

by Peter Allen of Advanced Energy Industries, Inc.

MDX-L 6 kW HALO

Product: MDX-L 6 kW HALO

Synopsis: High Accuracy Low Output control with Ignition Enhancement Circuit

- Pulse circuit
- Ramp circuit
- Ignition detection

Applications: Next generation metallization systems requiring high output power delivery with extremely fine regulation

Who benefits: OEM system designers and process engineers requiring the latest in high power delivery and control technology

The following is a description of the MDX-L 6 kW HALO (High Accuracy at Low Output) unit. The unit has the same electrical characteristics as the standard MDX-L 6 kW CE unit with the following enhanced features.

DUAL SLOPE HALO POWER REGULATION

The HALO feature of this member of the MDX-L family combines highly accurate power control at the low output power levels required for metallization systems. At the same time, the feature lets the unit retain the high power output capability needed for fast target conditioning.

Scaling

The power regulation program level and readback have been rescaled. An external program level of 0 to 8 V corresponds to an output power level of 0 to 1500 W. An external program level of 8.05 to 10 V corresponds to an output power level of 1612 to 6000 W.

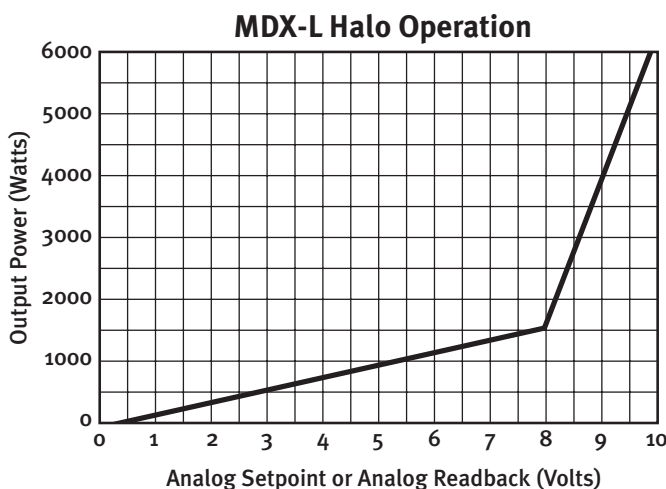


Figure 1.

Accuracy

The accuracy of the unit is 1% of setpoint or 3 W, whichever is greater, for power levels from 0 to 1500 W. The accuracy of the unit is 8% or 150 W, whichever is greater, for power levels from 1612 to 6000 W. The accuracy for power levels between 1500 and 1612 W is not defined due to hysteresis, but the unit's operation is continuous and monotonic. Figure 1 shows these relationships.

The HALO feature allows for accurate operation for low-power wafer processing and high-power target conditioning mode. (This allows the MDX-L HALO supply to replace two supplies [process and target burn-in]. If it replaces a single low-power supply, it allows increased throughput by shorting the target conditioning phase.)

IGNITION ENHANCEMENT CIRCUIT

(patent pending)

The ignition enhancement features contain three circuits intended to enhance plasma ignition. The three circuits are:

- Pulsed circuit
- Ramp circuit
- Ignition indication circuit

Pulse Circuit

In the event of ignition failure, the pulse circuit reinitiates the lighting sequence to ensure proper plasma ignition. The output of the unit is disabled for approximately 80 ms if the unit's output current does not rise above a



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threshold of 100 mA 60 ms after the unit is enabled. After 80 ms, the pulsing of the output will continue until successful plasma ignition is achieved. It has been shown that, for some processes, more consistent ignition takes place when a pulsed ignition voltage is applied.

Ramp Circuit

This feature is used to increase the rise time of the output voltage by adding, during ignition, offset to the loop integrator error signal. This offset provides the ability to vary the rate of rise of the ignition pulse's leading edge. Advanced Energy has found that the probability of ignition is increased the faster the output reaches ignition voltage. The rate of rise is a parameter set at the factory.

Ignition Indication Circuit

The ignition indication circuit monitors a sample of the output current and compares it to a threshold or fixed level. If the output current is above the threshold, the pulse circuit and the ramp circuit are disabled. A sustained output of at least 100 mA indicates successful ignition.

Advanced Energy Industries, Inc. has a patent pending relative to the ignition enhancement features included in this product.



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