will shorten the service life of the POWER switch and the internal input fuse.

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# Remote Sensing Function

Remote sensing is a function that stabilizes the output voltage across the load by reducing the influence of voltage drops and other effects caused by the load cable resistance.

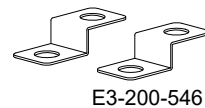
The PWR-01 remote sensing can compensate up to the values shown below. Select a load cable that has sufficient current capacity to prevent the voltage drop in the load cable from exceeding the compensation voltage.

When you perform remote sensing, set the voltage of the sensing point (across the load) so that it does not exceed the rated output voltage. If you are performing remote sensing with the voltage close to the maximum output voltage, the output is limited by the maximum output voltage (105 % of the rated output voltage). Electrolytic capacitors may be required at the sensing point (across the load).

To reduce the effect of noise, use twisted-pair cables or 2-core shielded cables. When you use shielded cables, connect the shield to the PWR-01 or the load grounding terminal.

	L type	ML type	MH type	H type
Compensation voltage	Approx. 1.5 V one way	Approx. 4 V one way	Approx. 5 V one way	Approx. 5 V one way

When the product is shipped from the factory, a sensing short bar is connected across the sensing terminals and DC OUTPUT terminals. When the sensing terminals are not used, connect the sensing short bar.



If the short bar is damaged or lost, contact your Kikusui agent or distributor.

## Connecting the sensing cables

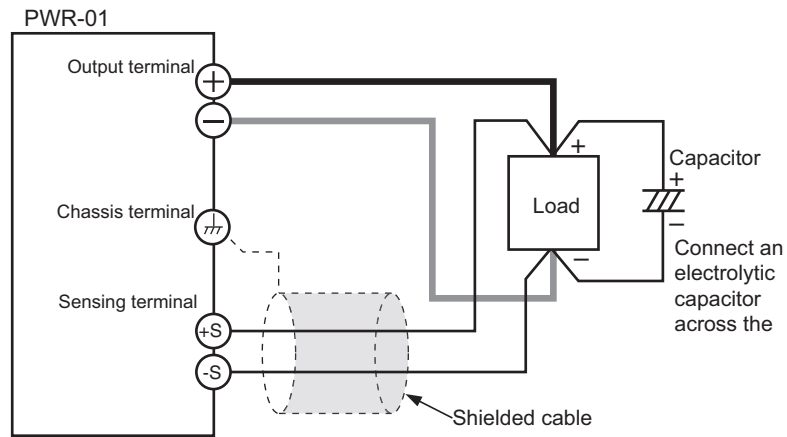


**Risk of electric shock and damage to internal circuits.**

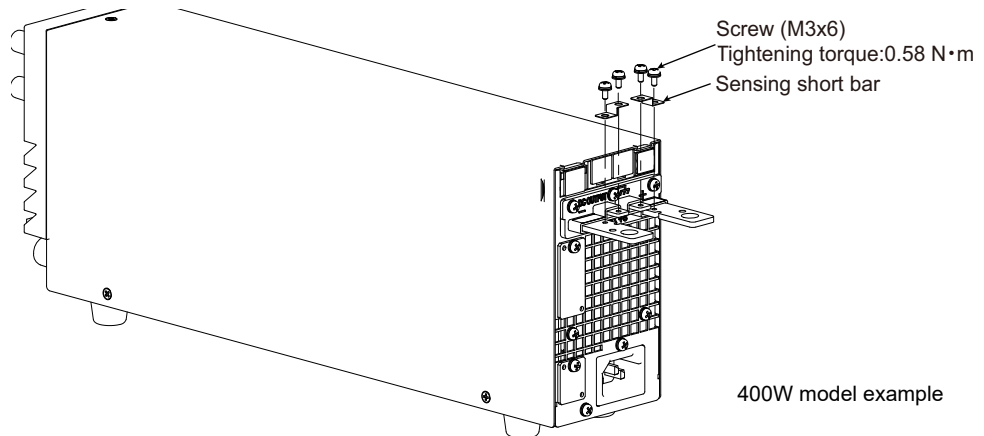
- Never wire the sensing terminals while the **POWER** switch is turned on.
- For sensing cables, use cables with a voltage rating that is higher than the PWR-01's isolation voltage. Protect the uncovered sections of the shielded cable by using insulation tubes whose withstand voltage is greater than the PWR-01's isolation voltage.
- Even if you turn the output off or turn the **POWER** switch off, if the bleeder circuit is set to off (CF01: 閉), the voltage that was present when the output was on will remain at the output terminals. Set the bleeder circuit to on (CF01: 開/ はずす) before you touch the sensing terminals.
- Be sure to attach the **OUTPUT** terminal cover before turning the **POWER** switch on.

If the sensing cables come loose, the output voltage will rise several volts. To prevent voltage output exceeding the voltage setting, set an appropriate OVP trip point.

After you finish using remote sensing, connect the sensing short bar.



- 1** Turn the **POWER** switch off.
- 2** Remove the sensing short bar that is connected across the sensing terminals and DC OUTPUT terminals.



- 3** Attach Solderless terminals to the sensing cables, and connect the sensing terminals to the sensing point (across the load).

Attach Solderless terminals that match the screws to be used, and securely fasten the cables.

If you cannot use shielded cables, twist the positive and negative cables sufficiently.

## Electrolytic capacitor to connect across the load

If the wiring inductance component is large, the following symptoms may appear.

- Oscillation  
If the wires used to connect to the load are long, the wiring inductance and capacitance can cause phase shifting at a level that cannot be ignored. This may lead to oscillation.
- Output fluctuation  
If the load current changes drastically in a pulse-shaped pattern, the output voltage may become large due to the wiring's inductance component.

You can reduce the inductance component by twisting the load cables, which stabilizes the voltage. However, if this does not correct the problem, connect an electrolytic capacitor across the load.

Electrolytic capacitor to use

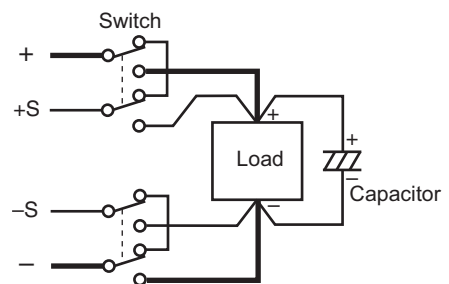
Capacitance: 0.1  $\mu\text{F}$  to several 100  $\mu\text{F}$

Withstanding voltage: At least 120 % of the rated output voltage of the PWR-01

	L type	ML type	MH type	H type
Withstanding voltage	48 V or more	96 V or more	288 V or more	780 V or more

### ■ If you are inserting a mechanical switch between the PWR-01 and the load

If you want to connect and disconnect the load using a mechanical switch that is inserted between the PWR-01 and the load, be sure to include switches in the sensing cables as shown in the following figure and turn on and off the load cable and the sensing cables simultaneously. Before you turn the mechanical switch on or off, be sure to turn off the OUTPUT key.





# 2

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## Basic Features

This chapter describes how to turn the output on and off and the basic operations that you can perform from the front panel.

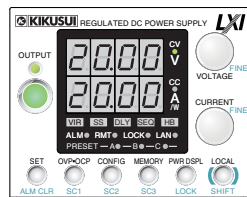
# Measured Value Display and Setting Display

The voltage and current displays have the following two states.

- Measured value display
- Setting display

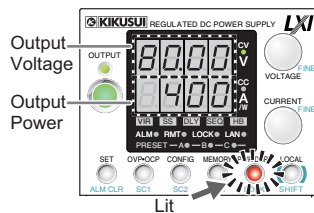
In addition to the voltmeter and ammeter, the PWR-01 can display the power, the set OVP, OCP, or UVL, and the system configuration.

## Measured value display



The present output voltage and output current are displayed. In this situation, the SET key is off. You can change the output voltage and output current in the measured value display (p.47).

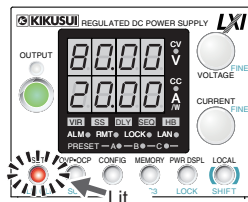
### ■ Power display



In the measured value display, press PWR DSPL to display the output voltage in the voltmeter and the output power on the ammeter. The output power is calculated from the measured output voltage and the measured output current.

When the power is being displayed, the PWR DSPL key lights. If you press the key again, the light turns off, and the output current is displayed.

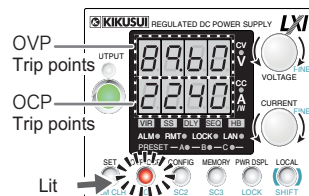
## Setting display



Press SET to light the key and display the present output voltage and output current settings. Pressing SET again turns off the key and shows the measured value display.

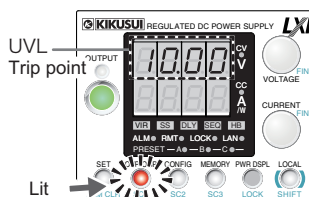
The value set with the SET key is invalid when the PWR-01 is being controlled externally.

### ■ Overvoltage protection, overcurrent protection, and undervoltage limit setting display

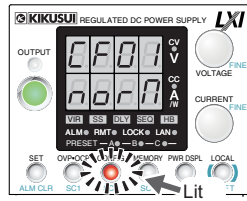


Press OVP•OCP to light the key and display the present overcurrent protection and overvoltage protection settings.

Press OVP•OCP again, the present undervoltage limit value is displayed.



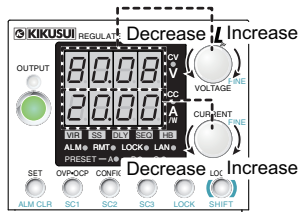
■ System configuration setting display



Press CONFIG to light the key and display the current system configuration settings.

# Panel Operations

## Measured value display, setting display, and set OVP/ OCP display



Turn the VOLTAGE knob to change the voltage. Turn the CURRENT knob to change the current.

When the output is on, press SET to switch to the setting display, and then change the output while you view the actual voltage or current settings.

### ■ Fine adjustment (FINE)

Hold down SHIFT while you turn the VOLTAGE knob or CURRENT knob to make small changes to the value. When the output is on, amount of change becomes even smaller.

The displayed current or voltage may not change even if you turn the VOLTAGE or CURRENT knob. This is because the value is being changed at a higher resolution than what is shown. In this situation, the display will change when the amount that you change the value by reaches the smallest display digit of the set voltage or current.

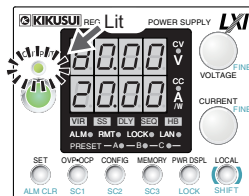


# Output Operation

The output turns on and off each time that you press OUTPUT. When output is on, the OUTPUT LED lights. When the output is off, the OUTPUT LED turns off.

When the output is on, output is generated at the present set values.

If you change the settings while the output is on, the changes are applied immediately to the output. If the output is off, the setting display will appear (the SET key lights) as soon as you change the settings. After changing the setting, pressing OUTPUT turns the output on.



You can use external control to turn the output on and off ([p.67](#), [p.101](#)).

## Setting limits

You can apply limits to the voltage and current settings ([p.52](#), [p.54](#), [p.59](#)).

Using CONFIG settings (CF22/ CF23), you can set limitations so that the values do not exceed about 95 % of the set overvoltage protection (OVP) trip point or about 95 % of the set overcurrent protection (OCP) trip point and so that the values are not set lower than the set undervoltage limit (UVL trip point).

You can avoid turning the output off by mistakenly setting the voltage or current to a value that exceeds the set OVP or OCP trip point or avoid setting a value that is lower than the set UVL trip point.

## Output on/off setting at power-on

By factory default, the output is off when the power is turned on. Using a CONFIG setting, you can set the output state at power-on ([p.71](#)).

About 2000W model, the breaker trip setting that is applied when an OVP/ OCP/ FOCP/ SD or PRL ALM activates is set to "trip" (CF25: □□) and the OVP trip point is set lower than the output voltage setting, the OVP will activate every time you turn the POWER switch on and the POWER switch will turn off.

If the condition above occurs and you are unable to change any of the settings, turn off the on / off control setting of the external control output, turn the POWER switch, and change the OVP trip point. Or, on while holding down the LOCAL key and PWR DSPL key to reset the PWR-01 to factory default settings ([p.101](#), [p.144](#)).



Risk of damage to load.

If you want to turn on the output at power-on, be sure to set an appropriate OVP/OCP trip point for the connected load before turning off the POWER switch ([p.52](#), [p.53](#)).

## Output-on startup state parameter

You can set whether to start the PWR-01 as a constant voltage (CV) power supply or a constant current (CC) power supply when the output is turned on (p.64).

Using the output-on startup state CONFIG parameter (CF02:  $\square \square / \square \square$ ), select prioritize CV (CF02:  $\square \square$ ) to start as a constant voltage (CV) power supply or prioritize CC (CF02:  $\square \square$ ) to start as a constant current (CC) power supply.

## Output-on/ off delay setting

You can set the delay from when the OUTPUT key is pressed to when the output actually turns on or off (p.65). This is a useful feature when you want to turn the output on or off by setting a delay according to the load characteristics.

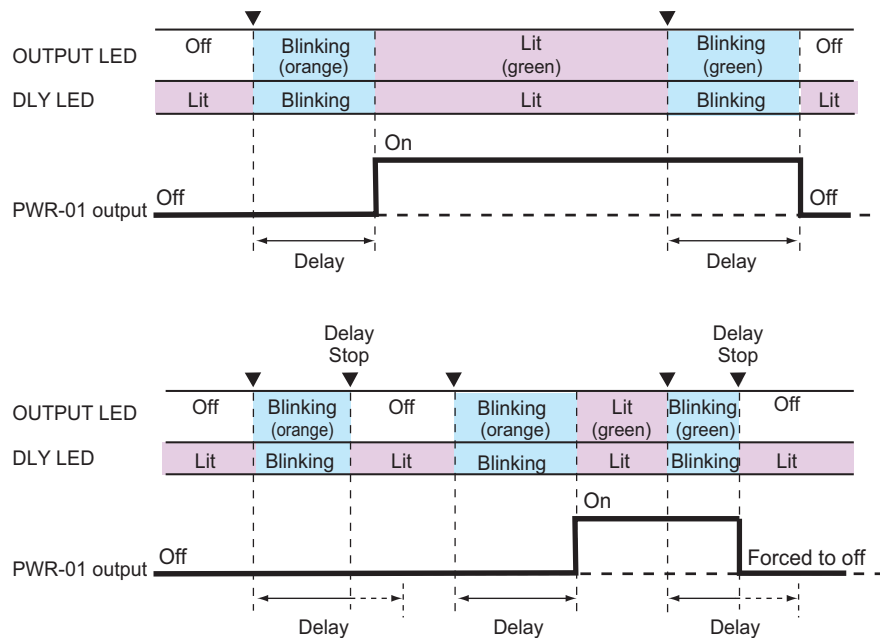
Use the output-on delay (CF08) or output-off delay (CF09) CONFIG parameter to set the delay. When you set the delay, DLY lights.

When the output-on/ off delay is in effect, DLY and the OUTPUT LED blink (orange if set to on, green if set to off).

If you press OUTPUT when the output-on/ off delay is in effect, the process is canceled, and the output is turned off. If you press OUTPUT again, the output-on delay resumes.

You can use the CONFIG settings to allow the output-on/ off delay function to be controlled through the output on/off control using an external contact (CF14:  $E_{nh}$ ).

▼ represents that the OUTPUT key has been pressed.



## Soft start/ soft stop function

You can set the rise time and fall time of output voltage/ output current.

This is useful when the load cannot follow the sudden rise or fall in the output voltage/ output current or when you want to avoid the overvoltage protection/ overcurrent protection from being activated.

Set the soft start time (CF04/ CF06) and soft stop time (CF05/ CF07) CONFIG parameters. The soft start and soft stop times are applied to the operation mode set by the output-on startup state (CF02:  $\square U / \square \square$ ).

When you set the this function, SS lights.

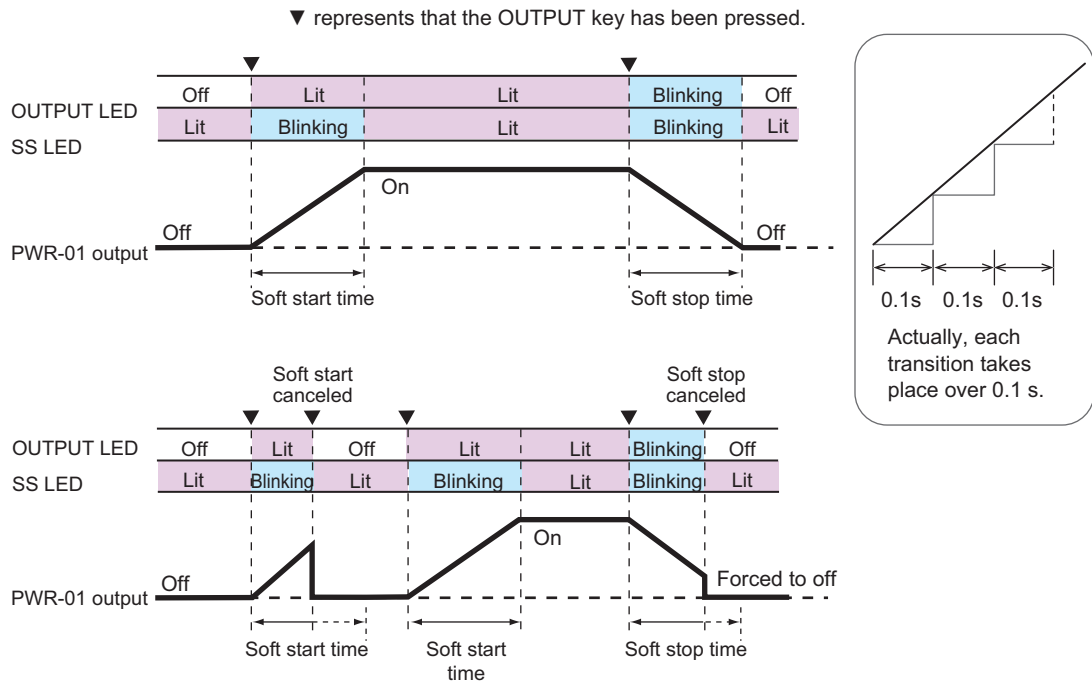
When soft start is in effect, SS blinks, and the OUTPUT LED lights green.

When soft stop is in effect, SS and the OUTPUT LED blink green.

If you press OUTPUT when soft start or soft stop is in effect, the process is canceled, and the output is turned off. If you press OUTPUT again, soft start resumes.

If the bleeder circuit is set to off, the output current may not fall gradually even if soft stop is used.

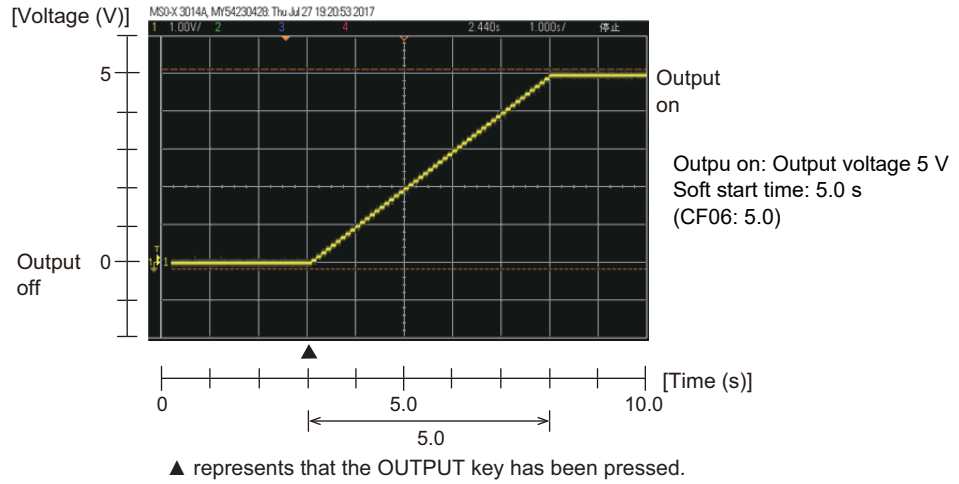
You can use the CONFIG settings to allow the soft start and soft stop functions to be controlled through the output on/off control using an external contact (CF14:  $E_{OH}$ ).



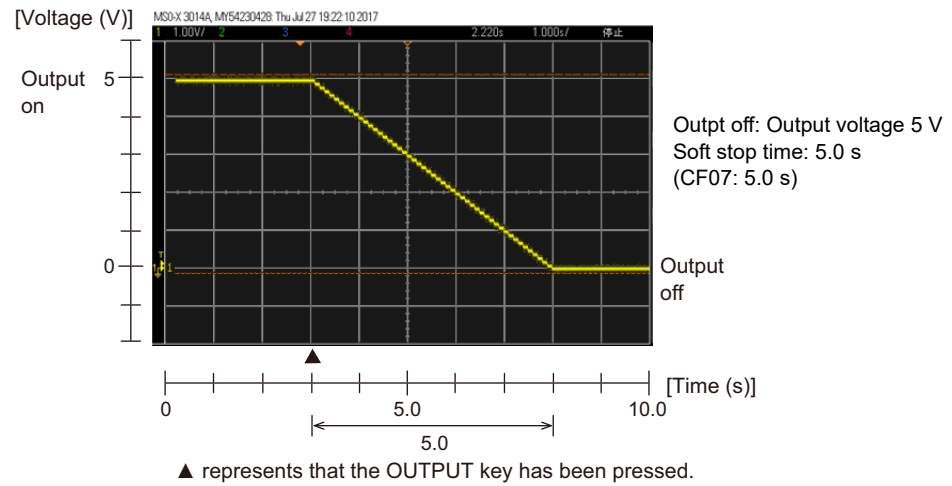
## Soft start and soft stop waveforms

Waveforms when soft start and soft stop are used are shown below.

### ■ Waveform when soft start is used



### ■ Waveform when soft stop is used



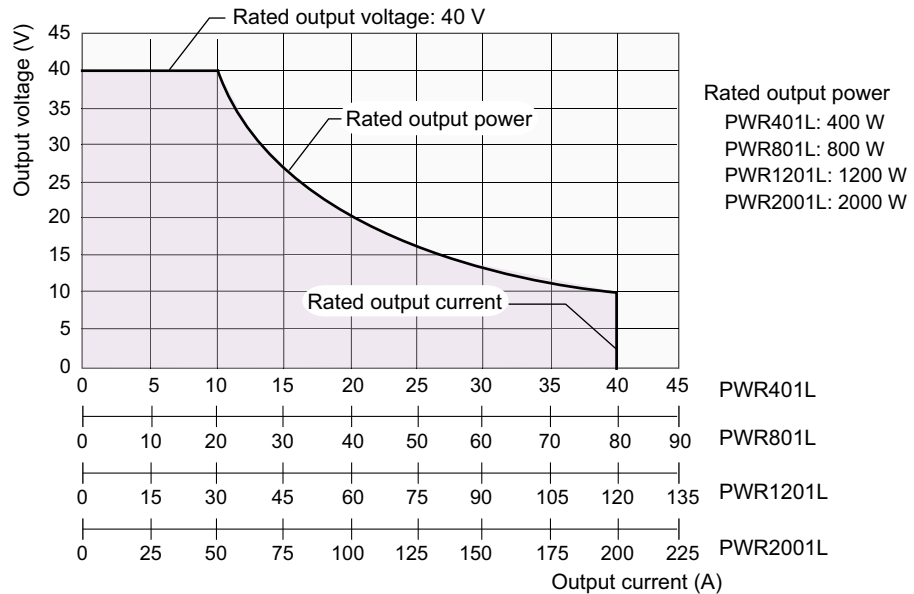
# Operation Overview

The PWR-01 is a constant voltage (CV)/ constant current (CC) regulated DC power supply that can output a wide range of voltage and current within rated output power.

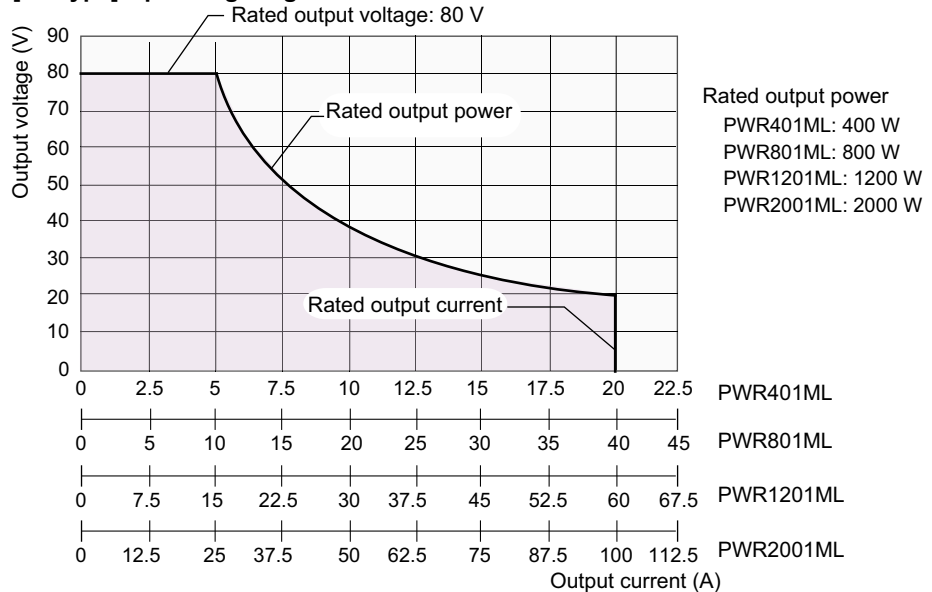
If you configure the settings so that "output voltage × output current" is less than or equal to the rated output power, the PWR-01 operates as a traditional constant-voltage (CV)/ constant-current (CC) power supply.

If you configure the settings so that "output voltage × output current" is greater than the rated output power, the actual output is limited (p.59) by the power limit (POWER LIMIT: approximately 105 % of the rated output power), and the output voltage and output current change depending on the load value.

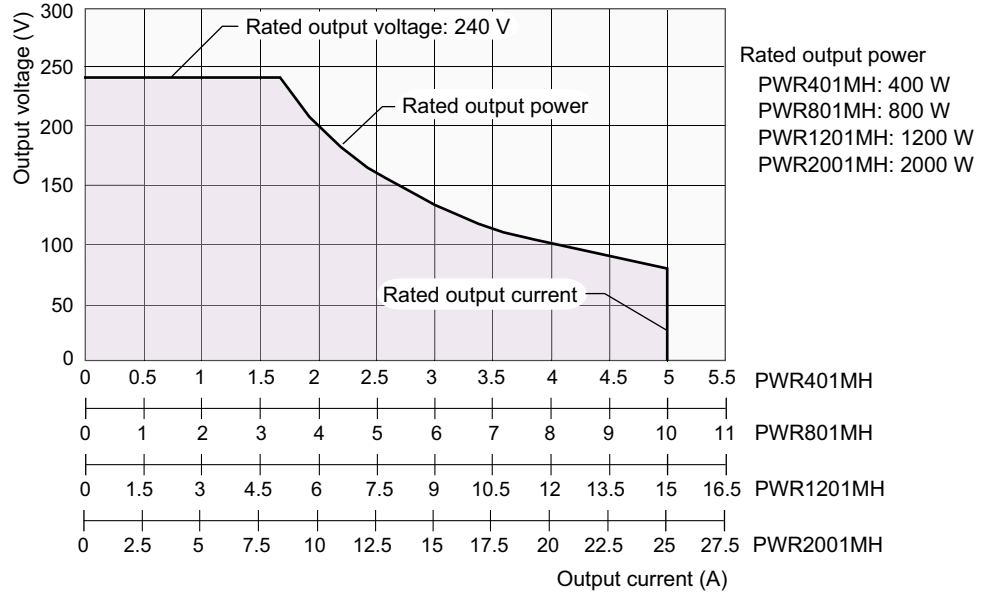
## [L type] Operating range



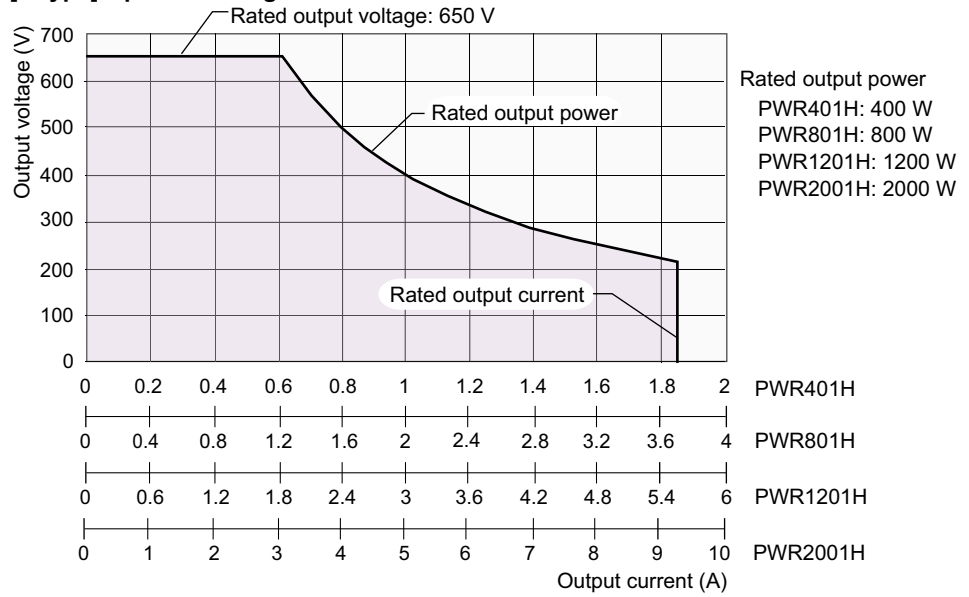
## [ML type] Operating range



**[MH type] Operating range**



**[H type] Operation range**

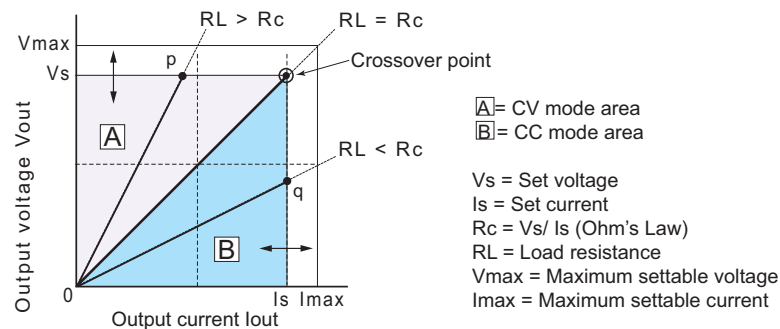


# CV Power Supply and CC Power Supply

The PWR-01 has features that makes it possible to function as a constant-voltage source and constant-current source even when the load is changed. The constant-voltage source operation is referred to as constant-voltage (CV) mode. The constant-current source operation is referred to as constant-current (CC) mode. The operation mode is determined by the following three values.

- Output voltage setting ( $V_s$ )
- Output current setting ( $I_s$ )
- Load resistance ( $R_L$ )

The operation modes are described below.



The above figure shows the PWR-01 operation modes. The load resistance is denoted as  $R_L$ . The resistance, which is denoted as  $R_c$ , is calculated from the set voltage and current ( $R_c = V_s / I_s$ . Resistance at the crossover point). The power supply is designed so that it operates in CV mode in area [A] and CC mode in area [B]. The boundary is the line defined by  $R_L = R_c$ . This line represents the load at which the output voltage and the set voltage are equal and the output current and the set current are equal. If load resistance  $R_L$  is greater than resistance  $R_c$ , the operating point is in area [A], and the PWR-01 operates in CV mode (point p). In this case, the set current  $I_s$  equals the current limit.

When the PWR-01 is operating in CV mode, the output voltage is maintained at the set voltage. Output current  $I$  is determined by the equation  $I = V_s / R_L$  and is a current that is less than current limit  $I_s$ . The actual current that flows is not necessarily equal to the specified value.

For loads in which transient peak current flows, current limit  $I_s$  must be set higher than the peak value.

Conversely, if load resistance  $R_L$  is less than resistance  $R_c$ , the operating point is in area [B], and the PWR-01 operates in CC mode (point q). In this case, set voltage  $V_s$  equals the voltage limit.

When the PWR-01 is operating in CC mode, the output current is maintained at the set current. Output voltage  $V$  is determined by the equation  $V = I_s \times R_L$  and is a voltage that is less than voltage limit  $V_s$ . The actual voltage that is applied is not necessarily equal to the specified value.

## ■ Crossover point

The PWR-01 switches automatically between CV mode and CC mode according to the changes in the load. A crossover point is the point at which the mode switches.

For example, when operating in CV mode, if the load changes and the output current reaches the current limit, the PWR-01 automatically switches to CC mode to protect the load. Likewise, when operating in CC mode, if the output voltage reaches the voltage limit, the PWR-01 switches to CV mode.

## CV mode and CC mode operation example

This section uses a power supply with a rated output voltage of 100 V and a rated output current of 10 A as an example.

A load resistance ( $R_L$ ) of 8  $\Omega$  is connected to the output terminals of the power supply. The output voltage and output current are set to 30 V and 5 A, respectively. In this case,  $R_c = 30 \text{ V} / 5 \text{ A} = 6 \Omega$ . Because 8  $\Omega$  is greater than 6  $\Omega$  ( $R_L > R_c$ ), the power supply operates in CV mode. When you want to increase the voltage in CV mode, you can increase the voltage up to the voltage defined by the following equation:  $V_s = I_s \times R_L$ . Substituting the values, we obtain  $V_s = 5 \text{ A} \times 8 \Omega = 40 \text{ V}$ . If you try to increase the voltage above this point, the crossover point is reached, and the power supply automatically switches to CC mode. To maintain operations in CV mode, increase the current limit.

Next, a load resistance ( $R_L$ ) of 5  $\Omega$  is connected to the output terminals of the power supply. The output voltage and output current are set to 30 V and 5 A, respectively. In this case,  $R_c = 30 \text{ V} / 5 \text{ A} = 6 \Omega$ . Because 5  $\Omega$  is less than 6  $\Omega$  ( $R_L < R_c$ ), the power supply operates in CC mode. If you want to increase the current in CC mode, you can increase the current up to the current defined by the following equation:  $I_s = V_s / R_L$ . Substituting the values, we obtain  $I_s = 30 \text{ V} / 5 \Omega = 6 \text{ A}$ . If you try to increase the current above this point, the crossover point is reached, and the power supply automatically switches to CV mode. To maintain operations in CC mode, increase the voltage limit.



# Using the PWR-01 as a CV or CC Power Supply

When the PWR-01 is used as a constant-voltage power supply, the set current is the limit to the current that can flow through the load.

When the PWR-01 is used as a constant-current power supply, the set voltage is the limit to the voltage that can be applied to the load.

If the specified limit is reached, the PWR-01 automatically switches its operation mode. When the PWR-01 switches its operation mode, the lighted LED, the CV LED (green) or CC LED (red), changes to indicate the switch.

## 1 Press SET to change to the setting display.

The SET key lights.

## 2 Turn the VOLTAGE knob to set the voltage.

Voltage setting range: 0 % to 105 % of the rated output voltage

PWR401L	0 V to 42 V	PWR801L	0 V to 42 V
PWR401ML	0 V to 84 V	PWR801ML	0 V to 84 V
PWR401MH	0 V to 252 V	PWR801MH	0 V to 252 V
PWR401H	0 V to 682.5 V	PWR801H	0 V to 682.5 V

PWR1201L	0 V to 42 V	PWR2001L	0 V to 42 V
PWR1201ML	0 V to 84 V	PWR2001ML	0 V to 84 V
PWR1201MH	0 V to 252 V	PWR2001MH	0 V to 252 V
PWR1201H	0 V to 682.5 V	PWR2001H	0 V to 682.5 V

## 3 Turn the CURRENT knob to set the current.

Current setting range: 0 % to 105 % of the rated output current

PWR401L	0 A to 42 A	PWR801L	0 A to 84 A
PWR401ML	0 A to 21 A	PWR801ML	0 A to 42 A
PWR401MH	0 A to 5.25 A	PWR801MH	0 A to 10.5 A
PWR401H	0 A to 1.943 A	PWR801H	0 A to 3.885 A

PWR1201L	0 A to 126 A	PWR2001L	0 A to 210 A
PWR1201ML	0 A to 63 A	PWR2001ML	0 A to 105 A
PWR1201MH	0 A to 15.75 A	PWR2001MH	0 A to 26.25 A
PWR1201H	0 A to 5.828 A	PWR2001H	0 A to 9.71 A

## 4 Press OUTPUT to turn output on.

The SET key turns off, and the OUTPUT LED lights. When the PWR-01 is operating as a constant-voltage power supply, the CV LED lights green. When the PWR-01 is operating as a constant-current power supply, the CC LED lights red.

Even when the output is on, you can set the voltage and current by carrying out Step2 and Step3 while checking the actual output voltage or current.

You can set the voltage that is actually output while checking the power ([p.38](#)).

You can use the CONFIG settings to set the output-on startup state (CF02:  $\square \square / \square \square$ ) ([p.64](#)).

Set this according to the operation mode that you are using. You can prevent overshoot from occurring when the output is turned on by prioritizing CV when using the PWR-01 as a constant-voltage power supply and by prioritizing CC when using the PWR-01 as a constant-current power supply.

When used as a slave device, CC is automatically prioritized.

When the output is turned on, the internal capacitors are charged. Depending on the set current, the PWR-01 may enter CC mode for an instant.

# Protection Functions

The PWR-01 protection functions can be divided into those that shut off the output and those that limit settings.

## Output shutoff (Alarm occurrence)

- Overvoltage protection (OVP)
- Front-panel output terminal overcurrent protection (FOCP)
- Overheat protection (OHP)
- Incorrect sensing connection protection (SENSE)
- Low AC input protection (AC-FAIL)
- Communication monitoring (WATCHDOG)
- Master-slave parallel operation protection (PRL ALM)
- Overcurrent protection (OCP)
- Shutdown (SD)

## Setting limits

- Voltage setting limit (limited to about 95 % of the OVP trip point)
- Undervoltage limit (UVL)
- Current setting limit (limited to about 95 % of the OCP trip point)
- Power limit (POWER LIMIT)

## Alarm occurrence and clearing alarms

### Alarm occurrence

When a protection function is activated and the output is shut off, an alarm occurs, and the PWR-01 is set to the following state.

- Output off  
For the OVP/ OCP/ FOCP/ SD/ PRL ALM activation, you can select breaker tripping using CONFIG settings (2000W model only).
- ALM LED on, indication of the cause of alarm  
OUTPUT LED blinking orange if the protection function was activated when the output was on  
When a CONFIG parameter is being displayed, the cause of alarm is not displayed.  
If breaker tripping is selected for OVP/ OCP/ FOCP/ SD/ PRL ALM (CF25: ON), indications of the cause of alarm and low AC input protection (AC-FAIL) are shown alternately on the front panel display (2000W model only).
- Alarm signal output  
Alarm signal generated from pin 14 of the J1 connector if PRL ALM or SD is activated  
Alarm signal generated from pin 4 of the J2 connector if OVP, OCP, FOCP, OHP, SENSE, AC-FAIL, WATCHDOG, or SD is activated  
Even when the breaker trips, an alarm signal is output (2000W model only).

## Clearing alarms

There are two methods to clear alarms.

- Press ALM CLR (SHIFT+SET) or apply a low level signal (0 V to 0.5 V) to or short pin 6 of the J1 connector to clear the alarm state. If you do not eliminate the cause of the alarm, an alarm will occur again.
- Turn off the POWER switch. Fix the problem that caused the alarm, and turn the POWER switch back on.

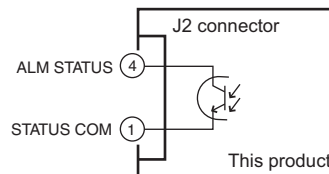
For shutdown (SD) and master-slave parallel operation (PRL ALM), use method “b” to clear the alarm.

If an alarm still occurs even after you have corrected all the causes of alarms, the PWR-01 may be malfunctioning. Stop using it immediately, and contact your Kikusui agent or distributor.

## Alarm signal

Alarm signal is generated from pin 14 of the J1 connector if PRL ALM or SD is activated. The J1 connector is at approximately the same electric potential as the negative output terminal.

Alarm signal is generated from pin 4 of the J2 connector if OVP, OCP, FOCP, OHP, SENSE, AC-FAIL, WATCHDOG, or SD is activated. The signal is isolated from other terminals through an open collector photocoupler.



Maximum voltage: 30 V  
Maximum current: 8 mA

# Output shutoff (alarm) protection function

## Overvoltage protection (OVP)

The overvoltage protection function is activated when the output terminal voltage exceeds the set voltage (OVP trip point).

You need to set an appropriate OVP trip point. Immediately after you purchase the PWR-01 or immediately after a load is changed, set the OVP trip point to a value that is appropriate for the load.

If the voltage setting limit is set to on (CF23:  $\square\text{ON}$ ), you cannot set an OVP trip point that is lower than the voltage setting.

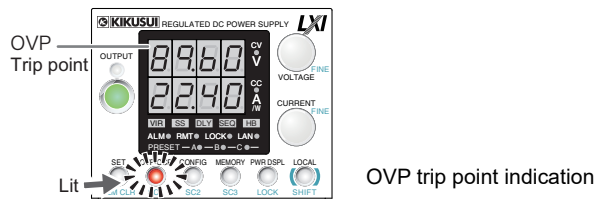
You can select using CONFIG settings whether to trip the breaker when the overvoltage protection (OVP) function is activated (CF25:  $\square\text{ON}$ / $\square\text{FF}$ ) (2000W model only).

### ■ Setting the OVP trip point

OVP operates on the output terminal voltage. If you want to activate the protection function according to the voltage across the load, take the voltage drop in the load cable into consideration when you set the OVP trip point.

#### 1 Press OVP•OCP.

The OVP•OCP key lights, and the voltmeter displays the present OVP trip point.



#### 2 Turn the VOLTAGE knob to set the OVP trip point.

OVP setting range: 10 % to 112 % of the rated output voltage

	L type	ML type	MH type	H type
OVP setting range	4 V to 44.8 V	8 V to 89.6 V	24 V to 268.8 V	65 V to 728 V

#### 3 Press OVP•OCP twice to finish the configuration.

The OVP trip point will be set. The OVP•OCP key turns off, and the measured value display appears.

### ■ Checking OVP operation

If the voltage setting limit is set to on (CF23:  $\square\text{ON}$ ), the output voltage cannot be set higher than the OVP trip point, so you cannot verify the OVP operation.

#### 1 Check that the OUTPUT LED is turned off.

#### 2 Set the output voltage to a value lower than the OVP trip point.

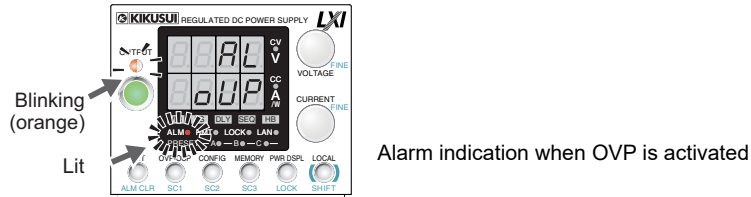
#### 3 Press OUTPUT to turn output on.

The OUTPUT LED lights.

**★ Memo**  
Press PWR DSP L to cancel the confirmation of the parameter.

**4 Slowly turn the VOLTAGE knob clockwise until the OVP is activated.**

When the output voltage exceeds the OVP trip point, an alarm will occur. The ALM LED lights, and the OUTPUT LED blinks.



**5 Check that output has turned off, or breaker trip (2000W model only).**

**6 If the output turns off, press ALM CLR (SHIFT + SET) to clear the alarm.**

If you do not change the output voltage, the OVP will be activated again.

**Overcurrent protection (OCP)**

The overcurrent protection (OCP) function is activated when the output current exceeds the set current (OCP trip point).

You need to set an appropriate OCP trip point. Immediately after you purchase the PWR-01 or immediately after a load is changed, set the OCP trip point to a value that is appropriate for the load.

If the current setting limit is set to on (CF22: ON), you cannot set an OCP trip point that is lower than the current setting.

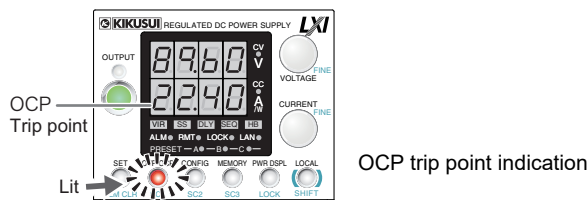
You can set the detection time of OCP activation.

You can select using CONFIG settings whether to trip the breaker when the overcurrent protection (OCP) function is activated (CF25: ON/ OFF) (2000W model only).

**Setting the OCP trip point**

**1 Press OVP•OCP.**

The OVP•OCP key lights, and the ammeter displays the present OCP trip point.



**2 Turn the CURRENT knob to set the OCP trip point.**

OCP setting range: 10 % to 112 % of the rated output current

	L type	ML type	MH type	H type	
OCP Setting range	400 W	4 A to 44.8 A	2 A to 22.4 A	0.5 A to 5.6 A	0.185 A to 2.072 A
	800 W	8 A to 89.6 A	4 A to 44.8 A	1 A to 11.2 A	0.37 A to 4.144 A
	1200 W	12 A to 134.4 A	6 A to 67.2 A	1.5 A to 16.8 A	0.555 A to 6.216 A
	2000 W	20 A to 224.0 A	10 A to 112.0 A	2.5 A to 28.0 A	0.93 A to 10.36 A

**★ Memo**

Press PWR DSP L to cancel the confirmation of the parameter.

**3 Press OVP•OCP twice to finish the configuration.**

The OCP trip point will be set. The OVP•OCP key turns off, and the measured value display appears.

**■ Setting the detection time of OCP activation**

You can set the amount of time that elapses after the OCP trip point is exceeded (the amount of time during which the OCP trip point is continuously exceeded) before the output is turned off (CF24). This is useful when you do not want the output to be turned off due to short-term overloads.

**Checking OCP operation**

If the current setting limit is set to on (CF22:  $\square \square$ ), the output current cannot be set higher than the OCP trip point, so you cannot verify the OCP operation.

**1 Short the output terminals.**

**2 Turn the POWER switch on.**

**3 Check that the OUTPUT LED is turned off.**

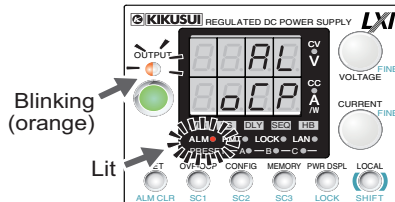
**4 Set the output current to a value lower than the OCP trip point.**

**5 Press OUTPUT to turn output on.**

The OUTPUT LED lights.

**6 Slowly turn the CURRENT knob clockwise until the OCP is activated.**

When the output current exceeds the OCP trip point, an alarm will occur. The ALM LED lights, and the OUTPUT LED blinks.



Alarm indication when OCP is activated

**7 Check that output has turned off, or breaker trip (2000W model only).**

**8 If the output turns off, press ALM CLR (SHIFT + SET) to clear the alarm.**

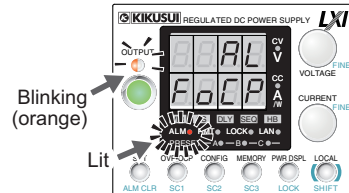
If you do not change the output current, the OCP will be activated again.

## Front-panel output terminal overcurrent protection (FOCP)

Front-panel output terminal overcurrent protection (FOCP) is activated when the output current from the front-panel output terminal exceeds 10 A (typical value). The trip point is fixed.

If the FOCP trip point is lower than the OCP trip point, OCP is prioritized.

You can select using CONFIG settings whether to trip the breaker when the front-panel output terminal overcurrent protection (FOCP) function is activated (CF25:  $\square n / \square FF$ ) (2000W model only).

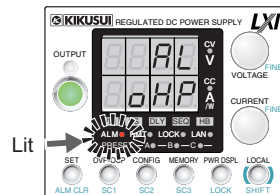


Alarm indication when FOCP is activated

## Overheat protection (OHP)

Overheat protection (OHP) is activated when the PWR-01's internal temperature rises to an abnormal level.

- When the PWR-01 is used in an environment that exceeds its operating ambient temperature range (0 °C to +50 °C).
- When the PWR-01 is used with its air inlet or outlet port blocked.
- When the fan motor has stopped.



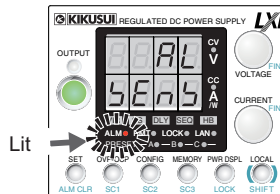
Alarm indication when OHP is activated

If you do not fix the problem that caused the OHP to be activated, OHP will be activated again even if you turn the POWER switch off and on ([p.68](#)).

## Incorrect sensing connection protection (SENSE)

Incorrect sensing connection protection is activated when the sensing wires are not connected securely or when the wires are connected with the polarities reversed.

It is also activated when the sensing voltage exceeds the maximum compensation voltage. For the maximum sensing compensation voltage of this product, see chapter 7 "Specifications" ([p.126](#), [p.129](#), [p.132](#), [p.135](#)).

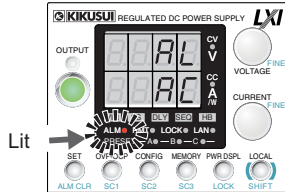


Alarm indication when incorrect sensing connection protection (SENSE) has been activated

### Low AC input protection (AC-FAIL)

Low AC input protection is activated when a low AC power line input voltage is detected.

You can select using the CONFIG settings whether to hold or release the alarm state (CF20: 5AFE/ RUL0) even after the cause of the AC-FAIL is removed after the low AC input protection (AC-FAIL) is activated.



Alarm indication when low AC input protection (AC-FAIL) is activated

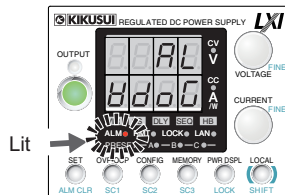
### Communication monitoring (WATCHDOG)

The watchdog function monitors the SCPI command communication status.

Communication is assumed to have stopped if there is no communication within the time period specified by the communication monitoring timer setting (CF21).

The function operates regardless of whether the product is in remote or local (panel control) mode. If you are not using remote control (commands), set communication monitoring off using a timer setting.

In the alarm state, turn off communication monitoring before clearing the alarm.



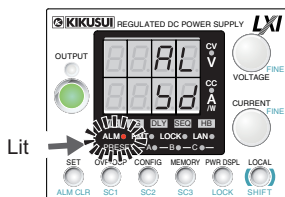
Alarm indication based on communication monitoring (watchdog)

### Shutdown (SD)

The shutdown function allows you to turn off the output by applying a signal to pin 16 of the J1 connector when an abnormal condition occurs ([p.103](#)).

To release the shutdown (SD) function, turn the POWER switch off and then back on.

You can select using CONFIG settings whether to trip the breaker when a shutdown (SD) is activated (CF25: 0n/ 0FF) (2000W model only).



Alarm indication when the shutdown (SD) function is activated



### Master-slave parallel operation protection (PRL ALM)

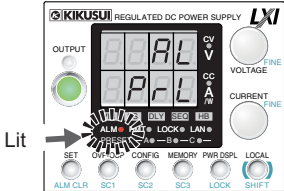
If a slave unit stops due to an error during master-slave parallel operation, the master unit detects the alarm and shuts down the output of the entire system.

This function protects devices by preventing the master unit and the remaining slave units from continuing the output.

Connect pin 14 of the J1 connectors of the master unit and slave units.

To release PRL ALM, turn the POWER switch off and then back on.

You can select using CONFIG settings whether to trip the breaker when the master-slave parallel operation protection (PRL ALM) function is activated (CF25: ON/OFF) (2000W model only).



Alarm indication when parallel alarm (PRL ALM) is activated

## Setting limit protection function

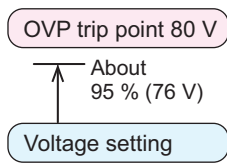
### Voltage setting limit

The maximum voltage that can be set is limited to about 95 % of the OVP trip point to prevent OVP activation due to mistaken operations.

By factory default, the voltage setting limit is set to on (CF23:  $\square \square$ ).

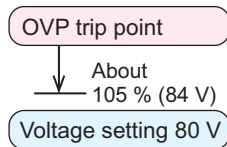
If you enable the voltage setting limit when the voltage setting is higher than 95 % of the OVP trip point, the voltage setting is retained, but the OVP trip point is changed to 105 % of the voltage setting.

The voltage setting limit (CF23) on/ off state is synchronized to undervoltage limit (UVL).



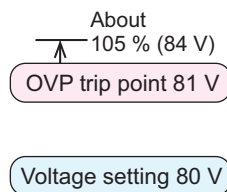
Example 1: Enable the voltage setting limit, set the OVP trip point to 80 V, and then set the voltage

Because the voltage setting is limited to approximately 95 % of the OVP trip point, the voltage can be set up to 76 V.



Example 2: Enable the voltage setting limit, set the voltage to 80 V, and then set the OVP trip point

Because the OVP trip point is limited to approximately 105 % of the voltage setting, the OVP trip point can be set at 84 V or higher.



Example 3: Disable the voltage setting limit, set the OVP trip point to 81 V, and then enable the setting limit (with the voltage setting at approximately 80 V)

When the setting limit is enabled, the OVP trip point is changed to approximately 105 % of the voltage setting. The voltage setting remains at 80 V, and the OVP trip point is changed to 84 V.

## Undervoltage limit (UVL)

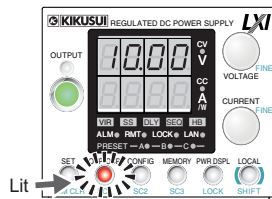
Undervoltage limit (UVL) limits the minimum voltage that can be set to the UVL trip point. Undervoltage limit (UVL) is synchronized to the on/off state of voltage setting limit (CF23). By factory default, the voltage setting limit is set to on (CF23:  $\square\Gamma$ ).

If you enable the voltage setting limit when the voltage setting is less than the set UVL trip point, the voltage setting is retained, but the UVL trip point is changed to the voltage setting.

### ■ Setting the UVL trip point

#### 1 Press OVP•OCP twice.

The present UVL trip point is displayed.



Display example of the UVL setting

#### 2 Turn the VOLTAGE knob to set the UVL trip point (p.50).

UVL setting range: 0 % to 105 % of the rated output voltage

	L type	ML type	MH type	H type
UVL setting range	0 V to 42 V	0 V to 84 V	0 V to 252 V	0 V to 682.5 V

#### 3 Press OVP•OCP to finish the configuration.

The UVL trip point will be set. The OVP•OCP key turns off, and the measured value display appears.

## Current setting limit

The maximum current that can be set is limited to about 95 % of the OCP trip point to prevent OCP activation due to mistaken operations.

By factory default, the current setting limit is set to on (CF22:  $\square\Gamma$ ).

If you enable the current setting limit when the current setting is higher than 95 % of the OCP trip point, the current setting is retained, but the OCP trip point is changed to 105 % of the current setting.

## Power limit (POWER LIMIT)

This function limits the output power to a value that is approximately 105 % of the rated output power. This function changes the output voltage or output current according to the changes in the load resistance (p.45).

When the output limit function has been activated, the ALM LED blinks (p.50).

	400W	800W	1200W	2000W
Power limit	420 W	840 W	1260 W	2100 W

# CONFIG Settings

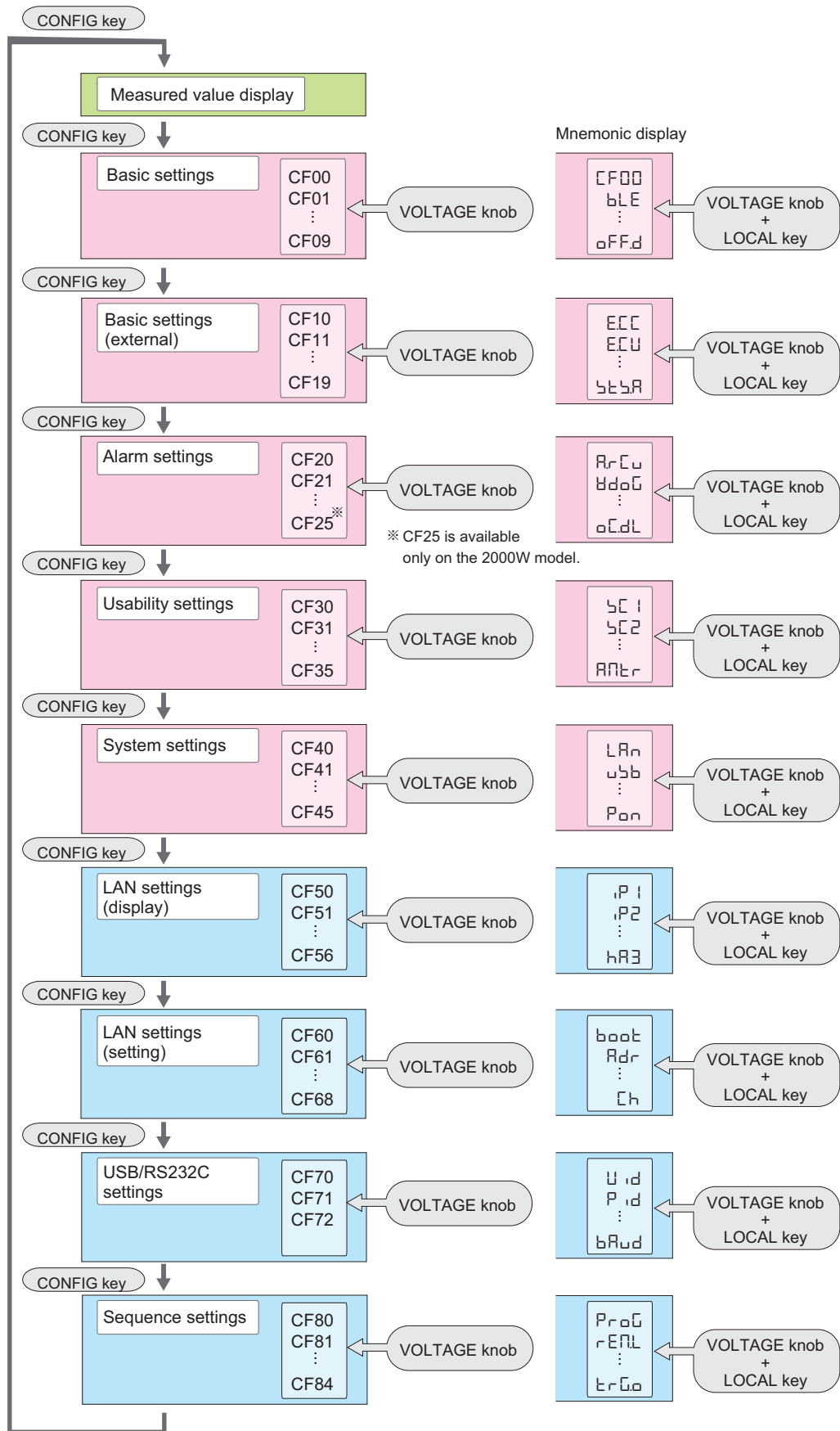
Use the CONFIG settings to set the PWR-01 system configuration. You can set and display the following parameters in the CONFIG settings.

- Effect: ● indicates that the parameter is affected when the panel settings are reset (CF00).  
 ■ indicates that the parameter may be affected when the LAN interface settings are reset (CF60: L L / dEF).  
 Note: ○ indicates that the change is immediately applied  
 △ indicates that the change is applied the next time the power is turned on  
 ◇ indicates that the change is applied when CF60: R P P L is executed

Display switching	Parameter number	Mnemonic		Setting/ display	Effect	Note
Basic	CF00	CF00 <sup>1</sup>	Reset	Resets the panel settings	—	○
	CF01 <sup>2</sup>	bLE	Bleeder	Sets the bleeder circuit	—	○
	CF02	Prio	Priority	Output-on startup state	—	○
	CF03	VIR	V.I.R	Internal resistance setting (VIR)	●	○
	CF04	S.Start CC	S.Start CCrise	Soft start time (CC mode)	●	○
	CF05	S.Stop CC	S.Stop CCfall	Soft stop time (CC mode)	●	○
	CF06	S.Start CV	S.Start CVrise	Soft start time (CV mode)	●	○
	CF07	S.Stop CV	S.Stop CVfall	Soft stop time (CV mode)	●	○
	CF08	On delay	On delay	Output-on delay setting	●	○
	CF09	Off delay	Off delay	Output-off delay setting	●	○
	CF10	Ext. CC	Ext. CC	CC control using an external voltage/ external resistance	●	○
	CF11	Ext. CV	Ext. CV	CV control using an external voltage/ external resistance	●	○
	CF12	Control range	Control range	CV/ CC control range	—	○
	CF13 <sup>2</sup>	Monitor range	Monitor range	Voltage/ Current monitor output range	—	○
	CF14	Ext. on/ off	Ext. on/ off	External control for turning output on/ off	●	○
	CF15	Ext. logic	Ext. logic	External control logic for turning output on/ off	—	○
	CF16	Stat. CC. pol	Stat. CC. pol	CC status signal polarity	—	○
	CF17	Stat. CV. pol	Stat. CV. pol	CV status signal polarity	—	○
	CF18	Stat. Output. pol	Stat. Output. pol	Output status signal polarity	—	○
CF19	Stat. Alarm. pol	Stat. Alarm. pol	Protection function/ alarm status signal polarity	—	○	
Alarm	CF20 <sup>2</sup>	Alarm recovery	Alarm recovery	Status when recovering from AC-FAIL protection	—	△
	CF21	Watchdog	Watchdog	Communication monitoring (WATCHDOG) timer	—	○
	CF22	CC limit auto	CC limit auto	Current setting limit	●	○
	CF23	CV limit auto	CV limit auto	Voltage setting limit	●	○
	CF24 <sup>2</sup>	OCP delay	OCP delay	Output off after OCP detection	—	○
	CF25 <sup>2,3</sup>	Breaker trip	Breaker trip	Breaker trip when the OVP/ OCP/ FOCP/ SD/ PRL ALM	—	△
Usability	CF30	Short cut 1	Short cut 1	CONFIG parameter shortcut registration (SC1)	—	○
	CF31	Short cut 2	Short cut 2	CONFIG parameter shortcut registration (SC2)	—	○
	CF32	Short cut 3	Short cut 3	CONFIG parameter shortcut registration (SC3)	—	○
	CF33	Beep	Beep	Buzzer on/ off	—	○
	CF34 <sup>2</sup>	Brightness	Brightness	Panel display brightness	—	○
	CF35	Ammeter	Ammeter	Slave unit display during master-slave parallel operation	—	○
System	CF40	LAN	LAN	LAN interface setting	■ <sup>4</sup>	△
	CF41	USB	USB	USB interface setting	—	△
	CF42	RS232C	RS232C	RS232C interface setting	—	△
	CF43	Trace	Trace	SCPI communication error display	—	○
	CF44 <sup>2</sup>	Parallel	Parallel	Master-slave parallel operation	—	△
	CF45	Power on	Power on	Output state at power-on	—	△

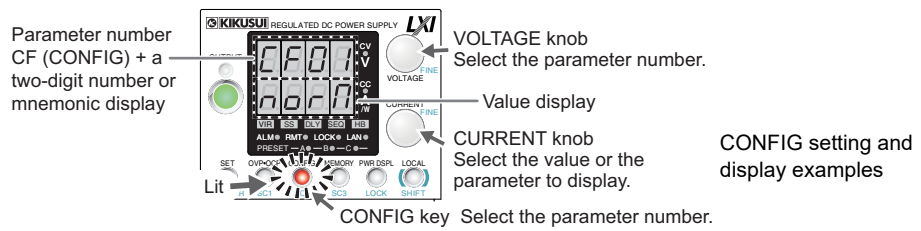
Display switching	Parameter number	Mnemonic	Setting/ display	Effect	Note		
LAN <sup>5</sup>	CF50	ᠶᠫᠢ	Ip addr. 1	IP address display (1)	—	—	
	CF51	ᠶᠫᠲ	Ip addr. 2	IP address display (2)	—	—	
	CF52	ᠶᠫᠳ	Ip addr. 3	IP address display (3)	—	—	
	CF53	ᠶᠫᠴ	Ip addr. 4	IP address display (4)	—	—	
	CF54	ᠬᠠᠠᠢ	HW. addr. 1, 2	MAC address display (1) and (2)	—	—	
	CF55	ᠬᠠᠠᠲ	HW. addr. 3, 4	MAC address display (3) and (4)	—	—	
	CF56	ᠬᠠᠠᠳ	HW. addr. 5, 6	MAC address display (5) and (6)	—	—	
	CF60	ᠪᠠᠵᠠ	LAN Reboot	LAN setting reset (LCI/ DEF)/ apply (APPL)	—	○	
	CF61	ᠶᠫᠳᠠ	Address config	IP address assignment method	■	△ / ◇	
	CF62	ᠶᠫᠶᠠ	Static IP 1	Manual IP address setting (1)	■	△ / ◇	
	CF63	ᠶᠫᠶᠲ	Static IP 2	Manual IP address setting (2)	■	△ / ◇	
	CF64	ᠶᠫᠶᠳ	Static IP 3	Manual IP address setting (3)	■	△ / ◇	
	CF65	ᠶᠫᠶᠴ	Static IP 4	Manual IP address setting (4)	■	△ / ◇	
	CF66	ᠶᠫᠶᠪ	Subnet Mask	IP address subnet mask	■	△ / ◇	
	CF67	ᠳᠠᠮᠠ	VMCB Dom.	Multichannel (VMCB) domain number	■ <sup>4</sup>	△	
	CF68	ᠴᠠᠬᠠ	VMCB Ch.	Multichannel (VMCB) channel number	■ <sup>4</sup>	△	
	USB	CF70	ᠶᠠᠳ	V. ID	Vendor ID (VID) display	—	—
		CF71	ᠶᠠᠳᠠ	P. ID	Product ID (PID) display	—	—
RS232C	CF72	ᠪᠠᠵᠠᠳ	Baud rate	RS232C baud rate	—	△	
Sequence	CF80	ᠶᠠᠳᠠᠳ	Program	Program's user code display (execute)	—	—	
	CF81	ᠶᠠᠳᠠᠳᠠ	Rem. Loop	Remaining program repetition count display	—	—	
	CF82	ᠶᠠᠳᠠᠳᠠ	Rem. Time	Remaining program time display	—	—	
	CF83	ᠶᠠᠳᠠᠳᠠ	Trig. In	Trigger input signal polarity	—	○	
	CF84	ᠶᠠᠳᠠᠳᠠ	Trig. Out	Trigger output signal polarity	—	○	

- 1 The CF00 display does not change.
- 2 You can also specify this parameter when the PWR-01 is being used as a slave unit.
- 3 Can be set only on the 2000W model.
- 4 This parameter is affected only when the LAN interface settings are reset (CF60: ᠳᠠᠳᠠ).
- 5 For details on the LAN interface settings, see the "Communication Interface Manual" on the included CD-ROM.



## Displaying and setting CONFIG parameters

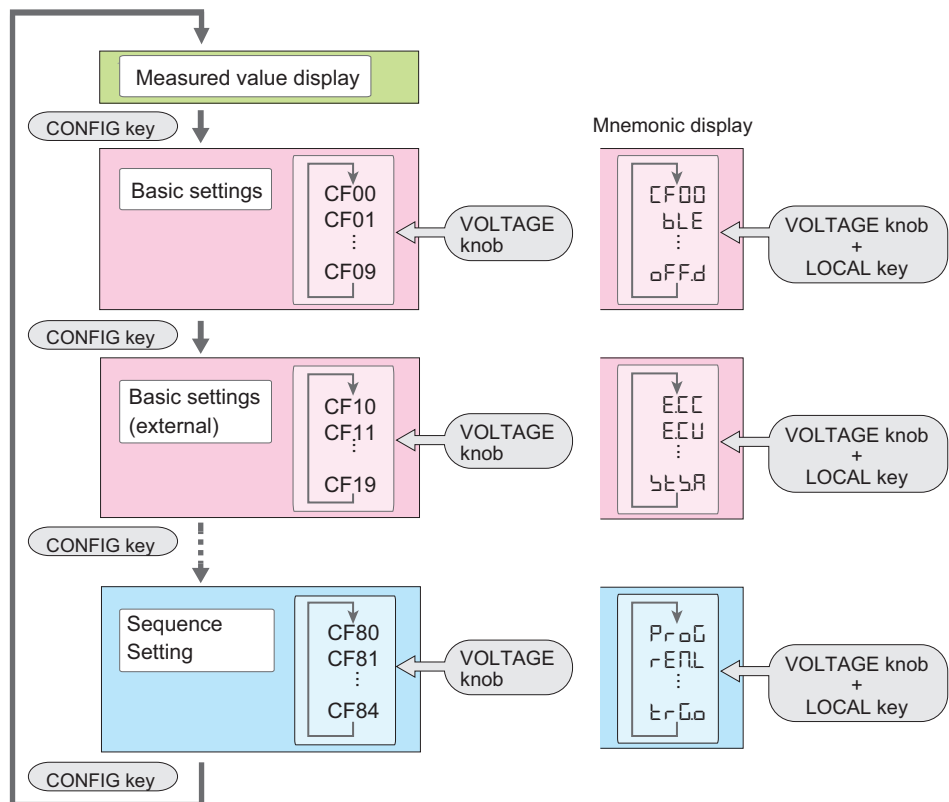
CF00, CF60, and CF80 are execution parameters of features. For the execution procedure, see the details of each CONFIG parameter.



### 1 Use the CONFIG key and the VOLTAGE knob to select the CONFIG parameter you want to set.

The CONFIG key lights. The voltmeter displays the parameter number. The ammeter displays the corresponding setting. Pressing CONFIG changes the tens digit. Turning the VOLTAGE knob changes the ones digit.

Pressing LOCAL changes the CONFIG parameter number to the mnemonic display (excluding CF00). Turning the VOLTAGE knob while holding down the LOCAL key switches the CONFIG parameter number to the mnemonic display while retaining the mnemonic display.



### 2 Turn the CURRENT knob to change the value of the parameter.

### 3 To specify or display other parameters, repeat Step1 and Step2 .

### 4 Hold down CONFIG until the measured value display appears, or press PWR DSPL.

There are parameters whose values are applied immediately, those whose values are applied after the power is turned off and then back on, and those whose values are applied when [RPPL] is executed using CF60 (p.60).

## CONFIG parameter details

The details of CONFIG parameters are provided below.

### CF00 (ꠤꠥꠦꠦ) Resets the panel settings

Select this to set the following parameters to their factory default settings (p.144). Then, press SET twice to execute the reset.

- Output on/ off
- Output voltage
- Output current
- Overvoltage protection
- Overcurrent protection
- Undervoltage limit
- Internal resistance (CF03)
- Soft start/ stop time (CF04 to CF07)
- Output-on/ off delay (CF08/ CF09)
- Constant current control using an external voltage/external resistance (CF10)
- Constant voltage control using an external voltage/external resistance (CF11)
- External control for turning output on/off (CF14)
- Current/ voltage setting limit (CF22/ CF23)

Display	Description	
ꠤꠥꠦꠦ	Reset	Resets the panel settings

### CF01 (ꠤꠤꠤ) Sets the bleeder circuit

Sets the bleeder circuit (p.82). You can turn the bleeder circuit off when you do not want current to be sunk by the internal bleeder circuit, such as when you are charging a battery.

When using master-slave parallel operation or series operation, use the same settings on all connected units.

You can also specify this parameter when the PWR-01 is being used as a slave unit.

Display	Description	
ꠤ ꠤꠤ	Disable	The bleeder circuit is turned off.
ꠤꠤꠤꠤ	Normal	Normal bleeder (factory default setting)
ꠤꠤꠤꠤꠤ	Hyper	Hyper bleeder

### CF02 (ꠤꠤ ꠤꠤ) Output-on startup state

Sets the prioritized operation mode when the output is turned on (p.49).

When used as a slave device, CC is automatically prioritized.

Display	Description	
ꠤꠤ	CV	CV (constant voltage) is prioritized (factory default setting)
ꠤꠤ	CC	CC (constant current) is prioritized.



### CF03 (⏏, ⏏) Internal resistance setting (VIR)

Sets the internal resistance (Rint) (p.84). The internal resistance setting range (p.84) varies depending on the model.

Display		Description
⏏FF	OFF	Variable internal resistance function is not used (factory default setting).
Rint (min) to Rint (max)		Rint (min) Ω to Rint (max) Ω

### CF04 (⏏⏏⏏) Soft start time (CC mode)

Sets the rise time of the output current (p.43).  
You can set the output current to rise gradually.

Display		Description
⏏⏏	0.0	Disable soft start (factory default setting)
⏏.5 to 10.0	0.5 to 10.0	Soft start time, 0.5 s to 10.0 s

### CF05 (⏏⏏⏏) Soft stop time (CC mode)

Sets the fall time of the output current (p.43).  
You can set the output current to fall gradually.

Display		Description
⏏⏏	0.0	Disable soft stop (factory default setting)
⏏.5 to 10.0	0.5 to 10.0	Soft stop time, 0.5 s to 10.0 s

### CF06 (⏏⏏⏏) Soft start time (CV mode)

Sets the rise time of the output voltage (p.43).  
You can set the output voltage to rise gradually.

Display		Description
⏏⏏	0.0	Disable soft start (factory default setting)
⏏.5 to 10.0	0.5 to 10.0	Soft start time, 0.5 s to 10.0 s

### CF07 (⏏⏏⏏) Soft stop time (CV mode)

Sets the fall time of the output voltage (p.43).  
You can set the output voltage to fall gradually.

Display		Description
⏏⏏	0.0	Disable soft stop (factory default setting)
⏏.5 to 10.0	0.5 to 10.0	Soft stop time, 0.5 s to 10.0 s

### CF08 (⏏⏏⏏) Output-on delay setting

You can set the delay from when the OUTPUT key is pressed to when the output actually turns on (p.42).

Display		Description
⏏⏏	0.0	No delay (factory default setting)
⏏.5 to 99.9	0.5 to 99.9	Output-on delay time, 0.5 s to 99.9 s

### CF09 (0FF.d) Output-off delay setting

You can set the delay from when the OUTPUT key is pressed to when the output actually turns off (p.42).

Display		Description
00	0.0	No delay (factory default setting)
05 to 99	0.5 to 99.9	Output-off delay time, 0.5 s to 99.9 s

### CF10 (E.L) CC control using an external voltage/ external resistance

Enables or disables constant current control using an external voltage or external resistance (p.99).

Display		Description
0FF	OFF	Disabled (factory default setting)
0n	ON	Enabled

### CF11 (E.L) CV control using an external voltage/ external resistance

Enables or disables constant voltage control using an external voltage or external resistance (p.97).

Display		Description
0FF	OFF	Disabled (factory default setting)
0n	ON	Enabled

### CF12 (E.n) CV/ CC control range

Sets the range for performing constant current or constant voltage control using an external voltage or external resistance (p.97, p.99).

Reference voltage for external control (J1-3 REFOUT) is also set to 5.25 V (CF12: L) or 10.5 V (CF12: H) according to the range setting.

Display		Description
L	LOW	0 V to 5 V (factory default setting)
H	HIGH	0 V to 10 V

### CF13 (n.n) Voltage/ Current monitor output range

Sets the voltage range when monitoring voltage or current (p.105). You can also set this parameter when the PWR-01 is being used as a slave unit.

Display		Description
L	LOW	0 V to 5 V (factory default setting)
H	HIGH	0 V to 10 V

### CF14 (ደግጋ) External control for turning output on/ off

Enables or disables output on/off control using an external contact ([p.101](#)) and enables or disables the output-on/ off delay function and soft start and soft stop functions. ([p.42](#), [p.43](#)).

Display	Description	
ጋፍፍ	OFF	Disabled (factory default setting)
ጋጠ	ON	Enabled
ደጠክ	Enhanced On	Enabled Use the output-on/ off delay and soft start and soft stop functions

### CF15 (ደጊጋ) External control logic for turning output on/ off

Sets the logic that is used for output on/ off control using an external contact ([p.101](#)).

Display	Description	
ጊጋ	LOW	The output is turned on with a low signal (0 V to 0.5 V) or short circuit (factory default setting).
ከጊ	HIGH	The output is turned on with a high signal (4.5 V to 5 V) or open circuit.

### CF16 (ኔጎ) CC status signal polarity

Sets the polarity of the status signal for monitoring the constant-current mode ([p.105](#)).

Display	Description	
ጠጂ	Negative	Negative (factory default setting)
ፆጋ	Positive	Positive

### CF17 (ኔጎ) CV status signal polarity

Sets the polarity of the status signal for monitoring the constant-voltage mode ([p.105](#)).

Display	Description	
ጠጂ	Negative	Negative (factory default setting)
ፆጋ	Positive	Positive

### CF18 (ኔጎ) Output status signal polarity

Sets the polarity of the status signal for monitoring the output-on state ([p.105](#)).

Display	Description	
ጠጂ	Negative	Negative (factory default setting)
ፆጋ	Positive	Positive

### CF19 (ኔጎ) Protection function/ alarm status signal polarity

Sets the polarity of the status signal for monitoring the protection function or alarm ([p.105](#)).

Display	Description	
ጠጂ	Negative	Negative (factory default setting)
ፆጋ	Positive	Positive

### CF20 (R-FE) Status when recovering from AC-FAIL protection

Sets the output status for when the AC power line returns to normal while a low AC input protection (AC-FAIL) is activated (p.56).

This parameter is applied when you turn the POWER switch off and on.  
You can also set this parameter when the PWR-01 is being used as a slave unit.

Display		Description
R-FE	Safe	The alarm status is retained even after the problem that caused the alarm is fixed. (factory default setting)
R-FE	Auto	The alarm status is cleared after the problem that caused the alarm is fixed (returns to the status before the alarm occurrence).

### CF21 (HDO) Communication monitoring (WATCHDOG) timer

Sets the interval for monitoring SCPI command communication (p.56).

The communication monitoring operates regardless of whether the product is in remote or local (panel control) mode.

If you are not using remote control (commands), set this to "OFF".

Display		Description
OFF	OFF	Communication monitor timer is set to off (factory default setting).
1 to 3000	1 to 3000	1 s, 3 s, 10 s, 30 s, 100 s, 300 s, 1000 s, 3000 s

### CF22 (CCL) Current setting limit

Sets whether to limit the output current setting at the OCP trip point (about 95 % of the OCP trip point) (p.53).

Display		Description
OFF	OFF	The setting is not limited.
ON	ON	The setting is limited (factory default setting).

### CF23 (CVL) Voltage setting limit

Sets whether to limit the output voltage setting at the OVP trip point (about 95 % of the OVP trip point) or at the UVL trip point (p.52).

Display		Description
OFF	OFF	The setting is not limited.
ON	ON	The setting is limited (factory default setting).

### CF24 (OOL) Output off after OCP detection

Sets the time from when an overcurrent is detected to when the output is turned off in steps of 100 ms.

You can also set this parameter when the PWR-01 is being used as a slave unit.

Display		Description
0.0	0.0	0.0 s (factory default setting)
0.1 to 2.0	0.1 to 2.0	0.1 s to 2.0 s

## CF25 (بءر ءء) Breaker trip when the OVP/ OCP/ FOCP/ SD/ PRL ALM (Only on the 2000W model)

Sets whether to trip the breaker (turn the POWER switch off) when the overvoltage protection (OVP), overcurrent protection (OCP), Front-panel output terminal overcurrent protection (FOCP), Shutdown (SD) or Master-slave parallel operation protection (PRL ALM) is activated (p.41).

This parameter is applied when you turn the POWER switch off and on. The setting is possible even when the product is used as a slave unit.

Display		Description
OFF	OFF	Not trip (turn the output off)
ON	ON	Trip (turn the POWER switch off) (factory default)

## CF30 (بءء ء) CONFIG parameter shortcut registration (SC1)

Registers a CONFIG setting parameter to the front panel's SC1 key (p.79).

Display		Description
00	00	CONFIG parameter not registered (factory default setting)
01 to 99	01 to 99	CF01 to CF99

## CF31 (بءء ء) CONFIG parameter shortcut registration (SC2)

Registers a CONFIG setting parameter to the front panel's SC2 key (p.79).

Display		Description
00	00	CONFIG parameter not registered (factory default setting)
01 to 99	01 to 99	CF01 to CF99

## CF32 (بءء ء) CONFIG parameter shortcut registration (SC3)

Registers a CONFIG setting parameter to the front panel's SC3 key (p.79).

Display		Description
00	00	CONFIG parameter not registered (factory default setting)
01 to 99	01 to 99	CF01 to CF99

## CF33 (بءءءء) Buzzer on/ off

Turns the buzzer on and off.

The buzzer sounds when settings are reset to factory defaults, when a communication command error occurs, or when a preset memory or sequence program cannot be recalled.

Display		Description
OFF	OFF	Buzzer off
ON	ON	Buzzer on (factory default setting).

### CF34 (亮度) Panel display brightness

Sets the panel display brightness. The larger the number, the brighter the display.  
 Even if you specify the same number, the brightness may be different between individual products.  
 The brightness is not proportional to the setting.  
 You can also set this parameter when the PWR-01 is being used as a slave unit.

Display	Description
1 to 7	Screen brightness adjustment (factory default setting: 7)

### CF35 (显示) Slave unit display during master-slave parallel operation

Sets whether the current or power on slave units is displayed during master-slave parallel operation. If the slave unit display is disabled, the ammeter shows "----."

Display	Description
OFF	Slave unit display disabled (factory default setting)
ON	Slave unit enabled

### CF40 (LAN) LAN interface setting

Enables or disables the LAN interface.  
 By setting this parameter to "OFF," you can disable the LAN interface function even when a LAN cable is connected.  
 This parameter is applied when you turn the POWER switch off and on.

Display	Description
OFF	LAN disabled
ON	LAN enabled (factory default setting).

### CF41 (USB) USB interface setting

Enables or disables the USB interface.  
 By setting this parameter to "OFF," you can disable the USB interface function even when a USB cable is connected.  
 This parameter is applied when you turn the POWER switch off and on.

Display	Description
OFF	USB disabled
ON	USB enabled (factory default setting).

### CF42 (RS232C) RS232C interface setting

Enables or disables the RS232C interface.  
 By setting this parameter to "OFF," you can disable the RS232C interface function even when a RS232C cable is connected.  
 This parameter is applied when you turn the POWER switch off and on.

Display	Description
OFF	RS232C disabled
ON	RS232C enabled (factory default setting).

## CF43 (ㄱㄱㄱ) SCPI communication error display

Sets whether to display communication errors.

Display		Description
OFF	OFF	SCPI communication errors are not displayed (factory default setting).
ON	ON	SCPI communication errors are displayed.

## CF44 (Pㄱㄱ) Starting master-slave parallel operation

Sets whether to use the PWR-01 as a master unit or slave unit in master-slave parallel operation (p.108).

If you want to use the PWR-01 as a master unit, set the total number of units. If you want to use the PWR-01 as a slave unit, select "ㄱㄱㄱ (Slave)."

This parameter is applied when you turn the POWER switch off and on.

You can also set this parameter when the PWR-01 is being used as a slave unit.

Display		Description
ㄱㄱㄱ	Slave	Use the PWR-01 as a slave unit.
1 to 3 <sup>1</sup>	1 to 3 <sup>1</sup>	Total number of units including the master unit (1: standalone operation (factory default setting) to 3)

<sup>1</sup> Up to two units for 1200W models/ 2000W models.

## CF45 (Pㄱㄱ) Output state at power-on

Sets the output condition that the PWR-01 will be in when the power is turned on (p.32). When you are using an external contact to turn the output off, this parameter is invalid.

This parameter is applied when you turn the POWER switch off and on.

When setting this to "ㄱㄱㄱ (Auto)" or "Fㄱㄱ (Force)," set the status when recovering from AC-FAIL protection to clear the alarm status after the problem that caused the alarm is fixed (CF20: ㄱㄱㄱ) (p.68).

Display		Description
ㄱㄱㄱ	Safe	Output off (factory default setting).
ㄱㄱㄱ	Auto	The output state that was in use immediately before the POWER switch was turned off.
Fㄱㄱ	Force	Output on

## CF50 to CF53 ( ,P 1 to ,P4) IP address display

These parameters display the set IP addresses.

To set a fixed IP address, set it from the panel (CF62 to CF65) or from the Web browser interface. When you access the PWR-01 through a Web browser, do so under conditions in which a DHCP server or AUTO IP can be used.

For details on the Web browser interface, see the Communication Interface Manual on the included CD-ROM.

Parameter number	Display		Description
CF50	0 to 255	0 to 255	First octet of the IP address
CF51	0 to 255	0 to 255	Second octet of the IP address
CF52	0 to 255	0 to 255	Third octet of the IP address
CF53	0 to 255	0 to 255	Fourth octet of the IP address

### CF54 to CF56 (hR 1 to hR3) MAC address display

These parameters display the set MAC addresses.

MAC addresses are set to 00.0F.CE.xx.xx (where x is a hexadecimal number between 0 and F).

Parameter number	Display		Description
CF54	□□□F	00.0F	First and second octets of the MAC address
CF55	□EHH	CE.xx	Third and fourth octets of the MAC address
CF56	HHHH	xx.xx	Fifth and sixth octets of the MAC address



CF54: 00.0F



CF55: CE.11



CF56: 22.33

Display example of the MAC address "00.0F.CE.11.22.33"

Display	h	b	□	d	E	F
Hexadecimal	A	B	C	D	E	F

### CF60 (h00h) LAN setting reset (LCI/ dEF)/ apply (APPL)

Sets whether to reset or apply the LAN interface settings (p.63).

Then, press SET twice to execute the reset or application.

If you select to reset the LAN interface settings (L□ , (LCI)/ dEF (Default)), the security password will be cleared, and the PWR-01 will be in a security-disabled state.

If the LAN LED turns red (p.9), set the settings again.

For details on the LAN interface settings, see the "Communication Interface Manual" on the included CD-ROM.

Display		Description
L□ ,	LAN Configuration Initialize	Resets the LAN interface settings (to their factory default values)
dEF	Default	The LAN interface and multichannel (VMCB) settings are reset (to their factory default values).
APPL	Apply	The LAN interface is restarted, and the CONFIG settings are applied.



## CF61 (אדג) IP address assignment method

Sets the IP address assignment method.

Set whether to use (on: 1) or not use (off: 0) the following: DHCP server, AUTO IP function (automatic assignment), and MANUAL IP function (manual assignment).

If DHCP and AUTO IP are both set to on and an IP address is not assigned through a DHCP server, AUTO IP is used.

To use MANUAL IP, set DHCP and AUTO IP to off. The IP address that is assigned by the AUTO IP function is 169.254.x.x (where x is a number between 1 and 254).

This parameter is applied when you turn the POWER switch off and on or when you execute RPPPL (Apply) with CF60.

Display	Description
001	DHCP: off, AUTO IP: off, MANUAL IP: on
010	DHCP: off, AUTO IP: on, MANUAL IP: off
011	DHCP: off, AUTO IP: on, MANUAL IP: on
100	DHCP: on, AUTO IP: off, MANUAL IP: off
101	DHCP: on, AUTO IP: off, MANUAL IP: on
110	DHCP: on, AUTO IP: on, MANUAL IP: off (factory default setting)
111	DHCP: on, AUTO IP: on, MANUAL IP: on

## CF62 to CF65 (אדג to אדג) Manual IP address setting (MANUAL IP)

If you are not using the DHCP server or the AUTO IP function, set the IP address manually. To do so, use CF61 to set MANUAL IP to on.

This parameter is applied when you turn the POWER switch off and on or when you execute RPPPL (Apply) with CF60.

Parameter number	Display	Description
CF62	0 to 255	First octet of the IP address
CF63	0 to 255	Second octet of the IP address
CF64	0 to 255	Third octet of the IP address
CF65	0 to 255	Fourth octet of the IP address

## CF66 (אדג) IP address subnet mask

If you want to set the IP address manually (MANUAL IP), set the subnet mask prefix. To do so, use CF61 to set MANUAL IP to on.

This parameter is applied when you turn the POWER switch off and on or when you execute RPPPL (Apply) with CF60.

Display	Description
16 to 31	Sets the subnet mask prefix

Examples: Display example when "16" is selected 255.255.0.0  
 Display example when "24" is selected 255.255.255.0  
 Display example when "31" is selected 255.255.255.255

### CF67 (㉔㉓) Multichannel (VMCB) domain number

Set the multichannel domain number. PWR-01s that have the same domain number perform multichannel operations. If you do not want to use the multichannel function, set this to “0” (this is the factory default setting).

This parameter is applied when you turn the POWER switch off and on.

For details on the multichannel function, see the Communication Interface Manual on the included CD-ROM.

Display	Description	
0	0	The multichannel function is not used (factory default setting).
1 to 254	1 to 254	The domain number when the multichannel function is used.

### CF68 (㉔㉔) Multichannel (VMCB) channel number

Set the multichannel channel number. Specify a unique number on the network. If you do not want to use the multichannel function, set this to “0” (this is the factory default setting).

This parameter is applied when you turn the POWER switch off and on.

For details on the multichannel function, see the Communication Interface Manual on the included CD-ROM.

Display	Description	
0	0	Master unit on the multichannel network (factory default setting).
1 to 30	1 to 30	Channel number of the slave unit on the multichannel network.

### CF70 (㉔㉕) Vendor ID (VID) display

This displays the USB vendor ID.

Display	Vendor ID.	
0b3E	0b3E	0x0B3E

### CF71 (㉔㉖) Product ID display

This displays the USB product ID.

#### ■ 400W model

Display	Product ID:	
1049	1049	0x1049

#### ■ 800W model

Display	Product ID:	
104A	104A	0x104A

#### ■ 1200W model

Display	Product ID:	
104B	104B	0x104B

#### ■ 2000W model

Display	Product ID:	
1055	1055	0x1055

## CF72 (bRud) RS232C baud rate

Sets the baud rate of the RS232C interface.

This parameter is applied when you turn the POWER switch off and on.

Display	Baud rate	
12	1.2	1200 bps
24	2.4	2400 bps
48	4.8	4800 bps
96	9.6	9600 bps
192	19.2	19200 bps (factory default setting)
384	38.4	38400 bps
576	57.6	57600 bps
1152	115.2	115200 bps

## CF80 (Prd) Program's user code display (execute)

Displays the user code for identifying the sequence program.

Press SET twice to execute the sequence program.

Display	Description	
nonE	None	Sequence program not written (factory default setting)
0000 to 9999	0000 to 9999	Set user code

## CF81 (rEPL) Remaining program repetition count display

Displays the remaining repetition count of the sequence program in execution.

Display	Repetition Count	
----	----	Sequence program not running
0 to 9999	0 to 9999	0 times to 9999 times
More	More	10000 times to 99998 times
Infinity	Infinity	Infinite

## CF82 (rEPL) Remaining program time display

Displays the remaining time of the sequence program in execution.

Display	Remaining time	
----	----	Sequence program not running
59s to 1s	59 s to 1 s	59 seconds to 1 minute
59 m to 1 m	59 m to 1 m	59 minutes to 1 minute
999 h to 1 h	999 h to 1 h	999 hours to 1 hour
More	More	1000 hours or more
Infinity	Infinity	Infinite

### CF83 (TRIG) Trigger input signal polarity

Sets the polarity of the trigger input signal.

Trigger signals are used to resume a sequence step and to perform synchronized operation.

Display	Description	
PTr	Positive Trigger	Positive trigger (factory default setting)
nTr	Negative Trigger	Negative trigger

### CF84 (TRIG) Trigger output signal polarity

Sets the polarity of the trigger output signal.

Trigger signals are output when a program step is resumed or when the output is turned on (must be set with a command).

Display	Description	
PTr	Positive Trigger	Positive trigger (factory default setting)
nTr	Negative Trigger	Negative trigger

# Preset Memory Function

There are three preset memory entries for saving combinations of voltage, current, OVP, OCP, and UVL settings. Saved settings can be recalled from the preset memory when needed.

## Saving settings

- 1 Set the voltage, current, OVP, OCP, and UVL to the values you want to save.**
- 2 Press MEMORY to select the preset memory (A, B, or C) to save them in.**  
The voltmeter, ammeter, PRESET A/ B/ C LED and SET key blink.  
Each time you press MEMORY, the selected memory entry switches between A, B, C, and unselected.  
If a preset memory entry already has settings saved, those will be displayed.
- 3 Hold down SET.**  
The selected PRESET LED lights, and the settings are saved.

## Recalling settings

You can recall settings from the preset memory on the measured value display (when the SET key is off) or the setting display (when the SET key is lit).

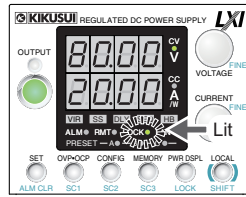
If the output is on, the settings are applied to the output the moment they are recalled.

- 1 Press MEMORY to select the preset memory entry (PRESET A, B, or C) you want to recall the settings from.**  
The voltmeter, ammeter, PRESET A/ B/ C LED and SET key blink.  
The saved settings are displayed.  
Each time you press MEMORY, the selected memory entry switches between A, B, C, and unselected.
- 2 Check the settings, and then press SET.**  
The SET key and the selected PRESET LED light, and the voltage and current are displayed.

### NOTE

If you hold down SET when recalling settings, the present settings will be saved to the preset memory entry.

# Locking Panel Controls (Key Lock)



The key lock function is available to prevent the settings from being changed by mistake.

When the keys are locked (when the LOCK LED is lit), only the OUTPUT key is valid.

- 1 Configure all the settings, such as the output voltage and output current, as necessary.**
- 2 Hold down LOCK (SHIFT+PWR DSPL) until the LOCK LED turns on.**  
The LOCK LED lights, and the keys are locked.

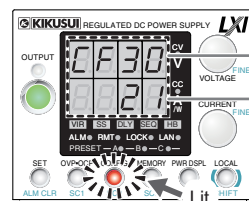
To unlock the keys, hold down LOCK again (SHIFT+PWR DSPL) until the LOCK LED turns off.

# CONFIG Shortcut Function

There is a CONFIG shortcut function that allows up to three CONFIG parameters of your choice (SC1, SC2, and SC3) to be registered. Registered CONFIG parameters can be recalled with the SC key without having to enter the CONFIG menu.

## Registering CONFIG shortcuts

- 1 Press CONFIG four times (CF30).**
- 2 Turn the VOLTAGE knob to select the CONFIG parameter number (CF30, CF31, or CF32) in which to register a shortcut.**  
CF30, CF31, and CF32 are assigned to SC1, SC2, and SC3, respectively.
- 3 Turn the CURRENT knob to set the CONFIG parameter number you want to register.**



CONFIG parameter number in which to register a shortcut

CONFIG parameter number you want to register

Example in which "CF21" is being registered to the SC1 key

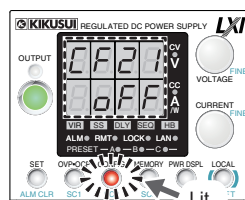
- 4 Hold down CONFIG until the measured value display appears, or press PWR DSPL.**

The setting is applied immediately.

## Using CONFIG shortcuts

- 1 Press SHIFT+SC1, SC2, or SC3 in which the CONFIG parameter you want to recall is registered.**

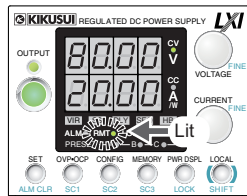
The registered CONFIG parameter is displayed.



Example in which "CF21" is being called with the SC1 key

- 2 Hold down CONFIG until the measured value display appears, or press PWR DSPL.**

## Switching from Remote Mode to Local Mode



When the PWR-01 is being controlled remotely, the RMT LED in the display area lights.

To switch the PWR-01 to local mode from the front panel, press LOCAL.





# 3

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## Advanced Features

This chapter describes how to use advanced operations such as the bleeder circuit function, variable internal resistance function, sequence function and synchronized operation.

# Bleeder Circuit Function



**Risk of electric shock. Set the bleeder circuit to on (CF01: 0000/ HYP) before you touch the output terminals. If it is set to off (CF01: 0000), the voltage that was present when the output was on will remain at the output terminals even if you turn off the output or POWER switch.**

Turn the bleeder circuit off when you do not want the internal bleeder circuit to sink output current. When you connect a battery, you can prevent excessive electrical discharges by turning the bleeder circuit off.

Set the bleeder circuit to off, normal bleeder, or hyper bleeder using a CONFIG setting (CF01).

When the POWER switch is turned on the next time, the PWR-01 starts with the settings that were in use the last time that the POWER switch was turned off.

Bleeder circuit	Displayed setting	Description
Off <sup>1</sup>	DIS	Bleeder circuit off
Normal bleeder	NORM	Bleeder circuit on
Hyper bleeder	HYP	Bleeder circuit on. HB lights on the display. The fan speed is fixed to the maximum speed. Provides strong sink performance (see the table below). The fall time at no load is reduced to about 70 % of that using the normal bleeder (reduction in test cycle time (takt time) is possible).

<sup>1</sup> Even if the output terminals are open and the output is turned off or the voltage setting is at 0 V, up to several hundred millivolts of voltage may appear across the output terminals.

When using master-slave parallel operation or series operation, use the same settings on all connected units. You can also specify this parameter when the PWR-01 is being used as a slave unit.

Depending on whether the bleeder circuit setting, the sink current when an external voltage source is connected will vary.

## ■ Sink current (reference value) from an external voltage source according to the bleeder circuit setting

Vout= Output terminal voltage

Model	Bleeder circuit	Sink current					
		5 Vout	10 Vout	15 Vout	20 Vout	30 Vout	40 Vout
PWR401L	Off	0.000 A	0.000 A	0.001 A	0.001 A	0.002 A	0.003 A
	Normal bleeder	0.381 A	0.347 A	0.312 A	0.277 A	0.208 A	0.139 A
	Hyper bleeder	0.583 A	0.546 A	0.512 A	0.477 A	0.409 A	0.339 A
PWR801L	Off	0.000 A	0.000 A	0.000 A	0.001 A	0.001 A	0.001 A
	Normal bleeder	0.730 A	0.660 A	0.590 A	0.525 A	0.386 A	0.248 A
	Hyper bleeder	1.130 A	1.060 A	1.000 A	0.930 A	0.780 A	0.640 A
PWR1201L	Off	0.000 A	0.001 A	0.001 A	0.001 A	0.001 A	0.002 A
	Normal bleeder	1.120 A	1.010 A	0.900 A	0.792 A	0.577 A	0.362 A
	Hyper bleeder	1.720 A	1.620 A	1.510 A	1.410 A	1.200 A	1.000 A
PWR2001L	Off	0.001 A	0.001 A	0.001 A	0.001 A	0.002 A	0.002 A
	Normal bleeder	1.850 A	1.680 A	1.510 A	1.330 A	0.983 A	0.632 A
	Hyper bleeder	2.840 A	2.670 A	2.490 A	2.320 A	1.970 A	1.630 A

Vout= Output terminal voltage

Model	Bleeder circuit	Sink current					
		5 Vout	10 Vout	20 Vout	40 Vout	60 Vout	80 Vout
PWR401ML	Off	0.000 A	0.000 A	0.000 A	0.001 A	0.001 A	0.002 A
	Normal bleeder	0.376 A	0.360 A	0.328 A	0.264 A	0.200 A	0.136 A
	Hyper bleeder	0.564 A	0.547 A	0.515 A	0.450 A	0.384 A	0.319 A
PWR801ML	Off	0.000 A	0.000 A	0.000 A	0.000 A	0.000 A	0.001 A
	Normal bleeder	0.754 A	0.721 A	0.656 A	0.526 A	0.395 A	0.265 A
	Hyper bleeder	1.128 A	1.096 A	1.029 A	0.901 A	0.769 A	0.640 A
PWR1201ML	Off	0.000 A	0.001 A	0.001 A	0.001 A	0.001 A	0.002 A
	Normal bleeder	1.141 A	1.092 A	0.994 A	0.797 A	0.601 A	0.404 A
	Hyper bleeder	1.700 A	1.650 A	1.550 A	1.360 A	1.160 A	0.970 A
PWR2001ML	Off	0.000 A	0.000 A	0.000 A	0.000 A	0.000 A	0.000 A
	Normal bleeder	1.850 A	1.770 A	1.600 A	1.280 A	0.963 A	0.641 A
	Hyper bleeder	2.760 A	2.680 A	2.520 A	2.200 A	1.880 A	1.560 A

Vout= Output terminal voltage

Model	Bleeder circuit	Sink current					
		10 Vout	20 Vout	50 Vout	100 Vout	200 Vout	240 Vout
PWR401MH	Off	0.000 A	0.001 A	0.001 A	0.001 A	0.001 A	0.002 A
	Normal bleeder	0.151 A	0.147 A	0.134 A	0.114 A	0.072 A	0.056 A
	Hyper bleeder	0.223 A	0.221 A	0.208 A	0.187 A	0.145 A	0.128 A
PWR801MH	Off	0.000 A	0.000 A	0.000 A	0.001 A	0.001 A	0.002 A
	Normal bleeder	0.304 A	0.295 A	0.267 A	0.221 A	0.128 A	0.091 A
	Hyper bleeder	0.441 A	0.432 A	0.407 A	0.364 A	0.279 A	0.250 A
PWR1201MH	Off	0.000 A	0.000 A	0.000 A	0.001 A	0.001 A	0.002 A
	Normal bleeder	0.442 A	0.429 A	0.392 A	0.331 A	0.208 A	0.159 A
	Hyper bleeder	0.661 A	0.648 A	0.610 A	0.546 A	0.419 A	0.370 A
PWR2001MH	Off	0.000 A	0.000 A	0.001 A	0.001 A	0.001 A	0.001 A
	Normal bleeder	0.719 A	0.701 A	0.640 A	0.537 A	0.328 A	0.245 A
	Hyper bleeder	1.080 A	1.060 A	0.995 A	0.894 A	0.688 A	0.605 A

Vout= Output terminal voltage

Model	Bleeder circuit	Sink current					
		25 Vout	50 Vout	100 Vout	200 Vout	500 Vout	650 Vout
PWR401H	Off	0.000 A	0.001 A	0.001 A	0.002 A	0.004 A	0.005 A
	Normal bleeder	0.067 A	0.065 A	0.063 A	0.057 A	0.041 A	0.033 A
	Hyper bleeder	0.081 A	0.080 A	0.077 A	0.072 A	0.057 A	0.049 A
PWR801H	Off	0.000 A	0.000 A	0.001 A	0.003 A	0.007 A	0.009 A
	Normal bleeder	0.128 A	0.125 A	0.119 A	0.108 A	0.075 A	0.059 A
	Hyper bleeder	0.160 A	0.157 A	0.152 A	0.142 A	0.111 A	0.094 A
PWR1201H	Off	0.000 A	0.000 A	0.001 A	0.004 A	0.009 A	0.012 A
	Normal bleeder	0.197 A	0.192 A	0.184 A	0.167 A	0.118 A	0.094 A
	Hyper bleeder	0.231 A	0.227 A	0.219 A	0.204 A	0.160 A	0.140 A
PWR2001H	Off	0.001 A	0.001 A	0.001 A	0.001 A	0.008 A	0.010 A
	Normal bleeder	0.306 A	0.293 A	0.280 A	0.253 A	0.185 A	0.150 A
	Hyper bleeder	0.381 A	0.359 A	0.347 A	0.320 A	0.251 A	0.217 A

# Variable Internal Resistance Function

The variable internal resistance function enables you to easily simulate rechargeable batteries, solar batteries, fuel cells, and other power supplies that have internal resistance. By setting the internal resistance value in constant voltage (CV) mode, you can decrease the output voltage according to the output current.

The variable internal resistance function can be configured only in constant voltage (CV) mode.

Use CONFIG parameter CF03 to set the internal resistance. If you are not using the variable internal resistance function, select off (factory default setting, CF03: OFF). VIR lights when the variable internal resistance function is set.

If the output voltage falls to or below 3 % of the rated voltage, the output voltage may not be stable. If the difference between the voltage setting and the output voltage (voltage drop due to internal resistance) is less than 20 % of the rated voltage, the accuracy of the resistance setting degrades. It cannot handle transient operation (variation).

## ■ Setting range

Vrtg: rated output voltage, Irtg: rated output current, Rint: internal resistance

$0 < Rint (\text{min}) \leq Rint (\text{max})$

L type, ML type:  $Rint (\text{max}) = Vrtg / Irtg$

MH type, H type:  $Rint (\text{max}) = Vrtg / Irtg \times 3/4$

	PWR401L	PWR401ML	PWR401MH	PWR401H
Vrtg [V]	40	80	240	650
Irtg [A]	40	20	5	1.85
Rint [ $\Omega$ ]	0.001 to 1.000	0.001 to 4.000	0.01 to 36.00	0.1 to 263.5
Resolution <sup>1</sup>	0.001	0.001	0.01	0.1

	PWR801L	PWR801ML	PWR801MH	PWR801H
Vrtg [V]	40	80	240	650
Irtg [A]	80	40	10	3.7
Rint [ $\Omega$ ]	0.001 to 0.500	0.001 to 2.000	0.01 to 18.00	0.1 to 131.8
Resolution <sup>1</sup>	0.001	0.001	0.01	0.1

	PWR1201L	PWR1201ML	PWR1201MH	PWR1201H
Vrtg [V]	40	80	240	650
Irtg [A]	120	60	15	5.55
Rint [ $\Omega$ ]	0.001 to 0.333	0.001 to 1.333	0.01 to 12.00	0.01 to 87.84
Resolution <sup>1</sup>	0.001	0.001	0.01	0.01

	PWR2001L	PWR2001ML	PWR2001MH	PWR2001H
Vrtg [V]	40	80	240	650
Irtg [A]	200	100	25	9.25
Rint [ $\Omega$ ]	0.001 to 0.200	0.001 to 0.800	0.01 to 7.20	0.01 to 52.70
Resolution <sup>1</sup>	0.001	0.001	0.01	0.01

<sup>1</sup> Resolution when FINE is in use

The maximum internal resistance that can be set during parallel operation is the value obtained by dividing Rint (max) during standalone operation by the number of units in parallel operation. The resolution is the value obtained by dividing the resolution during standalone operation by the number of units in parallel operation.

# Sequence Function

The sequence function enables you to automatically execute programs that you have set in advance one operation at a time.

You cannot configure sequence programs from the panel. Programs are created using commands.

Once a sequence program is executed through remote control, the program is written in the PWR-01, and you can execute this program from the panel.

When a program is written in the PWR-01, you can execute the program without a PC.

For details on sequence function, see the "Communication Interface Manual" in the included CD-ROM.

## Writing and executing a sequence program

Only a single program can be written in the PWR-01. If you execute another program through remote control, the program is overwritten. When executing a program from the panel, the trigger source setting is invalid.

### 1 If a program is not written in the PWR-01, execute a sequence program through remote control.

This will cause the program to be written in the PWR-01. Then, you can execute the program even without a PC.

### 2 If triggers are set in steps, set the trigger input signal polarity (CF83) and trigger output signal polarity (CF84) using CONFIG settings.

The factory default setting is positive trigger.

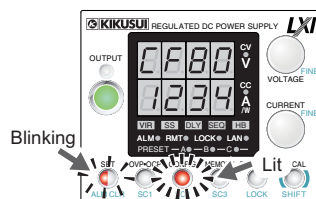
### 3 Press OUTPUT to turn output on.

### 4 Press CONFIG nine times to display CF80.

The ammeter displays the user code that is written, and the SET key blinks. To prevent unintentional execution of sequences, be sure to check the user code.

#### ★ Memo

If a sequence is not written, the ammeter displays "nonE."



Example of user code "1234" displayed for CF80

### 5 Press SET, which is blinking.

The PWR-01 switches to standby mode, and CF80, user code, the SET key, and SEQ on the display blink.

### 6 Press SET to execute the program.

SEQ is lit while the program is running.

# Synchronized Operation

Synchronized operation is a function that synchronizes settings and the resumption of sequence programs using trigger signals.

Different PWR-01 models (e.g., PWR400W and PWR800W) can be mixed and connected. Synchronized operation is also possible in parallel operation.

Synchronized operation has the following features. To perform synchronized operation, you need to configure various settings using commands through remote control. After configuration, synchronized operation can be performed without a PC.

- Synchronization of voltage and current settings (trigger subsystem: TRANSient)  
Output variation can be synchronized. This is useful when you want to synchronize to the operation of external devices. The trigger source needs to be set to hardware trigger wait state (TRIG:TRAN:SOURTRIGIN).
- Synchronization of sequence program steps (trigger subsystem: PROGram)  
The resumption of paused steps in a sequence program can be synchronized. On each model, the trigger input of specific steps needs to be set to on (PROG:STEP<n>:TRIGIN ON).

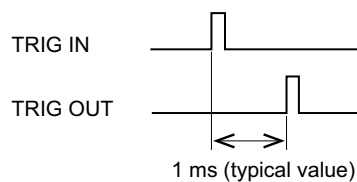
Set the trigger signal polarity using CONFIG settings (CF83: trigger input signal polarity, CF84: trigger output signal polarity) (p.76). Make the polarities of all trigger signals of connected devices the same. The factory default setting is positive trigger.

Synchronization pulses are signals with 100  $\mu$ s widths.

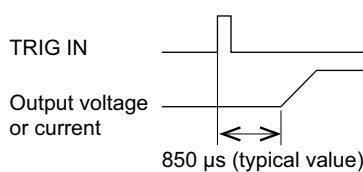
The RS232C connector and TRIG IN connector are the same. When performing synchronized operation through remote control, RS232C cannot be used.

For details on the setting, see the “Communication Interface Manual” in the included CD-ROM.

## ■ Synchronized operation delay



The delay from when a TRIG IN signal is received to when a TRIG OUT signal is transmitted is 1 ms (typical value).



The delay from when a TRIG IN signal is received to when the voltage/ current is produced is 850  $\mu$ s (typical value).

When using a cascade connection as shown in connection example 2 (p.88), carefully consider the number of connected units and the delay.

■ Connection

Use a standard LAN cable (category 5 and straight) up to 30 m in length to make the connection. If you need to use a LAN cable longer than 30 m, please contact your Kikusui agent or distributor.



**Risk of electric shock.**

- Do not touch the communication connectors while the power is turned ON.
- Do not leave the LAN cable connected to the PWR-01 when the other end is not connected.

LAN port  
RS232C/TRG IN connector  
TRG OUT connector



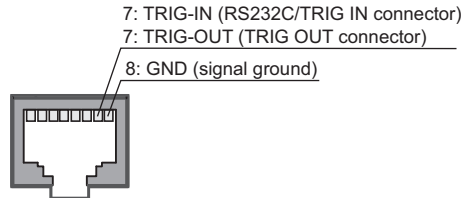
P1-000-131



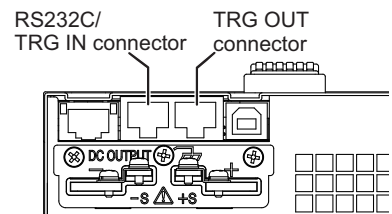
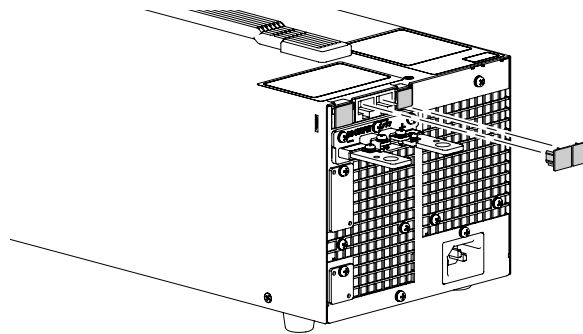
P1-000-132

When the PWR-01 is shipped from the factory, connector covers are attached to the communication connectors as shown in the figure on the left. Keep connector covers that you remove in a safe place. If you are not using a connector, attach the connector cover for safety reasons. If they are damaged or lost, contact your Kikusui agent or distributor.

The following figure shows the connector pinout when you are facing the rear panel.

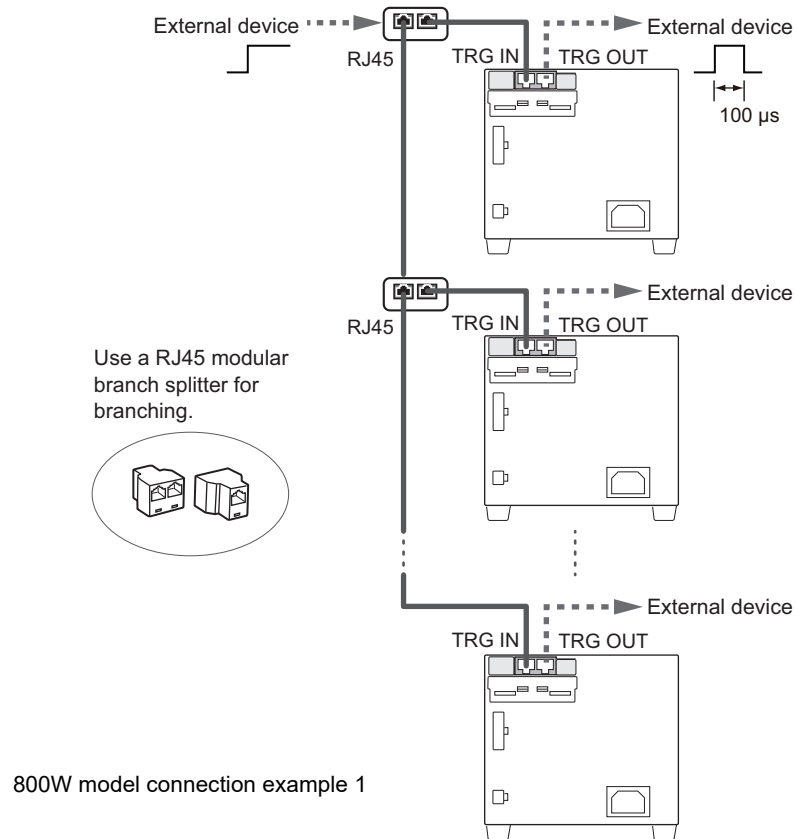


- 1 Check that all PWR-01s that you will connect are turned off.
- 2 Remove the covers from the RS232C/ TRG IN connector and TRG OUT connector.

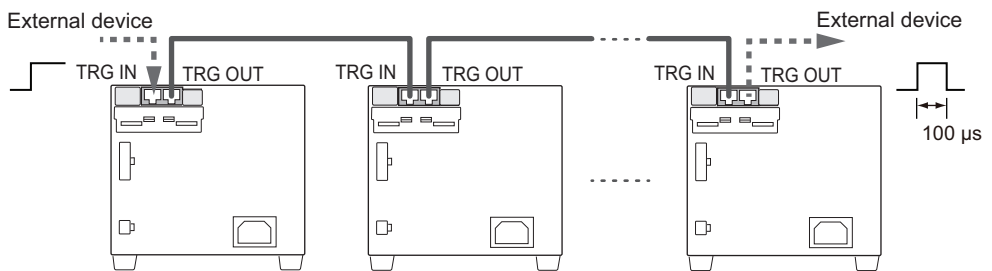


800W model example

### 3 Connect all the PWR-01s with LAN cables.



If you want to synchronize the resumption of steps in a sequence program, you can cascade PWR-01s as shown in the following figure by setting the trigger output (PROG:STEP<n>:TRIGOUT ON) in steps.



800W model connection example 2  
(only when synchronizing the resumption of steps in a sequence program)





# 4

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## External Control

This chapter explains external control and external monitoring using the J1 and J2 connectors.

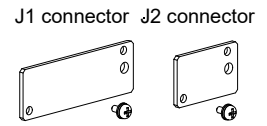
# Product Operation

The J1 or J2 connector on the rear panel of this product can be used to perform the following external controls.

- Output voltage control using external voltage or external resistance
- Output current control using external voltage or external resistance
- Turning output on and off using an external contact
- Output shutdown control using an external contact
- Clearing alarms using an external contact
- Monitoring operation modes

# About the J1/ J2 Connectors

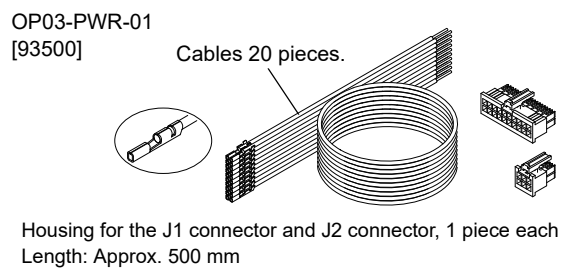
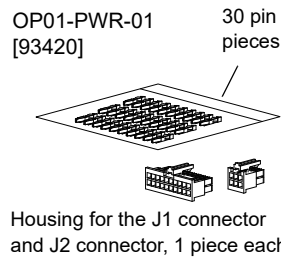
When the PWR-01 is shipped from the factory, terminal covers are attached to the J1 and J2 connectors. If the cover is damaged or lost, contact your Kikusui agent or distributor.



## Risk of electric shock.

**Be sure to attach the cover when you are not using the J1 or J2 connector.**

The connector parts necessary to connect to the J1 and J2 connectors are not included. Use parts that match the connectors to make the connections. The OP01-PWR-01 plug kit and OP03-PWR-01 external cable and connector set for making these connections is available as an option. The plug kit consists of connector parts made by WCON.



For information about how to obtain these tools or replacement parts, contact your Kikusui agent or distributor.

## ■ J1 and J2 connectors

	J1 connector	J2 connector
Connector type	WF2549-2WR10S3T01 (WCON)	WF2549-2WR03S3T01(WCON)
Housing type	WF2549-2H10W01 (WCON)	WF2549-2H03W01 (WCON)
Terminal (pin)	WF2549-TPS302 (WCON)	WF2549-TPS302 (WCON)
Wire diameter (core wire)	AWG22 or AWG24	AWG22 or AWG24
Manual pressure crimp tool	SN-28B (IWISS) or an equivalent product <sup>1</sup>	SN-28B (IWISS) or an equivalent product <sup>1</sup>

<sup>1</sup> When AWG22 wires are used, even if they are crimped with compatible slots (AWG22-20) indicated on the crimping tool, coupling may not be sufficient. If this is the case, use smaller slots (AWG28-24) to crimp the wires further. When crimping, be careful not to break the lock flip.

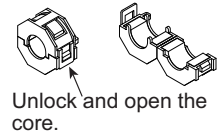
## Attaching a core

As a measure against noise, you need to attach a core to the cable that will be connected to the J1 connector (p.142).

The core is not included. Use an appropriate core.

Recommended core: E04SRS251512 by SEIWA ELECTRIC MFG. CO., LTD.

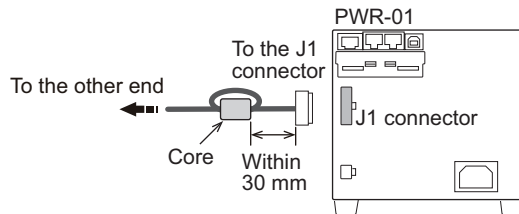
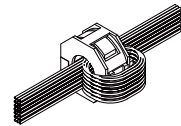
- 1 Unlock and open the core.**
- 2 Wrap the cable once (two turns) around either half of the open core.**



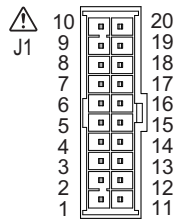
Wrap the cable so that the distance between the core and the J1 connector is within 30 mm.

- 3 Close the core making sure not to pinch the cable.**

Check that the core is locked securely in place.



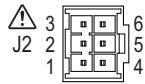
## J1 connector pin arrangement



Pin number positions when you are facing the rear panel

Pin No.	Signal name	Description
J1-1	VPGM	Terminal used to control the output voltage with an external voltage or external resistance. 0 V to 5 V; 0 % to 100 % of the rated output voltage (CF12: L □). 0 V to 10 V; 0 % to 100 % of the rated output voltage (CF12: h □).
J1-2	VMON	Output voltage monitor. 0 % to 100 % of the rated output voltage is generated as a voltage between 0 V and 5 V (CF13: L □) or a voltage between 0 V and 10 V (CF13: h □).
J1-3	REF OUT	Reference voltage for external resistance control. 5.25 V (CF12: L □) / 10.5 V (CF12: h □), maximum output current: 2.5 mA.
J1-4	PRL ON	On when parallel operation is in use and when output is on (output through an open-collector photo-coupler).
J1-5	A GND	External signal common for pins 1 to 3, 6 to 9, 11, 12, 14, 16, and 20. When remote sensing is not used, this is at the same electric potential as the negative output terminal. When remote sensing is used, this is at the same electric potential as the negative electrode (-S) of sensing input.
J1-6	ALM CLEAR	Alarm clear terminal. Alarms are cleared when a low level signal (0 V to 0.5 V) is received or shorted.
J1-7	I SUM	Current output terminal for parallel operation.
J1-8	PRL OUT	Positive output terminal for parallel operation.
J1-9	PRL COMP IN	Correction signal input terminal for parallel operation.
J1-10	A GND	External signal common for pins 1 to 3, 6 to 9, 11, 12, 14, 16, and 20. When remote sensing is not used, this is at the same electric potential as the negative output terminal. When remote sensing is used, this is at the same electric potential as the negative electrode (-S) of sensing input.
J1-11	IPGM	Terminal used to control the output current with an external voltage or external resistance. 0 V to 5 V; 0 % to 100 % of the rated output current (CF12: L □). 0 V to 10 V; 0 % to 100 % of the rated output current (CF12: h □).
J1-12	IMON	Output current monitor. 0 % to 100 % of the rated output current is generated as a voltage between 0 V and 5 V (CF13: L □) or a voltage between 0 V and 10 V (CF13: h □).
J1-13	PRL COM	Common for pin 4.
J1-14	PRL ALM	On when a protection function is activated during parallel operation or when an output shutdown signal is being received.
J1-15	A GND	External signal common for pins 1 to 3, 6 to 9, 11, 12, 14, 16, and 20. When remote sensing is not used, this is at the same electric potential as the negative output terminal. When remote sensing is used, this is at the same electric potential as the negative electrode (-S) of sensing input.
J1-16	SHUT DOWN	Output shutdown control terminal. The output is turned off when set to LOW (0 V to 0.5 V) or shorted.
J1-17	OUTPUT CONT	Output on/off terminal. On when set to LOW (0 V to 0.5 V) or shorted; off when set to HIGH (4.5 V or 5 V) or open (CF15: L □). On when set to HIGH (4.5 V to 5 V) or open; off when set to LOW (0 V or 0.5 V) or shorted (CF15: h □).
J1-18	PRL COMP OUT	Correction signal output terminal for parallel operation.
J1-19	PRL IN-	Negative input terminal for parallel operation.
J1-20	PRL IN+	Positive input terminal for parallel operation.

## J2 connector pin arrangement



Pin number positions when you are facing the rear panel

Pin No.	Signal name	Description
J2-1	STATUS COM	Common for pins 2 to 6. <sup>1</sup>
J2-2	OUT ON STATUS	Outputs a signal when output is on (output through an open-collector photocoupler). <sup>2</sup>
J2-3	PWR ON STATUS	Outputs a low level signal when the power is on (output through an open-collector photocoupler). <sup>2</sup>
J2-4	ALM STATUS	Outputs a signal when a protection function (OVP, OCP, FOCP, OHP, SENSE, AC-FAIL, WATCH-DOG) is activated or when an output shutdown signal is being received (output through an open-collector photocoupler). <sup>2</sup>
J2-5	CV STATUS	Outputs a signal during CV mode (output through an open-collector photocoupler). <sup>2</sup>
J2-6	CC STATUS	Outputs a signal during CC mode (output through an open-collector photocoupler). <sup>2</sup>

1 The status common is floating (isolation voltage of 800 V or less). It is isolated from the control circuit.

2 Open collector output:Maximum voltage: 30 V. Maximum current: 8 mA.

# Notes for Connecting External Voltage (Vext)

This section contains notes for controlling the output using external voltage (Vext).

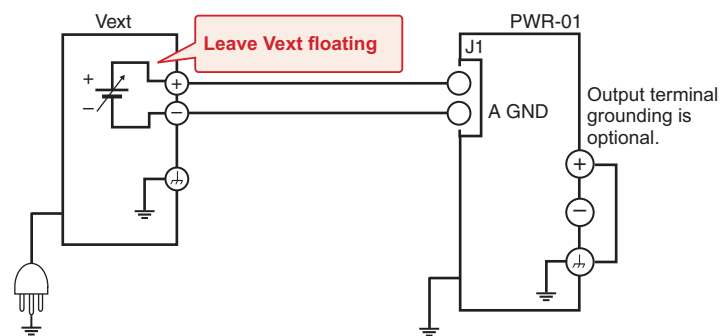
## A GND terminal

The electric potential of A GND (J1-5, J1-10, and J1-15) of the J1 connector that Vext is connected to varies depending on whether remote sensing is used.

- When remote sensing is not used: Same electric potential as the negative output terminal
- When remote sensing is used: Same electric potential as the negative electrode (-S) of sensing input

## Floating

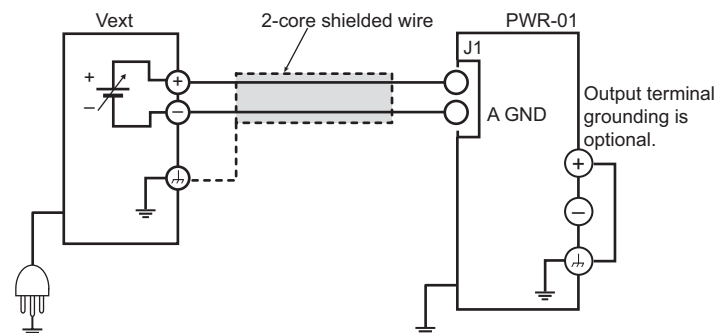
**CAUTION** In a system that uses external control, do not ground the Vext output, that is, leave it floating. If you do, the PWR-01 output may short and burn out the control cable.



## When using shielded cables

**CAUTION** Do not connect the shield to Vext and PWR-01 at the same time. If you do, the PWR-01 output may short and burn out the control cable.

When using shielded cables, connect the shield to either Vext or the PWR-01. The following figure shows an example of the shield connected to the Vext chassis terminal.

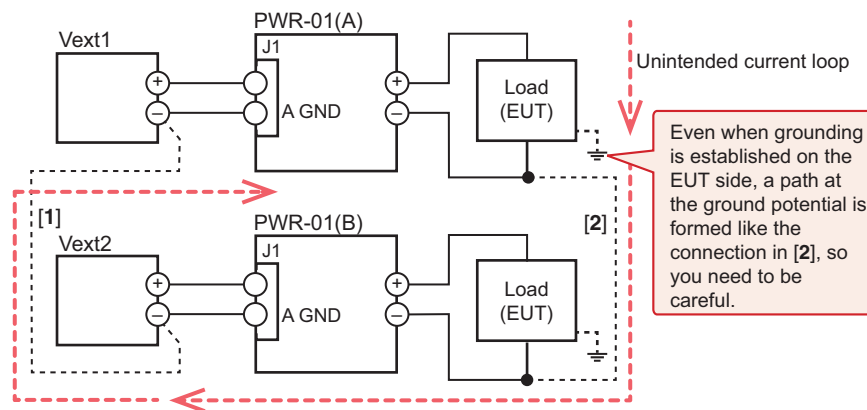


## System that controls multiple PWR-01s with multiple Vexts

**CAUTION** Connect the GND (negative) terminals between each Vext, but do not connect the negative output terminals between each PWR-01. Not following this rule may cause the system to malfunction or damage the devices.

When the GND (negative) terminals between each Vext is connected ([1]), the path connecting the A GND between each PWR-01 is formed. If you connect the negative output terminals between each PWR-01, an unintended current loop shown in the following figure will be created. This current loop may cause the system to malfunction or damage the devices.

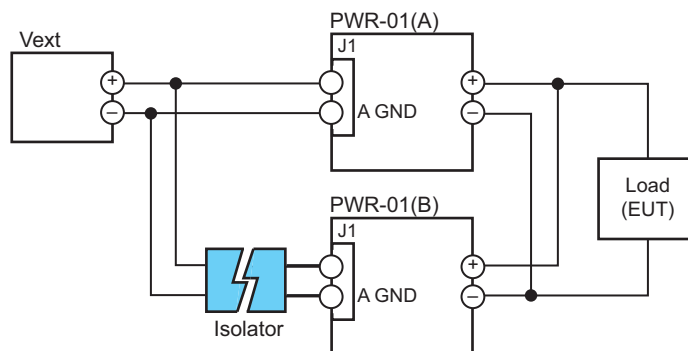
In a system that controls multiple PWR-01s with multiple Vexts, such as that shown in the following figure, we recommend that you do not connect [1] and [2]. If you need to for systematic reasons, connect either [1] or [2].



## System that controls PWR-01s connected in parallel using a single Vext

**CAUTION** Connect only a single PWR-01 directly to Vext through a control cable. Not following this rule may cause the system to malfunction or damage the devices.

In a system that uses a single Vext to control PWR-01s connected in parallel, such as that shown in the following figure, only a single PWR-01 can be connected directly to Vext through a control cable. Connect other PWR-01s through isolators.



**NOTE** The number of PWR-01s that can be connected directly is also one when using a system that controls the output through an external contact using a sequencer or the like.



# Output Voltage Control

This section explains how to control the output voltage using an external voltage ( $V_{ext}$ ) or an external variable resistor ( $R_{ext}$ ) of approximately 10 k $\Omega$ .

If no load is connected, it takes some time for the output voltage to decrease.



## Risk of electric shock.

- Ensure that the insulation of  $V_{ext}$  or  $R_{ext}$  and the connected cable is greater than or equal to the isolation voltage of the PWR-01. For details on the isolation voltage of each model, see Chap.7 "Specifications" (p.123).
- When using shielded cables for the connection, protect the uncovered sections of the shielded cable by using insulation tubes whose withstand voltage is greater than the PWR-01's isolation voltage.

## Control using an external voltage ( $V_{ext}$ )

To use an external voltage ( $V_{ext}$ ) to control the output voltage, set CV control using an external voltage or external resistance to on (CF11:  $\square_n$ ) in CONFIG settings.

The output voltage ( $E_o$ ) varies in the range of 0 to the rated output voltage ( $E_{rtg}$ ) when the external voltage ( $V_{ext}$ ) is changed in the range of 0 V to 5 V (CF12:  $L_{\square}$ ) or in the range of 0 V to 10 V (CF12:  $h_{\square}$ ).

External voltage ( $V_{ext}$ ) 0 V to 5 V (CF12:  $L_{\square}$ )

$$E_o = E_{rtg} \times V_{ext} / 5 \text{ [V]}$$

$$V_{ext} = 5 \times E_o / E_{rtg} \text{ [V]}$$

External voltage ( $V_{ext}$ ) 0 V to 10 V (CF12:  $h_{\square}$ )

$$E_o = E_{rtg} \times V_{ext} / 10 \text{ [V]}$$

$$V_{ext} = 10 \times E_o / E_{rtg} \text{ [V]}$$

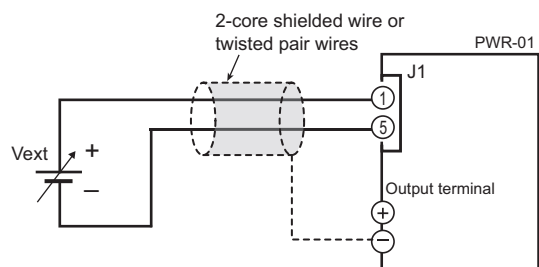
## External voltage ( $V_{ext}$ ) connection



- The signal cable may burn out. Do not connect the  $V_{ext}$  output, that is, leave it floating. Risk of damage.
- Pay careful attention to the polarity of  $V_{ext}$ .
- Do not apply a voltage of 10.5 V or greater or a reverse voltage across pins 1 and 5 of the J1 connector.

Use a low-noise, stable voltage source for  $V_{ext}$ . The noise in  $V_{ext}$  is multiplied by the amplification factor of the PWR-01 and appears in the output. Therefore, the output ripple noise may not meet the specifications of the PWR-01.

To reduce the influence of noise on the output, connect a 2-core shielded wire or a twisted-pair wire across  $V_{ext}$ , and keep the wire as short as possible. If the wiring between the PWR-01 and the external contact is long, it becomes easy for noise to influence the operation of the PWR-01. Even if you use cables that are designed to suppress noise, the PWR-01 may not operate properly.



Vext input	Common	Internal resistance
Pin 1	Pin 5	Approx.1 M $\Omega$

If you use a shielded cable, connect the shield to the negative output terminal. If the shield needs to be connected to the Vext side, see "Notes for Connecting External Voltage (Vext)"(p.95).

Use pins 1 and 5 of the J1 connector.

## Control using an external resistance (Rext)

By using an external resistance (Rext) to change the voltage-divider ratio of the reference voltage (J1-3 REF OUT), you can change the output voltage (Eo) to a value in the range of 0 to the 105 % of the rated output voltage (Ertg).

To use an external resistance (Rext) to control the output voltage, set CV control using an external voltage or external resistance to on (CF11:  $\square n$ ) in CONFIG settings.

In CONFIG settings (CF12), set the external voltage (Vext) range and reference voltage (J1-3 REF OUT).

The output voltage (Eo) varies in the range of 0 to the rated output voltage (Ertg) when the external voltage (Vext) is changed in the range of 0 V to 5 V (CF12:  $L \square$ ) or in the range of 0 V to 10 V (CF12:  $h \square$ ).

Reference voltage (REF OUT) 5.25 V  
External voltage (Vext) 0 V to 5 V (CF12:  $L \square$ )

$$E_o = E_{rtg} \times V_{ext} / 5 \text{ [V]}$$

$$V_{ext} = 5 \times E_o / E_{rtg} \text{ [V]}$$

Reference voltage (REF OUT) 10.5 V  
External voltage (Vext) 0 V to 10 V (CF12:  $h \square$ )

$$E_o = E_{rtg} \times V_{ext} / 10 \text{ [V]}$$

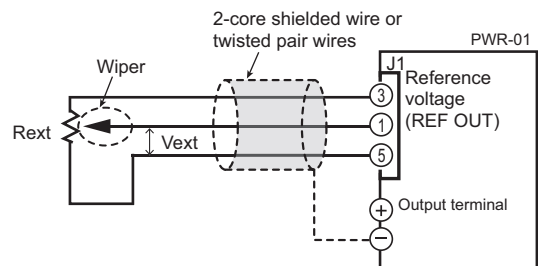
$$V_{ext} = 10 \times E_o / E_{rtg} \text{ [V]}$$

### External resistance (Rext) connection

For Rext, use a resistor that is rated at approximately 10 kΩ, 1/2 W or greater, that has a low temperature coefficient, and that will change little over time. Examples of such resistors are metal film or wire wound resistors.

To reduce the influence of noise on the output, connect a 2-core shielded wire or a twisted-pair wire across Rext, and keep the wire as short as possible. If the wiring between the PWR-01 and the external contact is long, it becomes easy for noise to influence the operation of the PWR-01. Even if you use cables that are designed to suppress noise, the PWR-01 may not operate properly.

If you use a shielded cable, connect the shield to the negative output terminal. Use pins 3, 1, and 5 of the J1 connector.



# Output Current Control

This section explains how to control the output current using an external voltage ( $V_{ext}$ ) or an external variable resistor of approximately 10 k $\Omega$  ( $R_{ext}$ ).



## Risk of electric shock.

- Ensure that the insulation of  $V_{ext}$  or  $R_{ext}$  and the connected cable is greater than or equal to the isolation voltage of the PWR-01. For details on the isolation voltage of each model, see Chap.7 "Specifications" (p.123).
- When using shielded cables for the connection, protect the uncovered sections of the shielded cable by using insulation tubes whose withstand voltage is greater than the PWR-01's isolation voltage.

## Control using an external voltage ( $V_{ext}$ )

To use an external voltage ( $V_{ext}$ ) to control the output current, set CC control using an external voltage or external resistance to on (CF10:  $\square \square$ ) in CONFIG settings.

The output current ( $I_o$ ) varies in the range of 0 to the rated output current ( $I_{rtg}$ ) when the external voltage ( $V_{ext}$ ) is changed in the range of 0 V to 5 V (CF12:  $\square \square$ ) or in the range of 0 V to 10 V (CF12:  $\square \square$ ).

External voltage ( $V_{ext}$ ) 0 V to 5 V (CF12:  $\square \square$ )

$$I_o = I_{rtg} \times V_{ext} / 5 \text{ [A]}$$

$$V_{ext} = 5 \times I_o / I_{rtg} \text{ [A]}$$

External voltage ( $V_{ext}$ ) 0 V to 10 V (CF12:  $\square \square$ )

$$I_o = I_{rtg} \times V_{ext} / 10 \text{ [A]}$$

$$V_{ext} = 10 \times I_o / I_{rtg} \text{ [A]}$$

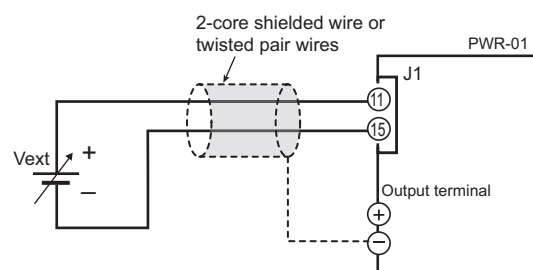
## External voltage ( $V_{ext}$ ) connection



- The signal cable may burn out. Do not connect the  $V_{ext}$  output, that is, leave it floating. Risk of damage.
- Pay careful attention to the polarity of  $V_{ext}$ .
- Do not apply a voltage of 10.5 V or greater or a reverse voltage across pins 11 and 15 of the J1 connector.

Connect a low-noise, stable voltage source to  $V_{ext}$ . The noise in  $V_{ext}$  is multiplied by the amplification factor of the PWR-01 and appears in the output. Therefore, the output ripple noise may not meet the specifications of the PWR-01.

To reduce the influence of noise on the output, connect a 2-core shielded wire or a twisted-pair wire across  $V_{ext}$ , and keep the wire as short as possible. If the wiring between the PWR-01 and the external contact is long, it becomes easy for noise to influence the operation of the PWR-01. Even if you use cables that are designed to suppress noise, the PWR-01 may not operate properly.



Vext input	Common	Internal resistance
Pin 11	Pin 15	Approx. 1 M $\Omega$

If you use a shielded cable, connect the shield to the negative output terminal. If the shield needs to be connected to the Vext side, see "Notes for Connecting External Voltage (Vext)"(p.95).

Use pins 11 and 15 of the J1 connector.

## Control using an external resistance (Rext)

By using an external resistance (Rext) to change the voltage-divider ratio of the reference voltage (J1-3 REF OUT), you can change the output current (Io) to a value in the range of 0 to the 105 % of the rated output current (Irtg).

To use an external resistance (Rext) to control the output current, set CC control using an external voltage or external resistance to on (CF10: ON) in CONFIG settings.

In CONFIG settings (CF12), set the external voltage (Vext) range and reference voltage (J1-3 REF OUT).

The output current (Io) varies in the range of 0 to the rated output current (Irtg) when the external voltage (Vext) is changed in the range of 0 V to 5 V (CF12: L) or in the range of 0 V to 10 V (CF12: H).

Reference voltage (REF OUT) 5.25 V  
External voltage (Vext) 0 V to 5 V (CF12: L)

$$I_o = I_{rtg} \times V_{ext} / 5 \text{ [A]}$$

$$V_{ext} = 5 \times I_o / I_{rtg} \text{ [A]}$$

Reference voltage (REF OUT) 10.5 V  
External voltage (Vext) 0 V to 10 V (CF12: H)

$$I_o = I_{rtg} \times V_{ext} / 10 \text{ [A]}$$

$$V_{ext} = 10 \times I_o / I_{rtg} \text{ [A]}$$

### External resistance (Rext) connection

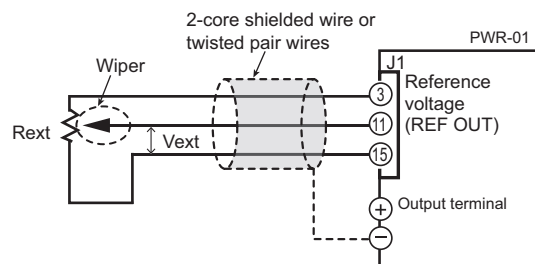
For Rext, use a resistor that is rated at approximately 10 kΩ, 1/2 W or greater, that has a low temperature coefficient, and that will change little over time. Examples of such resistors are metal film or wire wound resistors.

To reduce the influence of noise on the output, connect a 2-core shielded wire or a twisted-pair wire across Rext, and keep the wire as short as possible. If the wiring is long, it becomes

easy for noise to influence the operation of the PWR-01. Even if you use wires that are designed to suppress noise, the PWR-01 may not operate properly.

If you use a shielded cable, connect the shield to the negative output terminal.

Use pins 3, 11, and 15 of the J1 connector.



# Controlling the Output On and Off States

This section explains how to use an external contact to control the output on and off states.



## Risk of electric shock.

- Ensure that the insulation of external contact (S) and the connected cable is greater than or equal to the isolation voltage of the PWR-01. For details on the isolation voltage of each model, see Chap.7 "Specifications" (p.123).
- When using shielded cables for the connection, protect the uncovered sections of the shielded cable by using insulation tubes whose withstand voltage is greater than the PWR-01's isolation voltage.

To reduce the influence of noise on the output, connect a 2-core shielded wire or a twisted-pair wire across the external contact, and keep the wire as short as possible. If the wiring is long, it becomes easy for noise to influence the operation of the PWR-01. Even if you use cables that are designed to suppress noise, the PWR-01 may not operate properly.

If you use a shielded cable, connect the shield to the negative output terminal.

To use an external contact to control the output on and off states, set the appropriate CONFIG parameter (CF 15: ON). Then, select the logic setting from the following two options.

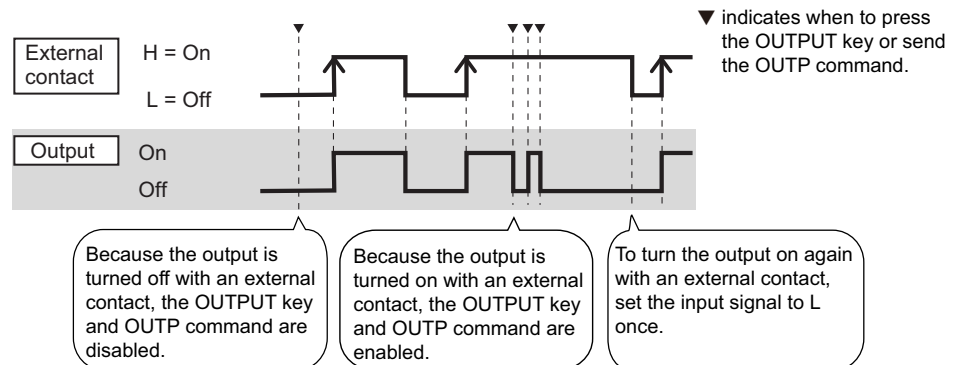
- Turn the output on at the falling edge of the LOW signal (CF15: LO)  
Output is turned on when a low (0 V to 0.5 V) signal is applied to pin 17 of the J1 connector or the pin is shorted.
- Turn the output on at the rising edge of the HIGH signal (CF15: HI)  
Output is turned on when a high (4.5 V to 5 V) signal is applied to pin 17 of the J1 connector or the pin is opened.

You can use the CONFIG settings to enable the output-on/ off delay function and soft start and soft stop functions (CF14: ENH).

Output on/off control is performed by detecting rising edges or falling edges. Because it is not a level detection, if you want to turn on the output at startup, you need to apply a signal so that an edge is detected.

External contact, the OUTPUT key on the panel, and output on/off control using the OUTP command are enabled simultaneously. (For details on commands, see the Communication Interface Manual.)

Because output off is prioritized, if the output is turned off with an external contact, the OUTPUT key and OUTP command are disabled.



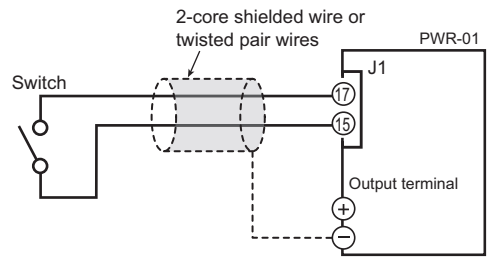
Controlling the output on and off states (in this example, a HIGH signal is used to turn the output on)

### External contact connection

Use pins 15 and 17 of the J1 connector.

The open-circuit voltage across pins 15 and 17 is approximately 5 V. The short-circuit current across pins 5 and 19 is approximately 0.5 mA.

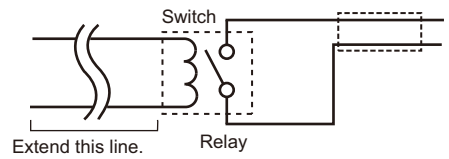
Use external contacts that have a contact rating greater than or equal to 0.5 mA at 5 Vdc.



If two or more units are floating, and you are using a single external contact to turn output on and off, use a relay or similar device for the external contact signal to isolate the signal transmitted to each unit.

#### ■ For long-distance wiring

When you are wiring over a great distance, use a small relay and extend the coil side of the relay.



# Controlling Output Shutdown

This section explains how to use an external contact to turn output off.



## Risk of electric shock.

- Ensure that the insulation of external contact (S) and the connected cable is greater than or equal to the isolation voltage of the PWR-01. For details on the isolation voltage of each model, see Chap.7 "Specifications" (p.123).
- When using shielded cables for the connection, protect the uncovered sections of the shielded cable by using insulation tubes whose withstand voltage is greater than the PWR-01's isolation voltage.

To reduce the influence of noise on the output, connect a 2-core shielded wire or a twisted-pair wire across the external contact, and keep the wire as short as possible. If the wiring is long, it becomes easy for noise to influence the operation of the PWR-01. Even if you use cables that are designed to suppress noise, the PWR-01 may not operate properly.

If you use a shielded cable, connect the shield to the negative output terminal.

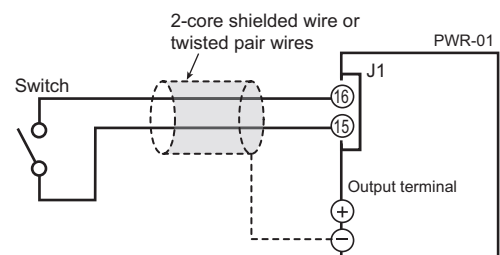
Output is turned off when a low (0 V to 0.5 V) signal is applied to pin 16 of the J1 connector or the pin is shorted.

To recover, set pin 16 of the J1 connector to HIGH (4.5 V to 5 V) or open the pin, and then turn the POWER switch off and then on.

## Output shutdown connection

Use pins 15 and 16 of the J1 connector. The open-circuit voltage across pins 15 and 16 is approximately 5 V. The short-circuit current across pins 5 and 19 is approximately 0.5 mA.

Use external contacts that have a contact rating greater than or equal to 0.5 mA at 5 Vdc.



If two or more units are floating, and you are using a single external contact to shut down the output for all the units, use a relay or similar device for the external contact signal to isolate the signal transmitted to each unit.

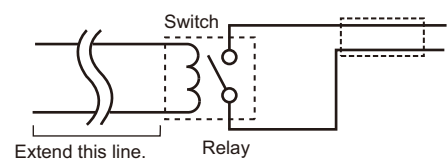
When pin 14 of the J1 connector is enabled, if a slave unit stops due to an error during master-slave parallel operation, the entire system will be shut down (p.57).

You can select using CONFIG settings whether to trip the breaker when a shutdown occurs (CF25: □□/□FF) (2000W model only).

By factory default, breaker tripping for output shutdown is enabled (CF25: □□) (p.69).

### ■ For long-distance wiring

When you are wiring over a great distance, use a small relay and extend the coil side of the relay.



# Controlling the Clearing of Alarms

This section explains how to use an external contact to clear alarms.



## Risk of electric shock.

- Ensure that the insulation of external contact (S) and the connected cable is greater than or equal to the isolation voltage of the PWR-01. For details on the isolation voltage of each model, see Chap.7 "Specifications" (p.123).
- When using shielded cables for the connection, protect the uncovered sections of the shielded cable by using insulation tubes whose withstand voltage is greater than the PWR-01's isolation voltage.

To reduce the influence of noise on the output, connect a 2-core shielded wire or a twisted-pair wire across the external contact, and keep the wire as short as possible. If the wiring is long, it becomes easy for noise to influence the operation of the PWR-01. Even if you use cables that are designed to suppress noise, the PWR-01 may not operate properly.

If you use a shielded cable, connect the shield to the negative output terminal.

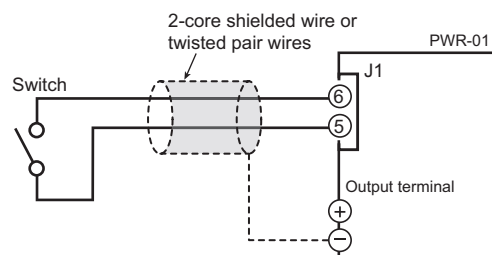
Alarms are cleared when a low (0 V to 0.5 V) signal is applied to pin 6 of the J1 connector or the pin is shorted.

## Alarm clear connection

Use pins 5 and 6 of the J1 connector.

The open-circuit voltage across pins 5 and 6 is approximately 5 V. The short-circuit current across pins 5 and 19 is approximately 0.5 mA.

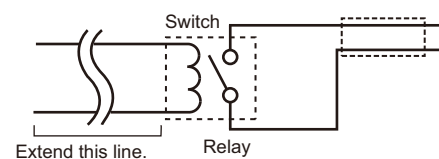
Use external contacts that have a contact rating greater than or equal to 0.5 mA at 5 Vdc.



If two or more units are floating, and you are using a single external contact to clear alarms, use a relay or similar device for the external contact signal to isolate the signal transmitted to each unit.

### ■ For long-distance wiring

When you are wiring over a great distance, use a small relay and extend the coil side of the relay.





# External Monitoring

## External monitoring of the output voltage and output current

The J1 connector has monitor outputs for the output voltage and the output current. You can set the monitor output voltage range using CONFIG settings (CF13).

Pin no.	Signal name	Description
J1-5 J1-10 J1-15	A GND	Monitor output common
J1-2	VMON	Monitor output of output voltage 0 V to approx. 5 V (CF13: L <sub>0</sub> ), 0 V to approx. 10 V (CF13: h <sub>1</sub> ) between 0 V to rated output voltage
J1-12	IMON	Monitor output of output current 0 V to approx. 5 V (CF13: L <sub>0</sub> ), 0 V to approx. 10 V (CF13: h <sub>1</sub> ) between 0 A to rated output current



Shorting VMON and IMON to A GND may damage the PWR-01.

### Monitor output rating

Output impedance: 1 k $\Omega$  or less. Maximum output current: Approx. 10 mA

The monitor output signals are used to monitor the DC voltage (mean value). They cannot be used to accurately monitor the AC components (such as ripple and transient response waveform) of the actual output voltage or current.

## External monitoring of the operating status

The J2 connector has status outputs that can be used to externally monitor the operation status of the PWR-01. The following five items make up the status outputs.

The outputs are open collector outputs of photocouplers; they are isolated from the internal circuits of the PWR-01.

The status common is floating (that is, it has an isolation voltage of less than or equal to 800 V).

The maximum ratings of the signal terminals are as follows:

Maximum voltage: 30 V. Maximum current (sink): 8 mA.

Pin no.	Signal name	Description	Circuit
J2-1	STATUS COM	Status output common. Photocoupler emitter output.	
J2-2	OUT ON STATUS <sup>1</sup>	The level changes when the output is on. LOW level (CF18: $\bar{n}E\bar{L}$ ), HIGH (CF18: P $\alpha$ b) Photocoupler open collector output.	
J2-3	PWR ON STATUS	This is set to low level when the POWER switch is turned on (PWR ON STATUS). Photocoupler open collector output.	
J2-4	ALM STATUS <sup>1</sup>	The level changes when a protection function (OVP, OCP, FOCP, OHP, SENSE, AC-FAIL) is activated or when an output shutdown signal is received. LOW level (CF19: $\bar{n}E\bar{L}$ ), HIGH (CF19: P $\alpha$ b) Photocoupler open collector output.	
J2-5	CV STATUS <sup>1</sup>	The level changes in constant-voltage mode. LOW level (CF17: $\bar{n}E\bar{L}$ ), HIGH (CF17: P $\alpha$ b) Photocoupler open collector output.	
J2-6	CC STATUS <sup>1</sup>	The level changes in constant-current mode. LOW level (CF16: $\bar{n}E\bar{L}$ ), HIGH (CF16: P $\alpha$ b) Photocoupler open collector output.	

<sup>1</sup> If the status output is set to HIGH level (POS), the status output will be at HIGH level for 5 seconds after the POWER switch is turned on.



# 5

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## Parallel/ Series Operation

This chapter describes the functions of series operation and the master-slave parallel operations as well as the connection, setup, and operation procedures.

# Master-Slave Parallel Operation

Master-slave parallel operation is a function used to control a whole parallel-connected system from a master unit. One unit is the master unit, and other PWR-01s connected in parallel are slave units. The master and slave units must all be the same model.

You can use master-slave parallel operation to increase the output current (maximum output current: the rated output current of one unit × the number of units connected in parallel).

	400W model	800W model	1200W model	2000W model
Maximum number of units connected in parallel	Up to three units including the master unit	Up to three units including the master unit	Up to two units including the master unit	Up to two units including the master unit

The difference in the output voltage and output current between the master unit and the slave units is within approximately 5 % of the rating.

## CAUTION

When using a PWR-01 independently or when there are PWR-01s not using parallel operation, disconnect the parallel operation connections. Otherwise, the PWR-01 may not operate properly.

## Features

The functions of the PWR-01 during master-slave parallel operation are as follows:

### Voltage display and current display

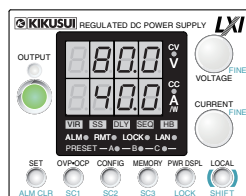
The voltmeter on the master unit displays the voltage. The master unit displays the last voltage that was set, and the voltmeter on the slave units displays “ $\square\square\square$ .”

The master unit’s ammeter displays the total of the currents of all the units connected in parallel. For slave units, the current display of each slave unit can be set (CF35:  $\square FF / \square \square$ ).

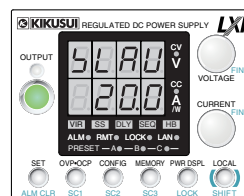
The maximum current display is 999.9.

You can switch the display so that it shows power (p.38). The master unit’s ammeter displays the total of the powers of all the units connected in parallel. For slave units, the power display of each slave unit can be set (CF35:  $\square FF / \square \square$ ).

Master unit



Slave unit



Example of the panel display during parallel operation (Output current at 20 A, slave unit display set to on)

If the number of units in parallel operation (CF44) set on the master unit does not match the actual number of units connected in parallel, the correct current will not be displayed.

### External control

This is only available on the master unit (p.89).

## External monitoring

### CAUTION

During parallel operation, do not connect the monitor common cable of the master unit to the monitor common cables of the slave units. If the cables connected to the load are disconnected, the common cables will be damaged.

- External monitoring of the output voltage (VMON) (p.105)  
This can be monitored from the master unit.
- External monitoring of the output current (IMON) (p.105)  
You can monitor the output current of the master unit and each slave unit. Use the master unit to monitor the total output current.
- Status monitors (p.106)  
You can monitor the status of the following items from the master unit and from the slave unit: constant-voltage mode (CV STATUS), constant-current mode (CC STATUS), output on, POWER switch on, and alarms. However, slave units always output the status of constant-current mode.

## Remote sensing

This is only available on the master unit (p.34).

## Alarms

If an alarm is detected, the units behave as follows:

### CAUTION

If an error occurs in a slave unit, the master-slave parallel operation protection (PRL ALM) turns off the output of the entire system. During master-slave parallel operation, connect pin 14 of the J1 connectors of the master unit and slave units.

- Alarm detected on the master unit  
The output of each slave unit is turned off, and then the output of the entire system is turned off.
- Alarm detected on a slave unit  
The master unit detects the alarm on the slave unit and then turns off the output of the entire system.

### ■ Clearing alarms

Press ALM CLR (SHIFT+SET) or apply a LOW level signal (0 V to 0.5 V) to or short pin 6 of the J1 connector to clear the alarm state (p.51), and eliminate the cause of the alarm.

If a shutdown (SD) or parallel alarm (PRL ARM) is activated, turn off the slave units first and then the master unit. Eliminate the cause of the alarm, and then turn on the master unit first and then the slave units (p.113).

## Remote control

Remote control can be used on the master unit.

For details, see the Communication Interface Manual.

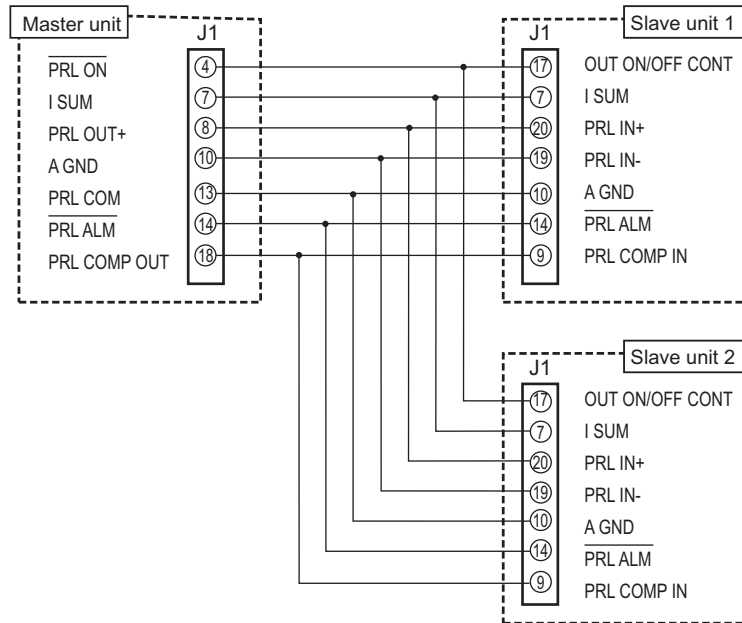
## Connection

### Connecting the signal cables

Use the J1 connector to make the connections for parallel operation.

The necessary cables are not included. For details, see "About the J1/ J2 Connectors" (p.91).

Example of connecting two slave units



- 1** Decide which PWR-01 you will use as the master unit.
- 2** Connect the J1 connector of the master unit to the J1 connector of the first slave unit.
- 3** If there is a second slave unit, connect the J1 connector of the first slave unit to that of the second slave unit.

The cable is available as an option (p.148).

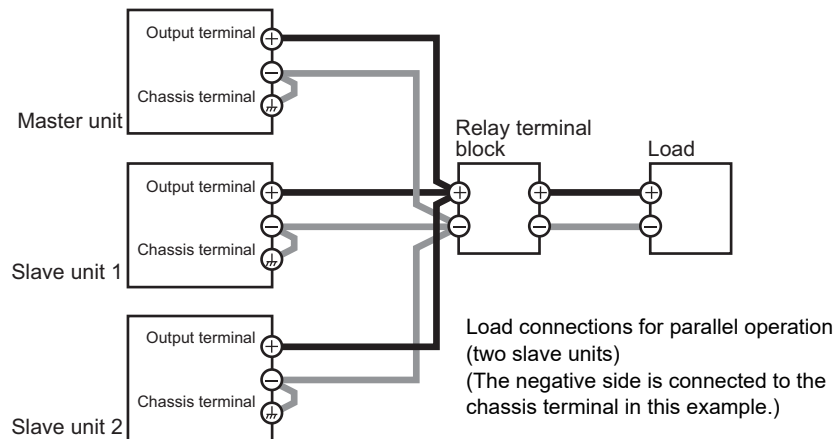
## Connecting the Load



**Risk of electric shock. Turn the POWER switch off before you touch the output terminals. Attach the OUTPUT terminal cover after you finish wiring the load.**



- When you ground the output terminals, be sure to connect the same polarity output terminals (positive or negative) of the master unit and the slave units to the chassis terminals. If you ground different polarity output terminals of the master unit and the slave units, the output will be grounded through the power cable's GND wire. Not only will this make the output incorrect, it will also damage the chassis connection short bar.
- To prevent oscillation, connect an electrolytic capacitor with a capacitance of a few hundred  $\mu\text{F}$  to a few ten thousand  $\mu\text{F}$  across the load as necessary. If the wires are long, the wiring inductance and capacitance can cause phase shifting at a level that can not be ignored. This may lead to oscillation. The withstand voltage of the electrolytic capacitor needs to be at least 120 % of the rated output voltage of the PWR-01.
- Twist the positive and negative cables together, and make the connection to the load as short as possible. Oscillation may occur as a result of wiring inductance.



- 1 Turn off all the PWR-01s that you want to connect in parallel.**
- 2 Remove the OUTPUT terminal covers.**
- 3 Connect the output terminals (positive or negative) of the master unit and the slave units to the chassis terminals.**  
Ground the same polarity output terminals of the master unit and slave units. If you are using the units under floating conditions, do not connect the terminals.
- 4 Connect the load cables (p.21) to the output terminals of the master unit and the slave units.**
- 5 Connect the load cables of the master unit and slave units to the load through a relay terminal block.**  
Use load cables that have sufficient current capacity. Use load cables of equivalent length and cross-sectional area to connect each PWR-01 to the relay terminal block, and wire the cables so that they are as short as possible (50 cm or less). Also, make the connection from the relay terminal block to the load block as short as possible. Wire the J1 connector signal cables and the load cables as far apart as possible.
- 6 Attach the OUTPUT terminal cover.**

## Setting

### Setting the master unit, the slave units, and the number of units in parallel operation (including the master unit)

Turn the output off, and then configure the master unit (CF44: 2 or 3) and the slave units (CF44: 5LRL). On the master unit, set the number of units in parallel operation (CF44: 2 or 3).

By factory default, the PWR-01 is set to independent operation (CF44: 1).

Turn the POWER switch off and on to enable the setting.

Be sure to set the number of units in parallel operation (CF44) to the actual number of units. If this parameter is incorrect, settings such as those for the current and the overcurrent protection (OCP) cannot be set correctly, and the measured current will not be displayed correctly.

### Setting the voltage and current

Use the master unit to set the voltage and current ([p.108](#)).

The current that is output is the sum of the currents of the master unit and the slave units.

When you set the number of units in parallel operation (CF44) in CONFIG settings, the maximum output current (105 % of the rated output current of a single unit × the number of units in parallel) is set. The value is displayed when the PWR-01 is showing the setting display (when the SET key is lit). The last voltage that was set on the master unit is used. When you press OUTPUT, the set voltage and current are output. You can set the voltage and current to any values.

### Setting the overvoltage protection (OVP) and overcurrent protection (OCP) of the master unit

In parallel operation, set the overvoltage protection (OVP) and overcurrent protection (OCP) of the master unit ([p.52](#)).

When you set the number of units in parallel operation (CF44) in CONFIG settings, the maximum overcurrent protection value (112 % of the rated output current of a single unit × the number of units in parallel) is set. The value is displayed when the PWR-01 is showing the OVP/OCP setting display (when the OVP•OCP key is lit). The last overvoltage protection value that was set on the master unit is used.

### Breaker trip setting for protection function (OVP/ OCP/ FOCP/ SD/ PRL ALM) activation (2000W model only)

In parallel operation, you can select using CONFIG settings whether to trip the breaker (turn off the POWER switch) when a protection function (OVP/ OCP/ FOCP/ SD/ PRL ALM) is activated (CF25: OFF/ON) ([p.69](#)). The factory default setting is ON.

The master unit setting is not applied to slave units. Set it in the master unit and slave units.



## Starting master-slave parallel operation

---

### Turning on the POWER switch

- 1 Turn on the master unit's POWER switch.**
- 2 Turn off the POWER switch of each slave unit.**
- 3 Operate the master unit normally.**

You cannot perform panel operations on the slave units. Turn output on and off from the master unit.

### Turning the POWER switch off

---

**⚠ CAUTION** After you turn the POWER switch off, wait at least 10 seconds after the panel display turns off before you turn the POWER switch back on. Repeatedly turning the POWER switch on and off at short intervals can cause damage to the inrush current limiter. Furthermore, this will shorten the service life of the POWER switch, internal input fuse, and other components.

---

- 1 Turn off the POWER switch of each slave unit.**
- 2 Turn off the master unit's POWER switch.**

# Series Operation



**Series operation is not possible on the H type (PWR401H, PWR801H, PWR1201H, PWR2001H). If you do, the output will exceed the isolation voltage resulting in a dangerous condition.**

Up to two PWR-01s whose output is less than 650 V can be connected in series. You cannot perform master-slave series operation. The total of the output voltages of the two units is applied to the load.

The voltage setting accuracy is the same as the accuracy of an individual unit.

## Features

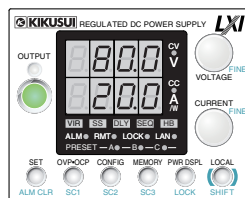
The functions of the PWR-01 during series operation are as follows:

### Voltage display and current display

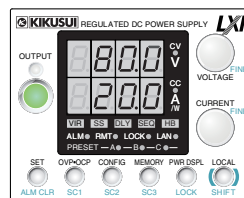
The voltage and current are displayed on unit 1 and unit 2. To calculate the total output voltage, add the voltages of unit 1 and unit 2.

You can switch the display so that it shows power. The power is displayed ([p.38](#)) on unit 1 and unit 2.

Unit 1



Unit 2



Example of the panel display during series operation (20 A output current)

### External control

This is available ([p.89](#)).

### External monitoring



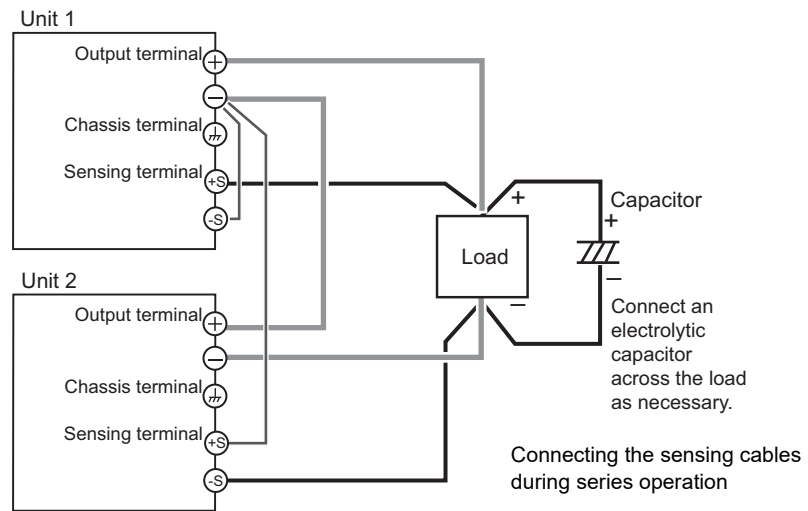
**During monitoring, be careful of shorts and electric shocks. When monitoring the output voltage or output current during series operation, the electric potential of the commons of unit 1's monitor signal and unit 2's monitor signal are different.**

- External monitoring of the output voltage (VMON) ([p.105](#))  
You can monitor the output voltage of each unit.  
To calculate the total output voltage, add the monitored values of unit 1 and unit 2.
- External monitoring of the output current (IMON) ([p.105](#))  
You can monitor the output current of each unit.
- Status monitors ([p.106](#))  
You can monitor the status of the following items from each unit: constant-voltage mode (CV STATUS), constant-current mode (CC STATUS), output on, POWER switch on, and alarms.

## Remote sensing

- CAUTION**
- If the sensing cables are not connected properly, the load may be exposed to excessive voltage, and the PWR-01s may be damaged.
  - To prevent oscillation, connect an electrolytic capacitor with a capacitance of a few hundred  $\mu\text{F}$  to a few ten thousand  $\mu\text{F}$  across the load as necessary. If the wires are long, the wiring inductance and capacitance can cause phase shifting at a level that can not be ignored. This may lead to oscillation.  
The withstand voltage of the electrolytic capacitor needs to be at least 120 % of the total rated output voltage of the PWR-01s connected in series.

To perform remote sensing, connect the PWR-01s in series, and then connect the sensing cables to them as shown in the following figure (p.34).



## Alarms

All alarms will be detected during series operation.

You can select whether to automatically turn on or off the output when the cause of the alarm is removed using a CONFIG setting (CF20: R<sub>1</sub>E<sub>0</sub>/ S<sub>1</sub>F<sub>1</sub>E) (AC-FAIL only).

### ■ Clearing alarms

Press ALM CLR (SHIFT+SET) or apply a low level signal (0 V to 0.5 V) to or short pin 6 of the J1 connector to clear the alarm state (p.51), and eliminate the cause of the alarm.

If a shutdown (SD) or parallel alarm (PRL ARM) is activated, turn off the POWER switch on unit 1 and unit 2. Eliminate the cause of the alarm, and then turn on the two units (p.117).

## Connection

### Connecting the Load



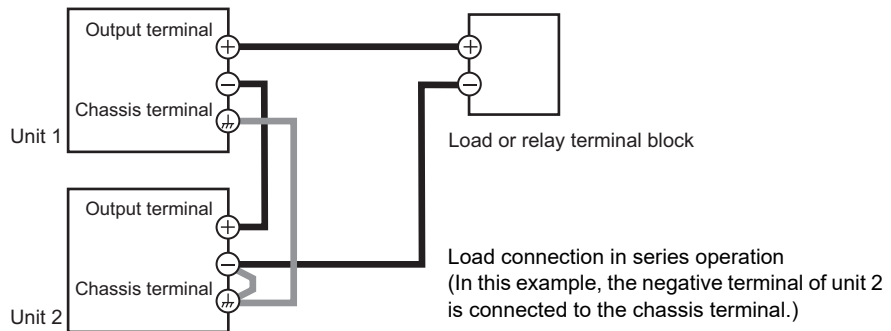
**WARNING** Risk of electric shock. Turn the **POWER** switch off before you touch the output terminals. Attach the **OUTPUT** terminal cover after you finish wiring the load.



To prevent oscillation, connect an electrolytic capacitor with a capacitance of a few hundred  $\mu\text{F}$  to a few ten thousand  $\mu\text{F}$  across the load as necessary. If the wires are long, the wiring inductance and capacitance can cause phase shifting at a level that can not be ignored. This may lead to oscillation.

The withstand voltage of the electrolytic capacitor needs to be at least 120 % of the total rated output voltage of the PWR-01s connected in series.

Connect the load as shown below.



- 1** Turn off all the PWR-01s that you want to connect in series.
- 2** Remove the **OUTPUT** terminal covers.
- 3** Connect the output terminal (positive or negative) of unit 1 or unit 2 to the chassis terminal.
- 4** Use load cables to connect unit 1 and unit 2 to the load or relay terminal block.

Use load cables that have sufficient current capacity ([p.21](#)). Wire the load cables so that they are as short as possible. If the voltage drop in the load cable is large, the difference in electric potential between power supply units and the load regulation become large.

- 5** Connect the cables to the output terminals of unit 1 and unit 2.
- 6** Attach the **OUTPUT** terminal cover.

## Setting

---

### Setting the voltage and current

Set the voltage and current on each unit. The voltage that is output is the total of the voltages of the two units. Set the current to the same value on the two units.

### Setting the overvoltage protection (OVP) and overcurrent protection (OCP)

In series operation, you have to set the overvoltage protection (OVP) and overcurrent protection (OCP) on both units ([p.52](#)). Specify the same values on the two units.

## Starting series operation

---

### Turning the POWER switch on and off

Turn the POWER switch on unit 1 and unit 2 on or off.



After you turn the POWER switch off, wait at least 10 seconds after the fan stops before you turn the POWER switch back on. Repeatedly turning the POWER switch on and off at short intervals can cause damage to the inrush current limiter. Furthermore, this will shorten the service life of the POWER switch, internal input fuse, and other components.

### Turning the output on/off

Press OUTPUT on unit 1 and unit 2 to turn the output on or off.



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# 6

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## Maintenance

This chapter explains how to perform calibration.

# Calibration

The product is calibrated before shipment. To maintain long-term reliable performance, we recommend periodic calibration.

To have your product calibrated, contact your Kikusui distributor or agent.

If you are going to calibrate the product, follow the procedure below. All the calibration parameters of this product are listed.

## Calibration overview

The following eight parameters can be calibrated.

Be sure to calibrate both the offset and full scale values.

- Output voltage offset (10 %)
- Voltmeter offset (0 %)
- Output current offset (10 %)
- Ammeter offset (0 %)
- Output voltage full scale (100 %)
- Voltmeter full scale (100 %)
- Output current full scale (100 %)
- Ammeter full scale (100 %)

## Required devices

- DC voltmeter (DVM) with a measurement accuracy of 0.02 % or more
- Shunt resistor

Model	Recommended shunt resistor	
	Rating	Tolerance
PWR401L	50 A/ 100 mV (2.00 mΩ)	
PWR401ML	20 A/ 100 mV (5.00 mΩ)	
PWR401MH	10 A/ 100 mV (10.00 mΩ)	
PWR401H	2 A/ 100 mV (50.00 mΩ)	
PWR801L	100 A/ 100 mV (1.00 mΩ)	
PWR801ML	50 A/ 100 mV (2.00 mΩ)	
PWR801MH	20 A/ 100 mV (5.00 mΩ)	
PWR801H	5 A/ 100 mV (20.00 mΩ)	
PWR1201L	200 A/ 50 mV (0.25 mΩ)	<±0.1 %
PWR1201ML	100 A/ 100 mV (1.00 mΩ)	
PWR1201MH	20 A/ 100 mV (5.00 mΩ)	
PWR1201H	10 A/ 100 mV (10.00 mΩ)	
PWR2001L	200 A/ 50 mV (0.25 mΩ)	
PWR2001ML	100 A/ 100 mV (1.00 mΩ)	
PWR2001MH	50 A/ 100 mV (2.00 mΩ)	
PWR2001H	10 A/ 100 mV (10.00 mΩ)	

## Environment

Perform calibration in the following environment.

- Temperature: 23 °C ± 5 °C
- Humidity: 80 %rh or less



To minimize the calibration error due to initial drift, warm up the PWR-01 for at least 30 minutes before calibration. In addition, warm up the DVM and shunt resistor for as long as is necessary.

## Calibration procedure

Use the KIKUSUI PWR-01 Calibration software application in the CD-ROM to calibrate the PWR-01. System requirements for PWR-01 Calibration are as follows:

### ■ OS

- Windows 10 (x86/ x64)
- Windows 8.1 (x86/ x64)
- Windows 8 (x86/ x64)
- Windows 7 (x86/ x64)
- .NET Framework 2.0 or later

### ■ VISA library

One of the following VISA libraries is required. Do not install multiple VISA libraries on the same PC. Doing so may cause errors.

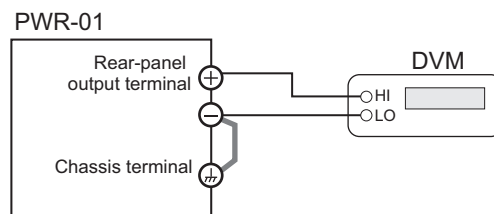
- NI-VISA by National Instruments Corporation (Ver. 5.0.3 or later)
- Keysight VISA by Keysight Technologies (Keysight IO Libraries Suite 16.0 or later)
- KI-VISA Ver. 5.0.4 or later

For details, see the PWR-01 Calibration - Manual that is installed together with the application software for calibrating the PWR-01.

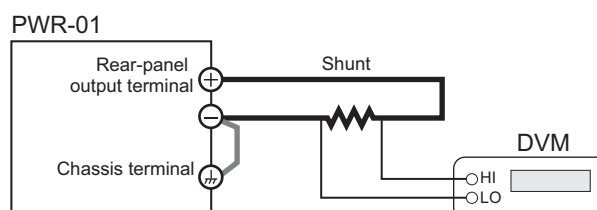
Be sure to execute the calibration procedure completely. If you change to a different type of calibration or turn off the POWER switch in the middle of the procedure, that calibration will be invalid.

## Connection

### ■ Voltage calibration



### ■ Current calibration



# Cleaning



**Risk of electric shock. Before you perform maintenance, be sure to turn the POWER switch off and remove the power plug from the outlet or turn off the switchboard.**

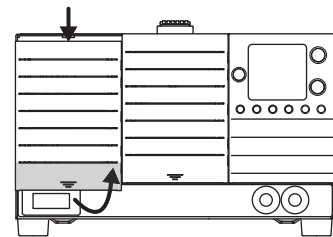
## Cleaning the Dust Filter

Dust filters are installed on the inside of the louver on the front panel. Periodically clean the filter to prevent clogging.



- A clogged filter hinders the cooling of the inside of the PWR-01, can cause malfunctions, and can shorten the PWR-01's service life.
- When the PWR-01 is in operation, air is sucked through the dust filter to cool the inside of the device. If moisture is present in the dust filter, the humidity inside the PWR-01 increases and may cause malfunctions.

- 1 While pulling the first slat from the bottom of the louver towards you, slide the entire louver down, and remove the louver from the panel.**



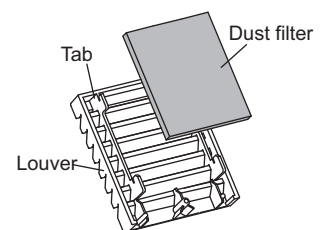
PWR1201L example

- 2 Remove the dust filter from the inside of each louver and clean it.**

Use a vacuum cleaner to dispose of the dust and foreign particles that are attached to the dust filter. If the filter is extremely dirty, clean it using water-diluted neutral detergent, and dry it completely.

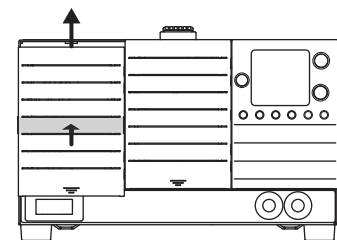
- 3 Attach the dust filter to each louver.**

Attach the dust filter so that it fits in between the left and right tabs.



- 4 Attach the louver to the panel.**

Insert the top louver tabs into the PWR-01, and while holding the fourth slab from the bottom, slide the entire louver upward to secure it in place.



PWR1201L example

- 5 The louver below the controls does not come off. Clean the dust filter from the front of the louver.**

Use a vacuum cleaner to dispose of the dust and foreign particles that are attached to the dust filter.



# 7

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## Specifications

This chapter contains the specifications and gives the dimensions of the PWR-01.

Unless specified otherwise, the specifications are for the following settings and conditions.

- Loads are purely resistive loads.
- The warm-up time is 30 minutes.
- The specifications of this product apply to the rear panel output terminals.
- After warm-up, the product must be calibrated correctly in a  $23\text{ °C} \pm 5\text{ °C}$  environment according to the appropriate calibration procedure.

The used terminology is as follows:

- TYP: These are typical values that are representative of situations where the product operates in an environment with an ambient temperature of  $23\text{ °C}$  ( $73.4\text{ °F}$ ). These values do not guarantee the performance of this product.
- rating: Indicates the rated.
- reading: Indicates the readout value.
- f.s.: Full scale.
- Rated load and no load:

In constant-voltage mode (when the output current is set to a value greater than or equal to the maximum output current with rated output voltage)

**Rated load:** Refers to a resistive load that, when the rated output voltage is applied, makes the flowing current 95 % to 100 % of the maximum output current with rated output voltage.

**No load:** Refers to a load through which no output current flows. In other words, refers to an open load.

In constant-current mode (when the output voltage is set to a value greater than or equal to the maximum output voltage with rated output current)

**Rated load:** Refers to a resistive load that, when the rated output current flows, makes the voltage drop to 95 % to 100 % of the maximum output voltage with rated output current.

Including the voltage drop in the load cables, the PWR-01 output voltage must not exceed the maximum output voltage with rated output current.

**No load:** Refers to a resistive load that, when the rated output current flows, makes the voltage drop to 10 % of the maximum output voltage with rated output current or 1 V whichever is higher.

- Rise time: The time it takes for the output voltage or output current to rise from 10 % to 90 % of the rating when the output is tuned on.
- Fall time: The time it takes for the output voltage or output current to fall from 90 % to 10 % of the rating when the output is tuned off.
- The PWR-01 operates over a wide range of output voltage and output current within rated output power. However, the current that can be output with rated output voltage and the voltage that can be output with rated output current are limited by the rated output power.
- The current that can be output with rated output voltage and the voltage that can be output with rated output current are as follows.

Maximum output current with rated output voltage = Rated output power / rated output voltage.

Maximum output voltage with rated output current = Rated output power / rated output current.

# 400W model

This section provides the specifications specific to the 400W model. For specifications common to all models (Protection functions, Signal output and input, Control functions, Other functions, Operation display, Interface, and General), see "Common Specifications"(p.137).

## AC input

	PWR401L	PWR401ML	PWR401MH	PWR401H
Nominal input rating	100 Vac to 240 Vac, 50 Hz to 60 Hz, single phase			
Input voltage range	85 Vac to 265 Vac			
Input frequency range	47 Hz to 63 Hz			
Current (TYP) <sup>1</sup>	100 Vac	5.6 A		
	200 Vac	2.8 A		
Inrush current	25 A or less			
Power (MAX) <sup>2</sup>	560 VA			
Power factor (TYP) <sup>1</sup>	0.99 (input voltage: 100 V), 0.97 (input voltage: 200 V)			
Efficiency (TYP) <sup>1</sup>	75 %			
Output hold time <sup>2</sup>	20 ms or more			

1. At the rated output power for the rated output current.
2. 100 Vac, at the rated output power.

## Output

		PWR401L	PWR401ML	PWR401MH	PWR401H	
Rating	Output voltage <sup>1</sup>	40 V	80 V	240 V	650 V	
	Output current <sup>1</sup>	40 A	20 A	5 A	1.85 A	
	Output power	400 W				
Voltage	Maximum settable voltage <sup>2</sup>	42 V	84 V	252 V	682.5 V	
	Setting accuracy	± (0.05 % of setting +0.05 % of rating)				
	Resolution		200 mV	400 mV	1000 mV	2500 mV
		Using FINE, OUT OFF	10 mV	10 mV	100 mV	100 mV
		Using FINE, OUT ON	1 mV	1 mV	10 mV	10 mV
		When using a communication interface	0.1 mV	0.1 mV	0.1 mV	0.1 mV
	Line regulation <sup>3</sup>	±6 mV	±10 mV	±26 mV	±67 mV	
	Load regulation <sup>4</sup>	±6 mV	±10 mV	±26 mV	±67 mV	
	Transient response <sup>5</sup>	1 ms or less	2 ms or less	2 ms or less	3 ms or less	
	Ripple noise <sup>6</sup>	p-p <sup>7</sup>	50 mV	50 mV	100 mV	300 mV
		rms <sup>8</sup>	5 mV	5 mV	20 mV	50 mV
	Rise time	At full load	50 ms or less		100 ms or less	
		No load	50 ms or less		100 ms or less	
	Fall time <sup>9</sup>	At full load	50 ms or less		150 ms	250 ms
		No load	500 ms or less		1200 ms	2000 ms
Maximum remote sensing compensation voltage (single line)		1.5 V	4 V	5 V	5 V	
Temperature coefficient <sup>10</sup>		100 ppm/°C				
Current	Maximum settable current <sup>2</sup>	42 A	21 A	5.25 A	1.9425 A	
	Setting accuracy <sup>11</sup>	± (0.5 % of setting +0.1 % of rating)				
	Resolution		200 mA	100 mA	20 mA	10 mA
		Using FINE, OUT OFF	10 mA	10 mA	1 mA	1 mA
		Using FINE, OUT ON	1 mA	1 mA	0.1 mA	0.1 mA
		When using a communication interface	0.1 mA	0.1 mA	0.1 mA	0.1 mA
	Line regulation	±6 mA	±4 mA	±2.5 mA	±2.2 mA	
	Load regulation	±13 mA	±9 mA	±6.0 mA	±5.4 mA	
	Ripple noise <sup>12</sup>	rms <sup>8</sup>	80 mA	40 mA	12 mA	6 mA
	Rise time (TYP)	At full load	50 ms		100 ms	
	Fall time (TYP)	At full load	50 ms		100 ms	
	Temperature coefficient <sup>10</sup>		100 ppm/°C			
	Maximum internal resistance that can be set		1.000 Ω	4.000 Ω	36.00 Ω	263.5 Ω

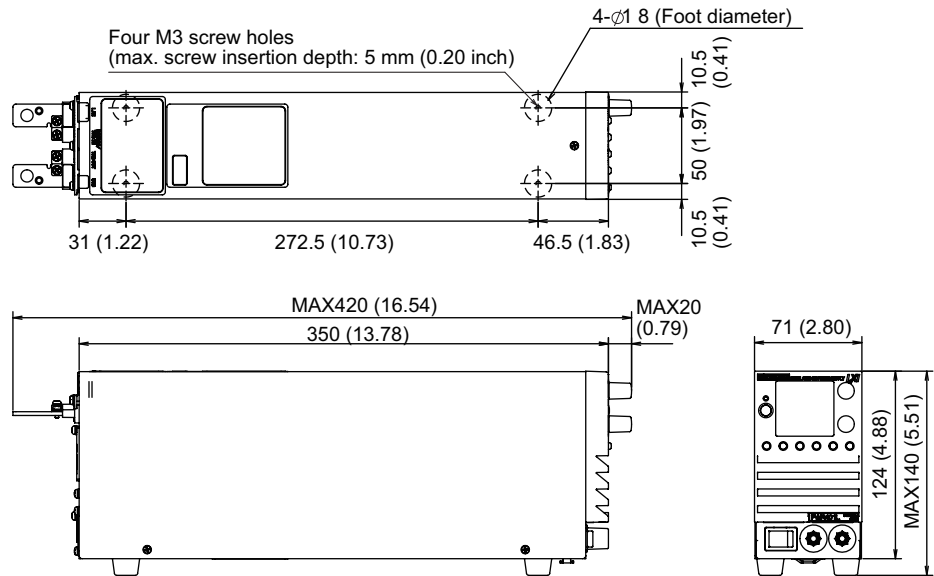
- The maximum output voltage and maximum output current are limited by the maximum output power.
- Can be limited to approximately 95 % of the OVP trip point or OCP trip point.
- 85 Vac to 135 Vac or 170 Vac to 265 Vac, fixed load
- The amount of change that occurs when the load is changed from no load to full load (rated output power/ rated output voltage) with rated output voltage. The value is measured at the sensing point.
- The amount of time required for the output voltage to return to a value within "rated output voltage ± (0.1 % + 10 mV)." The load current fluctuation is 50 % to 100 % of the maximum current with the set output voltage.
- Measured using an RC-9131C probe that conforms to the JEITA specifications. At the rated output current.
- When the measurement frequency bandwidth is 10 Hz to 20 MHz.
- When the measurement frequency bandwidth is 10 Hz to 1 MHz.
- When the bleeder circuit is set to bleeder normal.
- When the ambient temperature is within 0°C and 50 °C
- Applies to the range of 1 % to 100 % of the rated current. TYP (0.1 % of rating) for 0 % to 1 %.
- When the output voltage is 10 % to 100 % of the rating. At the rated output current.

### Display function

		PWR401L	PWR401ML	PWR401MH	PWR401H
Voltage display <sup>1</sup>	Maximum display	99.99		999.9	
	Display accuracy	± (0.2 % of reading + 5 digits)			
Current display <sup>1</sup>	Maximum display	99.99		9.999	
	Display accuracy	± (0.5 % of reading + 8 digits)			
Power display		The PWR DSPL LED lights in red.			
		Maximum display		9999	
		Display accuracy			
		Displays the result of multiplying the current and voltage. The display is toggled with the voltage or current display.			

- The output voltage and output current displayed in the measured value display state are updated in a cycle of 100 ms.

### Outline drawing



PWR-01 series 400W model outline drawing

Unit mm (inches)

# 800W model

This section provides the specifications specific to the 800W model. For specifications common to all models (Protection functions, Signal output and input, Control functions, Other functions, Operation display, Interface, and General), see "Common Specifications"(p.137).

## AC input

	PWR801L	PWR801ML	PWR801MH	PWR801H
Nominal input rating	100 Vac to 240 Vac, 50 Hz to 60 Hz, single phase			
Input voltage range	85 Vac to 265 Vac			
Input frequency range	47 Hz to 63 Hz			
Current (TYP) <sup>1</sup>	100 Vac	11.2 A		
	200 Vac	5.6 A		
Inrush current	50 A or less			
Power (MAX) <sup>2</sup>	1120 VA			
Power factor (TYP) <sup>1</sup>	0.99 (input voltage: 100 V), 0.97 (input voltage: 200 V)			
Efficiency (TYP) <sup>1</sup>	75 %			
Output hold time <sup>2</sup>	20 ms or more			

1. At the rated output power for the rated output current.
2. 100 Vac, at the rated output power.



## Output

		PWR801L	PWR801ML	PWR801MH	PWR801H	
Rating	Output voltage <sup>1</sup>	40 V	80 V	240 V	650 V	
	Output current <sup>1</sup>	80 A	40 A	10 A	3.70 A	
	Output power	800 W				
Voltage	Maximum settable voltage <sup>2</sup>	42 V	84 V	252 V	682.5 V	
	Setting accuracy	± (0.05 % of setting +0.05 % of rating)				
	Resolution		200 mV	400 mV	1000 mV	2500 mV
		Using FINE, OUT OFF	10 mV	10 mV	100 mV	100 mV
		Using FINE, OUT ON	1 mV	1 mV	10 mV	10 mV
		When using a communication interface	0.1 mV	0.1 mV	0.1 mV	0.1 mV
	Line regulation <sup>3</sup>	±6 mV	±10 mV	±26 mV	±67 mV	
	Load regulation <sup>4</sup>	±6 mV	±10 mV	±26 mV	±67 mV	
	Transient response <sup>5</sup>	1 ms or less	2 ms or less	2 ms or less	3 ms or less	
	Ripple noise <sup>6</sup>	p-p <sup>7</sup>	50 mV	50 mV	100 mV	300 mV
		rms <sup>8</sup>	5 mV	5 mV	20 mV	50 mV
	Rise time	At full load	50 ms or less		100 ms or less	
		No load	50 ms or less		100 ms or less	
	Fall time <sup>9</sup>	At full load	50 ms or less		150 ms	250 ms
		No load	500 ms or less		1200 ms	2000 ms
	Maximum remote sensing compensation voltage (single line)		1.5 V	4 V	5 V	5 V
Temperature coefficient <sup>10</sup>		100 ppm/°C				
Current	Maximum settable current <sup>2</sup>	84 A	42 A	10.5 A	3.885 A	
	Setting accuracy <sup>11</sup>	± (0.5 % of setting +0.1 % of rating)				
	Resolution		400 mA	200 mA	40 mA	20 mA
		Using FINE, OUT OFF	10 mA	10 mA	10 mA	1 mA
		Using FINE, OUT ON	1 mA	1 mA	1 mA	0.1 mA
		When using a communication interface	0.1 mA	0.1 mA	0.1 mA	0.1 mA
	Line regulation	±10 mA	±6 mA	±3 mA	±2.4 mA	
	Load regulation	±21 mA	±13 mA	±7.0 mA	±5.7 mA	
	Ripple noise <sup>12</sup>	rms <sup>8</sup>	160 mA	80 mA	24 mA	12 mA
	Rise time (TYP)	At full load	50 ms		100 ms	
	Fall time (TYP)	At full load	50 ms		100 ms	
	Temperature coefficient <sup>10</sup>		100 ppm/°C			
	Maximum internal resistance that can be set		0.500 Ω	2.000 Ω	18.00 Ω	131.8 Ω

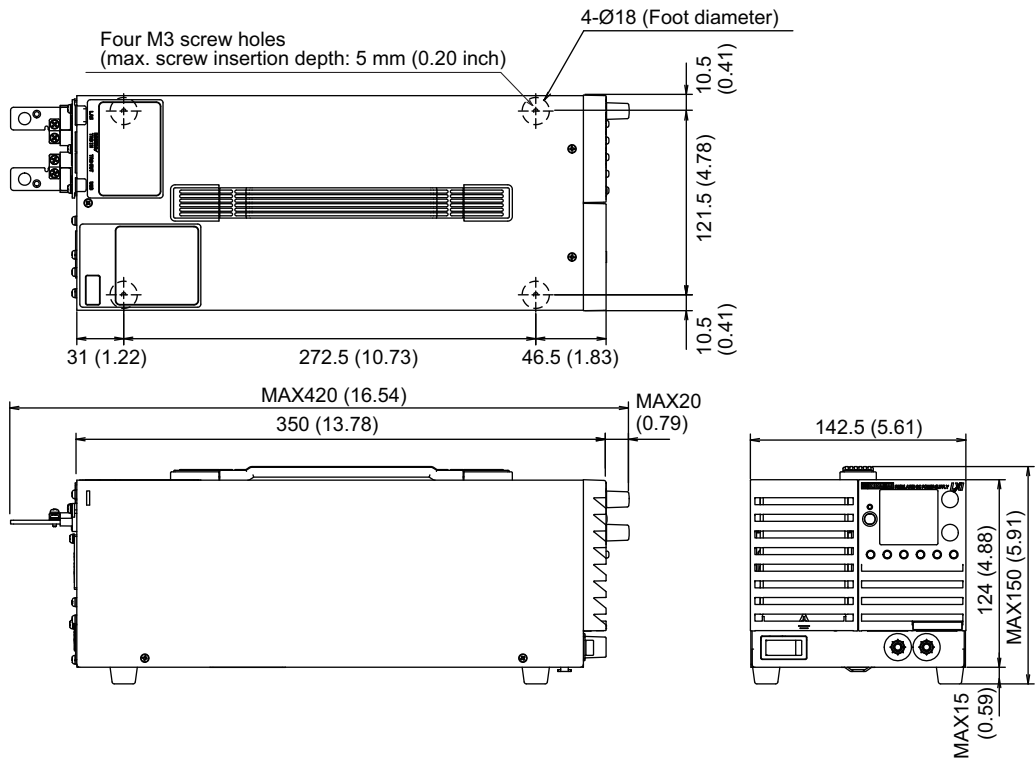
1. The maximum output voltage and maximum output current are limited by the maximum output power.
2. Can be limited to approximately 95 % of the OVP trip point or OCP trip point.
3. 85 Vac to 135 Vac or 170 Vac to 265 Vac, fixed load
4. The amount of change that occurs when the load is changed from no load to full load (rated output power/ rated output voltage) with rated output voltage. The value is measured at the sensing point.
5. The amount of time required for the output voltage to return to a value within "rated output voltage ± (0.1 % + 10 mV)." The load current fluctuation is 50 % to 100 % of the maximum current with the set output voltage.
6. Measured using an RC-9131C probe that conforms to the JEITA specifications. At the rated output current.
7. When the measurement frequency bandwidth is 10 Hz to 20 MHz.
8. When the measurement frequency bandwidth is 10 Hz to 1 MHz.
9. When the bleeder circuit is set to bleeder normal.
10. When the ambient temperature is within 0°C and 50 °C
11. Applies to the range of 1 % to 100 % of the rated current. TYP (0.1 % of rating) for 0 % to 1 %.
12. When the output voltage is 10 % to 100 % of the rating. At the rated output current.

### Display function

		PWR801L	PWR801ML	PWR801MH	PWR801H
Voltage display <sup>1</sup>	Maximum display	99.99		999.9	
	Display accuracy	± (0.2 % of reading + 5 digits)			
Current display <sup>1</sup>	Maximum display	99.99			9.999
	Display accuracy	± (0.5 % of reading + 8 digits)			
Power display		The PWR DSPL LED lights in red.			
		Maximum display	9999		
		Display accuracy	Displays the result of multiplying the current and voltage. The display is toggled with the voltage or current display.		

1. The output voltage and output current displayed in the measured value display state are updated in a cycle of 100 ms.

### Outline drawing



PWR-01 series 800W model outline drawing

Unit mm (inches)

# 1200W model

This section provides the specifications specific to the 1200W model. For specifications common to all models (Protection functions, Signal output and input, Control functions, Other functions, Operation display, Interface, and General), see "Common Specifications"(p.137).

## AC input

	PWR1201L	PWR1201ML	PWR1201MH	PWR1201H
Nominal input rating	100 Vac to 240 Vac, 50 Hz to 60 Hz, single phase			
Input voltage range	85 Vac to 265 Vac			
Input frequency range	47 Hz to 63 Hz			
Current (TYP) <sup>1</sup>	100 Vac	16.8 A		
	200 Vac	8.4 A		
Inrush current	75 A or less			
Power (MAX) <sup>2</sup>	1680 VA			
Power factor (TYP) <sup>1</sup>	0.99 (input voltage: 100 V), 0.97 (input voltage: 200 V)			
Efficiency (TYP) <sup>1</sup>	75 %			
Output hold time <sup>2</sup>	20 ms or more			

1. At the rated output power for the rated output current.
2. 100 Vac, at the rated output power.

## Output

		PWR1201L	PWR1201ML	PWR1201MH	PWR1201H	
Rating	Output voltage <sup>1</sup>	40 V	80 V	240 V	650 V	
	Output current <sup>1</sup>	120 A	60 A	15.0 A	5.55 A	
	Output power	1200 W				
Voltage	Maximum settable voltage <sup>2</sup>	42 V	84 V	252 V	682.5 V	
	Setting accuracy	± (0.05 % of setting +0.05 % of rating)				
	Resolution		200 mV	400 mV	1000 mV	2500 mV
		Using FINE, OUT OFF	10 mV	10 mV	100 mV	100 mV
		Using FINE, OUT ON	1 mV	1 mV	10 mV	10 mV
		When using a communication interface	0.1 mV	0.1 mV	0.1 mV	0.1 mV
	Line regulation <sup>3</sup>	±6 mV	±10 mV	±26 mV	±67 mV	
	Load regulation <sup>4</sup>	±6 mV	±10 mV	±26 mV	±67 mV	
	Transient response <sup>5</sup>	1 ms or less	2 ms or less	2 ms or less	3 ms or less	
	Ripple noise <sup>6</sup>	p-p <sup>7</sup>	50 mV	50 mV	100 mV	300 mV
		rms <sup>8</sup>	5 mV	5 mV	20 mV	50 mV
	Rise time	At full load	50 ms or less		100 ms or less	
		No load	50 ms or less		100 ms or less	
	Fall time <sup>9</sup>	At full load	50 ms or less		150 ms	250 ms
		No load	500 ms or less		1200 ms	2000 ms
Maximum remote sensing compensation voltage (single line)	1.5 V	4 V	5 V	5 V		
Temperature coefficient <sup>10</sup>	100 ppm/°C					
Current	Maximum settable current <sup>2</sup>	126 A	63 A	15.75 A	5.8275 A	
	Setting accuracy <sup>11</sup>	± (0.5 % of setting +0.1 % of rating)				
	Resolution		600 mA	300 mA	60 mA	30 mA
		Using FINE, OUT OFF	100 mA	10 mA	10 mA	1 mA
		Using FINE, OUT ON	10 mA	1 mA	1 mA	0.1 mA
		When using a communication interface	0.1 mA	0.1 mA	0.1 mA	0.1 mA
	Line regulation	±14 mA	±8 mA	±3.5 mA	±2.6 mA	
	Load regulation	±29 mA	±17 mA	±8.0 mA	±6.1 mA	
	Ripple noise <sup>12</sup>	rms <sup>8</sup>	240 mA	120 mA	36 mA	18 mA
	Rise time (TYP)	At full load	50 ms		100 ms	
	Fall time (TYP)	At full load	50 ms		100 ms	
	Temperature coefficient <sup>10</sup>	100 ppm/°C				
	Maximum internal resistance that can be set	0.333 Ω	1.333 Ω	12.00 Ω	87.84 Ω	

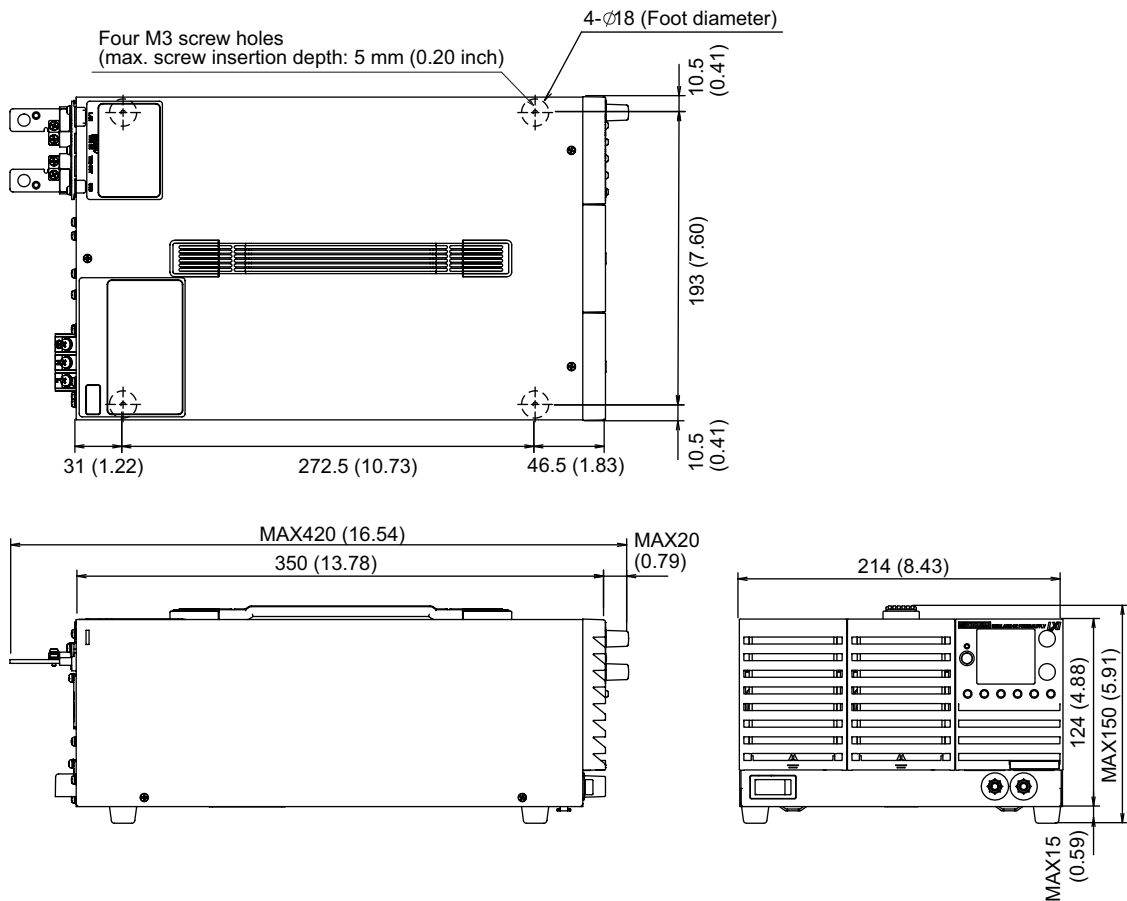
- The maximum output voltage and maximum output current are limited by the maximum output power.
- Can be limited to approximately 95 % of the OVP trip point or OCP trip point.
- 85 Vac to 135 Vac or 170 Vac to 265 Vac, fixed load
- The amount of change that occurs when the load is changed from no load to full load (rated output power/ rated output voltage) with rated output voltage. The value is measured at the sensing point.
- The amount of time required for the output voltage to return to a value within "rated output voltage ± (0.1 % + 10 mV)." The load current fluctuation is 50 % to 100 % of the maximum current with the set output voltage.
- Measured using an RC-9131C probe that conforms to the JEITA specifications. At the rated output current.
- When the measurement frequency bandwidth is 10 Hz to 20 MHz.
- When the measurement frequency bandwidth is 10 Hz to 1 MHz.
- When the bleeder circuit is set to bleeder normal.
- When the ambient temperature is within 0°C and 50 °C
- Applies to the range of 1 % to 100 % of the rated current. TYP (0.1 % of rating) for 0 % to 1 %.
- When the output voltage is 10 % to 100 % of the rating. At the rated output current.

### Display function

		PWR1201L	PWR1201ML	PWR1201MH	PWR1201H
Voltage display <sup>1</sup>	Maximum display	99.99		999.9	
	Display accuracy	± (0.2 % of reading + 5 digits)			
Current display <sup>1</sup>	Maximum display	999.9	99.99	9.999	
	Display accuracy	± (0.5 % of reading + 8 digits)			
Power display		The PWR DSPL LED lights in red.			
	Maximum display	9999			
	Display accuracy	Displays the result of multiplying the current and voltage. The display is toggled with the voltage or current display.			

1. The output voltage and output current displayed in the measured value display state are updated in a cycle of 100 ms.

### Outline drawing



PWR-01 series 1200W model outline drawing

Unit mm (inches)

# 2000W model

This section provides the specifications specific to the 2000W model. For specifications common to all models (Protection functions, Signal output and input, Control functions, Other functions, Operation display, Interface, and General), see "Common Specifications"(p.137).

## AC input

	PWR2001L	PWR2001ML	PWR2001MH	PWR2001H
Nominal input rating	100 Vac to 240 Vac, 50 Hz to 60 Hz, single phase			
Input voltage range	85 Vac to 265 Vac			
Input frequency range	47 Hz to 63 Hz			
Current (TYP) <sup>1</sup>	100 Vac	28.0 A		
	200 Vac	14.0 A		
Inrush current	125 A or less			
Power (MAX) <sup>2</sup>	2800 VA			
Power factor (TYP) <sup>1</sup>	0.99 (input voltage: 100 V), 0.97 (input voltage: 200 V)			
Efficiency (TYP) <sup>1</sup>	75 %			
Output hold time <sup>2</sup>	20 ms or more			

1. At the rated output power for the rated output current.
2. 100 Vac, at the rated output power.

## Output

		PWR2001L	PWR2001ML	PWR2001MH	PWR2001H	
Rating	Output voltage <sup>1</sup>	40 V	80 V	240 V	650 V	
	Output current <sup>1</sup>	200 A	100 A	25.0 A	9.25 A	
	Output power	2000 W				
Voltage	Maximum settable voltage <sup>2</sup>	42 V	84 V	252 V	682.5 V	
	Setting accuracy	± (0.05 % of setting +0.05 % of rating)				
	Resolution		200 mV	400 mV	1000 mV	2500 mV
		Using FINE, OUT OFF	10 mV	10 mV	100 mV	100 mV
		Using FINE, OUT ON	1 mV	1 mV	10 mV	10 mV
		When using a communication interface	0.1 mV	0.1 mV	0.1 mV	0.1 mV
	Line regulation <sup>3</sup>	±6 mV	±10 mV	±26 mV	±67 mV	
	Load regulation <sup>4</sup>	±6 mV	±10 mV	±26 mV	±67 mV	
	Transient response <sup>5</sup>	1 ms or less	2 ms or less	2 ms or less	3 ms or less	
	Ripple noise <sup>6</sup>	p-p <sup>7</sup>	50 mV	70 mV	120 mV	350 mV
		rms <sup>8</sup>	5 mV	5 mV	20 mV	50 mV
	Rise time	At full load	50 ms or less		100 ms or less	
		No load	50 ms or less		100 ms or less	
	Fall time <sup>9</sup>	At full load	50 ms or less		150 ms or less	250 ms or less
		No load	500 ms or less		1200 ms or less	2000 ms or less
	Maximum remote sensing compensation voltage (single line)		1.5 V	4 V	5 V	5 V
Temperature coefficient <sup>10</sup>		100 ppm/°C				
Current	Maximum settable current <sup>2</sup>	210 A	105 A	26.25 A	9.7125 A	
	Setting accuracy <sup>11</sup>	± (0.5 % of setting +0.1 % of rating)				
	Resolution		1000 mA	500 mA	100 mA	50 mA
		Using FINE, OUT OFF	100 mA	100 mA	10 mA	10 mA
		Using FINE, OUT ON	10 mA	10 mA	1 mA	1 mA
		When using a communication interface	0.1 mA	0.1 mA	0.1 mA	0.1 mA
	Line regulation	±22 mA	±12 mA	±4.5 mA	±2.9 mA	
	Load regulation	±45 mA	±25 mA	±10.0 mA	±6.9 mA	
	Ripple noise <sup>12</sup>	rms <sup>8</sup>	400 mA	200 mA	60 mA	30 mA
	Rise time (TYP)	At full load	50 ms		100 ms	
	Fall time (TYP)	At full load	50 ms		100 ms	
	Temperature coefficient <sup>10</sup>		100 ppm/°C			
	Maximum internal resistance that can be set		0.200 Ω	0.800 Ω	7.200 Ω	52.70 Ω

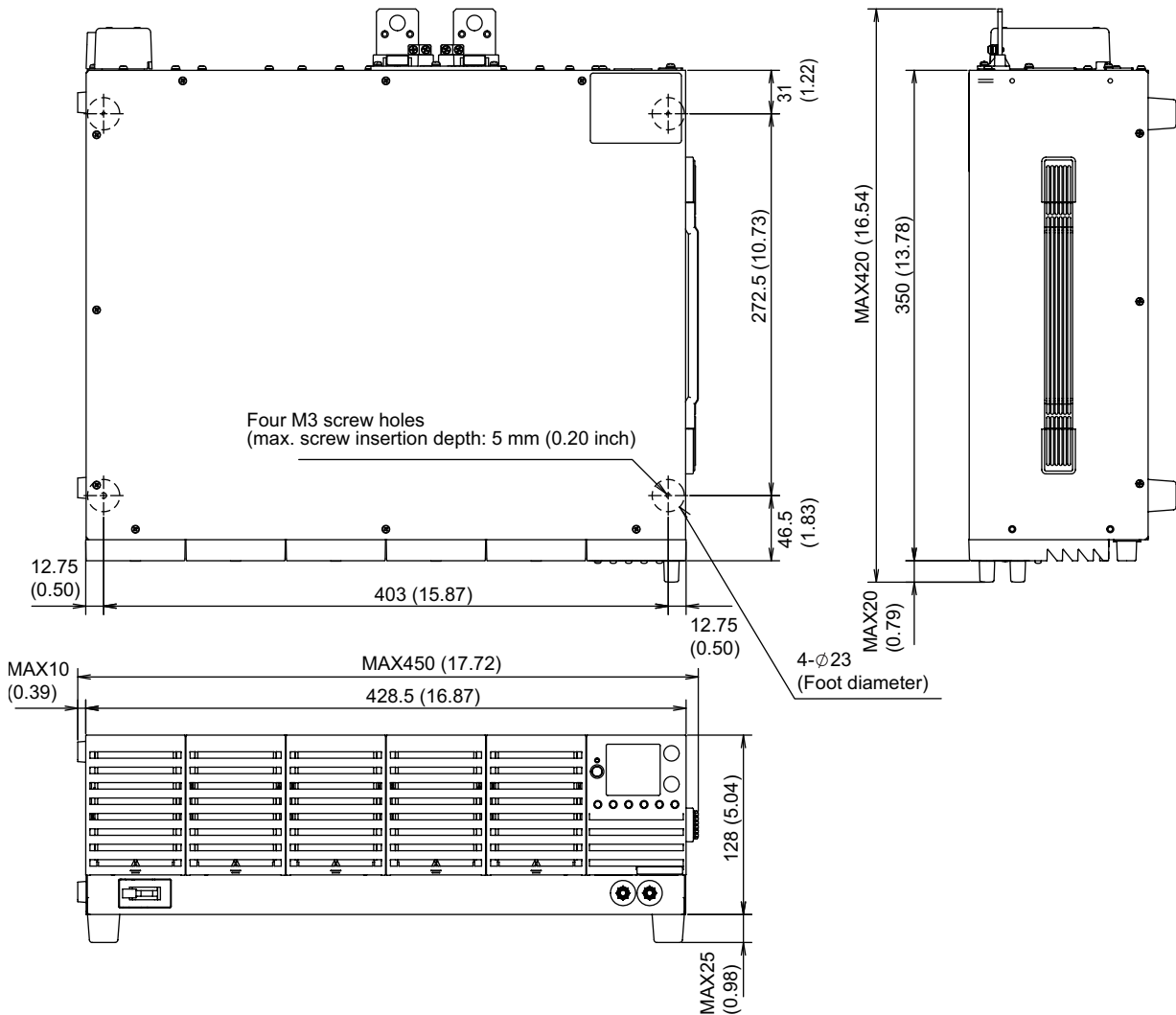
1. The maximum output voltage and maximum output current are limited by the maximum output power.
2. Can be limited to approximately 95 % of the OVP trip point or OCP trip point.
3. 85 Vac to 135 Vac or 170 Vac to 265 Vac, fixed load
4. The amount of change that occurs when the load is changed from no load to full load (rated output power/rated output voltage) with rated output voltage. The value is measured at the sensing point.
5. The amount of time required for the output voltage to return to a value within "rated output voltage ± (0.1 % + 10 mV)." The load current fluctuation is 50 % to 100 % of the maximum current with the set output voltage.
6. Measured using an RC-9131C probe that conforms to the JEITA specifications. At the rated output current.
7. When the measurement frequency bandwidth is 10 Hz to 20 MHz.
8. When the measurement frequency bandwidth is 10 Hz to 1 MHz.
9. When the bleeder circuit is set to bleeder normal.
10. When the ambient temperature is within 0 °C and 50 °C
11. Applies to the range of 1 % to 100 % of the rated current. TYP (0.1 % of rating) for 0 % to 1 %.
12. When the output voltage is 10 % to 100 % of the rating. At the rated output current.

### Display function

		PWR2001L	PWR2001ML	PWR2001MH	PWR2001H
Voltage display <sup>1</sup>	Maximum display	99.99		999.9	
	Display accuracy	± (0.2 % of reading + 5 digits)			
Current display <sup>1</sup>	Maximum display	999.9		99.99	
	Display accuracy	± (0.5 % of reading + 8 digits)			
Power display		The PWR DSPL LED lights in red.			
	Maximum display	9999			
	Display accuracy	Displays the result of multiplying the current and voltage. The display is toggled with the voltage or current display.			

1. The output voltage and output current displayed in the measured value display state are updated in a cycle of 100 ms.

### Outline drawing



PWR-01 series 2000W model outline drawing

Unit mm (inches)



# Common Specifications

## Protection functions

	Common
Overvoltage protection (OVP)	Turns the output off <sup>1</sup> , displays OVP, and lights ALM
Setting range	10 % to 112 % of the rated output voltage
Setting accuracy	± (1.5 % of rating)
Overcurrent protection (OCP) <sup>2</sup>	Turns the output off <sup>1</sup> , displays OCP, and lights ALM
Setting range	10 % to 112 % of the rated output current
Setting accuracy	± (3 % of rating)
Front-panel output terminal overcurrent protection (FOCP) <sup>3</sup>	Turns the output off <sup>1</sup> , displays FOCP, and lights ALM
Value (fixed)	11 A (TYP)
Undervoltage limit (UVL)	Cannot be set to a value less than or equal to the set voltage
Setting range	0 % to 105 % of the rated output voltage
Overheat protection (OHP)	Turns the output off, displays OHP, and lights ALM
Incorrect sensing connection protection (SENSE)	Turns the output off, displays SENS, and lights ALM
Low AC input protection (AC-FAIL)	Turns the output off, <sup>4</sup> displays AC, and lights ALM
Shutdown (SD)	Turns the output off <sup>1</sup> , displays SD, and lights ALM
Power limit (POWER LIMIT)	ALM blinking
Value (fixed)	Approx. 105 % of the rated output power
Communication monitoring (watchdog)	Turns the output off, displays WDOG, and lights ALM
Master-slave parallel operation protection (PRL ALM)	Turns the output off <sup>1</sup> , displays PRL, and lights ALM

1. Output off or breaker trip on the 2000W model.
2. This does not protect against the discharge current peak that is generated from the capacitors inside the PWR-01 output section when the load is changed suddenly.
3. Available on models with a maximum settable current of 11 A or more. If the OCP value is less than the FOCP value, the OCP value takes precedence.
4. Auto recovery after removing the cause of the alarm is selectable.

## Signal output and input

		Common
Monitor signal output	Voltage monitor (VMON)	Selectable monitor voltage range: 0 V to 5 V or 0 V to 10 V
	Setting accuracy	2.5 % of f.s. <sup>1</sup>
	Current monitor (IMON)	Selectable monitor voltage range: 0 V to 5 V or 0 V to 10 V
	Setting accuracy	2.5 % of f.s. <sup>1</sup>
Status signal output <sup>2</sup>	OUTON STATUS	On when output is on.
	CV STATUS	Turns on during CV operation
	CC STATUS	Turns on during CC operation
	ALARM STATUS	Turns on when an alarm has been activated
	POWER ON STATUS	Turns on when the power is turned on
Trigger signal	Input (TRG IN)	Logic selectable: LOW (0 V to 1.5 V), HIGH (3.5 V to 5 V) Input impedance: 10 kΩ (TYP)
	Output (TRG OUT)	Logic selectable: LOW (0 V to 0.6 V), HIGH (4.2 V to 5 V) Pulse width: 100 μs (TYP)

- f.s. is the full scale at the selected range. It is 10 V for the 10 V range and 5 V for the 5 V range.
- Photocoupler open collector output; maximum voltage 30 V, maximum current (sink) 8 mA; isolated from the output and control circuits; status commons are floating (withstand voltage of less than or equal to 60 V); and status signals are not mutually isolated.

## Control functions

		Common
External control	Output voltage control (VPGM)	0 % to 100 % of the rated output voltage Selectable control voltage range: 0 V to 5 V or 0 V to 10 V
	Accuracy	5 % of rating
	Output current control (IPGM)	0 % to 100 % of the rated output current Selectable control voltage range: 0 V to 5 V or 0 V to 10 V
	Accuracy	5 % of rating
	Output on/ off control OUTPUT ON/OFF CONT	Logic selectable: Output on when set to LOW (0 V to 0.5 V) or shorted; output off when set to HIGH (4.5 V or 5 V) or open Output on when set to HIGH (4.5 V to 5 V) or open; output off when set to LOW (0 V or 0.5 V) or shorted
	Output shutdown control SHUT DOWN	Output on when set to LOW (0 V to 0.5 V) or shorted
Alarm clear control ALM CLR	Alarm cleared when set to LOW (0 V to 0.5 V) or shorted	

## Other functions

	400W model	800W model	1200W model	2000W model
Output-on/ off delay	Setting range: 0.0 s, 0.5 s to 99.9 s <sup>1</sup> setting resolution: 0.1 s			
Soft start and soft stop	Setting range: 0.0 s, 0.5 s to 10.0 s <sup>1</sup> ?setting resolution: 0.1 s			
Overcurrent protection (OCP) activation delay	Setting range: 0.0 s to 2.0 s <sup>1</sup> ?setting resolution: 0.1 s			
Preset memory	Up to three sets of the following settings can be saved: the set voltage, the set current, the set OVP, the set OCP, and the set UVL.			
Key lock	Locks the operation of all keys other than the OUTPUT key.			
CONFIG shortcut	Up to three CONFIG parameters can be registered to the SC1, SC2, and SC3 keys.			
Sequence	Number of programs: 1 Number of steps: 64 Repetition count: 1 to 99998, INFINITY Number of configurable interval loops: 16 Number of interval loops: 2 to 99998 Step time: 0.1 s to 100 h (common to step transition and ramp transition)			
Synchronized Operation	Synchronization of voltage and current settings, synchronization of the resumption of steps in a sequence program			
Master-slave parallel operation <sup>2</sup>	Up to three units (same models) including the master unit		Up to two units (same models) including the master unit	
Series operation <sup>3</sup>	Two units (the same model)			
Multichannel (VMCB)	Connection between the master unit and PC	LAN, USB, RS232C		
	Connection with slave units	LAN		

1. Factory default is 0.0 s.
2. Current difference between the master and slaves is 5 % (TYP).
3. H type is excluded.

### Operation display

	Common		
OUTPUT ON/ OFF	OUTPUT LED lights green when the output is on.		
Output-on/ off delay	"DLY" lights when it is set and blinks when it is in effect. OUTPUT LED blinks orange while output-on delay is in effect. OUTPUT LED blinks green while output-off delay is in effect.		
Soft start and soft stop	"SS" lights when it is set and blinks when it is in effect. OUTPUT LED lights green when soft start is in effect. OUTPUT LED blinks green when soft stop is in effect.		
CV operation	CV LED lights in green.		
CC operation	CC LED lights in red.		
Alarm operation	ALM LED lights in red when a protection function has been activated. ALM LED blinks red when the power limit (POWER LIMIT) is activated. OUTPUT LED blinks orange when a protection function is activated when the output is on.		
Preset memory	PRESET A, B, or C LED lights green when a preset memory entry is being recalled or saved.		
Key lock operation	LOCK LED lights green when the keys are locked.		
Remote operation	REMOTE LED lights green during remote control.		
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%; padding: 2px;">LAN operation</td> <td style="padding: 2px;">LAN LED lights or blinks depending on the status. No fault status: Lights green. Fault status: Lights green. Standby status: Lights orange. WEB identify status: Blinks green.</td> </tr> </table>	LAN operation	LAN LED lights or blinks depending on the status. No fault status: Lights green. Fault status: Lights green. Standby status: Lights orange. WEB identify status: Blinks green.	
LAN operation	LAN LED lights or blinks depending on the status. No fault status: Lights green. Fault status: Lights green. Standby status: Lights orange. WEB identify status: Blinks green.		
Bleeder circuit	"HB" lights when the hyper bleeder is set.		
Variable internal resistance (VIR)	"VIR" lights when it is set.		
Sequence	"SEQ" lights when a sequence is being executed and blinks the PWR-01 is waiting for a trigger.		

## Interface

		Common
Common specifications	Software protocol	IEEE Std 488.2-1992
	Command language	Complies with SCPI Specification 1999.0
RS232C	Hardware	Complies with the EIA232D specifications (excluding the connector)
		RJ-45 connector (male) <sup>1</sup>
		Baud rate: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps
		Data length: 8 bits, Stop bits: 1 bit, Parity bit: None
	No flow control	
Program message terminator	LF during reception, CR/LF during transmission	
USB	Hardware	Complies with the USB 2.0 specifications; data rate: 480 Mbps (HighSpeed)
		Socket B type
	Program message terminator	LF or EOM during reception, LF + EOM during transmission
Device class	Complies with the USBTMC-USB488 device class specifications	
LAN	Hardware	IEEE 802.3 100Base-TX/ 10Base-T Ethernet Complies with LXI Specification 2011 Ver.1.4 Complies with LXI HiSLIP Extended Function Rev.1.01
		IPv4, RJ-45 connector <sup>2</sup>
	Communication protocol	VXI-11, SCPI-RAW, HiSLIP
Program message terminator	VXI-11, HiSLIP: LF or END during reception, LF + END during transmission SCPI-RAW: LF during reception, LF during transmission.	

1. The RD-8P/9P adapter cable is an option.
2. Category 5; use a straight cable.

## General

		400W model	800W model	1200W model	2000W model
Weight (main unit only)		Approx. 3 kg (6.61 lb)	Approx. 5.5 kg (12.13 lb)	Approx. 7.5 kg (16.53 lb)	Approx. 13 kg (28.66 lb)
Dimensions		See the outline drawing.			
Environmental conditions	Operating environment	Indoor use, overvoltage category II			
	Operating temperature	0 °C to +50 °C (32 °F to +122 °F)			
	Operating humidity	20 %rh to 85 %rh (no condensation)			
	Storage temperature	-25 °C to +60 °C (-13 °F to 140 °F)			
	Storage humidity	90 %rh or less (no condensation)			
	Altitude	Up to 2000 m			
Cooling method		Forced air cooling using fan			
Grounding polarity		Negative grounding or positive grounding possible			
Isolation voltage		L/ ML/ MH type: ±500 Vmax H type: ±800 Vmax			
With-standing voltage	Across the primary circuit and chassis	No abnormalities when 1500 Vac is applied for 1 minute			
	Across the primary and secondary circuits	L/ ML/ MH type: No abnormalities when 1650 Vac is applied for 1 minute H type: No abnormalities when 1900 Vac is applied for 1 minute			
	Across the secondary circuit and chassis	L/ ML/MH type: No abnormalities when 2300 Vdc is applied for 1 minute H type: No abnormalities when 2640 Vdc is applied for 1 minute			
Insulation resistance	Across the primary circuit and chassis	100 MΩ or more (70 %rh or less) at 500 Vdc			
	Across the primary and secondary circuits	L/ ML/ MH type: 100 MΩ or more (70 %rh or less) at 500 Vdc H type: 100 MΩ or more (70 %rh or less) at 1000 Vdc			
	Across the secondary circuit and chassis	L/ ML/ MH type: 40 MΩ or more (70 %rh or less) at 500 Vdc H type: 40 MΩ or more (70 %rh or less) at 1000 Vdc			
Accessories		See <a href="#">p.3</a> .			
Electromagnetic compatibility (EMC) <sup>1 2</sup>		Complies with the requirements of the following directive and standards. EMC Directive 2014/30/EU EN61326-1 (Class A <sup>3</sup> ) EN55011 (Class A, <sup>3</sup> Group 1 <sup>4</sup> ) EN61000-3-2 EN61000-3-3 Applicable under the following conditions The maximum length of all cabling and wiring connected to the product must be less than 3 m.			
Safety <sup>1</sup>		Complies with the requirements of the following directive and standards. Low Voltage Directive 2014/35/EU <sup>2</sup> EN61010-1 (Class I <sup>5</sup> , Pollution Degree 2 <sup>6</sup> )			

1. Does not apply to specially ordered or modified products.
2. Limited to products that have a CE/UKCA mark. Does not apply unless a core is attached to the J1 connector cable.
3. This is a Class A instrument. This product is intended for use in an industrial environment. This product may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.
4. This is a Group 1 instrument. This product does not generate and/or use intentionally radio-frequency energy, in the form of electromagnetic radiation, inductive and/or capacitive coupling, for the treatment of material or inspection/analysis purpose.
5. This is a Class I instrument. Be sure to ground this product's protective conductor terminal. The safety of this product is guaranteed only when the product is properly grounded.
6. Pollution is addition of foreign matter (solid, liquid or gaseous) that may produce a reduction of dielectric strength or surface resistivity. Pollution Degree 2 assumes that only non-conductive pollution will occur except for an occasional temporary conductivity caused by condensation.



# Appendix

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A Factory Default Settings

B Options

C Troubleshooting

# A Factory Default Settings

You can initialize the settings to their factory default conditions.

- 1** While holding down LOCAL and PWR DSPL, turn the POWER switch on.
- 2** When the voltmeter on the front panel displays “ 0.00 ” appears, release LOCAL and PWR DSPL.

If you keep holding down the keys when “ 0.00 ” is displayed, the keys will be locked (the LOCK LED will light) (p.78).

If the keys are locked (the LOCK LED is lit), you can hold down LOCAL and PWR DSPL again to release the key lock.

The factory default settings are shown below.

## ■ Basic settings

Basic item	Description
Output voltage	0 V
Output current	105 % of the rated output current
OVP (overvoltage protection)	112 % of the rated output voltage
OCP (overcurrent protection)	112 % of the rated output current
UVL (undervoltage limit)	0 V
Preset memory values A, B, C	Factory default settings (Output voltage, output current, OVP, OCP, UVL)
CONFIG shortcut SC1, SC2, SC3	No CONFIG parameter registration



### ■ CONFIG settings

Parameter number		Description	Description
CF01 <sup>1</sup>	ბლე	Sets the bleeder circuit	NORM (normal)
CF02	პრო	Output-on startup state	CV (CV prioritized)
CF03	ვირ	Internal resistance setting (VIR)	OFF (internal resistance disabled)
CF04	სსტ	Soft start time (CC mode)	0.0 (soft start disabled)
CF05	სსტ	Soft stop time (CC mode)	0.0 (soft stop disabled)
CF06	სსტ	Soft start time (CV mode)	0.0 (soft start disabled)
CF07	სსტ	Soft stop time (CV mode)	0.0 (soft stop disabled)
CF08	დრო	Output-on delay setting	0.0 (no delay)
CF09	დრო	Output-off delay setting	0.0 (no delay)
CF10	ეეე	CC control using an external voltage/ external resistance	OFF (control not used)
CF11	ეეე	CV control using an external voltage/ external resistance	OFF (control not used)
CF12	ვოლტ	CV/ CC control range	LO (0 V to 5 V)
CF13 <sup>1</sup>	ვოლტ	Voltage/ Current monitor output range	LO (0 V to 5 V)
CF14	ეონ	External control for turning output on/ off	OFF (external control not used)
CF15	ეონ	External control logic for turning output on/off	Turns on with LO (0 V to 0.5 V) or short
CF16	სსს	CC status signal polarity	NEG (negative)
CF17	სსს	CV status signal polarity	NEG (negative)
CF18	სსს	Output status signal polarity	NEG (negative)
CF19	სსს	Protection function/ alarm status signal polarity	NEG (negative)
CF20 <sup>1</sup>	საფ	Status when recovering from AC-FAIL protection	SAFE (output not automatically turned on)
CF21	ვოლტ	Communication monitoring (WATCHDOG) timer	OFF (timer off)
CF22	ეეე	Current setting limit	ON (apply limit)
CF23	ეეე	Voltage setting limit	ON (apply limit)
CF24 <sup>1</sup>	დრო	Output off after OCP detection	0.0 s
CF25 <sup>1, 2</sup>	ტრიპ	Breaker trip when the OVP/ OCP/ FOCP/ SD/ PRL ALM	ON (trip)
CF30	სსს	CONFIG parameter shortcut registration (SC1)	00 (not registered)
CF31	სსს	CONFIG parameter shortcut registration (SC2)	00 (not registered)
CF32	სსს	CONFIG parameter shortcut registration (SC3)	00 (not registered)
CF33	ბეე	Buzzer on/ off	ON (Buzzer on)
CF34 <sup>1</sup>	ბრ	Panel display brightness	7
CF35	სსს	Slave unit display during master-slave parallel operation	OFF (not displayed)
CF40	LAN	LAN interface setting	ON (used)
CF41	USB	USB interface setting	ON (used)
CF42	RS232C	RS232C interface setting	ON (used)
CF43	სსს	SCPI communication error display	OFF (not displayed)
CF44 <sup>1</sup>	სსს	Master-slave parallel operation	1 (1 unit)
CF45	პონ	Output state at power-on	SAFE (output off)
CF60	სსს	LAN setting reset/ apply	LCI (LAN interface setting reset)
CF61	IP	IP address assignment method	110 (DHCP: On, AUTO IP: On, MANUAL IP: Off)
CF66	სსს	IP address subnet mask	16
CF72	ბრ	RS232C baud rate	19.2 (kbit/s)
CF80	პრო	Program's user code display (execute)	NONE (not written)
CF83	ტრიპ	Trigger input signal polarity	PTR (positive trigger)
CF84	ტრიპ	Trigger output signal polarity	PTR (positive trigger)

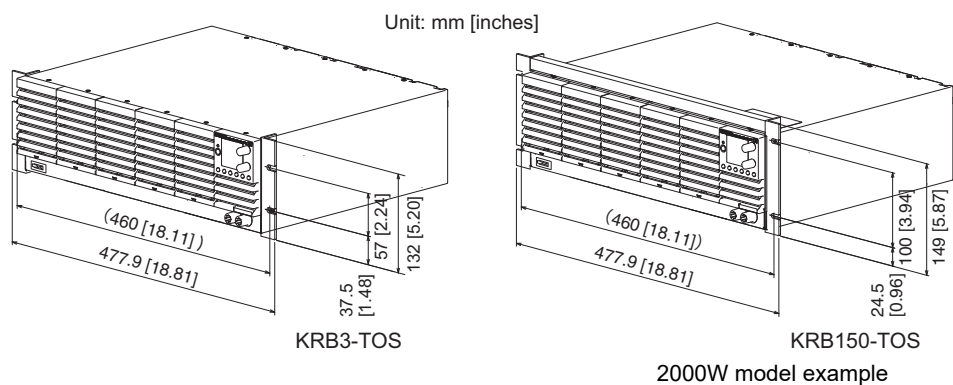
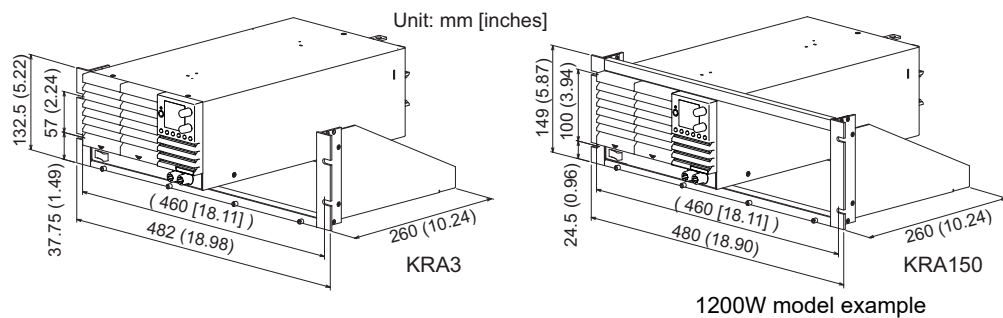
1. You can also specify this parameter when the PWR-01 is being used as a slave unit.
2. Can be set only on the 2000W model.

The PWR-01 has the following options.

For information about options, contact your Kikusui agent or distributor.

## Rack mount option

Name	Model	Note	Applicable model
Rack mount adapter	KRA3	For EIA inch racks	400W model
	KRA150	For JIS millimeter racks	800W model 1200W model
Rack mount bracket	KRB3-TOS	For EIA inch racks	2000W model
	KRB150-TOS	For JIS millimeter racks	



Remove the handle and feet before you mount the PWR-01 to a rack.

For information on rack mounting, see the KRA series or KRB series operation manual.

To support the main unit, attach an angle support to it that is appropriate for the rack.

We recommend that you keep all pieces that you remove from the PWR-01. You will need these pieces if you remove the PWR-01 from the rack mount adapter.

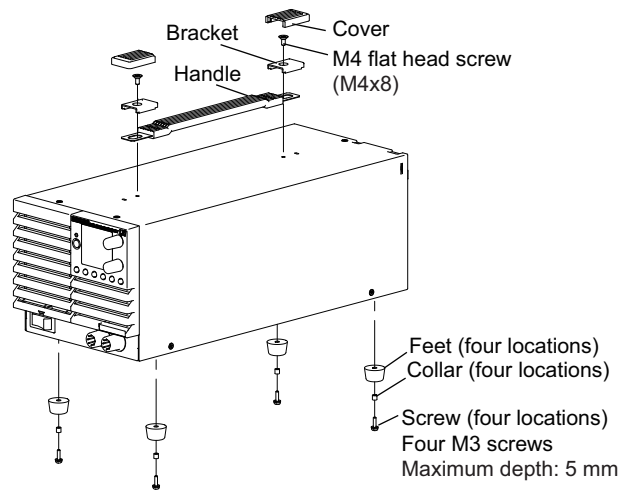
When you re-attach the original feet, use the pieces that you removed.

### NOTE

To reinstall the handle that has been removed, use screw locking agent (e.g., 1401B by ThreeBond International, Inc.) to prevent screws from loosening.

## Removing the handle and feet

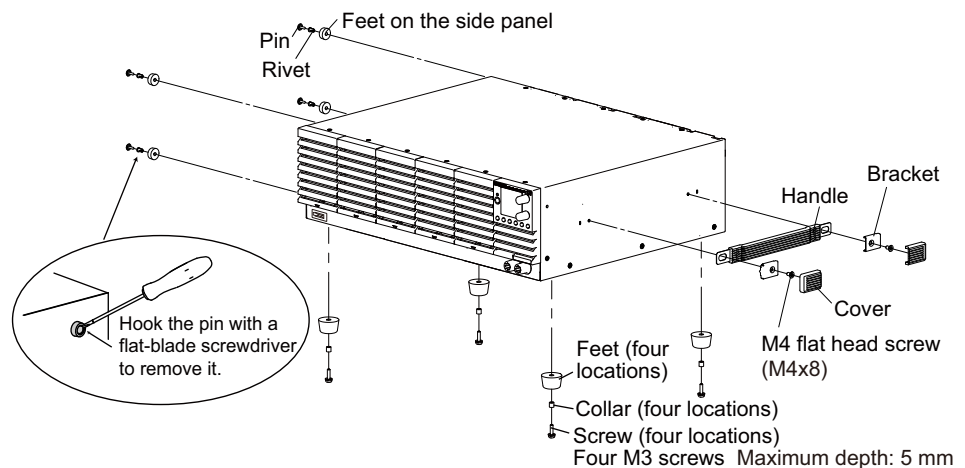
### ■ 400W model/ 800W model/ 1200W model



- 1** Remove the two handle covers.
- 2** Unfasten the two M4 flat head screws, and remove the entire handle.
- 3** Loosen the screws to remove the feet (in four locations).

This completes the removal.

### ■ 2000W model

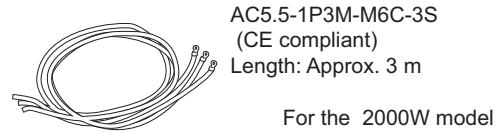
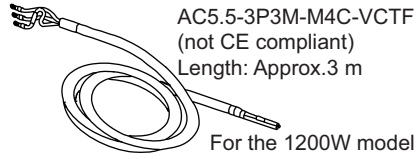


- 1** Remove the two handle covers.
- 2** Unfasten the two M4 flat head screws, and remove the entire handle.
- 3** Loosen the screws to remove the feet (in four locations).
- 4** Unfasten the internal pins from the feet (four locations) of the side panel using a flat-blade screwdriver, and then remove the feet.

This completes the removal.

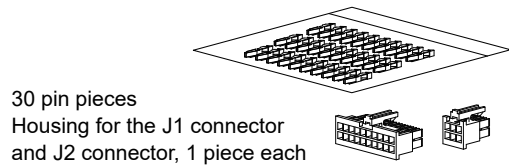
### Power cord

This is the power cord that is used to connect the product to the AC line.



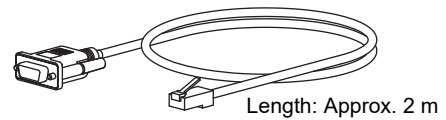
### J1/ J2 connector plug kit OP01-PWR-01

A plug kit for externally controlling the PWR through the J1/ J2 connector.



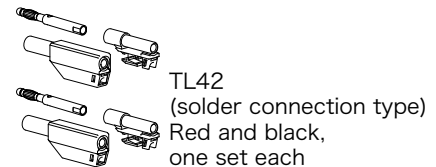
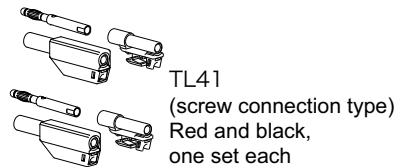
### Adapter cable (RD-8P/9P)

An adapter cable for connecting a D-sub 9-pin RS232C cable to the product.



### Safety plugs

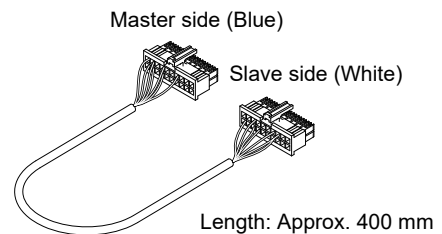
Plugs for connecting to the front-panel output terminals. There are two types.



### Parallel operation cable (OP02-PWR-01)

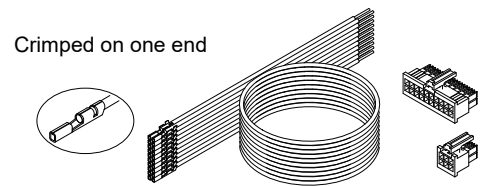
This cable is used when performing parallel operations.

For two units in parallel (one slave unit).



## External control cable and connector set (OP03-PWR-01)

A set of cables and connectors used for external control.

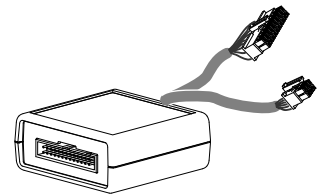


Cables 20 pcs., length: approx. 500 mm  
Housing for the J1 connector and J2 connector,  
1 piece each

## Terminal unit (TU01-PWR-01)

This terminal unit is used to convert the 20-pin J1 connector and 6-pin J2 connector of the Kikusui PWR-01 Series Regulated DC Power Supply into the 26-pin J1 connector of the PAS or PWR Series Regulated DC Power Supply.

This product makes it easy to transfer the external control of the PAS series or PWR series to the PWR-01 Series.



### NOTE

Output voltage (current) external resistance control, one-control parallel operation and series operation cannot be converted. PWR OFF STATUS on the PAS series has been changed to PWR ON STATUS on the PWR-01 series.

# C Troubleshooting

This section introduces troubleshooting measures. Typical symptoms are listed. Check whether any of the items listed below apply to your case. In some cases, the problem can be solved quite easily.

If none of the items apply to your case, we recommend that you initialize the PWR-01 to its factory default settings (p.144). If the remedy does not correct the problem, contact your Kikusui agent or distributor..

## The power does not turn on

Symptom	Items to check	Remedy	See
The PWR-01 does not operate when the POWER switch is turned on.	Is the power cord broken?	Exchange the power cord with a new one.	p.14
	Is the power cord connected correctly?	Connect the power cord correctly.	p.14

## Unable to perform panel operations

Symptom	Items to check	Remedy	See
Unable to carry out panel operations.	Is the LOCK LED lit?	Release the key lock.	p.78
	Is the REMOTE LED lit?	To control the PWR-01 from the panel, press the LOCAL key to switch to local mode.	p.80
	Is the PWR-01 being controlled via the RS232C, USB, or LAN interface?		
The PWR-01 does not switch to local mode even when I press the LOCAL key.	Was a local lockout (llo) command sent through the communication interface?	Send the "SYST:LOC" communication command to clear the local lockout (llo) status.	—

## Unable to set the output voltage/ current or OVP/ OCP.

Symptom	Items to check	Remedy	See
Unable to set the output voltage or the OVP trip point.	Is the voltage setting limit function enabled (CF23: $\square n$ )?	You cannot set the output voltage to a value greater than equal to approximately 95 % of the OVP trip point nor set the OVP trip point to a value less than equal to approximately 105 % of the voltage setting. Disable the setting limit function (CF23: $\square FF$ ), or check the OVP trip point.	p.68
		You cannot set the output voltage to a value less than the voltage specified by UVL. Disable the setting limit function (CF23: $\square FF$ ), or check the UVL trip point.	p.59
Unable to set the output current or the OCP trip point.	Is the current setting limit function enabled (CF22: $\square n$ )?	You cannot set the output current to a value greater than equal to approximately 95 % of the OCP trip point nor set the OCP trip point to a value less than equal to approximately 105 % of the current setting. Disable the setting limit function (CF22: $\square FF$ ), or check the OCP trip point.	p.68

## No output is generated

Symptom	Items to check	Remedy	See
No output is generated even when the OUTPUT key is turned on.	Is the output voltage set to 0 V and the output current set to 0 A?	Turn the knobs to set the output voltage and output current to the required values.	p.40
	Are you using an external contact to turn output on and off?	Yes: Use the external contact to turn output on. No: Set the external control for turning output on and off to "off" (CF14: $\square FF$ ).	p.101 p.67
The output turns off immediately even when it is set to on.	Is the overvoltage protection (OVP) function activated?	Set the OVP value higher than the voltage setting.	p.68
	Is the overheat protection (OHP) function activated?	The internal temperature is abnormally high. Check the operating conditions. After you have removed the cause of the abnormal temperature, turn the power switch on. The air inlet (louver) may be clogged, or the fan may be broken. Check these items.	p.55 —
	Is a shutdown (SD) signal being applied?	Set pin 16 of the J1 connector to HIGH (4.5 V to 5 V) or open.	p.103
The output does not turn on even when the problem that caused the low AC input protection (AC-FAIL) is removed.	Is the status when recovering from AC-FAIL protection (CF20) set to $\surd RFE$ or the output state at power-on (CF45) set to $\surd RFE$ ?	Set the status when recovering from AC-FAIL protection (CF20) to $\text{R}_{\text{L}}\text{E}_{\text{O}}$ and the output state at power-on (CF45) to $\text{F}_{\text{O}}\text{R}\text{E}$ or $\text{R}_{\text{L}}\text{E}_{\text{O}}$ .	p.68 p.71

## The output ripple is large

Symptom	Items to check	Remedy	See
The ripple sometimes becomes large.	Is the input voltage outside the range?	Apply a voltage that is within the input voltage range.	p.125 p.128 p.131
The ripple increased when the PWR-01 was installed in a different location.	Is something nearby generating a strong magnetic or electrical field?	Take measures such as moving the PWR-01 away from the field sources or twisting the cables connected to the PWR-01.	—
The output ripple is large during external control.	Is there a large amount of external voltage noise?	Take measures against noise.	—
The ripple increased when the load cable was changed.	Are the sensing cables connected?	When you are not using remote sensing, connect the sensing short bar.	p.34

## The output is unstable

Symptom	Items to check	Remedy	See
When the output is on, turning the VOLTAGE knob or CURRENT knob results in unstable output.	Is the operation mode switching from CV to CC or CC to CV?	Change the setting (output voltage or output current) that is limiting the output to a value greater than the present setting. If the setting is at maximum, you must use a power supply that has a larger output voltage or current.	p.49
The output voltage or output current fluctuates.	Are you using master-slave parallel operation?	Compared to independent operation, the performance degrades slightly during master-slave parallel operation.	–
	Are the sensing cables or sensing short bar connected?	When you are not using remote sensing, connect the sensing short bar.	p.34
	Are both the CV and CC LEDs turned on?	If the output is oscillating when you are using remote sensing, insert a capacitor across the load.  The circuit may be malfunctioning. Immediately stop using the PWR-01, and have it repaired.	p.34 –
	Do the sensing cables or load cables have poor contact, or are the cables broken?	Turn the POWER switch off, and check the wiring.	p.14
	Does the load current have peaks, or is it pulse shaped?	The peak values may be exceeding the set constant current. Increase the set constant current or increase the current capacity.	p.49
	Has 30 minutes passed since the power was turned on?	Warm up the PWR-01 for at least 30 minutes.	–
The output voltage is offset from the voltage that the PWR-01 was generating when it was turned on.	Is the bleeder circuit (CF01) set to off?	If the bleeder circuit is set to off (CF01: ㊟), the voltage when the output is on remains. Set the bleeder circuit to on (CF01: ㊟).	p.64
The output voltage does not decrease even when the output is turned off.	Is the internal resistance setting (CF03) set to a value other than off?	Set the internal resistance to off (CF03: ㊟).	p.65 p.84
	Is there any loose screw on the sensing short bar?	Be sure to securely connect the sensing short bar using the sensing terminals screws and the screws on the rear-panel DC OUTPUT terminals.	p.34



## The ALM LED lights when the OUTPUT key is turned on.

Symptom	Items to check	Remedy	See
The ALM LED lights when the OUTPUT key is turned on.	Are the sensing cables or sensing short bar connected?	When you are not using remote sensing, connect the sensing short bar.	p.34
	Are the polarities of the sensing cables connected in reverse?	The polarities of the sensing cables may be connected in reverse, or the ends of the cables may be shorted. Check them.	p.34
	Are you using remote sensing with long load cables?	Keep the voltage drop in the load cables within the compensation voltage range.	p.34
	Are you using external control with a loose control cable?	Connect the cable correctly.	p.91
	Is the external voltage excessive during external control?	Apply the correct voltage.	p.97 p.99
	Is the internal temperature too high?	The overheat protection function has been activated. Check the operating environment. The louver may be clogged, or the fan may be broken. Check these items.	p.55 p.137 p.122
The ALM LED lights when the load is changed.	Is a large external voltage—such as that of a battery load—being applied?	The overvoltage protection function or the overcurrent protection function may have been activated. Check them.	p.19 p.52
	Is the actual output voltage higher than the set voltage that is displayed on the panel?	The PWR-01 may be overloaded. Check the load.	
	Is a special load connected?		

## Unable to perform remote control

Symptom	Items to check	Remedy	See
Remote control through the communication interface cannot be performed.	Is the communication interface you want to use turned on in CONFIG settings?	Select the remote control communication interface (CF40/ CF41/ CF42).	p.70
When the LAN interface is in use, the IP address cannot be obtained from the DHCP server.	Is the LAN LED lit in orange or red?	If it is lit in orange, the PWR-01 is waiting for a response from the DHCP server. If it turns red afterward, the PWR-01 may have timed out. Consult your network administrator.	p.73

## Unable to control functions properly

Symptom	Items to check	Remedy	See
The bleeder circuit on/off function does not work.	Are you using master-slave parallel operation or series operation?	When using master-slave parallel operation or series operation, set the bleeder circuit settings (CF01) of all connected units to the same value.	p.64

## The fan speed is fast

Symptom	Items to check	Remedy	See
The fan rotates faster than normal when the POWER switch is turned on.	Is the bleeder circuit set to hyper bleeder (CF01: HYP)?	If hyper bleeder (CF01: HYP) was specified the last time the POWER switch was turned off, the fan speed will be set to the fastest setting. If necessary, set the bleeder circuit (CF01).	p.64 p.82



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## Warranty Period

Before delivery, our products have undergone strict testing and inspections and have been found to comply with the specifications. We offer different warranty periods for different product models. If the product should become defective within the specific warranty period applied to the product model after the date of purchase, we will repair the product or replace it with a new one for free. In a case in which the customer concluded a separate agreement with us regarding the warranty period, the conditions of the warranty period are applied based on such agreement.

## Scope of Warranty

If the product should become defective within the warranty period, we will repair the product or replace it with a new one. However, the warranty does not cover:

- Failure or damage caused by use that is not in accordance with the Operation Manual, misuse, or neglect.
- Failure or damage during transportation after delivery.
- Failure or damage caused by improper modification, adjustment, or repair.
- Failure or damage caused by an Act of God, fire, or other events beyond our control.
- Failure or damage caused by use in a corrosive atmosphere, a dusty environment, or an environment where salt damage occurs or contamination by liquid or foreign matters is likely to occur.
- Failure or damage due to causes that are not attributable to us.

## Disclaimer

Regardless of the warranty period, in no event shall we be liable for loss of opportunity or profit caused by the failure of our product, or initial or secondary damages, accident compensation, damages to products other than our products, or compensation for other operations caused by unavoidable circumstances that we may or may not have foreseen.

If you find any misplaced or missing pages in the manuals, they will be replaced. If the manual gets lost or soiled, a new copy can be provided for a fee. In either case, please contact your Kikusui agent or distributor. At that time, inform your agent or distributor of the "Part No." written on the front cover of this manual.

Every effort has been made to ensure the accuracy of this manual. However, if you have any questions or find any errors or omissions, please contact your Kikusui agent or distributor.

After you have finished reading this manual, store it so that you can use it for reference at any time.

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