

# Plasma Preen Cleaner/Etcher & Controls

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## Safety Notice

A thorough familiarity with all operating guidelines is essential to safe operation of the product. Failure to observe safety precautions could result in poor performance, damage to the system or other property, or serious bodily injury or death.

The following symbols are intended to call your attention to two levels of hazard involved in operation:



CAUTION

Cautions are used when failure to observe instructions could result in significant damage to equipment.



WARNING

Warnings are used when failure to observe instructions or precautions could result in injury or death.

The information presented here is subject to change without notice.

## 1.0 Introduction

This manual provides information on installing and operating your Terra Plasma Preen Cleaner/Etcher and Controls.

By studying this document carefully, you can be assured of a long, efficient service life from the unit.

## 2.0 Description

The Plasma Preen Cleaner/Etcher uses microwave energy (2.45 GHz) to generate a plasma that cleans organic and some inorganic contaminants from a wide range of components and materials, including semiconductors, ceramics and metals.

The complete Plasma Preen system consists of three modules.

### Plasma Preen Oven

The Plasma Preen Oven is a Litton microprocessor-controlled microwave oven that uses the relevant digital control functions to operate all plasma cleaning functions. The Plasma Preen system also has an analog power control feature that is added to give a wider control range of plasma power. Although the microwave oven no longer comes under the original manufacturer's warranty, the original manufacturer is confident to warrant the magnetron for 10 years as it is modified by Terra Universal.



**! WARNING:** Although a microwave oven is one of the safest appliances manufactured, it must be operated according to the original manufacturer's instructions. Study the Litton Guide to the Electronic Touch-Control Microwave Oven thoroughly before attempting to operate the Plasma Preen.

The Plasma Preen operates by flowing a process gas (usually oxygen or argon) at reduced pressure (about 1 torr) through the process chamber and exciting the plasma discharge with the microwave energy from the microwave



oven. This process produces ionized gas species and free radicals within the gas; these active species sputter and/or react with the work within the chamber.

Because this process occurs in the gas phase under reduced pressure, little material is consumed or discharged. Reactions occur at the work surface (gas-solid interface) and are subject to the geometrical constraints this arrangement introduces. For example if two flat parts are bonded together, the area attacked will be the narrow bond line exposed to the plasma.

Microwave generation allows you to control process temperatures between 25° and 200°C. Low process temperatures enable you to clean a wide variety of sensitive components without worrying about heat damage.

The Plasma Preen is available in two versions: a barrel reactor and a water-cooled unit (for applications with temperature-sensitive work, for better temperature control, and for a larger reactor chamber). This water-cooled unit is needed in many applications because much of the plasma power eventually gets dissipated as heat that can damage sensitive parts. For processing heat-sensitive components, it becomes necessary to limit the average plasma power (which slows the reaction rate) or to “heat sink” (thermally dissipate) the work in a water-cooled unit. Water used to cool these units is normally supplied by Terra Universal's Water Recirculating System.

Either design can be operated with oxygen, argon, or other process gas (see “Application” chart). In general, argon is suitable for applications that involve epoxy-bonded surfaces since it will not “sputter” epoxy. It is also the preferred medium for removing metal oxides. Oxygen, because it attacks epoxy, should be used selectively in the presence of epoxy bonding. It is, however, ideal for cleaning contaminants from ceramic or oxide parts.

The optional ion trap protects very sensitive materials (such as laser diode facets or soft solder) from the sputtering action of the plasma. This trap serves a dual function: it neutralizes the charged ions (leaving only neutral radicals to perform the cleaning action), and it acts as a Faraday cage that shields work from microwaves inside the chamber.

## **Plasma Preen Controller (TUI Cat. No. 9505-17)**

The Controller is specifically designed to simplify operation of the Plasma Preen by giving you complete control over vacuum and gas pumping. It includes separate “on/off” rocker switches for the pump power and system vacuum, as well as dual flow meters and pressure regulators for the incoming gas. It also allows you to vent the vacuum inside the chamber following processing, so that the processing chamber can be safely opened.

## **Plasma Preen Water Recirculating System (TUI Cat. No. 9505-16)**

This system is designed to enhance operation of the Water-Cooled Plasma Preen. By providing continuous water circulation, it allows the Plasma Preen to deliver high process rates for extended periods of time without generating high temperatures that could damage sensitive parts.

The heart of this system is a submersible water pump with a bottom screened inlet. To operate, you simply place this pump in a 5-gallon utility pan; it pumps water into the cooling coil of the Plasma Preen; water is then returned to the utility pan, where it reenters the pump.

The system lets you pump up to 1,500 gallons per hour, assuring you adequate circulation to keep the Plasma Preen process chamber within your required temperature limits. The oil-cooled motor has automatic overload protection and pumps with water level as low as 3/16". The light-weight, corrosive-resistant thermoplastic housing is clean and rugged, making this pump suitable for a wide range of operating environments.



**CAUTION: Under no circumstances should the temperature of the water circulating inside the pump be allowed to exceed 120° F (48° C) or damage to the pump and/or Plasma Preen could result. Because this water serves as a heat sink, it must be allowed to cool to room temperature following extended use of the**



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Plasma Preen (generally, continuous use of longer than about an hour). Always check to make sure that water temperature remains in the safe range and that the water level does not fall below the intake of the pump.

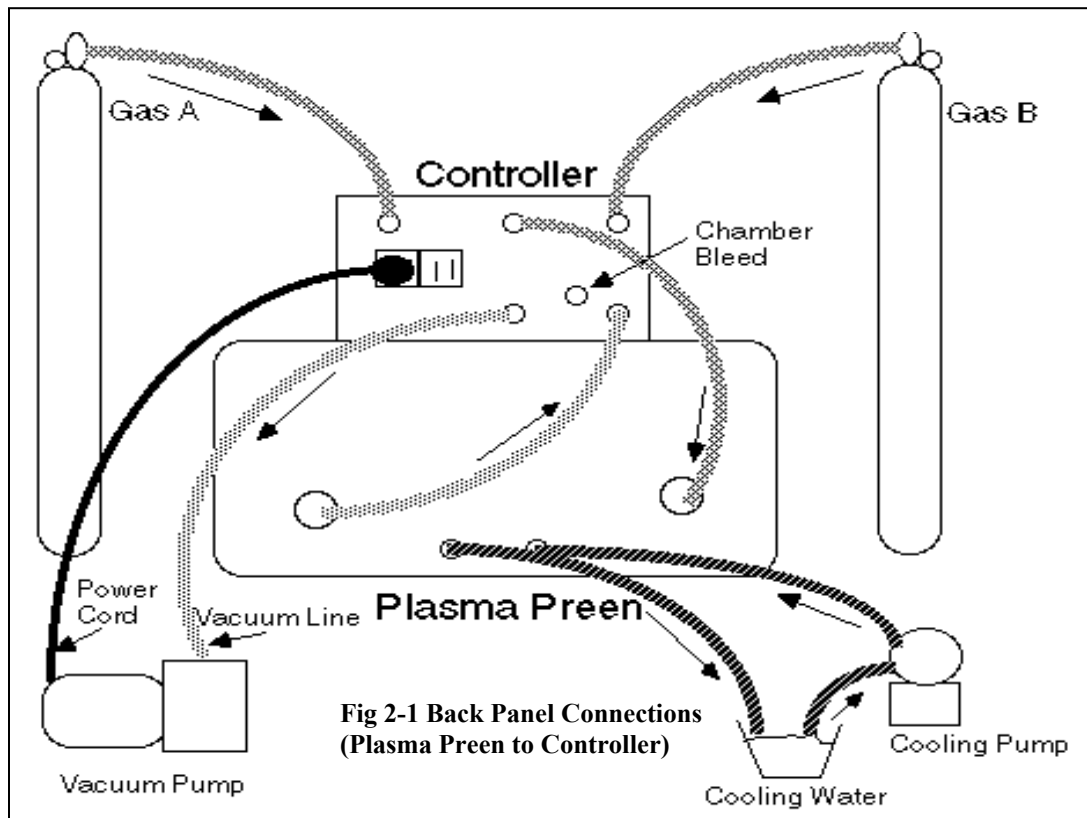
## 3.0 Installation

Carefully unpack the Plasma Preen and all system modules and look for any visible sign of damage. All damage should be reported according to the shipping agreement. Check to make sure that you have received all optional equipment, as indicated on the packing list. Be careful not to throw away any equipment with the packing materials!

**NOTE:** Be sure to complete and return the Litton registration card located inside the Plasma Preen Reactor, so that the manufacturer can contact you if necessary.

### Water-Cooled Reactor

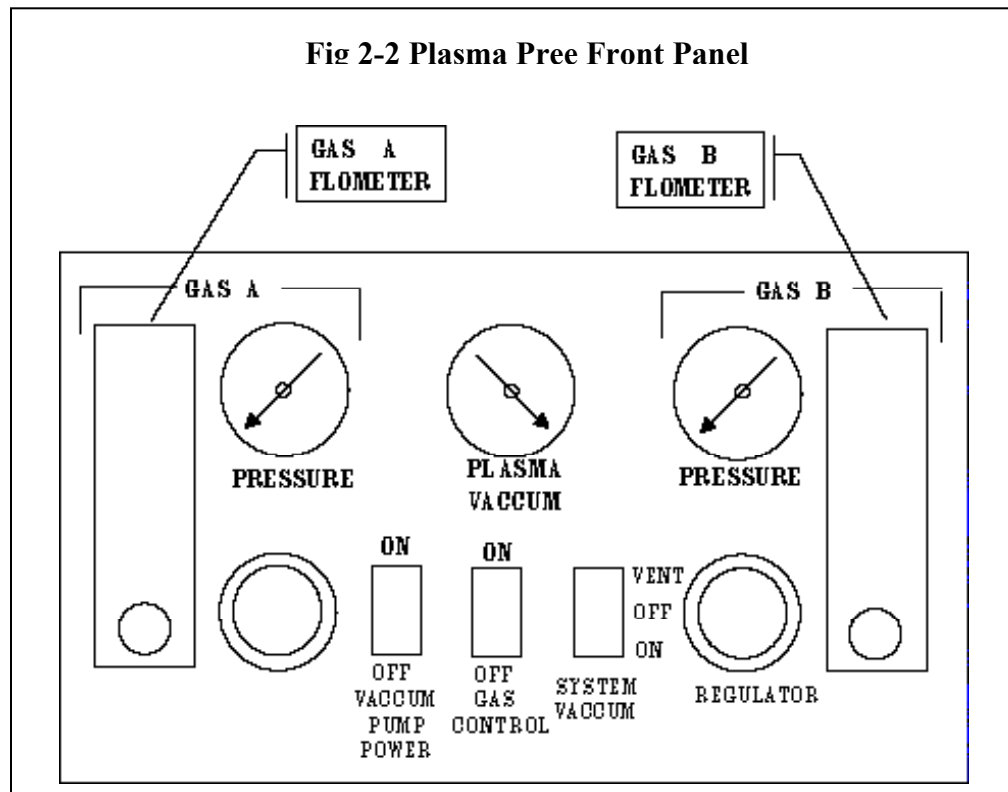
To set up the Water-Cooled Reactor:



1. Remove the bell jar and its contents from the inside of the Plasma Preen unit. The Plasma Preen is shipped with the vacuum tube (3/8" O.D. Aluminum tube) and water tubes (1/4" O.D. copper tubes with brass fittings) disconnected. Reconnect the vacuum tube and water tubes to the appropriate fitting in the rear of the unit using two wrenches to prevent the fittings from turning. Use one wrench inside the unit (5/8" for the brass water lines and 3/4" for the silver colored vacuum line) and one outside the unit (9/16" for the brass water lines and 11/16" for the vacuum line) to tighten the fittings. Mount the bell jar, open side down, on the gasket and on top of the base plate.



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- Place the unit in a location of your choice, but be sure to leave at least one inch of clearance at the top and three inches on each side to assure proper ventilation and access to the controls.
- Connect the Plasma Preen system to a vacuum pump with a capacity of at least 5 SCFM, capable of pumping down to 50 microns.
- If the vacuum pump was purchased from Terra Universal, remove the plastic plug nearest the motor, located on top of the pump, and screw in the handle. Point the pump exhaust (the rubber end of the handle has a 1/4" hole in the end which is the pump exhaust) toward the motor. Remove the large brass cap from the top of the pump inlet and screw in the copper and brass vacuum lines or attach a rubber vacuum line directly to the fitting. Tighten the flare nut securely with a 7/8" wrench. Connect the short length of rubber tubing to the vacuum line of the Plasma Preen system.
- Plug in the vacuum pump. The ON/OFF switch is located at the end of the vacuum pump motor. The pump switch should be left ON so that the power to the vacuum pump can be operated by the controller

**! CAUTION:** If your pump is oil-lubricated, make sure that it is filled with oil before you begin operation. You should not use an oil-lubricated pump in the presence of oxygen; instead, use a Terra Universal pump specially designed for non-combustible operations (Cat. No. 9505-11).

- Connect the controller, Plasma Preen unit, vacuum pump, water recirculating pump (if applicable), and gas bottles as shown in Figure 2-1. All air connections use Poly-Tite fittings; other connections use the connectors described in step 1 above.





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7. **Water Recirculating System:** if your configuration includes a water recirculating system, make sure that the holding pan contains enough water to cover the inlet of the recirculating pump. The more water you use, the longer you can operate the system without overheating.



**CAUTION:** Under no circumstances should the temperature of the water circulating inside the pump be allowed to exceed 120° F (48° C) or damage to the pump and/or Plasma Preen could result. Because this water serves as a heat sink, it must be allowed to cool to room temperature following extended use (generally, continuous use of longer than about an hour).

**Always check to make sure that water temperature remains in the safe range and that the water level does not fall below the intake of the pump.**

8. Plug the domestic model into a standard 110 to 120 VAC, 15 amp properly grounded outlet. For the export model, plug the unit into a 220 VAC/50Hz grounded outlet. A tone sounds once the unit is plugged in.
9. **NOTE:** If the unit has been stored in an extremely cold area, wait a few hours before plugging it in.
10. To ensure proper air flow, DO NOT remove the feet from the bottom of the unit.
11. If your system does NOT include the Water Recirculating System, connect the water lines to a water source and drain. The water inlet and outlet tubes are interchangeable. The unit requires a minimal water flow of about 0.3 gallons/minute.

## Barrel Reactor

### To set up the Barrel Reactor:

1. Open the door to the Plasma Preen and remove the literature inside. Locate the inner chamber and place it inside the outer chamber (all inside the unit). Connect the vacuum line to the copper vacuum tubing on the rear left side of the unit. If the vacuum pump was purchased from Terra Universal, set it up as described above.
2. Make all necessary gas and vacuum connections as described in step 6 above (see Figure 2-1).
3. Plug the domestic model into a standard 110 to 120 VAC, 15 amp properly grounded outlet. For the export model, plug the unit into a 220 VAC/50Hz grounded outlet. A tone sounds once the unit is plugged in.
4. **NOTE:** If the unit has been stored in an extremely cold area, wait a few hours before plugging it in.
5. To ensure proper air flow, DO NOT remove the feet from the bottom of the unit.

## Safety Information



**WARNING:** To reduce the risk of burns, electric shock, fire, injury to persons or exposure to excessive microwave energy, study these points before attempting to operate your Plasma Preen system.

1. Read all instructions before using this equipment.
2. Read and follow the specific "Precautions to Avoid Possible Exposure to Excessive Microwave Energy" guidelines below.



3. Install the Plasma Preen in such a way that you allow sufficient air circulation around the rear of the unit. Install it on a stable base where it will not fall or get wet. If the unit is water-cooled, make sure that the water lines are tight and secure.



**WARNING: THIS UNIT MUST BE ELECTRICALLY GROUNDED! Connect it only to a properly grounded outlet (see "Grounding Instructions" below).**

4. **DO NOT** run the unit with the bell jar at atmospheric pressure or without gas glowing throughout the reaction chamber (i.e., under "no load" condition) unless you are using the timer feature. Although short periods of no-load operation will not damage the unit, this procedure is not recommended.
5. **DO NOT** operate the unit if it has a damaged cord or plug, if it is not working properly, or if it has been damaged or dropped. Electric shock, fire or other hazard may result.
6. The unit should be serviced by qualified service personnel only.
7. **DO NOT** cover or block any opening on the oven, or fire may result.
8. **DO NOT** use the unit outdoors, or damage to the unit or electric shock may result.
9. **DO NOT** immerse the cord or plug in water, or electric shock may result.
10. Keep the cord away from heated surfaces, or electric shock may result.
11. See door surface cleaning instructions (under "Maintenance") to ensure a positive door seal.
12. Should materials inside the unit catch fire, keep the door closed, turn the unit off, and disconnect the power by pulling out the plug or shutting off the power to the unit at the fuse box or circuit box.
13. **DO NOT** use the unit for storage. **DO NOT** leave paper products, books, or other combustibles inside the unit in case it accidentally turns on.
14. **DO NOT** run the unit with metal parts external to the vacuum chamber.
15. Be certain the vacuum chamber is at atmospheric pressure before attempting to open it up.
16. The Plasma Preen unit has a built-in light filter which filters 90% of the light. **DO NOT** look at the glowing plasma at close range for extended periods of time or eye strain may result.
17. Treat the vacuum chamber as you would any large piece of glass.
18. **DO NOT** use incompatible gases (such as hydrogen and oxygen mixtures) in the reaction chamber.
19. **DO NOT** run the water-cooled unit at full power in the CW mode for more than 15 minutes at a time without a water flow. This will prevent overheating of the base plate.
20. **DO NOT** allow the temperature of the water circulating inside the water recirculating pump to exceed 120° F (48° C) or damage to the pump and/or Plasma Preen could result. Always check to make sure that the water temperature remains in the safe range and that the water level does not fall below the intake of the pump.



**CAUTION:** The glass vacuum chamber can become hot when operating at full power 100% duty cycling. Take proper precautions when handling the hot glass.

#### Precautions to Avoid Possible Exposure to Excessive Microwave Energy:

1. **DO NOT** attempt to operate the Plasma Preen unit with the door open: open-door operation can result in harmful exposure to microwave energy. It is very important not to defeat or tamper with the safety interlocks.
2. **DO NOT** place any object between the unit front face and the door or allow soil, cleaner or residue to accumulate on the sealing surface.
3. **DO NOT** operate the unit if it is damaged. It is particularly important that the oven door close properly and that there is no damage to the (1) door (check for bending, warping); (2) hinges and latches (make sure they are not broken or loosened); (3) door seals and sealing surfaces (make sure they are clean); or (4) the fittings in the rear of the unit (make sure they are tight).
4. The unit should not be adjusted or repaired by anyone except properly qualified service personnel.

#### Grounding Instructions

1. The Plasma Preen system must be grounded and connected to the same ground as the vacuum pump. In the event of an electrical short circuit, grounding reduces the risk of electric shock by providing an escape wire for the electric current. Both the Plasma Preen and the Plasma Preen Controller are equipped with a cord having a grounding wire with a grounding plug; the plug must be connected to an outlet that is properly installed and grounded.



**WARNING:** Improper use of the grounding plug can result in a risk of electric shock.

2. Consult a qualified electrician or serviceman if the grounding instructions are not completely understood or if doubt exists as to whether the unit is properly grounded.
3. If it is necessary to use an extension cord, use only a 3-wire extension cord that has a 3-blade grounding plug, and a 3-slot receptacle that will accept the plug on the unit. The marked rating of the extension cord must be equal to or greater than that of the unit.

## 4.0 Operation

**NOTE:** Instructions below assume some familiarity with the operation of the microwave control panel. If you are not familiar with these functions, refer first "Microwave Control Panel Functions" below.

#### Plasma Preen Controller

1. Before operating the system, make sure that objects to be cleaned are properly positioned beneath the bell jar.

Lift the bell jar with a metal or plastic tool or by the handle attached to the chamber, taking care not to scratch the rubber gasket, and hang the front edge on the hook provided. (For the Barrel Reactor, load the inner chamber with the work to be processed and insert it into the outlet chamber). Place the work inside of the process chamber, and cover the work with the bell jar by releasing the hook.





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2. Turn "Vacuum Pump Power" switch ON. **NOTE:** This switch turns on power to the outlets on the rear of the controller, thereby activating the vacuum pump and the water pump. Make sure that the power connections to these pumps are properly connected to these outlets, and that the utility pan of the water pump has sufficient water. You should hear the pumps operate as soon as you flip this switch.
3. Adjust the regulator pressure to between 20 and 30 PSI. **NOTE:** If you are using two gas sources, adjust both regulators to read the same level of pressure.
4. Turn the "System Vacuum" switch ON (by flipping the 3-position rocker switch to the "up" position). The vacuum gauge should rise to 30" Hg.
5. Turn the "Gas" switch ON.
6. Adjust the flowmeter until it reads approximately 2 SCFH. **NOTE:** If you are using a gas mixture, you will need to adjust both flowmeters until you receive the gas mixture you require. (For a 50%/50% mixture, both flowmeters should read the same.)
7. Set the power level on the microwave oven to 100% by turning the control knob (located on the right side of the oven) completely in the clockwise position.
8. Press "COOKTIME" and then set the microwave timer for the "# SEC" desired. Then, press the "START" switch on the key panel. You should now see the contents of the process chamber glow.
9. When the glow stops, shut the power on the controller "OFF."
10. Shut the "Gas Control" OFF.
11. Flip the "System Vacuum" switch to the VENT (bottom) position. The vacuum gauge should drop to 0" Hg.
12. Open the door to the process chamber. Lift the bell jar by the handle and place it on the retainer hook.

## Microwave Control Panel Functions

This section explains how to set and operate the following control features of the microwave key panel:

**Multi-Wave Energy Distribution System:** Produces an even distribution of microwave energy inside the plasma cavity.

**Touch Control Panel:** 100% solid-state panel allows easy, accurate settings. A tone sounds when the pad is pressed to indicate that information has been entered.

**Variable Duty Cycle and Analog Power Control:** Allow maximum flexibility in setting the correct plasma condition for almost any type of job.

**Time of Day Clock:** Indicates the time of day when programmed.

**Delay Start:** You can program the start of operation up to 12 hours in advance (including run time) and walk away.

**Recipe Saver:** Saves a frequently used process time and duty cycle level which can be recalled as often as you need it.



## Operation of the Control Panel

### 1. Setting the Time of Day Clock

After plugging in the unit or after a power outage, the display will be blank. If wet, the time of day will always be displayed when no other function is operational. If the time of day clock is not set, a colon will appear in the display for 5 minutes after operation; then the display will be blank. To check the time of day when programming your unit or during unit operation, push the CLOCK pad. Time of day will be displayed until the START pad is pushed.

### 2. Setting the Clock

Push CLOCK pad. The clock indicator light will come on. If you are changing the time of day clock while it is already operating, no changes will occur in the display window. Push CHANGE/CANCEL pad once. If you are setting the clock for the first time, no change will occur in the display window.

Set the time of day by punching the appropriate number pads. The time you set will appear in the display window. Push the START pad. The time of day clock will not be activated until the start pad is pushed again. The time will change in one-minute increments.

### 3. The Touch Control Panel

Your Plasma Preen system has a simple touch control to allow complete flexibility and convenience for operation. You can program the unit at one time for operations with two processing steps. The tone that sounds after Memory 1 is complete can be used to remind you to change other parameters such as gas or analog power level. Because there are no buttons or knobs on the panel, it is easy to keep clean.

## Changing or Canceling a Program

You can change or cancel any processing step at any time by pushing the CHANGE/CANCEL pad once to change the entry appearing in the Display Window or twice to cancel an entire program.

The unit is equipped with a series of indicator lights to let you know where you are in the processing sequence. Each indicator light is explained below. The indicator lights can be seen along the top and bottom of the display window.

**NOTE:** Some of the microwave oven functions are not used in the Plasma Preen system. These functions are indicated by an asterisk (\*) symbol.

The ANALOG POWER CONTROL KNOB is located on the right hand side of the unit. It is equipped with an indicator dial where 100 corresponds to 100% power and 0 corresponds to about 100 watts of power.

- A. Memory Indicator Light:** Indicates the number of memory levels programmed or the memory level being displayed.
- B. Power Level Indicator Light (For Duty Cycle Control):** Is ON when the Power Level appears in the display window.
- C. Power Level Pad:** Used to select or check the Power Level or Duty Cycle Level setting (based on a 12-second interval).
- D. Time Pad:** Push to set Process Time.



- E. **Number Pads:** Push to enter Run Time, Duty Cycle Power Level, or Timer.
- F. **Timer:** Push after entering Time and touching Power Level Pad to use unit as a timer with no microwave energy being generated.
- G. **Change/Cancel Pad:** Push once to change what appears in the display window. Push twice to cancel all programming.
- H. **Start Pad:** Push to start unit.
- I. **Clock Indicator Light:** ON when Time Of Day appears in the display window.
- J. **Delay Start Indicator Light:** Activated when Delay Start is in use.
- K. **Delay Start Pad:** Push to set Delay Start feature.
- L. **Recipe Saver Indicator Light:** ON when Recipe Saver is in use.
- M. **Recipe Saver Pad:** Use to program, check or activate Recipe Saver.

## **Process Controls: Determining Process Time**

When programming the duration of processes, start with the shortest time and add more if needed. Check the work to make certain that it is not being over-processed. A good starting time is 3 minutes.

The front door can be opened at any time during operation: the unit will automatically stop generating microwave energy and maintain the time setting for 3 minutes until the doors are closed and the Start Pad is pushed.

### **1. Operation**

- a. **OPEN THE DOOR:** The interior light will come on. Set up the work as described in section 3.1 above ("Operation of Plasma Preen Controller").
- b. **PUSH THE TIME PAD:** The colon appears in the Display and the Memory 1 Indicator Light comes on.
- c. **ET THE DESIRED TIME** by pushing the appropriate number pads: the times you set will appear in the Display. To set 1 minute, push 1-0-0. To set 1 minute 30 seconds, push 1-3-0. The duty cycle will be set at 100%.
- d. **TO CHANGE THE DUTY CYCLE (POWER LEVEL),** push the Power Level Pads. The power level indicator light will come on and "HI" (100%) will appear in the display. This is to remind you that the unit will always operate on HIGH unless you select a different Duty Cycle.

If you wish to operate at 100% Duty Cycle push the START pad after setting the time. Otherwise, press another number pad: "1" represents 10%, "5" represents 50%, "8" represents 80%, etc. (The time for a complete ON/OFF cycle is about 12 seconds.)

The number will be indicated in the display. After the duty cycle has been set, press the Start Pad. The interior light will come on and plasma will be generated within the bell jar. Time countdown will commence. When the time is up, a tone sounds 3 times.

### **2. Changing the Time and/or Duty Cycle Setting Before or During Operation**



- a. Time to be changed will show in the display.
- b. Push the Change/Cancel pad once.
- c. Follow the time and duty cycle setting instruction in Step 1 b-d above.

### **3. Timer Operation**

The unit may be used as a count-down timer by setting the duty cycle to zero in the following manner:

- a. Push the timer pad.
- b. Push the desired time by entering the appropriate number pads.
- c. Push the power level pad.
- d. Push the "0" (the number for the timer). "0" will appear in the display window indicating that there is 0% power.
- e. Push the Start Pad: the time will begin counting down in the display window with no microwave energy being generated. When the time is up, a tone sounds three times. The time of day will then appear in the display window.

**NOTE:** If you hear the blower start when the Start Pad is pushed, you have set the timer improperly. Push the Change/Cancel Pad twice and follow steps a-e above.

### **4. Memories**

Two steps for a single process can be pre-programmed using the Memory features. Any combination of time and duty cycle can be programmed. The Memory features automatically change the time and duty cycle settings. A tone will sound to remind you that the Memory is changing. This Memory tone will help you know exactly where you are in your process so you can make any necessary observations or change the analog power setting.

- a. Open the door and set up the work in the vacuum chamber. Close the door.
- b. Push the Time Pad.
- c. Set the desired time by pushing the appropriate number pads: the time you set will appear in the display.
- d. Set the Duty Cycle by pushing the power level pad and then the appropriate number pad.
- e. Push the Time Pad again. The Memory 2 Indicator Light will come on.
- f. Set the desired time by pushing the appropriate Number Pads.
- g. Set the Duty cycle setting by pushing the Power Level Pad and then the appropriate Number Pad.
- h. Push the Start Pad. When the Start Pad is pushed, the first Memory step will appear in the Display. At the end of the first memory, a tone will sound and the Memory 1 Indicator Light will go off. The process will automatically shift to the next memory and the Memory 2 Indicator Light will come on. At the end of the second memory, a tone will sound three times, and processing will stop.



## **5. Memory Operation: Checking Time Settings**

- a. Push the Time Pad. The Memory 1 time will be shown in the display window.
- b. Push the Time Pad again; Memory 2 will be displayed.

Push the Start Pad to start processing.

## **6. Memory Operation: Checking Duty Cycle Settings**

- a. Push the Time Pad. The memory to be checked will appear in the display window.
- b. Push the Power Level Pad.
- c. Push the Start Pad to return to time counting.

## **7. Memory Operation: Changing Time**

- a. Push the Time Pad until the memory to be changed appears in the display window.
- b. Push the Change/Cancel pad once.
- c. Perform operating steps 1 c-d above.
- d. Push the Start pad.

## **8. Memory Operation: Changing Duty Cycle**

- a. Push the Time Pad until the memory to be changed appears in the display window.
- b. Push the Time Level Pad.
- c. Enter the new duty cycle setting by pushing the number pads.
- d. Push the Start Pad.

## **9. Clearing Memories**

- a. Push the Change/Cancel Pad twice. All programs will be cleared.

## **10. Using Delayed Start**

If you want a process to begin at a later time (up to 12 hours after programming), use the Delay Start feature.

- a. Set up the work within the vacuum chamber and turn on the gas flow and vacuum pump.
- b. Check to see that the clock is set for the current time of day. If the time of day is incorrect, follow the appropriate steps outlined above.
- c. Push the Delay Start Pad. The display window will show the colon and the Delay Start Indicator Light will come on.



- d. Set the desired start time by pressing the appropriate Number Pads for the time of day when the process should begin.
- e. Push the Time Pad. The display will show a colon and the Memory 1 Indicator Light will come on. Set the length of the process time by pushing the appropriate number pads.
- f. Set the Duty Cycle by pushing Power Level and then the appropriate number pad. If Memory 2 is being used, repeat steps d-f again.
- g. Push the Start Pad. The time of day will appear in the display window. The unit will start operating automatically at the programmed start time. Counting down operating time will be displayed.
- h. Push the Delayed Start Pad to confirm the starting time, and the Time Pad and Power Level Pad to confirm those settings.

## **11. Using Processing Time Save ("Recipe Saver")**

The Recipe Saver allows you to permanently store frequently used processing parameters. It can also be used to simplify the system's use for people unfamiliar with operation. After programming the Recipe Saver, you can activate it at any time by pushing the Recipe Saver Pad.

A Recipe Saver Program can be changed easily by repeating the programming steps using the new processing setting. If power has been interrupted to the system, the Recipe Saver has to be reprogrammed.

- a. Push the Recipe Saver Pad. The Recipe Saver Indicator Light will come on.
- b. Push the Change/Cancel Pad once.
- c. Set the desired time by pushing the desired number pads. The time you select will appear on the display.
- d. Set the Duty Cycle by pushing the Power Level Pad and then the appropriate number pad.
- e. Push the Start Pad. The time of day, if programmed, will be shown in the display window. The process time and duty cycle are now stored in Recipe Saver.

## **12. Activating the Recipe Saver**

- a. Set up the system for operation and close the door.
- b. Push the Recipe Saver Pad. The Recipe Saver Indicator Light will come on and the process time will appear in the display.
- c. Push the Start Pad. The unit blower will start and the unit will begin operation. Time will count down. When time is up, a tone will sound three times and the unit will shut off. The time of day, if programmed, will appear in the display window.

## **13. Checking the Recipe Saver**

- a. Push the Recipe Saver Pad. The programmed process time will be shown in the display.
- b. Push the Power Level Pad. The programmed Duty Cycle will be shown in the display.





- c. Push the Clock Pad to return the time of day to the display.

## **5.0 Maintenance**

The Plasma Preen Cleaner/Etcher is designed to provide years of low-maintenance performance. It is important, however, to keep the unit clean in order to ensure trouble-free operation. In particular, you should make sure that the front door seal remains clean to prevent the escape of microwave energy from the process chamber.

### **Cleaning Your Plasma Preen System**

1. **DO NOT** use abrasive cleaners, cleaning pads or steel wool because they can scratch or dull the unit's door.
2. Clean the inside and outside with a damp cloth moistened with water. **DO NOT** use solvents because they may damage or discolor the plastic components.
3. Make certain that nothing is blocking the door and the sealing surfaces.
4. You may remove and clean the bell jar as you would any glassware. Use soap and water and rinse thoroughly. Avoid solutions containing hydrofluoric acid as it will weaken the glass. Additional bell jars may be ordered from Terra Universal.
5. The rubber gasket can also be cleaned with a damp cloth. **DO NOT** use sharp objects as they might cut the rubber and prevent the formation of the vacuum seal.
6. Should the unit become contaminated, you can clean it by operating it empty, at full power, for 15 to 30 minutes, preferably using oxygen as the process gas.

### **Replacing the Interior Light**

1. Unplug the system.
2. Remove the access screw in the rear of the unit and then open the panel.
3. Pull the lamp access panel out approximately 3" to expose the lamp.
4. Replace the bulb with a 40 watt (maximum) incandescent bulb.

### **Pump Maintenance**

If the pump you are using requires oil lubricant, change the oil on regular basis to remove accumulated contamination. Pumps with non-combustible lubrication (for operation with oxygen as a process gas) do not require regular maintenance. If trouble develops, call Terra Universal.



## 6.0 Troubleshooting

Use these tips to troubleshoot problems that may develop with your Plasma Preen system. If problems persist, contact Terra Universal.

1. **Problem: Unit stops by itself.**

**Solution:** The line voltage is too low or the unit is improperly grounded. Refer to "Grounding Instructions" above.

2. **Problem: Nothing happens when numbers are pushed.**

**Solution:** You may be pressing the number pads too softly. Remember also that you must press TIME before entering the time setting. Press the CHANGE/CANCEL pad and start again.

3. **Problem: The plasma appears concentrated in one corner of the bell jar.**

**Solution:** Check the vacuum connections and the vacuum tubing for leaks.

4. **Problem: Vacuum pump starts noisily.**

**Solution:** This condition is normal when pumps using a high-viscosity oil are started cold

5. **Problem: Vacuum pump continues to run noisily or gas can be felt exiting from the pump.**

**Solution:** The vent switch on the Plasma Preen Controller is in the open position (close it), or the bell jar is not fitting snugly against the rubber gasket (readjust it)

6. **Problem: No reaction occurs or the reaction rate is too slow.**

**Solution:** Increase the work temperature by placing a piece of glass between the work and the heat sink (for the water-cooled unit only) and/or increase the analog power or duty cycle.

7. **Problem: Work is getting too hot.**

**Solution:** Heat sink the work better (in the water-cooled unit only) and/or reduce the power or duty cycle. If your system uses the Water Recirculating Pump, make sure that the water is cool (it should never climb above 120°F).

8. **Problem: Solder on the work is sputtering or smearing.**

**Solution:** Follow the suggestions above for reducing the process temperature and/or use the ion trap.

9. **Problem: The vacuum baseplate is getting hot.**

**Solution:** Check the water flow and water temperature of the Water Recirculating Pump (for the water-cooled unit only).



## **7.0 Specifications**

The Plasma Preen Cleaner/Etcher comes in three versions: a barrel-type reactor and two sizes of water-cooled reactors.

### **Barrel Reactor System:**

Chamber Dimensions:	4.1" Diameter x 6.0" Length
Chamber Material:	Pyrex
Overall Dimensions:	21" x 11" x 15"
Plasma Power:	Variable from 100 to 500 Watts

### **Water-Cooled Systems:**

Chamber Dimensions:	8" x 6" x 2" (small model) model
Chamber Material:	Pyrex and aluminum
Overall Dimensions:	21"W x 11"H x 15"D (small) 24"W x 12"H x 15"D (large) Variable 100-700 Watts (large)

### **All Models:**

Frequency:	2.45 GHz
Cycle time:	From 10% to continuous
Electrical:	115VAC/15 amp service grounded
Utilities Required:	Vacuum pump, Gas supply (Oxygen or Argon)



## **8.0 Warranty**

**Products Manufactured by Terra:** Terra Universal, Inc., warrants products that it manufactures to be free from defects for a period of 12 months for parts and 90 days for labor, commencing from the date of shipment. Terra's sole responsibility is to repair or replace, at its option, any part of the product that proves defective or malfunctioning during this time limit. In some cases, components incorporated in Terra Universal products are covered by additional warranties from component manufacturers; obtain specific information from Terra sales representatives. This warranty is void if the equipment is abused or modified by the customer, is operated outside Terra's operating instructions or specifications, or is used in any application other than that for which it is specified. This warranty does not include routine maintenance or service procedures, breakage of quartz baths after 60 days, shipping damage, nor damage from misuse, intentional or unintentional abuse, neglect, natural disasters, or acts of God.

**Products Manufactured by Others:** Terra Universal, Inc., warrants that, to the best of its ability, Terra's representations of products that are manufactured by others reflect the manufacturer's representations, subject to change without notice. Sole warranty for these products is the original manufacturer's warranty that is passed forward to the purchaser and constitutes the customer's sole remedy for these products. Detailed warranties for distributed products are available through Terra sales representatives.

**Freight Shortage or Damage:** Upon receipt of any equipment from Terra Universal, Inc., customer shall immediately unpack and inspect for damage or shortage. The customer shall not accept a damaged package or a short shipment until the carrier makes a "damage or shortage" notation on both the carrier's and customer's copy of the freight bill or delivery receipt. Service title passes when the shipment is loaded, so customer is responsible for filing and collecting a freight claim. Any replacement products must be ordered and paid for separately. For Terra's "Policy and Procedures for Returning Goods," see Terra's Internet site: [www.TerraUniversal.com](http://www.TerraUniversal.com).

Generally, customers can improve the chance of collecting on a freight claim by following these procedures: 1) formally requesting that the carrier inspect the shipment immediately upon suspecting damage or shortage to verify condition; 2) notifying the carrier upon discovery of concealed damage and requesting an inspection within 15 days of receipt, both in person or phone and following up via mail; 3) keeping the shipment as intact as possible, including retaining original packaging materials and keeping the product as close to the original receiving location as possible; 4) holding salvage for disposition by the carrier.

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**Warranty Returns:** All warranty returns must be authorized in advance by Terra Universal and approved under an RMA. Unless approved in advance for good reason, all returns must be in original condition, including all manuals, and must be packaged in original packaging materials. All returned goods are to be shipped to Terra Universal, freight prepaid at customer's expense. See Terra's "Policy and Procedure for Returned Goods."

***Thank you for ordering from  
Terra Universal!***