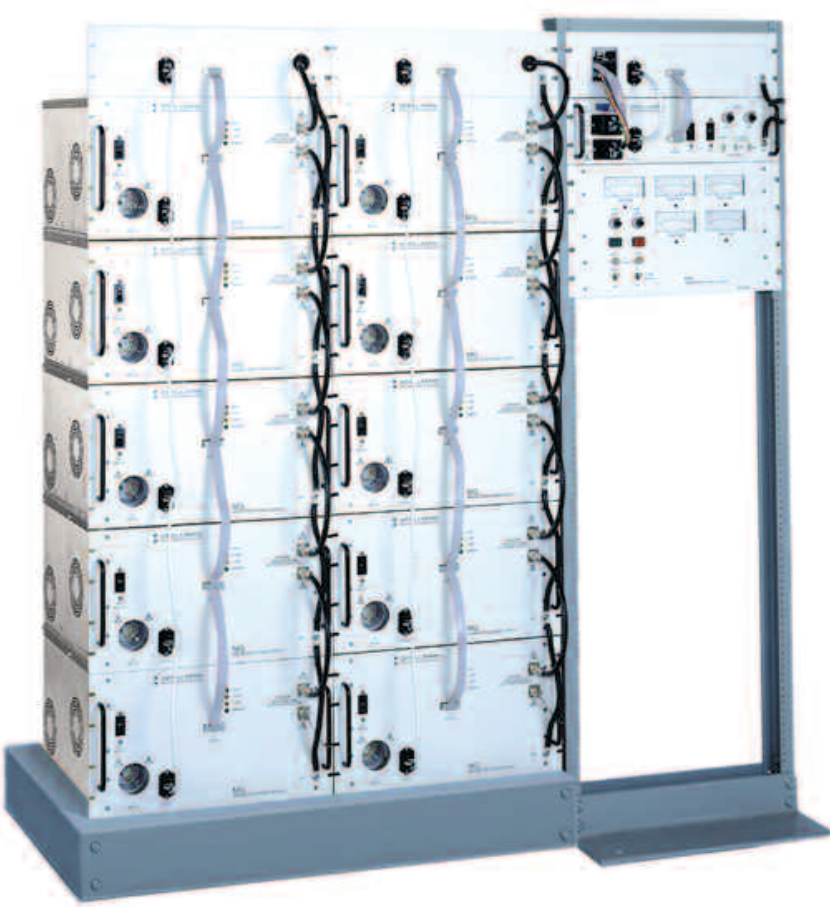
Spellman®
High Voltage Electronics Corporation

10kW to 120kW
MAGNETRON HV POWER SUPPLY



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Advantages of the Spellman MG Magnetron Power Supplies

High frequency (20kHz) resonant inverter technology provides these advantages:

- A true current source for the magnetron allows direct control of the magnetron output power and provides inherent current limiting capability during a fault.
- The output power can be shut down in less than 30 microseconds after a fault signal is received, and then reapplied according to a preset program. This fast response prevents damage to the magnetron when signals are applied from fault monitor circuits such as a (π -1) detector or an arc detector.
- The output power can be programmed through the remote (e.g. PLC) interface. Inputs may be derived from external sources such as a temperature probe.
- Magnetron stress is minimized through automatic ramping of the anode voltage and current.
- The modular design permits customization for OEM applications requiring DC power from 5kW to 120kW.
- Size and weight reduction of the power supplies is achieved because high frequency inverter technology allows the use of small and light magnetic components.

Magnetron Characteristics

With conventional unregulated voltage source power supplies where the applied voltage to the magnetron is fixed at all power levels by the turns ratio of the high voltage transformer, operation is only possible along a load line drawn across the top of the family of characteristic curves (X-X in Fig. 1). All other points on the curves are inaccessible. Output power can only be controlled by adjustment of magnet current. For example in Fig. 1, a reduction of magnet current from 4.0A to 3.7A increases the output power from 10kW to 75kW.

With the Spellman current-source MG designs, adjusting the magnet current simply affects the operating voltage across the magnetron and has little effect on output power and no effect on the value of magnetron current. It is, therefore, possible to independently set the values of the magnetron voltage and current, and this allows the magnetron to operate at any point within the characteristic curves.

Optimum Operating Conditions

Optimum operating conditions in the magnetron can be established by observing (on a spectrum analyzer) the cleanliness of the RF spectrum at each power level. By looking at the spectrum along each of the constant power curves, the points of maximum cleanliness of the RF spectrum can be found, and joining these points produces the optimum operating curve (shown as Y-Y in Fig. 1).

Too little filament current can approach the moding threshold in the magnetron which could shut down oscillation, while too much current produces excessive noise in the spectrum which could damage the magnetron. The filament current roll-back requirements are established by the magnetron manufacturer, and Spellman presets the filament current to these values at the factory.

Optimum values of anode current , magnet current and filament current for a Burle S94603E 75kW magnetron are shown in Fig. 2 for output power levels from 10kW to 100kW. These values may be set manually, or programmed into the programmable logic controller (PLC). The magnet current (and therefore the anode voltage) *increases* linearly as the power is increased, which is just the opposite of the *decrease* in anode voltage in conventional power supplies caused by the need to operate along a load line.

It is particularly advantageous at the lower power levels to operate along the optimum curve because the cleanest outputs are obtainable at the lower anode voltages, virtually eliminating the possibilities of moding in the magnetron.

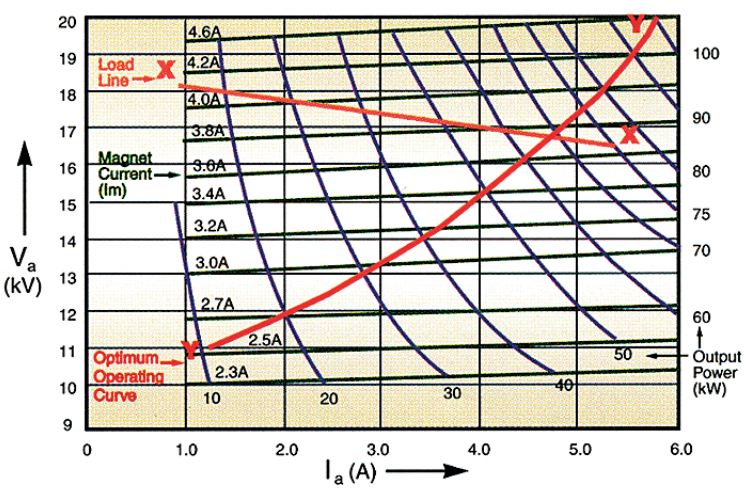


Fig. 1 **S94603E 75kW Magnetron Characteristic Curve**

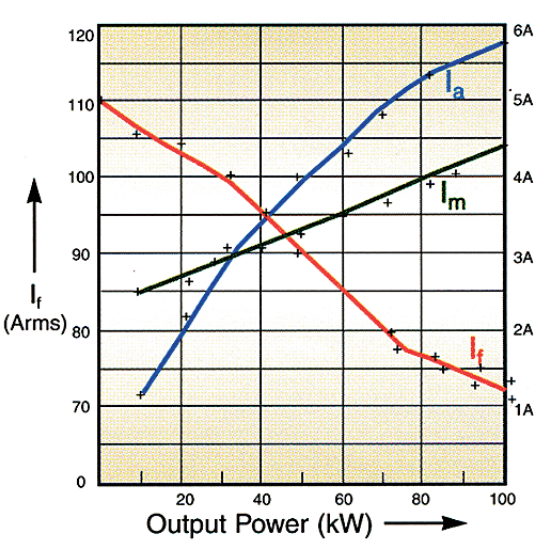


Fig. 2 **S94603E 75kW Magnetron Optimum Operating Curve Values**

MG 10kW and 12kW
MAGNETRON HV POWER SUPPLY

ADVANTAGES

- Current Output Source
- Low stored energy
- Fast Fault Shutdown (<30µsec)
- Programmable Filament Current Foldback

The MG 10 and MG12 Magnetron Power Supplies each comprise a single power module, measuring 10 1/2" x 19" x 19". They are designed to power CW magnetrons with RF output powers of 6kW and 8.5kW respectively. The units also contain the filament supply, and the interface circuits between the user's system and the power supply. The high voltage output of the module is applied to the cathode of the magnetron. Magnetron output power is controlled by the anode current. A Magnet Supply is available for magnetrons which do not have a permanent magnet.

At turn on, the filament current is first applied for the pre-heat period, followed by the anode voltage and current ramps. Provision is made in the control unit to allow local control of the output voltage and current. Filament current foldback is automatically adjusted according to the value of the anode current.

SPECIFICATIONS

INPUT VOLTAGE

480Vac per phase ±10%, 50/60 Hz, 3 phase
415V optional. Specify with order.

OUTPUTS

Anode/Cathode Supply (negative):

Voltage: 0 to -8kVdc.
Current:
MG10: 0 to - 1.25Adc.
MG12: 0 to - 1.70Adc.

Voltage Regulation:
Load: 0.5% for 0 to 100% change in load current
Line: ±0.1% for ±10% change in line voltage.

Current Regulation:
Load: 0.5% for 0 to 100% change in output voltage.
Line: ±0.1% for ±10% change in line voltage.

Current Ripple:
10% rms.

Efficiency: 90% typical.

Switching frequency (nominal): 24kHz.

Front Panel Indicator Lights:

HV READY: Green	FAULT: Red
HV OFF: Green	OVER CURRENT: Red
HV ON: Red	REG. FAULT: Red
INTLIK: Green	

Operating Temperature: 0°C to +40°C.

Cooling: Fan cooled.

Filament Supply

Preheat:
Voltage: 5Vac.
Current:
MG10: 33Aac.
MG12: 52Aac.
Time: 30 Seconds.
Filament Current at I max:
MG10: 0A.
MG12: 40A.
Filament Output:
Available at remotely located transformer.
Filament drive available at rear panel connector.

Magnet Supply

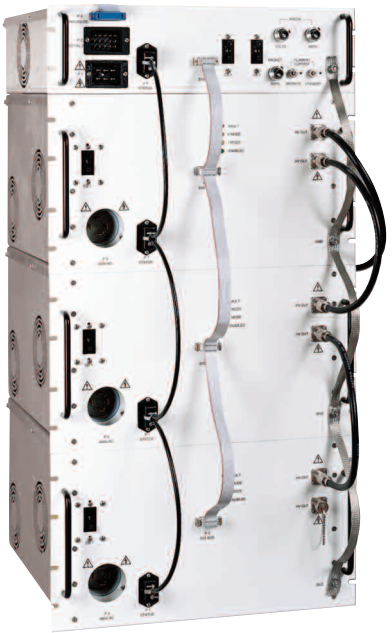
Voltage: 16Volt.
Current: 3 Ampere.

AC Line Input:
Flanged inlet Hubbell Twist-Lock PN2735.

Dimensions: 10.5"H x 19"W x 19"D.
(266.7 x 482.6 x 482.6mm).

Weight: 74 lb. (34kg).

MG 36kW
MAGNETRON HV POWER SUPPLY



ADVANTAGES

- Current Output Source
- Low stored energy
- Fast Fault Shutdown (<30µsec)
- Programmable Filament Current Foldback

The MG36 Magnetron Power Supply comprises three 12kW power modules, each measuring 10 1/2" x 19" x 19" to drive a 20kW magnetron. The units also contain the filament and magnet power supplies and the interface circuits between the user's system and the power supply. The high voltage outputs of the modules are connected in parallel and applied to the cathode of the magnetron.

At turn on, the filament and magnet currents are first applied for the pre-heat period, followed by the anode voltage and current ramps. Provision is made to allow local control of the output voltage and local or remote control of output current. RF output power is controlled by the anode current. The filament current foldback is automatically adjusted according to the value of output current.

SPECIFICATIONS

INPUT VOLTAGE

480Vac per phase ±10%, 50/60 Hz, 3 phase
415V optional. Specify with order.
110Vac ±10%, 50/60 Hz (for aux. power).

OUTPUTS

Anode/Cathode Supply (negative):
Voltage: 0 to -15kVdc.
Current: 0 to -2.5Adc.

Voltage Regulation:
Load: 0.5% for 0 to 100% change in load current.
Line: ±0.1% for ±10% change in line voltage.

Current Regulation:
Load: 0.5% for 0 to 100% change in output voltage.
Line: ±0.1% for ±10% change in line voltage.

Current Ripple:
5% rms.

Efficiency: 90% typical.

Switching frequency (nominal): 24kHz.

Front Panel Indicator Lights:
FAULT: Red V LIMIT: Yellow
ENABLE: Green I LIMIT: Yellow

Filament Supply

Preheat:
Voltage: 10Vac.
Current: 50Aac.
Time: 180 Seconds.

Filament Current at I max: 20A.

Filament Output:
Available at remotely located transformer.
Filament drive available at front panel connector.

Magnet Supply

Voltage: 50 Volt.
Current: 5 Ampere.

HV Output Cable:
30 ft. (9.15m) high voltage cable.

AC Line Input:
Inverters: Hubbell Twist-Lock PN2735.
Control Module: Cinch P-2406-DB.

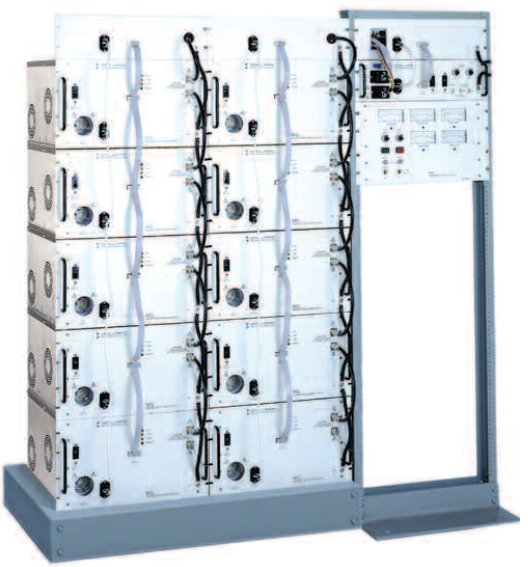
Operating Temperature: 0°C to +40°C.

Cooling: Fan cooled.

Dimensions: 36 3/4"H x 19"W x 19"D.
(933.5 x 482.6 x 482.6mm).

Weight: 275 lb. (125kg).

MG 120kW
MAGNETRON HV POWER SUPPLY



ADVANTAGES

- Current Output Source
- Low stored energy
- Fast Fault Shutdown (<30µsec)
- Programmable Filament Current Foldback

The MG120 Magnetron Power Supply comprises ten 12kW power modules, each measuring 10 1/2" x 19" x 19" and a control module measuring 5 1/4" x 19" x 19" to drive a 100kW magnetron.

The high voltage outputs of the modules are connected in parallel and applied to the cathode of the magnetron. The control unit contains the filament and magnet power supplies, and the interface circuits between the user's system and the power supply.

At turn on, the filament current is first applied for the pre-heat period, followed by the anode voltage and current ramps. Provision is made in the control unit to allow local control of the output voltage and local or remote control of current. The RF output power is controlled by the anode current. Filament current foldback is automatically adjusted according to the value of the anode current.

A vertical rack mount configuration is shown with an optional metered module.

SPECIFICATIONS

INPUT VOLTAGE

480Vac per phase ±10%, 50/60 Hz, 3 phase
415V optional. Specify with order.
110Vac ±10%, 50/60 Hz (for aux. power).

OUTPUTS

Anode/Cathode Supply (negative):
Voltage: 0 to -20kVdc.
Current: 0 to -6Adc.

Voltage Regulation:
Load: 0.5% for 0 to 100% change in load current.
Line: ±0.1% for ±10% change in line voltage.

Current Regulation:
Load: 0.5% for 0 to 100% change in output voltage.
Line: ±0.1% for ±10% change in line voltage.

Current Ripple:
5% rms.

Efficiency: 90% typical.

Switching frequency (nominal): 24KHz.

Front Panel Indicator Lights:
FAULT: Red V LIMIT: Yellow
ENABLE: Green I LIMIT: Yellow

Filament Supply

Preheat:
Voltage: 12.6Vac.
Current: 115Aac.
Time: 180 Seconds.

Filament Current at I max: 86A.

Filament Output:
Available at remotely located transformer.
Filament drive available at front panel connector.

Magnet Supply

Voltage: 0 to 60 Volt.
Current: 0 to 60 Ampere.

HV Output Cable:
30 ft. (9.15m) high voltage cable.

AC Line Input connectors:
Inverters: Hubbell Twist-Lock PN2735.
Control Module: Cinch P-2406-DB.

Operating Temperature: 0°C to +40°C.

Cooling: Fan cooled.

Dimensions: 63"H x 2 times 19"W x 19"D.
(160 x 2 times 48.26 x 48.26cm).

Weight: 800 lb. (364kg).

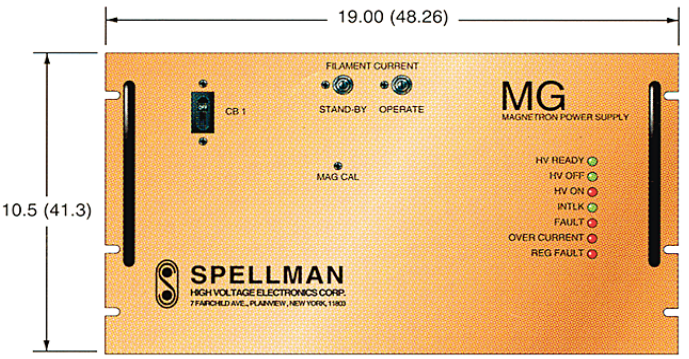
MG 10/12 REMOTE INTERFACES

CONTROL INTERFACE			
PIN	FUNCTION	PIN	FUNCTION
1	INTERLOCK	14	INTERLOCK
2	HVOFF	15	HVON/HVOFF
3	HVON	16	SPARE
4	READY STATUS	17	FAULT STATUS
5	STATUS RETURN	18	SPARE
6	SPARE	19	SPARE
7	PRGRM RETURN	20	V PROGRAM
8	PRGRM RETURN	21	I PROGRAM
9	FAST OFF	22	+10V REFERENCE
10	MONITOR RETURN	23	I Monitor
11	V Monitor	24	POWER Monitor
12	I MAGNET Monitor	25	I FILAMENT Monitor
13	SPARE		
MAGNET AND FILAMENT DRIVE INTERFACE			
PIN	FUNCTION	PIN	FUNCTION
7	FILAMENT DRIVE-A	10	SPARE
8	FILAMENT DRIVE-B	11	MAG OUTPUT +
9	SPARE	12	MAG OUTPUT RTN

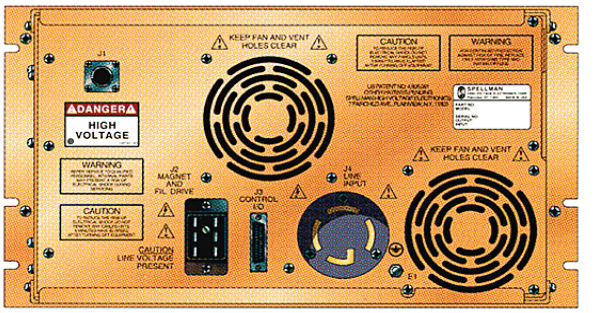
MG 24 to MG 120 REMOTE INTERFACES

ANALOG CONTROL INTERFACE			
PIN	FUNCTION	PIN	FUNCTION
1	RETURN	14	I PROGRAM
2	RETURN	15	I ANODE Monitor
3	RETURN	16	V CATHODE Monitor
4	RETURN	17	MAGNET PROGRAM
5	RETURN	18	MAGNET Monitor
6	RETURN	19	FILAMENT PRGRM
7	RETURN	20	I FILAMENT Monitor
8	RETURN	21	CONTROL FAULT
9	RETURN	22	+10V REFERENCE
10	RETURN	23	RF ARC
11	SPARE	24	SPARE
12	SPARE	25	SPARE
13	SPARE		
DIGITAL INTERFACE & 110Vac AUXILIARY POWER			
PIN	FUNCTION	PIN	FUNCTION
1	110Vac INPUT	9	ARC DETECT
2	110Vac RETURN	10	CONTROL FAULT
3	HV ENABLE	11	BREAKERS Healthy
4	HVON	12	TEMP Warning
5	POWER ON	13	FAULT 1
6	FILAMENT Warmup	14	FAULT 2
7	FILAMENT READY	15	FAULT 3
8	HVON Indicator		
POWER, FILAMENT & MAGNET CONNECTIONS			
PIN	FUNCTION	PIN	FUNCTION
7	480Vac (Phase A)	10	FILAMENT OUT - A
8	480Vac (Phase B)	11	MAG OUTPUT +
9	FILAMENT OUT - B	12	MAG OUTPUT RTN

OUTLINE DRAWINGS:

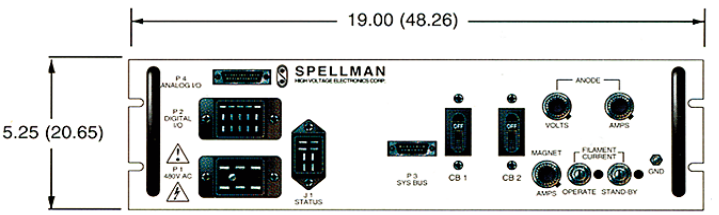


MG 10/12 FRONT VIEW

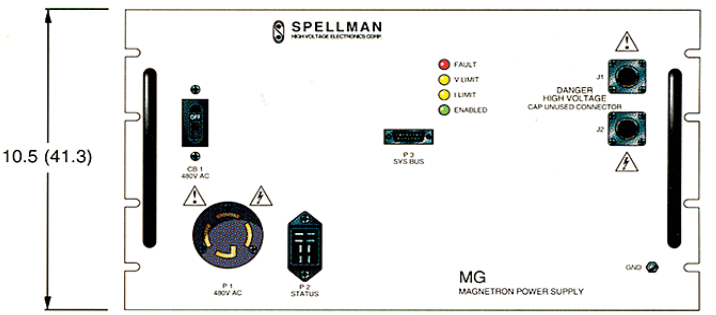


MG 10/12 BACK VIEW

Configuration Note: For power supply models above 24kW, 12kW modules are added in parallel up to a maximum of ten to provide 120kW output power. One MG Control Module, 5 1/4" high, is used with each desired configuration above 24kW.



MG 24 to 120 CONTROL MODULE



12kW MODULE

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