HIGH VOLTAGE POWER SUPPLIES, X-RAY GENERATORS & MONOBLOCK® X-RAY SOURCES

Powering the Future of Advanced Technologies

spellmanhv.com
01.08.2024
Spellman High Voltage.
Powering the Future of Advanced Technologies

For over 75 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 75 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
MONOBLOCK® X-RAY SOURCE

PRODUCT INDEX

MODULAR SUPPLIES
MODEL
MSA
MS
PMT
UM
UM8–40
MPS
MPD
MPS20W
SMS
UMW
SLM

MAX. VOLTAGE

MAX. POWER

1–3kV
300V–3kV
500V–7.5kV
62.5V–6kV
8kV–40kV
1kV–30kV
1kV–30kV
1kV–20kV
1kV–60kV
8kV–20kV
1kV–160kV

0.9W
3W
1.9–4W
4W–30W
4W–30W
10W
10W
20W
60W
60W, 125W
300W–1.2kW

PAGE
4-5
6-7
8-9
10-15
16-21
22-24
25-27
28-29
30-31
32-35
36-39

RACK MOUNT SUPPLIES
MODEL
SL
SL150KV
SL2KW
SLS
STA
STR
ST

MAX. VOLTAGE
1kV–130kV
150kV
500V–50kV
160kV–360kV
1kV–70kV
1kV–150kV
1kV–225kV

MAX. POWER
10W–1.2kW
1.2kW
2kW
2kW
4kW
6kW
12kW–180kW

PAGE
40-44
45-46
47-50
51-54
55-57
58-60
61-65

X-RAY GENERATORS
MODEL
MAX. VOLTAGE
XLG
30kV–130kV
XMPF
10kV
XMPG
10kV
MNX
50kV, 65kV
uX
50kV, 65kV
MFX
50kV, 65kV
XRF
160kV
uXHP
50kV–80kV
DXM
20kV–160kV
DXB
40kV–320kV
DXM100
100kV
XLF
60kV
XRV
160kV–450kV
XRV Controller
XRV I/O Box
DF/FF
60kV
VMX
40kV
PMX
49kV
PMX70
70kV
CCT
60kV–140kV
CT
60kV–140kV

MAX. POWER
3W–260W
5W
10W
50W, 65W, 75W
50W, 65W, 75W
50W, 65W, 75W
80W, 320W, 640W
100W
300W–1.2kW
300W–1.2kW
300W–1.2kW
600W–1.2kW
1.8kW–6kW

PAGE
66-67
68-69
70-71
72-74
75-79
80-82
83-84
85-88
89-93
94-96
97-99
100-101
102-105
286
287-290
3kW–4kW
106-107
5kW
108-110
5kW
111-113
12kW
114-116
32kW, 42kW, 50kW 117-118
32kW–110kW
119

PORTABLE X-RAY IMAGING
MODEL
MAX. VOLTAGE
SPX
160kV–300kV
Tube Stand
SPX Laser Pointer

MAX. POWER
800W–900W

PAGE
120-126
127-128
129

MODEL
MAX. VOLTAGE
XRB011
80kV
uXRB130P65
130kV
XRB80N100
80kV
XRB80PN100HR 80kV
XRB100N100
100kV
XRBHR
80kV–100kV
XRBD
160kV
XRB180PN200
180kV
XRBe80PN300
80kV
XRB80PN320
80kV
XRB200PN400/CT 200kV
XRB160PN480/1 160kV
XRB160PN480/2 160kV
XRB160PN480/CT 160kV
XRB200PN500
200kV
XRB150PN600
150kV
XRB160PN688/CT 160kV
PDM90PN900
90kV
MMB125PN3.5
125kV

MAX. POWER
20W, 50W
65W
100W
100W
100W
100W–500W
100W–500W
200W
300W
320W
400W
480W
480W
480W
500W
600W
688W
900W
3.5kW

PAGE
130-133
134-138
139-142
143-148
149-151
152-159
160-167
168-170
171-175
176-178
179-181
182-184
185-187
188-190
191-193
194-196
197-199
200-202
203-205

APPLICATION SPECIFIC
MODEL
MAX. VOLTAGE
Mass Spectrometry
MI1.5PN24
1.5kV
ML430
430V
ML1350
245V–1350V
MX2.5
2.5kV
MX8 PLUS
8kV
MX10
10kV
MX20
20kV
MXE
2.5kV–10kV
MX10 PLUS
2.3kV–10kV
MXR
20kV, 30kV
MCP
3kV
TOF3000
30kV
MCP4
4kV
E Beam/IBeam
FIB
35kV
EBM20N5/24
20kV
EBM-TEG
30kV
EBM-TEGR
30kV
EBM-FEG
30kV
EBM60-FEG
60kV
VS100
100kV
Power Feed Equipment
PFE-P
6kV
PFE-LV
6kV
PFE-HV
6kV–15kV
PFE-SB
6kV–20kV
Image Intensiﬁers
DGM935
30kV
DGM945
30kV
Electrophoresis/Electrospinning
CZE1000R
30kV
CZE2000
5kV–30kV
Capacitor Charging
CCM1KW
1kV–4kV
CCM
4kV
e-Beam Evaporation
EVA
5kV–10kV
Electrostatic Chuck
MSC2.5PN7.5
2.5kV
ECHUCK
2kV–5kV
Injector Control
ICA
15kV

MAX. CURRENT

PAGE

6.5mA
12mA–25mA
15mA
60μA
100μA
100μA
100μA
200μA
10μA–230μA
300μA
330μA
400μA
600μA

206-207
208-209
210-211
212-213
214-215
216-217
218-219
220-221
222-223
224-225
226-227
228-229
230-231

30μA
250μA
170μA
400μA
200μA
300μA
100μA

232-234
235-237
238-239
240-241
242-244
245-247
248-249

1.0A
1.2A
1.5A
2A-2.5A

250-252
253-254
255-256
257-260

30μA
50μA

261-262
263-264

300μA
0.3mA–2mA

265-266
267-268

500J/s– 1000J/s 269-271
3100J/s
272-273
3kW, 6kW, 12kW 274-280
3mA
5mA

281-282
283

5.5mA

284-285

ACCESSORIES
MODEL
XRV Controller
XRV I/O Box
HVD

PAGE
286
287-290
291


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: -20°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. 61010.1
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 (&gt;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. Accuracy = ±2%. Zout = 20kΩ</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>

To reset the unit after a fault condition, Pin1 (Enable) must be set high for at least 10 seconds
* pins 6 & 7 are linked internally

LOW VOLTAGE SIGNAL PINS FOR POWER AND CONTROL

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.

HIGHER 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>

To reset the unit after a fault condition, Pin1 (Enable) must be set high for at least 10 seconds
* pins 6 & 7 are linked internally

DANGER!
High Voltage
Spellman’s MS Modules have been designed for printed circuit board mounting with high reliability, small size and light weight. The MS 3W modules provide well regulated, low ripple, high stability output voltages ranging from 300V to 3kV in a versatile, compact and 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
- Maximum Isolation Voltage:
  - 40V for units ≤1kV
  - 100V for units >1kV
- Note: this option is only available for certain models, please consult Spellman for availability.

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

**Input Current:**
< 0.65A at full output.

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

**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. (<0.01% for MS0.3 units)
- Load: 0.05% for 100μA to full load change at maximum voltage. (<0.1% for MS0.3 units)

**Ripple:**
See MS selection table

**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:**
- Units ≤1kV: .87”H x 2.1”W x 3.1”D (23mm x 53mm x 78mm).
- Units >1kV: 1.1”H x 2.36”W x 4.2”D (28mm x 60mm x 106mm).

**Weight:**
- Units ≤1kV: 0.2lb (80g).
- Units >1kV: 0.4lb (160g).

**Regulatory Approvals:**
- Compliant to EEC Low Voltage Directive.
- UK Conformity Assessed.
- RoHS Compliant.
### 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>0.05</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>

**How To Order:**

MSXX*12/C/I

where:

- XX is the Output voltage (see selection table)
- * is the polarity: P for positive / N for negative
- 12 is the input voltage. This is 12V
- /I is the floating output option, if required

Examples: MS2P12/C

MS0.3P12/C/I

---

**DIMENSIONS: in.[mm]**

**SIDE VIEW**

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

**BOTTOM VIEW**

- DRILL DIA FOR PINS 1mm
  - 0.26 [6.5]
  - 2.22 [56.5]

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

**SIDE VIEW**

- 1.10 [28]

**BOTTOM VIEW**

- 3.05 [77.47]
- 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

**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:**  Convective 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:**

**Spellman High Voltage is an ISO 9001 and ISO 14001 registered company**

Copyright © 2005 Spellman High Voltage Electronics Corp.
**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>+9Vdc Reference</td>
<td>+9.0Vdc, 10mA maximum</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Voltage Program Input</td>
<td>See Voltage Monitor Table</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Local Voltage Program</td>
<td>Internal program potentiometer wiper,</td>
<td>9</td>
<td>9</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.
• 8 Voltage Ranges from 62.5V to 6kV, Fixed Negative or Positive Polarity
• Available Output Power Increments of 4, 20 and 30 Watts
• Voltage/Current Regulation with Automatic Crossover Control
• Voltage and Current Monitor Signals
• Fully Arc and Short Circuit Protected
• Precision +5V Reference Output
• Comprehensive Standard Interface
• CE Listed, UL Recognized and RoHS Compliant

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 programmability 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 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

### 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>10Ω</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>1.5MΩ</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>0.5μF</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>1.0Ω</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>

### 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>10Ω</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>20Ω</td>
<td>1.135V</td>
<td>1.5MΩ</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>1.0Ω</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>10Ω</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>1.5MΩ</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>9.85V</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>9.85V</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>

**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: -65°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

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

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>I Pgm</td>
<td>0 to 4.64Vdc = 0 to 100% rated output. Zin &gt; 47kΩ</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Leave open for preset current limit @103% 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</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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 =4750</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.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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.

### LEGACY 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</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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 =4750</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.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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. 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.**
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.

**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.

**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**

**Same as standard unit.**

**See page 6 of 6 for dimensional drawings**

**PHYSICAL INTERFACING**

Maximum short circuit discharge rate:

\[
\frac{CV^2}{Z} < 1 \text{ watt}
\]

- \(C\) = Output capacitance of unit
- \(C_{\text{ext}}\) = External capacitance
- \(V\) = Maximum rated voltage
- \(f\) = Frequency of discharge
- \(I\) = Nominal output current
- \(t_R\) = Rise time

**Typical Rise Time:**

\[
t_R = \sqrt{\frac{C + C_{\text{ext}}}{I}} (V)
\]

Minimum rise time is 3mS.

**PINS:**

Gold-Plated

0.025 (0.64) SQ.

**MOUNTING HOLES**

2-56 UNC X .15 DEEP 2X

0.093 DIA. THROUGH TYP. 4X

0.10 (2.5)

1.13 (28.6)

1.10 (27.9)

1.05 (26.7)

0.20 (5.1)

0.20 (5.1)

0.15 (3.8)

1.20 (30.5)

1.00 (25.4)

0.84 (21.3)

1.50 (38.1)

0.10 (2.5)

1.50 (38.1)

3.20 (81.3)

3.40 (86.4)

5.65 (143.5)

5.25 (133.4)

3.40 (86.4)

2.90 (73.7)

2.90 (73.7)

2.50 (63.5)

2.50 (63.5)
**UM HIGH VOLTAGE MODULE**

**SPELLMAN HIGH VOLTAGE ELECTRONICS CORPORATION**

**PAGE 5 OF 6**

**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).
DIMENSIONS: in.[mm]

17 PIN - Standard Interface

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Option Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 62.5Vdc</td>
<td>0.062</td>
</tr>
<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>
</tr>
<tr>
<td>0 to 6000Vdc</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Polarity</th>
<th>Option Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>P</td>
</tr>
<tr>
<td>Negative</td>
<td>N</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power</th>
<th>Option Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watts Output</td>
<td>4</td>
</tr>
<tr>
<td>Watts Output</td>
<td>20</td>
</tr>
<tr>
<td>Watts Output</td>
<td>30</td>
</tr>
</tbody>
</table>

STANDARD UNIT ORDERING EXAMPLE

UM1 N20

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>
</tr>
</tbody>
</table>

OPTION ORDERING EXAMPLE

UM4 P30/L/E

Note: There may be some restrictions on multiple option combinations. Please contact our sales department for more details.
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)
- 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:
2% on all programming and monitoring, except I Sense 10%

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

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:
- 25kV-40kV:

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: TV30 (min. length, 36˝ (914.4mm)

Model Output V Output Current Ripple(max) %Vp-p Output Capacitance Arc Limiting Resistance I Sense Scaling High Voltage Divider Resistance

UM4*4 0 to 8kV 0.5mA 0.05 6830pF 50Ω 0.72V 200MΩ
UM10*4 0 to 10kV 0.3mA 0.05 4380pF 50Ω 0.72V 300MΩ
UM12*4 0 to 12kV 0.33m 0.05 4380pF 50Ω 0.72V 300MΩ
UM15*4 0 to 15kV 0.26mA 0.05 3220pF 100Ω 1.69V 400MΩ
UM20*4 0 to 20kV 0.2mA 0.05 2310pF 100Ω 1.69V 500MΩ
UM25*4 0 to 25kV 0.16mA 0.05 1540pF 100Ω 1.1V 600MΩ
UM30*4 0 to 30kV 0.13mA 0.05 1370pF 140Ω 0.99V 900MΩ
UM35*4 0 to 35kV 0.115mA 0.05 1370pF 140Ω 0.72V 900MΩ
UM40*4 0 to 40kV 0.11mA 0.05 1370pF 140Ω 1.3V 900MΩ

UM8*30 0 to 8kV 3.75mA 0.05 6830pF 50Ω 5.36V 200MΩ
UM10*30 0 to 10kV 3mA 0.05 4380pF 50Ω 7.87V 300MΩ
UM12*30 0 to 12kV 2.5mA 0.05 4380pF 50Ω 7.87V 400MΩ
UM15*30 0 to 15kV 2mA 0.06 3220pF 100Ω 5.29V 500MΩ
UM20*30 0 to 20kV 1.5mA 0.06 2310pF 100Ω 8.15V 600MΩ
UM25*30 0 to 25kV 1.2mA 0.06 1540pF 100Ω 8.15V 800MΩ
UM30*30 0 to 30kV 1mA 0.06 1370pF 140Ω 5.52V 900MΩ
UM35*30 0 to 35kV 0.8mA 0.06 1370pF 140Ω 4.16V 900MΩ
UM40*30 0 to 40kV 0.75mA 0.05 1370pF 140Ω 8.15V 900MΩ

UM30W*30 0 to 30kV 3.75mA 0.05 6830pF 50Ω 5.36V 200MΩ
UM10*30 0 to 10kV 3mA 0.05 4380pF 50Ω 7.87V 300MΩ
UM12*30 0 to 12kV 2.5mA 0.05 4380pF 50Ω 7.87V 400MΩ
UM15*30 0 to 15kV 2mA 0.06 3220pF 100Ω 5.29V 500MΩ
UM20*30 0 to 20kV 1.5mA 0.06 2310pF 100Ω 8.15V 600MΩ
UM25*30 0 to 25kV 1.2mA 0.06 1540pF 100Ω 8.15V 800MΩ
UM30*30 0 to 30kV 1mA 0.06 1370pF 140Ω 5.52V 900MΩ
UM35*30 0 to 35kV 0.8mA 0.06 1370pF 140Ω 4.16V 900MΩ
UM40*30 0 to 40kV 0.75mA 0.05 1370pF 140Ω 8.15V 900MΩ

Grayed text indicates Legacy interface signals.

SPELLMAN HIGH VOLTAGE ELECTRONICS CORPORATION

Corporate Headquarters
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
Copyright © 2010 Spellman High Voltage Electronics Corp.
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.

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.
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>0 to 10kV</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>0 to 12kV</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>0 to 15kV</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>0 to 20kV</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>0 to 25kV</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>0 to 30kV</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>0 to 35kV</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>0 to 40kV</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Polarity</th>
<th>Positive</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negative</td>
<td>N</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power</th>
<th>Watts Output 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Watts Output 15</td>
</tr>
<tr>
<td></td>
<td>Watts Output 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
PINS:
GOLD-PLATED 0.025
(0.64) SQ.

CABLE:
DIA. 0.175
36.00 (914.4)
MIN. LENGTH

MOUNTING HOLES:
2-56 UNC X .187 (4.74) DEEP

DIMENSIONS: in.[mm]

15 PIN - Standard Interface

9 PIN - Legacy Interface
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.

RS-232 or RS-485 digital interfaces are also available as optional; both the standard analog and the optional digital controls are provided via a 15-pin D-type connector.

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
- Electronmultiplier 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 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

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

**Output Connector:**
A captive 39.4” (1 meter) long shielded HV cable is provided
### 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 (also used as analog signal ground on 1kV to 10kV units)</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±0.2% (20kΩ)</td>
</tr>
<tr>
<td>4</td>
<td>Local Programming Potentiometer Wiper Output</td>
<td>Potentiometer connected to +10Vdc and 0 to 10Vdc adjustable wiper output provided</td>
</tr>
<tr>
<td>5</td>
<td>Voltage Program Input</td>
<td>Ground</td>
</tr>
<tr>
<td>6</td>
<td>Voltage Program Differential Amplifier Output</td>
<td>0 to 10Vdc ±2% (20kΩ)</td>
</tr>
<tr>
<td>7</td>
<td>Voltage Program Differential Amplifier Input—Positive</td>
<td>0 to 10Vdc ±2% (20kΩ)</td>
</tr>
<tr>
<td>8</td>
<td>Current Monitor Output</td>
<td>0 to 10Vdc ±2% (20kΩ)</td>
</tr>
<tr>
<td>9</td>
<td>Voltage Program Differential Amplifier Input—Negative</td>
<td>0 to 10Vdc ±2% (20kΩ)</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</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 (accuracy: 0.05%, temperature coeff. &lt;5ppm/°C)</td>
</tr>
<tr>
<td>15</td>
<td>Analog Signal Ground (15kV to 20kV units)</td>
<td>Analog Signal Ground (No connection for 1kV to 10kV units)</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>MPS1*10/24</td>
<td>1kV</td>
<td>10mA</td>
<td>&lt;10mV</td>
</tr>
<tr>
<td>MPS2*10/24</td>
<td>2kV</td>
<td>5.00 mA</td>
<td>&lt;20mV</td>
</tr>
<tr>
<td>MPS2.5*10/24</td>
<td>2.5kV</td>
<td>4.00 mA</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.

### How To Order:

MPSXX*10/24/YYY
where:
XX is the output voltage (see selection table)
* is the polarity: P for positive / N for negative
YYY is the option: VCC / HS / DCC2 / DCC4
DIMENSIONS: in.[mm]

1-20kV
FRONT VIEW

30kV
FRONT VIEW

BOTTOM VIEW

SIDE VIEW

M3 x 5 DEEP MAX. 3 PLS.

1-20kV

15-20kV

15-20kV

1-10kV

1-10kV

1-10kV
Spellman’s MPD series is a family of high voltage, high performance 10 Watt modules with output voltages ranging from 1kV to 30kV.

Spellman’s hybrid topology of linear and switch mode power conversion techniques delivers ultra-low noise, excellent ripple and stability performance all within its compact footprint.

The MPD series can be controlled via analog or digital interfaces, both provided via a standard 15-pin D-type connector.

In analog mode, the unit features a differential amplifier input for the voltage programming signal to improve immunity from external system noise and address any offset issues. In digital mode, RS-232 and RS-485 interfaces provide additional features: current control, status flags, multiple units operation (RS-485 only), and wobbler function.

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

### TYPICAL APPLICATIONS

- Mass Spectrometry
- Electrostatic Printing
- Electrostatic Lenses
- Scintillators
- Automatic test equipment
- Electron Multipliers
- Capillary Electrophoresis
- Electrosprning
- Electron and Ion Beams
- Electrostatic Chucks
- Microchannel Plate Detectors
- Photomultiplier Tubes

### SPECIFICATIONS

**Input Voltage:**
+24 Vdc, ±2Vdc

**Input Current:**
≤1 amp maximum

**Output Voltage:**
7 models available from 1kV to 30kV

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

**Power:**
10 watts, maximum

- **Extremely Compact 10W High Performance Module**
- **Multiple Control Interfaces:** Differential Analog, RS-232 and RS-485
- **Voltage and Current Monitors**
- **High Stability, Low TC**
- **Ultra Low Ripple and Noise, Down to 1/f Band**
- **Free GUI for Testing and Development Work**
- **Digital Control Features:** Multiple Units Operation, Current Control, Status Flags and Wobbler Function

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

**Current Limit:**
110% of rated output current. In digital control mode, the current limit is settable from 0 to 110% of the rated output current.

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

**Stability:**
- After one hour warm up period.
  - 10ppm/hour
  - 25ppm/8 hours
  - 100ppm/1000 hours

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

**Protection:**
Arc and short circuit protected. Not designed to withstand continuous arcing. The unit monitors and reports faults through status flags (digital com). When a trip occurs, the output is disabled and the unit can be reset through enable, fault reset or power cycle.

**Control Software:**
A free GUI can be provided for customer testing and development work.

**Main Features:**
- Voltage control and enable inputs
- Voltage and current monitor outputs
- 10V voltage reference output

**Digital Features:**
The following features are available when operating in digital control mode.
- Multiple units operation (RS-485 only)
- Current control
- Wobbler function: sine wave superimposed to voltage output (programmable amplitude 0-300V, period 0.1 to 2s)

**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
**MPD SELECTION TABLE**

<table>
<thead>
<tr>
<th>Model</th>
<th>Output Voltage</th>
<th>Output Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPD1*10/24</td>
<td>1kV</td>
<td>10mA</td>
</tr>
<tr>
<td>MPD2.5*10/24</td>
<td>2.5kV</td>
<td>4.00mA</td>
</tr>
<tr>
<td>MPD5*10/24</td>
<td>5kV</td>
<td>2mA</td>
</tr>
<tr>
<td>MPD10*10/24</td>
<td>10kV</td>
<td>1mA</td>
</tr>
<tr>
<td>MPD15*10/24</td>
<td>15kV</td>
<td>0.66mA</td>
</tr>
<tr>
<td>MPD20*10/24</td>
<td>20kV</td>
<td>0.5mA</td>
</tr>
<tr>
<td>MPD30*10/24</td>
<td>30kV</td>
<td>0.33mA</td>
</tr>
</tbody>
</table>

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

**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 to 10Vdc for 0 to full scale output ±1% (wrt signal ground), Zout=10kΩ</td>
</tr>
<tr>
<td>4</td>
<td>Voltage Reference Output</td>
<td>10Vdc @ 10mA maximum</td>
</tr>
<tr>
<td>5</td>
<td>Voltage Program Input</td>
<td>0 to 10Vdc=0 to 100% rated output ±1%, Zin=10MΩ</td>
</tr>
<tr>
<td>6</td>
<td>Voltage Program Differential</td>
<td>0 to 10Vdc=0 to 100% rated output, Zout=10kΩ</td>
</tr>
<tr>
<td>7</td>
<td>Amplifier Input Positive</td>
<td>0 to 10Vdc=0 to 100% rated output, diode clamped to ground, Zin=38kΩ</td>
</tr>
<tr>
<td>8</td>
<td>Current Monitor Output</td>
<td>Voltage monitor 0 to 10Vdc for 0 to full scale output ±1% (wrt signal ground), Zout=10kΩ</td>
</tr>
<tr>
<td>9</td>
<td>Voltage Program Differential</td>
<td>0 to 10Vdc=0 to 100% rated output, diode clamped to ground, Zin=38kΩ</td>
</tr>
<tr>
<td>10</td>
<td>Amplifier Input Negative</td>
<td>0 to 10Vdc=0 to 100% rated output, diode clamped to ground, Zin=38kΩ</td>
</tr>
<tr>
<td>11</td>
<td>Voltage Program Digital Output</td>
<td>0 to 10Vdc = 0 to 100% rated output, Zout=10kΩ</td>
</tr>
<tr>
<td>12</td>
<td>Signal Ground</td>
<td>Signal ground for control and monitoring</td>
</tr>
<tr>
<td>13</td>
<td>Enable Input</td>
<td>Low = Enable, TTL, CMOS, open collector compliant</td>
</tr>
<tr>
<td>14</td>
<td>Digital Mode</td>
<td>RS-232 or RS-485 configuration</td>
</tr>
<tr>
<td>15</td>
<td>RS-232 Transmit Data (output)</td>
<td>Transmit data (output) wrt pin 1 or RS-485 inverting</td>
</tr>
<tr>
<td>16</td>
<td>RS-232 fXybox/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

**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-30kHz</th>
<th>30kHz-3MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPD1</td>
<td>7mV</td>
<td>7mV</td>
<td>7mV</td>
<td>4mV</td>
<td>4mV</td>
<td>4mV</td>
</tr>
<tr>
<td>MPD2.5</td>
<td>10mV</td>
<td>10mV</td>
<td>10mV</td>
<td>5mV</td>
<td>5mV</td>
<td>5mV</td>
</tr>
<tr>
<td>MPD5</td>
<td>10mV</td>
<td>10mV</td>
<td>10mV</td>
<td>10mV</td>
<td>10mV</td>
<td>10mV</td>
</tr>
<tr>
<td>MPD10</td>
<td>20mV</td>
<td>20mV</td>
<td>20mV</td>
<td>20mV</td>
<td>20mV</td>
<td>20mV</td>
</tr>
<tr>
<td>MPD15</td>
<td>30mV</td>
<td>30mV</td>
<td>30mV</td>
<td>30mA</td>
<td>30mA</td>
<td>30mA</td>
</tr>
<tr>
<td>MPD20</td>
<td>40mV</td>
<td>40mV</td>
<td>40mV</td>
<td>40mA</td>
<td>40mA</td>
<td>40mA</td>
</tr>
<tr>
<td>MPD30</td>
<td>60mV</td>
<td>60mV</td>
<td>60mV</td>
<td>60mA</td>
<td>60mA</td>
<td>60mA</td>
</tr>
</tbody>
</table>

**Dimensions:**

- 1kV-10kV: 1.18” H X 2.75” W X 5.12” D (30mm x 70mm x 130mm)
- 15kV-20kV: 1.18” H X 2.75” W X 6.50” D (30mm x 70mm x 165mm)
- 30kV: 1.38” H X 2.95” W X 8.46” D (35mm x 75mm x 215mm)

**Weight:**
- 1kV-10kV: 14.82 oz. (420g)
- 15kV-20kV: 22.93 oz. (650g)
- 30kV: 33.51 oz. (950g)

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

**Output Connector:**
- Captive 39.4” (1 meter) long un-terminated and shielded HV cable:
  - 1kV to 20kV units: HRG58
  - 30kV units: LEMO 130666

**Regulatory Approvals:**
- Note: for 1kV and 30kV units approvals, please inquire.
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:**

Spellman High Voltage is an ISO 9001 and ISO 14001 registered company
Copyright © 2007 Spellman High Voltage Electronics Corp.
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>
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

**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:**
3.1H x 5.0W x 9.0D (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:**
- Compliant to EEC EMC Directive.
- Compliant to EEC Low Voltage Directive.
- RoHS Compliant.
**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>
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 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>
</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>
<td></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>
<td></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>
<td></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>
<td></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>
<td></td>
</tr>
</tbody>
</table>

### UMW 125W 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>
</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>
<td></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>
<td></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>
<td></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>
<td></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>
<td></td>
</tr>
</tbody>
</table>

**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>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Polarity</th>
<th>Positive</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negative</td>
<td>N</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power</th>
<th>60Watts</th>
<th>60</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>125Watts</td>
<td>125</td>
</tr>
</tbody>
</table>

| 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.
## 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.

## 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.

### 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.

## 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 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 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.

## 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.

---

### 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>+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</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Leave open for preset current limit @103% of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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>

### LEGACY 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>+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>Leave open for preset current limit @103% of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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>

### HIGH VOLTAGE MATING CONNECTOR

<table>
<thead>
<tr>
<th>KV</th>
<th>CONNECTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>LGH1</td>
</tr>
<tr>
<td>10</td>
<td>SHV P.N. 304781-001</td>
</tr>
<tr>
<td>12</td>
<td>LGH1L</td>
</tr>
<tr>
<td>15</td>
<td>SHV P.N. 304781-101</td>
</tr>
<tr>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>
DIMENSIONS: in.[mm]

TOP VIEW
UMW UP TO 15KV

TOP VIEW
UMW 20KV

BOTTOM VIEW

SIDE VIEW

FRONT VIEW

CLOSE UP SHOWING
PIN CONFIGURATION
STANDARD INTERFACE SHOWN

CLOSE UP SHOWING
PIN CONFIGURATION
LEGACY INTERFACE SHOWN

SIDE VIEW
UMW 20KV

4X 2-56 PEMS

4X 4-40 PEMS

PIN 1
HV OUTPUT
LGH1 CONNECTOR

.V33 (8.32)
.V29 (7.36)
.V750 (19.05)
2.85 (72.39)
3.20 (81.28)
4.50 (114.3)
2.00 (5.08)
4.00 (101.6)
8.00 (203.2)
6.50 (165.1)
2.47 (62.73)
3.44 (87.37)
4.22 (107.19)
.DANGER HIGH VOL
TAG
+E OUT
MON
N/C
N/C
N/C
PWR RTN
PWR RTN
SIG R
SIG R
+5V REF
REMOTE ADJ
SIGNAL
GND
ENABLE
I SENSE
+ PWR
+ PWR

PIN OUT DETAIL A

ALL UMW UNITS

7
6
5
4
3
2
1

15
14
13
12
11
10
9
8
16

7
6
5
4
3
2
1

15
16
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, ≥0.98
  - 100-240Vac, ±10% (90-264Vac):
    - 47-63Hz @ 4.0A for 300 watt units
  - 200-240Vac, ±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:**

- ≤0.01% of rated output voltage over specified input voltage range
- ≤0.01% of rated output voltage for a full load change

**Current Regulation:**

- ≤0.01% of rated output current over specified input voltage range
- ≤0.01% of rated output current for a ±100μA for a full voltage change

**Ripple:**

- ≤0.2% rms of maximum rated voltage, measured with a 10 foot long HV cable

**Stability:**

- ≤50ppm/hr after a 2 hour warm up

**Temperature Coefficient:**

- ≤100ppm 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)
### SLM 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>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>Local Voltage Prog.</td>
<td>Multi-turn front panel potentiometer</td>
</tr>
<tr>
<td>6</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>Local Current Prog.</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>HV Enable Input</td>
<td>Connect to Pin 12 to HV Enable Supply</td>
</tr>
<tr>
<td>12</td>
<td>HV Enable Output</td>
<td>+15V @ Open, ≤15mA @ Closed</td>
</tr>
<tr>
<td>13</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>14</td>
<td>HV On Output Signal</td>
<td>Open Collector, 35V @ 10mA Maximum</td>
</tr>
<tr>
<td>15</td>
<td>Spare</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

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

### 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>

### 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>High Voltage Output</td>
</tr>
<tr>
<td>L (large)</td>
<td>High Voltage Output</td>
</tr>
</tbody>
</table>

---

**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- 600W**

<table>
<thead>
<tr>
<th>kV</th>
<th>mA</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>600</td>
<td>SLM1*600</td>
</tr>
<tr>
<td>3</td>
<td>200</td>
<td>SLM3*600</td>
</tr>
<tr>
<td>5</td>
<td>120</td>
<td>SLM5*600</td>
</tr>
<tr>
<td>10</td>
<td>60</td>
<td>SLM10*600</td>
</tr>
<tr>
<td>15</td>
<td>40</td>
<td>SLM15*600</td>
</tr>
<tr>
<td>20</td>
<td>30</td>
<td>SLM20*600</td>
</tr>
<tr>
<td>30</td>
<td>20</td>
<td>SLM30*600</td>
</tr>
<tr>
<td>40</td>
<td>15</td>
<td>SLM40*600</td>
</tr>
<tr>
<td>50</td>
<td>12</td>
<td>SLM50*600</td>
</tr>
<tr>
<td>60</td>
<td>10</td>
<td>SLM60*600</td>
</tr>
<tr>
<td>70</td>
<td>8.56</td>
<td>SLM70*600</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

AIR OUT

AIR OUT

10.47 [266.7]

21.50 [546.1]

19.00 [482.6]

AIR IN
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 Capacitor Charging
- Electrostatics Hipot Testing
- E-Beam Systems 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/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 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)
- 600W to 1200W: 3-conductor, 12AWG, 6’ (1.83m) cable permanently attached to unit.

**Dimensions:**
- 10W – 300W: 1¾”H(1U) x 19”W x 19”D**
  (4.45cm x 48.3cm x 48.3cm).
- 600W – 1200W: 3¾”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.
### SL SELECTION TABLE - 150W, 300W

<table>
<thead>
<tr>
<th>kV</th>
<th>150 Watt</th>
<th>300 Watt</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10 SL1PN150 30</td>
<td>SL1PN30 60</td>
</tr>
<tr>
<td>2</td>
<td>5 SL2PN150 15</td>
<td>SL2PN30 30</td>
</tr>
<tr>
<td>3.3</td>
<td>3.3 SL3PN150 10</td>
<td>SL3PN30 20</td>
</tr>
<tr>
<td>6.7</td>
<td>6.7 SL6PN150 5</td>
<td>SL6PN30 10</td>
</tr>
<tr>
<td>8.3</td>
<td>8.3 SL8PN150 3.75</td>
<td>SL8PN30 7.5</td>
</tr>
<tr>
<td>10</td>
<td>10.0 SL10*150 3.0</td>
<td>SL10*60 6.0</td>
</tr>
<tr>
<td>15</td>
<td>15.0 SL15*150 2.0</td>
<td>SL15*60 4.0</td>
</tr>
<tr>
<td>20</td>
<td>20.0 SL20*150 1.5</td>
<td>SL20*60 3.0</td>
</tr>
<tr>
<td>30</td>
<td>30.0 SL30*150 1.0</td>
<td>SL30*60 2.0</td>
</tr>
<tr>
<td>40</td>
<td>40.0 SL40*150 0.75</td>
<td>SL40*60 1.5</td>
</tr>
<tr>
<td>50</td>
<td>50.0 SL50*150 0.50</td>
<td>SL50*60 1.0</td>
</tr>
<tr>
<td>60</td>
<td>60.0 SL60*150 0.43</td>
<td>SL60*60 0.85</td>
</tr>
<tr>
<td>70</td>
<td>70.0 SL70*150 0.38</td>
<td>SL70*60 0.75</td>
</tr>
<tr>
<td>80</td>
<td>80.0 SL80*150 0.30</td>
<td>SL80*60 0.60</td>
</tr>
<tr>
<td>90</td>
<td>90.0 SL90*150 0.25</td>
<td>SL90*60 0.50</td>
</tr>
<tr>
<td>100</td>
<td>100.0 SL100*150 0.20</td>
<td>SL100*60 0.46</td>
</tr>
</tbody>
</table>

### SL SELECTION TABLE - 150W, 300W

<table>
<thead>
<tr>
<th>kV</th>
<th>150 Watt</th>
<th>300 Watt</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10.0 SL1PN150 3.0</td>
<td>SL1PN30 6.0</td>
</tr>
<tr>
<td>2</td>
<td>20.0 SL2PN150 1.5</td>
<td>SL2PN30 3.0</td>
</tr>
<tr>
<td>3</td>
<td>30.0 SL3PN150 1.0</td>
<td>SL3PN30 2.0</td>
</tr>
<tr>
<td>6</td>
<td>60.0 SL6PN150 0.5</td>
<td>SL6PN30 1.0</td>
</tr>
<tr>
<td>8</td>
<td>80.0 SL8PN150 0.43</td>
<td>SL8PN30 0.85</td>
</tr>
<tr>
<td>10</td>
<td>100.0 SL10PN150 0.25</td>
<td>SL10PN60 0.46</td>
</tr>
</tbody>
</table>

### SL INPUT CURRENT

<table>
<thead>
<tr>
<th>MODEL</th>
<th>115Vac</th>
<th>220Vac</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 watt</td>
<td>&lt;1A</td>
<td>&lt;1A</td>
</tr>
<tr>
<td>30 watt</td>
<td>&lt;1A</td>
<td>&lt;1A</td>
</tr>
<tr>
<td>60 watt</td>
<td>1.1A</td>
<td>&lt;1A</td>
</tr>
<tr>
<td>150 watt</td>
<td>2.8A</td>
<td>1.5A</td>
</tr>
<tr>
<td>300 watt</td>
<td>5.6A</td>
<td>3.0A</td>
</tr>
<tr>
<td>600 watt</td>
<td>11.1A</td>
<td>6.0A</td>
</tr>
<tr>
<td>1200 watt</td>
<td>n/a</td>
<td>12.0A</td>
</tr>
</tbody>
</table>

### SL TERMINAL BLOCK 26 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>+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 On</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 On=Active</td>
</tr>
<tr>
<td>20</td>
<td>Remote Current 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=No Fault, +15V, 0.1mA Max=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.

*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

Top View

Back View

600W-1200W

Front View

Top View

Back View

* Depth becomes 24" [609.60] for 80kV to 130kV range.
eSL OPTION

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 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 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.

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.

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 affecting 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.
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)


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 6 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 Voltage 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:**
- Load: ±0.5ppm/°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

**Output Cable:**
- 10’ (3.3m) of shielded high voltage cable removable at the rear panel.

**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 Spellman]

#### Standby
![0.00 mA 0.00 kV]

#### HV ON
![40.00 mA 50.00 kV]

---

### 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</td>
<td>mA</td>
</tr>
<tr>
<td>0.5</td>
<td>4000</td>
</tr>
<tr>
<td>1</td>
<td>2000</td>
</tr>
<tr>
<td>2</td>
<td>1000</td>
</tr>
<tr>
<td>3</td>
<td>666</td>
</tr>
<tr>
<td>6</td>
<td>333</td>
</tr>
<tr>
<td>8</td>
<td>250</td>
</tr>
<tr>
<td>10</td>
<td>200</td>
</tr>
<tr>
<td>15</td>
<td>133</td>
</tr>
<tr>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>30</td>
<td>66.6</td>
</tr>
<tr>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>50</td>
<td>40</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>Current Monitor</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 Out</td>
<td>+15V at Open, &lt;25mA at Closed</td>
</tr>
<tr>
<td>14</td>
<td>HV Off</td>
<td>Connect to HV OFF for FP Operation</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 Off, +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></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>Chassis 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 a 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 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.

• 160kV - 360kV Outputs
• Low Ripple
• High Stability
• Overcurrent, Overvoltage and Arc Protection
• Arc Detect
• Lightweight, Compact Size
• OEM Customization Available
SLS SELECTION TABLE

<table>
<thead>
<tr>
<th>MAXIMUM RATING</th>
<th>MODEL NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>160</td>
<td>SLS160*2000</td>
</tr>
<tr>
<td>200</td>
<td>SLS200*2000</td>
</tr>
<tr>
<td>260</td>
<td>SLS260*2000</td>
</tr>
<tr>
<td>300</td>
<td>SLS300*2000</td>
</tr>
<tr>
<td>360</td>
<td>SLS360*2000</td>
</tr>
</tbody>
</table>

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

Front Panel Status Indicators:
- Voltage Control Mode
- Current Control Mode
- Interlock Open
- Interlock Closed
- High Voltage Inhibit
- Regulation Error
- Overtemperature
- Overpower (optional)
- Overcurrent
- Overtorque

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.

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>
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 160P2000**

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

**HV ON**
- **12.50 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
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.
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:

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 cus-
tomize operational features of the STA while also providing basic
power supply operational features. Details of the STA’s digital inter-
face 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 sup-
ply 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 interven-
tion parameters (Arc Count, Arc Quench, Reramp Time, and Window
Time) within preset limits via the digital interface interface; cus-
tomized units can be provided for unique arc prone environments,
contact Spellman for details.
### 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 Reference</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 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 pin15 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>

---

**DIMENSIONS: in.[mm]**

**FRONT VIEW**

**TOP VIEW**

**BACK VIEW**

---

Spellman High Voltage is an ISO 9001 and ISO 14001 registered company

Copyright © 2013 Spellman High Voltage Electronics Corp.
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 +1V rms

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

Corporate Headquarters
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
Copyright © 2012 Spellman High Voltage Electronics Corp.

128102-001  REV. K

59
## 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= 1KO, 1%</td>
</tr>
<tr>
<td>6</td>
<td>kV Test Point</td>
<td>0-10Vdc = 0-100% rated output, Zout= 1KO, 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;10MO</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 Off/On Common</td>
<td>HV Off/On 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= 5KO, 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;10MO</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 High Voltage is an ISO 9001 and ISO 14001 registered company

Copyright © 2012 Spellman High Voltage Electronics Corp.
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.
**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:**
- Compliant to EEC EMC Directive
- Compliant to EEC Low Voltage Directive
- RoHS Compliant.

**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.
ST 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 12,000</td>
<td>ST1*12</td>
</tr>
<tr>
<td>2 6,000</td>
<td>ST2*12</td>
</tr>
<tr>
<td>3 4,000</td>
<td>ST3*12</td>
</tr>
<tr>
<td>4 3,000</td>
<td>ST4*12</td>
</tr>
<tr>
<td>5 2,000</td>
<td>ST6*12</td>
</tr>
<tr>
<td>6 1,500</td>
<td>ST8*12</td>
</tr>
<tr>
<td>8 1,200</td>
<td>ST10*12</td>
</tr>
<tr>
<td>10 1,000</td>
<td>ST12*12</td>
</tr>
<tr>
<td>12 900</td>
<td>ST15*12</td>
</tr>
<tr>
<td>15 600</td>
<td>ST20*12</td>
</tr>
<tr>
<td>20 400</td>
<td>ST30*12</td>
</tr>
<tr>
<td>30 300</td>
<td>ST40*12</td>
</tr>
<tr>
<td>40 240</td>
<td>ST50*12</td>
</tr>
<tr>
<td>50 200</td>
<td>ST60*12</td>
</tr>
<tr>
<td>60 171</td>
<td>ST70*12</td>
</tr>
<tr>
<td>70 150</td>
<td>ST80*12</td>
</tr>
<tr>
<td>80 120</td>
<td>ST100*12</td>
</tr>
<tr>
<td>100 100</td>
<td>ST120*12</td>
</tr>
<tr>
<td>120 67</td>
<td>ST130*10</td>
</tr>
<tr>
<td>150 40</td>
<td>ST150*10</td>
</tr>
<tr>
<td>225 36</td>
<td>ST225*10</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. 150kV and 225kV units are limited to a maximum output of 10kW each.

NOTE: ST225 units cannot be paralleled!

Parallel operation:
Additional power can be provided in increments of 12kW by first 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.

**ST10P48** 10kV @ 18kW
**ST10P60** 10kV @ 30kW
**ST10P72** 10kV @ 42kW

**ST 1-150kV rear panel view**

---

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>
ST 225kV

DIMENSIONS: in.[mm]

TOP VIEW
29.70 [754.38]

AIR INTAKE

SIDE VIEW
16.30 [414.02]

AIR EXHAUST

4.25 [107.95]

FRONT VIEW

REAR VIEW
20.55 [521.97]

NOTE:
Blank front panel on ST 225kV units
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:**

**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>XLG60P40*</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 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 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>XLG80P250*</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 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, -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</td>
</tr>
<tr>
<td>13</td>
<td>Remote Power Program In</td>
<td>(Optional)</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>+15V, 10mA Max=HV Off</td>
</tr>
<tr>
<td>18</td>
<td>Remote HV On Indicator</td>
<td>+15V, 10mA Max=HV Off</td>
</tr>
<tr>
<td>19</td>
<td>Remote Voltage Mode</td>
<td>Open Collector 50V Max, 10mA Max=HV Off</td>
</tr>
<tr>
<td>20</td>
<td>Remote Current Mode</td>
<td>Open Collector 50V Max, 10mA Max=HV Off</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, 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 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)

**Weight:**  
4.4 lbs. (2.0kg)

**Regulatory Approvals:**  
- Designed to meet IEC/UL 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use; CAN/CSA-C22.2 No.61010-1. CE marked to EN 61010-1. 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>0-0.8V = 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>0-10V from pre-set potentiometer. See note below.</td>
</tr>
<tr>
<td>8</td>
<td>HV Program Input</td>
<td>0-10Vdc = 0-10kV, Zin = 470kΩ, accuracy ±2% of FS</td>
</tr>
<tr>
<td>9</td>
<td>High Voltage Monitor</td>
<td>0-10Vdc = 0-10kV, Zout = 2.2kΩ, accuracy ±2% of FS</td>
</tr>
<tr>
<td>10</td>
<td>Emission Current Monitor</td>
<td>0-10Vdc = 0-500μA, Zout = 2.2kΩ, accuracy ±3% of FS</td>
</tr>
<tr>
<td>11</td>
<td>Filament Current Monitor</td>
<td>0-10Vdc = 0-500mA, Zin = 10MΩ, accuracy ±3% of FS</td>
</tr>
<tr>
<td>12</td>
<td>Emission Current Program Input</td>
<td>0-10V from pre-set potentiometer. See note below.</td>
</tr>
<tr>
<td>13</td>
<td>Emission Current Program Output</td>
<td>0-10V from pre-set potentiometer. See note below.</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>0-10V = 0-0.42A from pre-set potentiometer. See note below.</td>
</tr>
</tbody>
</table>

The pre-set potentiometers are accessible through the side of the case.
To pre-set the filament current limit, adjust the potentiometer (indicated “Preset fil max” on the case).
If external programming is not required:
To pre-set the HV, adjust the potentiometer (indicated RV4 on the case) to desired value, and link pins 7 and 8.
To pre-set the emission current, adjust the potentiometer (RV3), and link pins 12 and 13.

**How To Order:**
Model number: XMPF10NS/24
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

**Current Regulation:**
Line: ≤0.01% for 10% 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).
- **Temperature Coefficient:** <300ppm/˚C

**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)

**Weight:**
4.4 lbs. (2.0kg)

**Regulatory Approvals:**
- Designed to meet IEC/UL 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use; CAN/CSA-C22.2 No.61010-1. CE marked to EN 61010-1. 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.
### 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 Direct Program)</td>
<td>Do not connect</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 = 0-10kV, $Z_{in} = 5\text{M}\Omega$, accuracy ±2% of full scale</td>
</tr>
<tr>
<td>9</td>
<td>High Voltage Monitor</td>
<td>0-10Vdc = 0-10kV, $Z_{out} = 10\text{k}\Omega$, accuracy ±2% of full scale</td>
</tr>
<tr>
<td>10</td>
<td>Emission Current Monitor</td>
<td>0-10Vdc = 0-1mA, $Z_{out} = 10\text{k}\Omega$, accuracy ±3% of full scale</td>
</tr>
<tr>
<td>11</td>
<td>Filament Current Monitor</td>
<td>0-10Vdc = 0-5A, $Z_{out} = 2.2\text{k}\Omega$, accuracy ±5% of full scale</td>
</tr>
<tr>
<td>12</td>
<td>Emission Current Program Input</td>
<td>0-10Vdc = 0-1mA, $Z_{in} = 1\text{M}\Omega$, accuracy ±3% of full scale</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 (set value)</td>
<td>0-10Vdc from Internal Preset</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.

### How To Order:

Model number: XMPG10P10/24
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
The MNX is designed to run a variety of tubes from industry leading manufacturers. Contact Spellman sales to determine if the X-Ray tube of interest can be powered by the MNX.

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 ±1V, 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 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:
- 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.
**MNX 50W/65W/75W X-RAY GENERATOR**

**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:

<table>
<thead>
<tr>
<th>Option</th>
<th>Model Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>J4 ANALOG INTERFACE CONNECTOR</td>
<td>MNX50P50/XCC</td>
</tr>
<tr>
<td>J3 FILAMENT CONNECTOR</td>
<td>MNX50P50</td>
</tr>
</tbody>
</table>

### 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 HV/ON 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 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

---

**DIMENSIONS: in.[mm]**

![Diagram of X-ray generator](image)

**50kV with XCC Option**

![Diagram of X-ray generator with XCC option](image)

---

Spellman High Voltage is an ISO 9001 and ISO 14001 registered company

Copyright © 2004 Spellman High Voltage Electronics Corp.

www.spellmanhv.com
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**

The uX is designed to run a variety of tubes from industry leading manufacturers. Contact Spellman sales to determine if the X-Ray tube of interest can be powered by the uX.

**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.
- +24Vdc ±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 203.20mm).
- **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:**
Grid Bias Option (GB):
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 a separate integrated high frequency switching circuit, providing maximum 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 ±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 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>

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 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

| MATE 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, Zou=1KΩ</td>
</tr>
<tr>
<td>3</td>
<td>Current Monitor</td>
<td>0-10 volts = 0 to full scale, Zou=1KΩ</td>
</tr>
<tr>
<td>4</td>
<td>Interlock Output</td>
<td>Connect 12V HV0N 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, Zou=1KΩ</td>
</tr>
<tr>
<td>7</td>
<td>Voltage Program Input</td>
<td>0-10 volts = 0 to full scale, Zin=10MC</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=10MC</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, Zou=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
DANGER
HIGH VOLTAGE

J1
0-50KV
Output

Filament Connections

+24V Input Connections

uX Power Supply

Filament Connections

Voltage Monitor

Current Monitor

Filament Current Monitor

Filament Limit Setpoint

Filament Preheat Setpoint

Filament Monitor

Voltage Reference

Current Reference

Voltage Program In

Current Program In

Filament Power to HV Circuits

12V Lamp

External Interlock

3W-2W

10.00V

Filament Limit

Filament Preheat

Filament

X-Ray Tube

Typical uX Operating Setup

Alternate Interlock Configurations

Filament Power to HV Circuits

12V Lamp

External Interlock

3W-2W

10.00V

Filament Limit

Filament Preheat

Filament

X-Ray Tube

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

uX Power Supply

+24VDC

+12V, User Provided

Jumper J4-7 to J4-8

To Use Local Voltage Control

Jumper J4-10 to J4-11

To Use Local Current Control

EXTERNAL VOLTAGE CONTROL

EXTERNAL CURRENT CONTROL

Fail Safe Interlock / HV ON Connections

15 PIN

Filament Power to HV Circuits

+24VDC

15 PIN

Filament Power to HV Circuits

+24VDC

15 PIN

Filament Power to HV Circuits

+24VDC

15 PIN

Filament Power to HV Circuits
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.
**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</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>

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
**Typical MFX Operating Setup**

**Analog Interface**

- **+24V Input Connections**
- **24V @ 5A**

**Fail Safe Interlock / HV ON Connections**

- 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**

- **Fail Safe Lamp Replaced With a 270 Ohm Resistor**
- **Customer Provided +12V For HV ON Relay, Relay Return Grounded**

**External Voltage Control**

- **+10.00V**
- **-10.00V**
- **+10.00V REFERENCE**
- **+10.00V, Power to HV Circuits**

**MFX Power Supply**

- **+24V Input Return**
- **+24V @ 5A Input Power**

**Current Control**

- **LOCAL VOLTAGE CONTROL**
- **VOLTAGE PROGRAM IN**
- **+10.00V**

**Local Current Control**

- **CURRENT PROGRAM IN**
- **CURRENT LIMIT SETPOINT**

**External Current Control**

- **CURRENT LIMIT SETPOINT**

**Voltage Monitor**

- **FILAMENT LIMIT SETPOINT**

**Filament Monitor**

- **FILAMENT VOLTAGE**
- **FILAMENT CURRENT**

**Filament Monitor**

- **FILAMENT CURRENT**
- **FILAMENT VOLTAGE**

**Jumper J4-13 to an external +24V source or J4-12 to reconnect internal +24V.**

**Alternate Interlock Configuration:**

- Customer Provided +12V For HV ON Relay, Relay Return Grounded

**MFX Power Supply**

- **+24VDC**
- **+3VDC**

**MFX Power Supply**

- **+24VDC**
- **+3VDC**

**Typical MFX Operating Setup**

- **See Wiring Diagrams for Recommended Analog Interface Connections**

**65KV WITH SIC OPTION**

- **7.36 [123.6]**
- **1.00 [25.4]**
- **3.50 [88.9]**

**65KV**

- **9.00 [228.6]**
- **6.00 [152.4]**

**Dimensions: in.[mm]**

- **2.87 [72.9]**
- **7.00 [177.8]**

**M4x.7 x.28 [7.1] DP**

**= ALTERNATE MOUNTING OPTION**

**= STANDARD MOUNTING OPTION**

---

**Spellman High Voltage is an ISO 9001 and ISO 14001 registered company**

Copyright © 2012 Spellman High Voltage Electronics Corp.

www.spellmanhv.com
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**

| Dual Filament | AT | Arc Trip |
| Grid Supply   | IO | Instant ON |
| Slides        | SS(X) | Non Standard Slow Start |

**SPECIFICATIONS**

**Input Voltage:**
- 80W: 90-125Vac at 48-62Hz @ 1.9A
- 180-264Vac at 48-62Hz @ 0.9A
- 320W: 180-264Vac at 48-62Hz @ 3.5A
- 640W: 180-264Vac at 48-62Hz @ 7A

**Power Factor:**
- 0.9 or better.

**High Voltage Supply:**

<table>
<thead>
<tr>
<th>Output Voltage:</th>
<th>Output Current:</th>
<th>Output Voltage Stability:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-160kV, negative polarity.</td>
<td>80W: 0.5mA max.</td>
<td>Within 0.1% of set value after warm-up period at full load.</td>
</tr>
<tr>
<td>320W: 2.0mA at 160kV</td>
<td>640W: 4.0mA</td>
<td></td>
</tr>
</tbody>
</table>

**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:**

<table>
<thead>
<tr>
<th>Grid Supply:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The grid supply controls tube beam current in a closed-loop regulation design.</td>
</tr>
<tr>
<td>Grid Voltage:</td>
</tr>
<tr>
<td>0 to 1200Vdc.</td>
</tr>
</tbody>
</table>

**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. |

| Beam Tube Current Control: |
| 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: | Digital Control Inputs: | Digital Outputs: |
| (See tables for details) | (See tables for details) | (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:**

**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>
</tr>
</thead>
<tbody>
<tr>
<td>160</td>
<td>0.5</td>
<td>80</td>
<td>XRF160N80</td>
</tr>
<tr>
<td>160</td>
<td>2.0</td>
<td>320</td>
<td>XRF160N320</td>
</tr>
<tr>
<td>160</td>
<td>4.0</td>
<td>640</td>
<td>XRF160N640</td>
</tr>
</tbody>
</table>

**J2 AC INPUT CONNECTOR WIRING**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>CONNECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1 Aux</td>
<td>Auxiliary (Logic) Line</td>
</tr>
<tr>
<td>B</td>
<td>2 Aux</td>
<td>Auxiliary (Logic) Neutral</td>
</tr>
<tr>
<td>C</td>
<td>3 Ground</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>4 Main</td>
<td>Main (Inverter) Line</td>
</tr>
<tr>
<td>E</td>
<td>5 Main</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.

**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

**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

**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.

---

**Ask about our X-Ray subsystem capabilities**

- 50kV, 65kV and 80kV Output Voltage
- 100W Output Power
- Adjustable Ground Isolated Filament Supply
- Overvoltage & Short Circuit Protection
- Voltage & Current Programming
- Local and Remote Emission Control
- Safety Interlock
- RS-232, Ethernet, & USB Standard
- Redundant HV Monitor Signal
**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 INPUT CONNECTOR**

<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>+24 volts @ 1A, max.</td>
</tr>
<tr>
<td>2</td>
<td>+24V Control Power Return</td>
<td>Power Ground</td>
</tr>
</tbody>
</table>

**FILAMENT CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Filament Output</td>
<td>0.3A to 3.5A @ 5V, max.</td>
</tr>
<tr>
<td>2</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.

**ANALOG INTERFACE CONNECTOR**

<table>
<thead>
<tr>
<th>MALE 15 PIN MINI “D”</th>
</tr>
</thead>
</table>

**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** (50kV unit only)
  - 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**

<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>+10V = OK, 0V = Fault, Sink/Source 3mA max</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>+5Vdc</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>

**uXHP MODEL SELECTION TABLE**

**Note:**
- Denotes 10 turn potentiometer accessible through holes in cover.
- 9.54 ± 0.06 (242.32 ± 1.52)

**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.
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</th>
<th></th>
<th>600 Watt</th>
<th></th>
<th>1200 Watt</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mA</td>
<td>Model</td>
<td>mA</td>
<td>Model</td>
<td>mA</td>
<td>Model</td>
</tr>
<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></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
J6 CATHODE OUTPUT (160kV)

<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>

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
DXM 300W-1200W X-RAY GENERATOR MODULE

DIMENSIONS: in.[mm]

1200 Watt

Negative Polarity - Floating Filament

Positive Polarity - Ground Filament

10-32 BLIND PEMs
4 PLCS

AIR FLOW

1-50kV HV OUTPUT

60-70kV HV OUTPUT

128034-001  REV. AG

Spellman High Voltage is an ISO 9001 and ISO 14001 registered company
Copyright © 2005 Spellman High Voltage Electronics Corp.
DXM 300W-1200W X-RAY GENERATOR MODULE

DIMENSIONS: in.[mm]

300/600 Watt

Negative Polarity - Floating Filament

Positive Polarity - Ground Filament

Corporate Headquarters
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

Copyright © 2005 Spellman High Voltage Electronics Corp.
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
- Crystal Inspection
- Plating Measurement
- Thickness Gauging
- Food Inspection
- Mineral Analysis
- X-Ray Fluorescence
- X-Ray Diffraction
- Cargo Screening

**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)
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 Model</th>
<th>mA</th>
<th>600 Watt Model</th>
<th>mA</th>
<th>1200 Watt Model</th>
<th>mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>DXB40PN300</td>
<td>7.50</td>
<td>DXB40PN600</td>
<td>15.0</td>
<td>DXB40PN1200</td>
<td>30.0</td>
</tr>
<tr>
<td>60</td>
<td>DXB60PN300</td>
<td>5.00</td>
<td>DXB60PN600</td>
<td>10.0</td>
<td>DXB60PN1200</td>
<td>20.0</td>
</tr>
<tr>
<td>80</td>
<td>DXB80PN300</td>
<td>3.75</td>
<td>DXB80PN600</td>
<td>7.50</td>
<td>DXB80PN1200</td>
<td>15.0</td>
</tr>
<tr>
<td>100</td>
<td>DXB100PN300</td>
<td>3.00</td>
<td>DXB100PN600</td>
<td>6.00</td>
<td>DXB100PN1200</td>
<td>12.0</td>
</tr>
<tr>
<td>120</td>
<td>DXB120PN300</td>
<td>2.50</td>
<td>DXB120PN600</td>
<td>5.00</td>
<td>DXB120PN1200</td>
<td>10.0</td>
</tr>
<tr>
<td>140</td>
<td>DXB140PN300</td>
<td>2.14</td>
<td>DXB140PN600</td>
<td>4.28</td>
<td>DXB140PN1200</td>
<td>8.57</td>
</tr>
<tr>
<td>320</td>
<td>Not Available</td>
<td>Not Available</td>
<td>Not Available</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>Multi-turn front panel potentiometer</td>
</tr>
<tr>
<td>7</td>
<td>Voltage Monitor</td>
<td>0 to 10V=0 to 100% Rated Output, Zout=4.99k, 1%</td>
</tr>
<tr>
<td>8</td>
<td>Signal Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>9</td>
<td>Current Monitor</td>
<td>0 to 10V=0 to 100% Rated Output, Zout=4.99k, 1%</td>
</tr>
<tr>
<td>10</td>
<td>X-Ray Enable Input</td>
<td>Connect to Pin 12 to HV Enable Supply</td>
</tr>
<tr>
<td>11</td>
<td>X-Ray Enable Output</td>
<td>+15V @ Open, ≤15mA @ Closed</td>
</tr>
<tr>
<td>12</td>
<td>Filament Monitor</td>
<td>1 Volt=1 Amp, Zout=10kΩ</td>
</tr>
<tr>
<td>13</td>
<td>X-Ray Off Output Signal</td>
<td>Open Collector, 35V @10mA Maximum</td>
</tr>
<tr>
<td>14</td>
<td>Spare</td>
<td>N/C</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></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>

**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>
</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>

www.spellmanhv.com
**DXB 300W-1200W X-RAY GENERATOR MODULE**

**SPELLMAN HIGH VOLTAGE ELECTRONICS CORPORATION**

**PAGE 3 OF 3**

**DIMENSIONS: in. [mm]**

- **40-140kV**
  - Bottom View
  - Side View
  - Front View

- **320kV**
  - Top View
  - Side View
  - Front View
  - Dimensions: 19.00 [482.6] x 10.47 [266.7] x 19.00 [482.6]

**J2 CONTROL I/O**
- USB
- ETHERNET

**J3**
- RS 232

**J4**
- USB
- ETHERNET

**J5**
- AIR IN

**J6**
- HV OUT

**J7**
- AIR IN

**DANGER**

**HIGH VOLTAGE**

**Spellman High Voltage is an ISO 9001 and ISO 14001 registered company**

**Copyright © 2012 Spellman High Voltage Electronics Corp.**
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
- Plating Measurement
- Crystal Inspection
- 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:**
  - 12 mA 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.

- **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.

- **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:**
### 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, 35 V @ 10 mA Maximum</td>
</tr>
<tr>
<td>2</td>
<td>Current Program In</td>
<td>0 to 10 V = 0 to 100% Rated Output, Zin = 10 MΩ</td>
</tr>
<tr>
<td>3</td>
<td>Voltage Program In</td>
<td>0 to 10 V = 0 to 100% Rated Output, Zin = 10 MΩ</td>
</tr>
<tr>
<td>4</td>
<td>Filament Limit Input</td>
<td>0 to 10 V = 0 to 100% Rated Output, Zin = 10 MΩ</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 10 V = 0 to 100% Rated Output, Zin = 10 MΩ</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 10 V = 0 to 100% Rated Output, Zout = 4.99 kΩ, 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 10 V = 0 to 100% Rated Output, Zout = 4.99 kΩ, 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>+15 V @ Open, ≤ 15 mA @ Closed</td>
</tr>
<tr>
<td>13</td>
<td>Filament Monitor</td>
<td>1 Volts = 1 Amp, Zout = 10 kΩ</td>
</tr>
<tr>
<td>14</td>
<td>X-ray On Output Signal</td>
<td>Open Collector, 35 V @ 10 mA 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 V dc</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.
600W, 1200W XLF SELECTION TABLE

<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>Power Supply Common</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 On</td>
</tr>
<tr>
<td>17</td>
<td>Remote HV Off Indicator</td>
<td>0=HV Off, +15V, 10mA Max=HV On</td>
</tr>
<tr>
<td>18</td>
<td>Remote HV On Indicator</td>
<td>0=HV On, +15V, 10mA Max=HV Off</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>

HIGH VOLTAGE CONNECTOR PINOUT

- **High Voltage Output Connector**: LS-Internally Connected, C-Cathode HI Voltage
- **Filament**: X-Ray Tube, Anode

DIMENSIONS: in.[mm]

- Front View: 19.00 (482.6)
- Top View: 3.47 (88.1)
- Back View: 0.34 (8.7)

Spellman High Voltage is an ISO 9001 and ISO 14001 registered company

Copyright © 2002 Spellman High Voltage Electronics Corp.
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 currents. 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
- XRVC (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

1800 Watt units specifically designed for the HP and HPX families of X-Ray tubes used in high speed digital and industrial CT applications.

- **160kV, 225kV, 320kV, 350kV and 450kV Models**
- **Complete X-Ray Generator Package**
- **Power Factor Corrected AC Input Circuitry**
- **Integrated Dual Filament Supplies**
- **Digital Interface—USB, Ethernet and RS-232**
- **Excellent Stability and Regulation**
- **Available with Black Powder Coated Finish**
GUI Control Software for the XRV

- 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 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.

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. UL/CUL recognized, File E227588, all but 6000 watt unit. RoHS Compliant.

---

XRV Specifications:

### XRV160/320/350 Specifications

<table>
<thead>
<tr>
<th>XRV160*1800</th>
<th>XRV160*3000</th>
<th>XRV160*4000</th>
<th>XRV160*6000</th>
<th>XRV320P&amp;N1800</th>
<th>XRV320P&amp;N4500</th>
<th>XRV350P&amp;N4500</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Output Voltage</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>Polarity*</td>
<td>Pos or Neg</td>
<td>Pos or Neg</td>
<td>Pos or Neg</td>
<td>Pos or Neg</td>
<td>Bipolar</td>
<td>Bipolar</td>
</tr>
<tr>
<td>Output Rated Current</td>
<td>0-30mA</td>
<td>0-30mA</td>
<td>0-50mA</td>
<td>0-50mA</td>
<td>0-30mA</td>
<td>0-30mA</td>
</tr>
<tr>
<td>Output Power</td>
<td>1.8kW</td>
<td>3.0kW</td>
<td>4.0kW</td>
<td>6.0kW</td>
<td>1.8kW</td>
<td>4.5kW</td>
</tr>
<tr>
<td>Ripple/Noise (p-p)</td>
<td>&lt;0.025%</td>
<td>&lt;0.05%</td>
<td>&lt;0.1%</td>
<td>&lt;0.25%</td>
<td>&lt;0.025%</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>Dimensions</td>
<td>10.09˝ H x 17.16˝ W x 24˝ D (256mm x 436mm x 609mm)</td>
<td>2X 10.09˝ H x 17.16˝ W x 24˝ D (256mm x 436mm x 609mm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>150 lbs. (68kg)</td>
<td>150 lbs. (68kg)</td>
<td>150 lbs. (68kg)</td>
<td>155 lbs. (70.3kg)</td>
<td>300 lbs. (136 kg)</td>
<td>300 lbs. (136 kg)</td>
</tr>
<tr>
<td>Output Connector</td>
<td>R24</td>
<td>R24</td>
<td>R24</td>
<td>R24</td>
<td>Two R24</td>
<td>Two R24</td>
</tr>
</tbody>
</table>

### XRV225 Specifications

<table>
<thead>
<tr>
<th>XRV225*1800</th>
<th>XRV225*3000</th>
<th>XRV225*4000</th>
<th>XRV225*6000</th>
<th>XRV450P&amp;N1800</th>
<th>XRV450P&amp;N4500</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Output Voltage</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>Polarity*</td>
<td>Pos or Neg</td>
<td>Pos or Neg</td>
<td>Pos or Neg</td>
<td>Bipolar</td>
<td>Bipolar</td>
</tr>
<tr>
<td>Output Rated Current</td>
<td>0-30mA</td>
<td>0-30mA</td>
<td>0-30mA</td>
<td>0-30mA</td>
<td>0-30mA</td>
</tr>
<tr>
<td>Output Power</td>
<td>1.8kW</td>
<td>3.0kW</td>
<td>4.0kW</td>
<td>6.0kW</td>
<td>1.8kW</td>
</tr>
<tr>
<td>Ripple/Noise (p-p)</td>
<td>&lt;0.025%</td>
<td>&lt;0.05%</td>
<td>&lt;0.1%</td>
<td>&lt;0.25%</td>
<td>&lt;0.025%</td>
</tr>
<tr>
<td>Dimensions</td>
<td>15.90˝ H x 17˝ W x 30.72˝ D (404mm x 432mm x 780mm)</td>
<td>2X 15.90˝ H x 17˝ W x 30.72˝ D (404mm x 432mm x 780mm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>240 lbs. (109kg)</td>
<td>240 lbs. (109kg)</td>
<td>240 lbs. (109kg)</td>
<td>240 lbs. (109kg)</td>
<td>480 lbs. (218 kg)</td>
</tr>
<tr>
<td>Output Connector</td>
<td>R28**</td>
<td>R28**</td>
<td>R28**</td>
<td>Two R28**</td>
<td>Two R28**</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.
**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>
<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 in = 10M 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 Active low, interlock is closed, safe to enable HV</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Interlock 2 Active low, interlock is closed, safe to enable HV</td>
<td></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 Low = HVPS ready, open collector, 50V @ 10mA max</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>X-Ray ON X-Ray ON status, low = X-Rays are ON open collector, 50V @ 10mA max</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Interlock Status Low, interlocks are closed, can enable HV open collector, 50V @ 10mA max</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>GND Digital ground</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>X-Ray ON Pre-Warn Pre-warning, low, before X-Ray ON open collector, 50V @ 10mA max</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Reset Active low, minimum 10mS transition</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Arc fault Low, arc fault, the HVPS has detected an arc open collector, 50V @ 10mA max</td>
<td></td>
</tr>
</tbody>
</table>

*Not active on positive models

**J1 HV CONNECTOR—R24/R28**

<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>XRV320*1800</td>
<td>±160kV</td>
<td>1.8kW</td>
<td>Bipolar</td>
</tr>
<tr>
<td>XRV320P*1800</td>
<td>±160kV</td>
<td>1.8kW</td>
<td>Bipolar</td>
</tr>
<tr>
<td>XRV350P*1800</td>
<td>±175kV</td>
<td>4.5kW</td>
<td>Bipolar</td>
</tr>
<tr>
<td>XRV450P*1800</td>
<td>±225kV</td>
<td>1.8kW</td>
<td>Bipolar</td>
</tr>
<tr>
<td>XRV450P*3000</td>
<td>±225kV</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.

**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>XRV320*1800</td>
<td>±160kV</td>
<td>1.8kW</td>
<td>Bipolar</td>
</tr>
<tr>
<td>XRV320P*1800</td>
<td>±160kV</td>
<td>1.8kW</td>
<td>Bipolar</td>
</tr>
<tr>
<td>XRV350P*1800</td>
<td>±175kV</td>
<td>4.5kW</td>
<td>Bipolar</td>
</tr>
<tr>
<td>XRV450P*1800</td>
<td>±225kV</td>
<td>1.8kW</td>
<td>Bipolar</td>
</tr>
<tr>
<td>XRV450P*3000</td>
<td>±225kV</td>
<td>4.5kW</td>
<td>Bipolar</td>
</tr>
</tbody>
</table>

**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>VBUS +5 Vdc</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>D- Data -</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>D+ Data +</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>GND Ground</td>
<td></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 208Vac</td>
<td>±10%, 50/60Hz @ 25 amps</td>
</tr>
<tr>
<td>B</td>
<td>Line 2 208Vac</td>
<td>±10%, 50/60Hz @ 25 amps</td>
</tr>
<tr>
<td>C</td>
<td>Line 3 208Vac</td>
<td>±10%, 50/60Hz @ 25 amps</td>
</tr>
<tr>
<td>D</td>
<td>GND Ground</td>
<td></td>
</tr>
</tbody>
</table>

**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 208Vac</td>
<td>±10%, 50/60Hz (source 3 phase L1, L2)</td>
</tr>
<tr>
<td>B</td>
<td>Line 2 208Vac</td>
<td>±10%, 50/60Hz (source 3 phase L1, L2)</td>
</tr>
<tr>
<td>C</td>
<td>GND Ground</td>
<td></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.
XRV
1.8-6.0KW X-RAY GENERATORS

SPELLMAN HIGH VOLTAGE ELECTRONICS CORPORATION

DIMENSIONS: in.[mm]

XRV160
TOP VIEW

XRV225
TOP VIEW

XRV320 is comprised of two XRV160 units configured in a bipolar arrangement

XRV450 is comprised of two XRV225 units configured in a bipolar arrangement
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/phase, three phase
  - 4kW: 220Vac @ 39.3A, single phase
  - 208Vac @ 17.0A/phase, 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.

**Emission Current Regulation:**

- Load: 0.01% of rated output for a 10 to 60kV change
- Temperature Coefficient: 50 ppm/°C
- 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.

---

**JB1 MINI D CONNECTOR 50 PIN**

<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>Heset</td>
</tr>
<tr>
<td>9</td>
<td>Rmt/Lcl</td>
</tr>
<tr>
<td>10</td>
<td>24V Switched</td>
</tr>
<tr>
<td>11</td>
<td>+5Vcc</td>
</tr>
<tr>
<td>12</td>
<td>X-Ray On Status</td>
</tr>
<tr>
<td>13</td>
<td>Overvoltage</td>
</tr>
<tr>
<td>14</td>
<td>kvp</td>
</tr>
<tr>
<td>15</td>
<td>Overpower</td>
</tr>
<tr>
<td>16</td>
<td>Filament Current Limit</td>
</tr>
<tr>
<td>17</td>
<td>mA Current Limit</td>
</tr>
<tr>
<td>18</td>
<td>LCL Status</td>
</tr>
<tr>
<td>19</td>
<td>Power Supply Fault</td>
</tr>
<tr>
<td>20</td>
<td>Gnd</td>
</tr>
<tr>
<td>21</td>
<td>Spare</td>
</tr>
<tr>
<td>22</td>
<td>(DF) Remote X-Ray On</td>
</tr>
<tr>
<td>23</td>
<td>(DF) Remote X-Ray On Ret</td>
</tr>
<tr>
<td>24</td>
<td>Spare</td>
</tr>
<tr>
<td>25</td>
<td>Gnd</td>
</tr>
<tr>
<td>26</td>
<td>kvp</td>
</tr>
<tr>
<td>27</td>
<td>kv Com</td>
</tr>
<tr>
<td>28</td>
<td>mA Ref</td>
</tr>
<tr>
<td>29</td>
<td>mA Com</td>
</tr>
<tr>
<td>30</td>
<td>Spare</td>
</tr>
<tr>
<td>31</td>
<td>Spare</td>
</tr>
<tr>
<td>32</td>
<td>Spare</td>
</tr>
<tr>
<td>33</td>
<td>Pwr. Limit (OL Ref)</td>
</tr>
<tr>
<td>34</td>
<td>Pwr. Limit Com (OL Com)</td>
</tr>
<tr>
<td>35</td>
<td>Filament Current Limit</td>
</tr>
<tr>
<td>36</td>
<td>Filament Current Limit Com</td>
</tr>
<tr>
<td>37</td>
<td>Spare</td>
</tr>
<tr>
<td>38</td>
<td>kvp Monitor</td>
</tr>
<tr>
<td>39</td>
<td>mA Monitor</td>
</tr>
<tr>
<td>40</td>
<td>Spare</td>
</tr>
<tr>
<td>41</td>
<td>Spare</td>
</tr>
<tr>
<td>42</td>
<td>kvp Ref Mon</td>
</tr>
<tr>
<td>43</td>
<td>mA Ref Mon</td>
</tr>
<tr>
<td>44</td>
<td>Spare</td>
</tr>
<tr>
<td>45</td>
<td>Spare</td>
</tr>
<tr>
<td>46</td>
<td>Filament Monitor</td>
</tr>
<tr>
<td>47</td>
<td>Mon Common</td>
</tr>
<tr>
<td>48</td>
<td>Spare</td>
</tr>
<tr>
<td>49</td>
<td>Gnd</td>
</tr>
<tr>
<td>50</td>
<td>Spare</td>
</tr>
</tbody>
</table>

---

Spellman High Voltage is an ISO 9001 and ISO 14001 registered company
Copyright © 2001 Spellman High Voltage Electronics Corp.
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
- **Reproducibility:**
  <0.5%
- **Settling Time:**
  <10ms

**Ripple:**
≤1%

**Stability:**
≤0.01% per 8 hours

**Temperature Coefficient:**
≤100ppm/°C

**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
- **Reproducibility:**
  <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

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GND</td>
</tr>
<tr>
<td>2</td>
<td>+5Vdc Out</td>
</tr>
<tr>
<td>3</td>
<td>RS-232 Tx Out</td>
</tr>
<tr>
<td>4</td>
<td>RS-232 Rx In</td>
</tr>
</tbody>
</table>
| 5   | PREP 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.
| 6   | READY 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.
| 7   | ROTOR SHUTDOWN User signal to brake the rotor drive.
| 8   | EXPOSURE 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
| 9   | X-Ray ON 75% Status Transistor output to indicate X-Ray ON status synchronized with 75% of kVP setting point.
| 10  | X-Ray ON Status Transistor output to indicate X-Ray ON status synchronized with kV startup.
| 11  | NC N/C
| 12  | X-Ray SHUTDOWN/AEC User signal to generator to rapidly turn HV OFF and ON during serial exposure sequence.
| 13  | RS-232 ISO Ground Isolated ground from RS-232 transceiver IC.
| 14  | HVG-FAULT Status Generator signal indicating generator fault. Open collector transistor output. Low/Active = Fault
| 15  | Status Bit 1 3 bit status lines for up to 6 status messages. See separate matrix describing functionality. Open Collector. Low/Active = Message.
| 16  | Status Bit 2
| 17  | Status Bit 3
| 18  | N/C N/C
| 19  | N/C N/C
| 20  | kV Monitor Signal from generator. 0-10V = 0-40kV. Zout = 1kΩ
| 21  | Emission Monitor Signal from generator. 0-10V = 0-200mA. Zout = 1kΩ
| 22  | Filament Current Monitor Signal from generator. 0-10V = 0-6A. Zout = 1kΩ
| 23  | Program/Monitor Return Ground for reference of program and monitor signals.
| 24  | +24Vdc Out For connection to PREP and EXPOSURE control relay coils.
| 25  | SHIELD/GND For connection of interface cable shield to generator chassis ground.

TB2 ROTOR INTERFACE

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB2-1</td>
<td>PHASE To tube auxiliary winding</td>
</tr>
<tr>
<td>TB2-2</td>
<td>RUN To tube principle winding</td>
</tr>
<tr>
<td>TB2-3</td>
<td>COM To tube common winding</td>
</tr>
<tr>
<td>TB2-4</td>
<td>GROUND To tube housing ground</td>
</tr>
</tbody>
</table>

TB3 TUBE AND INTERLOCK INTERFACE

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB3-1</td>
<td>SMALL FIL Connection to tube small filament</td>
</tr>
<tr>
<td>TB3-2</td>
<td>COMMON Connection to tube filament common</td>
</tr>
<tr>
<td>TB3-3</td>
<td>LARGE FIL Connection to large filament</td>
</tr>
<tr>
<td>TB3-4</td>
<td>GROUND Generator chassis for cable shield connection</td>
</tr>
<tr>
<td>TB3-5</td>
<td>Interlock 2+ 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>
</tr>
<tr>
<td>TB3-7</td>
<td>Interlock 3+ 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>
</tr>
<tr>
<td>TB3-9</td>
<td>Safety Interlock+ 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>
</tr>
<tr>
<td>TB3-11</td>
<td>Contactor Coil+ Option for contactor coil control</td>
</tr>
<tr>
<td>TB3-12</td>
<td>Contactor Coil-</td>
</tr>
<tr>
<td>TB3-13</td>
<td>N/C</td>
</tr>
<tr>
<td>TB3-14</td>
<td>N/C</td>
</tr>
<tr>
<td>TB3-15</td>
<td>Tube Current+ Tube current flows out from this pin</td>
</tr>
<tr>
<td>TB3-16</td>
<td>Tube Current- Tube current flows into this pin</td>
</tr>
</tbody>
</table>
VMX 5kW MAMMOGRAPHY X-RAY GENERATOR

Dimensions: in. [mm]

Front View

- Anode Drive
  - TB1
  - TB2
  - COMMON
  - RUN
  - PHASE 1
  - 1.312 [84.12]
  - 1.187 [30.14]

- Ground
  - 1.187 [30.14]

- Ac Input
  - IPH 200-240 VAC ±10%
  - 50/60 Hz
  - 35A

Top View

- 12.00 [304.8]
- 5.75 [146.05]
- 6.750 [171.45]
- 0.875 [22.22]
- 4.750 [120.65]
- 4X M5 x 0.8 X 6.8mm Deep Blind Inserts
- 5X M5 x 0.8 X 6.8mm Deep Blind Inserts
- Ground Stud

Bottom View

- 0.875 [22.22]
- 5.75 [146.05]
- 3.875 [98.42]
- 0.88 [22.35]
- 5X M5 x 0.8 X 6.8mm Deep Blind Inserts
- Ground Stud

Side View

- 5.375 [136.52]
- 0.517 [13.13]
- 4X M5 x 0.8 X 6.8mm Deep Blind Inserts
- Ground Stud

Spellman High Voltage is an ISO 9001 and ISO 14001 registered company
Copyright © 2011 Spellman High Voltage Electronics Corp.

www.spellmanhv.com
128092-001 REV. L
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)

**Reproductibility:**
<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)

**Reproductibility:**
<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>
<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>
<tr>
<td>13</td>
<td>RS-232 ISO Ground</td>
<td>Isolated ground from RS-232 transceiver IC</td>
</tr>
<tr>
<td>14</td>
<td>HVG FAULT Status</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></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 = 0-50kV. 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>

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.</td>
</tr>
<tr>
<td>TB3-6</td>
<td>Interlock 2-</td>
<td>Open = OVER TEMP. (short terminals if not used)</td>
</tr>
<tr>
<td>TB3-7</td>
<td>Interlock 3+</td>
<td>Used if tube has cooling circulator flow switch.</td>
</tr>
<tr>
<td>TB3-8</td>
<td>Interlock 3-</td>
<td>Open = NO FLOW. (short terminals if not used)</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 &amp; &lt;1A typical</td>
</tr>
<tr>
<td>TB3-10</td>
<td>Safety Interlock-</td>
<td>N/C</td>
</tr>
<tr>
<td>TB3-11</td>
<td>Contact Coil+</td>
<td>Option for contactor coil control</td>
</tr>
<tr>
<td>TB3-12</td>
<td>Contact Coil-</td>
<td>N/C</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>
The PMX70 is Spellman's new high performance X-Ray generator designed to power Varex Mammography X-Ray tubes. It features a 12kW peak high frequency inverter and high voltage section complete with a smart learning filament power supply and high speed starter. State of the art power conversion technology provides stable and accurate X-Ray tube high voltage with fast rise and fall times. Ethernet and RS-232 interfacing provides easy system integration. 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:**
230Vac ±10%, single phase, 50Hz/60Hz

**Input Current:**
30 amps, customer to fuse.
Mains Contactor – not provided.
Customer is responsible for mains safety disconnection.

Less than 30 amps over a typical scan is defined as following: Due to unknown line impedance, customer supplied external inductors 100uH to 300uH in series with input connections, (200uH to 600uH total), may be required to keep rms currents below 30 amps and to avoid erroneous circuit breaker trips. Spellman can recommend appropriate inductors as required.

**Output (Tube) Voltage**

**Output Voltage Range:**
-25kV to -70kV

**Polarity:**
Negative output polarity; to drive rotating anode, floating cathode X-Ray tube (Varex M-1581).

**Accuracy:**
2% (measured per IEC60601-2-45)

**Reproducibility:**
<0.5%

**Output (Tube) Current/Power**

**Output Current Range:**
10mA to 200mA

**Output Power:**
12kW peak, 400 watt average.

**Duty Cycle:**
25%. A typical scan being at fixed settings in the range of 40kV-70kV and 16mA-200mA. Pulsed operation is supported.

**Accuracy:**
< ±10% on exposure less than 10ms (measured per IEC60601-2-45)

**Rise Time:**
1-2 milliseconds, typical (HV cable dependent). Fall time is load dependant, and the HV cable is a significant factor. The HV cable which is not provided with the PMX70, has a maximum length of 8 feet (2.4m).

**Fall Time:**
<10ms with a HV cable length of 8 feet (2.4 meters)

**Exposure Time (Loading Time):**

**Maximum Single Exposure Time:**
20 seconds

**Shortest Single Exposure Time:**
4ms

**Loading Time Accuracy:**
±3% +1ms (measured per IEC60601-2-45)

**Maximum mAs:**
3200mAs

**Exposure Timer:**
4ms-20 seconds

**Reproducibility:**
<0.5%

**Filament Configuration:**
AC high frequency 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.

**High Speed Starter:**
High speed (360Hz) starter configured via the serial interface. Boost and Brake capability provided.

**AC Input Connector:**
Two position terminal block

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

**Rotor Interface Connector:**
Four position terminal block

**Tube and Interlock Interface Connector:**
16 pin terminal block

- Compact Space Saving Modular Format
- Fast Rise/Fall Time Minimize Patient Exposure
- High Speed Starter, Boost/Brake Capability
- Ethernet/RS-232 Interfaces
High Voltage Connector:
Claymount CA-11 type or equivalent.

Communication Interface Connector:
Ethernet, RJ45 jack

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:
Forced air, internal fan

Dimensions:
10.08˝ H X 19.49˝ W X 10.75˝ D
(256mm x 495mm x 273mm)

Weight:
48.5 pounds (22.0kg)

Rotational Capability:
Capable of working on a rotating gantry with a nominal rotating speed of 0.5 Hertz.

Regulatory Approvals:
Designed to comply with IEC 60601. RoHS Compliant. Customer provided external EMC filter may be required to meet CE/EMC specifications.

X-Ray Tube Compatibility:
Varex M-1581

### PMX70 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 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>
<tr>
<td>13</td>
<td>RS-232 ISO Ground</td>
<td>Isolated ground from RS-232 transceiver IC</td>
</tr>
<tr>
<td>14</td>
<td>HVG FAULT Status</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></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 = 0-50kV. 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>
### 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</td>
</tr>
<tr>
<td>TB3-6</td>
<td>Interlock 2-</td>
<td>Open = OVER TEMP. (short terminals if not used)</td>
</tr>
<tr>
<td>TB3-7</td>
<td>Interlock 3+</td>
<td>Used if tube has cooling circulator flow switch</td>
</tr>
<tr>
<td>TB3-8</td>
<td>Interlock 3-</td>
<td>Open = NO FLOW. (short terminals if not used)</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>Such as door interlocks. Open turns HV OFF, or inhibits HV from being generated. Closed = OK 24Vdc @ &lt;1A typical</td>
</tr>
<tr>
<td>TB3-11</td>
<td>Contactor Coil+</td>
<td>Option for contactor coil control</td>
</tr>
<tr>
<td>TB3-12</td>
<td>Contactor Coil-</td>
<td>Option for contactor coil control</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 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
- **DG** Deflection Grid
- **CG** Cutoff Grid

### 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
- **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

**Optional grid box for Deflection or Cutoff Grid**

**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.

### 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

<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><strong>Model Designation</strong></td>
<td>CCT70PN32</td>
<td>CCT70PN42</td>
<td>CCT70PN50</td>
</tr>
<tr>
<td><strong>Input Power</strong></td>
<td>400Vac, 3Ø, +15%/-20%, 50/60Hz</td>
<td>220/230Vac, 1Ø +15%/-10%, 50/60Hz</td>
<td>220/230Vac, 1Ø +15%/-10%, 50/60Hz</td>
</tr>
<tr>
<td><strong>Auxiliary Input Power</strong></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><strong>kV Output Range</strong></td>
<td>60kV - 140kV (bipolar, 30kV - 70kV)</td>
<td>60kV - 140kV (bipolar, 30kV - 70kV)</td>
<td>60kV to 140kV</td>
</tr>
<tr>
<td><strong>kV Output Accuracy</strong></td>
<td>±0.5% of setting</td>
<td>±0.5% of setting</td>
<td>±0.5% of setting</td>
</tr>
<tr>
<td><strong>mA Output Range</strong></td>
<td>10mA – 300mA / 32kW maximum</td>
<td>10mA – 420mA / 50kW maximum</td>
<td>10mA – 667mA / 80kW maximum</td>
</tr>
<tr>
<td><strong>mA Regulation/Accuracy</strong></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><strong>Filament Output</strong></td>
<td>2 outputs: 15Vac @ 0-6A up to 8A available</td>
<td>1 output: 15Vac @ 0-6A, up to 15A available</td>
<td>2 outputs: 10Vac @ 0-8A, up to 15A available</td>
</tr>
<tr>
<td><strong>Filament Accuracy</strong></td>
<td>±5% of setting</td>
<td>±5% of setting</td>
<td>±2% from 25% to 75%, 5% above</td>
</tr>
<tr>
<td><strong>Filament Repeatability</strong></td>
<td>±0.2%</td>
<td>±0.2%</td>
<td>±0.2%</td>
</tr>
<tr>
<td><strong>Starter</strong></td>
<td>HSS configured to match X-Ray tube used</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Interface</strong></td>
<td>Custom serial interface</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rotation</strong></td>
<td>Up to 120 rpm</td>
<td>Up to 120 rpm</td>
<td>Up to 240 rpm</td>
</tr>
<tr>
<td><strong>Configuration</strong></td>
<td>Single Chassis</td>
<td>Two chassis</td>
<td>Four chassis</td>
</tr>
<tr>
<td><strong>Grid Option</strong></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><strong>Deflection Option</strong></td>
<td>n/a</td>
<td>n/a</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.

**TYPICAL APPLICATIONS**

- Aerospace
- Manufacturing
- Defense
- Aviation
- 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: 20 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: 0.7mm x 1.0mm (0.03in x 0.04in) EN12543
- 0.5mm x 0.5mm (0.02in x 0.02in) nominal 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: 3mm x 3mm (0.12in x 0.12in) EN12543
- Panoramic: 0.4mm x 4mm (0.016in x 0.16in) EN12543

**SPX300:**
- Standard: 3mm x 3mm (0.12in x 0.12in) EN12543

**Ambient Temp:**
100% duty cycle @ 120°F (49°C)

**Duty Cycle:**
100% - liquid or air cooled

**Operating Temp:**
32°F to 120°F (0°C to 49°C)

**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 Key Switch
- 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
### 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>SPX200ACDBC</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>SPX200/300 Laser pointer for air cooled tube</td>
</tr>
<tr>
<td>K937</td>
<td>SPX200 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 Outut, 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, 4 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 Line1</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 Line2/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 Line1 for Motor</td>
</tr>
<tr>
<td>D</td>
<td>120/220Vac Line2/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>KV 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>

---

Corporate Headquarters
Hauppauge, New York USA
www.spellmanhv.com
128121-001 REV. H
Spellman High Voltage is an ISO 9001 and ISO 14001 registered company
Copyright © 2017 Spellman High Voltage Electronics Corp.
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

COOLER
TOP VIEW

SPX160
TUBE HEAD
SIDE VIEW

FRONT VIEW

FRONT VIEW

SIDE VIEW

SIDE VIEW

ILE COOLED
28.50
[723.90]

AIR COOLED
30.00
[762.0]

SPX160
DIMENSIONS: in.[mm]
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.
DIMENSIONS: in. [cm]

43.00 [109] Min.

16.00 [40.65]

45.50 [115]

96.00 [244]

83.50 [212]

70.50 [179] Max.
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 IIIa 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
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**
Medical X-Ray: Fluoroscopy and Radiography for Extremities, Specimen Radiography.
Pulsed Fluoroscopy (contact Spellman sales)
Industrial X-Ray: Component inspection and Non-Destructive Testing

**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

**Voltage Temperature Coefficient:**
≤100ppm/°C

**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.

**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.

**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 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, 25μA/V (20W model) and 70μA/V (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:
20W and 50W option: Customer provided, external cooling fan, 50cfm, minimum

Analog Interface and 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 UL/CUL recognized file E242584.
CE to EN 61010-1 for non-medical applications.

**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>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>

**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=10kΩ</td>
</tr>
<tr>
<td>11</td>
<td>μA Monitor</td>
<td>Output, 0 to 10V = 0 to rated output current. Zout=100Ω</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>Filament 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</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>
20W Model

ORDERING INFORMATION

Medical Applications:
- XRB011-80PN20  80kV, 250uA, 20W, Analog Interface, RS-232
- XRB011-80PN20E  80kV, 250uA, 20W, Analog Interface, RS-232, Ethernet
- XRB011-80PN20A  80kV, 250uA, 20W, Analog Interface

Non-Medical Applications:
- XRB011-80PN20/CE  80kV, 250uA, 20W, Analog Interface, RS-232, CE
- XRB011-80PN20E/CE  80kV, 250uA, 20W, Analog Interface, RS-232, Ethernet, CE
- XRB011-80PN20A/CE  80kV, 250uA, 20W, Analog Interface, CE

XRB011
20W Model

DIMENSIONS: in.[mm]
50W Model

ORDERING INFORMATION

Medical Applications:
- XRB011-80PN50  80kV, 700μA, 50W, Analog Interface, RS-232
- XRB011-80PN50E 80kV, 700μA, 50W, Analog Interface, RS-232, Ethernet
- XRB011-80PN50A 80kV, 700μA, 50W, Analog Interface

Non-Medical Applications:
- XRB011-80PN50/CE 80kV, 700μA, 50W, Analog Interface, RS-232, CE
- XRB011-80PN50E/CE 80kV, 700μA, 50W, Analog Interface, RS-232, Ethernet, CE
- XRB011-80PN50A/CE 80kV, 700μA, 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**
- WB Wide Beam
- ET Extended Tube (wide beam only)
- LW Light Weight

**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

Photos provided by ThermoFisher Scientific
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.

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chamber Interlock Out</td>
<td>To close Chamber Interlock connect pin 1 to pin 2, R&lt;2Ω</td>
</tr>
<tr>
<td>2</td>
<td>Chamber Interlock In</td>
<td>To close Chamber Interlock connect pin 2 to pin 1, R&lt;2Ω</td>
</tr>
<tr>
<td>3</td>
<td>X-Ray ON Lamp Out</td>
<td>120Vac @ 3A/250Vac @ 1.5A rated contacts. Close at X-Ray ON</td>
</tr>
<tr>
<td>4</td>
<td>X-Ray ON Lamp In</td>
<td>120Vac @ 3A/250Vac @ 1.5A rated contacts. Close at X-Ray ON</td>
</tr>
<tr>
<td>5</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>6</td>
<td>Prime Power Interlock Out</td>
<td>To close Power Interlock connect pin 6, 7 to pin 8, 10, R&lt;2Ω</td>
</tr>
<tr>
<td>7</td>
<td>Prime Power Interlock Out</td>
<td>To close Power Interlock connect pin 6, 7 to pin 8, 10, R&lt;2Ω</td>
</tr>
<tr>
<td>8</td>
<td>Prime Power Interlock In</td>
<td>To close Power Interlock connect pin 8, 10 to pin 6, 7, R&lt;2Ω</td>
</tr>
<tr>
<td>9</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>10</td>
<td>Prime Power Interlock In</td>
<td>To close Power Interlock connect pin 8, 10 to pin 6, 7, R&lt;2Ω</td>
</tr>
<tr>
<td>11</td>
<td>+24Vdc Input (+)</td>
<td>+24Vdc Input (+)</td>
</tr>
<tr>
<td>12</td>
<td>+24Vdc Input (+)</td>
<td>+24Vdc Input (+)</td>
</tr>
<tr>
<td>13</td>
<td>+24Vdc Return (-)</td>
<td>+24Vdc Return (-)</td>
</tr>
<tr>
<td>14</td>
<td>+24Vdc Return (-)</td>
<td>+24Vdc Return (-)</td>
</tr>
<tr>
<td>15</td>
<td>X-Ray On Indicator Out</td>
<td>24Vdc @ 3A rated contacts. Close at X-Ray ON</td>
</tr>
<tr>
<td>16</td>
<td>X-Ray On Indicator In</td>
<td>24Vdc @ 3A rated contacts. Close at X-Ray ON</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DCD</td>
<td>Data Carrier Detect</td>
</tr>
<tr>
<td>2</td>
<td>RD</td>
<td>Received Data</td>
</tr>
<tr>
<td>3</td>
<td>TD</td>
<td>Transmitted Data</td>
</tr>
<tr>
<td>4</td>
<td>DTR</td>
<td>Data Terminal Ready</td>
</tr>
<tr>
<td>5</td>
<td>SGNO</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>DSR</td>
<td>Data Set Ready</td>
</tr>
<tr>
<td>7</td>
<td>RTS</td>
<td>Request to send</td>
</tr>
<tr>
<td>8</td>
<td>CTS</td>
<td>Clear to Send</td>
</tr>
<tr>
<td>9</td>
<td>RI</td>
<td>Ring Indicator</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>NARROW BEAM</th>
<th>WIDE BEAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Voltage Range</td>
<td>45-130kV</td>
<td>50-130kV</td>
</tr>
<tr>
<td>Maximum Power</td>
<td>65W, 130kV</td>
<td>65W, 130kV</td>
</tr>
<tr>
<td>Maximum Beam Current</td>
<td>0.500mA</td>
<td>0.500mA</td>
</tr>
<tr>
<td>Spot Size</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Watt</td>
<td>≤ 7μ, 45-130kV</td>
<td>≤ 8μ, 50-130kV</td>
</tr>
<tr>
<td>8 Watt</td>
<td>≤ 10μ, 45-130kV</td>
<td>≤ 14μ, 50-130kV</td>
</tr>
<tr>
<td>16 Watt</td>
<td>≤ 22μ, 45-130kV</td>
<td>≤ 24μ, 50-130kV</td>
</tr>
<tr>
<td>32 Watt</td>
<td>≤ 48μ, 70-130kV</td>
<td>≤ 48μ, 70-130kV</td>
</tr>
<tr>
<td>40 Watt</td>
<td>≤ 60μ, 80-130kV</td>
<td>≤ 60μ, 80-130kV</td>
</tr>
<tr>
<td>65 Watt</td>
<td>≤ 100μ, 130kV</td>
<td>≤ 100μ, 130kV</td>
</tr>
</tbody>
</table>

How to Order:
- Standard (Narrow Beam) PART NO.: µXRB130P65NB
- Wide Beam Option PART NO.: µXRB130P65WB
- Wide Beam Option and Extension Tube PART NO.: µXRB130P65WBET
DIMENSIONS: in.[mm]

**NARROW BEAM (Standard)**

**SIDE VIEW**

- 12.17 [309.11]
- 11.95 [303.53]
- 1.73 [43.89]
- 0.55 [13.97]

**BOTTOM VIEW**

- 3.543 ± 0.005 [89.9]
- 6.889 ± 0.005 [174.98]
- 0.600 [15.24]

**REAR VIEW**

- 6.89 ± 0.005 [175.0]
- 0.600 [15.24]
- 3.543 ± 0.005 [89.9]

**FRONT VIEW**

- 10.16 [258.06]
- 2.5 [63.5]
- 1.73 [43.89]
- 0.55 [13.97]

**UNIVERSAL FLANGE**

- 4.75 [120.65]

**NARROW BEAM (Standard)**

- .25-20 UNC-2B
- .25 DEEP, 4PL

**BOTTOM VIEW**

- .25-20 UNC-2B
- 20 DEEP, 4PL

**REAR VIEW**

- 7.677 ± 0.015 [194.99]

**FRONT VIEW**

- 7.677 ± 0.015 [194.99]

**DIMENSIONS: in.[mm]**

- 1.73 [43.89]
- 0.55 [13.97]
- 4.75 [120.65]

**UNIVERSAL FLANGE**

- 2.5 [63.5]
DIMENSIONS: in.[mm]

WIDE BEAM (WB Option)
SIDE VIEW

FRONT VIEW

REAR VIEW

BOTTOM VIEW
DIMENSIONS: in.[mm]

WIDE BEAM (WB Option) and
EXTENSION TUBE (ET Option)
SIDE VIEW

BOTTOM VIEW

REAR VIEW

FRONT VIEW

SOURCE OF X-RAY

4.75 [120.65]
UNIVERSAL FLANGE

6.89 ±.005 [175.0]
3.543 ±.005 [89.9]
0.600 [15.24]
6.889 ±.005 [174.98]

6.89 ±.005 [175.0]
3.543 ±.005 [89.9]
0.600 [15.24]

3.543 ±.005 [89.9]

4.75 [120.64]
25-20 UNC-2B
25 DEEP 4PL

2.20 [55.88]

7.677 ±.015 [194.99]
5.46 [138.73]
2.5 [63.5]

3.51 [89.25]

0.39 [10.00]

115°

3.84 [97.49]

2.00 [50.80]

11.95 [303.33]

25-20 UNC-2B
25 DEEP 4PL

0.600 [15.24]
3.543 ±.005 [89.9]

130KV @ 65W MICROFOCUS MONOBLOCK®

Spellman High Voltage is an ISO 9001 and ISO 14001 registered company
Copyright © 2020 Spellman High Voltage Electronics Corp.
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:**
150µA 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 150µA 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, 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:

**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>
<tr>
<td>9</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

**XRB 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>mA Program Input</td>
<td>0 to 9.00Vdc = 0 to 100% rated output, Zin =10MΩ</td>
</tr>
<tr>
<td>3</td>
<td>kV Program Input</td>
<td>0 to 9.00Vdc = 0 to 100% rated output, Zin =10MΩ</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</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>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>
**How to Order:**

<table>
<thead>
<tr>
<th>Standard: PART NO.: XRB80N100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risetime, Cone Beam, Fan and Elapsed Time Meter Options</td>
</tr>
<tr>
<td>PART NO.: XRB80N100/RT/CB/FN/M</td>
</tr>
</tbody>
</table>

**OPTIONS**

- **RT**: 5 second Risetime for both voltage and current
- **CB**: Cone Beam
- **FN**: Integrated Cooling Fan
- **M**: Elapsed Time Meter (measures X-Ray ON elapsed time)

**DIMENSIONS:** in. [mm]

**Standard Unit**

**Front View**

[Diagram of front view]

**Side View**

[Diagram of side view]

**Back View**

[Diagram of back view]

**Bottom View**

[Diagram of bottom view]
DIMENSIONS: in.[mm]

Cooling Fan Option

TOP VIEW

SIDE VIEW

BACK VIEW

AIR FLOW

7.00 [178]
10.30 [262]
2.86 [73]
5.26 [134]
.57 [14]
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 and comes with a 3 year warranty.

**TYPICAL APPLICATIONS**
X-Ray Scanning, Thickness Measurement, Food Inspection, Fill Level Confirmation, Parcel Inspection

**OPTIONS**
- CB Cone Beam
- .5mm .5mm focal spot X-Ray tube
- NF 80° x 10° Narrow Fan beam
- RA Right Angle cable
- SC Smart Controller

**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

**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:**
- 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:**
- 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

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% (with an additional 5μA offset at ≤10% mA programming)

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) Standard
Controller: 8.5˝L x 6.70˝W x 2.21˝H
(215.9mm x 170.2mm x 56.1mm) Smart
Controller: 8.5˝L x 7.14˝W x 2.40˝H
(215.9mm x 181.4mm x 61.0mm)

Weight:
X-Ray Tank: 36lbs (16.32kg)
Standard Controller: 3.7lbs (1.68kg)
Smart Controller: 3.9lbs (1.77kg)

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

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) Standard
Controller: 8.5˝L x 6.70˝W x 2.21˝H
(215.9mm x 170.2mm x 56.1mm) Smart
Controller: 8.5˝L x 7.14˝W x 2.40˝H
(215.9mm x 181.4mm x 61.0mm)

Weight:
X-Ray Tank: 36lbs (16.32kg)
Standard Controller: 3.7lbs (1.68kg)
Smart Controller: 3.9lbs (1.77kg)

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

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) Standard
Controller: 8.5˝L x 6.70˝W x 2.21˝H
(215.9mm x 170.2mm x 56.1mm) Smart
Controller: 8.5˝L x 7.14˝W x 2.40˝H
(215.9mm x 181.4mm x 61.0mm)

Weight:
X-Ray Tank: 36lbs (16.32kg)
Standard Controller: 3.7lbs (1.68kg)
Smart Controller: 3.9lbs (1.77kg)
### 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>
<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>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>

*Ethernet interface for Smart Controller option only

### 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>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>

### 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, Zo = 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, Zo = 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>
DIMENSIONS: in.[mm]

STANDARD CONTROL UNIT

TOP VIEW

SIDE VIEW

BOTTOM VIEW

WARNING!
REFER SERVICE TO QUALIFIED PERSONNEL
INTERNAL PARTS MAY PRESENT A RISK OF ELECTRICAL SHOCK DURING SERVICING

WARNING!
DO NOT CONNECT AC INPUT POWER TO UNIT WITH COVER REMOVED. DIREGARDING THIS MAY CAUSE FATAL ELECTRICAL SHOCK

Platform
2.56 [65]* Right Angle Cable (RA) Option

*Total height of RA connector from tank surface 2.84 [72]

Standard cable
Total height of standard connector making a 90° bend at minimum bend radius is 8.25" (210) from tank surface

Corporate Headquarters
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
Copyright © 2015 Spellman High Voltage Electronics Corp.

 Spellman High Voltage Electronics Corporation
**WARNING**
REFER SERVICE TO QUALIFIED PERSONNEL
INTERNAL PARTS MAY PRESENT A RISK OF ELECTRICAL SHOCK DURING SERVICING

**WARNING**
DO NOT CONNECT AC INPUT POWER TO UNIT WITH COVER REMOVED. DISREGARDING THIS MAY CAUSE FATAL ELECTRICAL SHOCK

**WARNING**
DO NOT CONNECT AC INPUT POWER TO UNIT WITH COVER REMOVED. DISREGARDING THIS MAY CAUSE FATAL ELECTRICAL SHOCK

**DIMENSIONS:** in. [mm]

**TOP VIEW**

**SIDE VIEW**

**BOTTOM VIEW**

**SMART CONTROL UNIT**

**BOTTOM VIEW**

4-40.7mm Deep (MOUNTING HOLES)

2.56 [65]* Right Angle Cable (RA) Option

Total height of RA connector from tank surface 2.84 [72]

Total height of standard connector making a 90° bend at minimum bend radius is 8.25˝ (210) from tank surface
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:**
- Tube Type: Stationary anode, tungsten target
- Focal Spot: 0.5mm (IEC 336)
- Beam Filter: Lexan: 3.2mm, Oil: 10mm ±0.1mm, Glass: 1.8mm max
- Beam Geometry: Symmetrical fan 74° x 10° ±1°

**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:**
- Line: ±0.1% of maximum output voltage over a ±10% change of nominal input line voltage
- Load: ±0.1% of maximum rated voltage for 100uA to 1mA load change

**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 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:**
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.

---

**AC LINE POWER CONNECTOR—J1 THREE POSITION PHOENIX CONTACT**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Earth Ground</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Line</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Neutral</td>
<td></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>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>

---

**XRB 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>mA Program Input</td>
<td>0 to 9.00Vdc = 0 to 100% rated output, Zin = 10MΩ</td>
</tr>
<tr>
<td>3</td>
<td>kV Program Input</td>
<td>0 to 9.00Vdc = 0 to 100% rated output, Zin = 10MΩ</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</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>OV</td>
<td></td>
<td>High kV occurs</td>
</tr>
<tr>
<td>LED 2</td>
<td>UV</td>
<td></td>
<td>Low kV occurs</td>
</tr>
<tr>
<td>LED 3</td>
<td>UC</td>
<td></td>
<td>Low mA occurs</td>
</tr>
<tr>
<td>LED 4</td>
<td>OC</td>
<td></td>
<td>High mA occurs</td>
</tr>
<tr>
<td>LED 5</td>
<td>ARC FLT</td>
<td></td>
<td>Arc fault occurs</td>
</tr>
<tr>
<td>LED 6</td>
<td>OT</td>
<td></td>
<td>Over temperature occurs</td>
</tr>
<tr>
<td>LED 7</td>
<td>X-RAY ON</td>
<td></td>
<td>X-Rays are enabled</td>
</tr>
<tr>
<td>LED 8</td>
<td>PWR</td>
<td></td>
<td>Power is ON</td>
</tr>
</tbody>
</table>
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 comes with a 3 year warranty.

**TYPICAL APPLICATIONS**

**OPTIONS**
- CB: Cone Beam
- .5mm: .5mm focal spot X-Ray tube
- ST-TE: See page 4 for Cable Options
- RA-SE: See page 4 for Cable Options
- RA-TE: See page 4 for Cable Options

**SPECIFICATIONS**

**X-Ray Characteristics:**
- Focal Spot: 0.8mm (IEC 336) standard
  - 0.5mm (IEC 336) optional
- Beam Filter:
  - Ultem: $1.50mm \pm 0.15mm$
  - Oil: $9.0mm \pm 0.25mm$
  - Glass: $1.7mm \pm 0.2mm$
  - 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

**X-Ray Tube Voltage:**
- See table. Minimum kV for emission current 35kV

**X-Ray Tube Current:**
- See table. Minimum emission current 150µA

**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 150µA 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**

<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

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 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 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

#### 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 @ 5amps</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>

It is critical to ensure that 24Vdc is supplied to pins 1 and 2.

#### 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.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Open/removal of +24Vdc will cause X-Ray</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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/O 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>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>
DIMENSIONS: in.[mm]

100/210W CONTROL UNIT

FRONT VIEW

RA Right Angle Tank Connector Option

TE Top Exit Controller Cable Option

BOTTOM VIEW

SE Side Exit Controller Cable (standard)

ST Straight Tank Connector (standard)

REAR VIEW

SIDE VIEW

SIDE VIEW

CABLE CONFIGURATIONS

ST-SE standard

ST-TE option

RA-SE option

RA-TE option

ST-Side Exit Controller Cable

ST-Straight Tank Connector

ST-Top Exit Controller Cable

RA-Side Exit Controller Cable

RA-Right Angle Tank Connector
DIMENSIONS: in.[mm]

350/500W CONTROL UNIT

FRONT VIEW

M5 GROUND STUD

BOTTOM VIEW

AIR FLOW

REAR VIEW

SIDE VIEW

Standard

SE Side Exit shown
DIMENSIONS: in.[mm]

100W TANK
TOP VIEW

SIDE VIEW

BACK VIEW

FRONT VIEW

Do not block the vent hole on the cover

4.60 [116.84]

10.00 [254.00]

7.25 [184.15]

14.50 [368.30]

13.75 [349.25]

10.50 [266.70]

13.37 [339.5]

13.75 [349.25]

10.50 [266.70]

6.00 [152.4]

3.00 [76.2]

12°
DIMENSIONS: in.[mm]

350/500W TANK

TOP VIEW

Do not block the vent hole on the cover.

SIDE VIEW

AIR FLOW

BACK VIEW

FRONT VIEW

SPELLMAN HIGH VOLTAGE ELECTRONICS CORPORATION

Corporate Headquarters
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
Copyright © 2018 Spellman High Voltage Electronics Corp.

128132-001 REV. U
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 |
| ST-TE | |
| RA-SE | See page 4 for Cable Options |
| RA-TE | |

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 ±0.4mm
    - 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 @ 2.0A
  - 210W @ 4.0A
  - 350W @ 6.0A
  - 500W @ 8.0A

- **X-Ray Tube Voltage:**
  - See table. Minimum kV for emission current 35kV

- **X-Ray Tube Current:**
  - See table. Minimum emission current 150uA

- **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
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 (1.18kg)
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:

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

<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></td>
<td>Red</td>
</tr>
<tr>
<td>2</td>
<td>UV Error 5</td>
<td>Low kV occurs</td>
<td></td>
<td>Red</td>
</tr>
<tr>
<td>3</td>
<td>UC Error 4</td>
<td>Low mA occurs</td>
<td></td>
<td>Red</td>
</tr>
<tr>
<td>4</td>
<td>OC Error 3</td>
<td>High mA occurs</td>
<td></td>
<td>Red</td>
</tr>
<tr>
<td>5</td>
<td>ARC Error 2</td>
<td>Arc fault occurs</td>
<td></td>
<td>Red</td>
</tr>
<tr>
<td>6</td>
<td>OT Error 1</td>
<td>Over temperature occurs</td>
<td></td>
<td>Red</td>
</tr>
<tr>
<td>7</td>
<td>X-Ray On</td>
<td>X-Rays are being generated</td>
<td></td>
<td>Green</td>
</tr>
<tr>
<td>8</td>
<td>Power On</td>
<td>AC input power is present</td>
<td></td>
<td>Green</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

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
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

### 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>100-240 Vac (high)</td>
</tr>
<tr>
<td>2</td>
<td>Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>3</td>
<td>AC Input (neutral)</td>
<td>100-240 Vac (neutral)</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>0-10 Vdc = 0-100% rated output voltage. Zout = 10 kΩ</td>
</tr>
<tr>
<td>5</td>
<td>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>mA Monitor</td>
<td>0-10 Vdc = 0-100% rated output current. Zout = 10 kΩ</td>
</tr>
<tr>
<td>7</td>
<td>Fault Signal</td>
<td>Open collector, High (Open) = No Fault. 35 Vdc @ 10 mA maximum</td>
</tr>
<tr>
<td>8</td>
<td>HV ON Lamp Relay N/O</td>
<td>N/O dry contacts. 50 volts maximum. Rated for 1 amp or less, 50 mA 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, 50 mA 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, 50 mA nominal load</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>

It is critical to ensure that 24Vdc is supplied to pins 1 and 2.

### 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>
DIMENSIONS: in.[mm]

350/500W
CONTROL UNIT

FRONT VIEW

BOTTOM VIEW

REAR VIEW

SIDE VIEW

SIDE VIEW

RA Right Angle Tank Connector Option

SE Side Exit Controller Cable (standard)
ST Straight Tank Connector (standard)

TE Top Exit Controller Cable Option

M5 GROUND STUD

AIR FLOW

M5 x 10mm Ø4P

3.93 [100]

.413 [10.5]

.515 [13.1]

12.52 [318.0]

6.12 [155.4]

13.55 [344.2]

3.25 [82.5]

60.0 ±2.0 [1524 ± 51]
DIMENSIONS: in.[mm]

210W TANK
TOP VIEW

13.75 [349.25]
10.50 [266.7]
14.50 [368.30]
10.00 [254]
7.25 [184.15]
3.00 [76.2]
6.00 [152.4]

Do not block the vent hole on the cover

SIDE VIEW

90°

BACK VIEW

13.37 [339.59]

FRONT VIEW

12°
Spellman’s XRB180PN200 is an integrated X-Ray source operating up to 180kV and 200W, providing OEM users a compact plug-and-play Monoblock for critical inspection and screening applications. The unit incorporates a 25° angle stationary anode X-Ray tube offering a fan beam of 80° x 4°. Proprietary emission control circuitry provides excellent regulation of X-Ray tube current, with industry leading dose stability and image quality. This compact model comes with standard analog and RS-232 digital control. Spellman can provide customized versions of this platform for specific OEM system requirements.

**TYPICAL APPLICATIONS**
Aviation Security Screening: Checked Baggage/EDS, Checkpoint, Vehicle Inspection, General NDT, Food Inspection

**SPECIFICATIONS**

**X-Ray Characteristics:**
- **Tube Type:** Stationary Anode, tungsten target
- **Focal Spot:** 0.8 x 0.8mm nominal (IEC60336)
- **Beam Filter:** Consists of oil and the curved Ultem 0.079” +/-0.01”. Inherent filtration in the X-Ray Tube is 1mm Be, 1.5mm +/-10% glass.
- **Beam Geometry:** Fan of 80° x 4°, ±1%
- **Anode Angle:** 25°

**Input Voltage:**
- Power factor corrected input to 0.98. 100Vac to 240Vac, ±10%, 50/60 Hertz. 5A, maximum

**X-Ray Tube Voltage:**
Nominal X-Ray tube voltage is adjustable between 90kV to 180kV.

**Voltage Accuracy:**
The high voltage measured at the X-ray tube will be within ±1% of the selected value.

**Voltage Ripple:**
Ripple will be ≤0.2% of maximum rated voltage for frequencies ≤1kHz.

**Voltage Regulation:**
< ±0.1% for ±10% of nominal input line change
< ±0.1% for 0.5mA to 1.11mA load change

**Voltage Overshoot:**
KV overshoot will return within 5% of full voltage in less than 10ms.

**Risetime:**
The voltage and current risetime is controlled by a ramping circuit. Ramp time is less than 0.5 second from 10% to 90% of output voltage and current.

**X-Ray Tube Current:**
0.5mA to 1.11mA @ 180kV, 200 Watts maximum

**Current Accuracy:**
<±1% of the selected value.

**Current Regulation:**
<0.5% at 90-180kV, 0.5mA to 1.1mA

**Arc Intervention:**
Unit will detect a single arc but HV will not shut down. If multiple arcs occur (4 in 10 seconds) then the unit will shut down.

**Filament Configuration:**
Internal high frequency AC filament drive operated in current mode with closed loop filament emission control.

**Analog Interface:**
Ground referenced 0 to 10Vdc for all monitoring signals. Relay contacts and open collector outputs for other signals.

**Digital Interface:**
The RS-232 interface allows for programming of the voltage, current, and X-Ray Enable. Provides monitoring for voltage, current and oil temperature. Tolerance is 3% (with additional 5uA offset at ≤10%mA programming).

**Control Software:**
A demo GUI is available for engineering evaluation.

**Operating Temperature:**
0°C to +40°C

**Storage Temperature:**
-40°C to +70°C

**Humidity:**
10% to 95% relative humidity, non-condensing.

**Cooling:**
Via natural convection/external cooling fans of 100CFM minimum or maintaining tank/oil temperature below 55°C.
Input Line Connector:
3 pin Phoenix Contact, p/n 1829167.
Mating connector provided with unit.

Analog Interface Connector:
10 pin Phoenix Contact, p/n 1755503.
Mating connector provided with unit.

Digital Interface Connector:
9 pin female D connector.
Mating connector provided with unit.

Grounding Point:
M4 grounding stud provided on chassis.

Dimensions:
See outline drawing.

Weight:
132 pounds (60kg).

Orientation:
Can be mounted in any orientation.

X-Ray Leakage:
Not to be greater than .5mR/hr at 5cm from any surface of the Monoblock® when measured at 180kV @ 1.1mA.

Regulatory Approvals:

---

**AC INPUT POWER**
3 PIN PHOENIX CONTACT P/N 1829167

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Line</td>
<td>100-240Vac, ±10%, 50/60 Hertz @ 6 amps</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>3</td>
<td>Neutral</td>
<td>100-240Vac, ±10%, 50/60 Hertz @ 6 amps</td>
</tr>
</tbody>
</table>

**ANALOG INTERFACE—10 PIN PHOENIX CONTACT P/N 1755503**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X-Ray On</td>
<td>+24Vdc = Enable X-Ray, Low or open = Disable X-Ray</td>
</tr>
<tr>
<td>2</td>
<td>X-Ray On Return</td>
<td>X-Ray on 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 200kV, Zout = 10kΩ</td>
</tr>
<tr>
<td>5</td>
<td>SGND</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>mA Monitor</td>
<td>0 to 10Vdc = 0 to 1.5mA, Zout = 10kΩ</td>
</tr>
<tr>
<td>7</td>
<td>Fault</td>
<td>Open Collector, High (Open) = No Fault, 35Vdc @ 10mA, maximum</td>
</tr>
<tr>
<td>8</td>
<td>HV On Lamp N/O</td>
<td>Relay dry contact, normally open, 30Vdc @ &lt;1A, nominal 50mA DC load</td>
</tr>
<tr>
<td>9</td>
<td>HV On Lamp Common</td>
<td>Relay dry contact, common, 30Vdc @ &lt;1A, nominal 50mA DC load</td>
</tr>
<tr>
<td>10</td>
<td>HV On Lamp N/C</td>
<td>Relay dry contact, normally closed, 30Vdc @ &lt;1A, nominal 50mA DC 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>No Connection</td>
</tr>
<tr>
<td>2</td>
<td>Transmit Data</td>
<td>Conforms to EAI RS-232-C</td>
</tr>
<tr>
<td>3</td>
<td>Receive Data</td>
<td>Conforms to EAI 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>

**FRONT PANEL LED INDICATORS**

<table>
<thead>
<tr>
<th>INDICATOR</th>
<th>SIGNAL NAME</th>
<th>CONDITION</th>
<th>LED COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED 1</td>
<td>OT</td>
<td>OverTemperature occurs</td>
<td>Red</td>
</tr>
<tr>
<td>LED 2</td>
<td>ARC</td>
<td>Arc fault occurs</td>
<td>Red</td>
</tr>
<tr>
<td>LED 3</td>
<td>UV</td>
<td>Low kV occurs</td>
<td>Red</td>
</tr>
<tr>
<td>LED 4</td>
<td>OV</td>
<td>High kV occurs</td>
<td>Red</td>
</tr>
<tr>
<td>LED 5</td>
<td>UC</td>
<td>Low mA occurs</td>
<td>Red</td>
</tr>
<tr>
<td>LED 6</td>
<td>OC</td>
<td>High mA occurs</td>
<td>Red</td>
</tr>
<tr>
<td>LED 7</td>
<td>X-RAY ON</td>
<td>X-Rays are enabled</td>
<td>Green</td>
</tr>
<tr>
<td>LED 8</td>
<td>PWR ON</td>
<td>Power is ON</td>
<td>Green</td>
</tr>
</tbody>
</table>
Spellman’s XRBe80PN300 beryllium window Monoblock® X-Ray sources are designed for OEM applications powering the internal Bipolar X-Ray tube at 80kV at a power level of 300W. Features such as universal input, compact package size and a standard RS-232 digital interface simplify integration of the XRBe80PN300 into your X-Ray system. It is available with a cone shaped beam geometry. Proprietary emission control circuitry provides excellent regulation of X-Ray tube current, along with outstanding stability performance.

**TYPICAL APPLICATIONS**

**OPTIONS**
- 0.8mm 0.8mm focal spot X-Ray tube
- ST-TE
- RA-SE Cable Options (see page 3)
- RA-TE

**SPECIFICATIONS**

**X-Ray Characteristics:**
- **Focal Spot:** 0.8mm (IEC 336) standard
- **Beam Filter:** Be 0.8mm
- **Beam Geometry:**
  - **Cone:** Standard. The beam angular coverage will be 40° with the beam plane perpendicular to the X-Ray tube axis

**Input Voltage:**
- 100- 240Vac, ±10%, 50/60 Hertz, .98 power factor

**Input Current:**
- 300W @ 6A

**X-Ray Tube Voltage:**
- See table. Minimum kV for emission current 40kV

**X-Ray Tube Current:**
- See table. Minimum emission current 300uA

**X-Ray Tube Power:**
- 300W

**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 pinout 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: 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
Controller: see drawings

Weight:
X-Ray Tank: 81.5lbs. (37kg)
Controller: 7lbs. (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

---

### LED INDICATORS

<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>DT 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>

---

### 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/O 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>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>

---

It is critical to ensure that 24Vdc is supplied to pins 1 and 2
The XRBe80PN300 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

The XRBe80PN300 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 XRBe80PN300 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.
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/CT 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>
</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>+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

---

**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>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>

**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>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>

**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</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>
</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>+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/c</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>

### 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 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% p-p 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

- Integrated HV Supply, Filament Supply, X-Ray Tube, Beam Port and Control Electronics
- Compact & Lightweight
- Can be Mounted in Any Physical Orientation
- Standard RS-232 Digital Interface
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>
<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>

---

### 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>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 XRB200PN500 is an integrated X-Ray source operating up to 200kV and 500W, providing OEM users a compact plug-and-play Monoblock® for critical inspection and screening applications. The unit incorporates a 15° angle stationary anode X-Ray tube offering a symmetrical fan beam of 85° X 4°. Proprietary emission control circuitry provides excellent regulation of X-Ray tube current, with industry leading dose stability and image quality. This compact model comes with standard analog and RS-232 digital control. Spellman can provide customized versions of this platform for specific OEM system requirements.

**TYPICAL APPLICATIONS**
Aviation Security Screening: Checked Baggage/EDS
Vehicle Inspection, Cargo Inspection, General NDT

**SPECIFICATIONS**

**X-Ray Characteristics:**
- **Tube Type:** Stationary Anode, tungsten target
- **Focal Spot:** 0.8 x 0.5mm nominal (IEC60336)
- **Beam Filter:** Glass 2.1mm, maximum. Oil 18mm.
- **Beam Geometry:** Symmetrical fan of 85° X 4°, ±1%
- **Anode Angle:** 15°

**Input Voltage:**
- Power factor corrected input to 0.98. 100Vac to 240Vac, ±10%, 50/60 Hertz. 6 Amps, maximum

**X-Ray Tube Voltage:**
- Nominal X-Ray tube voltage is adjustable between 100kV to 200kV

**Voltage Accuracy:**
- The high voltage measured at the X-ray tube will be within ±1% of the selected value.

**Voltage Ripple:**
- Ripple will be 1% of maximum rated voltage for frequencies ≤1kHz.

**Voltage Regulation:**
- < ±0.1% for ±10% of nominal input line change
- < ±0.1% for 0.5mA to 2.5mA load change

**Voltage Overshoot:**
- kV overshoot will return within 5% of full voltage in less than 100ms.

**Risetime:**
- The voltage and current risetime is controlled by a ramping circuit. Ramp time is less than 1.0 second from 10% to 90% of output voltage and current.

**X-Ray Tube Current:**
- 0.5mA to 2.5mA @ 200kV <±1% of the selected value.
- 500 watts maximum

**Current Regulation:**
- <0.5% at 100 - 200 kV, 0.5mA to 2.5mA

**Arc Intervention:**
- Unit will detect a single arc but HV will not shut down. If multiple arcs occur (4 in 10 seconds) then the unit will shut down.

**Filament Configuration:**
- Isolated high frequency AC filament drive operated in current mode with closed loop thermionic filament emission control.

**Digital Interface:**
- The RS-232 and Ethernet interfaces allow for programming of the voltage, current and X-Ray Enable. Provides monitoring for voltage, current and oil temperature. Tolerance is 3%.

**Control Software:**
- A demo GUI is available for engineering evaluation.

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

**Storage Temperature:**
- -40°C to +70°C

**Humidity:**
- 10% to 95% relative humidity, non-condensing.

**Cooling:**
- Heat exchanger with fan and oil pump. Customer provided +24Vdc @ 3A is required. In certain situations, external cooling fans of 250CFM may be required to maintain tank/oil temperature below 55°C.

**Input Line Connector:**
- 3 pin Phoenix Contact, p/n 1829167.
- Mating connector provided with unit.

**Analog Interface Connector:**
- 10 pin Phoenix Contact, p/n 1755503.
- Mating connector provided with unit.

**RS-232 Connector:**
- 9 pin female D connector. Mating connector provided with unit.

**Ethernet Connector:**
- 8 pin RJ45 connector.

**Heat Dissipation Unit Connector:**
- 4 pin AMP connector, TE Connectivity (206061-1)
- Mating connector provided with unit.
Grounding Point:
M4 grounding stud provided on chassis.

Dimensions:
See outline drawing.

Weight:
181 pounds (80kg).

Orientation:
Can be mounted in any orientation.

X-Ray Leakage:
Not to be greater than .5mR/hr at 5cm from any surface of the Monoblock® when measured at 200kV @ 2.5mA.

Regulatory Approvals:
Compliant to EEC Low Voltage Directive. Designed to meet EEC EMC Directive with customer provided external line filter, Corcom p/n 6EU1F or equivalent.

AC INPUT POWER
3 PIN PHOENIX CONTACT P/N 1829167

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Line</td>
<td>100-240Vac±10%, 50/60 Hertz @ 6 amps</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>3</td>
<td>Neutral</td>
<td>100-240Vac±10%, 50/60 Hertz @ 6 amps</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>+24Vdc</td>
<td>+24Vdc @ 3A*</td>
</tr>
<tr>
<td>2</td>
<td>24Vdc Return</td>
<td>Return</td>
</tr>
<tr>
<td>3</td>
<td>+24Vdc</td>
<td>+24Vdc @ 3A*</td>
</tr>
<tr>
<td>4</td>
<td>24Vdc Return</td>
<td>Return</td>
</tr>
</tbody>
</table>

*Both +24V supplies are required for pump and fans

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>No Connection</td>
</tr>
<tr>
<td>2</td>
<td>Transmit Data</td>
<td>Conforms to EAI RS-232-C</td>
</tr>
<tr>
<td>3</td>
<td>Receive Data</td>
<td>Conforms to EAI 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>

ETHERNET INTERFACE—8 PIN FEMALE 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>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>

ANALOG INTERFACE—10 PIN PHOENIX CONTACT P/N 1755503

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X-Ray On</td>
<td>+24Vdc = Enable X-Ray, Low or open = Disable X-Ray</td>
</tr>
<tr>
<td>2</td>
<td>X-Ray On Return</td>
<td>X-Ray on 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 10kV = 0 to 200kV, Zout = 10kΩ</td>
</tr>
<tr>
<td>5</td>
<td>SGND</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>mA Monitor</td>
<td>0 to 10kV = 0 to 2.5mA, Zout = 10kΩ</td>
</tr>
<tr>
<td>7</td>
<td>Fault</td>
<td>Open Collector, High (Open) = No Fault, 35Vdc @ 10mA, maximum</td>
</tr>
<tr>
<td>8</td>
<td>HV On Lamp N/O</td>
<td>Relay dry contact, normally open, 30Vdc @ &lt;1A, nominal 50mA DC load</td>
</tr>
<tr>
<td>9</td>
<td>HV On Lamp Common</td>
<td>Relay dry contact, common, 30Vdc @ &lt;1A, nominal 50mA DC load</td>
</tr>
<tr>
<td>10</td>
<td>HV On Lamp N/C</td>
<td>Relay dry contact, normally closed, 30Vdc @ &lt;1A, nominal 50mA DC load</td>
</tr>
</tbody>
</table>

FRONT PANEL LED INDICATORS

<table>
<thead>
<tr>
<th>INDICATOR</th>
<th>SIGNAL NAME</th>
<th>CONDITION</th>
<th>Illuminated When...</th>
<th>LED COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED 1</td>
<td>OT</td>
<td>OverTemperature occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>LED 2</td>
<td>ARC</td>
<td>Arc fault occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>LED 3</td>
<td>UV</td>
<td>Low kV occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>LED 4</td>
<td>OV</td>
<td>High kV occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>LED 5</td>
<td>UC</td>
<td>Low mA occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>LED 6</td>
<td>OC</td>
<td>High mA occurs</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>LED 7</td>
<td>X-RAY ON</td>
<td>X-Rays are enabled</td>
<td>Green</td>
<td></td>
</tr>
<tr>
<td>LED 8</td>
<td>PWR ON</td>
<td>Power is ON</td>
<td>Green</td>
<td></td>
</tr>
</tbody>
</table>

SMART XRB

The XRB200PN500 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, Arc, High Current, High Voltage, Low Voltage, Watchdog, Power Fault, Interlock

The XRB200PN500 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

Firmware Controlled Seasoning:
Every unit comes with an initial seasoning table, or customers can set their own. The XRB200PN500 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.
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, 0Vdcopen = 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>

Corporate Headquarters
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
Copyright © 2010 Spellman High Voltage Electronics Corp.
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:**
140 lbs ±10 lbs (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>
DIMENSIONS: in.[mm]

TOP VIEW

SIDE VIEW

BOTTOM VIEW
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: 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: 7.1"W x 9.8"H x 3.6"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) @ 1meter 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>Signal Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>7</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>8</td>
<td>Fault Signal</td>
<td>Output signal: Open Collector, High (Open) = No Fault</td>
</tr>
<tr>
<td>9</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>
<tr>
<td>10</td>
<td>HV ON Lamp, Common</td>
<td>Common</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>

## 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>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 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>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 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.

**Input Power:**

- **Input Voltage:** 190-264Vac, single phase, 50/60 Hz
- **Continuous Current:** ≤9A @ 600W, 220V
- **Peak Current:** ≤34A @ 3500W, 220V

**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 set is 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 ºC.
Storage Temperature: -20 to +70 ºC
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.
Spellman’s MI1.5PN24 is a well-regulated, high performance DC-DC converter featuring a floating 1.5kV @ 6.5mA output, it has an operational range 300V-1500V. The output is isolated, this allows connection to loads of +Ve, -Ve or switchable polarity and for pulse currents to be contained within prescribed paths, reducing noise and interference signatures. The MI1.5PN24 low output ripple specification makes it ideal for use with pulsers in Mass Spectrometry applications. This module is packaged in a shielded metal enclosure and the high voltage output is provided via two captive cables. The MI1.5PN24 has a large, high quality capacitance and rugged output network, this allows high energy pulsed loads to powered continuously without significant voltage drop or damage to the unit circuitry. 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.

**TYPICAL APPLICATIONS**

- Mass spec pulsers
- Pulsed load requirements

**SPECIFICATIONS**

**Input Voltage:**

+24Vdc, ±10%. Protected against reverse connection

**Input Current:**

725mA maximum at 1500V @ 6.5mA

**Output Voltage:**

300V to 1.5kV, continuously variable over entire output range

**Polarity:**

Positive or negative, isolated to 1.5kV

**Load Current:**

6.5mA, maximum

**Power:**

9.75 watts, maximum

**Regulation:**

Line: <0.5% for line change of ±10%

Load: <0.1% for zero to full load

**Stability:**

Better than 300ppm/hour after 1 hour warm up. 100ppm/hour after 2 hour warm up at constant operating conditions. Typically, 50ppm/hour after 1 hour and 15ppm/hour after 2 hours.

**Temperature Coefficient:**

<100ppm/°C, typically 25ppm/°C

**Ripple:**

<75mV peak to peak at full load when either end is grounded.

**Output Current Limit:**

The module will have an output current limit of 9mA. The module is capable of withstanding an indefinite short circuit or overload on its output and will recover automatically once the short circuit is removed.

**Supply Voltage Dynamic Rejection:**

< than 20mV for an input step of 1 volt (within the range of +24Vdc, +10%/-2%)

**Setting Time:**

500 milliseconds maximum under all conditions.

**Output Capacitance:**

>400nF – Connected directly between POSITIVE to NEGATIVE output nodes

**Environmental:**

Temperature Range:

- Operating: +15°C to +50°C
- Storage: -40°C to 70°C
- Humidity: 5% to 95% RH @ 40°C non-condensing

**Cooling:**

Convection cooled

**Interface Connector:**

20 pin IDC male connector

**High Voltage Output Connectors:**

Two Varex CA166 (Connectronics SCID compatible) right angle connectors, 10 inches (254mm) long. The +Ve cable will have a RED band and “POS” printed on the cable. The -Ve cable will have a BLUE band and “NEG” printed on the cable. High voltage outputs are floating.

**Star Ground Network:**

+24Vdc Return is central; case, analog input ground and digital ground are returned through a 100Ω resistor in parallel with a 0.001uF capacitor to the +24Vdc Return.

**Dimensions:**

4.53”L x 3.74”W x 1.54”D (115mm X 95mm X 39.2mm)

**Weight:**

0.66lbs. (0.3kg)

**Regulatory Approvals:**

The unit is CE marked. The unit has been designed to meet the requirements of EN61010, UL1950 and CSA 22.2 No. 950.

**EMC:**

As the unit is a component it will not be tested as a stand alone unit to meet the EMC directive. The user will need to follow sensible EMC precautions in using the unit.
**INTERFACE CONNECTOR — 20 PIN IDC MALE CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Voltage Control Return</td>
<td>Analog Ground</td>
</tr>
<tr>
<td>2</td>
<td>Voltage Control*</td>
<td>0Vdc to +10Vdc = 0 to 1.5kV (differential input) Zin = 100kΩ. Protected against inputs of &lt;11 volts and reverse voltages.</td>
</tr>
<tr>
<td>3</td>
<td>Voltage Control Return</td>
<td>Analog Ground</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>Voltage Control Return</td>
<td>Analog Ground</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>Voltage Control Return</td>
<td>Analog Ground</td>
</tr>
<tr>
<td>8</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>9</td>
<td>Voltage Control Return</td>
<td>Analog Ground</td>
</tr>
<tr>
<td>10</td>
<td>Voltage Monitor</td>
<td>+2Vdc to +10Vdc = 300 volts to 1.5kV, ±1%, Zout = 1kΩ</td>
</tr>
<tr>
<td>11</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>12</td>
<td>Enable</td>
<td>TTL: Low = HV ON. Referenced to +24Vdc Return.</td>
</tr>
<tr>
<td>13</td>
<td>N/C</td>
<td>No Connection</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>
<tr>
<td>16</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
<tr>
<td>17</td>
<td>+24Vdc Return</td>
<td>Power Return (Power Ground)</td>
</tr>
<tr>
<td>18</td>
<td>+24Vdc Power</td>
<td>+24Vdc @ 725mA</td>
</tr>
<tr>
<td>19</td>
<td>+24Vdc Return</td>
<td>Power Return (Power Ground)</td>
</tr>
<tr>
<td>20</td>
<td>+24Vdc Power</td>
<td>+24Vdc @ 725mA</td>
</tr>
</tbody>
</table>

*At voltage programming voltages less than 2 volts, parameters in this specification may not be met.

**How to Order:**

Standard: PART NO.: Mi1.5PN24

---

**DIMENSIONS: in.[mm]**

**TOP VIEW**

**SIDE VIEW**

**FRONT VIEW**
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

**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:**

- Compliant to EEC EMC Directive
- Compliant to EEC Low Voltage Directive
- UL/CUL recognized file E227588 & E354595
- RoHS compliant
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:**
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:** +24Vdc, ±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
### 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</td>
<td>Power Input</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 Within 300ms</td>
</tr>
<tr>
<td>6</td>
<td>Vmon</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>Imon</td>
<td>0-10V Output Current Monitor</td>
</tr>
</tbody>
</table>

**How to Order:**

Standard: PART NO.:MX2.5PN24
Spellman’s 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
(Linearity not guaranteed below 200V. Maximum offset ±20V when programmed to zero or disabled using remote enable.)

**Output Current:**
0 to 100μA max

**Output Polarity:**
Remotely reversible via TTL logic signal

**Polarity Reversal Time:**
<25ms from change of polarity command to 90% of output into 100pF load capacitance.
(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.)

**Voltage and Current Regulation:**
- Line: <0.1% for ±10% input voltage change
- Load: <0.1% for 0 to full load

**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
- Protection:
  - Arc and short circuit protected

**Output Voltage Limit:**
Output voltage does 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:**
2.4 pounds (1.1kg)

**Input Connector:**
14 way Molex receptacle p/n 39-01-2140. Cable length 508mm, mating connector not provided

**Output Connector:**
Alden F303RX, mating connector not provided

**Regulatory Approvals:**
- ±8kV 25mS Polarity Reversing Speed
- Optimized for EI and APCI Applications
- Precision Analog Voltage and Current Controls and Monitors
- High Stability
- Low Ripple and Noise
- High Voltage Inhibit Control
- UL Recognized, CE Marked and RoHS Compliant

Spellman High Voltage is an ISO 9001 and ISO 14001 registered company
Copyright © 2009 Spellman High Voltage Electronics Corp.
## MX8 PLUS - POWER AND CONTROL
### 14 PIN MOLEX MINI-FIT JR RECEPTACLE

<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 Input</td>
</tr>
<tr>
<td>3</td>
<td>Enable/Inhibit input. TTL high is enabled, TTL low is disabled (see Note 1)</td>
</tr>
<tr>
<td>4</td>
<td>Output voltage monitor. 0 to +8V for 0V to ±8kV output. Accuracy ±1%</td>
</tr>
<tr>
<td>5</td>
<td>Voltage control input. 0 to +8V for 0V to ±8kV output. Accuracy ±1%</td>
</tr>
<tr>
<td>6</td>
<td>Current monitor output. 0 - 10V for 0A to 100μA. Accuracy ±2%</td>
</tr>
<tr>
<td>7</td>
<td>Current control input. 0 to +10V for 0A to 100μA. Accuracy ±1%</td>
</tr>
<tr>
<td>8</td>
<td>Polarity control input. TTL high is positive, TTL low is negative (see Note 1)</td>
</tr>
<tr>
<td>9</td>
<td>Analog ground</td>
</tr>
<tr>
<td>10</td>
<td>Current/Voltage control indicator. TTL compatible output (3.3V max). TTL high when in current mode, TTL low when in voltage mode.</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>

Note 1: TTL input. The threshold is set to 1.65V for use with 3.3V or 5V input levels although the input will tolerate up to 15V being applied.

### 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**

- **Input Voltage:**
  - +24Vdc, ±1 volt

- **Input Current:**
  - <400mA continuous
  - <1.2A during reversing

- **Output Voltage:**
  - ±200Vdc to ±10kV

- **Output Current:**
  - 0 to 100uA max.

- **Polarity:**
  - Remotely reversible via logic signal, 250mS to settle to ±2%, 1 Hz maximum switch rate

- **Voltage Regulation:**
  - 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

- **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:**
### 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 = &quot;NEGATIVE&quot;; &lt;4V = &quot;POSITIVE&quot;</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**

- MOUNTING HOLES
- 3.5 X 3

---

www.spellmanhv.com
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 @ 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 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 100uA 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
- 0 to 10 volts corresponds to 0 to 100% of rated output voltage/current

**Programming and Monitor Accuracy:**
- ±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

**Regulatory Approvals:**
- Compliant to EEC EMC Directive
- Compliant to EEC Low Voltage Directive
- RoHS Compliant
### MX20 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.: MX20PN24
- VCC Option: PART NO.: MX20PN24/VCC

### Dimensions: in.[mm]

**SIDE VIEW**

**TOP VIEW**

MOUNTING HOLES 3.5 X 4

- 2.05 [52]
- 1.49 [38]
- 4.76 [121]
- 6.50 [165]
- 6.61 [168]
- 6.30 [160]
- 6.61 [168]
- 0.15 [4]
Spellman’s MXE series is a family of high voltage, high performance, ultra-compact, hot-switchable polarity reversing modules with output voltages ranging from 2.5kV to 10kV.

The MXE series is controlled via analog interface, provided via a standard 15-pin D-type connector. The units feature a differential voltage program input for low noise control and TTL compatible Enable and Polarity control signal inputs.

Spellman’s advanced low noise, high stability technology provides the high quality and performance needed for precision applications.

**TYPICAL APPLICATIONS**

- Mass Spectrometry
- Automatic Test Equipment
- Capillary Electrophoresis
- Dual Ion Surface Analysis
- Electrostatic Printing
- Electrostatic Lenses
- Electrospinning
- Precision Laboratory

**SPECIFICATIONS**

- **Input Voltage:**
  - +24Vdc, ±1.2Vdc
- **Input Current:**
  - 0.5A maximum
- **Output Voltage:**
  - 3 models available: ±2.5kV, ±5kV and ±10kV
  - The minimum programmable voltage is ±20V
  - The output is not designed to sink current
- **Output Polarity:**
  - Hot-switchable polarity reversing
- **Output Current:**
  - 200μA maximum
- **Voltage Regulation:**
  - Line: For a 5% line change 20ppm
  - Load: 0-100% load 20ppm
- **Accuracies:**
  - Voltage Programming: ±1% or ±10V*
  - Voltage Monitor: ±2% or ±20mV*
  - Current Monitor: ±5% or ±50mV*
  - *whichever is greater
- **Current Limit:**
  - 110% of rated output current.
- **Polarity Reversal Time:**
  - 10s to within 2ppm at max output voltage amplitude and 100pF load
- **Output Decay Time:**
  - 5s to <50V at no-load condition
- **Ripple:**
  - 30mV between 0.01Hz and 20MHz
- **Stability:**
  - 15ppm/8h after one hour warm up period
- **Temperature Coefficient:**
  - 15ppm per degree C
- **Protection:**
  - Arc and short circuit protected.
  - The power supply will fully recover once the short is removed with no subsequent damage to load, supply, input control, or input supply
- **Environmental:**
  - Temperature Range:
    - Operating: 10°C to 45°C
    - Storage: -20°C to 85°C
  - Humidity: 5% to 90% RH, non-condensing
- **Cooling:**
  - Convection cooled
- **Dimensions:**
  - 1.9” H X 5.7” W X 6.8” D (48mm x 144mm x 172mm)
- **Weight:**
  - 3.74 lbs (1.7kg)
- **Interface Connector:**
  - 15 pin male D connector
- **Output Connector:**
  - Captive 39.4” (1 meter) long un-terminated shielded HRG58 HV cable (URM76 compatible)
- **Regulatory Approvals:**
  - Compliant to EEC Low Voltage Directive. UK Conformity Assessed. RoHS Compliant.
**MXE SELECTION TABLE**

<table>
<thead>
<tr>
<th>Model</th>
<th>Output Voltage</th>
<th>Output Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>MXE2.5PN24</td>
<td>±2.5kV</td>
<td>200μA</td>
</tr>
<tr>
<td>MXE5PN24</td>
<td>±5kV</td>
<td>200μA</td>
</tr>
<tr>
<td>MXE10PN24</td>
<td>±10kV</td>
<td>200μA</td>
</tr>
</tbody>
</table>

**MXE 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>24Vdc Return</td>
<td>Input voltage return</td>
</tr>
<tr>
<td>2</td>
<td>+24Vdc Input</td>
<td>Input voltage +24dc @ 0.5A max</td>
</tr>
<tr>
<td>3</td>
<td>Voltage Monitor Output</td>
<td>0 to 10Vdc = 0 to 100% rated output, Zout=330Ω</td>
</tr>
<tr>
<td>4</td>
<td>Polarity Set Input</td>
<td>TTL level or open/short contact signal. Low or short = Positive, high or open = Negative</td>
</tr>
<tr>
<td>5</td>
<td>N/C</td>
<td>Pin used internally - do not connect</td>
</tr>
<tr>
<td>6</td>
<td>Voltage Program Return</td>
<td>0 to 10Vdc differential between pin 7 and pin 6 = 0 to 100% of rated output, Zin=100kΩ</td>
</tr>
<tr>
<td>7</td>
<td>Voltage Program Input</td>
<td>0 to 10Vdc = 0 to 200μA, Zout=330Ω</td>
</tr>
<tr>
<td>8</td>
<td>Current Monitor Output</td>
<td>0 to 10Vdc = 0 to 200μA, Zout=330Ω</td>
</tr>
<tr>
<td>9</td>
<td>N/C</td>
<td>Pin used internally - do not connect</td>
</tr>
<tr>
<td>10</td>
<td>N/C</td>
<td>Pin used internally - do not connect</td>
</tr>
<tr>
<td>11</td>
<td>Signal Ground</td>
<td>Signal ground for control and monitoring</td>
</tr>
<tr>
<td>12</td>
<td>Enable Input</td>
<td>TTL level or open/short contact signal. Low or short = enabled, high or open = disabled</td>
</tr>
<tr>
<td>13</td>
<td>Control Pin</td>
<td>Connect to pin 14</td>
</tr>
<tr>
<td>14</td>
<td>Control Pin</td>
<td>Connect to pin 13</td>
</tr>
<tr>
<td>15</td>
<td>N/C</td>
<td>Pin used internally - do not connect</td>
</tr>
</tbody>
</table>
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 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 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:** in.[mm]

**SIDE VIEW**

**TOP VIEW**

**FRONT VIEW**

---

SPELLMAN HIGH VOLTAGE ELECTRONICS CORPORATION

PAGE 2 OF 2
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 and are available either in analog or RS-232 digital control options. These units feature a logic signal input to control output polarity reversal. Voltage, polarity and current monitors are provided. The digital version also features an opto isolated interlock input (HV Enable/Inhibit). 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**
MXR can be ordered as an analog or a digital controlled unit. See How To Order information below.

Custom captive cable options available upon request.

**SPECIFICATIONS**

**Input Voltage:**
24Vdc (±5%)

**Input Current:**
≤1.25 A nominal continuous
≤4.5 A peak during reversing

**Output Voltage:**
- 0V to ±20kV (MXR20)
- 0V to ±30kV (MXR30)

**Output Current:**
<300μA

**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:**
- 20kV: 100mVp-p
- 30kV: 150mVp-p

**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 switching times available on request.

**Environmental:**
- Temperature Range:
  - Operating: 10°C to 50°C
  - Storage: -35°C to 85°C
- Humidity:
  - 0% to 85%, non-condensing
- Cooling: Convection cooled

**Dimensions:**
2.05” H X 8.47” W X 9.45” D (52mm X 215mm X 240mm)

**Weight:**
8.80 pounds (4.0kg)

**Input Connectors:**
- Analog units:
  - Power and Control: 12 way Samtec FWS 12-04-T-S-RA
- Digital units:
  - Power: 2 way Molex Mini-fit Jr 39-30-1022
  - Control: 10 way ‘IDC Ribbon cable’ connector

3M N3793-5302RB

**Output Connector:**
Standard output is GES HB30 receptacle (GES p/n: 7331051). Mating plug is GES HS30 (p/n: 7331050, not included). Mating cable assembly can be ordered separately, see How To Order information below.

**Regulatory Approvals:**
- UL recognized component (RC). File number E354595. Compliant to IEC/UL 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use; CAN/CSA-C22.2 No.61010-1. CE marked to EN 61010-1. UKCA marked to BS EN 61010-1. RoHS compliant. As the unit is designed for incorporation within the user’s system it is not tested against any specific EMC standards. Compliance with any relevant EMC standards on a system level are the responsibility of the equipment designer.
### ANALOG UNITS—POWER AND CONTROL

12 PIN SAMTEC FWS CONNECTOR

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Current monitor output 0-10V = 0V to 500μA</td>
</tr>
<tr>
<td></td>
<td>Zout=10kΩ, Accuracy ±5%</td>
</tr>
<tr>
<td>2</td>
<td>+24Vdc Input</td>
</tr>
<tr>
<td>3</td>
<td>Voltage monitor output 0-10V = 0V to Max V</td>
</tr>
<tr>
<td></td>
<td>Zout=10kΩ, Accuracy ±5%</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 0-10V = 0V to Max V</td>
</tr>
<tr>
<td></td>
<td>Zin&gt;1MΩ, Accuracy ±2%</td>
</tr>
<tr>
<td>8</td>
<td>Polarity set input, TTL levels: LO = +VE, HI/OPEN = -VE</td>
</tr>
<tr>
<td>9</td>
<td>Signal ground</td>
</tr>
<tr>
<td>10</td>
<td>Ground return for +24Vdc</td>
</tr>
<tr>
<td>11</td>
<td>N/C</td>
</tr>
<tr>
<td>12</td>
<td>Polarity status output LO (&lt;200mV, source 1.5kΩ) = +VE, HI (+24V, source 2.2kΩ) = -VE</td>
</tr>
</tbody>
</table>

*Note: 3.3V@6mA or 5V@10mA*

### DIGITAL UNITS—POWER

2 PIN MOLEX MINI-FIT JR

<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>

### DIGITAL UNITS—CONTROL

10 PIN 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 2</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 (0mA = Voltage Inhibit) see*</td>
</tr>
<tr>
<td>8</td>
<td>Interlock opto-isolator signal return</td>
</tr>
<tr>
<td>9</td>
<td>Polarity set opto-isolator input (0mA = -VE) see*</td>
</tr>
<tr>
<td>10</td>
<td>Polarity set opto-isolator signal return</td>
</tr>
</tbody>
</table>

*Note: 3.3V@6mA or 5V@10mA*

### How to Order:

**Analog (standard):** PART NO.: MXR20PN24  
PART NO.: MXR30PN24

**Digital (option):** PART NO.: MXR20PN24/DCC2  
PART NO.: MXR30PN24/DCC2

**Mating cable, length 2m:** PART NO.: HVC30/1S/1279

---

** Spoonman: 20kV and 30kV DC-DC CONVERTERS**

**Spellman High Voltage Electronics Corporation**

---

**How to Order:**

**Analog (standard):** PART NO.: MXR20PN24  
PART NO.: MXR30PN24

**Digital (option):** PART NO.: MXR20PN24/DCC2  
PART NO.: MXR30PN24/DCC2

**Mating cable, length 2m:** PART NO.: HVC30/1S/1279

---

**DIGITAL UNITS—POWER**

2 PIN MOLEX MINI-FIT JR

<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>

**DIGITAL UNITS—CONTROL**

10 PIN 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 2</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 (0mA = Voltage Inhibit) see*</td>
</tr>
<tr>
<td>8</td>
<td>Interlock opto-isolator signal return</td>
</tr>
<tr>
<td>9</td>
<td>Polarity set opto-isolator input (0mA = -VE) see*</td>
</tr>
<tr>
<td>10</td>
<td>Polarity set opto-isolator signal return</td>
</tr>
</tbody>
</table>

*Note: 3.3V@6mA or 5V@10mA*

---

**How to Order:**

**Analog (standard):** PART NO.: MXR20PN24  
PART NO.: MXR30PN24

**Digital (option):** PART NO.: MXR20PN24/DCC2  
PART NO.: MXR30PN24/DCC2

**Mating cable, length 2m:** PART NO.: HVC30/1S/1279
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 @ 330μA 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**

**Input Voltage:**

+24Vdc, ±0.5 volts

**Input Current:**

600mA maximum

**Output Voltage:**

+100V to +3kV, continuously variable over the entire output range

**Output Current:**

330μA maximum

**Polarity:**

Positive

**Isolation Voltage:**

Up to 15kV total to ground (resistance to ground 600M on each output)

**Line Regulation:**

≤0.01% for input voltage change of 1V

**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

**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:**

1.49” 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:**

### MCP INTERFACE/POWER CONNECTOR

<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**

- 4.08 [104]
- 3.42 [87]
- 1.13 [28.7]
- 0.65 [16.4]
- 0.45 [11.3]

**BACK VIEW**

- 7.8 [15.8]
- 4.08 [104]
- 3.42 [87]
- 1.13 [28.7]

**TOP VIEW**

- 6.73 [171]
- 5.55 [141]
- 0.086 [2.2]
- 0.65 [16.6]
- 0.45 [11.3]

**MOUNTING HOLES**

- 4 x 3.5

**MCP HIGH PERFORMANCE DC-DC CONVERTER**

Spellman High Voltage is an ISO 9001 and ISO 14001 registered company

Copyright © 2004 Spellman High Voltage Electronics Corp.
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 400uA, Zout = 4.7Kohm

Cooling:
Convection cooled

Dimensions:
3”H X 5”W X 12.625”D (76.2mm x 127mm x 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:
Compliant to EEC EMC Directive. Compliant to EEC Low Voltage Directive. UL/CUL recognized, File 148969. 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>

---

**SPELLMAN HIGH VOLTAGE ELECTRONICS CORPORATION**

**TOF3000 MASS SPECTROMETRY POWER SUPPLY**

**DIMENSIONS: in.[mm]**

**FRONT VIEW**

**BACK VIEW**

**TOP VIEW**

**BOTTOM VIEW**

---

**SPELLMAN HIGH VOLTAGE ELECTRONICS CORPORATION**

**Corporate Headquarters**
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
Copyright © 2004 Spellman High Voltage Electronics Corp.
Spellman's MCP4 is a well-regulated, high performance DC-DC converter featuring a floating 4kV @ 600μA 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:**
600μA maximum

**Current Limit:**
1900μA maximum

**Polarity:**
+VE Positive with respect to the high voltage source (-VE) which it is floated upon

**Isolation Voltage:**
Up to 15kV total to ground.

Note: When the unit output is set to zero and no load is connected: If the reference supply is positive (up to +15kV), +VE will always be less than 100V with respect to -VE. If the reference supply is negative (up to -15kV), a 47MΩ pre-load resistor fitted within the MCP4 limits +VE (with respect to -VE) to ≤ 1400V

**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. Accuracy ±1%. Iout=300μA maximum

**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:**
Both HV cables (+VE and -VE):
HRG58 coaxial 45.3”(1150mm)

**Regulatory Approvals:**
- Designed to meet IEC/UL 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use; CAN/CSA-C22.2 No.61010-1. CE marked to EN 61010-1. UKCA marked to BS EN 61010-1. RoHS compliant.

**EMC:**
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.
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. Accuracy=2%. Zin=20kΩ</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. Accuracy ±1%. Iout=300μA maximum</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.:MCP4P
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. Focused Ion Beam is typically used in the semiconductor industry, materials science and 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 ripple, excellent regulation, stability, temperature coefficient, drift and accuracy specifications.

Customer control of this integrated FIB power supply system is accomplished via a fiber optic or Ethernet interface. All high voltage safety interlocks are of a failsafe hardware based design.

**TYPICAL APPLICATIONS**
- Focused Ion Beam (FIB)
- Ion Gun Controller

**SPECIFICATIONS**

**Input Voltage:**
- +24Vdc, ±5% @ 5.5 amps maximum.
- Inrush is <6 amps for 1 second.

**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.

**FIB Input Power Connector:**
2 pin Mate-n-Lok (TE 1-350942-0)

**FIB Communication:**
Fiber Optics dual channel Avago HFBR- 2524z/1524z. RS-232.
Ethernet RJ-45 socket which supports 100BaseTX.
When Ethernet port is connected, RS-232 will not work.
A Spellman Fiber Optic to RS-232 converter can be ordered, as well as a complete Fiber Optic to USB communication kit.

**FIB Vacuum Interlock Connector:**
Dual channel Avago HFBR- 2524z (receiver) /1524z (transmitter)

**FIB to Lens Modules Interconnection:**
The modules are supplied with interconnecting cables for the power and communications. The same kit is used to connect the FIB to the lens module, and, if required, between a lens module and the next.

**FIB HV Output Connector:**
The main high voltage output is fitted with a custom 4 pole receptacle. A Spellman HV cable assembly, available in different lengths, can be ordered with the unit.

**Lenses HV Output Connectors:**
The lenses are fitted with Lemo ERA3Y430CTL receptacles.
A Spellman 5 meters mating HV cable assembly can be ordered with the units. (See the product manual for additional cables and connectors information)

**FIB and LGM Operation:**
When the modules are switched on / enabled, all output voltages are automatically set to 0V.

**Safety Interlocks:**
The vacuum interlock is an optical interlock. When it opens, the power supply is deactivated via relay contacts and will not reactivate until it is enabled through the computer control, even though the interlock may close. The FIB communication remains operational.
The interlock plate is situated around the FIB HV Output connector, and if removed will also disable all outputs.
The individual modules of the HVPS can be enabled and disabled through computer control, provided the appropriate hardware interlocks are enabled.

**Weight:**
- Main chassis: 67.46 lbs. (30.6 kg)
- Lens chassis: 27.56 lbs. (12.5 kg)

**Regulatory Approvals:**
Compliant to EEC Low Voltage Directive. UK Conformity Assessed. RoHS Compliant.
## Outputs Specifications

<table>
<thead>
<tr>
<th>Output</th>
<th>Accelerator</th>
<th>Filament</th>
<th>Suppressor</th>
<th>Extractor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Voltage</td>
<td>0 to 35kV, referenced to ground</td>
<td>0 to 5V, referenced to Accelerator, current controlled</td>
<td>-2kV to +2kV, referenced to Accelerator</td>
<td>0 to -15kV, referenced to Accelerator</td>
</tr>
<tr>
<td>Output current - max</td>
<td>30μA</td>
<td>5A</td>
<td>30μA</td>
<td>400μA</td>
</tr>
<tr>
<td>Output current limit</td>
<td>30μA current controlled</td>
<td>30μA</td>
<td>programmable 8 bit, 0 to 400μA</td>
<td></td>
</tr>
<tr>
<td>Output Absolute Accuracy</td>
<td>100V</td>
<td>5mA</td>
<td>20V</td>
<td>100V</td>
</tr>
<tr>
<td>Load Regulation</td>
<td>±0.01% of max for 0 to 30μA change</td>
<td>±0.1% of max for 0 to 5V change</td>
<td>±0.01% of max for 0 to 30μA change</td>
<td>±0.01% of max for 0 to 400μA change</td>
</tr>
<tr>
<td>Line Regulation</td>
<td>±0.01% of max for 0 to 30μA change</td>
<td>±0.1% of max for 0 to 5V change</td>
<td>±0.01% of max for 0 to 30μA change</td>
<td>±0.01% of max for 0 to 400μA change</td>
</tr>
<tr>
<td>Ripple p-p from 0.1Hz to 1MHz</td>
<td>200mV at max output</td>
<td>10mA</td>
<td>150mV</td>
<td>100mV at 30μA and below</td>
</tr>
<tr>
<td>Temperature Coefficient</td>
<td>25 ppm/°C</td>
<td>200 ppm/°C</td>
<td>25 ppm/°C</td>
<td>25 ppm/°C</td>
</tr>
<tr>
<td>Stability (after 2h warm up)</td>
<td>1.5V / 10h</td>
<td>5mA/10min</td>
<td>0.5V / 10h</td>
<td>0.5V / 10h</td>
</tr>
<tr>
<td>Programming</td>
<td>16 bit, 0 to 35kV</td>
<td>16 bit, 0 to 5A</td>
<td>16 bit, -2kV to +2kV</td>
<td>16 bit, 0 to -15kV</td>
</tr>
<tr>
<td>Voltage Monitoring</td>
<td>16 bit, 0 to 35kV ±1% accuracy ±50V offset</td>
<td>16 bit, 0 to 5V ±4% accuracy ±0.1V offset</td>
<td>16 bit, -2kV to +2kV ±1% accuracy ±8V offset</td>
<td>16 bit, 0 to -15kV ±1% accuracy ±15V offset</td>
</tr>
<tr>
<td>Current Monitoring</td>
<td>16 bit, 0 to 3μA ±1% accuracy ±0.3μA offset</td>
<td>16 bit, 0 to 5A ±4% accuracy ±50mA offset</td>
<td>N/A</td>
<td>16 bit 0 to 10μA: ±0.05μA accuracy ±0.05μA offset</td>
</tr>
<tr>
<td>Response (see note 1)</td>
<td>&lt;1.0 s</td>
<td>&lt;0.1 s</td>
<td>&lt;0.25 s</td>
<td>&lt;0.25 s</td>
</tr>
<tr>
<td>Additional info</td>
<td></td>
<td></td>
<td></td>
<td>see note 2</td>
</tr>
</tbody>
</table>

Note 1: This is the time taken for the output signal of a module to settle (to 0.2% of the step size, or 1 V (20 mA for the filament), whichever is greater) in response to a ±2% or less (of full scale) step in its output, as measured from when the output first starts to change.

Note 2: Hard trip at 400μA in < 0.25s programmable trip delay (for when current at 1 limit) 0 to 255s, 8 bit res. (.5s min, 20s default)

Note 3: The above specifications do not apply in the range -500V to +500V.

Note 4: Wobble range: 2V to 2.5kV p-p, sinusoidal. If wobbling occurs near zero, the wobble waveform will be clipped so as to prevent crossing zero.

Wobble Period: 1s to 4s

---

## Lens Modules

<table>
<thead>
<tr>
<th>Lens Modules</th>
<th>Lens 1 Output</th>
<th>Lens 2 Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available as Standard</td>
<td>Part number</td>
<td>Voltage</td>
</tr>
<tr>
<td>LGM30P/25PN</td>
<td>0V to +30kV</td>
<td>30μA</td>
</tr>
<tr>
<td>LGM30P/30PN</td>
<td>0V to +30kV</td>
<td>30μA</td>
</tr>
<tr>
<td>LGM30P/25N</td>
<td>0V to +30kV</td>
<td>30μA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Available on Request</th>
<th>Lens 1 Output</th>
<th>Lens 2 Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>LGM20PN/30PN</td>
<td>-20kV to 20kV</td>
<td>30μA</td>
</tr>
<tr>
<td>LGM30N/25PN</td>
<td>0V to -30kV</td>
<td>30μA</td>
</tr>
<tr>
<td>LGM20N/10N</td>
<td>0V to -20kV</td>
<td>50μA</td>
</tr>
</tbody>
</table>

Please consult with factory for availability and custom configuration requests.
The EBM20N5/24 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 EBM20N5/24 provides a highly regulated, low noise, ultra stable accelerator supply programmable from 0 to -20kV at 250μA. The EBM20N5/24 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 EBM20N5/24 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: 250μA maximum (including feedback current), continuous from -500V to -20kV

Current Trip Level: 275mA, ±10%. Trips off all outputs, reset by cycling input power

Accuracy (voltage program): ±1% from -500V to -20kV

Load Regulation: <±100ppm, 20μA to 250μA load change

Line Regulation: <±100ppm for 10% line change

Ripple: <20ppm p-p at -20kV, 250μA, 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 (voltage program): ±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

Rise Time (switch ON): <3 seconds (0% to 90%) with no overshoot

Fall Time (switch OFF): <100 seconds (to <50 volts)

**FILAMENT:**
(center voltage WRT accelerator output)

Power: 0 to 12W

Load Resistance: 1.33Ω ±5%

Accuracy: ±3% of FS

Load Regulation: <1% for 10% change in load resistance

Line Regulation: <1% for 10% line voltage change

Ripple: <0.1% p-p max

Temperature Coefficient: <300ppm/°C

Stability: 100ppm/10 minutes

**Rise Time (switch ON):**
<3 seconds (0% to 90%) with no overshoot

**Fall Time (switch OFF):**
<100 seconds (to <50 volts)
**INTERFACE:**

*Input:*  
Analog control for accelerator, filament and bias

*High Voltage 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:**  
UL recognized component (RC). File number E354595.  
Compliant to IEC/UL 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use;  
CAN/CSA-C22.2 No.61010-1, CE marked to EN 61010-1. UKCA marked to BS EN 61010-1. 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.

**POWER INPUT CONNECTOR**

**JHA2 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**

**JHA3 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>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>3</td>
<td>BIAS (+)</td>
<td>Bias (+) Input</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>5</td>
<td>ACC PROG (+)</td>
<td>ACC Voltage Program (+) Input</td>
</tr>
<tr>
<td>6</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>7</td>
<td>EMS</td>
<td>Emission Current Monitor Output</td>
</tr>
<tr>
<td>8</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>9</td>
<td>ACC MON</td>
<td>ACC Voltage Monitor Output</td>
</tr>
<tr>
<td>10</td>
<td>GND</td>
<td>Ground</td>
</tr>
</tbody>
</table>

**How to Order:**

*Standard:* PART NO.:EBM20N5/24  
HV Cable: PART NO.:HVC30/3IS/LL1650 (1.65m Cable)
The EBM30N/TEG is an integral solution that provides the high voltage required by Thermionic Emission Scanning Electron Microscope (SEM). Spellman’s proprietary packaging and encapsulation technology gives dramatic improvements in size, cost and performance compared to other SEM power supply offerings.

This unit provides a highly regulated, low noise, ultra-stable Accelerator supply programmable from 0 to -30kV at 170μA, together with Floating Filament and Bias supplies referenced to the Accelerator to control the beam. The unit also includes high voltage outputs to drive the Detector, comprising PMT, Scintillator and Collector grounded outputs.

Programming signals utilize differential analog inputs to minimize external noise and offset voltages effects. A ground referenced emission current monitor and a filament failure signal are provided.

**SPECIFICATIONS**

**Input Voltage:**

+24Vdc, ±5% @ 2.5A max.

**High Voltage Outputs:**

CA11 Mini 75 receptacle from Claymount. Spellman HV offers mating cable assemblies at different lengths (see HOW TO ORDER table below).

**Scintillator Output:**

Custom ‘Poke home’ receptacle manufactured by Spellman. For mating cables, see HOW TO ORDER information below.

**PMT and Collector Outputs:**

Industry standard BNC.HT receptacle: Radiall R316 553

**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 the top mounting bracket

**Weight:**

16.5 lbs. (7.5kg)

**Regulatory Approvals:**

UL recognized component (RC). File number E354595. Compliant to IEC/UL 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use; CAN/CSA-C22.2 No.61010-1. CE marked to EN 61010-1. UKCA marked to BS EN 61010-1. 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 appropriate EMC precautions when designing the unit in and verify the overall system EMC performance against any relevant standards.)

**OUTPUTS SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Output</th>
<th>Accelerator (Internal Supply)</th>
<th>Bias Cancellation (Internal Supply)</th>
<th>Filament</th>
<th>PMT</th>
<th>Scintillator</th>
<th>Collector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Voltage</td>
<td>0 to -30kV, referenced to ground</td>
<td>0 to +3.5kV referenced to Accelerator*</td>
<td>-1.936 to +1.936V referenced to Accelerator</td>
<td>0 to -1300V referenced to ground</td>
<td>+8kV to +11kV referenced to ground</td>
<td>30V to 500V referenced to ground</td>
</tr>
<tr>
<td>Output current - max</td>
<td>170μA</td>
<td>150μA</td>
<td>3.87A</td>
<td>1mA (current trip level: 1.2mA)</td>
<td>250μA</td>
<td>5mA</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±2% or ±20V (whichever is greater)</td>
<td>±10% or ±180V (whichever is greater)</td>
<td>0.1V</td>
<td>±2% or ±1V (whichever is greater)</td>
<td>±2%</td>
<td>±5%</td>
</tr>
<tr>
<td>Load Regulation</td>
<td>&lt;100ppm for 0 to 170μA</td>
<td>N/A</td>
<td>&lt;2% for 10% change in load resistance</td>
<td>&lt;100ppm for 0 to 1mA</td>
<td>&lt;500ppm for 0 to 250μA</td>
<td>&lt;5% for 0 to 5 mA</td>
</tr>
<tr>
<td>Line Regulation for a ±5% line change</td>
<td>&lt;100ppm</td>
<td>&lt;0.1%</td>
<td>&lt;1%</td>
<td>&lt;100ppm</td>
<td>&lt;500ppm</td>
<td>&lt;5%</td>
</tr>
<tr>
<td>Ripple p-p at max output</td>
<td>&lt;20ppm</td>
<td>&lt;0.5ppm</td>
<td>&lt;0.1%</td>
<td>&lt;200mV</td>
<td>&lt;0.1%</td>
<td>&lt;0.2%</td>
</tr>
<tr>
<td>Temperature Coefficient</td>
<td>&lt;100 ppm/°C</td>
<td>&lt;1000 ppm/°C</td>
<td>&lt;300 ppm/°C</td>
<td>&lt;1000 ppm/°C</td>
<td>&lt;100 ppm/°C</td>
<td>&lt;1000 ppm/°C</td>
</tr>
<tr>
<td>Stability (1hr warm up)</td>
<td>8ppm/3min</td>
<td>1%/10min</td>
<td>100ppm/10min</td>
<td>200ppm/1h</td>
<td>500ppm/8h</td>
<td>&lt;1500ppm/1h</td>
</tr>
<tr>
<td>Rise time (switch on)</td>
<td>1 to 3s (0 to 90%)</td>
<td>&lt;1s (0 to 90%)</td>
<td>250ms (0 to 90%)</td>
<td>&lt;1s (0 to 90%)</td>
<td>&lt;1s (0 to 90%)</td>
<td>&lt;1s (0 to 90%)</td>
</tr>
<tr>
<td>Fall time (switch off)</td>
<td>&lt;100s (to &lt; 50V)</td>
<td>&lt;100s (to &lt; 50V)</td>
<td>0.5s (100% to 10%)</td>
<td>&lt;10s (to &lt; 50V)</td>
<td>&lt;10s (to &lt; 100V)</td>
<td>&lt;10s (to &lt; 50V)</td>
</tr>
</tbody>
</table>

*The positive Bias Cancellation voltage reduces the negative Bias output, allowing the Emission current to flow (see User Guide for more information).
PL2 DIGITAL I/O CONNECTOR
JST MODEL S10B-EH

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>I/O</th>
<th>SIGNAL PARAMETERS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24V</td>
<td>I</td>
<td>DC24V Input</td>
<td>Pins connected internally</td>
</tr>
<tr>
<td>2</td>
<td>+24V</td>
<td>I</td>
<td>DC24V Input</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0V</td>
<td>I</td>
<td>DC24V Common</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0V</td>
<td>I</td>
<td>DC24V Common</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>FG</td>
<td>-</td>
<td>Case ground</td>
<td></td>
</tr>
</tbody>
</table>

PL3 ANALOG I/O CONNECTOR
JST MODEL S15B-EH

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>I/O</th>
<th>SIGNAL PARAMETERS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fil Prog (+)</td>
<td>I</td>
<td>0 to 4V differential input = 0 to 4V Filament output</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Fil Prog (-)</td>
<td>I</td>
<td>0 to 4V Filament output</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Bias Cancel Prog (+)</td>
<td>I</td>
<td>0 to 3.5V differential input = 0 to 3.5kV Bias Cancellation output</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Bias Cancel Prog (-)</td>
<td>I</td>
<td>0 to 3.5kV Bias Cancellation output</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Acc Prog (+)</td>
<td>I</td>
<td>0 to 6V differential input = 0 to -30kV Accelerator output</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Acc Prog (-)</td>
<td>I</td>
<td>0 to 6V Accelerator output</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>EMS Monitor</td>
<td>O</td>
<td>Emission Current Monitor Output. 0 to 10V = 0 to 200μA Limited to 12V max. ±3% or 0.1V, whichever is greater</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>EMS Mon 0V</td>
<td>O</td>
<td>Limit to 12V max. ±3% or 0.1V, whichever is greater</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>PMT Prog (+)</td>
<td>I</td>
<td>0 to 6.5V differential input = 0 to 1300V P.M.T output</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>PMT Prog (-)</td>
<td>I</td>
<td>0 to 1300V P.M.T output</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Scintillator Prog (+)</td>
<td>I</td>
<td>0 to 5.5V differential input = 0 to 11kV Scintillator output</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Scintillator Prog (-)</td>
<td>I</td>
<td>0 to 11kV Scintillator output</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Collector Prog</td>
<td>I</td>
<td>0 to 5.5V differential input = 0 to 500V Collector output</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Collector Prog 0V</td>
<td>I</td>
<td>0 to 500V Collector output</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>N/C</td>
<td>-</td>
<td>N/C</td>
<td></td>
</tr>
</tbody>
</table>

HOW TO ORDER

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBM-TEG</td>
<td>EBM30N/TEG</td>
</tr>
<tr>
<td>Low voltage mating connectors accessory Kit</td>
<td>13802-27</td>
</tr>
<tr>
<td>HV Out Cable - 2 meters</td>
<td>HVC30/3SO/1317</td>
</tr>
<tr>
<td>HV Out Cable - 3 meters</td>
<td>HVC30/3SO/1314</td>
</tr>
<tr>
<td>HV Out Cable - 5 meters</td>
<td>HVC30/3SO/1315</td>
</tr>
<tr>
<td>Scintillator Cable - 1 meter</td>
<td>HVC11/1SO/1320</td>
</tr>
<tr>
<td>Scintillator Cable - 2 meters</td>
<td>HVC11/1SO/1316</td>
</tr>
</tbody>
</table>

Note: An accessory kit which contains the mating housings and crimps for the low voltage connectors is available to order free of charge. See HOW TO ORDER table.
The EBM-TEGR is an integral solution that provides the high voltage required by Thermionic Emission Scanning Electron Microscope (SEM) in a 19” rack mountable chassis.

Spellman’s proprietary packaging and encapsulation technology gives dramatic improvements in size, cost and performance compared to other SEM power supply offerings. This unit provides a highly regulated, low noise, ultra stable Accelerator supply programmable up to -30kV at 400μA. This, together with Floating Filament and Grid supplies referenced to the Accelerator control the beam. The unit also includes high voltage outputs to drive the Detector, comprising PMT, Scintillator and Collector grounded outputs.

Customer control of this integrated EBM-TEGR power supply system is accomplished via RS-232 or the optional RS-485 interface. Five interlocks are provided. The unit is CE and UKCA marked.

**SPECIFICATIONS**

**Input Voltage:**
100 to 264 Vac @2A max. 47 to 63Hz

**Temperature:**
- Operating: 10°C to +45°C
- Storage: -10°C to +70°C

**Humidity:**
0 to 90% RH, non-condensing

**Interlocks:**
Five interlocks are provided on a 9 pin D connector (see pinout details).
- The EHT, Collector, Scintillator and PMT interlocks disable the corresponding outputs when open (the other outputs can be powered up).
- The Vacuum interlock disables the gun supplies (EHT and heater) when open.

**Front Panel Indicators:**
- POWER ON: Green LED
- INTERLOCKS: Yellow LED indicates that all the interlocks are closed and the unit is able to generate high voltage.
- HV ON: Yellow LED indicates that the high voltage EHT (Accelerator) Output is energized.
- RS-232/RS-485: Yellow LED indicates when communications are taking place on the RS-232/RS-485 bus.
- FAULT: Red LED indicates that an Error condition has occurred.

**Input Power Connector:**
I.E.C. 320 Receptacle with integral fuse

**High Voltage Output Connectors:**
- Grid and Filament: Claymount CA1 type 03 (see drawing)
- A mating cable assembly is available (see drawing and How To Order table)
- Collector and PMT: BNC HT-MHV Receptacle Radiall R316553000
- Scintillator: SHV Receptacle Radiall R317580000

---

**OUTPUTS SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Output</th>
<th>Accelerator (EHT)</th>
<th>Filament</th>
<th>Grid</th>
<th>PMT</th>
<th>Scintillator</th>
<th>Collector</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Output Voltage</strong></td>
<td>-100V to -30kV,</td>
<td>5V max</td>
<td>-35V to -1650V</td>
<td>-200V to -1300V,</td>
<td>-400V to +400V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>referenced to</td>
<td>15W max</td>
<td>referenced to</td>
<td>referenced to</td>
<td>referenced to</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ground</td>
<td>center</td>
<td>Accelerator</td>
<td>Accelerator</td>
<td>ground</td>
<td></td>
</tr>
<tr>
<td><strong>Output current - max</strong></td>
<td>400μA</td>
<td>5A</td>
<td>400μA</td>
<td>1mA (current trip level: 1.2mA)</td>
<td>200μA</td>
<td>4μA</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>±2% or ±30V (whichever is greater)</td>
<td>±5% or ±100mA (whichever is greater)</td>
<td>N/A</td>
<td>±2% or ±1V (whichever is greater)</td>
<td>&lt;1% or ±10V (whichever is greater)</td>
<td>±2% or ±2V (whichever is greater)</td>
</tr>
<tr>
<td><strong>Load Regulation</strong></td>
<td>&lt;10ppm for 30μA to 400μA</td>
<td>&lt;5mA for a 0.4Ω to 1Ω change at 3A</td>
<td>N/A</td>
<td>&lt;100ppm for 0 to 1mA</td>
<td>&lt;100ppm for 0 to 5mA</td>
<td>&lt;5mA</td>
</tr>
<tr>
<td><strong>Line Regulation at full load ±10% line change</strong></td>
<td>&lt;10ppm</td>
<td>&lt;5mA</td>
<td>N/A</td>
<td>&lt;100ppm</td>
<td>&lt;100ppm</td>
<td>&lt;10mA</td>
</tr>
<tr>
<td><strong>Ripple p-p at max output</strong></td>
<td>&lt;100mV</td>
<td>1mA at 50Hz, 30mA at 100kHz at 3A,1Ω</td>
<td>N/A</td>
<td>&lt;200mV</td>
<td>&lt;100mV</td>
<td>&lt;25mV</td>
</tr>
<tr>
<td><strong>Temperature Coefficient</strong></td>
<td>&lt;50 ppm/°C</td>
<td>&lt;300 ppm/°C</td>
<td>N/A</td>
<td>&lt;100 ppm/°C</td>
<td>&lt;250 ppm/°C</td>
<td>&lt;50 ppm/°C</td>
</tr>
<tr>
<td><strong>Stability (1hr warm up)</strong></td>
<td>&lt;10 ppm/15min, &lt;25 ppm/1h</td>
<td>&lt;2mA/1h</td>
<td>&lt;0.4μA/15min</td>
<td>200 ppm/1h</td>
<td>&lt;1%/1h</td>
<td>&lt;50mV/15min</td>
</tr>
</tbody>
</table>
Protection:
All outputs are protected from arcs in the load and continuous short circuit to ground and between each other.
- If the Beam Energy has more than 4 arcs in a 10 minutes period, unit will disable all outputs and sets all programs to zero.
- In case of an over temperature condition for greater than 100° C for ten seconds all outputs will be disabled.
- Over voltage, over current and internal communication issues are also monitored and trigger fault conditions.
- The unit reports fault or trip conditions through status flags. After a Trip occurs, the unit can be reset through software (digital interface) or power cycle.

Dimensions:
See drawing

Weight:
39.7 lbs. (18kg)

Regulatory Approvals:
Compliant to EEC Low Voltage Directive.
UK Conformity Assessed. RoHS Compliant.

INTERLOCKS CONNECTOR 9 PIN D SUB-FEMALE

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>I/O</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0V</td>
<td>-</td>
<td>Ground</td>
</tr>
<tr>
<td>2</td>
<td>24V O</td>
<td>-</td>
<td>24V Output from unit (connected to pin 6 internally)</td>
</tr>
<tr>
<td>3</td>
<td>Collector I</td>
<td>-</td>
<td>Input for collector interlock</td>
</tr>
<tr>
<td>4</td>
<td>Scintillator I</td>
<td>-</td>
<td>Input for Scintillator interlock</td>
</tr>
<tr>
<td>5</td>
<td>Vacuum I</td>
<td>-</td>
<td>Input for vacuum interlock (connected to pin 8 internally)</td>
</tr>
<tr>
<td>6</td>
<td>24V O</td>
<td>-</td>
<td>24V output from unit (connected to pin 2 internally)</td>
</tr>
<tr>
<td>7</td>
<td>EHT I</td>
<td>-</td>
<td>Input for EHT interlock</td>
</tr>
<tr>
<td>8</td>
<td>Vacuum I</td>
<td>-</td>
<td>Input for vacuum interlock (connected to pin 5 internally)</td>
</tr>
<tr>
<td>9</td>
<td>PMT I</td>
<td>-</td>
<td>Input for PMT interlock</td>
</tr>
</tbody>
</table>

DIGITAL COMMUNICATIONS CONNECTOR 9 PIN D SUB-MALE

<table>
<thead>
<tr>
<th>PIN</th>
<th>RS-232</th>
<th>RS-485</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-</td>
<td>-</td>
<td>N/C</td>
</tr>
<tr>
<td>2</td>
<td>RS-232 RxD</td>
<td>-</td>
<td>RS-232 data receive</td>
</tr>
<tr>
<td>3</td>
<td>RS-232 TxD</td>
<td>Z</td>
<td>RS-232 data transmit or RS-485 inverting</td>
</tr>
<tr>
<td>4</td>
<td>-</td>
<td>-</td>
<td>N/C</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>6</td>
<td>-</td>
<td>-</td>
<td>N/C</td>
</tr>
<tr>
<td>7</td>
<td>-</td>
<td>Y</td>
<td>RS-485 non-inverting</td>
</tr>
<tr>
<td>8</td>
<td>-</td>
<td>-</td>
<td>N/C</td>
</tr>
<tr>
<td>9</td>
<td>-</td>
<td>-</td>
<td>N/C</td>
</tr>
</tbody>
</table>

HOW TO ORDER

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBM-TEGR</td>
<td>EBM30N12/TEGR</td>
</tr>
<tr>
<td>EBM-TEGR with RS-485 option</td>
<td>EBM30N12/TEGR/DCC4</td>
</tr>
<tr>
<td>HV Output cable - 4 meters</td>
<td>HVC75/3SO/1282</td>
</tr>
</tbody>
</table>

Dimensions: in.[mm]

SIDE VIEW

TOP VIEW

FRONT VIEW

AC INPUT
100-240V 50/60Hz
2A MAX
FUSE: T3.15AH250V
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 applications knowledge 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, minimal micro-discharge, excellent regulation, stability, temperature coefficient and accuracy specifications for unprecedented image quality and resolution. 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 RS-232 interface. All high voltage safety interlocks are of a fail-safe hardware based design. The unit is UL and CE marked and is designed to be compliant with SEMI standards.

TYPICAL APPLICATIONS
- Scanning Electron Microscopes (SEM)
- Electron Beam Controller

SPECIFICATIONS

Input Voltage:
+24Vdc, ±5% @ 4 amps max. Inrush is <6 amps for 1 second.

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.

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 disables all of the outputs.

Front Panel Indicators:
- Power On: An illuminated green LED indicates that +24V power is present and it 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: An illuminated yellow LED indicates that the vacuum interlock is closed. The vacuum interlock LED must be illuminated for the unit to be able to generate high voltage.

Test GUI:
A product GUI can be provided free of charge for customer testing and development work.

Protection:
All outputs are protected from arcs in the load and continuous short circuit to ground and between each other. All low voltage inputs are protected against over voltages of ±30 volts. The power input is protected against over voltage and reversed connection.

If the Beam Energy has more than ‘A’ arcs in a nominal ‘B’ time (sec) period the unit will disable all outputs and sets all programs to zero. If there are less than ‘A’ arcs the unit will continue to operate. The default values are A = 8 and B = 10. Both ‘A’ and ‘B’ are settable via optical bus commands and GUI.

In case of an over temperature condition for greater than ten seconds all outputs will be disabled.

The unit reports fault or trip conditions through status flags. After a Trip occurs (arc, over current, over voltage, temperature etc.), the unit can be reset through software (optical bus command) or power cycle.

Weight:
44 lbs. (20kg)

Regulatory Approvals:
- UL recognized component (RC). File number E354595.
- Compliant to IEC/UL 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use.
- CAN/CSA-C22.2 No.61010-1. CE marked to EN 61010-1. UKCA marked to BS EN 61010-1. RoHS compliant.

As the unit is designed for incorporation within the user’s system it is not tested against any specific EMC standards. The user will need to take appropriate EMC precautions when designing the unit and verify the overall system EMC performance against any relevant standards.
## Outputs Specifications

<table>
<thead>
<tr>
<th>Output</th>
<th>Beam Energy</th>
<th>Filament</th>
<th>Suppressor</th>
<th>Extractor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Output Voltage</strong></td>
<td>-20V to -30kV referenced to ground. Amplitude does not exceed 35kV and is &lt;60 V when output disabled. Conditioning voltage -32.5kV at zero load current.</td>
<td>nominal 1.8V max 3V referenced to Beam Energy</td>
<td>-100V to -1kV referenced to Beam Energy</td>
<td>100V to 10kV referenced to Beam Energy</td>
</tr>
<tr>
<td><strong>Output current - max</strong></td>
<td>200μA</td>
<td>3A</td>
<td>100μA</td>
<td>700μA</td>
</tr>
<tr>
<td><strong>Current Trip</strong></td>
<td>250μA ±10% for 1s Output disabled and program set to zero</td>
<td>&gt;3.15A for 10s. All outputs disabled and programs set to zero</td>
<td>&gt;100mA ±10% for 5s. All outputs disabled and programs set to zero</td>
<td>Programmable 0 to 735μA. All outputs disabled and programs set to zero</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>&lt;1% or ±10V (whichever is greater)</td>
<td>±5mA (between 2A to 3A)</td>
<td>&lt;2% or ±6V (whichever is greater)</td>
<td>&lt;1% or ±20V (whichever is greater)</td>
</tr>
<tr>
<td><strong>Linearity</strong></td>
<td>&lt;± 25V</td>
<td>±10mA (between 0.5A to 3A)</td>
<td>±5V</td>
<td>±20V</td>
</tr>
<tr>
<td><strong>Load Regulation</strong></td>
<td>&lt;±100mV for 30μA to 200μA</td>
<td>&lt;5mA for 0.4 to 1Ω change at 3A</td>
<td>&lt;120mV for 10mA to 100μA</td>
<td>&lt;100mV at 40μA 0.1Hz to 20MHz, &lt;1V at 10 - 700μA</td>
</tr>
<tr>
<td><strong>Line Regulation for a ± 5% line change</strong></td>
<td>&lt;10ppm</td>
<td>&lt;1mA</td>
<td>&lt;5ppm</td>
<td>&lt;5ppm</td>
</tr>
<tr>
<td><strong>Ripple p-p at max. output</strong></td>
<td>&lt;50mVp-p 0.1Hz to 20MHz</td>
<td>&lt;1mAp-p 20Hz to 10kHz</td>
<td>&lt;20mVp-p at 0.1Hz to 20MHz</td>
<td>&lt;100mV p-p at 0.1Hz to 20MHz</td>
</tr>
<tr>
<td><strong>Temperature Coefficient</strong></td>
<td>&lt;5 ppm/°C from 20°C to 30°C, &lt;10 ppm/°C otherwise</td>
<td>&lt;50 ppm/°C</td>
<td>&lt;50 ppm/°C</td>
<td>&lt;25 ppm/°C</td>
</tr>
<tr>
<td><strong>Stability (1h warm up)</strong></td>
<td>200mV/15min</td>
<td>&lt;0.5mA/60min</td>
<td>&lt;0.3V/15min</td>
<td>&lt;0.3V/15min</td>
</tr>
<tr>
<td><strong>Ramp Rate Programable Range</strong></td>
<td>50 to 5000 V/s</td>
<td>1 to 3000 mA/s</td>
<td>10 to 1000 V/s</td>
<td>10 to 1000 V/s</td>
</tr>
<tr>
<td><strong>Voltage Monitor Resolution</strong></td>
<td>0.5V</td>
<td>2.5mV</td>
<td>0.25V</td>
<td>2.5V</td>
</tr>
<tr>
<td><strong>Voltage Monitor Accuracy</strong></td>
<td>±2% or ±10V</td>
<td>±5% or ±25mV</td>
<td>±2% or ±250mV</td>
<td>±1% or ±20V</td>
</tr>
<tr>
<td><strong>Current Monitor Resolution</strong></td>
<td>100nA</td>
<td>1mA</td>
<td>0.25μA</td>
<td>0.25μA</td>
</tr>
<tr>
<td><strong>Current Monitor Accuracy</strong></td>
<td>±2% or ±1μA</td>
<td>±10mA</td>
<td>±10%</td>
<td>±2% or ±2μA</td>
</tr>
<tr>
<td><strong>Additional info</strong></td>
<td>Programmable Wobble feature. Sinusoidal, amplitude up to 5% Beam Energy voltage, 0.5Hz to 1.6Hz</td>
<td>Open Circuit detection: Vout &gt; 5.2 ± 0.1V All outputs disabled and programs set to zero. Filament supply optimized for a nominal load resistance of 0.6Ω</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**INPUT POWER CONNECTOR**

**UNIVERSAL MATE-N-LOK 1-350942-0**

<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. A suitable Serial to optical communication kit including fiber optic cables, optic to RS-232 converter, RS-232 extension lead and RS-232 to USB cable is available. Optical to RS-232 converter can be ordered separately. See HOW TO ORDER table.

**HIGH VOLTAGE OUTPUT CONNECTOR**

The unit uses a custom high voltage 4 pole receptacle. A mating cable assembly in different lengths is available. See HOW TO ORDER table.

**HOW TO ORDER**

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBM-FEG</td>
<td>EBM30N6/FEG</td>
</tr>
<tr>
<td>Optical to RS-232 Communication Kit</td>
<td>EBMKFEG</td>
</tr>
<tr>
<td>Optical to RS-232 Converter (included in the above kit)</td>
<td>21777</td>
</tr>
<tr>
<td>HV Output Cable - 1.5 meters</td>
<td>HVC30/4ISO/1201</td>
</tr>
<tr>
<td>HV Output Cable - 2.8 meters</td>
<td>HVC30/4ISO/1197</td>
</tr>
</tbody>
</table>

**DIMENSIONS: in.[mm]**

**REAR VIEW**

**TOP VIEW**

**FRONT VIEW**
Spellman’s EBM60-FEG Series is an integrated, multiple high voltage power supply specifically designed to drive Field Emission Scanning Electron Microscope (SEM) columns. Spellman’s extensive applications knowledge 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 60kV supply, with integrated floating Filament, Extractor and Suppressor outputs required to drive Field Emission, Cold Cathode and Schottky Electron Sources. All outputs are offered with ultra-low output ripple, minimal micro-discharge, excellent regulation, stability, temperature coefficient and accuracy specifications for unprecedented image quality and resolution. Isolation and control of the respective floating sources is provided via Spellman’s proprietary high voltage isolation techniques.

Customer control of this integrated EBM60-FEG power supply system is accomplished via an RS-232 interface. The unit is CE and UKCA marked.

**TYPICAL APPLICATIONS**
- Scanning Electron Microscopes (SEM)
- Electron Beam Controller

**SPECIFICATIONS**

**Input Voltage:**
- 100 to 240 Vac ±10% @1A max. 50 to 60 Hz ±5%

**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: -25°C to +60°C
- Humidity: 0 to 85% RH, non-condensing

**Mechanical:**
The unit can be operated in any orientation.

**Front Panel Indicators:**
- Power On
- Interlocks enabled (both interlocks are closed)
- HV On (any of the HV outputs are enabled)
- Warning (any of the internal warning levels exceeded)
- Operating (unit running correctly)
- Trip
- Fault
- Serial Bus (communication taking place)

**Status Outputs:**
The unit has three digital outputs to indicate status conditions through TTL signals (high when the corresponding LED is illuminated)
- 1- HV on
- 2- Fault
- 3- Unit Operating

**Test GUI:**
A product GUI can be provided free of charge for customer testing and development work.

**Interlocks:**
Two separate interlocks are provided:
- Gun interlock: 24V output provided for an external volt free interlock
- HV cable interlock: interlock plate mounted over the HV connector

If any interlock is not present: all high voltage supplies including filament are shut down, however communication over the serial interfaces remains operational.

**Protection:**
- All outputs are protected from arcs in the load (repetition rate up to 0.1 Hz) and continuous short circuit.
- The unit monitors the temperature of the main power semiconductors and shutdown the relevant outputs if a temperature become excessive.
- All low voltage inputs are protected against over voltages of ±30 Volts.
- The power input is protected against over voltage and reversed connection.

**Weight:**
- 86 lbs. (39kg)

**Regulatory Approvals:**
Compliant to EEC Low Voltage Directive. UK Conformity Assessed. RoHS Compliant.
## OUTPUTS SPECIFICATIONS

<table>
<thead>
<tr>
<th>OUTPUT</th>
<th>Accelerator</th>
<th>Filament</th>
<th>Suppressor</th>
<th>Extractor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Output Voltage</strong></td>
<td>-200V to -60kV referenced to ground</td>
<td>nominal 1V max 1.5V referenced to Accelerator</td>
<td>-10V to -1kV referenced to Beam Energy</td>
<td>200V to 5kV referenced to Beam Energy</td>
</tr>
<tr>
<td><strong>Output current - max</strong></td>
<td>300μA</td>
<td>3A</td>
<td>100μA</td>
<td>500μA</td>
</tr>
<tr>
<td><strong>Current Trip</strong></td>
<td>350μA ±10%</td>
<td>&gt;3.15A for 10s. All outputs disabled and programs set to zero</td>
<td>&gt;120mA ±10% All outputs disabled and programs set to zero</td>
<td>600μA ±10% All outputs disabled and programs set to zero</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>±5V</td>
<td>±5mA (between 2A to 3A)</td>
<td>±14V</td>
<td>±2%</td>
</tr>
<tr>
<td><strong>Linearity</strong></td>
<td>&lt; ±5V between 500V and 60kV</td>
<td>±10mA</td>
<td>±14V</td>
<td>±2V</td>
</tr>
<tr>
<td><strong>Load Regulation</strong></td>
<td>&lt;±10ppm for 30μA to 400μA</td>
<td>&lt;5mA for 10% in load resistance</td>
<td>&lt;±100ppm for 10μA to 90μA</td>
<td>&lt;±100ppm for 10μA to 500μA</td>
</tr>
<tr>
<td><strong>Line Regulation for a ±10% line change</strong></td>
<td>&lt;±10ppm</td>
<td>&lt;1mA</td>
<td>&lt;±10ppm</td>
<td>&lt;±10ppm</td>
</tr>
<tr>
<td><strong>Ripple p-p at max. output</strong></td>
<td>&lt;120mVp-p at 1Hz to 1MHz</td>
<td>&lt;40mA p-p at 20Hz to 10kHz across 0.5Ω @ 2.5A</td>
<td>&lt;10mA p-p at 1Hz to 1MHz</td>
<td>&lt;50mV p-p at 1Hz to 1MHz</td>
</tr>
<tr>
<td><strong>Temperature Coefficient</strong></td>
<td>&lt;20 ppm/°C at 60kV after 1h warm up</td>
<td>&lt;20 ppm/°C</td>
<td>&lt;50 ppm/°C</td>
<td>&lt;25 ppm/°C</td>
</tr>
<tr>
<td><strong>Stability</strong></td>
<td>&lt;15ppm or 40mV (whichever is greater) /10min</td>
<td>&lt;30ppm/10min and 5mA/3 months @ 2.5A</td>
<td>&lt;100ppm/10min</td>
<td>&lt;20ppm/10min</td>
</tr>
<tr>
<td><strong>Voltage Monitor Resolution</strong></td>
<td>1.14V</td>
<td>62.5μV</td>
<td>19mV</td>
<td>97mV</td>
</tr>
<tr>
<td><strong>Voltage Monitor Accuracy</strong></td>
<td>±1% or ±50V</td>
<td>±5% or ±25mV</td>
<td>±0.5% or ±0.5V</td>
<td>±0.5% or ±3V</td>
</tr>
<tr>
<td><strong>Current Monitor Resolution</strong></td>
<td>5.7nA</td>
<td>62.5μA</td>
<td>2.3nA</td>
<td>11nA</td>
</tr>
<tr>
<td><strong>Current Monitor Accuracy</strong></td>
<td>±1μA</td>
<td>±1% or ±5mA</td>
<td>±2μA</td>
<td>±0.5% or ±2μA</td>
</tr>
<tr>
<td><strong>Additional info</strong></td>
<td>Programmable Wobble feature. Sinusoidal, 0V to 500V p-p, 0.2Hz to 2Hz</td>
<td>Open Circuit detection: Vout &gt; 3.1 ± 0.1V All outputs disabled and programs set to zero.</td>
<td>Optimized for a nominal load resistance of 0.5Ω</td>
<td></td>
</tr>
</tbody>
</table>

---

**OEM MODULE FOR SEM APPLICATIONS**

### EBM60-FEG

**SPELLMAN HIGH VOLTAGE ELECTRONICS CORPORATION**

**246**
EBM60-FEG
OEM MODULE FOR SEM APPLICATIONS

**GUN INTERLOCK CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>I/O</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Interlock -</td>
<td>I</td>
<td>24V Return</td>
</tr>
<tr>
<td>2</td>
<td>NC</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Interlock +</td>
<td>O</td>
<td>24V Drive</td>
</tr>
</tbody>
</table>

**STATUS OUTPUT CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>I/O</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HV ON</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>HV ON GND</td>
<td>-</td>
<td>High voltage status return</td>
</tr>
<tr>
<td>3</td>
<td>Fault</td>
<td>O</td>
<td>Fault status, logic high* when any internal fault is detected</td>
</tr>
<tr>
<td>4</td>
<td>Fault GND</td>
<td>-</td>
<td>Fault status return</td>
</tr>
<tr>
<td>5</td>
<td>UO</td>
<td>O</td>
<td>Unit Operating status, logic high* when the unit is running correctly</td>
</tr>
<tr>
<td>6</td>
<td>UO GND</td>
<td>-</td>
<td>Unit Operating status return</td>
</tr>
<tr>
<td>7</td>
<td>NC</td>
<td>-</td>
<td>No connection</td>
</tr>
<tr>
<td>8</td>
<td>NC</td>
<td>-</td>
<td>No connection</td>
</tr>
<tr>
<td>9</td>
<td>NC</td>
<td>-</td>
<td>No connection</td>
</tr>
</tbody>
</table>

* TTL Signal: High > 2.7V, Low < 0.8V

**RS-232 COMMUNICATION CONNECTOR**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>I/O</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NC</td>
<td>-</td>
<td>No connection</td>
</tr>
<tr>
<td>2</td>
<td>RS232 RXD</td>
<td>I</td>
<td>RS-232 receive data</td>
</tr>
<tr>
<td>3</td>
<td>RS232 TXD</td>
<td>O</td>
<td>RS-232 transmit data</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>-</td>
<td>No connection</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>-</td>
<td>Ground</td>
</tr>
<tr>
<td>6</td>
<td>NC</td>
<td>-</td>
<td>No connection</td>
</tr>
<tr>
<td>7</td>
<td>NC</td>
<td>-</td>
<td>No connection</td>
</tr>
<tr>
<td>8</td>
<td>NC</td>
<td>-</td>
<td>No connection</td>
</tr>
<tr>
<td>9</td>
<td>NC</td>
<td>-</td>
<td>No connection</td>
</tr>
</tbody>
</table>

**INPUT POWER CONNECTOR**

I.E.C. 320 Receptacle with integral fuse

**HIGH VOLTAGE OUTPUT CONNECTOR**

The unit uses a Claymount CA4 75kV 4 pin receptacle. Mating cable assemblies in different lengths are available. See HOW TO ORDER table.

**HOW TO ORDER**

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBM60-FEG</td>
<td>EBM60N18/FEG</td>
</tr>
<tr>
<td>HV Output Cable - 3 meters</td>
<td>HVC75/4SO/1365</td>
</tr>
<tr>
<td>HV Output Cable - 4 meters</td>
<td>HVC75/4SO/1366</td>
</tr>
</tbody>
</table>
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. Its 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, Zin = 100(\Omega)</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, Zout = 10(\Omega)</td>
</tr>
<tr>
<td>R</td>
<td>Current Monitor</td>
<td>0 to -5V = 0 to 100% rated output, Zout = 10(\Omega)</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>

**DIMENSIONS:** in.[mm]

**HV CHASSIS**

**FRONT VIEW**

**CONTROL CHASSIS**

**FRONT VIEW**

**TOP VIEW**

**BACK VIEW**
Spellman’s shipborne and land-based power feed equipment (PFE) is used to power submarine fiberoptic cable repeaters for telecommunications shore stations and during cable laying and repair operations. We are the leading supplier of Power Feed Equipment to the Submarine Telecom Industry.

Spellman’s Portable PFE (PFE-P) provides the consistent, reliable and safe high voltage power in a compact footprint. The PFE-P incorporates the same advanced digital management system as Spellman’s Shipborne PFE (PFE-SB); including voltage and current control, push-button polarity setting, continuous monitoring and alarm reporting from the Main Control Unit (MCU).

The system can be configured with the optional System Management Terminal (SMT) to provide programmable electroding functions, data and event logging and fully adjustable ramp rates, trips and alarms.

The system is powered from a 230Vac single phase mains supply.

**SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Voltage:</strong></td>
<td>230Vac ±10% 50/60Hz (Single Phase)</td>
</tr>
<tr>
<td><strong>Input Current:</strong></td>
<td>50A ac maximum at minimum line voltage</td>
</tr>
<tr>
<td><strong>Output Voltage:</strong></td>
<td>0 to 6kV, linearly controllable via the MCU</td>
</tr>
<tr>
<td><strong>Output Current:</strong></td>
<td>1A maximum at any output voltage up to 6kV</td>
</tr>
<tr>
<td><strong>Polarity:</strong></td>
<td>Reversible by selecting positive or negative mode on the MCU when the HV is disabled.</td>
</tr>
<tr>
<td><strong>Voltage and Current Ramp Rates:</strong></td>
<td>See MCU and SMT description.</td>
</tr>
<tr>
<td><strong>Voltage Ripple:</strong></td>
<td>&lt;0.1% pk-pk of max output +1Vrms</td>
</tr>
<tr>
<td><strong>Stability:</strong></td>
<td>Typically &lt;0.25% over any 24 hour period with a temperature range of 0°C to 30°C.</td>
</tr>
</tbody>
</table>

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

**Current Regulation:**
- Load: 0.05% of full current for any voltage change
- Line: +/-0.05% of full current over specified input range

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

**Operating Temperature:**
- 0 to +30°C

**Humidity:**
- 0% to 90%, non-condensing

**Cooling:**
- Local cooling and/or ventilation needs to be adequate to balance the system heat dissipation of 1.2kW at 6kV, 1A output.

**Safety:**
- The MCU is equipped with an Emergency Stop Button. Terminals in the rear of the cabinet allow connection of external emergency stop devices.

**Clamp/Safety Chassis:**
- Protects the connected line and PFE-P. A HV dump circuit will quickly and safely discharge the system in the event of emergency shutdown. Front panel mounted lamps indicate if the PFE-P output is safe or energized.

**HV Output:**
- The unit is supplied with 10 meters of RG213/URM67 cable terminated with a 15kV Lemo plug. See HV Output cable detail dwg.

**Control:**
- Manual controls for output voltage and current are provided on the MCU front panel. The PFE-P is capable of operating in either Constant Current or Constant Voltage mode as required by the operator.

**Protection:**
- Over-voltage and Over-current protection levels are settable on the MCU. In the event of a cooling fan failure, the internal temperature limit ensures a safe system shutdown.

**Regulatory Approvals:**
- RoHS compliant. Designed to meet IEC/UL 61010-1 safety requirements for electrical equipment for measurement, control and laboratory use; CAN/CSA-C22.2 No.61010-1.
Main Control Unit (MCU):
The system can be controlled manually using the MCU front panel controls.

- 4.2" LCD display
- Full output control and monitoring including polarity reversal
- 4mm socket monitor points for voltage and current
- Front panel controls for voltage and current
- Ramp rates available:
  Default: 60kV/min 6A/min
  Slow: 500V/min 0.2A/min
- Over volts/current trips
- HV ON and Alarm outputs provided for customer installation of warning lights and alarms

Interlock System:
Full protection for user and connected equipment. All PFE-P access panels and patch panel connections are interlocked. External connection terminals are provided to allow connection to CTCs, associated equipment or external E-Stop devices.

OPTIONS
Cable Termination Cubicle (CTC12/377)
Facility 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.

W 27.26” [692mm]
D 10.44” [265mm]
H 8.27” [210mm]

System Management Terminal (SMT):
The optional SMT is an advanced touchscreen control and monitoring system which can be installed on top of the PFE or remotely up to 80m from the PFE.

- Full output control and monitoring
- Fully adjustable ramp rates in current or voltage control: 10V-10kV/min and 10mA-10A/min
- User settable over/under voltage and current trips and alarms
- Output voltage and current logging
- Event logging
- Programmable electroding (tone generator 10-40Hz provided)

Typical System Management Screens:

SMT Main Screen
SMT Over Current Trip Screen
SMT Event Log
HV Output Cable
The unit is supplied with 10 meters of RG213/URM67 cable. Assembly terminated with a 15kV Lemo plug.
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:** Compliant to EEC EMC Directive, Compliant to EEC Low Voltage Directive. X2744 is GR-63-CORE, GR-189-CORE, ETSI ETS 300 019, ETS 300 118, ETS 300 127, ETSI EN 300 132-2, ETSI EN 300 386, EN 60950. UL/CUL recognized file E148969 (A5) (X2743, X2744, X2745).
DIMENSIONS: in.[mm]
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 foot print, 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 Power Feed Equipment (PFE-SB) has been optimized for shipborne use to provide continuous power to a line whilst being laid and 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.

It provides all of the features to allow safe, reliable operation with configuration functions to suit all cable installation requirements. The PFE system is designed to provide a well-regulated, low ripple, high voltage supply at varying current requirements.

An advanced digital management system provides output configuration, control, polarity setting, continuous monitoring and alarm reporting from the Main Control Unit (MCU), or the System Management Terminal (SMT).

The Electronic Test Load is an active solid-state design allowing the load to be dynamically varied using a manual front panel control.

The system is powered directly from 3-phase supply without the need for autotransformers.

**SPECIFICATIONS**

**PFE-SB—Input/Output**

<table>
<thead>
<tr>
<th>Model</th>
<th>Output Voltage</th>
<th>Output Current (per phase max)</th>
<th>Input Voltage</th>
<th>Input Current (per phase max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PFESB6PN12</td>
<td>6kV</td>
<td>2A max</td>
<td>400Vac 3 phase ±10% 50/60Hz</td>
<td>25A</td>
</tr>
<tr>
<td>PFESB10PN24</td>
<td>10kV</td>
<td>2.4A max</td>
<td>400Vac 3 phase ±10% 50/60Hz</td>
<td>40A</td>
</tr>
<tr>
<td>PFESB15PN36</td>
<td>15kV</td>
<td>2.4A max</td>
<td>400Vac 3 phase ±10% 50/60Hz</td>
<td>60A</td>
</tr>
<tr>
<td>PFESB20PN40</td>
<td>20kV</td>
<td>2A max</td>
<td>400Vac 3 phase ±10% 50/60Hz</td>
<td>75A</td>
</tr>
</tbody>
</table>

- **6kV to 20kV Versions Available**
- **Continuously Variable Electronic Test Load Capable of Dissipating 30kW**
- **Up and Down Ramp Rates for Voltage and Current**
- **Programmable Electroding Functions Provided**
- **Electronic Polarity Reversal**
- **Data and Event Logging Functions**
- **Alarm and Trip Functions**

**Input Wiring:**
3Φ + Neutral (Star). For a 3Φ supply without a neutral (delta), a single phase 230Vac 10A supply will be required to power the control modules.

**Voltage Ripple:**
<0.3%

**Stability:**
Typically <0.25% over any 24 hour period with a temperature range of 0°C to 30°C.

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

**Current Regulation:**
- Load: 0.05% of full current for any voltage change
- Line: +/-0.05% of full current over specified input range

**Temperature Coefficient:**
< 100 ppm/°C

**Operating Temperature:**
0 to +30°C

**Storage Temperature:**
-10 to +70°C

**Humidity:**
0% to 90%, non-condensing

**Cooling:**
Forced Air. 210 liters/sec (445 cfm) per cabinet, 1500 liters/sec (3180 cfm) for the test load

**Regulatory Approvals:**
Designed to meet IEC/UL 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use; CAN/CSA-C22.2 No.61010-1.
**Main Control Unit (MCU):**
The system can be controlled manually using the MCU front panel controls.

- 4.2” LCD display
- Full output control and monitoring including polarity reversal
- Test points for voltage and current
- Front panel controls for voltage and current
- Ramp rates available:
  - Default: 60kV/min 6A/min
  - Slow: 500V/min 0.2A/min
- Over volts/current trips
- HV and Alarm outputs

**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 the user.
- Max power: 30kW
- Max voltage: ± 15kV @ 2A
- Max current: 2.4A @ ±12.5kV

**Interlock System:**
Full protection for user and connected equipment. All PFE access panels and patch panel connections are interlocked. External connection terminals are provided to allow connection to CTCs, associated equipment or external E-Stop circuits.

**Optional Hood (17668-4):**
A flange at the rear provides attachment of exhaust ducting, allowing most of the heat dissipated from the system to be transferred outside the immediate environment of the PFE.

**Optional Cable Termination Cubicle (CTC12/377):**
Facility 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.

**Typical System Management Screens:**
- SMT Main Screen
- SMT Over Current Trip Screen
- SMT Event Log

**Key Features**

**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. A front panel mounted lamp indicates if the PFE output is energized.

**Output Control:**
Using either the Main Control Unit (MCU) 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):**
The SMT is an advanced touchscreen control and monitoring system which can be installed within the PFE cabinets or remotely up to 80m from the PFE.
- Full output control and monitoring
- Fully adjustable ramp rates in current or voltage control: 10V-10kV/min and 10mA-10A/min
- User settable over/under voltage and current trips and alarms
- Output voltage and current logging
- Event logging
- Programmable electroding (tone generator 10-40Hz provided)
DIMENSIONS: in.[mm]

**PFESB15PN36**

- Main Control Unit (MCU)
- Clamp/ Safety Chassis
- HV Converter
- HV Converter
- Fan Panel

**PFESB20PN40**

- Main Control Unit (MCU)
- Clamp/ Safety Chassis
- HV Converter
- HV Converter
- Fan Panel

**PFESB15PN36 Weight**
- Cabinet 1 507lbs. [230kg]
- Cabinet 2 309lbs. [140kg]
- Electronic Load 364lbs. [165kg]

**PFESB20PN40 Weight**
- Cabinet 1 507lbs. [230kg]
- Cabinet 2 419lbs. [190kg]
- Electronic Load 364lbs. [165kg]
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

**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)

**INPUT/OUTPUT CONNECTORS**

**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.

Spellman High Voltage is an ISO 9001 and ISO 14001 registered company
Copyright © 2015 Spellman High Voltage Electronics Corp.
DIMENSIONS: in.[mm]

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)

Configuration (B)

Configuration (C)
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)
**Input/Output Connectors**

**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>

**Dimensions:**
- Top View:
  - 5.47 [139.0]
  - 4.82 [122.5]
  - 2.41 [61.3]
  - 0.13 [3.5]

- Front View:
  - 1.98 [50.4]

- Side View:
  - 5.66 [143.7]
  - 1.61 [42.5]
  - 1.98 [50.4]
  - 2.28 [57.9]
  - 0.40 [10.2]
  - 0.42 [10.7]
  - 0.45 [11.5]

- Bottom View:
  - 6.50 [165.0]

---

**Spellman High Voltage**

Corporate Headquarters
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
Copyright © 2015 Spellman High Voltage Electronics Corp.
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
- RPO 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:**
<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, 1%</td>
</tr>
<tr>
<td>8</td>
<td>Current Test Point</td>
<td>0 to 10Vdc = 0 to 100% Rated Output, Zout = 10kΩ, 1%</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 provided 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**

**TOP VIEW**

**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**

**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:**
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.

---

Corporate Headquarters
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
Copyright © 2012 Spellman High Voltage Electronics Corp.
**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>

*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>kV</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.
CCM1KW
CAPACITOR
CHARGING MODULE

500 Joules per second
(unit with internal fan)
DIMENSIONS: in.[mm]

1000 Joules per second
(unit with internal and external fan)
DIMENSIONS: in.[mm]
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 \( \geq 0.98 \)
- 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:**
- \( \pm 0.6\% \) up to 120Hz

**Temperature Coefficient:**
- \( \leq 100\text{ppm per degree C} \)

**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**

**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%.

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.
**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 Description</th>
<th>Signal 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>LocalmA 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 Supply Ground</td>
<td></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 Description</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 Input</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 at 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>
The MSC2.5PN7.5 is a bipolar reversible power supply specifically designed for electrostatic chuck clamping applications. Two 0 to 2500 volt @ 7.5 watt reversible outputs that are of opposite polarity are provided on the two high voltage output connectors. Front panel controls via programming buttons and an OLED display allow local operation and control of the unit. The RS-232/RS-485/Ethernet digital interface allows for simple OEM integration into complex system designs.

**SPECIFICATIONS**

**Input:**
- +24Vdc ±5% @ <2 amps. Switch controlled on front panel and fuse protected.

**High Voltage Output 1 and Output 2**

**Voltage:**
- 0 to ±2500 volts. Output 1 and 2 amplitudes are independently programmable

**Current:**
- 0 to 3mA

**Current Limit:**
- Output current limits can be independently set in the range of 0.1mA to 3mA. Not designed to withstand continuous arcing.

**Power:**
- 7.5 watts, maximum

**Polarity:**
- Bipolar, High Voltage Output 1 polarity always opposite of High Voltage Output 2

**Voltage Control:**
- Resolution = 1V
- Accuracy = ±1% of programmed value

**Regulation:**
- Line: <0.1% for 10% input voltage change under any load conditions
- Load: <1.3% for zero to full load

**Stability:**
- <0.1%/hour, <0.2%/8 hours at constant operating conditions after 1 hour warm up

**Temperature Coefficient:**
- <50ppm per degree C

**Ripple:**
- <0.1% p-p at full load, maximum output

**Rise and Fall Times:**
- Rise time (0V to ±2500 V) and fall time (±2500V to 0V) are separately programmable in the range of 300ms to 9.9s (to within 1% of final voltage value)

**Voltage Monitor:**
- Resolution = 1V
- Accuracy = ±1% of actual output (±8 volt offset)

**Current Monitor:**
- Resolution = 1.25 μA
- Accuracy = ±2% of actual output ±100μA offset

**Typical Load Capacitance:**
- <20nF (for other load capacitance, contact Spellman)

**Protection:**
- Arc and short circuit protected. Equipped with input and output current limits. Output current limit settable from 0.1mA to 3mA. Not designed to withstand continuous arcing.

**Auto-Toggle/De-Chucking Function:**
- This unit has both a manual and a customer configurable automatic toggle function (degauss/de-chuck).

**Communication:**
- The unit can be operated locally from the front panel. It can also be controlled through the RS-232/RS-485 serial interface, or Ethernet. The serial interface can be configured via the front panel to either RS-232 or RS-485. The unit is shipped from the factory set to RS-232. 9600 baud, no parity, no handshake or flow control. Note: When Ethernet is connected to the LAN port, Serial comms is disabled.

**Front Panel Indicators:**
- The unit has a 20 character by 2 line back lit OLED display and a high voltage status LED. Configuration and setting of various parameters can be accomplished via push button switches. The OLED will power down after five minutes and is reactivated by pressing any button. The red LED indicator illuminates when high voltage is being produced. When the unit is shutdown due to a fault the LED will flash at a 1 Hertz rate until the fault is cleared.

**Front Panel Controls:**
- The unit has front panel buttons for local control.
  - **Local**
    - Front panel control and monitoring via the OLED display
  - **Toggle**
    - Manual change of output polarity
  - **Output On/Off**
    - Soft turns the high voltage output on and off
  - **Mode**
    - Changes the mode of operation and navigation menu
  - **Rotary Control/Enter**
    - For navigating and entering value changes
**Environmental:**
Temperature Range:
  - Operating: 0°C to 45°C
  - Storage: -35°C to 85°C
Humidity:
  - 0 to 85% RH, non-condensing

**Cooling:**
Convection cooled

**Input Power Connector:**
2 pin Molex VersaBlade connector. A mating input cable is available (see How To Order table)

**Serial Communications Connector:**
9 pin female D connector

**High Voltage Output Connectors:**
Radiall BNC-HT/MHV connector. Mating HV output cables are available (see How To Order table)

**Installation Brackets:**
A kit including 2 brackets and installation screws (M4x10) allows the unit to be mounted on a half width rack (see How To Order table)

**Dimensions:**
12.45” L x 8.03” W x 3.46” D (316mm x 204mm x 88mm)

**Weight:**
3.09lbs. (1.4kg)

**Regulatory Approvals:**
Compliant to EEC Low Voltage Directive.
UK Conformity Assessed. RoHS Compliant.

---

**INPUT POWER — Molex VersaBlade 2 Pin 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 @ 2A</td>
</tr>
<tr>
<td>2</td>
<td>+24Vdc Return (Gnd.)</td>
<td>Power Ground</td>
</tr>
</tbody>
</table>

**Serial Communications— 9 Pin Female D Connector**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>I/O</th>
<th>SIGNAL PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NC</td>
<td>-</td>
<td>Connection</td>
</tr>
<tr>
<td>2</td>
<td>Z/TXD</td>
<td>I/O</td>
<td>TXD RS-232/RS-485 Inverting</td>
</tr>
<tr>
<td>3</td>
<td>Y/RXD</td>
<td>I/O</td>
<td>RXD RS-232/RS-485 Non Inverting</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>-</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>-</td>
<td>Ground</td>
</tr>
<tr>
<td>6</td>
<td>NC</td>
<td>-</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>NC</td>
<td>-</td>
<td>No Connection</td>
</tr>
<tr>
<td>8</td>
<td>NC</td>
<td>-</td>
<td>No Connection</td>
</tr>
<tr>
<td>9</td>
<td>NC</td>
<td>-</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

**How To Order**

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSC Power Supply</td>
<td>MSC2.5PN7.5</td>
</tr>
<tr>
<td>Power input cable, 3m</td>
<td>HV/0S2NSO/1229</td>
</tr>
<tr>
<td>HV Output cable, 3m</td>
<td>HVCS/1ISO/1228</td>
</tr>
<tr>
<td>Set of brackets for rack mount</td>
<td>MSCK100</td>
</tr>
</tbody>
</table>
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

**ESC01.5PN7.5**

Output Configuration:
Floating, reversible polarity bipolar output with floating center tap

Input:
+24Vdc, ±10% @ 2amps, 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:
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)

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)
Inject 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 Fault</td>
<td>Red</td>
<td>Cathode current fault signal is active</td>
<td></td>
</tr>
<tr>
<td>Cathode Voltage ON</td>
<td>Amber</td>
<td>Cathode high voltage is present</td>
<td></td>
</tr>
</tbody>
</table>
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 manufactureres 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

**Intel Atom N270 CPU @ 1.6GHz**
**1GB Ram**
**7” Touch Screen LCD @ 800 x 600**
**Intel 945 Express Graphics**
**10/100/1000Mbit Ethernet**
**RS-232 Serial Ports**
**160GB Internal Hard Drive**

---

**Seasoning Screen**

**Status and Control Screen**

---

**Corporate Headquarters**
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
Copyright © 2011 Spellman High Voltage Electronics Corp.
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 integrators 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
### XRV I/O BOX SELECTION TABLE

<table>
<thead>
<tr>
<th>MODEL NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>XRV-9-1</td>
<td>Rack mount without XRV controller</td>
</tr>
<tr>
<td>XRV-9-2</td>
<td>Rack mount with XRV controller</td>
</tr>
<tr>
<td>XRV-9-3</td>
<td>Wall mount without XRV controller</td>
</tr>
<tr>
<td>XRV-9-4</td>
<td>Wall mount with XRV controller</td>
</tr>
<tr>
<td>XRV-9-5</td>
<td>Rack mount without XRV controller with optional safety relay for interlocks</td>
</tr>
<tr>
<td>XRV-9-6</td>
<td>Rack mount with XRV controller with optional safety relay for interlocks</td>
</tr>
</tbody>
</table>

### TB1, TB2, TB3-MAIN AC INPUT POWER—

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB1-1</td>
<td>Line 1</td>
<td>180 - 264Vac</td>
</tr>
<tr>
<td>TB2-1</td>
<td>Line 2</td>
<td>Neutral or 180 - 264Vac (3 phase source)</td>
</tr>
<tr>
<td>TB3-1</td>
<td>GND</td>
<td>Ground</td>
</tr>
</tbody>
</table>

### TB4- COOLER / CHILLER—MAINS AC OUTPUT

<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>180 - 264Vac or Neutral (3 phase source)</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>Ground</td>
</tr>
</tbody>
</table>

### TB5-COOLER / CHILLER INTERLOCKS

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Flow INTLK</td>
<td>Dry contacts, ≤24Vdc</td>
</tr>
<tr>
<td>2</td>
<td>Common</td>
<td>Dry contacts, ≤24Vdc</td>
</tr>
<tr>
<td>3</td>
<td>Temp INTLK</td>
<td>Dry contacts, ≤24Vdc</td>
</tr>
</tbody>
</table>

### TB6-LOW VOLTAGE / DOOR INTERLOCKS

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Door INTLK</td>
<td>Dry contacts, ≤24Vdc</td>
</tr>
<tr>
<td>2</td>
<td>Door INTLK</td>
<td>Dry contacts, ≤24Vdc</td>
</tr>
</tbody>
</table>

### TB7-XRV I/O MAINS TO CDRH* SAFETY INTERLOCK

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power INTLK Line 1 OUT</td>
<td>180 - 264Vac</td>
</tr>
<tr>
<td>2</td>
<td>Line 1 IN</td>
<td>180 - 264Vac</td>
</tr>
<tr>
<td>3</td>
<td>Power INTLK Line 2 OUT</td>
<td>Neutral or 180 - 264Vac (3 phase source)</td>
</tr>
<tr>
<td>4</td>
<td>Line 2 IN</td>
<td>Neutral or 180 - 264Vac (3 phase source)</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>Ground</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.

### TB8-XRV AUX AC OUTPUT—TO XRV JB1

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Line 1</td>
<td>180 - 264Vac</td>
</tr>
<tr>
<td>B</td>
<td>Line 2</td>
<td>Neutral or 180 - 264Vac (3 phase source)</td>
</tr>
<tr>
<td>C</td>
<td>GND</td>
<td>Ground</td>
</tr>
</tbody>
</table>

### 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</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>
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>HVD</th>
<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>
<td>0-400kVdc</td>
</tr>
<tr>
<td>Input Impedance</td>
<td>1000Mohms</td>
<td>2000Mohms</td>
<td>4000Mohms</td>
</tr>
<tr>
<td>Output Impedance</td>
<td>1M; 100kohms</td>
<td>20kohms</td>
<td>40kohms</td>
</tr>
<tr>
<td>Output Taps</td>
<td>100V, 10V</td>
<td>2V</td>
<td>4V</td>
</tr>
<tr>
<td>Accuracy</td>
<td>0.5%: (0.1% opt)*</td>
<td>0.5%: (0.25% opt)*</td>
<td>0.5%</td>
</tr>
<tr>
<td>Stability</td>
<td>0.01%/8hrs</td>
<td>0.025%/8hrs</td>
<td>0.025%/8hrs</td>
</tr>
<tr>
<td>Temp. Coefficient</td>
<td>25ppm/°C</td>
<td>25ppm/°C</td>
<td>25ppm/°C</td>
</tr>
<tr>
<td>Height</td>
<td>17.5” (44.5cm)</td>
<td>33.5” (84.5cm)</td>
<td>61” (154.94cm)</td>
</tr>
<tr>
<td>Max. Diameter</td>
<td>10” (25.4cm)</td>
<td>12” (30.5cm)</td>
<td>20” (50.8cm)</td>
</tr>
<tr>
<td>Weight</td>
<td>6.75 lbs (3.1kg)</td>
<td>12 lbs (5.5kg)</td>
<td>24.45 lbs (11.8kg)</td>
</tr>
<tr>
<td>Output Connector</td>
<td>BNC type</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.
Spellman USA and Corporate HQ
475 Wireless Blvd.
Hauppauge, NY 11788
United States
tel: +1 631-630-3000
dt: +1 631-435-1620
email: sales@spellmanhv.com

Spellman Valhalla NY USA
One Commerce Park
Valhalla, NY 10595
United States
tel: +1 914-686-3600
dt: +1 914-686-5424

Spellman UK
Broomers Hill Park #14, Broomers Hill
Pulborough, West Sussex,
United Kingdom RH20 2RY
tel: +44 (0) 1798 877000
dt: +44 (0) 1798 872479

Spellman Japan
Kano Bldg. 5F, 1-26-7 Nishigotanda,
Shinagawa-ku, Tokyo 141-0031 Japan
tel: +81 (0) 3-5436-9810
dt: +81 (0) 3-5436-9811

Spellman China
Spellman High Voltage Electronics (SIP) Co Ltd.
No. 86 Jinjiang Road,
Suzhou Industrial Park 215217 China
tel: +86-512-67630010
dt: +86-512-67630030

Spellman High Voltage Korea Co.,Ltd.
#B-720, BRC Smart Valley,
Song Do Mirae-ro 30,
Yeonsu-Gu, Incheon, Korea 406-081
tel: +82 32-719-2300
dt: +82 32-720-4300

Spellman de Mexico – Plant 2
Avenida Pedregal # 2 Esquina
Avenida Chapultepec
Parque Industrial FINSA Oriente
Matamoros, Tamps., Mexico 87340
tel. +52 868 150-1200

Spellman de Mexico – Plant 3
Avenida Chapultepec # 101 Esquina
Avenida Horizonte
Parque Industrial FINSA Oriente
Matamoros, Tamps., Mexico 87340
tel. +52 868 150-1200

Spellman High Voltage GmbH
Josef-Baumann-Straße 23
44805 Bochum
Germany
tel: +49 (0) 234 87906-0