

# **RDS Series (110VDC Input)**

## **Instruction Manual**

### **RDS50-110**

#### **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 is live, or shortly after shut down. There may be high voltage or high temperature present and you may receive an electric shock or burn.
- When 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 or electric shock.

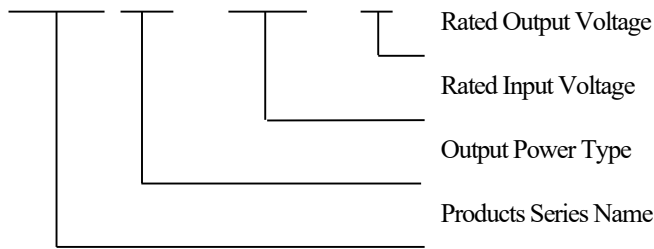
#### **CAUTION**

- 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 & power, Ambient temperature & 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 of this product. The injection of reverse voltage or over voltage exceeding nominal output voltage into the output terminal might cause damage to internal components.
- Never operate the product 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.
- When using commercial AC line (greater than 115VAC) of system level which has this product inside, please connect the input terminal of this product through AC/DC PSU (or Rectifier Unit) which has reinforced or double insulation.
- This product has Input Surge (Inrush) Current Suppressor inside. Frequent repetition of input might cause damage to internal components because of generating surge current by no operation of the suppressor circuit.
- Breaking of internal fuse is considered internal failure. In such cases, please contact us.
- 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.

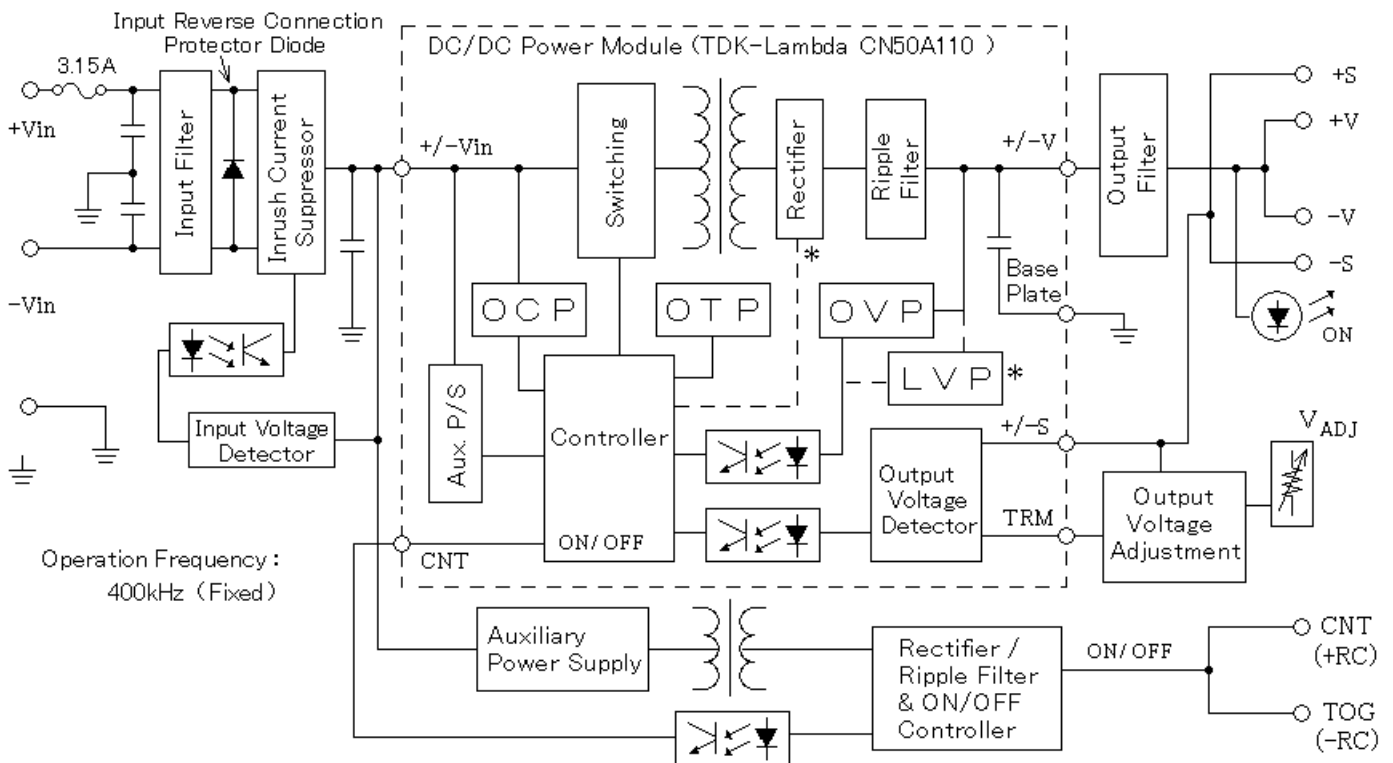
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## 1. Model Name Identification

RDS 50 - 110 - 5



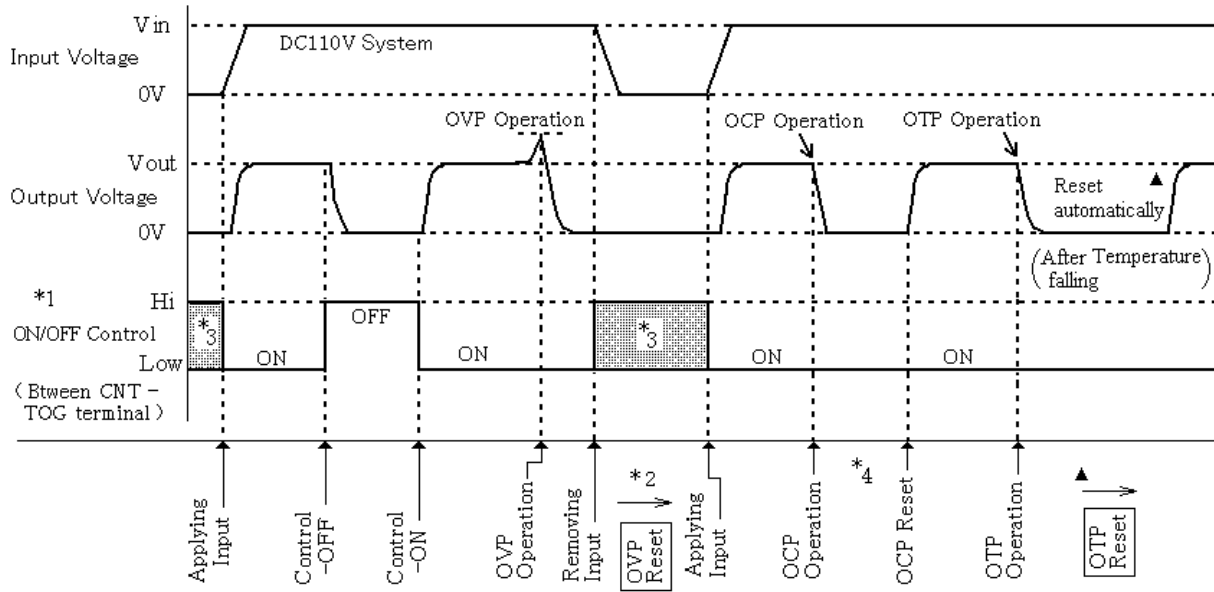
## 2. Block Diagram



Note) \* For the 5V output model, Rectifier is Synchronous type, and LVP function is built in.

[ Abbreviation Symbol ] OCP : Over Current Protection,    OTP : Over Temperature Protection,  
OVP : Over Voltage Protection,    LVP : Low Voltage Protection

### 3. Sequence Timing Chart



Note) \*1. ON / OFF Control Terminals (CNT ,TOG) are isolated from other terminals of this product (Floating).

For Remote ON/OFF { Control ON ..... Short the CNT and TOG terminals, or apply ext. voltage of 0 to 0.4V.  
Control OFF ... Open the CNT and TOG terminals, or apply ext. voltage of 1.5V to 5.0V.

Do not apply voltage greater than 5.5V to avoid over current flow into these terminals.

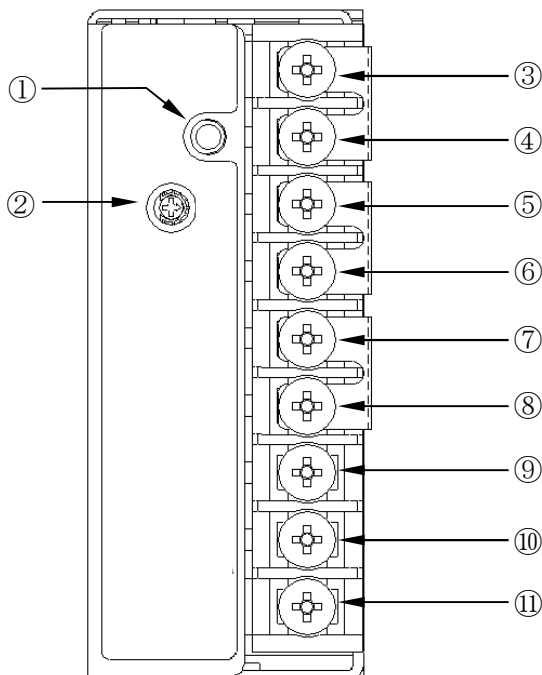
\*2. Please remove input once and apply again, or restart control ON/OFF to reset the OVP or LVP.

\*3. The terminal voltage between CNT & TOG is about 5.6V at open mode. It changes 0V when turning off input.

\*4. For 5V output model, OCP method is constant current limit with latch shutdown (by LVP). It can be reset as the 2 above.

Furthermore, for 12, 15, and 24V output model, OCP method is Constant Current Limit with automatically reset.

### 4. Terminal Layout Description



#### RDS50 Terminal & Function

- ① ON : Output Display (Green LED lights when output ON)
- ② V.ADJ : Output Voltage Adjustment  
(Output Voltage increases by turning the VR CW \* direction)
- ③ + S : + Remote Sensing
- ④ + V : + Output Terminal
- ⑤ - V : - Output Terminal
- ⑥ - S : - Remote Sensing
- ⑦ CNT : + Remote ON / OFF | Short the ⑦ & ⑧ to turn ON
- ⑧ TOG : - Remote ON / OFF | Open the ⑦ & ⑧ to turn OFF
- ⑨ + Vin : + Input Terminal (Internal Fuse inside)
- ⑩ - Vin : - Input Terminal
- ⑪ ⚡ : Terminal for Protective earth

Abbreviation Note) \* CW: Clock Wise

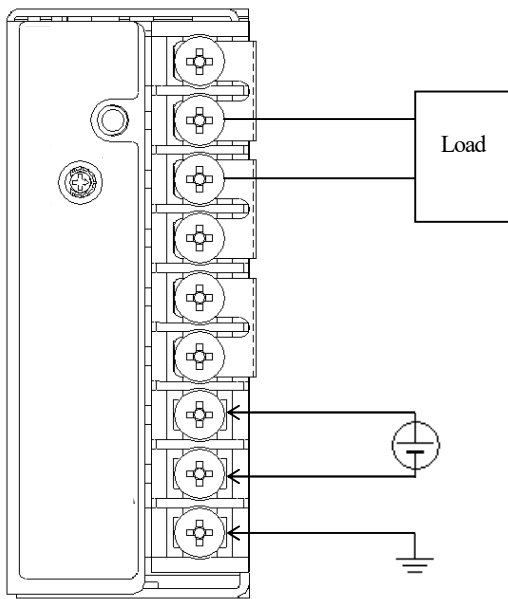
## 5. How to Wiring for the Terminal

Please be careful when wiring the input line. Improper connection would cause damage to power supply.

- Each terminal wiring must be held under the condition without no input.
- When applying Protection Ground, use the terminal with the symbol '⊥' or use fixing screw to the (sheet-metal) chassis.
- When wiring, please separate between input & output line to improve immunity of switching noise.
- When using Remote Sensing or Remote ON/OFF function, please prepare twisted pair or shield wire for sensing or ON/OFF signal line, and ensure to separate from the output (load) line.
- Current rating is 25A maximum for the each terminal, but ensure to operate within rated specification of each output.

### •Basic Connection (Local Sensing)

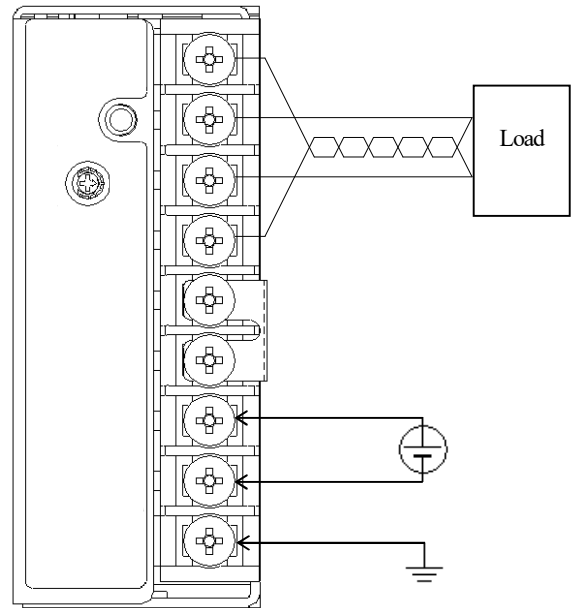
Connect +S to +V, and -S to -V terminal  
by using the short piece (sheet metal)  
(Short piece is attached when shipping.)



### •How to use Remote Sensing

- 1) Remove the short piece (originally attached).
- 2) Connect +S & +V terminal by wiring.
- 3) Connect -S & -V terminal by wiring.

\* Note) Output shuts down when sensing line is open



\* The short-piece is also connected between CNT and TOG terminals originally when shipping.

### [ Pre-Caution ] Insulation Classification and Safety Conformability

Although withstand voltage is 2kVAC (1minute) between Input and Output / between Input and Chassis (Protective Earth) for this product, insulation classification is different for each point as shown below..

Between Input and Output ----- Reinforced Isolation  
Between Input and Chassis (Protective Earth) ----- Basic Isolation

Please connect AC/DC PSU (or transformer and rectifier) which has Reinforced or Double Isolation to the input terminal of this product when using original AC input which is greater than 115V.

Furthermore, please refer Isolation and Withstand Voltage test method in the section 6-12 and 6-13 later.

## 6. Function & Precautions

### 6-1. Input Voltage Range

The range is 60 to 160V DC. Applying input voltage over than 160VDC will cause damage to power supply.  
This product is partially needed output derating for high input (143 to 160V), please refer the section 7-2.

### 6-2. Output Voltage Range

Output voltage is adjusted to the center of rated value when shipping. And output voltage can be adjusted by the VR of 'V.ADJ' rotation. Output voltage increases when rotating CW direction for the VR. Please use within rated output range as shown below.

5V Output Model : -10% / +20%,      12V, 15V and 24V Output Model : -10% / +10%

Please note that output will shutdown due to OVP activation when output voltage is adjusted too high..

And please use within rated output power when output voltage setting is higher than typical value of rated voltage.

### 6-3. Input Surge (Inrush) Current

RDS has input surge (inrush) current suppressor inside. The value in the data sheet is specified at 25°C ambient temperature.

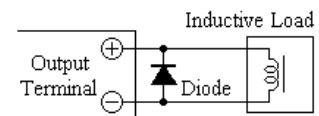
Inrush current increases during input recycling once the power supply has commenced operation.

Take caution when selecting external input switch or input fuse.

### 6-4. Over Voltage Protection (OVP)

OVP method is "Output Shutdown (Latch) / Manual Reset". OVP operates 120-150% of rated output voltage and shuts down output. After OVP operation, please turn off the input once and wait about 1 minute, then turn on input again or reset ON/OFF control terminal to reset OVP Latch inside. The OVP setting level is fixed and cannot be adjusted externally.

Be careful when applying external voltage directly to output higher than nominal as this might lead to damage of the RDS unit. When using inductive load, such as a motor or a relay, connect diode to output line as right side.



### 6-5. Over Current Protection (OCP)

5V output Model ----- Constant Current Limit with LVP Shut-down

OCP operates if output current exceeds the rated output current of the unit, approximately at 120% typ.

Then, if output decrease to 2V approximately, the output will be shut down by LVP inside.

After LVP operation, please turn off the input once and wait about 1 minute, then turn on input again

or reset ON/OFF control terminal to reset OVP Latch inside.

12, 15, 24V Output Model ----- Constant Current Limit with automatically reset.

OCP operates if output current exceeds the rated output current of the unit, approximately at 120% typ.

The outputs will be automatically recovered when the overload condition is canceled.

Please note that never operate the unit under over current or shorted conditions for more than 30seconds, as this might to lead damage or failure. The OCP setting level is fixed and cannot be adjusted externally.

### 6-6. Over Temperature Protection (OTP)

The output will be shut down when over rise temperature for ambient or internal of the RDS unit is detected. For this product, Temperature Detector is built in at Internal Power Module (RDS50-110) inside, then output shuts down when the temperature of the fin reaches approximately 100°C. This automatically resets after temperature less than 80°C approximately.

### 6-7. Remote Sensing Function (+S, -S Terminals)

This product has a remote sensing terminal to compensate a voltage drop between the output terminal of RDS and the load.

When using as local sensing (Not using remote sensing), please short +S/+V and -S/-V terminal by using a short piece sheet metal.

The short pieces are attached when shipping. The compensation line drop voltage is within adjust level and within maximum output power.

Voltage drop level between -V and -S must be less than 2V. Please use shield or twisted pair wire to decrease influence of switching noise.

### 6-8. Remote ON/OFF Control Function (CNT, TOG Terminals)

Remote ON/OFF function is available inside. It provides output ON/OFF control with input voltage applied condition as the table below.

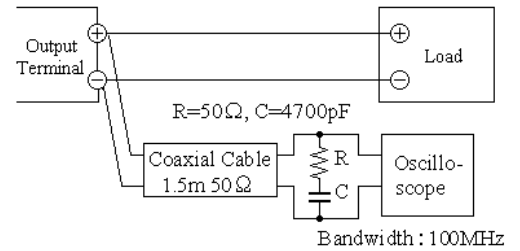
Between CNT / TOG terminal	Output Condition
Open or Apply 1.5 to 5V	OFF
Short or apply 0 to 0.4V	ON

### 6-9. Output Ripple & Noise

The specification for maximum ripple & noise value are measured according to measurement circuit specified by JEITA-RC9131B.

Output Ripple & noise level will be large when a load line is long.

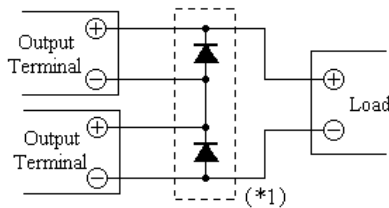
In such case, it might be necessary to connect electrolytic or film capacitor across the load terminal. The output ripple cannot be measure accurately if the probe ground lead of oscilloscope is too long.



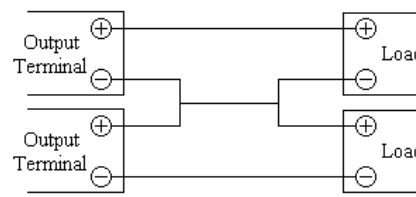
### 6-10. Series Operation

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

(A) Series Operation RDS to One Load



(B) Series Operation both RDS & Load



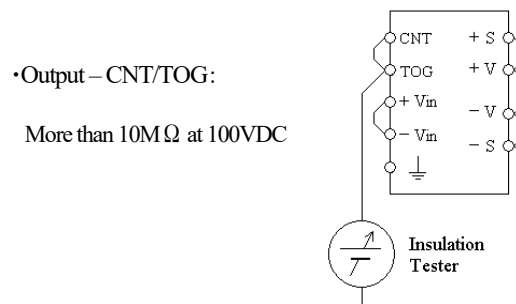
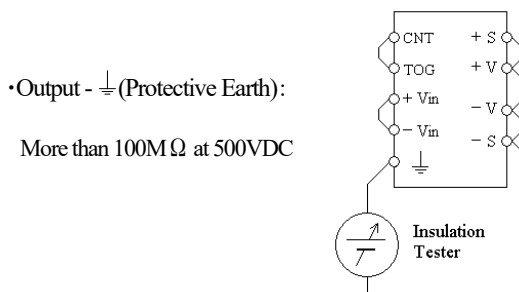
(\*1) In case of (A), please connect bypass diodes to prevent reverse voltage. Please select a bypass diode with maximum forward current rating more than output load current. And maximum reverse voltage must withstand each power supply output voltage.

### 6-11. Parallel Operation

The RDS50-110 can be used for Back-up Operation as (A) by setting output voltage same each other. For the (A), please connect By-pass diodes which have the rating forward current of load current or more, and reverse voltage more than output voltage. Furthermore, Parallel operation for higher power output cannot be used.

### 6-12. Isolation Resistance Test

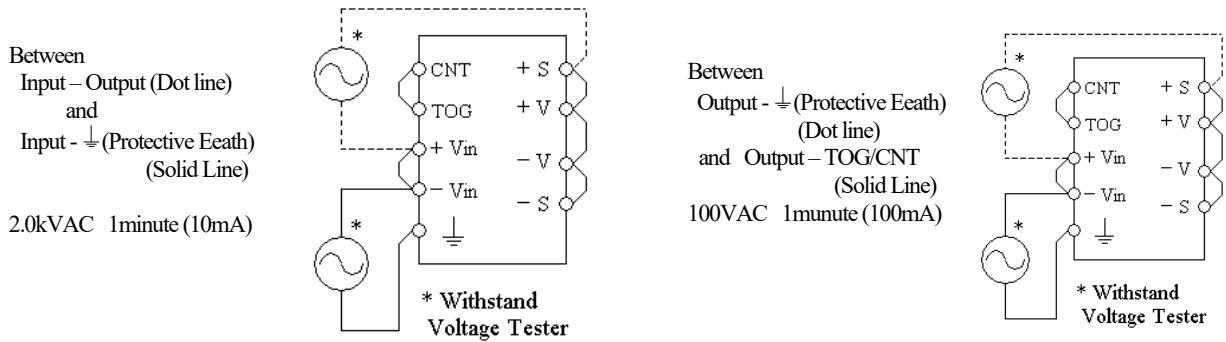
Isolation resistance is more than 100MΩ at 500VDC between Output -  $\perp$  (Protective Earth), and 10MΩ at 100VDC between Output - CNT/TOG. For safety operation, voltage setting of DC isolation tester must be done before the test. Ensure that the unit is fully discharged after the test.



### 6-13. Withstand Voltage

When testing withstand voltage, please connect each side terminals of input and output as follows.

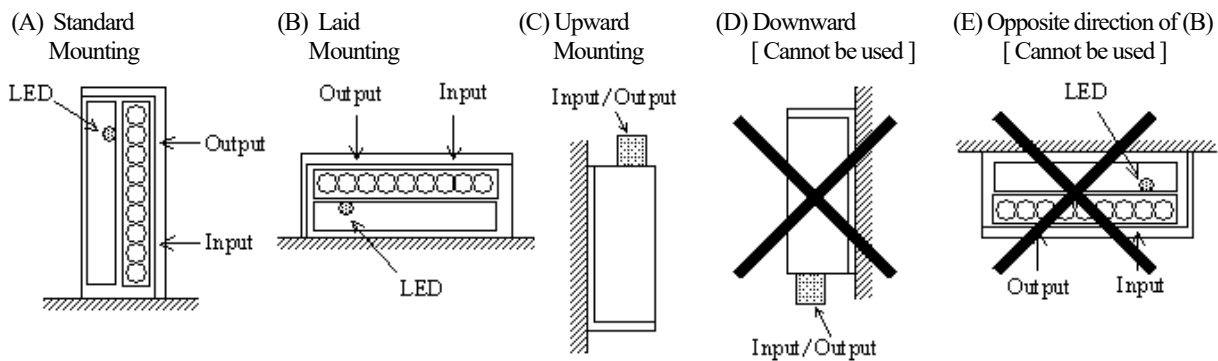
This series is designed to withstand 2.0kVAC between input and output, input and  $\perp$  (Protective Earth), and 100VAC between output and CNT/TOG each for 1 minute. When testing withstand voltage, set current limit of the withstand voltage test equipment as shown below. The applied voltage must be gradually increased from zero to the testing value and then gradually decreased after test. When timer is used, the power supply may be damaged by high impulse voltage at timer switch on and off.



## 7. Mounting Method etc.

### 7-1. Mounting Directions

Mounting directions are as the picture shown below. Standard mounting is (A). However, the mounting as (B) & (C) is also available. Do not mount using (D) - (E) method. Use RDS according to the derating curve area by mounting direction and ambient temperature. Derating curve limitations are determined shown in the section 7-2.

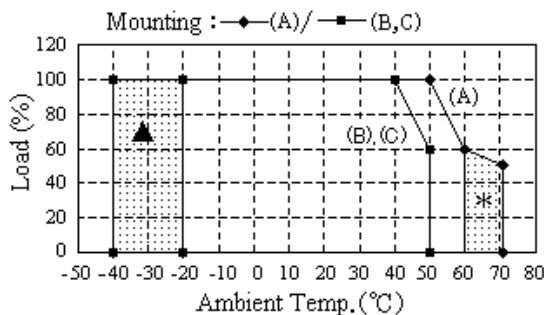


### 7-2. Output Derating

#### Natural Convection or Air-Forced Cooling

Output derating value is based on that of 100% output power.

Please apply 80% output power as the derating curve when the input voltage range is 143 to 160V.



Ambient Temp. (°C)	Load (%)	
	Mounting (A)	Mounting (B,C)
-40 - -20	▲	▲
-20 - +40	100	100
+50	100	70
+60	60	-
+71	50 *	-

Note) ▲ Only Start-up Guarantee.

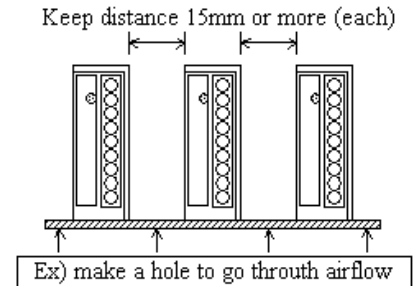
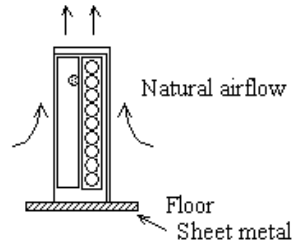
\* Air-Forced Cooling (More than 0.7m/s)



### 7-3. Precaution for Unit Mounting

- (1) The basic cooling method is Natural Convection. Keep a space more than 15mm each around RDS unit to avoid hot air from accumulating. And same application is also needed when using multiple RDS units. Please apply wind direction along the fin of RDS unit when using by Air-Forced cooling.
- (2) Connect Protective Earth Terminal ( $\perp$ ) to the Ground of the application equipment. Otherwise, noise \* will get worse.  
(\* Input conducted emission noise, Radiated Emission noise, or Output noise)
- (3) Insert stroke length of a fixing screw is less than 7mm. Avoid inserting failed screw.
- (4) Recommended fastening torque for fixing

M3 type screw : 0.51N·m (5.2 kgf·cm)  
M4 type screw : 1.27 N·m (13.0 kgf·cm)



## 8. Wiring Method

- (1) Separate wire for input & output (load) line. Further, by twisting wire for each input & output to improve switching noise.
- (2) Use short length and thick wires for input & output line in order to lower down line impedance
- (3) Switching noise will decrease by adding capacitor to load terminal.
- (4) Connect protective earth terminal ( $\perp$ ) to ground of the equipment by using thick wires.

## 9. External Fuse Rating

Please 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. Fuse rating is considered by in-rush current value at line turn-on. Do not select the fuse according to input average current values under the actual load condition. RDS unit has same rating fuse inside (+Vin Line).

RDS50 -110 : F3.2AL

## 10. Before Thinking that the Unit is Failure

- (1) Check if the rated input voltage is applied.
- (2) Check if the wiring of input or output line is correct.
- (3) Check if the terminal screw is fastened with specified torque certainly.
- (4) Check if the wire thickness is enough.
- (5) Check if the output current and output power does not exceed specification.
- (6) Check if the output voltage setting (V.ADJ) is properly adjusted. OVP might be triggered and output will shut down.
- (7) Check if sensing wire opened or not. OVP might be triggered and output will shut down.
- (8) Check if remote ON/OFF (CNT/TOG) terminal is opened or not. Output turns off if the terminal is opened.
- (9) Audible noise can be heard depending on frequency or current change rate condition during Dynamic-Load operation.

## 11. Warranty Period

Warranty period is 5 years. Free of charge repair is available for the damage under normal usage during warranty period.

Free of charge warranty covers following condition.

- (1) Average ambient temperature is less than 40°C.
- (2) Average load is less than 80% rate of nominal output power.
- (3) Mounting method is (A), standard mounting.

**Following cases are not covered by warranty.**

- (1) Improper usage like dropping products, applying shock, improper handling and operation exceeding maximum specification of the units.
- (2) Defects resulting from natural disaster (fire, flood etc).
- (3) Defects resulting from modifications or repair done by unauthorized or uncertified personnel by TDK-Lambda.

## **12. 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 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 and Restriction of the Use of Certain Hazardous Substances in Electrical & Electronic Equipment Regulations.