M60XP Oxygen Monitor

Operator's Manual

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For further information, or a copy of our most recent operating manual, please visit us at www.envent-eng.com. Envent Engineering Ltd. reserves the right to change product design and specifications at any time without prior notice.

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B. Introduction

B.1. About this Manual

The atmosphere is made up of 20.8% Oxygen and 78.08% Nitrogen along with trace amounts of CO_2 and other inert gases. The Envent Engineering Ltd. M60XP Oxygen Monitor measures the concentrations of Oxygen (O_2) in natural gas ranging from 0 - 2000 ppmv or 0 – 30% as the standard. This manual contains a comprehensive overview of Envent Engineering's M60XP Oxygen Monitor and step-by-step instructions on:

- Installation and Startup
- Operation
- Maintenance
- Troubleshooting

This manual should be read and referenced by the person who will install, operate, or have contact with the M60XP. Take time to familiarize yourself with the content of this Operator's Manual, reading each section carefully so you can quickly and easily install and operate the analyzer.

The manual includes images, tables, and charts that provide a visual understanding of the analyzer and its functions. Take note of all the caution symbols and notes, as they will alert you of potential hazards and important information.

B.2. Warnings and Cautions

CAUTION: Do not exceed 25 psig in sample system. Damage to sample system may result.

CAUTION: Seals Not Poured. Pour seals before energizing the circuit (see APPENDIX B).

CAUTION: Disassembly of the pressure regulator and solenoids in the field is not advised. Consult the factory if the regulator or solenoid appears contaminated.

CAUTION: Before resuming line pressure be sure that all port connections, sample sweep, and sample system are securely installed.

CAUTION: All connections must be LEAKTIGHT to insure the effectiveness of the analyzer as well as SAFETY. The user, through his own analysis and testing, is solely responsible for the product selection and ensuring all responsibility, safety and warning requirements of the application are met. If the equipment is used in a manner not specified by Envent Engineering Ltd., the protection provided by the equipment may be impaired.

CAUTION: Electrical certification for hazardous locations requires that the sensor and flame arrestor threads be coated with liquid thread sealant (Swagelok Swak or equivalent). Use of Teflon tape will invalidate the certification.

CAUTION: Do not use solvents, brake cleaner, soaps or detergents.

CAUTION: The analyzer should be mounted in an enclosed area in which it is not exposed to vibration and excessive pressure, temperature and environmental variations. The M60XP is designed for Class 1 Div 1 areas. Ensure that the housing received is suitable for area classification.

CAUTION: Turn off power before servicing. Ensure breakers are off before connecting or disconnecting supply power.

CAUTION: This unit requires a disconnect device rated 24VDC and 5A max, must be protected by a circuit breaker rated 24VDC and 5A max, and is to be installed in accordance with local electrical codes.

CAUTION: This unit requires a disconnect device rated 240VAC and 5A max, must be protected by a circuit breaker rated 240VAC and 5A max, and is to be installed in accordance with local electrical codes.

C. M60XP Oxygen Monitor Overview

C.1. Principle of Operation

The M60XP Oxygen Monitor is based on an electrochemical sensor that produces an electrical current proportional to the difference in oxygen between ambient air and the stream of interest. Two options of sensors are available, and they will perform best at concentrations ranging between 200-2000 ppmv or 2-30%, respectively.

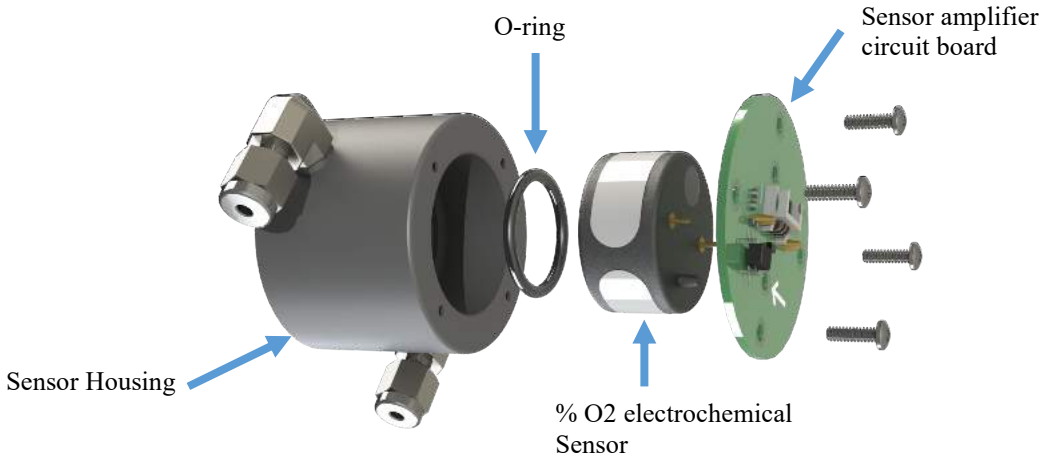


Figure 1: Electrochemical sensor for percent with flow through housing and signal amplifier

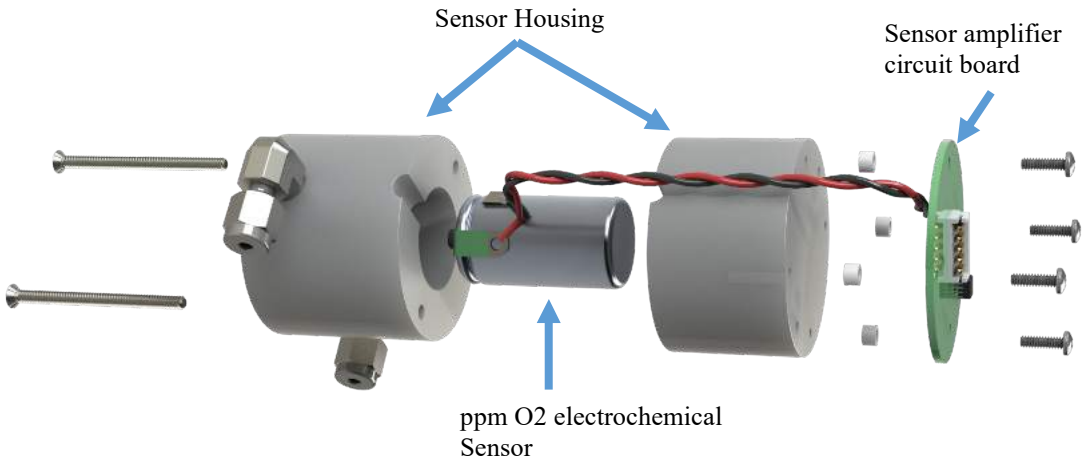


Figure 2: Electrochemical sensor for ppm with flow through housing and signal amplifier.

D. Technical Specifications

Performance

Oxygen Concentration (O_2)	0 – 200 ppmv to 0-2000 ppmv OR 0 – 2% to 0-30%
Accuracy (O_2)	±2% of reading or ±50ppm, whichever is greater
Response Time	60 Seconds to 90% of full scale

Application Data

Environmental Temperature Range	0-50°C Standard [a]
Sample Inlet Pressure	10 – 25 psig [a]
Sample Flow Rate	100 – 500 cc/min [a]
Contaminant Sensitivity	Resistant to Mercaptans, Methanol, Glycol, Amines

Electrical & Communications

Input Voltages	12-24 VDC @ 5 Watts Standard 120-240 VAC, 50/60 Hz @ 5 Watts Optional
Outputs	4-20 mA loop (concentration only) Serial RS-232 Standard (all parameters) [a][c] Dual 3 amp Solid State Alarm Relays Modbus (optional) [a]
Data Logging	6500 data points recorded every 10 minutes Standard [b] [c]
LCD Display	Dual-line, 16 Character Display Line 1: Oxygen in ppmv or % Line 2: Alarm State, Zero Offset, Sensor Gain Factor, Raw mV, Alarm Set Point(s), Analog Output Range
Maximum wattage at Start Up (Surge Watts)	12 VDC Powered: 0.62W 24 VDC Powered: 1.18W 120 VAC Powered: 7.49W 220 VAC Powered: 13.62W
Average Power Consumption (Running Watts)	12 VDC Powered: 0.57W 24 VDC Powered: 1.15W 120 VAC Powered: 6.61W 220 VAC Powered: 12.12W

Physical Specifications

Size	Sample system mounted 16” x 24” anodized aluminum panel Standard [a]
Weight	
Enclosure Type	Electronics are housed in an ADALET XIHLGGCX 5-5/8” x 5-5/8” The sensor is housed in an ADALET XIHMCXL junction box.
Enclosure Rating	Class 1, Division 1, Groups B, C&D

Area Classification

Certification	Class 1, Division 1, Groups B,C&D

(a) Consult factory for alternative requirements

(b) Data Logger can be configured to 1 minute, 5 minute, 10 minute, 15 minute, 20 minute, 30 minute, hourly or daily intervals

(c) Requires Serial Cable, ICE M60XP GUI software and Computer (not included)

E. Installation and Start-up

Your M60XP monitor was configured, functionally tested and calibrated at the factory. All test and calibration data is documented in the Factory Calibration Report.

The analyzer should be mounted in an enclosed area in which it is not exposed to vibration and excessive pressure, temperature and environmental variations. The M60XP is designed for Class 1 Div 1 areas. Ensure that the housing received is suitable for area classification.

Envent Engineering is available for installation and start-up, if required. See Envent's pre-commissioning guidelines on our website (http://www.envent-eng.com/documents.php).

E.1. Sample Point Selection

The sample delivered to the analyzer must be representative of the stream and should be taken from a point as close as possible to the analyzer to avoid lag times and sample degradation in the lines.

Note: The flame arrestor's act as heat sinks and will cool gas to ambient temperature if not insulated with sample inlet line for cold weather service.

E.2. Sample Volume and Flow Rate

Sample should be supplied to the analyzer at 10 - 15psig and at a flow between 100-500 cc/min. A bypass sweep is recommended to reduce sample lag time sample lines if they are at high pressure or longer than 15 feet. If the line pressure is over 400 psig, a heated regulator is recommended. It is best to reduce the pressure to 10 or 15 psig as close to the sample point as possible.

Note: The sample flow must be low enough as not to overload sensor heater.

E.3. Sample Conditioning

The function of the sample system, available as an option with the M60XP, is to regulate and filter particulate or free liquids in the sample. Consideration must be taken of upset conditions as well as normal conditions when designing the sample system. Figure 3 and Figure 4 show the typical sample system used for the M60XP Oxygen Monitor.

Figure 3: M60XP standard sample system

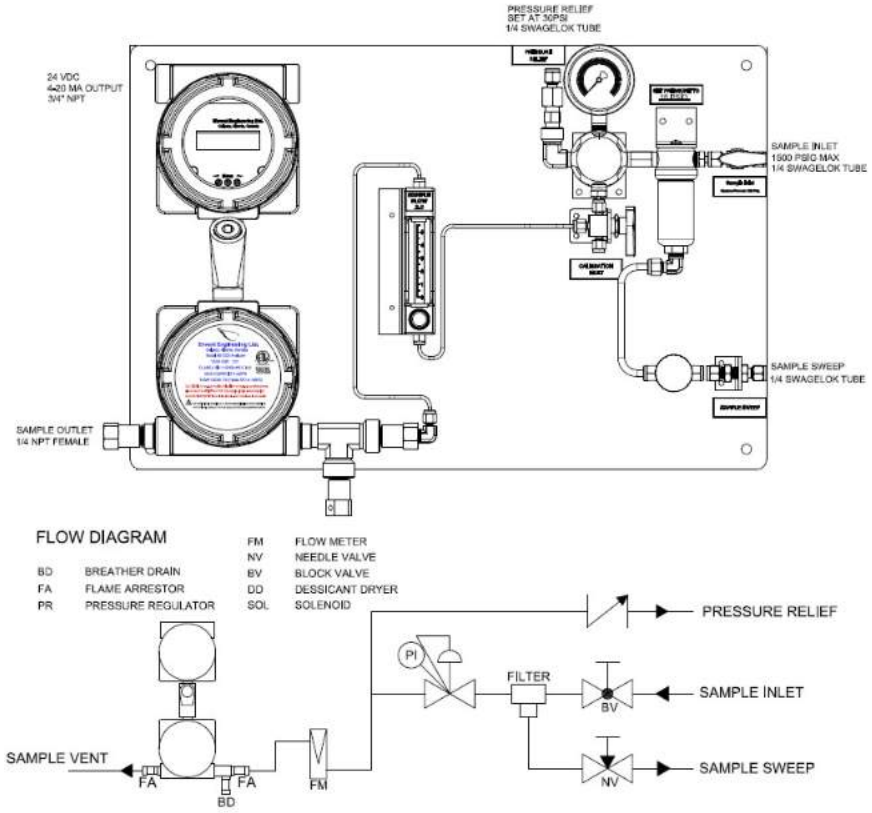


Figure 4: M60XP standard sample system drawing

E.4. Customer Connections

Figure 5 lists all the default customer connections (for VAC see APPENDIX C). Contact Envent Engineering Ltd. for additional options (such as ModBus or VAC connections). Note: if you have unreliable power, consider using a backup battery or an uninterrupted power source.

Note: The 4-20 mA output requires a 24 VDC power loop, which can be supplied by the analyzer.

CAUTION: This unit requires a disconnect device rated 24VDC and 5A max, must be protected by a circuit breaker rated 24VDC and 5A max, and is to be installed in accordance with local electrical codes.

CAUTION: Turn off power before servicing. Ensure breakers are off before connecting or disconnecting supply power.

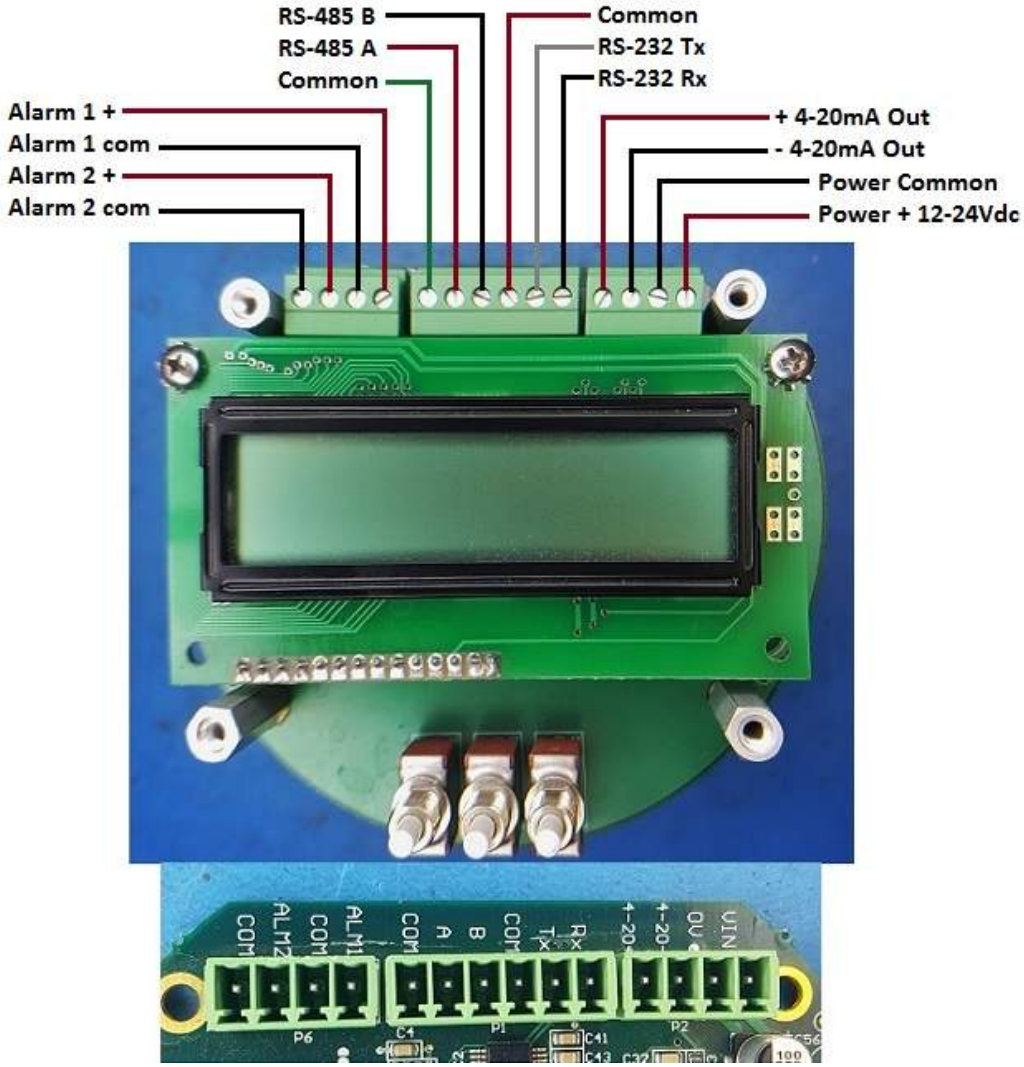


Figure 5: Customer connections

E.5. Installation Procedure

Step 1. Ensure that the selected installation site provides adequate room for maintenance and repair procedures. The site should be as close as possible to the process stream being measured.

Step 2. Unpack and check for damage.

Step 3. Wire the appropriate power to the analyzer (see Section E.4). When the analyzer is powered up, the system will perform a self-diagnostic procedure, flashing "Envent Engineering", Model #, Revision and display ppmv or % O_2.

Note: The output will be erratic on power-up until the internal signal-averaging buffer is filled. This will take around 5 minutes after start-up.

CAUTION: Seals Not Poured. Pour seals before energizing the circuit (see APPENDIX B).

CAUTION: Turn off power before servicing. Ensure breakers are off before connecting or disconnecting supply power.

The display will then show concentration on the first line and another variable or status on second line.

Note: Using the internal menu button, the second line of the display can be cycled to display various machine settings and outputs. Table 1 is a standard list of the second line variables.

Step 4. Turn on the sample gas and ensure the sample sweep is slightly open for proper filtration.

CAUTION: Before resuming line pressure be sure that all port connections, sample sweep, and sample system are securely installed.

Step 5. Set pressure to 10 psig.

CAUTION: Do not exceed 25 psig in sample system. Damage to sample system may result.

Step 6. Set sample flow to 2 (100-200cc/min).

CAUTION: All connections must be LEAKTIGHT to insure the effectiveness of the analyzer as well as SAFETY. The user, through his own analysis and testing, is solely responsible for the product selection and ensuring all responsibility, safety and warning requirements of the application are met. If the equipment is used in a manner not specified by Envent Engineering Ltd., the protection provided by the equipment may be impaired.

Step 7. Step through the remaining menu items to ensure raw sensor voltage, heating output load factor (0-1), and lastly gain factor.

Step 8. Confirm 4-20 ma output matches display reading for ppmv or %O_2 as indicated in the factory calibration data sheet.

Note: This is a 2-wire design and requires 24 VDC loop power.

F. Operation

F.1. Operational Notes

The M60XP Oxygen Monitor is a practical compromise between price and accuracy. The electronics are designed to provide reliable indication as well as good resistance to fouling from sample stream contaminants. Two options of sensors are available, and they will perform best at concentrations between 200-2000 ppmv or 2-30%, respectively. In the event that the sample must be vented to a pressurized flare, the sensor should be calibrated and maintained at as low a constant pressure as possible.

F.2. Manual Calibration

The calibration on the M60XP is set at the factory. The current settings can be read by toggling thru the menu items on the second line of the display using the middle push button. Their values can be adjusted from the front panel. If the oxygen concentration of the gas is known:

- Ensure plant is bypass for any work on O2 analyzer. No local bypass is available.
- Apply a calibration gas of 99.9% Nitrogen(N2) to gas calibration inlet.
- Set pressure of N2 to 15psi and a flow of two on the flowmeter.
- Let N2 purge sensor for five minutes.
- Press middle menu button until **Cal-Zero** appears on screen.
- Press the left or right arrow button to underline a desired number to adjust.
- Press the menu button to increase or decrease the number.
- Press the right arrow until display indicates **SAVED**.
- Continue to increase or decrease **Cal-Zero** value until display indicates **0.01** on the top line. (DO NOT SET VALUE 0.00).
- Remove N2 from calibration inlet.
- Apply a calibration standard of O2 balanced in N2 to calibration inlet.
- Set pressure to 15 psi and a flow of 2 on the flowmeter.
- Once reading has stabilized. Press the middle menu button until **Cal-Span** appears on screen.
- Press the left or right arrow buttons to underline a desired number to adjust.
- Press the menu button to increase or decrease the number.
- Press the right arrow button until display indicates **SAVED**.
- Continue adjusting **Cal-Span** value until concentration reading is the same as indicated by the calibration bottle.
- Remove calibration gas from calibration inlet.
- Re-apply sample gas to analyzer.

F.3. Alarm Set Points

There are two solid-state alarms normally set on ppmv or % concentration at the factory on increasing Oxygen. If the alarms need to be adjusted:

- Press the center button until the "**alm 1**" or "**alm 2**" appears on the second line of the display.
- Pressing the right or left button will bring up a cursor under a digit of the current set point number.
- Move the cursor by pressing left or right buttons under the digit to be adjusted.
- Adjust by pressing middle button.
- When the number is correct, press the right button until the cursor moves all the way to the right and "**Saved**" appears. To cancel and go back to the starting set point press the left button repeatedly until "**Cancel**" appears.

Note: Both alarms are normally open or de-energized and the hysteresis is set to 0.1 lbs.
Note: The alarms contacts are open collectors and solenoids can be wired as below.
Note: The solenoids MUST be low power, 12 VDC (0.5 – 2W).

CAUTION: Electrical certification for hazardous locations requires that the sensor and flame arrestor threads be coated with liquid thread sealant (Swagelok Swak or equivalent). Use of Teflon tape will invalidate the certification.

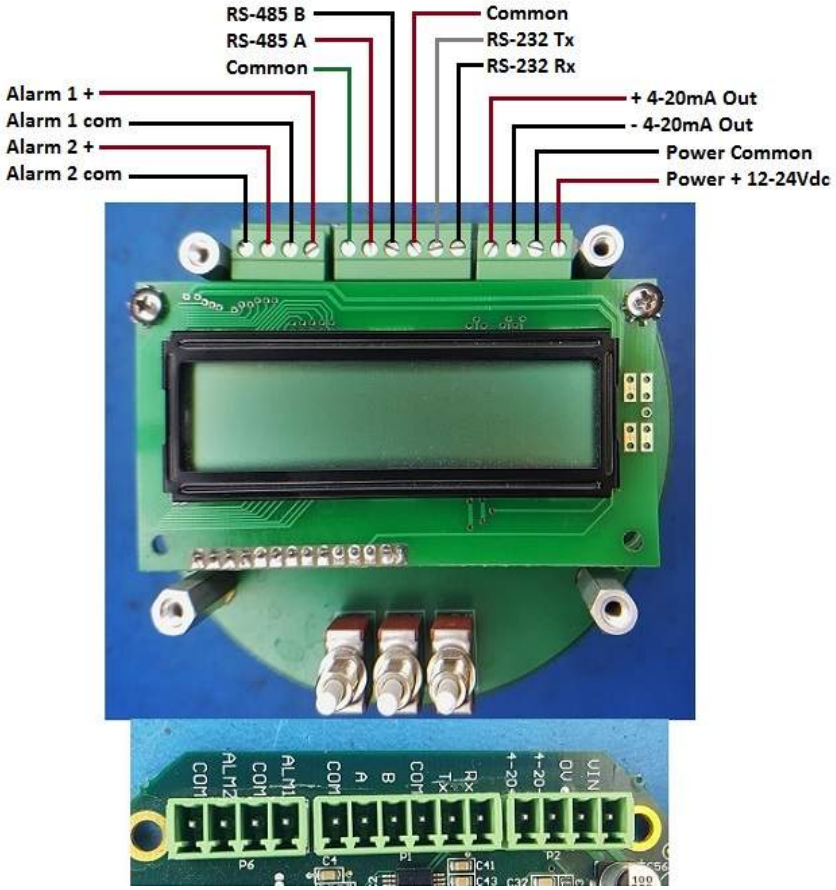


Figure 6: Alarm wiring

F.4. Display Menu

Using the internal menu buttons, the second line of the display can be cycled to display various machine settings and outputs. The middle menu button is used to cycle through the menu items.

If you choose to manual configure a menu item (Alm1&2, Span, Gain) you can select the number you wish to edit by pressing either the left or right menu button. Use the middle menu button to adjust the number. When you have completed entering the new value press the right menu button until the screen displays "**Saved**". If you choose not to save, you can return to the default value by pressing the left menu button until the screen displays "**Cancel**".

Table 1 below is a standard list of the second line variables. These are factory set and can be changed with the factory GUI (not included). The standard list may contain a portion of the following depending on customer specifications:

Figure 7: Display menu

Table 1: M60XP display menu list

Top Line	**Description**
XXX.XX ppmv (or $\%O_2$)	Oxygen Concentration in ppmv (or %)
Second Line	
XXXX.XX Zero	Sensor Calibration Zero*
XXXX.XX Span	Sensor Calibration Span*
XX.XX Gain	Sensor Gain Factor *
XX.XX Alm 1	Alarm 1 Set Point *
XX.XX Alm 2	Alarm 2 Set Point *
XX.XX AoSpan	4-20 mA output span in ppmv (or %)*
XXXX.XX mV	Raw Sensor mV Output
In Alarm Status	Alarm Status of M60XP

* User configurable

G. Maintenance

G.1. Monthly Check-up

Your analyzer will provide reliable service with very little attention. However, a monthly check-up will ensure that the analyzer is operating to specifications. Check filters and flow meters for liquid or solid contamination. Replace inlet filters as required.

G.2. Sensor Replacement

G.2.1. When to Replace the Sensor

It is recommended to replace the sensor only after contacting Event Engineering to insure that the sensor needs replacement. The sensor should last 3+ years, sample conditioning dependent.

G.2.2. Percent Sensor Replacement Procedure

Step 1. Disconnect power from the analyzer.
Step 2. Shut off line pressure before changing sensor, ensure there is no pressure in the sensor housing.
Step 3. Remove screw-on housing lid and insulation foam from the sensor enclosure.
Step 4. Unplug 3-wire connector.

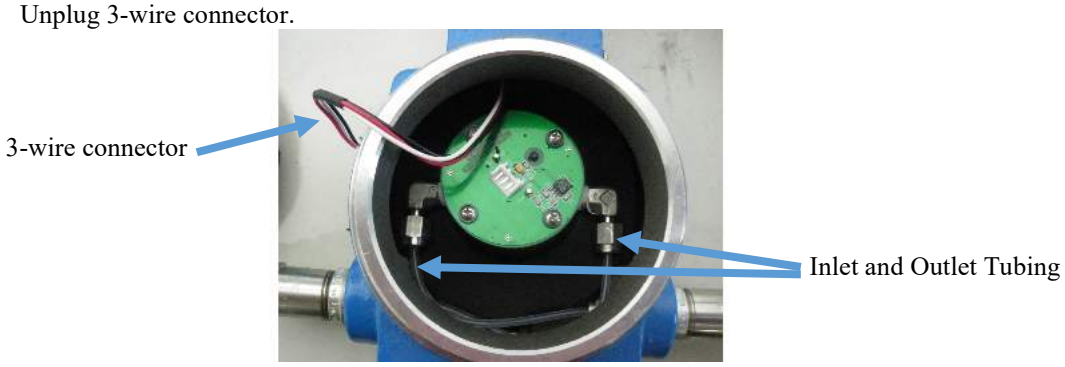


Figure 8: Sensor replacement procedure

Step 5. Disconnect 1/8” sample inlet and outlet tubing.
Step 6. Remove the four screws holding the sensor PCB to the sensor housing.
Step 7. Replace sensor, be sure to install the sensors keyed in the correct position.

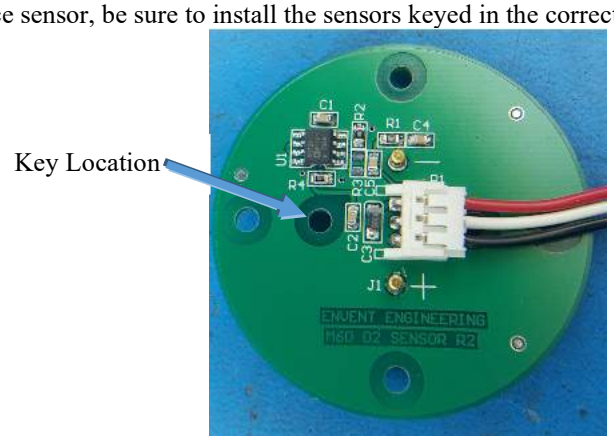


Figure 9: O2 sensor amplifier PCB.

Step 8. Check the condition and placement of the O-ring.
Step 9. Reinstall the PCB with the four mounting screws.
Step 10. Reconnect the sample inlet and outlet tubing.
Step 11. Reconnect 3-wire connector.

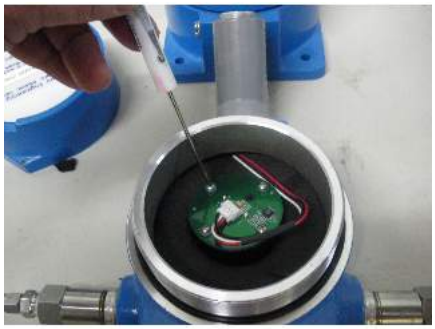


Figure 10: Replaced sensor with all fitting and screws tighten.

Step 12. Reinstall the insulation and cover.
Step 13. Before resuming line pressure be sure that all connections are LEAKTIGHT to insure effective oxygen concentration sampling as well as SAFETY.
Step 14. Connect power.
Step 15. Allow the M60XP to stabilize on sample for 10 minutes.
Step 16. Calibrate after 10 minutes or more on sample.

Note: The new calibration factor should be recorded for future reference.

G.2.3. PPM Sensor Replacement Procedure

PPM O2 sensors will be delivered assembled. The tubing inlets and outlets will have caps on to seal the sensor from outside air.

Figure 11: Assembled ppm O2 sensor.

Step 1. Disconnect power from the analyzer.
Step 2. Shut off line pressure before changing sensor, ensure there is no pressure in the sensor housing.
Step 3. Remove screw-on housing lid and insulation foam from the sensor enclosure.
Step 4. Unplug 3-wire connector.
Step 5. Disconnect 1/8” sample inlet and outlet tubing.
Step 6. Replace entire sensor assembly.
Step 7. Re-connect 1/8” sample inlet and outlet tubing.
Step 8. Re-connect 3-wire connector.

Figure 12: replaced ppm sensor with all fitting and screws tighten.

Step 9. Reinstall the insulation and cover.
Step 10. Before resuming line pressure be sure that all connections are LEAKTIGHT to insure effective oxygen concentration sampling as well as SAFETY.
Step 11. Connect power.
Step 12. Allow the M60XP to stabilize on sample for 10 minutes.
Step 13. Calibrate after 10 minutes or more on sample.

G.3. Filter Replacement

G.3.1. When to Change the Filter Element

It is recommended to replace the filter element when the pressure drop reaches 10 psig across the filter.

G.3.2. Filter Replacement Procedure

Step 1. Shut off the line pressure before changing elements. Ensure there is no pressure in the filter housing.
Step 2. Remove the bowl, element retainer and filter element.
Step 3. Replace Filter element with Bonded Coalescing Filter Element.
Step 4. Tightening the element retainer a ¼ to 1 turn after it first contacts the filter element securely seals the filter tube. The amount will depend on the housing type and element size. A mark on the end of the retainer can be used as a guide.
Step 5. Before replacing the housing bowl ensure that the mating threads and sealing surfaces are clean and damage free. It is recommended that the threads and sealing faces be lubricated with a small amount of silicone grease before assembly. Stainless steel housings fitting with a solid PTFE gasket the bowl should be tightened to a torque of between 30Nm and 40 Nm.
Step 6. Before resuming line pressure be sure that all the port connections, the drain plug, and the housing bowl are securely installed. All connections must be LEAKTIGHT to insure effective filtration as well as SAFETY.

G.4. Recommended Spare Parts List

Part Number	Part Description
100040	Sample flow meter 0-600 cc/min
70X-V	Replacement Sensor (percent)
C/NLL	Replacement Sensor (ppm)
605001	Controller Board
606001	Display
330406	Set of 10 membranes for inlet filter

G.5. M60XP Cleaning Procedures

When cleaning the Envent Engineering Ltd. M60 Oxygen Monitor sample system leave the sweep valve on the sample filter slightly open at all times. This will decrease the likelihood of contamination.

If the analyzer requires cleaning on a regular basis, the sample point may have to be relocated or additional sample conditioning may be required. Please consult Envent Engineering Ltd.

During startup or plant upset situations, the M60XP analyzer may become contaminated with a scavenger solution. The flowmeter should be inspected for liquids and to ensure the float moves freely.

Note: The scavenger solution is water-soluble and therefore is relatively easy to clean.

G.5.1. Cleaning Materials List

- Alconox Laboratory cleaner or equivalent residue free cleaning agent

CAUTION: Do not use solvents, brake cleaner, soaps or detergents.

- Fresh clean water
- 100% Isopropyl Alcohol. Do not use rubbing alcohol
- Large bucket to mix cleaning solution
- Rinse bottle

G.5.2. Cleaning Procedures

Mix 1% (2-1/2 tbsp. per gal.) of Alconox cleaner in warm water.

G.5.2.a. Sample Tubing

Step 1. Shut off flow at the sample point prior to sample system
Step 2. Flush the sample line and components with cleaning solution
Step 3. Rinse with fresh water
Step 4. Flush with isopropyl alcohol
Step 5. Dry with clean, dry instrument air or gas

G.5.2.b. Sample System

CAUTION: Disassembly of the pressure regulator and solenoids in the field is not advised. Consult the factory if the regulator or solenoid appears contaminated.

Step 1. Remove the filter element from the filter housing and discard
Step 2. Remove all sample system components and soak in cleaning solution
Step 3. Ensure valves are fully open when cleaning. 3-way valves should be cleaned with handle in all positions.
Step 4. Flush the sample components with fresh water
Step 5. Rinse with isopropyl alcohol
Step 6. Blow dry with clean compressed air or fuel gas
Step 7. If Teflon tubing appears discolored, replace with new tubing (tubing connecting the sensor)
Step 8. Rinse Sensor with isopropyl alcohol
Step 9. Install new filter elements into filter housings
Step 10. Re-assemble Stainless Steel Tubing to analyzer according to analyzer drawing.
Step 11. Adjust Gain to indicate the value from the factory calibration sheet or the last calibration.
Step 12. If the reading is not within range, then system may need further cleaning. Please consult factory.

H. ICE M60XP GUI

The M60XP is configured in the factory using a windows based software and serial cable (note you may need a serial to USB converter for most laptops). This software is not normally required in the field unless the user needs to make a fundamental change to displayed units or retrieve archived data. At the time of printing for this manual the ICE GUI for the M60XP is not shipped with unit. If you require a copy, Envent can forward via mail or electronically (Consult factory).

I. Troubleshooting Guide

1) Sensor reading is too high or low
   a) Check for 24VDC (12 to 30V) on the power terminals
   b) Perform calibration as per calibration procedure
   c) Check that the flow rate is between 100 and 500 cc/min
   d) Ensure that the sample vent line is not blocked
   e) Replace sensor

Note: If the calibration of the M60XP is believed to be incorrect, the sensor can be cleaned (refer to section G.5). If the oxygen content of the sample is known, the output of the M60XP can be adjusted. The sensor must be replaced (refer to section G.2) if the above procedure does not restore the M60XP to service. The M60XP electronics board has no user serviceable parts and must be replaced or returned to the factory if found to be non-functional.

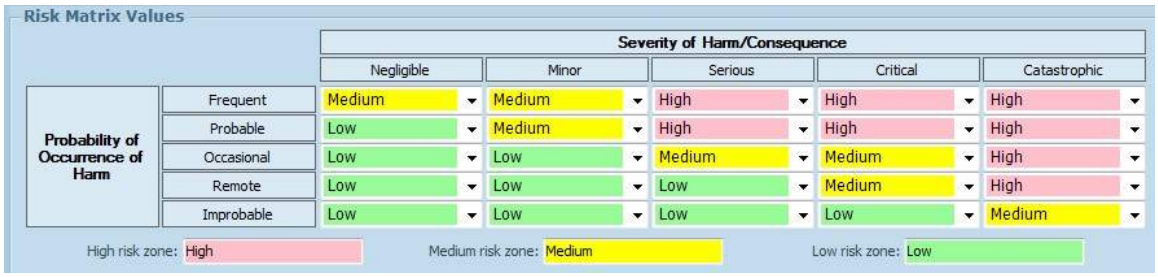
2) No 4-20 mA output.
   a) Ensure there is loop power connected

J. Risk Assessment – Safety Information

Hydrogen Sulfide Properties	
Physical State	Usually encountered as a gas
Color	Colorless - No visible sign of H2S to warn you of its presence
Odor	Characteristic smell of rotten eggs at 0.5 ppb; paralyzes the olfactory nerve around 100 ppm
Vapor Density	Heavier than air (1.19 compared to 1.0 for air) > In gas mixtures, it will be present wherever the gas mixture is found > Gas mixtures may be heavier or lighter than air, depending upon their vapor density and temperature compared to the ambient atmosphere (i.e. usually air) > In its pure state, or as a high proportion of a gas mixture, it may flow or settle into low-lying areas, such as pits, trenches and natural depressions
Flammability	Flammable Flammable at 4.3 - 46 percent vapor concentration in air, by volume

	Burns with a blue flame and gives off Sulphur dioxide (SO2) gas SO2 is also hazardous and irritates the eyes and the respiratory system
Solubility	Soluble in water and oil, solubility is inversely proportional to fluid temperature
Common Locations for H2S	Piping systems, pipelines, wellheads or wellbores, vessels, production facilities, tanks, pits and low spots, confined or enclosure spaces, shacks or buildings, bermed or diked area, sour spills.

Hydrogen Sulfide Quantities and Health Effects	
H2S Exposure	**Possible health Effects**
Less than 1 ppm	you can smell it
10 ppm	> No known health effects for most people > For 10 ppm or less, the exposure limit is 8 hours - Check your local legislation as they vary. > For 15 ppm, the exposure limit is 15 min with 60 minutes breaks. Check your local legislation as they vary.
20-200 ppm	> Eye and respiratory tract irritation and loss of smell > Headache and nausea - loss of smell after 2 - 5 min > Respiratory Protection is required beyond this level such as SCBA (Self-contained Breathing Apparatus) and SABA (Supplied Air Breathing Apparatus)
200 - 500 ppm	> Above effects, but sooner and more severe > Loss of breathing and death in 30 min to 1 hour
500 - 700 ppm	> Affects the central nervous system > Rapid unconsciousness, cessation of breathing, and death
700 ppm and above	> Immediate loss of consciousness > Permanent brain damage and death in a few minutes even if removed to fresh air at once



Risk Assessment					
Hazard Identification - Task	**Who might be harmed by this hazards**	**Health and Safety Risks**	**Initial Risk**	**Hazard Control Recommended**	**Residual Risk**
Maintenance: Changing filter in SCS	Operator(s)	Potential safety risk - release of gases at a high pressure level can cause serious injuries	Occasional – Critical (High)	Due to the fact that the filter is located before the pressure regulator, the operator could be dealing with pressures up to 3600 PSI. The operator must isolate the sample system before changing the filter As an overall practice when doing maintenance into an M-Series analyzer, the operator should carry a personal H2S monitor, wear a hard hat, hearing protection (if applicable), safety glasses, hand protection, steel toed boots. Depending on the location of the M-Series analyzer, appropriate breathing device might be required such as SCBA (Self-contained Breathing Apparatus) and SABA (Supplied Air Breathing Apparatus)	Improvable – Critical (Low)
Leakage or rupture due to high pressure	Operator(s)	Potential safety risk - release of gases at a high pressure level can cause serious injuries	Remote – Critical (Medium)	Depending on the sample conditioning system, the inlet maximum pressure varies. Please consult document package to find out about maximum pressure for the sample system. Do not apply more pressure than the one specified, as this can cause damage to the analyzer and can cause safety risks.	Improbable – Critical (Low)
H2S Exposure (Atmosphere)	Operator(s)	Potential safety and health risk - Death - Consult Table Hydrogen Sulfide Quantities and Health Effects.	Remote – Critical (Medium)	For atmospheres where there is H2S, depending on the levels and company policy, the operator must wear the appropriate equipment before servicing an M-Series analyzer As an overall practice when doing maintenance into an M-Series analyzer, the operator should carry a personal H2S monitor, wear a hard hat, hearing protection (if applicable), safety glasses, hand protection, steel toed	Improvable – Critical (Low)

				boots. Depending on the location of the M-Series analyzer, appropriate breathing device might be required such as SCBA (Self-contained Breathing Apparatus) and SABA (Supplied Air Breathing Apparatus)	
H2S Exposure (Leakage - Overpressure)	Operator(s)	Potential safety and health risk - Death - Consult Table Hydrogen Sulfide Quantities and Health Effects.	Remote – Catastrophic (Medium)	In case of a leakage, follow company's health and safety policies on how to deal with an H2S leak. Depending on the application and location of the M-Series analyzer, the operator might have to use the proper breathing equipment As an overall practice when doing maintenance into an M-Series analyzer, the operator should carry a personal H2S monitor, wear a hard hat, hearing protection (if applicable), safety glasses, hand protection, steel toed boots. Depending on the location of the M-Series analyzer, appropriate breathing device might be required such as SCBA (Self-contained Breathing Apparatus) and SABA (Supplied Air Breathing Apparatus)	Improvable – Catastrophic (Medium)
Exposure to other gases	Operator(s)	Potential safety and health risk – Explosion, Oxygen deprivation, Death	Remote – Catastrophic (Medium)	In case of a leakage, follow company's health and safety policies on how to deal with gas leak. Depending on the application and location of the M-Series analyzer, the operator might have to use the proper breathing equipment As an overall practice when doing maintenance into a M-Series analyzer, the operator should carry a personal H2S monitor, wear a hard hat, hearing protection (if applicable), safety glasses, hand protection, steel toed boots. Depending on the location of the M-Series analyzer, appropriate breathing device might be	Improvable – Catastrophic (Medium)

				required such as SCBA (Self-contained Breathing Apparatus) and SABA (Supplied Air Breathing Apparatus)	
Flooding the Sample system & analyzer	Operator(s)	Not immediate safety and health concern	Occasional – Minor (Low)	If the analyzer is flooded, the analyzer needs to be immediately isolated, turned off and cleaned. As an overall practice when doing maintenance into an M-Series analyzer, the operator should carry a personal H2S monitor, wear a hard hat, hearing protection (if applicable), safety glasses, hand protection, steel toed boots. Depending on the location of the M-Series analyzer, appropriate breathing device might be required such as SCBA (Self-contained Breathing Apparatus) and SABA (Supplied Air Breathing Apparatus)	Remote – Minor (Low)
Voltage hazards	Operator(s)	Immediate safety and health risk.	Remote – Critical (Medium)	It is important that the operator is trained on handling the analyzer when it is on. The analyzer does not need to be off when it goes into maintenance. However, it is very important that the operator is aware of the danger of an electric shock	Improvable – Critical (Low)
Electrostatic hazard - Explosion hazard	Operator(s)	Immediate safety and health risk.	Remote – Catastrophic (High)	Electrostatic Hazard – Backpan and Certification nameplate must be cleaned only with a damp cloth to prevent static charging hazard which could result in an explosion	Improbable – Catastrophic (High)
Analyzer heavy Weight	Operator(s)	Body Injury	Remote – Serious (Low)	In some cases, unpacking and transporting requires a minimum of two persons.	Improbable – Low (Low)
Re-configuring the GC Analyzer configuration file and or physical configuration to the analyzer and or sample conditioning system	Operator(s)	Potential safety risk	Remote – Critical (Medium)	Do not modify physically the M-Series analyzer or sample conditioning system as this void hazardous location certification. Software configuration should not be changed by the user.	Remote – Critical (Medium)

APPENDIX A

M60XP Default Modbus Setup

Output Status (Coils)	
Registry Number	**Data Field**
(0)	Relay 1
(2)	Relay 1
(4)	Relay 2
(6)	Relay 2

	Output Registry Numbers		
Data Field	**16 Bit Integers**	**32 Bit Integers**	**Floating Point**
% O_2	(40001)	(40007)	(40019)
% O_2	(40002)	(40009)	(40021)
ppmv	(40003)	(40011)	(40023)
ppmv	(40004)	(40013)	(40025)
mV	(40005)	(40015)	(40027)
mV	(40006)	(40017)	(40029)

APPENDIX B

Chico A Sealing Compound

For Sealing Fittings in Hazardous Locations
Installation & Maintenance Information

INSTALLATION

DAM:

Using "Chico X" Fiber, make a dam in each conduit hub (except the one extending upward) so that the "Chico A" sealing compound, while fluid, cannot leak out of the sealing chamber.

Use the EYS-TOOL-KIT to pack a proper fiber dam **(do not use metal tools)**. Proceed as follows:

1. Force the conductors forward.
2. Pack fiber into each conduit hub behind the conductors.
3. Push the conductors backward and force them apart.
4. Pack fiber between and around the conductors in each conduit hub. It is important that the conductors be permanently separated from each other, so that the sealing compound will surround each conductor.
5. Pack fiber into each conduit hub in front of the conductors.

⚠CAUTION:
Do not leave shreds of fiber clinging to side walls of sealing chamber or to the conductors. Such shreds when imbedded in the compound may form leakage channels. The completed dam should be even with the conduit stop.

6. If the Condulet is of a type or size that has a separate work opening, this should be closed by its cover before pouring the seal.

COMPOUND:

Follow these instructions carefully:
Use a CLEAN mixing vessel for every batch. Particles of previous batches or dirt may spoil the seal. The recommended proportions are, by VOLUME– 2 parts of Chico A compound to 1 part of clean water. Do not mix more than can be poured in 15 minutes after water is added. Use cold water. Warm water increases speed of setting. Stir immediately and thoroughly.

⚠CAUTION:
If a batch has started to set, do not attempt to thin it by adding water or by stirring. Such a procedure may spoil the seal. Discard partially set material and make up fresh batch. After pouring, immediately close the pouring opening.

FOR APPLICATIONS INVOLVING GROUPS C AND D

⚠CAUTION:
Sealing compound to be mixed ONLY at temperatures above 35°F (2°C) and ONLY poured into fittings that have been brought to a temperature above 35°F (2°C). Seals must NOT be exposed to temperatures below 35°F (2°C) for at least 8 hours.

FOR GROUP B APPLICATIONS

⚠CAUTION:
Sealing compound to be mixed ONLY at temperatures above 40°F (4.4°C) and ONLY poured into fittings that have been brought to a temperature above 40°F (4.4°C). Seals must NOT be exposed to temperatures below 40°F (4.4°C) for at least 72 hours.

KEEP compound dry by having container cover tightly closed when not in use.
NOTE: For additional details see IF 287 packed with sealing fitting.

APPENDIX C

VAC Customer Connections

For 100-240 VAC 50/60Hz connections, a CUI inc VSK-S15-24U-T Switching Mode Power Supply is used to convert the VAC power supply to a 12 VDC power supply.

Figure 13: CUI inc VSK-S15-24U-T Switching Mode Power Supply (NC=no connection)

Characteristics:

- Over temperature protection
- Overload protection
- Inrush current limiting

Specifications:

Input Voltage Range	100-240 VAC
Power (W)	15
Output Voltage (VDC)	24
Output Current (mA)	625
Dimensions (LxWxH)	3.78 x 2.17 x 1.26
Packaging	Encapsulated PCB

The Factory will connect the (+/–)Vout terminals from the switching mode power supply to the VIN/0V terminals on the mainboard.

The Factory will connect three 48” wires from the FG, AC(N) and AC(L) terminals from the switching mode power supply for the customer to connect the 100-240 VAC 50/60Hz power supply connections respectively.

Note: The 4-20 mA output requires a 24 VDC power loop, which can be supplied by the analyzer.

CAUTION: Turn off power before servicing. Ensure breakers are off before connecting or disconnecting supply power.

CAUTION: This unit requires a disconnect device rated 240VAC and 5A max, must be protected by a circuit breaker rated 240VAC and 5A max, and is to be installed in accordance with local electrical codes.

APPENDIX D

Controller board and Display Assembly

CAUTION: Turn off power before servicing. Ensure breakers are off before connecting or disconnecting supply power.

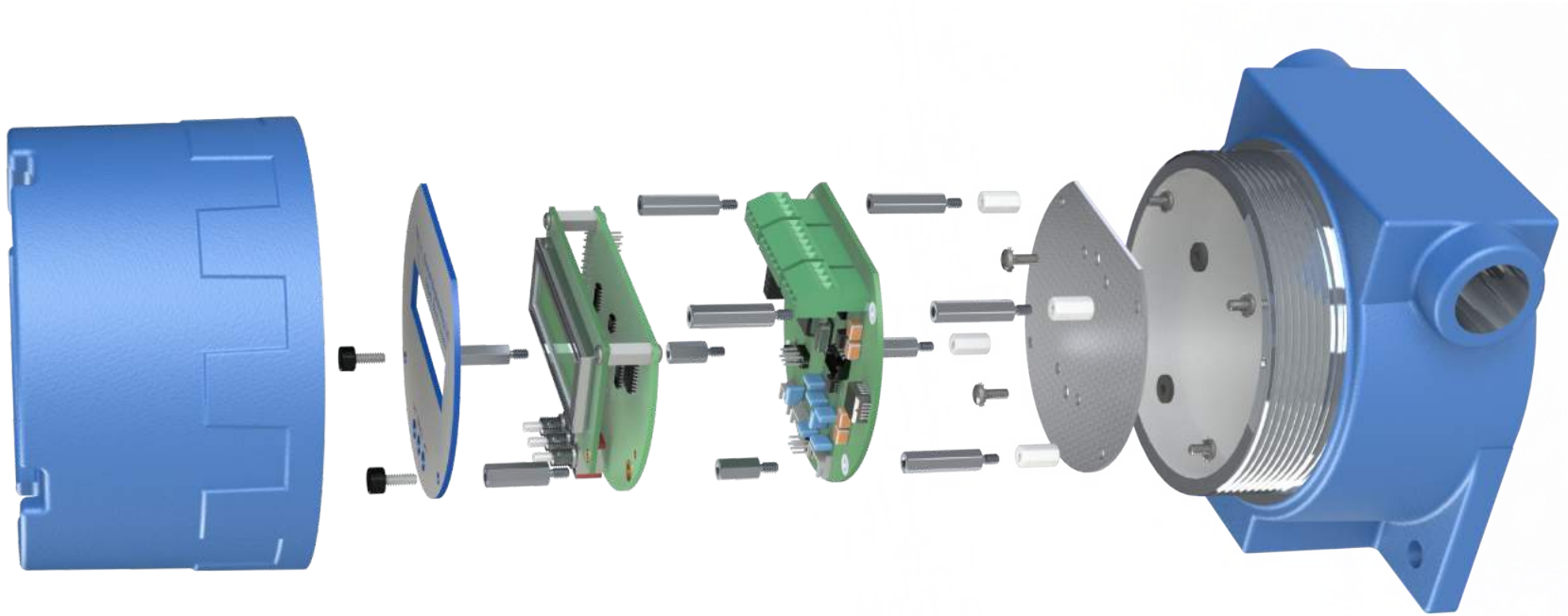


Figure 14: Assembly of Main Controller board and Display in explosion proof enclosure.

This document has been continuously improved and revised over time; see the table below for revision (rev) information.

Rev No.	*Rev Date*	*Rev Description*
2	30/05/11	Changed format, added warnings as per safety certification requirements
2.4	10/04/12	Update Manual Calibration Procedure.
3	27/02/13	Updated range in specification, referenced uninterrupted power supply and the availability of the customer pre-commissioning guideline.
4	18/06/13	Updated best operation ranges
5	14/10/14	Reviewed and changed sections on the manual
6	07/07/16	Updated all figures. Updated Replacement parts list. Updated Appendix C, Modified Sensor replacement procedure. Added Appendix D.
6.1	22 Oct 18	Updated Envents Address
7.0	29 Nov 18	Update Intertek Certification to 61010 Ed. 3
8.0	16 Mar 21	Added Group B to Analyzer
8.1	17 July 2021	Added Surge and Running wattages

For further information, or a copy of our most recent operating manual, please visit us at www.envent-eng.com. Envent Engineering Ltd. reserves the right to change product design and specifications at any time without prior notice

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