TELEDYNE API
9970 Carroll Canyon Road
San Diego, CA 92131
Tel: +1 858.657.9800
Email: api-sales@teledyne.com
Web: www.teledyne-api.com

OG5000™ Ozone Generator
Model OG5000B-A

User Manual

610-0082-01H DCN7785
25 September 2017

Contents

Figures

Tables

1. General Precautions

WARNINGS:

1. Ozone (O_3) is a toxic gas. High concentrations of ozone are dangerous and harmful to humans. Take reasonable steps to avoid exposure. The current maximum 8-hour exposure limit for ozone is 0.1 ppm (according to U.S. OSHA).
2. Install appropriate safety monitoring equipment wherever high concentrations of ozone are used. Teledyne API (TAPI) manufactures several ozone monitors for workplace safety applications.
3. Materials in contact with high concentrations of ozone should be suitable for such use. 316L Stainless, Teflon™, Chemraz™ and Kynar™ are recommended.
4. When performing any maintenance to the unit, make sure all AC power is disconnected from the unit.
5. Certain components may be hot to the touch. Please allow proper cooling time before working with these components.
6. Never attempt to open ozone catalyst canisters (if supplied). The content of the canisters can be hazardous if not handled properly.
7. Use only *TAPI*-recommended spare parts. Substitution parts could result in damage to the equipment, may create hazardous conditions, and will void the warranty.

CAUTIONS:

1. Read the operating manual before operating the unit.
2. Do not subject the unit to extreme physical or thermal shock.
3. Use care in handling the unit and any of its components.

GENERAL NOTES

1. All trademarks, registered trademarks, brand names or product names appearing in this document are the property of their respective owners and are used herein for identification purposes only.

2. This document is Copyright Protected.

3. Teledyne API (TAPI) reserves the right to make changes to the product covered in this manual to improve performance, reliability or manufacturability. Make sure that this Manual is used with the original Product it was shipped with.

4. Although every effort has been made to ensure accuracy of the information contained in this manual, TAPI assumes no responsibility for inadvertent errors. Contents of the manual are subject to change without notice.

5. TAPI assumes no responsibility for the use of any measuring schemes described herein.

6. This product is not intended or recommended by TAPI for use in (a) medical therapy or physical therapy of any kind whether as a direct or adjunct part of such therapy, including, without limitation, life support (i.e., critical medical) applications or (b) any nuclear facility applications. TAPI will not knowingly sell this product for use in such applications. Use of the IN USA-brand product in connection with medical or like treatment cannot be reasonably expected to produce accurate monitorings of therapy or treatment and may cause failure of the life support device or significantly affect its safety or effectiveness. Use by any direct purchaser or after-market purchaser in such applications whether or not known to TAPI shall absolve TAPI of any responsibility or liability to such purchaser (s) or to any person (s) subjected to or affected by such use knowingly or unknowingly.

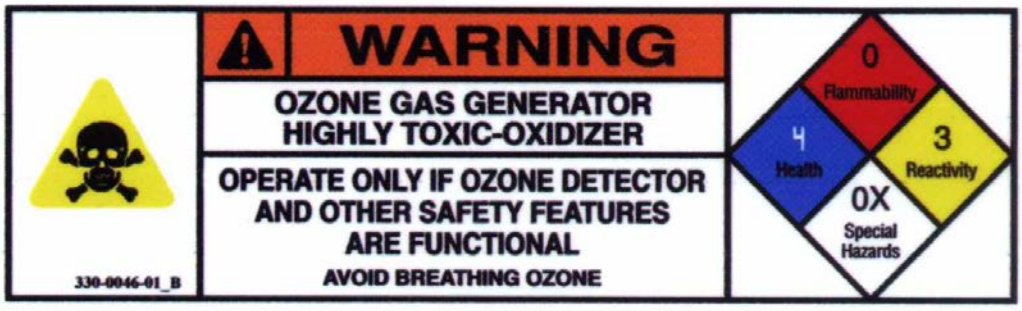
7. This product should only be used as specified by this manual. Any use other than as specified may impair the safety features of the system.

Safety

- Ozone (O3) is a toxic gas. High concentrations of ozone are dangerous and harmful to humans. Take reasonable steps to avoid exposure. The current maximum 8-hour exposure limit for ozone is 0.1 ppm (according to U.S. OSHA).
- Install appropriate safety monitoring equipment wherever high concentrations of ozone are used. *TAPI* manufactures several ozone monitors for workplace safety applications.
- Materials in contact with high concentrations of ozone should be suitable for such use. 316L Stainless, Teflon™, Chemraz™ and Kynar™ are recommended.
- When performing any maintenance to the unit, make sure all AC power is disconnected from the unit.
- Certain components may be hot to the touch. Please allow proper cooling time before working with these components.
- Never attempt to open ozone catalyst canisters (if supplied). The content of the canisters can be hazardous if not handled properly.
- Use only *TAPI*-recommended spare parts. Substitution parts could result in damage to the equipment, may create hazardous conditions, and will void the warranty.
- Use only stainless steel gasket for the VCR gas connections
- Ozone must be destroyed before it can be released to exhaust. TAPI manufactures a complete line of ozone destruction equipment. Please consult with us for your ozone destruction requirements.

Safety Label

- The safety-warning label is intended to warn the users about the toxicity and danger of the ozone gas. Prior to operating the generator, ensure that ozone detector is attached to the generator and is functional. Ensure that all other safety-monitoring features are functional.



2. OG5000™ Description

The IN USA-brand OG5000™ ozone generator is designed to produce high purity ozone gas. The ozone produced in the Model OG5000B-A comes from high purity oxygen that is subjected to electrical discharge in the generating cells.

Adding small amounts of 'doping' or 'spiking' gas, such as N_2 or CO_2, can increase ozone output as well as stabilize the long-term ozone gas production.

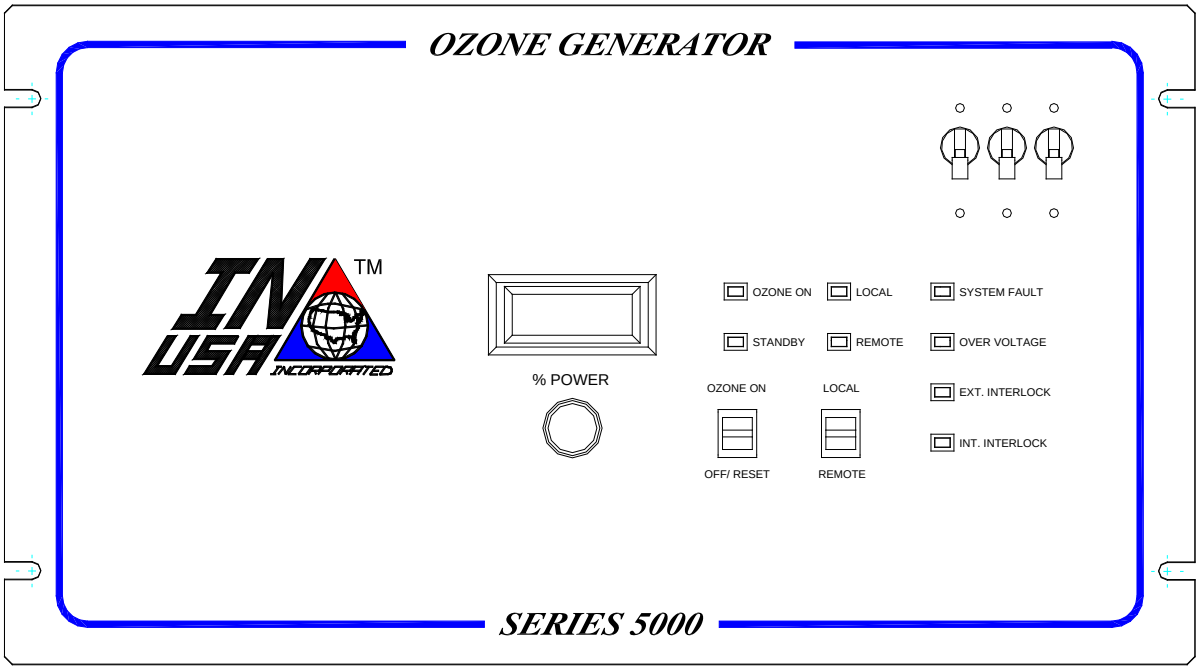


Figure 1: Ozone Generator Model OG5000B-A, Front View

3. OG5000B-A Specifications and Requirements

Specifications	
Dimensions (W x H x D)	19” x 10.5” x 18” (48 cm x 27 cm x 45 cm)
Oxygen Flow	0.5 to 20 slpm
Ozone Outlet Pressure	25 - 35 psig (Typically set to 30 psig)
Proof Pressure	80 psig
Ambient Temperature	5 – 35 °C
AC Power	208/240 VAC, 3ϕ, 50/60HZ
Dimensions (W x H x D)	19” x 10.5” x 18” (48 cm x 27 cm x 45 cm)
Weight	92 Lbs. (42 kg)

Facility Requirements	
Gas Service	
▪ Oxygen	Grade 6 or better. (Less than 1 PPM water, hydrocarbon and halocarbons.) See note below about the use of LOX.
▪ Spiking Gas (N_2 or CO_2)	0.5% N_2 (Grade 5 or better) Or 8.0% CO_2 (Grade 5 or better) (% of total feed gas volume)
▪ Inlet Pneumatic Port	¼ “ VCR (male)
▪ Ozone Outlet Port	¼ “ VCR (male)
Cooling Water	
▪ Temperature:	18 ºC ± 2ºC (keep water temperature above local dew point)
▪ Recommended Flow:	2.5 GPM or more
▪ Minimum Flow:	2.0 GPM @ 18°C
▪ Max Inlet Pressure:	60 PSIG
▪ Filtration:	20 Microns or better (Customer Supplied)
▪ Quality:	Demineralized
▪ Resistivity:	0.5 mΩ/cm (minimum)
▪ Thermal Load:	2.5 KW
▪ Water Supply/Return Port	¼” Compression (female)
Electrical Service	
▪ AC Power	208/240VAC, 50/60 Hz, 1ϕ, 2ϕ or 3ϕ
▪ Current	20 AMP RMS
▪ Breaker	30 Amp Breaker

Warning on the Use of LOX (Liquid Oxygen):

Liquid Oxygen is a highly flammable liquid. Oxygen is the oxidizing agent in most fires and Liquid Oxygen is extremely likely to cause combustion of any inflammable material that it is in contact with.

When Liquid Oxygen (LOX) is used (evaporated) to feed the Ozone generators, make sure that the LOX system is in good working condition and take special precautions to prevent LOX from entering the Ozone Generator.

An MSDS can be obtained from the Internet at 'www.uigi.com/MSDS_liquid_O2.html'.

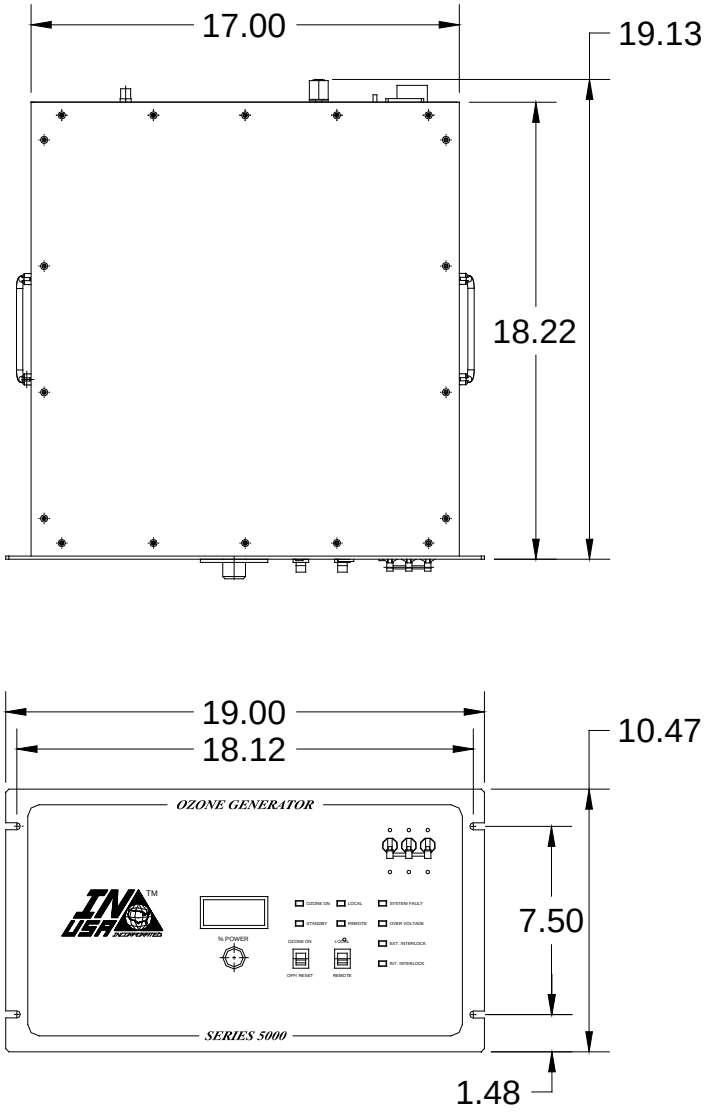


Figure 2: Ozone Generator, Model OG5000B-A, Mechanical Dimensions (inches).

4. Installation and Connections

Mounting

The OG5000B-A is designed to be mounted in a standard 19" rack. Due to its weight (82 lbs), support brackets are required. The hole pattern on the front panel accepts ¼-20 or 6 mm hardware.

Water Connection

The Model OG5000B-A is cooled by re-circulating chilling water. Refer to the Chilling Water Specification in Section 3.

Oxygen Connection

The Model OG5000B-A requires an Oxygen supply of Grade 6 or better. Less than 1-PPM water vapor, hydrocarbon and halocarbons. Connect the Oxygen gas supply to the Model OG5000B-A via the ¼"female VCR pneumatic port identified as GAS INLET.

IMPORTANT!!: Gas flow should be piped as indicated by the labels on the rear panel of the generator.

Ozone Connection

The Model OG5000B-A produces ozone gas that is available at the GAS OUTLET port. This is ***¼"*** female VCR pneumatic connector.

IMPORTANT!!: Gas flow should be piped as indicated by the labels on the rear panel of the generator.

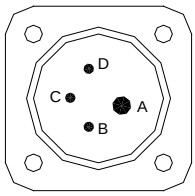
Power Connection

Operation from 208/240 VAC, 3 ϕ Δ, 50/ 60 Hz (Three Phase-Delta)

The Model OG5000B-A can operate from 240 VAC, 3 ϕ **Δ**, 50/ 60 Hz, at 20 Amp, max. Use 12 AWG four-conductor cable terminated in a 4-pin circular style jack connector to bring the mains VAC into the Model OG5000B-A. The following table illustrates the pin-out of the circular jack connector.

Table 1. 240 VAC, 3 ϕ Δ, 50/ 60 Hz OPERATION, MAINS VAC

Pin #	Description
A	Ground (Earth)
B	Line 1
C	Line 2
D	Line 3



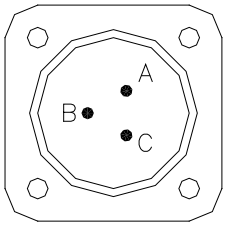
Note: Make sure that pin A (large Pin) is connected to Ground.
Note: Connect the three Lines to Pins B, C and D without regard to sequence.
Use P/N 245-0223-01 (Amphenol p/n CA3106E18-13SB).
More information can be found at:
http://www.ittcannon.com/media/pdf/catalogs/ms_e.pdf

Operation from 208/240VAC 1 ϕ, 50/60 Hz (Single Phase)

The Model OG5000B-A can operate from 208/240 VAC, 1 ϕ, 50/60 Hz, at 20 Amp, RMS. Use 12 AWG three-conductor cable terminated in a 3-pin circular style jack connector to bring the mains VAC in to the Model OG5000B-A. The following table illustrates the pin-out of the circular jack connector.

Table 2. 208/240 VAC, 1 ϕ, 50/60 Hz OPERATION, MAINS VAC

Pin #	Description
A	Line 1
B	Line 2 or Neutral
C	GROUND



Make sure that pin C is connected to Ground.
Use P/N 245-0204-01 (Amphenol p/n 97-3106A-16-10S)
More information can be found at:
http://www.ittcannon.com/media/pdf/catalogs/ms_e.pdf

Ground Connection

The Model OG5000B-A features a threaded stud, labeled “GROUND” located in the rear panel, intended to allow for the connection, via a cable, between earth ground and the chassis. Use 14 gauge wire (green and yellow) to connect to earth ground to chassis.

WARNING!!:
High voltages that can cause injury or death to operators are present in the Model OG5000B-A.
The Model OG5000B-A must be grounded before operation. Do not rely on the ground in the power cord, which can be removed.

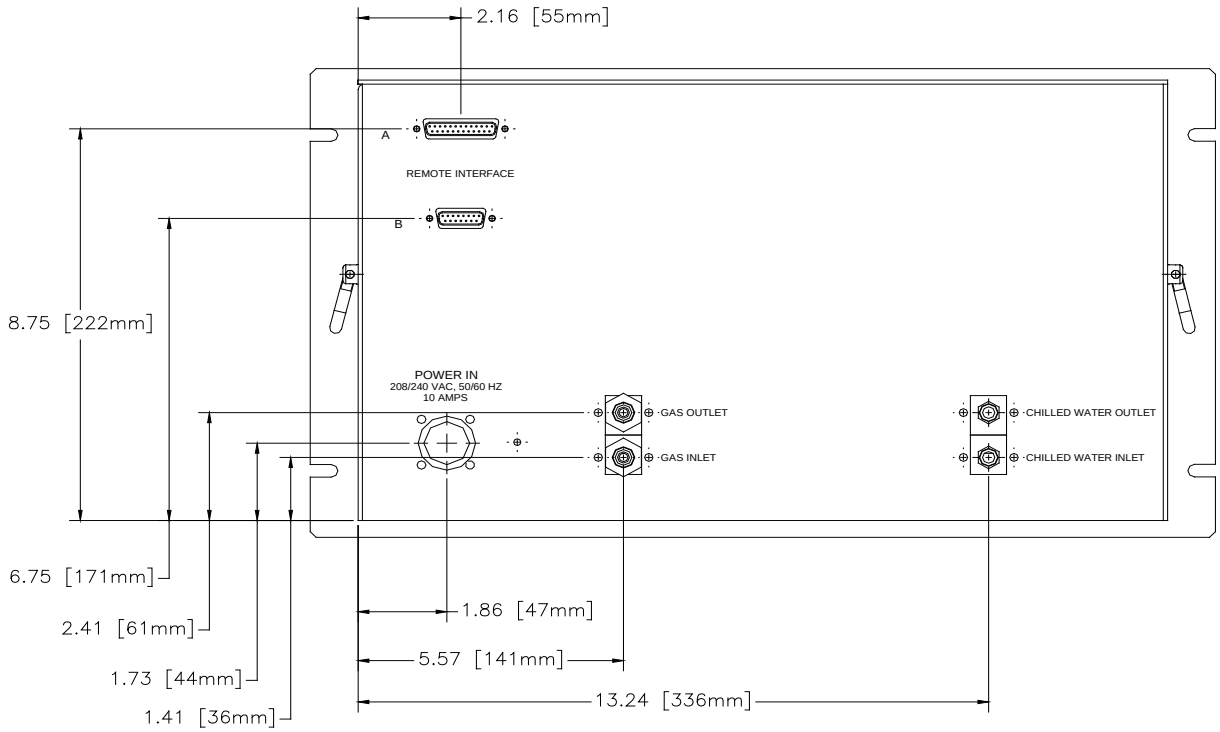


Figure 3: Rear Panel

The rear panel consists of:

- Two Electrical Connectors as follows:
  - Main power input,
  - DB-25 electrical connector for remote operation,

- Two Chilling Water Connectors as follows:
  - Chilled Water Inlet Port
  - Chilled Water Outlet Port

- Two Gas Ports as follows:
  - Gas Inlet Port (Oxygen)
  - Gas Outlet Port (Ozone)

5. Operation

The Model OG5000B-A can be operated locally, via the controls located in the Front Panel; or remotely, via the Remote Interface Connector (DB-25), located in the Rear Panel.

Refer to Figure 4, Model OG5000B-A: Front Panel, for location and identification of controls and indicators.

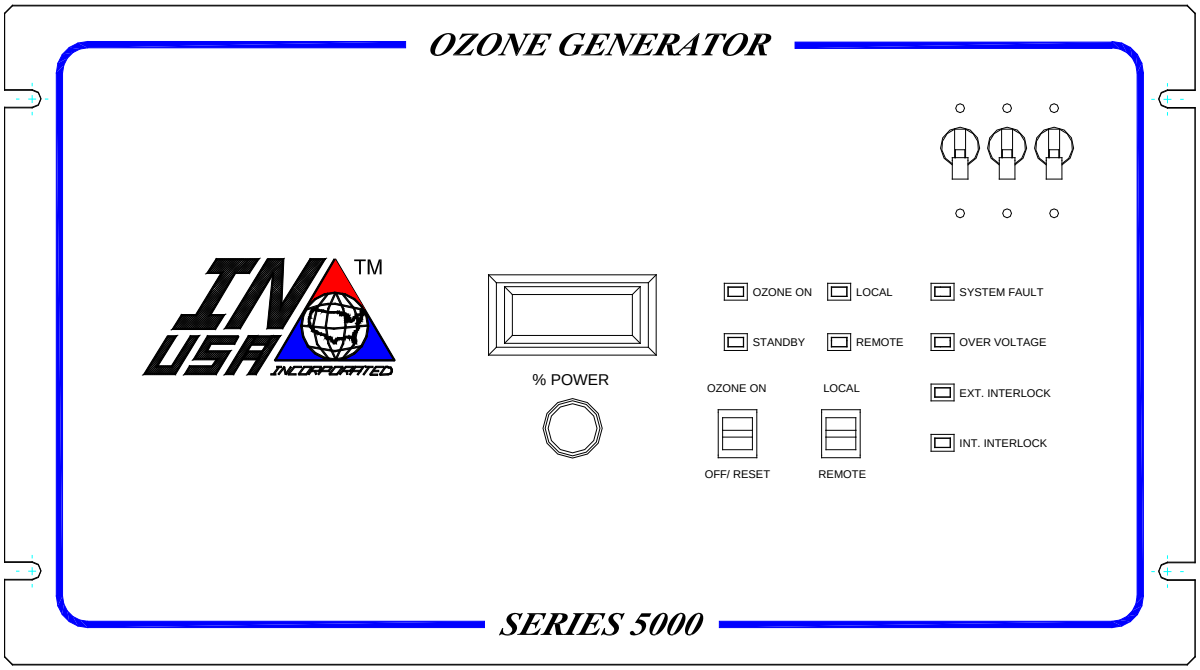


Figure 4: Front Panel

Table 3. below identifies Controls, Indicators and required External Signals

Table 3. Controls and Indicators, Front Panel

Identifier	Description
POWER BREAKER SWITCH	This breaker is used to switch the AC power to the unit. When the switch is in the ON position (breaker UP) the main AC power is applied to the unit. When the switch is in the OFF position (breaker down) no AC power is present.
OZONE ON – OFF/RESET SWITCH	When the switch is set to the OZONE ON position the control electronics will attempt to deliver the set-point power to the generating cells (1). When the switch is set to the OFF/RESET position, the control electronics will remove power from the generating cells
LOCAL – REMOTE SWITCH	In the LOCAL position it selects Local operation from the Front Panel Controls, in the REMOTE position it selects remote-controlled operation via the connector located in the Rear Panel
SET POINT KNOB	This knob controls the amount of power delivered to the generating cells (and ultimately the amount of ozone being generated)
OZONE ON LED	This indicator is ON when power is applied to the generating cells, and no alarm conditions are present
STANDBY LED	This indicator is ON when the generator is ready to make ozone and there is no alarm condition detected
LOCAL LED	This indicator is ON when the Local Mode of Operation has been selected
REMOTE LED	This indicator is ON when the Remote Mode of Operation has been selected.
SYSTEM FAULT LED	This indicator is ON when the control electronics detects an over-temperature condition in either the High Voltage Power Supply's switching transistors; the power magnetics components; or the generating cells. The control electronics shuts off the HVPS and the unit remains in this state until a reset (2) signal is detected
OVERVOLTAGE LED	This indicator is ON when an over-voltage condition is detected at the high voltage power supply (HVPS). The control electronics shuts off the HVPS and the unit remains in this state until a reset (2) signal is detected
EXT. INTERLOCK LED	This indicator is ON when the EXT. INTERLOCK signal (Pin #12 in the REMOTE-INTERFACE CONNECTOR) is HIGH.
INT.INTERLOCK LED	This indicator is ON when the control electronics detects that there is not enough chilled water flow.

Notes:

(1) The attempt will be successful only if all alarms signals are off and the unit is set to operate on Local Mode.

(2) A Reset signal occurs when the "OZONE ON – OFF/RESET" switch is toggled, or the "REMOTE ON" signal (Pin# 2 in the REMOTE-CONTROL CONNECTOR) is brought to a High (24 VDC) level. Refer to Table 4 for a detailed pin-out and functionality of the Remote-Interface Connector

Local Mode

In this mode, the front panel, (refer to Figure 4) is used to control the operation of the generator.

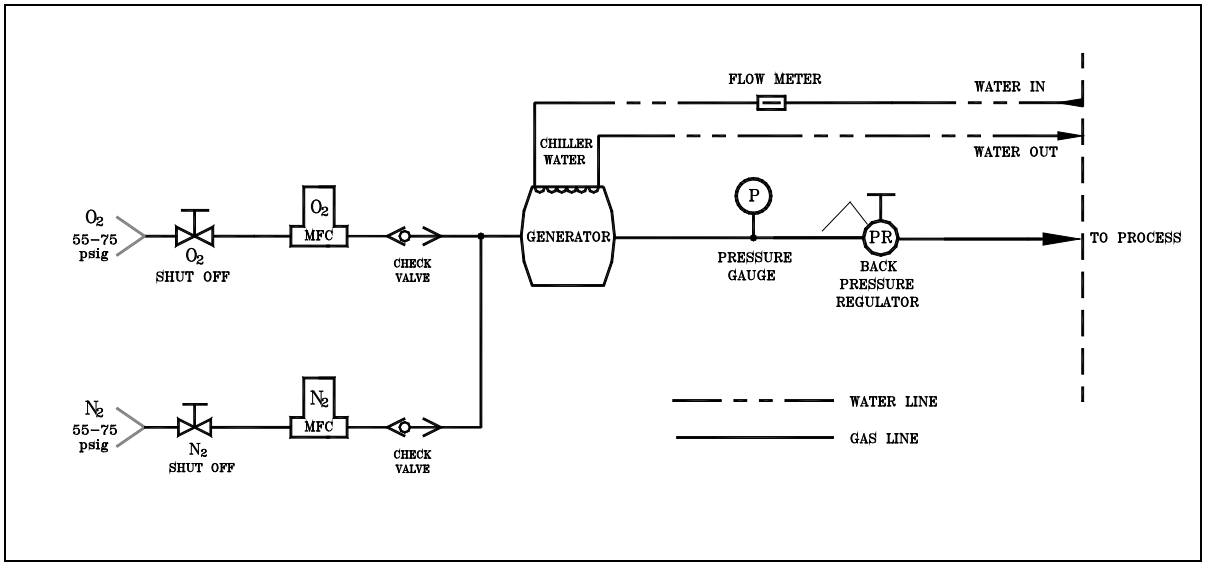
IMPORTANT!!: Feed Gas flow should be established before attempting to generate ozone.

IMPORTANT!!: Cooling water flow should be established before attempting to generate ozone.

Typically, the Ozone Generator is installed as part of an "Ozone System". Refer to Figure 5, "Typical Ozone System". The following is a list of pre-operation requirements that need to take place before Local Operation can start.

- Supply 24 VDC to the Remote Interface Connector. Use pin#1 for 24 VDC, and pin #7 for 24 VDC RETURN. (Refer to Table 4 for a complete pin-out description of the Remote Control Connector).
- Place a jumper between pin#12 and pin#7 in the Remote Interface Connector. This will enable the "External Interlock". A Dry Contact (relay) can be used to replace the electrical jumper. (Refer to Table 4 for a complete pin-out description of the Remote Control Connector).
- Verify that the cooling water connections are in place and that cooling water is flowing in accordance with the unit's requirements as specified in this manual.
- Verify that the Oxygen gas feed connection is in place.
- Turn on the flow of Oxygen feed
- Adjust the Back Pressure Regulator (BPR) to 30 psig.
- Set the "% POWER" knob fully counter clockwise
- Set the "LOCAL/REMOTE" toggle switch to the "LOCAL" position.
- The "LOCAL" Led Indicator should light
- Set the "OZONE ON/OFF-RESET toggle switch to the " OFF-RESET" position
- Set the Power Breaker to the "ON" position

- The “STANDBY” indicator should light
- Set the “OZONE ON/OFF-RESET toggle switch to the “ OZONE ON” position
- The “OZONE ON ” indicator should light and the “STANDBY” indicator should be off
- The “% POWER” digital readout should read 00
- Rotate the “% POWER” knob clockwise. This will apply increasingly larger voltage across the generating cells, creating discharge and generating ozone.



NOTE: Ozone is toxic. Make sure that it exhausted through the proper equipment or it is safely destroyed.

Figure 5. Typical Ozone System

Remote Mode

The ozone generator can be operated from a remote control device. In this mode, an external Analog Voltage, 0 to 10 VDC signal, controls the power delivered to the ozone generating cells (ultimately controlling the amount of ozone produced).

10 VDC corresponds to 100% Power. The analog voltage signal is generated by an external peripheral, and it is applied into the generator via the "Remote Interface Connector", a DB-25 electrical connector located in the rear panel. The following is a list of pre-operation requirements that need to take place before Remote Operation can start.

- Supply 24 VDC to the Remote Interface Connector. Use pin#1 for 24 VDC, and pin #7 for 24 VDC RETURN. (Refer to Table 4 for a complete pin-out description of the Remote Control Connector).
- Place a jumper between pin#12 and pin#7 in the Remote Interface Connector. This will enable the "External Interlock". A Dry Contact (relay) can be used to replace the electrical jumper. (Refer to Table 4 for a complete pin-out description of the Remote Control Connector).
- Verify that the cooling water connections are in place and that cooling water is flowing in accordance with the unit's requirements as specified in this manual.
- Verify that the Oxygen gas feed connection is in place.
- Turn on the flow of Oxygen feed
- Adjust the Back Pressure Regulator (BPR) to 30 psig.
- Set the "LOCAL/REMOTE" front panel toggle switch to the "REMOTE" position. This will disable the "OZONE ON – OFF/RESET" switch located in the Front Panel, and that function will be implemented via the REMOTE IN signal (PIN #2 in the Remote Interface Connector.)
- Set the "OZONE ON/OFF-RESET toggle switch to the " OFF-RESET" position
- Set the Power Breaker to the "ON" position
- The "STANDBY" indicator should light
- The "REMOTE" Led Indicator should light.

Table 4 shows the pin-out for the DB-25, located on the rear of the unit.

Table 4. OG5000™ Remote Interface Connector (DB – 25)

Pin #	Signal	Type	Description
1	24VDC	Power	24VDC Power input. Return on Pin 7.
2	Remote ON	Input	Remote enable for ozone generator. Connect to Pin 7. LOW=GENERATOR ON
3	Remote Set Point in	Input	External setpoint for remote mode. 0-10 VDC signal (4-20mA optional)
4	Remote Set Point Return	Input	Return for external setpoint signal
5	Remote Mode	Input	Selects LOCAL or REMOTE mode. Overrides front panel switch. Connect to Pin 7. LOW= REMOTE MODE
6	ON Status	Output	Status of ozone generator. Relative to Pin 7. LOW=GENERATOR ON
7	GND	Power	GND for 24VDC power input
8	Earth GND		
9	NC		
10	System Alarm	Output	Alarm output. Relative to Pin 7. LOW=FAULT
11	External Interlock Monitor	Output	External interlock alarm. Relative to Pin 7. LOW=FAULT
12	External Interlock	Input	Connect to Pin 7 -- Remote interlock signal. LOW=ACTIVE
13	NC		
14	Power Monitor	Output	Power delivered to cells. 0-10VDC (0-100%)
15	NC		
16	NC		
17	NC		
18	NC		
19	NC		
20	NC		
21	Earth GND		
22	Earth GND		
23	Earth GND		
24	Earth GND		
25	Earth GND		

Faults

The OG5000™ Ozone Generator has several internal diagnostic sensors. These are classified into four types:

- System Fault
- Over Voltage
- Internal Interlock
- External Interlock

There are 4 (four) red LED indicators located on the front panel, associated to each of the above conditions.

*A "*SYSTEM FAULT*"* condition takes place when the diagnostics routines detect and report error conditions associated with the hardware. These include temperature over-range at the HVPS, magnetic components or the generating cells.

The *""*OVER VOLTAGE" fault indicates that there is a problem associated with the high voltage power supply.

The *""*INTERNAL INTERLOCK" fault indicates that there is not enough chilled water flow, preventing the unit from generating ozone

The "EXTERNAL INTERLOCK" fault indicates that the 24-vdc signal that is required on pin 1 of the Remote Interface Connector, is not present &/or that any addition fault sensor that has been added in series with this signal, is causing the error. (For example, this 24-vdc signal could be routed through a set of dry-contacts associated to the relay alarms in the ozone safety monitor. This can be used to automatically shut off the generator in the case of an ozone leak). This fault also indicates no ground connection is provided to pin 12 of Remote Interface Connector.

IMPORTANT!!: Before restarting the unit, wait at least 15 seconds.

6. Maintenance

The OG5000™ Ozone Generator has no consumable or user serviceable parts. The Ozone Generator has high voltage, Ozone gas, and pressure hazards. It is only to be serviced after contacting the Technical Support Department. Follow these steps if the unit fails:

- **Contact TAPI Technical Support**
  Technical Support will review the symptoms with the customer and help determine if the generator has indeed failed. If the Ozone generator fails, Technical Support will direct the customer to complete an RMA Form.

- **Power off the generator and disconnect the Power cable on the back of the unit.**
  Purge the generator with Oxygen for 15 minutes. After the generator is completely purged, power off the generator.

- **Disconnect the Gas.**
  Shut off the Inlet Gas (Oxygen and Nitrogen). Disconnect the gas outlet first, and then disconnect the gas inlet.

- **Disconnect the Cooling water.**
  Shut off the cooling water. Prepare towels and a bucket to minimize spills. Disconnect the Outlet first, and then the inlet.

  To protect against freezing damage during shipment, purge the cooling water with compressed air (about 25 psig) in the outlet and out the inlet to drain all the water.

- **Ship the Generator back to TAPI for repair.**
  Properly package the Ozone generator. Reuse the package in which the generator was received, or use comparable packaging.

Be sure to insure the generator against damage during shipment.

Follow all shipping instructions.

7. Typical Performance Data

The ozone output of the OG5000™ OG5000B-A generator is a function of several parameters, such as pressure, chilled water temperature and flow, feed gas flow rate, spiking gas concentration, type and flow, and power setting. The following figures illustrate typical parametric performance.

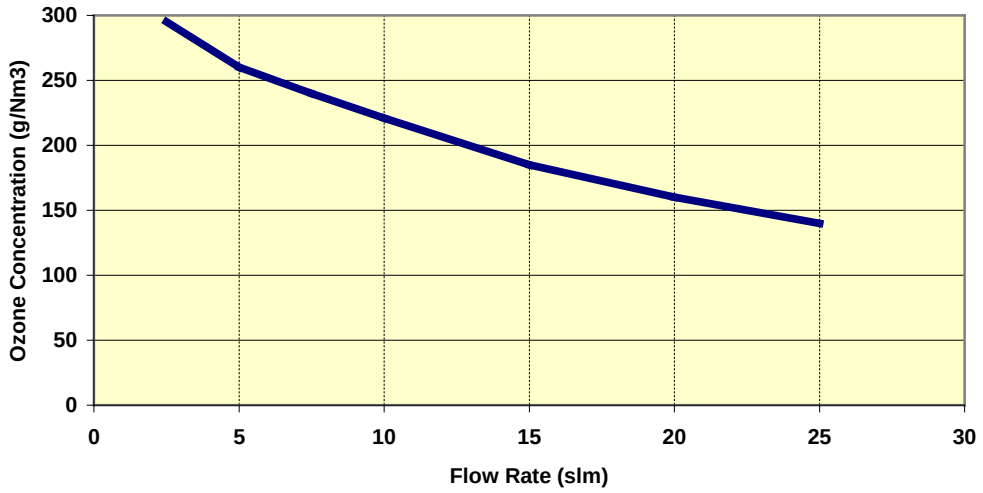


Figure 6: Concentration Vs Flow @ 100% power

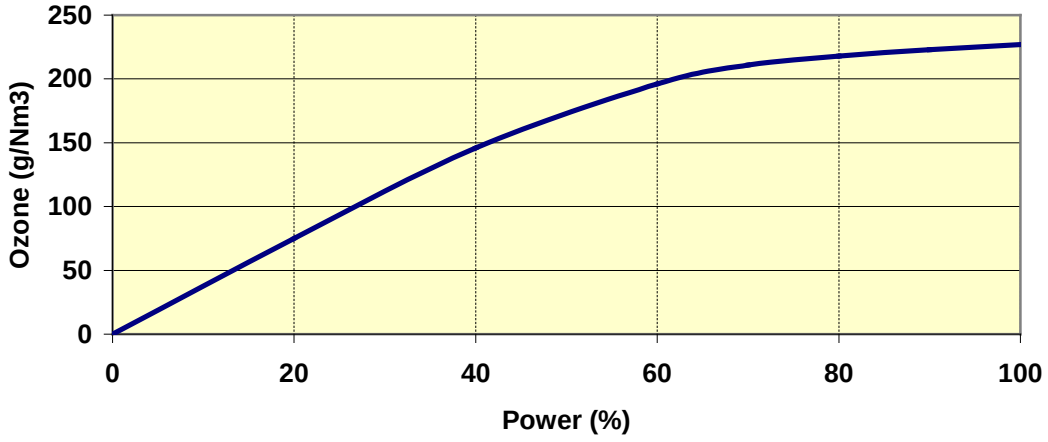


Figure 7: Concentration Vs Power @ 10 slpm

8. Contacting TAPI

TAPI Technical Support personnel are ready to help and can be reached by mail, e-mail, telephone, or fax.

Address: Teledyne API
ATTN Technical Support
9970 Carroll Canyon Road
San Diego, CA 92131-1106
U.S.A.

Telephone: (toll free) 800-324-5190
+1 858-657-9800
Fax: +1 858-657-9816
e-mail: sda_techsupport@teledyne.com