

**INSTALLATION & OPERATION  
MANUAL  
Plasma Blo<sub>3</sub>ck**

**10 - 20g**



Regular Chassis Configuration



Alternate Chassis Configuration

Appnote Plasma Block 10 -20g V7g  
10/17/17

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**PTI Plasma Block®  
Limited Warranty**

The PTI Plasma Block® unit is warranted by Plasma Technics, Inc®, to the original purchaser to be free from defects in material and workmanship under normal use and service for a period of **FOUR (4) years** from the date of purchase under the following terms and conditions:

The obligation of Plasma Technics, Inc®. is expressly limited to repairing or replacing, at the option of Plasma Technics, Inc®, any PTI Plasma Block® returned to it during the warranty period, which is determined by PTI to be defective in material or workmanship.

Any improper use /operation or installation other than in accordance with the published application materials, instructions and specifications established by Plasma Technics, Inc®. shall void this warranty.

The obligation of Plasma Technics, Inc®. Shall not include any transportation charges, costs of removal or installation, labor charges or any direct, indirect, consequential or delay damages.

Attachment or use of components or accessories not compatible with the PTI Plasma Block® shall void this warranty.

Any alteration not authorized by Plasma Technics, Inc. in writing, accident, misuse, abuse or damage to the PTI Plasma Block® shall void this warranty.

The Plasma Block® subject to this warranty is not warranted as suitable for any particular purpose or use of the purchaser. The suitability of any PTI Plasma Block® for any purpose particular to the purchaser is for the purchaser in the purchaser's sole judgment, to determine. Plasma Technics, Inc®. assumes no responsibility for the selection or furnishing of a Plasma Block® suitable to the purchaser's needs or the purposes of any particular purchaser.

**This warranty is in lieu of any other warranty express or implied, including specifically but without limitation warranties of merchantability or efficacy and of all other obligations or liabilities in connection with the sale or use of the PTI Plasma Block®.**

## Section 2 Safety Considerations

**Oxygen is a fire hazard.**

**Exposure to ozone should be limited (ozone has a distinctive odor).**

**Ozone is a toxic oxidizer, use of it should be controlled.**

**Ozone generators have high voltage and high capacitance.**

Due to these considerations, only experienced individuals should be allowed to operate and work on this equipment.

### **DANGEROUS VOLTAGES ARE ON THIS CIRCUIT BOARD**

To avoid injury to personnel and/or damage to equipment only qualified personnel should perform the procedures outlined in this chapter. This person must understand both the electrical and mechanical components associated with the application.

Thoroughly read and understand the following procedures before beginning the start-up process. The following specific safety procedures must be observed when performing any maintenance or adjustments on the amplifier.

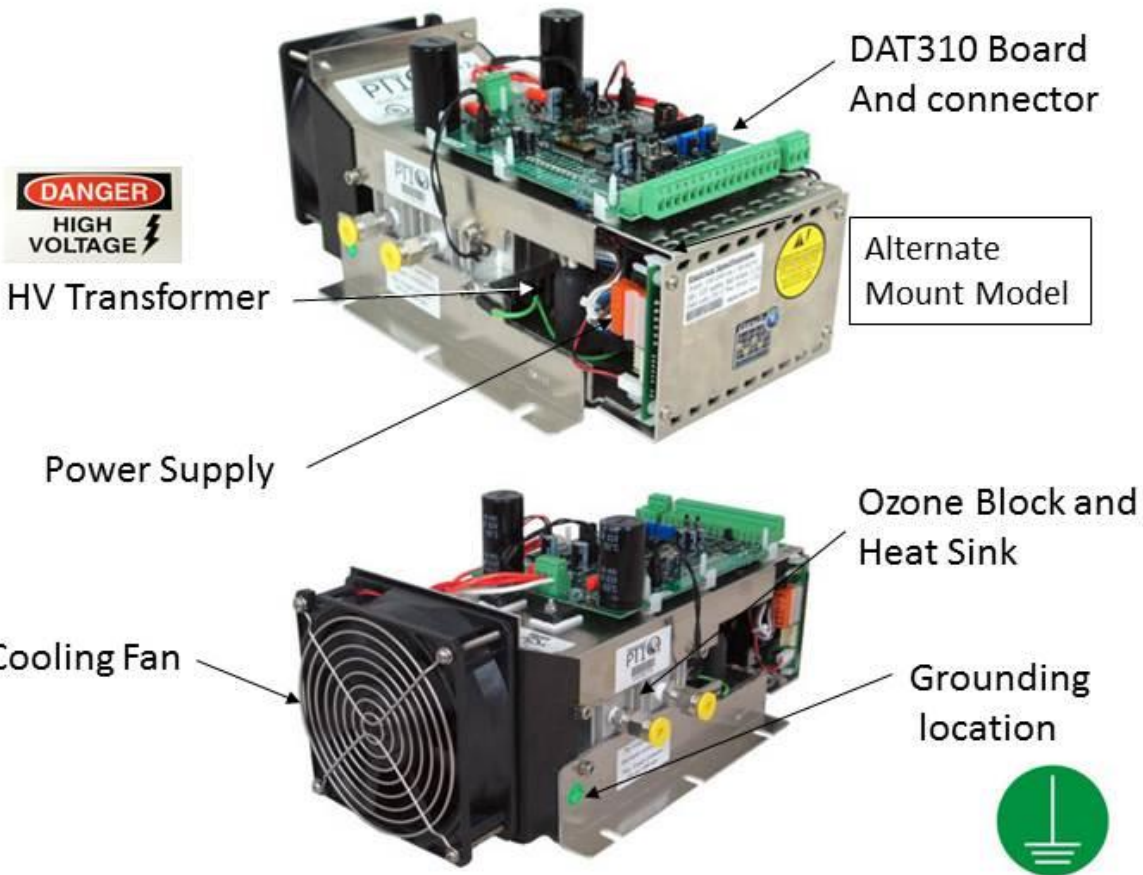
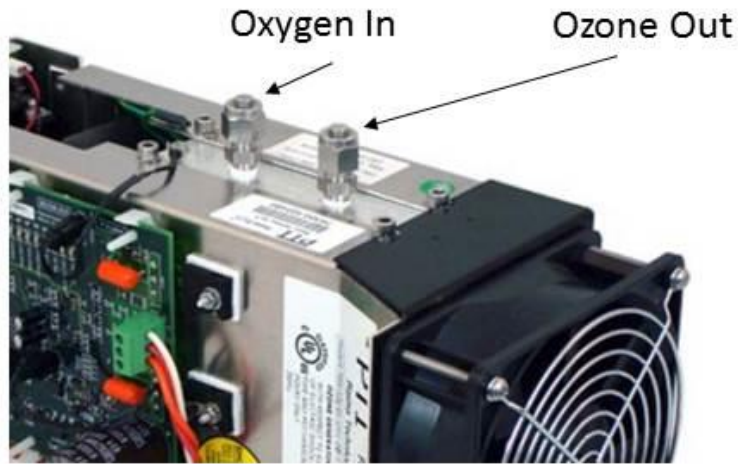
Always turn off and lock out AC power at the main machine disconnects switch. Do this before touching any electrical or mechanical components.

High voltage may be present even with all electrical power supplies disconnected.

Use an appropriate meter to verify that all DC bus capacitor banks have been discharged before working on any equipment. Do not rely exclusively on high voltage RED LED indicator for bus voltage, as dangerous voltage levels may remain even when the indicator is off.

Follow industry recognized safety procedures. Use only one hand to hold test equipment probes, wear approved eye protection, etc. Before energizing the inverter, make sure that device(s) connected to the output of the inverter will not result in injury or damage to equipment. Keep unnecessary personnel out of the immediate work area. Never leave an inverter cabinet open and unattended.

### Visual Product Overview – 10g 20g



## Section 4 General Installation

### General Mounting Requirements

1. Mount to allow O<sub>2</sub> flow meters to work for user feedback. The assembly contains a cooling fan which cools the transformer. Allow 1.25" to 1.5" clearance between the top of the fan and an enclosure surface.
2. Read the nameplate for operating line voltage and current adjustment levels. **Use copper conductors only.**
3. Apply only the line voltage indicated on the nameplate.
4. Ground the plate assembly to service green utilizing star washer. **See installation drawing on the product drawings for possible grounding locations and High Voltage safety considerations.**
5. It is **important** to at least **verify** that the **system is set to the proper pressure**. If the pressure is below 5 psi **DO NOT** apply power. A vacuum condition in the generator cell will cause it to fail.
6. Since the generator is set up for maximum power under varying conditions of mains voltage and gas pressure or flow, if the mains power specified for this generator varies by more than 10% at full load, the inverter must be readjusted as shown in the DAT210 manual.
7. Refer to the "PTI General Application Guide" at [www.plasmatechnics.com](http://www.plasmatechnics.com) Support Tab for additional installation drawings and schematics.

### Mounting Environment

The block should be mounted in an environment that is **free** from the following:

- Corrosive or volatile vapors
- Dust and particles
- Excessive moisture
- Shock, Excessive vibration
- Temperature extremes

The following environmental specifications apply:

Relative humidity: 5 to 90%, non-condensing. Altitude (maximum): 3,310 ft. (1,000 m), de-rating for altitude is 1% for every 300 ft. (100m) above 3000 ft. (1000m).

Mounting can be in **any axis**.

Pressure and flow requirements are the same as all other Plasma Block® products. Connect oxygen feed gas to port labeled INLET. OUTLET should have a flow restriction control downstream to produce an operating pressure range of 5 to 100psi. Oxygen feed should be filtered (.1 microns or less). There should be a pressure sensor on the oxygen INLET and ozone

OUTLET lines to assure a positive pressure at all times. The Plasma Block unit should NOT be engaged if positive pressure is not present.

Allow 1" (2.5 cm) **MINIMUM** of space around the fan and areas which vent cooling air. 2" (5 cm) is better.

Surrounding air ambient operating temperature: 0° to 40° C (32° to 104° F)

No heat inducing stray fields are to be present within 3 feet (1 M) of the unit. These fields can radiate from large motors or large power supplies in the KW range.

### **Wiring Standards and Codes**

The installation person is responsible for following the wiring plan produced by the design engineer for the specific application.

All wiring must conform to the following standards:

National Electrical Code, Publication NFPA No. 70.

All local and national codes which apply. For motor usage; use appropriate NEMA relay for protection.

See Section 9 for electrical operating specifications.

**The supplier cannot assume responsibility for the compliance or noncompliance to any code governing the proper installation of this equipment.**

### **Electrical Connection Wire Sizing and Fusing**

Refer to the Plasma Block® Current/Power Measurement Table on the PTI web site [http://www.plasmatechnics.com/products/support/general-support-and-maintenance-links/Plasma Block Current Power Table](http://www.plasmatechnics.com/products/support/general-support-and-maintenance-links/Plasma%20Block%20Current%20Power%20Table)

See graphs for complete power adjustment data. Use branch circuit fuses suitable for use on a circuit capable of delivering not more than 20 A RMS Slo-Blo, 250 volts maximum. Refer to the National Electrical Code[NEC], Publication NFPA No. 70, Article 310, and any local codes that may apply for wire sizing and selection. Use 60/75°C wire min. Use copper conductors only.

Terminal connection max torque .37 inch lbs [0.5 newton meters (Nm)].

See Section 9 for electrical operating specifications.

### **Case Ground**

Each of the blocks must be connected to ground at their case ground terminal. A grounding electrode conductor or bonding jumper must be connected from the ground terminal to either a grounding electrode buried in the earth or a suitable plant ground with solid connections to earth ground. Refer to NFPA No. 70, Article 250, for details on grounding and grounding electrodes.

## Safety Grounding

The case ground connections should be made at the ground terminals. The case ground of the various system components should be connected to the star grounding bus of the cabinet. A grounding electrode conductor or bonding jumper must be connected from the star grounding bus to either a grounding electrode buried in the earth or a suitable plant ground with solid connections to earth ground. Refer to NFPA No. 70, Article 250, for details on grounding and grounding electrodes.

**The only external connections for control needed are the ON/OFF switch. Note that an OFF contact closure will shut off the inverter even if the ON contact is made. The OFF contact takes priority.**

**All adjustments can be made on the inverter as shown with the jumper positions shown at the INTERNAL CONTROL position. Both VOLTAGE and FREQUENCY are pre-adjusted to your purchase order specifications. Power adjustment is only by the PDM potentiometer for normal operation range 0 – 100%. PDM may be changed from 0 – 10 VDC to 4 – 20 ma. for ozone output control in your final equipment. See the inverter jumper chart in the inverter manual.**

## General Operating Considerations

Refer to the Plasma Block® Current/Power Measurement Table for the proper electrical environment for each product. The table is in the support section on the PTI web site at [www.plasmatechnics.com](http://www.plasmatechnics.com).

1. When AC power is applied, an inrush will occur - this is normal. A typical system will require a 10-amp circuit breaker. If the inverter line voltage will be turned on frequently the relay or switch should be amply sized to prolong its life due to the high inrush current.
2. The Plasma Block® is built with aluminum and ceramic. While aluminum provides maximum safety for applications like water purification, it does react with nitric acid that would be produced if atmospheric air were to be used rather than a concentrate for gas feed. For this reason **ONLY a concentrator or O<sub>2</sub> can be used to provide the feed gas**. To maintain the warranty the feed gas must be at least -60°F dew point and 93% O<sub>2</sub> or more.
3. Important Plasma Block Differences

	Internal clearances	Internal metallurgy	Optimal operating psi
Gen1	standard	none	10 - 20
Gen1 Enhanced	greater than standard	special	10 or less
Gen2	less than standard	special	20 - 30



4. **BEFORE** the system is energized for the first time the Plasma Block® should be pre-dried by flowing the above feed gas for 3 to 5 minutes. If the installed system will be dormant for long intervals then the control system should do a pre-purge to insure the system is dry before power is applied to the cell.
5. **AFTER** when a system is off for an extended period, it is very important to prevent backflow of liquids and gasses through the cell. Backflows void the cell warranty. For example, systems which use a venturi and concentrator must contain a solenoid valve to block gas flow if it is possible that the venturi will be active while the concentrator is off. Purge the unit/cell of all ozone whether turned off for a short or extended period of time.
6. When the Block requires servicing, return it to the factory - DO NOT disassemble. The Plasma Block® is fitted with a tamper label. If the label is broken, the warranty is void.
7. **While it is possible to configure the system to accommodate negative pressures, negative pressures are problematic and tend to cause large power and ozone fluctuations. The most stable and predictable systems occur at positive pressures.**

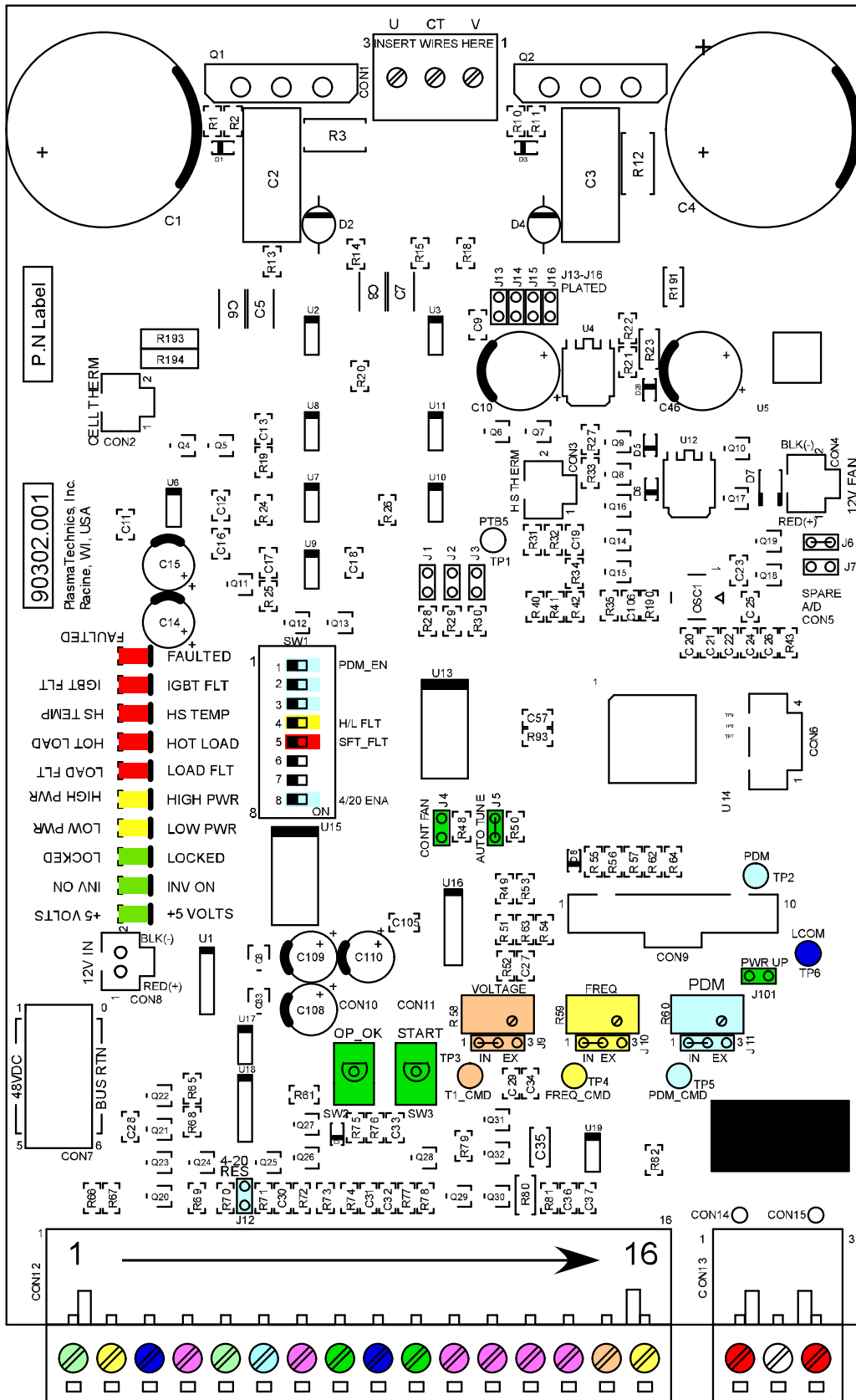
The ozone outlet fitting mounted into the plasma block® mates with other fittings inside of the unit and **must not be removed or changed** to another fitting type. Contact the factory if other sizes or styles are required.

## Section 5 Startup

### Start-up Checklist

To ensure a complete checkout and test, check off each step as it is completed. If the proper event does not occur while performing this start-up procedure, do not continue. Take the appropriate action to correct the malfunction before proceeding.

- Ensure the main disconnect switch is locked off. High voltage may be present even with all electrical power supplies are disconnected. Use an appropriate meter to verify that all DC bus capacitor banks have been discharged before working on any equipment. Do not rely exclusively on RED LED indicator of bus voltage, as dangerous voltage levels may remain even when indicator is off.
- Verify that the inverter mounting has been performed in accordance with the guidelines listed in Section 1.
- Inspect the inverter to verify that all optional modules have been selected and installed according to the system drawings and documentation.
- Verify that all wiring has been installed according to the wiring plan produced by the design engineer and according to the guidelines listed in Section 2 for proper connection, grounding, wire size, labeling, routing and applicable codes. The DAT210 does not have internal fusing. Install input and output (optional) fusing per suggestions in the DAT210 manual (Section 7).
- Verify that all electrical terminals, screws, nuts, and bolts are securely fastened.
- Apply high voltage DC or single-phase AC power to the inverter as specified.
- Check to make sure that the RED Bus voltage LED is on, indicating bus voltage.
- There is an inherent pressure drop associated with each Plasma Block. This can vary depending on the desired flow. Verification of the outlet pressure, at the desired flow, of the Plasma Block is crucial in order to prevent a negative pressure drop in the Plasma Block. This will damage the Plasma Block internals and is not a warrantied repair.



**Plasma Technics, Inc.     DAT310 (rev1)**

Control I/O (low voltage)

AC Power Input

## DAT 310 Status LED description

- +5vdc** Low voltage DC supplies are operational (line voltage applied to unit).
- INV ON** **On solid** – Inverter output enabled. Ozone output per PDM command, if enabled.  
**Flash** - Output enabled via ON command but disabled by PDM < 2ma (4/20). Output is re-enabled if PDM > 3ma, 'INV ON' LED on solid.
- LOCKED** **Flash** – Semi-Automatic tuning is enabled when jumper J5 is removed. Frequency tuning occurs during flash interval. Search rate varies automatically: See switch S8. The Voltage pot is active and should be used to set the desired full power operating level. See: 'Start' button adjustment procedure.  
**ON solid** – Occurs only in 'Auto-Tune mode when Jumper J15 is installed and signals that the proper operating point has been established and 'locked'. The indicator is ON continuously, and only winks off momentarily while a new scan of the operating parameters is conducted.
- LOW POWER** **Flash** – Output current is slightly below the programmed tolerance window. A service request enunciation is placed via the soft fault if switch S5 is ON. No disabling action is taken in this state. If the current continues to drop, the flash will transition to an on steady (solid) mode – see ON solid, below.  
  
Note: It is normal for the LOW POWER LED to flash for a few seconds when a large incremental increase in PDM is commanded. This can be helpful in that it will provide a visual indication that the PDM control input is being stimulated. No enunciation action is taken.  
**ON solid** – Output current to the ozone cell is lower than the allowable programmed window. If sustained, a hard fault will be generated in 32 seconds, which disables ozone production when FAULTED LED is ON solid. This LED will be latched on indefinitely to provide service diagnostics. The latched fault is cleared by either an OFF / ON transition (includes 4/20 off as well) or power cycle.
- HIGH POWER** **Flash** – Output current is slightly above the programmed tolerance window. A service request enunciation is placed via the soft fault if switch S5 is ON. No disabling action is taken in this state. If the current

continues to increase, the flash will transition to an on steady (solid) mode – see ON solid, below.

Note: It is normal for the LOW POWER LED to flash for a few seconds when a large incremental decrease in PDM is commanded. This can be helpful in that it will provide a visual indication that the PDM control input is being stimulated. No enunciation action is taken.

**ON solid** – Output current to the ozone cell is higher than the allowable programmed window. If sustained, a hard fault will be generated in 32 seconds, which disables ozone production when FAULTED LED is ON solid. This LED will be latched on indefinitely to provide service diagnostics. The latched fault is cleared by either an OFF / ON transition (includes 4/20 off as well) or power cycle.

■ LOAD FAULT

**ON solid** – Possible flooded cell, shorted cell or open transformer connection.

■ HOT LOAD

**Wink** – Cell temperature is slightly above programmed limit. No disabling action is taken in this state. If the temperature continues to increase, the wink will transition to a flash (longer duty cycle than wink) – see below. During this mode the processor is reducing the PDM level automatically in an effort to lower the cell temperature. This of course also reduces ozone output.

**Flash** – Cell temperature continues to rise. PDM is controlling power to hold cell temperature constant in an effort to produce some ozone and remain online. This elevated temperature will not damage the cell. A service request enunciation is placed via the soft fault if switch S5 is ON. No disabling action is taken in this state. If the temperature continues to rise, the flash will transition to an on steady (solid) mode – see ON solid, below.

**ON solid** – The ozone cell temperature is higher than the allowable programmed window. If sustained, a hard fault will be generated in 32 seconds, which disables ozone production when FAULTED LED is ON solid. This LED will be latched on indefinitely to provide service diagnostics. The latched fault is cleared by either an OFF / ON transition (includes 4/20 off as well) or a power cycle.

■ HS TEMP

**Wink** – Heat sink temperature (electronics) is slightly above programmed limit. No disabling action is taken in this state. If the temperature continues to increase, the wink will transition to a flash (longer duty cycle

than wink) – see below. During this mode the processor is reducing the PDM level automatically in an effort to lower the heat sink temperature. This, of course, also reduces ozone output.

**Flash** – Heat sink temperature continues to rise. PDM is controlling power to hold cell temperature constant in an effort to produce some ozone and remain on line. This elevated temperature will not damage the cell. A service request enunciation is placed via the soft fault if jumper J4 is in place. No disabling action is taken in this state. If the temperature continues to rise, the flash will transition to an on, steady (solid) mode – see ON solid, below.

**ON solid** – The heat sink temperature is higher than the allowable programmed window. If sustained, a hard fault will be generated in 32 seconds, which disables ozone production when FAULTED LED is ON solid. This LED will be latched on indefinitely to provide service diagnostics. The latched fault is cleared by either an OFF / ON transition (includes 4/20 off as well) or power cycle.

■ IGBT FAULTED

If a short circuit is present on the inverter output, sophisticated electronic circuits instantly disable the effected power section. If this occurs over too many cycles, the output is disabled and a fault is enunciated.

■ FAULTED

**Rapid Flash** – signals a **SOFT FAULT** via open collector to terminal #11. **Switch S5 must be ON for this mode to be active.** A soft fault up to 32 seconds in length can be produced by any one of the following: cell operational current signature, high or low current, high instantaneous current in the output power section, over temp in the electronics or cell. A hard fault will **not** be latched or reported as a hard fault if the fault self-corrects within 32 seconds.

Both cell and electronics over temp conditions invoke an automatic closed loop turndown control of the PDM function that results in a constant, but elevated, cell temp. This condition can be sustained indefinitely. If the system can manage the event, no hard fault is delivered. The soft fault is continuous. **This is a summons for service.** Ozone production is curtailed, but not disabled.

**On solid** - signals a **HARD FAULT** via terminal #11 (pulls low). Ozone production is OFF; the nature of the fault is latched and enunciated.

## Start Up and changing the factory power configuration (If needed)

### DAT 310 Power Adjustment

By altering the 'Voltage' setting, you can easily modify the full power operational point if need be. Remember that the purpose of the PDM control is to provide a turndown from the 100% power set-point established by the 'Voltage' pot. Adjustment is very easy and would likely be desired if it is determined that the Plasma Block® has much more ozone output than the application requires. You would know this if, for example, the closed loop control from an ORP unit always had the PDM adjusted to a very low value of current, like 6-10ma. For the sake of discussion, let's say we would like to adjust the 10g product from its normal 130w level down to 100w.

1. **Apply a current clip** to one of the AC power wires, terminals 1 or 3 of Con13.
2. **Switch S1 OFF**. This forces 100% output.
3. **Verify current** level at factory setting, which at 120vac should be per table: about 1.1a. If this does not agree try another amp meter, or better yet, a power analyzer. An inexpensive and surprisingly accurate power meter can be purchased for \$25-\$35: UPM model EM100 or Kill-A-Watt from P3 International.
4. **Switch S5 OFF**: fault enable. This will prevent any faults, such as current out of window, from shutting down the unit while it's being adjusted.
5. **Pull jumper J5**, which will select the Semi-Auto mode and allow the 'Voltage' pot to be observed.
6. **Adjust 'Voltage' pot** to desired value using the table below as a guide (J16 set to IN). Ozone levels alone can also be used if they are lower. The processor continues to optimize other aspects of the tuning process as indicated by the **occasional wink** of the 'Locked' LED. Additionally, the processor will not allow excessive levels to be commanded if that may endanger any of the unit's components. If the 'Voltage' control is increased excessively, and a safety limit is reached, the **'HS temp' and 'HOT load'** LEDs will **flash rapidly** in an alternating manor. Simply **reduce** (CCW) the voltage **control** to an acceptable level of current and the LEDs will extinguish.
7. Lock in the new set-point by **pushing the 'Op\_OK' button** per the description found in the section titled 'programming current and operating power level'. This permanently stores the new parameters in the processors memory and causes a reboot of the unit.
8. Switch S1 and S5 to ON. Reinstall J5. Re-enable by cycling the inverter OFF and ON.

You should now observe that the PDM level (power control) being commanded from the ORP unit is much greater, hence making the control loop more stable.

#### Power Level Table:

	120/60208/60240/60220/50				
Model	Watts	Amps	Amps	Amps	Amps
10g	100	.86	.52	.47	.48
10g	115	.98	.58	.52	.56
10g	130	1.10	.65	.58	.62

**DEFAULT**

20g	235	1.97	1.16	1.02	1.10	
20g	250	2.10	1.22	1.08	1.17	<b>DEFAULT</b>
20g	265	2.22	1.30	1.13	1.22	Must be in a cool environment

### Saving operating power configuration in memory

Method of setting "expected power" value and "tolerance" value (for running the "high power and low power" fault detection) is as follows:

Have inverter off for about 4 seconds to allow "offsets" filters to stabilize.

Turn inverter on, tune it up, making sure PDM duty cycle is at least 67%. A 100% PDM duty cycle is best, if the system can tolerate the resulting power level.

Allow inverter to run at desired operating point for at least 4 seconds.

Push "OP\_OK" button, and see two yellow LEDs come on. (This LED display pattern will remain, as long as you hold the button in for less than 5 seconds.) Release the button, and the two yellow LEDs blink slowly, indicating a loose tolerance of 40% on "expected power" for high-power and low-power detection.

Push "OP\_OK" button a second time, until you see the two yellow LEDs being on together. Release button, and blinking rate is medium, indicating medium tolerance of 20% for "hi/low detection."

Push "OP\_OK" button a third time, until you see the two yellow LEDs on together. Release button, and blinking rate is fast, indicating tight tolerance of 10% for "hi/low detection."

Push "OP\_OK" button a fourth time, until you see the two yellow LEDs being on together. Release button, and blinking rate is slow, indicating we're back to the "loose" tolerance level of 40%.

Select the desired band by the above process. 20% is the recommended default.

Now push "OP\_OK" button, and hold it in for more than 5 seconds, and you'll see two RED LEDs come on. Release the button, and all of the LEDs come on --> the inverter has computed an 'expected power' value, a 'tolerance' value, and has stored the values in on-chip FLASH, then did a power-down / power-up sequence.

If you held in the "OP\_OK" button for more than 5 seconds (so you get the two RED LEDs), and then released it, but you DON'T see the "power-up" flashing pattern of lights, then the software did not modify either the "expected power" nor "tolerance" data values. Try again.

#### Safety issues in the software:

1. If inverter is off, you can get the "two yellow LEDs" and "two RED LEDs" display patterns (by pushing the button "less than 5 seconds" or "more than 5 seconds"), but then nothing happens when you release the button. (Neither the "expected power" value nor the "tolerance" value is modified.)



2. If inverter is on, and you've set up a "tolerance" level (with a "less than 5 seconds" button push), but then don't do any follow-up button pushing, the whole "set up average power" stuff goes back to "idle" after a 60-second time-out.
3. If the inverter is on, and you did not first set up a tolerance value (with a "less than 5 seconds" button push), and then you try setting "expected power" (with a "more than 5 seconds" button push), the software will not modify any "expected power" or "tolerance" values.
4. If the PDM is set to something less than 100%, the "expected power" is computed by scaling the observed power level by  $1/(\text{PDM duty cycle})$ . In other words, if duty cycle is 80% when the OKAY button is held in for more than 5 seconds, the "expected power at 100% PDM" would be computed as  $\text{expected power} = (\text{observed power at 80\% PDM}) \times 1.25$ . But if the PDM duty cycle is less than 66%, the extrapolation might start to give bad values for "expected power at 100% PDM" and then the inverter's "expected power" values are not modified at low PDM settings.
5. If, when accounting for the PDM duty cycle, the software thinks that the computed "expected power" value would be higher than 0xFF (i.e., larger than what an 8-bit byte can hold), the maximum allowable power supply value will be substituted for expected power.

### Setting the power level without a meter, via the 'Start' switch

1. Check that J5 is removed. (This is the jumper plug that is most distant from the two pushbuttons.) Note: If J5 is installed, the inverter is set up to run "fully automatic" mode, not "semi-automatic".
2. Check that the jumper plug near the "T1\_CMD test point" is in the proper position for your "voltage" command level. For instance, if using the Voltage potentiometer on the board, the jumper should be in the INT position. If using an external potentiometer or PLC, the jumper should be in the EXT position.
3. Check that your system can tolerate having the inverter operate at full power for several minutes (PDM will be at 100% duty cycle).
4. Turn the inverter on. Look for the "INV ON" LED to be lit. Note: This procedure will not work unless the HS TEMP indicator is blinking.
5. Push the START button for a time interval between 2 and 4 seconds. (During this push, the HIGH PWR, LOW PWR, and LOCKED lights will all light up in a flashing pattern.)
6. When you release the START button, the "HS TEMP" indicator will blink once per second. Note: This setting procedure will only work if the HS TEMP indicator is blinking.
7. If the LOW PWR indicator is lit up, turn the Voltage pot "up" slightly. Then wait for 5 seconds to see how things stabilize. If using the Voltage potentiometer, turn it CW 1/2 turn, then wait 5 seconds. If the LOW PWR indicator continues to be lit (or blink), continue to turn the Voltage pot up slightly, and wait 5 seconds after each change, until the LOW PWR indicator goes dark.
8. If the HIGH PWR indicator is lit up, turn the Voltage pot "down" slightly. Then wait for 5 seconds to see how things stabilize. If using the Voltage potentiometer, turn it CCW 1/2 turn, then wait 5 seconds. If the HIGH PWR indicator continues to be lit (or blink), continue to turn the pot down slightly, and wait 5 seconds after each change, until the HIGH PWR indicator goes dark.

9. When you are "close" to the proper point, both the HIGH PWR and LOW PWR indicators will be dark. Turn the Voltage pot "up" slightly, until the HIGH PWR indicator starts to blink. Note the control's setting (or the screwdriver position). Turn the Voltage control "down" slightly, until the LOW PWR indicator starts to blink. Note the control's setting (or the screwdriver position). Put the Voltage pot setting midway between the "HIGH PWR blink" and "LOW PWR blink" positions. This will be very close to the proper power level.
10. Push the START button for approximately 2 to 4 seconds. (The HIGH PWR, LOW PWR, and LOCKED lights will all light up in a flashing pattern.) The "HS TEMP" indicator will stop blinking. If you don't do this step, then when 2 minutes elapsed since the last time you adjusted the Voltage, the "HS TEMP" indicator will stop blinking on its own. This confirms that the unit is operating at the proper frequency.

## **Section 6      Shutdown Procedure**

- (1) Shut off ozone
- (2) Continue oxygen flow
- (3) Shut off AC input to unit
- (4) Shut off oxygen flow
- (5) Shut off water cooling if being used
- (6) Verify backflow prevention methods are functional

## **Section 7      Technical Support**

Technical support is available by telephone daily (Mon – Fri 8am – 5pm Central Time Zone) at Plasma Technics Inc. 262-637-7180.

Online Support is available 24/7 thru the PTI web site [www.plasmatechnics.com](http://www.plasmatechnics.com) (Support Tab / Installation and Operation Manuals AND / OR Training/Instructional Videos). The pdf manuals and videos cover most of the typical customer support questions. The pdf manuals are downloadable.

## **Section 8      Maintenance and Return Procedure**

Product returns for repair/maintenance should have an RMA number clearly displayed on the packaging.

Call PTI at the number above to assign a specific RMA number to a return. RMA numbers are assigned to each individual unit being returned. Have the following information ready...

Unit type

Serial number

Model number

Your contact info

## Section 9 Specs and Features

- **All high voltage is safely contained completely within the Plasma Blo<sub>3</sub>ck© thereby eliminating shock hazards and dirt build up which can cause dangerous flash over. High voltage wiring is booted and all metal grounded. Directly installable by UL 508a panel house.**
- Advanced design eliminates the possibility of ozone leakage from the body or fittings. The only ozone leak possible is at the customer tightened ozone fitting. All non-metal materials are ozone rated.
- **Micro Channel®** design results in high concentration, reduced high voltage levels and more efficient operation. **Requires concentrator or bottle feed of at least -60°F dew point, filtered (.1 microns or less), positive pressure oxygen.** Materials in the gap are: **ceramic and aluminum.**
- Precision machined aluminum block eliminates inefficient hot spots and facilitates operation at **high pressures**, as well as **vacuum ride through**. Only 1 psi drop with 10 LPM. Flow. As with any cell, the most predictable performance occurs in the positive pressure domain. Maximum pressure 100 psi. 2.7 safety factor at 150 psi.
- Ozone level automatically controlled to ± 1% from 85 to 130vac; or 170v to 260vac depending on model.
- Pre-mounted, seasoned and tested package sub-system, which includes cell, transformer, inverter and fan. Design uses the finest quality material and machining for maximum performance and efficiency.
- Military grade conformal coating eliminates problems associated with condensation and mold as well as greatly retarding damage caused by accidental ozone exposure.
- The inverter is a reduced power version of PTI's popular DAT210. All control and interface features of the DAT210 are available in this product. The 10g, 20g, and 26g units have a DAT310 PCB with similar features.
- **23 kHz** operating frequency for **silent** operation. 10g 120/240 VAC, 50/60 Hz, 1.52 amps; 20g 120/240 VAC, 50/60 Hz, 3.0 amps.
- **Inlet 3/8", Outlet 3/8" both Stainless Compression** are standard; 1/4" or 1/4" NPT on request.

Pre-seasoned, calibrated and **pre-adjusted to customer's individual performance needs** – ready to **install**. Rigorous 100% performance and burn-in tests of all electricals are conducted to insure the highest level of product **quality, reliability and consistency**.

## Section 10 Performance Graphs

### Performance Measurement Technique

PTI's flow bench utilizes tank supplied oxygen, delivered through pressure regulators. Our customer's most often use oxygen concentrators and their feedback confirms the notion that ozone production is equal to or better than PTI's published data using pure oxygen. We use bottled oxygen because many customers require products set to pressures in the range of 20 to 100 psi.

Flow is measured at the cell inlet via both Rotameter and mass flow. **Inlet flow devices** are on the oxygen side at **test pressure**, which implies the Rotameter must be corrected to standard LPM for proper sizing of the concentrator. PTI's mass flow meter corrects for 100% oxygen as well as gas pressure and temperature.

All pressure readings are psig and are measured at the distribution manifold outlet and inlet to minimize any pressure drop errors caused by higher flow rates.

Ozone flows from the Plasma Block® under test into the flow bench, and has its flow rate controlled by precision needle valves. From this point on, ozone is essentially at atmospheric pressure. An ozone side stream is encouraged to travel into the analyzer at a rate of about 1 lpm, but is still at atmospheric pressure. A filter is also in-line with the analyzer inlet to prevent any possibility of fouling. All ozone leaves the flow bench at atmospheric pressure.

PTI has chosen the simple Rotameter method of performance presentation in the hope of simplifying the total process. Once a one-time correction is accounted for and the concentrator is sized, the actual running system will agree with PTI's published data, because virtually all installations use simple, inexpensive, air-calibrated Rotameters.

#### Equipment List:

Power by one of the following: Yokogawa WT110, Magtrol 5100, Fluke 43B, Fluke 41B.

Flow: Key Instruments Rotameters, Mass Flow TSI 4043 (with gas temp and absolute pressure display)

Pressure: mechanical pressure gauges, all \$100+

Ozone: InUsa Mini Hicon (g/nm<sup>3</sup>)

#### Compensation equation for PSA concentrator feed gas flow rate:

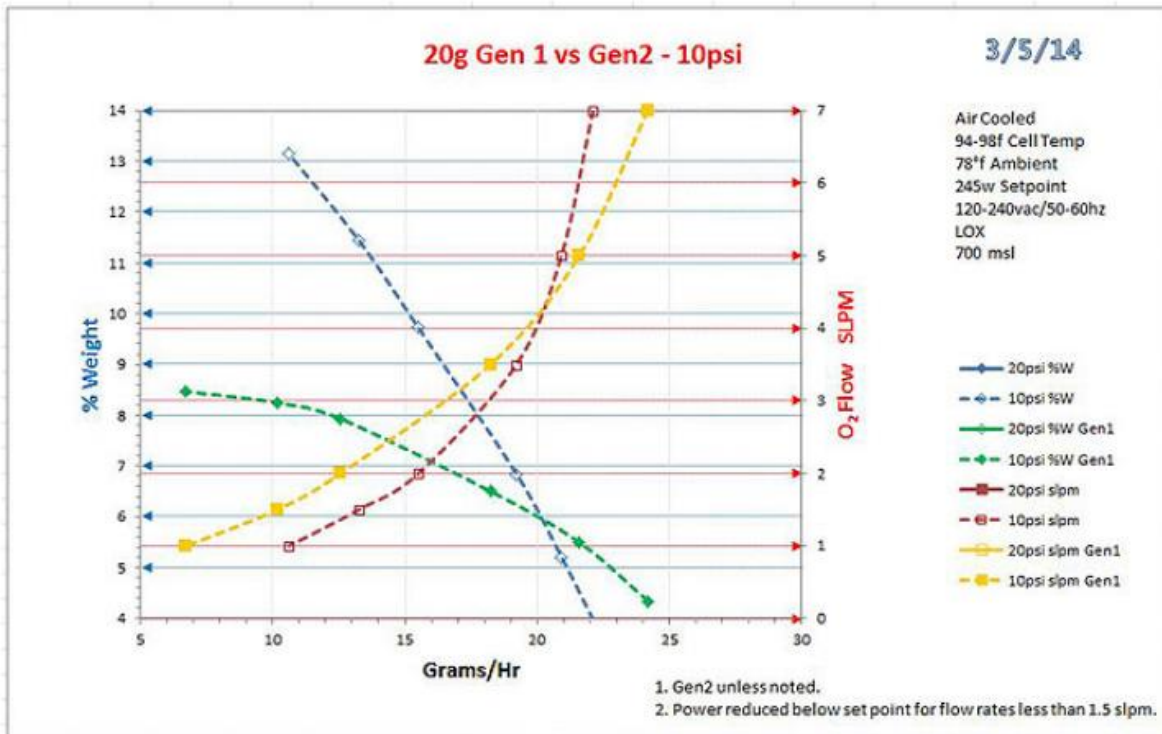
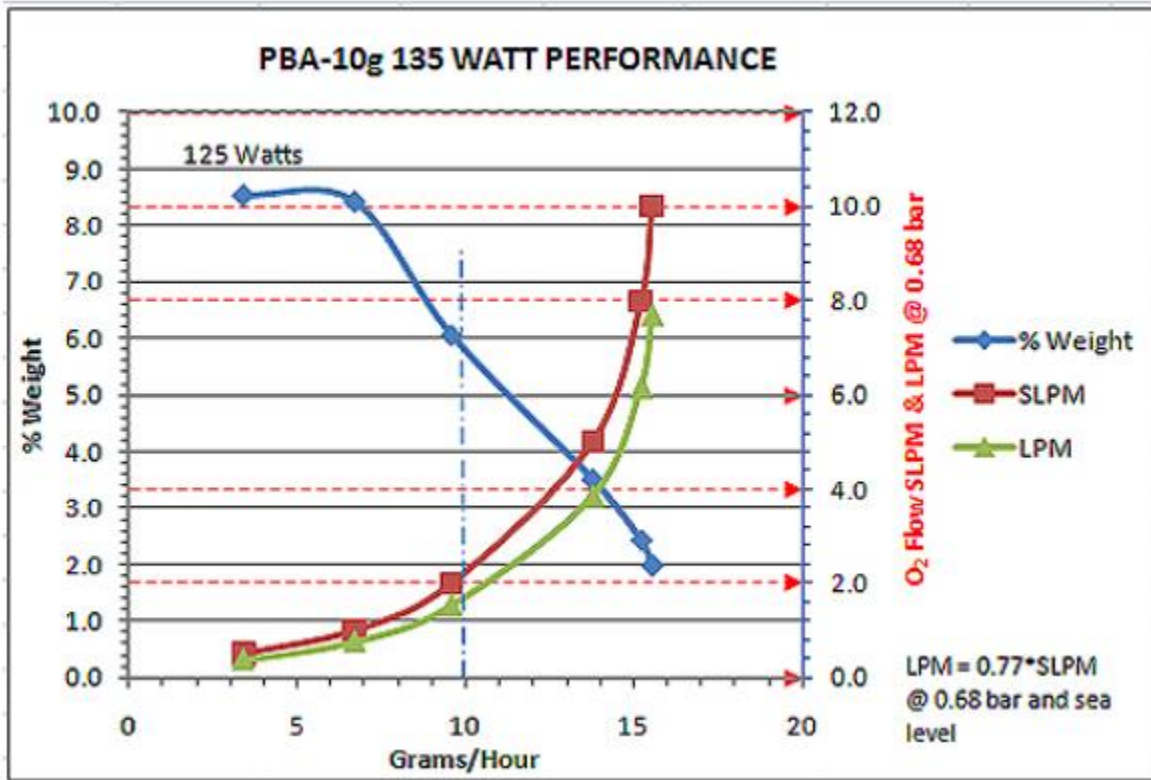
Actual Standard Liters/Minute  $\cong$  Rotameter flow \* (Air to Oxygen flow meter coefficient) \*  $\sqrt{(14.7+\text{psi})}/14.7$

Example: Inlet pressure = **10 psi**; Rotameter flow from test system or performance curves = **12 lpm**

Actual standard Liters/Min  $\cong 12 * .95 * \sqrt{(14.7+10)}/14.7$   
 $\cong 11.4 * \sqrt{1.68}$

≈ 14.78 lpm

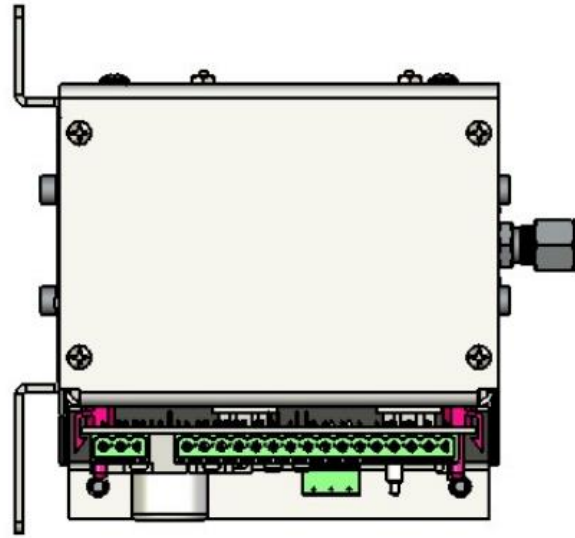
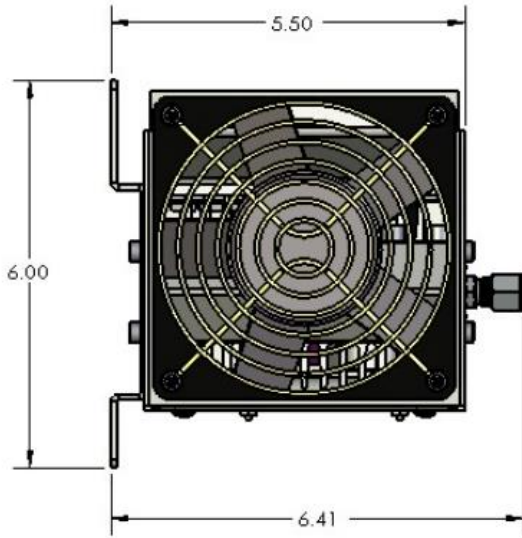
Note that temperature correction is generally neglected at typical room temperatures.



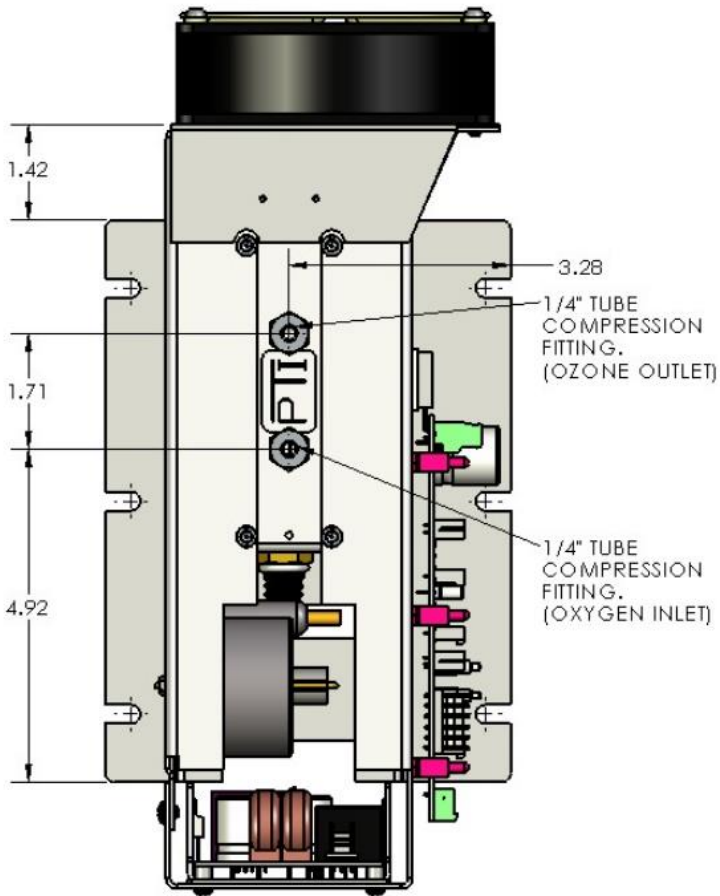
Additional performance charts are shown on the PTI web site [www.plasmatechnics.com](http://www.plasmatechnics.com)



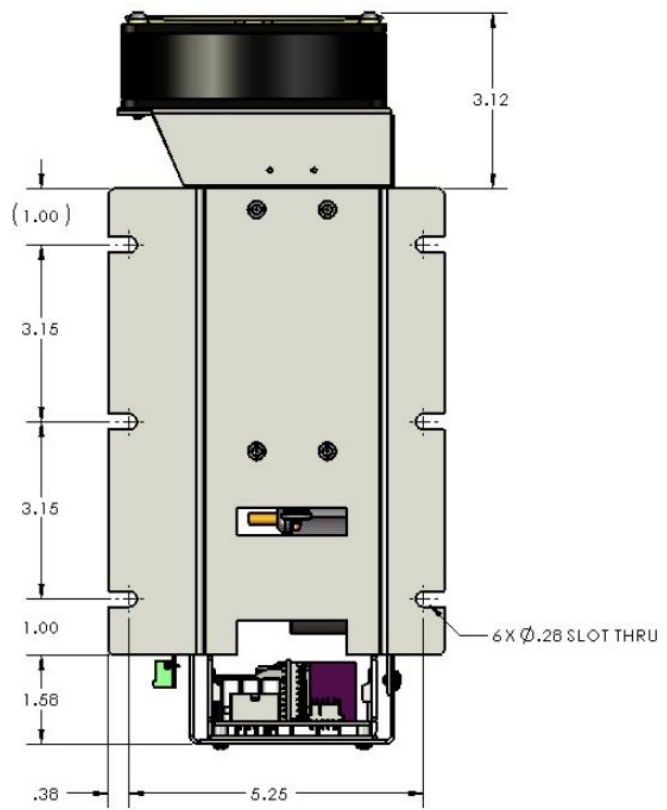
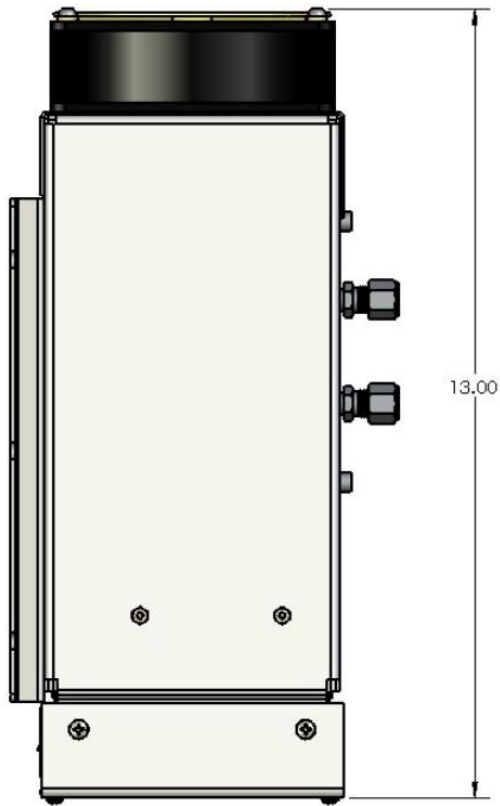
Section 11 Product Dimensions: Inches



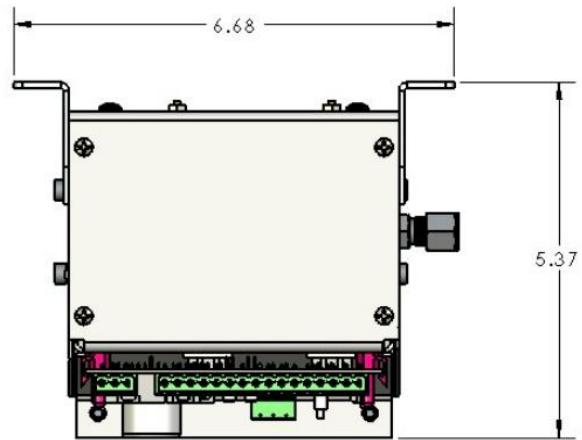
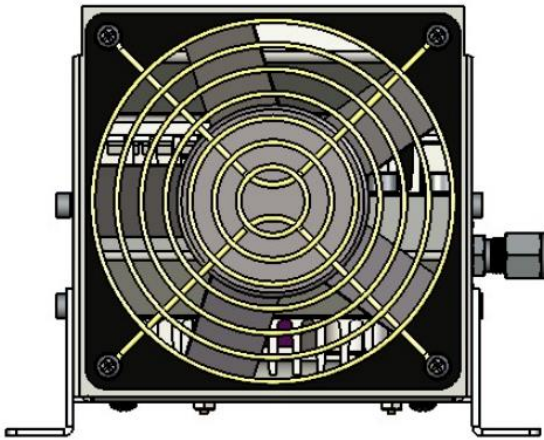
front back



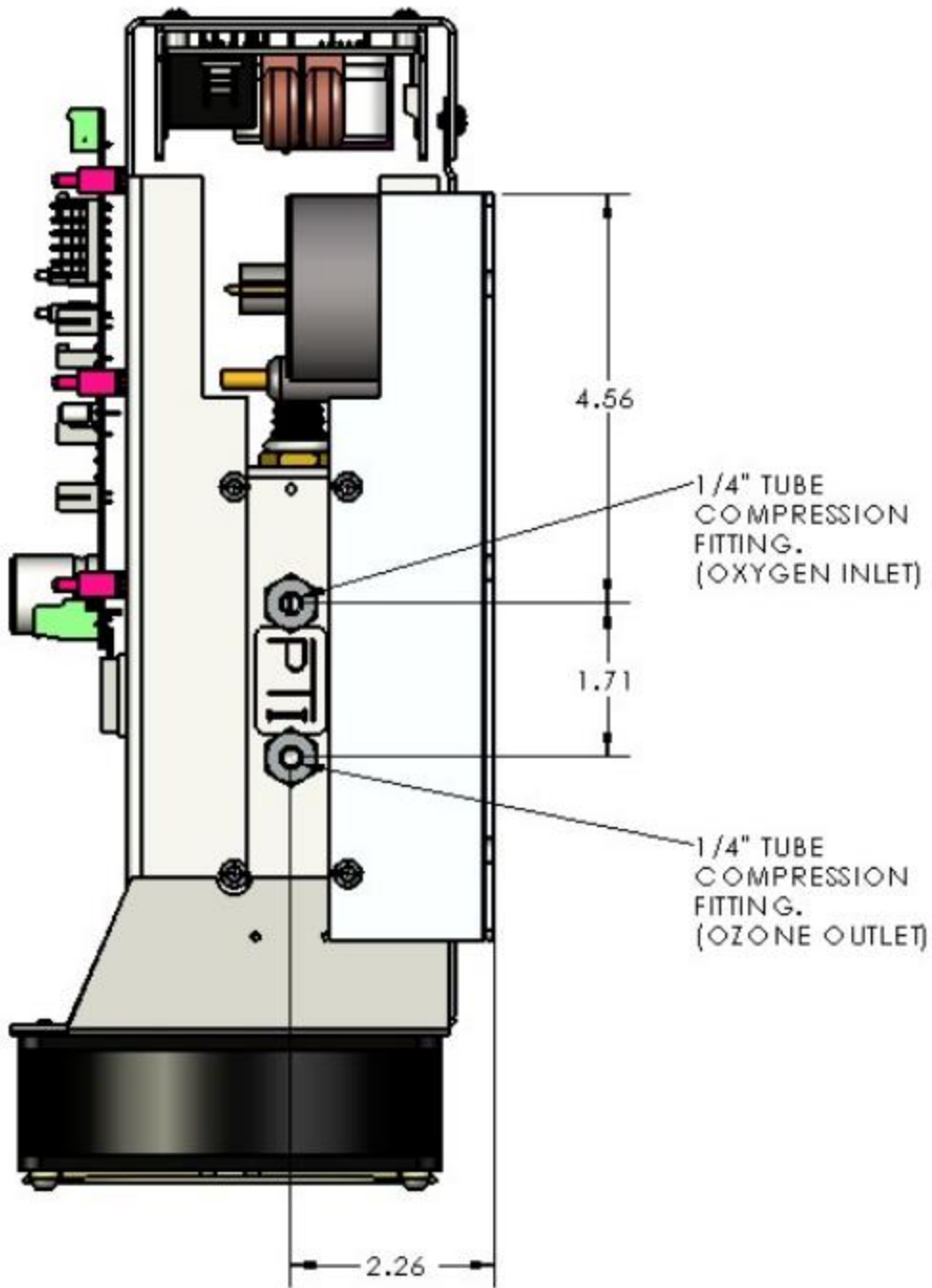
top



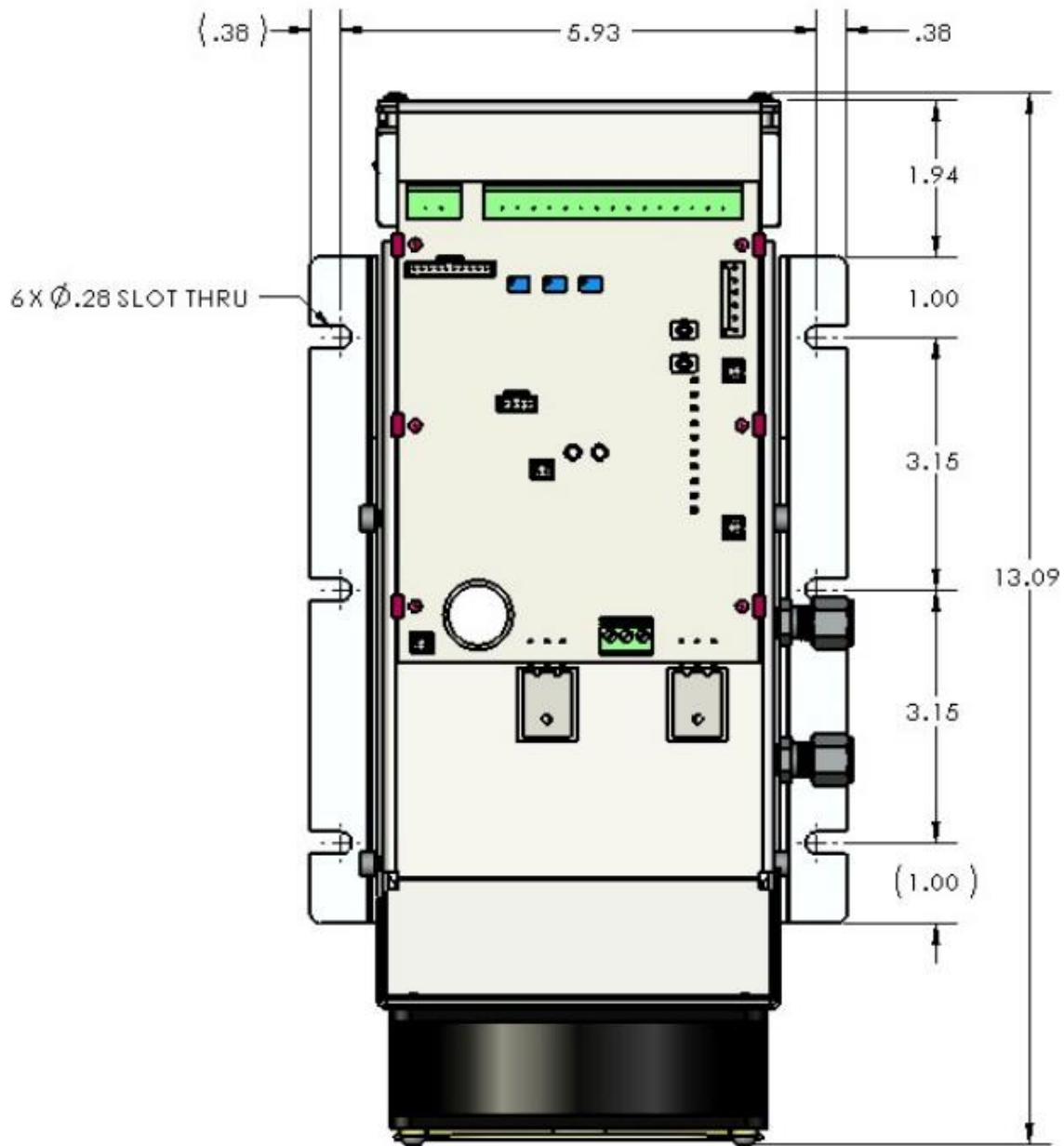
top bottom



front back alt mount

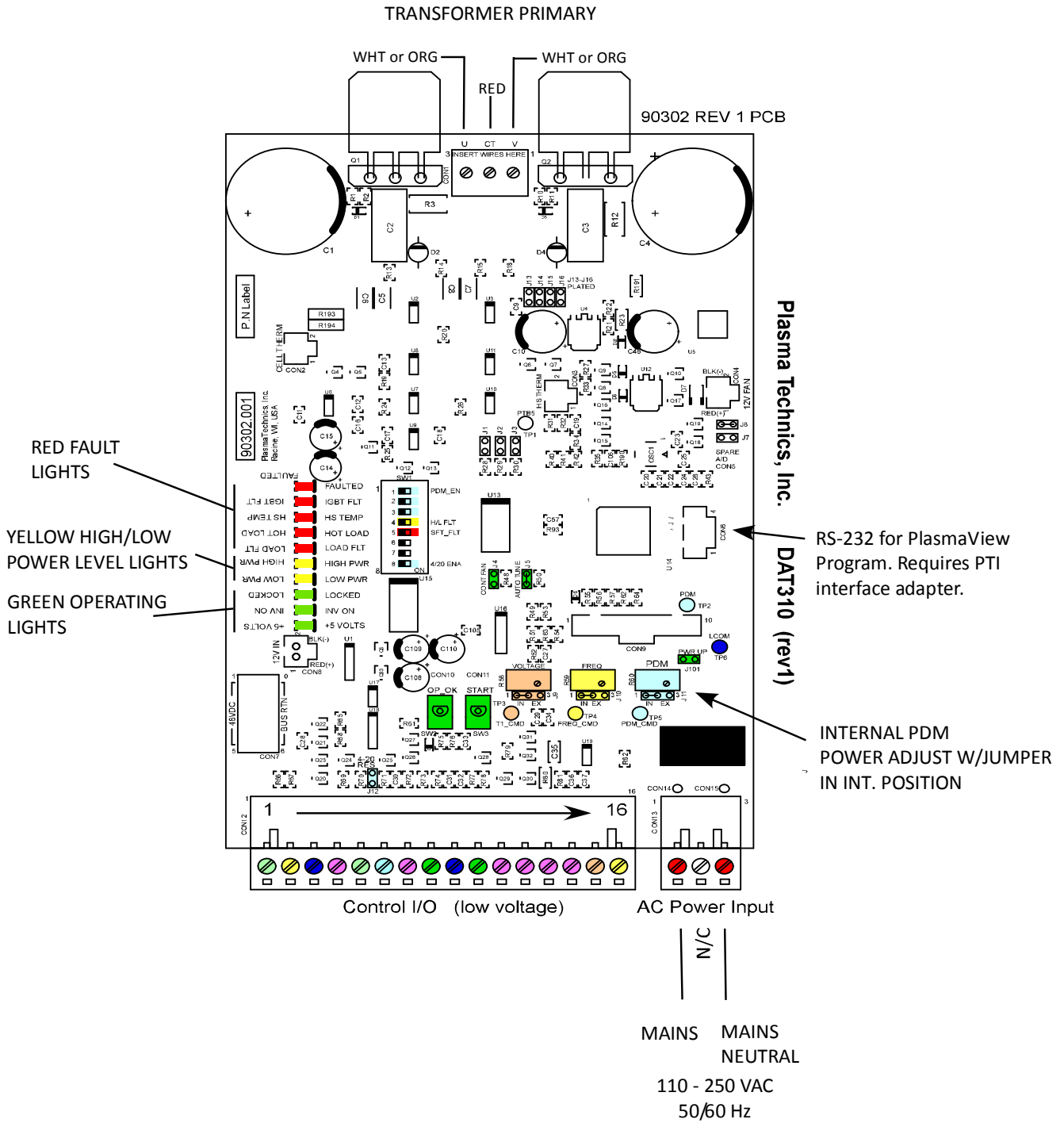


side alt mount



top alt mount

Section 12 Wiring Diagram and Connections



115 VAC wiring should be rated 10 Amps.

There **MUST** be a green wire earth ground from the chassis to conduit ground. This is an important safety and reliability feature.

Mains Connections (Con 13)

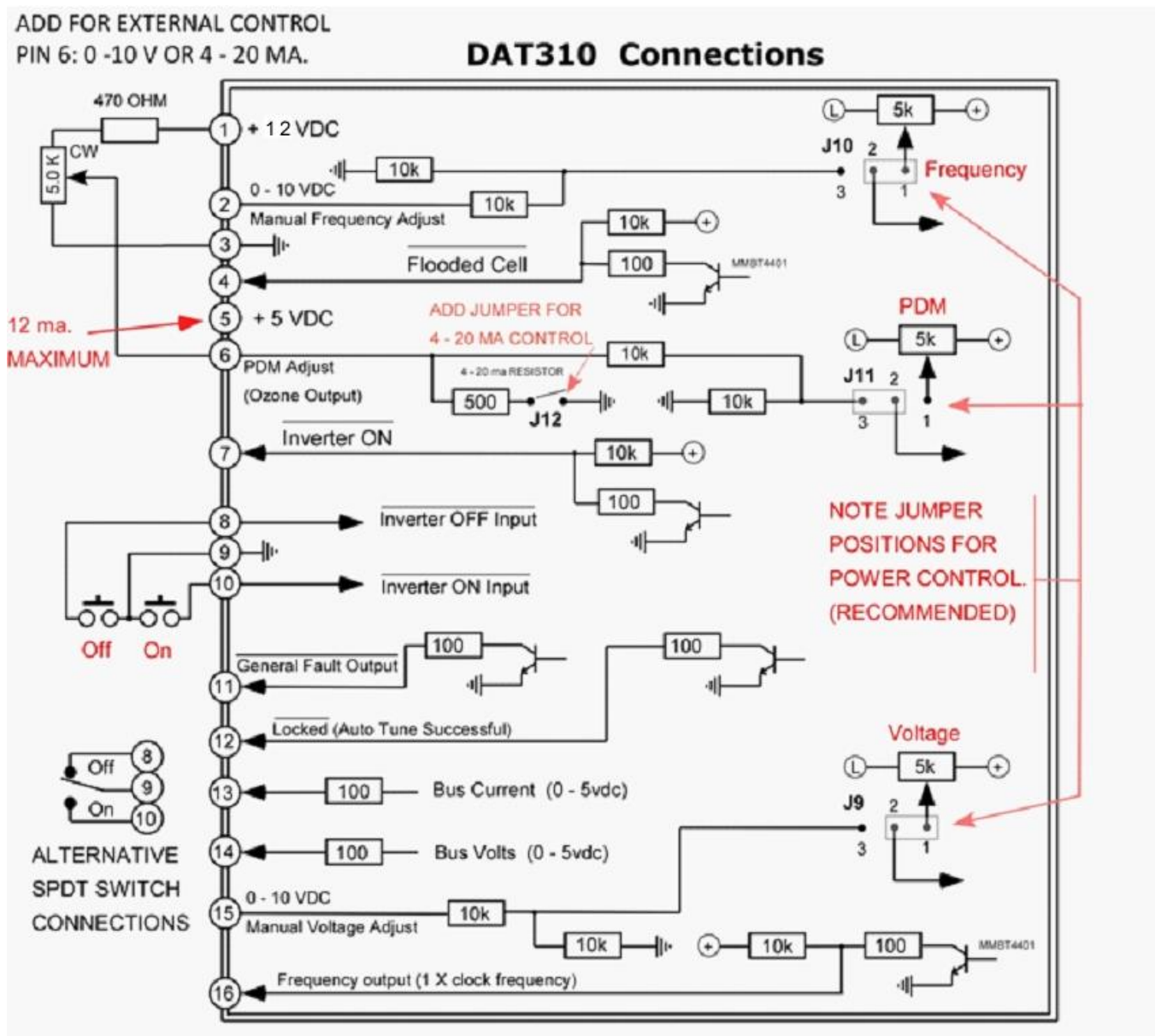
AC Line Power – 1 & 3. 100-240vac, 50/60Hz:

Power factor 0.94 – 0.95

Power supply approvals: UL/CSA/CE

AC power is connected via the 3 pin connector. Use pins 1 and 3. Polarity is irrelevant. Pin 2 is not connected and is used to provide proper electrical spacing only.

Connect a ground at any fastener that utilizes a star washer. A solid ground is essential for safety and to reduce electrical noise.

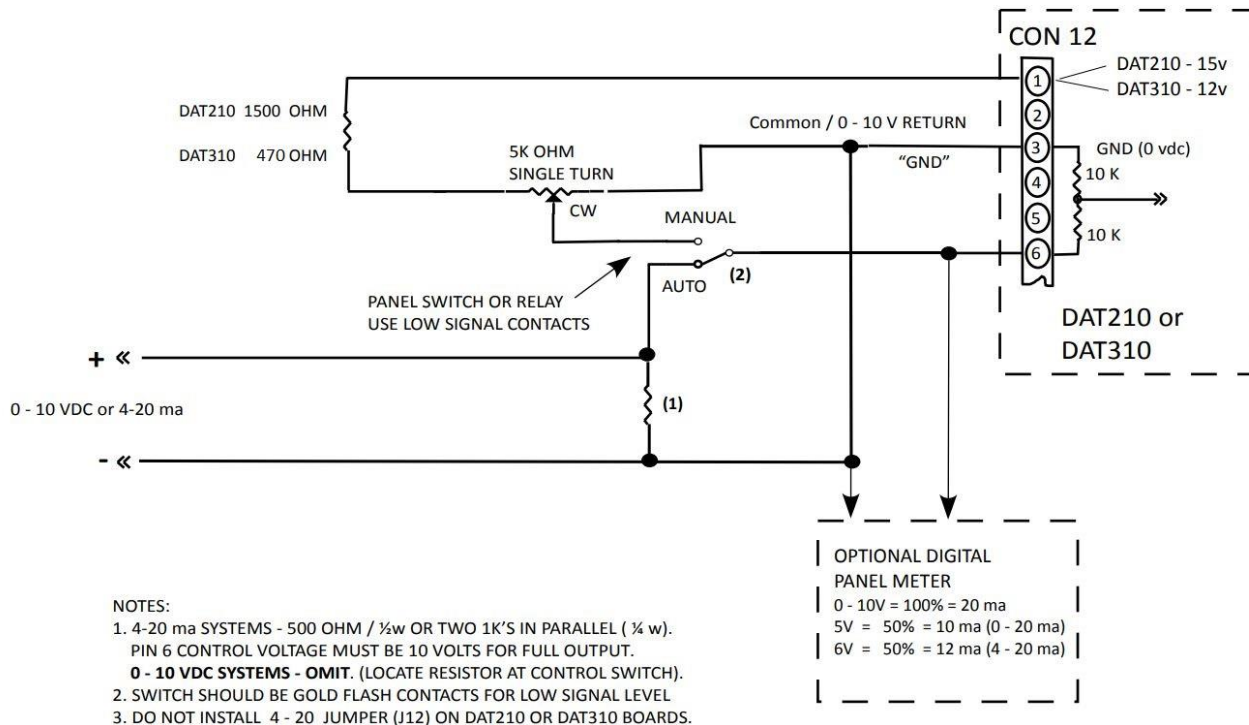


Grounding either #3 or #9 is not necessary and usually controlled by PLC.  
 External pots for frequency and voltage should be multi-turn, cermet substrate types for stability and precision. Rating of ¼ watt.  
 Shielded cable recommended for connection runs of 2 ft. or more.

- [1] 470 OHMS acceptable.
- [2] External pot 5k, resistance as per note 1.
- [3] Ground symbol represents circuit board floating common, not earth grounded.  
 Best to leave floating or allow PLC to establish ground relationship.
- [4] Optional SPDT toggle switch or relay.

### DAT210 SINGLE UNIT DUAL CONTROL (LOCAL - REMOTE)

#### 0 - 10 VDC or 4-20ma AUTO/MANUAL TRANSFER SWITCH CONTROL LOOP



## Jumper block configuration

(Earlier models use the DAT 300 inverter. A cross reference is at the rear of the manual.)

### DAT 310 JUMPER CHART

SWITCH SW1	SWITCH POSITION	NAME	FUNCTION IF INSTALLED
S1	ON	PDM Enable	If PDM is remotely commanded, remove to test 100% output level. This is especially useful if the unit is hard wired to a PLC or ORP controller.
S2	OFF	Alternate LOW PDM	Lower PDM period than 30 Hz
S3	OFF	Alternate PDM	Alternate PDM
S4	ON	HIGH/LOW current fault	A window of normal operating current. This will cause a fault if either the LOW or HIGH value is exceeded.
S5	OFF	Soft fault	Produces a wink in fault line #11 if one or more operational windows are exceeded beyond the factory limit. Will not shut down the inverter like a hard fault but attention is needed.
S6	OFF		Spare
S7	ON	Drop Back Mode	Detects load fault in multi-cell units and drops the power back to allow continuous ozone production, unless a fault is detected in two or more cells. If too many cells are faulted then unit will shut off ozone like a normal load fault condition.
S8	OFF	4/20 ma.	Configuration for 4 - 20 ma. control 0 - 100% ozone output. At 2 ma the INV_ON LED will flash. At 3 ma. The output is reinstated. If the jumper is removed, 0 - 10 (0 - 100%) volts controls the ozone output. At zero ozone, inverter is standby.

JUMPER	DEFAULT		
J101	OUT	ON with power up	ON-OFF command change. The inverter will turn ON 5 seconds after power is applied and turned OFF when power is removed. This is not recommended because it eliminates gas purge.
J1, J2		ON – OFF configuration	See schematics and tables in METHODS ON – OFF CONTROL
J3	OUT	SEMI-AUTO - Tune	J5 out. Voltage pot sets maximum power. Optimal frequency is automatic.
J4	OUT	Manual fan	Fan goes on when power is applied and off when removed.
J5	IN	Full AUTO-TUNE	J3 out. Voltage and frequency pots are not active. These parameters are controlled automatically. See SEMI-AUTO.
J9	IN	Voltage control pot	1 - 2 jumper = internal control. 2 - 3 = external
J10	IN	Frequency control pot	1 - 2 jumper = internal control. 2 - 3 = external
J11	IN	PDM control pot	1 - 2 jumper = internal control. 2 - 3 = external
J12	S	4/20 ma. or 0 - 10 VDC	Adds 500 ohm resistor to control input. If two or more DAT 310s are to be controlled via one current loop, wire all Connector CON12 term. 3 together and all term. 6 together and install J12 on <u>one</u> DAT 310 inverter. Usually S8 ON and J12 jumper are used together.



## Controls and switches

### Control Potentiometers (Pots)

**PDM** – The onboard Pulse Density Modulation control pot is primarily of use for simple applications running at a fixed turndown level. Also helpful for bench testing. Use jumper J18 to select on board (IN) or external terminal strip control (EX). Normally terminal #6 input delivers a voltage or current to the unit, which manages a closed loop process ozone level.

**Voltage** – Adjusts voltage applied to cell. Use jumper J16 to select onboard (IN) or external terminal strip control (EX). This control is used to set the maximum power operating point for the unit while in the Semi-Auto mode, but is not observed in the Full-Auto mode. Remote operation is via terminal # 15. If external control is used, it must be a voltage from 0 to 10vdc, unless a 500 ohm resistor is added to terminals 3 and 15. No 4/20ma current control jumper provisions exist on the PCB.

**Frequency** – Adjusts cell frequency. This pot is factory set and not observed unless the unit is in the factory set-up configuration. Frequency is dynamically managed by the processor for both Semi and Full Auto modes. Provisions have been made for remote control via terminal # 2, in which case J17 should be in the (EX) location.

### Switches

**Op\_OK** – This switch has multiple uses.

1. When the inverter is ON, stores the present running parameters of voltage, frequency range, current tolerance along with other internal configuration information available, as **normal** field operation. This information becomes the re-start information after a power cycle.
2. Recalls the factory set-up table to active memory when the inverter is OFF. The factory table is never overwritten and can be recalled as a last resort if the unit has been improperly adjusted beyond recognition. If this happens, just follow the instructions in the 'Power Adjustment' section.

**Start** – This switch has multiple uses.

1. An **extended tuning sweep** is conducted if pushed for 2 - 4 seconds AND J15 (J7 DAT 300) is installed, to eliminate the possibility of tuning aliases. In other words, it allows the user to force an extended tuning adjustment and witness the results as a troubleshooting tool if needed. This type of operation also occurs automatically, but the user would be unaware of it. If either the power or current is different than the values found in the 'Power Level Table' below, store the new value by removing J15(J7), adjusting the voltage pot (per 'Power Adjustment'), store the corrected running value (per above 'Op\_OK'), and re-install J15 (J7).
2. A sensitive **manual power adjustment** of the 'Voltage' control if pushed for 2 – 4 seconds AND J15 (J7) is removed. While this same function can be performed without pressing the 'Start' button, this mode converts the High/Low LEDs into a sensitive meter which is centered around the stored value of the programmed power table in the processors' memory. In other words, you can reset the power level with extreme accuracy to the previous or factory value, without an amp meter.

## Section 13 Install Options

### PlasmaLINK



A **new** way to connect and communicate with your **Plasma Block®**. The PlasmaLINK unit connects to the DAT series board on Plasma Block® units.

#### Links Available:

Wi-Fi

USB

RS232 via USB and Keyspan

Ethernet

HDMI

#### Design Features:

- Communicate via Wi-Fi , local LAN or Internet using a PC, laptop or smartphone
- Standard browser navigation screen
- Collect, store and analyze performance data from local or remote locations
- Monitor performance and/or troubleshoot a unit from local or remote locations

## PlasmaVIEW Software

PlasmaVIEW® software enables unprecedented access to the PlasmaBlock® processor thereby simplifying bench-top setup and field diagnostics. The program displays charts for all measurement parameters with an unlimited time base and disk drive storage for delayed retrieval and emailing. PlasmaVIEW can also be used as a file viewer so data can be studied and expanded at a later time or in another location. Observing a complete functional system over the weekend is as easy as plugging in a laptop computer and spending the weekend with the family.

Testing of the fully integrated ozone system is simplified by the programs ability to create a fault at the output terminals. This enables the user to evaluate the total systems response to the PlasmaBlock outputs without the need to jury-rig external wires thereby creating exactly the same outputs as would normally be produced. Want to see how the system handles a fault – just click on the ‘Faulted’ LED in the ‘Diagnostics’ tab.

**Supports all DAT series control boards.** Supplied with the software is: PTI’s custom RS232 processor interface adapter, USB/RS232 adapter and 10’ RS232 extension cable.

**Example Configuration Tab Screen:** Set baud rate, COM port, temperature units for all charts.

