

# ZWS-AF Series

## ZWS50AF /75AF /100AF/ 150AF

# Instruction Manual

### BEFORE USING THE POWER SUPPLY UNIT

Pay attention to all warnings and cautions before using the unit. Incorrect usage could lead to an electrical shock, damage to the unit or a fire hazard.

### WARNING and CAUTION

- Do not touch the internal components, they may have high voltage or high temperature.  
You may get electrical shock or burned.
- When the unit is operating, keep your hands and face away from it, you may get injured by an accident.
- This power supply is primarily designed and manufactured to be used and enclosed in other equipment.
- Do not operate overload or dead short condition for more than 30 seconds which could result in damage or insulation failure. There is no possibility for fire or burning.
- Confirm connections to input/output terminals are correct as indicated in the instruction manual.
- This power supply is PC board type unit. PCB stress such as bending, twisting could cause damage. Therefore, please handle with care.
- When handling, hold the board edge and take care not to touch component side. When mounting power supply unit on apparatus or equipment, lift the power supply with spacer.
- Do not drop or apply shock to power supply unit.
- This power supply has a possibility that hazardous voltage may occur in output terminal depending on failure mode.  
The outputs of these products must be earthed in the end use equipment to maintain SELV.  
If the outputs are not earthed, they must be considered hazardous and must not be made user accessible.

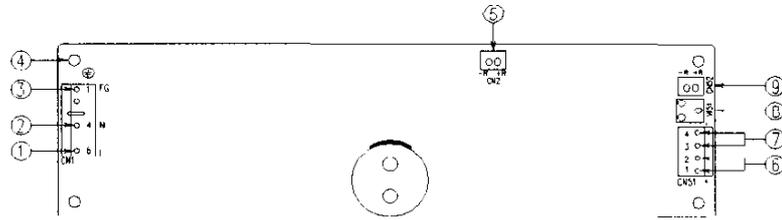
### Note: CE MARKING

CE Marking, when applied to a product covered by this handbook indicates compliance with the low voltage directive (73/23/EEC) as modified by the CE Marking Directive (93/68/EEC) in that it complies with EN60950.

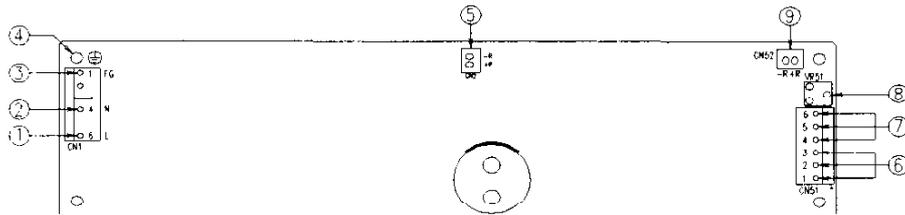
| DWG NO. : A193-04-02C |                 |                |
|-----------------------|-----------------|----------------|
| APPD                  | CHK             | DWG            |
| <i>Fukuda</i>         | <i>S. Kondo</i> | <i>M. Hada</i> |
| 5. Feb. '08           | 1. Feb. '08     | 1. Feb. '08    |

## 1. Terminal Explanation

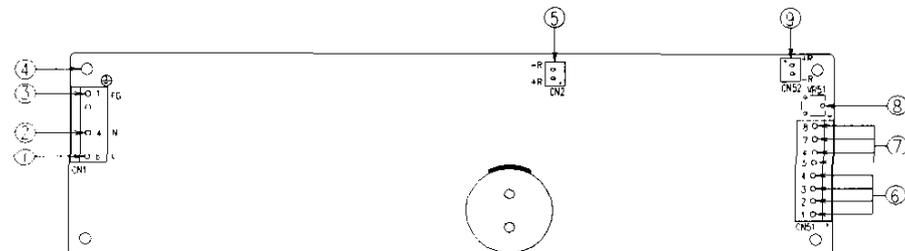
### ■ ZWS50AF



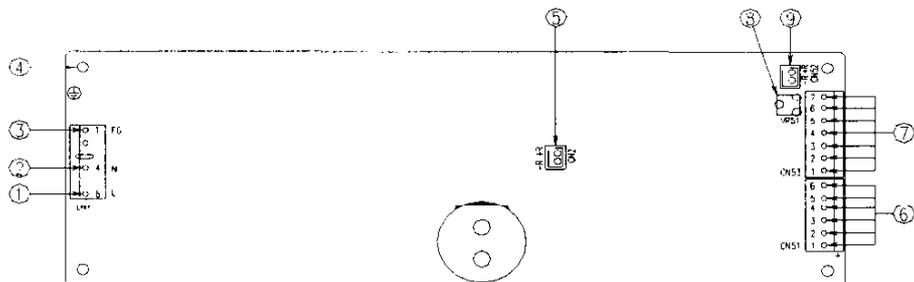
### ■ ZWS75AF



### ■ ZWS100AF



### ■ ZWS150AF



① L: AC input terminal (pin 6 of CN1)

Live line(fuse in line)

② N: AC input terminal (pin 4 of CN1)

Neutral line

③ FG: Input terminal FG (pin 1 of CN1)

Safety earth (Frame Ground)

Connect to safety ground of apparatus or equipment.

④ FG: Frame Ground (Connected to pin 1 of CN1)

Must be connected to electrically safety ground of apparatus or equipment by electrically conductive spacers. The mounting surface of the spacer should be within MAX 8mm.

⑤ CN2: ON/OFF control terminal (primary circuit)

See NOTE A

⑥ +: + Output terminal

⑦ : Output terminal

⑧ V.ADJ: Output voltage adjust trimmer.

The output voltage rises when a trimmer is turned clockwise.

⑨ CN52 : ON/OFF control terminal (secondary circuit)

(For power supply output on and off control with an external signal.)

See NOTE A

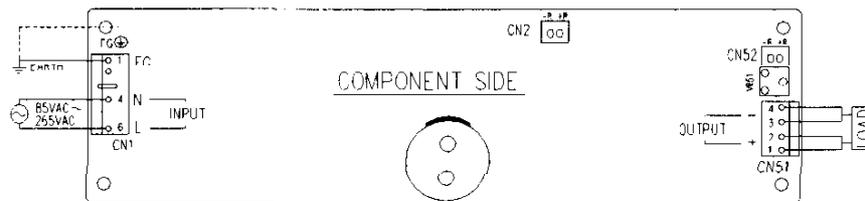
NOTE A: For COVER & CHASSIS type (MODEL: ZWS-AF/JA), remote ON/OFF control cannot be used.

## 2. Terminal Connection Method

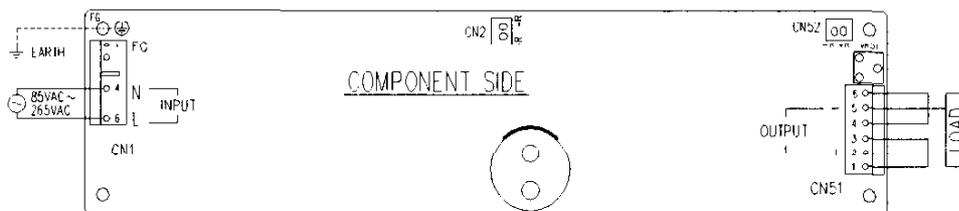
Pay attention to the input wiring. If it is connected to wrong terminal, the power supply will be damaged.

- Input must be off when making connection.
- Connect FG terminal to ground terminal of the equipment.
- Output current of each terminal pin must be less than 5A.
- The output load line and input line shall be separated and twisted to improve noise sensitivity.
- Remote ON/OFF control line shall be twisted or use shielded wire.
- When connecting or removing connector, do not apply stress to PCB.
- Use the input/output connector specified in outline drawing. Also, use recommended crimping tool.  
Connector is not included with this product.

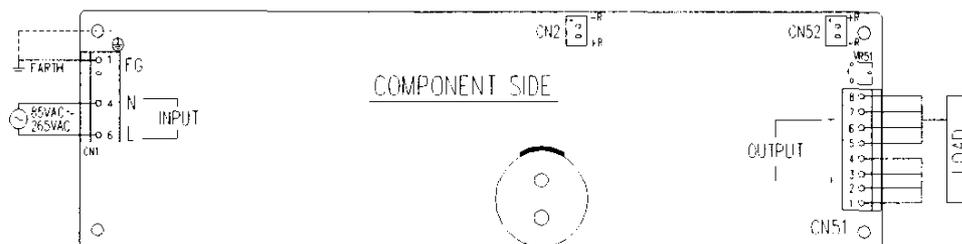
### ■ ZWS50AF



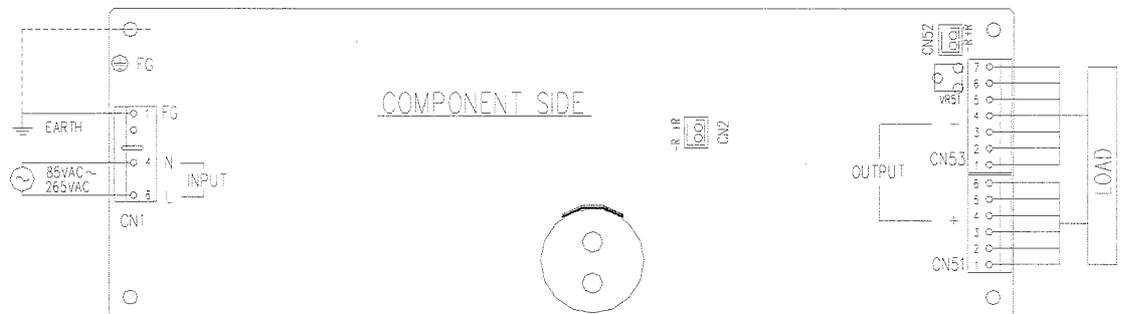
### ■ ZWS75AF



### ■ ZWS100AF



■ **ZWS150AF**



\* Connector for Remote ON/OFF Control : CN2, CN52(J.S.T)

| Connector | Housing | Terminal Pin                   |
|-----------|---------|--------------------------------|
| B2B-XH-AM | XHP-2   | BXH-001T-P0.6 or SXH-001T-P0.6 |

CN2 is normally shorted by JM-2W-96 (J.S.T)

Hand Crimping Tool : YC-110R (J.S.T) or YRS-110 (J.S.T)

\* Input & Output Connector (MOLEX)

|              | ZWS50AF   |         |              | ZWS75AF   |         |              |
|--------------|-----------|---------|--------------|-----------|---------|--------------|
|              | Connector | Housing | Terminal Pin | Connector | Housing | Terminal Pin |
| Input: CN1   | 5414-30B  | 5195-06 | 5194PBTL     | 5414-30B  | 5195-06 | 5194PBTL     |
| Output: CN51 | 5273-04A  | 5195-04 | 5194PBTL     | 5273-06A  | 5195-06 | 5194PBTL     |

|              | ZWS100AF  |         |              | ZWS150AF  |         |              |
|--------------|-----------|---------|--------------|-----------|---------|--------------|
|              | Connector | Housing | Terminal Pin | Connector | Housing | Terminal Pin |
| Input: CN1   | 5414-30B  | 5195-06 | 5194PBTL     | 5414-30B  | 5195-06 | 5194PBTL     |
| Output: CN51 | 5273-08A  | 5195-08 | 5194PBTL     | 5273-06A  | 5195-06 | 5194PBTL     |
| CN53         |           |         |              | 5273-07A  | 5195-07 | 5194PBTL     |

CN53 is used only for ZWS150AF

Hand Crimping Tool : JHTR5904 (MOLEX)

\* ZWS-AF/J Input & Output Connector (J.S.T)

|              | ZWS50AF/J |         |              | ZWS75AF/J |         |              |
|--------------|-----------|---------|--------------|-----------|---------|--------------|
|              | Connector | Housing | Terminal Pin | Connector | Housing | Terminal Pin |
| Input: CN1   | B3P-5-VH  | VHR-5N  | SVH-21T-P1.1 | B3P-5-VH  | VHR-5N  | SVH-21T-P1.1 |
| Output: CN51 | B4P-VH    | VHR-4N  | SVH-21T-P1.1 | B6P-VH    | VHR-6N  | SVH-21T-P1.1 |

|              | ZWS100AF/J |         |              | ZWS150AF/J |         |              |
|--------------|------------|---------|--------------|------------|---------|--------------|
|              | Connector  | Housing | Terminal Pin | Connector  | Housing | Terminal Pin |
| Input: CN51  | B3P-5-VH   | VHR-5N  | SVH-21T-P1.1 | B3P-5-VH   | VHR-5N  | SVH-21T-P1.1 |
| Output: CN51 | B8P-VH     | VHR-8N  | SVH-21T-P1.1 | B6P-VH     | VHR-6N  | SVH-21T-P1.1 |
| CN53         |            |         |              | B7P-VH     | VHR-7N  | SVH-21T-P1.1 |

CN53 is used only for ZWS150AF

Hand Crimping Tool : YC-160R (J.S.T)

Pin-order of J.S.T connectors are opposite to pin-order of MOLEX. Please refer to outline drawing.

### 3. Explanation of Functions and Precautions

#### 3-1. Input Voltage Range

Input voltage range is single phase 85 ~ 265VAC ( 47 ~ 63Hz ) or 120 ~ 370VDC. Input voltage which is out of specification may cause unit damage. For cases where conformance to various safety specs(UL,CSA,EN) are required, input voltage range will be 100~240VAC(50/60Hz).

#### 3-2. Output Voltage Range

V.ADJ trimmer(VR51) that is nearly output connector can adjust the output voltage within the range. Output voltage range is within +10% of nominal output voltage. To turn the trimmer clockwise, the output voltage will be increased. Note over voltage protection ( OVP ) function may trigger if the output voltage is increased excessively.

#### 3-3. Inrush Current

This series has used Power Thermistor to protect the circuit from Inrush Current. Please carefully select input switch and fuse in cases of the high temperature and re-input the power.

#### 3-4. Over Voltage Protection ( OVP )

The OVP function ( Inverter shut down method, manual reset type ) is provided. OVP function operates within 115-135% (5V type: 115-140%) of nominal output voltage. When OVP triggers, the output will be shut down. The input shall be removed for a few minutes, and then re-input for

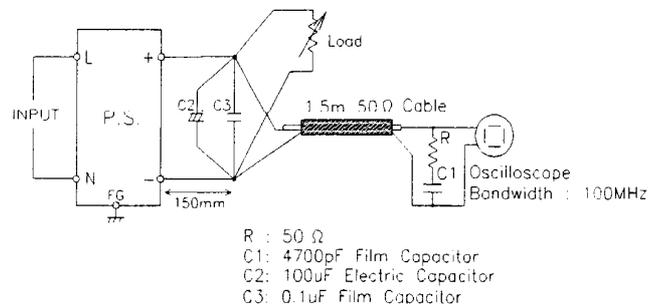
recovery of the output. OVP setting shall be fixed and not to be adjusted externally.

#### 3-5. Over Current Protection ( OCP )

Constant current limiting, automatic recovery. OCP function operates when the output current exceeds 125%( 5V type : 105%) of maximum output current of specification. The output will be automatically recovered when the overload condition is canceled. Do not operate overload or dead short conditions for more than 30 seconds, which could result in damage or insulation failure.

#### 3-6. Output Ripple & Noise

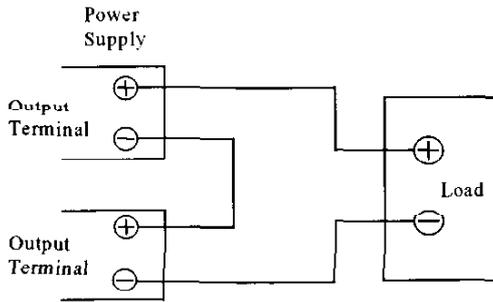
The standard specification for maximum ripple value is measured according to measurement circuit specified by EIAJ-RC9131. When load lines are longer, ripple becomes larger. In this case, electrolytic capacitor, film capacitor, etc., might be necessary to use across the load terminal. The output ripple cannot be measure accurately if the probe ground lead of oscilloscope is too long.



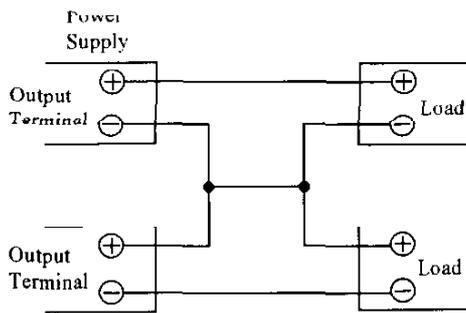
### 3-7. Series Operation

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

#### Method (A)

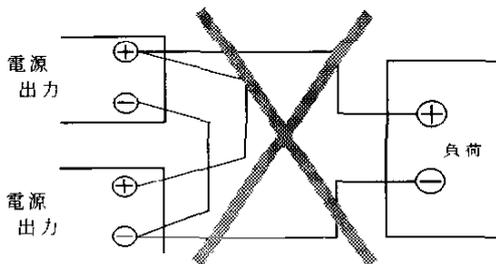


#### Method (B)



### 3-8. Parallel Operation

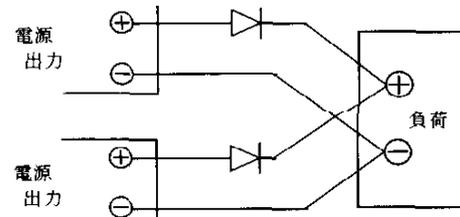
(A) To increase the output current is not possible.



(B) To use as Back-up Power Supply

1. Set power supply output voltage higher by the forward voltage drop ( $V_F$ ) of diode.
2. Adjust the output voltage of each power supply to be the same.

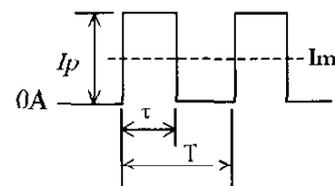
3. Use within the specifications for output voltage and output power.



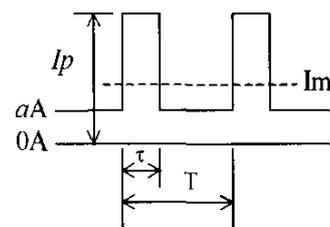
### 3-9. Peak Output Current

For ZWS-AF series, relation with average output current and peak output current must satisfy formulas below. Also operating time at peak output is less than 10sec.

When using pulse load, audible noise can be heard from power supply unit.



$$I_{av} \geq I_m = \frac{I_p \times \tau}{T}$$



$$I_{av} \geq I_m = \frac{(I_p - a) \times \tau}{T} + a$$

$I_p$  : Peak output current ( A )

$I_{av}$  : Average output current

( Maximum output current of Specification  
( A ) )

$I_m$  : Average output current ( A )

$\tau$  : Pulse width of peak output current ( sec )  
( Operating time at peak output )

T : Period ( sec )

### 3-10. Remote ON/OFF Control

Remote ON/OFF control(CN2,CN52) function is available. Using this function allows the user to turn the output on and off without having to turn the AC input on and off.

Remote ON/OFF control can be used by following 2 modes.

However, for Cover & Chassis type (MODEL: ZWS-AF/JA), can not be used.

#### \*Using CN2

It is controlled by short or open between +R & -R of CN2. CN2 is provided in the primary circuit for ON/OFF control by means of a switch or other device. When using this connector, which is considered to be electrically connected to the mains input voltage, all the requirements of EN60950 must be met with respect to the connector, wiring and switch etc.

In particular:

- 1) Basic insulation must be provided between the ON/OFF control circuit and earth.
- 2) Reinforced insulation must be provided between the ON/OFF control circuit and any secondary circuit or accessible part.
- 3) Wiring must be routed such that damage to the insulation of the wire or additional sleeving cannot occur.

- 4) The switch must meet requirements for reinforced insulation from the ON/OFF control circuit to actuator/accessible parts.

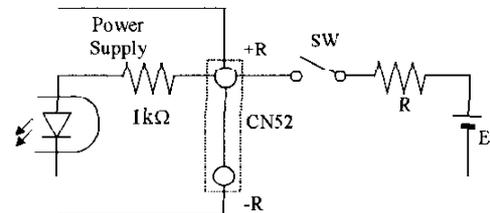
[CN2] The control mode is shown below.

| +R & -R terminal condition | Output Condition |
|----------------------------|------------------|
| SHORT                      | ON               |
| OPEN                       | OFF              |

#### \*Using CN52

At first, remove short piece of CN2.

It is controlled by the voltage applied to +R and -R. This circuit is in the Secondary ( output ) side of the power supply unit. Do not connect in the Primary ( input ) side. And this circuit is isolated from the output by a photo-coupler.



[CN52] The control mode is shown below.

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

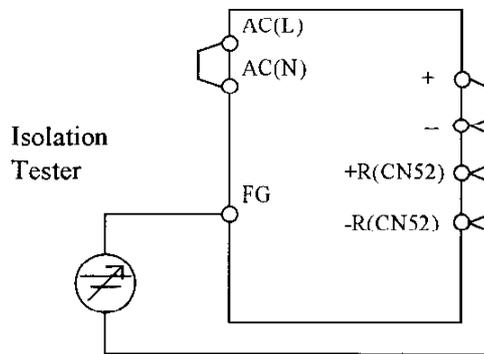
| External voltage level: E | External resistance : R |
|---------------------------|-------------------------|
| 4.5 ~ 12.5VDC             | No required             |
| 12.5 ~ 24.5VDC            | 1.5 k Ω                 |

**3-11. Isolation Test**

Isolation resistance between output and FG ( chassis ) shall be more than 100MΩ at 500VDC. For safety operation, voltage setting of DC isolation tester must be done before the test. Ensure that it is fully discharged after the test

Output ~ FG ( chassis )

500VDC 100MΩ or more



**3-12. Withstand Voltage**

This series is designed to withstand 3.0kVAC between input and output, 2.0kVAC between input and FG ( chassis ), and 500VAC between output and FG ( chassis ), each for 1 minute.

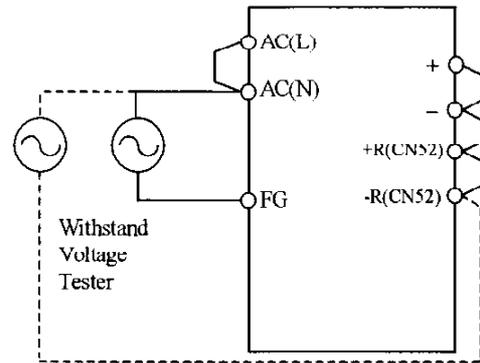
When testing withstand voltage, set current limit of withstand voltage test equipment at 20mA ( Output-FG ( chassis ) : 100mA ). The applied voltage must be gradually increased from zero to testing value and then gradually decreased for shut down. When timer is used, the power supply may be damaged by high impulse voltage at timer switch on and off. Connect input and output as follows.

Input ~ Output( dotted line )

3kVAC 1min. ( 20mA )

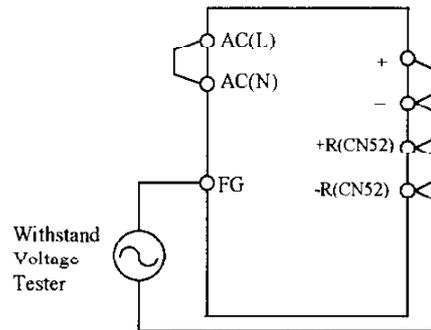
Input ~ FG( chassis )( solid line )

2kVAC 1min. ( 20mA )



Output ~ FG( chassis )

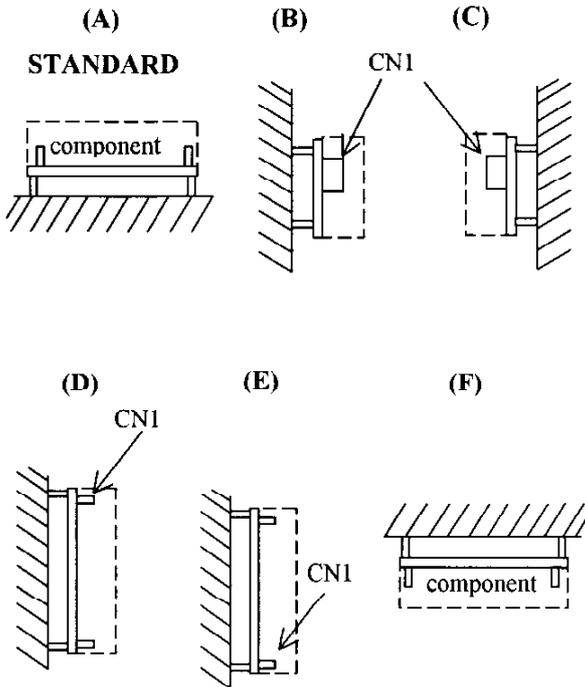
500VAC 1min. ( 100mA )



## 4. Mounting Directions

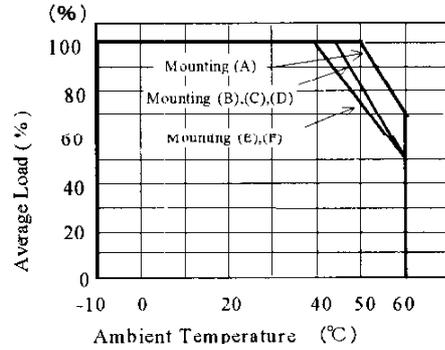
### 4-1. Output Derating according to the Mounting Directions

Recommended standard mounting method is (A). Method (B), (C), (D), (E), and (F) are also possible. Refer to the derating below. In the following derating curve, the average output current is considered to be 100%.



### Output Derating (Convection cooling)

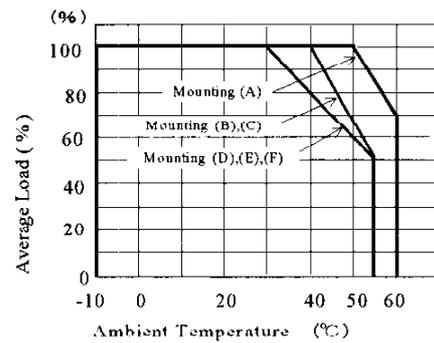
#### ZWS50AF



#### ZWS50AF Output Derating

| Mounting<br>Ta | LOAD (%) |     |     |     |     |     |
|----------------|----------|-----|-----|-----|-----|-----|
|                | A        | B   | C   | D   | E   | F   |
| -10~+40°C      | 100      | 100 | 100 | 100 | 100 | 100 |
| +45°C          | 100      | 100 | 100 | 100 | 88  | 88  |
| +50°C          | 100      | 83  | 83  | 83  | 75  | 75  |
| +55°C          | 85       | 66  | 66  | 66  | 62  | 62  |
| +60°C          | 70       | 50  | 50  | 50  | 50  | 50  |

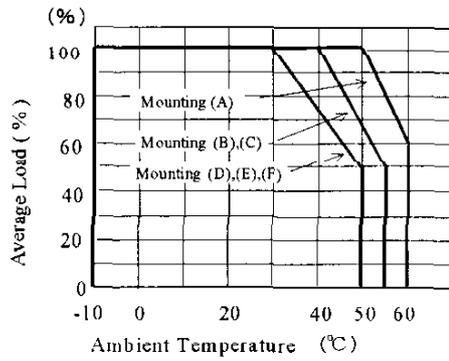
#### ZWS75AF



#### ZWS75AF Output Derating

| Mounting<br>Ta | LOAD (%) |     |     |     |     |     |
|----------------|----------|-----|-----|-----|-----|-----|
|                | A        | B   | C   | D   | E   | F   |
| -10~+30°C      | 100      | 100 | 100 | 100 | 100 | 100 |
| +40°C          | 100      | 100 | 100 | 80  | 80  | 80  |
| +50°C          | 100      | 66  | 66  | 60  | 60  | 60  |
| +55°C          | 85       | 50  | 50  | 50  | 50  | 50  |
| +60°C          | 70       | -   | -   | -   | -   | -   |

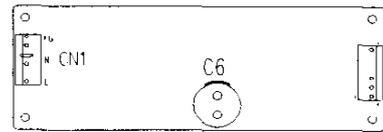
**ZWS100AF**



**Output Derating (Forced air cooling)**

For forced air cooling, airflow of 0.7m/s above is needed for component side.

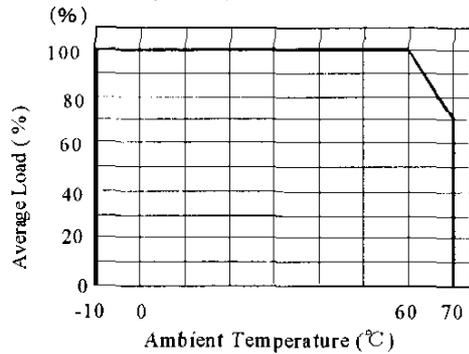
As a reference for forced cooling, let air flow so that E-cap.C6 temperature becomes lower than 85°C.



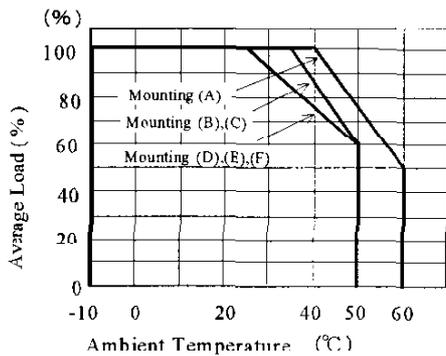
**ZWS100AF Output Derating**

| Mounting<br>Ta | LOAD (%) |     |     |     |     |     |
|----------------|----------|-----|-----|-----|-----|-----|
|                | A        | B   | C   | D   | E   | F   |
| -10~+30°C      | 100      | 100 | 100 | 100 | 100 | 100 |
| +40°C          | 100      | 100 | 100 | 75  | 75  | 75  |
| +50°C          | 100      | 68  | 68  | 50  | 50  | 50  |
| +55°C          | 80       | 50  | 50  | -   | -   | -   |
| +60°C          | 60       | -   | -   | -   | -   | -   |

**ZWS50AF,75AF,100AF**



**ZWS150AF**



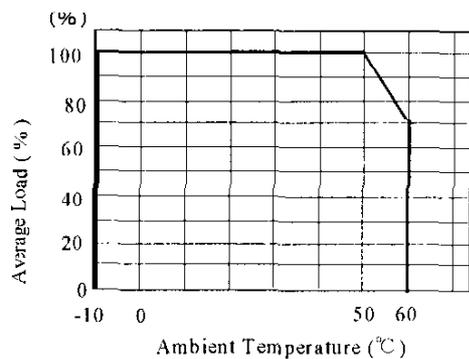
**ZWS50AF,75AF,100AF Output Derating**

| Mounting<br>Ta | LOAD (%)    |  |  |  |  |  |
|----------------|-------------|--|--|--|--|--|
|                | A,B,C,D,E,F |  |  |  |  |  |
| -10~+60°C      | 100         |  |  |  |  |  |
| +65°C          | 85          |  |  |  |  |  |
| +70°C          | 70          |  |  |  |  |  |

**ZWS150AF Output Derating**

| Mounting<br>Ta | LOAD (%) |     |     |     |     |     |
|----------------|----------|-----|-----|-----|-----|-----|
|                | A        | B   | C   | D   | E   | F   |
| -10~+25°C      | 100      | 100 | 100 | 100 | 100 | 100 |
| +35°C          | 100      | 100 | 100 | 84  | 84  | 84  |
| +40°C          | 100      | 88  | 88  | 76  | 76  | 76  |
| +50°C          | 75       | 60  | 60  | 60  | 60  | 60  |
| +60°C          | 50       | -   | -   | -   | -   | -   |

**ZWS150AF**

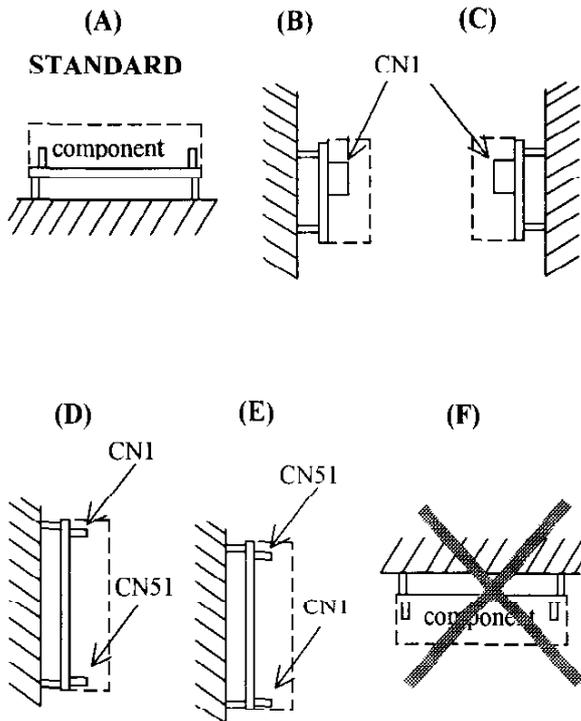


**ZWS150AF Output Derating**

|           |  | LOAD (%)         |
|-----------|--|------------------|
| Mounting  |  | A, B, C, D, E, F |
| Ta        |  |                  |
| -10~+50°C |  | 100              |
| +55°C     |  | 85               |
| +60°C     |  | 70               |

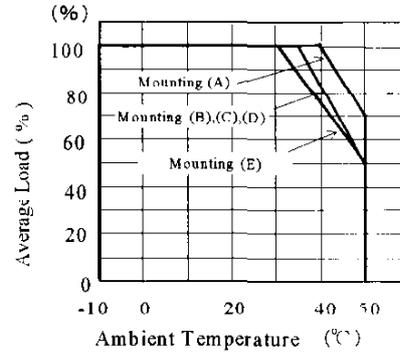
**4-2. Output Derating according to the Mounting Directions (With Cover & Chassis type : MODEL ZWS-AF/JA )**

This series has Cover & Chassis model as option. Recommended standard mounting method is (A). Method (B), (C), (D), (E) are also possible (Method F. is impossible). Refer to the derating below. In the following derating curve, the average output current is considered to be 100%



**Output Derating (Convection cooling)**

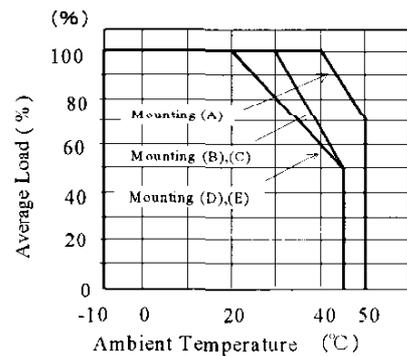
**ZWS50AF/JA**



**ZWS50AF/JA Output Derating**

|           |  | LOAD (%) |     |     |     |     |   |
|-----------|--|----------|-----|-----|-----|-----|---|
| Mounting  |  | A        | B   | C   | D   | E   | F |
| Ta        |  |          |     |     |     |     |   |
| -10~+30°C |  | 100      | 100 | 100 | 100 | 100 | - |
| +35°C     |  | 100      | 100 | 100 | 100 | 88  | - |
| +40°C     |  | 100      | 83  | 83  | 83  | 75  | - |
| +45°C     |  | 85       | 66  | 66  | 66  | 62  | - |
| +50°C     |  | 70       | 50  | 50  | 50  | 50  | - |

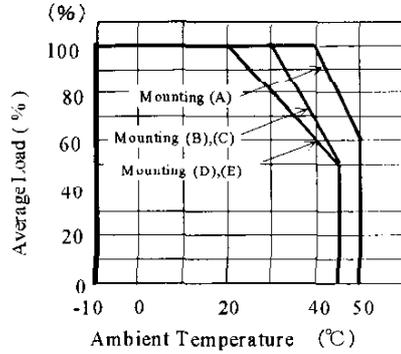
**ZWS75AF/JA**



**ZWS75AF/JA Output Derating**

|           |  | LOAD (%) |     |     |     |     |   |
|-----------|--|----------|-----|-----|-----|-----|---|
| Mounting  |  | A        | B   | C   | D   | E   | F |
| Ta        |  |          |     |     |     |     |   |
| -10~+20°C |  | 100      | 100 | 100 | 100 | 100 | - |
| +30°C     |  | 100      | 100 | 100 | 80  | 80  | - |
| +40°C     |  | 100      | 66  | 66  | 60  | 60  | - |
| +45°C     |  | 85       | 50  | 50  | 50  | 50  | - |
| +50°C     |  | 70       | -   | -   | -   | -   | - |

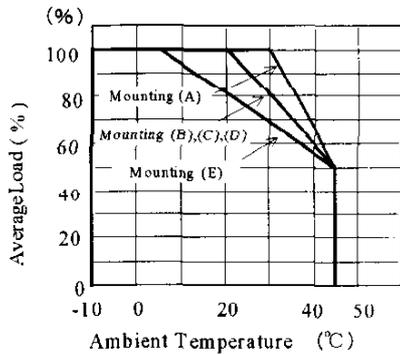
**ZWS100AF/JA**



**ZWS100AF/JA Output Derating**

| Mounting<br>Ta | LOAD (%) |     |     |     |     |   |
|----------------|----------|-----|-----|-----|-----|---|
|                | A        | B   | C   | D   | E   | F |
| -10~+20°C      | 100      | 100 | 100 | 100 | 100 | - |
| +30°C          | 100      | 100 | 100 | 80  | 80  | - |
| +40°C          | 100      | 67  | 67  | 60  | 60  | - |
| +45°C          | 80       | 50  | 50  | 50  | 50  | - |
| +50°C          | 60       | -   | -   | -   | -   | - |

**ZWS150AF/JA**



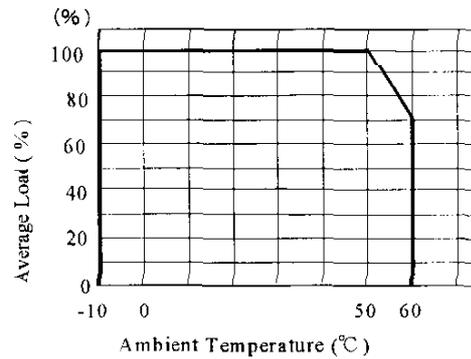
**ZWS150AF/JA Output Derating**

| Mounting<br>Ta | LOAD (%) |     |     |     |     |   |
|----------------|----------|-----|-----|-----|-----|---|
|                | A        | B   | C   | D   | E   | F |
| -10~+5°C       | 100      | 100 | 100 | 100 | 100 | - |
| +20°C          | 100      | 100 | 100 | 100 | 81  | - |
| +30°C          | 100      | 80  | 80  | 80  | 68  | - |
| +40°C          | 65       | 60  | 60  | 60  | 56  | - |
| +45°C          | 50       | 50  | 50  | 50  | 50  | - |

**Output Derating (Forced air cooling)**

For usage of ZWS-AF/JA model, method is the same as the standard type (ZWS-AF) forced cooling. Mounting method (F) is impossible

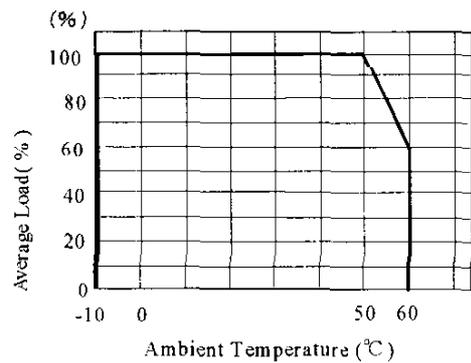
**ZWS50AF/JA, 75AF/JA**



**ZWS50AF/JA,75AF/JA Output Derating**

| Mounting<br>Ta | LOAD (%)  |
|----------------|-----------|
|                | A,B,C,D,E |
| -10~+50°C      | 100       |
| +55°C          | 85        |
| +60°C          | 70        |

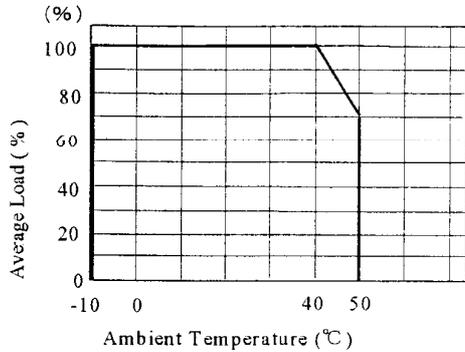
**ZWS100AF/JA**



**ZWS100AF/JA Output Derating**

| Mounting<br>Ta | LOAD (%)  |
|----------------|-----------|
|                | A,B,C,D,E |
| -10~+50°C      | 100       |
| +55°C          | 80        |
| +60°C          | 60        |

**ZWS150AF/JA**



**ZWS150AF/JA Output Derating**

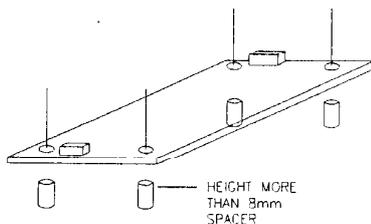
|           |  | LOAD (%)  |
|-----------|--|-----------|
| Mounting  |  | A,B,C,D,E |
| Ta        |  |           |
| -10~+40°C |  | 100       |
| +45°C     |  | 85        |
| +50°C     |  | 70        |

**4-3. Mounting Method**

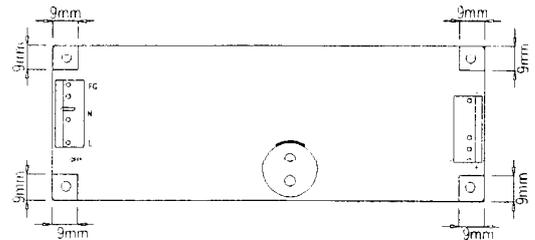
Please use the mounting hole as:

ZWS50AF~ZWS150AF: 4 holes of  $\phi 3.5$

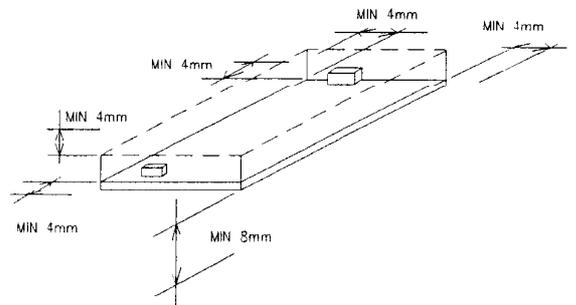
And insert the spacer (MAX  $\phi 8\text{mm}$ ) of height over 8mm to lift the unit. Also use all 4 mounting holes for the unit installation. The vibration spec. is the value taken when the unit is raised by 8mm spacers.



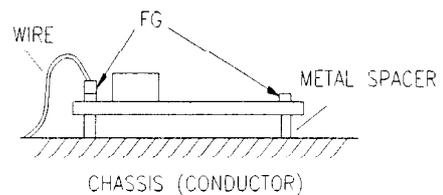
And allowable area by metal pieces is 9mm from each PCB corners. Refer to figure below.



Please leave 4mm space from the surfaces and the sides of PCB, especially from the solder surface, 8mm space is necessary. If the space is not enough, the specification of insulation and withstand will not be satisfied.



FG should be connected to the earth terminal of the apparatus. If not, the conducted noise and output noise will increase.



## 5. Wiring Method

- The output load line and input line shall be separated and twisted to improve noise sensitivity.
- Use all lines as thick and short as possible to make lower impedance.
- Noise can be eliminated by attaching a capacitor to the load terminals.
- For safety and EMI considerations, connect FG to ground terminal of equipment where power supply is mounted on.
- Recommended screw torque is 0.49N.m (5kg.cm).
- Select the wire materials to adapt the connector as follows.

INPUT : ZWS50AF~150AF---AWG#22~#18

OUTPUT : ZWS50AF~150AF---AWG#22~#18

## 6. External Fuse Rating

Refer to the following fuse rating when selecting the external fuses that are to be used on input line. Surge current flows when line turns on. Therefore use slow-blow fuse or time-lag fuse. Do not use fast-blow fuse. Fuse rating is specified by in-rush current value at line turn-on. Do not select the fuse according to input current (rms.) values under the actual load condition.

|          |         |
|----------|---------|
| ZWS50AF  | : 2.0A  |
| ZWS75AF  | : 3.15A |
| ZWS100AF | : 3.15A |
| ZWS150AF | : 5.0A  |

## 7. Before concluding that the unit is at fault...

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

- Check if the rated input voltage is connected.
- Check if the wiring of input and output is correct.
- Check if the wire material is not too thin.
- Check if the output voltage control (V.ADJ) is properly adjusted.
- Check if the output current and output wattage dose not over specification.
- Audible noise can be heard during Dynamic-Load operation.
- Audible noise can be heard when input voltage waveform is not sinusoidal wave.

## 8. Notes

1. Overvoltage Category II
2. Radio Interference Suppression Test is not performed.