



WatchmanTM Multigas Monitor

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, this unit 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. Read and understand the instruction manual completely before operating.

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 pertains to units with Serial Number prefix "A".

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Manufactured by
MSA INSTRUMENT DIVISION
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Chapter 1

Set-up

To ensure that the Watchman Multigas Monitor operates accurately, the user must refer to this Technical Manual to:

- Set the correct date and time
- Set the appropriate Internal Switch Settings
- Set the appropriate Alarm Levels
- Properly Calibrate the instrument
- Perform any necessary troubleshooting/maintenance procedures

Setting Correct Date and Time

Charge the battery pack with the Omega™ Charger:

1. Remove the instrument handle by releasing the two knurled thumbscrews from the left and right sides.

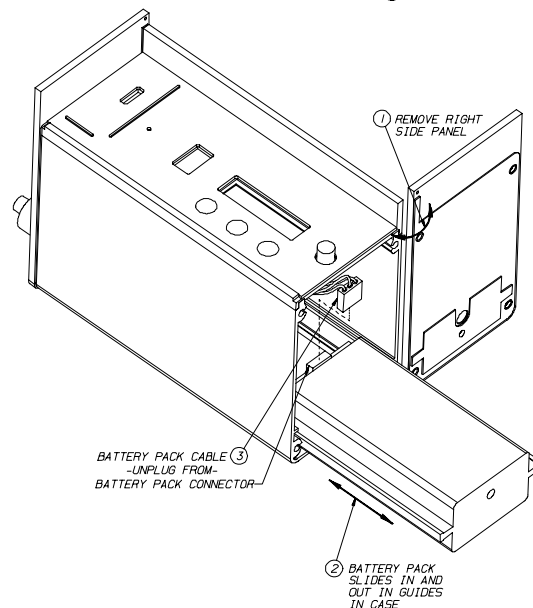


Figure 1-1. Battery Pack Removal and Installation

2. Remove the four screws securing the right side panel; remove right side panel and flip-top lid (see FIGURE 1-1).
3. Remove the battery pack retaining screw from below the charging jack cut-out on the right side panel.
4. Disconnect and then reconnect the battery pack power cable.

The instrument responds:

- backlight flashes
- screen flashes
- alarm sounds
- alarm lights flash
- major electronic components are tested automatically (FIGURE 1-2).

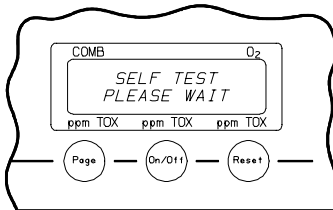


Figure 1-2. Self Test

After tests are completed, either ERROR or OK appears on display.

When ERROR appears:

- Alarm sounds; see the Troubleshooting Guidelines in Chapter 3.

When OK appears:

- The FIGURE 1-3 display appears.

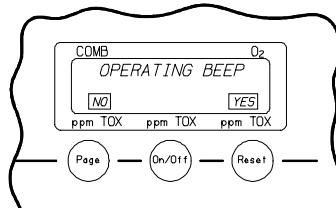


Figure 1-3. Operating Beep - No/Yes?

If PAGE (NO) is pressed, or no buttons are pressed for five seconds, the display changes to SET TIME.

If **RESET (YES)** is pressed, the alarm beeps about every 30 seconds, indicating the Watchman Monitor is turned ON. The beep does not occur if YES is not selected or the Watchman Monitor is turned OFF.

The FIGURE 1-4 display now appears.

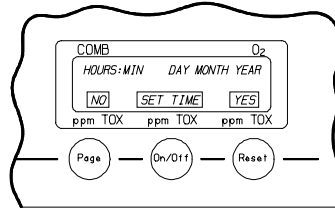


Figure 1-4. Time and Date Set

To cancel the Time and date set, press the **PAGE (NO)** button or wait five seconds.

- A long beep sounds and the FIGURE 1-5 display appears.

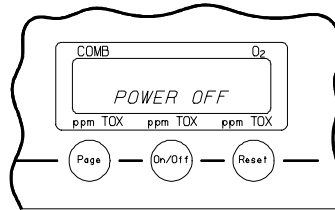


Figure 1-5. Power OFF

To set the time, press the **RESET (YES)** button.

- The FIGURE 1-6 display now appears.

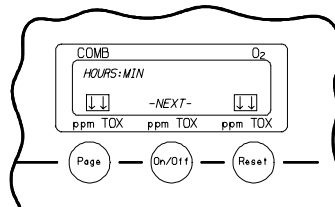


Figure 1-6. Time Set

- The hour flashes.
 - Press the **PAGE** button to lower the hours.

- Press **RESET** to raise the hours
- Press the **ON/OFF** button to accept the new number.
- The minutes now flash.
 - Adjust as needed.
 - Press the **ON/OFF (NEXT)** button to accept the reading.
- The **FIGURE 1-7** display momentarily appears; then,

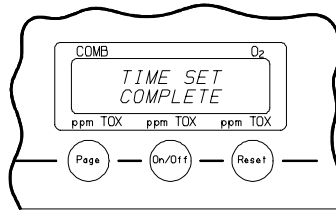


Figure 1-7. Time Set Complete

- The **FIGURE 1-8** display appears.

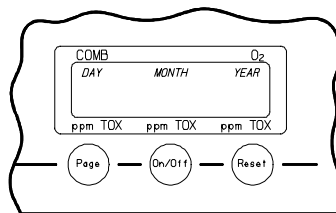


Figure 1-8. Day, Month, Year

- The day flashes.
 - Press the **PAGE** button to lower the day.
 - Press **RESET** to raise the day.
 - Press **ON/OFF (NEXT)** to accept the reading.
- The month now flashes.
 - Adjust as needed.
 - Press **ON/OFF (NEXT)** to accept the reading.
- The year now flashes.
 - Adjust as needed.
 - Press **ON/OFF (NEXT)** to accept the reading.
- When the selected time/date values are set, the **FIGURE 1-9** display now appears.

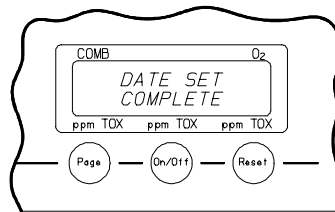


Figure 1-9. Date Set Complete

- The Alarm sounds.

NOTE: The small battery on the main board which runs the clock has an estimated life of 5-10 years if the main battery pack is not installed, or if it is installed but completely discharged. This clock battery has a much longer life if a charged battery pack is installed on the Watchman Multigas Monitor. If the clock is not holding the correct time when the battery pack is reinstalled, the clock battery is dead. Either replace the main board or send the Watchman Multigas Monitor to a service center to have a new battery soldered onto the main board.

- **POWER OFF (FIGURE 1-10)** displays for a few seconds, and the instrument turns OFF.
 5. Slide the battery pack into the case along the guides in the case housing.
 6. Replace the right side panel; be sure to reinstall the flip-top lid.
 7. Install and tighten (do not over-tighten) the screw below the charging jack opening to secure the battery pack and seal around the charging jack hole.
 8. Tighten the four side plate screws and replace handle and knurled knobs to secure handle.

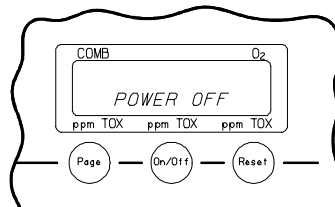


Figure 1-10. Power OFF

The Watchman Monitor is ready for use after a calibration or response check is performed.

Internal Switches

Watchman Monitor 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. Turn the instrument OFF.

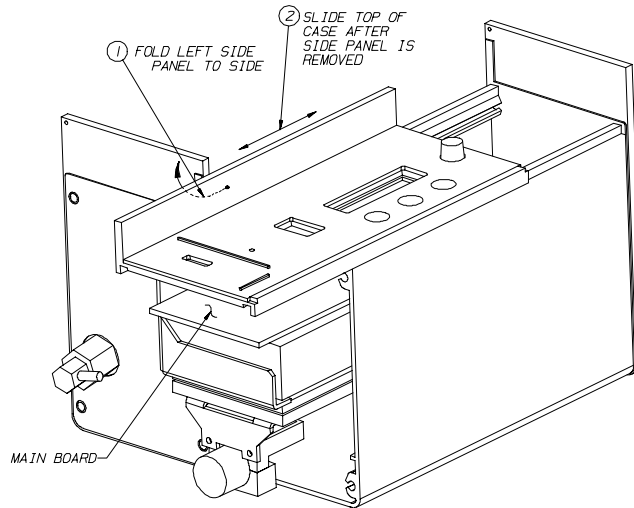


Figure 1-11. Remove Left Side Panel

2. Loosen the thumbscrews and remove handle from instrument.
3. Remove the four screws securing the left side panel (the side with gas inlet/outlet) and set panel on work surface (FIGURE 1-11).
4. Slide the top panel and electronics assembly to the left and remove from the case enclosure. The flip-top lid will be loose at this point and should be set aside (FIGURE 1-11).
5. Disconnect battery cable from battery pack (refer to FIGURE 1-1 no need to remove right side panel to access connector).
6. Carefully turn the front panel face down on the work surface; do not to kink the tubing connecting the pump to the left side panel.

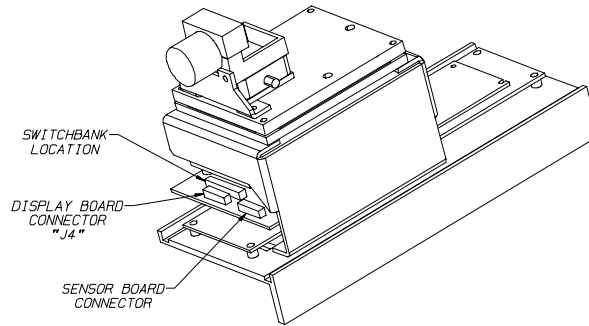


Figure 1-12. Turn Unit Over and Locate Switches

7. On the left end of the Main Printed Circuit Board Assembly, locate the two rows of switches "A" and "B" found behind the "J4" Connector to the Display Board (FIGURE 1-12).

NOTE: Connector "J4" may be removed for easier access but must be handled carefully to prevent cable damage (FIGURE 1-4).

Switch Settings

TABLE 1-1 shows switch settings for normal operation.

Setting Alarm Levels

To change the instrument alarm setpoints:

1. Locate the internal switches as described above.
2. Set switch A-1 to OFF. (Refer to TABLE 1-2 and FIGURE 1-13.)

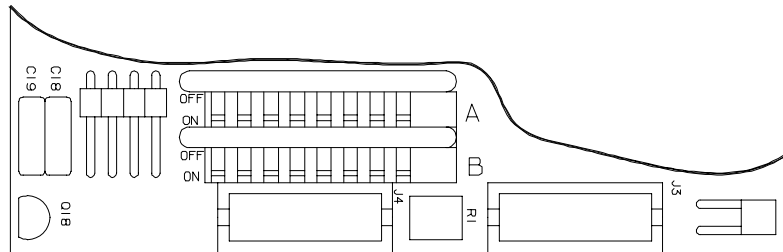


Figure 1-13.
Internal Switch banks "A" and "B"

Table 1-1. Internal Switch Settings for Normal Operation			
SWITCH "A":			
1 - ON: MEASURE (normal) operation, instrument will monitor for alarm conditions			
2 - Combustible Display ON: %CH ₄ (Methane) OFF: %LEL (Lower Explosive Limit)			
SENSOR	SWITCH "A"	ENABLE	DISABLE
Combustible Gas	3	ON	OFF
Oxygen	4	ON	OFF
Toxic Gas #1	5	ON	OFF
Toxic Gas #2	6	ON	OFF
Toxic Gas #3	7	ON	OFF
---	8	---	---
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
---	6	---	---
---	7	---	---
Factory Use Only	8	OFF	OFF

Table 1-2. Internal Switch Settings for Changing Alarm Setpoints			
SWITCH "A":			
1 - OFF: SET ALARMS, instrument will NOT monitor for alarm conditions			
2 - NO CHANGE			
SENSOR	SWITCH "A"	ENABLE	DISABLE
Combustible Gas	3	ON	OFF
Oxygen	4	ON	OFF
Toxic Gas #1	5	ON	OFF
Toxic Gas #2	6	ON	OFF
Toxic Gas #3	7	ON	OFF
---	8	---	---
FUNCTION	SWITCH "B"	ENABLE	DISABLE
---	1	---	---
TWA	2	ON	OFF
STEL	3	ON	OFF
---	4	---	---
---	5	---	---
---	6	---	---
---	7	---	---
---	8	---	---

3. Reconnect the battery pack cable.

Current alarm setpoints are now displayed when the instrument is turned ON. Only the setpoints for gas sensors turned ON in switch bank "A" (See TABLE 1-2) can be changed. Alarm points can be set in the following order:

- Combustible Gas
 - High Alarm
- Oxygen
 - Low Alarm
 - High Alarm
- Toxic Gas #1
 - High Alarm
 - Time Weighted Average (TWA)
 - Short Term Exposure Limit (STEL)
- Toxic Gas #2
 - High Alarm
 - Time Weighted Average (TWA)
 - Short Term Exposure Limit (STEL)
- Toxic Gas #3
 - High Alarm
 - Time Weighted Average (TWA)
 - Short Term Exposure Limit (STEL)

The first setpoint to be changed will be highlighted (FIGURE 1-14).

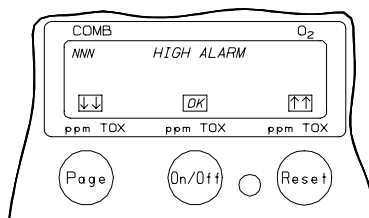


Figure 1-14. Combustible Alarm Setpoint Display

⚠ WARNING

Improper adjustment of alarm setpoints may 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.

To accept the setpoint:

- Push the **ON/OFF** (OK) button; the new setpoint is stored in memory. The Watchman Monitor moves automatically to the next setpoint (FIGURE 1-15).

When all selected alarm setpoints are set, a long beep sounds and the FIGURE 1-16 display appears.

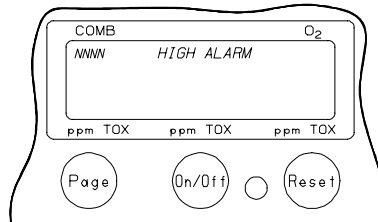


Figure 1-15. Accepted Setpoint Display

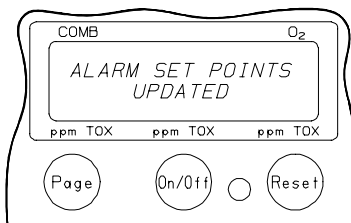


Figure 1-16. Alarm Setpoints Updated

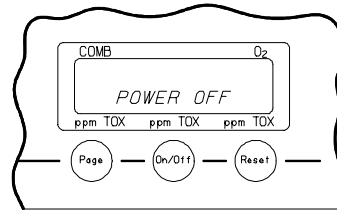


Figure 1-17. Power OFF

Another long beep sounds, and the Watchman Monitor turns OFF automatically (FIGURE 1-17).

Reset internal switch A-1 to ON for normal operation. (Refer back to TABLE 1-1.)

Combustible Gas Display

The units of measurement for the combustible gas display may be changed by the user. The display may indicate either %LEL (% of Lower Explosive Limit) or %CH₄ (Methane by volume). The display is controlled by an internal switch.

Activating %LEL Display

1. Locate the internal switches as previously described.
2. Turn Switch A-2 to the OFF position.

Activating %CH₄ Display

1. Locate the internal switches as previously described.
2. Turn Switch A-2 to the ON position.

⚠ WARNING

Changing the switch requires instrument recalibration and alarm setpoint verification. Failure to do so can result in inaccurate readings.

Reassemble the instrument

1. Turn the electronics assembly upright and slide it onto the case housing.
NOTE: Ensure there are no kinks in the flow system tubing and no pinched wires.
2. Tuck tubing into the housing and lift left the side panel into place.

3. Loosely install the four side panel screws and the case housing (top panel).
4. Reposition the flip-top lid and fully tighten the side panel screws; ensure that no wires are pinched between the side panel and the case.
5. Replace the handle and tighten the thumbscrews.

Chapter 2 Calibration

⚠ CAUTION

Before each day of use, 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. Accuracy may be corrected by specific adjustment procedure.

Optional Fresh Air Setup

The Watchman Multigas Monitor can be set to allow the user to automatically zero the measurement systems and calibrate the oxygen system when the unit is turned ON.

Activating the Fresh Air Setup Option

1. Disassemble the instrument and locate the internal switches as described in Chapter 1.
2. Turn Switch B-1 to the ON position.
3. Reassemble the unit.

When this feature is activated and the instrument is turned ON, the Watchman Monitor completes its self-tests and asks if a Fresh Air Setup is desired (FIGURE 2-1).

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.

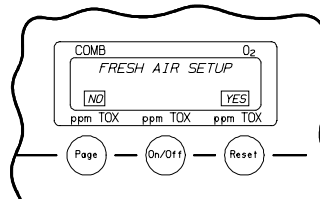


Figure 2-1. Fresh Air Setup?

To Perform Fresh Air Setup

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

- The Watchman Monitor begins to perform a Fresh Air Setup.
- Oxygen is set at 20.8 percent.
- All other gases are set at zero.

NOTE: If the Fresh Air Setup feature is activated and an error message displays, 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 run Fresh Air Setup again.

⚠ WARNING

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

If you do, the Watchman Monitor'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 Watchman Monitor must determine if 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

Watchman Monitor calibration can be adjusted easily by using gases of known mixtures and concentrations. Check the calibration each day before using your Watchman Monitor.

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 Watchman Monitor.
2. Allow the instrument to stabilize for several minutes in fresh air at the temperature and air pressure of intended use.

⚠ WARNING

The Watchman Multigas Monitor 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 both the **PAGE** button and the **RESET** button; then, simultaneously press the **ON/OFF** button. The instrument turns ON. The FIGURE 2-2 display appears.

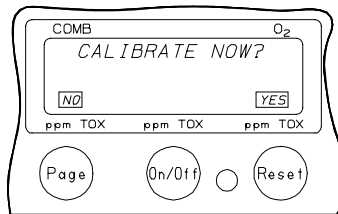


Figure 2-2.

Calibration Selection Display, Select Yes or No

To Cancel Calibration:

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

- The Watchman Monitor begins warming up and enters the Exposure display page.

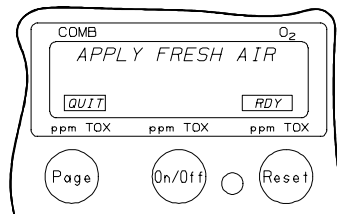


Figure 2-3.

Apply Fresh Air When Indicated

To Continue Calibration (FIGURE 2-3):

2. Press the **RESET** (YES) button.
 - Display prompts you for Fresh Air.

NOTE: At this point, allow the instrument to warm up for at least one minute. In order to reduce zero drifting and improve instrument accuracy, a longer warm-up time (up to 15 minutes) is desirable.

To cancel:

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

- Instrument beeps and automatically shuts OFF.

To proceed:

3. Press the **RESET** (READY) button.
4. Wait approximately 15 seconds for the Watchman Monitor to complete the fresh air adjustments .
 - During this time, the (FIGURE 2-4) display appears.

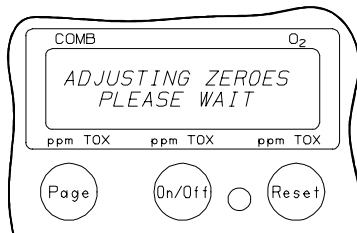


Figure 2-4.
Instrument Adjusts Zeros with Fresh Air

After the fresh air adjustments are made, the Watchman Alarm is ready to complete calibration.

5. **Applying Gases to Instrument**

Using the Gas Tank (Optional)

- a. Attach a 1.5 lpm (liters-per-minute) Flow Controller regulator to the gas tank (from Model RP Calibration Check Kit, P/N 477150).
- b. Attach a 30-inch sample line by screwing the connector adapter to the Watchman Monitor gas inlet .
- c. Attach the other end of the sample line to the 1.5 lpm regulator.
 - The Watchman Monitor 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 Watchman Monitor pump automatically restarts.

- The FIGURE 2-5 display appears.

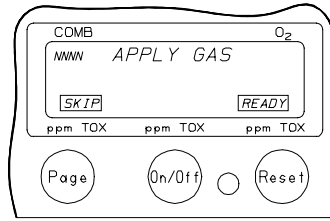


Figure 2-5.
Ready for Combustible Gas Calibration Display

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

- Combustible Gas
- Oxygen
- Toxic Gas #1
- Toxic Gas #2
- Toxic Gas #3

Only those gas sensors turned ON in switch bank "A" (by the corresponding internal switches) are displayed and can be calibrated. (See TABLE 1-2 in Chapter 1.)

Combustible Gas Calibration

6. When the calibration gas is flowing to the instrument, the display for combustible gas will change (see FIGURE 2-6). After the gas reading stabilizes, compare the reading to the acceptable levels and adjust the reading to the known gas concentration.
 - a. Press the PAGE (SKIP) button to skip this gas (or any other calibration gas you do not want to change).

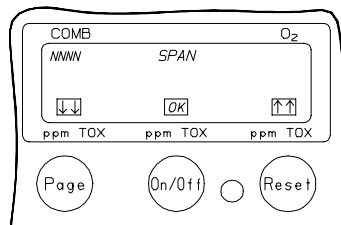


Figure 2-6.
Combustible Gas Span Adjustment Display

11. 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.
 - Pressing and holding either button causes the reading to rapidly roll either up or down.
12. Push the **ON/OFF (OK)** button to accept the reading.
 - The new reading is stored in memory, and the Watchman Monitor automatically moves to the next reading.
13. Change the gas sample as needed:

With a Gas Tank:

- a. Turn OFF the gas by turning the knob on the gas tank counterclockwise.
- b. Disconnect the Sample Line from the Watchman gas inlet.
- c. Disconnect the 1.50 lpm Flow Controller from the gas tank.
- d. Assemble the kit with the new gas tank.

When all the selected calibrations are set, a long beep sounds and the FIGURE 2-8 display appears.

The FIGURE 2-9 display then appears.

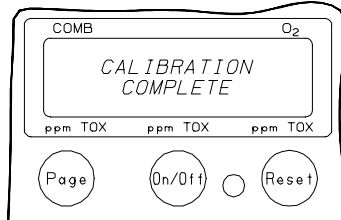


Figure 2-8.
Calibration Update

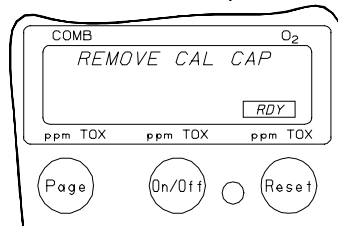


Figure 2-9.
Remove Calibration Equipment

- 14 Remove the Calibration Kit sample line from the instrument inlet.
15. Press the **RESET** button.
 - The FIGURE 2-10 Display appears and allows the calibration gases to clear from the sensors (about 30 seconds).

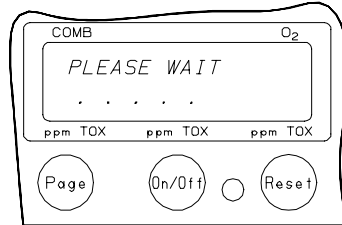


Figure 2-10.
Please Wait

- A long beep sounds
- The Watchman Monitor turns OFF automatically (FIGURE 2-11).

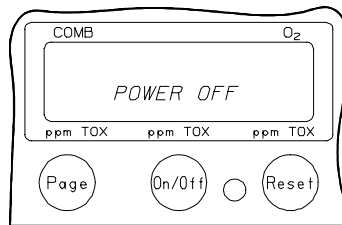


Figure 2-11.
Power Off

Chapter 3

Troubleshooting and Maintenance

Troubleshooting

The Watchman Multigas Monitor 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

Table 3-1. Troubleshooting Guidelines					
PROBLEM	REPLACE				
	BATTERY PACK*	DISPLAY MODULE	SENSOR	MAIN ELECTRONICS MODULE	PUMP AND PRESSURE SWITCH
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	√				
Combustible sensor does not calibrate			√		
Oxygen sensor does not calibrate			√		
Toxic sensor does not calibrate			√		
Clock not holding time.				√	
Pump Alarm will not trigger					√
Recharge or replace the cells before replacing battery pack.					
In all of the above cases and for any other problems, you may return the Watchman Multigas Monitor to MSA for repairs.					

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

Repair Procedures

Battery Pack Replacement

Remove the Battery Pack

1. Turn the Watchman Monitor OFF.
2. Loosen thumbscrews and remove the handle from the instrument.
3. Remove the four screws securing the right side panel (side with battery charging jack). See FIGURE 3-1.
4. Remove single retaining screw holding battery pack to right side panel.
5. Remove the right side panel and flip-top lid.

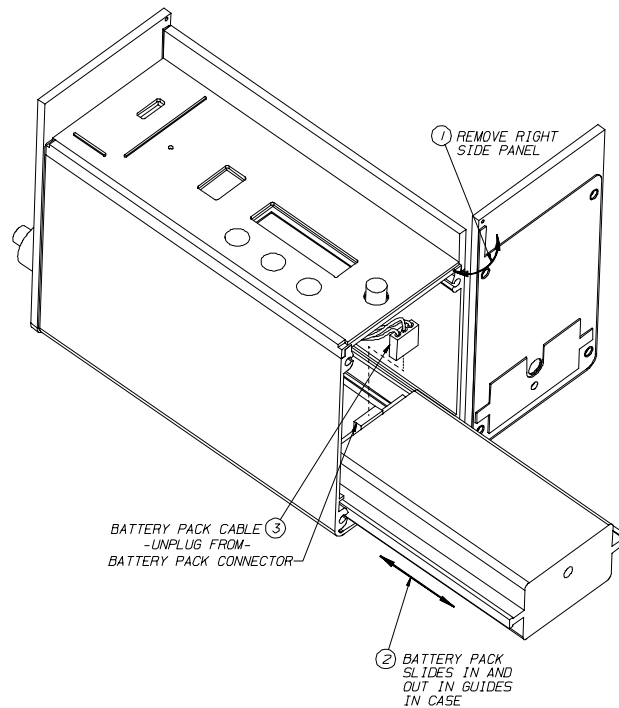


Figure 3-1.
Removing Battery Pack

6. Slide the battery pack out of the Watchman Monitor case.
7. Disconnect battery cable from the battery pack.

Replace the Battery Pack

1. Connect battery cable to the battery pack
2. Slide battery pack in between the guides provided in the Watchman Monitor case.
3. Replace the flip-top lid and realign the right side panel.
4. Replace the four side panel screws and tighten.
5. Replace the battery pack retaining screw (do not over-tighten).
6. Replace instrument handle and tighten thumb screws.

Sensor Replacement

1. Turn the instrument OFF.
2. Loosen thumb screws and remove instrument handle.
3. Remove the four screws securing the left side panel (side with gas inlet/outlet) and lay panel down on work surface.
4. Slide top panel and electronics assembly to the left and remove from case enclosure (FIGURE 3-2).

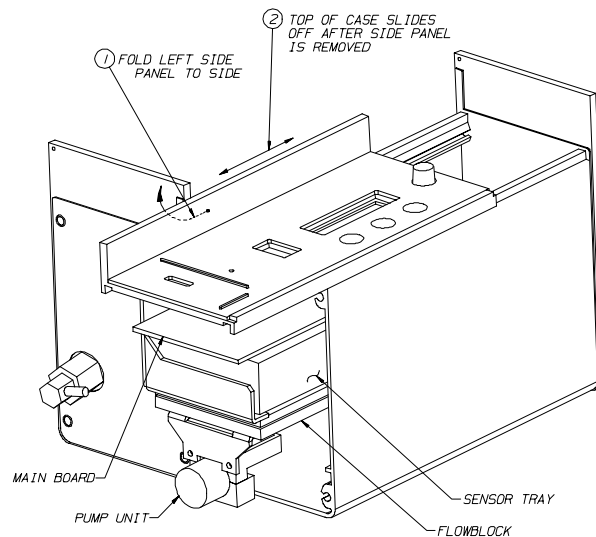


Figure 3-2.
Removing Left Side Panel

- The flip-top lid will be loose at this point and should be set aside.
5. Disconnect battery cable from battery pack (see FIGURE 3-1).
 6. Carefully turn the front panel face down on the work surface; ensure that tubing connecting the pump to the left side panel is not kinked.
 7. Remove the four Phillips head screws at the corners of the flow block (FIGURE 3-3).
 8. Lift flow block off of the sensor housing.
 9. Unplug, remove, and properly dispose of the expired sensor (FIGURE 3-4).
 10. Install the new sensor.
NOTE: If the replacement sensor is equipped with a shorting plate, clip or wire attached to its contact pins on the back of the sensor, remove the wire before inserting the replacement sensor.
 11. Replace the sensor gasket.
 12. Replace the flow block.

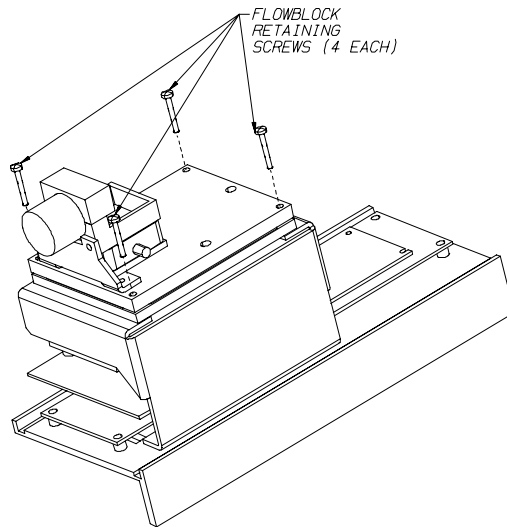


Figure 3-3.
Removing Flow block

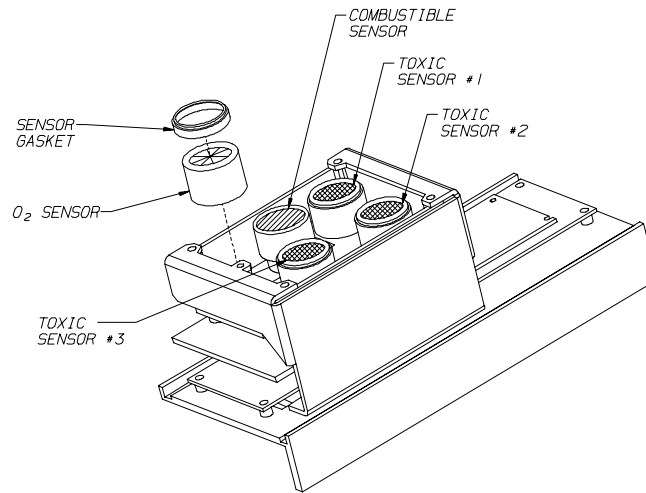


Figure 3-4.
Replacing Sensors

Reassemble The Instrument:

13. Connect battery cable to the battery pack.
 - The instrument will turn ON and allow opportunity to reset the date and time.
14. Turn the electronics assembly back upright and slide onto the case housing.

NOTE: Ensure there are no kinks in the flow system tubing and no pinched wires.
15. Tuck the tubing into the housing and lift the left side panel into place.
16. Loosely install the four side panel screws and the case housing (top panel).
17. Reposition the flip-top lid and fully tighten the side panel screws; ensure that no wires are pinched between the side panel.
18. Replace handle and tighten the thumb screws.
19. Recalibrate the instrument before using.

Main Electronics Board Replacement

⚠ CAUTION

Before handling the printed circuit 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 such as Radio Shack.

1. Turn the Watchman Monitor OFF.
2. Loosen thumbscrews and remove the instrument handle.
3. Remove the four screws securing the left side panel (side with gas inlet/outlet) and set panel on work surface. (See FIGURE 3-2.)
4. Slide top panel and electronics assembly to the left and remove from the case enclosure. The flip-top lid will be loose at this point and should be set aside.
5. Disconnect battery cable from the battery pack.
6. Carefully turn the front panel face down on the work surface; ensure the tubing connecting the pump to the left side panel is not kinked.
7. Remove the four Phillips head screws at the corners of the flow block. (See FIGURE 3-3.)
8. Lift flow block off sensor housing.
9. Remove the two retaining screws from the sensor housing (FIGURE 3-5).
10. Disconnect electrical connections to/from main board:
 - display board connector
 - keypad connector
 - sensor board connector
 - remote alarm connector
 - motor power connector from the display board.
11. Slide sensor housing out from the mounting bracket (FIGURE 3-5).
12. Remove four mounting screws for main board and set the motor power cable and spacers aside.
13. Remove the board and disconnect power connection (FIGURE 3-6).
14. Set the switches on the new Main Electronics Board to the same positions as those set on the old Main Electronics Board.
15. Insert the power connector on the new board.

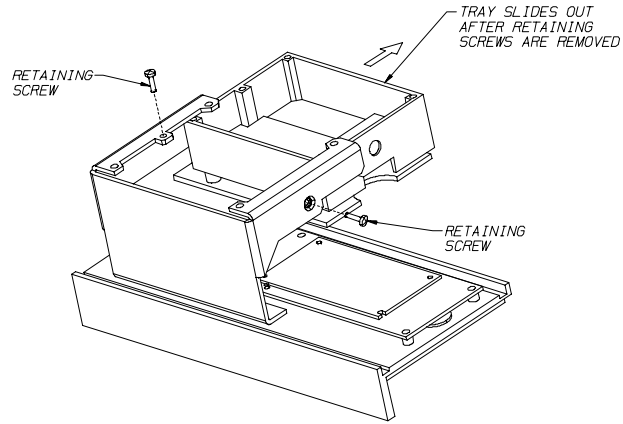


Figure 3-5.
Removing Retaining Screws and Sensor Housing

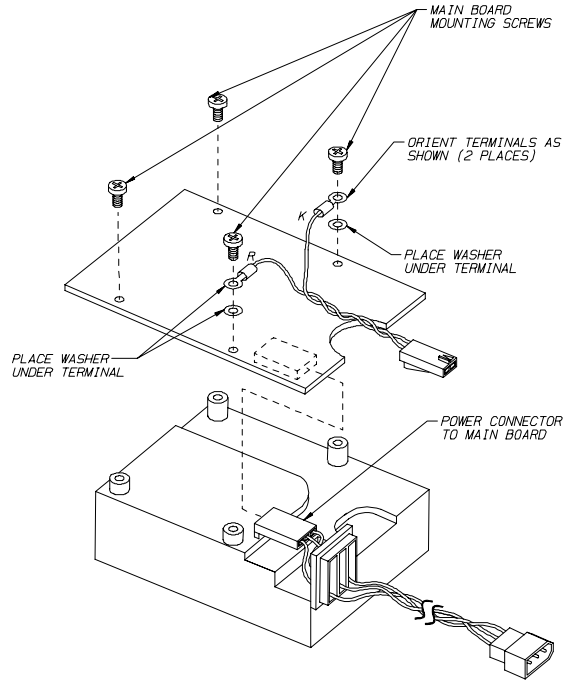


Figure 3-6.
Removing Main Board

16. Replace the motor power cable, spacers and screws.
17. Position sensor housing in the mounting bracket.
18. connect the following to/from the new board:
 - display board connector
 - keypad connector
 - sensor board connector
 - remote alarm connector
 - motor power connector to the display board
19. Replace the sensor housing retaining screws.
20. Replace the sensor gaskets and flow block.
21. Reconnect battery cable to battery pack.
22. Turn the electronics assembly upright and slide it onto the case housing.

NOTE: Ensure there are no kinks in the flow system tubing and no pinched wires.
23. Tuck tubing into housing and lift left side panel into place.
24. Loosely install the four side panel screws and the case housing (top panel).
25. Reposition flip-top lid and fully tighten the side panel screws checking that no wires are pinched between the side panel.
26. Replace handle and tighten thumb screws.
27. Completely recalibrate the Watchman Monitor.
28. Verify the alarm setpoints; adjust them if necessary.

Display Board Replacement

1. Perform *Main Board Replacement*, Steps 1 through 11.
2. Remove retaining nut and dust cap from the remote alarm jack.
3. Remove the six screws securing the display board (FIGURE 3-7).
4. Lift off the display board.
5. Remove gasket from the buzzer.
6. Place buzzer gasket on the new display board.
7. Remove pressure switch (connected by tubing to the sample inlet line) by removing the retaining screw and unplugging the switch.
8. Replace pressure switch on the new display board.

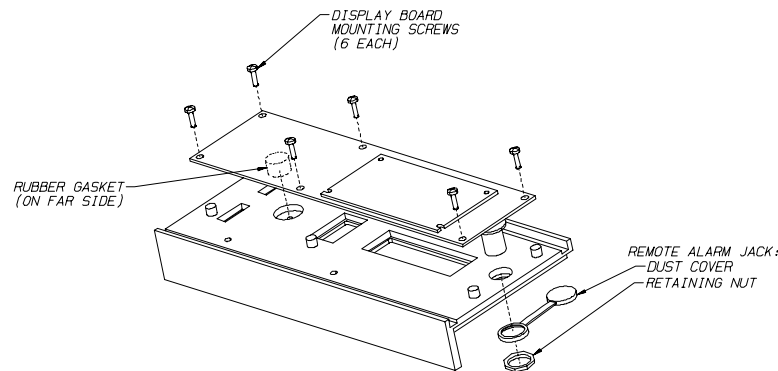


Figure 3-7.
Removing Display Board

9. Position new board relative to the buzzer and remote alarm jack openings in the front panel and rock gently it into place to seat the buzzer gasket.
10. Replace the six screws.
11. Replace dust cap and nut for the remote alarm jack.
12. Perform *Main Board Replacement Steps* 17 through 28.

Sensor Board Replacement

1. Perform *Main Board Replacement Steps* 1 through 8.
NOTE: The following steps can be performed without removing the main board connections by sliding the display board cable in-between the sensor housing and the mounting bracket.
2. Remove sensors and set aside.
3. Remove sensor chassis; retain screws (FIGURE 3-8).
4. Disconnect display board cable from the main board.
5. Remove the four mounting screws; lift and slide out the board.
6. Slide the new board into place.
7. Replace the mounting screws.
8. Connect the display board cable to the main board.
9. Reposition the sensor housing; replace the retaining screws.
10. Replace the sensors and gaskets.

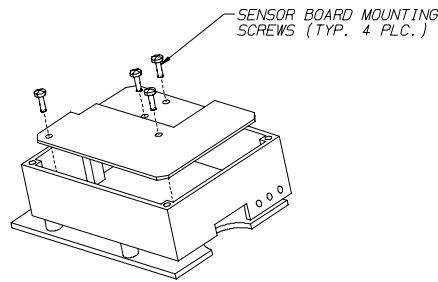


Figure 3-8.
Removing Sensor Board

11. Perform *Main Board Replacement Steps 20-28.*

Pump and Drive Unit Replacement

1. Perform *Sensor Replacement Steps 1 through 6.*
2. Unplug motor connector from Display Board "P4" connector (near pressure switch).
3. Using a small flat head screwdriver, remove the tubing from the pump inlet and outlet.
4. Remove the two screws securing the pump to the manifold bracket (see FIGURE 3-9).

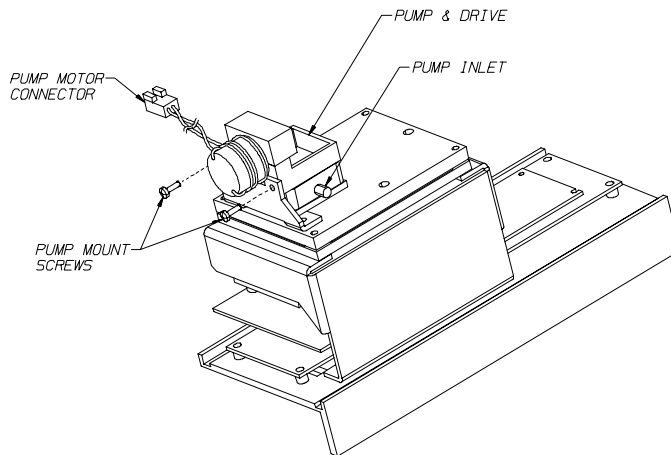


Figure 3-9.
Replacing Pump and Drive

5. Install the new pump and replace the two mounting screws.
6. Press the tubing firmly onto the pump inlet and outlet.
7. Plug the motor connector into the Display Board "P4" connector (near pressure switch).
8. Reassemble the instrument.

Pressure Switch Replacement

1. Perform *Main Board Replacement* Steps 1 through 11.
2. Remove pressure switch (connected by tubing to the sample line inlet tubing) by removing the retaining screw and unplugging the switch.
3. Remove the tubing from the old switch.
4. Install tubing on the new switch.

CAUTION

Be sure to install tubing on the switch port closest to the electrical contacts or the pump alarm will not operate properly.

5. Plug in the new pressure switch by orienting the tubing towards the front edge of the display board; replace the retaining screw.
6. Reassemble the instrument per *Main Board Replacement* Steps 19 through 28.

Chapter 4 Replacement Parts List

Table 4-1. Parts List	
ITEM	PART NO.
Battery Pack	814127
Sample Line, 5 Foot	011354
Sample Line, 10 Foot	011955
Sample Line, 15 Foot	011912
Sample Line, 25 Foot	011913
Sample Line, 50 Foot	011958
Probe, 20 inch, Plastic	486934
Probe, 3 Foot, Brass	011961
Probe, 3 Foot, Plastic	073743
Probe, 4 Foot, Brass	011960
Line Trap Assembly	074814
Water Trap Assembly	497199
Charger, Omega, 120 Volts AC	494716
Charger, Omega, 220 Volts AC	495965
Charger, Omega, 120/220 VAC, Five Unit	801759
Charger, Omega, 8 to 24 Volts DC	800525
Remote Alarm, 90 Decibels	800992
Remote Alarm, 110 Decibels	800991
Calibration Kit, Model RP with 1.5 Liters Per Minute Regulator	477150
Calibration Gas - LEL Pentane Simulant/15% Oxygen	478192
Calibration Gas - LEL Pentane Simulant/15% Oxygen/60 PPM Carbon Monoxide	478919
Calibration Gas - 10 PPM Hydrogen Sulfide	467898
Calibration Gas - LEL Pentane Simulant/15% Oxygen/ 300 PPM Carbon Monoxide/10 PPM Hydrogen Sulfide	804770
Calibration Gas - LEL Pentane Simulant/15% Oxygen/10 PPM Hydrogen Sulfide	804769
Main Electronics Board	802470
Display Board	814131
Sensor Board	814437
Pump and Drive Assembly	814933
Pressure Switch	635621
Combustible Sensor	478537
Oxygen Sensor	480566
Carbon Monoxide Sensor	636240
Hydrogen Sulfide Sensor	636241
Sulfur Dioxide Sensor	807476
Nitrogen Dioxide Sensor	807477
Nitric Oxide Sensor	808350