SPI Supplies
Plasma Prep III Process Controller
Operation Manual

SPI # 11052-AB 11052-AX

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For further information regarding any of the other products designed and manufactured by SPI Supplies, contact your local representative or directly to SPI Supplies at the address above, or visit **www.2spi.com**

- Carbon and Sputter Coaters
- Osmium Plasma Coaters
- Ion Mills
- Plasma Etchers/Cleaners
- High Vacuum Bench Top Evaporators
- Critical Point Dryers
- Electron Microscopy Supplies, Consumables and Accessories

Warranty

The SPI Supplies unit you have purchased is guaranteed to be free of defects in workmanship on the day of shipment. This warranty covers parts and labor for a period of one year, excluding shipping charges or consumables. Breakage of glassware is specifically excluded from this warranty.

Proper use of your unit, according to the operation manual, should result in trouble-free operation. Any improper use of the SPI Supplies unit through modifications or unreasonable operating procedures will void this warranty.

Disclaimer

SPI Supplies instruments are designed for simplicity of installation and operation. This manual provides full and complete information in both these areas. SPI Supplies therefore assumes no liability or responsibility of any kind for damage or injury resulting from incorrect installation or operation of the machine.

If any questions arise, call SPI Supplies from the USA/Canada 1-800-2424-SPI or 1-610-436-5400 for assistance. For all other countries, contact our nearest agent or SPI Supplies directly. A listing of our agents may be found on our website at:

http://www.2spi.com/info/agents/

1 Contents

1.1 Manual Layout

This Operation Manual is divided up into the following major sections, each section dealing with specific topics, as follows:

Section 1 – Contents

Section 2 - Health and Safety

General section which applies to all SPI Supplies products detailing the very important issues of Health and Safety applicable when using sample preparation equipment.

Section 3 - Introduction

Introduces this manual.

Section 4 - General Description

Identifies each of the equipment items and provides an overview of their functions and how they work.

Section 5 - Installation

Instructions on how this Instrument should be installed and the connections which should be made between the equipment items.

Section 6 - Operation

Instructions on how to start-up and run the instrument.

Section 7 - Maintenance

Instructions on routine maintenance checks and determining if the system is functioning correctly. Information on how to identify faults in the system and how to rectify these faults.

Section 8 – Technical Diagrams

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2 HEALTH AND SAFETY

Safety is very important when using any instrumentation and all users of our equipment should read this section.

This section of the Manual applies to all specimen preparation equipment supplied by SPI Supplies, not just the particular instrument for which the manual refers.

Included in this section are details on warning notations and good working practices.

2.1 Safety Policy

This section contains important information relating to all health and safety aspects of the equipment. As such it should be read, and understood, by all personnel using the instrument whether as an operator or in a service capacity.

SPI Supplies is committed to providing a safe working environment for its employees and those that use its equipment.

SPI Supplies regularly reviews its operations to make environmental, health and safety improvements in line with applicable legislation.

The equipment has been designed as a free-standing instrument. SPI Supplies cannot be held responsible for any damage, injury or consequential loss arising from the use of its equipment for any other purposes, or any unauthorized modifications made to the equipment.

All service work carried out on the equipment should only be undertaken by suitably qualified personnel. SPI Supplies is not liable for any damage, injury or consequential loss resulting from servicing by unqualified personnel. SPI Supplies will also not be liable for damage, injury or consequential loss resulting from incorrect operation of the instrument or customer modification of the instrument.

2.2 Service

2.2.1 Disclaimer

All service work on the equipment should be carried out by qualified personnel. SPI Supplies cannot be liable for damage, injury or consequential loss resulting from servicing from unqualified personnel.

SPI Supplies will also not be liable for damage, injury or consequential loss resulting from incorrect operation of the instrument or modification of the instrument.

2.2.2 Operators and Service Engineers

A normal operator of the equipment not trained in or qualified for service work on the equipment and may cause a hazard to himself/herself or others if such work is attempted. Operators should therefore restrict themselves to the normal operation of the equipment and not remove covers from the electronic equipment or dismantling of the instruments, or otherwise attempt to thwart the intent of the safety interlock system.

Service Engineers who are suitably trained to assess and isolate electrical, mechanical and vacuum hazards should be the only personnel who access the equipment.

2.3 Hazard Signals and Signs

2.3.1 Hazard Signal Words - Definitions

WARNING
Warnings are given where failure to observe the instruction could result in injury or death to people.

CAUTION
Cautions are given where failure to observe the instructions could result in damage to the equipment associated equipment and process.

Figure 2.1 - Sample Hazard Warning Symbols

	WARNING **Do NOT remove the instrument cover without first ensuring the unit is unplugged.**

Figure 2.2 - Typical Warning sign as shown in this Manual

	CAUTION **Do NOT depress button "P" as this will change the program.**

2.4 Good Working Practices

It is essential that good hygienic working practices are adopted at all times especially in an ultra high vacuum or cleanroom environment and are generally of the “Common sense” type. Some simple good practice rules are:

- If in doubt, don't.
- If in doubt, ask.
- When handling solvents wear face mask, gloves, apron and work only in a well ventilated area.
- Mop up any spillages immediately, using procedures appropriate for the spilled material.
- When handling or decanting mineral oils wear protective clothing.
- Aerosols of mineral oils, such as that produced by gas ballasting, can prove to be hazardous and an exhaust is recommended.
- Before attempting to service electrical apparatus, isolate from the mains.
- Treat all unknown substances as hazardous.
- Dispose of substances in an appropriate manner.
- Use the correct tool for the job.
- Keep a straight back and bend from the knees when lifting heavy objects.
- Wear protective clothing when using liquid nitrogen.
- Affix pressurized gas cylinders firmly to walls or racks. Use the correct regulating valves on gas cylinders and always transport cylinders using the appropriate specialist trolley.
- Obey safety regulations regarding lifts, hoists and machine tools.
- Always make sure you understand a procedure well before attempting it for the first time.

2.5 Plasma Prep III Process Controller Specific Potential Safety Hazards

The following Safety Hazards are specific to the SPI Supplies Plasma Prep III Process Controller

CAUTION
Be sure to keep all gas inlets clean, and free of any debris.

3 INTRODUCTION

This manual provides installation, operation and maintenance instructions for the **Plasma Prep III Process Controller**. You must use the Plasma Prep III Process Controller as described in this manual.

Note that the servicing and maintenance procedures should only be carried out by qualified service personnel and it is essential that all users should read the ***Health and Safety*** section of this manual.

3.1 Return of Goods

If goods are to be returned to SPI Supplies for repair or servicing the customer should contact SPI Supplies or their local distributor before shipment. A "Return Authorization Number" should be obtained in advance of any shipment. This number is to be clearly marked on the outside of the shipment. To obtain an RA#, contact our Customer Service Department and be sure to provide us with the following details:

* SPI Invoice Number and Invoice Date (if applicable)
* Method of shipment if applicable (post office, UPS, FedEx, Air Freight, etc.)
* Product(s) in question
* What is wrong with the product, or why do you want to make this return?

This can also be done expeditiously through the SPI Supplies website at:

http://www.2spi.com/return_number.html

For returns outside the United States, contact either your closest SPI Supplies agent (see http://www.2spi.com/info/agents/) or SPI Supplies in the USA by phone (1-610-436-5400), fax (1-610-436-5755), or by email (spi3spi@2spi.com).

3.2 Returns Procedure

Warranty Claim

All components are sold with a **return to factory warranty** (unless otherwise stated), which covers failure during the first 12 months after delivery.

Returns must be sent courier paid, SPI Supplies will cover the return courier costs. This covers defects, which arise as a result of a failure in design or manufacturing. It is a condition of warranty that equipment must be used in accordance with the manufacturers instructions and not have been subjected to misuse. This warranty does ***not*** cover consumable items or glassware. To make a claim under the terms of this warranty provision contact the Customer Service Department at SPI Supplies.

Chargeable Repairs

Contact the Customer Service Department at SPI Supplies to obtain an estimate of repair costs.
Service of equipment is generally completed within twenty working days after receipt of the equipment. A minimum evaluation fee is normally applied. Additional fees are charged as a per hour repair rate in addition to parts.

Returns

All returns to SPI Supplies are required to follow the procedure described above in Section 3.2. All returned items are required to have a Return Authorisation Number, which can also be obtained at www.2spi.com/return-number.html.

Packaging and Shipping

All goods shipped to the factory must be sealed and packed in a suitable carton. If the original packaging is not available SPI Supplies should be contacted for advice. **DO NOT SHIP ANY GLASSWARE ASSEMBLED INSIDE THE UNIT.** SPI Supplies will not be responsible for damage resulting from inadequate returns packaging or contamination of delicate structures by stray particles under any circumstances. All non-warranty goods returned to the factory must be sent courrier, pre-

paid. They will be returned courrier, pre-paid and added to the final invoice unless otherwise arranged.

4 DESCRIPTION

4.1 Overview

The SPI Supplies Plasma Prep III Process Controller is an add on module to the Plasma Prep III Plasma Etcher and the Plasma Prep III Plasma Cleaner table-top plasma chemistry reactors. This simple-to-operate instrument expands the capabilities of these instruments by allowing the flow and blending of up to two different process gasses, as well as a timing function which automatically ceases the plasma process once the preset time has been reached.

4.2 Technical Specifications

Model No.	Plasma Prep III Process Controller (SPI# 11052-AB or AX)
Weight	10 lbs / 4.5 kg
Height	7 inches / 18 cm
Width	9.5 inches / 24.5 cm
Length	14 inches / 36 cm
AC Power	100 to 240 V AC, 50/60 Hz
Gas Introduction	Gas inlets for connection with compressed gas cylinders

4.3 Controls and Indicators

4.3.1 Front Panel

Figure 4.4.1 – Front Panel

"POWER" – Controls the main power to the Plasma Prep III Process Controller.

"GAS 1" Flow meter – Controls the amount of gas that is flowing from the gas source connected to the GAS 1 inlet.

"GAS 2" Flow meter – Controls the amount of gas that is flowing from the gas source connected to the GAS 2 inlet.

"TIME DISPLAY" – Displays the process time in HH:MM:SS.

"SELECT" – Used to program the desired process time. Pressing it toggles between seconds, minutes, and hours on the Time Display.

"UP ▲/ DOWN ▼" – Used to set the desired process time.

"ENTER" – Stores the current process time and gas source(s) into memory.

“CLEAR” – Clears the memory of the stored process time and gas source(s).

“RECALL" –Recalls the last stored process time and gas source(s).

“READY” – Readies the process controller, and interlocks it with the Plasma Prep III system. The Process Controller is then engaged when the RF power on the Plasma Prep III is turned on.

“GAS 1” – Turns the flow from the GAS 1 inlet on and off.

“GAS 2” – Turns the flow from the GAS 2 inlet on and off.

4.4.2 Rear Panel

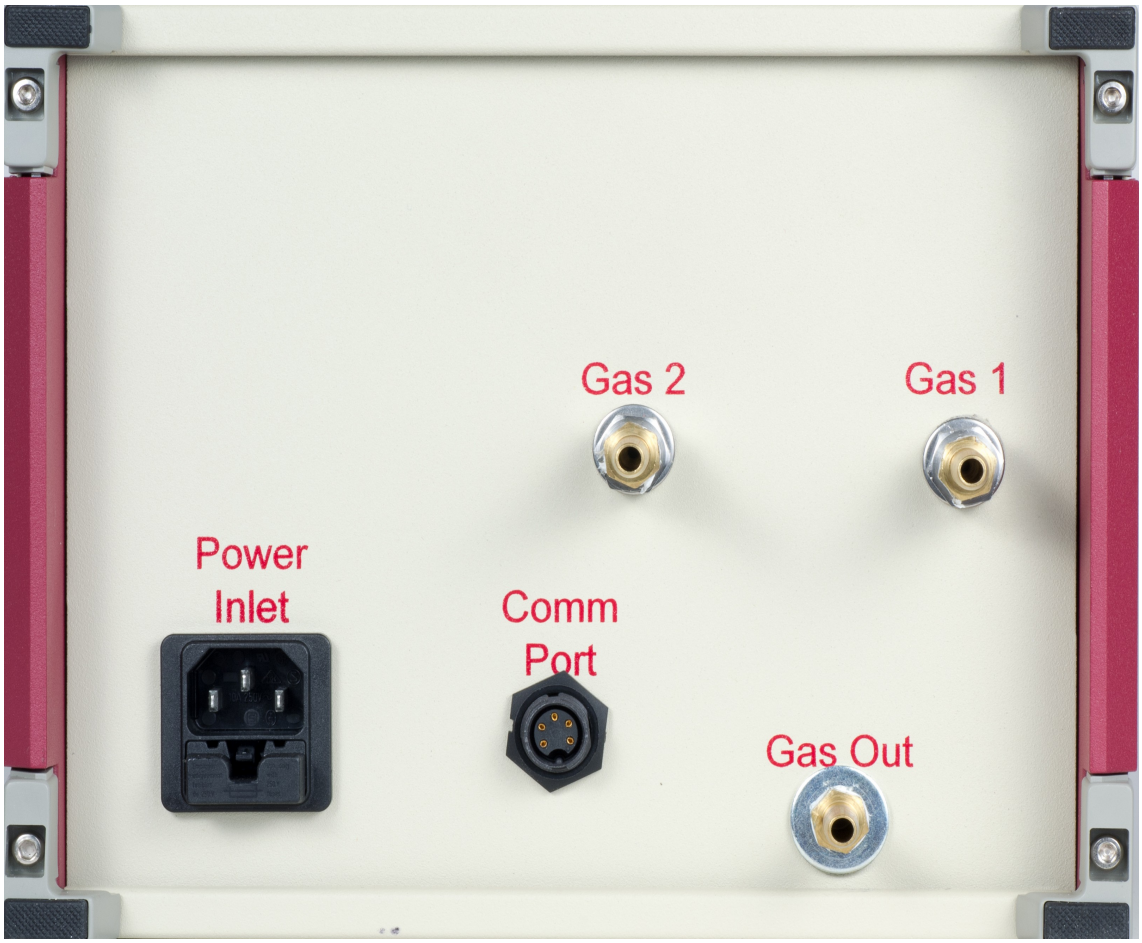


Figure 4.4.2 – Rear Panel

"POWER INLET" – This is where the power cord is plugged into the unit.

"COMM PORT" – This is where the communication cable is plugged into the unit. The other end of the cable connects to the Plasma Prep III

"GAS 1" – This is the gas inlet for the first process gas.

"GAS 2" – This is the gas inlet for the second process gas.

"GAS OUT" – This is where the gas line into the Plasma Prep III connects to the Process Controller.

5 INSTALLATION

5.1 Site Requirements

There are very few constraints on the location of the Plasma Prep III Process Controller. For convenience, it should be placed on top of, or near the Plasma Prep III. The machine should be far enough away from high voltage equipment to prevent possible high voltage interference. Finally, please ensure the you have the following available:

1) Gas supply – choice of process gas(es), with approved regulator(s) capable of supplying 5 PSIG and shut off valve
2) 100 to 240 V AC, 50/60 Hz, 15 amp service

5.2 Assembly

The only assembly required is to connect the power cord, communication cable, and gas lines.

5.3 Connecting the Process Gas

Connect the regulated gas supply hose(s) to the quarter-inch fitting GAS 1 and/or GAS 2 inlets located at the rear of the instrument. Connect the included gas supply hose from the GAS OUT on the Plasma Prep III Process Controller to the GAS IN on the Plasma Prep III.

5.4 Connecting the Communication Cable

Connect the supplied communication cable to the COMM PORT on the back of the Process Controller. Attach the other end of the cable to the Plasma Prep III COMM PORT located on the rear of the unit.

6 OPERATION

6.1 Overview

The Plasma Prep III Process Controller is designed to allow for precise, repeatable plasma processing conditions.

6.2 Operation

Turn the POWER switch to the ON position.

Power on the Plasma Prep III, following the directions in the Plasma Prep III manual.

Select the desired gas(es) to use, and press the coresponding GAS button (Note that the appropriate light will light up under the button(s)).

Once the vacuum level on the Plasma Prep III has reached ~ 250 mtorr, adjust the flow meter(s) for your selected gas(es) to obtain a steady chamber pressure of ~ 350 mtorr. Once the proper chamber pressure has been obtained, press the RF button on the Plasma Prep III, and utilizing the POWER and TUNING knobs, set the desired plasma condition. Press the RF button again to turn the plasma off.

Press the SELECT button to set the process time. The seconds will flash, and the light under the seconds portion of the Time Display will illuminate. Using the UP / DOWN arrows, set the desired number of seconds for the process. Pressing the SELECT button again will move illuminate the light under the minute portion of the Time Display. Use the UP/ DOWN arrows to set the number of minutes. Pressing the SELECT button a third time will illuminate the light under the hours portion of the Time Display. Use the UP / DOWN arrows to set the appropriate number of hours. Pressing the SELECT button again will go back to setting the number of seconds on the Time Display. Once the desired time has been entered, press the ENTER button to store it and the selected gas(es) into memory.

Press the READY button. The Process Controller is now ready to run.

Start the plasma process by pressing the RF Power button on the Plasma Prep III. The timer will now begin to count down.

Once the timer reaches 00:00:00, the plasma process will stop, and the vacuum valve to the chamber will be closed.

If this is the end of the process, vent the chamber and remove the sample by following the directions in the Plasma Prep III manual.

If the sample is to be run again, press the VACUUM button on the Plasma Prep III to re-evacuate the chamber.

Pressing the RECALL button will recall the conditions of the last run. Once vacuum has been achieved, pressing the RF button on the PPIII should bring the RF power level back to previous levels and the timer started. To change the conditions, press the SELECT button to set a new process time, and follow the instructions above.

Note – the last set of conditions is saved to memory even after the Process Controller is turned off.

If the Plasma Prep III is to be used without the timer function of the Plasma Prep III Plasma Controller, select the process gas(es) by pressing the appropriate button(s), and then press the RF button on the Plasma Prep III to start the plasma. This will require the plasma to be manually stopped by pressing the RF button again at the end of the process cycle.

Mixing gases

The Plasma Prep Process Controller allows the user to run two different gasses, or to mix two gasses into the PPIII. This is done by adjusting the control flow meters on the process controller.

A) Introduce GAS 1 and adjust the flow meter to the desire position and related pressure as observed on the pressure gauge on the PPIII.

B) Introduce GAS 2 and wait until the pressure has stabilized. Adjust the flow rate on gas to to be proportional to the that of GAS 1 at the desired range.

C) Adjust both GAS 1 and GAS 2 to get to the desired proportional levels.

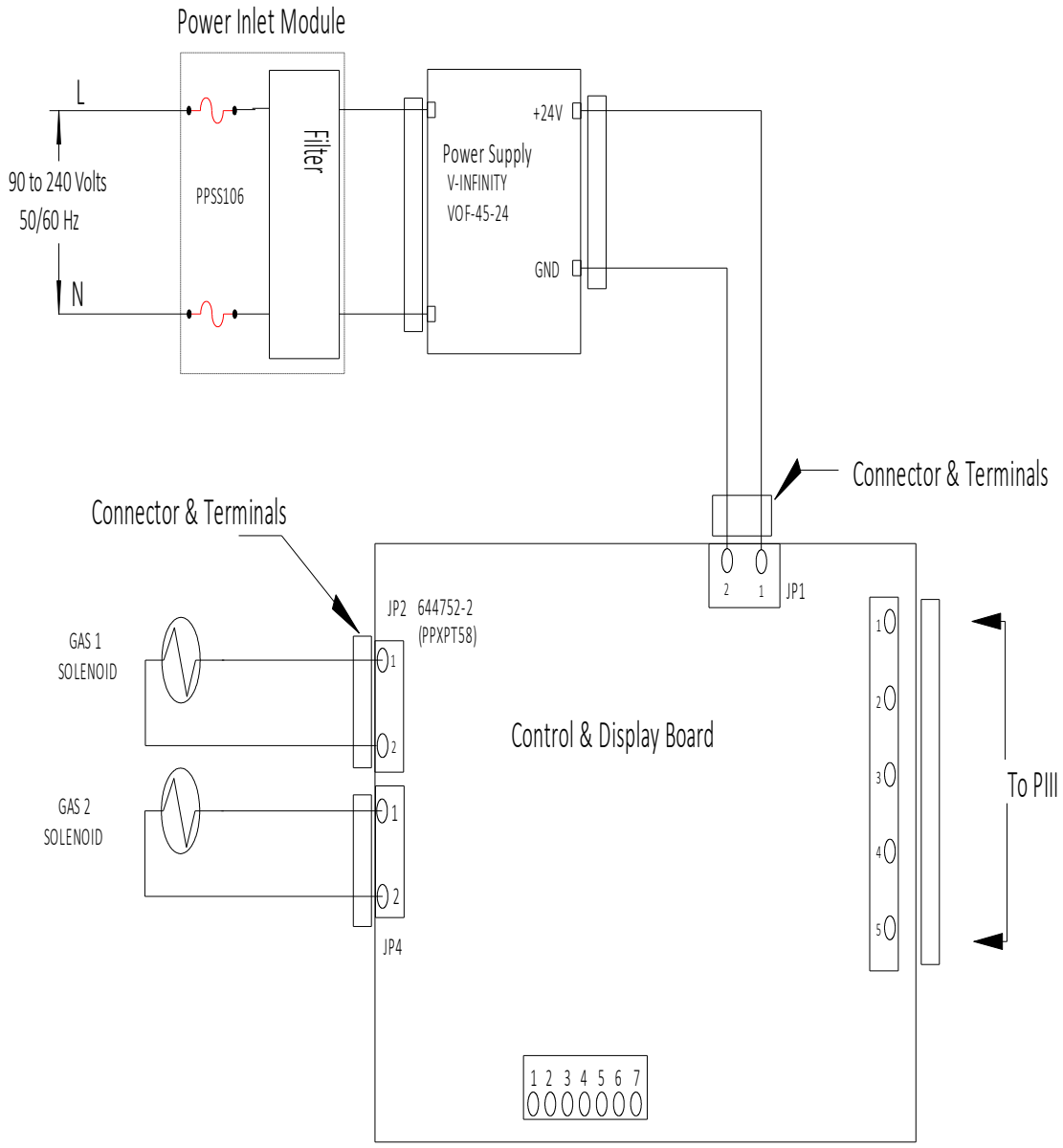
Example: An etching recipe calls for a mixture of two gases at a two to one ratio. Setting GAS 1 flow rate at 40 and GAS 2 flow rate at 20 should yield that ratio. Keep in mind that adjusting one or the other gas input may require readjustment of the second gas.

7 MAINTENANCE

7.1 Overview

The Plasma Prep III Process Controller is system designed for easy routine maintenance and should provide many years of service if routine procedures are used. Maintenance on the Plasma Prep III Process Controller consists of ensuring that the gas ports are free of any obstructions. Any other repairs should be performed by SPI Supplies qualified technicians.

8 TECHNICAL DIAGRAMS



Electrical Schematic for Process Timer for PPIII

Figure 8.1 – Process Controller Wiring Diagram