

CUS200LD Series

Instruction Manual

BEFORE USING THE POWER SUPPLY UNIT

Be sure to read this instruction manual thoroughly before using this product. Pay attention to all cautions and warnings before using this product. Incorrect usage could lead to an electrical shock, damage to the unit or a fire hazard.

DANGER

Never use this product in locations where flammable gas or ignitable substances are present. There are risks of igniting these substances and exploding by an arcing.

WARNING

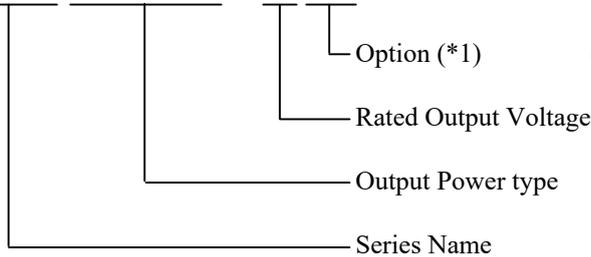
- Do not touch this product or its internal components while circuit in operation, or shortly after shutdown. There may be high voltage or high temperature present and you may receive an electric shock or burn.
- While this product is operating, keep your hands and face away from it as you may be injured by an unexpected situation.
- Do not make unauthorized changes to this product, otherwise you may receive an electric shock and void your warranty.
- Do not drop or insert anything into this product. It might cause a failure, fire and electric shock.
- Do not use this product under unusual condition such as emission of smoke or abnormal smell and sound etc. 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 these products in the presence of condensation. It might lead fire and electric shock.

CAUTION

- This power supply is designed and manufactured for use within an end product such that it is accessible to SERVICE ENGINEERS only.
- 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.
- Do not operate and store this product in an environment where condensation might occur. In such case, waterproof treatment is necessary.
- Do not use this product in environment with a strong electromagnetic field, corrosive gas or conductive substances.
- For applications, which require very high reliability (Nuclear related equipment, medical equipment, traffic control equipment, etc.), it is necessary to provide a fail-safe mechanism in the end equipment.
- Do not inject abnormal voltages into the output or signal of this product. The injection of reverse voltage or over voltage exceeding nominal output voltage into the output or signal terminals might cause damage to internal components.
- Never operate the product under over current or short-circuit conditions, or outside its specified Input Voltage Range. Insulation failure, smoking, burning or other damage may occur.
- 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.
- This product has used Power Thermistor to protect the circuit from Inrush Current. Frequent repetition of input on/off might cause damage to internal components because of generating surge current.
- The information in this document is subject to change without prior notice. Please refer to the latest version of the data sheet, etc., for the most up-to date specifications of the product.
- No part of this document may be copied or reproduced in any form without prior written consent of TDK-Lambda.

1. Model name identification method

CUS 200LD - 5 / □

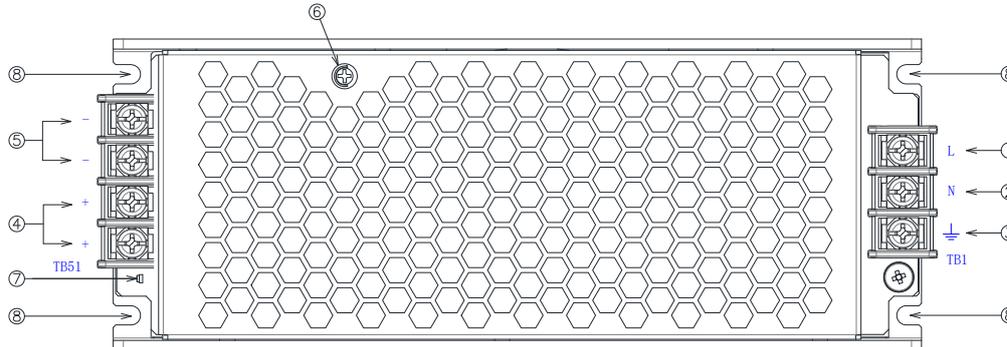


(*1) Designation for Optional models, blank for Standard model

2. Terminal Explanation

- ① L : Input terminal Live line (Fuse in line)
- ② N : Input terminal Neutral line
- ③ ⊥ : Earth terminal
- ④ +V : + Output terminal (20A max. / terminal)
- ⑤ -V : - Output terminal (20A max. / terminal)
- ⑥ Output voltage adjustment trimmer
- ⑦ Output monitoring indicator (Green LED)
- ⑧ Mounting hole (hole diameter: Ø 3.8mm)

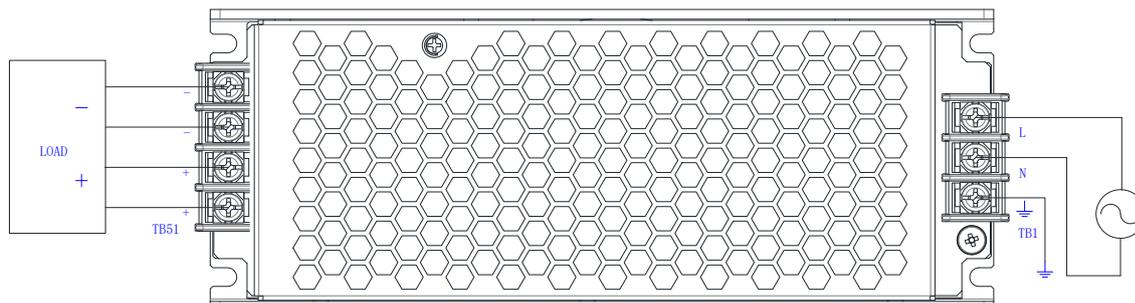
*All screws size is M3.0.



3. Connecting method

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

- Input must be off when making connections.
- Connect ⊥ terminal to earth (frame ground of the equipment etc.) by thick wire for safety and improvement of noise sensitivity.



Recommended torque :M3.0 screw 0.50N·m (5.1kgf·cm) ~ 0.70N·m (7.1kgf·cm)

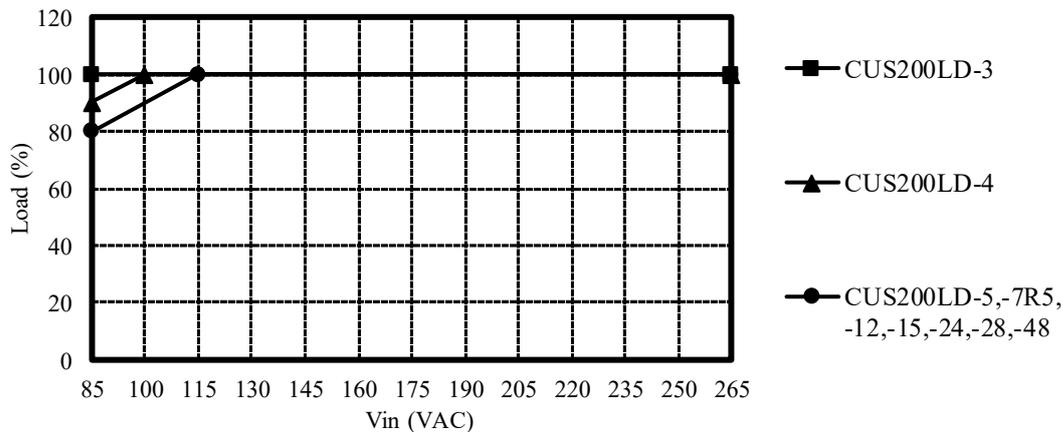
4. Explanation of Functions and Precautions

4-1. Input Voltage Range

Input voltage range is single phase 85-265VAC(47-63Hz). Never operate the unit out of the specified input voltage range to avoid unit failure. For cases where conformance to various safeties required, input voltage range will be 100-240VAC (50-60Hz). If input voltage is less than 115VAC, output power need to be derated.

Output derating vs. the input voltage

CUS200LD-3		CUS200LD-4		CUS200LD-5,-7R5,-12,-15,-24,-28,-48	
Input Voltage (VAC)	Load (%)	Input Voltage (VAC)	Load (%)	Input Voltage (VAC)	Load (%)
85~265	100	85	90	85	80
		100~265	100	115~265	100



4-2. Output Voltage Range

Output voltage is set at the nominal value at shipment. Output voltage can be adjusted by the V.ADJ trimmer (VR51), the output voltage setting should be within the range in the specifications. Turning the trimmer clockwise, the output voltage will be increased. Please note if the output voltage is increased excessively, over voltage protection (OVP) function may be triggered and output will be shut down. Furthermore, when increasing the output voltage, output current should be reduced so that the output power does not exceed the maximum output power in the specifications.

4-3. Inrush Current

Power thermistor is used for limiting the inrush current. Higher current will flow at higher ambient temperature or input re-power on. Please select input switch or external fuse carefully. The inrush current value specified in the specification is under cold start condition (at 25°C).

4-4. Over Voltage Protection (OVP)

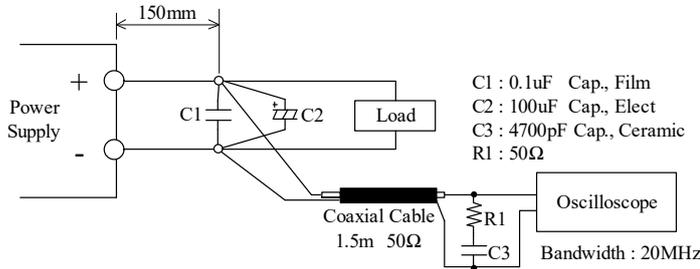
The OVP function (Inverter shut down method, manual reset type) is provided. Please refer to the specification for OVP trip level. When OVP is triggered, the output will be shut down. To reset OVP, turn off the input of power supply for a few minutes, and then re-power on. The OVP setting is fixed and can not be adjusted externally. Pay attention not to apply higher voltage externally to the output terminal to avoid unit failure. In case of inductive load, put protective diode in series to the output power line.

4-5. Over Current Protection (OCP)

The OCP is hiccup mode with automatic recovery. The outputs will be automatically recovered when the overload condition is removed. Please refer to the specification for OCP trip level. Never operate the unit under over current or shorted conditions, which may cause the unit damage. OCP setting is fixed and cannot be adjusted externally.

4-6. Output Ripple & Noise

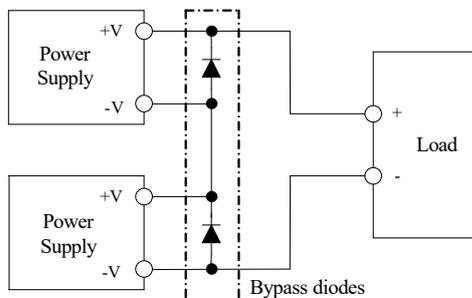
The measurement circuit of the output ripple and noise in the specifications is shown below. If the load wires are longer, the ripple and noise will be higher. In this case, electrolytic capacitor, film capacitor, etc. might be necessary to be used across the load terminal. The ground lead of probe should be short to avoid the noise interference



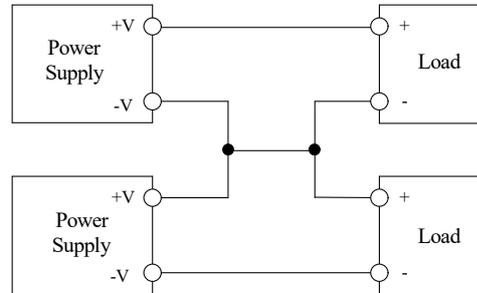
4-7. Series Operation

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

Method (A)



Method (B)



Note :

In case of method (A), it is recommended to connect the bypass diodes, power supply might be damaged without bypass diodes.

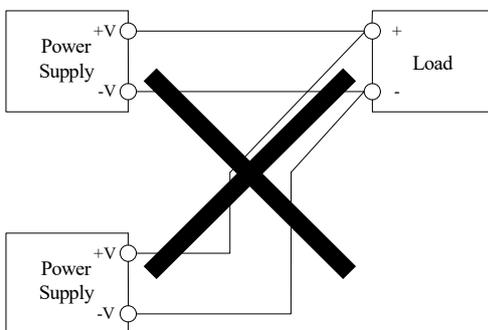
Please select a bypass diode with maximum forward current rating more than output load current. And maximum reverse voltage must withstand output voltage of each power supply.

Series operation is possible without bypass diode, but make sure all units must be in operation. (Never use in condition that one of the units is not operated.)

4-8. Parallel Operation

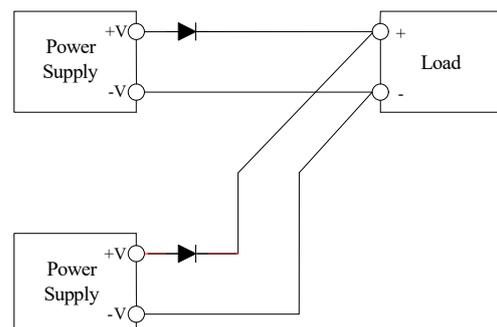
For parallel operation, method (B) is possible.

(A) To increase the Output Current is not possible.



(B) Operation as a Backup System is possible.

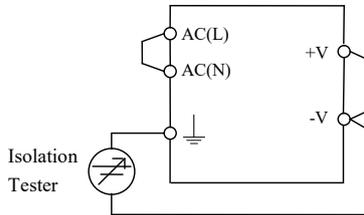
1. Adjust the output voltage higher to compensate the forward voltage drop (VF) of the diode.
2. Adjust each power supply output to same voltage.
3. Output voltage and output power should be used within specifications.
4. Use blocking diode to prevent reverse current. Diode current rating must be more than output load current.



4-9. Isolation Test

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

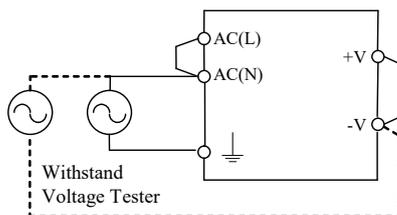
- Output - \perp terminal : 500VDC More than 100M Ω



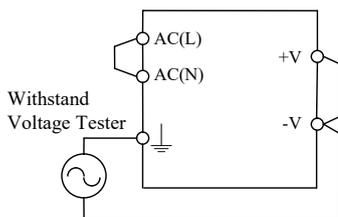
4-10. Withstand Voltage

CUS200LD is designed to withstand 3.0kVAC between input and output, 2.0kVAC between input and \perp terminal and 500VAC between output and \perp terminal each for 1 minute. When testing withstand voltage, set current limit of withstand voltage test equipment at 20mA (Output - \perp terminal : 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 switch on and off timing. Connect input and output as follows.

- Input - Output (dotted line) : 3.0kVAC, 1min (20mA)
- Input - \perp terminal (solid line) : 2.0kVAC, 1min (20mA)



- Output - \perp terminal : 500VAC, 1min (100mA)



Instructions for using the power supply in customer's system

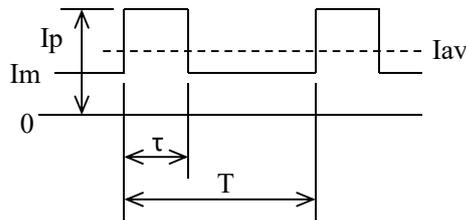
1. If the output of power supply is connected to FG in the application, the withstand voltage test between input and output (FG) should be tested at 2kVAC.
2. If there is external noise filter and Y-caps connected at the input and output of the power supply, the voltage distribution between primary and secondary circuit will be changed during the withstand voltage test, and may cause test fail. In this case, please contact TDK-Lambda for the technical support and instructions.

4-11. Surge Immunity Test (IEC61000-4-5)

Output voltage may dip in IEC61000-4-5 Surge immunity test at level 4 common mode (test voltage 4kV) for low output voltage 3.3V ~ 15V models. The dip duration is about 0.1~0.2ms, and dip level is 0~10% (3.3V:0~500mV) typical depends on the load conditions. Use external capacitors or filter circuit on the power supply output to reduce the voltage dip and smooth the output voltage if necessary.

4-12. Output Peak Current

CUS200LD has capability of 200W peak power operation, the peak and average current is defined as below:



Ip: Peak output current (A)
 Im: Minimum output current (A)
 Iav: Average output current (A)
 D: Duty cycle, τ/T (%)

$$I_{av} = I_p \times D + I_m \times (1-D)$$

Operating period at peak output current (τ) is less than 10 seconds for conduction cooling and 5 seconds for convection cooling, duty is less than 35%.

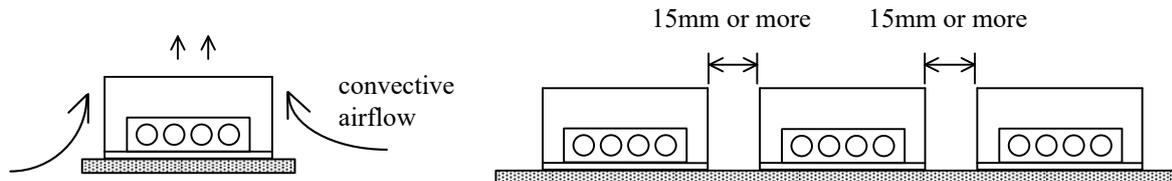
Average output power and output current is less than the Maximum output power and output current.

Peak output power and output current derating for input voltage, ambient temperature and base plate temperature (Conduction cooling only) is same as the derating curve of maximum output power and output current. Please refer to Input Voltage Derating (4-1) and Output Derating (5-3) for details

5. Mounting

5-1. Mounting Method

(1) For both conduction and convection cooling, as consideration for the heat radiation, keep a space more than 15mm between the power supply and the peripheral parts. Also when using multiple units, keep a space more than 15mm from each other.

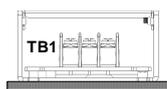


(2) For conduction cooling, Power supply should be mounted on an Aluminum plate or heat sink with bottom side of the chassis, please refer to the Output Derating of conduction cooling (5-3) for details.

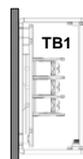
5-2. Mounting Directions

The standard mounting is direction (A). Direction (B), (C),(D) and (E) are also possible. Never use as mounting direction (F) shown below.

(A) Standard Mounting



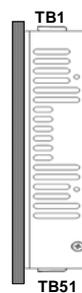
(B)



(C)



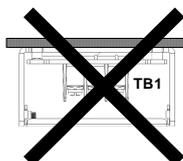
(D)



(E)



(F) Not Possible



5-3. Output Derating

Refer to the output derating below, load (%) is percent of maximum output current value at rated output voltage. Make sure that the specified temperature range is maintained.

Conduction cooling

Power supply should be mounted on an Aluminum plate or heat sink with bottom side of the chassis, recommended AL plate size is 400*400*2mm.

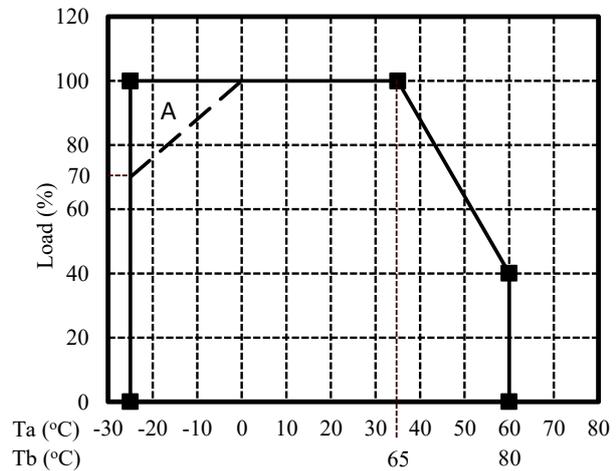
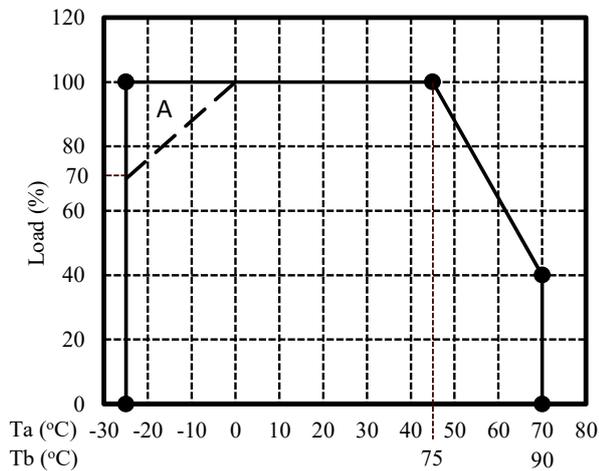
The power supply base plate temperature (as shown below) should be monitored to ensure the effectiveness of the heat sink, and both Ta and Tb must not exceed the derating curve below for safety operation of the power supply.

Maximum output power and output current derating vs. ambient temperature and base plate temperature:
 Mounting A,B,C

Ta (°C)	Tb (°C)	Load (%)
-25 - +45	-25 - +75	100
+70	+90	40

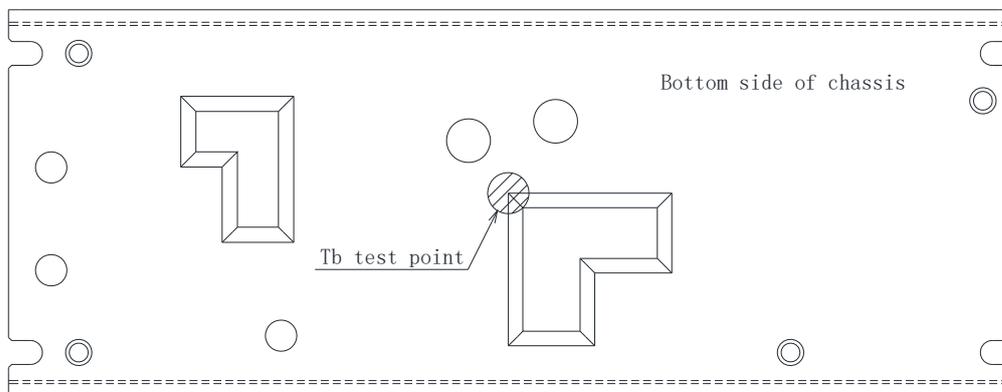
Mounting D,E

Ta (°C)	Tb (°C)	Load (%)
-25 - +35	-25 - +65	100
+60	+80	40



Ta: Ambient Temperature

Tb: Base plate temperature, measured at the center of the bottom side of the chassis, as shown in the picture below.



Convection Cooling

Maximum output power and output current derating vs. ambient temperature.

Mounting A

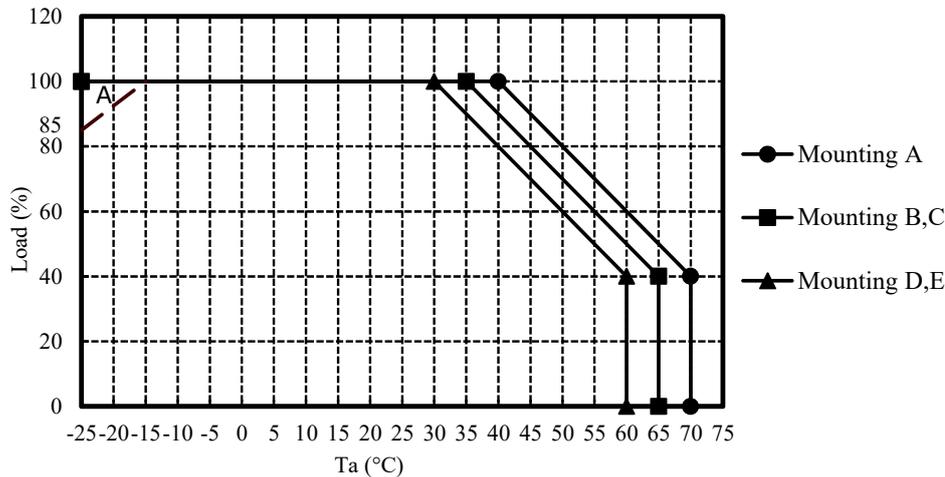
Ta (°C)	Load (%)
-25 - +40	100
+70	40

Mounting B,C

Ta (°C)	Load (%)
-25 - +35	100
+65	40

Mounting D,E

Ta (°C)	Load (%)
-25 - +30	100
+60	40



*** Low Temperature Operation Area (A) for conduction and convection cooling**

This power supply uses NTC power thermistor to limit the inrush current, and due to NTC characteristics of high impedance at low temperature, output voltage may be fluctuated during cold start up or sudden change of load conditions, such as no load to maximum load transient in this area when input voltage is below 115VAC. Output voltage will be stable after power supply warm up, or the input voltage is higher than 115VAC. Please note further derating of input voltage is required at $V_{in}=85\sim 115VAC$ (See 4-1) Please evaluate power supply low temperature start up and dynamic load response under worst case conditions in actual application to ensure no problem of the power supply operation.

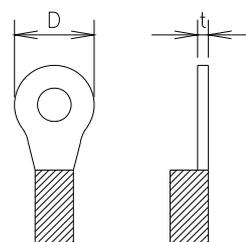
6. EMC and Wiring Method

This power supply is primarily designed and manufactured to be used and enclosed in other equipment. The installation, wiring, grounding and end application of the switching power supply in the equipment system may influence its EMC characteristics. Therefore, the EMC performance has to be tested on end system level. Additional filtering may be required depends on application and installation methods.

- (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) Noise can be eliminated by attaching a capacitor to the load terminals.
- (3) The recommended wire type, torque and crimp-type terminal :

Recommended Wire	Recommended torque	Recommended crimp-type terminal	
		D (MAX)	t (MAX)
AWG 12-22	M3.0 Screws 0.50N·m (5.1kgf·cm) ~ 0.70N·m (7.1kgf·cm)	6.5mm	1.2mm

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

CUS200LD : 3.15A

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

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

- (1) Check if the rated input voltage is connected.
- (2) Check if the wiring of input and output is correct.
- (3) Check if the wire size is not too thin.
- (4) Check if the output voltage 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.
- (8) Ensure that large capacitor is not connected on the output side.

Please use within maximum external capacitance shown in below table.

If connecting more than the maximum capacitance value is required, please contact us for details.

	Maximum External Capacitance								
MODEL	3.3V	4.2V	5V	7.5V	12V	15V	24V	28V	48V
CUS200LD	10000uF	10000uF	10000uF	10000uF	10000uF	10000uF	10000uF	7000uF	5000uF

9. Altitude

CUS200LD is safety approved for operation up to 5000m by IEC62368-1 clearance requirement.
 Thermal evaluation should be considered for products operating at elevated altitudes above 2000m.

10. 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.