

# HWS 15-150 Series 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 modify.
- 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. Stick the WARNING label for users on the system equipment and describe the notice in the instruction manual.
- Never operate the unit under over current or shorted conditions for long time, 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.
- Do not use the product in the environment with strong electromagnetic field, corrosive gas and conductive substance.

## 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. : A224-04-01D		
APPD	CHK	DWG
<i>Fukuda</i> 3. Jun. '08	<i>D. Kondo</i> 3. Jun. '08	<i>M. Hada</i> 3. Jun. '08

## 1. Terminal Explanation

### HWS15, HWS30, HWS50

- ① +V : + Output terminal  
( Standard type : 10A max. / terminal)
- ② -V : - Output terminal  
( Standard type : 10A max. / terminal)
- ③ FG : Frame Ground
- ④ L : Input terminal Live line (Fuse in line)
- ⑤ N : Input terminal Neutral line
- ⑥ Output voltage adjustment trimmer
- ⑦ Output monitoring indicator (Green LED)

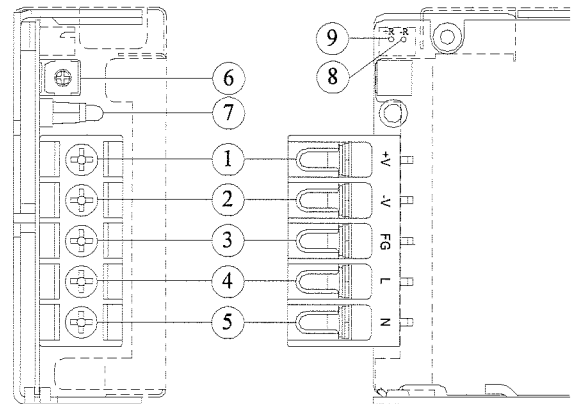
### HWS50/R\* (Option)

- ⑧ -R : Remote ON/OFF control (HWS50 : Option)
- ⑨ +R : Remote ON/OFF control (HWS50 : Option)

\* Connector (JST) for Remote ON/OFF control

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

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



### HWS80, HWS100, HWS150

- ① +V : + Output terminal  
(30A max. / terminal, M4 screw)
- ② -V : - Output terminal  
(30A max. / terminal, M4 screw)
- ③ FG : Frame Ground
- ④ L : Input terminal Live line(Fuse in line)
- ⑤ N : Input terminal Neutral line
- ⑥ +S : + Remote sensing terminal
- ⑦ -S : - Remote sensing terminal
- ⑧ Output voltage adjustment trimmer
- ⑨ Output monitoring indicator (Green LED)

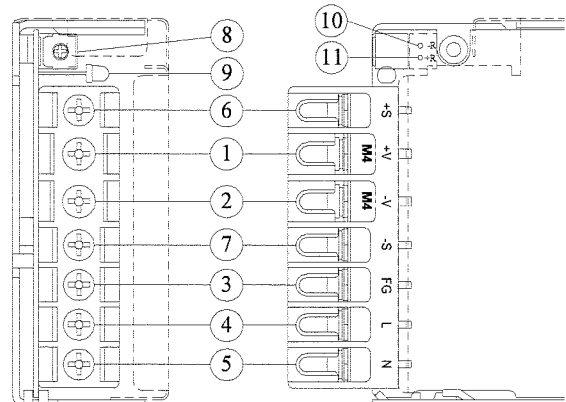
### HWS80/R\*, HWS100/R\*, HWS150/R\* (Option)

- ⑩ -R : Remote ON/OFF control (Option)
- ⑪ +R : Remote ON/OFF control (Option)

\* Connector (JST) for Remote ON/OFF control

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

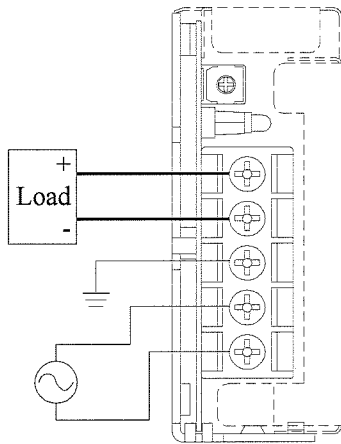
Matching housing and terminal pin --- Not included with the product



## 2. Terminal connecting method

- Input must be off when making connection.
- Connect FG terminal to ground terminal of the equipment.
- The output load line and input line shall be separated and twisted to improve noise sensitivity.
- Remote sensing lines shall be twisted or use shielded wire.
- Remote ON/OFF control lines shall be twisted or use shielded wire.
- Use the output connector specified in outline drawing. Also, use recommended crimping tool.

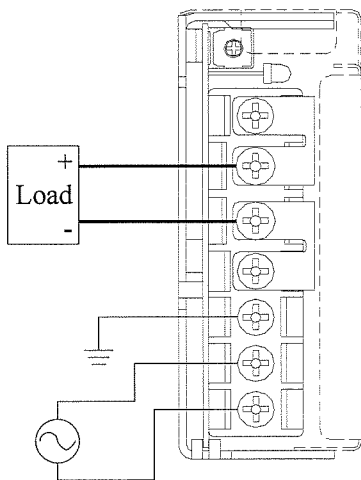
### HWS15, HWS30, HWS50



### HWS80, HWS100, HWS150

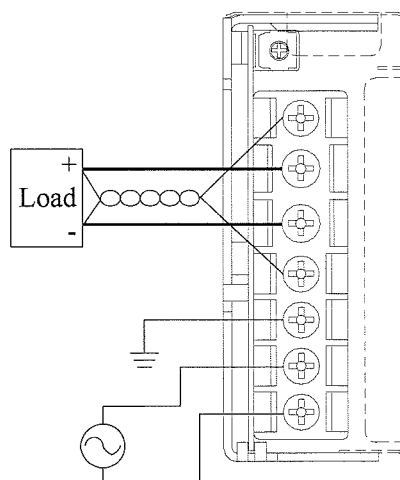
#### Basic connection (Local sensing)

Connect "+S" terminal to "+V" terminal, and "-S" terminal to "-V" terminal with the attached short pieces.



#### Remote sensing connection

Connect "+S" terminal to "+V" terminal of load, and "-S" terminal to "-V" output terminal of load with wires. When remote sensing terminals are opened, output is shut down.



### 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, to be described as 100 ~ 240VAC ( 50/60Hz ).

#### 3-2. Output Voltage Range

V.ADJ trimmer on the front panel side can adjust the output voltage within the range. Output voltage range is within +/- 20% (3.3V : +20%/-10%, 48V : +10%/-20%) 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. 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. Never apply more than rated output voltage to output terminal, which may leads damage. In the case of inductive load, use decoupling diode at output line.

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

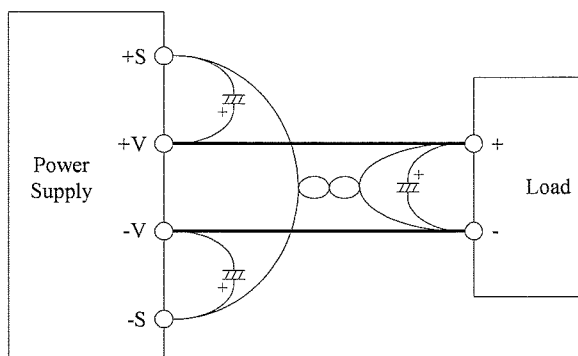
Constant current limiting and Hiccup (except HWS15,HWS30, which characterized fold back), automatic recovery. OCP function operates when the output current exceeds 105% of maximum output current on specification. The output will automatically recovered when the overload condition is canceled. Never operate the unit under over current or shorted conditions for more than 30 seconds, which could result in damage.

#### 3-6. Remote Sensing (+S, -S terminal) (For HWS80, HWS100, HWS150)

This function compensates voltage drop of wiring from output terminals to load terminals. Connect "+S" terminal to "+V" terminal of load and "-S" terminal to "-V" 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 necessary to put an electrolytic capacitor in following 3 placed;

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

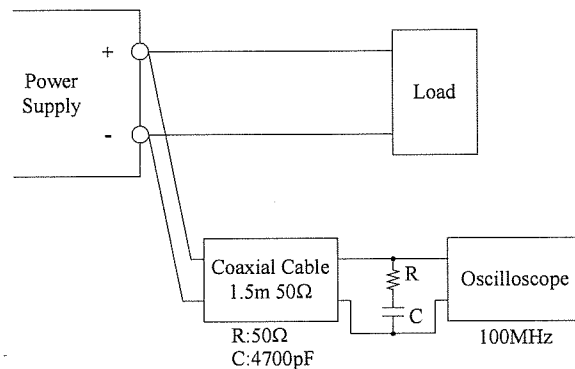
If remote sensing terminals are opened, the output will rise and OVP may be triggered.



### 3-7. Output Ripple & Noise

The standard specification for maximum ripple value is measured according to measurement circuit specified by JEITA RC-9131A. 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.

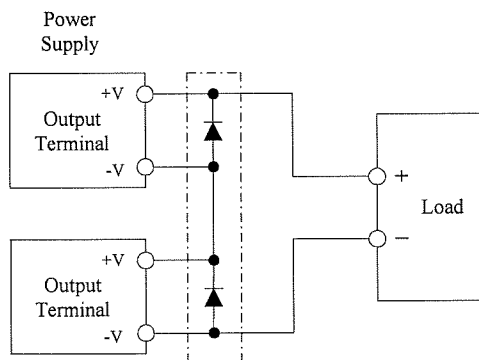
For start up at low ambient temperature and low voltage, output ripple noise of HWS15, HWS30 might not meet specification. However, there is no overshoot at start up and output ripple noise specification can be met after one second.



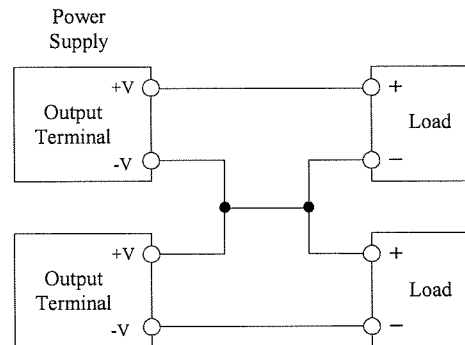
### 3-8. Series Operation

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

Method (A)



Method (B)



Note : In case of (A), please connect diodes to prevent the reverse voltage.

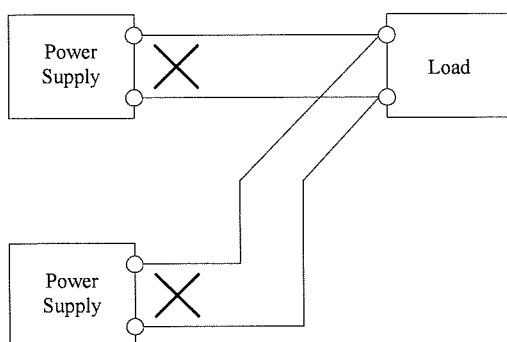
### 3-9. Parallel Operation

(A) Operation to increase the Output Current is not possible.

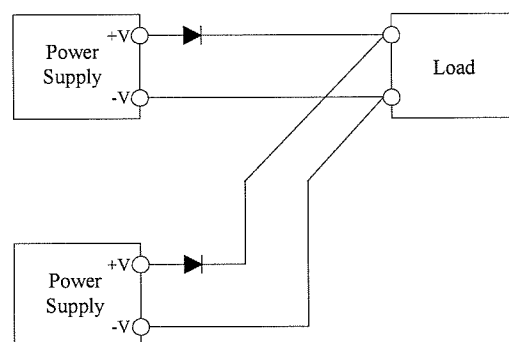
(B) Operation as a Backup Power Supply is possible as follows.

1. Set the power supply output voltage higher by the amount of forward voltage drop (VF) of the diode.
2. Please adjust the output voltage of each power supply to be the same.
3. Please use within the specifications for output voltage and output current.

(A)

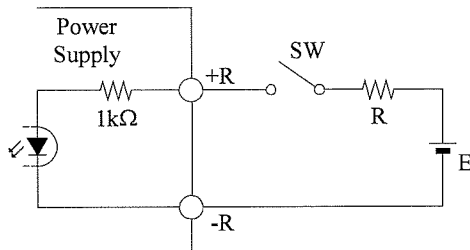


(B)



### 3-10. Remote ON/OFF Control ( HWS50-150 Optional Spec.)

Remote ON/OFF control function is available as option with model name followed by /R. Using this function allows the user to turn the output on and off without having to turn the AC input on and off. 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 photocoupler.



The control mode is shown below.

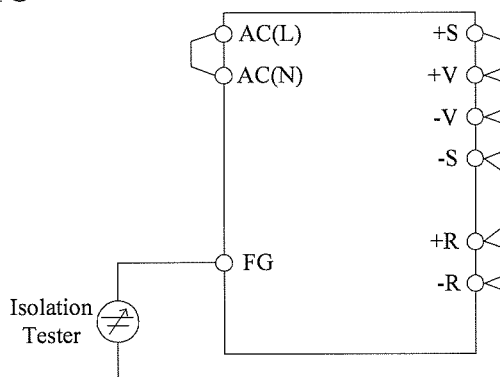
+R & -R terminal condition	Ouput condition
SW ON (Higher than 4.5V)	ON
SW OFF (Lower than 0.8V)	OFF

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

### 4-1. Isolation Test

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

Output ~ FG



500VDC, 100MΩ or more

### 4-2. Withstand Voltage

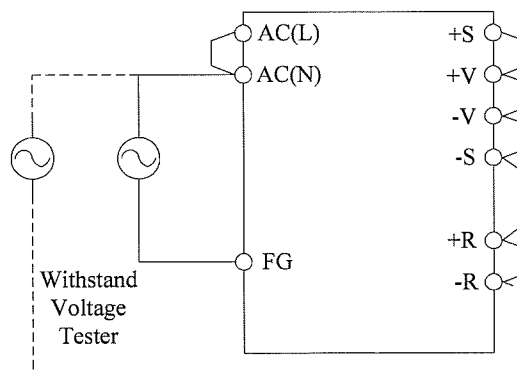
This series is designed to withstand 3.0kVAC between input and output, 2.0kVAC between input and FG and 500VAC between output and FG each for 1 minute. When testing withstand voltage, set current limit of withstand voltage test equipment at 20mA ( Output-FG : 100mA ). The applied voltage must be gradually 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 ~ FG : solid line

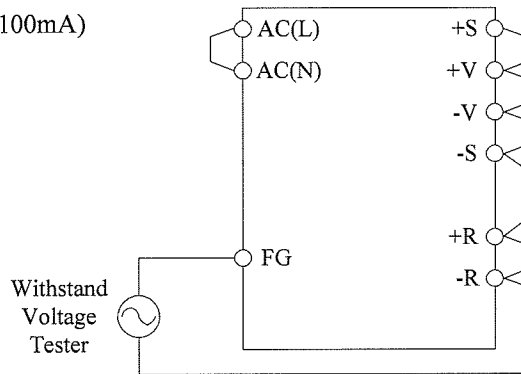
2.0kVAC, 1min (20mA)

Input ~ Output : dotted line

3.0kVAC, 1min



Output ~ FG  
 500VAC, 1min (100mA)

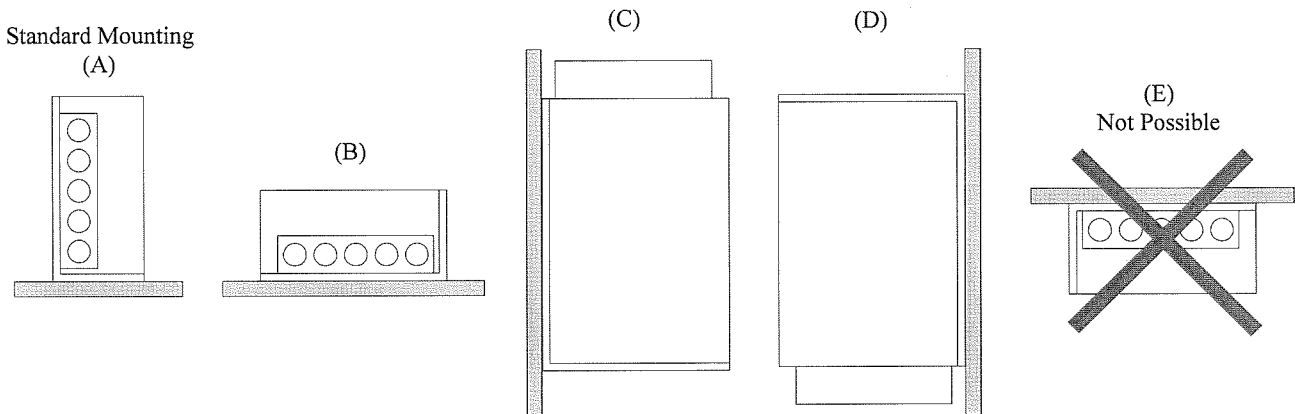


**5. Mounting Directions**

**5-1. Output Derating according to the Mounting Directions**

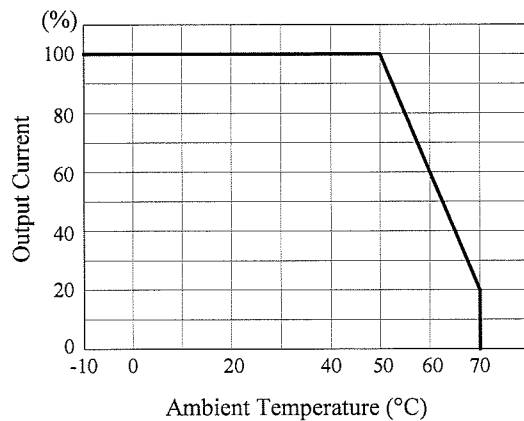
Recommend standard mounting is method ( A ). Method ( B ), ( C ) and ( D ) are also possible. Refer to the derating below. Please do not use installation method ( E ), where the PCB will be on the topside and heat will be trapped inside the unit. In the following derating curve, the maximum output current is considered to be 100%.

Standard Mounting ( A )



**Output Derating**

(A) Standard Mounting Direction (Open frame)



**Open Frame (Without Cover)**

Model	HWS15				HWS30				HWS50				HWS80, HWS100				HWS150			
Amb. Temp.	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
-10~+30°C	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
40°C	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	90	90
50°C	100	100	100	100	100	100	100	100	100	100	60	60	100	80	80	80	100	80	80	80
60°C	60	60	60	60	60	60	60	60	60	60	20	20	60	60	60	60	60	60	60	60
70°C	20	20	20	20	20	20	20	20	20	20	-	-	20	20	20	20	20	20	20	20

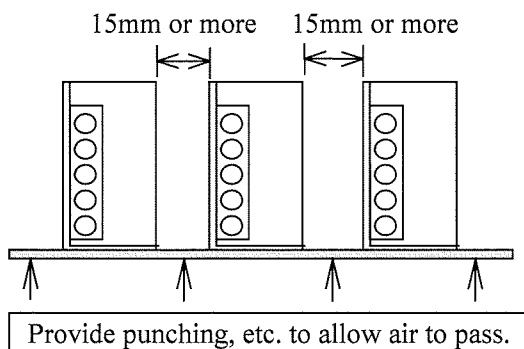
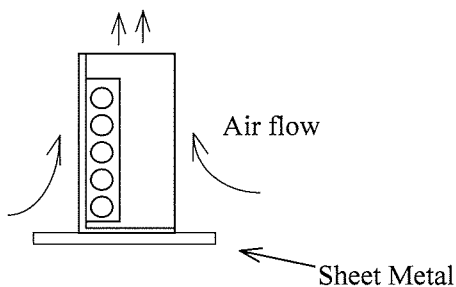
**With Cover (/RA Option)**

Model	HWS15				HWS30				HWS50				HWS80, HWS100			
Amb. Temp.	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
-10~+30°C	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
40°C	100	100	100	100	100	100	100	100	100	100	60	60	100	80	80	80
50°C	60	60	60	60	60	60	60	60	60	60	20	20	60	60	60	60
60°C	20	20	20	20	20	20	20	20	20	20	-	-	20	20	20	20

Model	HWS150			
Amb. Temp.	A	B	C	D
-10~+25°C	100	100	100	100
40°C	100	76	76	76
50°C	60	60	60	60
60°C	20	20	20	20

**5-2 Mounting Method**

- 1) This is convection cooling type power supply. In the consideration for the heat radiation and safety. Please take a distance more than 15mm between the power supply and the peripheral parts. When lining up multiple units, please make sure to place them 15mm or more apart from each other.
- 2) The maximum allowable penetration of mounting screws is 6mm.
- 3) Recommended torque for mounting screw  
HWS15-150 (M3 screw) : 0.49 N·m  
( 5.0 kgf·cm )





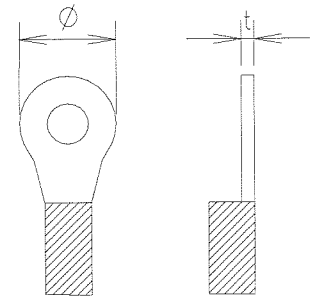
## 6. Wiring Method

- The output load line and input line shall be separated and twisted to improve noise sensitivity.
- The sensing lines shall be twisted and separated from the output lines.
- 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.
- In HWS15-50, the output current of each output terminal is limited to 10A.
- In HWS80-150, the output current of each output terminal is limited to 30A.
- For safety and EMI considerations, connect the FG terminal of HWS15-150 to mounting set ground terminal.
- The recommended wire type :

MODEL	Recommended Wire	Recommended torque	Recommended crimp-type terminal		
			D (MAX)	t (MAX)	Mounting pieces (MAX)
HWS15-50	AWG14-22	M3.5 Screws 1.0N·m(9.8kgf·cm) ~ 1.4N·m(13.7kgf·cm)	6.8mm	0.8mm	2 piece
HWS80 HWS100	AWG12-22	M4 Screws 1.2N·m(11.8kgf·cm) ~ 1.6N·m(15.6kgf·cm)	8.1mm	1.0mm	1 piece
				0.8mm	2 piece
	AWG14-22	M3.5 Screws 1.0N·m(9.8kgf·cm) ~ 1.4N·m(13.7kgf·cm)	6.8mm	0.8mm	2 piece
HWS150	AWG10-22	M4 Screws 1.2N·m(11.8kgf·cm) ~ 1.6N·m(15.6kgf·cm)	8.1mm	1.0mm	1 piece
				0.8mm	2 piece
	AWG14-22	M3.5 Screws 1.0N·m(9.8kgf·cm) ~ 1.4N·m(13.7kgf·cm)	6.8mm	0.8mm	2 piece

Note 1 : When using separate loads, use of two pcs. of 0.8mm thick crimp-type terminal is recommended.

Note 2 : For recommended diameter, refer to wire maker recommended allowable current and voltage drop.  
 Especially, for 3V or 5V models, output current is large. Thick diameter wire is recommended.



### 7. 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. 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.

HWS15, HWS50 : 2A      HWS30, HWS80, HWS100 : 3.15A  
HWS150 : 5A

### 8. 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 size is not too thin.
- Check if the output voltage control (V.ADJ) is properly adjusted.
- Check if the Remote ON/OFF control connector is not opened, when use Remote ON/OFF control function.
- 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.
- Ensure that a large capacitor is not connected on the output side. Please use within maximum capacitance shown below.

MODEL	Maximum external capacitance					
	3.3V	5V	12V	15V	24V	48V
HWS15	10,000uF		5,000uF	2,000uF	1,000uF	500uF
HWS30,HWS50	10,000uF		5,000uF		2,000uF	500uF
HWS80,HWS100,HWS150	10,000uF				5,000uF	1,000uF