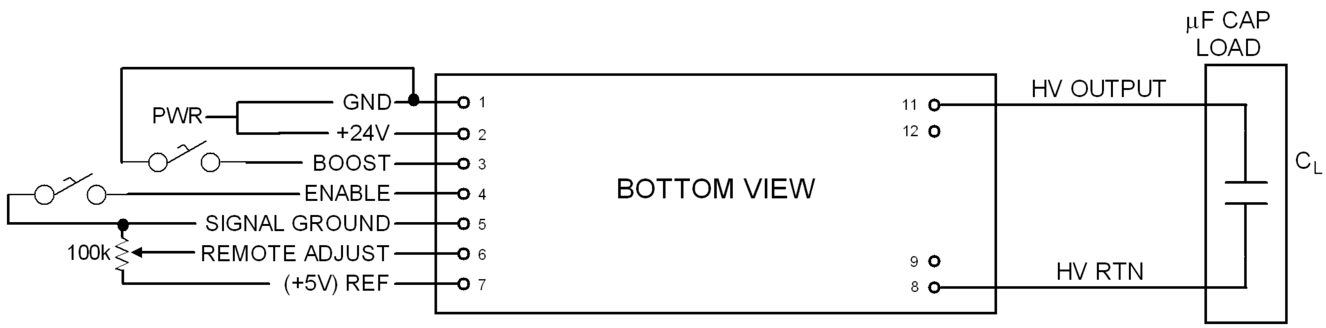
"C" Product Notes

UltraVolt's "A" Series units are designed for DC-bias applications with feedback compensation optimized for dynamic loading. Multiple tuned and untuned LC and RC filters provide low ripple without a need for external capacitors. "A" Series units are applicable to low-speed, capacitor-charging applications. When calculating T_{rise}, the output charge current available is 66% of rated Iout and capacitance-to-charge should have the "A" Series unit's internal capacitance added.

UltraVolt's "C" Series units are designed specifically for pulsed loads and high-speed charging of small and large capacitive loads. DC and AC feedback loops are compensated to provide fast rise time with low overshoot. Current-limit circuits are enhanced to get in and out of limit as fast as possible to maintain high average charge currents while protecting the high-voltage power supply (HVPS) power stage. When calculating "C" Series T_{rise}, the output charge current available is 100% of rated I_{out}. "C" Series units have ½ to 1/10 of the filter capacitance of "A" Series units, allowing more energy to go to the load capacitance (see Fig. F in the "C" Series datasheet). When using a "C" Series unit in a DC-bias application, an external capacitor is recommended for filtering.

CONNECTIONS:

Note: **CAP LOAD MUST RETURN** to *HV Ground Return* (pin 8).



"20W/30W"

If the HVPS is to be grounded to the case, it should also be grounded via pin 8.

ENABLE:

Using *Enable/Disable* (pin 4) to activate the power supply after input power has been applied permits the user to use TTL logic to control HV outputs, (i.e. "1" state = ON, "0" state = OFF). This can be helpful in setting up redundant interlocks or shutting off the HVPS prior to firing a high-energy load. It also acts as an easy method to measure rise time by connecting the oscilloscope external sweep trigger input to the *Enable/Disable* (pin 4) prior to generating a positive "1" rise command (see Application Note #1).

RISE TIME:

Rise times are measured from start of discharge to the time required to rise within 99% of final regulated output. All rise-time data, however, is taken at +24VDC because different input-voltage sources have somewhat different effects on rise time/overshoot (depending on capacitive load used).

The rise time required to charge an external capacitor load (C_L) can be computed in accordance with the formula shown below:

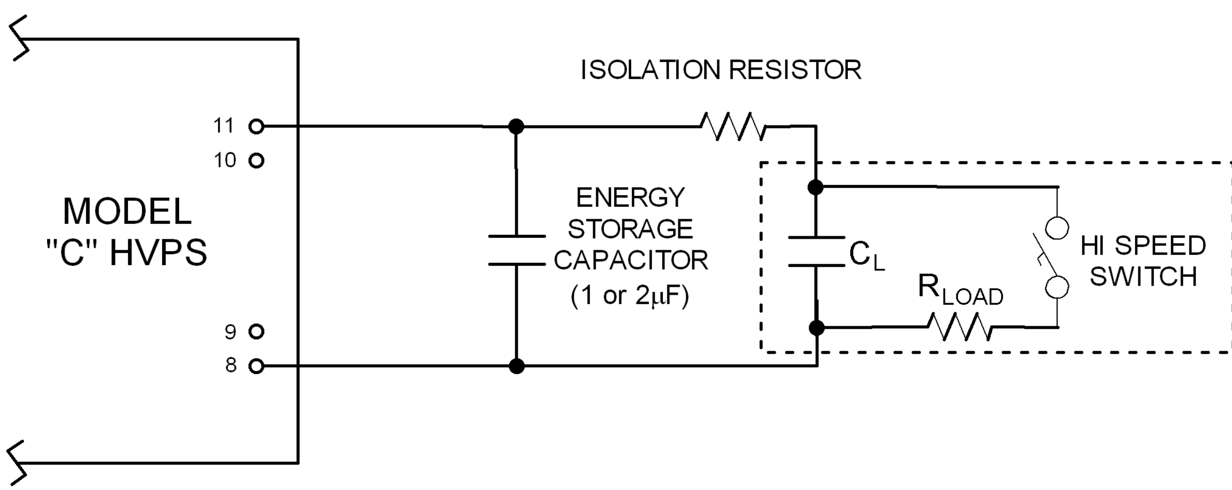
$$T = \frac{(C_L + C_{int})\ Volts}{(I_{short})}$$

Where:

T = Rise time in milliseconds to within 1% of final value (using an enable command)
C_L = External load capacitance in micro farads
C_{int} = Internal supply capacitance (see UV HVPS datasheet Fig. F)
Volts = Voltage in volts to which the capacitor is charged, starting from 0 volts
I_{short} = The output current of the “C” Series power supply in milliamperes when measured under output short-circuit conditions.

HIGH CURRENT PULSED APPLICATIONS:

In cases when large transient discharges of small duration are applied to the output of a “C” Series unit, the user may wish to isolate the “C” Series power supply from the load C_L. This is typically done to place a more average current demand on the high-voltage power supply, keeping peak currents below the HVPS current-limit point. This allows the HVPS to provide the maximum average power to the load by adding a filter cap directly across the *HV Output* (pins 10 & 11) and *HV Ground Return* (pins 8 & 9). A 10Ω to 1kΩ resistor can then be added between the HV output and the load C_L. This will also reduce the tendency to introduce overshoot in the output waveform, which could cause a ringing on the HV output when driving certain types of loads (see diagram below).

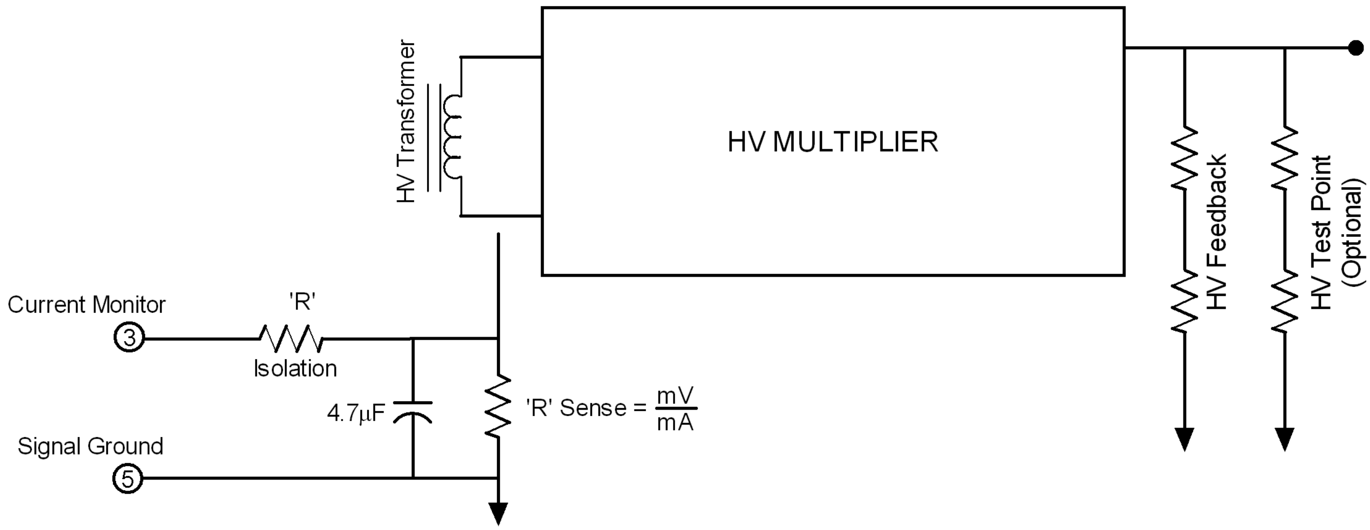


Note: The energy-storage capacitor and the isolation resistor control “pulse droop” during high-discharge-current conditions and average the peak current, thereby reducing the amount of time the HVPS is in peak current limit.

UltraVolt HVPS Output-Current Monitor

UltraVolt's high-voltage power supplies (HVPSs) have an output-current monitor (I_{out} Monitor), which allows the total output current of the HV multiplier to be monitored. Note, since the sense circuit is in the return path to the transformer, the current-monitor signal has a sign opposite of the sign of the HVPS. Therefore, a negative HVPS has a positive current-monitor voltage and a positive HVPS has a negative current-monitor voltage.

The current monitor is generated via an internal sense circuit and brought to the output pin through an isolation resistor. The signal can be integrated by connecting a small capacitor between the I_{out} Monitor and the Signal Ground Return to form an R*C with the internal isolation resistor. The isolation resistor varies with the HVPS series as does the internal sense-circuit impedance, which varies from model to model. The "A" Series has a 15kΩ, 1% isolation resistor. The 60W-, 125W-, and 250W-"C" Series units have a 5kΩ, 1% isolation resistor. The 20W- and 30W-"C" Series units have no isolation resistor because pin 3 is used for grounding (to achieve boost). The I_{out} Monitor output impedance is therefore very low (varying from 22Ω to <1Ω depending on the model).



The current monitor indicates all current flowing from the HVPS HV multiplier. This total current is comprised of the external HV load placed on the supply, the internal HV resistor used to provide a feedback signal to regulate the HVPS, and the internal HV resistor for the Eout test point (if the unit is so equipped). To develop a "true" output-current monitor, the leakage current in the HVPS internal resistor(s) has to be subtracted from the current monitor. If the current monitor is fed to a computer through an analog-to-digital converter, this nulling can be achieved in software by using Ohm's Law. To calculate the internal leakage current, divide the output voltage by the total of the internal resistor(s) and subtract that current from the current measured on the current-monitor pin. If the current monitor is used in an analog circuit, a simple analog-summing circuit can be created using the output-voltage monitor as a correction current. The analog-summing circuit is easily implemented, since the polarity of the output-voltage test point is opposite that of the output-current monitor.

It is important to note, the internal-divider leakage current is directly proportional to output voltage and reduces linearly to zero as output voltage is reduced toward zero. The leakage current represents a higher percentage of the current-monitor signal in higher voltage models and a lower percentage in lower voltage models. As an example, the 1/4A24-P30 has an output of up to 250VDC @ 120mA, and a 2.5MΩ internal-divider resistor with a current of 100µA. The internal current is <0.085% of the output-current-monitor signal, not significant enough in most applications to null out. On the 20A12-P4, the output is up to 20kV @ 200µA and the internal-divider resistor has a current of 40µA. The internal current is >16% of the output-current-monitor signal.

UltraVolt High Voltage Power Supply Total Internal HV Divider Resistance

"AA" Series Model	4/20/30 Watt
1/16AA	560k
1/8AA	1.1 Meg
1/4AA	2 Meg
1/2AA	5.4 Meg
1AA	40 Meg
2AA	67 Meg
4AA	100 Meg
6AA	151 Meg

"A" Series Model	4/15/20/30 Watt	"A-F" Version
1/8A	1.25 Meg	91.7k
1/4A	2.5 Meg	2.0 Meg
1/2A	5.0 Meg	3.3 Meg
1A	4W/50M, 20/30W 10 Meg	8.3 / 5 Meg
2A	100 Meg	50 Meg
4A	200 Meg	66.6 Meg
6A	300 Meg	75.0 Meg
10A	250 Meg	-
15A	375 Meg	-
20A	500 Meg	-
25A	625 Meg	-
30A	750 Meg	-
35A	2.22 Gig	-
40A	2.22 Gig	-

"C" Series Model	20/30 Watt	60/125/250 Watt
1/8C	909k	990k
1/4C	2 Meg	2.43 Meg
1/2C	3.3 Meg	4.76 Meg
1C	5.0 Meg	9.09 Meg
2C	50.0 Meg	50.0 Meg
4C	66.6 Meg	66.6 Meg
6C	75.0 Meg	75.0 Meg
8C	-	285.7 Meg
10C	-	333.3 Meg
12C	-	375.0 Meg
15C	-	500.0 Meg
20C	-	667.0 Meg
25C	-	770.0 Meg
30C	-	858.0 Meg