Gasport® Gas Tester

Technical 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, the product 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 repairs.

⚠ CAUTION

For safety reasons, this equipment must be operated by qualified personnel only.

In the U.S., to contact your nearest stocking location, dial toll-free 1-800-MSA-2222. To contact MSA International, dial 1-412-967-3000 or 1-800-MSA-7777.

This manual refers to instruments with serial number prefixes B.

Patent Pending

Manufactured by
MSA INSTRUMENT DIVISION
P.O. Box 427, Pittsburgh, Pennsylvania 15230

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Table of Contents

Chapter 1
Set-up

To ensure that the Gasport Gas Tester operates accurately, the user must refer to this Technical Manual to:

- Set the appropriate Internal Switch Settings
- Set the appropriate Alarm Levels (see Section 2, *Optional Alarm Configurations* in the Gasport **Instruction** Manual)
- Properly Calibrate the instrument
- Perform any necessary Troubleshooting and resulting maintenance procedures

⚠ CAUTION

Before handling the PC boards, ensure you are properly grounded; otherwise, static charges from your body could damage the electronics. Such damage is not covered by the warranty. Grounding straps and kits are available from electronics suppliers.

Internal Switches

Gasport Gas Tester operating parameters are controlled and adjusted by a set of switches located inside the unit. To access the switches, the instrument must be partially disassembled.

1. Remove the battery pack (FIGURE 1-1).

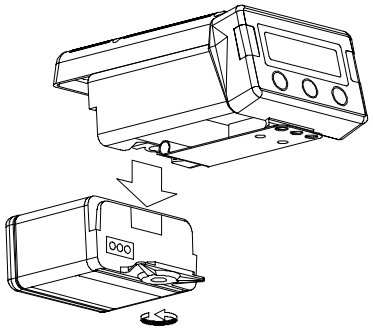

Figure 1-1.
Battery Pack Removal

2. Remove the pump module and sensors (FIGURE 1-2).

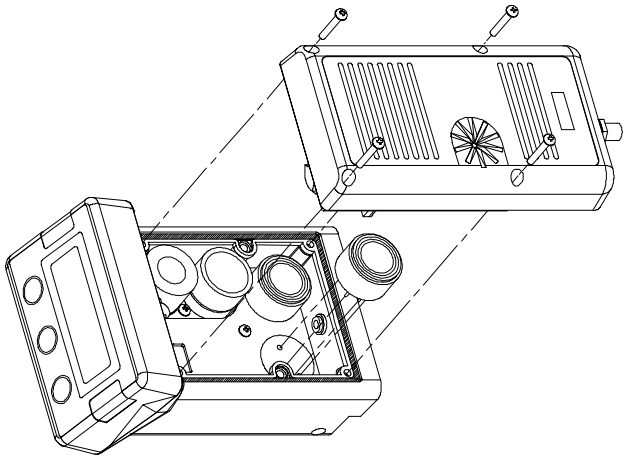

Figure 1-2.
Pump Module & Sensor Removal

3. While holding the body of the instrument in place, remove the "hold-down" screw (FIGURE 1-3).

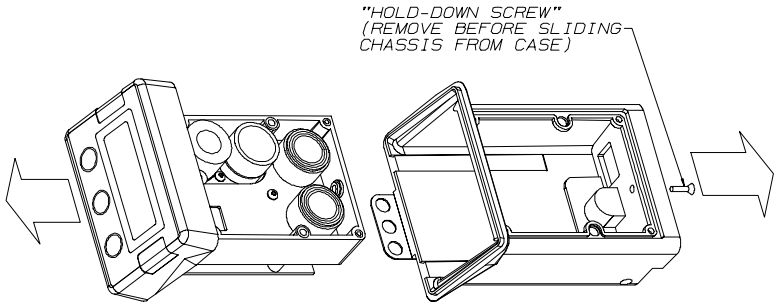

Figure 1-3.
Removing Chassis (sensors shown for reference)

4. Hold the display module by its sides, and slide out the internal chassis halfway.
5. Unplug the earphone connector from the chassis (FIGURE 1-4).

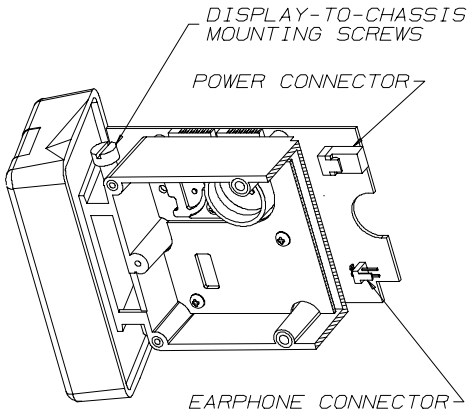

Figure 1-4.
Internal Connectors on the Main Electronics Board

6. Slide the chassis out completely.

Switch Settings

Table 1-1 shows switch settings for normal operation. The positions for the internal switches are up for "OFF" and down for "ON."

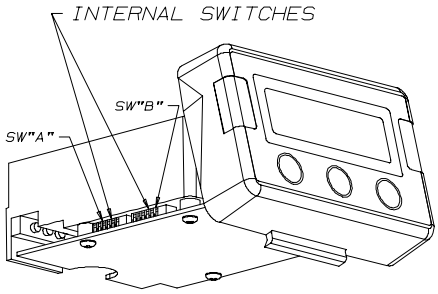

Figure 1-5.
Internal Switches

Table 1-1. Internal Switch Settings for Normal Operation

SWITCH "A":			
1 - ON: MEASURE (normal) operation, Gasport Gas Tester will monitor for gases OFF: SET ALARMS, Gasport Gas Tester will *not* monitor for gases			
2 - Methane Display ON: 0 - 5% CH_4 (Methane) OFF: 0 - 100% LEL (Lower Explosive Limit)			
SENSOR	**SWITCH "A"**	**ENABLE**	**DISABLE**
Methane Gas	3	ON	OFF
Oxygen	4	ON	OFF
CO	5	ON	OFF
H_2S	6	ON	OFF
FUNCTION	**SWITCH "B"**	**ENABLE**	**DISABLE**
Fresh Air Setup	1	ON	OFF
TWA Display/Alarm	2	ON	OFF
STEL Display/Alarm	3	ON	OFF
Peak Readings	4	ON	OFF
Data Tagging	5	ON	OFF
Factory Use Only	6	OFF	OFF

Setting Alarm Levels

If your unit has alarms active, alarm levels can be changed as follows.

1. Turn OFF the instrument.
2. Remove the battery pack.
3. Locate the internal switches as previously described.
4. Set switch A-1 to OFF. Refer to TABLE 1-1.
5. Re-assemble the instrument.
6. Replace the battery pack.

NOTE: If your Gasport Gas Tester alarm configuration is not suited to your application, contact your supervisor to arrange for the instrument to be updated. This can only be done at an MSA Repair Center.

⚠ WARNING

The Gasport Gas Tester does not provide any protection while the alarm levels are being set. To enable the alarms to function, the internal switches must be set for normal operation and the instrument turned ON.

Current alarm setpoints are displayed when the instrument is turned on, if alarms are activated. Only the setpoints for gas sensors selected by corresponding internal switches can be changed. Alarm points can be set in the following order:

- Methane Gas
    - High Alarm
- Oxygen
    - Low Alarm
    - High Alarm
- CO
    - High Alarm
    - Time Weighted Average (TWA)
    - Short Term Exposure Limit (STEL)
- H_2S
    - High Alarm
    - Time Weighted Average (TWA)
    - Short Term Exposure Limit (STEL)

The first setpoint to be changed will be highlighted (FIGURE 1-6).

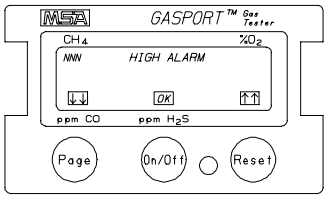

Figure 1-6.
Methane Alarm Setpoint Display

⚠ WARNING

Improper adjustment of alarm setpoints can cause the instrument to fail to alarm in a hazardous atmosphere. Serious personal injury or death could result.

To lower the setpoint:

- Push the **PAGE** (DOWN) button.

To raise the setpoint:

- Push the **RESET** (UP) button.

Holding either button causes the setpoint to change continuously.

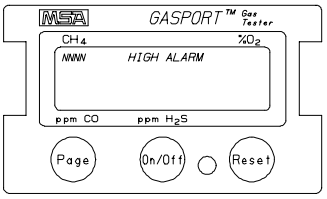

Figure 1-7.
Accepted Setpoint Display

To accept the setpoint:

- Push the **ON/OFF** (OK) button; the new setpoint is stored in memory. The Gasport Gas Tester moves automatically to the next setpoint.

When all selected alarm setpoints are set, a long beep sounds and the display reads:

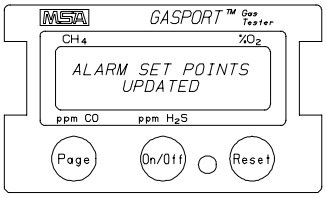

Figure 1-8.
Alarm Setpoints Updated

Another long beep sounds, and the Gasport Gas Tester turns OFF automatically.

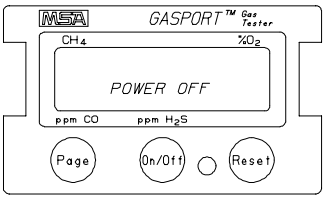

Figure 1-9.
Power OFF

Reset internal switch A-1 to ON.

Chapter 2
Calibration

⚠ CAUTION

Before each days usage, sensitivity must be tested on a known concentration of calibration gas equivalent to 25 to 60% of full scale concentration. Accuracy must be within -0 to +20% of actual or within the accuracy stated on the MSA-supplied calibration cylinder. Accuracy may be corrected by specific adjustment procedure.

Optional Fresh Air Setup

The Gasport Gas Tester can be set to allow the user to automatically zero the measurement systems and calibrate the oxygen system when the unit is turned ON. Unless otherwise requested on the order, units shipped from the factory will have the Fresh Air Setup option active.

Activating the Fresh Air Setup Option

1. Locate the internal switches as previously described.
2. Turn switch B-1 to the ON position (OFF to de-activate).
3. Reassemble the unit.
4. Replace the battery pack.

When this feature is activated and the instrument is turned ON, the Gasport unit completes its self-tests and asks if a Fresh Air Setup is desired.

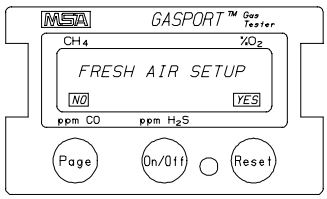

Figure 2-1.
Fresh Air Setup?

To Cancel Fresh Air Setup

- If the **PAGE** (NO) button is pressed or if no button is pressed within five seconds, the instrument does not perform a Fresh Air Setup. Instead, it goes on to operate in the normal measure mode and displays the Exposure page.

To Perform Fresh Air Setup

Press the **RESET** (YES) button within five seconds.

- The Gasport Gas Tester begins to perform a Fresh Air Setup.
- Oxygen reading is set at 20.8 percent.
- All other readings are set at zero.

NOTE: If the Fresh Air Setup feature is activated and an error message is displayed, press the RESET button to exit the Fresh Air Setup and enter the Measure mode. This may occur if the original readings were outside of the limits for the Fresh Air Setup feature. This is to protect the user from zeroing out potentially hazardous gases. Expose the instrument to known fresh air and try the Fresh Air Setup again.

⚠ WARNING

The Fresh Air Setup must only be used in fresh air; do not use it in atmospheres that are rich or deficient in oxygen, or that include combustible or toxic gases.

If you do, the Gasport Gas Tester's calibration will be incorrect and its readings will be false. False readings will endanger the lives of those users whose safety depends on the instrument.

Do not use the Fresh Air Setup as a substitute for regular calibration checks.

Persons responsible for the use of the Gasport Gas Tester must determine whether or not the Fresh Air Setup option should be used. The user's abilities, training, and normal work practices must be considered when making this decision.

Calibration Adjustment

Gasport Gas Tester calibration can be adjusted easily by using gases of known mixtures and concentrations. Check the calibration each day before using your Gasport Gas Tester. See *Calibration Check* in the Gasport Instruction Manual.

Preparing to Calibrate

Before starting, be certain that the instrument is in normal fresh air, free of combustible or toxic gases. To prepare to calibrate:

1. Turn OFF the Gasport Gas Tester.
2. Allow the instrument to stabilize for several minutes in fresh air at the temperature and air pressure of intended use.

⚠ WARNING

The Gasport Gas Tester does not provide any protection while the calibration is being adjusted. To enable the alarm function, the internal switches must be set for normal operation and the instrument must be turned ON.

Calibration Procedures

1. Push and hold the **PAGE** button and the **RESET** button, and then press the **ON/OFF** button. The instrument turns ON. The display is:

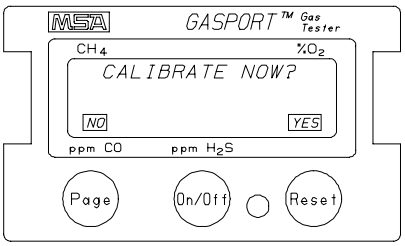

Figure 2-2.
Calibration - No/Yes?

To Cancel Calibration:

Press the **PAGE** (NO) button or wait five seconds.

- The Gasport Gas Tester begins warming up and enters the Exposure display page.

To Continue Calibration:

2. Press the **RESET** (YES) button.

- Display prompts you for Fresh Air.

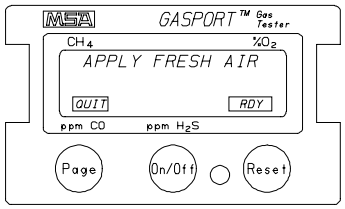

Figure 2-3.
Apply Fresh Air

NOTE: At this point, allow the instrument to warm up for approximately 15 minutes.

To cancel:

Press the **PAGE** (QUIT) button.

- Instrument beeps and automatically shuts OFF.

To proceed:

3. Press the **RESET** (READY) button.
4. Wait approximately 30 to 45 seconds for the Gasport Gas Tester to complete the fresh air adjustments.
   - During this time, the display appears:

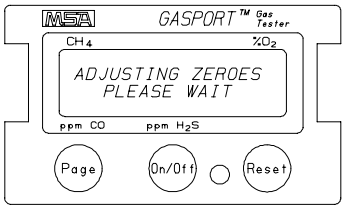

Figure 2-4.
Adjusting Zeroes

After the fresh air adjustments are made, the Gasport Gas Tester is ready to complete calibration.

The user can calibrate the gas sensors in the following order:

- Methane
  - 0 - 100% LEL or 0 - 5% CH_4 range (low gas)
- Oxygen
- Carbon Monoxide
- Hydrogen Sulfide
- Methane
  - 5 - 100% Gas range (line gas)

Only those gas sensors turned on by the corresponding internal switches are displayed and can be calibrated.

- Press the **PAGE** (SKIP) button to skip calibration for any gases you do *not* want to change.

NOTE: To maintain accuracy and repeatability over the entire methane scale, the 100% gas range (line gas) must not be adjusted unless the 0 - 100% LEL/0 - 5% (low gas) is adjusted first. If the 0 - 100% LEL/0 - 5% (range is skipped, the 0 - 100% gas range must also be skipped.

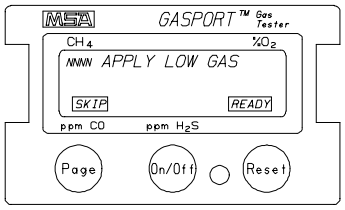

Figure 2-5.
Methane Gas Calibration Display

The display appears:

5. Attach the calibration fitting.
6. Attach tubing to the proper gas cylinder and open the cylinder valve. The flow rate should be 0.25 lpm.
7. Press the **RESET** (READY) button when you are ready to span this range.
   - The display reads:

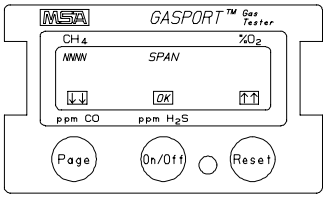

Figure 2-6.
Methane Gas Span Adjustment

8. Use the up and down arrows to set the span to the reading which corresponds to the low gas cylinder.
9. When this is done, press the ON/OFF (OK) button to accept the low gas span calibration.

   Oxygen and Toxic Gas Sensor Calibration

   The Gasport unit automatically moves to the oxygen and then toxic gas calibrations. Each toxic gas calibration can be completed in the same way as the methane gas calibration. It may be necessary to change gas samples to provide the proper gas.

   NOTE: The zero adjustment calibrates the oxygen sensor to 20.8%. Verify the oxygen reading is within the limits stated on the oxygen calibration cylinder. Do not adjust the oxygen reading to the cylinder value, as slight variations may occur.

10. *Using the Gas Tank*
    a. Attach a 0.25 lpm (liters-per-minute) Flow Controller to the gas tank.
    b. Attach a 6-inch Sample Line by screwing the connector adapter to the Gasport Gas Tester Pump Module inlet.
    c. Attach the other end of the Sample Line to the 0.25 lpm Flow Controller.
       - The Gasport Gas Tester Pump stops and does not restart until the gas tank nozzle is opened or an end of the sample line is opened.
    d. Turn the knob on the gas tank in a counterclockwise direction.
       - The Gasport Gas Tester Pump Module automatically restarts.
11. Press the **RESET** (READY) button.

12. Wait for the readings to stabilize.

    NOTE: During calibration, the display reading may appear more unstable than normal. The display's digital filtering has been disabled to provide the most rapid reading possible.

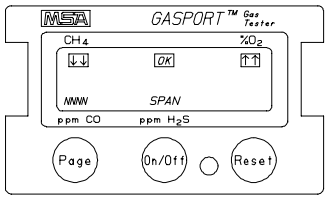

Figure 2-7.
CO Calibration Adjustment

13. After the display stabilizes, adjust the display reading to agree with the known amount of calibration gas.
    a. Push the PAGE (DOWN) button to lower the reading.
    b. Push the **RESET** (UP) button to raise the reading.
       • Holding either button causes the reading to change continuously.
14. Push the **ON/OFF** (OK) button to accept the reading.
    • The new reading is stored in memory, and the Gasport Gas Tester automatically moves to the next reading.
15. Change the gas sample as needed:

    With a Gas Tank:

    a. Turn OFF the gas by turning the knob on the gas tank clockwise.
    b. Disconnect the Sample Line from the Gasport Gas Tester Pump inlet.
    c. Disconnect the 0.25 lpm Flow Controller from the gas tank.
    d. Assemble the kit with the new gas tank.
    e. Repeat calibration procedure for next gas.

    • The display appears:

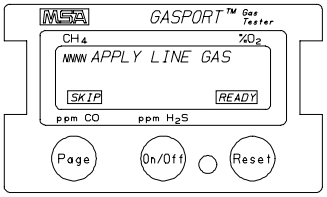

Figure 2-8.
Apply Line Gas

NOTE: We recommend the use of utility-supplied natural gas for the calibration. If this is not available, technical grade methane in the range of 95 - 100% CH_4 in N_2 can be used. The flow rate from the regulator must be 0.25 lpm.

16. Move the calibration sample line to the source of line gas.
17. Press **RESET** (READY) button when you are ready to span this range. (The display reads as shown in FIGURE 2-6.)
18. Use the up and down arrows to set the span to the percentage of methane in the line gas, if it is known. If it is not known, set the span to 100% gas.
19. Press the **ON/OFF** (OK) button to accept the line gas span calibration. This completes the methane gas calibration.

    When all the selected calibrations are set, a long beep sounds and the display reads:

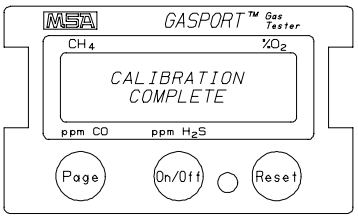

Figure 2-9.
Calibration Update

The display now reads:

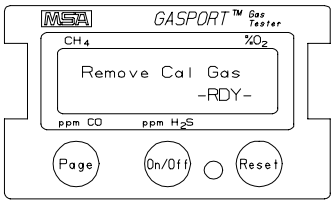

Figure 2-10.
Remove Cal Gas

20. Remove calibration gas and press the RESET (READY) button.
    - The Display now reads:

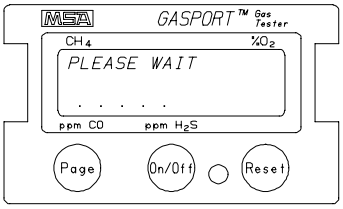

Figure 2-11.
Please Wait

and allows the calibration gases to clear from the sensors (about 30 seconds).

A long beep sounds and the Gasport Gas Tester turns OFF automatically:

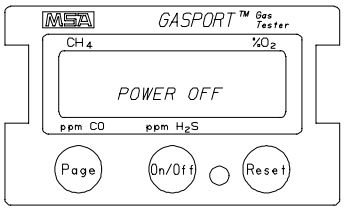

Figure 2-12.
Power OFF

See TABLE 4-1, *Calibration Equipment Parts List.*

If the pump flow is blocked or interrupted during calibration, a blocked pump alarm will occur. Before pressing the **RESET** button, verify that the blockage is cleared. Press the **RESET** button and finish the interrupted calibration.

If the low battery alarm occurs during calibration, the calibration cannot be completed. The Gasport Gas Tester will exit the Calibration mode and enter the Measure mode. Calibration can be restarted after a fully charged battery pack is attached to the Gasport unit. Please refer to Chapter 3, *Battery Pack Replacement*.

Chapter 3
Troubleshooting and Maintenance

Troubleshooting

The Gasport Gas Tester will operate reliably for years when cared for and maintained properly. If the instrument becomes inoperative, follow the Troubleshooting Guidelines in TABLE 3-1. These represent the most likely causes of a problem. You may return inoperative instruments to MSA for repair.

MSA Instrument Division
Service Department
300 Walden Road
Cranberry Township, PA 16066-5296
1-800-MSA-INST

To contact MSA International, please call:

1-412-967-3000 or 1-800-MSA-7777

When an inoperative component is located by using the guidelines, it may be replaced by using one of the following procedures:

Table 3-1. Troubleshooting Guidelines

PROBLEM	REPLACE			
	BATTERY PACK	DISPLAY MODULE	SENSOR	MAIN ELECTRONICS MODULE
Does not turn ON	√			√
Does not complete Self-Tests				√
Display segments missing or stuck		√		
"ERROR" message after battery installation				√
"ERROR" message during use				√
Battery pack does not hold charge	√			
Methane sensor does not calibrate			√	
Oxygen sensor does not calibrate			√	
Toxic sensor does not calibrate			√	
Clock not holding time.				√
In all of the above cases and for any other problems, you may return the Gasport Gas Tester to MSA for repairs.				

See TABLE 4-2, *Replacement Modules Parts List.*

Repair Procedures

Battery Pack Replacement

Recharge or replace Alkaline cells before replacing the battery pack. See Gasport Instruction Manual for details on charging battery packs. See TABLE 4-3, *Battery Packs and Chargers Parts List.*

Changing Cells in an Alkaline Battery Pack

1. Loosen the three captive screws on the bottom of the battery pack and remove the bottom cover.
2. Remove and properly dispose of old cells.
3. Install new cells, noting proper polarity marked on the inside of the battery pack.
4. Re-install bottom cover.

Remove the Battery Pack

1. Turn the "quarter-turn fastener" on the back of the instrument in a counterclockwise direction.

   NOTE: Do not remove any other screws from the Ni-Cd battery pack.

2. Slide the battery pack away from the pump module.

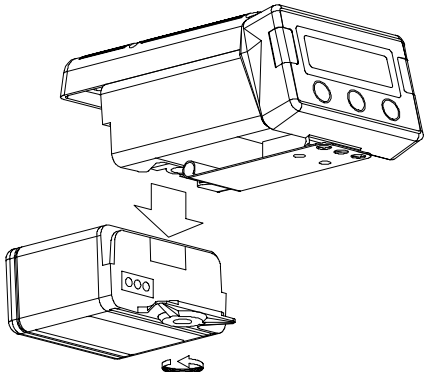

Figure 3-1.
Battery Pack Removal

Replace the Battery Pack

3. Examine the sliding battery contacts for damage.
4. Slide the battery pack toward the pump module.
5. Turn the "quarter-turn fastener" on the back of the instrument in a clockwise direction.

Sensor Replacement

⚠ CAUTION

Each sensor slot must be occupied by either an active sensor or an inactive sensor plug. Any open sensor position will interfere with the proper porting of the sample gas to the sensors, resulting in inaccurate readings and slow response.

1. Turn OFF the power, and remove the battery pack.
2. Remove the Pump Module .

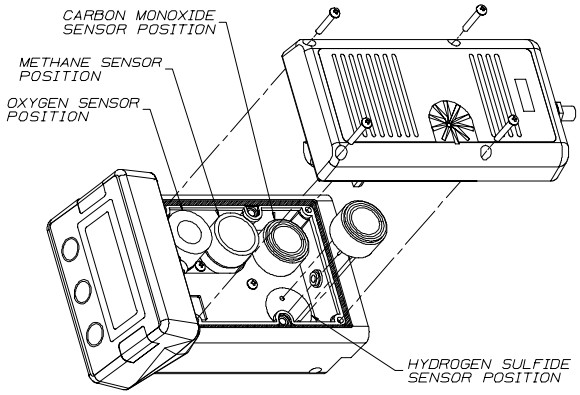

Figure 3-2.
Sensor Replacement

3. Unplug, remove, and properly dispose of the desired sensor.
4. If the replacement sensor is equipped with a shorting wire attached to its pins, remove the wire before inserting the replacement sensor.

⚠ CAUTION

The position of the toxic sensors is not interchangeable. If a carbon monoxide sensor is used, it must be placed in-line with the oxygen and methane sensors. Likewise, the hydrogen sulfide sensor must be opposite the slot which is in-line with the oxygen and methane sensors. Readings will not be accurate if sensors are in the wrong position.

5. Replace the pump module.
6. Replace the battery pack.
7. Recalibrate the instrument before using.

Main Electronics Board Replacement

⚠ CAUTION

Before handling the PC boards, ensure you are properly grounded; otherwise, static charges from your body could damage the electronics. Such damage is not covered by the warranty. Grounding straps and kits are available from electronics suppliers.

1. Turn the power OFF, and remove the battery pack.
2. Remove the Pump Module .
3. Remove the "hold-down" screw.
4. Remove the sensors.
5. Slide the chassis out halfway.
6. Disconnect the ear-phone connector.
7. Completely slide out the chassis.

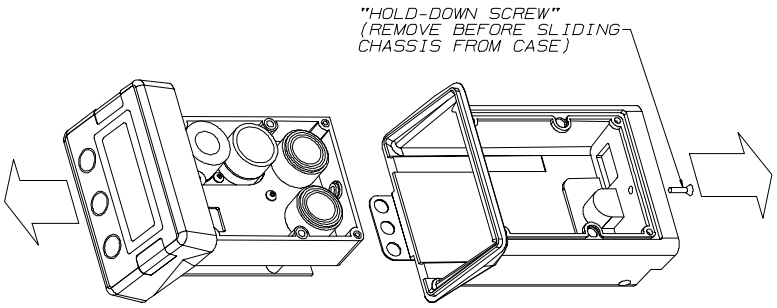

Figure 3-3.
Chassis and Sensor Removal

8. Remove the four main electronics board mounting screws.
9. Turn the instrument over, and lift up the main board to a 45-degree angle; disconnect the power connector.

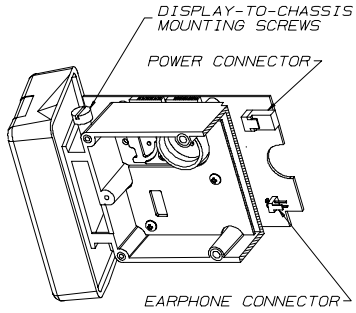

Figure 3-4.
Location of Mounting Screws & Power Connector

10. Lift up the board to about 90 degrees, and remove:
    - display connector
    - sensor connector
    - keypad connector
11. Remove the board.
12. Set the switches on the new main electronics board to the same positions as those set on the old Main Electronics Board.
13. Insert the new main electronics board.
14. Connect the
    - keypad connector
    - display connector
    - sensor connector

    to the new board.
15. Connect the power connector.
16. Fasten the four module-board mounting screws.
17. Slide the chassis half-way into the case.
18. Connect the ear-phone connector.

19. Slide the chassis completely into the case.
20. Install the "hold-down" screw.
21. Replace the sensors.
22. Install the pump module.
23. Replace battery pack.
24. Completely recalibrate the Passport Alarm.
25. Verify the alarm setpoints; adjust them if necessary.

Display Module Replacement

1. Turn the power off, and remove the battery pack.
2. Remove the Pump Module.
3. Remove the "hold-down" screw.
4. Slide the chassis out halfway.
5. Disconnect the ear-phone connector.
6. Completely slide out the chassis
7. Turn the instrument over, and remove the four mounting screws.
8. Lift up the main electronics board to a 45-degree angle, and disconnect the power connector.
9. Lift up the main electronics board to about 90 degrees. Remove:
   - display connector
   - sensor connector
   - keypad connector
10. Remove the two screws holding the display to the chassis (FIGURE 3-4).
    a. Remove the four screws holding the display module to the face piece.
11. Remove the display module.
12. Install the new display module.
13. Fasten the display mounting screws.
14. Connect the
    - keypad connector
    - display connector
    - sensor connector

    to the main electronics module.

15. Connect the power connector.
16. Replace the four module mounting screws.
17. Slide the chassis half-way into the case.
18. Connect the ear-phone connector.
19. Slide the chassis completely into the case.
20. Replace the "hold-down" screw.
21. Replace the pump module.
22. Replace battery pack.
23. Complete recalibration of the Gasport Gas Tester is recommended as a performance check.

Sensor Board Replacement

1. Turn the power OFF, and remove the battery pack.
2. Remove the Pump Module.
3. Remove the "hold-down" screw.
4. Slide the chassis out halfway.
5. Disconnect the ear-phone connector.
6. Completely slide out the chassis.
7. Remove the four main electronics-board mounting screws.
8. Turn the instrument over, and lift up the main board to a 45-degree angle; disconnect the power connector.
9. Lift up the board to about 90 degrees, and remove:
   - display connector
   - sensor connector
   - keypad connector
10. Remove the main board.
11. Remove all sensors.
12. Remove the four mounting screws on the sensor board.
13. Remove Sensor Board from chassis; replace with new Board, reinstalling screws and sensors from step 11 and 12.
14. Connect the
    - keypad connector
    - display connector
    - sensor connector

    to the main electronics module.

15. Connect the power connector.
16. Replace the four module mounting screws.
17. Slide the chassis half-way into the case.
18. Connect the ear-phone connector.
19. Slide the chassis completely into the case.
20. Replace the "hold-down" screw.
21. Replace the sensors.
22. Replace the pump module.
23. Replace battery pack.
24. Calibrate the Gasport Gas Tester.

Pump Module Replacement

1. Turn the power OFF and remove the battery pack.
2. Remove any optional sampling equipment.
3. Remove the four screws which mount the pump module.
4. Lift the pump module away from the instrument.
5. Verify that the sensors and pump-to-instrument gasket are in place in the instrument. Also, verify that the pump crank arm on the new pump module is centered on the pump eccentric bearing. (Equal amounts of bearing should show on either side of the crank arm.)
6. Secure the pump module in position with the four screws, and tighten screws until no gap exists between the pump module and the instrument case. Do not over-tighten the screws.
7. Verify proper pump module operation (see Instruction Manual).

   NOTE: Pump Filter System maintenance is described in the Gasport Instruction Manual, *General Maintenance.*

Rubber Manifold Replacement

1. Remove the pump module.
2. Peel the rubber manifold off of the two plastic case posts, which protrude through the pump printed circuit board.
3. Align the holes in the new manifold with the posts, and press directly over the posts with a finger or thumb to firmly seat the manifold against the pump board.
4. Replace the pump module.

Pump Board Replacement

1. Remove the pump module.
2. Remove the manifold.
3. Unplug the motor connector.
4. Tilt the pump board up and away from the motor at a 45 degree angle.
5. Unplug the pressure switch from the sockets on the pump board.
6. Plug the pressure switch into the new pump board.
7. Set the pump board fully into the case, making sure not to pinch the pressure switch tubing.
8. Connect the motor connector.
9. Replace the manifold.
10. Replace the pump module.
11. Verify proper pump module operation (see Gasport Instruction Manual).

Pump and Drive Replacement

1. Remove the pump module.
2. Remove the manifold.
3. Unplug the motor connector.
4. Remove the pump board.
5. Remove the two screws on the pump mounting collar located nearest the connector end of the motor.
6. Slide the tubing off the pump block to remove the pump and drive module.
7. Attach tubing to the new pump and drive module.
8. Secure the pump and drive module in place with the two screws and mounting collar; do not over-tighten the screws.
9. Replace the pump board and manifold.
10. Reconnect the motor connector.
11. Verify that the crank arm of the pump is approximately centered on the eccentric bearing (equal amounts of bearing should show on either side of the bearing).
12. Re-install the pump module.
13. Verify proper pump module operation (see Gasport Instruction Manual).

Pump Motor Replacement

1. Remove the pump and drive module.
2. Loosen the pump frame clamping screw.
3. Slide motor with attached eccentric and bearing from the frame.
4. If the eccentric and bearing are to be used again, remove them from the motor shaft by prying lightly with a small screwdriver. (Push only on the plastic eccentric, never on the bearing.)
5. Press eccentric and bearing completely onto the new motor shaft. (The end of the motor shaft should be flush with the end of the eccentric.)
6. Slide the motor into the frame and press the crank arm onto the bearing. The crank arm must be centered on the bearing, with equal amounts of bearing showing on either side of the crank arm. A .030" spacer or feeler gauge can be used to properly position the crank arm from the flat surface on the eccentric.
7. Use a small ruler or straight edge to adjust the motor so that the end is flush with the rounded pillars on the frame and the motor terminals are straight up and down; then, tighten the clamp screw.
8. Re-install the pump and drive module, pump board and manifold into the pump case.
9. Replace the pump module and verify proper operation (see Gasport Instruction Manual). The pump should draw a minimum of 240 ml/minute against a resistance of 30 inches of water suction.

Rebuilding the Pump and Drive

1. Remove the pump and drive module.
2. Remove the motor with attached eccentric and bearing.
3. Remove the four screws which attach the pump plate, gasket and pump block to the plastic frame.
4. Remove the pump block and diaphragm assemblies.
5. Place the new diaphragm and block assemblies on the frame. (The crank arm supplied with the rebuilding kit is marked with a black dot; alight the crank arm so that the side with the dot faces the motor. Align the block so the arrow points toward the motor.)

6. Place the gasket and plate on the pump block, and loosely attach these parts to the pump frame with the four screws.
7. Slide the motor into the frame and press the crank arm onto the bearing. The crank arm must be centered on the bearing so equal amounts of bearing can be seen on either side of the crank arm. A .030" spacer or feeler gauge can be used to properly position the crank arm from the flat surface of the eccentric.
8. Use a small ruler or straight edge to adjust the motor so that the end is flush with the rounded pillars on the frame and the motor terminals are straight up and down; then, tighten the clamp screw.
9. Make sure the diaphragm is free to "find" its optimum position; then, press the plate toward the frame and tighten the four screws sequentially and evenly. Do not over-tighten the screws.
10. Any time a pump and drive is disassembled and re-assembled, proper operation must be verified (see Gasport Instruction Manual). The pump should draw a minimum of 240 ml/minute against a resistance of 30 inches of water suction.

Chapter 4
Parts List

Table 4-1. Calibration Check Equipment Parts List	
PART	**PART NO.**
Calibration Kit Model RP with 0.25 lpm Regulator	477149
Calibration Gas - 2.5% methane	491041
Calibration Gas - 300 ppm CO	473180
Calibration Gas - 10 ppm H_2S	467898
Calibration Gas - 2.5% methane, 300 ppm CO, 10 ppm H_2S, 15% O_2	813720
Calibration Gas - 2.5% methane 60 ppm CO, 15% O_2	813718
Calibration Gas - 100% methane	711014
Quick-connect Calibration Adapter	636246

Table 4-2. Replacement Modules Parts List	
PART	**PART NO.**
Main Electronics Board	812078
Display Module	806557
Sensor Board	812149
Combustible Gas Sensor	813693
O_2 Sensor	480566
CO Sensor	804195
H_2S Sensor	805065
Inactive O_2 Sensor Plug	812377
Inactive Toxic Sensor Plug	812378
Plastic Top Assembly	805247

Table 4-3. Battery Packs and Chargers Parts List	
PART	**PART NO.**
Charger, Omega 120 VAC	494716
Charger, Omega 220 VAC	495965
Charger, Omega 110/220 VAC, Five Unit	801759
Charger, Omega 12 volt	800525
Battery Pack, "C" Cell Alkaline	800526
Battery Pack, "HD" Ni-Cd Rechargeable	800527

Table 4-4. Pump Module Parts List

PART	PART NO.
Pump Module	811724
Rubber Manifold	812025
Pump Board	811934
Pump and Drive Module	812138
Pump to Instrument Gasket	496373
Pump Rebuilding Kit • Block Assembly • Diaphragm Assembly	805341
Eccentric and Bearing	492921
Motor Assembly	812997