

Installation and User Guide

High Voltage Power Supply EBM20N/5/24 (5 Watt version)



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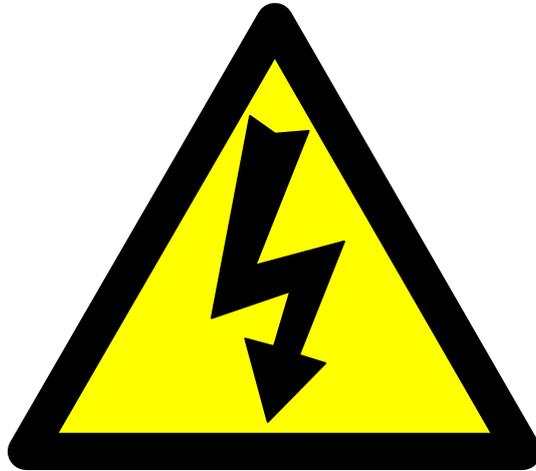
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2.2 3.3.3 Appendix 1 Appendix 2	Added regulatory information Updated cable part number Added voltage monitor to block diagram Added stripped end cable drawing	2

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SAFETY



DANGER HIGH VOLTAGE RISK OF ELECTROCUTION

Observe extreme caution when working with this equipment

- σ **High voltage power supplies must always be connected to protective earth.**
- σ **Do not touch connections unless equipment is turned off and the capacitance of both the load and power supply are grounded.**
- σ **Allow adequate time for discharge of internal capacitance of the power supply.**
- σ **Do not ground yourself or work under wet or damp conditions.**

Servicing Safety

- σ **Maintenance may require removing the Instrument cover with the power on.**
- σ **Servicing should only be done by qualified personnel aware of the hazards.**
- σ **If in doubt, return to supplier for servicing**

1. Description

The EBM20N/5/24 series is a range of 20kV electron gun power supplies designed to drive a Thermionic Scanning Electron Microscope gun with a tungsten filament, it comes in a 5 watt versions. It contains an accelerator power supply, filament supply and bias supply all independently controlled via an analog interface. Refer to appendix 1 for a block diagram of the unit. The unit is powered from a 24V supply, all input connections are via JST single in line connectors. The HV outputs are via a bespoke 3-pole output connector.

1.1 Unit ratings

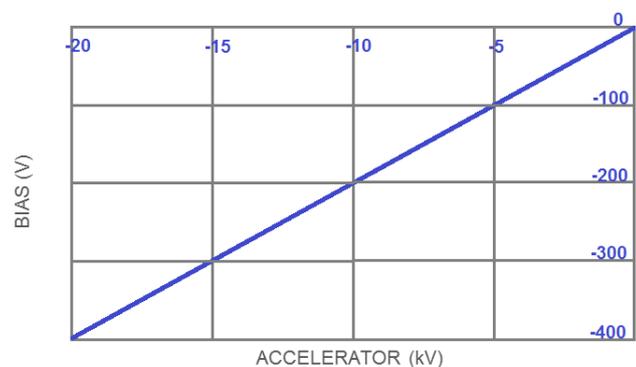
Output	EBM20N5
Accelerator	20kV, 250 μ A (i)
Bias	1.5kV, 150 μ A (ii)
Filament	12W max into 1.33 Ω (ii)

Notes:

- (i) voltages up to 25kV can be generated
- (ii) referenced to Accelerator output

1.2 Bias Operation

The Bias HV output is generated by the feedback resistor current and the load current flowing from the accelerator through a 10M Ω resistor to the filament centre tap. See the block diagram in Appendix 1. The maximum off-load Bias voltage is therefore dependent upon the accelerator voltage and the 500M Ω feedback resistor as shown in the block diagram. Beam current conduction is achieved by cancelling this bias voltage with the positive polarity HV generator.



An Accelerator output of 20kV will generate a current of 40 μ A feedback into the 500M feedback resistor, which is equal to a voltage of 400V generated across the 10M Ω resistor. So the Bias sits at -20400V which blocks the flow of electrons. A positive voltage on the Bias reduces the HV and allows current to flow.

1.3 Environmental conditions

- Operating temperature: +5°C to +40°C
- Relative humidity rating: 20% to 85% (non-condensing)
- Altitude: Up to 2000m above mean sea level

2. Safety

- The HV outputs are provided at a 3 pin bespoke connector. **The unit must be terminated safely before operation.** Hazardous voltages will be exposed if the connector is removed whilst the unit is enabled. The Earth stud of the unit is a protective earth and must be connected to the earth of the system.
- **The unit must be switched off for at least one minute before disconnecting the HV connector or removing the access panel.**
- The HV outputs of the unit are hazardous and the conditions of this manual must be complied with to maintain safety. Operating the unit in a manner not specified in this manual may impair the protection against electric shock provided by the unit.

2.1 Meaning of Symbols

SYMBOL	MEANING
	Refer to manual before operating
	Caution, possibility of electric shock
	Protective conductor terminal (PE)

2.2 Regulatory Approvals

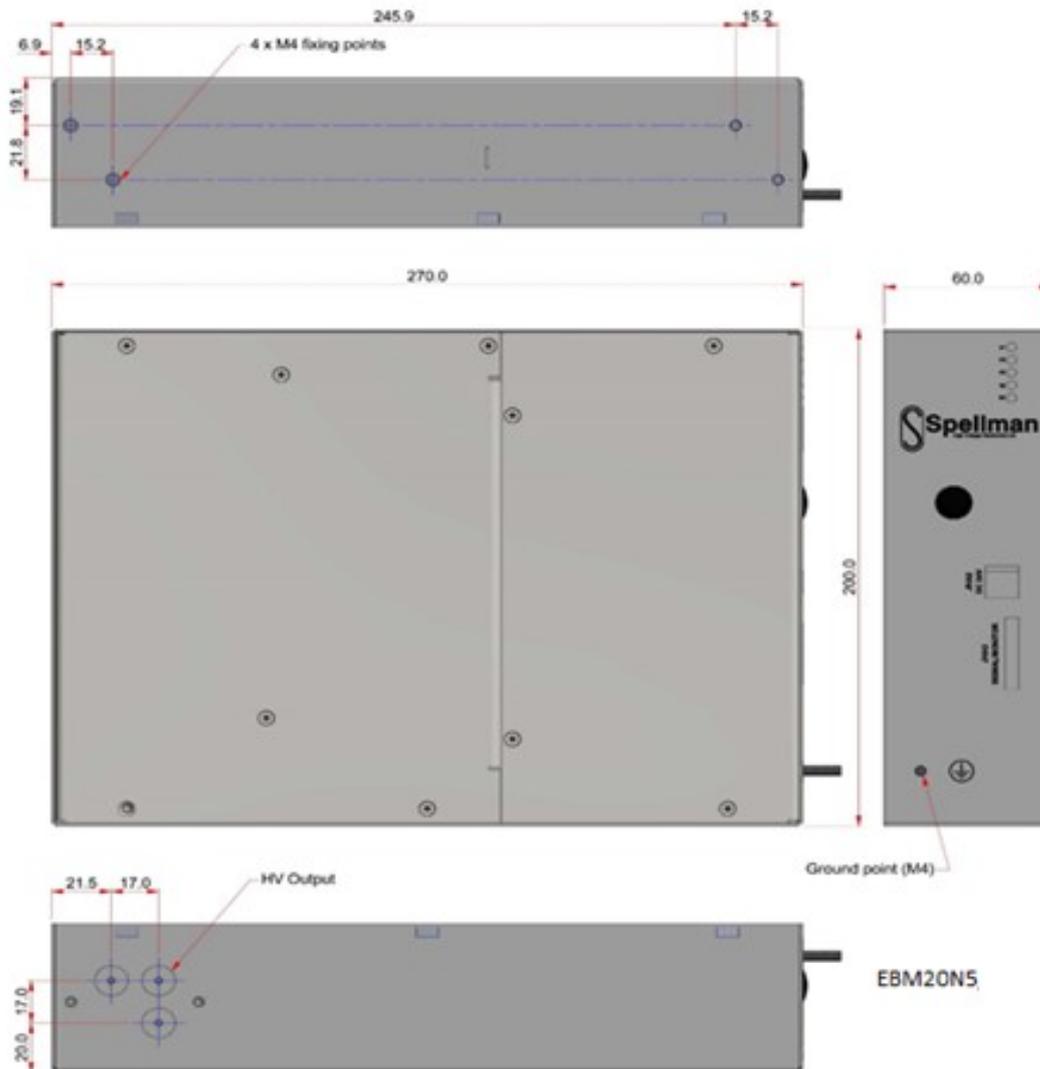
The unit is designed to meet the requirements of EN 61010-1, UL 61010-1 and CAN/CSA-22.2 No. 61010-1. Please consult the factory for further approval information.

3. Installation of the HV Unit

3.1 Mechanical Installation

The EBM20N/5/24 must be secured in position using the M4 mounting holes provided (see section 5 for details). A safety interlock should be used to prevent access to the unit when it is operating. The EBM20N/5/24 consists of one chassis containing the high voltage power supply. The chassis is 270mm X 200mm X 60mm.

Please see mechanical outline drawing below:



Mass:

- 4.4Kg

3.2 Electrical Installation

The EBM20N/5/24 is designed for operation from a double insulated or SELV 24Vdc ($\pm 5\%$) supply, the maximum continuous current requirement is 1.5A.

The unit is contained in an earthed case. The earth stud of the unit shall be properly bonded to the main protective earth termination in the end product. The unit should only be used in a Pollution Degree 2 Installation Category II environment.

Consideration should be given to conduct the following tests with the power supply installed in the end product :

- a) Dielectric withstand test, between live parts of the power supply and the end product chassis.
- b) Permissible Limits Test with the power supply installed in the end product.
- c) Temperatures on power electronics components, transformer windings and accessible surfaces.

The input and output connectors are not intended as field connections and should only be connected to internal wiring in the end use equipment.

The unit is intended for use as a component and no surface of the unit should be accessible in the end product.

Note: Failure to comply with the above could compromise the safe operation of the unit and invalidate the warranty.

3.3 Connections

3.3.1 Input Power Connector

JHA2, type JST Model B 3PS-VH

Pin Number	Signal
1	+24V
2	0V
3	Case ground

Pins 2 and 3 internally connected together

3.3.2 Signal I/O Connector

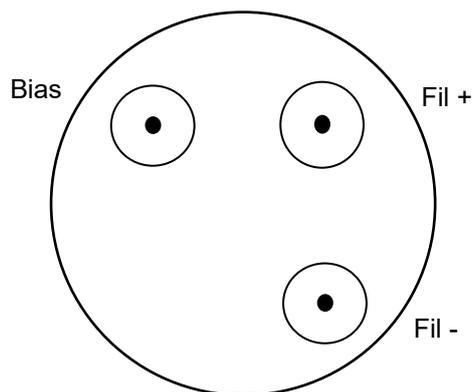
JHA3, type JST Model S10B-EH

Pin Number	Signal
1	Filament program
2	Ground
3	Bias program
4	Ground
5	Accelerator program
6	Ground
7	Emission current monitor
8	Ground
9	Accelerator monitor
10	Ground

3.3.3 High Voltage Output

The HV output connector is a bespoke 3 pin receptacle which mates with a Spellman HV cable assembly. The cable can be supplied as shown in appendix 2, contact your local Spellman HV sales office quoting part number HVC30/3IS/LL1650.

See diagram below for connection details:



View looking into receptacles

4. Operation of the HV Unit

4.1 Control Inputs

The EBM20N/5/24 unit is controlled by analogue inputs using the signal I/O connector shown in Section 3.3.2

The following table details the action of each control signal.

Input Signal	Voltage	Control
Accelerator Program Voltage	0 to 10V	This corresponds to 0kV to -20kV output (i)
Bias Program Voltage	0 to 10V	Corresponds to 0 to 1.5kV Bias output
Filament Program Voltage	0 to 10V	Corresponds to 0 to 4V Filament output

Notes:

- (i) Program accuracy only guaranteed above 500V

4.2 Monitor Outputs

The EBM20N/5/24 unit is monitored by analogue outputs using the signal I/O connector shown in Section 3.3.2

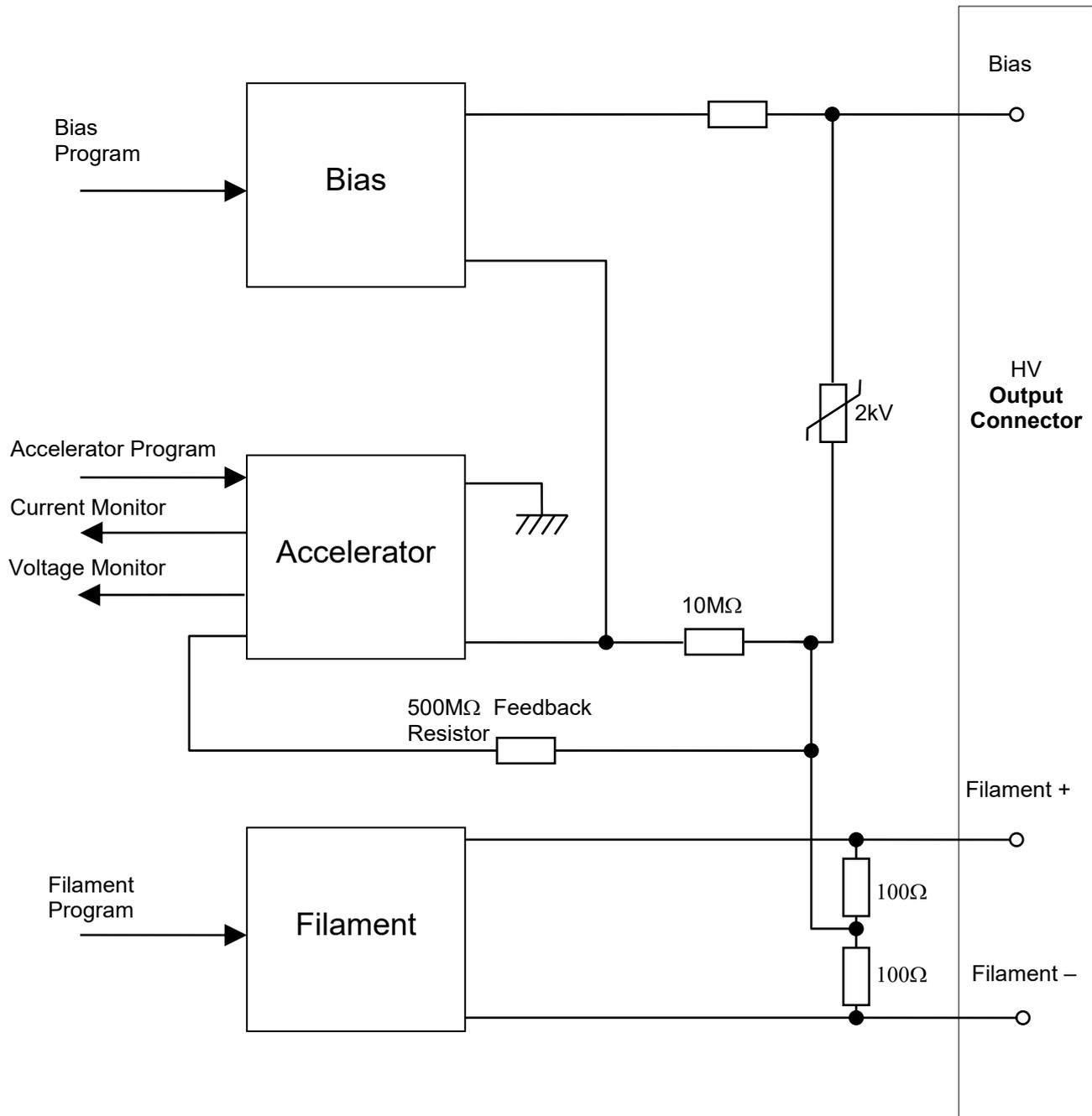
The following table details the action of each monitor signal.

Output Monitor	Voltage	Control
Accelerator Current Monitor	0 to 5V	This corresponds to 0 to 255 μ A output current Including the feedback current (i)
Accelerator Voltage Monitor	0 to 5V	Corresponds to 0kV to -20kV output (ii)

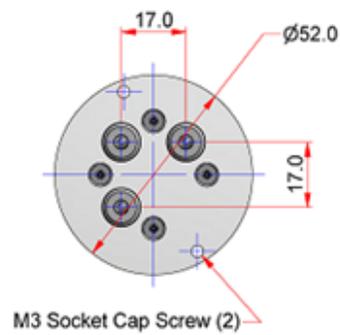
Notes:

- (i) Limited to 12V maximum.
(ii) Accuracy +/-3% of FS

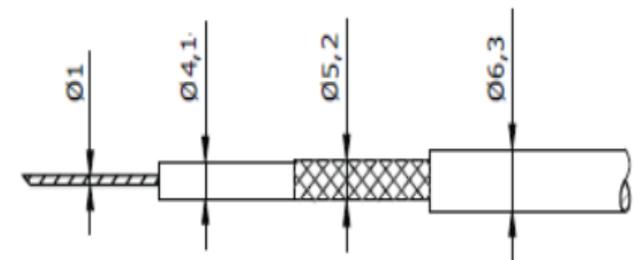
Appendix 1: HV Unit Block Diagram



Appendix 2 : HV Cable Assembly



HVC30/3IS/LL1650
73098 Issue A



Stripped end cable diameter information