ENMET **Corporation**
PO Box 979
Ann Arbor, MI 48106-0979

ISA – M

OPERATION & MAINTENANCE

MANUAL

80003-027
04/27/95
MCN-204, 10/20/98
MCN-285, 11/20/02

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List of Figures and Tables

Reference information:

NOTE: [important information about use of instrument – if not followed may have to redo some steps.]

CAUTION: [affects equipment – if not followed may cause damage to instrument, sensor etc…]

***WARNING*: [affects personnel safety – if not followed may cause bodily injury or death.]**

1.0 Introduction

The ***ENMET*** Model **ISA-M** detector/alarm is an all solid-state electronic gas-detecting instrument that minimizes the risk of harm or death to people who are exposed to potentially hazardous gas environments. It continuously monitors for combustible or toxic gases and warns of a dangerous gas situation with enough time to take action to avoid harm. Audio (horn) and visual (light) alarms are calibrated to trigger at both high and low level gas concentrations.

The **ISA-M** uses a gas-sensitive Metallic Oxide Semiconductor (MOS) sensing element which reacts to toxic and combustible gas molecules. An oxidation reaction occurs on the sensor surface when contaminants are present. The oxidation reaction changes the sensor's electrical resistance which then triggers the alarm circuitry when the concentration of gas goes beyond a preset level.

The sensor can be located up to 1000 feet from the circuit enclosure and connected electrically by wire or cable.

NOTE: *All specifications stated in this manual may change without notice.*

1.1 Unpack

Unpack the **ISA – M** and examine it for shipping damage. If such damage is observed, notify both ***ENMET*** customer service personnel and the commercial carrier involved immediately.

Regarding Damaged Shipments

NOTE: **It is your responsibility to follow these instructions. If they are not followed, the carrier will not honor any claims for damage.**

- ❑ This shipment was carefully inspected, verified and properly packaged at our company and delivered to the carrier in good condition.
- ❑ When it was picked up by the carrier at ***ENMET***, it legally became your company's property.
- ❑ If your shipment arrives damaged:
- Keep the items, packing material, and carton "As Is." Within 5 days of receipt, notify the carrier's local office and request immediate inspection of the carton and the contents.
- After the inspection and after you have received written acknowledgment of the damage from the carrier, contact ***ENMET*** Customer Service for return authorization and further instructions. Have your Purchase Order and Sales Order numbers available.
- ❑ ***ENMET*** either repairs or replaces damaged equipment and invoices the carrier to the extent of the liability coverage, usually $100.00. Repair or replacement charges above that value are your company's responsibility.
- ❑ The shipping company may offer optional insurance coverage. ***ENMET*** only insures shipments with the shipping company when asked to do so in writing by our customer. If you need your shipments insured, please forward a written request to ***ENMET*** Customer Service.

Regarding Shortages

If there are any shortages or questions regarding this shipment, please notify ***ENMET*** Customer Service within 5 days of receipt at the following address:

ENMET Corporation
680 Fairfield Court
Ann Arbor, MI 48108
734-761-1270 734-761-3220 Fax

1.2 Check Order

Check, the contents of the shipment against the purchase order. Verify that the **ISA – M** is received as ordered. Each **ISA – M** is labeled with its target gas. If there are accessories on the order, ascertain that they are present. Check the contents of calibration kits. Notify ***ENMET*** customer service personnel of any discrepancy immediately.

1.3 Serial Numbers

Each **ISA – M** is serialized. These numbers are on tags on the equipment and are on record in an ***ENMET*** database.

1.4 Read Manual

Read this manual carefully and thoroughly before installing and operating this instrument.

2.0 Features if the ISA – M

2.1 External Feature of the ISA – M

Figure 1 shows the **ISA-M** control unit which contains the electronic circuitry and controls. Main features are listed below.

Feature	Description
Meter	This is a non-linear device. Do not infer exact readings from unmarked regions of the meter scale. The scale is marked in units of measure for the gas depending on instrument calibration. ▪ PPM (Parts Per Million) for toxic gases ▪ % LEL (Lowest Explosive Level) for combustible gases
Operation Switch	A rotary switch for: ▪ OPERATE – Normal Operation ▪ HORN OFF – Disable Audio Alarm ▪ PURGE ON – (sensor temperature control) Purge ON to clean (purge) sensor surface of absorbed contaminants (sensor hot).
Switch Indicator (Red)	When the light is on, Indicates OPERATION SWITCH is not in OPERATE
Audio Alarm(Horn)	Audio alarm (2900 Hz, 95 dB at 2 ft.). The audio alarm is activated when the unit is in alarm.
Power Indicator (Green)	When the light is on, the unit is operating and is not in alarm. When this light is off, the unit is in alarm OR power to the unit has been interrupted.
Visual Alarms	Amber: Visual alarm (steady light). When this lamp is on, power to the unit is on and the unit is in low alarm. Red: Visual alarm (steady light). When this lamp is on, power to the unit is on and the unit is in high alarm.

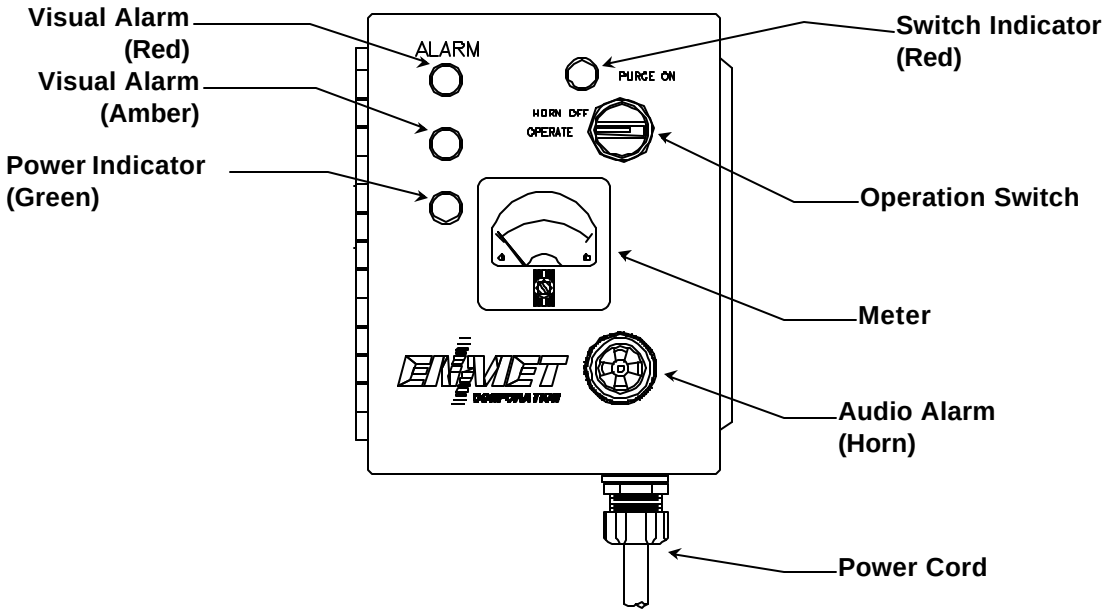


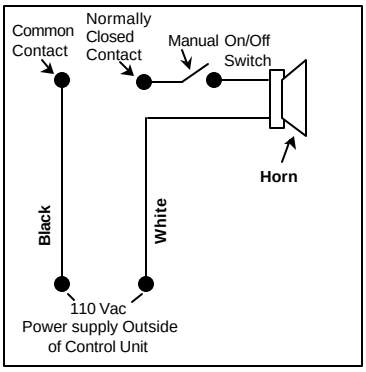
Figure 1: External Features of the ISA – M

2.2 Internal Features of the ISA – M

Figure 2 shows the circuit board and terminal blocks housed inside the hinged oiltight control unit. Specific relays and adjustments are defined in the table below.

Feature	Description
Internal Relay Contacts	There is one relay for each alarm level. Relays can be used to activate an external remote alarm signal when a hazardous gas level is detected, or when the ac or dc power is interrupted. These are double-pole relays with terminals "normally open", "normally closed" and "common" (see figure 3 for relay contact hook-up).
Potentiometers(POT)	The unit has five potentiometers. These vary circuit resistances and are essential to calibration procedures. These potentiometers are described below.
Heater Adjust (RV32)	For adjusting the sensor heater voltage (see section 4.4)
Low Level Alarm (RV35)	For low-level alarm adjustment (calibration, see section 6.2).
High Level Alarm (RV34)	For high-level alarm adjustment (calibration, see section 6.2).
Meter Adjust (RV33)	To adjust and set the meter for appropriate gas response during calibration. (See section 6.2)
Purge Adjust (RV38)	For adjusting the sensor heater voltage on units that require periodic purging (cleaning) of the sensor. (See section 4.4)

Suggested wiring configuration for Utilizing Relay Contacts
(manual on/off switch is suggested; user supplied component)



Non-Latching Relay contacts:
Identified below is the non-powered (power to unit is off), alarm positions of the non-latching relay contacts.

Terminal Block 2 see Figure 5	
Relay 1	High Alarm
Relay 2	Low Alarm

NOTE: N.C.= normally closed
N.O.= normally open

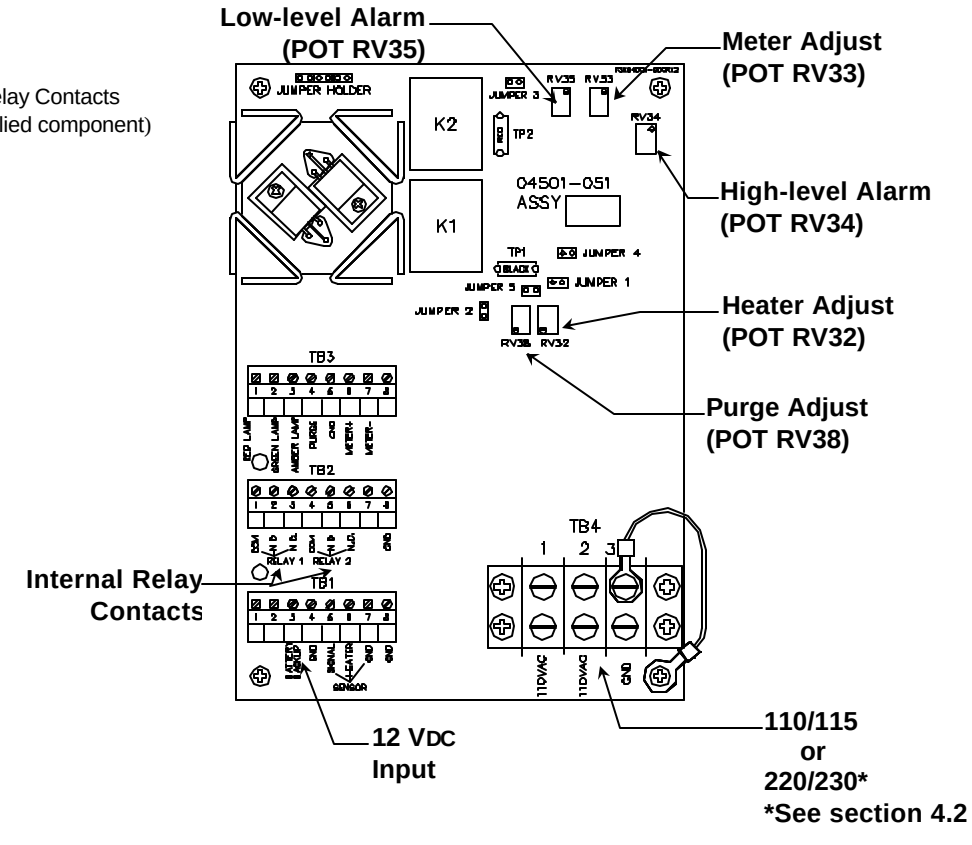


Figure 2: Internal Features of the ISA – M

4.0 Installation

The **ISA – M** is completely oiltight. Use the correct oiltight fitting for the cord or conduit when supplying power to the unit.

NOTE: This instrument is *NOT* rated for hazardous locations. The instrument must be located in a *NON*-Hazardous area.

4.1 Mounting and Power Hook-up

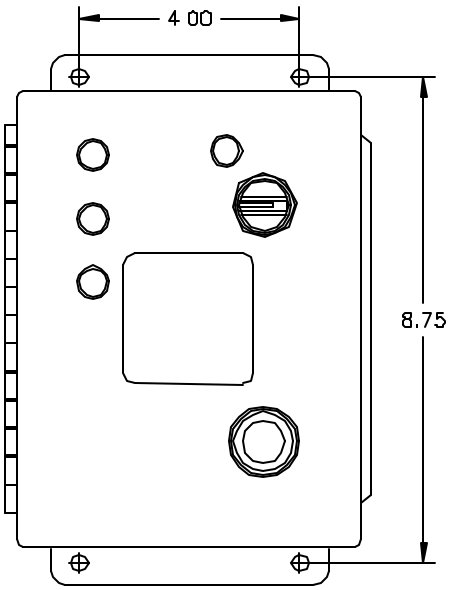


Figure 3: Mounting Dimensions of the ISA – M

1. A 110 VAC line cord is supplied, plug this into an appropriate outlet.
2. If conduit is preferred, remove the terminal strip cover from TB4 inside the control unit (simply pull the cover off of its holding prongs). Apply 110 VAC power to the appropriate terminals. (Refer to Figure 2).

CAUTION: Utilizing 220 VAC power requires a change in the transformer hook-up by a competent electrician or electronics technician; but this change is best done at ***ENMET***.

12 VDC may be used as a primary source (refer to Figure 2) or as an emergency back-up source, both ac and dc power can be applied at the same time. Current flows from the ac source; dc current will flow only when the ac power is interrupted.

3. Run the relay contact leads through the same oiltight fitting as the power supply leads or out through a second fitting.

NOTE: When the power supply is interrupted, the relays switch to the same position as for a true gas alarm condition, and the power light goes off. Do not connect the unit to other voltage supply lines.

4. Replace terminal strip cover on TB4 inside the control unit.
5. Proceed to Section 5.0 for initial warm-up and operating procedures.

4.2 Sensor Location

Gases have different densities. Some are heavier than air and concentrate at the bottom of a space. Some are lighter than air and gather at the top. Consider the density of the gas you want the sensor to detect when you install the sensor. Some examples are given below.

Table 1: Heavier than Air

Gas	Sensor Location
Bottled LP (liquefied petroleum)	Interior wall; 18-24" from floor. ▪ DO NOT locate directly above or beside gas appliances (ovens, heaters). ▪ Avoid locating anywhere near a vent or window or near an outside doorway.
Propane	
Butane	
Gasoline	
Trichloroethylene	
Vaporized hydrocarbons	
Hydrogen sulfide	

Table 2: Lighter than Air

Gas	Sensor Location
Natural gas (methane)	Near ceiling. ▪ DO NOT locate directly above appliances where it is subject to direct exposure to heat or steam.
Ammonia	
Hydrogen	

Table 3: Same Density as Air

Gas	Sensor Location
Carbon Monoxide	4-6 feet above the (generally uniform) floor. ▪ DO NOT locate in direct air currents of windows, doors, or vents.

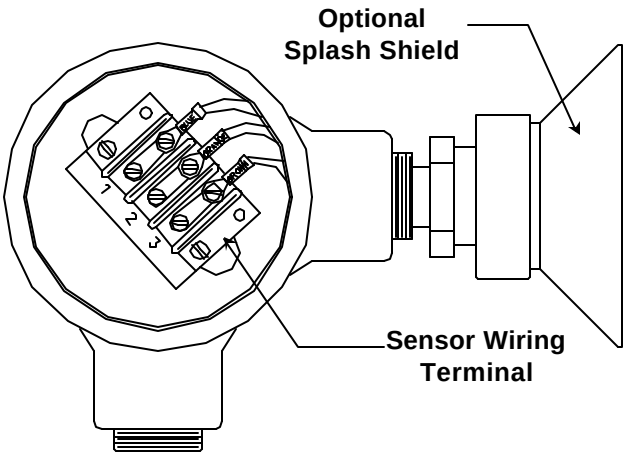
If you have a question involving the location of a unit or sensor, please contact your distributor or ***ENMET*** personnel. A technician will analyze the question and recommend a location.

4.3 Sensor Hook-up

The MOS sensor is connected to the **ISA-M** control unit with three conductor wiring, use the correct oiltight fitting. Two conductors supply heater current to the sensor. The third conductor is a signal wire. Size of heater wire depends on the distance between the particular sensor and the control unit. See Table 4.

Sensor wires correspond to the normal wire code:

orange – heater
brown – heater ground
blue – signal



Sensor Wiring		
FOR 812 / 813 / 814 SENSORS		
Position	**Function**	**Wire Color**
1	Signal	(Blue)
2	Heater	(Orange)
3	Ground	(Brown)

Figure 4: Internal View of Sensor Wiring

NOTE: The three color-coded wiring attachments must be performed by the user when replacing the sensor.

Table 4: Recommended Wire Gauge

Distance from Sensor to Control Unit	Recommended Wire Gauge
250 feet	16 AWG
350 feet	14 AWG
Longer Distances	Contact Factory

CAUTION: After you mount and install the **ISA – M,** you must adjust the sensor heater voltage (see section 4.4).

4.4 Sensor Heater Voltage

Heating the sensor promotes the oxidation reaction on the element surface. The temperature to which the sensor element is heated determines the selectivity of the equipment to certain gases.

A chart, located inside the instrument front cover, specifies the voltage for the sensor. Units requiring purging have two voltages specified. Refer to Figure 2 for potentiometer locations.

NOTE: Do not increase any sensor voltage to values greater than those given on the chart. Too high voltage can damage the sensor heater winding; and if that happens you have to replace the sensor.

YOU NEED:

- A digital voltmeter with a + or - 0.05% accuracy
- A small screwdriver for adjusting pots.

Measure DC volts across the brown and orange wires in the sensor assembly at the sensor, not at the terminal strip.

EXCEPTION: If your sensor is mounted directly onto the side of the enclosure, then measure DC volts at the terminal strip -- TB1-7 (ground) and TB1-6 (heater).

SENSORS REQUIRING PURGING:

1. Turn the switch to PURGE ON and adjust RV38 (purge POT.) to the voltage specified on the chart inside the unit (see Figure 2). NOTE: Adjust this pot. clockwise to increase, counterclockwise to decrease the voltage.
2. Switch to HORN OFF.
3. Now adjust the sensor heater pot. RV32 to the required voltage.
   NOTE: Adjust this pot. clockwise to increase, counterclockwise to decrease the voltage.

SENSORS NOT REQUIRING PURGING:

Adjust the sensor heater pot. (RV32; see Figure 2) to the required voltage.

NOTE: Sometimes, if a sensor is located a great distance from the control unit, the heater adjust may not, by itself, be able to bring the voltage to the required reading. If not, then adjust the purge adjust pot., RV38, to arrive at the necessary voltage.

NOTE: Once you have set the voltage at the sensor, check and record the voltage across TB1-7 (ground) and TB1-6 (heater). The next time you must check the sensor heater voltage, first check the voltage across TB1-7 and TB1-6. If this voltage has not changed, the sensor heater voltage at the sensor has also not changed. If the voltage across TB1-7 and TB1-6 has changed, you must reset the voltage at the sensor as described in the procedures above.

5.0 Operation

Mount and install the **ISA – M** electronics unit and sensor as outlined in the previous section (4.0).

NOTE: There is no ON/OFF switch on the unit. As a safety device, this unit is designed to be powered and ON at all times.

5.1 Warm – Up

1. Turn the switch to PURGE ON (when applicable) or HORN OFF.
2. For 5-30 minutes, after first applying power, the red gas alarm light stays on as the sensor heats and purges (clears) its surface of contaminating molecules that have collected while the sensor was inactive.
3. When the red and amber light turns off, and the green power light comes on, the initial warm-up is complete.
4. Turn the switch to OPERATE.

Reference: State of Operation of the ISA – M			
Normal Operation:	Green power light is on. No alarms. Switch is in the operate position. Enclosure feels warm to the touch.	**Alarm State:**	Green power light is off. Red or Amber light is on. Audio alarm on. Relay contacts in alarm position.

***WARNING*:** Any spontaneous alarm not triggered by the initial warm-up or rough test (see section 5.3) should be considered a potentially serious gas alarm situation. TAKE ACTION!

- ➔ Vacate all persons from the affected area. Observe these people for signs of toxic gas poisoning, carbon monoxide poisoning, etc.
- ➔ Open windows or vents where it is feasible; then, after the contaminated area is cleared, turn off all gas and electric appliances and gas pilot lights.
- ➔ Check all gas appliances and fixtures for leaking gas, pilot light failures, defective valves, and improper ventilation.
- ➔ Follow your company's prescribed safety procedures in addition to those mentioned above.

5.2 Precautions

Do not blow cigarette smoke on a sensor.

Do not squirt pure gases or liquid hydrocarbons, such as butane, propane, gasoline, etc. directly on the sensor.

Do not use a strong cleaning agent, wax or lacquer near a sensor.

5.3 Rough Test

To see that the instrument is capable of alarming:

1. Hold a butane lighter near the sensor cover.
2. Briefly depress the lever, without striking the flint, to squirt some butane vapors.
3. The alarm should trigger; green power light goes off and the red light and horn activate.

CAUTION: This rough test method is best for units that are set primarily for hydrocarbon responses (combustible). Many units set to respond to toxic gases or vapors require calibration gas to verify the alarm response capability.

6.0 Routine Gas Test and Recalibration

Perform this test at regular intervals, you decide how often; we recommend that you do it at least every six weeks.

NOTE: The gases should be identical, or equivalent (correlation gas) to those used to initially calibrate the unit, unless you want to recalibrate to a new gas or different concentration. In addition, calibration gases must be in a background of air; do not use gases with an inert gas background (such as nitrogen or argon).

6.1 Test

YOU NEED:

- Cylinder of high-level calibration gas with air used as background gas (for example 200 ppm CO in air)
- Calibration fixture (with humidifier/regulator, plastic tubing and calibration cup); ***ENMET*** part # 03700-001
- Clean water
- Small screwdriver

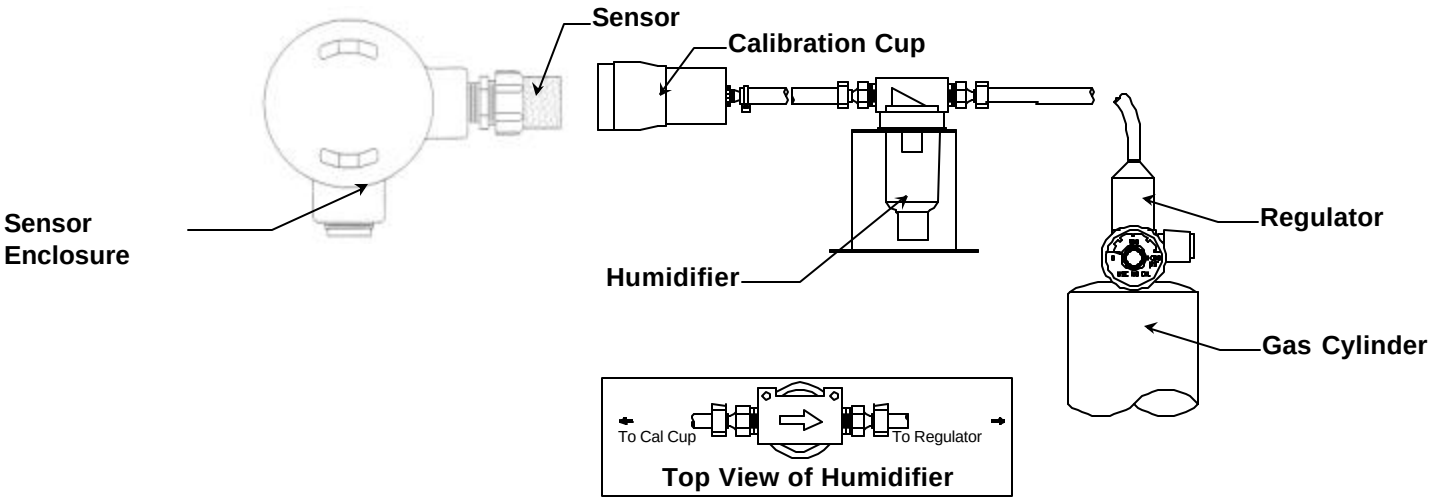


Figure 5: Exposing a Sensor to Test or Calibration Gas

PROCEDURE:

1. The unit must operate continuously for at least 24 hours before this test.
2. After 24 hours, turn the HORN OFF.
3. On units requiring purging, rotate switch to PURGE ON, purge for 20 minutes. After the purge, rotate switch to HORN OFF, wait 20 minutes for the sensor to stabilize.
4. Fill the humidifier bottle with tap water about half-way.
5. Attach the calibration fixture to the high-level gas cylinder. Set humidifier upright on a level surface.
6. Open the valve to allow a steady stream of gas to bubble through the water.
7. Put the cal cup of the calibration fixture over the sensor. Let the gas flow over the sensor until the alarm triggers. Use Table 5 for the approximate allowable time period until alarm:

Table 5: Approximate Alarm Time

Gas or Vapor	Time to Alarm
20 ppm CO	5 - 7 minutes
50 ppm CO	5 minutes
200 ppm CO	2 minutes
10% LEL methane	1 minute
20% LEL methane	1 minute
100 ppm vinyl chloride	1 - 2 minutes
typical hydrocarbon vapors	1 - 2 minutes
20% LEL propane	1 minute

8. After you verify the alarm response, turn the gas off and remove the calibration fixture from the gas cylinder.
9. Turn the switch back to OPERATE.

CAUTION: If steps 1 - 10 do not trigger the alarms, and no electrical or mechanical malfunction is apparent, you must recalibrate the instrument.

6.2 To Recalibrate

1. Wait 8 - 10 minutes for the sensor to recover from the test.
2. Repeat steps 3 - 7 as outlined in the test procedure above using the high level calibration gas.
3. With the gas still flowing, adjust the Meter Adjust potentiometer (Ref. Fig. 2) R33; ccw to increase, cw to decrease meter reading) with a small screwdriver.
   - You want to have the meter pass through the low level alarm point, to verify that the alarm light triggers.
   - If it does not, set the meter to the low alarm point and adjust R35 (low level alarm POT).
   - Then adjust the meter gain POT to pass through the high alarm point, verify that the alarm light triggers at the high alarm point.
   - If it does not, set the meter gain to the high alarm point adjust R34 to trigger the alarm light.
   - Turn the switch to OPERATE for a second to verify the horn is operational. This sets the alarm points (Refer to Figure 2).

CAUTION: *DO NOT* adjust for instantaneous alarm when test gas is first released. If you do, the calibration is inaccurate, and the sensor is overly sensitive.

4. Shut off the calibration gas flow at the valve on the gas cylinder.
5. Remove the calibration gas, the flow of clean air should clear the unit from its gas alarm state in less than one minute. After the alarms have cleared, turn the switch to OPERATE.

CAUTION: Do not use calibration gas with inert gases such as argon or nitrogen as a background. The background gas must be "air" or equivalent.

CAUTION: Do not totally dry gases directly from high-pressure cylinders.

7.0 Maintenance

The **ISA – M** gas monitor is a safety instrument and requires periodic testing and calibration at regular intervals. In addition, check for obvious mechanical damage or malfunctions such as burned out lamps. On units requiring purging, purge the sensor periodically. This interval varies with the amount of contaminants in the atmosphere.

4.1 Basic Troubleshooting

Symptom	Problem/Correction
When first plugged in, the unit alarms for up to 10 - 20 minutes.	If the unit has not been used recently, this is normal. The MOS sensor is cold and/or contaminated. Keep unit ON or PURGE (on units so equipped) overnight with the sensor in fresh air.
Red alarm light stays on continuously, even after allowed to operate (or PURGED) overnight.	Either hazardous gas conditions exist, or there is a contaminated sensor, or a bad circuit. Contact ***ENMET*** for voltage checks.
Either green or amber or red lights do not work.	There might be a burned out lamp.
Unit fails to alarm when calibration gas is applied.	Recalibration may be necessary. See section 6.0 If recalibration fails, check sensor voltage, cylinder contents and pressure.
Unit gradually creeps into alarm or sensitive.	Either hazardous gas conditions exist, or too recalibration is necessary. On units requiring purging, rotate to PURGE once a week for one hour to clean sensor surface.

7.2 Sensor Replacement

The MOS sensor is durable, it can be purged of contaminants by operating in PURGE for a sufficient length of time and at regular intervals.

Gross contamination usually occurs during unavoidable misuse. Close exposure to an open gas flame, dipping the sensor in a hydrocarbon such as lacquer, or continuous exposure to heavy concentrations of industrial vapors will grossly contaminate a sensor. A grossly contaminated sensor causes a continuous alarm.

If a sensor is bad, replace it.

PROCEDURE:

1. Obtain a new sensor assembly. Make sure the sensor type is identical to your original sensor (019, 030, 812, 813 or 109).
2. Disconnect the orange, brown and blue sensor wires.
3. Unscrew the assembly from the sensor enclosure.
4. Replace the bad sensor and reconnect the wires.
5. Set the sensor heater voltage (See Section 4.4).
6. Recalibrate the instrument (See Section 6.0).

7.3 Replacement Part Numbers

ENMET replacement part numbers:

Description	Part Number
Meter	03411-000
Lamp body	62012-010
Lens, red	62012-011
Lens, green	62012-012
Lens, amber	62012-013
Control unit light bulb	63001-002
Accessory Case	73083-000
Calibration adapter	03700-001
Cylinder of calibration gas	Contact ***ENMET*** for part number of target gas for each instrument. See note below.

NOTE: The gases should be identical, or equivalent (correlation gas) to those used to initially calibrate the unit, unless you want to recalibrate to a new gas or different concentration. In addition, calibration gases must be in a background of air; do not use gases with an inert gas background (such as nitrogen or argon).

8.0 Specifications

Enclosure	NEMA-12 enclosure
Size	Approximately 6" h x 8" w 4" d
Weight	Approximately 10 lbs.
Sensor Wiring Distance	Up to 1000 ft for most calibrations
Audio Alarm	2900 Hz, 95 decibels at 2 ft.
Maximum Power	117 VAC - 60 Hz - 25 watts
	12 VDC - 25 watts
Relay Current	2 amp steady, 5 amp surge
Sensor Life	Up to 3 years in clean air (no oil)
Response Time	Up to 5 minutes for low-level carbon monoxide gas calibrations

NOTE: *All specifications stated in this manual may change without notice.*

8.1 Options and Variations

Options:

220 VAC power input connection

NEMA-4X fiberglass enclosure

Variations:

a) Available in an explosion-proof instrument housing, Model ISA-44E. With this the equipment is suitable for operation in Class I, Division I, Groups C and D atmosphere, as defined in the National Electrical l Code. Units for Group B are available upon special order. Do not use the standard **ISA-M** where you are required by the National Electrical Code or local codes to use an explosion-proof variety.

b) Units that also monitor for oxygen deficiency in air are available; consult a distributor or ***ENMET***.

9.0 WARRANTY

ENMET warrants new instruments to be free from defects in workmanship and material under normal use for a period of one year from date of shipment from ***ENMET***. The warranty covers both parts and labor excluding instrument calibration and expendable parts such as calibration gas, filters, batteries, etc... Equipment believed to be defective should be returned to ***ENMET*** within the warranty period (transportation prepaid) for inspection. If the evaluation by ***ENMET*** confirms that the product is defective, it will be repaired or replaced at no charge, within the stated limitations, and returned prepaid to any location in the United States by the most economical means, e.g. Surface UPS/RPS. If an expedient means of transportation is requested during the warranty period, the customer is responsible for the difference between the most economical means and the expedient mode. ***ENMET*** shall not be liable for any loss or damage caused by the improper use of the product. The purchaser indemnifies and saves harmless the company with respect to any loss or damages that may arise through the use by the purchaser or others of this equipment.

This warranty is expressly given in lieu of all other warranties, either expressed or implied, including that of merchantability, and all other obligations or liabilities of ***ENMET*** which may arise in connection with this equipment. ***ENMET*** neither assumes nor authorizes any representative or other person to assume for it any obligation or liability other than that which is set forth herein.

9.1 Repair of Certain Units

The warranty does not apply to equipment returned in either of the conditions defined below. These are not the result of defective workmanship or material. We will renovate and return at owner's expense.

a) Gross Recalibration: We calibrate all **ISA – M** according to the customer order before shipping. Changing the potentiometers voids the warranty, except when following the calibration procedures (Sec. 6.0). When we receive such a unit for repair, and no defects exist, we will diagnose the problem and recalibrate the unit according to the original order.

b) Gross Sensor Contamination: The MOS sensor is durable. It can be purged of normal contaminants by operating the unit in the PURGE mode for a sufficient length of time. Gross contamination usually occurs during misuse. Here are three examples of gross sensor contamination:

Close exposure to an open gas flame.
Dipping the sensor in lacquer.
Continuous exposure to heavy concentrations of industrial vapors.

NOTE: When returning an instrument to the factory for service:

- Be sure to include paperwork.
- A purchase order, return address and telephone number will assist in the expedient repair and return of your unit.
- Include any specific instructions.
- For warranty service, include date of purchase
- If you require an estimate, please contact ***ENMET*** Corporation.

There are Return for Repair Instructions and Form on the last pages of this manual. This Form can be copied or used as needed.