

GXE600 Series

Instruction Manual

BEFORE USING THE POWER SUPPLY UNIT

Be sure to read this instruction manual thoroughly before using this product. Pay attention to all cautions and warnings before using this product. Incorrect usage could lead to an electrical shock, damage to the unit or a fire hazard.

DANGER

Never use this product in locations where flammable gas or ignitable substances are present.

INSTALLATION WARNING

- When installing, ensure that work is done in accordance with the instruction manual. When installation is improper, there is risk of electric shock and fire.
- Installation shall be done by Service personnel with necessary and appropriate technical training and experience. There is a risk of electric shock and fire.
- Do not cover the product with cloth or paper etc. Do not place anything flammable around. This might cause damage, electric shock or fire.

WARNING on USE

- Do not touch this product or its internal components while circuit in operation, or shortly after shutdown. You might receive a burn.
- While this product is operating, keep your hands and face away from it as you may be injured by an unexpected situation.
- For products with no cover, do not touch them as there are high-voltage and high temperature parts inside. Touching them might cause injury such as electric shock or burn.
- There are cases where high voltage charge remains inside the product. Therefore, do not touch even if they are not in operation as you might get injured due to high voltage and high temperature. You might also get electric shock or burn.
- Do not make unauthorized changes to this product nor remove the cover as you might get an electric shock or might damage the product. We will not be held responsible after the product has been modified, changed or dis-assembled.
- Do not use this product under unusual condition such as emission of smoke or abnormal smell and sound etc. Please stop using it immediately and shut off the product. It might lead to fire and electric shock. In such cases, please contact us. Do not attempt repair by yourself, as it is dangerous for the user.
- Do not operate and store these products in environments where condensation occurs due to moisture and humidity. It might lead fire and electric shock.
- Do not drop or apply shock to this product. It might cause failure. Do not operate these products mechanical stress is applied.

CAUTION on MOUNTING

- Confirm connections to input/output terminals are correct as indicated in the instruction manual before switching on.
- Input/output line, please use the wires as short and thick as possible.
- Do not use this product in special environment with strong electromagnetic field, corrosive gas or conductive substances and direct sunlight, or places where product is exposed to water or rain.
- Mount this product properly in accordance with the instruction manual, mounting direction and shall be properly be ventilated.
- Please shut down the input when connecting input and output of the product.
- When installing in environment where conductive foreign, dust and liquid might be present, please consider penetration of above foreign material in the power supply by installing filter, to prevent trouble or malfunction.

⚠ CAUTION on USE

- Product individual notes are shown in the instruction manual. If there is any difference with common notes individual notes shall have priority.
- Before using this product, be sure to read the catalog and instruction manual. There is risk of electric shock or damage to the product or fire due to improper use.
- Input voltage, Output current, Output power, ambient temperature and ambient humidity should be kept within specifications, otherwise the product will be damaged, or cause electric shock or fire.
- If the built-in fuse is blown, do not use the product even after replacing the fuse as there is risk of abnormality inside. Be sure to request repair to our company.
- For products without built-in protection circuit (element, fuse, etc.), insert fuse at the input to prevent smoke, fire during abnormal operation.
As for products with built-in protection circuit, depending on usage conditions, built-in protection circuit might not work. It is recommended to provide separate proper protection circuit.
- For externally mounted fuse do not use other fuses aside from our specified and recommended fuse.
- This product was made for general purpose electronic equipment use and is not designed for applications requiring high safety (such as extremely high reliability and safety requirements). Even though high reliability and safety are not required, this product should not be used directly for applications that have serious risk for life and physical safety. Take sufficient consideration in fail-safe design (such as providing protective circuit or protective device inside the system, providing redundant circuit to ensure no instability when single device failure occurs).
- When used in environments with strong electromagnetic field, there is possibility of product damage due to malfunction.
- When used in environment with corrosive gas (hydrogen sulfide, sulfur dioxide, etc.) , there is possibility that they might penetrate the product and lead to failure.
- When used in environments where there is conductive foreign matter or dust, there is possibility of product failure or malfunction.
- Provide countermeasure for prevention of lightning surge voltage as there is risk of damage due to abnormal voltage.
- Connect together the frame ground terminal of the product and the ground terminal of the equipment for safety and noise reduction. If these grounds are not connected together, there is risk of electric shock.
- Parts with lifetime specifications (built-in electrolytic capacitor) are required to be replaced periodically. Set the overhaul period depending on the environment of usage and perform maintenance.
Also, note that there are cases when EOL products cannot be overhauled.
- Take care not to apply external abnormal voltage to the output. Especially, applying reverse voltage or overvoltage more than the rated voltage to the output might cause failure, electric shock or fire.
- This product has possibility that hazardous voltage might occur in output terminal depending on failure mode. The output of these products must be protected in the end use equipment to maintain SELV.
- The output of these product is considered to be a hazardous energy level (The voltage is 2V or more and the power is 240VA or more). It must not be made accessible to users.
- Protection must be provided for Service Engineers against indirect contact with the output terminals and/or to prevent tools being dropped across them.
- While working on this product, the AC input power must be switched off and the input and output voltage should be zero.

⚠ Special Instructions for IEC/EN/ES/CSA 60601-1

- These products are designed for continuous operation within an overall enclosure, and must be mounted such that access to the mains terminals is restricted.
- These products are not suitable for use in the presence of flammable anesthetics mixtures with air or with oxygen, or with nitrous oxide.
- The output circuit has not evaluated for connecting to Applied Parts. For end products intended to connect the output circuit to Applied Parts, suitable evaluation of the separation, leakage current, dielectric voltage withstand, and related requirements should be conducted.
- Doublepole/ neutral fusing.  Option model “/SF” have fuse only live line.
- These products provide One Means Of Patient Protection (1MOPP) between Primary/Secondary and FG, and Two Means Of Patient Protection (2MOPP) between Primary and Secondary.

- The 48V model have possibility that hazardous voltage might occur in output terminal depending on failure mode (The output voltage is 60V or more on failure mode). The output of these products must be protected in the end use equipment. If it is not acceptable, contact us.
- These products are classed as ordinary equipment according to IEC/EN/ES/CSA60601-1 and are NOT protected against the ingress of water.
- Reference should be made to local regulations concerning the disposal of these products at the of their useful life.

⚠ Note

- Take note that traces of sheet metal processing be left in our power supplies.
- When disposing product, follow disposal laws of each municipality.
- Published EMI (CE, RE) or immunity is the result when measured in our standard measurement conditions at the factory default and might not satisfy specification when various settings are changed from the factory default or mounted and wired inside end-user equipment. Use the product after sufficiently evaluating at actual end-user equipment.
- When exporting our products, apply for necessary permissions as required by rules and regulations of Foreign Exchange and Foreign Trade Control Act.
- Catalogue, contents of the instruction manual might be changed without a prior notice. Refer to latest catalogue or instruction manual.
- Reproduction or reprinting the instruction manual or its portion is forbidden without our permission.

LONG-TERM STORAGE METHOD AND LONG-TERM STORAGE PERIOD

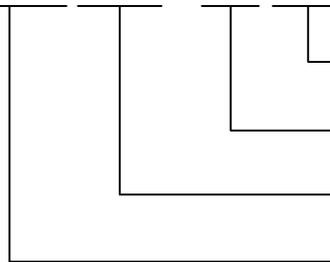
- Please keep the product in carton box.
- **⚠** Please do not apply excessive vibration, shock or mechanical stress applied directly to the product.
- Please keep away from direct sunlight.
- For long-term storage temperature and humidity, the following conditions shall be used as a guideline :
 - Temperature range : 5°C~30°C
 - Humidity range : 40%~60%RHPlease keep away from the places where temperature and humidity can change drastically.
It can cause condensation on the product or deterioration.
- For long-term storage period, we recommend to use within 2 years after receiving the product.
 - There is tendency that the leakage current of an aluminum electrolytic capacitor may increase when stored without using for a long time.
 - This phenomenon can be improved by applying voltage to the aluminum electrolytic capacitor to reduce the increased leakage current through the self-recovery effect of the electrolyte.
 - For reference, before using products that have been stored for a very long time, please warm-up first for 30 minutes or more without taking load.

< Criterion of warm up voltage condition >

 - (1)Implementation period : 1 year or above after the delivery
 - (2)Electrical continuity condition
 - Input voltage : Rating
 - Load : 0A
 - Ambient temperature : Normal temperature
 - Time : 30 minutes or more

1. Model name identification method

GXE 600 - 24 / □



Option (*1)

Rated Output Voltage

Output Power type

Series Name

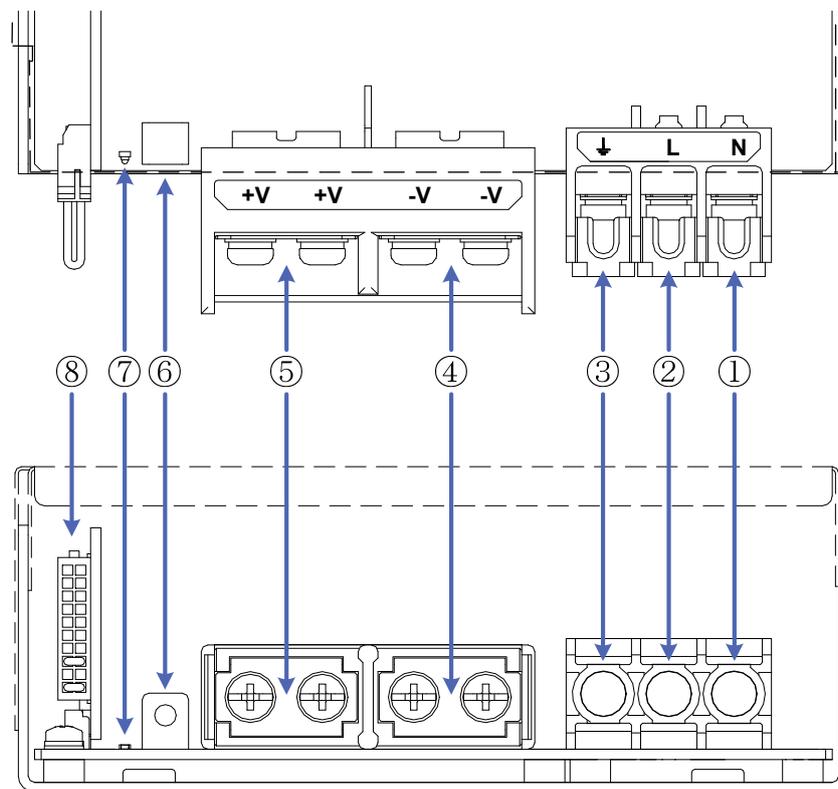
(*1) Blank : Standard

/A : With cover type.

/HD : High resistance against dust environment type.

/HDA : High resistance against dust environment with cover type.

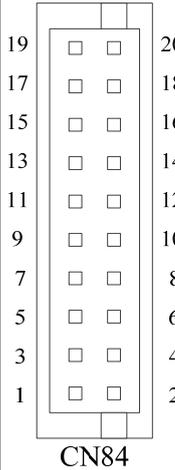
2. Terminal Explanation



Standard

- ① N : Input terminal Neutral line (Fuse in line) (M3.5 screw)
- ② L : Input terminal Live line (Fuse in line) (M3.5 screw)
- ③ ↓ : Earth terminal (M3.5 screw)
- ④ -V : - Output terminal (M4 screw)
- ⑤ +V : + Output terminal (M4 screw)
- ⑥ Output voltage adjustment trimmer
- ⑦ Output monitoring indicator (The green LED lights up at the PF signal is Low. Refer to "6-13. PF signal".)
- ⑧ CN84: Signal connector CN84

CN84 Connector pin Configuration and Functions

		No.	Configuration	Function
 <p style="text-align: center;">CN84</p>	1	+Vm	Output monitor terminal, internally connected to +output terminal. (+Vm terminal cannot supply load current.)	
	2	+S	Remote sensing terminal for +output. (For remote sensing function, which compensates for line drop between power supply terminals and load terminals. Connect to +Vm terminal when remote sensing function unnecessary.)	
	3	NC	Do not connect.	
	4	NC	Do not connect.	
	5	-Vm	Ground for output monitor terminal, internally connected to -output terminal. (-Vm terminal cannot supply load current.)	
	6	-S	Remote sensing terminal for -output side. (For remote sensing function, which compensates for line drop between power supply terminals and load terminals. Connect to -Vm terminal when remote sensing function unnecessary.)	
	7	PC	Current balance terminal. (For current balancing in parallel operation.)	
	8	CC	Output current external control terminal.	
	9	PV	Output voltage external control terminal.	
	10	COM	Ground for PC, CC and PV signal, internally connected to -S.	
	11	PF	Power Fail signal output terminal. (Open collector output. As the output voltage or current drops, PF signal will be "High".)	
	12	AC Fail	AC Fail signal output terminal. (Open collector output. As the input voltage drops to less than 85Vac, AC Fail signal will be "High".)	
	13	CNT 1	Remote ON/OFF control terminal (1).	
	14	+STB	External standby supply (5V/1A).	
	15	CNT 2	Remote ON/OFF control terminal (2).	
	16	-STB	Ground for External standby supply, internally connected to TOG terminal.	
	17	SG	Ground for DATA, internally connected to TOG terminal.	
	18	TOG	Ground for CNT, PF and AC Fail signal.	
	19	+DATA	+DATA signal terminal for RS-485. (Non-inverted differential pair.)	
	20	-DATA	-DATA signal terminal for RS-485. (Inverted differential pair.)	

* CN84 Connector (JST)

Connector	Housing	Terminal Pin
S20B-PHDSS	PHDR-20VS	SPHD-002T-P0.5 (AWG24 ~ 28) or SPHD-001T-P0.5 (AWG22 ~ 26)

Hand Crimping Tool : YRS-620 (SPHD-002T-P0.5) (JST) or YC-610R (SPHD-001T-P0.5) (JST)

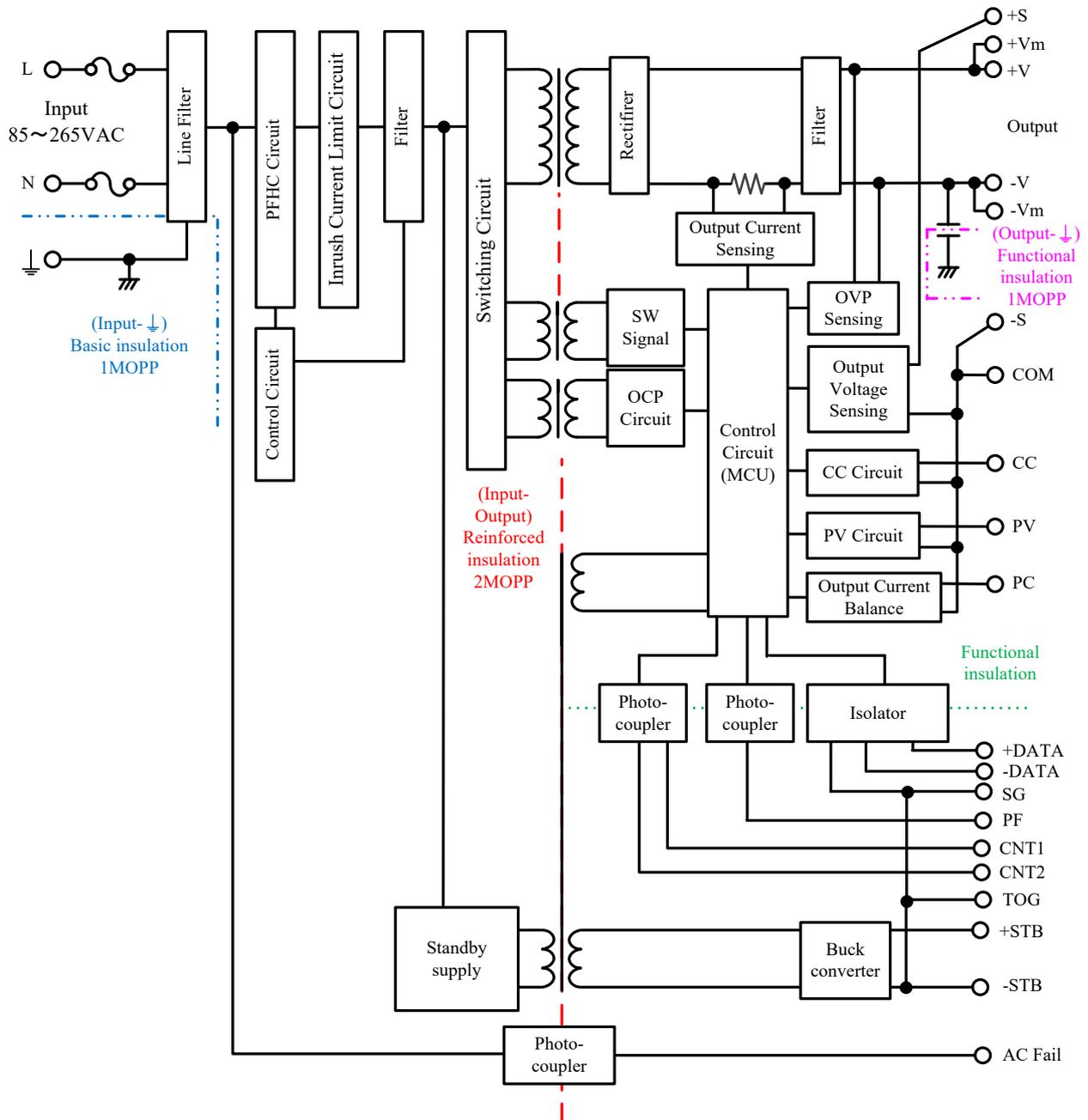
Use maker recommended crimping tool.

These are connected by short pieces at time of shipment.

"+Vm" terminal (Pin No.1) to "+S" terminal (Pin No.2)

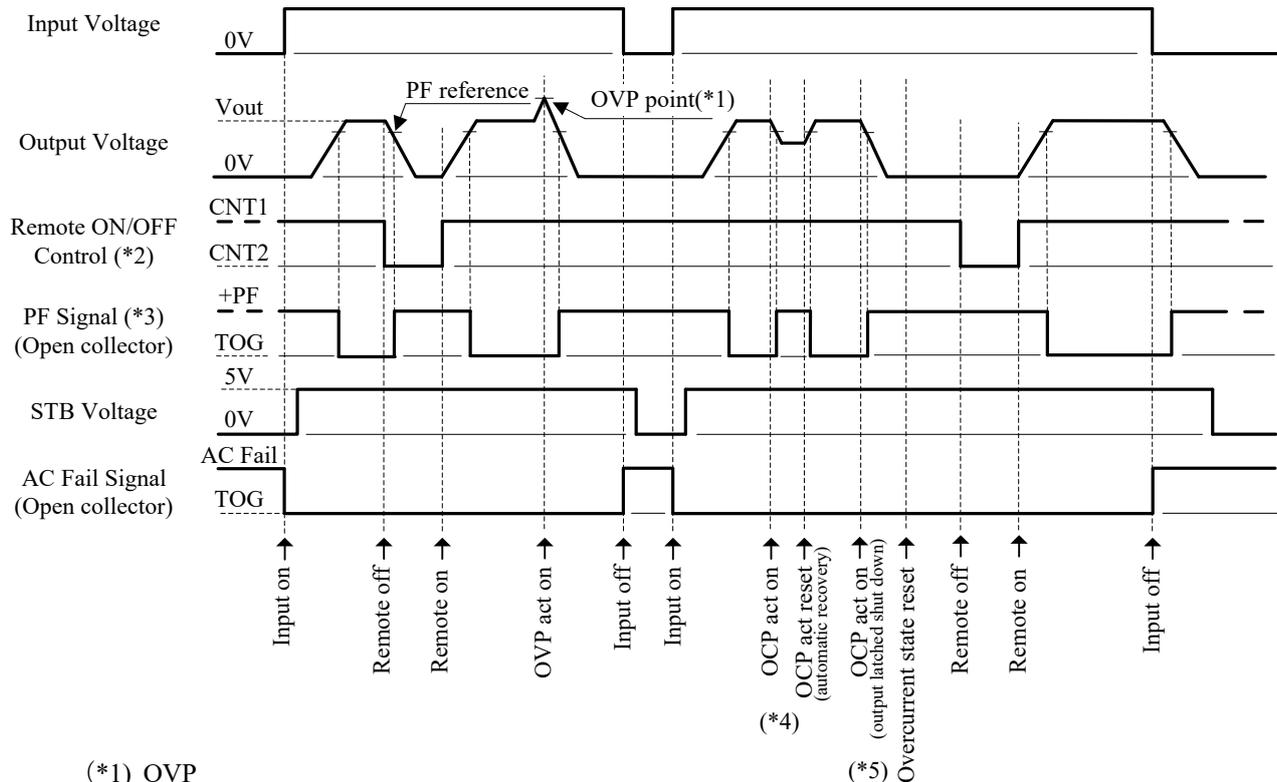
"-Vm" terminal (Pin No.5) to "-S" terminal (Pin No.6)

3. Block Diagram



- Circuit topology, switching frequency
 - Switching Circuit : Full-Bridge converter
 - 67kHz (Primary circuit), 134kHz (Secondary circuit)
 - *At light-load condition, it is intermittent operation.
 - PFHC circuit : Active filter
 - 100kHz
 - Standby supply : Flybuck converter
 - 65kHz
 - Buck converter (STB)
 - 1~2.5MHz
- Fuse rating
 - 12.5A

4. Sequence time chart



(*1) OVP

HWOVP : +/- Output terminal sensing
 <Factory default> 125%Typ. (Fixed), Output shut down (Selectable)
 SWOVP : +/-S terminal sensing
 <Factory default> 125%Typ. (Adjustable), Output shut down (Selectable)

(*2) Remote ON/OFF control

<Factory default> CNT terminal input mode (Selectable)

(*3) PF Signal

<Factory default> 80%Typ. (Adjustable), CV_PF mode (Selectable)

(*4) Static over current condition

Constant Current (CC) limit
 <Factory default> 115%Typ. (Adjustable)
 SWOCP

<Factory default> 120%Typ. (Adjustable), Automatic recovery (Selectable)

If the SWOCP threshold described in Section “6-5. Overcurrent Protection” is changed to the same value as the CC reference value or less, SWOCP will operate and output is shut down.

(*5) Dynamic overcurrent condition

HWOCP : Output latched shut down in abnormal conditions such as output short circuit.

OVP point, OCP point, PF target and CC limit can be adjusted by communication function. And, protection mode, Remote ON/OFF control mode and PF signal mode can be selected by communication function. When these are changed from the factory default, the operation may differ from the sequence time chart above. Refer to the “Communication Manual” for details.

If it is used as constant voltage (CV) power supply, use in the factory default setting is recommended.

If it is used as constant current (CC) power supply, refer to “6-11. Output Current External Control” and use within the output derating.

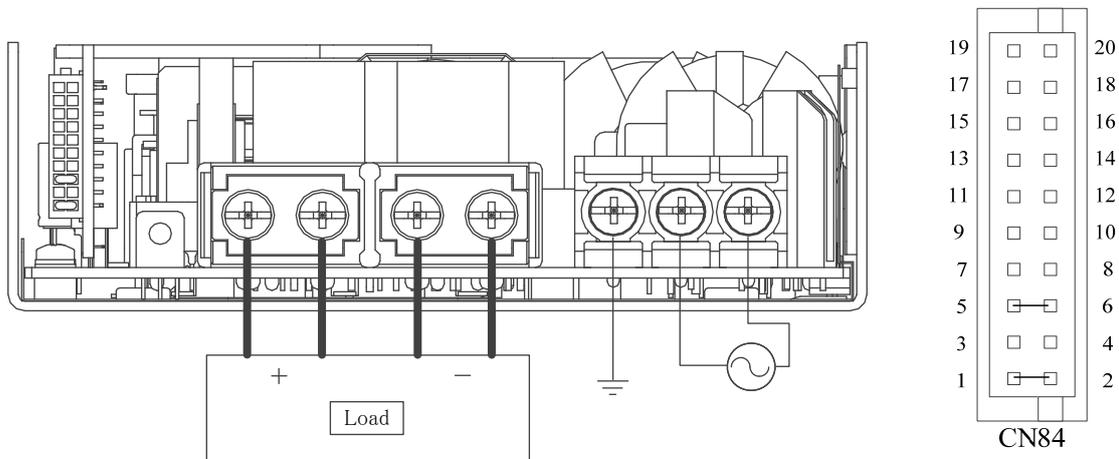
With the communication function, the PF reference can be adjusted, and the detection target can be selected from output voltage and current. Refer to “Communication Manual”.

5. Connection method

Pay attention to the input wiring. If it is connected to wrong terminal, the power supply will be damaged.

- Input must be off when making connections.
 - Connect \perp terminal to earth (frame ground of the equipment etc.) by thick wire for safety and improvement of noise sensitivity.
 - Because of the output voltage may rise, before connecting or disconnecting to CN84, make sure that the inside of the power supply is sufficiently discharged and the AC line is turned off.
- Basic connection (Local sensing)

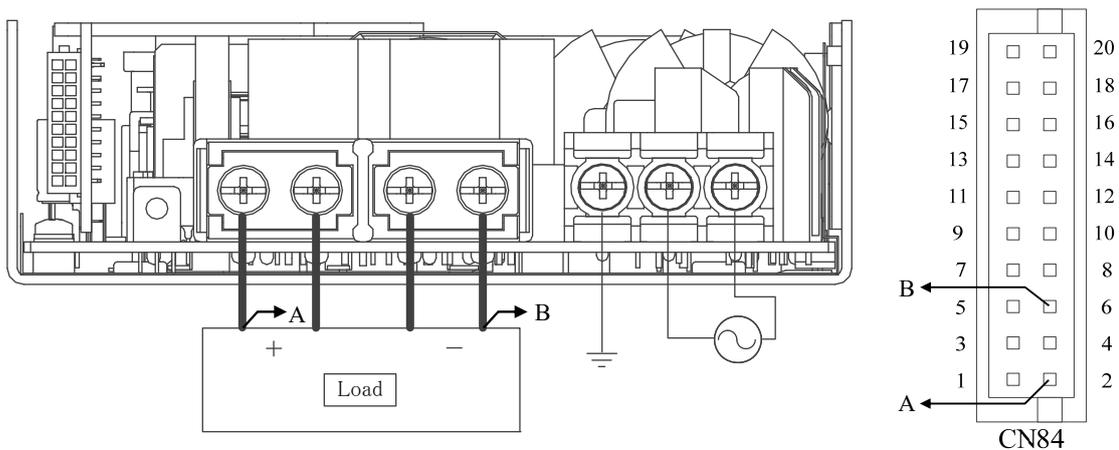
Connect "+S" terminal (Pin No.2) to "+Vm" terminal (Pin No.1), and "-S" terminal (Pin No.6) to "-Vm" terminal (Pin No.5) with the attached short pieces. (Short pieces are mounted at time of shipment.)



Recommended torque : Input terminal M3.5 screw 1.0N·m (10.2kgf·cm) ~ 1.6N·m (16.3kgf·cm)
 Output terminal M4 screw 1.2N·m (12.2kgf·cm) ~ 1.6N·m (16.3kgf·cm)

• Remote sensing connection

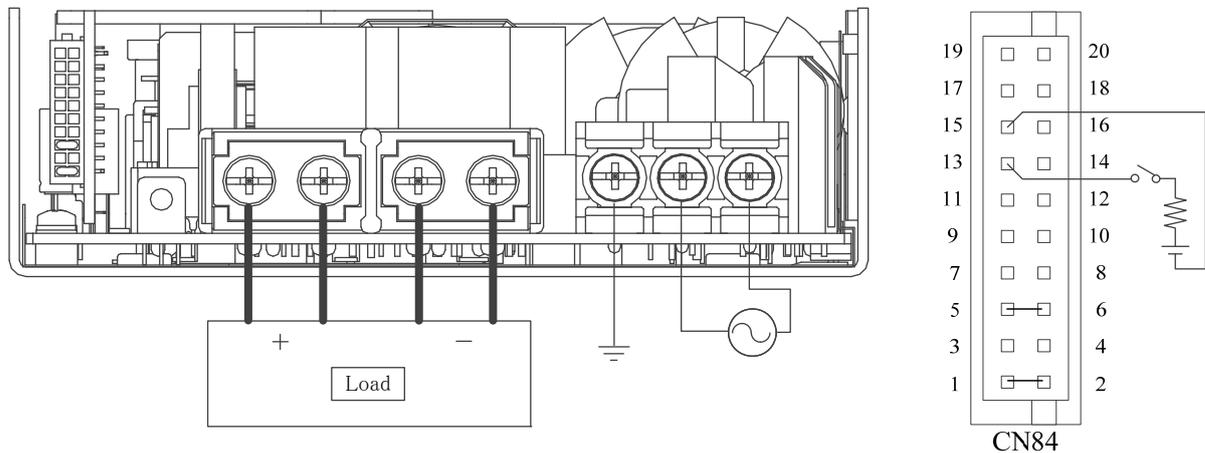
- 1) Connect "+S" terminal (Pin No.2) to "+" output terminal of load with wires.
 - 2) Connect "-S" terminal (Pin No.6) to "-" output terminal of load with wires.
- Sensing lines shall be twisted.



*If the remote sensing terminals are opened, the output will rise and OVP will operate.

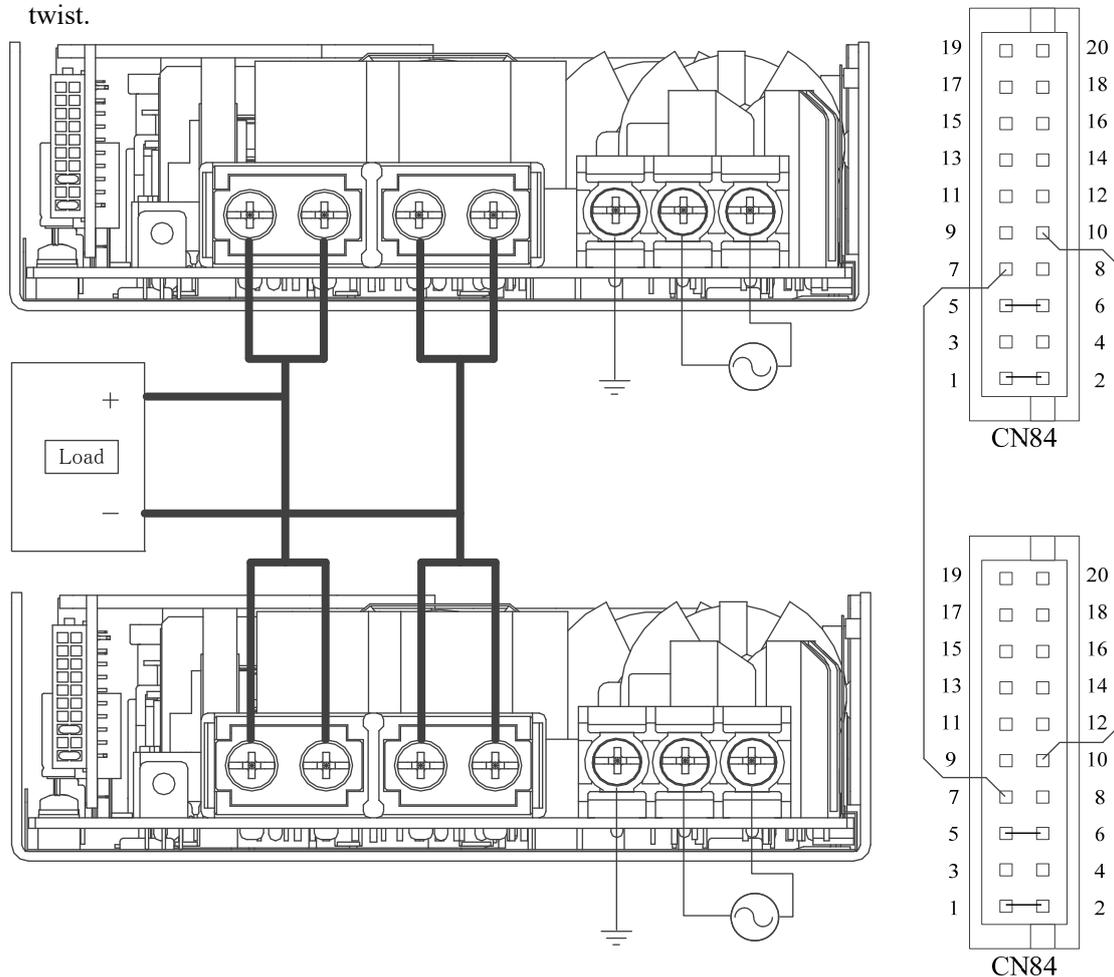
• Remote ON/OFF control (CNT terminal input mode)

When using an external power supply, connect the following circuit between "CNT1" terminal (Pin No.13) and "CNT2" terminal (Pin No.15) to perform remote ON/OFF control. Refer to the "6-16. Remote ON/OFF Control" section for alternative connections. ON/OFF control lines shall be twisted.



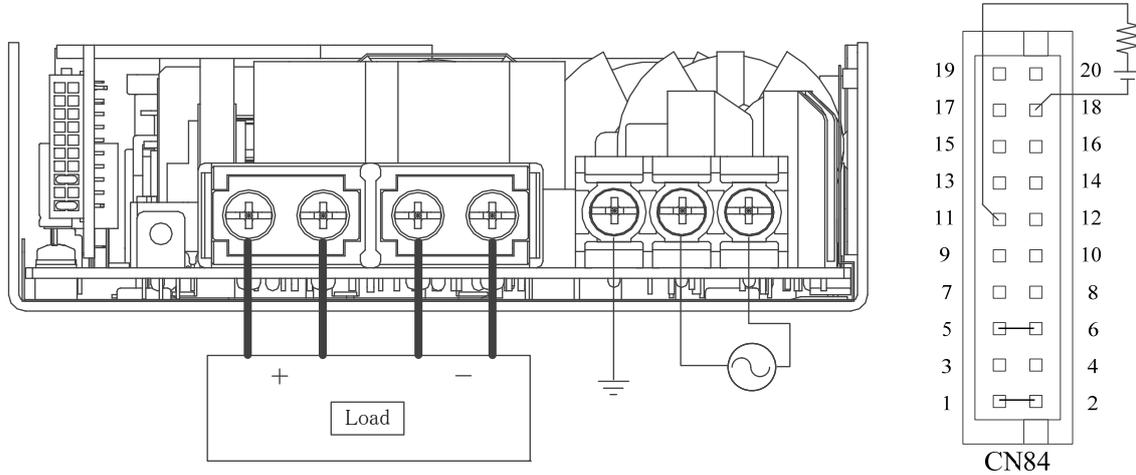
• Parallel operation

Connecting PC to PC terminal (Pin No.7) and COM to COM terminal (Pin No.10) of each power supply, the current balance function activates and output current of each power supply is equivalently supplied to load. Wires to PC terminals, COM terminals shall be as short as possible and same length with twist.



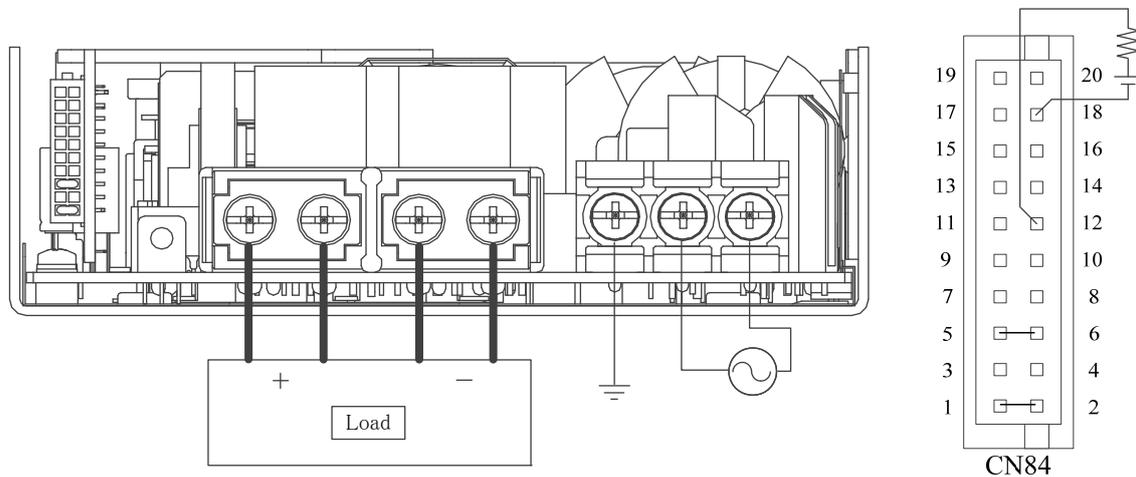
- PF signal output

PF signal is open collector output. Connect a following circuit between "PF" terminal (Pin No.11) and "TOG" terminal (Pin No.18) for PF signal output. Signal lines shall be twisted.

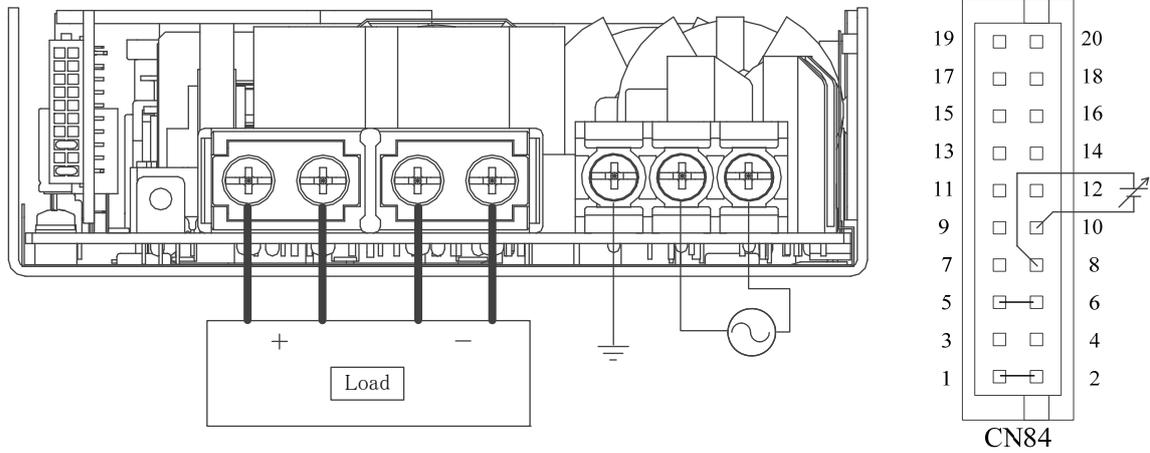


- AC Fail signal output

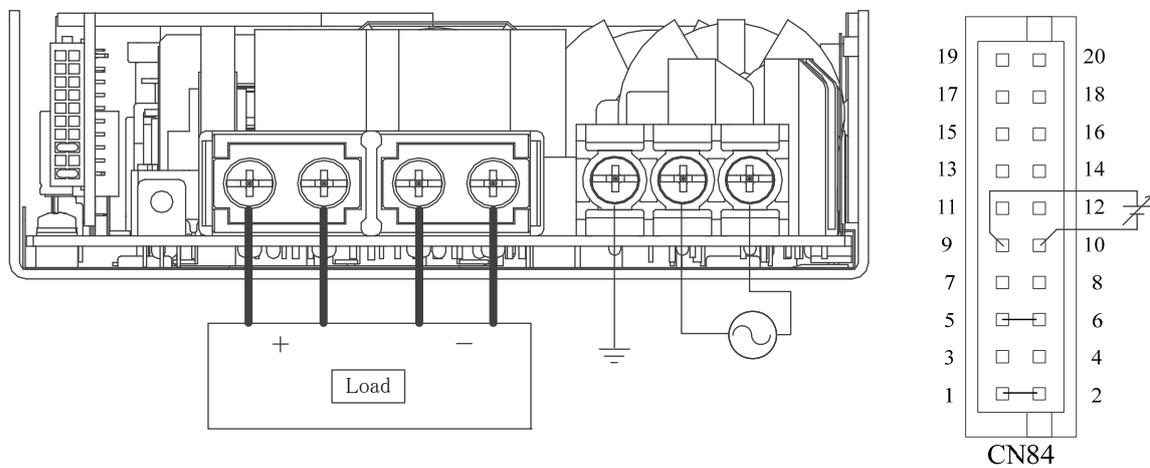
AC Fail signal is open collector output. Connect a following circuit between "AC Fail" terminal (Pin No.12) and "TOG" terminal (Pin No.18) for AC Fail signal output. Signal lines shall be twisted.



- Output current external control (CC)
 Connect external voltage source between "CC" terminal (Pin No.8) and "COM" terminal (Pin No.10) for output current external control. Signal lines shall be twisted.

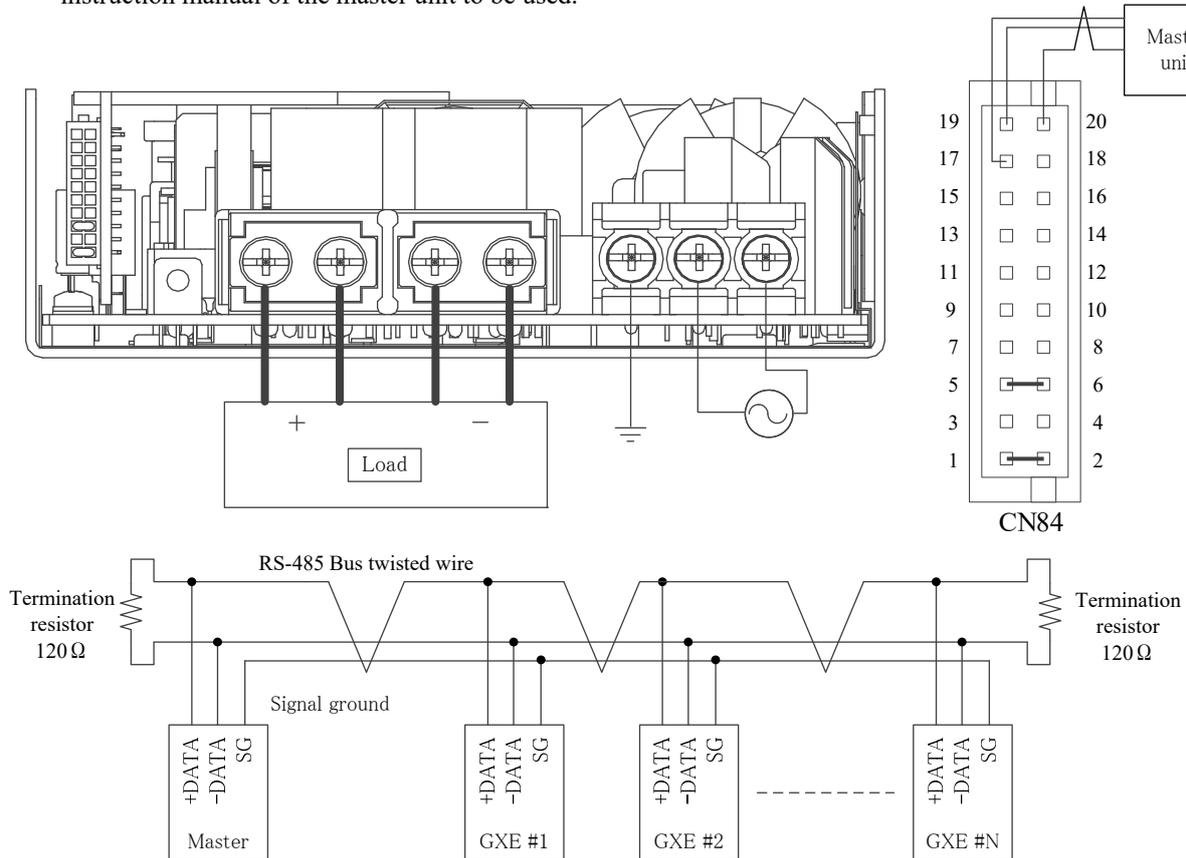


- Output voltage external control (PV)
 Connect external voltage source between "PV" terminal (Pin No.9) and "COM" terminal (Pin No.10) for output current external control. Signal lines shall be twisted.



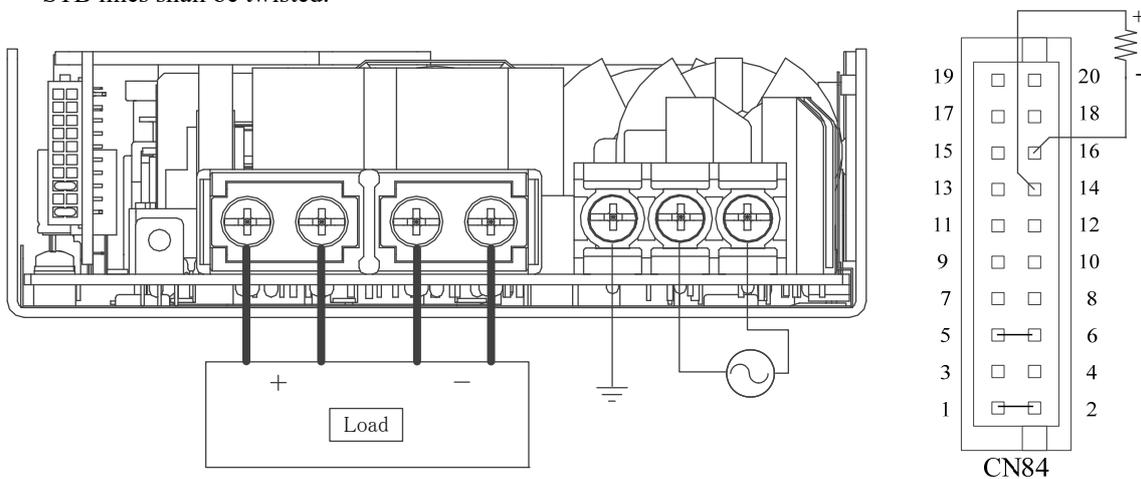
• **Communication function (RS-485)**

Connect "+DATA" terminal (Pin No.19), "-DATA" terminal (Pin No.20), "SG" terminal (Pin No.17) to master unit. Signal lines shall be twisted. This product does not have a built-in terminating resistor for RS-485. It is recommended to connect a terminating resistor to stabilize the communication quality. Connect the terminating resistor to the RS-485 port of the master unit and the connector of this product farthest from the master unit on the bus line. The master unit may have a built-in terminating resistor, so refer to the instruction manual of the master unit to be used.



• **External standby supply (STB)**

Connect "+STB" terminal (Pin No.14) and "-STB" terminal (Pin No.16) to load. STB lines shall be twisted.



6. Explanation of Functions and Precautions

6-1. Input Voltage Range

Input voltage range is single phase 85-265VAC (47-63Hz). DC input is inhibited.

Input voltage, which is out of specification, might lead unit damage. For cases where conformance to various safeties required, described as 100-240VAC (50-60Hz). Output derating is required for AC input voltage less than 170VAC.

* GXE is able to withstand input of 300VAC for 5 seconds (No damage). The electrical characteristics are satisfied at within 85-265VAC.

6-2. Output Voltage Range

Output voltage is set at the nominal voltage at time of shipment. The output voltage adjustment trimmer allows the output voltage to be variable within the range of +20% to -20% of the rated value.

Turning the trimmer clockwise, the output voltage will be increased. Take note when the output voltage is increased excessively, over voltage protection (OVP) function might operate.

It is also possible to adjust the output voltage by PV function. Refer to "6-12. Output Voltage External Control (PV)"

Furthermore, when the output voltage higher than nominal voltage, the output current must be reduced as not to exceed the maximum output power.

6-3. Inrush Current

The switch method is used for limiting the inrush current. Higher current might flow when input turn on interval is short.

First inrush current and second inrush current flow. Select input switch and external fuse carefully.

6-4. Over Voltage Protection (OVP)

Two overvoltage protection functions, SWOVP that detects the voltage between +/-S (remote sensing terminals) and HWOVP that detects the voltage between +/-V (output terminals), are provided.

The factory default protection setting is the output shut down method with manual reset type.

To reset OVP, remove the input of power supply for a few minutes and re-input. Or, use Remote ON/OFF control reset (Remote ON/OFF : OFF to ON).

Both OVP functions can be individually changed to the automatic recovery method by using the communication function.

For the communication function, refer to the "Communication Manual".

Never apply higher voltage from externally to the output terminal and the remote sensing terminal to avoid unit failure.

In case of inductive load, put protective diode in series to the output power line.

SWOVP : The operating point can be set within the range of 20% to 125% of the nominal output voltage by using the communication function, and it operates at 125% Typ. of the nominal output voltage in the factory default.

For using as a constant voltage power supply, when changing and adjusting the SWOVP operating point, as a guide, set it to a value 3% or more higher than the nominal output voltage with respect to the set output voltage. (24V output model is 0.72V or more, 48V output model is 1.44V or more.)

When considering the transient operation of the power supply and the prevention of malfunction due to external noise, etc., secure a sufficient margin with respect to the set output voltage.

It is recommended to confirm that the specifications and performance required for the actual end-user equipment are satisfied.

HWOVP : The operating point can't be changed. It operates 125% Typ. of nominal output voltage.

6-5. Over Current Protection (OCP)

Two output shut down overcurrent protections, SWOCP that responds to static overcurrent and HWOCP that responds to dynamic overcurrent, are provided.

It is also possible to set overcurrent protection using the CC reference values described later in Section 6-11.

SWOCP : The operating point can be set within the range of 20% to 120% of the maximum output current by using the communication function, and it operates at 120% Typ. of the maximum output current in the factory default.

The operation mode can be selected from "automatic recovery" and "latch stop" by using the communication function, and is set to "automatic recovery" in the factory default.

HWOCP : When the output current exceeds the SWOCP operating range, it operates in "latch stop" mode and output shut down. The operating point and operating mode can't be changed.

OCP using CC reference :

The operating point can be set within the range of 20% to 115% of the maximum output current by the output current external control function, and it operates at 115% Typ. of the maximum output current in the factory default.

The operation mode is "constant current limit" and can't be changed. Refer to "6-11. Output Current External Control" for more details.

Depending on the combination of above three functions, the operation during overcurrent protection will be one of the following.

1. Constant current limit and automatic recovery (Factory default) : [CC reference < SWOCP point]

In the overloaded state, the output voltage drops due to the constant current control operation. When changing the SWOCP operating point, take into consideration the transient operation of the power supply and the prevention of malfunction due to external noise etc., as a guide, it is recommended to set the difference of 5% or more of the maximum output current value with respect to the CC reference value.

2. Output shut down method and automatic recovery : [SWOCP point \leq CC reference]

When the SWOCP operation mode is set to "automatic recovery", the output shut down by the SWOCP function in the overloaded state, and it restarts after the automatic recovery time. The automatic recovery time in the factory default is set to 1 second and can be changed using the communication function.

3. Output shut down method and latch stop : [SWOCP point \leq CC reference]

When the SWOCP operation mode is set to "latch stop", the output is latched off by the SWOCP function in the overloaded state. To reset OCP, remove the input of power supply for a few minutes and re-input. Or, use Remote ON/OFF control reset (Remote ON/OFF : OFF to ON).

4. Latch shut down by HWOCP

When the dynamic overload such as an output short circuit, the output is latched shut down by the HWOCP function.

For the communication function, refer to the "Communication Manual".

Never operate the unit under overcurrent or shorted conditions, which might lead damage or insulation failure.

6-6. Over Temperature Protection (OTP)

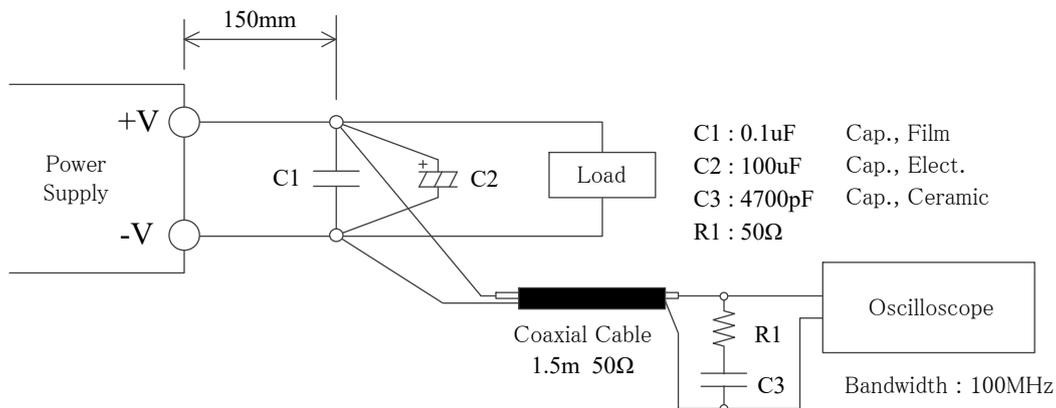
OTP is provided.

When used exceeding the output derating range of Section 7-3, OTP operates and output will be shut down. After shut down, remove the input and cool it down to reset OTP, and then re-input or use remote ON/OFF control reset (Remote : OFF to ON). OTP operates at out of the specification area. So, This function might not activate or cannot avoid power supply damage depending on the situation.

6-7. Output Ripple & Noise

The standard specification for maximum ripple value is measured according to measurement circuit specified by JEITA-RC9131C. When load lines are longer, ripple will becomes larger. In this case, electrolytic capacitor, film capacitor, etc. might be necessary to use across the load terminal.

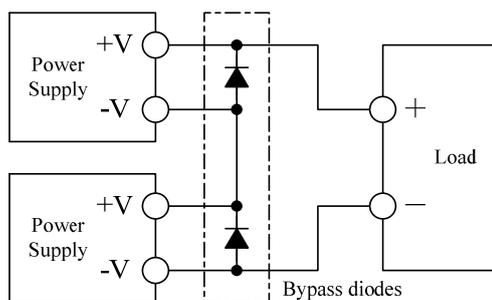
The output ripple cannot be measured accurately if the probe ground lead of oscilloscope is too long.



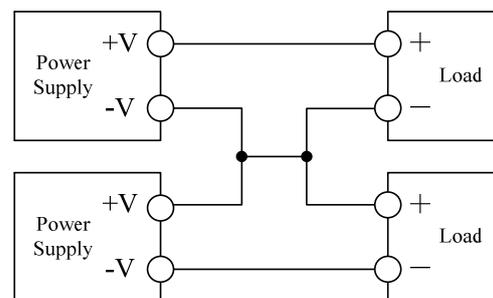
6-8. Series Operation

For series operation, either method (A) or (B) is possible.

Method (A)



Method (B)



Note : Ensure that all units must be in operation. (Never use in condition that one of the units is not operated.)

When connected the bypass diode, select a bypass diode with maximum forward current rating more than output load current. And maximum reverses voltage must withstand each power supply output voltage.

6-9. Parallel Operation

Current balancing function is provided. Both operation modes (A) and (B) are possible.

(A) To increase the output current

Connecting PC to PC terminal and COM to COM terminal, the current balancing function activates and output current of each power supply is equivalently supplied to load. Wire to PC terminal, COM terminals shall be as short as possible and same length with twist.

1. Adjust the output voltage of each power supply to be same value within 1%.
2. Use same length and type of wires for all load lines.
3. Parallel operation is possible up to 5 units.

Maximum value of output current in parallel is up to 90% of all paralleled models.

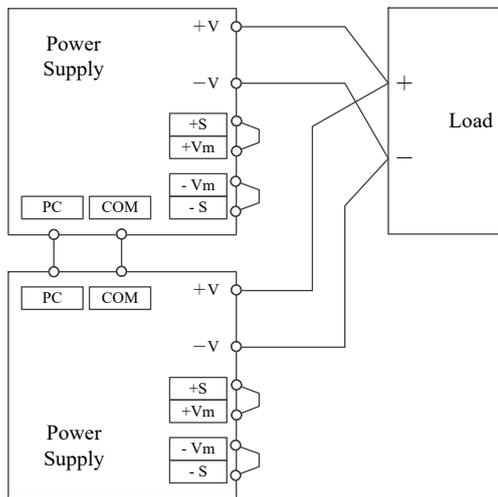
Output current of each power supply must be within output derating.

4. There is a possibility that output voltage dips at dynamic load change.

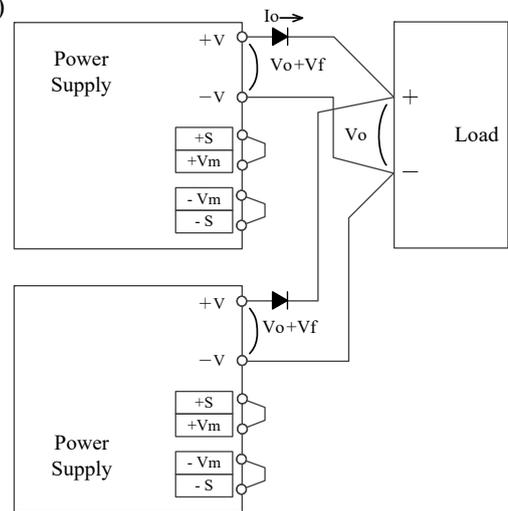
(B) To Use as a Backup Power Supply (by connecting reverse preventive diode or module "RP-60-20".)

1. Adjust the output voltage higher by the value of forward voltage drop (VF) of the diode.
2. Adjust each power supply output voltage to be same.
3. Output voltage and output power should be used within specifications.
4. Use blocking diode to prevent reverse current. Diode current rating must be more than output load current.

(A)



(B)



6-10. Remote Sensing (+S, -S terminal)

Remote Sensing function is provided.

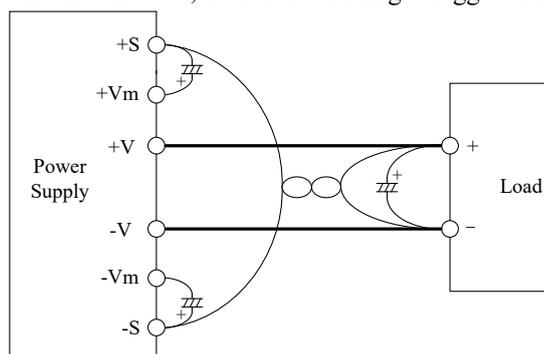
This function compensates voltage drop of wiring from output terminals to load terminals. Connect "+S" terminal to "+" terminal of load and "-S" terminal to "-" terminal of load with sensing wires.

The total line voltage drop (+ side line and - side line) shall be less than 0.3V.

In case that sensing line is too long, it is recommended to connect electrolytic capacitor in the following locations:

- 1) Across the load terminal,
- 2) Between "+S" terminal and "+Vm" terminal,
- 3) Between "-S" terminal and "-Vm" terminal.

Connect "+S" terminal to "+Vm" terminal, "-S" terminal to "-Vm" terminal with short pieces when remote sensing function is not used. If disconnected, OVP function might trigger and voltage will be shut down.



6-11. Output Current External Control (CC)

Output current external control function is provided.

By applying an external voltage (1-6V) between the "CC" terminal and "COM" terminal to set the CC (constant current) reference value, the CC operating current can be set within the range of 20% to 115% with respect to the maximum output current.

Please use after considering the following characteristics.

The CC reference can also be adjusted by using the communication function. Refer to "Communication Manual".

1. Use as Constant Current (CC) power supply

The CC operating current must be within the range of Section 7-3. "Output derating".

When the output voltage increases to the PV reference described in Section 6-12, the output changes to constant voltage (CV) mode. Again, the output power must be within the output derating range.

The CC reference is able to change to less than 20% of the maximum output current, but it is out of specifications area. The output current ripple might increase.

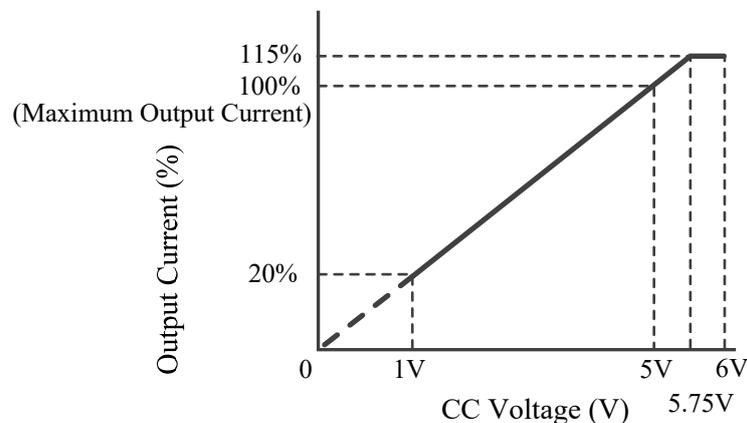
2. Use as Constant Voltage (CV) power supply

It can be used as a constant current protection function in the range higher than the maximum output current value. Refer to Section 6-5. "Overcurrent Protection".

If no external voltage is connected, it will operate at the default value of 115% Typ..

If the external voltage is 5.75V or more, the CC reference value is limited to 115% Typ. of the maximum output current.

The CC reference value may reach or the SWOCP function may operate due to overcurrent at the time of output rise or dynamic load. In that case, please confirm that the standard and performance required for the actual final equipment are satisfied. It is recommended to set the CC reference value and SWOCP setting to be larger than the steady current.



6-12. Output Voltage External Control (PV)

Output voltage external control function is provided.

By applying an external voltage (1-6V) between the "PV" terminal and "COM" terminal to set the PV reference value, the output voltage can be set within the range of 20% to 120% with respect to the nominal output voltage.

Please use after considering the following characteristics.

Take note when the output voltage is increased excessively or set too closely to the OVP operating point, the OVP function might operate.

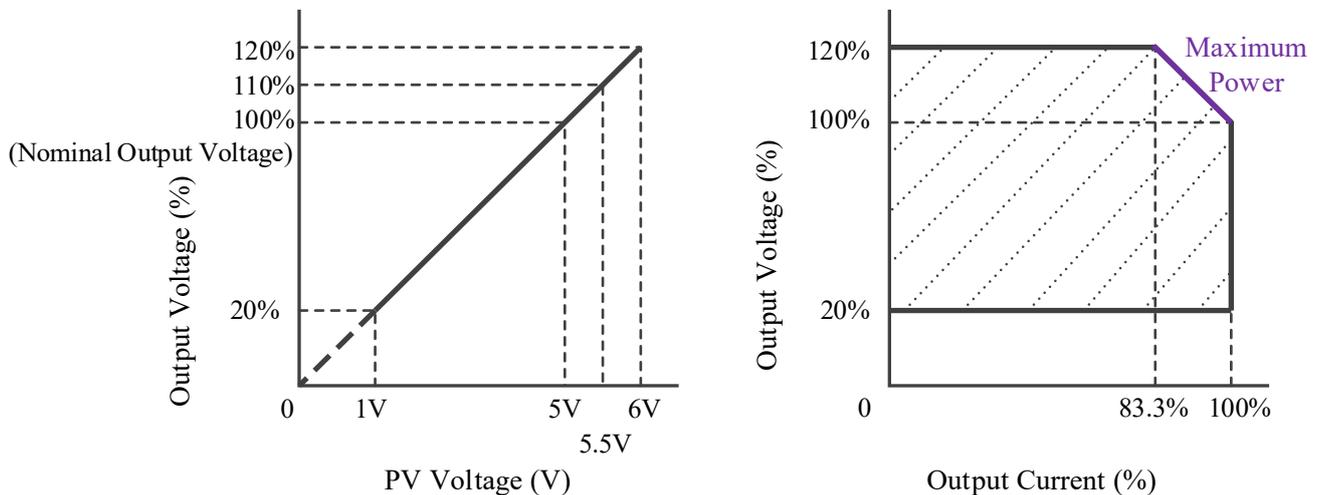
PV function have priority than the output voltage adjustment trimmer, described in Section 6-2, for the output voltage setting.

If an external voltage is not applied, the output voltage is set to the voltage that depend on the output voltage adjustment trimmer.

The PV reference can also be adjusted by using the communication function. Refer to "Communication Manual".

Use it so that the variable output power is the maximum output power or less.

PV reference is able to change to less than 20% of the nominal output voltage, but it is out of specifications area and certifications of safety standard.



6-13. Power Fail Signal (PF Signal)

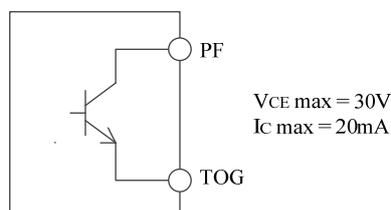
Power Fail (low output voltage or current) detection signal is provided. Power Fail (PF) signal will turn "High" level to indicate the abnormal status when the output voltage drops to less than 80%Typ. (Factory default) of the set value. It is caused by either the drop or brownout of the input voltage, OCP, OVP, OTP operation.

In addition to changing the threshold value and setting the sensitivity to prevent chattering by using the communication function, it is possible to switch to the "CC_PF" mode in which the PF signal becomes "High" when the output current falls the set threshold value or less.

When the PF signal is "Low", the output monitoring indicator (LED) lights up.

PF signal is isolated from input and output by a photo-coupler. It uses the open collector method shown in below.

Note that the PF signal may become undefined if an external voltage is applied to the output terminal similar to parallel operation, or if the input is turn off with an external capacitance added to the output.



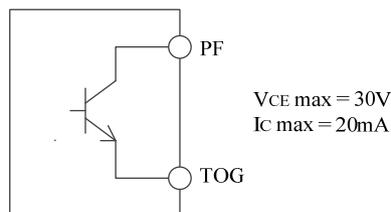
6-14. Low Input Voltage Detection Signal (AC Fail Signal)

The AC fail signal becomes "Low" when the input voltage is within the specified range, and becomes "High" when the input voltage is less than 85VAC when the input is shut down or when there is a momentary power failure.

When the output power is 20% or more of the maximum value, the time from the start of detection of insufficient input until the signal becomes "High" is 15ms or less.

This time may change when the output power is 20% or less of the maximum value or the input voltage is distorted.

AC Fail signal is isolated from input and output by a photo-coupler. It uses the open collector method shown in below.



6-15. External standby supply (+STB, -STB terminal)

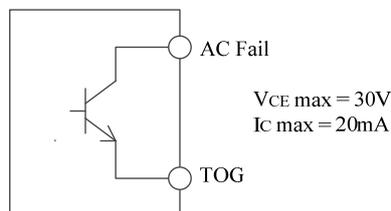
External standby supply 5V Typ. (4.8-5.2V) and 1A is provided. +/-STB terminal is isolated from input and output, and it is always available as long as input power in the specified voltage range is supplied.

OCP is constant current limit with automatic recovery method.

OCP function operates when the output current exceeds 130% of maximum output current of specification.

The output will be automatically recovered when the overload condition is canceled. Never operate the unit under over current or shorted conditions, which might lead damage or insulation failure. OCP point is fixed.

OVP is not built in. Never apply higher voltage externally to the output terminal to avoid unit failure. In case of inductive load, put protective diode in series to the output power line.



6-16. Remote ON/OFF Control (CNT terminal input mode)

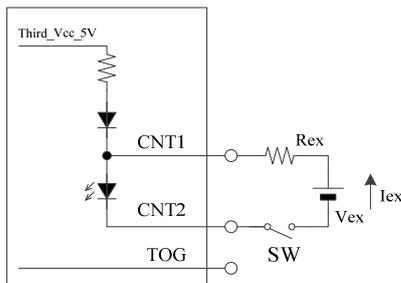
Remote ON/OFF control function is provided. Output ON/OFF is allowed to control without input voltage ON/OFF, dependent on the condition of CN84 (CNT1, CNT2 and TOG terminal).

Remote ON/OFF control circuit is isolated from input and output.

CNT1, CNT2 and TOG are not connected at time of shipment, so power supply output condition is ON.

It is also possible to perform remote ON/OFF control with the communication function. Refer to "Communication Manual".

(1) Input external Voltage_Active



SW	Output condition
OFF	ON
ON	OFF

Connect the external resistor (Rex)

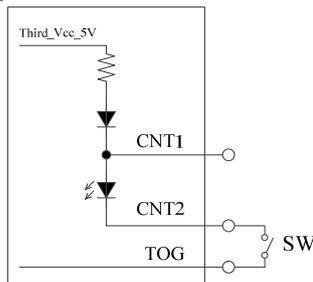
Decide Vex and Rex so that Iex is 2~5mA.

Decide Rex by following formula.

$$Rex = (Vex - 1.1) / (Iex)$$

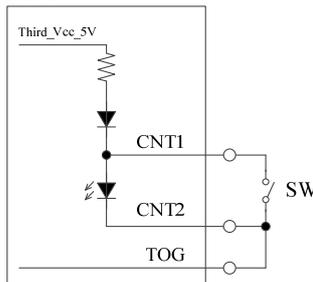
Vex	Rex
4.5 ~ 25.5VDC	680 - 12k Ω

(2) OFF_Active



SW	Output condition
OFF	ON
ON	OFF

(3) ON_Active



SW	Output condition
OFF	OFF
ON	ON

6-17. Sleep Mode

Sleep mode is provided and it contributes to reduction of standby power when all of the following conditions are satisfied.

- Output condition is "OFF" by remote ON/OFF control terminal.
- Output condition is "OFF" by communication function when CNT mode is "digital CNT".
- PF signal is "High".
- Protection has not occurred (all of the alarm history indicator register are "0").
- The query has not been sent for more than 30 minutes.

In sleep mode, the power supply returns to normal operation by turning remote ON/OFF control to "ON" or triggering the signal of RS-485. Take note that the communication function cannot be used during sleep mode and power supply cannot receive the signal of RS-485. In this case, send the query again.

When a voltage is applied to the output terminal of the power supply from the outside in sleep mode, if the PF threshold is exceeded, PF signal keeps "High". Refer to "Communication Manual" for details.

6-18. Communication Configuration Switch (SW81)

If the communication configuration (Slave ID, Baud Rate, Parity, Other) is unknown and the communication function is unusable, reset the configuration as follows. The starting-up with default configuration is possible by SW81.

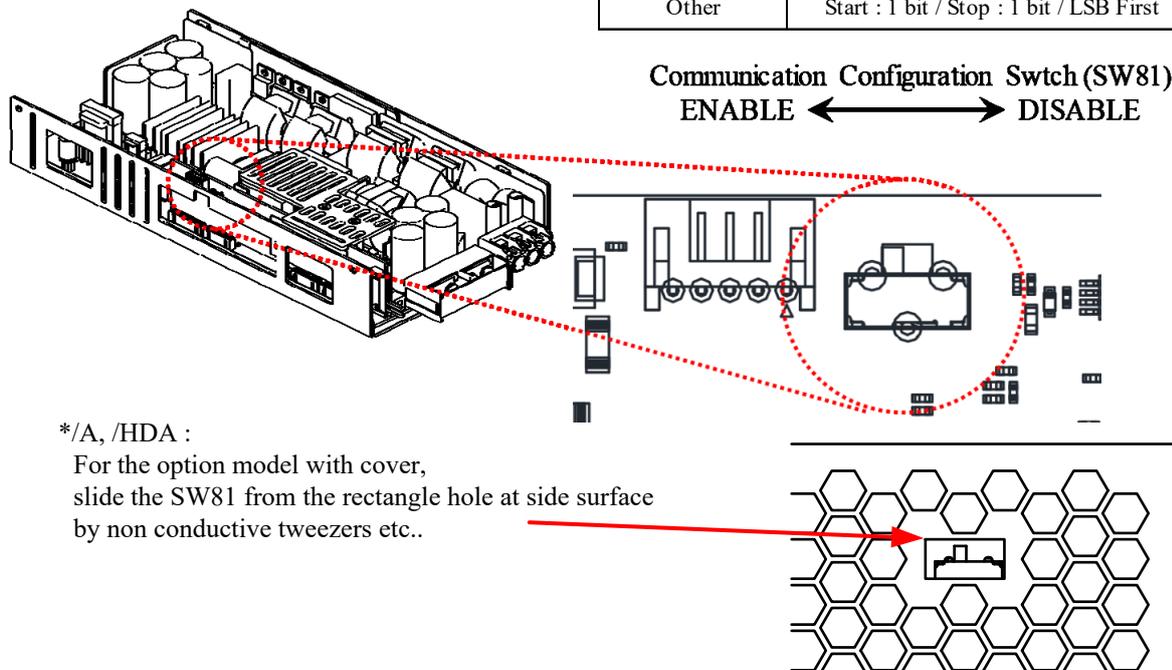
The SW81 is set at “ENABLE” side at time of shipment.

- Step 1: After the AC shut down and cool down the product, set the SW81 to “DISABLE” side.
- Step 2: After input the AC, read the communication configuration registers by communication function.
- Step 3: Modify the communication configuration registers as necessary.
- Step 4: After the AC shut down and cool down the product, set the SW81 to “ENABLE” side.

Refer to “Communication Manual” for details.

Do not touch this product or its internal components while circuit in operation, or shortly after shutdown. You might receive a burn.

Item	Default Setting
Slave ID	1
Baud Rate	19200 bps
Parity	Even parity
Other	Start : 1 bit / Stop : 1 bit / LSB First



*/A, /HDA :
 For the option model with cover,
 slide the SW81 from the rectangle hole at side surface
 by non conductive tweezers etc..

6-19. Communication Function (RS-485)

Communication function is provided. The physical layer is RS-485 and the protocol supports MODBUS. Refer to “Communication Manual” for details.

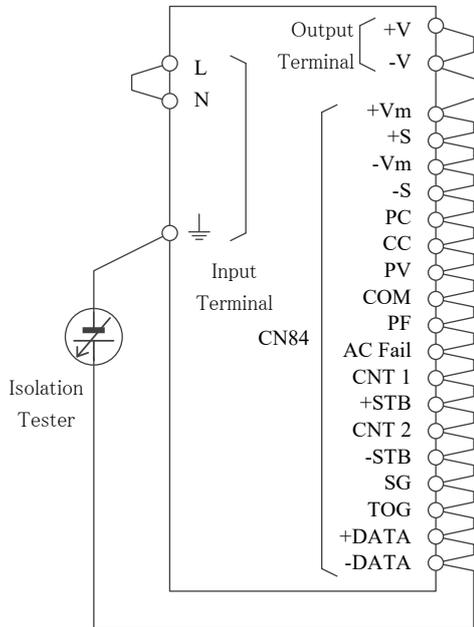
<Communication function example>

- Various monitoring function
 (Output voltage, Output Current, Converter operation time, Internal temperature)
- Protection history (OCP, OVP, OTP, etc.)
- Protection configuration (Threshold value, Protection mode auto recovery or latch)
- Remaining lifetime of the electrolytic capacitor calculation.
- Real time control of PV reference and CC reference
- Slew rate of the output voltage and current adjustment.
- Remote ON/OFF control and its configuration (CNT mode and CNT terminal input sensitivity)
- Communication configuration (Slave ID, Baud Rate, Parity, Other)
- Product information indication (Model name, Serial No., Lot No., Firmware ver.)
- Scratch Pad (Up to 30 characters of data can be stored in ASCII characters.)

6-20. Isolation Test

Isolation resistance between Output - \perp terminal is more than 100M Ω at 500VDC. For safety operation, voltage setting of DC isolation tester must be done before the test. Ensure that the unit is fully discharged after the test.

- Output - \perp terminal : 500VDC More than 100M Ω

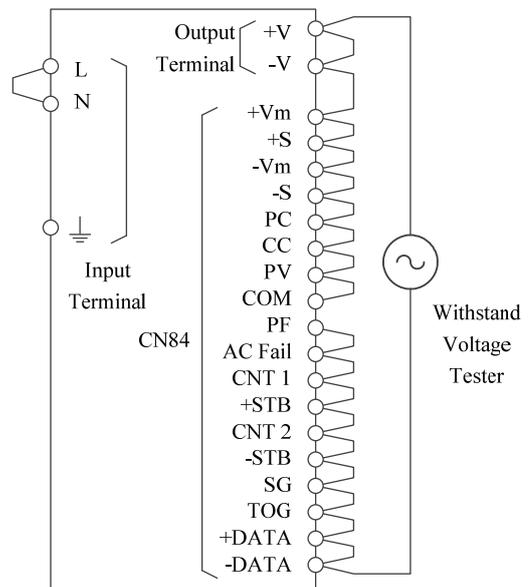
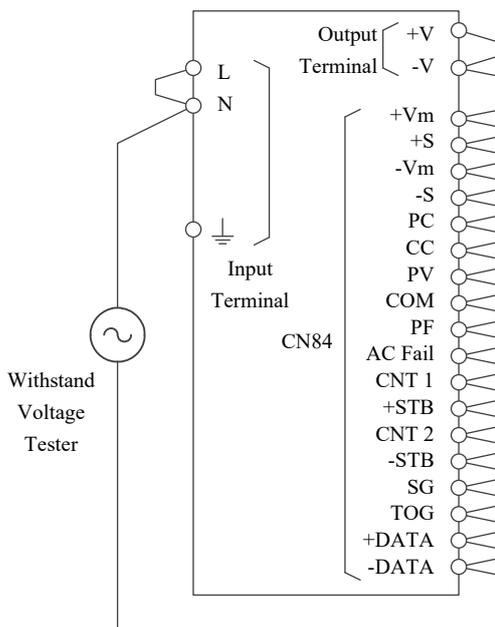


6-21. Withstand Voltage

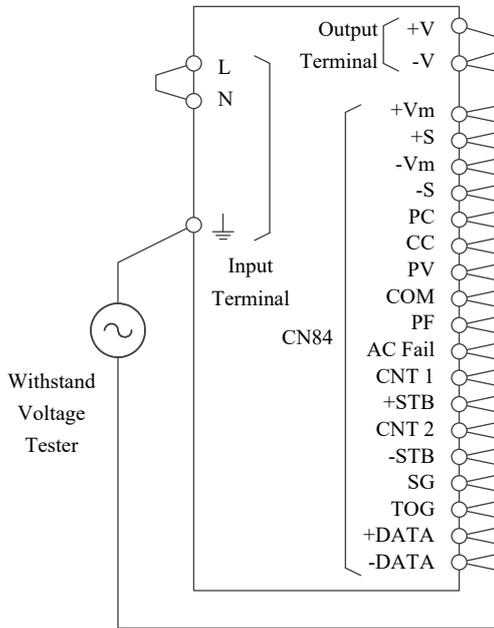
This series is designed to withstand 4.0kVAC between input and output, 2.0kVAC between input and \perp terminal, 1.5kVAC between output and \perp terminal and 100VAC between output and TOG, PF, STB, CNT, AC Fail, DATA, SG terminal each for 1 minute. In the withstand voltage tester, set current limit of the withstand voltage tester at 20mA. The applied voltage must be gradually increased from zero to test value and then gradually decreased for shut down. When timer is used, the power supply might be damaged by high impulse voltage at switch on and off timing. Connection as follows.

- Input - Output : 4.0kVAC 1min (20mA)

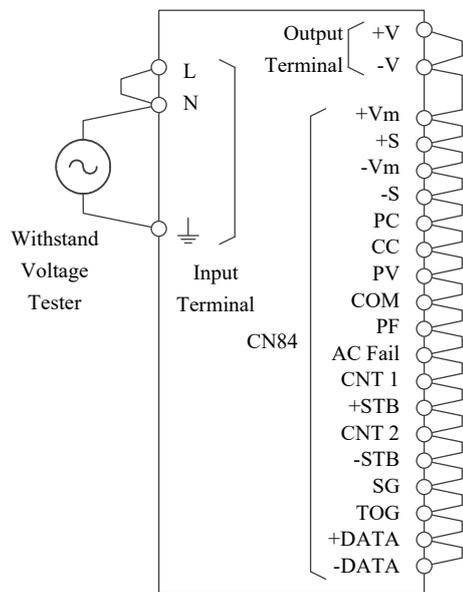
- Output - TOG, etc. : 100VAC 1 min (20mA)



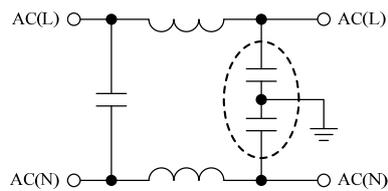
■ Output - \perp Terminal : 1.5kVAC 1min(20mA)



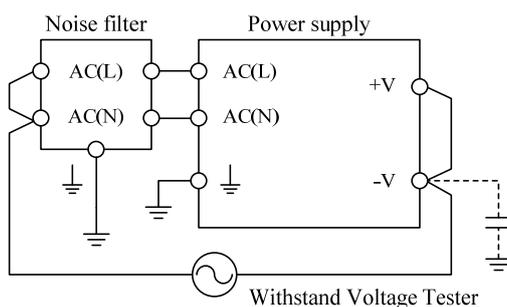
■ Input - \perp Terminal : 2.0kVAC 1min(20mA)



Note : In case of using external noise filter, capacitance between "Input and \perp terminal" might be increased. When testing withstand voltage between "Input and Output", there is a possibility exceeding withstand voltage between "Output and \perp terminal" (1.5kVAC). Check the voltage between "Output and \perp terminal". If the voltage exceeding withstand voltage, add external capacitor to "Output and \perp terminal" in order to decrease the voltage. On the other hand, no need to check the voltage in case of "Output and \perp terminal" is shorted.



The example of noise filter circuit that may increases capacitance value between "Input and \perp terminal". (Capacitance value dashed line is added.)

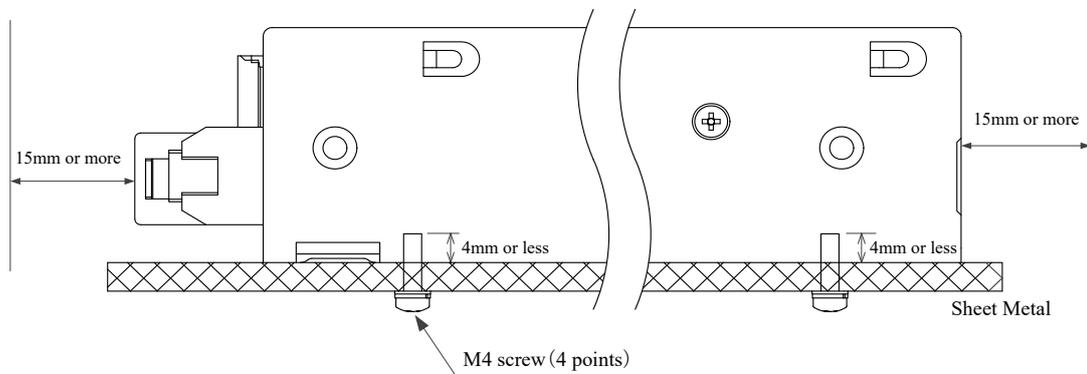
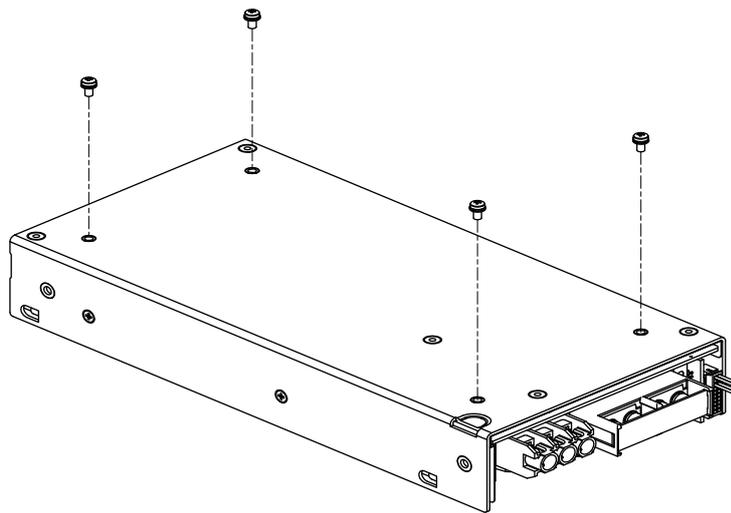
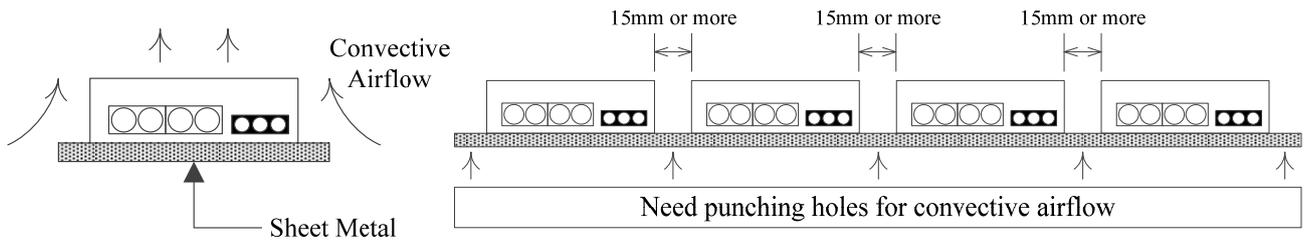


External capacitor adding point or short point. Even in the case of "+V and \perp ", there is a similar effect.

7. Mounting Method

7-1. Mounting Method

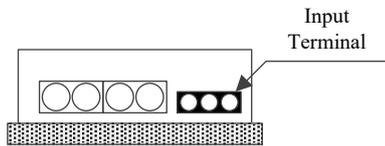
- (1) These models are convection cooling type power supply. As consideration for the heat radiation, keep a space more than 15mm between the power supply and the peripheral parts.
 Also when using multiple units, keep a space more than 15mm from each other.
- (2) Use 4 Mount Holes at bottom side.
- (3) The maximum allowable penetration of mounting screws is 4mm.
 Incomplete thread of mounting screw should not be penetrated.
- (4) Recommended torque for mounting screw : $1.2\text{N}\cdot\text{m}(12.2\text{kgf}\cdot\text{cm}) \sim 1.6\text{N}\cdot\text{m}(16.3\text{kgf}\cdot\text{cm})$



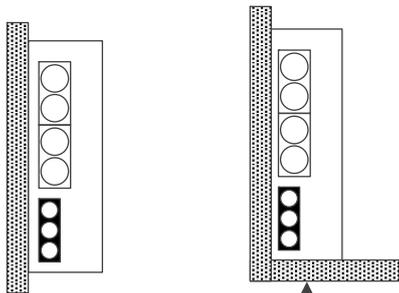
7-2. Mounting Directions

The standard mounting is direction (A). Direction (B) ~ (D) are also possible.
 Never use as mounting direction (E) and (F) shown below.

(A) Standard Mounting

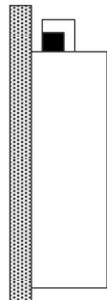


(B)

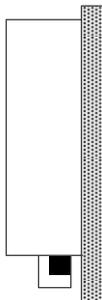


There are also mounting holes on this side. However, these mounting holes do not have strength enough to withstand the vibration / shock specifications by themselves.
 Therefore, Use 4 Mount Holes at bottom side to satisfy that.

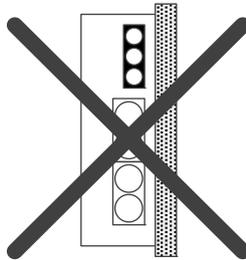
(C)



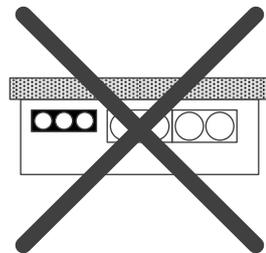
(D)



(E) Not possible



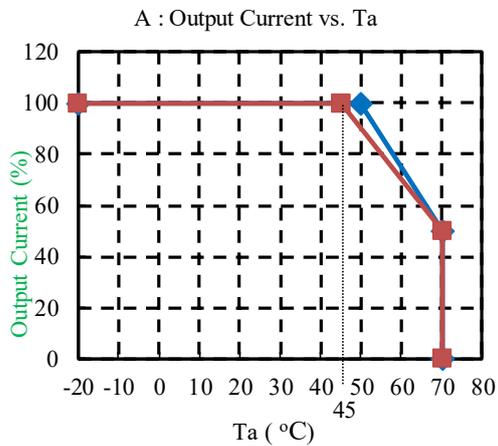
(F) Not possible



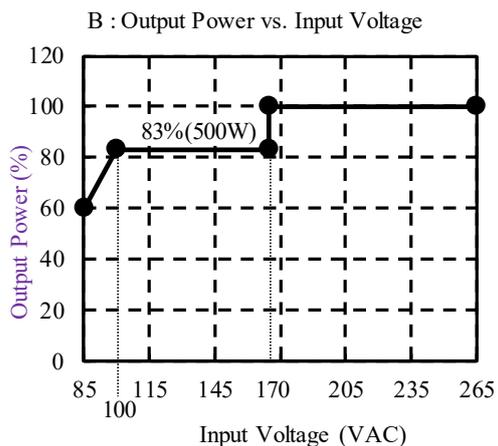
7-3. Output Derating

Refer to the output derating for the standard model and /HD model below.

■ Convection cooling



Ta (°C)	Output Current (%)	
	Mounting (A)(B)(D)	Mounting (C)
$-20 \leq Ta \leq +45$	100	100
50	100	90
70	50	50



Input Voltage (VAC)	Output Power
85	60% (360W)
100 <	83% (500W)
<170	83% (500W)
170 ≤	100% (600W)

Use so that both of A. and B. shall be satisfied.

A : Derating is necessary to **output current** in case of ambient temperature more than 50°C.

B : Derating is necessary to **output power** in case of input voltage less than 170VAC.

For example, in case of input voltage 100VAC and ambient temperature 60°C and mounting A at 24V model.

According to A. ambient temperature derating, **output current limit** is 75% (18.75A).---①

According to B. input voltage derating, **output power limit** is 500W.---②

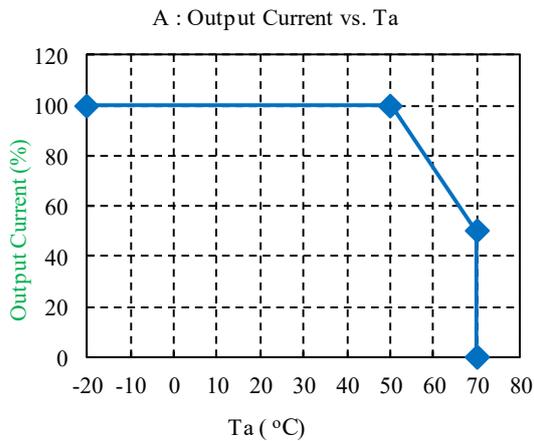
⇒ When $V_o \leq 26.6V$, the derating is determined by **output current** (18.75A) ①.

Because output power is less than 500W ($26.6V \times 18.75A$).

When $V_o > 26.6V$, the derating is determined by **output power** (500W) ②

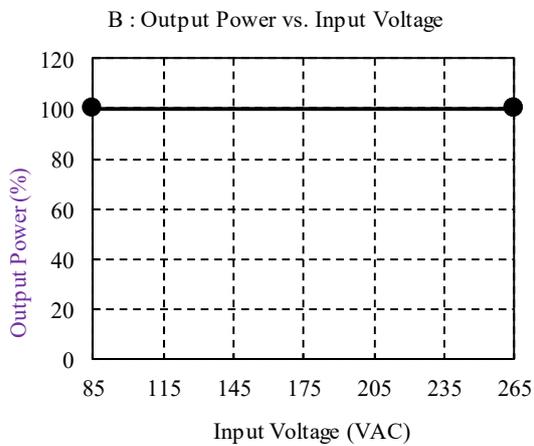
(Caution) The option model with cover (/A, /HDA) has the different derating vs. ambient temperature from the standard model. (-20 ~ +40°C : $I_o = 100\%$, +70°C : $I_o = 40\%$ for /A, /HDA option)
Refer to the specification of option model, and be careful the **output current limit**.

■ Forced air cooling



—◆— Forced air cooling

Ta (°C)	Output Current (%)
	Forced air cooling
$-20 \leq Ta \leq +50$	100
70	50



Input Voltage (VAC)	Output Power
85 ~ 265	100% (600W)

Use so that both of A. and B. shall be satisfied.

- A : Derating is necessary to **output current** in case of ambient temperature more than 50°C.
- B : Derating is unnecessary to **output power** in input voltage range 85-265VAC.

For example, in case of input voltage 100VAC and ambient temperature 60°C at 24V model.

According to A. ambient temperature derating, **output current limit** is 75% (18.75A).---①

According to B. input voltage derating is unnecessary, **output power limit** is 600W.---②

⇒ If $V_o=28.8V$ (max.), the derating is determined by **output current** (18.75A) ①.

Because output power is less than 600W ($28.8V \times 18.75A = 540W$).

In forced air condition, the entire components shall be cooled.

Temperature of L2 and L5 need to be less than 85 °C.

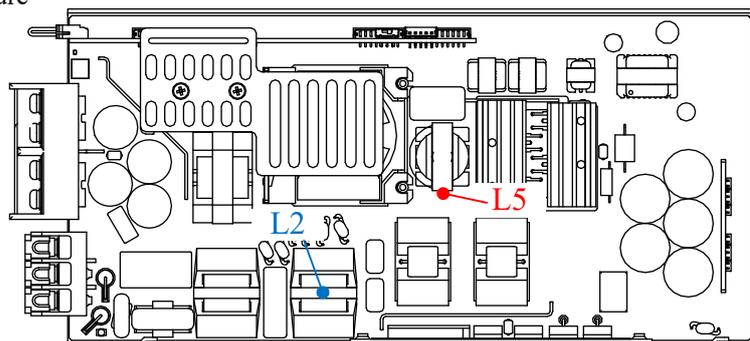
As reference, set wind velocity at 1.0m/s (height of space at 50mm. our test condition).

Choke coil allowable Max. temperature

Allowable Max. temperature	
L2	L5
85°C	85°C

Monitoring point

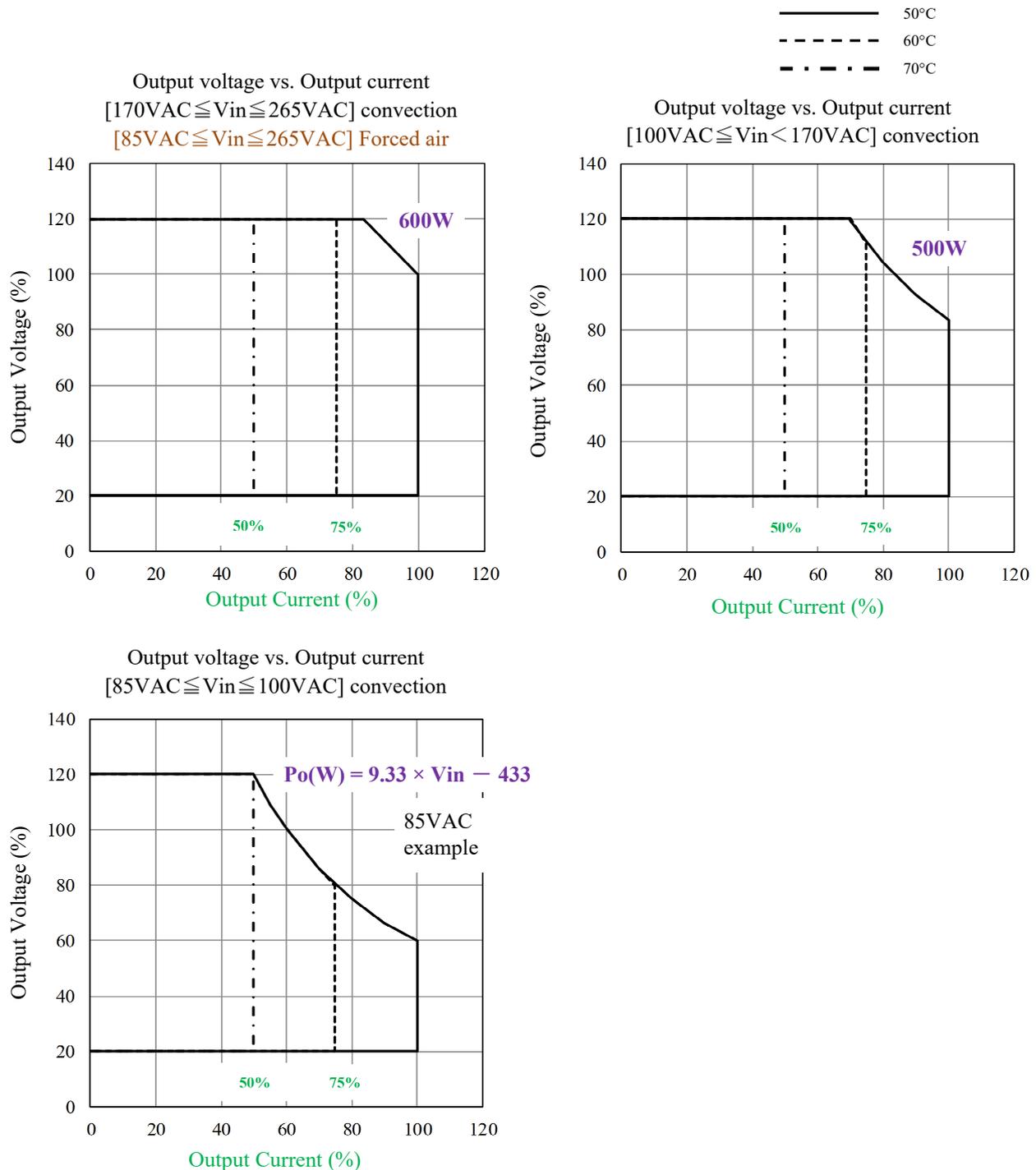
- L2: Top of core case
- L5: Side of core



The output voltage adjustment by PV function or “output voltage adjustment trimmer”, and the output current adjustment by CC function are provided.

Use the CC function within “output current vs. output voltage” and output derating.

For reference, Operating area of standard model at Mounting (A), (B), (D) and **Forced air cooling condition** are as follows.



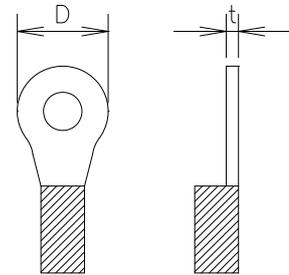
(Caution) The option model with cover (/A, /HDA) has the different derating vs. ambient temperature from the standard model. (-20 ~ +40°C : Io= 100%, +70°C : Io= 40% for /A, /HDA option)
It means the operation area is also difference.
Refer to the specification of option model, and be careful **the output current limit.**

8. Wiring Method

- (1) The output load line and input line shall be separated, and use all lines as thick and short as possible to make lower impedance. The output load line and input line shall be twisted or use shielded wire to improve noise sensitivity.
- (2) Remote sensing lines and remote ON/OFF control lines shall be twisted and separated from the output lines.
- (3) Noise can be reduced by attaching a capacitor to the load terminals.
- (4) The recommended wire type, torque and crimp-type terminal :

Model	Recommended Wire	Recommended torque	Recommended crimp-type terminal		
			D (MAX)	t (MAX)	Mounting pieces (MAX)
GXE600	AWG12-22	Input terminal M3.5 Screws 1.0N·m (10.2kgf·cm) ~ 1.6N·m (16.3kgf·cm)	8.1mm	1.0mm	1piece
	-	Output terminal M4 Screws 1.2N·m (12.2kgf·cm) ~ 1.6N·m (16.3kgf·cm)		0.8mm	2pieces

Note : Recommended wire type and crimp-type terminal vary depending on use conditions. Choice most appropriate wire type and crimp-type terminal by referring to wire maker recommended allowable current and voltage drop.



9. The life expectancy

The life of the power supply depends on the life of the built-in aluminum electrolytic capacitor. The life is described in reliability data.

The life of the aluminum electrolytic capacitor varies depending on the method of mounting the power supply, the load current and the ambient temperature. Please refer to “Electrolytic Capacitor Lifetime”.

Please do not use the product which passed over the life expectancy. There is a risk of unexpected output shutdown and specifications might not be satisfied.

Please contact us for maintenance or exchange the product which passed over the life expectancy.

10. External Fuse Rating

Refer to the following fuse rating when selecting the external input fuse.

Surge current flows when input turn on. Use slow-blow fuse or time-lag fuse. Fast-blow fuse cannot be used.

Fuse rating is specified by inrush current value at input turn on.

Do not select the fuse according to actual input current (rms.) values.

GXE600 : 12.5A

11. Before concluding that the unit is at fault...

- (1) Check if the rated input voltage is connected.
- (2) Check if the wiring of input and output is correct.
- (3) Check if the wire size is not too thin.
- (4) Check if the output voltage adjustment trimmer is properly adjusted.
OVP function might operate.
- (5) Check if the Remote sensing terminal is not opened.
OVP function might trigger and output voltage will be shut down.
If the connection to the signal connector (CN84) is disconnected after the input is shut down and before the internal charge is sufficiently discharged, the OVP function will operate by opening the sensing terminal, and the history may remain.
- (6) Check if the output current and output power are not over specifications.
- (7) Audible noise can be heard when input voltage waveform is not sinusoidal wave.
- (8) Audible noise can be heard at a Dynamic-Load operating frequency.
- (9) Check if the communication configuration is correct value.
When PV reference or CC reference is too small, or more than protection point, OVP or OCP might trigger and output voltage will be shut down.
If the output voltage setting value and overvoltage protection threshold value, output current and CC reference value, output current and overcurrent protection threshold value, CC reference value and overcurrent protection threshold value are set too close, unintended operation may occur due to transient response of the power supply or external noise, or the output may be shut down due to the operation of various protection function.
- (10) Check if the power supply is not the sleep mode.
The communication function cannot be used during sleep mode.
- (11) Ensure that large capacitor is not connected on the output side.
Use within 10,000uF as the output might shut down or be unstable operation.
Contact us, if connecting more than 10,000uF.
For capacitive loads such as batteries, use the CC function within output derating.

12. Warranty Period

This product is warranted for a period of 5 years from the date of shipment.
For damages occurring at normal operation within this warranty period, repair is free of charge.
Please read the General Safety Instruction before using the products.

13. CE MARKING / UKCA MARKING

CE MARKING

CE Marking, when applied to a product or packing material for a product covered by this handbook, indicates compliance with the Low Voltage Directive, EMC Directive and RoHS Directive.

UKCA MARKING

UKCA Marking, when applied to a product or packing material for a product covered by this handbook, indicates compliance with the Electrical Equipment (Safety) Regulations, Electromagnetic Compatibility Regulations and Restriction of the Use of Certain Hazardous Substances in Electrical & Electronic Equipment Regulations.