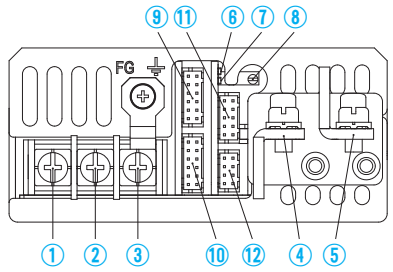
Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current [A]	Rated input fuse	Inrush current protection circuit	PCB/Pattern			Series/Parallel operation availability	
						Material	Single sided	Double sided	Series operation	Parallel operation
PCA600F	Active filter	15 - 400	7.3	250V 16A	Relay	FR-4	-	Yes	Yes	Yes
	Buck converter	88								
	Full - bridge converter	44								

* The value of input current is at ACIN 100VAC and rated load.

1 Terminal Blocks

● PCA600F



①AC (L) } Input Terminals 85 - 264VAC 1φ45 - 66Hz
②AC (N) } (M4)
③Frame ground (M4)
④–Output
⑤+Output
⑥LED for fault condition detection (ALARM)
⑦LED for output voltage confirmation (DC_OK)
⑧Output voltage adjustable potentiometer
⑨CN1
⑨CN2
⑩CN3 } Connectors
⑨CN4

∗ Please refer to optional parts for the exclusive harness.

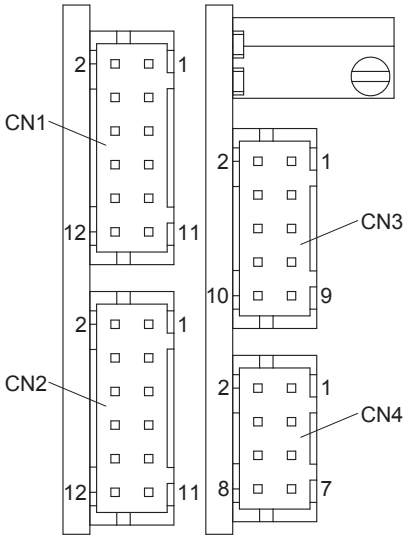


Fig.1.1 Connector pin numbers

Table 1.1 Pin Configuration and Functions of CN1, CN2

Pin No.	Function		Ground level
1	+S	+Remote sensing	COM
2	N.C.	No connection	-
3	N.C.	No connection	-
4	-S	-Remote sensing	COM
5	VTRM	Adjustment of output voltage	COM
6	COM	Common ground (for signal)	COM
7	INFO	Extended UART signal	SGND
8	CM	Current Monitor	COM
9	MS	Master Slave signal	SGND
10	SGND	Signal ground	SGND
11	RC2	Remote ON/OFF	RCG
12	RCG	Remote ON/OFF ground	RCG

∗ Each terminal of CN1 and CN2 are connected inside the power supply.

Table 1.2 Pin Configuration and Functions of CN3

Pin No.	Function		Ground level
1	AUX	Auxiliary output	AUXG
2	AUXG	Auxiliary output ground	AUXG
3	RC1	Remote ON/OFF	AUXG
4	AUXG	Auxiliary output ground	AUXG
5	PG	Alarm	PGG
6	PGG	Alarm ground	PGG
7	ITRM	Adjustment of output current	COM
8	COM	Common ground (for signal)	COM
9	VTRM_EN	Enable Vtrm	COM
10	SLV_EN	Enable Slave mode	COM

Table 1.3 Pin Configuration and Functions of CN4

Pin No.	Function		Ground level
1	N.C.	No connection	-
2	SGND	Signal ground	SGND
3	N.C.	No connection	-
4	N.C.	No connection	-
5	ADDR0	Address bit 0	SGND
6	ADDR1	Address bit 1	SGND
7	ADDR2	Address bit 2	SGND
8	SGND	Signal ground	SGND

Table 1.4 Matching connectors and terminals

Connector		Housing	Terminal	Mfr.
CN1	S12B-PHDSS	PHDR-12VS	Reel : SPHD-002T-P0.5 Loose : BPHD-001T-P0.5 ∗1 BPHD-002T-P0.5 ∗1	J.S.T
CN2				
CN3	S10B-PHDSS	PHDR-10VS		
CN4	S8B-PHDSS	PHDR-8VS		

∗1 The manufacturer prepares only the ratchet hand.

2 Wiring Input / Output Pin

2.1 Wiring input pin

(1) Fuse

■For the PCA series, AC(L) and AC(N) both have a fuse built in.

(2) Wire

■Please use an electric wire that is both as thick and short as possible.

■Noise could be improved if the wire is twisted. In addition, please be sure the input line and the output load are separated.

(3) Ground

■When installing the power supply with your unit, ensure that the input FG terminal is connected to safety ground of the unit.

2.2 Wiring output pin

■When wiring the load wire, select the wire in consideration of the heat generation so that the temperature of points A in Fig. 2.1 will be below the specified temperature.

In the case of PCA600F-5-P2

Input condition: Vin=85 to 264VAC

・When ambient temperature is 40℃ or less, point A is 65℃ or less

・When ambient temperature is 70℃, point A is 75℃ or less

(The ambient temperature 40℃ to 70℃ should be not more than the calculated value by linear interpolation)

In the case of PCA600F-12,-15,-24 -P2

Input condition: Vin=85 to 170VAC

・When ambient temperature is 40℃ or less, point A is 65℃ or less

・When ambient temperature is 70℃, point A is 75℃ or less

(The ambient temperature 40℃ to 70℃ should be not more than the calculated value by linear interpolation)

Input condition: Vin=170 to 264VAC

・When ambient temperature is 50℃ or less, point A is 80℃ or less

・When ambient temperature is 70℃, point A is 75℃ or less

(The ambient temperature 50℃ to 70℃ should be not more than the calculated value by linear interpolation)

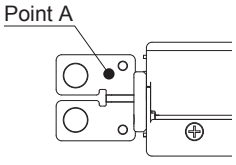


Fig. 2.1 Temperature measurement point

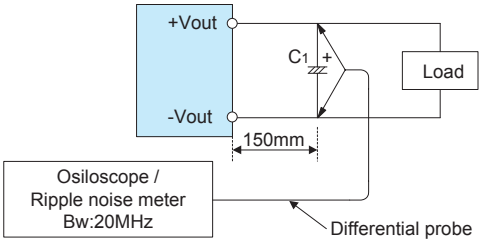
A thin electric wire could heat up and affect the power supply.

Please also use within the derating characteristics.

■The thermometry point is conductive. Please be careful of electric shocks.

■Output ripple noise may be influenced by measurement environment,measuring method Fig.2.2 is recommended.

■Output ripple and ripple noise is the value measured by the method shown in Fig.2.2.



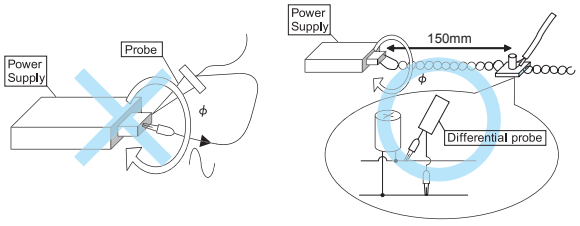
C1 : Aluminum electrolytic capacitor 22μF

Fig.2.2 Measuring method of Ripple and Ripple Noise

Remarks :

When GND cable of probe with flux of magnetic force from power supply are crossing, ripple and ripple noise might not measure correctly.

Please note the measuring environment.



Bad example Good example

Fig.2.3. Example of measuring output ripple and ripple noise

2.3 Output side attaching externally condenser

■Depending on the capacitance of the external capacitor, resonance may occur due to ESR, ESL, and wiring inductance, so please be careful of ripple increase.

■If the capacitance of the external capacitor is too large, the output voltage may not rise.

2.4 Connection to pulse load

■When connecting a pulse load to the PCA series, connect a capacitor Co between +Vout and -Vout.

＊If there is no external capacity when connected with pulse load, output may be stopped by the internal protection circuit.

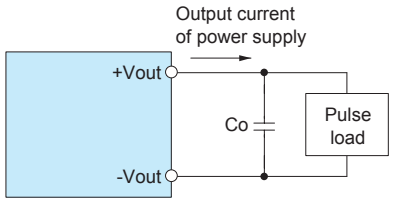


Fig. 2.4 Output side external capacitor connection method

■Be careful that the output current of the power supply does not exceed the rated current.

3 Functions

3.1 Input Voltage Range

■Input voltage range of the power supplies is from 85VAC to 264VAC.
In cases that conform with safety standard, input voltage range is 100-240VAC (50/60Hz).

■If input value doesn't fall within above range, a unit may not operate in accordance with specifications and/or start hunting or fail.
If you need to apply a square waveform input voltage, which is commonly used in UPS and inverters, please contact us.

3.2 Inrush Current Limiting

■An inrush current limiting circuit is built-in.

■If you need to use a switch on the input side, please select one that can withstand an input inrush current.

■Relay technique is used in the inrush current limiting circuit. When you turn the power ON/OFF repeatedly within a short period of time, please have enough intervals so that the inrush current limiting circuit becomes operative.

■When the switch of the input is turned on, the primary inrush current and secondary inrush current will be generated because the relay technique is used for the inrush current limiting circuit.

3.3 Overcurrent Protection

■An overcurrent protection circuit is built-in and activated at 105% or more of the rated current. A unit automatically recovers when a fault condition is removed.
Please do not use a unit in short circuit and/or under an overcurrent condition.

■Intermittent Operation Mode
Intermittent operation for overcurrent protection is included in a part of series. When the overcurrent protection circuit is activated and the output voltage drops to a certain extent, the output becomes intermittent so that the average current will also decrease.

3.4 Overvoltage Protection

■An overvoltage protection circuit is built in. When overvoltage protection operates, release it by shutting down input and re-input after 10 seconds or setting the voltage of RC2 terminal to logic to turn off output.
Note :

■Please avoid applying a voltage exceeding the rated voltage to an output terminal. Doing so may cause power supply to malfunction or fail. If this is unavoidable, for example, if you need to operate a motor, etc., please install an external diode on the output terminal to protect the unit.

3.5 Thermal Protection

■A thermal protection circuit is built-in.
The thermal protection circuit may be activated under following conditions and shut down the output.
①When a current and a temperature continue to exceed the values determined by the derating curve.
②When a fan stops or air flow weakens by intake port or exhaust port is blocked.

If the thermal protection circuit is activated, shut off the input voltage and eliminate all the overheating conditions. To recover the output voltage, have enough time to cool down the unit before turning on the input voltage again or setting the voltage of RC2 terminal to logic to turn off output.

3.6 External output voltage adjustment

■To increase an output voltage, turn a built-in potentiometer clockwise. To decrease the output voltage, turn it counterclockwise.

■When the VTRM_EN and COM terminals on CN3 are shorted and the power supply starts up, the VTRM will be enabled. The output voltage can be adjustable by external voltage applied between VTRM and COM on CN1 or CN2. In this case, the output voltage will be based on the calculation ①. However, even if 3.0V or more is applied, the output voltage cannot be changed 120% or more.
Do not set the external applied voltage of the terminal to -0.3V or less, and 5.0V or more.
In order to make it variable, it is necessary to apply voltage from the outside.

$$\text{Output voltage [V]} = \frac{\text{The voltage between VTRM and COM [V]}}{\text{2.5 [V]}} \times \text{Rated output voltage [V]} \cdots ①$$

■When the VTRM is enabled, the potentiometer for the output voltage adjustment will be disabled.

■Switch the VTRM terminal, it is necessary to turn on the power again.

■When using the external voltage control function, when the VTRM terminal becomes open, the output voltage drops to around 0V.

■When the output voltage is adjusted to less than the adjustment voltage range, the output ripple voltage might increase.

3.7 Constant current set value external variables

■The output current for the constant current can be adjustable by the external voltage applied to between ITRM and COM on CN3. Output current will be based on the calculation ②.

Do not set the external applied voltage of the terminal to -0.3 V or less, and 5.0 V or more.

When the output current is adjusted to around 0A, the unit might be unstable.

Load factor of 100% or higher should be avoided since it will be used outside the specifications.

To change it, you can connect an external resistor or apply voltage from the outside.

$$\text{Output current [A]} = \frac{\text{The voltage between ITRM and COM [V]}}{2.5\ \text{[V]}} \times \text{Rated output current [A]} \quad \cdots ②$$

3.8 Remote ON/OFF

■These models have a remote ON/OFF function.

■You can operate the remote ON/OFF function by sending signals to CN1 or CN2. Specifications are shown in Table 3.1 and connection examples are shown in Fig. 3.1.

■Remote ON/OFF circuit (RC2, RCG) is isolated from input, output, FG, AUX and various function terminals.

■Please note the followings when using the remote ON/OFF function.

①The output stops when the current is drawn in RC2.

②The current flowing into RC 2 is 5mA typ (12mA max).

③The PG signal turns to “High” when the output voltage is turned off with remote ON/OFF.

④AUX can be used even if the output is off with remote control.

⑤Even if the output is turned off by remote control, the built-in fans will continue to operate.

⑥Since the contents of this manual are values when using one unit, pay attention to the necessary current / voltage value when operating in parallel or in multiple units.

⑦If voltage / current other than those shown in Table 3.1 is applied between RC2 and RCG, the output voltage may not be output correctly.

Table 3.1 Specifications of remote ON/OFF

Connection method		Fig. 3.1 (a)	Fig. 3.1 (b)	Fig. 3.1 (c)
SW Logic	Output ON	SW open (0.1mA max)	SW open (0.1mA max)	SW close (0.5V max)
	Output OFF	SW close (3mA min)	SW close (3mA min)	SW open (0.1mA max)
Base pin		RCG	AUXG	RCG, AUXG

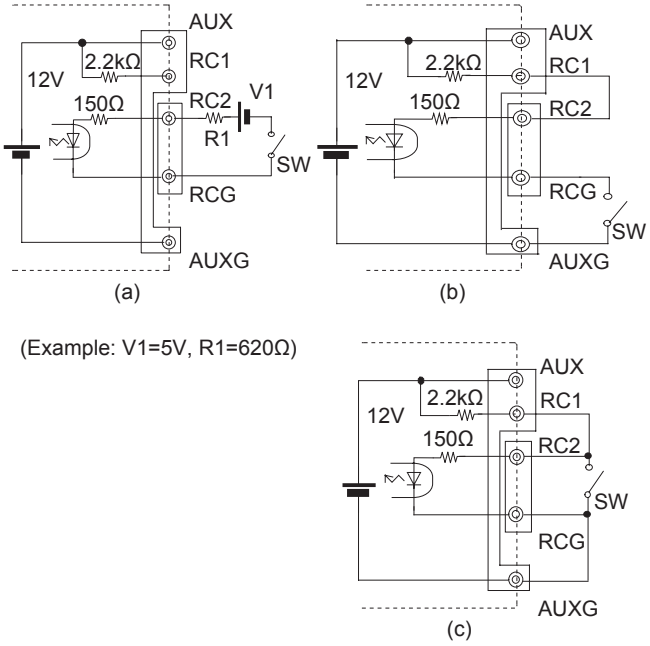


Fig. 3.1 Examples of connecting remote ON/OFF circuit

3.9 Remote sensing

■These models have a built-in remote sensing function.
When remote sensing is not used, +S and -S can be left open.

■Please see Fig. 3.2 if you do not use the remote sensing function.
Please see Fig. 3.3 if you use the remote sensing function.

■When you use the remote sensing function, please wire from +S and -S on CN1 or CN2. Harnesses are available for your purchase. For details, refer to the item of option parts.

■When you use the remote sensing, please note the followings.

①Wire carefully. When a connection of a load line becomes loose (due to such factors as loose screw), the load current flows to the sensing line and internal circuits of the power supply may be damaged.

②Use a sufficiently thick wire to connect between the power supply and the load and keep the line drop at 0.3V or below.

③Use a twisted pair wire or a shielded wire as the sensing line.

④Do not draw the output current from +S or -S.

⑤When the remote sensing function is used, the output voltage of the power supply may show an oscillating waveform or the output voltage may dramatically fluctuate because of an impedance of wiring and load conditions.
Please check and evaluate carefully before using the remote sensing function.
If the output voltage becomes unstable, we suggest you to try the followings.
・Connect C1, R1 and R2.

⑥If oscillation occurs because the sensing line is long, adjust with R1.
Please contact us for details.

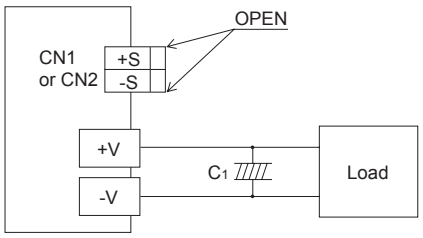


Fig. 3.2 When not using remote sensing function

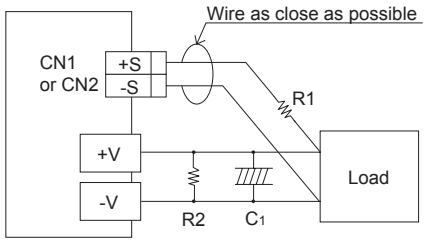


Fig. 3.3 When using remote sensing function

3.10 Signal Output (LED / Alarm)

■Functions of LED indicators and Output of Alarm are shown below.
LED indicators and Output of Alarm are signals to check the presence/absence of voltage at the output terminal of a power supply and to detect fault conditions.
The timing of signals might vary depending on input and load conditions. Please evaluate thoroughly.

Table 3.2 LED indicator and Condition of Power supply

LED indicator		Condition of Power supply	Output
Blue	Orange		
OFF	OFF	Turned off with remote ON/OFF, or decreased output voltage	OFF or Decreased
ON	OFF	Normal condition	ON
OFF	ON	Fault condition	OFF

Table 3.3 Explanation of alarm

Alarm		Output of Alarm
PG	The PG signals is “Low” when the power supply operates correctly. The signal turns to “High” when the power supply stops.	Open collector method Good : Low (0.5V max at 5mA) Bad : High 50V 5mA max

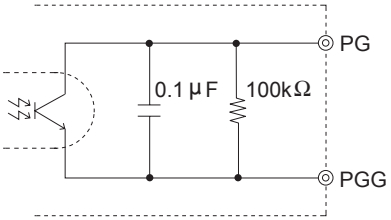


Fig.3.4 Internal circuit of PG

■Please note the followings when you use the alarms (PG signal).
① The PG signal turns to “High” when the output voltage is turned off with remote ON/OFF.
② When the output voltage drops to 40% or less of the rated output voltage, the PG signal is “High”.
■Circuit of the alarm is isolated from input, output, FG, AUX and various function terminals.

3.11 Communication function

■The power supply provides an “Extended UART”(INFO terminal) digital interface that enables the user to configure many aspects of the device operation as well as monitor the input and output parameters.
Please contact us for details.
■Extended UART is a communication protocol that enables single-wire, bidirectional, insulated, and multiple communication of UART, which is a general-purpose communication standard.
For details, please refer to the PCA Series Extended UART Manual.
■Communication function terminal is isolated from input, output, FG, AUX and various function terminals.

4 Series/Parallel Operation

4.1 Series Operation

■Wiring method with series operation is shown in Fig.4.1.
The MS and SGND must be connected with each other.
Please use option part H-PA-14 for connecting between MS and SGND.
Please decide one power supply (master power supply) to be operated on the volume and short circuit between SLV_EN and COM of the other power supply (slave power supply).
To short-circuit between SLV_EN and COM, please use option part H-SN-53.
Use the Master when changing the output voltage.
If one of the units operated in series stops or fails, all the power supplies are stopped by signal information of the MS terminal.
To start / stop use the remote ON/OFF control function. Connect RC 2 and RCG of all power supplies to be operated in series and start / stop all at the same time.
It is necessary to turn the power supply on again to switch the mode of Master/slave.
When using in series operation, use products of the same model name.

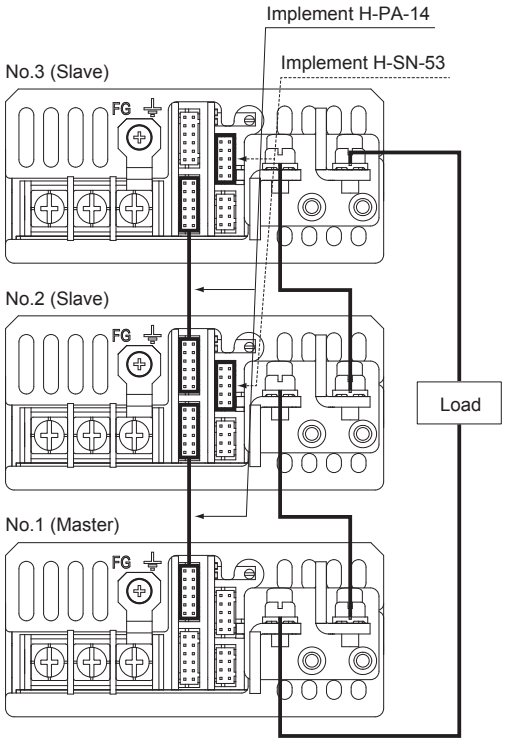


Fig.4.1 Connection method in series

∗Notes on series operation
(1) Constant current set value external variable function cannot be used.
(2) When the overcurrent condition occurs, the latch stop operation is performed.
In order to release the latch stop operation, input is shut down and input is restarted after 10 seconds or setting the voltage of RC2 terminal to logic to turn off output.

4.2 Parallel Operation/Master-slave Operation

■Wiring method with series operation is shown in Fig.4.2.
The MS and SGND must be connected with each other.
Please use option part H-PA-14 for connecting between MS and SGND.
Please decide one power supply (master power supply) to be operated on the volume and short circuit between SLV_EN and COM of the other power supply (slave power supply).
To short-circuit between SLV_EN and COM, please use option part H-SN-53.
Use the Master to change the output voltage.
If one of the units operating in parallel stops or fails, all the power supplies are stopped by signal information of the MS terminal.
To start / stop use the remote ON/OFF control function. Connect RC 2 and RCG of all power supplies to be operated in parallel and start / stop all at the same time.
It is necessary to turn the power supply on again to switch the mode of the Master/slave.
When using in parallel operation, use products of the same model name.
As variance of output current drew from each power supply is maximum 10%, the total output current must not exceed the value determined by the following equation.

(Output current at parallel operation)
= (the rated current per unit) × (number of unit) × 0.9

■When the number of units in parallel operation increases, the input current also increases. Please design input circuitry (including circuit pattern, wiring and current capacity for equipment) carefully.
■Please make sure that the wiring impedance of a load from each power supply becomes even. Otherwise, the output current balance circuit may become inoperative.
■The maximum number of units you can use in parallel operation is 3.

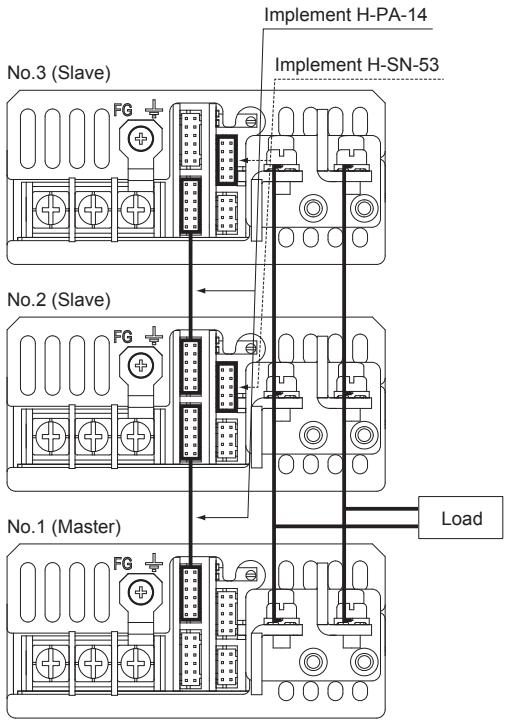


Fig.4.2 Connection method in parallel

✻Notes on parallel operation

(1) It is recommended to use the output current during parallel operation at 10% or more of the total of the rated output current.
If a current exceeding the rated current is instantaneously taken out where the total of the rated output currents is 10% or less, the output may decrease or stop.

(2) Constant current set value external variable function cannot be used.

(3) When the overcurrent condition occurs, the latch stop operation is performed.
In order to release the latch stop operation, input is shut down and input is restarted after 10 seconds or setting the voltage of RC2 terminal to logic to turn off output.

5 Assembling and Installation Method

5.1 Installation Method

■To keep enough isolation between screws and internal components, the length of mounting screws should not exceed Fig. 5.1.

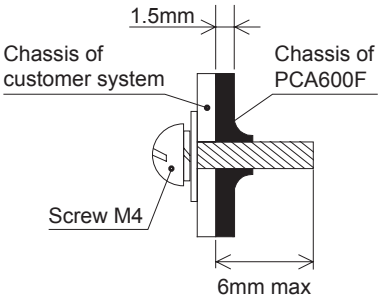


Fig.5.1 Mounting screw

■Please do not block built-in fans and ventilation holes.
When the power supply is mounted by screws, please consider its weight and set it in place. (Please see Fig. 5.2)

■If you use a power supply in a dusty environment, it can give a cause for a failure. Please consider taking such countermeasures as installing an air filter near the suction area of the system to prevent a failure.

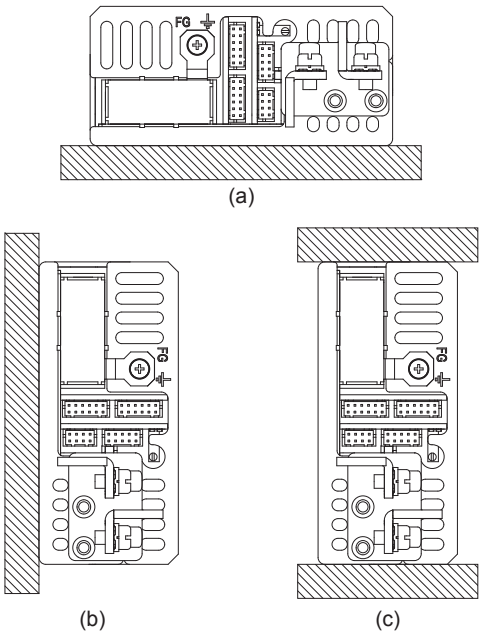


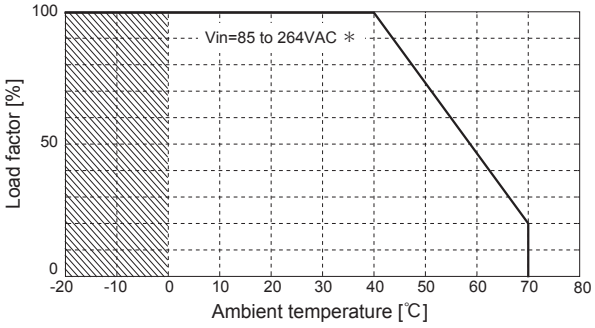
Fig.5.2 Installation method

5.2 Derating

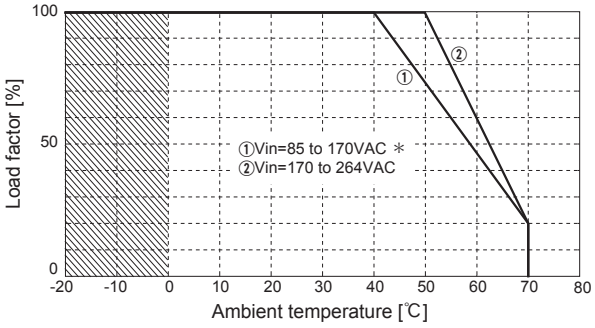
■Ambient Temperature Derating Curve

Fig. 5.3 shows the derating characteristics due to the operating ambient temperature of the power supply (the temperature of the air drawn in for cooling).

＊Specifications for ripple and ripple noise changes in the shaded area.



(a) PCA600F-5-P2



(b) PCA600F-12,-15,-24 -P2

Fig.5.3 Ambient temperature derating curve

＊With derating due to input voltage

■Input Voltage Derating Curve

Input voltage derating curve is shown in Fig.5.4.

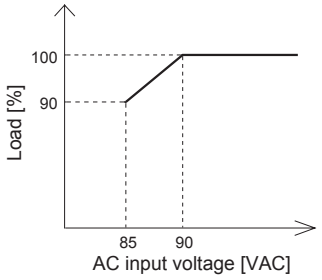


Fig.5.4 Derating curve depends on AC input voltage

5.3 Life expectancy and Warranty

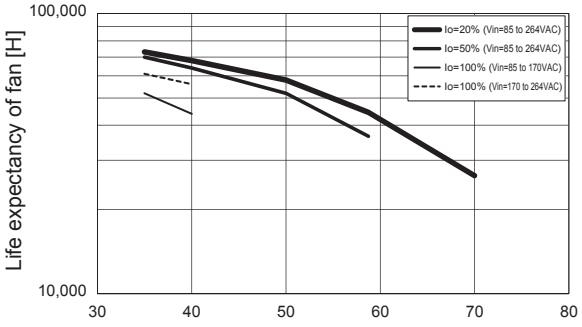
■Life expectancy

Life expectancy is as follows.

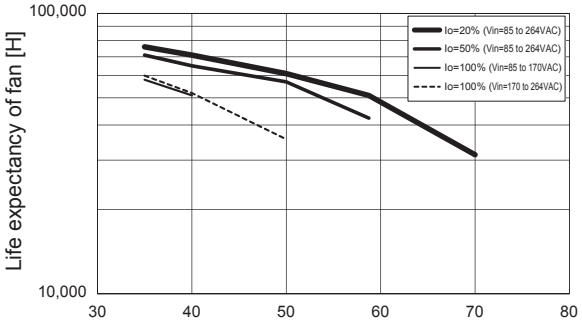
Table.5.1 Life expectancy

Mount	Average ambient temperature (yearly)	Life expectancy	
		0%≦Io≦50%	50%<Io≦100%
All mounting direction	Ta ≦ 35℃	8 years	6 years
	Ta = 40℃	7 years	5 years
	Ta = 50℃	6 years	4 years

■Life expectancy (R(t)=90%) of fan depends on use conditions as shown in Fig.5.5.



(a) PCA600F-5-P2



(b) PCA600F-12,-15,-24 -P2

Fig.5.5 Life expectancy of fan

■Warranty term

Warranty is as follows and shall be 5 years maximum.

Warranty does not apply if used outside of derating specifications.

Table.5.2 Warranty term

Mount	Average ambient temperature (yearly)	Free warranty period	
		0%≦Io≦50%	50%<Io≦100%
All mounting direction	Ta ≦ 35℃	5 years	5 years
	Ta = 40℃	5 years	5 years
	Ta = 50℃	5 years	4 years

6 Others

6.1 Output Current Monitor

■You can monitor an output current by measuring a voltage between the terminal CM and COM.

■Fig.6.1 shows the relationship between the voltage of the terminal CM and the output current.
The output current shown in Fig.6.1 should be used only as a guide.

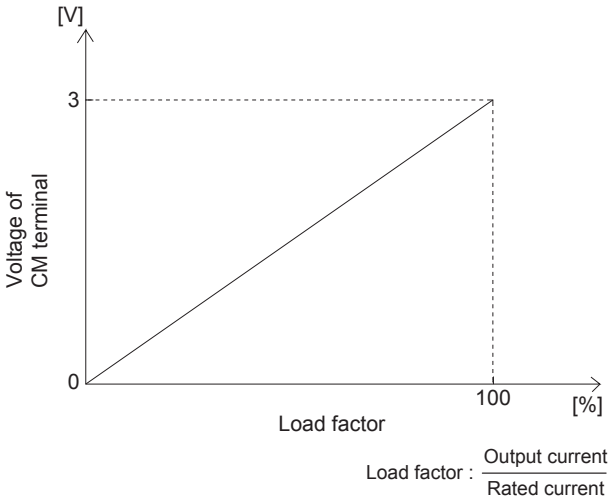


Fig.6.1 Load current conversion graph

■Please note the followings when measuring the voltage of the terminal CM.
- Wire carefully to avoid malfunction caused by noise.
- Use a measuring instrument whose input impedance is 500kΩ or more.
- Do not short-circuit between CM terminal and COM terminal. Doing so could cause a failure.

6.2 Isolation

■When you run a Hi-Pot test as receiving inspection, gradually increase the voltage to start. When you shut down, decrease the voltage gradually by using a dial. Please avoid a Hi-Pot tester with a timer because, when the timer is turned ON or OFF, it may generate a voltage a few times higher than the applied voltage.

■When you test a unit for isolation between the input and output, input and the terminal FG or between the output and the terminal FG, short-circuit between the output and all function terminals.

6.3 Auxiliary Power (AUX)

■Auxiliary power(AUX : 12V0.1A) is possible for remote ON/OFF and its attached circuit from CN3.

■AUX circuit(AUX,AUXG) is isolated from input ,output,FG,and function terminals other than RC1.

■Please do not take out the current which exceeds 0.1A from AUX to avoid the breakdown of the power supply or malfunction.
When you connect a DC-DC converter, a current a few times higher than normal current may flow at start-up. Please check the current.

■Output voltage can be varied (5V to 12V).
Please contact us for more details

■The maximum capacitance of the extermal capacitor is 22μF.

6.4 Variable Speed Fan

■The power supply has built-in variable speed cooling fan. The fan speed is a function of load and ambient temperature.

6.5 Medical Isolation Grade

■PCA series fit 2MOPP

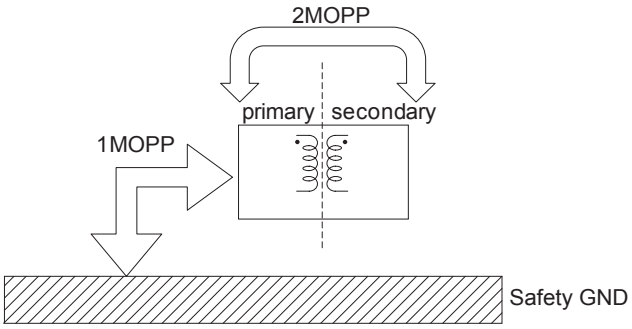


Fig.6.2 Medical Isolation Grade

7 Options

7.1 Outline of Options

＊Please inquire us for details of specifications and delivery timing.

● -TP2

■Option -T units have a terminal block in stead of an output bus bar.
■For PCA600F, this option is available in -12V, -15V and -24V types.
■When wiring the load wire, select the wire in consideration of the heat generation so that the temperature of points A in Fig. 7.2 will be below the specified temperature.
Please note that if the wire is thin, the wiring heats up, heat is transferred to the inside of the power supply, and the power supply may break down.
Please use within the item number 5.2 derating characteristics.

Input condition: Vin=85 to 170VAC
・When ambient temperature is 40℃ or less, point B is 70℃ or less
・When ambient temperature is 70℃, point B is 75℃ or less
(The ambient temperature 40℃ to 70℃ should be not more than the calculated value by linear interpolation)

Input condition: Vin=170 to 264VAC
・When ambient temperature is 50℃ or less, point B is 85℃ or less
・When ambient temperature is 70℃, point B is 75℃ or less
(The ambient temperature 50℃ to 70℃ should be not more than the calculated value by linear interpolation)

Please pay attention to electric shock and leakage during measurement. Temperature formulation place is conductive part.

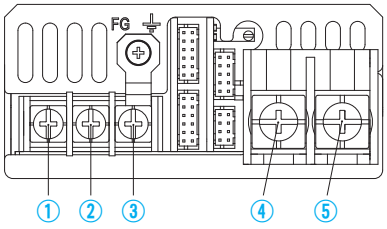


Fig.7.1 TP2 specification example (PCA600F)

①AC (L) } Input Terminals 85 - 264VAC 1 φ 45 - 66Hz
②AC (N) } (M4)
③Frame ground (M4)
④–Output (M5)
⑤+Output (M5)

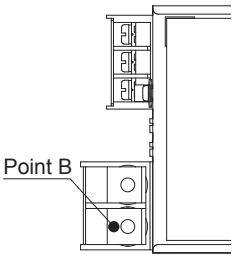


Fig.7.2 Temperature measurement point