AMERICAN HIGH VOLTAGE
POWER SUPPLIES FOR THE WORLD

TCR Series
High Voltage Power Supply

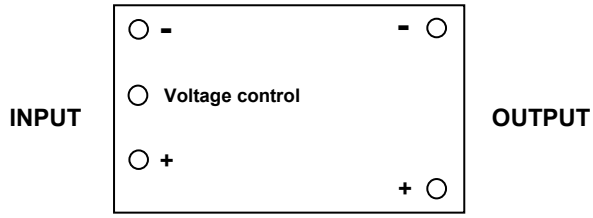
General Description

The TCR Series high voltage power supplies are regulated high voltage power supplies. They provide outputs of up 5kV and are rated at 1 Watt of power. The output voltage of the TCR may be varied either with an external trimpot or via an external voltage control signal. The output ripple is typically less than 1% at full power. The return output lead is internally connected to the input power return. Both positive and negative output TCR power supplies are available. Each power supply may be programmed down to zero volts output and offer 0.1% line and load regulation. All TCR's are reverse input voltage and short circuit protected.

Features

- Regulated Output
- Encapsulated
- 50 VDC to 5,000 VDC available
- 1 Watt power output
- 12 VDC input standard
- Resistance or Voltage Programming

Connection Diagram



Bottom View

Available Models: (Vin = 12VDC standard (other input voltages available)):

1 Watt Models: (Positive output)

Name	Maximum Output Voltage	Maximum Output Current	1st Year
TCR - 0.5P	50 (Vin = 12 VDC)	20 mA	1998
TCR – 1P	100 (Vin = 12 VDC)	10 mA	2003
TCR – 2P	200 (Vin = 12 VDC)	5 mA	2000
TCR – 5P	500 (Vin = 12 VDC)	2 mA	1995
TCR – 10P	1,000 (Vin = 12 VDC)	1 mA	1997
TCR --15P	1,500 (Vin = 12 VDC)	0.67 mA	2001
TCR – 20P	2,000 (Vin = 12 VDC)	0.5 mA	1993
TCR – 30P	3,000 (Vin = 12 VDC)	0.33 mA	1997
TCR – 40P	4,000 (Vin = 12 VDC)	0.25 mA	1998
TCR – 45P	4,500 (Vin = 12 VDC)	0.22 mA	2000

Available Models: (Vin = 12VDC standard (other input voltages available)):

1 Watt Models: (Negative output)

Name	Maximum Output Voltage	Maximum Output Current	1st Year
TCR - 0.5N	50 (Vin = 12 VDC)	20 mA	1997
TCR – 1N	100 (Vin = 12 VDC)	10 mA	2001
TCR – 2N	200 (Vin = 12 VDC)	5 mA	2004
TCR – 5N	500 (Vin = 12 VDC)	2 mA	1996
TCR – 10N	1,000 (Vin = 12 VDC)	1 mA	1998
TCR –15N	1,500 (Vin = 12 VDC)	0.67 mA	2003
TCR – 20N	2,000 (Vin = 12 VDC)	0.5 mA	1994
TCR – 30N	3,000 (Vin = 12 VDC)	0.33 mA	1996
TCR – 40N	4,000 (Vin = 12 VDC)	0.25 mA	1996
TCR – 45N	4,500 (Vin = 12 VDC)	0.22 mA	2001

*input voltages of 15, 24, 28 and 48 VDC available

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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)		10.8VDC	12VDC	13.2 VDC	VDC
Input Current:	No Load:		550	60	75	mA
	Full Load:		155	160	175	mA
Output Ripple:	No Load (all models): Full Load (all models):		0.7% 0.8%	0.7% 0.8%	1% 1%	Vpp Vpp
Load Regulation:	No Load to Full Load Half Load to Full Load				0.1% 0.1%	V_{NL}/V_L 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:				150	300	mA
Power Efficiency:	Full Load		50%	55%	60%	$\frac{P_{OUT}}{P_{IN}}$
Reverse Input Polarity	Protected to 20 VDC					
Temperature Drift:	No Load Full Load				200 200	ppm/DegC ppm/Deg C
Thermal Rise:	No Load (case) Full Load (case)				15 25	degrees C degrees C
Slew Rate (10% - 90%)	No Load Full Load				100 120	mS mS
Slew Rate (90% - 10%)	No Load Full Load				200 100	mS mS
Drain Out Time	No Load (5 TC)				150	mS

* Other input voltages available: 5VDC, 15VDC, 24VDC, 28VDC and 48VDC

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Physical Characteristics
(at 25 degrees C unless otherwise specified)

Parameter	Conditions	Value	Units
Dimensions	MKS	38.1 W x 25.4 L x 12.7 H	mm
	English	1.5 W x 1.0 L x 0.50 H	inches
Volume:	MKS	12.7	cm^3
	English	0.75	$inch^3$
Mass:	MKS	50	grams
	English	1.7	oz
Packaging:	Solid Epoxy Thermosetting		
Finish	Smooth Dial-Phthalate Case		
Terminations:	Gold Plated Brass pins (5)		

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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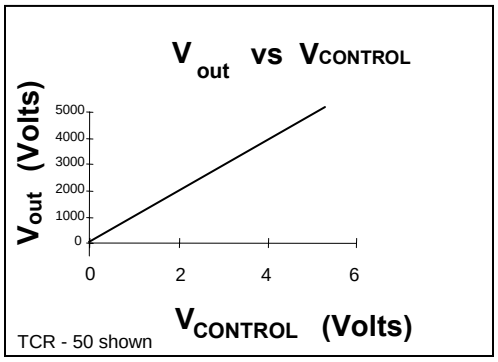
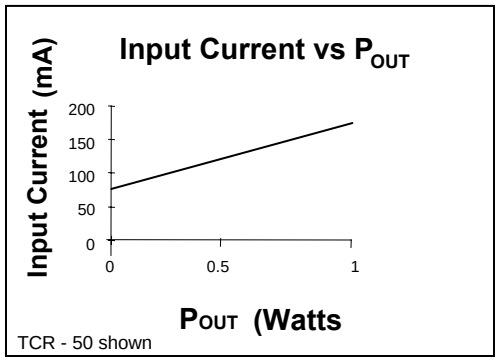
TCR Series Performance Charts





TCR Series Application Notes

The TCR Series high voltage power supplies are powered by an input voltage of 12 VDC. They can be either controlled by an external resistance or an external voltage. Figure 1 below shows the basic hookup which provides the maximum regulated output voltage that the power supply is designed for. No connection is made to the voltage control pin. This voltage is fixed by the model and is a regulated output. This means, 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 12 VDC input models, the input line may vary from 10.8 VDC to 13.2 VDC and the output voltage will remain regulated. Standard output loads may be as high as 1 Watt of power. As shown in Figure 1 below, the simple connection of an TCR unit to a DC source of voltage will provide a high voltage stepped-up output. 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.

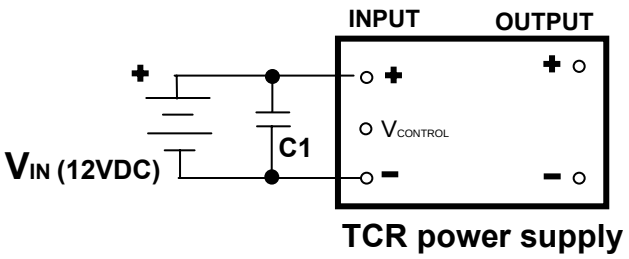


Figure 1: Basic TCR hookup schematic for maximum output
(top view of TCR shown)

The output voltage of the TCR unit may be reduced in value by placing a voltage lower than the +5.0 volt reference voltage onto the Vcontrol pin. 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 TCR power supply. Typical values of input impedance for the TCR are 5K Ohms. This makes programming via a DAC or operational amplifier an easy chore for the TCR power supply. The control voltage is referenced to the input ground. There exists an internal connection between the input ground and output ground in all TCR power supplies.

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TCR Series Application Notes (continued)

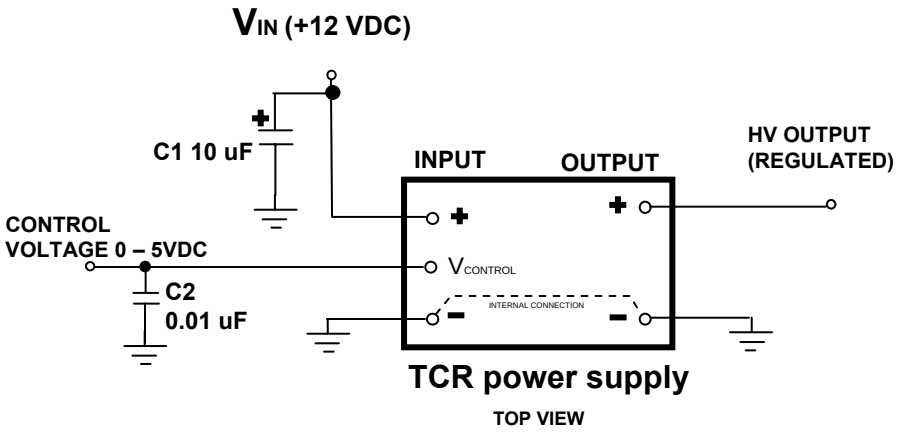
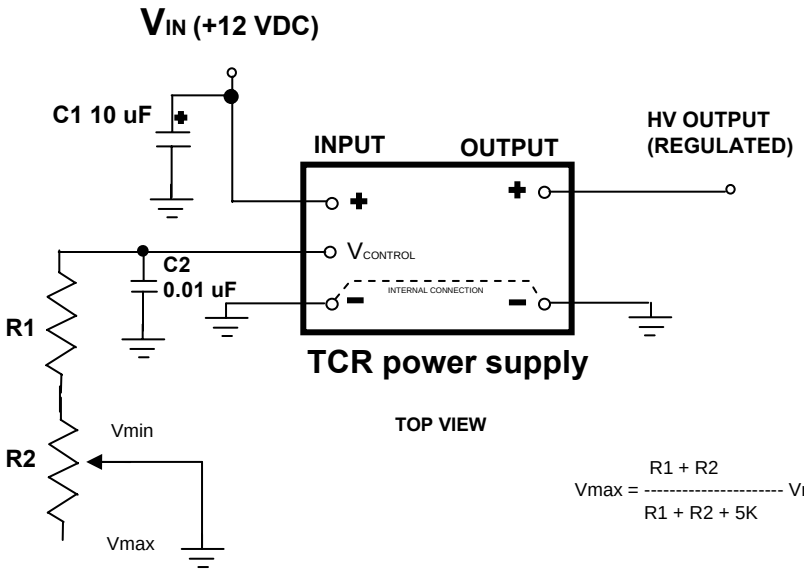


Figure 2: Voltage programming

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

The SCR 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 10K Ohms, the output of the SCR may be controlled between minimum and maximum values using the formulas given.



$$V_{max} = \frac{R1 + R2}{R1 + R2 + 5K} \text{ VmaxTCR}$$

$$V_{min} = \frac{R1}{R1 + 5K} \text{ VmaxTCR}$$

Figure 3: Resistance Programming

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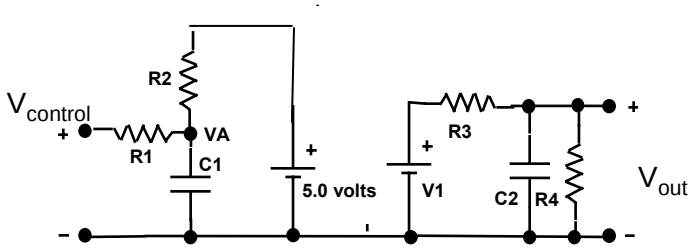
Equivalent TCR Circuit Model



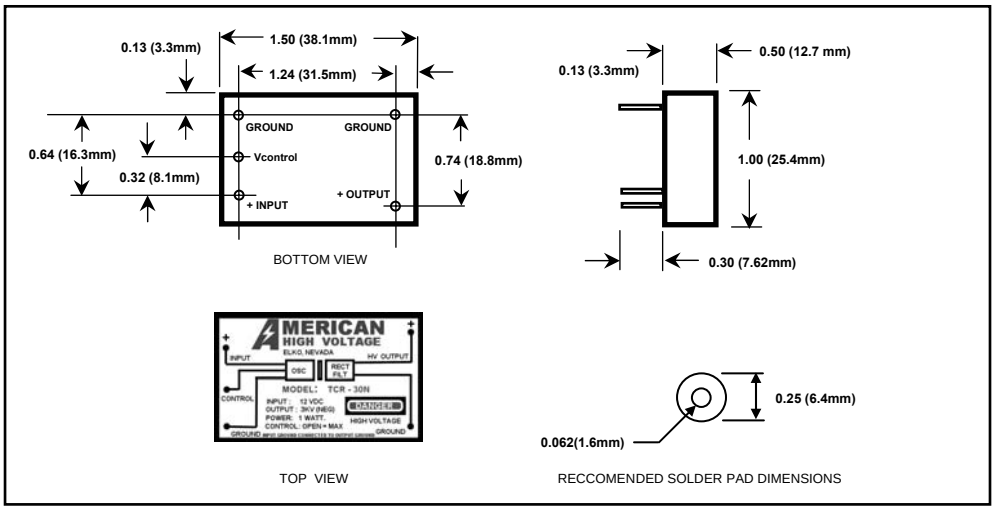
Equivalent TCR HVPS Circuit Model

R1 = 100 *Ohms*
R2 = 5K *Ohms*
R3 = R3 = (0.001 **x** Vout **max** / Iout **max**) *Ohms*
R4 = (22 **x** Vout $_{max}^{2}$) *Ohms*
C1 = 0.01 micro *Farads*
C2 = (0.01 **x** Iout$_{max}$ / Vout$_{max}$) *Farads*
V1 = (VA **x** Vout$_{max}$ / 5.0) *Volts*

For example, for an TCR - 50:

Vout**max** = 5,000 V
Pout**max** = 1 W
Iout**max** = 0.0002 A
R1 = 100 Ohms
R2 = 5K Ohms
R3 = 25K Ohms
R4 = 200 Megohm
C1 = 0.01 uF
C2 = 400 pF

Outline Drawing: (inches (millimeters))



Ordering Information:

TCR – XXY / Z

XX = Output voltage divided by 100
Y = P for positive, N for negative
Z = Input voltage (blank if 12VDC)

Example:

TCR – 30P: Maximum output = 3,000 V 12 VDC input
TCR – 30N/5: Maximum output = 3,000 V (negative) 5VDC input