

RWS 1000B•1500B Series

Instruction Manual

BEFORE USING THE POWER SUPPLY UNIT (Common)

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 may 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.
- There are cases where high voltage charge remains inside the product immediately after the input is cut off. 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 disassembled.
- 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.
- When necessary, this products is to be repaired only by us or our authorized agents. It is important that this product cannot be used in hazardous environments (facilities such as nuclear power control system or life support equipment) without our written consent.

CAUTION on MOUNTING

- Confirm connections to input/output terminals are correct as indicated in the instruction manual before switching on.
- Input voltage, Output current, Output power, ambient temperature and ambient humidity should be kept within specifications, otherwise the product will be damaged.
- Input 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 may 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 ground is not connected together, there is risk of electric shock.
- Parts with lifetime specifications (built-in fan 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 is designed under condition Material group IIIb, Pollution Degree (PD): PD2, Over Voltage category (OVC): OVCII and Class of equipment: Class I. This product is designed to be accessible only to service technicians as part of indoor use device.
- The outputs of this product may, under fault conditions, exceed SELV voltage limits. Therefore the outputs must be protected in the end equipment to maintain SELV.
- This product have a built-in fan for air-cooling. Do not block the air intake and exhaust as this might lead to fire.

Special Instructions for IEC/EN/ES/CSA 60601-1 [For RWS1000B/ME, RWS1500B/ME]

- There 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.
- The input circuit includes only one fuse in the Line conductor. Consideration shall be given in the end-use product regarding addition of the second fuse having the same or better characteristics in order to comply with fusing requirements of Clause 8.11.5 of the Standard.
- 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.

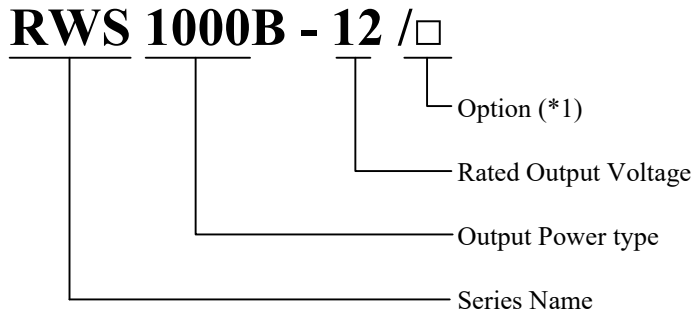
Note

- 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 and might not satisfy specification when 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 may 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 aluminium 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

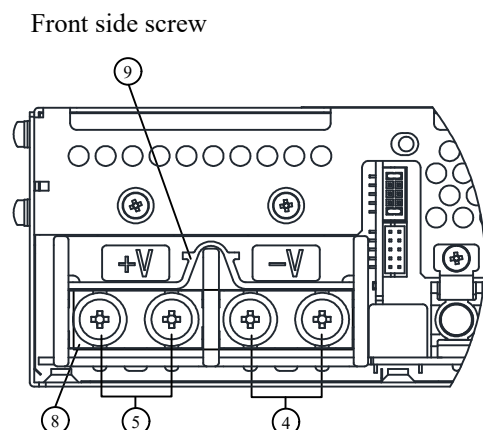
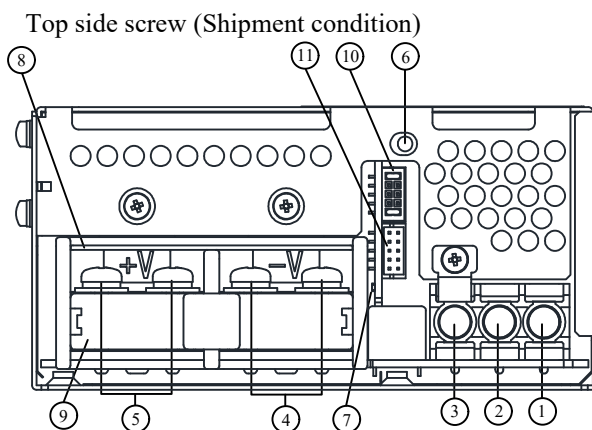
1. Model name identification method



- (*1) Blank : Standard
 /R : Remote ON/OFF control
 /FO : Power Fail (PF) signal
 Parallel Operation
 /RFO : Remote ON/OFF control
 Power Fail (PF) signal
 Parallel Operation
 /RF : Reverse fan (Intake air)
 /ME : Approved by safety standards
 for medical equipment
 /CO2 : With coating on both sides
 of PCB
 /S : Remote ON/OFF control
 Standby supply

Note : For “/CO2” model, to improve resistance against dust environment, both sides of assembled PCB are coated.
 However, complete effect is not guaranteed because some areas on the board are not coated.

2. Terminal Explanation



Standard

- ① N : Input terminal Neutral 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
(62.5A max. / terminal, M5 screw)
- ⑤ +V : + Output terminal
(62.5A max. / terminal, M5 screw)
- ⑥ Output voltage adjustment trimmer
- ⑦ Output monitoring indicator (Green LED)
- ⑧ Terminal cover 1
- ⑨ Terminal cover 2
- ⑩ Signal connector CN83
- ⑪ Signal connector CN84

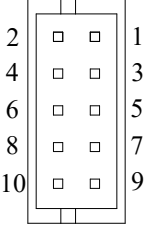
CN83, CN84 Connector pin Configuration and Function

CN83 and CN84 are same pin configuration and function (Standard and option model exclude /S).

They are connected to each other in this power supply unit.

When the pin of CN83 side is shorted, the same function pins of CN84 side are also shorted.

Please note that the function cannot be separately set with CN83 and CN84.

	No.	Configuration	Function
 <p>CN83,CN84</p>	1	+Vm	Output monitor terminal (+V). Internally connected to +Output terminal. (+Vm terminal can not 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. If connected may cause malfunction.
	4	NC	Do not connect. If connected may cause malfunction.
	5	NC	No connection
	6	NC	No connection
	7	NC	Do not connect. If connected may cause malfunction.
	8	NC	No connection
	9	-Vm	GND for Output monitor terminal. Internally connected to -Output terminal. (-Vm terminal can not supply load current.)
	10	-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.)

* CN83, CN84 Connector (JST)

Connector	Housing	Terminal Pin
S10B-PHDSS	PHDR-10VS	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.

CN83 : "+Vm" terminal (Pin No.1) to "+S" terminal (Pin No.2)

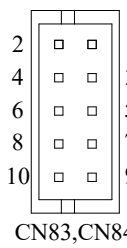
"-Vm" terminal (Pin No.9) to "-S" terminal(Pin No.10)

/FO, /RFO

⑩ CN83, CN84 : PF signal, Parallel operation setup

Remote ON/OFF control (Only /RFO)

No.	Configuration	Function
1	+Vm	Output monitor terminal (+V). Internally connected to +Output terminal. (+Vm terminal can not 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	+R	Remote ON/OFF control terminal (Only /RFO). Do not connect for /FO. If connected may cause malfunction.
4	-R	GND for Remote ON/OFF control terminal (Only /RFO). Do not connect for /FO. If connected may cause malfunction.
5	+PF	Power fail signal (PF signal) output terminal. (Open collector output. As the output voltage drops or FAN stop and AC input voltage down, "PF" signal will be "High".)
6	-PF	GND for PF signal.
7	COM	Current balance terminal. (For current balancing in parallel operation.)
8	PC	Current balance terminal. (For current balancing in parallel operation.)
9	-Vm	GND for Output monitor terminal. Internally connected to -Output terminal. (-Vm terminal can not supply load current.)
10	-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.)



* CN83, CN84 Connector (JST)

Each other terminals are same as standard model.

These are connected by short pieces at time of shipment.

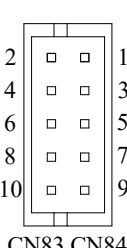
CN83 : "+Vm" terminal (Pin No.1) to "+S" terminal (Pin No.2)

"-Vm" terminal (Pin No.9) to "-S" terminal(Pin No.10)

/R

⑩ CN83, CN84 : Remote ON/OFF control

No.	Configuration	Function
1	+Vm	Output monitor terminal (+V). Internally connected to +Output terminal. (+Vm terminal can not 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	+R	Remote ON/OFF control terminal.
4	-R	GND for Remote ON/OFF control terminal.
5	NC	No connection
6	NC	No connection
7	NC	Do not connect. If connected may cause malfunction.
8	NC	No connection
9	-Vm	GND for Output monitor terminal. Internally connected to -Output terminal. (-Vm terminal can not supply load current.)
10	-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.)



* CN83, CN84 Connector (JST)

Each other terminals are same as standard model.

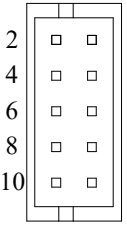
These are connected by short pieces at time of shipment.

CN83 : "+Vm" terminal (Pin No.1) to "+S" terminal (Pin No.2)

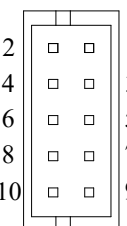
"-Vm" terminal (Pin No.9) to "-S" terminal(Pin No.10)

/S

⑩ CN83 : Remote ON/OFF control

		No.	Configuration	Function
 <p>CN83</p>	1	+Vm	Output monitor terminal (+V). Internally connected to +Output terminal. (+Vm terminal can not 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	+R	Remote ON/OFF control terminal.	
	4	-R	GND for Remote ON/OFF control terminal.	
	5	NC	No connection	
	6	NC	No connection	
	7	NC	Do not connect. If connected may cause miss operation.	
	8	NC	No connection	
	9	-Vm	GND for Output monitor terminal. Internally connected to -Output terminal. (-Vm terminal can not supply load current.)	
	10	-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.)	

⑪ CN84 : Remote ON/OFF control
 Standby supply

		No.	Configuration	Function
 <p>CN84</p>	1	NC	No connection	
	2	NC	No connection	
	3	+R	Remote ON/OFF control terminal.	
	4	-R	GND for Remote ON/OFF control terminal.	
	5	+STB	Standby supply (5V/1A).	
	6	+STB	Standby supply (5V/1A).	
	7	NC	Do not connect. If connected may cause miss operation.	
	8	NC	No connection	
	9	-STB	GND for Standby.	
	10	-STB	GND for Standby.	

* CN83, CN84 Connector (JST)

Each other terminals are same as standard model.

These are connected by short pieces at time of shipment.

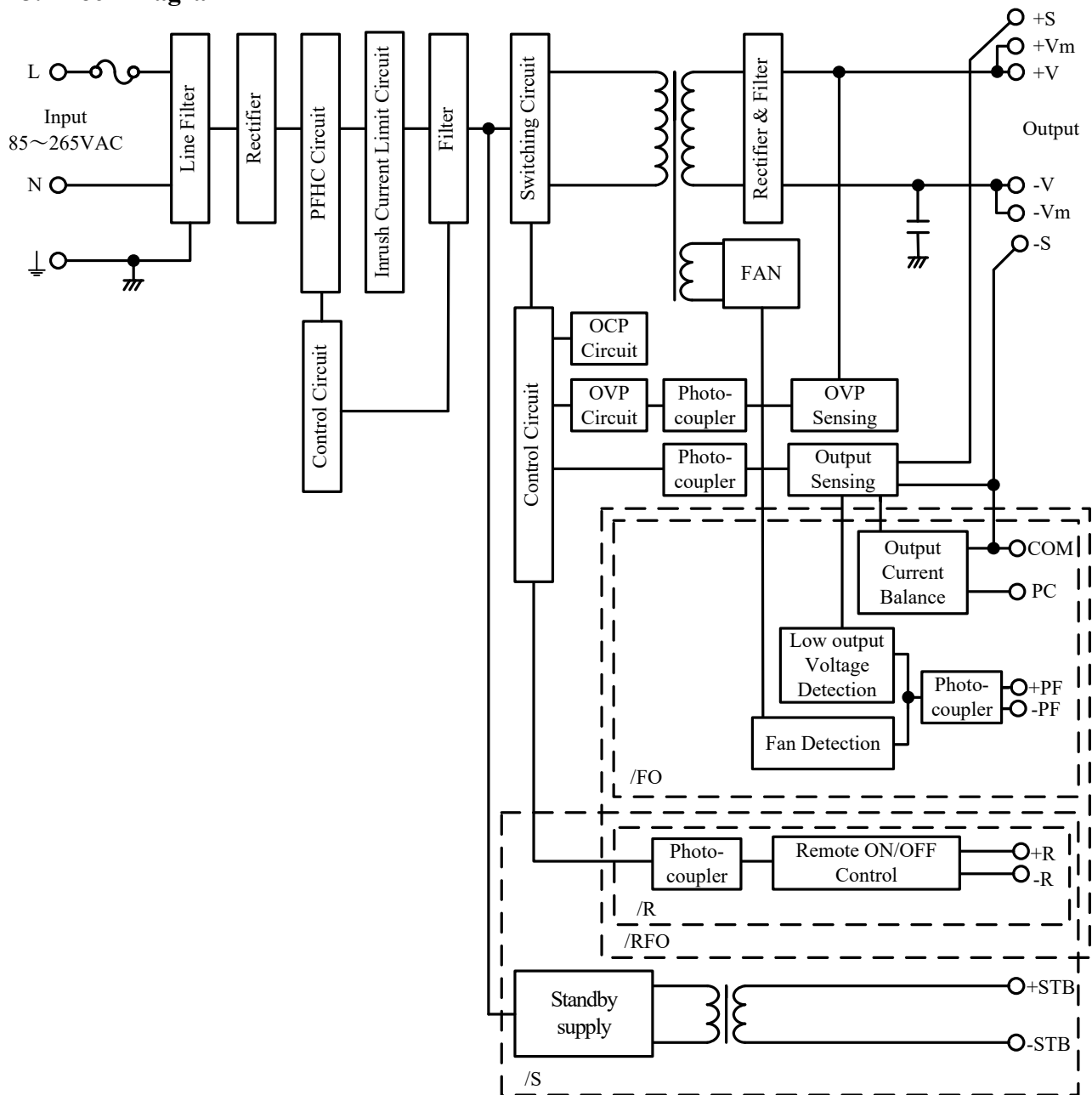
CN83 : "+Vm" terminal (Pin No.1) to "+S" terminal (Pin No.2)

"-Vm" terminal (Pin No.9) to "-S" terminal(Pin No.10)

CN84 : "+R" terminal (Pin No.3) to "+STB" terminal (Pin No.6)

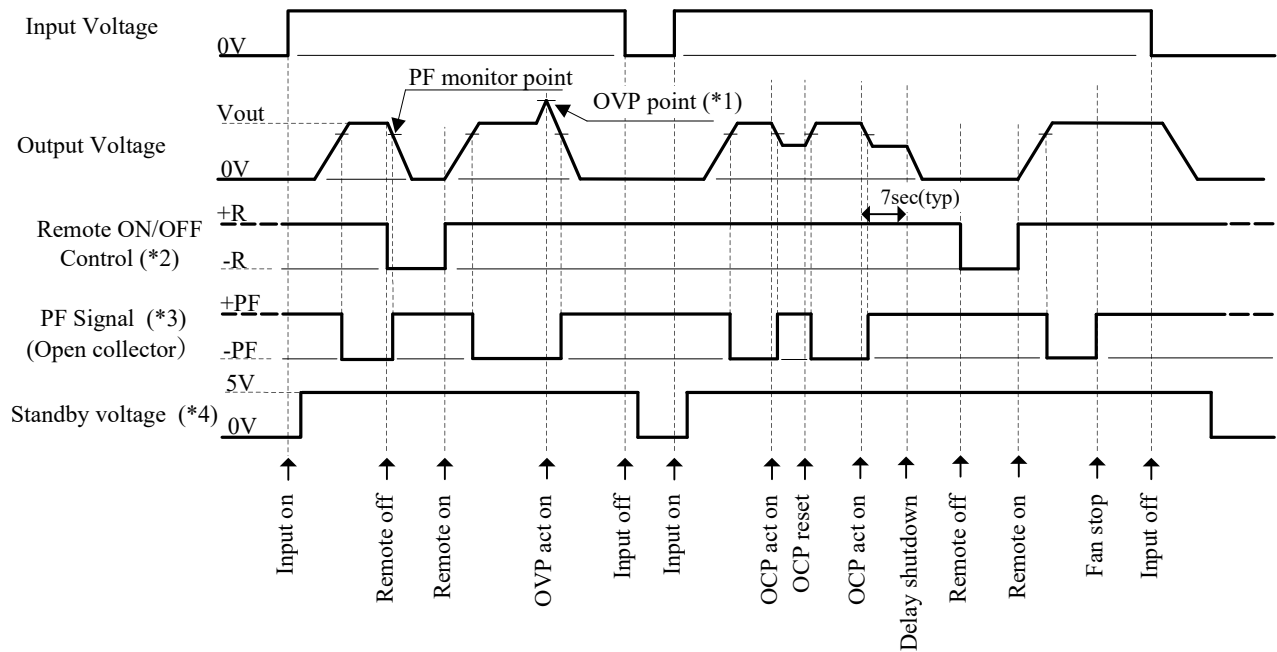
"-R" terminal (Pin No.4) to "-STB" terminal (Pin No.10)

3. Block Diagram



- Circuit topology, switching frequency
 Half-Bridge converter
 RWS1000B : 95kHz (fixed)
 RWS1500B : 83kHz (fixed)
 PFHC circuit : active filter
 65kHz (fixed)
- Fuse rating
 RWS1000B : 20A
 RWS1500B : 30A

4. Sequence time chart



(*1) OVP point : 115%~145%
 Please refer specification for detail OVP point.

(*2) Target option : /R, /RFO, /S
 Level
 Higher than 4.5V : Output on
 Lower than 0.5V : Output off
 This sequence is using external voltage.

(*3) Target option : /FO, /RFO

(*4) Target option : /S

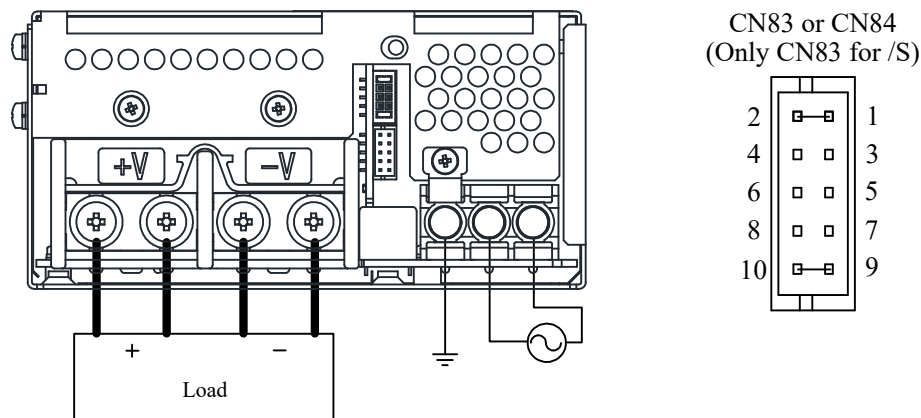
5. Connecting method

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.

Standard

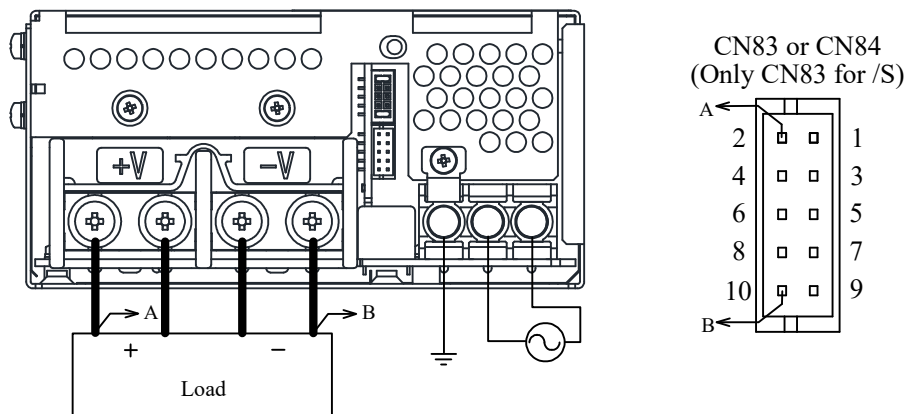
- Basic connection (Local sensing)
 Connect "+S" terminal (Pin No.2) to "+Vm" terminal (Pin No.1), and "-S" terminal (Pin No.10) to "-Vm" terminal (Pin No.9) with the attached short pieces. (Short pieces are mounted at time of shipment.)



Recommended torque : M3.5 screw 1.0N·m (10.2kgf·cm) ~ 1.6N·m (16.3kgf·cm)
 M5 screw 2.0N·m (20.4kgf·cm) ~ 2.4N·m (24.4kgf·cm)

- Remote sensing connection

- 1) Connect "+S" terminal (Pin No.2) to "+" output Terminal of load with wires.
- 2) Connect "-S" terminal (Pin No.10) to "-" output Terminal of load with wires. (Sensing lines shall be twisted.)

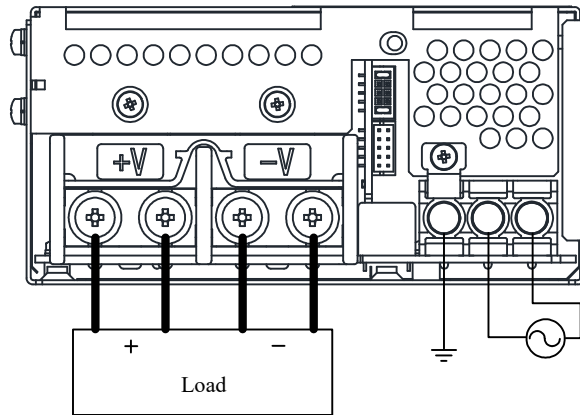


*If remote sensing terminals are opened, the output will rise and shut down.

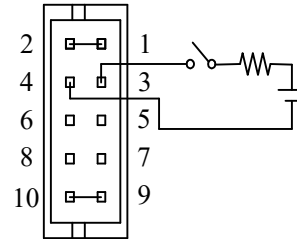
/R, /RFO, /S

- Remote ON/OFF control

Connect voltage between "+R" terminal (Pin No.3) and "-R" terminal (Pin No.4) for remote ON/OFF control. (ON/OFF control lines shall be twisted.)



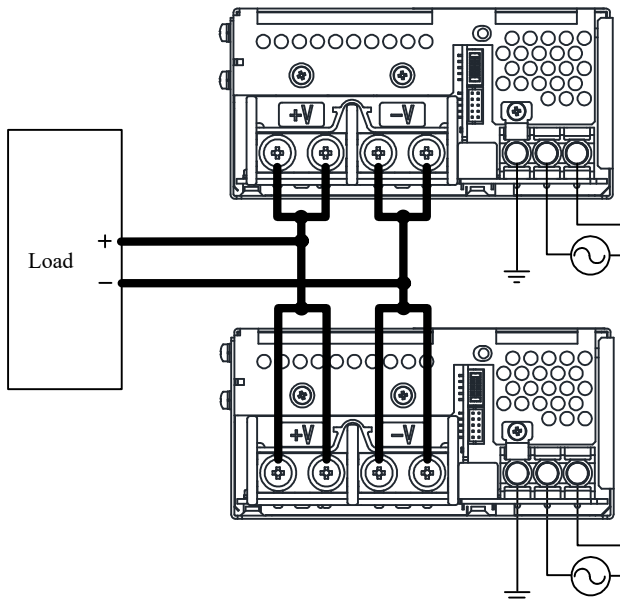
CN83 or CN84



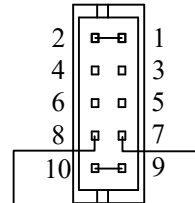
/FO, /RFO

- Parallel operation

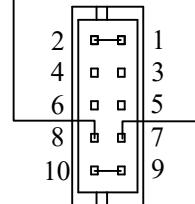
Connecting PC to PC terminal (Pin No.8) and COM to COM terminal (Pin No.7), the current balancing function activates and output current of each power supply is equivalently supplied to load. Wires to PC terminals, COM terminals shall be as short as possible and same length and twisted.



CN83 or CN84

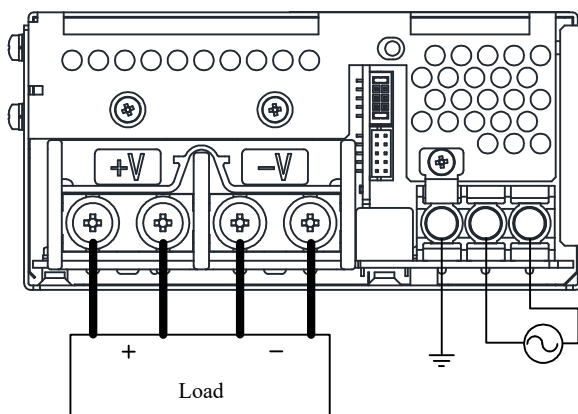


CN83 or CN84

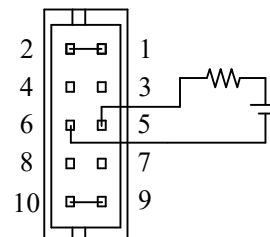


- PF signal output

PF signal is open collector output. Use as shown below. (Signal lines shall be twisted.)



CN83 or CN84



6. Explanation of Functions and Precautions

6-1. Input Voltage Range

Input voltage range is single phase 85-265VAC (47-63Hz) or 120-340VDC.

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 90VAC.

6-2. Output Voltage Range

Output voltage is set at the rated value. Output voltage within the range specified can be adjusted by V.ADJ trimmer. Output voltage must be within specification.

Turning the trimmer clockwise, the output voltage will be increased. Take note when the output voltage is increased. Excessively, over voltage protection (OVP) function may trigger and voltage will be shut down. Furthermore, when increasing the output voltage, reduce the output current as not to exceed the maximum output power.

When the trimmer turns quickly at no load condition, the output voltage might become unstable. To maintain the output voltage stable, flow the output current, or remove the input of power supply until the output be shut down, and then re-input. Please turn the trimmer slowly during the output voltage adjustment.

6-3. Inrush Current

Thyristor method is used for limiting the inrush current. Higher current may flow when input turn on interval is short.

First inrush current and second inrush current flow.

Please select input switch and external fuse carefully.

6-4. Over Voltage Protection (OVP)

The OVP function is inverter shut down method and manual reset type. OVP function operates within Specification.

When OVP triggers, the output will be shut down. To reset OVP, remove the input of power supply for a few minutes, and then re-input. Or, use Remote ON/OFF reset on option model /R and /RFO only (Remote : OFF to ON). In addition, the setting value of OVP is fixed and not adjustable. Never apply 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.

6-5. Over Current Protection (OCP)

Constant current limit with automatic recovery.

OCP function operates when the output current exceeds 105% of maximum DC output current of specification.

The outputs will be automatically recovered when the overload condition is removed. Never operate the unit under over current or shorted conditions, which may lead unit damage. OCP setting is fixed and cannot be adjusted externally.

6-6. Delay Shut Down

This product have a delay shut down function provided to protect power supply and equipment at the time when the output current exceeds maximum DC output current of specification. When the product operate over current condition for more than 5 seconds, delay shut down function operates and the output will be shut down.

To reset delay shut down, remove the input of power supply for a few minutes, and then re-input. Or, use Remote ON/OFF control reset on option model /R, /RFO and /S only (Remote : OFF to ON).

Delay Shut Down Time value is fixed and not to be adjusted externally.

6-7. Over Temperature Shut Down

Over temperature shut down function is provided.

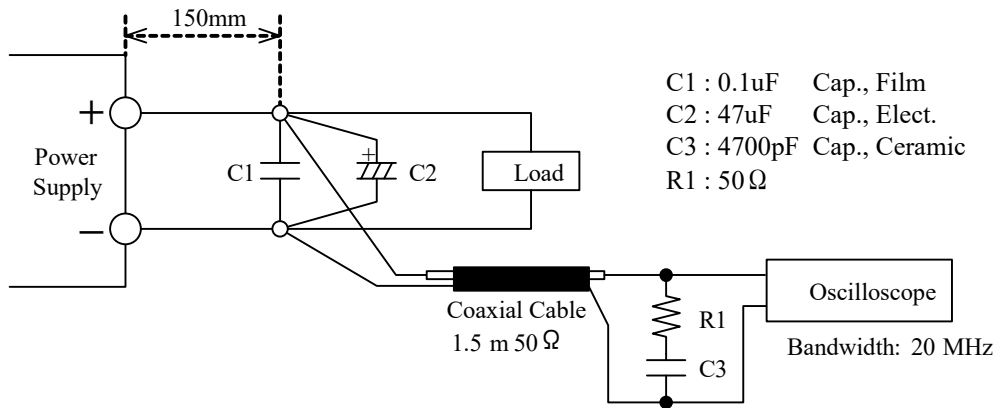
When ambient or internal temperature rises abnormally, over temperature shut down function operates and output will be shut down. After shut down, remove the input and cool it down to reset over temperature shut down, and then re-input. Over temperature shut down function operates at out of the specification area.

This function may not activate or cannot avoid power supply damage depending on the situation.

6-8. Output Ripple & Noise

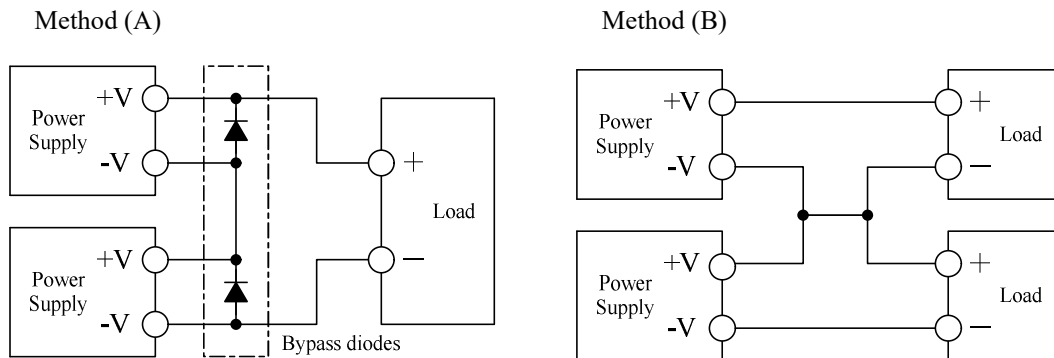
The standard specification for maximum ripple value is measured according to measurement circuit specified by JEITA-RC9131C. When load lines are longer, ripple will become larger. In this case, electrolytic capacitor, film capacitor, etc. might be necessary to use across the load terminal.

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



6-9. Series Operation

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

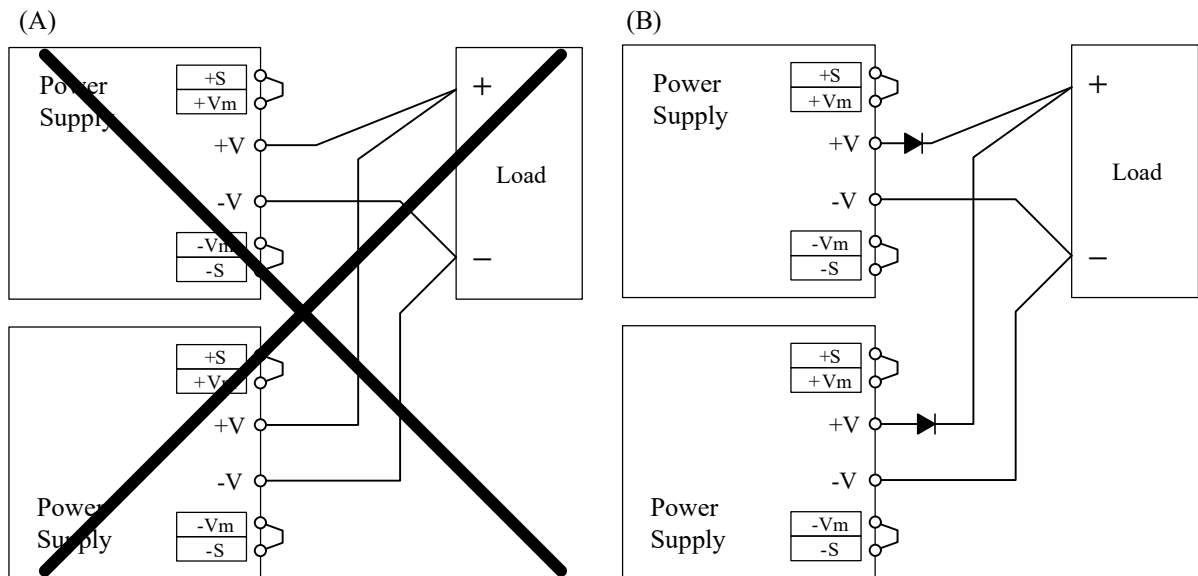


Note : Ensure that all units must be in operation. (Never use in condition that one of the units is not operated.)

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

6-10. Parallel Operation

- (A) Operation to increase the Output Current is not possible.
- (B) Operation as a Backup System is acceptable.
 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 protective diode to prevent reverse current. Diode current rating must be more than output load current.



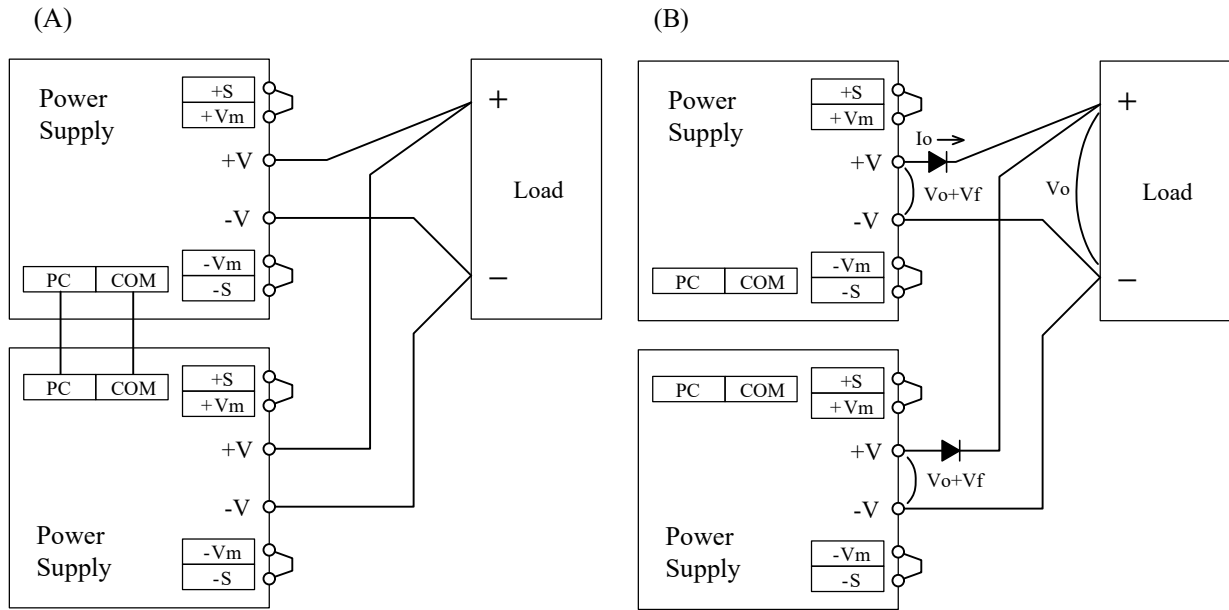
/FO,/RFO

Current balancing function is provided on option model /FO and /RFO. Both operations mode (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. Wires to PC terminals, COM terminals shall be as short as possible and same length and twisted.

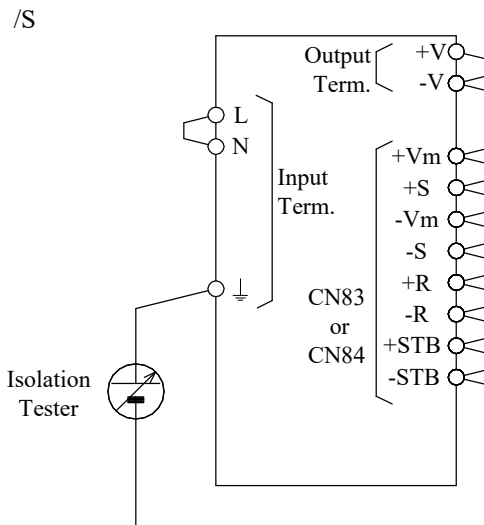
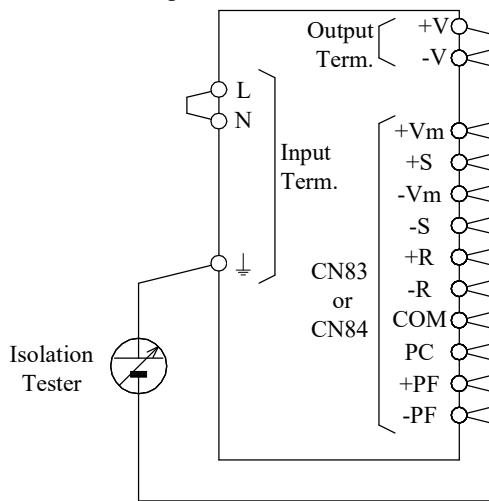
 1. Adjust the output voltage of each power supply to be same value within 1%.
 2. Use same length and type of wires for all load lines.
 3. Maximum value of output current in parallel is up to 90% of all paralleled models.
 Output current of each power supply must be within output derating.
 4. Parallel operation is possible up to 5 units.
 5. There is a possibility that output voltage dips at dynamic load change.
 6. Ensure that all units must be in operation. (Never use in condition that one of the units is not operated.)
 If one of the units does not work, shut down the input line immediately. Otherwise, connect protective diode so that no voltage is applied to the output terminal.
- (B) To Use as a Backup Power Supply
 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 protective diode to prevent reverse current. Diode current rating must be more than output load current.



6-11. 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
 Standard and option model exclude /S

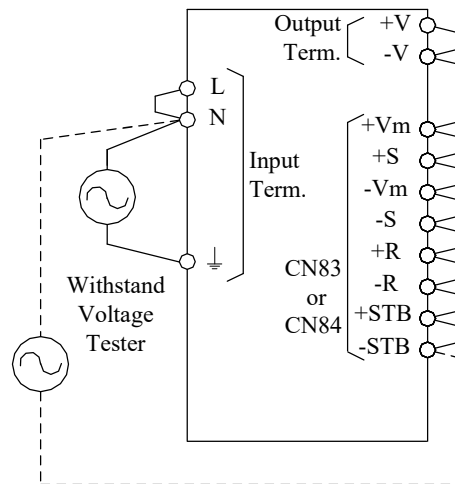
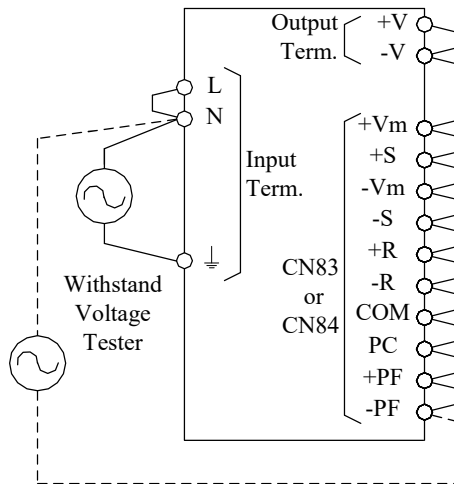


6-12. Withstand Voltage

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 R·PF·STB terminal each for 1 minute. When testing withstand voltage, set current limit of withstand voltage test equipment at 20mA. The applied voltage must be gradually increased from zero to testing value and then gradually decreased for shut down. When timer is used, the power supply may be damaged by high impulse voltage at switch on and off timing. Connect input and output as follows.

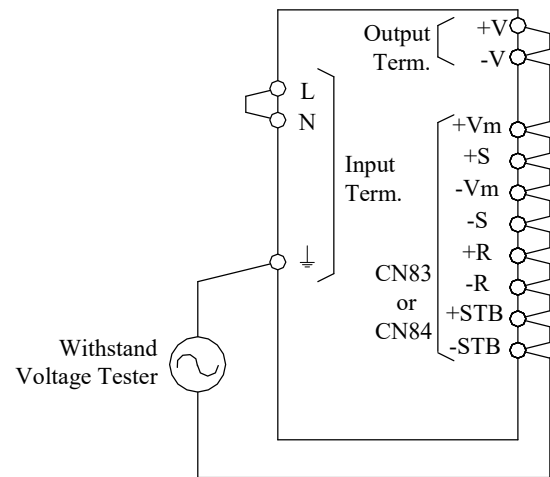
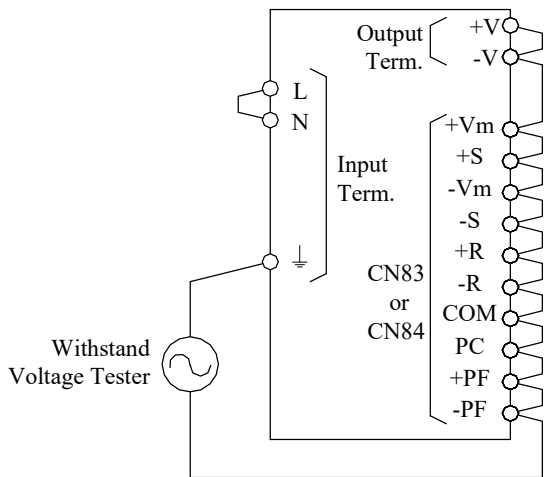
- Input - Output (dotted line) : 4.0kVAC, 1min (20mA)
 - Input - \perp terminal (solid line) : 2.0kVAC, 1min (20mA)
- Standard and option model exclude /S

/S



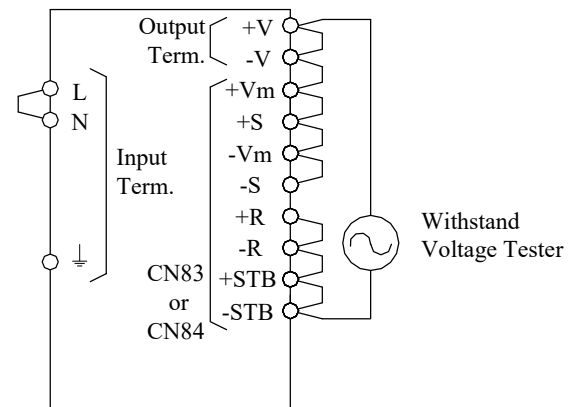
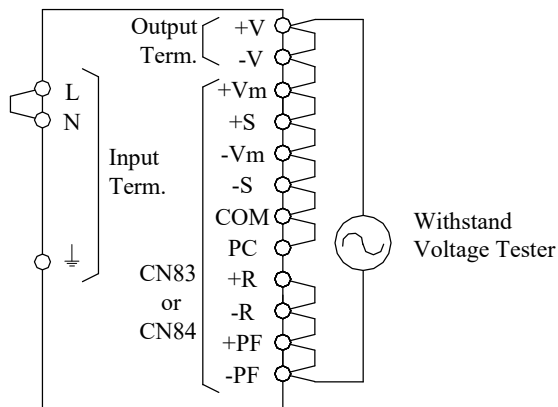
- Output - \perp terminal : 1.5kVAC, 1min (20mA)
- Standard and option model exclude /S

/S

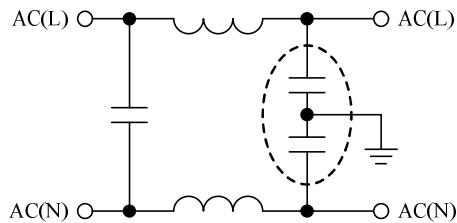


- Output - CNT · PF : 100VAC 1min (20mA)
- Standard and option model exclude /S

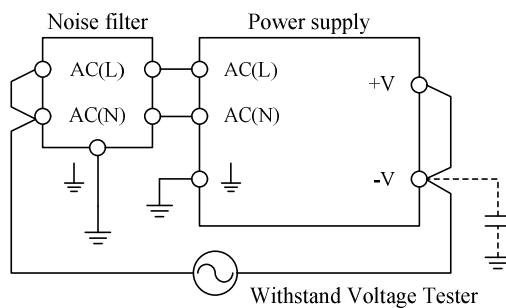
/S



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). Please check the voltage between "Output and \perp terminal". If the voltage exceeding withstand voltage, please add external capacitor to "Output and \perp ". It can 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 increasing 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.

6-13. Remote Sensing (+S, -S terminal)

Remote Sensing function is provided.

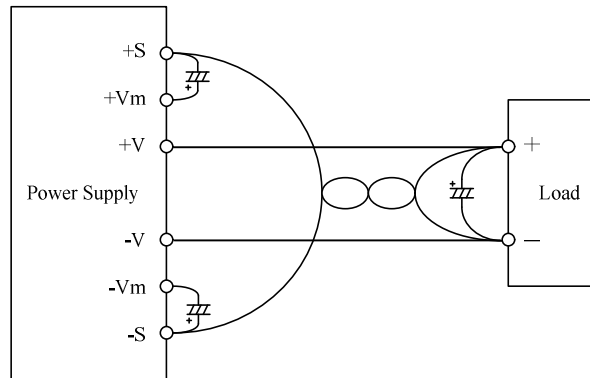
This function compensates voltage drop of wiring from output terminals to load terminals. Connect "+S" terminal to "+" terminal of load and "-S" terminal to "-" terminal of load with sensing wires.

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:

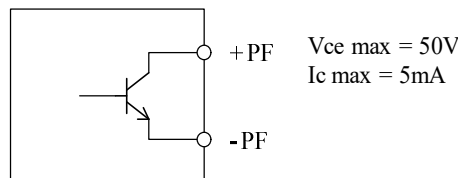
- 1) Across the load terminal,
- 2) Between "+S" terminal and "+Vm" terminal,
- 3) Between "-S" terminal and "-Vm" terminal.

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 may trigger and voltage will be shut down.



6-14. Low Output Voltage Detection Signal (PF Signal)

Low output voltage detection signal is provided on option model /FO and /RFO. Power Fail (PF) signal will turn "High" level to indicate the abnormal status when the output voltage becomes Less than 80% of rated value caused by either the drop or brownout of the input voltage, OCP, OVP or Delay Shut Down operation. When the built-in FAN motor of this power supply unit stops, PF signal will turn to "High". The PF signal is isolated from input and output by a photo-coupler. It uses the open collector method shown in below.



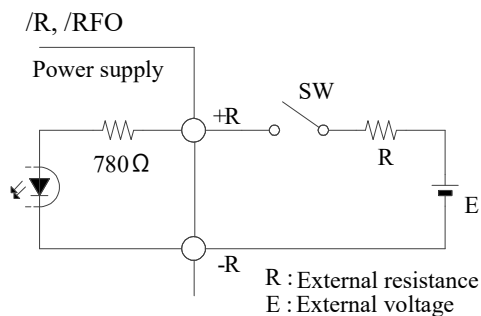
6-15. Remote ON/OFF Control

Remote ON/OFF control function is provided on option model /R, /RFO and /S.

Using this function allows the user to turn the output on and off without having to turn the AC input off and on.

It is controlled by the voltage applied to +R and -R. This circuit is in the secondary side of the power supply unit.

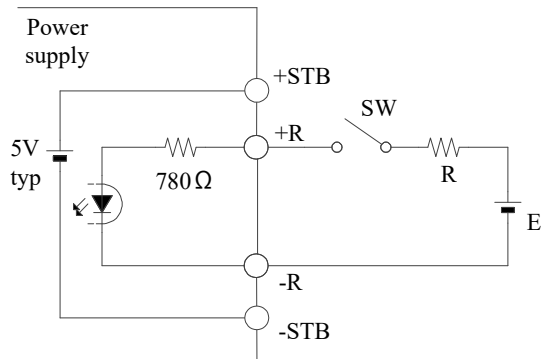
Never connect to primary side.



+R & -R terminal condition	Output condition	Fan condition
SW ON (Higher than 4.5V)	ON	Operate
SW OFF (Lower than 0.5V)	OFF	Not Operate

External voltage : E	External resistance : R
4.5 ~ 12.5VDC	No required
12.5 ~ 24.5VDC	1.5kΩ

/S
 Circuit example (a)

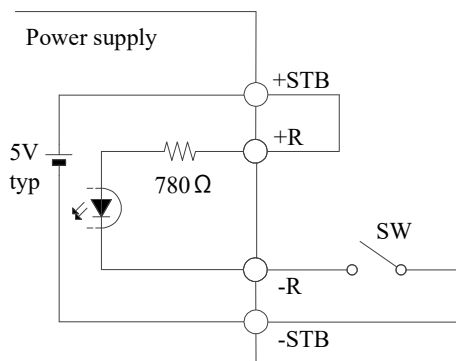


R : External resistance
 E : External voltage

+R & -R terminal condition	Output condition	Fan condition
SW ON (Higher than 4.5V)	ON	Operate
SW OFF (Lower than 0.5V)	OFF	Not Operate

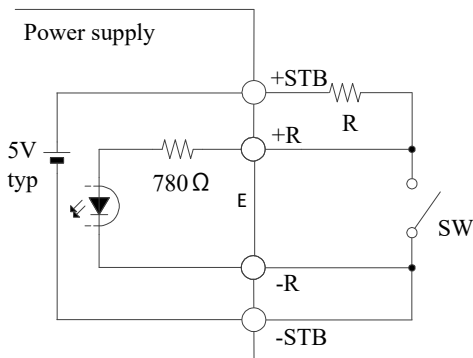
External voltage : E	External resistance : R
4.5 ~ 12.5VDC	No required
12.5 ~ 24.5VDC	1.5kΩ

Circuit example (b)



+R & -R terminal condition	Output condition	Fan condition
SW ON	ON	Operate
SW OFF	OFF	Not Operate

Circuit example (c)



R : External resistance

+R & -R terminal condition	Output condition	Fan condition
SW OFF	ON	Operate
SW ON	OFF	Not Operate

External resistance : 220Ω

6-16. Standby supply (+STB, -STB terminal)

Standby supply (5V, 1A) is provided to ease customer application. Standby supply voltage is functionally isolated from all other signal terminals and output terminals, and it is always available as long as input power in the specified voltage range is supplied.

Over Current Protection (OCP) is fold back limit and hiccup mode with automatic recovery.

OCP function operates when the output current exceeds 105% of maximum DC output current of specification. The outputs will be automatically recovered when the overload condition is canceled. Never operate the unit under over current or shorted conditions, which may leads damage or insulation failure. OCP setting is fixed and not to be adjusted externally. The Over Voltage Protection (OVP) is inverter shut down method and manual reset type. OVP function operates within 105%-170%.

When OVP triggers, the output will be shut down. To reset OVP, remove the input of power supply for a few minutes, and then re-input. In addition, the setting value of OVP is fixed and not adjustable. 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.

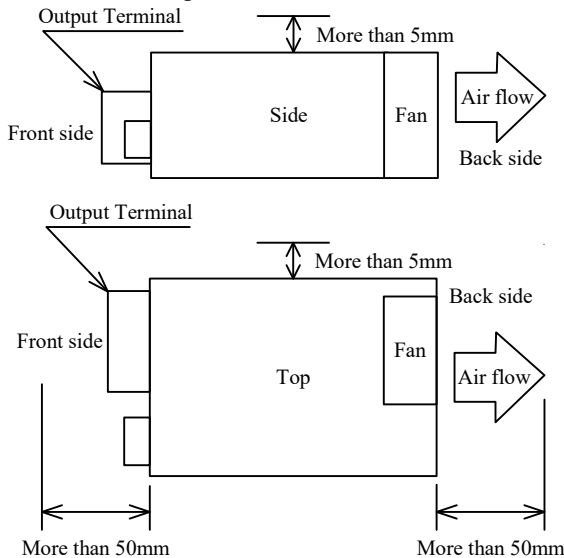
7. Mounting Method

7-1. Mounting Method

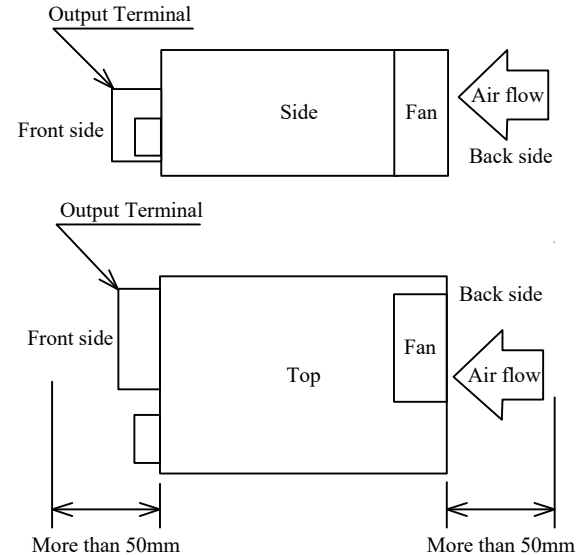
- (1) These models are forced air cooling type power supply. The power supply has ventilating holes. Keep a space more than 50mm from the front side and back side of the power supply to the peripheral parts. Standard and option model exclude /RF also keep a space more than 5mm between other surfaces and the peripheral parts. /RF does not require a space.

The power supply may cause damage when it intake conductive material, dust and liquid. Never use in the dusty environment.

- Standard and option model exclude /RF



- /RF



- (2) The maximum allowable penetration of mounting screws is 5mm.
 Incomplete thread of mounting screw should not be penetrated.
- (3) Recommended torque for mounting screw.
 M4 screw : 1.27N·m (13.0kgf·cm)

7-2. Output Derating according to the Mounting Directions

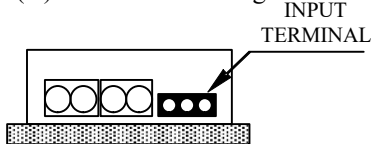
The standard mounting is direction (A). Direction (B), (C) and (D) are also possible. Please contact us for other mounting directions.

Never use as mounting direction (E) and (F) shown below.

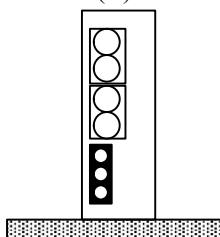
Refer to the output derating below, load (%) is percent of maximum output current value in a rated output voltage.

■ Mounting direction

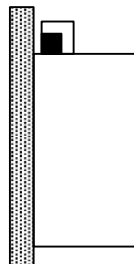
(A) Standard Mounting



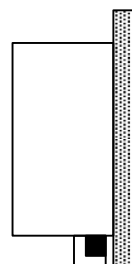
(B)



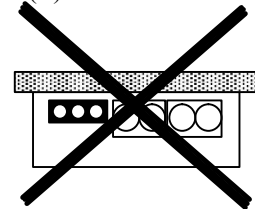
(C)



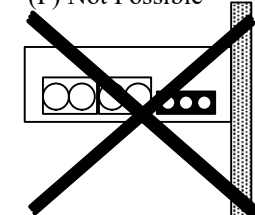
(D)



(E) Not Possible

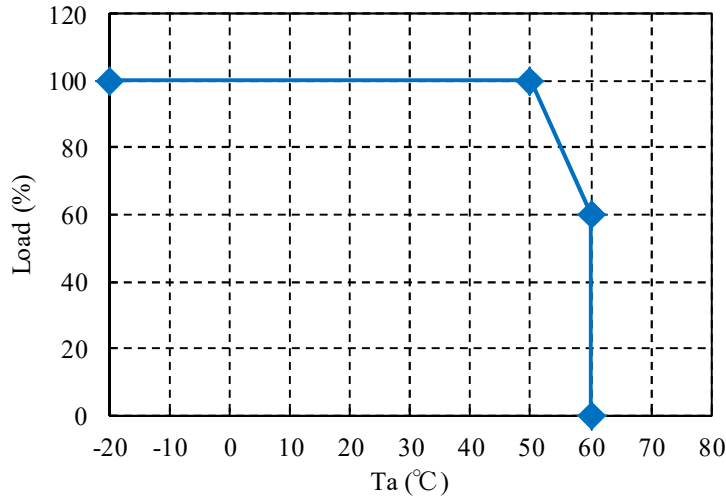


(F) Not Possible



■ Output Derating

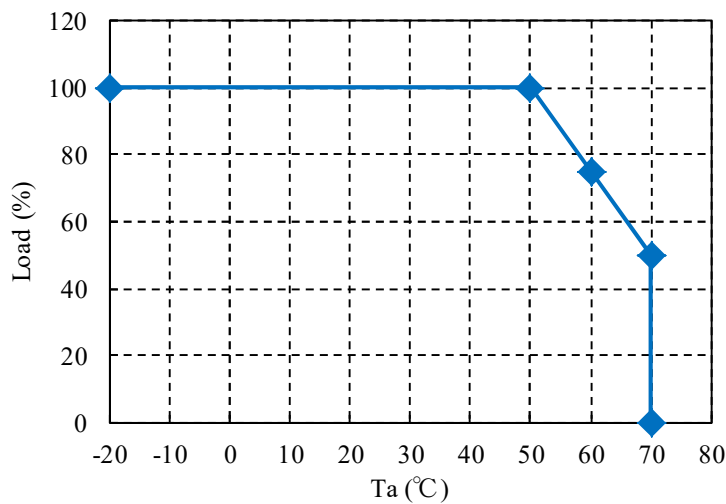
Standard and option model exclude /RF



—◆— Mounting (A)-(D)

Ta (°C)	Load (%)
	Mounting (A)-(D)
-20 - +50	100
60	60

/RF

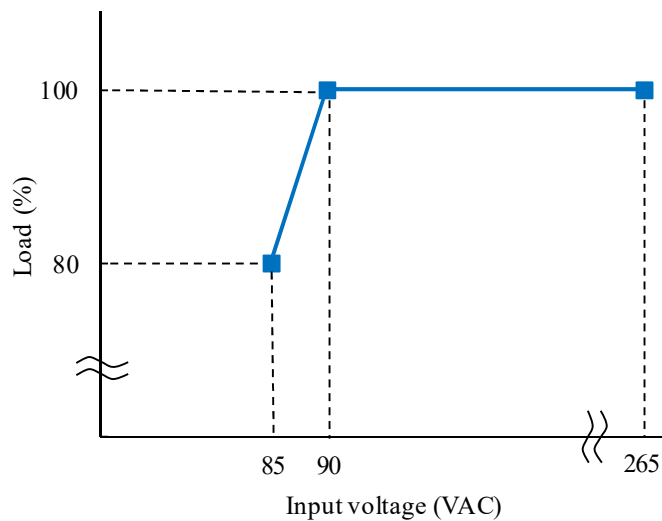


—◆— Mounting (A)-(D)

Ta (°C)	Load (%)
	Mounting (A)-(D)
-20 - +50	100
60	75
70	50

7-3. Output Derating according to the Input Voltage

Load (%) is percent of maximum output current value in a rated output voltage.



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 eliminated 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)
RWS1000B RWS1500B	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 M5 Screws 2.0N·m (20.4kgf·cm) ~ 2.4N·m (24.4kgf·cm)		0.8mm	2pieces

Note 1 : When connecting some units, use of two pcs. of 0.8mm thick crimp-type terminal is recommended for input terminal.

Note 2 : For recommended wire type, refer to wire maker recommended allowable current and voltage drop.

Especially for 12V models, output current is large.

Thick diameter wire is recommended.

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.

Note 3 : Output terminal is possible to install on arbitrary surface by customer. (Refer to Fig.1 and Fig.2 for reference.)

Recommended to install single surface at same time to attach terminal cover for safety.

At shipment condition, screw is installed on top side (Fig.1). When installing on front side, please reverse position of screw and terminal cover (Fig.2).

Do not recommend install dual surface at same time. It may cause touch each screw and cannot attach terminal cover.

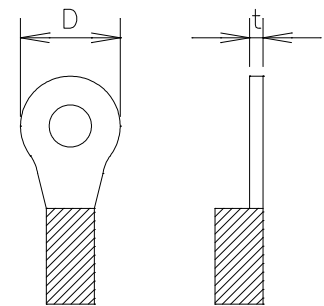


Fig.1 Top side screw (Shipment condition)

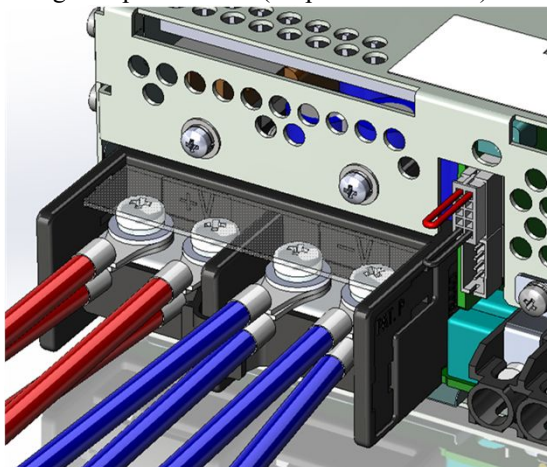
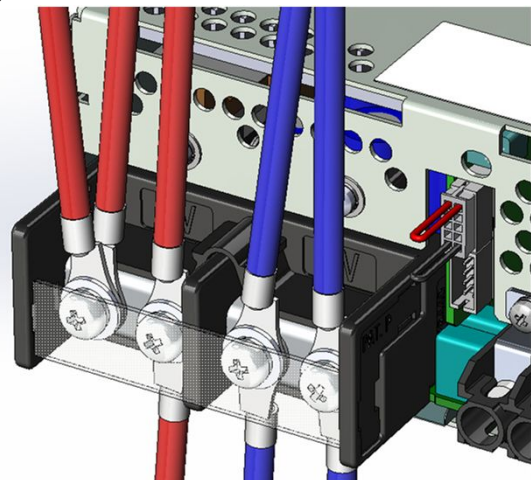


Fig.2 Front side screw



9. The life expectancy

The life of the power supply depends on the life of the built-in aluminum electrolytic capacitor being used and mounted fan. Each 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".

The life of the fan depends on the fan intake or exhaust temperature.

Please refer to "Fan Life Expectancy".

Please do not use the product which passed over the life expectancy.

There is a risk of unexpected output shutdown and specifications may 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 can not 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.

RWS1000B : 20A
 RWS1500B : 30A

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

Before concluding that the unit is at fault, make the following checks.

- (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 control (V.ADJ) is properly adjusted.
- (5) Check if the Remote ON/OFF control connector is not opened, when use Remote ON/OFF control function (/R, /RFO,/S).
- (6) Check if the output current and output power does not over specifications.
- (7) Audible noise can be heard when input voltage waveform is not sinusoidal wave.
- (8) Audible noise can be heard during Dynamic-Load operation.
- (9) Ensure that large capacitor is not connected on the output side.

Please use within maximum capacitance shown below.

Please contact us, if connecting more than the following capacitance value.

Model	Maximum external capacitance				
	12V	15V	24V	36V	48V
RWS1000B	100,000uF				
RWS1500B					

- (10) The built-in fan speed is reduced at light load (about 5% or less of rated output current).

The built-in fan is stopped due to output shut down. (Such as OVP or ON/OFF control, etc.)

- (11) Check if the Remote sensing terminal is not opened.

12. Warranty Period

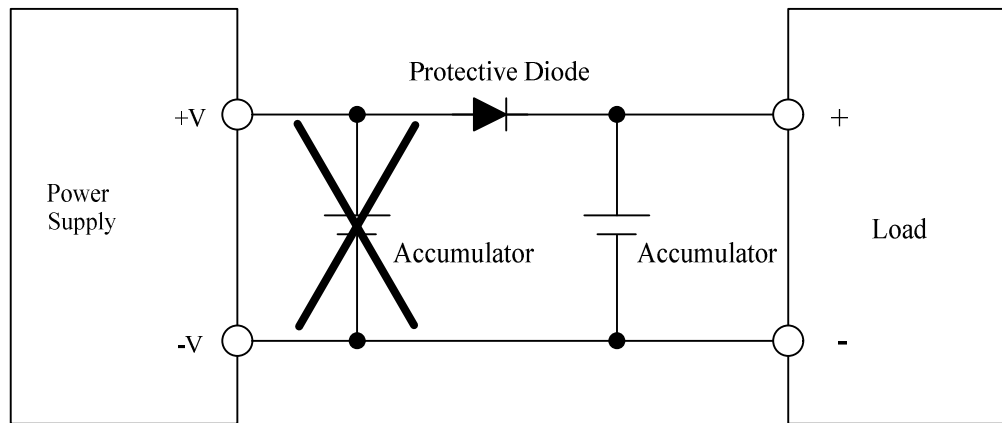
This product is warranted for a period of 5 years from the date of shipment.

For damages occurring at normal operation within this warranty period, repair is free of charge.

13. Precaution

- (1) This product is not adapted to use for apply voltage to output terminal from customer equipment. Must connect protective diode on the output line when possibility of apply voltage to output terminal.

example of application



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

- (2) Do not use in the condition that FAN stops. Except for the condition of output off status with remote ON/OFF function.

14. 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.