

MSA Ultima[®] XI Infrared Gas Monitor

Instruction Manual

⚠ WARNING

THIS MANUAL MUST BE CAREFULLY READ BY ALL INDIVIDUALS WHO HAVE OR WILL HAVE THE RESPONSIBILITY FOR USING OR SERVICING THE PRODUCT. Like any piece of complex equipment, this device will perform as designed only if it is used and serviced in accordance with the manufacturer's instructions. OTHERWISE, IT COULD FAIL TO PERFORM AS DESIGNED AND PERSONS WHO RELY ON THIS PRODUCT FOR THEIR SAFETY COULD SUSTAIN SEVERE PERSONAL INJURY OR DEATH.

The warranties made by Mine Safety Appliances Company with respect to the product are voided if the product is not used and serviced in accordance with the instructions in this manual. Please protect yourself and others by following them. We encourage our customers to write or call regarding this equipment prior to use or for any additional information relative to use or service.

In the U.S., to contact your nearest stocking location, dial toll-free 1-800-MSA-INST
To contact MSA International, dial 1-412-967-3354.

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Manufactured by

MSA INSTRUMENT DIVISION

P.O. Box 427, Pittsburgh, Pennsylvania 15230

(L) Rev 1

10052972

MSA Permanent Instrument Warranty

- 1. Warranty-** Seller warrants that this product will be free from mechanical defect or faulty workmanship for a period of eighteen (18) months from date of shipment or one (1) year from installation, whichever occurs first, provided it is maintained and used in accordance with Seller's instructions and/ or recommendations. This warranty does not apply to expendable or consumable parts whose normal life expectancy is less than one (1) year such as, but not limited to, non-rechargeable batteries, sensor elements, filter, lamps, fuses etc. The Seller shall be released from all obligations under this warranty in the event repairs or modifications are made by persons other than its own or authorized service personnel or if the warranty claim results from physical abuse or misuse of the product. No agent, employee or representative of the Seller has any authority to bind the Seller to any affirmation, representation or warranty concerning the goods sold under this contract. Seller makes no warranty concerning components or accessories not manufactured by the Seller, but will pass onto the Purchaser all warranties of manufacturers of such components. **THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY, AND IS STRICTLY LIMITED TO THE TERMS HEREOF. SELLER SPECIFICALLY DISCLAIMS ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.**
- 2. Exclusive Remedy-** It is expressly agreed that Purchaser's sole and exclusive remedy for breach of the above warranty, for any tortious conduct of Seller, or for any other cause of action, shall be the repair and/ or replacement at Seller's option, of any equipment or parts thereof, which after examination by Seller is proven to be defective. Replacement equipment and/ or parts will be provided at no cost to Purchaser, F.O.B. Seller's Plant. Failure of Seller to successfully repair any nonconforming product shall not cause the remedy established hereby to fail of its essential purpose.
- 3. Exclusion of Consequential Damage-** Purchaser specifically understands and agrees that under no circumstances will seller be liable to purchaser for economic, special, incidental or consequential damages or losses of any kind whatsoever, including but not limited to, loss of anticipated profits and any other loss caused by reason of non-operation of the goods. This exclusion is applicable to claims for breach of warranty, tortious conduct or any other cause of action against seller.

General Warnings and Cautions

WARNING

1. The Ultima XI Infrared Gas Monitors described in this manual must be installed, operated and maintained in strict accordance with their labels, cautions, warnings, instructions, and within the limitations stated.
2. The Ultima XI Infrared Gas Monitor is designed to detect gases or vapors in air. It can also measure the concentration of gases or vapors in steam or inert or oxygen-deficient atmospheres. .
3. Use only genuine MSA replacement parts when performing any maintenance procedures provided in this manual. Failure to do so may seriously impair instrument performance. Repair or alteration of the Ultima XI Infrared Gas Monitor, beyond the scope of these maintenance instructions or by anyone other than authorized MSA service personnel, could cause the product to fail to perform as designed.
4. The Ultima XI Infrared Gas Monitor detects the presence of most combustible gases by identifying the difference in the amount of infrared light energy absorbed during the presence of these gases. This monitor, however, does NOT detect the presence of hydrogen gas and must never be used to monitor for hydrogen gas.
5. The Ultima XI Infrared Gas Monitor does not detect the presence of acetylene gas. The presence of acetylene gas will desensitize sensor performance.

⚠ CAUTION

1. As with all gas monitors of this type, high levels of, or long exposure to, certain compounds in the tested atmosphere could contaminate the sensors. In atmospheres where an Ultima XI Infrared Gas Monitor may be exposed to such materials, calibration must be performed frequently to ensure that operation is dependable and display indications are accurate.
2. The Ultima XI Infrared Gas Monitor must not be painted. If painting is done in an area where a Monitor is located, care must be exercised to ensure that paint is not deposited on the environmental shield of the Ultima XI Infrared Gas Monitor, if so equipped. Such paint deposits would interfere with the diffusion process, whereby a sample of the atmosphere being monitored diffuses into the Monitor.
3. The only absolute method to ensure proper operation of an Ultima XI Infrared Monitor is to check it with a known concentration of the gas for which it has been calibrated. Consequently, calibration checks must be included as part of the routine inspection of the system.
4. Protect the Ultima XI Infrared Gas Monitor from extreme vibration. Do not mount the sensing head in direct sunlight as this may cause the sensor to overheat.

FAILURE TO FOLLOW THE ABOVE CAN RESULT IN PRODUCT DAMAGE AND/OR AN UNSAFE CONDITION.

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Chapter 1, Installation

General Description

The Ultima XI Infrared Gas Monitor is designed to sample the environment where mounted and alert you to potentially dangerous levels of combustible gas. The Ultima XI Infrared Gas Monitor is shipped factory-calibrated and is labeled with target gas, calibration gas and span setting information. The target gas is not field-configurable and cannot be changed. The Ultima XI Gas Monitor is a stand-alone unit with a 4 to 20 mA output.

Identifying Your Unit

- The Ultima XI Infrared Gas Monitor is housed in a 316 stainless steel explosion-proof enclosure (FIGURE 1-1).

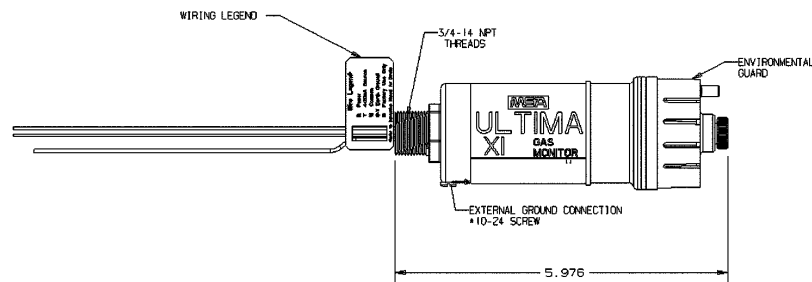


Figure 1-1. Explosion-Proof Ultima XI Infrared Gas Monitor

- The Ultima XI Infrared Gas Monitor is also available with an optional junction box equipped with a terminal strip for easy wiring (FIGURE 1-2).

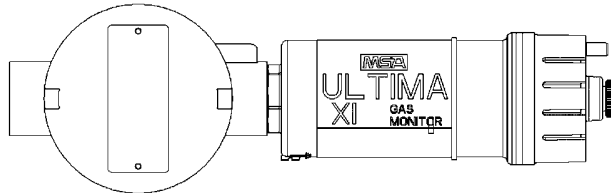


Figure 1-2. Explosion-Proof Ultima XI Infrared Gas Monitor with Junction Box

Installing Your Gas Monitor

Generally, the Ultima XI Gas Monitor should be mounted close to the area where a leak is likely to occur or where the gas is expected. Testing for ventilation patterns may be helpful in establishing locations for the Ultima XI Gas Monitor in enclosed areas. Smoke tubes (P/N 458481) are useful in measuring these patterns to help determine where gases may flow or accumulate.

Mount the Ultima XI Gas Monitor on a support by using suitable hardware (not supplied), and attach rigid conduit and a conduit seal fitting (for XP installations). The optional conduit assembly can also be used for wiring power and signal.

⚠ WARNING

The Ultima XI Infrared Gas Monitor contains no user- or field-serviceable parts and must be returned to the factory for repair. Any attempt to open the monitor will damage the unit and void the warranty.

⚠ CAUTION

Mount the Ultima XI Infrared Gas Monitor with the sensor inlet fitting extended horizontally from the main enclosure (FIGURES 1-1 and 1-2) to help prevent the build-up of particulate or liquid matter on the monitor's optical surfaces.

Do not paint the Ultima XI Infrared Gas Monitor. If painting is done in an area where a sensor is located, exercise caution to ensure paint is not deposited on the sensor inlet fitting. Such paint deposits would interfere with the diffusion

process, whereby a sample of the monitored atmosphere diffuses into the sensor. In addition, solvents in the paint may cause an alarm condition to occur.

Protect the Ultima XI Infrared Gas Monitor from extreme vibration. Do not mount sensing head in direct sunlight as this may cause the sensor to overheat.

During sensor installation or removal, do not use any tools or apply excessive force to the two legs that support the unit's reflectors (FIGURE 1-3). Applying force to the legs can permanently damage the monitor.

The monitor's environmental guard should be installed on the unit at all times. If the monitor is to be operated without the guard, frequent checks should be made to ensure particulate or liquid matter has not collected on the windows.

Use a wrench on the hex nut in the sensor neck to install or remove the sensor.

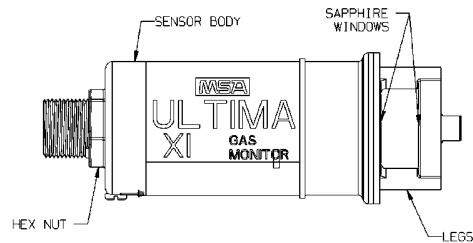


Figure 1-3. Ultima XI Infrared Gas Monitor

Ultima XI Electrical Connections

The Ultima XI Gas Monitor is provided with input wires for power and signal connections. An optional conduit assembly is also available.

An external power supply is required.

- For power requirements, see Chapter 3, "Specifications".
- All connections should be made by following appropriate wire code procedures.

NOTE: Refer to TABLE 3-3 for appropriate installation drawing.

⚠ WARNING

Before wiring the Ultima XI Infrared Gas Monitor, disconnect or isolate all power connected to the monitor; otherwise, electrical shock could occur.

Be sure to install your Ultima XI Infrared Gas Monitor in accordance with National and local Wiring Regulations. Failure to do so can result in an unsafe condition.

The Ultima XI Monitor is a three-wire transmitter that operates in the current source mode and can be wired directly to the input wires (FIGURE 1-4) or with the optional junction box (FIGURE 1-5). TABLE 1-1 provides typical cable lengths and wire sizes for installation.

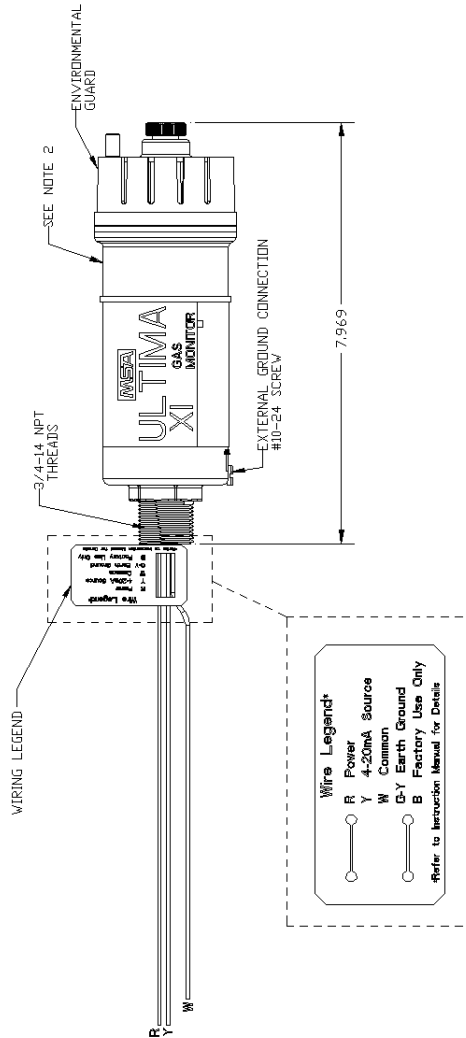


Figure 1-4. Ultima XI Installation Requirements

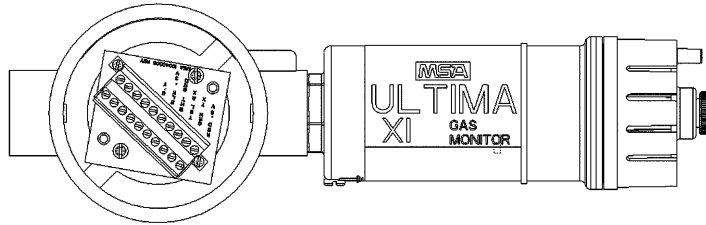


Figure 1-5. Ultima XI Infrared Gas Monitor with Junction Box

Table 1-1. Ultima XI Maximum Cable Length & 4-20 mA Signal Load

POWER SUPPLY	24 VOLTS	12 VOLTS
18 AWG CABLE	2,000 feet	300 feet
16 AWG CABLE	3,500 feet	500 feet
12 AWG CABLE	5,000 feet	900 feet
4 - 20 mA SIGNAL MAXIMUM LOAD	600 OHMS	300 OHMS

- In all installations, twisted-pair, instrument quality cable is recommended. Shielded cable is recommended for cable runs where radio frequency interference (RFI), electromagnetic interference (EMI), or other noise sources exist (such as motors, welding equipment, heaters, etc.).
- Conduit may also be needed in areas where a large amount of electrical noise is expected.

Proper installation should ensure that water and dirt are not able to enter the unit via the wire or conduit.

For Milliamp Output

The Ultima XI Infrared Gas Monitor may be connected to any device capable of accepting a 4 to 20 mA analog signal, such as:

- SUPREMA (with 4 to 20 mA input modules)
- 9010/9020 Controller
- Gasgard[®] 8 Controller
- Model 5000 Controller
- DCS's, etc.

Chapter 2, Start-up and Calibration

The Ultima XI Infrared Gas Monitor is factory-calibrated and ready for immediate use. The Ultima XI Gas Monitor provides a 4 to 20 mA output signal that can be used in conjunction with data acquisition controllers.

During instrument operation, the 4 to 20 mA output signal provides the information shown in TABLE 2-1.

Table 2-1. Instrument Operation

OPERATION	4 to 20 mA
NORMAL, NO ALARMS	Gas value
ALARMING	Gas value
FAULT	3.0 mA
POWER UP/ COUNTDOWN	3.75 mA (approximately 65 seconds)
SENSOR CAL	3.75 mA
CAL FAULT	Gas value
UNDER-RANGE	3.0 mA if gas value 0 or less; gas value otherwise
OVER-RANGE	21.0 mA

Calibration Basics

- While the Ultima XI Infrared Gas Monitor is factory-calibrated, it is good practice to calibrate the unit once it is installed in its final environmental destination.
- As with any type of gas monitor, the only true check of its performance is to apply gas directly to the sensor. The frequency of the calibration gas tests depends on the operating time and chemical exposures of the sensors. New sensors should be calibrated more often until the calibration records prove sensor stability. The calibration frequency can then be reduced to the schedule set by the safety officer or plant manager.
- Before calibrating, the Ultima XI Infrared Gas Monitor must be powered for a minimum of one hour to allow the sensor to settle into its new environment.
- Output signal during calibration is 3.75 mA.

- Read all calibration instructions before attempting an actual calibration.
- Identify and become familiar with all of the calibration components.
- During the calibration, it may be necessary to quickly apply the span gas to the unit. Prior connection of the calibration components will aid in the ease of unit calibration.
- The only true check of any gas monitor's performance is to apply gas directly to the sensor.
- The calibration procedure must be performed regularly.

⚠ CAUTION

Before attempting a calibration, power the monitor for at least one full hour. To ensure a fully functional sensor, perform a calibration check and adjustments at initial start-up and at regular intervals.

Ultima XI Calibration

- Although a full calibration (zero and span) can be performed on the Ultima XI Infrared Gas Monitor, a no-gas (zero) calibration is sufficient to properly calibrate the monitor.
 - Normally, any degradation of the sensor's performance is associated with slight drifts in its zero response that, in turn, will adversely affect its span performance. Restoring the sensor's zero is typically sufficient to restore its span performance.
 - The following steps are required to perform an Ultima XI calibration.
 - The calibration sequence diagram is shown in FIGURE 2-2.
1. Remove the environmental guard or flow cap from the Ultima XI Gas Monitor (FIGURE 2-3).
 2. Turn the switch on the calibration cap to the ON position.
 3. Connect the Ultima XI Calibration Cap (FIGURE 2-1) to the Ultima XI Gas Monitor.
 - The Calibration Cap display flashes "-", indicating the cap is interfacing with the Ultima XI Gas Monitor.
 - The Calibration Cap display flashes "C", indicating the unit is in zero calibration mode.

Apply zero gas to the calibration port. Zero gas can be supplied as ambient air or from the zero gas cylinder in the calibration kit as noted in TABLE 2-2.

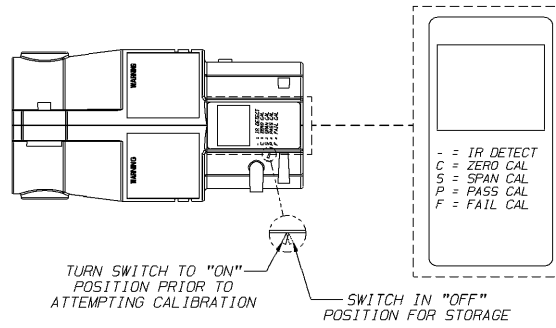


Figure 2-1. Intrinsically Safe Ultima XI Calibration Cap

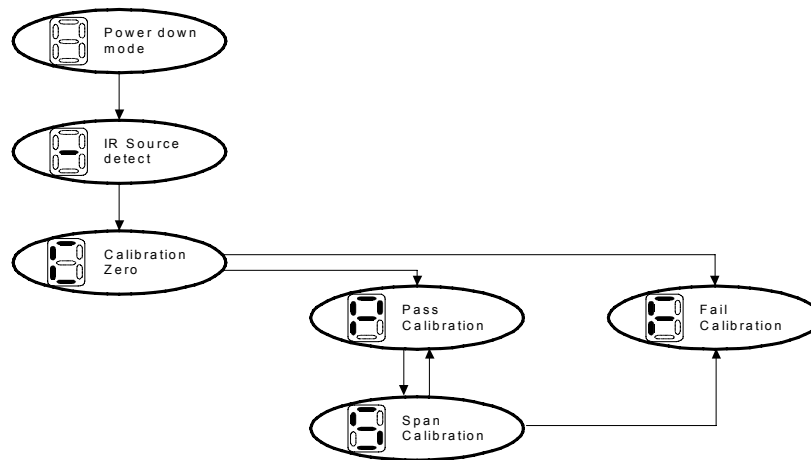


Figure 2-2. Calibration Sequence Diagram

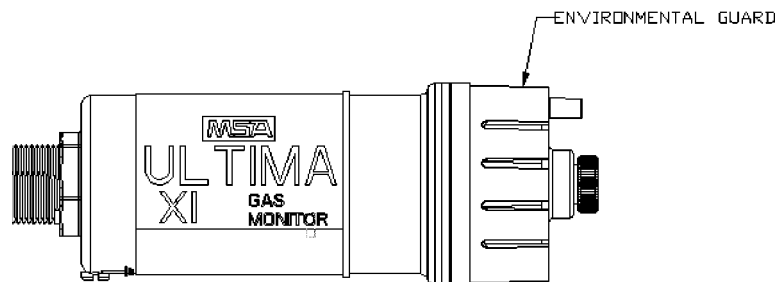


Figure 2-3. Environmental Guard

- If the user can confirm that the ambient air is free of detectable analyte gas, it can be used in place of the zero gas cylinder.
 - After approximately 60 seconds, the Calibration Cap display indicates "P" for pass or "F" for fail.
4. After successful completion of the zero calibration and, if only a zero calibration is being performed, a span check should be performed to ensure proper operation. If the span check does not yield accurate results, perform a full calibration (zero and span).
 5. After successful completion of the zero calibration, a span calibration can be performed by applying span gas through the Calibration Cap port (see TABLE 2-2 for span gas selection).
 - The unit must see gas within 30 seconds after successful completion of the zero calibration in order for the span calibration to initiate.
 - Initiating a span procedure causes the display to flash "S".
 - After approximately 60 seconds, the Calibration Cap display indicates "P" for pass or "F" for fail.
 6. When calibration is complete, remove the Calibration Cap and connect the environmental guard or flow cap. The 4- 20 mA is held at 4 mA for two minutes to reduce the chance of a nuisance alarm upon completion of a calibration procedure.
 7. Apply cap to next sensor to be calibrated. Turn switch to OFF position if the calibration cap will not be used for extended period to prolong battery capacity.

NOTE: When a zero or span calibration failure occurs, the Ultima XI Gas Monitor reverts back to its last successful calibration settings.

NOTE: If the Ultima XI Calibration Cap is left on for more than fifteen minutes after calibration concludes, the 4 to 20 mA signal indicates a fault status.

▲ WARNING

The Calibration Cap must be removed from the XI sensor after completing the Zeroing and/or Spanning procedure; otherwise, the sensor cannot perform properly.

Calibration Kit

Calibration Kits are available for the Ultima XI Infrared Gas Monitor in the event zero or span gas is required. The recommended calibration kits are shown in TABLE 2-2.

Table 2-2. Calibration Kit Table

GAS TYPE	CAL CYLINDER	CYLINDER P/N	SPAN VALUE	CAL KIT
Methane	2.5% Methane	10028032	50% LEL	40
Propane	0.6% Propane	10028032	29% LEL	40
Ethane	0.6% Propane	10028034	25% LEL	40
Butane	0.6% Propane	10028034	28% LEL	40
Pentane	0.6% Propane	10028034	33% LEL	40
Hexane	0.6% Propane	10028034	41% LEL	40
Cyclopentane	0.6% Propane	10028034	30% LEL	40
Ethylene	0.1% Propane	711054	28% LEL	40
Zero Gas	100% Nitrogen	10028030	0% LEL	40

Chapter 3, Specifications

Table 3-1 . Performance Specifications

TEMPERATURE RANGE		
		-40 to +60°C (-40 to +149°F)
DRIFT	ZERO DRIFT	Less than 5% per year, typically
	SPAN DRIFT	Less than 10% per year, typically
NOISE		Less than 1% FS
ACCURACY	IR COMBUSTIBLE GAS: METHANE, PROPANE	<50% LEL: ±2% FS
		>50%LEL ±5% FS: ±2% FS
STEP CHANGE RESPONSE	TIME TO REACH 50% OF SCALE COMBUSTIBLES	Less than 10 seconds
	TIME TO REACH 90% OF SCALE COMBUSTIBLES	Less than 30 seconds
HUMIDITY		15 to 95% RH, non-condensing, 24 hours or less
		35 to 95% RH, long term
SENSOR LIFE	FULL REPLACEMENT WARRANTY	Two years
WIRING REQUIREMENTS		Three-wire
POWER INPUT		7-30 VDC
SIGNAL OUTPUT	4-20 mA	Three-wire current source
ULTIMA XI PHYSICAL	SIZE	2-1/2 x 8" (64 x 203 mm)
	WEIGHT	6.6 lbs. (3 Kg.)

Table 3-2. Certification and Approval

UL	UL 1, 2 and 3 Class I, Div. 1, Groups A, B, C, and D
CSA	CSA C22.2-30 Class I, Div. 1, Groups B, C, and D
ATEX	CE Low Voltage Directive: 73/23/EEC CE EMC Directive: 89/336/EEC CE ATEX Directive: 94/9/EC EEx d IIC Tl

Table 3-3. Installation Drawings

INSTALLATION OUTLINE DRAWINGS	DOCUMENT NO.
UL	10000018418

Chapter 4, Maintenance

General

The Ultima XI Infrared Gas Monitor is:

- not field-serviceable and must be returned to the factory for repair.
- constantly performing a self-check.

When a critical error is detected in the unit, the 4 to 20 mA output signal goes to the 3.0 mA fault condition.

Ultima XI Cleaning Procedure

- The presence of particulate matter, oil films, liquid water, or the residue from water drops on the two monitor windows can adversely affect its performance.
- The environmental guard is designed to prevent foreign solids or liquids from reaching the monitor's optical system.
- Additionally, heating elements are incorporated into the unit to prevent water condensation.
- Under severe conditions, however, some material may collect on these surfaces, making it necessary to occasionally check and clean the windows.
- The windows can be readily inspected after removing the environmental guard.
- While both windows are made of a highly durable material that is not easily scratched, avoid excessive pressure when cleaning them. Clean, cotton-tipped applicators are the most convenient tool to remove material collected on the windows.
- Dust can be removed by wiping the window with a dry applicator or one moistened with distilled water. An additional clean, dry applicator should be used to remove any residual water.
- An applicator moistened with isopropyl alcohol can be used to remove heavy deposits of solids, liquids or oil films.
- Clean the window again with a second applicator moistened with distilled water; then, dry the window with a final applicator. Avoid using excessive amounts of water or alcohol in the cleaning procedure, and inspect the window to ensure that the entire

surface has been cleaned. If water or isopropyl alcohol was used, allow the unit to operate for 15 minutes to completely dry before replacing the environmental guard and continuing to monitor for combustible gas.

- After cleaning the windows, it is advisable to check the monitor's response to zero and to calibration gas (see Chapter 2, "Start-up and Calibration").

⚠ CAUTION

Do not place foreign objects in the sensor's analytical region; otherwise, the infrared beam can be partially blocked, causing the sensor to generate false readings. All objects must be removed from the sensor's analytical region for it to function properly.

Similarly, if water or isopropyl alcohol is used to clean the sensor's windows, any residue from the cleaning procedure must be completely dissipated before returning the unit to service.

Checking the sensor's response to zero gas is the best way to purge residual cleaning materials from the sensor and to make sure that sensor's reading is stable before zeroing or calibrating the sensor (see Chapter 2, "Start-up and Calibration").

Table 4-1. Parts List

PART	PART NO.
Environmental Guard	10041265
Flow Cap	10042600
Calibration Cap	10048801