



MicroGard[®] Pump Module

(high efficiency/low flow rate version
p/n 802830) for the MicroGard[®] Portable Alarm

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 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.

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.

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Manufactured by
MINE SAFETY APPLIANCES COMPANY
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Congratulations on your purchase of the MicroGard Pump Module, an accessory designed for use with the MicroGard Portable Alarm for sampling, and backed by years of MSA quality, dedication and service.

General Warnings

1. Do not charge the battery pack in areas that may contain a flammable mixture of combustible gases, vapors, or dust and air; otherwise, an explosion may occur because a source of ignition exists during charging.
2. Do not operate the pump in oxygen-enriched atmospheres (more than 21% oxygen) containing combustible gases, vapors, or other materials. Fire or explosion can result from operating in these atmospheres.
3. Use only genuine MSA replacement parts when performing maintenance procedures described in this manual; failure to do so may seriously impair the MicroGard Pump Module's performance. Repair or alteration 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.

Failure to follow the above warnings may result in severe personal injury or death.

General Cautions

1. Follow the National Electric Code and other applicable codes when locating and operating the pump.
2. When using the pump in a hazardous area (with respect to fire or explosion) as specified in the National Electric Code (NEC) Article 500 - Hazardous (Classified) Locations, the pump must be labeled stating that it meets the design criteria of the specific Division, Class, and Group. Users must operate the pump in accordance with the instructions for that Division, Class, and Group. A copy of the NEC Code can be obtained from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.
3. To ensure continued operation within the specified performance limits, maintain and calibrate the pump per the instructions in this manual; you must also maintain and calibrate the MicroGard Portable Alarm per its own instruction manual.
4. If, after thoroughly reading this manual, you are uncertain of the installation, operation, or maintenance procedures, call 1-800-MSA-2222 for assistance.

Failure to follow the above cautions may result in personal injury and/or damage to the unit.

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Section 1 General Information

Operating Specifications	
<i>Electrical Characteristics</i>	
POWER SUPPLY	<ul style="list-style-type: none">Operates in conjunction with standard battery packs for the Diffusion Mode MicroGard Portable AlarmsSee your MicroGard Portable Alarm Instruction Manual
<i>Operating and Physical Characteristics</i>	
FLOW RATE	<ul style="list-style-type: none">Approximately 175 ACCM
OPERATING RANGE	<ul style="list-style-type: none">At 2.4 volts and 35 inches of water load (equivalent to 50 feet of sample line and probe) up to 200 mL/min.
FLOW INDICATION	<ul style="list-style-type: none">Presence of yellow float indicates flow
OPERATING TEMPERATURE LIMITS	<ul style="list-style-type: none">-18 to 50 degrees Centigrade (0 to 122 degrees Fahrenheit)
DIMENSIONS	<ul style="list-style-type: none">2 inches deep x 3 inches wide x 7-7/8 inches high (5.1 centimeters deep x 7.6 centimeters wide x 8.2 centimeters high)
WEIGHT	<ul style="list-style-type: none">8.2 oz. (232 grams)
CASE	<ul style="list-style-type: none">Case plastic is electrically conductive to provide anti-static protection

Section 2 Theory of Operation

Introduction

This section describes the operation of the sample flow system of the MicroGard Pump Module (high efficiency, low flow rate version, part no. 802830) from MSA. The high efficiency, low flow rate version of the MicroGard Pump Module is easily identified from other MicroGard Pump Modules by the fact that it does not require its own special battery pack. The battery pack used with this pump module is the same as that used for the diffusion mode MicroGard Portable Alarm.

Functional Description of Operation

The MicroGard Pump Module (FIGURE 2-1) contains a diaphragm pump mechanism driven by an eccentric on a motor shaft. The battery pack (rechargeable or alkaline) for the MicroGard Portable Alarm powers the motor. Motor speed varies with the battery pack voltage level.

Sample Flow System Operation

Each revolution of the motor produces one pump stroke, which causes the diaphragm to draw ambient air through the sampling device.

Sample air exhausts directly to the manifold plenum directly below the MicroGard sensors and, from there, to the outside through a slot in the manifold.

- The flow indicator verifies operation of the pump. If the pump's sample inlet (or the sampling device connected to the pump) is blocked, the yellow float in the flow indicator will not be visible.

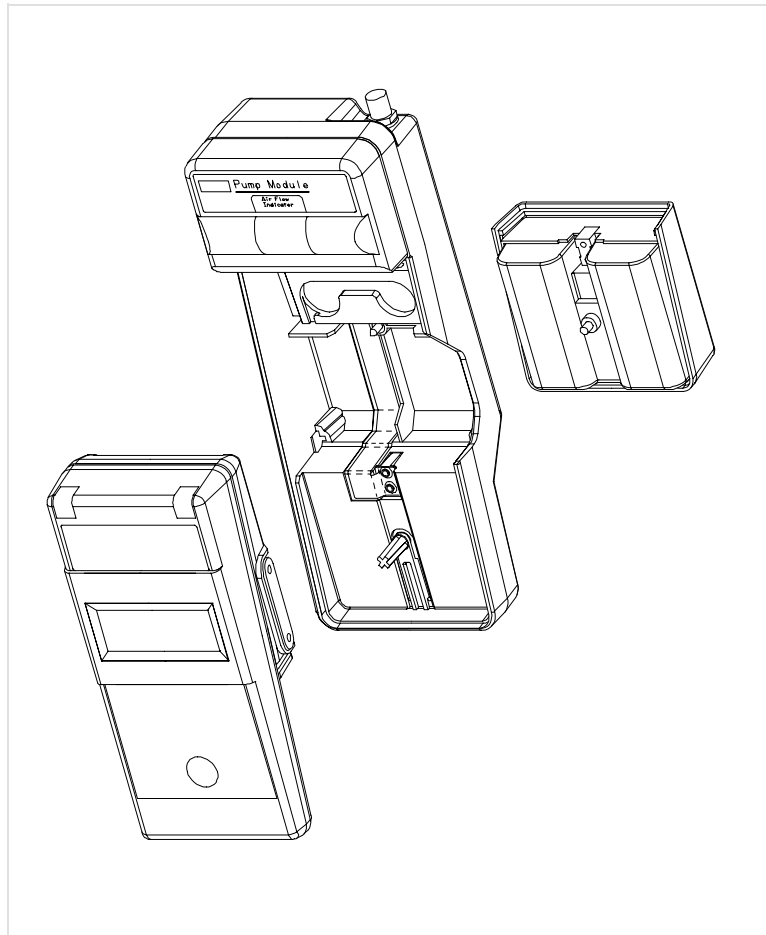


Figure 2-1. MicroGard Pump Module

Section 3 Operation

Charging the Battery Pack

See the MicroGard Portable Alarm Instruction Manual for information on charging the battery pack.

WARNING

Do not charge the battery pack in areas that may contain a flammable mixture of combustible gases, vapors, or dust and air; otherwise, an explosion may occur because a source of ignition exists during charging.

Failure to follow the above warning may result in severe personal injury or death.

Operating Time

The maximum expected operating time for a pump with a fully charged battery pack depends on 1) The vacuum load imposed by the sampling device, 2) the temperature, and 3) the age of the battery pack.

The approximate operating time for the pump module is in excess of eight hours. This is based on room temperature operation with a pack that can deliver at least 2.0 amp hours. At 0 degrees Centigrade, the operating time will be reduced by 10%. After several hundred charge/discharge cycles, the pack capacity may be reduced by 20%.

Personal/Area Sampling

The MicroGard Pump Module is designed for either personal or area sampling of ambient air. It provides flow of the sample air through sampling devices to measure the concentration of gases and vapors in the workplace.

Operating the Pump

Start with a MicroGard Portable Alarm equipped with a fully charged battery pack. See the MicroGard Instruction Manual for details

NOTE: A flat blade screw driver is required for the following procedure.

1. Remove the battery pack from the MicroGard Portable Alarm.

2. Remove the metal pocket clip originally supplied with the MicroGard (if still installed). Attach the plastic pocket clip to the MicroGard with the screws provided.
3. Place the MicroGard Portable Alarm straight down into the pump module and secure it with the captive screw on the back of the pump module.
4. Place the battery pack straight onto the back of the pump module and secure it with the captive screw in the battery pack. Do not overtighten screws.
5. Turn on the MicroGard Pump and verify flow by the presence of the yellow float in the flow indicator.
6. Calibrate the unit as described in Section 5 of this manual.

Removing the Instrument from the Pump Module

1. Loosen the captive screw on the battery pack and pull it straight away from the pump module.
2. Loosen the captive screw on the back of the pump module and pull the instrument straight away from the pump module.

Using Sampling Equipment

WARNING

Use only sampling equipment designed for high efficiency, low flow pumps as described in the *Section 4, Parts List* portion of this manual. Other sample lines may react with the gas sample, which will result in lower than actual gas readings.

Section 3, Operation

Failure to follow the above may result in severe personal injury or death.

Sampling lines and related equipment permit samples of gas to be taken from remote or inaccessible locations. Sampling lines are five to 50 feet long and made of a synthetic material specifically compounded to resist adsorption of combustible and toxic vapors. Gases are drawn through the lines to the MicroGard Portable Alarm by this pump module.

Using the shortest possible line reduces the time the pump must run before valid samples and readings can be obtained.

1. Turn off the MicroGard Portable Alarm.
2. Install the pump module if it is not already attached.
3. Attach the sampling line to the pump module by mating the connector ring of the line to the inlet fitting of the pump module. Finger-tighten this fitting.
4. Turn on the instrument and verify proper operation.
5. Plug the free end of the sampling line or probe. The motor may not stop but the yellow float should drop back into the opaque section of the flow indicator. When the line is open, the flow restarts automatically.

CAUTION

Never allow the end of the sampling line to touch or go under any liquid surface. If liquid is sucked into the instrument, readings will be inaccurate and the instrument could be damaged. We recommend the use of an MSA Sample Probe (part no. 497600, 800332, 800333, or equivalent) containing a special membrane filter, permeable

to gas but impermeable to water, to prevent such an occurrence.

Removing Sampling Equipment

1. Turn off the MicroGard Portable Alarm.
2. Unscrew the connector ring on the sampling line and remove the sampling line.

Performance

The Pump Module is capable of pulling adequate sample through as much as 50 feet of sample line (two part no. 497335 coupled together), including the added pressure drop of any one of several MSA sample probe assemblies (see the Section 4 Parts List for choices).

Typical transit times to alarm condition versus sample line lengths with a standard three foot probe (part no. 800333) are shown in the following table. This data was taken by introducing a 50% LEL Methane-in-air sample mixture at the probe inlet. The MicroGard Alarm was set at 10% LEL

Typical Transit Times to Alarm Condition Vs. Sample Line Lengths with a Three Foot Probe		
LENGTH IN FEET	TIME TO ALARM IN SECONDS	FINAL READING IN % LEL
5	4	50
10	5	50
25	7	50
50	12	50

Section 4 Maintenance

Introduction

The MicroGard Pump Module will perform as designed only if it is serviced in accordance with these instructions and by individuals who have the required skills and tools to follow these procedures.

WARNING

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 MicroGard Pump Module, 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 and persons who rely on this product for their safety could sustain severe personal injury or death. Any substitution of components may impair intrinsic safety requirements.

Instrument Cleaning

Periodically clean the Pump Module case with a soft cloth dampened with water.

CAUTION

Avoid water or debris contact with the connector sockets. If the manifold is dirty, it may be removed and cleaned with soap and water; see instructions for removal and replacement of the manifold. Be sure the manifold has dried completely before reinstalling it in the Pump Module.

Corrective Maintenance

When you locate an inoperative part, replace it according to one of the following procedures or return unit to an authorized MSA Service Center. Refer to “Obtaining Replacement Parts” later in this section for information on how to order the necessary part from MSA.

Manifold Replacement

1. Remove the MicroGard Portable Alarm and battery pack if installed.
2. Remove three cross-recess screws from the back of the Pump Module.
3. Lift the Pump Module cover away from the Pump Module body.
4. Pull the 1/8-inch tubing away from the manifold.

5. Pull the manifold away from the cover.
6. To reinstall, place the manifold in position on the cover with the small tabs extending through the holes. Using pliers, secure the manifold in position by pulling on the tabs until the manifold sits flush against the cover.
7. Using pliers, push the 1/8-inch tubing into the hole on the manifold. Properly installed tubing should extend through the hole to the plenum of the manifold.
8. Place the cover in position on the body and secure it with the three cross-recess screws.

Obtaining Replacement Parts

The MicroGard Pump Module parts and part numbers are listed in the following TABLE. To obtain parts, service, or information in the U.S., contact the local MSA sales office at 1-800-MSA-2222. To reach MSA International, call 1-412-967-3000.

Section 4, Maintenance

Replacement Parts List	
PART/COMPONENT	PART NO.
Pump Module	802830
Soft Carrying Case	805283
Probe, One Foot Teflon	497600
Probe, One Foot	800332
Probe, Three Foot	800333
Probe, Three Foot Side Sampling	803561
Probe, Three Foot, Handle Sampling	803962
Probe Filter (package of 10)	801582
Sampling Line, Five Foot	497332
Sampling Line, 10 Foot	497333
Sampling Line, 15 Foot	497334
Sampling Line, 25 Foot	497335
Calibration Kit, Model RP with 0.25 Lpm Regulator	477149
Tubing, 1/8 OD	603146
Manifold	478532
Fitting, Bulkhead	497187
Screw, Flat Head, 4-40 x 3/8, Cross Recess	629597
Screw, Captive	636731
Foam Tape (Two 1-inch pieces required)	28994
Pump and Drive Assembly	802920
Flow Indicator Assembly	803559
Motor	633736
Frame Set	800024
Sampling Line, Five Foot, Coiled	807469
Filter Assembly, Quick Disconnect	813409
Filter Screen Replacement (package of 10)	813408

Section 5 MicroGard Calibration with Pump Module

WARNING

The following calibration procedures apply only to the high efficiency/low flow rate version MicroGard Pump Module part no. 802830. Use of these procedures to calibrate any other MicroGard Pump Modules may result in failure to perform as designed, and persons who rely on this product for their safety could sustain severe personal injury or death.

Read the entire MicroGard Portable Alarm calibration procedure before making any adjustments. To assure proper operation, the MicroGard Portable Alarm must be checked on known concentrations of oxygen and pentane or methane. It is recommended that a calibration check be performed before each day of use. Allow the instrument to complete a warm-up period to stabilize sensors before calibration (typically 15 minutes).

Oxygen Calibration Test Procedure

Before using the MicroGard Portable Alarm:

1. Turn the MicroGard unit ON and allow it to stabilize in fresh air at the temperature of use.
2. Calibrate the instrument in fresh air to 20.8%. To calibrate the MicroGard unit:
 - a. Press the SELECT keypad until % OXY appears on the display.
 - b. Expose the instrument to fresh air until the display reading stabilizes.
 - c. Set display reading to 20.8% by adjusting the OXY S (SPAN) control located under the calibration cover.

NOTE: Replace the sensor when the OXY S control can no longer be adjusted to yield the 20.8% reading.

NOTE: If the calibration is done at an ambient temperature outside of the 32° to 104°F (0° to 40°C) range, allow the MicroGard Portable Alarm to stabilize at that temperature for about 1 hour before calibrating.

Oxygen calibration is stable over long periods of time and will not require large calibration control corrections during the life of a sensor. Near the end of its useful life (over 1 year), the calibration control requires more frequent and larger corrections to obtain the 20.8% fresh air reading. If the instrument cannot be adjusted to 20.8% in fresh air, the sensor must be replaced (see Section 3, *Maintenance in the MicroGard manual*).

Section 5, MicroGard Calibration with Pump Module

If required, adjust the oxygen alarm circuit by using the procedure given under Section 3, Maintenance, "Printed Circuit Board Adjustments" in the MicroGard manual.

The MicroGard unit indicates the partial pressure of oxygen in the atmosphere or calibration gas tested. Therefore, if the instrument is calibrated at one barometric pressure and subsequently used to test atmospheres at another pressure (i.e.: at a different altitude) the change in oxygen partial pressure will be indicated as an equivalent change in volume percent. To use the MicroGard Portable Alarm for oxygen deficiency measurements, it should, therefore, be calibrated to read 20.8% OXY when sampling fresh air at the conditions of intended use.

TABLE 5-1 shows the oxygen readings to be expected at various altitudes after calibrating at sea level.

Table 5-1. Volume Percent When Sampling Fresh Air			
ALTITUDE (IN FEET)	OXYGEN INDICATION (PERCENTAGE)	ALTITUDE (IN FEET)	OXYGEN INDICATION (PERCENTAGE)
-1000	21.6	5000	17.3
-500	21.2	5500	17.0
sea level	20.8	6000	16.7
500	20.4	6500	16.4
1000	20.1	7000	16.1
1500	19.7	7500	15.7
2000	19.3	8000	15.4
2500	19.0	8500	15.2
3000	18.6	9000	14.9
3500	18.3	9500	14.6
4000	18.0	10000	14.3
4500	17.6		

Combustible Calibration Test Procedure

Check the combustible indicator before each day's use, using a cylinder mixture of pentane in air with an analysis in the range of 0.75% (part no. 476304) or a mixture of methane in air with an analysis in the range of 2.5% (part no. 459942). (MSA supplies calibration equipment as accessory items.)

Sample Mode Response

The calibration sample will duplicate response for both a Diffusion Mode and a MicroGard pump instrument if taken directly from a cylinder equipped with a 0.25 LPM flow control.

CAUTION

Never use a 1.5 LPM flow control with this pump module; otherwise, damage to the flow system could occur.

Calibrate as follows:

1. In fresh air, with the instrument "warmed up," press the SELECT keypad until % LEL is displayed.
2. Adjust the LEL Z (CH₄ Z) (ZERO) control until a zero reading is obtained.
3. Attach the flow control to the calibration gas tank.
4. Attach the tubing furnished with the Calibration Kit between the flow control and the sampling calibration adapter connection (part no. 636246).

Section 5, MicroGard Calibration with Pump Module

5. Connect the calibration adapter to the MicroGard pump inlet fitting.
6. Open the flow control valve on the gas tank to pass the gas through the MicroGard unit.
 - As the % LEL reading increases, note the reading at which the combustible alarm activates. This point is factory-set at 10% LEL (0.5% CH₄).
 - When the combustible display stabilizes, the reading for 0.75% pentane-in-air should be between 47% and 55%.
 - If the instrument samples *methane*: When the combustible display stabilizes, the reading for 2.5% methane-in-air should be between 2.3% and 2.8% CH₄.
7. If the calibration check reading is not within 47% and 55%, set the display reading to 50% by adjusting the LEL S (SPAN) control located under the calibration cover.

If the instrument samples *methane*: If the calibration check reading is not between 2.3% and 2.8%, set the display reading to 2.5% by adjusting the CH₄ S control, located under the calibration cover.

8. Close the flow control valve.
9. Remove the sampling/calibration adapter from the MicroGard unit.
10. Recheck the zero reading in fresh air and repeat Steps 1 through 9 if fresh air reading is not equal to zero.
11. Remove the flow control from the calibration gas tank.

Calibration and Response Test Procedure with Combination Gas

(For use with LEL instrument only)

Use a cylinder mixture of pentane in air with an analysis in the range of 0.75% pentane (part no. 476304) and 15% oxygen. This sample can be used to test the calibration of the combustible gas function of the MicroGard Portable Alarm. Due to the wide tolerance of the oxygen sample, this sample can be used to test only the *response* of the oxygen function of the MicroGard Portable Alarm.

Test as follows:

1. Turn MicroGard unit ON and allow it to stabilize in fresh air at the temperature of use. Set display reading to 20.8% by adjusting the OXY S (SPAN) control under calibration cover.
2. Calibrate the instrument in fresh air to 20.8%.
NOTE: Replace sensor when the OXY S (SPAN) control can no longer be adjusted to yield the 20.8% reading.
3. Press the SELECT keypad until % LEL is displayed.
4. Adjust the LEL Z (CH₄ Z) (ZERO) control until a zero reading is obtained.
5. The sample for a MicroGard pump module instrument can be taken directly from the cylinder only if it is equipped with a 0.25 LPM flow control.
6. Attach the flow control to the calibration gas tank.
7. Attach the tubing, furnished with the Calibration Kit, between the flow control and the calibration adapter connection to the pump inlet fitting.

Section 5, MicroGard Calibration with Pump Module

8. Open the flow control valve on the gas tank to pass the gas through the MicroGard unit.
 - As the % LEL reading increases, note the reading at which the combustible alarm activates. This point is factory-set at 10% LEL.
 - When the combustible display stabilizes, the reading for 0.75% pentane-in-air should be between 47% and 55%.
9. If the calibration check reading is not within 47% and 55%, set the display reading to 50% by adjusting the LEL S (SPAN) control located under the calibration cover.
10. Close the flow control valve.
11. Remove the calibration adapter from the MicroGard pump unit.
12. Allow the display to stabilize, and reset the alarms.
13. Press the SELECT keypad until % OXY is displayed.
14. Re-connect calibration adapter on the MicroGard pump unit.
15. Open the flow control valve.
 - As the % OXY reading decreases, note the reading at which the oxygen alarm activates; this point is factory-set at 19.5%.
 - The reading for % oxygen should be between 13.0% and 17.0% oxygen.
16. If the calibration check reading is not within 13.0% and 17.0%, do not calibrate to 15% oxygen due to tolerances in the oxygen calibration gas sample. Replace the oxygen sensor, and recalibrate or return the MicroGard Pump to an authorized service center.

Section 5, MicroGard Calibration with Pump Module

17. Close the flow control valve.
18. Remove calibration adapter from the MicroGard pump unit.
19. Recheck the zero readings in fresh air, and repeat steps 3 through 13 above if fresh air readings are not equal to 0% LEL (0.0% CH₄) and span reading of 20.6 to 21.0% oxygen.

If the response of the MicroGard Portable Alarm is not within the limits stated, re-calibrate the instrument. If, after calibration, the instrument fails to respond as outlined above, contact the nearest MSA Repair Center to return the instrument for factory service. If you have any questions, call our toll-free number:

1-800-MSA-2222

or the MSA international number:

412-967-3000.

DANGER

Calibration gas tank contents are under pressure. Use no oil, grease or flammable solvents on the calibration gas tank. To prevent injury from potential rupture, do not store calibration gas tank near heat or fire; keep out of reach of children. When the tank is exhausted, discard in a safe place such as burial in the earth or in a sanitary landfill. Do not throw into fire or incinerate. Do not puncture. It is illegal and hazardous to refill the gas tank. Do not attach the calibration gas tank to any apparatus other than that described in these instructions.

Failure to follow the above may result in severe personal injury or death.