

# *LS50-75-100-150 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 as you may be injured by flying debris in the event of a fault.
- This power supply is designed for use within an end product. Stick the WARNING label for users on the system equipment and notify in the system instruction manual.
- Never operate the unit under over current or short-circuit conditions for more than 30 seconds or outside its specified Input Voltage Range. Insulation failure, smoking, burning or other damage may occur.
- Confirm connections to input/output terminals are correct as indicated in the instruction manual.
- This power supply has a possibility that hazardous voltage may occur at output terminal depending on the failure mode. The outputs of these products must be earthed in the end 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**

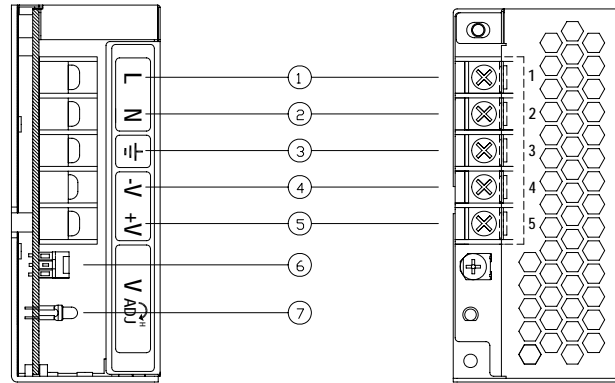
CE marking, when applied to the LS series products, indicates compliance with the Low Voltage Directive (2006/95/EC) in that it complies with EN60950-1.

| <b>DWG NO. : PA582-04-01</b>                                                                     |                                                                                                   |                                                                                                     |
|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| <b>APPD</b>                                                                                      | <b>CHK</b>                                                                                        | <b>DWG</b>                                                                                          |
| <br>7 May 08 | <br>7 May 08 | <br>7 May 2008 |

## 1. Terminal Explanation

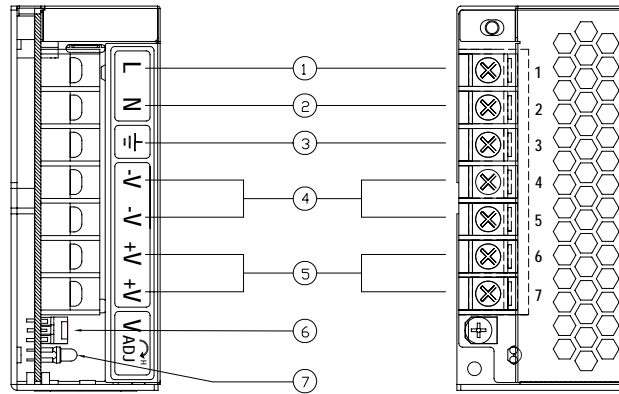
### LS50, LS75

- (1) L : Input terminal Live line (Fuse in line)
- (2) N : Input terminal Neutral line
- (3) FG  $\perp$  : Functional Ground
- (4) -V : - Output terminal
- (5) +V : + Output terminal
- (6) Output voltage adjustable trimmer
- (7) Output monitoring indicator (Green LED : ON)



### LS100, LS150

- (1) L : Input terminal Live line(Fuse in line)
- (2) N : Input terminal Neutral line
- (3) FG  $\perp$  : Functional Ground
- (4) -V : - Output terminal (25A max./ terminal)
- (5) +V : + Output terminal (25A max./ terminal)
- (6) Output voltage adjustable trimmer
- (7) Output monitoring indicator (Green LED : ON)



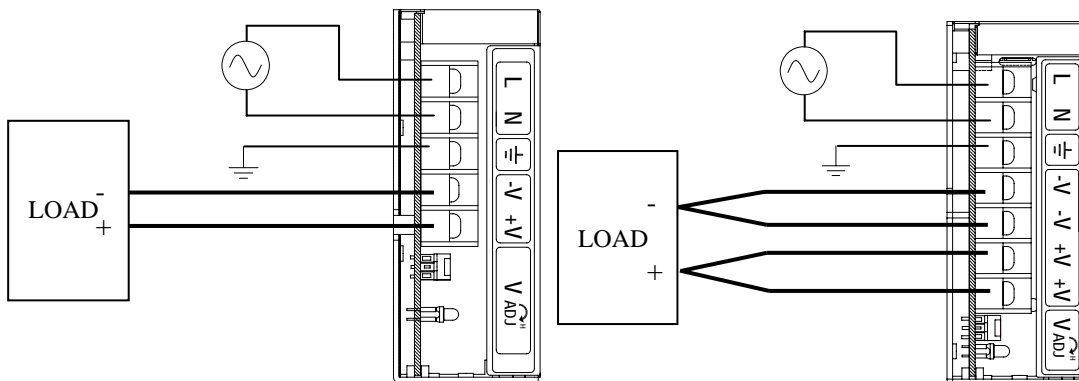
## 2. Terminal connecting method

- 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.

### LS50, LS75

### LS100, LS150

Maximum output current of each output terminal is 25A. If more than 25A, use 2 terminals



### 3. Explanation of Functions and Precautions

#### 3-1. Input Voltage Range

Input voltage range is single phase 88 ~ 264VAC ( 47 ~ 63Hz ) or 125 ~ 373VDC for LS50, LS75 and LS100. For LS150, selectable switch 115/230VAC will decide the input voltage range as mentioned in the table below. Input voltage which is out of specification may cause unit to damage. For cases where conformance to various safety specs(UL,CSA,EN) are required, input voltage range will be 100~240VAC (50/60Hz ).

Note : LS series can withstand Input Surge of 300VAC for 5 seconds.

LS150 – Selectable voltage range

| Selected Range | Applicable Input Voltage Range in VAC | Applicable Input Voltage Range in VDC |
|----------------|---------------------------------------|---------------------------------------|
| 115            | 88 ~ 132                              | NA                                    |
| 230            | 176 ~ 264                             | 248 ~ 373                             |

#### 3-2. Output Voltage Range

V.ADJ trimmer is for output voltage adjustment within the range of specifications. Turning the trimmer clockwise will cause the output voltage to be increased. Note over voltage protection ( OVP ) function may trigger if the output voltage is increased excessively.

#### 3-3. Inrush Current

Power Thermistor is built in 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 is fixed and not to be adjusted externally.

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

Current limiting, automatic recovery. OCP function operates when the output current exceeds OCP specifications. The output will be automatically recovered when the overload condition is removed. Do not operate overload or dead short conditions for more than 30 seconds, which could result in damage or insulation failure.

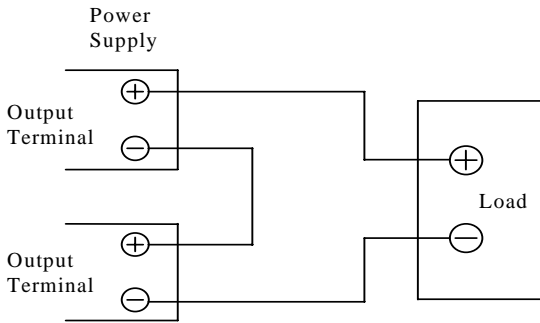
#### 3-6. Output Ripple & Noise

Ripple & noise are measured at 20MHz by using a 300mm twisted pair of load wires terminated with a 0.1uF film capacitor & 47uF electrolytic capacitor. When load lines are longer, ripple will become larger. The output ripple cannot be measured accurately if the probe ground lead of oscilloscope is too long. At low temperature, large ripple & noise may also be observed due to large ESR of the internal Electrolytic Capacitors especially at -25degC. Output voltage rise may not be smooth during initial turn on at low temperature.

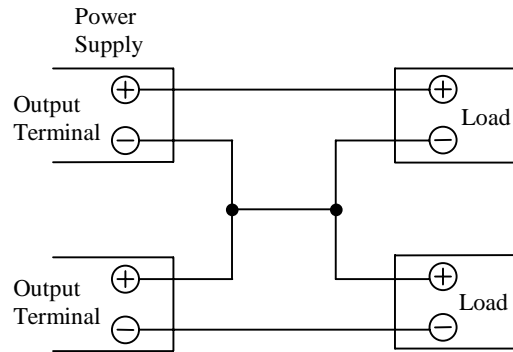
### 3-7. Series Operation

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

Method ( A )



Method ( B )



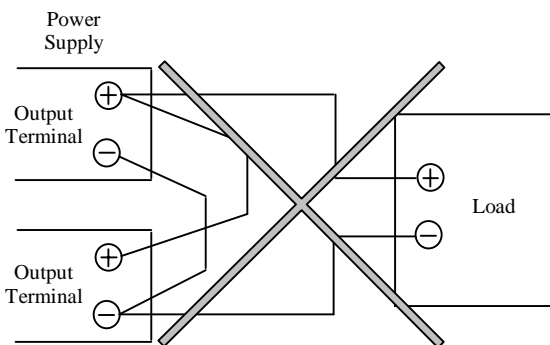
### 3-8. Parallel Operation

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

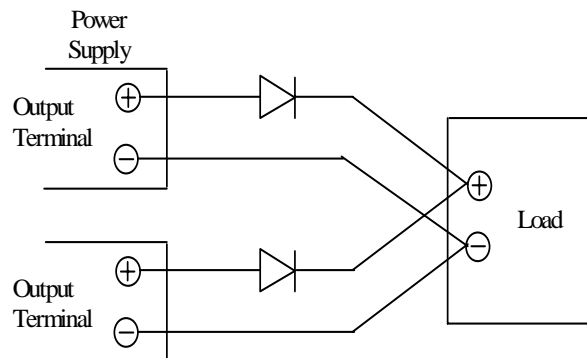
(B) Operation as a Backup Power Supply is possible as follows.

1. Set the power supply output voltage higher by the amount of forward voltage drop (  $V_F$  ) 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)

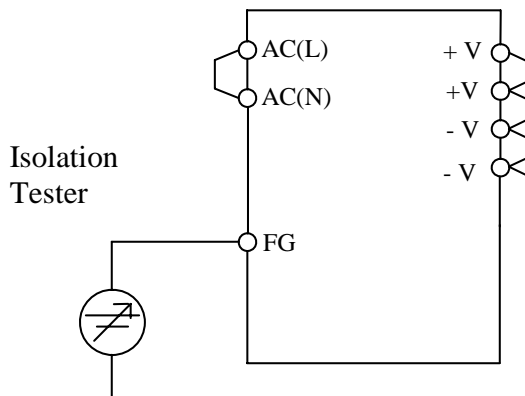


## 4. Isolation / Withstand Voltage

### 4-1. Isolation Test

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

- (a) Output ~ FG (chassis) : 500VDC, 100MΩ or more



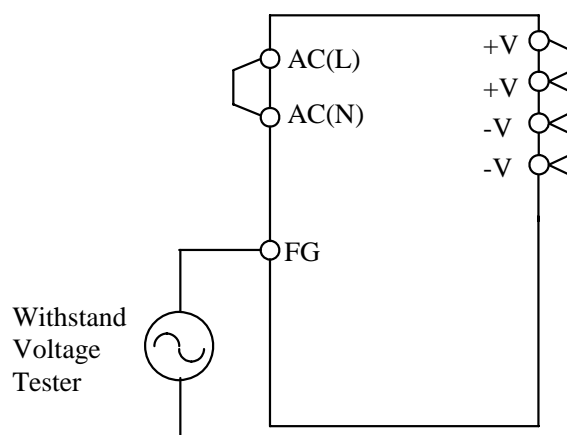
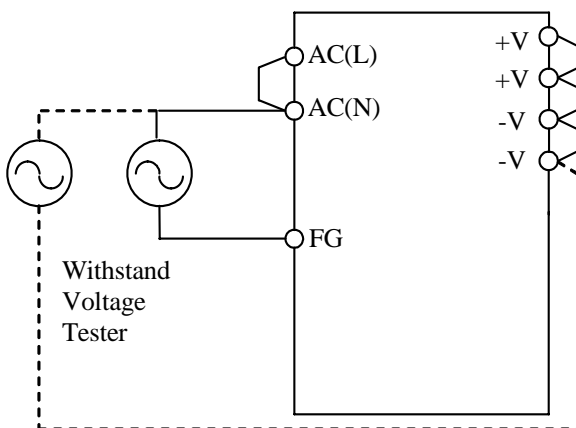
### 4-2. Withstand Voltage

This series is designed to withstand 3.0kVAC between input and output, 1.5kVAC 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 :

- (a) Input ~ FG (chassis) : solid line  
 1.5kVAC, 1min ( 20mA )

- (c) Output ~ FG (chassis) : 500VAC, 1min (100mA)

- (b) Input ~ Output : dotted line  
 3kVAC, 1min ( 20mA )

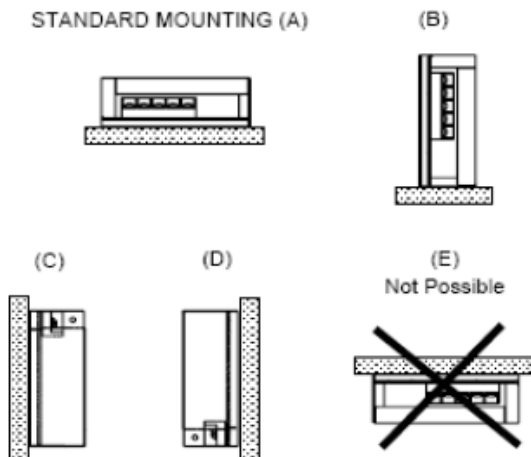


**5. Mounting Directions**

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

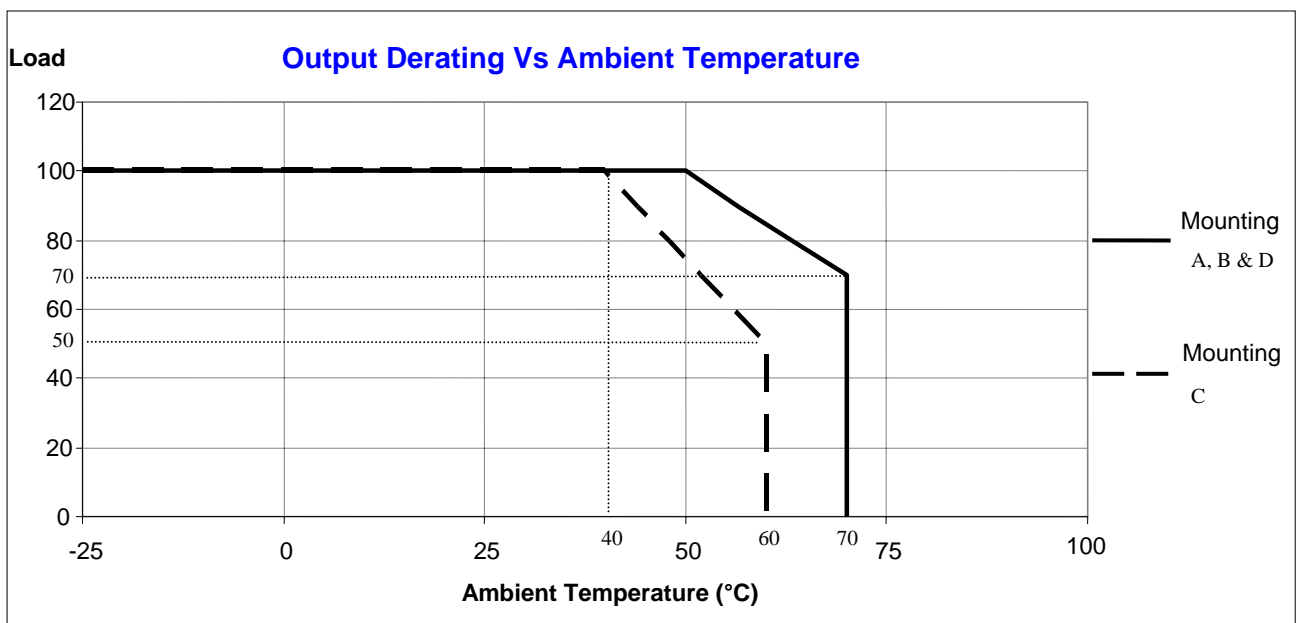
Recommended standard mounting is Method ( A ). Method ( B ), ( C ) and ( D ) are also possible. Refer to the derating below. Please do not use installation Method ( E ), where the PCB will be on the topside and heat will be trapped inside the unit.

In the following derating curve, the maximum output current is considered to be 100%.

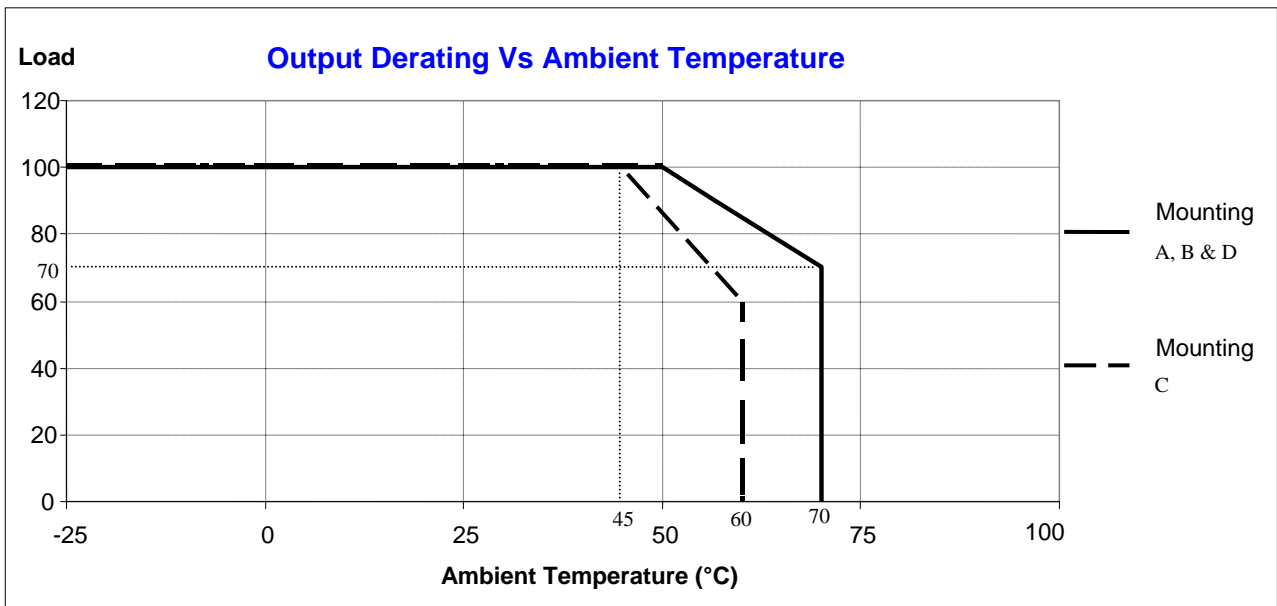


**(A) Output Derating versus Ambient Temperature (Convection Cooling)**

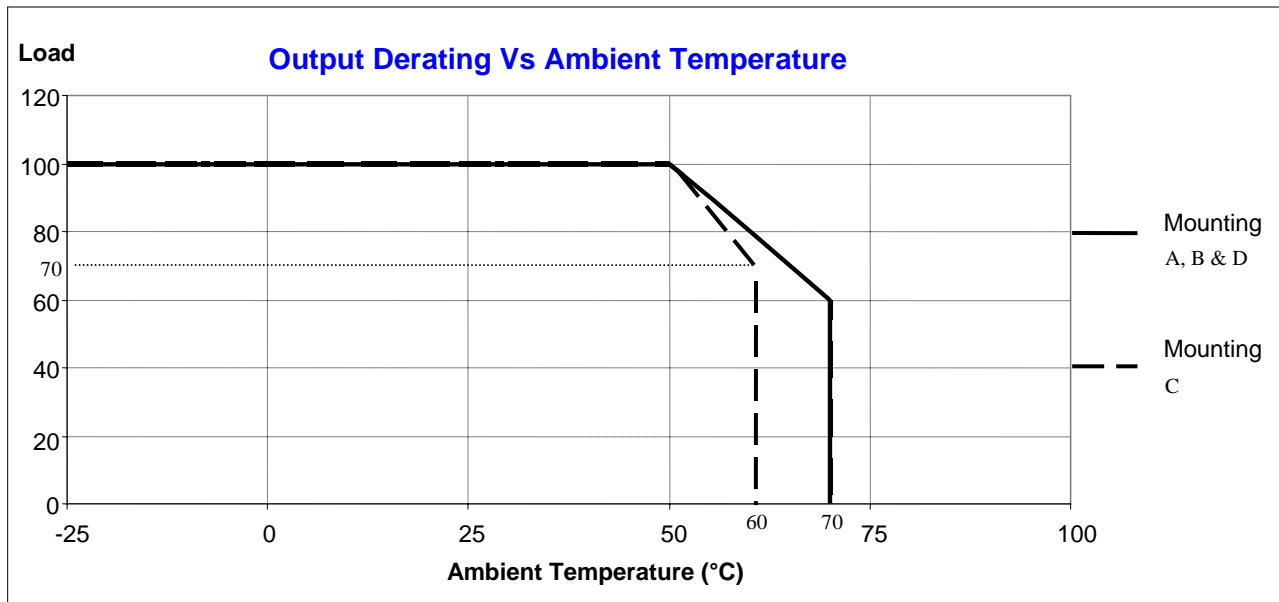
LS50-3.3, -5, -12, -15, -24, -36 & -48



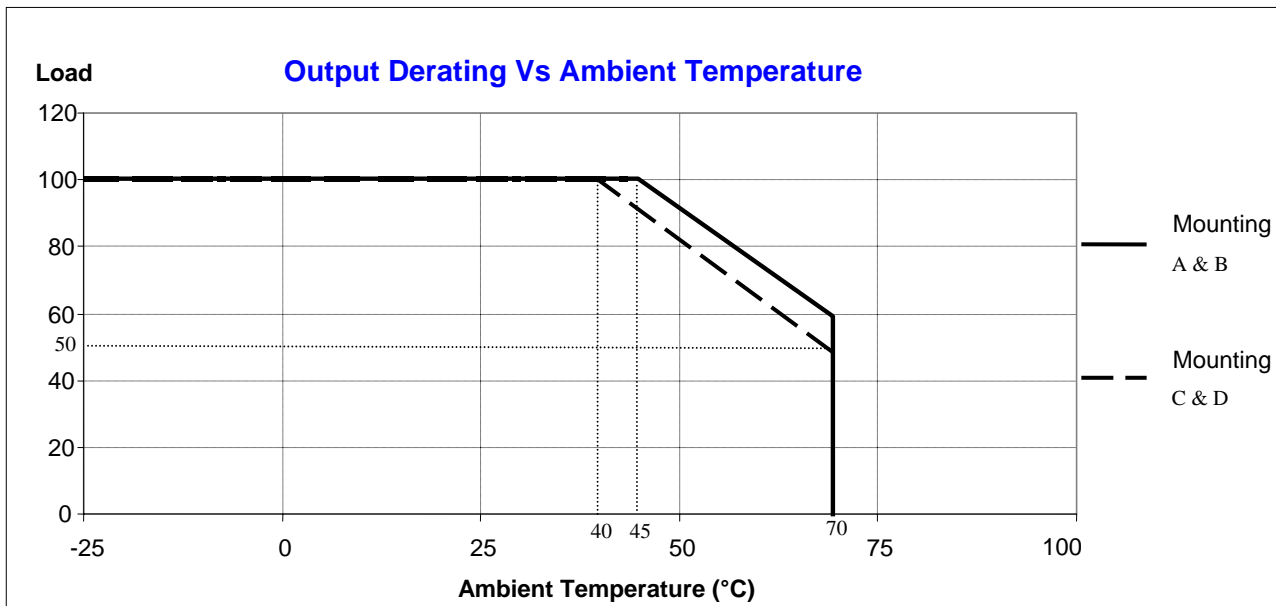
**LS75-3.3, -5**



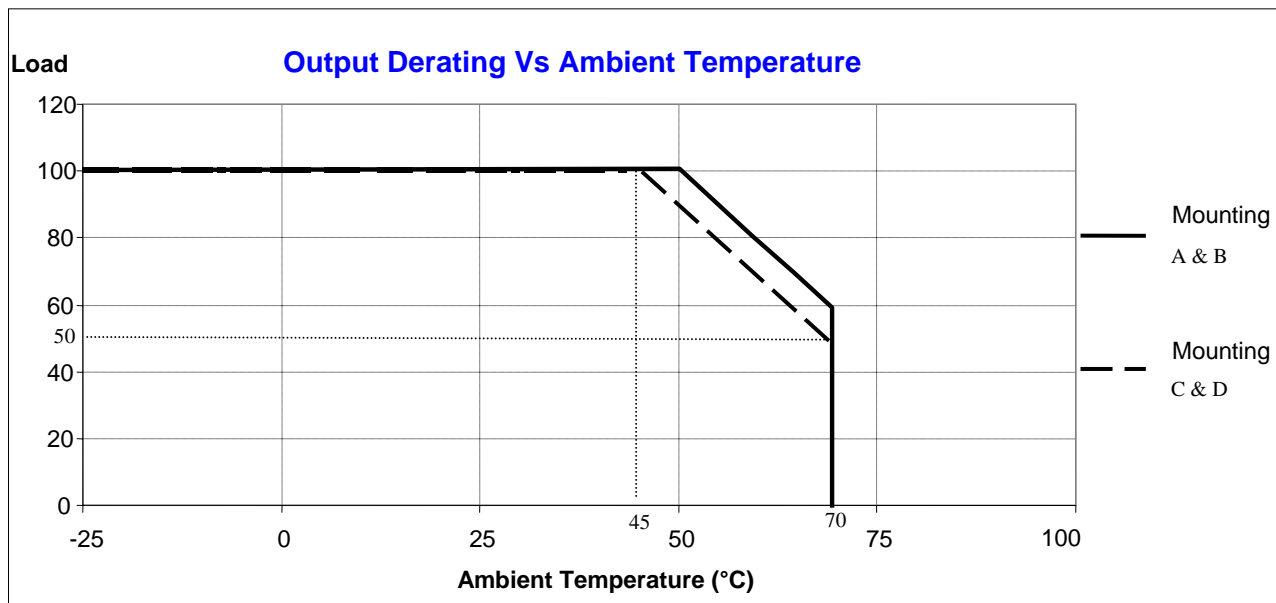
**LS75-12, -15, -24, -36 & -48**



**LS100-3.3, -5**

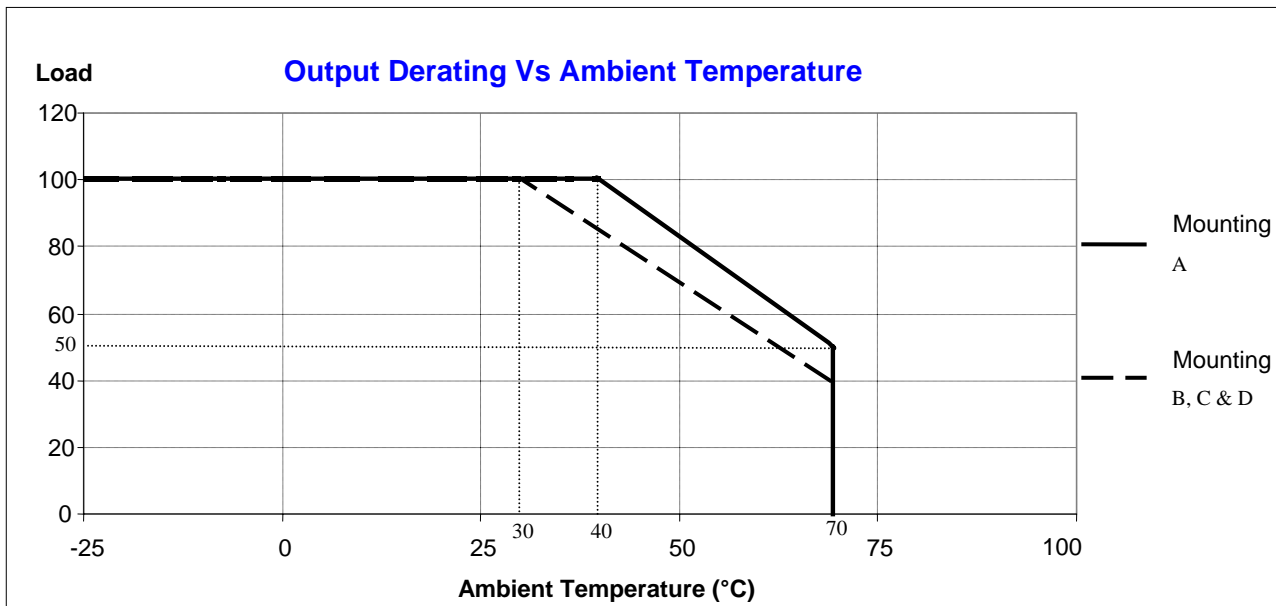


**LS100-12, -15, -24, -36 & -48**

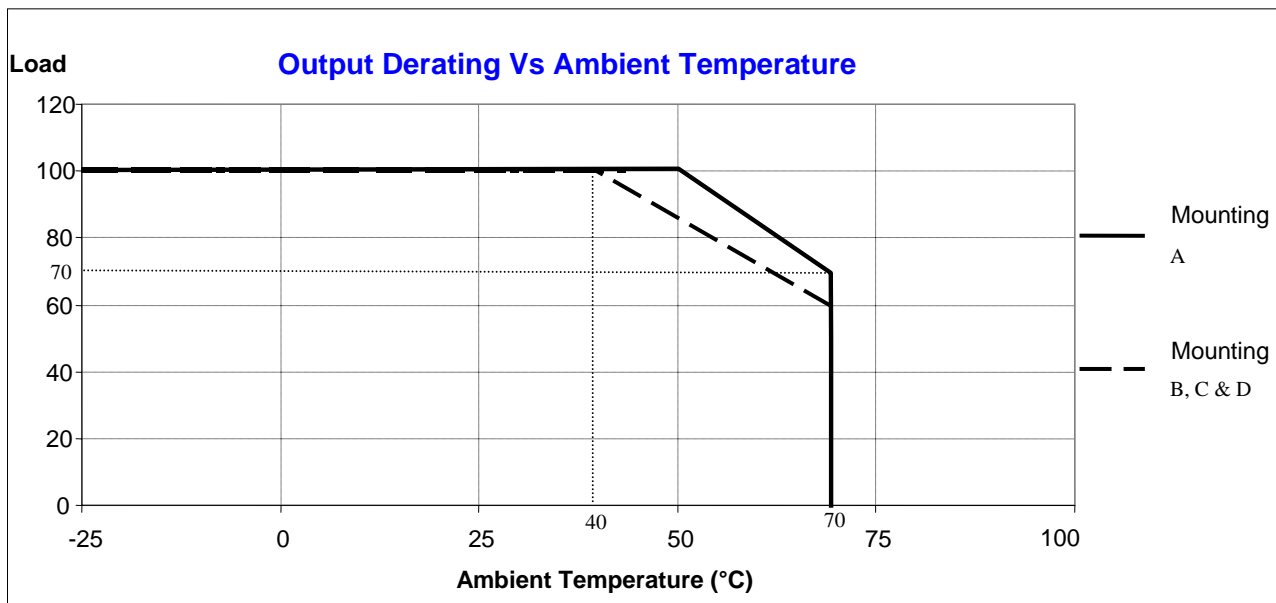




**LS150-3.3, -5**

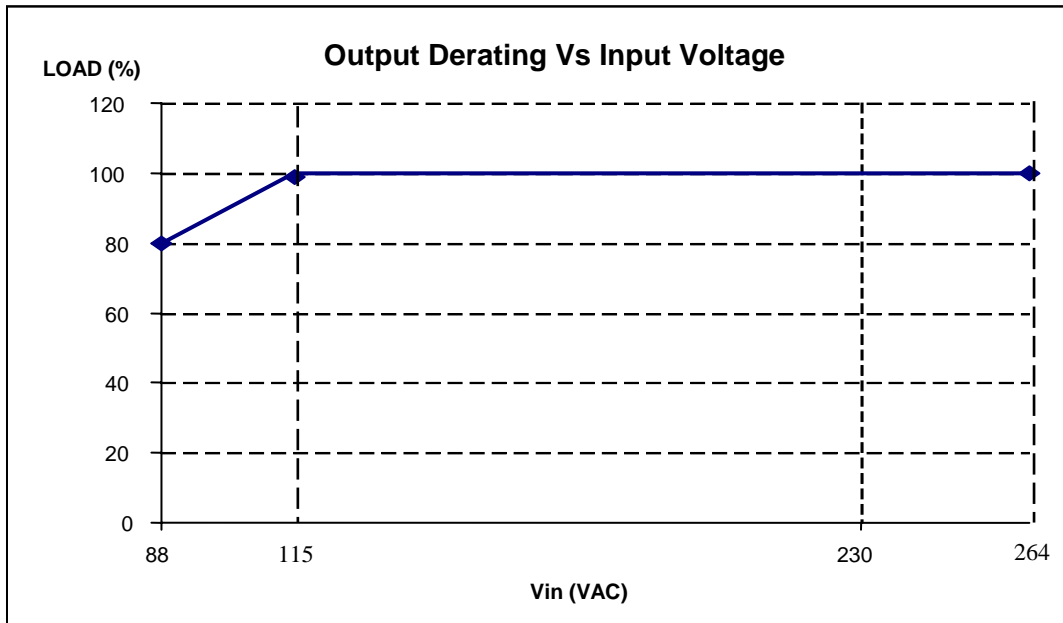


**LS150-12, -15, -24, -36 & -48**



**(B) Output Derating versus Input Voltage (Convection Cooling)**

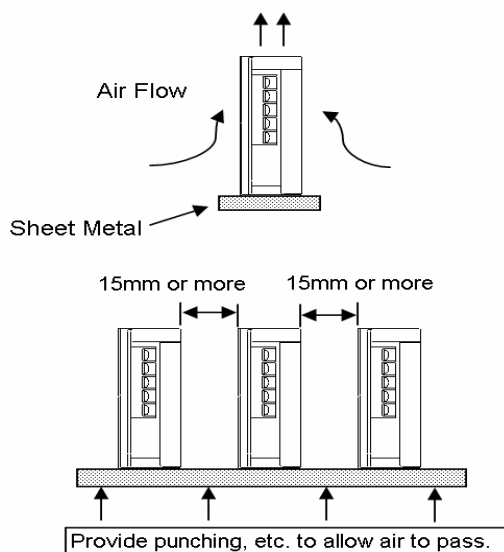
LS100-3.3, -5, -12, -15, -24, -36 & -48



**NOTE : LS50, LS75 & LS150 series do not require Input Voltage Derating.**

**5-2 Mounting Method**

- 1) This is convection cooling type power supply. In consideration of the heat radiation and safety, please keep a distance of 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 5mm.
- 3) Recommended torque for mounting screw LS50, LS75, LS100 & LS150 (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.
- Use all lines as thick and short as possible to make lower impedance.
- Noise can be reduced by attaching a capacitor to the load terminals.
- For safety and EMI considerations, connect the FG terminal of LS series 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) |
| LS50 ~ LS150 | AWG14-22         | M3.5 Screws<br>1.0 N·m (9.8 kgf·cm) ~<br>1.4 N·m (13.7 kgf·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.

|       |   |              |
|-------|---|--------------|
| LS50  | : | T2A , 250V   |
| LS75  | : | T2.5A , 250V |
| LS100 | : | F4A , 250V   |
| LS150 | : | F5A , 250V   |

## 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 material is not too thin.
- Check if the output voltage control (V.ADJ) is properly adjusted.
- Check if the output current and output wattage does not exceed the 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 at the output side. Please use within maximum capacitance shown below.

| MODEL      | Maximum external capacitance |    |         |         |         |         |     |
|------------|------------------------------|----|---------|---------|---------|---------|-----|
|            | 3.3V                         | 5V | 12V     | 15V     | 24V     | 36V     | 48V |
| LS50       | 10,000uF                     |    | 5,000uF |         | 2,000uF | 500uF   |     |
| LS75~LS150 | 10,000uF                     |    |         | 5,000uF |         | 1,000uF |     |