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1 Function

1.1 Input voltage range

- The range is from AC85V to AC264V. (please see SPECIFICATIONS for details).
- In cases that conform with safety standard, input voltage range is AC100 - AC240V (50/60Hz).
- If input value doesn't fall within above range, a unit may not operate in accordance with specifications and/or start output voltage hunting or fail. If you need to apply a square waveform input voltage, which is commonly used in UPS and inverters, please contact us.
- When the input voltage changes suddenly, the output voltage accuracy might exceed the specification. please contact us.

1.2 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.
- Thermistor 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 power supply cools down before being turned on.
- Surge current in the filter unit does not include (0.2ms or less).

1.3 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.
- Output voltage shuts down when the output voltage continuously drops due to overcurrent protection.
- Output voltage recovers from overcurrent protection by shutting down the input voltage and waiting more than 3 minutes then turning on AC input again.

1.4 Overvoltage protection

- An overvoltage protection circuit is built-in. If the overvoltage protection circuit is activated, shut down the input voltage, wait more than 3 minutes and turn on the AC input again to recover the output voltage. Recovery time varies depending on such factors as input voltage value at the time of the operation.

Remarks :

Please avoid applying a voltage exceeding the rated voltage to an output terminal. Doing so may cause a power supply to malfunction or fail. If you cannot avoid doing so, for example, if you need

to operate a motor, etc., please install an external diode on the output terminal to protect the unit.

1.5 Thermal protection

- Over Temperature Protection (OTP) is built-in. This protection circuit may be activated under the following conditions and shut down the output.
 - ① When a temperature continues to exceed the values determined by the derating curve.
 - ② When a current exceeding the rated current is applied.
 - ③ When convection stops.
 If the 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.

Remarks :

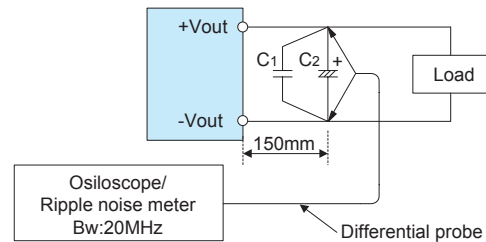
Please comply with recommended mounting method in "Assembling and Installation Method" and "Derating".

1.6 Output voltage adjustment range

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

1.7 Output ripple and ripple noise

- Output ripple noise may be influenced by measurement environment, measuring method Fig.1.1 is recommended.



- C1 : Film capacitor 0.1 μ F
- C2 : Aluminum electrolytic capacitor 22 μ F

Fig.1.1 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.

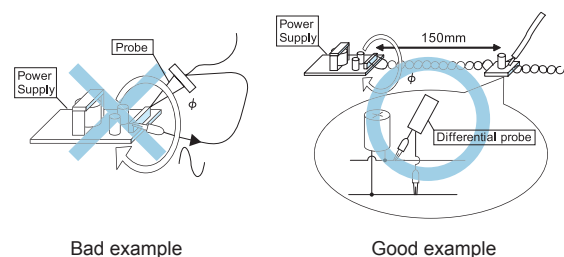


Fig.1.2 Example of measuring output ripple and ripple noise

1.8 Isolation

- For a receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage for the start (shut down). Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.
- 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 the terminals RCG and AUXG.

2 Series Operation and Parallel Operation

2.1 Series Operation

- Series operation is available by connecting the outputs of two or more power supplies with the same output voltage, as shown below. Output current in series connection should be lower than the lowest rated current in each unit.

Remarks :

Please be sure to have enough cooling in case one of the power supply stops due to activation of the protection circuitry. In case of malfunction (Failure of protection circuit activation), please stop the operation and replace the failed power supply.

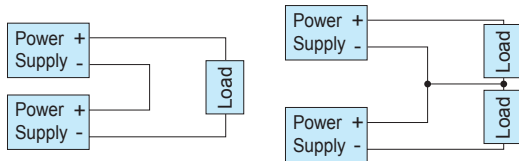


Fig.2.1 Examples of connecting in series operation

2.2 Parallel Operation

- Parallel operation is not possible.
- Redundancy operation is available by wiring as shown below.

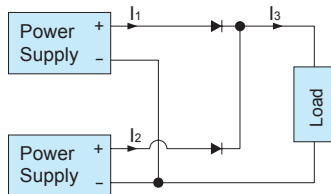


Fig.2.2 Example of redundancy operation

- Even a slight difference in output voltage can affect the balance between the values of I_1 and I_2 . Please make sure that the value of I_3 does not exceed the rated current of a power supply.

$$I_3 \leq \text{the rated current value}$$

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

3 Temperature Measurement Point

- For proper operation of the power supply, please note the following:
 - The temperature rise and heat dissipation of the converter must be considered.
 - Conditions vary with environment and input voltage.
 - Mounting surface will be very hot during operation, so please be careful not to touch the surface.
- For reliable and safe operation, please make sure the maximum component temperatures rise given in table 3.1 is not exceeded. Please refer to Fig.3.2 for recommended cooling condition. Operating at the maximum temperature rating results in 3-Years life expectancy. The actual life expectancy can be extended by reducing the ambient temperature. Please refer to section 5 for more information.
- Test Measuring points
 - Be aware of the conductive parts during the measurements. Please contact us for more detail.

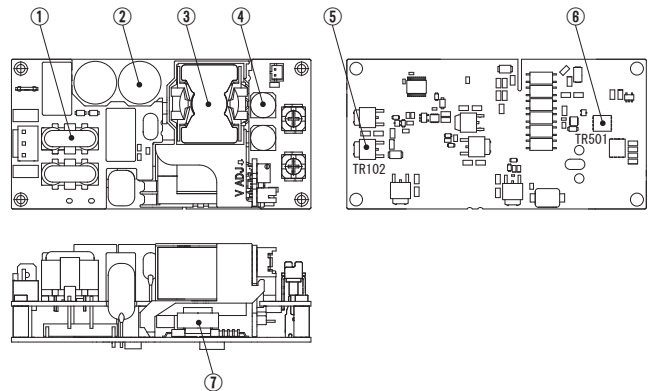


Fig.3.1 Temperature measurement points locations

Table 3.1 Maximum operating temperature

Point	Parts name	Symbol No.	Maximum temperature[°C]	Remarks
①	Line Filter	L101	100	
②	Input Capacitor	C114	89	
③	Transformer	T201	100	
④	Output Capacitor	C516	94	
⑤	Transistor	TR102	110	case temperature
⑥	Rectifier	TR501	110	case temperature
⑦	Transformer	T301	80	Applicable when -R3

Recommended cooling condition

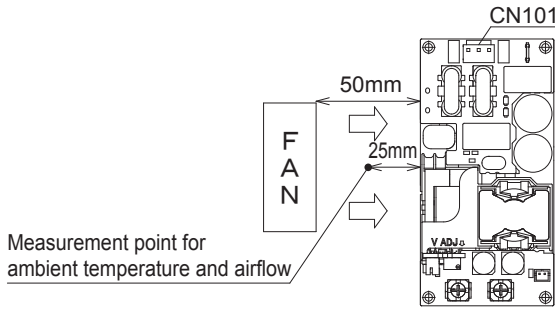


Fig.3.2 Recommended cooling condition

4 Ground

When installing the power supply with your unit, ensure that the input FG terminal or mounting hole FG is connected to safety ground of the unit. However when applying the safety agency, connect the input FG terminal to safety ground of the unit.

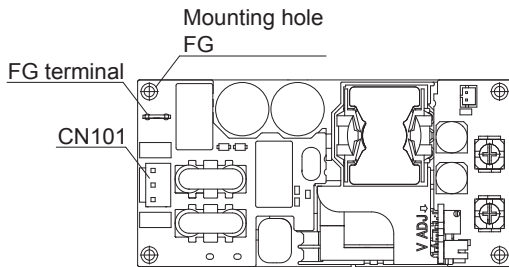


Fig.4.1 Location of FG

*It is recommended to electrically connect FG to metal chassis for reducing noise.

5 Life Expectancy and Warranty

Life Expectancy

Table 5.1 Life Expectancy

Cooling Method	Mounting Method	Average ambient temperature (year)	Life Expectancy	
			Io ≤ 75%	75% < Io ≤ 100%
Forced air	A,B,C,D,E,F	Ta = 40°C or less	Over 10years	Over 10years
		Ta = 50°C	Over 10years	Over 10years

Remarks:

The above life expectancy is the value at recommended cooling condition(3m/s).

Estimated life expectancy can be calculated by point temperature ②, ④ shown in instruction manual 3. Please contact us for details.

Warranty.

Table 5.2 Warranty

Cooling Method	Mounting Method	Average ambient temperature (year)	Warranty	
			Io ≤ 75%	75% < Io ≤ 100%
Forced air	A,B,C,D,E,F	Ta = 40°C or less	5years	4years
		Ta = 50°C	5years	3years

6 Option and Others

6.1 Outline of options

Option -C

Option -C models have coated internal PCB for better moisture resistance.

Option -J1

Option -J1 models, the Input connector is VH connectors (Mfr. J.S.T.).

Option -J3

The input connector is VH connectors (Mfr. J.S.T.) and the connector is oriented horizontally.

Please contact us for details about appearance.

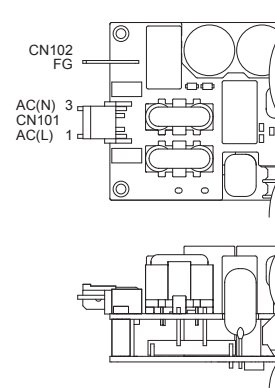


Fig.6.1 Example of option -J3

Option -R3

The following features are included.

Please refer to the optional parts for the dedicated harness.

AUX1 (12V 1A)

- This power supply is equipped with an auxiliary low power 12V output AUX1(12V±10% 1.0A) which is available from CN701.
- AUX has been isolated from other circuit (input, output, FG, RC).
- Do not exceed the current rating, it may causes malfunction or failure of the internal circuitry.

AUX2 (5V 1A)

- Output AUX2 will be generated from CN601. AUX2 (5V±5% 1.0A) can be used to power up remote control or other circuits.
- AUX has been isolated from other circuit (input, output, FG, RC).

- Do not exceed the current rating , it may causes malfunction or failure of the internal circuitry.

Table 6.1 External capacity on the output recommended capacity of AUX2

Output Voltage	Recommended capacitance [μF]
5V (AUX2)	0 to 330

Remarks:

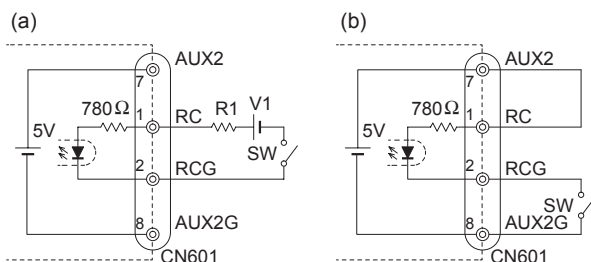
When the load current changes rapidly, for output stability improvement. Please contact us for details.

■Remote ON/OFF

- You can operate the remote ON/OFF function by sending signals to CN601. Please see Table 6.2 for specifications and Fig.6.2 for connecting examples.
- Remote ON/OFF circuits (RC and RCG) are isolated from input, output FG and AUX.
- Please note the following when using the remote ON/OFF function.
 - ① Turns on by drawing current to RC.
 - ②The current flow to RC is a 5mA typ (maximum 25mA).
 - ③If the output voltage is turned off through the remote ON/OFF circuit, 12V AUX stops.
 - ④If voltage or current of a value not listed in Table 6.2 is applied between RC and RCG, the output voltage may not be generated normally.
 - ⑤Please wire carefully. If you wire wrongly, the internal components of a unit may be damaged.

Table 6.2 Specifications of remote ON/OFF

Fig.6.2 RC circuit example		-R3
SW Logic	Output on	SW close (3mA min)
	Output off	SW open (0.1mA max)
Optional harness		H-SN-38



(Example V1 : 15V R1 : 2kΩ)

Fig.6.2 RC circuit example

- * If the output of an external power supply is within the range of 4.5 - 12.5V, you do not need a current limiting resistor R1. If the output exceeds 12.5V, however, please connect the current limiting resistor R1.

■To calculate a current limiting resistance value, please use the following equation.

R1 Recommended resister [Ω]	Ri : 780[Ω]
$\frac{V1 - (1.1 + Ri \times 0.005)}{0.005}$	

6.2 Medical Isolation Grade

■GMA series fit 2MOPP

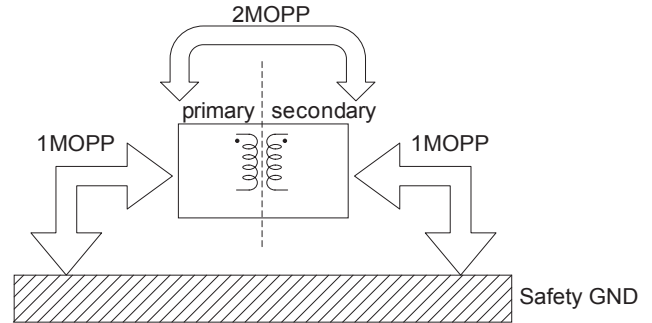


Fig.6.3 Medical Isolation Grade

6.3 External capacitor on the output side

■When the load current changes rapidly, for output stability improvement we recommend that you connect the capacitor to the output terminal.

Table 6.3 External capacity on the output recommended capacity [μF]

Model	Output voltage [V]	Recommended capacitance [μF]
GMA300F-12	11.4 ≤ Vo ≤ 13.2	0 to 15,000
GMA300F-24	22.8 ≤ Vo ≤ 26.4	0 to 8,800
GMA300F-48	45.6 ≤ Vo ≤ 52.8	0 to 220
GMA300F-56	52.0 ≤ Vo ≤ 56.0	0 to 120

Remarks:

When load current changes rapidly, some specifications may not meet the spec.

Please mount power supply after enough evaluation and comply with recommended amount of capacitors. If you exceed the rated amount of capacitor, output for power supply may be stopped or power supply may be unstable.

6.4 Others

■High voltage exists in the power supply for a few minutes after input voltage is stopped. Please pay attention to this during maintenance.

■This power supply is manufactured by SMD technology. The stress to PCB like twisting or bending causes the defect of the unit, so handle the unit with care.

- Notes for mounting

- ①All Mounting holes should be tight and secured.
 - ②Power supply should be mounted parallel to the mounting surface.
 - ③Avoid applying mechanical stress or shock to the power supply.
- When power supply is energized or immediately after power supply stops working, power supply is still very hot, so please handle it with care.