AMERICAN HIGH VOLTAGE

SF Series
High Voltage Power Supply

General Description

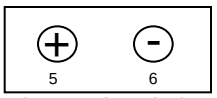
The SF Series high voltage power supplies are regulated modules that provide outputs of up 10kV and power levels to 15 Watts. The output voltage of each power supply is floating with respect to the input line. This allows either polarity to be configured The output voltage of the SF may be varied either with the unit trimpot, an external potentiometer, or via an external control signal. All SF models offer 0.01% line regulation and 3% maximum half load to full load regulation.The output ripple is typically less than 1% at full power. All SF's are reverse input voltage and short circuit protected.

Features

Regulated Output
Encapsulated
100 VDC to 10,000 VDC models available
15 Watt power (10W models available –V)
28 VDC input
Trimpot, Resistance or Voltage program

Connection Diagram

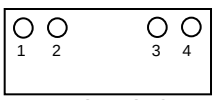
INPUT SIDE SHOWN



OUTPUT SIDE SHOWN

Pins:

5. **+ HV output**
6. **- HV output**



INPUT SIDE SHOWN

Pins:

1. **Ground**
2. **+5.0V Reference**
3. **Vcontrol**
4. **+28 VDC input**

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Electrical Characteristics

(at 25 degrees C unless otherwise specified)

Parameter	Conditions		Value			Units
			Min	Typical	Max	
Supply Voltage*:	(all power models)		25VDC	28VDC	31 VDC	VDC
Input Current:	No Load: (10 W models)		150	160	175	mA
	No Load: (15 W models)		160	175	185	mA
	Full Load: (10 W models)		550	600	650	mA
	Full Load: (15 W models)		850	900	950	mA
Output Ripple:	No Load (all models):		0.7%	0.7%	1%	Vpp
	Full Load (all models):		0.8%	0.8%	1%	Vpp
Load Regulation:	No Load to Full Load				20%	V_{NL}/V_L
	Half Load to Full Load				3%	VNL/VL
Output Linearity	No Load			1%		$\frac{\Delta V_{OUT}}{\Delta V_{OUT\ (ideal)}}$
Output Linearity	Full Load (all models):			1%		$\frac{\Delta V_{OUT}}{\Delta V_{OUT\ (ideal)}}$
Short Circuit Current:	10 Watt Models:			250	350	mA
	15 Watt Models:			350	450	mA
Power Efficiency:	Full Load (10 W)		60%	65%	65%	P_{OUT}/P_{in}
	Full Load (15W):		65%	70%	70%	P_{OUT}/P_{in}
Reverse Input Polarity	Protected to 50 VDC					
Temperature Drift:	No Load				200	ppm/DegC
	Full Load				200	ppm/Deg C
Thermal Rise:	No Load (case) (15W)				25	degrees C
	Full Load (case) (15W)				45	degrees C
Slew Rate (10% - 90%)	No Load				100	mS
	Full Load				120	mS
Slew Rate (90% - 10%)	No Load				300	mS
	Full Load				200	mS
Drain Out Time	No Load (5 TC)				150	mS

*** Other input voltages available: 15VDC, 24VDC, 28VDC and 48VDC**

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Physical Characteristics

(at 25 degrees C unless otherwise specified)

Parameter	Conditions	Value	Units
Dimensions	MKS	50.8 W x 101.6L x 20.6 H	mm
	English	2.0 W x 4.0 L x 0.81 H	inches
Volume:	MKS	105	cm^3
	English	6.4	$inch^3$
Mass:	MKS	156	grams
	English	5.6	oz
Packaging:	Black anodized aluminum case with RTV elastomer encapsulation		
Finish	Smooth brushed aluminum		
Terminations:	Input and control: Teflon terminals (4)		
	HV Output: Teflon terminals (2)		

Environmental Characteristics

(at 25 degrees C unless otherwise specified)

Parameter	Conditions	Value	Units
Temperature Range	case temperature	-40 degrees to + 71 degrees	Celsius
	case temperature	-40 degrees to + 160 degrees	Fahrenheit
Shock:	MIL-STD-810 Method 516	40 g's	Proc IV
Altitude:	pins sealed against corona	-350 to + 16,700	meters
	pins sealed against corona	-1,000 to +55,000	feet
Vibrations:	MIL-STD-810 Method 514	20 g's	Curve E
Thermal Shock	MIL-STD-810 Method 504	-40 deg C to + 71 deg C	Class 2

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Models Available (as of August 2019):

(Vin = 28 VDC)

Model	Output Voltage Range	Power	Ripple (max)
SF-1V	0 – 100 VDC	10 Watts	1 Vpp
SF-3V	0 – 300 VDC	10 Watts	3 Vpp
SF-6V	0 – 600 VDC	10 Watts	6 Vpp
SF-12V	0 – 1,200 VDC	10 Watts	12 Vpp
SF-25V	0 – 2,500 VDC	10 Watts	25 Vpp
SF-50V	0 – 5,000 VDC	10 Watts	50 Vpp
SF-100V	0 – 10,000 VDC	10 Watts	100 Vpp
SF-1	0 – 100 VDC	15 Watts	1 Vpp
SF-3	0 – 300 VDC	15 Watts	3 Vpp
SF-6	0 – 600 VDC	15 Watts	6 Vpp
SF-12	0 – 1,200 VDC	15 Watts	12 Vpp
SF-25	0 – 2,500 VDC	15 Watts	25 Vpp
SF-50	0 – 5,000 VDC	15 Watts	50 Vpp
SF-100	0 – 10,000 VDC	15 Watts	100 Vpp

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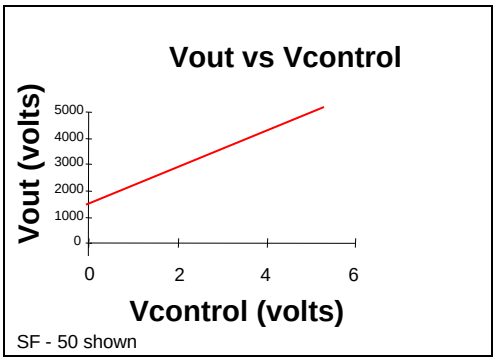
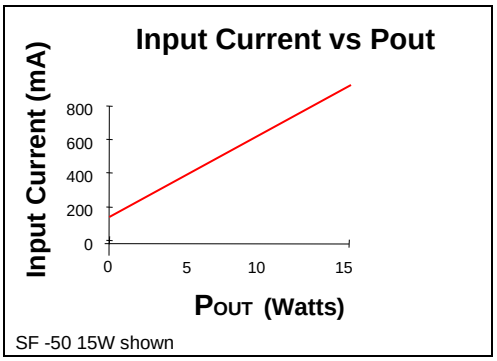
SF Series Performance Charts



SF - 50 shown



SF -50 15W shown

SF Series Application Notes

The SFSeries high voltage power supplies are powered by an input voltage of 28 VDC. They can be adjusted to provide a set output voltage or they can be controlled either by an external resistance or an external voltage. By connecting the Vcontrol pin to the +5.0 volt reference pin the maximum output voltage of the power supply is obtained and is adjustable via the trimpot located on the top of the power supply. Reductions in output voltage to 30% of maximum are possible by this method. This is shown in Figure 1 below. The maximum voltage is fixed by the model and is a regulated output. In this configuration, the output voltage will not vary with input line fluctuations or output load changes up to the maximum power rating for the power supply. For standard 28 VDC input models, the input line may vary from 25 VDC to 31 VDC and the output voltage will remain regulated within 0.01%. Standard output loads may be as high as 15 Watts of power (for 15 Watt models). The input AC bypass capacitor C1 is optional and is utilized to prevent switching spikes from riding back on the input power lines. Values of 0.1 uF to 10 uF are commonly used.

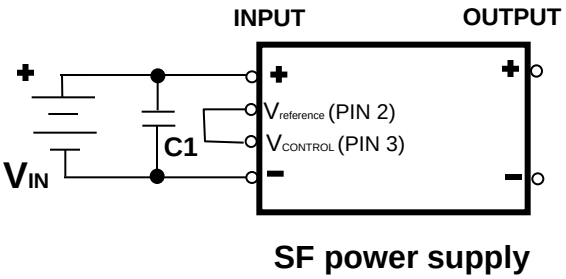


Figure 1: Basic SF hookup schematic for maximum output

The output voltage of the SF unit may be programmed from an external voltage. It may be reduced in magnitude by placing a voltage lower than the +5.0 volt reference voltage onto the Vcontrol pin (Pin 3). By placing a voltage of +2.5 VDC onto the control voltage pin the output will be reduced in half. Figure 2 details a simple method of using an external voltage source to vary the output voltage of the SF power supply. Typical values of input impedance for the SF are 5K Ohms. This makes programming via a DAC or operational amplifier an easy chore for the SF power supply. The control voltage is referenced to the input ground. There is no connection between the input ground and output HV return in all SF power supplies.

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SF Series Application Notes (continued)

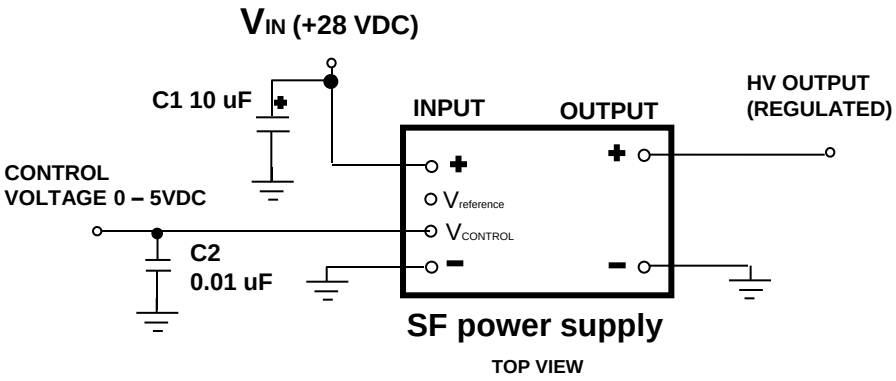
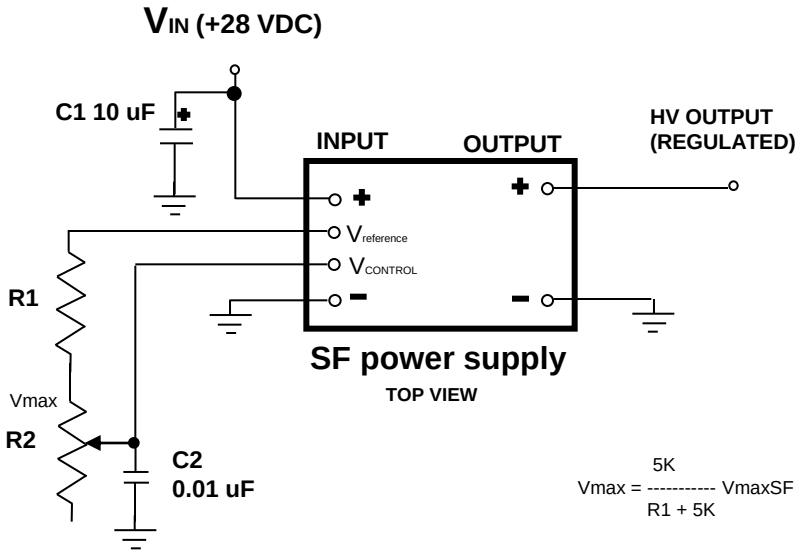


Figure 2: Voltage programming

Capacitor C1 removes switching spikes from the input line and C2 is an AC bypass to insure smooth voltage control levels.

The SF power supply may also be programmed by using a simple trimpot and the internal +5.0 volt reference. Figure 3 shows this topology. Because the input impedance of the control voltage pin is 5K Ohms, the output of the SF may be controlled between minimum and maximum values using the formulas given. The output in both configurations can always be lowered or adjusted via the internal trimpot located on the top surface of the power supply.



$$V_{max} = \frac{5K}{R1 + 5K} V_{maxSF}$$

$$V_{min} = \frac{5K}{R1 + R2 + 5K} V_{maxSF}$$

Figure 3: Resistance Programming

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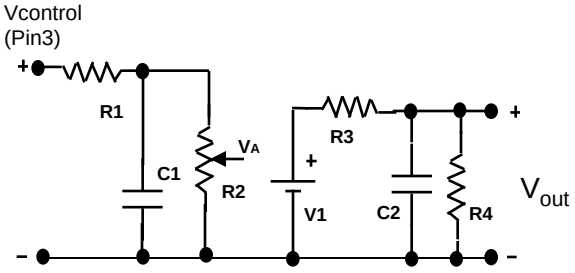
Note: R2 is internal trimpot accessible via top of power supply

Equivalent SF Circuit Model



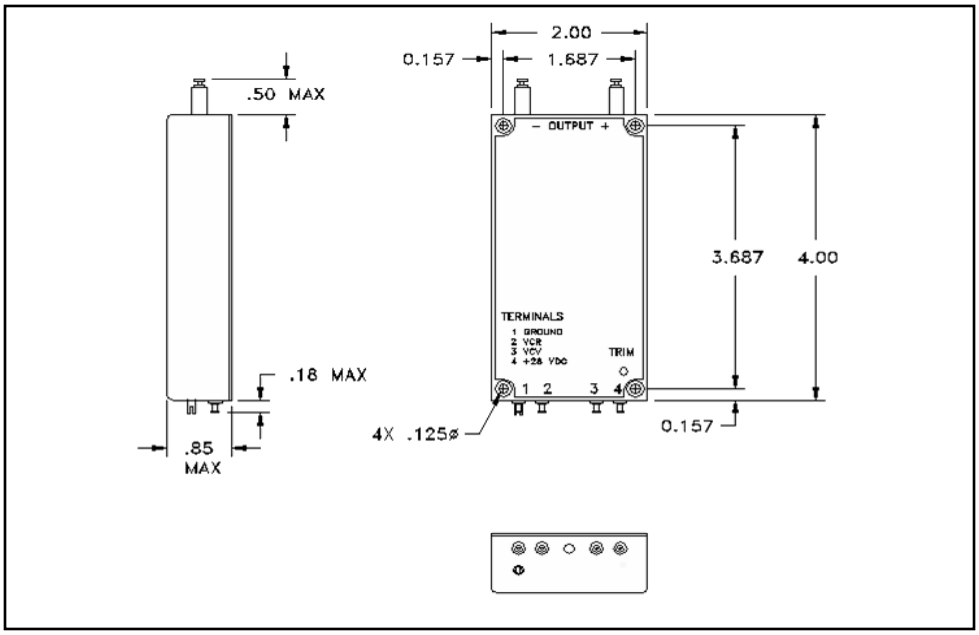
Equivalent SF HVPS Circuit Model

R1 = 100 *Ohms*
R2 = 5K *Ohms (timpot)*
R3 = (15 x $Vout_{max}$) *Ohms*
R4 = (4 x $Vout_{max}^2$) *Ohms*
C1 = (0.1 x 10^{-6}) *Farads*
C2 = (0.0075 x $Iout_{max}$ / $Vout_{max}$) *Farads*
V1 = (V_A x $Vout_{max}$ / 5.0) *Volts*

For example, for an SF – 50 10W:

Vout**max** = 5000 V
Pout**max** = 10 W
Iout**max** = 0.002 A
R1 = 100 Ohms
R2 = 5K Ohms
R3 = 75K Ohms
R4 = 100 Megohm
C1 = 0.1 uF
C2 = 0.003 uF

Outline Drawing: (inches (millimeters))



Ordering Information:

SFV* – Y

X = Output voltage
*** = Remove V for 15 Watt units**

Example:

SF – 50V 10W: Maximum output = 5,000 V 10 Watts 28 VDC input
SF – 50 Maximum output = 5,000 V 15 Watts 28 VDC input