

INSTRUCTION MANUAL

BIPOLAR POWER SUPPLY PBA SERIES

PBA20-12

PBA20-24

OPTIONAL RACK-MOUNTING ATTACHMENT OM-21E



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USING THE PRODUCT SAFELY

■ Preface




To use the product safely, read this instruction manual to the end. Make sure you understand how to correctly use this product before using it.

If you read this manual but you do not understand how to use the product, call our company or one of our service centers.

Save the instruction manual after you read it so that you can refer to it when necessary.

■ Pictorial indication and warning character indication

This instruction manual and the product show the warning and caution items required to safely use the product. The following pictorial indication and warning character indication are provided.

<Pictorial indication>	
	Some parts of this product or certain sections of the instruction manual may show this pictorial indication. In this case, if that part of the product is used incorrectly, the user's body or the product may be exposed to serious danger. Be sure to refer to this instruction manual when using parts with this pictorial indication.
	If you ignore this indication and incorrectly use the product, you may be killed or seriously injured. This indication means that a warning item is provided in order to avoid extreme risk.
	If you ignore this indication and incorrectly use the product, you may suffer slight injury or the product may be damaged. This indication means that a caution item is provided in order to avoid risk.

Our company will assume no responsibility for any damage resulting from the misuse of the product by the user or a third party, a failure or other trouble that occurs during operation, or the general use of the product, except for cases where our company is legally liable for the damage.

USING THE PRODUCT SAFELY



■ Do not remove the product's covers and panels

Never remove the product's covers and panels for any purpose.
Doing so may expose the user to electric shock, or result in a fire.

■ Caution on using the product

The warning items below are given to avoid danger to the user's body and life, and to prevent the damage and deterioration of the product. Observe the following warning and caution items as you use the product.

■ Warning items on power supply

● Power supply voltage

The applicable rated source voltage for this product is from 100VAC to 240VAC or 230ACV.

For the rated voltage of each respective product, see the indication on the rear panel of the product or the "SPECIFICATIONS" in this instruction manual.

Products for Japan and for regions of commercial power supply voltage up to 125VAC are supplied with a 125VAC rated power cable. However, this cable may need to be replaced with a different AC power cable when using the product on source voltage over 125VAC. Using the product on a high voltage that exceeds 125VAC without replacing the power cable may result in electric shock or fire.

For products that can switch between source-voltages, see the chapter about switching the source voltage in the instruction manual included with each respective product for details.

● Power cable

Important: The attached power cable can only be used for this product.

If the attached power cable is damaged, stop using it immediately and contact our company or one of our service centers. Continuing to use the damaged power cable may result in electric shock or fire.

● Protection fuse

If the input protection fuse is blown, the product will not operate. For products equipped with an external fuse holder, the fuse can be replaced. See the section about fuse replacement in this manual for details.

If no means of replacing the fuse is available to the user, it cannot be replaced.

If the fuse is blown, do not open the case. Contact our company or one of our service centers and request to have the fuse replaced by one of our representatives. Incorrectly replacing the fuse may result in electric shock or fire.

■ Warning about grounding

If the product is equipped with a GND terminal on the front or rear panel, be sure to connect a ground wire to the GND terminal to ensure safe operation.

■ Warning about installation conditions

● Operating Temperature and Humidity

Use the product within the operating temperature range described in the "SPECIFICATIONS". Do not use the product with the vent holes blocked or in a high ambient temperature. Failure to heed this warning may result in fire.

Use the product within the operating humidity range described in the "SPECIFICATIONS". When moving the product to a room with a different humidity, pay attention to dew condensation caused by a sudden humidity. Also, do not handle or operate the product with wet hands. Failure to heed to this warning may result in electric shock or fire.

● Using Product Near Gases

Do not use the product in or around a place where combustible gas, explosive gas, or vapor is produced or stored. Failure to heed this warning may result in explosion or fire.

Do not use the product in or around a place where corrosive gas is produced or accumulated. Failure to heed this warning may result in serious damage to the product.

● Installation Place

Do not install the product on an inclined surface or in a place subject to vibration. Otherwise, the product may fall down or tip over, resulting in damage or an injury.

USING THE PRODUCT SAFELY

■ Do not allow foreign objects to enter the product

Do not insert metal or flammable materials through the vent and into the product. Do not spill water on the product.

■ Warning about errors during operation

If the product emits smoke, fire, unusual odors, or abnormal noise while in use, stop using the product immediately. Turn off the switch and disconnect the power cable from the AC outlet to cut off the electric power supply. Contact our company or one of our service centers.

■ Input/output Terminal

Maximum input to the input terminals is specified to prevent the product from being damaged. Do not supply input, exceeding the specifications that are indicated in the "SPECIFICATIONS" section of this manual. Also, do not supply power to the output terminals from the outside. Failure to heed this warning may cause the product to fail.

■ Calibration

The performance and specifications of the product were inspected under strict quality control before shipment. However, the aging of the parts may cause the performance and the specifications to change. To ensure the performance and specifications of the product remain unchanged, we recommend that you have the product calibrated periodically. For calibration, please contact our company or one of our service centers.

■ Daily Maintenance

Do not use thinner, benzine or other solvents to clean the case, panels, knobs, etc. of the product. Doing so may cause the coating to peel off or the resin surface to deteriorate.

Use soft cloth moistened with neutral detergent to lightly clean the case, panels, knobs, and other parts.

While cleaning, be careful not to let water, detergent, or other foreign materials into the product. If a liquid or metal gets into the product, electric shock or fire may occur.

Before cleaning the product, make sure to disconnect the power cable from the AC outlet to cut off the electric power supply.

Use the product correctly and safely, observing the above warning and caution items. This manual indicates caution items in each individual section. Observe these caution items to correctly use the product.

If you have questions or comments about the content of this manual, contact our company or one of our service centers.

1. PBA SERIES

1-1. Product outline

PBA series

	Model Name	
	240W	480W
Rate Voltage 20 V	PBA20-12	PBA20-24

The PBA series are bipolar power supply units capable of Four-quadrants outputs. They can be used for constant-voltage operation as well as constant-current operation. The frequency characteristic is wide-band 100 kHz (-3dB) when in constant-voltage mode, and 10 kHz (-3dB) when in constant-current mode.

The unit is equipped with an external input terminal. A signal source can be connected to this terminal in order to amplify electric power.

1-2. Features

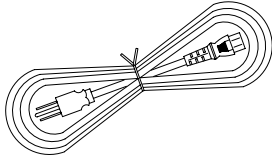
- **Four-quadrants output**
Four-quadrants output capable of sourcing and sinking the power supply.
- **Constant voltage/current modes**
Selectable operation of constant-voltage mode (CV) or constant-current mode (CC), by CV/CC switch.
The frequency characteristic is wide-band 100 kHz (-3dB) at constant-voltage mode, and 10 kHz (-3dB) at constant-current mode.
- **Voltage and current limit function**
Equipped with output limiter function at 4 points for the + side and – side of both the voltage limit (VL) and current limit (CL).
Testing devices connected to the unit are protected by utilizing the current limit when in CV mode, and the voltage limit when in CC mode.
- **External signal input terminal**
Equipped with an external signal input terminal. Voltage or current output can be amplified by inputting signals from a signal generator or other signal sources.
- **Remote sensing function**
Uses the remote sensing terminal to compensate for output voltage drop caused by the wires.
- **Protective functions**
The unit has functions to guard against over-voltage, over-current, and overheating of the internal heat sink.
- **Power factor correction circuit and wide range AC source voltage**
Equipped with a power factor correction circuit that has a power factor of approximately 0.95 (typical value at rated output).
Rated source voltage from 100 VAC to 240 VAC, without the settings.
- **Input/output isolation options**
Original factory options for isolating the external signal input and the voltage/current monitor outputs from the power output.
Four options are available. The option used depends on the isolation point.
PBA**-**V1 : Isolation of external signal input and voltage/current monitor outputs.
PBA**-**V2 : Isolation of external signal input.
PBA**-**V3 : Isolation of voltage monitor output.
PBA**-**V4 : Isolation of current monitor output.
In V1 and V2, the frequency characteristic when in CV mode is 10 kHz (-3dB).
In V3, only the frequency characteristic of the voltage monitor is 10 kHz (-3dB).

2. PRIOR TO USE

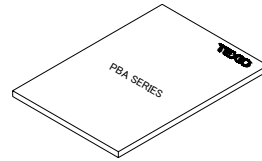
2-1. Accessories

Please make sure that all the correct accessories have been included. If an accessory is missing or if you notice any other problem, please contact one of our sales branches.

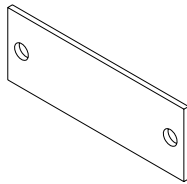
<Common accessories in the PBA series >



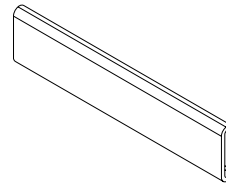
Power cable: 1 pc



Instruction manual: 1 set
[B68-0176]



Output terminal protective cover: 1 pc



External control terminal protective cover: 1 pc

2-2. Connecting the power cable

Connect the supplied power cable to the AC inlet.



WARNING

Make sure to properly connect the power cable. Failure to do so may result in electric shock or fire.

2-3. Connecting to the output terminals and external control terminals

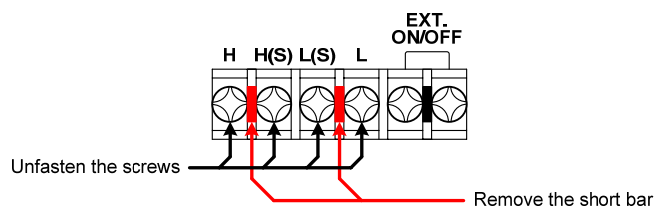
- ※ Make sure to disconnect the power cable from the AC outlet before attaching and/or removing the terminal protective covers.
- ※ Test cables are NOT supplied. Make sure to procure cables of the appropriate capacity and length.

When connecting the test cable, the wires used should be as short as possible. They should all be twisted to reduce impedance of the cables.

Use cables with a crimp terminal or similar style terminal to firmly attach the cables to the output terminals.

When grounding the H side or the L side, make sure to connect the GND terminal located in the middle to the terminal that is to be grounded.

When using the remote sensing function, make sure to remove the short bar of H and H(S), and the short bar of L and L(S). Then connect the sensing points of the tested device via the H (S) and L (S) terminals.



Use shielded wires or twisted pair wires for the wiring.

Connect H (S) to the H side of the tested device, and L (S) to the L side.



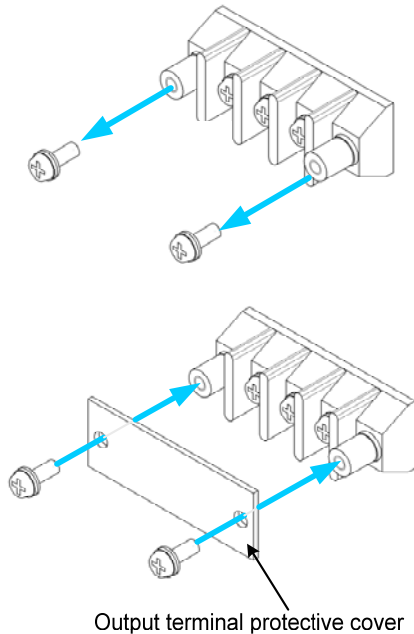
CAUTION

Improperly connecting to the terminals can lead to product failure or cause an over current on the device to be tested.

2-4. Attaching and removing the output terminal protective cover and external control terminal protective cover

※ Make sure to disconnect the power cable from the AC outlet before attaching and/or removing the terminal protective covers.

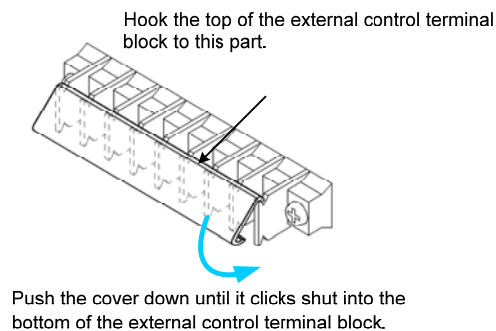
● Attaching the output terminal protective cover



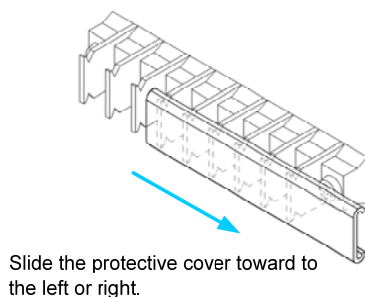
Unfasten the screws on each side of the terminal.

Use the unfastened screws to attach the supplied output terminal protective cover.

● Attaching the external control terminal protective cover



When attaching the supplied external control terminal protective cover, hook the top of the external control terminal block to the protective cover, then push the cover down until it clicks shut in the bottom of the external control terminal block.



When removing the external control terminal protective cover, push the cover down to release it from the bottom of the terminal block.

If you have trouble removing the cover, slowly slide it to the left or right.

Make sure the external control terminal protective cover is fully attached. Otherwise, it may fall off and cause a hazard to those in the vicinity.



Be sure to attach the output terminal protective cover and the external control terminal protective cover before using the product.
Using the product without attaching the terminal protective covers may result in electric shock or fire.
Make sure to disconnect the power cable from the AC outlet before attaching and/or removing the terminal protective covers.

3. PANELS

3-1. Front panel

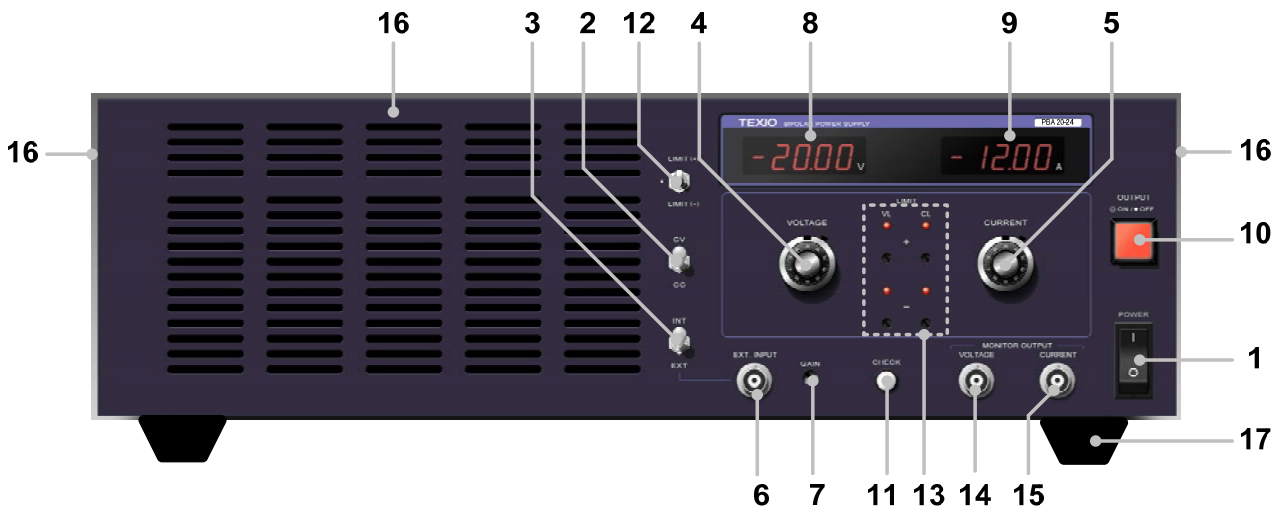


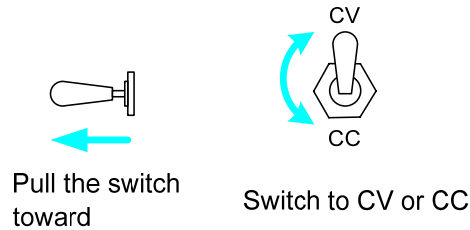
Fig. 3-1 Front Panel (The above figure shows the front panel of the PBA20-24.)

1. Power switch

- Turns the AC power on and off.

2. CV/CC switch

- Switches from the constant voltage mode (CV) to the constant current mode (CC), and vice versa. The switch has a lock mechanism; pull it for switching the mode.



**Do NOT switch over when the output is on.
Doing so may damage the device to be tested.**

3. INT/EXT switch

- Switches from the internal reference voltage source to the external signal input, and vice versa. The switch has a lock mechanism. Pull the switch toward to disable the lock.



**Do NOT switch over when the output is on.
Doing so may damage the device to be tested.**

4. Voltage setting dial (10-turn multi-dial)

- Sets the voltage.
Can only be used when the CV/CC switch is set to CV and the INT/EXT switch is set to INT.
The center value of the 10-turn multi-dial (scale 5) is approximately 0 V.
Turning the dial clockwise sets a value up to the + side rated value, and turning the dial counterclockwise sets a value down to the - side rated value.
Equipped with a dial lock mechanism.

5. Current setting dial (10-turn multi-dial).
 - Sets the current.

Can only be used when the CV/CC switch is set to CC and the INT/EXT switch is set to INT.
 The center value of the 10-turn multi-dial (scale 5) is approximately 0 A.
 Turning the dial clockwise sets a value up to the + side rated value, and turning the dial counterclockwise sets a value down to the - side rated value.
 Equipped with a dial lock mechanism.
6. External signal input terminal
 - Uses an external signal to control the output voltage (when in CV mode) and output current (when in CC mode).

Can be used when the INT/EXT switch is set to EXT.
 The differential input is not isolated from the output (except for the terminal equipped with the isolation option, which is identified as ISOLATED (OP)).
7. Signal input gain adjustment volume
 - Adjusts the signal input gain (10-turn).

When fully turned clockwise at an external signal of approximately 0 to $\pm 5V$, the output voltage or current changes from 0 to the rated voltage/current. Turning the switch counterclockwise lowers the input gain.
 To adjust the volume gain, use a needle-nosed tool such as a flat-head screw driver.
8. Output voltage indicator
 - Displays the output voltage, as well as the set voltage and set limit voltage.
9. Output current indicator
 - Displays the output current, as well as the set current and set limit current.
10. OUTPUT switch
 - Turns the output on and off. The switch has a backlight, which remains lit while the output is turned on.

Pressing the switch turns the output on, and pressing it again turns the output off.
11. CHECK switch
 - Displays the set values while the switch is held down.

Displays the set voltage on the voltage indicator when in CV mode.
 Displays the set current on the current indicator when in CC mode.
12. LIMIT (+)/LIMIT (-) switch
 - Displays + set limit values when the switch is pushed up, and – set limit values when the switch is pushed down.

Displays the set limit voltage on the voltage indicator, and the set limit current on the current indicator.
13. LIMIT
 - VL setting volume: Semi-fixed volume to set the voltage limit value.
 - CL setting volume: Semi-fixed volume to set the current limit value.

Both the VL and CL setting volumes have a + side and a – side.
 The LEDs, located above the respective volumes, remain lit while the VL or CL is activated.
 To adjust the limit, use a needle-nosed tool such as a flat-head screw driver.
14. Output voltage monitoring terminal
 - Outputs monitor signals, in a range of 0V to $\pm 10V$, for the output voltage of 0V to the rated voltage.

The common level is the SENSING L (S) (except for the terminal equipped with the isolation option, which is identified as ISOLATED (OP)).
15. Output current monitoring terminal
 - Outputs monitor signals, in a range of 0A to $\pm 10A$, for the output current of 0A to the rated current.

The common level is the SENSING L (S) (except for the terminal equipped with the isolation option, which is identified as ISOLATED (OP)).
16. Intake air port (both sides)
 - Intake air port. The 240 W model has intake air ports on both sides only.

Do NOT block the intake air ports or place foreign objects near them. Doing so may cause the internal temperature to rise.
17. Rubber legs
 - Detachable.

If the unit is mounted in a rack and the shoes are not needed, they may be removed.

3-2. Rear panel

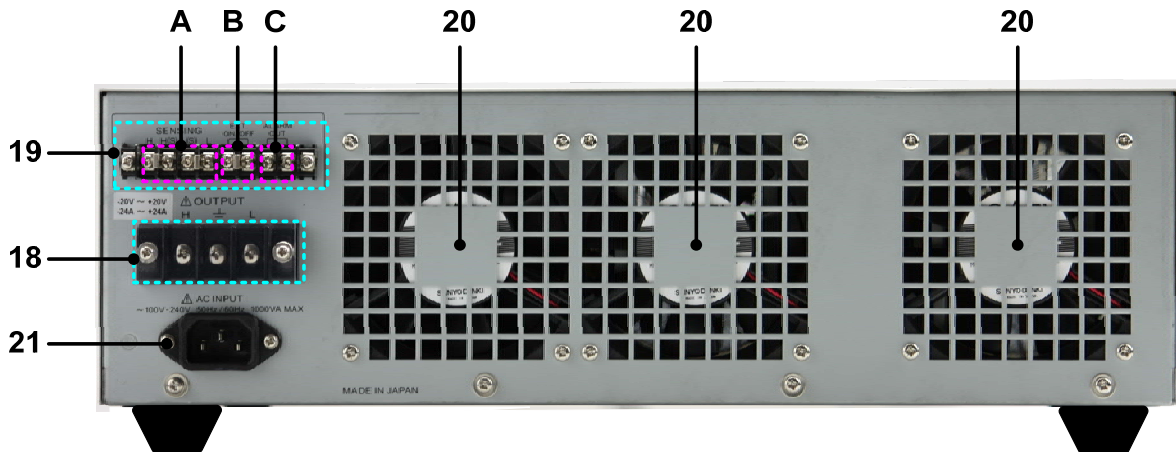


Fig. 3-2 Rear Panel (The figure shows the rear panel of PBA20-24.)

18. Output terminals

- Output terminals.

Output the rated voltage and rated current.

When set to the + side, the H terminal will be + voltage. The current runs from the H terminal to the L terminal.

The middle terminal is the GND terminal. This terminal is used to ground the H output or L output to the case.

19. External control terminals

- The external terminals consist of the SENSING terminals, EXT. ON/OFF terminals, and ALARM OUT terminals.

A. SENSING terminals

- Remote sensing terminals.

When applying the remote sensing function, remove the short bars and connect to the sensing points via H (S) and L (S) terminals. Connect H(S) to the H side of the tested device, and L(S) to the L side of the OUTPUT.



Improperly connecting to the terminals can lead to product failure or cause an over current on the device to be tested.

B. EXT. ON/OFF terminals

- Uses external contacts to turn the output on and off.

The EXT. ON/OFF terminals are serially configured to the OUTPUT switch on the front panel. Therefore, using an external contact to turn the output on or off should be done when the OUTPUT switch on the front panel is set to ON. Even when an external contact is used to turn the output ON, it can be turned off by using the OUTPUT switch on the front panel.



Be sure to use an isolated contact to open or close a terminal. Failure to do so may result in damage to the unit.

C. ALARM OUT terminals

- The ALARM OUT terminals make connection when an OVP, OCP, or OHP alarm occurs. These terminals are normally opened, and only make connection when an alarm occurs.

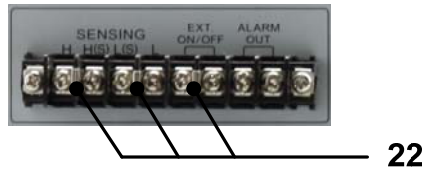
20. Cooling fan

- Cooling fan for the inside of the case.

Do NOT block the intake air ports or place foreign objects near them. Doing so may cause the internal temperature to rise.

21. AC inlet

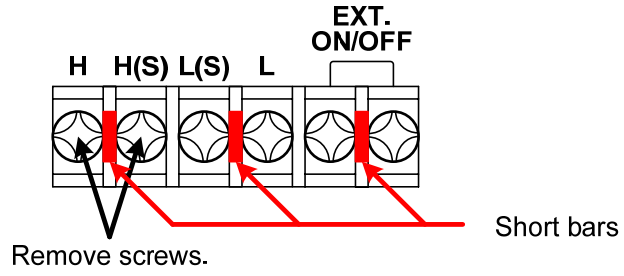
- AC power input terminal equipped with terminal GND. AC input from 100 to 240 VAC. Use the supplied power cable, and connect it to the AC inlet.



22. Short bar

Short-circuits between H and H(S), L(S) and L, and between ON and OFF for EXT. ON/OFF.

To remove or attach short bars, remove the screws from both sides.



4 GENERAL INSTRUCTIONS

4-1. Output limitation in DC operation

This product is a bipolar posere supply unit that features Four-quadrants outputs. The second and fourth quadrants have the following limitation.

As the figure below shows, there is no limitation for first and third quadrants when the unit is operated within the specifications (voltage, current, and ambient temperature). However, there is limitation in DC operation for the second and fourth quadrants.

There is a time restriction for when the unit is used outside of the area range. In addition, when the internal temperature exceeds the set temperature limit, over-heat protection (OHP) stops the output. Likewise, because the protective functions activate when a certain temperature is detected, it can also be affected by the ambient temperature.

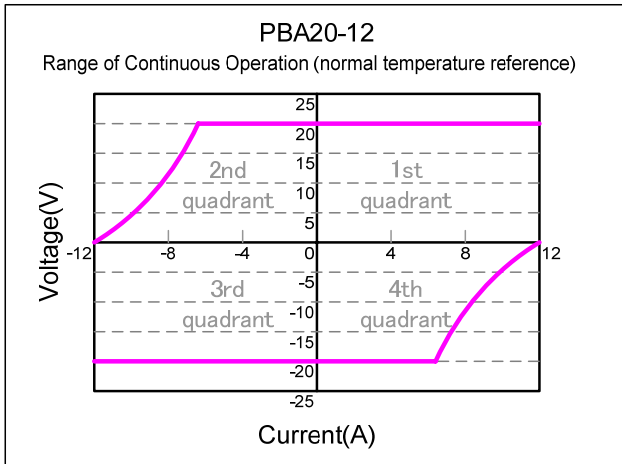


Fig 4-1

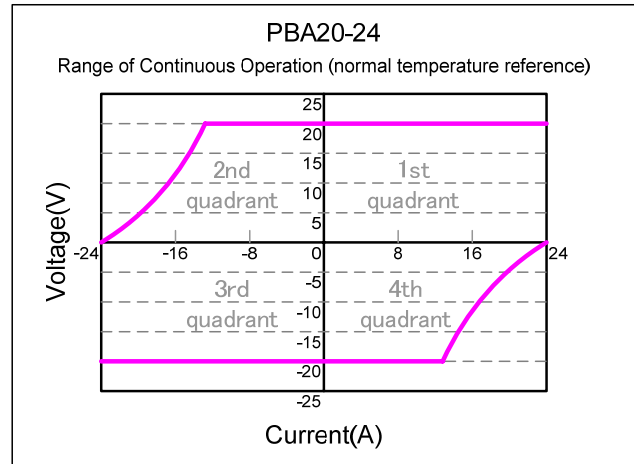


Fig 4-2

4-2. Alarm

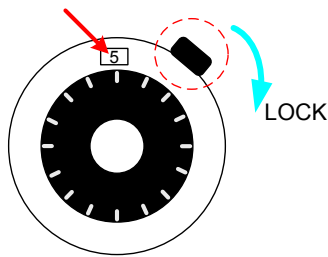
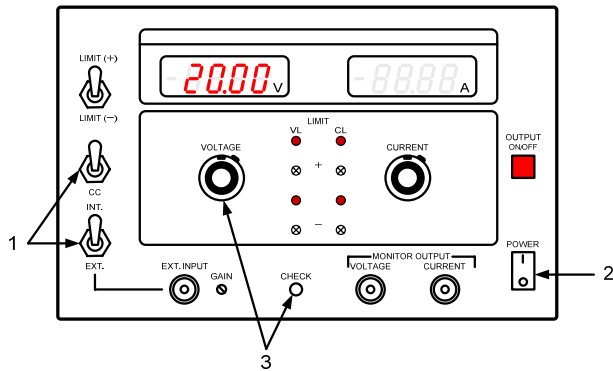
This product is equipped with protective functions such as over-voltage protection (OVP), over-current protection (OCP), and over-heat protection (OHP).

When a protective function activates, the output is stopped.

Turn the POWER switch to OFF, Fix the problem that caused the function to activate and then throw the POWER switch again.

5 FUNCTIONS AND OPERATION PROCEDURES

5-1. Voltage setting on the front panel (CV mode)



Operation procedure

1. While the POWER switch is OFF, set the INT/EXT switch to INT, and the CV/CC switch to CV.
2. Turn the POWER switch to ON.
3. Use the voltage setting dial to set the output voltage value.

Press the CHECK key to display the set voltage value on the voltage indicator.

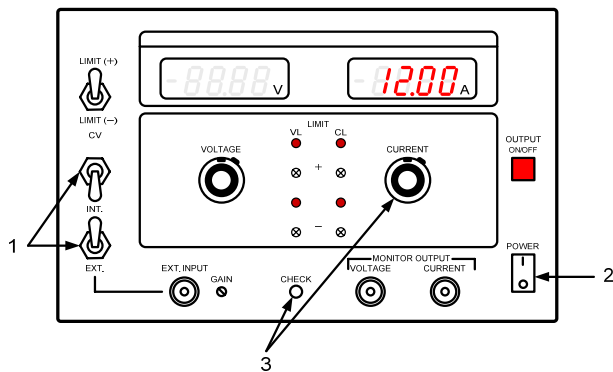
The voltage and current setting dials are equipped with a lock mechanism. You can lock each dial in place by rotating the lug located above the dial.

The center value (scale 5) of the 10-turn multi-dial is approximately 0 V.

Turning the dial clockwise sets a value up to the + side rated value, and turning the dial counterclockwise sets a value up to the - side rated value.

The value can be changed while OUTPUT switch is ON.

5-2. Current setting on the front panel (CC mode)



Operation procedure

1. While the POWER switch is OFF, set the INT/EXT switch to INT, and the CV/CC switch to CC.
2. Turn the POWER switch to ON.
3. Use the current setting dial to set the output current value.

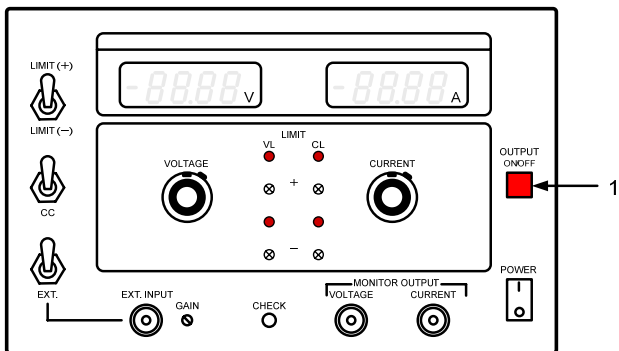
Press the CHECK key to display the set current value on the current indicator.

The center value (scale 5) of the 10-turn multi-dial is approximately 0 A.

Turning the dial clockwise sets a value up to the + side rated value, and turning the dial counterclockwise sets a value up to the - side rated value.

The value can be changed while OUTPUT switch is ON.

5-3. Turning the output on or off on the front panel



Operation procedure

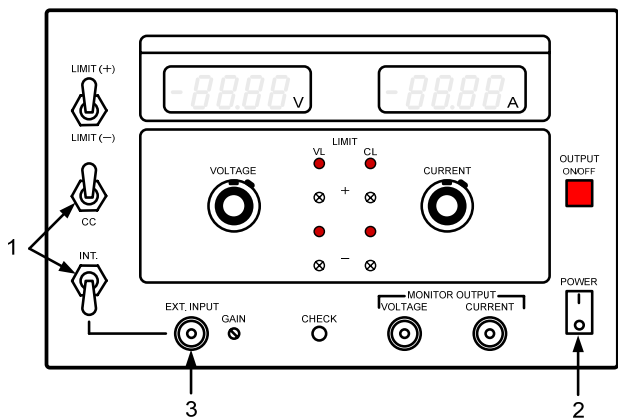
1. Press the OUTPUT ON/OFF switch, which is then lit in red.
Power is then supplied to the test device.

Press the OUTPUT ON/OFF switch again to turn the light off.

The supply of power to the test device is stopped.

The OUTPUT ON/OFF switch is OFF when turn the POWER ON.

5-4. The output voltage control via an external signal (CV mode)

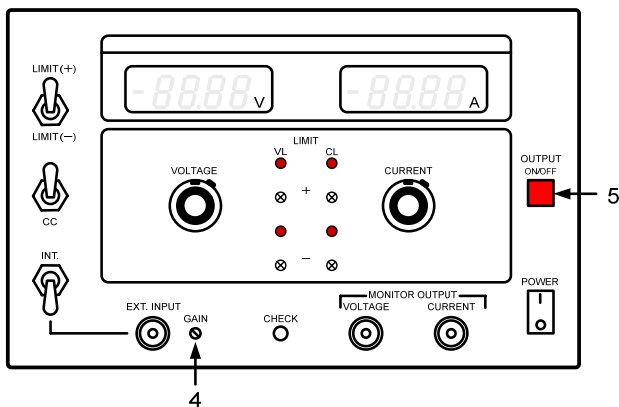


Operation procedure

1. While the POWER switch is OFF, set the INT/EXT switch to EXT and the CV/CC switch to CV.

Selecting EXT disables the voltage setting dial on the front panel.

2. Turn the POWER switch to ON.
3. Connect the signal cable from the external signal source to the external signal input terminal.



4. Adjust the gain.
To set the output at the rated voltage for an external signal of $\pm 10V$, turn the gain adjusting volume to the middle point (5 turns after it has been fully turned to the left or right). This adjusts the output to approximately the rated voltage.

To set the output at the rated voltage for an external signal of $\pm 5V$, fully turn the gain adjusting volume clockwise. This adjusts the output to approximately the rated voltage.

If a DC voltage input signal is being used, you can use the CHECK key for confirmation.

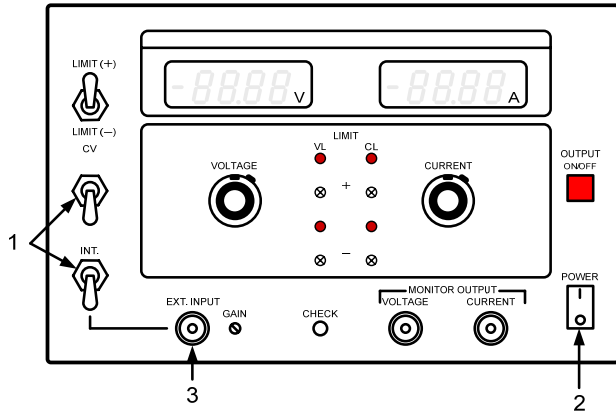
For final adjustments, fine tune the gain adjusting volume while checking the output.

For arbitrary signals, use an oscilloscope or other device to check the output waveforms.

5. Press the OUTPUT ON/OFF switch to on which is then lit in red. Power is then supplied to the test device.

Press the OUTPUT ON/OFF switch again to turn the light off. The supply of power to the test device is stopped.

5-5. Controlling the output current control via an external signal (CC mode)

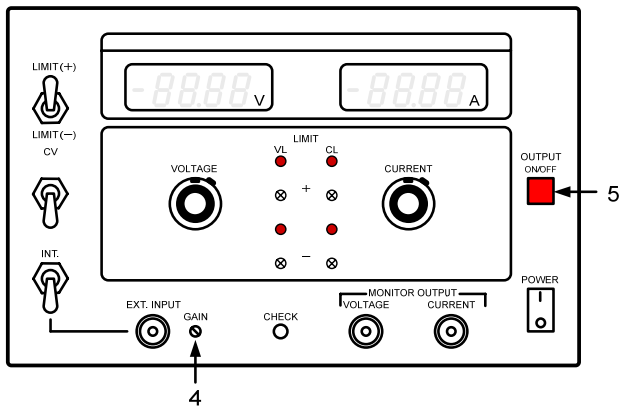


Operation procedure

1. While the POWER switch is OFF, set the INT/EXT switch to EXT and the CV/CC switch to CC.

Selecting EXT disables the current setting dial on the front panel.

2. Turn the POWER switch to ON.
3. Connect the signal cable from the external signal source to the external signal input terminal.



4. Adjust the gain.
To set the output at the rated current for an external signal of $\pm 10V$, turn the gain adjusting volume to the middle point (5 turns after it has been fully turned to the left or right). This adjusts the output to approximately the rated current.

To set the output at the rated current for an external signal of $\pm 5V$, fully turn the gain adjusting volume clockwise. This adjusts the output to approximately the rated current.

If a DC voltage input signal is being used, you can use the CHECK key for confirmation.

For final adjustments, fine tune the gain adjusting volume while checking the output.

For arbitrary signals, use an oscilloscope or other device to check the output waveforms.

5. Press the OUTPUT ON/OFF switch to on which is then lit in red. Power is then supplied to the test device.

Press the OUTPUT ON/OFF switch again to turn the light off. The supply of power to the test device is stopped.

The external signal input terminal is a differential input that is not isolated from the output terminals.

The external signal input impedance ranges from approximately $6k\Omega$ (maximum gain) to $10k\Omega$ (minimum gain).

(The terminal equipped with the isolation option, identified as ISOLATED (OP), is isolated and its input impedance is approximately $10k\Omega$.)

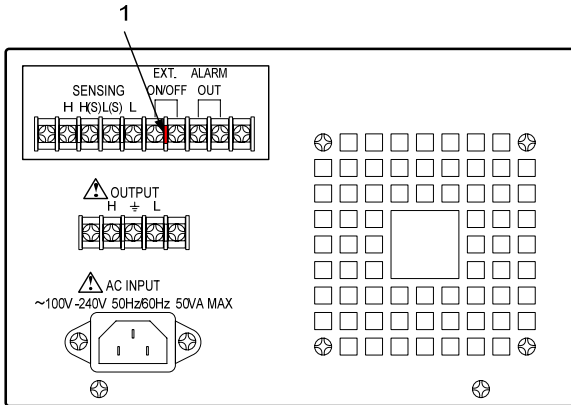
In CC mode, make sure to connect a load to the output terminals when checking the output.

If no load is connected, the unit will enter VL mode (voltage limit) or OVP.

5-6. Using external contacts to turn the output on or off



Be sure to use an isolated contact to open or close a terminal. Failure to do so may result in damage to the unit.



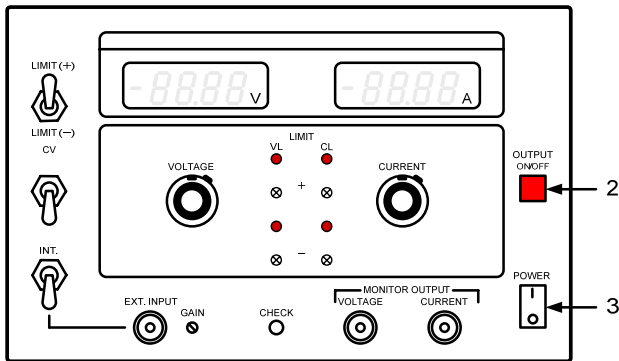
Operation procedure

1. **With the POWER switch is OFF**, remove the short bar from between the EXT. ON/OFF terminals on the terminal block of the rear panel and connect the outer contact.
2. Turn the POWER switch to ON.
3. Press the OUTPUT ON/OFF switch to ON.

The output is turned on when the external contact is closed.

The output is turned off when the external contact is opened.

If the signal line of the outer contact is disconnected or breaks, the output is turned off.



※ If the OUTPUT ON/OFF switch on the front panel is not pressed, no power will be output to the externally-connected device.

The output can be turned off on the front panel while it is on.

※ If an external contact signal is not being used to turn the output on or off, return the short bar to its original place.

5-7. Output voltage and output current monitors



The output voltage monitor terminal and output current monitor terminal are not isolated from the output terminals.

The common level is the SENSING L (S)terminal, which has an output impedance of approximately 200Ω. (Excludes the terminal equipped with the isolation option, which is identified as ISOLATED (OP).)

While the POWER switch is OFF, connect the monitoring devices to the output voltage monitor terminal and the output current monitor terminal, which are located at the lower right of the front panel.

When output voltage is 0 V, the voltage of the voltage monitor is 0 V.

When output voltage is a ± rated voltage, the voltage monitor outputs a voltage of ±10 V.

When output current is 0 A, the voltage of the current monitor is 0 V.

When output current is a ± rated current, the current monitor outputs a voltage of ±10 V.

6 OPTIONAL RACK-MOUNTING ATTACHMENT

The OM-21E (for EIA rack) is an optional and separately-sold rack-mounting attachment that can be used with the 480W model.

6-1. Mounting the attachment

- (1) Unfasten 4 screws on the right and left sides of the set (Fig. 6-1).
- (2) Use the unfastened screws to attach the rack-mounting attachment (common for right and left) to the set (fig. 6-2).

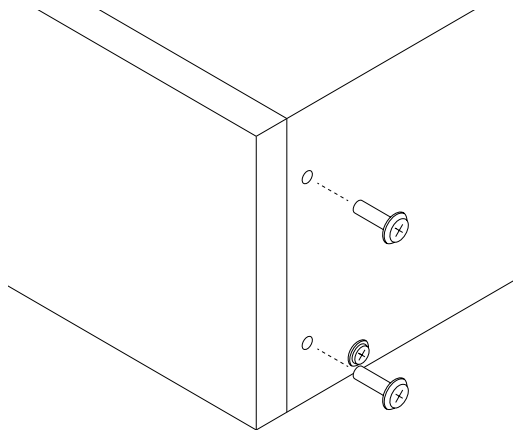


Fig 6-1

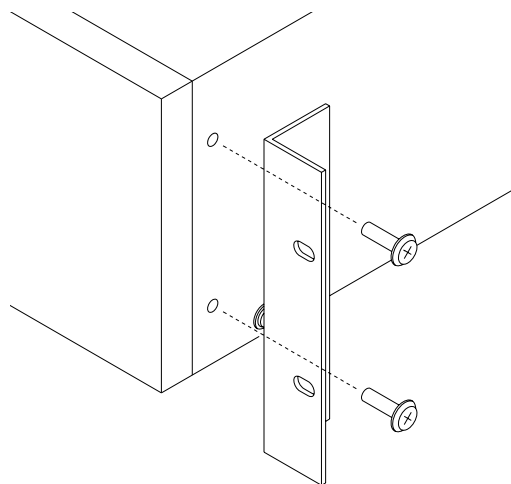


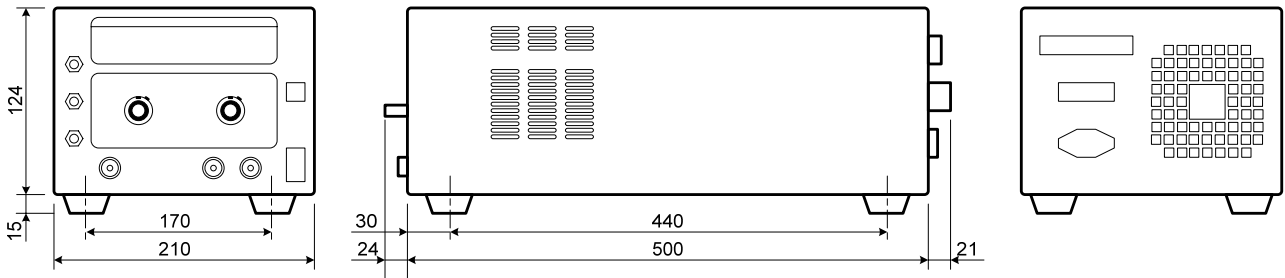
Fig 6-2

Appendix A. TROUBLE SHOOTING

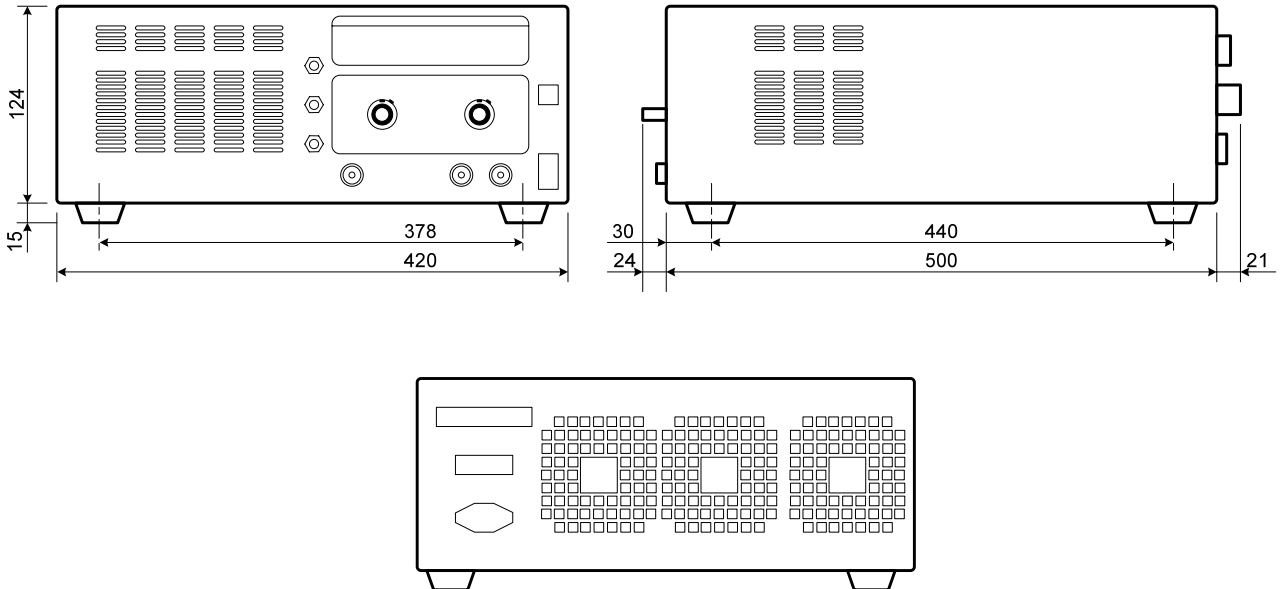
Phenomenon	Possible cause	Action
The POWER switch is thrown but the power does not turn on.	The AC cable is not connected securely or is broken.	Securely connect the AC cable. If the AC cable is broken, replace it immediately.
	An error in the PBA power supply unit has caused the internal fuse to blow.	The unit needs to be repaired and/or the internal fuse needs to be replaced. Please contact our service center.
	The input voltage is too low.	Adjust the input voltage. The input voltage range is between 100 VAC to 240 VAC, and 50Hz to 60Hz.
The OUTPUT ON/OFF switch is pressed but no voltage is output.	The CL setting is 0A. Or the unit is in CC mode because 0A was specified as the current setting for CC mode.	Increase the CL setting or the current setting.
	The unit is set to external input.	Switch to the internal setting, or input an external signal.
The OUTPUT ON/OFF switch is pressed but the LED does not light up.	The remote sensing terminal is not connected to the load when the remote sensing function is being used.	Connect the remote sensing terminal to the load.
	The output terminal and remote sensing terminal are not connected by the short bar.	Use the short bar to connect the output terminal to the remote sensing terminal.
	The EXT. ON/OFF is set to OFF.	Turn the output on when using the external contact.
	The short bar for the EXT. ON/OFF switch is not connected.	Connect the short bar for the EXT. ON/OFF terminal.
The output turns off during operation.	There are objects located in front or on the sides, or behind the PBA power supply unit, blocking the intake of air from the front or side grills and/or the flow of exhaust from the rear.	Make sure there is sufficient space between the objects and the front, side, and rear panels.
	The power exceeds the operation limit region.	Use the PBA power supply unit within the limit region by decreasing the power or applying VL and CL functions.
The output is turned off but the voltage does not fall.	A capacitive load is connected to the PBA power supply unit.	To prevent the risk of electric shock, use a voltmeter to measure the voltage of the unit's output terminals. Confirm that the voltage has fallen sufficiently before touching the output terminals.
The output voltage is unstable, or the noise is loud.	The main power voltage is too low.	Adjust the input voltage.
	There is a strong magnetic field or electrical field nearby.	Take countermeasures to fix the problem, such as twisting the wires or moving the unit away from the equipment that may be producing the magnetic or electrical field.
The output is on, but the meter display is unstable or indicates a reading that stays around 0.	The unit is outputting a waveform that contains AC components.	The meter mounted on the PBA power supply unit is a DC meter. The meter display may change, depending on the waveform or frequency, and at times may stay around 0. Use an oscilloscope to check the waveforms.

Appendix B. EXTERNAL DIMENSIONS

- 240 W model External dimensions: 124 mm (H) x 210 mm (W) x 500mm (D) Weight: Approx.11 kg



- 480 W model External dimensions: 124 mm (H) x 420 mm (W) x 500 mm (D) Weight: Approx. 16 kg



Appendix C. SPECIFICATIONS

	PBA20-12	PBA20-24
Specifications		
Input voltage	Single phase 100 VAC to 240 VAC, 50 Hz to 60 Hz	
Input power	500 VA max.	1000 VA max.
Power factor	0.95 (typ) (at 100 VAC of input voltage)	
Rush current	160 A or lower	
Output power	240 W	480 W
Output voltage	±20 V	±20 V
Output current	±12 A	±24 A
Control method	Toggle switch to switch between constant voltage (CV) and constant current (CC)	
Output terminal	Rear panel terminal block (3P: H, G, L)	
Constant-voltage Characteristics		
Constant voltage stability	Source fluctuation ^{*1} within ± 0.05% FS; Load fluctuation ^{*2} within ± 0.05% FS (when there is an input voltage of 100 VAC)	
Ripple ^{*3}	Within 20 mVrms (when there is no signal)	
Frequency characteristic	100 kHz -3dB (typ), Reference 1 kHz	
Rise/fall	Time 3.5μs(typ) (Overshoot of +5% or lower, except when turning the output on and off)	
Output voltage/external signal ratio	0 V to ± rated voltage / 0 V to ± 5 V (Maximum external signal ±10 V) Adjustable gain. Rated voltage to be output by ± 5 V input. Linearity: ±0.1% FS 23°C ±5°C	
Internal setting instrument	10-turn multi-dial (equipped with dial lock mechanism)	
Voltage indicator	4 digits, minimal digit: 10 mV Accuracy: ± (0.1% + 2 digits) 23°C ±5°C	
Output voltage monitor	0V to ± rated voltage / 0V to ±10V Accuracy: ± (0.5% + 100 mV) BNC terminal on the front panel (non-isolated ^{*4})	
Constant-current Characteristics		
Constant current stability	Source fluctuation ^{*1} : within ±0.1%FS Load fluctuation ^{*2} : within ±0.1%FS (At 100VAC of input voltage)	
Ripple ^{*3}	Within 50mArms (at none signal)	Within 70mArms (at none signal)
Frequency characteristic	10 kHz-3dB (typ), Reference 1 kHz	
Rise/fall	Time 35μs (typ) (Overshoot +5% or lower, except when turning the output on or off)	
Output current/external signal ratio	0 V to ± rated current / 0 V to ± 5 V (Maximum external signal ±10 V) Adjustable gain. Rated current to be output by 5 V input. Linearity: ±0.1% FS 23°C ±5°C	
Internal setting instrument	10-turn multi-dial (equipped with dial lock mechanism)	
Current indicator	4 digits, minimal digit: 10 mA Accuracy: ± (0.2% + 2 digits) 23°C ±5°C	
Output current monitor	0V to ± rated current / 0V to ± 10V Accuracy ± (0.5% + 100 mV) BNC terminal on the front panel (non-isolated ^{*4})	
Functions		
Voltage limit (±VL)	+VL and -VL can be set separately. Setting range: 0 to approx. 110% of rated voltage Set by semi-fixed volume. Enters simplified CV mode when VL is activated (automatic reset). Activation display LED (red) lights up.	
Current limit (±CL)	+CL and -CL can be set separately. Setting range: 0 to approx. 105% of rated current Set by semi-fixed volume. Enters simplified CC mode when CL is activated (automatic reset). Activation display LED (red) lights up.	
OUTPUT ON/OFF	Front panel	OUTPUT switch (backlight: red) when turn ON
	Outer contact control	Terminal block on the rear panel (Short bars must be inserted when the terminal block is not being used. Serial to front panel switch)
LIMIT switch	Center position	3-point toggle switch (Normally placed in the center position; voltage and current indicators display the measured values.)
	LIMIT (+)	Current indicator displays CL (+) and voltage indicator displays VL (+).
	LIMIT (-)	Current indicator displays CL (-) and voltage indicator displays VL (-).
CHECK key	While pressing and holding it down, voltage indicator displays set voltage value at CV mode. Current indicator displays set current value at CC mode.	
Remote sensing	Terminal block on the rear panel (Short bars must be inserted when the terminal block is not being used.)	
External control	BNC terminal on the front panel (non-isolated ^{*4} ; received by differential amplifier) Input impedance: Approx. 6kΩ (at maximum gain) to approx. 10kΩ (at minimum gain) Isolation option, which is identified as ISOLATED (OP): Approx. 10kΩ	
Switching control method	INT/EXT switch on the front panel	
Protection		
Over-voltage protection (OVP)	Activates when the output voltage exceeds approx. 120% (fixed) of the rated voltage.	
Over-current protection (OCP)	Activates when the output current exceeds approx. 110% (fixed) of the rated current.	
Over-heat protection (OHP)	Activates when the temperature of heat sink for the internal electron device exceeds approx. 100°C.	
Alarm output	Terminal block on the rear panel (common for OVP, OCP, and OHP)	
Others		
Cooling method	Fan for forced cooling	
To-GND voltage	±500 V	
Insulation resistance	Primary-casing: 500 VDC 20MΩ or more Secondary-casing: 500 VDC 20MΩ or more Primary-secondary: 500 VDC 20MΩ or more	
Dielectric strength voltage	Between case and power input terminal: AC 1500 V, no anomaly for 1 min.	
Operating temperature range	0°C to 40°C	
Operating humidity range	10% to 85% (No dew condensation)	
External dimensions	124 mm (H) x 210 mm (W) x 500 mm (D)	124 mm (H) x 420 mm (W) x 500 mm (D)
Weight	Approx. 11 kg	Approx. 16 kg
Accessories	Power cable: 1 pc; Instruction manual: 1 set; Output terminal protective cover: 1 pc; External control terminal protective cover: 1 pc	

※ The specifications stated in the table above are for when the rated input is 100 VAC.

^{*1} For ±10% input voltage fluctuation

^{*2} Measurement of remote sensing terminal for output current fluctuation between 0% to 100%.

^{*3} Measurement performed using the RMS method at a frequency between 5 Hz to 1 MHz.

^{*4} Excludes the terminal equipped with the isolation option, which is identified as ISOLATED (OP).



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