Spellman is your global resource for high voltage power conversion

Meeting Customers Needs
For over 70 years, Spellman has been helping technology companies grow by providing standard and custom high voltage power converters, X-Ray generators and Monoblock® X-Ray sources of exceptional value and performance and by aligning our procedures, processes and infrastructure to support our customers’ goals – a process we call homologation. At Spellman, homologation is in everything we do. From initial product concept through final delivery, we dedicate a team of experts to work with each customer.

Your Vision is Our Mission
Spellman advances medical care, industrial processes, quality control, scientific research, security and telecommunications by providing innovative high voltage power conversion solutions that enable equipment manufacturers to improve their systems’ performance, reliability, cost and bottom line.

Innovation & Quality
With over 70 years of high voltage innovation, world-class ISO certified production facilities and global support network, Spellman can meet the needs of discriminating global OEM’s system manufacturers

Compliance and Safety
Safety and Regulatory Agency approvals such as: UL, CSA, and IEC can be provided. In addition, Spellman is authorized to conduct UL sanctioned testing

Risk Management
Consistent processes across multiple facilities ensures a secure supply chain. Products can be manufactured at multiple Spellman sites. With standardized manufacturing, training and equipment, you can be assured of quality products and service for years to come

Support and Service
Our globally situated technical support centers are strategically located to provide rapid local response to customer needs. Support Centers are linked through a common ERP system and real-time data reporting so information is always available about your product and delivery status

spellmanhv.com
**MODULAR SUPPLIES**

Offer a single output up to 1200W in diverse form factors, and are designed to be integrated into systems, with either analog or digital control.

<table>
<thead>
<tr>
<th>CURRENT/POWER</th>
<th>MODEL</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.9W</td>
<td>MSA</td>
<td>4-5</td>
</tr>
<tr>
<td>3W</td>
<td>MS</td>
<td>6-7</td>
</tr>
<tr>
<td>4W</td>
<td>PMT</td>
<td>8-9</td>
</tr>
<tr>
<td>4W–30W</td>
<td>UM</td>
<td>10-15</td>
</tr>
<tr>
<td>10W</td>
<td>MPS</td>
<td>22-24</td>
</tr>
<tr>
<td>20W</td>
<td>MPD</td>
<td>25-26</td>
</tr>
<tr>
<td>30W</td>
<td>EPM</td>
<td>29-30</td>
</tr>
<tr>
<td>60W</td>
<td>SMS</td>
<td>34-35</td>
</tr>
<tr>
<td>60W/125W</td>
<td>UMW</td>
<td>36-39</td>
</tr>
<tr>
<td>120W</td>
<td>PCM</td>
<td>40-41</td>
</tr>
<tr>
<td>200W/350W</td>
<td>PTV</td>
<td>42-43</td>
</tr>
<tr>
<td>300W–1200W</td>
<td>SLM</td>
<td>44-47</td>
</tr>
</tbody>
</table>

**RACK MOUNT SUPPLIES**

From 1U to 6U, provide a single output and either full featured front panel controls, or a blank front with digital interfaces for integration in OEM systems.

<table>
<thead>
<tr>
<th>CURRENT/POWER</th>
<th>MODEL</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>10W–1200W</td>
<td>SL</td>
<td>48-52</td>
</tr>
<tr>
<td>1200W</td>
<td>SL150KV</td>
<td>53-54</td>
</tr>
<tr>
<td>2000W</td>
<td>SL2KW</td>
<td>55-58</td>
</tr>
<tr>
<td>4kW</td>
<td>STA</td>
<td>63-65</td>
</tr>
<tr>
<td>6kW</td>
<td>STR</td>
<td>66-68</td>
</tr>
<tr>
<td>12kW–100kW</td>
<td>ST</td>
<td>69-73</td>
</tr>
</tbody>
</table>

**X-RAY GENERATORS**

Consist of integrated high voltage and filament power supplies and emission loop control circuitry. They may be modular or rack mounted.

<table>
<thead>
<tr>
<th>CURRENT/POWER</th>
<th>MODEL</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3W–260W</td>
<td>XLG</td>
<td>74-75</td>
</tr>
<tr>
<td>5W</td>
<td>XMPF</td>
<td>76-77</td>
</tr>
<tr>
<td>10W</td>
<td>XMPP</td>
<td>78-79</td>
</tr>
<tr>
<td>50W/65W/75W</td>
<td>MNX</td>
<td>80-82</td>
</tr>
<tr>
<td></td>
<td>uX</td>
<td>83-87</td>
</tr>
<tr>
<td></td>
<td>MFX</td>
<td>88-90</td>
</tr>
<tr>
<td>80W–640W</td>
<td>XRF</td>
<td>91-92</td>
</tr>
<tr>
<td>100W</td>
<td>uXHP</td>
<td>93-96</td>
</tr>
<tr>
<td>300W–1200W</td>
<td>DXM</td>
<td>97-101</td>
</tr>
<tr>
<td></td>
<td>DXB</td>
<td>102-104</td>
</tr>
<tr>
<td></td>
<td>DXM100</td>
<td>105-107</td>
</tr>
<tr>
<td>600W–1200W</td>
<td>XLF</td>
<td>108-109</td>
</tr>
<tr>
<td>1.8kW–6.0kW</td>
<td>XRV</td>
<td>110-112</td>
</tr>
<tr>
<td></td>
<td>XRV Controller</td>
<td>113-116</td>
</tr>
<tr>
<td></td>
<td>XRV I/O Box</td>
<td>274-275</td>
</tr>
<tr>
<td>3kW–4kW</td>
<td>DF/FF</td>
<td>117-118</td>
</tr>
<tr>
<td>5kW</td>
<td>VMX</td>
<td>119-121</td>
</tr>
<tr>
<td></td>
<td>PMX</td>
<td>122-124</td>
</tr>
<tr>
<td>32kW/42kW/50kW</td>
<td>CCT</td>
<td>125-126</td>
</tr>
<tr>
<td>32kW–110kW</td>
<td>CT</td>
<td>127</td>
</tr>
</tbody>
</table>

**LORAD PORTABLE NDT**

<table>
<thead>
<tr>
<th>CURRENT/POWER</th>
<th>MODEL</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>160-300kV</td>
<td>SPX</td>
<td>128-134</td>
</tr>
<tr>
<td></td>
<td>Tube Stand</td>
<td>135-136</td>
</tr>
<tr>
<td></td>
<td>Laser Pointer</td>
<td>137</td>
</tr>
</tbody>
</table>

**MONOBLOCK® X-RAY SOURCE**

Is a single assembly containing both high voltage generation components and an X-Ray tube. The physical compactness and inherent elimination of cabling reduces cost and complexity.

<table>
<thead>
<tr>
<th>CURRENT/POWER</th>
<th>MODEL</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>80kV @ 20/50W</td>
<td>XRB011</td>
<td>138-141</td>
</tr>
<tr>
<td>130kV @ 65W</td>
<td>μXRB130P65</td>
<td>142-146</td>
</tr>
<tr>
<td>80kV @ 100W</td>
<td>XRB80N100</td>
<td>147-150</td>
</tr>
<tr>
<td>80kV @ 100W</td>
<td>XRB80PN100HR</td>
<td>151-154</td>
</tr>
<tr>
<td>80-100kV @ 100-500W</td>
<td>XRB80N100HR</td>
<td>155-157</td>
</tr>
<tr>
<td>160kV @ 100-500W</td>
<td>XRB160</td>
<td>158-165</td>
</tr>
<tr>
<td>160kV @ 192W</td>
<td>XRB160PN192</td>
<td>174-176</td>
</tr>
<tr>
<td>80kV @ 320W</td>
<td>XRB80PN320</td>
<td>177-179</td>
</tr>
<tr>
<td>200kV @ 400W</td>
<td>XRB200PN400</td>
<td>180-182</td>
</tr>
<tr>
<td>160kV @ 480W</td>
<td>XRB160PN480/1</td>
<td>183-185</td>
</tr>
<tr>
<td>160kV @ 480W</td>
<td>XRB160PN480/2</td>
<td>186-188</td>
</tr>
<tr>
<td>160kV @ 480W</td>
<td>XRB160PN480/CT</td>
<td>189-191</td>
</tr>
<tr>
<td>150kV @ 600W</td>
<td>XRB150PN600</td>
<td>192-194</td>
</tr>
<tr>
<td>160kV @ 688W</td>
<td>XRB160PN688/CT</td>
<td>195-197</td>
</tr>
<tr>
<td>50-90kV @ 900W</td>
<td>PDM90PN900</td>
<td>198-200</td>
</tr>
<tr>
<td>40-125kV @ 3.5kW</td>
<td>MM1B125PN3.5</td>
<td>201-203</td>
</tr>
</tbody>
</table>

**APPLICATION SPECIFIC**

<table>
<thead>
<tr>
<th>CURRENT/POWER</th>
<th>MODEL</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass Spectrometry</td>
<td>12mA</td>
<td>ML430</td>
</tr>
<tr>
<td></td>
<td>15mA</td>
<td>ML1350</td>
</tr>
<tr>
<td></td>
<td>60μA</td>
<td>MX2.5</td>
</tr>
<tr>
<td></td>
<td>100μA</td>
<td>MX8 PLUS</td>
</tr>
<tr>
<td></td>
<td>230μA</td>
<td>MX10 PLUS</td>
</tr>
<tr>
<td></td>
<td>300μA</td>
<td>MXR</td>
</tr>
<tr>
<td></td>
<td>330μA</td>
<td>MCP</td>
</tr>
<tr>
<td></td>
<td>400μA</td>
<td>TOF3000</td>
</tr>
<tr>
<td></td>
<td>600μA</td>
<td>MCP4</td>
</tr>
<tr>
<td>E Beam/Beam</td>
<td>30μA</td>
<td>FIB</td>
</tr>
<tr>
<td></td>
<td>170μA</td>
<td>FIBX</td>
</tr>
<tr>
<td></td>
<td>200μA</td>
<td>EBM</td>
</tr>
<tr>
<td></td>
<td>100μA</td>
<td>EBM-FEG</td>
</tr>
<tr>
<td></td>
<td>230μA</td>
<td>EBM20</td>
</tr>
<tr>
<td></td>
<td>300μA</td>
<td>VS100</td>
</tr>
<tr>
<td>Power Feed Equipment</td>
<td>1.2A</td>
<td>PFE-LV</td>
</tr>
<tr>
<td></td>
<td>1.8A</td>
<td>PFE-HV</td>
</tr>
<tr>
<td></td>
<td>0.8A-2.5A</td>
<td>PFE-SB</td>
</tr>
<tr>
<td>Image Intensifiers</td>
<td>30μA</td>
<td>DGM935</td>
</tr>
<tr>
<td></td>
<td>50μA</td>
<td>DGM945</td>
</tr>
<tr>
<td>Electrophoresis/Electrospinning</td>
<td>300μA</td>
<td>CZE1000R</td>
</tr>
<tr>
<td></td>
<td>0.3-2mA</td>
<td>CZE2000</td>
</tr>
<tr>
<td>Capacitor Charging</td>
<td>1000 Joules</td>
<td>CCM1KW</td>
</tr>
<tr>
<td></td>
<td>3100 Joules</td>
<td>CCM</td>
</tr>
<tr>
<td>e-Beam Evaporation</td>
<td>3/6/12kW</td>
<td>EVA</td>
</tr>
<tr>
<td>Electrostatic Chuck</td>
<td>5mA</td>
<td>ECHUCK</td>
</tr>
<tr>
<td>Injector Control</td>
<td>5.5mA</td>
<td>ICA</td>
</tr>
</tbody>
</table>

**ACCESSORIES**

<table>
<thead>
<tr>
<th>MODEL</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>XRV Controller</td>
<td>274</td>
</tr>
<tr>
<td>XRV I/O Box</td>
<td>275-278</td>
</tr>
<tr>
<td>HVD</td>
<td>279</td>
</tr>
</tbody>
</table>
The MSA Series are compact printed circuit board mountable (PCB) high voltage power supply module available from 1kV to 3kV with either a positive or negative output polarity. The MSA Series feature 0-10Vdc variable voltage programming that equals 0-100% of rated output voltage. A voltage monitor is provided where 0-10Vdc equals 0-100% of rated output voltage. Additionally a status signal and enable signal provides simple control of the power supply. All units have in-built protection against fault conditions.

The MSA Series are intended for general use where a compact high performance PCB mountable power supply is required, like driving an electron multiplier in a mass spectrometer. The aluminium enclosure helps shield the unit reducing radiated noise.

**TYPICAL APPLICATIONS**
- Photomultiplier Tubes
- Electron Multiplier
- Mass Spectrometry
- Electrostatic Lenses
- Nuclear Instruments

**SPECIFICATIONS**

**Input Voltage:**
+24 Vdc, ±2Vdc

**Input Current:**
- 150mA maximum input current
- 30mA pk-pk maximum input current ripple

**Output Polarity:**
Positive or negative, specify at time of order

**Output Power:**
0.9 watts, maximum

**Output Voltage Accuracy:**
±1%

**Voltage Regulation:**
- Line: 21.6Vdc to 26.4Vdc, ±0.02%
- Load: 0-100% rated load, ±0.02%

**Stability:**
50ppm/8hrs after one hour warm up period

**Temperature Coefficient:**
25ppm per degree C

**Settling Time:**
After Power On or Enable:
- 100 milliseconds, typical
  When power is removed the unit will decay to <±60 volts within 2 seconds

**Protection:**
Arc and short circuit protected.
Not designed to withstand continuous arcing

**Environmental:**
- Temperature Range:
  Operating: 0°C to 60°C
  Storage: -40°C to 70°C
- Humidity: 95% RH, non-condensing

**Cooling:**
Convection cooled

**Dimensions:**
- 2.73” L x 2.21” W x 1.21” D (69.4mm x 56.2mm x 30.7mm)

**Weight:**
7.0 oz. (200g)

**Regulatory Approvals:**
- Designed to meet EN 61010-1, UL 61010A-1 and CAN/CSA-22.2 No. 1010.1
- As the unit is intended for incorporation into end users equipment it will not be tested as a standalone unit to meet the EMC directive. The user will need to follow sensible EMC precautions in using the unit.
- The unit is compliant with the EU RoHS directive.
**LOW VOLTAGE SIGNAL PINS FOR POWER AND CONTROL**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>LEVEL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Enable</td>
<td>TTL</td>
<td>Enable = Low (≤1.2V). Disable = High (≥2.4V), when Enable pin is NC, 10kΩ pull up to +5V ±10%</td>
</tr>
<tr>
<td>2</td>
<td>Status</td>
<td>0V/5V</td>
<td>OK = 11kΩ pull up to +5.1V ±10%. Fault = ≤0.1V, Zout = 1kΩ</td>
</tr>
<tr>
<td>3</td>
<td>Voltage Program</td>
<td>0-10V</td>
<td>0 to +10Vdc = 0 to 100% rated output voltage. Accuracy ±1%. Zin ≥10kΩ.</td>
</tr>
<tr>
<td>4</td>
<td>Voltage Monitor</td>
<td>0-10V</td>
<td>0 to +10Vdc = 0 to 100% rated output voltage. Zout ≥10kΩ.</td>
</tr>
<tr>
<td>5</td>
<td>Input Voltage</td>
<td>24Vdc</td>
<td>Power Input</td>
</tr>
<tr>
<td>6*</td>
<td>Signal Ground</td>
<td>0V</td>
<td>Ground reference for control and monitoring signals</td>
</tr>
<tr>
<td>7*</td>
<td>Power Ground</td>
<td>0V</td>
<td>Power Return</td>
</tr>
</tbody>
</table>

1) Replace the * with “P” for positive output polarity and “N” for negative output polarity.
2) The ripple figure includes random non switch related noise, noise related to the oscillator, switching and feedback control circuitry and noise associated with the rectified primary switching frequency.

**HIGH VOLTAGE CONNECTION DETAIL**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>High Voltage Output</td>
<td>0-100% Rated Output. !!Danger: High Voltage!!</td>
</tr>
</tbody>
</table>
Spellman’s MS Modules have been designed for printed circuit board mounting with high reliability, small size and light weight. Each module provides 3W of output power to 3kV with well regulated low ripple, high stability and high voltage in a versatile, compact cost-effective design. The modules incorporate remote control and arc & short-circuit protection. Radiated pickup is eliminated by sealing each module in an aluminum enclosure.

TYPICAL APPLICATIONS
- Photomultiplier Tubes
- Precision Lenses
- Image Intensifiers
- Nuclear Instruments
- Spectroscopy

OPTIONS
- Isolated Input to Output
  - Isolation Voltage: 40V for units up to 1kV
    - 100V for units >1kV

SPECIFICATIONS
Input Voltage:
- +12Vdc ±1V. Other input voltages also available.

Input Current:
- < 0.56A at full output.

Output Voltage:
- Continuously adjustable over each entire range
- Models available in either positive or negative polarity.
- See table for voltage ranges.

- Low Cost
- Output Voltages up to 3kV
- 3 Watts Power Rating
- Positive or Negative Polarity
- Arc and Continuous Short Circuit Protected
- Low Stored Energy
- High Reliability
- Internal 5V Reference
- OEM Customization Available

Line Regulation:
- < 0.005% for input change of 1V

Load Regulation:
- < 0.05% for 100μA to full load change. (at max. voltage)

Output Voltage Control:
- Remote voltage programming such that 0-5Vdc gives 0 to full rated output

Output Power: 3W continuous.

Voltage Regulation:
- Line: 0.005% for input change of 1V
- Load: 0.05% for 100μA to full load change at maximum voltage.

Ripple: < 0.01% p-p of full output voltage.

5Vdc Reference: +5.0V (±0.2V)
- A maximum of 1mA can be drawn from this output.

Temperature:
- Operating: 0°C to +50°C.
- Storage: -35°C to +85°C.

Temperature Coefficient: 50ppm/°C typical.

Stability:
- < 0.05%/8 hrs at constant operating conditions
- after one hour warm-up.

Humidity: 0 to 90% non-condensing.

Dimensions:
- Up to 1000Vdc:
  - .87"H x 2.1"W x 3.1"D (23mm x 53mm x 78mm).
- 1000V to 3000Vdc:
  - 1.1"H x 2.36"W x 4.2"D (28mm x 60mm x 106mm).

Weight:
- Up to 1000V: 0.2lb (80g).
- Over 1000V: 0.4lb (160g).

Regulatory Approvals:
### MS SELECTION TABLE

<table>
<thead>
<tr>
<th>OUTPUT VOLTAGE (V)</th>
<th>OUTPUT CURRENT (mA)</th>
<th>RIPPLE V (p-p)</th>
<th>MODEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>10</td>
<td>0.03</td>
<td>MS0.3*</td>
</tr>
<tr>
<td>500</td>
<td>6</td>
<td>0.05</td>
<td>MS0.5*</td>
</tr>
<tr>
<td>750</td>
<td>4</td>
<td>0.075</td>
<td>MS0.75*</td>
</tr>
<tr>
<td>1000</td>
<td>3</td>
<td>0.10</td>
<td>MS1*</td>
</tr>
<tr>
<td>1500</td>
<td>2</td>
<td>0.15</td>
<td>MS1.5*</td>
</tr>
<tr>
<td>2000</td>
<td>1.5</td>
<td>0.20</td>
<td>MS2*</td>
</tr>
<tr>
<td>2500</td>
<td>1.2</td>
<td>0.25</td>
<td>MS2.5*</td>
</tr>
<tr>
<td>3000</td>
<td>1</td>
<td>0.30</td>
<td>MS3*</td>
</tr>
</tbody>
</table>

*Specify “P” for positive polarity or “N” for negative polarity.

### DIMENSIONS: in.[mm]

**UNIT UP TO 1000V**

**SIDE VIEW**

- DRILL DIA FOR PINS 1mm
- 0.91 [23]

**BOTTOM VIEW**

- 0.26 [6.5]
- 2.22 [56.5]
- 0.50 [12.73]
- 0.85 [21.7]
- 1.57 [40.00]

**UNIT > 1000V UP TO 3000V**

**SIDE VIEW**

- DRILL DIA FOR PINS 1mm
- 1.10 [28]

**BOTTOM VIEW**

- 0.26 [6.5]
- 3.07 [78]
- 3.05 [77.47]
- 0.26 [6.5]
- 1.58 [40.03]
- 0.50 [12.73]
- 0.88 [21.7]
- 0.57 [14.47]
- 3.46 [88]
- 4.09 [104]

View on pins. Recommended hole size for terminals 1mm.
Spellman’s Bertan brand of PMT modular high voltage power supplies offer well regulated, fixed polarity outputs up to 7.5kV, which operate off a low voltage DC input voltage. These fully enclosed modules are specifically designed with proprietary linear power conversion techniques to provide exceptionally low ripple and noise. The PMT is ideal for precision applications including: photomultiplier tubes, solid state detectors and ultrasonic transducers.

The output voltage can be controlled by either a local internal potentiometer or by a customer provided ground referenced signal for remote operation. Additionally a ground referenced output voltage monitor signal is provided. The PMT can be powered from either a single positive voltage source or a split ± voltage source, providing application flexibility.

**TYPICAL APPLICATIONS**

- Photomultiplier tubes
- Ultrasonic transducers
- Solid state detectors

**SPECIFICATIONS**

**Input Voltage:**
- Option 1: +24Vdc to +30Vdc @ 400mA
- Option 3: ±12Vdc to ±18Vdc @ 400mA
  specify “-1” (option 1) or “-3” (option 3) when ordering

**Efficiency:**
≈50%, typical

**Output Polarity:**
Positive or negative, specify at time of order

**Output Voltage:**
See “model selection” table

**Output Current:**
See “model selection” table

**Output Power:**
1.875W, 2W, 2.5W, 3W, 4W

**Voltage Regulation:**
- Line: ±0.001% of rated output voltage for a +1% input line change
- Load: ±0.001% of rated output voltage for a full load change

- 500V to 7.5kV @ 1.9 to 4 Watts
- Low Cost Modular Design
- Excellent Stability & Regulation
- Low Noise & Ripple
- Arc & Short Circuit Protected
- UL Recognized and RoHS Compliant

**Ripple:**
See “model selection” table

**Stability:**
≤0.005% per hour, 0.02% per 8 hours, after a 1/2 hour warm up

**Accuracy:**
Remote Programming ±(2% of setting, +0.5% of maximum)
Voltage Monitor ±2%

**Temperature Coefficient:**
≤50ppm/°C

**Arc/Short Circuit:**
All units are fully arc and short circuit protected and will limit continuous short circuit output current to less than 150% of maximum rated output current.

**Operating Temperature**
0°C to +50°C

**Storage Temperature:**
-40°C to +85°C

**Humidity:**
20% to 85% RH, non-condensing

**Interface Connector:**
12 position card edge connector, mate provided with unit

**Output Connector:**
A captive 24˝ (610mm) of RG-59B/U shielded cable, unterminated is provided

**Cooling:**
Convection cooled.

**Dimensions:**
3.875”W X 1.25”H X 6.3125”D (98mm x32mm x 160mm)

**Weight:**
≤2.0 pounds (0.9kg)

**Regulatory Approvals:**
### Model Selection Table

<table>
<thead>
<tr>
<th>Model</th>
<th>Output Voltage</th>
<th>Output Current</th>
<th>Ripple (Vpp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMT-05C-P,N</td>
<td>0 to 500V</td>
<td>0 to 8mA</td>
<td>5mV</td>
</tr>
<tr>
<td>PMT-10C-P,N</td>
<td>0 to 1kV</td>
<td>0 to 4mA</td>
<td>4mV</td>
</tr>
<tr>
<td>PMT-20C-P,N</td>
<td>0 to 2kV</td>
<td>0 to 2mA</td>
<td>2mV</td>
</tr>
<tr>
<td>PMT-30C-P,N</td>
<td>0 to 3kV</td>
<td>0 to 1mA</td>
<td>6mV</td>
</tr>
<tr>
<td>PMT-50C-P,N</td>
<td>0 to 5kV</td>
<td>0 to 0.5mA</td>
<td>10mV</td>
</tr>
<tr>
<td>PMT-75C-P,N</td>
<td>0 to 7.5kV</td>
<td>0 to 0.25mA</td>
<td>100mV</td>
</tr>
</tbody>
</table>

Specify “P” for positive polarity or “N” for negative polarity.

### Interface Connector

<table>
<thead>
<tr>
<th>Signal</th>
<th>Parameters</th>
<th>Option 1 Pin Number</th>
<th>Option 3 Pin Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ Power Input</td>
<td>+24Vdc to +30Vdc or +12Vdc to +18Vdc</td>
<td>3 &amp; 4</td>
<td>3 &amp; 4 &amp; 5</td>
</tr>
<tr>
<td>- Power Input</td>
<td>-12Vdc to -18Vdc</td>
<td>n/a</td>
<td>2 &amp; 6</td>
</tr>
<tr>
<td>Ground</td>
<td>Ground</td>
<td>1 &amp; 12</td>
<td>1 &amp; 12</td>
</tr>
<tr>
<td>Voltage Monitor</td>
<td>See Voltage Monitor Table</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Voltage Reference</td>
<td>+9.0Vdc, 10mA maximum</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Voltage Program Input</td>
<td>0 to 9Vdc = 0 to 100% rated output,</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>100kΩ Zin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local Voltage Program</td>
<td>Internal program potentiometer wiper,</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>0 to 9Vdc</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Voltage Monitor Table

<table>
<thead>
<tr>
<th>Model</th>
<th>Signal Voltage</th>
<th>Signal Impedance</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMT-05C-P,N</td>
<td>0 to 5 volts</td>
<td>50k ohms</td>
</tr>
<tr>
<td>PMT-10C-P,N</td>
<td>0 to 1 volts</td>
<td>10k ohms</td>
</tr>
<tr>
<td>PMT-20C-P,N</td>
<td>0 to 2 volts</td>
<td>25k ohms</td>
</tr>
<tr>
<td>PMT-30C-P,N</td>
<td>0 to 3 volts</td>
<td>30k ohms</td>
</tr>
<tr>
<td>PMT-50C-P,N</td>
<td>0 to 5 volts</td>
<td>100k ohms</td>
</tr>
<tr>
<td>PMT-75C-P,N</td>
<td>0 to 7.5 volts</td>
<td>200k ohms</td>
</tr>
</tbody>
</table>

Note: The Voltage Monitor polarity matches the high voltage output polarity.
Form, Fit and Function Design:
Spellman’s UM Series of printed circuit board mountable, high voltage modules offer a form, fit and function replacement for presently available commercially made units, while providing additional features and benefits at competitive pricing. Utilizing proprietary power conversion technology and Spellman’s six decades of high voltage experience, these SMT based high voltage modules provide improved performance/reliability and easier system integration at a lower cost when compared to the competition.

Advanced Power Conversion Topology:
UM converters use a proprietary zero voltage switching power conversion topology providing exceptional efficiency and inherent low noise and ripple. Radiated emissions are reduced compared to conventional switching topologies, minimizing or even eliminating the need to shield the unit from adjacent circuitry.

The high voltage output is generated using a ferrite core high voltage step up transformer which feeds the output circuitry. Units at 1kV or higher utilize an arrangement of half wave Cockcroft-Walton voltage multiplier stages to obtain the specified high voltage output, while lower voltage units use a robust rectification and filter circuit.

Due to the fixed, high frequency conversion rate the output capacitance is small resulting in minimal stored energy. Through the use of generously rated surge limiting resistors and a fast acting current loop, all units are fully arc and short circuit protected.

Control and Regulation:
The actual output voltage generated is sampled via a high impedance divider to create a voltage feedback signal. A current feedback signal is created via a current sense resistor in the low end return of the high voltage output circuitry. These two accurate ground referenced feedback signals are used to precisely regulate and control the units in addition to external monitoring purposes.

Due to the UM’s unique converter topology it can provide full current into low impedance loads or even a short circuit. Standard units limit at 103% of maximum rated output current.

Standard Interface:
The Spellman UM Series interface provides current program- ming capability and positive polarity, buffered, low output impedance voltage and current monitor signals (zero to +4.64Vdc equals zero to full scale rated). A voltage program- ming input is provided where 0 to +4.64Vdc equals 0 to 100% of rated voltage.

Current programmability allows the user to set where the unit will current limit, anywhere from 0 to 100% of maximum rated current. This feature is beneficial where less than full output current is desired, like in the case of protecting a sensitive load.

The buffered low impedance voltage and current monitor signals can drive external circuitry directly, while minimizing loading and pickup effects. These features save the user the expense and implementation of external interface buffering circuitry while improving overall signal integrity.

This standard interface is made available via a row of 13 pins with 0.1” pin spacing. A legacy interface (7 pins on a 0.2” spacing) that is compatible with presently available commercially made units can be provided by ordering the “L” option.

Mechanical and Environmental Considerations:
The UM Series are solid encapsulated, printed circuit board mountable, plastic cased converters measuring only 2.97˝ X 1.5˝ X 0.83˝ (75.4mm X 38.1mm X 21.1mm). All units are encapsulated using a silicon based potting material which is considerably lighter in weight than epoxy, Two isolated, non grounded 2-56 machine screws thread into the module to securely mount it to the printed circuit board, relieving any stress on the interface pins. Mounting plates, brackets and flanged mounting options are also available.

Regulatory Approvals:
**SPECIFICATIONS**

**Input Voltage:**
- 12Vdc for 4W, 24Vdc for 20W and 30W

**Nominal Voltage Range:**
- 11Vdc to 30Vdc for 4W, 23Vdc to 30Vdc for 20W and 30W

**Input Current:** (typical)
- Disabled: 30mA
- No load: 90mA
- Full load:
  - 4 watt units: 0.5A
  - 20 watt units: 1.0A
  - 30 watt units: 1.5A

**Efficiency:**
- 80-85%, typical

**Voltage Regulation:**
- Line: <0.01%
- Load: <0.01%

**Current Regulation:**
- Line: <0.01%
- Load: <0.01%

**Stability:**
- 0.01% per 8 hours, 0.02% per day after 30 min. warmup

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**Accuracy:**
- 2% on all programming and monitoring, except I Sense 10%

**Temperature Coefficient:** (typical)
- Standard: 100ppm/°C
- Optional: 25ppm/°C (T Option)

**Environmental:**
- Temperature Range:
  - Operating: 0˚C to 65˚C case temperature
  - Storage: -55˚C to 85˚C, non operational
- Humidity:
  - 10% to 90%, non-condensing.

**Cooling:**
- Convection cooled, typical. 30 watt units operating at full power might require additional cooling to maintain case temperature below 65˚C. Methods may include: forced air cooling, use of heat sink or metal case, etc. It is the user’s responsibility to maintain the case temperature below 65˚C. Damage to the power supply due to inadequate cooling is considered misuse and repairs will not be covered under warranty.

**Dimensions:**
- 2.96˝ L X 1.49˝ W X 0.81˝ H
- 75.2mm X 37.9mm X 20.6mm

---

**Weight:**
- 4 oz. (113g), typical

---

**UM 4W SELECTION TABLE**

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Output V</th>
<th>Output Current</th>
<th>Low Freq. Ripple %Vp-p @ 1Hz-1kHz</th>
<th>High Freq. Ripple %Vp-p @ 1kHz-1MHz</th>
<th>Output Capacitance</th>
<th>Arc Limiting Resistance</th>
<th>I Sense Scaling Full Scale Signal</th>
<th>High Voltage Divider Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>UM0.062’4</td>
<td>0 to 62.5V</td>
<td>64mA</td>
<td>0.030</td>
<td>0.028</td>
<td>8.8μF</td>
<td>1Ω</td>
<td>1.5V</td>
<td>0.5MΩ</td>
</tr>
<tr>
<td>UM0.125’4</td>
<td>0 to 125V</td>
<td>32mA</td>
<td>0.045</td>
<td>0.014</td>
<td>8.8μF</td>
<td>4.4Ω</td>
<td>2.75V</td>
<td>0.88MΩ</td>
</tr>
<tr>
<td>UM0.25’4</td>
<td>0 to 250V</td>
<td>16mA</td>
<td>0.034</td>
<td>0.017</td>
<td>2.2μF</td>
<td>20Ω</td>
<td>4.9V</td>
<td>1.50MΩ</td>
</tr>
<tr>
<td>UM0.5’4</td>
<td>0 to 500V</td>
<td>8mA</td>
<td>0.036</td>
<td>0.040</td>
<td>0.8μF</td>
<td>94Ω</td>
<td>10.1V</td>
<td>2.65MΩ</td>
</tr>
<tr>
<td>UM1’4</td>
<td>0 to 1kV</td>
<td>4mA</td>
<td>0.025</td>
<td>0.015</td>
<td>0.2μF</td>
<td>470Ω</td>
<td>10.75V</td>
<td>20MΩ</td>
</tr>
<tr>
<td>UM2’4</td>
<td>0 to 2kV</td>
<td>2mA</td>
<td>0.022</td>
<td>0.015</td>
<td>0.097μF</td>
<td>10.0Ω</td>
<td>10.4V</td>
<td>30MΩ</td>
</tr>
<tr>
<td>UM4’4</td>
<td>0 to 4kV</td>
<td>1mA</td>
<td>0.019</td>
<td>0.017</td>
<td>0.012μF</td>
<td>9.4KΩ</td>
<td>11.1V</td>
<td>100MΩ</td>
</tr>
<tr>
<td>UM6’4</td>
<td>0 to 6kV</td>
<td>0.67mA</td>
<td>0.016</td>
<td>0.015</td>
<td>0.007μF</td>
<td>20KΩ</td>
<td>9.9V</td>
<td>150MΩ</td>
</tr>
</tbody>
</table>

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**UM 20W SELECTION TABLE**

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Output V</th>
<th>Output Current</th>
<th>Low Freq. Ripple %Vp-p @ 1Hz-1kHz</th>
<th>High Freq. Ripple %Vp-p @ 1kHz-1MHz</th>
<th>Output Capacitance</th>
<th>Arc Limiting Resistance</th>
<th>I Sense Scaling Full Scale Signal</th>
<th>High Voltage Divider Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>UM0.062’20</td>
<td>0 to 62.5V</td>
<td>320mA</td>
<td>0.060</td>
<td>0.088</td>
<td>8.8μF</td>
<td>1Ω</td>
<td>330mV</td>
<td>0.5MΩ</td>
</tr>
<tr>
<td>UM0.125’20</td>
<td>0 to 125V</td>
<td>160mA</td>
<td>0.067</td>
<td>0.044</td>
<td>8.8μF</td>
<td>4.4Ω</td>
<td>675mV</td>
<td>0.88MΩ</td>
</tr>
<tr>
<td>UM0.25’20</td>
<td>0 to 250V</td>
<td>80mA</td>
<td>0.035</td>
<td>0.019</td>
<td>2.2μF</td>
<td>200Ω</td>
<td>1.135V</td>
<td>1.50MΩ</td>
</tr>
<tr>
<td>UM0.5’20</td>
<td>0 to 500V</td>
<td>40mA</td>
<td>0.041</td>
<td>0.040</td>
<td>0.8μF</td>
<td>94Ω</td>
<td>2.25V</td>
<td>2.65MΩ</td>
</tr>
<tr>
<td>UM1’20</td>
<td>0 to 1kV</td>
<td>20mA</td>
<td>0.039</td>
<td>0.095</td>
<td>0.2μF</td>
<td>470Ω</td>
<td>4.35V</td>
<td>20MΩ</td>
</tr>
<tr>
<td>UM2’20</td>
<td>0 to 2kV</td>
<td>10mA</td>
<td>0.026</td>
<td>0.016</td>
<td>0.097μF</td>
<td>1.0KΩ</td>
<td>6.6V</td>
<td>30MΩ</td>
</tr>
<tr>
<td>UM4’20</td>
<td>0 to 4kV</td>
<td>5mA</td>
<td>0.023</td>
<td>0.028</td>
<td>0.012μF</td>
<td>9.4KΩ</td>
<td>6.65V</td>
<td>100MΩ</td>
</tr>
<tr>
<td>UM6’20</td>
<td>0 to 6kV</td>
<td>3.3mA</td>
<td>0.017</td>
<td>0.018</td>
<td>0.007μF</td>
<td>20KΩ</td>
<td>6.74V</td>
<td>150MΩ</td>
</tr>
</tbody>
</table>

---

**UM 30W SELECTION TABLE**

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Output V</th>
<th>Output Current</th>
<th>Low Freq. Ripple %Vp-p @ 1Hz-1kHz</th>
<th>High Freq. Ripple %Vp-p @ 1kHz-1MHz</th>
<th>Output Capacitance</th>
<th>Arc Limiting Resistance</th>
<th>I Sense Scaling Full Scale Signal</th>
<th>High Voltage Divider Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>UM0.062’30</td>
<td>0 to 62.5V</td>
<td>480mA</td>
<td>0.075</td>
<td>0.112</td>
<td>8.8μF</td>
<td>1Ω</td>
<td>500mV</td>
<td>0.5MΩ</td>
</tr>
<tr>
<td>UM0.125’30</td>
<td>0 to 125V</td>
<td>240mA</td>
<td>0.075</td>
<td>0.056</td>
<td>8.8μF</td>
<td>4.4Ω</td>
<td>930mV</td>
<td>0.88MΩ</td>
</tr>
<tr>
<td>UM0.25’30</td>
<td>0 to 250V</td>
<td>120mA</td>
<td>0.055</td>
<td>0.031</td>
<td>2.2μF</td>
<td>20Ω</td>
<td>1.65V</td>
<td>1.50MΩ</td>
</tr>
<tr>
<td>UM0.5’30</td>
<td>0 to 500V</td>
<td>60mA</td>
<td>0.085</td>
<td>0.041</td>
<td>0.8μF</td>
<td>94Ω</td>
<td>3.4V</td>
<td>2.65MΩ</td>
</tr>
<tr>
<td>UM1’30</td>
<td>0 to 1kV</td>
<td>30mA</td>
<td>0.032</td>
<td>0.171</td>
<td>0.2μF</td>
<td>220Ω</td>
<td>6.5V</td>
<td>20MΩ</td>
</tr>
<tr>
<td>UM2’30</td>
<td>0 to 2kV</td>
<td>15mA</td>
<td>0.031</td>
<td>0.112</td>
<td>0.097μF</td>
<td>470Ω</td>
<td>9.95V</td>
<td>30MΩ</td>
</tr>
<tr>
<td>UM4’30</td>
<td>0 to 4kV</td>
<td>7.5mA</td>
<td>0.028</td>
<td>0.071</td>
<td>0.012μF</td>
<td>4.4KΩ</td>
<td>9.95V</td>
<td>100MΩ</td>
</tr>
<tr>
<td>UM6’30</td>
<td>0 to 6kV</td>
<td>5mA</td>
<td>0.020</td>
<td>0.051</td>
<td>0.007μF</td>
<td>9.4KΩ</td>
<td>10.0V</td>
<td>150MΩ</td>
</tr>
</tbody>
</table>

---

Note: Total ripple is the sum of the low frequency and high frequency ripple. Grayed text indicates Legacy interface signals.
**STANDARD INTERFACE**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Ground Return</td>
<td>+12Vdc or +24Vdc power return/HV return</td>
</tr>
<tr>
<td>1A</td>
<td>Signature Resistor</td>
<td>Unique identifying resistor connected to ground</td>
</tr>
<tr>
<td>2</td>
<td>+ Power Input</td>
<td>+12Vdc or +24Vdc power input</td>
</tr>
<tr>
<td>2A</td>
<td>N/C</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>I Sense</td>
<td>See I Sense text and tables</td>
</tr>
<tr>
<td>3A</td>
<td>I Mon</td>
<td>0 to 4.64Vdc = 0 to 100% rated output, Zout &lt; 10kΩ</td>
</tr>
<tr>
<td>4</td>
<td>Enable Input</td>
<td>Low (&lt;0.7V, Isink@1mA)=HV OFF, High (open or &gt;2V)=HV ON</td>
</tr>
<tr>
<td>4A</td>
<td>V Mon</td>
<td>0 to 4.64Vdc = 0 to 100% rated output, Zout &lt; 10kΩ</td>
</tr>
<tr>
<td>5</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>5A</td>
<td>Pgm</td>
<td>0 to 4.64Vdc = 0 to 100% rated output, Zin &gt; 47kΩ Leave open for preset current limit @105% of rated output current</td>
</tr>
<tr>
<td>6</td>
<td>Remote Adjust</td>
<td>Positive Polarity Unit:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 to +4.64VDC = 0 to 100% rated voltage, Zin &gt; 1MΩ</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Negative Polarity Unit:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+5VDC to 0.36V = 0 to 100% rated voltage, Zin &gt; 100kΩ Leave open if pin 6A (VPgm) is used for programming</td>
</tr>
<tr>
<td>6A</td>
<td>V Pgm</td>
<td>0 to 4.64Vdc = 0 to 100% rated voltage, Zin &gt; 100kΩ Leave open if pin 6 (remote adjust) is used for programming</td>
</tr>
<tr>
<td>7</td>
<td>+5V Reference Output</td>
<td>+5Vdc ±0.5%, 50ppm/°C, Zout =4750Ω</td>
</tr>
<tr>
<td>8</td>
<td>HV Ground Return</td>
<td>HV Ground Return</td>
</tr>
<tr>
<td>9</td>
<td>E Out Monitor</td>
<td>10:1 ratio for models below 1kV, 100:1 ratio for models 1kV and above. Polarity of Voltage Monitor signal equals polarity of unit. Accuracy is ±2%, 100ppm/°C. Calibrated with DVM with 10MΩ input impedance</td>
</tr>
<tr>
<td>10</td>
<td>HV Output</td>
<td>HV Output</td>
</tr>
<tr>
<td>11</td>
<td>HV Output</td>
<td>HV Output</td>
</tr>
</tbody>
</table>

Grayed out signals are provided for backward legacy compatibility and their use is not required.

Power Ground Return, Signal Ground and HV Ground Return are connected internally. For best performance they should not be connected externally.

**LEAGCY INTERFACE (L OPTION)**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Ground Return</td>
<td>+12Vdc or +24Vdc power return/HV return</td>
</tr>
<tr>
<td>2</td>
<td>+ Power Input</td>
<td>+12Vdc or +24Vdc power input</td>
</tr>
<tr>
<td>3</td>
<td>I Sense</td>
<td>See I Sense text and tables</td>
</tr>
<tr>
<td>4</td>
<td>Enable Input</td>
<td>Low (&lt;0.7V, Isink@1mA)=HV OFF, High (open or &gt;2V)=HV ON</td>
</tr>
<tr>
<td>5</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>Remote Adjust</td>
<td>Positive Polarity Unit:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 to +4.64VDC = 0 to 100% rated voltage, Zin &gt; 1MΩ</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Negative Polarity Unit:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+5VDC to 0.36V = 0 to 100% rated voltage, Zin &gt; 100kΩ Leave open if pin 6A (VPgm) is used for programming</td>
</tr>
<tr>
<td>7</td>
<td>+5V Reference Output</td>
<td>+5Vdc ±0.5%, 50ppm/°C, Zout =4750Ω</td>
</tr>
<tr>
<td>8</td>
<td>HV Ground Return</td>
<td>HV Ground Return</td>
</tr>
<tr>
<td>9</td>
<td>E Out Monitor</td>
<td>10:1 ratio for models below 1kV, 100:1 ratio for models 1kV and above. Polarity of Voltage Monitor signal equals polarity of unit. Accuracy is ±2%, 100ppm/°C. Calibrated with DVM with 10MΩ input impedance</td>
</tr>
<tr>
<td>10</td>
<td>HV Output</td>
<td>HV Output</td>
</tr>
<tr>
<td>11</td>
<td>HV Output</td>
<td>HV Output</td>
</tr>
</tbody>
</table>

Power Ground Return, Signal Ground and HV Ground Return are connected internally. For best performance they should not be connected externally.

**Standard Interface Connections**

Seventeen (17) gold plated 0.025" (0.64mm) square pins suitable for direct PCB mounting. See mechanical drawing for location and spacing details.

**Programming and Monitor Signals**

Voltage and current programming is done via positive polarity, high input impedance. 0 to 4.64Vdc signals. Voltage and current monitors are positive polarity, buffered low output impedance 0 to 4.64Vdc signals.

**I Mon**

The I Mon signal is a true output current monitoring signal. All internal offsets due to feedback divider currents have been compensated for.

**Signature Resistor**

A unique identifying signature resistor for each type of unit is connected from Pin 1A to ground. Details if desired are available upon request.

**Legacy Interface Connections**

Eleven (11) gold plated 0.025" (0.64mm) square pins suitable for direct PCB mounting. See mechanical drawing for location and spacing details.

**I Sense Signal**

The I Sense signal polarity is opposite of the output polarity of the module. This signal is protected via a transorb and provided via a series connected 47k isolation resistor. Internal HV dividers create a small, linear offset voltage on the I sense signal that can be compensated for.

**Adhesive Backed Heat Sink**

UM modules are provided with an uninstalled top mounted adhesive backed heat sink. Label removal is not required if the customer elects to install and use the provided heat sink. The UM’s internal power dissipation causes a case temperature rise. If the case exceeds 65°C, the unit needs external cooling (fan or heat sink). Even if the case is below 65°C, it is prudent to keep it much lower. Like a semiconductor device; the hotter it is, the shorter the life. For every 10°C reduction of temperature the lifetime will be increased by a factor of ≈2.35. The thermal resistance from internal circuitry to ambient is 8°C/watt without a heat sink (still air). This reduces to 6°C/watt with the heat sink.

Example:

Assuming ~80% efficiency for a 20 watt UM module, the 5 watts of internal power dissipation would create a 40°C rise. Using the heat sink there would be only a 30°C rise. Ultimately it is up to the user to determine what cooling method is applicable for their application, but the general recommendation is to keep the module as cool as possible.
UM OPTIONS

C Option
Fast Rise Time Applications-
If applications demand a power supply that is optimized for fast rise time/low overshoot requirements, then the C Option should be considered. A Hysteretic control circuit is employed providing improved performance in these unique applications with higher ripple observed (1% Vpp typical). If used for capacitor charging, a Spellman Capacitor Charging Questionnaire should be filled out to assure all aspects of the intended usage is understood assuring the appropriate unit is provided. Speak to a Spellman sales person for more details.

T Option
Low Temperature Coefficient-
The T Option offers the UM with an improved temperature coefficient. The standard voltage feedback divider is replaced with one having a superior temperature coefficient, resulting in a unit with 25ppm/C (typical) temperature coefficient.

B Option
Terminal Block-
The B Option provides terminal block connections for both the customer interface and high voltage output/return. This feature can be helpful in situations where frequent wiring changes are anticipated, as in a testing or prototype environment.

M Option
Mu Metal Shield-
UM modules can be fitted with an adhesive backed Mu Metal foil shield to help protect sensitive adjacent circuitry.

PHYSICAL INTERFACING

A Option
Adapter Board-
Spellman’s UM module can be fitted with an adapter board that will allow a drop in replacement for other commercially available modules of a physically larger size, while providing identical functionality with superior performance.

SHIELDING

Same as standard unit. See page 6 of 6 for dimensional drawings.
SHIELDING continued

S Option
RF Tight Shielded Can-
The S Option mounts the UM module inside of a flanged RF tight aluminum can.

CHASSIS MOUNTING

E Option
Eared Mounting Plate-
An eared mounting plate is affixed to the top surface of the UM module allowing simple chassis mounting of unit.

E2 Option
Eared Mounting Plate-
An eared mounting plate is affixed to the top surface of the UM module allowing simple chassis mounting of units ordered with the Adapter Board (A Option).
**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
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<td>4</td>
</tr>
<tr>
<td>0 to 125Vdc</td>
<td>20</td>
</tr>
<tr>
<td>0 to 250Vdc</td>
<td>30</td>
</tr>
<tr>
<td>0 to 500Vdc</td>
<td>6</td>
</tr>
<tr>
<td>0 to 1000Vdc</td>
<td>1</td>
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<td>0 to 2000Vdc</td>
<td>4</td>
</tr>
<tr>
<td>0 to 4000Vdc</td>
<td>6</td>
</tr>
<tr>
<td>0 to 6000Vdc</td>
<td>6</td>
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</table>

**STANDARD UNIT ORDERING EXAMPLE**

**OPTION ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>Option</th>
<th>Option Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legacy Interface</td>
<td>L</td>
</tr>
<tr>
<td>Fast Rise Time</td>
<td>C</td>
</tr>
<tr>
<td>Low Temperature Coefficient</td>
<td>T</td>
</tr>
<tr>
<td>Adapter Board</td>
<td>A</td>
</tr>
<tr>
<td>Terminal Block</td>
<td>B</td>
</tr>
<tr>
<td>Mu Metal Shield</td>
<td>M</td>
</tr>
<tr>
<td>RF Tight Shielded Can</td>
<td>S</td>
</tr>
<tr>
<td>Eared Mounting Plate</td>
<td>E</td>
</tr>
<tr>
<td>Eared Mounting Plate/Adapter Board</td>
<td>E2</td>
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<table>
<thead>
<tr>
<th>Voltage</th>
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<tr>
<td>0 to 125Vdc</td>
<td>0.125</td>
</tr>
<tr>
<td>0 to 250Vdc</td>
<td>0.25</td>
</tr>
<tr>
<td>0 to 500Vdc</td>
<td>0.5</td>
</tr>
<tr>
<td>0 to 1000Vdc</td>
<td>1</td>
</tr>
<tr>
<td>0 to 2000Vdc</td>
<td>2</td>
</tr>
<tr>
<td>0 to 4000Vdc</td>
<td>4</td>
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<td>Eared Mounting Plate/Adapter Board</td>
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</table>
Form, Fit and Function Design:
Spellman’s UM Series of printed circuit board mountable, high voltage modules offer a form, fit and function replacement for presently available commercially made units, while providing additional features and benefits at competitive pricing. Utilizing proprietary power conversion technology and Spellman’s six decades of high voltage experience, these SMT based high voltage modules provide improved performance/reliability and easier system integration at a lower cost when compared to the competition.

Advanced Power Conversion Topology:
UM converters use a proprietary zero voltage switching power conversion topology providing exceptional efficiency and inherent low noise and ripple. Radiated emissions are reduced compared to conventional switching topologies, minimizing or even eliminating the need to shield the unit from adjacent circuitry.

The high voltage output is generated using a ferrite core high voltage step up transformer which feeds a half wave Cockcroft-Walton voltage multiplier to obtain the specified high voltage output.

Due to the fixed, high frequency conversion rate the output capacitance is small resulting in minimal stored energy. Through the use of generously rated surge limiting resistors and a fast acting current loop, all units are fully arc and short circuit protected.

Control and Regulation:
The actual output voltage generated is sampled via a high impedance divider to create a voltage feedback signal. A current feedback signal is created via a current sense resistor in the low end return of the high voltage output circuitry. These two accurate ground referenced feedback signals are used to precisely regulate and control the units in addition to external monitoring purposes.

Due to the UM’s unique converter topology it can provide full current into low impedance loads or even a short circuit. Standard units limit at 103% of maximum rated output current.

Standard Interface:
The Spellman UM Series interface provides current programming capability and positive polarity, buffered, low output impedance voltage and current monitor signals (zero to +4.64Vdc equals zero to full scale rated). A voltage programming input is provided where 0 to +4.64Vdc equals 0 to 100% of rated voltage.

Current programmability allows the user to set where the unit will current limit, anywhere from 0 to 100% of maximum rated current. This feature is beneficial where less than full output current is desired, like in the case of protecting a sensitive load.

The buffered low impedance voltage and current monitor signals can drive external circuitry directly, while minimizing loading and pickup effects. These features save the user the expense and implementation of external interface buffering circuitry while improving overall signal integrity.

This standard interface is made available via a row of 13 pins with 0.1” pin spacing. A legacy interface (7 pins on a 0.2” spacing) that is compatible with presently available commercially made units can be provided by ordering the “L” option.

Mechanical and Environmental Considerations:
The UM Series are solid encapsulated, printed circuit board mountable, plastic cased converters. All units are encapsulated using a silicon based potting material which is considerably lighter in weight than epoxy. Isolated, non grounded 2-56 machine screws thread into the module to securely mount it to the printed circuit board, relieving any stress on the interface pins. Mounting plates, brackets and flanged mounting options are also available. High voltage output is provided via a 36” (914.4mm) minimum length of appropriately rated high voltage wire.

Regulatory Approvals:
**SPECIFICATIONS**

**Input Voltage:**
12Vdc for 4W, 24Vdc for 15W and 30W

**Nominal Voltage Range:**
11Vdc to 30Vdc for 4W, 23Vdc to 30Vdc for 15W and 30W.
4W units can operate at 24Vdc input with no deratings or damage to unit.

**Input Current:** (typical)
- Disconnected: 10mA @ 24Vdc
- Full output, no load: 160mA @ 24Vdc, 300mA @ 12Vdc
- Full output, full load:
  - 4 watt units: 330mA @ 24Vdc, 640mA @ 12Vdc
  - 15 watt units: 850mA @ 24Vdc
  - 30 watt units: 1590mA @ 24Vdc

**Voltage Regulation:**
- Line: <0.01%
- Load: <0.01%

**Current Regulation:**
- Line: <0.01%
- Load: <0.01%

**Stability:**
0.01% per 8 hours, 0.02% per day after 30 min. warmup

**Accuracy:**
2% on all programming and monitoring, except I Sense 10%

**Temperature Coefficient:** (typical)
- Standard: 100ppm/°C
- Optional: 25ppm/°C (T Option)

---

**Environmental:**
- **Temperature Range:**
  - Operating: -40°C to 65°C case temperature
  - Storage: -55°C to 105°C, non-operational
- **Humidity:** 10% to 90%, non-condensing.

**Cooling:**
- Convection cooled, typical. 30 watt units operating at full power might require additional cooling to maintain case temperature below 65°C. Methods may include: forced air cooling, use of heat sink or metal case, etc. It is the user’s responsibility to maintain the case temperature below 65°C. Damage to the power supply due to inadequate cooling is considered misuse and repairs will not be covered under warranty.

**Dimensions:**
- 8kV-12kV: 3.700” L X 1.500” W X 0.990” H (93.98mm X 38.10mm X 25.03mm)
- 15kV-20kV: 4.700” L X 1.500” W X 0.990” H (119.38mm X 38.10mm X 25.03mm)
- 25kV-40kV: 6.960” L X 1.600” W X 1.14” H (176.78mm X 40.84mm X 28.87mm)

**Weight:**
- 8kV-12kV: 5.7 ounces (162 grams), typical
- 15kV-20kV: 7.2 ounces (204 grams), typical
- 25kV-40kV: 13.1 ounces (371 grams), typical

**Output Cable:**
- UM8, UM10, UM12, UM15: TV20 (min. length, 36” (914.4mm)
- UM20, UM25, UM30, UM35, UM40: TV40 (min. length, 36” (914.4mm)

---

### UM 4W, 8kV TO 40kV SELECTION TABLE

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Output V</th>
<th>Output Current</th>
<th>Ripple(max) %Vp-p</th>
<th>Output Capacitance</th>
<th>Arc Limiting Resistance</th>
<th>I Sense Scaling</th>
<th>Full Scale Signal</th>
<th>High Voltage Divider Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>UM8*4</td>
<td>0 to 8kV</td>
<td>0.5mA</td>
<td>0.05</td>
<td>680pF</td>
<td>50kΩ</td>
<td>5.36V</td>
<td>20MΩ</td>
<td></td>
</tr>
<tr>
<td>UM10*4</td>
<td>0 to 10kV</td>
<td>0.4mA</td>
<td>0.05</td>
<td>4380pF</td>
<td>50kΩ</td>
<td>2.4V</td>
<td>30MΩ</td>
<td></td>
</tr>
<tr>
<td>UM12*4</td>
<td>0 to 12kV</td>
<td>0.33mA</td>
<td>0.05</td>
<td>4380pF</td>
<td>50kΩ</td>
<td>1.6V</td>
<td>40MΩ</td>
<td></td>
</tr>
<tr>
<td>UM15*4</td>
<td>0 to 15kV</td>
<td>0.26mA</td>
<td>0.05</td>
<td>3220pF</td>
<td>100kΩ</td>
<td>1.3V</td>
<td>50MΩ</td>
<td></td>
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<tr>
<td>UM20*4</td>
<td>0 to 20kV</td>
<td>0.2mA</td>
<td>0.05</td>
<td>2510pF</td>
<td>100kΩ</td>
<td>1.1V</td>
<td>60MΩ</td>
<td></td>
</tr>
<tr>
<td>UM25*4</td>
<td>0 to 25kV</td>
<td>0.16mA</td>
<td>0.05</td>
<td>1370pF</td>
<td>140kΩ</td>
<td>0.95V</td>
<td>90MΩ</td>
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</tr>
<tr>
<td>UM30*4</td>
<td>0 to 30kV</td>
<td>0.13mA</td>
<td>0.05</td>
<td>1370pF</td>
<td>140kΩ</td>
<td>0.72V</td>
<td>90MΩ</td>
<td></td>
</tr>
<tr>
<td>UM35*4</td>
<td>0 to 35kV</td>
<td>0.115mA</td>
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<td>1370pF</td>
<td>140kΩ</td>
<td>1.3V</td>
<td>90MΩ</td>
<td></td>
</tr>
<tr>
<td>UM40*4</td>
<td>0 to 40kV</td>
<td>0.1mA</td>
<td>0.05</td>
<td>1370pF</td>
<td>140kΩ</td>
<td>1.3V</td>
<td>90MΩ</td>
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</tr>
</tbody>
</table>

### UM 15W, 8kV TO 40kV SELECTION TABLE

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Output V</th>
<th>Output Current</th>
<th>Ripple(max) %Vp-p</th>
<th>Output Capacitance</th>
<th>Arc Limiting Resistance</th>
<th>I Sense Scaling</th>
<th>Full Scale Signal</th>
<th>High Voltage Divider Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>UM10*15</td>
<td>0 to 10kV</td>
<td>1.5mA</td>
<td>0.05</td>
<td>4380pF</td>
<td>50kΩ</td>
<td>5.36V</td>
<td>20MΩ</td>
<td></td>
</tr>
<tr>
<td>UM12*15</td>
<td>0 to 12kV</td>
<td>1.25mA</td>
<td>0.05</td>
<td>4380pF</td>
<td>50kΩ</td>
<td>2.4V</td>
<td>30MΩ</td>
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</tr>
<tr>
<td>UM15*15</td>
<td>0 to 15kV</td>
<td>1mA</td>
<td>0.05</td>
<td>3220pF</td>
<td>100kΩ</td>
<td>1.6V</td>
<td>40MΩ</td>
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<tr>
<td>UM20*15</td>
<td>0 to 20kV</td>
<td>0.75mA</td>
<td>0.05</td>
<td>2510pF</td>
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<td>UM25*15</td>
<td>0 to 25kV</td>
<td>0.6mA</td>
<td>0.05</td>
<td>1370pF</td>
<td>140kΩ</td>
<td>1.1V</td>
<td>60MΩ</td>
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<tr>
<td>UM30*15</td>
<td>0 to 30kV</td>
<td>0.5mA</td>
<td>0.05</td>
<td>1370pF</td>
<td>140kΩ</td>
<td>0.95V</td>
<td>90MΩ</td>
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<tr>
<td>UM35*15</td>
<td>0 to 35kV</td>
<td>0.425mA</td>
<td>0.05</td>
<td>1370pF</td>
<td>140kΩ</td>
<td>0.72V</td>
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<td>UM40*15</td>
<td>0 to 40kV</td>
<td>0.375mA</td>
<td>0.05</td>
<td>1370pF</td>
<td>140kΩ</td>
<td>1.3V</td>
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### UM 30W, 8kV TO 40kV SELECTION TABLE

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<th>Output Current</th>
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<th>Full Scale Signal</th>
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<tr>
<td>UM8*30</td>
<td>0 to 8kV</td>
<td>3.75mA</td>
<td>0.05</td>
<td>680pF</td>
<td>50kΩ</td>
<td>5.36V</td>
<td>20MΩ</td>
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<td>UM10*30</td>
<td>0 to 10kV</td>
<td>3mA</td>
<td>0.05</td>
<td>4380pF</td>
<td>50kΩ</td>
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<td>UM12*30</td>
<td>0 to 12kV</td>
<td>2.5mA</td>
<td>0.05</td>
<td>4380pF</td>
<td>50kΩ</td>
<td>1.6V</td>
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<td>UM15*30</td>
<td>0 to 15kV</td>
<td>2mA</td>
<td>0.05</td>
<td>3220pF</td>
<td>100kΩ</td>
<td>1.3V</td>
<td>50MΩ</td>
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</tr>
<tr>
<td>UM20*30</td>
<td>0 to 20kV</td>
<td>1.5mA</td>
<td>0.06</td>
<td>2510pF</td>
<td>100kΩ</td>
<td>1.1V</td>
<td>60MΩ</td>
<td></td>
</tr>
<tr>
<td>UM25*30</td>
<td>0 to 25kV</td>
<td>1.25mA</td>
<td>0.06</td>
<td>1370pF</td>
<td>140kΩ</td>
<td>0.95V</td>
<td>90MΩ</td>
<td></td>
</tr>
<tr>
<td>UM30*30</td>
<td>0 to 30kV</td>
<td>1mA</td>
<td>0.06</td>
<td>1370pF</td>
<td>140kΩ</td>
<td>0.72V</td>
<td>90MΩ</td>
<td></td>
</tr>
<tr>
<td>UM35*30</td>
<td>0 to 35kV</td>
<td>0.75mA</td>
<td>0.05</td>
<td>1370pF</td>
<td>140kΩ</td>
<td>1.3V</td>
<td>90MΩ</td>
<td></td>
</tr>
<tr>
<td>UM40*30</td>
<td>0 to 40kV</td>
<td>0.75mA</td>
<td>0.05</td>
<td>1370pF</td>
<td>140kΩ</td>
<td>1.3V</td>
<td>90MΩ</td>
<td></td>
</tr>
</tbody>
</table>

Grayed text indicates Legacy interface signals.
**Standard Interface Connections**

Fifteen (15) gold plated 0.025˝ (0.64mm) square pins suitable for direct PCB mounting.

**Legacy Interface Connections**

Nine (9) gold plated 0.025˝ (0.64mm) square pins suitable for direct PCB mounting.

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>Power Ground Return</td>
<td>+12Vdc or +24Vdc power return/HV return</td>
</tr>
<tr>
<td>2A</td>
<td>Signature Resistor</td>
<td>Unique identifying resistor connected to ground</td>
</tr>
<tr>
<td>2B</td>
<td>Power Input</td>
<td>+12Vdc or +24Vdc power input</td>
</tr>
<tr>
<td>3A</td>
<td>OT Output</td>
<td>+5Vdc @ 1mA = Over Temp fault</td>
</tr>
<tr>
<td>3B</td>
<td>I Sense</td>
<td>See I Sense text and tables for details</td>
</tr>
<tr>
<td>4A</td>
<td>Low</td>
<td>0 to 4.64Vdc = 0 to 100% rated output, Zout &lt; 10kΩ</td>
</tr>
<tr>
<td>4B</td>
<td>High</td>
<td>Open or &gt;2V = HV ON</td>
</tr>
<tr>
<td>5A</td>
<td>I Mon</td>
<td>-0.6 to -4.64Vdc = 0 to 100% rated output, Zout &lt; 10kΩ</td>
</tr>
<tr>
<td>6A</td>
<td>Remote Adjust</td>
<td>+5Vdc ±1%, 25ppm/°C, Zout = 47Ω</td>
</tr>
<tr>
<td>7A</td>
<td>HV Ground Return</td>
<td>HV Ground Return</td>
</tr>
<tr>
<td>8A</td>
<td>E Out Monitor</td>
<td>0 to 4.64Vdc = 0 to 100% rated output, Zout &gt; 47kΩ</td>
</tr>
</tbody>
</table>

**Programming and Monitor Signals**

Voltage and current programming is done via positive polarity, high input impedance, 0 to 4.64Vdc signals. Voltage and current monitors are positive polarity, buffered low output impedance 0 to 4.64Vdc signals.

**I Mon**

The I Mon signal is a true output current monitoring signal. All internal offsets due to feedback divider currents have been compensated for.

**Signature Resistor**

A unique identifying signature resistor for each type of unit is connected from Pin 1A to ground. Details if desired are available upon request.

**I Sense Signal**

The polarity of the I Sense signal is opposite of the polarity of the output voltage of the unit that generated it. So a positive output polarity unit creates a negative polarity current monitor signal; while a negative output polarity unit creates a positive polarity current monitoring signal. This signal is clamped to ground internally via a bidirectional transient protection device and the signal is made available via a series connected 47kΩ isolation resistor. Internal HV dividers create a small, linear offset voltage on this current monitor signal that can be compensated for.

**OT Output**

The unit is protected by an internal thermostat that will shut the unit off if the case temperature exceeds 65°C. The OT Output signal will change states indicating an over temperature fault has occurred. In order to clear the OT signal and re-enable the unit, the temperature has to drop below 55 degrees C and input power needs to be recycled. For details on unit cooling requirements and the OT Output signal please see the operator’s manual.

---

**Legacy Interface (L Option)**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>Power Ground Return</td>
<td>+12Vdc or +24Vdc power return</td>
</tr>
<tr>
<td>2A</td>
<td>Power Input</td>
<td>+12Vdc or +24Vdc power input</td>
</tr>
<tr>
<td>3A</td>
<td>I Sense</td>
<td>See I Sense text and tables for details</td>
</tr>
<tr>
<td>4A</td>
<td>Low</td>
<td>0 to 4.64Vdc = 0 to 100% rated output, Zout &gt; 10kΩ</td>
</tr>
<tr>
<td>5A</td>
<td>High</td>
<td>Open or &gt;2V = HV ON</td>
</tr>
<tr>
<td>6A</td>
<td>Remote Adjust</td>
<td>Positive Polarity Unit: 0 to +4.64VDC = 0 to 100% rated voltage, Zin &gt; 1MΩ Negative Polarity Unit: +5VDC to -0.36V = 0 to 100% rated voltage, Zin &gt; 100kΩ Leave open if pin 6A (VPgm) is used for programming</td>
</tr>
<tr>
<td>7A</td>
<td>HV Ground Return</td>
<td>HV Ground Return</td>
</tr>
<tr>
<td>8A</td>
<td>E Out Monitor</td>
<td>1000:1 ratio. Polarity of Voltage Monitor signal equals polarity of unit. Accuracy is ±2%, 100ppm/°C. Calibrated with DVM with 10MΩ input impedance</td>
</tr>
</tbody>
</table>

Power Ground Return, Signal Ground and HV Ground Return are connected internally. For best performance they should not be connected externally.
UM8-40 OPTIONS

C Option
Fast Rise Time Applications-
If applications demand a power supply that is optimized for fast rise time requirements, then the C Option should be considered. If used for capacitor charging, a Spellman Capacitor Charging Questionnaire should be filled out to assure all aspects of the intended usage is understood assuring the appropriate unit is provided. Speak to a Spellman sales person for more details.

T Option
Low Temperature Coefficient-
The T Option offers the UM with an improved temperature coefficient. The standard voltage feedback divider is replaced with one having a superior temperature coefficient, resulting in a unit with 25ppm/C° (typical) temperature coefficient.

PHYSICAL INTERFACING

B Option
Terminal Block-
The B Option provides terminal block connections for both the customer interface and high voltage output/return. This feature can be helpful in situations where frequent wiring changes are anticipated, as in a testing or prototype environment.

SHIELDING OPTIONS

S Option
RF Tight Shielded Can-
The S Option mounts the UM module inside of a flanged RF tight aluminum can.
SHIELDING OPTIONS (CONT)

**M Option**
Mu Metal Shield-
UM modules can be fitted with an adhesive backed Mu Metal foil shield to help protect sensitive adjacent circuitry.

CHASSIS MOUNTING OPTION

**E Option**
Eared Mounting Plate-
An eared mounting plate is affixed to the top surface of the UM module allowing simple chassis mounting of unit.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Voltage</th>
<th>0 to 8kV</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 to 10kV</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>0 to 12kV</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>0 to 15kV</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>0 to 20kV</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>0 to 25kV</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>0 to 30kV</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>0 to 35kV</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>0 to 40kV</td>
<td>40</td>
</tr>
<tr>
<td>Polarity</td>
<td>Positive</td>
<td>P</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>N</td>
</tr>
<tr>
<td>Power</td>
<td>Watts Output</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Watts Output</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Watts Output</td>
<td>30</td>
</tr>
</tbody>
</table>

STANDARD UNIT ORDERING EXAMPLE

**UM30N30**

OPTION ORDERING INFORMATION

<table>
<thead>
<tr>
<th>OPTION</th>
<th>OPTION CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legacy Interface</td>
<td>L</td>
</tr>
<tr>
<td>Fast Rise Time</td>
<td>C</td>
</tr>
<tr>
<td>Low Temperature Coefficient</td>
<td>T</td>
</tr>
<tr>
<td>Mu Metal Shield</td>
<td>M</td>
</tr>
<tr>
<td>RF Tight Shielded Can</td>
<td>S</td>
</tr>
<tr>
<td>Eared Mounting Plate</td>
<td>E</td>
</tr>
<tr>
<td>Terminal Block</td>
<td>B</td>
</tr>
</tbody>
</table>

OPTION ORDERING EXAMPLE

**UM25P15/L/E**

Spellman High Voltage is an ISO 9001 and ISO 14001 registered company
Copyright © 2010 Spellman High Voltage Electronics Corp.
Spellman’s new MPS series are a family of high voltage 10 Watt modules that provide output voltages ranging from 1kV to 30kV.

The MPS series are high performance products designed with Spellman’s hybrid topology of linear and switch mode power conversion techniques delivering lower noise with higher efficiency. The MPS series produces excellent ripple and stability performance specifications from a compact footprint. Additionally the MPS series features, as standard, a differential amplifier input for the voltage programming signal to improve immunity from external system noise and addressing any offset issues. Alternatively the output voltage may be pre-set by an internal potentiometer.

A fully featured remote user interface is provided via 15-pin D-type connector as standard and an optional RS-232 or RS-485 serial interface is also available.

Spellman’s proprietary HV technology coupled with SMT circuitry results in an ultra compact and lightweight module that is available as either a positive or negative supply that is ideal for OEM applications.

**TYPICAL APPLICATIONS**

- Photomultiplier Tubes
- Electrostatic Printing
- Electron and Ion Beams
- Scintillators
- Electromultiplier Detectors
- Mass Spectrometry
- Microchannel Plate Detectors
- Electrostatic Lenses
- Nuclear Instruments

**OPTIONS**

- **VCC** Variable Current Control
- **HS** High Stability
- **DCC 2** RS-232
- **DCC 4** RS-485

Note: It is not possible to supply the unit with both full HS and DCC options

**SPECIFICATIONS**

- **Input Voltage:** +24 Vdc, ±2Vdc
- **Input Current:** ≤1 amp maximum
- **Output Voltage:** 9 models available from 1kV to 30kV
- **Output Polarity:** Positive or negative, specify at time of order
- **Power:** 10 watts, maximum
- **Voltage Regulation:**
  - Line: ≤0.001% of rated output voltage over specified input voltage
  - Load: ≤0.001% of rated output voltage for full load change
- **Current Regulation (VCC Option):**
  - Line: ≤0.01% for 1V input voltage change under any load conditions
  - Load: ≤0.01% for full load to short circuit
- **Ripple:** See “model selection” table
- **Stability:**
  - ≤0.007% per hour, 0.02% per 8 hours after 1.0 hour warm up period.
  - ≤0.05% per 1000 hours after 1.0 hour warm up period (HS option)
- **Temperature Coefficient:**
  - ≤25ppm per degree C
  - ≤10ppm per degree C (HS option)
- **Environmental:**
  - Temperature Range:
    - Operating: 0˚C to 50˚C
    - Storage: -35˚C to 85˚C
  - Humidity: 20% to 85% RH, non-condensing
- **Cooling:** Convection cooled

www.spellmanhv.com/operatorsmanual
www.spellmanhv.com/faq
www.spellmanhv.com/dcc
**MPS ANALOG INTERFACE—15 PIN D CONNECTOR (NON-DCC UNITS)**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power/Signal Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>2</td>
<td>+24Vdc Input</td>
<td>+24Vdc @ 1 amp maximum</td>
</tr>
<tr>
<td>3</td>
<td>Voltage Monitor Output</td>
<td>0 to 10Vdc=0 to 100% Rated Output, Zout =10kΩ</td>
</tr>
<tr>
<td>4</td>
<td>Local Programming Potentiometer Wiper Output</td>
<td>Potentiometer connected to +10Vdc and Ground, 0 to 10Vdc adjustable wiper output provided</td>
</tr>
<tr>
<td>5</td>
<td>Voltage Program Input</td>
<td>0 to 10Vdc=0 to 100% Rated Output, Zin=10MΩ</td>
</tr>
<tr>
<td>6</td>
<td>Voltage Program Differential Amplifier Output</td>
<td>0 to 10Vdc=0 to 100% Rated Output, Zin=10kΩ</td>
</tr>
<tr>
<td>7</td>
<td>Voltage Program Differential Amplifier Input—Positive</td>
<td>0 to 10Vdc differential between pin 7 and pin 9 = 0 to 100% of rated output, diode clamped to ground, Zin =36kΩ</td>
</tr>
<tr>
<td>8</td>
<td>Current Monitor Output</td>
<td>0 to 10Vdc=0 to 100% Rated Output, Zout =10kΩ</td>
</tr>
<tr>
<td>9</td>
<td>Voltage Program Differential Amplifier Input—Negative</td>
<td>0 to 10Vdc differential between pin 7 and pin 9 = 0 to 100% of Rated Output, diode clamped to ground, Zin =36kΩ</td>
</tr>
<tr>
<td>10</td>
<td>No Connection</td>
<td>No Connection</td>
</tr>
<tr>
<td>11</td>
<td>Current Program Input</td>
<td>Standard: Internally connected to provide 110% fixed current limit VCC Option: 0 to 10Vdc=0 to 100% Rated Output, Zin=1MΩ</td>
</tr>
<tr>
<td>12</td>
<td>Enable Input</td>
<td>Low = Enable, TTL, CMOS, Open Collector Compliant</td>
</tr>
<tr>
<td>13</td>
<td>Internal Connection</td>
<td>No Connection</td>
</tr>
<tr>
<td>14</td>
<td>Vref (HS unit only)</td>
<td>+10V ultra high stability reference output. On standard units the reference voltage is available on pin 4</td>
</tr>
<tr>
<td>15</td>
<td>Analog Signal Ground</td>
<td>Analog Signal Ground (No connection for 15kV to 20kV units)</td>
</tr>
</tbody>
</table>

**MPS ANALOG INTERFACE—15 PIN D CONNECTOR (DCC UNITS)**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power/Signal Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>2</td>
<td>+24Vdc Input</td>
<td>+24Vdc @ 1 amp maximum</td>
</tr>
<tr>
<td>3</td>
<td>No Connection</td>
<td>No Connection</td>
</tr>
<tr>
<td>4</td>
<td>Local Programming Potentiometer Wiper Output</td>
<td>Potentiometer connected to +10Vdc and Ground, 0 to 10Vdc adjustable wiper output provided</td>
</tr>
<tr>
<td>5</td>
<td>No Connection</td>
<td>No Connection</td>
</tr>
<tr>
<td>6</td>
<td>No Connection</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>No Connection</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>No Connection</td>
<td>No Connection</td>
</tr>
<tr>
<td>9</td>
<td>No Connection</td>
<td>No Connection</td>
</tr>
<tr>
<td>10</td>
<td>No Connection</td>
<td>No Connection</td>
</tr>
<tr>
<td>11</td>
<td>Enable Input</td>
<td>Low = Enable, TTL, CMOS, open collector compliant</td>
</tr>
<tr>
<td>12</td>
<td>TxD</td>
<td>Transmit data (output) with respect to ground (pin 1)</td>
</tr>
<tr>
<td>13</td>
<td>RxD</td>
<td>Receive data (input) with respect to ground (pin 1)</td>
</tr>
</tbody>
</table>

**MPS SELECTION TABLE**

<table>
<thead>
<tr>
<th>Model</th>
<th>Output Voltage</th>
<th>Output Current</th>
<th>Ripple (Vpp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPS10/24</td>
<td>1kV</td>
<td>10mA</td>
<td>&lt;10mV</td>
</tr>
<tr>
<td>MPS2*10/24</td>
<td>2kV</td>
<td>5.00mA</td>
<td>&lt;20mV</td>
</tr>
<tr>
<td>MPS2.5*10/24</td>
<td>2.5kV</td>
<td>4.00mA</td>
<td>&lt;25mV</td>
</tr>
<tr>
<td>MPS3*10/24</td>
<td>3kV</td>
<td>3.3mA</td>
<td>&lt;25mV</td>
</tr>
<tr>
<td>MPS5*10/24</td>
<td>5kV</td>
<td>2mA</td>
<td>&lt;30mV</td>
</tr>
<tr>
<td>MPS10*10/24</td>
<td>10kV</td>
<td>1mA</td>
<td>&lt;50mV</td>
</tr>
<tr>
<td>MPS15*10/24</td>
<td>15kV</td>
<td>0.66mA</td>
<td>&lt;100mV</td>
</tr>
<tr>
<td>MPS20*10/24</td>
<td>20kV</td>
<td>0.5mA</td>
<td>&lt;150mV</td>
</tr>
<tr>
<td>MPS30*10/24</td>
<td>30kV</td>
<td>0.33mA</td>
<td>&lt;250mV</td>
</tr>
</tbody>
</table>

*Specify “P” for positive polarity or “N” for negative polarity. Custom units available.

**Regulatory Approvals:**

**Dimensions:**
1-10kV: 1.18˝ H X 2.75˝ W X 5.12˝ D (30mm x 70mm x 130mm)
15-20kV: 1.18˝ H X 2.75˝ W X 6.49˝ D (30mm x 70mm x 165mm)
30kV: 1.37˝ H X 2.95˝ W X 8.47˝ D (65mm x 75mm x 215mm)

**Weight:**
1-3kV: 9.88 oz. (280g)
5-10kV: 14.82 oz. (420g)
15-20kV: 22.92 oz. (650g)
30kV: 35.51 oz. (950g)

**Interface Connector:**
15 pin male D connector

**Output Connector:**
A captive 39.4˝ (1 meter) long shielded HV cable is provided
Spellman’s new MPD series are a family of high voltage 10 Watt modules that provide output voltages ranging from 2.5kV to 20kV. The MPD series are high performance products designed with Spellman’s hybrid topology of linear and switch mode power conversion techniques delivering lower noise with higher efficiency. The MPD series produces excellent ripple and stability performance specifications from a compact footprint. The MPD series features a differential amplifier input for the voltage programming signal to improve immunity from external system noise and addressing any offset issues.

A fully featured remote user interface is provided via 15-pin D-type connector as well as RS-232/RS-485 serial interface. The unit can be full analog or full digital control defined by interface connector links. Spellman’s proprietary HV technology coupled with SMT circuitry results in an ultra compact and lightweight module that is available as either a positive or negative supply that is ideal for OEM applications.

**TYPICAL APPLICATIONS**

- Photomultiplier Tubes
- Electron and Ion Beams
- Electromultipier Detectors
- Microchannel Plate Detectors
- Nuclear Instruments
- Electrostatic Printing
- Scintillators
- Mass Spectrometry
- Electrostatic Lenses

**SPECIFICATIONS**

**Input Voltage:**
+24 Vdc, ±2Vdc

**Input Current:**
≤1 amp maximum

**Output Voltage:**
5 models available from 2.5kV to 20kV

**Output Polarity:**
Positive or negative, specify at time of order

**Power:**
10 watts, maximum

**Voltage Regulation:**
- Line: For a 1V line change 10ppm
- Load: 0-100% load 10ppm

- Extremely Compact High Performance Module
- Digital or Differential Analog Voltage Program
- Standard RS-232/RS-485 Control
- 10 Watts Output Power
- Voltage and Current Monitors
- High Stability, Low TC
- Digital Oscillator Provides Ultra Low Ripple and Noise, Down to 1/f Band

**Current Limit:**
110% of rated output current

**Ripple:**
See “drift, ripple and noise” table

**Stability:**
- After one hour warm up period:
  - 10ppm/hour
  - 25ppm/8 hours
  - 500ppm/1000 hours

**Temperature Coefficient:**
10ppm per degree C

**Protection:**
Arc and short circuit protected. Not designed to withstand continuous arcing

**Environmental:**
- Temperature Range:
  - Operating: 0°C to 50°C
  - Storage: -35°C to 85°C
- Humidity:
  - 20% to 85% RH, non-condensing

**Cooling:**
Convection cooled

**Dimensions:**
- 2.5-10kV:
  - 1.18˝ H X 2.75˝ W X 5.12˝ D  (30mm x 70mm x 130mm)
- 15-20kV:
  - 1.18˝ H X 2.75˝ W X 6.50˝ D  (30mm x 70mm x 165mm)

**Weight:**
- 2.5/5/10kV:
  - 14.82 oz. (420g)
- 15/20kV:
  - 22.09 oz. (650g)

**Interface Connector:**
15 pin male D connector

**Output Connector:**
A captive 39.4˝ (1 meter) long HRG58 shielded HV cable is provided

**Regulatory Approvals:**
- Safety: The unit is designed to meet the requirements of EN61010-1, UL61010A-1 and CAN/CSA 22.2 No 1010.1.
- EMC: As the unit is intended for incorporation into the users equipment, it is not tested as a standalone unit to meet the EMC directive. The user will need to follow sensible EMC precautions in using the unit.
**MPD SELECTION TABLE**

<table>
<thead>
<tr>
<th>Model</th>
<th>Output Voltage</th>
<th>Output Current</th>
<th>Ripple (Vpp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPD2.5*10/24</td>
<td>2.5kV</td>
<td>4.00 mA</td>
<td>See table below</td>
</tr>
<tr>
<td>MPD5*10/24</td>
<td>5kV</td>
<td>2mA</td>
<td>See table below</td>
</tr>
<tr>
<td>MPD10*10/24</td>
<td>10kV</td>
<td>1mA</td>
<td>See table below</td>
</tr>
<tr>
<td>MPD15*10/24</td>
<td>15kV</td>
<td>0.66mA</td>
<td>See table below</td>
</tr>
<tr>
<td>MPD20*10/24</td>
<td>20kV</td>
<td>0.5mA</td>
<td>See table below</td>
</tr>
</tbody>
</table>

*Specify “P” for positive polarity or “N” for negative polarity. Custom units available.

**MPD DRIFT, RIPPLE and NOISE**

<table>
<thead>
<tr>
<th>Model</th>
<th>3mHz-30mHz</th>
<th>30mHz-3Hz</th>
<th>3Hz-30Hz</th>
<th>30Hz-300Hz</th>
<th>300Hz-3MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPD2.5</td>
<td>10μV</td>
<td>10μV</td>
<td>5μV</td>
<td>5μV</td>
<td>5μV</td>
</tr>
<tr>
<td>MPD5</td>
<td>10μV</td>
<td>10μV</td>
<td>10μV</td>
<td>10μV</td>
<td>10μV</td>
</tr>
<tr>
<td>MPD10</td>
<td>20μV</td>
<td>20μV</td>
<td>20μV</td>
<td>20μV</td>
<td>20μV</td>
</tr>
<tr>
<td>MPD15</td>
<td>30μV</td>
<td>30μV</td>
<td>30μV</td>
<td>30μV</td>
<td>30μV</td>
</tr>
<tr>
<td>MPD20</td>
<td>40μV</td>
<td>40μV</td>
<td>40μV</td>
<td>40μV</td>
<td>40μV</td>
</tr>
</tbody>
</table>

**MPD EXTERNAL INTERFACE—15 PIN MALE D CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>2</td>
<td>+24Vdc Input</td>
<td>+24Vdc @ 1 amp maximum</td>
</tr>
<tr>
<td>3</td>
<td>Voltage Monitor Output</td>
<td>Voltage monitor 0-10Vdc for 0 to full scale output ±1% (wrt signal ground)</td>
</tr>
<tr>
<td>4</td>
<td>Voltage Reference Output</td>
<td>10Vdc @ 1mA maximum</td>
</tr>
<tr>
<td>5</td>
<td>Voltage Program Input</td>
<td>0 to 10Vdc=0 to 100% rated output, Zin=10MΩ</td>
</tr>
<tr>
<td>6</td>
<td>Voltage Program Differential Amplifier Output</td>
<td>0 to 10Vdc=0 to 100% rated output, Zout =10kΩ</td>
</tr>
<tr>
<td>7</td>
<td>Voltage Program Differential Amplifier Input—Positive</td>
<td>0 to 10Vdc differential between pin 7 and pin 9 = 0 to 100% of rated output, diode clamped to ground, Zin =38kΩ</td>
</tr>
<tr>
<td>8</td>
<td>Current Monitor Output</td>
<td>Voltage monitor 0-10Vdc for 0 to full scale output ±1% (wrt signal ground)</td>
</tr>
<tr>
<td>9</td>
<td>Voltage Program Differential Amplifier Input—Negative</td>
<td>0 to 10Vdc differential between pin 7 and pin 9 = 0 to 100% of rated output, diode clamped to ground, Zin =38kΩ</td>
</tr>
<tr>
<td>10</td>
<td>Voltage Program Digital Output</td>
<td>0 to 10Vdc = 0 to 100% rated output, Zout =10kΩ</td>
</tr>
<tr>
<td>11</td>
<td>Analog Signal Ground</td>
<td>Analog signal ground for control and monitoring</td>
</tr>
<tr>
<td>12</td>
<td>Enable Input</td>
<td>Low = Enable, TTL, CMOS, open collector compliant</td>
</tr>
<tr>
<td>13</td>
<td>Digital Mode</td>
<td>RS-232 or RS-485 configuration, Low = RS-485, Open circuit = RS-232</td>
</tr>
<tr>
<td>14</td>
<td>RS-232 TxD/RS-485 (-)</td>
<td>Transmit data (output) wrt pin 1 or RS-485 inverting</td>
</tr>
<tr>
<td>15</td>
<td>RS-232 RxD/RS-485 (+)</td>
<td>Receive data (input) wrt pin 1 or RS-485 non inverting</td>
</tr>
</tbody>
</table>

Digital Control – Connect pin 5 to pin 10
Analog Control – Connect pin 5 to pin 6
Spellman’s new MPS20W series are a family of high voltage 20 Watt modules that provide output voltages ranging from 1kV to 20kV. The MPS20W series are high performance products designed with Spellman’s hybrid topology of linear and switch mode power conversion techniques delivering lower noise with higher efficiency. The MPS20W series produces excellent ripple and stability performance specifications from a compact footprint. Additionally the MPS20W series features, as standard, a differential amplifier input for the voltage programming signal to improve immunity from external system noise and addressing any offset issues. Alternatively the output voltage may be pre-set by an internal potentiometer. A fully featured remote user interface is provided via 15-pin D-type connector as standard. The output voltage is arc and short circuit protected and the power input has a current limiter fitted.

Spellman’s proprietary HV technology coupled with SMT circuitry results in an ultra compact and lightweight module that is available as either a positive or negative supply that is ideal for OEM applications.

**TYPICAL APPLICATIONS**
- Photomultiplier Tubes
- Microchannel Plate Detectors
- Scintillators
- Mass Spectrometry
- Electron and Ion Beams
- Electrostatic Lenses
- Nuclear Instruments
- Electrostatic Printing

**OPTIONS**
- VCC Variable Current Control

**SPECIFICATIONS**

**Input Voltage:**
+24 Vdc, ±2Vdc

**Input Current:**
≤1.5 amps

**Output Voltage:**
7 models available from 1kV to 20kV

**Output Polarity:**
Positive or negative, specify at time of order

**Power:**
≤20 watts

**Voltage Regulation:**
- Line: ≤0.001% of rated output voltage over specified input voltage
- Load: ≤0.001% of rated output voltage for full load change

**Current Regulation (Vcc Option):**
- Line: ≤0.01% for 1V input voltage change under any load conditions
- Load: ≤0.001% for 0 to full load

**Ripple:**
See “model selection” table

**Stability:**
≤0.01% per hour, 0.02% per 8 hours after 1.0 hour warm up period.

**Temperature Coefficient:**
≤25ppm per degree C

**Environmental:**
- Temperature Range:
  - Operating: 0˚C to 50˚C
  - Storage: -35˚C to 85˚C
- Humidity:
  - 20% to 85% RH, non-condensing

**Cooling:**
Convection cooled

**Dimensions:**
1-10kV: 1.31” H x 3.74” W x 5.91” D (33.5mm x 95mm x 150mm)
15-20kV: 1.31” H x 3.74” W x 7.28” D (33.5mm x 95mm x 185mm)

**Weight:**
- 1-2kV: 15.17 oz. (430g)
- 3-10kV: 25.76 oz. (730g)
- 15-20kV: 35.30 oz. (1000g)

**Interface Connector:**
15 pin male D connector

**Output Connector:**
A captive 39.4” (1 meter) long shielded HV cable is provided

**Regulatory Approvals:**
**MPS20W SELECTION TABLE**

<table>
<thead>
<tr>
<th>Model</th>
<th>Output Voltage</th>
<th>Output Current</th>
<th>Ripple (Vpp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPS1*20/24</td>
<td>0-1kV</td>
<td>20mA</td>
<td>&lt;25mV</td>
</tr>
<tr>
<td>MPS2*20/24</td>
<td>0-2kV</td>
<td>10mA</td>
<td>&lt;50mV</td>
</tr>
<tr>
<td>MPS3*20/24</td>
<td>0-3kV</td>
<td>6.67mA</td>
<td>&lt;75mV</td>
</tr>
<tr>
<td>MPS5*20/24</td>
<td>0-5kV</td>
<td>4mA</td>
<td>&lt;125mV</td>
</tr>
<tr>
<td>MPS10*20/24</td>
<td>0-10kV</td>
<td>2mA</td>
<td>&lt;250mV</td>
</tr>
<tr>
<td>MPS15*20/24</td>
<td>0-15kV</td>
<td>1.33mA</td>
<td>&lt;375mV</td>
</tr>
<tr>
<td>MPS20*20/24</td>
<td>0-20kV</td>
<td>1mA</td>
<td>&lt;500mV</td>
</tr>
</tbody>
</table>

*Specify “P” for positive polarity or “N” for negative polarity. Custom units available.

**MPS20W ANALOG INTERFACE—15 PIN D CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power/Signal Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>2</td>
<td>+24Vdc Input</td>
<td>+24Vdc @ 1.5 amp maximum</td>
</tr>
<tr>
<td>3</td>
<td>Voltage Monitor Output</td>
<td>0 to 10Vdc=0 to 100% Rated Output, Zout =2.2kΩ</td>
</tr>
<tr>
<td>4</td>
<td>Local Programming Potentiometer Wiper Output</td>
<td>Potentiometer connected to +10Vdc and Ground, 0 to 10Vdc adjustable wiper output provided</td>
</tr>
<tr>
<td>5</td>
<td>Voltage Program Input</td>
<td>0 to 10Vdc=0 to 100% Rated Output, Zin=10MΩ</td>
</tr>
<tr>
<td>6</td>
<td>Voltage Program Differential Amplifier Output</td>
<td>0 to 10Vdc=0 to 100% Rated Output, Zout =2.2kΩ</td>
</tr>
<tr>
<td>7</td>
<td>Voltage Program Differential Amplifier Input—Positive</td>
<td>0 to 10Vdc differential between pin 7 and pin 9 = 0 to 100% of rated output, diode clamped to ground, Zin =38kΩ</td>
</tr>
<tr>
<td>8</td>
<td>Current Monitor Output</td>
<td>0 to 10Vdc = 0 to 100% Rated Output, Zout =2.2kΩ</td>
</tr>
<tr>
<td>9</td>
<td>Voltage Program Differential Amplifier Input—Negative</td>
<td>0 to 10Vdc differential between pin 7 and pin 9 = 0 to 100% of Rated Output, diode clamped to ground, Zin =38kΩ</td>
</tr>
<tr>
<td>10</td>
<td>No Connection</td>
<td>No Connection</td>
</tr>
<tr>
<td>11</td>
<td>Current Program Input</td>
<td>Standard: Internally connected to provide 110% fixed current limit VCC Option: 0 to 10Vdc=0 to 100% Rated Output, Zin=1MΩ</td>
</tr>
<tr>
<td>12</td>
<td>Enable Input</td>
<td>Low = Enable, TTL, CMOS, Open Collector Compliant</td>
</tr>
<tr>
<td>13</td>
<td>Internal Connection</td>
<td>No Connection</td>
</tr>
<tr>
<td>14</td>
<td>No Connection</td>
<td>No Connection</td>
</tr>
<tr>
<td>15</td>
<td>Analog Signal Ground</td>
<td>Analog Signal Ground</td>
</tr>
</tbody>
</table>

**DIMENSIONS: in.[mm]**

1-10kV Unit

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.74</td>
<td>[95]</td>
</tr>
<tr>
<td>1.32</td>
<td>[33.5]</td>
</tr>
<tr>
<td>0.47</td>
<td>[12]</td>
</tr>
<tr>
<td>1.81</td>
<td>[46]</td>
</tr>
<tr>
<td>2.71</td>
<td>[69]</td>
</tr>
<tr>
<td>3.74</td>
<td>[95]</td>
</tr>
<tr>
<td>0.31</td>
<td>[8]</td>
</tr>
<tr>
<td>1.89</td>
<td>[48]</td>
</tr>
<tr>
<td>0.47</td>
<td>[12]</td>
</tr>
<tr>
<td>1.32</td>
<td>[33.5]</td>
</tr>
<tr>
<td>1.73</td>
<td>[44.0]</td>
</tr>
<tr>
<td>2.52</td>
<td>[64.0]</td>
</tr>
</tbody>
</table>

15-20kV Unit

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.74</td>
<td>[95]</td>
</tr>
<tr>
<td>1.32</td>
<td>[33.5]</td>
</tr>
<tr>
<td>0.47</td>
<td>[12]</td>
</tr>
<tr>
<td>1.81</td>
<td>[46]</td>
</tr>
<tr>
<td>2.71</td>
<td>[69]</td>
</tr>
<tr>
<td>3.74</td>
<td>[95]</td>
</tr>
<tr>
<td>0.31</td>
<td>[8]</td>
</tr>
<tr>
<td>1.89</td>
<td>[48]</td>
</tr>
<tr>
<td>0.47</td>
<td>[12]</td>
</tr>
<tr>
<td>1.32</td>
<td>[33.5]</td>
</tr>
<tr>
<td>1.73</td>
<td>[44.0]</td>
</tr>
<tr>
<td>2.52</td>
<td>[64.0]</td>
</tr>
<tr>
<td>7.28</td>
<td>[185]</td>
</tr>
</tbody>
</table>
The EPM series of high voltage power supplies provides very well regulated, low ripple high voltage in a highly efficient, compact design.

The output voltage and current are controllable over the full range of operation. Voltage and current programming and monitoring signals are all 0-10Vdc where corresponds to 0 to 100% rated output. A High Voltage Inhibit/Enable signal allows for simple on/off control of the power supply.

**TYPICAL APPLICATIONS**

- Electrophoresis
- Photomultipliers
- Electron Beam Laboratory Applications
- Ion Source
- Electrospinning

**SPECIFICATIONS**

**Input:**

+24Vdc ±10% @ 2A

**Output:**

8 models from 1kV to 30kV. Each model is available in positive or negative polarity output.

- Compact Package
- Voltage and Current Programming from Zero to Rated Output
- Test Points for Output Current and Voltage
- Control of Output Via Enable/Inhibit Signal
- OEM Customization Available

www.spellmanhv.com/manuals/EPM

**Voltage Regulation:**

- Load: 0.02% of output voltage for a full load change.
- Line: 0.01% for ±10% change in input voltage.

**Current Regulation:**

- Load: 0.01% of output current from 0 to rated voltage.
- Line: 0.01% of rated current over specified input range.

**Ripple:**

0.1% p-p of maximum rated output voltage.

**Dimensions:**

2.06"H x 5.63"W x 5.69"D
(52.32mm x 143mm x 144.53mm)

**Weight:**

2.2 pounds (1kg)

**Input Connector:**

9 pin AMP Metri-Mate. Mating connector and pins supplied.

**Output Cable:**

18" ±1" (457mm) of UL® listed high voltage wire.

**Voltage Stability:**

0.02% per 8 hours (after 1/2 hour warm-up).

**Voltage Temperature Coefficient:**

0.01% per °C.

**Voltage Test Point:**

10Vdc ±2% = maximum rated output.

**Current Test Point:**

10Vdc ±2% = maximum rated output.

**Remote Enable:**

3.4Vdc = HV ON.
1.0Vdc or open = HV OFF.

**Regulatory Approvals:**

Compliant to EEC EMC Directive (1kV to 15kV only).
Compliant to EEC Low Voltage Directive (1kV to 15kV only).
UL/CUL recognized, File E148969 (1kV to 15kV only).
**EPM SELECTION TABLE**

<table>
<thead>
<tr>
<th>Maximum Rating</th>
<th>Model Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>kV</td>
<td>mA</td>
</tr>
<tr>
<td>1</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td>20</td>
<td>1.5</td>
</tr>
<tr>
<td>25</td>
<td>1.2</td>
</tr>
<tr>
<td>30</td>
<td>1</td>
</tr>
</tbody>
</table>

*Specify “P” for positive polarity or “N” for negative polarity.

**INPUT— 9 PIN AMP CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Ground</td>
<td>Power Ground</td>
</tr>
<tr>
<td>2</td>
<td>+24Vdc</td>
<td>+24Vdc @ 1.85 amps, maximum</td>
</tr>
<tr>
<td>3</td>
<td>High Voltage Enable/Inhibit</td>
<td>0Vdc = HV OFF, +5Vdc = HV ON (see manual for details)</td>
</tr>
<tr>
<td>4</td>
<td>Voltage Test Point</td>
<td>0 to 10Vdc = 0 to 100% rated output, Zout = 10kΩ</td>
</tr>
<tr>
<td>5</td>
<td>Current Test Point</td>
<td>0 to 10Vdc = 0 to 100% rated output, Zout = 10kΩ</td>
</tr>
<tr>
<td>6</td>
<td>Voltage Programming</td>
<td>0 to 10Vdc = 0 to 100% rated output, Zin = 10MΩ</td>
</tr>
<tr>
<td>7</td>
<td>Current Programming</td>
<td>0 to 10Vdc = 0 to 100% rated output, Zin = 10MΩ</td>
</tr>
<tr>
<td>8</td>
<td>+10Vdc Reference</td>
<td>+10Vdc @ 1mA maximum</td>
</tr>
<tr>
<td>9</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
</tbody>
</table>

**DIMENSIONS: in.[mm]**

- **SIDE VIEW**
  - 3.750 [95.25] TYP
- **TOP VIEW**
  - 5.69 [144.53]
  - 0.91 [23.11]
- **FRONT VIEW**
  - 0.94 [23.88]
  - 6-32 UNC-2A TYP
  - 3.750 [95.25] TYP
  - 0.33 [8.38] TYP
  - AMP CONNECTOR 207439-1 WITH MALE PIN 66591-1
The V6 Series is a family of regulated, fixed output polarity modular high voltage power supplies which provide exceptional performance and value in many applications. The V6 Series units are fully enclosed and designed for system or bench top operation. A wide range of output voltages, up to 30kV is available.

The output voltage is controlled locally by an internal multi-turn potentiometer. Remote analog voltage or resistance programming capability is included in all models. Analog monitor outputs are also included for remote monitoring of both the high voltage and current outputs.

**TYPICAL APPLICATIONS**
- Spectrometers
- CRT Testing
- Detectors
- E Beam Systems
- General Laboratory Usage

**OPTIONS**
- RS  RS-232 Interface (analog control not included)

**SPECIFICATIONS**

**Input Voltage:**
- AC Model: 100-240Vac, ±10%; 50/60 Hertz; 1 amp
- DC Model: 24Vdc ±10%, 2 amps

**Voltage Regulation:**
- Line: ±0.005% of maximum 90-240Vac input line change
- ±0.005% of maximum ±10%Vdc input line change
- Load: ±0.01% of maximum for 0 to maximum rated output current change

**Current Regulation:**
- Line: ±0.05% of maximum current for 90-240Vac input line change
- 0.05% of maximum current for ±10% Vdc input change
- Load: 0.2% of maximum current for 0 to maximum rated output voltage change

**Ripple:**
- See “model selection” table

**Temperature Coefficient:**
≤50ppm/°C

**Stability:**
≤0.01%/hour, 0.02% per 8 hours after a 1/2 hour warm up

**Operating Temperature:**
0°C to +50°C

**Storage Temperature:**
-40°C to +85°C

**Humidity:**
20% to 85%RH, non-condensing

**Local Control:**
- Internal multi-turn potentiometer for 0 to maximum output voltage (±0.2%)

**Remote Programming:**
- 0 to +5Vdc analog input signal proportional to 0 to maximum rated output. Accuracy is ±(0.1% of setting +0.1% of maximum). The programming input impedance is 20 megohms.

**Voltage Monitor:**
- 0 to +5V proportional to 0 to maximum output voltage. Accuracy is ±(0.1% of reading +0.1% of maximum). The monitor impedance is 10 kilohms.

**Current Monitor:**
- 0 to +5V proportional to 0 to maximum output current. Accuracy is ±(2.0% of reading +1.0% of maximum). The monitor impedance is 10 kilohms.

**Enable:**
- Remote interlock enables (low) disables internally (high) the high voltage output. Signal is normally high and supply will default to a disabled condition.

**Current Limit:**
- All units provide short circuit current limiting to less than 110% of the maximum rated output current. Supply is self restoring upon removal of cause limit condition.

**Arc/Short Circuit:**
- Short circuit and arc protected; self restoring.

**Cooling:**
- Convection cooled
## V6A MODEL SELECTION TABLE

<table>
<thead>
<tr>
<th>V6A AC Series</th>
<th>Voltage</th>
<th>Current</th>
<th>Ripple</th>
</tr>
</thead>
<tbody>
<tr>
<td>V6A1*30</td>
<td>0 to 1kV</td>
<td>0 to 30mA</td>
<td>75mV</td>
</tr>
<tr>
<td>V6A1.5*30</td>
<td>0 to 1.5kV</td>
<td>0 to 20mA</td>
<td>75mV</td>
</tr>
<tr>
<td>V6A2*30</td>
<td>0 to 3kV</td>
<td>0 to 10mA</td>
<td>120mV</td>
</tr>
<tr>
<td>V6A5*30</td>
<td>0 to 5kV</td>
<td>0 to 6mA</td>
<td>150mV</td>
</tr>
<tr>
<td>V6A10*30</td>
<td>0 to 10kV</td>
<td>0 to 3mA</td>
<td>400mV</td>
</tr>
<tr>
<td>V6A15*30</td>
<td>0 to 15kV</td>
<td>0 to 2mA</td>
<td>900mV</td>
</tr>
<tr>
<td>V6A20*30</td>
<td>0 to 20kV</td>
<td>0 to 1.5mA</td>
<td>1.0V</td>
</tr>
<tr>
<td>V6A30*30</td>
<td>0 to 30kV</td>
<td>0 to 1mA</td>
<td>1.8V</td>
</tr>
</tbody>
</table>

*Specify “P” for positive polarity or “N” for negative polarity.

## Dimensions:

- **AC Model:** 3.05” W X 5.1” H X 7.06” D  
  (77mm X 132mm X 179mm)
- **DC Model:** 2.32” W X 5.1” H X 7.06” D  
  (59mm X 132mm X 179mm)

## Weight:

- **AC Model:** 4.5 pounds (2.0kg)
- **DC Model:** 3.75 pounds (1.7kg)

## Regulatory Approvals:

- Compliant to EEC EMC Directive.
- Compliant to EEC Low Voltage Directive.
- UL/CUL recognized, File E227588.
- RoHS Compliant.

## V6A ANALOG/DIGITAL INTERFACE—J1 15 PIN FEMALE D CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Local Voltage Program</td>
<td>Multi-turn front panel potentiometer</td>
</tr>
<tr>
<td>2</td>
<td>TX Out (optional)</td>
<td>RS232 Receive Data</td>
</tr>
<tr>
<td>3</td>
<td>RX In (optional)</td>
<td>RS232 Transmit Data</td>
</tr>
<tr>
<td>4</td>
<td>Voltage Program Input</td>
<td>0 to 5V=0 to 100% Rated Output, Zin=20MΩ</td>
</tr>
<tr>
<td>5</td>
<td>Signal Ground</td>
<td>RS232 Ground (optional)</td>
</tr>
<tr>
<td>6</td>
<td>Signal Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>7</td>
<td>+5V Reference Out</td>
<td>+5V @ 1mA Max</td>
</tr>
<tr>
<td>8</td>
<td>HV Enable Input</td>
<td>Active Low to Enable the HV</td>
</tr>
<tr>
<td>9</td>
<td>Current Program Input</td>
<td>0 to 5V=0 to 100% Rated Output, Zin=20MΩ</td>
</tr>
<tr>
<td>10</td>
<td>Current Monitor</td>
<td>0 to 5V=0 to 100% Rated Output, Zout=10kΩ</td>
</tr>
<tr>
<td>11</td>
<td>Voltage Monitor</td>
<td>0 to 5V=0 to 100% Rated Output, Zout=10kΩ</td>
</tr>
<tr>
<td>12</td>
<td>HV Enable Output</td>
<td>Active Low HV is Enabled</td>
</tr>
<tr>
<td>13</td>
<td>Signal Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>14</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>15</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

## V6D MODEL SELECTION TABLE

<table>
<thead>
<tr>
<th>V6D DC Series</th>
<th>Voltage</th>
<th>Current</th>
<th>Ripple</th>
</tr>
</thead>
<tbody>
<tr>
<td>V6D1*30</td>
<td>0 to 1kV</td>
<td>0 to 30mA</td>
<td>75mV</td>
</tr>
<tr>
<td>V6D1.5*30</td>
<td>0 to 1.5kV</td>
<td>0 to 20mA</td>
<td>75mV</td>
</tr>
<tr>
<td>V6D3*30</td>
<td>0 to 3kV</td>
<td>0 to 10mA</td>
<td>120mV</td>
</tr>
<tr>
<td>V6D5*30</td>
<td>0 to 5kV</td>
<td>0 to 6mA</td>
<td>150mV</td>
</tr>
<tr>
<td>V6D10*30</td>
<td>0 to 10kV</td>
<td>0 to 3mA</td>
<td>400mV</td>
</tr>
<tr>
<td>V6D15*30</td>
<td>0 to 15kV</td>
<td>0 to 2mA</td>
<td>900mV</td>
</tr>
<tr>
<td>V6D20*30</td>
<td>0 to 20kV</td>
<td>0 to 1.5mA</td>
<td>1.0V</td>
</tr>
<tr>
<td>V6D30*30</td>
<td>0 to 30kV</td>
<td>0 to 1mA</td>
<td>1.8V</td>
</tr>
</tbody>
</table>

*Specify “P” for positive polarity or “N” for negative polarity.

## V6D ANALOG/DIGITAL INTERFACE—J1 15 PIN FEMALE D CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Local Voltage Program</td>
<td>Multi-turn front panel potentiometer</td>
</tr>
<tr>
<td>2</td>
<td>TX Out (optional)</td>
<td>RS232 Receive Data</td>
</tr>
<tr>
<td>3</td>
<td>RX In (optional)</td>
<td>RS232 Transmit Data</td>
</tr>
<tr>
<td>4</td>
<td>Voltage Program Input</td>
<td>0 to 5V=0 to 100% Rated Output, Zin=20MΩ</td>
</tr>
<tr>
<td>5</td>
<td>Signal Ground</td>
<td>RS232 Ground (optional)</td>
</tr>
<tr>
<td>6</td>
<td>Signal Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>7</td>
<td>+5V Reference Out</td>
<td>+5V @ 1mA Max</td>
</tr>
<tr>
<td>8</td>
<td>HV Enable Input</td>
<td>Active Low to Enable the HV</td>
</tr>
<tr>
<td>9</td>
<td>Current Program Input</td>
<td>0 to 5V=0 to 100% Rated Output, Zin=20MΩ</td>
</tr>
<tr>
<td>10</td>
<td>Current Monitor</td>
<td>0 to 5V=0 to 100% Rated Output, Zout=10kΩ</td>
</tr>
<tr>
<td>11</td>
<td>Voltage Monitor</td>
<td>0 to 5V=0 to 100% Rated Output, Zout=10kΩ</td>
</tr>
<tr>
<td>12</td>
<td>HV Enable Output</td>
<td>Active Low HV is Enabled</td>
</tr>
<tr>
<td>13</td>
<td>Signal Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>14</td>
<td>+24V Return</td>
<td>Input Voltage Return</td>
</tr>
<tr>
<td>15</td>
<td>+24Vdc Input</td>
<td>Input Voltage 24V±10%, 2A</td>
</tr>
</tbody>
</table>

## ORDERING EXAMPLE

**V6 A 15 P 30 RS**

- **Model**
- **AC Input**
- **Voltage**
- **Polarity**
- **Power**
- **RS232 Option**

---

Output Connector:
Models up to and including 5kV use a Spellman P/N JAC high voltage connector. The required mating connector is a Spellman P/N 105808-384, which is provided. The 10kV through 30kV units use a Spellman P/N JGP high voltage connector (Alden 8101). All 10 through 30kV units are provided with mating connectors assembled to 2.0 meters of high voltage cable.

---

**Dimensions:**

- **AC Model:** 3.05” W X 5.1” H X 7.06” D  
  (77mm X 132mm X 179mm)
- **DC Model:** 2.32” W X 5.1” H X 7.06” D  
  (59mm X 132mm X 179mm)

---

**Weight:**

- **AC Model:** 4.5 pounds (2.0kg)
- **DC Model:** 3.75 pounds (1.7kg)

---

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Spellman’s SMS Series of 60 watt high voltage power supplies are based on a proprietary resonant fly back power conversion topology that provides over 80% efficiency. These fixed polarity modules (specify positive or negative at time of order) feature both voltage and current regulation with automatic crossover, making them ideal for sensitive load applications. The robust design of SMS Series along with comprehensive arc and short circuit protection allow operation in the most demanding environments.

**TYPICAL APPLICATIONS**
- Electrospinning
- Hipot Testing
- Detector Arrays
- Electrophoresis
- Cable Testing

**Output Voltages from 1kV to 60kV**
- **Arc and Short Circuit Protected**
- **Low Stored Energy**
- **Test Points for Output Current and Voltage**
- **Enable/Inhibit Control of Output**
- **OEM Customization Available**

**SPECIFICATIONS**

**Input:**
+24Vdc ±10% @ 4.0A

**Output:**
10 models from 1kV to 60kV. Positive or negative polarity outputs.

**Efficiency:**
80 to 85%, typical

**Voltage Regulation:**
- Load: 0.01% of output voltage no load to full load.
- Line: ±0.01% for ±10% change in input voltage.

**Current Regulation:**
- Load: 0.1% of output current from 0 to rated voltage.
- Line: 0.05% of rated current over specified input range.

**Stability:**
0.02% per 8 hours.

**Temperature Coefficient:**
0.01% per °C, voltage or current regulated.

**Ripple:**
0.1% p-p of maximum output voltage.

**Environmental:**
- **Temperature Range:**
  - Operating: 0˚C to 40˚C
  - Storage: -40˚C to 85˚C
- **Humidity:**
  - 0 to 90%, non-condensing
- **Dimensions:**
  - 3¼ H x 5¼ W x 9¼ D (7.6cm x 12.7cm x 23.0cm).
- **Weight:**
  - 5.25 pounds (2.38kg)
- **Input Connector:**
  - 12 pin AMP Metri-Mate (mating connector and pins provided)
- **Output Cable:**
  - 18’ ±1” (45.7cm) of UL® approved high voltage wire
- **Front Panel Ground Connection:**
  - Threaded 8-32 ground stud, nut provided

**Regulatory Approvals:**
**SMS SELECTION TABLE**

<table>
<thead>
<tr>
<th>Maximum Rating</th>
<th>Model Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>kV</td>
<td>mA</td>
</tr>
<tr>
<td>1</td>
<td>60</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>15</td>
<td>4</td>
</tr>
<tr>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td>30</td>
<td>2</td>
</tr>
<tr>
<td>40</td>
<td>1.5</td>
</tr>
<tr>
<td>50</td>
<td>1.2</td>
</tr>
<tr>
<td>60</td>
<td>1.0</td>
</tr>
</tbody>
</table>

*Specify “P” for positive polarity or “N” for negative polarity.

**CONNECTOR 12 PIN**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Ground</td>
<td>+24Vdc Return</td>
</tr>
<tr>
<td>2</td>
<td>+24Vdc Input</td>
<td>+24Vdc @ 3.5 amps, maximum</td>
</tr>
<tr>
<td>3</td>
<td>High Voltage Enable/Inhibit</td>
<td>Open = HV OFF, Ground = HV ON</td>
</tr>
<tr>
<td>4</td>
<td>Voltage Test Point</td>
<td>0 to 10Vdc = 0 to 100% of rated output</td>
</tr>
<tr>
<td>5</td>
<td>Current Test Point</td>
<td>0 to 10Vdc = 0 to 100% of rated output</td>
</tr>
<tr>
<td>6</td>
<td>Voltage Programming</td>
<td>0 to 10Vdc = 0 to 100% of rated output</td>
</tr>
<tr>
<td>7</td>
<td>Current Programming</td>
<td>0 to 10Vdc = 0 to 100% of rated output</td>
</tr>
<tr>
<td>8</td>
<td>+10Vdc Reference</td>
<td>+10Vdc @ 1mA maximum</td>
</tr>
<tr>
<td>9</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>10</td>
<td>Spare</td>
<td>No Connection</td>
</tr>
<tr>
<td>11</td>
<td>Spare</td>
<td>No Connection</td>
</tr>
<tr>
<td>12</td>
<td>Spare</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

---

**DIMENSIONS: in.[mm]**

**SIDE VIEW**

**TOP VIEW**

**BACK VIEW**
Form, Fit and Function Usability:
Spellman’s UMW Series of high voltage modules provides users with a form, fit and function replacement for presently available commercially made units, while providing superior features and benefits at competitive pricing. Utilizing proprietary power conversion technology, unique high voltage packaging, and Spellman’s unmatched encapsulation techniques, these SMT based high voltage modules provide improved performance and easier system integration at a lower cost when compared to the competition.

Advanced Power Conversion Topology:
UMW converters use a proprietary resonant power conversion topology providing exceptional efficiency and inherent low noise and ripple outputs. Radiated emissions are dramatically reduced compared to conventional switching topologies, effectively minimizing or even eliminating the need to shield the unit from adjacent circuitry.

The high voltage output is generated through the use of a ferrite core high voltage step up transformer which feeds the high voltage output circuitry. Units utilize an appropriate arrangement of low capacitance Cockcroft-Walton voltage multiplier stages to obtain the specified high voltage output.

Due to the fixed, high frequency conversion rate of the converter, the output capacitance is small resulting in minimal stored energy and fast rise times. Through the use of generously rated surge limiting resistors and a fast acting current loop, all units are fully arc and short circuit protected.

Control and Regulation:
The actual output voltage generated is sampled via a high impedance divider to create a voltage feedback signal. A current feedback signal is created via a current sense resistor being placed in the low end return of the high voltage output circuitry. These two accurate ground referenced feedback signals are used to precisely regulate and control the units output. These accurate and calibrated signals are also used for external monitoring purposes.

Due to the UMW’s unique converter topology it can provide full current into low impedance loads or even a short circuit. Standard units limit at 103% of maximum rated output current.

Standard User Interface:
The Spellman UMW Series offers a standard customer interface that provides current programming capability and positive polarity, buffered, low output impedance voltage and current monitor signals (0 to +4.64Vdc equals 0 to full scale rated). A voltage programming input is provided where 0 to +4.64Vdc equals 0 to 100% of rated voltage.

Current programmability allows the user to set where the unit will current limit, anywhere from 0 to 100% of maximum rated current. This feature is beneficial where less than full output current is desired, like in the case of protecting a sensitive load.

The buffered low impedance voltage and current monitor signals can drive external circuitry directly, while minimizing loading and pickup effects. These feature save the user the expense and implementation of external interface buffering circuitry while improving overall signal integrity.

Mechanical and Environmental Considerations:
The UMW Series are modular sheet metal enclosed converters measuring 8.00” X 4.50” X 1.075” (203mm X 114mm X 27mm). All units are encapsulated using a propriety silicon based potting material which is considerably lighter in weight than epoxy encapsulation techniques. Physical mounting of the unit is accomplished via the use of bottom mounted studs or threaded blind inserts, dependent upon model ordered.
SPECIFICATIONS

Input Voltage: 24Vdc

Normal Voltage Range: 23Vdc to 30Vdc

Derated Voltage Range: 11Vdc to 30Vdc

Input Current: (typical)
- Disabled: <40mA
- No load: <600mA
- Full load:
  - 60 watt units: 3 amps
  - 125 watt units: 6.2 amps

Voltage Regulation:
- Line: <0.01%
- Load: <0.01%

Current Regulation:
- Line: <0.01%
- Load: <0.01%

Stability:
- 0.01% per 8 hours, 0.02% per day after 30 min. warmup

Accuracy:
- 2% on all programming and monitoring, except I Sense 10%

Temperature Coefficient: (typical)
- 100ppm/°C

Overshoot:
- <0.1% Vp

Environmental:
- Temperature Range:
  - Operating: 0°C to 65°C case temperature
  - Storage: -55°C to 85°C, non operational
- Humidity:
  - 10% to 90%, non-condensing

Dimensions:
- 8.00” L X 4.50” W X 1.075” H
- (203mm X 114mm X 27mm)

Weight:
- 1.75 lbs. (0.79kg)

Regulatory Approvals:

---

UMW 60W SELECTION TABLE

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Output Voltage</th>
<th>Output Current</th>
<th>Ripple(max) %Vp-p</th>
<th>Output Capacitance</th>
<th>Arc Limiting Resistance</th>
<th>I Sense Scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>UMW8*60</td>
<td>0 to 8kV</td>
<td>7.5mA</td>
<td>&lt;1.0 (C load ≥0.05μF)</td>
<td>3553pF</td>
<td>14.1kΩ</td>
<td>1.6V</td>
</tr>
<tr>
<td>UMW10*60</td>
<td>0 to 10kV</td>
<td>6mA</td>
<td>&lt;1.0 (C load ≥0.05μF)</td>
<td>3553pF</td>
<td>14.1kΩ</td>
<td>1.47V</td>
</tr>
<tr>
<td>UMW12*60</td>
<td>0 to 12kV</td>
<td>5mA</td>
<td>&lt;1.0 (C load ≥0.05μF)</td>
<td>2870pF</td>
<td>30kΩ</td>
<td>1.24V</td>
</tr>
<tr>
<td>UMW15*60</td>
<td>0 to 15kV</td>
<td>4mA</td>
<td>&lt;1.0 (C load ≥0.05μF)</td>
<td>2460pF</td>
<td>30kΩ</td>
<td>1.0V</td>
</tr>
<tr>
<td>UMW20*60</td>
<td>0 to 20kV</td>
<td>3mA</td>
<td>&lt;1.0 (C load ≥0.01μF)</td>
<td>2460pF</td>
<td>45kΩ</td>
<td>4.61V</td>
</tr>
</tbody>
</table>

UMW 125W SELECTION TABLE

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Output Voltage</th>
<th>Output Current</th>
<th>Ripple(max) %Vp-p</th>
<th>Output Capacitance</th>
<th>Arc Limiting Resistance</th>
<th>I Sense Scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>UMW8*125</td>
<td>0 to 8kV</td>
<td>15.5mA</td>
<td>&lt;1.0 (C load ≥0.05μF)</td>
<td>7106pF</td>
<td>3kΩ</td>
<td>1.1V</td>
</tr>
<tr>
<td>UMW10*125</td>
<td>0 to 10kV</td>
<td>12.5mA</td>
<td>&lt;1.0 (C load ≥0.05μF)</td>
<td>7106pF</td>
<td>3kΩ</td>
<td>1.15V</td>
</tr>
<tr>
<td>UMW12*125</td>
<td>0 to 12kV</td>
<td>10.5mA</td>
<td>&lt;1.0 (C load ≥0.05μF)</td>
<td>5740pF</td>
<td>6.6kΩ</td>
<td>1.40V</td>
</tr>
<tr>
<td>UMW15*125</td>
<td>0 to 15kV</td>
<td>8.3mA</td>
<td>&lt;1.0 (C load ≥0.05μF)</td>
<td>4920pF</td>
<td>6.6kΩ</td>
<td>1.1V</td>
</tr>
<tr>
<td>UMW20*125</td>
<td>0 to 20kV</td>
<td>6.25mA</td>
<td>&lt;1.0 (C load ≥0.01μF)</td>
<td>4920pF</td>
<td>14.1kΩ</td>
<td>9.57V</td>
</tr>
</tbody>
</table>

Ordering Information

Voltage:
- 0 to 8kV: 8
- 0 to 10kV: 10
- 0 to 12kV: 12
- 0 to 15kV: 15
- 0 to 20kV: 20

Polarity:
- Positive: P
- Negative: N

Power:
- 60Watts: 60
- 125Watts: 125

Legacy Interface:
- Legacy Interface: L

Ordering Example

UMW15P125/L

Model  Voltage  Polarity  Power  Option

If a high voltage mating connector is required it should be included at time of order. See page 3 for details.
I Sense Signal
The polarity of the current monitor signal is opposite of the polarity of the output voltage of the unit that generated it. So a positive output polarity unit creates a negative polarity current monitoring signal; while a negative output polarity unit creates a positive polarity current monitoring signal. This signal is clamped to ground internally via a bidirectional 18 volt transient protection device and the signal is made available via a series connected 47kΩ isolation resistor. Internal HV dividers create a small, linear offset voltage on this current monitor signal that can be compensated for.

Interface Connections
Fourteen (14) gold plated 0.025˝ (0.63mm) square pins that will mate with AMP Mod-U connectors. See mechanical drawing for location and spacing details.

Programing and Monitor Signals
Voltage and current programming is done via positive polarity, high input impedance, 0 to 4.64Vdc signals. Voltage and current monitors are positive polarity, buffered low output impedance 0 to 4.64Vdc signals.

Signature Resistor
A unique identifying signature resistor for each type of unit is connected from Pin 10 to Ground. Details if desired are available upon request.

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Ground Return</td>
<td>+24Vdc power ground return</td>
</tr>
<tr>
<td>2</td>
<td>+ Power Input</td>
<td>+24Vdc power input</td>
</tr>
<tr>
<td>3</td>
<td>I Sense</td>
<td>See I Sense text and tables for details</td>
</tr>
<tr>
<td>4</td>
<td>Enable Input</td>
<td>Low (&lt;0.7V, Isink@1mA)=HV OFF, High (open or &gt;2V)=HV ON</td>
</tr>
<tr>
<td>5</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>Remote V Adjust</td>
<td>0 to +4.64Vdc = 0 to 100%, Zin &gt;1MΩ</td>
</tr>
<tr>
<td>7</td>
<td>+5V Reference Output</td>
<td>+5Vdc ±2%, Zout = 475Ω</td>
</tr>
<tr>
<td>8</td>
<td>Power Ground Return</td>
<td>+24Vdc Power Ground Return</td>
</tr>
<tr>
<td>9</td>
<td>+ Power Input</td>
<td>+24Vdc Power Input</td>
</tr>
<tr>
<td>10</td>
<td>Signature Resistor</td>
<td>Unique identifying resistor connected to ground</td>
</tr>
<tr>
<td>11</td>
<td>Remote I Adjust</td>
<td>0 to +4.64Vdc = 0 to 100%, Zin &gt;1MΩ Leave open for preset current limit @103% of rated output current</td>
</tr>
<tr>
<td>12</td>
<td>I Monitor</td>
<td>0 to +5Vdc = 0 to 107.5%, Zout &lt;10kΩ</td>
</tr>
<tr>
<td>13</td>
<td>V Monitor</td>
<td>0 to +5Vdc = 0 to 107.5%, Zout &lt;10kΩ</td>
</tr>
<tr>
<td>14</td>
<td>E Out Monitor</td>
<td>1.00 volt/kV, 1GΩ/1.1MΩ divider with 10MΩ meter</td>
</tr>
</tbody>
</table>

Low Voltage Interface Connector
A mating AMP Mod-U interface connector will be provided.

High Voltage Output Mating Connector
An appropriate mating LGH high voltage connector (36˝ long) will be required. Please see table to left for specific part number.

High Voltage Return
Two gold plated 0.025˝ (0.63mm) square pins (15 and 16) are provided. These are connected to Power Ground Return.
Spellman’s AC input PCM Series of 120 watt high voltage power supply modules feature a power factor corrected front end, providing 0.99 power factor along with universal input voltage (85Vac to 265Vac) capabilities. These fixed polarity modules (specify positive or negative at time of order) feature both voltage and current regulation with automatic crossover, making them ideal for sensitive load applications. The robust design of PCM Series along with comprehensive arc and short circuit protection allow operation in the most demanding environments.

TYPICAL APPLICATIONS
- Electrospinning
- Hipot Testing
- Detector Arrays
- Electrophoresis
- Cable Testing

SPECIFICATIONS
Input:
85-265Vac, 47-63Hz @ 1.8A, power factor corrected.
UL® rated for 85-250Vac input for 1kV to 5kV models.

Power Factor (Typical):
FL: 0.99
NL: 0.98

Efficiency:
80 to 85%, typical

Output:
11 models from 1kV to 70kV. Positive or negative polarity outputs, specify at time of order.

Voltage Regulation:
Load: 0.01% of output voltage, no load to full load.
Line: ±0.01% for ±10% change in input voltage.

Current Regulation:
Load: 0.01% of output current from 0 to rated voltage.
Line: 0.01% of rated current over specified input range.

- Output Voltages from 1kV to 70kV
- Arc and Short Circuit Protected
- Low Stored Energy
- Test Point for Output Current and Voltage
- Enable/Inhibit Control of Output
- Safety Interlock Circuit
- OEM Customization Available

www.spellmanhv.com/manuals/PCM

Ripple:
0.1% p-p of maximum output voltage.

Voltage Stability:
0.02% per 8 hours.

Temperature Coefficient:
100ppm per °C, voltage or current regulated.

Environmental:
Operational: 0 to 40°C
Storage: -40°C to +85°C
Humidity: 0 to 90%, non-condensing

Dimensions:
1kV to 50kV: 3.65”H x 5”W x 9”D (9.27cm x 12.7cm x 22.9cm).
60, 70kV: 3.65”H x 5”W x 11”D (9.27cm x 12.7cm x 27.9cm).

Weight:
7 pounds (3.18kg)

AC Input Connectors:
IEC320 with mating cable.

Interface Connector:
15 pin D connector.

HV Output Cable:
Spellman Delrin type connector with 36” (91.4cm) shielded cable.

Front Panel Ground Connection:
Threaded 8-32 ground stud

Regulatory Approvals:
Compliant to EEC EMC Directive. Compliant to EEC Low Voltage Directive. UL/CUL recognized, File E148969 (up to 60kV only). RoHS Compliant.
**PCM SELECTION TABLE**

<table>
<thead>
<tr>
<th>Maximum Rating</th>
<th>Model Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>kV  mA</td>
<td></td>
</tr>
<tr>
<td>1  120</td>
<td>PCM 1*120</td>
</tr>
<tr>
<td>3  40</td>
<td>PCM 3*120</td>
</tr>
<tr>
<td>5  24</td>
<td>PCM 5*120</td>
</tr>
<tr>
<td>10 12</td>
<td>PCM 10*120</td>
</tr>
<tr>
<td>15 8</td>
<td>PCM 15*120</td>
</tr>
<tr>
<td>20 6</td>
<td>PCM 20*120</td>
</tr>
<tr>
<td>30 4</td>
<td>PCM 30*120</td>
</tr>
<tr>
<td>40 3</td>
<td>PCM 40*120</td>
</tr>
<tr>
<td>50 2.4</td>
<td>PCM 50*120</td>
</tr>
<tr>
<td>60 2.0</td>
<td>PCM 60*120</td>
</tr>
<tr>
<td>70 1.7</td>
<td>PCM 70*120</td>
</tr>
</tbody>
</table>

*Specify “P” for positive polarity or “N” for negative polarity.

**PCM D CONNECTOR 15 PIN**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Remote mA Program</td>
<td>0 to 10Vdc = 0 to 100% of rated output</td>
</tr>
<tr>
<td>2</td>
<td>Remote kV Program</td>
<td>0 to 10Vdc = 0 to 100% of rated output</td>
</tr>
<tr>
<td>3</td>
<td>High Voltage Enable/Inhibit</td>
<td>Open = HV Inhibit, Ground = HV ON</td>
</tr>
<tr>
<td>4</td>
<td>mA Monitor</td>
<td>0 to 10Vdc = 0 to 100% of rated output</td>
</tr>
<tr>
<td>5</td>
<td>Interlock Return</td>
<td>Connect to pin 6 to close interlock circuit</td>
</tr>
<tr>
<td>6</td>
<td>Interlock Out</td>
<td>Connect to pin 5 to close interlock circuit</td>
</tr>
<tr>
<td>7</td>
<td>kV Monitor</td>
<td>0 to 10Vdc = 0 to 100% of rated output</td>
</tr>
<tr>
<td>8</td>
<td>Local kV Program</td>
<td>Multi-turn front panel pot (screwdriver)</td>
</tr>
<tr>
<td>9</td>
<td>Power Supply Fault</td>
<td>0Vdc = No Fault, +15Vdc @ 1mA = Fault</td>
</tr>
<tr>
<td>10</td>
<td>+10Vdc Reference</td>
<td>+10Vdc @ 1mA maximum</td>
</tr>
<tr>
<td>11</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>12</td>
<td>Spare</td>
<td>No Connection</td>
</tr>
<tr>
<td>13</td>
<td>Spare</td>
<td>No Connection</td>
</tr>
<tr>
<td>14</td>
<td>Spare</td>
<td>No Connection</td>
</tr>
<tr>
<td>15</td>
<td>Local mA Program</td>
<td>Multi-turn front panel pot (screwdriver)</td>
</tr>
</tbody>
</table>
Spellman’s PTV Series of modular high voltage power supplies deliver up to 350W of continuous power. A quasi-resonant inverter design provides over 80% efficiency with very fast dynamic response. PTV power supplies incorporate extensive standard features in two power output ranges (200W and 350W) with a wide range of output voltages operating to the most exacting specifications.

### Typical Applications
- Projection Television
- X-ray Systems
- E-beam Systems
- Capacitor Charging systems
- CPT/CRT Testing

### Options
- **FG**: Floating Ground (50V max)
- **BPM/S**: Bipolar Master/Slave
- **NSS**: No Slow Start
- **TP(x)**: Alternate Test Point Scaling

### Specifications

#### Input:
- 200W: 115Vac ±10% @ 2.5A, 50/60Hz
- 350W: 115Vac ±10% @ 4.3A, 50/60Hz
- 200W: 220Vac ±10% @ 1.3A, 50/60Hz
- 350W: 220Vac ±10% @ 2.2A, 50/60Hz

Optional:
- 200W: 100Vac ±10% @ 2.8A, 50/60Hz
- 350W: 100Vac ±10% @ 4.9A, 50/60Hz

Specify at time of ordering.

#### Output:
- Models from 1kV to 70kV, 200W or 350W. Each model is available in positive or negative polarity outputs.

#### Voltage Regulation:
- Load: 0.01% of output voltage no load to full load.
- Line: ±0.01% for a ±10% change in input voltage.

#### Current Regulation:
- Load: 0.01% of output current from 0 to rated voltage.
- Line: 0.01% of rated current over specified input range.

#### Efficiency:
- 80%, typical.

#### Ripple:
- PTV200: 0.1% p-p of output voltage.
- PTV350: 0.2% p-p of output voltage.

#### Switching Frequency:
- 45-65kHz, nominal

#### Temperature:
- Operating: 0°C to +40°C.
- Storage: -40°C to +85°C.

#### Voltage Temperature Coefficient:
- 0.01%/°C

#### Stability (voltage & current):
- 0.01%/hr after 1/2 hour warm-up.
- 0.02% per 8 hours.

#### Cooling:
- 200W: Convection cooled.
- 350W: Fan cooled, rear air intake.

#### Dimensions:
- 1-40kV: 3.187˝ H x 10.75˝ W x 10˝ D
  (8.1cm x 27.3cm x 25.4cm).
- 50-70kV: 4.187˝ H x 10.875˝ W x 11.812˝ D
  (10.65cm x 27.6cm x 35.1cm).

#### HV Output:
- Flying lead 18˝ ±1˝ (45.7cm) UL listed.
- AMP LGHI connector available for 40kV only.

#### Power Input Connector:
- IEC320.

#### AC Line Voltage Input Cable:
- Length: 8’ (2.4m).

#### Regulatory Approvals:
- Compliant to EEC EMC Directive. Compliant to EEC Low Voltage Directive. UL/CUL recognized, File E148969 (up to 5kV only). RoHS compliant.
**PTV SELECTION TABLE**

<table>
<thead>
<tr>
<th>Voltage</th>
<th>mA</th>
<th>Model Number</th>
<th>Voltage</th>
<th>mA</th>
<th>Model Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>200</td>
<td>PTV1*200</td>
<td>3</td>
<td>350</td>
<td>PTV1*350</td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>PTV3*200</td>
<td>5</td>
<td>40</td>
<td>PTV5*200</td>
</tr>
<tr>
<td>5</td>
<td>40</td>
<td>PTV5*200</td>
<td>10</td>
<td>20</td>
<td>PTV10*200</td>
</tr>
<tr>
<td>15</td>
<td>14</td>
<td>PTV15*200</td>
<td>20</td>
<td>10</td>
<td>PTV20*200</td>
</tr>
<tr>
<td>25</td>
<td>8</td>
<td>PTV25*200</td>
<td>30</td>
<td>7</td>
<td>PTV30*200</td>
</tr>
<tr>
<td>40</td>
<td>5</td>
<td>PTV40*200</td>
<td>50</td>
<td>4</td>
<td>PTV50*200</td>
</tr>
<tr>
<td>60</td>
<td>3.3</td>
<td>PTV60*200</td>
<td>70</td>
<td>2.85</td>
<td>PTV70*200</td>
</tr>
</tbody>
</table>

*Specify “P” for positive polarity or “N” for negative polarity.

**INTERFACE CONNECTOR 9 PIN**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+10Vdc Reference</td>
<td>+10Vdc @ 1mA, maximum</td>
</tr>
<tr>
<td>2</td>
<td>Current Program</td>
<td>0 to 10Vdc = 0 to 100% rated output, Zin = 10MΩ</td>
</tr>
<tr>
<td>3</td>
<td>Voltage Monitor</td>
<td>0 to 10Vdc = 0 to 100% rated output, Zout = 10kΩ</td>
</tr>
<tr>
<td>4</td>
<td>Voltage Program</td>
<td>0 to 10Vdc = 0 to 100% rated output, Zin = 10MΩ</td>
</tr>
<tr>
<td>5</td>
<td>Common Ground</td>
<td>Power Ground</td>
</tr>
<tr>
<td>6</td>
<td>Current Monitor</td>
<td>0 to 10Vdc = 0 to 100% rated output, Zout = 10kΩ</td>
</tr>
<tr>
<td>7</td>
<td>Enable/Inhibit</td>
<td>Ground = Inhibit, Open = HV ON</td>
</tr>
<tr>
<td>8</td>
<td>OVP Indicator</td>
<td>Collector w/1kΩ pull up to +5Vdc, transistor on = OVP</td>
</tr>
<tr>
<td>9</td>
<td>Signal Return</td>
<td>Signal Return</td>
</tr>
</tbody>
</table>

**DIMENSIONS:**

- **TOP VIEW**
  - W* = 7.87" [200.2mm]
  - D* = 2.44" [62.0mm]
  - 0.75" [19.05mm] FAN

- **BACK VIEW**
  - IEC 320 TYPE AC CONNECTOR LINE FILTER/FUSE
  - 115VAC Input (200VAC Optional)

- **SIDE VIEW**
  - 6-32 INSERT
  - 16 PL
  - 0.50 [12.70] 4 PL
  - 0.50 [12.70] 2 PL

Spellman’s SLM Series of high voltage modules are designed for OEM applications up to 160kV at 1200 watts. Its universal input, small package size and choice of three standard digital interfaces simplifies integrating the SLM into your system design. Models are available in either positive or negative polarity. The SLM is fully arc and short protected. Excellent regulation specifications are provided along with outstanding stability performance.

**TYPICAL APPLICATIONS**
- Capacitor Charging
- Electrostatics
- HiPot Testing
- E Beam Systems
- CRT Testing
- CW Lasers

**FIRMWARE CONFIGURATIONS**

**STANDARD BASED FEATURES**
- AOL: Adjustable Overload Trip
- AT: Arc Trip
- NAD: No Arc Detect
- NSS: No Slow Start
- PSS: Programmable Slow Start
- RFR: Remote Fault Reset
- RMI: Remote Mode Indicators
- ROV: Remote Overvoltage Adjust

**SPECIFICATIONS**

**Input Voltage:**
- Power factor corrected input, $\geq 0.98$
- 100-240Vac, $\pm 10\%$ (90-264Vac):
  - 47-63Hz @ 4.0A for 300 watt units
- 200-240Vac, $\pm 10\%$ (180-264Vac):
  - 47-63Hz @ 4.0A for 600 watt units
  - 47-63Hz @ 8.0A for 1200 watt units

**Output Voltage:**
- 12 models—1kV to 160kV

**Output Polarity:**
- Negative or positive, specify at time of order

**Local Indicators:**
- Arc, HV On, Temp Error, OVP, I Mode
- Power On, OC, Reg Error

**Power:**
- 3 power ranges available—300, 600 and 1200 watts.
- Other power levels available on special order.

**Voltage Regulation:**
- $\leq 0.01\%$ of rated output voltage over specified input voltage range
- $\leq 0.01\%$ of rated output voltage for a full load change

**Current Regulation:**
- $\leq 0.01\%$ of rated output current over specified input voltage range
- $\leq 0.01\%$ of rated output current for a $\pm 100\mu$A for a full voltage change

**Ripple:**
- $\leq 0.2\%$ rms of maximum rated voltage, measured with a 10 foot long HV cable

**Stability:**
- $\leq 50$ppm/hr after a 2 hour warm up

**Temperature Coefficient:**
- $\leq 100$ppm per degree C

**Environmental:**
- Temperature Range:
  - Operating: 0˚C to 40˚C
  - Storage: -40˚C to 85˚C
- Humidity:
  - 20% to 85% RH, non-condensing.

**Control Interface**

**Local Interface:**
- Potentiometers are provided to adjust voltage and current.

**Remote Interface:**
- USB, Ethernet and RS-232 are standard, implemented with 12 bits of resolution.
- All digital monitors have an accuracy specification of 2%.

**Control Software:**
- A Windows graphical user interface example is provided.

**HV Control Enable/Interlock:**
- A dry contact, hardware based interlock is provided for remote mode. In local mode this I/O is the enable.

**Monitor Signals:**
- Voltage and current monitor signals are scaled 0-10Vdc equals 0-100% of full scale, accuracy is 1%.

**Dimensions:**
- 300/600 watts: 4.75˝ H X 6˝ W X 12˝ D
  - (120.65mm x 152.4mm x 304.8mm)
- 1200 watts: 4.75˝ H X 12˝ W X 12˝ D
  - (120.65mm x 304.8mm x 304.8mm)
- 160kV: 10.5˝ H X 19˝ W X 21.5˝ D
  - (266.7mm x 482.6mm x 546.1mm)

**Weight:**
- 300/600 watts: 14 pounds (6.35kg)
- 1200 watts: 26 pounds (11.8kg)
- 160kV: 142 pounds (64.4kg)

**www.spellmanhv.com/manuals/SLM**

---

**Compact & Lightweight**
- Models from 1kV-160kV, 300W, 600W and 1200W
- Universal Input, Power Factor Corrected
- Low Cost Modular Design
- Standard Digital Interfaces: USB, Ethernet and RS-232
- CE Compliant, UL Recognized
Cooling:
Forced air

Input Line Connector:
IEC320 cord set with integrated EMI filter

Output Cable:
1-70kV units: A detachable 10’ (3.3m) long shielded HV cable is provided.
160kV units: R24 connector. Mating HV cable not provided

Regulatory Approvals:
Compliant to 204/108/EC, the EMC Directive and 2006/95/EC, the Low Voltage Directive. UL/CUL recognized, File 227588. RoHS compliant. SLM160*1200 is not UL recognized.

### SLM SELECTION TABLE- 300W

<table>
<thead>
<tr>
<th>kV</th>
<th>mA</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>300</td>
<td>SLM1*300</td>
</tr>
<tr>
<td>3</td>
<td>100</td>
<td>SLM3*300</td>
</tr>
<tr>
<td>5</td>
<td>60</td>
<td>SLM5*300</td>
</tr>
<tr>
<td>10</td>
<td>30</td>
<td>SLM10*300</td>
</tr>
<tr>
<td>15</td>
<td>20</td>
<td>SLM15*300</td>
</tr>
<tr>
<td>20</td>
<td>15</td>
<td>SLM20*300</td>
</tr>
<tr>
<td>30</td>
<td>10</td>
<td>SLM30*300</td>
</tr>
<tr>
<td>40</td>
<td>7.5</td>
<td>SLM40*300</td>
</tr>
<tr>
<td>50</td>
<td>6</td>
<td>SLM50*300</td>
</tr>
<tr>
<td>60</td>
<td>5</td>
<td>SLM60*300</td>
</tr>
<tr>
<td>70</td>
<td>4.28</td>
<td>SLM70*300</td>
</tr>
</tbody>
</table>

*Specify “P” for positive polarity or “N” for negative polarity

### SLM SELECTION TABLE- 1200W

<table>
<thead>
<tr>
<th>kV</th>
<th>mA</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1200</td>
<td>SLM1*1200</td>
</tr>
<tr>
<td>3</td>
<td>400</td>
<td>SLM3*1200</td>
</tr>
<tr>
<td>5</td>
<td>240</td>
<td>SLM5*1200</td>
</tr>
<tr>
<td>10</td>
<td>120</td>
<td>SLM10*1200</td>
</tr>
<tr>
<td>15</td>
<td>80</td>
<td>SLM15*1200</td>
</tr>
<tr>
<td>20</td>
<td>60</td>
<td>SLM20*1200</td>
</tr>
<tr>
<td>30</td>
<td>40</td>
<td>SLM30*1200</td>
</tr>
<tr>
<td>40</td>
<td>30</td>
<td>SLM40*1200</td>
</tr>
<tr>
<td>50</td>
<td>24</td>
<td>SLM50*1200</td>
</tr>
<tr>
<td>60</td>
<td>20</td>
<td>SLM60*1200</td>
</tr>
<tr>
<td>70</td>
<td>17.14</td>
<td>SLM70*1200</td>
</tr>
<tr>
<td>160</td>
<td>7.5</td>
<td>SLM160*1200</td>
</tr>
</tbody>
</table>

*Specify “P” for positive polarity or “N” for negative polarity
DIMENSIONS: in.[mm]

160kV

TOP VIEW

FRONT VIEW

SIDE VIEW
Spellman’s SL Series of high voltage power supplies are designed to meet uncompromising performance standards in a minimum of space. Their circuitry includes a resonant high frequency inverter with proprietary control which provides fault-free operation in extreme transient and arcing environments with greater than 85% efficiency. These full featured supplies are available in a wide range of outputs with many options.

TYPICAL APPLICATIONS

- Analytical X-ray
- Electrostatics
- E-Beam Systems
- Capacitor Charging
- Hipot Testing
- General Laboratory

OPTIONS

See page 5 for options and descriptions

SPECIFICATIONS

Status Indicators:
- Voltage and Current Control Mode, Interlock Open/Closed
- High Voltage Inhibit, Overcurrent and Overvoltage, Arc,
- Regulation Error, Overtemperature, Over Power (optional).

Input:
- 115Vac or 220Vac±10%, 50/60Hz. Specify with order.
- 1200W model available in 200/220Vac only. For input current see table on page 2.

Output:
- Models available from 1kV to 130kV. Each model is available in positive, negative or reversible polarity output.

Front Panel Controls:
- Voltage and current are continuously adjustable by ten-turn potentiometers with lockable counting dials, ON/OFF circuit breaker/amp, high voltage ON switch/indicator and high voltage OFF switch/indicator.

Voltage Regulation:
- Load: ±0.005% of maximum voltage +500mV for full load change.
- Line: ±0.005% of full voltage +500mV over specified input range

Current Regulation:
- Load: 0.01% of maximum current ±10μA for full voltage change.
- Line: ±0.005% of maximum current for a ±10% input line change.

Ripple:
- 0.1% p-p +1Vrms.

Temperature Coefficient:
- 100ppm/°C voltage or current regulated. Higher stability is available on special order.

Environmental:
- Temperature Range:
  - Operating: 0°C to 50°C.
  - Storage: -40°C to 85°C.
- Humidity: 10 to 90% relative humidity, non-condensing

Stability:
- 100ppm/hour after 1/2 hour warm-up for both voltage and current regulation.

Metering:
- Digital voltage and current meters, 3½ digit ±1 least significant digit.

Output Cable:
- 10’ (3.05m) of shielded high voltage cable removable at the rear panel.

AC Line Input Cable:
- 10 to 300W: IEC320 Cord Set, 6’ (1.83m)
- 600 to 1200W: 3-conductor, 12AWG, 6’ (1.83m) cable permanently attached to unit.

Dimensions:
- 10W – 300W: 13/4"H(1U) x 19"W x 19"D**
  (4.45cm x 48.3cm x 48.3cm).
- 600W – 1200W: 3 1/2"H(2U) x 19"W x 19"D**
  (8.9cm x 48.3cm x 48.3cm).
- **Depth becomes 24" (60.7cm) for 80 to 130kV ranges.

Weight:
- 17 to 30lbs (7.7 to 14kg) depending on model.

Regulatory Approvals:

Electronic Component (Power Source)

SL series is intended for installation as a component of a system. It is designed to meet CE standards, with conditions of acceptance often being: customer provided enclosure mounting, EMC filtering, and appropriate protection, and isolation devices. The SL series is not intended to be operated by end users as a stand-alone device. The SL series power supply can only be fully assessed when installed within a system, and as a component part within that system.
**Quick Delivery Program**

In the selection tables to the right, SL models shown in **RED** are available via Spellman’s Quick Delivery Program. Please contact Spellman sales for details.

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Supply Common</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>2</td>
<td>External Inhibit</td>
<td>Ground=Inhibit, Open=HV On</td>
</tr>
<tr>
<td>3</td>
<td>External Interlock</td>
<td>+15V at Open, &lt;15mA at Closed</td>
</tr>
<tr>
<td>4</td>
<td>External Interlock Return</td>
<td>Return for Interlock</td>
</tr>
<tr>
<td>5</td>
<td>Current Monitor</td>
<td>0 to 10V=0 to 100% Rated Output</td>
</tr>
<tr>
<td>6</td>
<td>kV Test Point</td>
<td>0 to 10V=0 to 100% Rated Output</td>
</tr>
<tr>
<td>7</td>
<td>+10Vdc Reference</td>
<td>+10Vdc, 1mA Max</td>
</tr>
<tr>
<td>8</td>
<td>Remote Current Program In</td>
<td>0 to 10V=0 to 100% Rated Output</td>
</tr>
<tr>
<td>9</td>
<td>Local Current Program Out</td>
<td>Front Panel Program Voltage</td>
</tr>
<tr>
<td>10</td>
<td>Remote Voltage Program In</td>
<td>0 to 10V=0 to 100% Rated Output</td>
</tr>
<tr>
<td>11</td>
<td>Local Voltage Program Out</td>
<td>Front Panel Program Voltage</td>
</tr>
<tr>
<td>12</td>
<td>Power Monitor</td>
<td>0 to 10V=0 to 100% Rated Output (Optional)</td>
</tr>
<tr>
<td>13</td>
<td>Remote Power Program In</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Local HV Off Out</td>
<td>+15V at Open, &lt;25mA at Closed</td>
</tr>
<tr>
<td>15</td>
<td>HV Off</td>
<td>Connect to HV OFF for FP Operation</td>
</tr>
<tr>
<td>16</td>
<td>Remote HV On</td>
<td>+15V, 10mA Max=HV Off</td>
</tr>
<tr>
<td>17</td>
<td>Remote HV Off Indicator</td>
<td>0=HV On, +15V, 10mA Max=HV Off</td>
</tr>
<tr>
<td>18</td>
<td>Remote HV On Indicator</td>
<td>0=HV Off, +15V, 10mA Max=HV On</td>
</tr>
<tr>
<td>19</td>
<td>Remote Voltage Mode</td>
<td>Open Collector 35V Max, 10mA Max</td>
</tr>
<tr>
<td>20</td>
<td>Remote Current Mode</td>
<td>On=Active</td>
</tr>
<tr>
<td>21</td>
<td>Remote Power Mode</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Remote PS Fault</td>
<td>0=Fault, +15V, 0.1mA Max=No Fault</td>
</tr>
<tr>
<td>23</td>
<td>+15V Output</td>
<td>+15V, 100mA Max</td>
</tr>
<tr>
<td>24</td>
<td>Power Supply Common</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>25</td>
<td>Spare</td>
<td>Spare</td>
</tr>
<tr>
<td>26</td>
<td>Shield Return</td>
<td>Chassis Ground</td>
</tr>
</tbody>
</table>

**How To Order:**

Sample model number:  SL80PN1200/NSS/DPM4
SL series unit, 80kV maximum output voltage, reversible polarity output, 1200 watts, no slow start, 4.5 digit panel meters

There may be some restrictions on multiple option combinations. Please contact our sales department for more details.

*S Specify “P” for positive, “N” for negative, or “PN” for reversible polarity.

Higher voltage models available on special order.
**DIMENSIONS: in.[mm]**

### 10W-300W
- **Front View**
  - Width: 19.00 [482.60]
  - Height: 19.00 [482.60]
  - Depth: 1.72 [43.66]
- **Top View**
  - Width: 17.00 [431.80]
- **Back View**
  - Width: 24.00 [609.60]
  - Height: 16.88 [428.62]
  - Depth: 2.40 [60.96]
- **IEC 320 Input Connector:** 16.88 [428.62]
- **26 Pin Terminal Block for Remote Control Monitoring:**
- **Mating Connector and 10ft. of High Voltage Cable Supplied with Unit:**

### 600W-1200W
- **Front View**
  - Width: 19.00 [482.60]
  - Height: 19.00 [482.60]
  - Depth: 5.00 [127.00]
- **Top View**
  - Width: 17.03 [432.49]
- **Back View**
  - Width: 24.00 [609.60]
  - Height: 16.87 [428.62]
  - Depth: 2.40 [60.96]
- **26 Pin Terminal Block for Remote Control Monitoring:**
- **6 ft of Line Cable Supplied with Unit:**
- **Mating Connector and 10ft. of High Voltage Cable Supplied with Unit:**

*Depth becomes 24” [609.60] for 80kV to 130kV range.*

---

**Spellman High Voltage Electronics Corporation**

**Corporate Headquarters**

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**www.spellmanhv.com 128009-001 REV. AL**

Spellman High Voltage is an ISO 9001 and ISO 14001 registered company  
Copyright © 2001 Spellman High Voltage Electronics Corp.
The eSL Option provides a vacuum fluorescent front panel display and Ethernet connectivity. Both the 1U (1.75”) and 2U (3.5”) SL product offerings are available with the eSL Option. Using the front panel local controls the main menu has the following features:

Local/Remote Control
Allows operation from either the local front panel or remotely via the Ethernet Category 5 connector.

Features Menu
Allows control over Adjustable Overload Trip and Slow Start features.

Tutorial Menu
Provides information on how to use the local front panel interface.

Diagnostics Menu
Provides information on the revisions of the hard ware, firmware and IP address. Additionally the Diagnostics Menu provides information on the status of the internal low voltage housekeeping power supply voltages.

eSL Option power supplies can still be fully controlled via the SL’s comprehensive remote analog interface, so these units are fully backwards compatible with standard SL power supplies.

Typical Front Panel Screens

Model Number

Standby

HV ON

Digital Interface
A front panel accessible Category 5 connector provides Ethernet connectivity. Spellman provides a basic demo GUI for convenience of the user, but most customers implement their own software.

About Screen
DSP part number, DSP revision, GUI part number, GUI revision, Command set part number, Command set revision

Coms Screen
Communications, IP address, IP port

HV Power and System Voltages Screen
HV power (watts) +24V, +15V, +10V, +5V, +3.3V

User Configuration Screen
Slow Start – kV, Slow Start – mA, Adjustable Over Load (AOL), Arc Control, Fault Indicators

Main Screen
kV Setpoint, kV Readback, mA Setpoint, mA Readback, HV OFF Button, HV ON Button, Arc Counter, System Diagnostics, Reset Faults Button
SL SERIES OPTIONS

AOL* Adjustable Overload Trip
A control board jumper is moved to make the power supply shut down if it ever operates in current mode. This allows the user to set the current programming level as a trip point that will turn the power supply off with an Over Current fault if it ever tries to operate in Current Mode.

APT Adjustable Power Trip
A third control loop is installed in the power supply, a power loop. This power loop uses an analog multiplier chip to multiply the voltage and current feedback signals to create a power feedback signal. Programming and feedback scaling is 0-10Vdc = 0-100% of rated power. The circuit is configured to trip the power supply off with an Over Power fault if the power loop ever tries to regulate.

CMS Current Mode Select
A front panel switch is provided to allow the power supply to either regulate in current mode or create an over current fault when operated in current mode, which will shut down the supply. This is basically a switch selectable AOL option.

CPC Constant Power Control
Identical to the APT Option with the exception the power supply will run and regulate when the power loop becomes active.

DPM4 Digital Panel Meter, 4.5 digits
The standard 3.5 digit front panel meters are replaced with 4.5 digit panel meters.

EFR External Fault Relay
A set of relay contacts are provided via the rear panel interface that will change state if the power supply shuts down due to a fault condition.

eSL Ethernet Connectivity/VFD Front Panel
The eSL Option provides a vacuum fluorescent front panel display, Ethernet connectivity and comprehensive front panel controls.

FCV Fine Control Voltage
This option adds a second potentiometer to the front panel of the unit. This allows for a finer local adjustment of the output voltage setting.

FG Floating Ground
All the analog returns inside the power supply are isolated from chassis and brought to one point on the rear panel. Any current that flows out of the power supply via the HV cable/connector on the high side must return back to the multiplier via the load return on the low side. With only one path to flow through on the low side, a current meter can be inserted in series and a safe ground referenced measurement can be made of the actual high voltage output current.

FGLL Floating Ground Low Leakage
Identical functionality as the FG Option but a shield is placed around the high voltage multiplier to capture any leakage current inside the power supply and return it to the top of the current sense resistor. This negates any internal leakage currents from effecting measurements being made.

IO* Instant On
A jumper is placed between TB1-15 and TB1-16 on the rear panel, causing the power supply to automatically toggle into HV ON when ever the line voltage is applied.

LL(X) Lead Length
Extra long high voltage output cable. 20, 40, 60 and 100 feet are standard lengths.

LR Low Ripple
Done on a case by case basis, the standard unit is evaluated and modifications are done to improve the output ripple to 0.05% peak to peak. The operating frequency might be increased, or additional filtering may be added to the HV multiplier.

NAD* No Arc Detect
This option removes the arc intervention circuitry from the power supply. Care must be exercised when using this option as damage to the HV multiplier could occur.

NSS No Slow Start
The standard 6 second long linear ramp of output voltage is removed allowing the high voltage to “step” to its set point when enabled.

PN Positive/Negative
Reversible polarity option. Units that are not inherently reversible by design (10kV to 130kV) can have their output polarity reversed by the process of exchanging the high voltage multiplier section.

RFR Remote Fault Reset
This option provides the ability to reset any power supply faults that might occur via toggling a signal on the rear panel interface.

ROV Remote Over Voltage
The programming signal for the over voltage comparator circuit is made available to the customer remotely, allowing the power supply to be set to trip the OVP circuit anywhere from 0 -110% of rated output voltage.

SL Slides
Industry standard rack mounted slides are installed on the power supply.

SS(X) Slow Start(X)
The standard slow start is modified to provide a time of (X) seconds. Time frames of 0.1 seconds to 120 seconds can be accommodated.

There may be some restrictions on multiple option combinations. Please contact our Sales department for more details.

* Option available with the Quick Delivery program
Spellman’s SL150kV rack mount high voltage power supply is designed for scientific and industrial OEM applications requiring 150kV at 1200 watts in a compact cable connected standard sized rack. Models are available in positive, negative or reversible polarity. The SL150kV is fully arc and short circuit protected. Excellent regulation specifications are provided along with outstanding stability performance. The vacuum encapsulated high voltage output section assures reliable corona free operation by eliminating any concerns due to environmental factors.

**TYPICAL APPLICATIONS**
- Electrostatics
- HiPot Testing
- Semiconductor Processing
- Capacitor Charging

**OPTIONS**
- 200 200Vac Input Voltage
- AOL Adjustable Overload Trip
- APT Adjustable Power Trip
- AT Arc Trip
- BFP Blank Front Panel
- CPC Constant Power Control
- DPM4 4.5 Digit Panel Meters
- EFR External Fault Relay
- LL(X) Non-Standard HV Cable Length (10 standard)
- NAD No Arc Detect
- NSS No Slow Start
- RFR Remote Fault Reset
- SS(X) Non-Standard Slow Start (6 seconds standard)

**SPECIFICATIONS**

**Front Panel Controls:**
- Power ON/OFF switch, HV ON Switch, HV OFF Switch
- with preset feature, 3.5 digit backlight digital meters for display of output voltage and output current, 10 turn locking potentiometers with counting dials for adjustment of both output voltage and output current.

**Front Panel Indicators:**
- HV ON
- High Voltage Inhibit
- HV OFF
- Over Current
- Voltage Control Mode
- Over Voltage
- Current Control Mode
- Arc
- Interlock Open
- Regulation Error
- Interlock Closed
- Overtemperature

**Input:**
- 220Vac ±10%, 50/60Hz @ 12A
- 200Vac ±10%, 50/60Hz @ 13.2A

**Output Voltage:**
- 0 to 150kV

**Output Polarity:**
- Positive, negative or reversible specify at time of order

**Output Current:**
- 8mA

**Output Power:**
- 1200W

**Voltage Regulation:**
- Load: 0.01% of rated voltage for a full load change
- Line: ±0.01% of rated voltage over specified input voltage range

**Current Regulation:**
- Load: 0.01% of rated current ±100μA for full voltage change.
- Line: ±0.01% of rated current over specified input voltage range

**Ripple:**
- 0.1% peak to peak of maximum output

**Temperature Coefficient:**
- 100ppm/°C.

**Stability:**
- 100ppm/hr after a 2 hour warm up, for both voltage and current regulation

**Operating Temperature:**
- 0 to 40°C operating

**Storage Temperature:**
- -40 to +85°C storage
**Humidity:**
20% to 85%, non-condensing

**Input Line Connector:**
3 conductor 12 AWG 6 ft (1.83m) cable, permanently attached

**Output Connector:**
A detachable 10 ft (3.05m) shielded HV cable is provided

**Cooling:**
Forced Air

**Dimensions:**
8.75”H x 19”W x 22”D rack mount.
(22.23cm x 48.26cm x 55.88cm)

**Weight:**
89 pounds (40.4kg)

**Regulatory Approvals:**

**Electronic Component (Power Source)**
SL150kV series is intended for installation as a component of a system.
It is designed to meet CE standards, with conditions of acceptance often being: customer provided enclosure mounting, EMC filtering, and appropriate protection, and isolation devices. The SL150kV series is not intended to be operated by end users as a stand-alone device. The SL150kV series power supply can only be fully assessed when installed within a system, and as a component part within that system.

**SL150KV ANALOG INTERFACE—JB4 25 PIN MALE D CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Supply Common</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>2</td>
<td>External Inhibit</td>
<td>Ground = Inhibit, Open = HV ON</td>
</tr>
<tr>
<td>3</td>
<td>External Interlock</td>
<td>+15Vdc @ open, ≤ 1mA @ closed</td>
</tr>
<tr>
<td>4</td>
<td>External Interlock Return</td>
<td>Connect to pin d to enable supply</td>
</tr>
<tr>
<td>5</td>
<td>Current Monitor</td>
<td>0 to 10Vdc = 0 to 100% rated voltage, Zout =10kΩ</td>
</tr>
<tr>
<td>6</td>
<td>Voltage Monitor</td>
<td>0 to 10Vdc = 0 to 100% rated voltage, Zout =10kΩ</td>
</tr>
<tr>
<td>7</td>
<td>+10Vdc Reference</td>
<td>+10Vdc @ 1mA. maximum</td>
</tr>
<tr>
<td>8</td>
<td>Remote Current Program Input</td>
<td>0 to 10Vdc = 0 to 100% rated voltage, Zout =10kΩ</td>
</tr>
<tr>
<td>9</td>
<td>Local Current Program Output</td>
<td>Multi-turn front panel pot for local control capability</td>
</tr>
<tr>
<td>10</td>
<td>Remote Voltage Program Input</td>
<td>0 to 10Vdc = 0 to 100% rated voltage, Zout =10kΩ</td>
</tr>
<tr>
<td>11</td>
<td>Local Voltage Program Output</td>
<td>Multi-turn front panel pot for local control capability</td>
</tr>
<tr>
<td>12</td>
<td>EFR (Common)</td>
<td>External Fault Relay (Optional)</td>
</tr>
<tr>
<td>13</td>
<td>EFR (Normally Open)</td>
<td>External Fault Relay (Optional)</td>
</tr>
<tr>
<td>14</td>
<td>Local HV OFF OUT</td>
<td>+15Vdc @ open, &lt;25mA @ closed, connect to HV OFF for front panel operation</td>
</tr>
<tr>
<td>15</td>
<td>HV OFF</td>
<td>Connect to HV OFF OUT for front panel operation</td>
</tr>
<tr>
<td>16</td>
<td>Remote HV ON</td>
<td>+15Vdc @ 10mA maximum = HV OFF</td>
</tr>
<tr>
<td>17</td>
<td>Remote HV OFF Indicator</td>
<td>0 = HV ON, +15Vdc @ 10mA maximum = HV OFF</td>
</tr>
<tr>
<td>18</td>
<td>Remote HV ON Indicator</td>
<td>0 = HV OFF, +15Vdc @ 10mA maximum = HV ON</td>
</tr>
<tr>
<td>19</td>
<td>Remote Voltage Mode</td>
<td>Open collector 50Vdc @ 10mA maximum, ON = Active</td>
</tr>
<tr>
<td>20</td>
<td>Remote Current Mode</td>
<td>Open collector 50Vdc @ 10mA maximum, ON = Active</td>
</tr>
<tr>
<td>21</td>
<td>Remote Power Mode</td>
<td>Open collector 50Vdc @ 10mA maximum, ON = Active</td>
</tr>
<tr>
<td>22</td>
<td>Power Supply Fault</td>
<td>Open collector, 50Vdc @ 10mA maximum</td>
</tr>
<tr>
<td>23</td>
<td>+15Vdc Output</td>
<td>+15Vdc @ 100mA, maximum</td>
</tr>
<tr>
<td>24</td>
<td>Power Supply Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>25</td>
<td>Shield Return</td>
<td>Chassis Ground</td>
</tr>
</tbody>
</table>

Specify “P” for positive polarity or “N” for negative polarity, and PN = reversible as illustrated below.

Sample Model Number: SL150P1200/BFP/LL(20)
Where SL = power supply series, 150 = maximum output voltage in kV,
P = positive output polarity, 1200 = maximum output power (watts), BFP = Blank Front Panel, LL(20) = 20 foot HV cable.
Spellman’s SL2KW Series of 2kW high voltage power supplies are designed to meet uncompromising performance standards in a minimum of space. Their circuitry includes a resonant high frequency inverter with proprietary control which provides fault-free operation in extreme transient and arcing environments with greater than 85% efficiency. These full featured supplies are available in a wide range of outputs with many options.

**TYPICAL APPLICATIONS**
- Semiconductor Manufacturing
- CPT/CRT Testing
- Electrostatics
- Hipot Testing
- E-Beam Systems
- General Laboratory
- Capacitor Charging
- CW Lasers

**OPTIONS**
See page 4 for options and descriptions

**SPECIFICATIONS**

**Status Indicators:** Voltage and Current Control Mode, Interlock Open and Closed, High Voltage Inhibit, Overcurrent and Overvoltage, Arc, Regulation Error, Overtemperature.

**Input:**
- Standard: 208Vac ±10%, 50/60Hz @ 8.5A/phase, three phase
- Optional: 220Vac ±10%, 50/60Hz @ 19.75A, single phase

**Output:**
Models available from 0.5kV to 50kV. Each model is available in positive, negative or reversible polarity output.

**Front Panel Controls:** Voltage and current are continuously adjustable by ten-turn potentiometers with lockable counting dials, ON/OFF circuit breaker/lamp, high voltage ON switch/indicator and high voltage OFF switch/indicator.

**Voltage Regulation:**
- Load: 0.005% of maximum voltage +500mV for full load change.
- Line: ±0.005% of full voltage +500mV over specified input range

**Current Regulation:**
- Load: 0.01% of maximum current ±100μA for full voltage change.
- Line: ±0.005% of maximum current for ±10% input line change.

**Ripple:**
0.1% p-p +1Vrms, three phase line input
0.3% p-p +1Vrms, single phase line input

**Temperature Coefficient:**
100ppm/°C voltage or current regulated.
Higher stability is available on special order.

**Environmental:**
- Temperature Range:
  - Operating: 0°C to 50°C.
  - Storage: -40°C to 85°C.
- Humidity:
  10 to 90% relative humidity, non-condensing

**Stability:**
100ppm/hour after 1/2 hour warm-up for both voltage and current regulation.

**Metering:**
Digital voltage and current meters, 3½ digit ±1 least significant digit.

**Interface Connector:**
25 pin male D connector

**AC Line Input Cable:**
A 6 foot (1.83m) cable is permanently attached to the unit.
Single phase units use 3 conductor 12AWG cable, three phase units use 4 conductor 16AWG cable.

**Dimensions:**
3.5” H(2U) x 19” W x 19” D
(8.9cm x 48.3cm x 48.3cm)

**Weight:**
17 to 26lbs (7.7 to 11.8kg) depending on model.

**Regulatory Approvals:**
Compliant to EEC EMC Directive for 3 phase units, conducted and radiated emission only for single phase units. Compliant to EEC Low Voltage Directive. RoHS Compliant.

**Electronic Component (Power Source)**
SL2KW series is intended for installation as a component of a system.
It is designed to meet CE standards, with conditions of acceptance often being: customer provided enclosure mounting, EMC filtering, and appropriate protection, and isolation devices. The SL2KW series is not intended to be operated by end users as a stand-alone device. The SL2KW series power supply can only be fully assessed when installed within a system, and as a component part within that system.
The eSL Option provides a vacuum fluorescent front panel display and Ethernet connectivity. Using the front panel local controls the main menu has the following features:

**Local/Remote Control**  
Allows operation from either the local front panel or remotely via the Ethernet Category 5 connector.

**Features Menu**  
Allows control over Adjustable Overload Trip and Slow Start features.

**Tutorial Menu**  
Provides information on how to use the local front panel interface.

**Diagnostics Menu**  
Provides information on the revisions of the hardware, firmware and IP address. Additionally the Diagnostics Menu provides information on the status of the internal low voltage housekeeping power supply voltages.

eSL Option power supplies can still be fully controlled via the SL2KW’s comprehensive remote analog interface, so these units are fully backwards compatible with standard SL2KW power supplies.

### Typical Front Panel Screens

#### Model Number
- **eSL 50P2000**

#### Standby
- **00.00 mA**

#### HV ON
- **40.00 mA**

### Digital Interface

A front panel accessible Category 5 connector provides Ethernet connectivity. Spellman provides a basic demo GUI for convenience of the user, but most customers implement their own software.

#### About Screen
- DSP part number, DSP revision, GUI part number, GUI revision, Command set part number, Command set revision

#### Coms Screen
- Communications, IP address, IP port

#### HV Power and System Voltages Screen
- HV power (watts) +24V, +15V, +10V, +5V, +3.3V

#### User Configuration Screen
- Slow Start – kV, Slow Start – mA, Adjustable Over Load (AOL), Arc Control, Fault indicators

#### Main Screen
- KV Setpoint, KV Readback, mA Setpoint, mA Readback, HV OFF Button, HV ON Button, Arc Counter, System Diagnostics, Reset Faults Button
### SL2KW SELECTION TABLE

<table>
<thead>
<tr>
<th>MAXIMUM RATING</th>
<th>MODEL NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>kV mA</td>
<td></td>
</tr>
<tr>
<td>0.5 4000</td>
<td>SL0.5PN2000</td>
</tr>
<tr>
<td>1 2000</td>
<td>SL1PN2000</td>
</tr>
<tr>
<td>2 1000</td>
<td>SL2PN2000</td>
</tr>
<tr>
<td>3 666</td>
<td>SL3PN2000</td>
</tr>
<tr>
<td>6 333</td>
<td>SL6PN2000</td>
</tr>
<tr>
<td>8 250</td>
<td>SL8PN2000</td>
</tr>
<tr>
<td>10 200</td>
<td>SL10*2000</td>
</tr>
<tr>
<td>15 133</td>
<td>SL15*2000</td>
</tr>
<tr>
<td>20 100</td>
<td>SL20*2000</td>
</tr>
<tr>
<td>30 66.6</td>
<td>SL30*2000</td>
</tr>
<tr>
<td>40 50</td>
<td>SL40*2000</td>
</tr>
<tr>
<td>50 40</td>
<td>SL50*2000</td>
</tr>
</tbody>
</table>

*Specify “P” for positive polarity or “N” for negative polarity or “PN” for reversible polarity.

### SL2KW 25 PIN D CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Supply Common</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>2</td>
<td>External Inhibit</td>
<td>Ground=Inhibit, Open=HV On</td>
</tr>
<tr>
<td>3</td>
<td>External Interlock</td>
<td>+15V at Open, &lt;15mA at Closed</td>
</tr>
<tr>
<td>4</td>
<td>External Interlock Return</td>
<td>Return for Interlock</td>
</tr>
<tr>
<td>5</td>
<td>kV Test Point</td>
<td>0 to 10V=0 to 100% Rated Output</td>
</tr>
<tr>
<td>6</td>
<td>+10Vdc Reference</td>
<td>+10Vdc, 1mA Max</td>
</tr>
<tr>
<td>7</td>
<td>Remote Current Program In</td>
<td>0 to 10V=0 to 100% Rated Output</td>
</tr>
<tr>
<td>8</td>
<td>Local Current Program Out</td>
<td>Front Panel Program Voltage</td>
</tr>
<tr>
<td>9</td>
<td>Remote Voltage Program In</td>
<td>0 to 10V=0 to 100% Rated Output</td>
</tr>
<tr>
<td>10</td>
<td>Local Voltage Program Out</td>
<td>Front Panel Program Voltage</td>
</tr>
<tr>
<td>11</td>
<td>EFR Common</td>
<td>Optional External Fault Relay</td>
</tr>
<tr>
<td>12</td>
<td>EFR-NC/EFR-NO</td>
<td>30V @ 2A Maximum</td>
</tr>
<tr>
<td>13</td>
<td>Local HV Off</td>
<td>+15V at Open, &lt;25mA at Closed</td>
</tr>
<tr>
<td>14</td>
<td>HV Off Connect to HV OFF for FP Operation</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Remote HV On</td>
<td>+15V, 10mA Max=HV Off</td>
</tr>
<tr>
<td>16</td>
<td>Remote HV Off Indicator</td>
<td>0=HV On, +15V, 10mA Max=HV Off</td>
</tr>
<tr>
<td>17</td>
<td>Remote HV On Indicator</td>
<td>0=HV Off, +15V, 10mA Max=HV On</td>
</tr>
<tr>
<td>18</td>
<td>Remote Voltage Mode</td>
<td>Open Collector 35V Max, 10mA Max, On=Active</td>
</tr>
<tr>
<td>19</td>
<td>Remote Current Mode</td>
<td>On=Active</td>
</tr>
<tr>
<td>20</td>
<td>Remote Power Mode</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Remote Power Mode</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Remote PS Fault</td>
<td>0=Fault, +15V, 0.1mA Max=No Fault</td>
</tr>
<tr>
<td>23</td>
<td>+15V Output</td>
<td>+15V, 100mA Max</td>
</tr>
<tr>
<td>24</td>
<td>Power Supply Common</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>25</td>
<td>Shield Return</td>
<td>Chasis Ground</td>
</tr>
</tbody>
</table>

### How To Order:

Sample model number: SL20PN2000/NSS/DPM4

SL2KW Series unit, 20kV maximum output voltage, reversible polarity output, 2000 watts, no slow start, 4.5 digit panel meters

There may be some restrictions on multiple option combinations. Please contact our Sales department for more details.
SL2KW SERIES OPTIONS

AOL  Adjustable Overload Trip
A control board jumper is moved to make the power supply shut down if it ever operates in current mode. This allows the user to set the current programming level as a trip point that will turn the power supply off with an Over Current fault if it ever tries to operate in Current Mode.

APT  Adjustable Power Trip
A third control loop is installed in the power supply, a power loop. This power loop uses an analog multiplier chip to multiply the voltage and current feedback signals to create a power feedback signal. Programming and feedback scaling is 0-10Vdc = 0-100% of rated power. The circuit is configured to trip the power supply off with an Over Power fault if the power loop ever tries to regulate.

ARC  Arc Sense
A signal is provided on a spare pin (TB1-21) that changes state whenever the power supply detects an arc.

AT  Arc Trip
A control board jumper is moved such that the first arc sensed will shut the power supply off with an ARC fault.

CMS  Current Mode Select
A front panel switch is provided to allow the power supply to either regulate in current mode or create an over current fault when operated in current mode, which will shut down the supply. This is basically a switch selectable AOL option.

CPC  Constant Power Control
Identical to the APT Option with the exception the power supply will run and regulate when the power loop becomes active.

DPM4 Digital Panel Meter, 4.5 digits
The standard 3.5 digit front panel meters are replaced with 4.5 digit panel meters.

EFR  External Fault Relay
A set of relay contacts are provided via the rear panel interface that will change state if the power supply shuts down due to a fault condition.

eSL  Ethernet Connectivity/VFD Front Panel
The eSL Option provides a vacuum fluorescent front panel display, Ethernet connectivity and comprehensive front panel controls.

FCV  Fine Control Voltage
This option adds a second potentiometer to the front panel of the unit. This allows for a finer local adjustment of the output voltage setting.

IO  Instant On
A jumper is placed between TB1-15 and TB1-16 on the rear panel, causing the power supply to automatically toggle into HV ON when ever the line voltage is applied.

LL(X) Lead Length
Extra long high voltage output cable. 20, 40, 60 and 100 feet are standard lengths. Non standard lengths can be custom ordered.

NAD  No Arc Detect
This option removes the arc intervention circuitry from the power supply. Care must be exercised when using this option as damage to the HV multiplier could occur.

NSS  No Slow Start
The standard 6 second long linear ramp of output voltage is removed allowing the high voltage to "step" to its set point when enabled.

PN  Positive/Negative
Reversible polarity option. Units that are not inherently reversible by design (10kV to 50kV) can have their output polarity reversed by the process of exchanging the high voltage multiplier section.

RFR  Remote Fault Reset
This option provides the ability to reset any power supply faults that might occur via toggling a signal on the rear panel interface.

ROV  Remote Over Voltage
The programming signal for the over voltage comparator circuit is made available to the customer remotely, allowing the power supply to be set to trip the OVP circuit anywhere from 0 -110% of rated output voltage.

SL  Slides
Industry standard rack mounted slides are installed on the power supply.

SS(X) Slow Start(X)
The standard slow start is modified to provide a time of (X) seconds. Time frames of 0.1 seconds to 120 seconds can be accommodated.

There may be some restrictions on multiple option combinations. Please contact our Sales department for more details.
The SLS series of high voltage power supplies provide up to 2000 watts of power with voltage outputs ranging from 160kV to 360kV. These power supplies utilize high frequency resonant inverters with proprietary controls for reliable operation in extreme environments. The high voltage multiplier unit is built with a hybrid design of solid encapsulation and air, thus reducing its overall size. Comprised of 20kV interlocking wafers, the multiplier unit offers flexible building blocks for many different output configurations.

**TYPICAL APPLICATIONS**
- Ion Implantation
- Particle Accelerators
- Electron Guns

**OPTIONS**
- eSL Ethernet Connectivity/VFD Front Panel

**SPECIFICATIONS**

**Input Voltage:**
- Standard: 220Vac ±10%, 50/60Hz @ 8A/phase, three phase
- Optional: 200Vac ±10%, 50/60Hz @ 8.9A/phase, three phase

**Output Voltage Range:**
- Models available from 160kV to 360kV and up to 2000W. Each model is available with positive or negative polarity outputs.

**Voltage Regulation:**
- Better than 0.05% for specified line variations and load variations.

**Ripple:**
- 0.1% p-p of maximum output voltage.

**Remote Voltage Control:**
- 0 to +10V for 0 to maximum voltage. Accuracy and repeatability: 1% of maximum rating.

**Remote Current Control:**
- 0 to +10V for 0 to maximum voltage. Accuracy and repeatability: 1% of maximum rating.

**Voltage Monitor:**
- 0 to 10V equivalent to rated voltage. Accuracy, 1% reading.

**Current Monitor:**
- 0 to 10V equivalent to rated current. Accuracy, 1% reading.

**Stability:**
- 0.05% per hour after 1/2 hour warm-up.
- 0.05% per 8 hours.

**Slow Start:**
- Slow start times: 6 seconds standard.

**Temperature Coefficient:**
- 0.01% per degrees C.

**Protection:**
- Overcurrent, Overvoltage, Arc protection, Overtemperature.

**Arc Detect:**
- If 8 arcs occur in a 10 second, non-synchronous time window, the supply reverts to the Power Down Mode with an ARC fault displayed on the front panel default diagnostic display.

**Environmental:**
- Temperature Range:
  - Operating: 0°C to 40°C
  - Storage: -20°C to 85°C
- Humidity: 10% to 70%, non-condensing.

**Dimensions:**
- Inverter Driver Chassis: 3.50˝ (2U) H x 19.0˝ W x 19.0˝ D (8.9cm x 48.3cm x 48.3cm)
- Multiplier Unit: See page 3.

**Distance from Stack to Driver:**
- 2.5 meters ±0.1 meter maximum.

**Signal Connector:**
- 25 pin, male D connector, J3.

**Metering:**
- Front panel, 3.5 digit, digital voltage and current meters.

**Front Panel Controls:**
- Voltage and current are continuously adjustable by ten-turn potentiometers with lockable counting dials, ON/OFF circuit breaker/lamp, high voltage ON switch/indicator and high voltage OFF switch/indicator.

www.spellmanhv.com/manuals/SLS
Front Panel Status Indicators:
- Voltage Control Mode
- Current Control Mode
- Interlock Open
- Interlock Closed
- High Voltage Inhibit
- Regulation Error

Overtemperature
Overpower (optional)
Overcurrent
Overvoltage
Arc

Regulatory Approvals:
RoHS compliant

Electronic Component (Power Source)
SLS series is intended for installation as a component of a system. It is designed to meet CE standards, with conditions of acceptance often being: customer provided enclosure mounting, EMC filtering, and appropriate protection, and isolation devices. The SLS series is not intended to be operated by end users as a stand-alone device. The SLS series power supply can only be fully assessed when installed within a system, and as a component part within that system.

Corona Dome Terminations:
The SLS Series of “stack” configured high voltage power supplies come in a various output voltages and different physical configurations. Appropriate corona relief is required for these units to operate at maximum output voltage. Frequently users will provide the corona relief needed so Spellman will provide stack assemblies that by themselves will not be able to operate at maximum output voltage corona free. Please be certain to discuss your requirements with Spellman to be assured you get a stack assembly in the physical configuration you require for your application. The optional K941 Toroid (5” x 20”) should be considered if customer corona relief will not be provided.

SPELLMAN HIGH VOLTAGE ELECTRONICS CORPORATION
PAGE 2 OF 4

SLS SELECTION TABLE

<table>
<thead>
<tr>
<th>MAXIMUM RATING</th>
<th>MODEL NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>kV</td>
<td>mA</td>
</tr>
<tr>
<td>160</td>
<td>12.5</td>
</tr>
<tr>
<td>200</td>
<td>10.0</td>
</tr>
<tr>
<td>260</td>
<td>7.7</td>
</tr>
<tr>
<td>300</td>
<td>6.6</td>
</tr>
<tr>
<td>360</td>
<td>5.5</td>
</tr>
</tbody>
</table>

*Specify “P” for positive polarity or “N” for negative polarity
Other combinations of voltage and current are available.

SLS I/O INTERFACE CONNECTOR 25 PIN

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Supply Common</td>
</tr>
<tr>
<td>2</td>
<td>External Inhibit</td>
</tr>
<tr>
<td>3</td>
<td>External Interlock</td>
</tr>
<tr>
<td>4</td>
<td>External Interlock Return</td>
</tr>
<tr>
<td>5</td>
<td>Current Monitor</td>
</tr>
<tr>
<td>6</td>
<td>Voltage Monitor</td>
</tr>
<tr>
<td>7</td>
<td>+10V Reference</td>
</tr>
<tr>
<td>8</td>
<td>Remote Current Program In</td>
</tr>
<tr>
<td>9</td>
<td>Local Current Program Out</td>
</tr>
<tr>
<td>10</td>
<td>Remote Voltage Program In</td>
</tr>
<tr>
<td>11</td>
<td>Local Voltage Program Out</td>
</tr>
<tr>
<td>12</td>
<td>Optional EFR (common)</td>
</tr>
<tr>
<td>13</td>
<td>Optional EFR (normally closed)</td>
</tr>
<tr>
<td>14</td>
<td>Local HV OFF Out</td>
</tr>
<tr>
<td>15</td>
<td>HV OFF</td>
</tr>
<tr>
<td>16</td>
<td>Remote HV ON</td>
</tr>
<tr>
<td>17</td>
<td>Remote HV OFF Indicator</td>
</tr>
<tr>
<td>18</td>
<td>Remote HV ON Indicator</td>
</tr>
<tr>
<td>19</td>
<td>Remote Voltage Mode</td>
</tr>
<tr>
<td>20</td>
<td>Remote Current Mode</td>
</tr>
<tr>
<td>21</td>
<td>Spare</td>
</tr>
<tr>
<td>22</td>
<td>Remote PS Fault</td>
</tr>
<tr>
<td>23</td>
<td>+15V Output</td>
</tr>
<tr>
<td>24</td>
<td>Power Supply Common</td>
</tr>
<tr>
<td>25</td>
<td>Shield Return</td>
</tr>
</tbody>
</table>

360kV Stack shown with optional K941 Toroid
The eSL Option provides a vacuum fluorescent front panel display and Ethernet connectivity. Using the front panel local controls the main menu has the following features:

**Local/Remote Control**
Allows operation from either the local front panel or remotely via the Ethernet Category 5 connector.

**Features Menu**
Allows control over Adjustable Overload Trip and Slow Start features.

**Tutorial Menu**
Provides information on how to use the local front panel interface.

**Diagnostics Menu**
Provides information on the revisions of the hardware, firmware and IP address. Additionally the Diagnostics Menu provides information on the status of the internal low voltage housekeeping power supply voltages.

eSL Option power supplies can still be fully controlled via the SL2KW’s comprehensive remote analog interface, so these units are fully backwards compatible with standard SL2KW power supplies.

---

**Typical Front Panel Screens**

**Model Number**

- **Off**: 0.00 mA
- **On**: 12.50 mA

**HV ON**
160.00 kV
Spellman’s STA Series of 4kW high voltage power supplies are available in positive or negative polarities in 15 different models with outputs ranging from 1kV to 70kV. A full featured front panel allows easy local control, while an extensive analog interface provides comprehensive remote capability. The standard Ethernet and RS-232 digital interfaces simplify integrating the STA into your system design.

The STA’s robust IGBT inverter is inherently fault tolerant and is ideal for demanding applications like semiconductor processing and vacuum deposition. Many operational features can be configured by the user to suit their particular requirements.

**TYPICAL APPLICATIONS**
- Ion Beam Implantation
- Semiconductor Processing
- Electron Beam Welding
- Capacitor Charging
- High Power RF Transmitters
- Electrostatic Precipitators
- X-Ray Systems

**HARDWARE BASED OPTIONS**
- **BFP** Blank Front Panel
- **HS** High Stability
- **LL(X)** High Voltage Cable Length
- **1PH** 180-264Vac, Single Phase Input

**SOFTWARE CONFIGURABLE FEATURES**
- Adjustable Overload Trip
- Arc Trip Count
- Arc Quench Time
- Arc Re-Ramp Time
- Constant Power Control
- Adjustable Power Trip
- Slow Start Ramp Times

**SPECIFICATIONS**

**Input Voltage:**
- **Standard:** 180-264Vac, 50/60Hz, three phase, 90% efficiency, 0.85 power factor
- **Optional:** 180-264Vac 50/60Hz, single phase (1PH)

**Input Current:**
- **Standard:** 180-264Vac, three phase 17 amps, maximum
- **Optional:** 180-264Vac, single phase 38 amps, maximum

**Output Voltage:**
15 models from 1kV to 70kV. Each model is available with positive or negative outputs.

**Local Output Controls:**
Voltage and current are continuously adjustable over entire range via ten-turn potentiometers with lockable counting dials.

**Voltage Regulation:**
- **Load:** 0.05% of full voltage +500mV for full load change.
- **Line:** 0.05% of full voltage +500mV over specified input range.

**Current Regulation:**
- **Load:** 0.05% of full current ±100µA for any voltage change.
- **Line:** 0.05% of full current over specified input range.

**Ripple:**
0.1% p-p +1Vrms

**Stability:**
0.02%/hr. after 1 hour warm-up.

**Temperature Coefficient:**
100ppm/°C. Higher stability (50ppm/°C) available on special order via the HS option

**Environmental:**
- **Temperature Range:**
  - Operating: 0°C to 40°C
  - Storage: -40°C to 85°C
- **Humidity:**
  10% to 90% RH, non-condensing.

**Cooling:**
Forced air; inlet through side panels, outlet at rear panel

**Metering:**
Digital voltage and current meters, accurate to within 1%

**System Status Display:**
“Dead Front” type indicators provide status of up to 12 system operations including voltage and current regulation, fault conditions and circuit control.

www.spellmanhv.com/manuals/STA
Analog Interface Connector:  
50 pin female D connector

High Voltage Output Cable:  
A detachable 10’ (3.05m) long shielded HV cable is provided

Dimensions:  
1kV to 70kV:  
5.25” (3U)H X 19” W X 21” D (133mm x 482mm x 533mm)

Weight:  
1kV to 8kV: 46 lbs. (20.87kg)  
10kV to 70kV: 58 lbs. (26.31kg)  
Individual kV models may vary

Regulatory Approvals:  
Designed to meet EEC EMC Directive. Compliant to  

Electronic Component (Power Source)  
STA series is intended for installation as a component of a system.  
It is designed to meet CE standards, with conditions of acceptance often being:  
customer provided enclosure mounting, EMC filtering, and appropriate protection,  
and isolation devices. The STA series is not intended to be operated by end users  
as a stand-alone device. The STA series power supply can only be fully assessed  
when installed within a system, and as a component part within that system.

Digital Interface  
The STA features a standard RS-232 and Ethernet digital interface.  
Utilizing these standard digital interfaces can dramatically simplify  
power supply interfacing requirements saving the user both time and money, while enhancing functionality and overall capability. Spellman  
provides a GUI with the STA that allows the customer to both customize operational features of the STA while also providing basic  
power supply operational features. Details of the STA’s digital interface capability are described in the STA manual, downloadable via  
the link on the first page of this data sheet.

Arc Intervention  
Spellman’s STA power supplies have an arc intervention feature  
that senses arc currents via a fast acting current sense transformer.  
The purpose of the arc intervention circuitry is to prevent power supply damage from continuous, long term arcing. The factory default  
configuration will trip off the unit with an Arc Fault if 4 arcs occur in  
a 10 second time period. Customers can change basic arc intervention parameters (Arc Count, Arc Quench, Reramp Time, and Window Time) within preset limits via the digital interface interface; customized units can be provided for unique arc prone environments,  
contact Spellman for details.

---

### STA SELECTION TABLE

<table>
<thead>
<tr>
<th>MAXIMUM RATING</th>
<th>MODEL NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>kV</td>
<td>mA</td>
</tr>
<tr>
<td>1</td>
<td>4,000</td>
</tr>
<tr>
<td>2</td>
<td>2,000</td>
</tr>
<tr>
<td>3</td>
<td>1,333</td>
</tr>
<tr>
<td>4</td>
<td>1,000</td>
</tr>
<tr>
<td>6</td>
<td>667</td>
</tr>
<tr>
<td>8</td>
<td>500</td>
</tr>
<tr>
<td>10</td>
<td>400</td>
</tr>
<tr>
<td>12</td>
<td>333</td>
</tr>
<tr>
<td>15</td>
<td>267</td>
</tr>
<tr>
<td>20</td>
<td>200</td>
</tr>
<tr>
<td>30</td>
<td>133</td>
</tr>
<tr>
<td>40</td>
<td>100</td>
</tr>
<tr>
<td>50</td>
<td>80</td>
</tr>
<tr>
<td>60</td>
<td>67</td>
</tr>
<tr>
<td>70</td>
<td>57</td>
</tr>
</tbody>
</table>

*Substitute “P” for positive polarity and “N” for negative polarity.  
Polarity must be specified at time of order.
# JB1 STA Analog Interface—50 Pin Female D Connector

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Supply Common</td>
<td>Power Supply Ground</td>
</tr>
<tr>
<td>2</td>
<td>Reset/HV Inhibit</td>
<td>Normally open, Low = Reset/Inhibit</td>
</tr>
<tr>
<td>3</td>
<td>External Interlock</td>
<td>+24Vdc @ open, &lt;25mA @ closed</td>
</tr>
<tr>
<td>4</td>
<td>External Interlock Return</td>
<td>Return for External Interlock</td>
</tr>
<tr>
<td>5</td>
<td>mA Test Point</td>
<td>0-10Vdc = 0-100% rated output, Zout= 1KΩ, 1%</td>
</tr>
<tr>
<td>6</td>
<td>kV Test Point</td>
<td>0-10Vdc = 0-100% rated output, Zout= 1KΩ, 1%</td>
</tr>
<tr>
<td>7</td>
<td>+10Vdc Reference Output</td>
<td>+10Vdc @ 1mA</td>
</tr>
<tr>
<td>8</td>
<td>mA Program Input</td>
<td>0-10Vdc = 0-100% rated output, Zin&gt;10MΩ</td>
</tr>
<tr>
<td>9</td>
<td>Local mA Program Output</td>
<td>0-10Vdc = 0-100% rated output, front panel pot</td>
</tr>
<tr>
<td>10</td>
<td>kV Program Input</td>
<td>0-10Vdc = 0-100% rated output, Zin&gt;10MΩ</td>
</tr>
<tr>
<td>11</td>
<td>Local kV Program Output</td>
<td>0-10Vdc = 0-100% rated output, front panel pot</td>
</tr>
<tr>
<td>12</td>
<td>Remote Power On Output</td>
<td>+24Vdc @ open, 2A peak, 1Adc @ closed</td>
</tr>
<tr>
<td>13</td>
<td>Remote Power On Return</td>
<td>Return for Remote Power On</td>
</tr>
<tr>
<td>14</td>
<td>Remote HV Off</td>
<td>+24Vdc @ open, 2A peak, 1Adc @ closed, connect to pin15 for front panel operation</td>
</tr>
<tr>
<td>15</td>
<td>Remote HV Off/On Common</td>
<td>HV On/Off Common</td>
</tr>
<tr>
<td>16</td>
<td>Remote HV On</td>
<td>+24Vdc @ open, 2A peak, 1Adc @ closed, momentarily connect to pin 15 enable high voltage</td>
</tr>
<tr>
<td>17</td>
<td>HV Off Indicator</td>
<td>+24Vdc @ 25mA = HV Off</td>
</tr>
<tr>
<td>18</td>
<td>HV On Indicator</td>
<td>+24Vdc @ 25mA = HV On</td>
</tr>
<tr>
<td>19</td>
<td>Power Supply Common</td>
<td>Supply Ground</td>
</tr>
<tr>
<td>20</td>
<td>+24Vdc Output</td>
<td>+24Vdc @ 100mA, maximum</td>
</tr>
<tr>
<td>21</td>
<td>Voltage Mode Status</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>22</td>
<td>Current Mode Status</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>23</td>
<td>Power Mode Status</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>24</td>
<td>Interlock Closed Status</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>25</td>
<td>Power Test Point</td>
<td>0-10Vdc = 0-100% rated output, Zout= 5KΩ, 1%</td>
</tr>
<tr>
<td>26</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Remote Overvoltage Adjust</td>
<td>0-10Vdc = 0-100% rated output</td>
</tr>
<tr>
<td>29</td>
<td>Over Power Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>30</td>
<td>Over Voltage Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>31</td>
<td>Over Current Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>32</td>
<td>System Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>33</td>
<td>RGLT Error Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>34</td>
<td>Arc</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>35</td>
<td>Over Temp Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>36</td>
<td>AC Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>37</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Remote Power Program Input</td>
<td>0-10Vdc = 0-100% rated output, Zin&gt;10MΩ</td>
</tr>
<tr>
<td>43</td>
<td>Local Power Program Output</td>
<td>0-10Vdc = 0-100% rated output, internal pot</td>
</tr>
<tr>
<td>44</td>
<td>+5Vdc Output</td>
<td>+5Vdc @ 100mA, maximum</td>
</tr>
<tr>
<td>45</td>
<td>+15Vdc Output</td>
<td>+15Vdc @ 100mA, maximum</td>
</tr>
<tr>
<td>46</td>
<td>-15Vdc Output</td>
<td>-15Vdc @ 10mA, maximum</td>
</tr>
<tr>
<td>47</td>
<td>RS232 Tx</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>RS232 Rx</td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>RS232 GND</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>Power Supply Common</td>
<td>Power Supply Ground</td>
</tr>
</tbody>
</table>

---

**Diagram:**

- Front View
- Top View
- Back View

**Dimensions:**

- **Front View:**
  - 18.25 [463.55]
  - 1.48 [37.69]
  - 1.25 R [32.56]
- **Top View:**
  - 19.00 [482.60]
  - 6 ft OF LINE CABLE SUPPLIED WITH UNIT. MATING CONNECTOR AND 10ft OF HIGH VOLTAGE CABLE SUPPLIED WITH UNIT.
- **Back View:**
  - 16.88 [428.75]
  - 17.00 [431.80]
Spellman’s STR Series of 6kW high voltage power supplies are available in positive or negative polarities in 19 different models with outputs ranging from 1kV to 150kV. A full featured front panel allows easy local control, while an extensive analog interface provides comprehensive remote capability. The standard Ethernet and RS-232 digital interfaces simplify integrating the STR into your system design.

The STR’s robust IGBT inverter is inherently fault tolerant and is ideal for demanding applications like semiconductor processing and vacuum deposition. Many operational features can be configured by the user to suit their particular requirements.

**TYPICAL APPLICATIONS**
- Ion Beam Implantation
- Semiconductor Processing
- Electron Beam Welding
- Capacitor Charging
- High Power RF Transmitters
- Electrostatic Precipitators
- X-Ray Systems

**HARDWARE BASED OPTIONS**
- BFP: Blank Front Panel
- HS: High Stability
- LL(X): High Voltage Cable Length
- 400VAC: 360-528Vac, Three Phase Input
- 1PH: 180-264Vac, Single Phase Input

**SOFTWARE CONFIGURABLE FEATURES**
- Adjustable Overload Trip
- Arc Trip Count
- Arc Quench Time
- Arc Re-Ramp Time
- Constant Power Control
- Adjustable Power Trip
- Slow Start Ramp Times

**SPECIFICATIONS**

**Input Voltage:**
- Standard: 180-264Vac, 50/60Hz, three phase, 90% efficiency, 0.85 power factor
- Optional: 360-528Vac 50/60Hz, three phase (400VAC)
  - 180-264Vac 50/60Hz, single phase (1PH)

**Input Current:**
- Standard: 180-264Vac, three phase 25 amps, maximum
- Optional: 360-528Vac, three phase 12.5 amps, maximum
  - 180-264Vac, single phase 57 amps, maximum

**Output Voltage:**
19 models from 1kV to 150kV. Each model is available with positive or negative outputs. 1kV to 10kV units are internally reversible.

**Local Output Controls:**
Voltage and current are continuously adjustable over entire range via ten-turn potentiometers with lockable counting dials.

**Voltage Regulation:**
- Load: 0.05% of full voltage +500mV for full load change.
- Line: 0.05% of full voltage +500mV over specified input range.

**Current Regulation:**
- Load: 0.05% of full current ±100μA for any voltage change.
- Line: 0.05% of full current over specified input range.

**Ripple:**
- 0.1% p-p +1Vrms

**Stability:**
- 0.02%hr. after 1 hour warm-up.

**Temperature Coefficient:**
- 100ppm/°C. Higher stability (50ppm/°C) available on special order via the HS option

**Environmental:**
- Temperature Range:
  - Operating: 0°C to 40°C
  - Storage: -40°C to 85°C
- Humidity:
  - 10% to 90% RH, non-condensing.

**Cooling:**
- Forced air; inlet through side panels, outlet at rear panel

**Metering:**
- Digital voltage and current meters, accurate to within 1%

**System Status Display:**
- “Dead Front” type indicators provide status of up to 12 system operations including voltage and current regulation, fault conditions and circuit control.
Analog Interface Connector:  
50 pin female D connector

High Voltage Output Cable:  
A detachable 10’ (3.05m) long shielded HV cable is provided

Dimensions:  
1kV to 120kV:  
10.5” (6U)H X 19” W X 21” D (266mm x 482mm x 533mm)  
150kV:  
10.5” (6U)H X 19” W X 23” D (266mm x 482mm x 584mm)

Weight:  
1kV to 50kV: <100 pounds (45.36kg)  
60kV to 120kV: <140 pounds (63.50kg)  
150kV: <150 pounds (68kg)  
Individual kV models may vary

Regulatory Approvals:  

Electronic Component (Power Source)  
STR series is intended for installation as a component of a system.  
It is designed to meet CE standards, with conditions of acceptance often being: customer provided enclosure mounting, EMC filtering, and appropriate protection, and isolation devices. The STR series is not intended to be operated by end users as a stand-alone device. The STR series power supply can only be fully assessed when installed within a system, and as a component part within that system.

### STR SELECTION TABLE

<table>
<thead>
<tr>
<th>MAXIMUM RATING</th>
<th>mA</th>
<th>MODEL NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>kV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>6,000</td>
<td>STR1*6</td>
</tr>
<tr>
<td>2</td>
<td>3,000</td>
<td>STR2*6</td>
</tr>
<tr>
<td>3</td>
<td>2,000</td>
<td>STR3*6</td>
</tr>
<tr>
<td>4</td>
<td>1,500</td>
<td>STR4*6</td>
</tr>
<tr>
<td>6</td>
<td>1,000</td>
<td>STR6*6</td>
</tr>
<tr>
<td>8</td>
<td>750</td>
<td>STR8*6</td>
</tr>
<tr>
<td>10</td>
<td>600</td>
<td>STR10*6</td>
</tr>
<tr>
<td>12</td>
<td>500</td>
<td>STR12*6</td>
</tr>
<tr>
<td>15</td>
<td>400</td>
<td>STR15*6</td>
</tr>
<tr>
<td>20</td>
<td>300</td>
<td>STR20*6</td>
</tr>
<tr>
<td>30</td>
<td>200</td>
<td>STR30*6</td>
</tr>
<tr>
<td>40</td>
<td>150</td>
<td>STR40*6</td>
</tr>
<tr>
<td>50</td>
<td>120</td>
<td>STR50*6</td>
</tr>
<tr>
<td>60</td>
<td>100</td>
<td>STR60*6</td>
</tr>
<tr>
<td>70</td>
<td>86</td>
<td>STR70*6</td>
</tr>
<tr>
<td>80</td>
<td>75</td>
<td>STR80*6</td>
</tr>
<tr>
<td>100</td>
<td>60</td>
<td>STR100*6</td>
</tr>
<tr>
<td>120</td>
<td>50</td>
<td>STR120*6</td>
</tr>
<tr>
<td>150</td>
<td>40</td>
<td>STR150*6</td>
</tr>
</tbody>
</table>

*Substitute “P” for positive polarity and “N” for negative polarity.  
Polarity must be specified at time of order.

1-10kV units are inherently reversible by design requiring an internal wiring change to swap polarities. Intermediate voltage units are available by special order.

Digital Interface  
The STR features a standard RS-232 and Ethernet digital interface. Utilizing these standard digital interfaces can dramatically simplify power supply interfacing requirements saving the user both time and money, while enhancing functionality and overall capability. Spellman provides a GUI with the STR that allows the customer to both customize operational features of the STR while also providing basic power supply operational features. Details of the STR’s digital interface capability are described in the STR manual, downloadable via the link on the first page of this data sheet.

Arc Intervention  
Spellman’s STR power supplies have an arc intervention feature that senses arc currents via a fast acting current sense transformer. The purpose of the arc intervention circuitry is to prevent power supply damage from continuous, long term arcing. The factory default configuration will trip off the unit with an Arc Fault if 4 arcs occur in a 10 second time period. Customers can change basic arc intervention parameters (Arc Count, Arc Quench, Reramp Time, and Window Time) within preset limits via the digital interface interface; customized units can be provided for unique arc prone environments, contact Spellman for details.

STR rear panel view
### JB1 STR ANALOG INTERFACE—50 PIN FEMALE D CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Supply Common</td>
<td>Power Supply Ground</td>
</tr>
<tr>
<td>2</td>
<td>Reset/HV Inhibit</td>
<td>Normally open, Low = Reset/Inhibit</td>
</tr>
<tr>
<td>3</td>
<td>External Interlock</td>
<td>+24Vdc @ open, &lt;25mA @ closed</td>
</tr>
<tr>
<td>4</td>
<td>External Interlock Return</td>
<td>Return for External Interlock</td>
</tr>
<tr>
<td>5</td>
<td>mA Test Point</td>
<td>0-10Vdc = 0-100% rated output, Zout= 1KΩ, 1%</td>
</tr>
<tr>
<td>6</td>
<td>kV Test Point</td>
<td>0-10Vdc = 0-100% rated output, Zout= 1KΩ, 1%</td>
</tr>
<tr>
<td>7</td>
<td>+10Vdc Reference Output</td>
<td>+10Vdc @ 1mA</td>
</tr>
<tr>
<td>8</td>
<td>mA Program Input</td>
<td>0-10Vdc = 0-100% rated output, Zin&gt;10MΩ</td>
</tr>
<tr>
<td>9</td>
<td>Local mA Program Output</td>
<td>0-10Vdc = 0-100% rated output, front panel pot</td>
</tr>
<tr>
<td>10</td>
<td>kV Program Input</td>
<td>0-10Vdc = 0-100% rated output, front panel pot</td>
</tr>
<tr>
<td>11</td>
<td>Local kV Program Output</td>
<td>0-10Vdc = 0-100% rated output, front panel pot</td>
</tr>
<tr>
<td>12</td>
<td>Remote Power On Output</td>
<td>+24Vdc @ open, 2A peak, 1Adc @ closed</td>
</tr>
<tr>
<td>13</td>
<td>Remote Power On Return</td>
<td>Return for Remote Power On</td>
</tr>
<tr>
<td>14</td>
<td>Remote HV Off</td>
<td>+24Vdc @ open, 2A peak, 1Adc @ closed, connect to pin15 for front panel operation</td>
</tr>
<tr>
<td>15</td>
<td>Remote HV On/Off COMMON</td>
<td>HV On/Off Common</td>
</tr>
<tr>
<td>16</td>
<td>Remote HV On</td>
<td>+24Vdc @ open, 2A peak, 1Adc @ closed, momentarily connect to pin 15 enable high voltage</td>
</tr>
<tr>
<td>17</td>
<td>HV Off Indicator</td>
<td>+24Vdc @ 25mA = HV Off</td>
</tr>
<tr>
<td>18</td>
<td>HV On Indicator</td>
<td>+24Vdc @ 25mA = HV On</td>
</tr>
<tr>
<td>19</td>
<td>Power Supply Common</td>
<td>Supply Ground</td>
</tr>
<tr>
<td>20</td>
<td>+24Vdc Output</td>
<td>+24Vdc @ 100mA, maximum</td>
</tr>
<tr>
<td>21</td>
<td>Voltage Mode Status</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>22</td>
<td>Current Mode Status</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>23</td>
<td>Power Mode Status</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>24</td>
<td>Interlock Closed Status</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>25</td>
<td>Power Test Point</td>
<td>0-10Vdc = 0-100% rated output, Zout= 5KΩ, 1%</td>
</tr>
<tr>
<td>26</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Remote Overvoltage Adjust</td>
<td>0-10Vdc = 0-100% rated output</td>
</tr>
<tr>
<td>29</td>
<td>Over Power Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>30</td>
<td>Over Voltage Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>31</td>
<td>Over Current Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>32</td>
<td>System Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>33</td>
<td>HGLT Error Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>34</td>
<td>Arc</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>35</td>
<td>Over Temp Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>36</td>
<td>AC Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>37</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Remote Power Program Input</td>
<td>0-10Vdc = 0-100% rated output, Zin&gt;10MΩ</td>
</tr>
<tr>
<td>43</td>
<td>Local Power Program Output</td>
<td>0-10Vdc = 0-100% rated output, internal pot</td>
</tr>
<tr>
<td>44</td>
<td>+5Vdc Output</td>
<td>+5Vdc @ 100mA, maximum</td>
</tr>
<tr>
<td>45</td>
<td>+15Vdc Output</td>
<td>+15Vdc @ 100mA, maximum</td>
</tr>
<tr>
<td>46</td>
<td>-15Vdc Output</td>
<td>-15Vdc @ 10mA, maximum</td>
</tr>
<tr>
<td>47</td>
<td>RS232 Tx</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>RS232 Rx</td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>RS232 GND</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>Power Supply Common</td>
<td>Power Supply Ground</td>
</tr>
</tbody>
</table>

**DIMENSIONS:** in.[mm]

**FRONT VIEW**

**TOP VIEW**

**BACK VIEW**
Spellman’s ST Series of 12kW high voltage power supplies are available in positive or negative polarities in 20 different models with outputs ranging from 1kV to 225kV. A full featured front panel allows easy local control, while an extensive analog interface provides comprehensive remote capability. The standard Ethernet and RS-232 digital interfaces simplify integrating the ST into your system design.

The ST’s robust IGBT inverter is inherently fault tolerant and is ideal for demanding applications like semiconductor processing and vacuum deposition. Many operational features can be configured by the user to suit their particular requirements. Power >100kW’s can be provided by configuring additional chassis in parallel.

**TYPICAL APPLICATIONS**
- Ion Beam Implantation
- Semiconductor Processing
- Electron Beam Welding
- Capacitor Charging
- High Power RF Transmitters
- Electrostatic Precipitators
- X-Ray Systems

**HARDWARE BASED OPTIONS**
- BFP: Blank Front Panel
- HS: High Stability
- LL(X): High Voltage Cable Length
- 400VAC: 360-528Vac Input

**SOFTWARE CONFIGURABLE FEATURES**
- Adjustable Overload Trip
- Arc Trip Count
- Arc Quench Time
- Arc Re-Ramp Time
- Constant Power Control
- Adjustable Power Trip
- Slow Start Ramp Times

**SPECIFICATIONS**
- **Input Voltage:**
  - Standard: 180-264Vac, 50/60Hz, three phase, 90% efficiency, 0.85 power factor
  - Optional: 360-528Vac 50/60Hz, three phase (400Vac)
- **Input Current:**
  - Standard: 180-264Vac, three phase; 50 amps, maximum
  - Optional: 360-528Vac, three phase; 25 amps, maximum
- **Output Voltage:**
  - 20 models from 1kV to 225kV. Each model is available with positive or negative outputs. 1kV to 10kV units are internally reversible.
- **Local Output Controls:**
  - Voltage and current are continuously adjustable over entire range via ten-turn potentiometers with lockable counting dials.
- **Voltage Regulation:**
  - Load: 0.05% of full voltage +500mV for full load change.
  - Line: 0.05% of full voltage +500mV over specified input range.
- **Current Regulation:**
  - Load: 0.05% of full current ±100µA for any voltage change.
  - Line: 0.05% of full current over specified input range.
- **Ripple:**
  - 0.3% p-p +1Vrms. Lower ripple available via special order
- **Stability:**
  - 0.02%hr. after 1 hour warm-up.
- **Temperature Coefficient:**
  - 100ppm/°C. Higher stability (50ppm/°C) available on special order via the HS option
- **Environmental:**
  - Temperature Range:
    - Operating: 0°C to 40°C
    - Storage: -40°C to 85°C
  - Humidity: 10% to 90% RH, non-condensing.
- **Cooling:**
  - Forced air; inlet through side panels, outlet at rear panel
- **Metering:**
  - Digital voltage and current meters, accurate to within 1%
- **System Status Display:**
  - “Dead Front” type indicators provide status of up to 12 system operations including voltage and current regulation, fault conditions and circuit control.
- **Input Line Connector:**
  - A 6 foot (1.8 meter) long captive line cord is provided.

www.spellmanhv.com/manuals/ST

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Analog Interface Connector:
50 pin female D connector

High Voltage Output Cable:
1-150kV: A detachable 10’ (3.05m) long shielded HV cable is provided
225kV: R-28 type X-Ray connector. No output cable is provided

Dimensions:
1kV to 120kV:
10.5” (6U)H X 19” W X 21” D (266mm x 482mm x 533mm)
150kV:
10.5” (6U)H X 19” W X 23” D (266mm x 482mm x 584mm)
225kV:
20.55” H X 17.01” W X 29.7” D (521mm x 432mm x 754mm)

Weight:
1kV to 50kV: <100 pounds (45.36kg)
60kV to 120kV: <140 pounds (63.50kg)
150kV: <150 pounds (68.03kg)
225kV: <260 pounds (117.9kg)
Individual kV models may vary

Regulatory Approvals:

Electronic Component (Power Source)
ST series is intended for installation as a component of a system. It is designed to meet CE standards, with conditions of acceptance often being: customer provided enclosure mounting, EMC filtering, and appropriate protection, and isolation devices. The ST series is not intended to be operated by end users as a stand-alone device. The ST series power supply can only be fully assessed when installed within a system, and as a component part within that system.

Parallel Capability
The ST series is designed to offer additional power capability by adding a chassis in parallel to create a main/secondary configuration providing up to and beyond 100kWs. The main chassis is the point of connection for customer interfacing; this multi-chassis system effectively functions as a single power supply. The main unit retains the full featured front panel, while secondary units have a Blank Front Panel. To configure an orderable model number, simply use Spellman’s applicable base ST model number and increment the power denominator in 12kW steps as required:

ST60P24 This would be an ST with a 60kV, positive polarity, providing 24kW’s of power (2 chassis)

Digital Interface
The ST features a standard RS-232 and Ethernet digital interface. Utilizing these standard digital interfaces can dramatically simplify power supply interfacing requirements saving the user both time and money, while enhancing functionality and overall capability. Spellman provides a GUI with the ST that allows the customer to both customize operational features of the ST while also providing basic power supply operational features. Details of the ST’s digital interface capability are described in the ST manual, downloadable via the link on the first page of this data sheet.

Arc Intervention
Spellman’s ST power supplies have an arc intervention feature that senses arc currents via a fast acting current sense transformer. The purpose of the arc intervention circuitry is to prevent power supply damage from continuous, long term arcing. The factory default configuration will trip off the unit with an Arc Fault if 4 arcs occur in a 10 second time period. Customers can change basic arc intervention parameters (Arc Count, Arc Quench, Reramp Time, and Window Time) within preset limits via the digital interface interface; customized units can be provided for unique arc prone environments, contact Spellman for details.
**MAXIMUM RATING** | **MODEL NUMBER**
---|---
12,000 | ST1*12
6,000 | ST2*12
4,000 | ST3*12
3,000 | ST4*12
2,000 | ST6*12
1,500 | ST8*12
1,200 | ST10*12
1,000 | ST12*12
800 | ST15*12
600 | ST20*12
400 | ST30*12
300 | ST40*12
240 | ST50*12
200 | ST60*12
171 | ST70*12
150 | ST80*12
120 | ST100*12
100 | ST120*12
67 | ST130*10
40 | ST225*10

*Substitute "P" for positive polarity and "N" for negative polarity. Polarity must be specified at time of order.

**NOTE:** ST225 units cannot be paralleled.

**Parallel operation:**
Additional power can be provided in increments of 12kW's by connecting chassis in parallel via the use of the ST’s main/secondary configuration.

Use the applicable base ST model number and increment the power denominated in 12kW steps as required.

ST10P24 10kV @ 24kW's
ST10P36 10kV @ 36kW's
ST10P48 10kV @ 48kW's

**JB1 ST ANALOG INTERFACE—50 PIN FEMALE D CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Supply Common</td>
<td>Power Supply Ground</td>
</tr>
<tr>
<td>2</td>
<td>Reset(HV Inhibit)</td>
<td>Normally open, Low = Reset/Inhibit</td>
</tr>
<tr>
<td>3</td>
<td>External Interlock</td>
<td>+24Vdc @ open, &lt;25mA @ closed</td>
</tr>
<tr>
<td>4</td>
<td>External Interlock Return</td>
<td>Return for External Interlock</td>
</tr>
<tr>
<td>5</td>
<td>mA Test Point</td>
<td>0-10Vdc = 0-100% rated output, Zout= 1KΩ, 1%</td>
</tr>
<tr>
<td>6</td>
<td>kV Test Point</td>
<td>0-10Vdc = 0-100% rated output, Zout= 1KΩ, 1%</td>
</tr>
<tr>
<td>7</td>
<td>+10Vdc Reference Output</td>
<td>+10Vdc @ 1mA</td>
</tr>
<tr>
<td>8</td>
<td>mA Program Input</td>
<td>0-10Vdc = 0-100% rated output, Zin&gt;10MΩ</td>
</tr>
<tr>
<td>9</td>
<td>Local mA Program Output</td>
<td>0-10Vdc = 0-100% rated output, front panel pot</td>
</tr>
<tr>
<td>10</td>
<td>kV Program Input</td>
<td>0-10Vdc = 0-100% rated output, Zin&gt;10MΩ</td>
</tr>
<tr>
<td>11</td>
<td>Local kV Program Output</td>
<td>0-10Vdc = 0-100% rated output, front panel pot</td>
</tr>
<tr>
<td>12</td>
<td>Remote Power On Output</td>
<td>+24Vdc @ open, 2A peak, 1Adc @ closed</td>
</tr>
<tr>
<td>13</td>
<td>Remote Power On Return</td>
<td>Return for Remote Power On</td>
</tr>
<tr>
<td>14</td>
<td>Remote HV Off</td>
<td>+24Vdc @ open, 2A peak, 1Adc @ closed, connect to pin 15 for front panel operation</td>
</tr>
<tr>
<td>15</td>
<td>Remote HV Off/On Common</td>
<td>HV On/Off Common</td>
</tr>
<tr>
<td>16</td>
<td>Remote HV On</td>
<td>+24Vdc @ open, 2A peak, 1Adc @ closed, momentarily connect to pin 15 enable high voltage</td>
</tr>
<tr>
<td>17</td>
<td>HV Off Indicator</td>
<td>+24Vdc @ 25mA = HV Off</td>
</tr>
<tr>
<td>18</td>
<td>HV On Indicator</td>
<td>+24Vdc @ 25mA = HV On</td>
</tr>
<tr>
<td>19</td>
<td>Power Supply Common</td>
<td>Supply Ground</td>
</tr>
<tr>
<td>20</td>
<td>+24Vdc Output</td>
<td>+24Vdc @ 100mA, maximum</td>
</tr>
<tr>
<td>21</td>
<td>Voltage Mode Status</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>22</td>
<td>Current Mode Status</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>23</td>
<td>Power Mode Status</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>24</td>
<td>Interlock Closed Status</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>25</td>
<td>Power Test Point</td>
<td>0-10Vdc = 0-100% rated output, Zout= 5KΩ, 1%</td>
</tr>
<tr>
<td>26</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Remote Overvoltage Adjust</td>
<td>0-10Vdc = 0-100% rated output</td>
</tr>
<tr>
<td>29</td>
<td>Over Power Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>30</td>
<td>Over Voltage Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>31</td>
<td>Over Current Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>32</td>
<td>System Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>33</td>
<td>RGLT Error Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>34</td>
<td>Arc</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>35</td>
<td>Over Temp Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>36</td>
<td>AC Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>37</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Remote Power Program Input</td>
<td>0-10Vdc = 0-100% rated output, Zin&gt;10MΩ</td>
</tr>
<tr>
<td>43</td>
<td>Local Power Program Output</td>
<td>0-10Vdc = 0-100% rated output, internal pot</td>
</tr>
<tr>
<td>44</td>
<td>+5Vdc Output</td>
<td>+5Vdc @ 100mA, maximum</td>
</tr>
<tr>
<td>45</td>
<td>+15Vdc Output</td>
<td>+15Vdc @ 100mA, maximum</td>
</tr>
<tr>
<td>46</td>
<td>-15Vdc Output</td>
<td>-15Vdc @ 10mA, maximum</td>
</tr>
<tr>
<td>47</td>
<td>RS232 Tx</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>RS232 Rx</td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>RS232 GND</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>Power Supply Common</td>
<td>Power Supply Ground</td>
</tr>
</tbody>
</table>
12kW->100kW POWER SUPPLY

SPELLMAN HIGH VOLTAGE ELECTRONICS CORPORATION

1kV-150kV

DIMENSIONS: in.[mm]

FRONT VIEW

TOP VIEW

BACK VIEW

DANGER
TO REDUCE THE RISK OF ELECTRICAL SHOCK DO NOT REMOVE ANY PANES UNTIL 5 MINUTES HAVE ELAPSED AFTER TURNING OFF EQUIPMENT.

DANGER
HIGH VOLTAGE
SPELLMAN HIGH VOLTAGE ELECTRONICS CORP.
Plainview, NY 11803        MADE IN USA

PART NO:
MODEL:
SERIAL NO:
OUTPUT:
INPUT:

Hight Voltage Output
Keep Fan and Vent Holes Clear
Line Input
Remote Interface
JB1
CB1
JB2

AIR INTAKE
AIR EXHAUST
AIR INTAKE
AIR EXHAUST

150kV Unit
23.00 [584.20]
150kV Unit
24.83 [630.68]
10.47 [265.94]
7.50 [190.53] 2 PL
2.25 [57.15] 2 PL
1.45 [37.59] 2 PL
0.38 [9.65] 18.25 [463.55]
19.00 [482.60]
19.25 TYP [6.35]
2 PL

17.00 [431.80]
DIMENSIONS: in.[mm]

TOP VIEW

29.70 [754.38]

AIR INTAKE

SIDESHOW VIEW

16.30 [414.02]

AIR EXHAUST

AIR INTAKE

FRONT VIEW

REAR VIEW

NOTE:
Blank front panel on ST 225kV units

20.55 [521.97]
Spellman’s XLG Series of X-Ray generators are well regulated high voltage power supplies with output voltages to 130kV and very low ripple achieved through the use of advanced resonant conversion techniques. Extremely stable voltage and emission current outputs result in significant performance improvements over previously available technology. The XLG Series provides all the power, control and support functions required for X-Ray applications including a regulated dc filament supply. These units incorporate local and remote programming, monitoring, safety interlock, short-circuit and overload protection.

**TYPICAL APPLICATIONS**
- Plating Measurement
- Mineral Analysis
- X-Ray Fluorescence

**OPTIONS**
- APT: Adjustable Power Trip
- AT: Arc Trip
- SS(x): Non-Standard Slow Start
- NSS: No Slow Start
- IO: Instant ON
- LL(x): Extra Length HV Cable
- SL: Slides

**FRONT PANEL STATUS INDICATORS:**
- Overvoltage: Voltage Control Mode
- Overtemperature: Current Control Mode
- Regulation Error: Interlock Open
- Arc: Interlock Closed
- HV ON: Red
- HV OFF: Green

**SPECIFICATIONS**

**Input Voltage:**
- 115Vac±10%, 50-60Hz single phase or
- 220Vac±10%, 50-60Hz single phase.
  For input current see table on page 2.

**Voltage and Current Control:**
- Local: continuously adjustable from zero to maximum rating via a ten-turn potentiometer with a lockable counting dial.
- Remote: 0 to +10Vdc proportional from 0 to full output.
  Accuracy: ±1%. Input Impedance: 10Mohm.

**Filament:**
- Specify at time of order:
  - FH: 9A, 3V.
  - FL: 3A, 3V.
  Preheat level is 0.45 amps in standby

**Voltage Regulation:**
- Load: 0.005% of full output voltage no load to full load.
- Line: 0.005% for input voltage range change.

**Current Regulation:**
- Load: 0.05% of full current ±100μA from 0 to full voltage.
- Line: 0.05% of rated current over specified input range.

**Ripple:**
- 0.03% rms below 1kHz.
- 0.75% rms above 1kHz.

**Temperature Coefficient:**
- 100ppm/°C.

**Stability:**
- 0.01%/8 hrs after 1/2 hour warm-up.
- 0.02% per 8 hours (typical).

**Cooling:**
- Free air convection.

**Metering:**
- Digital voltage and current meters (3.5 digits),
  1% accuracy.

**HV Output Cable:**
- 10’ (3.3m) of shielded HV cable removable at rear.

**I/O Connectors:**
- 25 pin D-type for control interface with mating connector provided.

**Dimensions:**
- 30 to 60kV:
  - 3.5”H x 19”W x 19”D (8.9cm x 48.3cm x 48.3cm).
- 80 to 130kV:
  - 3.5”H x 19”W x 24”D (8.9cm x 48.3cm x 61.0cm).

**Regulatory Approvals:**
- Compliant to EEC EMC Directive.
- Compliant to EEC Low Voltage Directive. RoHS Compliant.

Electronic Component (Power Source)

XLG series is intended for installation as a component of a system. It is designed to meet CE standards, with conditions of acceptance often being: customer provided enclosure mounting, EMC filtering, and appropriate protection, and isolation devices. The XLG series is not intended to be operated by end users as a stand-alone device. The XLG series power supply can only be fully assessed when installed within a system, and as a component part within that system.
### XLG SELECTION TABLE 0.1mA, 0.2mA, 0.5mA

<table>
<thead>
<tr>
<th>kV</th>
<th>0.1mA</th>
<th>0.2mA</th>
<th>0.5mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>XLG30P3*</td>
<td>XLG30P6*</td>
<td>XLG30P15*</td>
</tr>
<tr>
<td>35</td>
<td>XLG35P3.5*</td>
<td>XLG35P7*</td>
<td>XLG35P17.5*</td>
</tr>
<tr>
<td>40</td>
<td>XLG40P4*</td>
<td>XLG40P8*</td>
<td>XLG40P20*</td>
</tr>
<tr>
<td>50</td>
<td>XLG50P5*</td>
<td>XLG50P10*</td>
<td>XLG50P30*</td>
</tr>
<tr>
<td>60</td>
<td>XLG60P6*</td>
<td>XLG60P12*</td>
<td>XLG60P30*</td>
</tr>
<tr>
<td>80</td>
<td>XLG80P8*</td>
<td>XLG80P16*</td>
<td>XLG80P40*</td>
</tr>
<tr>
<td>100</td>
<td>XLG100P10*</td>
<td>XLG100P20*</td>
<td>XLG100P50*</td>
</tr>
<tr>
<td>120</td>
<td>XLG120P12*</td>
<td>XLG120P24*</td>
<td>XLG120P60*</td>
</tr>
<tr>
<td>130</td>
<td>XLG130P13*</td>
<td>XLG130P26*</td>
<td>XLG130P65*</td>
</tr>
</tbody>
</table>

*Specify FH for High power (27W) filament, FL for Low power (9W) filament.

### XLG SELECTION TABLE 1.0mA, 2.0mA, 3.0mA

<table>
<thead>
<tr>
<th>kV</th>
<th>1.0mA</th>
<th>2.0mA</th>
<th>3.0mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>XLG30P30*</td>
<td>XLG30P60*</td>
<td>XLG30P90*</td>
</tr>
<tr>
<td>35</td>
<td>XLG35P35*</td>
<td>XLG35P70*</td>
<td>XLG35P105*</td>
</tr>
<tr>
<td>40</td>
<td>XLG40P40*</td>
<td>XLG40P80*</td>
<td>XLG40P120*</td>
</tr>
<tr>
<td>50</td>
<td>XLG50P50*</td>
<td>XLG50P100*</td>
<td>XLG50P150*</td>
</tr>
<tr>
<td>60</td>
<td>XLG60P60*</td>
<td>XLG60P120*</td>
<td>XLG60P180*</td>
</tr>
<tr>
<td>80</td>
<td>XLG80P80*</td>
<td>XLG80P160*</td>
<td>---</td>
</tr>
<tr>
<td>100</td>
<td>XLG100P100*</td>
<td>XLG100P200*</td>
<td>---</td>
</tr>
<tr>
<td>120</td>
<td>XLG120P120*</td>
<td>XLG120P240*</td>
<td>---</td>
</tr>
<tr>
<td>130</td>
<td>XLG130P130*</td>
<td>XLG130P260*</td>
<td>---</td>
</tr>
</tbody>
</table>

*Specify FH for High power (27W) filament, FL for Low power (9W) filament.

### XLG INPUT CURRENT

<table>
<thead>
<tr>
<th>MODEL</th>
<th>115Vac</th>
<th>220Vac</th>
</tr>
</thead>
<tbody>
<tr>
<td>3W-30W</td>
<td>0.6A</td>
<td>0.3125A</td>
</tr>
<tr>
<td>40W-60W</td>
<td>1.2A</td>
<td>0.625A</td>
</tr>
<tr>
<td>70W-150W</td>
<td>3.0A</td>
<td>1.56A</td>
</tr>
<tr>
<td>160W-260W</td>
<td>5.25A</td>
<td>2.71A</td>
</tr>
</tbody>
</table>

### XLG CONNECTOR 25 PIN

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Supply Common</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>2</td>
<td>External Inhibit</td>
<td>Ground=Inhibit, Open=HV On</td>
</tr>
<tr>
<td>3</td>
<td>External Interlock</td>
<td>+15V at Open, &lt;15mA at Closed</td>
</tr>
<tr>
<td>4</td>
<td>External Interlock Return</td>
<td>Return for Interlock</td>
</tr>
<tr>
<td>5</td>
<td>Current Monitor</td>
<td>0 to 10V=0 to 100% Rated Output</td>
</tr>
<tr>
<td>6</td>
<td>kV Test Point</td>
<td>0 to 10V=0 to 100% Rated Output</td>
</tr>
<tr>
<td>7</td>
<td>+10V Reference</td>
<td>+10V, 1mA Max</td>
</tr>
<tr>
<td>8</td>
<td>Remote Current Program In</td>
<td>0 to 10V=0 to 100% Rated Output</td>
</tr>
<tr>
<td>9</td>
<td>Local Current Program Out</td>
<td>Front Panel Program Voltage</td>
</tr>
<tr>
<td>10</td>
<td>Remote Voltage Program In</td>
<td>0 to 10V=0 to 100% Rated Output</td>
</tr>
<tr>
<td>11</td>
<td>Local Voltage Program Out</td>
<td>Front Panel Program Voltage</td>
</tr>
<tr>
<td>12</td>
<td>Power Monitor</td>
<td>0 to 10V=0 to 100% Rated Output (Optional)</td>
</tr>
<tr>
<td>13</td>
<td>Remote Power Program In</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Local HV Off Out</td>
<td>+15V at Open, &lt;25mA at Closed</td>
</tr>
<tr>
<td>15</td>
<td>HV Off</td>
<td>Connect to HV OFF for Fp Operation</td>
</tr>
<tr>
<td>16</td>
<td>Remote HV On</td>
<td>+15V, 0mA Max=HV Off</td>
</tr>
<tr>
<td>17</td>
<td>Remote HV Off Indicator</td>
<td>0=HV On, +15V, 10mA Max=HV Off</td>
</tr>
<tr>
<td>18</td>
<td>Remote HV On Indicator</td>
<td>0=HV Off, +15V, 10mA Max=HV On</td>
</tr>
<tr>
<td>19</td>
<td>Remote Voltage Mode</td>
<td>Open Collector 50V Max, 10mA Max</td>
</tr>
<tr>
<td>20</td>
<td>Remote Current Mode</td>
<td>On=Active</td>
</tr>
<tr>
<td>21</td>
<td>Remote Power Mode</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Remote PS Fault</td>
<td>0=Fault, +15V, 0.1mA Max=No Fault</td>
</tr>
<tr>
<td>23</td>
<td>+15V Output</td>
<td>+15V, 10mA Max</td>
</tr>
<tr>
<td>24</td>
<td>Power Supply Common</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>25</td>
<td>Shield Return</td>
<td>Shield Return</td>
</tr>
</tbody>
</table>
The XMPF is a modular 10kV @ 5W X-Ray generator designed to drive a floating filament X-Ray tube via closed loop filamentary control of the 0 to 500μA emission current. The floating filament supply is rated at 0 to 0.42 amps @ 3.5Vac. The filament supply features an adjustable 0 to 0.42 amp filament limit.

The high voltage program and emission current program have internal preset capability simplify interfacing to this X-Ray generator. Alternatively, a customer provided 0 to 10Vdc signal can be used to remotely control these two signals. A high voltage monitor signal and emission current monitor signal is provided. Additionally a filament current monitor signal is also provided. A High Voltage Enable input provides control of the high voltage output.

**SPECIFICATIONS**

**Input Voltage:**
+24 Vdc, ±10%

**Input Current:**
500mA maximum

**Cathode Supply:**
Voltage: 10kV, controllable over the range 20V to 10kV
Accuracy: <2%
Polarity: Negative
Line Regulation: <0.05% for input voltage change of ±10%
Load Regulation: <0.1% for zero to full load
Stability: <0.1% per 24 hours at constant operating conditions, after 30 minutes warm up
Temperature Coefficient: <250 ppm/°C
Ripple: <0.01% p-p of output voltage at full voltage and current
Output Current Limit: 550μA ±10%
Ramp Rate: <20kV/sec

**Current Characteristics:**
Maximum Emission Current: 500μA
Stability: 0.5% using the internal reference and setting potentiometer. For increased stability an external reference can be used.

**Filament Supply:**
Voltage: 0V to 3.5Vac referenced to Cathode output
Load Current: 0.42A max, pre set adjustable limit
Stability: <0.1% over a 30 minute period at constant operating conditions.

**Environmental:**
Temperature Range:
- Operating: 5˚C to 40˚C
- Storage: -40˚C to 70˚C
Humidity:
- Operating: 20% to 80% RH, non-condensing
- Storage: 5% to 95%

**High Voltage Output:**
Flying leads, Reynolds 18kV rated FEP insulated wire, 1.02mm diameter. Conductors are 19/40 AWG. Overall length is 500mm, the two wires are sleeved together.

**Dimensions:**
1.18”H x 2.75”W x 6.69”D
(30mm x 70mm x 170mm)

**Regulatory Approvals:**
Compliant to CE Safety marking to meet the requirements of EN61010, Installation cat II, safety class 1, poll. degree 2 and UL61010A-1 and CSA 1010. RoHS compliant.

As the unit is designed for incorporation within the users system it is not tested against any specific EMC standards. The user will need to take sensible EMC precautions when designing the unit in and verify the overall system EMC performance against any relevant standards.
### CUSTOMER INTERFACE — 15 PIN MALE D CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24Vdc</td>
<td>+24Vdc @ 500mA, max.</td>
</tr>
<tr>
<td>2</td>
<td>Power Ground</td>
<td>Power Ground</td>
</tr>
<tr>
<td>3</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>4</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>5</td>
<td>HV Enable</td>
<td>0-0.6V = HV ON, 2.4V-12V = HV OFF</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>7</td>
<td>HV Program Output</td>
<td>Wiper of multi turn potentiometer</td>
</tr>
<tr>
<td>8</td>
<td>HV Program Input</td>
<td>0-10Vdc = 0-10kV, Zin = 10MΩ, accuracy ±2% of FS</td>
</tr>
<tr>
<td>9</td>
<td>High Voltage Monitor</td>
<td>0-10Vdc = 0-10kV, Zout = 10kΩ, accuracy ±2% of FS</td>
</tr>
<tr>
<td>10</td>
<td>Emission Current Monitor</td>
<td>0-10Vdc = 0-500mA, Zout = 10kΩ, accuracy ±5% of FS</td>
</tr>
<tr>
<td>11</td>
<td>Filament Current Monitor</td>
<td>0-10Vdc = 0-500mA, Zout = 10kΩ, accuracy ±3% of FS</td>
</tr>
<tr>
<td>12</td>
<td>Emission Current Program Input</td>
<td>0-10Vdc = 0-500mA, Zin = 10MΩ, accuracy ±3% of FS</td>
</tr>
<tr>
<td>13</td>
<td>Emission Current Program Output</td>
<td>Wiper of multi turn potentiometer</td>
</tr>
<tr>
<td>14</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>15</td>
<td>Filament Current Limit</td>
<td></td>
</tr>
</tbody>
</table>

The filament current limit is set by internal preset potentiometers accessible through the side of the case.

If external high voltage programming is not required link pins 7 and 8.
If external emission current control is not required link pins 12 and 13.
The XMPG is a modular 10kV @ 10W X-Ray generator designed to drive a grounded filament X-Ray tube via closed loop filamentary control of the 0 to 1mA emission current. The grounded filament supply is rated at 0-5 amps @ 3Vdc. The filament supply features an internally adjustable 0.5 to 2.5 amp filament preheat and a internally adjustable 0 to 5 amp filament limit.

The high voltage program and emission current program have internal preset capability simplify interfacing to this X-Ray generator. Or a customer provided 0 to 10Vdc signal can be used to remotely control these two signals. A high voltage monitor signal and emission current monitor signal is provided. A High Voltage Enable input provides control of the high voltage output and a Filament Stable output indicates the filament current is stable and the X-Ray tube is producing X-Rays.

**SPECIFICATIONS**

**Input Voltage:**
+24 Vdc, ±10%

**Input Current:**
2 amp maximum

**Output Voltage:**
10kV, controllable over the range 4kV to 10kV

**Voltage Accuracy:**
<2%

**Polarity:**
Positive

**Voltage Regulation:**
- Line: <0.01% for input voltage change of ±10%
- Load: <0.01% for zero to full load

**Voltage Stability:**
- < 0.1% per 24 hours at constant operating conditions, after 30 minutes warm up

**Ripple:**
- < 500mV p-p of output voltage at full load

**Ramp Rate:**
- < 20kV/second

**Temperature Coefficient:**
- <250ppm per degree C

**Output Voltage 4kV to 10kV**

**Integrated Ground Referenced Filament Supply**

**Low Ripple**

**Local and Remote Programming**

**OEM Customization Available**

**Current Regulation:**
- Line: ≤0.01% for 1V input voltage change under any load conditions
- Load: ≤0.01% for full load to short circuit

**Emission Current:**

- 0-1mA

**Current Accuracy:**
- <1% (above 10% of maximum output current)

**Current Stability:**
- < 0.02%

**Environmental:**
- Temperature Range:
  - Operating: 5°C to 40°C
  - Storage: -40°C to 70°C
- Humidity:
  - Operating: 20% to 80% RH, non-condensing
  - Storage: 5% to 95%

**Filament Supply:**
- Voltage: 0V to 3Vdc referenced to ground
- Load Current: 5A max, preset adjustable limit
- Stability: < 0.25% per 8 hours at constant operating conditions
- Ripple: <50mV p-p (at maximum load current).

**Filament Output:**
- A captive 500mm long unterminated 16 AWG twisted wire pair is provided.

**High Voltage Output:**
- A captive 500mm long unterminated length of URM76 shielded cable
- A red High Voltage On LED is provided next to the high voltage output to indicate that high voltage is being produced by the unit

**Dimensions:**
- 1.31”H x 4.13”W x 7.28”D (33.5mm x 105mm x 185mm)

**Regulatory Approvals:**
- Compliant to CE Safety marking to meet the requirements of EN61010, Installation cat II, safety class 1, poll. degree 2 and UL61010A-1 and CSA 1010.
- As the unit is designed for incorporation within the users system it is not tested against any specific EMC standards. The user will need to take sensible EMC precautions when designing the unit in and verify the overall system EMC performance against any relevant standards.
- RoHS compliant.

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128122-001 REV. A

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**FILAMENT OUTPUT**

<table>
<thead>
<tr>
<th>COLOR</th>
<th>NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>Filament +</td>
</tr>
<tr>
<td>Black</td>
<td>Filament -</td>
</tr>
</tbody>
</table>

**CUSTOMER INTERFACE—15 PIN MALE D CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24Vdc</td>
<td>+24Vdc</td>
</tr>
<tr>
<td>2</td>
<td>Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>3</td>
<td>Preheat (set value)</td>
<td>0-5Vdc from internal preset</td>
</tr>
<tr>
<td>4</td>
<td>Test (Filament Current</td>
<td>Do not connect</td>
</tr>
<tr>
<td></td>
<td>Direct Program)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>HV Enable</td>
<td>Digital Input</td>
</tr>
<tr>
<td>6</td>
<td>Filament Stable</td>
<td>Digital Output</td>
</tr>
<tr>
<td>7</td>
<td>HV Program Output</td>
<td>0-10Vdc from Internal Preset</td>
</tr>
<tr>
<td>8</td>
<td>HV Program Input</td>
<td>0-10Vdc Input</td>
</tr>
<tr>
<td>9</td>
<td>High Voltage Monitor</td>
<td>0-10Vdc Output</td>
</tr>
<tr>
<td>10</td>
<td>Emission Current Monitor</td>
<td>0-10Vdc Output</td>
</tr>
<tr>
<td>11</td>
<td>Filament Current Monitor</td>
<td>0-10Vdc Output</td>
</tr>
<tr>
<td>12</td>
<td>Emission Current Program Input</td>
<td>0-10Vdc Input</td>
</tr>
<tr>
<td>13</td>
<td>Emission Current Program Output</td>
<td>0-10Vdc from Internal Preset</td>
</tr>
<tr>
<td>14</td>
<td>Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>15</td>
<td>Preset Max. Filament Current</td>
<td>0-10Vdc from Internal Preset</td>
</tr>
<tr>
<td></td>
<td>(set value)</td>
<td></td>
</tr>
</tbody>
</table>

The filament Preheat level and current limit are set by internal preset potentiometers accessible through the side of the case.

If external high voltage enable control is not required link pins 7 and 8.
If external emission current control is not required link pins 12 and 13.
The MNX Series is the result of Spellman’s exceptional high voltage packaging and surface mount fabrication techniques coupled with proprietary encapsulation technology producing this ultra-compact X-Ray generator module. The MNX powers grounded cathode X-Ray tubes from a variety of well-known manufacturers, featuring a 0 to 50kV/65kV high voltage output @ 2mA limited to 50, 65 or 75 Watts. The MNX uses closed loop filament control circuitry providing highly regulated beam current. The ground referenced low noise dc filament supply operates between 0.3 and 3.5 amps. Offering tight regulation, high stability and low ripple, the MNX provides users local and remote analog control to set beam voltage, emission current and filament current limit.

TYPICAL APPLICATIONS

Powering grounded cathode X-ray tubes from Kevex, Oxford, RTW, Superior, Varex, Petrick and Trufocus.

OPTIONS

XCC XRM Compatible HV Cable (50kV only)
5VPM 0 to 5 Volt Programming and Monitor Scaling
5302 Mammoflex HV cable for MNX
2001 Mammoflex HV cable for MNX w/XCC option

SPECIFICATIONS

Input Voltage:
+24Vdc ±10%, for 50W or 75W units
+24Vdc ±1%, for 65kV @ 65W unit

Input Current:
MNX50P50: 4.0 amps, maximum
MNX50P75: 6.0 amps, maximum
MNX65P65: 5.0 amps, maximum
GB Option: 1.0 amp additional, maximum

Efficiency:
80-85%, typical

Output:
0 to 50kV at 0 to 2mA, limited to a maximum of 50 watts or 75 Watts. 0-65kV at 2mA limited to 65 Watts.

Voltage Control:
Local: Internal multi-turn potentiometer to set voltage from 0 to full output voltage.
Remote: 0 to +10Vdc proportional from 0 to full output current. Accuracy: ±1%. Zin: 10Mohm.

Emission Control:
Local: Internal potentiometer to set beam current between 0 and full output current.
Remote: 0 to +10Vdc proportional from 0 to full output current. Accuracy: ±1%. Zin: 10Mohm. Filament limit and filament preheat control capability is also provided.

DC Filament Supply:
Current: 3.5A, adjustable limit
Voltage: 5.0 volt limit

Voltage Regulation:
Load: 0.01% of output voltage no load to full load.
Line: ±0.01% for ±10% change in input voltage.

Current Regulation:
Load: 0.01% of output current from 0 to rated voltage.
Line: ±0.01% for ±10% change in input voltage.

Ripple:
0.1% p-p of maximum rated output voltage, 50kV units (50/75W)
0.1% rms maximum rated output voltage, 65kV units (65W)

Environmental:
Operational: 0°C to +50°C
Storage: -40°C to +85°C
Humidity: 0% to 90%, non-condensing

Temperature Coefficient:
0.01% per °C, voltage and current.

Stability:
0.05% per 8 hours after 1/2 hour warm-up.

Voltage and Current Monitors:
0 to +10Vdc proportional from 0 to rated output. Accuracy ±1%.

Dimensions:
50kV Unit: 5.00"H x 2.87"W x 8"D
(127.00mm x 72.90mm x 203.25mm)
65kV Unit: 5.00"H x 2.87"W x 9"D
(127.00mm x 72.90mm x 228.65mm)
XCC Option: 5.00"H x 2.87"W x 9"D (50/75W units only)
(127.00mm x 72.90mm x 228.65mm)

Weight:
6.5 lbs. (2.9kg)

Regulatory Approvals:
Compliant to EEC EMC Directive. Compliant to EEC Low Voltage Directive. UL/CUL recognized, File E227588;
MNX65P65 is not UL/CUL recognized. RoHS Compliant.

www.spellmanhv.com/manuals/MNX
X-Ray Tubes
The MNX powers grounded cathode X-Ray tubes from manufacturers such as Varex, Petrick GmbH and others.

J2 POWER INPUT CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24V Input</td>
<td>+24 volts @ 5A, max.</td>
</tr>
<tr>
<td>2</td>
<td>24V Return (Gnd.)</td>
<td>Power Ground</td>
</tr>
</tbody>
</table>

J3 FILAMENT CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Filament Out</td>
<td>0.3A to 3.5A, 5 volt, max.</td>
</tr>
<tr>
<td>2</td>
<td>Filament Return</td>
<td>Filament Ground</td>
</tr>
</tbody>
</table>

J4 ANALOG INTERFACE CONNECTOR
MALE 15 PIN MINI “D”

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Monitor Return</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>2</td>
<td>Voltage Monitor</td>
<td>0-10 volts = 0 to full scale, Zout=1KΩ</td>
</tr>
<tr>
<td>3</td>
<td>Current Monitor</td>
<td>0-10 volts = 0 to full scale, Zout=1KΩ</td>
</tr>
<tr>
<td>4</td>
<td>Interlock Output</td>
<td>Connect 12V HVON bulb to pin 15 to enable</td>
</tr>
<tr>
<td>5</td>
<td>+10 Volt Reference</td>
<td>+10 Volts at 1mA, maximum</td>
</tr>
<tr>
<td>6</td>
<td>Filament Monitor</td>
<td>1 volt = 1 amp, Zout=1KΩ</td>
</tr>
<tr>
<td>7</td>
<td>Voltage Program Input</td>
<td>0-10 volts, screwdriver adjust</td>
</tr>
<tr>
<td>8</td>
<td>Local Voltage Program*</td>
<td>0-10 volts, screwdriver adjust</td>
</tr>
<tr>
<td>9</td>
<td>Filament Limit Setpoint*</td>
<td>1 volt = 1 amp, screwdriver adjust</td>
</tr>
<tr>
<td>10</td>
<td>Current Program Input</td>
<td>0-10 volts = 0 to full scale, Zin=10MΩ</td>
</tr>
<tr>
<td>11</td>
<td>Local Current Program*</td>
<td>10 turn pot, screwdriver adjust</td>
</tr>
<tr>
<td>12</td>
<td>Not used (+24V Out for Interlock)</td>
<td>(Optional Interlock configuration)</td>
</tr>
<tr>
<td>13</td>
<td>Not used (Interlock Coil)</td>
<td>(Optional Interlock configuration)</td>
</tr>
<tr>
<td>14</td>
<td>Filament Preheat Setpoint*</td>
<td>1 volt = 1 amp, screwdriver adjust</td>
</tr>
<tr>
<td>15</td>
<td>Interlock Return</td>
<td>Interlock Ground</td>
</tr>
</tbody>
</table>

*Denotes 10 turn potentiometer located on front panel

J1 HIGH VOLTAGE OUTPUT CONNECTOR

Spellman drywell type detachable connector.

Standard: A one meter (39.4") long polyethylene mating high voltage cable is provided.

5302: A one meter (39.4") long Mammoflex mating high voltage cable is provided, SHV p/n 201946-007

2001: A one meter (39.4") long Mammoflex mating high voltage cable is provided, compatible with the XCC Option SHV p/n 201946-002

Drywell connector depth:
50kV: 7.25”
65kV: 8.25”
XCC Option: 8.25”

How To Order:

Sample model number:
50 Watt unit: MNX50P50
65 Watt unit: MNX65P65
75 Watt unit: MNX50P75

Options are added to the model number as follows:
MNX50P50/XCC
Typical MNX Operating Setup

MNX Power Supply

+24V Input Connections

Filament Connections

Filament Monitor

X-Ray Tube Filament

Analog Interface

Voltage Monitor

Current Monitor

FILAMENT LIMIT SETPOINT

FILAMENT PREHEAT SETPOINT

+10.00V REFERENCE

EXTERNAL CURRENT CONTROL

EXTERNAL VOLTAGE CONTROL

Jumper J4-7 to J4-8 to use local voltage control

Jumper J4-10 to J4-11 to use local current control

Alternate Interlock Configurations

Alternate Interlock Configuration: Fail Safe Lamp Replaced with a 270 Ohm Resistor

Alternate Interlock Configuration: Customer Provided +12V For HV ON Relay, Relay Return Grounded

MNX Power Supply

+24VDC

12

J4

13

15

12V Lamp .1W .2W

EXTERNAL INTERLOCK

Fail Safe Interlock / HV ON Connections

+24VDC

EXTERNAL INTERLOCK

+24VDC

+12V Provided

+24VDC

MX7 BLIND FASTENER

TYP 4 PLC3

MNX BLIND FASTENER

TYP 4 PLC3

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The uX Series is the result of Spellman’s exceptional high voltage packaging and surface mount fabrication techniques coupled with proprietary encapsulation technology producing this ultra-compact X-Ray generator module. The uX powers grounded cathode X-Ray tubes from a variety of well-known manufacturers, featuring a 0 to 50kV/65kV high voltage output @ 2mA limited to 50, 65 or 75 Watts. The uX uses closed loop filament control circuitry providing highly regulated beam current. The low noise dc filament supply operates between 0.3 and 3.5 amps. Offering tight regulation, high stability and low ripple, the uX provides users local and remote analog control to set beam voltage, emission current and filament current limit. USB, RS-232 and Ethernet interface is standard.

**TYPICAL APPLICATIONS**


**OPTIONS**

- XCC: XRM Compatible HV Cable (50kV only)
- 5VPM: 0 to 5 Volt Programming and Monitor Scaling
- GB: Grid Bias
- GF: Grounded Filament
- 5302: Mammoflex HV cable for uX
- 2001: Mammoflex HV cable for uX w/XCC option

**SPECIFICATIONS**

**Input:**
- +24Vdc ±10%, 5.0A maximum for either 50 Watts or 75 Watts.
- +32Vdc ±1V, 5.0A maximum for 65kV/65W units.

**Efficiency:**
- 75%, typical

**Output:**
- 0 to 50kV at 0 to 2mA, limited to a maximum of 50 watts or 75 Watts. 0-65kV at 2mA limited to 65 Watts.

**Voltage Control:**
- **Local:** Internal multi-turn potentiometer to set voltage from 0 to full output voltage.
- **Remote:** 0 to +10Vdc proportional from 0 to full output voltage. Accuracy: ±1%. Zin: 10Mohm.

**Emission Control:**
- **Local:** Internal potentiometer to set beam current between 0 and full output current.
- **Remote:** 0 to +10Vdc proportional from 0 to full output current. Accuracy: ±1%. Zin: 10Mohm. Filament limit and filament preheat control capability is also provided.

**DC Filament Supply:**
- Isolated filament power supply generates emission current feedback signal for accurate low X-Ray tube current performance.
- Current: 3.5A, adjustable limit
- Voltage: 5.0 volt limit

**Environmental:**
- Operational: 0°C to +50°C
- Storage: -40°C to +85°C
- Humidity: 0% to 90%, non-condensing

**Temperature Coefficient:**
- 0.01% per °C, voltage and current.

**Stability:**
- 0.05% per 8 hours after 1/2 hour warm-up.

**Voltage and Current Monitors:**
- 0 to +10Vdc proportional from 0 to rated output. Accuracy ±1%.

**Redundant Voltage Monitor:**
- A redundant high voltage feedback divider with proportional 0 to +10Vdc = 0 to 100% output voltage signal can be provided on a custom basis.

**Dimensions:**
- 50kV Unit: 4.00”H x 2.87”W x 8.00”D (101.6mm x 72.95mm x 202.20mm).
- 65kV Unit: 4.00”H x 2.87”W x 9.00”D (101.6mm x 72.95mm x 228.60mm).
- XCC Option: 4.00”H x 2.87”W x 9.00”D (101.6mm x 72.95mm x 228.60mm).

**Weight:**
- 4.5 lbs (2.1kg) typical

**Regulatory Approvals:**

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Grid Bias Option (GB):
Plug-n-Play compatibility for Oxford’s Apogee X-Ray Tube
Spellman’s Grid Bias Option for the uX Series is specifically
designed for popular commercially available grid bias X-Ray
tubes. The Grid Bias voltage is developed via the use of sepa-
rate integrated high frequency switching circuit, providing maxi-
mum flexibility and control. The Grid Bias output is a voltage
regulated, current compliant topology ideally suited for Wehnelt
electrode applications. Arc and short circuit protection of the
Grid Bias output prevents any damage due to transient events
or installation errors.

Tracking Mode Operation
Functioning in tracking mode the voltage monitor
(0-10Vdc = 0 to 50kV) of the main high voltage output
is internally connected to the Grid Bias programming input
(0-10Vdc = 0 to -300Vdc of Grid Bias). Connected in this
manner the Grid Bias output will track in a linearly
proportional fashion the setting of the main kV output.
A multiturn potentiometer limits the maximum magnitude
of Grid Bias output applied to the X-Ray tube, providing
unparalleled flexibility.

The output of the Grid Bias option is provided via an
auxiliary two position Phoenix Contact terminal block, the
mating connector is provided.

GRID BIAS SPECIFICATIONS
Output Voltage: 0 to -300Vdc
Output Current: 0.25mA, maximum
Load Regulation: 1% of output voltage, no load to full load
Line Regulation: 1% for a ±10% change in input voltage
Ripple: 1% of maximum rated voltage

Note: Units ordered with the
GB Option will be provided with the XCC Option
for proper high voltage cable compatibility.
HIGH VOLTAGE OUTPUT CONNECTOR
Spellman drywell type detachable connector.

**Standard:** A one meter (39.4") long polyethylene mating high voltage cable is provided.

**5302:** A one meter (39.4") long Mammoflex mating high voltage cable is provided, SHV p/n 201946-007

**2001:** A one meter (39.4") long Mammoflex mating high voltage cable is provided, compatible with the XCC Option SHV p/n 201946-002

### POWER INPUT/FILAMENT CONNECTOR

**4 PIN PHOENIX CONTACT**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24V Input</td>
<td>+24 volts @ 5A, max.</td>
</tr>
<tr>
<td>2</td>
<td>24V Return (Gnd.)</td>
<td>Power Ground</td>
</tr>
<tr>
<td>3</td>
<td>Filament Out</td>
<td>0.3A to 3.5A, 5 volt, max.</td>
</tr>
<tr>
<td>4</td>
<td>Filament Return</td>
<td>Filament Return</td>
</tr>
</tbody>
</table>

Note: On the standard uX unit, the filament return wire cannot be grounded as this would short circuit the tube return current monitoring to the uX. If grounding of the filament is required, please select the GF (Grounded Filament) option when ordering.

### ANALOG INTERFACE CONNECTOR

**MALE 15 PIN MINI “D”**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Monitor Return</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>2</td>
<td>Voltage Monitor</td>
<td>0-10 volts = 0 to full scale, Zout=1KΩ</td>
</tr>
<tr>
<td>3</td>
<td>Current Monitor</td>
<td>0-10 volts = 0 to full scale, Zout=1KΩ</td>
</tr>
<tr>
<td>4</td>
<td>Interlock Output</td>
<td>Connect 12V HVON bulb to pin 15 to enable</td>
</tr>
<tr>
<td>5</td>
<td>+10 Volt Reference</td>
<td>+10 Volts at 1mA, maximum</td>
</tr>
<tr>
<td>6</td>
<td>Filament Monitor</td>
<td>1 volt = 1 amp, Zout=1KΩ</td>
</tr>
<tr>
<td>7</td>
<td>Voltage Program Input</td>
<td>0-10 volts = 0 to full scale, Zin=10MΩ</td>
</tr>
<tr>
<td>8</td>
<td>Local Voltage Program*</td>
<td>0-10 volts, screwdriver adjust</td>
</tr>
<tr>
<td>9</td>
<td>Filament Limit Setpoint*</td>
<td>1 volt = 1 amp, screwdriver adjust</td>
</tr>
<tr>
<td>10</td>
<td>Current Program Input</td>
<td>0-10 volts = 0 to full scale, Zin=10MΩ</td>
</tr>
<tr>
<td>11</td>
<td>Local Current Program*</td>
<td>10 turn pot, screwdriver adjust</td>
</tr>
<tr>
<td>12</td>
<td>Not used (+24V Out for Interlock)</td>
<td>(Optional Interlock configuration)</td>
</tr>
<tr>
<td>13</td>
<td>Not used (Interlock Coil)</td>
<td>(Optional Interlock configuration)</td>
</tr>
<tr>
<td>14</td>
<td>Filament Preheat Setpoint*</td>
<td>1 volt = 1 amp, screwdriver adjust</td>
</tr>
<tr>
<td>15</td>
<td>Interlock Return</td>
<td>Interlock Ground</td>
</tr>
</tbody>
</table>

*Denotes 10 turn potentiometer accessible through holes in cover

### GRID BIAS CONNECTOR

**2 PIN PHOENIX CONTACT**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ground</td>
<td>Chassis Ground</td>
</tr>
<tr>
<td>2</td>
<td>Grid Bias</td>
<td>0 to -300Vdc</td>
</tr>
</tbody>
</table>

### USB DIGITAL INTERFACE—

**4 PIN USB “B” CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VBUS</td>
<td>+5 Vdc</td>
</tr>
<tr>
<td>2</td>
<td>D-</td>
<td>Data -</td>
</tr>
<tr>
<td>3</td>
<td>D+</td>
<td>Data +</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td>Ground</td>
</tr>
</tbody>
</table>

### ETHERNET DIGITAL INTERFACE—

**8 PIN RJ45 CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TX+</td>
<td>Transmit Data +</td>
</tr>
<tr>
<td>2</td>
<td>TX-</td>
<td>Transmit Data -</td>
</tr>
<tr>
<td>3</td>
<td>RX+</td>
<td>Receive Data +</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>6</td>
<td>RX-</td>
<td>Receive Data -</td>
</tr>
<tr>
<td>7</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>NC</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

### RS-232 DIGITAL INTERFACE—

**9 PIN FEMALE D CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>2</td>
<td>TX out</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>3</td>
<td>RX in</td>
<td>Receive Data</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>SGND</td>
<td>Ground</td>
</tr>
<tr>
<td>6</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>Voltage Monitor 2</td>
<td>0-10V = 0 to full scale, Zout = 1KΩ</td>
</tr>
<tr>
<td>9</td>
<td>Power Supply OK</td>
<td>+15V = OK, 0V = Fault, Sink/Source 3mA max</td>
</tr>
</tbody>
</table>

### How To Order:

Sample model number:
- 50 Watt unit: uX50P50
- 65 Watt unit: uX65P65
- 75 Watt unit: uX50P75

Options are added to the model number as follows:
- uX50P50/XCC or uX50P75/GB

Ask about our X-Ray subsystem capabilities
DIMENSIONS: in.[mm]

50kV

50kV with XCC Option
The MFX Series is the result of Spellman’s exceptional high voltage packaging and surface mount fabrication techniques, coupled with its proprietary encapsulation technology producing this ultra compact-sized OEM X-Ray generator module.

The MFX Series is designed to power floating filament X-Ray tubes from various manufacturers. It features a 0 to 50kV (or 0 to 65kV) high voltage output, and up to 2mA of emission current limited to 50, 65 or 75 Watts, operating from a +24Vdc input. The MFX utilizes a closed loop filamentry beam control circuit to provide a highly regulated beam current. The floating ac filament supply operates between 0.3 and 4 amps. Offering tight regulation, high stability and low ripple, the MFX provides users both local and remote analog control to set beam voltage, emission current and filament current limit. An optional USB, RS-232 and Ethernet interface is available.

**OPTIONS**

- **SIC**  Standard Interface Controller (Ethernet, USB & RS-232)
- **5VPM**  0 to 5 Volt Programming and Monitor Scaling

**SPECIFICATIONS**

**Input:**
+24Vdc ±10%, 5.0A maximum for either 50 Watts or 75 Watts.
+24Vdc ±1V, 5.0A maximum for 65kV/65W units.

**Efficiency:**
80-85%, typical

**Output:**
0 to 50kV at 0 to 2mA, limited to a maximum of 50 watts or 75 Watts. 0-65kV at 2mA limited to 65 Watts. Negative output polarity.

**Voltage Control:**
- **Local:** Internal multi-turn potentiometer to set voltage from 0 to full output voltage.
- **Remote:** 0 to +10Vdc proportional from 0 to full output voltage. Accuracy: ±1%. Zin: 10Mohm.

**Emission Control:**
- **Local:** Internal potentiometer to set beam current between 0 and full output current.
- **Remote:** 0 to +10Vdc proportional from 0 to full output current. Accuracy: ±1%. Zin: 10Mohm. Filament limit and filament preheat control capability is also provided.

**High Frequency AC Filament Supply:**
- **Current:** 0-4A, adjustable limit
- **Voltage:** 5.0 volt limit

**Voltage Regulation:**
- **Load:** 0.01% of output voltage no load to full load.
- **Line:** ±0.01% for ±10% change in input voltage.

**Current Regulation:**
- **Load:** 0.01% of output current from 0 to rated voltage.
- **Line:** ±0.01% for ±10% change in input voltage.

**Ripple:**
0.1% p-p of maximum rated output voltage, 50kV units (50/75W)
0.1% rms maximum rated output voltage, 65kV units (65W)

**Environmental:**
- **Operational:** 0°C to +50°C
- **Storage:** -40°C to +85°C
- **Humidity:** 0% to 90%, non-condensing

**Temperature Coefficient:**
0.01% per °C, voltage and current.

**Stability:**
0.05% per 8 hours after 1/2 hour warm-up.

**Voltage and Current Monitors:**
0 to +10Vdc proportional from 0 to rated output. Accuracy ±1%.

**Dimensions:**
- **50kV Unit:** 7.00"H x 2.87"W x 8"D (177.80mm x 72.90mm x 203.25mm)
- **65kV Unit:** 7.00"H x 2.87"W x 9"D (177.80mm x 72.90mm x 228.65mm)
- **SIC Option:** 7.75"H x 2.87"W x 8"D/9"D (196.85mm x 72.90mm x 203.25mm/228.65mm)

**Weight:**
7.0 lbs. (3.2kg)

**Regulatory Approvals:**
RoHS compliant.

[www.spellmanhv.com/manuals/MFX](http://www.spellmanhv.com/manuals/MFX)
### J2 POWER INPUT CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24V Input</td>
<td>+24 volts @ 5A, max.</td>
</tr>
<tr>
<td>2</td>
<td>24V Return (Gnd.)</td>
<td>Power Ground</td>
</tr>
</tbody>
</table>

### J4 ANALOG INTERFACE CONNECTOR

#### MALE 15 PIN MINI “D”

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Monitor Return</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>2</td>
<td>Voltage Monitor</td>
<td>0-10 volts = 0 to full scale, Zout=1KΩ</td>
</tr>
<tr>
<td>3</td>
<td>Current Monitor</td>
<td>0-10 volts = 0 to full scale, Zout=1KΩ</td>
</tr>
<tr>
<td>4</td>
<td>Interlock Output</td>
<td>Connect 12V HVON bulb to pin 15 to enable</td>
</tr>
<tr>
<td>5</td>
<td>+10 Volt Reference</td>
<td>+10 Volts @ 1mA, maximum</td>
</tr>
<tr>
<td>6</td>
<td>Filament Monitor</td>
<td>1 volt = 1 amp, Zout=1KΩ</td>
</tr>
<tr>
<td>7</td>
<td>Voltage Program Input</td>
<td>0-10 volts = 0 to full scale, Zin=10MΩ</td>
</tr>
<tr>
<td>8</td>
<td>Local Voltage Program*</td>
<td>10 turn pot., screwdriver adjust</td>
</tr>
<tr>
<td>9</td>
<td>Filament Limit Setpoint*</td>
<td>1 volt = 1 amp, screwdriver adjust</td>
</tr>
<tr>
<td>10</td>
<td>Current Program Input</td>
<td>0-10 volts = 0 to full scale, Zin=10MΩ</td>
</tr>
<tr>
<td>11</td>
<td>Local Current Program*</td>
<td>10 turn pot., screwdriver adjust</td>
</tr>
<tr>
<td>12</td>
<td>Not used (+24V Out for Interlock)</td>
<td>(Optional Interlock configuration)</td>
</tr>
<tr>
<td>13</td>
<td>Not used (Interlock Coil)</td>
<td>(Optional Interlock configuration)</td>
</tr>
<tr>
<td>14</td>
<td>Filament Preheat Setpoint*</td>
<td>1 volt = 1 amp, screwdriver adjust</td>
</tr>
<tr>
<td>15</td>
<td>Interlock Return</td>
<td>Interlock Ground</td>
</tr>
</tbody>
</table>

*Denotes 10 turn potentiometer located on front panel

### J1 CATHODE OUTPUT

#### CLAYMOUNT HV CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>OUTPUT CONNECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>C (common)</td>
<td>-High Voltage Output</td>
</tr>
<tr>
<td>S (small)</td>
<td>-High Voltage Output</td>
</tr>
<tr>
<td>L (large)</td>
<td>Filament Output</td>
</tr>
<tr>
<td>G (grid)</td>
<td>Filament Output</td>
</tr>
</tbody>
</table>

Note: No high voltage cable is provided

Recommended Cable:
Claymount part number: 11470
Cable assembly, L3 CA11, CA11, 10F, CS=Bare 10 foot,
Mini Federal Connectors on both ends, “C” and “S” are both connected to the bare wire

### How To Order:

Sample model number:
50 Watt unit: MFX50N50
65 Watt unit: MFX65N65
75 Watt unit: MFX50N75
Options are added to the model number as follows:
MFX50N75/SIC
Spellman’s XRF Series allow for a wide range of input voltages and supply either 80W, 320W or 640W of output power at up to 160kVdc. These lightweight rack-mountable X-Ray generators house a miniaturized high voltage system in a solid encapsulated, oil-free design. The XRF Series is designed with a power factor corrected input circuit which reduces harmonic emissions and noise normally associated with other high frequency switching power supplies. The XRF Series incorporates an internal floating filament and a closed-loop emission control circuit for precise regulation of emission current. Remote monitoring and control of voltage, current and filament current is also provided.

**TYPICAL APPLICATIONS**
- X-Ray Inspection, Non-Destructive Testing

**OPTIONS**
- DF Dual Filament
- GS Grid Supply
- SL Slides
- AT Arc Trip
- IO Instant ON
- SS(X) Non Standard Slow Start

**SPECIFICATIONS**

**Input Voltage:**
- 80W: 90-125Vac at 48-62Hz @ 1.9A
- 320W: 180-264Vac at 48-62Hz @ 3.5A
- 640W: 180-264Vac at 48-62Hz @ 7A

**Power Factor:**
0.9 or better.

**High Voltage Supply:**
- **Output Voltage:**
  - 80W: 0-160kV, negative polarity.
  - 320W: 0.5mA max.
  - 640W: 4.0mA

**Output Power Stability:**
Within 0.1% of set value after warm-up period at full load.

**Output Voltage Ripple:**
- 80W & 320W: <0.1%, or 160V p-p for high freq. and line freq. at full load.
- 640W: 0.03% rms <1kHz, 0.75% rms above 1kHz.

**Beam Current Stability:**
- 80W: Within 0.1% of set value after 1/2 hour warm-up at constant output setting of 30-160kV and line voltage of 90-125 & 180-264Vac.
- 320W & 640W: Same as 80W except line voltage of 180-264Vac.

**Filament Supply:**
- Constant current DC filament supply with closed-loop current feedback.

**Filament Voltage:**
- 7V rms (high frequency) max.

**Filament Current:**
- 5A max., adjustable 0-5.0A by external Filament Limit Programming input.

**Floating Grid Power Supply:**
- **Grid Supply:**
  - Controls tube beam current in a closed-loop regulation design.

**Grid Voltage:**
- 0 to 1200Vdc.

**Grid Voltage Ripple:**
- Less than 1.0V rms at any frequency.

**Grid Supply Response:**
- Less than 0.5mA in less than 10ms.

**Control and Monitoring:**
- **Analog Control Inputs:**
  - Three inputs have internal load resistance greater than 330kohms.
  - Voltage Programming:
    - 80W, 320W & 640W: 0 to +10Vdc, where 10.0Vdc = 160kV output.
    - 80W: 0 to +10Vdc, where 10.0Vdc = 0.5mA tube current.
    - 320W: 0 to +10Vdc, where 10.0Vdc = 2.0mA tube current.
    - 640W: 0 to +10Vdc, where 10.0Vdc = 4.0mA tube current.
  - Filament Current Control:
    - 0 to +10Vdc, where 5.0Vdc = 5.0A filament current.

**Analog Monitor Outputs:**
(See tables for details)

**Digital Control Inputs:**
(See tables for details)

**Digital Outputs:**
(See tables for details)

**Connections:**
- **Output Connector:**
  - R24 (see owners manual for details)
- **Input Power Connector:**
  - 5-pin male MS-type, Amphenol P/N 97-3102A-18-20P
- **Control Connector:**
  - 25-pin “D” connector, male, chassis-mounted.

**Environmental:**
- 0 to +50°C at 10-95% RH, non-condensing.
- Forced convection cooling.

**Dimensions:**
- 7”H x 19”W x 22”D (17.8cm x 48.3cm x 55.9cm).

**Regulatory Approvals:**
- Compliant to EEC EMC Directive.
- Compliant to EEC Low Voltage Directive.
- RoHS Compliant.

**Electronic Component (Power Source):**
- XRF series is intended for installation as a component of a system.
- It is designed to meet CE standards, with conditions of acceptance often being customer provided enclosure mounting, EMC filtering, and appropriate protection, and isolation devices. The XRF series is not intended to be operated by end users as a stand-alone device. The XRF series power supply can only be fully assessed when installed within a system, and as a component part within that system.
## 160kV XRF SELECTION TABLE

<table>
<thead>
<tr>
<th>OUTPUT VOLTAGE (kV)</th>
<th>OUTPUT CURRENT (mA)</th>
<th>OUTPUT POWER (W)</th>
<th>MODEL NUMBER</th>
<th>XRFxxx</th>
</tr>
</thead>
<tbody>
<tr>
<td>160</td>
<td>0.5</td>
<td>80</td>
<td>XRF160N80</td>
<td></td>
</tr>
<tr>
<td>160</td>
<td>2.0</td>
<td>320</td>
<td>XRF160N320</td>
<td></td>
</tr>
<tr>
<td>160</td>
<td>4.0</td>
<td>640</td>
<td>XRF160N640</td>
<td></td>
</tr>
</tbody>
</table>

## J2 AC INPUT CONNECTOR WIRING

<table>
<thead>
<tr>
<th>5 Pin MS Type</th>
<th>7 Pin UTG Type</th>
<th>CONNECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>Auxiliary (Logic) Line</td>
</tr>
<tr>
<td>B</td>
<td>2</td>
<td>Auxiliary (Logic) Neutral</td>
</tr>
<tr>
<td>C</td>
<td>3</td>
<td>Ground</td>
</tr>
<tr>
<td>D</td>
<td>4</td>
<td>Main (Inverter) Line</td>
</tr>
<tr>
<td>E</td>
<td>5</td>
<td>Main (Inverter) Neutral</td>
</tr>
</tbody>
</table>

## JB1 160kV XRF 80W, 320W, 640W 25 PIN

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Filament Limit</td>
<td>0-5V = 0-5A Filament Limit</td>
</tr>
<tr>
<td>2</td>
<td>High Voltage on Control</td>
<td>+12VDC IN = HV ON</td>
</tr>
<tr>
<td>3</td>
<td>N/C</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>High Voltage On Status</td>
<td>Low = HV ON</td>
</tr>
<tr>
<td>6</td>
<td>A-Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>7</td>
<td>kV Monitor</td>
<td>0-10V = 0-160kV</td>
</tr>
<tr>
<td>8</td>
<td>Interlock Control</td>
<td>+12VDC IN = Interlock Closed</td>
</tr>
<tr>
<td>9</td>
<td>N/C</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>mA Demand</td>
<td>0-10V = 0-100% Rated Output</td>
</tr>
<tr>
<td>11</td>
<td>N/C</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>N/C</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>D-Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>14</td>
<td>Fil. Monitor</td>
<td>0-5V = 0-5A</td>
</tr>
<tr>
<td>15</td>
<td>N/C</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>N/C</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>N/C</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>N/C</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>mA Monitor</td>
<td>0-10V = 0-100% Rated Output</td>
</tr>
<tr>
<td>20</td>
<td>N/C</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>+12VDC Out</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>kV Demand</td>
<td>0-10V = 0-160kV</td>
</tr>
<tr>
<td>23</td>
<td>Grid Inhibit/Fil. Select</td>
<td>Low = Grid Inhibit</td>
</tr>
<tr>
<td>24</td>
<td>N/C</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Chassis Gnd (I/O Shield)</td>
<td>Chassis Gnd.</td>
</tr>
</tbody>
</table>

## 160kV XRF 80W, 320W, 640W TERMINAL BLOCK 10 PIN

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Interlock</td>
<td>Jumper to TB1-2 to close interlock</td>
</tr>
<tr>
<td>2</td>
<td>Interlock Return</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>kV Monitor</td>
<td>0-10V = 0-160kV</td>
</tr>
<tr>
<td>4</td>
<td>mA Monitor</td>
<td>0-10V = 0-100% Rated Output</td>
</tr>
<tr>
<td>5</td>
<td>Filament Monitor</td>
<td>0-5V = 0-5A</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>HV ON Indicator</td>
<td>+15V = HV ON</td>
</tr>
<tr>
<td>8</td>
<td>Voltage Mode Indicator</td>
<td>Low = Voltage Mode.</td>
</tr>
<tr>
<td>9</td>
<td>Current Mode Indicator</td>
<td>Low = Current Mode.</td>
</tr>
<tr>
<td>10</td>
<td>GND</td>
<td>Ground</td>
</tr>
</tbody>
</table>
The uXHP Series is the result of Spellman’s exceptional high voltage packaging and surface mount fabrication techniques coupled with proprietary encapsulation technology producing this ultra-compact X-Ray generator module. The uXHP powers grounded cathode X-Ray tubes from a variety of well-known manufacturers, featuring a 0 to 50kV/65kV/80kV high voltage output @ 5mA limited to 100W. The uXHP uses closed loop filament control circuitry providing highly regulated beam current. The low noise dc filament supply operates between 0.3 and 3.5A. Offering tight regulation, high stability and low ripple, the uXHP provides users local and remote analog control to set beam voltage, emission current and filament current limit. USB, RS-232 and Ethernet interface is standard.

TYPICAL APPLICATIONS
- Powering grounded cathode X-Ray tubes from Varex, Kevex, Oxford, RTW, Superior and Trufocus.

SPECIFICATIONS

Input:
+24Vdc ±1V; 7.75A maximum

Efficiency:
75%, typical

Output:
See model selection table on page 2

Voltage Control:
- Local: Internal multi-turn potentiometer to set voltage from 0 to full output voltage.
- Remote: 0 to 10Vdc = 0 to 100% rated output voltage. Accuracy: ±1%. Z_in = 10Mohm.

Emission Control:
- Local: Internal potentiometer to set beam current from 0 to full output current.
- Remote: 0 to 10Vdc = 0 to 100% rated output current. Accuracy: ±1%. Z_out = 10Mohm. Filament limit and filament preheat control capability is also provided.

Voltage and Current Monitors:
0 to 10Vdc = 0 to 100% rated output
Accuracy: ±1%. Z_out = 1kohm

Redundant Voltage Monitor:
A redundant high voltage feedback divider where 0 to 10Vdc = 0 to 100% rated output is monitored via firmware. The analog monitor signal can be provided by special order.

DC Filament Supply:
- Ground isolated filament power supply allows actual tube current feedback signal for monitoring accurate low X-Ray tube current performance.
- Current: 0–3.5A, adjustable limit
- Voltage: 5.0V, maximum compliance

Temperature Coefficient:
0.01% per °C, voltage and current.

Stability:
0.05% per 8 hours after 1/2 hour warm-up.

Digital Interface:
- RS-232, Ethernet and USB is standard

Redundant HV Monitor Signal

Environmental:
- Operational: 0° C to +50° C
- Storage: -40° C to +85° C
- Humidity: 0% to 90%, non-condensing

Dimensions:
- 50/65kV Unit: 7.00”H x 3.07”W x 9.00”D (177.80mm x 78.00mm x 228.60mm)
- 80kV Unit: 7.00”H x 3.07”W x 10.50”D (177.80mm x 78.00mm x 266.70mm)

Weight:
- 50/65kV Unit: 8.5 lbs. (3.85kg)
- 80kV Unit: 10.0 lbs. (4.53kg)

Cooling:
- User provided forced air cooling is required

Regulatory Approvals:
- RoHS Compliant.

www.spellmanhv.com/manuals/uXHP
**uXHP MODEL SELECTION TABLE**

<table>
<thead>
<tr>
<th>OUTPUT VOLTAGE</th>
<th>OUTPUT CURRENT</th>
<th>OUTPUT POWER</th>
<th>MODEL NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-50kV</td>
<td>0-5mA</td>
<td>100W</td>
<td>uXHP50P100</td>
</tr>
<tr>
<td>0-65kV</td>
<td>0-5mA</td>
<td>100W</td>
<td>uXHP65P100</td>
</tr>
<tr>
<td>0-80kV</td>
<td>0-5mA</td>
<td>100W</td>
<td>uXHP80P100</td>
</tr>
</tbody>
</table>

**CONTROL POWER/FILAMENT CONNECTOR**

4 PIN PHOENIX CONTACT

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24V Control Power</td>
<td>+24V @ 1A max</td>
</tr>
<tr>
<td>2</td>
<td>+24V Control Power Return</td>
<td>Power Ground</td>
</tr>
<tr>
<td>3</td>
<td>Filament Output</td>
<td>0.3A to 3.5A @ 5V, max</td>
</tr>
<tr>
<td>4</td>
<td>Filament Return</td>
<td>Filament Return</td>
</tr>
</tbody>
</table>

Note: The filament return wire cannot be grounded as this would short circuit the tube return current monitoring to the uXHP. If grounding of the filament is required, please consult the factory.

**HIGH VOLTAGE OUTPUT CONNECTOR**

Spellman drywell type detachable connector.

50/65kV:
- A one meter (39.4”) long polyethylene mating high voltage cable with banana plug termination is provided.

80kV:
- A one meter (39.4”) long polyethylene mating high voltage cable with corona ball termination is provided.

HV Cable Options:

5302:
- A one meter (39.4”) long Mammoflex mating high voltage cable is provided, SHV p/n 201946-007

2001:
- (50kV with XCC option and 65kV units only)
- A one meter (39.4”) long Mammoflex mating high voltage cable is provided, compatible with the XCC Option SHV p/n 201946-002

**HIGH VOLTAGE POWER INPUT CONNECTOR**

2 PIN PHOENIX CONTACT

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24V High Voltage Power Input</td>
<td>+24V @ 7.75A max</td>
</tr>
<tr>
<td>2</td>
<td>+24V High Voltage Power Return</td>
<td>Power Ground</td>
</tr>
</tbody>
</table>

**ETHERNET DIGITAL INTERFACE—8 PIN RJ45 CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TX+</td>
<td>Transmit Data +</td>
</tr>
<tr>
<td>2</td>
<td>TX-</td>
<td>Transmit Data -</td>
</tr>
<tr>
<td>3</td>
<td>RX+</td>
<td>Receive Data +</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>6</td>
<td>RX-</td>
<td>Receive Data -</td>
</tr>
<tr>
<td>7</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>NC</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

**RS-232 DIGITAL INTERFACE—9 PIN FEMALE D CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>2</td>
<td>TX out</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>3</td>
<td>RX in</td>
<td>Receive Data</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>SGND</td>
<td>Ground</td>
</tr>
<tr>
<td>6</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>Voltage Monitor 2</td>
<td>0-10V = 0 to full scale, Zout = 1KΩ</td>
</tr>
<tr>
<td>9</td>
<td>Power Supply OK</td>
<td>+13V = OK, 0V = Fault, Sink/Source 3mA max</td>
</tr>
</tbody>
</table>

**How To Order:**

Sample model number:
- 50kV unit: uXHP50P100
- 65kV unit: uXHP65P100
- 80kV unit: uXHP80P100

Ask about our X-Ray subsystem capabilities

---

**uXHP 100W X-RAY GENERATOR**

SPELLMAN HIGH VOLTAGE ELECTRONICS CORPORATION

**uXHP MODEL SELECTION TABLE**

<table>
<thead>
<tr>
<th>OUTPUT VOLTAGE</th>
<th>OUTPUT CURRENT</th>
<th>OUTPUT POWER</th>
<th>MODEL NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-50kV</td>
<td>0-5mA</td>
<td>100W</td>
<td>uXHP50P100</td>
</tr>
<tr>
<td>0-65kV</td>
<td>0-5mA</td>
<td>100W</td>
<td>uXHP65P100</td>
</tr>
<tr>
<td>0-80kV</td>
<td>0-5mA</td>
<td>100W</td>
<td>uXHP80P100</td>
</tr>
</tbody>
</table>

**CONTROL POWER/FILAMENT CONNECTOR**

4 PIN PHOENIX CONTACT

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24V Control Power</td>
<td>+24V @ 1A max</td>
</tr>
<tr>
<td>2</td>
<td>+24V Control Power Return</td>
<td>Power Ground</td>
</tr>
<tr>
<td>3</td>
<td>Filament Output</td>
<td>0.3A to 3.5A @ 5V, max</td>
</tr>
<tr>
<td>4</td>
<td>Filament Return</td>
<td>Filament Return</td>
</tr>
</tbody>
</table>

Note: The filament return wire cannot be grounded as this would short circuit the tube return current monitoring to the uXHP. If grounding of the filament is required, please consult the factory.

**HIGH VOLTAGE OUTPUT CONNECTOR**

Spellman drywell type detachable connector.

50/65kV:
- A one meter (39.4”) long polyethylene mating high voltage cable with banana plug termination is provided.

80kV:
- A one meter (39.4”) long polyethylene mating high voltage cable with corona ball termination is provided.

HV Cable Options:

5302:
- A one meter (39.4”) long Mammoflex mating high voltage cable is provided, SHV p/n 201946-007

2001:
- (50kV with XCC option and 65kV units only)
- A one meter (39.4”) long Mammoflex mating high voltage cable is provided, compatible with the XCC Option SHV p/n 201946-002

**HIGH VOLTAGE POWER INPUT CONNECTOR**

2 PIN PHOENIX CONTACT

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24V High Voltage Power Input</td>
<td>+24V @ 7.75A max</td>
</tr>
<tr>
<td>2</td>
<td>+24V High Voltage Power Return</td>
<td>Power Ground</td>
</tr>
</tbody>
</table>

**ETHERNET DIGITAL INTERFACE—8 PIN RJ45 CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TX+</td>
<td>Transmit Data +</td>
</tr>
<tr>
<td>2</td>
<td>TX-</td>
<td>Transmit Data -</td>
</tr>
<tr>
<td>3</td>
<td>RX+</td>
<td>Receive Data +</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>6</td>
<td>RX-</td>
<td>Receive Data -</td>
</tr>
<tr>
<td>7</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>NC</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

**RS-232 DIGITAL INTERFACE—9 PIN FEMALE D CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>2</td>
<td>TX out</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>3</td>
<td>RX in</td>
<td>Receive Data</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>SGND</td>
<td>Ground</td>
</tr>
<tr>
<td>6</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>Voltage Monitor 2</td>
<td>0-10V = 0 to full scale, Zout = 1KΩ</td>
</tr>
<tr>
<td>9</td>
<td>Power Supply OK</td>
<td>+13V = OK, 0V = Fault, Sink/Source 3mA max</td>
</tr>
</tbody>
</table>

**How To Order:**

Sample model number:
- 50kV unit: uXHP50P100
- 65kV unit: uXHP65P100
- 80kV unit: uXHP80P100

Ask about our X-Ray subsystem capabilities
**Digital Interface**

The uXHP features a standard USB, RS-232 and Ethernet digital interface. Utilizing these standard digital interfaces can dramatically simplify power supply interfacing requirements saving the user both time and money, while enhancing functionality and overall capability. Spellman provides a GUI with the uXHP that allows the customer to both customize operational features of the uXHP while also providing basic power supply operational features. Details of the uXHP’s digital interface capability are described in detail in the uXHP manual.

**Varex VF-80J X-Ray Tube**

The uXHP was specifically designed in cooperation with Varex to power their new VF-80J X-Ray tube. This joint effort resulted in the creation of both the VF-80J X-Ray tube and the uXHP X-Ray generator. The Varex VF-80J tube is uniquely rated to run at up to 80kV @ 100 watts, 4mA maximum. The uXHP was explicitly designed to operate at up to 80kV and provide 100 watts down to 25kV, so customers could make full use of the capabilities of the VF-80J X-Ray tube. Varex and Spellman, working together to push the boundaries of X-Ray technology.
DIMENSIONS: in.[mm]

50kV, 50kV/XCC and 65kV

80kV
Spellman’s new DXM Series of X-Ray generator modules are designed for OEM applications up to 160kV at 1200 watts. Its universal input, small package size and choice of three standard digital interfaces simplifies integrating the DXM into your X-Ray analysis system. Models are available to operate either floating filament (negative HV polarity) or ground referenced filament (positive HV polarity), X-Ray tube designs. DSP based emission control circuitry provides excellent regulation of emission current, along with outstanding stability performance.

**TYPICAL APPLICATIONS**
- Plastics Sorting
- Crystal Inspection
- Plating Measurement
- Diamond Inspection
- Mineral Analysis
- X-Ray Fluorescence
- X-Ray Diffraction

**SPECIFICATIONS**

**Input Voltage:**
- Power factor corrected input
  - 100-240Vac ±10% (90-264Vac):
    - 47-63Hz @ 4.6A for 300 watt units
  - 200-240Vac ±10% (180-264Vac):
    - 47-63Hz @ 4.3A for 600 watt units
    - 47-63Hz @ 8.2A for 1200 watt units

**Output Voltage:**
- 8 models—20kV, 30kV, 40kV, 50kV, 60kV, 70kV, 75kV and 160kV

**Output Polarity:**
- Negative- for floating filament X-Ray tubes
- Positive- for ground referenced filament X-Ray tubes

**Power:**
- 3 power ranges available:
  - 300 watts, 600 watts and 1200 watts.
  - Other power levels available on special order.

**Output Voltage Regulation:**
- ≤0.01% of rated output voltage over specified input voltage range
- ≤0.01% of rated output voltage for a full load change

**Emission Current Regulation:**
- ≤0.01% of rated output current over specified input voltage range
- ≤0.01% of rated output current for a change from 30% to 100% of rated output voltage
- Filament is disabled when kV is <30% of full scale output

**Ripple:**
- ≤1%rms at >20kHz, 0.1%rms below 20kHz

**Stability:**
- ≤25ppm/hr after a 2 hour warm up

**Temperature Coefficient:**
- ≤50ppm per degree C

**Environmental:**
- Temperature Range:
  - Operating: 0°C to 40°C
  - Storage: -40°C to 85°C
- Humidity:
  - 20% to 85% RH, non-condensing.

**Filament Configuration:**
- Closed loop emission control regulates filament setting to provide desired X-Ray tube emission current.
- Two types are available: Floating Filament (ac output referenced to negative output voltage) and Ground Referenced Filament (dc output referenced to ground).

**Output:**
- 0-5 amps at a compliance of 10 volts, maximum.
- The filament loop is disabled when the kV output is less than 30% of full scale output to protect the X-Ray tube.
- Standard filament Preheat adjustable 0-2.5 amps.
- Other filament levels available on special order.
Control Interface

Local Interface:
Potentiometers are provided to adjust filament limit and preheat levels

Remote Interface:
USB, Ethernet and RS-232 are standard.
All digital monitors have an accuracy specification of 2%

Control Software:
A Windows graphical user interface example is provided

High Voltage Enable:
A hardware based, dry contact closure will enable the power supply into the high voltage on mode

Monitor Signals:
Voltage and current monitor signals are scaled 0-10Vdc equals 0-100% of full scale, accuracy is 1%

Dimensions:
300/600 Watts: 4.75˝ H X 6˝ W X 12˝ D
(120.65mm x 152.4mm x 304.8mm)
1200 Watts: 4.75˝ H X 12˝ W X 12˝ D
(120.65mm x 304.8mm x 304.8mm)
160kV: 10.5˝ H X 19˝ W X 21.5˝ D
(266.7mm x 482.6mm x 546.1mm)

Weight:
300/600 Watts: 14 pounds (6.35kg)
1200 Watts: 26 pounds (11.8kg)
160kV: 142 pounds (66.4kg)

Cooling:
Forced air

Input Line Connector:
IEC320 with EMI filter

Output Connector:
Depends upon polarity selected. See table and drawing. Other connectors and pinouts available on special order.

Regulatory Approvals:

DXM SELECTION TABLE—300W, 600W, 1200W

<table>
<thead>
<tr>
<th>kV</th>
<th>300 Watt mA</th>
<th>Model</th>
<th>600 Watt mA</th>
<th>Model</th>
<th>1200 Watt mA</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>15</td>
<td>DXM20*300</td>
<td>30</td>
<td>DXM20*600</td>
<td>60</td>
<td>DXM20*1200</td>
</tr>
<tr>
<td>30</td>
<td>10</td>
<td>DXM30*300</td>
<td>20</td>
<td>DXM30*600</td>
<td>40</td>
<td>DXM30*1200</td>
</tr>
<tr>
<td>40</td>
<td>7.5</td>
<td>DXM40*300</td>
<td>15</td>
<td>DXM40*600</td>
<td>30</td>
<td>DXM40*1200</td>
</tr>
<tr>
<td>50</td>
<td>6</td>
<td>DXM50*300</td>
<td>12</td>
<td>DXM50*600</td>
<td>24</td>
<td>DXM50*1200</td>
</tr>
<tr>
<td>60</td>
<td>5</td>
<td>DXM60*300</td>
<td>10</td>
<td>DXM60*600</td>
<td>20</td>
<td>DXM60*1200</td>
</tr>
<tr>
<td>70</td>
<td>4.28</td>
<td>DXM70*300</td>
<td>8.56</td>
<td>DXM70*600</td>
<td>17.12</td>
<td>DXM70*1200</td>
</tr>
<tr>
<td>75</td>
<td>4</td>
<td>DXM75*300</td>
<td>8</td>
<td>DXM75*600</td>
<td>16</td>
<td>DXM75*1200</td>
</tr>
<tr>
<td>160</td>
<td></td>
<td>DXM160N1200</td>
<td></td>
<td></td>
<td>7.5</td>
<td>DXM160N1200</td>
</tr>
</tbody>
</table>

*Specify “P” for positive polarity or “N” for negative polarity

FILAMENT TERMINAL BLOCK—TB1 TWO POSITION TERMINAL BLOCK

<table>
<thead>
<tr>
<th>POSITION</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Filament Output</td>
<td>0-5 amps, 10Vdc Maximum</td>
</tr>
<tr>
<td>2</td>
<td>Filament Return</td>
<td>Filament Return</td>
</tr>
</tbody>
</table>

For positive polarity/ground referenced filament units

DXM ANALOG INTERFACE—J2 15 PIN MALE D CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Supply Fault</td>
<td>Open Collector, 35V @ 10mA Maximum</td>
</tr>
<tr>
<td>2</td>
<td>Current Program In</td>
<td>0 to 10V=0 to 100% Rated Output, Zin=10MΩ</td>
</tr>
<tr>
<td>3</td>
<td>Voltage Program In</td>
<td>0 to 10V=0 to 100% Rated Output, Zin=10MΩ</td>
</tr>
<tr>
<td>4</td>
<td>Filament Limit Input</td>
<td>0 to 10V=0 to 100% Rated Output, Zin=10MΩ</td>
</tr>
<tr>
<td>5</td>
<td>Local Filament Limit</td>
<td>Multi-turn front panel potentiometer</td>
</tr>
<tr>
<td>6</td>
<td>Filament Preheat Input</td>
<td>0 to 10V=0 to 100% Rated Output, Zin=10MΩ</td>
</tr>
<tr>
<td>7</td>
<td>Local Filament Preheat</td>
<td>Multi-turn front panel potentiometer</td>
</tr>
<tr>
<td>8</td>
<td>Voltage Monitor</td>
<td>0 to 10V=0 to 100% Rated Output, Zout =4.99k, 1%</td>
</tr>
<tr>
<td>9</td>
<td>Signal Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>10</td>
<td>Current Monitor</td>
<td>0 to 10V=0 to 100% Rated Output, Zout =4.99k, 1%</td>
</tr>
<tr>
<td>11</td>
<td>X-Ray Enable Input</td>
<td>Connect to Pin 12 to HV Enable Supply</td>
</tr>
<tr>
<td>12</td>
<td>X-Ray Enable Output</td>
<td>+15V @ Open, ≤15mA @ Closed</td>
</tr>
<tr>
<td>13</td>
<td>Filament Monitor</td>
<td>1 Volt=1 Amp, Zout=10kΩ</td>
</tr>
<tr>
<td>14</td>
<td>X-Ray On Output Signal</td>
<td>Open Collector, 35V @10mA Maximum</td>
</tr>
<tr>
<td>15</td>
<td>Spare</td>
<td>N/C</td>
</tr>
</tbody>
</table>

RS-232 DIGITAL INTERFACE—J3 9 PIN FEMALE D CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>2</td>
<td>TX out</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>3</td>
<td>RX in</td>
<td>Receive Data</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>SGND</td>
<td>Ground</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>9</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
</tbody>
</table>
USB DIGITAL INTERFACE—J4 4 PIN USB “B” CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VBUS</td>
<td>+5 Vdc</td>
</tr>
<tr>
<td>2</td>
<td>D-</td>
<td>Data -</td>
</tr>
<tr>
<td>3</td>
<td>D+</td>
<td>Data +</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td>Ground</td>
</tr>
</tbody>
</table>

ETHERNET DIGITAL INTERFACE—J5 8 PIN RJ45 CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TX+</td>
<td>Transmit Data +</td>
</tr>
<tr>
<td>2</td>
<td>TX-</td>
<td>Transmit Data -</td>
</tr>
<tr>
<td>3</td>
<td>RX+</td>
<td>Receive Data +</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>6</td>
<td>RX-</td>
<td>Receive Data -</td>
</tr>
<tr>
<td>7</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

R24 HV CONNECTOR PINOUT

<table>
<thead>
<tr>
<th>PIN</th>
<th>OUTPUT CONNECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>C (common)</td>
<td>High Voltage Output</td>
</tr>
<tr>
<td>S (small)</td>
<td>Filament Output</td>
</tr>
<tr>
<td>L (large)</td>
<td>Filament Output</td>
</tr>
</tbody>
</table>

HIGH VOLTAGE OUTPUT CONNECTOR—J6 FLOATING FILAMENT

20kV-75kV Negative Polarity:
Claymount Mini Federal standard X-Ray connector

160kV Negative Polarity:
R24 (cable not provided)

HIGH VOLTAGE OUTPUT CONNECTOR—J6:GROUND FILAMENT

Positive Polarity: Spellman High Voltage Delrin Drywell connector.
4 foot (1.21m) long high voltage cable provided

For positive polarity units a ground referenced filament output is provided on a two position terminal TB1. See table

CLAYMOUNT HV CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>OUTPUT CONNECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>C (common)</td>
<td>High Voltage Output</td>
</tr>
<tr>
<td>S (small)</td>
<td>High Voltage Output</td>
</tr>
<tr>
<td>L (large)</td>
<td>Filament Output</td>
</tr>
<tr>
<td>G (grid)</td>
<td>Filament Output</td>
</tr>
</tbody>
</table>

Note: No high voltage cable is provided

Recommended Cable: Claymount part number: 12096
Cable assembly, L3 CA11, CA11, 10F, CS=Bare 10 foot, Mini Federal Connectors on both ends, “C” and “S” are both connected to the bare shield wire
DANGER
HIGH VOLTAGE

Negative Polarity - Floating Filament

Positive Polarity - Ground Filament

DIMENSIONS: in.[mm]

300/600 Watt

Corporate Headquarters
Hauppauge, New York USA
+1-631-630-3000 FAX: +1-631-435-1620
e-mail: sales@spellmanhv.com

www.spellmanhv.com
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Spellman’s new DXB Series of bipolar X-Ray generator modules are designed for OEM applications up to 320kV (±160kV) at 1200 watts. Its universal input, small package size and choice of three standard digital interfaces simplifies integrating the DXB into your X-Ray analysis system. DSP based emission control circuitry provides excellent regulation of emission current, along with outstanding stability performance.

**TYPICAL APPLICATIONS**

- Plastics Sorting
- Mineral Analysis
- Crystal Inspection
- X-Ray Fluorescence
- Plating Measurement
- X-Ray Diffraction
- Thickness Gauging
- Cargo Screening
- Food Inspection

**SPECIFICATIONS**

**Input Voltage:**
- Power factor corrected input
- 100-240Vac, ±10% (90-264Vac):
  - 47-63Hz @ 5.7A for 300 watt units
- 200-240Vac, ±10% (180-264Vac):
  - 47-63Hz @ 4.8A for 600 watt units
  - 47-63Hz @ 8.0A for 1200 watt units

**Output Voltage:**
- 7 models: 40kV, 60kV, 80kV, 100kV, 120kV, 140kV and 320kV

**Output Polarity:**
- ± bipolar output, filament referenced to negative output

**Power:**
- 3 power ranges available—300 watts, 600 watts and 1200 watts
- Other power levels available on special order.

**Output Voltage Regulation:**
- ≤0.01% of rated output voltage over specified input voltage range
- ≤0.01% of rated output voltage for a full load change

**Emission Current Regulation:**
- ≤0.01% of rated output current over specified input voltage range
- ≤0.01% of rated output current for a change from 30% to 100% of rated output voltage
- Filament is disabled when kV is <30% of full scale output

**Ripple:**
- ≤1%rms at >20 kHz, 0.1%rms below 20 kHz

**Stability:**
- ≤25ppm/hr after a 2 hour warm up

**Temperature Coefficient:**
- ≤50ppm per degree C

**Environmental:**
- Temperature Range:
  - Operating: 0˚C to 40˚C
  - Storage: -40˚C to 85˚C
- Humidity:
  - 20% to 85% RH, non-condensing.

**Filament Configuration:**
- Closed loop emission control regulates filament setting to provide desired X-Ray tube emission current.
- Floating Filament (ac output referenced to negative output voltage).

**Control Interface**
- **Local Interface:** Potentiometers are provided to adjust filament limit and preheat levels
- **Remote Interface:** USB, Ethernet and RS-232 are standard.
- All digital monitors have an accuracy specification of 2%
- **Control Software:** A Windows graphical user interface example is provided.
- **High Voltage Enable:** A hardware based, dry contact closure will enable the power supply into the high voltage on mode
- **Monitor Signals:** Voltage and current monitor signals are scaled 0-10Vdc equals 0-100% of full scale, accuracy is 1%

**Cooling:**
- Forced air

**Dimensions:**
- 40-140kV:
  - 4.75” H X 12” W X 12” D (120.65mm x 304.8mm x 304.8mm)
- 320kV:
  - 10.5” H X 19.0” W X 21.5” D (266.7mm x 482.6mm x 546.1mm)

**Weight:**
- 40-140kV: 26 pounds (11.8kg)
- 320kV: 150 pounds (68kg)

[www.spellmanhv.com/manuals/DXB](http://www.spellmanhv.com/manuals/DXB)
Input Line Connector:
IEC320 with EMI filter

Output Connectors:
- 40-140kV.
- Other connectors and pinouts available on special order.
- 320kV:
- R24 X-Ray connectors.
- Other connectors and pinouts available on special order.

Regulatory Approvals:
- RoHS Compliant. DXB320PN1200 is not UL recognized.

DXB SELECTION TABLE — 300W, 600W, 1200W

<table>
<thead>
<tr>
<th>kV</th>
<th>300 Watt</th>
<th>600 Watt</th>
<th>1200 Watt</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mA</td>
<td>Model</td>
<td>mA</td>
</tr>
<tr>
<td>40</td>
<td>7.50</td>
<td>DXB40PN300</td>
<td>15.0</td>
</tr>
<tr>
<td>60</td>
<td>5.00</td>
<td>DXB60PN300</td>
<td>10.0</td>
</tr>
<tr>
<td>80</td>
<td>3.75</td>
<td>DXB80PN300</td>
<td>7.50</td>
</tr>
<tr>
<td>100</td>
<td>3.00</td>
<td>DXB100PN300</td>
<td>6.00</td>
</tr>
<tr>
<td>120</td>
<td>2.50</td>
<td>DXB120PN300</td>
<td>5.00</td>
</tr>
<tr>
<td>140</td>
<td>2.14</td>
<td>DXB140PN300</td>
<td>4.28</td>
</tr>
<tr>
<td>320</td>
<td>Not Available</td>
<td>Not Available</td>
<td>3.75</td>
</tr>
</tbody>
</table>

DXB ANALOG INTERFACE — J2 15 PIN MALE D CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Supply Fault</td>
<td>Open Collector, 35V @ 10mA Maximum</td>
</tr>
<tr>
<td>2</td>
<td>Current Program In</td>
<td>0 to 10V=0 to 100% Rated Output, Zin=10MΩ</td>
</tr>
<tr>
<td>3</td>
<td>Voltage Program In</td>
<td>0 to 10V=0 to 100% Rated Output, Zin=10MΩ</td>
</tr>
<tr>
<td>4</td>
<td>Filament Limit Input</td>
<td>0 to 10V=0 to 100% Rated Output, Zin=10MΩ</td>
</tr>
<tr>
<td>5</td>
<td>Local Filament Limit</td>
<td>Multi-turn front panel potentiometer</td>
</tr>
<tr>
<td>6</td>
<td>Filament Preheat Input</td>
<td>0 to 10V=0 to 100% Rated Output, Zin=10MΩ</td>
</tr>
<tr>
<td>7</td>
<td>Local Filament Preheat</td>
<td>Multi-turn front panel potentiometer</td>
</tr>
<tr>
<td>8</td>
<td>Voltage Monitor</td>
<td>0 to 10V=0 to 100% Rated Output, Zout =4.99k, 1%</td>
</tr>
<tr>
<td>9</td>
<td>Signal Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>10</td>
<td>Current Monitor</td>
<td>0 to 10V=0 to 100% Rated Output, Zout =4.99k, 1%</td>
</tr>
<tr>
<td>11</td>
<td>X-Ray Enable Input</td>
<td>Connect to Pin 12 to HV Enable Supply</td>
</tr>
<tr>
<td>12</td>
<td>X-Ray Enable Output</td>
<td>+15V @ Open, ≤15mA @ Closed</td>
</tr>
<tr>
<td>13</td>
<td>Filament Monitor</td>
<td>1 Volt=1 Amp, Zout=10kΩ</td>
</tr>
<tr>
<td>14</td>
<td>X-Ray On Output Signal</td>
<td>Open Collector, 35V Ø10mA Maximum</td>
</tr>
<tr>
<td>15</td>
<td>Spare</td>
<td>N/C</td>
</tr>
</tbody>
</table>

CLAYMOUNT HV CONNECTOR PINOUT

J6 CATHODE OUTPUT (40-140kV)

<table>
<thead>
<tr>
<th>PIN</th>
<th>OUTPUT CONNECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-High Voltage Output</td>
</tr>
<tr>
<td>S</td>
<td>-High Voltage Output</td>
</tr>
<tr>
<td>L</td>
<td>Filament Output</td>
</tr>
<tr>
<td>G</td>
<td>Filament Output</td>
</tr>
</tbody>
</table>

J7 ANODE OUTPUT (40-140kV)

<table>
<thead>
<tr>
<th>PIN</th>
<th>OUTPUT CONNECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>+High Voltage Output</td>
</tr>
<tr>
<td>S</td>
<td>+High Voltage Output</td>
</tr>
<tr>
<td>L</td>
<td>+High Voltage Output</td>
</tr>
<tr>
<td>G</td>
<td>+High Voltage Output</td>
</tr>
</tbody>
</table>

Note: No high voltage cable is provided
Recommended Cable:
Claymount part number: 12096
Cable assembly, L3 CA11, CA11, 10F, CS=Bare 10 foot,
Mini Federal Connectors on both ends, “C” and “S” are both connected to the bare wire

R24 HV CONNECTOR PINOUT

J6 CATHODE OUTPUT (320kV)

<table>
<thead>
<tr>
<th>PIN</th>
<th>OUTPUT CONNECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-High Voltage Output</td>
</tr>
<tr>
<td>S</td>
<td>Filament Output</td>
</tr>
<tr>
<td>L</td>
<td>Filament Output</td>
</tr>
</tbody>
</table>

J7 ANODE OUTPUT (320kV)

<table>
<thead>
<tr>
<th>PIN</th>
<th>OUTPUT CONNECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>+High Voltage Output</td>
</tr>
<tr>
<td>S</td>
<td>+High Voltage Output</td>
</tr>
<tr>
<td>L</td>
<td>+High Voltage Output</td>
</tr>
</tbody>
</table>
DIMENSIONS: in.[mm]

40-140kV

320kV

BOTTOM VIEW

TOP VIEW

AIR IN

AIR OUT

10.50 [266]

21.50 [546.1]

10-32 BLIND PEM 4 PLCs

4.75 [120]

10.47 [266.7]

19.00 [482.6]

10-32 BLIND PEM 4 PLCs

AIR IN

AIR OUT

AIR IN

AIR OUT
Spellman's new DXM100 X-Ray generator module is designed for OEM applications up to 100kV at 1200 watts. Its universal input, small package size and choice of three standard digital interfaces simplifies integrating the DXM100 into your X-Ray analysis system. DSP based emission control circuitry provides excellent regulation of emission current, along with outstanding stability.

**TYPICAL APPLICATIONS**
- NDT Analysis
- Crystal Inspection
- Plating Measurement
- Diamond Inspection
- Mineral Analysis
- Food/Product Inspection

**SPECIFICATIONS**

- **Input Voltage:**
  - Power factor corrected input, ≥0.98
  - 180-264Vac, 47-63Hz, 8.25A maximum

- **Output Voltage:**
  - 100kV, maximum

- **Output Polarity:**
  - Negative for floating filament X-Ray tubes

- **Output Current:**
  - 12mA maximum

- **Output Power:**
  - 1200 Watts maximum

- **Output Voltage Regulation:**
  - ≤0.01% of rated output voltage over specified input voltage range
  - ≤0.01% of rated output voltage for a full load change

- **Emission Current Regulation:**
  - ≤0.01% of rated output current over specified input voltage range
  - ≤0.01% of rated output current for a change from 30% to 100% of rated output voltage
  - Filament is disabled when kV is <30% of full scale output

- **Ripple:**
  - ≤1%rms at >20 kHz, 0.1%rms below 20 kHz

- **Stability:**
  - ≤25ppm/hr after a 2 hour warm up

- **Temperature Coefficient:**
  - ≤50ppm per degree C

- **Environmental:**
  - Temperature Range:
    - Operating: 0°C to 40°C
    - Storage: -40°C to 85°C
  - Humidity: 20% to 85% RH, non-condensing.

- **Cooling:**
  - Forced air

- **Dimensions:**
  - 6.25” H X 12” W X 15.5” D (158.75mm x 304.79mm x 393.7mm)

- **Weight:**
  - 43 pounds (19.5kg)

- **Input Line Connector:**
  - IEC320 with EMI filter, 6’ (1.83 meter) cord set provided

- **Output Connector:**
  - CA10 (R10). See table for pin out information

- **Regulatory Approvals:**

**Filament Configuration:**
Closed loop emission control regulates filament setting to provide desired X-Ray tube emission current.

**Output:**
5.0 amps at a compliance of 10.0 volts, maximum. The filament loop is disabled when the kV output is less than 30% of full scale output to protect the X-Ray tube. Standard filament Preheat adjustable 0-2.5 amps. Other filament levels available on special order.

**Control Interface:**
- **Local Interface:**
  - Potentiometers are provided to adjust filament limit and preheat levels

- **Remote Interface:**
  - USB, Ethernet and RS-232 are standard. All digital monitors have an accuracy specification of 2%

**Control Software:**
A Windows graphical user interface example is provided.

**High Voltage Enable:**
A hardware based, dry contact closure will enable the power supply into the high voltage on mode

**Monitor Signals:**
Voltage and current monitor signals are scaled 0-10Vdc equals 0-100% of full scale, accuracy is 1%

**Over Power Fault:**
The maximum power the unit can supply can be programmed (0-1200 watts) via the digital interface, this setting will be stored in memory. An over power fault will occur if the output power is ≥105% of the set point value. When an over power fault occurs the high voltage output will be disabled and the Over Power Fault indicator will be activated on the GUI/Applet. Additionally both the UV and OV fault LED’s on the DXM100 will be illuminated.
### DXM100 Analog Interface—J2 15 Pin Male D Connector

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Signal Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Supply Fault</td>
<td>Open Collector, 35V @ 10mA Maximum</td>
</tr>
<tr>
<td>2</td>
<td>Current Program In</td>
<td>0 to 10V=0 to 100% Rated Output, Zin=10MΩ</td>
</tr>
<tr>
<td>3</td>
<td>Voltage Program In</td>
<td>0 to 10V=0 to 100% Rated Output, Zin=10MΩ</td>
</tr>
<tr>
<td>4</td>
<td>Filament Limit Input</td>
<td>Multi-turn front panel potentiometer</td>
</tr>
<tr>
<td>5</td>
<td>Local Filament Limit</td>
<td>Multi-turn front panel potentiometer</td>
</tr>
<tr>
<td>6</td>
<td>Filament Preheat Input</td>
<td>Multi-turn front panel potentiometer</td>
</tr>
<tr>
<td>7</td>
<td>Local Filament Preheat</td>
<td>Multi-turn front panel potentiometer</td>
</tr>
<tr>
<td>8</td>
<td>Voltage Monitor</td>
<td>0 to 10V=0 to 100% Rated Output, Zout=4.99k, 1%</td>
</tr>
<tr>
<td>9</td>
<td>Signal Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>10</td>
<td>Current Monitor</td>
<td>0 to 10V=0 to 100% Rated Output, Zout=4.99k, 1%</td>
</tr>
<tr>
<td>11</td>
<td>X-ray Enable Input</td>
<td>Connect to Pin 12 to HV Enable Supply</td>
</tr>
<tr>
<td>12</td>
<td>X-ray Enable Output</td>
<td>+15V @ Open, ≤15mA @ Closed</td>
</tr>
<tr>
<td>13</td>
<td>Filament Monitor</td>
<td>1 Volt=1 Amp, Zout=10kΩ</td>
</tr>
<tr>
<td>14</td>
<td>X-ray On Output Signal</td>
<td>Open Collector, 35V @10mA Maximum</td>
</tr>
<tr>
<td>15</td>
<td>Spare</td>
<td>NC</td>
</tr>
</tbody>
</table>

### RS-232 Digital Interface—J3 9 Pin Female D Connector

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Signal Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>2</td>
<td>TX out</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>3</td>
<td>RX in</td>
<td>Receive Data</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>SGND</td>
<td>Ground</td>
</tr>
<tr>
<td>6</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>9</td>
<td>NC</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

### USB Digital Interface—J4 4 Pin USB “B” Connector

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Signal Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VBUS</td>
<td>+5 Vdc</td>
</tr>
<tr>
<td>2</td>
<td>D-</td>
<td>Data -</td>
</tr>
<tr>
<td>3</td>
<td>D+</td>
<td>Data +</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td>Ground</td>
</tr>
</tbody>
</table>

### Ethernet Digital Interface—J5 8 Pin RJ45 Connector

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Signal Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TX+</td>
<td>Transmit Data +</td>
</tr>
<tr>
<td>2</td>
<td>TX-</td>
<td>Transmit Data -</td>
</tr>
<tr>
<td>3</td>
<td>RX+</td>
<td>Receive Data +</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>6</td>
<td>RX-</td>
<td>Receive Data -</td>
</tr>
<tr>
<td>7</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>NC</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

### J6 CA10 (R10) HV Connector

<table>
<thead>
<tr>
<th>Pin</th>
<th>Output Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>C (common)</td>
<td>High Voltage Output</td>
</tr>
<tr>
<td>S (small)</td>
<td>High Voltage Output</td>
</tr>
<tr>
<td>L (large)</td>
<td>Filament Output</td>
</tr>
</tbody>
</table>

Note: No high voltage cable is provided.
Spellman’s XLF Series of X-Ray generators are well regulated high voltage power supplies with output voltages to 60kV and very low ripple achieved through the use of advanced resonant conversion techniques. Extremely stable voltage and emission current outputs result in significant performance improvements over previously available technology. The XLF Series provides power, control and support functions required for X-Ray applications including a regulated ac filament supply referenced to the cathode. These units also incorporate local and remote programming, monitoring, safety interlock, short-circuit and overload protection.

**TYPICAL APPLICATIONS**
- Plastics Sorting
- Crystal Inspection
- Diamond Inspection

**OPTIONS**
- APT: Adjustable Power Trip
- AT: Arc Trip
- SS(x): Non-Standard Slow Start
- NSS: No Slow Start
- IO: Instant ON
- SL: Slides

**FRONT PANEL STATUS INDICATORS:**
- Overvoltage: Voltage Control Mode
- Overtemperature: Current Control Mode
- Regulation Error: Interlock Open
- Arc: Interlock Closed
- HV ON: Red
- HV OFF: Green

**SPECIFICATIONS**

**Input Voltage:**
- XLF 600W:
  - 115Vac ±10% @ 11.4A, 50-60Hz single phase
  - 220Vac ±10% @ 5.9A, 50-60Hz single phase
- XLF 1200W:
  - 220Vac ±10% @ 11.8A, 50-60Hz single phase

**Voltage and Current Control:**
- Local: continuously adjustable from zero to maximum rating via a ten-turn potentiometer
- Remote: 0 to +10Vdc proportional from 0 to full output
- Accuracy: ±1%
- Input Impedance: 10Mohm

- **Output Voltages to 60kV**
- **Integrated Floating Filament Supply**
- **Low Ripple**
- **“Hot Cathode”**
- **Negative Polarity**
- **Local & Remote Programming**
- **OEM Customization Available**

**Filament:**
- 12 volts @ 5 amps, preheat level is 0.45 amps in standby

**Voltage Regulation:**
- Load: 0.005% of full output voltage no load to full load
- Line: 0.005% for input voltage range change

**Current Regulation:**
- Load: 0.05% of full current ±100μA from 0 to full voltage
- Line: 0.05% of rated current over specified input range

**Ripple:**
- 0.03% rms below 1kHz
- 0.75% rms above 1kHz

**Temperature Coefficient:**
- 100ppm/°C.

**Stability:**
- 0.01%/8 hrs after 1/2 hour warm-up
- 0.02% per 8 hours (typical)

**Cooling:**
- Fan cooled

**Metering:**
- Digital voltage and current meters (3.5 digits), 1% accuracy

**Voltage and Current Monitors:**
- 0 to +10Vdc proportional to rated output

**HV Output:**
- 75kV, 3 conductor Federal Standard X-Ray connector

**I/O Connectors:**
- 25 pin D-type for control interface with mating connector provided

**Dimensions:**
- 3.5”H x 19”W x 20”D (8.9cm x 48.3cm x 50.8cm)

**Regulatory Approvals:**

**Electronic Component (Power Source)**
- XLF series is intended for installation as a component of a system.
- It is designed to meet CE standards, with conditions of acceptance often being: customer provided enclosure mounting, EMC filtering, and appropriate protection, and isolation devices. The XLF series is not intended to be operated by end users as a stand-alone device. The XLF series power supply can only be fully assessed when installed within a system, and as a component part within that system.
### JB1 CONNECTOR 25 PIN

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Supply Common</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>2</td>
<td>External Inhibit</td>
<td>Ground=Inhibit, Open=HV On</td>
</tr>
<tr>
<td>3</td>
<td>External Interlock</td>
<td>+15V at Open, &lt;15mA at Closed</td>
</tr>
<tr>
<td>4</td>
<td>External Interlock Return</td>
<td>Return for Interlock</td>
</tr>
<tr>
<td>5</td>
<td>Current Monitor</td>
<td>0 to 10V=0 to 100% Rated Output</td>
</tr>
<tr>
<td>6</td>
<td>kV Test Point</td>
<td>0 to 10V=0 to 100% Rated Output</td>
</tr>
<tr>
<td>7</td>
<td>+10V Reference</td>
<td>+10Vdc @ 1mA Max</td>
</tr>
<tr>
<td>8</td>
<td>Remote Current Program In</td>
<td>0 to 10V=0 to 100% Rated Output</td>
</tr>
<tr>
<td>9</td>
<td>Local Current Program Out</td>
<td>Front Panel Program Voltage</td>
</tr>
<tr>
<td>10</td>
<td>Remote Voltage Program In</td>
<td>0 to 10V=0 to 100% Rated Output</td>
</tr>
<tr>
<td>11</td>
<td>Local Voltage Program Out</td>
<td>Front Panel Program Voltage</td>
</tr>
<tr>
<td>12</td>
<td>Power Monitor</td>
<td>0 to 10V=0 to 100% Rated Output (Optional)</td>
</tr>
<tr>
<td>13</td>
<td>Remote Power Program In</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Local HV Off Out</td>
<td>+15V at Open, &lt;25mA at Closed</td>
</tr>
<tr>
<td>15</td>
<td>HV Off</td>
<td>Connect to HV OFF for FP Operation</td>
</tr>
<tr>
<td>16</td>
<td>Remote HV On</td>
<td>+15V, 10mA Max=HV Off</td>
</tr>
<tr>
<td>17</td>
<td>Remote HV Off Indicator</td>
<td>0=HV On, +15V, 10mA Max=HV Off</td>
</tr>
<tr>
<td>18</td>
<td>Remote HV On Indicator</td>
<td>0=HV Off, +15V, 10mA Max=HV On</td>
</tr>
<tr>
<td>19</td>
<td>Remote Voltage Mode</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Remote Current Mode</td>
<td>Open Collector 50V Max, 10mA Max</td>
</tr>
<tr>
<td>21</td>
<td>Remote Power Mode</td>
<td>On=Active</td>
</tr>
<tr>
<td>22</td>
<td>Remote PS Fault</td>
<td>0=Fault, +15V, 0.1mA Max=No Fault</td>
</tr>
<tr>
<td>23</td>
<td>+15V Output</td>
<td>+15V, 100mA Max</td>
</tr>
<tr>
<td>24</td>
<td>Power Supply Common</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>25</td>
<td>Shield Return</td>
<td>Shield Return</td>
</tr>
</tbody>
</table>

### 600W, 1200W XLF SELECTION TABLE

<table>
<thead>
<tr>
<th>600 Watt</th>
<th>1200 Watt</th>
</tr>
</thead>
<tbody>
<tr>
<td>kV</td>
<td>mA</td>
</tr>
<tr>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>40</td>
<td>15</td>
</tr>
<tr>
<td>50</td>
<td>12</td>
</tr>
<tr>
<td>60</td>
<td>10</td>
</tr>
</tbody>
</table>

### DIMENSIONS: in.[mm]

**FRONT VIEW**
- 0.38 [9.5] TYP
- 19.00 [482.6]
- 3.47 [88.1]
- 0.34 [8.7]
- 18.313 [465.1]
- 0.24 [6.0]

**TOP VIEW**
- 20.00 [508]

**BACK VIEW**
- 6 ft of line cable supplied with unit
- Mating HV cable not provided

---

**Spellman High Voltage**

Hauppauge, New York USA
+1-631-630-3000 FAX: +1-631-435-1620
e-mail: sales@spellmanhv.com

www.spellmanhv.com

Spellman High Voltage is an ISO 9001 and ISO 14001 registered company

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Spellman’s XRV320PN1200 X-Ray Generator sets the standard for compact 320kV @ 1200 watt single chassis high performance X-Ray inspection generators. It’s bipolar output at +160kV and -160kV is provided via industry standard R24 high voltage connectors. Active power factor correction circuitry reduces input current requirements while minimizing line related EMI. Spellman’s proprietary inverter topology allows for unprecedented efficiencies and power densities. A solid encapsulated high voltage section further reduces size and weight while providing reliable, maintenance free operation. Analog interfacing along with DSP based control circuitry provides your choice of USB, Ethernet and RS-232 simplifying OEM system integration. A floating filament referenced to the cathode output uses a current source to provide the longest filament lifetime possible. Sophisticated emission current regulation circuitry provide accurate and stable X-Ray tube currents. Comprehensive fault diagnostic circuitry, and Arc Sense, Arc Quench and Arc Count functionality is also incorporated into this compact X-Ray generator.

### Typical Applications
- Break Bulk Cargo Screening
- Vehicle Screening
- Pallet Freight Inspection
- Industrial CT
- Security Applications

### Specifications
- **Input Voltage:** Power factor corrected input, ≥0.98
  180-264Vac, single phase, 47-63Hz
- **Input Current:** <10A maximum
- **Inrush Current:** <32 amps @ 264Vac
- **Output Voltage:** 0 to 320kV (±160kV)
- **Output Polarity:** Bipolar
- **Ripple:** ≤1%rms at >20 kHz, 0.1%rms <20 kHz
- **Temperature Coefficient:** ±50ppm per degree C
- **Line Regulation:** ±0.01%
- **Load Regulation:** ±0.01%
- **Accuracy:** 0.5%
- **Filament Voltage:** 10Vrms
- **Filament Current:** 0-5A
- **Filament Accuracy:** ±2.5%
- **Environmental:**
  - **Temperature Range:** Operating: 0°C to 40°C
    Storage: -40°C to 85°C
  - **Humidity:** 20% to 85% RH, non-condensing
- **Input Line Connector:** Type 97-3102A-24-11P, Mains and Auxiliary
- **HV Output Connector:** R24
- **Analogue Interface:** Analog/Digital control signals, DB25 connector
- **Control Interface:**
  - Remote Interface:
    Analog, USB, Ethernet and RS-232 are standard
  - Control Software:
    A Windows graphical user interface example is provided.
- **Cooling:** Forced air
- **Dimensions:** 10.5"H x 19"W x 21.5"D (266.7mm x 482.6mm x 546.1mm)
- **Weight:** 150 pounds (68kg)
- **Regulatory Approvals:** Regulatory approvals are pending.

- **320kV @ 1200 Watts in a Single Chassis**
- **Interface Compatibility with Spellman’s XRV Series**
- **Ethernet, RS-232 and USB Digital Interfaces**
- **Universal AC Input, Works Worldwide Trouble Free**
- **Power Factor Corrected, Lower Input Currents/Lower EMI**
- **Provided GUI for Customization of Operational Features**
- **Complete Tested Imaging Subsystems Available**
GUI Control Software for the XRV320PN1200

GUI is specifically designed for controlling XRV320PN1200 power supply. As an alternative to the analog control, the GUI will allow the user to control all necessary functions of the HVPS from a user-friendly windows based menu. Additionally the GUI can be used as a diagnostic tool when the HVPS is controlled via the analog interface.

**J2 ANALOG INTERFACE—25 PIN D CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Supply Fault</td>
<td>Low, sum of faults, HVPS detected a fault, open collector, 50V @ 10mA max</td>
</tr>
<tr>
<td>2</td>
<td>mA Program</td>
<td>0 to 10V FS Z in = 10M ohms</td>
</tr>
<tr>
<td>3</td>
<td>kV Program</td>
<td>0 to 10V FS Z in = 10M ohms</td>
</tr>
<tr>
<td>4</td>
<td>Filament Limit L/S Ref.*</td>
<td>0 to 10V FS Z in = 10M ohms</td>
</tr>
<tr>
<td>5</td>
<td>Filament Preheat L/S Ref.*</td>
<td>0 to 10V FS Z in = 10M ohms</td>
</tr>
<tr>
<td>6</td>
<td>kV Monitor</td>
<td>0 to 10V FS Z out = 4.99k ohms</td>
</tr>
<tr>
<td>7</td>
<td>mA Monitor</td>
<td>0 to 10V FS Z out = 4.99k ohms</td>
</tr>
<tr>
<td>8</td>
<td>Filament Current Monitor*</td>
<td>0 to 10V FS Z out = 4.99k ohms</td>
</tr>
<tr>
<td>9</td>
<td>Signal Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>10</td>
<td>X-Ray Enable</td>
<td>+24Vdc = X-Ray ON, connect to pin 14 with dry contact relay</td>
</tr>
<tr>
<td>11</td>
<td>Filament ON*</td>
<td>Filament ON status, low, filament is ON open collector, 50V @ 10mA max</td>
</tr>
<tr>
<td>12</td>
<td>Interlock 1</td>
<td>Active low, interlock is closed, safe to enable HV</td>
</tr>
<tr>
<td>13</td>
<td>Interlock 2</td>
<td>Active low, interlock is closed, safe to enable HV</td>
</tr>
<tr>
<td>14</td>
<td>+24Vdc</td>
<td>+24Vdc @ 100mA, maximum</td>
</tr>
<tr>
<td>15</td>
<td>Filament Enable*</td>
<td>Active low, turn filament ON</td>
</tr>
<tr>
<td>16</td>
<td>Filament Control*</td>
<td>Active low, filament is regulated by ECR (HV must be ON). Not active, the filament is regulated by the preheat reference</td>
</tr>
<tr>
<td>17</td>
<td>Filament L/S Select</td>
<td>Filament selection large or small, low = small spot is selected</td>
</tr>
<tr>
<td>18</td>
<td>Filament L/S Confirm</td>
<td>Open collector, 50V @ 10mA max Filament selection confirm, low = small spot is selected</td>
</tr>
<tr>
<td>19</td>
<td>HVPS RDY</td>
<td>Low = HVPS ready, open collector, 50V @ 10mA max</td>
</tr>
<tr>
<td>20</td>
<td>X-Ray ON</td>
<td>X-Ray ON status, low = X-Rays are ON open collector, 50V @ 10mA max</td>
</tr>
<tr>
<td>21</td>
<td>Interlock Status</td>
<td>Low, interlocks are closed, can enable HV open collector, 50V @ 10mA max</td>
</tr>
<tr>
<td>22</td>
<td>GND</td>
<td>Digital ground</td>
</tr>
<tr>
<td>23</td>
<td>X-Ray ON Pre-Warn</td>
<td>Pre-warning, low, before X-Ray ON open collector, 50V @ 10mA max</td>
</tr>
<tr>
<td>24</td>
<td>Reset</td>
<td>Active low, minimum 10mS transition</td>
</tr>
<tr>
<td>25</td>
<td>Arc fault</td>
<td>Low, arc fault, the HVPS has detected an arc open collector, 50V @ 10mA max</td>
</tr>
</tbody>
</table>

*Not active on positive models

**J1 R24 HV CONNECTOR CATHODE**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>(common) High Voltage Output</td>
<td>0 to -160kV</td>
</tr>
<tr>
<td>S</td>
<td>(small) Filament Output</td>
<td>10Vrms @ 0-5A</td>
</tr>
<tr>
<td>L</td>
<td>(large) Filament Output</td>
<td>10Vrms @ 0-5A</td>
</tr>
</tbody>
</table>

**J6 R24 HV CONNECTOR ANODE**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>(common) High Voltage Output</td>
<td>0 to +160kV</td>
</tr>
<tr>
<td>S</td>
<td>(small) High Voltage Output</td>
<td>0 to +160kV</td>
</tr>
<tr>
<td>L</td>
<td>(large) High Voltage Output</td>
<td>0 to +160kV</td>
</tr>
</tbody>
</table>

**J4 ETHERNET DIGITAL INTERFACE—8 PIN RJ45 CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TX+</td>
<td>Transmit Data +</td>
</tr>
<tr>
<td>2</td>
<td>TX-</td>
<td>Transmit Data -</td>
</tr>
<tr>
<td>3</td>
<td>RX+</td>
<td>Receive Data +</td>
</tr>
<tr>
<td>4</td>
<td>RX-</td>
<td>Receive Data -</td>
</tr>
<tr>
<td>5</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

**J5 USB DIGITAL INTERFACE—4 PIN USB “B” CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VBUS</td>
<td>+5 Vdc</td>
</tr>
<tr>
<td>2</td>
<td>D-</td>
<td>Data -</td>
</tr>
<tr>
<td>3</td>
<td>D+</td>
<td>Data +</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td>Ground</td>
</tr>
</tbody>
</table>

**J3 RS-232 DIGITAL INTERFACE—9 PIN FEMALE D CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>2</td>
<td>TX out</td>
<td>Receive Data</td>
</tr>
<tr>
<td>3</td>
<td>RX in</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>9</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
</tbody>
</table>
DIMENSIONS: in.[mm]

TOP VIEW

AIR IN

FRONT VIEW

10.47 [265.9]
6.52 [165.6]
3.20 [81.28]
7.19 [182.62]

SIDE VIEW

24.29 [616.96]
21.62 [549.14]

AIR OUT
Spellman’s XRV series of X-Ray high voltage power supplies sets the standard for compact 1.8kW to 6.0kW, high performance X-Ray inspection generators. Spanning an output voltage range of 160kV to 450kV in negative, positive or bipolar output configurations, there’s a model available for virtually every application requirement.

Active power factor correction circuitry reduces input current requirements while minimizing line related EMI. Spellman’s proprietary inverter topology allows for unprecedented efficiencies and power densities. A solid encapsulated high voltage section further reduces size and weight and provides reliable, maintenance free operation.

DSP based SMT control circuitry provides your choice of USB, Ethernet and RS-232 along with analog interfacing, simplifying OEM system integration. The two DC output, current regulated filament power supplies are controlled via sophisticated emission current regulation circuitry to provide accurate and stable X-Ray tube current. Comprehensive fault diagnostic circuitry, and Arc Sense, Arc Quench and Arc Count functionality is also incorporated into this compact, space saving X-Ray generator.

TYPICAL APPLICATIONS
- Non Destructive Testing
- X-Ray Scanning
- Security Applications
- Medical Applications

OPTIONS
- 400Vac ±10% (6kW only)
- GUI Control Software for XRV
- XRV Controller (XRV Controller)

SPECIFICATIONS
Input Voltage:
- 1.8kW, 3.0kW, 4.0kW and 4.5kW models:
  - 180-264Vac, single phase, 47-63 Hertz, active power factor corrected input to ≥0.98
- 6.0kW models:
  - 208 or 400Vac, ±10%, three phase, 47-63 Hertz, passive power factor corrected

Input Current:
- 1.8kW, 3.0kW, 4.0kW and 4.5kW models: <30 amps
- 6.0kW models: <25 amps per phase for 208Vac
  - <15 amps per phase for 400Vac

Output Voltage:
- Accuracy: 0.25%
- Stability: ≤0.1% per 8 hours, after 1 hour warm up

1.8kW, 3.0kW, 4.0kW and 4.5kW models:
- Load: ±0.05% of rated output voltage for a full load change
- Line: ±0.05% of rated output voltage over specified input voltage range

6.0kW models:
- Load: ±0.1% of rated output voltage for a full load change
- Line: ±0.1% of rated output voltage over specified input voltage range

Output Polarity:
See “model selection” table

Output Current:
See “model selection” table

Ripple:
See “model selection” table

Temperature Coefficient:
- 1.8kW, 3.0kW, 4.0kW and 4.5kW models:
  - ±50ppm/°C
- 6.0kW models:
  - ±50ppm/°C

Emission Current:
- Accuracy: 0.25%
- Stability: 100ppm/°C

1.8kW, 3.0kW, 4.0kW and 4.5kW models:
- Load: ±0.05% of rated output current for a change from 30% to 100% of rated output voltage
- Line: ±0.05% of rated output current over specified input voltage range

6.0kW models:
- Load: ±0.1% of rated output current for a change from 30% to 100% of rated output voltage
- Line: ±0.1% of rated output current over specified input voltage range

Filament:
- Output:
  - 0-6 amps at a compliance of 10Vdc, maximum

Dual Focal Spot:
Small and large, selectable via interface signal

Configuration:
- DC filament drive. Closed loop emission control regulates filament setting to provide desired X-Ray tube emission current
GUI is specifically designed for controlling XRV series power supplies. As an alternative to the analog control, the GUI will allow the user to control all necessary functions of the HVPS from a user-friendly windows based menu. Additionally the GUI can be used as a diagnostic tool when the HVPS is controlled via the analog interface.

Automatic warm-up of the X-Ray tube
Max watts operation
Timed or Continuous Exposure modes
Configuration menu for user options setting of HVPS
Fault and status monitor

GUI Control Software for the XRV

Control Interface:
Remote Interface:
Analog, USB, Ethernet and RS-232 are standard

Control Software:
A Windows graphical user interface example is provided.

Environmental:
Temperature Range:
Operating: 0˚C to 50˚C
Storage: -40˚C to 85˚C
Humidity:
20% to 85% RH, non-condensing.

Mains Input Connector:
1.8kW, 3.0kW, 4.0kW and 4.5kW models:
Type 97-3102A-24-11P

6.0kW models:
Type 97-3102A-24-22P

Interface Connectors:
Digital—Ethernet, RS-232 and USB
Analog—25 pin connector

Output Connector:
See "model selection" table

Cooling:
Forced air

Regulatory Approvals:
Compliant to EEC EMC Directive/Compliant to EEC Low Voltage Directive, all but 6000 watt unit. NFC 74-100 compliant. UL/CUL recognized, File E227588, all but 6000 watt unit. RoHS Compliant.

---

**XRV160/320/350 SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Model</th>
<th>DC Output Voltage</th>
<th>DC Output Voltage</th>
<th>DC Output Voltage</th>
<th>DC Output Voltage</th>
<th>DC Output Voltage</th>
<th>DC Output Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>XRV160*1800</td>
<td>5kV to 160kV</td>
<td>5kV to 160kV</td>
<td>5kV to 160kV</td>
<td>5kV to 160kV</td>
<td>5kV to ±160kV</td>
<td>5kV to ±175kV</td>
</tr>
<tr>
<td>XRV160*3000</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>XRV160*4000</td>
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<tr>
<td>XRV160*6000</td>
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</tr>
<tr>
<td>XRV320P&amp;N1800</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>XRV320P&amp;N4500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>XRV350P&amp;N4500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**XRV225/450 SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Model</th>
<th>DC Output Voltage</th>
<th>DC Output Voltage</th>
<th>DC Output Voltage</th>
<th>DC Output Voltage</th>
<th>DC Output Voltage</th>
<th>DC Output Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>XRV225*1800</td>
<td>5kV to 225kV</td>
<td>5kV to 225kV</td>
<td>5kV to 225kV</td>
<td>5kV to ±225kV</td>
<td>5kV to ±225kV</td>
<td>5kV to ±225kV</td>
</tr>
<tr>
<td>XRV225*3000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>XRV225*4000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>XRV225*6000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>XRV450P&amp;N1800</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>XRV450P&amp;N4500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Units** are available in positive output polarity without filament, see model selection table for ordering details.

*Specify "P" for positive or "N" for negative polarity.

**Order SHV HV cable flange p/n 407141-024 if using Comet HV cable with R28SL spring loaded plug.

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**J1 HV CONNECTOR—R24/R28**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
</table>
| C   | HV Output | XRV160 and XRV320—R24 Connector  
XRV225 and XRV450—R28 Connector |
| S   | Small Filament Output | 0 to 6 amps @ 10Vdc |
| L   | Large Filament Output | 0 to 6 amps @ 10Vdc |

**J2 ANALOG INTERFACE—25 PIN D CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
</table>
| 1   | Power Supply Fault | Low, sum of faults, HVPS detected a fault,  
open collector, 50V @ 10mA max |
| 2   | mA Program | 0 to 10V FS Z in = 10M ohms |
| 3   | kV Program | 0 to 10V FS Z in = 10M ohms |
| 4   | Filament Limit L/S Ref.* | 0 to 10V FS Z in = 10M ohms |
| 5   | Filament Preheat L/S Ref.* | 0 to 10V FS Z in = 10M ohms |
| 6   | kV Monitor | 0 to 10V FS Z out = 4.99k ohms |
| 7   | mA Monitor | 0 to 10V FS Z out = 4.99k ohms |
| 8   | Filament Current Monitor* | 0 to 10V FS Z out = 4.99k ohms |
| 9   | Signal Ground | Ground |
| 10  | X-Ray Enable | +24Vdc = X-Ray ON, connect to pin 14 with dry contact relay |
| 11  | Filament ON* | Filament ON status, low, filament is ON  
open collector 50V @ 10mA max |
| 12  | Interlock 1 | Active low, interlock is closed, safe to enable HV |
| 13  | Interlock 2 | Active low, interlock is closed, safe to enable HV |
| 14  | +24Vdc | +24Vdc @ 100mA, maximum |
| 15  | Filament Enable* | Active low, turn filament ON |
| 16  | Filament Control* | Active low, filament is regulated by ECR (HV must be ON).  
Regulated by the preheat reference |
| 17  | Filament L/S Select | Filament selection large or small, low = small spot is selected |
| 18  | Filament L/S Confirm | Open collector, 50V @ 10mA max  
Filament selection confirm, low = small spot is selected |
| 19  | HVPS RDY | Low = HVPS ready, open collector, 50V @ 10mA max |
| 20  | X-Ray ON | X-Ray ON status, low = X-Rays are ON  
open collector, 50V @ 10mA max |
| 21  | Interlock Status | Low, interlocks are closed, can enable HV  
open collector, 50V @ 10mA max |
| 22  | GND | Digital ground |
| 23  | X-Ray ON Pre-Warn | Pre-warning, low, before X-Ray ON open collector,  
50V @ 10mA max |
| 24  | Heset | Active low, minimum 10ms transition |
| 25  | Arc fault | Low, arc fault, the HVPS has detected an arc  
open collector, 50V @ 10mA max |

*Not active on positive models

**MODEL SELECTION TABLE**

<table>
<thead>
<tr>
<th>MODEL</th>
<th>VOLTAGE</th>
<th>POWER</th>
<th>POLARITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>XRV160*1800</td>
<td>160kV</td>
<td>1.8kW</td>
<td>Pos or Neg</td>
</tr>
<tr>
<td>XRV160*3000</td>
<td>160kV</td>
<td>3.0kW</td>
<td>Pos or Neg</td>
</tr>
<tr>
<td>XRV160*4000</td>
<td>160kV</td>
<td>4.0kW</td>
<td>Pos or Neg</td>
</tr>
<tr>
<td>XRV160*6000/208V</td>
<td>160kV</td>
<td>6.0kW</td>
<td>Pos or Neg</td>
</tr>
<tr>
<td>XRV160*6000/400V</td>
<td>160kV</td>
<td>6.0kW</td>
<td>Pos or Neg</td>
</tr>
<tr>
<td>XRV225*1800</td>
<td>225kV</td>
<td>1.8kW</td>
<td>Pos or Neg</td>
</tr>
<tr>
<td>XRV225*3000</td>
<td>225kV</td>
<td>3.0kW</td>
<td>Pos or Neg</td>
</tr>
<tr>
<td>XRV225*4000</td>
<td>225kV</td>
<td>4.0kW</td>
<td>Pos or Neg</td>
</tr>
<tr>
<td>XRV225*6000/208V</td>
<td>225kV</td>
<td>6.0kW</td>
<td>Pos or Neg</td>
</tr>
<tr>
<td>XRV225*6000/400V</td>
<td>225kV</td>
<td>6.0kW</td>
<td>Pos or Neg</td>
</tr>
<tr>
<td>XRV450P*1800</td>
<td>±160kV</td>
<td>1.8kW</td>
<td>Bipolar</td>
</tr>
<tr>
<td>XRV450P*1800</td>
<td>±160kV</td>
<td>1.8kW</td>
<td>Bipolar</td>
</tr>
<tr>
<td>XRV450P*4500</td>
<td>±175kV</td>
<td>4.5kW</td>
<td>Bipolar</td>
</tr>
<tr>
<td>XRV450P*4500</td>
<td>±175kV</td>
<td>4.5kW</td>
<td>Bipolar</td>
</tr>
<tr>
<td>XRV450P*4500</td>
<td>±175kV</td>
<td>4.5kW</td>
<td>Bipolar</td>
</tr>
</tbody>
</table>

*Specify P for positive polarity and N for negative polarity. Positive polarity models do not have integrated filament power supplies. Contact Spellman for custom output voltage/power models.

**RS-232 DIGITAL INTERFACE—J3 9 PIN FEMALE D CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>2</td>
<td>TX out</td>
<td>Receive Data</td>
</tr>
<tr>
<td>3</td>
<td>RX in</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>SGND</td>
<td>Ground</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>9</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

**ETHERNET DIGITAL INTERFACE—J4 8 PIN RJ45 CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TX+</td>
<td>Transmit Data +</td>
</tr>
<tr>
<td>2</td>
<td>TX-</td>
<td>Transmit Data -</td>
</tr>
<tr>
<td>3</td>
<td>RX+</td>
<td>Receive Data +</td>
</tr>
<tr>
<td>4</td>
<td>RX-</td>
<td>Receive Data -</td>
</tr>
<tr>
<td>5</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

**USB DIGITAL INTERFACE—J5 4 PIN USB “B” CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VBUS</td>
<td>+5 Vdc</td>
</tr>
<tr>
<td>2</td>
<td>D-</td>
<td>Data -</td>
</tr>
<tr>
<td>3</td>
<td>D+</td>
<td>Data +</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td>Ground</td>
</tr>
</tbody>
</table>

**JB1 MAIN AND AUXILIARY INPUT POWER—TYPE 97-3102A-24-11P (Single Phase Units)**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Auxiliary AC Line Power</td>
<td>180-264Vac</td>
</tr>
<tr>
<td>B</td>
<td>Auxiliary Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>C</td>
<td>Auxiliary AC Neutral</td>
<td>Neutral</td>
</tr>
<tr>
<td>D</td>
<td>Main AC Line Power</td>
<td>180-264Vac</td>
</tr>
<tr>
<td>E</td>
<td>Main Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>F</td>
<td>Main AC Neutral</td>
<td>Neutral</td>
</tr>
</tbody>
</table>

**JB1 MAIN AC INPUT POWER—TYPE 97-3102A-24-22P (Three Phase Units)**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Line 1</td>
<td>208Vac ±10%, 50/60Hz @ 25 amps</td>
</tr>
<tr>
<td>B</td>
<td>Line 2</td>
<td>208Vac ±10%, 50/60Hz @ 25 amps</td>
</tr>
<tr>
<td>C</td>
<td>Line 3</td>
<td>208Vac ±10%, 50/60Hz @ 25 amps</td>
</tr>
<tr>
<td>D</td>
<td>GND</td>
<td>Ground</td>
</tr>
</tbody>
</table>

Note: Use 4 conductor cable or single isolated wires rated no less than 600Vac, 30 amps (10AWG, minimum)

**JB2 AUXILIARY AC INPUT POWER—TYPE 97-3102A-20-3P (Three Phase Units)**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Line 1</td>
<td>208Vac ±10%, 50/60Hz (source 3 phase L1, L2)</td>
</tr>
<tr>
<td>B</td>
<td>Line 2</td>
<td>208Vac ±10%, 50/60Hz (source 3 phase L1, L2)</td>
</tr>
<tr>
<td>C</td>
<td>GND</td>
<td>Ground</td>
</tr>
</tbody>
</table>

System Ground: System ground wires (10AWG minimum) to the ground terminal E1 GND to the power supply using ground stud M6 X 20MM, with M6 nut.

---

Spellman High Voltage is an ISO 9001 and ISO 14001 registered company

www.spellmanhv.com

Spellman High Voltage is an ISO 9001 and ISO 14001 registered company

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128060-001    REV. AB

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XRV

1.8-6.0KW X-RAY GENERATORS

SPELLMAN HIGH VOLTAGE ELECTRONICS CORPORATION

PAGE 4 OF 4

XRV160

TOP VIEW

XRV225

TOP VIEW

DIMENSIONS: in.[mm]

24.00 [609]

30.72 [780]

10.09 [256]

17.16 [436]

XRV320 is comprised of two XRV160 units configured in a bipolar arrangement

XRV450 is comprised of two XRV225 units configured in a bipolar arrangement

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Spellman's DF/FF Series of X-Ray Generators feature our new inverter design which incorporates IGBTs for power switching and provides new levels of reliability. In addition, re-engineering of the DF/FF’s internal filament power supply eliminates audio noise at normal operating levels by operating at a higher frequency. The DF/FF’s utilize a sine wave current source, produced by phase shifting series resonant circuits at switching frequencies greater than 20kHz to generate high voltage dc. This technique eliminates undesirable electromagnetic radiation normally associated with switching and power control regulators. The high efficiency of these units allows for air cooling in a 5.25” (3U) high chassis.

**TYPICAL APPLICATIONS**

- X-Ray Diffraction (XRD)
- X-Ray Fluorescence (XRF)

**OPTIONS**

- 220FSI: 220Vac Fail Safe Interlock
- 208-3P: 208Vac Three Phase Input

**SPECIFICATIONS**

- **Input Voltage:**
  - 220Vac ±10%, 50-60Hz, single phase (three phase optional)

- **Input Current:**
  - 3kW: 220Vac @ 29.5A, single phase
  - 208Vac @ 12.8A, three phase
  - 4kW: 220Vac @ 39.3A, single phase
  - 208Vac @ 17.0A, three phase

- **Output Voltage:**
  - DF3: 0 to 60kV negative polarity
  - FF3: 0 to 60kV positive polarity
  - Other output voltages are available

- **Output Current:**
  - DF3: 0 to 80mA
  - FF3: 0 to 100mA
  - Other output currents are available

- **Maximum Output Power:**
  - 3kW (4kW optional)

- **Output Voltage Regulation:**
  - Load: 0.005% of rated output for full load change
  - Line: 0.005% of rated output over specified input range
  - Temperature Coefficient: 50 ppm/°C (20 ppm/°C optional)
  - Long Term Stability: 0.01%/8 hours

- **Ripple:**
  - 0.03% rms <1kHz, 0.75% rms above 1kHz

- **Environmental:**
  - Temperature Range:
    - Operating: 0˚C to 40˚C
    - Storage: -20˚C to 85˚C
  - Humidity: 10% to 90%, non-condensing

- **Filament Voltage:**
  - DF: 12Vac
  - FF: 12Vdc

- **Filament Current:**
  - 5A (up to 12A max available)

- **Dimensions:**
  - 5.25” (3U) H x 19” W x 22” D (13.3cm x 48.3cm x 55.9cm)

- **Weight:**
  - 90lbs (40kg)

- **Regulatory Approvals:**
  - Compliant to EEC EMC Directive.
  - Compliant to EEC Low Voltage Directive.

**ADDITIONAL FEATURES**

- **Water Flow Switch:**
  - A 24Vdc signal is available on the rear panel to turn on the cooling water to the X-Ray tube. This signal can be enabled either when control power is on or when the high voltage is turned on. (Customer must specify)

- **Fail Safe Interlock:**
  - A 24Vdc signal is available on the rear panel to energize an external X-Ray on lamp. This signal is energized when the high voltage is turned on. High voltage will not enable if this circuit is open. (A 220Vac signal is optional)

- **Preheat and Ramp:**
  - Automatic preheat and ramp control circuits are provided which ramp the kV and mA slowly to set levels. kV ramps in approximately 10 seconds while mA ramps in approximately 20 seconds.

- **Output Connector:**
  - 75kV, 3 conductor Federal Standard X-Ray connector. 60kV is connected to terminal “C”. Terminals “S” and “L” are jumped together. The filament output is connected between terminals “C” and “S”. Other configurations are optional. (On the FF3, all output connections S, L, & C are connected together)

- **Remote Signal Connector:**
  - Remote interface is available via a 50 pin mini D connector. Extensive remote programming and monitoring is provided.
Electronic Component (Power Source)

DF/FF series is intended for installation as a component of a system. It is designed to meet CE standards, with conditions of acceptance often being: customer provided enclosure mounting, EMC filtering, and appropriate protection, and isolation devices. The DF/FF series is not intended to be operated by end users as a stand-alone device. The DF/FF series power supply can only be fully assessed when installed within a system, and as a component part within that system.

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+5Vdc (or connect to pin-11)</td>
</tr>
<tr>
<td>2</td>
<td>Control Power On</td>
</tr>
<tr>
<td>3</td>
<td>Intlk</td>
</tr>
<tr>
<td>4</td>
<td>X-Ray On</td>
</tr>
<tr>
<td>5</td>
<td>X-Ray Off</td>
</tr>
<tr>
<td>6</td>
<td>Spare</td>
</tr>
<tr>
<td>7</td>
<td>Spare</td>
</tr>
<tr>
<td>8</td>
<td>Reset</td>
</tr>
<tr>
<td>9</td>
<td>Rmt/Lcl</td>
</tr>
<tr>
<td>10</td>
<td>+5Vch</td>
</tr>
<tr>
<td>11</td>
<td>X-Ray On Status</td>
</tr>
<tr>
<td>12</td>
<td>kV Min</td>
</tr>
<tr>
<td>13</td>
<td>Overvoltage</td>
</tr>
<tr>
<td>14</td>
<td>mA Current Limit</td>
</tr>
<tr>
<td>15</td>
<td>LCL Status</td>
</tr>
<tr>
<td>16</td>
<td>Power Supply Fault</td>
</tr>
<tr>
<td>17</td>
<td>Gnd</td>
</tr>
<tr>
<td>18</td>
<td>Spare</td>
</tr>
<tr>
<td>19</td>
<td>(DF) Remote X-Ray On</td>
</tr>
<tr>
<td>20</td>
<td>(DF) Remote X-Ray On Ret</td>
</tr>
<tr>
<td>21</td>
<td>Spare</td>
</tr>
<tr>
<td>22</td>
<td>Gnd</td>
</tr>
<tr>
<td>23</td>
<td>kV Ref</td>
</tr>
<tr>
<td>24</td>
<td>kV Com</td>
</tr>
<tr>
<td>25</td>
<td>mA Ref</td>
</tr>
<tr>
<td>26</td>
<td>mA Com</td>
</tr>
<tr>
<td>27</td>
<td>Spare</td>
</tr>
<tr>
<td>28</td>
<td>Spare</td>
</tr>
<tr>
<td>29</td>
<td>Spare</td>
</tr>
<tr>
<td>30</td>
<td>Pwr. Limit (OL Ref)</td>
</tr>
<tr>
<td>31</td>
<td>Pwr. Limit Com (OL Com)</td>
</tr>
<tr>
<td>32</td>
<td>Filament Current Limit</td>
</tr>
<tr>
<td>33</td>
<td>Filament Current Limit Com</td>
</tr>
<tr>
<td>34</td>
<td>Spare</td>
</tr>
<tr>
<td>35</td>
<td>kV Monitor</td>
</tr>
<tr>
<td>36</td>
<td>mA Monitor</td>
</tr>
<tr>
<td>37</td>
<td>Spare</td>
</tr>
<tr>
<td>38</td>
<td>kV Ref Mon</td>
</tr>
<tr>
<td>39</td>
<td>mA Ref Mon</td>
</tr>
<tr>
<td>40</td>
<td>Spare</td>
</tr>
<tr>
<td>41</td>
<td>Spare</td>
</tr>
<tr>
<td>42</td>
<td>Filament Monitor</td>
</tr>
<tr>
<td>43</td>
<td>Mon Common</td>
</tr>
<tr>
<td>44</td>
<td>Spare</td>
</tr>
<tr>
<td>45</td>
<td>Gnd</td>
</tr>
<tr>
<td>46</td>
<td>Spare</td>
</tr>
<tr>
<td>47</td>
<td>Spare</td>
</tr>
<tr>
<td>48</td>
<td>Spare</td>
</tr>
<tr>
<td>49</td>
<td>Spare</td>
</tr>
<tr>
<td>50</td>
<td>Spare</td>
</tr>
</tbody>
</table>

Cost reduced version for OEM quantities available, contact Sales.
Spellman’s VMX redefines the standard for high performance, low cost Mammography X-Ray generators. The VMX was born from an integrated, high performance, value added design perspective so there’s no need to compromise critical specifications to meet ever-demanding system price targets.

The 40kV/5kW X-Ray generator integrates a dual filament power supply and a dual speed starter. A DC current source filament power supply provides fast rise times with stable and accurate X-Ray tube emission currents. The solid encapsulated high voltage output section eliminates oil concerns while reducing the effects of environmental humidity and contamination.

Flexibility in interfacing is provided via RS-232 and optional Ethernet connectivity. The VMX supports advanced mammography application features including Smart AEC Exposure, Automatic Filament Calibration, Tube Anode Heat Calculator and user configurable Tube Library. Compact, full featured, high performance, low cost. Spellman’s VMX, the next generation Mammography X-Ray generator.

**SPECIFICATIONS**

**Input Voltage:**
200-240Vac (±10%), single phase, 50Hz/60Hz

**Input Current:**
Minimum 35A service recommended for 5kW operation
External EMC Filter (Schaffner FN2070-36-08-36A) required to meet CE/EMC specifications – Not provided with the generator
Mains Contactor – Not provided within the generator. Customer is responsible for mains safety disconnection.

**Output Voltage**
- **Output Voltage Range:** 20kV to 40kV
- **Polarity:** Positive, grounded cathode X-Ray tube
- **Accuracy:** Within 1% of programmed values
- **Reproductibility:** <0.5%
- **Settling Time:** <10ms

**Output Current/Power**
- **Output Current Range:** 10mA to 200mA
- **Output Power:** 5kW @ 0.1 second loading time
  30W maximum average power
- **Maximum mAs:** 600mAs
- **Exposure Timer:** 5ms-10 seconds
- **Accuracy:** Within 2% of programmed values measured after mA rises to stable DC level
- **Reproductibility:** <0.5%
- **Settling Time:** <10ms

**Filament Configuration:**
DC filament drive: self corrected filament preheat settings with closed loop emission control and smart learning algorithm

**Filament Output:**
0-6 amps at a compliance of 5.5 volts, maximum

**Dual Speed Starter:**
High speed (180Hz) and low speed (60Hz) can be configured via the serial interface.
Boost and Brake capability provided.

**High Voltage Connector:**
60kV, Claymount CA-3 type or equivalent

**Optional Communication Interface:**
Ethernet (RJ45)

**Grounding Point:**
M5 ground stud provided on chassis

**Environmental:**
- **Temperature Range:** Operating: 10°C to 40°C
  Storage: -40°C to 85°C
- **Humidity:** 20% to 85% RH, non-condensing.
Cooling:
Convection cooled, no internal fans.
Forced air cooling not required.

Dimensions:
9.38” H X 6.6” W X 12” D
(237.5mm x 167.6mm x 304.8mm)

Weight:
<22 pounds (10kg)

Regulatory Approvals:
Compliant to EMC: IEC 60601-1-2. UL/CUL recognized file E242584. RoHS compliant.

Application Features:
- 2 point/3 point exposure modes
- AEC/Smart AEC exposure modes
- Automatic filament current calibration
- Tube anode heat calculator
- User configurable tube library

---

### VMX STANDARD SYSTEM INTERFACE—JB1 25 PIN MALE D CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GND</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>2</td>
<td>+5Vdc Out</td>
<td>+5Vdc, 100mA max.</td>
</tr>
<tr>
<td>3</td>
<td>RS-232 Tx Out</td>
<td>RS-232 Transmit</td>
</tr>
<tr>
<td>4</td>
<td>RS-232 Rx In</td>
<td>RS-232 Receiver</td>
</tr>
<tr>
<td>5</td>
<td>PREP</td>
<td>User signal (Contact Closure) to alert the generator that exposure sequence will begin. Once this signal is active, exposure parameters are locked in and cannot be changed. The generator enables the starter to boost the rotor. Contact connection to pin 24. Closed = PREP, the filament is placed in preheat mode</td>
</tr>
<tr>
<td>6</td>
<td>READY</td>
<td>Generator signal to user to indicate the rotor runs to speed and the generator is ready for X-Ray exposure. Open Collector. Low/Active = Ready</td>
</tr>
<tr>
<td>7</td>
<td>ROTOR SHUTDOWN</td>
<td>User signal to brake the rotor drive</td>
</tr>
<tr>
<td>8</td>
<td>EXPOSURE</td>
<td>User signal (Contact Closure) to generator to generate X-Rays. Filament is boosted, and high voltage is generated after the boost time. Contact connection to pin 24. Closed = Exposure</td>
</tr>
<tr>
<td>9</td>
<td>X-Ray ON 75% Status</td>
<td>Transistor output to indicate X-Ray ON status synchronized with 75% of kVP setting point.</td>
</tr>
<tr>
<td>10</td>
<td>X-Ray ON Status</td>
<td>Transistor output to indicate X-Ray ON status synchronized with kV start up.</td>
</tr>
<tr>
<td>11</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>12</td>
<td>X-Ray SHUTDOWN/AEC</td>
<td>User signal to generator to rapidly turn HV OFF and ON during serial exposure sequence</td>
</tr>
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<td>RS-232 ISO Ground</td>
<td>Isolated ground from RS-232 transceiver IC</td>
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<td>14</td>
<td>HVG FAULT</td>
<td>Generator signal indicating generator fault. Open collector transistor output. Low/Active = Fault</td>
</tr>
<tr>
<td>15</td>
<td>Status Bit 1</td>
<td>3 bit status lines for up to 6 status messages. See separate matrix describing functionality. Open Collector. Low/Active = Message</td>
</tr>
<tr>
<td>16</td>
<td>Status Bit 2</td>
<td>Status Bit 3</td>
</tr>
<tr>
<td>17</td>
<td>Status Bit 3</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>19</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>20</td>
<td>kV Monitor</td>
<td>Signal from generator. 0-10V = 0-40kV. Zout = 1kΩ</td>
</tr>
<tr>
<td>21</td>
<td>Emission Monitor</td>
<td>Signal from generator. 0-10V = 0-200mA. Zout = 1kΩ</td>
</tr>
<tr>
<td>22</td>
<td>Filament Current Monitor</td>
<td>Signal from generator. 0-10V = 0-6A. Zout = 1kΩ</td>
</tr>
<tr>
<td>23</td>
<td>Program/monitor Return</td>
<td>Ground for reference of program and monitor signals</td>
</tr>
<tr>
<td>24</td>
<td>+24Vdc Out</td>
<td>For connection to PREP and EXPOSURE control relay coils</td>
</tr>
<tr>
<td>25</td>
<td>SHIELD/GND</td>
<td>For connection of interface cable shield to generator chassis ground</td>
</tr>
</tbody>
</table>

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### TB2 ROTOR INTERFACE

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB2-1</td>
<td>PHASE</td>
<td>To tube auxiliary winding</td>
</tr>
<tr>
<td>TB2-2</td>
<td>RUN</td>
<td>To tube principle winding</td>
</tr>
<tr>
<td>TB2-3</td>
<td>COM</td>
<td>To tube common winding</td>
</tr>
<tr>
<td>TB2-4</td>
<td>GROUND</td>
<td>To tube housing ground</td>
</tr>
</tbody>
</table>

### TB3 TUBE AND INTERLOCK INTERFACE

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB3-1</td>
<td>SMALL FIL</td>
<td>Connection to tube small filament</td>
</tr>
<tr>
<td>TB3-2</td>
<td>COMMON</td>
<td>Connection to tube filament common</td>
</tr>
<tr>
<td>TB3-3</td>
<td>LARGE FIL</td>
<td>Connection to large filament</td>
</tr>
<tr>
<td>TB3-4</td>
<td>GROUND</td>
<td>Generator chassis for cable shield connection</td>
</tr>
<tr>
<td>TB3-5</td>
<td>Interlock 2+</td>
<td>Used if tube has separate thermostat switch. Open = OVER TEMP. (short terminals if not used)</td>
</tr>
<tr>
<td>TB3-6</td>
<td>Interlock 2-</td>
<td></td>
</tr>
<tr>
<td>TB3-7</td>
<td>Interlock 3+</td>
<td>Used if tube has cooling circulator flow switch. Open = NO FLOW. (short terminals if not used)</td>
</tr>
<tr>
<td>TB3-8</td>
<td>Interlock 3-</td>
<td></td>
</tr>
<tr>
<td>TB3-9</td>
<td>Safety Interlock+</td>
<td>User signal (Contact Closure) for safety interlocks such as door interlocks. Open turns HV OFF, or inhibits HV from being generated. Closed = OK 24Vdc @ &lt;1A typical</td>
</tr>
<tr>
<td>TB3-10</td>
<td>Safety Interlock-</td>
<td></td>
</tr>
<tr>
<td>TB3-11</td>
<td>Contactor Coil+</td>
<td>Option for contactor coil control</td>
</tr>
<tr>
<td>TB3-12</td>
<td>Contactor Coil-</td>
<td></td>
</tr>
<tr>
<td>TB3-13</td>
<td>Spare</td>
<td>N/C</td>
</tr>
<tr>
<td>TB3-14</td>
<td>Spare</td>
<td>N/C</td>
</tr>
<tr>
<td>TB3-15</td>
<td>Tube Current+</td>
<td>Tube current flows out from this pin</td>
</tr>
<tr>
<td>TB3-16</td>
<td>Tube Current-</td>
<td>Tube current flows into this pin</td>
</tr>
</tbody>
</table>
Spellman’s PMX is a high performance X-Ray generator designed specifically for mammography applications including FFDM and DBT. It features 2 and 3 point exposure modes as well as smart AEC with a pre exposure.

The PMX is a 5kW high frequency X-Ray generator integrated with a dual filament power supply, and a dual speed X-Ray tube starter. Due to the PMX’s superior power conversion technology and inverter design it can provide stable and accurate X-Ray tube high voltage with fast rise and fall times.

Smooth system integration of the PMX is accomplished through the use of RS-232 and optional Ethernet digital interface, preloaded X-Ray tube parameters, easy access interlocks and I/O connections, and internal generator diagnostics. Optional GUI utility software is also offered to help with initial system integration.

**SPECIFICATIONS**

**Input Voltage:**
200-240Vac (±10%), single phase, 50Hz/60Hz

**Input Current:**
Minimum 35A service recommended for 5kW operation
External EMC Filter (Schaffner FN2070-36-08-36A) required to meet CE/EMC specifications – Not provided
Mains Contactor – Not provided
Customer is responsible for mains safety disconnection.

**Output (Tube) Voltage**

**Output Voltage Range:**
20kV to 49kV

**Polarity:**
Positive, grounded cathode X-Ray tube

**Accuracy:**
2% (measured per IEC60601-2-45)

**Reproducibility:**
<0.5%

**Rise Time:**
<1ms to within 98% of the programmed voltage

**Fall Time:**
<10ms with a maximum HV cable length of 8 feet (2.4 meters)

**Ripple:**
≤4% p-p

**Output (Tube) Current/Power:**

**Output Current Range:**
10mA to 200mA

**Output Power:**
5kW @ 0.1 second loading time, 300 Watts maximum average power

**Accuracy:**
< ±10% on exposure less than 10ms (measured per IEC60601-2-45)

**Rise Time:**
<1ms to within 95% of the programmed mA value

**Fall Time:**
<10ms with a maximum HV cable length of 8 feet (2.4 meters)

**Exposure Time (Loading Time):**

**Maximum Single Exposure Time:**
10 seconds

**Shortest Single Exposure Time:**
5ms

**Loading time accuracy:**
±3% +1ms (measured per IEC60601-2-45)

**Maximum mAs:**
600mAs

**Exposure Timer:**
5mS-10 seconds

**Accuracy:**
< ±10% (measured per IEC60601-2-45)

**Reproducibility:**
<0.5%

**Filament Configuration:**
DC filament drive: self corrected filament preheat settings with closed loop emission control and smart learning algorithm

**Filament Output:**
0-6 amps at a compliance of 5.5 volts, maximum.

**Dual Speed Starter:**
High speed (180Hz) and low speed (60Hz) can be configured via the serial interface. Boost and Brake capability provided.
High Voltage Connector:
60kV, Claymount CA-3 type or equivalent

Communication Interface:
RS-232 standard, optional Ethernet

Grounding Point:
M5 ground stud provided on chassis

Environmental:
Temperature Range:
  - Operating: 10˚C to 40˚C
  - Storage: -40˚C to 85˚C
Humidity:
  - 20% to 85% RH, non-condensing.
Cooling:
Internal fan

Dimensions:
9.47˝ H X 7.19˝ W X 13.72˝ D
(240.5mm x 182.6mm x 348.5mm)

Weight:
<23 pounds (10.5kg)

Regulatory Approvals:
Designed to meet EMC: IEC 60601-1-2. UL/CUL recognized file E242584. RoHS compliant.

Application Features:
- 2 point/3 point exposure modes
- AEC/Smart AEC exposure modes
- Dual Speed Starter
- X-Ray tube anode heat calculator
- Preloaded X-Ray tube parameters and expandable X-Ray tube library

PMX STANDARD SYSTEM INTERFACE —
JB1 25 PIN MALE D CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GND</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>2</td>
<td>+5Vdc Out</td>
<td>+5Vdc, 100mA max.</td>
</tr>
<tr>
<td>3</td>
<td>RS-232 Tx Out</td>
<td>RS-232 Transmit</td>
</tr>
<tr>
<td>4</td>
<td>RS-232 Rx In</td>
<td>RS-232 Receive</td>
</tr>
<tr>
<td>5</td>
<td>PREP</td>
<td>User signal (Contact Closure) to alert the generator that exposure sequence will begin. Once this signal is active, exposure parameters are locked in and cannot be changed. The generator enables the starter to to boost the rotor. Contact connection to pin 24. Closed = PREP, the filament is placed in preheat mode</td>
</tr>
<tr>
<td>6</td>
<td>READY</td>
<td>Generator signal to user to indicate the rotor runs to speed and the generator is ready for X-Ray exposure. Open Collector, Low/Active = Ready</td>
</tr>
<tr>
<td>7</td>
<td>ROTOR SHUTDOWN</td>
<td>User signal to brake the rotor drive</td>
</tr>
<tr>
<td>8</td>
<td>EXPOSURE</td>
<td>User signal (Contact Closure) to generator to generate X-Rays. Filament is boosted, and high voltage is generated after the boost time. Contact connection to pin 24. Closed = Exposure</td>
</tr>
<tr>
<td>9</td>
<td>X-Ray ON 75% Status</td>
<td>Transistor output to indicate X-Ray ON status synchronized with 75% of kVP setting point.</td>
</tr>
<tr>
<td>10</td>
<td>X-Ray ON Status</td>
<td>Transistor output to indicate X-Ray ON status synchronized with kV start up.</td>
</tr>
<tr>
<td>11</td>
<td>N/C</td>
<td>N/C</td>
</tr>
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<td>12</td>
<td>X-Ray SHUTDOWN/AEC</td>
<td>User signal to generator to rapidly turn HV OFF and ON during serial exposure sequence</td>
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TB2 ROTOR INTERFACE

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TB3 TUBE AND INTERLOCK INTERFACE

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<td>N/C</td>
</tr>
<tr>
<td>TB3-15</td>
<td>Tube Current+</td>
<td>Tube current flows out from this pin</td>
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<td>Tube Current-</td>
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</table>
Spellman High Voltage has been designing, manufacturing and providing CT generators for OEM customers for over three decades. We have unrivaled experience being the first provider of a CT generator used in a commercially available continuous rotating CT scanner in 1985. Since then Spellman has enhanced performance and developed new CT generators year after year, setting the standard for CT generator technology.

Spellman’s CCT series of CT generators provide a unique combination of performance and price. Ideally suited for the economy 16 slice CT scanner, this generator has the ability to be scaled from 32kW to 50kW. Its compact size and unique bend makes it suitable for small footprint gantry designs. Designed to easily pair with many off the shelf CT tubes.

OPTIONS

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>DG</td>
<td>Deflection Grid</td>
</tr>
<tr>
<td>CG</td>
<td>Cutoff Grid</td>
</tr>
</tbody>
</table>

SPECIFICATIONS

- **Input Voltage:**
  - Main: 400Vac, three phase, +15%/-20%, 50/60Hz
  - Auxiliary: 220/230Vac, single phase, +15%/-10%, 50/60Hz

- **Output Voltage:**
  - Range: 60kV to 140kV (bipolar, 30kV to 70kV)
  - Accuracy: ±0.5% of setting

- **Output Current:**
  - Range: 10mA to 420mA, 50kW maximum.
  - 10mA to 350mA, 42kW maximum.
  - 10mA to 275mA, 32kW maximum.

- **Filament Output:**
  - Type: Two filament outputs, large and small
  - Voltage/Current: 15Vac (30kHz-40kHz) @ 0-6A maximum, referenced to cathode output
  - Power:
    - Maximum mA: 420mA, 50kW maximum
    - Maximum kV: 140kV, 50kW maximum
    - Peak: 50kW
    - Maximum mA: 350mA, 42kW maximum
    - Maximum kV: 140kV, 42kW maximum
    - Peak: 42kW
    - Maximum mA: 275mA, 32kW maximum
    - Maximum kV: 140kV, 32kW maximum
    - Peak: 32kW

- **Gantry Rotation:**
  - 0.5 seconds

- **Starter:**
  - Type: Dual Speed Starter
  - Compatibility: All industry standard X-Ray tubes

**GRID SPECIFICATIONS**

- **Deflection Grid:**
  - The deflection grid (also called the Flying Focal Spot) allows for dynamic movement of the focal spot providing double X sampling which increases effective resolution while decreasing unwanted artifacts.
  - Type: Deflection grid, single box assembly
  - Input Power: 24Vdc, ±10% @ 4.2A maximum, negative input ties to chassis ground internally
  - Connectors:
    - High Voltage Input: 3 pin 75kV Federal Standard (Cathode, Large, Small)
    - High Voltage Output: 4 pin 75kV CA7 (Cathode, Large, G1, G2)
  - Number of Grids: 2 grids, switching out of phase
  - Bandwidth: DC to 5kHz
  - Output Voltage: 0V to -4KV, from grid to cathode. User input will command the bi-level grids to switch between adjustable voltages, VLOW and VHi. The two grids switch out of phase: If G1 is at VLOW, G2 will be at VHi and vice versa. The VLOW and VHi levels for G1 and G2 are independently adjustable from 0 to -4KV but VLOW range is constrained by: |VLOW| ≤ |VHi|

- **Cutoff Grid:**
  - A cutoff grid truncates the high voltage at the end of the X-Ray exposure, reducing patient radiation dosing that does not contribute to the imaging process.
  - Type: Cutoff grid, single box assembly
  - Input Power: 24Vdc, ±10% @ 0.75A maximum, negative input ties to chassis ground internally
  - Connectors:
    - High Voltage Input: 3 pin 75kV Federal Standard (Cathode, Large, Small)
    - High Voltage Output: 4 pin 75kV CA7 (Cathode, Large, G1, G2)
  - Number of Grids: One, switched between “Zero” (0V≥Vg-c ZERO  ≥ -10V) and “Cutoff” (Vg-c CUTOFF = -4kV±10% @ steady state)
How to Order:
32kW maximum: PART NO.: CCT70PN32
42kW maximum: PART NO.: CCT70PN42
50kW maximum: PART NO.: CCT70PN50

Consult sales for grid options
Spellman High Voltage has been designing, manufacturing and providing CT generators for OEM customers for over three decades. We have unrivaled experience being the first provider of a CT generator used in a commercially available continuous rotating CT scanner in 1985. Since then Spellman has enhanced performance and developed new CT generators year after year, setting the standard for CT generator technology.

Spellman High Voltage has manufactured over 30,000 CT generators. We have the knowledge, capability and experience to provide you with the CT generator technology you need.

### 32kW - 110kW CT Generators

- **CT Generators from 32kW to 110kW**
- **60-140kV output**
- **Rotational CT up to 240rpm**
- **Fast rise time**
- **Designed to drive industry standard CT tubes**
- **Digital interface allows for ease of integration**
- **OEM customization**

### Specifications

<table>
<thead>
<tr>
<th>MODEL</th>
<th>32/42/50kW Compact CT Generator</th>
<th>50/80kW CT Generator</th>
<th>110kW CT Generator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model Designation</td>
<td>CCT70PN32</td>
<td>CCT70PN50</td>
<td>CT140N110</td>
</tr>
<tr>
<td>Input Power</td>
<td>400Vac, 3Ø, +15%/-20%, 50/60Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auxiliary Input Power</td>
<td>220/230Vac, 1Ø +15%/-10%, 50/60Hz</td>
<td>220/230Vac, 1Ø +15%/-10%, 50/60Hz</td>
<td>Not required</td>
</tr>
<tr>
<td>kV Output Range</td>
<td>60kV - 140kV (bipolar, 30kV – 70kV)</td>
<td>60kV - 140kV (bipolar, 30kV – 70kV)</td>
<td>60kV to 140kV Anode grounded</td>
</tr>
<tr>
<td>kV Output Accuracy</td>
<td>±0.5% of setting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mA Output Range</td>
<td>10mA – 300mA / 32kW maximum</td>
<td>10mA – 420mA / 50kW maximum</td>
<td>6mA to 900mA, 110kW maximum</td>
</tr>
<tr>
<td>mA Regulation/Accuracy</td>
<td>2% or 2mA or which is larger for 20mA -350mA</td>
<td>2% or 1mA or which is larger for 20mA -420mA</td>
<td>2% or 1mA or which is larger for 20mA -900mA</td>
</tr>
<tr>
<td>Filament Output</td>
<td>2 outputs: 15Vac @ 0-6A up to 8A available</td>
<td>1 output: 15Vac @ 0-6A, up to 15A available 2 filament/no grid configuration available</td>
<td>2 outputs: 10Vac @ 0-8A,</td>
</tr>
<tr>
<td>Filament Accuracy</td>
<td>±5% of setting</td>
<td>±5% of setting</td>
<td>±2% from 25% to 75%, 5% above</td>
</tr>
<tr>
<td>Filament Repeatability</td>
<td>±0.2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Starter</td>
<td>HSS configured to match X-Ray tube used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interface</td>
<td>Custom serial interface</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotation</td>
<td>Up to 120 rpm</td>
<td>Up to 120 rpm</td>
<td>Up to 240 rpm</td>
</tr>
<tr>
<td>Configuration</td>
<td>Single Chassis</td>
<td>Two chassis</td>
<td>Four chassis</td>
</tr>
<tr>
<td>Grid Option</td>
<td>Dual grid/single filament, 0-4kV @ 0-4kHz (separate assembly)</td>
<td>Dual grid/single filament, 0-4kV @ 0-4kHz (built-in)</td>
<td>n/a</td>
</tr>
<tr>
<td>Magnetic Z Deflection Option</td>
<td>n/a</td>
<td>Ground based single channel beam steering</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Please consult factory regarding product configuration availability and regulatory requirements for specific markets.
Spellman’s SPX Series are perfectly suited for today’s demanding NDT inspection requirements. SPX units are rugged, yet easy to transport and economical to maintain. They can be line or portable generator powered automatically adapting to standard input voltages to permit all day inspection under extreme conditions virtually anywhere.

The end grounded X-Ray tubes have a focal spot size of 1.5mm sq. and the exposed anode allows for easy and flexible positioning of the tube head assembly. Tube ports use a low-absorption beryllium window that allows the radiographer to utilize the full spectrum of X-Ray energy. The high radiation output of the SPX systems allow for lower kV per exposure, shorter exposure times and increased film contrast for superior radiographic imaging.

The SPX microprocessor-driven control unit provides automatic warm-up and comprehensive self-diagnostic circuitry. Memory to store and recall exposure techniques is standard and the last set of exposure parameters is retained before powering down. The SPX is adjustable in 1kV and 0.1mA increments. Exposure duration can be set from 1 second to 99 min 59 seconds in 1 second increments. There are three models to choose from: 160kV, 200kV and 300kV.

- Constant Potential Output
- Excellent Stability and Regulation
- Power Factor Corrected AC Input Circuitry
- Digital Interface, Ethernet and RS-232
- End Grounded Exposed Anode
- Portable, Repeatable, Accurate
- 100% Duty Cycle
- Unparalleled Resolution Imaging
- Liquid or Air Cooled Models
- Penetration of up to 76mm of Fe (300kV unit)

TYPICAL APPLICATIONS
- Aerospace
- Manufacturing
- Defense
- Avionics
- Energy
- Security Systems
- NDT Applications

SPECIFICATIONS
Input Line Requirements:
Automatically adapts to input line voltage
100-130Vac, 50/60Hz, 20 Amperes maximum
200-250Vac, 50/60Hz, 10 Amperes maximum
May also be portable-generator powered

X-Ray Output:
SPX160: 10 to 160kV, 0.5mA to 5.0mA (800 watts max.)
SPX200: 10 to 200kV, 0.5mA to 10.0mA (900 watts max.)
SPX300: 10 to 300kV, 0.5mA to 10.0mA (900 watts max.)
Constant potential, end-grounded anode, air or liquid cooled versions available

X-Ray Tube Window:
SPX160: Beryllium 0.8mm (directional)
   Nickel 0.6mm (panoramic)
SPX200: Beryllium 1.0mm
SPX300: Beryllium 1.0mm

Radiation Coverage:
SPX160: 40° directional or 360° panoramic tube available
SPX200: 40° directional or 360° panoramic tube available
SPX300: 40° x 60°

Radiation Output:
SPX160: 14R/min at 50cm filtered with 0.5 inches (12.7mm) aluminum at 160kV, 5mA
SPX200: 21R/min at 50cm filtered with 0.5 inches (12.7mm) aluminum at 200kV, 4.5mA
SPX300: 30R/min at 50cm filtered with 0.5 inches (12.7mm) aluminum at 300kV, 3mA

Radiation Leakage:
Less than 2.0 Roentgens per hour at 1 meter from the X-Ray tube target.
Effective Focal Spot:

**SPX160:**
- Standard: 0.03 x 0.04 in. (0.7 x 1.0mm) EN12543
- 0.02 in. sq. (0.5mm sq.) IEC60336
- Panoramic: This tube has a flat target (0 degree) and therefore it is without dimension along the tube axis (other than panoramic tubes with conical targets). The true focal spot on the target can only be estimated by taking two focal spot film exposures in the main beam 90 degrees apart from each other. Due to this no focal spot is inferred.

**SPX200:**
- Standard: 0.031 x 0.047 in. (0.8 x 1.2mm) EN12453
- 0.060 in. sq. (1.5mm sq.) IEC60336
- Panoramic: 0.015 x 0.15 in. (0.4 x 4.0mm) EN12543

**SPX300:**
- Standard: 0.12 in. sq. (3mm sq.) EN12543

Ambient Temp:
- 100% duty cycle @ 120°F (49°C)

Duty Cycle:
- 100% - liquid or air cooled

Storage Temp:
- -30°F to 160°F (-35°C to 71°C)

Anode Cooling:
- Liquid coolant solution closed loop between X-Ray tube anode and cooling unit, or fan forced air cooling.

Liquid Cooling Unit Dimensions:
- Please reference dimension drawings

Liquid Cooling Unit Weight:
- 54lbs. (15.4kg) approx.

Tube Head Dimensions:
- Please reference dimension drawings

Tube Head Weight:
- **SPX160:**
  - Liquid Cooled: 29lbs. (13.15kg)
  - Air Cooled: 33lbs. (14.97kg)
  - Panoramic: 29lbs. (13.15kg)
- **SPX200:**
  - Liquid Cooled: 37lbs. (16.78kg)
  - Air Cooled: 41lbs. (18.60kg)
  - Panoramic: 37lbs. (16.78kg)
- **SPX300:**
  - Liquid Cooled: 98lbs. (44.5kg)
  - Air Cooled: 105lbs. (47.61kg)

X-Ray Control Unit:
- Digital microcomputer based with local control, RS-232 and Ethernet

X-Ray Control Unit Dimensions:
- Please reference dimension drawings

X-Ray Control Unit Weight:
- 26lbs. (11.8kg) approx.

---

**Safety Devices:**
- Tubehead Pressure Relief Valve
- Tubehead Thermal Cut-Out
- Tubehead Pressure Gauge
- Tubehead Low Pressure Cut-Out @ 25psi (1.72 Bar)
- Coolant Flow Sensor (liquid cooled only)
- Control Unit Safety Keyswitch
- Microcomputer-based Self Diagnostics
- Continuous Exposure Parameter Display

**Standard Accessories:**
- Operation manual
- Tubehead carrying case
- Tubehead Cable- 100’ with strain relief
- Extra key (1) for Control Unit Safety Lock
- Power cable - 25’ with strain relief
- Coolant hose - twin, 50’ with self-sealing terminations (liquid cooled only)
- Cooler power cable

---

**SPX EXPOSURE CHART**

Afga D7 Film, 700mm SFD, D=2.5

This chart is for reference only (actual settings may vary due to SFD, material, and film type)
### SPX160 MODEL SELECTION TABLE

<table>
<thead>
<tr>
<th>MODEL NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPX160ACDBG</td>
<td>Air Cooled, 40° Directional Beam, Glass insert</td>
</tr>
<tr>
<td>SPX160LCDBG</td>
<td>Liquid Cooled, 40° Directional Beam, Glass insert</td>
</tr>
<tr>
<td>SPX160LCPANG</td>
<td>Liquid Cooled, PANoramic Beam, Glass insert</td>
</tr>
</tbody>
</table>

### SPX200 MODEL SELECTION TABLE

<table>
<thead>
<tr>
<th>MODEL NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPX200ACDBG</td>
<td>Air Cooled, 40° Directional Beam, metal Ceramic insert</td>
</tr>
<tr>
<td>SPX200LCDBG</td>
<td>Liquid Cooled, 40° Directional Beam, Glass insert</td>
</tr>
<tr>
<td>SPX200LCPANC</td>
<td>Liquid Cooled, PANoramic beam, metal Ceramic insert</td>
</tr>
<tr>
<td>SPX200LCDBC</td>
<td>Liquid Cooled, 40° Directional Beam, metal Ceramic insert</td>
</tr>
</tbody>
</table>

### SPX300 MODEL SELECTION TABLE

<table>
<thead>
<tr>
<th>MODEL NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPX300LCDBC</td>
<td>Liquid Cooled, 40° Directional Beam, metal Ceramic insert</td>
</tr>
<tr>
<td>SPX300ACDBC</td>
<td>Air Cooled, 40° Directional Beam, metal Ceramic insert</td>
</tr>
</tbody>
</table>

### SPX OPTIONS

<table>
<thead>
<tr>
<th>MODEL NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-000-0754</td>
<td>SPX160/200 tubehead stand</td>
</tr>
<tr>
<td>3-000-0756</td>
<td>SPX300 tubehead stand</td>
</tr>
<tr>
<td>3-000-0792</td>
<td>Laser pointer for liquid cooled tube</td>
</tr>
<tr>
<td>K935</td>
<td>SPX160 Laser pointer for air cooled tube</td>
</tr>
<tr>
<td>K936</td>
<td>SPX200 Laser pointer for air cooled tube</td>
</tr>
<tr>
<td>K937</td>
<td>SPX200/300 Laser pointer for liquid cooled tube</td>
</tr>
<tr>
<td>K938</td>
<td>SPX300 Laser pointer for liquid cooled tube</td>
</tr>
</tbody>
</table>

### SPX MAIN AC INPUT

**Controller Side:** Male, 3 pins MS type

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Line 1 120/220Vac</td>
</tr>
<tr>
<td>B</td>
<td>Line 2 Neutral 120/220Vac</td>
</tr>
<tr>
<td>C</td>
<td>Ground</td>
</tr>
</tbody>
</table>

### SPX INTERLOCK CONNECTOR

**Controller Side:** Female, 8 pins MS type

| Tube Side: Male, 8 pins MS type
<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>External Interlock</td>
</tr>
<tr>
<td>B</td>
<td>External Interlock</td>
</tr>
<tr>
<td>C</td>
<td>X-Ray ON External Light</td>
</tr>
<tr>
<td>D</td>
<td>External Lights Common</td>
</tr>
<tr>
<td>E</td>
<td>Pre-Warning External Light</td>
</tr>
<tr>
<td>F</td>
<td>External Light Confirm Input</td>
</tr>
<tr>
<td>G</td>
<td>24Vdc Out, 1A max.</td>
</tr>
<tr>
<td>H</td>
<td>24Vdc Return (com.)</td>
</tr>
</tbody>
</table>

### SPX FAN CONNECTOR (A/C ONLY)

**Controller Side:** Female, 8 pins MS type

**Tube Side:** Male, 8 pins MS type

<table>
<thead>
<tr>
<th>PIN (Control)</th>
<th>PIN (Tube Head)</th>
<th>SIGNAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>A</td>
<td>Fan 120Vac Line 1</td>
</tr>
<tr>
<td>C</td>
<td>B</td>
<td>Fan 220Vac Tap</td>
</tr>
<tr>
<td>G</td>
<td>C</td>
<td>Fan 120Vac Line 2/Neutral</td>
</tr>
<tr>
<td>B</td>
<td>D</td>
<td>Ground</td>
</tr>
<tr>
<td>E</td>
<td></td>
<td>N/C</td>
</tr>
<tr>
<td>F</td>
<td></td>
<td>N/C</td>
</tr>
<tr>
<td>A</td>
<td></td>
<td>Flow Interlock</td>
</tr>
<tr>
<td>H</td>
<td></td>
<td>Flow Interlock</td>
</tr>
</tbody>
</table>

### SPX COOLER CONNECTOR (W/C ONLY)

**Controller Side:** Female, 8 pins MS type

**Tube Side:** Male, 8 pins MS type

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Flow Interlock</td>
</tr>
<tr>
<td>B</td>
<td>Ground</td>
</tr>
<tr>
<td>C</td>
<td>120/220Vac Line 1 for Motor</td>
</tr>
<tr>
<td>D</td>
<td>120/220Vac Line 2/Neutral for Motor</td>
</tr>
<tr>
<td>E</td>
<td>120Vac Motor Tap</td>
</tr>
<tr>
<td>F</td>
<td>120/220Vac Motor Tap</td>
</tr>
<tr>
<td>G</td>
<td>220Vac Motor Tap</td>
</tr>
<tr>
<td>H</td>
<td>Flow Interlock</td>
</tr>
</tbody>
</table>

### SPX160 TUBE HEAD CONNECTOR

**Controller Side:** Female, 10 pins MS type

**Tube Side:** Male, 10 pins MS type

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Interlock Temperature/Pressure</td>
</tr>
<tr>
<td>B</td>
<td>Ground</td>
</tr>
<tr>
<td>C</td>
<td>Ground</td>
</tr>
<tr>
<td>D</td>
<td>HV Transformer</td>
</tr>
<tr>
<td>E</td>
<td>mA Feedback</td>
</tr>
<tr>
<td>F</td>
<td>Filament Transformer</td>
</tr>
<tr>
<td>G</td>
<td>KV Feedback</td>
</tr>
<tr>
<td>H</td>
<td>HV Feedback Return (GND)</td>
</tr>
<tr>
<td>I</td>
<td>Filament Transformer</td>
</tr>
<tr>
<td>J</td>
<td>HV Transformer</td>
</tr>
</tbody>
</table>

### SPX200/300 TUBE HEAD CONNECTOR

**Controller Side:** Female, 14 pins MS type

**Tube Side:** Male, 14 pins MS type

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Interlock Temperature/Pressure SPX200, N/C SPX300</td>
</tr>
<tr>
<td>B</td>
<td>Ground</td>
</tr>
<tr>
<td>C</td>
<td>Ground</td>
</tr>
<tr>
<td>D</td>
<td>HV Transformer</td>
</tr>
<tr>
<td>E</td>
<td>mA Feedback</td>
</tr>
<tr>
<td>F</td>
<td>Filament Transformer</td>
</tr>
<tr>
<td>G</td>
<td>KV Feedback</td>
</tr>
<tr>
<td>H</td>
<td>KV Feedback Return (GND)</td>
</tr>
<tr>
<td>I</td>
<td>Filament Transformer</td>
</tr>
<tr>
<td>J</td>
<td>HV Transformer</td>
</tr>
<tr>
<td>K</td>
<td>N/C</td>
</tr>
<tr>
<td>L</td>
<td>Interlock Temperature/Pressure SPX300, N/C SPX200</td>
</tr>
<tr>
<td>M</td>
<td>N/C</td>
</tr>
<tr>
<td>N</td>
<td>N/C</td>
</tr>
</tbody>
</table>
OPTIONAL ACCESSORIES

GUI Control Software for the SPX
GUI is specifically designed for controlling SPX series systems. As an alternative to the front panel control, the GUI will allow the user to control all necessary functions of the system from a user-friendly windows based menu. Additionally the GUI can be used as a diagnostic tool when the system is controlled via the front panel.

- Automatic warm-up of the X-Ray tube
- Timed or Continuous Exposure modes
- Fault and status monitor

Laser Pointer
Spellman’s exclusive Laser Pointer allows pinpoint image area targeting. The Laser Pointer projects a highly visible reference laser beam from the tubehead to surfaces up to 75 feet away, showing precisely where the central X-Ray beam will be located, providing unmatched accuracy for greater efficiency and reduced set-up times.

Tubehead Stand
An optional X-Ray Tubehead Stand allows for quick set up and provides rigid support for optimal image quality with three-axis positioning of the tube head assembly. The stand incorporates telescoping legs, a hand wheel-driven variable height adjustment and lockable hand wheel controlling the tubehead tilt and horizontal rotation. The tubehead cradle is cushioned for secure mounting and vibration damping. A bubble-type indicator is included for quick and easy leveling of the tubehead. Black anodized aluminum construction. 35lbs. (16kg) approx.

Air Cooled Tube Head Assembly
The air cooled tube head assembly uses a heat sink and high volume fan to dissipate heat from the anode and typically is used in applications that do not have limited access and are not in a volatile fuel vapor atmosphere. The air cooled tube head assembly does not require the cooler unit and the associated mixing and maintenance of liquid coolant. This unit requires less user maintenance and could be considered more environmentally friendly.

Panoramic Tube Head Assembly
The panoramic tube head assembly comes in a liquid cooled version only and produces radiation in a 360 degree cone making it ideal for aircraft FOD inspection, inspection of tanks or pipes or any application that requires circumferential radiographic inspection.
**SPX160**

**DIMENSIONS:** in. (mm)

- **CONTROL UNIT TOP VIEW**
  - 17.06 [433.31]
  - 15.00 [381.0]

- **COOLER TOP VIEW**
  - 15.70 [398.76]

- **SPX160 TUBE HEAD SIDE VIEW**
  - 15.50 [393.70]
  - 15.50 [393.70]

- **FRONT VIEW**
  - 6.75 [171.5]
  - 6.00 [152.4]
  - 14.00 [355.6]
  - 14.77 [375.21]
  - 16.10 [409.0]

- **SIDE VIEW**
  - 12.70 [322.58]
  - 7.25 [184.29]

- **SIDE VIEW**
  - 12.70 [322.58]
  - 12.70 [322.58]

- **SIDE VIEW**
  - 9.57 [141.5]
  - 9.57 [141.5]

- **SIDE VIEW**
  - 15.50 [393.70]

---

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Spellman’s LPX Series are perfectly suited for today’s demanding NDT inspection requirements. LPX units are rugged, easy to transport and the optional LPX1620 Tubehead Stand allows for quick set up and provides rigid support for optimal image quality. The tubehead stand incorporates telescoping legs, a hand wheel-driven variable height adjustment and lockable hand wheel controlling the tubehead tilt and horizontal rotation. The tubehead cradle is cushioned for secure mounting and vibration damping. A bubble-type indicator is included for quick and easy leveling of the tubehead.

**SPECIFICATIONS**

**Horizontal Rotation:**
360°

**Tilt:**
-45° to +90°

**Dimensions:**
- Footprint of legs: 43” (109cm) min., 70.5” (179cm) max.
- Floor to center line of tubehead ring: 45.5” (115cm) min., 83.5” (212cm) max.

**Weight:**
35lbs. (16kg)

**SET-UP**

1. Extend tripod legs outward
2. Loosen height lock knob and raise gearhead mount approx. 3 inches
3. Place gearhead on tripod shaft. Align set screw hole in shaft with hole in gearhead mount. Using supplied hex key, tighten set screw to engage gear head mount.
4. Mount tubehead in cradle. Open knurled latch and outer ring to remove cradle assembly. Release the two hook latches on the cradle to open it. Fit cradle over tubehead making sure any cooling manifolds are positioned between cushioning pads. Latch the hook latches securely.
5. Mount cradle in the gear head outer ring. Close and latch the knurled knob locking mechanism.
6. Use the height, tilt, and rotation controls to position the X-Ray tubehead as needed. Lock all adjustments before making X-Ray exposures.

**LPX1620 MODEL SELECTION TABLE**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-000-0754</td>
<td>Tubehead stand for LPX160 and LPX200</td>
</tr>
<tr>
<td>3-000-0756</td>
<td>Tubehead stand for LPX300</td>
</tr>
</tbody>
</table>

The LPX1620 Tubehead Stand is compatible with all LPX160, LPX200 and LPX300 tubehead assemblies.
Other imaging systems may produce inconsistent results and require repeat exposures. Spellman’s Laser Pointer, exclusive to Lorad’s LPX Systems, locates the centerline of the X-Ray beam for unmatched accuracy and efficiency. The Laser Pointer shows precisely where the central X-Ray beam will contact the test area by projecting a highly visible reference beam from the X-Ray tube head to surfaces up to 75 feet away. The beam is activated by a push button and automatically shuts off after 30 seconds. The Laser Pointer is lightweight and powered by three (3) AAA batteries. The Laser Pointer can be used with Lorad’s end-grounded exposed anode tube heads and also with air cooled tube heads with the addition of the air cooled adaptor.

**SPECIFICATIONS**

- **Wavelength:**
  670nm typical
- **Output power:**
  4.2mW +/-5%
- **Laser Class:**
  Class IIla Conforming (CDRH 21CFR)
  Class 3R (IEC 60825 1)
- **Operating Current:**
  @ 5Vdc 45mA typical, 125mA max
- **Battery Lifetime:**
  20 hours typical (Alkaline AAA cells)
- **Operating Temp:**
  10°C to +40°C
- **Operating time w/o restart:**
  30 seconds
- **Dimensions:**
  1.75” H x 2.72” W x 2.72” D
  (4.44cm x 6.90cm x 6.90cm)

**Adaptors:**

- LPX160 A/C Part Number 9-200-0110
- LPX160 L/C N/A
- LPX160 Panoramic N/A
- LPX200 A/C Part Number 9-200-0327
- LPX200 L/C Part number 9-200-0370
- LPX200 Panoramic N/A
- LPX300 L/C 9-200-0465

The LPX Laser Pointer is compatible with most LPX160, LPX200 and LPX300 tubehead assemblies.
Spellman’s XRB011 Series of Monoblock® X-Ray sources are designed for OEM applications powering its internal X-Ray tube up to 80kV at 20W and 80kV at 50W. Features like 24Vdc input voltage, small package size, standard analog interface and RS-232/Ethernet digital interface simplify integrating the XRB011 into your X-Ray system. Proprietary emission control circuitry provides excellent regulation of X-Ray tube current, along with outstanding stability and performance.

**TYPICAL APPLICATIONS**

**SPECIFICATIONS**

**X-Ray Characteristics:**
- Tube Type: Micro focus tube
- Focal Spot: 33μm Nominal, 50μm max. (IEC 336)
- Beam Filter: Ultem 0.060” (1.5mm) Oil 0.175” (4.4mm)
- Beam Geometry: Symmetrical 40° cone

**Input Voltage:**
- 20W: 24Vdc ±1V @ 2.5A
- 50W: 24Vdc ±1V @ 4A

**X-Ray Tube Voltage:**
- Nominal X-Ray tube voltage is adjustable between 35kV to 80kV

**X-Ray Tube Current:**
- 20W: 0-250μA over specified tube voltage range
- 50W: 0-700μA over specified tube voltage range

**X-Ray Tube Power:**
- 20/50W maximum continuous

**Voltage Regulation:**
- Line: ±0.5% for a ±1V change of nominal input line voltage
- Load: ±0.1% for a load change of 25μA to maximum rated current

**Voltage Accuracy:**
- Voltage measured across the X-Ray tube is within ±1% of the programmed value

**Voltage Risetime:**
- Ramp time shall be <250ms from 10% to 90% of maximum rated output voltage

**Over Temperature Fault:**
Indicates that the internal oil temperature has exceeded 65° C. The high voltage output will be disabled. Toggling the X-Ray ON Command OFF and ON will reset the fault.

**Voltage Ripple:**
1% peak to peak

**Current Regulation:**
- Line: ±0.5% for a ±1V change of nominal input line voltage
- Load: ±0.5% for a voltage change of 35kV to 80kV

**Current Accuracy:**
- Current measured through the X-Ray tube is within ±2.5% of the programmed value

**Over Voltage Fault:**
An overvoltage (OV) fault is detected when the output voltage exceeds 82kV. The high voltage output will be disabled. Toggling the X-Ray ON Command OFF and ON will reset the fault.

**Over Current Fault:**
An overcurrent (OC) fault is detected when the emission current exceeds 275μA (20W model) and 710μA (50W model). Toggling the X-Ray ON Command OFF and ON will reset the fault.

**Arc Intervention:**
One arc fault. The high voltage output will be disabled. Toggling the X-Ray ON command OFF and ON will reset the fault.

**Filament Configuration:**
Internal high frequency AC filament drive with closed loop filament emission control

**Analog Interface:**
Ground referenced 10kV/V, 25μAV (20W model) and 70μAV (50W model) for programming and monitoring analog interface signals. Open collector, active low digital signal interface. Internal jumper is needed to be configured for analog interface.
### Digital Interface:
- RS-232: standard
- Ethernet: optional

### Control Software:
A demo GUI is available for engineering evaluations

### Interlock/Signals:
A hardware interlock functions in both analog and digital programming modes.

### Operating Temperature:
0°C to +40°C

### Storage Temperature:
-20°C to +70°C

### Humidity:
10% to 95% relative humidity, non-condensing

### Cooling:
50W option: Customer provided, external cooling fan, 50cfm, minimum

---

#### Analog Interface—Input Line Connector:
25 pin D connector, male

#### Digital Interface Connector:
- RS-232: 9 pin D connector, female
- Ethernet: RJ45 connector

#### Grounding Point:
6-32 ground stud provided on chassis

#### Dimensions:
- 20W: 5.81"W x 5.0"H x 10.81"D (147.57mm x 127mm x 274.57mm)
- 50W: 6.00"W x 5.0"H x 10.81"D (152.4mm x 127mm x 274.57mm)

#### Weight:
- 20W: 18lbs (8.165kg)
- 50W: 20lbs (9.072kg)

#### Orientation:
Can be mounted in any orientation.

#### X-Ray Leakage:
Less than 1mR/hr at 1 meter

#### Regulatory Approvals:
Compliant to EMC 60601-1-2. UL/CUL recognized file E242584. CE to EN 61010-1 for Non-Medical Applications.

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#### RS-232 DIGITAL INTERFACE—
**J5 9 PIN FEMALE D CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>2</td>
<td>TX Out</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>3</td>
<td>RX In</td>
<td>Receive Data</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>SGND</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>9</td>
<td>NC</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

#### ETHERNET DIGITAL INTERFACE—
**RJ45 8 PIN CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TX +</td>
<td>Transmit Data +</td>
</tr>
<tr>
<td>2</td>
<td>TX -</td>
<td>Transmit Data -</td>
</tr>
<tr>
<td>3</td>
<td>RX +</td>
<td>Receive Data +</td>
</tr>
<tr>
<td>4</td>
<td>RX -</td>
<td>Receive Data -</td>
</tr>
<tr>
<td>5</td>
<td>SGND</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>NC</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

#### ANALOG INTERFACE—
**J1 25 PIN MALE D CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24V</td>
<td>+24Vdc±1Vdc @ 4A</td>
</tr>
<tr>
<td>2</td>
<td>+24V</td>
<td>+24Vdc±1Vdc @ 4A</td>
</tr>
<tr>
<td>3</td>
<td>+24V</td>
<td>+24Vdc±1Vdc @ 4A</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>+24V RETURN</td>
<td>+24V RETURN</td>
</tr>
<tr>
<td>6</td>
<td>+24V RETURN</td>
<td>+24V RETURN</td>
</tr>
<tr>
<td>7</td>
<td>+24V RETURN</td>
<td>+24V RETURN</td>
</tr>
<tr>
<td>8</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>9</td>
<td>Interlock Input</td>
<td>Input, Active low. Interlock is low safe to enable high voltage. Connect to +24V Return</td>
</tr>
<tr>
<td>10</td>
<td>kV Monitor</td>
<td>Output, 0 to 8V = 0 to rated output voltage. Zout=1000</td>
</tr>
<tr>
<td>11</td>
<td>μA Monitor</td>
<td>Output, 0 to 10V = 0 to rated output current. Zout=1000</td>
</tr>
<tr>
<td>12</td>
<td>X-Ray Ready status</td>
<td>Output, Active Low, Open Collector, 24Vdc @ 10mA max</td>
</tr>
<tr>
<td>13</td>
<td>X-Ray ON status</td>
<td>Output, Active Low, Open Collector, 24Vdc @ 10mA max</td>
</tr>
<tr>
<td>14</td>
<td>Filament Standby status</td>
<td>Output, Active Low, Open Collector, 24Vdc @ 10mA max</td>
</tr>
<tr>
<td>15</td>
<td>Over Voltage Fault</td>
<td>Output, Active Low, Open Collector, 24Vdc @ 10mA max</td>
</tr>
<tr>
<td>16</td>
<td>Over Current Fault</td>
<td>Output, Active Low, Open Collector, 24Vdc @ 10mA max</td>
</tr>
<tr>
<td>17</td>
<td>ARC Fault</td>
<td>Output, Active Low, Open Collector, 24Vdc @ 10mA max</td>
</tr>
<tr>
<td>18</td>
<td>Priment Current Limit Fault</td>
<td>Output, Active Low, Open Collector, 24Vdc @ 10mA max</td>
</tr>
<tr>
<td>19</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>20</td>
<td>Interlock Output</td>
<td>Output, Active Low, Open Collector, 24Vdc @ 10mA max</td>
</tr>
<tr>
<td>21</td>
<td>μA Program</td>
<td>Input, 0 to 10V = 0 to rated output current. Zin=10kΩ</td>
</tr>
<tr>
<td>22</td>
<td>kV Program</td>
<td>Input, 0 to 8V = 0 to rated output voltage. Zin=10kΩ</td>
</tr>
<tr>
<td>23</td>
<td>X-Ray ON Command</td>
<td>Input, Active low. Low (short) = X-Ray ON. High (open) = X-Ray OFF. Internal pull up resistor to +15V</td>
</tr>
<tr>
<td>24</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>25</td>
<td>Over Temperature</td>
<td>Output, Active Low, Open Collector, 24Vdc @ 10mA max</td>
</tr>
</tbody>
</table>
XRB011
80KV @ 20/50W MONOBLOCK®

20W Model

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Voltage</th>
<th>Current</th>
<th>Interface</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>XRB011-80PN20</td>
<td>80kV</td>
<td>250uA</td>
<td>20W</td>
<td>Analog Interface, RS-232</td>
</tr>
<tr>
<td>XRB011-80PN20E</td>
<td>80kV</td>
<td>250uA</td>
<td>20W</td>
<td>Analog Interface, RS-232, Ethernet</td>
</tr>
<tr>
<td>XRB011-80PN20A</td>
<td>80kV</td>
<td>250uA</td>
<td>20W</td>
<td>Analog Interface</td>
</tr>
<tr>
<td>XRB011-80PN20/CE</td>
<td>80kV</td>
<td>250uA</td>
<td>20W</td>
<td>Analog Interface, RS-232, CE</td>
</tr>
<tr>
<td>XRB011-80PN20E/CE</td>
<td>80kV</td>
<td>250uA</td>
<td>20W</td>
<td>Analog Interface, RS-232, Ethernet, CE</td>
</tr>
<tr>
<td>XRB011-80PN20A/CE</td>
<td>80kV</td>
<td>250uA</td>
<td>20W</td>
<td>Analog Interface, CE</td>
</tr>
</tbody>
</table>

XRB011
20W Model

DIMENSIONS: in.[mm]
50W Model

ORDERING INFORMATION

- XRB011-80PN50  80kV, 700uA, 50W, Analog Interface, RS-232
- XRB011-80PN50E 80kV, 700uA, 50W, Analog Interface, RS-232, Ethernet
- XRB011-80PN50A 80kV, 700uA, 50W, Analog Interface
- XRB011-80PN50/CE 80kV, 700uA, 50W, Analog Interface, RS-232, CE
- XRB011-80PN50E/CE 80kV, 700uA, 50W, Analog Interface, RS-232, Ethernet, CE
- XRB011-80PN50A/CE 80kV, 700uA, 50W, Analog Interface, CE

**XRB011 50W Model**

DIMENSIONS: in.[mm]
Spellman’s µXRB130P65 microfocus Monoblock® X-Ray sources are designed for high resolution imaging applications powering its internal microfocus X-Ray tube up to 130kV @ 65W. Features like 24Vdc input voltage, small package size and standard RS-232 digital interface simplify integrating the µXRB130P65 into your X-Ray system. The small, round focal spot size, optimized over the range of operating voltage, and high magnification, combined with stable high intensity output provides distortion free, superior quality 2D and 3D images.

**TYPICAL APPLICATIONS**

Industrial X-Ray:
- Circuit board and electronic component inspection
- High resolution Non Destructive Testing of metal and plastic parts
- Micro CT for Industrial applications
- Battery inspection

Medical X-Ray:
- Micro CT for life sciences applications

**OPTIONS**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WB</td>
<td>Wide Beam</td>
</tr>
<tr>
<td>ET</td>
<td>Extended Tube (wide beam only)</td>
</tr>
<tr>
<td>LW</td>
<td>Light Weight</td>
</tr>
</tbody>
</table>

**SPECIFICATIONS**

**Narrow Beam Benefits (Standard):**
The small round spot is optimized over the range of kV and power to provide distortion free images. Operated at 4 watts yields a 6 micron spot for high resolution imaging. The 14mm spot to window spacing offers high geometric magnification.

**Narrow Beam X-Ray Characteristics (Standard):**
- Spot Ellipticity: ±20% @ 16 watts, 130kV (either axis referred to average)
- Beam Geometry: ≥ 53°, round beam, uniform beam profile in any direction
- Spot to Window Spacing: 14mm ±0.5mm
- Window Diameter (uncollimated): ≈19mm
- Window Material and Thickness: Beryllium, 0.25mm
- Target Material: Tungsten

**Wide Beam Benefits (WB Option):**
The 115 degree round beam is well suited for automated inspection where a large field of view is required for maximum throughput or off angled views. The 10mm spot to window spacing provides superior high geometric magnification.

**Wide Beam X-Ray Characteristics (WB Option):**
- Spot Ellipticity: ±20% @ 16 watts, 130kV (either axis referred to average)
- Cone of Illumination: 115°, round beam, uniform beam profile in any direction
- Spot to Window Spacing: 10mm ±0.5mm
- Window Diameter (uncollimated): ≈38mm
- Window Material and Thickness: Beryllium, 0.51mm
- Target Material: Tungsten
- X-Ray Leakage: Behind X-Ray tube is ≤0.5mR/hr at 2.55cm

**Input Voltage:**
- +24-27Vdc

**Input Current:**
- <6 amps
Anode Supply:
Output Voltage: 20kV to 130kV (referenced to Cathode Gun Supply)
Output Current: up to 0.5mA, from 20kV to 130kV

Environmental:
Operating Temperature: 0°C to +32°C
Storage Temperature: -20°C to +70°C
Humidity: 0 to 95%, non-condensing
Altitude: Up to 5,000 feet (1524 meters)

Cooling:
Internal fan is incorporated. Adequate air circulation around unit must be provided.

Digital Interface:
RS-232

Mechanical:
See drawings

Weight:
Standard: 30lbs. (13.60kg)
Standard/Extended Tube: 34lbs. (15.40kg)
Light Weight (LW option): 23lbs. (10.43kg)
Light Weight/Extended Tube: 27lbs. (12.24kg)

Regulatory Approvals:
Compliant to EEC EMC Directive.
Compliant to EEC Low Voltage Directive.

Grapical User Interface
Spellman provides an example of a Graphical User Interface (GUI) for the convenience of the user but most customers implement their own software.
uXRB130P65
130KV @ 65W MICROFOCUS MONOBLOCK®

DIMENSIONS: in.[mm]

NARROW BEAM (Standard)
SIDE VIEW

12.17 [309.11]
11.95 [303.53]
1.73 [43.89]
0.55 [13.97]
4.75 [120.65]
53°
2.5 [63.5]

BOTTOM VIEW

3.543 ±0.005 [89.9]
6.889 ±0.005 [174.98]

REAR VIEW

8.89 ±0.005 [225.8]
0.600 [15.24]
3.543 ±0.005 [89.9]

FRONT VIEW

4.75 [120.64]
7.677 ±0.015 [194.99]
10.16 [258.06]
3.30 [83.82]
4.92 [124.9]
2.5-20 UNC-2B
25 DEEP 4PL

CAUTION
EASY SOURCE

SPELLMAN HIGH VOLTAGE ELECTRONICS CORPORATION

www.spellmanhv.com

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e-mail: sales@spellmanhv.com

130KV @ 65W MICROFOCUS MONOBLOCK®

uXRB130P65
DIMENSIONS: in.[mm]

WIDE BEAM (WB Option)
SIDE VIEW

FRONT VI
E
W

WIDEBEAM(AMOption)
SID
E
VI
W

REAR VIEW

FRONT VIEW

uXRB130P65
130KV@65W MICROFOCUS MONOBLOCK®
Spellman’s XRB80N100 Monoblock® X-Ray source is designed for OEM applications powering its internal X-Ray tube up to 80kV at 100W. Features like universal input, small package size and a standard analog and RS-232 digital interface simplify integrating this unit into your X-Ray system. The XRB80N100 is available either with fan shaped (standard) or (optional) cone shaped beam geometries. Proprietary emission control circuitry provides excellent regulation of X-Ray tube current, along with outstanding stability performance.

**TYPICAL APPLICATIONS**
X-Ray Scanning: Bone Densitometry, Thickness Measurement, Food Inspection, Fill Level Confirmation, Parcel Inspection

**SPECIFICATIONS**

**X-Ray Characteristics:**
- Focal Spot: 0.5mm (IEC 336)
- Beam Filter:
  - Ultem: 3.30mm ±0.15mm
  - Oil: 8mm ±0.1mm
  - Glass: 1.8mm ±0.25mm
  - BE: 0.8mm
- Beam Geometry:
  - Fan: Standard. The beam angular coverage will be 75° with the beam plane perpendicular to the X-Ray tube axis and 13° wide.
  - Cone: Optional, 25° cone beam

**Input Voltage:**
Power factor corrected input 0.98, 100-240Vac ±10% 50/60Hz, 2A, maximum

**X-Ray Tube Voltage:**
Nominal X-Ray tube voltage is adjustable up to 80kV

**X-Ray Tube Current:**
150uA to 1.25mA over specified tube voltage range

**X-Ray Tube Power:**
100W maximum continuous

**Voltage Regulation:**
- Line: ±0.05% of maximum output voltage over a ±10% change of nominal input line voltage
- Load: ±0.1% of maximum rated voltage for 150uA to 1.25mA load change

**Voltage Accuracy:**
Voltage measured across the X-Ray tube is within ±2% of the programmed value

**Voltage Risetime:**
- Standard: Ramp time shall be 500ms from 10% to 90% of maximum rated output voltage
- Optional: 5 seconds. Specify at time of order

**Voltage Overshoot:**
5% of maximum voltage, to return within 2.5% of maximum voltage in less than 100ms

**Voltage Ripple:**
1% peak to peak of maximum voltage for frequencies ≤1kHz

**Emission Current Parameters**

**Current Regulation:**
- Line: ±0.05% of rated output current over a ±10% change of nominal input line voltage
- Load: ±0.1% of rated output current for a change from 50% to 100% of rated output voltage

**Current Accuracy:**
Current measured through the X-Ray tube is within ±2% of the programmed value

**Current Risetime:**
- Standard: Ramp time shall be 500ms from 10% to 90% of maximum rated current
- Optional: 5 seconds. Specify at time of order

**Arc Intervention:**
3 arcs in 10 seconds with a 200ms quench = Shutdown

**Filament Configuration:**
Internal high frequency AC filament drive with closed loop filament emission control
Analog Interface:
Ground referenced 0 to 9Vdc for all programming and monitoring signals. Relay contacts and open collector signals for other signals. See analog interface connector pin out table.

Digital Interface:
Jumpers are needed to be configured and the digital interface cable installed to enable the RS-232 interface.

Control Software:
A demo GUI is available for engineering evaluations

Interlock/Signals:
A hardware interlock functions in both analog and digital programming modes. The hardware X-Ray Enable signal only functions in analog programming mode.

Operating Temperature:
0°C to +40°C

Storage Temperature:
-40°C to +70°C

Humidity:
10% to 95% relative humidity, non-condensing

Cooling:
Customer provided 150cfm external cooling fan as required to maintain oil temperature below 55°C. (External cooling is not required if fan option is selected)

Input Line Connector:
3 pin, Phoenix Contact 1829167, SHV part number 105725-219. Mating connector Phoenix Contact #1805990, SHV part number 105808-475 provided with unit.

Analog Interface Connector:
15 pin D connector, male

Digital Interface Connector:
9 pin D connector, female

Grounding Point:
8-32 ground stud provided on chassis

Dimensions:
See line drawings

Weight:
32lbs (14.5kg)

Orientation:
Can be mounted in any orientation.

X-Ray Leakage:
Not to be greater than 0.5mR/hr at 5cm outside the external surface

Regulatory Approvals:
DIMENSIONS: in.[mm]

Cooling Fan Option

TOP VIEW

SIDE VIEW

BACK VIEW
Spellman’s XRB80PN100HR (high reliability) Monoblock® X-Ray source is designed for OEM applications powering its internal Bipolar X-Ray tube up to 80kV at 100W. Features like universal input, small package size and a standard RS-232 digital interface simplify integrating this Monoblock® into your X-Ray system. The XRB80PN100HR is available either with fan shaped (standard) or (optional) cone shaped beam geometries. Proprietary emission control circuitry provides excellent regulation of X-Ray tube current, along with outstanding stability performance. The XRB80PN100HR is designed for long field life.

TYPICAL APPLICATIONS
X-Ray Scanning, Thickness Measurement, Food Inspection, Fill Level Confirmation, Parcel Inspection

SPECIFICATIONS
X-Ray Characteristics:
- Focal Spot: 0.8mm (IEC 336) standard
  0.5mm (IEC 336) optional
- Beam Filter:
  - Ultem: 3.00mm ±0.15mm
  - Oil: 7.5mm ±0.25mm
  - Glass: 1.7mm ±0.2mm
  - Be: 0.8mm
- Beam Geometry:
  - Fan: The standard beam angular coverage will be 80° with the beam plane perpendicular to the X-Ray tube axis and 20° wide (with a 2° tolerance)
  - An optional 80° x 10° (with a 2° tolerance) is also available
  - Cone: Optional, 20° cone beam (with a 2° tolerance)
- Input Voltage:
  - Power factor corrected input 0.98, 100-240Vac ±10%
  - 50/60Hz, 2A maximum

- Integrated HV Supply, Filament Supply, X-Ray Tube, Beam Port and Control Electronics
- Compact & Lightweight
- Universal Input, Power Factor Corrected with Internal EMI Filter
- Can be Mounted in Any Physical Orientation
- Analog Monitoring Interface and Standard RS-232 Digital Program and Monitor Interface
- Elapsed Time Meter Provided on Controller to Monitor X-Ray Tube Usage

www.spellmanhv.com/manuals/XRB80PN100HR

X-Ray Tube Voltage:
- Nominal X-Ray tube voltage is adjustable 40kV (±20kV) to 80kV (±40kV)

X-Ray Tube Current:
- 150uA to 2.00mA over specified tube voltage range (100W max.)

X-Ray Tube Power:
- 100W maximum continuous

Voltage Regulation:
- Line: ±0.05% of maximum output voltage over a ±10% change of nominal input line voltage
- Load: ±0.1% of maximum rated voltage for 150uA to 2.00mA load change

Voltage Accuracy:
- Voltage measured across the X-Ray tube is within ±2% of the programmed value

Voltage Risetime:
- Standard: Ramp time shall be <500ms from 10% to 90% of maximum rated output voltage

Voltage Ripple:
- 0.5% peak to peak of maximum voltage for frequencies ≤1kHz

Emission Current Parameters
Current Regulation:
- Line: ±0.05% of rated output current over a ±10% change of nominal input line voltage
- Load: ±0.1% of rated output current for a change from 50% to 100% of rated output voltage

Current Accuracy:
- Current measured through the X-Ray tube is within ±2% of the programmed value

Current Risetime:
- Standard: Ramp time shall be <500ms from 10% to 90% of maximum rated current

Arc Intervention:
- 4 arcs in 10 seconds with a 100ms quench/100ms re-ramp = Shutdown

Filament Configuration:
- Internal AC filament drive with closed loop filament emission control
**XRB80PN100HR**

80KV @ 100W MONOBLOCK®

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**Analog Monitoring Interface:**
Ground referenced 0 to 9Vdc for all monitoring signals. Relay contacts and open collector signals for other signals. See analog interface connector pin out table.

**Digital Programming and Monitoring Interface:**
The RS-232 interface allows for programming of kV, mA output and X-Ray enable. Provides monitoring for kV, mA output and oil temperature. Tolerance 3%.

**Control Software:**
A demo GUI is available for engineering evaluations

**Operating Temperature:**
0°C to +40°C

**Storage Temperature:**
-40°C to +70°C

**Humidity:**
10% to 95% relative humidity, non-condensing

**Cooling:**
- X-Ray Tank: Customer provided 250 cfm external cooling fan as required to maintain oil temperature below 55°C.
- Controller: Forced air via internal fan.

**Input Line Connector:**
3-pin Phoenix Contact 1829167. Mating connector provided with unit

**Analog Interface Connector:**
15 pin male D connector provided with unit

**Digital Interface Connector:**
9 pin female D connector provided with unit

**Grounding Point:**
M4 ground stud provided on chassis

**Dimensions:**
- X-Ray Tank: 11.3˝L x 9.625˝W x 4.93˝H (287.02mm x 244.4mm x 125.2mm)
- Controller: 8.5˝L x 6.70˝W x 2.21˝H (215.9mm x 170.2mm x 56.1mm)

**Weight:**
- X-Ray Tank: 36lbs (16.32kg)
- Controller: 3.7lbs (1.68kg)

**Orientation:**
Can be mounted in any orientation.

**X-Ray Leakage:**
Not to be greater than 0.5mR/hr at 5cm outside the external surface.

**Regulatory Approvals:**
Compliant to EEC EMC Directive. Compliant to EEC Low Voltage Directive. UL/CUL recognized file E235530

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**LED INDICATORS**

<table>
<thead>
<tr>
<th>INDICATOR</th>
<th>SIGNAL NAME</th>
<th>CONDITION</th>
<th>Illuminated When...</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED 1</td>
<td>OV</td>
<td>High kV occurs</td>
<td></td>
</tr>
<tr>
<td>LED 2</td>
<td>UV</td>
<td>Low kV occurs</td>
<td></td>
</tr>
<tr>
<td>LED 3</td>
<td>UC</td>
<td>Low mA occurs</td>
<td></td>
</tr>
<tr>
<td>LED 4</td>
<td>QC</td>
<td>High mA occurs</td>
<td></td>
</tr>
<tr>
<td>LED 5</td>
<td>ARC FLT</td>
<td>Arc fault occurs</td>
<td></td>
</tr>
<tr>
<td>LED 6</td>
<td>OT</td>
<td>Over temperature occurs</td>
<td></td>
</tr>
<tr>
<td>LED 7</td>
<td>X-RAY ON</td>
<td>X-Rays are enabled</td>
<td></td>
</tr>
<tr>
<td>LED 8</td>
<td>PWR</td>
<td>Power is ON</td>
<td></td>
</tr>
</tbody>
</table>

---

**AC LINE POWER CONNECTOR—J1 THREE POSITION PHOENIX CONTACT**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Earth Ground</td>
</tr>
<tr>
<td>2</td>
<td>Line</td>
</tr>
<tr>
<td>3</td>
<td>Neutral</td>
</tr>
</tbody>
</table>

Mating connector provided with unit

**RS-232 DIGITAL INTERFACE—J3 9 PIN FEMALE D CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>2</td>
<td>TD</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>3</td>
<td>RD</td>
<td>Receive Data</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>SGND</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

**XRB80PN100HR ANALOG INTERFACE—J2 15 PIN MALE D CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Supply Fault Output</td>
<td>Open collector, 35V @ 10mA max, high = no fault</td>
</tr>
<tr>
<td>2</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>3</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>4</td>
<td>X-Ray On Lamp Relay Output</td>
<td>Common, dry contacts, 30Vdc @ 1A, max</td>
</tr>
<tr>
<td>5</td>
<td>X-Ray On Lamp Relay Output</td>
<td>Normally open, X-Ray ON = closed</td>
</tr>
<tr>
<td>6</td>
<td>mA Monitor Output</td>
<td>0 to 9Vdc = 0 to 100% rated output, Zout =10kΩ</td>
</tr>
<tr>
<td>7</td>
<td>X-Ray On Lamp Relay Output</td>
<td>Normally closed, X-Ray ON = open</td>
</tr>
<tr>
<td>8</td>
<td>kV Monitor Output</td>
<td>0 to 9.00Vdc = 0 to 100% rated output, Zout =10kΩ</td>
</tr>
<tr>
<td>9</td>
<td>Signal Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>10</td>
<td>Signal Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>11</td>
<td>HV Interlock Return Input</td>
<td>Connect to Pin 12 to close HV interlock</td>
</tr>
<tr>
<td>12</td>
<td>HV Interlock Output</td>
<td>+15Vdc @ open, 5mA when connected to pin 11</td>
</tr>
<tr>
<td>13</td>
<td>X-Ray Enable Output</td>
<td>+15Vdc @ open, 5mA when connected to pin 15</td>
</tr>
<tr>
<td>14</td>
<td>X-Ray Status Output</td>
<td>Open collector, 35V @ 10mA max, high = X-Ray OFF</td>
</tr>
<tr>
<td>15</td>
<td>X-Ray Enable Return Input</td>
<td>Connect to pin 13 to enable X-Ray generation (for local enable)</td>
</tr>
</tbody>
</table>
**OPTIONS**
- **CB** Cone Beam
- **.5mm** .5mm focal spot X-Ray tube
- **NF** 80° x 10° Narrow Fan beam
- **RA** Right Angle cable

**DIMENSIONS:** in.[mm]

**STANDARD CONTROL UNIT**

**TOP VIEW**

**SIDE VIEW**

**BOTTOM VIEW**

**How to Order:**

<table>
<thead>
<tr>
<th>Standard:</th>
<th>PART NO.: XRB80PN100HR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cone Beam Option</td>
<td>PART NO.: XRB80PN100HR/CB</td>
</tr>
<tr>
<td>0.5mm Focal Spot Option</td>
<td>PART NO.: XRB80PN100HR/.5mm</td>
</tr>
<tr>
<td>80° X 10° Narrow Fan Beam Option</td>
<td>PART NO.: XRB80PN100HR/NF</td>
</tr>
<tr>
<td>Cable Option:</td>
<td>PART NO.: XRB80PN100HR/RA</td>
</tr>
</tbody>
</table>

**WARNING!**
- Do not connect AC input power to unit with cover removed. Disregarding this may cause fatal electrical shock.

<table>
<thead>
<tr>
<th>Part Name</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Connector</td>
<td>XRB80PN100HR</td>
<td>4-M40.7mm Deep (MOUNTING HOLES)</td>
</tr>
<tr>
<td>Cone Beam Connector</td>
<td>XRB80PN100HR/CB</td>
<td>4-M40.7mm Deep (MOUNTING HOLES)</td>
</tr>
<tr>
<td>0.5mm Focal Spot Connector</td>
<td>XRB80PN100HR/.5mm</td>
<td>4-M40.7mm Deep (MOUNTING HOLES)</td>
</tr>
<tr>
<td>80° X 10° Narrow Fan Beam Connector</td>
<td>XRB80PN100HR/NF</td>
<td>4-M40.7mm Deep (MOUNTING HOLES)</td>
</tr>
<tr>
<td>Cable Connector</td>
<td>XRB80PN100HR/RA</td>
<td>4-M40.7mm Deep (MOUNTING HOLES)</td>
</tr>
</tbody>
</table>
Spellman’s XRB100N100 Monoblock® X-Ray source is designed for OEM applications powering its internal X-Ray tube up to 100kV at 100W. Features like universal input, small package size and a standard analog and RS-232 digital interface simplify integrating this Monoblock® into your X-Ray system. Proprietary emission control circuitry provides excellent regulation of X-Ray tube current, along with outstanding stability performance.

### TYPICAL APPLICATIONS

X-Ray Scanning: Food Inspection, Fill Level Confirmation and Security Applications

### SPECIFICATIONS

**X-Ray Characteristics:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tube Type:</td>
<td>Stationary anode, tungsten target</td>
</tr>
<tr>
<td>Focal Spot:</td>
<td>0.5mm (IEC 336)</td>
</tr>
<tr>
<td>Beam Filter:</td>
<td>Lexan: 3.2mm</td>
</tr>
<tr>
<td></td>
<td>Oil: 10mm ±0.1mm</td>
</tr>
<tr>
<td></td>
<td>Glass: 1.8mm max</td>
</tr>
<tr>
<td>Beam Geometry:</td>
<td>Symmetrical fan</td>
</tr>
<tr>
<td></td>
<td>74° x 10° ±1°</td>
</tr>
</tbody>
</table>

**Input Voltage:**

- Power factor corrected input 0.98, 100-240Vac ±10%
- 50/60Hz, 2A, maximum

**X-Ray Tube Voltage:**

Nominal X-Ray tube voltage is adjustable between 40kV to 100kV

**X-Ray Tube Current:**

100uA to 1mA over specified tube voltage range

**X-Ray Tube Power:**

100W maximum continuous

**Voltage Regulation:**

<table>
<thead>
<tr>
<th>Type</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line</td>
<td>±0.1% of maximum output voltage over a ±10% change of nominal input line voltage</td>
</tr>
<tr>
<td>Load</td>
<td>±0.1% of maximum rated voltage for 100uA to 1mA load change</td>
</tr>
</tbody>
</table>

**Voltage Accuracy:**

Voltage measured across the X-Ray tube is within ±2% of the programmed value

**Voltage Risetime:**

Ramp time shall be 1 second from 10% to 90% of maximum rated output voltage

**Voltage Overshoot:**

5% of maximum voltage, to return within 2.5% of maximum voltage in less than 50ms

**Voltage Ripple:**

0.5% peak to peak of maximum voltage for frequencies ≤1kHz

**Emission Current Parameters**

**Current Regulation:**

- Line: ±0.5% of rated output current over a ±10% change of nominal input line voltage
- Load: ±0.5% of rated output current for a change from 50% to 100% of rated output voltage

**Current Accuracy:**

Current measured through the X-Ray tube is within ±1% of the programmed value

**Current Risetime:**

Ramp time shall be 1 second from 10% to 90% of maximum rated current

**Arc Intervention:**

3 arcs in 10 seconds with a 200ms quench = Shutdown

**Filament Configuration:**

Internal high frequency AC filament drive with closed loop filament emission control
**Analog Interface:**
Ground referenced 0 to 9Vdc for all programming and monitoring signals. Relay contacts and open collector signals for other signals. See analog interface connector pin out table.

**Digital Interface:**
Jumpers are needed to be configured and the digital interface cable installed to enable the RS-232 interface.

**Control Software:**
A demo GUI is available for engineering evaluations.

**Interlock/Signals:**
A hardware interlock functions in both analog and digital programming modes. The hardware X-Ray Enable signal only functions in analog programming mode.

**Operating Temperature:**
0°C to +40°C

**Storage Temperature:**
-40°C to +70°C

**Humidity:**
10% to 95% relative humidity, non-condensing

**Cooling:**
Forced air and natural convection augmented by customer provided external cooling fan to maintain oil temperature below 55°C.

**Input Line Connector:**
3 pin, Phoenix Contact 1829167, SHV part number 105672-219. Mating connector Phoenix Contact #1805990, SHV part number 105808-475 provided with unit.

**Analog Interface Connector:**
15 pin D connector, male

**Digital Interface Connector:**
9 pin D connector, female

**Grounding Point:**
M4 ground stud provided on chassis

**Dimensions:**
See page 3 of 3

**Weight:**
55lbs (25kg)

**Orientation:**
Can be mounted in any orientation.

**X-Ray Leakage:**
Not to be greater than 0.5mR/hr at 5cm outside the external surface.
**WARNING**

DO NOT CONNECT AC INPUT POWER TO UNIT WITH COVER REMOVED. DISREGARDING THIS MAY CAUSE FATAL ELECTRICAL SHOCK.

**WARNING**

REFER SERVICE TO QUALIFIED PERSONNEL. INTERNAL PARTS MAY PRESENT A RISK OF ELECTRICAL SHOCK DURING SERVICING.

---

**X-RAY GENERATOR**

**FRONT VIEW**

**TOP VIEW**

**SIDE VIEW**

**BOTTOM VIEW**

**DIMENSIONS:** in. [mm]

**CONTROL UNIT**

**FRONT VIEW**

**TOP VIEW**

**SIDE VIEW**

**BOTTOM VIEW**
Spellman’s XRBHR (high reliability) Series of Monoblock® X-Ray sources are designed for OEM applications powering their internal Bipolar X-Ray tube at 80kV and 100kV at power levels of 100W, 210W, 350W and 500W. Features such as universal input, compact package size and a standard RS-232 digital interface simplify integration of any XRBHR model into your X-Ray system. Each XRBHR model is available with fan shaped (standard) or cone shaped (optional) beam geometries. Proprietary emission control circuitry provides excellent regulation of X-Ray tube current, along with outstanding stability performance. The XRBHR Series is designed for long field life and available with a warranty of up to 3 years.

TYPICAL APPLICATIONS

OPTIONS
CB Cone Beam
.5mm .5mm focal spot X-Ray tube
RA Controller to tank right angle connector
TE Controller to tank top exit cable

SPECIFICATIONS
X-Ray Characteristics:
- Focal Spot: 0.8mm (IEC 336) standard
  0.5mm (IEC 336) optional
- Beam Filter:
  Ultem: 1.50mm ±0.15mm
  Oil: 9.0mm ±0.25mm
  Glass: 1.7mm ±0.2mm
  Be: 0.8mm
- Beam Geometry:
  Fan: Standard. The beam angular coverage will be 90° with the beam plane perpendicular to the X-Ray tube axis and 12° wide (with a 2° tolerance)
  Cone: Optional. 40° cone beam (with a 2° tolerance)
- Input Voltage: 100- 240Vac, ±10%, 50/60 Hertz, .98 power factor
- Input Current:
  100W @ 2A
  210W @ 4A
  350W @ 6A
  500W @ 8A

- Compact & Lightweight
- Universal Input, Power Factor Corrected
- Can be Mounted in Any Physical Orientation
- Analog Monitoring Interface, Standard RS-232 Digital Interface and Ethernet
- Data Logging and Firmware Controlled X-Ray Tube Seasoning

X-Ray Tube Voltage:
See table
X-Ray Tube Current:
See table
X-Ray Tube Power:
See table
Voltage Regulation:
- Line: ±0.05% of maximum output voltage over a ±10% change of nominal input line voltage
- Load: ±0.1% of maximum rated voltage for 150uA to full rated load change

Voltage Accuracy:
Voltage measured across the X-Ray tube is within ±2% of the programmed value

Voltage Risetime:
Standard ramp time shall be <500ms from 10% to 90% of maximum rated output voltage

Voltage Ripple:
0.5% peak to peak of maximum voltage for frequencies ≤1kHz

Emission Current Parameters
Current Regulation:
- Line: ±0.05% of rated output current over a ±10% change of nominal input line voltage
- Load: ±0.1% of rated output current for a change from 50% to 100% of rated output voltage

Current Accuracy:
Current measured through the X-Ray tube is within ±2% of the programmed value

Current Risetime:
Standard ramp time shall be <500ms from 10% to 90% of maximum rated current

Arc Intervention:
4 arcs in 10 seconds with a 100ms quench/100ms re-ramp = Shutdown

Filament Configuration:
Internal floating AC filament drive with closed loop filament emission control circuitry

Analog Interface:
Ground referenced 0 to 9Vdc for all monitoring signals. Relay contacts and open collector signals for other signals. See analog interface connector pin out table.

Digital Interface:
The RS-232 interface allows for programming of kV, mA output and X-Ray enable. Provides monitoring for kV, mA output and oil temperature.
Operating Temperature:  
0°C to +40°C

Storage Temperature:  
-40°C to +70°C

Humidity:  
10% to 95% relative humidity, non-condensing

Cooling:  
X-Ray Tank:  
100W: Convection/customer supplied forced air so tank is <55˚C  
210W: Externally powered forced air cooling, 24Vdc @ 2A  
350W: Externally powered forced air cooling with oil pump and heat exchanger, 24Vdc @ 5A  
500W: Externally powered forced air cooling with oil pump and heat exchanger, 24Vdc @ 5A

Controller:  
Forced air via internal fan.

Grounding Point:  
M5 ground female thread on tank  
M5 ground stud on control chassis provided

Dimensions:  
X-Ray Tank:  see drawings  
100W/210W Controller:  see drawings  
350W/500W Controller:  see drawings

Weight:  
X-Ray Tank:  
100W @ 75 lbs. (34kg)  
210W @ 75lbs. (34kg)  
350W @ 81.5lbs. (37kg)  
500W @ 81.5lbs. (37kgs)  
Controller:  
100W/210W: 4 pounds (1.18kg)  
350W/500W: 7 pounds (3.18kg)

Orientation:  
Can be mounted in any orientation.

X-Ray Leakage:  
Not to be greater than 0.5mR/hr at 5cm outside the external surface.

Regulatory Approvals:  
Compliant to EEC EMC Directive. Compliant to EEC Low Voltage Directive. UL/CUL recognized file E235530

**MODEL SELECTION TABLE**

<table>
<thead>
<tr>
<th>Model</th>
<th>Max. Voltage</th>
<th>Max. Current</th>
<th>Max. Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>XRB80PN210HR</td>
<td>80kV</td>
<td>5.25mA</td>
<td>210 watts</td>
</tr>
<tr>
<td>XRB80PN350HR</td>
<td>80kV</td>
<td>8mA</td>
<td>350 watts</td>
</tr>
<tr>
<td>XRB80PN500HR</td>
<td>80kV</td>
<td>8mA</td>
<td>500 watts</td>
</tr>
<tr>
<td>XRB100PN100HR</td>
<td>100kV</td>
<td>2mA</td>
<td>100 watts</td>
</tr>
<tr>
<td>XRB100PN210HR</td>
<td>100kV</td>
<td>4.2mA</td>
<td>210 watts</td>
</tr>
<tr>
<td>XRB100PN350HR</td>
<td>100kV</td>
<td>7mA</td>
<td>350 watts</td>
</tr>
<tr>
<td>XRB100PN500HR</td>
<td>100kV</td>
<td>8mA</td>
<td>500 watts</td>
</tr>
</tbody>
</table>

**LED INDICATORS for 100W and 200W Units**

<table>
<thead>
<tr>
<th>INDICATOR</th>
<th>SIGNAL</th>
<th>CONDITION</th>
<th>ILLUMINATED WHEN...</th>
<th>LED COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OV Error 6</td>
<td>High kV occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>UV Error 5</td>
<td>Low kV occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>UC Error 4</td>
<td>Low mA occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Power On</td>
<td>AC input power is present</td>
<td>Green</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>OC Error 3</td>
<td>High mA occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>ARC Error 2</td>
<td>Arc fault occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>OT Error 1</td>
<td>Over temperature occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>X-Ray On</td>
<td>X-Rays are being generated</td>
<td>Green</td>
<td></td>
</tr>
</tbody>
</table>

**LED INDICATORS for 350W and 500W Units**

<table>
<thead>
<tr>
<th>INDICATOR</th>
<th>SIGNAL</th>
<th>CONDITION</th>
<th>ILLUMINATED WHEN...</th>
<th>LED COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OV Error 6</td>
<td>High kV occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>UV Error 5</td>
<td>Low kV occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>UC Error 4</td>
<td>Low mA occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>OC Error 3</td>
<td>High mA occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>ARC Error 2</td>
<td>Arc fault occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>OT Error 1</td>
<td>Over temperature occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>X-Ray On</td>
<td>X-Rays are being generated</td>
<td>Green</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Power On</td>
<td>AC input power is present</td>
<td>Green</td>
<td></td>
</tr>
</tbody>
</table>

**SMART XRB**

The XRBHR has two new digital features: data logging and firmware controlled seasoning.

Data Logging:  
Think of this as an “airplane black box”. The data logging captures data on fault events and non-fault events. Fault events will turn off the high voltage:

**FAULT EVENTS**

- Temperature  
- High Current  
- High Voltage Watchdog  
- Power Fault Interlock  
- Total kV  
- Filament Temperature

The XRBHR stores data 620ms before the event, the event itself and for 620ms after the event. Data is recorded every 20ms (62 samples total) showing:

- Anode kV  
- Cathode kV  
- Total mA  
- Low Current Filament Limit Set point  
- Pre Heat Set point  
- Line Dip  
- HV Off  
- mA Set point  
- Filament Limit Set point  
- Line Dip

Fault event data is actual graphical data. Non fault event data is just stored as event type, data and timestamp. We also have a preventative maintenance fault, which throws a non-shutdown fault if the X-Ray tube has been factory installed over 4 years ago or if over 15,000 hours of HV ON is logged.

**NON FAULT EVENTS**

- HV On  
- kV Set point  
- Low Current  
- Pre Heat Set point  
- Filament Limit Set point  
- Line Dip

Firmware Controlled Seasoning:  
Every unit comes with an initial seasoning table, or customers can set their own. The XRBHR knows when the unit has been on, when it has been off, hours on the X-Ray tube, etc. As a preventative maintenance feature upon turn on, we review the data and suggest that a particular seasoning protocol be run based upon the actual usage history of the unit. Proper seasoning compliance of the X-Ray tube will help get the longest lifetime.
### Power and Interface Connections for 100W and 210W Units

**AC INPUT—6 PIN MOLEX 09-50-8061**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AC Input (high)</td>
<td>100-240Vac (high)</td>
</tr>
<tr>
<td>2</td>
<td>Pin Removed</td>
<td>N/C</td>
</tr>
<tr>
<td>3</td>
<td>AC Input (neutral)</td>
<td>100-240Vac (neutral)</td>
</tr>
<tr>
<td>4</td>
<td>Pin Removed</td>
<td>N/C</td>
</tr>
<tr>
<td>5</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
<td>N/C</td>
</tr>
</tbody>
</table>

**ANALOG INTERFACE—7 PIN MOLEX 09-50-8071**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X-Ray Interlock Enable</td>
<td>Apply +24Vdc to enable interlock.  Open/removal of +24Vdc will cause X-Ray generation to stop.</td>
</tr>
<tr>
<td>3</td>
<td>Pin removed</td>
<td>N/C</td>
</tr>
<tr>
<td>4</td>
<td>kV Monitor</td>
<td>0-10Vdc = 0-100% rated output voltage. Zout = 10kΩ</td>
</tr>
<tr>
<td>5</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>mA Monitor</td>
<td>0-10Vdc = 0-100% rated output current. Zout = 10kΩ</td>
</tr>
<tr>
<td>7</td>
<td>Fault Signal</td>
<td>Open collector, High (Open) = No Fault, 35Vdc @ 10mA maximum</td>
</tr>
</tbody>
</table>

**RS-232 DIGITAL INTERFACE—9 PIN MALE D CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>2</td>
<td>Transmitted Data</td>
<td>Conforms to EIA RS-232-C</td>
</tr>
<tr>
<td>3</td>
<td>Received Data</td>
<td>Conforms to EIA RS-232-C</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>5</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>7</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>8</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>9</td>
<td>N/C</td>
<td>N/C</td>
</tr>
</tbody>
</table>

**ETHERNET DIGITAL INTERFACE—RJ45 8 PIN FEMALE CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TX +</td>
<td>Transmit Data +</td>
</tr>
<tr>
<td>2</td>
<td>TX -</td>
<td>Transmit Data -</td>
</tr>
<tr>
<td>3</td>
<td>RX +</td>
<td>Receive Data +</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>6</td>
<td>RX -</td>
<td>Receive Data -</td>
</tr>
<tr>
<td>7</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

**HV LAMP ON RELAY—3 PIN MOLEX 09-50-8031**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Normally Closed dry contact</td>
<td>50V max. Rated for 1 amp or less, 50mA nominal load</td>
</tr>
<tr>
<td>2</td>
<td>Common</td>
<td>50V max. Rated for 1 amp or less, 50mA nominal load</td>
</tr>
<tr>
<td>3</td>
<td>Normally Open dry contact</td>
<td>50V max. Rated for 1 amp or less, 50mA nominal load</td>
</tr>
</tbody>
</table>

### Power and Interface Connections for 350W and 500W Units

**AC INPUT—3 PIN PHOENIX CONTACT 1858772**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AC Input (high)</td>
<td>100-240Vac (high)</td>
</tr>
<tr>
<td>2</td>
<td>Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>3</td>
<td>AC Input (neutral)</td>
<td>100-240Vac (neutral)</td>
</tr>
</tbody>
</table>

**DC INPUT FOR HEAT DISSIPATION UNIT—4 PIN AMP (210/350/500W) 206060-1**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>DESCRIPTION</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24Vdc</td>
<td>Fan/Pump Power</td>
<td>24Vdc @ 5 amps</td>
</tr>
<tr>
<td>2</td>
<td>24Vdc Return</td>
<td>No Connection</td>
<td>N/C</td>
</tr>
<tr>
<td>3</td>
<td>N/C</td>
<td>No Connection</td>
<td>N/C</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
<td>No Connection</td>
<td>N/C</td>
</tr>
</tbody>
</table>

**ANALOG INTERFACE—10 PIN PHOENIX CONTACT 1792605**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X-Ray Interlock Enable</td>
<td>Apply +24Vdc to enable interlock.  Open/removal of +24Vdc will cause X-Ray generation to stop.</td>
</tr>
<tr>
<td>3</td>
<td>Pin removed</td>
<td>N/C</td>
</tr>
<tr>
<td>4</td>
<td>kV Monitor</td>
<td>0-10Vdc = 0-100% rated output voltage. Zout = 10kΩ</td>
</tr>
<tr>
<td>5</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>mA Monitor</td>
<td>0-10Vdc = 0-100% rated output current. Zout = 10kΩ</td>
</tr>
<tr>
<td>7</td>
<td>Fault Signal</td>
<td>Open collector, High (Open) = No Fault, 35Vdc @ 10mA maximum</td>
</tr>
<tr>
<td>8</td>
<td>HV ON Lamp Relay N/O</td>
<td>N/C dry contacts. 50 volts maximum. Rated for 1 amp or less, 50mA nominal load</td>
</tr>
<tr>
<td>9</td>
<td>HV ON Lamp Relay C</td>
<td>Common dry contacts. 50 volts maximum. Rated for 1 amp or less, 50mA nominal load</td>
</tr>
<tr>
<td>10</td>
<td>HV ON Lamp Relay N/C</td>
<td>N/C dry contacts. 50 volts maximum. Rated for 1 amp or less, 50mA nominal load</td>
</tr>
</tbody>
</table>

**RS-232 DIGITAL INTERFACE—9 PIN MALE D CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>2</td>
<td>Transmitted Data</td>
<td>Conforms to EIA RS-232-C</td>
</tr>
<tr>
<td>3</td>
<td>Received Data</td>
<td>Conforms to EIA RS-232-C</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>5</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>7</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>8</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>9</td>
<td>N/C</td>
<td>N/C</td>
</tr>
</tbody>
</table>

**ETHERNET DIGITAL INTERFACE—RJ45 8 PIN FEMALE CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>2</td>
<td>Transmitted Data</td>
<td>Conforms to EIA RS-232-C</td>
</tr>
<tr>
<td>3</td>
<td>Received Data</td>
<td>Conforms to EIA RS-232-C</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>5</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>7</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>8</td>
<td>N/C</td>
<td>N/C</td>
</tr>
</tbody>
</table>

**HV LAMP ON RELAY—3 PIN MOLEX 09-50-8031**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Normally Closed dry contact</td>
<td>50V max. Rated for 1 amp or less, 50mA nominal load</td>
</tr>
<tr>
<td>2</td>
<td>Common</td>
<td>50V max. Rated for 1 amp or less, 50mA nominal load</td>
</tr>
<tr>
<td>3</td>
<td>Normally Open dry contact</td>
<td>50V max. Rated for 1 amp or less, 50mA nominal load</td>
</tr>
</tbody>
</table>

It is critical to ensure that 24Vdc is supplied to pins 1 and 2.
80-100KV/100-500W MONOBLOCK®

DIMENSIONS: in.[mm]

100/210W
CONTROL UNIT

FRONT VIEW

BOTTOM VIEW

REAR VIEW

SIDE VIEW

SIDE VIEW

6.12 [155.4]

13.46 [341.9]

RA Right Angle Connector Option

Side Exit Cable (standard)
Straight Connector (standard)

M5 x 10mm 4PL

3.93 [100]

.413 [10.5]

.470 [11.9]

12.52 [318.0]

AIR FLOW

60.0 ±2.0 [510 ± 51]
Dimensions: in.[mm]

100W Tank

Top View

- 13.75 [349.25]
- 10.50 [266.70]
- M8X1.25 THD (4PL)
- Do not block the vent hole on the cover

Side View

- 90°
- 6.00 [152.4]
- 3.00 [76.2]
- F.S.

Back View

- 13.37 [339.5]
- 12°
- F.S.

Front View

- 163
350/500W TANK

TOP VIEW

Do not block the vent hole on the cover

DIMENSIONS: in.[mm]

18.99 [482.34]
13.75 [349.25]
10.50 [266.7]

M8X1.25 ThD (4PL)

SIDE VIEW

90°

AIR FLOW

6.08 [154.4]

F.S.

10.50 [266.7]

BACK VIEW

13.37 [339.59]

FRONT VIEW

12°

Do not block the vent hole on the cover
Spellman’s XRBD Series of Monoblock® X-Ray sources are designed for OEM applications powering their internal bipolar X-Ray tube at 160kV at power levels of 100W, 210W, 350W and 500W. Features such as universal input, compact package size and a standard RS-232 digital interface simplify integration of any XRBD model into your X-Ray system. Each XRBD model is available with fan shaped (standard) or cone shaped (optional) beam geometries. Proprietary emission control circuitry provides excellent regulation of X-Ray tube current, along with outstanding stability performance.

**TYPICAL APPLICATIONS**

**OPTIONS**
- CB: Cone Beam
- .5mm: .5mm focal spot X-Ray tube
- RA: Controller to tank right angle connector
- TE: Controller to tank top exit cable

**SPECIFICATIONS**

**X-Ray Characteristics:**
- **Focal Spot:** 0.8mm (IEC 336) standard
  0.5mm (IEC 336) optional
- **Beam Filter:**
  - Ultem: 1.50mm ±0.15mm
  - Oil: 9.0mm ±0.25mm
  - Glass: 1.7mm ±0.2mm
  - Be: 0.8mm
- **Beam Geometry:**
  - Fan: Standard. The beam angular coverage will be 90° with the beam plane perpendicular to the X-Ray tube axis and 12° wide (with a 2° tolerance)
  - Cone: Optional. 40° cone beam (with a 2° tolerance)
- **Input Voltage:**
  100-240Vac, ±10%, 50/60 Hertz, .98 power factor
- **Input Current:**
  - 100W @ 1.4A
  - 210W @ 2.8A
  - 350W @ 4.6A
  - 500W @ 6.6A

**X-Ray Tube Voltage:**
See table

**X-Ray Tube Current:**
See table

**X-Ray Tube Power:**
See table

**Voltage Regulation:**
- **Line:** ±0.05% of maximum output voltage over a ±10% change of nominal input line voltage
- **Load:** ±0.1% of nominal input voltage to full rated load change

**Voltage Accuracy:**
Voltage measured across the X-Ray tube is within ±2% of the programmed value

**Voltage Risetime:**
Standard ramp time shall be <500ms from 10% to 90% of maximum rated output voltage

**Voltage Ripple:**
0.5% peak to peak of maximum voltage for frequencies ≤1kHz

**Emission Current Parameters**

**Current Regulation:**
- **Line:** ±0.05% of rated output current over a ±10% change of nominal input line voltage
- **Load:** ±0.1% of rated output current for a change from 50% to 100% of rated output voltage

**Current Accuracy:**
Current measured through the X-Ray tube is within ±2% of the programmed value

**Current Risetime:**
Standard ramp time shall be <500ms from 10% to 90% of maximum rated current

**Arc Intervention:**
4 arcs in 10 seconds with a 100ms quench/100ms re-ramp = Shutdown

**Filament Configuration:**
Internal floating AC filament drive with closed loop filament emission control circuitry

**Analog Interface:**
Ground referenced 0 to 9Vdc for all monitoring signals. Relay contacts and open collector signals for other signals. See analog interface connector pin out table.
Digital Interface:
The RS-232 interface allows for programming of kV, mA output and X-Ray enable. Provides monitoring for kV, mA output and oil temperature.

Operating Temperature:
0°C to +40°C

Storage Temperature:
-40°C to +70°C

Humidity:
10% to 95% relative humidity, non-condensing

Cooling:
X-Ray Tank:
100W: Convection/customer supplied forced air so tank is <55°C
210W: Externally powered forced air cooling, 24Vdc @ 2A
350/500W: Externally powered forced air cooling with oil pump and heat exchanger, 24Vdc @ 5A
Controller: Forced air via internal fan.

Grounding Point:
M5 ground female thread on tank
M5 ground stud on control chassis provided

Dimensions:
see drawings

Weight:
X-Ray Tank:
100/210W @ 78lbs. (35.4kg)
350/500W @ 84.5lbs. (38.3kg)
Controller:
100W/210W: 4 pounds (1.8kg)
350W/500W: 7 pounds (3.18kg)

Orientation:
Can be mounted in any orientation.

X-Ray Leakage:
Not to be greater than 0.5mR/hr at 5cm outside the external surface.

Regulatory Approvals:
Designed to meet UL/EN61010-1
Designed to meet EN61326-1
(may require an external line filter)

MODEL SELECTION TABLE

<table>
<thead>
<tr>
<th>Model</th>
<th>Max. Voltage</th>
<th>Max. Current</th>
<th>Max. Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>XRBD160PN100</td>
<td>160kV</td>
<td>1mA</td>
<td>100 watts</td>
</tr>
<tr>
<td>XRBD160PN210</td>
<td>160kV</td>
<td>2.1mA</td>
<td>210 watts</td>
</tr>
<tr>
<td>XRBD160PN350</td>
<td>160kV</td>
<td>3.5mA</td>
<td>350 watts</td>
</tr>
<tr>
<td>XRBD160PN500</td>
<td>160kV</td>
<td>4mA</td>
<td>500 watts</td>
</tr>
</tbody>
</table>

---

**LED INDICATORS for 100W and 200W Units**

<table>
<thead>
<tr>
<th>INDICATOR</th>
<th>SIGNAL</th>
<th>CONDITION</th>
<th>ILLUMINATED WHEN...</th>
<th>LED COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OV Error 6</td>
<td>High kV occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>UV Error 5</td>
<td>Low kV occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>UC Error 4</td>
<td>Low mA occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Power On</td>
<td>AC input power is present</td>
<td>Green</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>OC Error 3</td>
<td>High mA occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>ARC Error 2</td>
<td>Arc fault occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>OT Error 1</td>
<td>Over temperature occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>X-Ray On</td>
<td>X-Rays are being generated</td>
<td>Green</td>
<td></td>
</tr>
</tbody>
</table>

**LED INDICATORS for 350W and 500W Units**

<table>
<thead>
<tr>
<th>INDICATOR</th>
<th>SIGNAL</th>
<th>CONDITION</th>
<th>ILLUMINATED WHEN...</th>
<th>LED COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OV Error 6</td>
<td>High kV occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>UV Error 5</td>
<td>Low kV occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>UC Error 4</td>
<td>Low mA occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>OC Error 3</td>
<td>High mA occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>ARC Error 2</td>
<td>Arc fault occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>OT Error 1</td>
<td>Over temperature occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>X-Ray On</td>
<td>X-Rays are being generated</td>
<td>Green</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Power On</td>
<td>AC input power is present</td>
<td>Green</td>
<td></td>
</tr>
</tbody>
</table>

**SMART XRB**

The XRBD has two new digital features: data logging and firmware controlled seasoning.

**Data Logging:**
Think of this as an “airplane black box”. The data logging captures data on fault events and non-fault events. Fault events will turn off the high voltage.

**FAULT EVENTS**
- Temperature
- High Current
- High Voltage
- Power Fault
- Interlock

The XRBD stores data 620ms before the event, the event itself and for 620ms after the event. Data is recorded every 20ms (62 samples total) showing:
- Anode kV
- Cathode kV
- Total kV
- Total mA
- Filament
- Temperature

We also log non-fault events, these are changes in set points or state of the unit.

**NON FAULT EVENTS**
- HV On
- HV Off
- KV Set point
- mA Set point
- Low Current
- Filament Limit Set point
- Pre Heat Set point
- Line Dip

Fault event data is actual graphical data. Non fault event data is just stored as event type, data and timestamp. We also have a preventative maintenance fault, which throws a non-shutdown fault if the X-Ray tube has been factory installed over 4 years ago or if over 15,000 hours of HV ON is logged.

**Firmware Controlled Seasoning:**
Every unit comes with an initial seasoning table, or customers can set their own. The XRBD knows when the unit has been on, when it has been off, hours on the X-Ray tube, etc. As a preventative maintenance feature upon turn on, we review the data and suggest that a particular seasoning protocol be run based upon the actual usage history of the unit. Proper seasoning compliance of the X-Ray tube will help get the longest lifetime.
## Power and Interface Connections for 100W and 210W Units
### AC Input—6 Pin Molex 09-50-8061
<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AC Input (high)</td>
<td>100-240Vac (high)</td>
</tr>
<tr>
<td>2</td>
<td>Pin Removed</td>
<td>N/C</td>
</tr>
<tr>
<td>3</td>
<td>AC Input (neutral)</td>
<td>100-240Vac (neutral)</td>
</tr>
<tr>
<td>4</td>
<td>Pin Removed</td>
<td>N/C</td>
</tr>
<tr>
<td>5</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
<td>N/C</td>
</tr>
</tbody>
</table>

### Analog Interface—7 Pin Molex 09-50-8071
<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X-Ray Interlock Enable</td>
<td>Apply +24Vdc to enable interlock. Open/removal of +24Vdc will cause X-Ray generation to stop.</td>
</tr>
<tr>
<td>3</td>
<td>Pin Removed</td>
<td>N/C</td>
</tr>
<tr>
<td>4</td>
<td>KV Monitor</td>
<td>0-10Vdc = 0-100% rated output voltage. Zout = 10kΩ</td>
</tr>
<tr>
<td>5</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>mA Monitor</td>
<td>0-10Vdc = 0-100% rated output current. Zout = 10kΩ</td>
</tr>
<tr>
<td>7</td>
<td>Fault Signal</td>
<td>Open collector. High (Open) = No Fault, 25Vdc @10mA maximum</td>
</tr>
</tbody>
</table>

### RS-232 Digital Interface—9 Pin Male D Connector
<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>2</td>
<td>Transmitted Data</td>
<td>Conforms to EIA RS-232-C</td>
</tr>
<tr>
<td>3</td>
<td>Received Data</td>
<td>Conforms to EIA RS-232-C</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>5</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>7</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>8</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>9</td>
<td>N/C</td>
<td>N/C</td>
</tr>
</tbody>
</table>

### Ethernet Digital Interface—RJ45 8 Pin Female Connector
<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TX +</td>
<td>Transmit Data +</td>
</tr>
<tr>
<td>2</td>
<td>TX -</td>
<td>Transmit Data -</td>
</tr>
<tr>
<td>3</td>
<td>RX +</td>
<td>Receive Data +</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>6</td>
<td>RX -</td>
<td>Receive Data -</td>
</tr>
<tr>
<td>7</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

### HV Lamp On Relay—3 Pin Molex 09-50-8031
<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Normally Closed dry contact</td>
<td>50V max. Rated for 1 amp or less, 50mA nominal load</td>
</tr>
<tr>
<td>2</td>
<td>Common</td>
<td>50V max. Rated for 1 amp or less, 50mA nominal load</td>
</tr>
<tr>
<td>3</td>
<td>Normally Open dry contact</td>
<td>50V max. Rated for 1 amp or less, 50mA nominal load</td>
</tr>
</tbody>
</table>

## Power and Interface Connections for 350W and 500W Units
### AC Input—3 Pin Phoenix Contact 1858772
<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AC Input (high)</td>
<td>100-240Vac (high)</td>
</tr>
<tr>
<td>2</td>
<td>Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>3</td>
<td>AC Input (neutral)</td>
<td>100-240Vac (neutral)</td>
</tr>
</tbody>
</table>

### DC Input For Heat Dissipation Unit—4 Pin AMP (210/350/500W) 206060-1
<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>DESCRIPTION</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24Vdc</td>
<td>Fan/Pump Power</td>
<td>24Vdc @ 5 amps</td>
</tr>
<tr>
<td>2</td>
<td>24Vdc Return</td>
<td></td>
<td>N/C</td>
</tr>
<tr>
<td>3</td>
<td>N/C</td>
<td>No Connection</td>
<td>N/C</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
<td>No Connection</td>
<td>N/C</td>
</tr>
</tbody>
</table>

### Analog Interface—10 Pin Phoenix Contact 1792605
<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X-Ray Interlock Enable</td>
<td>Apply +24Vdc to enable interlock. Open/removal of +24Vdc will cause X-Ray generation to stop.</td>
</tr>
<tr>
<td>3</td>
<td>Pin removed</td>
<td>N/C</td>
</tr>
<tr>
<td>4</td>
<td>KV Monitor</td>
<td>0-10Vdc = 0-100% rated output voltage. Zout = 10kΩ</td>
</tr>
<tr>
<td>5</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>mA Monitor</td>
<td>0-10Vdc = 0-100% rated output current. Zout = 10kΩ</td>
</tr>
<tr>
<td>7</td>
<td>Fault Signal</td>
<td>Open collector. High (Open) = No Fault, 25Vdc @10mA maximum</td>
</tr>
</tbody>
</table>

### RS-232 Digital Interface—9 Pin Male D Connector
<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>2</td>
<td>Transmitted Data</td>
<td>Conforms to EIA RS-232-C</td>
</tr>
<tr>
<td>3</td>
<td>Received Data</td>
<td>Conforms to EIA RS-232-C</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>5</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>7</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>8</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>9</td>
<td>N/C</td>
<td>N/C</td>
</tr>
</tbody>
</table>

### Ethernet Digital Interface—RJ45 8 Pin Female Connector
<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TX +</td>
<td>Transmit Data +</td>
</tr>
<tr>
<td>2</td>
<td>TX -</td>
<td>Transmit Data -</td>
</tr>
<tr>
<td>3</td>
<td>RX +</td>
<td>Receive Data +</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>6</td>
<td>RX -</td>
<td>Receive Data -</td>
</tr>
<tr>
<td>7</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

### HV Lamp On Relay—3 Pin Molex 09-50-8031
<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Normally Closed dry contact</td>
<td>50V max. Rated for 1 amp or less, 50mA nominal load</td>
</tr>
<tr>
<td>2</td>
<td>Common</td>
<td>50V max. Rated for 1 amp or less, 50mA nominal load</td>
</tr>
<tr>
<td>3</td>
<td>Normally Open dry contact</td>
<td>50V max. Rated for 1 amp or less, 50mA nominal load</td>
</tr>
</tbody>
</table>
DIMENSIONS: in.[mm]

350/500W
CONTROL UNIT
FRONT VIEW

RA Right Angle Connector Option

Side Exit Cable (standard)
Straight Connector (standard)

M5 GROUND STUD

6.12 [155.4]

13.55 [344.2]

BOTTOM VIEW

AIR FLOW

60.0 ±2.0 [510 ± 51]

REAR VIEW

M5 x 10mm Dp 4PL

SIDE VIEW

SIDE VIEW
Spellman’s XRB160PN192 Monoblock® X-Ray source is designed for OEM applications powering its internal X-Ray tube up to 160kV at 192W. Features like universal input, small package size and a standard analog and RS-232 digital interface simplify integrating this Monoblock® into your X-Ray system. Standard models are available with fan shaped beam geometry. Proprietary emission control circuitry provides excellent regulation of X-Ray tube current, along with outstanding stability performance.

**TYPICAL APPLICATIONS**

X-Ray Scanning: Plating Measurement, Food Inspection, Fill Level Confirmation and Security Applications

**SPECIFICATIONS**

**X-Ray Characteristics:**
- Tube Type: Glass tube, Tungsten target, Be filter
- Focal Spot: 0.8mm x 0.8mm
- Beam Filter: 0.016” thick 6061 Al
- Beam Geometry: Asymmetrical fan 80° x 10° ±2°

**Input Voltage:**
- 100-240Vac ±10%, 50/60Hz, 5A maximum

**X-Ray Tube Voltage:**
- Nominal X-Ray tube voltage is adjustable between 80kV to 160kV

**X-Ray Tube Current:**
- 0.1mA to 1.2mA, 192W maximum over specified tube voltage range

**X-Ray Tube Power:**
- 192W maximum continuous

**Voltage Regulation:**
- Line: ±0.1% for a ±10% input line change of nominal input line voltage
- Load: ±0.1% for a 0.1mA to 1.2mA load change

**Voltage Accuracy:**
- Voltage measured across the X-Ray tube is within ±2% of the programmed value

**Voltage Risetime:**
- Ramp time shall be <200ms from 10% to 90% of rated output

**Voltage Overshoot:**
- Within 5% of rated voltage in <10ms

**Voltage Ripple:**
- 1% pp of rated voltage @ ≤1kHz

**Current Regulation:**
- Line: ±0.1% for a ±10% input line change of nominal input line voltage
- Load: 0.5% @ 80-160kV, 0.1mA to 1.2mA

**Current Accuracy:**
- Current measured through the X-Ray tube is within ±2% of the programmed value

**Current Risetime:**
- <200ms from 10% to 90% of rated output

**Arc Intervention:**
- 4 arcs in 10 seconds with a 200ms quench = Shutdown

**Filament Configuration:**
- Internal high frequency AC filament drive with closed loop filament emission control

**Analog Interface:**
- 0 to 10Vdc ground referenced signals

**Digital Interface:**
- RS-232 interface.

**Control Software:**
- A demo GUI for engineering evaluations will be provided for the RS-232 digital interface upon request.

**Interlock Signals:**
- A hardware interlock function is provided

**Operating Temperature:**
- 0°C to +40°C

**Storage Temperature:**
- -40°C to +70°C

**Humidity:**
- 10% to 95% relative humidity, non-condensing

**Cooling:**
- Natural convection augmented by customer provided 250cfm cooling fans for 200W operation
Input Line Connector:
6 pin Molex 26-60-4060

Analog Interface Connector:
7 pin Molex 26-60-5070

Digital Interface Connector:
9 pin D connector, female

Grounding Point:
8-32 ground stud provided on chassis

Dimensions:
18” x 13.5” x 7.63” (458mm x 343mm x 193.80mm)

Weight:
90lbs (40.5kg)

Orientation:
Can be mounted in any orientation.

X-Ray Leakage:
Not to be greater than 0.5mR/hr at 5cm outside the external surface

Regulatory Approvals:

### AC INPUT POWER

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Line</td>
<td>Line</td>
</tr>
<tr>
<td>2</td>
<td>Removed</td>
<td>N/C</td>
</tr>
<tr>
<td>3</td>
<td>Neutral</td>
<td>Neutral</td>
</tr>
<tr>
<td>4</td>
<td>Removed</td>
<td>N/C</td>
</tr>
<tr>
<td>5</td>
<td>Spare</td>
<td>N/C</td>
</tr>
<tr>
<td>6</td>
<td>Spare</td>
<td>N/C</td>
</tr>
</tbody>
</table>

### RS-232 DIGITAL INTERFACE—JB16 9 PIN FEMALE D CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>2</td>
<td>RD</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>3</td>
<td>RD</td>
<td>Receive Data</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>SGND</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>9</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

### ANALOG INTERFACE—J7 7 PIN MOLEX CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ex Gate</td>
<td>Low = X-Ray OFF, +12Vdc = X-Ray ON</td>
</tr>
<tr>
<td>2</td>
<td>Signal Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>3</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>4</td>
<td>kV Monitor</td>
<td>0-9 Vdc = 0 to 100% rated output</td>
</tr>
<tr>
<td>5</td>
<td>Signal Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>6</td>
<td>mA Monitor</td>
<td>0 to 9Vdc = 0 to 100% rated output</td>
</tr>
<tr>
<td>7</td>
<td>Fault</td>
<td>Open collector, 35V @ 10mA max, High = No Fault</td>
</tr>
</tbody>
</table>

### LED INDICATORS

<table>
<thead>
<tr>
<th>INDICATOR</th>
<th>SIGNAL NAME</th>
<th>CONDITION</th>
<th>Illuminated When...</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED 1</td>
<td>OV</td>
<td>High kV occurs</td>
<td></td>
</tr>
<tr>
<td>LED 2</td>
<td>UV</td>
<td>Low kV occurs</td>
<td></td>
</tr>
<tr>
<td>LED 3</td>
<td>UC</td>
<td>Low mA occurs</td>
<td></td>
</tr>
<tr>
<td>LED 4</td>
<td>QC</td>
<td>High mA occurs</td>
<td></td>
</tr>
<tr>
<td>LED 5</td>
<td>ARC FLT</td>
<td>Arc fault occurs</td>
<td></td>
</tr>
<tr>
<td>LED 6</td>
<td>OT</td>
<td>Over temperature occurs</td>
<td></td>
</tr>
<tr>
<td>LED 7</td>
<td>X-RAY ON</td>
<td>X-Rays are enabled</td>
<td></td>
</tr>
<tr>
<td>LED 8</td>
<td>PWR</td>
<td>Power is ON</td>
<td></td>
</tr>
</tbody>
</table>
Spellman’s XRB80PN320 Monoblock® X-Ray source is designed for OEM applications powering its internal X-Ray tube up to 80kV at 320W. Features like small package size and RS-232 digital interface simplify integrating this Monoblock® into your X-Ray system. Standard models are available with fan shaped beam geometry. Proprietary emission control circuitry provides excellent regulation of X-Ray tube current, along with outstanding stability performance.

**TYPICAL APPLICATIONS**

X-Ray Scanning: Food Inspection, Fill Level Confirmation and Security Applications

**SPECIFICATIONS**

**X-Ray Characteristics:**
- Tube Type: Glass tube, Tungsten target, Be filter
- Focal Spot: 0.8mm x 0.8mm (IEC 336)
- Beam Filter: 5052 Al, 0.040" (+0.01")
- Beam Geometry: Asymmetrical fan 80° x 10° ±2°

**Input Voltage:**
- 200-240Vac ±10%, 50/60Hz, 6.5A max

**X-Ray Tube Voltage:**
- Nominal X-Ray tube voltage is adjustable between 40kV to 80kV

**X-Ray Tube Current:**
- 0.5mA to 4mA over specified tube voltage range

**X-Ray Tube Power:**
- 320W maximum continuous

**Voltage Regulation:**
- Line: ±0.05% for a ±10% input line change
- Load: ±0.05% for a 0.5mA to 4mA load change

**Voltage Accuracy:**
- Voltage measured across the X-Ray tube is within ±2% of the programmed value

**Voltage Risetime:**
- Ramp time shall be <500ms from 10% to 90% of rated output

**Voltage Overshoot:**
- Within 5% of rated voltage in <10ms

**Voltage Ripple:**
- ≤1% p-p of rated voltage @ 1kHz

**Current Regulation:**
- Line: ±0.5% @ 50-100% V nominal over specified Line range
- Load: ±0.5% @ 50-100% V nominal over specified Load range

**Current Accuracy:**
- Current measured through the X-Ray tube is within ±2% of the programmed value

**Current Risetime:**
- <500ms from 10% to 90% of rated output

**Arc Intervention:**
- 4 arcs in 10 seconds = shutdown

**Filament Configuration:**
- Internal high frequency AC filament drive with closed loop filament emission control

**Analog Interface:**
- 0 to 10Vdc ground referenced monitoring signals

**Digital Interface:**
- RS-232

**Control Software:**
- A demo GUI for engineering evaluations will be provided for the RS-232 digital interface upon request.

**Interlock Signals:**
- A hardware interlock functions in digital programming modes.

**Operating Temperature:**
- 0°C to +40°C

**Storage Temperature:**
- -40°C to +70°C

**Humidity:**
- 10% to 90% relative humidity, non-condensing

**Cooling:**
- Heat exchanger w/fan and oil pump
Input Line Connector:
Terminal block, Schurter, Inc. part no. 6100-33

Digital Interface Connector:
9 pin D, female

Analog Monitoring Connector:
10 pin Phoenix Contact 1755503

Grounding Point:
8-32 ground stud provided on chassis

Dimensions:
See line drawing

Weight:
120lbs (54.4kg) maximum

Orientation:
Can be mounted in any orientation.

X-Ray Leakage:
Not to be greater than 0.5mR/hr at 5cm outside the external surface

Regulatory Approvals:
Designed to be compliant to EEC EMC Directive and EEC Low Voltage Directive with an external filter.

### AC INPUT POWER TERMINAL BLOCK

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Line</td>
<td>Line</td>
</tr>
<tr>
<td>2</td>
<td>Line</td>
<td>Line</td>
</tr>
<tr>
<td>3</td>
<td>Line</td>
<td>Line</td>
</tr>
<tr>
<td>4</td>
<td>Neutral</td>
<td>Neutral</td>
</tr>
<tr>
<td>5</td>
<td>Neutral</td>
<td>Neutral</td>
</tr>
<tr>
<td>6</td>
<td>Neutral</td>
<td>Neutral</td>
</tr>
</tbody>
</table>

### RS-232 DIGITAL INTERFACE

**JB16 9 PIN FEMALE D CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>2</td>
<td>TX</td>
<td>RS-232 Transmit</td>
</tr>
<tr>
<td>3</td>
<td>RX</td>
<td>RS-232 Receive</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>SGND</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>9</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

### ANALOG MONITORING—
**JB11 10 PIN PHOENIX CONTACT**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X-Ray Enable</td>
<td>+24Vdc = Enable X-Ray, 0Vdc/Open = Disable X-Rays</td>
</tr>
<tr>
<td>2</td>
<td>RTN</td>
<td>Signal Return</td>
</tr>
<tr>
<td>3</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>4</td>
<td>kV Monitor</td>
<td>0 to 10Vdc = 0 to 100kV, Zout = 10kΩ</td>
</tr>
<tr>
<td>5</td>
<td>SGND</td>
<td>Signal Return</td>
</tr>
<tr>
<td>6</td>
<td>mA Monitor</td>
<td>0 to 10Vdc = 0 to 5mA, Zout = 10kΩ</td>
</tr>
<tr>
<td>7</td>
<td>Fault</td>
<td>Open Collector, High (Open) = No Fault, 35Vdc @10mA max</td>
</tr>
<tr>
<td>8</td>
<td>HV On Lamp, Relay N/O</td>
<td>Relay Normally Open, 50Vdc @ 1A maximum</td>
</tr>
<tr>
<td>9</td>
<td>HV On Lamp, Relay Common</td>
<td>Relay Common, 50Vdc @ 1A maximum</td>
</tr>
<tr>
<td>10</td>
<td>HV On Lamp, Relay N/C</td>
<td>Relay Normally Closed, 50Vdc @ 1A maximum</td>
</tr>
</tbody>
</table>
Spellman’s XRB200PN400 Monoblock® X-Ray source is designed for OEM applications powering its internal X-Ray tube up to 200kV at 400W. Features like universal input, small package size, standard analog monitoring and RS-232 digital interface simplify integrating this unit into your X-Ray system. Standard models are available with fan shaped beam geometry. Proprietary emission control circuitry provides excellent regulation of X-Ray tube current, along with outstanding stability performance.

**TYPICAL APPLICATIONS**

X-Ray Scanning: Food Inspection, Fill Level Confirmation, Security Applications

**SPECIFICATIONS**

**X-Ray Characteristics:**
- Tube Type: Glass tube, Tungsten target, Be filter
- Focal Spot: 0.8mm x 0.5mm (IEC336)
- Beam Filter: Glass 1.8mm, Oil 10mm, Al 1mm
- Beam Geometry: Symmetrical fan 85° x 10° ±1°

**Input Voltage:**
100Vac-240Vac ±10%, 50/60Hz, 6A maximum

**X-Ray Tube Voltage:**
Nominal X-Ray tube voltage is adjustable between 100kV to 200kV

**X-Ray Tube Current:**
0.5mA to 2mA over specified tube voltage range

**X-Ray Tube Power:**
400W maximum continuous (350W average without external forced air)

**Voltage Regulation:**
- Line: ±0.1% for a ±10% input line change
- Load: ±0.1% for a 0.5mA to 2mA load change

**Voltage Accuracy:**
Voltage measured across the X-Ray tube is within ±1% of the programmed value

**Voltage Risetime:**
<1 second from 10% to 90% of rated output

**Voltage Overshoot:**
5% in less than 100ms

**Voltage Ripple:**
≤0.2% pp of rated maximum voltage

**Current Regulation:**
- Line: ±0.1% @ 100-200kV, 0.25mA to 2mA
- Load: ±0.5% @ 100-200kV, 0.25mA to 2mA

**Current Accuracy:**
Current measured through the X-Ray tube is within ±1% of the programmed value

**Current Risetime:**
<1 second from 10% to 90% of rated output

**Arc Intervention:**
4 arcs in 10 seconds = shutdown

**Filament Configuration:**
Internal high frequency AC filament drive with closed loop filament emission control

**Digital Interface:**
RS-232 interface.

**Control Software:**
A demo GUI for engineering evaluations will be provided for the RS-232 digital interface upon request.

**Interlock Signals:**
A hardware interlock function is provided

**Operating Temperature:**
0°C to +40°C

**Storage Temperature:**
-40°C to +70°C

**Humidity:**
5% to 95% relative humidity, non-condensing

**Cooling:**
Heat exchanger w/fan and oil pump, powered from 24Vdc, 2A power supply (customer provided). External forced air cooling if needed to keep oil temperature below 55°C
Input Line Connector:  
3 pin Phoenix Contact 1829167

Analog Interface Connector:  
10 pin Phoenix Contact 1755503

Digital Interface Connector:  
9 pin D connector, female

Grounding Point:  
M5 ground stud provided on chassis

Dimensions:  
See drawing

Weight:  
148.0lbs (67.0kg)

Orientation:  
Can be mounted in any orientation.

X-Ray Leakage:  
Not to be greater than 5uSv/hr at 5cm outside the external surface

### AC INPUT POWER  
3 PIN PHOENIX CONTACT

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Line</td>
<td>Line</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>3</td>
<td>Neutral</td>
<td>Neutral</td>
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</table>

### DC POWER FOR HEAT DISSIPATION UNIT  
4 PIN AMP 206061-1 CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24</td>
<td>+24Vdc</td>
</tr>
<tr>
<td>2</td>
<td>RTN</td>
<td>Return</td>
</tr>
<tr>
<td>3</td>
<td>+24</td>
<td>+24Vdc</td>
</tr>
<tr>
<td>4</td>
<td>RTN</td>
<td>Return</td>
</tr>
</tbody>
</table>

### ANALOG INTERFACE—  
10 PIN PHOENIX CONTACT

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X-Ray</td>
<td>+24Vdc = enable X-Ray</td>
</tr>
<tr>
<td>2</td>
<td>X-Ray Return</td>
<td>X-Ray Return</td>
</tr>
<tr>
<td>3</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>4</td>
<td>KV Monitor Output</td>
<td>0 to 9Vdc = 0 to 100% Rated Voltage</td>
</tr>
<tr>
<td>5</td>
<td>SGND</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>mA Monitor Output</td>
<td>0 to 9Vdc = 0 to 100% Rated Current</td>
</tr>
<tr>
<td>7</td>
<td>Fault</td>
<td>Open Collector, Open = No Fault</td>
</tr>
<tr>
<td>8</td>
<td>Relay N/O</td>
<td>HV On, 50V @ 1A maximum</td>
</tr>
<tr>
<td>9</td>
<td>Relay Common</td>
<td>HV On, 50V @ 1A maximum</td>
</tr>
<tr>
<td>10</td>
<td>Relay N/C</td>
<td>HV On, 50V @ 1A maximum</td>
</tr>
</tbody>
</table>

### RS-232 DIGITAL INTERFACE—  
9 PIN FEMALE D CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>2</td>
<td>Transmit Data</td>
<td>Conforms to E/A RS-232-C</td>
</tr>
<tr>
<td>3</td>
<td>Receive Data</td>
<td>Conforms to E/A RS-232-C</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>SGND</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>9</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
</tbody>
</table>
Spellman’s XRB160PN480/1 Monoblock® X-Ray source is designed for OEM applications powering its internal X-Ray tube up to 160kV at 480W. Features like power factor correction, small package size, standard analog monitoring and RS-232 digital interface simplify integrating this Monoblock® into your X-Ray system. Standard models are available with fan shaped beam geometry. Proprietary emission control circuitry provides excellent regulation of X-Ray tube current, along with outstanding stability performance.

TYPICAL APPLICATIONS
X-Ray Scanning: Food Inspection, Fill Level Confirmation and Security Applications

SPECIFICATIONS
X-Ray Characteristics:
- Tube Type: Glass tube, Tungsten target, Be filter
- Focal Spot: 0.8mm x 0.8mm (IEC336)
- Beam Filter: Curved 1mm Al
- Beam Geometry: Asymmetrical fan 80° x 10° ±2°

Input Voltage:
220Vac, ±10%, 50/60Hz, 6.5A max

X-Ray Tube Voltage:
Nominal X-Ray tube voltage is adjustable between 80kV to 160kV

X-Ray Tube Current:
0.25mA to 3mA over specified tube voltage range

X-Ray Tube Power:
480W maximum continuous

Voltage Regulation:
- Line: ±0.1% for a ±10% input line change of nominal input line voltage
- Load: ±0.1% for a 0.25mA to 3mA load change

Voltage Accuracy:
Voltage measured across the X-Ray tube is within ±2% plus 1.785kV of the programmed value

Voltage Risetime:
Ramp time shall be ≤2 seconds from 10% to 90% of rated output

Voltage Overshoot:
±1% switching between 90kV to 160kV @ 0.25mA

Voltage Ripple:
≤0.1% of rated voltage from 10Hz to 1kHz

Current Regulation:
- Line: ±0.5% @ 80-160kV, 0.25mA to 3mA
- Load: ±0.5%, 0.25mA to 3mA

Current Accuracy:
Current measured through the X-Ray tube is within 2% of the programmed value

Current Risetime:
≤2 seconds from 10% to 90% of rated output

Arc Intervention:
4 arcs in 10 seconds = shutdown

Filament Configuration:
Internal high frequency AC filament drive with closed loop filament emission control

Analog Interface:
0 to 10Vdc ground referenced signals

Digital Interface:
RS-232 interface

Control Software:
A demo GUI for engineering evaluations will be provided for the RS-232 digital interface upon request.

Interlock Signals:
A hardware interlock function is provided

Operating Temperature:
0°C to +40°C

Storage Temperature:
-20°C to +70°C

Humidity:
5% to 95% relative humidity, non-condensing
Cooling:
Heat exchanger w/fan and oil pump, powered from AC

Input Line Connector:
6 position terminal block

Analog Interface Connector:
7 pin Molex 26-60-5070

Digital Interface Connector:
9 pin D connector, female

Grounding Point:
8-32 ground stud provided on chassis

Dimensions:
20" x 22.5" x 10.75" (508mm x 572mm x 273mm)

Weight:
125lbs (56.7kg)

Orientation:
Can be mounted in any orientation.

X-Ray Leakage:
Not to be greater than 0.5mR/hr at 5cm outside the external surface

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Line</td>
<td>Line</td>
</tr>
<tr>
<td>2</td>
<td>Removed</td>
<td>N/C</td>
</tr>
<tr>
<td>3</td>
<td>Neutral</td>
<td>Neutral</td>
</tr>
<tr>
<td>4</td>
<td>Removed</td>
<td>N/C</td>
</tr>
<tr>
<td>5</td>
<td>Spare</td>
<td>N/C</td>
</tr>
<tr>
<td>6</td>
<td>Spare</td>
<td>N/C</td>
</tr>
</tbody>
</table>

AC INPUT POWER
J1 6 POSITION TERMINAL BLOCK

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X-Ray</td>
<td>+12Vdc @16mA = enable X-Ray</td>
</tr>
<tr>
<td>2</td>
<td>X-Ray Return</td>
<td>X-Ray Return</td>
</tr>
<tr>
<td>3</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>4</td>
<td>KV Monitor Output</td>
<td>0 to 1.6Vdc = 0 to 160kV</td>
</tr>
<tr>
<td>5</td>
<td>SGND</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>mA Monitor Output</td>
<td>0 to 3Vdc = 0 to 3mA</td>
</tr>
<tr>
<td>7</td>
<td>Fault</td>
<td>Open Collector, Open = No Fault</td>
</tr>
</tbody>
</table>

ANALOG INTERFACE CONNECTOR—7 PIN MOLEX, 0.156 CENTER

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>2</td>
<td>TX</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>3</td>
<td>RX</td>
<td>Receive Data</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>SGND</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>X-Ray Enable</td>
<td>+12Vdc @16mA = Enable</td>
</tr>
<tr>
<td>9</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
</tbody>
</table>
Spellman’s XRB160PN480/2 Monoblock® X-Ray source is designed for OEM applications powering its internal X-Ray tube up to 160kV at 480W. Features like universal input, small package size and a standard analog and RS-232 digital interface simplify integrating this Monoblock® into your X-Ray system. Standard models are available with fan shaped beam geometry. Proprietary emission control circuitry provides excellent regulation of X-Ray tube current, along with outstanding stability performance.

TYPICAL APPLICATIONS
X-Ray Scanning: Food Inspection, Fill Level Confirmation and Security Applications

SPECIFICATIONS
X-Ray Characteristics:
  Tube Type: Glass tube, Tungsten target, Be filter
  Focal Spot: 0.8mm x 0.8mm (IEC336)
  Beam Filter: 1mm curved window
  Beam Geometry: Asymmetrical fan 80° x 10° ±2°

Input Voltage:
  100-240Vac ±10%, 50/60Hz, 6.5A max; 12Vdc @ 5A

X-Ray Tube Voltage:
  Nominal X-Ray tube voltage is adjustable between 80kV to 160kV

X-Ray Tube Current:
  0.25mA to 3mA over specified tube voltage range

X-Ray Tube Power:
  480W maximum

Voltage Regulation:
  Line: ±0.1% for a ±10% input line change of nominal input line voltage
  Load: ±0.1% for a 0.3mA to 3mA load change

Voltage Accuracy:
  Voltage measured across the X-Ray tube is within ±1% of the programmed value

Voltage Risetime:
  Ramp time shall be <1 second from 10% to 90% of rated output

Voltage Overshoot:
  Within 5% of rated voltage in <10ms

Voltage Ripple:
  0.1% pp of rated voltage @ ≤1kHz

Current Regulation:
  Line: ±0.1% for a ±10% input line change of nominal input line voltage
  Load: ±0.5% @ 80-160kV, 0.3mA to 3mA

Current Accuracy:
  Current measured through the X-Ray tube is within ±1% of the programmed value

Current Risetime:
  <1 second from 10% to 90% of rated output

Arc Intervention:
  4 arcs in 10 seconds with a 200ms quench = Shutdown

Filament Configuration:
  Internal high frequency AC filament drive with closed loop filament emission control

Analog Interface:
  0 to 10Vdc ground referenced signals

Digital Interface:
  RS-232 interface.

Control Software:
  A demo GUI for engineering evaluations will be provided for the RS-232 digital interface upon request.

Interlock Signals:
  A hardware interlock functions in both analog and digital programming modes.

Operating Temperature:
  0°C to +40°C

Storage Temperature:
  -40°C to +70°C

Humidity:
  95% relative humidity, non-condensing

Cooling:
  Heat exchanger w/fan and oil pump, powered from DC input
Input Line Connector:
3 pin, Phoenix Contact 1829167

Analog Interface Connector:
10 pin, Phoenix Contact 1755503

Digital Interface Connector:
9 pin D connector, female

Heat Exchanger Power Connector:
4 pin AMP part no. 206061-1

Grounding Point:
8-32 ground stud provided on chassis

Dimensions:
See outline drawing

Weight:
125lbs (56.7kg)

Orientation:
Can be mounted in any orientation.

X-Ray Leakage:
Not to be greater than 0.5mR/hr at 5cm outside the external surface

### AC INPUT POWER
#### 3 PIN PHOENIX CONTACT

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Line</td>
<td>Line</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>3</td>
<td>Neutral</td>
<td>Neutral</td>
</tr>
</tbody>
</table>

### DC POWER FOR HEAT DISSIPATION UNIT
#### 4 PIN AMP 206061-1 CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+12</td>
<td>+12Vdc</td>
</tr>
<tr>
<td>2</td>
<td>RTN</td>
<td>Return</td>
</tr>
<tr>
<td>3</td>
<td>+12</td>
<td>+12Vdc</td>
</tr>
<tr>
<td>4</td>
<td>RTN</td>
<td>Return</td>
</tr>
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</table>

### ANALOG INTERFACE—JB15 10 PIN PHOENIX CONTACT

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X-Ray Signal</td>
<td>+24Vdc = Enable X-Ray, 0Vdc/open = Disable X-Ray, Zin=2.2kΩ</td>
</tr>
<tr>
<td>2</td>
<td>X-Ray Signal Return</td>
<td>Signal Return</td>
</tr>
<tr>
<td>3</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>4</td>
<td>kV Monitor</td>
<td>0-10Vdc = 0 to 178kV, Zout = 10kΩ</td>
</tr>
<tr>
<td>5</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>mA Monitor</td>
<td>0-10Vdc = 0 to 3.4mA, Zout = 10kΩ</td>
</tr>
<tr>
<td>7</td>
<td>Fault Signal</td>
<td>Open collector, High (Open) = No Fault, 35Vdc @10mA maximum</td>
</tr>
<tr>
<td>8</td>
<td>HV ON Lamp Relay n/o</td>
<td>Relay Normally Open, 50Vdc @ 1A maximum</td>
</tr>
<tr>
<td>9</td>
<td>HV ON Lamp Relay common</td>
<td>Relay Common, 50Vdc @ 1A maximum</td>
</tr>
<tr>
<td>10</td>
<td>HV ON Lamp Relay n/c</td>
<td>Relay Normally Closed, 50Vdc @ 1A maximum</td>
</tr>
</tbody>
</table>

### LED INDICATORS

| INDICATOR | SIGNAL NAME | CONDITION | Illuminated When...
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LED 1</td>
<td>OT</td>
<td>Over temperature occurs</td>
<td></td>
</tr>
<tr>
<td>LED 2</td>
<td>ARC FLT</td>
<td>Arc fault occurs</td>
<td></td>
</tr>
<tr>
<td>LED 3</td>
<td>UV</td>
<td>Low kV occurs</td>
<td></td>
</tr>
<tr>
<td>LED 4</td>
<td>OV</td>
<td>High kV occurs</td>
<td></td>
</tr>
<tr>
<td>LED 5</td>
<td>UC</td>
<td>Low mA occurs</td>
<td></td>
</tr>
<tr>
<td>LED 6</td>
<td>OC</td>
<td>High mA occurs</td>
<td></td>
</tr>
<tr>
<td>LED 7</td>
<td>X-RAY ON</td>
<td>X-Rays are enabled</td>
<td></td>
</tr>
<tr>
<td>LED 8</td>
<td>PWR</td>
<td>Power is ON</td>
<td></td>
</tr>
</tbody>
</table>

### RS-232 DIGITAL INTERFACE—9 PIN FEMALE D CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
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<tbody>
<tr>
<td>1</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>2</td>
<td>Transmit Data</td>
<td>Conforms to EIA RS-232-C</td>
</tr>
<tr>
<td>3</td>
<td>Receive Data</td>
<td>Conforms to EIA RS-232-C</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>SGND</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>9</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
</tbody>
</table>
Spellman’s XRB160PN480/CT Monoblock® X-Ray source is designed for OEM applications powering its internal X-Ray tube up to 160kV at 480W. Features like small package size and RS-232 digital interface simplify integrating this Monoblock® into your X-Ray system. Standard models are available with fan shaped beam geometry. Proprietary emission control circuitry provides excellent regulation of X-Ray tube current, along with outstanding stability performance.

**TYPICAL APPLICATIONS**
X-Ray Scanning: Food Inspection, Fill Level Confirmation and Security Applications

**SPECIFICATIONS**

**X-Ray Characteristics:**
- Tube Type: Glass tube, Tungsten target, Be filter
- Focal Spot: 0.8mm x 0.8mm (IEC336)
- Beam Filter: 1.7mm of glass, 1mm of Al, and 10mm of oil
- Beam Geometry: Symmetrical fan 105° ±3° x 4° ±1°

**Input Voltage:**
- Monoblock®: 100-240Vac ±10%, 50/60Hz, 6.5A max
- Heat Dissipation Unit: 24Vdc, 3A

**X-Ray Tube Voltage:**
- Nominal X-Ray tube voltage is adjustable between 20kV to 160kV

**X-Ray Tube Current:**
- 0.3mA to 6mA over specified tube voltage range

**X-Ray Tube Power:**
- 320W continuous, 480W peak

**Voltage Regulation:**
- Line: ±0.1% for a ±10% input line change of nominal input line voltage
- Load: ±0.1% for a 0.3mA to 6mA load change

**Voltage Accuracy:**
- Voltage measured across the X-Ray tube is within ±1% of the programmed value

**Voltage Risetime:**
- Ramp time shall be <1 second from 1% to 90% of rated output

**Voltage Overshoot:**
- Within 5% of rated voltage

**Voltage Ripple:**
- 0.1% pp of rated voltage @ ≤1kHz

**Current Regulation:**
- Line: ±0.5%
- Load: ±0.5%

**Current Accuracy:**
- Current measured through the X-Ray tube is within ±1% of the programmed value

**Current Risetime:**
- <1 second from 1% to 90% of rated output

**Arc Intervention:**
- 4 arcs in 10 seconds = Shutdown

**Filament Configuration:**
- Internal high frequency AC filament drive with closed loop filament emission control

**Digital Interface:**
- RS-232

**Control Software:**
- A demo GUI for engineering evaluations will be provided for the RS-232 digital interface upon request.

**Interlock Signals:**
- A hardware interlock functions in digital programming modes.

**Operating Temperature:**
- 0°C to +40°C

**Storage Temperature:**
- -40°C to +70°C

**Humidity:**
- 5% to 90% relative humidity, non-condensing

**Cooling:**
- Heat exchanger w/fan and oil pump, powered from customer provided 24Vdc @ 3A
Input Line Connector:  
3 pin Phoenix Contact part no. 1829167

Digital Interface Connector:  
9 pin D, female

Analog Signal Connector:  
10 pin Phoenix Contact part no. 1755503

Cooler Power Connector:  
4 pin AMP part no. 206061-1

Grounding Point:  
8-32 ground stud provided on chassis

Dimensions:  
24.00” x 16.00” x 6.50”  
(609.60mm x 406.40mm x 165.10mm)

Weight:  
125lbs (49.5kg) ±10lbs (±4.5kg)

Orientation:  
Can be mounted in any orientation.

X-Ray Leakage:  
Not to be greater than 0.5mR/hr at 5cm  
outside the external surface

Special Features:  
Stationary or rotating CT application up to 90rpm  
at a max. radius of 24.75” (629mm)

---

**AC INPUT POWER**  
3 PIN PHOENIX CONTACT

<table>
<thead>
<tr>
<th>PIN</th>
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<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Line</td>
<td>Line</td>
</tr>
<tr>
<td>2</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Neutral</td>
<td></td>
</tr>
</tbody>
</table>

**ANALOG INTERFACE—**  
10 PIN PHOENIX CONTACT

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X-Ray Return</td>
<td>+24Vdc = enable X-Ray</td>
</tr>
<tr>
<td>2</td>
<td>X-Ray Return</td>
<td>X-Ray Return</td>
</tr>
<tr>
<td>3</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>4</td>
<td>kV Monitor Output</td>
<td>0 to 9Vdc = 0 to 100% Rated Voltage</td>
</tr>
<tr>
<td>5</td>
<td>SGND</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>mA Monitor Output</td>
<td>0 to 9Vdc = 0 to 100% Rated Current</td>
</tr>
<tr>
<td>7</td>
<td>Fault</td>
<td>Open Collector, Open = No Fault</td>
</tr>
<tr>
<td>8</td>
<td>Relay N/C</td>
<td>HV On, 50V @ 1A maximum</td>
</tr>
<tr>
<td>9</td>
<td>Relay Common</td>
<td>HV On, 50V @ 1A maximum</td>
</tr>
<tr>
<td>10</td>
<td>Relay N/O</td>
<td>HV On, 50V @ 1A maximum</td>
</tr>
</tbody>
</table>

**RS-232 DIGITAL INTERFACE—**  
9 PIN FEMALE D CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>2</td>
<td>Transmit Data</td>
<td>Conforms to E/A RS-232-C</td>
</tr>
<tr>
<td>3</td>
<td>Receive Data</td>
<td>Conforms to E/A RS-232-C</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>SGND</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>9</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
</tbody>
</table>
Spellman’s XRB150PN600 Monoblock® X-Ray source is designed for OEM applications powering its internal X-Ray tube up to 150kV at 600W. Features like power factor correction, small package size and a standard analog and RS-232 digital interface simplify integrating this unit into your X-Ray system. Standard models are available with cone shaped beam geometry. Proprietary emission control circuitry provides excellent regulation of X-Ray tube current, along with outstanding stability performance.

**TYPICAL APPLICATIONS**

X-Ray Scanning: Bone Densitometry, Food Inspection, Security

**SPECIFICATIONS**

**X-Ray Characteristics:**
- Tube Type: Glass tube, Tungsten target, Be filter
- Focal Spot: 0.5mm x 0.5mm (IEC 336)
- Beam Filter: 0.06” Ultem
- Beam Geometry: Cone, 18° ± 1°

**Input Voltage:**
200-240Vac ±10%, 50/60Hz, 6.5A maximum

**X-Ray Tube Voltage:**
Nominal X-Ray tube voltage is adjustable between 70kV to 150kV

**X-Ray Tube Current:**
1.0mA to 4.0mA over specified tube voltage range

**X-Ray Tube Power:**
- 160W continuous, 600W peak
- Duty Cycle: 30 seconds on, 300 seconds off @ 600W peak

**Voltage Regulation:**
- Line: ±0.1% for a ±10% input line change of 180 to 264Vac
- Load: ±0.1% for a 1.0mA to 4.0mA load change. 600W maximum

**Voltage Accuracy:**
Voltage measured across the X-Ray tube is within ±2% of the programmed value

**Voltage Risetime:**
±1% in less than 300ms

**Voltage Overshoot:**
±10% during 300ms risetime

**Voltage Ripple:**
1% rms of rated voltage @ 10Hz to 1MHz

**Current Regulation:**
- Line: ±0.1% from 180-264Vac
- Load: ±0.5% @ 70kV-150kV, 1.0mA to 4.0mA

**Current Accuracy:**
Current measured through the X-Ray tube is within ±2% of the programmed value

**Current Risetime:**
±1% in less than 300ms

**Arc Intervention:**
4 arcs in 10 seconds with a 200ms quench = Shutdown

**Filament Configuration:**
Internal high frequency AC filament drive with closed loop filament emission control

**Analog Interface:**
0 to 5Vdc ground referenced signals

**Digital Interface:**
RS-232 interface.

**Control Software:**
A demo GUI for engineering evaluations will be provided for the RS-232 digital interface upon request.

**Interlock/Signals:**
A hardware interlock function is provided

**Operating Temperature:**
0°C to +40°C

**Storage Temperature:**
-40°C to +70°C

**Humidity:**
10% to 95% relative humidity, non-condensing

**Cooling:**
External fan required. 250cfm minimum to maintain an oil temperature of 55°C
Input Line Connector:
3 pin Phoenix Contact P/N 1829167

Analog Interface Connector:
10 pin Phoenix Contact P/N 1755503

Digital Interface Connector:
9 pin D connector, female

Grounding Point:
8-32 ground stud provided on chassis

Dimensions:
13.46” x 13.38” x 6.24”
(341.89mm x 339.85mm x 158.50mm)

Weight:
66lbs (30kg)

Orientation:
Can be mounted in any orientation.

X-Ray Leakage:
Less than 100mR/hr at 1m distance, measured at 140kV, 3mA

### AC INPUT POWER
**JB1 3 PIN PHOENIX CONTACT**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Line</td>
<td>Line</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>Chassis Ground</td>
</tr>
<tr>
<td>3</td>
<td>Neutral</td>
<td>Neutral</td>
</tr>
</tbody>
</table>

### RS-232 DIGITAL INTERFACE—**JB16 9 PIN FEMALE D CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Spare</td>
<td>N/C</td>
</tr>
<tr>
<td>2</td>
<td>Transmit</td>
<td>RS-232</td>
</tr>
<tr>
<td>3</td>
<td>Receive</td>
<td>RS-232</td>
</tr>
<tr>
<td>4</td>
<td>Spare</td>
<td>N/C</td>
</tr>
<tr>
<td>5</td>
<td>Signal Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>6</td>
<td>Spare</td>
<td>N/C</td>
</tr>
<tr>
<td>7</td>
<td>Spare</td>
<td>N/C</td>
</tr>
<tr>
<td>8</td>
<td>Spare</td>
<td>N/C</td>
</tr>
<tr>
<td>9</td>
<td>Spare</td>
<td>N/C</td>
</tr>
</tbody>
</table>

### ANALOG INTERFACE—**JB15 10 PIN PHOENIX CONTACT**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X-Ray Signal</td>
<td>+12Vdc =Enable X-Ray, 0Vdc/open = Disable X-Ray, Zin=1kΩ</td>
</tr>
<tr>
<td>2</td>
<td>X-Ray Signal Return</td>
<td>Signal Return</td>
</tr>
<tr>
<td>3</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>4</td>
<td>kV Monitor</td>
<td>0 to 5Vdc = 0 to 175kV, Zout= 10kΩ</td>
</tr>
<tr>
<td>5</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>mA Monitor</td>
<td>0 to 5Vdc = 0 to 4.5mA, Zout= 10kΩ</td>
</tr>
<tr>
<td>7</td>
<td>Fault Signal</td>
<td>Open collector, High (Open) = No Fault, 35Vdc @10mA maximum</td>
</tr>
<tr>
<td>8</td>
<td>HV ON Lamp Relay n/o</td>
<td>Relay Normally Open, 50Vdc @ 1A maximum</td>
</tr>
<tr>
<td>9</td>
<td>HV ON Lamp Relay common</td>
<td>Relay Common, 50Vdc @ 1A maximum</td>
</tr>
<tr>
<td>10</td>
<td>HV ON Lamp Relay n/c</td>
<td>Relay Normally Closed, 50Vdc @ 1A maximum</td>
</tr>
</tbody>
</table>

### LED INDICATORS

<table>
<thead>
<tr>
<th>INDICATOR</th>
<th>SIGNAL NAME</th>
<th>CONDITION</th>
<th>Illuminated When...</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED 1</td>
<td>OT</td>
<td>Over temperature occurs</td>
<td></td>
</tr>
<tr>
<td>LED 2</td>
<td>ARC FLT</td>
<td>Arc fault occurs</td>
<td></td>
</tr>
<tr>
<td>LED 3</td>
<td>UV</td>
<td>Low kV occurs</td>
<td></td>
</tr>
<tr>
<td>LED 4</td>
<td>OV</td>
<td>High kV occurs</td>
<td></td>
</tr>
<tr>
<td>LED 5</td>
<td>UC</td>
<td>Low mA occurs</td>
<td></td>
</tr>
<tr>
<td>LED 6</td>
<td>OC</td>
<td>High mA occurs</td>
<td></td>
</tr>
<tr>
<td>LED 7</td>
<td>X-RAY ON</td>
<td>X-Rays are enabled</td>
<td></td>
</tr>
<tr>
<td>LED 8</td>
<td>PWR</td>
<td>Power is ON</td>
<td></td>
</tr>
</tbody>
</table>
Spellman's XRB160PN688/CT Monoblock® X-Ray source is designed for OEM applications powering its internal X-Ray tube up to 160kV at 688W. Features like small package size and RS-232 digital interface simplify integrating this unit into your X-Ray system. Proprietary emission control circuitry provides excellent regulation of X-Ray tube current, along with outstanding stability performance.

**TYPICAL APPLICATIONS**
X-Ray Scanning: Food Inspection, Fill Level Confirmation and Security Applications

**SPECIFICATIONS**

**X-Ray Characteristics:**
- **Tube Type:** Glass tube, Tungsten target, Be filter
- **Focal Spot:** 2.5mm x 2.5mm (IEC 60336)
- **Beam Filter:** 1.5mm glass, 9-26mm oil, 0.4mm Al
- **Beam Geometry:** Asymmetrical fan 93° x 15° ±2°

**Input Voltage:**
230Vac, ±15%, 50/60Hz, 5A max

**X-Ray Tube Voltage:**
Nominal X-Ray tube voltage is adjustable between 50kV to 160kV

**X-Ray Tube Current:**
0.25mA to 4.3mA over specified tube voltage range

**X-Ray Tube Power:**
688W maximum continuous

**Voltage Regulation:**
- **Line:** ±0.1% ±10%
- **Load:** ±0.1% 0.25 to 4.3mA

**Voltage Accuracy:**
Voltage measured across the X-Ray tube is within 1% of the programmed value

**Voltage Risetime:**
Ramp time shall be 500ms nominal, 1 second maximum from 10% to 90% of rated output

**Voltage Overshoot:**
Within 5% of rated voltage

**Voltage Ripple:**
1% p-p of rated voltage

**Current Regulation:**
- **Line:** ±0.5% ±10%
- **Load:** ±0.5% 0.25 to 4.3mA

**Current Accuracy:**
Current measured through the X-Ray tube is within 5% of the programmed value

**Current Risetime:**
500ms nominal, 1 second maximum

**Arc Intervention:**
4 arcs in 10 seconds = shutdown

**Filament Configuration:**
Internal high frequency AC filament drive with closed loop filament emission control

**Digital Interface:**
RS-232 interface.

**Control Software:**
A demo GUI for engineering evaluations will be provided for the RS-232 digital interface upon request.

**Interlock Signals:**
A hardware interlock function is provided

**Operating Temperature:**
5°C to +40°C

**Storage Temperature:**
-25°C to +65°C

**Humidity:**
10% to 90% relative humidity, non-condensing

**Cooling:**
Heat exchanger w/fan and oil pump, powered from AC
Input Line Connector:
5 pin Molex 26-60-4050

Heat Exchanger Power Connector:
4 pin AMP part no. 206061-1

Digital Interface Connector:
9 pin D connector, female

Grounding Point:
M5 ground stud provided on chassis

Dimensions:
See drawing

Weight:
140lbs ±10lbs (64kg ±4.5kg)

Orientation:
Can be mounted in any orientation.

X-Ray Leakage:
Less than 300uR/hr at a distance of 10cm from all surfaces

Special Features:
Stationary or rotating CT application up to 100rpm at a maximum radius 20.25˝ (514mm)

AC INPUT POWER
J1 5 PIN MOLEX 26-60-4050 CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Line</td>
<td>230Vac Input</td>
</tr>
<tr>
<td>2</td>
<td>Line</td>
<td>230Vac Input</td>
</tr>
<tr>
<td>3</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>4</td>
<td>Neutral</td>
<td>230Vac Neutral</td>
</tr>
<tr>
<td>5</td>
<td>Neutral</td>
<td>230Vac Neutral</td>
</tr>
</tbody>
</table>

AC POWER FOR HEAT DISSIPATION UNIT
4 PIN AMP 206061-1 CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Line</td>
<td>230Vac Input</td>
</tr>
<tr>
<td>2</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>3</td>
<td>Neutral</td>
<td>230Vac Neutral</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td>Chassis Ground</td>
</tr>
</tbody>
</table>

RS-232 DIGITAL INTERFACE—
J5 9 PIN FEMALE D CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>2</td>
<td>TX</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>3</td>
<td>RX</td>
<td>Receive Data</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>SGND</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>9</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
</tbody>
</table>
Spellman’s new Panoramic Dental Monoblock® consists of an integrated X-Ray tube, dual-output high voltage power supply, and filament supply with control circuitry. The PDM90PN900 is designed for extra oral dental X-Ray applications including CT and Panoramic X-Ray. Features like small package size, standard analog and RS-232 digital interface simplify integrating this Monoblock® into your X-Ray system. Proprietary emission control circuitry provides excellent regulation of X-Ray tube current, along with outstanding stability and performance.

**TYPICAL APPLICATIONS**
Dental X-Ray: Panoramic and CT Imaging

**SPECIFICATIONS**

- **X-Ray Tube Characteristics:**
  - Target Angle: 5 degrees
  - Focal Spot: 0.5mm nominal
  - Beam Filtration: 3mm of Al equivalent
  - Beam Geometry: see page 3

- **X-Ray Tube Voltage:**
  Nominal X-Ray tube voltage is adjustable between 50kV to 90kV

- **Voltage Regulation:**
  - Line: ±0.5% for a ±1V change of nominal input line voltage
  - Load: ±0.1% for a load change of 25μA to maximum rated current

- **X-Ray Tube Current:**
  1mA to 10mA over specified tube voltage range

- **Current Regulation:**
  - Line: ±0.5% for a ±1V change of nominal input line voltage
  - Load: ±0.5% for a voltage change of 35kV to 80kV

- **X-Ray Tube Power:**
  900W peak power

- **Duty Cycle:**
  - CT (Pulsed): ≤45 seconds scan time cycle at up to 40 pulses per second available
  - Panoramic (Continuous): Maximum scan time = 30s, with 60s off-time. Five consecutive scans

- **Input Voltage:**
  100-240Vac ±10% 50/60 Hz, 10 amps RMS maximum

- **Interface:**
  - The RS-232 serial communications interface will be used to program and monitor output voltage and current, control various functions and report status and faults.

- **Digital Interface Connector:**
  - RS-232: 9 pin D connector, male

- **Operating Temperature:**
  0°C to +40°C

- **Storage Temperature:**
  -20°C to +70°C

- **Humidity:**
  5% to 95% relative humidity, non-condensing

- **Cooling:**
  - Tank: Convection
  - Controller: Forced air via provided fan

- **Dimensions:**
  - X-Ray Tank: 9.7"W x 7.7"H x 4.7"D (247mm x 195mm x 119mm)
  - Inverter/Controller: 7.10"W x 9.80"H x 3.60"D (180mm x 250mm x 92mm)

- **Weight:**
  - X-Ray Tank: 17lbs (7.7kg)
  - Inverter/Controller: 6.5lbs (3kg)

- **X-Ray Leakage:**
  Less than 100mR/hour (or <1mGy/hr) @ 1 meter from the Monoblock® surface.

- **Regulatory Approvals:**
  - Compliant to EMC 60601-1-2 (external EMC filter and shielding required). UL/CUL recognized file E242584.

---

**TYPICAL APPLICATIONS**
Dental X-Ray: Panoramic and CT Imaging

**SPECIFICATIONS**

- **X-Ray Tube Characteristics:**
  - Target Angle: 5 degrees
  - Focal Spot: 0.5mm nominal
  - Beam Filtration: 3.0mm of Al equivalent
  - Beam Geometry: see page 3

- **X-Ray Tube Voltage:**
  Nominal X-Ray tube voltage is adjustable between 50kV to 90kV

- **Voltage Regulation:**
  - Line: ±0.5% for a ±1V change of nominal input line voltage
  - Load: ±0.1% for a load change of 25μA to maximum rated current

- **X-Ray Tube Current:**
  1mA to 10mA over specified tube voltage range

- **Current Regulation:**
  - Line: ±0.5% for a ±1V change of nominal input line voltage
  - Load: ±0.5% for a voltage change of 35kV to 80kV

- **X-Ray Tube Power:**
  900W peak power

- **Duty Cycle:**
  - CT (Pulsed): ≤45 seconds scan time cycle at up to 40 pulses per second available
  - Panoramic (Continuous): Maximum scan time = 30s, with 60s off-time. Five consecutive scans

- **Input Voltage:**
  100-240Vac ±10% 50/60 Hz, 10 amps RMS maximum

- **Interface:**
  - The RS-232 serial communications interface will be used to program and monitor output voltage and current, control various functions and report status and faults.

- **Digital Interface Connector:**
  - RS-232: 9 pin D connector, male

- **Operating Temperature:**
  0°C to +40°C

- **Storage Temperature:**
  -20°C to +70°C

- **Humidity:**
  5% to 95% relative humidity, non-condensing

- **Cooling:**
  - Tank: Convection
  - Controller: Forced air via provided fan

- **Dimensions:**
  - X-Ray Tank: 9.7"W x 7.7"H x 4.7"D (247mm x 195mm x 119mm)
  - Inverter/Controller: 7.10"W x 9.80"H x 3.60"D (180mm x 250mm x 92mm)

- **Weight:**
  - X-Ray Tank: 17lbs (7.7kg)
  - Inverter/Controller: 6.5lbs (3kg)

- **X-Ray Leakage:**
  Less than 100mR/hour (or <1mGy/hr) @ 1 meter from the Monoblock® surface.

- **Regulatory Approvals:**
  - Compliant to EMC 60601-1-2 (external EMC filter and shielding required). UL/CUL recognized file E242584.
### Analog Interface—J2 10 Pin Phoenix Contact

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X-Ray Ready/Sync</td>
<td>+5 V Logic</td>
</tr>
<tr>
<td>2</td>
<td>X-Ray Enable</td>
<td>+5 V Logic</td>
</tr>
<tr>
<td>3</td>
<td>X-ray Signal (Exgate)</td>
<td>+5VDC = Enable X-Ray, Low (or Open) = Disable X-Ray</td>
</tr>
<tr>
<td>4</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>5</td>
<td>VMTR Signal (KV monitor)</td>
<td>Voltage: 0 to +5.00 V max, Scale Factor: 0 – 5.00 Vdc = 0 to 100 kV</td>
</tr>
<tr>
<td>6</td>
<td>IMTR Signal (mA monitor)</td>
<td>Voltage: 0 to +5.00 V max, Scale Factor: 0 – 5.00 Vdc = 0 – 12.1mA</td>
</tr>
<tr>
<td>7</td>
<td>Fault Signal</td>
<td>Output Signal: Open Collector, High (Open) = No Fault</td>
</tr>
<tr>
<td>8</td>
<td>HV ON Lamp, Relay N/O</td>
<td>Relay Normally Open, Dry contacts rated 1A or less will handle a nominal 50mA DC load.</td>
</tr>
</tbody>
</table>

### RS-232 Digital Interface—J5 9 Pin Male D Connector

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>2</td>
<td>TX</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>3</td>
<td>RX In</td>
<td>Receive Data</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>SGND</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>9</td>
<td>NC</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

### LED Indicators

<table>
<thead>
<tr>
<th>INDICATOR</th>
<th>SIGNAL NAME</th>
<th>CONDITION</th>
<th>ILLUMINATED WHEN...</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED 1</td>
<td>OV</td>
<td>High kV occurs</td>
<td></td>
</tr>
<tr>
<td>LED 2</td>
<td>UV</td>
<td>Low kV occurs</td>
<td></td>
</tr>
<tr>
<td>LED 3</td>
<td>UC</td>
<td>Low mA occurs</td>
<td></td>
</tr>
<tr>
<td>LED 4</td>
<td>OC</td>
<td>High mA occurs</td>
<td></td>
</tr>
<tr>
<td>LED 5</td>
<td>ARC FLT</td>
<td>Arc fault occurs</td>
<td></td>
</tr>
<tr>
<td>LED 6</td>
<td>OT</td>
<td>Over temperature occurs</td>
<td></td>
</tr>
<tr>
<td>LED 7</td>
<td>PW (Pulse mode)</td>
<td>Pulse mode selected</td>
<td></td>
</tr>
<tr>
<td>LED 8</td>
<td>CW (CW mode)</td>
<td>CW mode selected</td>
<td></td>
</tr>
<tr>
<td>LED 9</td>
<td>CW (CW mode)</td>
<td>X-Ray is ON</td>
<td></td>
</tr>
</tbody>
</table>
Spellman’s MMB125PN3.5 Medical Monoblock® with <1ms rise time is ideal for extremeties, specialized applications and vascular imaging. Benefit from Spellman’s 70 plus years of high voltage innovation with this MMB125PN3.5 Monoblock® X-Ray source specifically designed for the C-Arm OEM. Our advanced technology and design expertise in conjunction with our depth of manufacturing capabilities position Spellman as the wise choice for your Monoblock® requirements.

Spellman’s Ultra-Fast MMB Series utilizes our unique technologies that increases the quality of the X-Ray beam and significantly reduces patient dose. Pulsed Fluoroscopy enhances imaging of dense and complex anatomy to further support dose management. With a rise time of <1ms, Spellman’s MMB Series is among the fastest in the industry.

**Typical Applications**
C-Arm OEM

**Specifications**

**X-Ray Characteristics:**
- Focal Spot: 0.5mm for small focus, 1.6mm for large focus
- Target Angle: 16°
- Target Material: Tungsten
- Beam Filter: 0.8mm Al
- Beam Geometry: Refer to line drawing
- X-Ray Leakage: Less than <1mGy/hour @ 1meter from tank surface.

**Maximum Filament Current:** 4.3A
- Filament Inverter Switching Frequency: 20kHz
- Anode Heat Content: 35.5kJ
- Maximum Anode Heat Dissipation: 600W
- Distance Between Focal Spot to X-Ray Output Window: 45mm
- Focal Spot Position: Refer to outline drawing, additionally it is marked on tank cover.

**X-Ray Tube Voltage:**
- Operational Range: 40 to 125kV
- kV Rise Time: <1ms (from 10% to 90%)
- Reproducibility: ≤0.05 per IEC60601-2-54
- kV Ripple: ≤1%
- kV Accuracy:
  - Fluoroscopy: ±5%
  - kV Overshoot: ±5%

**X-Ray Tube Current:**
- Fluoro: 0.2mA to 6 mA (small focal spot)
- Pulsed Fluoro: 0.5mA to 10 mA (small focal spot)
- Radiography: 10mA to 40mA (large focal spot)
- mA Accuracy: ±10%

**Maximum Operating Conditions:**
- Continuous Low Level Fluoro: 6 mA for 5 minutes
- Continuous High Level Fluoro: 10 mA for 2 minutes
- Pulsed Fluoro: 0.5fps, 1fps, 2fps, 4fps, 8fps, 15fps, 25fps, 30fps for 2 minutes
- Pulse on time: the lower value of 40ms or 50% duty cycle
- Radiographic: Single shot large focal spot, 0.1 seconds @ 3500 watts
- Maximum Anode Heat Dissipation: 600W
- Average Power: 600W for 5 minutes
- Tank Heat Content: No less than 675kHU
- Max. Cooling Rate: 150W

**X-Ray Tube Current Protection:**
- Over Current (High mA): Trip point is set at 15% over maximum rated current, or at 15% over programmed output current value for longer than 50ms.
- Under Current (High mA): Trip point is set at 15% under programmed output current value for longer than 50ms.
- Over Current (Low mA): Trip point is set at 20% over maximum rated current, or at 20% over programmed output current value for longer than 50ms.
- Under Current (Low mA): Trip point is set at 20% under programmed output current value for longer than 50ms.
X-Ray Tube Voltage Protection:
Over Voltage (High kV): Trip point is when the kV output exceeds 137.5kV for more than 10ms or it is set at 10% over programmed output voltage value for longer than 30ms.
Under Voltage (Low kV): Trip point is set at 10% under the programmed output voltage value for longer than 30ms.

X-Ray Tube Arc Protection:
Arc Intervention: Unit will detect an Arc but HV will not be shut down, but if multiple arcs occur (4 arcs in 10 seconds) the unit will shut down.

Over Temperature Protection:
Over Temperature: Over temperature of tank cover trip point shall be within 60°C ±5°C. Over temperature of tank oil trip point shall be set 65°C.

Operating Temperature:
0 to +40 °C.

Storage Temperature:
-20 to +70 °C

Altitude:
0 to 8000 feet (0 to 2438 meters)

Humidity:
5 to 95%, non-condensing.

Dimensions:
X-Ray Tank: 12.2” x 6.2” x 5.7” (310mm x 158mm x 145mm) Refer to outline drawing.
Controller: 14.9” x 10.6” x 3.2” (380mm x 270mm x 83mm) Refer to outline drawing.

Weight:
X-Ray Tank: 27.5 pounds (13kg)
Controller: 9.9 pounds (4.5kg)

Regulatory Approvals:
Designed to be compliant to:
IEC 60601-1:2005+A
Medical electrical equipment Part 1: General requirements for basic safety and essential performance.
IEC 60601-1-2
2007 Medical electrical equipment Part 1-2: General requirements for basic safety and essential performance- Collateral standard: Electromagnetic compatibility—Requirements and tests.
IEC 60601-1-3
IEC 60601-2-54
2009 Medical electrical equipment Part 2: Particular requirements for the basic safety and essential performance of X-Ray equipment for radiography and radioscopy.

EMC
Designed to meet IEC requirements for medical components. (Note: External EMI filter may be required)

RoHS
Controller and Tank Assembly are RoHS compliant.

---

### AC LINE POWER CONNECTOR—
**TE: 1-350943-0**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ground</td>
<td>Earth Ground</td>
</tr>
<tr>
<td>2</td>
<td>AC Input 1</td>
<td>190 - 264Vac, single phase, 50/60Hz, 34A max.</td>
</tr>
<tr>
<td>3</td>
<td>AC Input 2</td>
<td>190 - 264Vac, single phase, 50/60Hz, 34A max.</td>
</tr>
</tbody>
</table>

Note: Ground stud is provided on chassis.

### DIGITAL INTERFACE—9 PIN FEMALE D CONNECTOR TE: 5747844-5

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>2</td>
<td>RS-232 TX Out</td>
<td>RS-232 Transmit</td>
</tr>
<tr>
<td>3</td>
<td>RS-232 RX In</td>
<td>RS-232 Receive</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>RS-232 Ground</td>
<td>Ground from RS-232 transceiver IC</td>
</tr>
<tr>
<td>6</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>9</td>
<td>NC</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

### ANALOG INTERFACE—15 PIN FEMALE D CONNECTOR TE: 5747845-5

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GND</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>2</td>
<td>+5Vdc Out</td>
<td>+5Vdc, 100mA max.</td>
</tr>
<tr>
<td>3</td>
<td>Prep</td>
<td>User signal (Contact Closure) to alert the generator that exposure sequence will begin. Once this signal is active, exposure parameters are locked in and cannot be changed. Contact connection to pin 14. Closed = PREP, the filament is placed in preheat mode</td>
</tr>
<tr>
<td>4</td>
<td>Ready</td>
<td>The generator is ready for X-Ray exposure. Open Collector. Low/Active = Ready</td>
</tr>
<tr>
<td>5</td>
<td>Exposure</td>
<td>User signal (Contact Closure) to generator to generate X-Rays. Filament is boosted, and high voltage is generated after the boost time. Contact connection to pin 14. Closed = Exposure</td>
</tr>
<tr>
<td>6</td>
<td>X-Ray ON 75% Status</td>
<td>Transistor output to indicate X-Ray ON status synchronized with 75% of kV set point</td>
</tr>
<tr>
<td>7</td>
<td>X-Ray ON Status</td>
<td>Transistor output to indicate X-Ray ON status synchronized with kV start up</td>
</tr>
<tr>
<td>8</td>
<td>X-Ray Shutdown</td>
<td>User signal to generator to rapidly turn HV OFF and ON during serial exposure sequence. Low/Active=HV OFF</td>
</tr>
<tr>
<td>9</td>
<td>HVG Fault Status</td>
<td>Generator signal indicating generator fault. Open collector transistor output. Low/Active = Fault</td>
</tr>
<tr>
<td>10</td>
<td>kV Monitor</td>
<td>Signal from generator. 0-10V = 0-140kV</td>
</tr>
<tr>
<td>11</td>
<td>mA Monitor</td>
<td>Signal from generator. Large focus: 0-10V = 0-50mA Small focus: 0-5V=0-10mA</td>
</tr>
<tr>
<td>12</td>
<td>Filament Current Monitor</td>
<td>Signal from generator. 0-10V = 0-6A</td>
</tr>
<tr>
<td>13</td>
<td>Monitor GND</td>
<td>Ground for reference of monitor signals</td>
</tr>
<tr>
<td>14</td>
<td>+24Vdc Out</td>
<td>For connection to PREP and EXPOSURE control relay coils</td>
</tr>
<tr>
<td>15</td>
<td>Shield Ground</td>
<td>For connection of interface cable shield to generator chassis ground</td>
</tr>
</tbody>
</table>
Spellman’s ML430 power supply module has been designed specifically to drive high voltage amplifiers. This compact, low cost, SMT based high performance module is printed circuit board mountable. Its dual output is ideal for amplifier driver requirements together with electrostatic lenses, deflectors and biasing supplies. This voltage regulated, current limited, fixed, dual output unit provides up to 25mA of load current. The ML430 is fully protected against arc and short circuit conditions. The grounded metal case provides both shielding and heat sinking functions. An Enable feature is provided, allowing simple remote operation of the supply.

**TYPICAL APPLICATIONS**
- High Voltage Amplifiers
- Electrostatic Lenses

**SPECIFICATIONS**

**Input Voltage:**
+24 Vdc, ±1.2Vdc

**Input Current:**
≤1.2 amp

**Output Voltage:**
- Output 1-Positive:
  +430 volts fixed. Accuracy ±7%
- Output 2-Negative:
  -430 volts fixed. Accuracy ±7%
  Accuracy specified over full temperature, input voltage and load ranges

**Output Current:**
- 12mA maximum – Output 1-Positive
- 25mA maximum – Output 2-Negative

- **High Voltage Lens Power Supply**
- **Dual Positive and Negative Outputs**
- **Low Cost, Air Insulated Design**
- **SMT Design—Small Size and Low Weight**
- **UL Approved to UL61010-1**
- **Arc and Short Circuit Protected**
- **Remote Enable Control Provided**

**Line Regulation:** (typical)
- ±0.1% – Positive output
- ±1.0% – Negative output

**Load/Cross Regulation:** (typical)
- ±0.1% – Positive output
- ±3.5% – Negative output

**Output Current Limit:**
An auto-recovering short circuit fold back limit is employed. Fully arc protected, capable of 10 arcs in 5 seconds.

**Ripple:**
≤0.5% p-p of full rated output voltage

**Stability:**
≤0.25% per hour, constant operating conditions after 1 hour warm up

**Temperature Coefficient:**
≤200ppm per degree C

**Environmental:**
- **Temperature Range:**
  - Operating: 0˚C to 50˚C
  - Storage: -35˚C to 85˚C
- **Humidity:**
  - 10% to 90% RH, non-condensing

**Cooling:**
Unit must be mounted in free air, in any position with the exception of inverted (pins up). Forced air cooling is recommended

**Dimensions:**
0.984” H X 2.362” W X 2.362” D (25mm x 60mm x 60mm)

**Weight:**
3.31 oz. (94g)

**Regulatory Approvals:**
How to Order:

PART NO.: ML430P/N16/24
Spellman’s ML1350 power supply module has been designed specifically to drive quadrupoles used in mass spectrometry. This compact, low cost, SMT based high performance module is printed circuit board mountable. This quad output supply is ideal for quadrupole drivers and electrostatic lenses.

This voltage regulated, current limited, fixed quad output unit provides up to 15mA of load current from each output. The ML1350 is fully protected against arc and short circuit conditions. The grounded metal case provides both shielding and heat sinking functions. An Enable feature is provided, allowing simple remote operation of the supply.

**TYPICAL APPLICATIONS**
- Quadrupole HVPS
- Electrostatic Lenses

**SPECIFICATIONS**

**Input Voltage:**
+24 Vdc, ±1.2Vdc

**Input Current:**
≤3.0 amps

**Output Voltage:**
- Output 1-Positive: +245 volts, fixed, accuracy <±10%
- Output 2-Negative: -245 volts, fixed, accuracy <±10%
- Output 3-Positive: +1350 volts, fixed, accuracy <±7%
- Output 4-Negative: -1350 volts, fixed, accuracy <±7%

**Output Current:**
15mA maximum for each output

**Line Regulation:** (typical)
±1 volt all outputs

**Load Regulation:** (typical)
±3% all outputs

**Output Current Limit:**
An auto-recovering short circuit fold back limit is employed. Fully arc protected, capable of 10 arcs in 5 seconds.

**Ripple:**
≤0.1% p-p of full rated output voltage

**Stability:**
≤0.25% per hour, constant operating conditions after 1 hour warm up.

**Under Voltage Shutdown:**
The power supply will shut down when an input under voltage condition is detected. When the input voltage is restored above 11.8 volts, operating the enable pin will reset this fault.

**Temperature Coefficient:**
≤200ppm per degree C

**Environmental:**
- Temperature Range:
  - Operating: 0˚C to 50˚C
  - Storage: -35˚C to 85˚C
- Humidity: 10% to 90% RH, non-condensing

**Cooling:**
Unit must be mounted in free air, in any position with the exception of inverted (pins up). Forced air cooling is recommended.

**Dimensions:**
0.984” H X 4.331” W X 3.150” D (25mm x 110mm x 80mm)
Width does not include mounting tab

**Weight:**
7.27 oz. (206g)

**Regulatory Approvals:**
How to Order:
PART NO.: ML1350P/N50/24
Spellman’s MX2.5 is a well-regulated high performance DC-DC converter featuring a “hot switchable” polarity reversal capability. The MX’s low ripple specification makes it ideal for Mass Spectrometry applications, especially security detection systems, Dynodes, sample ionization as well as capillary electrophoresis and electrostatic printing applications.

The MX2.5 is rated at 2.5kV @ 60uA and is packaged in a shielded metal enclosure. This unit features a logic signal input to control output polarity reversal. A HV inhibit feature, along with voltage and current monitors are provided. Easily customized to meet OEM requirements, the MX2.5 can be provided with improved ripple performance and higher voltage and current capabilities.

**TYPICAL APPLICATIONS**
- Mass Spectrometry
- Capillary Electrophoresis
- Electrostatic Printing

**SPECIFICATIONS**

- **Input Voltage:** $24\text{V}_{\text{dc}}$, ±0.5 volt
- **Input Current:** <200mA continuous
- **Output Voltage:** ±100Vdc to ±2.5kV
- **Output Current:** 0 to 60uA max.
- **Polarity:** Remotely reversible via logic signal, 300mS to settle to ±1%, 1 Hz maximum switch rate
- **Voltage Regulation:**
  - Load: 0.05% of maximum output voltage for a no load to full load change
  - Line: 0.05% of maximum output voltage for a 1 volt input line change
- **Voltage Programming:**
  - 0 to 10 volt corresponds to 0 to 100% of rated output voltage
- **Voltage/Current Monitor:**
  - 0 to 10 volt corresponds to 0 to 100% of rated output voltage/current
- **Programming and Monitor Accuracy:**
  - ±1% Voltage Programming/Monitor
  - ±2% Current Monitor
- **Ripple:** ≤0.02% Volts p-p
- **Stability:**
  - 0.02% per hour after 1 hour warmup
- **Temperature Coefficient:** ≤50ppm per degree C
- **Environmental:**
  - Temperature Range:
    - Operating: 0°C to 40°C
    - Storage: -40°C to 85°C
  - Humidity: 10% to 90%, non-condensing
- **Cooling:** Convection cooled
- **Dimensions:** 1.18” H X 2.36” W X 4.72” D (30mm X 60mm X 120mm)
- **Weight:** Approximately 8.82 oz. (250g)
- **Interface/Power Connector:** PCB mount pins
- **HV Output Connector:** PCB mount pins
- **Regulatory Approvals:**
### MX2.5 INPUT/OUTPUT CONNECTIONS

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24V Power Input</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0V</td>
<td>Signal and Power Ground</td>
</tr>
<tr>
<td>3</td>
<td>Vprog</td>
<td>0-10V Programming Voltage</td>
</tr>
<tr>
<td>4</td>
<td>Polarity Change</td>
<td>Polarity Change Input</td>
</tr>
<tr>
<td>5</td>
<td>Shutdown</td>
<td>Output Inhibit, Disables HV Output Down to &lt;60V in 300ms</td>
</tr>
<tr>
<td>6</td>
<td>V_mon</td>
<td>0-10V Output Voltage Monitor</td>
</tr>
<tr>
<td>7</td>
<td>Output</td>
<td>HT Output</td>
</tr>
<tr>
<td>8</td>
<td>I_mon</td>
<td>0-10V Output Current Monitor</td>
</tr>
</tbody>
</table>

### How to Order:
- Standard: PART NO.: MX2.5PN24

---

**Dimensional Information:**

**SIDE VIEW**
- Dimension: 30.0 x 7.4 x 4.0 (OVER LUGS)
- Dimension: Ø1.1 (P1-P8)
- LUG 1.0 x 0.6mm (4 OFF) POSITION "X"

**BOTTOM VIEW ON PINS**
- Dimension: 60.0 x 20.3 x 10.1
- Dimensions of P1 to P8

---

How to Order:
Standard: PART NO.: MX2.5PN24
Spellman’s RoHS compliant MX8 Plus is a well-regulated high performance fast reversible supply featuring a 25ms “hot switchable” polarity reversing capability.

The MX8 Plus’s low ripple specification is typical of the topologies that make Spellman High Voltage your ideal choice for mass spectrometry applications; especially security detection systems, dynodes, sample ionisation as well as capillary electrophoresis and electrostatic printing applications. The MX8 has been designed especially for EI and APCI applications.

The MX8 Plus can be easily tailored to an OEM’s requirement, such as improved ripple performance, or different voltage and/or current capabilities.

### TYPICAL APPLICATIONS
- Mass Spectrometry
- Capillary Electrophoresis
- Electrostatic Printing

### SPECIFICATIONS

#### Input Voltage:
+24Vdc, ±10%

#### Input Current:
- <0.5A nominal continuous
- <1.2A peak during reversing

#### Output Voltage:
0V to ±8kV (see note 1)

#### Output Current:
100μA

#### Output Polarity:
Bipolar

#### Voltage Regulation:
- Line: <±0.1% for ±10% input voltage change
- Load: <0.1% for 0 to full load

#### Current Regulation:
- Line: ±0.1% for +1V input voltage change for any load condition
- Load: ±0.1% for full load to short circuit

- ±8kV 25mS Polarity Reversing Speed
- Precision Analog Voltage and Current Controls
- Precision Analog Voltage and Current Monitors
- High Stability
- Low Ripple and Noise
- High Voltage Inhibit Control
- RoHS Compliant

**Ripple:**
<0.1% p-p @ 100μA

**Temperature Coefficient:**
≤100ppm per degree C

**Environmental:**
- Temperature Range:
  - Operating: 5°C to 45°C
  - Storage: -35°C to 85°C
- Humidity: 10% to 85%, non-condensing

**Stability:**
0.05% per hour after 1 hour warm up

**Polarity Reversal Time:**
<25ms from command to 90% into 100pF load capacitance (see note 2)

**Protection:**
Arc and short circuit protected

**Output Voltage Limit:**
Output voltage must not exceed ±8kV ±250V under any input or output conditions

**Dimensions:**
1.48” H X 3.23” W X 9.45” D (37.6mm X 82mm X 240mm)

**Weight:**
Approximately 3.3 pounds (1.5kg)

**Input Connector:**
14 way Molex housing p/n 39-01-2140 or similar with female terminals. Cable length 508mm

**Output Connector:**
Alden F303RX12, mating connector not provided

**Regulatory Approvals:**

Note 1: Linearity not guaranteed below 200V. Maximum offset ±20V when programmed to zero or disabled using remote enable.

Note 2: Unit incorporates circuitry to minimize the effects of low programmed current on reversing time. Polarity reversal time applies when current is programmed to 3μA or above.
### MX8 PLUS 14 PIN SOCKET

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24Vdc Input</td>
</tr>
<tr>
<td>2</td>
<td>Chassis and 24Vdc Ground</td>
</tr>
<tr>
<td>3</td>
<td>Enable/Inhibit Input</td>
</tr>
<tr>
<td>4</td>
<td>8kV Voltage Monitor Output</td>
</tr>
<tr>
<td>5</td>
<td>Voltage Control Input</td>
</tr>
<tr>
<td>6</td>
<td>Current Monitor Output</td>
</tr>
<tr>
<td>7</td>
<td>Current Control Input</td>
</tr>
<tr>
<td>8</td>
<td>Polarity Control Input</td>
</tr>
<tr>
<td>9</td>
<td>Analog Ground</td>
</tr>
<tr>
<td>10</td>
<td>Current/Voltage Control Indicator</td>
</tr>
<tr>
<td>11</td>
<td>N/C</td>
</tr>
<tr>
<td>12</td>
<td>N/C</td>
</tr>
<tr>
<td>13</td>
<td>N/C</td>
</tr>
<tr>
<td>14</td>
<td>N/C</td>
</tr>
</tbody>
</table>

### DIMENSIONS: in.[mm]

**SIDE VIEW**

- 0.74 [18.8]
- 1.48 [37.6]
- 8.10 [205.74]

**TOP VIEW**

- 0.49 [12.4]
- 2.25 [57.15]
- 3.23 [82]
- 8.10 [205.74]
- 0.67 [17.1]

**FRONT VIEW**

- 8-32 UNC INSERTS X 7MM DEEP EX

---

**How to Order:**

Standard: PART NO.: MXP8PN24
Spellman’s MX10 is a well-regulated high performance DC-DC converter featuring a “hot switchable” polarity reversal capability. The MX10’s low ripple specification makes it ideal for Mass Spectrometry applications, especially security detection systems, Dynodes, sample ionization as well as capillary electrophoresis and electrostatic printing applications.

The MX10 is rated at 10kV @ 100uA and is packaged in a shielded metal enclosure. This unit features a logic signal input to control output polarity reversal. A HV inhibit feature, along with voltage and current monitors are provided. Easily customized to meet OEM requirements, the MX10 can be provided with current control, improved ripple performance and higher voltage and current capabilities.

### TYPICAL APPLICATIONS
- Mass Spectrometry
- Capillary Electrophoresis
- Electrostatic Printing

### OPTIONS
- **VCC:** Voltage and Current Control

### SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Voltage:</strong></td>
<td>+24Vdc, ±1 volt</td>
</tr>
<tr>
<td><strong>Input Current:</strong></td>
<td>&lt;400mA continuous, &lt;1.2A during reversing</td>
</tr>
<tr>
<td><strong>Output Voltage:</strong></td>
<td>±200Vdc to ±10kV</td>
</tr>
<tr>
<td><strong>Output Current:</strong></td>
<td>0 to 100uA max.</td>
</tr>
<tr>
<td><strong>Polarity:</strong></td>
<td>Remotely reversible via logic signal, 250mS to settle to ±2%, 1 Hz maximum switch rate</td>
</tr>
<tr>
<td><strong>Voltage Regulation:</strong></td>
<td>Load: 0.1% of maximum output voltage for a no load to full load change, Line: 0.1% of maximum output voltage for a 1 volt input line change</td>
</tr>
</tbody>
</table>

Current Regulation: (VCC Option)
- Load: 0.1% of maximum rated current for a 0 to 100% voltage change
- Line: 0.1% of maximum rated current for a 1 volt input line change

Voltage/Current Programming:
- 0 to 10 volt corresponds to 0 to 100% of rated output voltage

Voltage/Current Monitor:
- 0 to 10 volt corresponds to 0 to 100% of rated output voltage

Programming and Monitor Accuracy:
±2%

Ripple:
≤0.005% Volts p-p

Stability:
0.1% per hour after 1 hour warmup

Temperature Coefficient:
≤100ppm per degree C

Environmental:
- Temperature Range:
  - Operating: 0°C to 40°C
  - Storage: -40°C to 85°C
  - Humidity: 10% to 90%, non-condensing.

Cooling:
Convection cooled

Dimensions:
1.63” H X 6.61” W X 4.53” D (41.5mm X 168mm X 115mm)

Weight:
Approximately 3 pounds (1.4kg)

Interface/Power Connector:
9 pin male D connector

HV Output Connector:
39.4” (1m) Flying Lead of URM76 LSF cable

Regulatory Approvals:
- Compliant to EEC EMC Directive.
- Compliant to EEC Low Voltage Directive.
- UL/CSA recognized file E227588.
- RoHS Compliant.
**MX10 TERMINAL BLOCK 9 PIN**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Voltage Monitor</td>
<td>0-10V=0-100% of Rated Output</td>
</tr>
<tr>
<td>2</td>
<td>External Inhibit Input</td>
<td>Open or &gt;10V = “OFF”; &lt;4V = “ON”</td>
</tr>
<tr>
<td>3</td>
<td>Current Programming Input</td>
<td>0-10Vdc = 0-100% of Rated Output (on VCC option)</td>
</tr>
<tr>
<td>4</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>5</td>
<td>Current Monitor</td>
<td>0-10Vdc = 0-100% of Rated Output</td>
</tr>
<tr>
<td>6</td>
<td>Polarity Control Input</td>
<td>Open or &gt;10V = “NEGATIVE”; &lt;4V = “POSITIVE”</td>
</tr>
<tr>
<td>7</td>
<td>Voltage Programming Input</td>
<td>0-10Vdc = 0-100% of Rated Output</td>
</tr>
<tr>
<td>8</td>
<td>+24V Input</td>
<td>+24V Input</td>
</tr>
<tr>
<td>9</td>
<td>Power Ground</td>
<td>Power Ground</td>
</tr>
</tbody>
</table>

**How to Order:**
- Standard: PART NO.: MX10PN24
- VCC Option: PART NO.: MX10PN24/VCC

---

**DIMENSIONS:** in.[mm]

**SIDE VIEW**

**TOP VIEW**

---

**Spellman High Voltage is an ISO 9001 and ISO 14001 registered company**
Spellman’s MX20 is a well-regulated high performance DC-DC converter featuring a “hot switchable” polarity reversal capability. The MX20’s low ripple specification makes it ideal for Mass Spectrometry applications; especially security detection systems, Dynodes, sample ionization as well as capillary electrophoresis and electrostatic printing applications.

The MX20 is rated at 20kV @ 100µA and is packaged in a shielded metal enclosure. This unit features a logic signal input to control output polarity reversal. A HV inhibit feature, along with voltage and current monitors are provided. Easily customized to meet OEM requirements, the MX20 can be provided with current control, improved ripple performance and higher voltage and current capabilities.

**TYPICAL APPLICATIONS**
- Mass Spectrometry
- Capillary Electrophoresis
- Electrostatic Printing

**OPTIONS**
- VCC: Variable Current Control

**SPECIFICATIONS**
- **Input Voltage:** +24Vdc, ±1.2 volts
- **Input Current:** <500mA continuous, <1.2A during reversing
- **Output Voltage:** ±500Vdc to ±20kV
- **Output Current:** 0 to 100µA max.
- **Polarity:** Remotely reversible via logic signal, 500mS to settle to ±2%, 1 Hz maximum switch rate
- **Voltage Regulation:** Load: 0.02% of maximum output voltage for a no load to full load change
  
  Line: 0.01% of maximum output voltage for a 1 volt input line change

- **Current Regulation:** (VCC Option)
  - Load: 0.1% of maximum rated current for a 0 to 100% voltage change
  - Line: 0.01% of maximum rated current for a 1 volt input line change

- **Voltage/Current Programming:**
  - 0 to 10 volts corresponds to 0 to 100% of rated output voltage/current

- **Voltage/Current Monitor:**
  - ±2% Voltage Programming/Monitor
  - ±5% Current Programming/Monitor

- **Ripple:** ≤0.0025% Volts p-p

- **Stability:** 0.1% per hour after 1 hour warmup

- **Temperature Coefficient:** ≤100ppm per degree C

- **Environmental:**
  - Temperature Range:
    - Operating: 0°C to 40°C
    - Storage: -40°C to 85°C
  - Humidity: 10% to 90%, non-condensing

- **Cooling:** Convection cooled

- **Dimensions:** 2.05˝ H X 6.61˝ W X 6.50˝ D (52mm X 168mm X 165mm)

- **Weight:** Approximately 5.51 pounds (2.5kg)

- **Interface/Power Connector:** 9 pin male D connector

- **HV Output Connector:** 39.4˝ (1m) Flying Lead of URM76 LSF cable

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Voltage Monitor</td>
<td>0-10V = 0-100% of Rated Output</td>
</tr>
<tr>
<td>2</td>
<td>External Inhibit Input</td>
<td>Open or &gt;10V = “OFF”; &lt;4V = “ON”</td>
</tr>
<tr>
<td>3</td>
<td>Current Programming Input</td>
<td>0-10Vdc = 0-100% of Rated Output (on VCC option)</td>
</tr>
<tr>
<td>4</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>5</td>
<td>Current Monitor</td>
<td>0-10Vdc = 0-100% of Rated Output</td>
</tr>
<tr>
<td>6</td>
<td>Polarity Control Input</td>
<td>Open or &gt;10V = “NEGATIVE”; &lt;4V = “POSITIVE”</td>
</tr>
<tr>
<td>7</td>
<td>Voltage Programming Input</td>
<td>0-10Vdc = 0-100% of Rated Output</td>
</tr>
<tr>
<td>8</td>
<td>+24V Input</td>
<td>+24V Input</td>
</tr>
<tr>
<td>9</td>
<td>Power Ground</td>
<td>Power Ground</td>
</tr>
</tbody>
</table>

**How to Order:**
- Standard: PART NO.: MX20PN24
- VCC Option: PART NO.: MX20PN24/VCC

**DIMENSIONS:**
- SIDE VIEW: 2.06 [52]
- TOP VIEW: 6.61 [168]
Spellman’s RoHS compliant MX10 Plus is a well-regulated high performance fast reversible dynode supply featuring a 25ms “hot switchable” polarity reversing capability with an integrated -2.3kV electron multiplier supply. The MX10 Plus’s low ripple specification is typical of the topologies that make Spellman High Voltage your ideal choice for mass spectrometry applications; especially security detection systems, dynodes, sample ionisation as well as capillary electrophoresis and electrostatic printing applications. The MX10 Plus has been designed especially for dynode detector applications. The MX10 Plus can be easily tailored to an OEM’s requirement, such as improved ripple performance, or different voltage and/or current capabilities.

**TYPICAL APPLICATIONS**
- Dynode Supply
- Electron Multiplier Supply

**SPECIFICATIONS**

- **Input Voltage:**
  - +15Vdc, ±.75Vdc

- **Input Current:**
  - ≤500mA nominal continuous
  - <2A during reversing

- **Temperature Coefficient:**
  - ≤100ppm per degree C

- **Environmental:**
  - Operating: 5°C to 45°C
  - Storage: -35°C to 85°C
  - Humidity: 10% to 85%, non-condensing

- **Stability:**
  - (constant operating conditions) ≤300ppm per hour after 1 hour warm up

- **Protection:**
  - Arc and Short circuit protected

- **Regulatory Approvals:**

**DYNODE SPECIFICATIONS**

- **Output Voltage:** ±10kV
- **Output Current:** 10μA
- **Output Polarity:** Remotely reversible via TTL logic signal
- **Switching Speed:** 25ms to settle 90% into 50pF load
- **Voltage Regulation:**
  - Line: ≤0.02% for a 1.5V input voltage change
  - Load: <5V for no load to 22M Ohms load change
- **Ripple:** ≤10 Volts p-p

**ELECTRON MULTIPLIER SPECIFICATIONS**

- **Output Voltage:**
  - Fixed: -2.3kV
- **Output Polarity:** Negative
- **Output Current:** ≤230μA
- **Voltage Regulation:**
  - Line: ≤0.02% for a 1.5V input voltage change
  - Load: ≤5V for no load to 22M Ohms load change
- **Ripple:** ≤200mV p-p @ 2.3kV into 22M Ohm load
- **Output Rise Time:** 10ms
- **Output Fall Time:** 10ms
- **Dimensions:** 2.00” H X 5.30” W X 8.00” D (50.8mm X 134.6mm X 203mm)
- **Weight:** Approximately 3.3 pounds (1.5kg)
- **Interface/Power Connector:**
  - 20 pin flat ribbon connector
- **Output Connector:**
  - ±10kV: modified Alden #A200 connector
  - -2.3kV: MHV Kings bulkhead KV-79-15 or similar
## MX10 PLUS TERMINAL BLOCK 20 PIN

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+15Vdc Input</td>
</tr>
<tr>
<td>2</td>
<td>+15Vdc Input</td>
</tr>
<tr>
<td>3</td>
<td>N/C</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
</tr>
<tr>
<td>5</td>
<td>Ground</td>
</tr>
<tr>
<td>6</td>
<td>Ground</td>
</tr>
<tr>
<td>7</td>
<td>Output Voltage Control</td>
</tr>
<tr>
<td>8</td>
<td>Signal Reference Ground</td>
</tr>
<tr>
<td>9</td>
<td>10kV On</td>
</tr>
<tr>
<td>10</td>
<td>10kV On</td>
</tr>
<tr>
<td>11</td>
<td>Output Polarity Control</td>
</tr>
<tr>
<td>12</td>
<td>EM Protect</td>
</tr>
<tr>
<td>13</td>
<td>-2.3kV Output Monitor</td>
</tr>
<tr>
<td>14</td>
<td>EM On</td>
</tr>
<tr>
<td>15</td>
<td>Ground</td>
</tr>
<tr>
<td>16</td>
<td>Ground</td>
</tr>
<tr>
<td>17</td>
<td>±10kV Output Monitor</td>
</tr>
<tr>
<td>18</td>
<td>N/C</td>
</tr>
<tr>
<td>19</td>
<td>+15Vdc Input</td>
</tr>
<tr>
<td>20</td>
<td>+15Vdc Input</td>
</tr>
</tbody>
</table>

### How to Order:
Standard: PART NO.: MXP10PN15

### Dimensions:
- **Side View**
  - Dimensions: in. [mm]
  - Side View dimensions:
    - Width: 6.50 [165]

- **Top View**
  - Dimensions: in. [mm]
  - Top View dimensions:
    - Width: 5.30 [134.6]

- **Front View**
  - Dimensions: in. [mm]
  - Front View dimensions:
    - Width: 3.62 [92.1]

---

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Spellman High Voltage is an ISO 9001 and ISO 14001 registered company
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Spellman’s MXR Series are well-regulated high performance DC-DC converters. The MXR’s low ripple specification makes it ideal for Mass Spectrometry and electron microscopes. The MXR20 is rated at 20kV @ 300uA and MXR30 is rated at 30kV @ 300uA. Both are packaged in a shielded metal enclosure. These units feature a logic signal input to control output polarity reversal. A HV inhibit feature, along with voltage and current monitors are provided. Easily customized to meet OEM requirements, the MXR Series can be provided with current control, improved ripple performance and higher voltage and current capabilities.

TYPICAL APPLICATIONS
- Mass Spectrometry
- Electron Microscopes
- Capillary Electrophoresis
- Electrostatic Printing

OPTIONS
- /DDC 2 RS-232
- /LL#### mating HV cable length specified in mm

SPECIFICATIONS
Input Voltage: 24Vdc (±10%)
Input Current: 1.25A
Output Voltage:
- ± 20V to ±20kV (MXR20)
- ± 30V to ±30kV (MXR30)
Output Current: 300μA

• Hot Switchable Polarity Reversible within 2s settling to <3ppm
• Remote Polarity Reversal and HV Inhibit
• Voltage and Current Monitor Outputs
• Arc and Short Circuit Protected
• Well Regulated, Low Ripple, High Stability
• UL Recognized
• OEM Customization Available

Voltage Regulation:
- Load: 50ppm of maximum output voltage for a no load to full load change
- Line: <20ppm of maximum output voltage for a 5% input line change

Programming and Monitor Accuracy:
±2% Voltage Programming/Monitor

Ripple:
10ppm

Stability:
- 1hr = 10ppm max. after 1 hr warm-up
- 8hrs = 20ppm max. after 1 hr warm-up

Temperature Coefficient:
10ppm/°C

Reversing Time:
2s for +20kV to -20kV or +30kV to -30kV settling to <3ppm, faster versions are available

Environmental:
- Temperature Range:
  - Operating: 0°C to 50°C
  - Storage: -40°C to 85°C
- Humidity: 10% to 90%, non-condensing

Cooling:
- Convection cooled

Dimensions:
2.05” H X 8.47” W X 9.13” D (52mm X 215mm X 230mm)

Weight:
- Approximately 8.80 pounds (4.0kg)

Input Connectors:
- Power: 2 way Molex Mini-fit Jr connector
- Digital: 10 way ‘IDC Ribbon cable’ connector
- Analog: 12 way Molex KK5.08 series connector

Output Connectors:
- Standard output is GES HB30 receptacle. Mating cable is specified by adding /LL##### after model number, where #### is cable length in millimeters.

Regulatory Approvals:
### MXR POWER VIA 2 WAY MOLEX

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24Vdc Input</td>
</tr>
<tr>
<td>2</td>
<td>Ground return for +24Vdc</td>
</tr>
</tbody>
</table>

### MXR DIGITAL INPUT—10 WAY IDC RIBBON CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Transmit data (output) with respect to pin 1</td>
</tr>
<tr>
<td>2</td>
<td>Serial signal ground return (if required)</td>
</tr>
<tr>
<td>3</td>
<td>Receive data (input) with respect to pin 2</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
</tr>
<tr>
<td>5</td>
<td>N/C</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
</tr>
<tr>
<td>7</td>
<td>Interlock opto-isolator input</td>
</tr>
<tr>
<td>8</td>
<td>Interlock opto-isolator signal return</td>
</tr>
<tr>
<td>9</td>
<td>Polarity change signal opto-isolator input</td>
</tr>
<tr>
<td>10</td>
<td>Polarity change signal opto-isolator signal return</td>
</tr>
</tbody>
</table>

### MXR ANALOG INPUT—12 WAY MOLEX KK5.08 CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Current monitor output</td>
</tr>
<tr>
<td>2</td>
<td>+24Vdc Input</td>
</tr>
<tr>
<td>3</td>
<td>Voltage monitor output</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
</tr>
<tr>
<td>5</td>
<td>N/C</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
</tr>
<tr>
<td>7</td>
<td>Voltage program input</td>
</tr>
<tr>
<td>8</td>
<td>Polarity set input</td>
</tr>
<tr>
<td>9</td>
<td>Signal ground</td>
</tr>
<tr>
<td>10</td>
<td>+24Vdc return</td>
</tr>
<tr>
<td>11</td>
<td>N/C</td>
</tr>
<tr>
<td>12</td>
<td>Polarity status output</td>
</tr>
</tbody>
</table>

How to Order:

- Standard: PART NO.: MXR20PN24
- PART NO.: MXR30PN24
Spellman’s MCP Module is a well-regulated, high performance DC-DC converter featuring a floating 3kV output, isolated to 15kV. The MCP low output ripple specification makes it ideal for use with detectors in Mass Spectrometry applications like: Electron Multipliers (EM’s), Microchannel Plates Detectors (MCP’s) and Channel Electron Multipliers.

This +3kV @ 330uA module is packaged in a shielded metal enclosure. The unit has remote voltage programming and a voltage monitor, and features low injected ripple when used with biasing supplies. The MCP module is easily customized to meet OEM requirements with improved ripple performance, improved stability and configurable output lead terminations as required.

**TYPICAL APPLICATIONS**
- Mass Spectrometry Detectors
- Microchannel Plates
- Electron Multipliers
- Channel Electron Multipliers

**SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Voltage</strong></td>
<td>+24Vdc, ±0.5 volts</td>
</tr>
<tr>
<td><strong>Input Current</strong></td>
<td>600mA maximum</td>
</tr>
<tr>
<td><strong>Output Voltage</strong></td>
<td>+100V to +3kV, continuously variable over the entire output range</td>
</tr>
<tr>
<td><strong>Output Current</strong></td>
<td>330uA maximum</td>
</tr>
<tr>
<td><strong>Polarity</strong></td>
<td>Positive</td>
</tr>
<tr>
<td><strong>Isolation Voltage</strong></td>
<td>Up to 15kV total to ground (resistance to ground 600M on each output)</td>
</tr>
<tr>
<td><strong>Line Regulation</strong></td>
<td>≤0.01% for input voltage change of 1V</td>
</tr>
</tbody>
</table>

**Load Regulation:** ≤0.1% for a no load to full load change

**Voltage Programming:**
- 0 to 10 volt corresponds to 0 to 100% of rated output voltage

**Voltage Monitor:**
- 0 to 5 volts corresponds to 0 to 100% of rated output voltage

**Accuracy:**
- ±1% from 10% to 100% of output. Below 10% accuracy spec is not guaranteed

**Ripple:** ≤0.1% Volts p-p, 0.1Hz to 1MHz

**Stability:** ≤1000 ppm/hour at constant operating conditions after a 1 hour warm up

**Temperature Coefficient:** ≤300ppm per degree C

**Temperature Range:**
- Operating: 0°C to 40°C
- Storage: -40°C to 85°C

**Humidity:** 10% to 90%, non-condensing.

**Cooling:** Convection cooled

**Dimensions:** 1.49” H X 4.09” W X 6.73” D (38mm X 104mm X 171mm)

**Weight:** 2.2 pounds (1kg)

**Interface/Power Connector:**
- 9 pin male D connector

**High Voltage Output Cable:**
- HV positive: 29.5” (750mm) fly wire, URM76 coaxial HV cable
- HV negative: 29.5” (750mm) fly wire, URM76 coaxial HV cable

**Regulatory Approvals:**
<table>
<thead>
<tr>
<th>JB1</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>2</td>
<td>Voltage Programming Input</td>
<td>0-10Vdc = 0-100% of Rated Output</td>
</tr>
<tr>
<td>3</td>
<td>+24V Input</td>
<td>+24V Input</td>
</tr>
<tr>
<td>4</td>
<td>+24V Input</td>
<td>+24V Input</td>
</tr>
<tr>
<td>5</td>
<td>Voltage Monitor</td>
<td>0-5Vdc = 0-100% of Rated Output</td>
</tr>
<tr>
<td>6</td>
<td>Power Ground</td>
<td>Power Ground</td>
</tr>
<tr>
<td>7</td>
<td>Power Ground</td>
<td>Power Ground</td>
</tr>
<tr>
<td>8</td>
<td>Power Ground</td>
<td>Power Ground</td>
</tr>
<tr>
<td>9</td>
<td>Power Ground</td>
<td>Power Ground</td>
</tr>
</tbody>
</table>

**dimensions:** in. [mm]

**Front View**

**Back View**

**Top View**

MCP INTERFACE/POWER CONNECTOR

---

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The TOF3000 offers critical specifications like ultra low ripple and noise, excellent temperature coefficient; a stable, repeatable and accurate output, along with remote output polarity reversing capability. These superior specifications result in improved mass spectrometer resolution. Unique high voltage packaging and surface mount fabrication techniques, coupled with Spellman’s proprietary encapsulation technology provide this unit in an attractive sized OEM package.

Featuring a 0-30kV @ 400μA output with remote polarity reversing capability and dimensions of 3”H x 5”W x 12 5/8”L, the TOF3000 is a small, cost-effective high voltage power supply with technology that sets the standard for the future of Mass Spectrometry applications.

**TYPICAL APPLICATIONS**

- Mass Spectrometry

**SPECIFICATIONS**

**Input Voltage:**
- +24 Vdc, +5%, -2%

**Input Current:**
- 2 amps maximum

**Output Voltage:**
- 0 to 30kV

**Output Current:**
- 0 to 400 microamperes

**Polarity:**
- Positive or Negative with respect to ground, reversible via TTL signal

**Voltage Regulation:**
- Line: 0.001% for input change of 1 volt
- Load: 0.001% for 100μA to full load change

**Current Regulation:**
- Line: 0.05% for +5% to -2% input change
- Load: 0.1% for 0 to maximum output voltage

**Ripple:**
- ≤70mV peak to peak

**Stability:**
- 0.01% per hour. 0.02% per 8 hours after 1.0 hour warm up period

**Temperature Coefficient:**
- 25ppm per degree C

**Environmental:**
- Temperature Range:
  - Operating: 0˚C to 50˚C
  - Storage: -20˚C to 65˚C
- Humidity:
  - 10% to 90% RH, non-condensing

**Control Interface**

**Voltage Program Input:**
- 0 to +10Vdc corresponds to 0 to ±30kV, Zin ≥ 1 megohm

**Program Accuracy:**
- ±0.15% at 15KV, with overall accuracy of ±0.25% of maximum output

**TTL Polarity Reversal:**
- High = positive polarity
- Low = negative polarity

**Voltage Monitor:**
- 0 to 10Vdc corresponds to 0 to 30KV, Zout = 4.7Kohm

**Current Monitor:**
- 0 to 10Vdc corresponds to 0 to 400μA, Zout = 4.7Kohm

**Cooling:**
- Convection cooled

**Dimensions:**
- 3” H × 5” W × 12.625” D (76.2mm × 127mm × 321.7mm)

**Weight:**
- 9.5 pounds (4.31kg)

**Interface Connector:**
- 15 pin male D connector

**Output Connector:**
- Alden B102, which accepts Alden B200 cable plug

**Regulatory Approvals:**
- RoHS Compliant
**JB1 INTERFACE CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Spare</td>
<td>N/C</td>
</tr>
<tr>
<td>2</td>
<td>Voltage Program</td>
<td>0 to 10V=0 to 100% Rated Output</td>
</tr>
<tr>
<td>3</td>
<td>Spare</td>
<td>N/C</td>
</tr>
<tr>
<td>4</td>
<td>Spare</td>
<td>N/C</td>
</tr>
<tr>
<td>5</td>
<td>Voltage Monitor</td>
<td>0 to 10V=0 to 100% Rated Output</td>
</tr>
<tr>
<td>6</td>
<td>TTL Polarity Control Signal</td>
<td>Hi=Positive Polarity, Low=Negative Polarity</td>
</tr>
<tr>
<td>7</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>8</td>
<td>Power Ground</td>
<td>Power Ground</td>
</tr>
<tr>
<td>9</td>
<td>Spare</td>
<td>N/C</td>
</tr>
<tr>
<td>10</td>
<td>Spare</td>
<td>N/C</td>
</tr>
<tr>
<td>11</td>
<td>Spare</td>
<td>N/C</td>
</tr>
<tr>
<td>12</td>
<td>TTL HV Enable</td>
<td>Hi=Inhibit, Low=Enable</td>
</tr>
<tr>
<td>13</td>
<td>Current Monitor</td>
<td>0 to 10V=0 to 100% Rated Output</td>
</tr>
<tr>
<td>14</td>
<td>Spare</td>
<td>N/C</td>
</tr>
<tr>
<td>15</td>
<td>+24Vdc</td>
<td>+24Vdc</td>
</tr>
</tbody>
</table>

**DIMENSIONS:** in.[mm]

**FRONT VIEW**

**BACK VIEW**

**TOP VIEW**

**BOTTOM VIEW**

---

**SPELLMAN HIGH VOLTAGE ELECTRONICS CORPORATION**

MASS SPECTROMETRY POWER SUPPLY

**TOF3000**

**Corporate Headquarters**
Hauppauge, New York USA
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e-mail: sales@spellmanhv.com

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Spellman High Voltage is an ISO 9001 and ISO 14001 registered company
Copyright © 2004 Spellman High Voltage Electronics Corp.
Spellman’s MCP4 is a well-regulated, high performance DC-DC converter featuring a floating 4kV @ 600uA output, isolated to 15kV. The MCP4 low output ripple specification and high stability make it ideal for use with detectors in Mass Spectrometry applications such as: Electron Multipliers (EM’s), Microchannel Plates Detectors (MCP’s) and Channel Electron Multipliers. This module is packaged in a shielded metal enclosure and the high voltage output is provided via two captive one meter long shielded coaxial cables. The unit has remote 0-10Vdc = 0-100% rated voltage programming and voltage monitor. A TTL compliant Enable signal provides simple control of the high voltage output. This unit has specifically designed to minimize crosstalk with the high voltage source which it is floated upon. The MCP4 can be customized to meet OEM requirements.

**TYPICAL APPLICATIONS**
- Mass Spectrometry Detectors
- Microchannel Plates
- Electron Multipliers
- Channel Electron Multipliers

**SPECIFICATIONS**

**Input Voltage:**
+24Vdc, ±5%

**Input Current:**
700 mA maximum

**Output Voltage:**
0 to 4kV, continuously variable over the entire output range

**Output Current:**
600uA maximum

**Current Limit:**
1900uA maximum

**Polarity:**
Reversible polarity inherent by design

**Isolation Voltage:**
Up to 15kV total to ground.

Note: Resistors in the MCP HV network will allow a voltage on the MCP +VE output whenever the HV input is negative for a positive connected unit, or for a positive HV input, a negative connected MCP. This voltage will be 47:500 of the isolation voltage, thus <1400V at 15kV, without a load connected.

- **Floating, Programmable 4kV Output**
- **Output Isolated to 15kV**
- **Well Regulated, Low Ripple**
- **Output Voltage Monitor**
- **Compact Shielded Metal Enclosure**
- **Arc and Short Circuit Protected**

**Line Regulation:**
50ppm for a ±5% line change

**Load Regulation:**
300ppm for a 10% to 100% load change

**Voltage Programming:**
0 to 10 volt corresponds to 0 to 100% of rated output voltage

**Voltage Monitor:**
0 to 10 volts corresponds to 0 to 100% of rated output voltage, ±1%, Zout = 10kΩ

**Accuracy:**
±2%

**Ripple:**
100mVpp

**Injected Ripple:**
30mVpp, on an appropriate, properly connected ground referenced high voltage generator

**Temperature Coefficient:**
20ppm per degree C

**Drift:**
50ppm, maximum excursion in any 8 hours period at 40°C

**Environmental:**
- **Temperature Range:**
  - Operating: 0°C to 50°C
  - Storage: -30°C to 85°C
- **Humidity:**
  5% to 90%, non-condensing.

**Cooling:**
Convection cooled

**Dimensions:**
1.81” H X 5.74” W X 9.53” D (46mm X 139mm X 242mm)

**Weight:**
3.85 pounds (1.75kg)

**Interface/Power Connector:**
9 pin male D connector

**High Voltage Output Cable:**
HV positive: 45.3” (1150mm) fly wire, HRG58 coaxial HV cable
HV negative: 45.3” (1150mm) fly wire, HRG58 coaxial HV cable

**Regulatory Approvals:**
Compliant to EEC Low Voltage Directive. RoHS compliant. The unit is designed to meet the requirements of EN 61010-1, IEC/JUL 61010-1 and CAN/CSA-22.2 No. 61010-1.

**EMC:**
As this unit is intended for incorporation into user’s equipment it will not be tested as a stand-alone unit to EMC directive. The user will need to follow sensible EMC precautions in using the unit.
**INTERFACE/POWER CONNECTOR—9 PIN MALE D**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Voltage Programming Input</td>
<td>0 to 10 volt corresponds to 0 to 100% of rated output voltage</td>
</tr>
<tr>
<td>2</td>
<td>Voltage Programming Return</td>
<td>Differential return for Voltage programming</td>
</tr>
<tr>
<td>3</td>
<td>Enable</td>
<td>Enable = High (&gt;2V) Vmax = 11V, Imax = 19mA</td>
</tr>
<tr>
<td>4</td>
<td>Enable Return</td>
<td>Differential return for Enable</td>
</tr>
<tr>
<td>5</td>
<td>Power Ground</td>
<td>Power Ground</td>
</tr>
<tr>
<td>6</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>7</td>
<td>Voltage Monitor</td>
<td>0 to 10 volt corresponds to 0 to 100% of rated output voltage</td>
</tr>
<tr>
<td>8</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>9</td>
<td>+24V Input</td>
<td>+24Vdc Input</td>
</tr>
</tbody>
</table>

**How to Order:**
Standard: PART NO.: MCP4PN24

**DIMENSIONS:** in.[mm]

**FRONT VIEW**

**SIDE VIEW**

**TOP VIEW**
Spellman’s FIB Series is an integrated multiple output high voltage power supply specifically designed for focused ion beam applications. It incorporates a high stability accelerator voltage with the floating outputs to drive traditional Ga Ion and Plasma Sources. An additional Lens Chassis is available, providing the high performance fixed or reversible polarity high voltage lenses required to focus the Ion Beam. Both the Main Chassis and Lens Chassis are 19” rack mountable. Focused Ion Beam is typically used in the semiconductor industry, materials science and increasingly in the biological field for imaging, etching and deposition of materials.

The Main Chassis provides an Acceleration voltage up to 35kV, with floating Filament, Extractor and Suppressor outputs, all designed to the exacting performance requirements for FIB applications. The Lens Chassis offers Lens voltages up to 30kV, with fixed or Reversible polarity. All outputs are offered with ultra-low output ripple, excellent regulation, stability, temperature coefficient, drift and accuracy specifications. Isolation and control of the respective floating sources is provided via Spellman’s proprietary high voltage isolation techniques. Customer control of this integrated FIB power supply system is accomplished via a fiber optic interface. All high voltage safety interlocks are of a failsafe hardware based design. The FIB is CE marked and is designed to be compliant with applicable IEC, UL and SEMI standards. Consult factory for final configuration requirements.

**SPECIFICATIONS**

- **Input Voltage:**
  +24Vdc, ±5% @ 5.5 amps maximum.
  Inrush is <6 amps for 1 second.

- **Safety Fuse:**
  A 5 x 20mm ceramic fuse changeable from the outside and marked with the fuse value.

- **Power Switch:**
  A shielded rocker switch allows the unit to be switched ON and OFF from the rear panel.

- **Environmental:**
  - **Operating Temperature:**
    +10°C to +45°C ambient for normal operation.
    The unit will operate from 0°C but will require an extended warm up period.
  - **Storage Temperature:**
    -20°C to +60°C
  - **Humidity:**
    0 to 80% RH, non-condensing
  - **Altitude:**
    2000 meters ASL at full power. For altitudes above 2000 meters the maximum ambient operating temperature is linearly derated by 1.1°C per 300 meter interval.

- **Mechanical:**
  - Main chassis (rack mountable): See dimension drawings
  - Lens chassis (rack mountable): See dimension drawings

- **Weight:**
  - Main chassis: <66.12 lbs. (<30kg)
  - Lens chassis: <22.04 lbs. (<10kg)

- **Software:**
  All communications to the power supply is through a fiber optic link operating at 19.2 kbaud, or Ethernet. A basic self-test capability is provided. This self-test will verify internal consistency of the HVPS, including internal supply voltage levels, reference voltages, firmware integrity, etc. However, the HVPS will not change any output voltages during this test.

- **Regulatory Approvals:**

**TYPICAL APPLICATIONS**

- Focused Ion Beam (FIB)
- Ion Gun Controller
ACCELERATOR SUPPLY

Output Voltage: 0 V to +35 kV, referenced to ground.
100V absolute accuracy

Output Current: 30μA maximum

Current Limit: 30μA maximum

Load Regulation: ±0.01% of maximum for 0-100% rated current change

Line Regulation: 100mV over input power range

Ripple: 200mV p-p, from 0.1Hz to 1MHz at 30kV and 30μA

Temperature Coefficient: 25ppm/°C

Stability: 1.5V/10 hours after 2 hour warm-up

Programming: 16 bit resolution, 0V to +35kV

Monitoring: 14 bit resolution, 0V to +35kV, ±1% accuracy (±50V offset)
           14 bit resolution, 0μA to 30μA, ±1% accuracy (±0.3μA offset)

Response: <1.0 second

FILAMENT SUPPLY

Output Voltage: 0 to 5Vdc, referenced to Accelerator, current controlled

Output Current: 0 to 5 amp, 5mA absolute accuracy

Load Regulation: ±0.1% of maximum for 0 to maximum rated voltage change

Line Regulation: 5mA over input power range

Ripple: 10mA p-p, from 0.1Hz to 1MHz

Temperature Coefficient: 200 ppm/°C

Stability: 5 mA/10 minutes after 2 hour warm-up

Programming: 16 bit resolution, 0A to 5A

Monitoring: 16 bit resolution, 0V to 5V, ±4% accuracy (±0.1V offset)
           16 bit resolution, 0μA to 30μA, ±4% accuracy (±50mA offset)

Response: < 0.10 sec, >5A/s measured between 10% to 90% or 90% to 10%

SUPPRESSOR SUPPLY

Output Voltage: -2 kV to +2kV, referenced to Accelerator,
±20V absolute accuracy

Output Current: 30μA

Current Limit: 30μA

Load Regulation: ±0.01% of maximum for 0 to maximum rated voltage change

Line Regulation: 100mV over input power range

Ripple: 150mV p-p, from 0.1Hz to 1MHz

Temperature Coefficient: 25 ppm/°C

Stability: 0.5 V/10 hours after 2 hour warm-up

Programming: 16 bit resolution, -2kV to +2kV

Monitoring: 14 bit resolution, -2kV to +2kV, ±1% accuracy (±8V offset)
           14 bit resolution, 0μA to 30μA, ±1% accuracy (±0.3μA offset)

Response: <0.25 sec

EXTRACTOR SUPPLY

Output Voltage: 0 to -15kV, referenced to Accelerator,
100V absolute accuracy

Output Current: 400μA

Current Limit: programmable, 8 bit resolution, 0 μA to 400μA, (default value on supply enable is 400μA)

Load Regulation: ±0.01% of maximum for 0 to maximum rated voltage change

Line Regulation: 100 mV over input power range

Ripple: 100mV p-p, from 0.1Hz to 1MHz at 30μA and below

Temperature Coefficient: 25 ppm/°C

Stability: 0.5 V/10 hours after 2 hour warm-up

Programming: 16 bit resolution, 0V to -15kV

Monitoring: 16 bit resolution, 0V to -15kV, ±1% accuracy (±15V offset)
           16 bit resolution, 0μA to 400μA,
           10μA to 400μA, ±3% accuracy (±5μA offset)
           0μA to 10μA, > 5kV, ±0.05μA accuracy (±0.05μA offset)

Response: <1 sec
           >1.33kV/s measured between 10% to 90% and 90% to 10%

Trips: Hard trip at 400μA in <0.25 sec programmable trip delay (for when current at I limit), 0 sec to 255 sec, 8 bit resolution (5 sec minimum, 20 second default)
LENS 1 SUPPLY

Output Voltage:
0kV to +30 kV referenced to ground
100V absolute accuracy

Output Current:
30μA

Current Limit:
30μA

Load Regulation:
±0.01% of maximum for 0 to maximum rated current change

Line Regulation:
100mV over input power range

Ripple:
100mV p-p, from 0.1Hz to 1MHz

Temperature Coefficient:
25 ppm/°C

Stability:
1.0 V / 10 hours after 2 hour warm-up

Programming:
16 bit resolution, 0 to +30kV

Monitoring:
16 bit resolution, 0kV to +30kV, ± 1% accuracy (±30V offset)
16 bit resolution, 0μA to +30μA, ± 3% accuracy (±1μA offset)

Response:
<0.1 s
<4 sec to reach <2V away from steady state for 20kV to 18kV change.
<4 sec to reach <2V away from steady state for 18kV to 20kV change.
>6.0kV/s measured between 10% to 90% or 90% to 10%

Wobble Range:
2V to 2.5kV peak to peak, sinusoidal. If wobbling occurs near zero, the wobble waveform will be clipped so as to prevent crossing zero.

Wobble Period:
1 second to 4 seconds

Additional Bipolar:
The above specifications do not apply in the range -500V to +500V. Operation at 0V output is not a requirement. The module must enable at 0V output. Programming and monitoring is offset binary.

Indicators:
Power On:
A green LED illuminates when 24Vdc is applied to the unit

Interlock:
A yellow LED illuminates when the interlock(s) are made

Interlocks:
If the interlock is not present communication over the optical bus will remain operational.
Output voltages will be <1000V in <30 seconds when the interlock opens. The interlock will deactivate the power supply via relay contacts and will not reactivate until the supply is enabled through the computer control, even though the interlock may close.
Panel removal: all outputs disabled
Upper column: All outputs except lens 2 disabled
Lens 2: Disable only the lens 2 output
The individual modules of the HVPS can be enabled and disabled through computer control, provided the appropriate hardware interlocks are enabled.

Lens Supply Options:

<table>
<thead>
<tr>
<th>Lens 1</th>
<th>Lens 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>+30kV</td>
<td>+25kV/-15kV</td>
</tr>
<tr>
<td>-30kV</td>
<td>+25kV/-15kV</td>
</tr>
<tr>
<td>+/-30kV</td>
<td>+/-30kV</td>
</tr>
<tr>
<td>+/-20kV</td>
<td>+/-30kV</td>
</tr>
</tbody>
</table>

LENS 2 SUPPLY

Output Voltage:
-30kV to +30kV referenced to ground
100V absolute accuracy

Polarity:
Bipolar

Output Current:
30μA

Current Limit:
30μA

Load Regulation:
±0.005% of maximum for 0 to maximum rated current change

Line Regulation:
100mV over input power range

Ripple:
200mV pk-pk, from 0.1Hz to 1MHz

Temperature Coefficient:
25 ppm/°C

Stability:
1.0V / 10 hours after 2 hour warm-up
INPUT POWER—
AMP/TYCO 2-PIN MATE-N-LOCK

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>I/O</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24Vdc</td>
<td>I</td>
<td>Power input</td>
</tr>
<tr>
<td>2</td>
<td>0V</td>
<td>I</td>
<td>Power ground</td>
</tr>
</tbody>
</table>

MAIN HV CONNECTOR

The main high voltage output is fitted with a custom 4 pole receptacle. See page 5 of 6 for detail.

INTERLOCK—
9 PIN FEMALE D CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Not used</td>
<td>Not connected internally</td>
</tr>
<tr>
<td>2</td>
<td>Not used</td>
<td>Not connected internally</td>
</tr>
<tr>
<td>3</td>
<td>Not used</td>
<td>Not connected internally</td>
</tr>
<tr>
<td>4</td>
<td>Not used</td>
<td>Not connected internally</td>
</tr>
<tr>
<td>5</td>
<td>+ Upper Column Interlock</td>
<td>Current limited interlock supply</td>
</tr>
<tr>
<td>6</td>
<td>- Upper Column Interlock</td>
<td>Opto isolated interlock input</td>
</tr>
<tr>
<td>7</td>
<td>+ Lens 2 Interlock</td>
<td>Current limited interlock supply</td>
</tr>
<tr>
<td>8</td>
<td>- Lens 2 Interlock</td>
<td>Opto isolated interlock input</td>
</tr>
<tr>
<td>9</td>
<td>Shield/Ground</td>
<td>Ground</td>
</tr>
</tbody>
</table>

Switch closure turns ON or enables the supplies

RJ45 ETHERNET CONNECTOR —

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TD+</td>
<td>TD+</td>
</tr>
<tr>
<td>2</td>
<td>TCT (3V3)</td>
<td>TCT (3V3)</td>
</tr>
<tr>
<td>3</td>
<td>TD-</td>
<td>TD-</td>
</tr>
<tr>
<td>4</td>
<td>RD+</td>
<td>RD+</td>
</tr>
<tr>
<td>5</td>
<td>RCT (3V3)</td>
<td>RCT (3V3)</td>
</tr>
<tr>
<td>6</td>
<td>RD-</td>
<td>RD-</td>
</tr>
<tr>
<td>7</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>OV (reference)</td>
<td>OV (reference)</td>
</tr>
<tr>
<td>9</td>
<td>OV (reference)</td>
<td>OV (reference)</td>
</tr>
<tr>
<td>10</td>
<td>OV (reference)</td>
<td>OV (reference)</td>
</tr>
<tr>
<td>11</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>12</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

The RJ45 socket is fitted for future use, it is configured for 10/100 Mb/s systems using the IEEE 802.3 serial management interface and can only be used for this purpose and is fitted with a blanking plug

LENS 1 CONNECTOR—Lemo ERA3Y430CTL

LENS 2 CONNECTOR—Lemo ERA3Y430CTL

FIBER CONNECTOR

The fiber optics communications connector is a dual channel Avago HFBR- 2524z/1524z connector.

INTERCONNECTIONS BETWEEN CHASSIS

COMMUNICATIONS

The main chassis is provided with a 9 pin D connector which connects via a “one to one” cable to the same connector on the lens chassis. This allows the main chassis to control and monitor the lens outputs. An additional connector is provided on the lens chassis to allow a second lens chassis to be connected to the base unit via the first lens chassis.

INTERCONNECTION POWER—
AMP/TYCO 3-PIN MATE-N-LOCK

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>I/O</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OV</td>
<td>I</td>
<td>DC24V Common</td>
</tr>
<tr>
<td>2</td>
<td>N/C</td>
<td>I</td>
<td>No Connection</td>
</tr>
<tr>
<td>3</td>
<td>+ 24V</td>
<td>I</td>
<td>DC24V Input</td>
</tr>
</tbody>
</table>

Power is transferred between the two chassis via 3 pin “Mate-n-Lok” style connectors. This is interlocked via the main chassis.

An additional power connector is also provided on the lens chassis to allow 24V to be provided to a second lens chassis.

Input and Output cables are not provided with unit.

Interconnect cables are provided with the unit.

Consult factory for available options.
Lens Chassis

DIMENSIONS: in.[mm]

SIDE VIEW

TOP VIEW

17.01 [431.8]

15.95 [405.5]

17.25 [438.0]

FRONT VIEW

19.01 [482.6]

1.75 [44.5]

18.32 [465]

REAR VIEW
Spellman’s FIBX power supply is an integrated multiple output high voltage power supply specifically designed for focused ion beam. Typical applications include transmission and scanning electron microscopy; semiconductor analysis, milling and repair; disc drive head trimming, ion beam etching and focused ion-beam lithography.

A modular design approach allows individual sub-assemblies to be easily configured in a common rack mounted 6U chassis assembly. Interface, logic and control circuitry utilizes surface mount technology, minimizing cost and size. Spellman’s leadership in patented power conversion technology and proprietary high voltage packaging and encapsulation techniques provides reliable and fault free operation in all FIB operating environments.

Individual supplies (Accelerator, Filament, Extractor, Suppressor or Lens) are designed to exacting application specific standards, with ultra low output ripple, excellent regulation, stability, temperature coefficient, drift and accuracy specifications. Isolation and control of the respective floating sources are provided via Spellman’s proprietary high voltage isolation techniques.

Customer control of this integrated FIB power supply system is accomplished via a fiber optic isolated RS-232 interface. All high voltage safety interlocks are of a fail-safe hardware based design. The FIBX is CE marked and is designed to be compliant with applicable IEC, UL and SEMI standards.

TYPICAL APPLICATIONS
Transmission scanning electron microscopy
Scanning electron microscopy
Semiconductor analysis, milling and repair
Ion beam etching
Focused ion-beam lithography

SPECIFICATIONS
Input Voltage: 105 to 240 Vac, 47 to 63 Hz

ACCELERATOR SUPPLY Referenced to Ground
Output Voltage: 0 to +45 kV
Output Current: 30 μA
Ripple: 200 mV p-p, from 0.1 Hz to 1 MHz
Line Regulation: 100 mV for +/-10% line change
Load Regulation: ±0.01% of maximum voltage for full load change
Stability: 1.5 volts/10 hours after 2 hour warm-up
Temperature Coefficient: 25 ppm/°C

FILAMENT SUPPLY Referenced to Accelerator
Output Voltage: 0 to 5 Vdc
Output Current: 0 to 5 A
Ripple: 10 mA p-p from 0.1 Hz to 1 MHz
Line Regulation: 5 mA for +/-10% line change
Load Regulation: ±0.1% of maximum voltage for full load change
Stability: 5 mA/10 minutes after 2 hour warm-up
Temperature Coefficient: 200 ppm /°C
SUPPRESSOR SUPPLY  Referenced to Accelerator
Output Voltage:  -2 kV to +2 kV
Output Current:  30 μA
Ripple:  150 mV p-p from 0.1 Hz to 1 MHz
Line Regulation:  100 mV for +/-10% line change
Load Regulation:  ±0.01% of maximum voltage for full load change
Stability:  500mV/10 hours after 2 hour warm-up
Temperature Coefficient:  25 ppm/°C

EXTRACTOR SUPPLY  Referenced to Accelerator
Output Voltage:  0  to -15 kV
Output Current:  400 μA
Ripple:  100 mV p-p, from 0.1 Hz to 1 MHz at 30 μA and below
Line Regulation:  100 mV for +/-10% line change
Load Regulation:  ±0.01% of maximum voltage for full load change
Stability:  500mV/10 hours after 2 hour warm-up
Temperature Coefficient:  25 ppm/°C

LENS 1 SUPPLY  Referenced to Ground
Output Voltage:  0  to -40 kV
Output Current:  30 μA
Ripple:  150 mV p-p from 0.1 Hz to 1 MHz
Line Regulation:  100 mV for +/-10% line change
Load Regulation:  ±0.01% of maximum voltage for full load change
Stability:  500 mV/10 hours after 2 hour warm-up
Temperature Coefficient:  25 ppm/°C

LENS 2 SUPPLY  Referenced to Ground
Output Voltage:  0  to +25 kV
Output Current:  30 μA
Ripple:  150 mV p-p from 0.1 Hz to 1 MHz
Line Regulation:  100 mV for +/-10% line change
Load Regulation:  ±0.005% of maximum voltage for full load change
Stability:  1.0 volts/10 hours after 2 hour warm-up
Temperature Coefficient:  25 ppm/°C

Remote Interface:
A fiber optic isolated RS232 interface is provided for remote digital control and monitoring of all power supplies and their functions.

Environmental:
Operating temperature:  10°C to 40°C
Storage temperature:  -30°C to 70°C
Humidity:  10% to 90%, non-condensing

Connectors:
Accelerator, Filament and Suppressor:  75kV, 3 conductor Federal Standard Xray connector
Extractor:  LGH 2I
Lens 1:  LGH 3I
Lens 2:  LGH 21

Input Voltage:
IEC320 EMI filtered input connector

Dimensions:
Industry standard 6U rack mounted chassis
10.5˝ High X 19˝ Wide X 21˝ Deep
26.7 cm X 48.3 cm X 53.34 cm

Weight:
Approximately 73 lbs (33 kg)

Regulatory Approvals:
Compliant to EEC EMC Directive. Compliant to EEC Low Voltage Directive. Designed to meet SEMI S2. UL/CUL recognized file E227588 (FIBX3434, FIBX3548, FIB35/655, MFIBX3193)
The EBM powers E-Beam Columns in Scanning Electron Microscopes providing acceleration, bias and filament sources in a single compact package. Spellman’s proprietary HV packaging and encapsulation technology gives dramatic improvements in size, cost and performance compared to other SEM power supply offerings. The EBM provides a highly regulated, low noise, ultra stable accelerator supply programmable from 0 to -30kV at 170μA. The EBM has floating bias and filament supplies referenced to the accelerator. Programming signals utilize differential analog inputs to minimize external noise and offset voltages effects. A ground referenced accelerator current monitor is provided. The EBM is arc and short circuit immune, along with over voltage and over current protection.

**TYPICAL APPLICATIONS**
- Scanning Electron Microscope

**SPECIFICATIONS**

**Input Voltage:**
+24Vdc, ±5%

**High Voltage Outputs:**

**ACCELERATOR:**
- **Voltage:** 0V to -30kV full load with respect to ground
- **Current:** 170μA maximum, continuous from -300V to -3kV
- **Accuracy:** ±2% or ±15V (whichever is greater)
- **Load Regulation:** ≤±100ppm
- **Line Regulation:** ≤±100ppm for 22.8V to 26.4V line change
- **Ripple:** ≤15ppm p-p at -30kV, 170μA, maximum bias and filament output
- **Temperature Coefficient:** ≤100ppm/°C
- **Stability:** 8ppm/3 minutes at 150μA load current after 1 hour warm up

**BIAS:**
- (Referenced to Accelerator)
- **Voltage:** 0 to +3.5kV (max allowable output limited to 2kV)
- **Current:** 150μA maximum
- **Accuracy:** ±5% of full scale

**FILAMENT:**
- **Power:** 0 to 15W
- **Load Resistance:** 1 ±5%
- **Accuracy:** ±3% of FS or 0.1V, which ever is greater
- **Load Regulation:** <2% for 10% change in load resistance
- **Line Regulation:** <1% for 10% line change
- **Ripple:** ≤0.1% p-p max
- **Temperature Coefficient:** ≤300ppm/°C
- **Stability:** 100ppm/10 minutes

**INTERFACE:**

**Input:**
- Analog control for beam energy, filament and bias

**Output:**
- Mini75 receptacle (Claymount CA11 or similar)

**Temperature:**
- Operating: 0°C to +45°C
- Storage: -20°C to +75°C

**Humidity:**
- 0 to 85% RH, non-condensing

**Dimensions:**
- 4.13˝H x 9.85˝W x 7.48˝D (105mm x 250mm x 190mm) excluding any mounting brackets

**Weight:**
- <22 lbs. (10kg)

**Regulatory Approvals:**
- RoHS compliant.
DIMENSIONS: in.[mm]

FRONT VIEW

TOP VIEW

SIDE VIEW
Spellman’s EBM-FEG Series is an integrated multiple output high voltage power supply specifically designed to drive Scanning Electron Microscope (SEM) Columns. Spellman’s extensive knowledge in this application has enabled us to develop a range of technology platforms that can be customized to meet the demanding requirements of SEM.

The main Acceleration Voltage is a high stability 30kV supply, with integrated floating Filament, Extractor and Suppressor outputs required to drive Field Emission, Cold Cathode and Schottky Electron Sources in a compact solution with extenders to mount in a 19” rack. All outputs are offered with ultra-low output ripple, excellent regulation, stability, temperature coefficient, drift and accuracy specifications. Isolation and control of the respective floating sources is provided via Spellman’s proprietary high voltage isolation techniques.

Customer control of this integrated EBM-FEG power supply system is accomplished via a fiber optic interface. All high voltage safety interlocks are of a failsafe hardware based design and the EBM-FEG is CE marked and is designed to be compliant with applicable IEC, UL and SEMI standards. Spellman’s EBM-FEG offers exceptional performance with low ripple, micro-discharge, and ppm level stability for unprecedented image quality and resolution.

**TYPICAL APPLICATIONS**
- Scanning Electron Microscopes (SEM)
- Electron Beam Controller

**SPECIFICATIONS**

**Input Voltage:**
+24Vdc, ±5% @ 4 amps maximum. Inrush is <6 amps for 1 second.

**Safety Fuse:**
A 5 x 20mm ceramic fuse changeable from the outside and marked with the fuse value.

**Leakage Current:**
<200μA to case

**Power Switch:**
A shielded rocker switch allows the unit to be switched ON and OFF from the front panel.

- **Integrated Accelerator and Electron Source Supplies**
- **Very Low Ripple and Ultra Stable Outputs**
- **Robust Arc and Short Circuit Protection**
- **Designed to Minimize Micro-discharge Events**
- **Optically Isolated Digital Interface**
- **CE Marked & Designed to Meet SEMI S2**

**Environmental:**
- **Operating Temperature:**
  +10°C to +45°C ambient for normal operation.
  The unit will operate from 0°C but will require an extended warm up period.
- **Storage Temperature:**
  -20°C to +60°C
- **Humidity:**
  0 to 80% RH, non-condensing
- **Altitude:**
  2000 meters ASL at full power. For altitudes above 2000 meters the maximum ambient operating temperature is linearly derated by 1.1°C per 300 meter interval.

**Mechanical:**
The unit is provided with a pair of removable mounting flanges; these allow the unit to mount in a 19” rack system. The unit can be operated in any orientation. An M5 x 23mm protective ground stud is mounted in the vicinity of the HV connector

**Weight:**
<48.5 lbs. (<22kg)

**Regulatory Approvals:**

**Beam Energy Supply**

**Output Voltage:**
20V to 30kV, negative polarity. A conditioning voltage of 32.5kV with no load current is settable. The output will not exceed 35kV under any condition. The output can be set to OFF which disables the Beam Energy converter, in this case the output will be <60 volts.

**Output Current:**
200μA maximum, 20kV to 30kV

**Output Current Trip Level:**
250μA ±10% The output is disabled and latched off with a delay of approximately 1 second. The program voltage is set to zero.

**Accuracy (Voltage Program):**
<1% or ±10V (whichever is greater) over control range

**Voltage Control:**
16 bit, resolution 0.5V, full scale = 32,768 volts

**Linearity:**
-20 to -30kV ±25V
Load Regulation: 
<±100mV for a 30μA to 200μA load change

Line Regulation: 
<±10ppm from 22.8V to 26.4V line change

Ripple: 
<50mV-p-p @ 0μA to 200μA, 0.1Hz to 20MHz

Temperature Coefficient: 
<10ppm/˚C from +10˚C to +45˚C,
<5ppm/˚C from +20˚C to +30˚C

Stability: 
<200mV/15 minute period after 1 hour warm up under constant operating conditions.

Voltage Monitor: 
16 bit, resolution 0.5V. Accuracy with respect to actual output voltage is ±2% or ±10V.

Current Monitor: 
12 bit, resolution 100nA, accuracy is ±2% or ±1μA.

Wobble Amplitude: 
0 to 100% modulation in steps of 1%, where 100% is defined as ±5% of the Beam Energy output with a minimum value of ±50V. The peak to peak value is twice the amplitude.

Wobble Period: 
666 to 2000 milliseconds. Adjustable in 1 millisecond steps. A sinusoidal output with 16 points per period. The wobble always starts and stops at a zero crossing.

Stored Energy: 
<850mJ

Filament Supply

Connection: 
The center of the filament is connected to the Beam Energy output. The output can be set to off which disables the filament converter.

Voltage: 
Nominally 1.8V, maximum 3V

Maximum Current: 
3A, control range 0.5A to 3A

Load Resistance: 
Nominal at 0.6Ω

Accuracy: 
± 5mA between 2 and 3 Amperes

Current Control: 
12 bit, resolution 1mA. Full scale = 4.096 Amperes

Linearity: 
± 10mA between 0.5A and 3A

Load Regulation: 
<5mA for 0.4Ω to 1.0Ω change at 3A. (Including output lead)

Line Regulation: 
<1mA for 5% change in supply voltage.

Ripple: 
<1mA-p-p, 20Hz to 10 kHz and <30mV p-p at approximately 100kHz both across 0.6Ω @ 3.0A

Temperature Coefficient: 
<50ppm/˚C

Stability: 
<0.5mA/60 minutes. After one hour warm up under constant operating conditions.

Voltage Monitor: 
12 bit, resolution 2.5V, full scale = 10.24V. Accuracy with respect to actual output voltage: ±5% or ±25V

Current Monitor: 
12 bit, resolution +/-1mA, full scale = 4.096 Amperes. Accuracy with respect to actual output current ±10mA.

Trip OC: 
Open circuit detection, Vout > 5.2 ± 0.1 Volts. All outputs will be disabled and programs set to zero.

Trip Current: 
Over current detected if the output current exceeds 3.15A for ten seconds. All outputs will be disabled and programs set to zero.

Extractor Supply

Voltage: 
0V to 10kV (positive with respect to Beam Energy). Control range +100V to +10kV. The output can be set to OFF which disables the extractor converter.

Current: 
700μA over control range.

Current Trip Level: 
Programmable 0 to 735μA resolution 0.25μA. Accuracy ±2% or 2μA. All outputs shall be disabled and programs set to zero.

Accuracy (Voltage Program): 
<1% or ±20V (whichever is greater) over control range

Voltage Control: 
12 bit, resolution 2.5V, full scale = 10.24kV

Linearity: 
±20V over the control range

Load Regulation: 
<±1V (10μA – 700μA output current change)
<100mV @ 40μA 0.1Hz to 20MHz

Line Regulation: 
<±5ppm for a +/-5% line change

Ripple: 
<100mVp-p at 10kV, 700μA, 0.1Hz – 20MHz

Temperature Coefficient: 
<25ppm/˚C

Stability: 
<0.3V/15 minutes; after one hour warm up under constant operating conditions

Ramp Rate: 
10V/s to 1000V/s

Voltage Monitor: 
12 bit, resolution 2.5V, full scale = 10.24kV. Accuracy with respect to actual output voltage: ±1% or ±20V

Current Monitor: 
12 bit, resolution 0.25μA, full scale = 1.024mA. Accuracy with respect to actual output current: ±2% or ±2μA

Protection: 
Continuous/intermittent arcs to the Beam Energy supply and ground.

Stored Energy: 
<150mJ
Suppressor Supply
Voltage:
0V to 1000V (negative with respect to Beam Energy). Control range 100V to 1000V. The output can be set to OFF which disables the extractor converter.

Current:
<100μA over control range.

Current Trip Level:
100μA ±10% with a nominal five second delay. All outputs will be disabled and programs set to zero.

Accuracy (Voltage Program):
<2% or ±6V (whichever is greater) over control range

Voltage Control:
12 bit, resolution 0.25V, full scale = 1024V

Linearity:
±5V over the control range

Load Regulation:
<120mV for a 10μA to 100μA load current change.

Line Regulation:
<±5ppm for a +/-5% line change

Ripple:
<20mV p-p over control range, 0.1Hz to 20 MHz.

Accuracy (Voltage Program):
<2% or ±6V (whichever is greater) over control range

Temperature Coefficient:
<50ppm/°C

Stability:
<0.3V/15 minutes; after one hour warm up under constant operating conditions

Voltage Monitor:
12 bit, resolution 0.25V, full scale = 1.024kV. Accuracy with respect to actual output voltage: ±2% or ±250mV

Current Monitor:
12 bit, resolution 0.25uA, full scale = 1.024mA. Accuracy with respect to actual output current: ±10%

Protection:
Continuous/intermittent arcs to the Beam Energy or extractor

Stored Energy:
<2.5mJ

Vacuum Interlock:
The vacuum interlock is an optical interlock which is made when light is present on the fiber. When no light is present the interlock is broken and the unit shuts down all of the outputs.

Indicators:
Power On (front panel):
A green LED will be illuminated to indicate that +24V power is present. This LED will be illuminated over the range 22.8 to 25.2 volts and will flash with a 1 second period when out of range.

Vacuum Interlock (front panel):
A yellow LED will be illuminated to indicate that all the vacuum interlock is closed. The vacuum interlock LED must be illuminated for the unit to be able to generate high voltage.

Protection:
All outputs are protected from arcs in the load and continuous short circuit. Dielectric strength test voltage capability of outputs to be 36kV however no output is capable of exceeding this voltage.

All low voltage inputs are protected against over voltages of ±30 Volts. The power input is protected against over voltage and reversed connection.

Over Temperature:
Any semiconductor device exceeding an over temperature condition for greater than ten seconds will initiate a shut down and send an error message.

Shutdown Requirements:
Beam Energy output can be shut down independently. Filament, Suppressor and Extractor outputs (Emission) should be shut down together.

INPUT POWER CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24Vdc</td>
<td>+24Vdc @ 4A</td>
</tr>
<tr>
<td>2</td>
<td>Power Ground</td>
<td>Power Ground</td>
</tr>
</tbody>
</table>

VACUUM INTERLOCK CONNECTOR

The vacuum interlock connector is a dual channel Avago HFBR-2524z/1524z connector.

OPTICAL COMMUNICATIONS CONNECTOR

The fiber optics communications connector is a dual channel Avago HFBR-2524z/1524z connector.

HIGH VOLTAGE OUTPUT CONNECTOR

The main high voltage output will be fitted with a custom 4 pole receptacle:

Mating cable can either be supplied by Spellman or Spellman will provide manufacturing drawings such that the customer can manufacture the cable assembly.

How To Order:

PART NUMBER: EBM30N6/FEG
DIMENSIONS: in.[mm]

**REAR VIEW**

**TOP VIEW**

**SIDE VIEW**

**FRONT VIEW**
The EBM20 powers E-Beam Columns in Thermionic Scanning Electron Microscopes providing acceleration, bias and filament sources in a single compact package. Spellman’s proprietary HV packaging and encapsulation technology gives dramatic improvements in size, cost and performance compared to other SEM power supply offerings. The EBM20 provides a highly regulated, low noise, ultra stable accelerator supply programmable from 0 to -20kV at 200μA. The EBM20 has floating bias and filament supplies referenced to the accelerator. Programming signals utilize differential analog inputs to minimize external noise and offset voltages effects. A ground referenced accelerator current monitor is provided. The EBM20 is arc and short circuit immune, along with over voltage and over current protection.

**TYPICAL APPLICATIONS**
Scanning Electron Microscope

**SPECIFICATIONS**

**Input Voltage:**
+24Vdc, ±5%, 1.5A maximum

**High Voltage Outputs:**

**ACCELERATOR:**
- Voltage: 0V to -20kV full load with respect to ground
- Current: 200μA maximum, continuous from -500V to -20kV
- Accuracy: ±1% from -500V to -20kV
- Load Regulation: <±100ppm, 20μA to 200μA load change
- Line Regulation: <±100ppm for 10% line change
- Ripple: <30ppm p-p at -20kV, 200μA, maximum bias and filament output
- Temperature Coefficient: <100ppm/°C
- Stability: 30ppm/3 minutes at 100μA load current after 1 hour warm up

**BIAS:**
(Referenced to Accelerator)
- Voltage: 0 to +1.5kV (max allowable output limited to 2kV)
- Current: 150μA maximum
- Accuracy: ±3% of full scale
- Line Regulation: <±0.1% for 10% line change
- Ripple: <0.1% p-p
- Temperature Coefficient: <1000ppm/°C
- Stability: 1%/10 minutes

**FILAMENT:**
(Referenced to Accelerator)
- Power: 0 to 12W
- Load Resistance: 1Ω ±5%
- Accuracy: ±3% of FS
- Load Regulation: <1% for 10% change in load resistance
- Line Regulation: <1% for 10% line change
- Ripple: <0.1% p-p max
- Temperature Coefficient: <300ppm/°C
- Stability: 100ppm/10 minutes
INTERFACE:
Input:
  Analog control for accelerator, filament and bias
Output:
  Custom 3 pin receptacle and cable assembly
Temperature:
  Operating: 5°C to +40°C
  Storage: -20°C to +50°C
Humidity:
  20% to 85% RH, non-condensing
Dimensions:
  10.63" H x 2.36" W x 7.87" D (270mm x 60mm x 200mm)
  excluding any mounting brackets
Weight:
  <10 lbs. (4.5kg)
Regulatory Approvals:
  The unit is CE marked against EN61010:2010 safety requirements for electrical equipment for measurement, control and laboratory use and is RoHS compliant.
  The unit is designed to meet: UL61010-1:2012 safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: general requirements and CAN/CSA-C22.2 No.61010-1-12:2015.

POWER INPUT CONNECTOR
3 PIN JST MODEL B 3PS-VH

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24V High Voltage Power Input</td>
<td>+24Vdc Input</td>
</tr>
<tr>
<td>2</td>
<td>0V Input</td>
<td>+24Vdc Common</td>
</tr>
<tr>
<td>3</td>
<td>FG</td>
<td>Chassis Ground</td>
</tr>
</tbody>
</table>

CONTROL AND MONITORING CONNECTOR
10 PIN JST MODEL S10B-EH

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FIL PROG (+)</td>
<td>Filament Program (+) Input</td>
</tr>
<tr>
<td>2</td>
<td>FIL PROG (-)</td>
<td>Filament Program (-) Input</td>
</tr>
<tr>
<td>3</td>
<td>BIAS (+)</td>
<td>Bias (+) Input</td>
</tr>
<tr>
<td>4</td>
<td>BIAS (-)</td>
<td>Bias (-) Input</td>
</tr>
<tr>
<td>5</td>
<td>ACC PROG (+)</td>
<td>Acc Voltage Program (+) Input</td>
</tr>
<tr>
<td>6</td>
<td>ACC PROG (-)</td>
<td>Acc Voltage Program (-) Input</td>
</tr>
<tr>
<td>7</td>
<td>EMS</td>
<td>Emission Current Monitor Output</td>
</tr>
<tr>
<td>8</td>
<td>EMS GND</td>
<td>Emission Current Monitor Grid (0V)</td>
</tr>
<tr>
<td>9</td>
<td>ACC MON</td>
<td>ACC Voltage Monitor Output</td>
</tr>
<tr>
<td>10</td>
<td>ACC MON GND</td>
<td>ACC Voltage Monitor GND (0V)</td>
</tr>
</tbody>
</table>

How to Order:
Standard: PART NO.:EBM20N4/24
HV Cable: PART NO.:HVC30/3IS/LL1650 (1.65m Cable)
The Bertan VS100 high voltage power supply was specifically designed for precision electron beam applications like semiconductor nano-lithography, micro-optics and development mask work. It’s ultra low ripple and excellent stability specifications make it ideal for use in these demanding applications. A switch selectable low and high output current range is featured.

The solid encapsulated high voltage section eliminates any user maintenance issues, while isolating the components from environmental variables. The unit is fully overload, arc and short circuit protected. Remote control programming and monitoring capability is provided. A second high voltage monitor, separate from the control electronics is provided. This allows accurate passive measurement of the high voltage output.

**TYPICAL APPLICATIONS**
- Micro-Optics
- Semiconductor lithography
- Development mask work

**SPECIFICATIONS**
- **Input Voltage:**
  - 220Vac, ±10%, single phase 50/60 Hertz
- **Output Voltage:**
  - 0 to 100kV, negative polarity. Externally switch selectable to 105kV, ±500 volts
- **Output Current:**
  - 0-10µA, low range
  - 0-100µA, high range
  - Switch selectable
- **Line Regulation:**
  - ±0.001% of rated voltage over specified input voltage range
- **Load Regulation:**
  - ≤20V for a current change of 25µA to 60µA and 60µA to 25µA
- **Ripple:**
  - ≤75mV peak to peak

**Partial High Voltage Discharge:**
- less than 200mV

**Stability:**
- 0.001% per 8 hours after a 6 hour warm up, for a temperature of 20°C ±0.2°C

**Temperature Coefficient:**
- 50ppm per degree C over a 10°C to 40°C range

**Environmental:**
- Operating Temperature: 0 to 40 degrees C
- Storage Temperature: -40 to 85 degrees C
- Humidity: 10 to 90% RH, non condensing

**Cooling:**
- Forced Air-control chassis;
- Convection Cooled- high voltage chassis

**Front Panel:**
- Power ON/OFF switch
- HV ON/OFF switch
- HV ON/OFF indicator
- Analog output voltage meter

**Dimensions:**
- Control Chassis: 5.25” H X 19” W X 15.3” D
  (13.3cm X 48.3cm X 38.4cm)
- HV Chassis: 10.25” H X 19” W X 27” D
  (26.7cm X 48.3cm X 55.9 cm)

**Weight:**
- Control Chassis: 20 pounds (9kg)
- HV Chassis: 116 pounds (50kg)

**Interface Connector:**
- 19 pin Burndy GOB1619SNE
  (mating connector provided)

**AC Input Connector:**
- 3 pin IEC320 input socket

**Output HV Connector:**
- Claymount 2050-073

**Output HV Cable:**
- Detachable at rear panel, cable not provided.
### Remote Interface Connector

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>-5V Reference</td>
<td>-5.0 volts @ 10mA output</td>
</tr>
<tr>
<td>B</td>
<td>Voltage Programming</td>
<td>0 to -5V = 0 to 100% rated output</td>
</tr>
<tr>
<td>C</td>
<td>Spare</td>
<td>N/C</td>
</tr>
<tr>
<td>D</td>
<td>Spare</td>
<td>N/C</td>
</tr>
<tr>
<td>E</td>
<td>Monitor Common</td>
<td>Ground</td>
</tr>
<tr>
<td>F</td>
<td>HV Status</td>
<td>TTL High = HV OFF, TTL Low = HV ON</td>
</tr>
<tr>
<td>G</td>
<td>+5V</td>
<td>5 volts @ 250mA output</td>
</tr>
<tr>
<td>H</td>
<td>Interlock</td>
<td>Ground or TTL low to enable interlock</td>
</tr>
<tr>
<td>J</td>
<td>Program Common</td>
<td>Ground</td>
</tr>
<tr>
<td>K</td>
<td>Spare</td>
<td>N/C</td>
</tr>
<tr>
<td>L</td>
<td>Spare</td>
<td>N/C</td>
</tr>
<tr>
<td>M</td>
<td>Spare</td>
<td>N/C</td>
</tr>
<tr>
<td>N</td>
<td>Spare</td>
<td>N/C</td>
</tr>
<tr>
<td>P</td>
<td>Voltage Monitor</td>
<td>0 to -5V = 0 to 100% rated output</td>
</tr>
<tr>
<td>Q</td>
<td>Current Monitor</td>
<td>0 to -5V = 0 to 100% rated output</td>
</tr>
<tr>
<td>R</td>
<td>Program Common</td>
<td>Ground</td>
</tr>
<tr>
<td>S</td>
<td>Spare</td>
<td>N/C</td>
</tr>
<tr>
<td>T</td>
<td>Spare</td>
<td>N/C</td>
</tr>
<tr>
<td>U</td>
<td>Spare</td>
<td>N/C</td>
</tr>
<tr>
<td>V</td>
<td>Spare</td>
<td>N/C</td>
</tr>
</tbody>
</table>

### HV Chassis

- **Dimensions:** in.[mm]
  - Control Chassis: 19.00 [483]
  - Remote Interface Connector: 15.13 [384]
  - Back View: 18.31 [465.12]
  - Front View: 10.50 [267]
  - Top View: 22.00 [559]

### Spellman High Voltage Electronics Corporation

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Spellman High Voltage Electronics, the leading independent supplier of Power Feed Equipment to the Telecom industry, has developed a new generation of Low Voltage Power Feed Equipment, (PFE-LV). This proposed new PFE-LV is targeted at the emerging requirements for shorter submarine cable installations, while addressing underlying markets issues such as lower cost, smaller footprint, and easier operation.

**KEY FEATURES**
- Redundancy is provided for the converters (1+1)
- Simplified sliding drawers for PFE open, grounding, test modes
- Redundancy is provided for the LCU. In case of failure of LCU, the PFE will continue to operate normally
- LCU contains pull-out 17” LCD screen, keyboard, trackball and CPU
- Simplified keylock scheme ensures safety of operating personnel
- Highly visible Vacuum Fluorescent Display (VFD) on each Converter displays voltage, current and modes of operation
- Unique protective “trap door” barrier allows a converter or test load to be replaced safely while the PFE is still powering the cable

**SPECIFICATIONS**

**Output Voltage:**
- 6kV maximum rated continuous operation, 5kV nominal

**Output Current:**
- 1.2A maximum rated continuous operation, 1.0A nominal

**Output Power:**
- 5kW for 1+1 redundancy

**Input Voltage:**
- -40.5 VDC to -60 VDC

**Programming:**
- Full-featured programming, monitoring, alarms, diagnostics, and ramping functions provided via LCU module.

**Monitoring:**
- Full local and remote monitoring via Ethernet connection.

**Current Ripple:**
- 10mA peak to peak of maximum output

**Voltage Ripple:**
- 0.2% peak to peak of maximum output

**Current Stability:**
- 0.1% (constant load) after a 4 hour warm up

**Operating Temperature:**
- 5 to 40°C operating

**Storage Temperature:**
- -40 to +85°C storage

**Humidity:**
- 5% to 85%, non-condensing

**Cooling:**
- Forced Air

**Dimensions:**
- 86.68”H x 23.64”W x 23.64”D
  - (2200mm x 600mm x 600mm)

**Weight:**
- 900 pounds (335.9kg)

**Regulatory Approvals:**
Spellman High Voltage Electronics, the leading independent supplier of Power Feed Equipment to the Telecom industry, has developed a new generation of High Voltage Power Feed Equipment, (PFE-HV). This PFE-HV is targeted at the emerging requirements for longer submarine cable installations, while addressing underlying issues such as lower cost, smaller footprint, and easier operation.

KEY FEATURES

Redundancy is provided for the converters (n+1)
Simplified sliding drawers for PFE open, grounding, test modes
Redundancy is provided for the LCU. In case of failure of LCU, the PFE will continue to operate normally
LCU contains pull-out 17” LCD screen, keyboard, mouse pad and CPU
Simplified keylock scheme ensures safety of operating personnel
Highly visible Vacuum Fluorescent Display (VFD) on the output module (OMU) and each converter displays voltage, current and modes of operation
Unique protective “trap door” barrier allows a converter to be replaced safely while the PFE is still powering the cable

SPECIFICATIONS

Output Voltage:
18kV maximum rated continuous operation, up to 15kV nominal

Output Current:
1.8A maximum rated continuous operation, 1.5A nominal

Output Power:
Up to 22.5kW for n+1 redundancy

Input Voltage:
-40.5Vdc to -60Vdc

Programming:
Full-featured programming, monitoring, alarms, diagnostics, and ramping functions provided via LCU module.

Monitoring:
Full local and remote monitoring via Ethernet connection.

Current Ripple:
10mA peak to peak of maximum output

Voltage Ripple:
0.2% peak to peak of maximum output

Current Stability:
0.1% (constant load) after a 4 hour warm up

Operating Temperature:
5 to 40°C operating

Storage Temperature:
-40 to +85°C storage

Humidity:
5% to 85%, non-condensing

Cooling:
Forced Air

Dimensions: (per bay)
86.68”H x 23.64”W x 23.64”D
(2200mm x 600mm x 600mm)

Weight: (per bay)
900 pounds (335.9kg)

Regulatory Approvals:
(X4146, X4147, X4148, X4149, X4750)
Spellman High Voltage is the leading independent supplier of Power Feed Equipment to the Telecom industry and most frequently utilized power supplies for shipborne uses. Our shipborne Power Feed Equipment (PFE-SB) is known for its reliability and quality. It is used with repeatered fiber optic cable systems for telecommunications and has been installed on numerous cable laying ships around the world.

**SPECIFICATIONS**

**Output Voltage and Current:**

<table>
<thead>
<tr>
<th>Voltage</th>
<th>1 Slave</th>
<th>2 Slaves</th>
<th>3 Slaves</th>
<th>5 Slaves</th>
</tr>
</thead>
<tbody>
<tr>
<td>10kV</td>
<td>1.3A</td>
<td>2.0A</td>
<td>2.5A</td>
<td></td>
</tr>
<tr>
<td>12kV</td>
<td>1.1A</td>
<td>1.65A</td>
<td>2.2A</td>
<td></td>
</tr>
<tr>
<td>15kV</td>
<td>0.8A</td>
<td>1.2A</td>
<td>1.6A</td>
<td>2.0A</td>
</tr>
<tr>
<td>20kV</td>
<td>1.0A</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Each system has 1 Master generator and X Slaves

**Input Voltage:**
- 220Vac 3 phase
- 380/415/440Vac 3 phase via autotransformer

**Current Ripple:**
- 10mA peak to peak of maximum output

**Voltage Ripple:**
- 0.25% p-p of maximum output, voltage or current regulated

**Current Stability:**
- 0.1% (constant load) after a 4 hour warm up

**Operating Temperature:**
- 5 to 40°C operating

**Storage Temperature:**
- -40 to +85°C storage

**Humidity:**
- 5% to 85%, non-condensing

**Cooling:**
- Forced Air

**Dimensions:**
- 68.93"H x 70.86"W x 31.49"D (1751mm x 1800mm x 800mm)

**Weight:**
- 900 pounds (410kg)

**Regulatory Approvals:**
- Compliant to 2014/EU (Low Voltage Directive)

**KEY FEATURES**

- **3kV to 20kV Versions Available**
- **Local or Remote-Controlled Electronic Test Load Capable of Dissipating 24kW**
- **Up and Down Ramp Rates for Voltage and Current**
- **Programable Electroding Functions Provided**
- **Built-in Data Logging Function**
- **Alarm and Trip Functions**

**Clamp/Safety Chassis:**
Protects the repeaters/cable and PFE. A HV relay and dump circuit will quickly and safely discharge the system in case of emergency shutdown.

**Output Control:**
Using either the Master front panel or SMT; the system output can be operated in constant current or constant voltage control and as a feed for a single end, double end or branched line.

**System Management Terminal (SMT):**
An advanced touchscreen control and monitoring system, the SMT can be installed within the PFE cabinets or remotely up to 80m from the PFE. Features include:
- Full output control and monitoring
- Ramp up and down in current or voltage control
- User set alarm and trip system
- Output voltage and current logging
- Event logging
- Tone generator 10-40Hz

**Patch Panel:**
User configurable interconnects from Converter(s) to Electronic Load or Cable Termination Cubicles (CTC’s).

**Electronic Load:**
Fully isolated and actively adjustable resistance by a user. The electronic load allows input voltages from 600V to 12,000V in either polarity.

**Interlock System:**
Full protection for user and connected equipment. All PFE access panels and patch panel connections are interlocked. External connection terminals provided to allow connection to CTCs, associated equipment or external E-Stop circuits.
Optional Cable Termination Cubicle (CTC12/377):
Used to safely accommodate half joints and bare cables for installation and repairs. The CTC provides a safe, interlocked enclosure for connection of the PFE HV to the cable conductors. 2 clamps and strain relief allow the fiber core to be separated and safely routed out of the box to external optical equipment.
Spellman’s new DGM935 high voltage power supply for Image Intensifier applications continues to set the standards for high voltage power conversion technology. The DGM series can be adapted to suit specific requirements with a wide selection of multiple output voltages and power capabilities in a compact package, making it perfect for the OEM user.

Monitoring of all output voltages is possible via local test points. The unit can operate in four modes selectable via three inputs. The output voltages are independently adjustable in each mode by the pre-set potentiometer located on the front of the unit.

**TYPICAL APPLICATIONS**
- Radiology
- Cardiology
- Neuroradiology
- Night Surveillance
- Non Destructive X-Ray Inspection
- Image Intensifiers

**SPECIFICATIONS**

**Input Voltage:**
+24Vdc ±1%

**Input Current:**
500mA maximum

**Output Voltages:**
- **Anode:**
  - Output Voltage: 30kV
  - Output Current: 30μA
- **Electrode 1:**
  - Output Voltage: 50V to 300V
  - Output Current: 0 to 1μA
- **Electrode 2:**
  - Output Voltage: 300V to 2kV
  - Output Current: 0 to 1μA
- **Electrode 3:**
  - Output Voltage: 2kV to 18kV
  - Output Current: 0 to 18μA

**Test Point Terminals:**
Wire type suitable for clip on probe.

**Output Terminals (0V, OVP and GND):**
6.3mm Fast-on connector and M4 x 12mm stud

**Output Connector Anode:**
M14 X 1 thread, 53mm deep x 8.5mm internal diameter.

**Output Connector (electrodes 1 & 2):**
5/16 x 32 UNF thread, 26.5mm deep x 5mm internal diameter.

**Inputs PC and G:**
6.3mm Fast-on connector

**Note:** 0V, OVP and GND are all connected together internally.
All outputs are protected against high voltage breakdown in the user’s equipment and short-circuit protected.

**Ripple:**
<0.3%

**Temperature Coefficient:**
<200ppmK⁻¹

**Stability:**
<0.3% over 8 hrs

**Temperature:**
- Operating: +5°C to +55°C

**Input:**
8 pin header

**Dimensions:**
6.30”H x 5.51”W x 1.93”D (160mm x 140mm x 49mm)

**Weight:**
2.86 lb. (1.5kg)

**Regulatory Approvals:**
DIMENSIONS: in.[mm]

TOP VIEW
(A)
Configuration

0.19 [5.0]
5.12 [130.0]
0.15 [4.0]
5.98 [152.0]
6.30 [160.0]

FRONT VIEW

0.29 [7.2]
1.93 [49.0]
0.29 [7.2]
0.39 [10.0]
0.76 [20.0]
0.78 [20.0]
0.94 [24.0]
1.89 [48.0]
0.47 [12.0]

SIDE VIEW

INPUT 8 PIN HEADER

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24V Power Input</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0V Power Ground</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0V Power Ground</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>24V Linked internally to pin1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>M2 Mode select input 2</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>M1 Mode select input 1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>N/C N/C</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>M3 Mode select input 3</td>
<td></td>
</tr>
</tbody>
</table>

ALTERNATE CONFIGURATIONS AVAILABLE
(Specify at time of order)

(B)
Configuration

(C)
Configuration
Spellman’s new DGM945 high voltage power supply for Image Intensifier applications continues to set the standards for high voltage power conversion technology.

The DGM945 also has inputs to allow measurement of the photocathode current and getter current. The photocathode measurement has two ranges: sensitive range: 0 to 50nA and a standard range: 0 to 15μA. The sensitive input is used to provide a monitor output with a sensitivity of 0.1V/nA. The getter input allows measurement of the getter current, indicating if the Image Intensifier tube is still holding a good vacuum and is without gases causing ions.

Monitoring of all output voltages is possible via local test points or over the serial interface. The unit can also store up to eight modes of operation. The output voltages are independently adjustable in each mode either by the rotary encoders built into the unit or via the serial interface.

The DGM series can be adapted to suit specific requirements with a wide selection of multiple output voltages and power capabilities in a compact package, making it perfect for the OEM user.

TYPICAL APPLICATIONS

Radiology
Cardiology
Neuroradiology
Night Surveillance
Non Destructive X-Ray Inspection
Image Intensifiers

SPECIFICATIONS

Input Voltage:  
+24Vdc ±10%

Input Current:  
500mA maximum

Programmable Output Voltages:

Anode:
- Output Voltage: 30kV
- Output Current: 5μA continuous (50μA peak)

Electrode 1:
- Output Voltage: 10V to 350V
- Output Current: 0 to 10μA

Electrode 2:
- Output Voltage: 200V to 2kV
- Output Current: 0 to 10μA

Electrode 3:
- Output Voltage: 2kV to 20kV
- Output Current: 0 to 20μA

Electrode 4:
- Output Voltage: 2.7kV
- Output Current: 0 to 10μA

Ripple:  
<0.3%

Temperature Coefficient:  
<200ppmK⁻¹

Stability:  
<0.3% over 8 hrs

Temperature:
- Operating: +5°C to +55°C

Input Connector:
- 15 pin male sub D

Dimensions:
- 5.47”H x 5.67”W x 1.97”D (139mm x 144mm x 50mm)

Weight:
- 2.86 lb. (1.3kg)

Regulatory Approvals:
- UL/CUL recognized, File E242588. RoHS Compliant.
**Test Point Terminals:**
Copper pad plus 1.1 mm Ø pth.

**Output Terminals (0V, OVP and GND):**
6.3mm Fast-on connector and M4 x 12mm stud

**Output Connector Anode:**
LGH1

**Output Connector (other electrodes):**
LGH½

**Inputs PC and G:**
6.3mm Fast-on connector

Note: 0V, OVP and GND are all connected together internally.
All outputs are protected against high voltage breakdown in the user’s equipment and short-circuit protected.

---

**INPUT 15 PIN MALE D CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0V</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>2</td>
<td>RxD</td>
<td>RS-232 receive data input</td>
</tr>
<tr>
<td>3</td>
<td>TxD</td>
<td>RS-232 transmit data output</td>
</tr>
<tr>
<td>4</td>
<td>0V</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>5</td>
<td>0V</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>UC2</td>
<td>Mode select input 2</td>
</tr>
<tr>
<td>7</td>
<td>0V</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>8</td>
<td>OVP</td>
<td>Power return</td>
</tr>
<tr>
<td>9</td>
<td>DTR</td>
<td>RS-232 Data terminal ready output</td>
</tr>
<tr>
<td>10</td>
<td>CTS</td>
<td>RS-232 Clear to send input</td>
</tr>
<tr>
<td>11</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>12</td>
<td>Ipc</td>
<td>Ipc = 10nA / volt</td>
</tr>
<tr>
<td>13</td>
<td>UC3</td>
<td>Mode select input 3</td>
</tr>
<tr>
<td>14</td>
<td>UC1</td>
<td>Mode select input 1</td>
</tr>
<tr>
<td>15</td>
<td>24V</td>
<td>Power input</td>
</tr>
</tbody>
</table>

---

**INPUT/OUTPUT CONNECTORS**

**TOP VIEW**

**SIDE VIEW**

**FRONT VIEW**

**DIMENSIONS:** in.[mm]

---

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e-mail: sales@spellmanhv.com

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Spellman’s CZE1000R is a full feature rack mountable high voltage power supply ideal for laboratory usage. It’s designed to meet the needs of applications requiring a hot switched reversible output voltage. The output polarity can be quickly and safely reversed via a front panel switch.

Both the output voltage and current are fully adjustable from 0 to 30kV and 0 to 300μA via front panel ten turn locking counting dials. Remote control operation is done by 0 to +10Vdc programming signals; either user generated or using the provided +10 Vdc reference and external potentiometers.

Front panel voltage and current meters provide local monitoring. Voltage and current test points are provided such that 0 to 10Vdc corresponds to 0 to 100% rated output. A two position, normally closed, external interlock is provided for protection of external high voltage accessible areas. If the interlock is opened the high voltage will shut off and fall to zero in less than one second and not be able to be re-energized until the interlock is closed.

Excellent load and line regulation specifications along with outstanding stability and low ripple of the CZE1000R assure a stable high voltage output for consistent process results.

**TYPICAL APPLICATIONS**
- Electrospinning
- Mass Spectrometry
- Capillary Electrophoresis
- Electrostatic Research

**OPTIONS**
- 220Vac Input Voltage
- Rear Panel HV Output

**SPECIFICATIONS**
- **Input Voltage:**
  - 115Vac, ±10%, 50/60Hz
- **Input Current:**
  - Less than 1 amp
- **Efficiency:**
  - 75% typical
- **Output Voltage:**
  - 0 to 30kV
- **Polarity:**
  - Auto reversible via front panel switch

**Output Current:**
- 0 to 300μA

**Power:**
- 9 watts, maximum

**Line Regulation:**
- 0.01% for a 10% input voltage change

**Load Regulation:**
- 0.01% for a full load change

**Ripple:**
- 0.1% Vp-p

**Stability:**
- 0.02% per 8 hours (after 1/2 hr warmup)

**NL Time Constant:**
- 100ms

**Stored Energy:**
- 0.2 Joules at 30kV

**Temperature Coefficient:**
- 100ppm/°C

**Operating Temperature:**
- 0°C to 40°C

**Storage Temperature:**
- -40°C to 85°C

**Humidity:**
- 10% to 85% RH, non condensing

**Cooling:**
- Convection cooled

**Dimensions:**
- 5.25”H x 19”W x 17”D (13.3cm x 48.3cm x 43.2cm).

**Weight:**
- 22lbs. (10kg)

**Interface Connector:**
- 14 pin terminal block

**AC Input Connector:**
- IEC320 connector with 6’ (1.83m) cord

**HV Output Connector:**
- Detachable 36˝ (0.91m) cable provided

**Regulatory Approvals:**

www.spellmanhv.com/manuals/CZE1000R
## CZE1000R TERMINAL BLOCK 14 PIN

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+10Vdc Reference Output</td>
<td>+10Vdc, 4mA maximum</td>
</tr>
<tr>
<td>2</td>
<td>Internal Voltage Control</td>
<td>Front Panel Program Voltage (programming potentiometer)</td>
</tr>
<tr>
<td>3</td>
<td>Voltage Program Input</td>
<td>0 to 10Vdc = 0 to 100% rated output, Zin =10MΩ</td>
</tr>
<tr>
<td>4</td>
<td>Internal Current Control</td>
<td>Front Panel Current Control (programming potentiometer)</td>
</tr>
<tr>
<td>5</td>
<td>Current Program Input</td>
<td>0 to 10Vdc = 0 to 100% rated output, Zin =10MΩ</td>
</tr>
<tr>
<td>6</td>
<td>Signal Common</td>
<td>Ground</td>
</tr>
<tr>
<td>7</td>
<td>Voltage Test Point</td>
<td>0 to 10Vdc = 0 to 100% rated output, Zout =10kΩ</td>
</tr>
<tr>
<td>8</td>
<td>Current Test Point</td>
<td>0 to 10Vdc = 0 to 100% Rated Output, Zout =10kΩ</td>
</tr>
<tr>
<td>9</td>
<td>External Interlock Out</td>
<td>32Vdc @ 2 amps, max, (connect to pin 10 through safety switch)</td>
</tr>
<tr>
<td>10</td>
<td>External Interlock In</td>
<td>Return for interlock (connect to pin 9 through safety switch)</td>
</tr>
<tr>
<td>11</td>
<td>+10Vdc Reference Output</td>
<td>+10Vdc, 4mA maximum</td>
</tr>
<tr>
<td>12</td>
<td>Enable</td>
<td>Open or ground = HV OFF; &gt;3.4Vdc (up to 15Vdc) = HV ON</td>
</tr>
<tr>
<td>13</td>
<td>Spare</td>
<td>No Connection</td>
</tr>
<tr>
<td>14</td>
<td>Spare</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

### Note:
The unit is shipped with the following pins jumpered for front panel operation: 2-3, 4-5, 9-10, 11-12. It is strongly recommended to remove the 9-10 jumper and use a high voltage safety interlock switch.

### High Voltage Cable:
A mating high voltage connector is provide with the unit. Have a spare on hand or replace broken/lost mating high voltage cables by ordering Spellman part number 105719-034.

## DIMENSIONS: in.[mm]

**FRONT VIEW**
- 2.25 [57.2]
- 5.25 [133]
- 4-PLCS
- 1.48 [38]
- 18.30 [466]
- 19.00 [483]

**TOP VIEW**
- 17.00 [431]

**BACK VIEW**
Spellman’s CZE2000 modular high voltage power supply is ideal for OEM usage. It is specifically designed to meet the needs of applications requiring a hot switched reversible output voltage. The output polarity of the unit can be quickly and safely reversed via the Polarity Control Signal provided on the interface connector.

Both the output voltage and current are fully adjustable via ground referenced remote programming signals such that 0 to 10Vdc corresponds to 0 to 100% rated output voltage and current. Remote motioning functionality is provided by voltage and current test points such that 0 to 10Vdc corresponds to 0 to 100% rated voltage and current. Additionally remote polarity and mode indicators provide a comprehensive overview of power supply operation.

Excellent load and line regulation specifications along with outstanding stability and low ripple assure a stable high voltage output for consistent process results.

**TYPICAL APPLICATIONS**
- Electrospinning
- Mass Spectrometry
- Capillary Electrophoresis
- Electrostatic Research

**SPECIFICATIONS**

**Input Voltage:**
24Vdc, ±10%

**Input Current:**
Less than 1 amp

**Efficiency:**
75% typical

**Output Voltage:**
See selection table

**Output Current:**
See selection table

**Polarity:**
Auto reversible via command

**Power:**
10 watts, maximum

- Ideal for Electrospinning
- 0-30kV Remotely Programmable
- 0-300µA Remotely Programmable
- Polarity Reversible Upon Command in <1 Sec at No Load
- Low Stored Energy, Current Limited Output
- Cost Effective Modular Design

www.spellmanhv.com/manuals/CZE2000

**Line Regulation:**
0.01% for a 10% input voltage change

**Load Regulation:**
0.01% for a full load change

**Ripple:**
0.1% Vp-p

**Stability:**
0.02% per 8 hours (after 1/2 hr warmup)

**NL Time Constant:**
100ms

**Stored Energy:**
0.2 Joules at 30kV

**Temperature Coefficient:**
100ppm/°C

**Operating Temperature:**
0°C to 40°C

**Storage Temperature:**
-40°C to 85°C

**Humidity:**
10% to 85% RH, non condensing

**Cooling:**
Convection cooled

**Dimensions:**
3.5”H x 5”W x 10”D (8.9cm x 12.7cm x 25.4cm).

**Weight:**
6.2lbs. (2.8kg)

**Interface Connector:**
25 pin male D connector

**HV Output Connector:**
Detachable 36˝ (0.91m) cable provided

**Regulatory Approvals:**
Compliant to EEC EMC Directive. Compliant to EEC Low Voltage Directive. UL/CUL recognized file E148969
## CZE2000 SELECTION TABLE

<table>
<thead>
<tr>
<th>MAXIMUM RATING</th>
<th>MODEL NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>kV</td>
<td>mA</td>
</tr>
<tr>
<td>5</td>
<td>2.0</td>
</tr>
<tr>
<td>10</td>
<td>1.0</td>
</tr>
<tr>
<td>15</td>
<td>0.67</td>
</tr>
<tr>
<td>20</td>
<td>0.50</td>
</tr>
<tr>
<td>30</td>
<td>0.30</td>
</tr>
</tbody>
</table>

## CZE2000 25 PIN MALE D CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24Vdc Return</td>
<td>Power Return</td>
</tr>
<tr>
<td>2</td>
<td>+24Vdc Return</td>
<td>Power Return</td>
</tr>
<tr>
<td>3</td>
<td>+24Vdc Return</td>
<td>Power Return</td>
</tr>
<tr>
<td>4</td>
<td>HV Enable/Inhibit</td>
<td>Open or &lt;1Vdc = HV OFF, &gt;3.4Vdc (up to 15Vdc) = HV ON</td>
</tr>
<tr>
<td>5</td>
<td>Voltage Test Point</td>
<td>0 to 10Vdc = 0 to 100% rated output, Zout =10kΩ, 1%</td>
</tr>
<tr>
<td>6</td>
<td>Current Test Point</td>
<td>0 to 10Vdc = 0 to 100% rated output, Zout =10kΩ, 1%</td>
</tr>
<tr>
<td>7</td>
<td>Chassis Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>8</td>
<td>Remote Voltage Control</td>
<td>0 to 10Vdc = 0 to 100% Rated Output, Zin =10MΩ</td>
</tr>
<tr>
<td>9</td>
<td>Remote Current Control</td>
<td>0 to 10Vdc = 0 to 100% Rated Output, Zin =10MΩ</td>
</tr>
<tr>
<td>10</td>
<td>+10Vdc Reference Output</td>
<td>+10Vdc, 4mA maximum</td>
</tr>
<tr>
<td>11</td>
<td>Signal Return</td>
<td>Signal Return</td>
</tr>
<tr>
<td>12</td>
<td>Polarity Control</td>
<td>Open or &gt;3.4Vdc (up to 15Vdc) = Positive Polarity, Grounded or &lt;1Vdc = Negative Polarity</td>
</tr>
<tr>
<td>13</td>
<td>Positive Polarity Indicator</td>
<td>+24Vdc sourced through a 100Ω series limiting resistor, +24Vdc = active signal</td>
</tr>
<tr>
<td>14</td>
<td>+24Vdc Input</td>
<td>Power Input</td>
</tr>
<tr>
<td>15</td>
<td>+24Vdc Input</td>
<td>Power Input</td>
</tr>
<tr>
<td>16</td>
<td>Chassis Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>17</td>
<td>Negative Polarity Indicator</td>
<td>+24Vdc sourced through a 100Ω series limiting resistor, +24Vdc = active signal</td>
</tr>
<tr>
<td>18</td>
<td>I Mode Indicator</td>
<td>Open collector pulled up internally to +15Vdc through 2.7kΩ resistor with a 470Ω limiting resistor in series. Transistor OFF = signal active</td>
</tr>
<tr>
<td>19</td>
<td>V Mode Indicator</td>
<td>Open collector pulled up internally to +15Vdc through 2.7kΩ resistor with a 470Ω limiting resistor in series. Transistor OFF = signal active</td>
</tr>
<tr>
<td>20</td>
<td>Return Current Test Point</td>
<td>0 to 10Vdc = 0 to 100% rated output current, as measured returned from load. Zout =10kΩ, 1%</td>
</tr>
<tr>
<td>21</td>
<td>Load Return</td>
<td>High Voltage Return Point. Required for GFI circuit functionality</td>
</tr>
<tr>
<td>22</td>
<td>Ground Fault Indicator</td>
<td>Open collector pulled up internally to +15Vdc through 4.7kΩ resistor with a 470Ω limiting resistor in series. Transistor OFF = signal active</td>
</tr>
<tr>
<td>23</td>
<td>Spare</td>
<td>No Connection</td>
</tr>
<tr>
<td>24</td>
<td>Spare</td>
<td>No Connection</td>
</tr>
<tr>
<td>25</td>
<td>Spare</td>
<td>No Connection</td>
</tr>
</tbody>
</table>
Spellman’s CCM1KW capacitor charging module is designed to provide up to 1000 Joules per second at an output voltage up to 4000 Volts. The power factor corrected AC input, small package size and both a comprehensive and minimal analog interface simplifies integrating the CCM1KW into your OEM system design. Available in either positive or negative polarity, the CCM1KW is fully arc, open and short circuit protected. Units can be operated in parallel for applications requiring higher power (see manual for details).

**TYPICAL APPLICATIONS**
UV light sources for curing and sterilization
Industrial and medical laser applications

**SPECIFICATIONS**

**Input Voltage:**
90-264 Vac, 50/60 Hertz, power factor corrected input ≥0.98

**Input Current:**
14 Amps worst case, 1000 Joules per second
7 Amps worst case, 500 Joules per second

**Efficiency:**
>85%

**Output Power:**
1000 Joules per second, 500 Joules per second

**Output Voltage:**
0-1kV, 0-2kV and 0-4kV version available

**Output Polarity:**
Positive or negative, specify at time of order

**Stored Energy:**
Less than 0.2 Joules

**Pulse to Pulse Repeatability:**
±0.2% up to 1kHz

**Temperature Coefficient:**
≤100ppm per degree C

**Fault Diagnostic System:**

Over Temperature and Over Voltage
Over Voltage Fault is latched requiring AC power recycle to clear.
Over Temperature Fault is latched but can be cleared via inhibit/fault reset line.

**Environmental:**

- **Temperature Range:**
  Operating: 0˚C to 40˚C
  Storage: -40˚C to 85˚C

- **Humidity:**
  10% to 90% RH, non-condensing

**Cooling:**
Forced air

**Input Line Connector:**
2 position Phoenix MSTB connector, straight and right angle mating connector provided

**HV Output Connector:**
Standard: Kings/Winchester Electronics SHV 1707-1
Optional: Amphenol MHV UG-931/U

**Interface-A Connector:**
15 pin D, female

**Interface-B Connector:**
4 pin male Molex 705530038

**Ground Stud:**
10-32, nut supplied

**Dimensions:**
3” H X 6” W X 9” D (76.2mm x 152.4mm x 228.6mm)

**Mounting:**
M4 screw. Max. depth is 0.188” (4.78mm)

**Weight:**
6.9lb. (3.13kgs)

**Regulatory Approvals:**
Compliant to 60601-1-1. Compliant to 60601-1-2. UL/CUL recognized file E242584. RoHS compliant.

www.spellmanhv.com/manuals/CCM1KW
**AC INPUT—2 POSITION TERMINAL BLOCK**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AC Input High/Phase 1</td>
<td>Line Hot/Phase 1</td>
</tr>
<tr>
<td>2</td>
<td>AC Input Low/Phase 2</td>
<td>Line Neutral/Phase 2</td>
</tr>
</tbody>
</table>

**ANALOG INTERFACE A—15 PIN FEMALE D CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Inhibit/Fault Reset</td>
<td>Ground = HV Enable, Open/+15Vdc = HV Inhibit</td>
</tr>
<tr>
<td>2</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>3</td>
<td>OverTemp Fault</td>
<td>No OT Fault = +15Vdc @ 3mA, OT Fault = Ground</td>
</tr>
<tr>
<td>4</td>
<td>Signal Ground</td>
<td>Signal Ground (optional)*</td>
</tr>
<tr>
<td>5</td>
<td>Voltage Program</td>
<td>0 to 10Vdc = 0 to 100% rated output voltage</td>
</tr>
<tr>
<td>6</td>
<td>Overvoltage Status</td>
<td>No OVP = +15Vdc @ 3mA, OVP Fault = Ground</td>
</tr>
<tr>
<td>7</td>
<td>Peak Hold Monitor</td>
<td>Peak output voltage displayed, 0 to 10Vdc = 0 to 100% rated output voltage with a 5 second time constant</td>
</tr>
<tr>
<td>8</td>
<td>Voltage Monitor</td>
<td>0 to 10Vdc = 0 to 100% rated output voltage, ±1%</td>
</tr>
<tr>
<td>9</td>
<td>+15Vdc</td>
<td>+15Vdc @ 150mA, maximum**</td>
</tr>
<tr>
<td>10</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>11</td>
<td>+15Vdc</td>
<td>+15Vdc @ 150mA, maximum (optional)**</td>
</tr>
<tr>
<td>12</td>
<td>Signal Ground</td>
<td>Signal Ground (optional)*</td>
</tr>
<tr>
<td>13</td>
<td>End of Charge</td>
<td>Charging = +15Vdc @ 1.5mA, End of Charge = Ground</td>
</tr>
<tr>
<td>14</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>15</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
</tbody>
</table>

Note: Output status signals are NMOS transistor controlled, 100mA maximum sink current. Actual signals are 5kΩ pull ups to the internal +15Vdc logic source.
*Optional interface signals can be provided to be compatible with other pre-existing legacy interfaces. On standard units these signals are N/C.
**+15Vdc ±10% is provided on the standard unit. Optional +12Vdc ±5%/100mA, maximum can be provided.

**INTERFACE B—4 PIN MALE D HEADER**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Inhibit/Fault Reset</td>
<td>Ground = HV Enable, Open/+15Vdc = HV Inhibit</td>
</tr>
<tr>
<td>2</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>3</td>
<td>Voltage Program</td>
<td>0 to 10Vdc = 0 to 100% rated output voltage</td>
</tr>
<tr>
<td>4</td>
<td>+15Vdc</td>
<td>+15Vdc @ 150mA, maximum (optional)*</td>
</tr>
</tbody>
</table>

**CCM1KW SELECTION TABLE**

<table>
<thead>
<tr>
<th>kW</th>
<th>JOULES/SECOND</th>
<th>MODEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>500</td>
<td>CCM1*500</td>
</tr>
<tr>
<td>2</td>
<td>500</td>
<td>CCM2*500</td>
</tr>
<tr>
<td>4</td>
<td>500</td>
<td>CCM4*500</td>
</tr>
<tr>
<td>1</td>
<td>1000</td>
<td>CCM1*1000</td>
</tr>
<tr>
<td>2</td>
<td>1000</td>
<td>CCM2*1000</td>
</tr>
<tr>
<td>4</td>
<td>1000</td>
<td>CCM4*1000</td>
</tr>
</tbody>
</table>

*Specify P for positive or N for negative
500 J/S units have a single internal fan, 1000 J/S units have both an internal and external fan.

**TYPICAL GRAPH FOR CCM1P1000**

By utilizing a unique inverter topology, a reduction in peak power is achieved for the same average output power.

Straight and right angle AC input mating connectors are provided.

**OPTION ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>OPTION</th>
<th>OPTION CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MHV UG-931/U HV Connector</td>
<td>MHV</td>
</tr>
<tr>
<td>Legacy Interface Signals</td>
<td>L</td>
</tr>
</tbody>
</table>

**OPTION ORDERING EXAMPLE**

CCM4P1000/MHV

<table>
<thead>
<tr>
<th>Model</th>
<th>Voltage</th>
<th>Polarity</th>
<th>J/S</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**OPTION ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>OPTION CODE</th>
<th>OPTION CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MHV</td>
<td>MHV</td>
</tr>
<tr>
<td>L</td>
<td>L</td>
</tr>
</tbody>
</table>
CCM1KW
CAPACITOR
CHARGING MODULE

500 Joules per second
(unit with internal fan)
DIMENSIONS: in.[mm]

REAR VIEW

FRONT VIEW

BOTTOM VIEW

1000 Joules per second
(unit with internal and external fan)
DIMENSIONS: in.[mm]

REAR VIEW

FRONT VIEW

BOTTOM VIEW

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e-mail: sales@spellmanhv.com

www.spellmanhv.com
Spellman High Voltage is an ISO 9001 and ISO 14001 registered company
Copyright © 2012 Spellman High Voltage Electronics Corp.
Spellman’s CCM capacitor charging module is designed to provide 3100 joules per second at an output voltage up to 4000 Volts. With a power density of 6.6 watts per cubic inch, the CCM packs more than 30% more power into the same volume when compared to other commercially available units. The power factor corrected AC input, small package size and comprehensive analog interface simplifies integrating the CCM into your OEM system design. Available in either positive or negative polarity, the CCM is fully arc, open and short circuit protected.

TYPICAL APPLICATIONS
- UV light sources for curing and sterilization
- Industrial and medical laser applications
- ICP-MS applications

SPECIFICATIONS

Input Voltage:
- Power factor corrected input ≥0.98
- 180-264Vac @ 20.3A, 47-63Hz, fused via externally accessible fuses

Efficiency:
- >85%

Output Power:
- 3100 Joules per second, average

Output Voltage:
- 4000 Volts, maximum

Output Polarity:
- Positive

Pulse to Pulse Repeatability:
- ±0.6% up to 120Hz

Temperature Coefficient:
- ≤100ppm per degree C

Fault Diagnostic System:
- Over Temperature, Over Voltage and Open Load sensing

Environmental:
- Temperature Range:
  - Operating: 0˚C to 40˚C
  - Storage: -40˚C to 85˚C
- Humidity:
  - 10% to 90% RH, non-condensing

Cooling:
- Forced air

Ground Stud:
- M6 X10mm, M6 nut supplied

Input Line Connector:
- 2 position Phoenix HDFK4 connector

HV Output Connector:
- Kings KV-79-15, Bulkhead mounted

+24Vdc Output Connector:
- AMP #1-350942-0

Dimensions:
- 5.81˝ H X 5.8˝ W X 14˝ D (148mm x 147mm x 356mm)

Weight:
- 14.5lb. (6.6kgs)

Regulatory Approvals:
- Compliant to the EEC EMC directive. Compliant to EEC low voltage directive.
### Auxiliary +24VDC Connector J2 2 Position AMP Connector

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24Vdc</td>
<td>+24Vdc @ 2.2 amps</td>
</tr>
<tr>
<td>2</td>
<td>Ground</td>
<td>Ground</td>
</tr>
</tbody>
</table>

### CCM Analog Interface—J1 15 Pin Female D Connector

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Inhibit</td>
<td>Ground = HV ON, High = HV OFF</td>
</tr>
<tr>
<td>2</td>
<td>Temperature Fault</td>
<td>Fault = OV, no fault = +15Vdc through 6.8kΩ</td>
</tr>
<tr>
<td>3</td>
<td>General Fault</td>
<td>Fault = OV, no fault = +15Vdc through 6.8kΩ</td>
</tr>
<tr>
<td>4</td>
<td>HV ON Indicator</td>
<td>Ground = HV ON, +15Vdc = HV OFF +15Vdc through 6.8kΩ</td>
</tr>
<tr>
<td>5</td>
<td>Voltage Program</td>
<td>0 to 10Vdc = 0 to 100% Rated Output</td>
</tr>
<tr>
<td>6</td>
<td>Open Circuit Detector</td>
<td>Fault = OV; no fault = +15Vdc through 6.8kΩ</td>
</tr>
<tr>
<td>7</td>
<td>Peak Voltage Monitor</td>
<td>0 to 10Vdc = 0 to 100% Rated Output held for 10 seconds at peak level</td>
</tr>
<tr>
<td>8</td>
<td>Voltage Monitor</td>
<td>0 to 10Vdc = 0 to 100% Rated Output, Instantaneous output</td>
</tr>
<tr>
<td>9</td>
<td>+15Vdc Output</td>
<td>+15Vdc @ 150ma output, maximum</td>
</tr>
<tr>
<td>10</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>11</td>
<td>+15Vdc Output</td>
<td>+15Vdc @ 150ma output, maximum</td>
</tr>
<tr>
<td>12</td>
<td>+15Vdc Output</td>
<td>+15Vdc @ 150ma output, maximum</td>
</tr>
<tr>
<td>13</td>
<td>End of charge Indicator</td>
<td>Ground = End of Charge, High Impedance = Charging</td>
</tr>
<tr>
<td>14</td>
<td>Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>15</td>
<td>Ground</td>
<td>Ground</td>
</tr>
</tbody>
</table>

**How to Order:**

Standard: PART NO.: CCM4P3100
Spellman’s new EVA Series is specifically designed for demanding electron beam coating applications. A full featured front panel provides local control, while an extensive analog interface allows remote capability. The included Ethernet and RS-232 digital interfaces simplify integrating the EVA into your system design.

The EVA’s robust IGBT inverter design is inherently fault tolerant. The proprietary low capacitance, low stored energy high voltage output section is ideal for dynamic load and fault conditions encountered in coating applications. Fast arc recovery times (<2ms) minimize process interruptions. Many operational parameters can be configured by the user to suit their particular requirements via the provided graphical user interface (GUI).

An optional filament gun supply is available. The EVA can support one, two or three filament gun supply channels providing unprecedented flexibility and cost effectiveness.

**HARDWARE BASED OPTIONS**

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3PH</td>
<td>180-264Vac Three Phase Input (3kW &amp; 6kW only)</td>
</tr>
<tr>
<td>1PH</td>
<td>180-264Vac Single Phase Input (6kW &amp; 12kW only)</td>
</tr>
<tr>
<td>400VAC</td>
<td>360-528Vac, Three Phase Input (6kW &amp; 12kW only)</td>
</tr>
<tr>
<td>LL(X)</td>
<td>High Voltage Cable Length</td>
</tr>
<tr>
<td>HV2</td>
<td>Two High Voltage Output Connectors</td>
</tr>
<tr>
<td>HV3</td>
<td>Three High Voltage Output Connectors</td>
</tr>
<tr>
<td>FIL1</td>
<td>Filament Gun Supply—One Channel</td>
</tr>
<tr>
<td>FIL2</td>
<td>Filament Gun Supply—Two Channels</td>
</tr>
<tr>
<td>FIL3</td>
<td>Filament Gun Supply—Three Channels</td>
</tr>
<tr>
<td>HPF</td>
<td>50 Amp Filament Supply</td>
</tr>
</tbody>
</table>

**SOFTWARE CONFIGURABLE FEATURES**

- Adjustable Overload Trip
- Arc Trip Count
- Arc Quench Time
- Arc Reramp Time
- Arc Window Time

**3/6/12kW HV SPECIFICATIONS**

**Input Voltage:** (must be specified at time of order)

- Option 3PH: 180-264Vac, 50/60Hz, three phase, 90% efficiency, 0.85 power factor
- Option 1PH: 180-264Vac 50/60Hz, single phase, 90% efficiency, 0.65 power factor (3kW & 6kW only)
- Option 400VAC: 360-528Vac 50/60Hz, three phase, 90% efficiency, 0.85 power factor (6kW & 12kW only)

**Input Current:**

- Option 3PH: 180-264Vac, 50/60Hz, three phase
  - 3kW—13 amps, maximum
  - 6kW—25 amps, maximum
  - 12kW—50 amps, maximum
- Option 1PH: 180-264Vac, 50/60Hz, single phase
  - 3kW—29 amps, maximum
  - 6kW—57 amps, maximum
- Option 400VAC: 360-528Vac, 50/60 Hz, three phase
  - 6kW—13 amps, maximum
  - 12kW—25 amps, maximum

**Output Voltage:**

- 5kV @ 600mA, negative polarity. 3kW maximum.
- 10kV @ 600mA, negative polarity. 6kW maximum.
- 10kV @ 1200mA, negative polarity. 12kW maximum.

**Local Output Controls:**

- Voltage is continuously adjustable over entire range via a 10 turn potentiometer.

**Voltage Regulation:**

- Load: 0.05% of full voltage +500mV for full load change.
- Line: 0.05% of full voltage +500mV over specified input range.

**Ripple:**

- <3% Vrms

**Stability:**

- 0.02%hr. after 1 hour warm-up.

**Temperature Coefficient:**

- 100ppm/°C.

**Environmental:**

- Temperature Range:
  - Operating: 0°C to 40°C
  - Storage: -40°C to 85°C
- Humidity:
  - 10% to 90% RH, non-condensing.

**Cooling:**

- Forced air; inlet through side panels, outlet at rear panel

**Metering:**

- Front panel digital voltage and current meters, 3.5 digit, accurate to within 1%.
3/6/12KW HV SPECIFICATIONS

System Status Display:
“Dead Front” type indicators provide status of up to 12 system parameters including voltage regulation, fault conditions and circuit control.

Input Power Connector:
A 6 foot (1.8 meter) long captive line cord will be provided.

Analog Interface Connector:
50 pin female D connector

High Voltage Output Cable:
10 ft (3.05m) shielded high voltage cable, removable at rear panel.

Dimensions:
3kW/6kW Units:
5.25”(3U)H x 19” W x 21” D (133mm x 482mm x 533mm)
12kW Units:
10.5”(6U)H x 19” W x 21” D (266mm x 482mm x 533mm)

Weight:
3kW/6kW Units: 46 pounds (20.87kg)
12kW Units: 90 pounds (40.82kg)

Regulatory Approvals:

Digital Interface
The EVA features a standard RS-232 and Ethernet digital interface, simplifying power supply communication requirements saving the user time and money, while enhancing functionality and overall capability. Spellman provides a GUI allowing customization of operational features while also providing basic power supply functionality and control via a sample simulated front panel.

Arc Intervention
Spellman’s EVA power supplies sense arc events via a fast acting current sense transformer. The arc intervention circuitry prevents power supply damage from continuous, long term arcing. Customers can change arc intervention parameters (Arc Count, Arc Quench, Reramp Time, and Window Time) within preset limits via the provided GUI. Customized units can be configured for unique arc prone environments, contact Spellman for details.

Additional High Voltage Output Connectors
Spellman’s EVA is designed to provide 1, 2 or 3 parallel configured high voltage output connectors. The standard unit provides one high voltage output connector. If you intend to use the EVA in a multi channel application but want to utilize your own filament power supply, this factory installed option provides the additional high voltage connections required. Hardware Option HV2 provides two high voltage output connectors, while Hardware Option HV3 provides three high voltage output connectors.

Optional Beam Controller (Filament Power Supply) and Gun Output Box

Multiple beam control units can be provided, allowing 1, 2 or 3 separate electron guns to be independently operated.

Each beam control unit consists of a beam controller and a gun output box. The beam controller is a 1U rack-mounted chassis containing the filament power, control and emission regulation circuitry. The gun output box contains the high frequency filament transformer which is referenced to the high voltage output potential. This box should be mounted close to the electron gun to minimize the length of the high current filament connections. The box also contains electron gun emission current monitoring circuitry and provides a feedback signal used to regulate the electron gun emission current.

Each beam control channel, if operated alone, can utilize 0 to 100% of the rated emission current capacity. When two or three beam control channels are used at the same time, the total system emission current capacity remains the same. Individual channel programming must be done such that the total current does not exceed the system’s total emission current available.

BEAM CONTROLLER SPECIFICATIONS

Input Voltage:
180-264 Vac, 50/60Hz, single phase, 7.5 amps maximum

Output Voltage/Current:
0-12Vrms at = 30kHz, 0-35 amps. An optional 50 amp filament (HPF) is available.

Metering:
Front panel digital filament current and emission current meters, 3.5 digit, accurate to within 1%.

System Status Display:
“Dead Front” type indicators provide status of up to 12 system operations including voltage regulation, fault conditions and circuit control.

Input Power Connector:
A 6 foot (1.8 m) long IEC320 Cord Set will be provided.
BEAM CONTROLLER SPECIFICATIONS

**Analog Interface Connector:**
Male 25 pin D connector

**Filament Output Connections:** (gun drive cable)
The secondary leads of the filament power transformer exiting the gun output box are 36” (91.44cm) long. The cover of this box is interlocked for safety purposes.

**Environmental:**
- **Temperature Range:**
  - Operating: 0˚C to 40˚C
  - Storage: -40˚C to 85˚C
- **Humidity:**
  - 10% to 90% RH, non-condensing.

**Cooling:**
Forced air; inlet through side panels, outlet at rear panel.

**Dimensions:**
- **Beam Controller:**
  1.75”H (1U) x 15” W x 19”D (44.5 x 381 x 482.6mm)
- **Gun Output Box:**
  4.06”H x 6.13”W x 11”D (103.2 x 155.7 x 279.4mm)

**Weight:**
- **Beam Controller:**
  18 pounds (8.1kg)
- **Gun Output Box:**
  6 pounds (2.7kg)

Emission current is programmed locally (front panel adjustment) or remotely (0-10Vdc = 0-100% of rated current) via each beam controller. Filament Limit Set Point, Filament PreHeat Set Point, and Automatic Filament PreHeat functionality are provided.

EVA MODEL CONFIGURATION

**Ordering:**
- EVA5N3/1PH: 3 kilowatt unit, single phase
- EVA10N6/3PH: 6 kilowatt unit, three phase
- EVA10N12/400VAC: 12 kilowatt unit, 360-528Vac

Note: Input voltage must be specified at time of order. EVA model number must contain input voltage option code to be valid.

**Sample Options:**
- EVA10N6/1PH/HV2: Single Phase Input & 2 HV Connectors
- EVA10N12/400VAC/FIL3: 360-528Vac Input & 3 Gun Supplies

The signal cable connecting the high voltage power supply to the beam controller is 39.4” (1m) long. A captive but field replaceable 10 foot (3.05m) long high voltage cable is provided to connect each beam control output box to the high voltage power supply.
### HV POWER SUPPLY INTERFACE—50 PIN FEMALE D CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Supply Common</td>
<td>Power Supply Ground</td>
</tr>
<tr>
<td>2</td>
<td>Reset/HV Inhibit</td>
<td>Normally open, Low = Reset/Inhibit</td>
</tr>
<tr>
<td>3</td>
<td>External Interlock</td>
<td>+24Vdc @ open, &lt;25mA @ closed</td>
</tr>
<tr>
<td>4</td>
<td>External Interlock Return</td>
<td>Return for External Interlock</td>
</tr>
<tr>
<td>5</td>
<td>mA Test Point</td>
<td>0-10Vdc = 0-100% rated output, Zout = 1KΩ, 1%</td>
</tr>
<tr>
<td>6</td>
<td>kV Test Point</td>
<td>0-10Vdc = 0-100% rated output, Zout = 1KΩ, 1%</td>
</tr>
<tr>
<td>7</td>
<td>+10Vdc Reference Output</td>
<td>+10Vdc @ 1mA</td>
</tr>
<tr>
<td>8</td>
<td>mA Program Input</td>
<td>0-10Vdc = 0-100% rated output, Zin=10MΩ</td>
</tr>
<tr>
<td>9</td>
<td>Local mA Program Output</td>
<td>0-10Vdc = 0-100% rated output, front panel pot</td>
</tr>
<tr>
<td>10</td>
<td>kV Program Input</td>
<td>0-10Vdc = 0-100% rated output, Zin=10MΩ</td>
</tr>
<tr>
<td>11</td>
<td>Local kV Program Output</td>
<td>0-10Vdc = 0-100% rated output, front panel pot</td>
</tr>
<tr>
<td>12</td>
<td>Remote Power On Output</td>
<td>+24Vdc @ open, &lt;25mA @ closed</td>
</tr>
<tr>
<td>13</td>
<td>Remote Power On Return</td>
<td>Return for Remote Power On</td>
</tr>
<tr>
<td>14</td>
<td>Remote HV Off</td>
<td>+24Vdc @ open, &lt;25mA @ closed, connect to pin 15 for front panel operation</td>
</tr>
<tr>
<td>15</td>
<td>Remote HV Off/On Common</td>
<td>HV On/Off Common</td>
</tr>
<tr>
<td>16</td>
<td>Remote HV On</td>
<td>+24Vdc @ open, &lt;25mA @ closed, momentarily connect to pin 15 for high voltage</td>
</tr>
<tr>
<td>17</td>
<td>HV Off Indicator</td>
<td>+24Vdc @ 25mA = HV Off</td>
</tr>
<tr>
<td>18</td>
<td>HV On Indicator</td>
<td>+24Vdc @ 25mA = HV On</td>
</tr>
<tr>
<td>19</td>
<td>Power Supply Common</td>
<td>Supply Ground</td>
</tr>
<tr>
<td>20</td>
<td>+24Vdc Output</td>
<td>+24Vdc @ 100mA, maximum</td>
</tr>
<tr>
<td>21</td>
<td>Voltage Mode Status</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>22</td>
<td>Current Mode Status</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>23</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Interlock Closed Status</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>25</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Remote Overvoltage Adjust</td>
<td>0-10Vdc = 0-100% rated output</td>
</tr>
<tr>
<td>29</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Over Voltage Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>31</td>
<td>Over Current Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>32</td>
<td>System Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>33</td>
<td>RGLT Error Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>34</td>
<td>Arc</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>35</td>
<td>Over Temp Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>36</td>
<td>AC Fault</td>
<td>Open Collector, Low = Active</td>
</tr>
<tr>
<td>37</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>+5Vdc Output</td>
<td>+5Vdc @ 100mA, maximum</td>
</tr>
<tr>
<td>45</td>
<td>+15Vdc Output</td>
<td>+15Vdc @ 100mA, maximum</td>
</tr>
<tr>
<td>46</td>
<td>-15Vdc Output</td>
<td>-15Vdc @ 10mA, maximum</td>
</tr>
<tr>
<td>47</td>
<td>RS232 1x</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>RS232 Rx</td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>RS232 GND</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>Power Supply Common</td>
<td>Power Supply Ground</td>
</tr>
</tbody>
</table>

### BEAM CONTROLLER INTERFACE—25 PIN FEMALE D CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Supply Common</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>2</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>External Interlock</td>
<td>+15Vdc at Open, &lt;15mA @ Closed</td>
</tr>
<tr>
<td>4</td>
<td>External Interlock Return</td>
<td>Return for Interlock</td>
</tr>
<tr>
<td>5</td>
<td>Filament Current Test Point</td>
<td>0 to 10Vdc = 0 to 100% rated output</td>
</tr>
<tr>
<td>6</td>
<td>Beam Current Test Point</td>
<td>0 to 10Vdc = 0 to 100% rated output</td>
</tr>
<tr>
<td>7</td>
<td>+10Vdc Reference</td>
<td>+10Vdc, 1mA Max</td>
</tr>
<tr>
<td>8</td>
<td>Filament Limit Program Input</td>
<td>0 to 10Vdc = 0 to 100% rated output</td>
</tr>
<tr>
<td>9</td>
<td>Local Filament Limit Program</td>
<td>Front panel potentiometer wiper</td>
</tr>
<tr>
<td>10</td>
<td>Beam Current Program Input</td>
<td>0 to 10Vdc = 0 to 100% rated output</td>
</tr>
<tr>
<td>11</td>
<td>Local Beam Current Program</td>
<td>Front panel potentiometer wiper</td>
</tr>
<tr>
<td>12</td>
<td>Filament Preheat Program In</td>
<td>0 to 10Vdc = 0 to 100% rated output</td>
</tr>
<tr>
<td>13</td>
<td>Local Fil. Preheat Program</td>
<td>Internal potentiometer</td>
</tr>
<tr>
<td>14</td>
<td>Beam Off</td>
<td>+15Vdc @ Open, &lt;25mA @ Closed</td>
</tr>
<tr>
<td>15</td>
<td>Beam On/Off Common</td>
<td>Connect together for FP operation</td>
</tr>
<tr>
<td>16</td>
<td>Beam On</td>
<td>Momentarily connect to pin 15 = Beam On</td>
</tr>
<tr>
<td>17</td>
<td>Remote Beam Off Indicator</td>
<td>0=Beam On, +15V, 10mA Max=Beam Off</td>
</tr>
<tr>
<td>18</td>
<td>Remote Beam On Indicator</td>
<td>0=Beam Off, +15V, 10mA Max=Beam On</td>
</tr>
<tr>
<td>19</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Remote PS Fault</td>
<td>0 = Fault, +15Vdc @ 0.1mA = No Fault</td>
</tr>
<tr>
<td>23</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Power Supply Common</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>25</td>
<td>Shield Return</td>
<td>Chassis Ground</td>
</tr>
</tbody>
</table>
3U 6kW Power Supply

**DIMENSIONS:** in.[mm]

**FRONT VIEW**

**TOP VIEW**

**BACK VIEW**

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EVA Beam Controller

Beam Controller Gun Output Box

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www.spellmanhv.com
Spellman’s ESC Series of electrostatic chuck power supplies provide clean and accurate voltages required for electrostatic chuck wafer processing applications. These custom designed, well regulated supplies precisely secure the wafer during lengthy process cycles. Versions are available with a ground referenced reversible output in addition to units featuring a true floating bipolar output with associated floating center tap point. Comprehensive fault diagnostic circuitry monitors power supply functionality and communicates status data to the user interface. Spellman’s ESC Series power supplies are housed in compact, lightweight packages designed for OEM installations requiring minimal system footprint space.

**TYPICAL SPECIFICATIONS**

**ESC5PN25**

Output Configuration:
- Single ground referenced HV output, positive or negative polarity

Input:
- +24Vdc, ±5% @ 2 amps, maximum

Output:
- +2kV to -5kV. 2mA @ +2kV, 5mA @ -5kV

Short Circuit Current Limit:
- 5.5mA, maximum

Output Isolation:
- None, ground referenced output

Slew Rate:
- 80ms, typical

Maximum Cycle Frequency:
- 10 times per second

Overshoot:
- <10% of set point value

Ripple:
- 10Vrms

Line Regulation:
- ±0.7% over specified range

Load Regulation:
- ±0.7% over specified range

Output Voltage Accuracy:
- <2% of set point value between 50-5000Vdc

Program/Monitor Accuracy:
- 1% of full scale, ±50mV

Dimensions:
- 9 W x 1.5 H x 6.1 L (228.6mm x 30.5mm x 155mm)

Weight:
- 4.5lbs. (2kg)

**ESC01.5PN7.5**

Output Configuration:
- Floating, reversible polarity bipolar output with floating center tap

Input:
- +24Vdc, ±10% @ 2 amps, maximum

Output:
- Bipolar, 0 to ±750Vdc (0 to 1500Vdc total) @ 5mA

Short Circuit Current Limit:
- 5.5mA, maximum

Output Isolation:
- Center tap is isolated for ±2kV from ground

Slew Rate:
- 40ms, typical

Maximum Cycle Frequency:
- 10 times per second

Ripple:
- 2.5Vrms

Line Regulation:
- ±0.7% over specified range

Load Regulation:
- ±0.7% over specified range

Output Voltage Accuracy:
- <1% of set point between 50-1500Vdc

Program/Monitor Accuracy:
- 0.5% of full scale, ±50mV

Dimensions:
- 3.4 W x 3 H x 10.5 L (86.5mm x 76.5mm x 266.7mm)

Weight:
- 5lbs. (2.3kg)
Spellman’s Injector Control Assembly (ICA) multi-output high voltage power supplies are used to supply the appropriate electrode voltages to a triode electron gun in order to inject electrons into a Linear Accelerator (LINAC). The resulting high-energy electron pulses are used to create high-energy X-Rays for applications such as cargo screening and cancer therapy.

This multi-output, rack mount power supply provides the Cathode, Heater and Grid voltages required by the e-gun. The Cathode current can be pulsed up to 500Hz. The Heater and Grid supplies float at the Cathode voltage potential, typically up to -15kV. Injector current is regulated by programming the Grid Pulse Voltage. Remote control and monitoring is via standard Ethernet protocols. LED indicators on the front panel provide basic output and fault status, including Cathode Current and Arc faults. The ICA series can be customized for specific system requirements.

**TYPICAL APPLICATIONS**
Cargo screening, cancer therapy

**SPECIFICATIONS**

**Input Voltage:**
100-240Vac, 50-60Hz

**Cathode:**
- Output Voltage: 0 to -15kV
- Pulsed Cathode Current: 200mA to 1500mA
- Mean Cathode Current: 5.5mA (max)
- Current Pulse Width: Up to 6μs (90% to 90%)
- Current Pulse Frequency: Up to 500Hz
- Current Risetime: 200ns (typical)

**Heater:**
- Output Voltage: 0 to -6.5Vdc (wrt Cathode)
- Current: 3A
- Resistance: 0.7ohm

**Grid (fixed):**
- Voltage: -60 to -135Vdc (wrt Cathode)
- Current: 250mA
- Pulse Voltage: 0 to 340Vdc (wrt Cathode)

Injector current is regulated by programming the Grid Pulse Voltage

**Connections:**
- **Front Panel:**
  - Ethernet (RJ45 jack)
  - Interlock (24V nominal, 9 pin D-sub male pin plug)
  - Pulse Input (BNC)
- **Rear Panel:**
  - AC Power In (IEC320 C14 male pin receptacle)
  - HV Out (3 pin terminal block)

**Interlock:**
24V must be present to enable output high voltage cathode. It is intended to connect to the system to disable the ICA in case any system interlocks have not been satisfied.

**Operating Temperature:**
10°C to +40°C

**Storage Temperature:**
-40°C to +70°C

**Humidity:**
30% to 60% relative humidity, non-condensing

**Weight:**
15lbs. (6.8kg)

**Regulatory Approvals:**
The ICA is designed to meet 60601-1, and is RoHS compliant.

**FRONT PANEL LED INDICATORS**

<table>
<thead>
<tr>
<th>INDICATOR</th>
<th>COLOR</th>
<th>CONDITION</th>
<th>Illuminated When...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trigger Present</td>
<td>Green</td>
<td>Input trigger is present</td>
<td></td>
</tr>
<tr>
<td>AC Power</td>
<td>Green</td>
<td>AC supply voltage is present</td>
<td></td>
</tr>
<tr>
<td>Interlock In</td>
<td>Green</td>
<td>Interlock in signal is present</td>
<td></td>
</tr>
<tr>
<td>Arc Fault</td>
<td>Red</td>
<td>Arc fault signal is active</td>
<td></td>
</tr>
<tr>
<td>Cathode Current</td>
<td>Red</td>
<td>Cathode current fault signal is active</td>
<td></td>
</tr>
<tr>
<td>Voltage ON</td>
<td>Amber</td>
<td>Cathode high voltage is present</td>
<td></td>
</tr>
</tbody>
</table>
DIMENSIONS: in.[mm]

FRONT VIEW

TOP VIEW

BACK VIEW
The XRV Controller (XRVC) provides intuitive, touch screen driven programming and control of any of Spellman’s popular XRV Series of X-Ray generators. This sophisticated and robust controller was designed using an embedded computing system running a custom Graphical User Interface (GUI). The GUI, embedded computer and ancillary hardware are housed in a rugged rack mount or bench top chassis. Capability of the XRVC include: creation of custom X-Ray tube seasoning profiles, one shot or continuous user fabricated operational profiles, automatic X-Ray tube configuration and much more.

SPECIFICATIONS

Input Voltage:
180-264Vac, 50/60Hertz

Dimensions:
Rack mount:
5.25”H x 19”W x 13”D (133.35mm x 482.6mm x 330.2mm)
Bench top:
5.21”H x 17”W x 13”D (132.35mm x 431.8mm x 330.2mm)

Weight:
12 lbs (5.44kg)

Input Power Connector:
14 pin circular connector type 97-3102A-22-19P

Environmental:
Temperature Range:
Operating: 0°C to +50°C
Storage: -20°C to +80°C
Humidity:
0% to 95% RH

Cooling:
Convection cooled

Regulatory Approvals:
Compliant to EEC EMC Directive. Compliant to EEC Low Voltage Directive. RoHS Compliant

ADVANCED CONTROLLER FUNCTIONALITY

Seasoning
• Ability to create, save and load customized seasoning profiles (Default profiles are included)
• Real time seasoning progress, elapsed time and remaining time clocks
• Automatic notice when seasoning is required

Communications
• Ability to communicate with the XRV over RS-232 serial port
• Ability to communicate with the XRV over a direct crossover Ethernet connection or Ethernet switch

One Shot Profiles
• Ability to create, save and load customized one shot profiles
• Verification of profiles within the operating capabilities of the connected XRV unit

X-Ray Tube Selection
• Specific X-Ray tubes automatically configures the system with the recommended manufacturers operational profiles
• Supported tubes for automatic configuration can be uploaded into the XRVC

Easy to Use
• Intuitive, touch-centric, menu driven system allows operator use with little to no learning curve.
• Communication settings are retained by the XRVC, requiring only a single configuration session.
• Comprehensive status/control screen provides information on all critical operational parameters and system status indicators.

SOFTWARE FEATURES

• Designed for compact, touch centric environment
• Integrated on screen keyboard provides rich input capabilities for operation without an external keyboard
• Adaptive software detects XRV controller and configures accordingly
• Dynamic feedback allows control of unit with real time viewing of the output
Spellman’s optional XRV I/O box is the ideal accessory for integrating Spellman’s XRV X-Ray generators to a system environment. The XRV can now easily be packaged with industry standard metal ceramic X-Ray tubes, coolers and chillers while meeting all necessary safety and interlock requirements. The XRV I/O box is capable of accommodating a number of control interface options and can be installed in rack or wall configurations to best suit the integrator’s system placement requirements.

**TYPICAL APPLICATIONS**

Power distribution for system components

**SPECIFICATIONS**

**Input Voltage:**
180-264Vac, 50/60Hz

**Operating Temperature:**
0°C to +50°C

**Storage Temperature:**
-20°C to +80°C

**Humidity:**
0% to 95% relative humidity, non-condensing

**Cooling:**
Convection

**Dimensions:**
19.0"W X 5.21"H X 18.00"D
(482.6mm X 132.33mm X 330.2mm)

**Weight:**
30lbs (11.19kg)

**Regulatory Approvals:**
Compliant to EEC EMC Directive. Compliant to EEC Low Voltage Directive. RoHS Compliant
TB9-XRV I/O TO XRV CONTROLLER INTERFACE

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Line 1</td>
<td>180 - 264Vac</td>
</tr>
<tr>
<td>2</td>
<td>Line 2</td>
<td>Neutral or 180 - 264Vac (3 phase source)</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>4</td>
<td>INTLK 1</td>
<td>Dry contacts, ≤24Vdc</td>
</tr>
<tr>
<td>5</td>
<td>INTLK 2</td>
<td>Dry contacts, ≤24Vdc</td>
</tr>
<tr>
<td>6</td>
<td>INTLK Common</td>
<td>Common for INTLK 1, 2</td>
</tr>
<tr>
<td>7</td>
<td>X-Ray ON Light</td>
<td>Dry contacts, ≤24Vdc</td>
</tr>
<tr>
<td>8</td>
<td>Pre-Warn Light</td>
<td>Dry contacts, ≤24Vdc</td>
</tr>
<tr>
<td>9</td>
<td>Light Common</td>
<td>Light common</td>
</tr>
<tr>
<td>10</td>
<td>Key Switch 2</td>
<td>Dry contacts, ≤24Vdc</td>
</tr>
<tr>
<td>11</td>
<td>Key Switch 3</td>
<td>Dry contacts, ≤24Vdc</td>
</tr>
<tr>
<td>12</td>
<td>Key Switch Common</td>
<td>Key common</td>
</tr>
</tbody>
</table>

TB11-X-RAY ON / PRE-WARN LIGHTS

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X-Ray ON Light</td>
<td>180 - 264Vac, 5 amp</td>
</tr>
<tr>
<td>2</td>
<td>X-Ray ON Light</td>
<td>180 - 264Vac, 5 amp</td>
</tr>
<tr>
<td>3</td>
<td>Pre-Warn Light</td>
<td>180 - 264Vac, 5 amp</td>
</tr>
<tr>
<td>4</td>
<td>Pre-Warn Light</td>
<td>180 - 264Vac, 5 amp</td>
</tr>
</tbody>
</table>

*CDRH (Center for Devices and Radiological Health) Safety Interlock Switch meets FDA 21 CFR 1020.40 requirements. This switch has both low voltage interlock and power interlocks for the XRV mains.
Resistive Voltage Dividers
...for the measurement of high voltages using a standard digital voltmeter*

Spellman’s HVD Series of high voltage dividers provide laboratory or production facilities with a convenient method of measuring up to 100kVdc, 200kVdc or 400kVdc with accuracy better than 0.5%. These dividers are designed for use with high impedance digital voltmeters. All HVD dividers are housed in a polycarbonate cylinder containing a matched set of precision metal film resistors which have a temperature coefficient of less than 25ppm. A ladder-type construction technique is used in conjunction with polished high voltage bushings specifically designed to minimize corona. BNC connectors are used to provide the low voltage proportional output signal.

The HVD Series of high voltage dividers have no inferred bandwidth measurement capability what so ever. They are intended for DC steady state measurement only.

Custom Encapsulated OEM High Voltage Dividers
Spellman designs and manufactures a wide array of custom encapsulated high voltage dividers for OEM applications like ion beam implantation for semiconductor manufacturing. Unique HV divider sizes, shapes, mounting arrangements and terminations can be provided addressing specific custom requirements. Contact Spellman to discuss your needs with our knowledgeable sales staff.

Calibration
Spellman provides an NIST traceable calibration certificate with each HVD. A yearly recalibration cycle is recommended. Contact Spellman for calibration services.

<table>
<thead>
<tr>
<th>HVD100</th>
<th>HVD200</th>
<th>HVD400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Voltage</td>
<td>0-100kVdc</td>
<td>0-200kVdc</td>
</tr>
<tr>
<td>Input Impedance</td>
<td>1000Mohms</td>
<td>2000Mohms</td>
</tr>
<tr>
<td>Output Impedance</td>
<td>1M; 100kohms</td>
<td>20kohms</td>
</tr>
<tr>
<td>Output Taps</td>
<td>100V, 10V</td>
<td>2V</td>
</tr>
<tr>
<td>Accuracy</td>
<td>0.5%; (0.1% opt)*</td>
<td>0.5%; (0.25% opt)*</td>
</tr>
<tr>
<td>Stability</td>
<td>0.01%/8hrs</td>
<td>0.025%/8hrs</td>
</tr>
<tr>
<td>Temp. Coefficient</td>
<td>25ppm/°C</td>
<td>25ppm/°C</td>
</tr>
<tr>
<td>Height</td>
<td>17.5&quot; (44.5cm)</td>
<td>33.5&quot; (84.5cm)</td>
</tr>
<tr>
<td>Max. Diameter</td>
<td>10&quot; (25.4cm)</td>
<td>12&quot; (30.5cm)</td>
</tr>
<tr>
<td>Weight</td>
<td>6.75 lbs (3.1kg)</td>
<td>12 lbs (5.5kg)</td>
</tr>
<tr>
<td>Output Connector</td>
<td>BNC type</td>
<td>BNC type</td>
</tr>
</tbody>
</table>

(1) For accuracy of 0.1% specify HVD100-1
(2) For accuracy of 0.25% specify HVD200-1
*for use with digital voltmeter 10Gohms or higher.

Note: Due to the high input impedance requirement connecting the HVD to an oscilloscope input (1Mohms input impedance) will cause erroneous, inaccurate measurements.

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**WARNING**

DANGEROUS LIFE THREATENING VOLTAGES MAY BE PRESENT ON THIS EQUIPMENT. OBSERVE EXTREME CAUTION WHEN OPERATING OR WORKING NEAR HIGH VOLTAGE DEVICES. NEVER TOUCH ANY HIGH VOLTAGE ASSEMBLY THAT IS SUSPECTED TO BE ENERGIZED OR CHARGED. DO NOT HANDLE OR COME WITHIN THE PROXIMITY OF HIGH VOLTAGE CONNECTIONS UNTIL ALL EQUIPMENT IS TURNED OFF AND THE SETUPS CAPACITANCE IS DISCHARGED. FAILURE TO FOLLOW SAFETY PROCEDURES MAY BE FATAL.

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