

INSTRUCTION MANUAL

REGULATED DC POWER SUPPLY

PD-AD SERIES

PD18-10AD PD18-20AD PD18-30AD

PD36-10AD PD36-20AD

PD56-6AD PD56-10AD

PD110-3AD PD110-5AD

■ **About Brands and Trademarks**

“TEXIO” is the product brand name of our industrial electronic devices.

All company names and product names mentioned in this manual are the trademark or the registered trademark of each company or group in each country and region.

■ **About the Instruction Manual**

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USING THE PRODUCT SAFELY

■ Preface

To use the product safely, read instruction manual to the end. Before using this product, understand how to correctly use it. If you read the manuals but you do not understand how to use it, ask us or your local dealer. After you read the manuals, save it so that you can read it anytime as required.

■ Pictorial indication

The manuals and product show the warning and caution items required to safely use the product. The following pictorial indication is provided.

Pictorial indication	
	Some part of this product or the manuals may show this pictorial indication. In this case, if the product is incorrectly used in that part, a serious danger may be brought about on the user's body or the product. To use the part with this pictorial indication, be sure to refer to the manuals.
 	If you use the product, ignoring this indication, you may get killed or seriously injured. This indication shows that the warning item to avoid the danger is provided. If you incorrectly use the product, ignoring this indication, you may get slightly injured or the product may be damaged. This indication shows that the caution item to avoid the danger is provided.

Please be informed that we are not responsible for any damages to the user or to the third person, arising from malfunctions or other failures due to wrong use of the product or incorrect operation, except such responsibility for damages as required by law.

USING THE PRODUCT SAFELY



■ Do not remove the product's covers and panels

Never remove the product's covers and panels for any purpose. Otherwise, the user's electric shock or fire may be incurred.

■ Warning on using the product

Warning items given below are to avoid danger to user's body and life and avoid the damage or deterioration of the product. Use the product, observing the following warning and caution items.

■ Warning items on power supply

● Power supply voltage

The rated power supply voltages of the product are 100, 120, 220 and 240VAC. The rated power supply voltage for each product should be confirmed by reading the label attached on the back of the product or by the "rated" column shown in the instruction manual. The specification of power cord attached to the products is rated to 125VAC for all products which are designed to be used in the areas where commercial power supply voltage is not higher than 125VAC. Accordingly, you must change the power cord if you want to use the product at the power supply voltage higher than 125VAC. If you use the product without changing power cord to 250VAC rated one, electric shock or fire may be caused. When you used the product equipped with power supply voltage switching system, please refer to the corresponding chapter in the instruction manuals of each product.

● Power cord

(IMPORTANT) The attached power cord set can be used for this device only.

If the attached power cord is damaged, stop using the product and call us or your local dealer. If the power cord is used without the damage being removed, an electric shock or fire may be caused.

● Protective fuse

If an input protective fuse is blown, the product does not operate. For a product with external fuse holder, the fuse may be replaced. As for how to replace the fuse, refer to the corresponding chapter in the instruction manual. If no fuse replacement procedures are indicated, the user is not permitted to replace it. In such case, keep the case closed and consult us or your local dealer. If the fuse is incorrectly replaced, a fire may occur.

USING THE PRODUCT SAFELY

■ **Warning item on Grounding**

If the product has the GND terminal on the front or rear panel surface, be sure to ground the product to safely use it.

■ **Warnings on Installation environment**

● **Operating temperature and humidity**

Use the product within the operating temperature indicated in the “rating” temperature column. If the product is used with the vents of the product blocked or in high ambient temperatures, a fire may occur. Use the product within the operating humidity indicated in the “rating” humidity column. Watch out for condensation by a sharp humidity change such as transfer to a room with a different humidity. Also, do not operate the product with wet hands. Otherwise, an electric shock or fire may occur.

● **Use in gas**

Use in and around a place where an inflammable or explosive gas or steam is generated or stored may result in an explosion and fire. Do not operate the product in such an environment. Also, use in and around a place where a corrosive gas is generated or spreading causes a serious damage to the product. Do not operate the product in such an environment.

● **Installation place**

Do not insert metal and inflammable materials into the product from its vent and spill water on it. Otherwise, electric shock or fire may occur.

■ **Do not let foreign matter in**

Do not insert metal and inflammable materials into the product from its vent and spill water on it. Otherwise, electric shock or fire may occur.

■ **Warning item on abnormality while in use**

If smoke or fire is generated from the product while in use, stop using the product, turn off the switch, and remove the power cord plug from the outlet. After confirming that no other devices catch fire, ask us or your local dealer.

USING THE PRODUCT SAFELY

■ **Input / Output terminals**

Maximum input to terminal is specified to prevent the product from being damaged. Do not supply input, exceeding the specifications that are indicated in the "Rating" column in the instruction manual of the product. Also, do not supply power to the output terminals from the outside. Otherwise, a product failure is caused.

■ **Calibration**

Although the performance and specifications of the product are checked under strict quality control during shipment from the factory, they may be deviated more or less by deterioration of parts due to their aging or others.

It is recommended to periodically calibrate the product so that it is used with its performance and specifications stable. For consultation about the product calibration, ask us or your local dealer.

■ **Daily Maintenance**

When you clean off the dirt of the product covers, panels, and knobs, avoid solvents such as thinner and benzene. Otherwise, the paint may peel off or resin surface may be affected. To wipe off the covers, panels, and knobs, use a soft cloth with neutral detergent in it.

During cleaning, be careful that water, detergents, or other foreign matters do not get into the product.

If a liquid or metal gets into the product, an electric shock and fire are caused.

During cleaning, remove the power cord plug from the outlet.

Use the product correctly and safely, observing the above warning and caution items. Because the instruction manual indicates caution items even in individual items, observe those caution items to correctly use the product.

If you have questions or comments about the manuals, ask us or E-Mail us.

1. GENERAL

The PD-AD series are compact DC power supplies regulated by phase control. They have sufficient reliability and accurate electrical characteristics and are suitable for research, experiments, aging of many hours, and for control, etc. They are provided also with means of protection and remote control. They are designed totally for the ease of use.

2. FEATURES

- The size is compact owing to the built-in phase-controlled preregulator.
- Characteristics of voltage regulation and against noises including ripples are very good.
- Both voltage and current vary little with temperature.
- The output voltage and output current may be changeable in small steps with a potentiometer turnable as many as ten positions.
- The V / I CHECK switch provided permits to check the preset values of voltage and current even during operation.
- The OUTPUT switch turns on and off the output.
- The use of the external contact allows the output to be turned on and off from outside.
- Protection is complete from overvoltage, overcurrent, and excessive temperature rise. The OVP CHECK function provided permits to preset the overvoltage protection level and check the preset level during operation.
- Master / slave control is possible by series and parallel connections.
- The output voltage and current may be remote-controlled using an external resistance or external signals.
- Rapid transient characteristics are good.

3. SPECIFICATION

Model PD	PD18-10AD	PD18-20AD	PD18-30AD	PD36-10AD	PD36-20AD	PD56-6AD	PD56-10AD	PD110-3AD	PD110-5AD
Output									
Output voltage 10-positions	0 to 18V			0 to 36V		0 to 56V		0 to 110V	
Resolution (theoretical)	3.1mV			6.2mV		9.6mV		18.7mV	
Output current 10-positions	0 to 10A	0 to 20A	0 to 30A	0 to 10A	0 to 20A	0 to 6A	0 to 10A	0 to 3A	0 to 5A
Resolution (theoretical)	1.7mA	3.4mA	5.1mA	1.7mA	3.4mA	1.02mA	1.7mA	0.51mA	0.85mA
Constant –voltage characteristics (CV)									
Input regulation *1 (for AC± 10% fluctuation)	0.005%+1mV								
Load regulation *1 (for 0 to 100% fluctuation)	0.005%+1mV	0.005%+2mV		0.005%+1mV	0.005%+2mV	0.005%+1mV	0.005%+2mV	0.005%+1mV	
Ripples / noises *2 (10Hz to 1MHz) rms	0.5mVrms								1mVrms
Transient response (standard value)	50 μ sec (Typical)	100 μ sec(Typical)		50 μ sec (Typical)	100 μ sec (Typical)	50 μ sec(Typical)			
Temperature characteristics (standard value)	100PPM/°C (Typical)								
Remote control resistance/voltage	Approx. 0 to 10k Ω / 0 to 10V								
Constant-current characteristics (CC)									
Input regulation *1 (for AC± 10% fluctuation)	1mA	5mA		1mA	5mA	1mA	3mA	1mA	
Load regulation *1 (for 0 to 100% fluctuation)	5mA								
Ripples / noises *2 (10Hz to 1MHz) rms	3mArms	10mArms		3mArms	10mArms	2mArms	3mArms	1mArms	
Remote control resistance/voltage	Approx. 0 to 10k Ω / 0 to 10V								

Model PD	PD18-10AD	PD18-20AD	PD18-30AD	PD36-10AD	PD36-20AD	PD56-6AD	PD56-10AD	PD110-3AD	PD110-5AD
Protection									
Operation	Turn off power switch								
Temperature detection	100°C								
Overvoltage protection level (standard value)	15 to 110% of rated output voltage								
Input fuse (at AC 100V)	7A	15A	20A	12A	20A	10A	15A	10A	15A
Meter and indications									
D type	Voltage at digital display (Auto range)	3-1/2 digits 19.99V, 199.9V, (F.S) two ranges $\pm (0.1\%rdg + 1 \text{ digit}) 23^{\circ}\text{C} \pm 5^{\circ}\text{C}$, Less than 80% RH							
	Current at digital display (Fix, range)	3-1/2 digits 19.99A, (F.S) $\pm (0.5\%rdg + 1 \text{ digit}) 23^{\circ}\text{C} \pm 5^{\circ}\text{C}$, Less than 80% RH	3 digits 99.9A(F.S), $\pm (0.5\%rdg + 1 \text{ digit}) 23^{\circ}\text{C} \pm 5^{\circ}\text{C}$, Less than 80% RH	3-1/2 digits 19.99A (F.S) $\pm (0.5\%rdg + 1 \text{ digit}) 23^{\circ}\text{C} \pm 5^{\circ}\text{C}$, Less than 80% RH	3 digits 99.9A(F.S), $\pm (0.5\%rdg + 1 \text{ digit}) 23^{\circ}\text{C} \pm 5^{\circ}\text{C}$, Less than 80% RH	3-1/2 digits 19.99A, (F.S) $\pm (0.5\%rdg + 1 \text{ digit}) 23^{\circ}\text{C} \pm 5^{\circ}\text{C}$, Less than 80% RH			
Indication of constant Voltage operation	CV green LED lights								
Indication of constant Current operation	CC red LED lights								
Indication of output	OUTPUT red LED lights when turned on								
Function									
Output switch	Turns on and off output								
Voltage/current check switch	Preset voltage and current indicated with meters during on time								
Overvoltage protection (OVP) preset	Indicates the over voltage protection level on the voltmeters during on time								
Remote sensing	Via the rear panel sensor terminal								

Model PD	PD18-10AD	PD18-20AD	PD18-30AD	PD36-10AD	PD36-20AD	PD56-6AD	PD56-10AD	PD110-3AD	PD110-5AD
Series control	Master / slave control								
Parallel control	Master / slave control								
Operating conditions									
Temperature	0°C to 40°C								
Humidity	Less than 80%								
Cooling	Fan								
Output polarity	Positive or negative side grounded								
Withstand voltage to ground	± 250VDC								
Insulation resistance									
Chassis – input line	30MΩ or more at 500VDC								
Chassis – output line	20MΩ or more at 500VDC								
Power supply									
Input voltage	AC100V/120V/200V/220V/240V ± 10% (Max. 250VAC) 50/60Hz 1 φ								
Power consumption (at AC 100V)	Approx. 360W	Approx. 620W	Approx. 1kW	Approx. 560W	Approx. 1kW	Approx. 500W	Approx. 800W	Approx. 500W	Approx. 800W
	Approx. 530VA	Approx. 1kVA	Approx. 1.5kVA	Approx. 830VA	Approx. 1.6kVA	Approx. 800VA	Approx. 1250VA	Approx. 800VA	Approx. 1250VA
Dimension and weight									
Enclosure Dimensions (mm)	(W)	208							
	(H)	147							
	(D)	300	420	457	300	420	300	348	300

Model PD		PD18-10AD	PD18-20AD	PD18-30AD	PD36-10AD	PD36-20AD	PD56-6AD	PD56-10AD	PD110-3AD	PD110-5AD
Maximum Dimensions (mm)	(W)	208								
	(H)	168								
	(D) (including power input connector)	346 (355)	483 (486)	520 (523)	346 (361)	483 (486)	346 (361)	394 (409)	346 (361)	394 (409)
Weigh		Approx. 13kg	Approx. 19kg	Approx. 24kg	Approx. 14kg	Approx. 23kg	Approx. 14kg	Approx. 18kg	Approx. 14kg	Approx. 18kg
Accessories										
Instruction manual		CD-ROM								
Input power code	100V,120V area	2 or 3-core AC cable(2m)	2 or 3-core AC cable(2 or 2.5m)							
	200V,220V,240V area	3-core AC cable(2m)	3-core AC cable(2.5m)	3-core AC cable(2m)	3-core AC cable(2.5m)	3-core AC cable(2m)				
Connector retainer	100V,120V area	None	1	1	1	1	1	1	1	1
	200V,220V,240V area	None	None	1	None	1	None	None	None	None
Replacement fuse	100V,120V area	7A×1	None	None	12A×1	None	10A×1	15A×1	10A×1	15A×1
	200V,220V,240V area	4A×1	None	None	6A×1	None	5A×1	8A×1	5A×1	8A×1

* 1 Measured via the sensing terminal.

* 2 Measured with plus or minus grounded.

■ Circuit and ratings are subject to change to without notice to developments in technology.

4. PRECAUTION FOR USE



Never detach the case or panel from this product. Detaching the case or panel may cause damages to this product or electrocution or other dangerous accidents to the use.

1) CHECKING INPUT VOLTAGE

- ① Keep the permitted range of input voltage. Single phase, 100/120/200/220/240 V AC, $\pm 10\%$, 50/60 Hz.
- ② The rated input voltage of this product is adjusted before shipment. It cannot be changed by the user.
If it is necessary to change the rated input voltage of this product, please contact your dealer or our distributor.
- ③ Each model having the rated output not less than 20 A has a built-in protection fuse. The user cannot replace the fuse in a model having 20 A or more output rating. If the fuse blows out and needs to be replaced, please contact your dealer or our distributor.

2) POWER CORD CONNECTION

Some models have a connector retainer on the AC cord connector to hold the cord from slipping off.

For safe operation, be sure the retainer is locked.

PD18-30AD, PD36-20AD are cannot connect with a commercial AC power inlet because those current ratings are larger than same of the AC power source.

Process the attached unterminated cord shown below and connect it to an appropriate AC power source.

In that case, wiring work must be done by either an electric engineer or a qualified person.

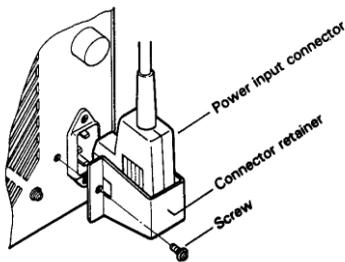
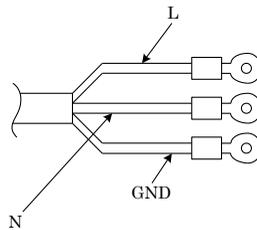


Fig. 1



	L	N	GND
1	BLACK	WHITE	GREEN
2	BROWN	BLUE	GREEN/YELLOW

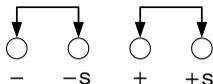
* The color combination is ether item 1 or item 2.



1) OUTPUT CONNECTION

- Make sure that the rear-panel output terminals and control terminals are connected with jumpers as shown Fig. 2.

Output terminals of rear panel



Control terminals

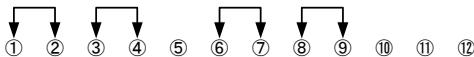


Fig . 2

- ② The output lines are floating. Connect either of the front-panel output terminals to GND normally with short bar.

2) ENVIRONMENTAL CONDITIONS

- ① Keep the operating temperature range of 0°C to 40°C. If the ambient temperature rises excessively, the device's protection system works and cuts off power.
- ② Keep clear the ventilation openings (at sides and bottom) and the passage of fan air. Install any other devices more than 30 cm apart from those openings.
- ③ Avoid to install the power supply in a dusty place and where there are much corrosive gases.
- ④ Avoid to install sensitive instruments on and beside the power supply.

3) Replacing Fuse

The PD-AD power supply unit will not run if the fuse blows out.

Some models are supplied with spare fuses, in addition to the fuses built in the units.
(Models of rated outputs below 10 A)

The PD-AD power supply unit employs a special fuse filled with anti-arc agent (quartz sand). If the spare fuses also blows out, do not try to replace it by yourself. Please contact your dealer or our distributor.

A model of 20 A or more rating is not supplied with a spare fuse. The built-in fuse cannot be replaced without opening the case. Trial to replace the fuse by yourself may result in electrocution or fire. If the fuse should be replaced, be sure to contact your dealer or our distributor.

5. CONTROLS AND INDICATORS

5-1. FRONT PANEL

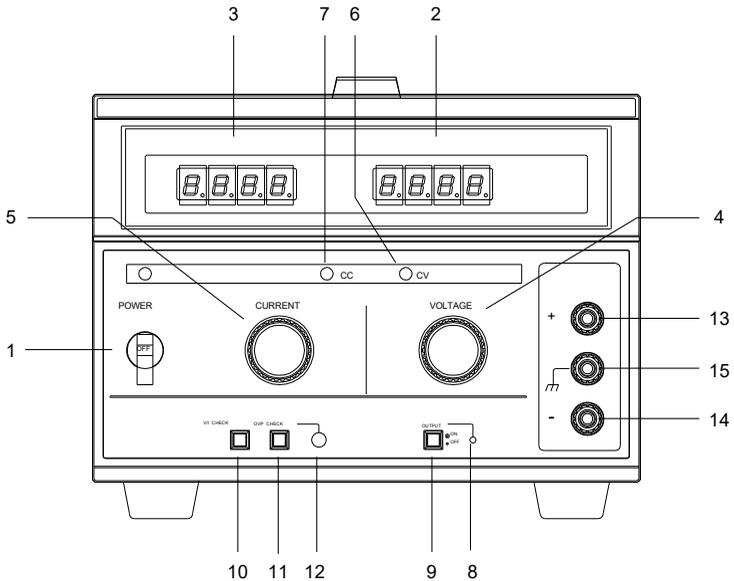


Fig. 3

1 POWER switch

When turned on, the indicators POWER and either of CC and CV light.

The power switch is automatically cut off when protection (overvoltage/ Overcurrent / temperature) has operated.

2 Voltmeter

Indicates the output voltage or the preset voltage.

3 Ammeter

Indicates the output current or the preset current.

4 VOLTAGE

Control that presets voltage for constant-voltage operation.

Turn it clockwise to raise the output voltage.

5 CURRENT

Control that presets current for constant-current operation.

Turn it clockwise to increases the output current.

6 CV indicator

Indicates during constant-voltage operation.

7 CC indicator

Indicates during constant-current operation.

8 OUTPUT indicator

Red LED indicates when the output is on. The preset voltage is available at the output terminals when this indicator is on.

9 OUTPUT switch

Output switch (contactless) that turns on and off the output electrically.

When the output is on, the OUTPUT indicator 8 lights and the voltage the voltmeter is reading is output at the output terminals and the ammeter reads the current.

10 V/I CHECK

Voltage/current check switch. As long as this switch is depressed, the voltmeter reads the preset voltage and the ammeter the preset current so that you may preset voltage and current. To check the preset voltage and current, depress this switch when the OUTPUT switch is on.

11 OVP CHECK

Overvoltage protection level check switch. Depress this switch and the voltmeter reads the preset overvoltage protection level so that you may preset the level with the OVP adjuster 12.

12 OVP adj. control

Semi-fixed adjustment control permitting to preset the overvoltage protection level.

13 Output terminal (+)

Positive output terminal (red).

14 Output terminal (-)

Negative output terminal (white).

15 GND

Ground terminal connected to the frame. This is connected also to the output terminal (-) normally.

5-2. REAR PANEL

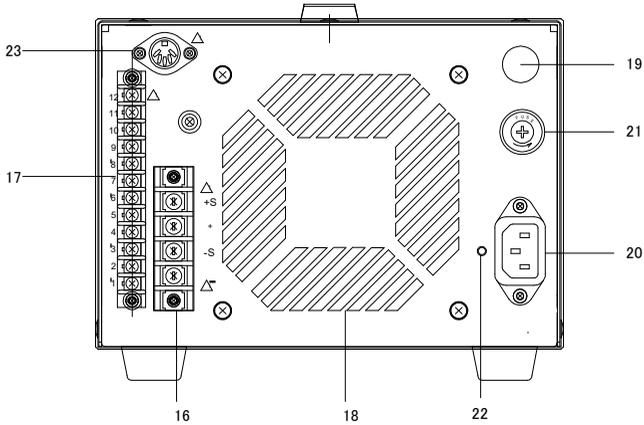


Fig. 4

16 Output terminal

(\pm) output terminals and (\pm) sensor terminals.

17 Control terminals

Terminals for remote control and series/parallel operation.

18 Fan

Forced air cooled fan. Keep it apart from walls more than 30 cm.

19 Cap

Cap of the fuse holder.

20 AC input terminals

Input terminals of power supply. Connect the AC cord provided.

21 Fuse holder

(A model having 20 A or 30 A output rating is not fitted with a fuse holder.

It has a blind cap, instead of the fuse holder.)

Input fuse holder of power supply.

22 Hole for mounting the retainer of power input connector.

23 External control terminal (Output ON/OFF terminal)

Input external contact signals for turning on and off the output of this product into this terminal.

6. OPERATION

6-1. As a Constant-Voltage Power Supply

- 1) Check the rated input voltage, then connect the power cord.
- 2) Turn the voltage adjuster knob (VOLTAGE) fully counter-clockwise.
- 3) Turn on the power switch. The POWER (red) indicator light and the device is operated.
Make sure the OUTPUT switch is off (the indicator is out).
- 4) Set a desired voltage with the voltage adjuster knob (VOLTAGE). No voltage develops at the output terminals still.
- 5) Set a current limit.
Keeping the V/I CHECK switch depressed, set a desired limit of output current with the current adjuster knob (CURRENT).
- 6) Turn on output
Turn on the OUTPUT switch, and the preset voltage is output at the output terminals with the output indicator lit.

Note 1 : If excessive current flows as when the load is shorted, the device performs constant-current operation at the preset limit of output current and the output voltage falls.

Note 2 : If the overvoltage protection level is set lower than the preset level of output voltage, the power switch will be turned off by overvoltage protection.
See how to set overvoltage protection.

6-2. As a Constant-Current Power Supply

- 1) Check the rated input voltage, then connect the power cord.
- 2) Turn the current adjuster knob (CURRENT) fully counter-clockwise.
- 3) Turn on the power switch. The POWER (red) indicator lights and the device is in constant-current mode. Make sure that the OUTPUT switch is off (the indicator is out)
- 4) Set a desired current.
Keeping the V/I CHECK switch depressed, set a desired constant current with the current adjuster knob (CURRENT).
- 5) Set a voltage limit.
Set a desired voltage limit with the voltage adjuster knob (VOLTAGE). It is the overvoltage protection level.

6) Turn on output.

Turn on the OUTPUT switch, and the output indicator lights and the power is output through the output terminals.

Note : If it is not preferable to apply current suddenly like to a large inductance load, turn the current adjuster knob (CURRENT) fully counterclockwise and increase current gradually after turning on the output.

6-3. How to Check Voltage and Current

1) Voltage/Current presetting

When the V/I CHECK switch is depressed, the constant-voltage is indicated on the voltmeter and constant current is indicated on the current meter.

Hereupon, it is possible to set a desired voltage or current with the voltage adjuster knob (VOLTAGE) or current adjuster knob (CURRENT).

2) Voltage/Current check

When the V/I CHECK switch is depressed at constant-current operation, the preset current and the preset voltage can be checked.

6-4. How to Set Overvoltage Protection (OVP) Level

Keeping the OVP CHECK switch depressed, the overvoltage protection level indicated on the voltmeter.

1) Turn off the OUTPUT switch.

2) Keeping the OVP CHECK switch depressed, screw the OVP adjuster with a screwdriver and set an overvoltage protection level.

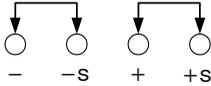
3) Turn on the OUTPUT switch with no load connected (the indicator lights). Raising the output voltage gradually, check if the power switch turns off at the preset overvoltage protection level.

4) Set the overvoltage protection level at the maximum reading or the output voltmeter if overvoltage protection is not necessary.

7. APPLICATION

7-1. Use of Rear-Panel Terminals

Rear-panel output control



Control terminals

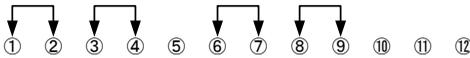


Fig. 5

The output and control terminals shown above are equipped on the rear panel. These terminals may be used to perform remote sensing, remote control of output voltage and output current, master/slave control operation with power supply connected in series or parallel.

7-2. Remote Sensing

When the device is connected to a load, voltage drops due to contact resistance at the output terminals and resistance of conductors. Remote sensing is performed to compensate for the voltage drop.

- 1) Turn off power.
- 2) Remove the short bars (+)–(+S) and (–)–(–S).
- 3) Connect (+S) and (–S) to the load. Use a two-core shield cable for these sensing lines and connect the shield line to (+) output.
- 4) (+) and (–) may be taken out from the output terminals on the panel or directly connected to the load from the (+) and (–) terminals of the rear panel. Voltage drop of up to 1.2V per way of the output line may be compensated for. If the voltage drop is larger than 0.5V, the maximum rated voltage drops accordingly.

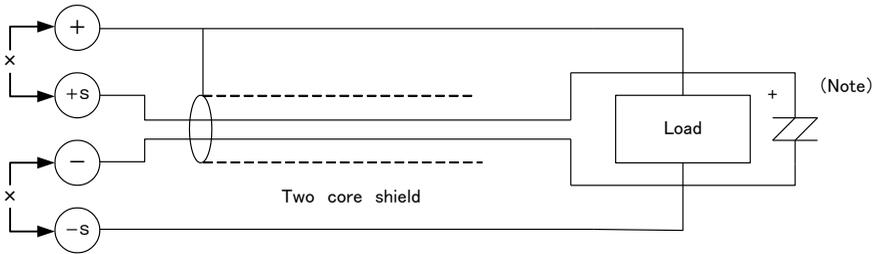


Fig. 6

Note : If the load is remote, oscillation might happen due to inductance and capacitance of the output line. In such a case, connect an electrolytic capacitor of some 100 μ F in parallel with the load as shown above.

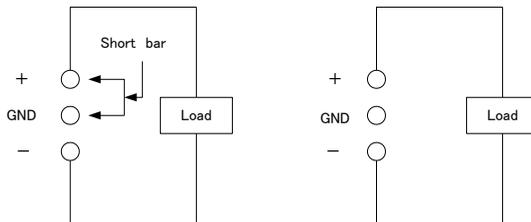
7-3. Remote Control of Constant-voltage (Resistance, voltage)

----- Precautions When Using Remote Control -----

This unit adopts the floating circuit system. It has terminals isolated from the frame and controls output power on the basis of the positive (+) output terminal.

To control the constant voltage and constant current settings using external voltage, connect the positive (+) output terminal and GND terminal on the front panel as follows.

The GND and positive (+) terminals should be connected with the short bar (as shown above) or open (as shown below) :



Note : In case of output voltage or current control by external voltage, the negative side of the external voltage line is connected to the (+S) terminal (GND level of the analog control circuit inside of the unit) side.

Use floated external voltage circuit from any conductive materials against output potential of the main unit in a floating condition to prevent accidents or malfunctioning. In case of using plural number of power supplies with external controllers, each unit should be floated independently.

7-3-1. Control by resistance (I)

It is possible to output voltage which is proportional to resistance.

- 1) Turn off power.
- 2) Remove the short bar ①—②.
- 3) Connect variable resistor R_1 (10k ohms) across 1 and 3 as shown Fig. 7.

Note : R_1 must be 10k ohms. Use a two-core shield cable and connect the shield line to ⑤. For R_1 select one which will be affected little by temperature changes, aging effects, and noises.

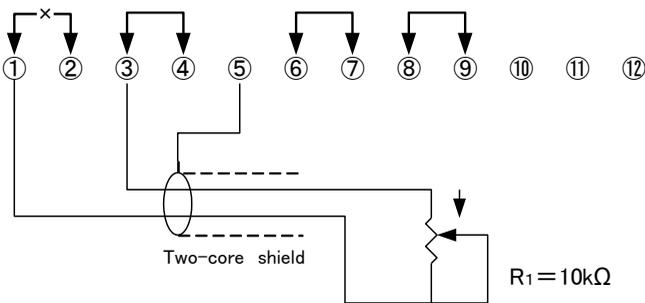


Fig. 7

Output voltage $V_0 \doteq \frac{V_{max}}{10} \times R_1$ [V]

$(R_1 \leq 10k\Omega)$

V_0 [V] : Output voltage

V_{max} [V] : Maximum rated output voltage

R_1 [kΩ] : External resistance

7-3-2. Control by resistance (II)

It is possible to output voltage which is inversely proportional to resistance. Overshoot does not occur when switching resistance.

- 1) Turn off power.
- 2) Remove the short bar ③—④ and connect variable resistor R_2 across ③ and ④ as shown Fig. 8. Use a two-core shield cable and connect the shield line to ⑤.

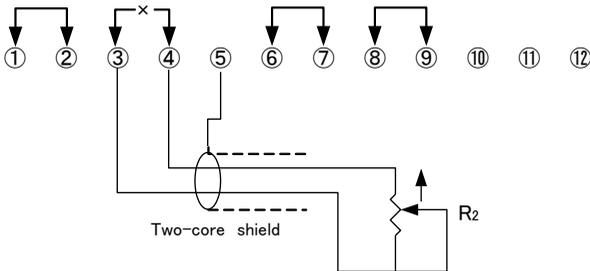


Fig. 8

$$\text{Output voltage } V_0 \doteq \frac{R_f}{R_s + R_2} \times V_{\text{ref}} \text{ [V]}$$

V_{ref} : Reference voltage (approx. 0 to 10V)

Set with the voltage control of the panel.

R_2 : $0 \leq R_2 \leq \infty$

R_s, R_f : Constants depending on model.

Rated output voltage

	R_s	R_f
18 V	10k Ω	18k Ω
36 V	10k Ω	36k Ω
56 V	10k Ω	56k Ω
110 V	10k Ω	110k Ω

Note 1 : The output voltage is determined with R_2 and R_{ref} as given above. The output voltage is 0V if R_2 is infinite (open). Set V_{ref} with the voltage control provided on the panel. To fix it or set it externally, connect a 10k ohm resistor which has a good temperature characteristic across ① and ③ according to “Control by resistance (I)”. The voltage control of the panel is now ineffective.

Note 2 : Be sure to adjust the output voltage at OUTPUT ON mode. In OUTPUT OFF or V/I CHECK mode, there is a slight error in meter reading.

7-3-3. Control by external voltage

It is possible to output voltage which is proportional to voltage.

- 1) Turn off power.
- 2) Remove the short bar ③—④ and connect external voltage V_1 across ④ and ⑤ as shown Fig. 9. Be very careful about the polarity.

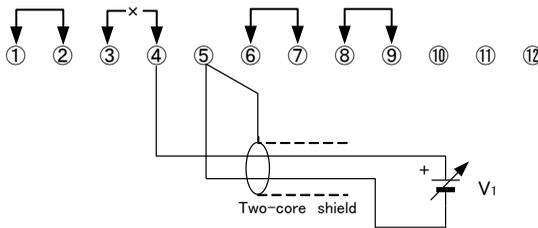


Fig. 9

Note : The external signal voltage should be 0 to 10V. The input impedance across ④ and ⑤ is approximately 10k ohms. Use a two-core shield cable and connect the shield line to ⑤.

$$V_0 \doteq \frac{V_{max}}{10} \times V_1 [V]$$

$$(0 \leq V_1 \leq 10V)$$

$V_0 [V]$: Output voltage

$V_1 [V]$: External signal voltage

$V_{max} [V]$: Maximum rated output voltage

7-4. Remote Control of Constant Current (Resistance, Voltage)

Refer to the “PRECAUTIONS WHEN USING REMOTE CONTROL” under “REMOTE CONTROL OF CONSTANT-VOLTAGE”

7-4-1. Control by resistance

Control of constant-current is possible in proportion with resistance.

- 1) Turn off power.
- 2) Remove the short bar ⑥—⑦.
- 3) Connect variable resistor R_3 ($10k\Omega$) across ⑥ and ⑧ as shown Fig. 10.

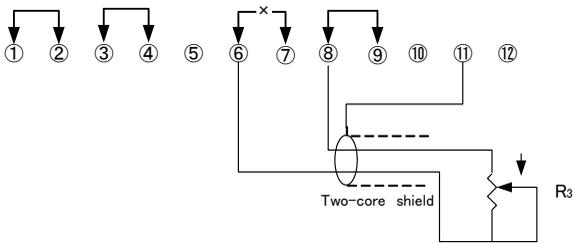


Fig. 10

Output current $I_0 \doteq \frac{I_{max}}{10} \times R_3$ [A]

$(R_3 \leq 10k\Omega)$

I_0 [A] : Output current

I_{max} [A] : Maximum rated current

R_3 [k Ω] : External resistance

Note : R_3 must be $10k\Omega$ or less ($R_3 \leq 10k\Omega$). Use a two-core shield cable and connect the shield line to ⑪.

7-4-2. Control by external voltage

It is possible to control constant current in proportion to voltage.

- 1) Turn off power.
- 2) Remove the short bar ⑧—⑨ and connect external voltage V_2 across ⑨ and ⑪ as shown Fig. 11. Be very careful about the polarity.

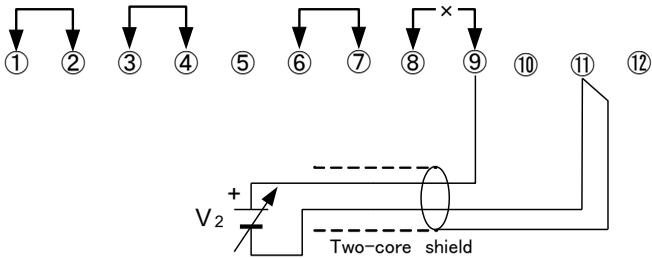


Fig. 11

$$I_0 \doteq \frac{I_{\max}}{10} \times V_2 \text{ [A]}$$

$$(0 \leq V_2 \leq 10\text{V})$$

I_0 [A] : Output current

I_{\max} [A] : Maximum rated current

V_2 [V] : External signal voltage

Note : The external signal voltage should be 0 to 10V. The input impedance across ⑨ and ⑪ is approximately 10k ohms. Use a two-core shield cable and connect the shield line to ⑪.

7-5. Series/Parallel Connection Operation

With some units connected in series or in parallel, it is possible to control all units with one unit taken as the master and the other as slaves.

7-5-1. Series connection

The output voltage is the sum of the output voltages of the units. The output voltage and current of each slave unit are controllable with the constant-voltage and constant-current controls of the master unit.

- 1) Turn off power.
- 2) Remove the short bar ③—④ of each slave unit.
- 3) Connect external resistor R as shown Fig. 12.
- 4) Ground the GND terminal either of the master unit if the positive line is grounded or of the last slave unit if the negative line is grounded. (The output connection diagram shown the negative line grounded.)

Connect of control terminals

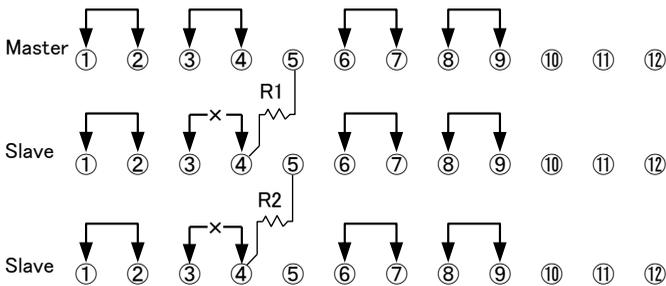


Fig. 12

Output connection

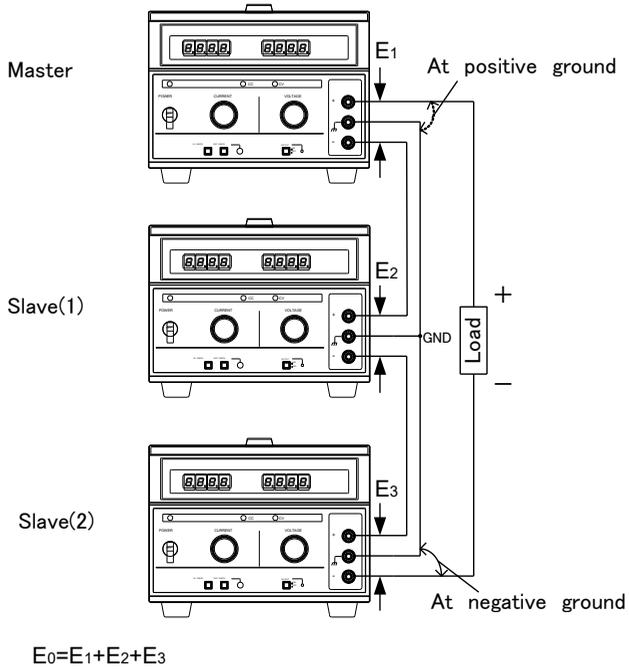


Fig. 13

* Set the current controls of all slave units at maximum position.

7-5-2. How to determine external resistance R₁ and R₂.

$$R_1 \doteq \frac{E_1}{E_2} \times R_f - R_s [\text{k}\Omega]$$

E₁ [V] : Output voltage of master

E₂ [V] : Output voltage of slave ① when master's output voltage is E₁

R_s, R_f : Slave ①'s constants depending on model.

Rated output voltage

	R _s	R _f
18 V	10kΩ	18kΩ
36 V	10kΩ	36kΩ
56 V	10kΩ	56kΩ
110 V	10kΩ	110kΩ

To obtain R₂, replace E₁ and E₂ with E₃ in the above equation.

Now, master unit controls slave unit 1 and slave unit 1 controls slave unit 2.

Maximum voltage during series operation does not exceed rating of the withstand voltage to ground. Be careful about the power ratings of R₁ and R₂ and use ones having a good temperature characteristic.

$$\text{Power rating [W]} = \left(\frac{E_1}{R_1 + R_s} \right)^2 \times R_1$$

For remote sensing during series operation, use the (+S) terminal of the master with the (+) sensor or the (-S) terminal of the last slave with the (-) sensor (refer to the section of remote sensing).

7-5-3. Parallel connection

The output current is the sum of the output currents of the units. The output voltage and current of each slave unit are controllable with the constant-voltage and constant-current controls of the master unit.

- 1) Turn off power.
- 2) Remove the short bar ⑧—⑨ of each slave unit.

- 3) Connect the master and slave units as shown Fig. 15.
- 4) Make connection between each unit and load with a cable of the same length.
- 5) Ground the GND terminal of the master unit's panel. (The output connection diagram shows the negative line grounded.)

Connect of control terminal

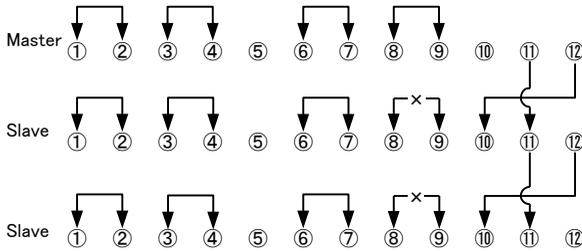


Fig. 14

Output connection

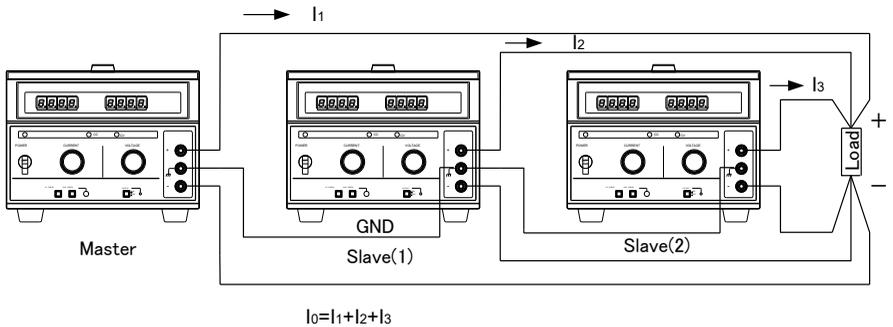


Fig. 15

* Set the voltage controls of all slave units at maximum position.

The master unit performs constant-voltage operation (CV) and the slave units constant-current operation (CC).

For remote sensing during parallel operation, make connection from the (+S) and (-S) terminals of the master (refer to the section of remote sensing).

With the rated output voltage is less than 10V, this connection is not possible.

Note : For connection of the parallel operation with different models, consult agent and our distributor.

7-6. Constant-Current Charging/Discharging of Battery

7-6-1. Constant-current charging

It is possible to charge a battery or capacitor automatically with a charging current or a final voltage preset.

- 1) Keeping the V/I CHECK switch depressed, set the final charging voltage with the constant-voltage control and the charging current with the constant-current control.
- 2) Close switch S1, and constant-current charging starts and continues until the final voltage is reached.

Output switch

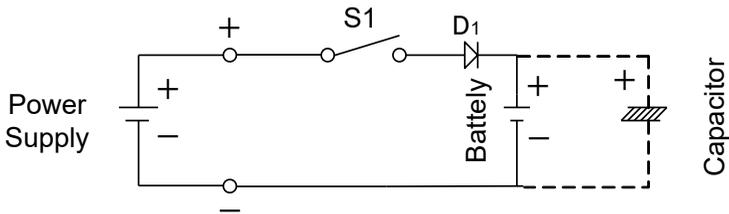


Fig. 16

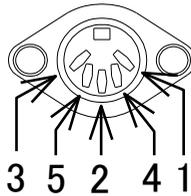
Note 1 : Be sure to equalize the polarity of the supply power and battery.

Note 2 : Current would flow back into the power source if the supply voltage is lower than the battery voltage, the OUTPUT switch is off, or power supply is turned off. In this case reconnect diode D₁ in the forward direction.

7-7. Turning On and Off the Output Using External Contact Signals

- 1) Set the OUTPUT selector switch on the front panel to OFF.
Short-circuit the DIN connector pins 1 and 4 in the upper left of the rear panel.
- 2) Set the OUTPUT switch to ON. The output of this product is turned off.
- 3) In the condition established in 2) above, open the DIN connector pins 1 and 4. The output of this product is turned on.

Note 1 : The DIN connector pins are electrically connected to the positive output terminal. Thus, be sure to use them in the float condition.



Note 2 : A 7-pin connector cable for connecting the GP-IB adapter <GP-600B> cannot be connected to the 5-pin connector shown above. To turn on add off the output or make interruptions in the CV/CC mode or power off mode, the external I/O unit <OP-18-PD> need be installed.

(The OP-18-PD is a factory option, since the PD-A power supply unit need be remade internally to install the OP-18-PD.)

Note 3 : If the external I/O unit <OP-18-PD> is installed on the PD-A power supply unit, the above-shown connector is changed into the 7-pin DIN connector exclusive for the <GP-600B>. Thus, the output cannot be turned on or off using the external contact signals.

8. OPTIONAL ACCESSORIES

- 1) Rack mount adapter----- RK-601
- 2) GP-IB adapter ----- GP-600B

9. MAINTENANCE



Replacing Fuse

The PD-A power supply unit will not run if the fuse blows out.

Some models are supplied with spare fuses, in addition to the fuses built in the units.
(Models of rated outputs below 10A)

The PD-A power supply unit employs a special fuse filled with anti-arc agent (quartz sand). If the spare fuses also blows out, do not try to replace it by yourself. Please contact your dealer or our distributor.

A model of 20A or more rating is not supplied with a spare fuse. The built-in fuse cannot be replaced without opening the case. Trial to replace the fuse by yourself may result in electrocution or fire. If the fuse should be replaced, be sure to contact your dealer or our distributor.

10. TROUBLESHOOTING

Check as noted below if there is anything wrong.

If the trouble cannot be correct, call the dealer.

Sympton	Check	Cause
Power switch does not turn on.	<ul style="list-style-type: none"> * Power lamp not lit. * Short bar coming off. * Overvoltage protection worked. 	<ul style="list-style-type: none"> * Power cord disconnected or connected defectively. * Input switch defective. * Input fuse blown. * Rear-panel short bar disconnected or loose. * Voltage set too low.
Output voltage is zero or low.	<ul style="list-style-type: none"> * Short bar coming off. * Constant-voltage/current Lamps do not switch. * Ammeter deflects with output off. * Oscillating 	<ul style="list-style-type: none"> * Short bar installed defectively. * Circuit defective. * Output diode broken. * Oscillation by remote sensing.
Output is excessive.	<ul style="list-style-type: none"> * Short bar coming off. * Output voltage/current do not fall. 	<ul style="list-style-type: none"> * Short bars 1 – 2 and 6 – 7 come off. * Power transistor or control circuit defective.
Output is not steady.	<ul style="list-style-type: none"> * Short bar coming off. * Input voltage wrong. * Oscillating * Sensing terminal floating. * Strong magnetic/electric fields near-by. * Other 	<ul style="list-style-type: none"> * Short bar installed defectively. * Out of the rated input voltage range. * Oscillation by special load. * Proper connection of sensing terminal. * Keep away from oscillation sources.

11. DIMENSIONS

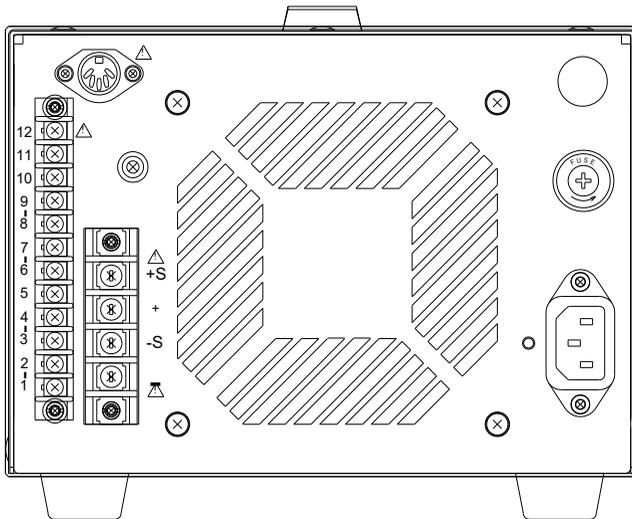
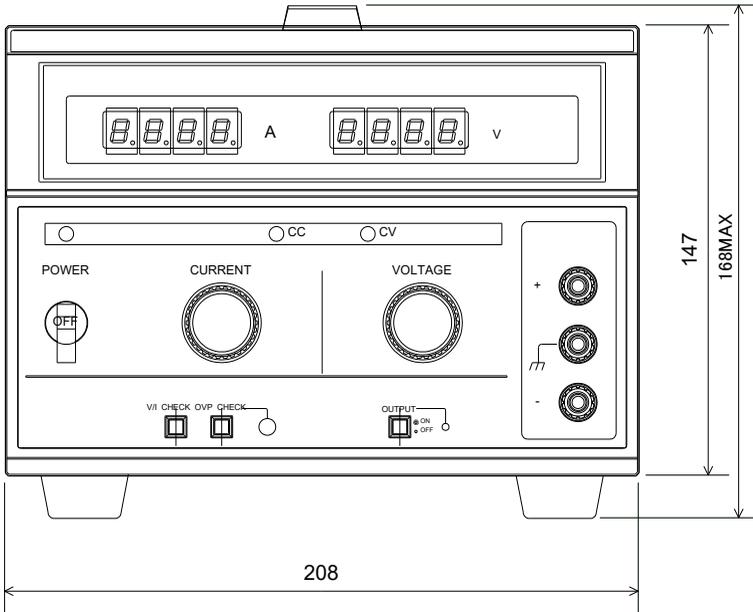


Fig. 17

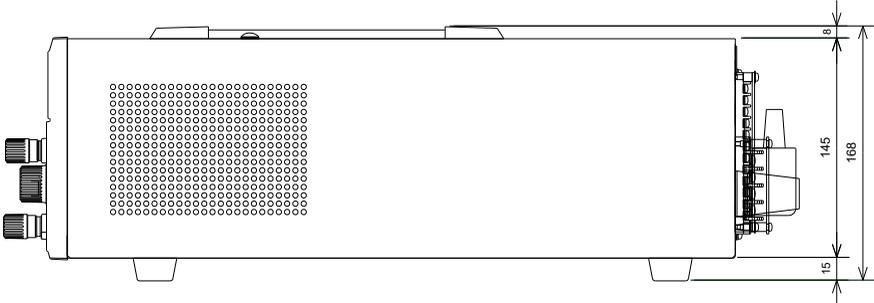
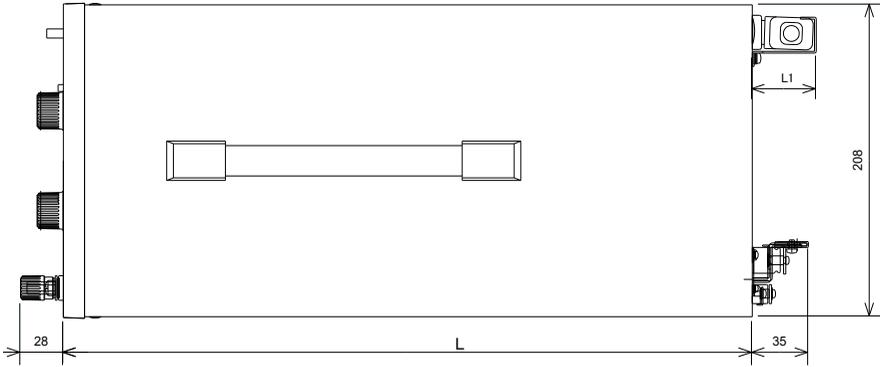


Fig. 18

Model	PD18-20AD	PD18-30AD	PD36-20AD
L	420	457	420
L ₁ (mm) (including power input connector)	38	38	38

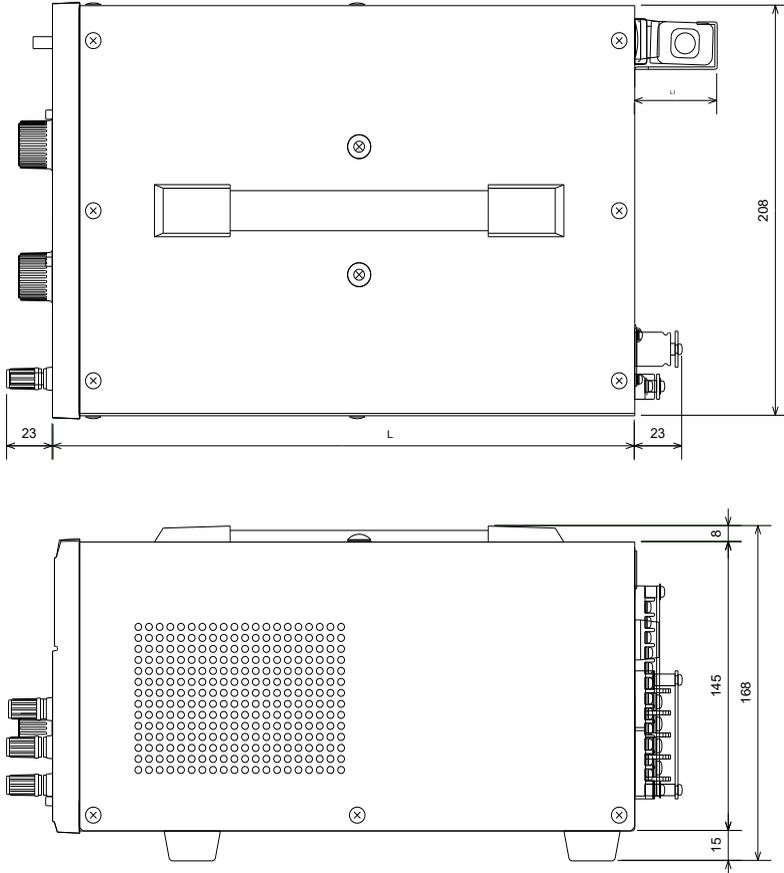


Fig. 19

Model	PD18 -10AD	PD36 -10AD	PD56 -6AD	PD56 -10AD	PD110 -3AD	PD110 -5AD
L	300	300	300	348	300	348
L ₁ (mm) (including power input connector)	32	38	38	38	38	38



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