APPLICATION NOTES FOR USE WITH SPELLMAN HIGH VOLTAGE POWER SUPPLIES

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The Limits of Front Panel Digital Meters

Most of Spellman's rack mounted high voltage power supplies and X-Ray generators have full feature front panels complete with digital meters to display output voltage and current. These meters are intended to be used as a non-precision reference of the functional state of the power supply. Because of inherent limitations as described below, it is not recommended to use the front panel meters as a means of obtaining precision process control, especially for small signal readings.

Digital Meter Voltage Maximum Input Requirements

The series of digital meters employed utilize a 0-2Vdc input voltage signal. 2Vdc is the absolute maximum input signal the meter can accept. Spellman uses a 0-10Vdc programming signal for programming and monitoring of the high voltage power supply. This means the 0-10Vdc voltage and current monitor signals generated power supply feedback circuitry must be divided down to 2Vdc or less in order to be displayed on the front panel meters. Dividing down a signal brings it closer to background noise, reducing the signal to noise ratio.

Signal Attenuation

A 30kV power supply would have a 10Vdc full scale voltage monitor signal provided on the rear panel interface connecter. But to get the front panel digital meter to read properly, this 10Vdc signal must be attenuated to 300mV. Yes 300mV, because 10Vdc would not display the proper numbers on the digital meter, and dividing the 10Vdc signal to 3Vdc is still too large for the meters 2Vdc maximum input.

Signal to Noise Ratios

Noise is present in most electrical systems. It's the low level background signal that is due to switching regulators, clock circuits and the like. Ideally zero noise would be desired, but some amount is present and must be dealt with. In switching power supplies, 25mV's of background noise on the analog control lines is not uncommon. Typically it is desirable to have the signal as large as possible when compared to the noise providing the highest signal to noise ratio.

Example

With the 10Vdc full scale rear panel voltage monitor:
10V/25mV = 400, the signal is 400 times the noise.

With the 300mV full scale front panel digital meter:
300mV/25mV = 12, the signal is 12 times the noise.

Once the power supply is operated at less than maximum output voltage, the signal to noise ratio condition only worsens. Trying to obtain accurate, repeatable results at very small percentages of maximum rated output can be difficult to downright impossible is some instances.

Meter Accuracy

The series of front panel meters used have a typical accuracy of 2%, ± 1 least significant bit. They refresh the display at the rate of about 2 times per second. These specifications are fine for use for informal reference metering, but they should not be considered precision measurement equipment.

Summary

Because of the mentioned issues with small signal levels, signal to noise ratios and the non-precision nature of the front panel meters themselves, relying on these meters to make critical process control measurements is not recommended. The use of the power supply's full scale 0-10Vdc rear panel monitor signals coupled with an external, high precision, 5.5 or 6.5 digit meter will provide the best option in the measurement of the power supplies performance.