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MINI-HICON OZONE ANALYZER OPERATING AND MAINTENANCE INSTRUCTIONS

Designed and Manufactured by IN USA, Inc.





IN USATM



**MINI-HICON
OZONE ANALYZERS**
Operating and Maintenance Instructions

610-0017-01, Rev. H 23 July 2015

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1 Introduction/Safety




1.1 General safety guidelines



	<p style="text-align: center;"> WARNING</p> <p>Use this product ONLY as detailed in this manual.</p> <p>This product is not intended or recommended by IN USA 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. IN USA will not knowingly sell this product for use in such applications. Use of the IN USA 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 IN USA shall absolve IN USA of any responsibility or liability to such purchaser (s) or to any person (s) subjected to or affected by such use knowingly or unknowingly.</p>
 	<p style="text-align: center;"> WARNING</p> <p>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).</p> <ul style="list-style-type: none"> • Install appropriate safety monitoring equipment wherever high concentrations of ozone are used. <i>IN USA, INC.</i> 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. • Use only stainless steel gaskets for VCR[®] gas connections • Ozone must be destroyed before it can be released to exhaust. IN USA, Inc. manufactures a complete line of ozone destruction equipment. Please consult with us for your ozone destruction requirements. • Never attempt to open ozone catalyst canisters (if supplied).


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The content of the canisters can be hazardous if not handled properly.
Use only *IN USA, INC.* recommended spare parts. Substitution parts could result in damage to the equipment and may create hazardous conditions and will void the warranty.

	 WARNING
	<p style="text-align: center;">TOXIC OZONE LEAK HAZARD!</p> <p>USE ONLY MATERIALS WHICH ARE RESISTANT TO HIGH OZONE CONCENTRATIONS SUCH AS TEFLON[®] and 316L Stainless Steel. Materials in contact with ozone should be suitable for such use. 316L Stainless, Teflon[®], Chemraz[®] and Kynar[®] are recommended.</p> <p>EXPOSURE TO OZONE IS HAZARDOUS. ENSURE THAT ALL GAS CONNECTIONS ARE TIGHT AND THAT NO LEAKS EXIST. THE EXHAUST STREAM WILL TYPICALLY CONTAIN LARGE AMOUNTS OF OZONE. ENSURE PROPER MEANS OF SAFELY DISPOSING OF THE OZONE CONTENT OF THE EXHAUST STREAM. PLEASE CONTACT <i>IN USA, INC.</i> FOR TECHNICAL ADVICE OR TO ASK ABOUT AVAILABLE OZONE DESTRUCTION UNITS.</p>

 	 WARNING
	<p style="text-align: center;">UV RADIATION HAZARD!</p> <p>Remove all power from the system before servicing the UV lamp.</p> <p>NEVER PULL THE LAMP OUT ENTIRELY OF ITS HOUSING WHEN POWER IS ON. DO NOT LOOK AT THE LIGHTED PART OF THE LAMP WITHOUT PROPER EYE PROTECTION.</p> <p>DO NOT look directly at a UV lamp as irreversible, disabling eye damage can occur. Always wear proper eye protection equipment to prevent accidental exposure.</p>

	 WARNING
	<p style="text-align: center;">ELECTRIC SHOCK HAZARD!</p> <p>DO NOT OPEN COVERS to the ozone analyzer or any panel to access electrical equipment with the power on, unless you are certified to perform specific troubleshooting/repair tasks.</p> <p>When performing any maintenance to the unit, make sure all AC power is disconnected from the unit.</p>

	! WARNING
	BURN HAZARD! Certain components may be hot to the touch. Please allow proper cooling time before working with these components.

  	! CAUTION
	Read the operating manual before operating the unit.
	Do not subject the unit to extreme physical or thermal shock.
	Use care in handling the unit and any of its components. DO NOT use this equipment in any manner not specified by the manufacturer. If the equipment is used in a manner other than as specified in this document, the safety protections may be impaired.

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2 System Description

2.1 System Overview

The MINI-HICON Ozone Analyzers are ultraviolet (UV) absorption analyzers designed for the monitoring of high concentrations of ozone in the gaseous phase. The Mini-Hicon is available in a variety of configurations to meet specific usage/process needs.

Typical measuring range is up to 900 g/m³. Contact IN USA for your specific requirements.

Key features of the Mini-HiCon include:

- Microprocessor-based control
- Automatic temperature and pressure compensation
- Isolated 0-10 VDC and 4-20 mA outputs
- Bi-directional RS-232 communications
- Minimal maintenance requirements — UV lamp replacement every 24 months.
- High zero stability
- Remote zero standard; automatic purge optional



Figure 1 - Available in Multiple Configurations (HP-NEMA, Rack-Mount, Desktop)

MINI HICON analyzers are designed for continuous, uninterrupted operation and require minimal maintenance. The instruments feature internal diagnostic routines which continuously check key instrument parameters to ensure fail-safe operation. Upon instrument failure or power interruption, an "instrument error" message will be displayed and a corresponding instrument error relay will be de-energized.

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The Mini-HiCon ozone monitor contains the following major devices:

- Optical bench (cuvette)
- UV lamp (and housing)
- UV lamp power supply
- CPU board
- AC/DC power supply
- Front panel with display and keyboard
- Rear or bottom panel with electrical and gas interconnections

The Mini-HiCon is available in standard NEMA mount, stand-alone, as well as custom rack mount configurations.

General System Specifications:

Measuring Principle	UV absorption; dual optical path sample sensing (patent pending)
Application	Continuous measurement of high concentrations of ozone in the gas phase
Pressure and Temperature	Automatic compensation for pressure and temperature.
UV Light Source	Low pressure mercury vapor lamp
Units of Measure	% Weight, g/m ³ , g/Nm ³
Measuring Range	0 – 50 g/Nm ³ 0 – 200 g/Nm ³ 0 – 400 g/Nm ³
Repeatability	Larger of 0.05 g/Nm ³ or 1% of reading, (0-50 g/Nm ³ unit) Larger of 0.4 g/Nm ³ or 1% of reading, (0-200 and 0-400 g/Nm ³ units)
Measurement Resolution	0.1 g/m ³ , 0.01 % weight
Cycle Time	Continuous measurement; 0.5 second (2 Hz) readout update rate
Signal Inputs and Outputs	Isolated 4-20 mA & 0-10 VDC; bi-directional RS-232; remote zero; auto purge
Sample Flow	0.2 to 1 slpm.
Sample Pressure	40 psia operating; 80 psia proof
Sample Ports	1/4" Swagelok™ (others available)
Wetted Materials	316L, sapphire, PFA

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Display	20 character alphanumeric, backlit LCD
Dimensions (W x H x D)	5.6" x 2.8" x 9.5" [143mm x 71 mm x 241mm], Panel Mount 12.75" x 6.87" x 15.50" [324mm x 175mm x 394mm], Wall mount
Compliance	Meets CE
Power Requirements	90 - 264 VAC 47 - 63 HZ 75 WATTS

(Specifications subject to change)

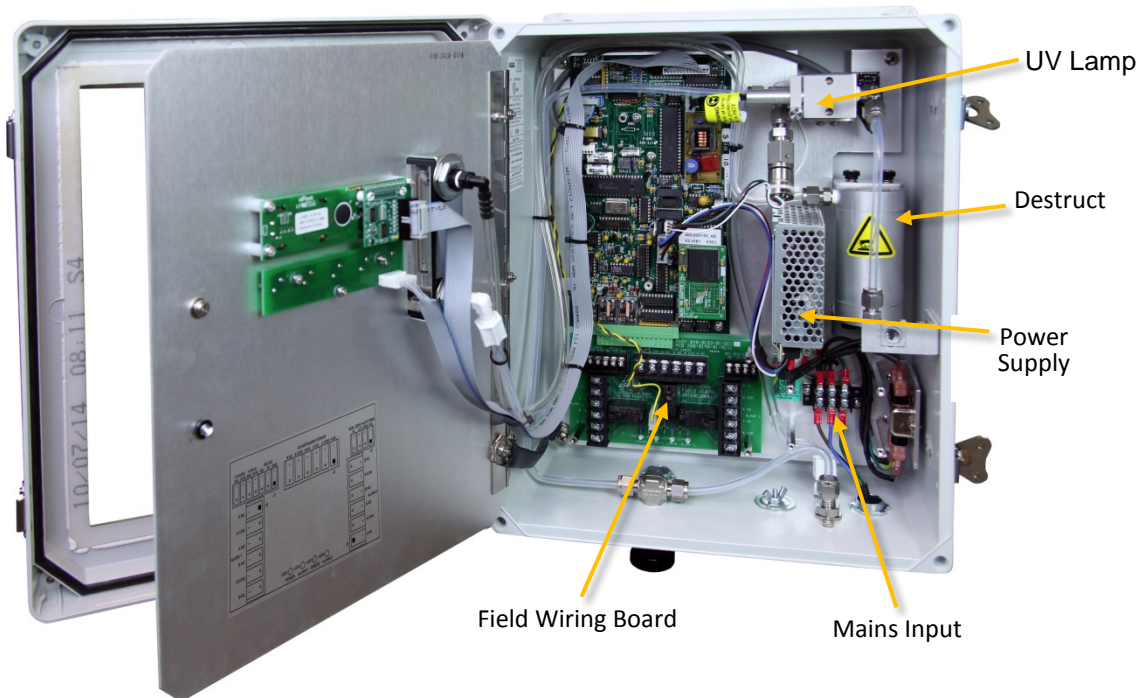


Figure 2 - Mini-Hicon HP NEMA Unit Inside View

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Figure 3 - Bottom Connections – NEMA

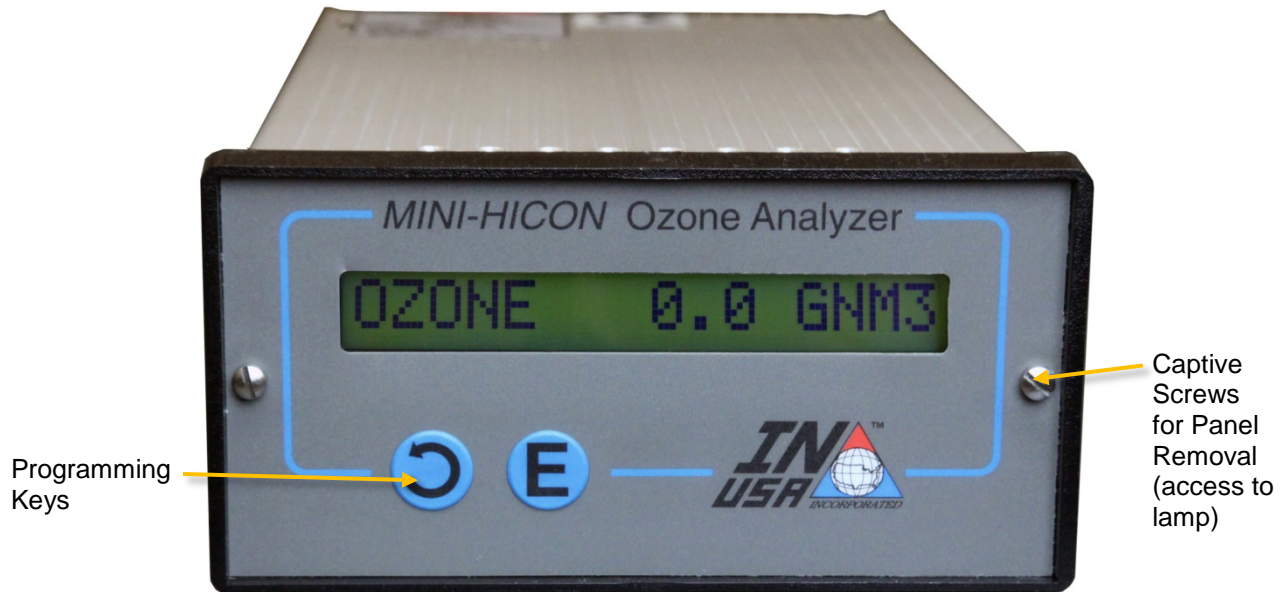


Figure 4 - Front Panel, Mini-HiCon

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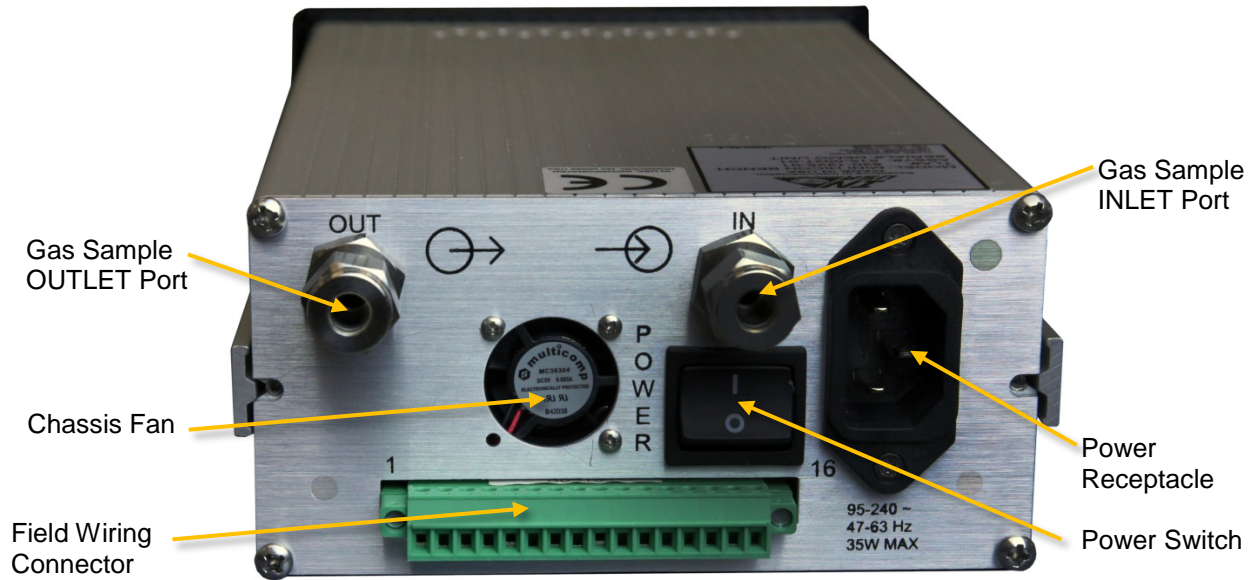


Figure 5 - Rear Panel, Panel Mounted Mini-HiCon

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3 Installation and Connections

3.1 Location Requirements

The Mini-HiCon should be located in a vibration free area, where air circulation is provided. Ambient temperature conditions should be within 0°C to 45°C, at a relative humidity no higher than 95%, non-condensing.

3.2 Dimensions

Figure 6 - Mechanical Dimensions, Stand-Alone Enclosure

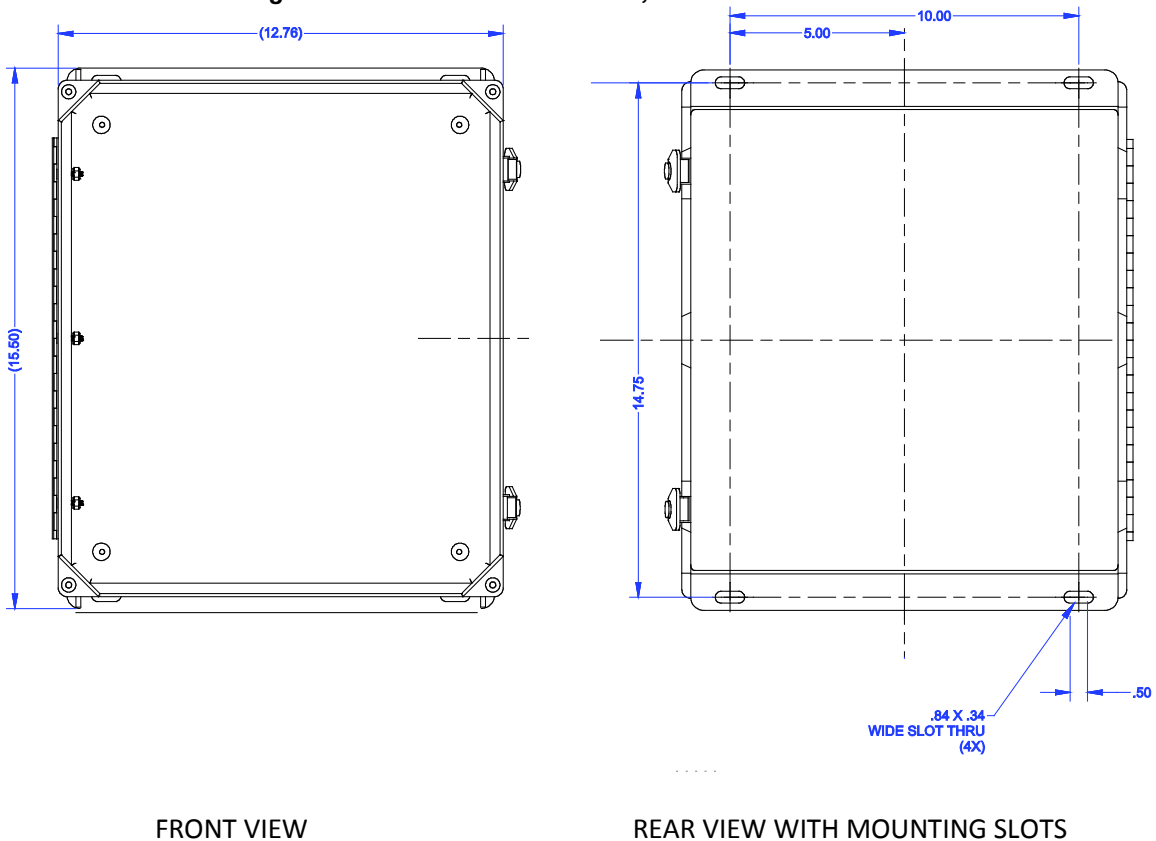


Figure 7 - Mechanical Dimensions – NEMA Unit

Note: This enclosure is 6.87" (175 mm) deep. Allow an additional 12" (305mm) depth clearance for opening of door.

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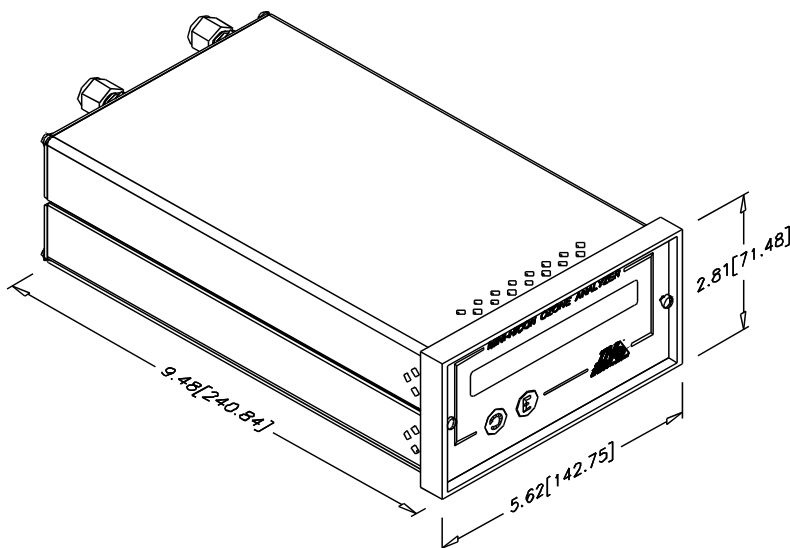


Figure 8 - Mechanical Dimensions – Desktop Unit

3.3 Mounting

The Mini-HiCon can be mounted as a bench top unit, as a panel mount unit, as a 19" rack unit, and as a wall mounted unit.

The monitor can be mounted in virtually any orientation, but it should always be isolated from vibration and protected from physical shock.

NOTE: Do not expose the monitor to direct sunlight, water or dust.

For wall-mounted units, use the drilled flanges to mount the enclosure. Allow 12" [305 mm] minimum for the door to swing open.

When the Mini-HiCon is mounted in a panel of up to 0.5" (12.7 mm) thickness, the panel cutout should have the following dimensions:

Table 1: Panel Cutout Dimensions

WIDTH	HEIGHT
5.35 to 5.37 inches [136.02 to 136.52 mm]	2.65 to 2.67 inches [67.28 to 67.79 mm]

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The panel thickness is "sandwiched" between the instrument's front bezel and the aluminum rails on either side of the monitor's enclosure. The back of the bezel should be flush with the outside panel surface, and the aluminum rails should then press against the inside panel surface. To press the rails against the panel, tighten the rail screws located in the rear of the instrument. Refer to the following figure for details, and follow these steps:

1. Remove rail screws and slide the rails out from their slots.
2. Insert monitor into panel cut-out as shown in the figure.
3. Slide the rails back into the slots and tighten with rail screws.

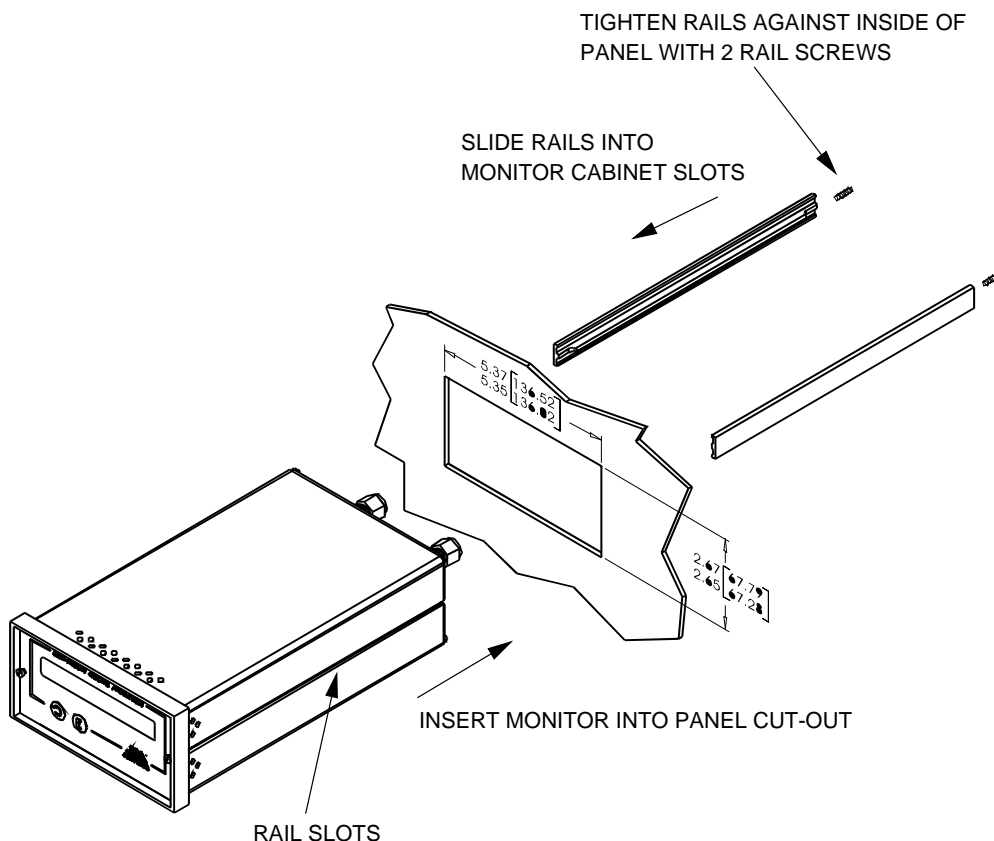


Figure 9

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3.4 Electrical Connections

Panel Mount Units

Main power: is connected to the AC receptacle using the cord supplied with the unit. The monitor's universal power supply allows operation from 95 - 240 ~ (VAC) at frequencies between 47 to 63 Hz. No changes are required in order to operate at one voltage vs. another. Power rating is 150 mA @ 110 VAC.

Field Wiring: The pin-out for the 16-pin connector of the field wiring terminal block can be unplugged from the rear panel of the unit

Table 2a: Field Wiring Terminal Block, Bench and Panel Mounted Units

Pin #	Function	Notes
1	Output, 0-10 VDC Signal (isolated)	0 to 10 VDC is an isolated low impedance, short-circuit protected analog output, intended primarily for data acquisition (recording) and monitoring. The signal is proportional to Ozone Concentration
2	Output, 0-10 VDC Return (isolated)	
3	Output, 4-20 mA Source (isolated)	4- 20 mADC is an isolated current loop. Compliance is 500 Ohms and the loop is open-circuit protected
4	Output, 4-20 mA Return (isolated)	
5	RS-232 RX	The RS232 is configured for 9600 bits per seconds, no parity, 8 Data Bits and 1 Stop Bit
6	RS-232 TX	
7	RS-232 GND	
8	K2 De-energized open – open on error	The Instrument Error (IE) relay is energized when no error is present (fail-safe). If there is a "malfunction" of the power supply, or any key component in the unit, the relay will de-energize indicating an alarm. It is a Form-C single pole double throw (SPDT) break before make relay. The contact ratings are 5 Amp at 250 VAC-resistive load
9	K2 Common	
10	K2 De-energized closed – closed on error	
11	Input, Remote zero, high	Pins # 11 and #12 are intended for interfacing the unit with external equipment. The Mini HiCon continuously monitors Pins 11 and 12, "looking" for a contact closure, called "hardware autozero request". Refer to "Zeroing the Mini-HiCon section for more details.
12	Input, Remote zero, low	
13	not used – do not connect	
14	Digital Ground	
15	Output, Auto purge, pin 1, COM	Pins #15 and #16 are the Normally Open (NO) contacts of an auxiliary relay provided for optional equipment that might be used in purging the Mini-HiCon. The relay contacts ratings are 5 Amp at 250 VAC- resistive loads. Refer to "Zeroing the unit" section for additional information.
16	Output, Auto purge pin 2, NO	

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Wall Mounted Units

1. Feed mains power through the conduit port labeled "MAIN POWER" and connect the wire leads to the power connection.
2. Feed Field Wires through the conduit port labeled "FIELD WIRING" and connect the wire leads to connectors.

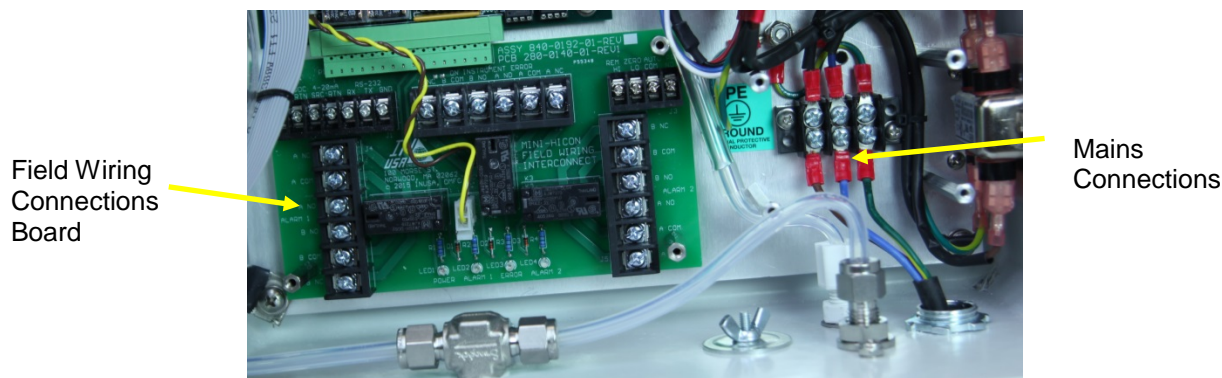


Figure 10 - Standard Interconnect and Power Connections

Mini-Hicon HP Field Wiring Pin-Outs

ANALOG/RS-232 OUTPUT			
	Connector	Function	Notes
J1	1	RS-232 GND	The RS232 is configured for 9600 bits per seconds, no parity, 8 Data Bits and 1 Stop Bit
	2	RS-232 TX	
	3	RS-232 RX	
	4	4-20mA Return (ISOLATED)	4- 20 mADC is an isolated current loop. Compliance is 500 Ohms and the loop is open-circuit protected
	5	4-20mA Source (ISOLATED)	
	6	0-10 VDC Return (ISOLATED)	0 to 10 VDC is an isolated low impedance, short-circuit protected analog output, intended primarily for data acquisition (recording) and monitoring. The signal is proportional to Ozone Concentration
	7	0-10 VDC Source (ISOLATED)	

INSTRUMENT ERROR RELAY			
	Connector	Function	Notes
J2	1	A NC	The Instrument Error (IE) relay is energized when no error is present (fail-safe). It is a Form-C double pole double throw (DPDT) break before make relay. The contact ratings are 5 Amp at 250 VAC-resistive load
	2	A COM	
	3	A NO	
	4	B NO	
	5	B COM	
	6	B NC	

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REMOTE ZERO/AUTO PURGE			
	Connector	Function	Notes
J3	1	Remote Zero High (Input)	Intended for interfacing the unit with external equipment. The Mini HiCon continuously monitors Pins 1 and 2, "looking" for a contact closure, called "hardware autozero request". Refer to "Zeroing the Mini-HiCon section for more details.
	2	Remote Zero Low (Input)	
	3	Auto purge, COM (Output)	Normally Open (NO) contacts of an auxiliary relay provided for optional equipment that might be used in purging the Mini-HiCon. The contacts ratings are 5 Amp at 250 VAC- resistive loads. Refer to "Zeroing the unit" section for additional information.
	4	Auto purge, NO (Output)	

ALARM 1 (DPDT)			
	Connector	Function	Notes
J4	1	A NC	
	2	A COM	
	3	A NO	
	4	B NO	
	5	B COM	
	6	B NC	

ALARM 2 (2DPDT)			
	Connector	Function	Notes
J5	1	A NC	
	2	A COM	
	3	A NO	
	4	B NO	
	5	B COM	
	6	B NC	

L-Style Interconnect Board

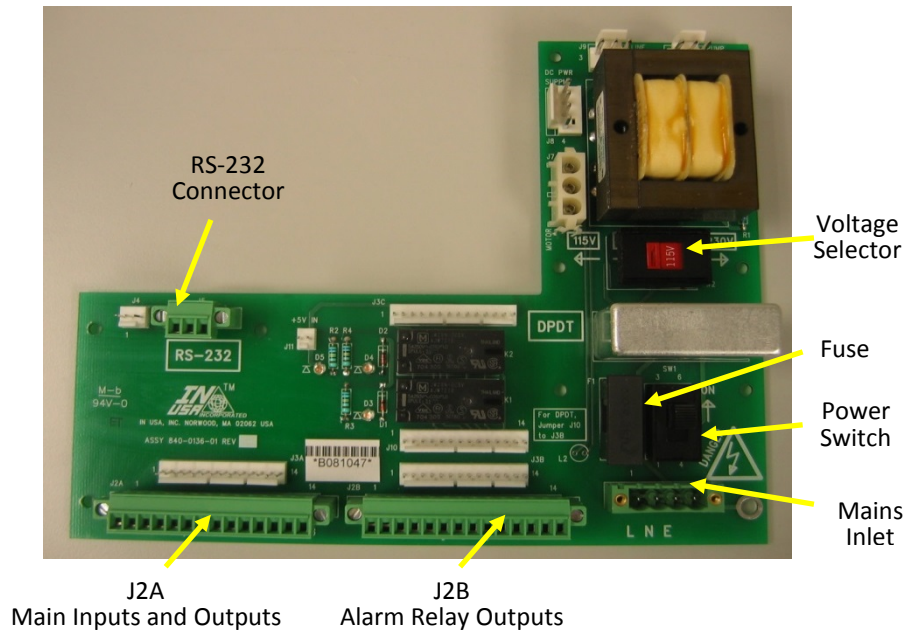


Figure 11 - L-Style Power/Interconnect Board

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L-Board: J2A Main Inputs and Outputs

Pos	Function	Operation	
1	Analog Voltage Output	+	0 to 1 volts Out , Isolated (can be jumpered for 0 – 10V)
2		-	
3	Analog Current Output	+	4 to 20 mA, Isolated
4		-	
5-7	Not used		
8	K3 Purge Relay	These contacts close to energize a solenoid under software control	
9			
10	K2 De-energized Open	Instrument Error – error when de-energized (Fail Safe)	
11	K2 Common		
12	K2 De-energized Closed		
13	Zero	Close these contacts to perform a zero operation	
14			

Table 3b

When configured at the factory, Alarm 1 and Alarm 2 appear at J2B as DPDT relays:

L-Board: J2B Relay K1 and K2 Outputs (DPDT)

Pos	Function	Operation
15	K1A De-energized Open	Alarm 1 – alarm when energized
16	K1A Common	
17	K1A De-energized Closed	
18	K1B De-energized Open	
19	K1B Common	
20	K1B De-energized Closed	
21	K2A De-energized Open	Alarm 2 – alarm when energized
22	K2A Common	
23	K2A De-energized Closed	
24	K2B De-energized Open	
25	K2B Common	
26	K2B De-energized Closed	
27-28	Not Used	

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Analog Outputs

The analog outputs are isolated.

The full-scale range of the analog outputs is related to the full-scale measuring range of the monitor, which is factory set at the time of order. The analog output ranges for standard measuring ranges are shown in Table 4* below.

*The values shown in Analog Outputs Full Range table apply to Models of MiniHiCon High Concentration Ozone Analyzer fitted with INUSA Part Number 860-0001-05 revision N or higher.

The Output DAC is calibrated at the factory using the procedure described below. This has no effect on Ozone Calibration against the Standard.

Field Calibration. Contact the factory and ask for spreadsheet (910-1709-01.xls) and menu chart (910-1686-01.doc) for accessing the programming menus. The procedure is briefly described below:

Set both calibration parameters to 1.000

Enter the output voltages and currents into the spreadsheet

Load the desired calibration parameters (voltage, current or combination) into the Mini HiCon

Verify the Calibration Parameters

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Analog Output Full Ranges

Sensor Range	Span [g/m3]	Span [g/Nm3]	Span [% by Weight]
0 – 900 [g/m3]	0 – 900	0 – 400	0 – 26
0 – 400 [g/m3]	0 – 900	0 – 400	0 – 26
0 – 200 [g/m3]	0 – 200	0 – 200	0 – 16
0 – 150 [g/m3]	0 – 150	0 – 150	0 – 12
0 – 125 [g/m3]	0 – 125	0 – 125	0 – 10
0 – 100 [g/m3]	0 – 100	0 – 100	0 – 8
0 – 50 [g/m3]	0 – 50	0 – 50	0 – 4
0 – 25 [g/m3]	0 – 25	0 – 25	0 – 2
0 – 10 [g/m3]	0 – 10	0 – 10	0 – 1

Instrument Error Relay

The instrument error relay can be used as either **opened on error mode** or **closed on error mode**. Refer to the Fault Condition Table for a complete description of the I.E. Relay Status under different Error Message Conditions.

Remote Zero

Zeroing the monitor is described in complete detail on page 30.

There are three ways to initiate a zero remotely:

1. Generate a “Hardware Autozero Request” by momentarily shorting pins:
J3 Pines 1 and 2 for Mini HiCon-HP units
11 and 12 in the Bench or Panel Mounted units
13 and 14 in L Board Wall Mounted Units.
2. Use an external Voltage. For Bench and Panel Mounted Units only: Apply a 24 VDC max signal into pin 12, and ground to pin 14. (Max. 6 mA).
3. Use an RS-232 command (see RS-232 Communications on page 23).

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NOTE: The monitor must be purged with ozone-free reference gas prior to initiating the zero sequence.

In units with the automatic purge option properly installed, the reference gas will be generated internally.

Please refer to Zeroing the Monitor, page 30, for more details.

Auto Purge

When the automatic purge option is active, the auto purge relay can be used to automatically operate a device that allows reference gas to purge the monitor. The automatic purge option is factory installed.

Mini-Hicon NEMA L-Board: Pins 15 and 16

Mini-Hicon-HP: J3 Pins 3 and 4

Zeroing and purging the instrument is described in more detail beginning on page 30.

RS-232 Communications

The RS-232 protocol is 9600, N, 8, 1 (9600 bps, no parity, 8 data bits, 1 stop bit).

When the command "H <cr>" is issued from a terminal, the terminal will display a help menu showing the commands available. The available commands are shown in the table below. Every command must be followed by a carriage return.

Table 5: RS-232 Commands

Command	Description
?	Polled ozone concentration: returns ozone concentration and error codes
!	As above, but also includes pressure and temperature
S	Polled status: returns status codes (refer to 7, page 24.)
Z	Initiate zeroing
Rxxxx	Set data streaming rate from 5 to 3600 seconds (example: R60 will output data every minute)
D	Start data output stream
E	End data output stream
Ix	Set data identifier to "x", where "x" is a letter from A to Z; all data output is preceded by the identifier (default is A)
H	Display the help screen

The data output is comma delimited. Note that if more than one error condition is present, all respective error codes are transmitted. If there are no errors, the error code "0" is transmitted.

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RS-232 Data Output Format

Data Output	Format (see format codes below)
Polled ozone ("?" command)	?I, xxx, z <cr>
Polled ozone ("!" command)	!!, xxx, ppp, ttt, z <cr>
Polled error status ("S" command)	S z <cr>
Continuous data stream output	I, xxx, ppp, ttt, z <cr>

Format Code	Description
I	Identifier I (default is A)
xxx	Ozone concentration
ppp	Gas pressure
ttt	Gas temperature
z	RS-232 Status code (see table below)

NOTE: When more than one status condition is present, status codes are comma delimited.

A status code of "0" (zero) means no errors.

RS-232 Status Codes

Code	Status Condition
0	No errors
1	Zeroing procedure active
2	Error: Optical Signal intensity over-range
3	Warning: Optical Signal intensity low
4	Error: Optical Signal intensity very low
5	Error: Excessive Zero Drift
6	Warning: Ozone Density (g/m ³) over-range (*)
7	Error: Zeroing Failure
8	Error: Optical Signal Unstable

(*) Self-clearing condition: Clears automatically when over-range condition clears.

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3.5 Pneumatic Connections

The Mini-HiCon monitor can be pneumatically configured in two ways:

1. Bypass Mode, **(RECOMMENDED MODE)**, refer to page 25
2. Return Mode , refer to page 28)

For applications requiring a full flow, in-line ozone sensor, *IN USA, INC.* recommends its "gFFOZ" line of full-flow, in-line ozone sensors. Please contact *IN USA, INC.* for further information.

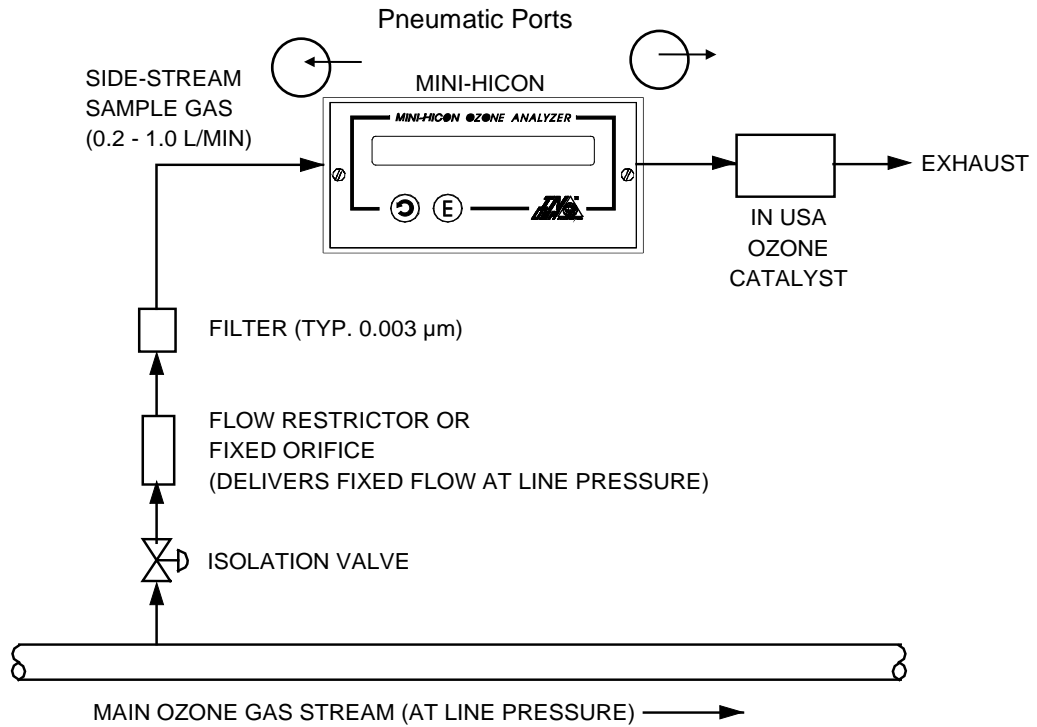
REMINDER: When making pneumatic connections, use parts made of materials suitable for use in high ozone concentrations.

Bypass Mode (Recommended Mode)

This is the recommended pneumatic configuration for the Mini-HiCon monitor. In bypass mode, the line pressure of the main ozone gas stream drives a 0.2-1.0 l/min sample of gas through the monitor. After being measured by the Mini-HiCon, the sample gas is then exhausted through an ozone catalyst (available from *IN USA, INC.*). The catalyst destroys the ozone by converting it back into oxygen.

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Figure 12 - Recommended Pneumatic Configuration (Bypass Mode)



NOTE: A particulate filter is recommended in order to protect the monitor's optical components from potential soiling.

NOTE: The exhaust from the catalyst can be vented to ambient. However, it should *not* be vented into a clean-room environment.

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NOTE: It is also possible to use a throttling valve instead of the flow restrictor.

Return Mode

The Mini-HiCon can also be configured such that the sample gas is returned to the main ozone gas stream. In this case the pressure drop between the sample bleed point and the sample return point must be greater than the pressure drop through the monitor and ancillary components (valves, filters, tubing, etc.).

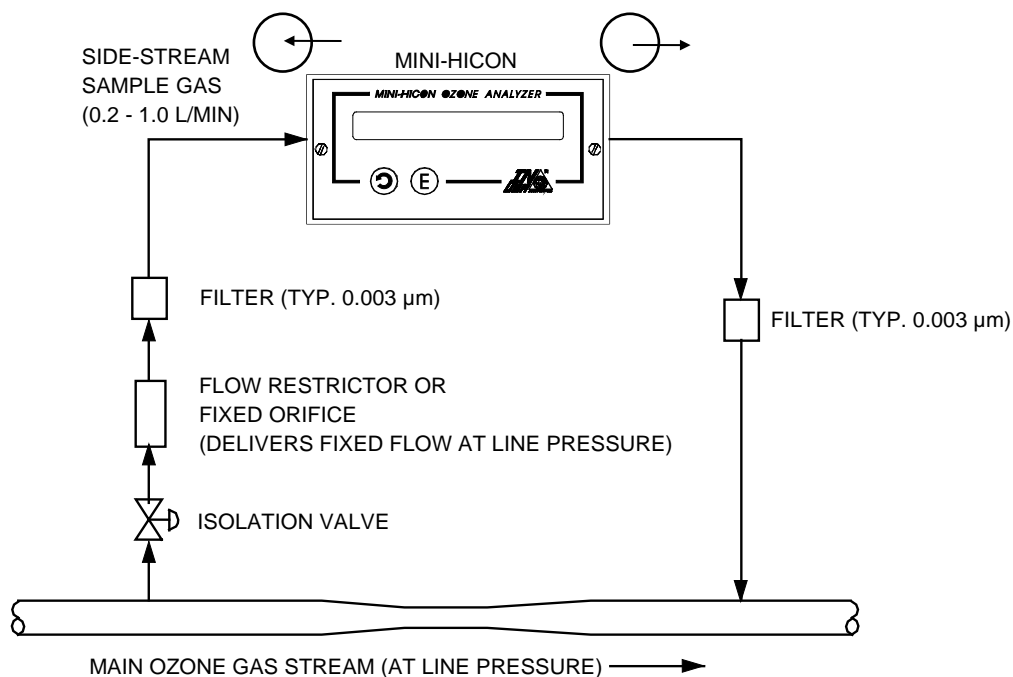
NOTE: In "return mode", the monitor operates at the pressure of the main ozone gas stream.

CAUTION: Do not exceed the maximum operating pressure of the monitor.

REMINDER: *IN USA, INC.* supplies ozone sensors specifically designed for full-flow, in-line applications. Contact *IN USA, INC.* about the "gFFOZ" ozone sensor.

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**Figure 13 - Recommended Pneumatic Configuration (Bypass Mode)
Optional Pneumatic Configuration (Return Mode)**



Connections to the Inlet and Outlet Ports

In order to insure a proper leak-tight connection, follow the fitting manufacturer's guidelines for tightening.

Provisions for Zero (Purge) Gas

Please refer to the section on Zeroing (page 30) for complete details on providing zero reference gas to the instrument.

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4 Operation

4.1 Initial Power-on and Warm-up

Both the AC power receptacle and power switch are located in the rear panel of the Panel Mounted unit. Wall Mounted Units do not feature a Power On-Off Switch.

Upon initial power-up, the monitor will briefly display its software version and sensor type. The unit will go through a several minutes (under five minutes) warm-up period during which the display is blocked out with asterisks.

In order to achieve maximum performance and stability, it is **strongly recommended to allow for an overnight warm up on initial startup or on a "cold" start**. This warm up should preferably be done while the unit is purging with ozone-free gas (typically oxygen). After this warm up period, the unit can be zeroed as explained on page 30.

NOTE: It is recommended that the monitor be powered on at all times (24 hours/day, 7 days/week). This will insure peak performance, minimal zero drift, and maximum system life.

4.2 Keyboard

There are two keyboard layouts. The Bench/Panel Mount Mini-HiCon is via the two keys on the front panel. The NEMA or HP version is by a five button keyboard. By using the scroll key, the user can view various parameters on the front panel display. The front panel display (20 character alphanumeric) provides real-time information and easy to understand messages.

4.3 Information Displayed

If warnings or fault conditions are active, the ozone concentration screen will show "ERR" and the conditions can be viewed by pressing "E".

NOTE: During warm-up and under certain fault conditions, the ozone concentration is blanked out with asterisks.

4.4 Units of Measure

The units of measure for ozone concentration, pressure and temperature are factory set.

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4.5 Zero Command

The instrument will prompt the user with instructions to initiate a zero. If the purge option is not installed, the user will be reminded to purge the instrument. Please refer to Zeroing the Monitor, below.

4.6 Lamp Index

The lamp index is a calculated parameter closely related to the UV lamp intensity output.

4.7 Zeroing the Monitor

Because of its advanced patented design, the Mini-HiCon is a highly zero-stable instrument. However, as with any similar device, the Mini-HiCon must be zeroed periodically with an ozone-free reference gas. The frequency of the zero procedure depends on the applications. Please consult with IN USA about the specifics of your application, to better determine the most appropriate "zeroing scheme".

Zeroing Phases

Zeroing the instrument involves the following phases:

Table 8: Zeroing Phases

Phase	Purpose
Purging with reference gas	To get rid of ozone gas inside the optical chamber prior to zeroing
Zeroing	To make internal parameter adjustments to reflect the true zero of the instrument
Purging with ozone sample gas	To get rid of reference gas inside the optical chamber prior to resumption of ozone measurements

The zeroing phase can be initiated in three ways:

- via the front panel
- via the Remote Zero field wiring (see Remote Zero, page 22)
- via an RS-232 command (see RS-232 Communications, page 23)

If a zero is initiated via the front panel, the display will prompt the user to press "Enter" several times before and after the zero is complete. If a zero is initiated remotely, the display will automatically return to ozone measurement when the zero is complete.

The user may purge the monitor externally, or it may be purged automatically with the automatic purge option. The automatic purge uses an external reference gas and automatically purges (and then zeroes) the monitor.

During a zeroing sequence, the RS-232 status code will be set to "1" (see RS-232 Communications, page 23).

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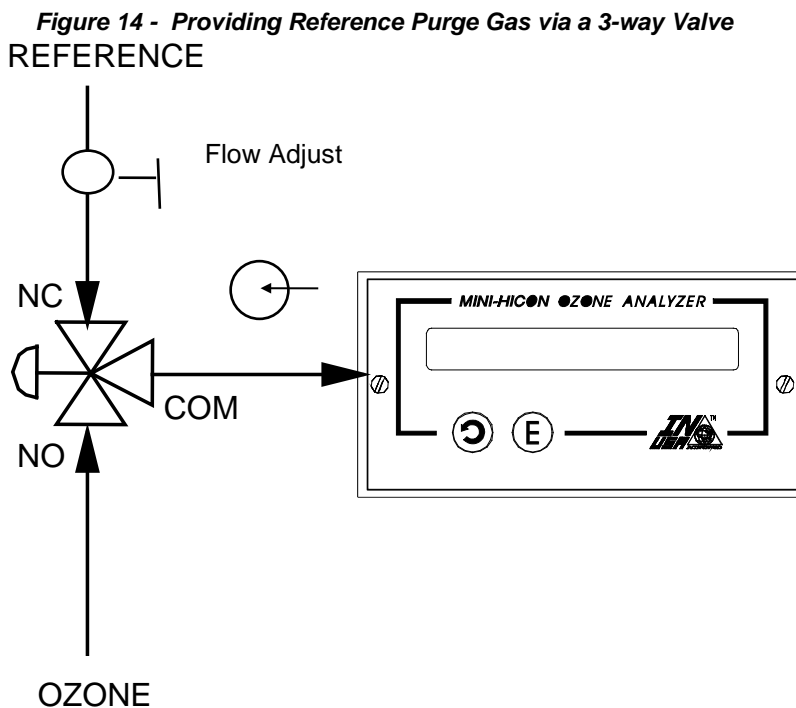
Type of Reference Gas and Purge Time

The most commonly used ozone-free reference (purge) gas is oxygen. Nitrogen and clean dry air may also be used.

On start-up, the unit should be warmed up and purged overnight prior to zeroing. Thereafter, if the unit is warm, a ~15 minute purge is adequate.

4.8 Pneumatic Configuration for Purging

If the automatic purge option is not active, provisions must be made to allow delivery of purge reference gas to the monitor. By using a valve as shown in Figure , the user can purge the monitor. The valve can be electrically or manually actuated. The valve is used to "turn off" the flow of ozone and "turn on" the flow of reference gas. The reference gas flow should be regulated to 0.2 to 1 l/min. Note that when the automatic purge option is active, hardware and software in the monitor automatically provide the flow of reference gas, and there is no need for additional hardware.



NOTE: Regulate the pressure of the reference gas so as not to exceed the pressure rating of the 3-way valve

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5 Troubleshooting

5.1 Fault Conditions

The monitor continuously checks for conditions that may cause measurements to be unreliable. Warning messages are issued if such a condition is impending, or if the user can easily correct the condition. Conditions are considered "fatal errors" if they make the measurements immediately unreliable. In this case, the ozone measurement is "blanked out" with asterisks.

Fault conditions are detected during normal operation and during zeroing. When a fault condition is detected, the ozone concentration screen will display "ERR" on the left-hand side. To view the fault condition messages:

1. Press the "E" key from the ozone concentration display
2. Press the "Scroll" key to view more than one fault condition message
3. Press the "E" again to clear warnings and return to the ozone concentration display.

Certain error conditions can only be cleared by zeroing the machine or by powering the unit off. However, if the faults persist, the error conditions will return. Warnings can be cleared as explained below.

REMINDER: Error conditions are also transmitted via RS-232

Certain error conditions will also trip the instrument error alarm relay.

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Fault Conditions

Error Message	Fault Type	Instrument Error Relay	Likely Causes	Likely Remedies
OVERRANGE	Warning (readings capped)	Yes	Ozone density above range of unit	Contact <i>IN USA, INC.</i> for a monitor with a higher range
REZERO	Warning	Yes	Insufficient warm-up Monitor hasn't been zeroed	Allow warm-up Zero the unit
LOW INDEX	Warning	No	Weak lamp	Replace lamp
	Fatal	Yes	Dead lamp	Replace lamp
WARNING UNSTABLE	Warning	Yes	Insufficient warm-up Loose UV lamp UV Lamp failure	Allow warm-up Check or replace UV lamp
INTENSITY O/R [OVER RANGE]	Fatal	Yes	Optical bench failure	Call service
SENSOR FAILURE	Fatal	Yes	Optical bench or electronic failure	Call service

5.2 Programming Buttons

There are 3 hidden buttons on the front face of the *Bench/Panel mount* unit to the right of the ENTER key that are not labeled but need to be used to access the hidden menus. The following is a layout of the keypad, the 2 blackened circles are the 2 labeled keys (MAIN SCROLL and ENTER).



The *Mini HiCon-HP* units have a different key pattern but display all five buttons.



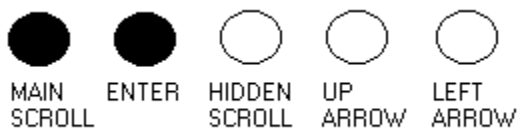
The HIDDEN SCROLL and the "D" (Display) keys have the same function.

Advanced settings and parameters can be changed using the Programming Buttons, as detailed in the following sections.

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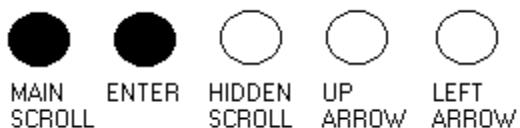
Verify ALL factory set parameters

If the system is experiencing problems, verify all factory parameters before proceeding.



1. Press the MAIN SCROLL key 3 times, the screen should read "ZERO-PRESS ENTER".
2. Press the HIDDEN SCROLL or "D" (DISPLAY) key 5 times, the screen should read "SENSOR PARAMS".
3. Press the ENTER key, the screen should read "TYPE: 01".
4. Use the HIDDEN SCROLL or "D" (DISPLAY) to scroll through parameters.
5. Verify factory set parameters. If set at default, re initialize the sensor and reinstall factory set parameters.

5.3 Re-initializing the MINI Hicon analyzer



1. Press the MAIN SCROLL key 3 times, the screen should read "ZERO-PRESS ENTER".
2. Press the HIDDEN SCROLL or "D" (DISPLAY) key 6 times, the screen should read "OPERATING PARAMS".
3. Press the ENTER key, the screen should read "AVERAGING: 08".
4. Press the HIDDEN SCROLL or "D" (DISPLAY) key 9 times. The screen should read "INIT EEROM".
5. Use the UP ARROW to change to SYST
6. Press the E key.
7. The sensor is set back to default.
8. Re-install all factory parameters.

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5.4 Reprogramming the Sensor Parameters

1. Press the MAIN SCROLL key 3 times, the screen should read "ZERO-PRESS ENTER".
2. Press the HIDDEN SCROLL or "D" (DISPLAY) key 5 times, the screen should read "SENSOR PARAMS".



3. Press the ENTER key, the screen should read "TYPE: 01".
4. Refer to figure 1 for the value of the parameters in the SENSOR PARAMS menu.
5. Once the screen is on a parameter that needs the value changed, use the LEFT ARROW to move from character to character and the UP ARROW to increment the character to the desired value.
6. When you are finished changing an individual parameter press the HIDDEN SCROLL or "D" (DISPLAY) to go to the next parameter.
7. When you are finished changing all the parameters in the SENSOR PARAMS menu press the ENTER key, the screen should return to reading "SENSOR PARAMS". Go to the next section, "Reprogramming the Operating Parameters".

Table 1: SENSOR PARAMS

TYPE:	01
REV:	1.00
S/N:	000783
#1 LEN:	0.2MM
#2 LEN:	0.7MM
SYS CAL:	0.986
PSI (PSIA):	81.30
OFF (PSIA):	1.273
SENS GD #1:	1020
SENS GD #2:	1030
RANGE:	200
P TWEAK:	1.00
T TWEAK:	10.00

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5.5 Reprogramming the Operating Parameters

1. Press the HIDDEN SCROLL or “D” (DISPLAY) key 1 times, the screen should read “OPERATING PARAMS”.



2. Press the ENTER key, the screen should read “AVERAGING: 08”.
3. Refer to Table 2 for the order and value of the parameters in the OPERATING PARAMS menu.
4. Once the screen is on a parameter that needs the value changed, use the LEFT ARROW to move from character to character and the UP ARROW to increment the character to the desired value.
5. When you are finished changing an individual parameter press the HIDDEN SCROLL or “D” (DISPLAY) key to go to the next parameter.
6. When you are finished changing all the parameters in the OPERATING PARAMS menu press the ENTER key, the screen should return to reading “OPERATING PARAMS”.

Table 2: OPERATING PARAMS

AVERAGING:	08
OZ UNITS:	G/NM3
GAIN DEP Z:	1000
NON GAIN Z:	995
REMOTE PROBE:	NO
PRESS/TEMP:	YES
PSIA/MBAR:	mBARS
CARRIER:	OXYGEN
ZERO PURGE:	YES
INIT EEROM:	NO
IDX NORM:	NO
SIMUL DA:	0%
DA OFFSET:	0.9848
DA SCALE:	0.9972
LAMP ON/OFF:	ON

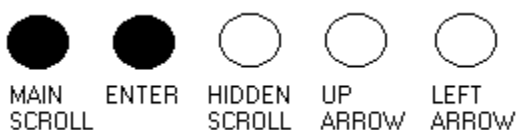
7. After all parameters have been reprogrammed, press the MAIN SCROLL key, the screen should return to the main ozone concentration reading screen.
8. Let the unit sit for about a minute.
9. Power the unit down.
10. Wait about a minute and power it back up.
11. Allow the unit to finish its warm up cycle.
12. When it finishes warming up press the MAIN SCROLL key 3 times, the screen should read “ZERO-PRESS ENTER”.

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13. Press the ENTER key 3 times, the screen should read "ZEROING".
14. When the screen reads "ZERO OK: PRESS E" press the ENTER key, the screen should now return to the main ozone concentration reading screen and display a 0.0 g/nm³ reading.
15. At this point the unit should be fully functional.

5.6 Changing the Range on Mini HICONS

1. Press the MAIN SCROLL key 3 times, the screen should read "ZERO-PRESS ENTER".
2. Press the HIDDEN SCROLL or "D" (DISPLAY) key 5 times, the screen should read "SENSOR PARAMS".



3. Press the ENTER key, the screen should read "TYPE: 01".
4. Press the "HIDDEN SCROLL" key 10 times and the display should read "RANGE: XXX".
5. Use the "UP ARROW" key or the "LEFT ARROW" key to cycle through the available ranges until the display reads the range desired.
6. Press the "MAIN SCROLL" key and the display will return to the ozone concentration reading and the parameter change is now stored in memory.

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5.7 Lamp Issues

Improper Warmup, Lack of Ozone-Free ‘Zero’

Many ozone reading issues can be caused by improper warmup and zeroing of the device.

The Mini HICON must be properly warmed up and purged with ozone-free gas prior to usage, as follows:

1. Turn on power.
2. Allow the unit to warm up for at least 4 hours (overnight warmup is recommended). This will allow sufficient time for the lamp to become warm and stable.
3. Once the analyzer has fully warmed up, an ozone free gas needs to be applied for 15 minutes. We recommend oxygen. Compressed air or nitrogen is also acceptable.
4. With ozone-free gas flowing through the monitor, a ZERO must be done. See next section.

Zero the Mini Hicon

1. After the monitor has been fully warmed up (see prior section), connect an ozone-free gas to the inlet of the analyzer. After 15 minutes of ozone free gas flow, the monitor is ready to be zeroed.
2. With the ozone-free gas still flowing through the analyzer, Press the MAIN SCROLL key 3 times, the screen should read “ZERO-PRESS ENTER”.
3. Press the ENTER Key 3 times. The Mini Hicon is now being zeroed.
4. Once the zero has been completed, the display should read “ZERO OK: Press E”
5. Press the E key to return to the main ozone screen.
6. If the display is blinking after a zero has been completed, Press the “E” key. This will display a message.

Most common errors:

Message	Meaning	Solution
RE ZERO	Analyzer received an inadequate zero.	Re-zero the analyzer
UNSTABLE UV	Lamp is unstable.	Verify the lamp is not loose in the lamp holder. Check lamp diagnostics. If counts are moving by 20+ counts, try to adjust the lamp. (See lamp adjustment) Once lamp is adjusted and counts are stable, re zero the analyzer. If UNSTABLE error does not clear, replace lamp.

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Message	Meaning	Solution
LOW CELL VALUE	Lamp is weak	<ul style="list-style-type: none"> Check the lamp diagnostics to verify lamp is working properly. Cell is contaminated. Replace lamp. If error does not clear, Call INUSA Inc. for further instructions.

Lamp Diagnostics

- Press the Scroll button 3 times.
Display shows "Zero press enter".
- Press the "hidden button" or "D" (Display) key to the right of the "E" button 3 times.
Display Shows "diagnostics".
- Press the "E" button.
The gains are displayed and they should be at: 1+2, 2+1, and 2+2.
- Press the hidden key twice for counts. Counts should be at 12500 or higher.



Understanding lamp diagnostics

Item	Description
Gains	<p>When entering the DIAGNOSTIC menu, the first thing you will see is the lamp Gain. Gains are 1/2/4/8/16. The gain is a multiplier that reflects the lamp counts. (See lamp counts)</p> <p>With a clean cell and a new lamp, ideal gains are 1/1 – 1/2 – 2/2. When gains reach 8 for either channel, this is an indication that the lamp is weak and needs replacing and/or the cell is contaminated. If the lamp is replaced, the analyzer has been zeroed and the gains do not decrease, this is a sign the cell is contaminated.</p>
Zero Term	The ratio between light intensity between channel A and B with Zero gas (Non ozone gas).
Lamp Counts	<p>Lamp counts indicate the stability of the lamp and the intensity of the lamp. Lamp counts should be between 12,500 – 26,000.</p> <p>When the lamp counts drop below 12,500 on either channel A or B, this will indicate that the gain factor will increase.</p> <p>When the lamp counts are greater than 25,000 this indicates the gain factor will decrease.</p> <p>When counts are below 13K or above 26K, a zeroing of the analyzer is required for the gain factor to increase or decrease.</p> <p>The lamp counts can be increased or decreased by rotating the lamp</p>

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	<p>1/16 inch either clockwise or counterclockwise.</p> <p>Once the analyzer has warmed up and the analyzer has been zeroed, the lamp counts should be stable. The lamp counts should not move more than 5-10 increments at a time. IF they move by 50/100 or more, you will receive an UNSTABLE error on the front display. This most likely indicates there is an issue with the lamp.</p> <p>The lamp will be required to be replaced.</p>
Lamp Index	<p>This is located on the main ozone screen. When a lamp is new, the index is 100%. As the lamp is being used, the intensity will decrease. In return, the lamp index will also decrease. When the lamp index reaches 20%, this is an indication to replace the lamp soon.</p> <p>If a new lamp has been installed, the lamp index needs to be normalized.</p> <p>(Please refer to the instructions “Normalizing lamp index)</p> <p>If this is not done when the lamp is replaced, the lamp index value will not be true. When the lamp is replaced and Normalization has been completed, the lamp index should read 100%.</p>

Lamp Adjustment

	 WARNING
	<p>UV RADIATION HAZARD Remove all power from the system before servicing the UV lamp.</p> <p>NEVER PULL THE LAMP OUT ENTIRELY OF ITS HOUSING WHEN POWER IS ON. DO NOT LOOK AT THE LIGHTED PART OF THE LAMP WITHOUT PROPER EYE PROTECTION.</p> <p>DO NOT look directly at a UV lamp as irreversible, disabling eye damage can occur. Always wear proper eye protection equipment when calibrating UV lamps to prevent accidental exposure.</p>

Use the lamp adjustment procedure as directed from the diagnostic steps in the prior section of this guide:

1. Go into the diagnostic menu. Once in diagnostics, scroll until lamp counts are visible. You will need to view the lamp counts when making adjustments.

	 WARNING
	<p style="text-align: center;">BURN HAZARD!</p> <p>The lamp and certain components may be hot to the touch. Please use care to prevent personal injury.</p>

2. Locate the lamp in the unit and loosen the setscrew on the lamp block.
3. Turn the lamp 1/16th inch either clockwise/counterclockwise.
4. Once the lamp is set properly, tighten the setscrew. (DO NOT OVER TIGHTEN THE SETSCREW; THIS WILL CAUSE DAMAGE TO THE LAMP).
5. Re-zero analyzer.

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5.8 Other Error Conditions

Condition	What it Means	Effect on Measurement	Possible Cause	Solution
OZONE READINGS WITH NO OZONE	-	-	Unit has not properly warmed up	Allow sufficient warm-up time (>4 hours)
			Interfering gas present	Remove interfering gas
OZONE READINGS TOO LOW OR CREEPING DOWN	-	-	Unit has not properly warmed up	Allow sufficient warm-up time (>4 hours)
			Unit leaking	Stop ozone flow, check for leaks, correct leaks
Negative Ozone Concentration Values			Insufficient warm-up time	Allow at least 4 hours of warm-up
			Reference catalyst contamination caused by: - high moisture content - other gases (ClO ₂ , NOx)	Replace the reference catalyst
			Inappropriate materials for tubing, filters	Use only materials compatible with ozone. Do NOT use Tygon or other plasticized materials.
Run Time Error			This error is rare, and typically is cleared by switching main power to the analyzer off and back on. If the error persists, a corruption of the software has probably occurred. Please call IN USA for service.	

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6 MAINTENANCE


Performance of periodic maintenance requires advanced knowledge, understanding, and training with the Ozone Analyzer System. NEVER perform a maintenance task unless you are trained and certified to perform the task safely. All seals, connections, and fittings must be leak-tight. Refer to procedures for details and warnings.

6.1 Preventative Maintenance Schedule

Item	Interval				
	As Needed	Monthly	3 Months	1 Year	2 Years
Replace Inlet Sample Filter	YES	-	YES	YES	YES
Replace the UV Lamp	YES	-	-	YES	YES
Inspect Optics Cell*	-	-	-	YES	YES
Replace Optics Cell Components*	-	-	-	-	YES
Replace Catalyst*	-	-	-	YES	YES
Unit Calibration*	-	-	-	YES	YES

*Factory service is recommended.

6.2 Consumable Parts Ordering Information

Item	Description	Part Number	Qty
	Filter	390-0373-01	1
	UV Lamp	810-0055-01	1

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	Ozone Catalyst	810-0008-01	1
	Filter Assembly	390-0048-01	1
	Filter Element	390-0049-01	1
	Ozone Destruct	810-0941-01	1

Optics Cell Replacement Parts

Item	Components to Replace	Part Number	Qty
1	UV Lamp	810-0055-01	1
2	Spacer, Insulator	110-1040-01	1
3	Spacer, O-Ring Compression	110-1041-01	3
4	O-ring	390-0363-01	4
5	Window	450-0018-01	2
6	Window	450-0017-01	2
7	Filter, 254M	420-0003-01	2
8	Spacer Insulation	110-1043-01	2
9	#4 Nylon Washer	302-0001-01	3
10	#4 Flat Washer	411005	3
11	#4 Split Lock washer	411001	3

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The following parts illustration is provided for reference, should repair become necessary. Contact IN USA with any questions.

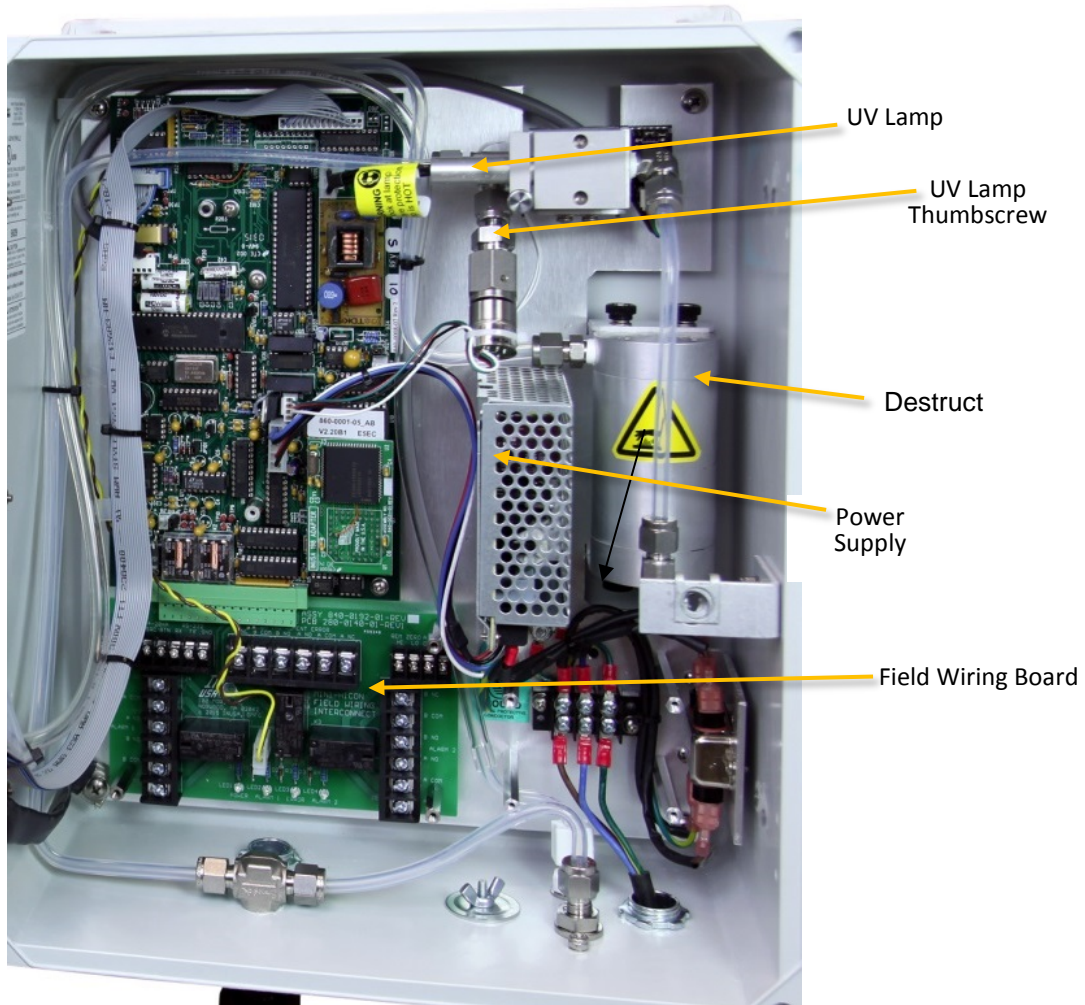


Figure 15 - Mini-Hicon HP Unit Inside View

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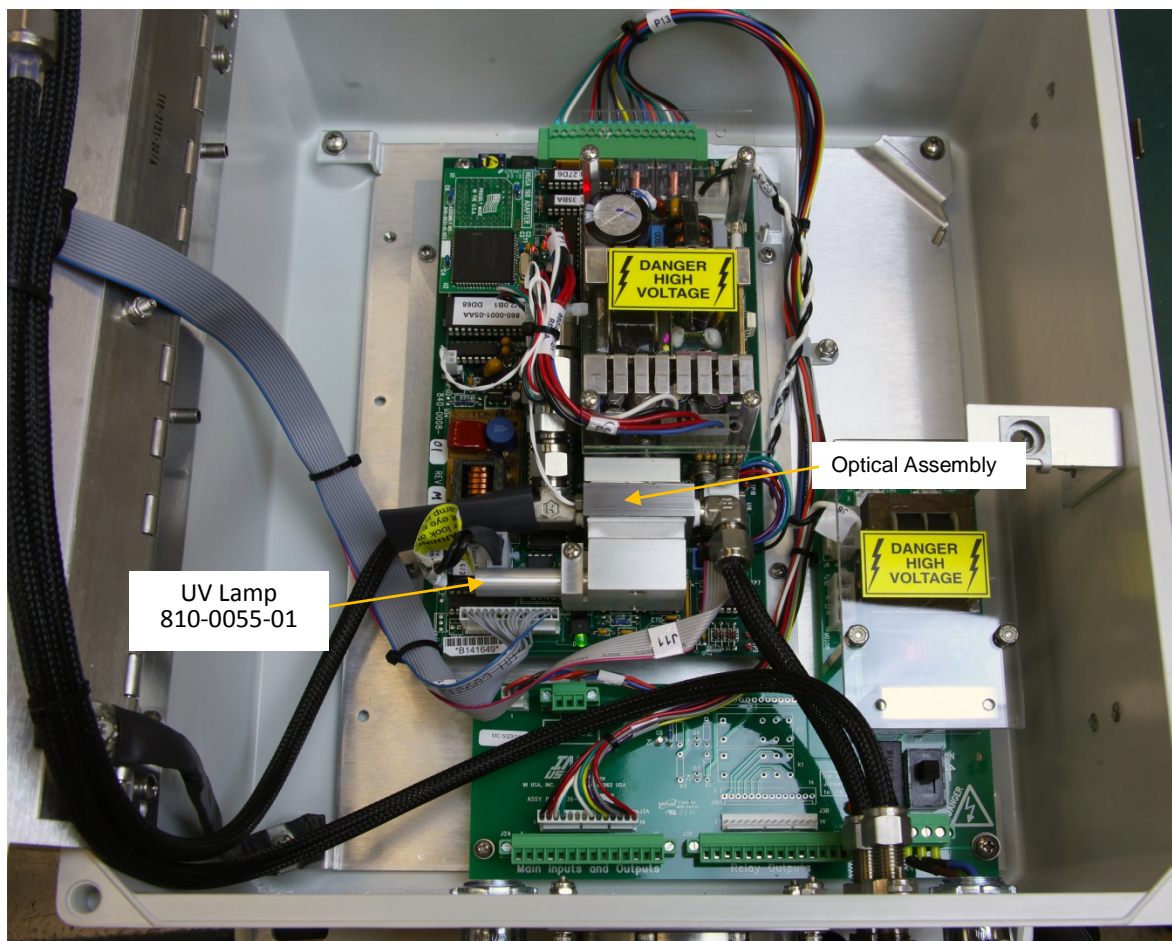


Figure 16 - NEMA Unit with L-Board

(Note: Some internal components and boards may vary, depending on model type.)

6.3 Removing the Front Panel

Applicable for Panel Mounted Units.

Access to the UV lamp does NOT require removing the instrument from its panel mounting. Removing the front panel using the two screws as shown in Figure 9 accesses the lamp.

REMINDER: SAFETY FIRST!! Disconnect AC power from the unit before opening the front panel.

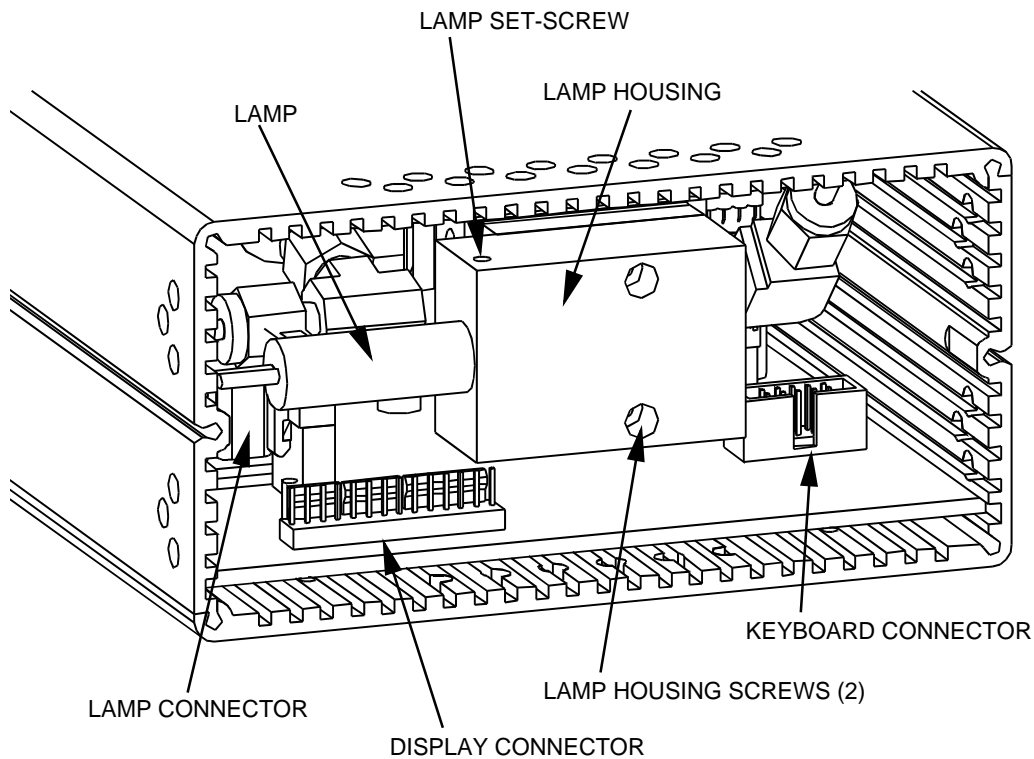
<p>Title: Mini-HiCon High Concentration Ozone Monitor Operating and Maintenance Instructions</p>	<p>Doc. #: 610-0017-01</p>	<p>Rev: H</p>
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NOTE: There are electrical connections between the front panel and the main board inside the cabinet. These connections are for the display and for the keyboard. If they are disconnected, make sure to re-connect them properly before installing the front panel.

6.4 Accessing the UV Lamp – Standalone Units


Once the front panel is removed as described above, the lamp housing may be removed via two lamp housing screws (see figure below). The UV lamp should then be unplugged from its connector (see figure below). The lamp can be removed from its housing by loosening the lamp set screw. Re-install in the reverse order.

Figure 17 - Accessing the UV Lamp Housing, Panel Mounted



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6.5 Inlet Filter Replacement

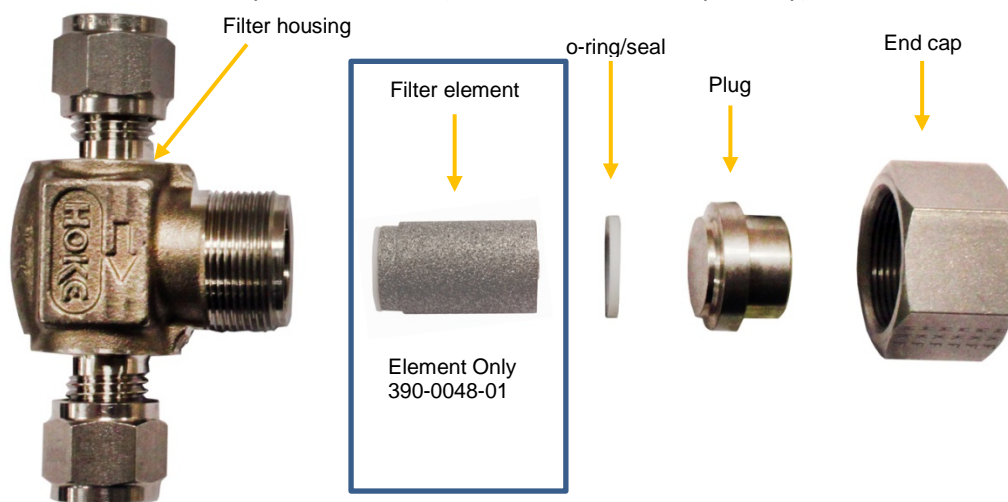
	! WARNING
	<p>TOXIC GAS HAZARD! Ozone (O₃) is a toxic gas. High concentrations of ozone are dangerous and harmful to humans. Take reasonable steps to avoid exposure. The current maximum 8-hour exposure limit for ozone is 0.1 ppm (according to U.S. OSHA). Stop the flow of all ozonated gas before replacing the gas line filter.</p>

1. Stop the flow of process/sample gas through the inlet line.
2. Purge the inlet line with ozone-free gas.
3. Disconnect the inlet filter from the inlet line. Fittings are standard compression seals.
4. Install a replacement filter.
5. Return unit to operation. Verify there are no leaks.

6.6 PM: Replace Inlet Sample Gas Filter Element

1. Stop the flow of gas to the unit.
2. Use two wrenches: one to hold the filter housing firmly in place, and one to remove the end cap.
3. Remove and replace the filter element and o-ring/seal, then re-install the plug, and cap, as shown below:

390-0049-01 – Components shown (filter element sold separately)



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6.7 UV Lamp Replacement

The UV lamp will degrade (output) over time, and may discolor (as shown below).



(lamp filaments may vary from that shown)

Required Equipment:



- Power-free latex gloves to handle the lamp
- UV protective eyeglasses
- Hex wrench or Phillips screwdriver, depending on model

CAUTIONS:

	WARNING
	<p>UV RADIATION HAZARD Remove all power from the system before servicing the UV lamp.</p> <p>NEVER PULL THE LAMP OUT ENTIRELY OF ITS HOUSING WHEN POWER IS ON. DO NOT LOOK AT THE LIGHTED PART OF THE LAMP WITHOUT PROPER EYE PROTECTION.</p> <p>DO NOT look directly at a UV lamp as irreversible, disabling eye damage can occur. Always wear proper eye protection equipment when calibrating UV lamps to prevent accidental exposure.</p>



 	CAUTION
	<p>MERCURY CONTENT!</p> <p>The UV lamp contains Mercury (Hg). Dispose of according to Local, State, and Federal Laws! If you have any questions, return the UV lamp to IN USA, Inc. for proper disposal.</p>

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 	! IMPORTANT
	<p>USE ONLY IN USA LAMPS</p> <p>Use ONLY UV Lamps purchased from or approved by IN USA. The Analyzer will not operate properly and could be severely damaged if an improper lamp is used. In this case, any warranty, expressed or implied will become null and void.</p>

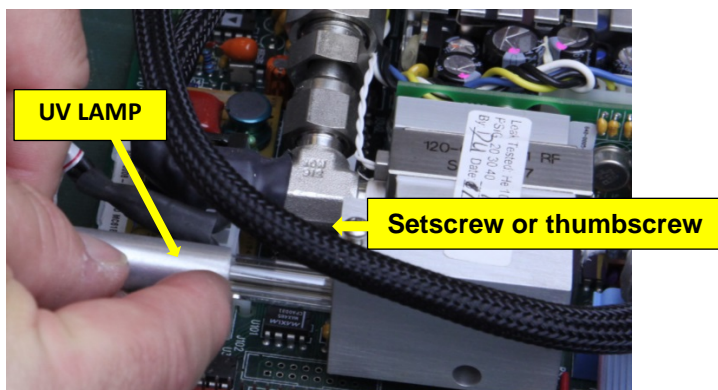
Procedure:

1. Stop the flow of any gas to the unit.
2. Disconnect power to the unit.



 	! WARNING
	<p>UV RADIATION HAZARD!</p> <p>Remove all power from the system before servicing the UV lamp.</p> <p>NEVER PULL THE LAMP OUT ENTIRELY OF ITS HOUSING WHEN POWER IS ON. DO NOT LOOK AT THE LIGHTED PART OF THE LAMP WITHOUT PROPER EYE PROTECTION.</p> <p>DO NOT look directly at a UV lamp as irreversible, disabling eye damage can occur. Always wear proper eye protection equipment when calibrating UV lamps to prevent accidental exposure.</p>

3. Open the front door of the wall-mount unit or remove the rear panel from the stand-alone unit, as necessary to access the lamp.

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4. Loosen the setscrew on the lamp block.
5. Remove lamp, disconnect plug, and then install a new lamp.
6. Once the new lamp is installed, tighten the setscrew. (DO NOT OVER TIGHTEN THE SET SCREW; THIS WILL CAUSE DAMAGE TO THE LAMP).
7. Let the unit warm up for 3-4 hours for lamp to become stable and check the lamp data. Refer to the operator's manual for details.

 	<p>! WARNING</p> <p>UV RADIATION HAZARD</p> <p>NEVER PULL THE LAMP OUT ENTIRELY OF ITS HOUSING WHEN POWER IS ON. DO NOT LOOK AT THE LIGHTED PART OF THE LAMP WITHOUT PROPER EYE PROTECTION.</p> <p>DO NOT look directly at a UV lamp as irreversible, disabling eye damage can occur. Always wear proper eye protection equipment when calibrating UV lamps to prevent accidental exposure.</p>
---	---


8. Adjust the lamp accordingly. (Adjustments can be made by loosening the set screw and turning the lamp 1/16th inch either clockwise/counterclockwise.)
9. Once the lamp is set at the desired value, tighten the set screw.
10. If adjustment is made, let unit sit for 5 minutes.
11. Zero analyzer. See 0 Zero the Mini Hicon, page 38.
12. Re-initialize the lamp index.

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6.8 Replace Optics Cell Windows and O-rings

Replacement of the optics cell is an advanced procedure and should only be completed by qualified technicians. This procedure is typically performed at IN USA as part of a yearly PM, cleaning, and recertification of the Analyzer. Consult with IN USA with any questions.

NOTE: Unless windows are returned to original location, a calibration will be required after re-assembly.

	! WARNING
	<p style="text-align: center;">Leak Hazard!</p> <p>This procedure <u>violates</u> the leak tightness of the instrument.</p> <p>Careless reassembly of the Optical Chamber could result in leaks of the gas sample. These leaks can cause damage to components inside the analyzer, pose a health hazard, and cause erroneous ozone measurements. <u>You should leak-test the analyzer prior to resuming its normal use.</u> IN USA, INC. assumes no responsibility and shall be held harmless for problems caused as a result of improper handling of the optical components. The optical chamber and all other gas-tight components of the analyzer have been leak tested at the factory to 10^{-5} cc/sec using Helium.</p> <p>EXPOSURE TO OZONE IS HAZARDOUS. ENSURE THAT ALL GAS CONNECTIONS ARE TIGHT AND THAT NO LEAKS EXIST. THE EXHAUST STREAM WILL TYPICALLY CONTAIN LARGE AMOUNTS OF OZONE. ENSURE PROPER MEANS OF SAFELY DISPOSING OF THE OZONE CONTENT OF THE EXHAUST STREAM. PLEASE CONTACT IN USA, INC. FOR TECHNICAL ADVICE OR TO ASK ABOUT AVAILABLE OZONE DESTRUCTION UNITS.</p>

Required Equipment:

- Powder-free latex gloves to handle the optics elements (optional)
- Cleanroom wipes
- Isopropyl alcohol (for cleaning of metal components)
- Large, medium, and small Phillips screwdriver
- L-shaped Phillips screwdriver
- O-ring extractor (optional)
- Pointed razor blade (xActo[®] blade or equivalent)
- Two (2) 7/16" open end wrenches
- Hex wrench sets, English and Metric

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Procedure:

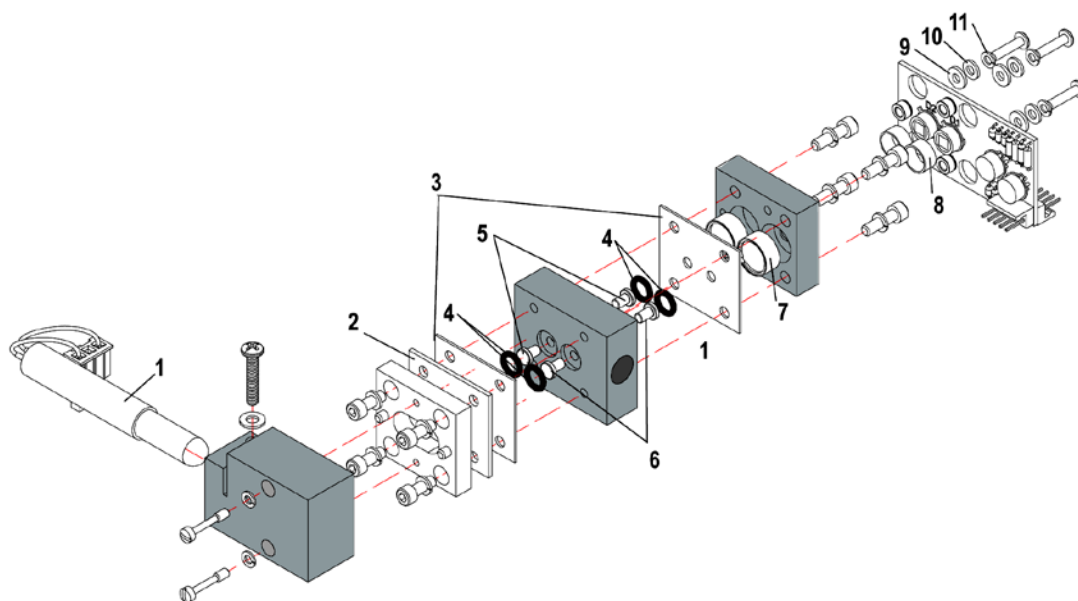
Step 1: Prepare for Maintenance

1. Stop the flow of any gas to the unit.
2. Disconnect power to the unit.
3. Remove covers or open the doors as necessary to access the interior.
4. Disconnect the UV Lamp's power connector, loosen the UV lamp setscrew and carefully pull the lamp out of its housing. Refer to the lamp replacement procedure to verify the condition of the lamp, and to replace the lamp after completing this procedure.

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Step 2: Disassemble Optics Cell

1. Completely remove the optics cell from the unit. Disconnect tubes from the cell and remove any hold-downs.
2. Disassemble the optics cell completely, refer to illustration below. Carefully remove all o-rings and optics. Discard o-rings.



Refer to table below for parts identification:

Item	Components to Replace	Part Number	Qty
1	UV Lamp	810-0055-01	1
2	Spacer, Insulator	110-1040-01	1
3	Spacer, O-Ring Compression	110-1041-01	3
4	O-ring	390-0363-01	4
5	Window	450-0018-01	2
6	Window	450-0017-01	2
7	Filter, 254M	420-0003-01	2
8	Spacer Insulation	110-1043-01	2
9	#4 Nylon Washer	302-0001-01	3
10	#4 Flat Washer	411005	3
11	#4 Split Lock washer	411001	3

Step 3: Clean Blocks and Components

1. Clean the optics supports and blocks with IPA and clean wipes. You can rinse the components in DI water but ensure that they are FULLY DRY prior to re-assembly.

Step 4: Install Replacement Optics and O-Rings

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1. Install new optic windows and o-rings.
Use extreme care to NEVER TOUCH the center surface of the optics, if you do they typically cannot be cleaned and must be discarded.

Step 5: Re-install Components and Re-connect Tubing

1. Re-install the clean, re-assembled components into the unit.
2. Re-connect any removed tubing.
3. Refer to the bulb replacement procedure to install a new bulb, complete the leak test procedure (below), then refer to the bulb replacement procedure to properly position the bulb for use.

Step 6: Leak test the assembly

1. Leak test the optics assembly using standard helium-leak checking procedures. Consult IN USA with any questions. The unit should be leak-tested to 10^{-5} cc/sec.

	 WARNING
	<p>Leak Hazard! This procedure <u>violates</u> the leak tightness of the instrument.</p> <p>Careless reassembly of the Optical Chamber could result in leaks of the gas sample. These leaks can cause damage to components inside the analyzer, pose a health hazard, and cause erroneous ozone measurements. You <u>should</u> leak-test the analyzer prior to resuming its normal use. IN USA, INC. assumes no responsibility and shall be held harmless for problems caused as a result of improper handling of the optical components. The optical chamber and all other gas-tight components of the analyzer have been leak tested at the factory to 10^{-5} cc/sec using Helium.</p> <p>EXPOSURE TO OZONE IS HAZARDOUS. ENSURE THAT ALL GAS CONNECTIONS ARE TIGHT AND THAT NO LEAKS EXIST. THE EXHAUST STREAM WILL TYPICALLY CONTAIN LARGE AMOUNTS OF OZONE. ENSURE PROPER MEANS OF SAFELY DISPOSING OF THE OZONE CONTENT OF THE EXHAUST STREAM. PLEASE CONTACT IN USA, INC. FOR TECHNICAL ADVICE OR TO ASK ABOUT AVAILABLE OZONE DESTRUCTION UNITS.</p>



Step 7: Calibrate the System

Consult IN USA, Inc.

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6.9 Reference Catalyst Replacement

1. Turn off all gas supplies to the system.
2. Remove all power from the system.
3. Disconnect all inlet and outlet tubes from the reference catalyst cell.

	 WARNING
	<p>Hazardous Chemicals! DO NOT open the catalyst unit. PLEASE CONTACT IN USA, INC. with any questions for proper disposal in accordance with all Local, State, and National laws.</p>

4. Remove the catalyst unit from the system and return to IN USA for proper disposal, or consult IN USA Technical Support for proper disposal in accordance with all local and national codes.
5. Install a replacement catalyst unit and reconnect all tubing.

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7 CPU and L-Board Replacement

7.1 MINI HICON NEMA CPU AND ELECTRONICS BOARD REPLACEMENT

STEP 1: Flush the Unit with Ozone Free Gas, Remove Power

1. Flush the unit with ozone free gas to remove all ozone from the lines and components.
2. Remove all power from the unit.

STEP 2: Remove the CPU/L-Board and Mounting Plate from the Unit

1. Disconnect both ¼" compression fittings marked "A".
2. Cut the cable ties marked "B".
3. Remove the ¼" compression fitting marked "C"
4. Remove 2 cables marked "D" It may be necessary to remove the fitting above the connector to gain access
5. Remove the 4 plate mounting screws marked "E"
Now remove the mounting plate from the enclosure.

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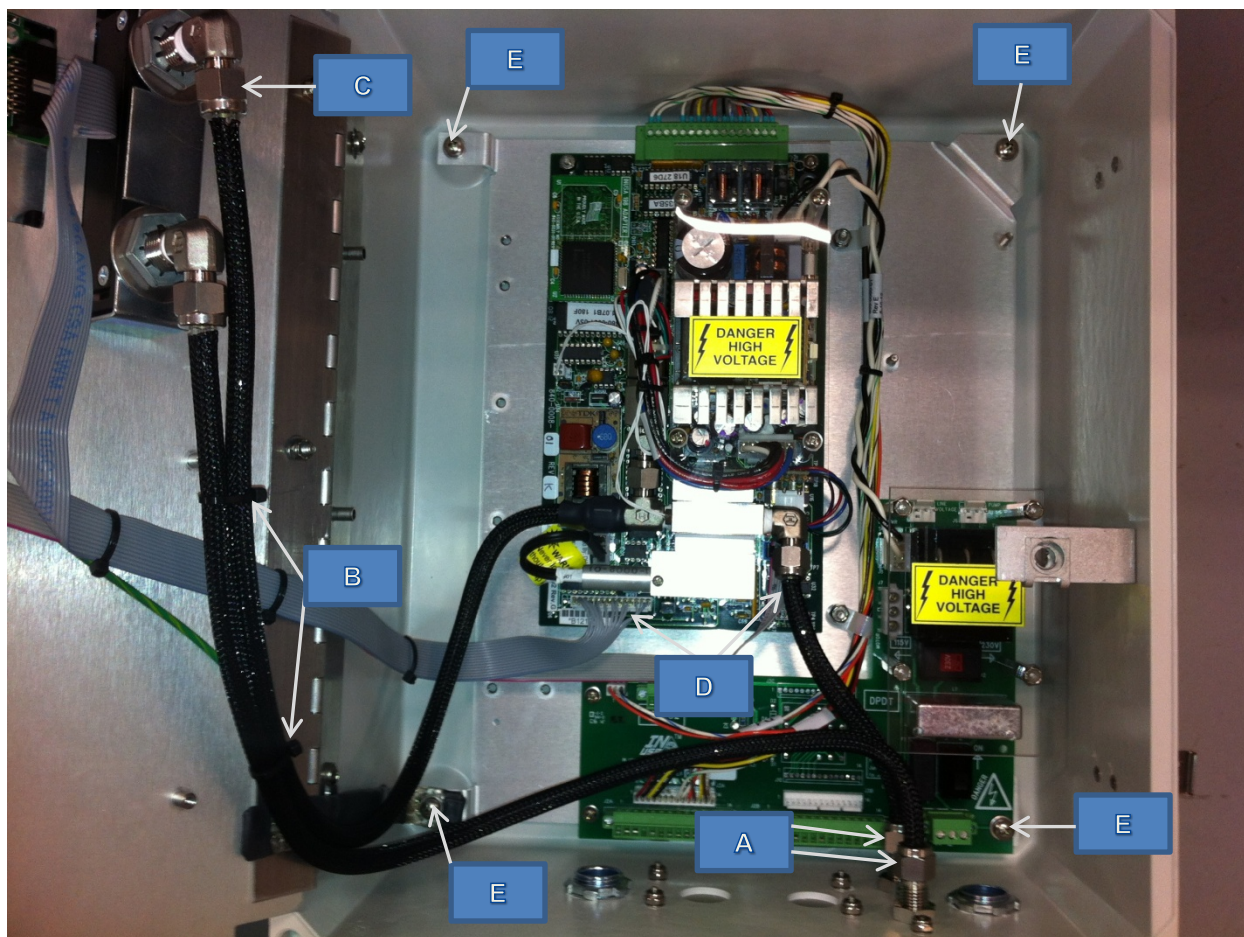
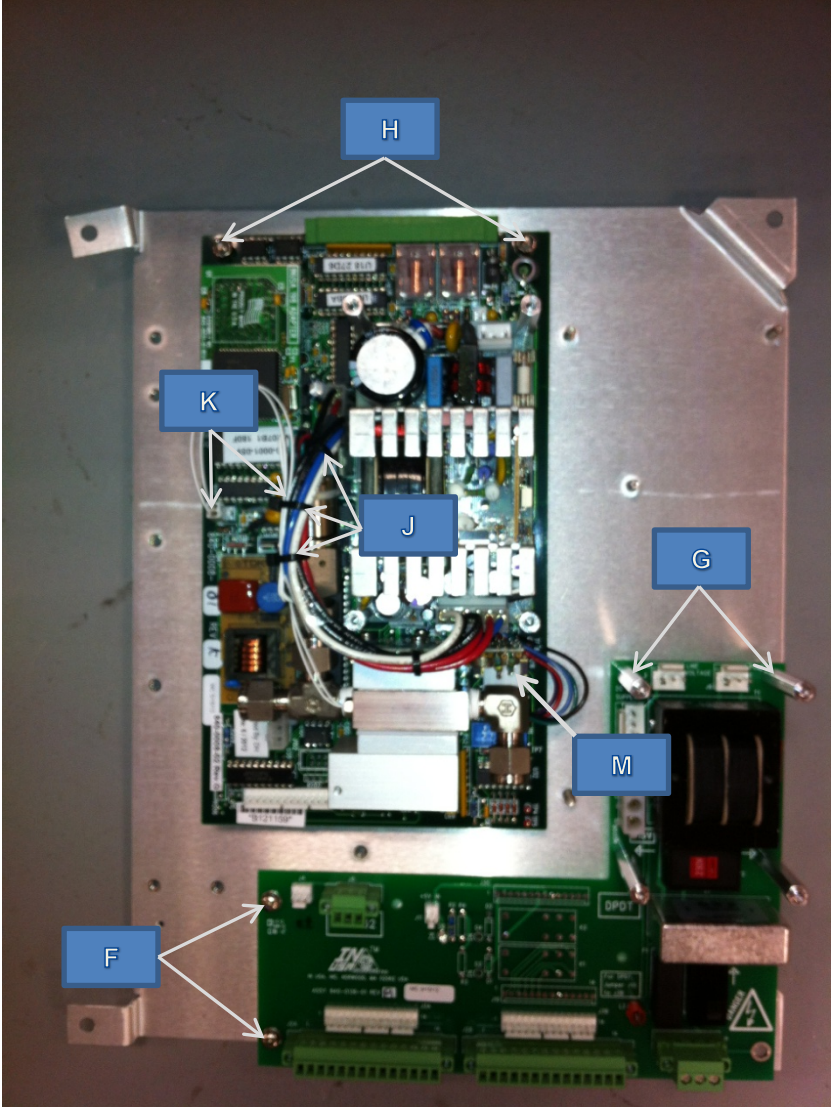


Figure 18 - L-Board Configuration

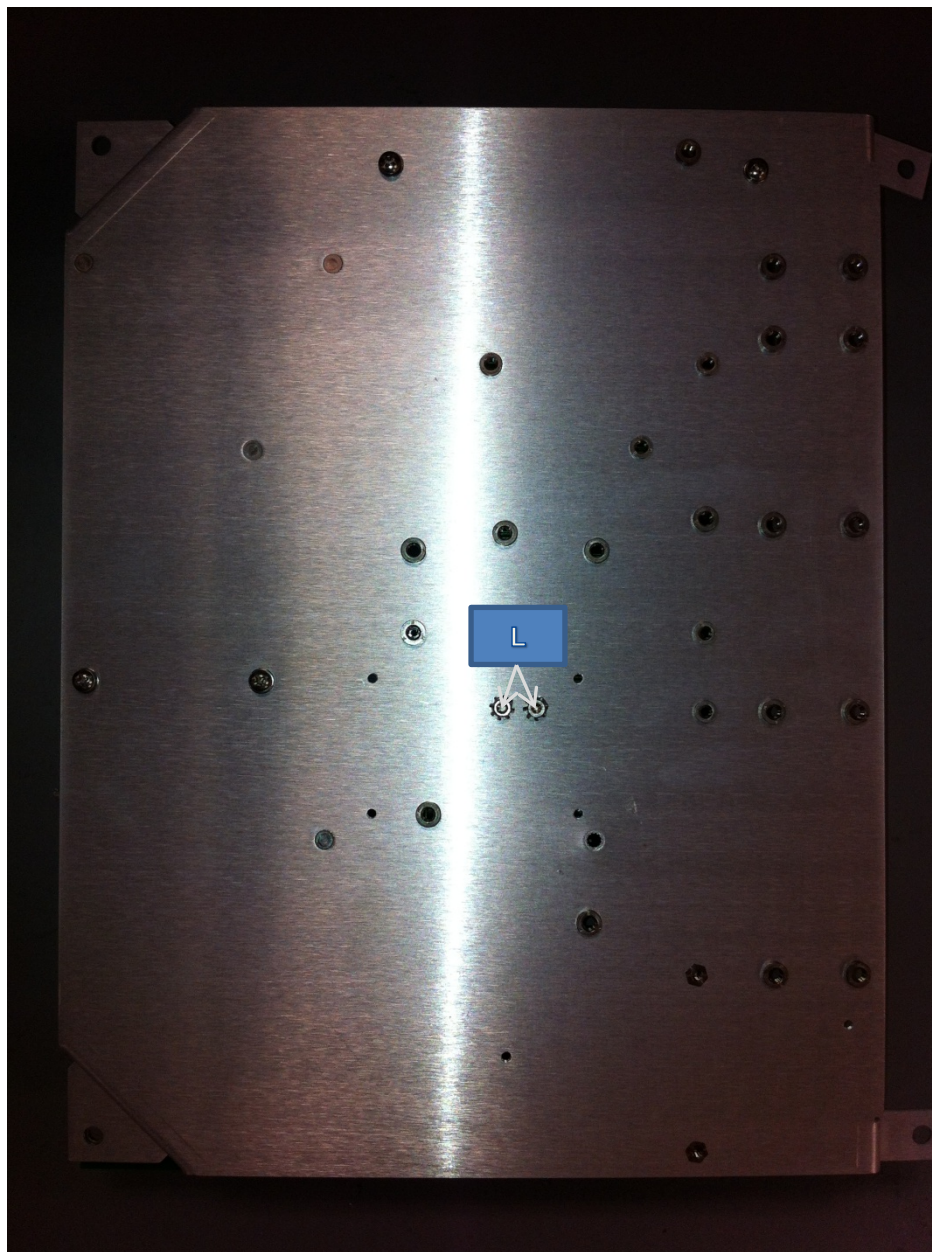
STEP 3: Replace the PCBs

1. Remove the two screws marked "F".
2. Remove the two standoffs marked "G".
3. The Power Distribution PCB "L" board is now loose and can be replaced.
4. Disassemble the hardware at location marked "H".
5. Carefully cut the cable ties as indicated at location "J"
6. Unplug two cable's from J8 and J9 as shown at location marked "K"
7. Turn the mounting plate over and loosen the two screws marked "L". DO NOT REMOVE ALL THE WAY. Be careful as these screws hold the Cell in place as well as the CPU PCB.
8. Disconnect the connector attached to the preamp of the Cell, "M"
9. Holding the Cell and the CPU PCB, remove the screws marked "L"

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STEP 4: Re-assemble the Unit

1. Re-assemble the unit in the reverse order. ENSURE THE CABLE IS INSTALLED PRIOR TO REMOUNTING THE PLATE IN THE ENCLOSURE.
2. After the mechanical parts are reinstalled on the plate, install the new supplied cable, 850-0413-01.
3. Each connector is labeled with the mating header location.

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7.2 Service, Accuracy, and Calibration by IN USA

Calibration Standard

Each unit has been carefully calibrated against a factory standard unit. This factory standard unit was calibrated against the Potassium Iodide (KI) methodology per IOA standards or Beer-Lambert methodology. A certificate of calibration is issued with each unit. Further details on this procedure are available from IN USA, Inc. Each unit should be returned to the factory yearly for re-calibration.

PM Service and Recertification by IN USA

Many end users send their instruments to our facility on a yearly scheduled basis for optics cell component replacement, PM service or quotation/evaluation, and leak integrity testing and system calibration recertification. Please consult with IN USA, Inc. to determine the most appropriate calibration schedule for your application.

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8 Declaration of Conformity

DECLARATION OF CONFORMITY
according to ISO/IEC Guide 22 and EN 45014

Manufacturer's Name: **IN USA, Incorporated**
Manufacturer's Address: **100 Morse Street
Norwood, Massachusetts
02062 USA**

declares that the product

Product Name: **Mini Controller with dFFOZ/gFFOZ Sensor
Mini Hi-Con Analyzer**
Model Number:
Product Options:

conforms to the following product specifications

Safety: **EN 601010 + A1, A2
FCC Part 15 Subpart B Class A**
EMC: **CISPR-22:1985/EN 55022: 1988 class B
EN 50082-1:1992
IEC 801-2:1984 / 4 kV CD, 8 kV AD
IEC 801-3:1984 / 3 V/m
IEC 801-4:1988 / 0.5 kV Signal Lines, 1 kV Power Lines**

Supplementary Information:

The product herewith complies with the requirements of the Low Voltage Directive 72/23/EEC and the EMC Directive 89/336/EEC.

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9 FCC Regulation

This equipment has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

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About IN USA

IN USA, INC. manufactures instrumentation and control systems. The company is the world's leading manufacturer of Ozone monitoring equipment. IN USA, INC. provides customized, optical-based monitoring systems which include sophisticated process control hardware and software.



Air-Cooled
Ozone Generator
AC Series



Ambient/Safety
Monitor
IN2000 L2-LC



Dissolved Ozone
Analyzer
W1



High
Concentration
Calibration
Checker
Mini HiCon



Handheld Ozone
Monitor
AET-55



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SERVICE: service@inusacorp.com



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APPENDIX A: Model SC-010R/SC-010

This addendum applies to Model Mini-HiCon high concentration ozone Monitor manual 610-0017-01. This addendum provides the necessary information for Mini-HiCon/SC-010-R model by incorporating SC-010-R with Mini-HiCon high concentration ozone monitor.

9.1 Introduction

The Mini-Hicon series SC-010R sample conditioning systems are used for measurement of ozone gas which is saturated with respect to water vapor and/or contains water in the form of droplets or mist. The functions of the Mini-HiCon/SC-010R units are:

- to remove water droplets and/or mist
- to lower the dew point of the sample by removing water vapor
- to draw the sample gas stream through the analyzer at the nominal flow rate of 0.5 l/min.
- Measure and monitor the ozone concentration.

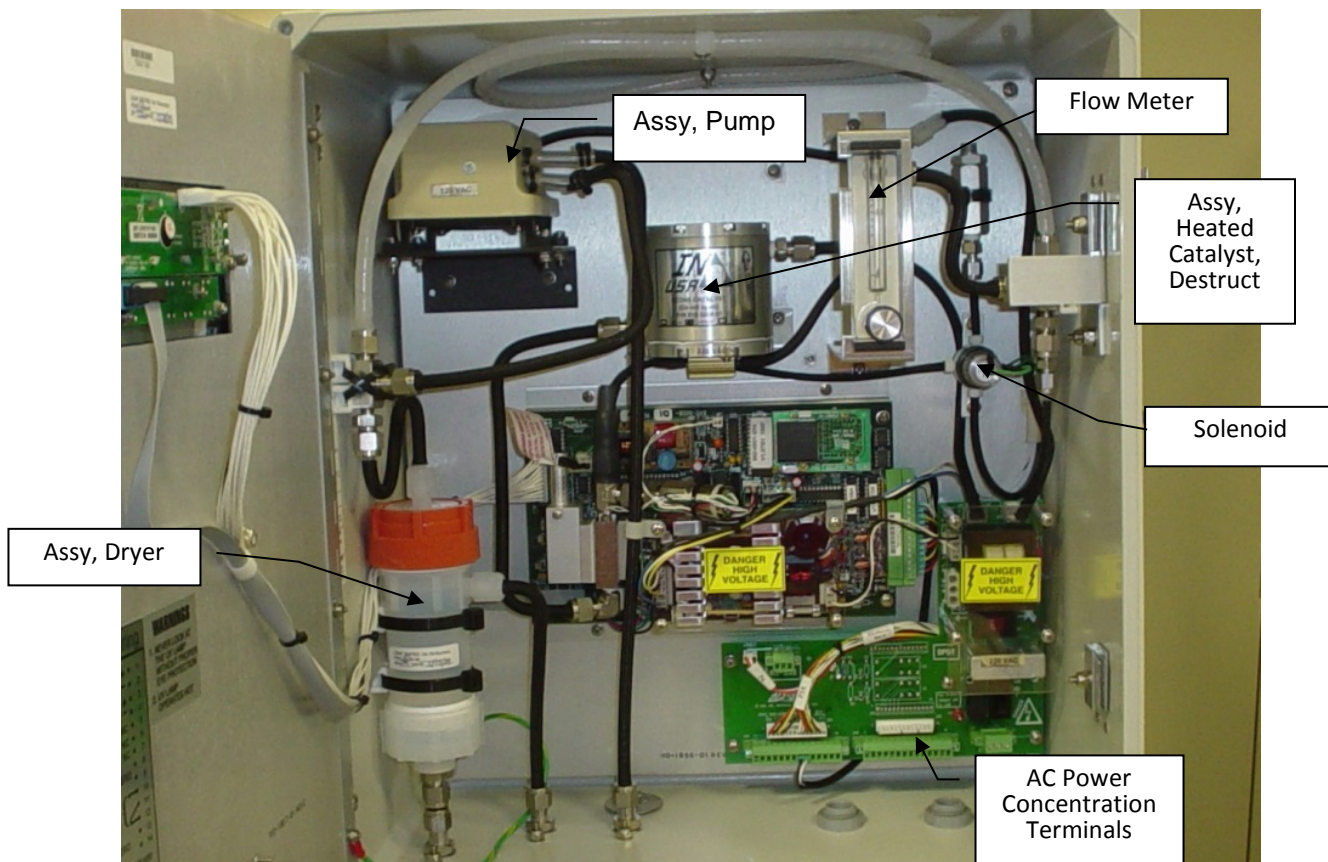
The Mini HiCon/SC-010-R plays a key role in reducing or eliminating the risk of water condensation inside the analyzer (on the surfaces of optical and pneumatic components).

The Mini-HiCon/SC-010-R consists of the following components housed in a non-metallic, NEMA 4x (IP65) rated wall mountable enclosure, refer to figure 1.:

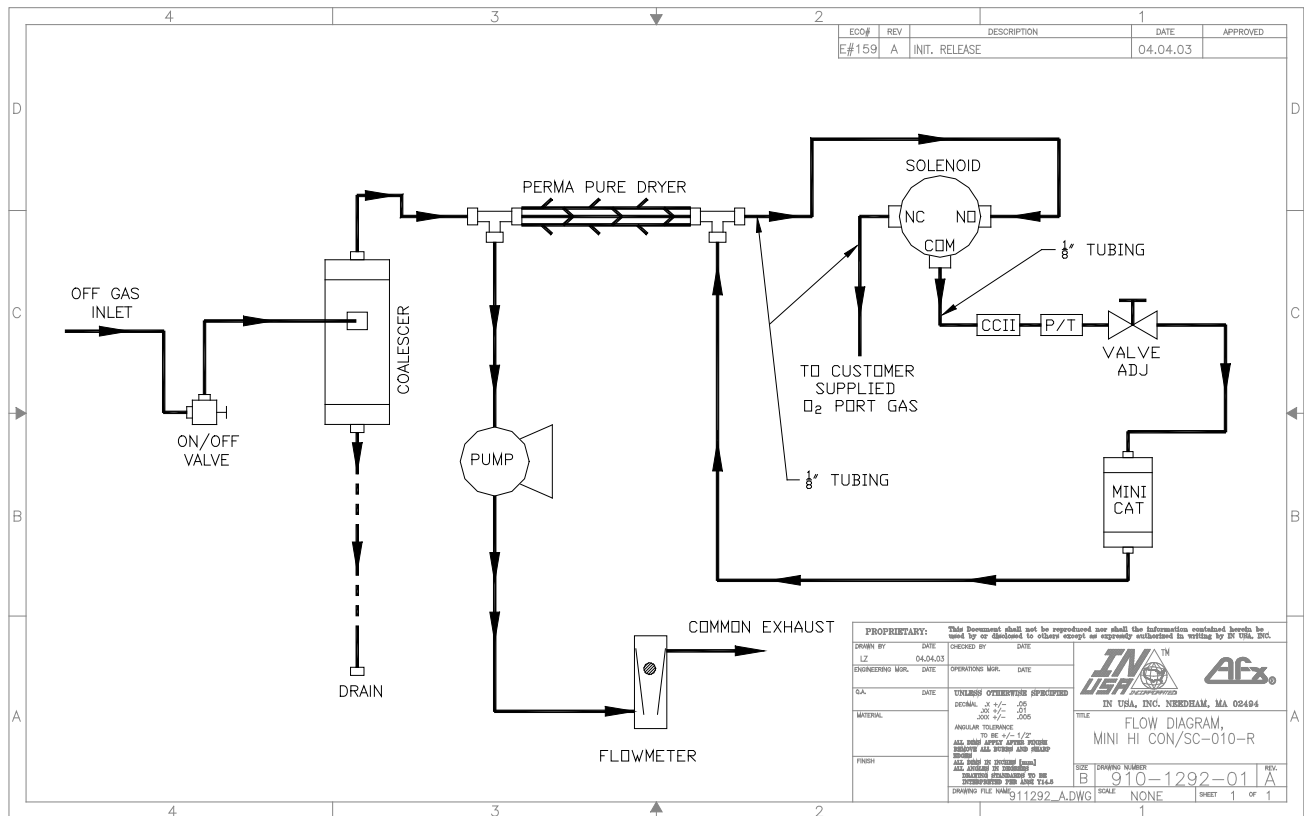
- A coalescing filter to capture mist or droplets. There is a drain port, which is used to drain the liquid water trapped by the filter.
- A hygroscopic, ion exchange, counter-current flow membrane to remove water vapor and thus lower the sample dew point. This process requires counter-current flow of a dry purge gas.
- A pump capable of pulling 0.5 l/min at a vacuum of ~300 mm of mercury (~160 inches of water)
- A throttling valve to control the flow rate
- A heated catalyst to destroy ozone in the gas stream exhaust.
- A terminal block for AC power connections
- A fuse block (2 fuses, 3AG 1.5A 250V)

The source of dry purge gas can either be external or it can be the exhaust from the analyzer (closed loop). Model Mini HiCon/SC-010R is configured for use of an external source of dry purge gas. Model Mini HiCon/SC-010-R is configured for use of the exhausted analyzer sample gas as the dry purge gas. This is referred to as "Reflux of Dry Product".

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The Mini-HiCon/SC-010-R requires AC power to run the pump and heated catalyst. The electrical conduit fitting in the right wall of the enclosure should be used to feed the AC connections to the inner AC Power Terminal Block. Refer to the terminal block label to identify the Hot, Neutral and Ground connections. The terminal block will accept wires sizes from 14 to 22 AWG. Connect 120 VAC (or 220 VAC if configured for this voltage) to this terminal block.

9.2 Gas sample

Gas sample connections are via bulkhead compression fittings. The fittings typically accept 1/4" OD tubing (or other sizes if so ordered). The sample gas should flow as explained before. Note that even though the exhaust has passed through the internal heated ozone destruction catalyst, it may contain some trace ozone levels, and it should be properly vented.

9.3 Dryer purge gas

The membrane filter removes water vapor via the counter current flow of dry gas. Basically, the filter consists of a tube within a tube: the wet sample flows through the inner, porous tube while dry gas flows in the opposite direction through the outer tube. The dry air carries the water vapor away. Please refer to the attached technical document about the dryer for further details.

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Connections for the purge air inlet and outlet are via bulkhead compression fittings. The fittings accept 1/4" OD tubing (or other sizes if so ordered).

For the external purge system (SC-010), the dry gas should flow at 1 l/min or more. Suitable purge gases include clean dry air, Nitrogen, Oxygen and Helium.

For the reflux purge (SC-010-R), set the throttle so that the flow as indicated by the flow meter on the Mini-Hicon is 1.0 l/min

9.4 Electrical

The Mini-HiCon/SC-010-R requires AC power to run the pump and heated catalyst.

The electrical conduit fitting in the right wall of the enclosure should be used to feed the AC connections to the inner AC Power Terminal Block. Refer to the terminal block label to identify the Hot, Neutral and Ground connections. The terminal block will accept wires sizes from 14 to 22 AWG. Connect 120 VAC (or 220 VAC if configured for this voltage) to this terminal block.

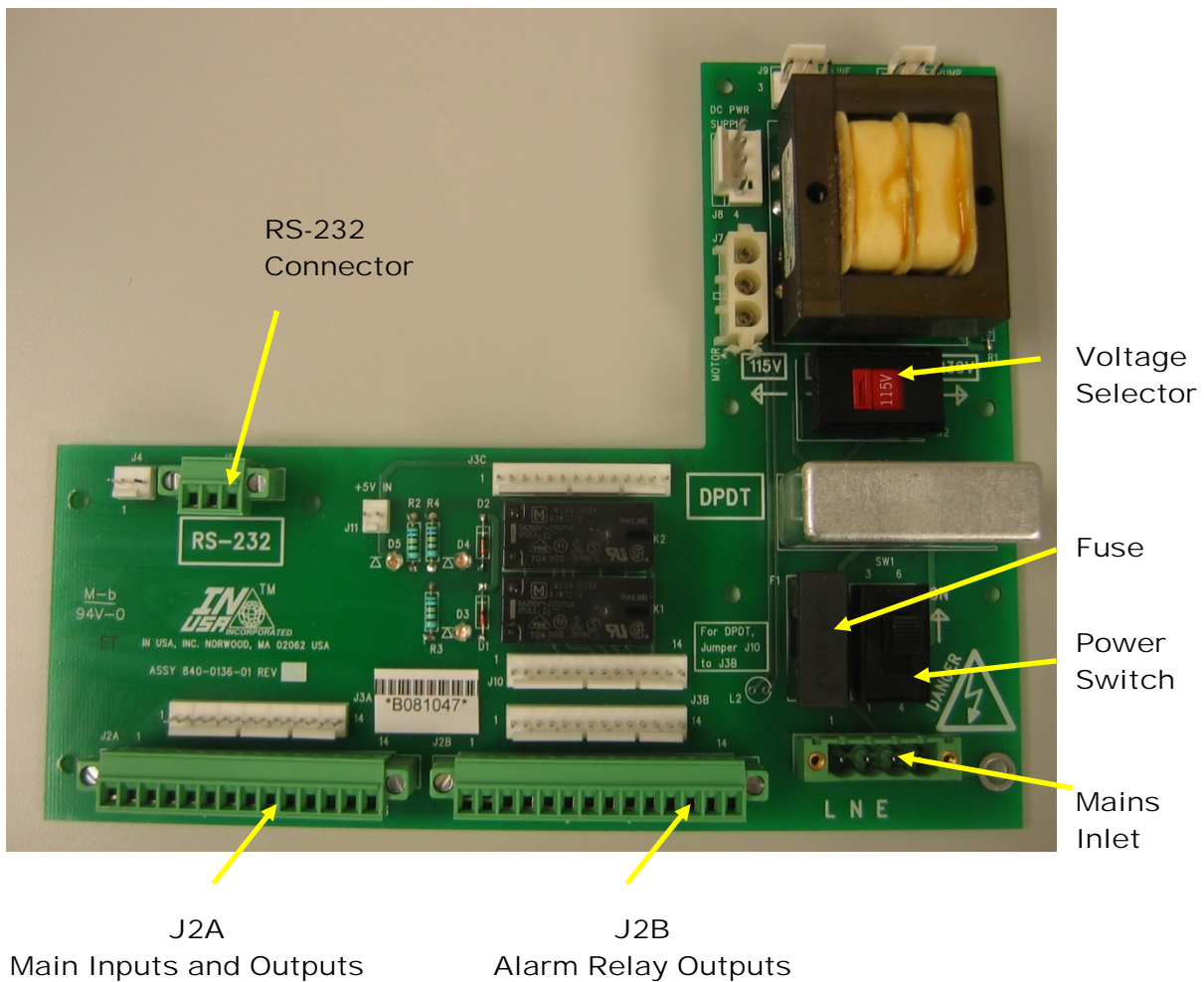
9.5 Gas sample

Gas sample connections are via bulkhead compression fittings. The fittings accept 1/4" OD tubing (or other sizes if so ordered). The sample gas should flow as explained before. Note that even though the exhaust has passed through the internal heated ozone destruction catalyst, it may contain some trace ozone levels, and it should be properly vented.

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9.6 Operation

1. Connect AC Mains power to the unit. Turn on the Power Switch. The heated catalyst should begin to warm up and the pump should start operating.
2. Adjust the throttle on the valve so that the flow rate (as indicated by the flow meter on the front panel of the analyzer) is 0.5 l/min.
3. Over time, it may be necessary to drain the coalescer. To do so, remove the plug on the bottom of the SC-010-R and allow the water to drain out.



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Summary for New Power Distribution L Board: All available CPU signals are available at once at Field Wiring. The L Board can be configured to double up the contacts for relays K1 & K2. This is done at the factory.

J2A Main Inputs and Outputs

Pos	Function	Operation	
1	Analog Voltage Output	+	0 to 10 volts Out
2		-	
3	Analog Current Output	+	4 to 20 mA
4		-	
5-9	Not used		
10	K3 De-energized Open	Instrument Error – error when de-energized	
11	K3 Common		
12	K3 De-energized Closed		
13	Zero	Close these contacts to perform a zero operation	
14			

J2B Relay K1 and K2 Outputs (SPDT)

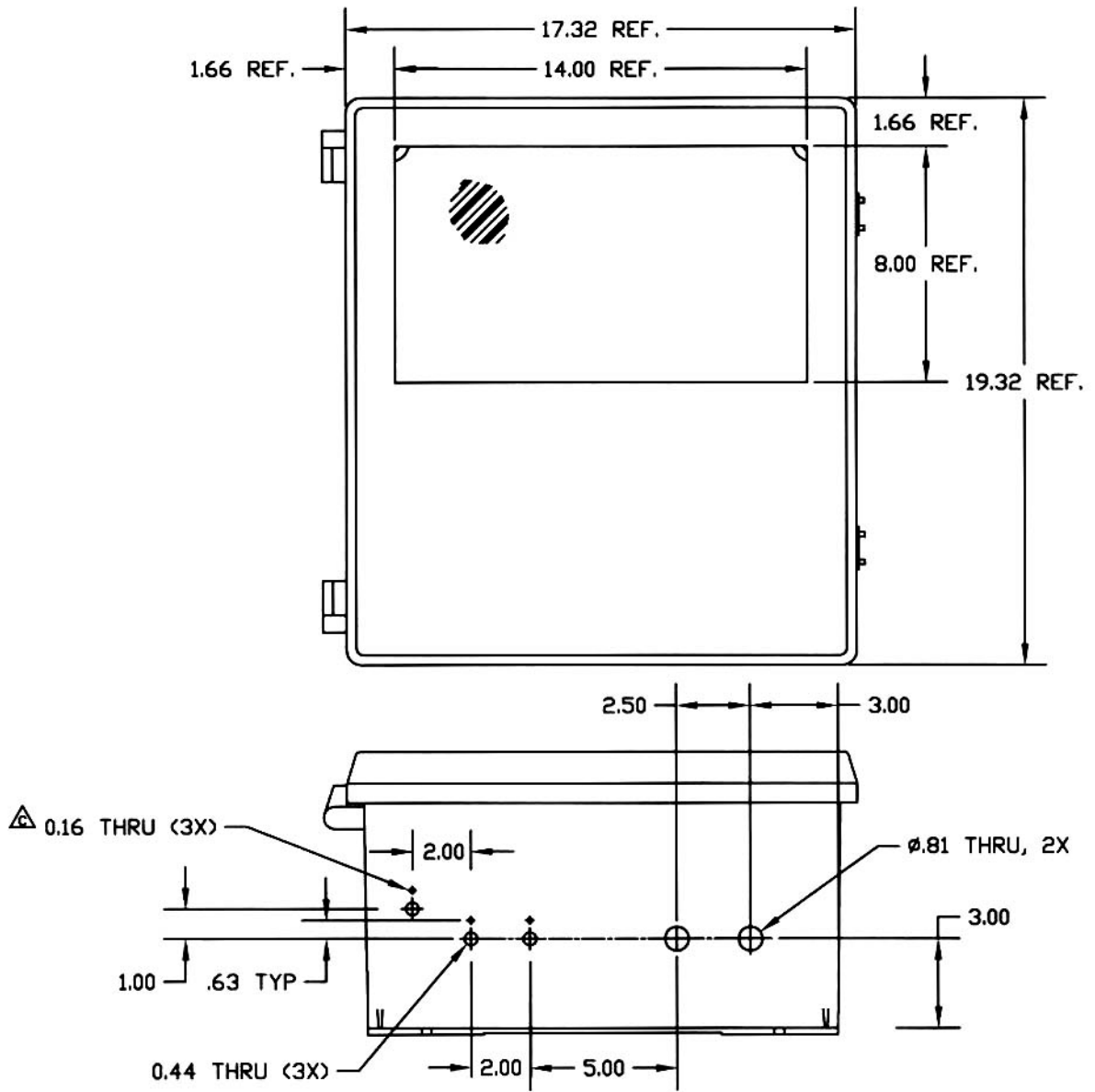
Pos	Function	Operation
15	K1 De-energized Open	Alarm 1 – alarm when energized
16	K1 Common	
17	K1 De-energized Closed	
18-20	Not Used	
21	K2 De-energized Open	Alarm 2 – alarm when energized
22	K2 Common	
23	K2 De-energized Closed	
24-28	Not Used	

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When configured at the factory, Alarm 1 and Alarm 2 appear at J2B as DPDT relays:

J2B Relay K1 and K2 Outputs (DPDT)

Pos	Function	Operation
15	K1A De-energized Open	Alarm 1 – alarm when energized
16	K1A Common	
17	K1A De-energized Closed	
18	K1B De-energized Open	
19	K1B Common	
20	K1B De-energized Closed	
21	K2A De-energized Open	Alarm 2 – alarm when energized
22	K2A Common	
23	K2A De-energized Closed	
24	K2B De-energized Open	
25	K2B Common	
26	K2B De-energized Closed	
27-28	Not Used	



Large Enclosure for Mini HiCon SC-010

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