Instruction manual

PWMAPR [three-phase step-down type]

RPWD2040-1C
RPWD2080-1C
RPWD2160-1C

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Request: Please be sure that the instruction manual will be handed over to the final user.

Safety design of equipment (request)

You are invited to take the following into consideration in designing and manufacturing equipment with AC power regulator (APR hereafter).

1. Scope of application of product

   The APR mentioned in the present instruction manual is designed and manufactured as a general purpose instrument destined to industrial fields in general, and must be excluded from application for nuclear power control, aerospace, medical science, traffic devices, passenger vehicles and concerned systems of special application that may considerably affect the human life and property.

2. Failure of product

   The instrument is provided in the main circuit and control circuit with electronics parts centered on semiconductors. The electronics parts are subject to failure occurrence at certain rates. It is important to sufficiently take into account redundant design, fire spread preventive design, erratic operation preventive design and other safety designs so that any failure of equipment resorting to APR will not further cause human accident, fire, social damage nor other consequences.

3. Malfunctions of main circuit semiconductors

   IGBT is used in the main circuit of the instrument. As its failure, a short-circuit may occur although rarely. In such a case, the incorporated quick fuse will blow to detach the main circuit from the power source. However, safety design must be respected as in 2 above so that any malfunction will not entail serious damages.

Preface

We thank you for purchasing Fuji PWMAPR.

Carefully read the instruction manual so that the instrument can be handled safely and correctly, thereby making full use of its functions and performances.

If any point is dubious, contact the shop you purchased it from or our local business office.

[General precaution] ⚠ ATTENTION

Respect the data and advises mentioned in the manual at all times so as to avoid dangers, damages and losses.

It is presupposed that the unit is handled (installed, wired, operated, maintained, inspected) by qualified persons, and checked by a responsible person of skill.

1 Precautions in safety ≡

(1) Be sure to carefully read the manual before installation, wiring, operation, maintenance or inspection. Use the instrument only after sufficiently understanding the device handling, precautions in safety, etc.

(2) In the manual, "WARNING" and "CAUTION" for safety are distinguished as follows.

Indication	Description
⚠ Warning	Case where, if handled wrongly, a dangerous situation may occur, thereby incurring death or serious injury.
⚠ Caution	Case where, if handled wrongly, a dangerous situation may occur, thereby incurring medium or slight injury, or only physical damage.

Note that even a matter mentioned under CAUTION may incur serious consequences.

Be sure to observe any mention because any item is as important as others.

(3) Indication of attentions for safety and their locations

On the front and inside of the unit, following attentions are indicated.

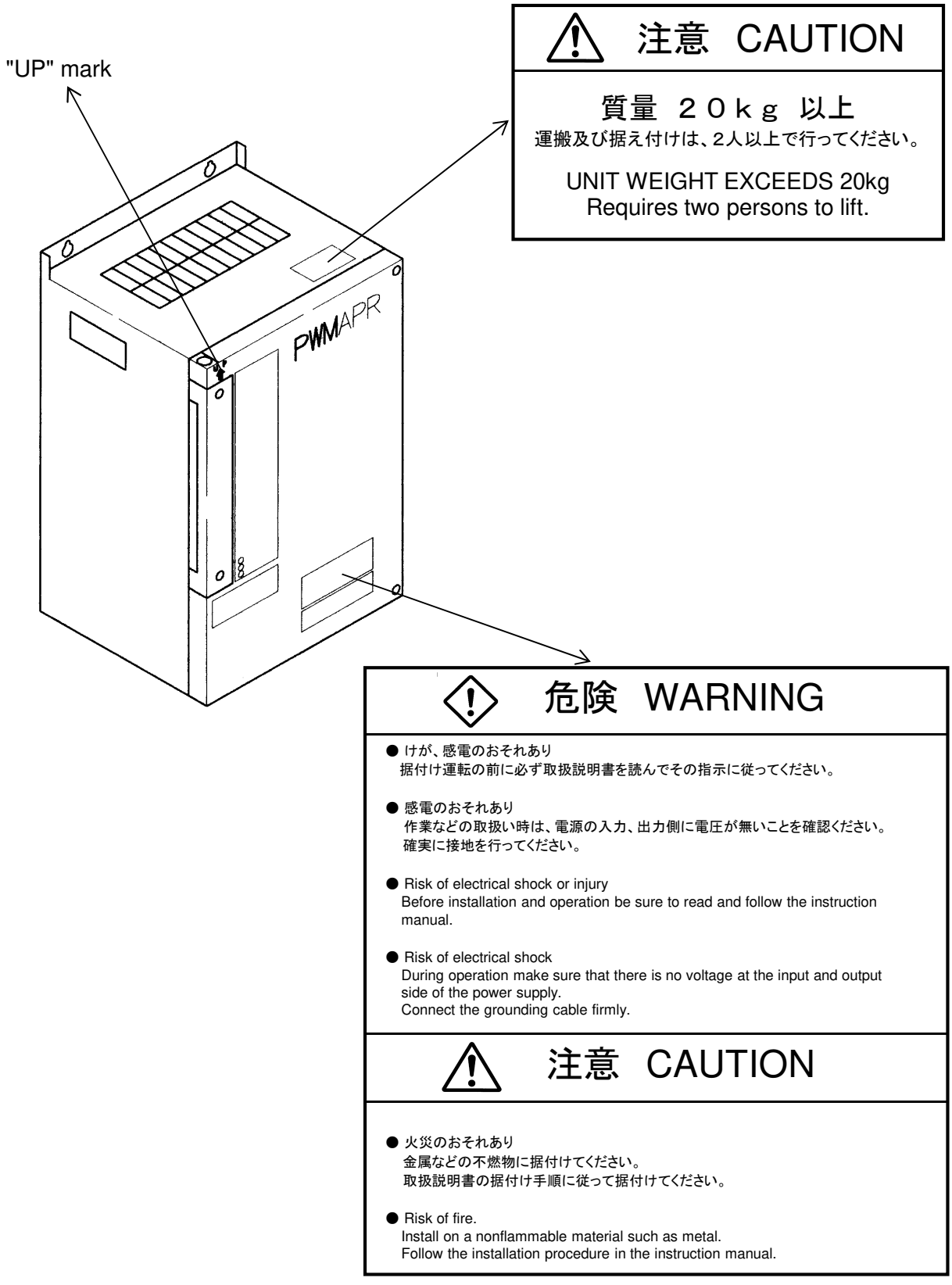
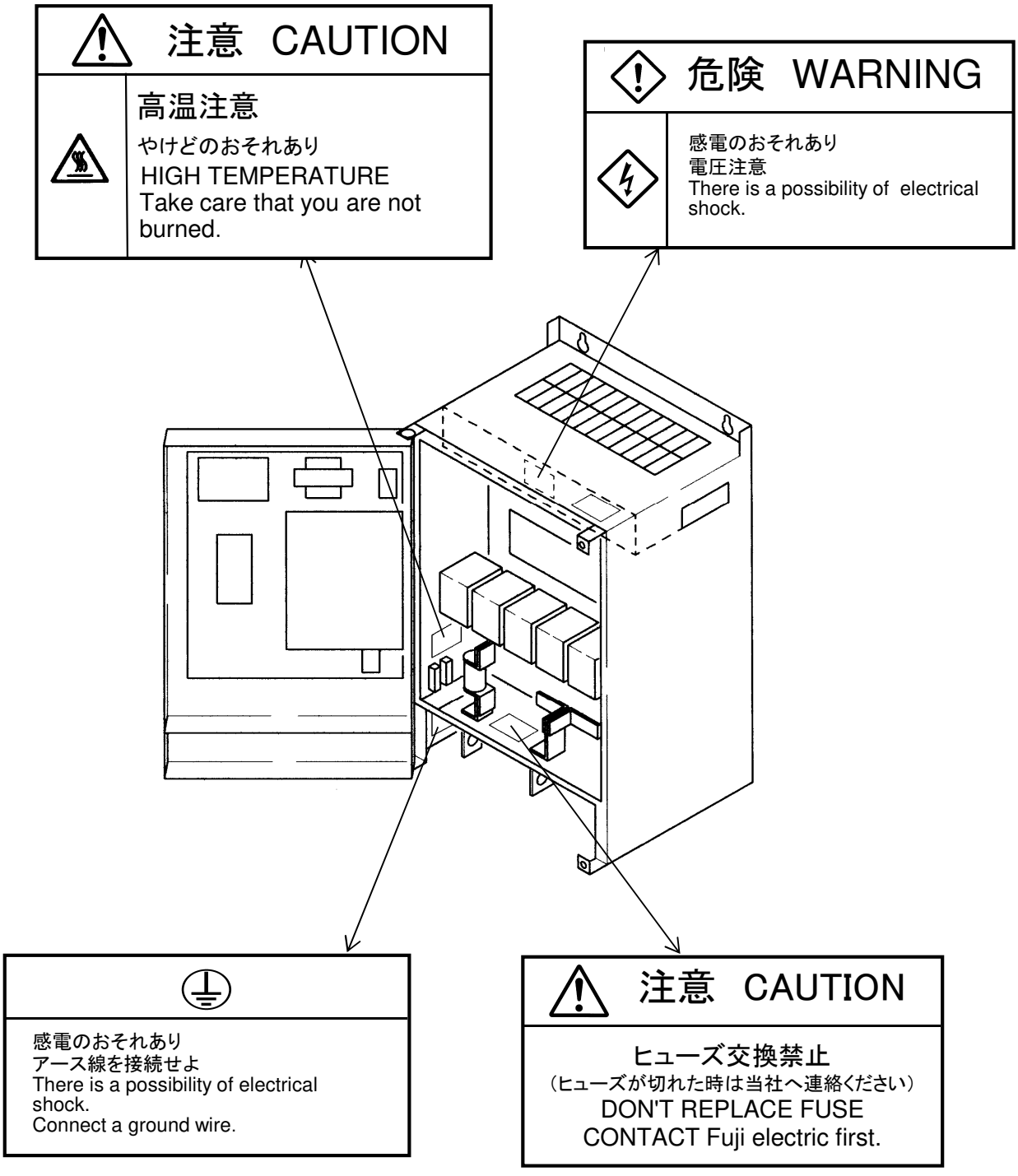


Fig. 1 Indication of attentions for safety of APR and their locations


注意 CAUTION
高温注意
やけどのおそれあり
HIGH TEMPERATURE
Take care that you are not burned.
危険 WARNING
感電のおそれあり
電圧注意
There is a possibility of electrical shock.
感電のおそれあり
アース線を接続せよ
There is a possibility of electrical shock.
Connect a ground wire.
注意 CAUTION
ヒューズ交換禁止
（ヒューズが切れた時は当社へ連絡ください）
DON'T REPLACE FUSE
CONTACT Fuji electric first.

2 Check of unit

Before installation, check the following points.

(1) Whether the type, rated voltage, rated current, external dimensions and other specifications of the unit are as ordered.

(2) Whether all accessories are present, and their types and rated values are correct.

(3) Whether everything is free from damages caused during transportation, etc.

3 Type

RPW D 2 080 – 1 C N – N

(1) Type

Type	Code
PWM-APR series	RPW

(2) Phases

Phases	Code
Three phases	D

(3) Input voltage

Input voltage	Code
200 V – 220 V	2

(4) Output current

Output current	Code
40 A	040
80 A	080
160 A	160

(5) Circuit type

Circuit type	Code
Non-isolated step-down	1

(6) Regulation type

Regulation type	Code
AC voltage regulation + AC current limitation (AC AVR + AC CLR)	C

(7) Setting mode

Setting mode	Code
Current signal: 4 – 20 mA DC (automatic) Voltage signal: 1 – 5 V DC (automatic)	N
Rheostat (manual)	A
Two-position (H-L) control	B
Automatic control with gradient setting	C
Automatic-Manual control with gradient setting	E
Automatic-Manual control without gradient setting	F
Other current, voltage signals	Z

(8) Version

Version	Code
Standard	N
Special	Z

Accessories versus setting mode	
N	No accessories
A	Scale plate (setting), rheostat, knob, 1 each
B	Scale plate (HIGH setting, LOW setting), 1 each. Rheostat, knob 2 each.
C	Scale plate (gradient setting), rheostat, knob 1 each
E	Scale plate (gradient setting, setting), 1 each. Rheostat, knob, 2 each.
F	Scale plate (setting), rheostat, knob, 1 each

Accessories versus regulation type	
C	Scale plate (CLR setting), rheostat, knob, 1 each

Note: 1. The type symbol according to setting mode is designated according to the type and quantity only of accessories, and all main bodies have common specifications. Therefore, the unit proper remains unchanged regardless of any change of a standard setting mode given above.

4 Specifications

Type		RPWD2040-1C	RPWD2080-1C	RPWD2160-1C
Input	Phases	Three phases		
	Rated input voltage and frequency	200 V – 220 V AC, 50/60 Hz		
	Input voltage fluctuation	± 10% of rated input voltage		
	Frequency fluctuation	50/60 Hz ± 1 Hz		
	Capacity of control power supply	70 VA	110 VA	190 A
Output	Output current	40 A	80 A	160 A
	Cooling type	Air cooling		
	Applied load Note 1	Resistive load, inductive load, transformer primary regulation, rectifier primary regulation, capacitive load		
	Dissipation	600 W	1000 W	1800 W
Regulation function	Waveform control type	Sine wave output by PWM		
	Output voltage adjustable range	0 – 95% (to input voltage)		
	Gradient settable range	0 – 100% (to setting signal)		
	Setting signal	Rheostat: 1 kΩ, current signal: 4 - 20 mA DC (250 Ω)		
		voltage signal: 1 – 5 V (1 kΩ)		
	Soft start, soft up/down	1 sec		
	Feedback control Note 2	AC AVR + AC CLR		
Protective function	Load short-circuit: (1)	Protection by momentary current limitation		
	Overcurrent	Protection by current limitation (AC CLR)		
	Open/negative phases of source: (2)	Output stop		
	Heat sink overheat: (3)	Output stop (automatically recovered by soft start after cooling)		
	Input under-voltage	Output stop at -15% of rated value (automatically recovered by soft start after power recovery)		
	Alarm output ((1) above)	Red LED lighting, no-voltage contact closure command (contact capacity 220 V AC, 3 A)		
	Alarm output ((2) above)	Red LED lighting, no-voltage contact closure command (contact capacity 220 V AC, 3 A)		
	Alarm output ((3) above)	Yellow LED lighting, no-voltage contact closure command (contact capacity 220 V AC, 3 A)		
	Alarm output (IGBT error)	Green LED lighting, no-voltage contact closure command (contact capacity 220 V AC, 3 A)		
	Alarm reset	Reset of load short-circuit and open/negative phases of source		
Operating environment	Ambient temperature	- 10°C – 55°C (if 40°C is exceeded, current is reduced from rated value)		
	Storage temperature	- 20°C – 65°C		
	Relative humidity	30 - 90% RH (no condensing)		
	Atmosphere	Free from corrosive gas, dust and vibration		
	Altitude	1000 m max.		
Dielectric strength	Dielectric strength (from ground)	2 kV AC, 1 min (main circuit)		
	Insulation resistance (from ground)	20 MΩ min. by 500 V megger (main circuit)		

Notes 1. For the applied load, refer to precautions in 5.

2. AC voltage regulation (AVR) is performed upon detecting a maximum value out of output voltages across U-V, V-W and W-U.
AC current limitation (CLR) is performed upon detecting a maximum value out of load currents at U, V and W phases.

5 Precautions in use

5.1 Applied load

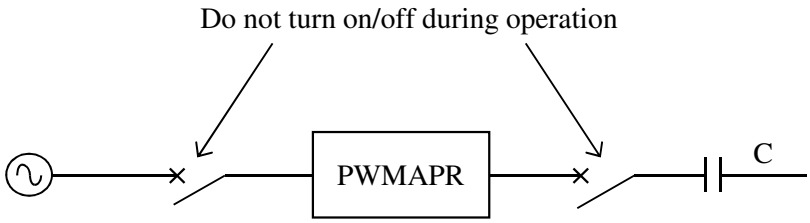
(1) Capacitive load

Under a capacitive load, a high frequency current shown in Table 1 flows.
Use a capacitive load upon checking the allowable value of high frequency current specified by the capacitor manufacturer.

Table 1 High frequency current flowing through load

Rated current of PWMAPR	High frequency current (rms)	Frequency	Remarks
40 A	Approx. 2.5 A	Approx. 16 kHz	At 50% output voltage
80 A	Approx. 5 A		
160 A	Approx. 10 A		

During the operation, refrain from turning on/off the circuits between power source and APR, and between APR and load. Otherwise, the voltage may rise in the APR, which may get troubled.



(2) Rectifier load

In case of rectifier load and capacitive input, the peak current must not exceed the peak value of rated current of PWMAPR.

Ip ≤ peak value ($80\sqrt{2}$ = 113 A if rated at 80 A) of rated current

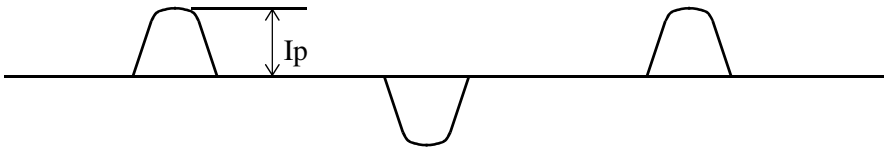


Fig. 2 Load current in case of rectifier load

5.2 Startup-shutdown sequence

At operation of PWMAPR, the startup-shutdown conditions are specified.
Carry out the operation in the following sequence. (Minimum time is shown.)

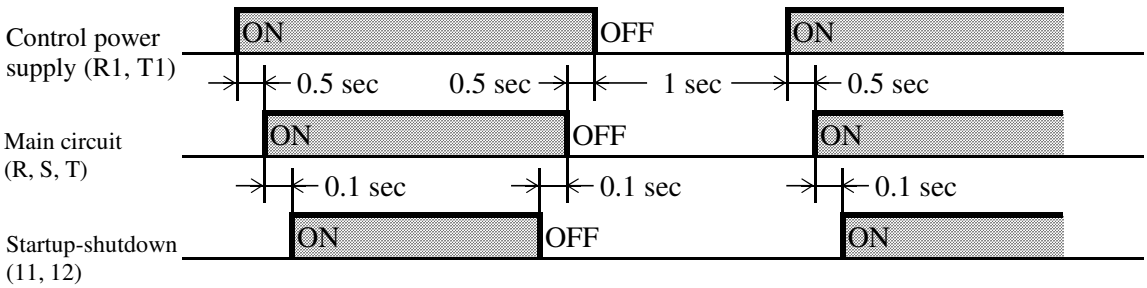


Fig. 3 Startup-shutdown sequence

5.3 Load short-circuit

The PWMAPR minimizes the output voltage immediately upon detecting any short-circuit of the load.
At this time, an alarm will be delivered, but the PWMAPR remains operating.
It holds a current limitation status although depending on the current intensity marked at the short-circuit. The normal status will be recovered when the load is not short-circuited any longer. Refer to Fig. 4.

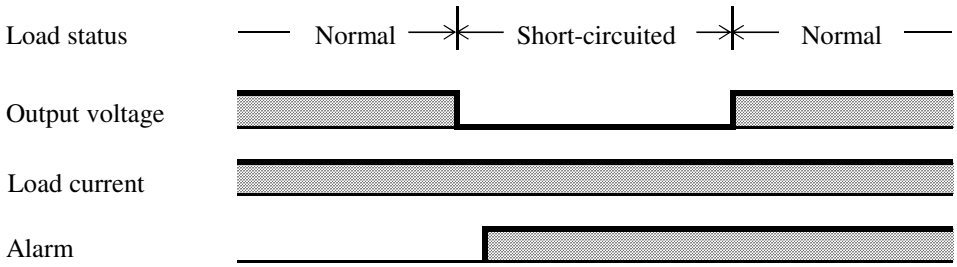
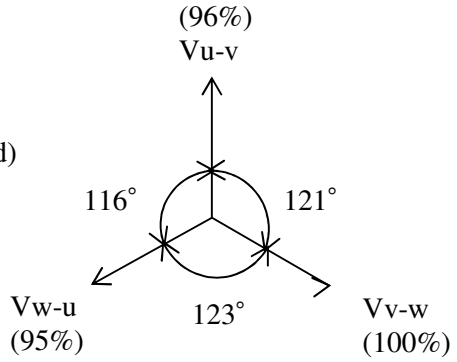


Fig. 4 Outputs and alarm at short-circuit of load

5.4 Unbalance of output voltages

There is several percent of unbalance in level between output voltage phases.
There is about 7° of difference in angle between output voltage phases.

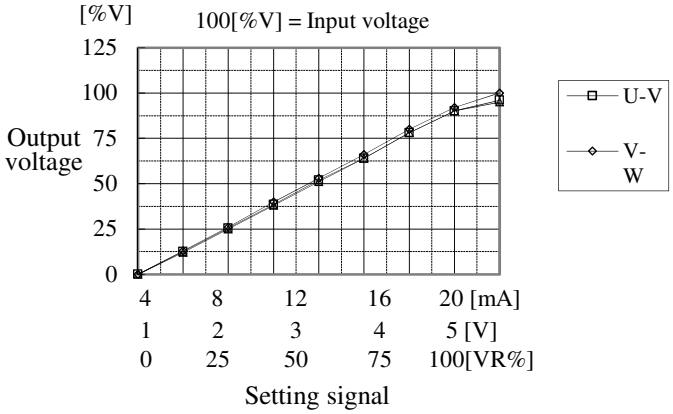
Typical (rated load, resistive load)



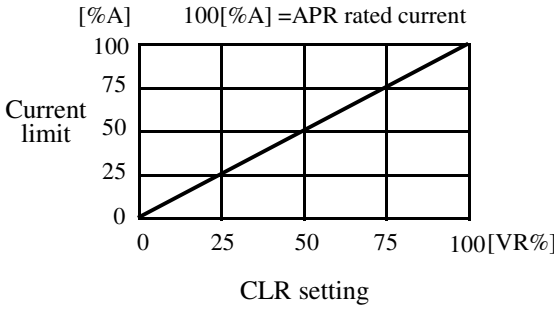
Design a transformer taking this point into account in case of transformer primary regulation.

6 Characteristics

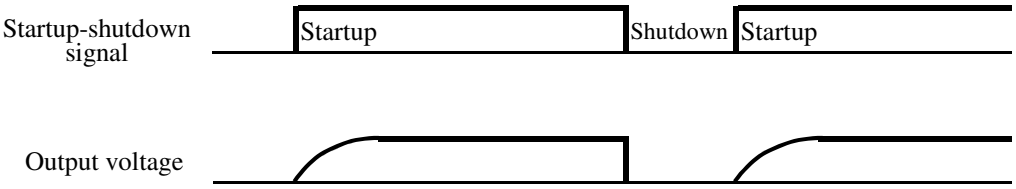
(1) Output voltage-to-setting characteristics (Note 1)



(2) Current limitation (CLR)-to-setting characteristics



(3) Startup-shutdown characteristics



(4) Voltage regulation (AVR) accuracy (resistive load)

Fluctuation factor	Regulation accuracy	Condition
Source voltage fluctuation ± 10%	± 1 %	Load constant, output voltage 50% or higher
Load fluctuation 10 times	± 1 %	Source voltage constant, output voltage 50% or higher
Temperature change 0 - 40°C	± 1 %	Load constant, source voltage constant, output voltage 50% or higher

(5) Current limitation (CLR) accuracy (resistive load)

Fluctuation factor	Regulation accuracy	Condition
Source voltage fluctuation ± 10%	± 1 %	Load constant, output voltage 50% or higher
Load fluctuation 10 times	± 2 %	Source voltage constant, output voltage change 100% → 10%

Note: 1. The output voltage-setting characteristics are factory adjusted at 220 V of input voltage. If the rated voltage is 200 V, the output voltage becomes MAX. when the setting signal is about 90%. If you desire to have a MAX. output voltage at 100% of setting signal, adjust (approx. 90%) the gradient setter.

7 Installation

⚠ CAUTION

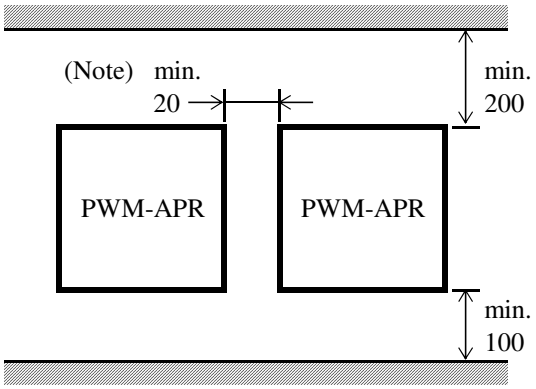
- The unit weight exceeds 20 kg. Requires two or more persons to lift.
- Install the unit in a specified posture (arrow UP-ward).
- Select a place where environmental conditions (temperature, humidity, dust, spacing, vibration, etc.) are cleared.
- Install the unit on a nonflammable material such as metal.
- Do not install the unit near combustible materials.
- Mount the unit on a place that bears it with specified screws and according to specified torque.
- After installation, make sure screws, tools, etc. are not left.
- Do not install nor operate an APR that is damaged or whose part is missing. Otherwise, fire or injury may be caused.

(1) Install the unit in a place free from dust and where the cooling is effective.

(2) Above and below the main body, secure spaces necessary for radiation.
If two or more units are installed above one another, arrange so that the heat underneath will not affect upper units.

Secure sufficient spaces vertically and sidewise

Note: We recommend you to secure at least 50 mm of space for maintenance and checkup.



Unit: mm

(3) A humidity of 30 to 90%RH (no condensing) is recommended for operation.

(4) Contact us if the unit must be installed in a place exposed to corrosive gases (sulfur dioxide, chlorine, etc.) or suffering from salt.

(5) Do not install the unit where the temperature may rise excessively.
(Maximum allowable temperature inside is 55°C.)

(6) The ambient temperature for rated current is 40°C.
As the temperature exceeds 40°C, the allowable current reduces.

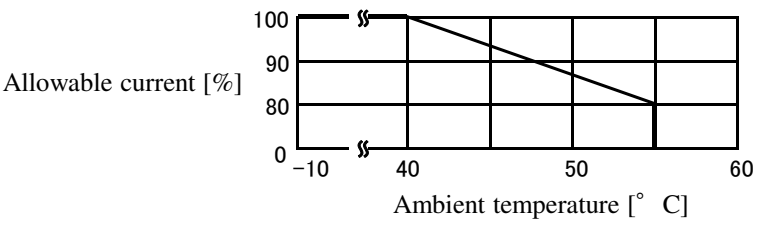
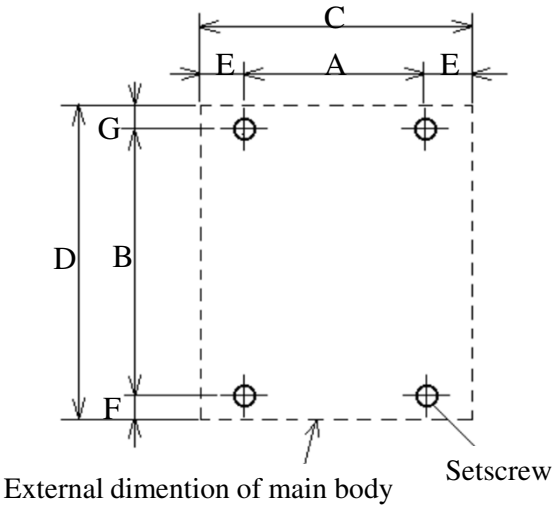


Fig. 5 Allowable current versus ambient temperature

8 External dimensions

(1) Mounting pitches (drilling)

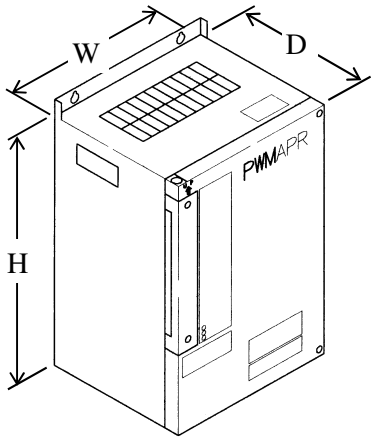


Unit: mm

Dimention	40 A	80 A	160 A
A	220	370	520
B	520	578	638
C	300	470	620
D	540	600	660
E	40	50	50
F	10	10	10
G	10	12	12
Setscrew	M8	M10	M10

Fig. 6 Mounting pitches

(2) External dimensions and weight



Unit: mm

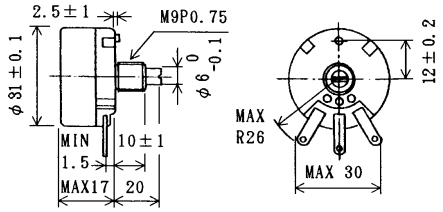
Dimention	40 A	80 A	160 A
W	300	470	620
H	540	600	660
D	335	285	285
Weight	35 kg	55 kg	75 kg

Fig. 6 External dimentions

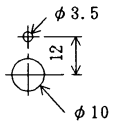
(3) Accessories

Setter (used for setting mode "rheostat setting, two-position control, gradient setting")

1 Rheostat

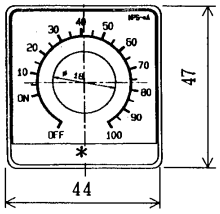


Panel cutout



Rated value
1 kΩ, 10 kΩ 2.5W
Type
RA30YN20SBJ

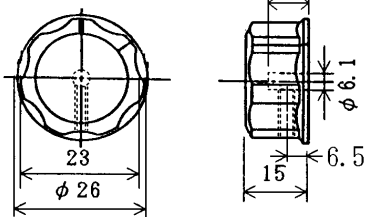
2 Scale plate



t - 0.5

Setting mode	Name at "*"	Type
Rheostat	Setting	NPS-MX
H setting for two-position control	HIGH setting	
L setting for two-position control	LOW setting	
Gradient setting	Gradient setting	
Current limit setting	CLR setting	

3 Knob



Screw: M4

Type
CM-2S

Note: The rheostat, scale plate and knob are furnished as a set.

⚠ WARNING

- Connect the ground terminal.
- Before connection, make sure the input power supply (main circuit and control power supply circuit) is turned off.
- After installing the APR, carry out wiring and tighten screws for the main circuit. Make sure the screws are tightened properly.
- Use wires that clears the operating conditions. Otherwise, electrical shock or fire may be caused.

⚠ CAUTION

- Make sure the power supply voltage coincides with the rated input voltage for the unit.
- Do not confound the input terminal and output terminal (never connect wrongly).
- Double check the connections of control circuit.
- Tighten screws to a specified torque.
- Never apply the main circuit voltage to the control circuit (except power supply).
- Do not pinch a finger when opening or closing the front door of the main body. Otherwise, fire or injury may be caused.

9.1 Connecting terminal block position, applied wire size and tightening torque

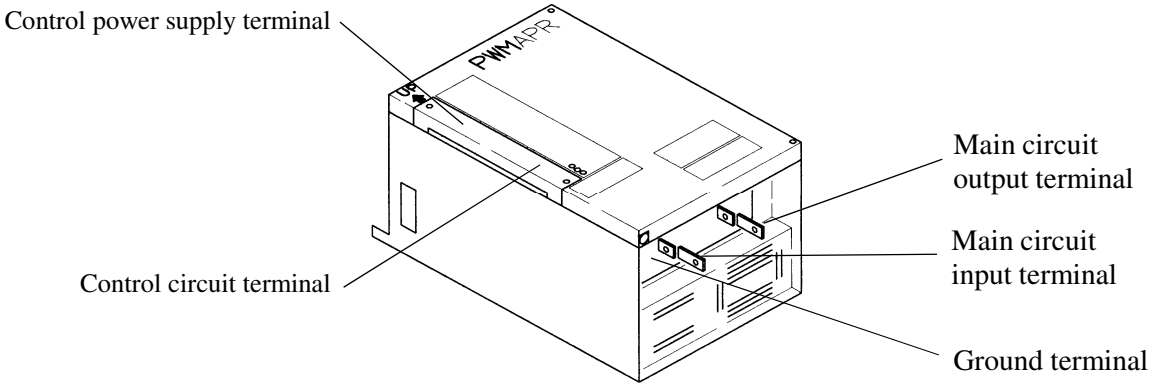
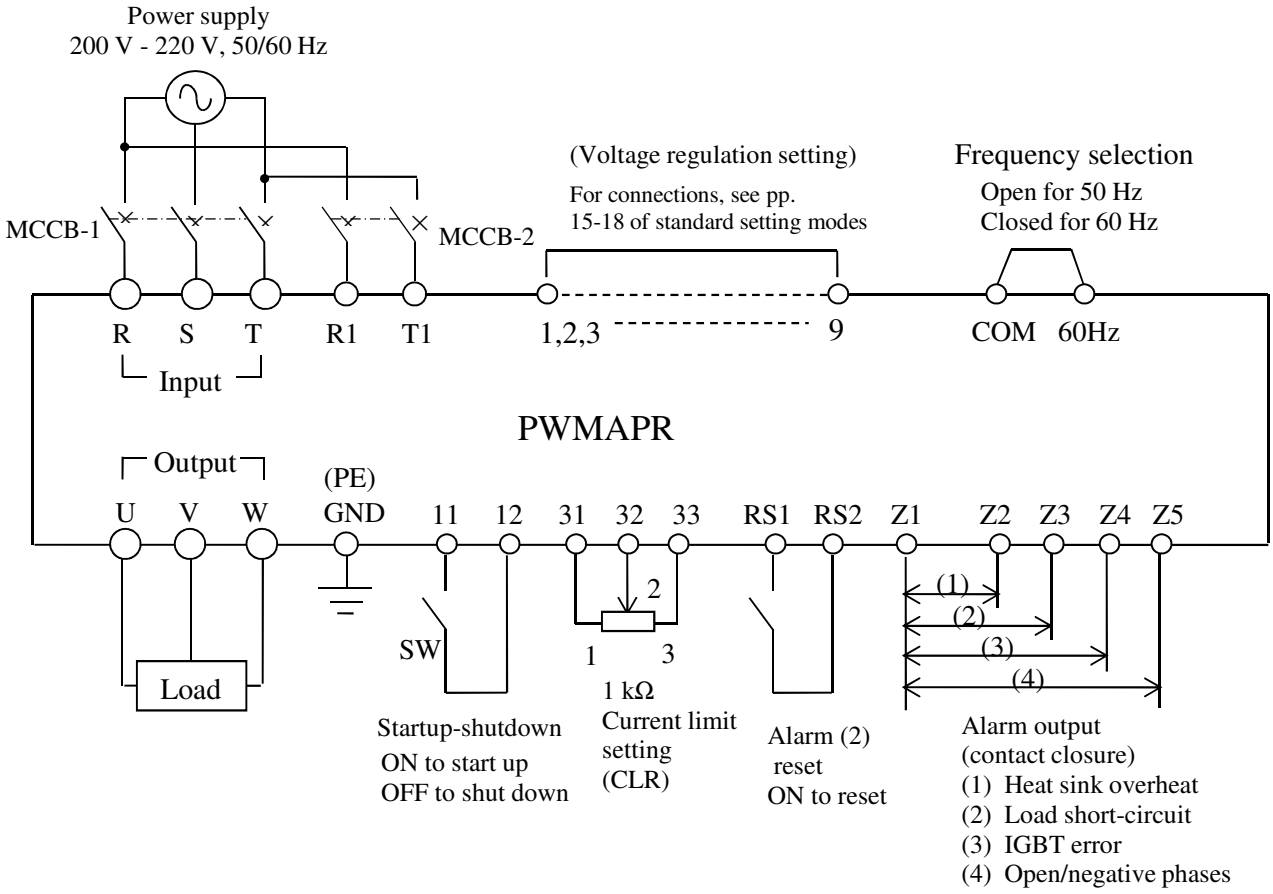


Table 2 Applied wire size and tightening torque for each terminal

Terminal		Applied wire size	Tightening torque [N•m] ± 10%		
			40 A	80 A	160 A
Main circuit	R, S, T, U, V, W	Depends on rated capacity of APR	5.7 (58 kgf.cm)	13.3 (135 kgf.cm)	26.5 (270 kgf.cm)
Ground	GND(PE)	Depends on rated capacity of APR	5.7 (58 kgf.cm)	13.3 (135 kgf.cm)	26.5 (270 kgf.cm)
Control power supply	R1, T1	1.25 mm^2 min.	1.72 (18 kgf.cm)		
Control circuit	Others	0.3 - 0.75 mm^2	1.72 (18 kgf.cm)		
Main body setscrew		———	13.3 (135 kgf.cm)		



Note: 1. Turning on/off of main circuit breaker (MCB-1), control power supply breaker (MCB-2) and startup-shutdown signal (SW) must follow a specified sequence. Refer to 5.2 (P. 5)

Fig. 8 Overall connection diagram

Table 3 Functions of connecting terminals

Symbol	Function, rating	If unconnected
R, S, T	Main circuit input terminal	No operation
U, V, W	Main circuit output terminal	Can check how output voltage varies.
GND (PE)	Ground terminal	Operates (Note 1).
R1, T1	Control power supply terminal (Note 2)	No operation
1, 2, 3	Input terminal for setting mode A (rheostat setting) • Connected rheostat: 1 kΩ, 2.5W • 1 – 3 (+): 10 V • 1 – 2 input resistance: 10 kΩ	No output voltage developed.
4, M0	Input terminal for setting mode N (current signal setting) • 4-M0 input resistance: 250 Ω (5-M0 closed)	No output voltage developed.
5, M0	Input terminal for setting mode N (voltage signal setting) • 5-M0 input resistance: 1 kΩ (4 – 5 closed)	No output voltage developed.
4A, MA	Output terminal for several APRs for parallel run (current signal/voltage signal) • 4 A (+)-MA: 5 V (20 mA/5 V)	No output voltage developed. (2nd unit and on)

Symbol	Function, rating	If unconnected
7, 8	Selects setting mode N (current signal/voltage signal) • 7 – 8 closed (10 V DC, 0.5 mA)	No output voltage developed.
8, 9	Selects setting mode A (rheostat) • 8 – 9 closed (10 V DC, 0.5 mA)	No output voltage developed.
1 A, 2 A, 3 A	Input terminal for gradient setter • 10 V at 1A-3A (-):	No output voltage developed.
11, 12	Startup-shutdown command • 11 – 12: Open for shutdown, closed for startup. 15 V DC, 4 mA.	Shutdown status (no output voltage).
31, 32, 33	Current limit setting (CLR setting) • Connected rheostat: 1 kΩ, 2.5 W • 10 V DC at 31-33 (-)	Current limit set at 100%.
COM, 60 Hz	Frequency selection • COM-60Hz: Open for 50 Hz, closed for 60 Hz	Operation for 50 Hz. If operated at 60 Hz, load current is distorted.
RS1, RS2	Reset terminal for "load short-circuit" • Reset if closed at RS1 - RS2 (5 V DC, 3 mA)	No reset.
Z1, Z2	Alarm contact for "heat sink overheat" • Z1 – Z2 closed at alarm • Automatically opens after cooling • Contact capacity: 220 V, 3 A	No alarm is delivered. LED lights at alarm.
Z1, Z3	Alarm contact for "load short-circuit" • Z1 – Z3 closed at alarm, open after reset • Contact capacity: 220 V, 3 A	No alarm is delivered. LED lights at alarm.
Z1, Z4	Alarm contact for "IGBT error" • Z1 – Z4 closed at alarm • To reset, turn off control power supply • Contact capacity: 220 V, 3 A	No alarm is delivered. LED lights at alarm.
Z1, Z5	Alarm contact for "open/negative phases" • Z1 – Z5 closed at alarm • Contact capacity: 220 V, 3 A	No alarm is delivered. LED lights at alarm.

Notes 1. Be sure to perform grounding for securing the safety.
2. The control power supply terminal (R1, T1) need not be synchronized with the main circuit.

9.3 Wiring

1) Refer to Fig. 8 for connections of main circuit and control circuit.
2) According to a particular setting mode, select connections out of pages 15 to 18.
This setting mode constitutes setting for regulated output voltage.
3) For opening/closing the startup-shutdown network, setting signal selection circuit, reset circuit and other signal circuits, use dependable relays (gold-plated, for ex.) capable of making and breaking voltages and currents given in Table 3.
4) The main circuit, control power supply circuit and startup-shutdown circuit must follow a specified sequence. To constitute a proper sequence, design a proper circuitry referring to page 5.

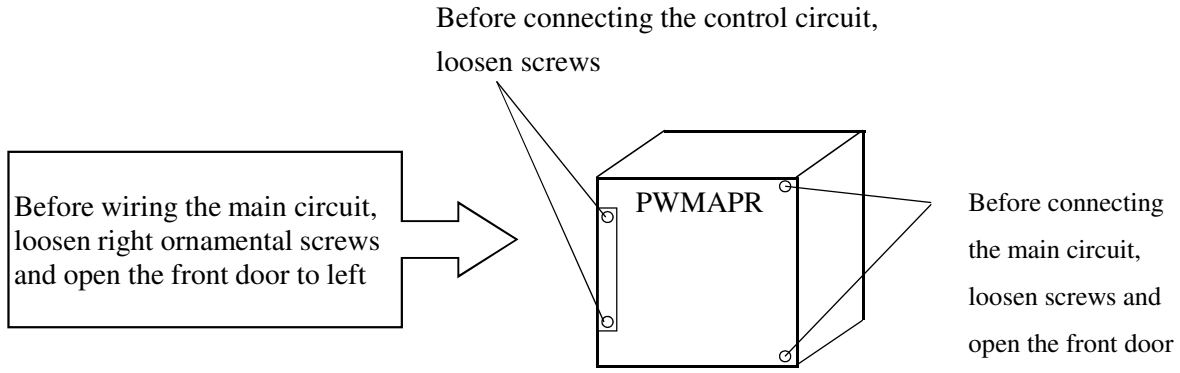


Fig. 9 Screws to be loosened before wiring

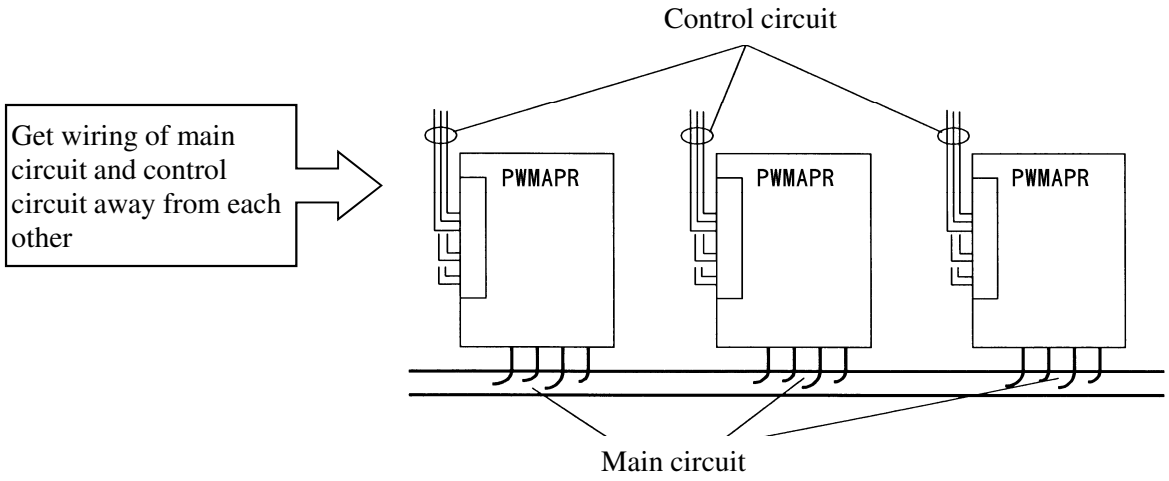


Fig. 10 Wiring method for main circuit and control circuit

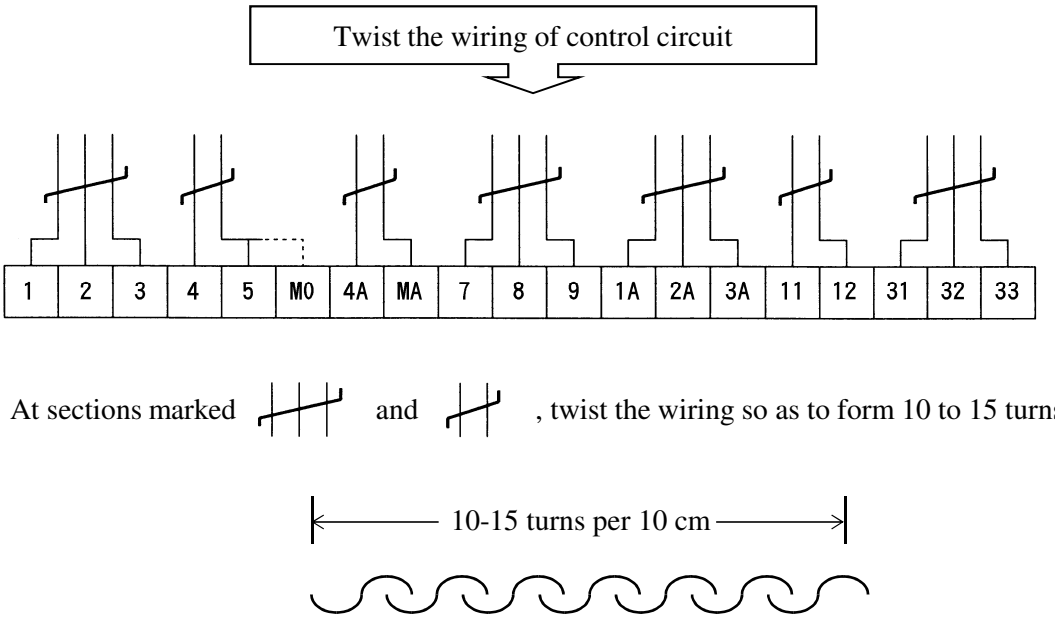
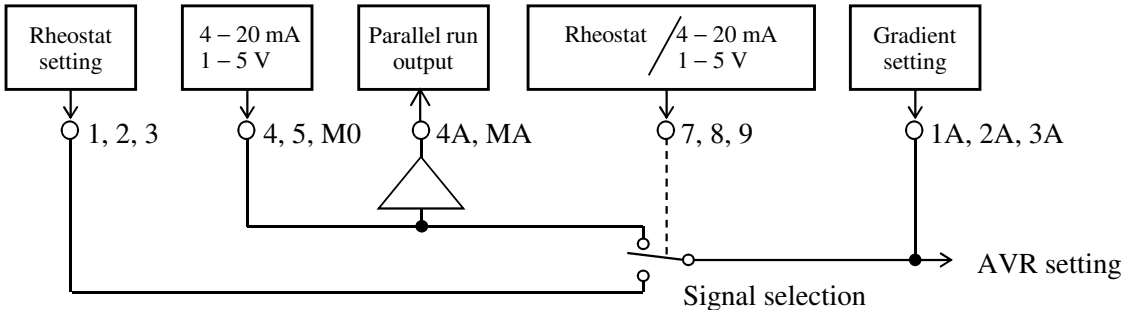


Fig. 11 Twisting the control circuit

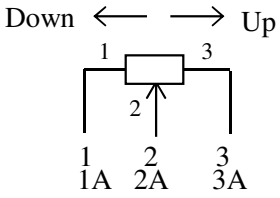
9.5 Connection diagram according to standard setting modes

1) The connection diagram shown below is for a circuit where The APR output voltage is set by external current/voltage signals. Such setting modes are for voltage regulation setting (AVR).
2) The internal functions of APR by standard setting modes are outlined below.

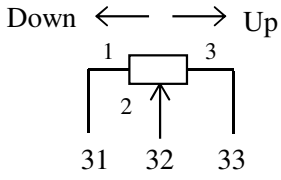


3) The increase and decrease directions of rheostat setter, gradient setter and current limit setter are as follows.

Rheostat setter, gradient setter (1 kΩ)

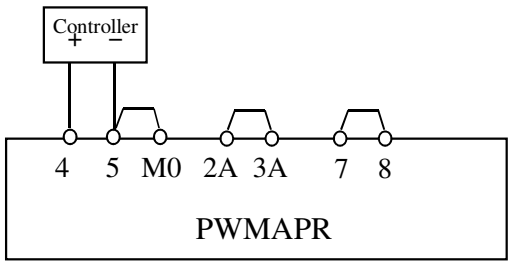


Current limit setter (1 kΩ)

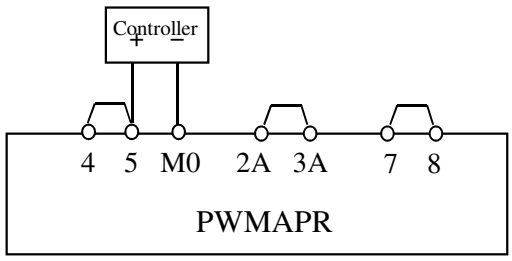


CAUTION	These are input/output circuits for signals. Never apply 100 V, 200 V or other main circuit voltage.

Standard current signal / 4 – 20 mA	Setting mode N	Standard current signal / 1 – 5 V	Setting mode N



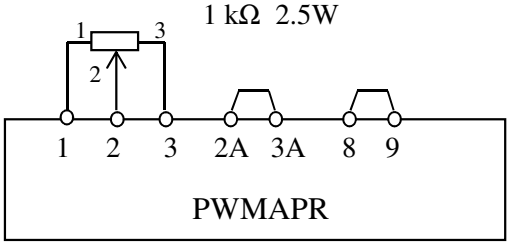
Internal resistance of APR as viewed from controller is 250 Ω

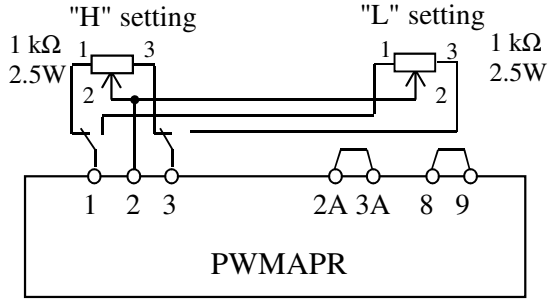


Internal resistance of APR as viewed from controller is 1 kΩ

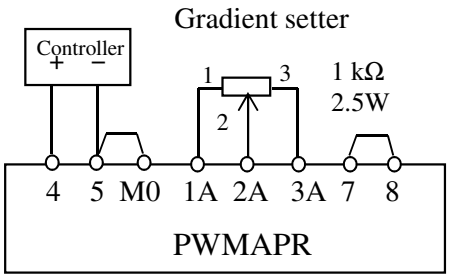
Manual setting (rheostat setting)	Setting mode A	Two-position (H-L) control	Setting mode B

Rheostat setting



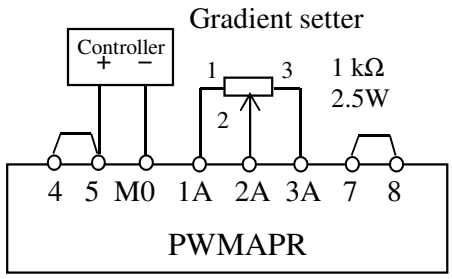


Standard current signal / 4-20 mA with gradient setter	Setting mode C



Internal resistance of APR as viewed from controller is 250 Ω

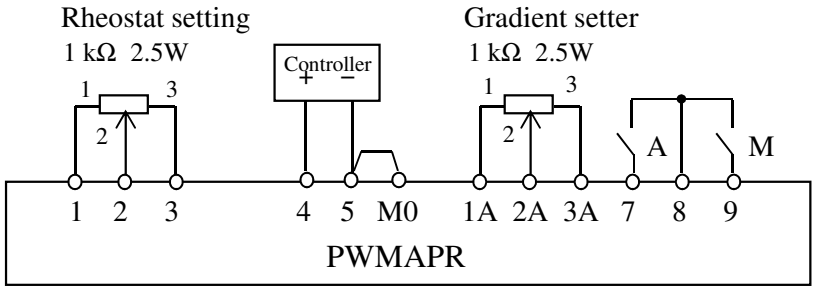
Standard current signal / 1-5 V with gradient setter	Setting mode C



Internal resistance of APR as viewed from controller is 1 kΩ

Manual-Automatic changeover with gradient setter / Automatic: 4-20 mA / Manual: Rheostat setting	Setting mode E

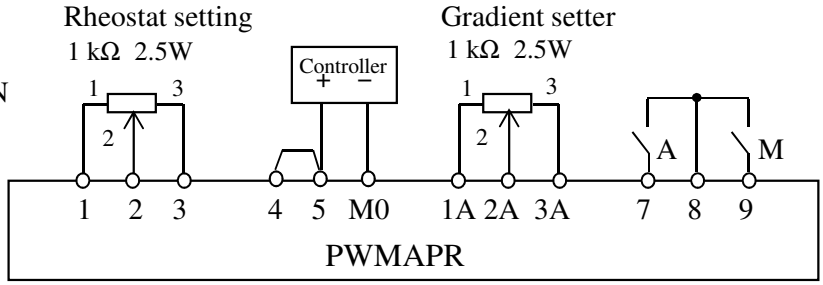
Manual: M contact ON
Automatic: A contact ON



Internal resistance of APR as viewed from controller is 250 Ω

Manual-Automatic changeover with gradient setter / Automatic: 1-5 V / Manual: Rheostat setting	Setting mode E

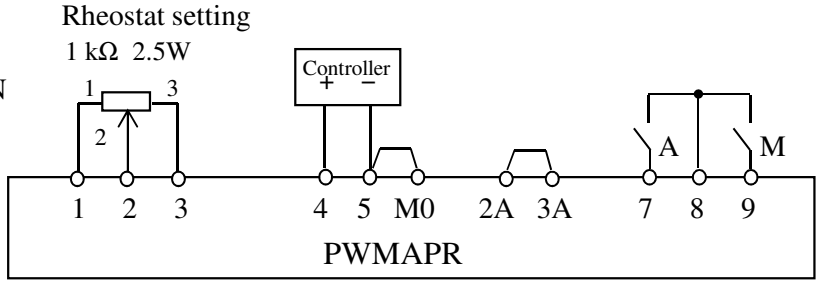
Manual: M contact ON
Automatic: A contact ON



Internal resistance of APR as viewed from controller is 1 kΩ

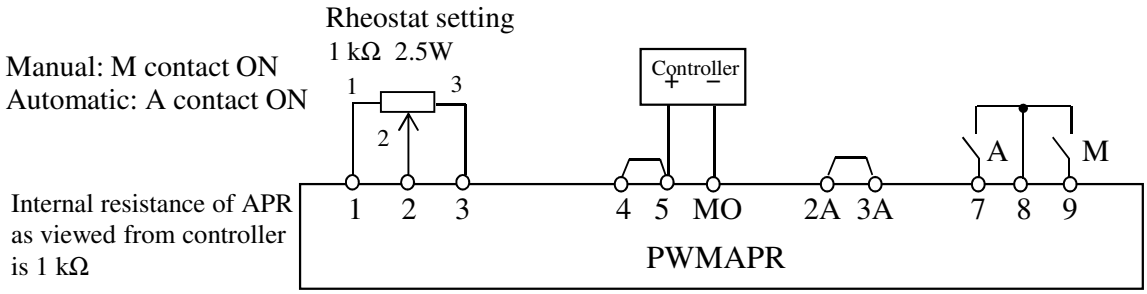
Manual-Automatic changeover / Automatic: 4-20 mA / Manual: Rheostat setting	Setting mode F

Manual: M contact ON
Automatic: A contact ON

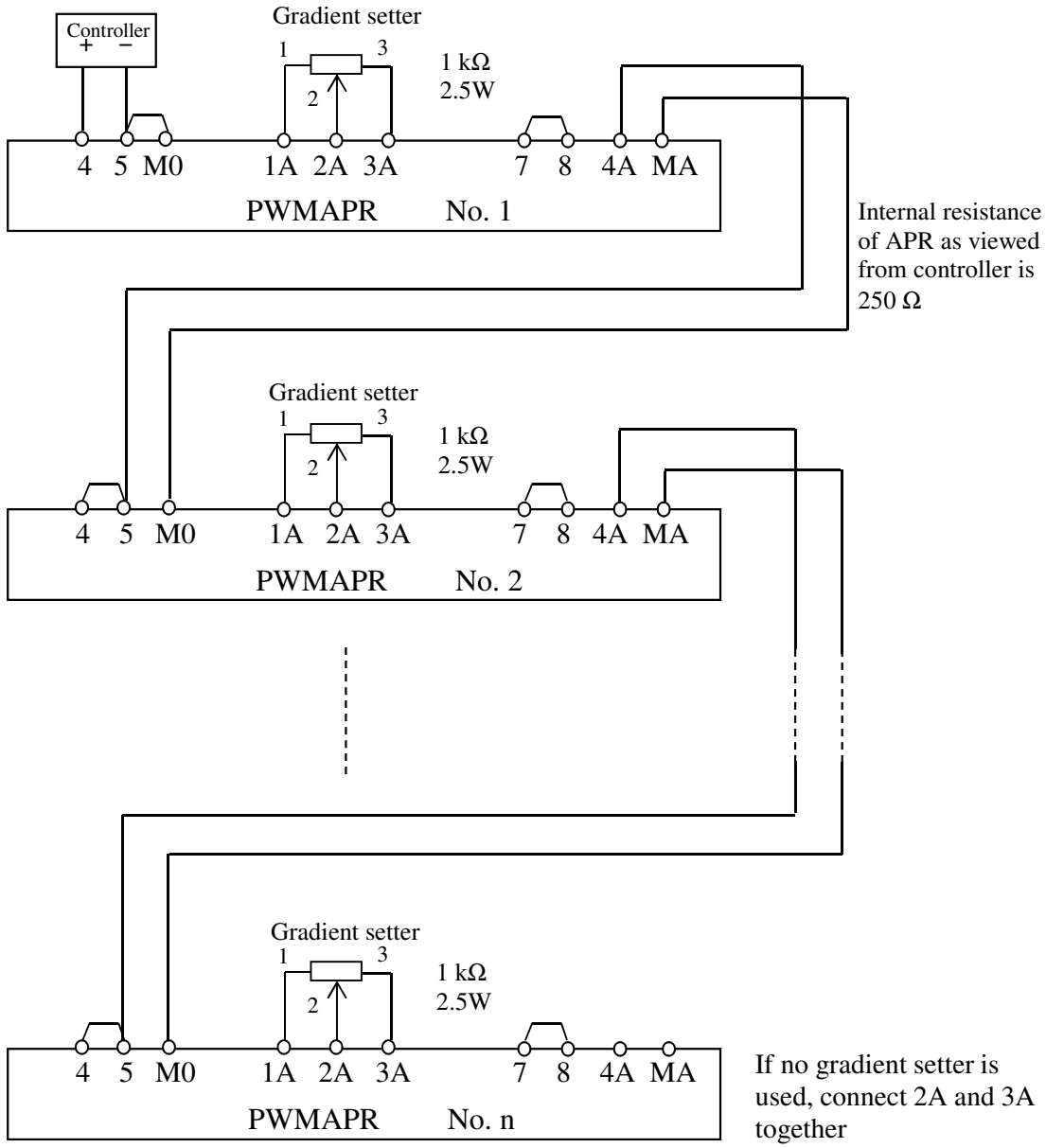


Internal resistance of APR as viewed from controller is 250 Ω

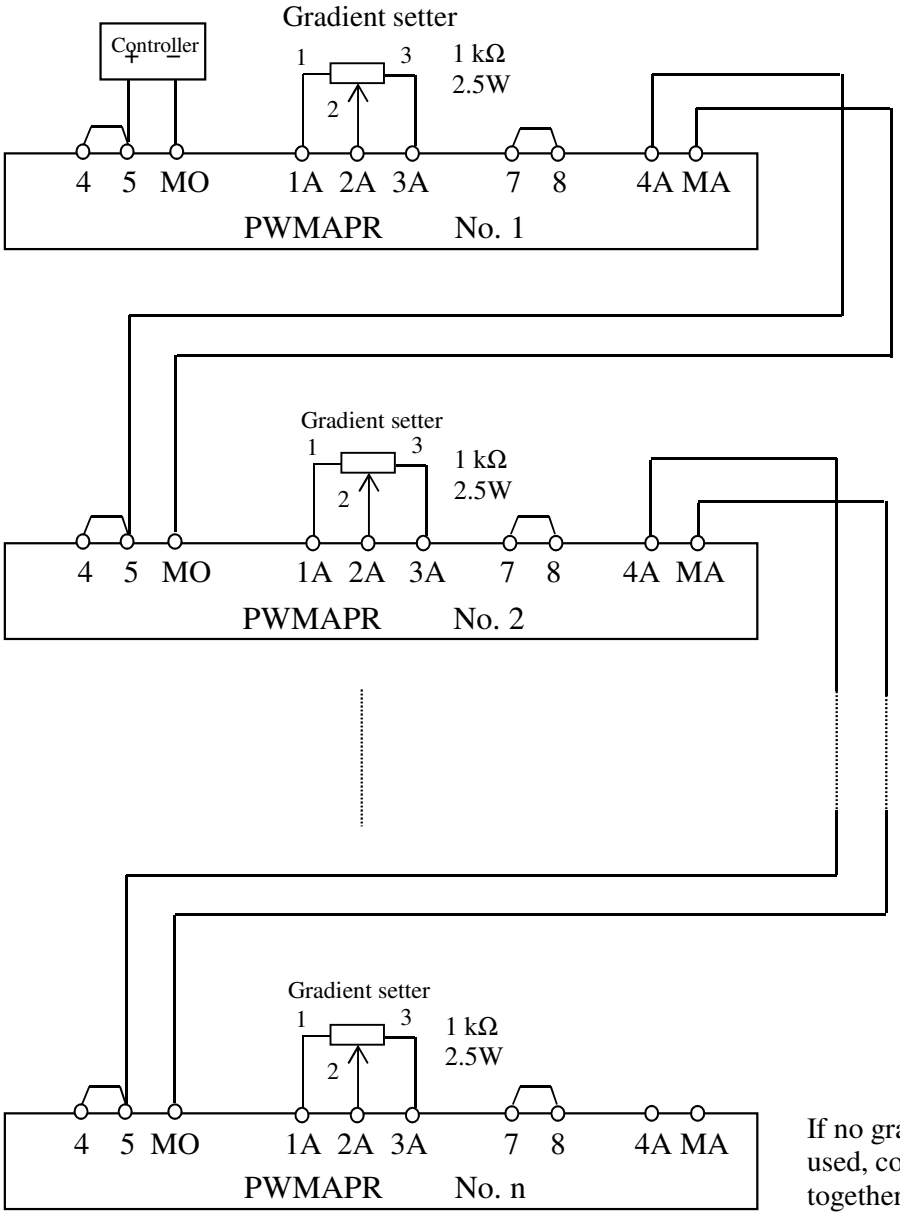
Manual-Automatic changeover / Automatic: 1-5 V / Manual: Rheostat setting	Setting mode F



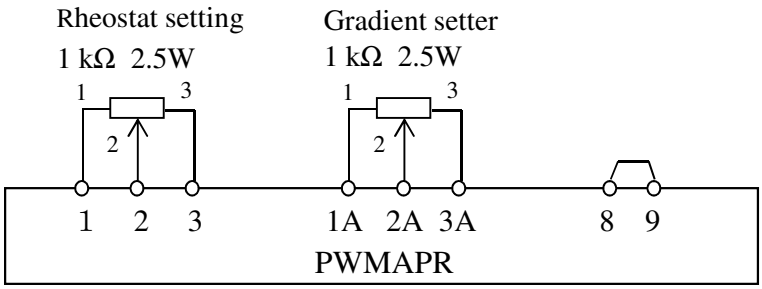
Parallel run of 2 or more units by single controller / Standard current signal / 4-20 mA with gradient setter



Parallel run of 2 or more units by single controller / Standard voltage signal / 1-5 V with gradient setter



Manual setting (rheostat setting) with gradient setter



10 Running

WARNING

- Carefully check the installation and connections so that wiring is not left unconnected nor wrong nor precarious.
- Turn on power only after closing the front door and tightening the screws. Do not open the front door while power is applied.
- Do not allow water or other liquids to drip on the APR.
- Put nothing on the APR. Also, make sure nothing is left there.
- If an alarm has been produced, or if unusual odor or other anomalies have been recognized, turn off power according to the shutdown sequence. If alarm or other anomalies recur, and if they cannot be located, contact the sales agent or our business office. Otherwise, electrical shock or fire may be caused.

CAUTION

- Do not touch a cooling fan that is running. Otherwise, you may get injured.

Now that the unit has been installed and wired, carry out the following preparations.

(1) Carefully check the installation and connections so that wiring is not left unconnected nor wrong nor precarious. Otherwise, erratic operation or trouble may be caused.

(2) The adjusting rheostats in the APR are factory adjusted, and must not be tampered with. Otherwise, erratic operation or trouble may be caused.

(3) Make sure the input voltage of the main circuit and voltage of the control power supply circuit are the same as the rated values of the APR.

(4) Make sure the load is not above the rated value of the APR.

(5) The output voltage can be adjusted under no load on this APR unlike conventional thyristor type. We recommend you to carry out an initial energization test under no load.

11 Maintenance and checkup

WARNING

- Before checkup, turn off the main circuit power supply, control power supply and power supply for the control circuit.
- Discharge or separate any load (capacitor, battery, etc.) where energy is accumulated.
- Using a circuit tester, make sure no voltage is present on any terminals.
- Only qualified persons are allowed to proceed to maintenance or checkup, or replace parts. Parts must be replaced with designated ones.
  [When working, use isolated tools and detach metallic objects (watch, ring, etc.)]
- Never remodel the unit. Otherwise, electrical shock or fire may be caused.

(1) Occurrence and remedy of anomaly

If an anomaly has occurred, LED and relay operate. Table 4 indicates alarm actions and details.

Table 4 Alarm indication and remedy

Alarm item	LED indication	Relay output	Remedy
Load short-circuit	Red	Z1-Z3 ON	Remove short-circuit status from load
Open/negative phases	Red	Z1-Z5 ON	Connect phases correctly
Heat sink overheat	Yellow	Z1-Z2 ON	• Check the rated current-ambient temperature • Check the cooling fan
IGBT error	Green	Z1-Z4 ON	Contact us

Notes 1. When the heat sink has cooled, the "heat sink overheat" alarm will automatically be reset, and the output voltage will reappear. However, check whether or not the current is within the allowable range against the rated current versus ambient temperature diagram (Fig. 5). Also, the alarm may occur if the cooling fan is faulty.

2. "IGBT error" alarm may be attributable to an error of the APR. In such a case, contact us.

(2) Quick fuse blown

A quick fuse is located upstream the main circuit in the main unit. Nothing is indicated when the fuse is blown. It will blow by anomaly in the main unit unless used for a long time. In such a case, contact us. A new fuse replaced with without notifying us may soon blow.

(3) Periodic replacement of parts

The life of the cooling fan is relatively short. Its periodic replacement is advised. The life is about three years of continuous operation at ambient temperature of 40°C. How to replace the cooling fan is depicted in Fig. 17.

[How to replace cooling fan]

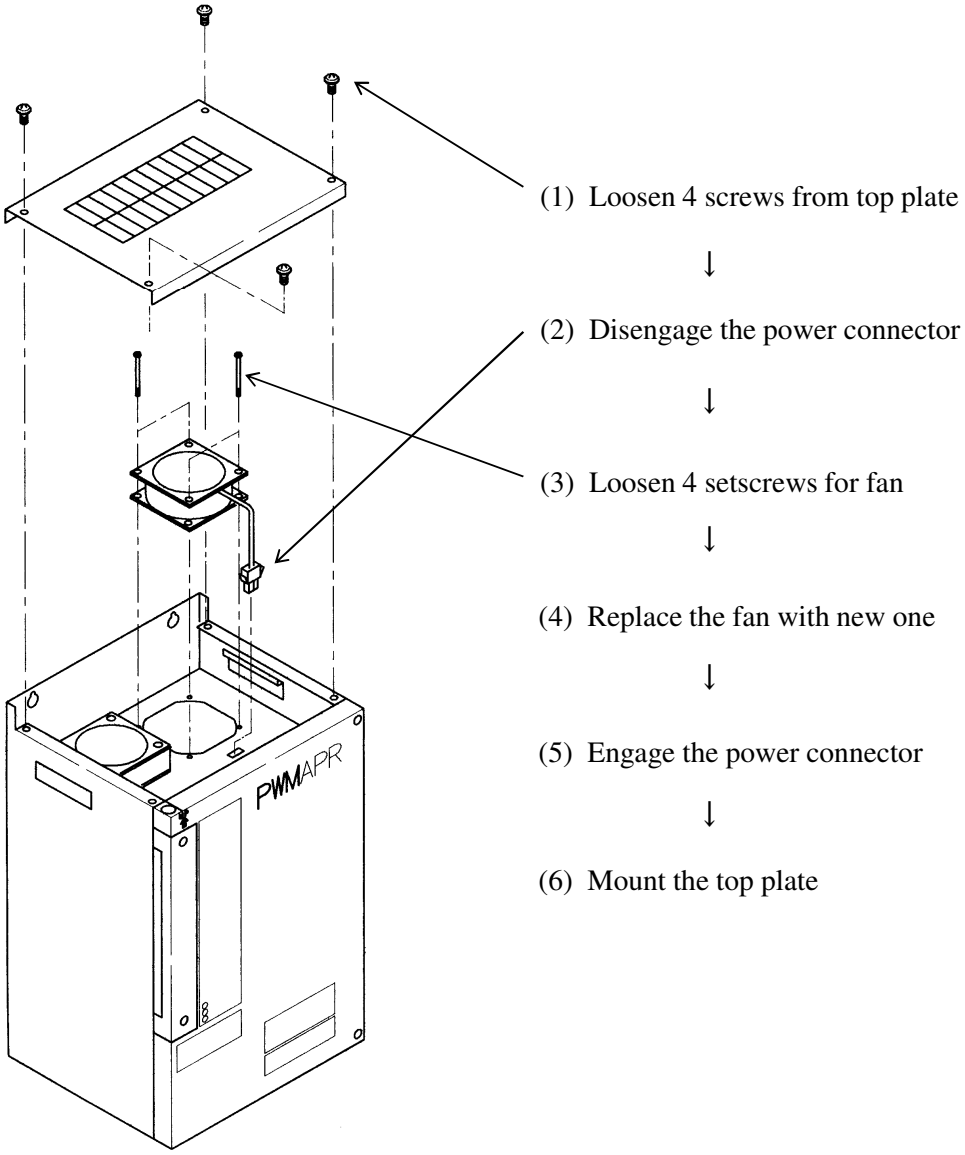
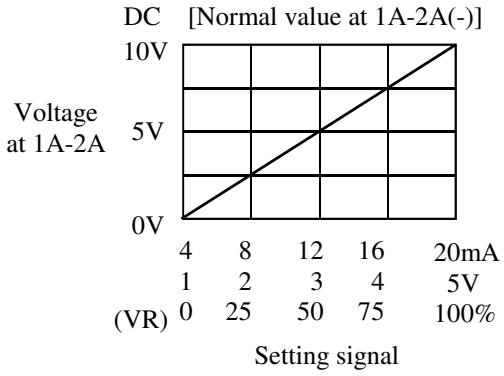
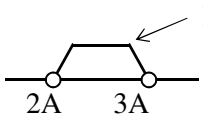
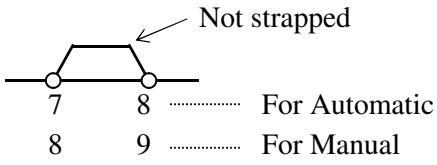


Fig. 12 How to replace cooling fan

12 Trouble shooting

The trouble shooting given below is based on single symptom and cause.

The description may not necessarily apply if there is more than one cause.

Symptom 1	Output would not appear		
No.	Cause	Remedy	See:
1	Control power supply is not connected	Connect R1 and T1 to control power supply	p. 13
2	Start signal is absent	Apply ON signal to 11-12 of control circuit	p. 13
3	Setting input signal is absent	(1) Check the value of external signals of controller, etc. (2) Check the rheostat and gradient setter proper, and their connections (3) Check the control terminal 1A-2A(-) 	p. 16 - 19
4	Wiring for particular setting mode is left unconnected or wrong	Perform wiring correctly for particular setting mode Wiring easy to be overlooked (1) In case gradient setter is unnecessary  (2) Manual-Automatic left unselected 	p. 16 - 19
5	Alarm being delivered	Remedy faulty status, and reset the alarm (RS1 - RS2 ON)	p. 14
6	Current limit is set at 0%	Set the current limit to match the load	p. 16
7	Any phase is left open	Restore normal status	p. 14
8	Phase sequence is negative	Restore normal status	p. 14

Symptom 2	Output would not stop		
No.	Cause	Remedy	See:
1	Setting input signal is left applied	(1) Check the value of external signals of controller, etc. (Same as 3 in Symptom 1)	p. 16 - 19
2	Wiring for particular setting mode is wrong	Perform wiring correctly for particular setting mode	p. 16 - 19
3	IGBT in main circuit is short-circuited	Contact us	

Symptom 3	Output would not change in proportion to setting		
No.	Cause	Remedy	See:
1	Wiring for particular setting mode is wrong	Perform wiring correctly for particular setting mode	p. 16 - 19
2	Checked by current limit	Change the current limit or load	p.16

Symptom 4	Load voltage is not sinusoidal		
No.	Cause	Remedy	See:
1	Load is short-circuited	Remedy short-circuited status	p. 7
2	Source frequency is not set for control circuit	Open COM-60Hz for 50 Hz of source frequency Close COM-60Hz for 60 Hz of source frequency	p. 13

13 Guarantee period

The product is strictly factory tested and inspected. However, if any point is faulty or dubious, contact the shop you purchased it from or our local business office.

Guarantee period: For one year after purchase

14 Discarding

Should the case arise, entrust a specialized agent for discarding the product as industrial waste.

Note: If you have any unclear or ambiguous points for handling of the product, contact the shop you purchased it from or our local business office.
The description in the manual is subject to change without prior notice.