



PLASMA TECHNICS GENERAL APPLICATION GUIDE

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Please refer to the DAT 210 or SSD 110 manuals for inverter specific installation and operational details. Refer to the specific PlasmaBlock® Manual for installation guidance and performance curves.

SECTION 1.

GENERAL PTI OZONE CELL OPERATION CONSIDERATIONS

1.1 General Plasma BLO₃CK[®] considerations:

1. 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 O₂ can be used to provide the feed gas.** To maintain the warranty the feed gas must be at least **-76 C (-60°F)** dew point and 93% O₂ or more.
2. **IMPORTANT! BEFORE** the system is energized for the first time the Plasma Block[®] should pre-dried by flowing the above feed gas for 3 to 5 minutes. The installed control system should do a pre-purge to insure the gas piping and ozone cell is dry before power is applied to the cell. **Failure to do this step may result in nitric acid being formed in the ozone cell.**
3. The best cell seasoning is accomplished with a PSA oxygen concentrator. All cells have been factory seasoned but it is always a good idea to operate the finished system for a few hours after installation. The oxygen feed should be filtered (.1 microns or less).
4. **IMPORTANT!** 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, a system which uses a venturi and concentrator must contain a solenoid valve or other reliable means to block gas flow if it is possible that the venturi will be active while the concentrator is off.
5. **TIP!** An easy way to prevent check valve or solenoid valve backflow when all systems are shut down is a tubing loop from the venturi to an elevation higher than the highest water level to the check valve to the ozone cell.
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 ABOVE 5 psi (0.3 bar). 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.**

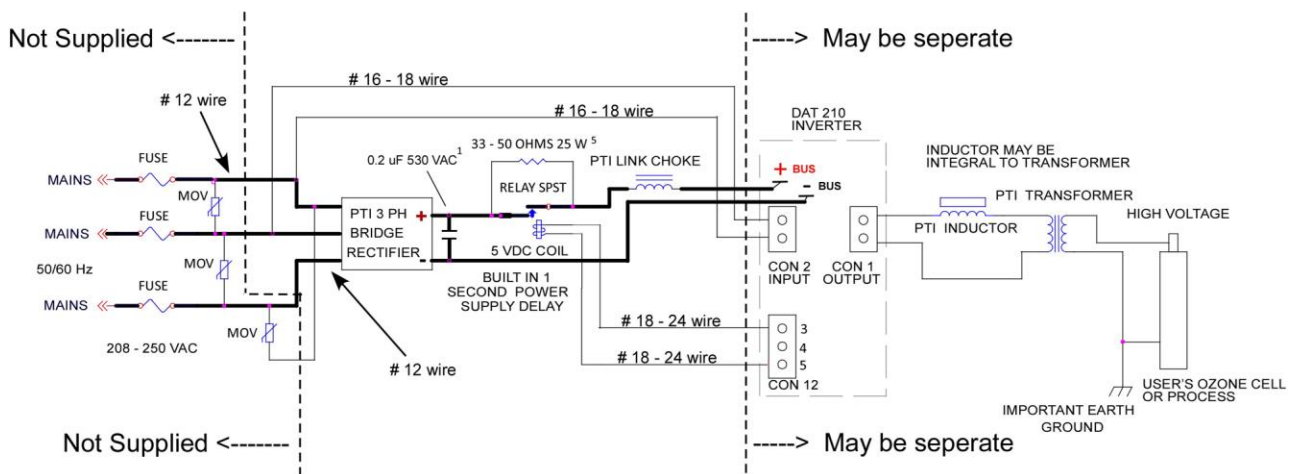
8. **TIP! A throttling needle valve after the GAS OUT port to maintain cell pressure is required. Operating venturi produce vacuum in the ozone line. Maintain cell pressure no less than 5psi (0.3 bar)(5 psi).**
9. The ozone outlet fitting mounted into the plasma block[®] mates with other fittings inside of the unit and **must not be removed or changed** to another fitting type. Contact the factory if other sizes or styles are required.

1.2 Suggested soft start circuits.

The schematics below demonstrate the typical electrical user schematic using the DAT210 inverter. PlasmaBlocks[®] have the inverter as an integral part of the generator component. A soft start DIN rail mount assembly has the relay and terminal blocks conveniently provided. Factory P/N (TBD) is available for \$95.00.

The link choke is necessary for three phase mains. PTI P/N 90142-2 at \$78.00 to improve the power factor to 0.9 and limit peak currents for better reliability. See Section 3.4

Recommended Installation



NOTES:

1. PREFERRED: ASC CAPACITORS U1C1
 2. PREFERRED: CERAMIC RESISTOR HVRAPC U2125A330L
 3. THE DAT210 BRIDGE RECTIFIER IS REMOVED FOR 3 PHASE MAINS AND D.C. POWER.
 4. POLARITY MUST BE FOLLOWED OR SIGNIFICANT DAMAGE WILL OCCUR.
 5. SUPPLIER BLUE CERAMIC RESISTOR IS 4.5 W, CUSTOMER WIRE WOUND 25 W.
- # 12 wire

Soft start bill of materials

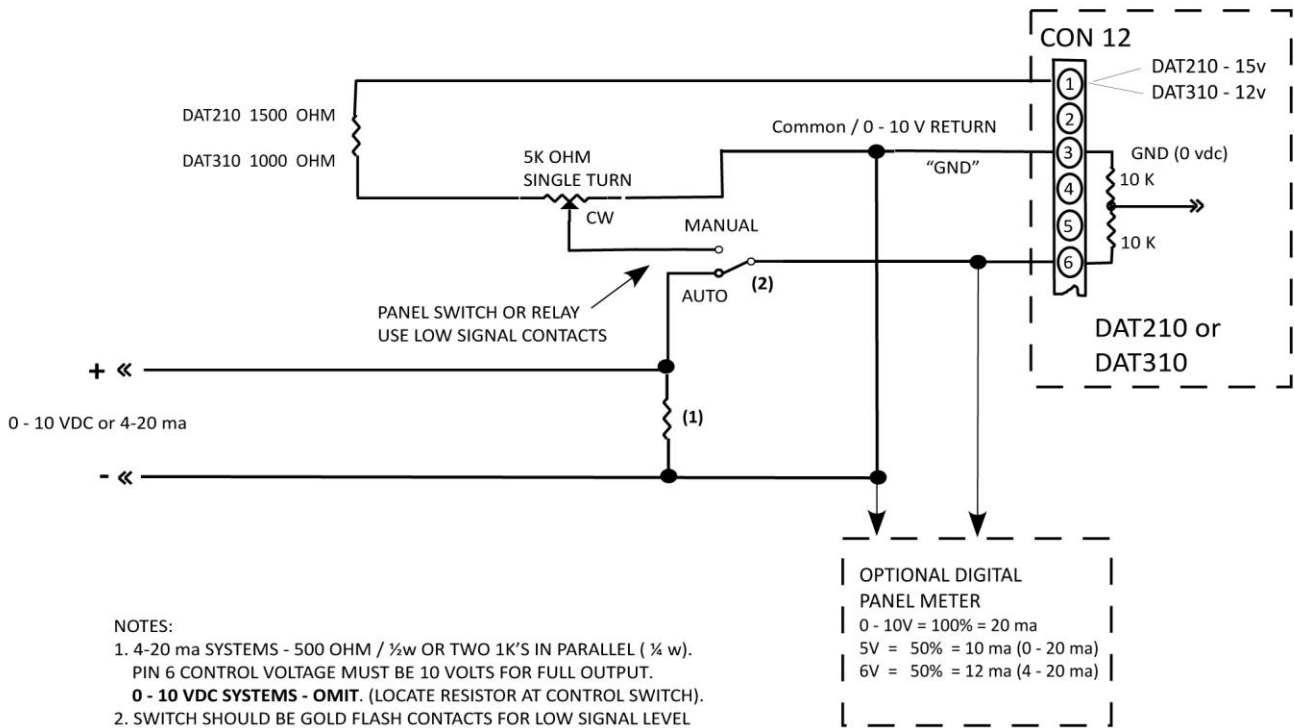
INVERTER 70250 ASSEMBLY

QUANTITY	PART NO.	DESCRIPTION	SOURCE	NOTES
1	U2125A330L	Ceramic surge resistor	HVRA	716.693.4700 www.hvrapc.com
1	W9AS1D52-5	30 Amp 5 VDC coil relay	Magnecraft	866.433.5722 www.alliedelec.com
1	DF30AA160	30 Amp three phase rectifier	SanRex	516.625.1313 308.284.3611
1		0.2 uF 1600 VDC/530 VAC capacitor	ASC or PTI	www.ascapacitor.com
1	235	14 Amp DC link choke (inductor)	PTI	4 KVA maximum
1	237	20 Amp DC link choke (inductor)	PTI	> 4 KVA use the 237
1	DAT210	Inverter to 4 KW	PTI	Purchased separately

Refer to the inverter prewired assembly shown in Section 3.3

DAT210 SINGLE UNIT DUAL CONTROL (LOCAL - REMOTE)

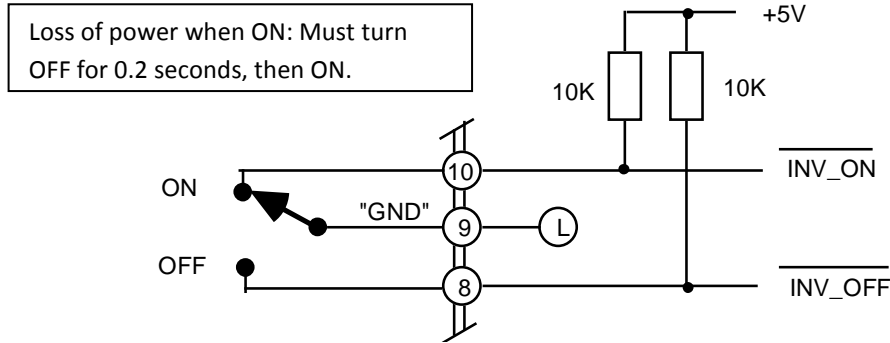
0 - 10 VDC or 4-20ma AUTO/MANUAL TRANSFER SWITCH CONTROL LOOP



1.4

METHODS OF ON – OFF CONTROL
JUMPER BLOCK CONFIGURATION AND FUNCTION

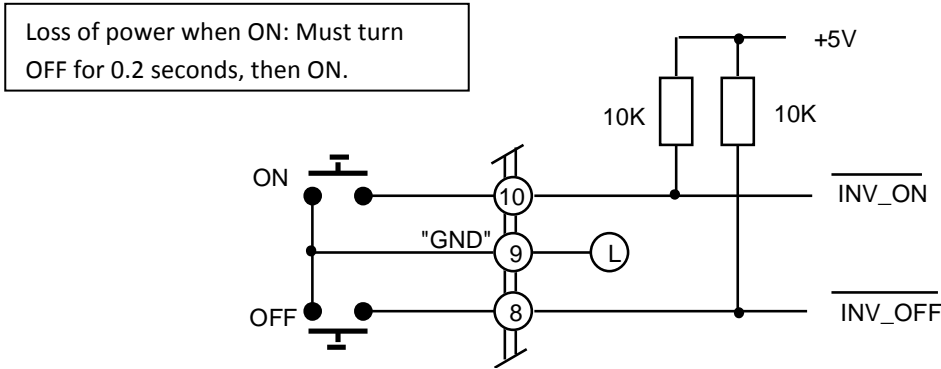
SPDT RELAY OR SWITCH



Loss of power when ON: Must turn OFF for 0.2 seconds, then ON.

FUNCTION	PWR_UP	J1	J2	J3
To start the inverter the switch must first be in the OFF position, then moved to the ON position for ozone to start.	OMIT	OMIT	X	X
To start the inverter the switch or jumper wire must first be across 9 and 10 position, then power is applied to produce ozone. The inverter will start after the "LED banner flash". If 8,9,& 10 are open with this jumper in, the inverter cannot start until the power is removed and 9 and 10 connected.	IN	OMIT	X	X
X = Don't care condition.				

ON – OFF PUSHBUTTONS



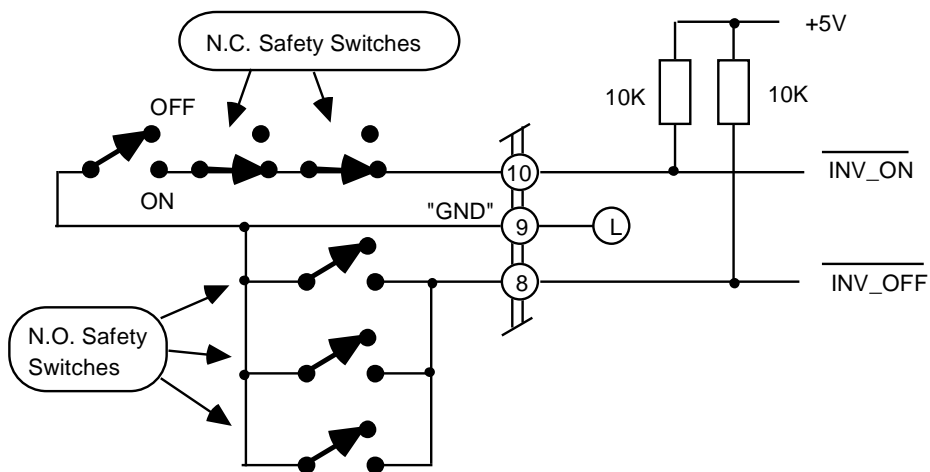
Loss of power when ON: Must turn OFF for 0.2 seconds, then ON.

JUMPER BLOCK CONFIGURATION AND FUNCTION

FUNCTION	PWR_UP	J1	J2	J3
Push ON and push OFF to start ozone production. If both pushbuttons are actuated simultaneously, the inverter will stay OFF.	X	OMIT	X	X
X = Don't care condition.				

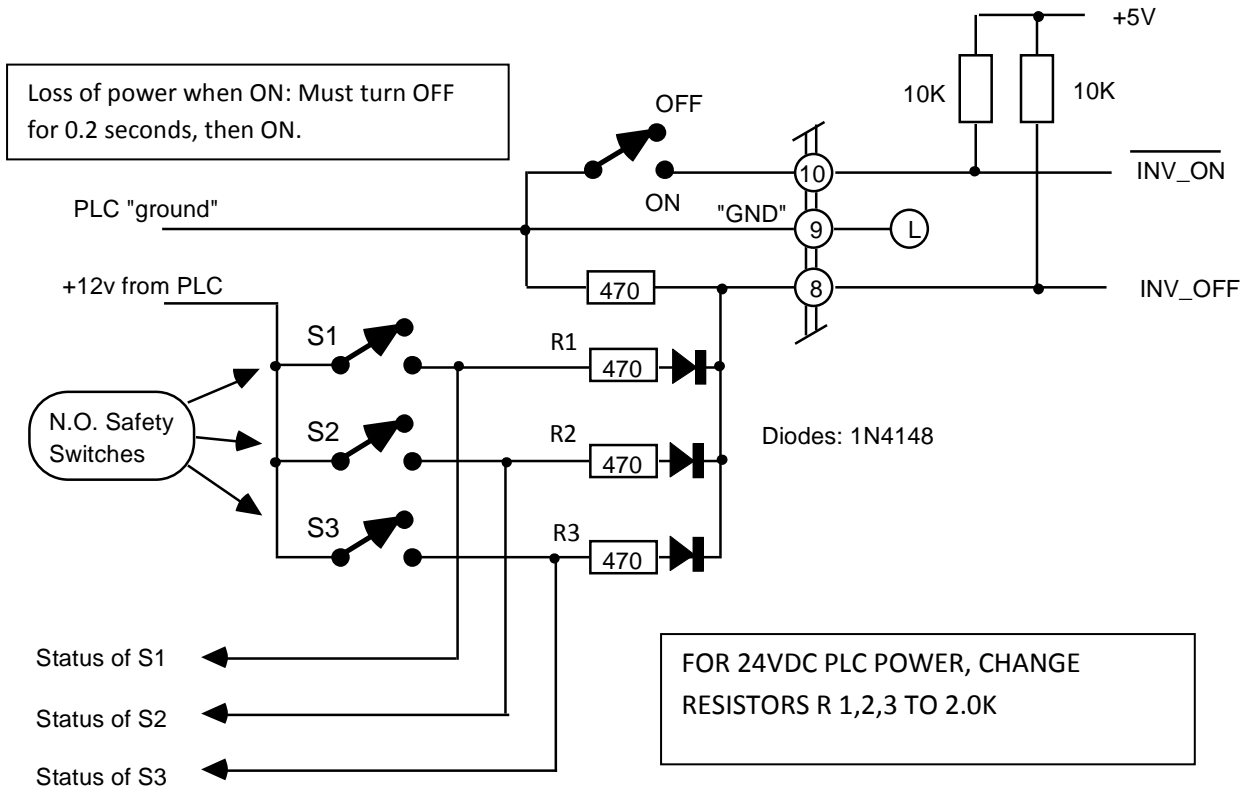
SAFETY SWITCH INVERTER CONTROL CIRCUITS

Loss of power when ON: Must turn OFF for 0.2 seconds, then ON.



FUNCTION	PWR_UP	J1	J2	J3
To start the inverter the switch must first be in the OFF position, then moved to the ON position for ozone to start.	OMIT	IN	OMIT	X
To start the inverter the switch must first be in the ON position, then power is applied to produce ozone. The inverter will start after the "LED banner flash".	IN	IN	OMIT	X
X = Don't care condition.				
If any of the normally open (N.O.) safety switches goes closed then ozone production cannot start or will cease if operating.				

PLC POWERED SAFETY SWITCHES WITH STATUS REPORTING



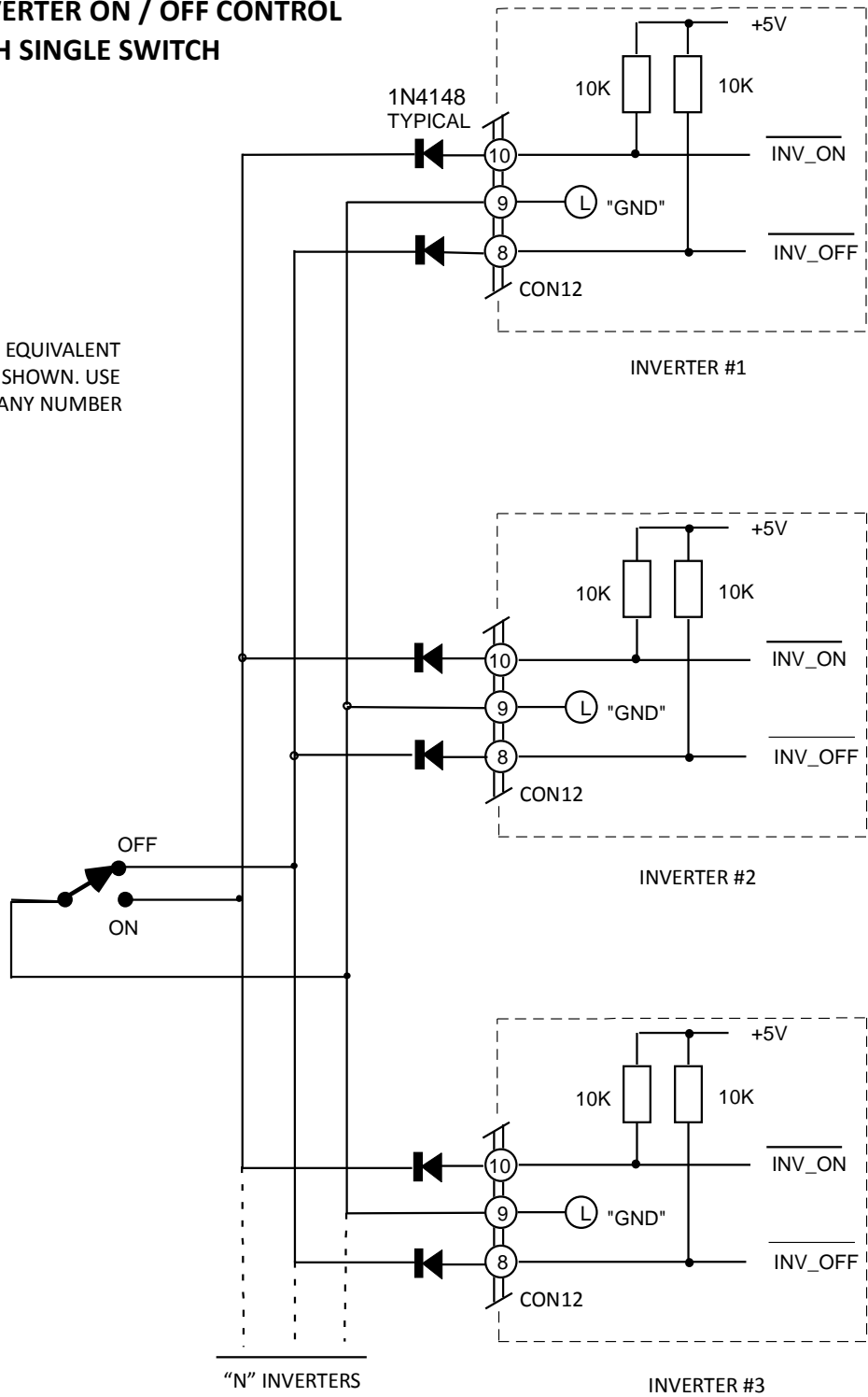
FUNCTION	PWR_UP	J1	J2	J3
To start the inverter the switch must first be in the OFF position, then moved to the ON position for ozone to start.	OMIT	IN	IN	X
To start the inverter the switch must first be in the ON position, then power is applied to produce ozone. The inverter will start after the "LED banner flash".	IN	IN	IN	X
X = Don't care condition.				
If any of the normally open (N.O.) safety switches goes closed then ozone production cannot start or will cease if operating. This circuit allows the PLC to monitor the switch status.				

1.5

**MULTIPLE INVERTER ON / OFF CONTROL
WITH SINGLE SWITCH**

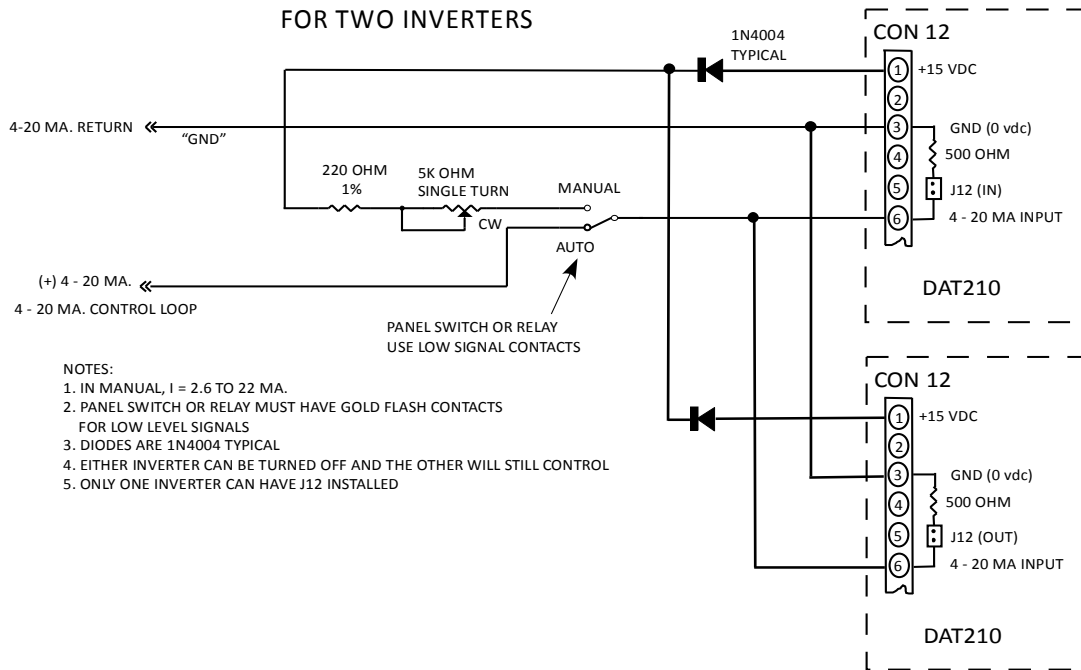
NOTES:

- 1. USE DIODE 1N4148 OR EQUIVALENT
- 2. THREE INVERTERS ARE SHOWN. USE THIS TECHNIQUE FOR ANY NUMBER OF INVERTERS.

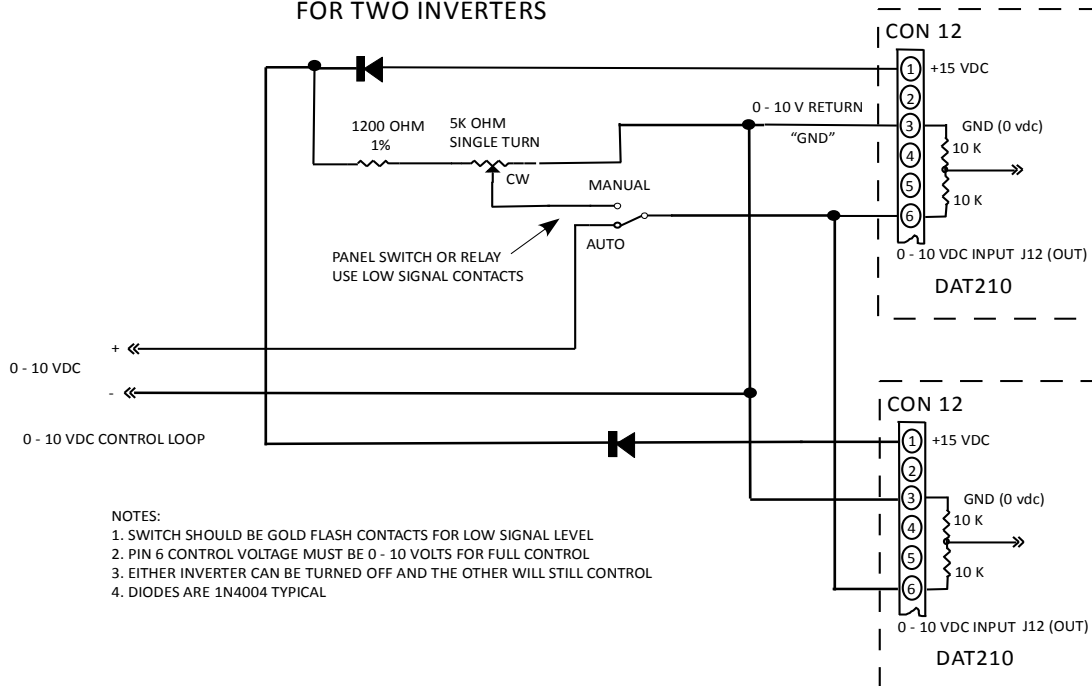


1.6 Two user wiring options are shown. If an Auto/Manual front panel switch is desired to control one or two inverters, use the schematic shown. This also allows a single control input to control both inverters with either inverter powered down.

4 - 20 MA. AUTO/MANUAL TRANSFER SWITCH CONTROL LOOP FOR TWO INVERTERS



0 - 10 VDC AUTO/MANUAL TRANSFER SWITCH CONTROL LOOP FOR TWO INVERTERS

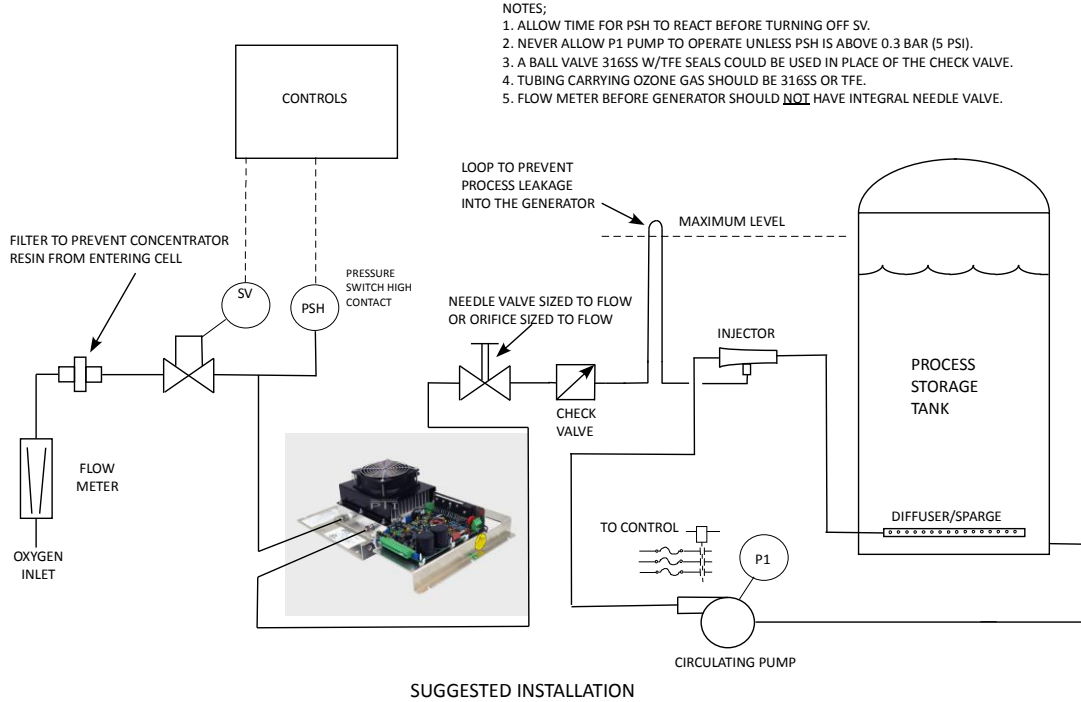


Section 2 Operation and Tuning – BLO₃CK Systems

1. The generator is normally shipped to the customer's specifications for operating pressure, and ozone output control pre-tuned. No further adjustment is necessary.
2. If feed gas pressure or flowrate is to be controlled by other means than specified on your purchase order, refer to the detailed section on inverter operation.
3. The plate-mounted system has been pre-configured for optimum performance for each customer's pressure circumstances, if they were specified. Typically the range will be 5 to 15 psi (0.3 to 1 bar). If the pressure was not specified or requires changing, follow the power up instructions and subsequent tuning instructions in the detailed section. If the pressure is expected to fluctuate over a range then create the highest pressure condition and then tune the system.
4. Start the gas flow, adjust to desired values, turn the generator ON and wait for several minutes for all components to reach normal operating temperature.
5. Adjust the ozone output with the PDM control either internal or external to the desired ozone output.

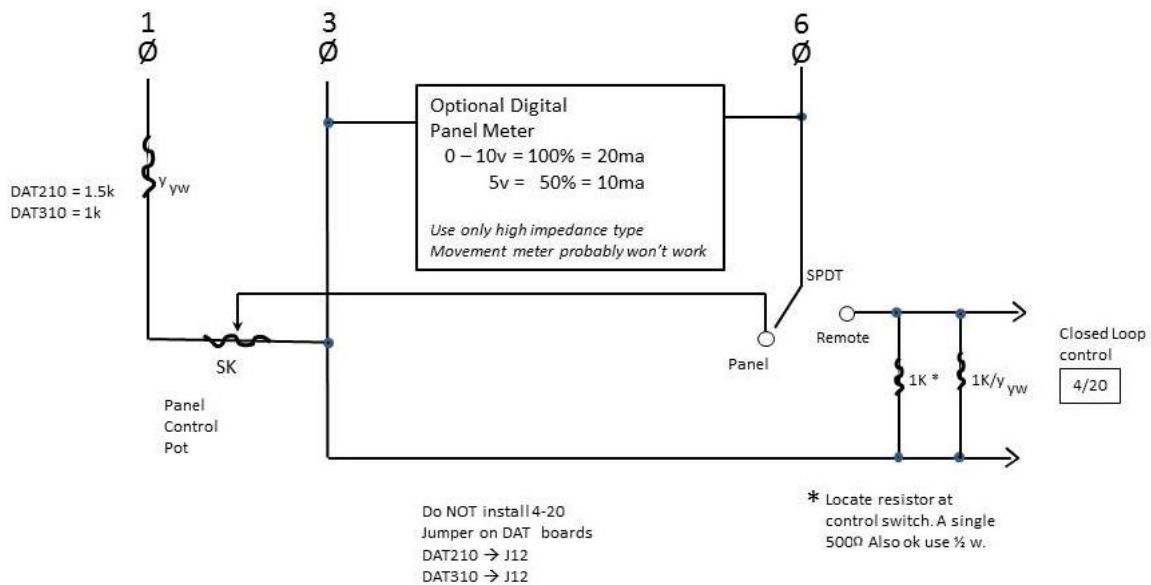
Section 3 System application guidance

3.1 Suggested general installation. Not a complete system for all applications.



3.1a Plasma Block Connection diagram

PlasmaBlock® Connection Diagram – Voltage Control System
Manual Pot & 4/20



3.2 Valves and other devices for generator protection

If it is not possible to use a baric loop as shown in the example above, the check valve shown is NOT adequate. When the system is offline, injector pressures are down and check valves will leak. Some installers thought that 2 or even 3 check valves on the ozone out line would prevent water backflow only to find out they all leaked.

The best success is achieved with a positive no leak shutoff typical of ball valves. Solenoid valves, even direct acting solenoid valves will also leak. The ball valve can be:

Manual – if the system is rarely shut down and part of shutdown procedure.

This is not the case with most systems.

Motorized ball valve – Worchester actuator with valve, Asahi valves

Pneumatic actuated ball valve – requires 80 psi (5.4 bar) clean dry air

The valve body material 316SS and PTFE seals are recommended for any materials in contact with ozone.

Inlet valve – An inlet shutoff valve is recommended to keep moisture out of the inlet piping when the system is offline. The selected valve should be for oxygen service.

Pressure switch - A pressure switch ahead of the shut off valve can prevent the valve from opening unless there is positive pressure in the oxygen feed line. Sometimes it is possible to interlock these devices plus the oxygen generator (if used) with circulating pump auxiliary contacts. This prevents any operation when the entire system is offline.

A better approach is to locate the pressure switch after the inlet shutoff valve with a time delay (either a relay or PLC output) to allow pressure to rise after the inlet valve is opened and before the generator is turned on. The pressure switch will prevent turning the generator on if – for any reason – there is a vacuum inside the ozone cell. **A vacuum inside the ozone cell with power applied to the cell will destroy the cell.**

Inlet filter – A .1 or less micron filter is recommended for the oxygen inlet to the ozone cell. Eventually oxygen concentrators will discharge resin dust, a white powder that will clog/foul the ozone cell and stop ozone production. Ozone cell passages and the exit orifice are small and easily fouled. If fouling happens, the ozone generator must be returned to the factory for cleaning and repair.

3.3 Fusing table

Because the line rectifier has large filter capacitors, there will be a high inrush current to charge the capacitors. Sizing the fuse too close to the operating current will cause nuisance trips. Using a soft start circuit from PTI (See PTI Part Number 70250 assembly manual) or your own design eliminates the inrush during start up. However a brown-out condition of temporary low line voltage will cause inrush when full voltage becomes available. The 70250 assembly also corrects the power factor to reduce operating RMS current.

Currents shown below are true RMS. Be sure the meter being used is designed to read RMS. Lower cost meters that read average will only be accurate for corrected power factor to 0.95. See the 70250 manual.

FUSING SUGGESTIONS

GENERATOR MODEL	115 VAC			208 - 240 VAC			NOTES
	FULL LOAD AMPS (RMS)	SLO-BLO FUSE W/SOFT START	SLO-BLO FUSE WOut/SOFT START	FULL LOAD AMPS (RMS)	SLO-BLO FUSE W/SOFT START	SLO-BLO FUSE WOut/SOFT START	
PBA-10G	1.1	X	5	0.6	X	5	Universal supply
PBA-20G	2.2	X	5	1.1	X	5	Universal supply
PBA-30G	4.3	X	10	X	X	X	240 VAC special order
PBA-50G	5.8	X	10	X	X	X	240 VAC special order
PBA-60G	8.7	15	20	4.1	10	15	115 VAC special order
PBA-120G				5.1	20	N/R	
PBW-150G				6.1	20	N/R	
PBW-300G				12.2	20	N/R	
PBW-450G				18.2	30	N/R	
QuadBlock®				12.2	20	N/R	

X = Unnecessary

N/R = Not recommended

3.4 Soft start and rectifier accessories

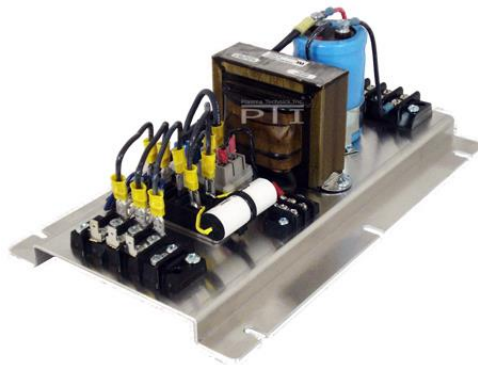
Single phase soft start for smaller generators

P/N 70258



It is practical to use this simple low cost DIN rail mounted soft start assembly to extend the inverter filter capacitor life. Another large benefit is reducing line fuse stress during turn on. It is recommended for PBA-30 through PBA-60 models.

Single and three phase rectifier plate P/N 70262



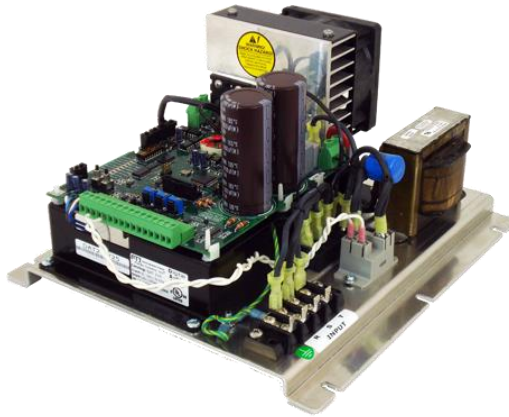
PBA 120 (1KW) and larger single phase and three phase applications benefit from the 70262 rectifier plate. Direct current through a smoothing and power factor correcting link choke is applied to the inverter instead of AC. Soft start is provided. Filter capacitor life and fusing stress are improved significantly. Also for larger power consumption, power factor correcting to 0.95 lowers power costs as well as improving system reliability. European standards require power factor corrected equipment.

The QuadBlock® requires a DC power supply. This rectifier plate is a required accessory.

Inverter assembly P/N 70250

This inverter assembly is necessary for individual PlasmaBlocks that do not have an integral inverter attached. It is also very useful converting WEDECO and Ozonia equipment to more reliable electronics. Contact the factory for more information on converting other generators.

The DAT 210 inverter is mounted on its own frame and assembled with rectifier, smoothing link choke and soft start.



REASONS FOR SPECIFYING THE ASSEMBLY

The DAT210 inverter component is designed with a single phase line rectifier providing pulsating direct current (DC) to large input filter capacitors. If the line is connected directly to the line input of the inverter, there will be an initial large inrush current to charge the capacitors. This current is only limited by the mains source (wiring and utility transformers) and filter capacitor internal resistance. The effect is particularly pronounced when the inverter is operated from 240 VAC single or 3 phase at power over 1 KVA.

There are three disadvantages to directly connecting the line to the inverter.

1. High inrush can stress the filter capacitors shortening its life.
2. High inrush currents can stress the safety circuit breakers (and will blow fuses) that may work fine during testing but will deteriorate over time causing nuisance trips.
3. Connecting any rectifier filter capacitor directly to the line causes a strong 3rd harmonic line current causing a 0.6 power factor. Many companies prefer clean (low harmonics) devices in their facility to lessen interference with other more sensitive equipment.

The 70250 inverter assembly solves these problems. A soft-start relay circuit is automatically controlled by the inverter, pre-charge components limit inrush currents and a high current link choke to eliminate the harmonics and correct the power factor to 0.95.

Lastly, the assembly is cost effective by eliminating the need to individually design and mount these essential components.

Section 4

PERFORMANCE MEASUREMENT

4.1

Ozone 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

A power meter is the best way to measure power and the instruments have many desirable features for your review.

For minimum cost, power on the mains can also be computed if the mains current can be accurately measured.



Fluke i200s AC current clamp can plug into a Fluke True RMS meter for true RMS current measurements from 40 Hz to 10 KHz. Two ranges 20A and 200A F.S. are included.

For single phase, Power = Voltage (if constant) x Current
 For three phase Power = Voltage x Current x 1.73

Flow:

Key Instruments Rotameters,
 Mass Flow TSI 4043 (with gas temp and absolute pressure display)
 Allborg or Omega Instruments
 Sierra

Pressure: mechanical pressure gauges certified for oxygen

Ozone gas analyzer:

InUsa Mini Hicon (g/nm³)
 BMT High concentration

Dissolved ozone monitor:

API
 Rosemount

4.2 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**

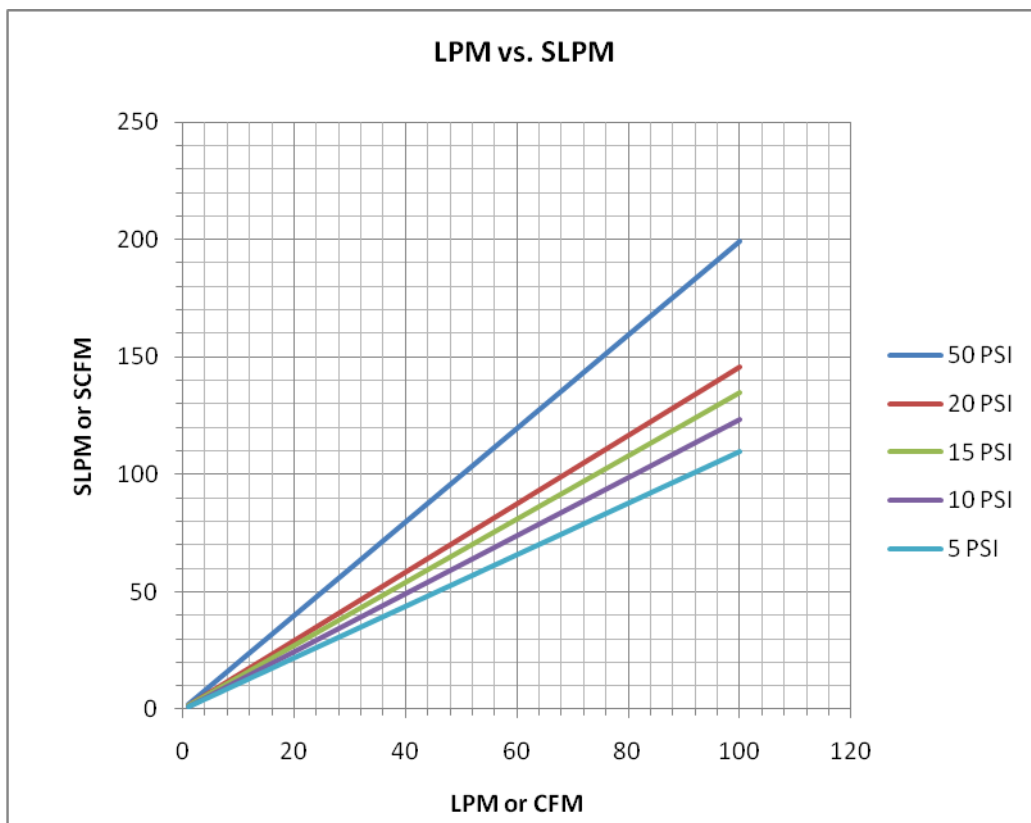
Actual standard Liters/Min \cong 12 * .95 * $\sqrt{(14.7+10)/14.7}$
 \cong 11.4 * $\sqrt{1.68}$
 \cong **14.78 LPM**

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

The graph below demonstrates the rotameter LPM (or CFM) and the pressure standardized mass flow SLPM (or SCFM {Standard Cubic Feet per Minute}).

$$\text{SCFM} = \text{SLPM}/28.3 \quad \text{and}$$

$$\text{SCFH} = \text{SLPM}/0.47$$



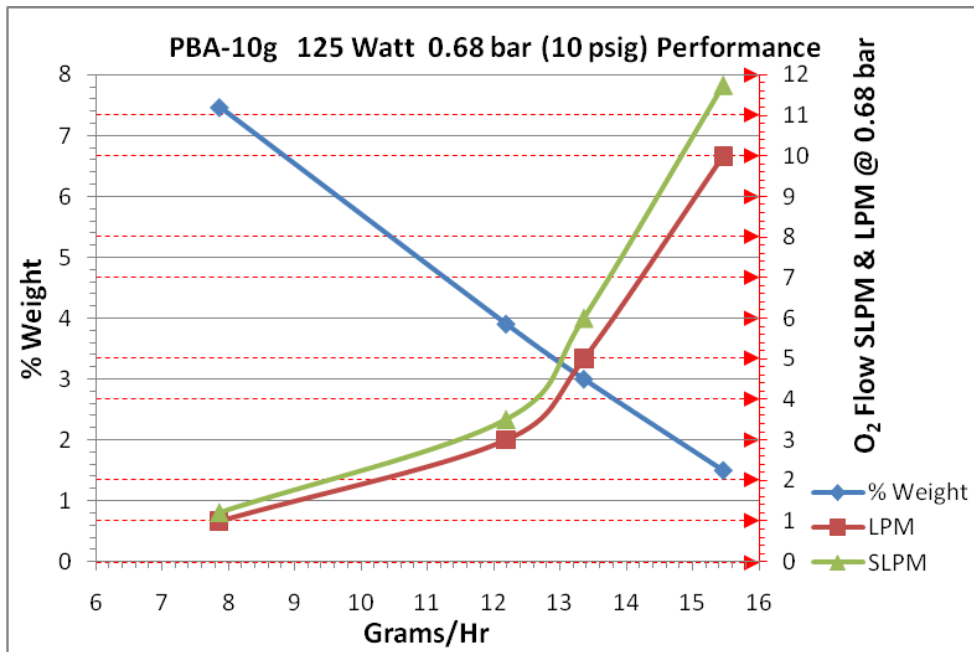
Section 5

Using performance graphs for generator selection

(For using the graph instructions, please see the 30 gram graph)

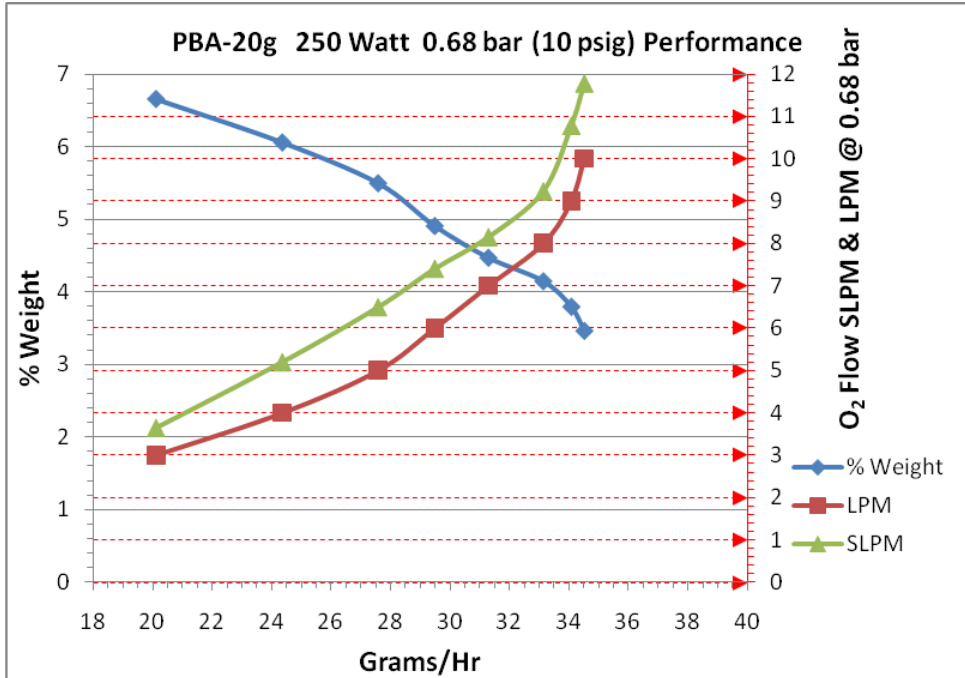
PBA10g

10 grams/hour at 5% concentration



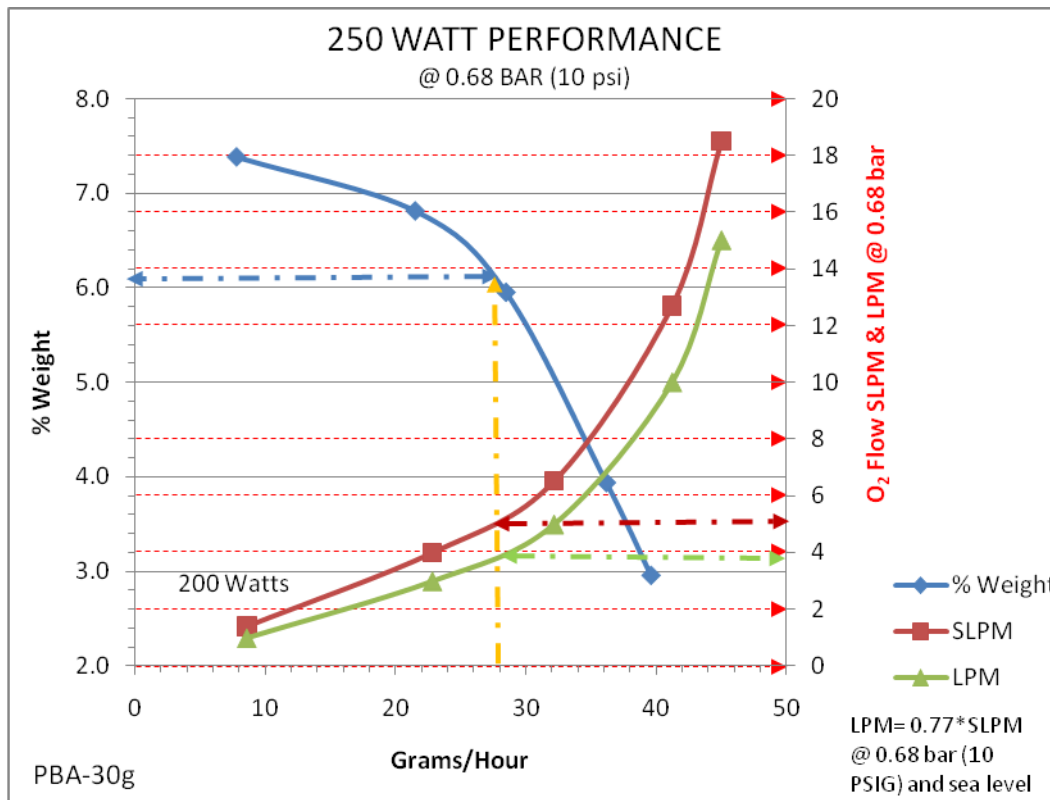
PBA20g

20 grams/hour at 5% concentration



PBA30g

30 grams/hour at 5% concentration



Flow measured in **LPM** via **uncorrected** Rotameter at inlet port. Ozone at 0 psi from side stream.
 Fan and power supply burden of 17 watts is included in above chart.

Procedure 1, Grams per hour desired at maximum power:

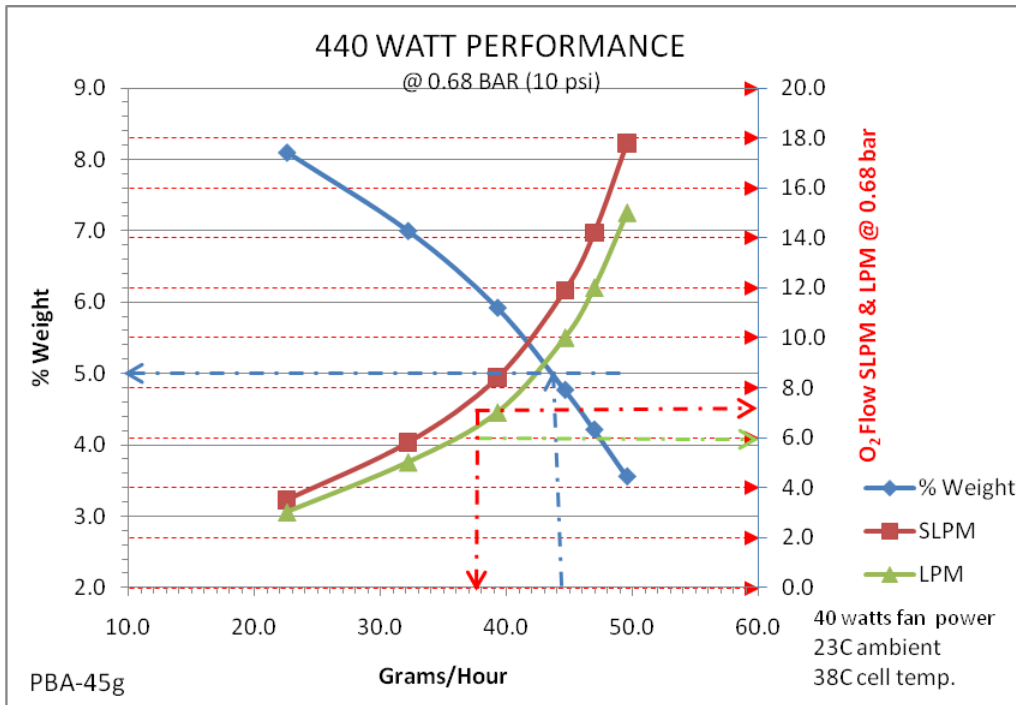
1. Determine the Grams/Hr desired for the chemical reaction. 29 gram/hr for this example.
2. Moving vertically from the value on the horizontal scale at 29 gr/hr, note the % weight (Blue line) on the left axis at 6.1 % wt for the maximum power at 29 gr/Hr.
3. At the same Grams/Hr value move vertically and note both the SLPM at 5 SLPM (red) and indicated LPM (green) at 3.9 LPM at the recommended pressure [0.68 bar (10 psi)] on the right vertical axis.
4. If a higher % weight is desired at the Grams/Hr needed, a larger generator must be selected. A generator can always be run at a lower power than maximum.

Procedure 2 example, Oxygen flow of 2 LPM maximum at 0.68 bar (10 psi) on a rotameter. What is the maximum gr/Hr production?

1. Start on the left vertical scale at 2 LPM rotameter reading. Move horizontally to intercept the green LPM line at 2 LPM.
2. Drop down vertically to see what gr/Hr is available. It is 18 gr/hr in this case.
3. Move vertically to intercept the red SLPM line at 3 SLPM and the blue % wt line at 7 % wt.
4. Note that at this low oxygen flow point, maximum power should be below 250 watts to about 230 watts to achieve these numbers.

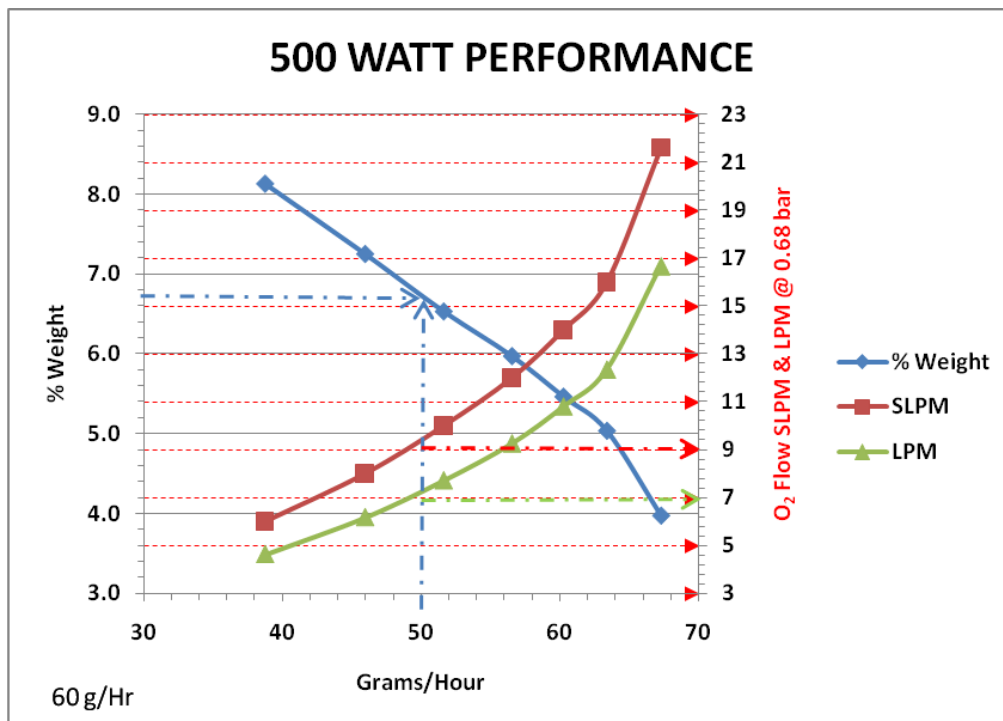
PBA50g

45 grams/hour at 5% concentration

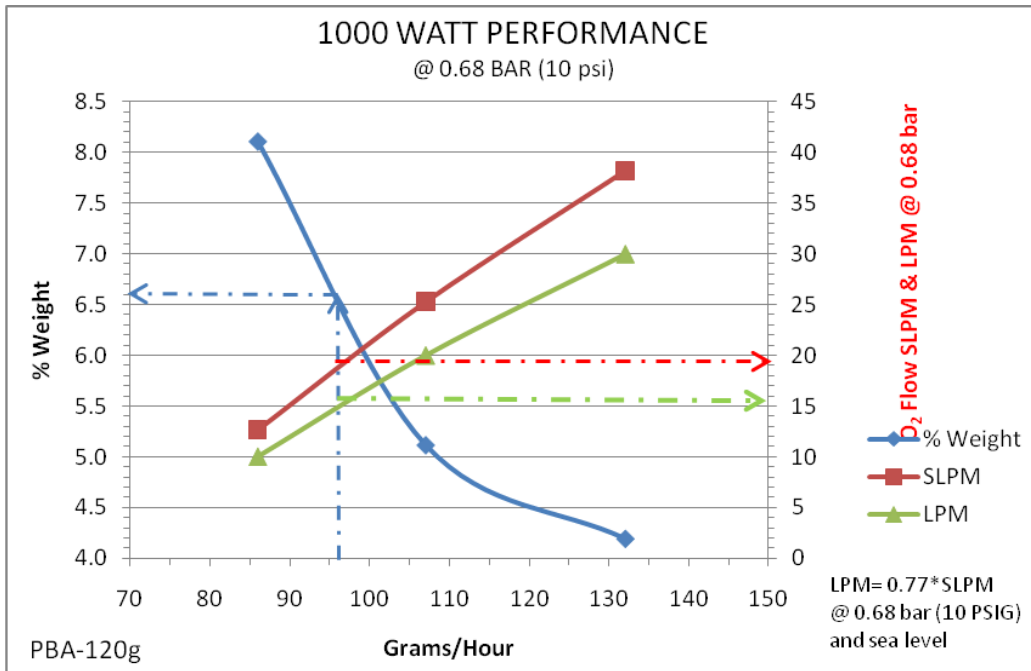


PBA60g

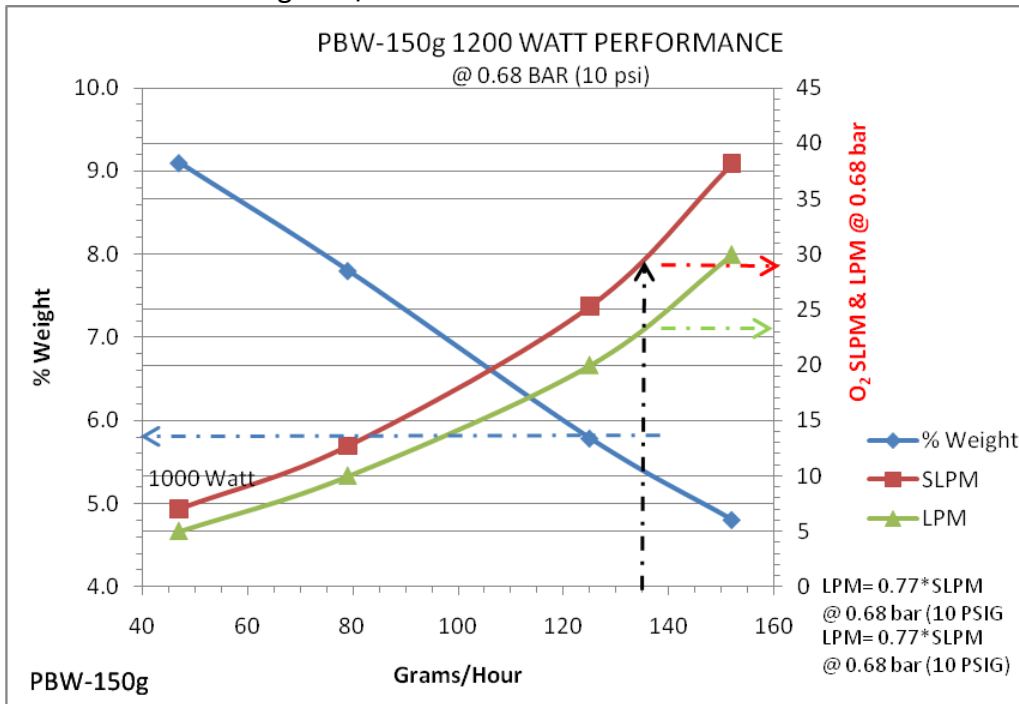
60 grams/hour at 5% concentration



PBA 120g 120 grams/hour at 5% concentration

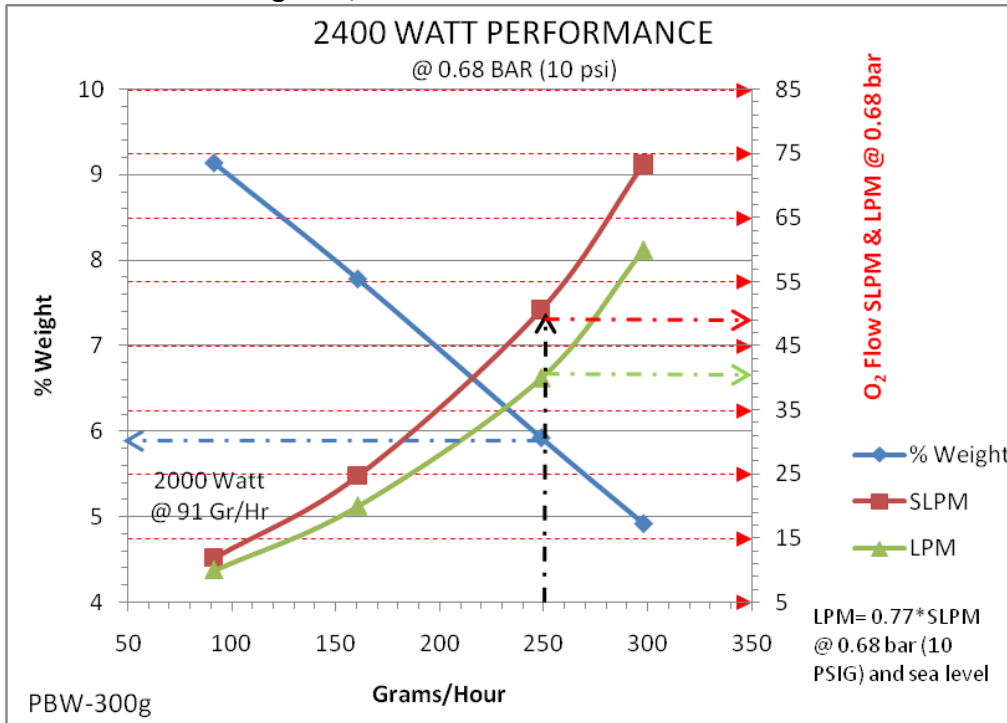


PBW150g Water cooled 150 grams/hour at 5% concentration



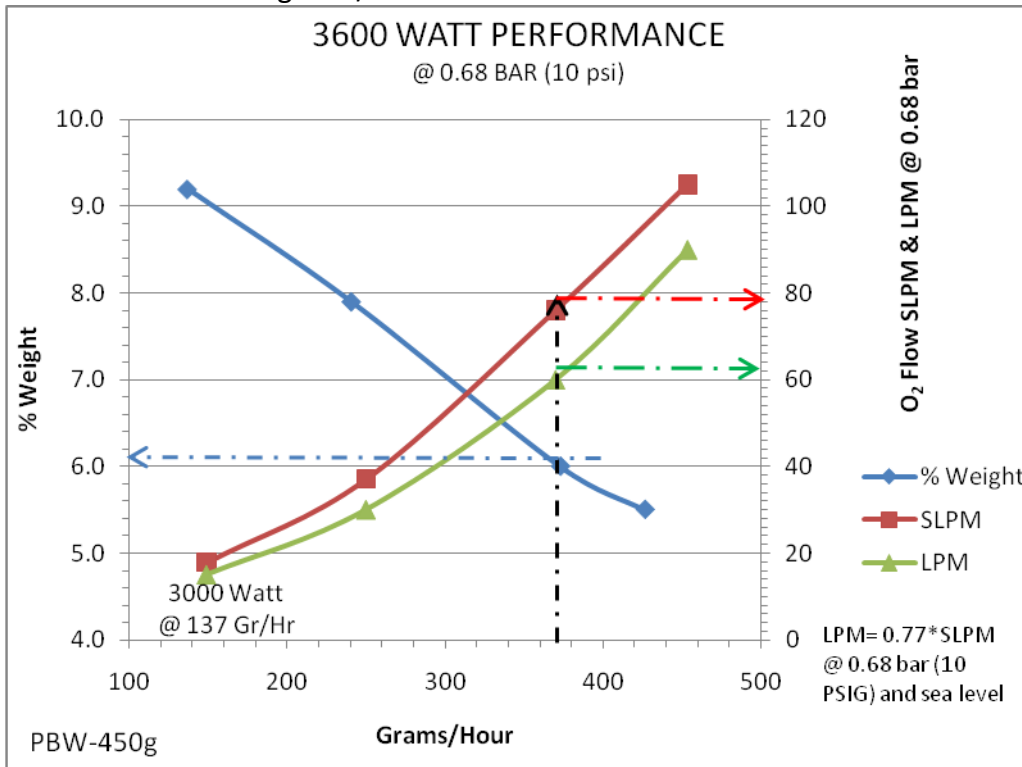
PBW300g

Water cooled 150 grams/hour at 5% concentration



PBW450g

Water cooled 150 grams/hour at 5% concentration



Section 6

TROUBLESHOOTING

PROBLEM	STEP	VERIFY	NEXT STEP
ON - OFF switch/PLC control - nothing happens	1	Is there power to the inverter?	No - troubleshoot elsewhere. Yes - Get a voltmeter and do Step 2
	2	Was there 5 seconds between applying power and the ON command?	No - increase the timing between application of power and the ON command. See Section 6 p.18 & 19. Yes - Step 3
	3	+5 VDC between Terminals 5(+) and 3 on CON12 and +5 green LED ON?	No - Check connector seating, broken wires to the small power supply inside the generator toward the rear. Replace supply if necessary. Yes - There is power to the inverter. Step 4.
	4	Verify Is the external command output power setting at zero? Verify 4/20 or 0 - 10 VDC control as set by Switch 8 on the inverter board.	No - Step 5 Yes - Increase the ozone output control voltage/current.
	5	If you have gone through steps 1 - 4 without results, it is possible that the inverter board has failed.	Replace the inverter circuit board. Refer to the instruction sent with the replacement to ensure reliable operation.

FAULT indicators on the circuit board illuminated.

FAULTED light - Flashing = soft fault temporary condition

1	Caused by: High or Low cell current, high instantaneous current in power section, over temperature in the electronics or cell.	Usually this fault is a result of improper tuning of the inverter beyond factory limits. Go to Step 2
2	Is the ambient temperature greater than 40 C (104 F)?	Yes - Improve ambient air flow. Inverter will eventually compensate by running at reduced power. No - Go to Step 3
3	Retune the inverter using the procedure in Section 7. Review Section 4.	This should solve the problem if flashing. Flashing is a "call for service" with reduced ozone output.

<p>FAULTED light - On solid = Hard fault condition and the inverter is locked OFF but the LED lights are ON for diagnosis below.</p> <p>IGBT FAULTED</p> <p>HS TEMP</p> <p>HOT LOAD</p> <p>LOAD FAULT</p> <p>HIGH POWER</p> <p>LOW POWER</p>	1	Look at other fault lights to diagnose the problem. Ozone production is turned OFF.	Go to step 2.
	2	Is IGBT faulted light ON?	Yes - There is a short in the inverter output section that has exceeded the allowable event limit. Look for damaged or loose wires, metal chips, water corrosion or anything that could cause a short. No - Go to step 3
	3	Is HS TEMP faulted light ON?	Yes - Review Status LED description for detail No - Go to Step 4
	4	Is HOT LOAD faulted light ON	Yes - Review Status LED description Section 6 for detail. No - Go to Step 5
	5	Is LOAD FAULT light ON?	Yes - Possible water flooded cell due to the process leaking back into the cell. The best option is to return the cell to the factory for cleaning. If the process water is clean, empty the water out of the cell and flush with DI water or 91% alcohol. Then dry with very dry oil free air or oxygen for several minutes. Try to operate again. Do not try to disassemble the cell without calling the factory. No - Go to Step 6
	6	Is HIGH POWER light ON?	Yes - Review Status LED description Section 6 for detail.
	1	Is LOW POWER flashing?	Yes - This is non-critical indication that the power is less than the programmed window. No - Go to Step 2
2	Is LOW POWER ON steady?	Yes - Output current is too low than the programmed window. If this condition remains for more than 32 seconds, a hard fault will be generated to shut off ozone and turn on the fault LEDs for diagnostics. Review Status LED description in Section 7 for more detail.	

Other problems
in your
equipment:

The gas inlet
solenoid valve
chatters rapidly

1	The time delay for the gas pressure switch to operate and keep the valve open.	Yes - Fixed by increasing the time delay in the PLC or controls. No - Go to step 2
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Ozone output too low and under spec.	2	Gas flow restrictions upstream from the generator or gas pressure too low for the pressure switch.	
	1	Is the PDM control voltage/current correct? Are the jumpers configured right for current/voltage control?	Yes - Go to Step 2 No - Review Jumper Block Configuration in Section 6
	2	Is the oxygen generator producing at least 92% oxygen?	Yes - Did you check this with an oxygen gas analyzer? You need more than 90% O2. Don't know - If an analyzer isn't available, get an oxygen bottle from a welding shop or compressed gas supplier. Install the bottled gas instead of the PSA oxygen generator. No - Go to Step 3
Inverter may or may not show a fault but NO ozone output detected	3	Is there process water in the cell? The DAT 310 inverter may be faulted too.	Yes -See Troubleshooting comments under LOAD FAULT for remedy. No - It may be necessary to return the entire generator for analysis. Call the factory.
	1	Was there a vacuum pulled in the cell by the injector with inverter power applied?	Yes - The cell(s) must be returned to the factory and be rebuilt. They cannot be field repaired due to excessive damage. Check to see if the gas inlet valve was closed while the injector was running and inverter power was applied. This is a common process design mistake. The cell should have no less than 5 psi with power applied. No - Go to step 2
	2	Is the PSA oxygen generator undersized or marginal causing it to run near maximum capacity?	Yes - This another common process mistake. The cell may be full of PSA resin and needs to be cleaned. A HEPA filter on the PSA oxygen outlet is good practice and may be necessary. No - Go to step 3
	3	Has the ozone monitor sufficient sample flow. Most monitors require about 1 LPM to operate?	Yes - Call the factory. The usual causes have been covered but there are other process considerations. No - Or no monitor available. Call the factory for further instructions.

Section 7

DISCLAIMER

Plasma Technics, Inc. (PTI) assumes no responsibility or liability for specific applications results. PTI supplies only components for ozone systems and not the complete system. The complete system is the responsibility of the ozone system manufacturer and/or others involved in a specific project.

Section 8

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®.