Part No. Z1-003-672, IA003982
Apr. 2008

OPERATION MANUAL

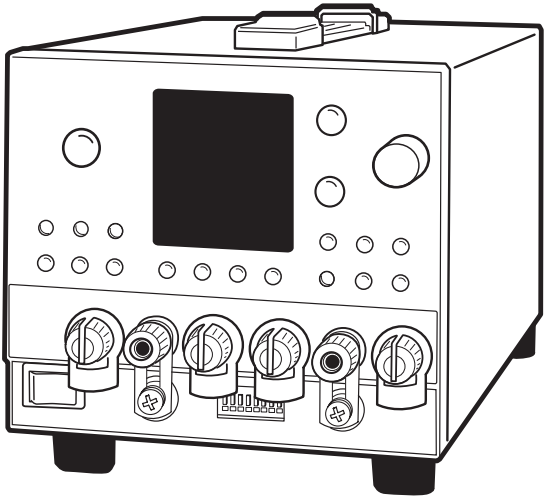
Multiple-output Regulated DC
Power Supply PMP Series

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.**

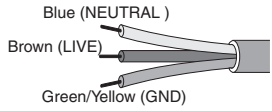
Power Requirements of this Product(Cont'd)

☐ Power cord

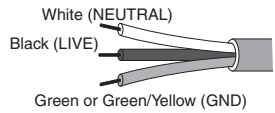
The product is provided with power cords described below. If the power cord has no plug, attach a plug or crimp-style terminals to the power cord in accordance with the wire colors specified in the drawing.

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

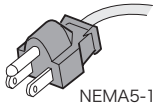
☐ Without a plug



☐ Without a plug

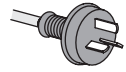


☐ Plug for USA



☐ 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.

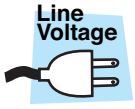
⚠ Safety Symbols

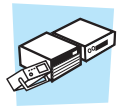
For the safe use and safe maintenance of this product, the following symbols are used throughout this manual and on the product. Note the meaning of each of the symbols to ensure safe use of the product. (Not all symbols may be used.)

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

⚠ Safety Precautions

The following safety precautions must be observed to avoid fire hazards, electric shock, accidents, and other failures. Keep them in mind and make sure to observe them.
Using the product in a manner that is not specified in this manual may impair the protection functions provided by the product.

Users 	• This product must be used only by qualified personnel who understand the contents of this operation manual. • If unqualified personnel is to use the product, be sure the product is handled under the supervision of qualified personnel (those who have electrical knowledge). This is to prevent the possibility of personal injury.
Purpose of use 	• Never use the product for purposes other than the product's intended use. • This product is not designed or manufactured for general home or consumer use.
Input power 	• Use the product within the rated input power voltage range. • For applying power, use the power cord provided. For details, see the respective page in the operation manual. • This product is designed as an equipment of IEC Overvoltage Category II (energy-consuming equipment supplied from the fixed installation).
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 	• Before using the product, be sure to check the input power voltage and that there is no abnormality in the appearance of the power cord. Be sure to remove the power plug from the outlet before checking it. • If a malfunction or abnormality is detected on the product, stop using it immediately, and remove the power plug from the outlet. Make sure the product is not used until it is completely repaired. • Use cables or wires with sufficiently large current capacity for output wires and load cables. • Do not disassemble or modify the product. If you need to modify the product, contact your Kikusui distributor/agent.
Maintenance and inspection 	• To prevent the possibility of electric shock, make sure to unplug the power plug before carrying out maintenance or inspection. • Do not remove the external cover during maintenance or inspection. • 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.

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.

Structure of this manual

This Operation Manual consists of the following chapters. The following outlines each chapter.

Chapter 1 General Description

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

Chapter 2 Installation and Preparation

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

Chapter 3 Before Using the PMP

This chapter describes matters that users are requested to thoroughly understand before using the PMP. Be sure to read this chapter.

Chapter 4 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.

Chapter 5 External Control

This chapter gives description on the external control and remote sensing functions.

Chapter 6 Maintenance

This chapter describes maintenance and inspection of the PMP.

Chapter 7 Specifications

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

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 depressing the named switch (shown in blue) while the SHIFT switch is held down.

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Preparation

Usage scenarios	Manual sections	See page
Confirming accessories	“2.1 Checking the Package Contents”	2-2
Rated input values - quantities	“2.5 Connecting the Power Cord” “ Electrical Specifications”	2-6 7-3
Space requirements around rear vent	“2.2 Precautions Concerning Installation Location”	2-3
What may be used with power supply connected to load	“4.4 Connecting the Load”	4-10
Precautions for connecting to remote sensing lines	“5-3 Remote Sensing Connection Checklist”	5-12
Necessary preparations for rack mounting	“1.4 Option” “ Dimension Diagram”	1-4 7-12

Use

Usage scenarios	Manual sections	See page
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Suspending panel operations	“4.9 Locking the Panel Operation (KEY LOCK)”	4-29
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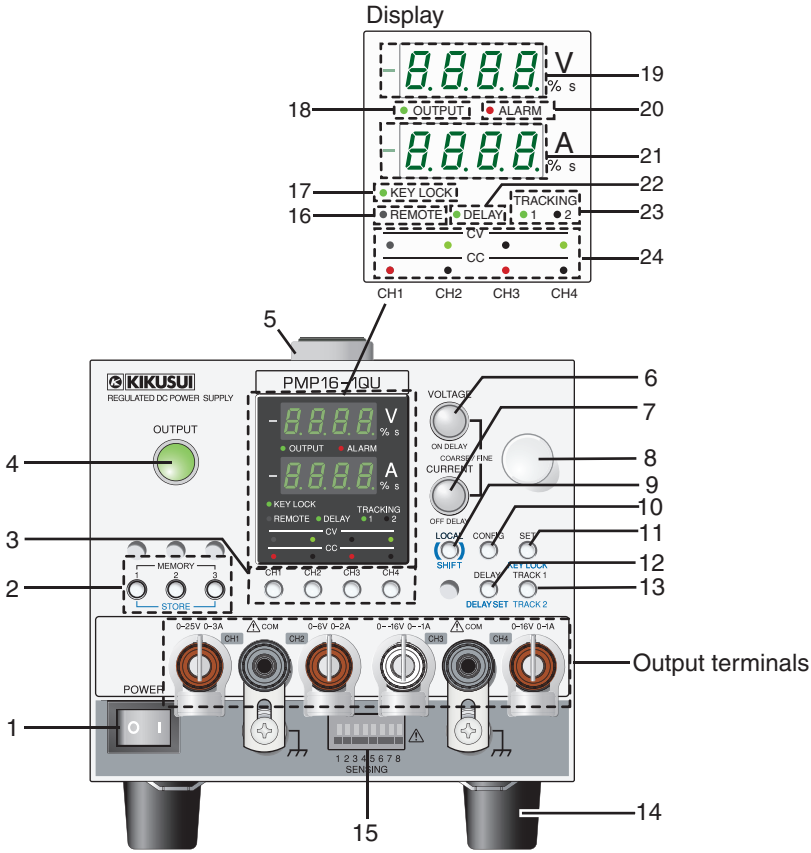
Diagnostics	“6.4 Troubleshooting”	6-11

Front panel



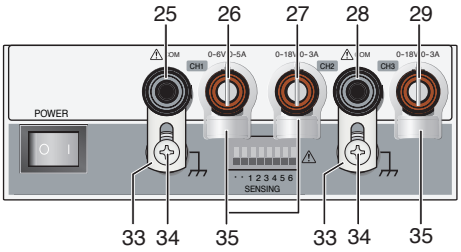
* Figure refers to 4-output model PMP16-1QU

No.	Name	+SHIFT	Description	See page
1	POWER switch		POWER switch Depress side (I) for on / (O) for off	4-2
2	MEMORY switch		Memory recall	4-26
		STORE	Memory save	4-25
3	Output display selection switch		Output display select (CH1, CH2, CH3 or CH4)	4-22 4-29
4	OUTPUT switch		Output on/off switch	4-6
5	Handle		Carrying handle	–
6	VOLTAGE switch		Voltage value setup, value digit change	4-5
		ON DELAY	On setup delay time initialization, value digit change	4-23
7	CURRENT switch		Current value setup, value digit change	4-5
		OFF DELAY	Start delay time setup, value digit change	4-23
8	Rotary knob		Setup value(s) change	–
9	LOCAL switch		Switching for local operations at interface options	–
		SHIFT	SHIFT switch (set function shown in blue)	–
10	CONFIG switch		Config(uration) setup.	4-30
11	SET switch		Set and confirm output voltage or output current values	4-4
		KEYLOCK	Panel operations lock/lock release	4-29
12	DELAY switch		Delay function on/off	4-23
		DELAY SET	Delay function setup mode switchover	4-23
13	TRACK1 switch		Tracking function 1 on/off	4-16
		TRACK2	Tracking function 2 on/off	4-16
14	Rubber feet		4 underside points	–
15	Sensing terminal		Remote sensing terminal	5-9
16	Remote		Illuminates in remote control operation	–
17	Key lock		Illuminates when the key lock function is activated	4-29
18	Output		Illuminates when the output is turned on	–
19	Voltmeter		Displays for voltage value, tracking function 2 voltage variation, ONDELAY setup time or config settings	4-6 4-16 4-23 4-29

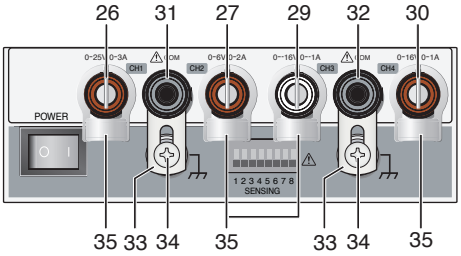
No.	Name	+SHIFT	Description	See page
20	Alarm		Illuminates when the protection circuit is activated	3-9
21	Ammeter		Displays for current value, tracking function 2 current variation, OFF DELAY setup time or config setting details	4-7 4-16 4-23 4-29
22	Delay		Illuminates when the delay function is activated	4-23
23	TRACKING1/ TRACKING2		Illuminates when either tracking function is activated	4-16
24	Constant voltage/ constant current display unit		Illuminates during the constant voltage or constant current operation	–

Output terminals

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

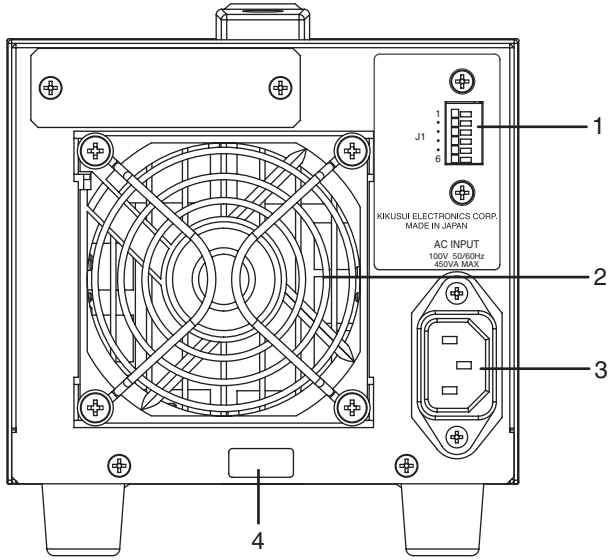


4-output model (PMP16-1QU)

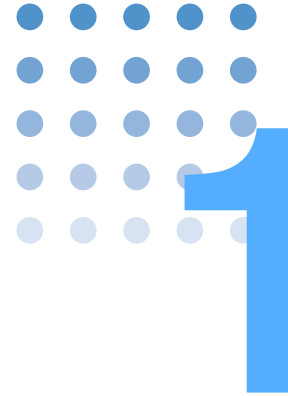


No.	Name	Description	See page
25	CH1 COM	Channel 1 common terminal	4-12
26	OUTPUT CH1	Voltage current output terminal	3-11
27	OUTPUT CH2	Voltage current output terminal	3-11
28	CH2/CH3 COM	CH2 and CH3 common terminal	4-12
29	OUTPUT CH3	Voltage current output terminal	3-11
30	OUTPUT CH4	Voltage current output terminal	3-11
31	CH1/CH2 COM	CH1 and CH2 common terminal	4-12
32	CH3/CH4 COM	CH3 and CH4 common terminal	4-12
33	Short bar	Bar connecting COM terminal to chassis terminal	4-12
34	Protective conductor terminal	Protective conductor connection terminal [lightning arrestor]	–
35	Binding post cover	Terminal insulation cover	–

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	–



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	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	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 1.0x

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 ratio, or with the same width (absolute value)
- Delay function
  Possible to change the timing of output rise/decay at OUTPUT on/off time.
- Memory function
  Possible to store setup contents for each output in 3 different ways and recall them when necessary.
- 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 has an option for rack mounting, described below.

Rack mount frame

Product	Model	Notes
Rack mount adapter	KRA3 [9929-0-H01]	Inch rack EIA standard
	KRA150 [9930-0-H01]	Milli rack JIS standard
Rack mount bracket	KBP3-3	Blank panel
	BP191 (-M)	Inch rack EIA standard
	BP1H (-M)	Milli rack JIS standard

WARNING

- **In order to maintain strong cooling air intake, at least one layer (*1) of "blank panel" must be installed when the product of the PMP is rack-mounted.**

  *1 JIS standard: 50 mm, EIA standard: 44.45 mm

Inquire with Kikusui distributor/agent concerning the details.

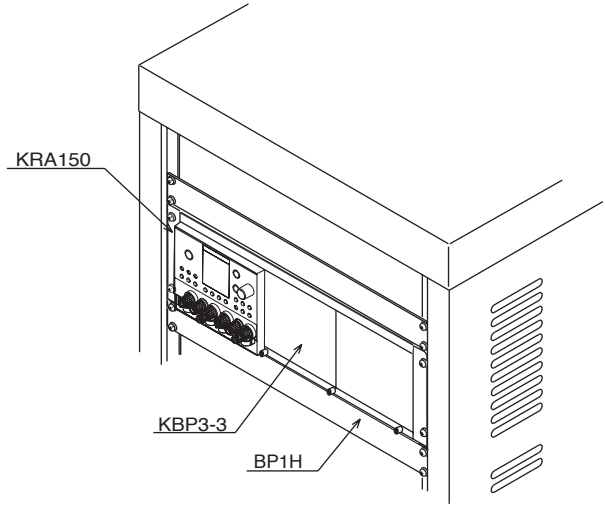
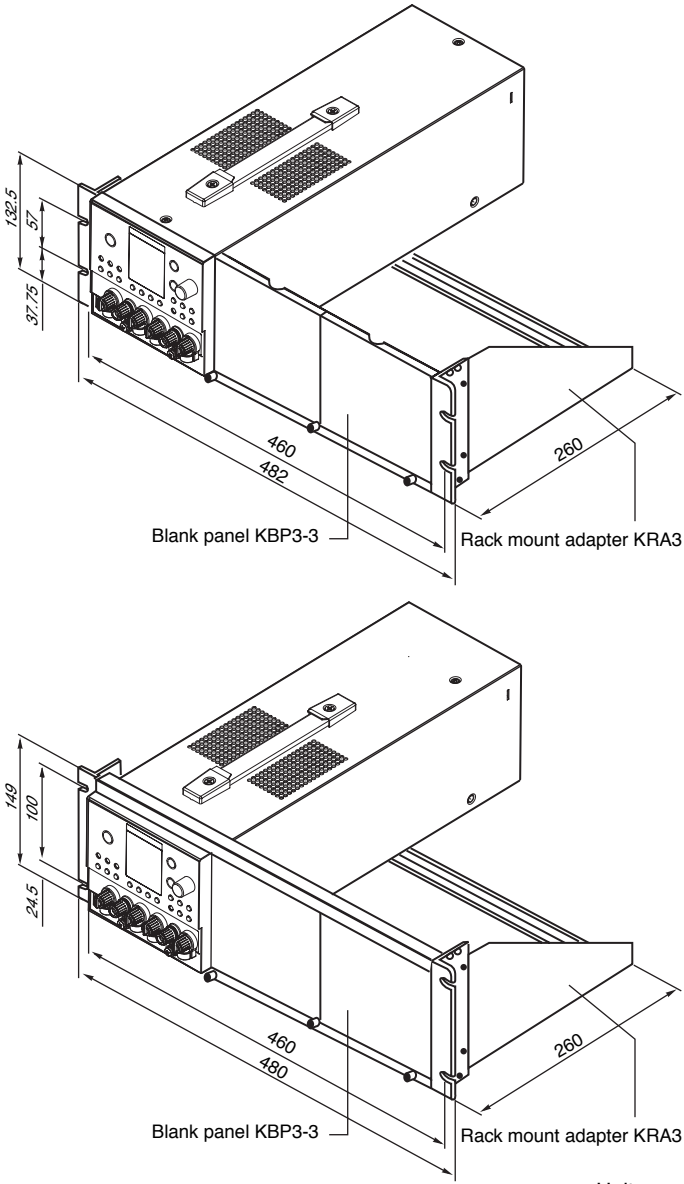


Fig. 1-1 Rack-mounting example



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.

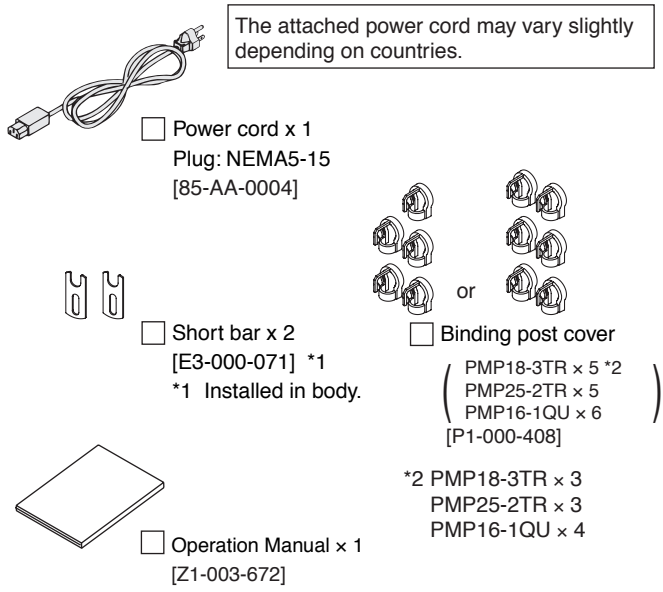


Fig. 2-1 Accessories

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
  Storage temperature range: –10 ºC to +60 ºC

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

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

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

- **Be sure to use it indoors.**
  The 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 •C 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.

- **Make sure that there is sufficient space in the immediate area around the POWER switch.**
  Install in a location that won't obstruct POWER switch operations, and do not put anything near the switch that might impede the use of it.

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 1-4

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

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

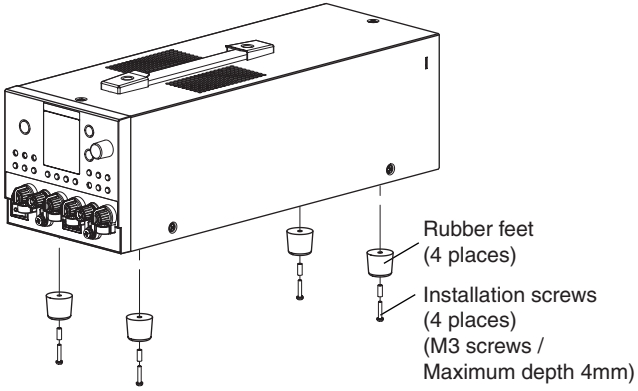


Fig. 2-2 Removing rubber feet

Removing rubber feet

While pulling downward on the rubber feet (4 places), turn the installation screws, and pull the rubber feet out.

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).

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.

100 Vsystem power cord
[85-AA-0004]
Rated voltages : 125 VAC
Rated current : 10 A

Fig. 2-3 Attached 3-prong plug power cord

See Page 2-7

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 the POWER switch.
3. Connect the power cord to the AC inlet on the rear panel.
4. Insert the power plug to an outlet.

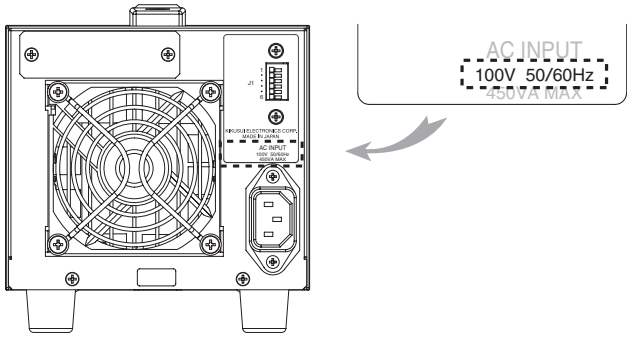


Fig. 2-4 Confirmation of nominal input rating

2.6 Ground (Earth)

⚠WARNING

- **The PMP is an IEC Safety Class I equipment (equipment with a protective conductor terminal). Be sure to ground the product to prevent electric shock.**
- **Connect the ground terminal to earth ground.**

⚠CAUTION

- **If you do not ground the product, malfunction may occur due to external noise, or the noise generated by the product may become large.**

Connect the power cord to a three-prong power outlet with proper grounding.

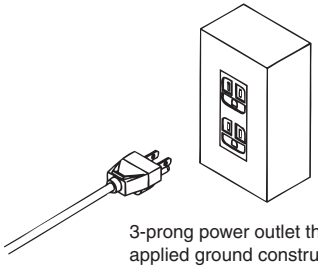


Fig. 2-5 Grounding the unit

Before Using the PMP

This chapter describes matters that users are requested to thoroughly understand before using the PMP. Be sure to read this chapter.

3.1 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.

3.2 Reverse Polarity

In the following case, a 0 V-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.

- When the current or voltage is set up as zero with the OUTPUT switched off.

3.3 Load

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

- When the load current has peaks or is pulse-shaped
- When the load generates a reverse current to the power supply
- When the load has accumulated energy such as batteries

3.3.1 When the Load Current Has Peaks or is Pulse-shaped

The current meter on 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. In such cases, 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.

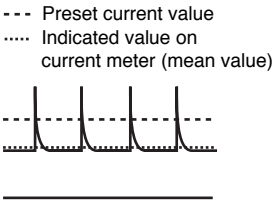


Fig. 3-1 Load current with peaks

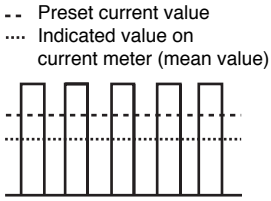


Fig. 3-2 Pulse-shaped load current

3.3.2 When the Load Generates a 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 R_D as shown in Fig. 3-3 to bypass the reverse current. However, the amount of current to the load decreases by Irp.

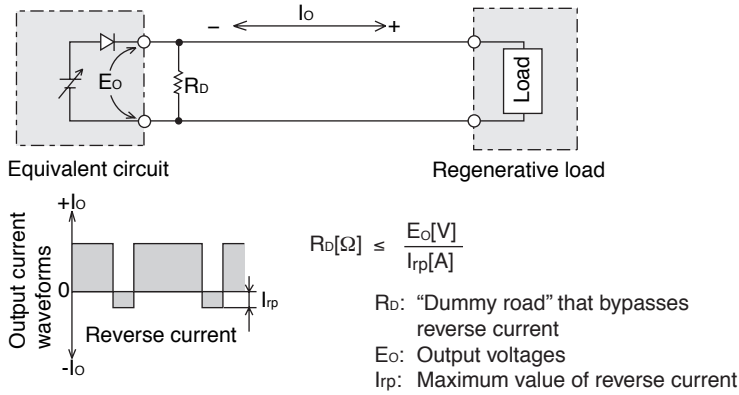


Fig. 3-3 Remedy for regenerative load

⚠CAUTION

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

3.3.3 When the Load Has Accumulated Energy Such As Batteries

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

For any such load, connect a reverse current protection diode DRP in series between the PMP and the load, as shown in Fig. 3-4.

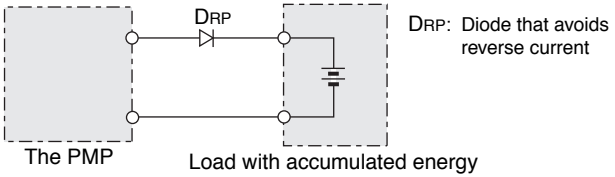


Fig. 3-4 Remedy against load with accumulated energy

⚠CAUTION

- To protect the load and the 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.

3.4 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 setup value (Vs)
- Output current setup value (Is)
- Load resistance value (RL)

These operations are detailed in the following.

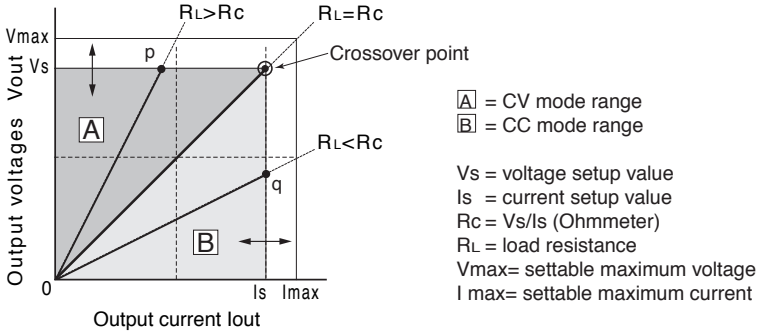


Fig. 3-5 Constant voltage operation and constant current operation

Fig. 3-5 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 setup 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 setup voltage are equalized, or which the output current and the setup current are equalized. If load resistance RL is greater than load resistance Rc, the power supply operates in CV mode

because the operating point is within the A range. At this time, the current setup value Is becomes the current limit value.

When operating in CV mode, the output voltage is maintained at the voltage setup value. The output current is determined by the relation I=Vs/RL, and is reduced to a value below the current limit value Is. Note that the current of the setup 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 Rc is greater than load resistance RL, the power supply operates in CC mode because the operating point is within the B range. At this time, the voltage setup 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=Is × RL, and is reduced to a value below the current limit value Vs. Note that the voltage of the setup 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 R_C= 30V/5 A = 6 Ω and 5 Ω < 6 Ω (R_L< R_C). When the current rises while still in CC mode, it is possible that the current value will rise to a level higher than I_S=V_S/R_L up to I_S=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.

3.5 Protection Function

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.

3.5.1 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.

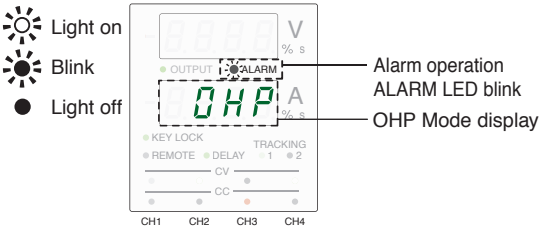


Fig. 3-6 OHP Mode display

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.

Even with power restored, 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.

3.5.2 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.

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 ammeter displays “OVP”.

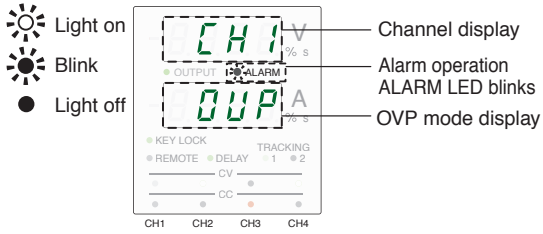


Fig. 3-7 OVP alarm display (example of activation of over-voltage protection in CH1)

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

Table 3-1 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 V	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.

To cancel, turn off the POWER switch once, and after removing the source of the problem, turn on the POWER switch again.

If, after restoring power, over-voltage protection (OVP) is activated again, it is possible that there is an internal malfunction. Inquire at your Kikusui distributor/agent.

3.6 OUTPUT CH Number

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

Table 3-2 Relation between output and OUTPUT CH 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

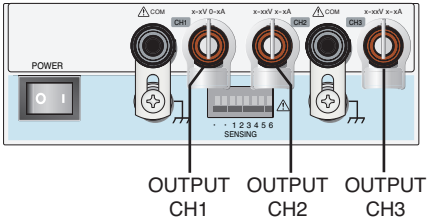


Fig. 3-8 PMP18-3TR/PMP25-2TR output terminals

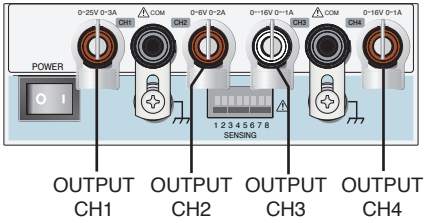


Fig. 3-9 PMP16-1QU output terminals

4 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.

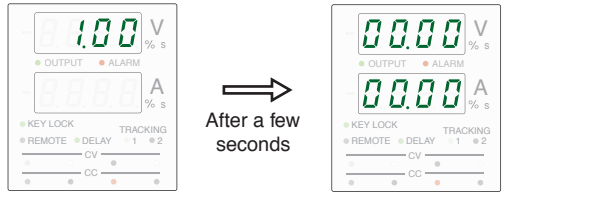
4.1 Turning On the Power

POWER Switch-on

1. Turn off the POWER switch on the (O) side.
2. Check that the power cord is correctly connected.
3. Turn on the POWER switch on the (I) side.

   Depress the POWER switch on the (I) 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.
4. Check 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.

POWER Switch-off

Depressing the POWER switch (O) side turns the PMP off.

The PMP saves the items below just before the POWER switch is turned off. These items are set to the values and states that are set when the POWER switch is turned on.

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

⚠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.
- 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.

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 depressed, the factory-shipped settings are restored.

Table 4-1 Factory-shipped settings

Item		Factory-shipped settings
Output voltage setting values		Each set to 0 V
Output current setting values		Each output set to the maximum possible current
SET switch		Turned off
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
CONFIG	POWER ON OUTPUT	OFF
	TRACKING setting	0 (OFF)
	Remote sensing setting	0 (OFF)
	Voltage limits	HOLD (The digits lower than the setting digit are fixed.)
	Current limits	HOLD (The digits lower than the setting digit are fixed.)
	Voltage fine setting	OFF (Fine unavailable)
	Current fine setting	OFF (Fine unavailable)

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

About voltage/current setting digit

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

Output settings can be performed when the SET switch is lit. To set the output voltage, depress the VOLTAGE switch, and to set the output current, depress the CURRENT switch. With each depress, the highlighted digit in the voltmeter or ammeter display is changed. The highlighted digit can also be set with the rotary knob.

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

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

   When this 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.

4. Check that the SET switch is lit.

   When not lit, depressing the SET switch lights it. When the SET switch is not lit, the actual output value is displayed on the panel.

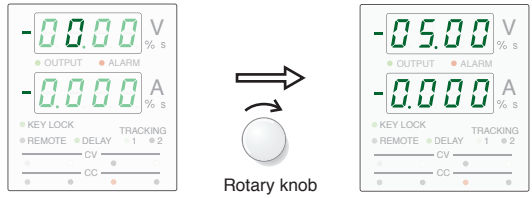
NOTE

- When the OUTPUT switch is turned on, the SET switch being lit means that the setting value is displayed and the outputs will differ.
- Hereafter, the digits are numbered from the side of the most significant digit (leftmost).

5. Select CH3 of the output display selection switches.

6. Depress the VOLTAGE switch and select digit 2 in the voltmeter.

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



Select digit 2 of the voltmeter

Set digit 2 to “5”

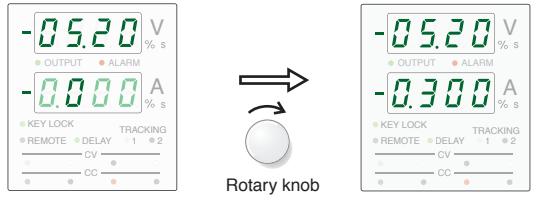
8. Depress the VOLTAGE switch one more time and select digit 3 of the voltmeter.

9. Turn the rotary knob right to set the value to “2”.

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

10. Depress the CURRENT switch and select digit 2 of the voltmeter.

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



Select digit 2 of the voltmeter

Set digit 2 to “5”

12. Depress the CURRENT switch one more time and select digit 3 of the voltmeter.

13. 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 configuration 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.
  While the least significant digit is selected and highlighted, depress the VOLTAGE switch or the CURRENT switch one more time. The figure of the least significant digit will blink to indicate that the digit below it is being set.
- When doing output setting, the most significant digit cannot be set.

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

See Page 3-6

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 output display 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, depressing the OUTPUT switch turns the OUTPUT off.

See Page 4-10

2. Connect the load to the output terminal.

3. Turn on the POWER switch.

4. Check that the SET switch is lit.

   When it is not lit, depressing the SET switch will set the voltage/current setting state.

5. Select the set output channel using the output display select switch.

   The selected output display selection switch lights up.

See Page 4-5

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

   Set the voltage value.

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

   Set the current value.

8. Repeat steps 5-7 for other channels.

9. Depress 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 output display 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 steps 5, 6 and 7.

The voltage value is changed by depressing the VOLTAGE switch, and the current value is changed by depressing the CURRENT switch.

4.4 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.
  It is possible by the CONFIG setting to automatically turn the output to on when the POWER switch is turned on. If the setting has been set, even if it previously turn the POWER switch off while the output is off, the output will be turned to on when PMP is restarted. The POWER switch and the output are turned on at a time and it can cause load failures.

4.4.1 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.

Table 4-2 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

When there is a long distance to the load, use as thick a line as possible, more than recommended.

Dependence of allowable cable current on the maximum allowable insulator temperature

The temperature of a cable is determined by the resistance loss due to the flowing current, ambient temperature and the thermal resistance with respect to the outside of the cable. The allowable current in Table 4-2 show the current capacities that can be flowed through a heat-resistant PVC wire (single wire) with a maximum allowable temperature of 60ºC when the wire is stretched horizontally under an ambient temperature of 30ºC. The current capacity should be lower when the heat resistant temperature of the PVC wire is lower, the ambient temperature is higher than 30ºC or the heat radiation is degraded due to the use of bundled wires.

Taking measures against noise

It is better to make heat radiation as great as possible to allow a larger current to flow, when wires having the same heat-resistant temperature are installed. For measures against noise in the load cables, however, installing the + (pos.) and – (neg.) output lines side by side or bundling them together is more effective against unwanted noise. The Kikusui-recommended currents shown in Table 4-2 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.

4.4.2 Connecting to the Output Terminal

⚠WARNING

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

⚠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.

See Page 4-10

2. Attach crimping terminals to the load cable and connect it to the output terminal.

3. Check the connection.

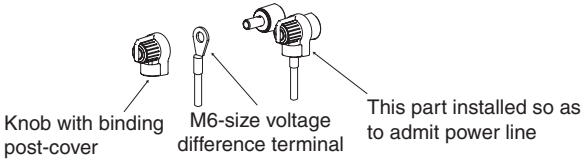
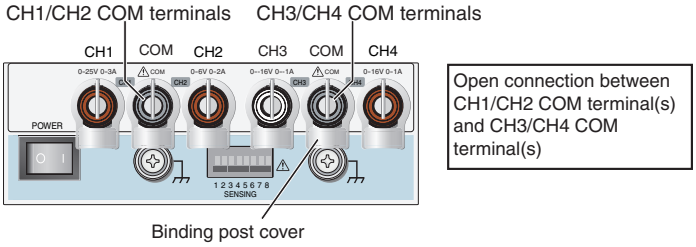


Fig. 4-2 Connecting to the output terminal 1

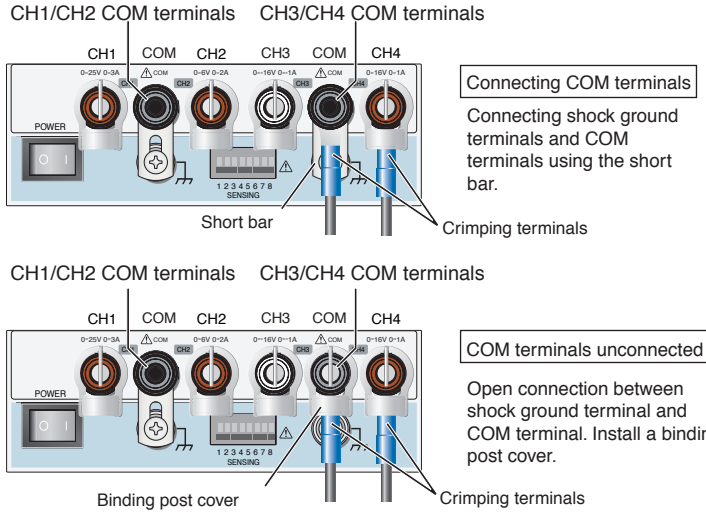
When using open (ungrounded) connection between the chassis and a COM terminal, use the unit with the short bar removed.

Fig. 4-3 shows an example of open connection to the COM terminal unconnected to a load, and Fig. 4-4 shows an example of connection when the PMP is connected to the load.



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

Fig. 4-3 Example of open connection between COM terminals (for PMP16-1QU)



* The COM terminals are independent of one another.

Fig. 4-4 Example connection to output terminal PMP16-1QU CH4

⚠WARNING • **To avoid shock, when chassis ground terminal and COM terminal are unconnected, install a binding post cover.**

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 depress it in until it can not be removed.

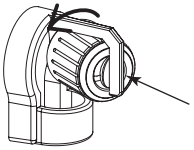


Fig. 4-5 Installing binding post cover

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

4.5 Tracking Function (TRACKING)

The tracking function permits changing multiple channels simultaneously in accordance with changes in a 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.

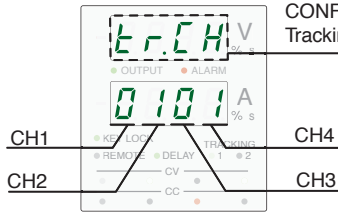
Tracking function 1	Function that uses an absolute value that is the same as the variation in the output voltage value (or the output current value) in a reference channel to vary the output voltage value (or the output current value) in other channels.
Tracking function 2	Function that uses a relative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

It is possible to freely set the channel selection that performs a tracking operation, and the channel that will be the reference.

Setting the channel that performs the tracking operation

See Page 4-21

The selection of the channel that performs the tracking operation can be done using “tr.CH” in the CONFIG settings, and the output display selection switch. A channel with tracking function set will have “1” displayed in the ammeter, and if not set will have “0”.



Item	Tracking operation
CH1	OFF
CH2	ON
CH3	OFF
CH4	ON

Fig. 4-6 Display example of setting a tracking function (for PMP16-1QU)

Tracking function 1 (absolute value variable)

When this tracking function is activated, the output of each channel other than the reference channel, which is selected using the output display selection switch, varies by the same value (absolute value) as the variation in the reference channel. Note that the variation of the output of each non-reference channel occurs with respect to its voltage or current setting.

Depress the TRACK 1 switch on the front panel to activate the tracking function 1.

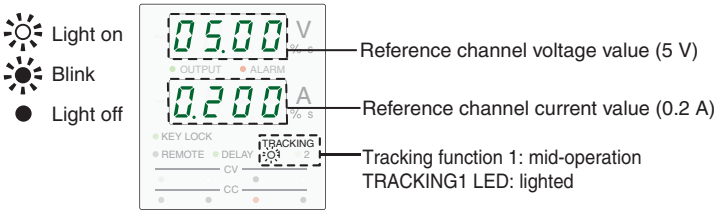


Fig. 4-7 Tracking function 1: Example of display during operation

With tracking function 1, the output of a non-reference channel does not go beyond the maximum available voltage or 0 V even when the voltage variation of the reference channel is larger than the change in the non-reference channel voltage until it reaches the maximum available voltage or 0 V. However, in this case, the variation of the reference channel is saved in memory so that the output of the non-reference channel returns to the original level when that of the reference channel returns to the original level.

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.

[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.
	▼		Output display selection switch is depressed 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 (variable ratio)

When this tracking function is activated, the output of each channel other than the reference channel, which is selected using the output display selection switch, varies by the same percentage (ratio) as the variation in the reference channel. Note that the variation of the output of each non-reference channel occurs with respect to its voltage or current setting that is assumed to be 100%. The value variation range is between 0.0% and 200.0%.

Depress the TRACK 2 (SHIFT+TRACK 1) switch on the front panel to activate the tracking function 2.

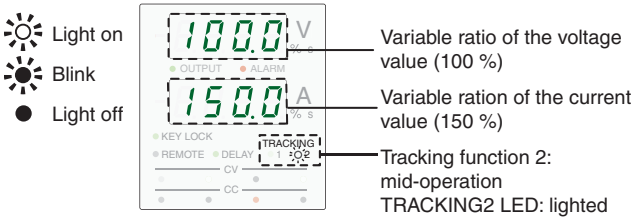


Fig. 4-8 Tracking function 2: Example of display during operation

With tracking function 2, as well, the output of a non-reference channel does not go beyond the maximum available voltage or 0 V even when the voltage variation of the reference channel is larger than the change in the non-reference channel voltage until it reaches the maximum available voltage or 0 V.

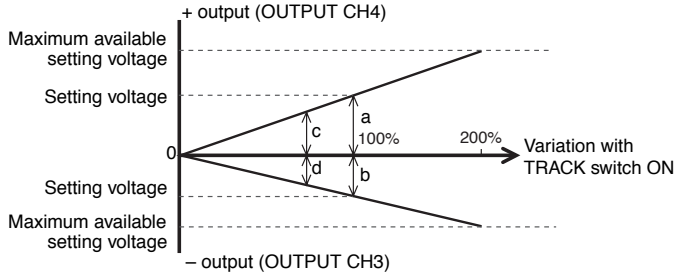
However, the variation of the reference channel is saved in memory so that the output of the non-reference channel returns to the original level when that of the reference channel returns to the original level (100%).

Example1) Examples of the voltage variation of CH3 and CH4 of PMP16-1QU is shown in Fig. 4-9.

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. 4-9. 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

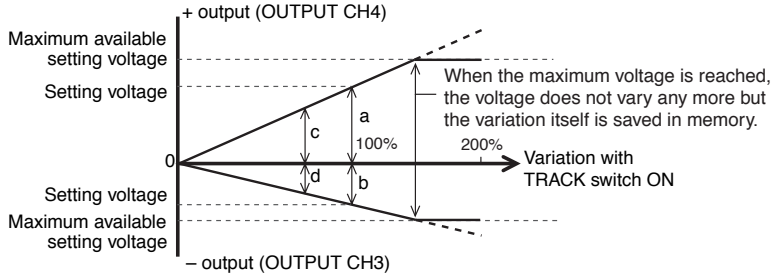


Fig. 4-9 Voltage setting and tracking output

⚠CAUTION

- If another output display selection switch is depressed during tracking operation, the past variation is cleared, the channel selected with the switch becomes the reference channel and the settings of the channels at the moment the switch is depressed become the new original values. Also, when the output of a channel reaches the rated voltage or 0 V as a result of tracking operation, changing the reference channel clears the past variation and sets the current values as the new original values. Note this well before depressing another output display selection switch during tracking operation.
- If a memory switch is depressed during tracking operation, the settings stored in the memory become the reference values.

Setting resolution in tracking operation

When setting the resolution for the tracking operation, select the digit to be selected using the VOLTAGE or CURRENT switch and set it with the rotary knob.

NOTE

- The output resolution is restricted by the least significant digit on the display. Therefore, if the setting at the moment the TRACK switch is depressed is smaller than the minimum resolution, the output may not be varied by turning the rotary knob.
  In such a case, the rotary knob should be turned until the output and display changes.

Operation procedure of the tracking function

1. Confirm that the OUTPUT is turned off.

See Page 4-30

2. Depress the CONFIG switch and select “tr.CH” in the Configuration setup.

See Page 4-32

3. Depress the output display selection switches to set the channels to perform the tracking operation.

4. Depress the CONFIG switch until the CONFIG setup is exited and the display returns to the normal display.

See Page 4-5

5. Set the output values of each channel.

6. Depress the TRACK 1 switch for tracking by the same value (absolute value variation), or depress the TRACK 2 (SHIFT+TRACK 1) switch for tracking by the same percentage (ratio variation).

   The TRACKING 1 or TRACKING 2 LED lights on the display. When tracking function 1 is selected, the voltmeter display will show the voltage value and the ammeter display shows the current value. When tracking function 2 is selected, they will be displayed in percentages.

7. Depress the output display selection switch to select the reference channel.

   The settings or percentages of the selected channel are displayed.

8. Turn on the OUTPUT switch.

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

To exit from the tracking operation, depress the switch corresponding to the tracking function in use, that is, either the TRACK 1 switch or the TRACK 2 (SHIFT + TRACK 1) switch.

When the TRACK 2 is selected, it can also be exited by depressing the TRACK 1 switch twice to shift the mode from TRACK 2 → TRACK 1 → Tracking OFF.

NOTE

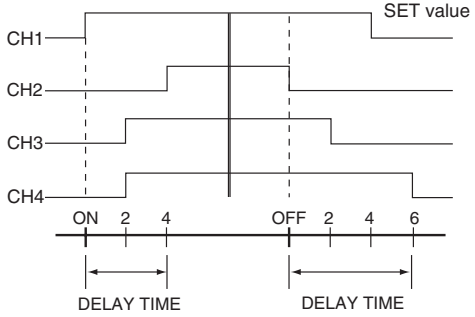
- Turning off the POWER switch with the tracking function set clears the settings. When the PMP is turned on the next time, the unit is started up with the settings of the tracking function canceled.

4.6 Delay Function

The time period between the depress of the OUTPUT switch and the actual switching of the outputs to ON (ON DELAY) or OFF (OFF DELAY) can be set.

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

The following timing chart of ON DELAY and OFF DELAY shows the concepts of the delay function.



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. 4-10 Timing chart of delay function

NOTE

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

Setting the ON DELAY and OFF DELAY time

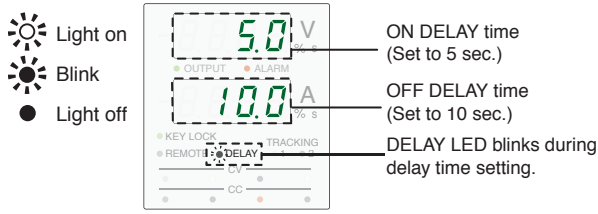


Fig. 4-11 Example of delay time setting display

1. Confirm that the OUTPUT is turned off.
2. Set the output values of each channel.
3. Depress the DELAY SET (SHIFT+DELAY) switch to activate the DELAY SET mode.

   In the initial condition, both the voltmeter and ammeter displays show "00.0". However, if their values have already been set previously, the set values are displayed.
4. Depress the output display selection switch to select the desired channel.

   Check that the output display selection switch of the channel is lit.

See Fig. 4-11

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

   Set the ON DELAY time in the voltmeter display and the OFF DELAY time in the ammeter display.
6. Depress the VOLTAGE or CURRENT switch to select the digit to be varied and turn the rotary knob to set its figure.

   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.

To exit from the DELAY SET mode, depress the DELAY SET (SHIFT+DELAY) switch.

NOTE

- The DELAY LED on the display blinks during the delay time setting.

Operation procedure of the delay function

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

1. Check that the OUTPUT is turned off.
2. Set the output values for each channel.
3. Depress the DELAY SET (SHIFT+DELAY) switch to set the delay time.

See Page 4-24

For the delay time setting method, see “Setting the ON DELAY and OFF DELAY time”.

NOTE

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

4. Depress the DELAY SET (SHIFT+DELAY) switch to exit from the DELAY SET mode.
5. Depress the DELAY switch to activate the delay function.

   Check that the DELAY LED on the display is lit.
6. Depress the OUTPUT switch to turn the outputs on.

   During the 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.

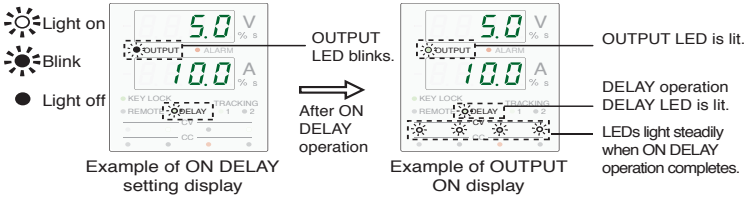


Fig. 4-12 Example of display during ON DELAY operation

7. Depress the OUTPUT switch to turn the outputs off.

   During the 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.

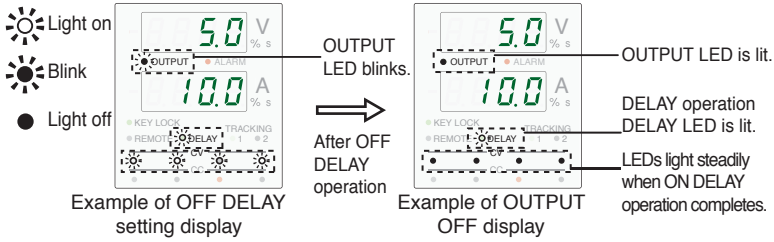


Fig. 4-13 Example of display during OFF DELAY operation

Depress the DELAY switch to exit from the delay function.

4.7 Memory Function

Up to three sets of voltage/current and delay settings (delay time) of the outputs can be stored in memory banks, which include memory 1, memory 2 and memory 3.

Any memory can be recalled whenever required for switching operation.

Storing settings in memory

The memory stores the present settings of each output channel. Before proceeding to the memory storage operation, set the desired output settings to each output channel.

1. Check that the OUTPUT is turned off.
2. Set the desired output settings.

   Set the voltage value, current value and delay time.
3. Depress 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 depressed, the settings are not stored in memory.

Recalling settings

⚠CAUTION
- When memory settings are recalled while the OUTPUT switch 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.

To select the memory you want to recall, depress the memory switch that stores the setting values.

The settings in the selected memory will be recalled.

NOTE
- 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.

4.8 Series Connection of Outputs (only for PMP16-1QU)

With PMP16-1QU, the output voltages of two channels can be combined and magnified by connecting the load to their + (positive) and – (negative) output terminals.

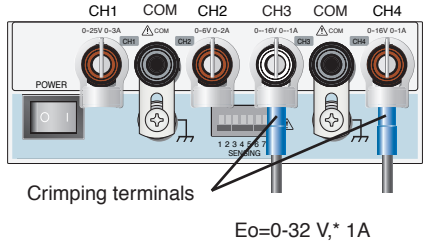


Fig. 4-14 Example of load connection for series operation of PM16-1QU (Example of connection to CH3 - and CH4 + output terminals)

⚠CAUTION

- The series operation is possible only with PMP16-1QU. It is not available with PMP18-3TR/PMP25-2TR.
  However, even with PMP16-1QU, only the output terminals of a single unit can be combined. 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.

4.9 Locking the Panel Operation (KEY LOCK)

When the PMP is used by fixing the settings, the control operations using the front panel keys can be inhibited to prevent the settings from being altered by mistake. Once the front panel keys are locked, operation of switches other than the OUTPUT switch, output display selection switches and KEY LOCK (SHIFT+SET) switch will become invalid.

Locking or unlocking the panel keys

Each depress 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.

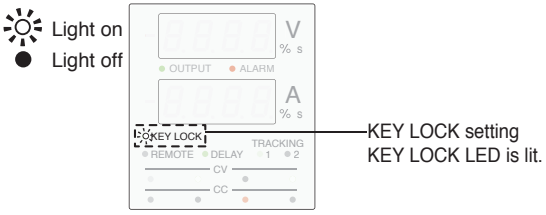


Fig. 4-15 KEY LOCK display

NOTE

- If the KEY LOCK is set while the SET switch is depressed (with the SET switch lit), the display continues to show the SET values and does not show the output values. If it is required to display the output values, cancel the KEY LOCK, depress the SET switch to display the output values, and then set the KEY LOCK again.

4.10 Configuration Setup (CONFIG)

The configuration setup sets the operating conditions of the PMP.

See Fig. 4-16

It is performed by using the voltmeter display, ammeter display, CONFIG switch and the rotary knob and/or output display selection switches.

1. Depress the CONFIG switch.

   The display changes to the CONFIG display.
   The voltmeter display shows the CONFIG setup item, which can be switched in sequence by depressing the CONFIG switch. Depress the CONFIG switch repeatedly until the operating condition to be set is displayed. Depressing the CONFIG switch repeatedly eventually returns the display to the normal display.

2. Set the condition by turning the rotary knob or depressing the output display selection switches.

   The ammeter display shows the content of the setup.

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

   The operating condition can be changed using the rotary knob or output display selection switches.

4. After completing the setup, depress the CONFIG switch repeatedly until the display returns to the normal display. The configuration setup is exited at this moment.

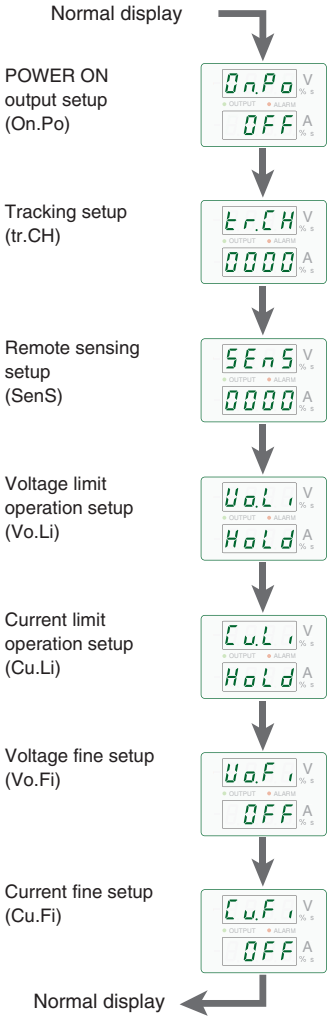


Fig. 4-16 CONFIG settings
(Factory-shipped settings)

When the CONFIG switch is depressed after completing the current fine setup to exit from the configuration setup, "----" is displayed in the voltmeter and the ammeter for a few seconds before the display returns to the normal display.

POWER ON OUTPUT setup (“ON.PO”: On.Po)

Rotary knob

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

Use the rotary knob for the setup.

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

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

Tracking setup (“TR.CH”: tr.CH)

output display selection switches

CH1 CH2 CH3 CH4

This sets the channels to perform the tracking operation.

Use the output display selection switches for the setup.

In the 4 digits of the ammeter display, the most significant digit (leftmost digit) indicates CH1 and the least significant digit (rightmost digit) indicates CH4.
(With PMP18-3TR/PMP25-2TR, the 3 digits on the right are used.)

1 (1111): Tracking ON.

0 (0000): Tracking OFF.

Remote sensing setup (“SENS”: SEnS)

output display selection switches

CH1 CH2 CH3 CH4

This sets the channels to perform the remote sensing operation.

Use the output display selection switches for the setup.

In the 4 digits of the ammeter display, the most significant digit (leftmost digit) indicates CH1 and the least significant digit (rightmost digit) indicates CH4.
(With PMP18-3TR/PMP25-2TR, the 3 digits on the right are used.)

1 (1111): Remote sensing ON.

0 (0000): Remote sensing OFF.

Voltage limit operation setup ("Vo.LI": Vo.L)

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.

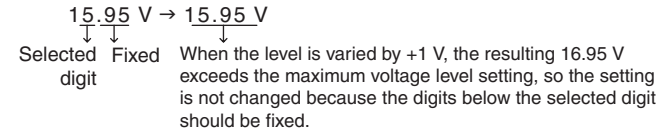
Use the rotary knob for the setup.

HOLD (Hold): Digits lower than the selected digit are fixed.

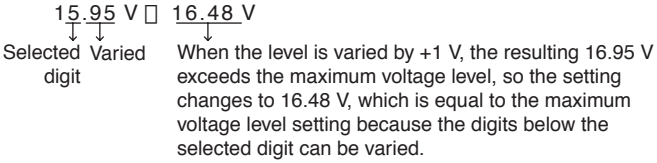
CHAN (ChAn): Digits lower than the selected digit are varied.

Example) With PMP16-1QU, when the maximum voltage level of CH4 is set to 16.48 V, the present voltage is 15.95 V, and the digit of 1 V is selected and varied in the positive direction.

- 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)

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 setup.

HOLD (Hold): Digits lower than the selected digit are fixed.

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

Example) With PMP16-1QU, when the maximum current level of CH4 is set to 1.030 A, the present current is 0.950 A, and the digit of 0.1 A is selected and varied in the positive direction.

- When digits lower than the selected digit are fixed:

0.950 A → 0.950 A

Selected digit, Fixed digit

When the level is varied 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:

0.950 A → 1.030 A

Selected digit, Varied digit

When the level is varied 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": UoF1)

Rotary knob

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

Example) When the rated voltage is 16 V: Operation of the digit of 1 mV.
When the rated voltage is 6 V: Operation of the digit of 0.1 mV.

Use the rotary knob for the setup.

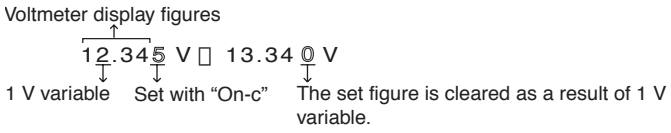
When this setup is made, the figure of the least significant digit (rightmost digit) blinks to indicate that the digit of 1 mV or 0.1 mV is being set.

Although this setup can set the digit below the least significant digit, the change may not be reflected in the output voltage due to the restrictions of the PMP.

ON-C (On-C): Voltage fine setup enabled

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. However, when the figure of another digit is changed after setting the digit of 1 mV or 0.1 mV, the figure in the digit of 1 mV or 0.1 mV is cleared to "0".

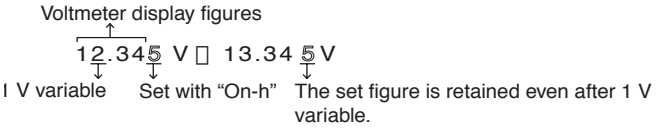
Example) When the voltage value of 12.345 V is set with "ON-C" and then the voltage is varied by 1 V.



ON-H ([On-h]): Voltage fine setup enabled

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. The figure in the digit of 1 mV or 0.1 mV is retained even when the figure of another digit is changed after setting the digit of 1 mV or 0.1 mV.

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



OFF ([oFF]): Voltage fine setup disabled

NOTE

- 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 ammeter display.

Use the rotary knob for the setup.

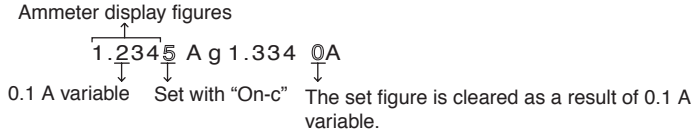
When this setup is made, the figure of the least significant digit (of 1 mA) blinks to indicate that the digit of 0.1 mA is being set.

Although this setup can set the digit below the least significant digit, the change may not be reflected in the output current due to the restrictions of the PMP.

ON-C ([On-C]): Current fine setup enabled

The current can be set by the digit (0.1 mA) below the least significant digit displayed in the voltmeter display. However, when the figure of another digit is changed after setting the digit of 0.1 mA, the figure in the digit of 0.1 mA is cleared to "0".

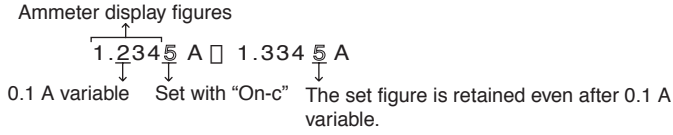
Example) When the current value of 1.2345 A is set with "ON-C" and then the current is varied by 0.1 A.



ON-H ([On-h]): Current fine setup enabled

The current can be set by the digit (of 0.1 mA) below the least significant digit displayed in the ammeter display. The figure in the digit of 0.1 mA is retained even when the figure of another digit is changed after setting the digit of 0.1 mA.

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



OFF ([oFF]): Current fine setup disabled

NOTE

- 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.

External Control

This chapter gives description on the external control and remote sensing functions.

5.1 External Control Function

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

5.1.1 Handling the Screw-less 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

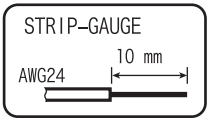
Wire stripper suitable for the wires described above

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

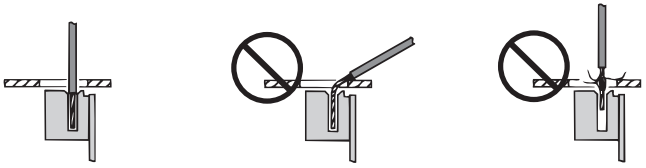
Connection procedure

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

5.1.2 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

- **Never connect wires to the J1 terminals while the POWER switch is turned on. Otherwise, an electric shock or damage to the internal circuitry may result.**
- **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.**

Connection procedure 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

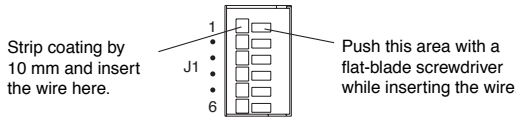


Fig. 5-2 J1 terminal block connection

5.1.3 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. When the alarm signal is input, the POWER switch should be turned off to release the alarm.

Connection procedure

1. Turn off the POWER switch.
2. Connect a contact switch to terminals 1 and 6 of the J1 terminal block.
3. Check the connection.

See Fig. 5-3

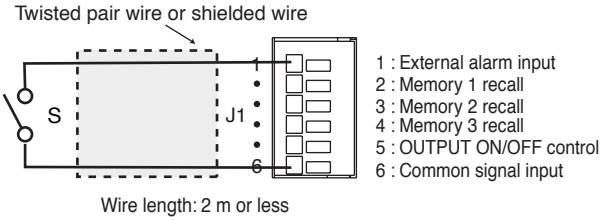


Fig. 5-3 Connecting a contact switch to alarm input

■ Operation

Short-circuit the contact switch to apply an alarm signal input.

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

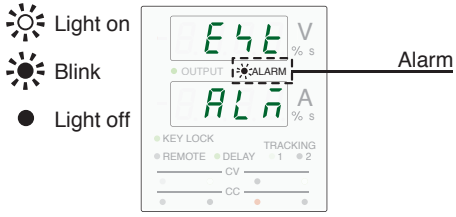


Fig. 5-4 Display during alarm input

Once the contact is short-circuited, the alarm input is retained and cannot be reset unless the POWER switch is turned off.

5.1.4 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.

Connection procedure

1. Turn off the POWER switch.
2. Connect contact switches to terminals 2, 3, 4 and 6 of the J1 terminal board.
3. Check the connection.

See Fig. 5-5 Fig. 5-6

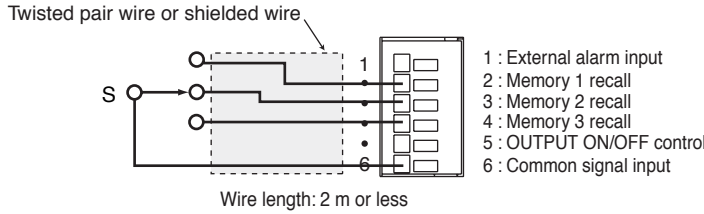


Fig. 5-5 Connecting a contact switches for memory recall 1

⚠CAUTION • Use a non-shorting type switch as switch S.

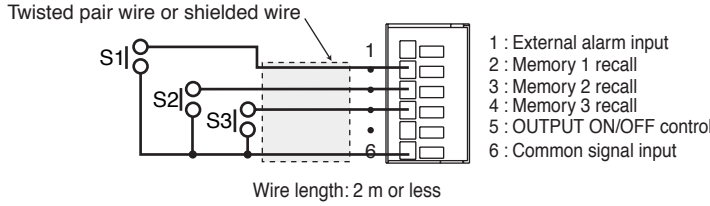


Fig. 5-6 Connecting a contact switches for memory recall 2 (When using push switches)

⚠CAUTION
- Use non-lock (momentary) switches as switches S1, S2 and S3.
- Do not depress more than one switch at a time.

■ Operation

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.

DESCRIPTION

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

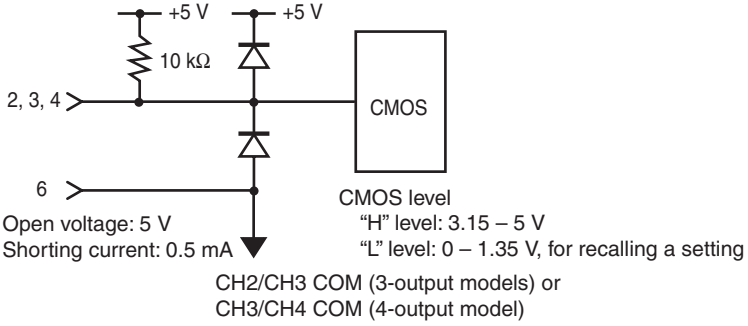


Fig. 5-7 Equivalent circuit

5.1.5 Turning OUTPUT On/Off Using External Contact

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

Connection procedure

1. Turn off the POWER switch.
2. Connect contact switches to terminals 5 and 6 of the terminal block.

See Fig. 5-8

3. Check the connection.

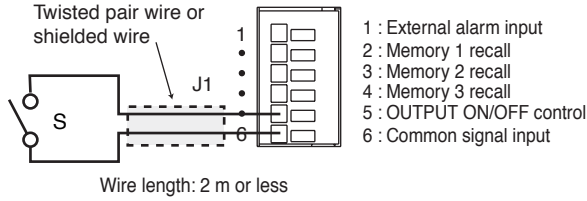


Fig. 5-8 Connecting a contact switches for OUTPUT on/off

■ Operation

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.

5.2 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).

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.

NOTE

- The function of the PMP is fulfilled fully when the remote sensing function is used. It is recommended to use the remote sensing function when accurate setting is required.
- With the factory setup, 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 6.3 “Calibration” for details.
- To use the remote sensing function, it is required to turn it on in the CONFIG setup. If the remote sensing function is not turned on, an error of about 30 mV may result.

Remote Sensing Connection Procedure

⚠WARNING

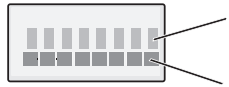
- **There is a risk of electric shock or damage to the internal circuitry.**
  Be sure to turn off the POWER switch before connecting wires to the sensing terminals.
- **The rated voltages of the wires connected to the sensing terminals should be equal to or larger than the isolation voltage of the PMP.**

1. Turn off the POWER switch.

See Page 5-3

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

   Use twisted pair or shielded wires as the sensing wires. This will prevent the output ripple voltage from being degraded due to induction.



Push this area with a flat-blade screwdriver while insert the wire.

Strip coating by 10 mm and insert the wire here.

Fig. 5-9 Connection to sensing terminals

Table 5-2 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.

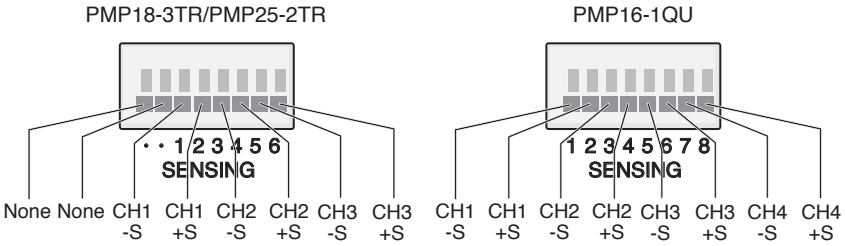


Fig. 5-10 Corresponding remote sensing terminals

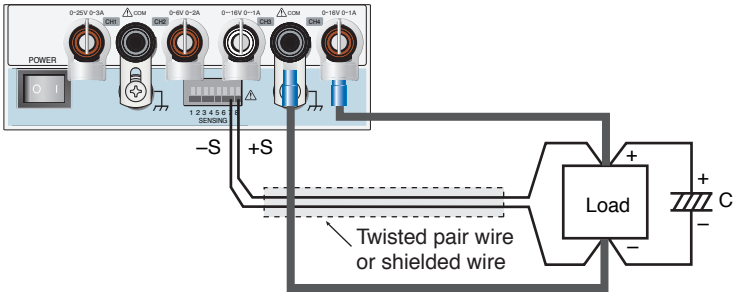


Fig. 5-11 Remote sensing connection

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.

⚠CAUTION

- Use a capacitor with a withstanding voltage of 150% or more of the rated voltage of the PMP. Its capacitance should be between a few hundreds and a few thousands of μF.

See Page 4-30

4. In “SEnS” of the Configuration setup, select the channels for setting the remote sensing function using the output display selection switch.

The channels to which the remote sensing is set are indicated with “1” on the ammeters, and those to which the remote sensing is not set are indicated with “0”.

5. Confirm the connection of the sensing terminals.

Be sure to connect the sensing wires securely by referring to the checklist in Table 5-3.

⚠WARNING • **To turn on/off the power supplied to a load using a mechanical switch, provide additional switches between the sensing wires as shown in Fig. 5-12, and turn on/off the power supply and remote sensing wires simultaneously. Be sure to turn off the OUTPUT or POWER switch before turning on/off the mechanical switch.**

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

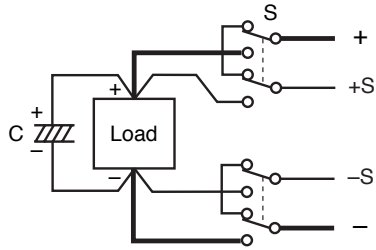


Fig. 5-12 On/off using the mechanical switch

Table 5-3 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.
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.

Check Item	Phenomena and Remedy
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.

6

Maintenance

This chapter describes maintenance and inspection of the PMP.

Conduct periodic maintenance and inspection to maintain the initial performance as long as possible. This chapter also describes the countermeasures to be taken when malfunction is suspected during use of the PMP.

6.1 Cleaning

WARNING • **To prevent the possibility of electric shock and may result in death or serious injury, be sure to turn off the POWER switch and remove the power cord plug or turn off the switchboard when cleaning the PMP.**

6.1.1 Cleaning the Panels

If the panel needs cleaning, gently wipe using a soft cloth with water-diluted neutral detergent.

CAUTION • Do not use volatile solvents such as thinner or benzine. Otherwise, discoloration of the surface, erasure of printed characters or whitening of the display surface may result.

6.2 Inspection

■ Power cord

Check that the insulation coating is not broken and that the plug is not cracked or falling apart.

WARNING • **Breaks in the insulation coating may cause electric shock. If a break is found, stop using it immediately.**

To purchase accessories, contact your Kikusui agent or distributor.

6.3 Calibration

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

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, please contact your Kikusui agent or distributor.

6.3.1 Test Equipment Required

For calibration or 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 types	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 type	PMP16-1QU	3 A/300 mV (100 mW) 2 A/200 mV (100 mW) 1 A/1 V (1 W)	

6.3.2 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.

6.3.3 Adjustments

The PMP should be set to the CAL mode before adjustment.

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

The CAL mode is displayed and the PMP enters the CAL mode.

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

To exit the CAL mode, turn off the POWER switch.

6.3.4 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

- After adjusting the offset and full-scale values of either voltage or current of an output, be sure to depress the SET switch to complete the adjustments. If a different output is adjusted or the POWER switch is turned off before depressing the SET switch, the last performed adjustments are invalidated.
- 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. Be sure to connect the sensing terminals for accurate adjustments.
  For details on the connection, see “Remote Sensing Connection Procedure” on page 5-10

■ Connecting the equipment

1. Turn off the POWER switch.

See Page 5-10

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.

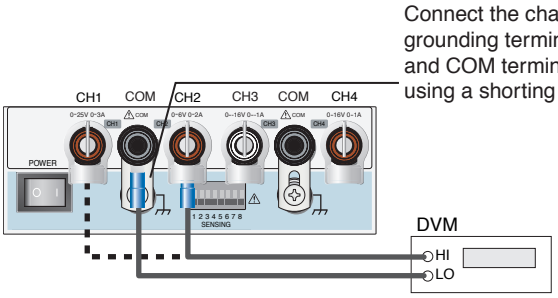


Fig. 6-1 PMP16-1QU voltage adjustment connection example 1
(Connection to CH1 or CH2 output terminal)

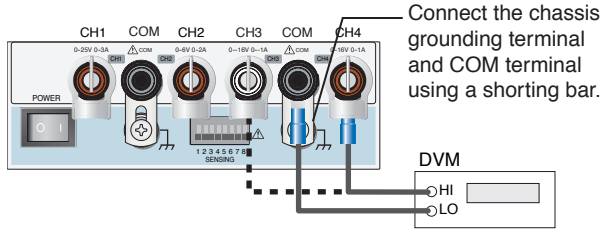


Fig. 6-2 PMP16-1QU voltage adjustment connection example 2 (Connection to CH3 or CH4 output terminal)

■ 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.

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

   If it is lit, depress 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 output display selection switch for the channel to be adjusted (one of CH1 to CH4).

8. Depress the VOLTAGE switch to display “OF 0” on the voltmeter.

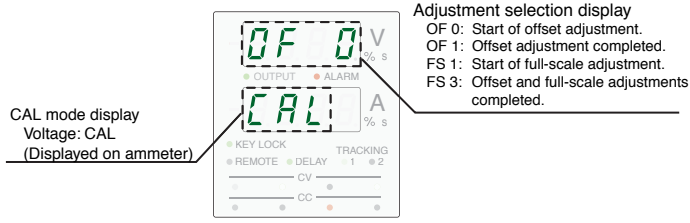


Fig. 6-3 Panel display in voltage calibration mode

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

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

10. 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.

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

    The voltmeter shows “OF 1”.

12. Depress the VOLTAGE switch to display “FS 1” on the ammeter.

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

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

14. 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.

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

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

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

    The voltmeter returns to display “FS 0”.

    The adjustment values are not stored if a switch other than the SET switch is depressed.

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

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.

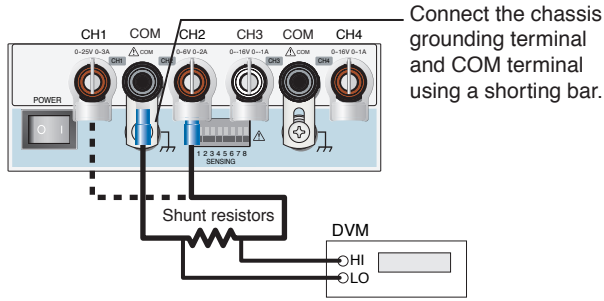


Fig. 6-4 PMP16-1QU current adjustment connection example 1 (Connection to CH1 or CH2 output terminal)

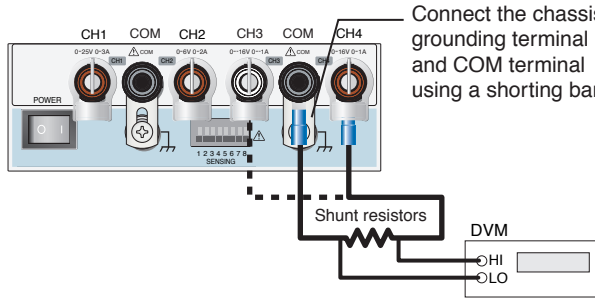


Fig. 6-5 PMP16-1QU current adjustment connection example 2 (Connection to CH3 or CH4 output terminal)

■ 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.

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 output display selection switch for the channel to be adjusted (one of CH1 to CH4).

7. Depress the CURRENT switch to display “OF 0” on the ammeter.

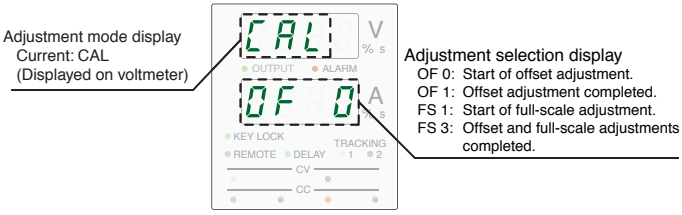


Fig. 6-6 Panel display in current calibration mode

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 shows “OF 1”.

11. Depress the CURRENT switch to display “FS 1” on the ammeter.

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 shows “OF 3” and the SET switch flashes.

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

    The ammeter returns to display “FS 0”.
    The adjustment values are not stored if a switch other than the SET switch is depressed.

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

6.4 Troubleshooting

If a trouble occurs, first check the product by referring the following checklists. Some troubles may be solved with easy remedies.

When a check item that meets the current status of the product, follow the remedy given for that item. If no check item meets the current status, it is recommended to initialize the product (but note that this clears the memory contents). If the trouble still persists, please contact your Kikusui agent.

■ Symptom 1: The display shows nothing.

Check item	Cause and Remedy	See Page
Is the rated 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 Page
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.	3-8
Are remote sensing wires connected properly?	• Check that the remote sensing wires are connected properly. Also check if they are disconnected.	5-10
	• 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 Page
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 Page
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 setup.	4-32 5-9
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 Page
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.	4-12
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 Page
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 setup.	4-32 5-9
	• 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.	3-3

Specifications

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

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 ± 5•C and the humidity be between 10 %rh and 80 %rh.
- Typical 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 voltage	25.0 V	6.0 V	6.0 V
		Maximum available voltage *1	25.75 V	6.180 V	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 voltage	6.0 V	18.0 V	25.0 V
		Maximum available voltage *1	6.180 V	18.54 V	25.75 V
		Minimum setting resolution	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 voltage	–16.0 V	18.0 V	25.0 V
		Maximum available voltage *1	–16.48 V	18.54 V	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 voltage	16.0 V	—	—
		Maximum available voltage *1	16.48 V	—	—
		Minimum setting resolution	10 mV	—	—
		Setting accuracy *2*3	± (0.15 % of set + 20 mV)	—	—

Model			PMP16-1QU	PMP18-3TR	PMP25-2TR
Output					
Voltages	CH1	Rated current	3.0 A	5.0 A	5.0 A
		Maximum available current *1	3.090 A	5.150 A	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 current	2.0 A	3.0 A	2.0 A
		Maximum available current *1	2.060 A	3.090 A	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 current	–1.0 A	3.0 A	2.0 A
		Maximum available current *1	–1.030 A	3.090 A	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)
	CH4	Rated current	1.0 A	—	—
		Maximum available current *1	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 and CH2 common CH3 independent.	
		Withstand voltage across COMMON	30 VDC		
Ground		Polarity	Positive, COM and negative grounding possible		
		Isolation voltage	DC ± 250 V		

Model			PMP16-1QU	PMP18-3TR	PMP25-2TR
Output					
Voltage/current setting method	Setting method		Switch CH and CV/CC, and then turn the rotary knob.		
	Voltage/current setting selection		Select the CH using the output display selection switch.		
	SET (Limit)		Press the SET switch while the output is turned off.		
	Resolution variation		Select resolution using the VOLTAGE or CURRENT switch.		
	Resolution display		Indicated by the change in brightness of the 7 segments on the variable position.		
Rated output power			119 W	138 W	130 W
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	—	—

Model		PMP16-1QU	PMP18-3TR	PMP25-2TR
Constant voltage characteristics				
Full-load rise time (TYP) *5	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) *6	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/Ammeter						
	Voltmeter	Display	Digital display	4-digit LED display (The value of each CH is switched using the output display selection switch.)		
			Negative display	Negative sign LED display.		
		Output rating 10 V or more	Accuracy 1 *3*7	± (0.2% of rdng + 20 mV)		
			Accuracy 2 *3*7*8	± (0.5% of rdng + 80 mV)		
			Resolution	10 mV		
		Output rating 10 V or less	Accuracy 1 *3*7	± (0.3% of rdng + 5mV)		
			Accuracy 2 *3*7*8	± (0.5% of rdng + 60 mV)		
			Resolution	1 mV		
	Ammeter	Display	Digital display	4-digit LED display (The value of each CH is switched using the output display selection switch.)		
			Negative display	Negative sign LED display.		
		Output rating 3 A or more	Accuracy 1 *7	± (0.5% of rdng + 5 mV)		
			Accuracy 2 *7*8	± (0.8% of rdng + 30 mV)		
			Resolution	1mA		
		Output rating 3 A or less	Accuracy 1 *7	± (0.5% of rdng + 10 mV)		
			Accuracy 2 *7*8	± (0.8% of rdng + 50 mV)		
			Resolution	1mA		
Display						
	CV/CC lamp			LED indication of CV (green) or CC (red) for each CH.		
	OUTPUT on			Lighting OUTPUT LED		

*1 The maximum available voltage and current simply determine the rated output values and do 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.
*5 Time until the output voltage rises from 10% to 90% of the rated output voltage after OUTPUT is turned on.
*6 Time until the output voltage falls from 90% to 10% of the rated output voltage after OUTPUT is turned off.
*7 Difference of the displayed value with respect to the actual output value.
*8 Under temperatures from 0•C to 40•C.

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 the7-segment LED display.		
Over-voltage protection (OVP)	Operating voltage	Activated at 110% to 130% of the rated voltage of each CH.		
	Operation	All-CH OUTPUT off.		
	Display	Blinking ALARM LED. “OVP” displayed on the 7-segment LED display.		
Input fuses	100 VAC to 120 VAC Input	7 A fuse mounted inside the cabinet.		
	220 VAC to 230 VAC Input	4 A fuse mounted inside the cabinet.		
Sensing function	Operating channels	Any CH		
	Selection	Select the CH in the Configuration setup. Use remote sensing terminals.		
	Compensating voltage *1	± 0.3 V.		
Tracking	Operating channels	Any CH		
	ON/OFF	Switched on the front panel. Operating channels can be selected in the Configuration setup.		
	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)		

Model		PMP16-1QU	PMP18-3TR	PMP25-2TR
Delay	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 OUTPUT is turned on.		
	Setting range	0.1 s to 99.9 s		
	Setting resolution	0.1 s		
	Setting accuracy *3 (Theoretical)	± 50 ms		
Memory function	Item	Output voltage, output current, delay time		
	Memory	3		
	Selection	Selection using the 3 switches on the front panel.		
	Selection display	Selected memory is displayed on the 7-segment LED display.		
Factory-shipped setting (Initialized)		Can be selected using the front panel switch.		
POWER On / OUTPUT On		Can be selected in the Configuration setup.		
KEY LOCK	Settings	Can be selected using the front panel switch.		
	Operation	Switches other than the OUPUT and output display 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 ALARM” displayed on the7-segment LED display		
	Operation	All outputs OUTPUT 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 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.
However, the variation stops when the reference output value or interlocked output value exceeds the available value range.

*3 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.

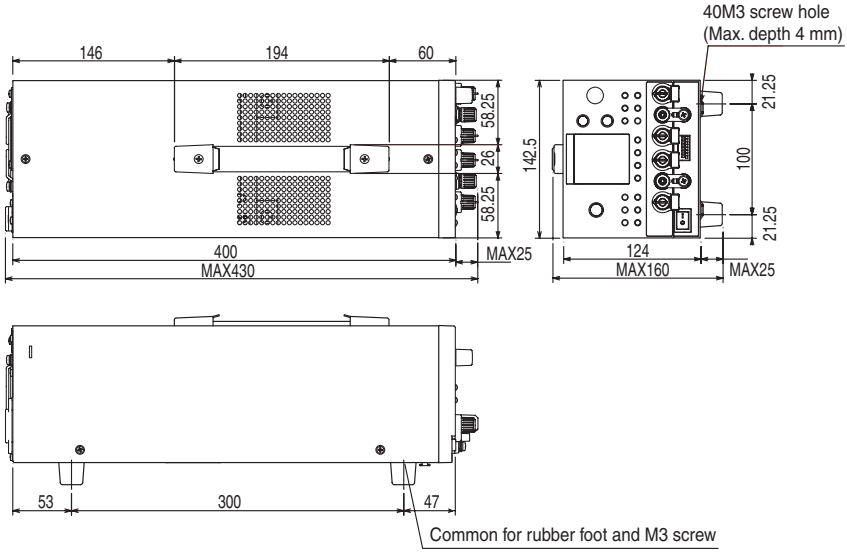
General Specifications

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, 10 %rh to 80 %rh (without condensation)		
	Storage temperatures/ humidity		–10 •C to 60 •C, less than 90 %rh (without 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 ⇔ Cabinet	More than 500VDC 30 MΩ		
		Primary ⇔ Secondary	More than 500VDC 30 MΩ		
		Secondary ⇔ Cabinet	More than 500VDC 30 MΩ		
Withstanding voltage		Primary ⇔ Cabinet	1500 V AC: No abnormality for 1 min.		
		Primary ⇔ Secondary	1500 V AC: No abnormality for 1 min.		
Grounding circuit continuity		AC INLET GND ⇔ Cabinet	Within 25 AAC 0.1 Ω		
Cooling method			Forced cooling using a fan motor (thermal sensor controlled)		
AC Input	Nominal input rating		100 VAC, 50 Hz/60Hz		
		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	SVT3 18AWG: × 1 With a plug Length: Approx. 2.5 meters		
	Binding post cover		PMP18-3TR/PMP25-2TR: × 5 (3 of these attached on the main body) PMP16-1QU: × 6 (4 of these attached on the main body)		
Weight			9 kg		
Dimensions			See “Dimension Diagram”.		

*1 Not applicable to modified products.

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

Dimension Diagram



Unit: mm

Fig. 7-1 The PMP - Dimension diagram

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