



# SP7158/Y; SP7159/Y 1W PROGRAMABLE REGULATED HV DC/DC CONVERTERS



## FEATURES

- ▶ **Customer Selects Output Voltage**
- ▶ Fully Regulated Outputs to +5kVdc & -5kVdc
- ▶ 0-100% Programmable Output
- ▶ High Stability (<0.005%/°C)
- ▶ Low Output Noise & EMI/RFI
- ▶ External Calibration Adjustment
- ▶ Continuous Short Circuit Protection
- ▶ UL & CE Pending

The SP7158/Y; SP7159/Y Series miniature regulated high voltage DC/DC converter offers a 100% programmable high voltage output using a 0-5Vdc analog signal. Their small size, low output ripple, and excellent regulation make them ideally suited for applications that demand a high degree of performance. All models will will tolerate a short circuit indefinitely.

## ELECTRICAL SPECIFICATIONS

Output Voltage (SP7158Y) .....	0V to +5kVdc (Programmable)	Programming Voltage Shutdown .....	> 5.2Vdc
Output Voltage (SP7159Y) .....	0V to -5kVdc (Programmable)	Input Filter .....	Low ESR Capacitor
Input Voltage Range .....	11.5V - 16Vdc	Input Current (No Load) .....	<100mA
Output Voltage Accuracy .....	+/- 1%	Input Current (Full Load) .....	<230mA
Line Regulation .....	<0.05%	<b>Reverse Input Protection .....</b>	<b>50Vdc</b>
Load Regulation .....	<0.05%	<b>Short Circuit Protection .....</b>	<b>Continuous</b>
Output Ripple .....	<0.15% P-P	Switching Frequency .....	180 kHz
Programming Voltage .....	0 - 5Vdc @ <100uA	Gain Adjustment .....	5 to 10%
Programming Linearity (15% to 100% Vout) .....	<1%	Response Time .....	<200 ms (Full Load, full scale response)

## GENERAL SPECIFICATIONS

Stability .....	< 0.01 / Hr.	Thermal Shock Limit .....	1°C / 10 Seconds
Temp. Stability .....	+/- 0.005%/°C	EMI/RFI .....	Six Sided Shield
<b>Temp. (Operating, Case) .....</b>	<b>-20 to +65°C</b>	Derating .....	None
Temp. (Storage) .....	-40 to +125°C	Cooling .....	Free-Air Convection
Humidity .....	0 to 95% (Non-Condensing)	Certifications .....	UL & CE Pending

## PHYSICAL SPECIFICATIONS

Dimensions & Weight .....	1.1 x 2.6 x 0.5 inches @ 1.8 Oz	Case Material .....	Nickle Plated Metal (With Non-Conductive Base Plate)
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## OUTPUT VOLTAGES +5kVDC; -5kVDC

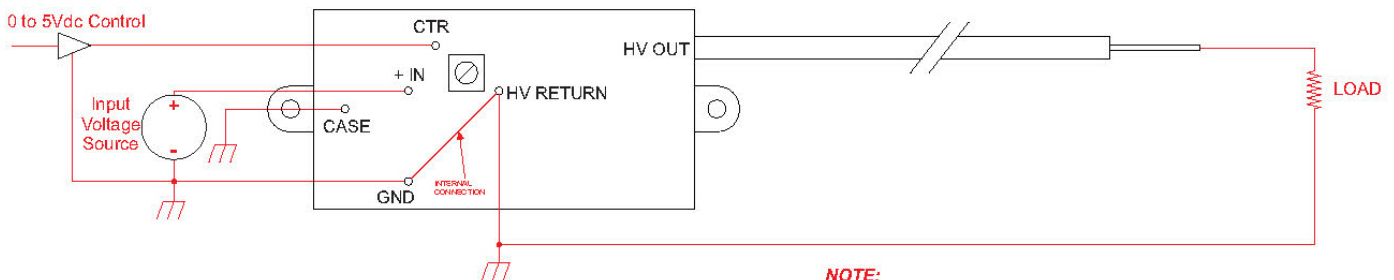
### REPRESENTATIVE MODEL LISTING

MODEL NUMBER		INPUT CURRENT		OUTPUT SPECIFICATIONS					SWITCHING FREQUENCY
RoHs	NO LOAD	FULL LOAD	VOLTAGE	RIPPLE	CURRENT	REGULATION			
							LOAD	LINE	
SP7158/Y	<100 mA	<230 mA	0V to +5000Vdc	<0.1% (5.0V p-p)	0 - 0.2mA	<0.35%	<0.1%	180 kHz	
SP7159/Y	<100 mA	<230 mA	0V to -5000Vdc	<0.1% (5.0V p-p)	0 - 0.2mA	<0.25%	<0.1%	180 kHz	

## Application Note

### Connection Diagram

The figure below shows how to connect the SP7158/Y; SP7159/Y Series converter with output voltages + 5kV and - 5kV.



**NOTE:**

An internal RC network connects the Case (Pin 5) to Gnd (Pins 2 and 4).

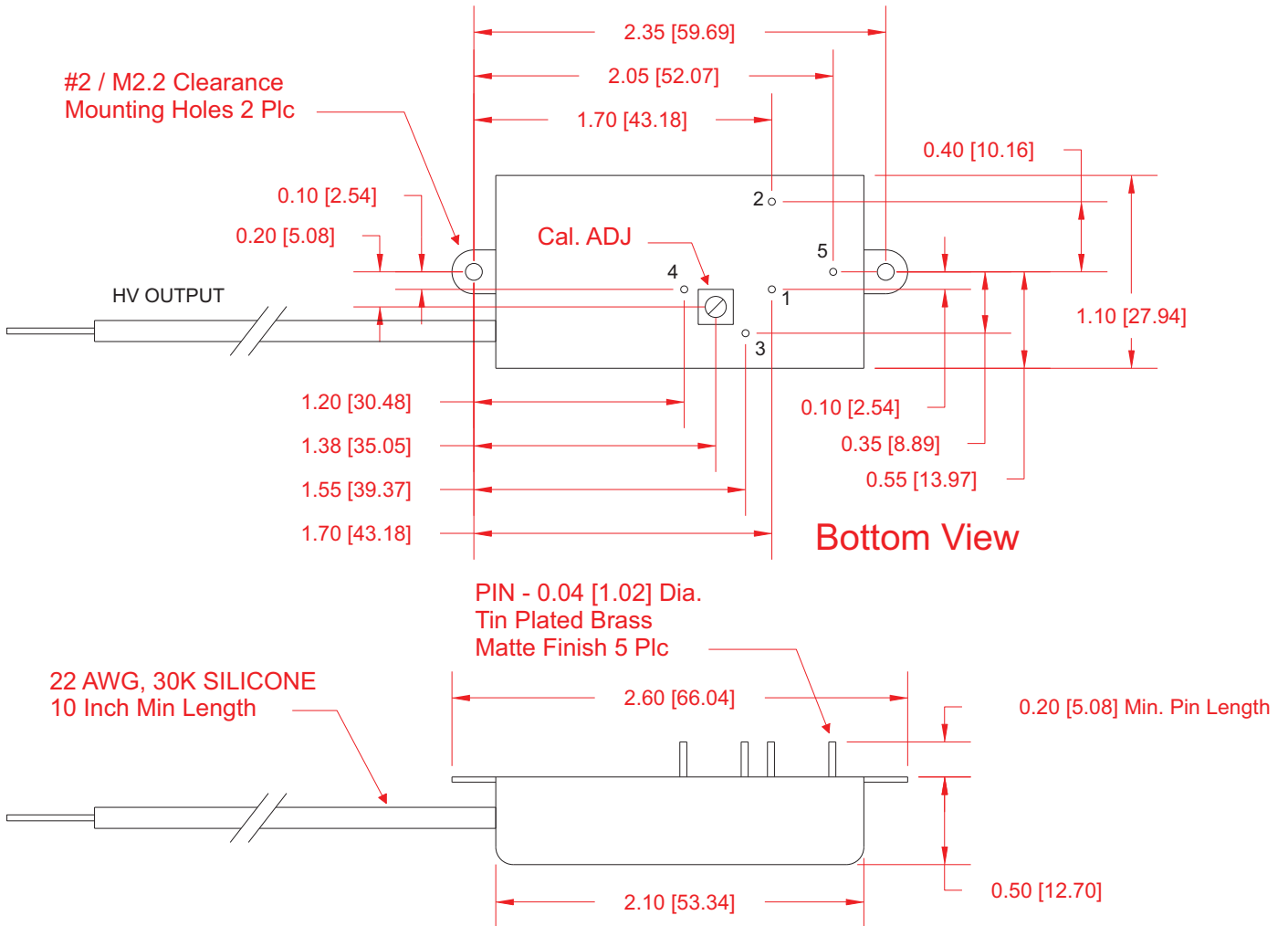
No more than 50 volts potential between the case ground (Pin 5) and the circuit ground (Pins 2 and 4) otherwise, the supply may be permanently damaged .

Case pin (Pin 5) should be connected to ground for optimum operation.



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**OUTPUT VOLTAGES +5kVDC; -5kVDC**



PIN #	FUNCTION
1	+ Input
2	Gnd
3	Control / Programming Voltage
4	HV Return
5	Case Gnd

*Dimensions are in Inches  
[Metric equivalents in brackets]*



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## APPLICATION NOTES

### INRUSH CURRENT

The inrush current of the SP7158 / SP7159 Series has been kept as low as possible. However, a series resistor may be inserted in the input line to limit this current further.

### REVERSE INPUT PROTECTION

The SP7158 / SP7159 Series is equipped diode placed in series with the + Input (Pin 1) of the converter, this allows current to flow only if the correct polarity is applied.

### SHORT CIRCUIT PROTECTION

The SP7158 / SP7159 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.

### 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 no load current with no additional output filtering.

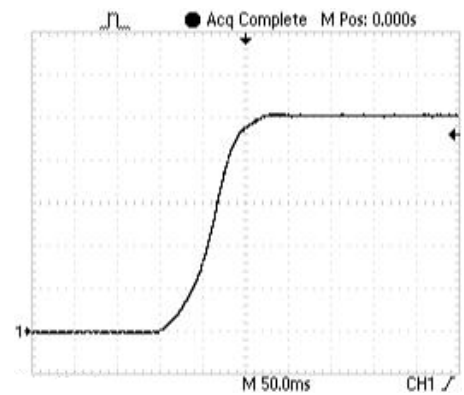
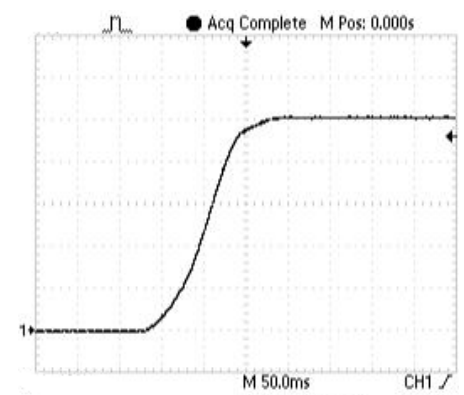
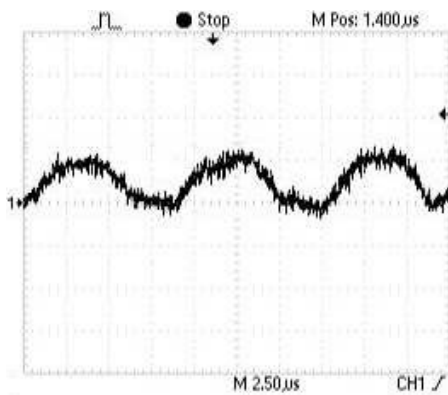


Figure below shows a typical output voltage during turn-on, measured at full rated load current with no additional output filtering.





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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 no load current with no additional output filtering.

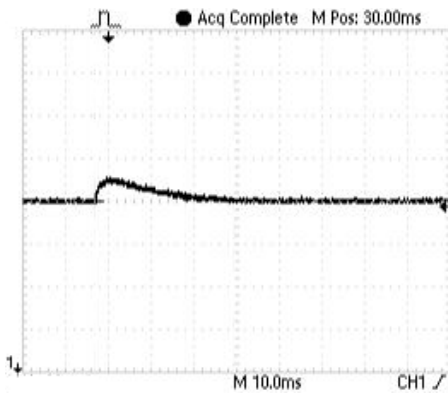
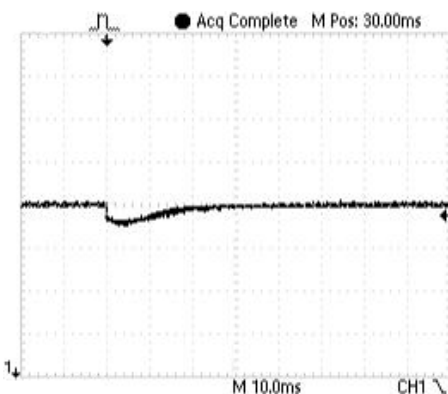


Figure below shows a typical output voltage response, measured during a transition from no load current to full rated load current with no additional output filtering.



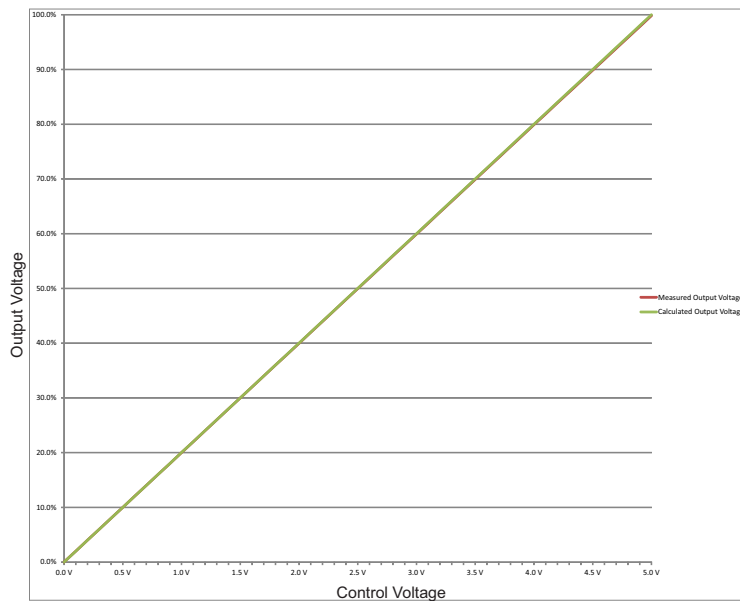
### PROGRAMMING VOLTAGE

A 0V to +5V signal will program the power supply for 0 to 100% rated output voltage. The input impedance for this control pin is typically 100KΩ.

### OUTPUT VOLTAGE TRACKING

The output voltage tracks the Control pin (Pin 3) within 0.5% from 5% to 100% of output voltage.

Figure below show a typical plot of both the actual and calculated output voltage as a function of control voltage.



**Operating Conditions:**

Nominal Input Voltage = Fixed

Output Load = Resistive (fixed at full output current @ 100% output voltage)



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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
11.5-16Vdc	0.5A

If one input fuse is used for a group of modules, the maximum fuse rating should not exceed 10A.

### 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.