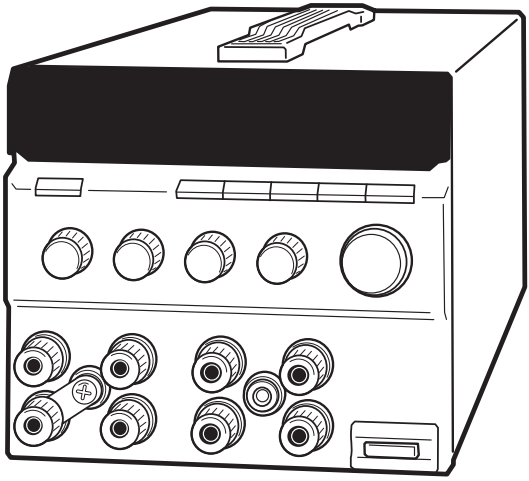
Part No. Z1-004-082, IA004201
May 2008

OPERATION MANUAL

Multiple-output Regulated DC
Power Supply PMM Series

PMM18-2.5DU
PMM35-1.2DU
PMM25-1TR
PMM24-1QU



KIKUSUI

Use of Operation Manual

Please read through and understand this Operation Manual before operating the product. After reading, always keep the manual nearby so that you may refer to it as needed. When moving the product to another location, be sure to bring the manual as well.

If you find any misplaced or missing pages in this manual, 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 Kikusui distributor/agent, and provide the "Kikusui Part No." given on the cover.

This manual has been prepared with the utmost care; however, if you have any questions, or note any errors or omissions, please contact Kikusui distributor/agent.

Power Requirements of this Product

Power requirements of this product have been changed and relevant sections of the Operation Manual should be revised accordingly. (Revision should be applied to items indicated by a check mark ☑.)

☐ Input voltage

The input voltage of this product is _____ Vac,

and the voltage range is _____ to _____ Vac. Use the product within this range only.

☐ Input fuse

The rating of this product's input fuse is _____ A, _____ Vac,

and _____.

⚠WARNING

- **To avoid electrical shock, always disconnect the power cord or turn off the switchboard before attempting to check or replace the fuse.**
- **Use a fuse element having a shape, rating, and characteristics suitable for this product. The use of a fuse with a different rating or one that short circuits the fuse holder may result in fire, electric shock, or irreparable damage.**

Power Requirements of this Product(Cont'd)

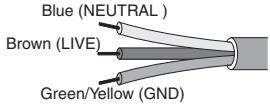
☐ Power cord

The product is provided with power cords described below. If the cord has no power plug, attach a power plug or crimp-style terminals to the cord in accordance with the wire colors specified in the drawing.

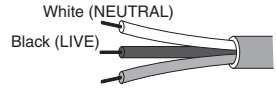
⚠WARNING

- **The attachment of a power plug or crimp-style terminals must be carried out by qualified personnel.**

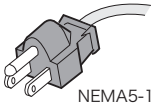
☐ Without a plug



☐ Without a plug

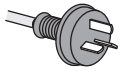


☐ Plug for USA



☐ Plug for Europe

☐ Plug for China



☐ Provided by Kikusui distributor/agent

Kikusui agents can provide you with suitable power cord.
For further information, contact Kikusui distributor/agent.

⚠ Safety Symbols

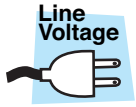
For the safe use and safe maintenance of this product, the following symbols are used throughout this manual and on the product. Note the meaning of each of the symbols to ensure safe use of the product. (Not all symbols may be used.)

ϟ or ⚠ϟ	Indicates that a high voltage (over 1000 V) is used here. Touching the part causes a possibly fatal electric shock. If physical contact is required by your work, start work only after you make sure that no voltage is output here.
DANGER	Indicates an imminently hazardous situation which, if ignored, will result in death or serious injury.
⚠ **WARNING**	Indicates a potentially hazardous situation which, if ignored, could result in death or serious injury.
⚠ **CAUTION**	Indicates a potentially hazardous situation which, if ignored, may result in damage to the product and other property.
	Shows that the act indicated is prohibited.
	Indicates a general danger, warning, or caution. When this symbol is marked on the product, see the relevant sections in this manual.
	Protective conductor terminal.
	Chassis (frame) terminal.
	On (supply)
	Off (supply)
	In position of a bi-stable push control
	Out position of a bi-stable push control

⚠ Safety Precautions

The following safety precautions must be observed to avoid fire hazards, electric shock, accidents, and other failures. Keep them in mind and make sure to observe them.

Using the product in a manner that is not specified in this manual may impair the protection functions provided by the product.

Users 	• This product must be used only by qualified personnel who understand the contents of this operation manual. • If unqualified personnel is to use the product, be sure the product is handled under the supervision of qualified personnel (those who have electrical knowledge). This is to prevent the possibility of personal injury.
Purpose of use 	• Never use the product for purposes other than the product's intended use. • This product is not designed or manufactured for general home or consumer use.
Input power 	• Use the product within the rated input power voltage range. • For applying power, use the power cord provided. For details, see the respective page in the operation manual. • This product is designed as an equipment of IEC Overvoltage Category II (energy-consuming equipment supplied from the fixed installation).
Fuse 	• The fuse can be replaced with a new one. When replacing a fuse, use the one which has appropriate shape, ratings, and specifications. For details, refer to the specification section in this manual.
Cover 	• Some parts inside the product may cause physical hazards. Do not remove the external cover.

Grounding 	• This product is an IEC Safety Class I equipment (equipment with a protective conductor terminal). To prevent the possibility of electric shock, be sure to connect the protective conductor terminal of the product to electrical ground (safety ground).
Installation 	• This product is designed for safe indoor use. Be sure to use it indoors. • When installing this product, be sure to observe the description in “2.2 Precautions Concerning Installation Location” in this manual.
Relocation 	• Turn off the POWER switch, and disconnect all cables before relocating the product. • When relocating the product, be sure to include the manual.
Operation 	• If a malfunction or abnormality is detected on the product, stop using it immediately, and remove the power plug from the outlet. Make sure the product is not used until it is completely repaired. • Use cables or wires with sufficiently large current capacity for output wires and load cables. • Do not disassemble or modify the product. If you need to modify the product, contact your Kikusui distributor/agent.
Maintenance and inspection 	• To prevent the possibility of electric shock, make sure to unplug the power plug before carrying out maintenance or inspection. Do not remove the external cover during maintenance or inspection. • Check that the insulation coating of the power cord is not broken and that the plug is not cracked or falling apart. • If the panel needs cleaning, gently wipe using a soft cloth with water-diluted neutral detergent. • To maintain the performance and safe operation of the product, it is recommended that periodic maintenance, inspection, cleaning, and calibration be performed.
Service 	• Kikusui service engineers will perform internal service on the product. If the product needs adjustment or repairs, contact your Kikusui distributor/agent.

How to Read This Manual

Preface

Thank you for purchasing the PMM Series multiple-output regulated DC power supply.
This manual is intended for first-time users of the PMM Series (hereafter abbreviated as: the PMM). It gives an overview of the PMM and describes various settings, operation, maintenance, safety precautions, etc.
Read this manual thoroughly to use the functions of the PMM effectively. You can also review this manual; when you are confused about an operation or when a problem occurs.

How to read this manual

This manual is designed to be read from beginning to end. We recommend that you read the manual thoroughly from the beginning before using the PMM for the first time.

Intended readers of this manual

This manual is intended for those using the PMM of multiple-outputregulated DC power supply and teaching other users on how to operate the PMM.
It assumes that the reader has knowledge of a regulated DC power supply.

Notations used in this manual

The following marks are used with the corresponding explanations in this manual.

⚠WARNING	Indicates an imminently hazardous situation which, if ignored, could result in death or serious injury.
⚠CAUTION	Indicates a potentially hazardous situation which, if ignored, may result in damage to the product and other property.
NOTE	Indicates information that you should know.
DESCRIPTION	Explanation of terminology or operation principle.
See	Indicates reference to detailed information.

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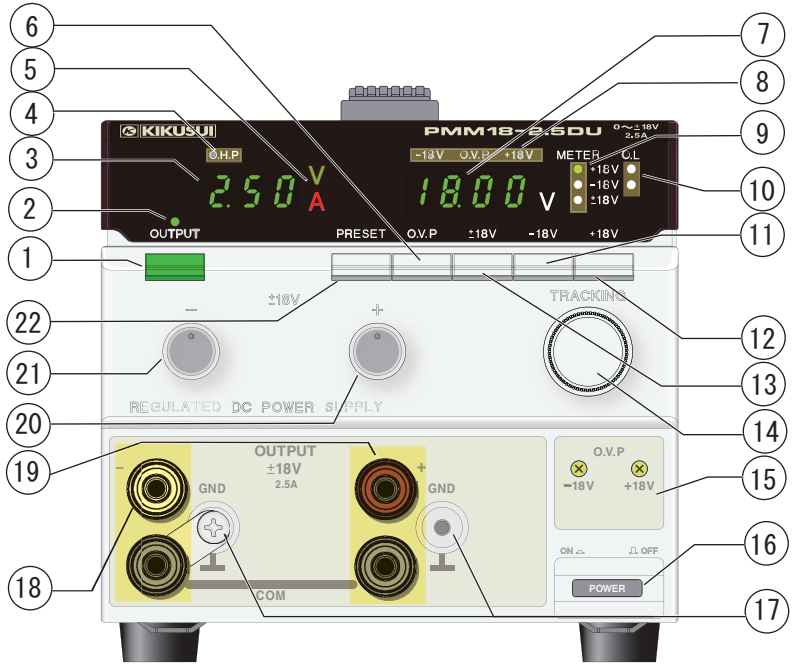
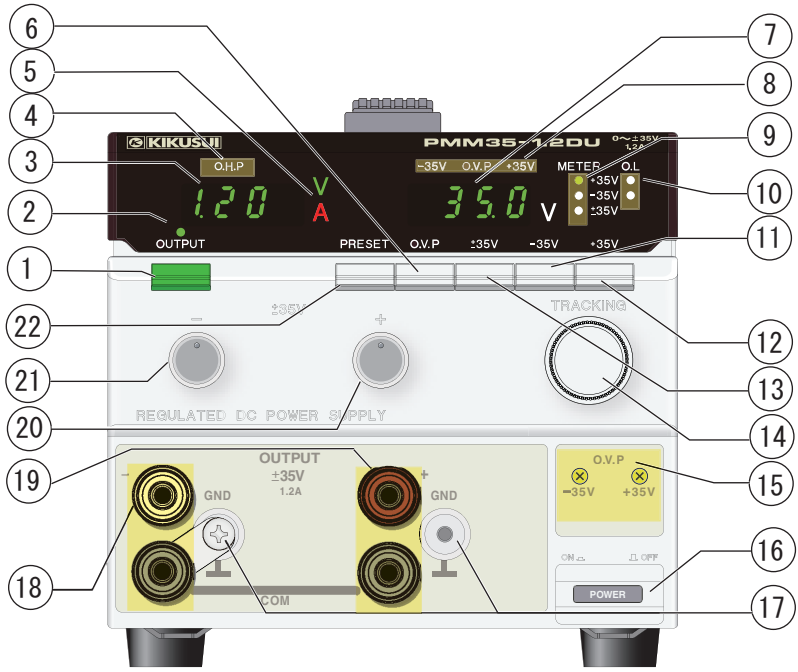
Front panel (PMM18-2.5DU)



No.	Name	Description
1	OUTPUT switch	Output on/off switch. Depressed position is ON.
2	OUTPUT LED	Lights when the output is ON.
3	Meter 2	Voltmeter or Ammeter. Changes display to the current value (Ammeter) by pressing the +18 V or the -18 V of the meter display select switch.
4	O.H.P LED	Lights when the over heat protection is activated.
5	Display status of meter 2	Displays the voltage as a voltmeter when “V” is illuminated, and displays the current as an ammeter when “A” is illuminated.
6	O.V.P switch	While this switch is pressed, the OVP trip point of the +18 V output displays on meter 1, and the OVP trip point of the -18 V output displays on meter 2.

No.	Name	Description
7	Meter 1	Voltmeter. Changes display by pressing the meter display select switch.
8	O.V.P LED	Lights when the overvoltage protection is activated.
9	METER LED	Lights when the selected output is displayed on the meter.
10	O.L LED	Lights when the output is under the current limit.
11	-18 V switch	Meter display select switch. Displays the voltage of the -18 V output on meter 1, and displays the current value on meter 2.
12	+18 V swich	Meter display select switch. Displays the voltage of the +18 V output on meter 1, and displays the current value on meter 2.
13	±18 V switch	Meter display select switch. Displays the voltage of +18 V output on meter 1, and displays the voltage of -18 V output on meter 2.
14	TRACKING knob	Varies the output of + and - for same ratio simultaneously.
15	O.V.P variable resistor	Sets the OVP (Overvoltage Protection) trip point.
16	POWER switch	Depressed position is ON.
17	GND terminal	Connected to the chassis of the power supply. This terminal is normally connected to any of the + or - or COM terminal.
18	-18 V output terminal	Output terminal of the -18 V output.Outputs the negative voltage to the white colored terminal against COM terminal.
19	+18 V output terminal	Output terminal of the +18 V output.Outputs the positive voltage to the red colored terminal against COM terminal.
20	+18 V voltage setting knob	Sets the voltage of the +18 V output.
21	-18 V voltage setting knob	Sets the voltage of the -18 V output.
22	PRESET switch	While this switch is pressed, the setting voltage of the +18 V output displays on meter 1, and the setting voltage of the -18 V output displays on meter 2.

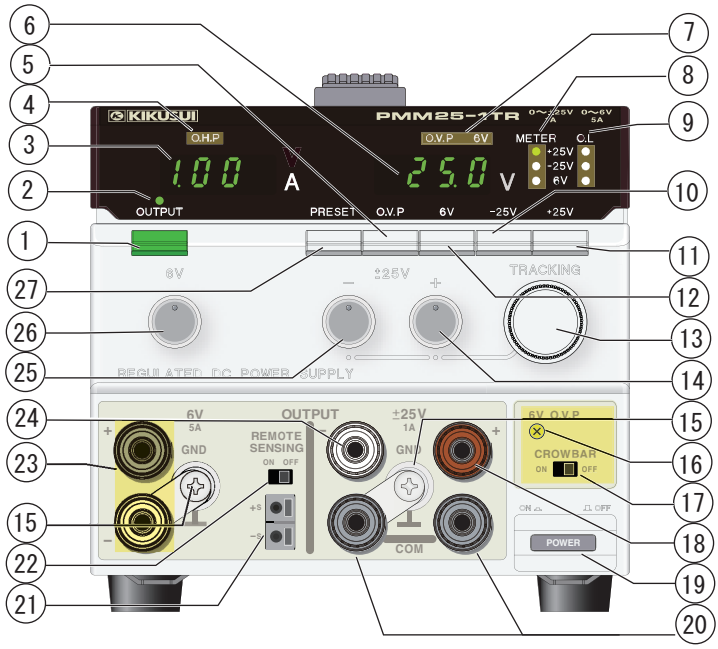
Front panel (PMM35-1.2DU)



No.	Name	Description
1	OUTPUT switch	Output on/off switch. Depressed position is ON.
2	OUTPUT LED	Lights when the output is ON.
3	Meter 2	Voltmeter or Ammeter. Changes display to the current value (Ammeter) by pressing the +35 V or the -35 V of the meter display select switch.
4	O.H.P LED	Lights when the over heat protection is activated.
5	Display status of meter 2	Displays the voltage as a voltmeter when “V” is illuminated, and displays the current as an ammeter when “A” is illuminated.
6	O.V.P switch	While this switch is pressed, the OVP trip point of the +35 V output displays on meter 1, and the OVP trip point of the -35 V output displays on meter 2.

No.	Name	Description
7	Meter 1	Voltmeter. Changes display by pressing the meter display select switch.
8	O.V.P LED	Lights when the overvoltage protection is activated.
9	METER LED	Lights when the selected output is displayed on the meter.
10	O.L LED	Lights when the output is under the current limit.
11	-35 V switch	Meter display select switch. Displays the voltage of the -35 V output on meter 1, and displays the current value on meter 2.
12	+35 V switch	Meter display select switch. Displays the voltage of the +35 V output on meter 1, and displays the current value on meter 2.
13	±35 V switch	Meter display select switch. Displays the voltage of +35 V output on meter 1, and displays the voltage of -35 V output on meter 2.
14	TRACKING knob	Varies the output of + and - for same ratio simultaneously.
15	O.V.P variable resistor	Sets the OVP (Overvoltage Protection) trip point.
16	POWER switch	Depressed position is ON.
17	GND terminal	Connected to the chassis of the power supply. This terminal is normally connected to any of the + or - or COM terminal.
18	-35 V output terminal	Output terminal of the -35 V output. Outputs the negative voltage to the white colored terminal against COM terminal.
19	+35 V output terminal	Output terminal of the +35 V output.Outputs the positive voltage to the red colored terminal against COM terminal.
20	+35 V voltage setting knob	Sets the voltage of the +35 V output.
21	-35 V voltage setting knob	Sets the voltage of the -35 V output.
22	PRESET switch	While this switch is pressed, the setting voltage of the +35 V output displays on meter 1, and the setting voltage of the -35 V output displays on meter 2.

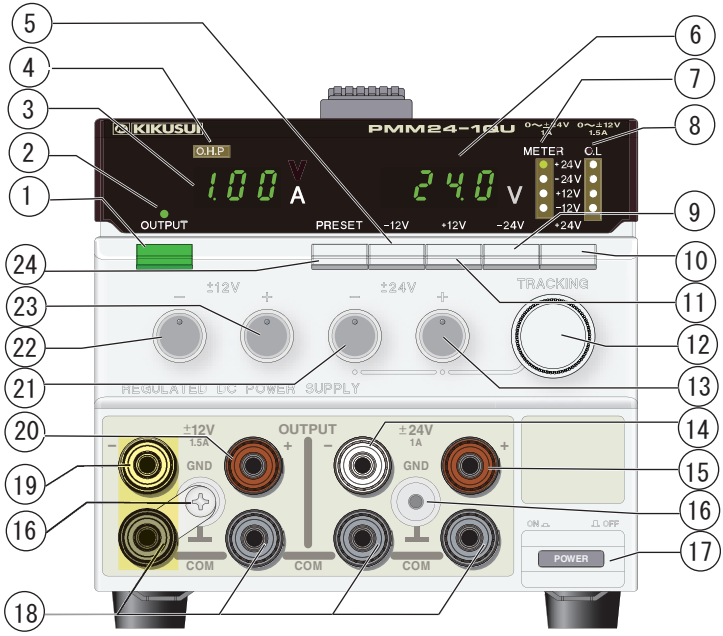
Front panel (PMM25-1TR)



No.	Name	Description
1	OUTPUT switch	Depressed position is ON.
2	OUTPUT LED	Lights when the output is ON.
3	Meter 2	Ammeter. Changes display by pressing the meter display select switch.
4	O.H.P LED	Lights when the over heat protection is activated.
5	O.V.P switch	While this switch is pressed, the OVP trip point of the 6 V output displays on meter 1, and displays the current value on meter 2.
6	Meter 1	Voltmeter. Changes display by pressing the meter display select switch.
7	O.V.P 6 V LED	Lights when the OVP is activated.
8	METER LED	Lights when the selected output is displayed on the meter.
9	O.L LED	Lights when the output is under the current limit.

No.	Name	Description
10	-25 V switch	Meter display select switch. Displays the voltage of the -25 V output on meter 1, and displays the current value on meter 2.
11	+25 V switch	Meter display select switch. Displays the voltage of the +25 V output on meter 1, and displays the current value on meter 2.
12	6 V switch	Meter display select switch. Displays the voltage of 6 V output on meter 1, and displays the current value on meter 2.
13	TRACKING knob	Varies the output of the +25V output and the -25V output for same ratio simultaneously.
14	+25 V voltage setting knob	Sets the voltage of the +25 V output.
15	GND terminal	Connected to the chassis of the power supply. This terminal is normally connected to any of the + or - or COM terminal.
16	6 V O.V.P variable resistor	Sets the overvoltage protection trip point.
17	CROWBAR ON/OFF switch	When the OVP is tripped while the switch is in ON position, short-circuits the 6 V output terminal by the thyristor. When the switch is in OFF position, the output voltage is shut down because of the thyristor is not conducted.
18	+25 V output terminal	Output terminal of the +25 V output. Outputs the positive voltage to the red colored terminal against COM terminal.
19	POWER switch	Depressed position is ON.
20	COM terminals	Common terminal for the ±25 V output.
21	Remote sensing terminal (for 6 V output)	The remote sensing is used to reduce the influence of the voltage drops due the load cable resistance and stabilize the output voltage across the load.
22	Remote sensing switch (for 6 V output)	Sets the switch to ON position, when remote sensing is applied.
23	6 V output terminal	Output terminal of the 6 V output.
24	-25 V output terminal	Output terminal of the -25 V output.Outputs the negative voltage to the white colored terminal against COM terminal.
25	-25 V voltage setting knob	Sets the voltage of the -25 V output.
26	6 V voltage setting knob	Sets the voltage of the 6 V output.
27	PRESET switch	While this switch is pressed, the setting voltage of output set by the meter display select switch as indicated from No. 10 to 12 displays on meter 1, the current value displayed on meter 2 is not changed.

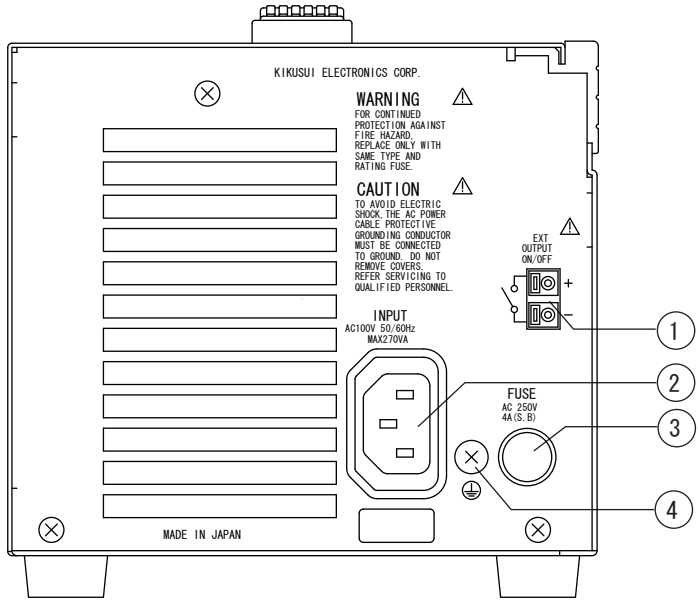
Front panel (PMM24-1QU)



No.	Name	Description
1	OUTPUT switch	Depressed position is ON.
2	OUTPUT LED	Lights when the output is ON.
3	Meter 2	Ammeter. Changes display by pressing the meter display select switch.
4	O.H.P LED	Lights when the over heat protection is activated.
5	-12 V switch	Meter display select switch. Displays the voltage of the -12 V output on meter 1, and displays the current value on meter 2.
6	Meter 1	Voltmeter. Changes display by pressing the meter display select switch.
7	METER LED	Lights when the selected output is displayed on the meter.
8	O.L LED	Lights when the output is under the current limit.

No.	Name	Description
9	-24 V switch	Meter display select switch. Displays the voltage of the -24 V output on meter 1, and displays the current value on meter 2.
10	+24 V switch	Meter display select switch. Displays the voltage of the +24V output on meter 1, and displays the current value on meter 2.
11	+12 V switch	Meter display select switch. Displays the voltage of +12 V output on meter 1, and displays the current value on meter 2.
12	TRACKING knob	Varies the output of the +24V output and the -24V output for same ratio simultaneously.
13	+24 V voltage setting knob	Sets the voltage of the +24 V output.
14	-24 V output terminal	Output terminal of the -24 V output. Outputs the negative voltage to the white colored terminal against COM terminal.
15	+24 V output terminal	Output terminal of the +24 V output.Outputs the positive voltage to the red colored terminal against COM terminal.
16	GND terminal	Connected to the chassis of the power supply. This terminal is normally connected to any of the + or - or COM terminal.
17	POWER switch	Depressed position is ON.
18	COM terminals	Common terminal for the ±24 V and ±12 V outputs.
19	-12 V output terminal	Output terminal of the -12 V output. Outputs the negative voltage to the white colored terminal against COM terminal.
20	+12 V output terminal	Output terminal of the +12 V output.Outputs the positive voltage to the red colored terminal against COM terminal.
21	-24 V voltage setting knob	Sets the voltage of the -24 V output.
22	-12 V voltage setting knob	Sets the voltage of the -12 V output.
23	+12 V voltage setting knob	Sets the voltage of the +12 V output.
24	PRESET switch	While this switch is pressed, the setting voltage of output set by the meter display select switch as indicated No. 5 and No. 9 to 11 displays on meter 1, the current value displayed on meter 2 is not changed.

Rear panel (Common)



No.	Name	Description
1	EXT OUTPUT ON/ OFF terminal	Terminals for analog remote control and monitoring function.
2	INPUT connector	Power cord connector for supplying power to the power supply.
3	Fuse holder	Contains an AC input fuse (S.B type)
4	⏚	Protective conductor terminal. Always ground the power supply.

1 General Description

This chapter gives an overview and introduces the features of the PMM.

1.1 About This Manual

This operation manual applies to the PMM series as specified follows.

The PMM series are designed individually by model for functions and specifications. This operation manual is consisting of the common and the individual part of the description. The individual part can be referred by model name as indicated on the edge of right side pages.

■ Applied model

PMM18-2.5DU PMM35-1.2DU PMM25-1TR PMM24-1QU

1.2 Product Overview

The PMM Series, multiple-output regulated DC power supply, allows to vary the value for each output from zero volt individually and it has equipped the dual tracking function which enables to vary the value of positive and negative voltage at the same proportion.

1.3 Features

● Highly stable output with Low output noise

The adoption of series regulated design realizes a highly stable output with a low level of output noise.

● Digital display for voltage and current at the same time

The PMM series has two bright LED meters that display the output voltage, output current, and their settings.

● High-resolution setting for Dual tracking control

10-turn wire wound type of the variable resistors is used for the TRACKING knob which allows high-resolution settings.

● Output ON/OFF by external contact

The ON/OFF of each output can be switched by the external contact.

● Remote sensing function

The remote sensing function is available to stabilizes the output voltage across the load. (equipped with 6 V output of model PMM25-1TR)

● Overvoltage protection (OVP) function.

The overvoltage protection function (OVP) is equipped for model PMM18-2.5DU, PMM35-1.2DU and PMM25-1TR*.

*The OVP applies to the 6 V output of model PMM25-1TR.

1.4 Options

The following options are available for the PMM series.
For details, contact your Kikusui agent or distributor.

■ Guard cap (GP01-PMC)

Exchanged with the knob to prevent inadvertent operation of voltage or current setting.

■ Rack mount options

The following options are available for rack mount system.

Name	Model	Note
Rack adapter	KRA3	Inch rack (EIA standard)
	KRA150	Milli rack (JIS standard)
Blank panel	KBP3-3	(EIA, JIS common) - 1/3 width)
	BP191(-M)*1	Inch rack (EIA standard)
	BP1H(-M)*1	Milli rack (JIS standard)

*1 The model added with “-M” is “mesh” type.

⚠CAUTION

- In order to maintain strong cooling air intake, at least one layer (★) of “blank panel” must be installed when the product is rack mounted.

★ JIS standard：50 mm、EIA standard：44.45 mm

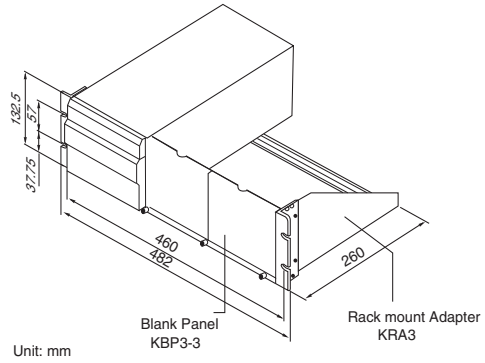


Fig. 1-1 Example of installation for rack mount options (Inch rack EIA standard)

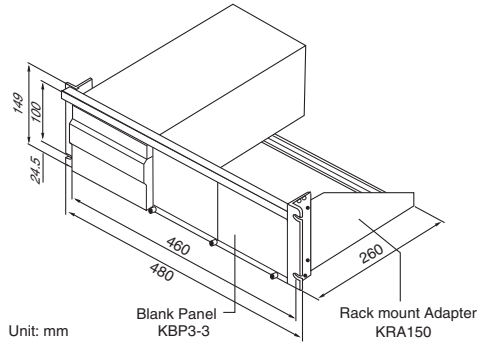


Fig. 1-2 Example of installation for rack mount options (Milli rack JIS standard)

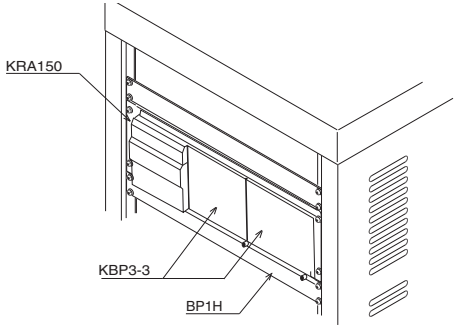


Fig. 1-3 Example of installation options for rack mounting

2 Installation and Preparation

This chapter explains how to prepare the product for use, from unpacking to installation.

2.1 Checking the Package Contents

When you receive the product, check that all accessories are included and that the accessories have not been damaged during transportation.

If any of the accessories are damaged or missing, contact your Kikusui agent or distributor.

We recommend that all packing materials be saved, in case the product needs to be transported at a later date.

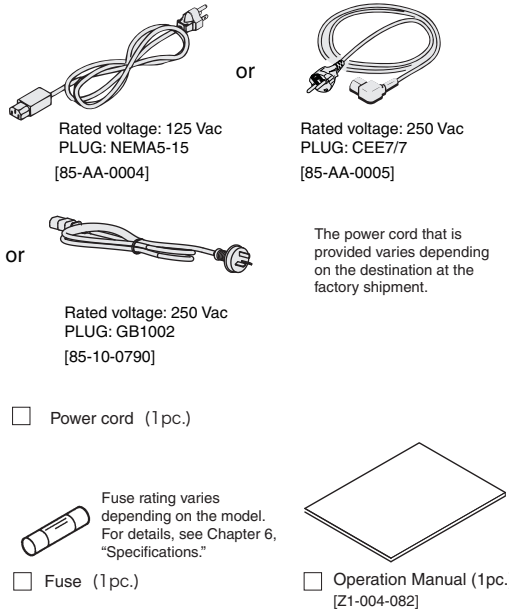


Fig. 2-1 Accessories

2.2 Precautions Concerning Installation Location

Critically important points when installing the product

- **Do not use the product in a flammable atmosphere.**
  To prevent the possibility of explosion or fire, do not use the product near alcohol, thinner or other combustible materials, or in an atmosphere containing such vapors.

- **Avoid locations where the product is exposed to high temperature or direct sunlight.**
  Do not place the product near a heater or in areas subject to drastic temperature changes.

Operating temperature range:	0 ºC to +40 ºC
Storage temperature range:	–10 ºC to +60 ºC

- **Avoid humid environments.**
  Do not place the product in high-humidity locations-near a boiler, humidifier, or water supply.

Operating humidity range:	10 %rh to 80 %rh (no condensation)
Storage humidity range:	less than 90 %rh (no condensation)

  Condensation may occur even within the operating relative humidity range. In such cases, do not use the product until the condensation dries up completely.

- **Be sure to use it indoors.**
  The product is designed for safe indoor use.

- **Do not place the product in a corrosive atmosphere.**
  Do not install the product in a corrosive atmosphere or in environments containing sulfuric acid mist, etc. This may cause corrosion of various conductors and bad contacts of connectors leading to malfunction and failure, or in the worst case, a fire.

  However, operation in such environments may be possible through alteration. If you wish to use the product in such environments, consult your Kikusui agent or distributor.

- **Do not place the product in a dusty location.**
  Accumulation of dust can lead to electric shock or fire.

- **Do not use the product where ventilation is poor.**
  The product employs a forced air cooling system. Air is taken in from air inlet located on panels other than the rear panel and exhausted from the air outlet on the rear panel. Secure adequate space around the product to prevent the possibility of fire caused by accumulation of heat.

  Allow at least 20 cm of space between the air inlet/outlet and the wall (or obstacles). Hot air (approximately 20 ºC higher than the ambient temperature) is exhausted from the air outlet. Do not place objects that are affected by heat near the air outlet.

- **Do not place objects on top of the product.**
  Placing objects on top of the product can cause failures (especially heavy objects).
  Do not stack the PMM series.

- **Do not place the product on an inclined surface or location subject to vibrations.**
  The product may fall or tip over causing damages and injuries.

- **Do not use the product in a location where strong magnetic or electric fields are nearby or a location where large amount of distortion and noise is present on the input power supply waveform.**
  The product may malfunction.

- **Do not use the product near highly sensitive measuring instruments or transceivers.**
  The noise generated by the product may affect them.

2.3 Precautions to Be Taken When Moving the Product

When moving the product to the installation location or when transporting the product, note the following points.

- **Turn off the POWER switch.**
  Moving the product while the power is turned on can cause electric shock or damage to it.

- **Remove all wiring.**
  Moving the product with the cables connected can cause wires to break or injuries due to the product falling over.

- When transporting the product, be sure to use the original packing materials.
  Otherwise, damage may result from vibrations or from the product falling during transportation.
- Make sure this manual has been included.

2.4 Rack-mount Frame Installation

See p. 24

Before installing the rack-mount frame, remove the rubber feet. How to remove rubber feet is illustrated in Fig. 2-2.

Concerning installation, refer to the KRA3 or the KRA150 installation instructions.

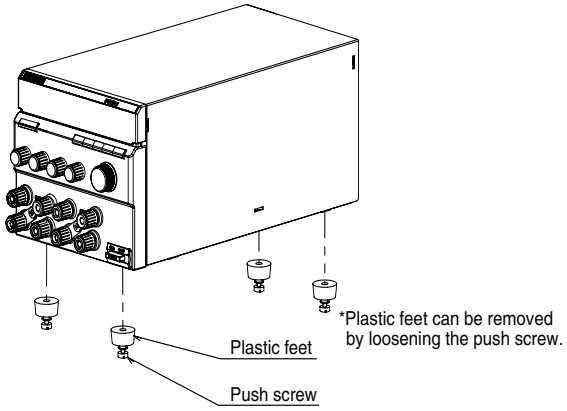


Fig. 2-2 Removing rubber feet

Removing rubber feet

In case the PMM is detached from the rack adapter, we recommendthat you keep all the parts.

When you attach the plastic feet again, use the parts which were removed.

2.5 Connecting the Power Cord

The PMM is designed as an equipment of IEC Overvoltage Category II (energy-consuming equipment supplied from the fixed installation).

NOTE

- To connect to the AC line, use the attached power cord.
- The power cord with a plug can be used to disconnect the PMM from the AC line in an emergency. Connect the power plug to an easily accessible power outlet so that the plug can be removed from the outlet at any time. Be sure to allow enough space around the power outlet.
- Do not use the attached power cord as the power cord for other equipment.

1. Check that the AC line to be connected is compatible with the input rating of the product.

   The product's nominal input rating is shown on the rear panel. When it is filled in, as in Fig. 2-3, the line voltage will be 100 V. Input can be within ±10 % of the nominal input voltage shown. The frequency can be 50 Hz or 60 Hz.

2. Turn off the POWER switch.

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

4. Insert the power plug to an outlet.

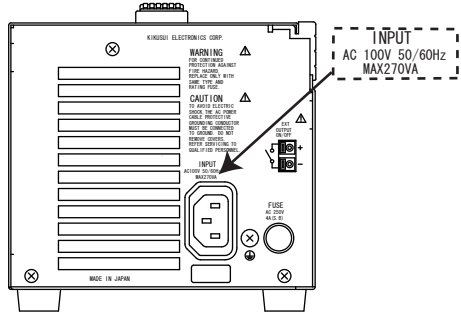


Fig. 2-3 Confirmation of nominal input rating

2.6 Ground (Earth)

⚠WARNING • **Possible electric shock. The PMM is an IEC Safety Class I equipment (equipment with a protective conductor terminal). Be sure to ground the product to prevent electric shock.**

For your safety, be sure to ground the unit.

Securely connect the protective conductor (earth) terminal on the rear panel.

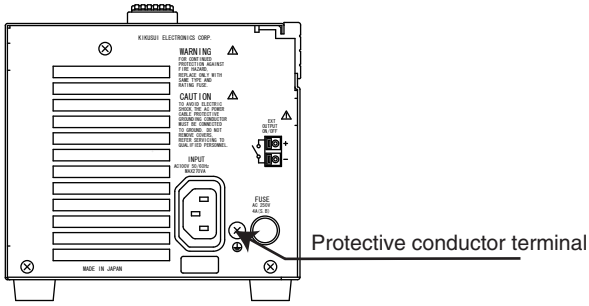


Fig. 2-4 Confirmation of ground (protective conductor terminal)

2.7 Turning On the Power

Before turning on the POWER switch, be sure to observe the status of OUTPUT switch. It is on when the switch is pressed position, and it is off when the switch is depressed position.

⚠CAUTION • If the POWER switch is turned on while the OUTPUT switch remains on, a preset voltage or current is supplied to the load.

1. Check that the OUTPUT switch is turned off.
2. Check that the remote sensing switch is turned off.

(Applied for Model PMM25-1TR only)

3. Turn on the POWER switch.

   The LED on the control panel lights up.

4. Press the meter display select switch voltage, then while pressing the PRESET switch, and turn the VOLTAGE control knob; check that the output voltage can be preset in a range from zero to the rated output voltage value.

Now, the PMM is ready for use.

Inrush Current

When the power switch is turned on, the maximum inrush current of 70 A may flow. In particular, with a system using multiple units of the PMM, when the power switch is turned on at the same time, make sure that there is enough of a margin, taking into consideration the capacity of the power distributor panel or the AC power line.

Reverse Polarity

When the current or voltage is set up as zero with the OUTPUT switched off, a 0 V to 0.6 V reverse polarity voltage can arise. Because of this voltage, an opposite-directed 1 mA current flows to the load. Note that this load can reduce the life time of the product.

3 Connecting the Load

This chapter describes the consideration to be given to the load, explains how to connect the load wires, and explains how to connect to the output terminal.

3.1 Load Considerations

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

3.1.1 When the Load Current has Peaks or is Pulse-shaped

The current meter on the PMM indicates only mean values. Even when the indicated value is less than the preset current value, the peak values may actually exceed the current limit value(O.L), in such case, the PMM is instantaneously put into constant-current operation mode, and the output voltage drops accordingly. When it occurs, the O.L LED lights on.

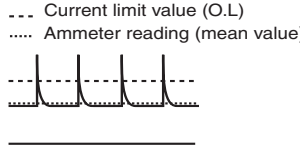


Fig. 3-1 Load current with peaks

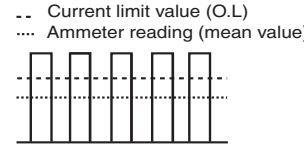


Fig. 3-2 Pulse shaped load current

3.1.2 When the Load Generates a Reverse Current to the Power Supply

The PMM 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.

For these types of loads, connect a resistor R_D as shown in Fig. 3-3 to bypass the reverse current. However, the amount of current to the load decreases by Irp.

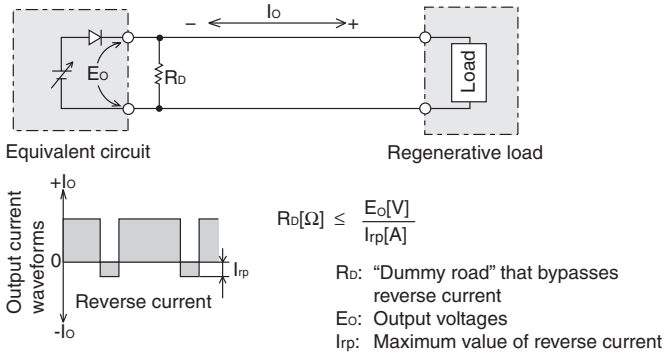


Fig. 3-3 Remedy for regenerative load

⚠CAUTION

- For resistor R_D, select an appropriate resistor rated for the power (allowing sufficient margin).
- If a resistor with insufficient rated power for the circuit is used, R_D may burn out.

3.1.3 When the Load has Accumulated Energy Such As Batteries

When connecting to a load that has stored energy such as a battery, a large current flows from the load to the product's internal capacitor through a protection diode in an internal output control circuit, and depending on the situation, the product may burn out or the load's working life may be reduced.

For any such load, connect a reverse current protection diode D_{RP} in series between the PMM and the load, as shown in Fig. 3-4.

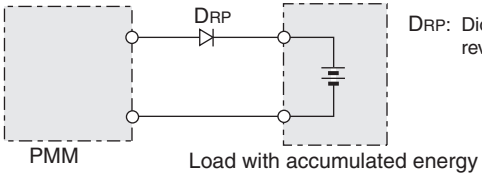


Fig. 3-4 Remedy against load with accumulated energy

⚠CAUTION

- To protect the load and the PMM, select DRP according to the following criteria.

  Reverse voltage withstand capacity: At least twice the rated output voltage of the power supply.
  Forward current capacity: Three to ten times the rated output current of the power supply.
  A diode with small loss.
- Be sure to take into account the heat generated by DRP. DRP may burn out if heat dissipation is inadequate.

3.2 Connecting the Load

This section describes the wire used to connect the PMM to the load, and the connection to the output terminal.

⚠CAUTION

- Before connecting to the load, confirm that the POWER switch is turned on, and that the OUTPUT is turned off.

3.2.1 Load Cable

⚠WARNING

- **To prevent the possibility of fire, use a load cable with sufficient current capacity with respect to the rated output current of the PMM.**
- **To prevent the possibility of electric shock, use a load cable with a higher voltage rating than the isolation voltage of the PMM.**
  For the isolation voltage, see Chapter 6, "Specifications".

Current capacity of the load cable

Load cables must be rated to carry the maximum rated output current of the PMM. If their current rating exceeds the maximum rated output current, the cable will remain intact even if the load is short-circuited. When there is a long distance to the load, use as thick a line as possible, more than recommended.

Table 3-1 Nominal cross-sectional area of cables and allowable currents

Nominal cross sectional area [mm^2]	AWG	(Reference cross sectional area) [mm^2]	Allowable current *1 [A] (Ta = 30 °C)	Current recommended by Kikusui [A]
0.9	18	(0.82)	17	4
1.25	16	(1.31)	19	6
2	14	(2.08)	27	10

*1. Excerpts from Japanese laws related to electrical equipment

Dependence of allowable cable current on the maximum allowable insulator temperature

The temperature of a cable is determined by the resistance loss due to the flowing current, ambient temperature and the thermal resistance with respect to the outside of the cable. The allowable current in Table 3.1 "Load Considerations" show the current capacities that can be flowed through a heat-resistant PVC wire (single wire) with a maximum allowable temperature of 60 °C when the wire is stretched horizontally under an ambient temperature of 30 °C. The current capacity should be lower when the heat resistant temperature of the PVC wire is lower, the ambient temperature is higher than 30 °C or the heat radiation is degraded due to the use of bundled wires.

Taking measures against noise

It is better to make heat radiation as great as possible to allow a larger current to flow, when wires having the same heat-resistant temperature are installed. For measures against noise in the load cables, however, installing the + (pos.) and – (neg.) output lines side by side or bundling them together is more effective against unwanted noise. The Kikusui-recommended currents shown in Table 3-1 "Nominal cross-sectional area of cables and allowable currents" are allowable current that have been reduced in consideration of the potential bundling of load cables. Use these values as a guideline when installing load wires.

Voltage rating of the load cable

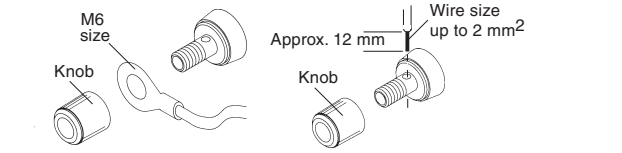
Use a load cable with a higher voltage rating than the isolation voltage of the PMM.

3.2.2 Connecting to the Output Terminal

WARNING • **To prevent the possibility of electric shock, be sure to turn off the POWER switch.**

1. Turn off the POWER switch.
2. Connect the load cable to the output terminal.

   To secure the firm connection, use the crimping terminal for the load cable to the output terminal.
3. Check the connection.



When using the crimping terminal

When using the wire by stripping the cover

Fig. 3-5 Connecting to the output terminal

4 Operations

This chapter describes the functions and basic operations of each model.

4.1 Dual Tracking Function

The positive and negative value of output voltage can be varied at the same time by turning the TRACKING knob which is equipped on the front panel of the product. Within the range of operating rated voltage, the value of output voltage can be varied from zero to the rated value keeping with same proportion of output voltage set by the positive or negative knob of the selected voltage.

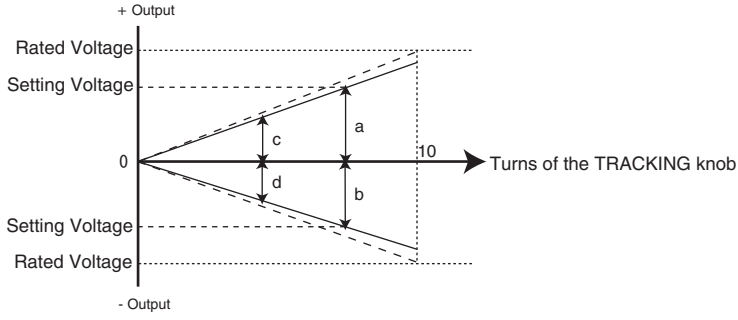


Fig. 4-1 Setting voltage and Tracking output

The following proportional expression can be demonstrated by Fig. 4-1.

$$\frac{b}{a} = \frac{d}{c}$$

NOTE

- When either positive or negative output is tripped into the current limit status, the output corresponds to decrease depending on the load. In such case, the other output is not effected.

4.2 Protection Function

The PMM is equipped with the following protection function.

4.2.1 Overvoltage Protection (OVP) Function

The overvoltage protection (OVP) function protects the load from unexpected and excessive voltage. When overvoltage protection (OVP) is activated, the O.V.P LED lights and the OUTPUT is turned off.

- OVP function is equipped for model PMM18-2.5DU, PMM35-1.2DU and the 6 V output of PMM25-1TR.
  For details, refer to p. 41 "Overvoltage Protection (OVP) Function"for model PMM18-2.5DU, PMM35-1.2DU, and p. 46 "6 V Output Overvoltage Protection (OVP) Function"for model PMM25-1TR.

4.2.2 Overheat Protection (OHP) Function

The overheat protection (OHP) is activated when the built-in heat sink equipped with the PMM reaches approximately 95 °C (±5 °C). When tripped to the status of OHP, the OHP LED lights and the output is turned off.

4.2.3 Other Protection Functions

■ Thermal fuse

The thermal fuse is built into the wire-wound section of the power transformer. When this fuse is blown out, the input power is shut down and the output is turned off. It is suspected that the product may have malfunctioned, contact your Kikusui distributor or agent.

■ Input fuse

A fuse for AC input. If the fuse is blown out, the input power is shut down and the output is turned off. When replacing the fuse, see p. 57 "Replacing the Fuse".

4.3 Remote Sensing

The remote sensing function is used to reduce the influence of voltage drops due to the load cable resistance and stabilize the output voltage across the load. However, the maximum rated voltage will be decreased for the portion of voltage drop due to the load cable.

- The remote sensing function is equipped for the 6 V output of model PMM25-1TR. For details, see p. 48 "Remote Sensing".

4.4 PMM18-2.5DU, PMM35-1.2DU

4.4.1 Basic Operation

NOTE

- When pressing more than two switches of the meter display select switch, the display will not appear properly.
- The COM terminals of each output are internally connected in the product.

ON/OFF of the POWER switch

When turning on the POWER switch, always check the status of OUTPUT switch. Depressed position is ON, out position is OFF.

⚠WARNING **Possible electric shock.**

- **When the POWER switch is turned on while the OUTPUT switch is on, the output of setting voltage will be turned on at a time.**

⚠CAUTION

- When the power switch is turned on, the maximum inrush current of approximately 70 A (5 ms) may flow. Take into consideration of the effect such as the capacity of power distribution if other devices are connected on the same power line.
- If the POWER switch is repeatedly turned on and off, it may cause to blow out the input fuse. Allow more than 5 seconds of interval to turn on the power again.

Setting the output voltage

1. Check that the OUTPUT switch is off.
2. Turn the TRACKING knob clockwise all the way.

   If the TRACKING knob is positioned in half way, it can not be varied to set up to the rated voltage.
3. While holding down the PRESET switch, set the voltage by the voltage setting knob of your desired output.

At this time, the setting voltage of the + (pos.) output is displayed on the right hand side of the meter and the - (neg.) output is displayed on the left hand side of the meter.

- The ±18 V output displays up to the first decimal place.

4. Turn on the OUTPUT switch.

The setting voltage will be output. The actual output voltage displays on the meter.

When the OUTPUT switch is on, the output voltage can be varied by the voltage setting knob of each output.

The TRACKING knob can vary each output with same proportion.

NOTE

- When the voltage setting knob is turned counter-clockwise all the way, or the OUTPUT switch is turned off, the several tens mV of reverse voltage will be output.

Overvoltage Protection (OVP) Function

The overvoltage protection (OVP) function protects the load from unexpected and excessive voltage. When the OVP is activated, the O.V.P LED lights on, and the output is turned off.

■ Setting range of the overvoltage protection (OVP)

- PMM18-2.5DU: 1 V to 19 V, -1 V to -19 V
- PMM35-1.2DU: 1 V to 37 V, -1 V to -37 V

Setting the OVP trip point

⚠CAUTION

- To set the OVP trip point, an overvoltage must actually be output. If a load is connected to the output terminal, remove it.

NOTE

- When the overvoltage protection is activated, approximately 300 mV of the reverse polarity voltage will be generated on the output.
- To clear the OVP setting, turn off the POWER switch and remove the cause of occurrence, then set the OVP trip point accordingly.

1. Check that the OUTPUT switch is off and turn on the POWER switch.

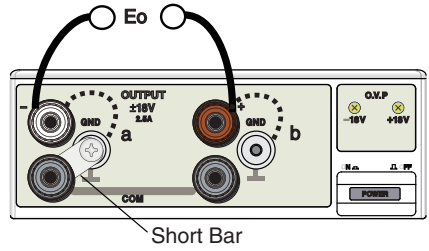
2. While holding down the O.V.P switch, set the OVP trip point using a flat-blade screwdriver to turn the O.V.P variable resistor.

   The positive (+) setting value displays on the meter 1, and the negative (-) setting value displays on the meter 2.

4.4.2 Applied Operation

Series operation

The product can be used to increases the output voltage combining two outputs with connecting the + (pos.) and the - (neg.) terminals.



PMM18-2.5DU : Eo = 0 V to 36 V 2.5 A
PMM35-1.2DU : Eo = 0 V to 70 V 1.2 A

a : Negative (-) : Connect the short bar to the (-) terminal
b : Positive (+) : Connect the short bar to the (+) terminal

Fig. 4-2 Connection of Series operation (Model PMM18-2.5DU)

Output ON/OFF by external contact

The output on/off on each output can be controlled at the same time by using an external contact.

⚠CAUTION

- When wiring to the EXT OUTPUT ON/OFF terminal located on the rear panel of the product, be sure to observe that any of conductive area of wiring cables are not touched to the chassis or the output terminal. If the wiring touch to those area, the product may malfunction.

ON/OFF method

While the OUTPUT switch on the front panel is turned on, the output is turned on when the EXT OUTPUT ON/OFF terminal on the rear panel are open-circuit, and the output is turned off when the positive (+) and the negative (-) terminal are short-circuit.

If the output is turned off either from the front panel or the EXT OUTPUT ON/OFF terminal on the rear panel, you can not turn on the output from the other side of on/off method. The status of turning “OFF” always takes priority.

- Terminal open voltage: Approx. 5.8 V
- Terminal short-circuit current: Approx.1.8 mA

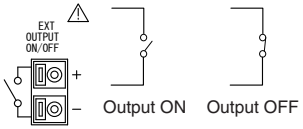


Fig. 4-3 EXT OUTPUT ON/OFF connector

NOTE

- The negative (-) terminal of the EXT OUTPUT ON/OFF terminals is internally connected to the COM terminal of the output and inside of the product.

Handling of connectors

■ Wires can be used

- Solid wire: ϕ 0.4 to ϕ 1.0 (AWG 26 to 18)
- Twisted wire: 0.3 mm^2 to 0.75 mm^2 (AWG 22 to 20)
  Element wire diameter: ϕ 0.18 or greater

■ Standard strip-off

- Appox. 10 mm

1. Turn off the POWER switch.
2. Strip the wire insulation and insert the wire into the hole while holding down part A of the terminal using a flat-blade screw driver.

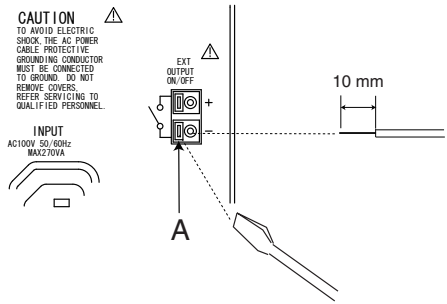


Fig. 4-4 Connection for EXT OUTPUT ON/OFF

3. Check that the wire does not come out from the hole of connector.

⚠CAUTION

- Make sure that the stripped wire does not touch to the chassis or other wires.

4.5 PMM25-1TR

4.5.1 Basic Operation

NOTE

- When pressing more than two switches of the meter display select switch, the display will not appear properly.
- The COM terminals of each output are internally connected in the product.

ON/OFF of the POWER switch

When turning on the POWER switch, always check the status of OUTPUT switch. Depressed position is ON, out position is OFF.

⚠WARNING **Possible electric shock.**

- **When the POWER switch is turned on while the OUTPUT switch is on, the output of setting voltage will be turned on at a time.**

⚠CAUTION
- When the power switch is turned on, the maximum inrush current of approximately 70 A (5 ms) may flow. Take into consideration of the effect such as the capacity of power distribution if other devices are connected on the same power line.
- If the POWER switch is repeatedly turned on and off, it may cause to blow out the input fuse. Allow more than 5 seconds of interval to turn on the power again.

Setting the output voltage

± 25 V Output

1. Check that the OUTPUT switch is off.
2. Press the meter display select switch of the setting output.

   Select either +25 V or -25V of the switch.
3. Turn the TRACKING knob clockwise all the way.

   If the TRACKING knob is positioned in half way, it can not be varied to set up to the rated voltage.
4. While holding down the PRESET switch, set the voltage by the voltage setting knob of your desired output.
5. Turn on the OUTPUT switch.

   The setting voltage will be output. By this time, the 6 V output will be also output at the same time, so in case the 6 V output is not required, make sure that the 6 V voltage setting knob is turned counter-clockwise all the way.

When the OUTPUT switch is on, the output voltage can be varied by the voltage setting knob of each output.

The TRACKING knob can vary for the +25 V and -25 V output with same proportion.

6 V Output

1. Check that the OUTPUT switch is off.
2. Press the 6 V output of the meter display select switch.

   Select either +25 V or -25V of the switch.
3. While holding down the PRESET switch, set the voltage by the 6 V output voltage setting knob of your desired output.
4. Turn on the OUTPUT switch.

   The setting voltage will be output. By this time, the ±25 V output will be also output at the same time, so in case the ±25 V output is not required, make sure that the + (pos.) and the - (neg.) of the ±25 V voltage setting knob is turned counter-clockwise all the way.

NOTE

- When the voltage setting knob is turned counter-clockwise all the way, or the OUTPUT switch is turned off, the several tens mV of reverse voltage will be output.

6 V Output Overvoltage Protection (OVP) Function

The 6 V output has equipped with the overvoltage protection (OVP) function which protects the load from unexpected and excessive voltage. When the OVP is activated, the O.V.P 6 V LED lights on, and the output is turned off.

NOTE

- When the OVP is activated, the several tens mV of reverse polarity voltage will be generated at the output.

■ Setting range of the overvoltage protection (OVP)

- PMM25-1TR: 1 V to 6.4 V

NOTE

- The detection of overvoltage is performed by the sensing terminals. If the sensing cables are breaking or mis-wiring, the OVP function will not be activated even the voltage at the load terminal exceeds the OVP setting value. For details, see "4.5.2 Remote Sensing".

Setting the OVP trip point

⚠CAUTION
- To set the OVP trip point, an overvoltage must actually be output. If a load is connected to the output terminal, remove it.

NOTE
- To clear the OVP setting, turn off the POWER switch and remove the cause of occurrence, then set the OVP trip point accordingly.

1. Check that the OUTPUT switch is off and turn on the POWER switch.
2. While holding down the O.V.P switch, set the OVP trip point using a flat-blade screwdriver to turn the O.V.P variable resistor.

   The positive (+) setting value displays on the meter 1.

CROWBAR function

The PMM25-1TR has equipped with the CROWBAR function. When the OVP is tripped while the CROWBAR switch is tuned on, it short-circuits the 6 V output terminal by the thyristor. At this time, there will be approximately 0.6 V of the voltage occurred at the output terminal.

⚠CAUTION
- The CROWBAR switch should be always turned off when connecting to a load such as a battery which can store the energy. It may lead to damage the product or the connecting load devise caused by discharge current when it passes through the thyristor.

■ Setting of the CROWBAR function

The CROWBAR switch should be turned on or off when the POWER switch is turned off.

4.5.2 Remote Sensing

The remote sensing function is equipped for the 6 V output. The remote sensing function is used to reduce the effect such as the voltage drop caused by the resistance of the load cable and to stabilize the output voltage across the load. However, the maximum rated voltage will be decreased for the portion of voltage drop due to the load cable.

⚠CAUTION

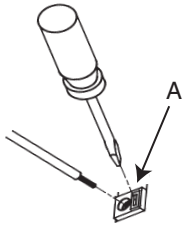
- Make sure the polarity of the sensing wire, and connect firmly that the wire does not come loose. If the sensing wire comes off or mis wired, the voltage at the load terminal exceeds the setting value. At this time, the OVP (Overvoltage Protection) will not be activate because of the voltage of the sensing wire is detected. It may cause to damage the load.

NOTE

- Do not run the current from the remote sensing terminal.
- When the remote sensing function is not used, make sure that the REMOTE SENSING switch is in OFF position.

Handling of SENSING terminals

Strip the wire insulation and insert the wire into the hole while holding down part A of the terminal using a flat-blade screw driver or other similar means.



Wires can be used
- Solid wire : ϕ 0.4 to ϕ 1.0 (AWG26 to 18)
- Twisted wire: 0.3 mm to 0.75 mm (AWG22 to 20)
- Element wire diameter: ϕ 0.18 or greater
- Standard length of stripped wire: 10 mm

Fig. 4-5 Connection to sensing terminals

⚠CAUTION

- After inserting the wire, check that it does not come loose.

- Be sure the exposed section of the wire does not touch the chassis or other wires such as the wire of the adjacent terminal.

Connection and setup procedure

1. Turn off the POWER switch and the OUTPUT switch.
2. Connect the cables as shown in Fig. 4-6.

   For the handling of the SENSING terminal, see Fig. 4-5.
3. Turn on the REMOTE SENSING switch.

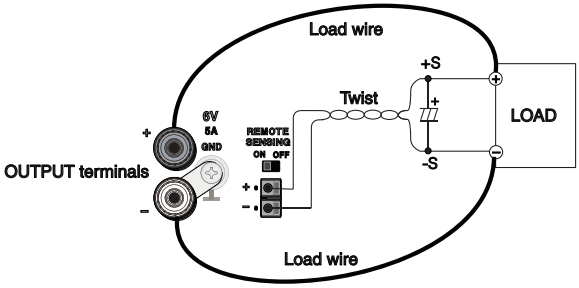


Fig. 4-6 Connection of the sensing wires

WARNING **Possible electric shock.**

- **For sensing wires, use cables with a higher voltage rating than the isolation voltage of the power supply.**

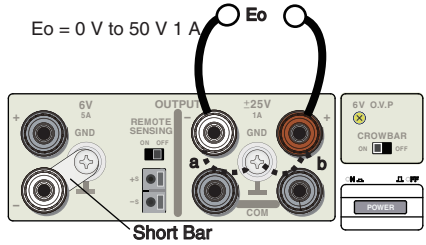
CAUTION

- Burnout may occur in the load. If the sensing wires come loose, the output voltage across the load can not be stabilized and may cause excessive voltage to be applied to the load. Securely connect the sensing wires such as using crimp terminals.

4.5.3 Applied Operation

Series operation

The product can be used to increases the output voltage combining two outputs with connecting the +25 V output terminal and the -25 V output terminal.



a : Negative (-) Ground ----- Connect the Short Bar to the (-) terminal
b : Positive (+) Ground ----- Connect the Short Bar to the (+) terminal

Fig. 4-7 Connection of series operation

Series connection

The PMM25-1TR will be the type of the 6 V 5 A, 31 V 1 A, 56 V 1 A of the power supply by wiring with following figure. By this wiring, remove the short bar on the ±25 V output.

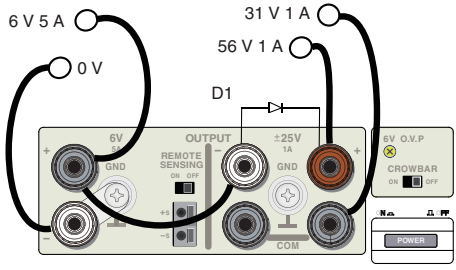


Fig. 4-8 Connection of series connection (case for the negative ground)

⚠CAUTION

- In case of series connection as shown in Fig. 4-8, there will be 5 A of current flow at the ±25 V output if the output is short-circuit. and it may cause to burnout the internal diode used as a protection. Therefore, attach the diode “D1” (with rating of 5 A or greater) as shown in Fig. 4-8.

NOTE

- If each output is used at the same time, the amount of current flow is limited by the rated value of each output.
  In case of Fig. 4-8, if 0.8 A is used for the 56 V output, 0.2 A for the 31 V output and less than 4 A for the 6 V output can be used. Moreover, if 0.3 A for the 56 V output and 0.5 A for the 31 V output are used, less than 4.2 A can be used for the 6 V output.

Output ON/OFF by external contact

The output on/off on each output can be controlled at the same time by using an external contact.

⚠CAUTION

- When wiring to the EXT OUTPUT ON/OFF terminal located on the rear panel of the product, be sure to observe that any of conductive area of wiring cables are not touched to the chassis or the output terminal. If the wiring touch to those area, the product may malfunction.

ON/OFF method

While the OUTPUT switch on the front panel is turned on, the output is turned on when the EXT OUTPUT ON/OFF terminal on the rear panel are open-circuit, and the output is turned off when the positive (+) and the negative (-) terminal are short-circuit.

If the output is turned off either from the front panel or the EXT OUTPUT ON/OFF terminal on the rear panel, you can not turn on the output from the other side of on/off method. The status of turning “OFF” always takes priority.

- Terminal open voltage: Approx. 5.8 V
- Terminal short-circuit current: Approx.1.8 mA

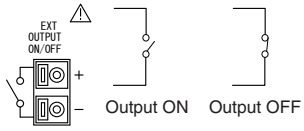


Fig. 4-9 EXT OUTPUT ON/OFF connector

NOTE

- The negative (-) terminal of the EXT OUTPUT ON/OFF terminals is internally connected to the COM terminal of the output and inside of the product.

Handling of connectors

■ Wires can be used

- Solid wire: ϕ 0.4 to ϕ 1.0 (AWG 26 to 18)
- Twisted wire: 0.3 mm^2 to 0.75 mm^2 (AWG 22 to 20)
  Element wire diameter: ϕ 0.18 or greater

■ Standard strip-off length

- Appox. 10 mm

1. Turn off the POWER switch.
2. Strip the wire insulation and insert the wire into the hole while holding down part A of the terminal using a flat-blade screw driver.

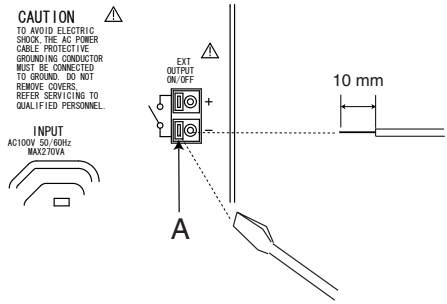


Fig. 4-10 Connection for EXT OUTPUT ON/OFF

3. Check that the wire does not come out from the hole of connector.

⚠CAUTION

- Make sure that the stripped wire does not touch to the chassis or other wires.

4.6 PMM24-1QU

4.6.1 Basic Operation

NOTE

- When pressing more than two switches of the meter display select switch, the display will not appear properly.
- The COM terminals of each output are internally connected in the product.

ON/OFF of the POWER switch

When turning on the POWER switch, always check the status of OUTPUT switch. Depressed position is ON, out position is OFF.

⚠WARNING **Possible electric shock.**

- **When the POWER switch is turned on while the OUTPUT switch is on, the output of setting voltage will be turned on at a time.**

⚠CAUTION

- When the power switch is turned on, the maximum inrush current of approximately 70 A (5 ms) may flow. Take into consideration of the effect such as the capacity of power distribution if other devices are connected on the same power line.
- If the POWER switch is repeatedly turned on and off, it may cause to blow out the input fuse. Allow more than 5 seconds of interval to turn on the power again.

Setting the output voltage

1. Check that the OUTPUT switch is off.
2. Press the meter display select switch of the setting output.
3. Turn the TRACKING knob clockwise all the way.

   If the TRACKING knob is positioned in half way, it can not be varied to set up to the rated voltage.

4. While holding down the PRESET switch, set the voltage by the voltage setting knob of your desired output.

   The ±12 V output displays up to the first decimal place.

5. Turn on the OUTPUT switch.

   The setting voltage will be output.

When the OUTPUT switch is on, the output voltage can be varied by the voltage setting knob of each output.

The TRACKING knob can vary the +24 V output and the -24 V output with same proportion.

NOTE

- When the voltage setting knob is turned counter-clockwise all the way, or the OUTPUT switch is turned off, the several tens mV of reverse voltage will be output.

4.6.2 Applied Operation

Series operation

The product can be used for the 24 V (or the 48 V) of the output voltage connecting with the load between the positive (+) output terminal of the ±12 V output (or the ±24 V output) and the negative (-) terminal.

NOTE

- Do not connect between the 24 V output terminal and the 48 V output terminal because all COM terminals are internally connected in the product.
  Connect the GND by the short bar to the output terminal of either one of the four outputs or the COM terminal.

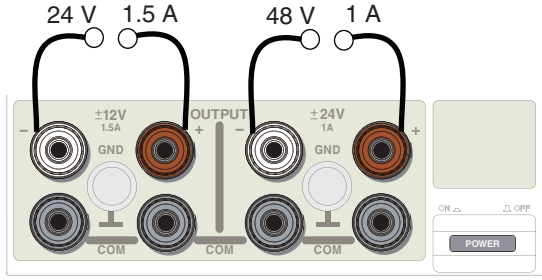


Fig. 4-11 Connection of Series operation (Model PMM24-1QU)

Output ON/OFF by external contact

The output on/off on each output can be controlled at the same time by using an external contact.

⚠CAUTION

- When wiring to the EXT OUTPUT ON/OFF terminal located on the rear panel of the product, be sure to observe that any of conductive area of wiring cables are not touched to the chassis or the output terminal. If the wiring touch to those area, the product may malfunction.

ON/OFF method

While the OUTPUT switch on the front panel is turned on, the output is turned on when the EXT OUTPUT ON/OFF terminal on the rear panel are open-circuit, and the output is turned off when the positive (+) and the negative (-) terminal are short-circuit.

If the output is turned off either from the front panel or the EXT OUTPUT ON/OFF terminal on the rear panel, you can not turn on the output from the other side of on/off method. The status of turning “OFF” always takes priority.

- Terminal open voltage: Approx. 5.8 V
- Terminal short-circuit current: Approx.1.8 mA

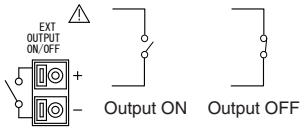


Fig. 4-12 EXT OUTPUT ON/OFF connector

NOTE

- The negative (-) terminal of the EXT OUTPUT ON/OFF terminals is internally connected to the COM terminal of the output and inside of the product.

Handling of connectors

■ Wires can be used

- Solid wire: ϕ 0.4 to ϕ 1.0 (AWG 26 to 18)
- Twisted wire: 0.3 mm^2 to 0.75 mm^2 (AWG 22 to 20)
  Element wire diameter: ϕ 0.18 or greater

■ Standard strip-off length

- Appox. 10 mm

1. Turn off the POWER switch.
2. Strip the wire insulation and insert the wire into the hole while holding down part A of the terminal using a flat-blade screw driver.

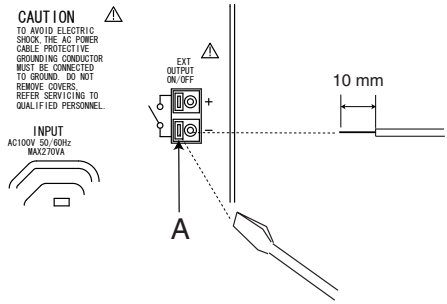


Fig. 4-13 Connection for EXT OUTPUT ON/OFF

3. Check that the wire does not come out from the hole of connector.

⚠CAUTION

- Make sure that the stripped wire does not touch to the chassis or other wires.

5 Maintenance

This chapter describes replacing the fuse and calibration procedure.

5.1 Replacing the Fuse

⚠WARNING

- **To prevent the possibility of electric shock, turn off the POWER switch on the power supply and unplug the power cord plug before replacing the fuse.**
- **Use a fuse of shape, rating, and characteristics that conform to the power supply.**
- **Using a fuse of a different rating or shorting the fuse holder is dangerous. Never carry out such acts.**

1. Turn off the POWER switch and unplug the power cord.
2. Remove the power cord from the INPUT connector on the rear panel.
3. Remove the fuse holder using a tool such as a flat-blade screwdriver as shown in Fig. 5-1.

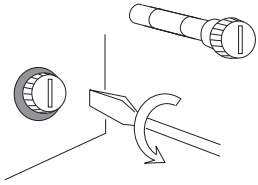


Fig. 5-1 Removing the fuse holder

5.2 Calibration

The power supply is calibrated at the factory before shipment. However, periodic calibration is necessary due to changes that occur after extended use.

For calibration, contact your Kikusui agent or distributor. If you wish to calibrate the power supply, follow the procedure below.

Test equipment required for calibration

For calibration, the following equipment is necessary.

- DC voltmeter (DVM) with measuring accuracy of 0.02 % or better.
- Shunt resistor with accuracy of 0.1 % or better (a resistor capable of handling the rated output current of the PMM series power supply being calibrated).

Environment

Perform calibration under the following environment.

- Ambient temperature: 23 °C ± 5 °C
- Ambient humidity: 80 %rh or less

To minimize the calibration error due to initial drift, warm up (turn on) the power supply for at least 30 minutes before calibration. In addition, warm up the DVM and shunt resistor for their appropriate time.

Connecting the equipment

The connecting of equipment for calibration varies for each voltage and current system of calibration procedure. For each of the wiring instruction, follow the procedure as described by the model.

NOTE

- Use the connecting cable with sufficient current capacity with respect to the rated output current of the calibrated model.
  It is recommended to use the cross sectional area of copper wire with more than 0.75 mm^2

5.2.1 PMM18-2.5DU, PMM35-1.2DU

Calibration items can be grouped into two types: voltage system and current system. Calibration is performed using No. 1 through No. 11 of the variable resistors located on left side of the external panel.

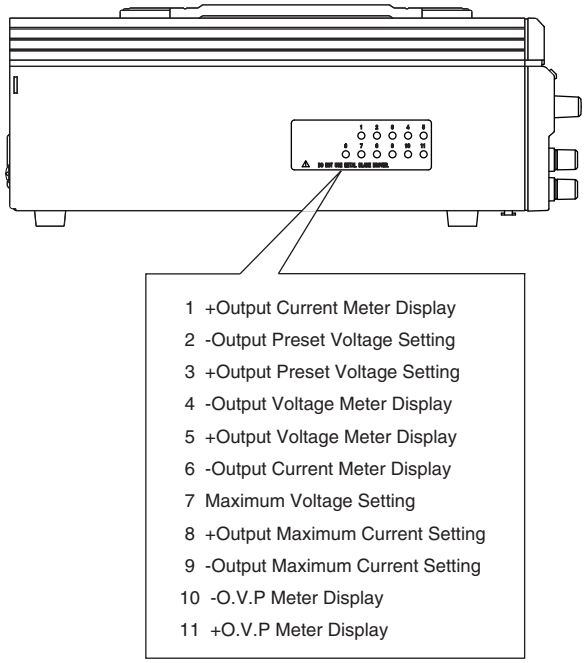


Fig. 5-2 Variable resistors for calibration (PMM18-2.5DU, PMM35-1.2DU)

Voltage system calibration procedure

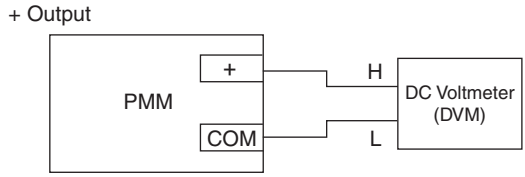
Before starting the calibration, the following condition should be set on the front panel.

- Turn the TRACKING knob clockwise all the way.
- Turn the +Output voltage setting knob clockwise all the way.
- Turn the -Output voltage setting knob clockwise all the way.
- Turn the +Output O.V.P setting variable resistor clockwise all the way.
- Turn the -Output O.V.P setting variable resistor clockwise all the way.

■ +Output Maximum Voltage

The voltage specified in the ( ) is for the PMM35-1.2DU.

1. Connect the DVM between the +18 V (+35 V) OUTPUT terminal and the COM terminal.



2. Check the voltage of DVM which should be read as following table.

   If the adjustment is necessary, use No. 7 (Maximum Voltage Setting) of the variable resistor.

MODEL	Maximum Voltage
PMM18-2.5DU	18.5 V ±0.1 V
PMM35-1.2DU	36.7 V ±0.2 V

■ +Output Voltage Display

The voltage specified in the ( ) is for the PMM35-1.2DU.

1. Press the meter display select switch of the +18 V (+35 V) while the calibration of “+Output Maximum Voltage” is performed.
2. Check the voltage displayed on the Meter 1 (the meter on the right hand side) which matches to the reading value of the DVM (DC voltmeter).

   If the adjustment is necessary, use No. 5 (+Output Voltage Meter Display) of the variable resistor.

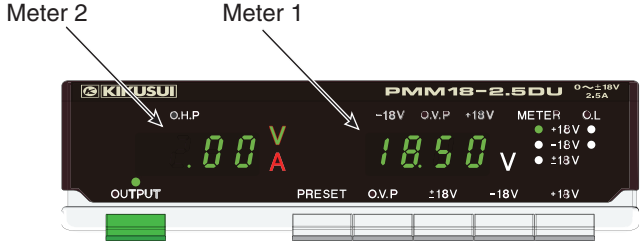
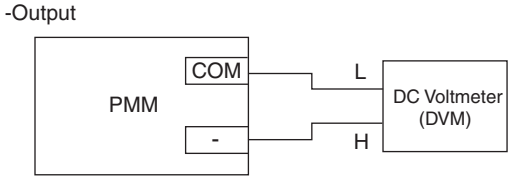


Fig. 5-3 Meter Display (PMM18-2.5DU)

■ -Output Voltage Display

The voltage specified in the ( ) is for the PMM35-1.2DU.

1. Connect the DVM between the -18 V (-35 V) OUTPUT terminal and the COM terminal.



2. Press the meter display select switch of the -18 V (-35 V).
3. Check the voltage displayed on the Meter 1 (the meter on the right hand side) which matches to the reading value on the DVM (DC voltmeter).

   If the adjustment is necessary, use No. 4 (-Output Voltage Meter Display) of the variable resistor.

■ +Output Voltage Preset Value

The voltage specified in the ( ) is for the PMM35-1.2DU.

1. Press the meter display select switch of the +18 V (+35 V).
2. Take a note for the reading value of +Output voltage displayed on the Meter 1 (the meter on the right hand side).
3. While pressing the PRESET switch, check the voltage displayed on the Meter 1 (the meter on the right hand side) which matches to the note taken in Step 2 as the value of +Output voltage.

   If the adjustment is necessary, use No. 3 (+Output Preset Voltage Setting) of the variable resistor.

■ -Output Voltage Preset Value

The voltage specified in the ( ) is for the PMM35-1.2DU.

1. Press the meter display select switch of the -18 V (-35 V).
2. Take a note for the reading value of -Output voltage displayed on the Meter 1 (the meter on the right hand side).
3. While pressing the PRESET switch, check the voltage displayed on the Meter 2 (the meter on the left hand side) which matches to the note taken in Step 2 as the value of -Output voltage.

   If the adjustment is necessary, use No. 2 (-Output Preset Voltage Setting) of the variable resistor.

■ +Output OVP Setting Display

The voltage specified in the ( ) is for the PMM35-1.2DU.

1. Press the meter display select switch of the +18 V (+35 V).
2. Turn the “+Output Voltage Setting” knob to set the rated voltage at +18.00 V (+35.00 V).
3. Turn the O.V.P variable resistor (for +output OVP setting) on the front panel counterclockwise slowly until when it reaches the trip point of OVP, then keep off your hand from the variable resistor. (Do not move the trip point)
4. While pressing the O.V.P switch, check the voltage displayed on the Meter 1 (the meter on the right hand side) which matches to the rated voltage of +18.00V (+35.00 V).

   If the adjustment is necessary, use No. 11 (+O.V.P Meter Display) of the variable resistor.

■ -Output OVP Setting Display

The voltage specified in the ( ) is for the PMM35-1.2DU.

1. Press the meter display select switch of the -18 V (-35 V).
2. Turn the “-Output Voltage Setting” knob to set the rated voltage at -18.00 V (-35.00 V).
3. Turn the O.V.P variable resistor (for -output OVP setting) on the front panel counterclockwise slowly until when it reaches the trip point of OVP, then keep off your hand from the variable resistor. (Do not move the trip point)
4. While pressing the O.V.P switch, check the voltage displayed on the Meter 2 (the meter on the left hand side) which matches to the rated voltage of -18.00 V (-35.00 V).

   If the adjustment is necessary, use No. 10 (-O.V.P Meter Display) of the variable resistor.

Current system calibration procedure

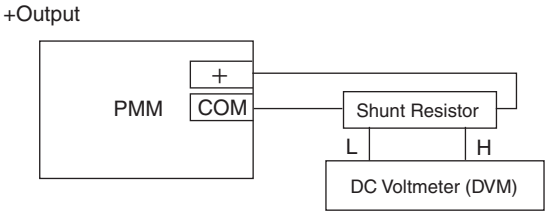
The calibration for the Current system should be performed under the condition of current limit.

If the voltage will not be displayed on the DVM(DC Voltmeter), increase the output voltage until the “O.L” LED lights on.

■ +Output Maximum Current

The voltage specified in the ( ) is for the PMM35-1.2DU.

1. Connect the shunt resistor and the DVM between the +18 V (+35 V) OUTPUT terminal and the COM terminal.



2. Press the meter display select switch of the +18 V (+35 V).
3. Check the conversion value of the DVM which should be less than indicated value in the following table.

   If the adjustment is necessary, use No. 8 (+Output Maximum Current Setting) of the variable resistor.

MODEL	Maximum Current
PMM18-2.5DU	2.60 A ±0.04 A
PMM35-1.2DU	1.26 A ±0.02 A

■ +Output Current Display

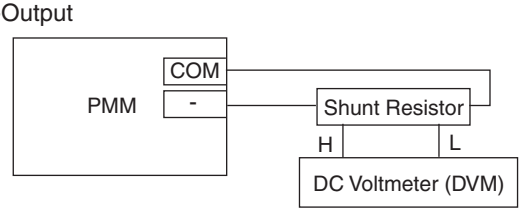
Check the voltage displayed on the Meter 2 (the meter on the left hand side) which matches to the converted value on the DVM (DC voltmeter) while the calibration of "+Output Maximum Current" is performed.

If the adjustment is necessary, use No. 1 (+Output Current Meter Display) of the variable resistor.

■ -Output Maximum Current

The voltage specified in the ( ) is for the PMM35-1.2DU.

1. Connect the shunt resistor and the DVM between the -18 V (-35 V) OUTPUT terminal and the COM terminal.



2. Press the meter display select switch of the -18 V (-35 V).
3. Check the conversion value of the DVM which should be less than indicated value in the following table.

If the adjustment is necessary, use No. 9 (-Output Maximum Current Setting) of the variable resistor.

MODEL	Maximum Current
PMM18-2.5DU	-2.60 A ±0.04 A
PMM35-1.2DU	-1.26 A ±0.02 A

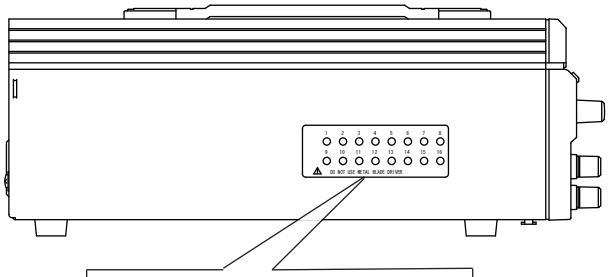
■ -Output Current Display

Check the voltage displayed on the Meter 2 (the meter on the left hand side) which matches to the converted value on the DVM (DC voltmeter) while the calibration of "-Output Maximum Current" is performed.

If the adjustment is necessary, use No. 6 (-Output Current Meter Display) of the variable resistor.

5.2.2 PMM25-1TR

Calibration items can be grouped into two types: voltage system and current system. Calibration is performed using No. 1 through No. 16 of the variable resistors located on left side of the external panel.



1 -25 V Output Maximum Current Setting
2 +25 V Output Maximum Current Setting
3 +25 V Output Current Meter Display
4 6 V Maximum Voltage Setting
5 O.V.P. Maximum Value Setting
6 ±25 V Output Maximum Voltage Setting
7 +25 V Output Voltage Meter Display
8 +25 V Output Preset Voltage Setting
9 6 V Current Meter Setting
10 6 V Maximum Current Setting
11 6 V Voltage Meter Setting
12 6 V Preset Voltage Setting
13 O.V.P. Meter Setting
14 -25 V Output Current Meter Display
15 -25 V Output Voltage Meter Display
16 -25 V Output Preset Voltage Setting

Fig. 5-4 Variable resistors for calibration (PMM25-1TR)

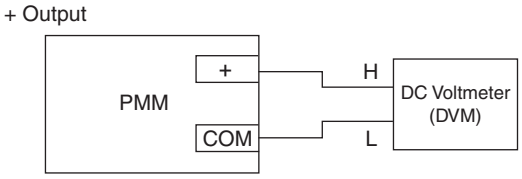
Voltage system calibration procedure

Before starting the calibration, the following condition should be set on the front panel.

- Turn the TRACKING knob clockwise all the way.
- Turn the +25 V voltage setting knob clockwise all the way.
- Turn the -25 V voltage setting knob clockwise all the way.
- Turn the 6 V setting knob clockwise all the way.
- Turn the 6 V O.V.P setting variable resistor clockwise all the way.

■ ±25 V Output Maximum Voltage

1. Connect the DVM between the +25 V OUTPUT terminal and the COM terminal.



2. Check the voltage of DVM which should be read at 25.8 V ±0.2 V.

   If the adjustment is necessary, use No. 6 (±25 V Maximum Voltage Setting) of the variable resistor.

■ +25 V Output Voltage Display

1. Press the meter display select switch of the +25 V while the calibration of "±25 V Output Maximum Voltage" is performed.
2. Check the voltage displayed on the Meter 1 (the meter on the right hand side) which matches to the reading value of the DVM (DC voltmeter).

   If the adjustment is necessary, use No. 7 (+25 V Output Voltage Meter Display) of the variable resistor.

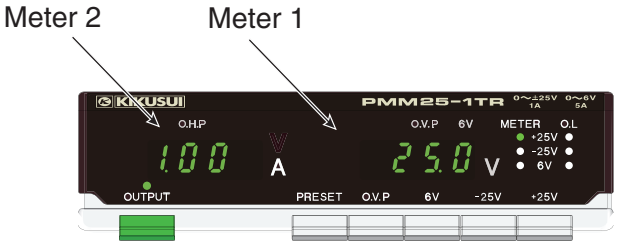
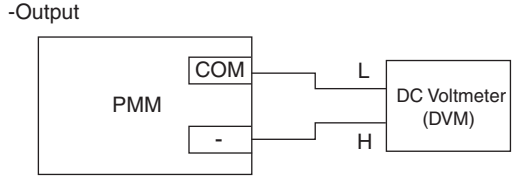


Fig. 5-5 Meter Display (PMM25-1TR)

■ -25 V Output Voltage Display

1. Connect the DVM between the -25 V OUTPUT terminal and the COM terminal.



2. Press the meter display select switch of the -25 V.
3. Check the voltage displayed on the Meter 1 (the meter on the right hand side) which matches to the reading value on the DVM (DC voltmeter).

   If the adjustment is necessary, use No. 15 (-25 V Output Voltage Meter Display) of the variable resistor.

■ 6 V Output Maximum Voltage

1. Connect the DVM between the 6 V OUTPUT terminal and the COM terminal.
2. Check the voltage of DVM which should be read at 6.2 V ±0.1 V.

   If the adjustment is necessary, use No. 4 (6 V Output Maximum Voltage Setting) of the variable resistor.

■ 6 V Output Voltage Display

1. Press the meter display select switch of the 6 V while the calibration of “6 V Output Maximum Voltage” is performed.
2. Check the voltage displayed on the Meter 1 (the meter on the right hand side) which matches to the reading value of the DVM (DC voltmeter).

   If the adjustment is necessary, use No. 11 (6 V Voltage Meter Display) of the variable resistor.

■ +25 V Output Voltage Preset Value

1. Press the meter display select switch of the +25 V.
2. Take a note for the reading value of +Output voltage displayed on the Meter 1 (the meter on the right hand side).
3. While pressing the PRESET switch, check the voltage displayed on the Meter 1 (the meter on the right hand side) which matches to the note taken in Step 2 as the value of +Output voltage.

   If the adjustment is necessary, use No. 8 (+25 V Output Preset Voltage Setting) of the variable resistor.

■ -25 V Output Voltage Preset Value

1. Press the meter display select switch of the -25 V.
2. Take a note for the reading value of -Output voltage displayed on the Meter 1 (the meter on the right hand side).
3. While pressing the PRESET switch, check the voltage displayed on the Meter 1 (the meter on the right hand side) which matches to the note taken in Step 2 as the value of -Output voltage.

   If the adjustment is necessary, use No. 16 (-25 V Output Preset Voltage Setting) of the variable resistor.

■ 6 V Output Voltage Preset Value

1. Press the meter display select switch of the 6 V.
2. Take a note for the reading value of +Output voltage displayed on the Meter 1 (the meter on the right hand side).
3. While pressing the PRESET switch, check the voltage displayed on the Meter 1 (the meter on the right hand side) which matches to the note taken in Step 2 as the value of +Output voltage.

If the adjustment is necessary, use No. 12 (6 V Output Preset Voltage Setting) of the variable resistor.

■ 6 V OVP Setting Display

1. Press the meter display select switch of the 6 V.
2. Turn the “6 V Voltage Setting” knob to set the rated voltage at 6.00 V.
3. Turn the O.V.P variable resistor (6 V OVP setting) on the front panel counterclockwise slowly until when it reaches the trip point of OVP, then keep off your hand from the variable resistor. (Do not move the trip point)
4. While pressing the O.V.P switch, check the voltage displayed on the Meter 1 (the meter on the right hand side) to be read as 6.00 V.

   If the adjustment is necessary, use No. 13 (O.V.P Meter Setting) of the variable resistor.

■ 6 V OVP Maximum Value

1. Press the meter display select switch of the 6 V.
2. While pressing the O.V.P switch, check the voltage displayed on the Meter 1 (the meter on the right hand side) to be read as 6.60 V.

   If the adjustment is necessary, use No. 5 (O.V.P Maximum Value Setting) of the variable resistor.

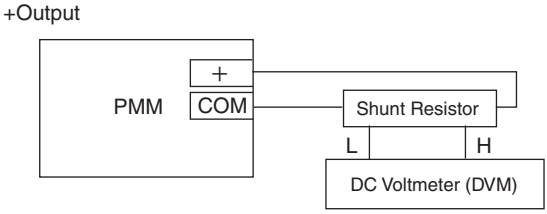
Current system calibration procedure

The calibration for the Current system should be performed under the condition of current limit.

If the voltage will not be displayed on the DVM(DC Voltmeter), increase the output voltage until the “O.L” LED lights on.

■ +25 V Output Maximum Current

1. Connect the shunt resistor and the DVM between the +25 V OUTPUT terminal and the COM terminal.



2. Press the meter display select switch of the +25 V.
3. Check the conversion value of the DVM which should be read at 1.05 A ±0.016 A.

   If the adjustment is necessary, use No. 2 (+25 V Output Maximum Current Setting) of the variable resistor.

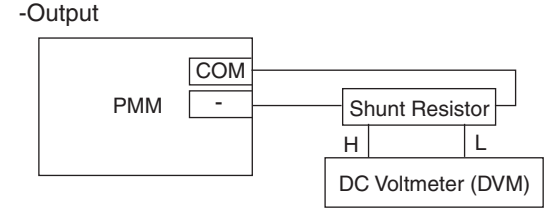
■ +25 V Output Current Display

Check the voltage displayed on the Meter 2 (the meter on the left hand side) which matches to the converted value on the DVM (DC voltmeter) while the calibration of "+25 V Output Maximum Current" is performed.

If the adjustment is necessary, use No. 3 (+25 V Output Current Meter Display) of the variable resistor.

■ -25 V Output Maximum Current

1. Connect the shunt resistor and the DVM between the -25 V OUTPUT terminal and the COM terminal.



2. Press the meter display select switch of the -25 V.

3. Check the conversion value of the DVM which should be read at -1.05 A ±0.016 A.

   If the adjustment is necessary, use No. 1 (-25 V Output Maximum Current Setting) of the variable resistor.

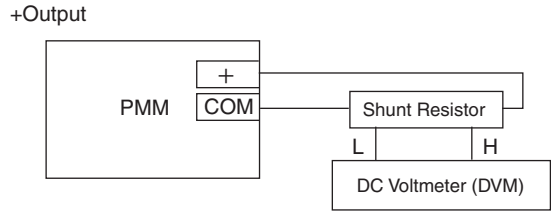
■ -25 V Output Current Display

Check the voltage displayed on the Meter 2 (the meter on the left hand side) which matches to the converted value on the DVM (DC voltmeter) while the calibration of "-25 V Output Maximum Current" is performed.

If the adjustment is necessary, use No. 14 (-25 V Output Current Meter Display) of the variable resistor.

■ 6 V Output Maximum Current

1. Connect the shunt resistor and the DVM between the 6 V OUTPUT terminal and the COM terminal.



2. Press the meter display select switch of the 6 V.
3. Check the conversion value of the DVM which should be read at 5.2 A ±0.016 A.

   If the adjustment is necessary, use No. 10 (6 V Output Maximum Current Setting) of the variable resistor.

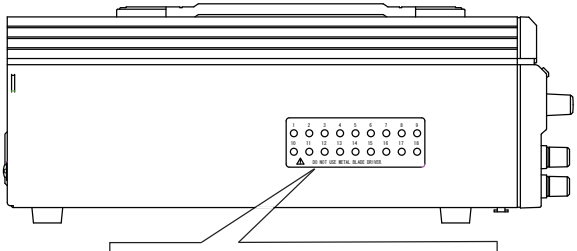
■ 6 V Output Current Display

Check the voltage displayed on the Meter 2 (the meter on the left hand side) which matches to the converted value on the DVM (DC voltmeter) while the calibration of "6 V Output Maximum Current" is performed.

If the adjustment is necessary, use No. 9 (6 V Output Current Meter Display) of the variable resistor.

5.2.3 PMM24-1QU

Calibration items can be grouped into two types: voltage system and current system. Calibration is performed using No. 1 through No. 18 of the variable resistors located on left side of the external panel.



1 + 24 V Output Current Meter Display
2 + 24 V Output Maximum Current Setting
3 - 24 V Output Maximum Current Setting
4 - 24 V Output Current Meter Display
5 + 24 V Output Preset Voltage Setting
6 + 24 V Output Voltage Meter Display
7 - 24 V Output Preset Voltage Setting
8 - 24 V Output Voltage Meter Display
9 ± 24 V Maximum Voltage Setting
10 + 12 V Output Current Meter Display
11 + 12 V Output Maximum Current Setting
12 - 12 V Output Maximum Current Setting
13 - 12 V Output Current Meter Display
14 + 12 V Output Preset Voltage Setting
15 + 12 V Output Voltage Meter Display
16 - 12 V Output Preset Voltage Setting
17 - 12 V Output Voltage Meter Display
18 ±12 V Maximum Voltage Setting

Fig. 5-6 Variable resistors for calibration (PMM24-1QU)

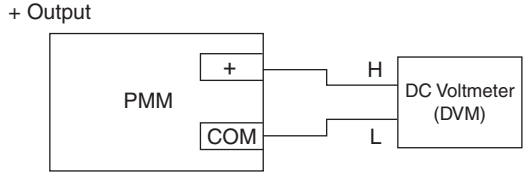
Voltage system calibration procedure

Before starting the calibration, the following condition should be set on the front panel.

- Turn the TRACKING knob clockwise all the way.
- Turn the +24 V voltage setting knob clockwise all the way.
- Turn the -24 V voltage setting knob clockwise all the way.
- Turn the +12 V setting knob clockwise all the way.
- Turn the -12 V setting knob clockwise all the way.

■ ±24 V Output Maximum Voltage

1. Connect the DVM between the +24 V OUTPUT terminal and the COM terminal.



2. Check the voltage of DVM which should be read at 24.8 V ±0.2 V.

   If the adjustment is necessary, use No. 9 (±24 V Maximum Voltage Setting) of the variable resistor.

■ +24 V Output Voltage Display

1. Press the meter display select switch of the +24 V while the calibration of "±24 V Output Maximum Voltage" is performed.
2. Check the voltage displayed on the Meter 1 (the meter on the right hand side) which matches to the reading value of the DVM (DC voltmeter).

   If the adjustment is necessary, use No. 6 (+24 V Output Voltage Meter Display) of the variable resistor.

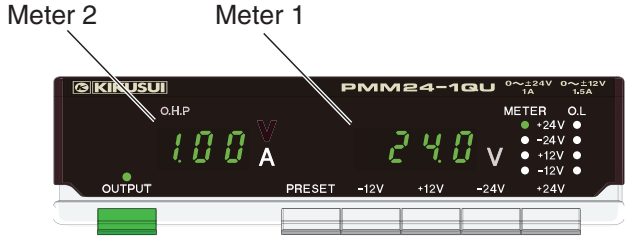
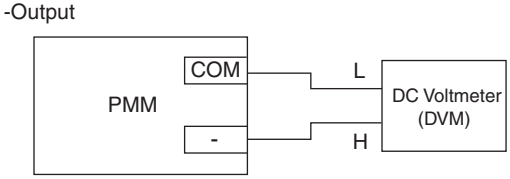


Fig. 5-7 Meter Display (PMM24-1QU)

■ -24 V Output Voltage Display

1. Connect the DVM between the -24 V OUTPUT terminal and the COM terminal.

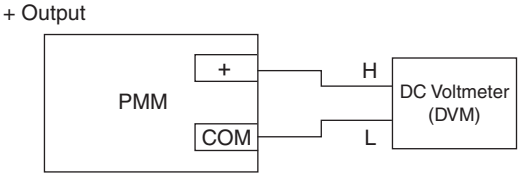


2. Press the meter display select switch of the -24 V.
3. Check the voltage displayed on the Meter 1 (the meter on the right hand side) which matches to the reading value on the DVM (DC voltmeter).

   If the adjustment is necessary, use No. 8 (-24 V Output Voltage Meter Display) of the variable resistor.

■ ±12 V Output Maximum Voltage

1. Connect the DVM between the +12 V OUTPUT terminal and the COM terminal.



2. Check the voltage of DVM which should be read at 12.4 V ±0.1 V.

   If the adjustment is necessary, use No. 18 (±12 V Output Maximum Voltage Setting) of the variable resistor.

■ +12 V Output Voltage Display

1. Press the meter display select switch of the +12 V while the calibration of “±12 V Output Maximum Voltage” is performed.

2. Check the voltage displayed on the Meter 1 (the meter on the right hand side) which matches to the reading value of the DVM (DC voltmeter).

   If the adjustment is necessary, use No. 15 (+12 V Voltage Meter Display) of the variable resistor.

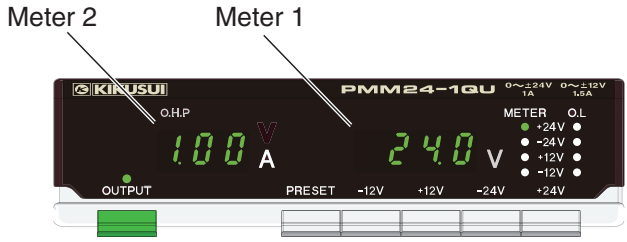
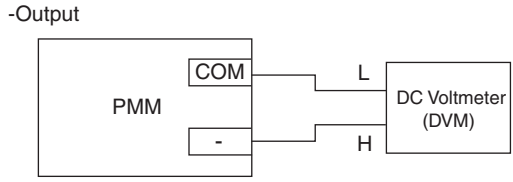


Fig. 5-8 Meter Display (PMM24-1QU)

■ -12 V Output Voltage Display

1. Connect the DVM between the -12 V OUTPUT terminal and the COM terminal.



2. Press the meter display select switch of the -12 V.
3. Check the voltage displayed on the Meter 1 (the meter on the right hand side) which matches to the reading value on the DVM (DC voltmeter).

   If the adjustment is necessary, use No. 17 (-12 V Output Voltage Meter Display) of the variable resistor.

■ +24 V Output Voltage Preset Value

1. Press the meter display select switch of the +24 V.

2. Take a note for the reading value of +Output voltage displayed on the Meter 1 (the meter on the right hand side).
3. While pressing the PRESET switch, check the voltage displayed on the Meter 1 (the meter on the right hand side) which matches to the note taken in Step 2 as the value of +Output voltage.

   If the adjustment is necessary, use No. 5 (+24 V Output Preset Voltage Setting) of the variable resistor.

■ -24 V Output Voltage Preset Value

1. Press the meter display select switch of the -24 V.
2. Take a note for the reading value of -Output voltage displayed on the Meter 1 (the meter on the right hand side).
3. While pressing the PRESET switch, check the voltage displayed on the Meter 1 (the meter on the right hand side) which matches to the note taken in Step 2 as the value of -Output voltage.

   If the adjustment is necessary, use No. 7 (-24 V Output Preset Voltage Setting) of the variable resistor.

■ +12 V Output Voltage Preset Value

1. Press the meter display select switch of the +12 V.
2. Take a note for the reading value of +Output voltage displayed on the Meter 1 (the meter on the right hand side).
3. While pressing the PRESET switch, check the voltage displayed on the Meter 1 (the meter on the right hand side) which matches to the note taken in Step 2 as the value of +Output voltage.

   If the adjustment is necessary, use No. 14 (+12 V Output Preset Voltage Setting) of the variable resistor.

■ -12 V Output Voltage Preset Value

1. Press the meter display select switch of the -12 V.
2. Take a note for the reading value of +Output voltage displayed on the Meter 1 (the meter on the right hand side).
3. While pressing the PRESET switch, check the voltage displayed on the Meter 1 (the meter on the right hand side) which matches to the note taken in Step 2 as the value of +Output voltage.

   If the adjustment is necessary, use No. 16 (-12 V Output Preset Voltage Setting) of the variable resistor.

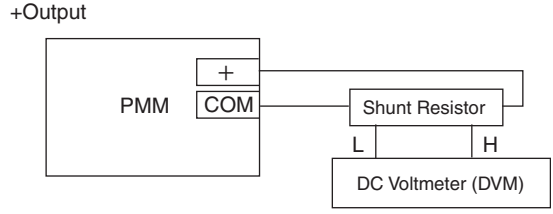
Current system calibration procedure

The calibration for the Current system should be performed under the condition of current limit.

If the voltage will not be displayed on the DVM(DC Voltmeter), increase the output voltage until the “O.L” LED lights on.

■ +24 V Output Maximum Current

1. Connect the shunt resistor and the DVM between the +24 V OUTPUT terminal and the COM terminal.



2. Press the meter display select switch of the +24 V.
3. Check the conversion value of the DVM which should be read at 1.05 A ±0.016 A.

   If the adjustment is necessary, use No. 2 (+24 V Output Maximum Current Setting) of the variable resistor.

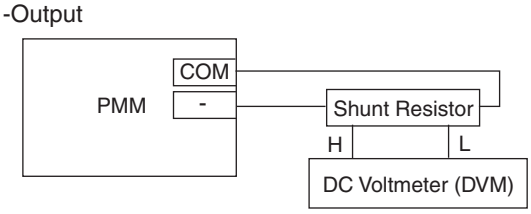
■ +24 V Output Current Display

Check the voltage displayed on the Meter 2 (the meter on the left hand side) which matches to the converted value on the DVM (DC voltmeter) while the calibration of "+24 V Output Maximum Current" is performed.

If the adjustment is necessary, use No. 1 (+24 V Output Current Meter Display) of the variable resistor.

■ -24 V Output Maximum Current

1. Connect the shunt resistor and the DVM between the -24 V OUTPUT terminal and the COM terminal.



2. Press the meter display select switch of the -24 V.
3. Check the conversion value of the DVM which should be read at -1.05 A ±0.016 A.

   If the adjustment is necessary, use No. 3 (-24 V Output Maximum Current Setting) of the variable resistor.

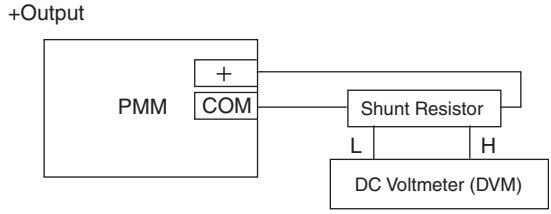
■ -24 V Output Current Display

Check the voltage displayed on the Meter 2 (the meter on the left hand side) which matches to the converted value on the DVM (DC voltmeter) while the calibration of "-24 V Output Maximum Current" is performed.

If the adjustment is necessary, use No. 4 (-24 V Output Current Meter Display) of the variable resistor.

■ +12 V Output Maximum Current

1. Connect the shunt resistor and the DVM between the +12 V OUTPUT terminal and the COM terminal.



2. Press the meter display select switch of the +12 V.
3. Check the conversion value of the DVM which should be read at 1.57 A ±0.025 A.

   If the adjustment is necessary, use No. 11 (+12 V Output Maximum Current Setting) of the variable resistor.

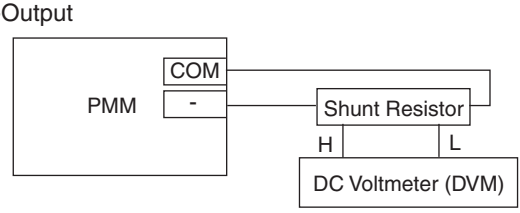
■ +12 V Output Current Display

Check the voltage displayed on the Meter 2 (the meter on the left hand side) which matches to the converted value on the DVM (DC voltmeter) while the calibration of "+12 V Output Maximum Current" is performed.

If the adjustment is necessary, use No. 10 (+12 V Output Current Meter Display) of the variable resistor.

■ -12 V Output Maximum Current

1. Connect the shunt resistor and the DVM between the -12 V OUTPUT terminal and the COM terminal.



2. Press the meter display select switch of the -12 V.

3. Check the conversion value of the DVM which should be read at 1.57 A ±0.025 A.

   If the adjustment is necessary, use No. 12 (-12 V Output Maximum Current Setting) of the variable resistor.

■ -12V Output Current Display

Check the voltage displayed on the Meter 2 (the meter on the left hand side) which matches to the converted value on the DVM (DC voltmeter) while the calibration of "-12 V Output Maximum Current" is performed.

If the adjustment is necessary, use No. 13 (-12 V Output Current Meter Display) of the variable resistor.

6 Specifications

This chapter gives description on the electrical and mechanical specifications of the PMM series.

Unless specified otherwise, the specifications are for the following settings and conditions.

- The load is a pure resistance.
- Connect the COM terminal to the chassis terminal using the short bar provided.
- After a warm-up time of 30 minutes has elapsed with the load current flowing at 23 ºC ± 5 ºC and 80 %rh or less.
- Typical values, standard values, and calculated values do not guarantee the performance. Use these values as a guideline when using the product.
- Measured terminals

  PMM18-2.5DU: Between the COM terminal of the +18 V output and each output.

  PMM35-1.2DU: Between the COM terminal of the +35 V output and each output.

  PMM25-1TR : Between the COM terminal of the +25 V output and each output for the ±25 V range. Between the outputs for 6 V output.

  PMM24-1QU : Between the COM terminal of the +24 V output and each output.

6.1 Electrical Specifications

Model			PMM 18-2.5DU	PMM 35-1.2DU	PMM 25-1TR	PMM 24-1QU
Input specifications						
	Input power		100 Vac ± 10 %, 50/60 Hz, single phase (117 V, 200 V, 217 V, and 234 V are factory options)			
	Power consumption		Approx. 240 VA			
	Inrush current		Approx. 70 A			
Output specifications						
	Output 1	Rated voltage variable range	0 V to +18 V	0 V to +35 V	0 V to +25 V	0 V to +24 V
		Resolution (Calculated value)*1	33 mV	62 mV	45 mV	43 mV
		Rated current (Fixed)	+2.5 A	+1.2 A	+1 A	+1 A
	Output 2	Rated voltage variable range	0 V to -18 V	0 V to -35 V	0 V to -25 V	0 V to -24 V
		Resolution (Calculated value)*1	-33 mV	-62 mV	-45 mV	-43 mV
		Rated current (Fixed)	-2.5 A	-1.2 A	-1 A	-1 A
	Output 3	Rated voltage variable range	—	—	0 V to +6 V	0 V to +12 V
		Resolution (Calculated value)*1	—	—	11 mV	22 mV
		Rated current (Fixed)	—	—	+5 A	+1.5 A
	Output 4	Rated voltage variable range	—	—	—	0 V to -12 V
		Resolution (Calculated value)*1	—	—	—	-22 mV
		Rated current (Fixed)	—	—	—	-1.5 A
	Dual Tracking control		Output 1 and Output 2			
	Tracking error		1 % of the rated voltage			

Model			PMM 18-2.5DU	PMM 35-1.2DU	PMM 25-1TR	PMM 24-1QU
Constant voltage characteristics						
	Source effect[*2]	Output 1	1 mV	2 mV	2 mV	2 mV
		Output 2	1 mV	2 mV	2 mV	2 mV
		Output 3	—	—	2 mV	1 mV
		Output 4	—	—	—	1 mV
	Load effect[*3]	Output 1	3 mV	3 mV	2 mV	2 mV
		Output 2	3 mV	3 mV	2 mV	2 mV
		Output 3	—	—	5 mV	3 mV
		Output 4	—	—	—	3 mV
	Ripple noise (RMS) 5 Hz to 1 MHz		500 µV			
	Transient response[*4]		50 µs (TYP)			
	Temperature coefficient		100 ppm ／ ℃ (TYP)			
Output ON/OFF			ON/OFF for all output simultaneously			
Protection functions						
	Current limit	Output 1	2.6 A ± 2 %	1.26 A ± 2 %	1.05 A ± 2 %	1.05 A ± 2 %
		Output 2	-2.6 A ± 2 %	-1.26 A ± 2 %	-1.05A ± 2 %	-1.05 A ± 2 %
		Output 3	—	—	5.25 A ± 2 %	1.57 A ± 2 %
		Output 4	—	—	—	-1.57 A ± 2 %
	Over-heat protection		Output turns off when the temperature reaches 95 ℃ ±5 ℃			
	Over-voltage protection (OVP)	Type of activation behavior	OUTPUT OFF		Thyristor Crowbar: CROWBAR ON/OFF	—
		Setting range (Output 1)	1 V to 19 V	1 V to 37 V	—	—
		Setting range (Output 2)	-1 V to -19 V	-1 V to -37 V	—	—
		Setting range (Output 3)	—	—	1 V to 6.4 V	—
	Output fuse		3 A	2 A	1.5 A / 7 A	1.5 A / 2 A
	Thermal fuse		Outputs turns off when the wire-wound section at the power transformer reaches 130 ℃.			
	Input fuse	100 V system	4 A (S.B) [99-02-0155]			
		200 V system	2 A (S.B) [99-02-0153]			

Model			PMM 18-2.5DU	PMM 35-1.2DU	PMM 25-1TR	PMM 24-1QU
External control						
	Output ON/OFF		ON/OFF for all output simultaneously			
	Remote sensing		—	—	Available on Output 3	—
Voltmeter (fixed range)						
	Maximum display		±18 V output 19.99	±35 V output 199.9	±25 V output 199.9 6 V output 19.99	±24 V output 199.9 ±12 V output 19.99
	Accuracy		±(0.5 % of F.S + 2 digit) at 23 °C ±5 °C			
Ammeter (Fixed range)						
	Maximum display		Max. 19.99 (Fixed range)			
	Accuracy		±(1 % of F.S + 2 digit) at 23 °C ±5 °C			
Display						
	METER LED		Each output: Green LED lights on			
	O.L (Over Load) LED		Each output: Red LED lights on			
	OUTPUT ON		Green LED lights on			
	OVP		Red LED lights on			
	ALM		Red LED lights on when OHP is activated.			
Series output			0 V to 36 V	0 V to 70 V	0 V to 56 V	0 V to 48 V, 0 V to 24 V
General						
	Grounding polarity		Positive, COM and negative grounding possible			
	Common		Common for each output		±25 V common, 6 V independent	Common for each output
	Insulation resistance					
		Between chassis and input terminals	More than 500 Vdc 30 MΩ			
		Between chassis and each output terminals	More than 500 Vdc 20 MΩ			
	Isolation voltage		±250 Vdc			
	Withstanding voltage					
		Between input and output terminals	No abnormalities at 1500 Vac for 1 minute.			

Model		PMM 18-2.5DU	PMM 35-1.2DU	PMM 25-1TR	PMM 24-1QU
General					
Environment specifications					
	Operation ambient temperature	0 °C to +40 °C			
	Operation ambient humidity	10 %rh to 80 %rh (without condensation)			
	Storage ambient temperature	-10 °C to +60 °C			
	Storage ambient humidity	Less than 90 %rh (without condensation)			
Cooling method		Forced cooling using a fan motor			
Weight		Approx. 6.5 kg			
Dimensions		Fig. 6-1	Fig. 6-2	Fig. 6-3	Fig. 6-4
Accessories					
	Operation manual	1 pc.			
	Power cord	1 pc.			
	Fuse	1 pc.			

*1. Calculated value by the volume numbers of variable resistor. The actual value may be 3 to 5 times of the calculated value.
*2. With respect to ±10 % of line voltage fluctuation.
*3. With respect to 0 to 100 % of the output current.
*4. Time until the output voltage returns to within 0.05 % + 10 mV of the rating value when the output current is varied from 10 % to 100 %.

6.2 Dimension Diagram

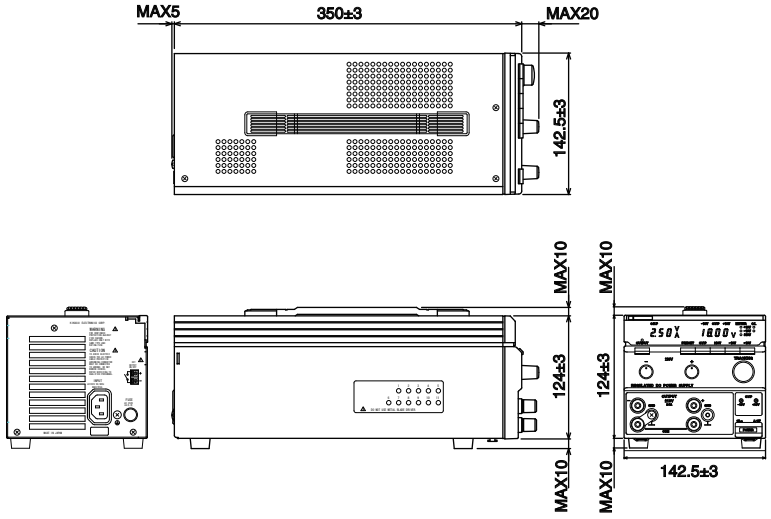


Fig. 6-1 PMM18-2.5DU Dimension Diagram Unit: mm

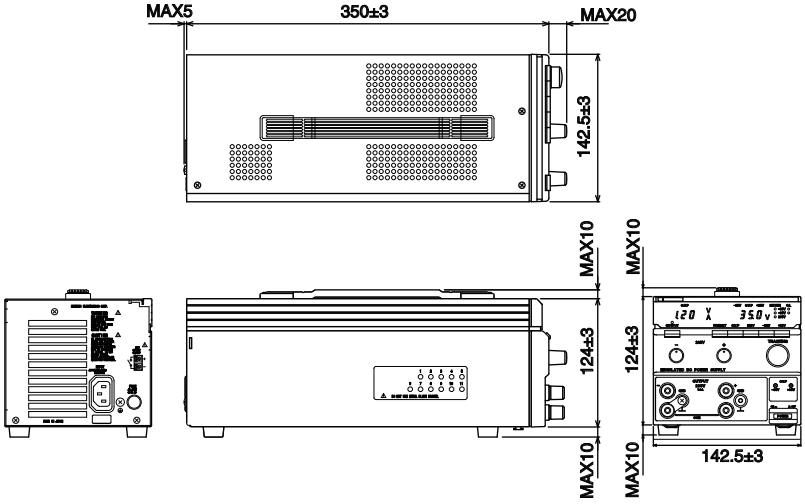


Fig. 6-2 PMM35-1.2DU Dimension Diagram Unit: mm

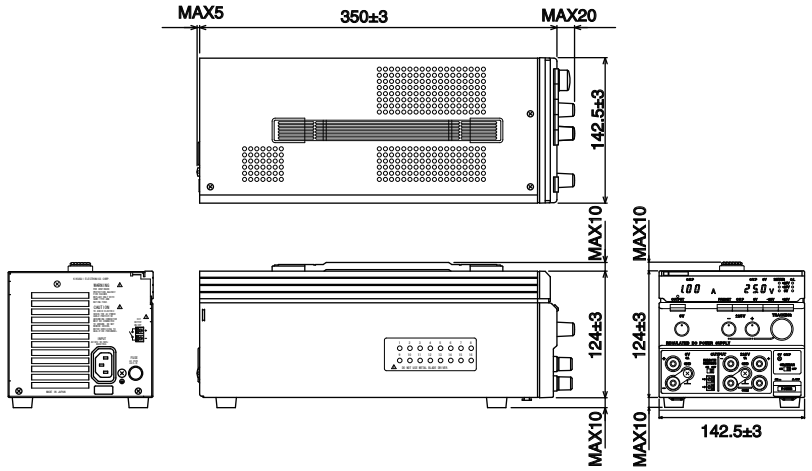


Fig. 6-3 PMM25-1TR Dimension Diagram Unit: mm

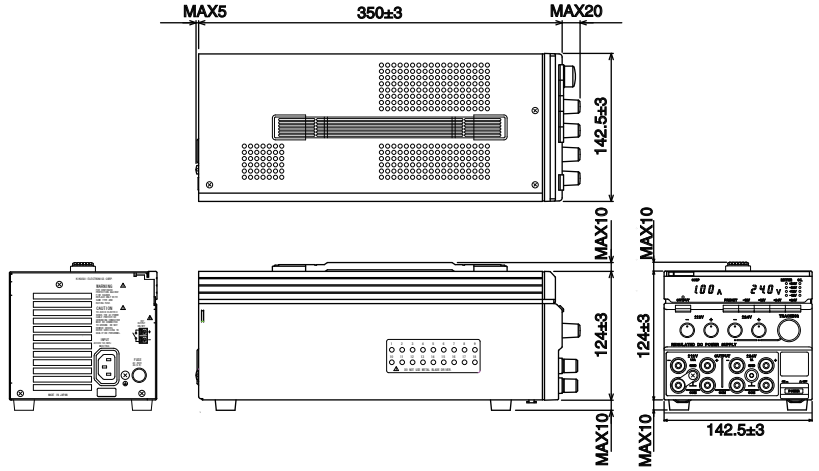


Fig. 6-4 PMM24-1QU Dimension Diagram Unit: mm

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