RDS Series (24V, 48VDC Input)
Instruction Manual
RDS30-24, RDS60-24, RDS100-24, RDS180-24, RDS30-48, RDS60-48

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.
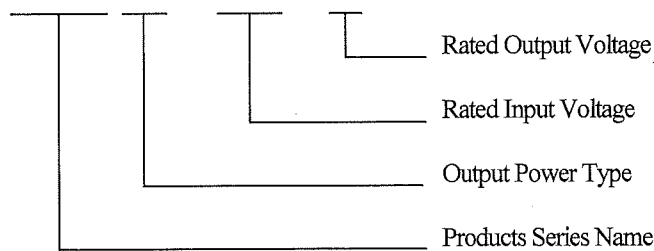
⚠ **CAUTION**
- This power supply is designed and manufactured for use within an end product such that it is accessible to SERVICE ENGINEERS only.
- Confirm connections to input/output and signal terminals are correct as indicated in the instruction manual before switching on.
- Input voltage, Output 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 and signal terminal 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.
- The outputs of this product may, under fault conditions, exceed SELV voltage limits. Therefore the outputs 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.
- This product has Input Surge (Inrush) Current Suppressor inside.
  Frequent repetition of input might cause damage to internal components because of generating surge current.
- 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.

DWG No. : B028-04-01		
APPD	CHK	DWG
N. Uesono	*J. Kurosawa*	*A. Rozak*
17. Oct. '11	*14. Oct. '11*	*14. Oct. '11*

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1. Model Name Identification

RDS 60 – 24 – 5

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RDS 60 – 24 – 5
                └──── Rated Output Voltage
           └──────── Rated Input Voltage
      └───────────── Output Power Type
  └───────────────── Products Series Name
```

2. Block Diagram

【 RDS30 RDS60 】

DC/DC Power Module (TDK-Lambda Products)

Operation Frequency (Fixed)
RDS30-24, RDS60-24: 315kHz
RDS30-48, RDS60-48: 325kHz

【 RDS100 RDS180 】

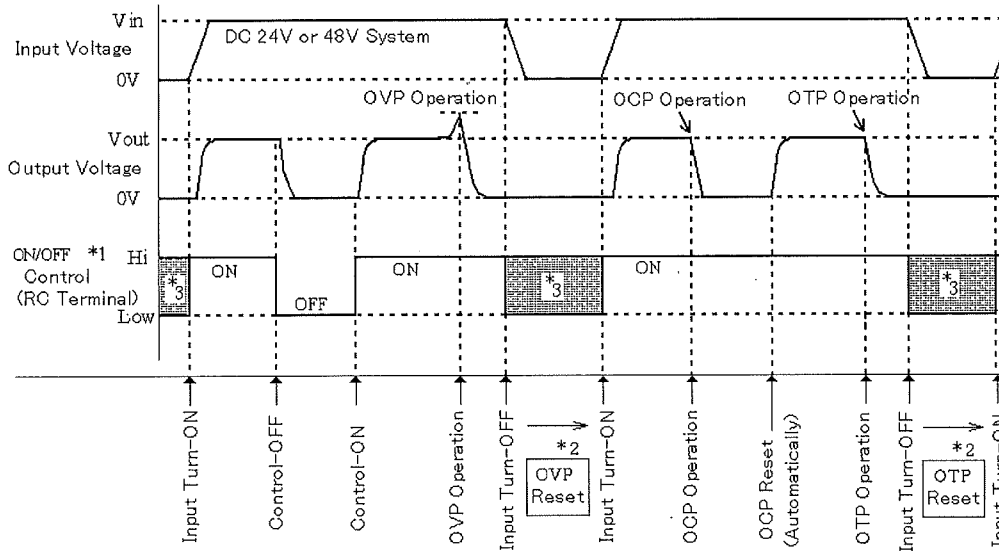DC/DC Power Module (TDK-Lambda Products)

Operation Frequency (Fixed)
RDS100-24, RDS180-24: 290kHz

3. Sequence Timing Chart

Abbreviation Symbol
{ OVP: Over Voltage Protection
OCP: Over Current Protection
OTP: Over Temperature Protection
RC: Remote (ON/OFF) Control }

Note)
*1 +RC/-RC Terminal are isolated from other terminals. (Floating)
{ Control-ON :
Open the +/- RC terminal or apply external voltage 1.5V~5V
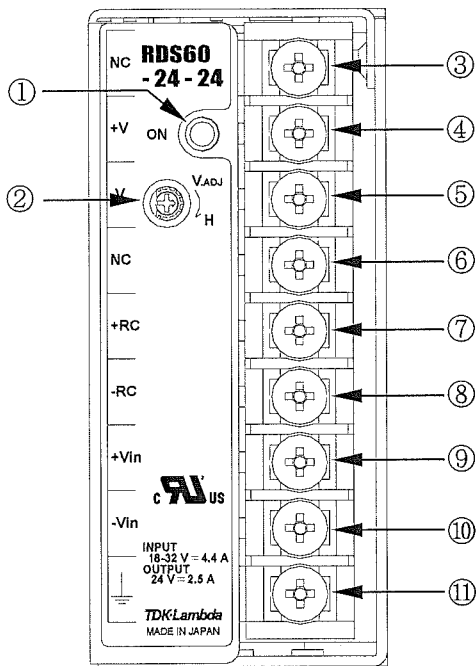Control-OFF :
Short the +/- RC terminal or apply external voltage 0V-0.4V }

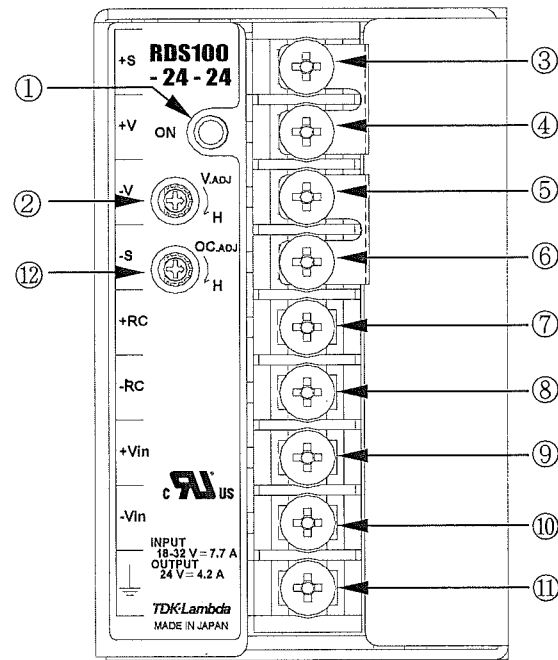*2 Please turn off the input once to reset OVP or OCP shutdown.

*3 When turning ON by +/- RC terminal opening, this terminal voltage will be lost if input is turned off.

4. Terminal Layout Description

RDS30-24, RDS60-24, RDS30-48, RDS60-48

RDS100-24

RDS30, RDS60 Terminal & Function

① ON : Output Indicator (Green LED lights up when output is ON)
② V.ADJ : Output Voltage Adjustment
(Output Voltage increases by turning the VR in CW* direction)
③ N C : No Connection
④ + V : + Output Terminal
⑤ − V : − Output Terminal
⑥ N C : No Connection
⑦ + RC : + Remote ON / OFF | Open the ⑦ & ⑧ to turn ON
⑧ − RC : − Remote ON / OFF | Short 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, **CCW : Counter Clock Wise
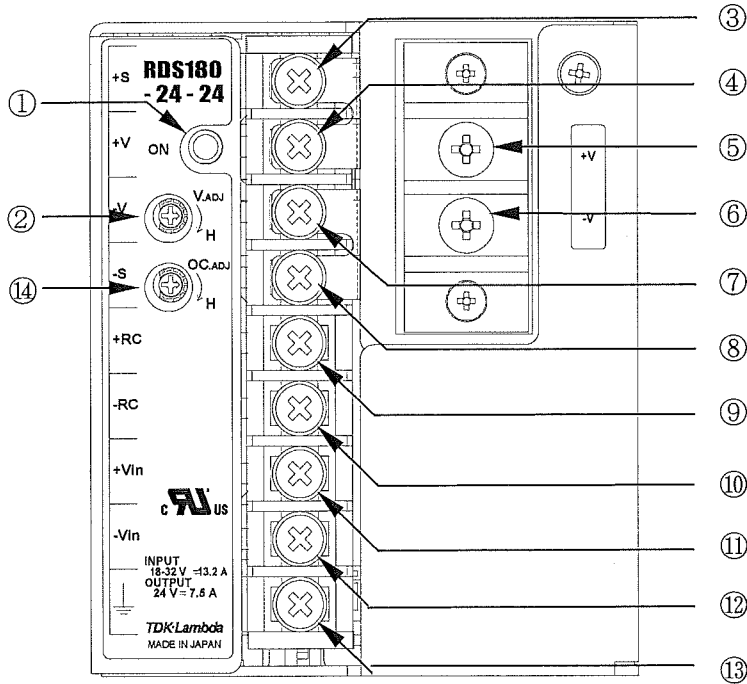
RDS100 Terminal & Function

① ON : Output Indicator (Green LED lights up when output is ON)
② V.ADJ : Output Voltage Adjustment
(Output Voltage increases by turning the VR in CW* direction)
③ + S : + Remote Sensing
④ + V : + Output Terminal
⑤ − V : − Output Terminal
⑥ − S : − Remote Sensing
⑦ + RC : + Remote ON / OFF | Open the ⑦ & ⑧ to turn ON
⑧ − RC : − Remote ON / OFF | Short the ⑦ & ⑧ to turn OFF
⑨ + Vin : + Input Terminal (Internal Fuse inside)
⑩ − Vin : −| Input Terminal
⑪ ⏚ : ⏚ Terminal for Protective earth
⑫ OC.ADJ : OCP Adjustment
(Output Current decreases by turning the VR in CCW** direction)

RDS180 - 24

RDS180 Terminal & Function

① ON   : Output Indicator (Green LED lights up when output is ON)

② V.ADJ   : Output Voltage Adjustment
      (Output Voltage increases by turning the VR in CW* direction)

③ + S   : + Remote Sensing

④,⑤ + V   : + Output Terminal

⑥,⑦ − V   : − Output Terminal

⑧ − S   : − Remote Sensing

⑨ + RC   : + Remote ON / OFF | Open the ⑨ & ⑩ to turn ON

⑩ − RC   : − Remote ON / OFF | Short the ⑨ & ⑩ to turn OFF

⑪ + Vin   : + Input Terminal (Internal Fuse inside)

⑫ − Vin   : − Input Terminal

⑬ ⏚   : Terminal for Protective earth

⑭ OC.ADJ   : OCP Adjustment
      (Output Current decreases by turning the VR in CCW** direction)

Abbreviation Note) * CW : Clock Wise,   ** CCW : Counter Clock Wise

5. How to Wire the Terminal

Take enough caution when wiring the input line. Improper connection would cause damage to power supply unit.

- Be sure that the input is cut off when wiring each terminal.
- When applying Protection Ground, use the terminal with the symbol '⏚' or use fixing screw of the (sheet-metal) chassis.
- When wiring, separate input & output line to improve immunity for switching noise.
- When using Remote Sensing or Remote ON/OFF function, be sure to use twisted pair or shield wire for sensing or ON/OFF signal line, and separate them from the output (load) line.
- Current rating is 25A maximum for the each terminal, but use within the maximum current rating of each RDS model. Only for RDS180-24-5 model, when load current is more than 25A, use 2set +/-V terminal of 2P & 9P terminal housing while taking into account current balance, and connect +V(2P) / +V(9P), -V(2P) /-V(9P) to each other.

RDS30-24, RDS60 -24, RDS30-48, RDS60 -48
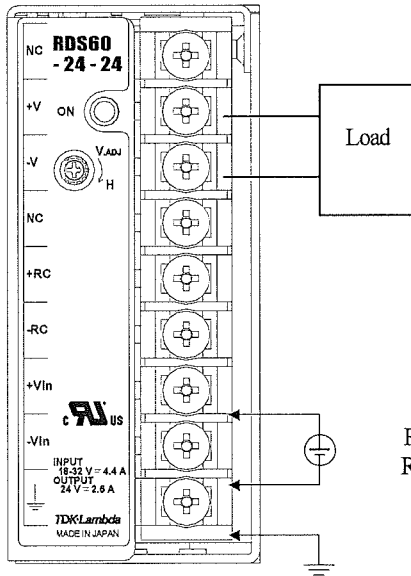
RDS30 & RDS60 have the same terminal layout.
RDS60 is shown here as a representative.

RDS100 -24

·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 cut.
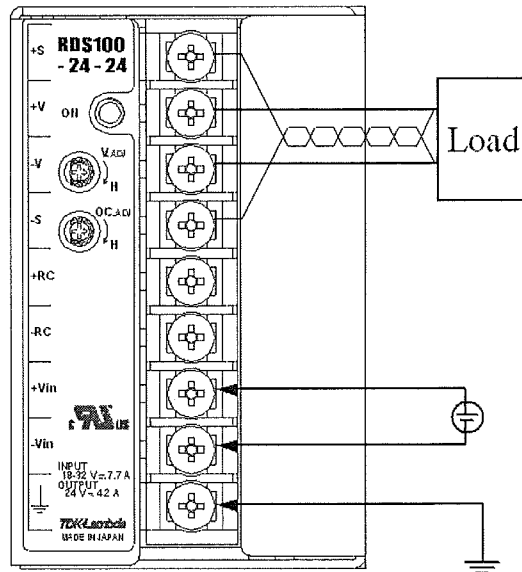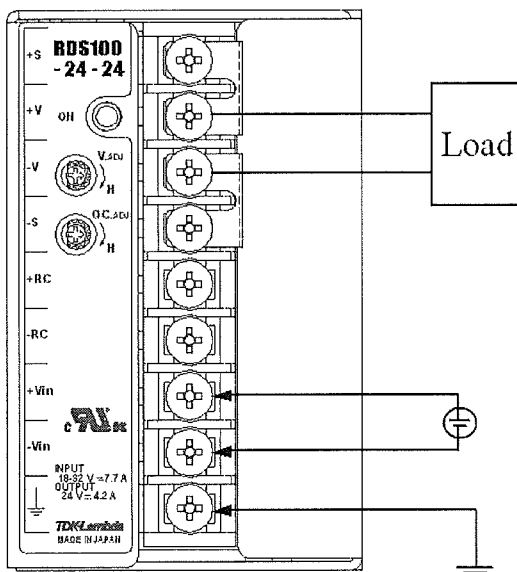
RDS180-24

• Basic Connection (Local Sensing)	• How to use Remote Sensing
Connect +S to +V, and −S to -V terminal	1) Remove the short piece (originally attached).
by using the short piece (sheet metal).	2) Connect +S & +V terminal by wiring.
(Short piece is attached when shipping.)	3) Connect -S & -V terminal by wiring.
	* Note) Output shuts down when sensing line is cut.

Please consider the current balance for output terminal when wiring. (Current rating of the terminal is 30A for 2P type, and 25A for 9P type.)
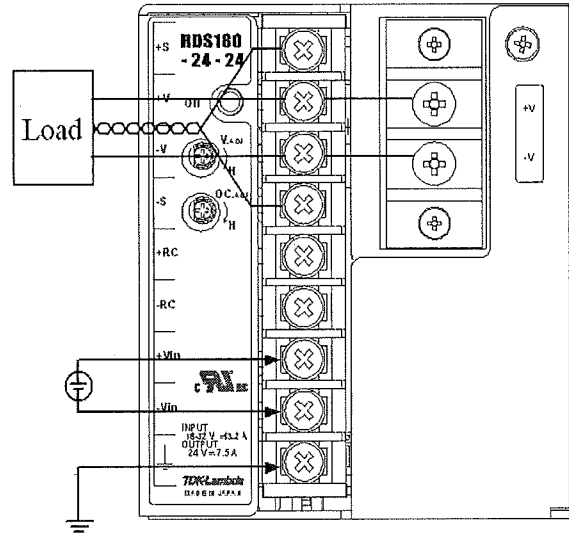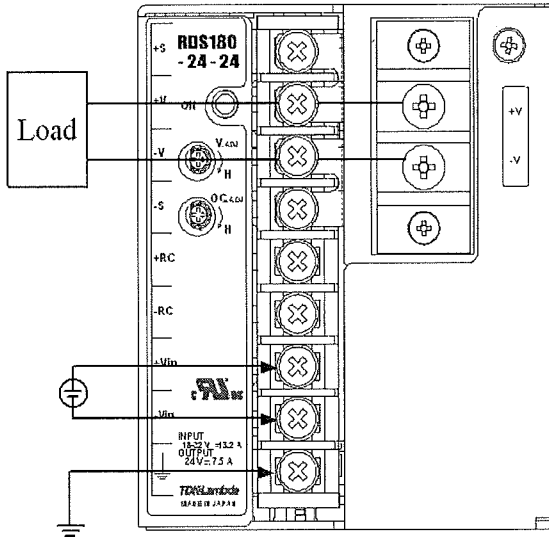
6. Function & Precautions

6-1. Input Voltage Range

Input voltage range is as shown below. Take note that product will be damaged especially when input voltage exceeds maximum rating.
- RDS30-24, RDS60-24, RDS100-24, RDS180-24 : $18 \sim 32V$ DC
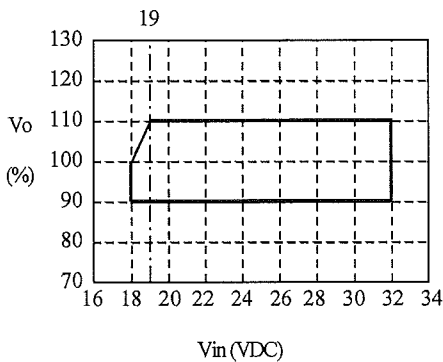- RDS30-48, RDS60-48 : $36 \sim 63VDC$

6-2. Output Voltage Range

Output voltage is adjusted to the center of rated value during shipment. Output voltage can be adjusted by the rotating VR of 'V.ADJ'.
Adjustment range of output voltage is as shown on the graphs below. Output voltage increases when rotating VR in CW direction.
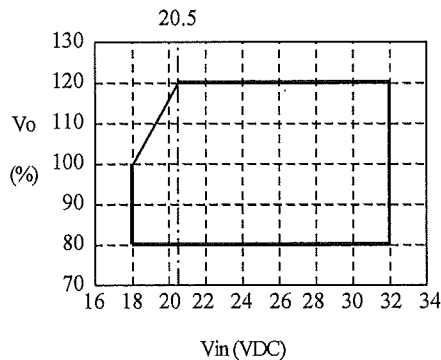Please note that output will shutdown due OVP activation when output voltage is adjusted too high..
Also, when output voltage is set higher than the typical rated setting, use within maximum output power rating.
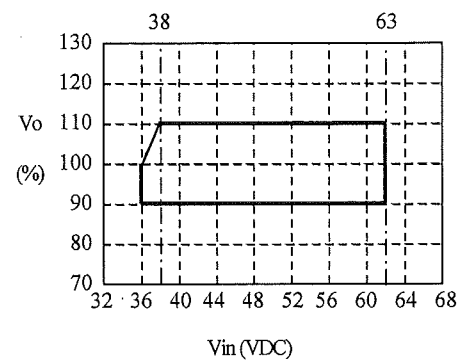

RDS30-24, RDS60-24   RDS100-24, RDS180-24   RDS30-48, RDS60-48

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 to reset OVP Latch.
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.

Inductive Load
Output Terminal ⊕ ⊖ Diode
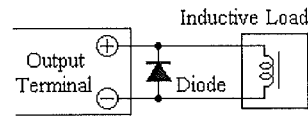
6-5. Over Current Protection (OCP)

OCP method is Constant Current Limit and automatic recovery. 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.
Never operate the unit under over current or shorted conditions for more than 30seconds, as this might to lead damage or failure.

·RDS30-24(48), RDS60-24(48) : OCP setting is fixed and cannot be adjusted externally.
·RDS100-24, RDS180-24 : OCP limit is adjustable by the VR of 'OC.ADJ'. OCP setting will decrease if the VR rotation is
CCW* direction. Minimum OCP set point is about 30% of nominal output current.
Avoid using in overload condition (more than 100% output current).

Abbreviation Note) * CCW : Counter Clock Wise

6-6. Over Temperature Protection (OTP)

The output will be shut down when abnormal rise of temperature for ambient or internal of the RDS unit is detected.
When OTP operation, please turn off input once, and turn on again after the temperature sufficiently dropped down to reset level.

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

The RDS100 & RDS180 have a remote sensing terminal to compensate voltage drop between RDS output terminal and the load.
When using as local sensing (Not using remote sensing), short +S/+V and –S/-V terminal by using a short piece sheet metal.
The compensation line drop voltage should be within adjust level and within maximum output power. Voltage drop level between
-V and -S must be less than 2V. Use shield or twisted pair wire to decrease influence of switching noise.

6-8. Remote ON/OFF Control Function (+RC, -RC Terminals)

Remote ON/OFF function is available inside. By using this function, ON/OFF control can be done according to the table below
even with input voltage applied.

Between +RC/-RC terminal	Output Condition
Open or Apply 1.5 to 5V	ON
Short or apply 0 to 0.4V	OFF

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.
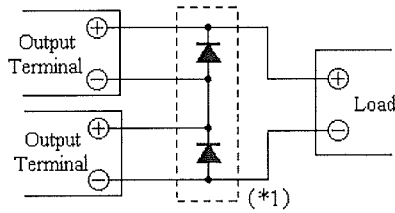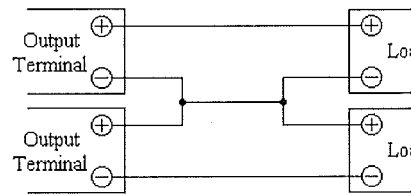

Output Terminal ⊕ ⊖ — Load ⊕ ⊖
R=50Ω, C=4700pF
Coaxial Cable 1.5m 50Ω — R, C — Oscilloscope
Bandwidth : 100MHz
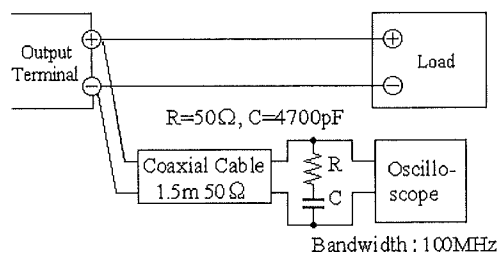
6-10. Series Operation

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

(A) Series Operation RDS to One Load

Output Terminal ⊕ ⊖
Output Terminal ⊕ ⊖
Load ⊕ ⊖
(*1)

(B) Series Operation both RDS & Load

Output Terminal ⊕ ⊖
Output Terminal ⊕ ⊖
Loа ⊕ ⊖
Loа ⊕ ⊖

(*1) Connect bypass diodes to prevent reverse voltage for (A). 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.
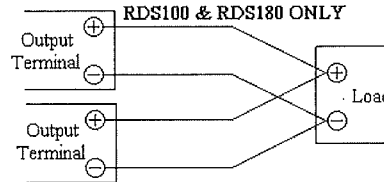
6-11. Parallel Operation

All RDS series can be used for Back-up Operation as shown in (A) connection below by setting output voltage to be equal to each other. And the parallel operation to increase output current is possible for RDS100 & RDS180 by setting OCP level to less than 90% each.

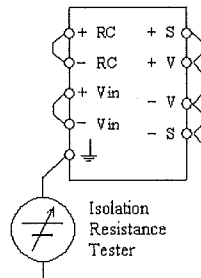(A) To use as Back-up Power Supply

Output Terminal ⊕ ⊖
Output Terminal ⊕ ⊖
Load ⊕ ⊖
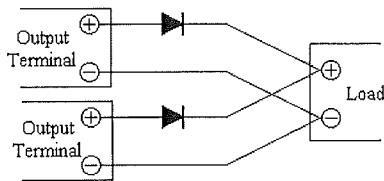
(B) To increase the Output Current

RDS100 & RDS180 ONLY

Output Terminal ⊕ ⊖
Output Terminal ⊕ ⊖
Load ⊕ ⊖

6-12. Isolation Resistance Test

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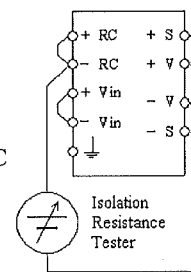
·Output - $\perp$ (Protective Earth) :

More than $100M\Omega$ at 500VDC

+ RC + S
− RC + V
+ Vin − V
− Vin − S
$\perp$

Isolation Resistance Tester

·Output - (+/-) RC :

More than $10M\Omega$ at 100VDC

+ RC + S
− RC + V
+ Vin − V
− Vin − S
$\perp$

Isolation Resistance Tester

6-13. Withstand Voltage

When testing withstand voltage, connect each input and output, or +RC and -RC terminals as follows.
RDS is designed to withstand 2.0kVAC between input & output, input & $\perp$ (Protective Earth), and 100VAC between output & (+/-) RC each for 1 minute. When testing, set current limit of the withstanding voltage tester to 10mA (For output & (+/-) RC: 100mA). The applied voltage must be gradually increased from zero to the testing value during testing and then gradually decrease after test. When timer is used, the power supply may be damaged by high impulse voltage generated during timer switch on and off.

Input - Output as dot line
and
Input - $\perp$ (Protective Earth) as solid line

2.0kVAC, 1 minute at 10mA Limit

+ RC + S
− RC + V
+ Vin − V
− Vin − S
$\perp$

* Withstanding Voltage Tester
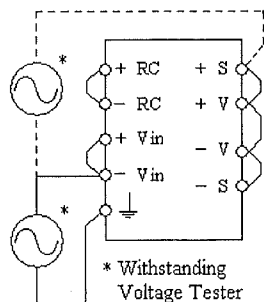
Output − (+/-) RC

100VAC, 1 minute

with 100mA Limit

+ RC + S
− RC + V
+ Vin − V
− Vin − S
$\perp$

* Withstanding Voltage Tester
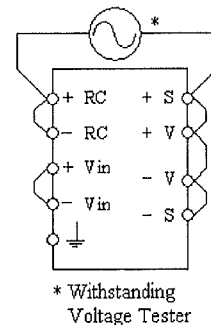
7. Mounting Method

7-1. Mounting Directions

Mounting directions for RDS are as shown below. Standard mounting is (A). However, laid mounting as (B) is also available.
Do not mount using (C) - (E) method. For RDS180 with the output more than 150W, use floating mount as shown below.
Use RDS according to the derating curve area by mounting direction and ambient temperature. Derating curve limitations are determined
by 100% of the rating output power of RDS series. For mounting method aside from the following, Please contact TDK-Lambda.

(A) Standard Mount (B) Laid Mount (C) Do not use (D) Do not use (E) Do not use (A) Standard Mount (RDS180-24)
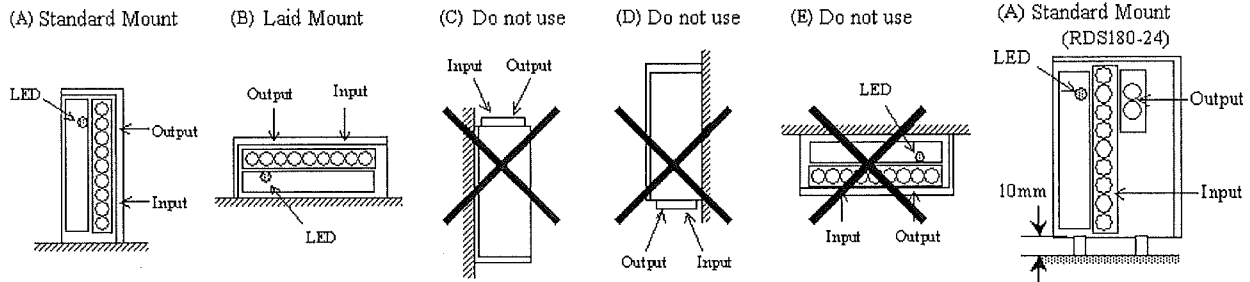
7-2. Output Derating

Natural Convection Cooling
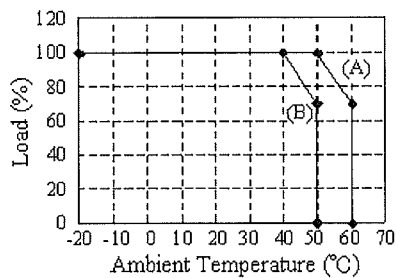
	Mount (A)	
	Mount (B)	
Ambient Temperature (°C)	Load (%)	
	Mount (A)	Mount (B)
-20 - +40	100	100
+50	100	70
+60	70	-

7-3. Precaution for Unit Mounting

(1) RDS Cooling method is natural convection. Keep a space more than 15mm each around RDS unit to avoid hot air from accumulating.
by providing a make natural air flow path by convection cooling. And same application is needed when using multiple RDS units.
(2) Connect Protective Earth Terminal (⏚) 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

M4 type screw : 1.27 N·m
(13.0kgf·cm)

Natural airflow
Floor
Sheet metal

Keep distance 15mm or more (each)

Ex) make a hole to go throuth airflow
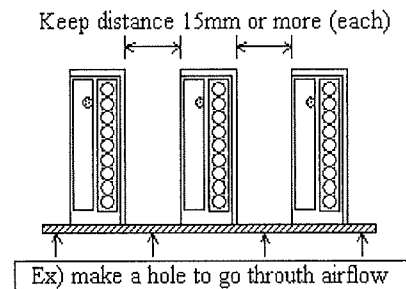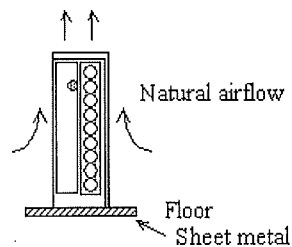
8. Wiring Method

(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 (⏚) 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).

RDS30 -24 : F5AL   RDS60 -24 : F6.3AL   RDS100-24 : F10AL   RDS180-24 : F30AL

RDS30 -48 : F3.15AL   RDS60 -48 : F4AL

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 OCP setting VR (OC.ADJ) is properly adjusted. OCP might be triggered and output will drop.
(7) Check if the output voltage setting (V.ADJ) is properly adjusted. OVP might be triggered and output will shut down.
(8) Check if sensing wire opened or not. OVP might be triggered and output will shut down.
(9) Check if remote ON/OFF (+/-RC) terminal is shorted or not. Output turns off if the terminal is shorted.
(10) 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.