

M90XP CO₂ Monitor

Operator's Manual

Last Updated: November 30, 2011
Revision: 2.3



Envent
Engineering Ltd.

Bay E 7060 Farrell Road S.E.
Calgary, Alberta, Canada
T2H 0T2
Tel: 403.253.4012
Fax: 403.253.4016
Email: info@envent-eng.com
www.envent-eng.com

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 Envent Engineering Ltd. M90XP CO₂ Monitor measures the concentrations of carbon dioxide (CO₂) in natural gas in % concentration. This manual contains a comprehensive overview of Envent Engineering's M90XP CO₂ 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 M90XP. 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: Disassembly of the pressure regulator and solenoids in the field is not advised. Consult the factory if the regulator or solenoid appears contaminated.



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 M90XP 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 24 VDC and 5 Amax, must be protected by a circuit breaker rated 24 VDC and 5 Amax, and is to be installed in accordance with local electrical codes.



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

C. M90XP CO₂ Monitor Overview

C.1. Principle of Operation

The M90XP dual-beam IR CO₂ detection system continuously measures and corrects for the short and long-term changes. The M90XP is a compact CO₂ sensor, which uses less than 2 Watts of operating power, provides linear analog or digital measurement outputs. Options include adjustable set point control relays.

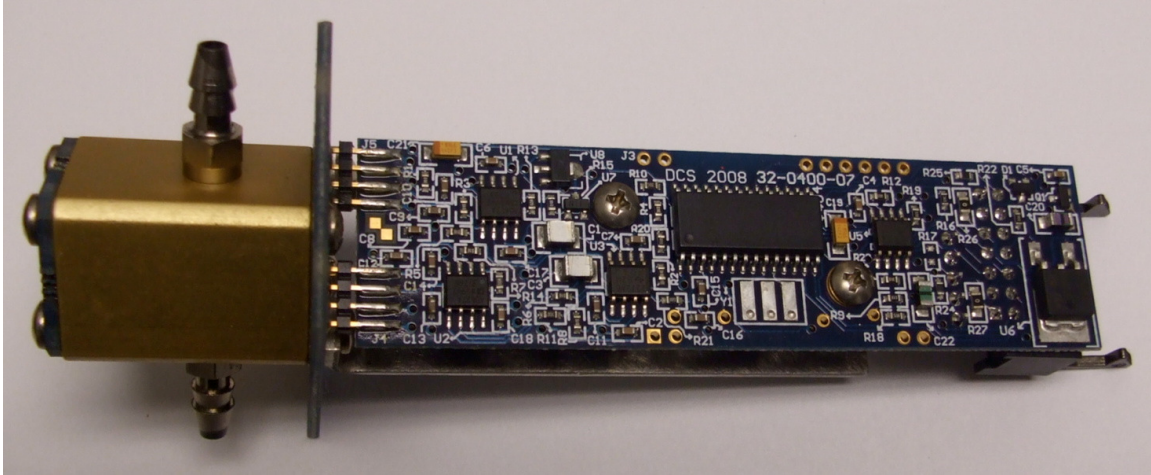


Figure 1: CO₂ sensor

C.2. CO₂ Sensor

The CO₂ sensor optics are resistant to drift. The dual beam principle uses a second wavelength of light that is outside the absorption band of interest to null out source intensity changes. Any source drift will affect both the reference and measurement wavelengths and be cancelled out by the signal processor. The sensor is temperature compensated for thermal shifts due to gas law effects.

D. Technical Specifications

Performance

Carbon Dioxide Concentration (CO ₂)	0 - 20% Standard ^(a)
Accuracy (H ₂ O)	±1% of reading
Response Time	20 seconds to 90% of step change 0 to 20%

Application Data

Environmental Temperature Range	0-50°C Standard ^(a)
Sample Inlet Pressure	5 – 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) 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: CO ₂ concentration in % Line 2: Alarm State, Raw mV, Alarm Set Point(s), Calibration Span, Calibration Zero

Physical Specifications

Size	Sample system mounted 16" x 24" anodized aluminum panel Standard ^(a)
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 C&D
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(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 M90XP GUI software and Computer (not included)

E. Installation and Start-up

Your M90XP 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 M90XP is designed for Class 1 Div 1 areas. Ensure that the housing received is suitable for area classification.

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 arrestors act as heat sinks and will cool gas to ambient temperature if not insulated along with sample inlet line for cold weather service.

E.2. Sample Volume and Flow Rate

Sample should be supplied to the analyzer at 10-15 psig 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.

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 M90XP 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 2 and Figure 3 show the typical sample system used for the M90XP CO₂ Monitor.



Figure 2: M90XP standard sample system

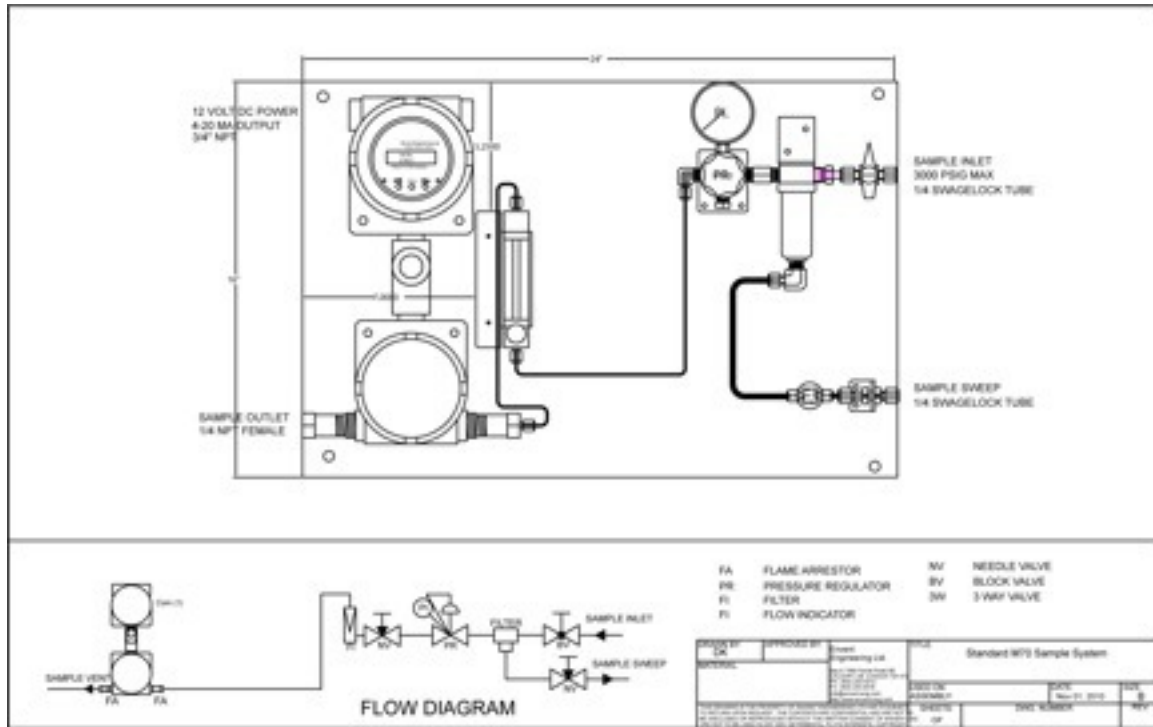


Figure 3: M90XP standard sample system drawing

E.4. Customer Connections

Figure 4 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: 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 24 VDC and 5 Amax, must be protected by a circuit breaker rated 24 VDC and 5 Amax, 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.

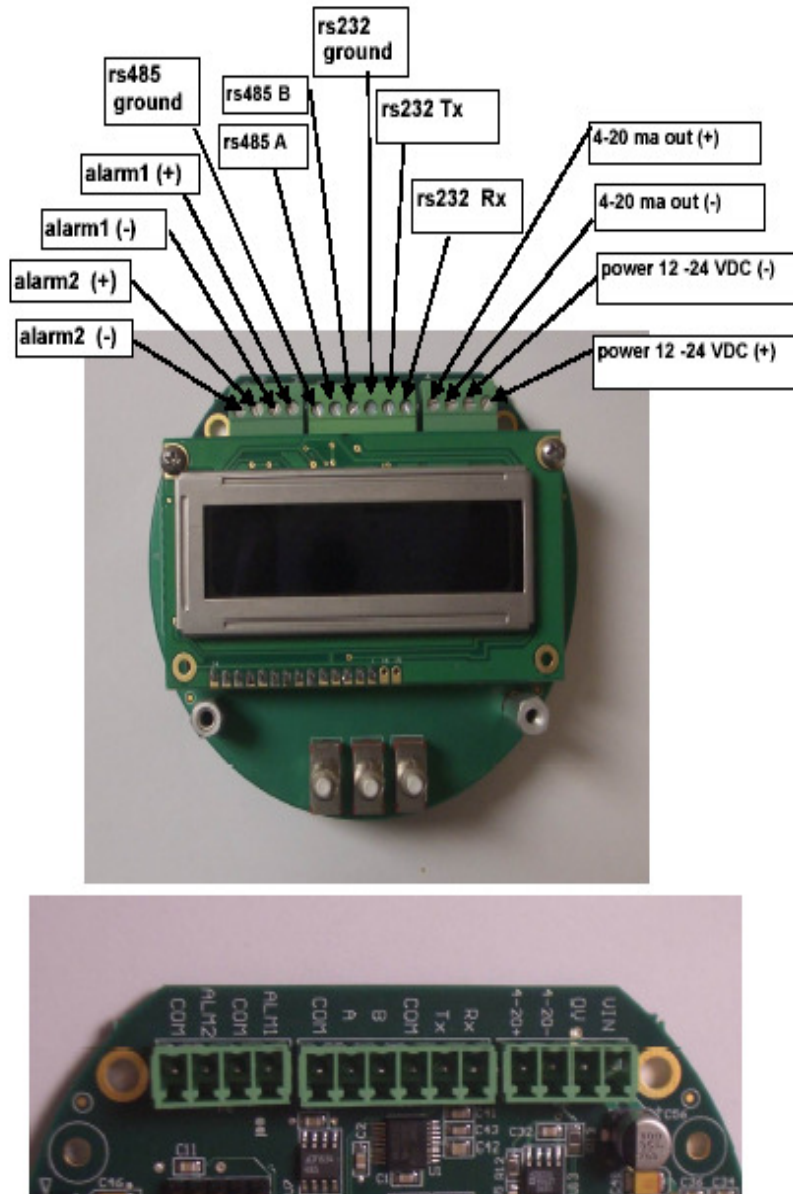


Figure 4: Customer connections

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 % CO₂.

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 (150 cc/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 calibration factor.
- Step 8. Confirm 4-20 ma output matches display reading for % CO₂ as indicated in factory calibration data sheet.

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

F. Operation

F.1. Operational Notes

The M90XP CO₂ 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. The output of the M90XP will vary slightly with pressure applied to the sample vent. It is recommended to operate the system at atmospheric pressure to reduce this effect.

F.2. Manual Calibration

The calibration on the M90XP 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 CO₂ concentration of the gas is known:

- Adjust the calibration "*Span*" by pressing the center button until the "*Span*" factor 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 "*Span*" number. Move the cursor by pressing left or right buttons to under the digit to be adjusted.
- Adjust by pressing middle button.
- When the number is right press the right button until the cursor moves all the way to the right and "*saved*" appears. To cancel press the left button repeatedly until "*cancel*" appears.
- Adjust the "*Span*" until the M90XP % CO₂ display agrees with the value of obtained from the calibration bottle.

Note: If a zero CO₂ calibration gas is available this procedure can be repeated for the calibration "Zero".

F.3. Alarm Set Points

There are two solid state alarms normally set on % CO₂ concentration at the factory on increasing CO₂. 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.

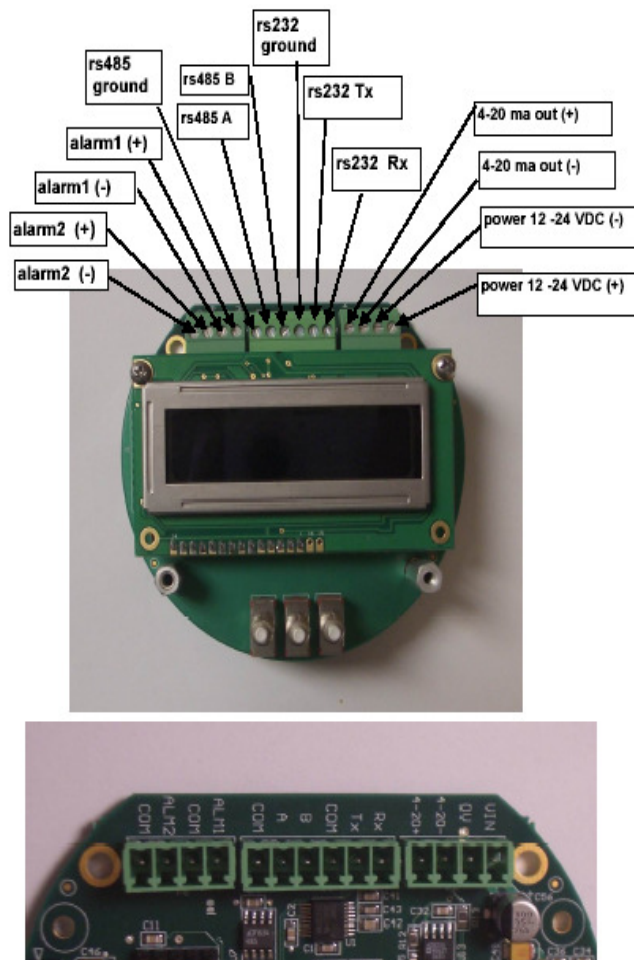


Figure 5: Alarm wiring

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, Zero, Span) 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 4 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:

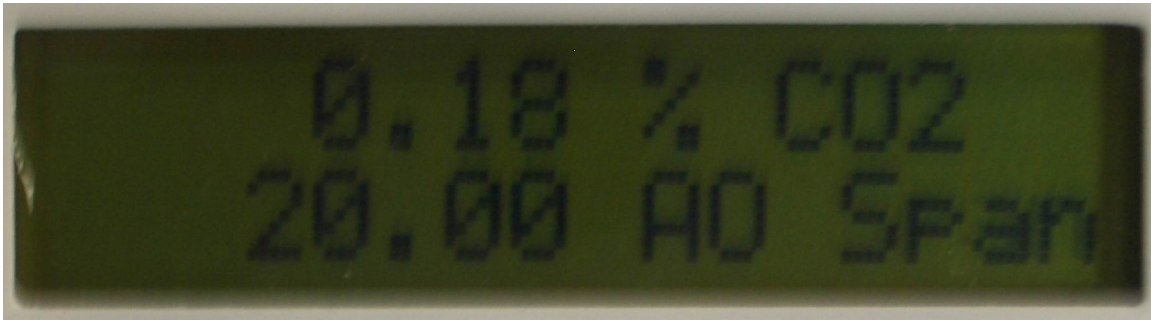


Figure 6: Display menu

Table 1: M90XP display menu list

Top Line	Description
XXX.XX %CO ₂	CO ₂ Concentration in %
Second Line	
XXXX.XX Zero	Sensor Zero Offset *
XX.XX Span	Sensor Span Factor *
XX.XX Alm 1	Alarm 1 Set Point *
XX.XX Alm 2	Alarm 2 Set Point *
XXXX.XX mV	Raw Sensor mV Output
In Alarm Status	Alarm Status of M90XP
Optional	
XXX.XX AO Span	4-20 mA output span in %CO ₂ *
XXX.XX AO Zero	4-20 mA zero output in %CO ₂ *

* 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 dependant.

G.2.2. Sensor Replacement Procedure

- Step 1. Disconnect power from the analyzer.
- Step 2. Shut off line pressure before changing sensor.
- Step 3. Remove sensor screw on housing lid, insulation and disconnect 1/8" sample inlet and outlet tubing.
- Step 4. Unplug 5-pin connector and plug in replacement sensor.
- Step 5. Reconnect the sample inlet and outlet tubing and reinstall the insulation and cover.
- Step 6. Connect power.
- Step 7. Before resuming line pressure be sure that all connections are LEAKTIGHT to insure effective CO₂ concentration sampling as well as SAFETY.
- Step 8. Allow the M90XP to warm up to the set sensor temperature (normally 60°C.)
- Step 9. Calibrate after 10 or more minutes on sample.

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

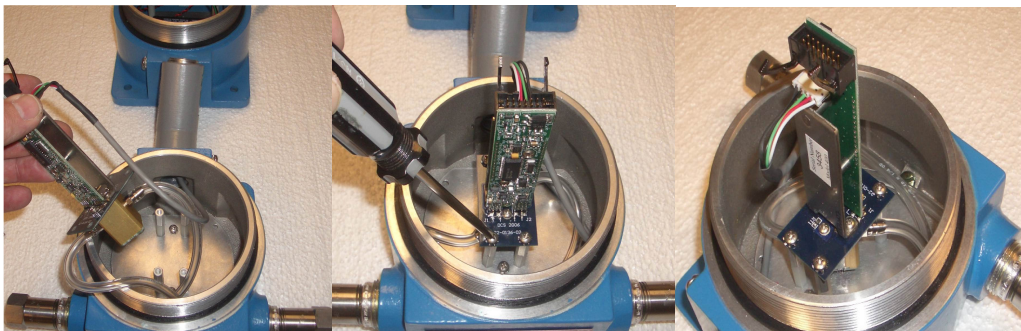


Figure 7: Sensor replacement procedure

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 Microfibre 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
330400	CO ₂ Sensor
20100-R1	Controller Board
20100-4	Display
20209	Foam insulation kit
330405	Set of 5 membranes for inlet filter

G.5. M90XP Cleaning Procedures

When cleaning the Envent Engineering Ltd. M90XP CO₂ 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 M90XP 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 the Span and Zero 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 M90XP GUI

The M90XP 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 M90XP 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 sluggish:
 - a. Check for leaks
 - b. Check that the flow rate is between 100 and 500 cc/min
 - c. Ensure that the sample vent line is not blocked
 - d. Check for 24 VDC (18 – 30 V) on the power terminals
 - e. Replace sensor

Note: If the calibration of the M90XP is believed to be incorrect, the sensor can be cleaned (refer to section G.5). If the CO₂ content of the sample is known, the output of the M90XP can be adjusted. The sensor must be replaced (refer to section G.2) if the above procedure does not restore the M90XP to service. The M90XP electronics board has no user serviceable parts and must be replaced or returned to the factory if found to be non-functional.

APPENDIX A

M90XP 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
% CO ₂	(40001)	(40007)	(40019)
% CO ₂	(40002)	(40009)	(40021)
ppmv	(40003)	(40011)	(40023)
ppmv	(40004)	(40013)	(40025)
mV	(40005)	(40015)	(40027)
mV	(40006)	(40017)	(40030)

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 V-Infinity FSC-S15-12U Switching Mode Power Supply is used to convert the VAC power supply to a 12 VDC power supply.



Figure 8: V-Infinity FSC-S15-12U Switching Mode Power Supply

Characteristics:

- Over temperature protection
- Overload protection
- Inrush current limiting

Specifications:

Input Voltage Range	85-264 VAC
Power (W)	15.6
Output Voltage (VDC)	12
Output Current (A)	1.3
Dimensions (LxWxH)	2.76x1.77x0.77
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 240 VAC and 5 Amax, must be protected by a circuit breaker rated 240 VAC and 5 Amax, and is to be installed in accordance with local electrical codes.

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

<i>Rev No.</i>	<i>Rev Date</i>	<i>Rev Description</i>
02	30/05/11	Changed format, added warnings as per safety regulation standards

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

Head Office

7060E Farrell Road SE
 Calgary, AB T2H 0T2 Canada
 T +1.403.253.4012
 F +1.403.253.4016
 CAN Toll Free 1.877.936.8368
info@envent-eng.com

USA Office

T +1.713.568.4421
 USA Toll Free 1.877.936.8368
usasales@envent-eng.com

China Office

Beijing, China
 T +86.138.0119.1148
chinasales@envent-eng.com

