AMERICAN HIGH VOLTAGE

HTR Series
200 Deg C High Voltage Power Supply

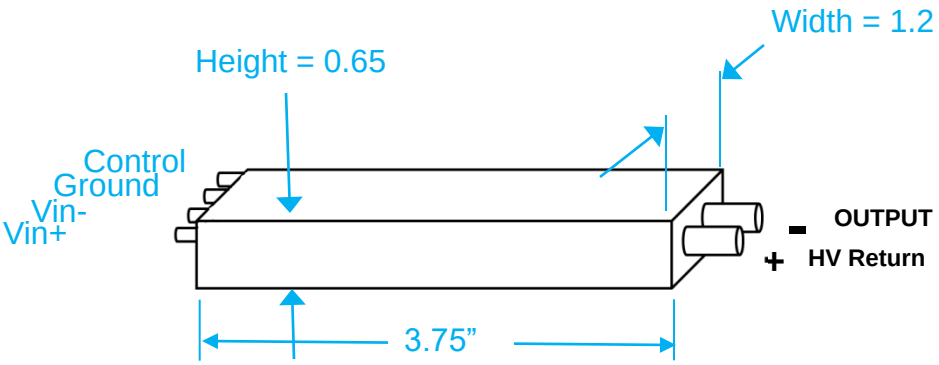
General Description

The HTR Series high voltage power supplies are the ultimate in exotic DC to DC converters. They are designed for severs environmental applications requiring a regulated voltage. The output is directly sensed and can be adjusted over a 3 to 1 range by means of a trim resistor. The HTR utilizes advanced high voltage techniques and compensation networks. All components specially selected and burned in prior to assembly. In addition, the high voltage transformer is totally encapsulated with a low loss high temperature epoxy resin that guards against internal breakdown or corona. The HTR is not restricted by orientation. Moreover, as the unit is hard potted, it does not contain oil that could leak out and damage other equipment.

Features

- Output regulated to 0.01 % (HL-FL)
- Encapsulated
- 1,000 VDC to 3,000 VDC available
- 0.3 Watt power
- Various input voltages available
- Ripple 600 mVpp

Outline Drawing:



HTR-MVN-15 shown

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Electrical Characteristics

(at 25 degrees C unless otherwise specified)

Parameter	Conditions		Value			Units
			Min	Typical	Max	
Supply Voltage*:	HTR-MVP - 15 HTR-MVP - 24 HTR-MVP- 30		14 VDC 22 VDC 27 VDC	15VDC 24VDC 30VDC	16 VDC 26 VDC 33 VDC	VDC VDC VDC
Input Current:	NL: (15Vin model): NL: (24Vin model): NL: (30Vin model): FL: (15Vin model): FL: (24Vin model): FL: (30Vin model):		45 30 30 75 36 36	50 35 35 80 40 40	55 40 40 85 44 44	mA mA mA mA mA mA
Output Ripple:	No Load (all models): Full Load (all models):		0.015 % 0.02 %	0.02 % 0.03 %	0.03 % 0.035%	Vpp Vpp
Load Regulation:	No Load to Full Load Half Load to Full Load		0.01 % 0.01 %	0.02 % 0.01 %	0.025 % 0.01 %	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:	(maximum input current)			100	125	mA
Power Efficiency:	Full Load		20%	25%	30%	$\frac{P_{OUT}}{P_{IN}}$
Reverse Input Polarity	Protected to 50 VDC					
Temperature Drift:	No Load Full Load				25 25	ppm/DegC ppm/Deg C
Thermal Rise:	No Load (case) Full Load (case)				2 5	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

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Physical Characteristics

(at 25 degrees C unless otherwise specified)

Parameter	Conditions	Value	Units
Dimensions	MKS	95.3 L x 30.5 W x 16.5 H	mm
	English	3.75 L x 1.2 W x 0.65 H	inches
Volume:	MKS	46.95	cm^3
	English	2.95	$inch^3$
Mass:	MKS	135	grams
	English	4.6	oz
Packaging:	Brass Tubing with solid epoxy encapsulation		
Finish	Flat black		
Terminations:	Input:	Teflon Terminals	
	Output:	Teflon Terminals	

Environmental Characteristics

(at 25 degrees C unless otherwise specified)

Parameter	Conditions	Value	Units
Temperature Range	case temperature (max)	-40 degrees to + 200 degrees	Celsius
	case temperature (max)	-40 degrees to + 392 degrees	Fahrenheit
Shock:	MIL-STD-810 Method 516	200 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 +200 deg C	Class 2

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Models Available (as of September 2019):

Model	Output Voltage Range	Input Voltage	Polarity
HTR-MVP - 15	2,000 VDC @ 150 uA	15 VDC	Positive
HTR-MVP - 24	2,000 VDC @ 150 uA	24 VDC	Positive
HTR-MVP – 30	2,000 VDC @ 150 uA	30 VDC	Positive
HTR-MVN - 15	-2,000 VDC @ 150 uA	15 VDC	Negative
HTR-MVN – 24	-2,000 VDC @ 150 uA	24 VDC	Negative
HTR-MVN – 30	-2,000 VDC @ 150 uA	30 VDC	Negative

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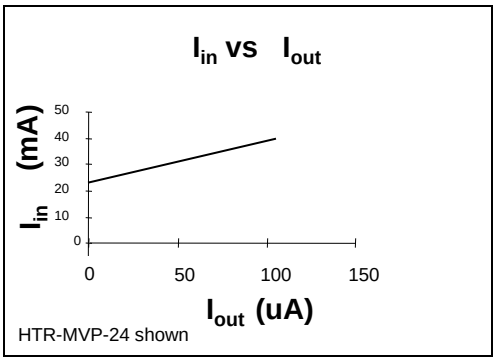
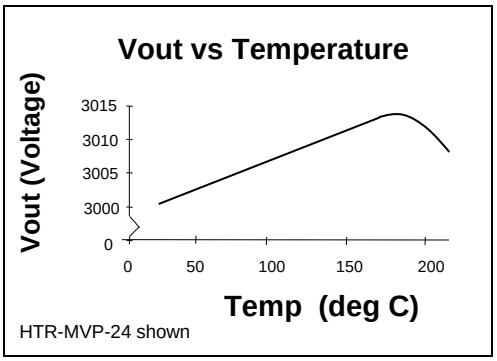
HTR Series Application Notes



HTR-MVP-24 shown



HTR-MVP-24 shown

HTR Series Performance:

The HTR Series high voltage power supplies are regulated against both line and load changes to better than 0.01% for Half Load to Full Load changes. The output load has an effect on the input current as shown in the above graph. There is a fixed input current at the No Load condition to power the regulation circuitry and oscillator. This input current will rise as the temperature of the power supply increases due to leakage in the high voltage diodes. Input current can be expected to increase at least 10 mA when operated to 200 degrees Celsius.

Likewise, the output voltage will vary due to temperature changes that the power supply is subjected to. The above chart indicates the amount of change expected by a HVP unit set to put out 3,000 VDC. Because the high voltage output changes approximately 10 volts from room temperature to 200 degrees Celsius, this is calculated out to bee less than 20 ppm/deg C.

Since the output of HTR units are regulated they can also be adjusted to any desired voltage lower than the maximum that the unit is designed for. This can be done either with a resistance of voltage programming. The following sections detail how this is accomplished.

Keep in mind that all HTR units are NON-isolated. The output high voltage return is internally connected to the input ground. The output is NOT floating. In addition, the case is not connected to any circuitry and may be grounded to any reasonable low voltage point. Grounding of the metallic case may lower the output ripple at full load. To improve noise immunity, it is suggested that at 10 uF capacitor is placed across the input power lines (Vin+ and Vin-). This will improve both line and load regulations.

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HTR Series Application Notes (continued)

Resistance program of positive output

To set the output voltage to a fixed value lower than the maximum that the unit can provide is easily accomplished. In the resistance programming mode, a resistor is inserted from the Control Pin to Ground. For positive output units, a resistance value of zero Ohms yields the maximum output voltage. For negative output units, an open circuit yields the maximum. Figure 1 shows the connections for a positive output power supply. Figure 2 shows the output voltage as a function of control resistor. The output ground is internally connected to the input ground. HTR units are NON-Isolated.

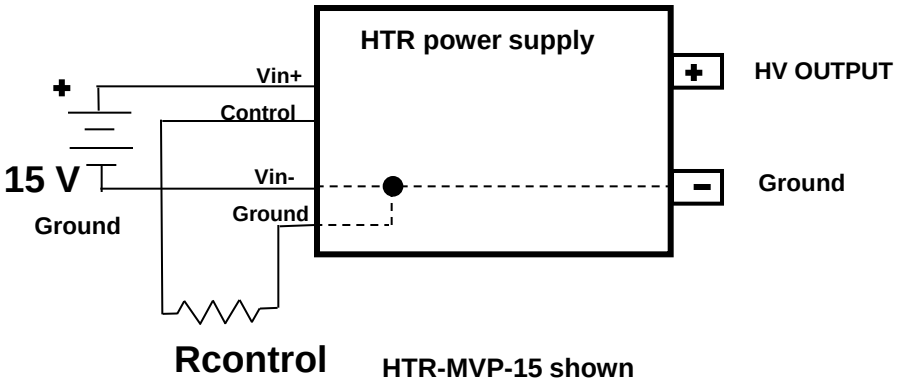

Figure 1: Resistance program of positive output of HTR

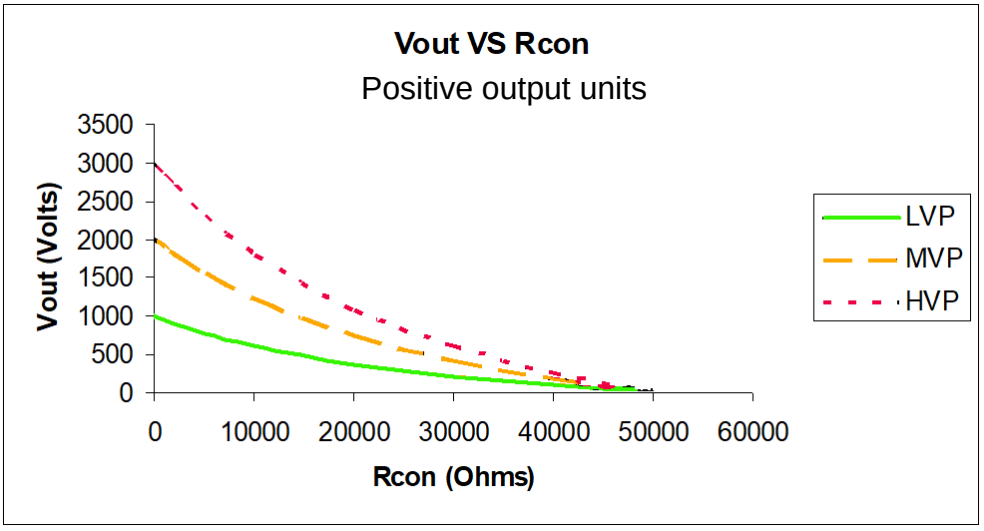

Figure 2: Positive Style HTR Output Voltage as a function of control resistor

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HTR Series Application Notes (continued)

Resistance program negative output:

Some models of the HTR Series high voltage power supplies can provide a negative output voltage. To set the output voltage to a fixed value lower than the maximum that the unit can provide is easily accomplished. In the resistance programming mode, a resistor is inserted between the Control Pin and the Ground Pin. For negative output units, an open circuit yields the maximum output voltage. Figure 3 shows the connections for a negative output power supply. Figure 4 shows the output voltage as a function of control resistor.

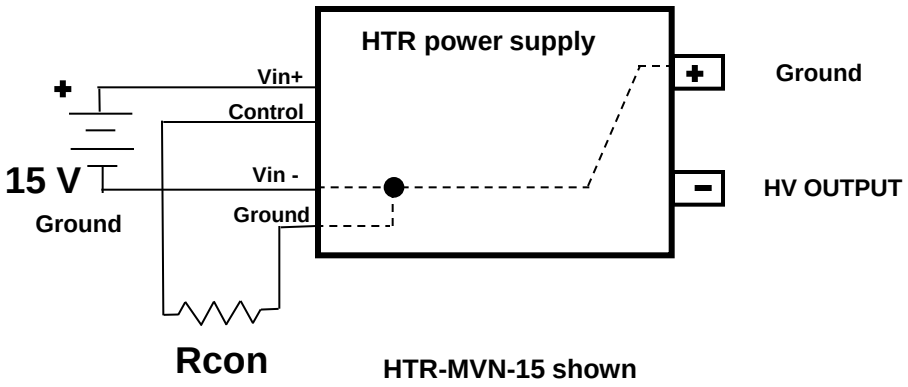

Figure 3: Resistance program of negative output of HTR

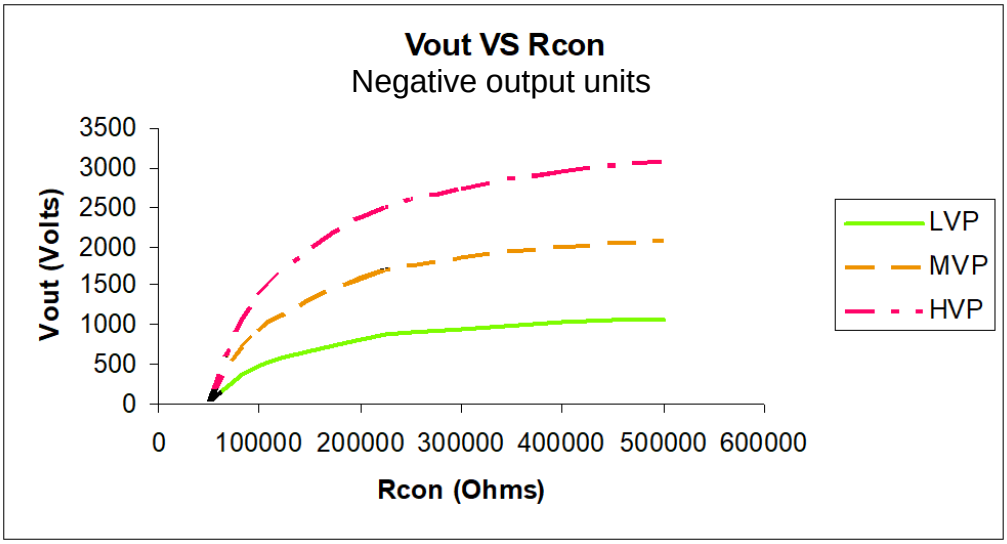

Figure 4: Negative Style HTR Output Voltage as a function of control resistor

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HTR Series Application Notes (continued):

Voltage Control Positive Output:

All HTR power supplies can be controlled by an external reference voltage placed into the Control Pin. Figure 5 details this connection for positive style output units while Figure 6 shows the effect of this external voltage on the output voltage of the unit. The power supply will regulate at the set voltage and be stable against line and load variations as long as the external control voltage is fixed in magnitude.

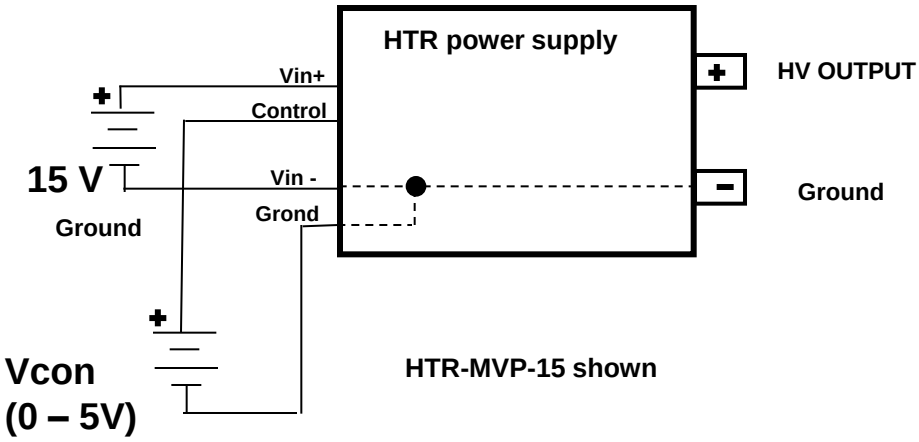

Figure 5: Voltage programming of positive output HTR

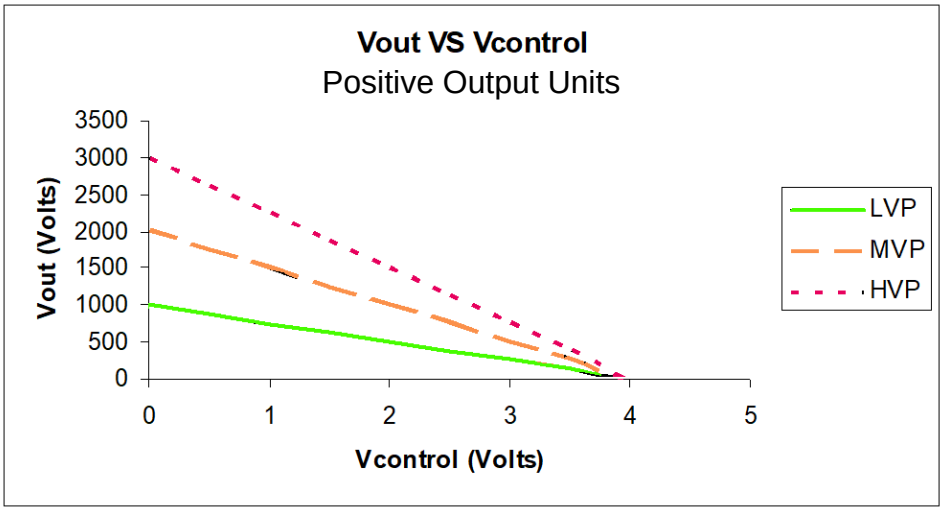

Figure 6: Positive Style HTR Output Voltage as a function of program voltage

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HTR Series Application Notes (continued):

Voltage Control Negative Output:

Negative output HTR power supplies can also be controlled by an external reference voltage placed into the Control Pin. Figure 7 details this connection for negative style output units while Figure 8 shows the effect of this external voltage on the output voltage of the unit. The power supply will regulate at the set voltage and be stable against line and load variations as long as the external control voltage is fixed in magnitude.

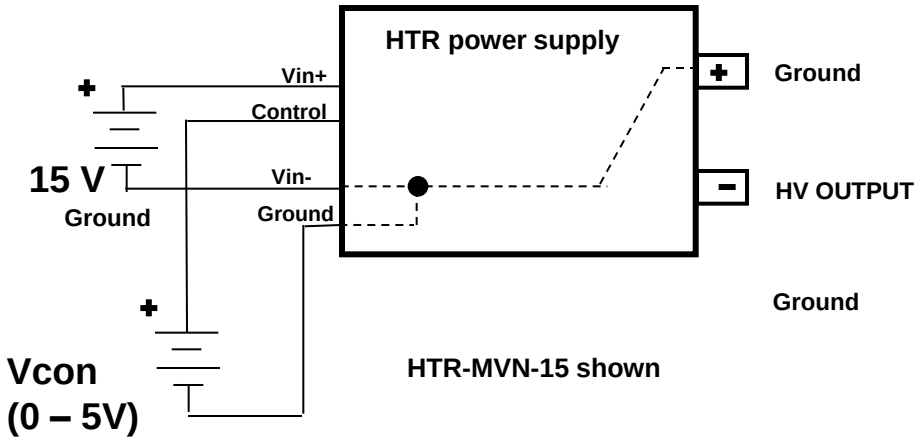

Figure 7: Voltage programming of negative output HTR

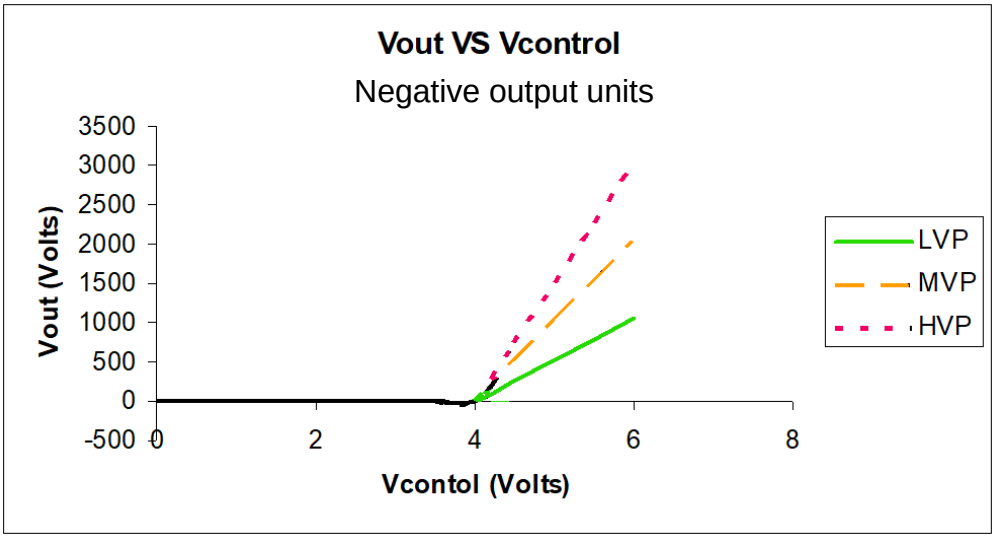

Figure 8: Negative Style HTR Output Voltage as a function of program voltage

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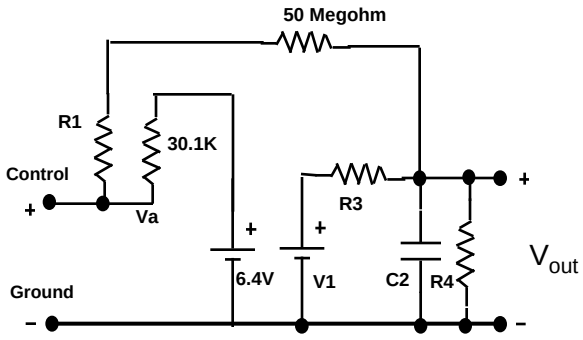
Equivalent HTR Circuit Model



HTR Circuit Model

R1 = 201K Ohm (LVP)
100K Ohm (MVP)
67K Ohm (HVP)
90K Ohm (LVN)
30K Ohm (MVN)
10K Ohm (HVN)

R3 = 1 K Ohm
R4 = 100 Megohm (diode leakage)
C2 = (3×10^{-9}) *Farads*

V1 = Positive output units: 4.01 + (2 E8) / R1 – (50 E6)(Va)/R1
= Negative output units: (50 E6)(Va)/R1 – (2 E8)/R1 + 4.01

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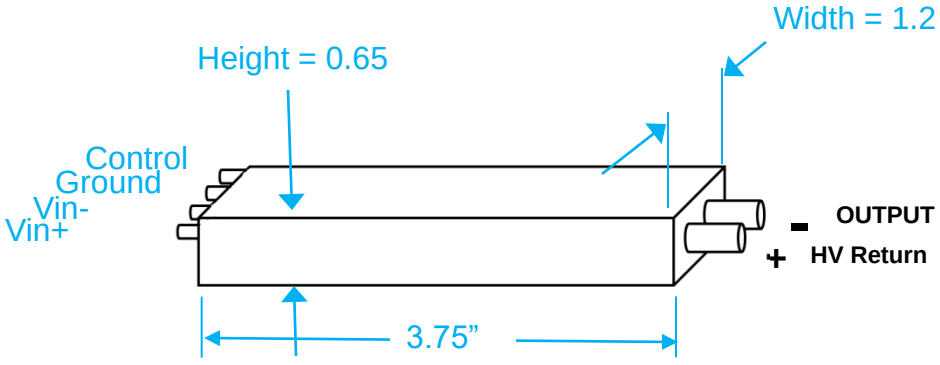
Outline Drawing: (inches)



HTR-MVN-15 shown

Pins:		
	Vin+:	Power Input
	Vin-:	Power return
	Control:	Control
	Ground:	Ground

Ordering Information:

HTR-XVY - Z

X = Output voltage range: L = 1KV, M = 2KV, H = 3KV
Y = polarity P = positive, N = negative
Z = Input voltage 15, 24, 30

Example:

HTR-MVP-24: Maximum output = 2,000 V positive polarity 24 VDC input
HTR-MVN-30 Maximum output = 2,000 V negative polarity 30 VDC input
HTR-HVP-15: Maximum output = 3,000 V positive polarity 15 VDC input
HTR-LVN-30 Maximum output = 1,000 V negative polarity 30 VDC input