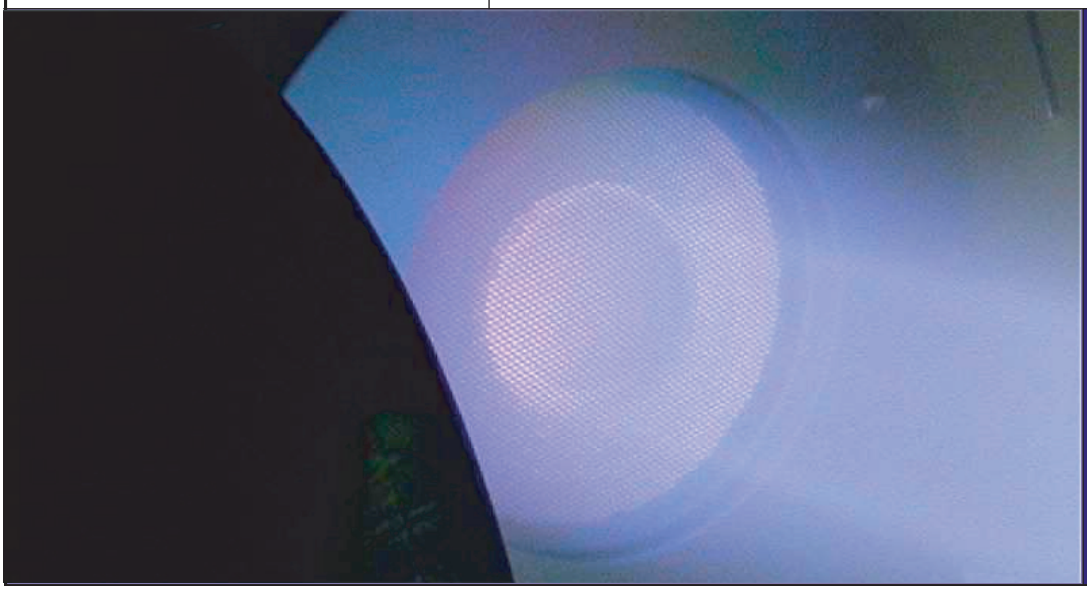
MPS 3000
Power Supply

Technical Manual

9311-002



MPS-3000

Power Supply

Technical Manual

Veeco

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Manual #9311-002 Rev G

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Chapter 1: Safety

Understanding the correct installation, operation, and maintenance procedure is necessary for safe and successful operation. This safety alert symbol precedes safety messages in this manual, along with one of the three signal words explained below. Obey the messages that follow these words to avoid possible injury or death.

DANGER This symbol marks an imminent hazard which will kill or injure if ignored.

WARNING This symbol marks a potential hazard which may kill or injure if ignored.

CAUTION This symbol marks a potential hazard which may cause minor injury if ignored.

CAUTION This symbol marks a potential hazard which may cause damage if ignored.

Please read the following before continuing:

WARNING To avoid electrical shock, keep clear of "live" circuits. Follow all local lock-out/tag-out procedures, before repairing or replacing any electrical devices.

It is recommended that only trained, qualified persons using established safety procedures perform any work related to the installation, start-up, operation or maintenance of this system.

WARNING To avoid electrical shock, check that all hardware interlocks are working. Keep all guards and panels in place during routine system operation.

Complete ion beam systems from Veeco Instruments Inc. are supplied with hardware interlocks and software safeguards at various points in the system. Whenever components or retrofits are added to existing systems, a local review of system safety is recommended.

Chapter 2: Overview

The MPS-3000 power supply system is specifically designed and optimized to power and control Veeco ion beam sources.

- The built-in microprocessor provides reliability and flexibility to the user. The microprocessor automatically checks each of the power supplies each time the system is turned on.
- When an unsatisfactory condition occurs, an error code appears on the power supply display. Refer to "Troubleshooting/Error Code Definitions" on page 71 to determine the cause and remedy to the problem.
- Programmable limits on the power supplies allow the users to adjust the system. On the neutralizer power supply, the filament current limit might be adjusted up or down as required, depending upon the size and type of filament wire used.
- Operate in Manual, Local, Local Restricted, or Remote mode.

Manual Mode

Each of the individual power supplies is controlled from the front panel. Recall or store complete operating conditions from one of two nonvolatile memories.

Use these steps to change a parameter:

1. Select a power supply with the MODULE select switch.
2. Select a parameter with the FUNCTION select switch.
3. Turn the Adjust knob to reach the chosen value.

Local Mode

Beam voltage, beam current, and accelerator voltage are adjustable from the front panel when operating in Local mode. Recall or store two complete sets of operating conditions from the two nonvolatile memories.

Local Restricted Mode

No adjustments may be made to any parameters from the front panel. Recall operating conditions from the memory.

NOTE

Operating conditions may not be stored in the memory when operating in Local Restricted mode.

Remote Mode

No adjustments may be made to any parameter from the front panel. Operating conditions may not be stored from the front panel and conditions may not be recalled from the memory when operating in Remote mode.

By using an EIA-232[1] interface, a computer may control power supplies and may recall conditions from memory.

- The SOURCE, BEAM, and MEMORY switches may be controlled with remote switches.
- The MEMORY, MODULE, and FUNCTION select switches are nonfunctional in Remote mode.
- The SOURCE and BEAM switches may be turned off, but may not be turned on at the front panel.
- The KEYLOCK switch may "lock" the power supply into any of the modes.
- When in the Disable position, the mode may not be changed.

1. Formerly known as, and identical to RS-232. The EU equivalent is CCITT V.24

Chapter 3: Installation

WARNING

To avoid electrical shock, keep clear of "live" circuits. Follow all local lock-out/tag-out procedures before installing any electrical devices.

Single Power Supply System Assembly

The MPS-3000 power supply is designed for bench or rack mount. It is shipped with the rack mount brackets attached.

1. Install the unit in the chosen location.

   If cabinet installation is chosen, use the four holes in the rack mount brackets to attach the unit to a cabinet.

CAUTION

Do not obstruct the cooling ports on the MPS-3000 power supply. An insufficient supply of cooling air will result in the unit overheating, causing a thermal shutdown and possible damage.

The power supply's cooling air ports are located in the sides of the chassis, and the cooling fan port is located in the rear panel of the chassis.

2. Connect the following:
   a. The source/beam cable to the source/beam connector (P33) located on the unit's back panel.
   b. The neutralizer cable to the neutralizer connector (P32) located on the unit's back panel.
   c. The interlock cable to the interlock connector (P31) located on the unit's back panel.
   d. The source/beam cable to the ion beam source (refer to "Drawings" on page 84).
   e. The neutralizer cable to the ion beam source (refer to "Drawings" on page 84).

WARNING

The shield in the source cable must be attached to facility ground with a low impedance connection. If the cable is not attached correctly, the power supply and facility may float at high voltages.

   f. The probe cable to the probe connector (P30) if applicable.
   g. The other end of the probe cable:

- if the cable has lug terminations, the **A** lug attaches to the vacuum chamber's single pin feedthrough, while the **GND** lug attaches to facility or earth ground.
- If the cable has a connector, attach it to the source's **Probe** connector.

3. Connect the interlock cable to the series-connected external interlock circuitry.

NOTE

The external interlock conditions are met when all series switches are closed. The number and type of interlock switches differ from system to system.

Use only dry closure (relay) contacts in the interlock circuit.

CAUTION

Do not connect the external interlock circuit to a powered circuit. Refer to FIGURE 3.1.

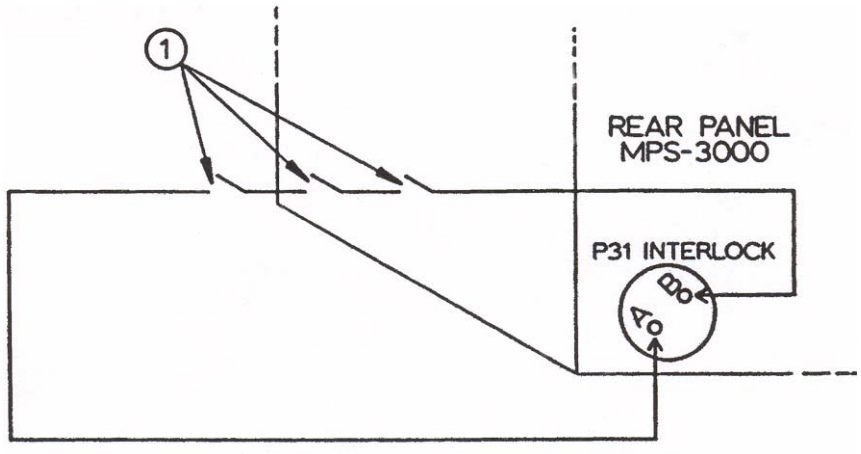


FIGURE 3.1 External Interlock Wiring - Single MPS System.

4. Verify that the **POWER ON/OFF** switch (on the power supply front) is in the STANDBY position and that the CB1 circuit breaker (on the power supply rear panel) is in the **OFF** position.

5. Connect the unit's line cord to an appropriate power source. See "Specifications" on page 76.

- If connecting to a three-wire power service with two hot lines and facility ground, the power cord is wired as follows:

Service	Power Supply
Hot	Blue (White)
Hot	Brown (Black)
Ground	Green (Green)

- If connecting to a three-wire power service with one hot line, a neutral line, and earth, the power cord is wired as follows:

Service	Power Supply
Hot	Brown (Black)
Neutral	Blue (White)
Earth	Green (Green)

NOTE

It is the user's responsibility to meet all local and national electrical codes when installing this equipment.

6. Turn the CB1 circuit breaker on the power supply's rear panel to the ON position.

This completes installation of a single power supply.

- If the ion source system includes more than one power supply, refer to "Multiple Unit System Assembly" .
- If the unit interfaces with an external microprocessor, refer to "Serial Communications" on page 46, for correct installation.
- If a gas flow controller option was selected, refer to the gas flow controller technical manual.

Multiple Unit System Assembly

For any multiple MPS-3000 power supply system that was not purchased as a complete unit from Veeco Instruments Inc., or if another power supply is installed into an existing system, attach the units' external interlocks according to FIGURE 3.2.

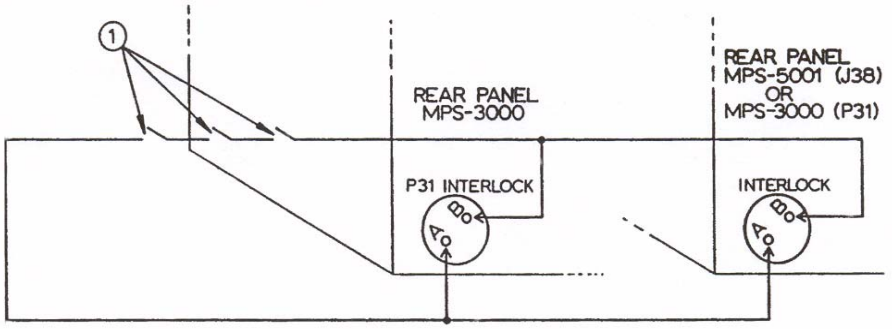


FIGURE 3.2 External Interlock Wiring - Multiple MPS System.

NOTE

For any multiple MPS-3000 power supply system that is purchased as a complete unit from Veeco Instruments Inc., disregard FIGURE 3.2.

Chapter 4: Controls

The numbers in FIGURE 4.1 through FIGURE 4.3 will appear throughout to identify the power supply's controls as their use and function is referenced.

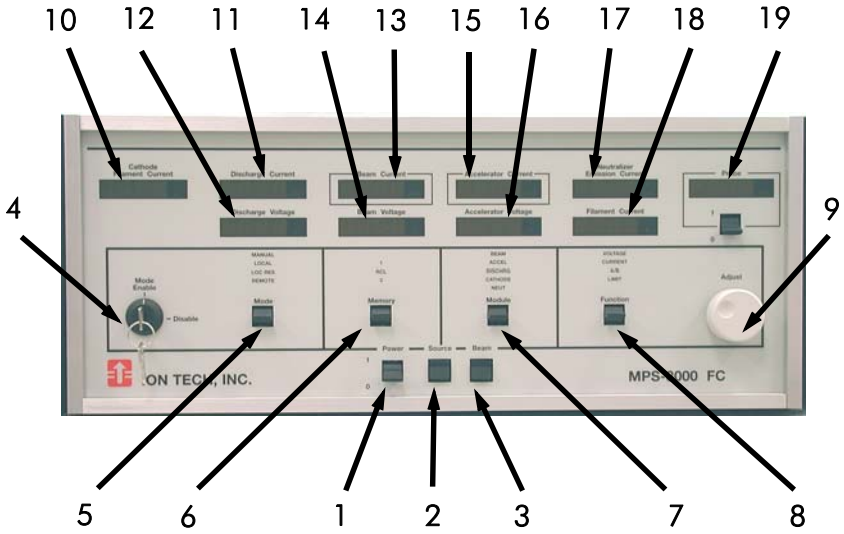


FIGURE 4.1 Front Panel: MPS-3000 FC

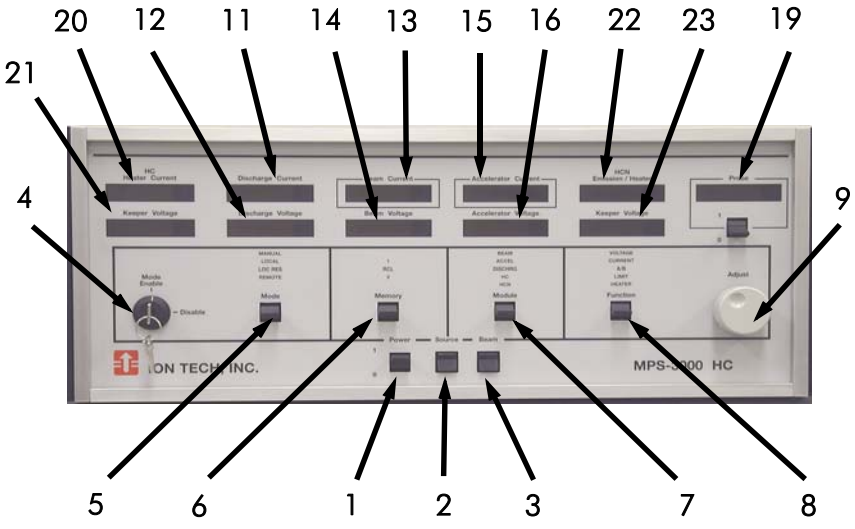


FIGURE 4.2 Front Panel: MPS-3000 HC

FIGURE 4.3 Front Panel: MPS-3000 PBN

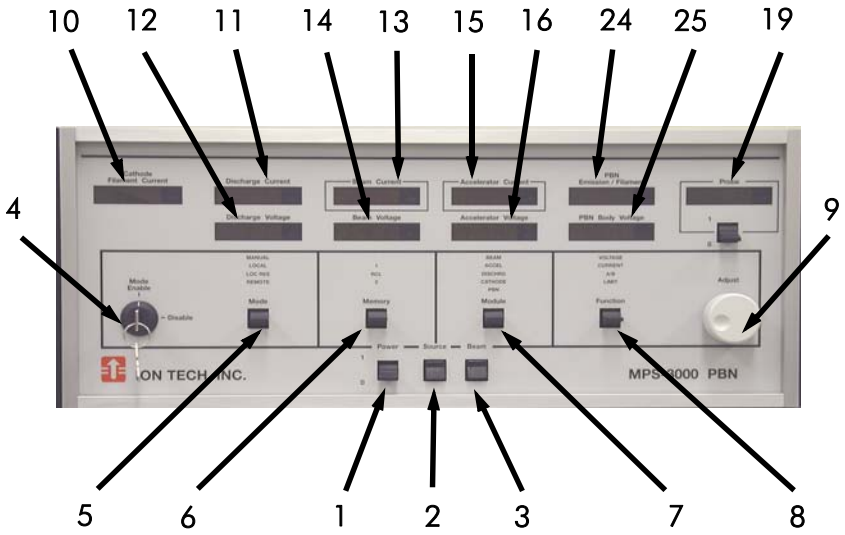


Table 4.1: MPS-3000 FC/HC/PBN Front Panel Keys and Switches

1	Power On/Standby	14	Beam Voltage Display
2	Source On/Off	15	Accelerator Current Display
3	Beam On/Off	16	Accelerator Voltage Display
4	Keylock	17	Neutralizer Emission Current Display
5	Mode	18	Neutralizer Filament Current Display
6	Memory	19	Probe
7	Module	20	HC Heater Current Display
8	Function	21	HC Keeper Voltage Display
9	Adjust	22	HCN Emission/Heater Current Display
10	Cathode Filament Current Display	23	HCN Keeper Voltage Display
11	Discharge Current Display	24	PBN Emission/Filament Current Display
12	Discharge Voltage Display	25	PBN Body Voltage Display
13	Beam Current Display		

Power - On/Standby (1)

The **POWER** switch controls the AC power to the unit and is controllable in all modes of operation. When the **POWER** switch is turned on, the following occurs:

- Power is applied to the controller board and to all the displays on the display board. The test program is initiated.
- After about six seconds the main contactor is energized. Each power supply is checked. The letter "P" will appear on the upper display of that power supply.

Source - On/Off (2)

The **SOURCE** switch applies power from the Cathode, Discharge, and Neutralizer power supplies to the appropriate pins of the neutralizer connectors (P33 and P32), located on the power supply's rear panel.

- The word SOURCE appears above the switch indicating the **SOURCE** switch has been selected.
- The **SOURCE** switch may be turned off in any mode.
- While in Remote mode, the **SOURCE** switch may be turned on through the remote device or by using an external switch.
- In any other mode, the **SOURCE** switch may be controlled from the front panel.

Beam - On/Off (3)

The **BEAM** switch applies power from the Beam and Accelerator power supplies to the appropriate pins of the source connector (P33) located on the power supply's rear panel.

- The word BEAM appears above the switch indicating the **BEAM** switch has been selected.
- While in Manual, Local, and Local Restricted modes, the beam may be turned on only if the source is already on.
- The **BEAM** switch may be turned off in any mode.
- While in Remote mode, the **BEAM** switch may be turned on through the remote device or by using an external switch.
- In any other mode, the **BEAM** switch may be controlled from the front panel.

Keylock (4)

The KEYLOCK switch enables or disables the MODE switch.

- In the disable position, the MODE switch will not function, and the active mode will be locked in.
- The KEYLOCK switch must be in the enable position to change the mode of operation.

Mode (5)

The MODE switch selects the power supply's operation mode.

- The KEYLOCK switch must be in the Enable position to change from one mode to another.

Manual

All parameters, except beam current, may be adjusted from the front panel.

- Operating conditions may be stored or recalled from memory.
- All switches on the front panel are active in this mode.
- The word MANUAL appears indicating that Manual mode has been selected.

Local

Only the following parameters may be adjusted: beam voltage, beam current, accelerator voltage, and A/B Ratio when in Local mode. All remaining parameters may not be changed from the front panel.

- The micro-processor controls the non-adjustable parameters to obtain the programmed values.
- Operating conditions may be stored in or recalled from memory.
- All the front panel switches are active in this mode.
- The word LOCAL appears above the MODE switch indicating that Local mode has been selected.

Local Restricted

No parameter may be adjusted in this mode. However, parameters may be recalled from memory.

- The enunciators above the FUNCTION and MODULE switches will be dark when in Local Restricted mode.
- The letters LOC RES appear above the MODE switch.
- All switches, except the FUNCTION and MODULE switches, are active in this mode.

Remote

Allows the unit to be controlled by a computer or by remote switches. The computer may select the Remote mode, recall conditions from either memory, and turn the SOURCE and BEAM switches on or off.

- All adjustable parameters may be changed through the remote microprocessor.
- When used, remote switches turn the SOURCE and BEAM switches on or off and may select either MEMORY 1 or MEMORY 2.
- In Remote mode, the SOURCE and BEAM switches may be turned off but may not be turned on at the front panel.
- The KEYLOCK, MODE, and POWER switches are fully functional, while the MEMORY, MODULE, and FUNCTION switches are not functional.
- The word REMOTE appears above the MODE switch indicating that Remote mode has been selected.

Memory (6)

Selects one of the two sets of parameters that are stored in memory. The MEMORY switch is active in all modes, except Remote.

MEM 1

When the number 1 appears above the MEMORY switch, the power supply will operate from memory location one. When any parameter is changed, the new value will be stored automatically in MEMORY 1.

MEM 2

When the number 2 appears above the MEMORY switch, the power supply will operate from memory location two. When any parameter is changed, the new value will be stored automatically in MEMORY 2.

RCL

When Recall has been selected, the parameters will be displayed from the memory location not being used. While the parameters are being recalled from a memory location, the letters RCL appear above the MEMORY switch. After about four seconds, the displays will return to their previous readings. The running conditions will not be affected by selecting Recall.

Module (7)

Selects the power supply that may have changes made to its parameters. The MODULE switch is active in Manual or Local mode only. In Local Restricted or Remote mode, the enunciators above the MODULE switch will be dark.

Beam

The word BEAM appears above the MODULE switch indicating that Beam power supply has been selected.

- Beam voltage may be adjusted in Manual, Local or Remote mode.
- Beam current may be adjusted in Local or remote mode.

Accel

The letters ACCEL appear above the MODULE switch indicating that Accelerator power supply has been selected.

- The accelerator voltage may be adjusted in Manual, Local or Remote mode.
- The A/B Ratio may be adjusted in Manual, Local, or Remote mode.

Discharge

The letters DISCHRG appear above the MODULE switch indicating that Discharge power supply has been selected.

- MPS-3000 FC, PBN, and HC: The discharge current limit may be selected and adjusted in Manual or Remote mode.
- MPS-3000 FC and PBN: The discharge voltage may be selected and adjusted in Manual mode or may be adjusted through a remote microprocessor.
- MPS-3000 HC: The discharge current may be selected and adjusted only in Manual mode.

Cathode

The Cathode power supply is part of the MPS-3000 FC and PBN.

- The word CATHODE appears above the MODULE switch indicating that Cathode power supply has been selected.
- Cathode filament current and current limit are adjustable in Manual mode and through a computer.

NOTE

The filament current may not be adjusted above the programmed current limit value, and the limit value may not be adjusted below the target filament current.

HC

The HC power supply is part of the MPS-3000 HC.

- The letters HC appear above the **MODULE** switch indicating that Hollow Cathode power supply has been selected.
- The hollow cathode keeper voltage limit is the only adjustable parameter on the Hollow Cathode power supply.
- The keeper voltage limit may be adjusted in Manual mode or through a remote microprocessor.

NEUT

The Neutralizer power supply is part of the MPS-3000 FC.

- The letters NEUT appear above the **MODULE** switch indicating that Neutralizer power supply has been selected.
- Neutralizer filament current and current limit are adjustable in Manual mode and through a computer.

HCN

The HCN power supply is part of the MPS-3000 HC.

- The letters HCN appear above the **MODULE** switch indicating that Hollow Cathode Neutralizer power supply has been selected.
- The heater current may be viewed by selecting HEATER with the **FUNCTION** switch in Manual or Local mode.

PBN

The PBN power supply is part of the MPS-3000 PBN

- The letters PBN appear above the **MODULE** switch indicating that PBN power supply has been selected.
- The PBN filament limit may be adjusted either in Manual mode or through a remote computer.
- The emission current may be adjusted only in Manual mode.
- The PBN filament current may be viewed in Manual or Local mode by selecting LIMIT with the **FUNCTION** switch.

NOTE

Do not adjust the filament current limit below the actual filament current.

Function (8)

Selects the parameter to adjust.

- The **FUNCTION** switch is active only in Manual or Local mode. The enunciators above the **FUNCTION** switch will be blank when in Local Restricted or Remote mode.

Voltage

For an MPS-3000 FC power supply, voltage is adjustable for the Beam, Accelerator, or Discharge power supply. The word VOLTAGE appear above the **FUNCTION** switch.

For an MPS-3000 HC power supply, voltage is adjustable for the Beam and Accelerator power supplies only. The word VOLTAGE appears above the **FUNCTION** switch.

Current

MPS-3000 FC: The current is adjustable only when the Neutralizer or Cathode power supply has been selected.

MPS-3000 HC: The current is adjustable only when the Hollow Cathode Neutralizer or Discharge power supply has been selected.

MPS-3000 PBN: The current is adjustable only when the Cathode or PBN power supply has been selected.

The beam current may be selected when operating in Local mode. The word CURRENT appears above the **FUNCTION** switch indicating that beam current has been selected.

A/B Ratio

The A/B Ratio may be adjusted only when the Accelerator power supply has been selected when operating in Manual or Local mode.

- The letters A/B appear above the **FUNCTION** switch indicating that A/B Ratio has been selected. The A/B Ratio may also be adjusted through a computer.

Limit

MPS-3000 FC, HC, or PBN: The limit is adjustable, when the Cathode, Neutralizer or Discharge power supply has been selected.

- The word LIMIT appears above the **FUNCTION** switch. Limits may be adjusted in Manual mode or through a computer.

MPS-3000 PBN: The PBN filament current may be viewed when in Local mode. Select PBN and LIMIT with the **MODULE** and **FUNCTION** switches.

Heater

The letters HCN appear above the module switch indicating that Hollow Cathode Neutralizer has been selected. The word HEATER appears above the **FUNCTION** switch.

Adjust Knob (9)

The Adjust knob is used to change the value of a selected parameter.

- Turning the knob clockwise increases the parameter value.
- Turning the knob counterclockwise decreases the parameter value.

If the selected power supply is off, the target parameter will be changed by turning the Adjust knob, and changes may be viewed on the appropriate display.

- When the selected power supply is operating and the Adjust knob is turned, the target parameter will be changed, but the power supply will react to the new parameter immediately.
- Target parameters are displayed while the knob is being turned.
- Actual values are displayed when the knob is not being turned.
- Anytime the knob is turned, the new value is stored automatically in the selected memory.

Cathode Filament Current Display (10)

Indicates the amount of current supplied from the Cathode power supply for heating the cathode filament.

Discharge Current Display (11)

Displays the amount of electron current collected by the ion source anode.

Discharge Voltage Display (12)

Displays the amount of voltage (positive with respect to the cathode) applied to the ion source anode.

Beam Current Display (13)

Displays the amount of ion current being extracted from the ion source.

Beam Voltage Display (14)

Displays the amount of voltage (positive with respect to facility ground) applied to the ion source.

Accelerator Current Display (15)

Indicates the amount of current being collected by the accelerator (downstream) extraction grid.

Accelerator Voltage Display (16)

Indicates the amount of voltage (negative with respect to facility ground) applied to the accelerator (downstream) extraction grid.

Neutralizer Emission Current Display (17)

Indicates the amount of electron emission current being supplied by the neutralizer power supply into the ion beam.

Neutralizer Filament Current Display (18)

Indicates the amount of current being supplied by the neutralizer power supply for heating of the neutralizer filament.

Probe (19)

The PROBE switch applies the output of an internal probe supply to the appropriate pin of the Probe connector (P30) on the power supply's rear panel.

- If the probe cable is attached to a functional probe, the collected ion current will appear on the Probe display.
- When the switch is in the off (0) position, the display will be blank.

HC Heater Current Display (20)

Indicates the amount of current provided by the Hollow Cathode power supply for heating the internal hollow cathode.

HC Keeper Voltage Display (21)

Indicates the amount of keeper voltage necessary for the operation of the internal hollow cathode or shows the setting of the keeper voltage limit.

- When the letters HC is selected on the **MODULE** switch and LIMIT is selected on the **FUNCTION** switch, the keeper voltage limit will be displayed.

HCN Emission / Heater Current Display (22)

Indicates the emission current or heater current parameters. The display will show emission current unless HEATER is selected by the **FUNCTION** switch.

- The emission current indicates the amount of current being provided by the Hollow Cathode Neutralizer power supply to neutralize the ion beam.

- The heater current display indicates the amount of current provided by the Hollow Cathode Neutralizer power supply for heating the internal hollow cathode neutralizer.

HCN Keeper Voltage Display (23)

Indicates the amount of keeper voltage necessary for the operation of the internal hollow cathode neutralizer or shows the setting of the keeper voltage limit.

- When HCN is selected on the **MODULE** switch and LIMIT is selected on the **FUNCTION** switch, the keeper voltage limit is displayed.
- When HCN is the module selection and LIMIT has not been selected with the **MODULE** switch, the actual keeper voltage will be displayed.

PBN Emission / Filament Current Display (24)

Indicates one of two parameters: emission current or filament current. The display will show emission current unless PBN and LIMIT have been selected by the **MODULE** and **FUNCTION** switches.

- The emission current indicates the amount of current being provided by the Plasma Bridge Neutralizer power supply to neutralize the ion beam.
- The filament current display shows the amount of current being provided to heat the PBN filament.

PBN Body Voltage Display (25)

Indicates the voltage difference between the body and filament on a PBN.

FIGURE 4.4 Rear Panel: MPS-3000

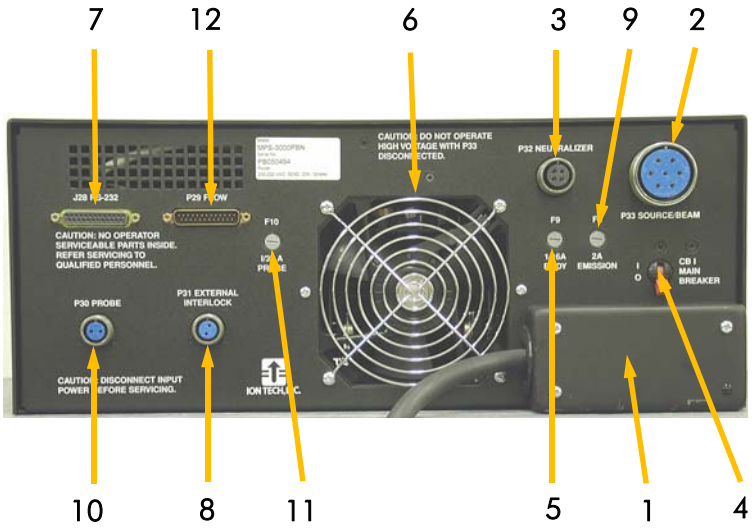


Table 4.2: Power Supply Rear Panel

1	Power Line Input
2	Source/Beam Connector (P33)
3	Neutralizer Connector (P32)
4	Circuit Breaker (CB1)
5	Body Fuse (F9)
6	Cooling Fan
7	EIA-232 Interface Connector (J28)
8	Interlock Connector (P31)
9	Emission Fuse (F8)
10	Probe Connector (P30)
11	Probe Fuse (F10)
12	Flow Connector (P29)

Power Input (1)

The cable provides power attachment between the power supply and the facility mains.

Source/Beam Connector (P33) (2)

Output connector for the Cathode, Discharge, Beam, and Accelerator power supplies and the source cable.

Neutralizer Connector (P32) (3)

Output connector for the Neutralizer power supply and the neutralizer cable.

Circuit Breaker (CB1) (4)

Primary circuit breaker for the input power.

Body Fuse (F9) (5)

This fuse protects circuitry from positive high-voltage-to-ground shorts.

Cooling Fan (6)

Circulates air through the entire chassis of the power supply.

EIA-232 (RS-232) Interface Connector (J28) (7)

Connector for interfacing with an external computer.

Interlock Connector (P31) (8)

Output cable connection of the external interlock circuit.

Emission Fuse (F8) (9)

Protects the neutralizer emission circuitry.

Probe Connector (P30) (10)

This is the output cable connection for the probe power supply.

Probe Fuse (F10) (11)

This fuse protects the probe power supply circuitry.

Flow Connector (P29) (12)

This connector provides the interface to the optional gas flow controller.

Controller Board Switch Definitions

The power supply is designed to allow the user to select several different operating options. The options are selected and programmed into the

power supply by the appropriate positioning of switches located on the controller board. To change switch settings refer to "Replacing the Switches" on page 70.

- The on position indicates that the switch is towards the top of the board.
- The off position indicates that the switch is towards the bottom of the board.

Switch Settings for Switch Bank #1

SW1-1:

For factory use only. Do not change the positions of this switch.

SW1-2, SW1-3:

Power supply identifier. Selects a number for identification of a power supply through the computer. When more than one power supply is part of a computer-controlled system, each power supply may be assigned a different identification number.

ID #	SW 1-2	SW 1-3
1	On	On
2	On	Off
3	Off	On
4	Off	Off

SW1-4:

Neutralizer Fault Switch

MPS-3000 FC

On - In the on position, the Discharge power supply will turn on without a neutralizer filament current present. The purpose of this switch is to allow operation of an ion source without a neutralizer current. Request zero neutralizer filament current when the Neutralizer Fault Switch is in the on position.

Off - In the off position, the discharge, beam, and accelerator outputs will be held low until the neutralizer filament current is within 0.5A of the target value and the cathode current is greater than 0.75A. Start-up of the ion source will not be possible if the neutralizer filament is open; the outputs of all power supplies will be shutdown if the filament fails during ion source operation. When an open filament is detected, an intermittent audio alarm will sound, an E23 error message appears on the Neutralizer Filament Current display, and all other displays will be dark. The SOURCE and

BEAM switches will be inoperative until the neutralizer fault has been corrected and the power has been cycled.

MPS-3000 HC and PBN

On - In the on position, the entire neutralizer supply is kept off.

Off - In the off position, the requested emission current is compared to the beam current. In Local, Local Restricted, or Remote mode, the emission current will automatically track the beam current, with the emission being 125% or 200% of the beam current. If the emission current is below 100% of the beam current, an E24 error message appears on the HCN Emission/Heater display, an audio alarm will sound (if enabled), and the BEAM switch will be turned off.

SW1-5, SW1-6:

Selects the baud rate. Baud rate represents the speed that the power supply will communicate to an external computer through an EIA-232 interface.

Baud Rate	SW 1- 5	SW 1- 6
9600	On	Off
4800	Off	On
2400	On	On
1200	Off	Off

NOTE

The baud rate is factory preset to 9600 bps.

SW1-7:

Selects the emission-current-to-beam-current ratio in Local or Remote mode.

On - In the on position, the emission current will track the beam current at 200%.

Off - In the off position, the emission current will track the beam current at 125%.

SW1-8:

On - In the on position, the front panel will remain locked following a power cycle if it was locked with the serial communication command NK1.

Off - In the off position. The front panel will be unlocked following a power cycle.

Table 4.3: Factory Switch Settings For Switch Bank #1

SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
Off	Off	Off	Off	On	Off	Off	Off

NOTE

All switches will be factory-set. The SW1-1 switch is for factory use only and should never be changed.

Switch Settings for Switch Bank #2

SW2-1:

Not used.

SW2-2:

Controller Board Alarm Switch

On - In the on position, the controller board alarm will sound when a Fatal error has been detected and will sound at power-up of the unit.

Off - In the off position, the controller board alarm will not sound when a Fatal error has been detected or at unit power-up.

Table 4.4: Factory Switch Settings For Switch Bank #2

SW1	SW2
Off	On

NOTE

All switches will be factory-set. The SW1-1 switch is for factory use only should never be changed.

Chapter 5: Manual Operation

MPS-3000 FC

Before beginning FC power supply operation, check the following:

- The appropriate ion beam source has been properly installed in the vacuum system.
- The vacuum system pressure is 3 x 10^{-4} Torr or lower.
- Sufficient gas flow is being introduced into the ion beam source for appropriate operation.

NOTE

Refer to the ion source's technical manual for installation and operation information.

FC Start-up

1. Turn the unit's POWER switch (on the power supply front) to the on position.
   a. The fan will start.
   b. Random displays will appear, and the audio alarm will sound. This condition will last about one second.

      The controller will self-test each of the power supplies (from right to left). A power supply has been tested when the letter P appears in the top display.
   c. A click will be heard when the main contactor energizes after about six seconds.
   d. The unit is ready to operate an ion source after each power supply has been tested.

2. Follow these steps to operate the power supply in Manual Mode:
   a. Turn the KEYLOCK switch to the Mode Enable position.
   b. Select Manual using the MODE switch. The word MANUAL appears above the switch indicating that Manual mode has been selected.
   c. To lock the power supply in Manual mode, turn the KEYLOCK switch to the disable position and remove the key.

3. Use the MEMORY switch to select the memory location the unit will use to store parameters; the selected memory location will appear.

4. Select the discharge voltage. For initial start-up and training purposes, select 55V.
   a. Select the Discharge power supply with the **MODULE** switch. The letters DISCHARG appear above the switch.
   b. Select Voltage with the **FUNCTION** switch. The word VOLTAGE appears above the switch.
   c. Enter the value by turning the Adjust knob. The programmed value appears on the Discharge Voltage display.
   d. As the Adjust knob is turned, the discharge voltage is entered automatically into the selected memory.

5. Select the discharge current limit. For initial start-up and training purposes, select 1.00A.
   a. Select the Discharge power supply with the **MODULE** switch on the front panel. The letters DISCHARG appear above the switch.
   b. Select Limit with the **FUNCTION** switch. The word LIMIT appears above the switch.
   c. Enter the chosen value by turning the Adjust knob. The programmed value appears on the Discharge Current display.
   d. As the Adjust knob is turned, the discharge current limit is entered automatically into the selected memory.

6. Select the cathode filament current limit.

   Refer to the "Tables" on page 83 for current limits for various ion sources.
   a. Select the Cathode power supply with the **MODULE** switch. The word CATHODE appears above the switch.
   b. Select Limit with the **FUNCTION** switch. The word LIMIT appears above the switch.
   c. Adjust the current limit up or down as needed. The value appears on the Cathode Filament Current display.

NOTE

Different sizes and types of filament wire may require adjustments to the cathode filament current limit. Unless the source size is known, the cathode current limit will be factory-set at 6.5A.

   d. The final selected value is stored automatically in the memory, as indicated above the **MEMORY** switch.

7. Select the cathode filament current.

   Refer to the "Tables" on page 83 for initial filament currents for various ion sources.

NOTE

The current values assume that 0.25mm (0.010 in.) tungsten wire is used for the cathode filament. If the actual filament is a different size and/or material, other filament currents could be required.

   a. Select the Cathode power supply with the **MODULE** switch and Current with the **FUNCTION** switch. The words CATHODE and CURRENT appear above the appropriate switches.

   b. Select the chosen value by turning the Adjust knob. The new value appears on the Cathode Filament Current display.

   c. As the Adjust knob is turned, the cathode filament current is entered automatically into the selected memory.

8. Select the neutralizer filament current limit.

   Refer to the "Tables" on page 83 for current limits for various ion sources.

   a. Select the neutralizer power supply with the **MODULE** switch. The word NEUTRALIZER appears above the switch.

   b. Select Limit with the **FUNCTION** switch. The word LIMIT appears above the switch.

   c. Adjust the current limit upwards or downwards as needed. The value appears on the Neutralizer Filament Current display.

NOTE

Different sizes and different types of filament wire may require adjustments to the neutralizer filament current limit. Neutralizer current limit will be factory-set at 6.5A.

   d. The final selected value is stored automatically in the memory, as indicated above the **MEMORY** switch.

9. Select the neutralizer filament current.

   Refer to the "Tables" on page 83 for initial filament currents for various ion sources.

   a. Select the neutralizer power supply with the **MODULE** switch and current with the **FUNCTION** switch. The words NEUT and CURRENT appear above the appropriate switches.

   b. Enter the chosen value by turning the Adjust knob. The value will appear on the Neutralizer Filament Current display.

   c. As the Adjust knob is turned, the neutralizer filament current is entered automatically into the selected memory location.

10. Apply power to the source.

WARNING

To avoid electrical shock, keep clear of "live" circuits.

Refer to the "Tables" on page 83 for current limits for various ion sources.

a. Press the SOURCE ON/OFF switch. The word SOURCE appears above the switch.

- When the SOURCE switch is activated, several changes will be observable on the front panel:
  - The cathode filament current will increase from 0.0 to the programmed value.
  - The neutralizer filament current will increase from 0.0 to the programmed value.
- When the neutralizer current is within 0.5A of the selected target, and the cathode current is greater than 0.75A, the discharge voltage will increase to about 150V.
- As the source discharge starts, the discharge current will increase and the discharge voltage will decrease to the programmed value.

b. Increase the cathode current, if necessary.

1.) Select the Cathode power supply with the MODULE switch and Current with the FUNCTION switch.

2.) Turn the Adjust knob clockwise until the discharge stabilizes or until the recommended cathode current limit is reached.

NOTE

When the current limit has been reached, cathode current may not be increased.

If the discharge has not started before the recommended current limit is reached:

1.) Reduce the cathode current.

2.) Select Cathode with the MODULE switch.

3.) Select Current with the FUNCTION switch.

4.) Turn the Adjust knob counterclockwise until the cathode current reaches the original selected value.

NOTE

If the discharge does not start (i.e., no discharge current) or is unstable, and the discharge voltage oscillates between the approximate programmed value and 150V, insufficient cathode current or insufficient gas flow could be the cause.

c. Increase the gas flow to the ion beam source by about 1sccm and repeat Step 10.

- If necessary, repeat Steps a. and b. until either a flow rate of 10sccm or a chamber pressure of 5 x 10^{-4} Torr is reached.
- If the discharge still will not start, refer to the "Troubleshooting/ Error Code Definitions" on page 71 and to the ion source technical manual.

11. Select the beam voltage. For initial start-up purposes, use a value of 1000V.

a. Select the Beam power supply with the **MODULE** switch. Voltage will automatically be selected in the Manual mode. The words BEAM and VOLTAGE appear above the appropriate switches.

b. Enter the chosen voltage by turning the Adjust knob. The changing values appear on the Beam Voltage display.

c. As the Adjust knob is turned, the beam voltage is entered automatically into the selected memory.

12. Set the A/B Ratio.

NOTE

The recommended and factory-set A/B Ratio is 10% for all sources.

a. Select the Accelerator power supply with the **MODULE** switch. The letters ACCEL appear above the switch.

b. Select the A/B Ratio with the **FUNCTION** switch. The letters A/B appear above the switch.

c. With the Adjust knob, select the accelerator-current-to-beam-current ratio. The A/B Ratio appears on the Accelerator Voltage display.

d. The final selected ratio is stored automatically in the memory, as indicated above the **MEMORY** switch.

13. Select the accelerator voltage. For initial start-up purposes, use a value of 250V.

a. Select the Accelerator power supply with the **MODULE** switch and Voltage with the **FUNCTION** switch. The words ACCEL and VOLTAGE appear above the appropriate switches.

b. Enter the voltage by turning the Adjust knob. The changing value will appear on the Accelerator Voltage display.

c. As the Adjust knob is turned, the accelerator voltage is entered automatically into the selected memory.

14. Start the ion beam.

⚠WARNING

To avoid electrical shock, keep clear of "live" circuits.

15. Press the **BEAM ON/OFF** switch. The word BEAM appears above the switch.
    - A beam current value should appear on the Beam Current display.
    - An accelerator current value should appear on the Accelerator Current display.

NOTE

The actual current values depend on other parameters, such as source size, cathode filament current request, gas flow, and beam and accelerator voltage requests.

16. The ion source should operate and extract an ion beam.

FC Adjustment

Follow these steps to adjust the system to the chosen operating conditions.

1. Adjust the beam current.
    a. Select the beam voltage (refer to Step 11. on page 27).
    b. Adjust the discharge voltage to the chosen level (refer to Step 4. on page 24). When operating with argon, the recommended voltage is 55V.
    c. Adjust the cathode current to obtain the chosen beam current (refer to Step 6. on page 24).

CAUTION

If the chosen beam current requires an increase in cathode filament current, carefully monitor this filament current to ensure that it does not exceed the recommended values of 6.5A for 5cm or smaller sources.

If the chosen beam current is obtainable, (i.e., within specified performance limits) but not reachable without exceeding the recommended maximum filament current, increase the discharge voltage and/or gas flow.

- If the discharge voltage is less than 55V, increase the value to acquire the beam current.
- If the beam current is not acquired with a 55V discharge request and a maximum recommended filament current, increase the gas flow.

NOTE

Avoid system pressures in excess of 5 x 10^{-4} Torr. This increases arcing within and around the ion source.

Special circumstances may require operation with the discharge voltage and/or system pressures in excess of the recommended values. While operating at these conditions is possible, reduced source operating efficiency and lifetime may be experienced.

NOTE

Do not select beam current while in Manual mode.

2. Adjust for a minimum accelerator current:
    a. Adjust the accelerator voltage to minimize the accelerator current (refer to Step 13. on page 39). Typically, the accelerator current should be no more than 10% of the beam current.
        - Excessive accelerator currents may be an indication of misaligned grids or a system pressure above 3 x 10^{-4} Torr.
        - Refer to the ion source technical manual for grid alignment procedures.
    b. Adjust the operating conditions and/or gas flow rate to bring the A/B Ratio within the recommended limits.

NOTE

When the accelerator-current-to-beam-current ratio exceeds the programmed A/B Ratio value, an audio alarm will sound, if enabled, and an E25 error message will appear on the Accelerator Current display.

CAUTION

Operating the ion source with high accelerator current may damage the grids.

3. Adjust the neutralizer filament current until the neutralizer emission current is about 110% to125% of the beam current (refer to Step 9. on page 25).
    - When the neutralizer current is satisfactory, the MPS-3000 FC power supply should be completely adjusted for Manual mode operation.
    - The user may continue operating in Manual mode or may select Local mode (refer to "Local Operation" on page 42).

FC Storing Operating Conditions

All adjustable operating conditions are stored automatically in the selected memory location when the Adjust knob is turned. This is the only method of storing parameters.

FC Recalling Operating Conditions

Selecting RCL with the MEMORY switch, allows the user to view the operating conditions stored in the unused memory location. After about four seconds, the original parameters will be displayed.

MPS-3000 HC

Before beginning HC power supply operation, check the following:

- The appropriate ion beam source has been properly installed in the vacuum system.
- The vacuum system pressure is 3 x 10^{-4} Torr or lower.
- Sufficient gas flow is introduced into the ion beam source, internal HC, and internal HCN for appropriate operation.

NOTE

Refer to the ion source's technical manual for installation and operation information.

HC Start-up

1. Turn the unit's POWER switch (on the power supply front) to the on position.
   a. The fan will start.
   b. Random displays will appear, and the audio alarm will sound. This condition will last about one second.
      - The controller will self-test each of the power supplies (from right to left). A power supply has been tested when the letter P appears in the top display.
   c. A click will be heard when the main contactor energizes after about six seconds.
   d. The unit is ready to operate an ion source after each power supply has been tested.

2. Follow these steps to operate the power supply in Manual mode.
   a. Turn the KEYLOCK switch to the Mode Enable position.
   b. Select Manual using the MODE switch. The word MANUAL appears above the switch indicating that Manual mode has been selected.
   c. To lock the power supply in Manual mode, turn the KEYLOCK switch to the disable position and remove the key.

3. Use the MEMORY switch to select the memory location the power supply will use to store parameters; the selected memory location will appear above the switch.

4. Select the discharge current limit. For initial start-up and training purposes, select 1.00A.

   Refer to "Recommended Discharge Current Limits" on page 83 for suggested discharge current limits for different source sizes.

   a. Select the Discharge power supply with the **MODULE** switch. The letters DISCHARG appear above the switch.

   b. Select Limit with the **FUNCTION** switch. The word LIMIT appears above the switch.

   c. Adjust the current limit up or down as needed. The value appears on the Discharge Current display.

NOTE

Unless the source size is known, discharge current limit will be factory-set at 2.00A.

   d. The final selected value is stored automatically in the memory, as indicated above the **MEMORY** switch.

5. Select the discharge current. For initial start-up and training purposes, select 1.00A.

   a. Select the discharge supply with the **MODULE** switch and current with the **FUNCTION** switch. The words DISCHARG and CURRENT appear above the appropriate switches.

   b. Enter the chosen value by turning the Adjust knob. The programmed value appears on the Discharge Current display.

   c. As the Adjust knob is turned, the discharge current is entered automatically into the selected memory.

6. Select the hollow cathode keeper voltage limit.

NOTE

The recommended and factory-set keeper voltage limit is 25V.

   a. Select the Hollow Cathode power supply with the **MODULE** switch. The letters HC appear above the switch.

      - Limit will be selected automatically and the word LIMIT appears above the **FUNCTION** switch.

   b. Adjust the keeper voltage limit up or down as needed. The value will appear on the Hollow Cathode Keeper Voltage display.

   c. The final selected value is stored automatically in the memory, as indicated above the **MEMORY** switch.

7. Select the hollow cathode neutralizer keeper voltage limit.

NOTE

The recommended and factory-set keeper voltage limit is 25V.

   a. Select the Hollow Cathode Neutralizer power supply with the **MODULE** switch. The letters HCN appear above the switch.

b. Select Limit with the **FUNCTION** switch. The word LIMIT appears above the switch.

c. Adjust the keeper voltage limit up or down as needed. The value appears on the Hollow Cathode Neutralizer Keeper Voltage display.

d. The final selected value is stored automatically in the memory, as indicated above the **MEMORY** switch.

8. Select the hollow cathode neutralizer emission current.

   Emission current may be selected before the internal HCN starts, but no current will be provided by the Hollow Cathode Neutralizer power supply until the internal HCN starts and the keeper voltage is below the keeper voltage limit.

   a. Select the Hollow Cathode Neutralizer power supply with the **MODULE** switch and Current with the **FUNCTION** switch. The words HCN and CURRENT appear above the appropriate switches.

   b. Enter the chosen value by turning the Adjust knob. The value appears on the Hollow Cathode Neutralizer Emission Current display.

   c. As the Adjust knob is turned, the emission current is entered automatically into the selected memory location.

9. Apply power to the source.

⚠WARNING

To avoid electrical shock, keep clear of "live" circuits.

   a. Press the **SOURCE ON/OFF** switch. The word SOURCE appears above the switch. When the **SOURCE** switch is activated, several changes may be observed on the front panel:

   - The hollow cathode heater current will ramp to 7.25A.
   - The hollow cathode neutralizer heater current will ramp to 7.25A. Select HCN with the **MODULE** switch and HEATER with the **FUNCTION** switch to view the heater current.
   - When the source discharge starts, the discharge current will increase to the programmed value, and the discharge voltage will decrease.
   - When the internal hollow cathode starts, the keeper voltage will drop below 25V, and the heater current will decrease to 3.75A.
   - When the internal hollow cathode neutralizer starts, the keeper voltage will drop below 25V, and the heater current will decrease to 3.75A.
   - The emission current will increase to the programmed value after the keeper voltage drops below the keeper voltage limit.

10. Select the beam voltage. For initial start-up purposes, use a value of 1000V.
    a. Select the Beam power supply with the **MODULE** switch. Voltage will automatically be selected in the Manual mode. The words BEAM and VOLTAGE appear above the appropriate switches.
    b. Enter the chosen voltage by turning the Adjust knob. The changing values appears on the Beam Voltage display.
    c. The beam voltage is entered automatically into the selected memory as the Adjust knob is turned.

11. Set the A/B Ratio.

NOTE

The recommended and factory-set A/B Ratio is 10% for all sources.

    a. Select the Accelerator power supply with the **MODULE** switch. The letters ACCEL appear above the switch.
    b. Select the A/B Ratio with the **FUNCTION** switch. The letters A/B appear above the switch.
    c. Select the accelerator-current-to-beam-current ratio using the Adjust knob. This ratio appears on the Accelerator Voltage display.
    d. The final selected A/B Ratio is stored automatically in the memory, as indicated above the **MEMORY** switch.

12. Select the accelerator voltage. For initial start-up purposes, use a value of 250V.
    a. Select the Accelerator power supply with the **MODULE** switch and Voltage with the **FUNCTION** switch. The words ACCEL and VOLTAGE appear above the appropriate switches.
    b. Enter the chosen voltage by turning the Adjust knob. The changing value appears on the Accelerator Voltage display.
    c. The accelerator voltage is entered automatically into the selected memory as the Adjust knob is turned.

13. Start the ion beam.

⚠WARNING

To avoid electrical shock, keep clear of "live" circuits.

    a. Press the **BEAM ON/OFF** switch. The word BEAM appears above the switch.
        - A beam current value appears on the Beam Current display.
        - An accelerator current value should appear on the Accelerator Current display.

NOTE

Actual current values depend on other parameters, such as source size, gas flow, and beam and accelerator voltage requests.

    b. The ion source should operate and extract an ion beam.

HC Adjustment

Follow these steps to adjust the system to the chosen operating conditions.

1. Adjust the beam current.
   a. Select the beam voltage (refer to Step 10. on page 33).
   b. Adjust the discharge current to obtain the chosen beam current (refer to Step 5. on page 31).

NOTE

Do not select beam current while in Manual mode.

2. Adjust for a minimum accelerator current.
   a. Adjust the accelerator voltage to minimize the accelerator current (refer to Step 12. on page 33). Typically, the accelerator current should be no more than 10% of the beam current.
      - Excessive accelerator currents may be an indication of misaligned grids or a system pressure above 3 x 10^{-4} Torr.
      - Refer to the ion source technical manual for grid alignment procedures.
   b. Adjust the operating conditions and/or gas flow rate to bring the A/B Ratio within the recommended limits.

NOTE

When the accelerator-current-to-beam-current ratio exceeds the programmed A/B Ratio value, an audio alarm will sound, if enabled, and an E25 error message will appear on the Accelerator Current display.

CAUTION

Operating the ion source with high accelerator current may damage the grids.

3. Adjust the hollow cathode neutralizer emission current until the emission current is about 100% to 125% of the beam current (refer to Step 8. on page 32).
   - When the neutralizer current is satisfactory, the MPS-3000 HC should be completely adjusted for Manual mode operation.
   - The user may continue operating in Manual mode or may select Local mode (refer to "Local Operation" on page 42).

HC Storing Operating Conditions

All adjustable operating conditions are stored automatically in the selected memory location when the Adjust knob is turned. This is the only method of storing parameters.

HC Recalling Operating Conditions

Selecting RCL with the MEMORY switch allows the user to view the operating conditions stored in the unused memory location. After about four seconds, the original parameters will be displayed.

MPS-3000 PBN

Before beginning PBN power supply operation, check the following:

- The ion beam source has been properly installed in the vacuum system.
- The vacuum system pressure is 3 x 10^{-4} Torr or lower.
- Sufficient gas flow introduced into the ion beam source and internal PBN for appropriate operation.

NOTE

Refer to the ion source's technical manual for installation and operation information.

PBN Start-up

1. Turn the unit's POWER switch (on the power supply front) to the on position.
   a. The fan will start.
   b. Random displays will appear, and the audio alarm will sound. This condition lasts about one second.
      - The controller will self-test each of the power supplies (from right to left). The letter P on the top display indicates a tested power supply.
   c. A click will be heard when the main contactor energizes after about six seconds.
   d. The unit is ready to operate an ion source after each power supply has been tested.

2. Follow these steps to operate the power supply in Manual mode.
   a. Turn the KEYLOCK switch to the Mode Enable position.
   b. Select Manual using the MODE switch. The word MANUAL appears above the switch when Manual mode has been selected.
   c. To lock the power supply in Manual mode, turn the KEYLOCK switch to the disable position and remove the key.

3. Use the **MEMORY** switch to select the memory location the power supply will use to store parameters; the selected memory location appears above the switch.

4. Select the discharge voltage. For initial start-up and training purposes, select 55V.
   a. Select the Discharge power supply with the **MODULE** switch on the front panel. The word DISCHARGE appears above the switch.
   b. Select Voltage with the **FUNCTION** switch and the word VOLTAGE appears above the switch.
   c. Enter the chosen value by turning the Adjust knob. The value appears on the Discharge Voltage display.
   d. The discharge voltage is entered automatically into the selected memory as the Adjust knob is turned.

5. Select the discharge current limit. For initial start-up and training purposes, select 1.00A.
   a. Select the Discharge power supply with the **MODULE** switch on the front panel. The word DISCHARG appears above the switch.
   b. Select Limit with the **FUNCTION** switch. The word LIMIT appears above the switch.
   c. Enter the chosen value by turning the Adjust knob. The programmed value appears on the Discharge Current display.
   d. The discharge current limit is entered automatically into the selected memory as the Adjust knob is turned.

6. Select the cathode filament current limit.

   Refer to the "Tables" on page 83 for current limits for various ion sources.
   a. Select the Cathode power supply with the **MODULE** switch. The word CATHODE appears above the switch.
   b. Select Limit with the **FUNCTION** switch. The word LIMIT appears above the switch.
   c. Adjust the current limit up or down as needed. The value appears on the Cathode Filament Current display.

NOTE

Different sizes and different types of filament wire may require adjustments to the cathode filament current limit. Unless the source size is known, the cathode current limit will be factory-set at 6.5A.

   d. The final selected value is stored automatically in the memory, as indicated above the **MEMORY** switch.

7. Select the cathode filament current.

   Refer to the "Tables" on page 83 for initial filament currents for various ion sources.

NOTE

The current values assume that 0.25mm (0.010 in.) tungsten wire is used for the cathode filament. If the actual filament is a different size and/or material, other filament currents could be required.

   a. Select the Cathode power supply with the **MODULE** switch and Current with the **FUNCTION** switch. The words CATHODE and CURRENT appear above the appropriate switches.

   b. Select the chosen value by turning the Adjust knob. The new value appears on the Cathode Filament Current display.

   c. The cathode filament current is entered automatically into the selected memory as the Adjust knob is turned.

8. Select the PBN filament current limit.

   Refer to the "Tables" on page 83 for current limits for various ion sources.

   a. Select the PBN power supply with the **MODULE** switch. The letters PBN appear above the switch.

   b. Select Limit with the **FUNCTION** switch. The word LIMIT appears above the switch.

   c. Adjust the current limit up or down as needed. The value appears on the PBN Emission/Filament Current display.

NOTE

Different sizes and different types of filament wire may require adjustments to the PBN filament current limit, which is factory-set at 6.5A.

   d. The final selected value is stored automatically in the memory, as indicated above the **MEMORY** switch.

9. Select the PBN emission current.

   a. Select an emission current that will be greater than the expected beam current.

   b. Select the PBN power supply with the **MODULE** switch and Current with the **FUNCTION** switch. The words PBN and CURRENT appear above the appropriate switches.

   c. Enter the chosen value by turning the Adjust knob. The value appears on the PBN Emission/Filament Current display.

   d. The PBN emission current is entered automatically into the selected memory location as the Adjust knob is turned.

10. Apply power to the source.

WARNING

To avoid electrical shock, keep clear of "live" circuits.

Refer to the "Tables" on page 83 for current limits for various ion sources.

a. Press the **SOURCE ON/OFF** switch. The word SOURCE appears above the switch.

b. When the **SOURCE** switch is activated, several changes are observed on the front panel:

- The cathode filament current will increase from 0.0 to the programmed value.
- The PBN filament current increases until the body voltage has dropped to between 20V and 25V.

NOTE

The PBN filament current will not increase beyond the limit.

- When the cathode current is greater than 0.75A, the discharge voltage will increase to about 150V.
- As the source discharge starts, the discharge current will increase and the discharge voltage will decrease to the programmed value.

c. Increase the cathode current, if necessary.

1.) Select the cathode power supply with the **MODULE** switch and current with the **FUNCTION** switch.

2.) Turn the Adjust knob clockwise until the discharge stabilizes or until the recommended cathode current limit is reached.

NOTE

When the current limit has been reached, cathode current may not be increased.

If the discharge has not started before the recommended current limit is reached:

1.) Reduce the cathode current.

2.) Select Cathode with the MODULE switch.

3.) Select Current with the FUNCTION switch.

4.) Turn the Adjust knob counterclockwise until the cathode current reaches the original selected value.

NOTE

If the discharge does not start (i.e., no discharge current) or is unstable, and the discharge voltage oscillates between the approximate programmed value and 150V, insufficient cathode current or insufficient gas flow could be the cause.

d. Increase the gas flow to the ion beam source by about 1sccm and repeat Step c.

- If necessary, repeat Steps c. through d. until a flow rate of 10sccm or a chamber pressure of 5 x 10^{-4} Torr is reached.
- If the discharge still will not start, refer to the "Troubleshooting/ Error Code Definitions" on page 71 and to the ion source technical manual.

11. Select the beam voltage. For initial start-up purposes, use a value of 1000V.
    a. Select the beam power supply with the **MODULE** switch. Voltage will automatically be selected in the Manual mode. The words BEAM and VOLTAGE appear above the appropriate switches.
    b. Enter the chosen voltage by turning the Adjust knob. The changing values appears on the Beam Voltage display.
    c. The beam voltage is entered automatically into the selected memory as the Adjust knob is turned.

12. Set the A/B Ratio.

NOTE

The recommended and factory-set A/B Ratio is 10% for all sources.

    a. Select the Accelerator power supply with the **MODULE** switch. The letters ACCEL appear above the switch.
    b. Select the A/B Ratio with the **FUNCTION** switch. The letters A/B appear above the switch.
    c. Use the Adjust knob to select the accelerator-current-to-beam-current ratio. The A/B Ratio will appear in the Accelerator Voltage display.
    d. The final selected ratio is stored automatically in the memory, as indicated above the **MEMORY** switch.

13. Select the accelerator voltage. For initial start-up purposes, use a value of 250V.
    a. Select the Accelerator power supply with the **MODULE** switch and Voltage with the **FUNCTION** switch. The words ACCEL and VOLTAGE appear above the appropriate switches.
    b. Enter the chosen voltage by turning the Adjust knob. The changing value appears on the Accelerator Voltage display.
    c. The accelerator voltage is entered automatically into the selected memory as the Adjust knob is turned.

14. Start the ion beam.

⚠WARNING

To avoid electrical shock, keep clear of "live" circuits.

a. Press the **BEAM ON/OFF** switch. The word BEAM appears above the switch.

- A beam current value should appear on the Beam Current display.
- An accelerator current value should appear on the Accelerator Current display.

NOTE

Actual current values depend on other parameters, such as source size, cathode filament current request, gas flow, and beam and accelerator voltage requests.

b. The ion source should operate and extract an ion beam.

PBN Adjustment

Follow these steps to adjust the system to the chosen operating conditions.

1. Adjust the beam current.
   a. Select the chosen beam voltage (refer to Step 11. on page 39).
   b. Adjust the discharge voltage the recommended voltage is 55V (refer to Step 4. on page 36).
   c. Adjust the cathode current to obtain the chosen beam current (refer to Step 6. on page 36).

CAUTION

If the chosen beam current requires an increase in cathode filament current, carefully monitor this filament current to ensure it does not exceed the recommended values of 6.5A for 5cm and smaller sources.

If the chosen beam current is available (i.e., within specified performance limits), but not reachable without exceeding the recommended maximum filament current, increase the discharge voltage and/or gas flow.

- If the discharge voltage is less than 55V, increase the value to acquire the beam current.
- If the beam current is not acquired with a 55V discharge request an a maximum recommended filament current, increase the gas flow.

NOTE

Avoid system pressures in excess of 5 x 10^{-4} Torr. Increased arcing within and around the arc will occur.

Special circumstances may require operating with the discharge voltage and/or system pressures in excess of the recommended values. While operating at these conditions is possible, reduced source operating efficiency and lifetime may occur.

NOTE

Do not select beam current while in Manual mode.

2. Adjust for a minimum accelerator current.
    a. Adjust the accelerator voltage to minimize the accelerator current (refer to Step 13. on page 39). Typically, the accelerator current should be no more than 10% of the beam current.
        - Excessive accelerator currents may be an indication of misaligned grids or a system pressure above 3 x 10^{-4} Torr.
        - Refer to the ion source technical manual for grid alignment procedures.
    b. The excessive accelerator current may be lowered by adjusting the operating conditions and/or gas flow rate to bring the A/B Ratio within recommended limits.

NOTE

When the accelerator-current-to-beam-current ratio exceeds the programmed A/B Ratio value, an audio alarm will sound, if enabled. An E25 error message will appear on the Accelerator Current display.

CAUTION

Operating the ion source with a high accelerator current could damage the grids.

3. Adjust the neutralizer emission current until the value is about 100% to 125% of the beam current (refer to Step 9. on page 37).
    - When the PBN emission current is satisfactory, the MPS-3000 PBN should be completely adjusted for Manual mode operation.
    - The user may continue operating in Manual mode or may select Local mode (refer to "Local Operation" on page 42).

PBN Storing Operating Conditions

All adjustable operating conditions are stored automatically in the selected memory location when the Adjust knob is turned and is the only method of storing parameters.

PBN Recalling Operating Conditions

Selecting RCL with the MEMORY switch allows the user to view the operating conditions stored in the unused memory location. After about four seconds, the original parameters will be displayed.

Chapter 6: Local Operation

Operating conditions may need to be maintained over time without user attention. The MPS-3000 power supply incorporates a Local or Automatic mode of operation. The internal microprocessor monitors and controls several parameters including the accelerator-current-to-beam-current ratio (A/B Ratio).

If the value exceeds the limit programmed into the A/B Ratio, an E25 error message appears on the Accelerator Current display and a continuous audio signal will be heard if the audio alarm is enabled.

MPS-3000 FC:

In Local mode, the internal microprocessor constantly monitors the beam current and maintains it at the programmed value by making adjustments to the cathode filament current. The microprocessor also monitors the neutralizer emission current and adjusts the neutralizer supply as required to keep the emission-current-to-beam-current ratio at 125%. A 200% emission-to-beam-current ratio may be selected through SW1-7 (refer to "Controller Board Switch Definitions" on page 19).

MPS-3000 HC:

In Local mode, the internal microprocessor constantly monitors the beam current and maintains it at the programmed value by making adjustments to the discharge current. The microprocessor also monitors the hollow cathode neutralizer emission current to keep the emission-current-to-beam-current ratio at 125%. A 200% emission-to-beam-current ratio may be selected through SW1-7 (refer to "Controller Board Switch Definitions" on page 19).

MPS-3000 PBN:

In Local mode, the internal microprocessor constantly monitors the beam current and maintains it at the programmed value by making adjustments to the cathode filament current. The microprocessor also monitors the plasma bridge neutralizer emission current and keeps the emission-to-beam- current ratio at 125%. A 200% emission-to-beam-current ratio may be selected through SW1-7 (refer to "Controller Board Switch Definitions" on page 19).

In Local mode, stored values may be recalled from the memories. Use the switches and Adjust knob on the front panel to make changes in beam voltage, beam current, accelerator voltage, and A/B Ratio. No changes may be made for any parameters in Cathode, HC, Discharge, Neutralizer or HCN power supplies.

WARNING

To avoid electrical shock, keep clear of "live" circuits. Follow all local lock-out/tag out procedures before continuing.

Follow these steps for operation in Local mode:

1. Turn the unit's **POWER** switch (on the power supply front) to the on position.

2. Wait for completion of the self-test procedure.

3. Select Local mode with the **MODE** switch. The word LOCAL appears above the switch.

4. Select the chosen memory with the **MEMORY** switch. The parameters stored in the selected memory location appears and may be verified on the front panels.

5. The chamber pressure and ion source gas flow rate must be adequate for the requested conditions.

6. Press the **SOURCE** switch. The word SOURCE appears above the switch.

NOTE

Consider the age of the filament when recalling values from memory. An older filament does not require as much current as a new filament to start or function.

MPS-3000 FC

The cathode filament current will ramp to the programmed value.

The neutralizer filament current will ramp to the value from memory.

- When the neutralizer filament current is within 0.5A of the target current, and the cathode filament current is greater than 0.75A, the discharge voltage will rise to about 150V. As the ion source discharge starts, a discharge current appears and the discharge voltage will ramp to the value from memory.

MPS-3000 HC

The hollow cathode heater current will ramp to 7.25A.

- When the internal hollow cathode has started, the heater current will ramp down to 3.75A, and the keeper voltage should drop below 25V.

The hollow cathode neutralizer heater current will ramp to 7.25A.

- When the internal hollow cathode neutralizer has started, the heater current will ramp down to 3.75A, and the keeper voltage should drop below 25V. The emission current will increase to the programmed value after the keeper voltage drops below the keeper voltage limit.

- In Local mode, the emission current must be greater than the beam current to prevent an E24 error condition.

MPS-3000 PBN

The cathode filament current will ramp to the programmed value.

The plasma bridge neutralizer filament current will ramp up until the body voltage drops to between 20 and 25V or until the filament current limit is reached.

- Once the body voltage is between 20 and 25V, the emission current will increase to the programmed value.
- In Local mode, the emission current must be greater than the beam current to prevent an E24 error condition.

7. Wait for the discharge voltage and/or current to stabilize.

8. Press the **BEAM** switch. The word BEAM should appear above the **MODULE** switch.

9. The beam current, beam voltage, and accelerator voltage should ramp to their programmed values.

NOTE

When changing from Manual to Local mode, the displayed beam current in Manual mode will become the new beam current target for Local mode. This value will be stored in the memory locations used.

10. Change the memory locations.
    a. Operating conditions that are stored in the unused memory location may be viewed by selecting RCL with the **MEMORY** switch.
    b. Use the **MEMORY** switch to change to other memory locations. The power supply will ramp to the new parameters as soon as the memory location is changed.

Chapter 7: Other Modes of Operation

Local Restricted

This mode of operation is limited to conditions recalled from memory. The user may not change any parameter, and the Adjust knob is nonfunctional. All switches are active, except the MODULE and FUNCTION switches.

The Local Restricted mode of operation is useful when limited user intervention is needed. Parameters must be stored in the memory locations in advance.

1. Select the chosen operating conditions in Manual or Local mode.

2. Select the LOC RES mode with the MODE switch.

3. Turn the KEYLOCK switch to the disable position and remove the key.

4. The user may turn the SOURCE or BEAM switches on or off and change from one memory location to another.

5. The MPS-3000 power supply will function as if it were in Local mode.

Remote Operation

The MPS-3000 power supply may be controlled remotely, by a computer, through an EIA-232 interface or by remote switches. To operate by remote switches the unit must be in Remote mode.

The only front panel switches that are functional in the Remote mode are the MODE, SOURCE, and BEAM OFF switches.

Chapter 8: Serial Communications

The EIA-232 interface standard[1] (formerly known as RS-232C) establishes electrical and mechanical interface requirements. It does not define the exact function of all the signals that are used by the various manufacturers of data communications equipment and serial I/O devices. Consequently, when the serial interface is plugged into an EIA-232 connector, there is no guarantee that the device may communicate unless the user has configured certain parameters to match the computing device requirements. Refer to the computing device's technical manual for information on electrical and mechanical interfacing, setting the interface format, and data transfer range.

The following information for the MPS-3000 power supply will be needed for successful connection and communication with the computing device:

- serial communications rate - 9600 baud

NOTE

The serial communications rate may be adjusted using switches SW1-5 and SW1-6 on the controller board. Refer to "Controller Board Switch Definitions" on page 19.

- other parameters - 1 start bit, 8 data bits, 2 stop bits, no parity.

Refer toFIGURE 8.1 for detailed pin assignment.

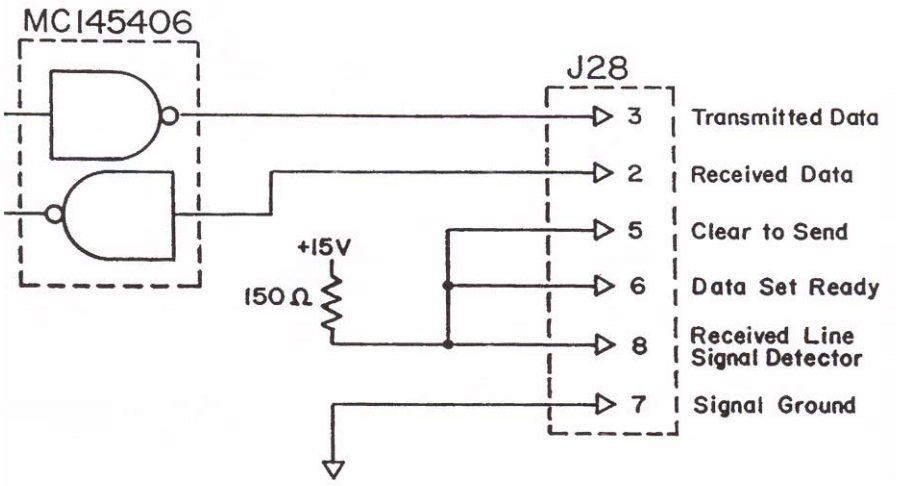


FIGURE 8.1 EIA-232 Pin Assignment

1. EIA-232 is a data communication standard established by the Electronic Industries Association (EIA). The EU equivalent is CCITT V.24

A command is executed when a carriage return <cr> is received. All characters are echoed by the unit. Two commands per second will be accepted; commands received at a faster rate are placed in a 250 character buffer. When this buffer is filled, additional characters will be lost.

The RS-232 communications is active in all modes. Refer to "Command Summary Table" on page 48.

Responses:

Unless stated otherwise, all commands that are accepted will respond with:

<lf><cr>OK<lf><cr><eot>

If the command is not accepted, the response will be:

<lf><cr>?<lf><cr><eot>

Command Summary Table

Table 8.1: Command Summary Table

Command	Description
A	Attention
AB	Set A/B Ratio
AC	Enable/Disable Auto Cathode Mode
AD	Enable/Disable Auto Data Logging
AE	Enable/Disable Auto Error Logging
B	Turn Beam Supplies On/Off
BE	Set Beam Current Tolerance
BI	Set Beam Current
BV	Set Beam Voltage
CI	Set Cathode Current
CL	Set Cathode Limit
DI	Set Discharge Current
DL	Set Discharge Current Limit
DT	Set Discharge Current Threshold
DV	Set Discharge Voltage
M	Set Power Supply Mode
NE	Enable/Disable E/B Ratio Error
NI	Set Neutralizer Current
NK	Enable/Disable Front Panel
NL	Set Neutralizer Limit
R	Recall Memory
RC	Request Running Conditions, Condensed Format
RH	Manual Data Log Request, no Header
RN	Request Target Parameters, Condensed Format
RP	Request Target Parameters
RS	Manual Data Log Request
RST	Reset power supply
S	Turn Source Supplies On/Off
T	Set Auto Data Logging Interval
V	Request Power Supply Version
VI	Request Power Supply Version, Condensed Format

Detailed Command Description

Command Name: ATTENTION

Syntax: A<cr>

Units: N/A

Range: N/A

Description: This command places the power supply into Remote mode.

Command Name: SET ACCELERATOR TO BEAM CURRENT RATIO LIMIT (A/B RATIO)

Syntax: AB[n]<cr>

Units: %

Range: n = 0 - 99

Description: This command sets the value for the accelerator current to beam current ratio limit. If this limit is exceeded, an E25 error message appears in the accelerator current display.

Set the A/B Ratio limit to 15% using the following command: AB15<cr>

EXAMPLE 8.1 Set the A/B Ratio Limit

Command Name: AUTO CATHODE MODE

Syntax: AC[N]<cr>

Units: N/A

Range: n = 0 or 1

Description: This command enables (AC1) or disables (AC0) the Auto Cathode (AC) mode, which is active only when the power supply is in Remote mode. However, the command will be accepted in any mode.

MPS-3000 FC/PBN:

When the AC mode is active, the cathode filament current increases automatically until the cathode filament current has reached its limit, or the discharge current has exceeded the discharge current threshold.

MPS-3000 HC:

When the Auto Cathode mode is active, the minimum discharge current target is equal to the discharge current threshold. The value of the AC command is stored in non-volatile RAM and stays in effect until it is changed.

Disable the Auto Cathode mode using the following command: AC0<cr>

EXAMPLE 8.2 Disable the Auto Cathode Mode

Command Name: AUTOMATIC DATA LOGGING

Syntax: AD[N]<cr>

Units: N/A

Range: n = 0 or 1

Description: This command is used to enable (AD1) or disable (AD0) automatic data logging.

When enabled, the power supply will transmit its actual running conditions at the time interval specified by the T<n> command.

Logging will begin when the source is turned on and will end when the source is turned off.

EXAMPLE 8.3 Disable Auto Data Logging

Disable auto data logging using the following command: AD0<cr>

Command Name: AUTOMATIC ERROR LOGGING

Syntax: AE[n]<cr>

Units: N/A

Range: n = 0 or 1

Description: This command is used to enable (AE1) or disable (AE0) automatic error logging.

When enabled, the power supply will transmit any error conditions that occur while the source and beam are on.

EXAMPLE 8.4 Enable Auto Error Logging

Enable auto error logging using the following command: AE1<cr>

Command Name: SET ACCELERATOR VOLTAGE

Syntax: AV[n]<cr>

Units: volts

Range: n = 0 - 1023

Description: Sets the target value for the accelerator voltage. When the beam is on, the accelerator voltage will ramp to this value.

EXAMPLE 8.5 Set the Accelerator Voltage

Set the accelerator voltage to 400V using the following command: AV400<cr>

Command Name: BEAM ON/OFF

Syntax: B[n]<cr>

Units: N/S

Range: n = 1 or 0

Description: Used to turn the beam supply on (B1) or off (B0).

EXAMPLE 8.6 Turn the Beam Supply On

Turn the beam supply on using the following command: B1<cr>

Command Name: SET BEAM CURRENT TOLERANCE LIMIT

Syntax: BE[n]<cr>

Units: %

Range: n = 0 - 99

Description: Sets the beam current tolerance limit. When the beam is on and the power supply is not in Manual mode, check that the beam current remains within the specified limit.

If it is out of tolerance for more than one second, the beam will be turned off and an E13 error message will appear in the beam current display.

To disable this feature, send the following command to the power supply BE0<cr>.

EXAMPLE 8.7 Set the Beam Current Tolerance Limit

Set the beam current tolerance limit to 5% using the following command: BE5<cr>

Command Name: SET BEAM CURRENT

Syntax: BI[n]<cr>

Units: mA

Range: n = 0 - 300

Description: Sets the target value for the beam current. When the beam is on and the power supply is not in Manual mode, the beam current will ramp to this value.

EXAMPLE 8.8 Set the Beam Current

Set the beam current to 200mA using the following command: BI200<cr>

Command Name: SET BEAM VOLTAGE

Syntax: BV[n]<cr>

Units: volts

Range: n = 0 - 1200

Description: Sets the target value for the beam voltage. When the beam is on, the beam voltage will ramp to this value.

EXAMPLE 8.9 Set the Beam Voltage

Set the beam voltage to 1000V using the following command: BV1000<cr>

Command Name: SET CATHODE CURRENT

Syntax: CI[n]<cr>

Units: MPS-3000 FC/PBN: amperes
MPS-3000 HC: N/A

Range: MPS-3000 FC/PBN: 0.00 - 20.00
MPS-3000 HC: N/A

Description:

MPS-3000 FC and PBN:

Used to set the cathode filament current target. The filament current will ramp to this value when the power supply is in Manual mode. In all other modes, this command has no effect, but is still accepted. The command will not be accepted if the entered value is greater than the cathode current limit.

MPS-3000 HC:

Command is not valid.

EXAMPLE 8.10 Set the Cathode Filament Current Target

Set the MPS-3000 FC/PBN cathode filament current target to 4.50A using the following command: CI4.50<cr>

Command Name: SET CATHODE LIMIT

Syntax: CL[n]<cr>

Units: MPS-3000 FC/PBN: amperes
MPS-3000 HC: volts

Range: MPS-3000 FC/PBN: 0.00 - 20.00
MPS-3000 HC: 0 - 50

Description:

MPS-3000 FC and PBN:

Used to set the cathode filament current's software limit. The actual filament current will not ramp above this value.

MPS-3000 HC:

Used to set the hollow cathode keeper voltage limit.

EXAMPLE 8.11 Set the Cathode Filament Limit

Set the MPS-3000 FC/PBN cathode filament limit to 5.50A using the following command: CL5.50<cr>

EXAMPLE 8.12 Set the Keeper Voltage Limit

Set the MPS-3000 HC hollow cathode keeper voltage limit to 25V using the following command: CL25<cr>

Command Name: SET DISCHARGE CURRENT

Syntax: DI[n]<cr>

Units: amperes

Range: n = 0.00 - 6.00

Description: Sets the target value for the discharge current. When the source is on and in Manual mode, the discharge current will ramp to this value.

This command is effective only in Manual mode, but is accepted in all modes and is only valid for an MPS-3000 HC power supply.

EXAMPLE 8.13 Set the Discharge Current

Set the discharge current to 2.00A using the following command: DI2.00<cr>

Command Name: SET DISCHARGE CURRENT LIMIT

Syntax: DL[n]<cr>

Units: amperes

Range: n = 0.00 - 6.00 (MUST BE IN THE FORM n.nn)

Description: Sets the discharge current limit value. This discharge current will not be allowed to ramp above this value.

MPS-3000 FC OR PBN:

The cathode current will ramp down if this value is exceeded. An E02 error message will appear in the discharge current display.

MPS-3000 HC:

The discharge current target will not be allowed to be greater than this value.

EXAMPLE 8.14 Set the Discharge Current Limit

Set the discharge current limit to 2.00A using the following command: DI2.00<cr>

Command Name: SET DISCHARGE CURRENT THRESHOLD

Syntax: DT[n]<cr>

Units: amperes

Range: n = 0.00 - 6.00 (MUST BE IN THE FORM n.nn)

Description: Sets the discharge current threshold value. Refer to the auto cathode command for a description of the discharge current threshold.

EXAMPLE 8.15 Set the Discharge Current Threshold

Set the discharge current threshold to 0.05A using the following command: DT0.05<cr>

Command Name: SET DISCHARGE VOLTAGE

Syntax: DV[n]<cr>

Units: volts

Range: n = 0 - 150.0

Description: Sets the target value for the discharge voltage. When the source is on, this is the value the discharge voltage will ramp to.

This command is only valid for an MPS-3000 FC power supply.

EXAMPLE 8.16 Set the Discharge Current Voltage

Set the discharge voltage to 55.0V using the following command: DV55.0<cr>

Command Name: SET MODE

Syntax: M[n]<cr>

Units: N/A

Range: n = 0, 1, 2, or 3

Description: Used to set the operating mode of the power supply.

n	Mode
0	Manual
1	Local
2	Local Restricted
3	Remote

EXAMPLE 8.17 Place the MPS-3000 power supply in Local mode

Place the power supply in Local mode using the following command: M1<cr>

Command Name: DISABLE E/B RATIO ERROR

Syntax: NE[n]<cr>

Units: N/A

Range: n = 0 or 1

Description:

When disabled (NE1), the E/B Ratio error (E24) will not be activated if the emission current drops below the beam current. In all modes (except Manual mode), the emission current will still automatically servo to 125% of the beam current.

When enabled (NE0), the E/B Ratio error will function normally.

The value of the NE command is stored in non-volatile RAM and stays in effect until it is changed.

EXAMPLE 8.18 Disable the E/B Ratio Error

Disable the E/B Ratio error using the following command: NE1<cr>

Command Name: SET NEUTRALIZER CURRENT

Syntax: NI[n]<cr>

Units: MPS-3000 FC: amperes
MPS-3000 PBN: mA
MPS-3000 HCN: mA

Range: MPS-3000 FC: 0.00 - 15.00
MPS-3000 PBN: 0 - 600
MPS-3000 HCN: 0 - 600

Description:

MPS-3000 FC:

Used to set the neutralizer filament current target. The filament current will ramp to this value when the MPS-3000 FC power supply is in Manual mode. In all other modes, this command has no effect, but is still accepted. The command will not be accepted if the entered value is greater than the neutralizer current limit (NL[n]).

MPS-3000 HCN/PBN:

Used to set the emission current target. The emission current will ramp to this value when the MPS-3000 HC/PBN power supply is in Manual mode. In all other modes, this command has no effect, but is still accepted.

EXAMPLE 8.19 Set the Neutralizer Filament Current Target

Set the MPS-3000 FC neutralizer filament current target to 4.50A using the following command: NI4.50<cr>

EXAMPLE 8.20 Set the Emission Current

Set the MPS-3000 HCN/PBN emission current to 250mA using the following command: NI250<cr>

Command Name: LOCKOUT FRONT PANEL SWITCHES

Syntax: NK[n]<cr>

Units: N/A

Range: n = 0 or 1

Description:

When enabled (NK1), all of the switches on the power supply's front panel will not function. Also, the alarm will not sound on any fatal of non-fatal error.

When disabled (NK0), all switches and the buzzer act normally. The value of the NK command is stored in non-volatile RAM and stays in effect until it is changed. If SW1-8 is in the off position, the front panel will be unlocked following a power cycle. To maintain a lock on the front panel, SW 1-8 should be set to the on position.

EXAMPLE 8.21 Front Panel Switches Lockout

Lockout the front panel switches using the following command: NK1<cr>

Command Name: SET NEUTRALIZER LIMIT

Syntax: NL[n]<cr>

Units: MPS-3000 FC: amperes
MPS-3000 PBN: amperes
MPS-3000 HCN: volts

Range: MPS-3000 FC: 0.00 - 15.00
MPS-3000 PBN: 0.00 - 10.23
MPS-3000 HCN: 0 - 50

Description:

MPS-3000 FC/PBN:

Used to set the neutralizer filament currents software limit. The actual filament current will not ramp above this value.

MPS-3000 HC:

Used to set the HCN keeper voltage limit.

EXAMPLE 8.22 Set the Neutralizer Limit

Set the MPS-3000 FC/PBN neutralizer limit to 5.50A using the following command: NL5.50<cr>

EXAMPLE 8.23 Set the Keeper Voltage Limit

Set the MPS-3000 HCN keeper voltage limit to 25V using the following command: NL25<cr>

Command Name: RECALL TARGETS FROM MEMORY

Syntax: R[n]<cr>

Units: N/A

Range: n = 1, 2

Description: Recalls the target parameters from the selected memory. The recalled values will be the new running parameters.

EXAMPLE 8.24 Recalling Memory 1

Recall memory 1 using the following command: R1<cr>

Command Name: REQUEST RUNNING CONDITIONS, COMPRESSED FORMAT

Syntax: RC<cr>

Units: N/A

Range: N/A

Response:

<lf><cr>

AA.AA,BB.BB,CCC.C,^DDDD,^EEEE,^FFFF,^GGGG,^HHHH,II.II,^JJJJ,^KKKK,^LLLL,M,

<lf><cr><eot>

Where:

Parameter		Model	Units
AA.AA	Cathode Current HC Heater Current	MPS-3000 FC MPS-3000 HC	Amps Amps
BB>BB	Discharge Current	All	Amps
CCC.C	Discharge Voltage	All	Volts
DDDD	Beam Current	All	mA
EEEE	Beam Voltage	All	Volts
FFFF	Accelerator Current	All	mA
GGGG	Accelerator Voltage	All	Volts
HHHH	Emission Current	All	mA
II.II	Neut Filament Current HCN Heater Current PBN Filament Current	MPS-3000 FC MPS-3000 HCN MPS-3000 PBN	Amps Amps Amps
JJJJ	HC Keeper Voltage	MPS-3000 HC	Volts
KKKK	HCN Keeper Voltage	MPS-3000 HCN	Volts
LLLL	Fatal Error Code	All	N/A
M - Power Supply Mode	0 = Manual 1 = Local 2 = Local Restricted 3 = Remote = ACSII Blank Space (32)	All	N/A

Description: Used to request the power supply's running conditions. All of the above parameters will be transmitted. If a value is off or not present for that model, its value is replaced with ASCII blank spaces (32).

Command Name: MANUAL DATA LOG REQUEST WITHOUT HEADER
Syntax: RH<c>
Units: N/A
Range: N/A
Response:

With the source and/or beam on:

<cr><lf>^ ^ ^ ^ ^ ^AA:BB:CC^ ^ ^DD.DD^ ^ ^E.EE^ ^ ^F FF.F^ ^ ^

GGG^ ^ ^HHHH^ ^ ^IIII^ ^ ^JJJ^ ^ ^ ^ ^KKK^ ^LL.LL

<lf><cr><eot>

Where:

Parameter		Model	Units
AA.BB.CC	Time since source was turned on		Hours/ Minutes/ Seconds
DD.DD	Cathode Filament Current HC Heater Current	MPS-3000 FC MPS-3000 HC	Amps Amps
E.EE	Discharge Current	All	Amps
FFF.F	Discharge Voltage	All	mA
GGG	Beam Current	All	mA
HHHH	Beam Voltage	All	Volts
IIII	Accelerator Current	All	Volts
JJJ	Accelerator Current	All	mA
KKK	Emission Current	All	mA
ll.ll	Neut Filament Current HCN Heater Current PBN Filament Current	MPS-3000 FC MPS-3000 HC MPS-3000 PBN	Amps Amps Amps
^	ACSII Blank Space (32)		

With the source and beam off:

<lf><cr>^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^SOURCE^&^BE AM^ARE^OFF^DDDD

<lf><cr><eot>

Where:

DDDD - Fatal error message. If there is no fatal error message when the RH command is received, DDDD = Blank Space (32).

^ = ASCII BLANK SPACE (32)

Description: Used to request data logging parameters without header information. If a value is off, it will be replaced with ASCII blank spaces (32).

Command Name: REQUEST TARGET PARAMETERS WITH HEADER

Syntax: RP[n]<cr>

Units: N/A

Range: n = 1, 2

Response:

MPS-3000 FC/PBN:

<lf><cr>MEM^1^PARAMETERS:

<lf><cr>BEAM^V^^^^BEAM^I^^^^ACCEL^V^^^^A/B^RATIO

^^^^CATH^LIM^^^^NEUT^LIM^^^^DISCH^V

<lf><cr>XXXX^V^^^^XXX^mA^^^^XXXX^V^^^^^^^^XX^%

^^^^^^XX.XX^A^^^^^XX.XX^A^^^^^XXX.X^V

<lf><cr><eot>

MPS-3000 HC:

<lf><cr>MEM^1^PARAMETERS:

<lf><cr>BEAM^V^^^^BEAM^I^^^^ACCEL^V^^^^A/B^RATIO

^^^^CATH^LIM^^^^NEUT^LIM

<lf><cr>XXXX^V^^^^XXX^mA^^^^XXXX^V^^^^^^^^XX^%

^^^^^^^^XXX^V^^^^^^^XXX^V

<lf><cr><eot>

^ = ASCII BLANK SPACE (32)

Description: This command is used to request the above target values, with header information, for the selected memory.

EXAMPLE 8.25 Request Target Parameters

Request the target parameters stored in Memory 2 using the following command: RP2<cr>

Command Name: REQUEST ALL TARGET PARAMETERS IN COMPRESSED FORMAT

Syntax: RN[n]<cr>

Units: N/A

Range: n = 1, 2

Response:

<lf><cr>^AAAA,^BBBB,^CCCC,^ ^ ^DD,EEEEE,FFFFF,GGGGG,HHHHH,IIIII,JJJJJ,KKKKK,

<lf><cr><eot>

Where:

Parameters		Model	Units
AAAAA	Beam Voltage	All	Volts
BBBBB	Beam Current	All	mA
CCCCC	Accelerator Voltage	All	Volts
DDDDD	A/B Ratio	All	%
EEEEE	Cathode Filament Limit HC Keeper Voltage Limit	MPS-3000 FC MSP-3000 HC	Amps Volts
FFFFF	Neutralizer Filament Limit HCN Keeper Voltage Limit PBN Filament Limit	MPS-3000 FC MPS-3000 HCN MPS-3000 PBN	Amps Volts Amps
GGGGG	Discharge Voltage Discharge Current	MPS-3000 FC MPS-3000 HC	Volts Amps
HHHHH	Beam Current Tolerance	All	%
IIIII	Discharge Current Threshold	All	Amps
JJJJJ	Cathode Filament Current	MPS-3000 FC	Amps
KKKKK	Neutralizer Filament Current Emission Current	MSP-3000 FC MPS-3000 HCN/PBN	Amps mA

Description: Used to request all target values, in the compressed format, from the selected memory. If the value is not reported for a particular model, it is replaced with ASCII blank spaces (32).

EXAMPLE 8.26 Request all Target Parameters

Request all the target parameters stored in Memory 1 using the following command: RN1<cr>

Command Name: MANUAL DATA LOG REQUEST

Syntax: RS<cr>

Units: N/A

Range: N/A

Response:

If the source and/or beam are on:

<lf><cr>^^^^^^^^TIME^^^^^^^CI^^^^^DI^^^^^DV^^^^^BI

^^^^^BV^^^^^AV^^^^^AI^^^^^EI^^^^^NI

<lf><cr>^^^^^^HH:MM:SS^^^^AMPS^^^AMPS^^^VOLTS

^^^mA^^^^VOLTS^^VOLTS^^^mA^^^^^mA^^^^AMPS

<cr><lf>^^^^^^XX:XX:XX^^^XX.XX^^^X.XX^^^XXX.X^^XXXX^^^XXXX^^^XXXX^^^XXX^^^^XXXX^^XX.XX

<lf><cr><eot>

If the source and beam are off:

<lf><cr>^^^^^^^^^^^^^^^^^SOURCE^&^BEAM^ARE^OFF^DDDD

<lf><cr><eot>

Where:

DDDD - Fatal Error Message. If there is no fatal error message when the RS command is received, DDDD = blank spaces (32).

^ = ASCII BLANK SPACE (32)

Description: This command is used to request data logging parameters. It is only valid when automatic data logging is disabled.

Command Name: RESET MPS-3000

Syntax: RST<cr>

Units: N/A

Range: N/A

Description: This command is used to reset the power supply.

Command Name: SOURCE ON/OFF

Syntax: S[n]<cr>

Units: N/A

Range: n = 1 or 0

Description: Used to turn the source supplies on (S1) or off (S0).

EXAMPLE 8.27 Turn On the Source Supplies

Turn the source supplies on using the following command: S1<cr>

Command Name: SET AUTOMATIC DATA LOG TIME INTERVAL

Syntax: T[n]<CR>

Units: N/A

Range: n = 0 - 9

Description: Used to set the time interval at which the power supply will transmit data when automatic data logging is enabled.

T0 - 2 Second Interval

T1 - 10 Second Interval

T2 - 20 Second Interval

T3 - 30 Second Interval

T4 - 1 Minute Interval

T5 - 2 Minute Interval

T6 - 5 Minute Interval

T7 - 10 Minute Interval

T8 - 30 Minute Interval

T9 - 1 Hour Interval

EXAMPLE 8.28 Setting the Auto Data Log Time Interval

Set the auto data log time interval to 1 minute using the following command: T4<cr>

Command Name: REQUEST POWER SUPPLY TYPE

Syntax: V<cr>

Units: N/A

Range: N/A

Response: (Only one response will be transmitted.)

MPS-3000 FC:

<lf><cr>MPS-3000 FC #x<lf><cr><eot>

MPS-3000 HC:

<lf><cr>MPS-3000 HC #x<lf><cr><eot>

MPS-3000 PBN:

<lf><cr>MPS-3000 PBN #x<lf><cr><eot>

Where: x = ID NUMBER 1 - 4

Description: Used to request the type of power supply.

Command Name: REQUEST POWER SUPPLY MODEL & MODULE TYPES

Syntax: V1<cr>

Units: N/A

Range: N/A

Response:

<lf><cr>ABCDEF<lf><cr><eot>

Where:

A - Power Supply Model:1 = MPS-3000

B - Cathode Type: 0 = FC1 = HC

C - Beam Type: 0 = NORMAL

D - Neutralizer Type: 0 = FN1 = HCN2 = PBN

E - Discharge Type: 0 = FC1 = HC

F - Accelerator Type: 0 = NORMAL

Description: Used to request the power supply model.

Chapter 9: Remote I/O

Remote Switch Control

Some MPS-3000 power supply and ion source operating conditions require precise control of the SOURCE and BEAM switches by a timer or another sensing device. The EIA-232 (RS-232) connector on the power supply's rear panel has four pins that allow a remote contact closure to control the SOURCE, BEAM, and MEMORY switches. The unit must be in the Remote mode for the remote switches to function.

The memory location may be changed at any time. When a new memory location is selected, the power supply will operate immediately from the new parameters. The KEYLOCK, MODE and POWER switches are fully functional in this mode. The SOURCE and BEAM switches may be turned off with the respective front panel switches but may not be turned on.

Table 9.1: Remote Switch Control Guide

Remote Switch	Source	Beam	Memory
Position Change	Switch	Switch	Switch
Open to Closed	On	On	2
Closed to Open	Off	Off	1

Remote Source/Beam - Pin Designations on J28 (Refer to FIGURE 9.1 on page 66):

J28-25 Remote Source

Shorting J28-25 to J28-7 will allow power from the Cathode or HC, Discharge, and Neutralizer or HCN power supplies to the ion source (equivalent to pressing the SOURCE switch). If the contact is left open, all outputs will be low.

J28-18 Remote Beam

Shorting J28-18 to J28-7 will allow power from the beam and accelerator power supplies to the ion source, but only if the SOURCE switch is on (equivalent to pressing the BEAM switch). If the connection is left open, the beam and accelerator power supply output will be low.

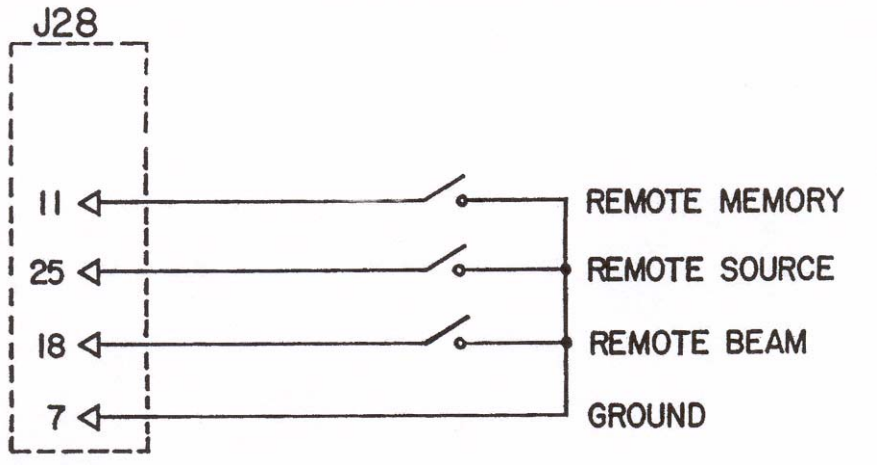
J28-25 and J28-18

May be tied together and controlled by one switch (equivalent to turning both the SOURCE and BEAM switches off or on).

J28-11 Remote Memory

Shorting J28-11 to J28-7 selects Memory 2. If the connection is left open, Memory 1 will be selected.

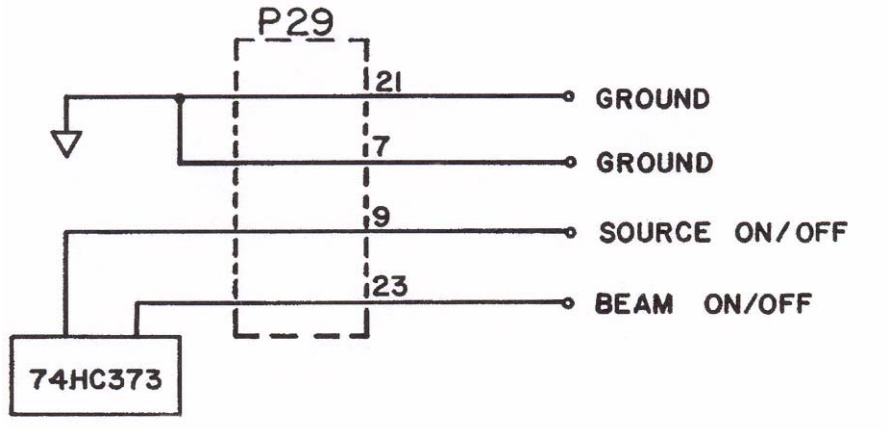
FIGURE 9.1 Remote Switch Pin Assignment.



Digital Output Signals

The MPS-3000 power supply provides signals to indicate the status of the source and beam switches (refer to FIGURE 9.2). The TTL level signals are driven by a 74HC373 octal D-type transparent latch: a high level signal indicates the switch is on, while a low level signal indicates the switch is off. A plug in module is available as an option that converts these TTL signals to relay contact closures. Order Veeco part number 6900-016.

FIGURE 9.2 Digital Output Signal Pin Assignment.



Chapter 10: Maintenance

General

There are no user serviceable parts inside, except fuses. Refer servicing to qualified personnel at Veeco.

WARNING

To avoid electrical shock, keep clear of "live" circuits. Follow all local lock-out/tag-out procedures, before repairing components or replacing fuses.

Fuse List

MPS-3000 FC

Power Board

F1 Cathode	6A
F2 Discharge	5A
F3 Neutralizer	5A
F4 Beam	5A
F5 Accelerator	2A
F6 Power Input	2A, Slo-Blo
F7 Logic Supply	2A, Slo-Blo

Rear Panel

F8 Emission	2A
F9 Body	1/16A, Slo-Blo
F10 Probe	1/32A

MPS-3000 HC

Power Board

F1 Hollow Cathode	2A
F2 Discharge	5A
F3 Hollow Cathode Neutralizer	2A
F4 Beam	5A
F5 Accelerator	2A
F6 Power Input	2A, Slo-Blo
F7 Logic Supply	2A, Slo-Blo

Rear Panel

F8 Emission	2A

F9 Body	1/16A, Slo-Blo
F10 Probe	1/32A

MPS-3000 PBN

Power Board

F1 Cathode	6A
F2 Discharge	5A
F3 Plasma Bridge Neutralizer	5A
F4 Beam	5A
F5 Accelerator	2A
F6 Power Input	2A, Slo-Blo
F7 Logic Supply	2A, Slo-Blo
F12 PBN Body	1A Picofuse

Rear Panel

F8 Emission	2A
F9 Body	1/16A, Slo-Blo
F10 Probe	1/32A

A spare parts kit, containing extra fuses, is included with the power supply. Use Veeco part number 6290-002 to reorder this spare parts kit.

Replacing the Fuses

To avoid electrical shock, keep clear of "live" circuits. Follow all local lock-out/tag-out procedures, before replacing any power supply fuses.

Replace Fuse F1 through F7

1. Turn off the CB-1 circuit breaker on the power supply's rear panel.
2. Remove the 26 screws holding the top cover and mounting ears to the chassis.
3. Remove the top cover.
4. Locate the appropriate fuse holder.
5. Remove the fuse holder and fuse.
6. Replace the fuse (refer to "Fuse List" on page 67 for the correct rating of the fuse).
7. Insert the fuse holder into the appropriate location.
8. Replace the top cover, mounting ears (if applicable), and screws.

9. Reconnect to power, and verify that the unit operates correctly. If the problem persists, contact "Service Support" on page 75

Replace Fuse F8, F9, or F10

1. Remove the correct fuse holder and fuse.
2. Replace the fuse (See "Fuse List" on page 67. for the correct rating).
3. Insert the fuse holder into the appropriate location on the rear panel.

Updating the Software

⚠WARNING

To avoid electrical shock, keep clear of "live" circuits. Follow all local lock-out/tag-out procedures, before continuing.

To update software on the MPS-3000 power supply, a single PROM must be changed. Updated PROM versions are sent in static-protected bags.

CAUTION

Handle the PROM a static station to limit possible damage.

1. Turn off the CB-1circuit breaker on the power supply's rear panel.
2. Remove the 26 screws holding the top cover and mounting ears to the chassis.
3. Remove the top cover.
4. Replace the PROM located in the XU9 socket.
5. Use a small screwdriver to pry the PROM upward until loose.
6. Remove the PROM from the socket.
7. Orient the new PROM with the notched end toward the inside of the controller board and insert it into the socket.
8. Apply equal pressure across the PROM until fully and evenly seated. All the legs must enter straight into the socket and may need to be formed before inserting the PROM.
9. Verify that the PROM is fully seated and all pins are in the socket.
10. Verify that the notch on the PROM is in the correct orientation.
11. Replace the top cover, mounting ears (if applicable), and screws.
12. Reconnect the power.
13. Verify that the power supply operates correctly.

- If the unit does not complete the self-test sequence, recheck the seating and orientation of the PROM.
- If the problem persists, contact "Service Support" on page 75

Replacing the Switches

WARNING

To avoid electrical shock, keep clear of "live" circuits. Follow all local lock-out/tag-out procedures, before continuing.

1. Turn off the CB-1 circuit breaker on the power supply's rear panel.
2. Remove the 26 screws holding the top over and mounting ears to the chassis.
3. Remove the top cover.
4. Locate SW1 and SW2 on the controller board.
5. Set the appropriate switch(es) to the chosen position.
6. Replace the top cover, mounting ears (if applicable), and screws.
7. Reconnect the power.
8. Verify that the power supply operates correctly.
    - If a problem occurs, verify that all switches are in the appropriate position.
    - If the problem persists, contact "Service Support" on page 75.

Returning an MPS-3000 Power Supply

1. Seal the power supply in a plastic bag.
2. Pack the unit using the original packing material and shipping box.

NOTE

If the original packing material is not available, surround and cover the power supply with foam and ship in a double-walled box.

3. Contact "Service Support" on page 75 before returning any equipment to Veeco.

Chapter 11: Troubleshooting/Error Code Definitions

⚠WARNING To avoid electrical shock, keep clear of "live" circuits. Follow all local lock-out/ tag-out procedures, before repairing or replacing any electrical devices. Disconnect the unit's main power before replacing any fuse or troubleshooting any electrical connection.

Table 11.1: MPS-3000 Power Supply Troubleshooting

Problem	Possible Cause	Remedy
Front panel displays will not light, fan will not start.	The power cord is not plugged in.	Connect the power cord.
	The unit's CB1 circuit breaker on rear panel is tripped.	Close circuit breaker on the unit's rear panel.
	The power plug is wired incorrectly.	Correctly wire the power plug.
Front panel displays light. Fan starts. An E20 error message appears on all upper displays.	The external interlock string in not complete.	Complete the interlock string.
An E22 error message appears on the cathode module (MPS-3000 FC power supply only).	Open cathode filament.	Replace the filament. See "Maintenance" on page 67.
	Cable is not connected	Connect the cable.
An E23 error message appears on the neutralizer module (MPS-3000 FC/PBN power supply only).	Open neutralizer filament.	Replace the filament. See "Maintenance" on page 67.
	Cable is not connected.	Connect the cable.
The ion source discharge will not start.	The Body Fuse (F9) is open.	Replace the fuse with the correct value (refer to "Maintenance" on page 67), and check that the source body is not grounded through cable connections or internal connections.
Accelerator displays no current or a very small current.	If the Accelerator output is shorted to the discharge output (the anode) while the high voltage is on, damage to an accelerator series resistor may result. When this occurs, the Accelerator Current display will show zero current and the Accelerator Voltage display will show the programmed value. No accelerator voltage will be present at the source connector (P33-F) on the unit's rear panel.	Replace the resistor if damaged. Contact "Service Support" on page 75.
Power supply fails to retain stored parameters in memory.	Battery is low. Internal circuitry or a component is damaged.	Contact "Service Support" on page 75.

WARNING To avoid electrical shock, keep clear of "live" circuits. Follow all local lock-out/tag-out procedures before continuing. Disconnect the controller's main power before troubleshooting any electrical connection.

Table 11.2: Error Code Definitions

Error Code	Definition	Probable Cause	Suggested Remedy
E01	The keeper voltage has dropped below 100V but has not dropped below the keeper voltage limit. Applies to both hollow cathode and hollow cathode neutralizer power supplies.	Insufficient gas flow.	Raise the gas flow.
	The keeper voltage does not drop below the keeper voltage limit (MPS-3000 HC unit).	The keeper voltage limit is set too low.	Raise the keeper voltage limit.
E02	The discharge current has reached the programmed discharge current limit.	Insufficient gas flow.	Raise the gas flow.
		Discharge current limit set too low.	Raise the limit.
E03	The operating value is low and is unable to increase to meet the requested target.	Power into the power supply is low.	Cycle the power.
		A power supply fuse has failed.	Check the fuses on the Power Board. Refer to "Maintenance" on page 67 for fuse replacement.
		Facility voltage is low.	Raise facility voltage.
		If the error message is on the neutralizer, the neutralizer filament may be open (When SW1-4 is in the on position on the controller board, an open filament is not a Fatal error).	Replace the neutralizer filament.
E04	The operating parameter is high and may not be reduced to target value.	Requested target value is below operational limits.	Increase the target value.
E05	Current Limit.	Requested target value is above the maximum current capability of the power supply.	Reduce the requested target value.
		The output is shorted.	Check the ion beam source and cable connections (refer to the ion source technical manual).
		A power supply has failed.	Contact "Service Support" on page 75 to arrange for factory repair.

WARNING To avoid electrical shock, keep clear of "live" circuits. Follow all local lock-out/tag-out procedures before continuing. Disconnect the controller's main power before troubleshooting any electrical connection.

Table 11.2: Error Code Definitions (Continued)

Error Code	Definition	Probable Cause	Suggested Remedy
E06	Thermal shutdown. Fatal error (refer to the NOTE on page 74).	Blockage of air flow.	Remove the blockage and cycle the power.
		Defective fan.	Contact "Service Support" on page 75.
E07	Clock fault.	Defective component.	Contact "Service Support" on page 75.
E08	Cathode filament or neutralizer filament error. This is a Fatal error (refer to the NOTE on page 74). If a neutralizer filament is the cause of this error, SW 1-4 is on (controller board).	Broken cathode or neutralizer filament.	Replace filament.
		Cable is disconnected.	Connect the cable.
E09	Only active if Auto Cathode (AC1 command). Cathode filament is at its limit and the discharge current is less than the discharge current threshold (DT command).	Discharge threshold set is elevated (DT command).	Decrease value.
		Cathode limit set too low.	Increase value.
		Insufficient gas flow.	Raise gas flow.
E13	Beam current is out of the tolerance set by the BE command.	Insufficient gas flow.	Raise the gas flow.
		A large change in beam current was requested.	Disable E13 (BEO) before changing beam current.
		Cathode limit is set too low, 3000 FC or PBN only.	Increase limit.
		Discharge current set too low.	Increase limit.
E18	HC shorted.	various.	Contact "Service Support" on page 75.
E19	HCN shorted.	various.	Contact "Service Support" on page 75.
E20	External interlock failure.	External interlock circuit is incomplete.	Complete the external interlock circuit.
E21	Internal interlock failure. Fatal error (refer to the NOTE on page 74).	Voltage is low from the internal line conditioner.	Cycle the power.
		Facility voltage is low.	Raise facility voltage.
		Power plug is wired incorrectly.	Rewire power plug.
E22	Cathode filament. Fatal error (refer to the NOTE on page 74); MPS-3000 FC or PBN power supplies only.	Broken cathode filament.	Replace filament.
		Cable is disconnected.	Connect cable.

WARNING To avoid electrical shock, keep clear of "live" circuits. Follow all local lock-out/tag-out procedures before continuing. Disconnect the controller's main power before troubleshooting any electrical connection.

Table 11.2: Error Code Definitions (Continued)

Error Code	Definition	Probable Cause	Suggested Remedy
E23	Neutralizer filament. SW 1-4 is on (controller board); MPS-3000 FC or PBN units only. Fatal error (refer to the NOTE below).	Broken neutralizer filament.	Replace filament.
		Cable is disconnected.	Connect cable.
E24	Emission-current-to-beam-current ratio is less than 100%. The error will occur only in Local, Local Restricted, or Remote mode and only when SW 1-4 is off (controller board).	Low neutralizer filament current is causing the emission current to be less than 100% of the beam current (filament neutralizer).	Go to Manual mode, and raise the filament current. Return to Local, Local Restricted, or Remote mode.
		Neutralizer filament current limit is set too low in Local, Local Restricted, or Remote mode (flashes the LED on the LIMIT switch). Filament neutralizer only.	Go to Manual mode to set current limit. Return to Local, Local Restricted, or Remote mode.
		The emission current may not meet the programmed value as a result of an impedance in cabling or in the ion source (HCN & PBN only). A low impedance to ground on the body is causing heavy current draw from the beam power	Find and remove low impedance to ground. Cycle the power.
E25	Accelerator-current-to-beam-current ratio exceeds the programmed A/B Ratio.	Accelerator voltage is not set to minimize accelerator current.	Adjust accelerator voltage.
		System pressure exceeds 3×10^{-4} Torr.	Reduce system pressure.
		Excessive gas flow.	Reduce gas flow.
		Requested A/B Ratio is too low.	Adjust A/B Ratio.
		Extraction grids are misaligned.	Realign ion extraction grids (refer to the ion source technical manual for details).
		A low impedance is present between the extraction grids (accompanied by an E05 error message on the beam).	Check the ion extraction grids for a low impedance connection.
E26	Short to ground, external to the power supply. Fatal error (refer to the NOTE below).	A low impedance is present between the source cathode or hollow cathode and facility ground.	Remove the short to facility ground that may exist at the source, feedthroughs, or cables. Cycle the power.

NOTE A Fatal error will shut down the power supply until the problem is corrected. Power must be cycled (CB1 circuit breaker on the unit's rear panel).

Chapter 12: Service Support

For service, contact:

Veeco Instruments Inc.
2330 East Prospect
Fort Collins, CO 80525
Phone: 1.888.221.1892
Fax: 970.493.1439
ftcsupport@veeco.com

When contacting Veeco Instruments Inc. for parts or service:

Provide the ion source model number, serial number, and grid serial number. The model and serial number are engraved on the downstream surface of the grid mount plate. The grid serial number is engraved on the upstream surface of the grid.

Provide the ion source power supply model and serial number; a list of all operating parameters and/or error messages displayed by the power supply; gas flow rate; and vacuum chamber pressure.

Appendix A: Specifications

General

The MPS-3000 consists of a chassis containing these power supplies:

- beam voltage
- accelerator voltage

Each chassis contains one current supply from each of the following two groups, depending on the end use:

1. cathode
    - filament
    - hollow (HC)
2. neutralizer
    - filament
    - hollow cathode (HCN)
    - plasma bridge (PBN)

Each chassis also contains one of two discharge supply types, depending on the end use:

- voltage (FC, PBN)
- current (HC)

Mechanical

The power supply is designed to be bench or rack mounted in a standard 19 inch equipment rack.

Dimensions (height, width, and depth): 17.8 x 44.1 x 45.7cm
(7 x 17.38 x 18 in.)

Weight:18.4kg (40.5 lbs.)

It is recommended that two persons move each unit by grasping the unit's case.

⚠CAUTION

To avoid back and other injuries, two persons should move each unit by grasping the case.

Electrical

NOTE

It is the user's responsibility to meet all local and national electrical codes when installing this equipment.

Input power to the unit should be 200 to 220V ~, single phase, 50-60Hz, with a current draw of 20A.

Power Output

NOTE

Some values may not be attainable due to individual source limitations.

MPS-3000 FC

Cathode Current Supply:

- 0-20A AC
- 875W
- Programmable current limit.
- Sensing of open filament, causing shutdown of outputs.
- Soft start filament.
- Current limit protection.
- Filament current readout.
- Thermal protection.

Discharge Voltage Supply:

- 0-150V DC
- 300W, 6A maximum.
- Cathode open-filament interlock prevents discharge voltage from rising when no cathode current is present.
- Over-voltage protection.
- Under no-load condition, output rises to 150V.
- Current limit protection.
- Voltage and current readouts.
- Thermal protection.
- Programmable current limit.

Beam Voltage Supply:

- 0-1200V DC
- 300mA maximum.

- 300W maximum.
- Current select for automatic operation.
- Over-voltage protection.
- Current limit protection.
- Accuracy ± 0.1% to 1000V.
- Voltage and current readouts.
- Thermal protection.

Accelerator Voltage Supply:

- 0-1000V DC
- 30W maximum.
- 100mA maximum.
- Over-voltage protection.
- Current limit protection.
- Programmable accelerator-current-to-beam-current ratio limit.
- Voltage and current readouts.
- Thermal protection.

Neutralizer Current Supply:

- 0-15A AC
- 450W
- Programmable current limit.
- Sensing of open filament, causing shutdown of outputs over-ride on controller board.
- Soft start filament.
- Current limit protection.
- Filament current and emission current readouts.
- Thermal protection.

Probe Supply:

- 30V Bias
- 40mA maximum
- Current read out.

MPS-3000 HC

Hollow Cathode Current Supply:

- 0-7.25A AC heater supply.
- Programmable keeper voltage limit.
- Soft start.
- Current limit protection.
- Heater current readout.
- Keeper voltage readout.
- Thermal protection.

Discharge Current Supply:

- 0-150V DC
- 300W, 6A maximum.
- Programmable current limit.
- Over-voltage protection.
- Under no-load condition, output rises to 150V.
- Current limit protection.
- Voltage and current readouts.
- Thermal protection.

Beam Voltage Supply:

- 0-1200V DC
- 300mA
- 300W maximum.
- Current select for automatic operation.
- Over-voltage protection.
- Current limit protection.
- Accuracy ± 0.1% to 1000V.
- Voltage and current readouts.
- Thermal protection.

Accelerator Voltage Supply:

- 0-1000V DC
- 30W maximum.
- 100mA maximum.
- Over voltage protection.
- Current limit protection.

- Programmable accelerator-current-to-beam-current ratio limit.
- Voltage and current readouts.
- Thermal protection.

Hollow Cathode Neutralizer Current Supply:

- 0-7.25A AC heater supply.
- 0-500mA DC emission current.
- Programmable keeper voltage limit.
- Soft start.
- Current limit protection.
- Heater current readout.
- Emission current and keeper voltage readouts.
- Thermal protection.

Probe Supply:

- 30V Bias
- 40mA maximum
- Current read out.

MPS-3000 PBN

Cathode Current Supply:

- 0-20A AC
- 875W
- Programmable current limit.
- Sensing of open filament, causing shutdown of outputs.
- Soft start filament.
- Current limit protection.
- Filament current readout.
- Thermal protection.

Discharge Voltage Supply:

- 0-150V DC
- 300W, 6A maximum.

- Cathode open-filament interlock prevents discharge voltage from rising when no cathode current is present.
- Over-voltage protection.
- Under no-load condition, output rises to 150V.
- Current limit protection.
- Voltage and current readouts.
- Thermal protection.
- Programmable current limit.

Beam Voltage Supply:

- 0-1200V DC
- 300mA maximum.
- 300W maximum.
- Current select for automatic operation.
- Over-voltage protection.
- Current limit protection.
- Accuracy ± 0.1% to 1000V.
- Voltage and current readouts.
- Thermal protection.

Accelerator Voltage Supply:

- 0-1000V DC
- 30W maximum.
- 100mA maximum.
- Over-voltage protection.
- Current limit protection.
- Programmable accelerator-current-to-beam-current ratio limit.
- Voltage and current readouts.
- Thermal protection.

Plasma Bridge Neutralizer Current Supply:

- 0-10A AC Filament Supply.
- 0-600mA DC Emission Supply.
- 200mA DC Body Supply.
- Programmable filament current limit.
- Soft start.
- Current limit protection.
- Filament current and emission current readouts.

- Body voltage readout.
- Thermal protection.

Probe Supply:

- 30V Bias
- 40mA maximum
- Current read out.

Programmed Limit Values

Table A.1: Programmed Limit Values

Parameter	Default Value
Cathode Filament Current Limit	Set at 6.5A for 5cm or smaller ion source
Hollow Cathode Keeper Voltage Limit	Set at 25V
Neutralizer Filament Current Limit	Set at 6.5V
Hollow Cathode Neutralizer Keeper Voltage Limit	Set at 25V
A/B Ratio Limit	10%
Plasma Bridge Neutralizer Filament Current Limit	6.5V
Discharge Current Limit	2.0A

The above limits are programmed into the power supplies at the factory. The PBN filament current limit is set for tungsten wire, 0.25mm (0.010 in.), but the preset A/B Ratio limit is the recommended value for operation of all ion sources. Although the above are the recommended limits programmed into the power supply, the limits may be changed for operation of different sources or different filaments. New values will be stored along with the operating parameters in one of the two nonvolatile memories. (Refer to "FC Storing Operating Conditions" on page 29, "HC Storing Operating Conditions" on page 34, or "PBN Storing Operating Conditions" on page 41).

NOTE

For the MPS-3000 power supply, the recommended cathode filament limit (using 0.25mm/0.010 in. tungsten wire) for ion sources 5cm or smaller is 6.5A. Check that both of the nonvolatile memories have the correct limit of 6.5A stored.

Appendix B: Tables

NOTE Initial filament current values apply for 0.25mm (0.010 in.) tungsten wire.

Recommended Initial Filament Current Limits

Table B.1: Circular Ion Source

Circular Ion Source Size (in cm)	Initial Cathode Current	Initial Neutralizer Current
2.5	3.5A	3.5A
3	3.5A	3.5A
5	3.5A	3.5A

Recommended Current Filament Current Limits

Table B.2: Circular Ion Source

Circular Ion Source Size (in cm)	Cathode Current Limit	Neutralizer Current Limit	PBN Current Limit
2.5	6.5A	6.5A	6.5A
3	6.5A	6.5A	6.5A
5	6.5A	6.5A	6.5A

NOTE Discharge current limit is selectable only on the MPS-3000 HC power supply.

Recommended Discharge Current Limits

Table B.3: Recommended Discharge Current Limits

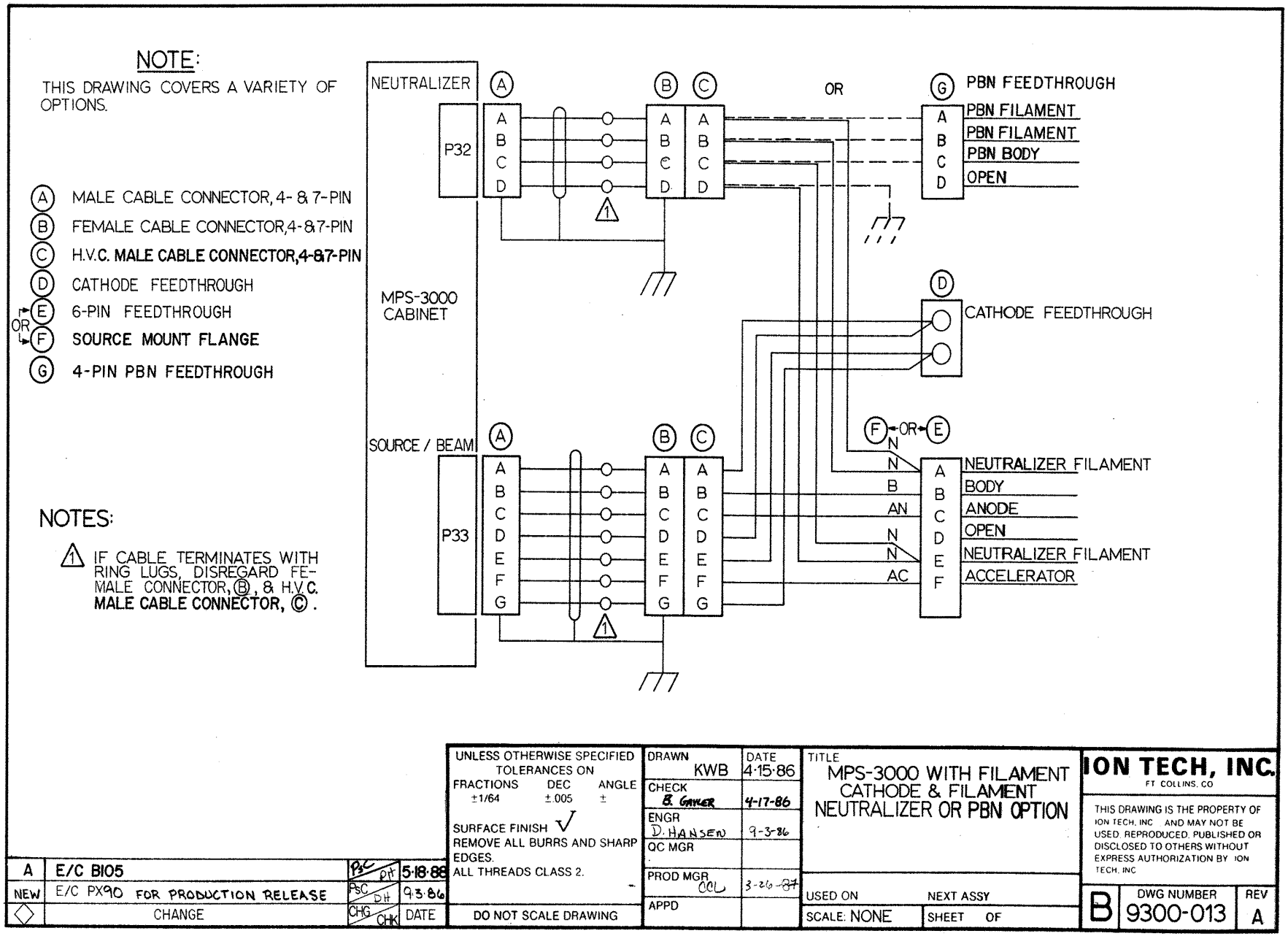
Circular Ion Source Size (in cm)	Discharge Current Limit
2.5 HP or LP	3.00A
3	2.50A
5	4.50

Appendix C: Drawings

One of the following drawings applies to your system:

"Filament Cathode with Filament Neutralizer or PBN Option"
"Hollow Cathode and HCN - 7 pin or 2 x 4 pin feedthrough"
"Hollow Cathode and Hollow Cathode Neut - 6 pin feedthrough"
"Filament Cathode with Filament Neutralizer or PBN Option"
"3cm Source Filament Cathode and Filament Neutralizer"
"3cm Source Hollow Cathode and Hollow Cathode Neutralizer"
"3cm Source Plasma Bridge Neutralizer"

Filament Cathode with Filament Neutralizer or PBN Option



A	E/C B105	PSC PH	5-18-88
NEW	E/C PX90 FOR PRODUCTION RELEASE	PSC DH	9-3-86
◇	CHANGE	CHG CHK	DATE

UNLESS OTHERWISE SPECIFIED TOLERANCES ON
FRACTIONS ±1/64 DEC ±.005 ANGLE ±
SURFACE FINISH √
REMOVE ALL BURRS AND SHARP EDGES.
ALL THREADS CLASS 2.
DO NOT SCALE DRAWING

DRAWN	KWB	4-15-86
CHECK	B. GAHLER	4-17-86
ENGR	D. HANSEN	9-3-86
QC MGR		
PROD MGR	CCL	3-26-87
APPD		

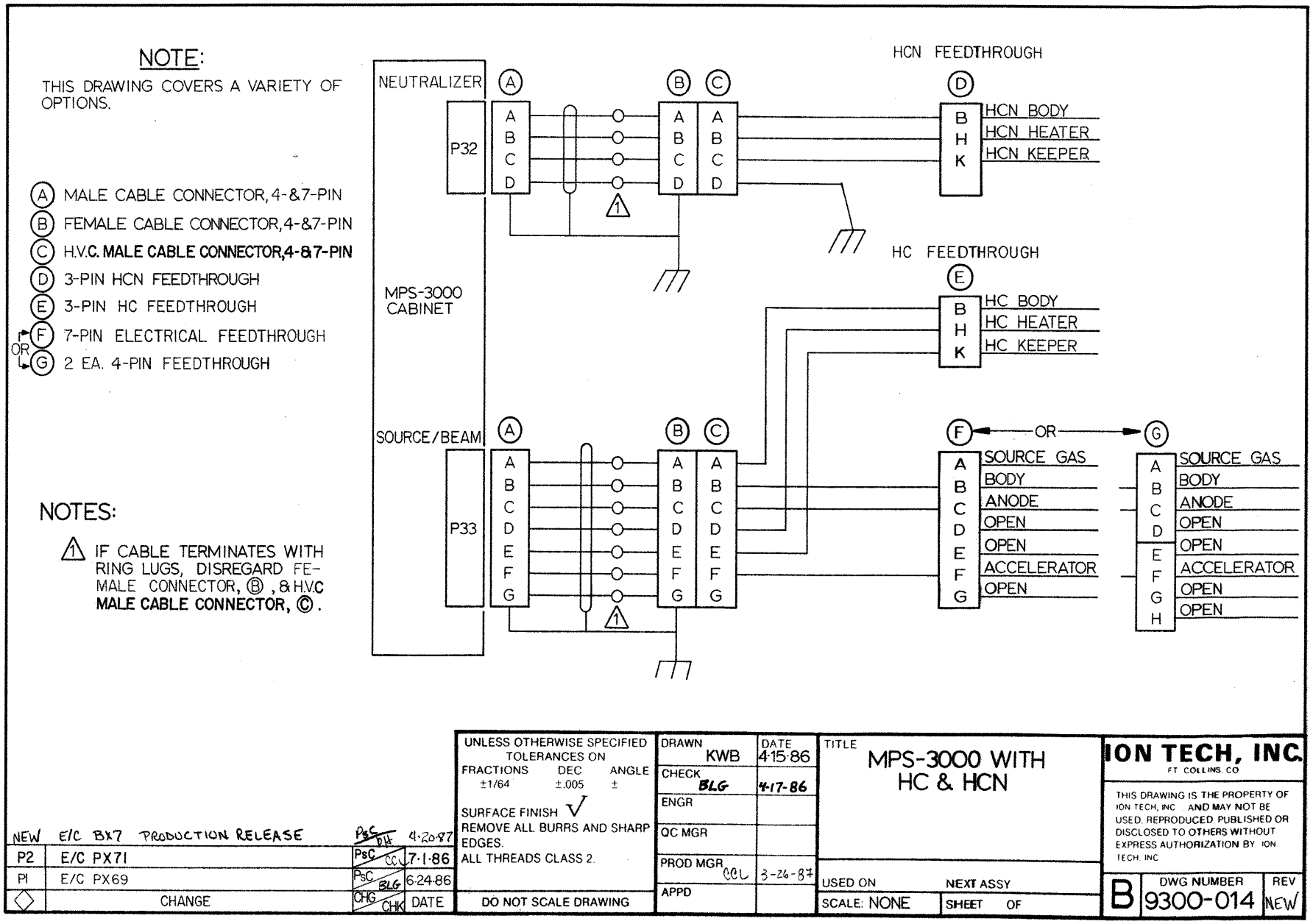
TITLE: MPS-3000 WITH FILAMENT CATHODE & FILAMENT NEUTRALIZER OR PBN OPTION

USED ON | NEXT ASSY
SCALE: NONE | SHEET OF

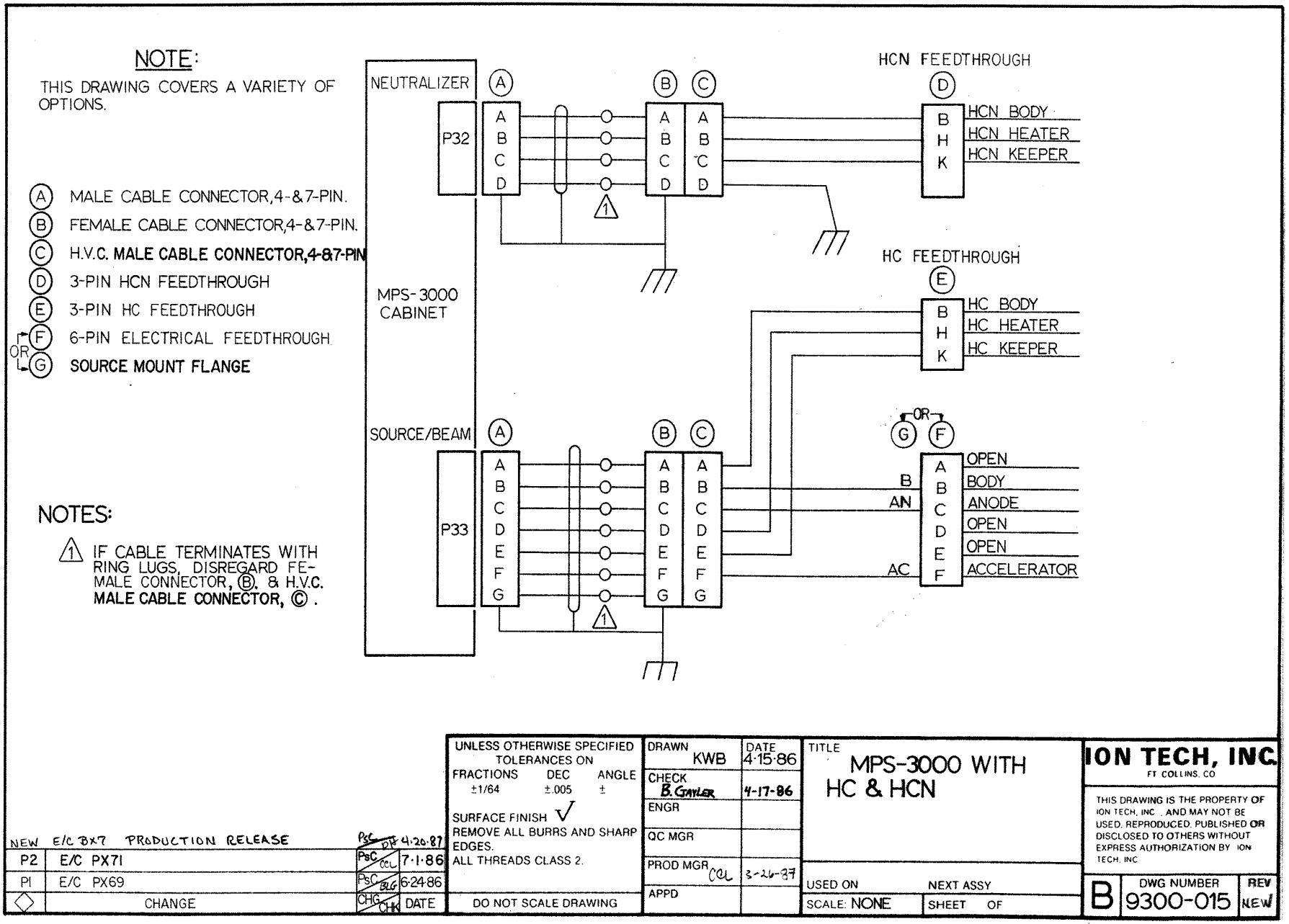
ION TECH, INC.
FT. COLLINS, CO

	DWG NUMBER	REV
B	9300-013	A

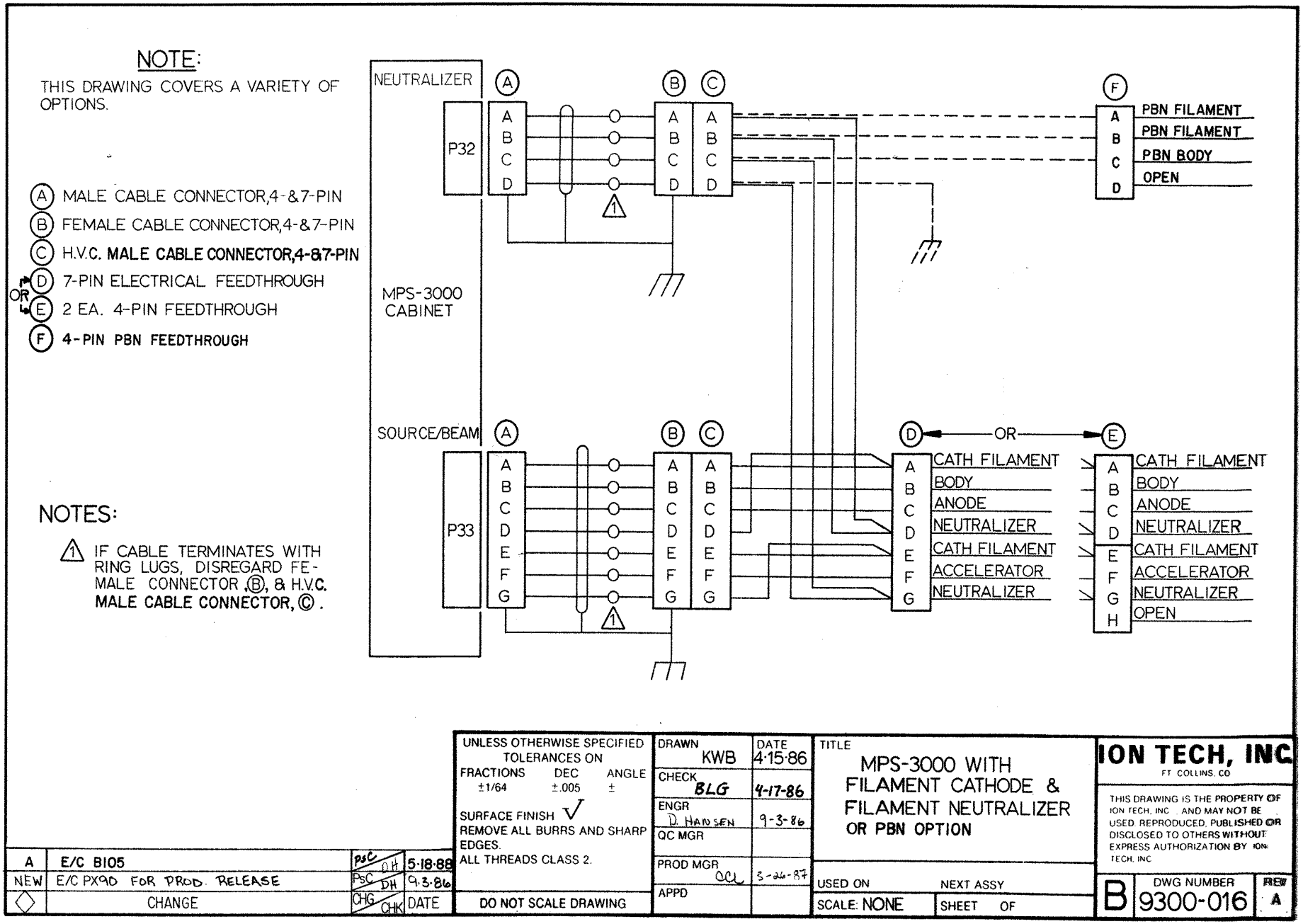
Hollow Cathode and HCN - 7 pin or 2 x 4 pin feedthrough



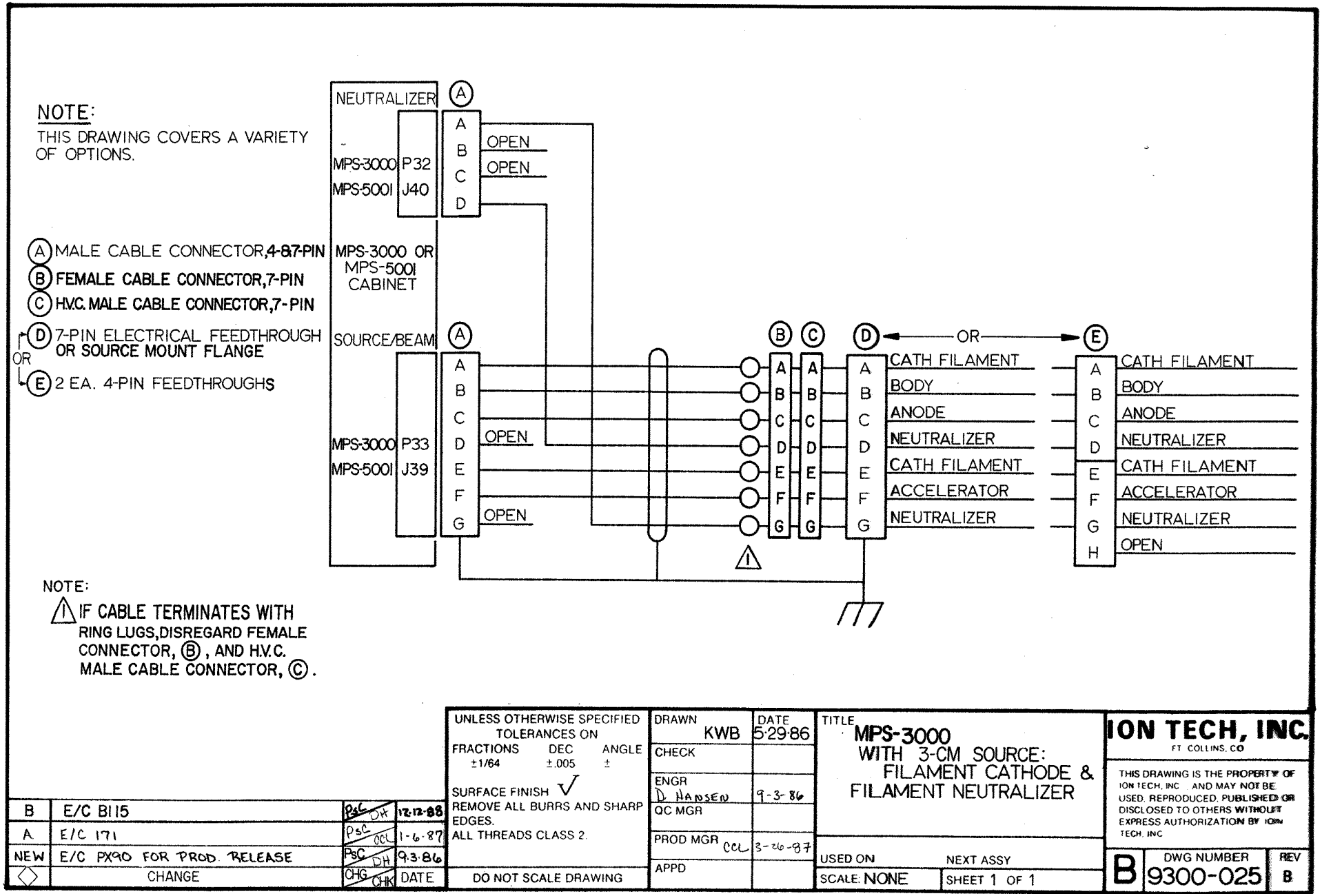
Hollow Cathode and Hollow Cathode Neut - 6 pin feedthrough



Filament Cathode with Filament Neutralizer or PBN Option



3cm Source Filament Cathode and Filament Neutralizer



B	E/C B115	PSC DH	12-12-88
A	E/C 171	PSC CCL	1-6-87
NEW	E/C PX90 FOR PROD. RELEASE	PSC DH	9-3-86
◇	CHANGE	CHG CHK	DATE

UNLESS OTHERWISE SPECIFIED TOLERANCES ON
FRACTIONS ±1/64 DEC ±.005 ANGLE ±
SURFACE FINISH √
REMOVE ALL BURRS AND SHARP EDGES.
ALL THREADS CLASS 2.
DO NOT SCALE DRAWING

DRAWN	KWB	5-29-86
CHECK		
ENGR	D HANSEN	9-3-86
QC MGR		
PROD MGR	CCL	3-26-87
APPD		

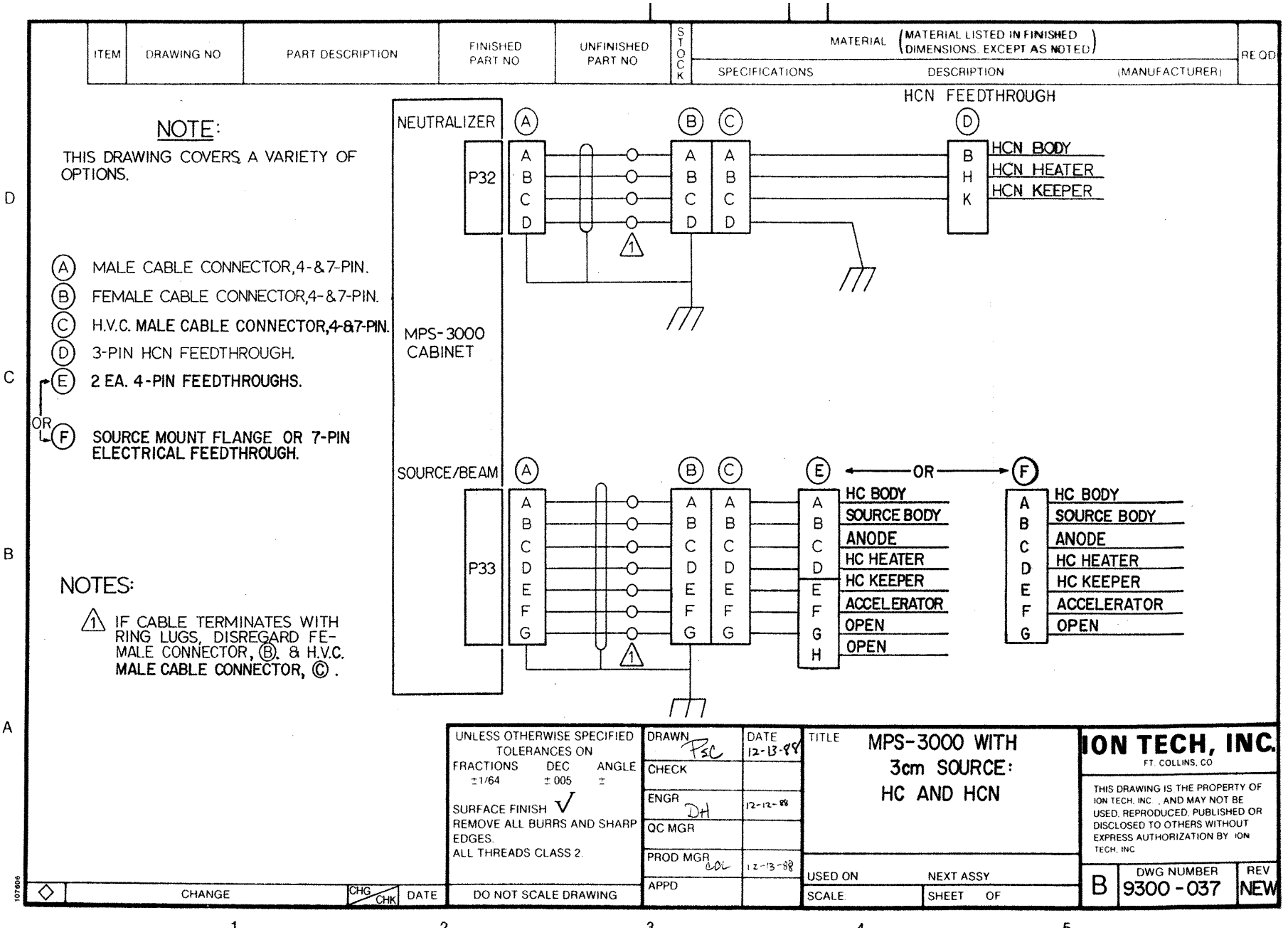
TITLE: MPS-3000 WITH 3-CM SOURCE: FILAMENT CATHODE & FILAMENT NEUTRALIZER

USED ON | NEXT ASSY
SCALE: NONE | SHEET 1 OF 1

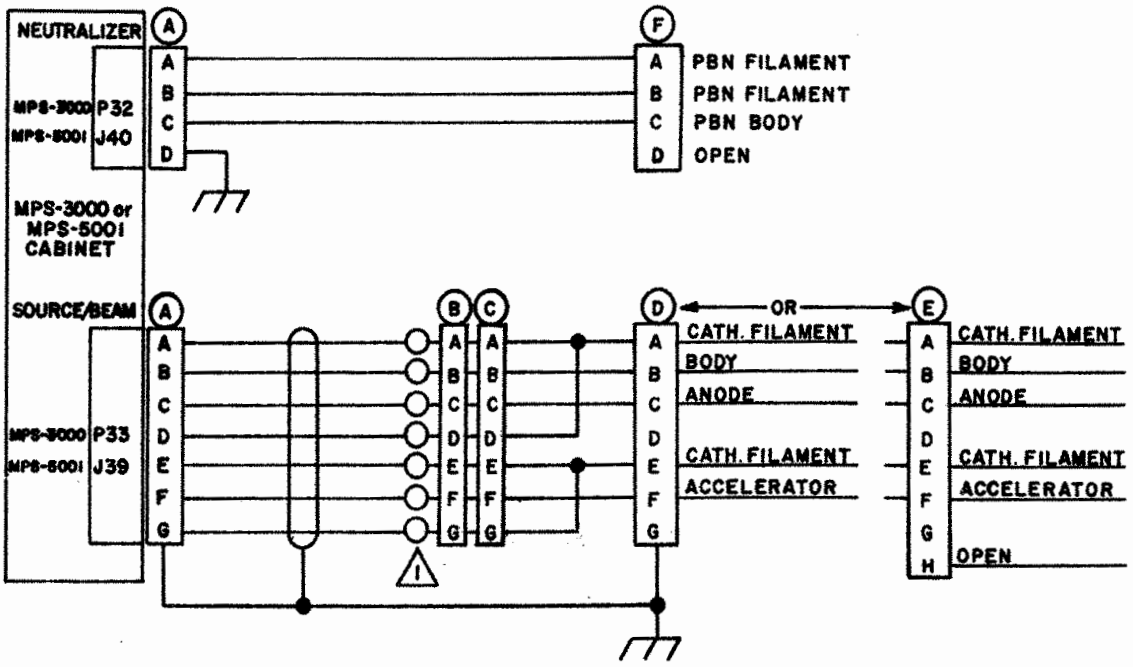
ION TECH, INC.
FT. COLLINS, CO

B | DWG NUMBER 9300-025 | REV B

3cm Source Hollow Cathode and Hollow Cathode Neutralizer



3cm Source Plasma Bridge Neutralizer



NOTE: THIS DRAWING COVERS A VARIETY OF OPTIONS.

(A) MALE CABLE CONNECTOR, 4- AND 7-PIN

(B) FEMALE CABLE CONNECTOR, 7-PIN

(C) HVC MALE CABLE CONNECTOR, 7-PIN

(D) 7-PIN ELEC. FEEDTHROUGH OR SOURCE MOUNT FLANGE

OR

(E) 2 EA. 4-PIN FEEDTHROUGH

(F) 4-PIN PBN FEEDTHROUGH

NOTE:

1. IF CABLE TERMINATES WITH RING LUGS, DISREGARD FEMALE CONNECTOR (B) AND HVC MALE CABLE CONNECTOR (C)

MPS-3000 WITH 3cm SOURCE
PLASMA BRIDGE NEUTRALIZER
DRAWING NO. 9300-051