

OSMONICS® E-SERIES OZONE GENERATOR

Operation and Maintenance Manual



5951 Clearwater Drive, Minnetonka, MN 55343-8995 USA
Phone (800) 848-1750 or Fax (952) 988-6063
<http://www.osmonics.com>

Please take the time to read and understand this Operation and Maintenance Manual, paying special attention to the sections on INSTALLATION and MAINTENANCE.



Osmonics Customer Support Center can be reached by calling (800) 848-1750 or faxing (952) 988-6060, Monday through Friday, 7:30 a.m. - 5:30 p.m. CST.



Mail should be sent to:

OSMONICS, INC.
Attn: Customer Support Center
5951 Clearwater Drive
Minnetonka, MN 55343-8995 USA

OPERATION AND MAINTENANCE MANUAL

OSMONICS E-SERIES OZONE GENERATOR

TABLE OF CONTENTS

	<u>Page</u>
1.0 SAFETY PRECAUTIONS	1
1.1 Safety Summary	1
1.1.1 Read This Manual	1
1.1.2 Use Proper Wire Connections	1
1.1.3 Device Labeling	2
1.2 Oxygen	2
1.2.1 Oxygen Characteristics	2
1.2.2 Oxygen Safety Precautions	2
1.3 Ozone	3
1.3.1 Ozone Characteristics	3
1.3.2 Ozone Safety Precautions	3
1.4 Ozone Generator Safety	5
1.4.1 Ozone Detectors	5
1.5 Electricity	6
1.6 Ozone First Aid	6
1.7 Ambient Monitoring for Ozone	7
2.0 INTRODUCTION	8
2.1 Principles of Operation	8
2.2 Features	10
2.3 Installation	10
2.3.1 Utility Requirements	10
2.3.2 Interfacing	12
2.4 Main Fuses	12
2.5 Initial Inspection	12
2.6 Location	12
2.7 Plumbing	13
2.8 Electrical	13
2.8.1 Supply Power	14
2.8.2 Output Signals	14
2.8.2.1 Fault Relay	14
2.8.2.2 Remote Ready	15

2.8.3	Input Signals	-15
2.8.3.1	Remote Control 4-20 mA	-15
2.8.3.2	Remote Enable	-15
2.8.3.3	Room Ozone Monitor	-16
3.0	START-UP	-17
3.1	Generator Start-Up	-17
3.2	Generator Idle	-18
3.3	Operation Status Display Screen	-19
3.4	Keypad	-20
3.5	Security Levels	-21
4.0	OPERATION	-22
4.1	Local Mode	-22
4.2	Remote Mode	-22
5.0	OPERATOR MENU	-24
5.1	Operator Mode	-24
5.2	Operation Status Screen	-25
5.3	Local/Remote Menu	-25
5.4	Firmware Version Menu	-26
5.5	Time and Date Menu	-26
5.5.1	Setting the Day	-27
5.5.2	Setting the Date	-27
5.5.3	Setting the Time	-27
6.0	TECHNICIAN MENU	-28
6.1	Operator Security Menu	-29
6.2	Relays	-29
6.2.1	Manual Override	-29
6.2.2	Auto/Manual Select	-30
6.3	Alarms	-31
6.3.1	Cell Temperature	-31
6.3.2	Cell Pressure	-31
6.3.3	Feed Pressure	-32
6.3.4	Oxygen Flow	-32
6.3.5	Remote Input	-32
6.4	Water Meter	-32
6.4.1	Contacting Head	-33
6.4.2	Paddle Wheel	-33
6.4.3	Autotrol Turb 1-Inch	-33
6.4.4	Autotrol Turb 2-Inch	-33
6.4.5	Water Meter	-34
6.5	System Set-Up	-34
6.5.1	Local Remote Set-Up	-34

6.5.2	Remote Enable Configuration Set-Up	-35
6.5.2.1	Remote Enable Configuration	-35
6.5.2.2	Room Ozone Alarm Timer Configuration	-35
6.5.3	Initialization	-35
6.5.3.1	Restore Defaults	-36
6.5.3.2	Calibrate Pressure	-36
6.5.3.3	Calibrate Gas Flow	-37
6.5.3.4	Flow Constant	-38
6.5.4	Security	-39
6.5.5	Diagnostics	-39
6.5.5.1	Analog I/O	-39
6.5.5.2	Digital I/O	-40
6.5.5.3	Alarms/Control	-40
6.5.5.4	Calibration	-40
6.5.6	Firmware Version	-41
6.5.7	Date and Time	-41
6.5.8	Drop Security Level to Operator Mode (View Only)	-41
7.0	RELAY OUTPUTS (Engineering Use)	-42
8.0	SHUTDOWN	-43
8.1	General Emergency Shutdown	-43
8.2	General Normal "Manual" Shutdown - Local Mode	-43
8.3	General Normal "Manual" Shutdown - Remote Mode	-43
8.4	Generator Fault Shutdown	-43
8.5	Shut Down Alarms	-43
9.0	ESTIMATING OZONE OUTPUT	-44
9.1	Cooling Temperature Effect on Ozone Output	-44
10.0	MAINTENANCE	-46
10.1	Daily	-46
10.2	Monthly	-46
10.3	Quarterly	-47
10.4	Annually	-47
10.5	Cabinet Entry and Cell Removal	-47
10.6	Cell Reinstallation in Cabinet	-48
10.7	Circuit Board Replacement	-48
11.0	TROUBLESHOOTING	-52
11.1	Alarms	-52
11.1.1	Shutdown Alarms	-52
11.1.2	Warnings	-52
11.2	Troubleshooting Chart	-54

12.0	SPARE PARTS LIST	-59
13.0	DRAWINGS	-60
13.1	Electrical Drawing	-60
13.2	Installation Drawing	-60
14.0	RETURN GOODS AUTHORIZATION (RGA) PROCEDURE	-63
15.0	WARRANTY	-64

APPENDIX A

MSDS Data Sheet
Ozone Generator Performance Data Sheet

LIST OF FIGURES

<u>Figure</u>	<u>Title</u>	
2.1	Front Control Panel and Indicators	-9
2.2	Bottom View of Generator with Connections	-11
3.1	Welcome Screen	-17
3.2	Operation Status Screen	-19
5.1	Operator Menu	-24
5.2	Operation Status Screen	-24
5.3	Local/Remote Menu Screen	-25
5.4	Firmware Version Menu Screen	-26
5.5	Day, Date, & Time Menu Screen	-26
6.1	Technician Menu	-28
9.1	Ozone Output vs Water Temperature	-45
13.1	Electrical Hook-Up Drawing	-60
13.2	Installation Drawing	-61
13.3	Electrical Schematic	-62

LIST OF TABLES

<u>Table</u>	<u>Title</u>	
1.1	Effects of Ozone at Various Concentrations	-4
10.1	Suggested Maintenance Intervals	-49
10.2	Maintenance Log	-50

I.0 SAFETY PRECAUTIONS

I.1 Safety Summary

The safety summary does not contain all of the safety statements in this manual. Other safety statements are included within the manual text and are enhanced and defined as follows:

NOTE: Indicates statements that provide further information and clarification.

CAUTION: Indicates statements that are used to identify conditions or practices that could result in equipment or other property damage.

WARNING: Indicates statements that are used to identify conditions or practices that could result in injury or loss of life.

WARNING: FAILURE TO FOLLOW THE REQUIREMENTS SET FORTH IN THIS SECTION I.0 COULD POSE A RISK OF SERIOUS INJURY OR DEATH TO INDIVIDUALS WORKING WITH OZONE.

I.1.1 Read This Manual

Prior to operating or servicing this device, this manual must be read and understood. Keep it and other associated information near the machine for future reference.

This manual has been prepared to provide the operator with information on the installation, operation, maintenance, and troubleshooting of the E-Series Ozone Generator System.

The E-Series Ozone Generator must be installed, operated, and maintained by qualified and properly trained operators. It is the responsibility of the owner to ensure that operators have been properly trained to operate and maintain the E-Series Ozone Generator.

I.1.2 Use Proper Power Connections

Use proper wiring and connection methods as stated in this manual and local regulations.

1.1.3 Device Labeling

Do not, under any circumstances, remove any Caution, Warning, or other descriptive labels from the devices.

The E-Series Ozone Generator is a durable piece of equipment, which with proper care will last for many years. Whenever possible precautionary measures have been made to reduce the possibility of a dangerous condition. However, as a result of misuse or improper maintenance, dangerous conditions may present themselves. The areas of potential danger include:

- Oxygen
- Ozone
- High Voltage Electricity

1.2 Oxygen

Oxygen is used as the parent gas for the production of ozone in the E-Series Ozone Generator. Certain precautions must be taken to ensure safety. This section discusses the basics of oxygen safety, including oxygen characteristics and oxygen safety precautions. This section is provided as information only. It is the owner's responsibility to determine and follow all national and local codes and regulations.

1.2.1 Oxygen Characteristics

- Colorless, odorless, tasteless
- Heavier than air
- Supports and accelerates burning (particularly in concentrations > 25%)

1.2.2 Oxygen Safety Precautions

Oxygen must not be exposed to the following:

- Open flames
- Oil and grease

Open flames in the presence of oxygen can cause a potentially explosive situation. Under no circumstances should smoking, welding, or any source of ignition (sparking) be allowed in the vicinity of the oxygen producing equipment.

Oil and grease in the presence of oxygen can rapidly combust. Therefore, the oxygen equipment must be kept free of oil and grease. This includes operator and maintenance personnel's clothing in order to reduce the potential for danger.

Use only oxygen-compatible greases in the system.

1.3 Ozone

The E-Series Ozone Generator converts oxygen-enriched air to ozone. Certain safety precautions must be taken. This section discusses the basics of ozone safety; including ozone characteristics and ozone safety precautions. This section is provided as information only. It is the owner's responsibility to determine and follow all national and local codes and regulations.

1.3.1 Ozone Characteristics

- Toxic
- Corrosive
- Accelerates burning
- Heavier than air and oxygen
- Acrid odor
- Unstable

NOTE: Ozone can be detected by humans (by the sense of smell) at a level as low as 0.003 ppm (odor threshold).

NOTE: The owner and/or user is responsible for compliance with all national and local regulations regarding the use of ozone.

1.3.2. Ozone Safety Precautions

- Follow national and local regulations and guidelines for handling ozone.

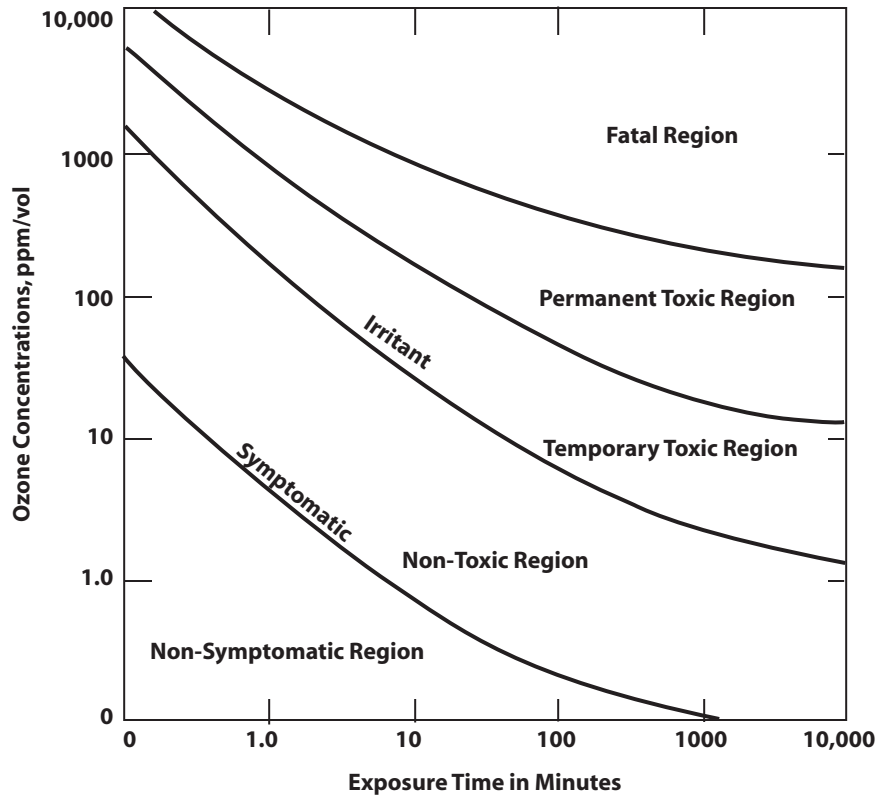
Ozone must not be exposed to the following:

- Open flames
- Oil and grease
- Non-compatible grease

Open flames in the presence of ozone can cause a potentially explosive situation. Under no circumstances should smoking, welding, or any source of ignition (sparking) be allowed in the vicinity of the ozone producing equipment.

Oil and grease in the presence of ozone can rapidly combust. Therefore, the ozone equipment must be kept free of oil and grease. This includes operator and maintenance personnel's clothing in order to reduce the potential for danger.

Table I.1
Effects of Ozone at Various Concentrations



Ozone Regulations:

EPA Discharge Limits: 1.0 ppm to Atmosphere

OSHA Exposure Limits: 0.1 ppm for 8 hours
0.3 ppm for 10 minutes
10+ ppm - Fatal Level

1.4 Ozone Generator Safety

The E-Series Ozone Generators are designed to operate safely. The potentially lethal nature of ozone requires the equipment owner to follow additional safety precautions.

1.4.1 Ozone Detectors

Ozone generators can produce ozone concentrations up to 15% wt and higher. This concentration is above the lethal limit. Even small leaks can produce dangerous concentrations of ozone in a local area. For this reason, ozone-warning devices must be installed in the area near the ozone generator and ozone process manufacturing areas. For information on installing ozone detectors see Ambient Ozone Monitoring (Section 1.7). To ensure safety the following precautions should be taken:

- Access to ozone generator should be limited to authorized and trained personnel only.
- Evacuation routes must be clearly marked in the event of an ozone leak.
- Install an electrical disconnect switch on the power feed to the ozone generator. This electrical disconnect switch disconnects the electrical supply to the equipment. This switch should be in an accessible location and installed per local regulations.
- Install ozone detectors to monitor for the presence of ozone. Wire the detectors into the discreet ozone generator shut down input whenever possible.
- Have suitable breathing apparatus available on site. A breathing apparatus must be worn before entering areas with suspected concentrations of ozone.

WARNING: Once the ozone generator has been turned off, the machine still contains ozone gas. Before opening the machine or piping, flush the equipment thoroughly with dry air or oxygen gas until no ozone can be detected.

1.5 Electricity

WARNING: Never open the electrical equipment when power is supplied. Always remove power (unplug) before opening electrical equipment.

WARNING: The internal capacitors can hold a dangerous electrical charge for up to five (5) minutes after turning the machine off. Wait at least five (5) minutes after machine is turned off before opening the door. Always disconnect power from the machine before opening the door.

WARNING: NEVER WORK ON LIVE EQUIPMENT! HIGH VOLTAGE CAN CAUSE INJURY AND DEATH.

1.6 Ozone First Aid

IMPORTANT: The owner and/or user must ensure that first aid measures meet local codes and regulations.

Following exposure to ozone, the following first aid measures must be performed immediately.

1. Bring the victim into fresh air.
2. Call emergency services, stating ozone exposure.
3. Give medical-oxygen.
4. Lay victim down and keep victim calm until help arrives.
5. Check pulse, breathing, and consciousness.
6. If breathing stops, begin CPR.

1.7 Ambient Monitoring for Ozone

Ambient monitoring units must be installed in all areas where ozone can potentially escape. Air currents need to be taken into consideration. Several monitoring units may need to be installed, depending upon the size of the room.

When in an ambient alarm condition:

- Evacuate all personnel from the contaminated area.
- Enter room wearing a suitable breathing apparatus.
- Disconnect electrical supply and ventilate the area.

WARNING: If the ambient monitors give a warning or fail, the feed gas supply and the electrical supply must be immediately and automatically disconnected. Simultaneously, the warning must initiate an optical and acoustic alarm, so that personnel in the respective rooms are warned. As long as the area monitors indicate a high ozone concentration, the rooms are only to be entered when wearing suitable breathing apparatus.

- Wiring terminals are provided on the E-Series Ozone Generator for connecting a safety monitor alarm output to automatically shut down the ozone generator.
- Rooms where ozone will be produced or used should be properly ventilated.

2.0 INTRODUCTION

Ozone (O₃) is a three-atom allotrope of oxygen (O₂). It is second only to fluorine in electronegative oxidation potential. Ozone is a natural ingredient of the earth's upper atmosphere, generated by solar energy, and exists in a gaseous form at ambient conditions. Unreacted ozone decomposes in a matter of hours to simple molecular oxygen and therefore it cannot efficiently be stored. It must be produced on site. A wide variety of ozone equipment configurations and sizes are available for municipal, industrial, and laboratory applications.

Ozone is emerging as the most efficient and ecologically sound oxidant to treat both organic and inorganic substances in air and water.

2.1 Principles of Operation

The Osmonics E-Series Ozone Generator is designed to continuously generate ozone. The generator offers the user the capability to regulate the ozone output from 0 - 100% of its rated capacity. This adjustment can be made from the local control panel or remotely via a 4-20 mA current loop.

Ozone generators produce ozone from a very dry form of oxygen. The supplied oxygen should be dried to -62°C (-80°F) dewpoint, or drier, and should be particulate free to 1 micron. The oxygen should have a minimum concentration of 90%. The E-Series Ozone Generators rated output is based on an oxygen feed of 93% purity.

Prior to entering the E-Series Ozone Generator, the clean, dry oxygen should be pressure-regulated to between 0.62 and 1.03 barg (9 and 15 psig).

Feed gas passes through a passage that is machined between the electrodes and the dielectric. This passage is known as the "dielectric gap." The dielectric gap is the point where electrical energy is applied to the feed gas, creating ozone. By controlling the amount of energy applied to the cell, ozone output can be controlled. Cooling passages are also machined inside the electrodes, allowing cooling water to carry off excess heat from the process. The entire cell is contained in a housing, which provides mechanical structure for the cell, as well as a measure of safety for operators and maintenance personnel.

As feed gas passes through the dielectric gap, a portion of the oxygen molecules are converted to ozone. An ozone output data sheet is included in this manual to assist you in estimating the ozone output at certain machine settings.

The amount of ozone created is dependent on several factors:

- Oxygen flow rate, temperature, and pressure
- Cooling water temperature and flow rate
- Applied voltage and frequency
- Oxygen purity and dew point
- Cell contamination

The resultant ozone output can be estimated by observing operating conditions on the front display on the front panel and comparing them to the data sheet in this manual. The data sheet reflects test results taken at the factory on this specific generator.

After the parent gas and ozone mixture leaves the dielectric assemblies, it passes through an adjustable flow control valve prior to exiting the generator cabinet. The ozone outlet can be connected to the process via PTFE or stainless steel tubing.

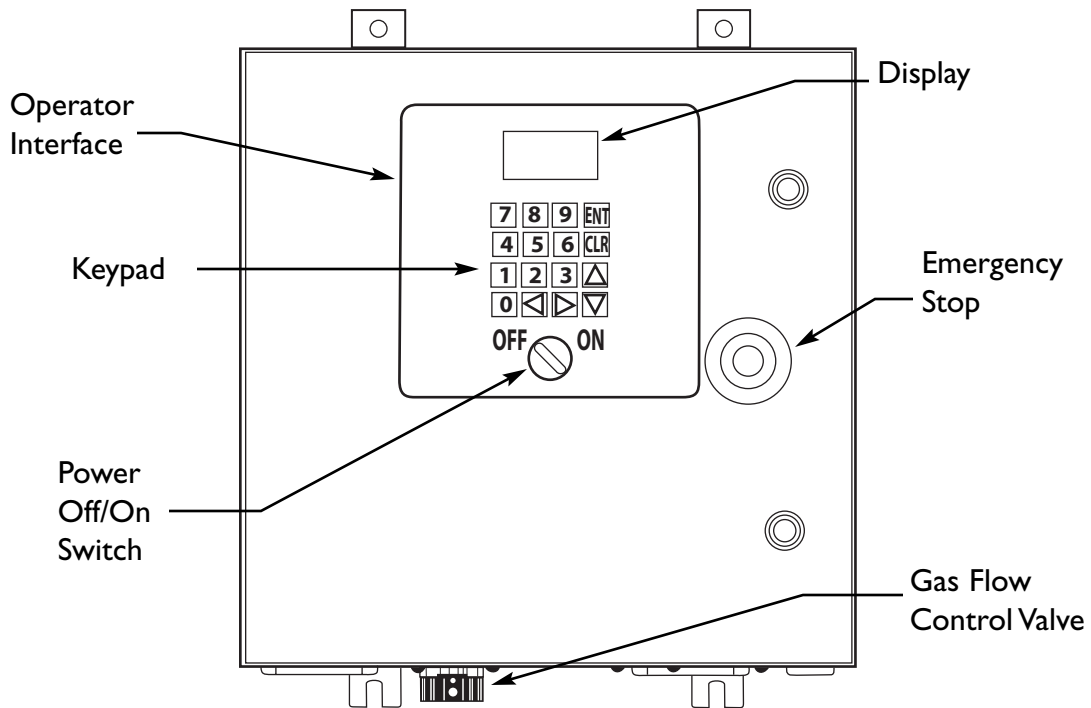


Figure 2.1
Front Control Panels and Indicators

2.2 Features

Generator Power Switch	Main power switch for generator. Switch illuminates when inverter is enabled.
Emergency Stop Switch	Palm press switch that quickly removes power from the generator and stops flow of oxygen in emergency conditions.
Multi-Line Digital Display	Displays operating parameters, warnings, faults, and alarms.
16 Key Keypad	Allows the user to adjust settings of the generator and change views on the display.
Gas Flow Valve	Located on the bottom of the unit, adjusts gas flow through the ozone generator cell.

2.3 Installation

2.3.1 Utility Requirements for E-Series Ozone Generator

Electrical

- 200 - 240VAC, single-phase
- 50/60 Hz
- 3.5 amps full load

Cooling Water

- 1.9 to 3.2 Lpm [30 to 50 gph (0.5 to 0.8 gpm)]
- Potable or better quality (softened water is preferred)
- Maximum pressure: 2.4 barg [35 psig] (10 to 15 psig typical)
- 10 - 29°C (50 - 85°F)

WARNING: If the cooling water is too cold, condensation may form inside the generator cabinet and damage internal circuitry. The temperature of the cooling water should be near ambient room temperature.

To prevent mineral deposits from damaging the cooling system, the cooling water must have a low mineral content. To protect the generator, a solenoid valve (1/2 inch 220 Vac) and water flow switch (0.5 gpm) should

be installed in the cooling water supply line. Power the solenoid from terminals 35 and 36 to energize the valve when the generator is turned on, or power the valve and generator from a common disconnect.

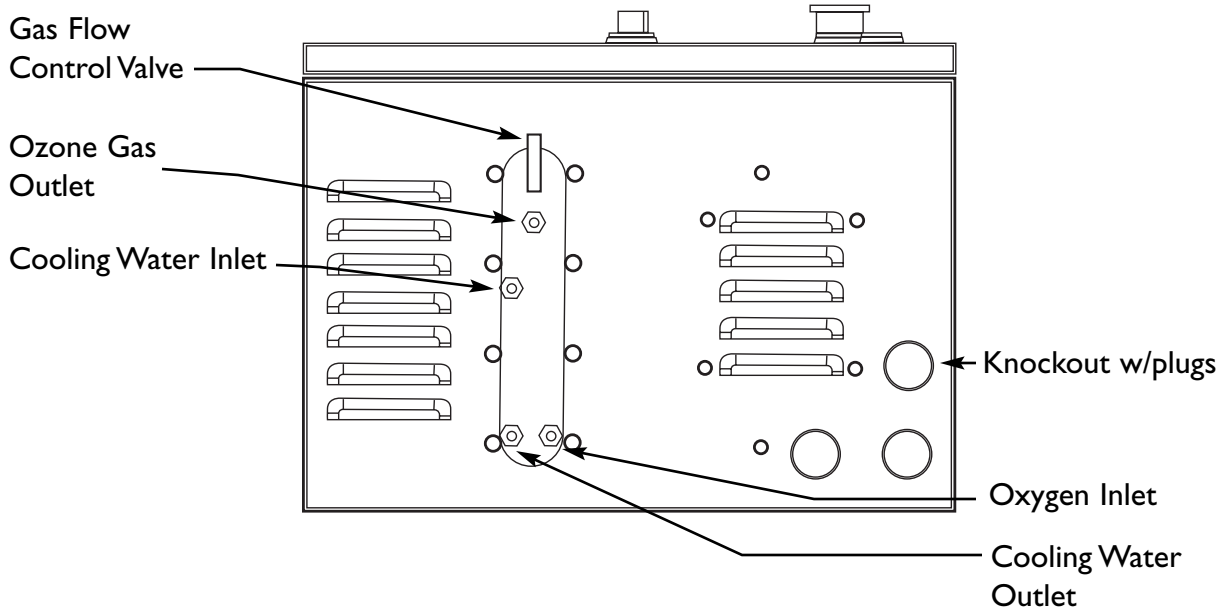


Figure 2.2
Bottom View of Generator with Connections

Dry Oxygen Supply

- Pressure: 0.62 to 1.03 barg (9 to 15 psig)
- Flow: 2 to 12 sLpm (4.2 to 25 scfh)
- Moisture content: -62°C (-80°F) dewpoint max.
- Maximum temperature: 29°C (85°F)
- Purity: greater than 90% oxygen

NOTE: If using an oxygen concentrator, such as SeQual ATF-25, be sure there is no air pressure into the concentrator except when power is applied. On systems using plant air, a solenoid valve (3/4-inch, 220 Vac) must be installed at the concentrator input and powered with the concentrator. On systems with a compressor, the concentrator and compressor must be powered from a common switch. Terminals are also provided on the wiring strip inside the cabinet for connecting a cooling water flow switch and remote 4-20 mA control signals.

2.3.2 Interfacing


Connect room ozone safety monitor and any remote alarm devices to the wiring strip inside the cabinet.

2.4 Main Fuses

These fuses are located in the fuse holders on the main terminal strip. All current for the ozone generator unit passes through these fuses.

2.5 Initial Inspection

Inspect the shipping carton for obvious external damage. Note on the carrier's bill-of-lading the extent of the damage, if any, and notify the carrier. Save the shipping carton until your ozone generator is up and running.

 If there was shipping damage, call the Osmonics Customer Support Center at (800) 848 - 1750 or (952) 933 - 2277 for instructions.

2.6 Location

Place the ozone generator as near as possible to where ozone is to be applied to the process. There should be a minimum of three (3) feet (0.91 m) clearance below and in front of the generator.

CAUTION: DO NOT SUBJECT THE OZONE GENERATOR OR AIR COMPRESSOR TO DIRECT SUNLIGHT, WATER, OR FREEZING CONDITIONS OR EXCESSIVELY DUSTY, HUMID AND CORROSIVE ENVIRONMENTS. CHEMICAL FUMES MUST ALSO BE AVOIDED.

Your Osmonics E-Series Ozone Generator must be operated in a clean, dry environment that does not contain any corrosive or volatile airborne contaminants. Excessive moisture, dust and/or vapors from stored chemicals, paints, or solvents will damage the generator's electronic components. Vapors from chlorine or chlorine-containing compounds are especially damaging.

CAUTION: THE OPERATION OF YOUR OZONE GENERATOR IN A DAMAGING ENVIRONMENT MAY VOID ITS WARRANTY!

2.7 Plumbing

Connect the water inlet and outlet on the ozone generator using not less than 1/4-inch (0.635 cm) diameter tubing. The incoming water pressure must be less than 2.4 barg (35 psig). The use of a pressure regulator and flow switch on the water source is recommended (refer to Figure 2.2).

Do not hard plumb the water fittings to the generator cabinet. All plumbing connections must be removed from the cabinet to service the generator cell.

The ozone plumbing needs to extend at least two (2) feet (60 cm) above the highest water level in the process being treated.

Connect the oxygen inlet using oxygen safe tubing, such as copper, stainless steel, PTFE, or other such tubing. Connect the ozone outlet using stainless steel tubing, PTFE tubing or other ozone resistant plumbing (refer to Figure 2.2).

Do not hard plumb the gas fittings to the generator cabinet. All plumbing connections must be removed from the cabinet to service the generator cell.

WARNING: SEVERE DAMAGE WILL RESULT IF WATER BACKS UP INTO THE OZONE GENERATOR! IT IS THE CUSTOMER'S RESPONSIBILITY TO PROVIDE AN INSTALLATION WHICH WILL PREVENT THE BACKFLOW OF WATER INTO THE OZONE PIPE LINE.

CAUTION: FAILURE TO FOLLOW THE ABOVE WARNING WILL VOID WARRANTY.

To avoid water backflow, install a stainless steel checkvalve in the ozone piping. Turn the generator ON to a 0% setting to provide oxygen flow before turning on your process water.

2.8 Electrical

A terminal strip is provided inside the enclosure for all electrical connections (refer to Figure 13.1).

WARNING: NEVER WORK ON LIVE EQUIPMENT! INSTALLATION MUST ADHERE TO NATIONAL AND LOCAL CODES AND BE PERFORMED BY A QUALIFIED ELECTRICIAN.

2.8.1 Supply Power

The generator needs a clean and consistent source of 200 to 240 VAC, single phase power in 50 or 60 Hz. Fluctuations in power may affect ozone output. Power levels outside the 200 to 240 VAC range may result in ozone generator failure. Failures from an improper power supply are not covered under warranty.

200 to 240 Vac, single-phase, 50/60 Hz, 3.5 amp full load.

Supply power can be: one leg of 208 V or 240 V 3-phase, opposing 115 V phases, or grounded neutral 230 V, etc. Grounded neutral is acceptable, but not required.

Connect power and ground wires to the terminals provided at the right-hand end of the terminal strip: L1, L2, and Gnd.

Main fuses are located inside the L1 and L2 terminal blocks.

A single wall-mounted disconnect, or power cord, may be used to supply both the EO3 generator and the Oxygen Prep system, if permitted by local electrical regulations.

2.8.2 Output Signals

2.8.2.1 FAULT RELAY (alarm output)

This relay switches whenever the EO3 shuts down in an alarm or fault condition. These contacts are available for customer use to signal external equipment or alarm.

- Isolated form-C relay contacts
- Rating: 5 A, 250 Vac, 1/3 Hp

Terminal

- | | |
|----|-------------------|
| 18 | - normally open |
| 19 | - common |
| 20 | - normally closed |

2.8.2.2 REMOTE READY (output relay)

- Terminals 16 and 17
- Rating: 5 A, 250 Vac, 1/3 Hp
- Isolated normally open relay contacts
- Closes when the following conditions are met:
 - The Local/Remote menu item is set to REMOTE mode.
 - The Remote Enable input signal is closed.
 - No shutdown alarms are active.

The Remote Ready output to external process control equipment indicates that the EO3 is producing ozone based on the remote 4-20 mA signal input. The Remote Ready output follows the condition of the Remote Enable input for remote control applications.

2.8.3 Input Signals

2.8.3.1 REMOTE CONTROL 4-20 mA analog input

A 4-20 mA signal from external process control equipment controls the amount of ozone being generated when the EO3 is operated in the REMOTE mode (refer to Section 5.3).

Terminal 15 (+) 4-20 mA signal input
Terminal 14 (-) (ground in the EO3).

- Terminal 15 has a load resistance to ground of 200 ohms. The external source of the 4-20 mA control signal must be capable of driving a 200 ohm grounded load.
- Shielded cable must be used for the 4-20 mA signal wiring. The shield must be grounded at the source end only.

The EO3 power setting, and amount of ozone being generated, is determined by the value of the 4-20 mA signal, from 0% at 4 mA, to 100% at 20 mA.

2.8.3.2 REMOTE ENABLE (digital input)

Terminal 12 and 13.

Connect to isolated (“dry”) relay or switch contact in external equipment to inhibit ozone production when open. Close to run.

Terminal 12 is grounded in the EO3.
Terminal 13 has a 5k-ohm resistor to +5 Vdc (1 mA DC).

In Remote mode (refer to Section 5.3):

Open - forces the power level to 0% and causes the Remote Ready relay to open.

If the Remote Enable signal remains open for longer than 10 minutes, the Oxygen Flow will also stop.

Closed - energizes the Remote Ready relay, and the power setting returns to the value determined by the 4-20 mA control signal.

- The EO3 will do a 30-second purge if Oxygen flow was stopped, then it will resume normal operation.

In Local mode, the Setup menu item (Section 6.5.2) can be set for:

- 1 Display message only (default).
- 2 Force power level to 0%
- 3 Force power level to 0%, and stop oxygen flow.

2.8.3.3 ROOM OZONE MONITOR (shutdown digital input)

Terminal 10 and 11.

Terminal 10 is ground in the EO3.
Terminal 11 has a 5k-ohm resistor to +5 Vdc (1 mA DC).

Connect to an isolated (“dry”) relay or switch contact, such as from a room ambient ozone monitor and/or coolant water flow switch to shut down the EO3 when the circuit is opened.

Several normally closed devices may be wired in series between terminals 10 and 11. Displays the message: “Room Ozone or Coolant”.

Coolant water flow switch should be wired in series with the ambient monitor.

The circuit must be closed to run. To re-start the EO3, press the **[ENT]** key.

3.0 START-UP

3.1 Generator Start-Up

1. Turn on the cooling water supply to the generator cabinet. Water pressure should not exceed 2.4 barg (35 psig). Pressurize line and check plumbing for water leaks before starting. Refer to data sheet for minimum water flow requirements.

On systems with a solenoid valve installed in the cooling water and/or air supply lines, the air and water flow will start when the generator is turned on in step 3.

2. Ensure that all ozone supply lines to your process are properly connected.
3. Switch the master ON/OFF switch to ON to illuminate the display screen. Then press any key on the keypad to start oxygen flow. After 30 seconds, the green light in the switch should come on, indicating that the generator is enabled. If the system fails to power up, check to be sure the Emergency Stop button is released (twist to release).

Turning the Power Switch ON turns on the ozonator and displays the "Welcome" screen. Press Clear [**CLR**] to display the Operation Status display screen.

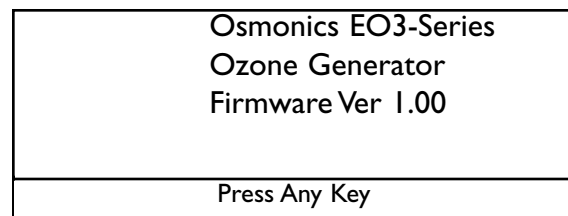


Figure 3.1
Welcome Screen

4. Adjust cooling water pressure and flow to 0.5 to 0.8 gpm (1.9 to 3.2 Lpm). If necessary, press the [**ENT**] key to clear alarms.
5. If using an ATF-25 oxygen concentrator, adjust the air pressure into the concentrator to 36 to 40 psi.
6. Press the UP or DOWN ARROW key to change the display to show gas pressure, oxygen flow, etc. (see Section 3.3).

7. Adjust oxygen feed pressure to the generator until it is between 0.62 - 1.03 barg (9 - 15 psig). Refer to the generator data sheet for some suggested gas flow rates, as well as gas pressure vs. flow curves.
8. Adjust the oxygen flow rate to desired setting (see data sheet) with the T-handle needle valve at the underside of the generator while ozone generator is not producing ozone (0.0%). 9.0 SLMP is best for most applications.

NOTE: Since pressure affects flow, some balancing of the pressure and flow controls may be required to stabilize flow at desired settings. Achieving proper gas flow and pressure ensures that the generator operates efficiently.

9. Allow the oxygen to flow through the generator for a minimum of 15 minutes if generator has not been operating within six (6) hours. This allows clean, dry oxygen to flow through the generator dielectrics, purging any moisture that may have accumulated.

CAUTION: If the generator cell contains any moisture, nitric acid will form in the cell. Nitric acid is a strong acid and can be dangerous. Formation of nitric acid will decrease the performance of the generator. If nitric acid has formed inside the cell, contact the Osmonics Customer Support Center for instructions.

10. Check that the process to be treated is filled and operating properly, and that all ozone destruct, safety, and ventilation devices are operating.
11. Use the LEFT and RIGHT ARROW keys to adjust the generator power level and therefore the amount of ozone produced.
12. If any faults or alarms occur during the start-up period, they will show on a flashing banner on the display. Refer to Troubleshooting (Section 11.0).

3.2 Generator Idle

3.2.1 The generator will not produce ozone under the following conditions:

- During the first thirty (30) seconds after start-up.
- In Manual Mode, if the generator output is set to 0%.
- In Remote Mode, if the input signal drops to 4 mA.
- In Remote Mode, if the remote enable signal input is open.

3.2.2 In idle conditions, gas will flow through the system unless the solenoid valve is programmed to shut off under certain conditions. The solenoid valve may be shut off for the following conditions:

- In Remote Mode, if the remote enable signal input is open longer than 10 minutes.
- Alarm conditions (refer to Sections 8.5 and 11.1)
- Failure conditions

3.2.3 The generator is preprogrammed to stop gas flow under the following conditions:

- Door open
- High Feed pressure (oxygen)
- Inverter fault
- Room Ozone or Coolant fail
- High Temperature

3.3 Operation Status Display Screen

Top Section:	Displays the Power Setting of the generator as a percentage of full power. Performance Charts are provided for the Concentration and Lbs/day (gms/hr) of Ozone output, based on the Power setting (%) and gas flow (slpm).
Alarm Display Line:	Displays any active alarms (refer to Section 11). In Remote mode, displays “Remote Control Mode” message.
Lower Section:	Displays various operating parameters, as selected by the Up and DOWN Arrow Keys.
Bottom Line:	Displays system status messages.

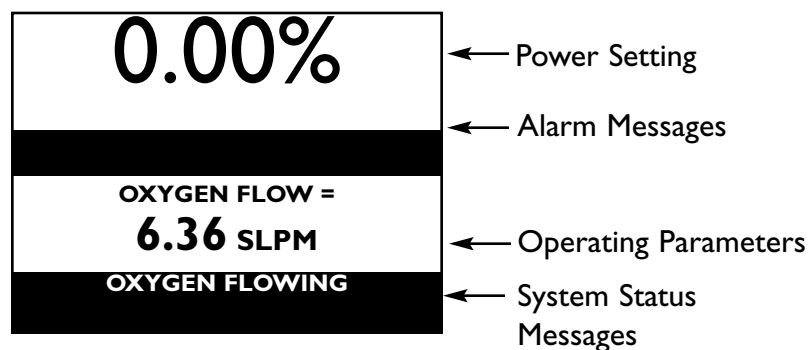


Figure 3.2
Operation Status Screen

The operating parameters displayed in the lower portion of the screen can be selected using the UP and DOWN ARROW Keys:

- OXYGEN FLOW (0 - 16.0 SLPM)
- CELL PRESSURE (0 - 2.00 BARG)
- FEED PRESSURE (0 - 2.00 BARG)
- CELL TEMPERATURE (0 - 99.9 °C)
- REMOTE INPUT (4 - 20 mA)
- PROCESS WATER FLOW (not currently implemented)
- TIME AND DATE.
- RELAYS AND TIMERS (engineering use).

3.4 Keypad

Enter (ENT)	Use in the menus to select items and enter data.
Clear (CLR)	Brings up either the Operator Mode or the Technician Mode, depending on which Security Level is active. When in the Menus, the [CLR] Key will exit back to the previous menu.
Scroll Keys	UP and DOWN Arrow Keys select which of the operating parameters is displayed in Operation Mode (refer to Section 3.3) or select items in the menus.
Power Control Keys	LEFT and RIGHT Arrow Keys increase and decrease the power applied to the cell from 0 to 100%, in steps of 6.25%.

3.5 Security Levels

Pressing the [**CLR**] Key from the main Operation status display will bring up either the Operator Menu, or the Technician Menu, depending upon which security level is active.

Technician Mode

View and adjust alarm settings, and perform diagnostics and calibrations. To enter the Technician Mode from the Main Operation Status screen, enter the 4-digit security code (“5951”) using the number keys.

Operator Mode

The Operator Mode is read-only. To enter from the Technician Menu press the [**0**] key. The Operator Mode allows adjustment of the time, date, power level, and local/remote.

4.0 OPERATION

To select Local or Remote mode, refer to Section 5.3.

4.1 Local Mode

1. Before applying power to the ozonator, be sure that the cooling water supply is turned on and the oxygen supply to the generator is between 0.62 to 1.03 barg (9 to 15 psig).

On some systems the cooling water and oxygen will come on with the main power.

2. After power is applied and any Key on the keyboard is depressed, the gas solenoid valve is energized. The message "OXYGEN FLOWING" will appear on the bottom line. The oxygen flows for 30 seconds to purge the system of moisture and any residual ozone before the ozonator power level can be brought up.
3. No alarm messages should appear in the Alarm Display Line.

If any alarm messages appear in the Alarm Display Line, clear the message by correcting the fault condition before proceeding. Refer to Troubleshooting (Section 11.0) for assistance.

4. Use the Flow Control Valve on the underside of the cabinet to adjust the gas flow to the desired flow rate between 2.0 slpm (4.2 scfh) and 12.0 slpm (25 scfh).
5. Thirty (30) seconds after the "OXYGEN FLOWING" message, the Inverter Enable relay should energize. The bottom line of the display should display: "MAKING OZONE," indicating that the generator is ready to make ozone.
6. Check for proper cooling water flow, ozone destruct and safety equipment are operating, the process being treated is operating properly, and there are no ozone leaks.
7. After the "MAKING OZONE" message appears, Press the RIGHT Arrow Key to increase the Power Setting display to the desired output level. The reading will increase by 6.25% for each press of the RIGHT Arrow Key. Press the LEFT Arrow Key to decrease the power setting of the inverter to the desired level. The reading will decrease by 6.25% for each press of the LEFT Arrow Key.

When operating with oxygen flow of less than 4.0 slpm, do not raise the power level above 75%.

4.2 Remote Mode

Remote Mode is exactly the same as Local mode, except at step 6, check that the dissolved ozone monitor and 4-20 mA controller are powered on and operating.

After the “Making Ozone” message appears, the power setting will automatically increase to the value determined by the 4-20 mA control signal.

The message “Remote Control Mode” will be flashing on the display.

5.0 OPERATOR MENU

5.1 Operator Mode

Press Clear [**CLR**] from the main Operation status display. This brings up the Operator Menu.*

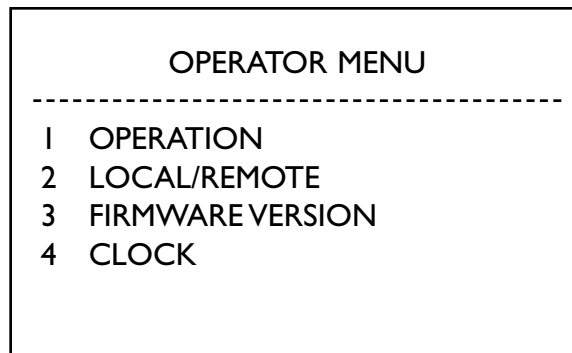


Figure 5.1
Operator Menu

Menu Selection

Select the desired menu item by either:

- Pressing the number key corresponding to the desired item,

or,

- Using the UP and DOWN ARROW Keys to select the desired item, then press [**ENT**] to select.

* If the “Technician Menu” comes up instead, press the [0] key (while the Technician Menu is displayed), then select “Yes” to drop the security level.

5.2 Operation Screen [1]

Press [1] or [ENT] to exit the Operator Menu and return to the main Operation Status Screen (refer to Section 3.3).

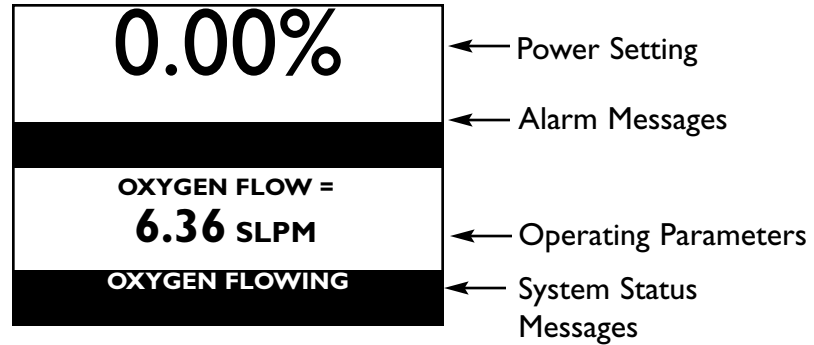


Figure 5.2
Operation Status Screen

5.3 Local/Remote Menu [2] (from Operator Menu)

Press [2] to display the "CONTROL MODE" screen. Select "LOCAL" or "REMOTE" control of the Power setting;

In LOCAL Mode the % Power is controlled by the LEFT and RIGHT Arrow keys.

In REMOTE Mode, the generator % Power is controlled by the 4 - 20mA input signal.

Press [CLR] to exit back to the Operator Menu.

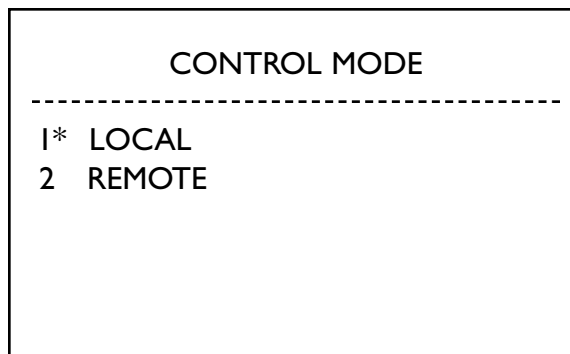


Figure 5.3
Local/Remote Status Screen

* Indicates the current operating mode.

5.4 Firmware Version Menu [3]

This screen indicates the version of firmware used with your generator. This information may be useful in future maintenance or troubleshooting situations.

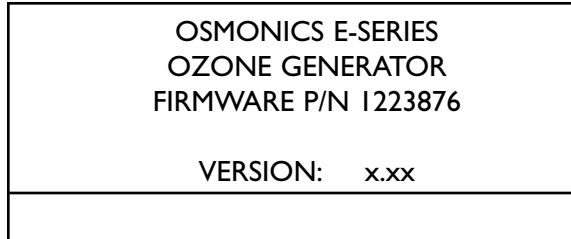


Figure 5.4
Firmware Version Menu Screen

Press [**CLR**] to exit back to the Operator Menu.

5.5 Clock Menu [4]

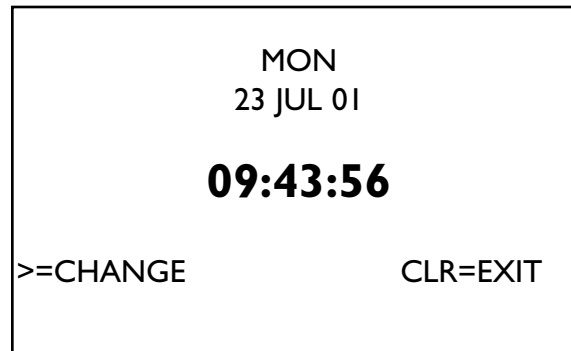


Figure 5.5
Day, Date, and Time Menu Screen

Press [**4**] from Operator menu to bring up the Clock Menu Screen.

Press the [**CLR**] key at any time to exit back to the Operator Menu, leaving the clock unchanged.

5.5.1 Setting the Day

1. Pressing the RIGHT ARROW Key highlights the weekday.
2. Use the UP and DOWN ARROW Keys until the correct weekday is displayed.
3. Press **[ENT]** to save the weekday and highlight the Day of the Month.

5.5.2 Setting the Date

1. Press the Number Keys to set the numerical day of the month.
2. Press **[ENT]** to save the Day (highlights the month).
3. Press the UP and DOWN ARROW Keys to set the Month.
4. Press **[ENT]** to save the month (highlights Year).
5. Press the Number Keys to set the year.
6. Press **[ENT]** to save the year (highlights the Time).

5.5.3 Setting the Time

1. Use the number keys and **[ENT]** to set the Time.
2. Press **[ENT]** to save the new Date, Day, Time settings.

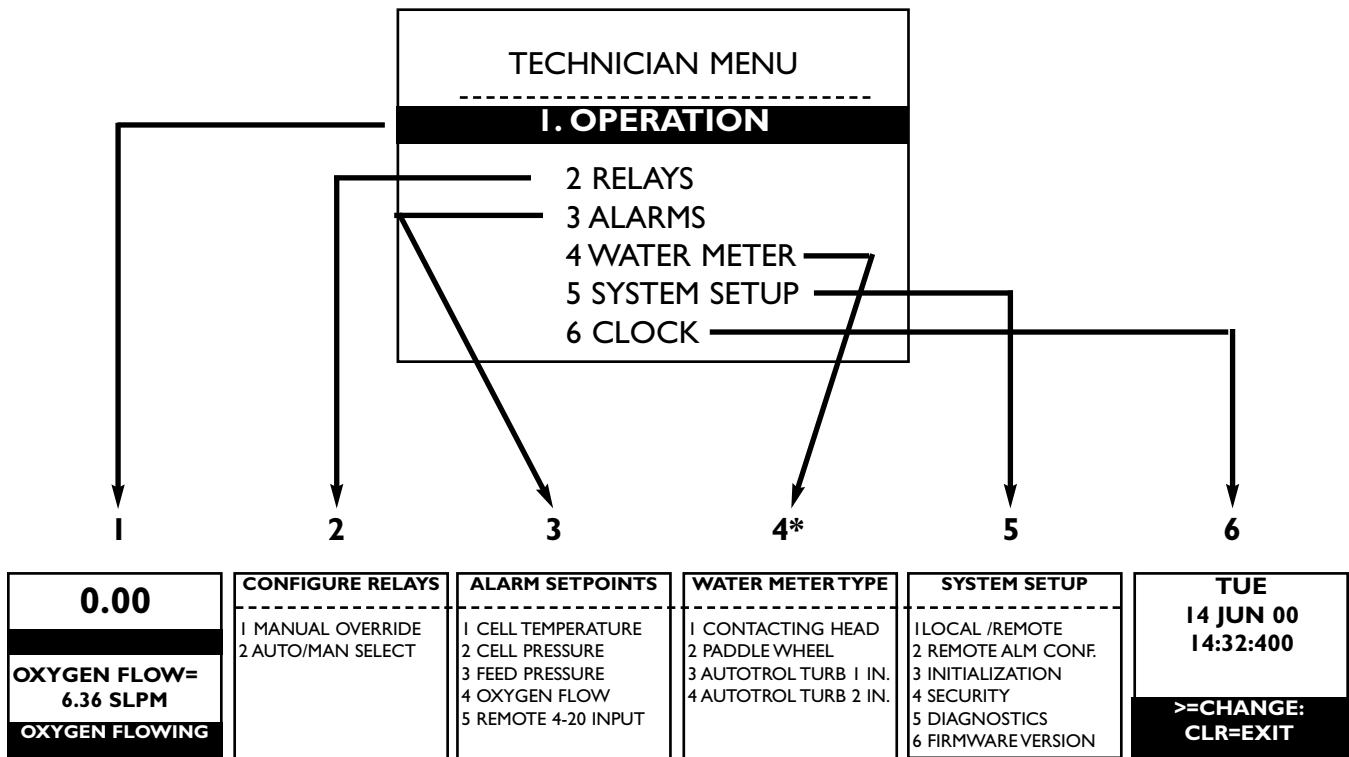
NOTE: Pressing Clear **[CLR]** at any time returns you to the previous Menu and does not save any changes.

6.0 TECHNICIAN MENU

From the main Operation Status screen, enter the Password to get to the Technician Menu, refer to Section 3.5.

As an introduction, here is a graphic overview of the first level of each option in the Technician Menu to see how it operates. Complete detail of each option is provided on the following pages.

To select a menu item, use the UP and DOWN ARROW keys to scroll to the desired item, then press **[ENT]**, or simply press the number key.



* The water meter option is not currently programmed for operation.

Figure 6.1
Technician Menu

Press **[CLR]** to return to a previous screen. Repeated use of **[CLR]** allows you to return all the way back to the Technician Menu from anywhere in the program.

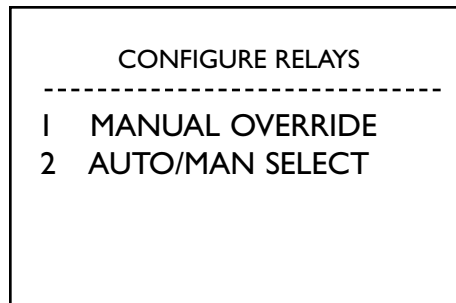
NOTE: Some menus return to the Operation Status screen. If desired, press the **[CLR]** key to bring up the Technician Menu.

6.1 Technician Menu

Press [0] to change to the Operator Security Mode (read-only).

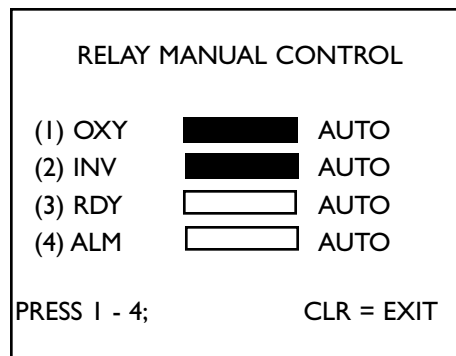
Press [1] or [ENT] to return to the Operation Status Display (Section 3.3).

6.2 Relays [2] (For Engineering Use Only)



Press the [CLR] key to return to the Technician menu.

6.2.1 Manual Override [1]



This menu is used to manually turn the relays On and Off.

The rectangle in the center column displays the status of the relay (Filled = On, Clear = Off). The mode of each relay is shown on the right.

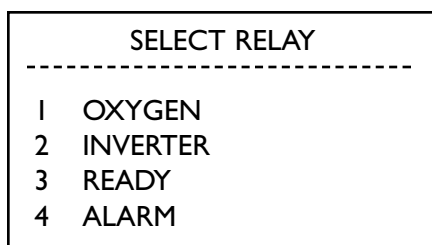
CAUTION: This is only to be for troubleshooting external connections. **NEVER set the OXY or INV relays to MANUAL.**

When a relay is in MAN mode, press the respective number key to switch the relay On and Off. When the relay is in AUTO mode, pressing the number key has no effect.

6.2.2 Auto/Manual Select [2]

1. Press [**CLR**] to go back to the “Configure Relays” menu.
2. Press [2] (Auto/MAN Select).

This menu is used to bring up the “Select Relay” menu.

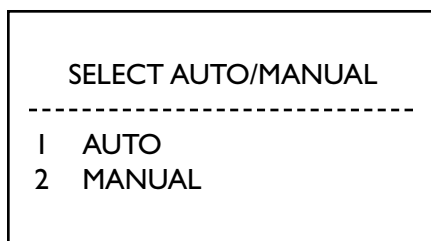


Select the desired relay using the number keys. Press [**CLR**] to go back to the “Configure Relays” menu.

CAUTION: This is only to be for troubleshooting external connections. **NEVER set the OXY or INV relays to MANUAL.**

All the relays default to AUTO when the system power is removed. To set a relay to MAN mode:

1. Press the number key for the desired relay.
2. Press [1] (Auto) or [2] (Manual).



3. Press [**CLR**] to go back to the “Configure Relays” menu, then select [1] to go to the “Relay Manual Control” menu.

6.3 Alarms [3]

To view or adjust the alarm setpoints, press the desired number key.

ALARM SETPOINT	

1	CELL TEMPERATURE
2	CELL PRESSURE
3	FEED PRESSURE
4	OXYGEN FLOW
5	REMOTE INPUT

6.3.1 Cell Temperature [1]

NOTE: The values shown are defaults. Actual values are adjusted during final test and calibration.

To adjust the settings, enter new value using the number keys, then press [**ENT**]. Press [**CLR**] to leave the values unchanged.

HIGH ALARM
30.0°C
LOW ALARM
8.00°C
ENT = ACCEPT CLR = EXIT

6.3.2 Cell Pressure [2]

HIGH ALARM
1.15 BARG
LOW ALARM
0.69 BARG
ENT = ACCEPT CLR = EXIT

(6.3 Alarms continued) under the Technician Menu

6.3.3 Feed Pressure [3]

HIGH ALARM 2.00 BARG LOW ALARM 0.69 BARG ENT = ACCEPT CLR = EXIT
--

6.3.4 Oxygen Flow [4]

HIGH ALARM 11.50 SLPM LOW ALARM 2.00 SLPM ENT = ACCEPT CLR = EXIT

6.3.5 Remote Input [5]

HIGH ALARM 20.0 MA LOW ALARM 4.0 MA ENT = ACCEPT CLR = EXIT

6.4 Water Meter [4]

NOTE: Water Meter [4] (*not currently implemented*).

WATER METER TYPE	

1	CONTACTING HEAD
2	PADDLE WHEEL
3	AUTOTROL TURB 1 IN.
4	AUTOTROL TURB 2 IN.

6.4.1 Contacting Head [1]

MTR I
GALLONS OR LITERS
PER CONTACT =

0100.00

To adjust the setting, enter another value.

6.4.2 Paddle Wheel [2]

MTR I
K-FACTOR =

100.00

6.4.3 Autotrol Turb 1-Inch [3]

MTR I
AUTOTROL TURB. 1 IN.
GALLONS OR LITERS

1* GALLONS
2 LITERS

6.4.4 Autotrol Turb 2-Inch [4]

MTR I
AUTOTROL TURB. 2 IN.
GALLONS OR LITERS

1* GALLONS
2 LITERS

6.4.5 Water Meter [4] [1 - 4] (type) - [1 - 2] (parameter)

```
RESET TOTAL COUNT?  
  
1* YES  
2 NO
```

6.5 System Setup [5]

From the “Technician Menu” press [5] to bring up the “System Setup” menu.

```
SYSTEM SETUP  
-----  
1 LOCAL/REMOTE  
2 REMOTE ALM CONFIG.  
3 INITIALIZATION  
4 SECURITY  
5 DIAGNOSTICES  
6 FIRMWARE VERSION
```

Press [CLR] to return to the “Technician Menu”.

6.5.1 Local/Remote Set-Up [1]

```
CONTROL MODE  
-----  
1* LOCAL  
2 REMOTE
```

* Indicates the current operating mode of the E-Series ozone generator. In Local mode, the % ozone power is controlled by the LEFT and RIGHT ARROW Keys. In Remote mode the % ozone power is controlled by the remote 4-20 mA signal. (This is the same as in the Operator Menu, Section 5.3.)

6.5.2 Remote Alarm Configuration Set-Up [2] (from Technician Menu - Setup)

```
REMOTE CONFIGURATION
-----
1  REMOTE ENABLE INPUT
2  03 ALARM TIMER
```

6.5.2.1 Remote Enable Configuration [1]

```
REMOTE ENABLE INPUT
-----
1* DISPLAY MSG ONLY
2  INVERTER OFF
3  INVERTER + GAS OFF
```

* Indicates the current active setting.

NOTE: These settings determine the action performed by the Remote Enable input signal when the system is in LOCAL operating mode. Refer to Section 5.3.

6.5.2.2 Room Ozone Alarm Timer Configuration [2]

```
TIMER VALUE =

      002 SEC

ENT = ACCEPT CLR=QUIT
```

6.5.3 Initialization [3] (from Technician Menu - Setup)

```
INITIALIZATION
-----
1  RESTORE DEFAULTS
2  CALIBRATE PRESSURE
3  CALIBRATE GAS FLOW
4  FLOW CONSTANTS
```

6.5.3.1 Restore Defaults [1]

WARNING
THIS OPTION MAY
REQUIRE YOU TO
RE-CALIBRATE THE
CONTROLLER

ARE YOU SURE?
1 YES
2* NO

This will reset all the Alarms, Pressure, and Flow calibrations to their default values.

NOTE: Pressure, Flows, and Alarms are calibrated at the factory. This will cause the factory **calibrations to be lost!**

6.5.3.2 Calibrate Pressure [2] (from Technician Menu - Setup - Installation).

CLOSE THE OUT-FLOW
GAS VALVE, THEN
SET FEED PRESSURE
TO 1.0 BARG (14.5 PSI)

ENTER TO CALIBRATE

Pressure is calibrated at the factory. Pressure only needs to be calibrated after replacing the Display circuit board, transducer circuit board, or cell module.

To calibrate the Pressure and Flow display, you will need a pressure gauge (to read 14.5 psi), and a gas flowmeter (1-10 Lpm) (rotameter) is needed.

Pressure is the most important and must be calibrated first with power setting at 0%.

Flow will be within about 10% without calibration, but only after the Pressure has been calibrated.

Pressure may appear accurate but needs to be calibrated for Oxygen Flow to work, because Flow uses the 3rd and 4th digits after the decimal in Pressure, which are not displayed.

1. Close the T-handle needle valve (bottom of EO3), and adjust the Pressure Regulator at the oxygen supply output to set the Feed Pressure to 14.5 psi (1.0 bar). The needle valve may need to be opened slightly when making small corrections of the Regulator.

If no pressure gauge is available, adjust the oxygen supply so the Feed Pressure display reads “1.00 barg”.

2. Allow a minute for the pressure to stabilize at 14.5 psi.
3. In the Technician menu (see Section 3.5) select: 5-Setup, 3-Initialization, 2-Pressure. Then press the **[ENT]** key to calibrate.

Press **[CLR]** several times to go to the Main Operation Status screen and check the Flow readings.

6.5.3.3 Calibrate Gas Flow [3] (from Technician Menu - Setup - Initialization)

SET CELL PRESSURE
TO 1.0 BARG
ENTER OXYGEN FLOW
FROM 10 - 12

ENT TO CALIBRATE

Flow is calibrated at the Factory!
Oxygen flow should not need to be calibrated in the field.
Accuracy is within 10% without calibration.

This procedure should only be done if higher accuracy is required.

It is normal for the flow display to show an error at power settings above 0%.

To calibrate the Flow (power must be at 0%):

1. First perform the pressure calibration.
2. Adjust the needle valve to get a flow of about 8.0 Lpm. Allow it to stabilize for a minute.

3. Multiply the rotameter Lpm reading by 1.25 to get SLPM (at 14.5 psi).
4. In the Technician menu select: 5-Setup, 3-Initialization, 3-Flow. Then enter the SLPM value calculated in step 3 (i.e. $8.0 \times 1.25 = 10.00$).
5. Due to pulsations from the oxygen supply, the flow calibration process may have to be repeated several times to get good results.

Press [**CLR**] several times to go to the Operation screen and check the Flow readings.

Adjust the Flow Alarm high or low setpoint to avoid getting the alarm at higher % power settings when the Flow reading drifts.

In the Technician menu, press the “0” key, then the “1” (yes) to return to the Operator menu (read-only).

When operating with Flow less than approximately 4.0 SLPM, the power level must not be set higher than 75%.

NOTE: Pressure Calibration (Section 6.5.3.2).

6.5.3.4 Flow Constant [4]

EDIT FLOW CONSTANTS	
(1)	+1.687
(2)	-2.870
(3)	+5.227
(4)	+7.966
ENT=ACCEPT	CLR=EXIT

NOTE: The flow constants are factory settings and should never be changed.

6.5.4 Security [4] (from Technician Menu - System Setup)

The Security Code is used at the Main Operation Status Screen to return to the Technician Mode from the Operator Mode (refer to Section 3.5).

PASSWORDS ARE 4 KEYS ENTER A NEW PASSWORD OLD PASSWORD = NEW PASSWORD =
--

This screen is used to change the security code.
(Press [**CLR**] to return to the Setup menu.)

6.5.5 Diagnostics [5] (from Technician Menu - System Setup)

DIAGNOSTICS	

1	ANALOG I/O
2	DIGITAL I/O
3	ALARMS/CONTROL
4	CALIBRATION

6.5.5.1 Analog I/O [1]

(from the Technician Menu - System Setup - Diagnostics)

AD08:	0	RA20:	00.0
AD09:	71	TMP	26.74
AD10:	1886	CELL	0.879
AD11:	7072	FEED:	0.938
DA01:	0	03%:	0.00
WATER;	0		31
SCAN COUNT:			255

Displays the values of the analog input signals. Values shown are typical, not actual.

6.5.5.2 Digital I/O [2]

(from the Technician Menu - System Setup - Diagnostics)

RC4 (DOOR OPEN):	ON
RC5 (REM ENABLE):	ON
RC6 (REM OZONE):	OFF
RA1 (INV FAULT):	OFF
RG7 (INV 2 FLT):	OFF
SCAN COUNT	

Displays the status of the digital input signals.

6.5.5.3 Alarms/Control [3]

(from the Technician Menu - System Setup - Diagnostics)

CELL TEMP:	NORMAL
CELL PRESSURE:	LOW
FEED PRESSURE:	LOW
OXYGEN FLOW:	LOW
REMOTE ANALOG:	NORMAL
CONTROL MODE	LOCAL
ALARM LATCH:	0
SCAN COUNT:	125

Displays the condition of alarms. Values shown are typical, not actual.

6.5.5.4 Calibration [4]

(from the Technician Menu - System Setup - Diagnostics)

== FLOW CONSTANTS ==	
TX OFFSET:	0000
PRESSURE	77
TEMPERATURE	25.0
FLOW:	10.0
CONSTANT:	1.0
SCAN COUNT	255

Displays the constants used in the gas flow calculations. These values are subject to change when the Flow Calibration is executed. They are not adjustable from the keypad.

6.5.6 Firmware Version [6]

OSMONICS E-SERIES
OZONE GENERATOR
FIRMWARE P/N 1223876

VERSION: x.xx

6.5.7 Date and Time [6]

SUN
23 JUN 00

09:43:56

>=CHANGE CLR=EXIT

Refer to Section 5.5 for detailed instructions on adjusting the date and time.

6.5.8 Drop Security Level to Operator Mode (View Only)
(from the Technician Menu press the “0” key)

DROP SECURITY LEVEL
TO OPERATOR ACCESS?
WARNING: PASSWORD IS
REQUIRED TO RETURN
TO TECHNICIAN MODE

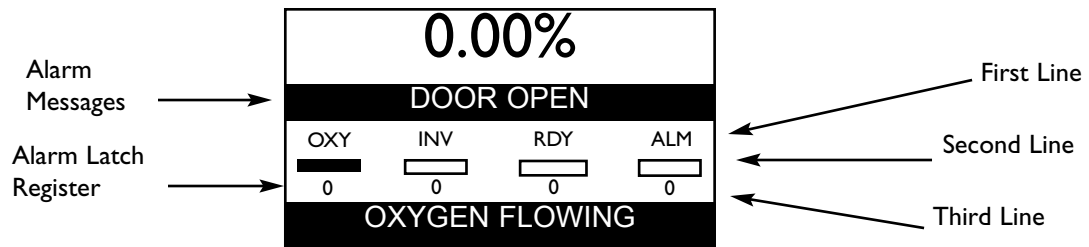
1 = YES
2 = NO

Select yes or no by pressing the “1” or “2” key.

7.0 RELAY OUTPUTS (Engineering use)

Additional diagnostics are available in the Technician Menu, under System Setup (see Section 6.5.5)

7.1 'RELAY STATES' in the Operation status Display. Use the UP and DOWN ARROW Keys to view.



Three lines are shown in the lower half of the display:

- The First Line identifies the four relays:
 - OXY (Oxygen) - RDY (Ready)
 - INV (Inverter) - ALM (Alarm)
- The Second Line shows a graphic representation of the state (On or Off) of each relay. A filled in box indicates On.
- The Third Line reads independently of the other lines. It shows the contents of the Alarm Latch Register (Hexadecimal value) in the left most position (under the OXY relay symbol) (for use only by Osmonics engineering).

To the right of the Alarm Latch value are the: Room Ozone timer, Inverter Fault timer, and the High Temperature timer.

7.2 The alarm code that is displayed in the Alarm Latch Register is in the form of a binary number. All alarms are displayed in plain text in the center of the screen. Refer to Section 11 and Section 6.5.5.3 for more information on alarms.

Example: Alarm code 25 means that the Inverter is disabled, the Oxygen solenoid is disabled, and the Room Ozone input signal is On (probably causing the disables).

7.2.1 Alarm Codes (Engineering use, also screen messages)

0	Room Ozone	4	Inverter Disabled
1	High Temperature	5	Door Open
2	High Cell Pressure	6 & 7	(Unused)
3	Oxygen Disabled		

8.0 SHUTDOWN

8.1 Generator Emergency Shutdown

- Initiate Emergency Stop Switch. If required, evacuate the area.
- If you are able, turn generator switch to the OFF position.
- Turn the cooling water off.
- Turn the process water off if necessary.

8.2 Generator Normal “Manual” Shutdown - Local Mode

- Push the LEFT Arrow Key until the generator is at minimum power.
- Turn the process water off, if necessary.
- Allow the gas to purge at least two minutes.
- Turn the generator switch to the OFF position.
- Turn the cooling water off.

8.3 Generator Normal “Manual” Shutdown - Remote Mode

- Remote command generator to “Disable.”
- Turn the process water off, if necessary.
- Allow the gas to purge at least two minutes.
- Turn the generator switch to the OFF position.
- Turn the cooling water off.

8.4 Generator Fault Shutdown

Should the ozone generator shut down with a fault, the display will indicate which alarms are active. Alarms will be displayed on the alarm banner in the middle of the display screen. The generator will flash each alarm in a cycle. Be sure to observe all alarm conditions before continuing.

- Observe all alarm conditions.
- Turn the master switch to OFF.
- Consult Troubleshooting (Section 11.0).

8.5 Shut Down Alarms

- | | |
|-------------------------------|------------|
| • Room Ozone | 1 second |
| • High Temperature | 30 seconds |
| • High Feed Pressure (Oxygen) | immediate |
| • Door Open | immediate |
| • Inverter Fault | 60 seconds |
| • Remote Idle relay | 10 minutes |

9.0 ESTIMATING OZONE OUTPUT

Your ozone generator has been factory tested to ensure it meets performance specifications and output. As part of the factory test procedure, your generator's ozone output has been measured using the ultraviolet absorption method of measurement at various machine settings. This information is recorded on the Ozone Generator Test Data Sheet in the Appendix of this manual. From time to time, you may have the need to estimate approximately how much ozone your generator is producing. The most accurate method would be to purchase or rent an ozone monitor capable of measuring high concentration ozone and re-measuring the actual output at your site.

If access to a monitor is not practical, it is possible to closely estimate your ozone output by adjusting the machine settings to match the settings shown on the data sheet. At these settings (and assuming that your generator has been well maintained) your ozone output should be similar to the output indicated in the data sheet. The most critical settings to duplicate are:

- Gas flow rate (taken from display screen).
- Generator operating pressure (taken display screen).
- Observed power level (0 - 100%)
- Cooling water temperature and flow rate.

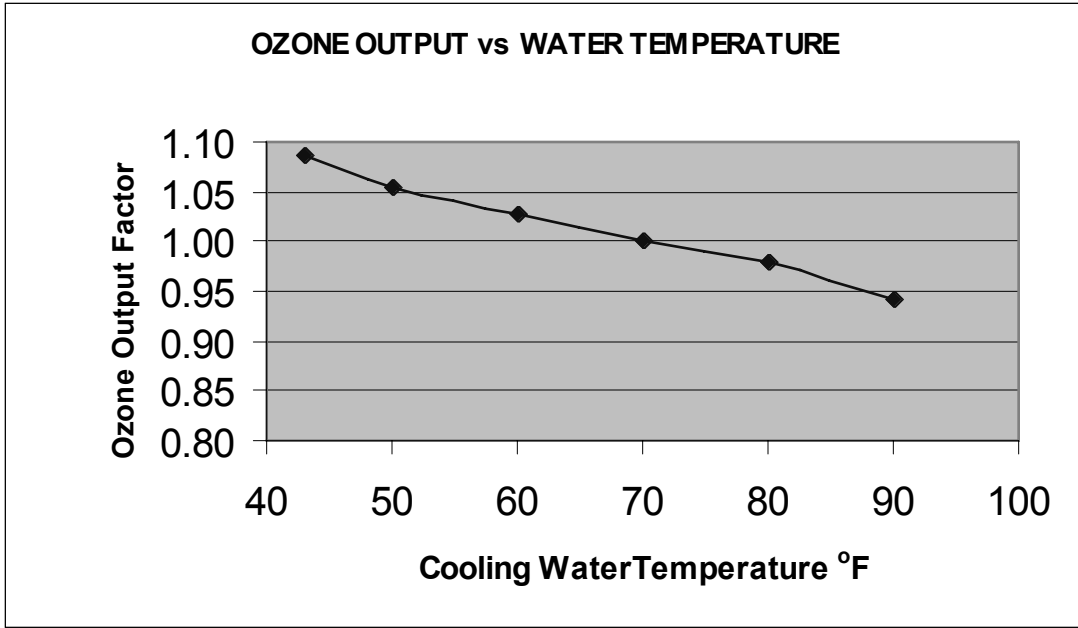
To select a specific ozone output, first duplicate a gas flow and generator pressure setting suggested on the data sheet. While referencing the ozone data sheet or output curve, apply power by pushing the RIGHT ARROW Key until the power level is in the range that matches your desired ozone output shown on the graph.

Tip: Your ozone system will operate most efficiently at a low gas flow. Unfortunately, decreasing the gas flow rate limits how much ozone is created. Select the lowest gas flow rate that still allows the generator to create the necessary amount of ozone.

9.1 Cooling Temperature Effect on Ozone Output

Cooling water temperature has an effect on ozone output. Refer to the graph which can be used to more accurately determine ozone output at your actual cooling water temperature.

WARNING: If the cooling water temp is too low, condensation may form inside the generator cabinet and damage internal circuitry.



Note: Cooling water temperature must be higher than ambient dewpoint to prevent condensation.

Figure 9.1
Ozone Output vs Water Temperature

10.0 MAINTENANCE

It is highly recommended that service and maintenance be performed as set forth below. There are tables available (at the end of this section) that allow the logging of maintenance work and daily checks as they are performed. You may want to copy these tables from the manual and keep the copies with the ozone generator. All service should be performed and logged to ensure warranty compliance.

WARNING: Shut power off to the generator at the feed disconnect before performing any service or maintenance inside the cabinet.

10.1 Daily

Generator

1. Be sure that all gas parameters (gas pressure, flow and temperature) are within the specified operating limits.
2. Check cooling water flow to ensure it is in pressure and temperature ranges. See Utility Requirements (Section 2.3.1) for ranges.
3. Check overall system for water or gas leaks and repair as necessary.
4. Verify that the process water stream has not backed into generator.

10.2 Monthly

1. Perform a daily inspection (as above).
2. Inspect oxygen supply system.
3. Check the filters in the oxygen supply system and replace as necessary (if installed).
4. Optional: check ozone output with a high concentration ozone monitor. If out of desired range (% wt.), adjust the Power Level on generator display to correct. Some gas flow rate balancing may be required.
5. Check cooling water connections for possible scale formation and clean with citric acid solution as required.
6. For air compressor, refer to manufacturer's instructions.

10.3 Quarterly

1. Perform a monthly inspection (as above).
2. Use low pressure compressed air to remove any obvious dust or lint from the generator.
3. Check the oxygen feed filter (if installed).
4. Inspect gas outlet check valve (if installed).
5. Replace compressor piston rings, gaskets and seals as directed by manufacturer (if installed).
6. Replace air filters every 6 months.

10.4 Annually

1. Perform a quarterly inspection (as above).
2. With power disconnected and locked out, check the tightness of all nuts and screws including the electrical terminals and ground wires.
3. Inspect the interior for gas or water leaks.

10.5 Cabinet Entry and Cell Removal

WARNING: Use care to prevent damage to the plastic tubing and fittings above the transformers. Damage will cause ozone gas to escape into work area.

1. Disconnect all electrical feed to unit.
2. Open the cabinet door.
3. Remove all plumbing connections from the bottom of the unit. (Ensure that the gas and water supplies are off before disconnecting lines).
4. Disconnect the plugs and wires from the control board and the inverter.
5. Disconnect the harness to the pressure transducer board.
6. Remove the two screws from the right hand front and rear corners of the inverter.

7. Remove the eight (8) screws underneath that attach the cell assembly to the cabinet.
8. The manifold and cell assembly will tilt out of the cabinet. You may need to adjust the position of the flow control knob to allow the manifold to slide through the hole in the bottom of the cabinet.
9. Drain as much water as possible from the assembly, then blow the rest out carefully, using compressed air regulated to 20 psi maximum.

10.6 Cell Reinstallation in Cabinet

WARNING: Use care to prevent damage to the plastic tubing and fittings above the transformers. Damage will cause ozone gas to escape into work area.

1. Re-install the cell in reverse order of removal, paying particular attention to not damage the connectors, circuit board, and tubing.
2. Make sure all wiring is reconnected correctly, and securely.
3. Connect the plumbing to the same places it was removed from.
4. Do the System Startup as shown in Section 3.0.
5. Do the Pressure Calibration (Section 6.5.3.2) if the transducer board was replaced.

10.7 Circuit Board Replacement

The inverter power board requires special care in mounting the power semiconductors. Repairs should only be done by the Osmonics' service center (see Section 14.0).

When replacing the display control board, first record the alarm settings.

After replacing the display control board or transducer board, you must do the Pressure Calibration (Section 6.5.3.2) even if the display appears good. Otherwise the Oxygen Flow will not be correct. Pressure Calibration must be done first, then Flow Calibration is usually not required.

**Table 10.1
Osmonics E-Series Ozone Generator
Suggested Maintenance Intervals**

	DAILY	MONTHLY	QUARTERLY	SEMI-ANNUALLY	ANNUALLY
OXYGEN PREPARATION					
Compressed Air Pressure	Inspect				
Gas Flow	Inspect				
Pressure Relief Valves			Check		
Air Filters		Inspect	Clean		Replace
Oil Vapor Filter		Inspect	Clean	Replace	
Compressor Air Intake Filters		Inspect & Clean	Inspect & Clean		Replace
Oxygen Concentrator		Inspect			
OZONE GENERATOR					
Cooling Water Flow	Inspect				
Electrical Supply Amps	Inspect				
General Cleaning (w/compressed air)			Clean		
Ozone Check Valve & Backflow Preventer		Inspect			Replace
Ozone Safety Monitor	Inspect	Test			Calibration
Ozone Detector	Inspect	Clean			

**Table 10.2
Osmonics E-Series Ozone Generator
Maintenance Log**

Ozone Generator Serial Number: _____ Feed Gas: Oxygen

	DATE											
Compressed Air Pressure (psig)												
Oxygen Pressures (psig)												
Generator Pressure (psig)												
Gas Flow (Lpm)												
Dewpoint Reading (optional)												
Compressed Air Filter(s) (replace annually)												
Compressor Air Intake Filters (clean/replace monthly)												
Cooling Water Flow (gpm/Lpm)												
Supply Amps												
General Cleaning (w/compressed air)												
Gas Outlet Check Valve												
Ozone Safety Monitor (test weekly)												
Ozone Destructor												

Make copies of these sheets for your maintenance log book!

11.0 TROUBLESHOOTING

This troubleshooting guide will assist you in identifying the most common operating problems you may experience with your machine. Many of these problems are easily corrected by the operator, but with other problems or those not understood, you should contact the Osmonics Technical Service Department. Have the problem and symptoms clearly defined and operating data available. Have the following information available when calling your equipment supplier:

1. Serial number (found on the right-hand side of front panel)
2. Daily Log Sheets
3. Description of problem

11.1 Alarms

11.1.1 Shutdown Alarms

These alarms must be cleared by pressing [**ENT**], except for Inverter Fault which can only be cleared by shutting the power off.

HIGH FEED PRESSURE - oxygen pressure to the EO3 is too high.

HIGH TEMPERATURE (30 second delay) - cooling water is too warm or not enough cooling water flow, cell overheating.

INVERTER FAULT (60 second purge) - indicates a malfunction in the high voltage circuitry.

DOOR OPEN - the cabinet door is open, or interlock switch malfunction.

ROOM OZONE OR COOLANT - not enough cooling water flow, or ambient ozone safety monitor has detected a leak.

NOTE: If the system shuts down (green light off) but no alarm message is displayed, check for fluctuations in cooling water pressure, or door interlock switch needs adjustment.

11.1.2 Warnings

These alarms display a warning message but do not cause shutdown. The values for high and low limits are set in the Alarms section under the Technician Menu.

LOW FEED PRESSURE - oxygen pressure into the EO3 is too low or zero.

HIGH CELL PRESSURE - gas pressure inside the cell chamber is too high.

LOW CELL PRESSURE - gas pressure inside the cell chamber is too low.

HIGH OXYGEN FLOW - Flow Control needle valve is open too much.

LOW OXYGEN FLOW - Flow Control needle valve is closed, or piping is blocked.

LOW TEMPERATURE - cooling water is too cold, or possible sensor failure.

HIGH REMOTE INPUT - 4-20 mA input current is too high.

LOW REMOTE INPUT - 4-20 mA input current is too low, or wiring is bad.

REMOTE CONTROL MODE (not an alarm) - indicates that the EO3 is being controlled by the 4-20 mA input signal, the left and right arrow keys are disabled.

REMOTE ENABLE INPUT (10 minute delay) - the Remote Enable input circuit is opened [input terminals #12 and #13].

- In LOCAL mode a menu can be set to cause: message only, ozone off, or ozone and gas off.
- In Remote mode: ozone power goes to 0%. Gas flow will stop after 10 minutes.
- To resume operation, close #12 and #13.

If the suggested remedy fails to correct the problem, and no other malfunction can be found, it is possible that the alarm menu setting may be incorrect, or a sensor needs to be re-calibrated, or has failed and may need to be replaced.

11.2 Troubleshooting Chart

PROBLEM	WHAT THIS MEANS	CORRECTIVE ACTION
Ozone generator does not turn on.	Emergency Stop button pressed.	Turn the knob on the Emergency Stop to release.
	One or both of the fuses might be blown.	Check continuity of the fuse with a multimeter. Find cause of blowing fuse; shorted component, etc. (Should be accomplished by a qualified electrician.). Spare fuses are located inside the fuse holders.
	The unit may be unplugged, or a remote circuit breaker might be off.	Plug in unit, or reset circuit breaker. Check electrical supply voltage at L1 and L2.
High Temperature Alarm or abnormally high temperature display.	The cooling water flow may be too low or off.	Refer to data sheet for minimum cooling water flow at 29°C (85°F) water inlet temperature. NOTE: ALLOW 10 MINUTES FOR THE OZONE GENERATOR TO COOL BEFORE RESTART.
	The oxygen flow may be too low.	Refer to data sheet for specific oxygen flow rate.
	4-20 mA signal wired incorrectly.	Reverse 4-20 mA wires (+ on I5). Shield on 4-20 mA should be grounded at only one end.

PROBLEM	WHAT THIS MEANS	CORRECTIVE ACTION
Generator temperature high (cont.)	The inlet water temperature may be too high.	May have to find other source for cooling water or add chiller (maybe go to closed-loop system). Refer to data sheet for specific water temperature. Too cold will cause condensation damage.
	Clogged plumbing fitting in the water cooling system.	Check for water flow at flow meter. Filter this water prior to entry of cooling system.
	Alarms settings incorrect	Verify correct settings in Alarm Menu.
	Failed temperature sensor.	Transducer board may need to be replaced.
“Room Ozone or Coolant” Alarm shutdown	Not enough cooling water.	Check the supply of cooling water.
	Ozone leak.	Evacuate the area until safe, then repair the leak.
	The set point of remote ambient ozone monitor has been exceeded by a source of ozone.	Locate the source of the ozone: leak in plumbing fitting, too much ozone to process, etc., and take corrective measures.
	The set point on the monitor has been set too low, or a problem exists with the monitor's operation.	Refer to the monitor's manual.
	There may be interference from other gases or smoke near the monitor gas sample inlet.	Smoke from cigarettes, etc., can cause false alarm situations. Many chemicals and gases can cause alarm conditions. The monitor's environment must be free of gases, chemicals or smoke. Refer to the monitor's manual.

PROBLEM	WHAT THIS MEANS	CORRECTIVE ACTION
"Door Open" alarm shut-down	Door switch may be open or intermittent	Ensure door is completely closed and locked. Door switch may need adjustment.
"Inverter Fault" alarm	Faulty cable or connector to fixed Frequency Board.	Check cable connectors at Display Board and Fixed Frequency Board.
	Inverter Power Board failed.	Return to factory for repair.
Generator turns on, does not produce ozone, or produces only small amounts of ozone.	O ₂ supply not working.	Check and correct oxygen supply. If using an oxygen concentrator, ensure that the exhaust air pulse occurs about once each second. Oxygen flow may be too high.
	Ceramic plate cracked (not repairable).	Check for leaking process water back into generator. Ozone cell will require replacement.
Pressure and/or flow displays fluctuate widely or stuck at zero.	Faulty ground connection.	Check and repair ground connections and terminals.
	Faulty cable connection.	Check wire connections at transducer board and display board.
	Failed pressure transducer.	May need pressure calibration. Replace pressure transducer.
Flow display changes when power setting is raised above 0%.	Interference from high voltage supply.	This characteristic is normal - adjust alarm settings as needed. Set power to 0% for accurate readings.

PROBLEM	WHAT THIS MEANS	CORRECTIVE ACTION
4-20 mA display fluctuates.	Faulty connection.	Check wire connections at terminal strip and Display board.
“High Feed Pressure” alarm.	Oxygen pressure into the generator is too high.	Check the oxygen supply, lower the pressure into the EO3, 1.2 barg (18 psi) maximum. Note: maximum from ATF-25 is 15 psi.
“Low Feed Pressure” alarm.	Not enough oxygen pressure.	Check for problem in oxygen supply. Increase oxygen pressure. Adjust the alarm setpoint.
“High Cell Pressure” alarm.	Ozone output pressure is too high.	Check for blockage or back-pressure in the ozone piping.
“Low Cell Pressure” alarm.	Gas pressure in cell is too low. Oxygen valve failed.	Check for excessive vacuum from injector, or failed oxygen valve (located behind fan).
“Low Temperature” alarm.	Cooling water too cold. Alarm setpoint incorrect. Failed temperature sensor.	Use warmer water, adjust alarm setpoint, transducer board may need to be replaced.
“Low Remote Input” alarm.	4-20 mA signal is too low. Faulty wiring connection.	Check 4-20 mA wiring. Check connections at terminal strip.
Oxygen flow display incorrect.	This is normal.	Set power to 0% to read flow.
	Needs pressure calibration.	Calibrate pressure (Technician Menu).
	Failed Transducer.	Transducer Board may need to be replaced.

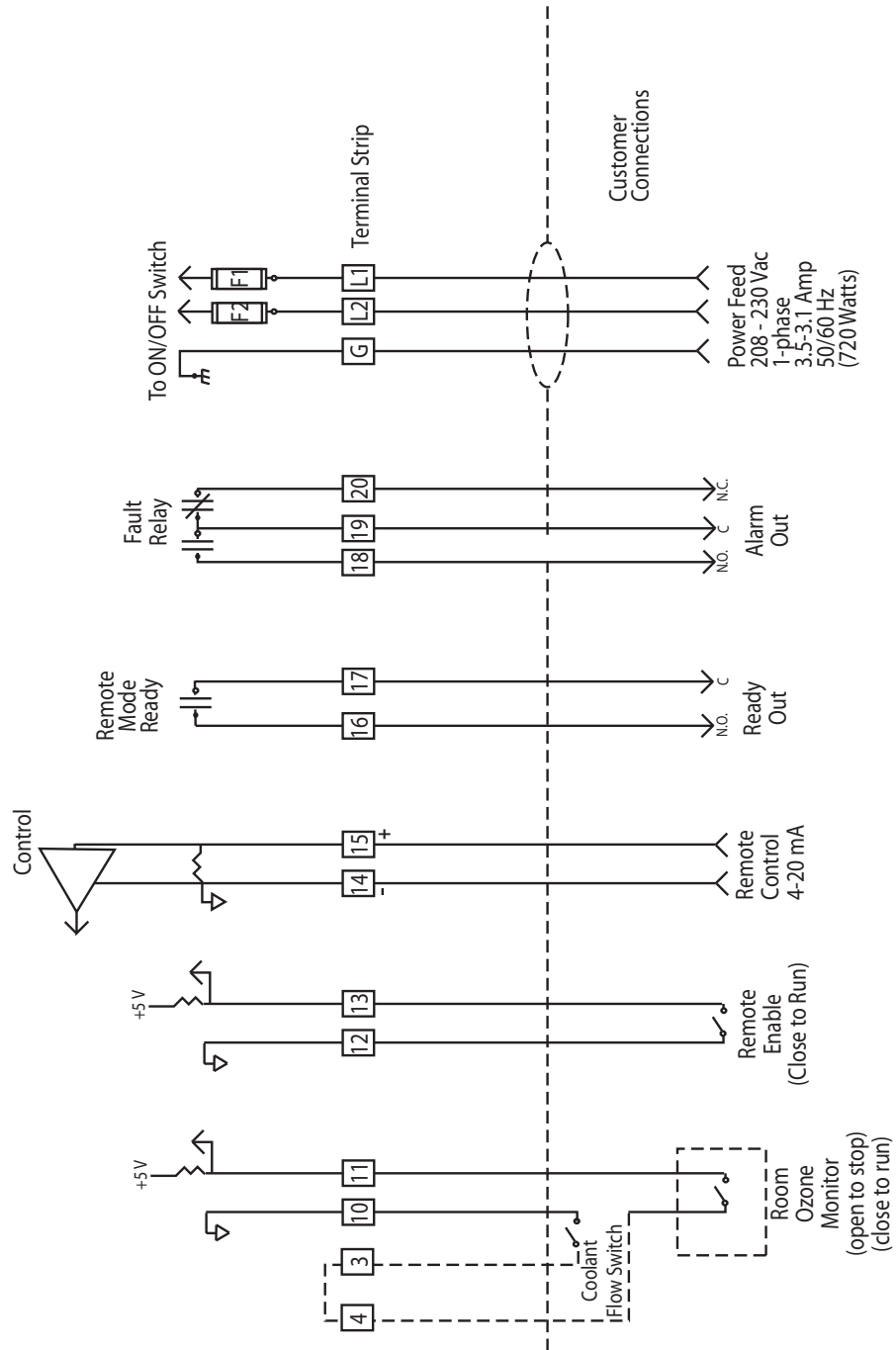
PROBLEM	WHAT THIS MEANS	CORRECTIVE ACTION
(All alarms)	Alarm setpoint may be incorrect.	Check to be sure the actual pressures and flows are within specifications, and adjust the alarm setpoints (in Technician menu).
	Oxygen Flow or Pressure display readings change when power setting is raised.	This characteristic is normal, adjust alarm setpoints to avoid nuisance alarms.
	Failed transducer.	Transducer board may need to be replaced - requires pressure calibration.
Generator on, but stops producing ozone, "Press any Key" message is displayed.	There was a momentary loss of cooling water, or fluctuating pressure. (wire terminals 10 and 11).	Increase the cooling water flow. Ensure that the supply of cooling water is reliable.
	There was a momentary alarm from room ozone monitor.	Repair any ozone leaks. Adjust the monitor for latching alarm output, or increase the delay.
	There was a momentary "Door Open" condition.	Door switch may need adjustment.

12.0 SPARE PARTS

<u>I/O P/N</u>	<u>Description</u>
I100946	Door Switch
I103142	Kynar Bottom Fitting 0.25" T x 0.13" PM
I103144	Kynar 90 degree Elbow 0.25"T x 0.13"PM
I225049	Generator Module Assembly
I225077	Cooling Fan, 24 V DC, 100 CFM
I225074	Fuse, 10 A, 250 V, DELAY, 3AG, CERAMIC
I229915	ON/OFF Switch Assmbly
I229916	Emergency Stop Switch Assembly
I225091	Control PCA and Liquid Crystal Display Panel
I225083	PCA, Transducer, EO3 gen
I229917	PCA, Inverter Power Board Kit, EO3 gen
I225095	VALVE-SOL, 2 way, 24 VDC, Manifold mt
I222960	Power Supply, 24 VDC, 20W
I225116	Adapter, kynar, 0.16 HBX 10-32 (min. qty 2)
I225114	Bushing, ceramic, High Voltage

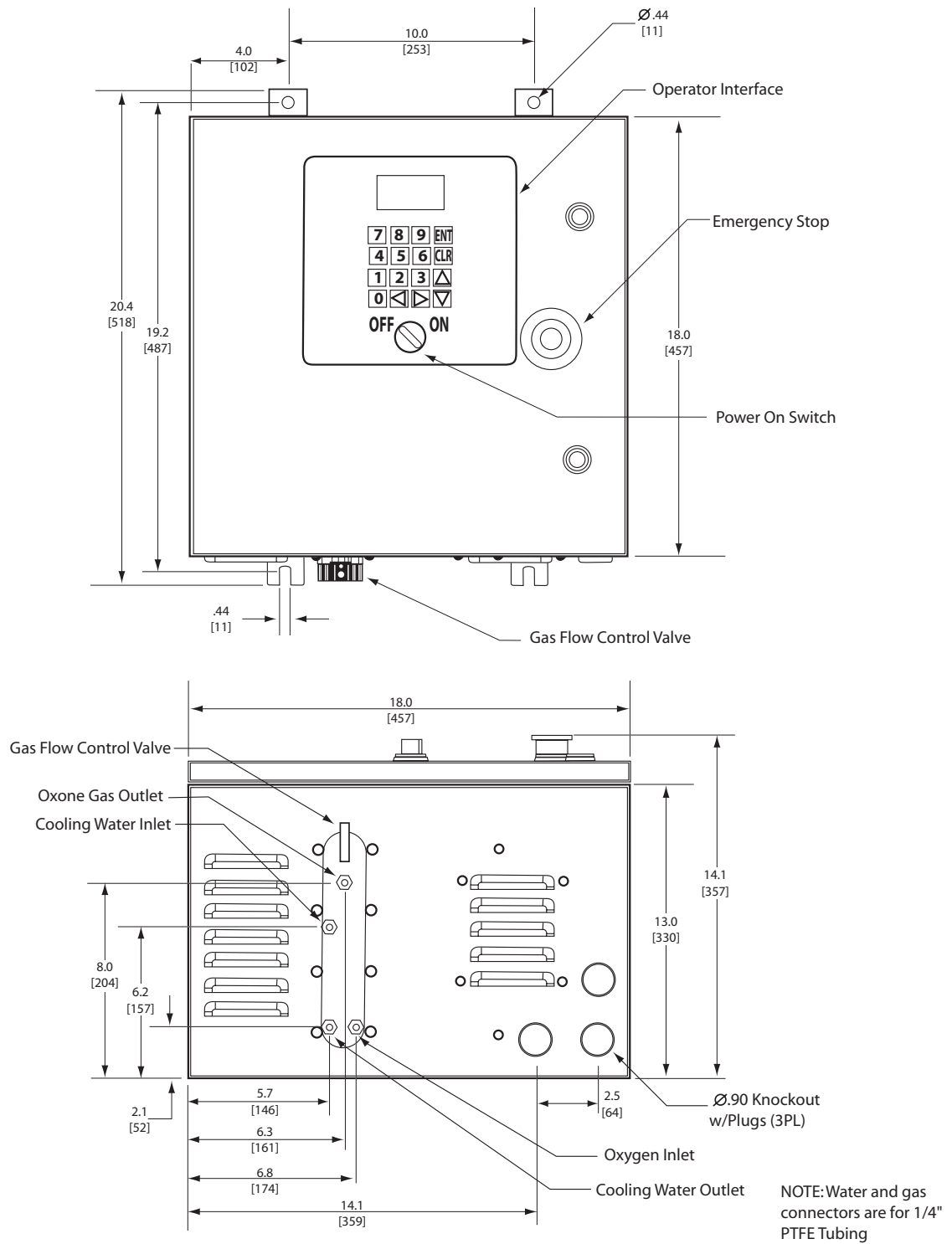
13.0 DRAWINGS

13.1 Electrical Drawing



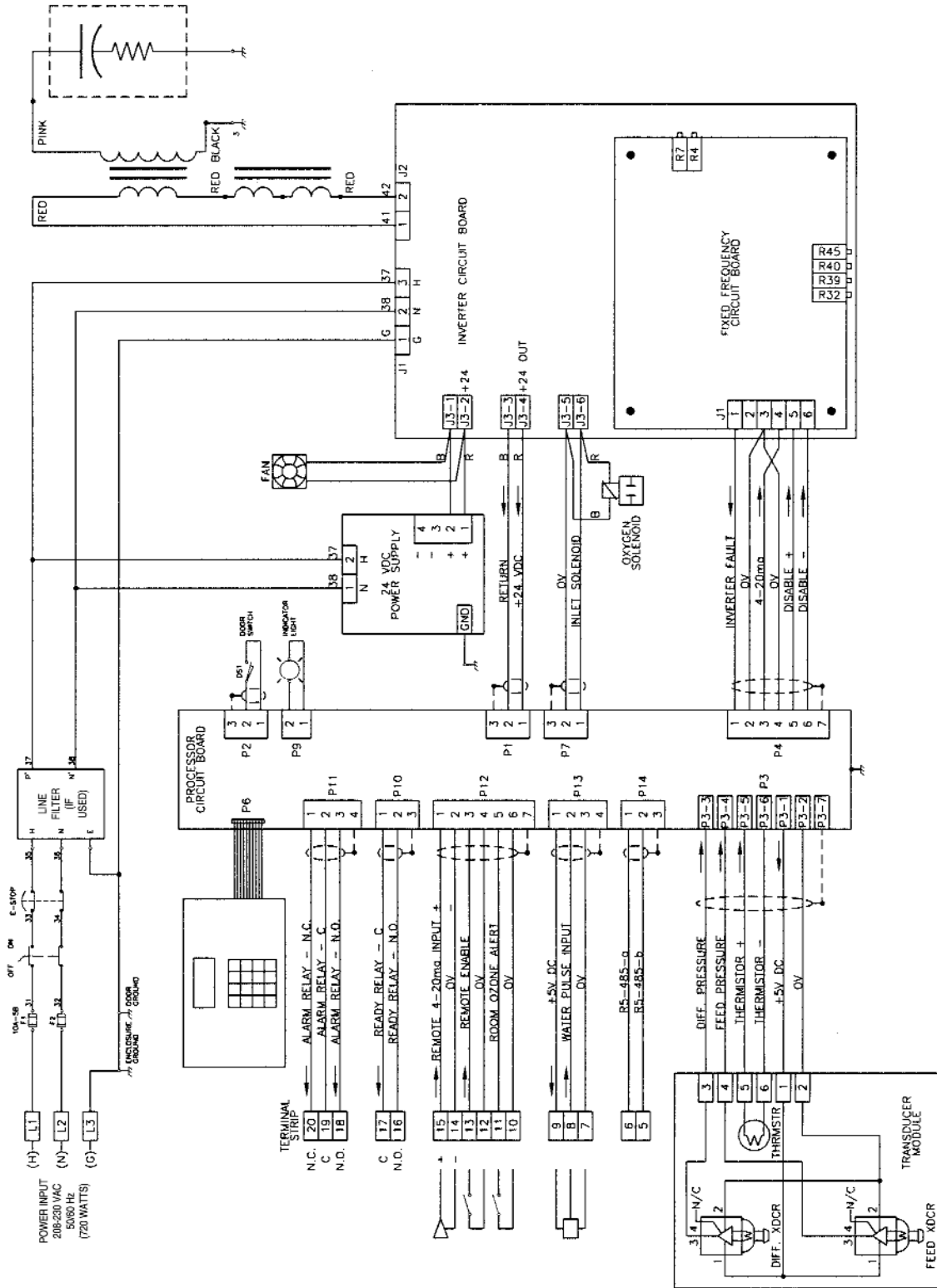
**Figure 13.1
Electrical Hook-Up Drawing**

13.2 Installation Drawing



**Figure 13.2
Installation Drawing**

13.3 Electrical Schematic



14.0 RETURN GOODS AUTHORIZATION (RGA) PROCEDURE

If you wish to return goods for repair, warranty evaluation and/or credit, please have your original sales order or invoice available when you call Osmonics. Call (800) 848-1750 and ask to speak with Technical Service. An Osmonics Technical Service representative will provide instructions and a return authorization number which needs to be clearly written on the outside of the box used to ship your materials. A customer supplied purchase order is required by Osmonics policy to issue an RGA. Nothing will be charged against this P.O. in the event the claim is verified to be under warranty. All equipment must be shipped to Osmonics with the freight prepaid by the customer. Call our Customer Service Center with any questions or issues concerning freight claims and a representative will discuss your situation.

All materials to be returned must be rendered into a non-hazardous condition prior to shipping.

15.0 WARRANTY

Osmonics, Inc. warrants its products to be free from defects in design, material or workmanship for a period of 15 months from receipt or 12 months from installation of the product, whichever occurs first, when said products are operated in accordance with written instructions and are installed properly. If products are altered or repaired without prior approval of Osmonics, all warranties are void. If any defects or malperformance occur during the warranty period, Osmonics' sole obligation shall be limited to alteration, repair or replacement at Osmonics' expense, Ex-works, of parts or equipment, which upon return to Osmonics and upon Osmonics' examination prove to be defective. Equipment and accessories not manufactured by Osmonics are warranted only to the extent of and by the original manufacturer's warranty. Osmonics shall not be liable for damage or wear to equipment caused by abnormal conditions, excessive temperatures, vibration, failure to properly prime, or to operate equipment without flow, or caused by abrasives or foreign objects or corrosives. The foregoing warranty is exclusive and in lieu of all other warranties, whether expressed or implied, including any warranty of merchantability or fitness for any particular purpose. In no event shall Osmonics, Inc. be liable for consequential or incidental damages.

**OSMONICS**

5951 Clearwater Drive, Minnetonka, MN 55343-8995 USA Phone (952) 933-2277 or Fax (952) 933-0141

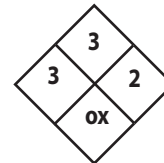
MATERIAL SAFETY DATA SHEET

Product Name: Ozone (Ambient Air or Oxygen Feed Gas) **Date Prepared:** 16 Jan 01

PRODUCT AND COMPANY IDENTIFICATION

Manufacturer/Supplier:

Osmonics
5951 Clearwater Drive
Minnetonka, MN 55343-8995
Emergency Telephone:
(952) 933-2277
(800) 424-9300 CHEMTREC
Common Name: Ozone
Chemical Name: Triatomic Oxygen

NFPA Codes:

Health: 3
Fire: 3
Reactivity: 2
Special: Oxidizer

MATERIAL COMPOSITION

Hazardous Components <small>(1% or greater for hazardous components, 0.1% or greater for carcinogens)</small>	CAS#	%	OSHA PEL	ACGIH TLV	Other Limits Recommended
Ozone (O ₃)	10028-15-16	100*	0.1 ppm (0.2 mg/m ³)	0.1 ppm (c) (0.2 mg/m ³)	0.3 ppm STEL, 5 ppm IDLH

*Equipment emits ozone at 1-11% concentration by weight for oxygen feed gas.

PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling point: -170°F (-112°C)**Specific gravity:** 1.614**Vapor pressure:** >1atm
[1 mm Hg & -292.7°F (-180.4°C)]**Melting point:** -313°F (-192°C)**Vapor density:** 1.65
(Air = 1)**Evaporation rate:** Not applicable
(H₂O = 1)**Solubility in water:** Almost insoluble
[0.0003 g/100 mL at 68°F (20°C)]**Water reactive:** Not applicable**Appearance and odor:** Colorless/blueish gas with pungent odor detectable at 0.01 to 0.04 ppm, sharp disagreeable odor at 1 ppm**pH:** Not applicable

FIRE AND EXPLOSION HAZARD DATA

Flash point: Not applicable

Auto-ignition temp: Not applicable

Flammability limits in air % by volume:

Lower explosive limit (LEL): Not applicable

Upper explosive limit (UEL): Not applicable

Special fire fighting procedures: Ozone is an oxidizer and will accelerate combustion; use media appropriate for extinguishing surrounding materials.

Unusual fire and explosion hazards: Can react explosively with readily oxidizable substances and reducing agents. It may present dangerous fire hazards when exposed to aniline, diethyl ether, hydrogen iodide, nitrogen oxides, organic liquids, lithium aluminum hydride, metal hydrides, nitroglycerin, hydrazine, stilbene, ammonia, arsine, nitrogen, and phosphine. Ozone is also incompatible with acetylene, alkyl metals, citronellic acid, fluoroethylene, hydrogen, and tetramethyl ammonium chloride. Ozone reacts with alkenes to form peroxides that are often explosive. Gelatinous explosive ozonides are formed with benzene and other aromatic compounds. Ozone may also react with bromine and hydrogen bromide. Combustion is also possible if high concentrations of ozone off-gas are exposed to carbon-containing ozone destruct devices.

STABILITY AND REACTIVITY DATA

Stability: Unstable. Ozone gas rapidly decomposes to oxygen (O₂).

Reactivity: Reacts with any oxidizable organic or inorganic material. Ozone reacts with alkenes and other unsaturated organic compounds to form ozonides, many of which are highly unstable and explosive.

Conditions to avoid: Avoid contact with oxidizable materials, powerful reducing agents, and heat or flame.

Hazardous decomposition: None.

HEALTH HAZARD DATA

Emergency overview: Ensure adequate ventilation has been engineered in the area where the ozone generation equipment is located. Exposure to ozone may cause headaches, irritation of the eyes, throat and mucous membranes, coughing, dizziness and tightness in the chest.

Potential health effects:

Eyes: Irritating to eyes

Skin: Not an expected route of entry

Ingestion: Not an expected route of entry

Inhalation: Irritating to respiratory system. May cause respiratory complications, coughing, difficulty breathing, chest pain, headache, pulmonary edema, and bronchial pneumonia.

Chronic/carcinogenicity:

NTP: Not listed

OSHA: Not listed

IARC: Not listed

Medical Restrictions: Persons with asthma, allergies, respiratory disorders, or emphysema may be further aggravated by exposure to ozone.

FIRST AID MEASURES

Eyes: In the event of irritating eye contact, promptly wash eyes with copious amounts of water for 15 minutes (lifting upper and lower lids occasionally) and obtain medical attention.

Skin: Not applicable

Ingestion: Not applicable

Inhalation: Respiratory protection may be necessary in the event of an accidental release of ozone. An ozone leak can easily be detected by its characteristic pungent odor. If a large amount of ozone is inhaled, move the person to fresh air and seek medical attention immediately.

EXPOSURE CONTROL/PERSONAL PROTECTION

Engineering controls: Ozone generation equipment should never be operated without the parallel use of an efficient destruct unit to destroy any off-gassing ozone. Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible.

Personal protection:

Eyes/face: None required

Skin: None required

Respiratory: For concentrations greater than 0.1 ppm, use a NIOSH-approved supplied air respirator or self-contained breathing apparatus.

Handling: Not applicable.

Storage: Ozone cannot be stored. Use ambient room ozone monitor for detection.

DISPOSAL INFORMATION

RCRA hazardous waste: Not applicable (gas)

Waste disposal: Ozone rapidly decomposes to form oxygen (O₂). Small to moderate amounts of excess ozone can be vented to a fume hood or other exhaust system. A 1% off gas at 10 cfm or more is considered to be a large amount of ozone. When large amounts of excess ozone are anticipated, the excess gas should be passed through a series of traps containing a 1 to 2% solution of potassium iodide (or other reducing agent), or a catalytic destruct module before venting to atmosphere.

OTHER

Prepared by: Osmonics Regulatory Affairs Department (952) 933-2277

The above information and recommendations are believed accurate and reliable. Because it is not possible to anticipate all conditions of use, additional safety precautions may be required.

User responsibility: Each user should read and understand this information and incorporate it into individual site safety programs in accordance with applicable hazard communication standards and regulations.

For More Information:

Call Osmonics Process Water Group at (952) 933-2277 or (800) 848-1750, or visit www.osmonics.com



OSMONICS

North American Sales

5951 Clearwater Drive
Minnetonka, MN
55343-8995
USA
(952) 933-2277 Phone
(952) 988-6060 Fax

Euro/Africa Sales

230 rue Robert Schurman
ZA des Uselles
77350 Le Mée sur Seine.
FRANCE
+33 1 64 10 2000 Phone
+33 1 64 10 3747 Fax

Asia/Pacifics Sales

1044/8 SOI 44/2
Sukhumvit Road Parkanog
Bangkok 10110
THAILAND
+ 66 2 38 14213 Phone
+ 66 2 39 18183 Fax