



X50 SERIES 50 WATT HIGH VOLTAGE DC/DC CONVERTERS



- ▶ Ultra Wide Input Ranges
(9-36Vdc , 20-60Vdc , 36-72Vdc)
- ▶ Efficiency 87% (typ.)
- ▶ **Independently Isolated Outputs**
- ▶ Six-Sided Shielded Case
- ▶ Remote On/Off Control
- ▶ Continuous Short Circuit Protection
- ▶ UL Certified Encapsulant Meets 94V-0 Flammability

* **Option for Dual: UNBALANCED OUTPUT**

UL Certified Encapsulant Meets 94V-0 Flammability

The X50 Series of DC/DC converters accepts ultra wide input ranges of 9-36 Vdc, 20-60 Vdc and 36-72 Vdc. Outputs are independently isolated. In the case of duals, up to 40 watts may be taken from either output. All models will tolerate a short circuit indefinitely. Also included is a Pi input filter and remote on/off.

ELECTRICAL SPECIFICATIONS

| | | | |
|------------------------|------------|--|------------|
| Voltage Accuracy | +/- 1% | Input Filter | Pi Network |
| Line Regulation | +/- 0.1% | Efficiency | 87% (typ.) |
| Load Regulation | +/- 0.3% | Short Circuit Protection | Continuous |
| Output Ripple | < 0.4% P-P | Switching Frequency | 120 kHz |
| | | Isolation (Input-Output(1)-Output(2)-Case) | 1000 Vdc |
| | | Input / Output Capacitance | < 100pF |

GENERAL SPECIFICATIONS

Option for Dual: UNBALANCED OUTPUT e.g...Out_1 = 300V / OUT_2 = 150V

| | | | |
|--------------------------------|---------------|----------------------|---------------------|
| Temp. Stability | +/- 0.02%/°C | Logic Shutdown | Logic 0 (on) |
| Temp. (Operating , Case) | -45 to +85°C | EMI/RFI | Six Sided Shield |
| Temp. (Storage) | -55 to +100°C | Derating | None |
| | | Cooling | Free-Air Convection |

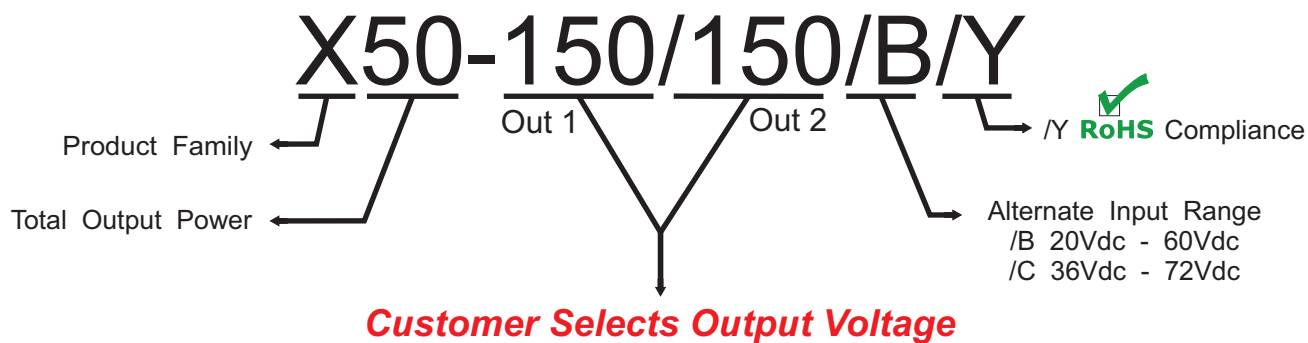
PHYSICAL SPECIFICATIONS

| | | | |
|------------------|---------------------------|---------------------|----------------------------------|
| Dimensions | 2.57 x 4.57 x 0.84 inches | Case Material | Black Coated Metal |
| Weight | 12.7 Oz | | (With Non-Conductive Base Plate) |



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| REPRESENTATIVE MODEL LISTING | | | | | | | | | |
|------------------------------|---------|---------|--------|----------------------------|---------------|---------------|-----------------|---------------|-----------------|
| OUTPUT SPECS | | | | MODEL NUMBER / INPUT RANGE | | | | | |
| VOLTAGE | | CURRENT | | 9-36VDC | | 20-60VDC | | 36-72VDC | |
| OUT #1 | OUT #2 | OUT #1 | OUT #2 | Non-RoHS | RoHS | Non-RoHS | RoHS | Non-RoHS | RoHS |
| 48 Vdc | - | 1 A | - | X50-48 | X50-48/Y | X50-48/B | X50-48/B/Y | X50-48/C | X50-48/C/Y |
| 48 Vdc | 48Vdc | 500 mA | 500 mA | X50-48/48 | X50-48/48/Y | X50-48/48/B | X50-48/48/B/Y | X50-48/48/C | X50-48/48/C/Y |
| 50 Vdc | - | 1 A | - | X50-50 | X50-50/Y | X50-50/B | X50-50/B/Y | X50-50/C | X50-50/C/Y |
| 50Vdc | 50 Vdc | 500 mA | 500 mA | X50-50/50 | X50-50/50/Y | X50-50/50/B | X50-50/50/B/Y | X50-50/50/C | X50-50/50/C/Y |
| 75Vdc | - | 666 mA | - | X50-75 | X50-75/Y | X50-75/B | X50-75/B/Y | X50-75/C | X50-75/C/Y |
| 75 Vdc | 75 Vdc | 333 mA | 333 mA | X50-75/75 | X50-75/75/Y | X50-75/75/B | X50-75/75/B/Y | X50-75/75/C | X50-75/75/C/Y |
| 100 Vdc | - | 500 mA | - | X50-100 | X50-100/Y | X50-100/B | X50-100/B/Y | X50-100/C | X50-100/C/Y |
| 100 Vdc | 100Vdc | 250 mA | 250 mA | X50-100/100 | X50-100/100/Y | X50-100/100/B | X50-100/100/B/Y | X50-100/100/C | X50-100/100/C/Y |
| 150 Vdc | - | 333 mA | - | X50-150 | X50-150/Y | X50-150/B | X50-150/B/Y | X50-150/C | X50-150/C/Y |
| 150 Vdc | 150 Vdc | 166 mA | 166 mA | X50-150/150 | X50-150/150/Y | X50-150/150/B | X50-150/150/B/Y | X50-150/150/C | X50-150/150/C/Y |
| 200 Vdc | - | 250 mA | - | X50-200 | X50-200/Y | X50-200/B | X50-200/B/Y | X50-200/C | X50-200/C/Y |
| 200Vdc | 200Vdc | 125 mA | 125 mA | X50-200/200 | X50-200/200/Y | X50-200/200/B | X50-200/200/B/Y | X50-200/200/C | X50-200/200/C/Y |
| 300 Vdc | - | 166 mA | - | X50-300 | X50-300/Y | X50-300/B | X50-300/B/Y | X50-300/C | X50-300/C/Y |
| 300 Vdc | 300 Vdc | 83 mA | 83 mA | X50-300/300 | X50-300/300/Y | X50-300/300/B | X50-300/300/B/Y | X50-300/300/C | X50-300/300/C/Y |
| 400Vdc | - | 125 mA | - | X50-400 | X50-400/Y | X50-400/B | X50-400/B/Y | X50-400/C | X50-400/C/Y |
| 400Vdc | 400 Vdc | 62 mA | 62 mA | X50-400/400 | X50-400/400/Y | X50-400/400/B | X50-400/400/B/Y | X50-400/400/C | X50-400/400/C/Y |
| 500 Vdc | - | 100 mA | - | X50-500 | X50-500/Y | X50-500/B | X50-500/B/Y | X50-500/C | X50-500/C/Y |
| 500 Vdc | 500Vdc | 50 mA | 50 mA | X50-500/500 | X50-500/500/Y | X50-500/500/B | X50-500/500/B/Y | X50-500/500/C | X50-500/500/C/Y |

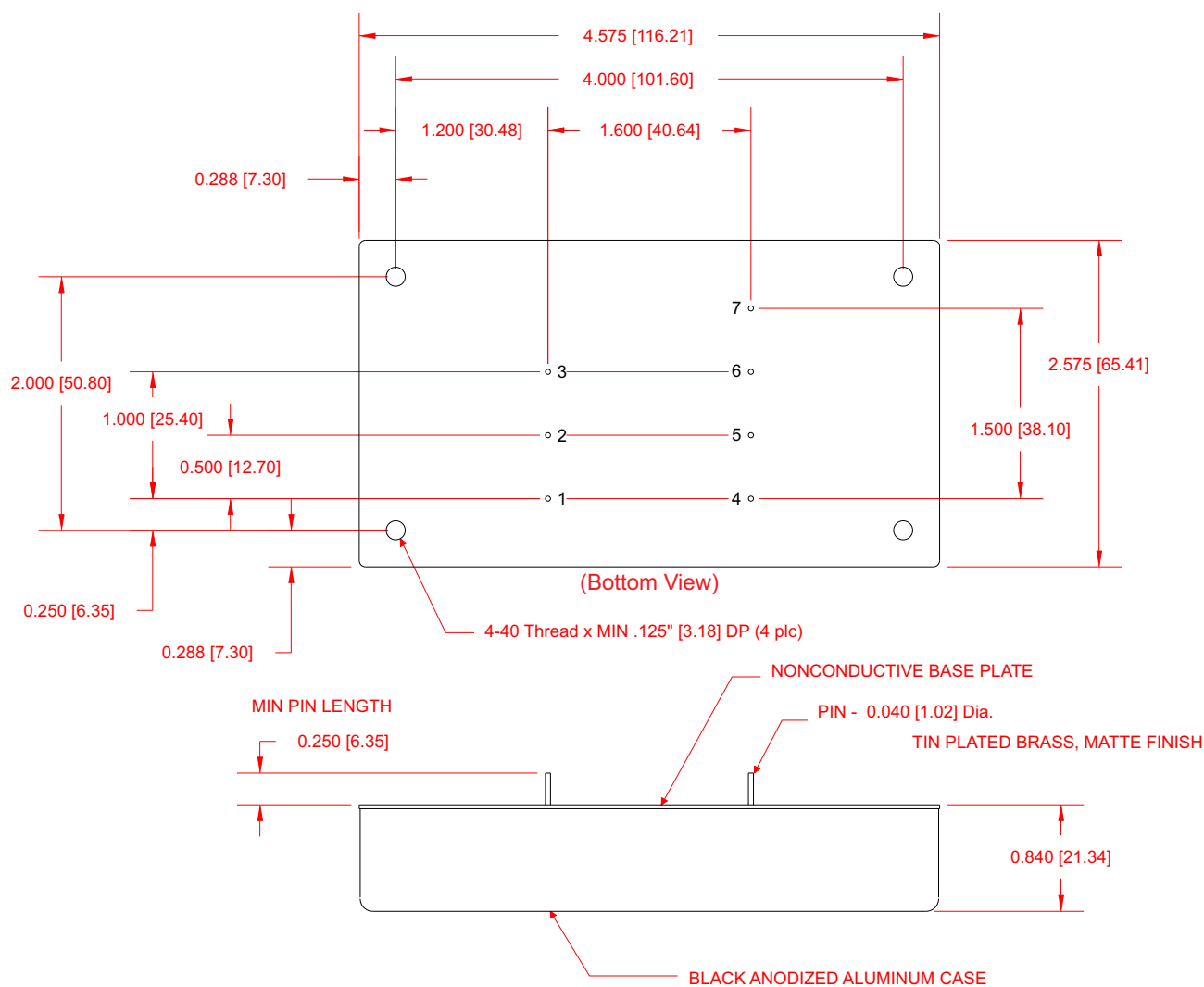


The X50 Series are designed such that the customer may order any output voltage from 48Vdc to 500Vdc at no additional charge.

Option for Dual: UNBALANCED OUTPUT e.g. Out_1 = 300V/OUT_2 = 150V/Ordering Example: X30-300/150/B/Y Unbalanced



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| PIN # | SINGLE | DUAL |
|-------|------------|------------|
| 1 | - Input | - Input |
| 2 | On/Off | On/Off |
| 3 | + Input | + Input |
| 4 | No Pin | + Output 2 |
| 5 | No Pin | - Output 2 |
| 6 | - Output 1 | - Output 1 |
| 7 | + Output 1 | + Output 1 |

Dimensions are in Inches
[Metric equivalents in brackets]



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APPLICATION NOTES

INPUT AND OUTPUT IMPEDANCE

The X50 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 μ F 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 X50 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.

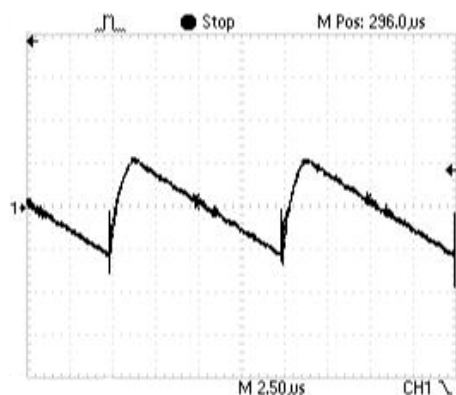
ISOLATION

The output(s) of the X50 Series is galvanically isolated from both the input and case, capacitance is < 100 pF and resistance is > 10G Ohm.

In the case of dual's, the outputs are independently isolated from one another as well as the input and case.

RIPPLE AND NOISE

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



STARTUP TRANSIENT

Figure below shows a typical output voltage during turn-on, measured at 20% load current with no additional output filtering.

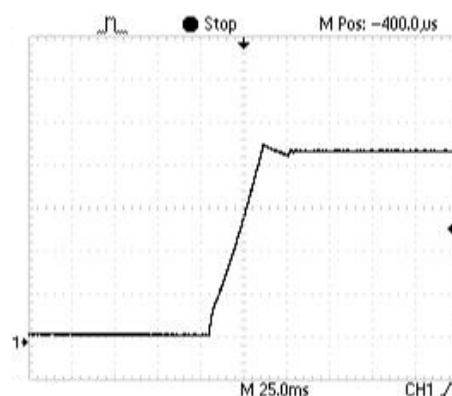
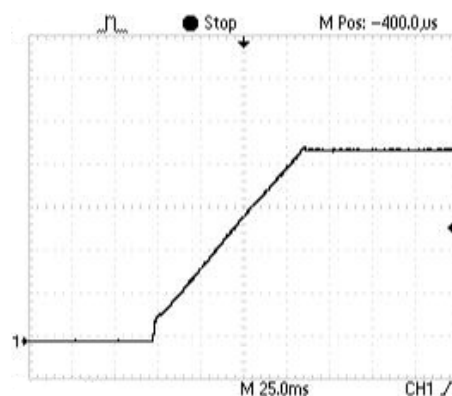


Figure below shows a typical output voltage during turn-on, measured at full rated load current with no additional output filtering.





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APPLICATION NOTES

LOAD TRANSIENT

Figure below shows a typical output voltage response, measured during a transition from full rated load current to 20% load current with no additional output filtering.

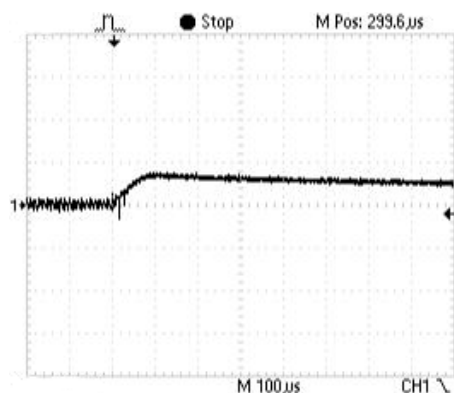
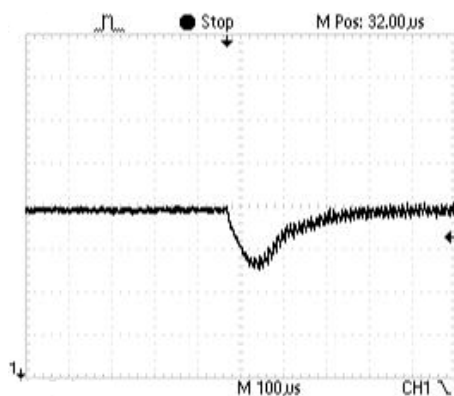


Figure below shows a typical output voltage response, measured during a transition from 20% load current to full rated load current with no additional output filtering.



INRUSH CURRENT

The inrush current of the X50 Series has been kept as low as possible. However, a series resistor may be inserted in the input line to limit this current further.

REMOTE ON/OFF CONTROL

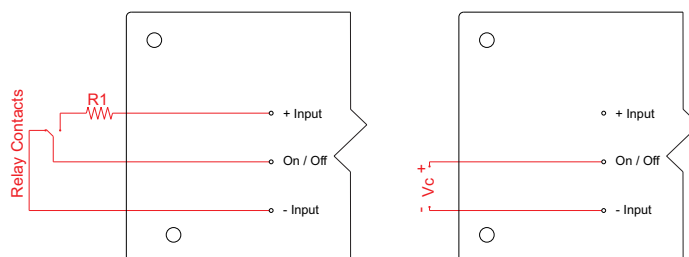
The On/Off control pin allows the user to shut down the converter mechanically or logically using a relay or a TTL or CMOS logic signal.

Connect Remote On/Off pin to -Input when not in use to ensure proper operation.

Resistor R1 can be calculated by:

$$R1 = \frac{(+ Input - 5)}{1mA}$$

Converter Off: $V_c > 3V_{dc}$
Converter On: $V_c < 1.5V_{dc}$



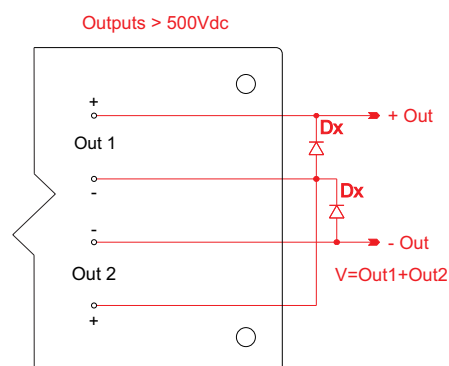
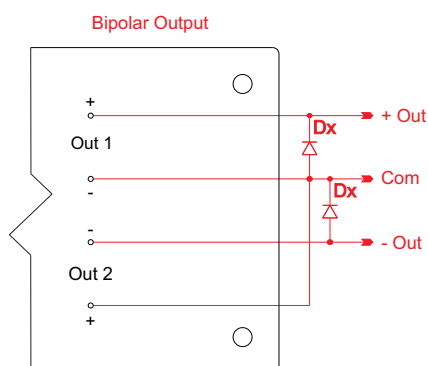
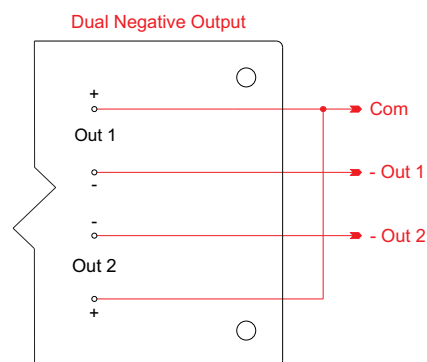
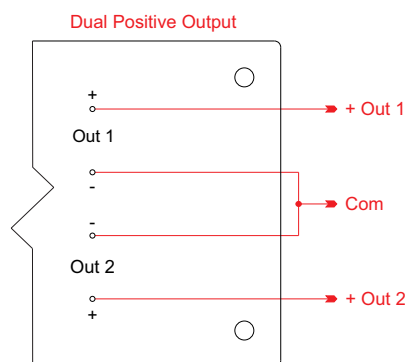
NOTE:
Do not exceed 6Vdc on remote On/Off, otherwise, the supply may be permanently damaged.



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OUTPUT CONFIGURATIONS

Due to the unique independently isolated outputs of the X50 series both Output #1 and Output #2 may be connected in a wide variety configurations.
The Figures below are some examples.



NOTE:
The ratings of Dx should be 1.5 times the maximum current and voltage expected in each branch.

UNBALANCED OUTPUT POWER for Dual OUTPUT

When using a dual output converter up to 40 watts (80% of total power) can be drawn from either output. However, a minimum 10 watts (20% of total power) must be maintained on the other output.

Example: If Output #1 has a 20 watt load than Output #2 must have a minimum load of 5 watts.

NOTE:
The total power (Out 1 + Out 2) must not exceed 50 Watts.

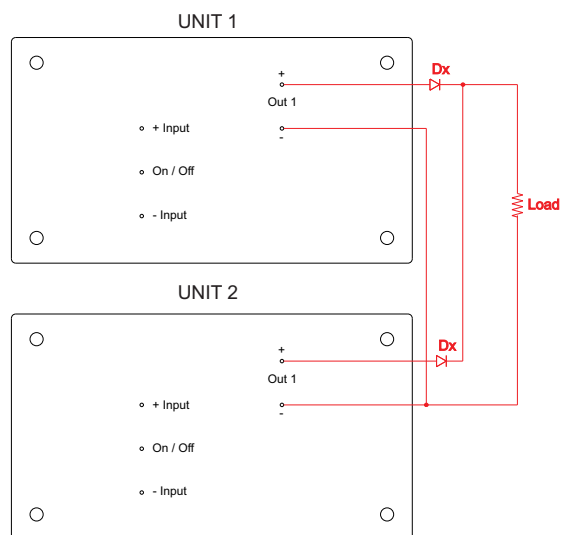


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APPLICATION NOTES

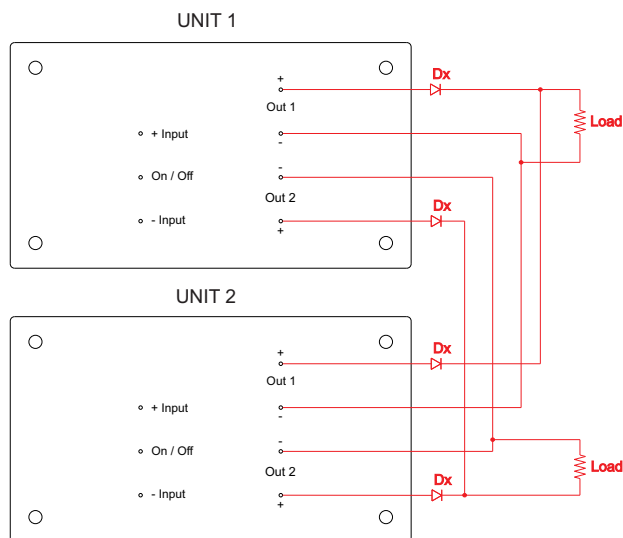
CONNECTION IN PARALLEL

The figure below shows how to connect several single output units with equal nominal output voltage in parallel.



NOTE:
The ratings of Dx should be 1.5 times the maximum current and voltage expected in each branch.

The figure below show how to connect several dual output units with equal nominal output voltage in parallel.

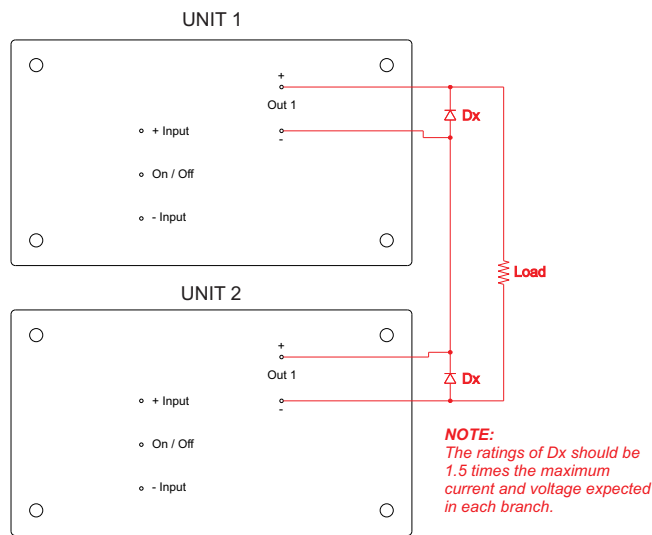


NOTE:
The ratings of Dx should be 1.5 times the maximum current and voltage expected in each branch.

CONNECTION IN SERIES

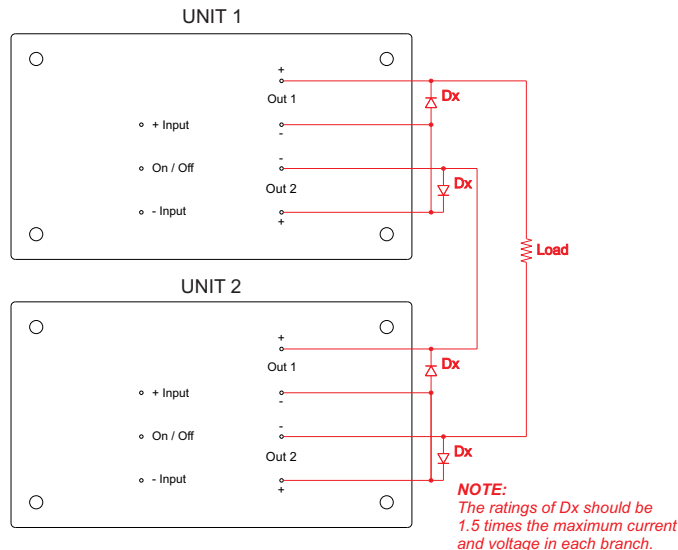
When connecting units in series, the highest achieved output voltage should remain below the rated isolation voltage.

Figure below shows how to connect multiple single output units in series with the use of shunt diodes.



NOTE:
The ratings of Dx should be 1.5 times the maximum current and voltage expected in each branch.

Figure below shows how to connect multiple dual output units in series with the use of shunt diodes.



NOTE:
The ratings of Dx should be 1.5 times the maximum current and voltage expected in each branch.



"The best high voltage design solution"

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APPLICATION NOTES

CLEANING AGENTS

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

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.

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 |
|---------------------|-------------|
| 9-36Vdc | 7 A |
| 20-60Vdc | 3.5 A |
| 36-72Vdc | 2 A |

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.