Part No. Z1-003-672, IA003984
Mar. 2009

OPERATION MANUAL

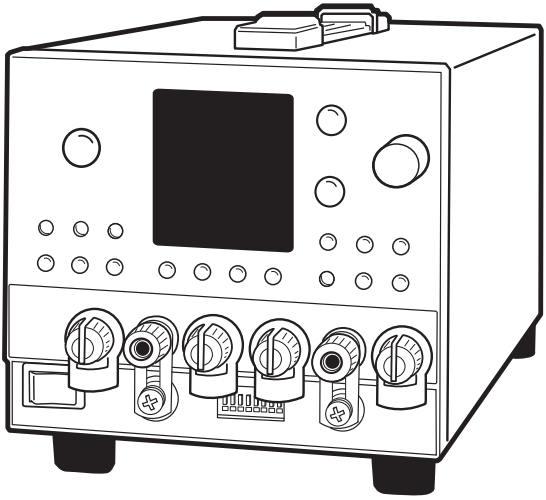
Multiple-output Regulated DC
Power Supply PMP Series

3-Output Models

PMP18-3TR
PMP25-2TR

4-Output Model

PMP16-1QU



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.**

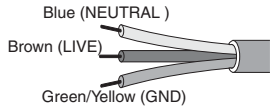
Power Requirements of this Product(Cont'd)

☐ Power cord

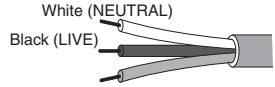
The product is provided with power cords described below. If the power cord has no plug, attach a plug or crimp-style terminals to the power cord in accordance with the wire colors specified in the drawing.

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

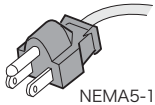
☐ Without a plug



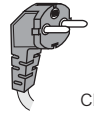
☐ Without a plug



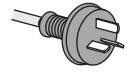
☐ Plug for USA



☐ 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.

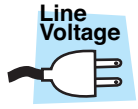
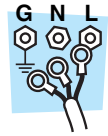
⚠ Safety Symbols

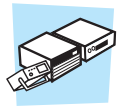
For the safe use and safe maintenance of this product, the following symbols are used throughout this manual and on the product. Note the meaning of each of the symbols to ensure safe use of the product. (Not all symbols may be used.)

ϟ or ⚠	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).
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. • Conduct periodic inspection for checking the tears or breaks of the power cable. • If the panel needs cleaning, gently wipe using a soft cloth with waterdiluted neutral detergent. Do not use volatile chemicals such as benzene or thinner. • 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 PMP Series regulated DC power supply.
This manual is intended for first-time users of the PMP Series (hereafter abbreviated as: the PMP). It gives an overview of the PMP and describes various settings, operation, maintenance, safety precautions, etc.
Read this manual thoroughly to use the functions of the PMP 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 PMP for the first time.

Related manuals

If the remote interface factory option is installed, see the PMP Series Communication Interface Manual.

Intended readers of this manual

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

Notations used in this manual

- "PMP" refers to the Multiple-output Regulated DC Power Supply PMP Series.
- 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.

>

Indicates menu item to be selected. The menu item to the left of ">" becomes the upper layer.

SHIFT+switch name (shown in blue)

Indicates an operation involving pressing the named switch (shown in blue) while the SHIFT switch is held down.

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Preparation

Usage scenarios	Manual sections	See page
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What may be used with power supply connected to load	“3.3 Connecting the Load”	3-4
Precautions for connecting to remote sensing lines	“4.13 Remote Sensing Function”	4-39
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Use

Usage scenarios	Manual sections	See page
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Suspending panel operations	“4.11 KEY LOCK Function (KEY LOCK)”	4-31
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Learning available function	“1.3 Features”	1-3
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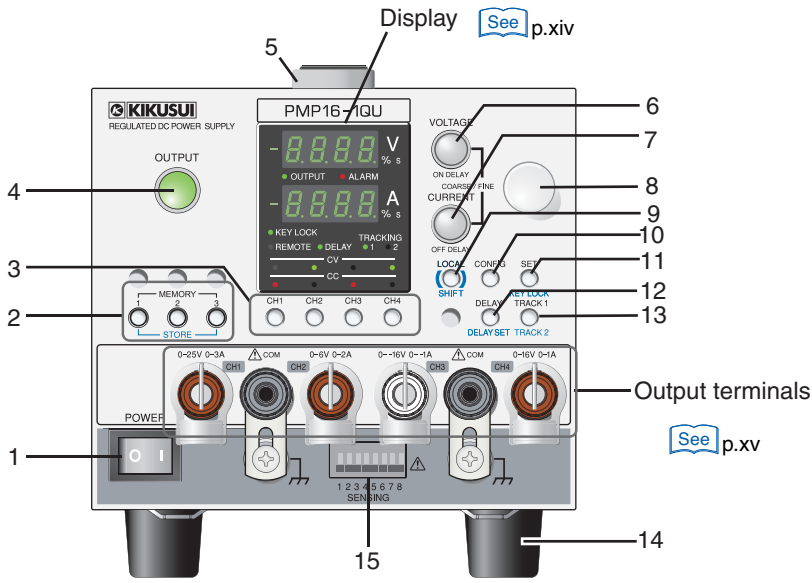
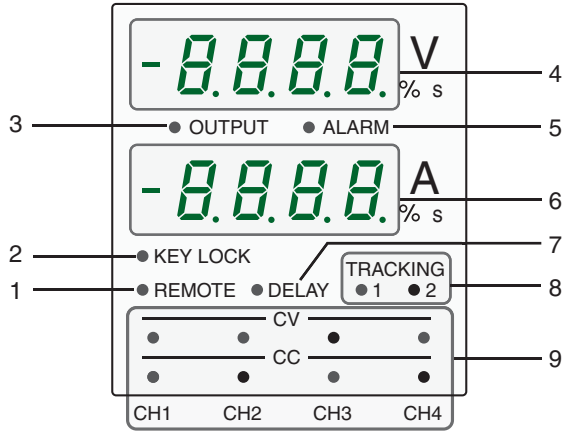
Front panel



* Figure refers to 4-output model PMP16-1QU

No.	Name	+SHIFT	Description	See page
1	POWER switch		POWER switch Press side (I) for on / (O) for off	4-2
2	MEMORY switch		Memory recall (Memory1, Memory2 or Memory3)	4-28
		STORE	Memory save (Memory1, Memory2 or Memory3)	4-27
3	Channel selection switch		Selects display channel (CH1, CH2, CH3 or CH4.) The switch of the selected channel is lit.	4-20 4-32 4-39
4	OUTPUT switch		Output on/off switch	4-6
5	Handle		Carrying handle	–
6	VOLTAGE switch		Selects the voltage value setting and changes the setting digit (Coarse/Fine.)	4-5
		ON DELAY	Selects the output on delay value setting and changes the setting digit.	4-25
7	CURRENT switch		Selects the current value setting and changes the setting digit (Coarse/Fine.)	4-5
		OFF DELAY	Selects the output off delay value setting and changes the setting digit.	4-25
8	Rotary knob		Setting value(s) change	–
9	LOCAL switch		Switching for local operations at remote control operation (options)	–
		SHIFT	SHIFT switch (set function shown in blue)	–
10	CONFIG switch		Config(uration) setting	4-32
11	SET switch		Set and confirm output voltage or output current values	4-5
		KEYLOCK	Panel operations lock/lock release	4-31
12	DELAY switch		Delay function on/off	4-25
		DELAY SET	Delay function setting mode switchover	4-25
13	TRACK1 switch		Tracking function 1 on/off	4-17
		TRACK2	Tracking function 2 on/off	4-17
14	Rubber feet		4 underside points	–
15	Sensing terminal		Remote sensing terminal	4-39

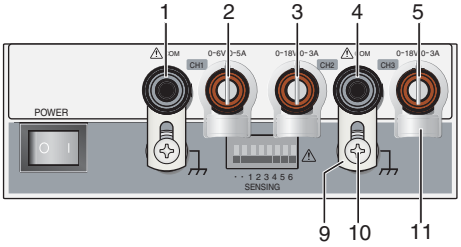
■ Display



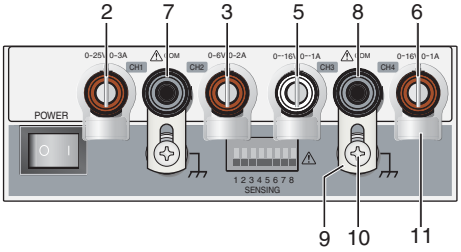
No.	Name +SHIFT	Description	See page
1	REMOTE LED	Illuminates in the remote control status is activated.	–
2	KEY LOCK LED	Illuminates in the key lock status is activated.	4-31
3	OUTPUT LED	Illuminates when the output is turned on. Blinks during the delay time of output on/off.	–
4	Voltmeter display	Displays for voltage value, tracking function 2 voltage variation, output on delay time setting or config settings.	4-5 4-17 4-25 4-31
5	ALARM LED	Blinks in the protection circuit is activated.	4-13
6	Ammeter display	Displays for current value, tracking function 2 current variation, output off delay time setting or config setting.	4-5 4-17 4-25 4-31
7	DELAY LED	Blinks during setting the delay time. Illuminates when the delay function is activated.	4-25
8	TRACKING1/ TRACKING2 LED	Illuminates when either tracking function is activated.	4-17
9	CC/CV LED	Illuminates during the constant voltage or constant current operation.	–

Output terminals

3-output models (PMP18-3TR/25-2TR)

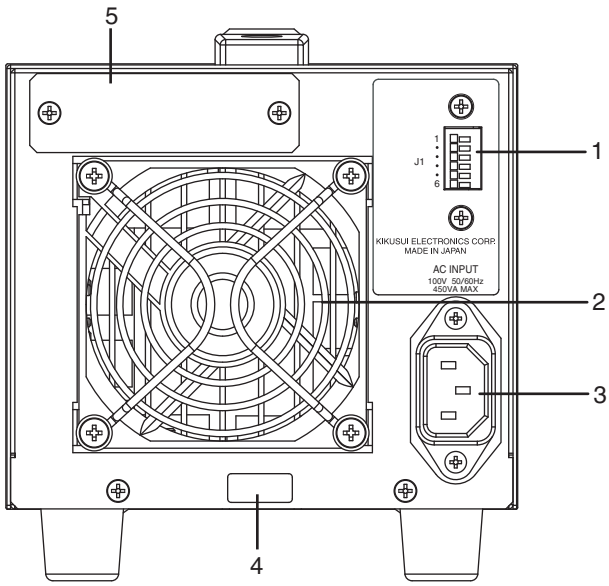


4-output model (PMP16-1QU)

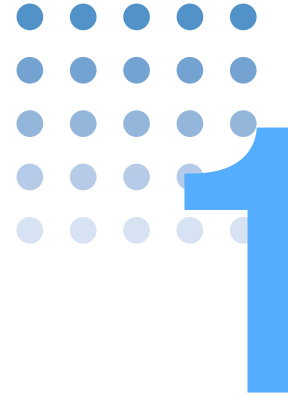


No.	Name	Description	See page
1	CH1 COM	Channel 1 common terminal	3-6
2	OUTPUT CH1	Voltage current output terminal with cover	4-16
3	OUTPUT CH2	Voltage current output terminal with cover	4-16
4	CH2/CH3 COM	CH2 and CH3 common terminal	3-6
5	OUTPUT CH3	Voltage current output terminal with cover	4-16
6	OUTPUT CH4	Voltage current output terminal with cover	4-16
7	CH1/CH2 COM	CH1 and CH2 common terminal	3-6
8	CH3/CH4 COM	CH3 and CH4 common terminal	3-6
9	Short bar	Bar connecting COM terminal to chassis terminal	3-6
10	Protective conductor terminal	Protective conductor connection terminal	–
11	Binding post cover	Terminal insulation cover	3-8

Rear panel



No.	Name	Description	See page
1	J1 Terminal block	External control terminal block	5-4
2	Exhaust Port	Exhaustion of the internal heat using a fan motor	–
3	AC INPUT	AC inlet	2-6
4	Serial number	This product's unit number	–
5	Option slot	Installs an option board.	1-4



General Description

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

1.1 Use of This Manual

The PMP consists of two models that differ in the number of outputs. This manual covers the model described below.

Type	Model	Output terminals	Rated Output Voltages	Rated Output Current
3-output models (3CH) 	PMP18-3TR	CH1	6 V	5.0 A
		CH2	18 V	3.0 A
		CH3	18 V	3.0 A
	PMP25-2TR	CH1	6 V	5.0 A
		CH2	25 V	2.0 A
		CH3	25 V	2.0 A
4-output model (4CH) 	PMP16-1QU	CH1	25 V	3.0 A
		CH2	6 V	2.0 A
		CH3	–16 V	–1.0 A
		CH4	16 V	1.0 A

1.2 Overview

The PMP is a line of multiple-output regulated DC power supplies, aimed at providing simple functionality in a compact unit. These power supplies are most useful for experiments and testing on production lines. Products in this line are designed as testing apparatus, with the essential functions needed for designers, developers and quality assurance personnel.

Applicable firmware versions for this product manual

This manual applies to products loaded with

Version 1.1x

of the firmware.

When making inquiries about the product, inform us of

- Model name (on the upper part of the front panel)
- Firmware version
- Serial number (on lower part of the rear panel)

See
Page 4-2

Verify the firmware version at power-on time.

1.3 Features

● Zero-volt control

Possible to control each output separately from zero volts.

● Tracking function

Possible to vary multiple outputs simultaneously, in the same width (absolute value), or with the same ratio(%).

● Delay function

Possible to change the timing of output rise/decay at output on/off time.

● Memory function

Possible to store up to three sets of channel settings (combination of the output voltage and current settings and the delay time). You can simply select a set of settings that you want to use rather than having to specify each setting every time.

● Series regulator method

Possible to get noise-minimized, stabilized output using a series regulator system.

● All-positive outputs (PMP18-2/PMP25-2TR)

With the two 3-output models, all outputs are positive, making them appropriate for use as power sources for control systems that do not need negative output.

● Two common circuits

Each model has two common circuits are available so that it can be used as testing power supplies for both digital signal systems and analog signal systems.

● High capacity

Suitable as a power supply for higher power control signal systems, with large output capacity.

1.4 Option

The PMP Series has options, described below.

If you have any inquiry or doubt of option, contact your Kikusui agent or distributor.

Interface boards

Three types of interface boards are available as options. If you install any of the interface boards, the number of memory banks increases from 3 to 10 during remote control mode.

These interface boards are factory options.

- RS232C interface board
- GPIB interface board
- USB interface board

Rack mount frame

Rack moounting oprions shown the below.

Product	Model	Notes
Rack mount adapter	KRA3	Inch rack EIA standard
	KRA150	Milli rack JIS standard
Blank panel	KBP3-3	Blank panel
	BP191 (-M)	Inch rack EIA standard
	BP1H (-M)	Milli rack JIS standard

⚠CAUTION

- In order to maintain strong cooling air intake, at least 1U (JIS standard: 50 mm, EIA standard: 44.45 mm) of “blank panel” must be installed when the product of the PMP is rack-mounted.

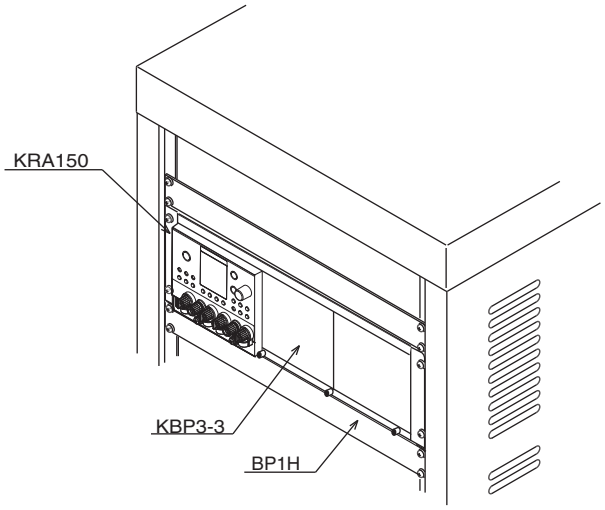
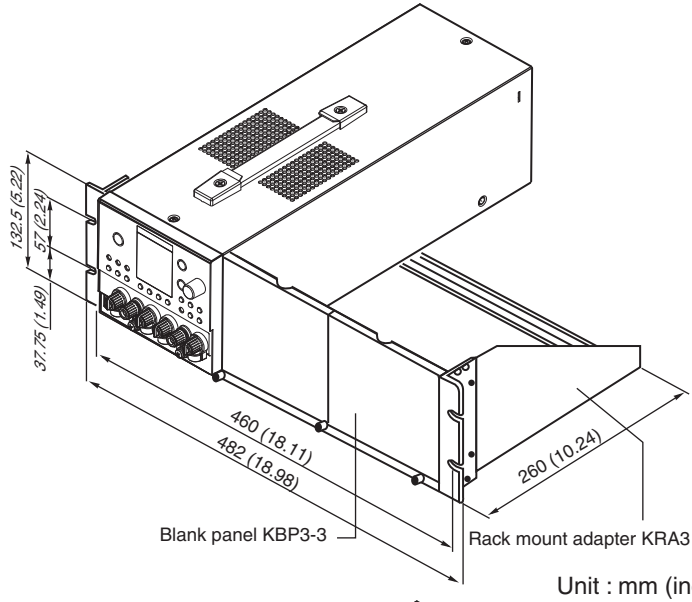
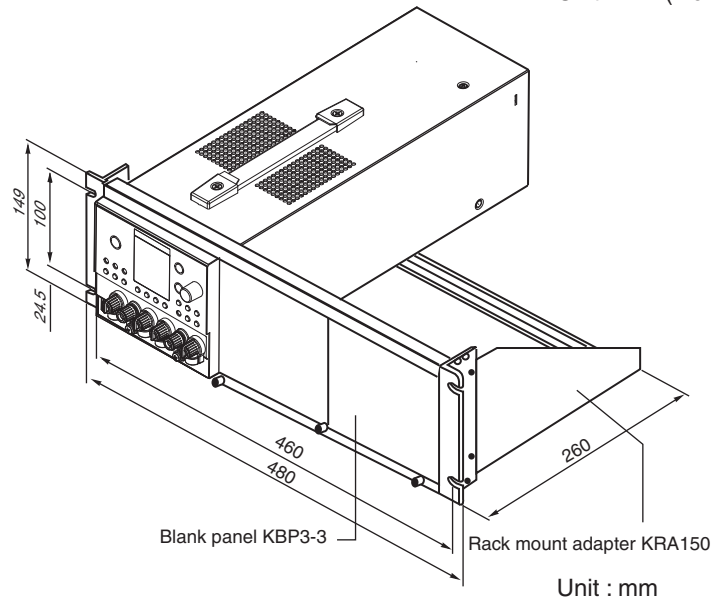


Fig. 1-1 Rack-mounting example



Unit : mm (inch)



Unit : mm

Fig. 1-2 Example of installation options for rack mounting

Installation and Preparation

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

2.1 Checking the Package Contents

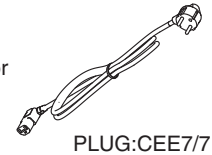
When you receive the product, check that all accessories are included and that the accessories have not been damaged during transportation.

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.

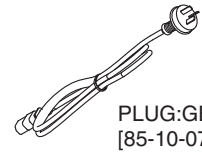
PLUG: NEMA5-15
[85-AA-0004]

or



PLUG:CEE7/7
[85-AA-0005]

or

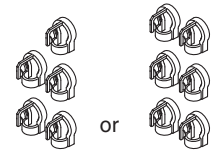


PLUG:GB1002
[85-10-0790]

☐ Power cord x 1

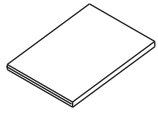
The attached power cord may vary slightly depending on countries.

☐ Short bar x 2
[E3-000-071] *1
*1 Installed in body.



☐ Binding post cover
(PMP18-3TR × 5 *2
PMP25-2TR × 5
PMP16-1QU × 6)
[P1-000-408]

*2 PMP18-3TR × 3
PMP25-2TR × 3
PMP16-1QU × 4



☐ Operation Manual × 1
[Z1-003-672]

Fig. 2-1 Accessories

2.2 Precautions Concerning Installation Location

Critically important points when installing the PMP

- **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 (32 ºF to 104 ºF)
Storage temperature range:	–10 ºC to +60 ºC (14 ºF to 140 ºF)

- **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 humidity range. In such cases, do not use the product until the condensation dries up completely.

- **Be sure to use it indoors.**
  The PMP 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 PMP 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 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
Page 1-5

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

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

Install the suitable support angles applying to the used rack system to support the instrument.

We recommend that you keep all the parts so that you can use them again when you detach the product from the frame.

To reattach the rubber feet, use the screws that you removed.

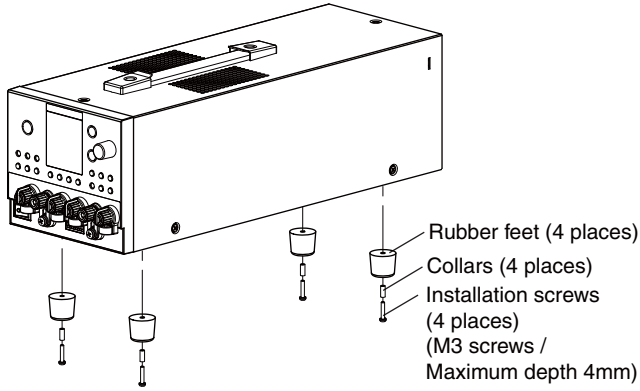


Fig. 2-2 Removing rubber feet

Removing rubber feet

Unfasten the screws and remove the four rubber feet.

2.5 Connecting the Power Cord

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

⚠WARNING **Possible electric shock.**

- **The PMP is an IEC Safety Class I equipment (equipment with a protective conductor terminal). Be sure to ground the product.**
- **The PMP is grounded through the power cord ground wire. Connect the ground terminal to earth ground.**

NOTE

- To connect to the AC line, use the attached power cord.
- The power cord with a plug can be used to disconnect the PMP 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.

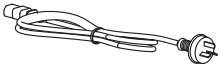
 [85-AA-0004] PLUG: NEMA5-15	Power cord for 100 V system Rated voltage: 125 VAC Rated current: 10 A
 [85-AA-0005] PLUG: CEE7/7  [85-10-0790] PLUG: GB1002	Power cord for 200 V system Rated voltage: 250 VAC Rated current: 10 A

Fig. 2-3 Attached properly grounded power cord

See Page 2-8

1. Check that the AC line to be connected is compatible with the product's rated input value.

   The product's nominal input rating is shown on the rear panel. When it is filled in, as in Fig. 2-4, 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 (O) the POWER switch.

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

4. Insert the power plug to an outlet.

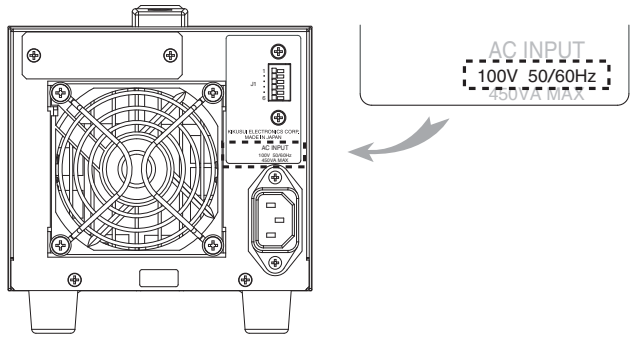


Fig. 2-4 Confirmation of nominal input rating

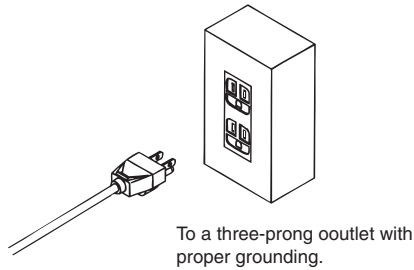


Fig. 2-5 Connecting the plug

Connecting the Load

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

3.1 Reverse Polarity

When the current or voltage is set up as zero with the OUTPUT switched off case, 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 product's working life.

3.2 Load Considerations

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

Load with peaks and pulse-shaped current

The PMP indicates only mean values. Even when the indicated value is less than the preset current value, the peak values may actually exceed the preset current value. If this happens, the PMP is instantaneously put into constant-current operation mode, and the output voltage drops accordingly.
For these types of loads, you must increase the preset current value or increase the current capacity.

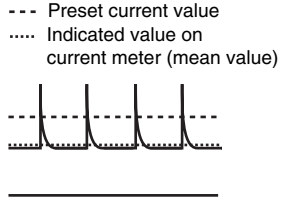


Fig. 3-1 Load current with peaks

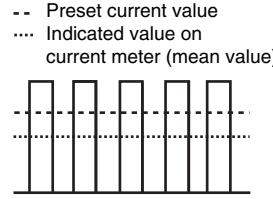


Fig. 3-2 Pulse-shaped load current

Load that generates reverse current to the power supply

The PMP 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 RD as shown in Fig. 3-3 to bypass the reverse current. However, the amount of current to the load decreases by max. reverse current Irp.

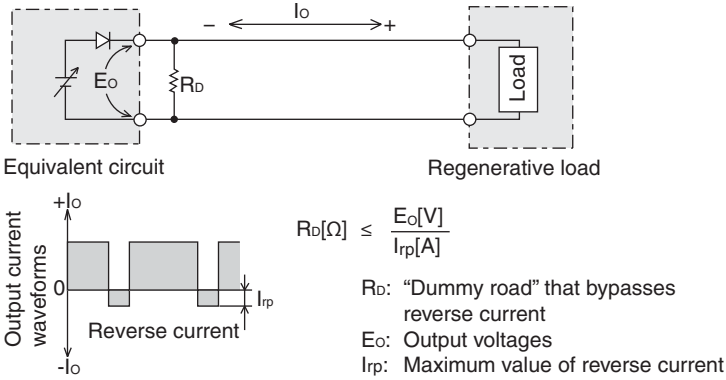


Fig. 3-3 Remedy for regenerative load

⚠CAUTION

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

Load with accumulated energy

Connecting a load with accumulated energy, such as a battery, to the PMP may cause current to flow from the load to the internal circuit of the PMP. This current may damage the PMP or reduce the life of the battery.
For this type of loads, connect a reverse-current-prevention diode (DRP) between the PMP and the load in series as shown in Fig. 3-4.

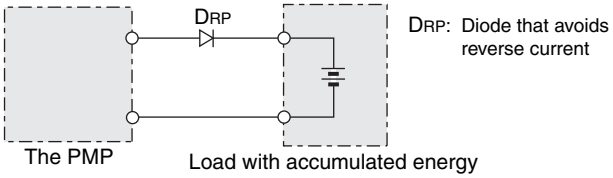


Fig. 3-4 Remedy against load with accumulated energy

⚠CAUTION
- To protect the load and the PMP, 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.

3.3 Connecting the Load

This section describes the wire used to connect the PMP 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.
- Using a CONFIG setting, you can set the power-on output state. Check the output state before you connect the load. For details on the output state, see “Output state at power-on setup (“ON.PO”)” on page 4-34.

3.3.1 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 PMP.**
- **To prevent the possibility of electric shock, use a load cable with a higher voltage rating than the isolation voltage of the PMP.**
  For the isolation voltage, see Chapter 7, “Specifications”.

Current capacity of the load cable

Load cables must be rated to carry the maximum rated output current of the PMP. 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.

Allowable current of the cable dependent on the maximum allowable temperature of the cable insulation

The cable temperature is determined by a current-caused resistance loss, ambient temperature, and thermal resistance to the outside. Table 3-1 shows the allowable capacity of current that can flow through a heat-resistant PVC wire (single wire) having a maximum allowable temperature of 60 ºC when the wire is stretched horizontally in the air at an ambient temperature of 30 ºC. If the condition is such that PVC wires with lower heat-resistant temperature are used, the ambient temperature exceeds 30 ºC, or the wires are bundled resulting in low heat radiation, the current capacity needs to be reduced.

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
3.5	12	(3.31)	37	–
5.5	10	(5.26)	49	20

*1. Excerpts from Japanese laws related to electrical equipment

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 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.

Limitations of the sensing function

Because wires have resistance, voltage drop in wires becomes greater as the wire becomes longer or the current becomes larger. This causes the voltage applied at the load end to be smaller. The PMP has a sensing function that compensates for this voltage drop, but compensation of up to approximately 0.3 V is available for a single line. If the voltage drop exceeds this level, wires having a greater sectional area should be used. When the voltage drop exceeds 0.6 V, internal circuits might break down.

As well, when using the sensing function, a negligible current will flow through the sensing line. For this reason, if there is a resistive component in the sensing line, it becomes a source of measurement error. Use a sensing wire with the lowest resistance as possible.

Withstanding voltage of the load wire

For load cables, use a cable with a rated voltage higher than the ground contact voltage of the PMP.

3.3.2 Connecting to the Output Terminal

⚠WARNING Possible electric shock.

- **Be sure to turn off the POWER switch off before connecting the output terminal.**
- **When chassis ground terminal and COM terminal are unconnected, install a binding post cover.**
- **If you are using the CH1, CH2, CH3, or CH4 terminal, be sure to attach the binding post cover.**

⚠CAUTION

- Use a crimping terminal to reliably connect the load cable to the output terminals.
- Each output is output to a COM terminal. The 3-output models have internal circuits with the outputs isolated between CH1 and CH2/CH3, and separated COM terminals. As well, the 4-output model has internal circuits with the outputs isolated between CH1/CH2 and CH3/CH4, and separated COM terminals. With both models, the allowable voltage gap between COM terminals is 30 V. Be careful when using the unit where the electric potentials differ.

1. Turn off the POWER switch.
2. Attach crimping terminals to the load cable and connect it to the output terminal.
3. Check the connection.

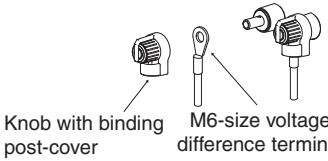


Fig. 3-5 Connecting to the output terminal 1

Installing binding post cover

1. Remove knob from body.

2. From the side of the post binding cover, fit the binding post cover onto the center of the knob, and press it in until it can not be removed.

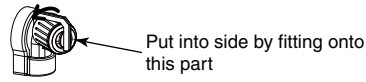
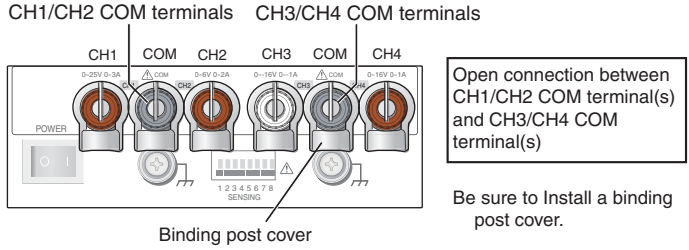


Fig. 3-6 Installing binding post cover

3. To remove binding post cover, twist around the knob axis and then shift it.

When using open (ungrounded) connection between the chassis and a COM terminal, use the unit with the short bar removed.

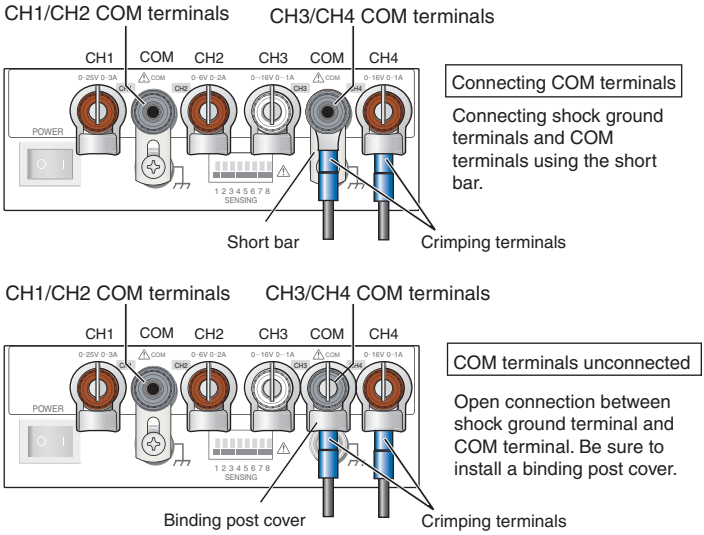
■ When the open connection to the COM terminal unconnected to a load



* The COM terminals are independent of one another.
Remove the corresponding short bars as necessary.

Fig. 3-7 Example of open connection between COM terminals (for PMP16-1QU)

■ When the connected to the load



* The COM terminals are independent of one another.

Fig. 3-8 Example connection to output terminal PMP16-1QU CH4

Operations

This chapter describes how to turn the power on, the basic operations that can be performed from the front panel and the series operation that is available by combining the outputs.

4.1 Turning On the Power

Turn the power on without the load connected.

⚠CAUTION

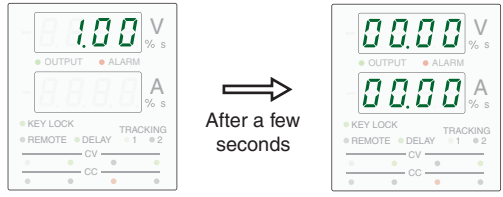
- The CONFIG parameters can be set so that the output is automatically turned on when the POWER switch is turned on. When this function is enabled, the PMP powers up with the output turned on even if the output was off when the PMP was turned off the last time. There is a possibility that a load may break, if you connect a different load and turn the POWER and output on simultaneously.

POWER Switch-on

1. Check that the power cord is correctly connected.
2. Turn on the POWER switch on the (|) side.

   Press the POWER switch on the (|) side and the instrument turns on. If there is an odd sound or odor, any abnormality, fire or fumes, pull the plug from the outlet.
3. Check the firmware version on the front panel display.

   After displaying the version as shown in Fig. 4-1, the screen shows held-settings status (displays output values).



Firmware version display (Ver. 1.00 pattern/example)

Output held-settings status (example of factory-shipped state)

Fig. 4-1 Examples of power-up display

After purchase, when first turning on the POWER switch, the factory-shipped settings will come up. Apart from these, previous states may come up when turning on the POWER switch.

However, the tracking function settings being cancelled, these will show.

■ Inrush Current

When the power switch is turned on, the maximum inrush current of 120 A may flow. In particular, with a system using multiple models of the product, 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 distributor panel or the AC power line.

POWER Switch-off

pressing the POWER switch (○) side turns the PMP off.

The PMP saves the items below just before the POWER switch is turned off. These items are previous states may come up when turning on the POWER switch.

- Setting values of each output
- Setting state of each switch

If you immediately turn off the POWER switch after changing the settings, the last settings may not be saved. Take an interval of 2 seconds or more.

⚠CAUTION • Allow an interval of 5 seconds or more between power cycles. Any shorter interval poses the risk of shorting the working life of the input fuse and the POWER switch.

4.2 Factory-shipped Settings (Initialize)

When the POWER switch is turned on while holding down the LOCAL switch, the voltmeter displays “ini” and the SET switch blinks. At this time, if the SET switch is pressed, the factory-shipped settings are restored.

Table 4-1 Factory-shipped settings of basic item

Basic item	Settings
Output voltage setting values	Each set to 0 V
Output current setting values	Each output set to the maximum possible current
Memory 1, 2, 3	For the three memories, each output's voltage value: 0 V, current value: set to maximum possible current
Delay function	OFF
KEY LOCK function	OFF

Table 4-2 Factory-shipped settings of the CONFIG paramwrwers

CONFIG parameter		Settings
POWER ON OUTPUT setup	On.Po	OFF
Tracking setup	tr.CH	0 (OFF)
Remote sensing setup	Vo.Li	0 (OFF)
Voltage limit operation setup	Cu.Li	HOLD (The digits lower than the setting digit are fixed.)
Current limit operation setup	Cu.Li	HOLD (The digits lower than the setting digit are fixed.)
Voltage fine setup	Vo.Fi	OFF (Voltage fine setting enabled.)
Current fine setup	Cu.Fi	OFF (Current fine setting enabled.)

4.3 Basic Operation

First, output setting methods are explained. Then, methods for using constant voltage power supply and constant current power supply are explained.

4.3.1 Setting the Output

The PMP can select and set the setting digit when output voltage and output current are being selected.

1. Check that the display's KEYLOCK LED on the display is extinguished.

   When this KEYLOCK LED is lit, the output cannot be set.

2. Check that the rear panel J1 terminal base is open.

3. Check that the display OUTPUT LED on the display is not lit.

   If the OUTPUT LED on the display is lit, turn off the OUTPUT switch. Also, if the OUTPUT switch is turned on, the output will vary depending on the settings.

See
Page 4-34

   Using a CONFIG setting, you can set the power-on output state. Check the output state before you connect the load.

4. Press the SET switch to change to the setting display.

   SET switch lights it.
   When the SET switch is lit, the panel display shows the setting. When it is not lit, the panel displays the actual output value.

NOTE

- When the OUTPUT is turned on, the SET switch being lit means that the setting value is displayed and the outputs will differ.
- If the SET switch is lit when the output is on, you can change the output value while viewing the setting. Changing the setting changes the actual output value.

5. Press the channel selection switch that corresponds to the channel whose output value you want to set.

   The selected channnel selection switch lights up.

6. To set the output voltage, press the VOLTAGE switch, and to set the output current, press the CURRENT switch.

   With each press, the highlighted digit in the voltmeter or ammeter display is changed.

7. The highlighted digit can also be set with the rotary knob.

Hereafter, the digits are numbered from the side of the most significant digit (leftmost).

The most significant digit (leftmost) cannot be selected and set.

See
Page 4-35 to
Page 4-37

Using CONFIG settings, you can set how the voltage and current settings behave when they are near the maximum or minimum limits and set how the digit that is one digit lower than the least-significant, displayed digit behaves (fine setting).

As an example, output setting methods are explained below, using PMP16-1QU with the CH3 (-16V, -1 A) output set to -5.2 V and -0.35 A.

1. Pressing the SET switch Setting display.

   SET switch lights it.

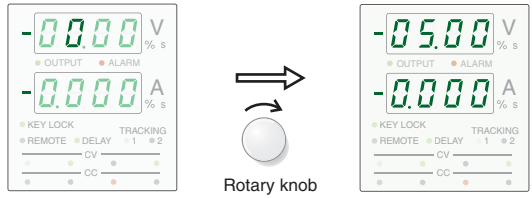
2. Pressing the channel selection switches of CH3.

   The selected channel selection switch of CH3 lights up.

3. Press the VOLTAGE switch and select digit 2 in the voltmeter display.

   Digit 2 on the voltmeter is highlighted.

4. Turn the rotary knob right to set the value to “5”.



Select digit 2 of the voltmeter

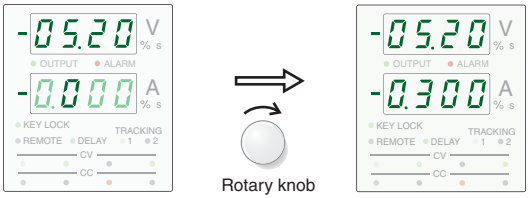
Set digit 2 to “5”

5. Press the VOLTAGE switch one more time and select digit 3 of the voltmeter display, and turn the rotary knob right to set the value to “2”.

The above voltage setting is finished. Next is the current setting.

6. Press the CURRENT switch and select digit 2 of the ammeter display.
   Digit 2 on the ammeter is highlighted.

7. Turn the rotary knob right to set the value “3”.



Select digit 2 of the voltmeter

Set digit 2 to “5”

8. Press the CURRENT switch one more time and select digit 3 of the ammeter display, and turn the rotary knob right to set the value to “5”.

The current setting above is finished.
Similar steps are performed for other output settings.

NOTE

- If turning the rotary knob causes the set digit to go above “9”, or below “0”, the value of the digit that is higher by one step is changed.
- By enabling the fine voltage/current setting function during the CONFIG setting, it is possible to set the value of the digit that is by one digit lower than the least significant digit shown on the voltmeter/ammeter. You can set the digit when the least-significant digit is highlighted and is blinking.
  For details on the voltage and current fine settings, see “Voltage fine setup (“VO.FI”)” on page 4-36 and “Current fine setup (“CU.FI”)” on page 4-37.

4.3.2 Output Operation

The OUTPUT switch is a toggle switch. When the output is on, the OUTPUT indicator on the display illuminates; when the output is off, the OUTPUT indicator does not illuminate.

When the output is on, the present setting is output. If you change the setting while the output is on, the change is applied to the output.

See Page 5-5

You can also turn the output on and off through external control.

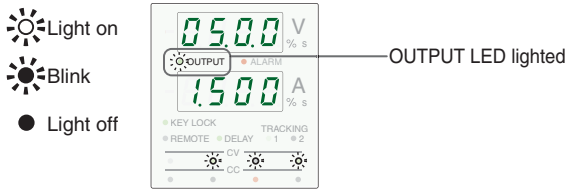


Fig. 4-2 Examples of output on display

Output on/off when power is turned on

See Page 4-34

By factory default, the output is off when the power is turned on. You can set the output state at power-on to on (ON.PO) in the CONFIG settings.

If you set the output state at power-on to on, check the voltage setting value and current setting value before you turn off the POWER switch.

Output on/off delay function

See Page 4-25

You can set a delay time (in the range of 0.1 s to 99.9 s) that specifies how long it takes for the output to actually turn on or off after you press the OUTPUT switch. You can use this function when you want to turn the output on and off by specifying a time offset based on load characteristics.

4.4 Constant Voltage (CV) and Constant Current (CC) Power Supplies

The product has functions for constant voltage power supply to maintain a fixed/regularized output voltage, and for constant current power supply that maintain a fixed output current, even as the load changes. The state of operation for constant voltage supply is called “CV mode”, and for constant current supply, “CC mode”. These operating modes are determined by the following three values.

- Output voltage setting value (Vs)
- Output current setting value (Is)
- Load resistance value (RL)

These operations are detailed in the following.

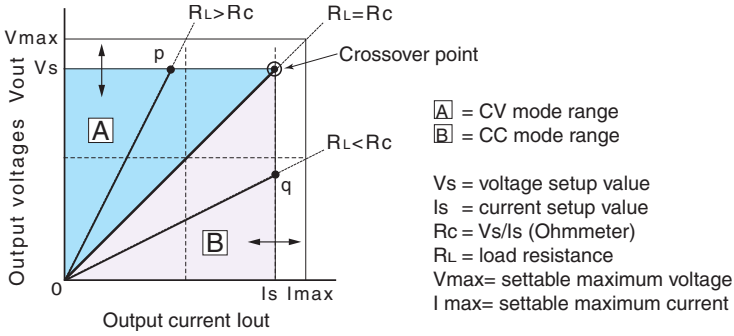


Fig. 4-3 Constant voltage operation and constant current operation

Fig. 4-3 illustrates the operating modes for the PMP. RL stands for the load resistance value, and Rc stands for the resistance value calculated from the current and the voltage setting value (Rc = Vs/Is). The regulated power supply is designed as operating in CV mode when the operating point is in the A range, and in CC mode when the operating point is in the B range. The straight line (RL = Rc) is a line between CV mode and CC mode. This line shows loads for which the output voltage and the setting voltage are equalized, or which the output current and the setting current are equalized. If load resistance RL is

greater than load resistance R_C, the power supply operates in CV mode because the operating point is within the A range. At this time, the current setting value Is becomes the current limit value.

When operating in CV mode, the output voltage is maintained at the voltage setting value. The output current is determined by the relation $I=V_S/R_L$, and is reduced to a value below the current limit value Is. Note that the current of the setting value does not flow at this time.

For the loads to allow transient peak current flow, the current limit value must be set so that the peak current does not reach the limit value.

Conversely, if load resistance R_C is greater than load resistance R_L, the power supply operates in CC mode because the operating point is within the B range. At this time, the voltage setting value Is becomes the voltage limit value.

When operating in CC mode, the output current is maintained at an established current value. The output voltage is determined by the relation $V=I_S \times R_L$, and is reduced to a value below the current limit value V_S. Note that the voltage of the setting value is not applied at this time.

For the loads in which transitory surge voltage arises, the voltage limit value must be set so that the surge voltage does not reach the voltage limit value.

■ Crossover point

The unit switches between CV mode and CC mode automatically depending on the load. The points where the transition occurs are called crossover points.

For example, in CV mode, when the load changes and the output current reaches the current limit value, there is an automatic transition to CC mode in order to protect the load. Similarly, in CC mode, when the output voltage reaches the voltage limit value, there is an automatic transition to CV mode.

Example of CV/CC mode operation

The following example assumes a power supply at rated output voltage 100 V and rated output current 10 A.

Connect an 8Ω load resistance (R_L) to the power supply's output terminal and set the output voltage to 30 V and the output current to 5 A. In this case, because Rc=30 V/5 A, and 8Ω > 6Ω (R_L > Rc), CV mode is activated. When the voltage rises while still in CV mode, because Vs=5 A × 8Ω = 40 (Vs=Is × R_L), the voltage can go up to 40 V. When the voltage goes higher than this value, the crossover point is reached, and there is an automatic transition to CC mode. To maintain CV mode, raise the current limit value.

Next, connect a 5 Ω load resistor (R_L) to the power supply's output terminal, and establish a 30 V output voltage and a 5 A output current. In this case, CC mode is activated because Rc= 30V/5 A = 6 Ω and 5 Ω < 6 Ω (R_L< Rc). When the current rises while still in CC mode, it is possible that the current value will rise to a level higher than Is=Vs/R_L up to Is=30V/5 Ω=6A. When the current goes higher, it reaches the crossover point, and there is an automatic transition to CV mode. To maintain CC mode, raise the voltage limit value.

4.4.1 Using the Unit as a Constant Voltage (CV) or Constant Current (CC) Power Supply

When you use the unit as a constant voltage power supply, the current setting value becomes the current limit value used to make current flow to the load.

When you use the unit as a constant current power supply, the voltage setting value becomes the voltage limit value that can be applied to the load.

When the voltage or current value reaches the set limit value, the active mode is automatically shifted. In accordance with the active mode, the lighting of the CV LED or CC LED over the channel selection switch of the applicable constant voltage/current is shifted, which indicates to shift the active mode between them.

The step for using the unit as a constant voltage (CV) or constant current (CC) power supply are explained below.

1. Check that the OUTPUT is turned off when the POWER switch is turned on.

   When the OUTPUT LED on the display is lit, pressing the OUTPUT switch turns the OUTPUT off.

See Page 4-34

   Using a CONFIG setting, you can set the power-on output state. Check the output state before you connect the load.

2. Turn off the POWER switch.

See Page 3-4

3. Connect the load to the output terminal.

4. Turn on the POWER switch.

5. Press the SET switch to change to the setting display.

   SET switch lights it.

6. Press the channel select switch using the set output channel.

   The selected channnel selection switch lights up.

See Page 4-5

7. Select the digit you want to set by pressing the VOLTAGE switch, and make the setting by turning the rotary knob.

   Set the voltage value.

8. Select the digit that you want to set by pressing the CURRENT switch and make the setting using the rotary knob.

   Set the current value.

9. Repeat steps 5-7 for other channels.

10. Output on by pressing the OUTPUT switch.

The OUTPUT LED on the display is lit, and voltage/current is output to each output terminal. When the unit is activated as a constant voltage power supply, the CV LED over the applicable channel selection switch is lit. When activated as a constant current power supply, the CC LED is lit.

When the OUTPUT is turned on, it is possible to set the actual output voltage/current while checking them by performing step 7 and step 8 .

4.5 Protection Function and Alarm

The PMP is equipped with the following protection function.

When any protection function is activated, in the front panel display part, the ALARM LED blinks and OUTPUT is turned off.

4.5.1 Overheat Protection (OHP) Function

Overheat protection (OHP) is activated in the following situations.

- When the PMP is used in an environment exceeding the operating temperature range
- When the PMP is used with the intake or exhaust port blocked
- When the fan motor stops

When overheat protection (OHP) is activated, the ALARM LED blinks and output is turned off, and “OHP” is displayed on the front panel ammeter display.

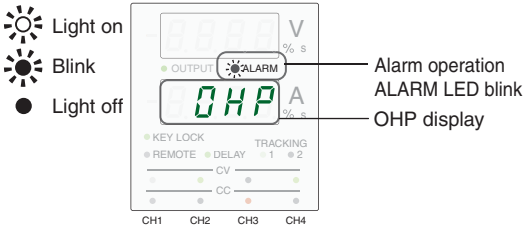


Fig. 4-4 OHP Mode display

Releasing the alarm (OHP)

In order to cancel the overheat protection (OHP) state, turn off the POWER switch once, and after removing the cause, turn on the POWER switch again.

If the operative cause of the overheat protection (OHP) is still present, there may be yet another OHP. Turn on the POWER switch after the internal temperature has dropped sufficiently.

If you cannot clear the alarm even when all of the causes of the alarm occurrence are eliminated, the PMP may have malfunctioned. If this happens, stop using the PMP and contact your Kikusui agent or distributor.

4.5.2 Overvoltage Protection (OVP) Function

The over-voltage protection (OVP) function protects the load from unexpected and excessive voltages. Over-voltage protection (OVP) is activated under the following situations.

- When an output caused by an internal control circuit failure results in an unregulated high voltage.
- When an abnormal external voltage is applied to an output terminal.

Activate over-voltage protection (OVP) operates at voltages that are 110% to 130% of each output's rated voltage. This voltage depends on the internal circuitry of the product. It cannot be changed.

Table 4-3 Over-voltage protection (OVP) activation points

Model	Output terminal	Rated output voltage	OVP operating voltage*1
PMP18-3TR	CH1	6 V	Approx. 7.2 V
	CH2	18 V	Approx. 20.2 V
	CH3	18 V	Approx. 20.2 V
PMP25-2TR	CH1	6 V	Approx. 7.2 V
	CH2	25 V	Approx. 28.5 V
	CH3	25 VRe	Approx. 28.5 V
PMP16-1QU	CH1	25 V	Approx. 31.0 V
	CH2	6 V	Approx. 7.2 V
	CH3	–16 V	Approx. –19.0 V
	CH4	16 V	Approx. 19.0 V

*1. The above OVP operating voltage is not chosen for efficiency reasons.

When over-voltage protection (OVP) is activated, the ALARM LED blinks, the output is turned off, the voltmeter displays the channel on which OVP is activated, and the current displays "OVP".

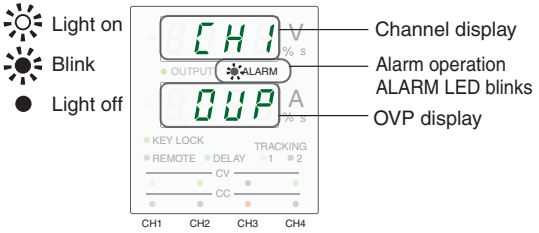


Fig. 4-5 OVP alarm display (example of activation of over-voltage protection in CH1)

Releasing the alarm (OVP)

In order to cancel the overvoltage protection (OVP) state, turn off the POWER switch once, and after removing the cause, turn on the POWER switch again.

If you cannot clear the alarm even when all of the causes of the alarm occurrence are eliminated, the PMP may have malfunctioned. If this happens, stop using the PMP and contact your Kikusui agent or distributor.

4.6 Channel Number (OUTPUT CH)

With the PMP, each output is assigned an channel number. The channel number is used to individually control the outputs when the PMP is under external control. The channel number for each model's output is discussed below.

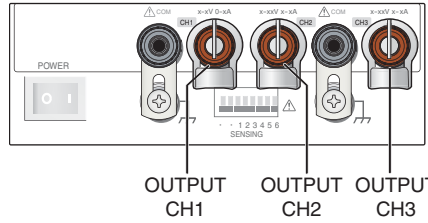


Fig. 4-6 PMP18-3TR/PMP25-2TR output terminals

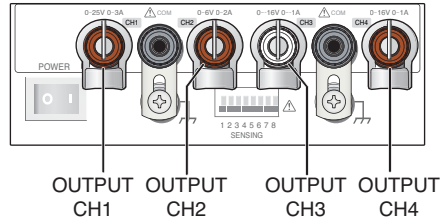


Fig. 4-7 PMP16-1QU output terminals

Table 4-4 Relation between output and Channel Number

Model	OUTPUT CH1	OUTPUT CH2	OUTPUT CH3	OUTPUT CH4
PMP18-3TR	+6 V output	+18 V output	+18 V output	–
PMP25-2TR	+6 V output	+25 V output	+25 V output	–
PMP16-1QU	+25 V output	+6 V output	–16 V output	+16 V output

4.7 Tracking Function (TRACKING)

The tracking function varies the values of multiple specified channels by the absolute amount of change in the reference channel or in proportion (%) to the amount of change in the reference channel.

If performed within an active area, it can be varied from 0 V (or 0 A) to the rated voltage (or the rated current).

There are the following two kinds of tracking functions for PMP series.

Tracking function 1	Function that uses an absolute value that is the same as the variation in the output voltage value (or the output current value) in a reference channel to vary the output voltage value (or the output current value) in other channels.
Tracking function 2	Function that changes the output voltage (or output current) of specified channels in proportion (%) to the specified output voltage (or current) reference.

It is possible to freely set the channel selection that performs a tracking operation, and the channel that will be the reference (only Tracking function 1).

Turning off the POWER switch, clears the settings of the tracking function set. When the PMP is turned on the next time, the unit is started up with the settings of the tracking function canceled.

Tracking function 1 (absolute value variation)

This function varies the output of specified channels by the absolute amount of change in the selected reference channel. The voltage and current values of each channel that are in effect when tracking function 1 is activated become base values, and the voltage and current are varied from these values.

When you change the reference channel voltage or current and the output of a specified channel reaches the maximum settable output or 0 V (or 0 A), the output no longer changes. Even in this condition, the PMP keeps track of the changes in the reference channel so that when the reference channel output is returned to its original value, the tracking channel output also returns to its original value.

Example) When tracking function 1 is activated with CH1 and CH2 of PMP16-1QU:

Set CH1 = 10.00 V, CH2 = 3.00 V, and assign CH1 as the reference channel. When CH1 is set as the reference channel, its settings are shown on the display.

Example 1)	[CH1]	[CH2]	
	10.00 V	3.00 V	Reference voltage Set TRACKING function 1.
	▼		▶Increase CH1 by 4 V.
	14.00 V	6.18 V	CH2 increase stops at the maximum voltage, but its variation result, which is 3 V + 4 V = 7 V, is saved.
	▼		▶Decrease CH1 by 0.5 V.
	13.50 V	6.18 V	CH2 becomes 7 V - 0.5 V = 6.5 V internally, but its actual voltage remains at 6.18 V.
	▼		▶Decrease CH1 by 0.5 V.
	13.50 V	6.00 V	CH2 becomes 6.5 V - 0.5 V = 6.0 V.
	▼		▶Decrease CH1 by 3 V.
	10.00 V	3.00 V	CH2 returns to the original voltage.

Example 2)	[CH1]	[CH2]	
	10.00 V	3.00 V	Reference voltage Set TRACKING function 1.
	▼		▶Increase CH1 by 4 V.
	14.00 V	6.18 V	CH2 increase stops at the maximum voltage, but its variation result, which is 3 V + 4 V = 7 V, is saved.
	▼		▶Channel selection switch is pressed to set the reference channel to CH2.
	14.00 V	6.18 V	The reference level changes to the voltage as shown on the left, and the past variation is cleared.
	▼		▶Decrease CH2 by 3.00 V.
	11.00 V	3.18 V	CH1 becomes 14.00 V - 3.00 V = 11.00 V.
	▼		▶Decrease CH2 by 0.18 V.
	10.82 V	3.00 V	CH2 returns to the original reference voltage, but CH1 becomes 10.82 V and does not return to the original reference voltage.

Tracking function 2 (variation ratio)

This function varies the output of specified channels in proportion (%) to the changes in the reference channel. The voltage and current values of each channel that are in effect when tracking function 2 is activated become base values (that correspond to 100 %), and the voltage and current are varied from these values.

The variable range is from 0.0 % to 200.0 %.

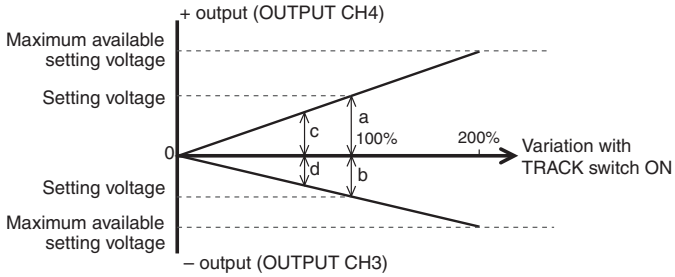
When you change the ratio and the output of a specified channel reaches the maximum settable output or 0 V (or 0 A), the output no longer changes. Even in this condition, the PMP keeps track of the changes in the tracking channel so that when the reference channel output is returned to 100 %, the tracking channel output also returns to its original value.

Example) Examples of the voltage variation of CH3 and CH4 of PMP16-1QU is shown in Fig. 4-8.

When the rotary knob is turned during tracking operation, the output levels vary in the same ratio as the set ± output ratio (b/a) as shown in Fig. 4-8. In other words, the following proportional expression is applied in this case.

b/a = d/c

(a) Variation within the rated output level



(b) Variation beyond the maximum available level

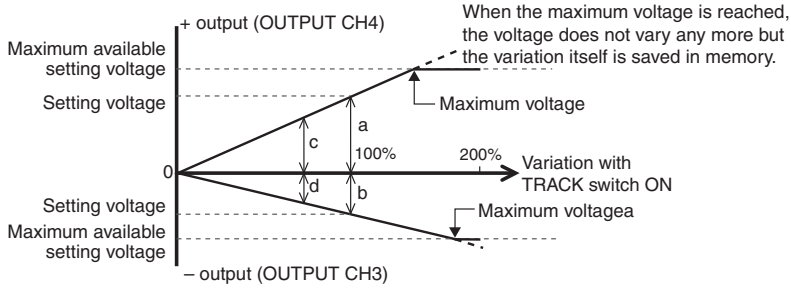


Fig. 4-8 Voltage setting and tracking output

Setting the channel that performs the tracking operation

See Page 4-34

The selection of the channel that performs the tracking operation can be done using “tr.CH” of CONFIG settings. Each time you press the channel selection switch, the tracking function turns on and off, and the setting is indicated on the ammeter.

A channel with tracking function set will have “1” displayed in the ammeter display, and if not set will have “0”.

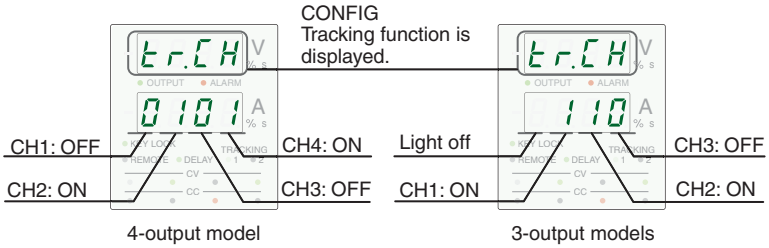


Fig. 4-9 Display example of setting a tracking function

For tracking function 1, if the function is turned off on the reference channel, tracking does not take place on any channels (even if the tracking function on the tracking channels is turned on). To use tracking function 1, be sure to turn on the function on the reference channel.

Setting resolution in tracking operation

When setting the resolution for the tracking operation, to be selected using the VOLTAGE or CURRENT switch.

NOTE

- The output resolution of each channel is equal to the least-significant, displayed digit. If the reference-channel resolution is less than the tracking-channel resolution, the output on the tracking channel may not change when you turn the rotary knob.
  If this happens, keep turning the rotary knob until the tracking channel output or display changes.

Operation procedure of the tracking function 1 (absolute value variation)

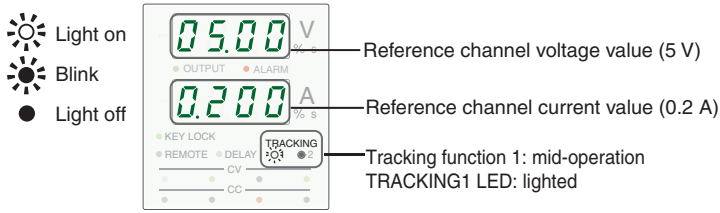


Fig. 4-10 Tracking function 1: Example of display during operation

1. Press the OUTPUT switch to turn the outputs off.

See Page 4-20
Page 4-32

2. Using CONFIG settings, select the channels that will track the reference channel.

See Page 4-5

3. Set the output value of each tracking channel.

4. Press the TRACK1 switch.

   The TRACKING1 LED of display lights up.

5. Press the channel select switch of reference channel.

   The selected channel selection switch of channel lights up, and settings value displayed.

6. Press the OUTPUT switch to turn the outputs on.

7. Turn the rotary knob to set the displayed output value to the desired value.

To exit from the tracking operation1, press the TRACK1 switch.

NOTE

About tracking function 1

- During tracking operation, you can press a channel selection switch to display the corresponding channel setting. When you do this, the amount of change in the tracking operation is cleared. The settings of each channel at this point become base values, and the reference channel switches to the selected channel.
- During tracking operation, if you change the reference channel when the tracking channels have reached their rated output, 0 V, or 0 A, the amount of change is also cleared. In this case, the rated output, 0 V, or 0 A becomes the base value.
- Be aware of these facts when you press the channel selection switch during tracking operation.
- If a memory switch is pressed during tracking function operation, the settings stored in the memory become the reference values.

Operation procedure of the tracking function 2 (variation ratio)

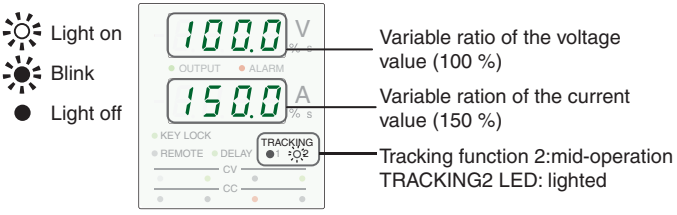


Fig. 4-11 Tracking function 2: Example of display during operation

1. Press the OUTPUT switch to turn the outputs off.
2. Using CONFIG settings, select the channels that will track the reference channel.

See
Page 4-20
Page 4-32

See Page 4-5

3. Set the output value of each tracking channel.

4. Press the TRACK2(SHIFT + TRACK1) switch.

   The TRACKING2 LED of display lights up.
   The channel selection switch that corresponds to the selected channel illuminates, and both the voltmeter and ammeter display 100.0.

5. Press the OUTPUT switch to turn the outputs on.

6. Turn the rotary knob to set the displayed output ratio to the desired ratio.

To exit from the tracking operation2, press the TRACK2 (SHIFT + TRACK1) switch.

It can also be exited by pressing the TRACK 1 switch twice to shift the mode from TRACK 2 → TRACK 1 → Tracking OFF.

NOTE

About tracking function 2

- Even if the channel that is currently displayed has its tracking function turned off, channels that have the tracking function turned on perform tracking operation.
  As with the channels that have their tracking function turned on, the percentage that is displayed for a channel that has its tracking function turned off also changes, but the actual setting does not change.
- If a memory switch is pressed during tracking function operation, the settings stored in the memory become the reference values.

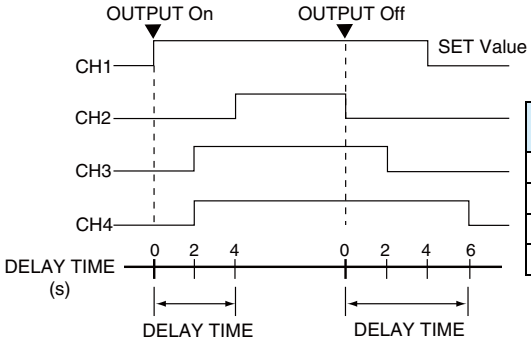
4.8 Delay Function

The actually delay time period between the press of the OUTPUT switch and the actual switching of the outputs to ON (ON DELAY) or OFF (OFF DELAY) can be set. You can set separate delay times for ON and OFF.

The available setting range of DELAY TIME is between 0.1 to 99.9 seconds.

The following timing chart of ourput on delay and output off delay shows the concepts of the delay function.

▼The timing that pushes a OUTPUT switch



Item	ON DELAY SET value	OFF DELAY SET value
CH1	0 s	4 s
CH2	4 s	0 s
CH3	2 s	2 s
CH4	2 s	6 s

Fig. 4-12 Timing chart of delay function

The actual rise time with output on and actual fall time with output off vary depending on the output and the load condition. Note that the timing chart above ignores the rise and fall time.

NOTE

- Due to the internal processing time, the time until the output is turned on or off after the OUTPUT switch is pressed contains an error of a few tens of milliseconds even when the delay time is set to 0 second to delay time.

Setting the output value, output on delay time and output off delay time

During setting the delay time, the DELAY LED blinks.

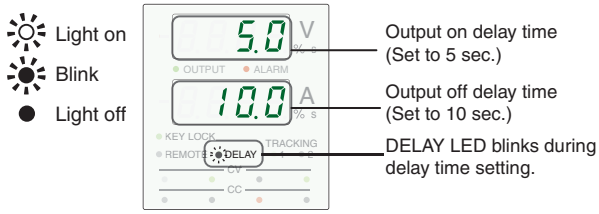


Fig. 4-13 Example of delay time setting display

1. Press the OUTPUT switch to turn the outputs off.

See Page 4-5

2. Set the output values of each channel in a delay operation.

3. Press the DELAY SET (SHIFT+DELAY) switch.

   The previously set value appears, and the DELAY LED blinks.

4. Press the channel selection switch to select the desired channel.

   The selected channel selection switch of lights up.

5. Press the VOLTAGE or CURRENT switch to initiate the SET status.

   Set the output on delay time in the voltmeter display and the output off delay time in the ammeter display.

6. Press the VOLTAGE or CURRENT switch to select the setting digit, and turn the rotary knob to set dellay time.

   The unit of setting is second.

7. To set the delay time for other channels, repeat steps 4 to 6 above for each of them.

8. To exit from the setting of output on dilay time and output off dilay time, press the DELAY SET (SHIFT + DELAY) switch.

   DELAY LED turns off.

NOTE

- If the POWER switch is turned off before exiting from the DELAY SET mode, the delay time settings are not saved in memory.

Operation of the delay function

The delay function allows you to turn the outputs on/off.

During the delay time until the output on or off, the OUTPUT LED blinks. If you press the OUTPUT switch while the OUTPUT LED is blinking, the output on or off operation stops.

1. Press the OUTPUT switch to turn the outputs off.

See
Page 4-5
Page 4-26

2. Set the output values and output on/off delay time.
3. Press the DELAY switch to activate the delay function.

   DELAY LED on the display lights it.
4. Press the OUTPUT switch to turn the outputs on.

   During the output on delay operation, the OUTPUT LED on the display blinks to indicate the delay operation. The LED stops blinking and starts lighting steadily when all of the outputs are turned on.

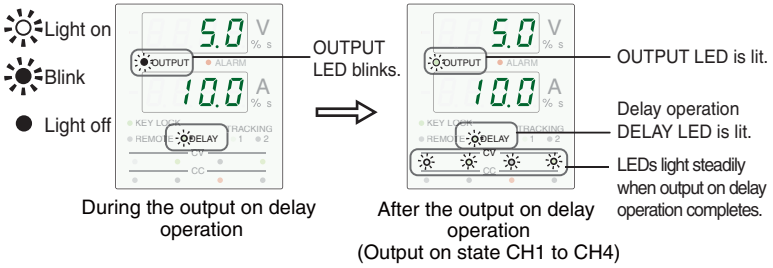


Fig. 4-14 Example of display during output on delay operation

5. Press the OUTPUT switch to turn the outputs off.

   During the output off delay operation, the OUTPUT LED on the display blinks to indicate the delay operation. The LED stops blinking and turns off when all of the outputs are turned off.

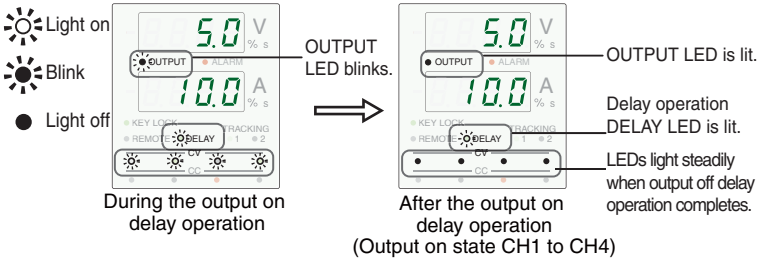


Fig. 4-15 Example of display during output off delay operation

6. Press the DELAY switch to exit from the delay function.

4.9 Memory Function

Up to three sets of voltage/current and delay time of the outputs can be stored in memory banks. Select memory 1, 2, or 3 to save the settings.

Storing settings in memory

1. Press the OUTPUT switch to turn the outputs off.

See
Page 4-5
Page 4-26

2. Set the desired output settings.

   Set the voltage value, current value and delay time at need.

3. Press the STORE (SHIFT+MEMORY) switch to select the memory switch (1, 2 or 3) you want to store the settings.

   The settings are stored in the selected memory.

NOTE

- If a switch other than the STORE (SHIFT+MEMORY) switch is pressed, the settings are not stored in memory.

Recalling settings

⚠CAUTION
- When memory settings are recalled while the output on is turned on, the recalled setting values are output. Be careful not to recall a wrong memory number to avoid applying an unexpectedly high power to the load.
  In the memory banks that you would not use, it is recommended to store the voltage and current values that would not damage the load.

Press the memory switch that stores the setting values.
The settings in the selected memory will be recalled.

To view the stored settings, press a memory switch while the OUTPUT switch is off. The settings stored in the specified memory are displayed. If you want to use the settings immediately, turn the OUTPUT switch on.

When memory settings are recalled while the OUTPUT switch is turned on, the rise time of each output may be deviated by about 1.5 second.

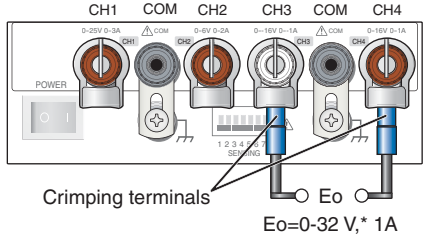
NOTE
- You cannot recall settings while the delay function is in operation.

4.10 Series Connection (only for PMP16-1QU)

⚠CAUTION

- The series operation is possible only with PMP16-1QU. It is not available with PMP18-3TR/PMP25-2TR.
- It is not permitted to perform the series operation by combining the outputs of more than one unit. Otherwise, flowing a current into the internal circuitry may cause a failure.

The output voltages of two channels can be combined and magnified by connecting the load to their + (positive) and – (negative) output terminals.



* The voltage obtained by adding the CH3 and CH4 outputs is output.

Fig. 4-16 Example of load connection for series operation of PM16-1QU (Example of connection to CH3 - and CH4 + output terminals)

4.11 KEY LOCK Function (KEY LOCK)

You can prohibit (lock) panel operations to prevent the settings from being changed by mistake. Once the front panel keys are locked, operation of switches other than the OUTPUT switch, channel selection switches and KEY LOCK (SHIFT+SET) switch will become invalid.

Locking or unlocking the panel keys

Each press of the KEY LOCK (SHIFT+SET) switch can lock or unlock the front panel operation alternately.

When the KEY LOCK is set, the KEY LOCK LED on the display lights up. The LED lights off when the KEY LOCK is canceled.

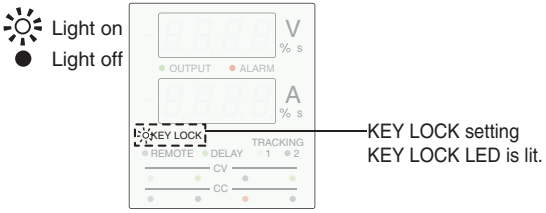


Fig. 4-17 Key lock display

NOTE

- If you set the key lock function while the SET switch is pressed (the SET switch is lit), the panel display is locked displaying the voltage and current settings (you cannot switch to the output display). If you want to display the actual output values, clear the key lock function, press the SET switch to display output values, and then set the key lock function again.

4.12 Configuration setting (CONFIG)

See Fig. 4-18

The CONFIG setting the operating conditions of the PMP.
It is performed by using the voltmeter display, ammeter display, CONFIG switch and the rotary knob and/or channel selection switches.

1. Press the CONFIG switch.

   The display changes to the CONFIG display.
   The voltmeter display shows the CONFIG setting item, which can be switched in sequence by pressing the CONFIG switch. Press the CONFIG switch repeatedly until the operating condition to be set is displayed. Pressing the CONFIG switch repeatedly eventually returns the display to the output value display.

2. Set the condition by turning the rotary knob or pressing the channel selection switches.

   The ammeter display shows the content of the setting.

3. To set another operating condition, press the CONFIG switch.

   The content of the setting can be changed using the rotary knob or channel selection switches.

4. After completing the setting, press the CONFIG switch repeatedly until the display returns to the output value display. The CONFIG setting is exited at this moment.

Table 4-5 Lists of CONFIG parameters

† : 1 indicate using rotary knob, 2 indicate using channel select switch.

CONFIG parameters	Setting/Display	Setting	†
On.Po	Output state at power-on setup	ON (on) / OFF (off)	1
tr.CH	Tracking setup	ON (1) / OFF (0)	2
SEnS	Remote sensing setup	ON (1) / OFF (0)	2
Vo.Li	Voltage limit operation setup	HOLD (HoLd) / CHANGE (ChAn)	1
Cu.Li	Current limit operation setup	HOLD (HoLd) / CHANGE (ChAn)	1
Vo.Fi	Voltage fine setup	ENABLE (On-c, On-h) / DISABLE(oFF)	1
Cu.Fi	Current fine setup	ENABLE (On-c, On-h) / DISABLE(oFF)	1

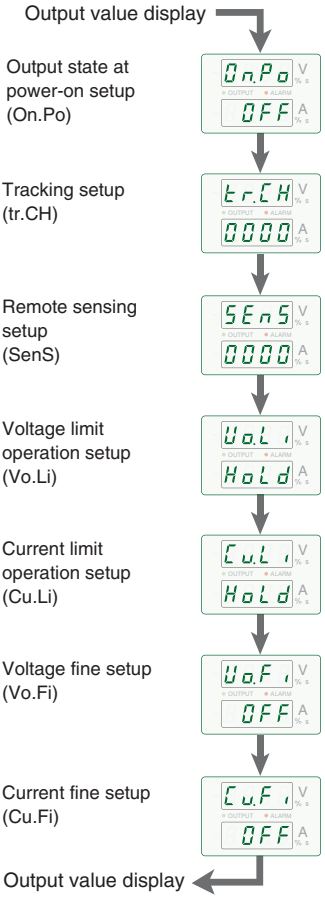


Fig. 4-18 CONFIG settings (Factory-shipped settings)

When the CONFIG switch is pressed after completing the current fine setting to exit from the CONFIG setting, "----" is displayed in the voltmeter and the ammeter display for a few seconds before the display returns to the output value display.

If a factory option interface board is installed, a menu for the installed interface is added to the normal CONFIG items.

For details, see the PMP Series Communication Interface Manual.

Output state at power-on setup (“ON.PO” On.Po)

Rotary knob

This sets the output status at the moment the POWER switch is turned on.

Use the rotary knob for the setting.

ON (On): Start in the OUTPUT ON status.

OFF (oFF): Start in the OUTPUT OFF status.

NOTE

- If you set the power-on output state to on, it may take a few seconds for the output to turn on after the firmware version is displayed due to internal processing.

Tracking setup (“TR.CH” tr.CH)

channel selection switches

CH1 CH2 CH3 CH4

Set the channels that will track the reference channel using the channel selection switch.

Each time you press the switch, the tracking function turns on and off, and the setting is indicated on the ammeter.

On a four-output model, the CH1, CH2, CH3, and CH4 settings are indicated in order starting with the leftmost digit.

On a three-output model, the CH1, CH2, and CH3 settings are indicated in order starting with the second leftmost digit.

1: Tracking ON.

0 : Tracking OFF.

Remote sensing setup (“SENS” SEnS)

channel selection switches

CH1 CH2 CH3 CH4

This sets the channels to perform the remote sensing operation.

Use the channel selection switches for the setting.

Each time you press the switch, the tracking function turns on and off, and the setting is indicated on the ammeter.

On a four-output model, the CH1, CH2, CH3, and CH4 settings are indicated in order starting with the leftmost digit.

On a three-output model, the CH1, CH2, and CH3 settings are indicated in order starting with the second leftmost digit.

1: Remote sensing ON.

0: Remote sensing OFF.

Voltage limit operation setup ("Vo.LI" [Vo.L ı])

Rotary knob

This sets the operation of the digits lower than the selected digit when the voltage approaches the maximum or minimum limit of the voltage setting range.

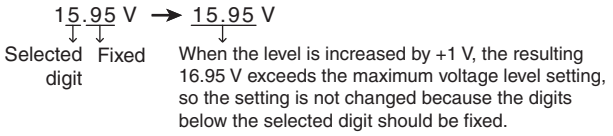
Use the rotary knob for the setting.

HOLD ([HoLd]): Digits lower than the selected digit are fixed.

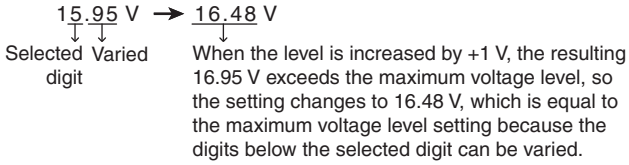
CHAN ([ChAn]): Digits lower than the selected digit are varied.

Example) With PMP16-1QU (The maximum voltage level of CH4 is set to 16.48 V), the present voltage is 15.95 V, and the 1 V is increase.

- When digits lower than the selected digit are fixed:



- When digits lower than the selected digit are varied:



Current limit operation setup ("CU.LI" [CuL ı])

Rotary knob

This sets the operation of the digits lower than the selected digit when the current approaches the maximum or minimum limit of the current setting range.

Use the rotary knob for the setting.

HOLD ([HoLd]): Digits lower than the selected digit are fixed.

CHAN ([ChAn]): Digits lower than the selected digit are varied.

Example) With PMP16-1QU (The maximum current level of CH4 is set to 1.030 A) the present current is 0.950 A, and the 0.1 A is increase.

- When digits lower than the selected digit are fixed:

Selected digit, Fixed digit

When the level is increased by +0.1 A, the resulting 1.050 A exceeds the maximum current level setting, so the setting is not changed because the digits below the selected digit should be fixed.

- When digits lower than the selected digit are varied:

Selected digit, Varied digit

When the level is increased by +0.1 A, the resulting 1.050 A exceeds the maximum current level, so the setting changes to 1.030 A, which is equal to the maximum current level setting because the digits below the selected digit can be varied.

Voltage fine setup ("VO.FI" [Uo.F i])

Rotary knob

This sets the operation of the digit below the least significant digit that can be set in the voltmeter display.

When the rated output voltage is or more 10 V: Operation of the digit of 1 mV.
When the rated output voltage is ress than 10 V: Operation of the digit of 0.1 mV.

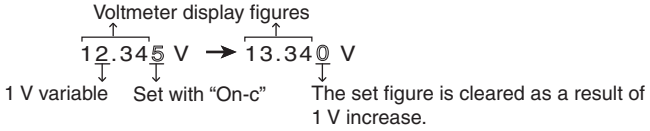
Use the rotary knob for the setting.

During fine setting mode, the least significant (rightmost) digit blinks to indicate that the next lower digit is being set. The next lower digit is not displayed even while you set it. Also, even though you can set this digit, but it may not be reflected in the actual output voltage due to PMP limitations.

ON-C ([On-C]): Voltage fine setting enabled (Clear)

The voltage can be set by the digit (of 1 mV or 0.1 mV) below the least significant digit displayed in the voltmeter display. If you move to another digit and set it, the value at the 1-mV or 0.1-mV digit is cleared to zero.

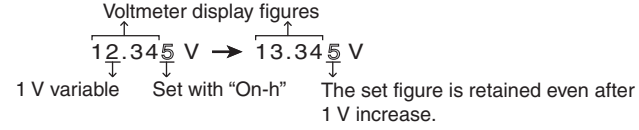
Example) When the voltage value of 12.345 V is set with "ON-C" and then the voltage is increased by 1 V.



ON-H (On-h): Voltage fine setting enabled (Hold)

The voltage can be set by the digit (of 1 mV or 0.1 mV) below the least significant digit displayed in the voltmeter display. Even if you move to another digit and set it, the value at the 1-mV or 0.1-mV digit is retained.

Example) When the voltage value of 12.345 V is set with "ON-H" and then the voltage is increased by 1 V.



OFF (OFF): Voltage fine setting disabled

Tip:

- The output varies in about 1 mV steps when the rated voltage is 16 V and in about 0.2 mV steps when it is 6 V. However, these figures do not represent the guaranteed performance. Use this information simply as references.

Current fine setup ("CU.FI" CU.FI)

Rotary knob

This sets the operation of the digit below the least significant digit that can be set in the current display.

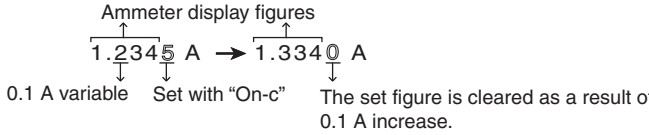
Use the rotary knob for the setting.

During fine setting mode, the least significant (the 1-mA digit) digit blinks to indicate that the next lower digit is being set. The next lower digit is not displayed even while you set it. Also, even though you can set this digit, but it may not be reflected in the actual output current due to PMP limitations.

ON-C (On-c): Current fine setting enabled (Clear)

The current can be set by the digit (0.1 mA) below the least significant digit displayed in the voltmeter display. If you move to another digit and set it, the value at the 0.1-mA digit is cleared to zero.

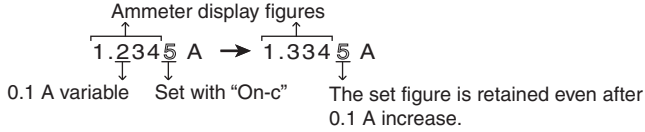
Example) When the current value of 1.2345 A is set with "ON-C" and then the current is increased by 0.1 A.



ON-H (On-h): Current fine setting enabled (Hold)

The current can be set by the digit (of 0.1 mA) below the least significant digit displayed in the current display. Even if you move to another digit and set it, the value at the 0.1-mA digit is retained.

Example) When the current value of 1.2345 A is set with "ON-H" and then the current is increased by 0.1 A.



OFF (OFF): Current fine setting disabled

Tip:

- The output varies in about 0.1 mA steps when the rated voltage is 3 A and in about 0.2 mA steps when it is 5 A. However, these figures do not represent the guaranteed performance. Use this information simply as references.

4.13 Remote Sensing Function

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.

The remote sensing function of the PMP can compensate up to approximately 0.3 V for a single line. Select a load cable with sufficient current capacity so that the voltage drop in the load cable does not exceed the compensation voltage.

If the voltage drops by more than 0.6 V, the internal circuitry may be destroyed.

To perform remote sensing, an electrolytic capacitor may be required at the sensing point (load terminal).

NOTE

- With the factory setting, the PMP has been calibrated by connecting sensing wires to the output terminals. When calibrating the PMP, be sure to connect wires to the sensing and output terminals and execute calibration on the load side. See section 6.1 “Calibration” for details.
- To use the remote sensing function, it is required to turn it on in the CONFIG setting. If the remote sensing function is not turned on, an error of about 30 mV may result.

Remote Sensing Connection Procedure

⚠WARNING Electric shock or damage to the internal circuitry may result.

- **Never connect wires to the sensing terminals while the POWER switch is turned on.**
- **The rated voltages of the wires to the sensing terminals should be equal to or larger than the isolation voltage of the PMP. The isolation voltage of the PMP is ±250 Vmax.**

A small amount of current (max. 10 mA) flows through the sensing wires during the remote sensing operation. To prevent

an error that may occur due to the resistance component of the sensing wires, use wires with as low resistance as possible.

When you are not using the sensing function, be sure to remove the sensing wires.

■ Electrolytic capacitor required

Capascitance 0.1 µF to several hundred µF

Withstand voltage: Greater than or equal to 150 % of the rated output voltage of the PMP

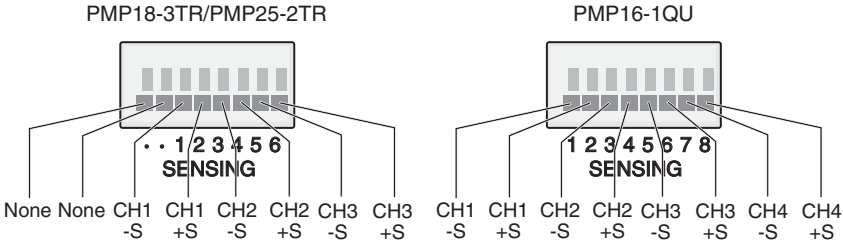


Fig. 4-19 Corresponding remote sensing terminals

Table 4-6 Correspondence of sensing terminals

SENSING terminal No.	Corresponding remote sensing terminal	Remote sensing terminal/Load wire connection correspondence		
		4-output model	3-output models	
		PMP16-1QU	PMP18-3TR	PMP25-2TR
1	CH1 -S	CH1_COM wiring	CH1_COM wiring	CH1_COM wiring
2	CH1 +S	CH1_+ wiring	CH1_+wiring	CH1_+wiring
3	CH2 -S	CH2_COM wiring	CH2_COM wiring	CH2_COM wiring
4	CH2 +S	CH2_+wiring	CH2_+wiring	CH2_+wiring
5	CH3 -S	CH3_-wiring	CH3_COM wiring	CH3_COM wiring
6	CH3 +S	CH3_COM wiring	CH3_+wiring	CH3_+wiring
7*1	CH4 -S	CH4_COM wiring	None	None
8*1	CH4 +S	CH4_+wiring	None	None

*1. PMP18-3TR/PMP25-2TR also has these terminals, but they are not connected to the internal circuitry.

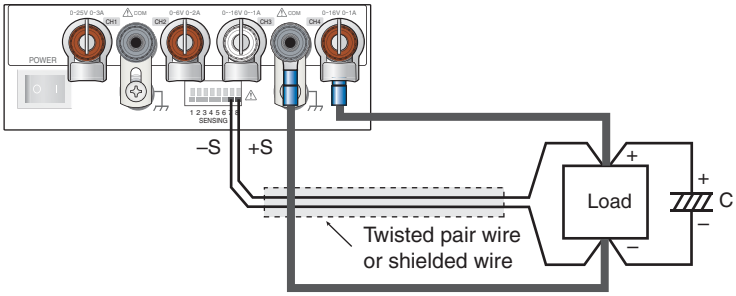


Fig. 4-20 Remote sensing connection example
(Connected to CH4 for PMP16-1QU)

1. Turn off the POWER switch.

2. Connect a wire across each sensing terminal (+S or –S) of the PMP and the sensing point of the load end.

See Page 5-3

Use twisted pair or shielded wires as the sensing wires. This will prevent the output ripple voltage from being degraded due to induction. Use sensing wires of 1 m or less in length.

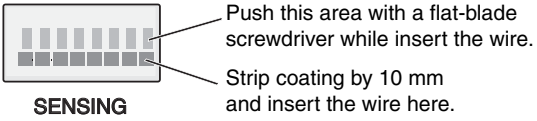


Fig. 4-21 Connection to sensing terminals

3. Connect an electrolytic capacitor to the load end.

With the electrolytic capacitor, the side connected to the +S terminal always has the + (positive) polarity. Attaching the capacitor results in changing the rise and fall time longer than usual.

4. Press the CONFIG switch and select “SEnS”.

See Page 4-32

See
Page 4-20
Page 4-34

5. Press the channel selection switches to set the channel to use the remote sensing function.

   The channels to which the remote sensing is set are indicated with "1" on the ammeter display, and those to which the remote sensing is not set are indicated with "0". The procedure to configure the channels is the same as that for performing tracking operation.

6. Confirm the connection of the sensing terminals.

Be sure to connect the sensing wires securely by referring to the checklist in Table 4-7.

■ If you are inserting a mechanical switch between the PMP and the load

If you want to turn the signals on and off using a mechanical switch that is inserted between the PMP and the load, be sure to include the sensing wires in the switch as shown in Fig. 4-22 and turn on and off the load wire and the sensing wires simultaneously. Be sure to turn off the OUTPUT or POWER switch before turning on/off the mechanical switch.

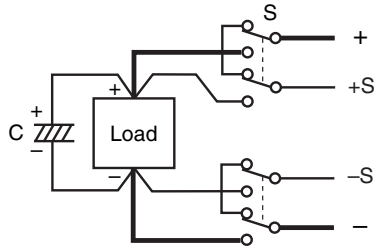


Fig. 4-22 On/off using the mechanical switch

Table 4-7 Remote Sensing Connection Checklist

Check Item	Phenomena and Remedy
Is insulation OK?	The rated voltages of the sensing wires should be equal to or larger than the isolation voltage of the PMP.

Check Item	Phenomena and Remedy
Is connection OK?	Be sure to connect the sensing wires firmly. If a sensing wire is disconnected, the output voltage at the load end goes unstable and the load may be subjected to an excessive voltage. Also take care of the polarity of connection to prevent malfunction of the product.
Is a mechanical switch in use?	When turning the power supply to the load on/off using a mechanical switch, also insert a mechanical switch between the sensing wires to maintain the status of the load and sensing wires identical.
Is the product being used near the rated output voltage?	The outputs from the PMP are guaranteed only up to the rated voltage. If the voltage drops till the load end is too large and the voltage at the output end exceeds the rated voltage, stable voltage cannot be supplied to the load end and malfunction of the PMP may also result. In this case, replace the load wire with a wire with a larger cross-sectional area so that the voltage at the output end does not exceed the rated voltage.
Is induction prevented?	Use twisted pair or shielded wires as the sensing wires, and be sure to connect the shield to the COM terminal. If a shielded area is exposed, protect it using an insulation tube having a higher withstanding voltage than the isolation voltage of the PMP.
Is the withstanding voltage of the electrolytic capacitor enough?	Use an electrolytic capacitor with a withstanding voltage of 150% or more of the rated voltage of the PMP.
Aren't the wire lengths too long?	When the length of the wire to the load is longer than 1 meter, oscillation may occur due to the inductance or capacitance of the wire. In this case, insert capacitors (with a rated voltage of some hundreds of μF) between the +S sensing terminal and the + output and between the –S sensing terminal and the – terminal. When connecting the capacitors, take care of their polarity so that the + (positive) polarity of the capacitor between +S and + comes on the + terminal side and that the + (positive) polarity side of the capacitor between –S and – come on the –S terminal side.
Are the countermeasures against pulsed load current sufficient?	If the load current changes suddenly into a pulse, the output voltage may be increased due to the inductance of the wire. To prevent this, use a sufficiently thick wire and use a capacitor with large capacitance on the load end.

External Control

This chapter gives description on the external control functions.

In addition to the control using the front panel, the PMP can control the following operations by means of the J1 terminals on the rear panel.

- Output on/off control based on external contact input signals
- Recall of memory 1, 2 and 3 based on external contact input signals
- Alarm input based on an external contact input signal

5.1 Handling the Screw-less Terminals

Screw-less terminals are provided on the J1 terminals and as the sensing terminals.

Wires and tools required for connection

Wires

Single wire : ϕ 0.32 (AWG28) to ϕ 0.65 (AWG22)

Stranded wire: 0.08 mm^2 (AWG28) to 0.32 mm^2 (AWG22)

Flat-blade screwdriver

Axis diameter: ϕ 3

End width: 2.6 mm

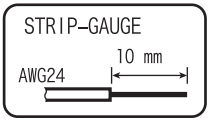
Wire stripper

Wire stripper suitable for the wires described above

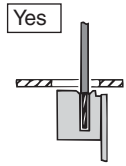
Connection for screw-less terminals

1. Turn off the POWER switch.
2. Use a wire stripper to remove 10 mm of the covering from the wires.

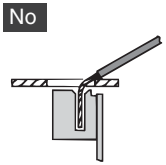
   Using the strip gauge that is indicated on the top panel to easily take the strip-gauge's measure.



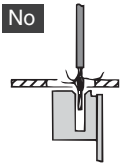
3. Insert a wire into the screw-less terminal.
4. Move the screwdriver away from the terminal block and confirm that the wire does not come out.



Correct connection



Conductors are in contact with the chassis because the coating is removed too much. The coating should be removed by a length of 10 mm.



Conductor debris is in contact with the chassis.
Twist the conductors before insertion.

Fig. 5-1 Precautions to be taken when connecting

5.2 J1 Terminals

This section describes the connection methods and precautions for the J1 terminals that are used for the external control connection.

Table 5-1 J1 terminals arrangement

Terminal No.	Signal Name	Description	Operation
1	ALM IN	External alarm input	Short-circuit terminals 1 and 6.
2	MEMORY1	Memory 1 recall	Short-circuit terminals 2 and 6.
3	MEMORY2	Memory 2 recall	Short-circuit terminals 3 and 6.
4	MEMORY3	Memory 3 recall	Short-circuit terminals 4 and 6.
5	OUTPUT ON	OUTPUT ON/OFF control	Short-circuit terminals 5 and 6.
6	COMMON	Common signal input	–

⚠WARNING Electric shock or damage to the internal circuitry may result.

- **Never connect wires to the J1 terminals while the POWER switch is turned on.**
- **The potential of terminals of the J1 terminals are almost equivalent to the CH2/CH3 COM terminals with PMP18-3TR/PMP25-2TR or to the CH3/CH4 COM terminals with PMP16-1QU. If conductor debris from the J1 terminal block contacts the chassis, an electric shock or damage to the internal circuitry may result. Be sure to insert the wire so that the conductors exposed by stripping the coating do not go over the terminal block.**
- **The rated voltages of the wires connected to the J1 terminals should be equal to or larger than the isolation voltage of the PMP. The isolation voltage of the PMP is ±250 Vmax.**

Connection for J1 terminal block

1. Turn off the POWER switch.
2. Insert a wire into a terminal on the J1 terminal block.

See Page 5-3

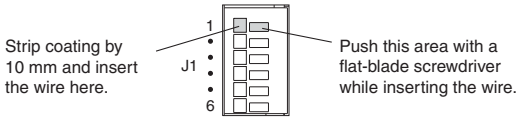


Fig. 5-2 J1 terminal block connection

5.3 Turning Output On/Off Using External Contact

Turning the OUTPUT on/off can be controlled using external contacts.

Connection for output on/off control

Connect a contact switch S to terminals 5 and 6 of the terminal block.

Short-circuit the contact to turn the output on, Open the contact to turn the output off.

When the contact is shorted, the output cannot be turned off using the OUTPUT switch on the front panel.

When the output is turned on by the front panel while the contact is open, the output can be turned off by shorting and then opening the contact.

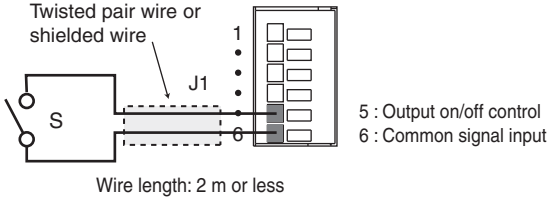


Fig. 5-3 Connecting a contact switches for output on/off

5.4 Recalling Memory 1, 2 or 3 Using External Contacts

The settings stored in memory banks 1, 2 and 3 can be recalled using external contact input signals.

To recall a memory setting, short-circuit the terminal with the target memory number with the COMMON terminal. The short-circuiting period should be longer than 500 ms.

It is invalid to short-circuit more than one pair of terminals at a time.

When a memory is selected by means of the external control terminals, the MEMORY switch on the front panel is invalid.

Connection for memory recall

Connect contact switches to terminals 2, 3, 4 and 6 of the J1 terminal board. The following figures show the connection that uses a non-shorting switch and the connection that uses momentary switches.

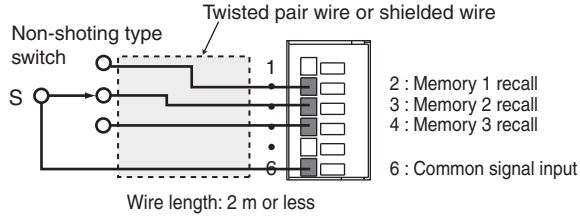


Fig. 5-4 Connecting a contact switches for memory recall 1 (When using a non-shoting type switch)

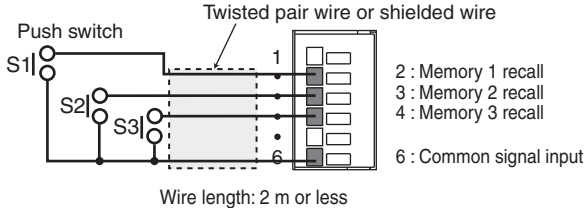


Fig. 5-5 Connecting a contact switches for memory recall 2 (When using push switches)

If you connect terminals using momentary switches, do not press two or more switches at the same time.

When you recall settings from a memory, the PMP displays the following indication momentarily and then switches to displaying the output values.

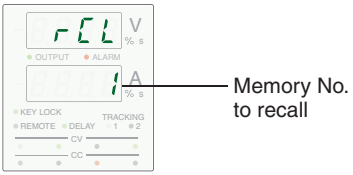


Fig. 5-6 Example when recalling memory No.

DESCRIPTION

- Fig. 5-7 shows an equivalent circuit of terminals 2, 3 and 4 of the J1 terminal block.

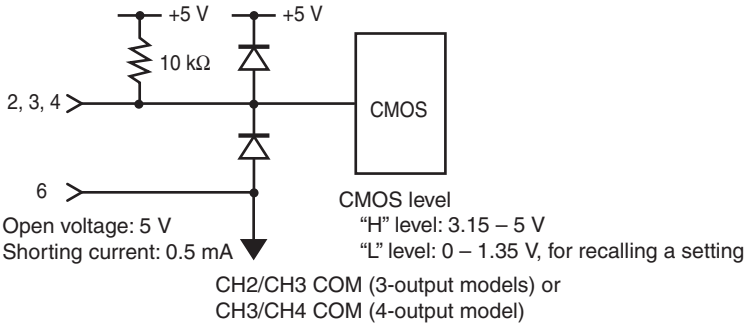


Fig. 5-7 Equivalent circuit

5.5 Controlling the Alarm Input (ALM IN) Using External Contact

This function shuts off the outputs from the PMP according to the input from an external contact. Short-circuit the contact switch to apply an alarm signal input at 0.5 s or longer.

Connection for alarm input

Connect a contact switch to terminals 1 and 6 of the J1 terminal block.

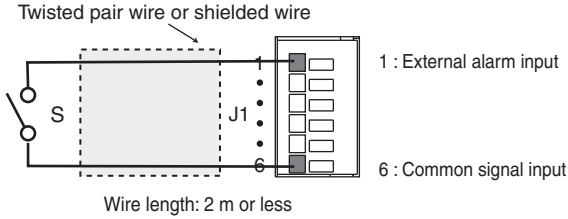


Fig. 5-8 Connecting a contact switch to alarm input

Apply alarm signals for 0.5 s or longer.
If the short-circuit duration is short, the PMP may noy detect the alarm.

When the alarm signal is input, the ALARM LED on the front panel blinks and the display becomes as shown below.

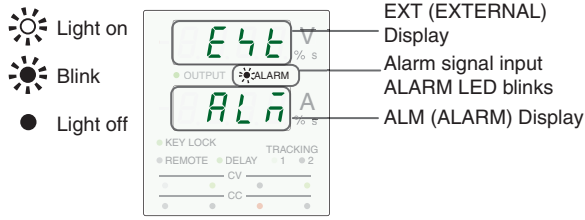


Fig. 5-9 Display during alarm input

Releasing the alarm signal

Once an alarm signal is applied, the alarm input is retained. Turn the POWER switch off to clear the alarm and then turn it back on.

6 Maintenance

This chapter describes maintenance, inspection, cleaning and troubleshooting of the PMP.

Periodic inspection is essential to maintain the initial performance of the PMP over an extended period.

Check for tears in the power cord insulation and breaks in the terminal block.

⚠WARNING • **Tears in the insulation coating may cause electric shock or fire. If a tear is found, stop using it immediately.**

To purchase accessories or oprions, contact your Kikusui agent or distributor.

6.1 Calibration

The PMP has been shipped after proper calibrations. To maintain the performance, it is recommended to apply periodical calibration to it.

For caliblation, request your Kikusui agent or distributor.

Follow the procedures described below when adjustment is required. This section lists all of the adjustment operations required for the PMP.

If you have any inquiry or doubt, contact your Kikusui agent or distributor.

6.1.1 Test Equipment Required

For control, the following equipment is necessary.

- DC voltmeter (DVM) with measuring accuracy of 0.02 % or better.
- Shunt (See Table 6-1.)

Table 6-1 Recommended shunt resistors

Model		Shunt resistors	
		Rating	Tolerance
3-output models	PMP18-3TR	5 A/500 mV (100 mW) 3 A/300 mV (100 mW)	±0.1 % or less
	PMP25-2TR	5 A/500 mV (100 mW) 2 A/200 mV (100 mW)	
4-output model	PMP16-1QU	3 A/300 mV (100 mW) 2 A/200 mV (100 mW) 1 A/1 V (1 W)	

6.1.2 Environment

Perform calibration or control under the following environment.

- Temperature: 23 °C ± 5 °C
- Humidity: 10 %rh to 80 %rh

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

6.1.3 Adjustments

The PMP set to the CAL mode before adjustment.

The panel display of the voltage CAL mode appears at the start of CAL mode.

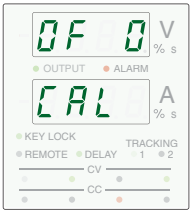


Fig. 6-1 Panel display when activation calibration mode

Adjustment Procedures

The following four items can be adjusted for each output.

- Output voltage, offset
- Output voltage, full-scale
- Output current, offset
- Output current, full-scale

The adjustment can be started with any output. It is possible to adjust only the output voltage or output current, but both the offset and full-scale values should always be adjusted.

NOTE

- In the CAL mode, the PMP outputs a voltage or a current for use in the offset and full-scale adjustments. However, the output value is not identical to the value used in the last performed adjustments. It is about 10% of the rated output in the offset adjustment and near the rated output in the full-scale adjustment.

Voltage adjustment procedure

⚠CAUTION

- Be sure to connect wires to the output and sensing terminals before starting the voltage adjustments. If the sensing terminals are left unconnected, the output voltage may be deviated by some tens of millivolts due to the effects of the internal circuitry and the load may be subjected to an excessive voltage. For details on the connection, see “Remote Sensing Connection Procedure” on page Page 4-39

■ Connecting the equipment

1. Turn off the POWER switch.

See Page 4-39

2. Connect the sensing and output terminals to the load.
3. Connect a DVM to the output terminal.

Connect a DVM according to the output to be adjusted.

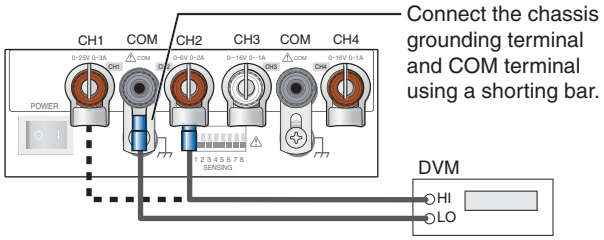


Fig. 6-2 PMP16-1QU voltage adjustment connection example 1
(Connection to CH1 or CH2 output terminal)

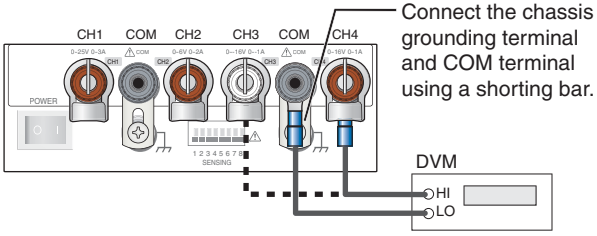


Fig. 6-3 PMP16-1QU voltage adjustment connection example 2
(Connection to CH3 or CH4 output terminal)

■ Warm-up

4. While holding down the SET switch, turn on the POWER switch.

Hold the SET switch until the panel display of the CAL mode is displayed. The panel display switches to voltage CAL mode, and the ammeter displays "CAL."

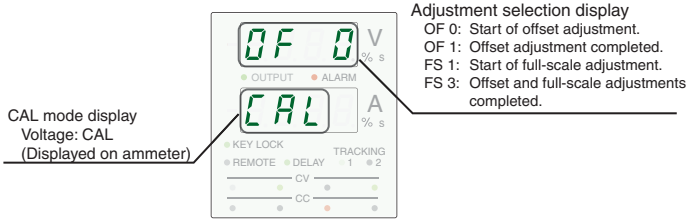


Fig. 6-4 Panel display in voltage calibration mode

5. Check that the OUTPUT LED on the display is not lit.

   If it is lit, press the OUTPUT switch to turn the output off.

6. Warm up the equipment including the DVM for sufficient time.

■ Output voltage offset and full scale

7. Depress the channel selection switch for the channel to be adjusted (CH1, CH2, CH3 or CH4).

   The corresponding channel selection switch lights.
   Offset adjustment starts.

8. Depress the OUTPUT switch to turn the output on.

   The PMP outputs approximately 10 % of the rated output voltage.

9. Turn the rotary knob so that the DVM reading is equal to 10 % of the rated output voltage.

   Turning the rotary knob while holding down the SHIFT switch increases the resolution.

10. Depress the OUTPUT switch to turn the output on.

    The voltmeter display shows “OF 1”. and the offset adjustment completed.

11. Depress the VOLTAGE switch to start of full-scale adjustment.

    The voltmeter display shows “FS 1”.

12. Depress the OUTPUT switch to turn the output on.

    The PMP outputs approximately 100 % of the rated output voltage.

13. Turn the rotary knob so that the DVM reading is equal to 100 % of the rated output voltage.

    Turning the rotary knob while holding down the SHIFT switch increases the resolution.

14. Depress the OUTPUT switch to turn the output off.

"FS 3" is displayed in the voltmeter display and the SET switch flashes.

15. Depress the SET switch to store the adjustment values in memory.

The voltmeter display shows "FS 0".

To exit from the output voltage adjustments, turn off the POWER switch.

If a different output is adjusted or the POWER switch is turned off before depressing the SET switch, the last performed adjustments are not stored. Be sure to depress the SET switch to complete the adjustments.

Current adjustment procedure

■ Connecting the equipment

1. Turn off the POWER switch.
2. Connect a shunt resistor and a DVM to the output terminal.

   Connect them according to the output to be adjusted.

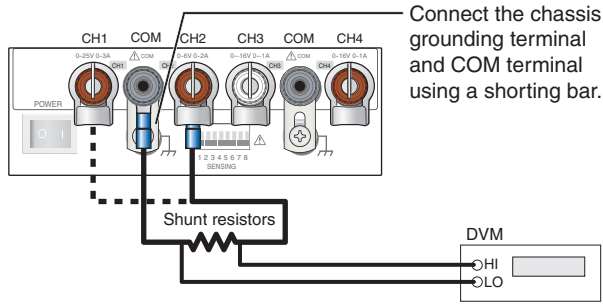


Fig. 6-5 PMP16-1QU current adjustment connection example 1
(Connection to CH1 or CH2 output terminal)

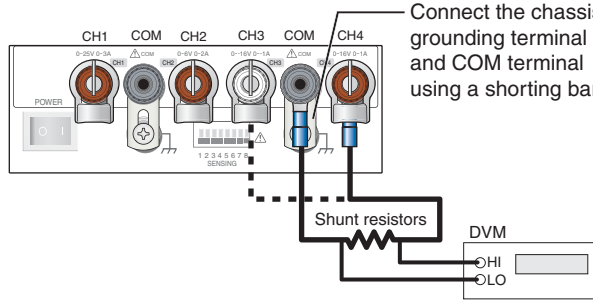


Fig. 6-6 PMP16-1QU current adjustment connection example 2
(Connection to CH3 or CH4 output terminal)

■ Warm-up

3. While holding down the SET switch, turn on the POWER switch.

   Hold the SET switch until the panel display of the CAL mode is displayed. The panel display switches to voltage CAL mode.

See Fig. 6-4

4. Check that the OUTPUT LED on the display is not lit.

   If it is lit, depress the OUTPUT switch to turn the output off.

5. Warm up the equipment including the shunt resistor and DVM for sufficient time.

■ Output current offset and full scale

6. Depress the CURRENT switch to start of offset adjustment.

   The panel display switches to current CAL mode, and the voltmeter displays "CAL." Offset adjustment starts.

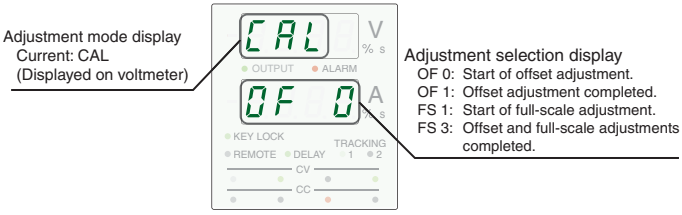


Fig. 6-7 Panel display in current calibration mode

7. Depress the channel selection switch for the channel to be adjusted (CH1, CH2, CH3 or CH4).

   The corresponding channel selection switch lights.

8. Depress the OUTPUT switch to turn the output on.

   The PMP outputs approximately 10 % of the rated output current.

9. Turn the rotary knob so that the DVM reading is equal to 10 % of the rated output current.

   Turning the rotary knob while holding down the SHIFT switch increases the resolution.

10. Depress the OUTPUT switch to turn the output off.

    The ammeter display shows “OF 1”, and to the offset adjustment completed.

11. Depress the CURRENT switch to start of full-scale adjustment.

    The ammeter display shows “FS 1”

12. Depress the OUTPUT switch to turn the output on.

    The PMP outputs approximately 100 % of the rated output current.

13. Turn the rotary knob so that the direct ammeter reading is equal to 100 % of the rated output current.

    Turning the rotary knob while holding down the SHIFT switch increases the resolution.

14. Depress the OUTPUT switch to turn the output off.

    The ammeter display shows “OF 3” and the SET switch flashes.

15. Depress the SET switch to store the adjustment values in memory.

    The ammeter display shows “FS 0”

To exit from the output current adjustments, turn off the POWER switch.

If a different output is adjusted or the POWER switch is turned off before depressing the SET switch, the last performed adjustments are not stored. Be sure to depress the SET switch to complete the adjustments.

6.2 Troubleshooting

This section introduces troubleshooting measures. Typcal symptoms are listed. Check whether any of the items below apply to your case. In some cases, the problem can be solved quite easily.

See Page 4-4

When a check item that meets the current status of the product, follow the remedy given for that item. If none of the items apply to your case, we recommend that you initialize the PMP to factory default settings (but note that this clears the memory contents). If the remendy does not correct the problem, contact your Kikusui agent or distributor.

■ Symptom 1: The display shows nothing.

Check item	Cause and Remedy	See
Is the rated output voltage supplied to the AC power input?	• Check the connection of the AC input.	2-6
Are the power cord is broken?	• Check that the power cord is not damaged. If it is damaged, replace it with a new one.	2-6

■ Symptom 2: The ALARM LED lights when the OUTPUT switch is turned on.

Check item	Cause and Remedy	See
Has the internal temperature risen abnormally high?	• The ambient temperature is higher than the specified operating temperature, the air inlet or outlet is stopped or the fan may be failed. If an alarm occurs without any problem in the operating environment, immediately stop using the PMP and request for repairs.	4-13
Are remote sensing wires connected properly?	• Check that the remote sensing wires are connected properly. Also check if they are disconnected.	4-39
	• Check if the load wires are disconnected.	

■ Symptom 3: No output even when the OUTPUT switch is turned on.

Check item	Cause and Remedy	See
Is the voltage or current setting set to the minimum level?	• Check that the required output levels are set.	4-5

■ Symptom 4: The output is unstable.

Check item	Cause and Remedy	See
Is the remote sensing function being used?	• When not using the remote sensing function, disconnect the remote sensing wires and switch off the remote sensing function in the CONFIG setting.	4-34 4-39
Has a period of more than 30 minutes elapsed after turning power on?	• The output is unstable due to drift in the initial period. The product should be warmed up (with power on) for at least 30 minutes.	7-2
Is the ammeter displays a higher value than tolerance while no load is connected?	• The internal circuitry may be failed. Immediately stop using the PMP and request for repairs.	–
Does the output continue even after the OUPUT switch is turned off?	• The internal circuitry may be failed. Immediately stop using the PMP and request for repairs.	–

■ Symptom 5: The output ripple is high.

Check item	Cause and Remedy	See
Is the input voltage within the rated range?	• Apply a supply voltage of no more than the rated voltage.	–
Are the output and chassis terminals floating?	• There is induction of the AC line frequency (50/60 Hz). If possible, ground the output terminal using a capacitor of 0.1 mF or higher capacitance.	3-6
Is there a source of strong magnetic or electrical field in the proximity?	• The product is subjected to electromagnetic induction. Take proper measures such as installing the product away from the source or twisting the wires, etc.	–

■ Symptom 6: The actual output value does not follow the setting or the displayed value does not follow the actual output value.

Check item	Cause and Remedy	See
Is the remote sensing function being used?	• When not using the remote sensing function, disconnect the remote sensing wires and switch off the remote sensing function in the CONFIG setting.	4-34 4-39
	• A sensing or load wire may be in a contact failure or disconnected. Turn off the POWER switch and check the wires.	
Does the load current includes a peak or is it pulsed?	• Increase the constant current setting or the current capacity.	3-2
Is the key lock function on with the SET key pressed?	• You activated the key lock while you were viewing or setting the voltage or current. Press the SET switch, exit from the voltage or current viewing or setting state, and set the key lock.	4-31

■ Symptom 7: Cannot recall settings even when I press a memory switch.

Check item	Cause and Remedy	See
Is the output being delayed?	• You cannot recall settings during the delay. Disable the delay function.	4-29

Specifications

This chapter gives description on the electrical and mechanical specifications of the PMP and its interface board of options.

7.1 Specifications

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.
- Warm up the PMP for 30 minutes (with power on).
- For the environmental conditions after the warm-up, the temperature should be 23 °C ± 5 °C and the humidity be between 10 %rh and 80 %rh.
- TYP value: Typical values do not guarantee the performance.
- rtg: Indicates the rated output.
- rdng: Indicates the reading.
- set: Indicates the settng.
- Rated load and no load are defined as follow:

  During constant voltage operation (when the output current is set to the maximum available current)

Rated load:	A load having resistance with which the current flowing when the rated output voltage is applied is 95% to 100% of the rated output current.
No load:	Refers to a load at which no output current flows or an open load (no load is connected).

  During constant current operation (when the output voltage is set to the maximum available voltage)

Rated load:	A load having a resistance with which the voltage drop when the rated output current flows is 95 % to 100 % of the rated output voltage. The output voltage from the PMP should not exceed the rated output voltage even when the voltage of the load wire drops.
No load:	A load having a resistance with which the voltage drop when the rated output current flows is the higher value of either 10% of the rated output voltage or 1 V.

Electrical Specifications

Model			PMP16-1QU	PMP18-3TR	PMP25-2TR
Output					
Output channels			4	3	
Voltages	CH1	Rated outpput voltage	25.0 V	6.0 V	6.0 V
		Settable output voltage *1	0 V to 25.75 V	0 V to 6.180 V	0 V to 6.180 V
		Minimum setting resolution	10 mV	1 mV	1 mV
		Setting accuracy *2*3	± (0.15 % of set + 20 mV)	± (0.2 % of set + 5 mV)	± (0.2 % of set + 5 mV)
	CH2	Rated outpput voltage	6.0 V	18.0 V	25.0 V
		Settable output voltage *1	0 V to 6.180 V	0 V to 18.54 V	0 V to 25.75 V
		Minimum setting reso-lution	1 mV	10 mV	10 mV
		Setting accuracy *2*3	± (0.2 % of set + 5 mV)	± (0.15 % of set + 20 mV)	± (0.15 % of set + 20 mV)
	CH3	Rated outpput voltage	–16.0 V	18.0 V	25.0 V
		Settable output voltage *1	–16.48 V to 0 V	0 V to 18.54 V	0 V to 25.75 V
		Minimum setting resolution	10 mV	10 mV	10 mV
		Setting accuracy *2*3	± (0.15 % of set + 20 mV)	± (0.15 % of set + 20 mV)	± (0.15 % of set + 20 mV)
	CH4	Rated outpput voltage	16.0 V	—	—
		Settable output voltage *1	0 V to 16.48 V	—	—
		Minimum setting resolution	10 mV	—	—
		Setting accuracy *2*3	± (0.15 % of set + 20 mV)	—	—

*1. Settable output voltage does not guarantee the supply of power above the rated output values to the load.
*2. Difference of the output value with respect to the set value.
*3. Measured by connecting the sensing and output terminals.

Electrical Specifications (Continued)

Model			PMP16-1QU	PMP18-3TR	PMP25-2TR
Output					
Currentes	CH1	Rated outpput current	3.0 A	5.0 A	5.0 A
		Settable outpput current *1	0 A to 3.090 A	0 A to 5.150 A	0 A to 5.150 A
		Minimum setting resolution	1 mA	1 mA	1 mA
		Setting accuracy *2	± (0.3 % of set + 5 mA)	± (0.4 % of set + 5 mA)	± (0.4 % of set + 5 mA)
	CH2	Rated outpput current	2.0 A	3.0 A	2.0 A
		Settable outpput current *1	0 A to 2.060 A	0 A to 3.090 A	0 A to 2.060 A
		Minimum setting resolution	1 mA	1 mA	1 mA
		Setting accuracy *2	± (0.3 % of set + 5 mA)	± (0.3 % of set + 5 mA)	± (0.3 % of set + 5 mA)
	CH3	Rated outpput current	–1.0 A	3.0 A	2.0 A
		Settable outpput current *1	–1.030 A to 0 A	0 A to 3.090 A	0 A to 2.060 A
		Minimum setting resolution	1 mA	1 mA	1 mA
		Setting accuracy	± (0.3 % of set + 5 mA)	± (0.3 % of set + 5 mA)	± (0.3 % of set + 5 mA)
	CH4	Rated outpput current	1.0 A	—	—
		Settable outpput current *1	0 A to 1.030 A	—	—
		Minimum setting resolution	1 mA	—	—
		Setting accuracy *2	± (0.3 % of set + 5 mA)	—	—
Common		Common	CH1 and CH2 common CH3 and CH4 common	CH1 independent CH2 and CH3 common	
		Withstand voltage across COMMON	30 VDC		
Ground		Polarity	Positive, COM and negative grounding possible		
		Isolation voltage	DC ± 250 V		
Rated output power			119 W	138 W	130 W

Model		PMP16-1QU	PMP18-3TR	PMP25-2TR
Constant voltage characteristics				
Source effect *3 (With respect to ±10% line voltage fluctuation)	CH1	± 2 mV	± 2 mV	± 2 mV
	CH2	± 2 mV	± 1 mV	± 2 mV
	CH3	± 1 mV	± 1 mV	± 2 mV
	CH4	± 1 mV	—	—
Load effect *3 (with respect to 0% to 100% output current variation)	CH1	± 5 mV	± 5 mV	± 5 mV
	CH2	± 3 mV	± 3 mV	± 3 mV
	CH3	± 3 mV	± 3 mV	± 3 mV
	CH4	± 3 mV	—	—
Inter-channel variation *3 (when the loads of all output CHs other than the measured CH are changed from rated loads to no load)	CH1	± 5 mV	± 5 mV	± 5 mV
	CH2	± 3 mV	± 3 mV	± 3 mV
	CH3	± 3 mV	± 3 mV	± 3 mV
	CH4	± 3 mV	—	—
Ripple noise (5 Hz to 1 MHz)	CH1	0.5 mVrms	0.5 mVrms	0.5 mVrms
	CH2	0.5 mVrms	0.5 mVrms	0.5 mVrms
	CH3	0.5 mVrms	0.5 mVrms	0.5 mVrms
	CH4	0.5 mVrms	—	—
Transient response (TYP) *4	CH1	50 µs	50 µs	50 µs
	CH2	50 µs	50 µs	50 µs
	CH3	50 µs	50 µs	50 µs
	CH4	50 µs	—	—

*1. Settable output voltage does not guarantee the supply of power above the rated output values to the load.
*2. Difference of the output value with respect to the set value.
*3. Measured by connecting the sensing and output terminals.
*4. Time until the output voltage returns to ± (0.05 % of rdng + 10 mV).when the output current is varied from 10 % to 100 % of the rated output current.

Electrical Specifications (Continued)

Model		PMP16-1QU	PMP18-3TR	PMP25-2TR
Constant voltage characteristics				
Full-load rise time (TYP) *1	CH1	100 ms	100 ms	100 ms
	CH2	100 ms	100 ms	100 ms
	CH3	100 ms	100 ms	100 ms
	CH4	100 ms	—	—
No-load fall time (TYP) *2	CH1	400 ms	300 ms	300 ms
	CH2	300 ms	300 ms	400 ms
	CH3	300 ms	300 ms	400 ms
	CH4	300 ms	—	—
Temperature coefficient (TYP)		All outputs: 100 ppm/°C		
Constant current characteristics				
Source effect (With respect to ±10% line voltage fluctuation)	CH1	± 4 mA	± 4 mA	± 4 mA
	CH2	± 3 mA	± 3 mA	± 2 mA
	CH3	± 2 mA	± 3 mA	± 2 mA
	CH4	± 2 mA	—	—
Load effect (with respect to variation from short-circuit to 100% output voltage)	CH1	± 10 mA	± 10 mA	± 10 mA
	CH2	± 10 mA	± 5 mA	± 5 mA
	CH3	± 5 mA	± 5 mA	± 5 mA
	CH4	± 5 mA	—	—
Ripple noise (5 Hz to 1 MHz)	CH1	3 mArms	4 mArms	4 mArms
	CH2	3 mArms	3 mArms	3 mArms
	CH3	2 mArms	3 mArms	3 mArms
	CH4	2 mArms	—	—
Temperature coefficient (TYP)	CH1	300 ppm/°C	300 ppm/°C	300 ppm/°C
	CH2	300 ppm/°C	300 ppm/°C	200 ppm/°C
	CH3	200 ppm/°C	300 ppm/°C	200 ppm/°C
	CH4	200 ppm/°C	—	—

Model		PMP16-1QU	PMP18-3TR	PMP25-2TR
Voltmeter				
Display		4-digit LED display (Green)		
Output rating 10 V or more	Accuracy *3*3 *4	± (0.2 % of rdng + 20 mV) Under temperatures from 0 °C to 40 °C ± (0.5 % of rdng + 80 mV)		
	Resolution	10 mV		
Output rating 10 V or less	Accuracy *3 *4	± (0.3 % of rdng + 5 mV) Under temperatures from 0 °C to 40 °C ± (0.5 % of rdng + 60 mV)		
	Resolution	1 mV		
Ammeter				
Display		4-digit LED display (Green)		
Output rating 3 A or more	Accuracy *3 *4	± (0.5 % of rdng + 10 mA) Under temperatures from 0 °C to 40 °C ± (0.8 % of rdng + 50 mA)		
	Resolution	1mA		
Output rating 3 A or less	Accuracy *3 *4	± (0.5 % of rdng + 5 mA) Under temperatures from 0 °C to 40 °C ± (0.8 % of rdng + 30 mA)		
	Resolution	1 mA		
Operation Display				
CV Operation		The CV LED lights for each channel (Green)		
CC Operation		The CC LED lights for each channel (Red)		
Output on/off		Output on :Lighting OUTPUT LED (Green) Output off :Light off OUTPUT LED		

*1. Time until the output voltage rises from 10 % to 90 % of the rated output voltage after OUTPUT is turned on.
*2. Time until the output voltage falls from 90 % to 10 % of the rated output voltage after OUTPUT is turned off.
*3. Measured by connecting the sensing and output terminals.
*4. Difference of the dispayed vallue with respect to the acrual output value.

Functional Specifications

Model		PMP16-1QU	PMP18-3TR	PMP25-2TR
Protection function				
Overheat protection (OHP)	Detection	Detection of the internal heat sink temperature.		
	Operation	All-CH OUTPUT off.		
	Display	Blinking ALARM LED. “OHP” displayed on the ammeter display.		
Over-voltage protection (OVP)	Operating voltage	Activated at 110 % to 130 % of the rated voltage of each CH.		
	Operation	All output off		
	Display	Blinking ALARM LED. Channel displayed on the voltmeter display, “OVP” displayed on the ammeter display.		
Input fuses	100 VAC to 120 VAC Input	7 A fuse mounted inside the chassis.		
	220 VAC to 230 VAC Input	4 A fuse mounted inside the chassis.		
Sensing function	Operating channels	Any CH		
	Selection	Select the CH in the CONFIG setting. Use remote sensing terminals.		
	Compensating voltage *1	± 0.3 V		
Tracking function	Operating channels	Any CH		
	ON/OFF	Settable from the front panel or by using a CONFIG setting		
	Display	TRACKING LED on the front panel lights up when the output is turned on.		
	Operation modes	Absolute value variation (TRACK1)		
		Ratio variation (TRACK2)		
	Operation area *2	In absolute value variation: Variation range of the reference CH.		
		In ratio variation: 0 % to 200 %.		
	Error voltage (Theoretical)	± (0.4 % of rtg + 40 mV)		
	Error current (Theoretical)	± (0.7 % of rtg + 10 mA)		

*1. The voltage setting accuracy cannot be guaranteed when the difference between the remote sensing terminal voltage (voltage on the load end) and the output terminal voltage exceeds the compensating voltage.
A small amount of current (max. 10 mA) flows through the sensing wires during the remote sensing operation. To prevent an error that may occur due to the resistance component of the sensing wires, use wires with as low resistance as possible. If the difference between the remote sensing terminal (voltage on the load end) and the output voltage exceeds 0.6 V, the internal circuitry may be damaged.

*2. The variation of the TRACK 1 function is possible within the range of the voltage (or current) output values of the reference channel.
The variation of the TRACK 2 function follows the ratio of the output of the reference channel with respect to the output value at the start of tracking.
The variation stops when the reference output value or interlocked output value exceeds the available value range.

Functional Specifications (Continued)

Model		PMP16-1QU	PMP18-3TR	PMP25-2TR
Delay function	Operation channels	Any CH		
	Settings	Setting of the time after output is turned on and the time after output is turned off.		
	On/Off	Switched using the front panel switch.		
	Display	DELAY LED on the front panel lights when delay function is on. During the delay time until the output on or off, the OUTPUT LED blinks.		
	Setting range	0.1 s to 99.9 s		
	Setting resolution	0.1 s		
	Setting accuracy *1 (Theoretical)	± 50 ms		
Memory function	Item	Output voltage, output current, delay time		
	Memory	3 memories*2		
	Selection	Selection using the 3 switches on the front panel.		
	Display	Selected memory is displayed on the voltmeter display and ammeter display.		
Factory-shipped setting (Initialized)		Can be selected using the front panel switch.		
Output state at power on status		Can be selected in the CONFIG setting.		
KEY LOCK function	Settings	Can be selected using the front panel switch.		
	Operation	Switches other than the OUPUT and channel select switches are defeated.		
External control function				
Output on/off	Input	Short-circuiting of the terminals turns the outputs on.		
	Operation	Simultaneous for all CHs.		
Alarm signal input	Input	Short-circuiting of terminals.		
	Display	Lighting ALARM LED. "EXT" EXt displayed on the voltmeter display "ALM" ALm displayed on the voltmeter display		
	Operation	All outputs off		
	Release	Released when the POWER switch is turned off.		
Memory recall	Input	Short-circuiting of terminals recalls a memory setting.		
	Contacts	COM, Memory 1, Memory 2, Memory 3		
	Function	Recalls memory 1, 2 or 3		

*1. Difference between the time after the reference output reaches 5% of the set value until the measures output value reaches 5% of the set value and the delay time. This difference is variable depending on the load conditions and ambient temperature.

*2. If an optional interface board is installed, 10 memory banks are available.

General Specifications

Model			PMP 16-1QU	PMP 18-3TR	PMP 25-2TR
Environment	Operating environment		Indoors, over-voltage category II		
	Operating temperatures/ humidity		0 °C to 40 °C (32°F to 104 °F), 10 %rh to 80 %rh (no condensation)		
	Storage temperatures/ humidity		–10 °C to 60 °C (14 °F to 140 °F), less than 90 %rh (no condensation)		
	Altitude		Less than 2000 m		
Safety*1			Complies with the requirements of the following standards: IEC 61010-1 Class I, Pollution Degree 2		
Insulation resistance		Primary ⇔ Chassis	More than 30 MΩ at a 500 VDC		
		Primary ⇔ Secondary			
		Secondary ⇔ Chassis			
Withstanding voltage		Primary ⇔ Chassis	No abnormality at 1500 VAC for 1 min.		
		Primary ⇔ Secondary			
Earth continuity		AC INLET GND ⇔ Chassis	25 AAC / 0.1 Ω or less		
Cooling method			Forced cooling using a fan motor (thermal sensor controlled)		
AC Input	Nominal input rating		100 VAC, 50 Hz/60 Hz		
		Factory option	120 VAC, 220 VAC or 230 VAC		
	Input voltage range		± 10 % of nominal input voltage		
Power consumption	Max. power consumption		450 VA		
	Rated load at 100 V AC (TYP)	Power consumption	370 VA	400 VA	380 VA
		Efficiency	0.71	0.74	0.72
		Power factor	50 %	49 %	51 %
Accessories	Output terminal shorting bars		× 2 (attached on the main body)		
	Operation manual		× 1		
	Power cord*2	100 VAC to 120 VAC Input	1 pc. With plug, Length: Approx. 2.5 m		
	Binding post cover		PMP18-3TR/PMP25-2TR: × 5 pc. (3 of these attached on the main body) PMP16-1QU: × 6 pc. (4 of these attached on the main body)		
Weight			9 kg (19.84 lbs)		
Dimensions			See “Dimension Diagram”.		

*1 Not applicable to modified products.

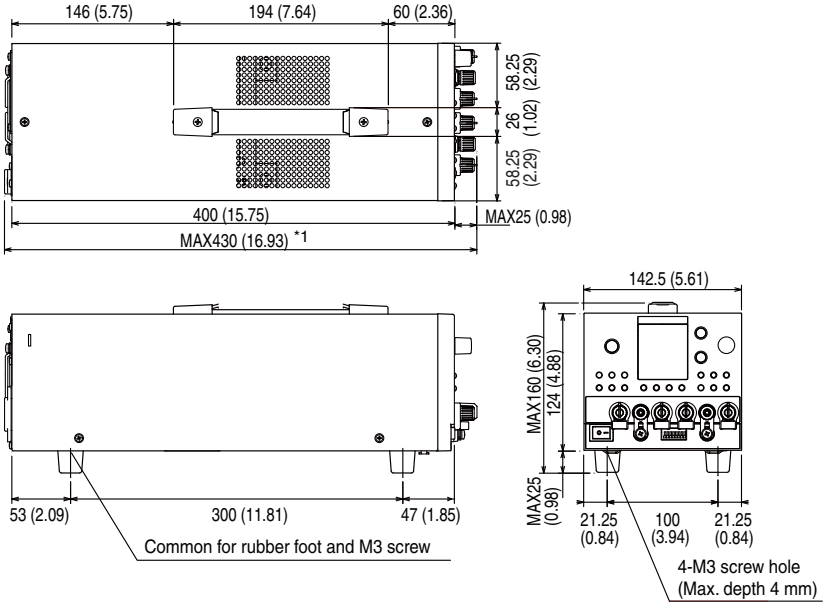
*2 The power cord provided as standard has a rated voltage of 125 VAC. A different power cord may be provided depending on the destination of the PMP.

Interface Specifications (Factory option)

Common specification	Software protocol	IEEE Std 488.2-1992
	Command language	Complies with the SCPI Specification 1999.0
	Functions expanded when an option is installed	Memory: 10 memories[*1]
RS232C	Hardware	Complies with EIA232D
		D-SUB 9-pin connector (male)[*2]
		Baud rate: 1200, 2400, 4800, 9600, 19200, and 38400 bps
		Date length: 8 bits. Stop bit: 1 bit. No parity.
		Flow control X-Flow or none.
	Program message terminator	LF during reception, CR/LF during transmission.
GPIB	Hardware	Complies with IEEE Std 488.1-1987
		SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, and E1.
	Program message terminator	LF or EOI during reception, LF+EOI during transmission.
	Primary address	1 to 30
USB	Hardware	Complies with USB 2.0. Data rate: 12 Mbps (full speed).
		Socket B type
	Program message terminator	LF or EOM during reception, LF+EOM during transmission.
	Device class	Complies with the USBTMC-USB488 device class specifications.

*1. Activated when the RS232C, GPIB, or USB is installed and during remote control.
Includes the three standard memories.
*2. Use a cross cable (null modem cablle).

7.2 Dimension Diagram



*1 MAX435 (17.13) (When an option is installed)

Unit: mm (inch)

Fig. 7-1 The PMP - Dimension diagram

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