

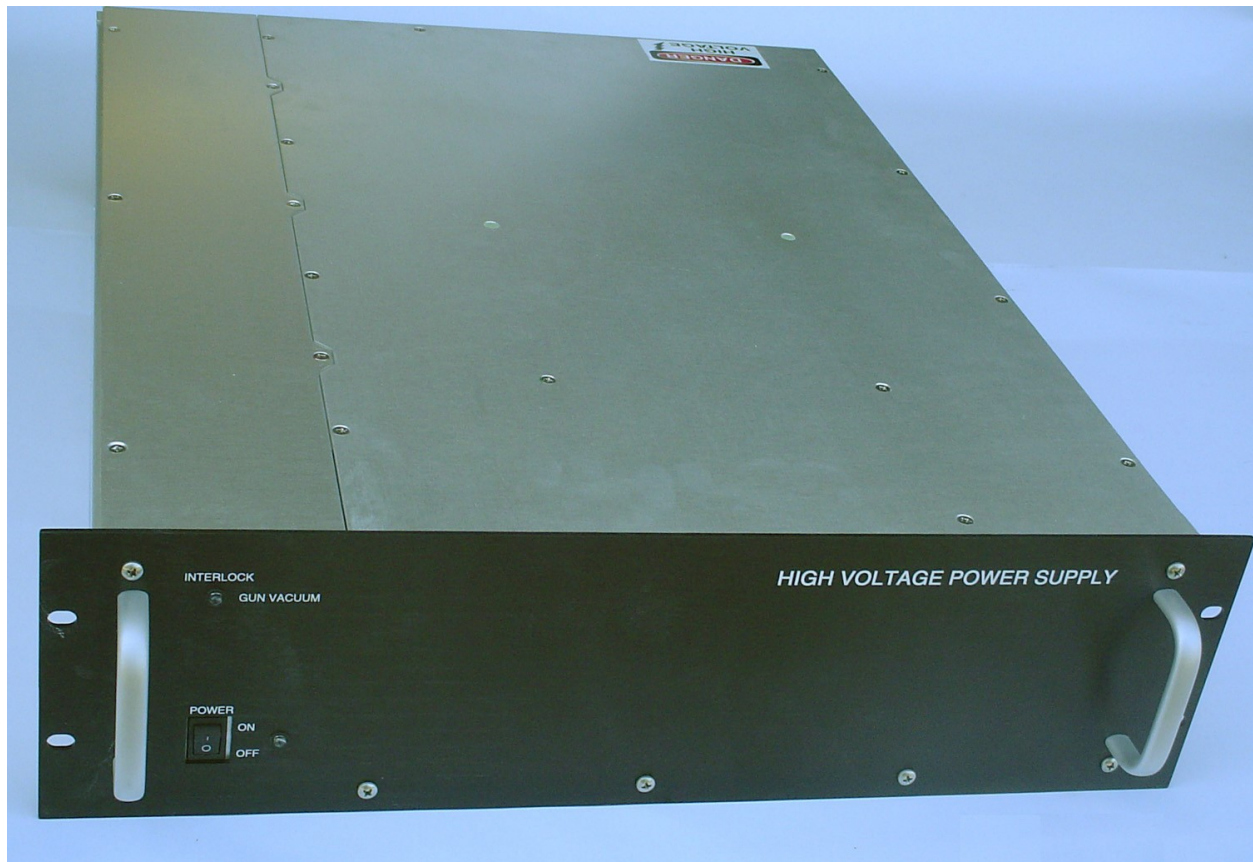
## **ELECTRON BEAM HIGH VOLTAGE POWER SUPPLY**

**MODEL EB-05-06 ACCELERATING VOLTAGE OUTPUT -6kV 200 $\mu$ A**

### **DESCRIPTION**

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The Model EB-05-06 is ultra-quiet negative-polarity Electron-Beam power supply designed for low acceleration voltage operation in Scanning Electron Microscope (SEM) instruments with Schottky Field Emission (SFE) electron source and acceleration voltages up to -6kV. It consists of five independently-operated supplies: Accelerator (Beam), Suppressor (Wehnelt or Bias), Extractor, Gun (Anode or Column), and Filament. Filament is constant current supply and the rest of the supplies are constant voltage. Bias, Extractor, Gun voltages and Filament current are floating on the Accelerator potential. Output voltages and currents are precisely controlled and monitored through a microprocessor interface using commands sent to the power supply over a serial interface from a controller. The controller would typically be a PC or workstation with a serial interface. RS-232 serial interface standard, Ethernet and USB are optional.



# **! DANGER !**

High voltage power supply provides extreme electrical tension, and may output current or store electrical charge at levels which are inherently hazardous. Improper installation or usage could result in electrical discharge or sustainable arc, and may cause fire, burns, shock, electrocution, and death. User is solely responsible for high voltage safety and fully accepts all liability for any damages or harm sustained, caused, or inflicted while handling, installing, or operating high voltage modules, power supplies, and other instrumentation, systems, or components.

## **OUTPUT SPECIFICATIONS**

### **Accelerator (Beam) voltage source:**

- 0 to -6kV @200uA - **referenced to Ground**
- $\pm 2$ V absolute accuracy
- $\leq 5.5$ mV p-p ripple and noise, including common mode ripple
- 200mV line regulation
- 200mV load regulation
- 0.01% stability over 8 hours period (after 20 min warm-up)
- 25ppm/C<sup>0</sup> temperature coefficient (after 20 min warm-up)
- Remote programming via RS232 interface 0 to -6kV with 16bit resolution
- Remote voltage and current monitor via RS232 interface with 16bit resolution

### **Gun (Anode or Column) voltage source:**

- 0 to +2kV @50 uA - **referenced to Accelerator**
- $\pm 2$ V absolute accuracy
- $< 200$ mV p-p ripple and noise (100mV p-p typical)
- 200mV line regulation
- 200mV load regulation
- 0.01% stability over 8 hours period (after 20 min warm-up)
- 25ppm/C<sup>0</sup> temperature coefficient (after 20 min warm-up)
- Remote programming via RS232 interface 0 to +2kV with 16 bit resolution
- Remote voltage and current monitor via RS232 with 16 bit resolution

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## **Suppressor (Wehnelt or Bias) voltage source:**

- 0 to -2kV @ 10 $\mu$ A -referenced to Accelerator
- $\pm$  1V absolute accuracy
- < 100mV p/p ripple and noise
- 10mV line and load regulation
- 0.01% stability over 8 hours period (after 20 min warm-up)
- 25ppm/C<sup>0</sup> temperature coefficient (after 20 min warm-up)
- Remote programming via RS232 interface 0 to -2kV with 16 bit resolution
- Remote voltage and current monitor via RS232 with 16 bit resolution

## **Extractor voltage source:**

- 0 to +10kV @ 1000 $\mu$ A -referenced to Accelerator
- $\pm$  5 V absolute accuracy
- 100 mV p-p ripple and noise
- < 200 mV line and load regulation
- 0.01% stability over 8 hours period (after 20 min warm-up)
- 25 ppm/C<sup>0</sup> temperature coefficient (after 20 min warm-up)
- Remote programmings via RS232 interface 0 to +10kV with 16 bit resolution
- Remote voltage and current monitor via RS232 with 16 bit resolution

## **Filament current source:**

- 0 to 3A DC limited to 6V 18W -referenced to Accelerator
- 10mA / 50mV line and load regulation
- 3mA / 12mV p-p ripple and noise
- Remote programming via RS232 interface 0 to 3A with 16 bit resolution
- Remote current and voltage monitors via RS232 with 16 bit resolution

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## **GENERAL SPECIFICATIONS**

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- AC powered: 120-240V AC  $\pm$  10%; @ 1.5A
- DC powered: 48V dc  $\pm$  10% ; @ 3A
- 19" rack mount with rails; 5U modular design with access for repair and service
- All outputs can be enabled and disabled through RS232 control and interlock switch via relay contact (separate connector). After PS is deactivated via interlock it should not be reactivated until the PS is re-enabled through RS232 control, even if the interlock is restored.
- Remote control via RS232 interface with 19.2kbaud/sec rate for floating and for ground referenced supplies
- Zero corona operation at all times
- Output voltages should be less than 200V in 10 seconds when interlock opens or "zero output" signal is sent via interface.
- Fault and normal operation indicators should be provided on the front panel
- All supplies should go into current limit mode when maximum current is reached
- Short circuit and arc protections are provided, recovery is automatic
- Units must be non-microphonic as measured at any output within frequency range 0.1 to 1000 Hz

### **Interlock:**

A High Voltage Interlock inputs are provided for the protection of the operator of this power supply. External switch closure is necessary to activate all supplies. Power supplies should not reactivate until the supply is re-enabled through the RS-232 control even though the external interlock switch may close. Interlock shall deactivate the power supply through relay contacts. When either interlock opens, output voltages shall decay to <200V in <10sec.

### **Grounding:**

The Input power cord must be connected to a grounded socket. The output load should be returned to the case ground terminal located on the rear of the power supply. Case ground terminal must have permanent and reliable connection to low-impedance ground and/or common-potential chassis of the system at all times.

### **Input Power:**

The unit operates from 120-240V AC +/- 10% or 48V DC +/- 5%.

### **Front Panel Controls and Indicators:**

Power ON/OFF:	ON/OFF power switch;
Power LED:	Indicates if the input power is ON or OFF.
Interlock LED:	Indicates if the interlock is closed or open. If Interlock is open, LED is OFF, High Voltage is OFF.
HV Out LED:	Indicates if the High Voltage Output is Enabled.

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## **Rear Panel Controls and Connectors:**

DC Power Inlet:	Standard AMP connector
HV Connector:	Filament Return, Filament +, Suppressor, Extractor and Gun are Federal Standard circular connector, 30kV rated
Fiber optic connector	Ground Level and Floating Level interface RS-232 Standard
Interlock:	DB9M Type connector, female. Pins 5-6 Enable high/Disable low 5volts will enable and 0 volts will disable the unit. (TTL logic).

## **MECHANICAL SPECIFICATIONS**

### **Dimensions:**

17"W x 5 1/4"H x 22"D, max. Rack mount

### **Temperature Range:**

10°C to 40°C operating, -30°C to 70°C non-condensing humidity storage

### **Weight:**

Below 50lbs (25kg)

### **Accessories:**

- Two fiber optic cables. Length 3meter;
- Two Fiber optic convertors with 25 pin RS-232 connector;

### **Mounting:**

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The Model EB-05 E-Beam power supply should be mounted in a standard 19" rack

## **REMOTE PROGRAMMING**

### **General Information:**

The model EB-04 power supply includes a microprocessor interface that allows the power supply to be remotely controlled and monitored using commands sent to the power supply over a serial interface from a controller. The controller would typically be a PC or workstation with a serial interface, although a simple CRT terminal can be used. The microprocessor interface supports RS-232 serial interface standard, Ethernet and USB are optional.

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## Serial Interface:

The serial interface is an asynchronous RS-232 interface. The interface operates at:

Baud Rate	19200.
Parity	N-none.
Data Bits	8.
Stop Bits	1.

## Command definition:

Wdhhh<CR> Load DAC d with hhhh hexadecimal  
Md<CR> Monitor (read) ADC d. Returns hhhh<CR>  
Hd<CR> Disable output d  
Ld<CR> Enable output d

## Assignment of character “d”

### Wd Command:

#### *Ground Level Link*

0 Accelerator (0 to -6kV)

#### *Floating Level Link*

0 Filament (0 to 3A)  
1 Suppressor (0 to -2kV)  
2 Extractor (0 to +10kV)  
3 Gun (0 to +2kV)

### Md Command:

#### *Ground Level Link*

0 Accelerator Voltage Monitor (0 to -6kV)  
1 Accelerator Current Monitor (0 to 100μA)  
7 Temperature inside of enclosure

#### *Floating Level Link*

0 Filament Voltage Monitor (0 to 6V)  
1 Filament Current Monitor (0 to 3A)  
2 Suppressor Voltage Monitor (0 to -2kV)  
3 Suppressor Current Monitor (0 to 10μA)  
4 Extractor Voltage Monitor (0 to +10kV)  
5 Extractor Current Monitor (0 to 1000μA)  
6 Gun Voltage Monitor (0 to +2kV)  
7 Gun Current Monitor (0 to 50μA)

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## **Hd and Ld Commands:**

### ***Ground Level Link***

0 Accelerator enable/disable

### ***Floating Level Link***

0 Filament enable/disable  
1 Suppressor enable/disable  
2 Extractor enable/disable  
3 Gun enable/disable

## **USER RESPONSIBILITY**

Case ground terminal must have permanent and reliable connection to low-impedance ground and/or common-potential chassis of the system at all times. User is solely responsible for all aspects of safe operation of the high voltage power supplies and modules, including but not limited to installing, establishing and following all the necessary insulating, grounding, guarding, interlocking, shielding, and discharging procedures, measures, and connection

## **LIABILITY DISCLAIMER**

By purchasing PBS&T high-voltage power supply or module user declares that (s)he is in the possession of technical expertise for safely building, powering, connecting, and operating high voltage electrical machinery with hazardous levels of electrical tension, supplied currents, and stored energy, and unconditionally accepts full and complete responsibility for all and any possible damage, injury, harm, loss of life, loss of property, loss of profits, and any other direct, indirect, and consequent damages sustained, inflicted, resulted from, or associated with use, misuse, or inability to use PBS&T™ high-voltage power supplies or modules for any purpose or application. Any PBS&T liability for such damages is hereby unconditionally disclaimed and fully waived.

## **CUSTOM MODELS**

The EB-05-xx series power supplies were designed for operating Schottky Field Emission sources and can be economically and quickly adapted to satisfy custom applications. Other output voltage and/or current ratings, custom control features, connectors, programming, or special mechanical constraints are some of the varied requirements which can be satisfied.