1 Wiring Input / Output Pin PCA-21

1.1 Wiring input pin ---- PCA-21
1.2 Wiring output pin ---- PCA-21
1.3 Output side attaching externally capacitance ---- PCA-22
1.4 Connection to pulse load ---- PCA-22

2 Functions PCA-22

2.1 Input Voltage Range ---- PCA-22
2.2 Inrush Current Limiting ---- PCA-23
2.3 Overcurrent Protection ---- PCA-23
2.4 Overvoltage Protection ---- PCA-23
2.5 Thermal Protection ---- PCA-23
2.6 External output voltage adjustment ---- PCA-23
2.7 Constant current set value external variables ---- PCA-24
2.8 Remote ON/OFF ---- PCA-24
2.9 Remote sensing ---- PCA-25
2.10 Signal Output (LED / Alarm) ---- PCA-25
2.11 Communication function ---- PCA-25

3 Series/Parallel Operation PCA-26

3.1 Series Operation ---- PCA-26
3.2 Parallel Operation ---- PCA-26
3.3 N+1 Parallel Redundancy Operation ---- PCA-27

4 Life expectancy and Warranty PCA-27

5 Others PCA-29

5.1 Output Current Monitor ---- PCA-29
5.2 Isolation ---- PCA-30
5.3 Auxiliary Power (AUX) ---- PCA-30
5.4 Variable Speed Fan ---- PCA-30
5.5 Medical Isolation Grade ---- PCA-30
5.6 External Component (EMI/EMC Filter) ---- PCA-30

6 Options PCA-30

6.1 Outline of Options ---- PCA-30

1 Wiring Input / Output Pin

1.1 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 FG is connected to safety ground of the unit.

1.2 Wiring output pin

■When wiring the load wire, because of heat generation, so that the temperature of points A in Fig1.1 or Fig1.2 is lower than the temperature specified in Table 1.1 - Table 1.4

Table 1.1 Ambient temperature and specified temperature of point A (PCA300F)

Model	Ambient temperature	Temperature of point A
		Vin=85 - 264VAC Vin=88 - 370VDC
-5	Ta≦40℃	65℃
	Ta=70℃	75℃
-12 -15 -24 -32 -48	Ta≦50℃	80℃
	Ta=70℃	75℃

For PCA300F-5

＊The ambient temperature 40℃ to 70℃ should not be more than the calculated value by linear interpolation. (at Vin=85 - 264VAC / Vin=88 - 370VDC)

For PCA300F-12, -15 ,-24, -32, -48

＊The ambient temperature 50℃ to 70℃ should not be more than the calculated value by linear interpolation. (at Vin=85 - 264VAC / Vin=88 - 370VDC)

Table 1.2 Ambient temperature and specified temperature of point A (PCA600F)

Model	Ambient temperature	Temperature of point A	
		Vin=85 - 170VAC Vin=88 - 240VDC	Vin=170 - 264VAC Vin=240 - 370VDC
-5	Ta≦40℃	65℃	65℃
	Ta=70℃	75℃	75℃
-12 -15 -24 -32 -48	Ta≦40℃	65℃	80℃
	Ta≦50℃	68℃	
	Ta=70℃	75℃	75℃

For PCA600F-5

＊The ambient temperature 40℃ to 70℃ should not be more than the calculated value by linear interpolation. (at Vin=85 - 264VAC / Vin=88 - 370VDC)

For PCA600F-12,-15,-24,-32,-48

＊The ambient temperature 40℃ to 70℃ should not be more than the calculated value by linear interpolation. (at Vin=85 - 170VAC / Vin=88 - 240VDC)

＊The ambient temperature 50℃ to 70℃ should not be more than the calculated value by linear interpolation. (at Vin=170 - 264VAC / Vin=240 - 370VDC)

Table 1.3 Ambient temperature and specified temperature of point A (PCA1000F)

Model	Ambient temperature	Temperature of point A	
		Vin=85 - 170VAC	Vin=170 - 264VAC
-5 -12 -15	Ta≦40℃	55℃	55℃
	Ta=70℃	75℃	75℃
-24 -32 -48	Ta≦40℃	55℃	-
	Ta≦50℃	-	60℃
	Ta=70℃	75℃	75℃

For PCA1000F-5, -12, -15

＊The ambient temperature 40℃ to 70℃ should not be more than the calculated value by linear interpolation. (at Vin=85 - 264VAC)

For PCA1000F-24, -32, -48

＊The ambient temperature 40℃ to 70℃ should not be more than the calculated value by linear interpolation. (at Vin=85 - 170VAC)

＊The ambient temperature 50℃ to 70℃ should not be more than the calculated value by linear interpolation. (at Vin=170 - 264VAC)

Table 1.4 Ambient temperature and specified temperature of point A (PCA1500F)

Model	Ambient temperature	Temperature of point A	
		Vin=85 - 170VAC	Vin=170 - 264VAC
-5 -12 -15	Ta≦40℃	50℃	50℃
	Ta=70℃	75℃	75℃
-24 -32 -48	Ta≦40℃	50℃	-
	Ta≦50℃	-	60℃
	Ta=70℃	75℃	75℃

For PCA1500F-5, -12, -15

＊The ambient temperature 40℃ to 70℃ should not be more than the calculated value by linear interpolation. (at Vin=85 - 264VAC)

For PCA1500F-24, -32, -48

∗The ambient temperature 40℃ to 70℃ should not be more than the calculated value by linear interpolation. (at Vin=85 - 170VAC)

∗The ambient temperature 50℃ to 70℃ should not be more than the calculated value by linear interpolation. (at Vin=170 - 264VAC)

■The above specification does not change installation method.

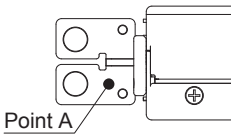


Fig. 1.1 PCA300F to PCA1000F
Temperature measurement point

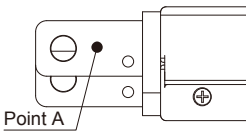


Fig. 1.2 PCA1500F
Temperature measurement point

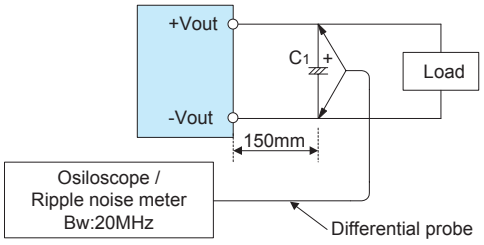
A thin electric wire could heat up and affect the power supply.

Please also use within the “Derating”.

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

■Output ripple noise may be influenced by measurement environment,measuring method Fig.1.3 is recommended.

■Output ripple and ripple noise is the value measured by the method shown in Fig.1.3.



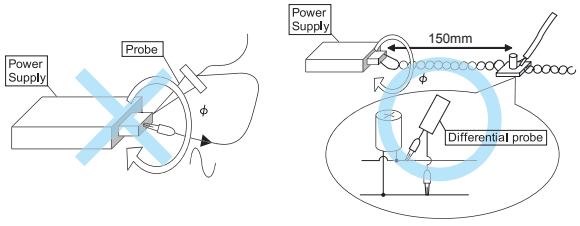
C1 : Aluminum electrolytic capacitor 22μF

Fig.1.3 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.1.4. Example of measuring output ripple and ripple noise

1.3 Output side attaching externally capacitance

■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.

■Please do not connect the external capacitor during operations.

Table 1.5 Connectable External capacitor on the output side [μF]

Model / Output voltage[V]	PCA300F PCA600F	PCA1000F PCA1500F
5	0 - 110,000	0 - 220,000
12	0 - 34,000	0 - 68,000
15	0 - 34,000	0 - 68,000
24	0 - 34,000	0 - 68,000
32	0 - 7,500	0 - 15,000
48	0 - 3,400	0 - 7,500

1.4 Connection to pulse load

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

∗The operation of the power supply might stop due to the internal protection or its life expectancy might get shorter under the following conditions.

①With pulse load and without the external capacitor.

②With pulse load and with remote sensing function.

③Depending on the frequency of pulse load.

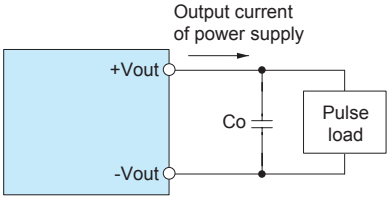


Fig. 1.5 Output side external capacitor connection method

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

2 Functions

2.1 Input Voltage Range

■Input voltage range of the power supplies is from 85VAC to 264VAC / 88VDC to 370VDC (Excluding PCA1000F and PCA1500F).
In cases that conform with safety standards, 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 not start correctly or fail.
UPS recommends Sine Wave UPS.
Please contact us for square wave input voltage.

■The power supply can work at the input voltage dip with the derating.

Table 2.1 IEC60601-1-2 Maximum output load factor

Voltage Dip	duration [ms]	PCA300F	PCA600F	PCA1000F	PCA1500F
100VAC→ 0VAC	20	70%	70%	60%	55%
100VAC→ 40VAC	100	60%	60%	60%	50%
100VAC→ 70VAC	500	100%	100%	100%	100%
240VAC→ 0VAC	20	80%	80%	80%	75%
240VAC→ 96VAC	100	100%	100%	100%	100%
240VAC→168VAC	500	100%	100%	100%	100%

Table 2.2 SEMI F47-0706 Maximum output load factor

Voltage Dip	duration [ms]	PCA300F	PCA600F	PCA1000F	PCA1500F
100VAC→ 50VAC	200	80%	70%	70%	70%
100VAC→ 70VAC	500	100%	100%	100%	100%
100VAC→ 80VAC	1000	100%	100%	100%	100%
200VAC→100VAC	200	100%	100%	100%	100%
200VAC→140VAC	500	100%	100%	100%	100%
200VAC→160VAC	1000	100%	100%	100%	100%

2.2 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.

2.3 Overcurrent Protection

■An overcurrent protection circuit is built-in and activated over 105% 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.

■Hiccup Operation Mode

Hiccup 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 hiccup so that the average current will also decrease.

2.4 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.

2.5 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.

2.6 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.

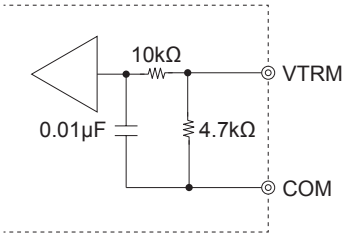


Fig. 2.1 VTRM circuit

■When the output voltage is adjusted to less than approximately 5% of the rated voltage, the output might be unstable or stop. Please contact us for more details.

2.7 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. When the ITRM terminal voltage is set at less than 2.5 V, the constant current set value can be changed.
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.

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

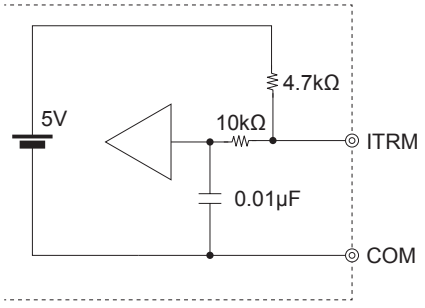


Fig. 2.2 ITRM circuit

■If the output voltage becomes less than approximately 5% of the rated voltage during constant current operation, the output might be unstable or stop. Please contact us for more details.

2.8 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 2.3 and connection examples are shown in Fig. 2.3.
■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 2.3 is applied between RC2 and RCG, the output voltage may not be output correctly.

Table 2.3 Specifications of remote ON/OFF

Connection method		Fig. 2.3 (a)	Fig. 2.3 (b)	Fig. 2.3 (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)
Ground level		RCG	AUXG	RCG, AUXG

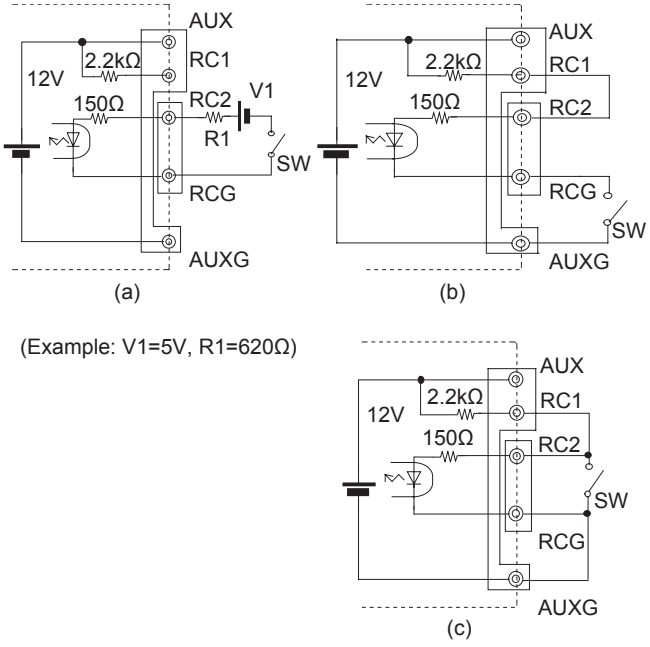


Fig. 2.3 Examples of connecting remote ON/OFF circuit

2.9 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. 2.4 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, C2, C3, R1 and R2.

⑥When connected to a pulse load, the internal protection activates depending on the frequency.
If the protection activates, we suggest you to try the followings.
・connect C1,C2,C3,R1 and R2.

⑦If oscillation occurs because the sensing line is long, adjust with R1.
Please contact us for details.

⑧When power supplies are connected in parallel, the remote sensing function cannot be used.

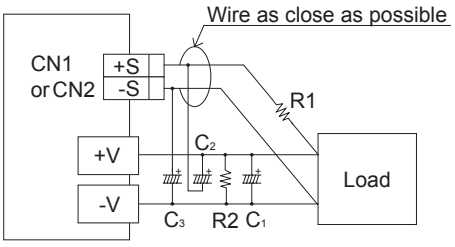


Fig. 2.4 When using remote sensing function

2.10 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 2.4 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 2.5 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

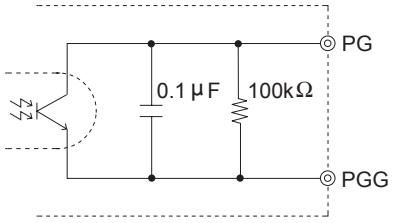


Fig.2.5 Internal circuit of PG

■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.

2.11 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.
For details, please refer to the PCA Series Extended UART Manual.

■Extended UART is a communication protocol that enables single-wire, bidirectional, isolated, and multiple communication of UART, which is a general-purpose communication standard.

■Communication function terminal is isolated from input, output, FG, AUX and various function terminals.

3 Series/Parallel Operation

3.1 Series Operation

■The series operation is available to obtain higher output voltage. However care should be taken as follows:

Notes of (a) :

In case of malfunction (Protection circuit activation or Failure),please stop the operation and replace the failed power supply.

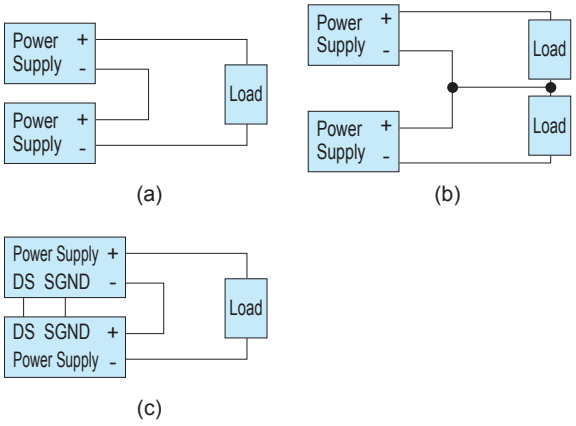


Fig.3.1 Examples of connecting in series operation

■In the case of Figure 3.1 (C), if one power supply stops or fails, all remaining power supplies also stop.
The DS and SGND must be connected with each other as shown in Fig.3.2.
Option part “H-PA-14” can be used for connecting between DS and SGND.

■When turning on and off by 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.

■When using in series operation, use products of the same model name.

■In series operation, the maximum operative number of units is 10. The combined output voltage of series operation is 200V.

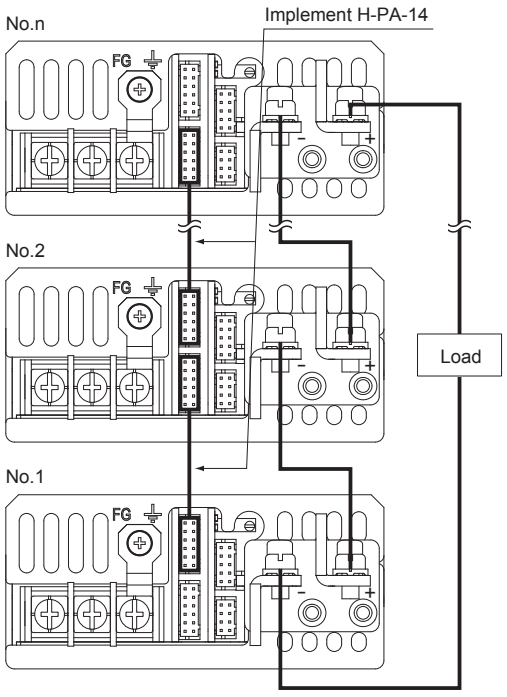


Fig.3.2 Connection method in series (PCA300F, PCA600F)

✻Notes on series operation

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

3.2 Parallel Operation

■Wiring method with parallel operation is shown in Fig.3.3.
The CB and SGND must be connected with each other.
Please use option part H-PA-15 for connecting between CB and SGND.

■When turning on and off by remote ON/OFF control function, connect RC 2 and RCG of all power supplies to be operated in parallel and start / stop at the same time.
The difference between the maximum and minimum of the output voltage of each power supply connected in parallel should be within 1%.
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 6.

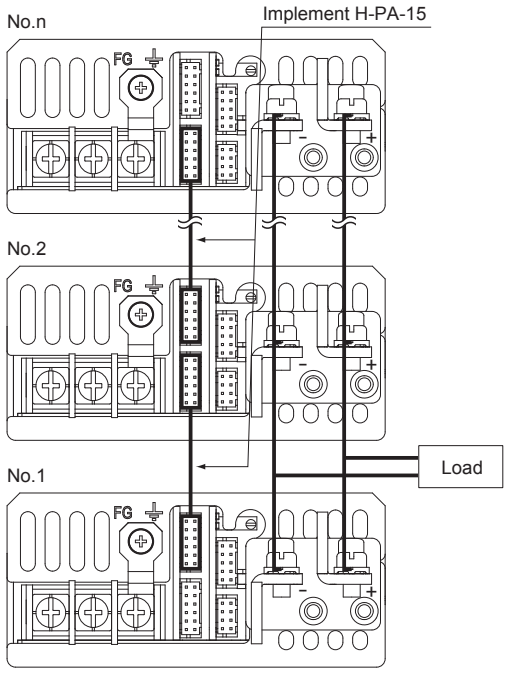


Fig.3.3 Connection method in parallel (PCA300F, PCA600F)

∗Notes for parallel operation

(1) Specification value of ripple and ripple noise is tripled.
(2) Load regulation is 3% of the rated output voltage.
(3) Constant current set value external variable function cannot be used.
(4) The remote sensing function cannot be used.

3.3 N+1 Parallel Redundancy Operation

■N+1 redundancy operation is available for improved system reliability.

■If one extra power supply in parallel operation is added, even if one of the power supplies in your system fails, the remaining power supplies continue to function. When one of the power supplies stops operating, the output voltage may change about 5%.

■When unit replacement is required due to unit failure, input voltage for all units must be cut off.

■After replacement, please make sure that all wiring is completed correctly, before re-applying input voltage.

■Hot-swap or Hot-plug is not available.

■If 2 or more units fail, sufficient power cannot be provided to the system. Please replace the failed unit immediately when unit failure is found.

■Wiring, specifications and precautions are the same as in parallel operation.

■Depending on the failure mode of the power supply, redundant operation may not be performed.
When performing full redundant operation, redundant functions such as oring diodes on the output of the power supply should be considered.

■If you have any questions about series, parallel and N+1 redundancy operations, please contact us.

4 Life expectancy and Warranty

■Life expectancy
Life expectancy is as follows.

Table.4.1 Life expectancy (PCA300F)

Mount	Average ambient temperature (yearly)	Life expectancy	
		0%≦Io≦50%	50%<Io≦100%
All mounting direction	Ta ≦ 35℃	10 years	10 years
	Ta = 40℃	10 years	10 years
	Ta = 50℃	10 years	10 years

Table.4.2 Life expectancy (PCA600F)

Mount	Average ambient temperature (yearly)	Life expectancy	
		0%≦Io≦50%	50%<Io≦100%
All mounting direction	Ta ≦ 35℃	10 years	10 years
	Ta = 40℃	10 years	10 years
	Ta = 50℃	10 years	10 years

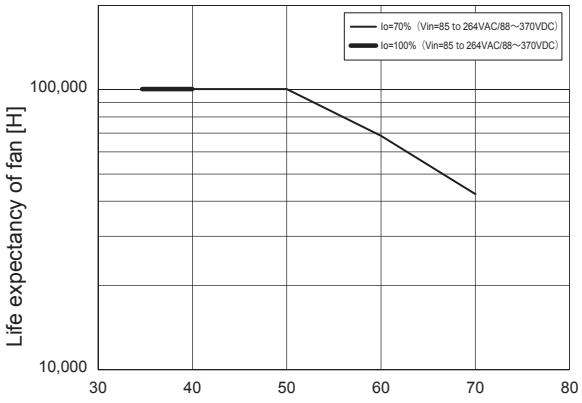
Table.4.3 Life expectancy (PCA1000F)

Mount	Average ambient temperature (yearly)	Life expectancy	
		0%≦Io≦50%	50%<Io≦100%
All mounting direction	Ta ≦ 35℃	10 years	6 years
	Ta = 40℃	10 years	5 years
	Ta = 50℃	8 years	5 years

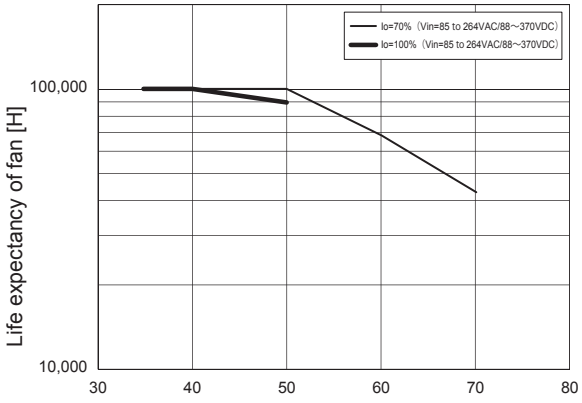
Table.4.4 Life expectancy (PCA1500F)

Mount	Average ambient temperature (yearly)	Life expectancy	
		0%≦Io≦50%	50%<Io≦100%
All mounting direction	Ta ≦ 35℃	10 years	7 years
	Ta = 40℃	10 years	5 years
	Ta = 50℃	10 years	5 years

■Life expectancy (R(t)=90%) of fan depends on use conditions as shown in Fig.4.1 - Fig.4.4

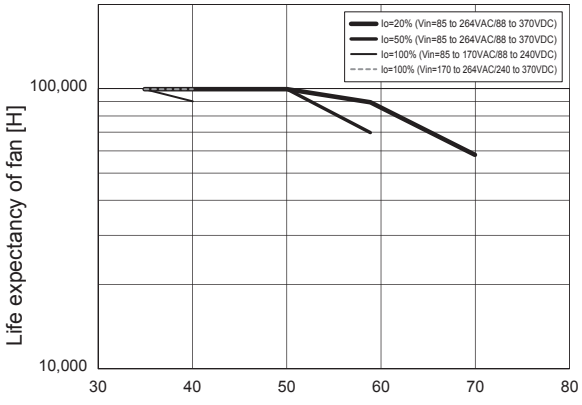


(a) PCA300F-5

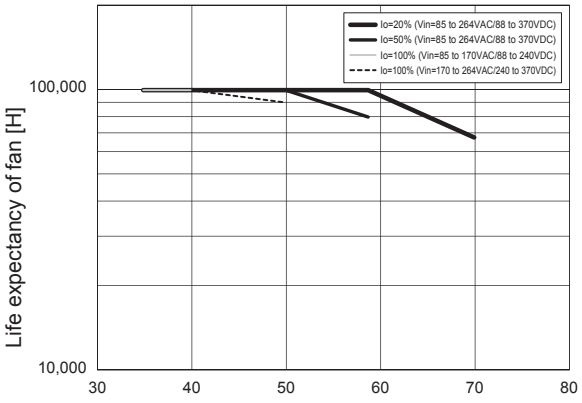


(b) PCA300F-12,-15,-24,-32,-48

Fig.4.1 Life expectancy of fan (PCA300F)

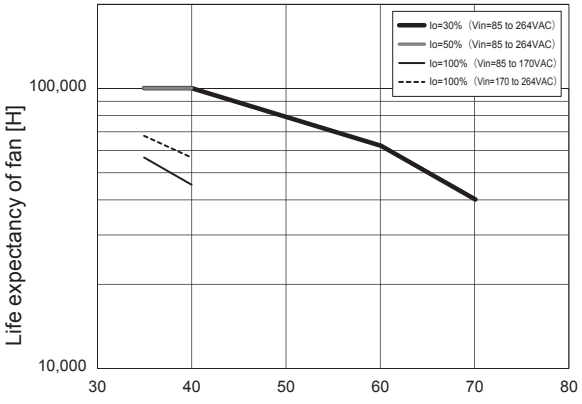


(a) PCA600F-5

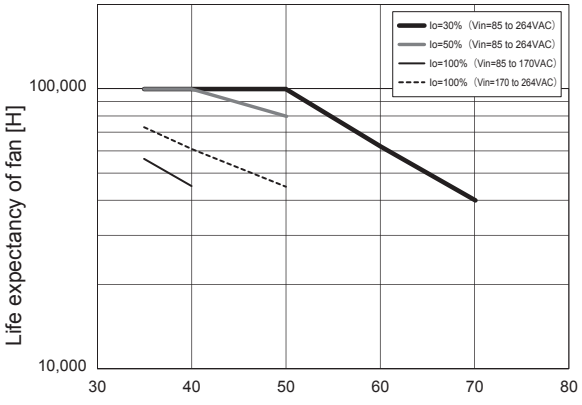


(b) PCA600F-12,-15,-24,-32,-48

Fig.4.2 Life expectancy of fan (PCA600F)

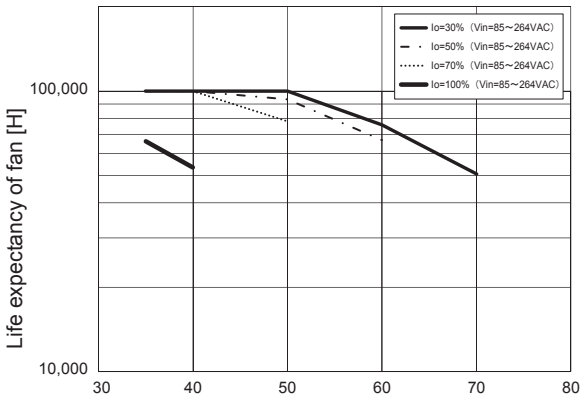


(a) PCA1000F-5,-12,-15

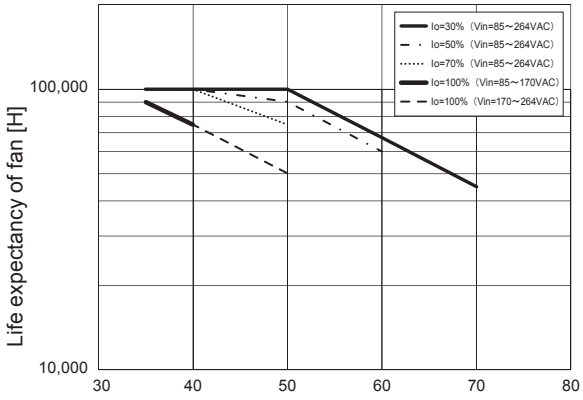


(b) PCA1000F-24,-32,-48

Fig4.3 Life expectancy of fan (PCA1000F)



(a) PCA1500F-5,-12,-15



(b) PCA1500F-24,-32,-48

Fig.4.4 Life expectancy of fan (PCA1500F)

■Warranty term

The warranty period is 5 years if a power supply is used within "Derating".

Warranty does not apply if used outside of "Derating".

5 Others

5.1 Output Current Monitor

■The output current can be monitored by voltage between the terminal CB and COM.

■Fig.5.1 shows the relationship between the voltage of the terminal CB and the output current.

The output current shown in Fig.5.1 is for reference only.

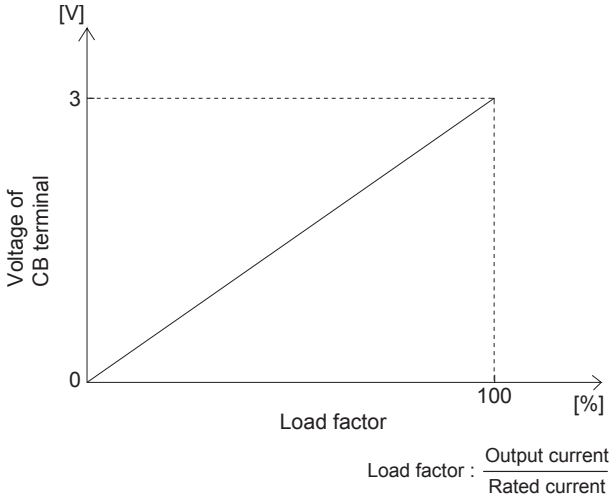


Fig.5.1 Load current conversion graph

■Please note the following notes when measuring the voltage of the terminal CB.

- Wire carefully to avoid malfunction caused by noise.
- Use a measuring instrument whose input impedance is 500kΩ or more.
- Do not short-circuit between CB terminal and COM terminal to not cause a failure.
- Do not connect more than 1μF to CB terminal to prevent output voltage malfunction.

5.2 Isolation

■When Hi-Pot test is conducted for the inspection, gradually increase the voltage and 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 a unit is tested for isolation between input and output, input and FG or output and FG, short the output to all function terminals.

5.3 Auxiliary Power (AUX)

■The unit has the auxiliary power (AUX:12V0.1A) in CN3 to provide for the remote ON/OFF and external circuits.

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

■If the output current of Aux exceed 0.1A, the unit might be damaged or malfunction.
When a DC-DC converter is connected to AUX, the current might be severalfold of normal current when starting up. Please check the current.

■The maximum capacitor to AUX 22μF.
The output voltage can be adjusted from 5V to 12V by the communication function. (Refer to item 2.11)

5.4 Variable Speed Fan

■The power supply has built-in variable speed fan. The fan speed varies depending on load and ambient temperature.

5.5 Medical Isolation Grade

■PCA series fit 2MOPP

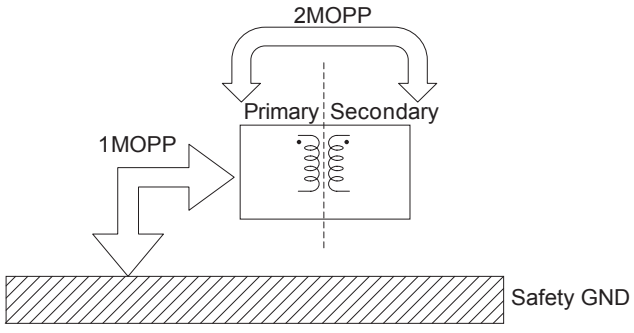


Fig.5.2 Medical Isolation Grade

6.5 External Component (EMI/EMC Filter)

● PCA1500F

■You can have the power supplies comply with FCC Part 15 class B and EN55022-B by connecting an external EMI/EMC Filter.

Recommended EMI/EMC Filter
PCA1500F : NBH-30-432 (COSEL)

6 Options

6.1 Outline of Options

＊Please inquire us for details of specifications.

● -C

■Except a certain (e.g.terminal, potentionmeter), PCB is coated.

● -G

■This power supply is low leakage current type.

■Differences from standard versions are summarized in Table 6.1.

Table 6.1 Low leakage current type

Leakage Current (AC240V)	0.15mA max
Conducted Noise	N/A
Output Ripple Noise	150% of standard units

● -T

■Option -T models have a terminal block instead of an output bus bar. (Excluding PCA1500F)

■This option is available for the following models.
・All models of PCA300F.
・PCA600F-12, -15, -24, -32, -48
・PCA1000F-24, -32, -48

■When wiring the load wire, select the wire in consideration of the heat generation so that the temperature of points B in Fig. 6.3 is lower than the temperature specified in Table 6.2 - Table 6.4.
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 malfunction.
Please use within “Derating”.

Table 6.2 Ambient temperature and specified temperature of point B (PCA300F)

Model	Ambient temperature	Temperature of point B Vin=85 - 264VAC Vin=88 - 370VDC
-5	Ta≦40℃	60℃
-12 -15	Ta≦70℃	75℃
	Ta≦50℃	85℃
-24 -32 -48	Ta≦70℃	75℃
	Ta≦50℃	65℃
	Ta=70℃	75℃

For PCA300F-5
＊The ambient temperature 40℃ to 70℃ should not be more than the calculated value by linear interpolation. (at Vin=85 - 264VAC / Vin=88 - 370VDC)

For PCA300F-12, -15 ,-24, -32, -48
＊The ambient temperature 50℃ to 70℃ should not be more than the calculated value by linear interpolation. (at Vin=85 - 264VAC / Vin=88 - 370VDC)

Table 6.3 Ambient temperature and specified temperature of point B (PCA600F)

Model	Ambient temperature	Temperature of point B	
		Vin=85 - 170VAC Vin=88 - 240VDC	Vin=170 - 264VAC Vin=240 - 370VDC
-12 -15 -24 -32 -48	Ta≦40℃	70℃	85℃
	Ta≦50℃	71℃	
	Ta=70℃	75℃	75℃

For PCA600F-12,-15,-24,-32,-48

＊The ambient temperature 40℃ to 70℃ should not be more than the calculated value by linear interpolation. (at Vin=85 - 170VAC / Vin=88 - 240VDC)

＊The ambient temperature 50℃ to 70℃ should not be more than the calculated value by linear interpolation. (at Vin=170 - 264VAC / Vin=240 - 370VDC)

Table 6.4 Ambient temperature and specified temperature of point B (PCA1000F)

Model	Ambient temperature	Temperature of point B	
		Vin=85 - 170VAC	Vin=170 - 264VAC
-24 -32 -48	Ta≦40℃	55℃	-
	Ta≦50℃	-	60℃
	Ta=70℃	75℃	75℃

For PCA1000F-24, -32, -48

＊The ambient temperature 40℃ to 70℃ should not be more than the calculated value by linear interpolation. (at Vin=85 - 170VAC)

＊The ambient temperature 50℃ to 70℃ should not be more than the calculated value by linear interpolation. (at Vin=170 - 264VAC)

■The above specification does not change in installation method.

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

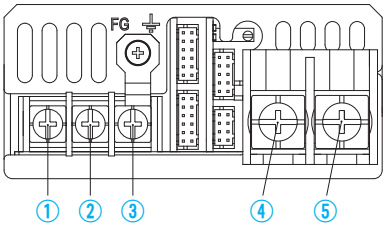


Fig.6.1 T specification example (PCA300F, PCA600F)

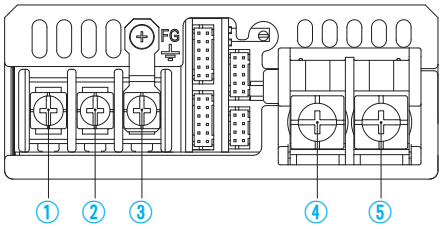


Fig.6.2 T specification example (PCA1000F)

①AC (L) } Input Terminals 85 - 264VAC 1φ45 - 66Hz
②AC (N) } (M4) 88 - 370VDC (Excluding PCA1000F)
③Frame ground (M4)
④-Output (M5)
⑤+Output (M5)

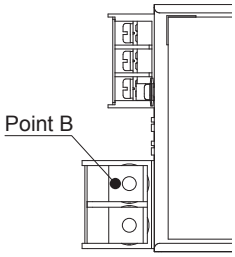


Fig.6.3 Temperature measurement point

● -I

■Option -I units is PMBus communication possible.
For details, please refer to the PCA series PMBus Manual.

● -F2

■The cooling fan direction is reversed from the standard model.

■Differences from standard versions are summarized in Fig.6.4 and Fig.6.5.

■Please contact us for the life expectancy of fan and warranty term.

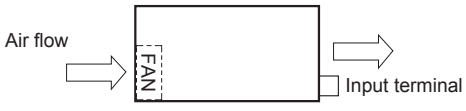
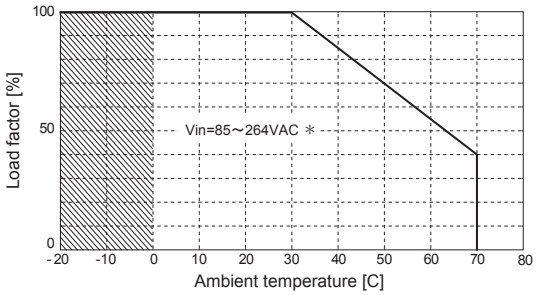


Fig.6.4 Air flow (-F2)



*With derating due to input voltage

Fig.6.5 Ambient temperature derating curve (PCA1500F-5-F2)

● -P3

■The specification for series/parallel operation of this power supply has been changed. And the Master/slave operation function has been added.

[Series Operation]

■Wiring method with series operation is shown in Fig.6.6.
The DS and SGND must be connected with each other.
Please use option part H-PA-14 for connecting between DS 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 DS 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.
In series operation, the maximum operative number of units is 10.
The combined output voltage of series operation is 200V.

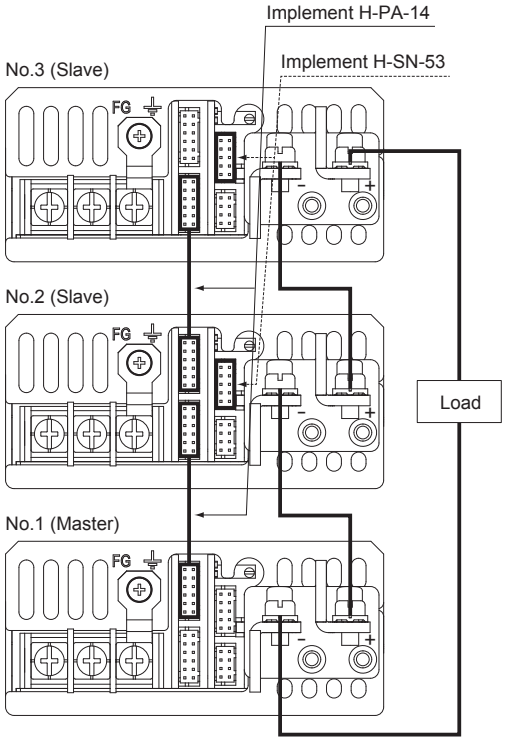


Fig.6.6 Connection method in series (PCA300F, PCA600F)

∗Notes on series operation
(1) Constant current set value external variable function cannot be used.

[Parallel Operation]

■Wiring method with series operation is shown in Fig.6.7.
The DS,SGND,CB and COM must be connected with each other.
Please use option part H-PA-16 for connecting between DS, SGND, CB and COM.
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 6.

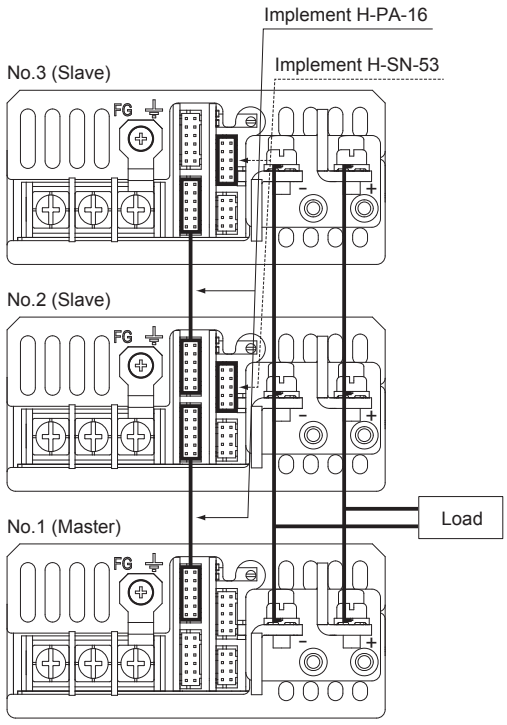


Fig.6.7 Connection method in parallel (PCA300F, PCA600F)

＊Notes on parallel operation

(1) Specification value of ripple and ripple noise is tripled.

(2) Load regulation is 3% of the rated output voltage.

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

(4) The remote sensing function can be used. Connect the sensing wire to the load only from the mastering power supply.

● -W1

■The PG signal dose not output unless any protection operates.

■The logic for the PG signal is reversed.

[Alarm function]

■Table 6.5 shows the function of the built-in alarm.

Table 6.5 alarm function

PG	The PG signal turns to “Low” when any protection operates.	Open collector method Good : High Bad : Low (0.5V max at 5mA) 50V 5mA max

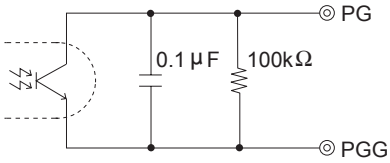


Fig.6.8 Internal circuit of alarm

＊Usage notes for PG signal are shown below.

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

(2) The PG signal turns to “High” when the output voltage is led to be decreased by the adjustment or CC functions.

(3) Circuit of the alarm (PG, PGG) is isolated from input, output, FG, AUX and terminals for various functions.

● -E1 (PCA1000F)

■This option is available for the following models.

・PCA1000F-24, -32, -48

■EMI classB

■The difference from standard is shown Table 6.6.

Table 6.6 -E1 option type

LEAKAGE CURRENT [mA]	1.0max (ACIN 240V 60Hz, Io=100%, According to IEC60601-1)
CONDUCTED NOISE	Complies with FCC Part15 classB, VCCI-B, CISPR32-B, EN55011-B, EN55032-B
SAFETY AGENCY APPROVALS	ANSI/AAMI ES60601-1,EN60601-14 3rd C-UL (equivalent to CAN/CSA-C22.2 No.60601-1) Not available

● -T5

- Acquired UL508.
- CN1 to CN4 will be changed to push-in type terminal blocks.
- The constant currrent set value external variables, Remote sensing, Series operation, and AUX functions are deleted.
- How to use remote ON/OFF contorols changes.
- The RC2 and RCG isolation specifications are deleted.
- Please contact us for any other conditions.

Table 6.7 Isolation

OUTPUT-PG, INFO, DS	AC500V 1minute, Cutoff current = 100mA, DC500V 50MΩ min (At Room Temperature)

Table 6.8 Specifications of remote ON/OFF

Fig.6.9 RC circuit example		-T5
SW Logic	Output on	SW open (0.1mA max)
	Output off	SW short (0.5mA min)

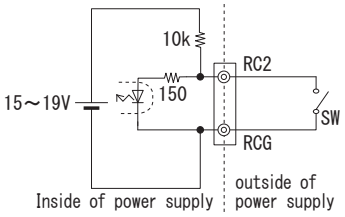


Fig.6.9 RC circuit example

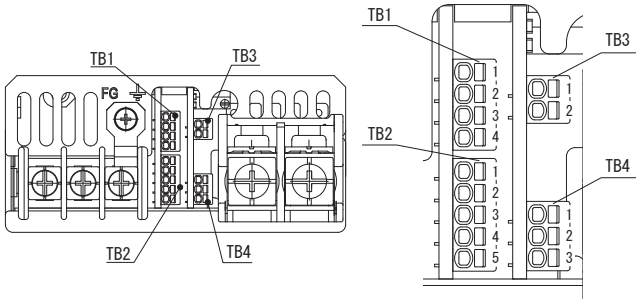


Fig.6.10 Example of option T5

Table 6.9 Pin assignments

Terminal blocks	Pin No.	Function	Ground level
TB1	1	VTRM : Adjustment of output voltage	COM
	2	COM : Common ground (for signal)	COM
	3	CB : Current Balance	COM
	4	CB : Current Balance	COM
TB2	1	INFO : Extended UART signal	SGND
	2	DS : Data Shared signal	SGND
	3	SGND : Signal ground	SGND
	4	RC2 : Remote ON/OFF	COM
	5	RCG : Remote ON/OFF ground	COM
TB3	1	PG : Alarm	PGG
	2	PGG : Alarm ground	PGG
TB4	1	COM : Common ground (for signal)	COM
	2	VTRM_EN : Enable Vtrm	COM
	3	SLV_EN : Enable Slave mode	COM

Table 6.10 Input and Output terminal wire size

Terminal blocks	Wire size	Crimp terminal	
		Type	Manufacturer
Input	AWG 20 - 10	-	
Output	AWG 14 - 10	-	
	AWG8	R8-5S	NICHIFU
	AWG6	R14-5S	

Table 6.11 Recommended Ferrule terminals

Type	Manufacturer	Wire size	Model	Crimp tool
Square type	Phoenix Contact	AWG 20	AI0.5-6WH	CRIMPFOX 6
		AWG 22	AI0.34-6TQ	
		AWG 24 - 26	AI0.25-6BU	

Table 6.12 For TB1 to TB4 Applicable wire size

Wire size	AWG 20 - 26
Wire insulation strip length	6mm

・Fig.6.11and Fig.6.12 is the how to connect/release the wire.

・How to connect the Ferrule terminals and the solid wire

Step1: Insert the wire until the electrode is not visible. (Refer to the fig.6.11(a).)
Inserting a flat-blade screwdriver into the release hole makes it easier to insert. (Refer to the fig.6.11(b).)

Step2: Pull the wire lightly in order to make sure it is fixed.

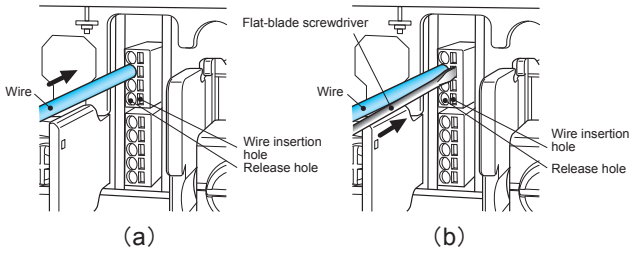


Fig.6.11 Connecting method of Ferrule terminal and Solid wire

・How to release the Ferrule terminal and Solid wire

Step1: Insert a flat-blade screwdriver into the release hole. (Refer to the fig.6.12(a).)

Step2: Remove the wire with the flat-blade screwdriver inserted in the release hole. (Refer to the fig.6.12(b).)

Step3: Remove the flat-blade screwdriver from the release hole. (Refer to the fig.6.12(c).)

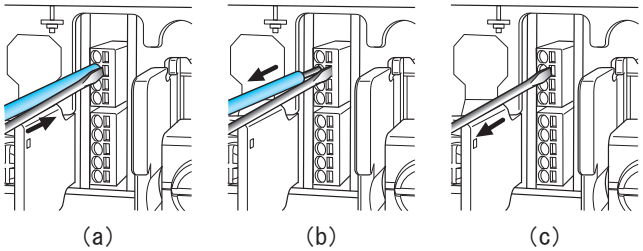


Fig.6.12 Releasing method of Ferrule terminal, Solid wire and Stranded wire