

**ENMET Corporation**

**PO Box 979**

**Ann Arbor, MI 48106-0979**

## **Spectrum ON-LINE**

## **Instrument Manual**

**80003-033**

**September 1997**

**MCN-186; 03/06/98**

**MCN-204; 10/20/99**

**MCN-221; 11/10/99**

**MCN-228; 11/30/99**

**MCN-244; 09/25/00**

**MCN-252; 04/05/01**

**MCN-268; 11/05/01**

**MCN-276; 05/10/02**

**MCN-293; 05/27/03**

**MCN-308; 10/16/03**

**MCN-315; 02/12/04**



## Table of Contents

<b>INTRODUCTION</b> .....	<b>1</b>
1.1 Unpack.....	1
1.1.1 Check Order.....	1
1.1.2 Serial Numbers.....	1
1.2 Turn the instrument ON.....	2
1.2.1 Verify.....	2
1.2.2 Acknowledge alarm.....	2
1.2.3 Remove gas.....	2
1.2.4 Contact ENMET.....	2
<b>2.0 FEATURES AND INSTALLATION</b> .....	<b>2</b>
2.1 Features.....	2
2.2 Installation.....	3
2.2.1 Mount Enclosure.....	3
2.2.2 Relay Contacts.....	3
2.2.3 Turn On.....	3
<b>3.0 OPERATION</b> .....	<b>4</b>
3.1 Operational Menu.....	4
3.2 Gas Concentration Display and Alarms.....	5
3.4 Alarm Acknowledge.....	5
3.5 Data.....	5
3.6 Interference Gases.....	5
<b>4.0 MAINTENANCE</b> .....	<b>6</b>
4.1 Maintenance Menu.....	6
4.1.1 Key.....	7
4.1.2 Zero.....	7
4.1.3 Calibration.....	8
4.1.4 Changing the Alarm Level.....	9
4.1.5 Setting a New Key.....	9
4.2 Changing Components.....	9
4.2.1 Sensor Removal and Replacement.....	9
<b>5.0 REPLACEMENT PART NUMBERS</b> .....	<b>10</b>
<b>6.0 WARRANTY</b> .....	<b>11</b>
<b>APPENDIX A: CALIBRATION DATA TABLES</b> .....	<b>12</b>
<b>APPENDIX B: INTERFERENCE GASES</b> .....	<b>14</b>

## List of Illustrations

Figure 1: SPECTRUM ON-LINE Features.....	3
Figure 2: Operation Menu Diagram.....	4
Figure 3: Maintenance Menu Diagram.....	6
Figure 4: Intial Calibration of Replacement Sensor.....	8
Table 1: Gas Ranges, Alarm Points and Sensor Life.....	12
Table 2: Spectrum Calibration Voltage and Countdown Times.....	13
Figure 5: Identification of Calibration Adapters & Sample Draw System.....	13

### 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.]



## Introduction

The SPECTRUM ON LINE is a small powered by an AC adapter operated single channel gas detection instrument. Depending on the sensor supplied with the instrument, it can detect one of a number of potential target gases. An electrochemical cell detects the gas, and the gas concentration is displayed on an LCD. Audio and visual alarms occur when the target gas concentration exceeds a preset alarm point. At relatively low concentrations of the gas, an alarm can be acknowledged, which results in the temporary cessation of the audio alarm. Operation and maintenance procedures are managed with two pushbutton switches. For ruggedness and EMF protection, the instrument enclosure is an aluminum die casting. The instrument is shown in Figure 1.

A number of sensors have been qualified for target gases, the list is found in Table 1.

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

### 1.1 Unpack

Unpack the SPECTRUM ON LINE 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**

##### 1.1.1 Check Order

Check the contents of the shipment against the purchase order. Verify that the SPECTRUM ON LINE is received as ordered. Each SPECTRUM ON LINE 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.

##### 1.1.2 Serial Numbers

Each SPECTRUM ON LINE is serialized. These numbers are on tags on the equipment and are on record in an **ENMET** database.

## 1.2 Turn the instrument ON

Turn the instrument ON, by plugging the power supply into a standard 110 VAC wall outlet. In *uncontaminated* air, for most instruments the display should read 0000 within ten seconds of turn-on. For an oxygen SPECTRUM ON LINE, the display reads near 20.9%.

NOTE: Instruments using biased sensors, this time is extended to 4 minutes, stabilization may take as long as 1 hour. See Table 1.

### 1.2.1 Verify

The SPECTRUM ON LINE is calibrated prior to shipment. However, if the target gas is available, expose the sensor to it to verify that no damage occurred during shipment.

### 1.2.2 Acknowledge alarm

If the concentration of the target gas is greater than the alarm set point, the instrument indicates an alarm condition. Acknowledge the alarm by pressing and releasing the right hand pushbutton, SELECT; this silences the audio alarm for four minutes unless the concentration of the target gas is greater than the upper alarm limit. See Table 1 for a list of alarm set points and upper alarm limits for various target gases.

### 1.2.3 Remove gas

Remove the source of the target gas. After the display reads zero or close to it, unplug the instrument.

### 1.2.4 Contact ENMET

If the instrument does not operate as described, contact **ENMET** customer service personnel immediately.

## 2.0 Features and Installation

### 2.1 Features

The features of the SPECTRUM ON LINE are shown in Figure 1. These are:

DISPLAY	An LCD upon which either the gas concentration, or prompts for the operational and maintenance menus, are given.
PUSHBUTTON SWITCHES	There are two of these, as follows: <ul style="list-style-type: none"> <li>•OPTION The left hand switch.</li> <li>•SELECT The right hand switch.</li> </ul> <p>These switches are used to access and utilize the operational and maintenance menus.</p>
SENSOR HOUSING	A small cylindrical turret on the display surface; the membrane of the electrochemical sensor is exposed to the atmosphere through the hole in the turret.
VISUAL ALARM	A red LED which is ON whenever the target gas concentration is above the alarm point.
AUDIO ALARM	A small horn, which is ON whenever, the gas concentration is above the alarm point, until the alarm is acknowledged.
COVER	Retained with four screws and removed to change the sensor and access the terminal strip.
RELAY CONTACTS	On a terminal strip inside the enclosure.

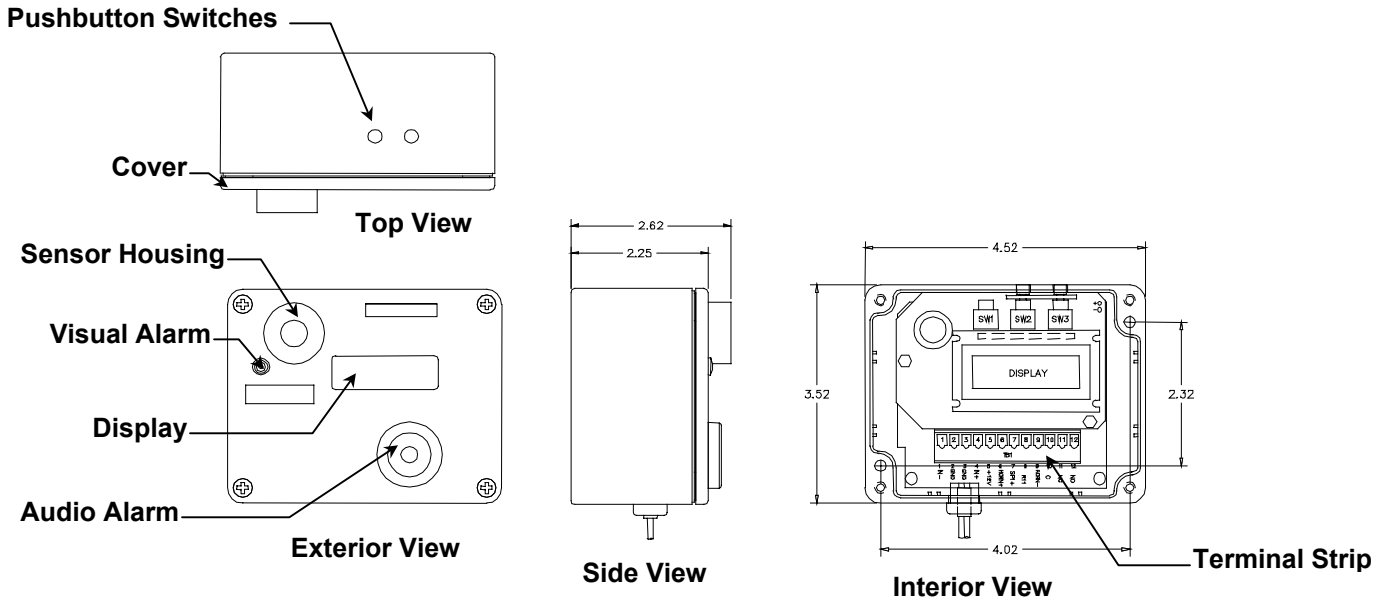


Figure 1: SPECTRUM ON-LINE Features

2.2 Installation

2.2.1 Mount Enclosure

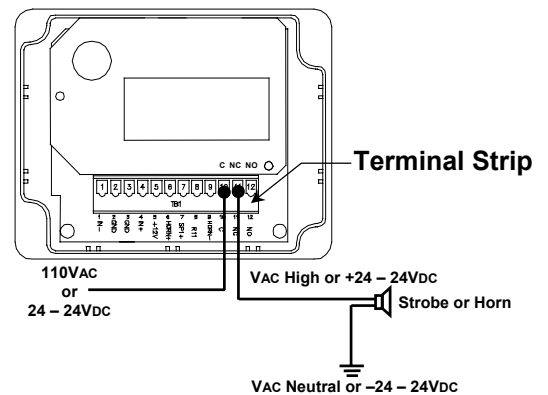
Mount enclosure at an appropriate location using the four mounting holes accessible inside the enclosure. See Figure 1 Dimensions are in inches.

2.2.2 Relay Contacts

One set of alarm relay contacts are accessible on a spring-clamp terminal strip inside the enclosure after removing the cover. See below for Terminal strip locations and suggested relay wiring.

Terminal position	Connection
10	C
11	NC
12	NO

Contact position refers to the unpowered condition that is also the alarm condition. Relay contacts are rated at 2amps. Instrument ground is accessible at terminal strip locations 2 and 3, and +12 VDC is available at locations 5, and 6. When powering an auxiliary device with +12 VDC, do not overload the power supply (exceed 200mA). If desired, the relay wires exit through the hole on the right side of the enclosure. Remove the hole plug and use an appropriate strain relief. The strain relief is available from ENMET; see Section 5.0, Replacement Parts List.



Suggested Relay wiring

2.2.3 Turn On

Plug the power supply into a 110 VAC outlet. The display should read “0000” within ten seconds when the monitor is supplied with uncontaminated air.

NOTE: Instruments using biased sensors, this time is extended to 4 minutes and stabilization may take as long as 1 hour. See Table 1.

### 3.0 Operation

#### 3.1 Operational Menu

The operational menu diagram is shown in Figure 2. This menu is accessed with the OPTION pushbutton switch, the left hand switch as viewed from the front of the instrument. Successive displays are achieved by repeatedly pushing the switch; as indicated by "O" in the menu diagram. The alarm acknowledgement function, the displays and function in the "see DATA" area, are accessed with SELECT pushbutton, indicated by "S" in the menu diagram.

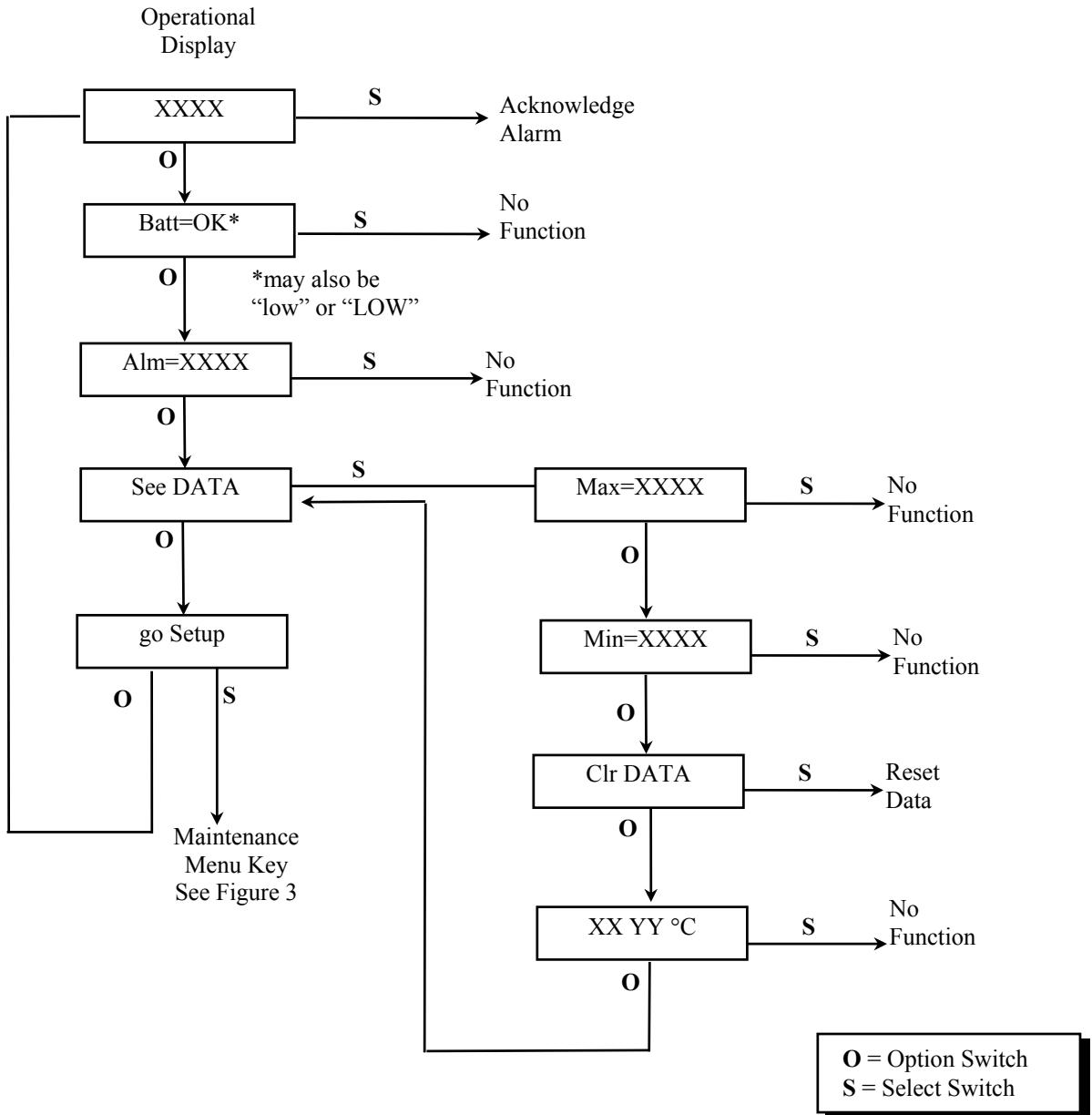


Figure 2: Operation Menu Diagram



### 3.2 Gas Concentration Display and Alarms

The LCD furnishes a numerical display of the target gas concentration from 0000 to the upper limit of the range, shown in Table 1. The display of the target gas concentration is termed the "operational display". If the target gas concentration exceeds the upper limit of the range, the display is the numerical upper limit and a plus sign, for example, "0200+", for hydrogen sulfide. When the concentration of the target gas exceeds the alarm set point, the audio and visual alarms are activated. The gas concentration continues to be displayed during alarm. The alarm point is adjustable between a lower and upper alarm limit by accessing the maintenance menu; these and the factory setting of the alarm point are also given in Table 1. A user should have a justifiable application-based reason for setting the alarm point higher than the factory setting. When the target gas concentration drops below the alarm point, the audio and visual alarms cease operation. The alarm point setting can be observed on the display by pushing the OPTION pushbutton twice.

Some types of gases are difficult to detect in an ambient/static atmosphere. For these types of gases **ENMET** recommends using a sampling system similar to **ENMET** Sample Draw Module 03700-029. See Appendix A Table 2.

For the oxygen SPECTRUM ON LINE, the zero gas display is 20.9% oxygen, and the two alarm points are at 19.5% (adjustable) and 23.5% (fixed).

If an alarm concentration is encountered when the display is at a location in the operational menu other than the operational display, the audio and visual alarms are activated and the alarm cannot be acknowledged.

If the display is left idle at a location other than the operational display for 45 seconds it automatically transfers to the operational display.

### 3.4 Alarm Acknowledge

When the instrument is in alarm, and the target gas concentration is below the upper alarm limit, the alarm can be acknowledged by pressing and releasing the SELECT pushbutton, but only when the instrument is at the operational display. The acknowledgement causes the temporary cessation of the audio alarm; the red LED continues to be ON. The audio alarm is OFF for a period of four minutes, after which it is reactivated, if the gas concentration is still above the alarm point. The alarm can again be acknowledged. However, acknowledgement of the alarm at gas concentrations above the upper alarm limit does not result in audio alarm cessation, and if the gas concentration rises above the upper alarm limit during an alarm condition which has been acknowledged, the audio alarm resumes operation.

### 3.5 Data

The SPECTRUM ON LINE retains the maximum and minimum gas concentration values encountered since turn-on, or since the data was cleared and reset. To access this press the OPTION pushbutton three times; "see DATA" is displayed. Press the SELECT pushbutton; the maximum concentration since turn-on or last reset is displayed. Press the OPTION pushbutton again; the minimum concentration since turn-on or last reset is displayed. Press the OPTION pushbutton again; "clr DATA" is displayed. Pushing the SELECT pushbutton clears the data and resets it to the current concentration. See comments on the use of this feature in Section 4.1.3, Calibration.

Pushing the OPTION pushbutton once more results in a display the internal temperature of the instrument in degrees centigrade and Fahrenheit. Another push of the OPTION pushbutton results in a display of the version of the code stored in the instrument. Push the OPTION pushbutton three more times to return to the operational display.

### 3.6 Interference Gases

For each target gas, some gases other than the target gas cause a sensor response, and thus are termed "interference gases". A compilation of known interference gases for the various target gases is given in Appendix B, along with gases that are known to not cause a sensor response.

## 4.0 Maintenance

### 4.1 Maintenance Menu

From the operational display, press the OPTION pushbutton four times; "go SETUP" is displayed. This is the entrance to the maintenance menu. The maintenance menu flow diagram is shown in Figure 3.

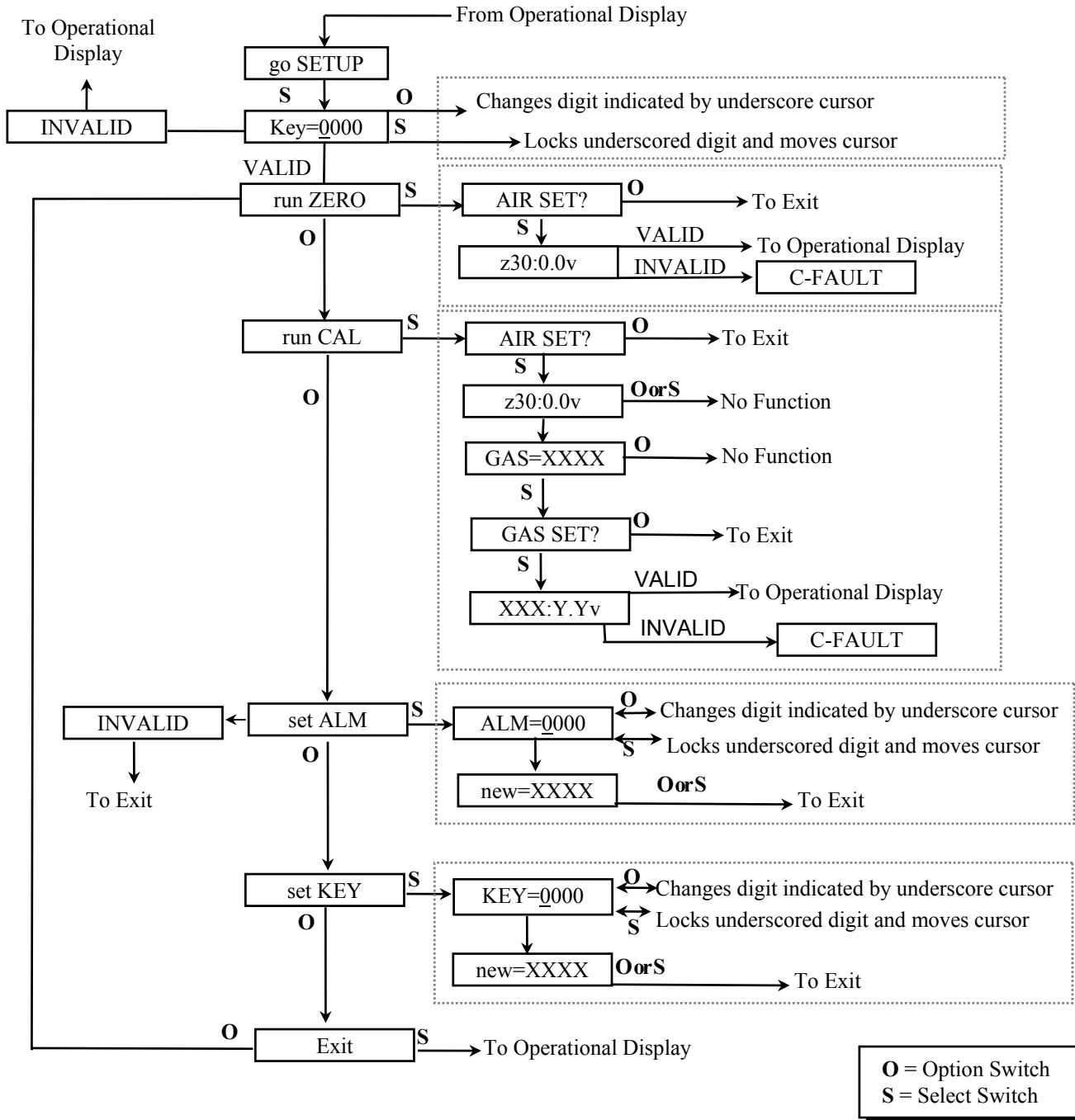


Figure 3: Maintenance Menu Diagram

#### 4.1.1 Key

Entrance to the maintenance menu is guarded with a four digit numerical key. The factory default setting of the key is 1270 (The process by which a different key is set is given in paragraph 4.1.5, below). When the valid numerical key is inserted, the user is allowed to enter the maintenance menu.

When in the "go SETUP" location, press the SELECT pushbutton; "Key=0000" is displayed. The underscore cursor is under the left hand digit. To insert the key, press the OPTION pushbutton to change the left hand digit, and choose the correct digit; then press the SELECT pushbutton, which locks in the chosen left hand digit and moves the underscore cursor one space to the right. Continue this process until the four digit key is complete. When the valid key is inserted in this manner, the display is transferred to the "run ZERO" portion of the maintenance menu. When an invalid key is inserted, "INVALID" is briefly displayed, and the instrument returns to the operational display.

#### 4.1.2 Zero

A valid key entry sets the instrument at the "run ZERO" location, of the maintenance menu, which enables the setting of the zero gas concentration point. This is desirable if the zero reference of the gas sensor has drifted over a period of time, indicated by a persistent gas concentration reading in a clean environment. Note that the calibration sequence given below also includes setting the zero point. If a full calibration is required, instead of setting just the zero point, push the OPTION button once; "run CAL" is displayed. See paragraph 4.1.3, below.

To set the zero point without performing full calibration, from the "run ZERO" location press the SELECT pushbutton; "AIR SET?" is displayed. Be certain that the instrument is in clean air, uncontaminated by the target gas. If uncertain of the environment, use pure compressed air from a pressurized cylinder, and flow it over the sensor at a low rate.

With the instrument in "AIR SET?", press the SELECT pushbutton again. "z30:0.0v" is displayed; this is a counter that counts down in seconds from 30 to 0. The validity of the new zero setting is then examined; if it is within preset parameters, the display is transferred to the operational display in the operation menu.

If the new zero setting is not between preset parameters, "C-FAULT" is displayed. Unplugging and then plugging in the power supply turns the instrument OFF, then ON again. This re-boots the system with the most recent valid zero setting.

### 4.1.3 Calibration

**NOTE:** Calibration must be performed at normal room temperature (20-25°C) for optimal performance. If the instrument is exposed to temperature extremes just prior to calibration, allow it to stabilize to room temperature. The internal temperature of the instrument is verified by cycling through the "see DATA" menu.

In order to calibrate the instrument, it is first zeroed in a procedure similar to the one described above. Then the sensor is presented with a known concentration of the target gas, in air or an inert gas such as nitrogen, called the "span gas". After an appropriate interval, which is timed, the new span setting is examined for validity.

In some cases, the concentration of target gas in the span gas is greater than the concentration expected in the workplace. If action is not taken, the calibration gas concentration may become the permanent maximum concentration retained and displayed as data (see Section 3.5). It is good practice to record any data desired before calibration, and then to reset after calibration to clear the calibration gas concentration from memory.

A valid key entry sets the instrument at the "run ZERO" location of the maintenance menu. Press the **OPTION** pushbutton once to access the "run CAL" display, then press the **SELECT** pushbutton; "AIR SET?" is displayed. Zero the instrument as described in paragraph 4.1.2 above. When the zero timer is complete, the display indicates "GAS=XXXX", where the numbers indicate the correct span gas concentration the instrument is equipped to detect; for a CO SPECTRUM the span gas is 100 ppm CO, for Cl<sub>2</sub> SPECTRUM the span gas is 5 ppm chlorine, and so forth. The correct span gas is given in Table 2 of Appendix A, for various target gases.

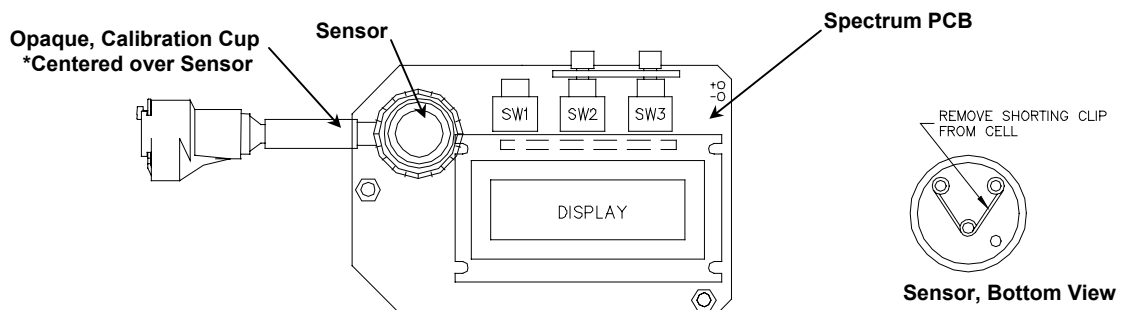
#### At the "GAS=XXXX" display:

1. Assure that the correct span gas is available.
2. Connect the calibration adapter to the cylinder along with the correct calibration cover; see Appendix A Table 2.
3. Open the calibration valve so that the span gas flows.
4. Press the **SELECT** pushbutton; "GAS SET?" is displayed.
5. Connect the span gas to the instrument so the calibration gas flows over the sensor.
6. Press the **SELECT** pushbutton; "XXX:Y.Yv" is displayed.
7. Remove span gas

The XXX is a counter which counts down in seconds to zero from the correct starting time to provide the proper time interval for calibration; this time interval may vary depending on your target gas. The Y.Y v indicates a sensor signal which is used during the sensor replacement procedure. When the timer reaches zero, the new calibration and zero gas settings are examined for validity. If the value is within preset parameters, the display is transferred to the gas operational display in the operations menu.

During calibration the audio alarm is disabled, and after calibration is complete the audio alarm remains disabled for up to 2.5 minutes.

If the new settings are not within preset parameters, "C-FAULT" is displayed. Unplugging and then plugging in the power supply turns the instrument OFF, then ON again. This re-boots the system with the most recent valid zero and calibration settings. Recalibrate. If after recalibration the instrument still displays "C-FAULT" the sensor may be expired. Replace the sensor in accordance with Section 4.2.1.



**\*CAUTION:** Having the calibration cup too tight will cause the sensor to become deadheaded resulting in an inaccurate calibration.

**Figure 4:Initial Calibration of Replacement Sensor**

#### 4.1.4 Changing the Alarm Level

A valid key entry sets the instrument at the "run ZERO" location of the maintenance menu. Press the OPTION pushbutton twice to access the "set ALM" display, then press the SELECT pushbutton; ALM=0000" is displayed. This is called the alarm update window, and the value displayed is the present alarm setpoint. The underscore cursor is under the far left digit. Press the OPTION pushbutton to change the underscored digit; select the desired digit, and press the SELECT pushbutton to lock in the desired digit and move the underscore cursor one position to the right. When the desired new alarm point is set "new=XXXX" is displayed. Press either the OPTION or SELECT pushbutton to exit the alarm update window. If the new alarm setting is valid, "exit" is displayed. Press the OPTION pushbutton to return to the operational display, or the SELECT pushbutton to return to "run ZERO".

For the safety of the user, there are upper and lower limits past which the alarm setting is invalid, and the instrument does not accept them. If an invalid alarm setting is attempted, after the numerical value is inserted in the "ALM=0000" window, pressing the OPTION or SELECT pushbutton results in a momentary display of "INVALID" after which the display returns to the alarm update window. Exiting the alarm update window at this point results in an alarm point setting unchanged from the value present when the procedure was begun.

Factory default alarm setpoints and alarm limits are shown in Table 1.

#### 4.1.5 Setting a New Key

A valid key entry sets the instrument at the "run ZERO" location of the maintenance menu. Press the OPTION pushbutton four times to access the "set KEY" display. Press the SELECT pushbutton once; "KEY=0000 is displayed. A new key can be set by changing the underscored number with the OPTION pushbutton and moving the underscore cursor with the SELECT pushbutton. After the new key is entered "new-XXXX" is displayed, press the OPTION or SELECT pushbutton to display to "exit", then press the OPTION pushbutton to return to "run ZERO".

NOTE: Four digit key numbers should be selected carefully and recorded. Without the correct key, the maintenance menu cannot be accessed. If a four digit key number is lost, call **ENMET** customer service personnel.

## 4.2 Changing Components

Changing the sensor, or the display requires that the cover of the instrument to be removed; remove the four phillips head, cover retaining, screws and then the cover.

#### 4.2.1 Sensor Removal and Replacement

A sensor must be replaced when it no longer responds adequately to the target gas. This is indicated by a low gas concentration reading when exposed to a known concentration of the target gas, and the inability to calibrate the instrument, without a "C-FAULT" display after calibration. Expected sensor lifetimes in normal environments are given in Table 1.

After removing the cover of the enclosure, unplug the sensor from the circuit board.

**CAUTION:** New sensors may come with a shorting clip that must be removed for proper operation.

Remove the shorting clip (if present) from the new sensor and plug the new sensor in place. Allow the sensor to stabilize in the instrument with the power on for one hour before the initial calibration of a new sensor.

The initial calibration of a new sensor must be performed with the cover removed from the instrument enclosure. Follow the procedure for calibrating the instrument as outlined in Section 4.1.3 of this manual with the following modification:

NOTE: During this procedure put the OPAQUE calibration cup, 02552-008, directly over the sensor and make sure it stays centered.

**During the application of the span gas, the counter counts down from an upper value given in Table 2. When the counter gets down to 60, adjust the potentiometer located to the left of the display on the instrument circuit board, so that the display to the right of the counter reads a little above the calibration voltage given for the target gas in Table 2. As the counter continues, turn the pot so that the calibration voltage is reached when the counter reaches 30. This is a one-time adjustment to align the sensor output with the instrument electronics. It should only be performed upon sensor replacement. All future calibrations should follow the procedure in Section 4.1.3.**

Replace the cover of the instrument. Recalibrate the instrument according to the procedure in Section 4.1.3. to assure sensor output alignment.

NOTE: that the sensor must be replaced with a sensor for the same target gas; the instrument cannot be changed to detect a different target gas without modifications in addition to changing the sensor type.

## 5.0 Replacement Part Numbers

**ENMET** part numbers for replacement parts and accessories:

### Calibration Equipment

Cylinder Adapter, 34 liters	02506-002
Cylinder Adapter, 17 liters	02506-004
*Calibration cup, (Initial Calibration)	02552-008 (Opaque)
Calibration cup	03620-011 (White)
Sampling Adapter	03620-018
Female Quick Release	73073-020

\*Used on all Sensor Replacements.

### Calibration Gas

Calibration gas, chlorine	03231-005
Calibration gas, hydrogen sulfide	03214-020
Calibration gas, hydrogen cyanide	03203-010
Calibration gas, sulfur dioxide	03215-015
Calibration gas, ammonia	03218-025
Ozone generator	04055-0800

Other calibration gases are available, contact **ENMET** for details.

### Replacement Sensors and parts

Replacement chlorine sensor	67020-0100
Replacement hydrogen sulfide sensor	67020-0200
Replacement hydrogen cyanide sensor	67020-0300
Replacement hydrogen chloride sensor	67020-0400
Replacement sulfur dioxide sensor	67024-0500
Replacement phosgene sensor	67020-0600
Replacement hydrogen fluoride sensor	67020-0700
Replacement ozone sensor	67020-0803
Replacement oxygen sensor	67016-1114
Replacement carbon monoxide sensor	67020-1200
Replacement fluorine sensor	67020-1400
Replacement hydrogen sensor	67020-1500
Replacement nitrogen dioxide sensor	67020-1700
Replacement nitrous oxide sensor	67020-1750
Replacement ammonia sensor	67020-2400
Replacement arsine sensor	67020-4000
Replacement silane sensor	67020-4003
Display Assembly	62022-007
Strain relief	73046-002

## 6.0 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/FedEx Ground. 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.

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

## Appendix A: Calibration Data Tables

**Table 1: Gas Ranges, Alarm Points and Sensor Life**

Gas	Range	Alarm lower limit	Alarm upper limit	Factory Alarm Set Point	Expected Sensor Lifetime
Ammonia	0-100ppm	15ppm	50ppm	25ppm	1 year
Arsine	0-0.99ppm	0.03ppm	0.10ppm	0.05ppm	1-1.5 years
Carbon Monoxide	0-1000ppm	5ppm	200ppm	35ppm	2-3 years
Chlorine	0-10ppm	0.5ppm	5.0ppm	1.0ppm	1-2 years
Fluorine	0-10ppm	1ppm	5ppm	1ppm	2-3 years
Hydrogen	0-1000ppm	200ppm	750ppm	200ppm	1-2 years
Hydrogen Chloride ①	0-20ppm	3.0ppm	10.0ppm	5.0ppm	1-2 years
Hydrogen Cyanide	0-20ppm	3.0ppm	10ppm	4.7ppm	2-3 years
Hydrogen Fluoride	0-10ppm	2.0ppm	6.0ppm	3.0ppm	1 year
Hydrogen Sulfide	0-200ppm	5.0ppm	25ppm	10ppm	2-3 years
Nitric Oxide ①	0-100ppm	15ppm	50ppm	25ppm	1-2 years
Nitrogen Dioxide	0-10ppm	1.0ppm	5.0ppm	3.0ppm	1-2 years
Oxygen	0-25%	16%	23.5%	19.5% & 23.5%	1.5-2 years
Ozone	0-0.99ppm	0.05ppm	0.2ppm	0.1ppm	1-1.5 years
Phosgene	0-0.99ppm	0.05ppm	0.20ppm	0.1ppm	1 years
Phosphine	0-0.99ppm	0.15ppm	0.30ppm	0.50ppm	1-1.5 years
Silane	0-30ppm	3ppm	5ppm	5ppm	1-1.5 years
Sulfur Dioxide	0-20ppm	2.0ppm	10ppm	5ppm	1-2 years

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

① **Biased Sensors:** Instruments using biased sensor, stabilization time is extended to 4 minutes. Complete stabilization may take as long as 1 hour. When instrument is turned on it may display **XXXX +**. If instrument has been off for an extended amount of time it may be necessary to “cycle” (turn on and off) the instrument several times.



**Table 2: Spectrum Calibration Voltage and Countdown Times**

NOTE: The following are values used for production calibration. Not all gases are available for field calibration; contact **ENMET** customer service personnel.

Gas	Calibration Gas	* Calibration Cup Δ	Calibration Voltage	Countdown Time
Ammonia	25ppm	* 03620-011	0.67	180 sec
Arsine (2)	0.5ppm PH <sub>3</sub> = 0.38ppm	03620-018 Δ	0.10	120 sec
Carbon Monoxide	100ppm	* 03620-011	1.70	120 sec
Chlorine (2)	5ppm	03620-011 Δ	1.40	180 sec
Fluorine (2)	3ppm Cl <sub>2</sub> = 7.5ppm	03620-011 Δ	1.80	240 sec
Hydrazine	0.3ppm	TBD	0.91	240 sec
Hydrogen	800ppm	* 03620-011	2.20	180 sec
Hydrogen Chloride (2)	10ppm	03620-018 Δ	2.10	180 sec
Hydrogen Cyanide	10ppm	* 03620-011	2.10	120 sec
Hydrogen Fluoride (1)	5ppm	TBD	1.40	240 sec
Hydrogen Sulfide	20ppm	* 03620-011	0.46	120 sec
Nitric Oxide	25ppm	TBD	0.67	90 sec
Nitrogen Dioxide	5ppm	* 03620-011	1.30	120 sec
Oxygen	20.9%(air)	* 03620-011	2.80	120 sec
Ozone (1)	0.3ppm	03620-018 Δ	0.75	240 sec
Phosgene (1)	0.66ppm	03620-018 Δ	0.18	240 sec
Phosphine (2)	0.5ppm	* 03620-011	0.13	120 sec
Silane	5ppm	TBD	0.54	120 sec
Sulfur Dioxide	10ppm	TBD	2.10	90 sec

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

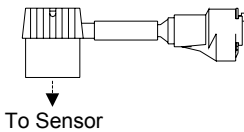
TBD – To Be Determined

(1) Require use of Sample Draw System. See Figure 5.

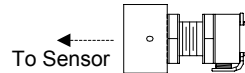
(2) Recommended use of Sample Draw System, for enhanced sensitivity and speed of response. See Figure 5.

**\* Initial Calibration Cup 02552-008**

For ALL Sensor Replacement

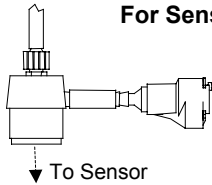


**Calibration Cup 03620-011**

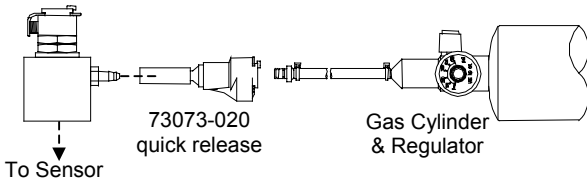


**Δ Initial Calibration Cup 02552-023**

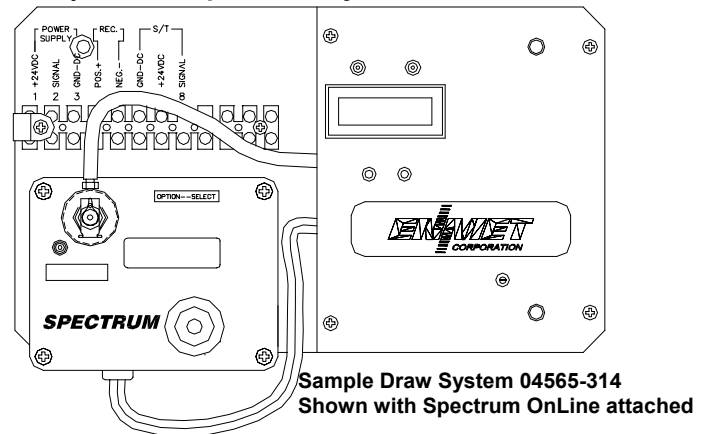
For Sensor Replacement



**Sample Adapter 03620-018**



**Example of Sample Draw System**



**Figure 5: Identification of Calibration Adapters & Sample Draw System**

## Appendix B: Interference Gases

### Interference Table for Selected Spectrum Sensors

#### SPECTRUM Series for AMMONIA (3E-100 sensor)

The following gases cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Interferant Concentration in ppm</b>	<b>Instrument Reading in ppm</b>
ethanol	1000	1
isopropanol	450	1
hydrogen sulfide	14	10
methanol	1200	3
hydrogen	1000	80
carbon monoxide	300	100
sulfur dioxide	25	-21
nitrogen dioxide	50	25
hydrogen cyanide	10	-18

The following gases or vapors have been tested and do not cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Concentration in ppm</b>
chlorine	5
unsaturated hc (ethylene)	1.0 %
saturated hydrocarbons	abundant

#### SPECTRUM Series for CARBON MONOXIDE (3E sensor)

The following gases cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Interferant Concentration in ppm</b>	<b>Instrument Reading in ppm</b>
hydrogen	1000	450
nitric oxide	100	25

The following gases or vapors have been tested and do not cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Concentration in ppm</b>
ammonia	100
chlorine	5
hydrogen cyanide	10
ethylene	2.0 % *
carbon dioxide	5,000
methane	10,000
sulfur dioxide	10 *
hydrogen sulfide	10 *
nitrogen dioxide	10 *
isopropanol	1,025 *
gasoline vapor	saturated *

\*with onboard filter; continuous high level exposure may reduce the filter efficiency

**SPECTRUM Series for CHLORINE (3E sensor)**

The following gases cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Interferant Concentration in ppm</b>	<b>Instrument Reading in ppm</b>
hydrogen sulfide	10	-0.3
sulfur dioxide	5	-1.2
nitrogen dioxide	5	0.1
bromine	1	1.0
chlorine dioxide	0.32	0.3
ammonia	1,000	-1.1

The following gases or vapors have been tested and do not cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Concentration in ppm</b>
carbon monoxide	300
carbon dioxide	100,000
nitrogen	100. %
hydrogen chloride	20
hydrocarbons, general	% range
hydrogen	1,000
ethanol	6.6 %
ammonia	65

**SPECTRUM Series for HYDROGEN SULFIDE (3E sensor)**

The following gases cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Interferant Concentration in ppm</b>	<b>Instrument Reading in ppm</b>
carbon monoxide	100	3
chlorine	20	-1
ethylene	500	2
hydrogen	100	5
hydrogen	20,000	100
hydrogen cyanide	10	1
sulfur dioxide	10	3

The following gases or vapors have been tested and do not cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Concentration in ppm</b>
ammonia	100
carbon dioxide	5,000
methane	10,000
sulfur dioxide	3
nitrogen dioxide	10

**SPECTRUM Series for Hydrogen Chloride (3E 30 sensor)**

The following gases cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Interferant Concentration in ppm</b>	<b>Instrument Reading in ppm</b>
hydrogen bromide	5	5
hydrogen sulfide	14	30
sulfur dioxide	5	3.5
chlorine	5	1
hydrogen cyanide	14	1
arsine	330 ppb	.4
ethanol	6.6%	6

The following gases or vapors have been tested and do not cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Concentration in ppm</b>
carbon monoxide	300
carbon dioxide	5000
nitrogen	100%
hydrocarbons	% range
hydrogen	1000
phosgene	.5
chlorinated hydrocarbons	% range
ammonia	300

**SPECTRUM Series for Hydrogen Fluoride (3E 10 sensor)**

The following gases cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Interferant Concentration in ppm</b>	<b>Instrument Reading in ppm</b>
chlorine or bromine	5	.51
sulfur dioxide	2	2
hydrogen chloride	5	.75

The following gases or vapors have been tested and do not cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Concentration in ppm</b>
alcohols (i.e. IPA)	1000
ammonia	100
hydrogen	1000
carbon monoxide	50
carbon dioxide	10%
unsaturated HC(ethylene)	1%
hydrogen sulfide	20

**SPECTRUM Series for Fluorine (3E 10 sensor)**

The following gases cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Interferant Concentration in ppm</b>	<b>Instrument Reading in ppm</b>
chlorine	1	2
hydrogen sulfide	10	-1
sulfur dioxide	5	-3.2
nitrogen dioxide	5	.5
bromine	1	3
ammonia	1000	-3.1

The following gases or vapors have been tested and do not cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Concentration in ppm</b>
carbon monoxide	300
carbon dioxide	100000
nitrogen	100%
hydrogen chloride	10
hydrocarbons	% range
hydrogen	1000
hydrogen cyanide	10
ethanol	4%

**SPECTRUM Series for Hydrogen (2E 2000 sensor)**

The following gases cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Interferant Concentration in ppm</b>	<b>Instrument Reading in ppm</b>
carbon monoxide	50	.06
ethylene	500	.28
sulfur dioxide	2	.06
isopropanol	1090	180

The following gases or vapors have been tested and do not cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Concentration in ppm</b>
ammonia	100
carbon dioxide	1000
chlorine	5
hydrogen cyanide	10
hydrogen sulfide	10*
methane	10000
nitrogen dioxide	10
sulfur dioxide	2

\*with onboard filter; continuous high level exposure may reduce the filter efficiency

**SPECTRUM Series for Nitric Oxide (3E 100 sensor)**

The following gases or vapors have been tested and do not cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Concentration in ppm</b>
chlorine	5
nitrogen dioxide	100
hydrogen	1000
carbon monoxide	1000
carbon dioxide	10000
saturated HC, alcohols	abundant
sulfur dioxide	50

**SPECTRUM Series for Nitrogen Dioxide (3E sensor)**

The following gases cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Interferant Concentration in ppm</b>	<b>Instrument Reading in ppm</b>
chlorine	1	3
ozone	1	0.7

The following gases or vapors have been tested and do not cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Concentration in ppm</b>
hydrogen chloride	5
nitrogen oxide	100
hydrogen	1000
carbon monoxide	1000
carbon dioxide	10000
saturated HC, alcohols	abundant
sulfur dioxide	50
ammonia	30

**SPECTRUM Series for Hydrazine (2E sensor)**

The following gases cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Interferant Concentration in ppm</b>	<b>Instrument Reading in ppm</b>
ammonia	200	0.4
methyl hydrazine	1	0.72
1.1 dimethyl hydrazine	1	0.45
chlorine	3	-0.02
hydrogen sulfide	20	0.1

The following gases or vapors have been tested and do not cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Concentration in ppm</b>
ethanol	1000
Isopropanol	450
hydrogen peroxide	10
hydrogen chloride	7
methanol	1200
hydrogen	2000
carbon monoxide	1000
carbon dioxide	5000
unsaturated HC (ethylene)	1%

**SPECTRUM Series for Ozone (3E 1 sensor)**

The following gases cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Interferant Concentration in ppm</b>	<b>Instrument Reading in ppm</b>
chlorine	1	0.80
fluorine	100ppb	0.07
germane	1	1
nitrogen dioxide	1	0.09

The following gases or vapors have been tested and do not cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Concentration in ppm</b>
hydrogen sulfide	1
sulfur dioxide	2
phosphine	100 ppb
carbon monoxide	300
carbon dioxide	5000
nitrogen	100%
nitrogen monoxide	10
hydrocarbons	% range
hydrogen	1000
hydrogen cyanide	10
ammonia	10
hydrogen fluoride	3.8
hydrochloric acid	10

**SPECTRUM Series for Hydrogen Cyanide (2E 30 sensor)**

The following gases cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Interferant Concentration in ppm</b>	<b>Instrument Reading in ppm</b>
hydrogen sulfide	15	40†
chlorine	5	-1
nitrogen dioxide	100	-40†

The following gases or vapors have been tested and do not cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Concentration in ppm</b>
hydrogen chloride	10*
methane	2000
carbon monoxide	300
carbon dioxide	10 %
freon 12	5000
petrol	300
sulfur dioxide	50*
nitrogen	100 %
nitrogen monoxide	100
chlorinated hydrocarbons	<200

† Long term exposure may destroy the sensor.

\*with onboard filter; continuous high level exposure may reduce the filter efficiency

**SPECTRUM Series for Sulphur Dioxide(4S sensor)**

The following gases cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Interferant Concentration in ppm</b>	<b>Instrument Reading in ppm</b>
carbon monoxide	300	<3
hydrogen sulphide	15	0
nitric oxide	35	0
nitrogen dioxide	5	≈-5

The following gases or vapors have been tested and do not cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Concentration in ppm</b>
chlorine	1
hydrogen	200
hydrogen cyanide	10
hydrogen chloride	5
ethylene	100

**SPECTRUM Series for Arsine (2E sensor)**

The following gases cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Interferant Concentration in ppm</b>	<b>Instrument Reading in ppm</b>
phosphine	100 ppb	110
chlorine	5	-400
hydrogen cyanide	10	100
ammonia	100	10
diborane	100	35
silane	1	100
germane	1.1	100
hydrogene selenide	50 ppb	5

The following gases or vapors have been tested and do not cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Concentration in ppm</b>
hydrogen sulfide	1*
sulfur dioxide	2
hydrochloric acid	5
carbon monoxide	300
carbon dioxide	5000
nitrogen	100 %
hydrocarbons	% range
hydrogen	1000

\*with onboard filter; continuous high level exposure may reduce the filter efficiency



**SPECTRUM Series for Phosgene (3E sensor)**

The following gases cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Interferant Concentration in ppm</b>	<b>Instrument Reading in ppm</b>
ammonia	50	5, drops to 0 in short time
abundant change in humidity		yes

The following gases or vapors have been tested and do not cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Concentration in ppm</b>
hydrogen sulfide	1*
sulfur dioxide	2
hydrochloric acid	5*
carobn monoxide	300
carbon dioxide	5000
nitrogen	100%
chlorine	1
hydrocarobons	% range
hydrogen	1000
sulfuric acid	5

\*with onboard filter; continuous high level exposure may reduce the filter efficiency

**SPECTRUM Series for Silane (3E 50 sensor)**

The following gases cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Interferant Concentration in ppm</b>	<b>Instrument Reading in ppm</b>
chlorine	0.5	-4
hydrogen cyanide	10	1
ammonia	100	<1
diborane	100	0.4
arsine	1	0.7
germane	1	1
disilane	5	yes
phosphine	300ppb	0.2

The following gases or vapors have been tested and do not cause a reading:

<b>Interferant Gas/Vapor</b>	<b>Concentration in ppm</b>
hydrogen sulfide	1*
sulfur dioxide	2
hydrochloric acid	5‡
carobn monoxide	300
carbon dioxide	5000
nitrogen	100%
chlorine	1.5
hydrocarobons	% range
hydrogen	1000
hydrogen fluoride	3.8
hydrogen selenide	50ppb

\*with onboard filter; continuous high level exposure may reduce the filter efficiency

‡short term gas exposure (min.)

*Notes:*



PO Box 979  
680 Fairfield Court  
Ann Arbor, Michigan 48106-0979  
734.761.1270 Fax 734.761.3220

# Returning an Instrument for Repair

**ENMET** instruments may be returned to the factory or any one of our Field Service Centers for regular repair service or calibration. The **ENMET** Repair Department and Field Service Centers also perform warranty service work.

When returning an instrument to the factory or service center for service, paperwork must be included which contains the following information:

- A purchase order number or reference number.
- A contact name with return address, telephone and fax numbers
- Specific instructions regarding desired service or description of the problems being encountered.
- Date of original purchase and copy of packing slip or invoice for warranty consideration.
- If a price estimate is required, please note it accordingly *and be sure to include a **fax number***.

Providing the above information assists in the expedient repair and return of your unit.

**Failure to provide this information can result in processing delays.**

**ENMET** charges a one hour minimum billing for all approved repairs with additional time billed to the closest tenth of an hour. All instruments sent to **ENMET** are subject to a minimum \$30 evaluation fee, even if returned unrepaired. Unclaimed instruments that **ENMET** has received without appropriate paperwork or attempts to advise repair costs that have been unanswered, after a period of 60 days, may be disposed of or returned unrepaired COD with the evaluation fee. Service centers may have different rates or terms. Be sure to contact them for this information.

**Repaired instruments are returned by UPS/FedEx Ground and are not insured unless otherwise specified. If expedited shipping methods or insurance is required, it must be stated in your paperwork.**

**Note:** Warranty of customer installed components.

If a component is purchased and installed in the field, and fails within the warranty term, it can be returned to **ENMET** and will be replaced, free of charge, per **ENMET**'s returned goods procedure.

If the entire instrument is returned to **ENMET** Corporation with the defective item installed, the item will be replaced at no cost, but the instrument will be subject to labor charges at half of the standard rate.





# Repair Return Form

**Mailing Address:**  
ENMET Corporation  
PO Box 979  
Ann Arbor, Michigan 48106

**Shipping Address:**  
ENMET Corporation  
Attn: Repair Department  
680 Fairfield Court  
Ann Arbor, Michigan 48108

**Phone Number:** 734.761.1270  
**FAX Number:** 734.761.3220

**Your Mailing Address:**

**Your Shipping Address:**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Contact Name:** \_\_\_\_\_ **Your Phone:** \_\_\_\_\_

**Your PO/Reference Number:** \_\_\_\_\_ **Your FAX:** \_\_\_\_\_

**Payment Terms:**  COD  
(Check one)  VISA / MasterCard \_\_\_\_\_  
Card number Expiration

**Return Shipping Method:**

- UPS:  Ground  3 Day Select  Next Day Air  ND Air Saver  2-Day Air
- Federal Express:  Ground  Express Saver  P-1  Standard  2-Day Air
- FedEx Account number: \_\_\_\_\_

**Would you like ENMET to insure the return shipment?**

No  Yes **Insurance Amount:** \$ \_\_\_\_\_

