

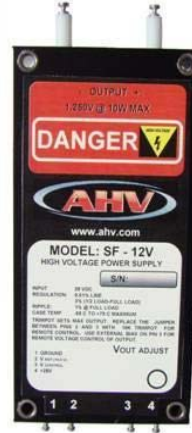


AMERICAN HIGH VOLTAGE
POWER SUPPLIES FOR THE WORLD

SF Series High Voltage Power Supply

General Description

The SF Series high voltage power supplies are regulated high voltage power supplies. They provide outputs of up to 10kV and power levels to 15 Watts. The output 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 trimpot, or via an external control signal. The output ripple is typically less than 1% at full power. Each power supply may be programmed down to 30% of the maximum output voltage. All SF models offer 0.01% line regulation and 3% maximum half load to full load regulation. All SF's are reverse input voltage and short circuit protected.

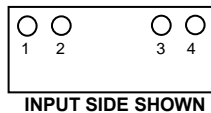


SF Series

Features

- Regulated Output
- Encapsulated
- 100 VDC to 10,000 VDC models available
- 10 Watt and 15 Watt power
- 28 VDC input
- Trimpot, Resistance or Voltage program

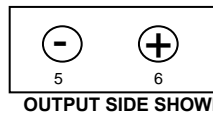
Connection Diagram



Pins:

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

INPUT SIDE SHOWN



Pins:

5. - HV output
6. +HV output

OUTPUT SIDE SHOWN

Available Models: ($V_{in} = 28$ VDC standard (other input voltages available 12, 15, 24, and 48V)):

10 Watt Models:

| Name | Maximum Output Voltage | Maximum Output Current | 1st Year |
|-----------|------------------------|------------------------|----------|
| SF - 1V | 100 | 100 mA | 2003 |
| SF - 2V | 200 | 50 mA | 1999 |
| SF - 6 V | 600 | 16.67 mA | 1991 |
| SF - 12 V | 1,250 | 8 mA | 1986 |
| SF - 25V | 2,500 | 4 mA | 1983 |
| SF- 50V | 5,000 | 2 mA | 1984 |
| SF-100V | 10,000 | 1 mA | 1992 |

Available Models: Vin = 28 VDC standard (other input voltages available 12,15,24, and 48V):

15 Watt Models:

| Name | Maximum Output Voltage | Maximum Output Current | 1st Year |
|-------------|-------------------------------|-------------------------------|-----------------|
| SF - 1 | 100 | 150 mA | 2000 |
| SF - 2 | 200 | 75 mA | 1993 |
| SF - 6 | 600 | 25 mA | 1990 |
| SF - 12 | 1,250 | 12 mA | 1989 |
| SF - 25 | 2,500 | 6 mA | 1985 |
| SF - 50 | 5,000 | 3 mA | 1985 |



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Electrical Characteristics

(at 25 degrees C unless otherwise specified)

SF Series

| 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% | V _{NL} /V _L |
| 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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SF Series

Physical Characteristics

(at 25 degrees C unless otherwise specified)

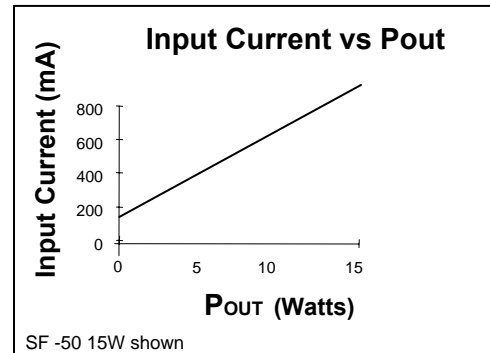
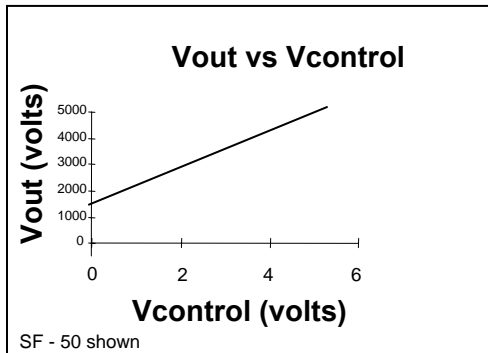
| Parameter | Conditions | Value | Units |
|---------------|--|--------------------------|-------------------|
| Dimensions | MKS | 50.8 W x 101.6L x 20.6 H | mm |
| | English | 2.0 W x 4.0 L x 0.81 H | inches |
| Volume: | MKS | 105 | cm ³ |
| | English | 6.4 | inch ³ |
| Mass: | MKS | 156 | grams |
| | English | 5.6 | oz |
| Packaging: | Black anodized aluminum case with RTV elastomer encapsulation | | |
| Finish | Smooth arushed 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 |

SF Series Performance Charts



SF Series Application Notes

The SF Series 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.

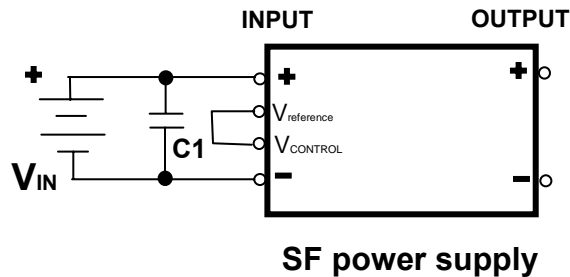


Figure 1: Basic SF hookup schematic for maximum output

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)

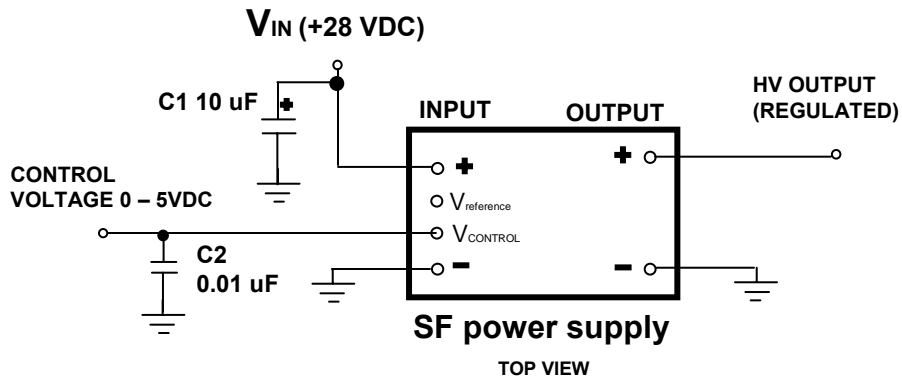


Figure 2: Voltage programming

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.

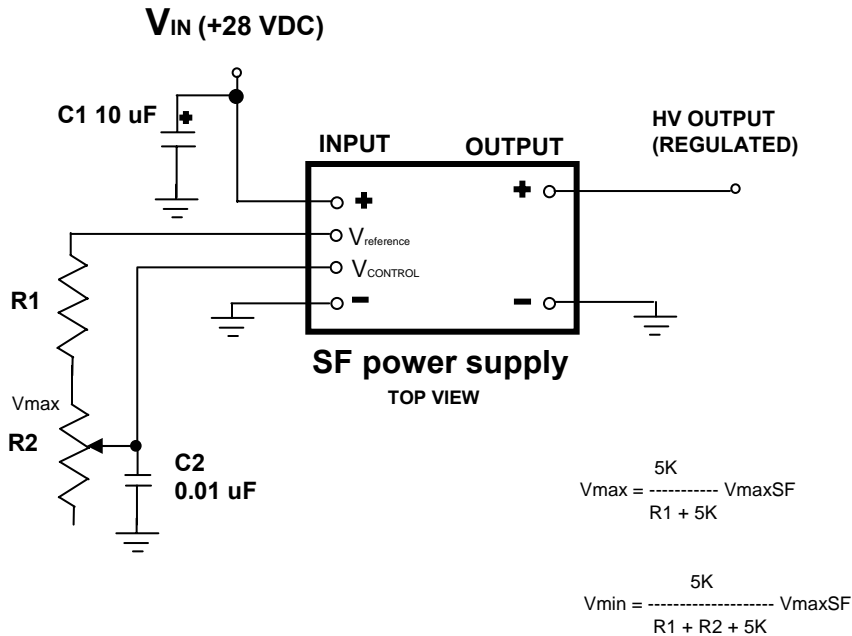


Figure 3: Resistance Programming

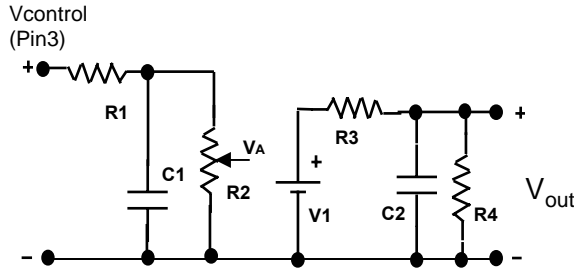


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SF Series

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

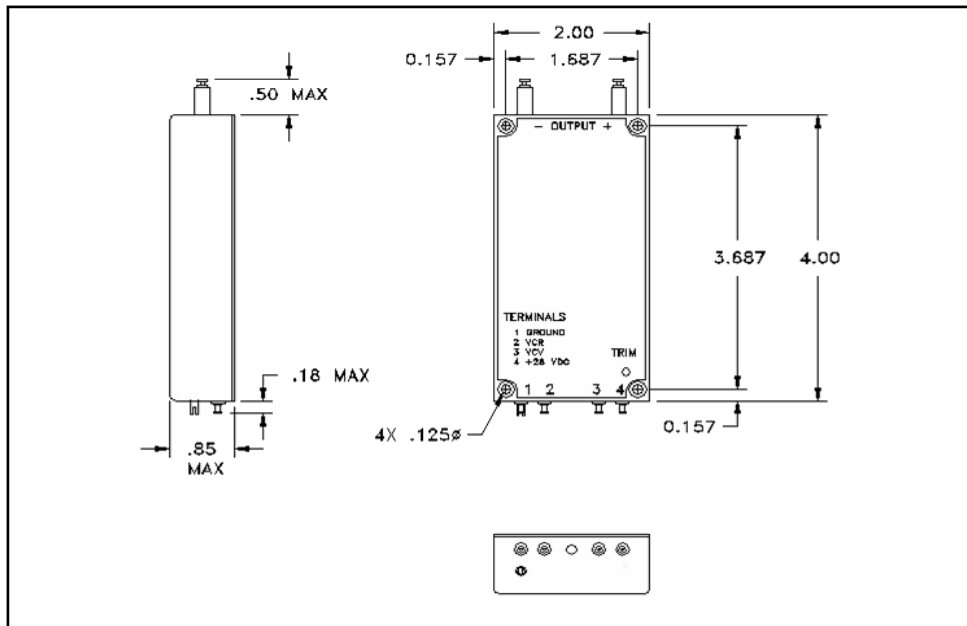
Equivalent SF Circuit Model



Equivalent SF HVPS Circuit Model

- R1 = 100 Ohms
 - R2 = 5K Ohms (trimpot)
 - R3 = $(15 \times V_{out\ max})$ Ohms
 - R4 = $(4 \times V_{out\ max}^2)$ Ohms
 - C1 = (0.1×10^{-6}) Farads
 - C2 = $(0.0075 \times I_{out\ max} / V_{out\ max})$ Farads
 - V1 = $(V_A \times V_{out\ max} / 5.0)$ 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:

SF - XXV* / Z

XX = Output voltage
Z = Input voltage (blank if 28VDC)
* = Remove V for 15 Watt units

Example:

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