ZWS300RC Series
Instruction Manual

BEFORE USING THE PRODUCT

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 product 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.
・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.
・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 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.
・Please check the connector is locked securely, and be careful the harness does not come off the connector after connecting.

⚠ 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, noise and static electricity 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 (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 or III (Only EN62477-1) and Class of equipment: Class I. This product is designed to be accessible only to service technicians as part of indoor use device.
- This product contains a printed circuit board utilizing surface mounted devices. PCB stress such as bending, twisting etc. could cause damage. Therefore, please handle with care.
- When handling this product, hold the board edge and take care not to touch the component side. When installing this product in apparatus or equipment, mount it on spacers.
- The outputs of this product may, under fault conditions, exceed ES1 voltage limits. Therefore the outputs must be protected in the end equipment to maintain ES1.
- This product has used Power Thermistor to protect the circuit from Inrush Current. Frequent repetition of input might cause damage to internal components because of generating surge current.
- The output power 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.

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.

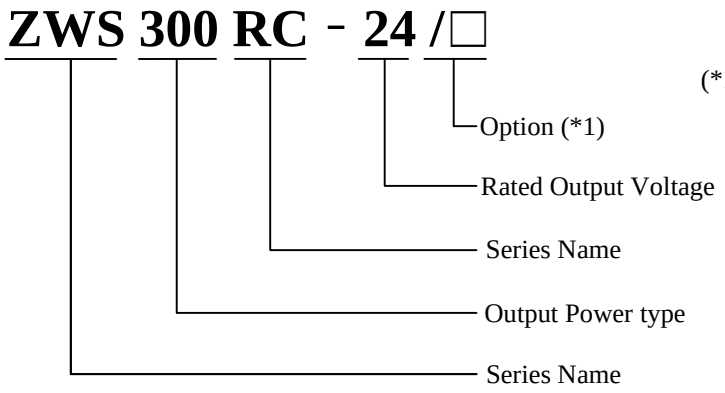
LONG-TERM STORAGE METHOD AND LONG-TERM STORAGE PERIOD

・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℃～30℃
Humidity range : 40%～60%RH
Please 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

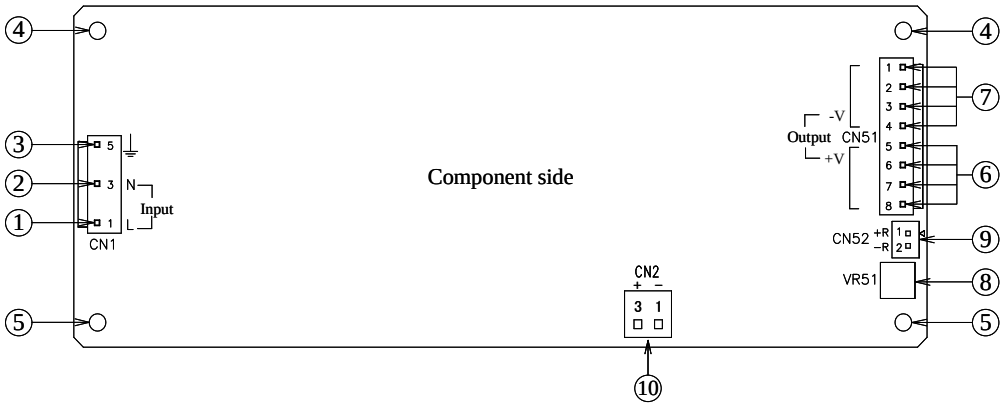
Input voltage	: Rating
Load	: 0A
Ambient temperature	: Normal temperature
Time	: 30 minutes or more

1. Model name identification method



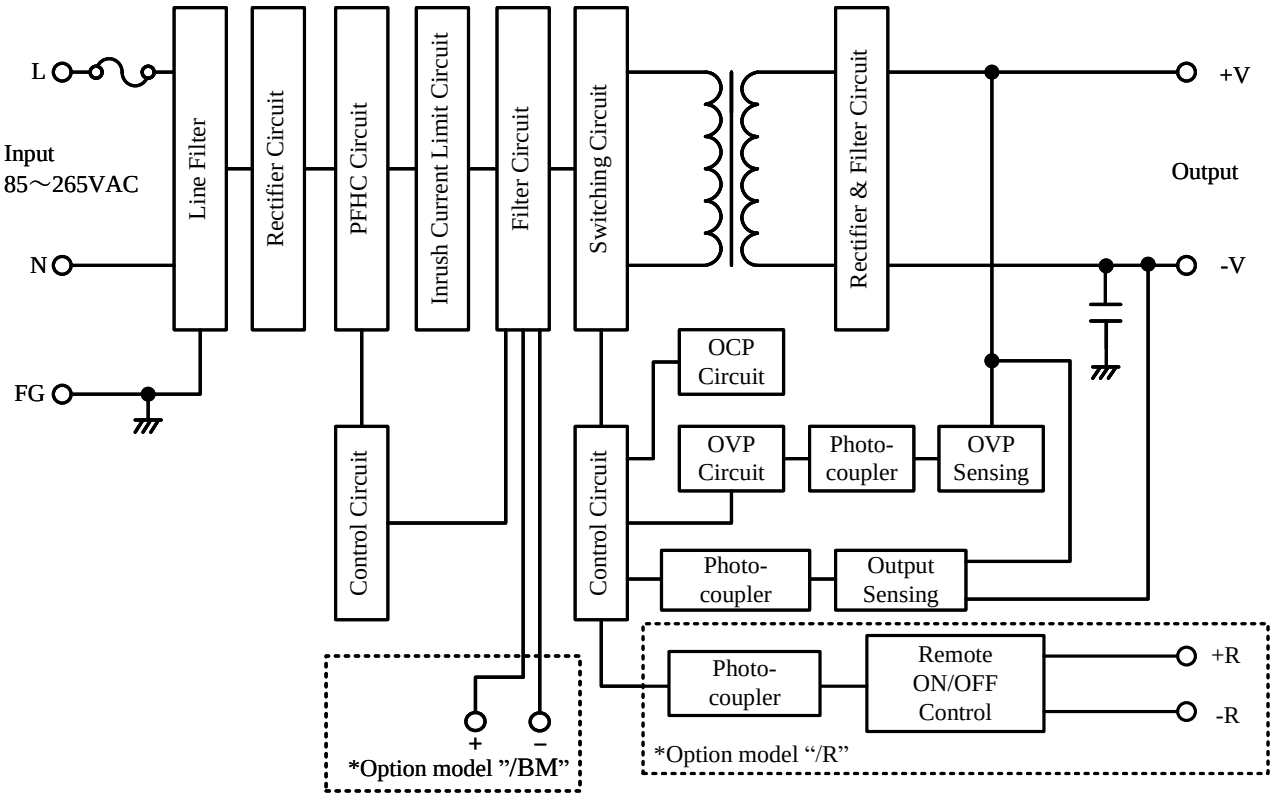
(*1) ZWS300RC options
Blank : Standard
/R : With remote ON/OFF control model.
/BM : Model for connect ZBM-AC.
/RBM: With remote ON/OFF control model.
Model for connect ZBM-AC.
*Composite model of /R and /BM

2. Terminal Explanation



① L : AC Input terminal Live line (Fuse in line)
② N : AC Input terminal Neutral line
③ ⏚ : Earth terminal
④ Mounting hole (hole diameter : ϕ 3.5mm)
These holes are connected to ⏚ terminal of CN1.
Must be connected to Chassis (Conductor) of the equipment by electrically conductive spacer.
⑤ Mounting hole (hole diameter : ϕ 3.5mm)
These holes are not connected to ⏚ terminal of CN1.
⑥ +V : + Output terminal
⑦ -V : - Output terminal
⑧ V.ADJ : Output voltage adjustment trimmer. The output voltage rises when a trimmer is turned clockwise.
⑨ Remote ON/OFF control terminal (Option model "/R")
⑩ ZBM-AC connection terminal (Option model "/BM")

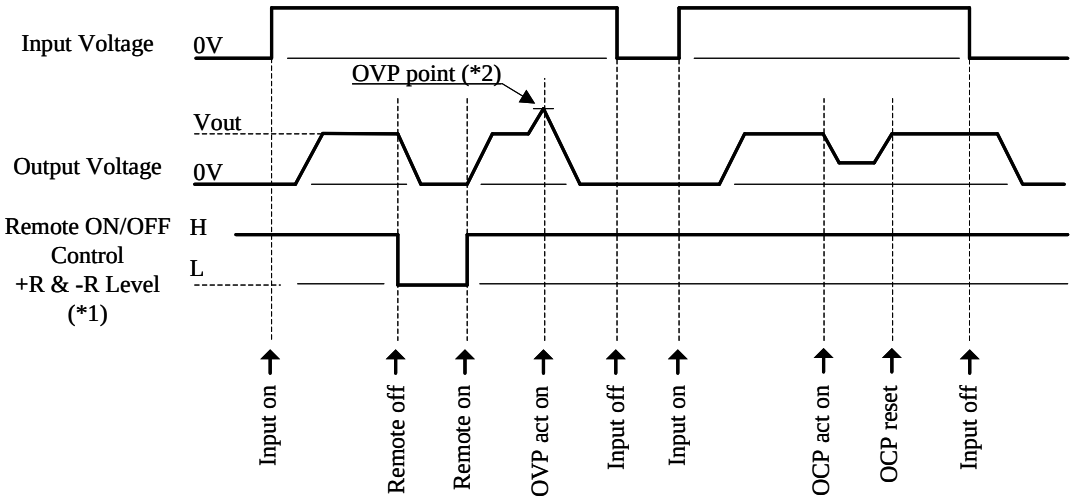
3. Block Diagram



•Circuit topology, switching frequency
Switching Circuit : Cascade forward topology 130kHz
PFHC circuit : Active filter 50kHz-70kHz (Spread)

•Fuse rating : 6.3A

4. Sequence time chart



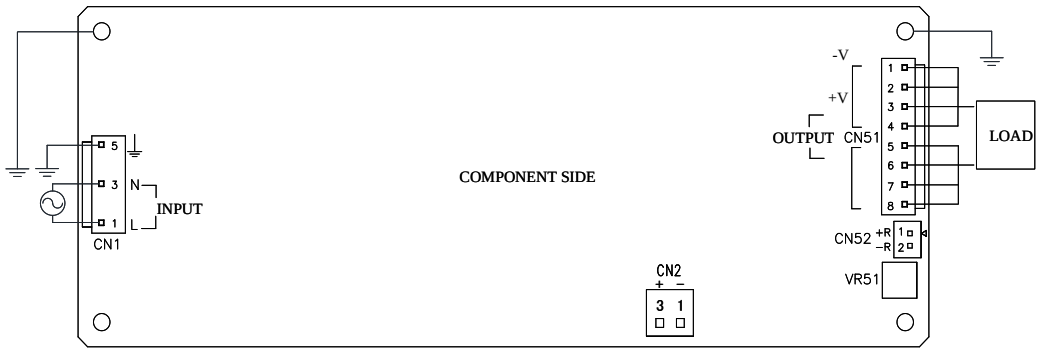
(*1) Target option : /R
+R & -R Level
Higher than 4.5V : Output on
Lower than 0.8V : Output off
This sequence is using external voltage.

(*2) OVP detection point
115%～135%

5. Terminal Connection method

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

- Input must be off when making connections.
  Please insert or remove CN2 after the internal voltage drop enough. (More than 3 min after input turn off)
  CN2 is connected to an internal capacitor, and high voltage remains even if the input turn off.
- Connect ⏚ terminal to earth (frame ground of the equipment etc.) by thick wire for safety and improvement of noise sensitivity.
- The output load line and input line shall be separated to improve noise sensitivity.
- Do not apply stress to PCB, when connecting or removing connector.
- Use input/output connector (housing) specified by the table below. Housing or Terminal pin is not included with this product.
- Use the terminal pin SVH-21T-P1.1 or BVH-21T-P1.1, when output current per connector pin is 5A or less.
- Use the terminal pin SVH-41T-P1.1 or BVH-41T-P1.1, when output current per connector pin is 7A or less.
- Use recommended crimping tool.



■Connector / Housing and Terminal Pin

Terminal	Symbol	Connector	Housing	Terminal Pin	Maker
Input Connector	CN1	B3P5-VH	VHR-5N	(In the case of 5A MAX per PIN) SVH-21T-P1.1 or BVH-21T-P1.1	J.S.T.
Output Connector	CN51	B8P-VH	VHR-8N	(In the case of 7A MAX per PIN) SVH-41T-P1.1 or BVH-41T-P1.1	
Remote ON/OFF Control (Option model "/R")	CN52	B2B-XH-AM	XHP-2	SXH-001T-P0.6 or BXH-001T-P0.6	
ZBM-AC Connection Terminal (Option model "/BM")	CN2	B2P3-VH-FB-B	VHR-3N	SVH-21T-P1.1 or BVH-21T-P1.1	

Matching housing and terminal --- Not included with the product

■Hand Crimping Tool

Hand Crimping Tool	Terminal Pin	Maker
YC-160R	SVH-21T-P1.1 or BVH-21T-P1.1	J.S.T.
YC-930R	SVH-41T-P1.1 or BVH-41T-P1.1	
YC-110R or YRS-110	SXH-001T-P0.6 or BXH-001T-P0.6	

6. Explanation of Functions and Precautions

6-1. Input Voltage Range

Input voltage range is single phase 85-265VAC (47-63Hz) or 120-370VDC. Input voltage, which is out of specification, might lead the product damage.
For cases where conformance to various safeties required, described as 100-240VAC (50-60Hz). Output derating is required for input voltage less than 90VAC or less than 127VDC.

6-2. Output Voltage Adjustment Range

Output voltage is set to rated value at shipment. Output voltage can be adjusted by output voltage adjustment trimmer (VR51). Please set output voltage within specified adjustable range.
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 the product until the output be shut down, and then re-input. Please turn the trimmer slowly during the output voltage adjustment.

6-3. Inrush Current

Inrush current is suppressed by power thermistor for the product. Higher current will flow at higher ambient temperature or re-input on condition. Please select input switch or external fuse carefully. The inrush current value specified in the specification is under cold start condition (at 25^{o}C).

6-4. Over Voltage Protection (OVP)

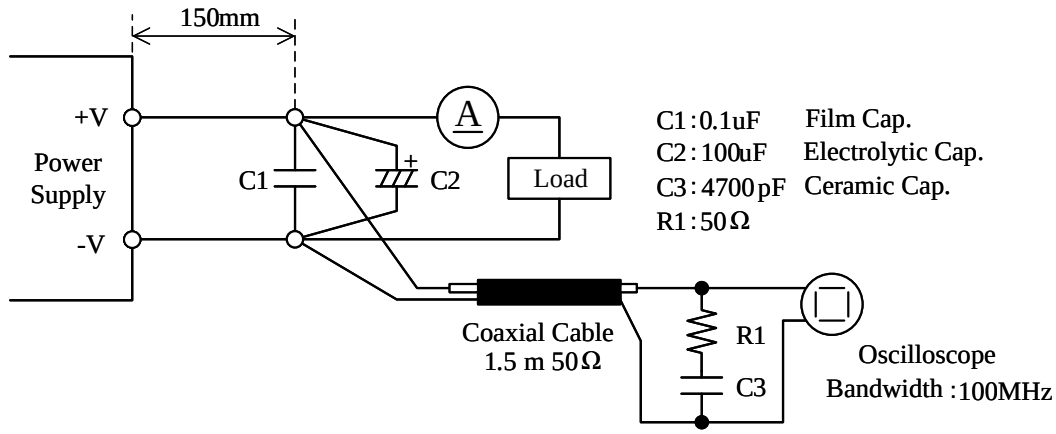
The OVP function is output shut down method and manual reset type. OVP function operates within 115-135% of nominal output voltage.
When OVP triggered, the output will be shut down. To reset OVP, remove the input of the product for a few minutes, and then re-input or remote control (Option) OFF/ON is required. In addition, the setting value of OVP is fixed and not adjustable. Never apply higher
voltage externally to the output terminal to avoid the product 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.

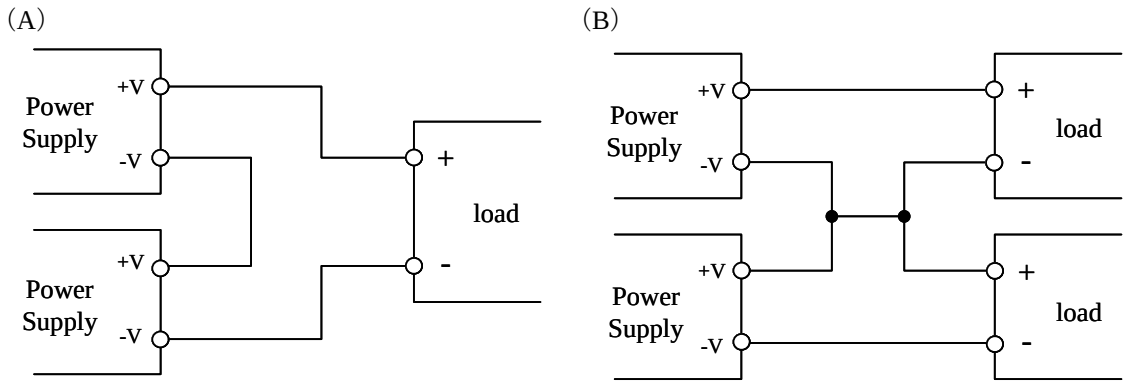
6-6. Output Ripple & Noise

The specified maximum ripple & noise value is measured according to below measurement circuit. When load lines are longer, ripple will becomes larger. In this case, electrolytic capacitor, film capacitor, etc. might be necessary to be used across the load terminal.
The output ripple cannot be measured accurately if the probe ground lead of oscilloscope is too long.



6-7. Series Operation

For series operation, either method (A) or (B) is possible.
Never use when one of the unit not operate, which leads damage.
In series operation, the rising waveform may have steps.



6-8. Parallel Operation

(A) Operation to increase the output current is not possible.

(B) Operation as a Backup System

Connect our reverse prevention module "RP-60-20" or ORing-diode to the output side of the product.

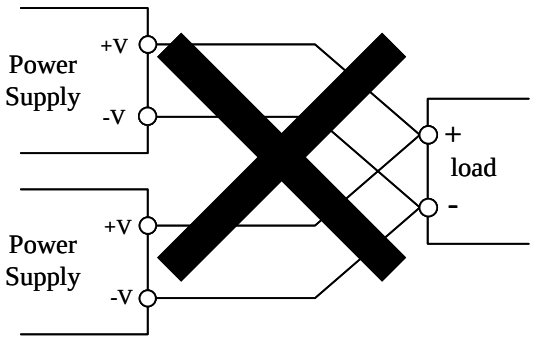
(1) Adjust each product output to same voltage. (The difference of each product output voltage should be within ±5%.)

(2) Adjust the output voltage higher by the value of the voltage drop (90mV typ.) of RP-60-20 or the forward voltage drop (Vf) of ORing-diode.

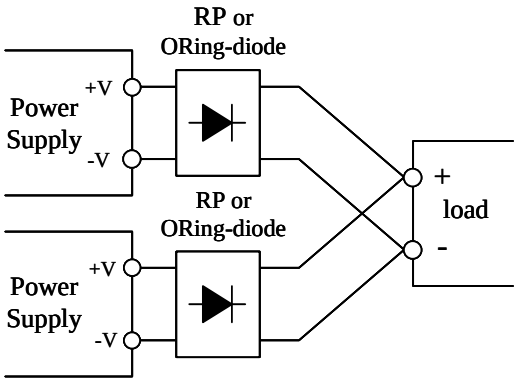
(3) Output voltage and output power should be used within specifications.

(4) When using RP-60-20, output load current should be used within specifications. When using ORing-diode, current rating must be more than output load current.

(A)



(B)

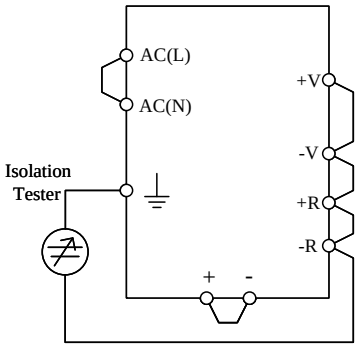


For more information about RP-60-20, please refer to "RP-60-20 Instruction Manual". RP-60-20 can be replaced by ORing-diode. In such case, please take care of ORing-diode temperature.

6-9. Isolation Test

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

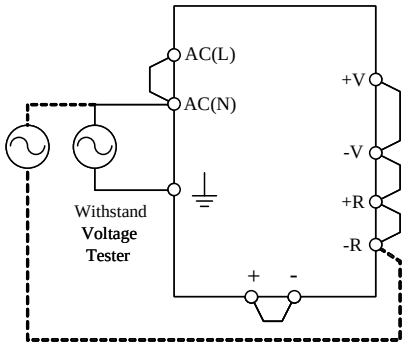
■ Output - ⏚ terminal : 500VDC More than 100MΩ

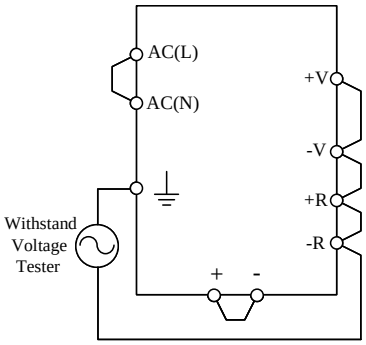


6-10. Withstand Voltage

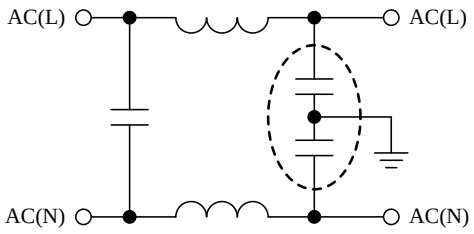
The product is designed to withstand 3.0kVAC between input and output, 2.0kVAC between input and ⏚ terminal and 500VAC between output and ⏚ terminal each for 1 minute. When testing withstand voltage, set current limit of withstand voltage test equipment at 10mA (Output - ⏚ terminal : 20mA).
The applied voltage must be gradually increased from zero to testing value and then gradually decreased for shut down. When timer is used, the product may be damaged by high impulse voltage at switch on and off timing.
Connect input and output as follows.

■ Input - Output (dotted line) : 3.0kVAC, 1min (10mA) ■ Output - ⏚ terminal : 500VAC, 1min (20mA)
Input - ⏚ terminal (solid line) : 2.0kVAC, 1min (10mA)

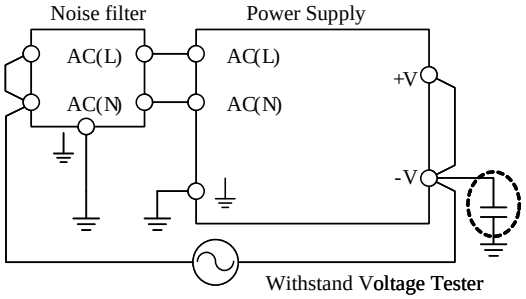




Note1 : In case of using external noise filter, capacitance between "Input and ⏚ terminal" might be increased. When testing withstand voltage between "Input and Output", there is a possibility exceeding withstand voltage between "Output and ⏚ terminal" (500VAC). Please check the voltage between "Output and ⏚ terminal". If the voltage exceeding withstand voltage, please add external capacitor to "Output and ⏚ terminal". It can decrease the voltage.
On the other hand, no need to check the voltage in case of "Output and ⏚ terminal" is shorted.



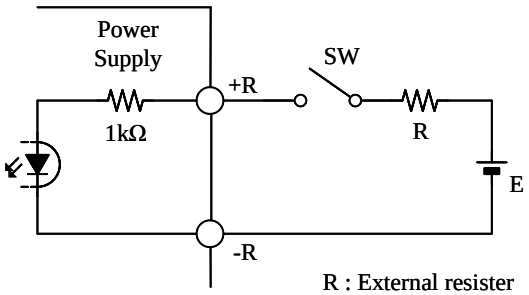
The example of noise filter circuit that may increase capacitance value between "Input and ⏚ ".
(Capacitance value in dashed line is added.)



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

6-11. Remote ON/OFF Control (Option "/R")

Remote ON/OFF control function is provided on option model "/R". 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 external voltage applied to +R and -R of remote ON/OFF terminal. This circuit is in the secondary side of the product. Never connect to primary side. And this circuit is isolated from the secondary (output).



R : External resister
E : External voltage

+R & -R terminal condition	Output Condition
SW ON (Higher than 4.5V)	ON
SW OFF (Lower than 0.8V)	OFF

External voltage : E	External resistor : R
4.5 - 12.5VDC	No required
12.5 - 24.5VDC	1.5kΩ

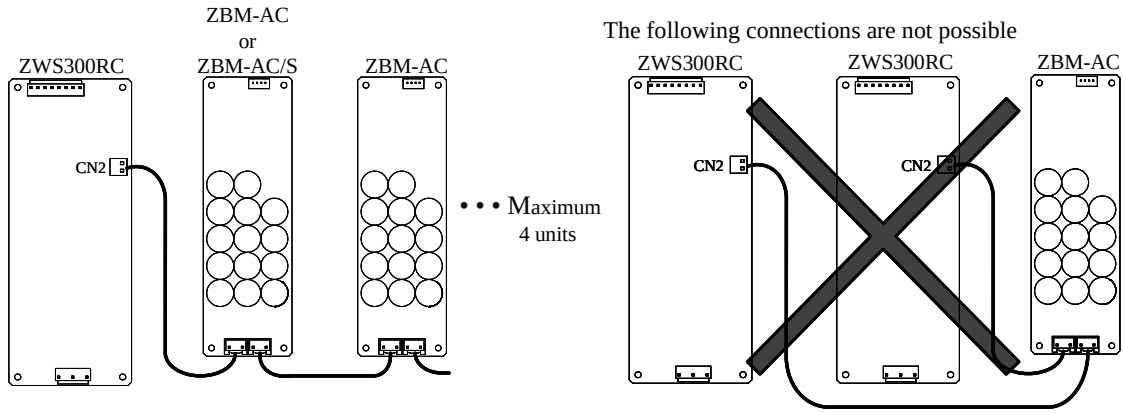
6-12. Connecting method of Buffer module ZBM-AC (Option "/BM")

By connecting our ZBM-AC to CN2, the Hold up time of ZWS300RC can be extended.
Derating the output power of ZWS300RC by 10W per ZBM-AC connection.
The ZBM-AC that can be connected to ZWS300RC is as follows.
When using multiple ZBM-AC units, the maximum number of /S option is one unit.
It is necessary to use harness with withstand voltage of 400V or higher and equivalent to AWG18.
Please be careful about insulation of harness, because CN2 is on the primary side. An optional harness (sold separately) for connection is available.
For details on how to use ZBM-AC and precautions, refer to the ZBM-AC instruction manual.

■ZBM-AC connectable quantity

Input Voltage	Maximum number of units
85-170VAC or 120-240VDC	1 unit
170-265VAC or 240-370VDC	4 units

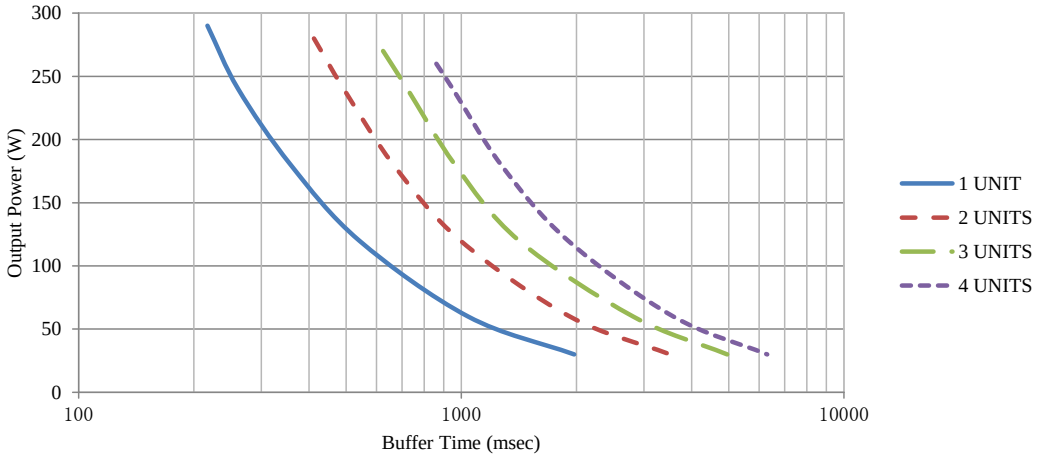
■ZBM-AC connection example



■Output power vs. Hold up time characteristics

ZWS300C Input Voltage : 200VAC, Ta=25℃, Initial state of capacitor capacity

Output Power of ZWS300RC-24/BM	Buffer Time (msec)			
	1 UNIT	2 UNITS	3 UNITS	4 UNITS
300 W	Do not use	Do not use	Do not use	Do not use
290 W	217	Do not use	Do not use	Do not use
280 W	225	412	Do not use	Do not use
270 W	235	450	625	Do not use
260 W	245	470	705	860
240 W	261	493	723	950
180 W	358	665	963	1270
120 W	541	995	1415	1900
60 W	1041	1920	2810	3580
30 W	1972	3510	4950	6300

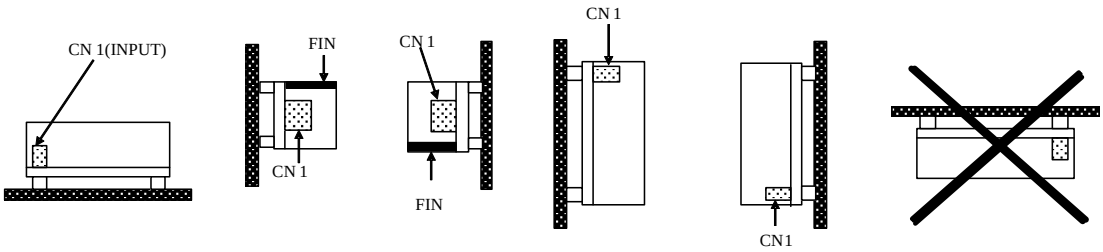


7. Mounting Method

7-1. Mounting Direction

The standard mounting is direction (A).
Possible mounting directions are (A), (B),(C), (D) and (E). Do not mount the product in any other directions.
Do not exceed the derating of maximum load, which is limited by mounting direction and ambient temperature.
Refer to "7-2.Output Derating" for more information.

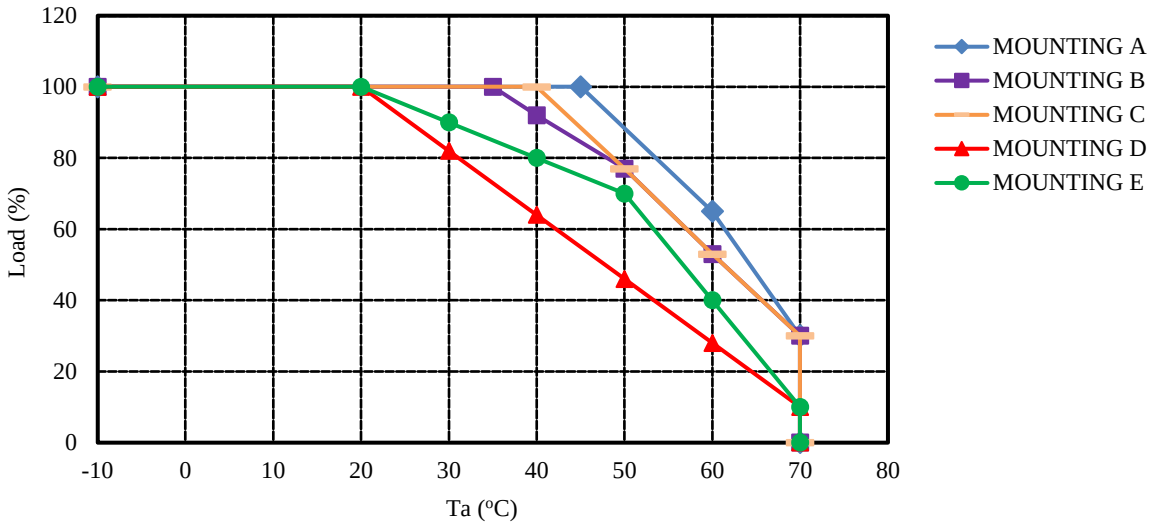
(A) Standard Mounting (B) (C) (D) (E) (F) Not Possible



7-2. Output Derating

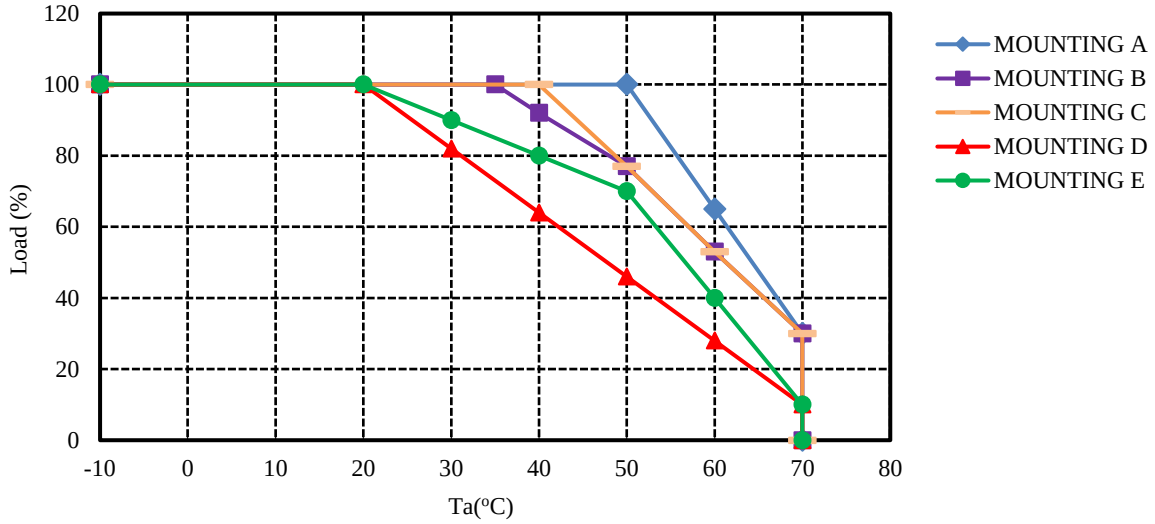
Refer to the output derating below, load (%) is percent of maximum output current value in a rated output voltage.

■Convection Cooling (85≤Vin<170VAC or 120≤Vin<240VDC)
*Derating is required for less than 90VAC or less than 127VDC. Refer to "7-3.Output Derating according to the Input Voltage" for more information.



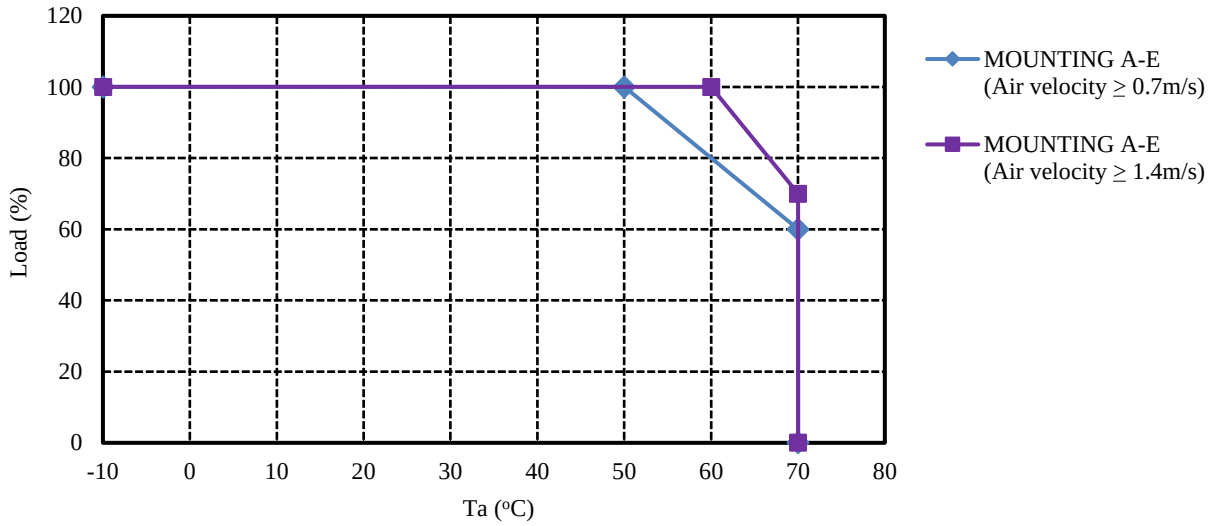
Ta (°C)	Load (%)				
	MOUNTING A	MOUNTING B	MOUNTING C	MOUNTING D	MOUNTING E
-10 - +20	100	100	100	100	100
35	100	100	100	73	85
40	100	92	100	64	80
45	100	85	88	55	75
50	88	77	77	46	70
60	65	53	53	28	40
70	30	30	30	10	10

■Convection Cooling (170≤Vin≤265VAC or 240≤Vin≤370VDC)



Ta (°C)	Load (%)				
	MOUNTING A	MOUNTING B	MOUNTING C	MOUNTING D	MOUNTING E
-10 - +20	100	100	100	100	100
35	100	100	100	73	85
40	100	92	100	64	80
45	100	85	88	55	75
50	100	77	77	46	70
60	65	53	53	28	40
70	30	30	30	10	10

■Forced Air Cooling



Air velocity ≥ 0.7m/s

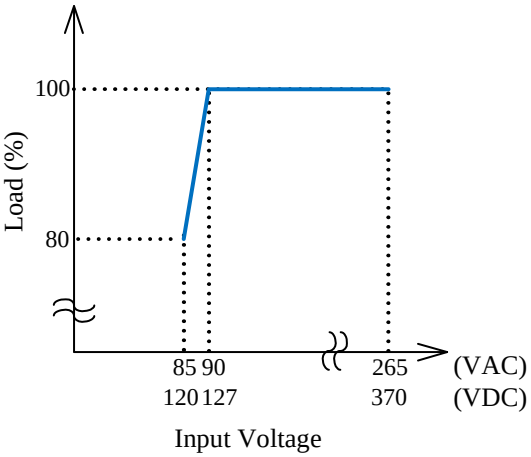
Ta (°C)	Load (%)
	MOUNTING A-E
-10 - +50	100
70	60

Air velocity ≥ 1.4m/s

Ta (°C)	Load (%)
	MOUNTING A-E
-10 - +60	100
70	70

7-3. Output Derating according to the Input Voltage

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



Input AC

Input Voltage (VAC)	Load (%)
85	80
90-265	100

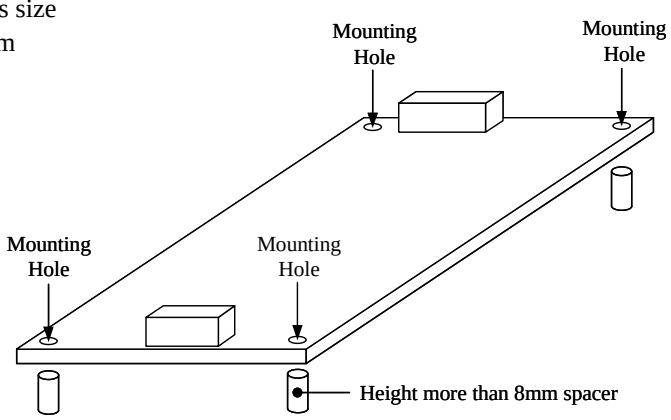
Input DC

Input Voltage (VDC)	Load (%)
120	80
127-370	100

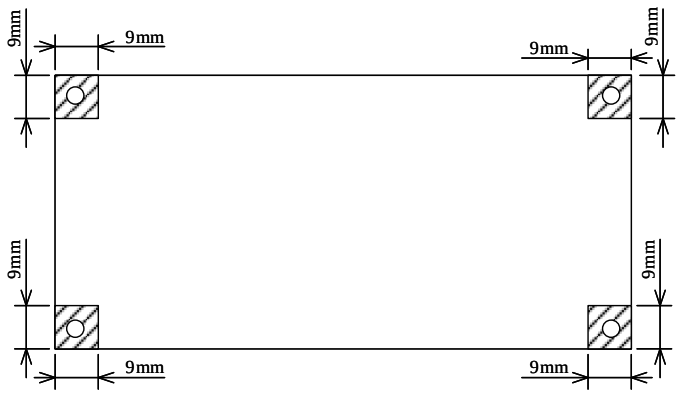
7-4. Mounting Method

Insert the spacer (Max ϕ 8) of height more than 8mm to lift the product. And use all mounting holes for the product installation.

(1) Mounting Holes size
4 holes ϕ 3.5mm

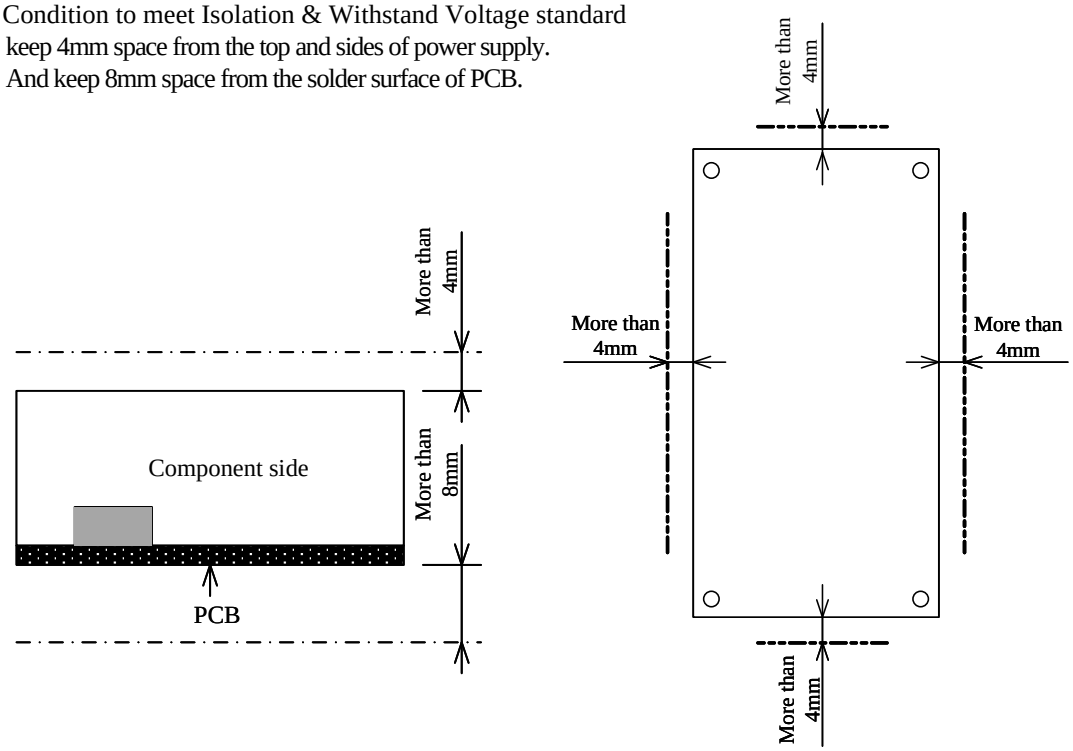


Allowable area by metal pieces is 9mm from each PCB corners. Refer to figure below.

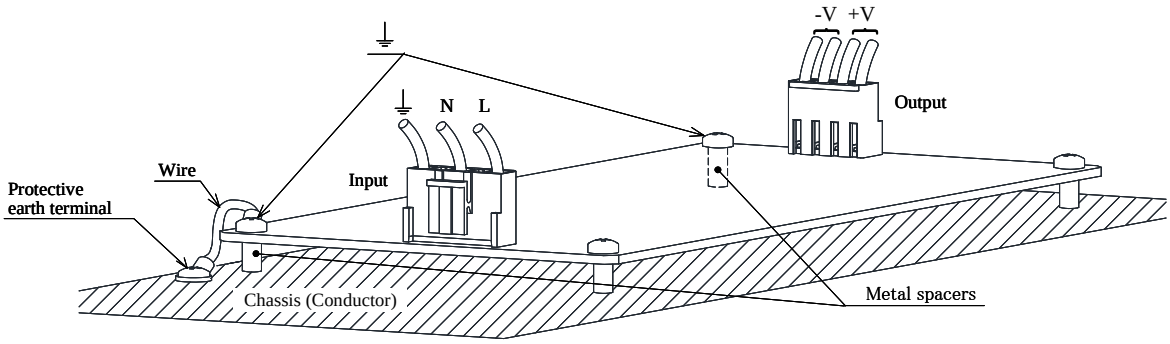


If the space is not enough, the specification of isolation and withstand will not be satisfied. Take the space in the product surroundings and the upper area of components to keep enough for convection cooling.

(2) Condition to meet Isolation & Withstand Voltage standard
keep 4mm space from the top and sides of power supply.
And keep 8mm space from the solder surface of PCB.



(3) ⏚
⏚ must be connected to the Protective earth terminal of the equipment. Also 2 mounting holes are must be connected to the Chassis (Conductor) by Metal spacer. When screw clamping the mounting holes, please use the screw with spring washer. If not connect to the Chassis (Conductor), the conducted noise, radiation noise and output noise will increase. (The location of 2 mounting holes for Chassis connection is shown with ⏚ mark in below figure.)



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) Input/Output lines shall be twisted and separated from the output lines.
(3) Noise can be eliminated by attaching a capacitor to the load terminals.
(4) For safety and EMI considerations, connect between ⏚ terminal of input connector and protective earth terminal firmly.
(5) The recommended wire type, torque and crimp-type terminal :

Input	:	AWG#22 ~ AWG#18
Output	:	AWG#22 ~ AWG#16

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 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-lug 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.

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11. Before concluding that the product is at fault…

Before concluding that the product 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 output current and output power does not over specifications.
(6) Audible noise can be heard when input voltage waveform is not sinusoidal wave.
(7) Audible noise can be heard during Dynamic-Load operation.

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. 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.