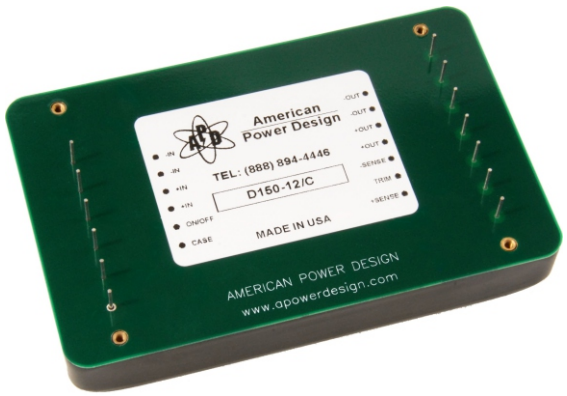
American Power Design, Inc.

"The best high voltage design solution"

RoHS

D150 SERIES 150 WATT DC/DC CONVERTERS



FEATURES

- Customer Selects Output Voltage
- Outputs to 28 Vdc
- Wide Input Ranges
  (10-20Vdc, 18-36Vdc, 20-60Vdc, 36-72Vdc)
- Excellent Line & Load Regulation
- Low Output Ripple
- 500 Vdc Output Isolation
- Continuous Short Circuit Protection
- Available in Chassis Mount
- Thermal Shutdown *(Self-Resetting)*

The D150 Series of DC/DC converters is available with single, dual, and triple outputs which are isolated from the input. They are enclosed in a six-sided metal case. Their low output ripple, and excellent regulation characteristics make them ideally suited for applications that demand a high degree of performance. All models will tolerate a short circuit indefinitely.

ELECTRICAL SPECIFICATIONS

Voltage Accuracy	+/-1%
Line Regulation	+/- 0.2%
Load Regulation	+/-1%
Outputs Ripple	< 100mV P-P
Outputs <10Vdc Ripple	< 75mV P-P
Output Trim (Single & Dual Models Only)	+/-10%
Input Filter	PI Network
Efficiency	87% (typ.)
Short Circuit Protection	Continuous
Switching Frequency	130 kHz
Output Isolation	500 Vdc
Input / Output Capacitance	< 1300pF

GENERAL SPECIFICATIONS

Temp. Stability	+/-0.02%/°C
Temp. (Operating , Case)	-40 to +85°C
Temp. (Storage)	-40 to +125°C
EMI/RFI	Six Sided Shield
Derating	None
Cooling	Free-Air Convection or Forced Air
Thermal Shut Down	100°C +/- 5°C *(Self-Resetting)*

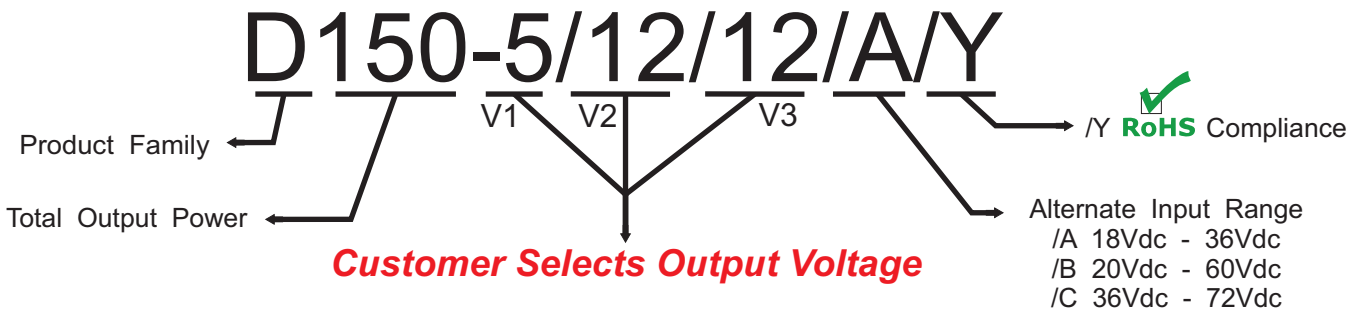
PHYSICAL SPECIFICATIONS

Dimensions	3.5 x 5.5 x 0.92 inches
Weight	19.5 Oz
Case Material	Black Coated Metal *(With Non-Conductive Base Plate)*

D150 SERIES 150 WATT DC/DC CONVERTERS

REPRESENTATIVE MODEL LISTING

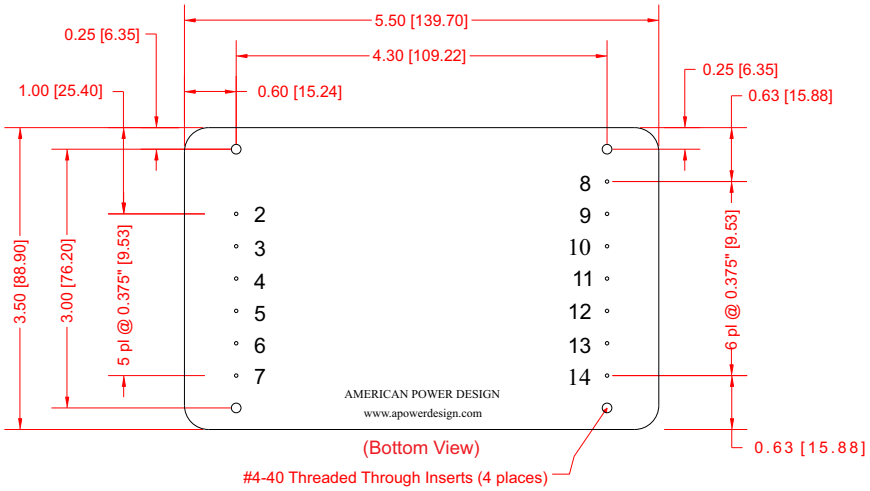
MODEL NUMBER		INPUT SPECIFICATIONS		OUTPUT SPECIFICATIONS					
				OUTPUT #1		OUTPUT #2		OUTPUT #3	
Non-RoHs	RoHs	VOLTAGE	CURRENT	VOLTAGE	CURRENT	VOLTAGE	CURRENT	VOLTAGE	CURRENT
D150-5	D150-5/Y	10V - 20Vdc	10.4 A	5 Vdc	20 A	-	-	-	-
D150-12	D150-12/Y	10V - 20Vdc	12.8 A	12 Vdc	10.4 A	-	-	-	-
D150-12/12	D150-12/12/Y	10V - 20Vdc	12.24 A	12 Vdc	5.2 A	12 Vdc	5.2 A	-	-
D150-15	D150-15/Y	10V - 20Vdc	12.8 A	15 Vdc	8.3 A	-	-	-	-
D150-15/15	D150-15/15/Y	10V - 20Vdc	12.21 A	15 Vdc	4.15 A	15 Vdc	4.15 A	-	-
D150-24	D150-24/Y	10V - 20Vdc	12.4A	24 Vdc	5 A	-	-	-	-
D150-5/12/12	D150-5/12/12/Y	10V - 20Vdc	11.2 A	5 Vdc	12 A	-12 Vdc	3 A	+12 Vdc	3 A
D150-5/15/15	D150-5/15/15/Y	10V - 20Vdc	11.2 A	5 Vdc	12 A	-15 Vdc	2.5 A	+15 Vdc	2.5 A
D150-5/A	D150-5/A/Y	18V - 36Vdc	7.4 A	5 Vdc	30 A	-	-	-	-
D150-12/A	D150-12/A/Y	18V - 36Vdc	8.8 A	12 Vdc	15 A	-	-	-	-
D150-12/12/A	D150-12/12/A/Y	18V - 36Vdc	8.8 A	12 Vdc	7.5 A	12 Vdc	7.5 A	-	-
D150-15/A	D150-15/A/Y	18V - 36Vdc	8.8 A	15 Vdc	12 A	-	-	-	-
D150-15/15/A	D150-15/15/A/Y	18V - 36Vdc	8.8 A	15 Vdc	6 A	15 Vdc	6 A	-	-
D150-24/A	D150-24/A/Y	18V - 36Vdc	9.5 A	24 Vdc	8 A	-	-	-	-
D150-5/12/12/A	D150-5/12/12/A/Y	18V - 36Vdc	8.6 A	5 Vdc	15 A	-12 Vdc	4 A	+12 Vdc	4 A
D150-5/15/15/A	D150-5/15/15/A/Y	18V - 36Vdc	8.6 A	5 Vdc	15 A	-15 Vdc	3.3 A	+15 Vdc	3.3 A
D150-5/B	D150-5/B/Y	20V - 60Vdc	7.7 A	5 Vdc	30 A	-	-	-	-
D150-12/B	D150-12/B/Y	20V - 60Vdc	9.1 A	12 Vdc	15 A	-	-	-	-
D150-12/12/B	D150-12/12/B/Y	20V - 60Vdc	9.1 A	12 Vdc	7.5 A	12 Vdc	7.5 A	-	-
D150-15/B	D150-15/B/Y	20V - 60Vdc	9.1 A	15 Vdc	12 A	-	-	-	-
D150-15/15/B	D150-15/15/B/Y	20V - 60Vdc	9.1 A	15 Vdc	6 A	15 Vdc	6 A	-	-
D150-24/B	D150-24/B/Y	20V - 60Vdc	9.8 A	24 Vdc	8 A	-	-	-	-
D150-5/12/12/B	D150-5/12/12/B/Y	20V - 60Vdc	8.9 A	5 Vdc	15 A	-12 Vdc	4 A	+12 Vdc	4 A
D150-5/15/15/B	D150-5/15/15/B/Y	20V - 60Vdc	8.9 A	5 Vdc	15 A	-15 Vdc	3.3 A	+15 Vdc	3.3 A
D150-5/C	D150-5/C/Y	36V - 72Vdc	3.7 A	5 Vdc	30 A	-	-	-	-
D150-12/C	D150-12/C/Y	36V - 72Vdc	4.4 A	12 Vdc	15 A	-	-	-	-
D150-12/12/C	D150-12/12/C/Y	36V - 72Vdc	4.4 A	12 Vdc	7.5 A	12 Vdc	7.5 A	-	-
D150-15/C	D150-15/C/Y	36V - 72Vdc	4.4 A	15 Vdc	12 A	-	-	-	-
D150-15/15/C	D150-15/15/C/Y	36V - 72Vdc	4.4 A	15 Vdc	6 A	15 Vdc	6 A	-	-
D150-24/C	D150-24/C/Y	36V - 72Vdc	4.7 A	24 Vdc	8 A	-	-	-	-
D150-5/12/12/C	D150-5/12/12/C/Y	36V - 72Vdc	4.6 A	5 Vdc	15 A	-12 Vdc	4 A	+12 Vdc	4 A
D150-5/15/15/C	D150-5/15/15/C/Y	36V - 72Vdc	4.6 A	5 Vdc	15 A	-15 Vdc	3.3 A	+15 Vdc	3.3 A



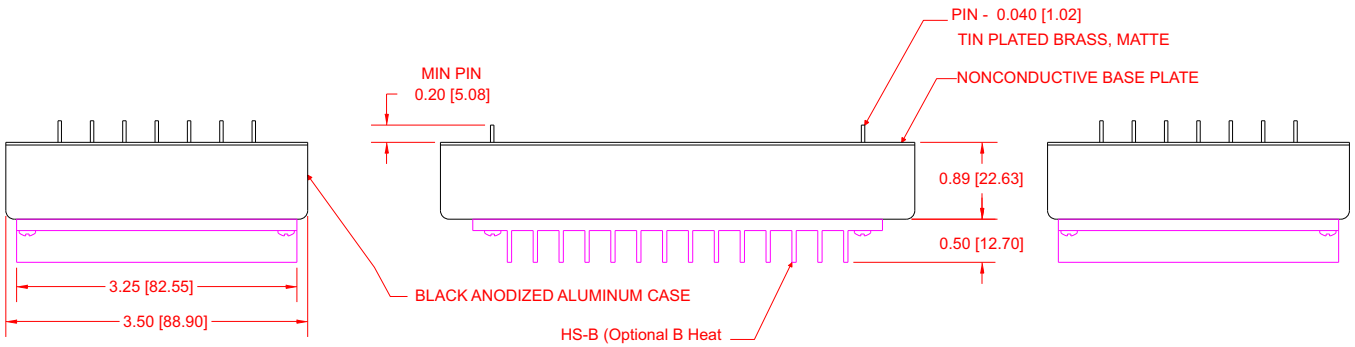
The D150 Series are designed such that the customer may order any output voltage combination from 5Vdc to 28Vdc at no additional charge.

D150 SERIES 150 WATT DC/DC CONVERTERS

STANDARD PC MOUNT



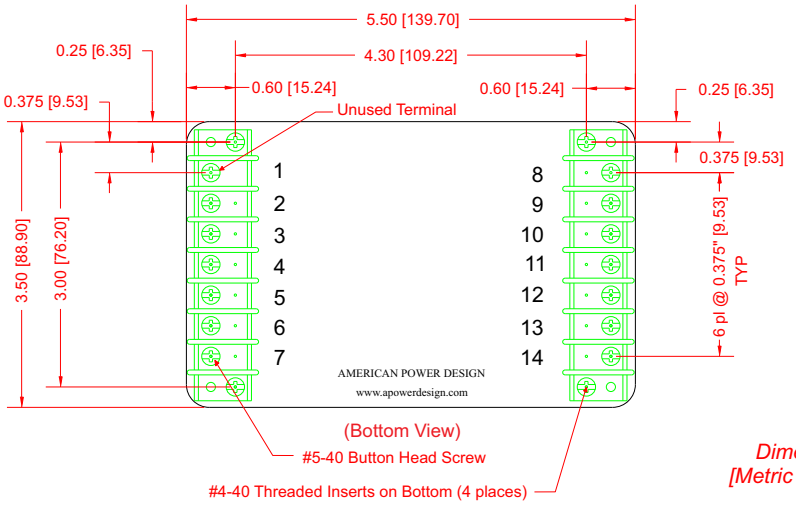
Dimensions are in Inches
[Metric equivalents in brackets]



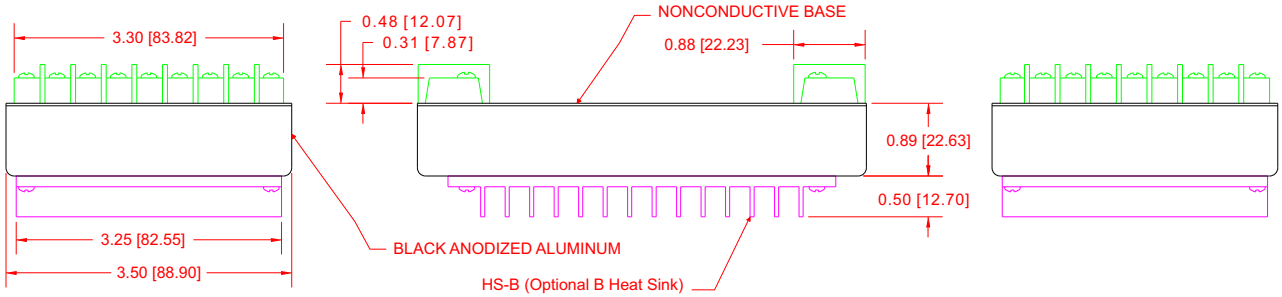
PIN #	FUNCTION			PIN #	FUNCTION		
	Single	Dual	Triple		Single	Dual	Triple
1	No Pin	No Pin	No Pin	8	-V1 Out	-V1 Sense	-V1 Sense
2	- Input	- Input	- Input	9	- V1 Out	-V1 Out	-V1 Out
3	- Input	- Input	- Input	10	+V1 Out	+V1 Out	+V1 Out
4	+ Input	+ Input	+ Input	11	+V1 Out	+V1 Sense	+V1 Sense
5	+ Input	+ Input	+ Input	12	-V1 Sense	-V2 Out	-V2 Out
6	On / Off	On / Off	On / Off	13	V1 Trim	V2 Trim	Com 2 & 3
7	Case	Case	Case	14	+V1 Sense	+V2 Out	+V3 Out

D150 SERIES 150 WATT DC/DC CONVERTERS

-TS CHASSIS MOUNT OPTION



Dimensions are in Inches
[Metric equivalents in brackets]



PIN #	FUNCTION			PIN #	FUNCTION		
	Single	Dual	Triple		Single	Dual	Triple
1	N/C	N/C	N/C	8	-V1 Out	-V1 Sense	-V1 Sense
2	- Input	- Input	- Input	9	- V1 Out	-V1 Out	-V1 Out
3	- Input	- Input	- Input	10	+V1 Out	+V1 Out	+V1 Out
4	+ Input	+ Input	+ Input	11	+V1 Out	+V1 Sense	+V1 Sense
5	+ Input	+ Input	+ Input	12	-V1 Sense	-V2 Out	-V2 Out
6	On / Off	On / Off	On / Off	13	V1 Trim	V2 Trim	Com 2 & 3
7	Case	Case	Case	14	+V1 Sense	+V2 Out	+V3 Out

D150 SERIES 150 WATT DC/DC CONVERTERS

APPLICATION NOTES

INPUT AND OUTPUT IMPEDANCE

The D150 Series of power converters have been designed to be stable with no external capacitors when used in low inductance input and output circuits. However, in some applications, the inductance associated with the distribution from the power source to the input of the converter can affect the stability of the converter. The addition of a 100 µF electrolytic capacitor with an ESR <1 Ohm across the input helps ensure stability of the converter. In many applications, the user has to use decoupling capacitance at the load.

SHORT CIRCUIT PROTECTION

The D150 Series is equipped with short circuit protection. The converter will fold-back the input power whenever a short circuit is applied to its output and automatically recover after the overload condition is removed.

REMOTE SENSING

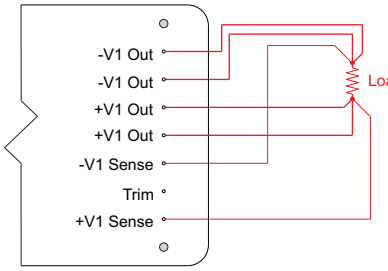
The D150 Series is equipped with remote sensing, this feature compensates for voltage drops occurring between the output pins of the converter and the load.
The SENSE(-) and SENSE(+) pins should be connected at the load or at the point where regulation is required.

The feedback through the sensing pins allows the converter to output a higher voltage at the output pins to compensate for the voltage drop on the connections between the converters output and the load. It will compensate for up to 0.5V drop between the converter and the load.

Because the sense leads carry minimal current, large traces on the end-user board are not required. However, sense traces should be located close to a ground plane to minimize system noise and insure optimum performance. When wiring discretely, twisted pair wires should be used to connect the sense lines to the load to reduce susceptibility to noise.

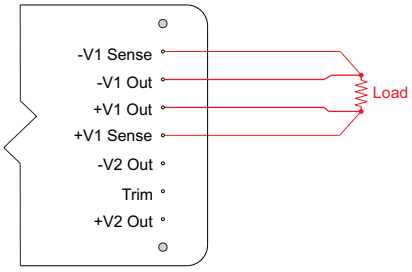
The figures below show the correct method of installation using this option.

SINGLE OUTPUT



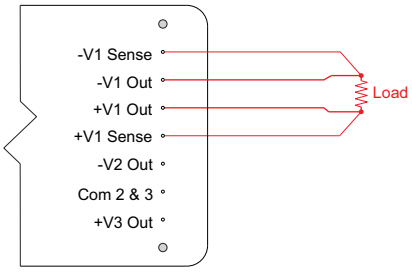
NOTE:
In the case of Single output models all 4 output pins should be used to achieve the highest efficience and reliability.

DUAL OUTPUT



NOTE:
Always disconnect the sense wires before disconnecting the output wires when the unit is under power. otherwise, the supply may be permanently damaged.

TRIPLE OUTPUT



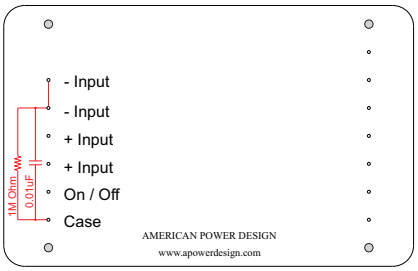
If remote sensing is not required, the SENSE(-) pin must be connected to the Output(-) pin and the SENSE(+) pin must be connected to the Output(+) pin to ensure the converter will regulate at the specified output voltage. If these connections are not made, the converter will deliver an output voltage that is slightly higher than the specified value.

D150 SERIES 150 WATT DC/DC CONVERTERS

APPLICATION NOTES

ISOLATION

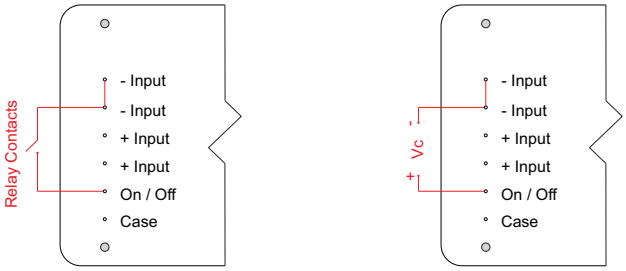
The output of the D150 Series is galvanically isolated from both the input and case, capacitance is < 1300pF and resistance is > 10G Ohm.
The figure below shows the internal RC network that connects the Case (Pin 7) to Input(-) (Pins 2&3). This aides in reducing unwanted noise.



REMOTE ON/OFF CONTROL

The On/Off control (Pin 6) allows the user to shut down the converter mechanically or logically using a relay or a TTL or CMOS logic signal.

Converter Off: Vc <1.5Vdc
Converter On: Vc >3Vdc



INRUSH CURRENT

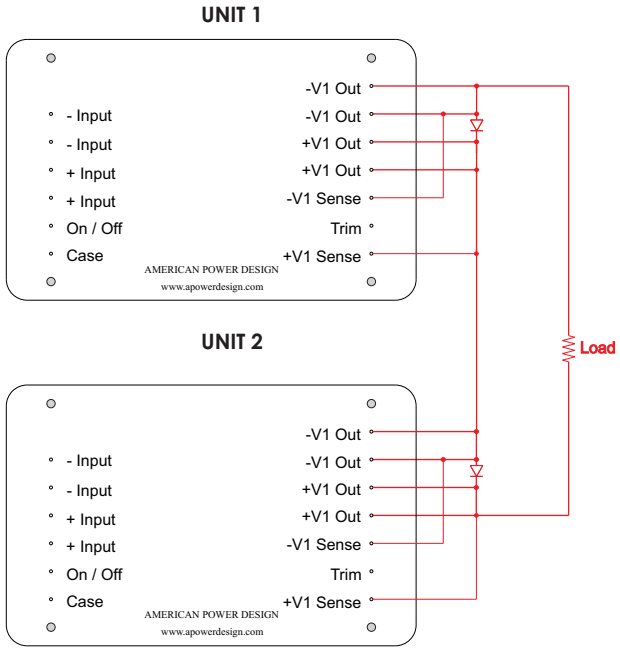
The inrush current of the D150 Series has been kept as low as possible. However, a series resistor may be inserted in the input line to limit this current further.

THERMAL PROTECTION

The D150 Series is equipped with a self-resetting thermal protection circuit. The converter will shut down if the internal temperature exceeds 100°C +/- 5°C output and automatically recover once the temperature drops below 80°C +/- 5°C.

CONNECTION IN SERIES

Figure below shows how to connect multiple outputs in series with the use of shunt diodes, taking into consideration that the highest achieved output voltage should remain below the rated isolation voltage.



NOTE:
Series connection is recommended for single output models only.

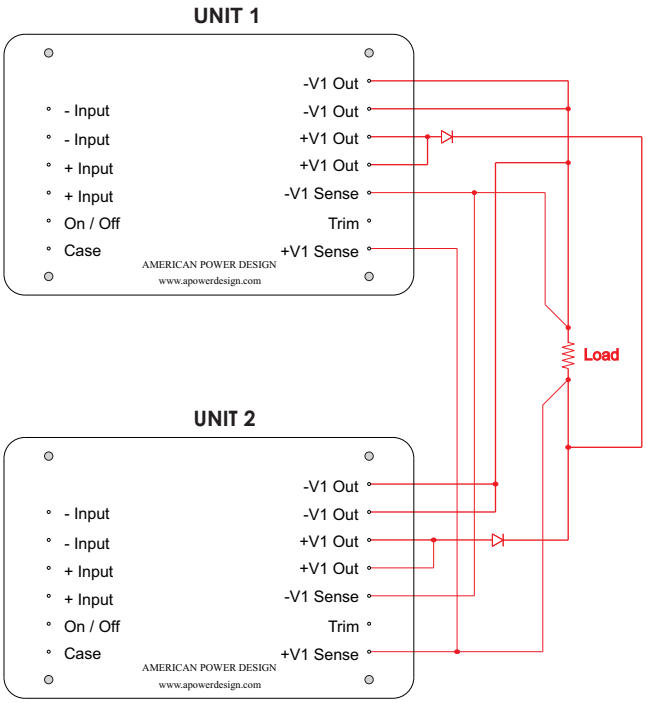
D150 SERIES 150 WATT DC/DC CONVERTERS

APPLICATION NOTES

CONNECTION IN PARALLEL

The figure below shows how to connect outputs of several units with equal nominal output voltage in parallel with the use of oring diodes.

NOTE:
Parallel Operation is recommended for single output models only.



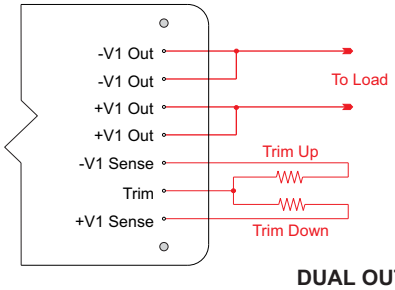
NOTE:
Current sharing can be adjusted by trimming both converters to the same output voltage

TRIM OUTPUT

The D150 Series Single & Dual models are equipped with an output trim (Pin 13), this feature allows the user to adjust the output voltage up or down 10% using a fixed precision resistor or adjustable trim pot.

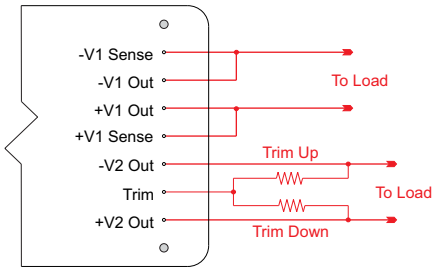
The figures below show how to adjust the output voltage using a fixed precision resistor.

SINGLE OUTPUT



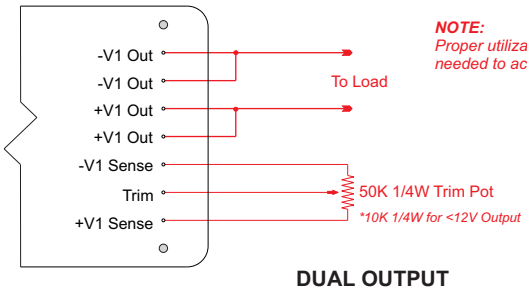
NOTE:
Proper utilization of Remote Sensing is needed to achieve a stable output voltage

DUAL OUTPUT



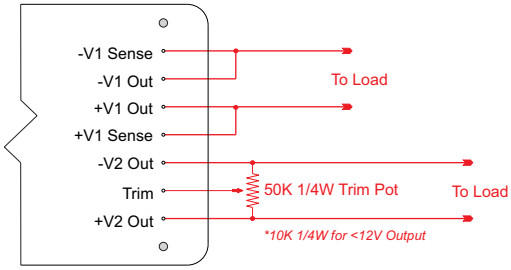
The figures below show how to adjust the output voltage using an external Trim Pot.

SINGLE OUTPUT



NOTE:
Proper utilizations of Remote Sensing is needed to achieve a stable output voltage

DUAL OUTPUT



D150 SERIES 150 WATT DC/DC CONVERTERS

APPLICATION NOTES

LOAD TRANSIENT

Figure below shows a typical output voltage response, measured during a transition from full rated load current to no load current with no additional output filtering.

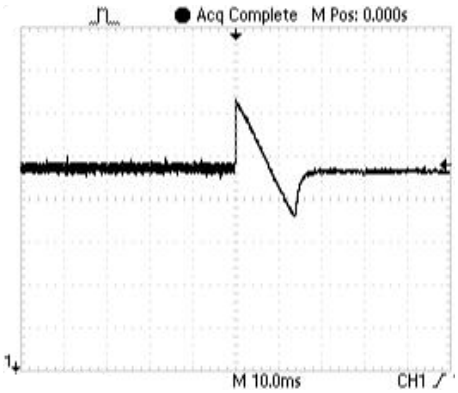
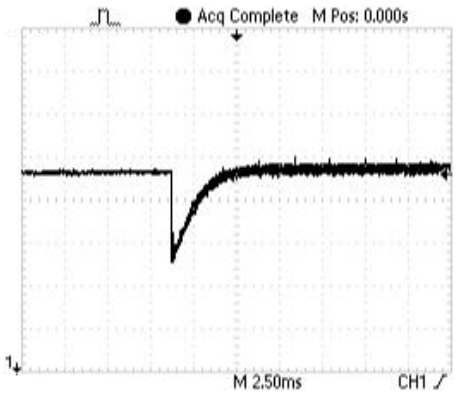


Figure below shows a typical output voltage response, measured during a transition from no load current to full rated load current with no additional output filtering.



STARTUP TRANSIENT

Figure below shows a typical output voltage during turn-on, measured at no load current with no additional output filtering.

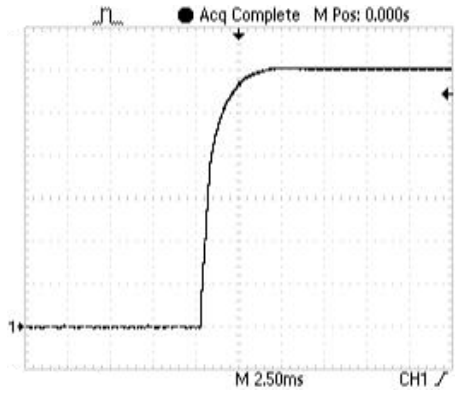
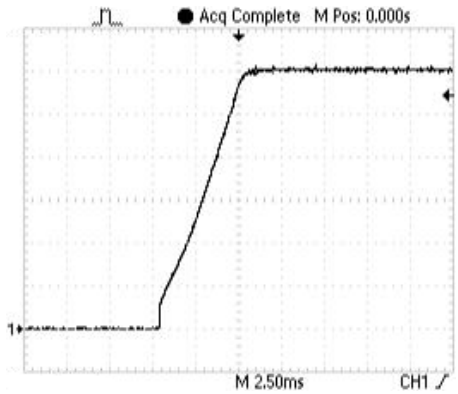


Figure below shows a typical output voltage during turn-on, measured at full rated load current with no additional output filtering.

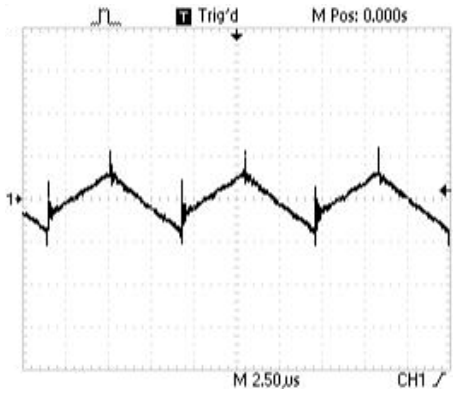


D150 SERIES 150 WATT DC/DC CONVERTERS

APPLICATION NOTES

RIPPLE AND NOISE

Figure below shows a typical output voltage ripple waveform, measured with 20MHz bandwidth filter at full rated load current with no additional output filtering. External low ESR capacitors may be added across output to further reduce ripple.



NUCLEAR AND MEDICAL APPLICATIONS

American Power Design products are not designed, intended for use in, or authorized for use as critical components in life support systems, equipment used in hazardous environments, or nuclear control systems without the express written consent of American Power Design, Inc.

CLEANING AGENTS

In order to avoid possible damage, any penetration of cleaning fluids must be prevented, since the power supplies are not hermetically sealed.

TECHNICAL REVISIONS

The appearance of products, including safety agency certifications pictured on labels, may change depending on the date manufactured. Specifications are subject to change without notice.

SAFETY REQUIREMENTS

The converters are designed to meet North American and International safety regulatory requirements per UL 60950-1/CSA 22.2 No. 60950-1-07 Second Edition, IEC 60950-1: 2005, and EN 60950-1:2006. Basic Insulation is provided between input and output. To comply with safety agencies requirements, an input line fuse must be used external to the converter. The table below provides the recommended fuse rating for use with this family of products.

Input Voltage Range	Fuse Rating
10-20Vdc	20A
18-36Vdc	11A
20-60Vdc	10A
36-72Vdc	5.5A

If one input fuse is used for a group of modules, the maximum fuse rating should not exceed 20A.

WARRANTY

All products manufactured by American Power Design, Inc. (APD) are warranted to be free of defects due to material or workmanship for a period of one year from date of shipment. At our option, APD will repair or replace any non-conforming product.
APD expressly disclaims any liability for consequential or incidental damages resulting from the use or misuse of its products by the purchaser or others.
This warranty is in lieu of all warranties expressed or implied, including the warranties of merchantability. No other warranties, obligations, or liabilities are expressed or implied.
All products being returned for repair require a return material authorization(RMA) assigned by APD prior to return shipment.