

Continuous Gas Monitor

Model MX251

Description and Use

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1. GENERAL

- 1.01 This section describes the MX251 continuous gas monitor. A continuous duty oxygen and combustible gas monitor for testing and monitoring manholes and cable vaults. The unit has an aspirator bulb and hose used for pre entry sampling. (See figure 1)
- 1.02 Whenever this section is reissued, the reason will be listed in this paragraph.
- 1.03 Before operating the MX251 continuous gas monitor, the technician must be familiar with the following procedures: THE USE OF THE CONTINUOUS GAS MONITOR DOES NOT ELIMINATE THE NEED TO VENTILATE THE MANHOLE.

PROPRIETARY

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SW 620-135-010 - Warning Devices - Use Guarding Work Areas.
SW 620-135-100 - Outside Plant - Guarding Work Areas Description and Use
SW 620-140-501 - Testing and Ventilating Manholes
SW 620-102-010 - Outside Plant - Precautions - Underground and Buried Work

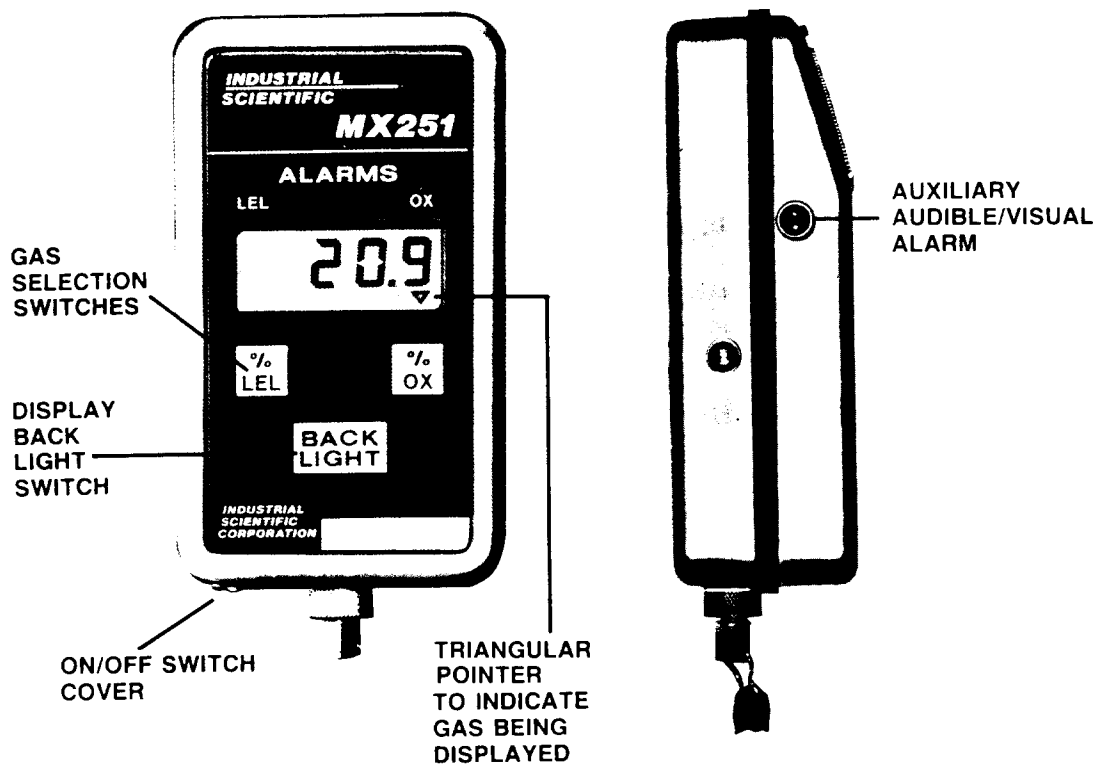


Figure 1 - Industrial Scientific Model MX251 Continuous Gas Monitor

2. DESCRIPTION

- 2.0 The MX251 Monitor continuously and simultaneously monitors ambient levels of oxygen and combustible gases. Both gases are monitored simultaneously; only one is displayed on the instrument's liquid crystal display (LCD). When one of two membrane switches located immediately below the LCD panel is touched, the respective gas readout will appear on the display. A small triangular pointer also appears on the display, just above the switch that was pressed, to indicate which gas is being displayed. The last gas selected will remain on display until a different switch is pressed. When the instrument is first turned on it will automatically display the oxygen readout. (See figure 1).
- 2.01 The MX251 Monitor has a back light display which is activated by momentarily pressing the switch located just below the gas selection switches. The light is self cancelling after 8 / 10 seconds.
- 2.02 Although only one gas can be displayed at a time, both alarm circuits are active and continuously monitoring for unsafe conditions. If either of the gases reaches a preset safety limit, the audible and visual alarms are activated immediately. The audible alarm is a high pitched tone that alternates between two frequencies at the rate of approximately two times per second. A rectangular LCD enunciator appears near the top of the display panel to indicate which gas or gases caused alarm activation. The LCD will continue to display the readout of the gas range last selected by touching one of the membrane switches. (See figure 2).
- 2.03 Combustible gases are displayed in percent of lower explosive limit (LEL) in 1% LEL increments and oxygen (OX) in percent by volume in 0.1% increments. (LEL) is sometimes referred to as (LFL) lower flammable limit.
- 2.04 The MX251 Monitor consists of two basic assemblies: an aspirator bulb with sampling hose for use before entering manhole and the MX251 continuous monitor.
- 2.05 The MX251 Monitor weighs less than 2 pounds.



(Normal) Oxygen Reading



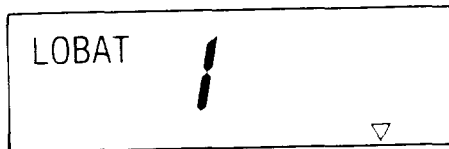
Unsafe Oxygen Level

(Do Not Enter or
Leave Space Immediately)



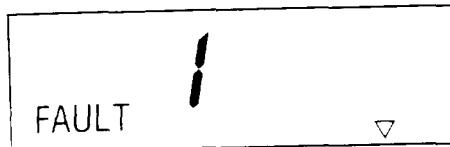
Normal Oxygen Level Displayed,
Combustible Gases in Alarm Mode

(Do Not Enter or
Leave Space Immediately)



Battery Failure

(Do Not Use Instrument,
Recharge Battery)



Sensor Fault

(Instrument Inoperable
Return To Factory - Refer
To Page 17)

Figure 2 - Display and Alarms

3. CAUTION STATEMENTS

- 3.01 CERTAIN CONDITIONS OR FAILURE TO OBSERVE CERTAIN NECESSARY PROCEDURES WILL IMPAIR THE PERFORMANCE OF THE INSTRUMENT. THESE ARE OUTLINED BELOW TO BE READ AND UNDERSTOOD BY THOSE USING THE INSTRUMENT.

- (1) Oxygen deficient atmospheres will cause erroneous low determinations of the combustible gas content of the air. (Do not enter or withdraw from space.)
- (2) Oxygen enriched atmospheres will cause erroneous high determinations of the combustible gas content of the air. (Do not enter or withdraw from space.)
- (3) Verify the calibration (Refer to 6.05) of the combustible detecting mode of the instrument after use where the combustible gas content as a percent of the LEL was 100% or greater. Long continuous use (hours for one test) at high LEL concentrations (50% to 100%) may cause damage to the LEL detector, resulting in reduction of sensitivity and erratic behavior, including inability to calibrate. If this occurs, the LEL detector should be replaced.
- (4) Slow combustible response of the MX251 Monitor may be caused by exposure to sulfur or silicone compounds. If this condition occurs recalibrate the MX251 Monitor (Refer to 6.05). If proper calibration is not possible return to factory (Refer to page 17)
- (5) Any rapid up-scale reading followed by a declining or erratic reading, or reading greater than 100% LEL, may indicate a gas concentration beyond the accurate response range of the LEL detector. Take immediate corrective action to eliminate this potential hazard; or, withdraw from it.
- (6) Readings that are either negative or greater than 100% LEL may indicate an explosive concentration of combustible gas. Do not enter or withdraw from space immediately.
- (7) Obstruction of the screened sensor ports will cause erroneous low readings. These screens must be kept clean. Refer to section 6.04.
- (8) Sudden changes in temperature or pressure may cause temporary fluctuations in the oxygen reading. Natural condition - allow instrument to stabilize.

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4. TESTING AND SETTING UP THE MX251 MONITOR

4.01 The tests and monitor adjustments described in paragraphs 4.02 through 4.04 shall be made each day before the MX251 Monitor is used to test a manhole or cable vault. Some shall be made more often as indicated.

4.02 **ASPIRATOR BULB TEST:** Test the bulb to determine whether it is in working order, as follows.

- (1) Remove the 10-foot sampling hose from the bulb.
- (2) Hold finger tightly over inlet fitting on bulb.
- (3) Squeeze and release the bulb.

NOTE: If bulb inflates in less than 10 seconds, replace the bulb before making further tests and then repeat test in paragraph 4.02.

- (4) If bulb operates satisfactorily (remains deflated for at least 10 seconds), reattach the 10-foot sampling hose to the monitor and proceed.

4.03 **SAMPLING HOSE TEST:** Squeeze the bulb and hold in the deflated position. Place your finger over the dust filter inlet and release the bulb. The bulb must remain in the deflated position for 10 seconds. If the bulb inflates, there is a leak in the hose and it must be replaced before sampling.

4.04 **HOSE CONTAMINATION TEST:** Test the hose to determine whether it is contaminated by combustible gases or vapors, as follows.

The hose generally can be cleared by aspirating fresh air through it or by flushing with nitrogen. This test should be repeated if the hose has been subjected to a heavy concentration of gas. Replace if conditions can not be corrected. Refer to page 17 for replacement information.

5.01 Switching the instrument ON or OFF (See Figure 3)

1. Loosen the knurled nut that holds the calibration cover in place.
2. Rotate the cover so that the metal button is inserted in the oval-shaped hole.
3. Tighten the nut until the calibration cover is flush with the case. Do not over tighten. (Prevents accidental turn off).
4. The monitor is ready for use as soon as the display stabilizes (approximately 60 seconds).

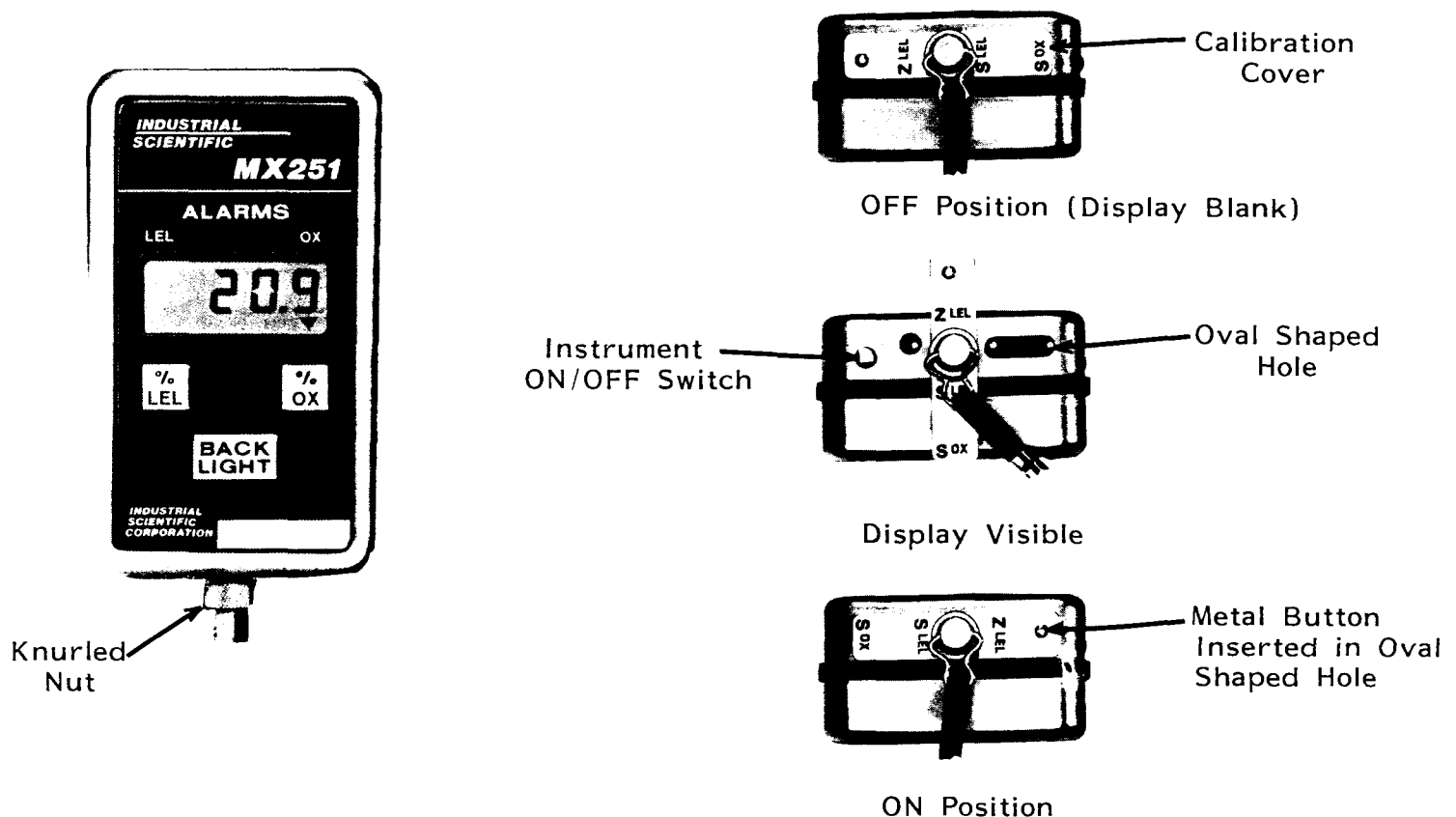
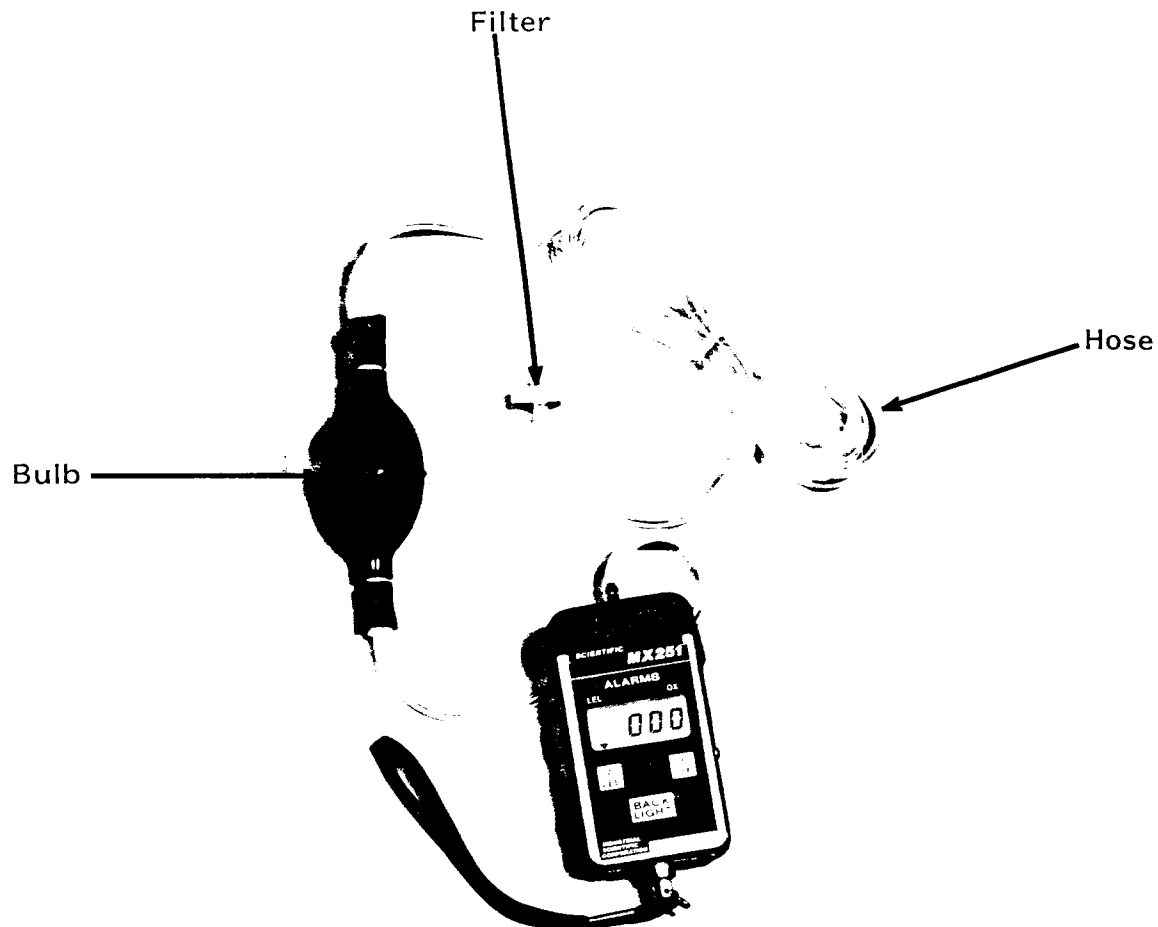


Figure 3 - Instrument ON / OFF Procedure

NOTE: Before proceeding to use the instrument, make sure that the batteries are charged (Refer to 6.01 Charging) and that the instrument has been properly calibrated. Refer to 6.05 Calibration.

- 5.02 Before entering the manhole, place the free end of the sampling hose in the manhole (cover removed); draw the atmosphere to be tested through the monitor until the highest and lowest oxygen and highest LEL reading is obtained. Make sure that the end of the sampling hose never touched water in the manhole. Ten full squeezes of the bulb are required. (See Figure 4).

DO NOT ENTER MANHOLE IF OXYGEN READING IS BELOW 19.5% OR LEL READING IS ABOVE 10% LEL.



**Figure 4 - Hand Aspirator Assembly
(Ready for Pre-entry testing of manhole)**

- 5.03 Combustible gases are displayed in percent of lower explosive limit (LEL) in 1% LEL increments. A reading between 0 and 100 percent shows how closely the atmosphere approaches the minimum concentration required for an explosion. Readings above the alarm level of 10% LEL indicate an explosive potential. (Do not enter or withdraw from space immediately.)
- 5.04 Oxygen concentration (OX) is displayed in percent by volume in 0.1% increments. Readings above the 23% high oxygen alarm level indicate a fire hazard. Readings below the 19.5% low oxygen alarm level indicate an oxygen deficient atmosphere. (Do not enter or withdraw from space immediately.)
- 5.05 Testing with the monitor in the manhole. The gas monitor may be used in the manhole only after a test made from the street indicates that the manhole atmosphere is satisfactory and the manhole is being properly ventilated as described in section 620-140-501. **THE USE OF A CONTINUOUS GAS MONITOR, MODEL MX251, DOES NOT ELIMINATE THE NEED FOR PROPER VENTILATION.**
- 5.06 **BEFORE ENTERING THE MANHOLE:**
- (1) Verify to see if MX251 Monitor is on. (See figure 3). **(MX251 Monitor is to be in the ON position for the entire work operation while in the manhole.)**
 - (2) Test for oxygen (%OX) and combustible gas (%LEL). If gas is detected, do not enter manhole and continue ventilation.

Readings below 19.5% or above 23% oxygen and above 10% combustible indicate unsatisfactory atmosphere. Follow the procedure as outlined in Section 620-140-501.

- 5.07 When the battery pack is almost fully discharged (approximately 1/2 hour of operating time remaining), the monitor will start to emit short audible tone bursts to warn of a low battery pack condition. The tone bursts are about one to five seconds in duration and two to three minutes apart. The duration increases in length until the batteries are no longer capable of supplying sufficient power. Then, the monitor will go into the battery failure mode. The battery failure mode is indicated by all of the display digits being blanked except for the numeral (1) at the far left position; the word LOBAT appears in the upper left corner of the display; and the audible alarm sounds a continuous tone. (See Figure 2.) The above condition will continue for several minutes or until the monitor is switched off. When battery pack fail mode occurs, recharge the battery pack for at least 14 hours before reuse. (Refer to 6.01 Charging).

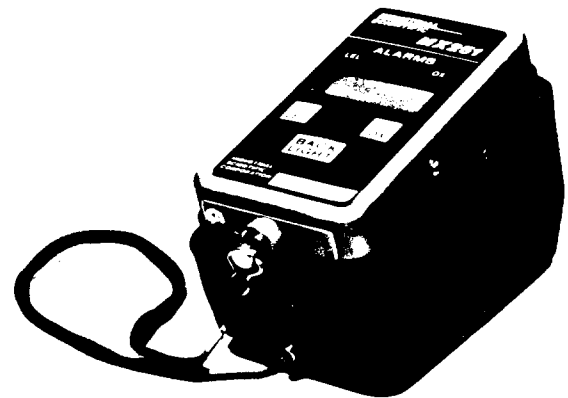
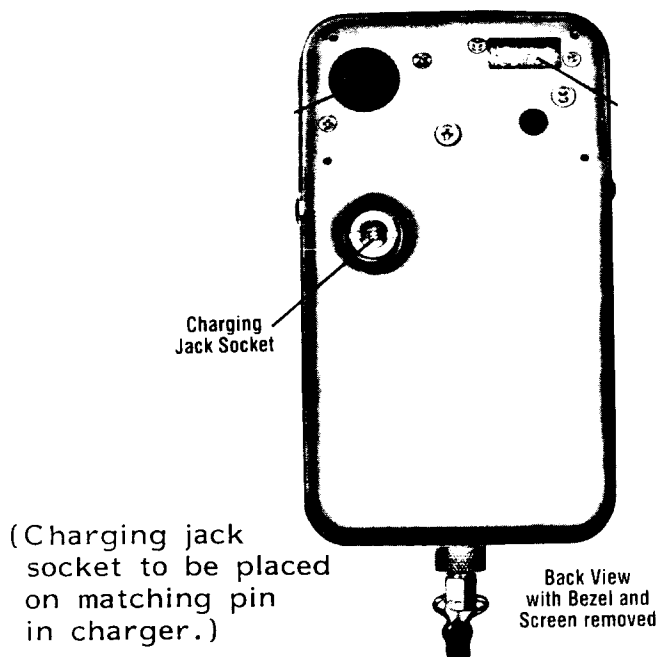
NOTE: After the MX251 Monitor goes into the battery failure, it should be switched off within a few minutes. If the unit is not switched off within 5 minutes, inaccurate fluctuating readings will appear on the display and serious battery damage may result.

The MX251 Monitor is also equipped with circuitry that detects LEL sensor faults. If a fault condition should occur, the monitor will go into a failure mode similar to the low battery failure mode and the word FAULT will appear in the lower left corner of the display. (See Figure 2)

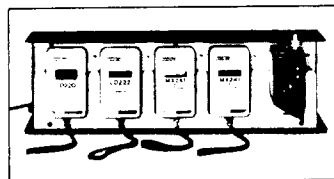
6. MAINTENANCE

- 6.01 **CHARGING BATTERIES:** A completely discharged battery's full potential will be restored by 14 hours of charging. There is no danger of overcharging the batteries when using the constant current battery chargers supplied with the instrument. (See figure 5) Instrument **must be in the off** position during charging operation.

Apparent reductions in battery capacity may result from repetitive use patterns. A fully charged battery that does not deliver energy for at least 10 hours continuous monitoring may have developed a "memory" condition. To eradicate this, entirely discharge the battery (until low battery warning) and then fully recharge the battery. (Refer to 6.01 Charging Battery). The memory effect can be avoided by using the MX251 Monitor so that the battery is discharged to varying depths.



Red light lit when unit is properly placed on charge.



5-Unit Charger

Figure 5 - Instrument Chargers

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6.02 Place MX251 Monitor on charger immediately after use. Turn Monitor OFF and place unit face up in charger, connecting jack socket on rear with pin projecting inside the charger recess. The red LED light will show a correct position and unit will recharge in 14 hours. (See Figure 5)

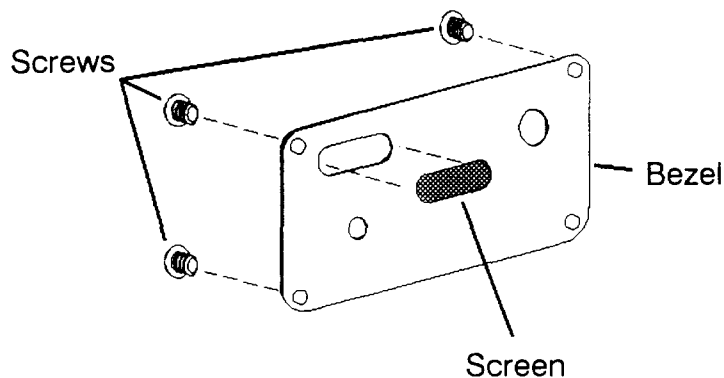
6.03 IF BATTERY IS NOT CHARGEABLE RETURN TO FACTORY (REFER TO PAGE 17)

6.04 **LEL Screen Servicing and/or Replacement**

A stainless steel screen protects the LEL sensor from direct impact and dust particles.

To remove the LEL screen:

1. Remove the four (4) screws that hold the bezel and screen in place.
2. Forced air cleaning may not remove very fine dust particles clogging the screen. NEVER USE ANY TYPE OF SOLVENT TO CLEAN THE SCREEN, since it may degrade sensor performance. A screen that cannot be cleaned should be replaced. Refer to page 17 - Replacement Parts.
3. Reassemble the screen and bezel to the monitor.



6.05 **CALIBRATION****General Information**

Maximum safety will be insured by performing a calibration check on the MX251 prior to each use. A calibration kit and replacement cylinders of calibration gas are available from ISC (See Table II).

For best calibration accuracy, the MX251 Monitor should be allowed to stabilize at room temperature for at least one (1) hour before calibration.

TABLE II. CALIBRATION EQUIPMENT**Part number Description**

1810-1261	Calibration Kit, consisting of: Carrying Case 2 cylinders of Pentane Regulator Calibration Cup
1810-1162	Replacement cylinder of Pentane

Refer to Page 17 for ordering instruction.

(1) Checking Alarm Settings

Before calibrating the instrument, it is good practice to check all of the alarm settings to verify that they are set correctly. The calibration cover must first be released and turned ninety degrees to expose the three calibration adjustments along the bottom end of the instrument. The function of the three control adjustments are: (1) LEL zero offset **Z LEL**, (2) LEL span sensitivity **S LEL**, (3) OX calibration **S OX**. (See figure 7)

(2) **To Check LEL**

To check the LEL alarm setting, switch the display to the LEL mode. Slowly turn the **Z LEL** (LEL zero offset) adjustment in the clockwise direction until the alarm is activated. When the alarm point is reached, slowly turn the adjustment back and forth through the point at which the alarm is activated. Observe the display. The display will show the percent of the LEL at which the alarm is set to activate. Turn the adjustment back to the zero display reading. The factory setting for the LEL alarm is 10%.

(3) **To Check OX**

Unlike the LEL, the OX section does not require a Z adjustment. After switching to the OX mode, observe and note the display reading, which should be 20.9% in normal room air. Slowly turn the **S OX** (OX calibration) adjustment counterclockwise until the oxygen alarm setting is reached. Slowly turn the adjustment back and forth through the alarm point to verify the setting. After the low alarm setting is located, slowly turn the adjustment back and forth through the alarm point to verify the setting. Return the display to the original setting. The oxygen alarms are factory set at 19.5% for the low alarm and 23.0% for the high alarm.

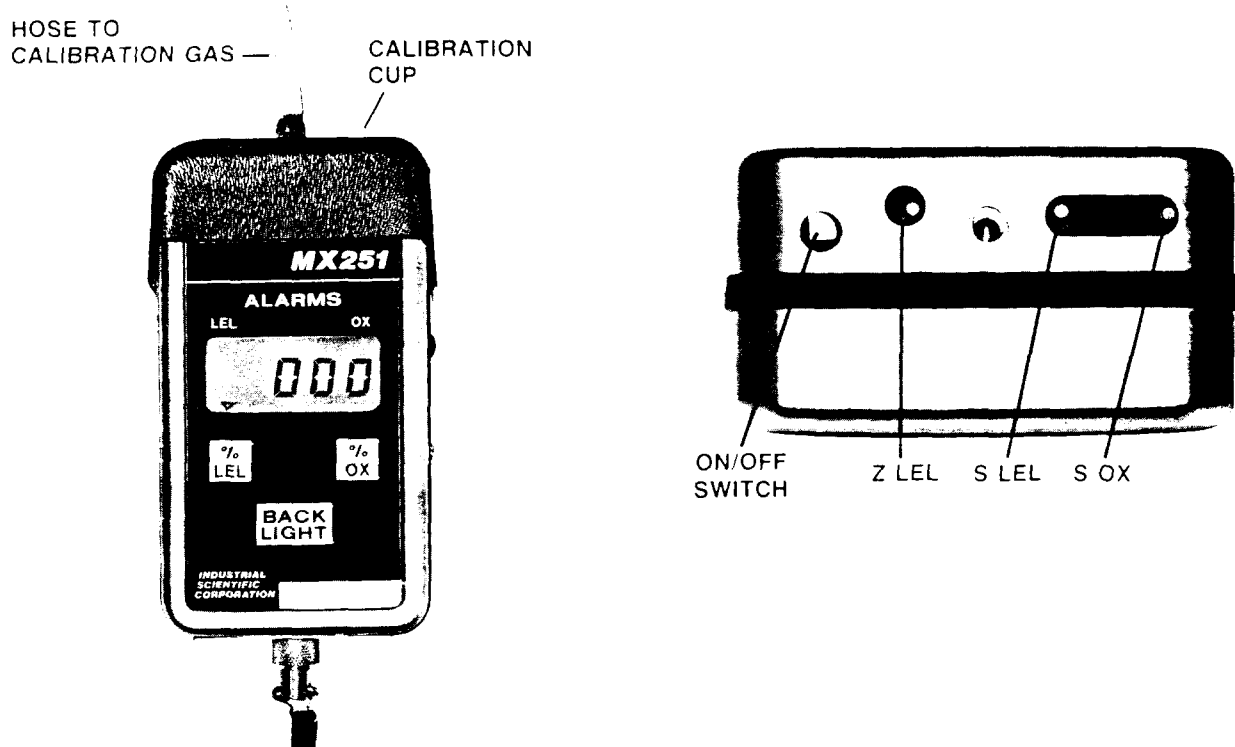


Figure 7

(4) **ZERO ADJUSTMENT**

In clean air, switch the display to the LEL mode and adjust the **Z LEL** (LEL zero offset) control by turning it counterclockwise until the minus sign (-) appears on the display. Very slowly turn the **Z LEL** control clockwise until the minus sign just goes off, leaving (000) in the display.

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(5) **SPAN ADJUSTMENTS**

After the LEL zero has been properly set, the span sensitivity may be calibrated. Switch the display to the LEL mode, and apply the span gas of 25% LEL Pentane (see note 1) to the MX251 Monitor using the calibration cup. Allow the gas to flow for two (2) minutes. With the gas still flowing, adjust the **S LEL** (LEL span sensitivity) control, on the bottom of the instrument, so that the display reads the percent LEL, to the nearest percent, that is printed on the calibration gas cylinder. Remove the calibration gas.

In clean air, known to have 20.9% oxygen, the **S OX** (OX calibration) control should be adjusted so the display reads 20.9% oxygen. Final calibration of the oxygen readout should only be done in the free air if the user is sure that the air contains the normal 20.9% oxygen. The readout should then be adjusted so that the display reads 20.9%. If there is any doubt of the oxygen content of the air, calibration gas of a known percentage of oxygen in nitrogen should be used.

NOTE 1

Industrial Scientific Corporation recommends that the calibration gas used for general combustible gas measurement is 25% LEL Pentane. If you are measuring a known combustible gas, span calibration should be made using a known % LEL concentration of that gas.

7.0 FACTORY SERVICING AND RECONDITIONING

In the event that factory service is required, equipment should be sent to Industrial Scientific Corporation at the following address.

Industrial Scientific Corporation
355 Steubenville Pike
Oakdale, PA 15071

Attention: Service Department

To help expedite your repair, please enclose the following information.

1. Your name
2. Company name.
3. Address
4. Phone number
5. Brief description of trouble experienced.

ACCESSORIES, REPLACEMENT PARTS, AND ORDERING INFORMATION

1810-1527	MX251 Oxygen and Combustible Gas Monitor
1810-0123	Single Unit Battery Charger (120 VAC)
1810-0115	5-Unit Battery Charger (120VAC)
1810-0297	Single Unit Charger, 12 VDC, with Cigarette Lighter Adaptor
1810-1204	Leather Carrying Case, Single Instrument
1810-1154	External Alarm w/6' cable
1810-1394	Extension Cable for Alarm
1810-0628	Detachable Shoulder Strap
1810-1022	Hand Aspirator Assembly
1810-1261	Calibration Kit (Pentane 25%)
1810-1162	Calibration Gas Replacement Cylinder
1701-7152	Dust Filter / Water Stop
1700-4078	Instrument Strap Assembly
1700-5380	Calibration Cover Assembly
1700-6933	Calibration Cup
1700-7592	Tygon tubing .125 ID
1701-7914	Screw 2-56 x 12
1703-6195	Bezel
1703-1345	Screen

7.01 Orders should be worded:

<u>Part number</u>	<u>Description</u>
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1703-6195	Bezel for MX251 Monitor
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For assistance in ordering, please feel free to contact us at the following location.

Industrial Scientific Corporation
355 Steubenville Pike
Oakdale, PA 15071-1093
(412) 788-4353, TWX 510-697-4065
Fax (412) 788-8353
Call toll free 1-800-DETECTS