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RDS SERIES

Single Output 60~100W

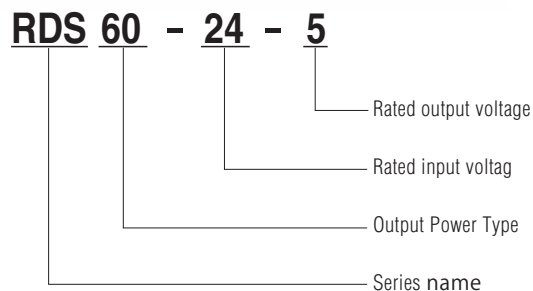
Unit Board



Features

- DC24V Input Unit Power Supply
- Models conform to JIS E3014, 3015 2-B (railway signaling anti-vibration and impact test standards)
- Coated circuit board

Model naming method



Application



RoHS Compliance

According to EU Directive 2002/95/EC, except for an exempt purpose, lead, cadmium, mercury, hexavalent chromium, and specific bromine-based flame retardant agent PBB, PBDE have not been used.

Product Line-up

Input Voltage	24V							
Output power	30W		60W		100W		180W	
Model name	RDS30-24		RDS60-24		RDS100-24		RDS180-24	
Output Voltage	Output current	Type name	Output current	Type name	Output current	Type name	Output current	Type name
5V	6A	Under development	12A	RDS60-24-5	20A	RDS100-24-5	36A	Under development
12V	5A	Under development	5A	RDS60-24-12	8.3A	RDS100-24-12	15A	Under development
15V	4A	Under development	4A	RDS60-24-15	6.6A	RDS100-24-15	12A	Under development
24V	1.3A	Under development	2.5A	RDS60-24-24	4.2A	RDS100-24-24	7.5A	Under development

Input Voltage	48V			
Output power	30W		60W	
Model name	RDS30-48		RDS60-48	
Output Voltage	Output current	Type name	Output current	Type name
5V	6A	Under development	12A	Under development
12V	5A	Under development	5A	Under development
15V	4A	Under development	4A	Under development
24V	1.3A	Under development	2.5A	Under development

* Please note that all the information listed here is subject to change without prior notice due to technical improvements.

RDS60-24 specifications

(Please read before use)

ITEMS	SPECIFICATIONS ITEM 1	MODEL	RDS60-24-5	RDS60-24-12	RDS60-24-15	RDS60-24-24
Input	Input Voltage Range	VDC	18 - 32			
	Efficiency (Typ) (*1)	%	78	79		80
	Input Current (Typ) (*1)	A	3.3			
	Inrush Current (Typ) (*1)	A	4.7A at Cold Start			
Output	Nominal Output Voltage	VDC	5	12	15	24
	Maximum Output Current	A	12	5	4	2.5
	Maximum Output Power	W	60			
	Maximum Line Regulation (*3)	mV	40	96	120	192
	Maximum Load Regulation (*4)	mV	100		200	
	Temperature Coefficient		Less than 0.02 % / °C			
	Maximum Ripple (*2)	mVp-p	50	80		100
	Maximum Ripple & Noise (*2)	mVp-p	100	170	200	290
	Output Voltage Range (*8)	VDC	4.5 - 5.5	10.8 - 13.2	13.5 - 16.5	21.6 - 26.4
Features	Over Current Protection (*5)	A	12.3 - 13.8	5.2 - 6.0	4.2 - 4.9	2.6 - 3.1
	Over Voltage Protection (*6)	VDC	6.0 - 7.5	15.0 - 18.0	17.6 - 22.5	28.0 - 36.0
	Remote ON/OFF Control		Possible			
	Parallel Operation		-			
	Series Operation		Possible			
Environment	Operating Temperature (*7)	°C	-20 to +60(-20 to +50°C : 100%, +60°C : 70%)			
	Storage Temperature	°C	-25 - +75			
	Operating Humidity	%RH	20 - 95%RH (Non Condensing)			
	Storage Humidity	%RH	20 - 95%RH (Non Condensing)			
	Vibration		10 - 55Hz : 19.6m/s ² , X,Y,Z 1 hour each Designed to meet JIS E 3014-2-B			
	Shock		294m/s ² (time : 6±3ms) Designed to meet JIS E 3015-2-B			
	Cooling		Natural Air Cooling			
Isolation	Withstand Voltage		I/P - O/P - FG : 2kVAC (10mA) for 1min., O/P- CNT(RC) : 100VAC (100mA) for 1min.			
	Isolation Resistance		O/P- FG : 500VDC 100MΩ, O/P-CNT (RC) : 100VDC 10MΩ			
Standards	Safety		Designed to meet UL60950-1, CSA60950-1, EN60950-1			
	Conducted Emission		Designed to meet EN55011/EN55022-A, FCC-ClassA, VCCI-A			
	Immunity		Designed to meet IEC61000-4-2(Level 2, 3), -4(Level3), -8(Level 4)			
Mechanical	Weight	g	550			
	Size (W x H x D)	mm	43 x 95 x 160 (Refer to Outline Drawing)			

(*1) At 24VDC, Ta=25°C, nominal output voltage and maximum output power.

(*1) Measure with JEITA RC-9131A probe, Bandwidth of scope : 100MHz.

(*3) 18 - 32VDC, constant load.

(*4) No load-Full load, constant input voltage.

(*5) OCP TYPE : Constant current limit with automatic recovery.

(*6) OVP circuit will shut the output down. manual reset (Re Power on).

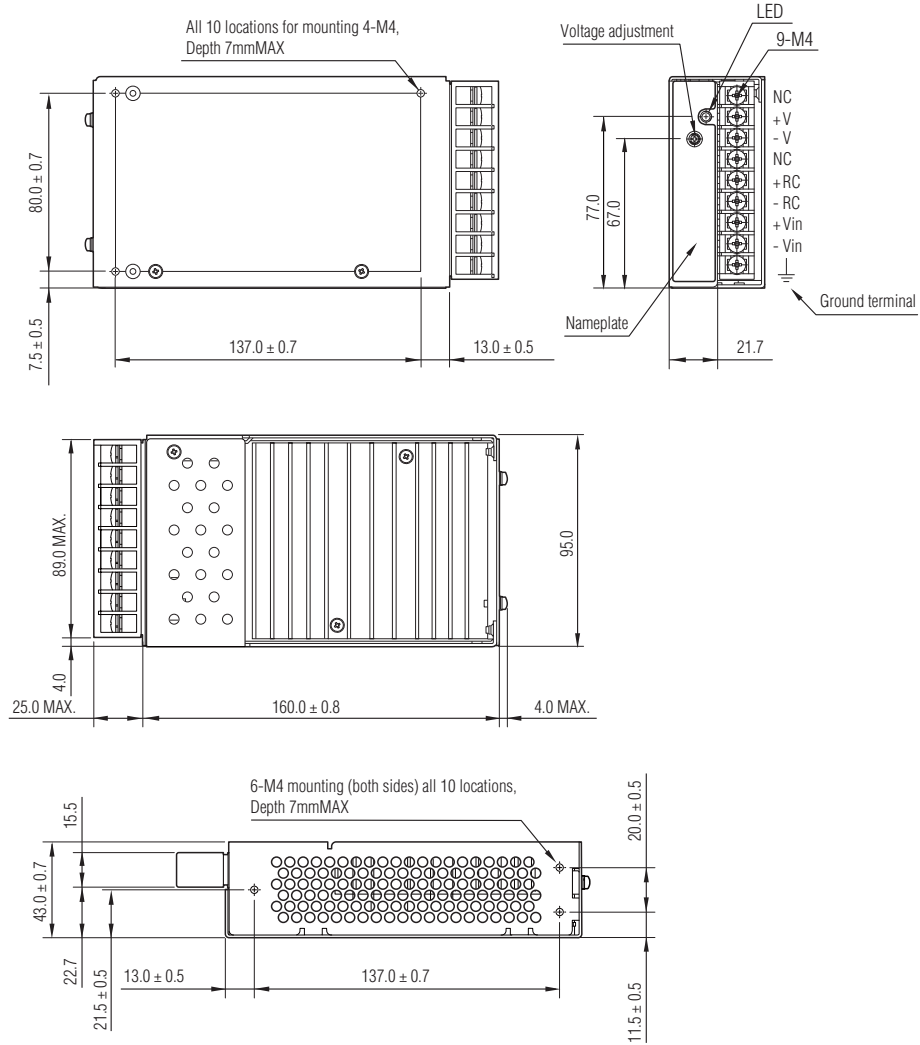
(*7) Ratings

- Derating at standard mounting. Refer to output derating curve (B028-01-02)

- Load (%) is percent of maximum output power or maximum output current, whichever is greater.

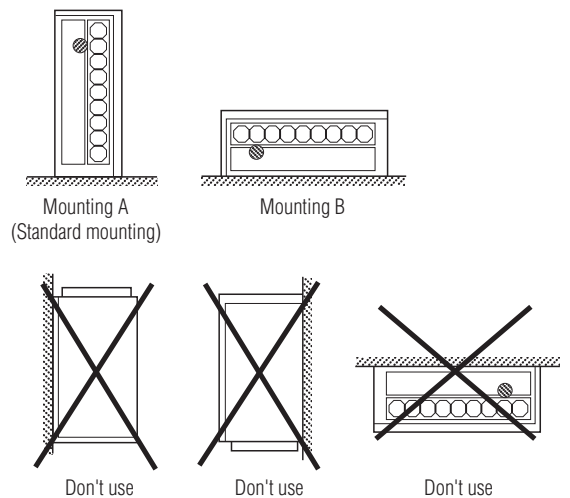
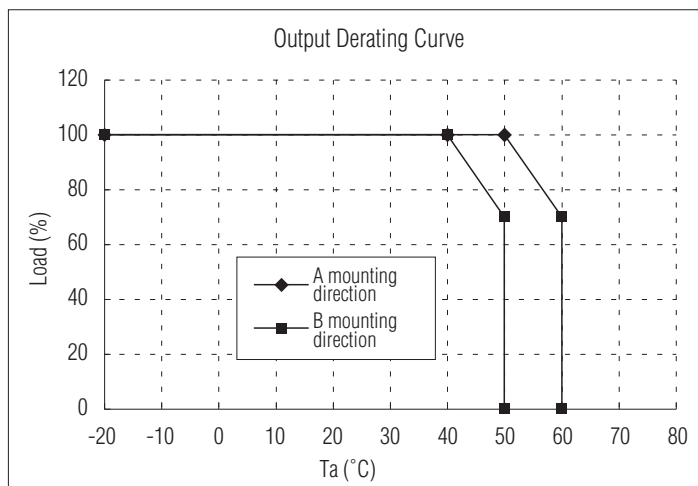
(*8) At 24VDC Input. (Refer to instruction manual.)

Outline Drawing



* Tolerance ± 1mm no indication
Unit: mm

Output Drawing



* Please note that all the information listed here is subject to change without prior notice due to technical improvements.

RDS100-24 specifications

(Please refer to prior use)

ITEMS	Specifications Item 1	MODEL	RDS100-24-5	RDS100-24-12	RDS100-24-15	RDS100-24-24
Input	Input Voltage Range	VDC	18 - 32			
	Efficiency (Typ) (*1)	%	78	79		80
	Input Current (Typ) (*1)	A	5.4			
	Inrush Current (Typ) (*1)	A	4.7A at Cold start			
Output	Nominal Output Voltage	VDC	5	12	15	24
	Maximum Output Current	A	20	8.3	6.6	4.2
	Maximum Output Power	W	100	99.6	99	100.8
	Maximum Line Regulation (*3)	mV	40	96	120	192
	Maximum Load Regulation (*4)	mV	50	100		200
	Temperature Coefficient		Less than 0.02 % / °C			
	Maximum Ripple (*2)	mVp-p	50	80		100
	Maximum Ripple & Noise (*2)	mVp-p	100	170	200	290
Features	Output Voltage Range (*8)	VDC	4.0 - 6.0	9.6 - 14.4	12.0 - 18.0	19.2 - 28.8
	Over Current Protection (*5)	A	22 - 24	9.3 - 9.9	7.4 - 7.9	4.7 - 5.1
	Over Voltage Protection (*6)	VDC	6.2 - 7.5	15.0 - 18.0	18.5 - 22.5	29.5 - 36.0
	Remote ON/OFF control		Possible			
	Parallel Operation		-			
Environment	Series Operation		Possible			
	Operating Temperature (*7)	°C	-20 to +60(-20 to +50° : 100%, +60°C : 70%)			
	Storage Temperature	°C	-25 - +75			
	Operating Humidity	%RH	20 - 95%RH (Non Condensing)			
	Storage Humidity	%RH	20 - 95%RH (Non Condensing)			
	Vibration		10 - 55Hz : 19.6m/s ² , X,Y,Z 1 hour each Designed to meet JIS E 3014-2-B			
	Shock		294m/s ² (time : 6±3ms) Designed to meet JIS E 3015-2-B			
Isolation	Cooling		Natural Air Cooling			
	Withstand Voltage		I/P - O/P - FG : 2kVAC (10mA) for 1min., O/P- CNT(RC) : 100VAC (100mA) for 1min.			
Standards	Isolation Resistance		O/P- FG : 500VDC 100MΩ, O/P-CNT (RC) : 100VDC 10MΩ			
	Safety		Designed to meet UL60950-1, CSA60950-1, EN60950-1			
	Conducted Emission		Designed to meet EN55011/EN55022-A, FCC-ClassA, VCCI-A			
Mechanical	Immunity		Designed to meet IEC61000-4-2(Level 2, 3), -4(Level3), -8(Level 4)			
	Weight	g	850			
	Size (W x H x D)	mm	60 x 95 x 220 (Refer to Outline Drawing)			

(*1) At 24VDC, Ta=25°C, nominal output voltage and maximum output power.

(*2) Measure with JEITA RC-9131A probe, Bandwidth of scope : 100MHz.

(*3) 18 - 32VDC, constant load.

(*4) No load-Full load, constant input voltage.

(*5) OCP TYPE : Constant current limit with automatic recovery.

(*6) OVP circuit will shut the output down. manual reset (Re Power on).

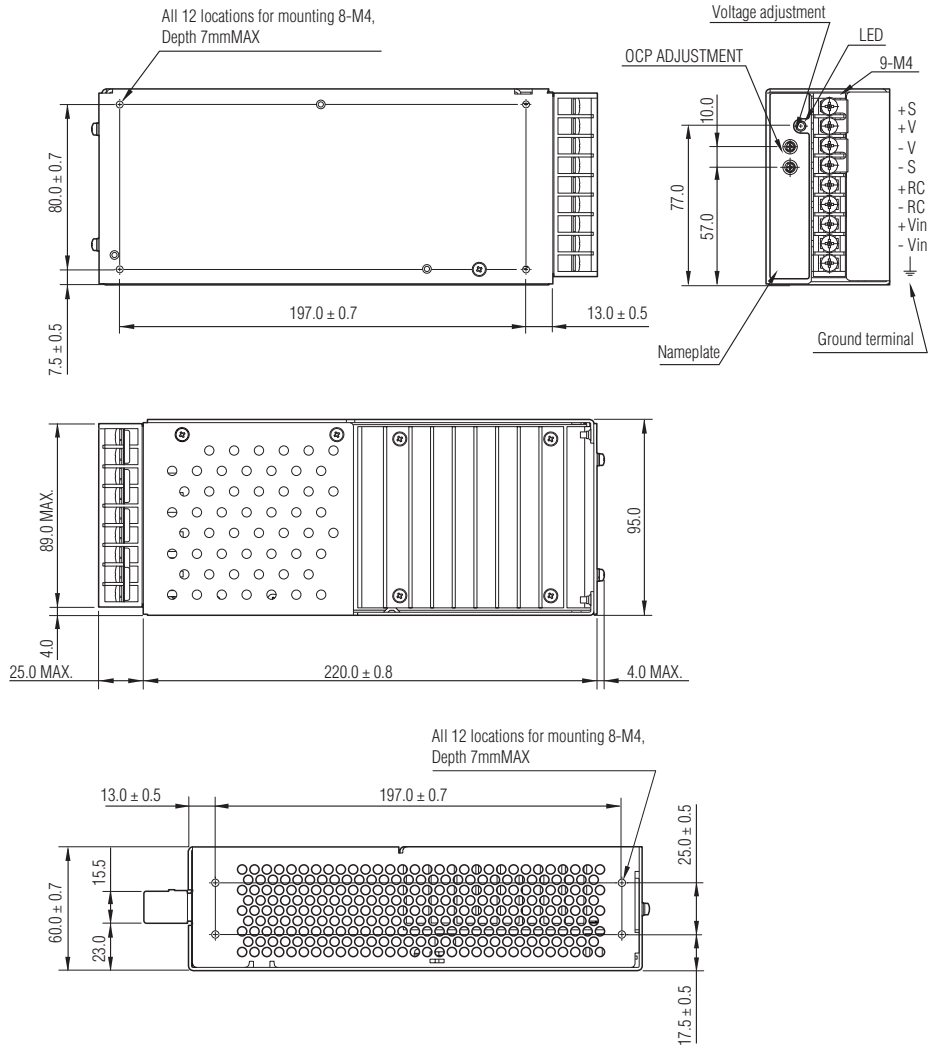
(*7) Ratings

- Derating at standard mounting. Refer to output derating curve (B028-01-02)

- Load (%) is percent of maximum output power or maximum output current, whichever is greater.

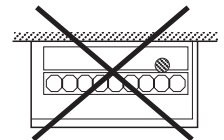
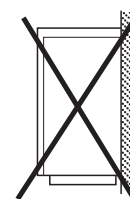
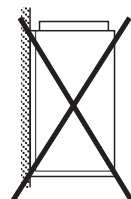
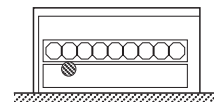
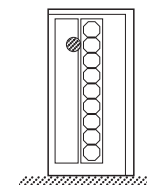
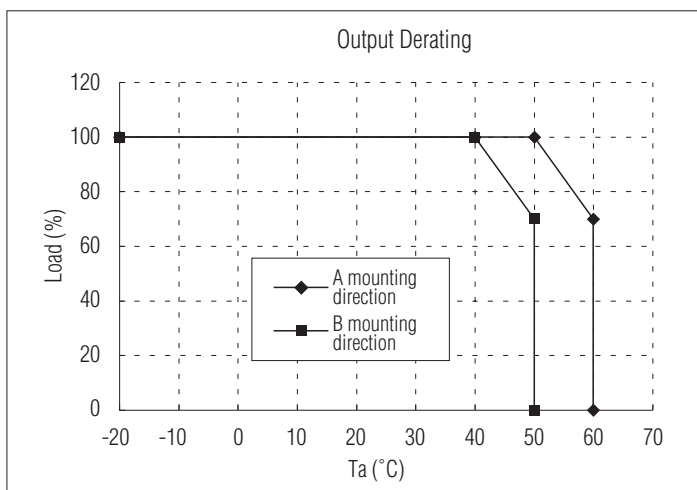
(*8) At 24VDC Input. (Refer to instruction manual.)

Outline Drawing



* Tolerance ± 1mm no indication
Unit: mm

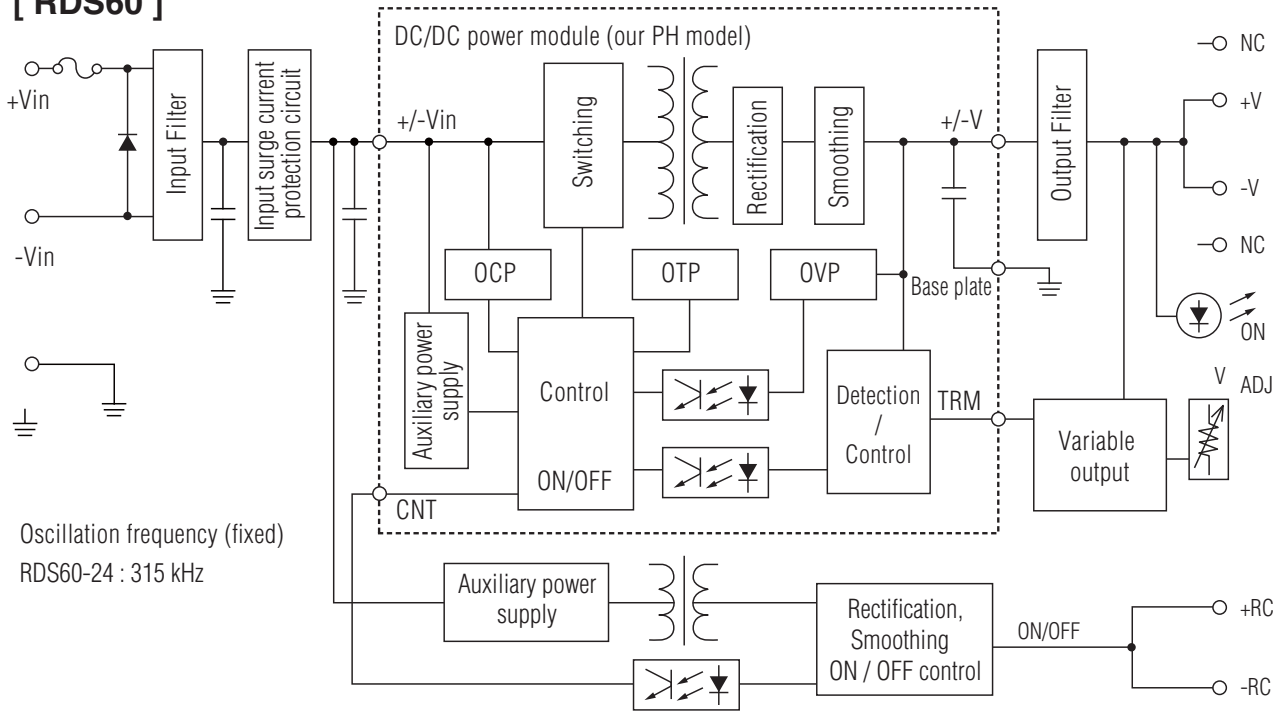
Output Derating



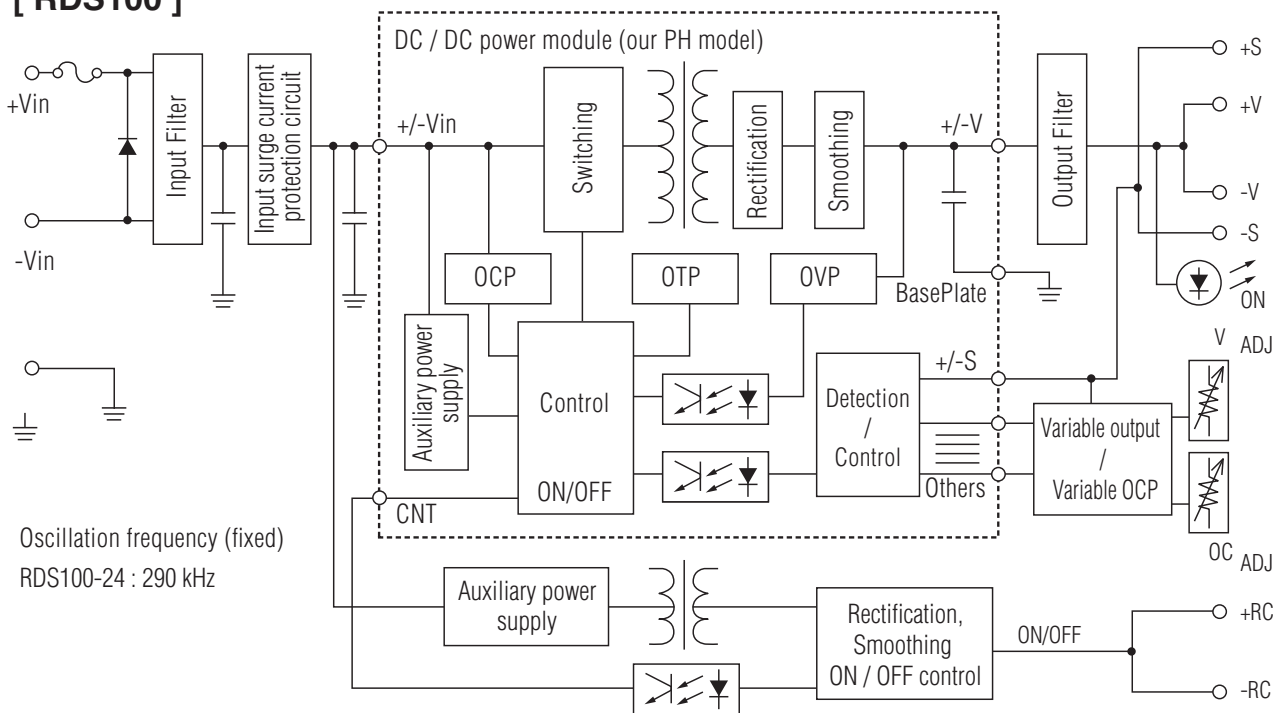
* Please note that all the information listed here is subject to change without prior notice due to technical improvements.

Block Diagram

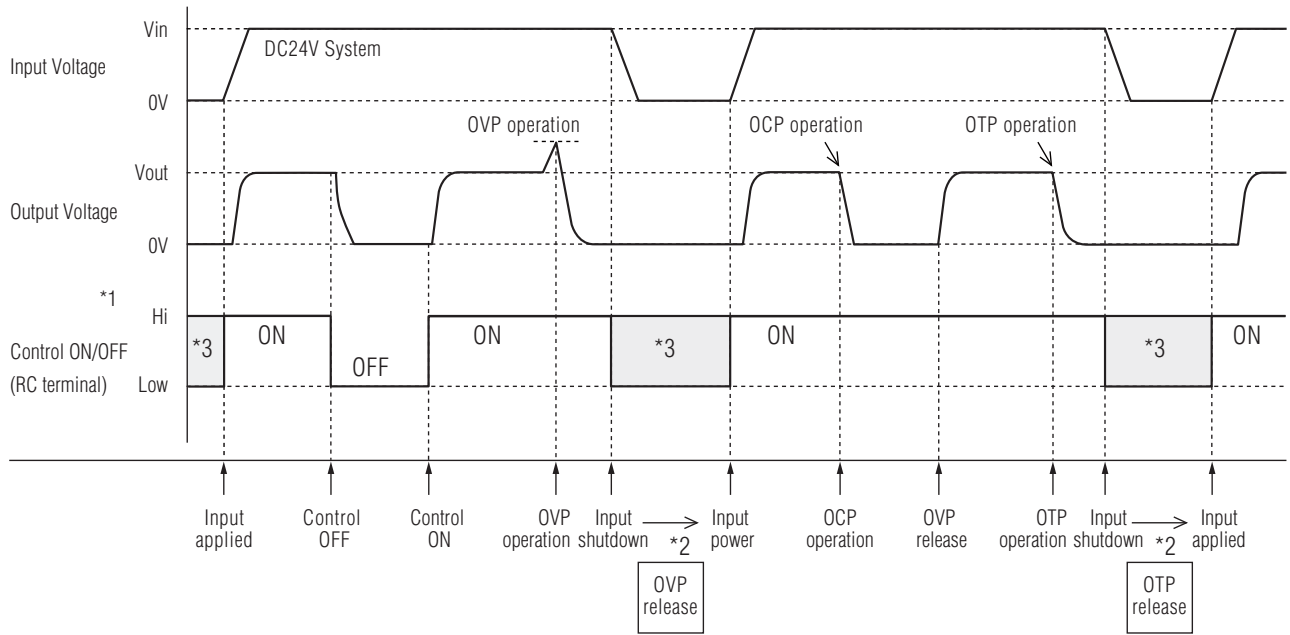
[RDS60]



[RDS100]



Sequence Time Chart



Abbreviation name — [OVP : Over-Voltage Protection
 OCP : Over-Current Protection
 OTP : Over-Temperature Protection
 RC : Remote Control

Note:

- *1 The RC terminals (+RC, -RC) are insulated from other terminals (floating).
 Control ON: RC terminals are open or an external voltage of 1.5 to 5 V is applied.
 Control OFF: RC terminals are short-circuited or an external voltage of 0 to 0.4 V is applied.
- *2 To cancel OVP and OTP, you must turn off the input and reenter it.
- *3 Turning off the input when +/- RC terminals are open will also set power voltage of the RC terminals to zero.

RDS Series Instruction Manual

Use of the Product

Be sure to read this instruction manual before starting to use the power supply. Carefully observe all precautions when using the power supply. Incorrect operation may lead to electrical shock, damage to the power supply or fire.

⚠ DANGER

- Do not use the power supply in the presence of flammable gas or other ignitable substances. Sparks from the power supply could ignite these substances and cause an explosion.

⚠ WARNING

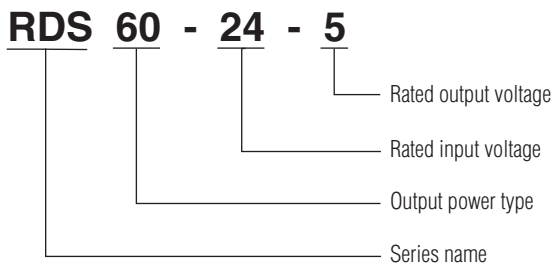
- During operation and immediately after powering it down, the surface of the power supply and internal components may contain high voltages and be very hot. Do not touch the power supply during operation or immediately after powering it down to prevent electrical shock and burn injuries.
- Do not bring your face or hands near the power supply during operation. Unforeseen circumstances could lead to injury.
- Do not modify, remove covers or disassemble the product. Failure to heed this instruction could lead to electrical shock or damage. Note that TDK-Lambda will not accept any liability for accidents arising from processing or modifications.
- Do not insert or drop foreign matter into the power supply. Use of the power supply under these conditions could lead to accidents or fire. And do not use the product if it has been dropped.
- If the product produces smoke, strange noise or exhibits other abnormal behavior, shut it down immediately. Otherwise, electrical shock or fire may result. Should this happen, contact TDK-Lambda. The customer should never attempt to repair the product himself as it will expose him to danger.
- Do not use the product if condensation has occurred. Otherwise, electrical shock or fire may result.

⚠ CAUTION

- This product is designed and manufactured to be incorporated in electronic assemblies and should be handled only by authorized service person.

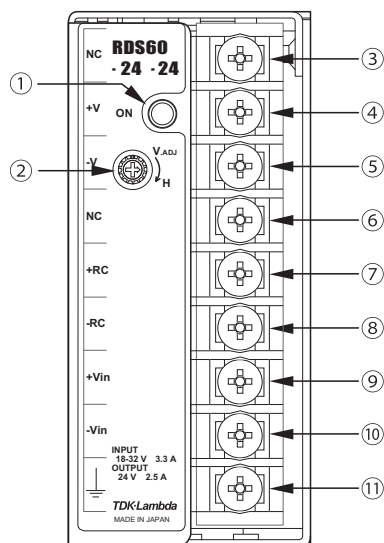
- Make sure that connections to input, output and signal terminals are correctly performed as stated in this instruction manual.
- Use the power supply within the input voltage, output current, output power, ambient temperature and humidity specifications. If operated outside the specifications, the power supply will break down.
- Do not use or store the power supply in a location exposed to condensation from moisture or humidity. If the product will be used under such conditions, measures to protect it from exposure to moisture must be taken.
- Do not use the power supply in a location exposed to strong magnetic fields or corrosive gas or where conductive foreign matter could enter it.
- The power supply may break down due to accident or unforeseen conditions. It must therefore be provided with a failsafe function when used in equipment where extremely high reliability is required (such as in nuclear equipment, traffic control equipment and medical instruments).
- Make sure no abnormal voltages are applied to the output and signal terminals. A reverse voltage or over-voltage that exceeds the rated voltage applied between the output terminals may damage the internal components of the power supply.
- Avoid overload and output short-circuit conditions lasting 30 seconds or longer. Otherwise, damage or dielectric breakdown may result.
- The output voltage of the power supply may, when damaged, exceed SELV. To maintain SELV, connect the secondary side to a protective grounding terminal when incorporating the power supply into your product.
- This power supply has a built-in rush current prevention circuit. If input to the power supply is frequently turned on and off, the inrush current prevention circuit may fail to work resulting in damage to the supply.
- If the internal fuse is blown, contact TDK-Lambda as an internal failure is likely.
- The information in this instruction manual is subject to change without prior notice. Be sure to refer to the most recent data sheet to ensure that you can fully meet its specifications.
- This instruction manual may not be copied or reproduced in whole or in part without the permission of TDK-Lambda.

1. Model name identification method

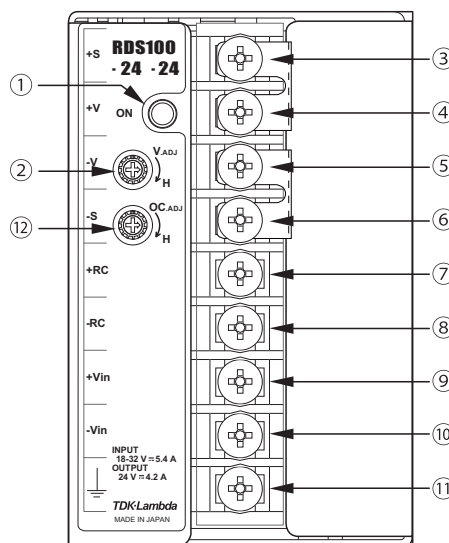


2. Terminal description

RDS60 - 24



RDS100 - 24



RDS60 Terminal and function description

- ① ON : Output indicator LED (lights green during power output)
- ② V. ADJ : Output voltage adjustment (turn clockwise to raise output)
- ③ NC : Not connected
- ④ + V : + output terminal
- ⑤ - V : - output terminal
- ⑥ NC : Not connected
- ⑦ + RC : Remote On/Off terminal | Off when ⑦⑧ are short-circuited
- ⑧ - RC : Remote On/Off terminal | On when ⑦⑧ are open
- ⑨ + Vin : + input terminal (the fuse is built-in)
- ⑩ - Vin : - input terminal
- ⑪ ↓ ↓ Ground terminal

RDS100 Terminal and function description

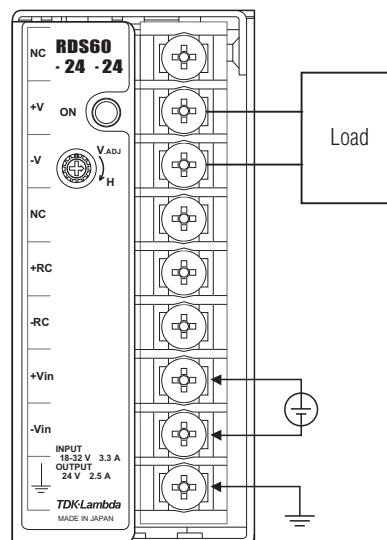
- ① ON : Output indicator LED (lights green during power output)
- ② V. ADJ : Output voltage adjustment (turn clockwise to raise output)
- ③ + S : + remote sensing terminal
- ④ + V : + output terminal
- ⑤ - V : - output terminal
- ⑥ - S : - remote sensing terminal
- ⑦ + RC : Remote On/Off terminal | Off when ⑦⑧ are short-circuited
- ⑧ - RC : Remote On/Off terminal | On when ⑦⑧ are open
- ⑨ + Vin : + input terminal (the fuse is built-in)
- ⑩ - Vin : - input terminal
- ⑪ ↓ ↓ Ground terminal
- ⑫ OC. ADJ : Over-current protection adjustment (turn counterclockwise to reduce set over-current)

3. Terminal connections

Input connections must be performed with care as an incorrect connection could damage the power supply.

- * Make sure all inputs are turned off before connecting an input.
- * Connect a protective grounding to the power supply (protective grounding terminal) or to a securing screw on the power supply receptacle.
- * Input lines should be separated from output lines to increase noise immunity.
- * Use twisted pair or shielded wires for the sensing and remote On/Off signal wires when using the remote sensing function and remote On/Off function and be sure to keep them separate from the output (load) wires.
- * The current per terminal should be 25 A or less and be sure to use the power supply within its rated value.

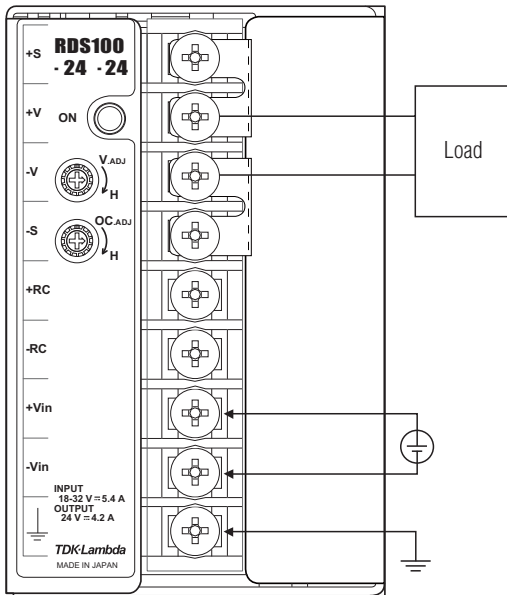
RDS60 - 24



RDS100 - 24

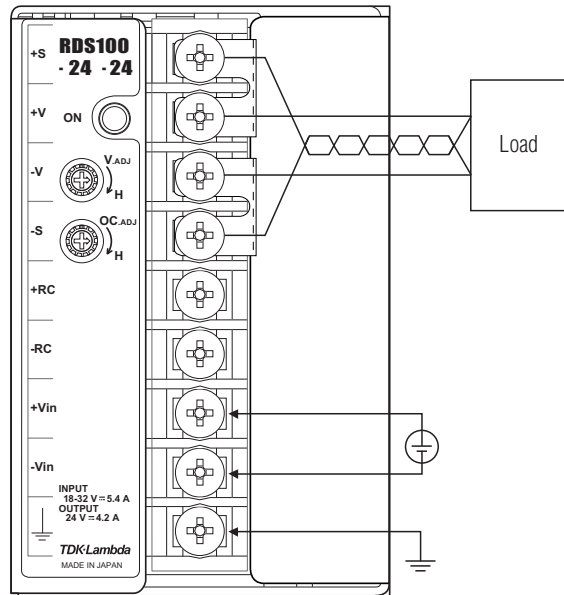
● Basic connections (local sensing)

Connect short-circuit pieces between the +S terminal and +V terminal and between the -S terminal and -V terminal. (The short-circuit pieces are packed with the power supply at shipment.)



● When using remote sensing function

- 1) Connect the +S terminal to + load terminal.
 - 2) Connect the -S terminal to - load terminal.
- * When the sensing terminal is open, the output is turned off.



4. Function description and handling precautions

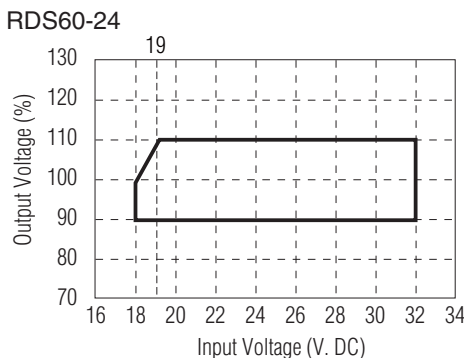
1 Input voltage

The input voltage range is 18 to 32 V DC. Note that applying an input voltage that exceeds stipulated range may damage the power supply.

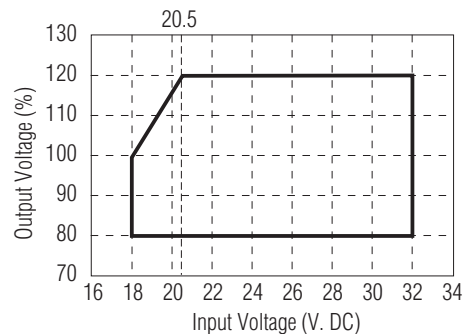
2 Output voltage range

The output voltage range is set to the rated output voltage value at shipment. Use the volume adjuster (V. ADJ) to change the output voltage. Use the product within the output voltage range shown in the table below. Turn the control clockwise to raise the output voltage. Note that raising the output voltage too high may trip the over-voltage protection function and turn off the output. When the output voltage is raised, be sure to set the output power of the power supply at a value that is below the rated output power value.

Output voltage range



RDS100-24



3 Input surge current (input rush current)

This power supply is provided with an input surge current prevention circuit. Note that reentry of input after power on increases input surge current.

The value in the specifications is the value at cold start in an ambient temperature of 25°C. This must be taken into account when selecting input switches and external fuses.

4 Over-voltage protection (OVP)

This is the power supply comes with an OVP function (output shutdown method and manual reset type).It shuts down the power supply when it operates in a range between 115 to 150% of rated output voltage. When OVP is triggered, the inputs are temporarily shut down. Reentry of the inputs about 1 minute later will recover the output.

The OVP setting is fixed and cannot be changed.

Note that applying a voltage to the output terminals that exceeds the output voltage range may damage the power supply. When an inductive load is used, connect a protective diode to the output line.

5 Over-current protection (OCP)

This power supply has constant current and voltage limit with automatic recovery. The OCP function lowers the current when the maximum output current is exceeded. The output is automatically restored when the over-current or short-circuit condition is cleared.

Do not allow the product to operate in an over-current or output short-circuit state for 30 seconds or longer as it will damage the power supply.

RDS60-24 : The OCP setting is fixed and cannot be changed.

RDS100-24 : Use the (OC.ADJ) control to change the OCP set value. Turning the control counterclockwise lowers the OCP set value. The lower limit of the OCP set value is about 30% of maximum rated output current.

6 Over-temperature protection (OTP)

When ambient power supply temperature or internal power supply temperature rises abnormally high, this function shuts down the output.

When the over-temperature function is triggered, inputs are temporarily shut down. If inputs are reentered when the temperature has dropped sufficiently, the output is restored.

7 Remote sensing (+S, -S terminals)

The RDS100-24 is equipped with a remote sensing terminal that corrects line drops (voltage drops in the line) from the output terminal of the power supply to the load terminal.

If the remote sensing function is not needed (and local sensing will be used), short circuit the +S terminal and the +V output terminal as well as the -S terminal and the -V output terminal. Use the correction voltage range for line drops when the +V and -V output voltage is in the output variable range and within maximum output power.

And the line drop voltage between -V and -S is 2 V or less. Use shielded or twisted pair wire to lower the impact of noise for remote sensing wire.

8 Remote On/Off control function

The remote On/Off function is built in. This function turns the output on and off as shown in the table below when an input voltage is applied.

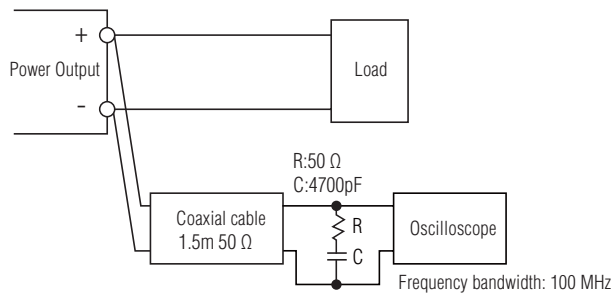
State of output between +RC and -RC terminals	Output state
$1.5 \leq H \leq 5V$ or open	ON
$0 \leq L \leq 0.4V$ or shorted	OFF

9 Output ripple and noise

The standard specification for maximum ripple and noise voltage value is a value measured by a prescribed measurement circuit. (specified by JEITA: RC-9131A)

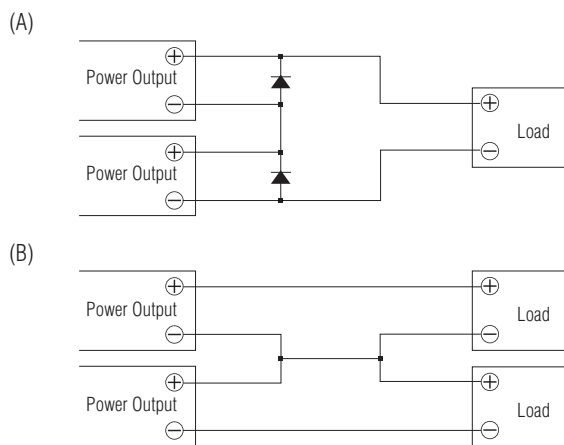
When load lines are longer, connect an electrolytic capacitor, a film capacitor or the like to the load terminal to suppress ripple and noise.

Note that an accurate ripple and noise measurement is not possible if the probe ground lead of the oscilloscope is too long.



10 Series operation

Use either method (A) or (B) for series operation.



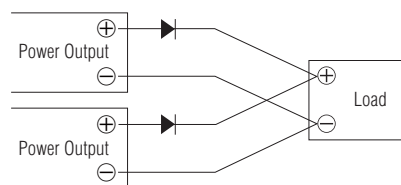
When using series operation (A), connect a bypass diode. Use a bypass diode with a forward current rating that is equal to that of the load current and with a reverse withstand voltage rating that will be capable of handling each power supply output voltage.

11 Parallel operation

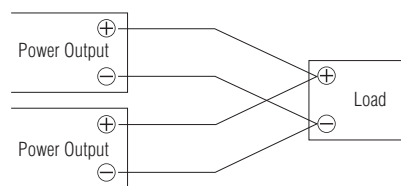
Both the RDS60-24 and the RDS100-24 permit parallel operation according to method (A).

The RDS100-24 also permits parallel operation according to method (B). However, set the OCP set value to 90% or less of the rated value in parallel operation according to (B).

(A) To operate the supply as a backup power supply



(B) To increase output current

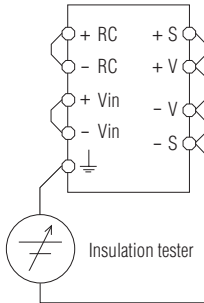


12 Insulation resistance test

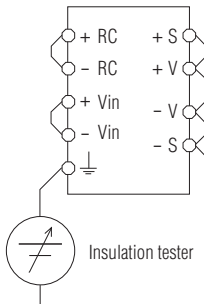
The insulation resistance between output and protective grounding must be 100 MΩ or greater at 500 V DC and the insulation resistance between output and RC must be 10 MΩ or greater at 100 V DC.

For the sake of safety, set the voltage of the DC insulation tester before the insulation test and use a resistor or other device to perform proper discharging after the test.

* Between output and protective grounding: 100 MΩ or greater at 500 V DC



* Between output and RC: 10 MΩ at 100 V DC



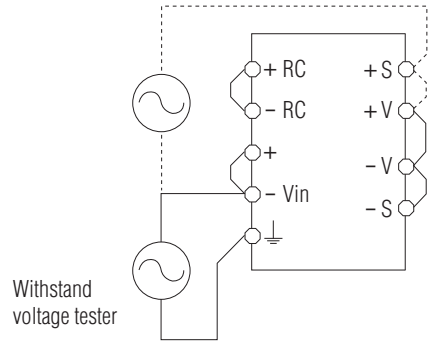
Raise test voltage application gradually from zero and gradually decrease the voltage to shut down. If the test is performed using a timer, an impulsive high voltage could be generated between voltage application and shutdown resulting in damage to the power supply.

Make the connections to the input and output sides as shown below.

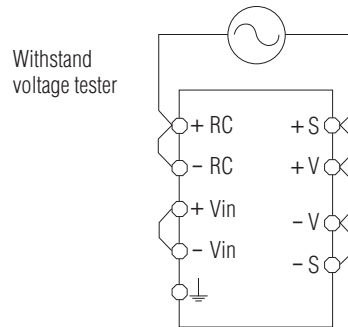
Tests of outputs when open may lead to instantaneous generation of output voltages.

Input – output (dotted line): 2.0 kV AC, 1 minute (10 mA)

Input – protective grounding (solid line): 2.0 kV AC, 1 minute (10 mA)



Output – RC 100 V AC, 1 minute (100 mA)



13 Withstand voltage test

This series is designed to withstand 2.0 kV AC between input and output, 2.0 kV AC between input and protective grounding and 100 V AC between output and RC each for one minute.

The withstand voltage tester should be set to a limit value of 10 mA before testing (output to protective grounding: 100 mA).

5. Installation procedure

1 Installation procedure

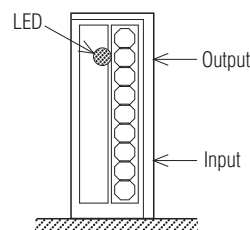
The power supply can be mounted as shown in the figures below. (A) shows standard mounting.

(B) is also possible. Mount the supply only as shown in (A) or (B).

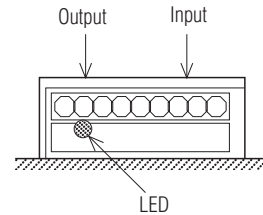
Make sure that operation at ambient power supply temperature and preferred mounting attitude satisfies the output derating value shown in the figure below. Consult us if you want to install the supply as shown in (A) but upside down.

The output derating value below is 100% of maximum rated output value.

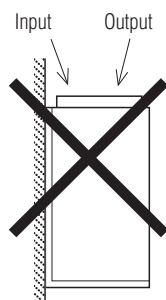
(A) Standard installation



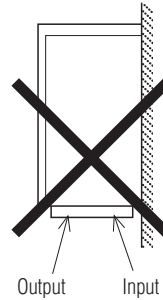
(B) Standard installation



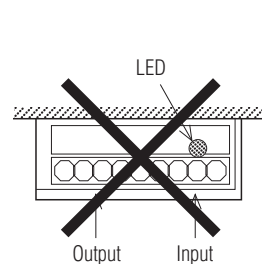
(C) Don't use



(D) Don't use

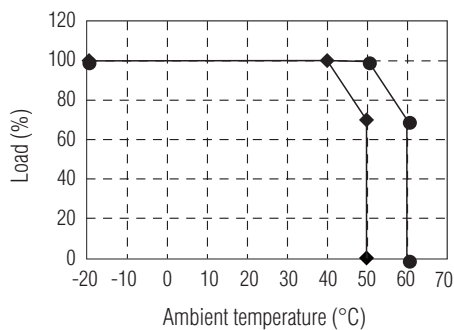


(E) Don't use



2 Output derating

Natural convection cooling

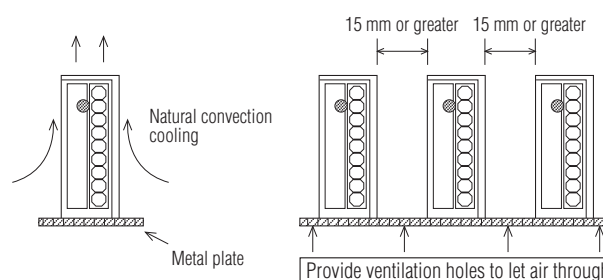


- Installation procedure (A)
- ◆ Installation procedure (B)

Ambient temperature (°C)	Load (%)	
	Installation procedure (A)	Installation procedure (B)
-20 - +40	100	100
+50	100	70
+60	70	-

3 Precautions to be taken during installation

- (1) This power supply uses natural convection cooling. Provide free space of 15 mm or more around the supply for adequate natural convection cooling to prevent heat from the supply building up inside. When multiple units are used, provide the same amount of space around the units.
- (2) Be sure to connect the protective grounding terminal to the protective grounding terminal of the device or equipment. Input feedback noise, radiation noise and output noise increase if not connected.
- (3) The securing screws of the power supply should not reach more than 7 mm into the supply. Make sure that improperly tightened screws do not fall into the power supply.
- (4) Recommended tightening torque for power supply screws
M4 screws: 1.27 N m (13.0 kgf. cm)



6. Wiring procedure

- (1) Be sure to separate input and output wires. Also use twisted pair wire to raise sound to noise ratio.
- (2) Be sure to twist sensing wires and separate them from the output load.
- (3) Input and output wires should be as thick and short as possible to lower impedance.
- (4) Connect a capacitor to the load terminal to improve the noise elimination effect.
- (5) For better safety and noise removal, use thick wires to connect instruments with a power supply to a ground terminal.

7. External fuse rating

Use fuses with the rating described below when installing an external fuse in the power supply input line.
 The fuse rating should accommodate the inrush current (input surge current) that occurs when an input is applied.
 A fuse rating cannot be selected from the input current value (RMS) at actual load.

- RDS60 - 24 : F6.3AL
- RDS100-24 : F10AL

8. Troubleshooting

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

- (1) Check if the rated input voltage is applied.
- (2) Check if input and output terminals have been correctly wired.
- (3) Check if the input and output terminal connections have been tightened to the prescribed torque value.
- (4) Check if the wire material is too thin.
- (5) Check if the supply uses output current and output power that is higher than the prescribed value.
- (6) Check whether the OCP control has been turned up too much. If set too high, the over-current protection function will be triggered and cause the output voltage to drop.
- (7) Check whether the variable output voltage control has been turned up too much. If set too high, the over-voltage protection function will be triggered and shut down the output.
- (8) Check whether the sensing terminal is open. If open, the over-voltage protection function will be triggered and shut down the output.
- (9) Check whether the remote ON/OFF control terminal has been short-circuited. When short-circuited, the output will stop. Check whether prescribed connections have been made.
- (10) The power supply may generate noise at certain frequencies when the load fluctuates.

9. Warranty

This product is warranted for a period of 5 years from the date of shipment.

During the warranty period, breakdowns that occur during normal use of the product will be repaired free of charge.

The warranty defines normal use as use under the following conditions.

- (1) An average operating temperature of 40°C or less (ambient supply temperature)
- (2) An average load rate of 80% or less
- (3) Installation method: Standard installation

However, the maximum rating must be within the output derating range.

The following are not covered by the warranty.

- (1) Improper handling such as dropping the supply or exposing it to impact and operating it at conditions that exceed product specifications.
- (2) Damages arising from fire, floods and other natural disasters.
- (3) Breakdowns arising from conditions beyond the responsibility of TDK-Lambda, for example, modifications and repairs performed by personnel other than TDK-Lambda or personnel designated by TDK-Lambda.