MiniCO®, MiniH_2S®, MiniOX®, MiniOX® Remote, MiniCl_2™, and MiniClO_2™ Responder® Detectors

Instruction Manual

⚠ WARNING

THIS MANUAL MUST BE CAREFULLY READ BY ALL INDIVIDUALS WHO HAVE OR WILL HAVE THE RESPONSIBILITY FOR USING OR SERVICING THESE PRODUCTS. Like any complex equipment, these instruments will perform as designed only if used and serviced in accordance with the manufacturer's instructions. OTHERWISE, THEY COULD FAIL TO PERFORM AS DESIGNED AND PERSONS WHO RELY ON THESE PRODUCTS 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 1-412-967-3354.

This manual is available on the internet at www.msanet.com

Manufactured by
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(L) Rev 5 **10004100**

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Section 1
MiniCO® Responder Carbon Monoxide Detector (P/Ns 710424, 710510, 10008671 and 10008673)

Instructions for Use and Maintenance

⚠ WARNINGS

FAILURE TO FOLLOW CAN RESULT IN SERIOUS PERSONAL INJURY OR DEATH:

1. **The MiniCO Responder is designed to measure carbon monoxide in air only. Do not use these detectors to sample for CO in gases other than air.**
2. **Alarm functions must be checked and a response check must be performed before each day's use. If the instrument fails the response check and cannot be calibrated, DO NOT use the instrument. The sensor or battery must be replaced, or the instrument must be serviced.**
3. **Calibration must be checked if the sensor is replaced, if the battery is replaced, or if the instrument is dropped or subjected to severe physical shock.**
4. **The CO sensors are sealed units containing sulfuric acid electrolyte. If a sensor develops a leak, dispose of it properly. Should contact occur with skin or clothing, rinse area with large quantities of water. In case of eye contact, immediately flush eyes for at least 15 minutes, holding eyes open; call a physician.**
5. **Do not change the battery in hazardous locations.**
6. **Substitution of components may impair intrinsic safety.**
7. **Once a high alarm condition is detected and the alarms latch, the displayed reading may not fall within the specified accuracy range for the instrument.**

⚠ CAUTIONS

To prevent sensor damage, store the instrument under the following conditions:

INTERMITTENT TEMPERATURE	OPTIMAL STORAGE TEMPERATURE
-30°C to 50°C (-20°F to 120°F)	4°C to 32°C (40°F to 90°F)

Turning ON/OFF

When unit is delivered, the battery is not connected. See "Installing/Replacing the Battery" later in this section prior to use. To turn the instrument ON, press the Power/Peak button on the left-hand side of the display. All segments of the display light upon turn-ON. To turn OFF the monitor, press and hold the Power/Peak button for five seconds. After a series of beeps, the display turns OFF.

NOTE: MiniCO Responder (P/Ns 710510 and 10008673) are designed in such a way that the only way to turn the instrument OFF is to disconnect the battery.

FAS (Fresh Air Setup)

Upon instrument turn-ON, the display flashes "zero." While the "Zero" is flashing, pressing the Zero button zeroes the instrument. The monitor will not zero out background concentrations greater than 5 ppm. If a concentration higher than this is detected, the instrument will display the actual concentration and not zero out the background.

Gas Alarms

There are two levels of audible and visual alarms. The warning level alarms are low-rate intermittent and non-latching. This is indicated by a "W" on the display and a beep approximately every five seconds on P/N 710424 and every

1/2-second on P/N 710510. The high level alarms are high rate intermittent and latching. This is indicated by an "A" on the display and a beep approximately every 1/2-second.

NOTE: On MiniCO Responder (P/Ns 710510 and 10008673), the "A" alarm can be changed to non-latching by setting the alarm setpoint at 999 ppm.

To mute a Warning level, press the RESET button. This silences the audible tone, but the visual indicator remains. If a warning condition remains, the tone will only be temporarily silenced. It is not possible to mute the alarm level while it persists. The alarm level can only be reset once the concentration falls below the alarm level.

Low Battery Alarm

The low battery alarm occurs when a minimum of 24 hours of battery life remains. This is indicated by a "B" on the display and a beep approximately every 40 seconds.

Vibrating Alarms

Certain Responders are equipped with vibrating alarms that cause the unit to vibrate each time any alarm is activated.

Backlight

Pressing the Power Peak button briefly turns ON the backlight for approximately 30 seconds.

Peak Readings

Press the Power Peak button briefly to turn ON the backlight. The backlight will light. Anytime the backlight is ON, briefly press the Power Peak button again. The Peak (highest) concentration of that sampling period will be displayed along with a "P" for three seconds. The Peak can be reset by turning the instrument OFF or by performing a calibration.

Calibration Check/Adjustment

Turn the unit ON and press and hold both the Zero and Reset; then, Press the Power Peak button. The descriptor "↑SET↓" will appear on the display. The monitor will then automatically zero out the background concentration (display shows "Zero"). When this is complete, the calibration gas can be added. Connect the calibration cap to the sensor cap. Attach the calibration gas to the cal cap. Turn on the gas. Wait for the display reading to stabilize; then, adjust the concentration on the display by pressing the ↓ (labeled Zero) or ↑ (labeled Reset) to read the same as the concentration of the cylinder of gas attached.

Once the display is reading the same as the attached cylinder, press the Power Peak button briefly to accept the reading. (Pressing and holding the Power Peak at this point enables setting of alarm setpoints; see "Setting Alarm Setpoints.") Calibration is now complete; the gas may be turned OFF and removed. If you will be using the Peak function, turn the instrument OFF and then ON to reset the Peak.

Setting Alarm Setpoints

If alarm setpoints have been engaged (see above), you will see the descriptor "↓SET↑" at the bottom of the display and the "W" will light. The previous warning level will be displayed. Press the ↓ (Zero) and ↑ (Reset) to adjust the reading to the new level which you desire; once the reading shows this number, press the Power Peak button to accept the reading. The descriptor "↓SET↑" will then be displayed along with an "A". The alarm level is entered by the same method. After accepting the alarm level, the monitor will then return to displaying the concentration reading.

Installing/Replacing the Battery

Remove belt clip by pressing the two tabs near the top and releasing from the back. Remove the two slotted head screws on the back of the case, located under the clip. Remove the 9-V battery from the snap connector and replace with a fresh 9-V battery or install a fresh 9-V battery for first time use. Replace the battery cover and the two slotted screws and snap the belt clip back. Wait one minute before turning the instrument on and rezeroing it. The instrument will not turn ON for 45 seconds. The backlight is ON and **---** is displayed during this period.

⚠ CAUTION

When installing the battery, be careful not to press the Zero button. Pressing Zero within one minute of battery installation can cause an incorrect zeroing; the instrument will show a positive value in fresh air and must to be re-zeroed.

Replacing Sensor Assembly

Remove phillips screw from sensor assembly. Rotate approximately 15^{o} clockwise. Pull assembly out. Remove the shorting bar from the new assembly. Place the assembly into the instrument. Rotate approximately 15^{o} counterclockwise. Insert phillips screw and tighten. The sensor assembly can be opened if you choose to replace only the sensor.

Hot Gas Sampling

(for use with MiniCO Responders only)

1. Connect Hot Gas Sampler (PN 803848) to the sampling line.
2. Connect Aspirator Assembly (P/N 809964) to the sampling line.
3. Attach the aspirator to Calibration Cap (P/N 710492).

- The calibration cap is fitted on the instrument, over top of the sensor housing.
- Maximum sampling line length is 25 feet.
- Minimum sampling line length is 10 feet.

Specifications	
RANGE	0-999 ppm, over range indicated by - - -
RESPONSE TIME	90 seconds or less to 90% of final reading
TEMPERATURE RANGE (COMPENSATED)	-10°C to 50°C (14°F to 122°F)
HUMIDITY	15 - 90% (non-condensing)
BATTERY LIFE	60 days with five minutes of alarm per day
	90 days with no alarm
WARM-UP TIME	Less than five minutes when a new sensor or battery is installed
ALARM RANGE	1 to 999
DIMENSIONS	4-1/8"(L) x 2-1/4"(W) x 1-3/4" (H)
WEIGHT	7 oz.
ACCURACY	±5 ppm (0-100 ppm) or 10% of gas concentration (101-1000) at calibrated temperature. ±5 ppm (0-100) or 10% of previous reading (101-1000) at 10°C or ±10 ppm or 20% of the previous reading at 50°C, whichever is greater
dB LEVEL OF ALARMS (P/N 710424)	93 dB at one foot typical
dB LEVEL OF ALARMS (P/N 710510)	103 dB at one foot typical

Interferant Data	
This data is presented as the indicated output in ppm, which would result from the application of 100 ppm of the test gas.	
TEST GAS	**EQUIVALENT PPM**
Carbon monoxide (CO)	100 ±0
Hydrogen sulfide (H_2S)	0
Chlorine (CL_2)	3 ±1
Nitrogen Dioxide (NO_2)	1 ±1
Sulfur dioxide (SO_2)	1 ±0
Hydrogen Cyanide (HCN)	1 ±2
Hydrogen Chloride (HCL)	2 ±1
Nitric Oxide (NO)	28 ±11
Ethylene (C_2H_4)	68 ±19
Hydrogen (H_2)	56 ±7
Methane (CH_4)	1 ±0
Ethanol (EtOH)	1 ±2
Ethylene Oxide	0 ±3
Toluene	0 ±1
Ammonia (NH_3)	1 ±1

Replacement Parts		
COMPONENT/ASSEMBLY		**PART NO.**
CO Sensor		636240
CO Sensor Assembly		710490
9-V Battery		628817
Calibration Cap		710492
Battery Cover Door with slotted screws		710493
Slotted Screwdriver		632655
Belt Clip		710489
Calibration Gas	60 ppm CO	461768
	300 ppm CO	473180
Calibration Regulator		495895
Calibration Tubing, 30-inch		485030

Section 2
MiniH_2S® Responder Hydrogen Sulfide Detector (P/Ns 710850 and 10008672)

Instructions for Use and Maintenance

⚠ WARNINGS

FAILURE TO FOLLOW CAN RESULT IN SERIOUS PERSONAL INJURY OR DEATH.

1. **The MiniH_2S Responder is designed to measure Hydrogen Sulfide in air only. Do not use this monitor to sample for H_2S in gases other than air.**
2. **Alarm functions must be checked and a response check must be performed daily. If the instrument fails the response check and cannot be calibrated, either the sensor must be replaced, the battery must be replaced, or the instrument must be serviced.**
3. **Calibration must be checked if the sensor is replaced, if the battery is replaced, or if the instrument is dropped or subjected to severe physical shock.**
4. **The H_2S sensor is a sealed unit containing sulfuric acid electrolyte. If a sensor develops a leak, dispose of it properly. Should contact occur with skin or clothing, rinse area with large quantities of water. In case of eye contact, immediately flush eyes for at least 15 minutes, holding eyes open; call a physician.**
5. **Do not change battery in hazardous locations.**
6. **Substitution of components may impair intrinsic safety.**
7. **Once a high alarm condition is detected and the alarms latch, the displayed reading may not fall within the specified accuracy range for the instrument.**

⚠ CAUTIONS

To prevent sensor damage, store the instrument under the following conditions:

INTERMITTENT TEMPERATURE	OPTIMAL STORAGE TEMPERATURE
-30°C to 50°C (-20°F to 120°F)	4°C to 32°C (40°F to 90°F)

Turning ON/OFF

When unit is delivered, the battery is not connected. See "Installing/Replacing the Battery" later in this section prior to use. To turn the instrument ON, press the Power/Peak button on the left-hand side of the display. All segments of the display light upon turn-ON. To turn OFF the monitor, press and hold the Power/Peak button for five seconds. After a series of beeps, the display turns OFF.

FAS (Fresh Air Setup)

Upon instrument turn-ON, the display flashes "Zero." While the "Zero" is flashing, pressing the Zero button zeroes the instrument. The monitor will not zero out background concentrations greater than 5 ppm. If a concentration higher than this is detected, the instrument will display the actual concentration and not zero out the background.

Gas Alarms

There are two levels of audible and visual alarms. The warning level alarms are low rate intermittent and non-latching. This is indicated by a "W" on the display and a beep approximately every five seconds. The high level alarms are high rate intermittent and latching. This is indicated by an "A" on the display and a beep approximately every 1/2-second.

To mute a Warning level, press the RESET button. This silences the audible tone, but the visual indicator remains. If a warning condition remains, the tone will only be temporarily silenced. It is not possible to mute the alarm level while it persists. The alarm level can only be reset once the concentration falls below the alarm level.

Low Battery Alarm

The low battery alarm occurs when a minimum of 24 hours of battery life remains. This is indicated by a "B" on the display and a beep approximately every 40 seconds.

Vibrating Alarms

Certain Responders are equipped with vibrating alarms that cause the unit to vibrate each time any alarm is activated.

Backlight

Pressing the Power Peak button briefly turns ON the backlight for approximately 30 seconds.

Peak Readings

Press the Power Peak button briefly to turn ON the backlight. The backlight will light. Anytime the backlight is ON, briefly press the Power Peak button again. The Peak (highest) concentration of that sampling period will be displayed along with a "P" for three seconds. The Peak can be reset by turning the instrument OFF or performing a calibration.

Calibration Check

While the instrument is turned ON, press and hold both the Zero and Reset; then, press the Power Peak button. The descriptor "↑SET↓" will appear on the display. The monitor then automatically zeroes out the background concentration (display shows "Zero"). When this is complete, the calibration gas can be added.

Connect the calibration cap to the sensor cap. Attach the calibration gas to the cal cap. Turn ON the gas. Wait for the display reading to stabilize; then, adjust the concentration on the display by pressing the ↓ (labeled Zero) or ↑ (labeled Reset) to read the same as the concentration of the cylinder of gas attached. Once the display is reading the same as the attached cylinder, press the Power Peak button briefly to accept the reading. (Pressing and holding the Power Peak at this point enables setting of alarm setpoints; see "Setting Alarm Setpoints.") Calibration is now complete and the gas may be turned OFF and removed. If you will be using the Peak function, turn the instrument OFF; the Peak value will be reset.

Setting Alarm Setpoints

If alarm setpoints have been engaged (see above), the descriptor "↑SET↓" appears at the bottom of the display and the "W" lights. The previous warning level displays. Press the ↓ (Zero) and ↑ (Reset) to adjust the reading to the new desired level; once the reading shows this number, press the Power Peak button to accept the reading. The descriptor "↑SET↓" displays along with an "A." The alarm level is entered by the same method. After accepting the alarm level, the monitor returns to displaying the concentration reading.

Installing/Replacing the Battery

Remove belt clip by pressing the two tabs near the top and releasing from the back. Remove the two slotted head screws on the back of the case, located under the clip. Remove the 9-V battery from the snap connector and replace with a fresh 9-V battery or install a fresh 9-V battery for first-time use. Replace the battery cover and the two slotted screws; snap the belt clip back. Wait one minute before turning the instrument ON and zeroing it. The instrument will not turn ON for 45 seconds. The backlight is ON and **---** is displayed during this period.

Replacing Sensor Assembly

Remove phillips screw from sensor assembly. Rotate approximately 15° clockwise. Pull assembly out. Remove the shorting bar from the new assembly. Place the assembly in the instrument and rotate approximately 15° counterclockwise; insert the phillips screw and tighten.

Specifications	
RANGE	0-5000 ppm, over range indicated by - - -
RESPONSE TIME	90 seconds or less to 90% of final reading
TEMPERATURE RANGE (COMPENSATED	-10°C to 40°C (14°F to 104°F)
	40°C to 50°C if calibrated at temperature of use and recalibrated again if temperature drops within the compensated range
HUMIDITY LIMITS	15 - 90% (non-condensing)
BATTERY LIFE	60 days with five minutes of alarm per day
	90 days with no alarm
WARM-UP TIME	Less than five minutes when a new sensor or battery is installed
ALARM RANGE	0 to 500
DIMENSIONS	4-1/8"(L) x 2-1/4"(W) x 1-3/4" (H)
WEIGHT	7 oz.
ACCURACY	±2 ppm or 10% of gas concentration, whichever is greater (0-500 ppm) at calibrated temperature. ±4 ppm (0-50 ppm) or 10% of reading of previous stable concentration (51-500 ppm) over range or -10°C to 40°C. ±4 ppm (0-50 ppm) or 20% of reading of previous stable concentrations (51-500 ppm) from 40°C to 50°C
dB LEVEL OF ALARMS	93 dB at one foot typical

Interferant Data	
This data is presented as the indicated output in ppm, which would result from the application of 2 ppm of the test gas.	
TEST GAS	**EQUIVALENT PPM**
Hydrogen Sulfide (H_2S)	100 ±4
Hydrogen Chloride (HCL)	0 ±0
Ethanol (EtOH)	0 ±0
Acetylene (C_2H_{42})	0 ±1
Methane (CH_4)	0 ±0
Hydrogen Cyanide (HCN)	0 ±0
Hydrogen (H_2)	0 ±0
Ammonia (NH_3)	0 ±0
Nitric Oxide (NO)	0 ±0
Sulfur Dioxide (SO_2)	3 ±1
Carbon monoxide (CO)	1 ±3
Toluene	0 ±0
Nitrogen Dioxide (NO_2)	-21 ±5
Chlorine (CL_2)	-16 ±3
α - Pinene	1 ±0

Replacement Parts		
COMPONENT/ASSEMBLY		**PART NO.**
H_2S Sensor Assembly		710944
9-V Battery		628817
Calibration Cap		710492
Battery Cover Door with slotted screws		710493
Slotted Screwdriver		632655
Belt Clip		710489
Calibration Gas	10 ppm H_2S	467898
	40 ppm H_2S	467897
Calibration Regulator		465895
Calibration Tubing, 30-inch		485030

Section 3
MiniOX® Responder Oxygen Detector (P/Ns 710965 and 10008676)

Instructions for Use and Maintenance

⚠ WARNINGS

FAILURE TO FOLLOW CAN RESULT IN SERIOUS PERSONAL INJURY OR DEATH.

1. **Alarm functions must be checked and a response check must be performed daily. If the instrument fails the response check and cannot be calibrated, either the sensor or battery must be replaced, or the instrument must be serviced.**
2. **Calibration must be checked if the sensor or battery is replaced, or if the instrument is dropped or subjected to severe physical shock. Make sure the instrument is in fresh air when performing an FAS or calibration.**
3. **The oxygen sensor is a sealed unit containing sulfuric acid electrolyte. If a sensor develops a leak, dispose of it properly. Should contact occur with skin or clothing, rinse area with large quantities of water. In case of eye contact, immediately flush eyes for at least 15 minutes, holding eyes open; call a physician.**
4. **Do not change battery in hazardous locations.**
5. **Substitution of components may impair intrinsic safety.**
6. **High or low pressure samples will give erroneous readings; calibrate at altitude of use.**
7. **Once a high alarm condition is detected and the alarms latch, the displayed reading may not fall within the specified accuracy range for the instrument.**

⚠ CAUTIONS

1. **To prevent sensor damage, store the instrument under the following conditions:**

INTERMITTENT TEMPERATURE	OPTIMAL STORAGE TEMPERATURE
-30°C to 50°C (-20°F to 120°F)	4°C to 32°C (40°F to 90°F)

2. **Acid gases, such as CO_2, will shorten the life of the sensor.**

Turning On/OFF

When unit is delivered, the battery is not connected. See "Installing/Replacing the Battery" later in this section. To turn the instrument ON, simply press the Power/Peak button on the left-hand side of the display. All segments of the display will light upon turn-ON. To turn OFF the monitor, press and hold the Power/Peak button for five seconds. After a series of beeps, the display will turn OFF.

FAS (Fresh Air Setup)

Upon instrument turn-ON, the display will flash "FAS." While "FAS" flashes, pressing the Zero button will fresh air calibrate the instrument. The FAS will not be performed if the oxygen concentration is below 19.6%.

Gas Alarms

There are two levels of audible and visual alarms. The high or warning level alarms, indicating oxygen enrichment, are low-rate intermittent and non-latching. This is indicated by a "W" on the display and a beep approximately every five seconds. To mute a warning level, press the RESET button. This silences the audible tone, but the visual indicator remains. If a warning condition remains, the tone will only be temporarily silenced. The factory default for the "W" alarm is 22% O_2.

The low alarm, indicating oxygen deficiency, is high-rate intermittent and latching. This is indicated by an "A" on the display and a beep approximately every 1/2-second. It is not possible to mute the low alarm level while the deficiency persists. The alarm level can only be reset once the oxygen concentration rises above the alarm level. The factory-default for the "A" alarm is 19.5% O_2.

Low Battery Alarm

The low battery alarm occurs when a minimum of 24 hours of battery life remains. This is indicated by a "B" on the display and a beep approximately every 40 seconds.

Vibrating Alarms

Certain Responders are equipped with vibrating alarms that cause the unit to vibrate each time any alarm is activated.

Backlight

Pressing the Power Peak button briefly turns ON the backlight for approximately 30 seconds.

Peak Readings

Press the Power Peak button briefly to turn ON the backlight. Anytime the backlight is ON, briefly press the Power Peak button again. The Peak (lowest) concentration of that sampling period will be displayed along with a "P" for three seconds. The Peak can be reset by turning the instrument OFF or by performing a calibration.

Calibration Check

While the instrument is turned ON, press and hold both the Zero and Reset buttons; then, press the Power Peak button. The instrument will beep once. The descriptor "↑SET↓" will

appear on the display. The monitor then spans the instrument. When calibration is complete, the instrument beeps three times. Within the next five seconds, if you press and hold the Power Peak button for two seconds, you will be able to change the alarm settings.

Setting Alarm Setpoints

If alarm setpoints have been engaged (see "Calibration Check"), the descriptor "↑SET↓" appears at the bottom of the display, the "W" lights and the previous warning level displays. Press the ↓ (Zero) and ↑ (Reset) to adjust the reading to the new desired levels; once the reading shows this number, press the Power Peak button to accept the reading.
The descriptor "↑SET↓" and an "A" will then display. The alarm level is entered by the same method. After accepting the alarm level, the monitor returns to the concentration reading display.

Installing/Replacing the Battery

Remove belt clip by pressing the two tabs near the top and releasing from the back. Remove the two slotted head screws on the back of the case, located under the clip. Remove the 9-V battery from the snap connector and replace with a fresh 9-V battery or install a fresh 9-V battery for first time use. Replace the battery cover and two slotted screws; snap the belt clip back. Wait one minute before turning the instrument ON and zeroing it. The instrument will not turn ON for 45 seconds. The backlight is ON and **---** is displayed during this period.

Replacing Sensor Assembly

Remove the phillips screw from the sensor assembly. Rotate approximately 15^{o} clockwise. Pull assembly out and place it into the instrument. Rotate approximately 15^{o} counterclockwise. Insert Phillips screw and tighten.

Specifications	
RANGE	0-100% oxygen, over range indicated by - - -
RESPONSE TIME	30 seconds or less to 90% of final reading
TEMPERATURE RANGE (COMPENSATED)	-10°C to 40°C (14°F to 104°F)
HUMIDITY	15 - 90% (non-condensing)
BATTERY LIFE	60 days with five minutes of alarm per day
	90 days with no alarm
WARM-UP TIME	Less than five minutes when a new sensor or battery is installed
ALARM RANGE	0 to 25%
DIMENSIONS	4-1/8"(L) x 2-1/4"(W) x 1-3/4" (H)
WEIGHT	7 oz.
ACCURACY	±5% O_2 at constant temperature; at -10°C and 50°C, the reading shall not change by more than 1.0% O_2 than at ambient temperature
dB LEVEL OF ALARMS	93 dB at one foot typical

Replacement Parts	
COMPONENT/ASSEMBLY	**PART NO.**
Oxygen Sensor Assembly	710966
9-V Battery	628817
Calibration Cap	710492
Battery Cover Door with slotted screws	710493
Slotted Screwdriver	632655
Belt Clip	710489

Section 4
MiniOX® Responder Remote Oxygen Detector (P/Ns 10001923 and 10008675)

Instructions for Use and Maintenance

⚠ WARNINGS

FAILURE TO FOLLOW CAN RESULT IN SERIOUS PERSONAL INJURY OR DEATH

1. **Alarm functions must be checked and a response check must be performed daily. If the instrument fails the response check and cannot be calibrated, either the sensor or battery must be replaced, or the instrument must be serviced.**
2. **Calibration must be checked if the sensor or battery is replaced, or if the instrument is dropped or subjected to severe physical shock. Make sure the instrument is in fresh air when performing an FAS or calibration.**
3. **The oxygen sensor is a sealed unit containing sulfuric acid electrolyte. If a sensor develops a leak, dispose of it properly. Should contact occur with skin or clothing, rinse area with large quantities of water. In case of eye contact, immediately flush eyes for at least 15 minutes, holding eyes open; call a physician.**
4. **Do not change battery in hazardous locations.**
5. **Substitution of components may impair intrinsic safety.**
6. **High or low pressure samples will give erroneous readings; calibrate at altitude of use.**
7. **Once a high alarm condition is detected and the alarms latch, the displayed reading may not fall within the specified accuracy range for the instrument.**

⚠ CAUTIONS

1. **To prevent sensor damage, store the instrument under the following conditions:**

INTERMITTENT TEMPERATURE	OPTIMAL STORAGE TEMPERATURE
-30°C to 50°C (-20°F to 120°F)	4°C to 32°C (40°F to 90°F)

2. **Acid gases, such as CO_2, will shorten the life of the sensor**

Turning ON/OFF

When unit is delivered, the battery is not connected. See "Installing/Replacing the Battery" later in this section. To turn the instrument ON, press the Power/Peak button on the left-hand side of the display. All segments of the display will light upon turn-ON. To turn OFF the monitor, press and hold the Power/Peak button for five seconds. After a series of beeps, the display turns OFF.

FAS (Fresh Air Setup)

Upon instrument turn-ON, the display flashes "FAS." While "FAS" is flashing, pressing the Zero button will fresh air calibrate the instrument. The FAS will not be performed if the oxygen concentration is below 19.6%.

Gas Alarms

There are two levels of audible and visual alarms. The high or warning level alarms, indicating oxygen enrichment, are low-rate intermittent and non-latching. This is indicated by a "W" on the display and a beep approximately every five seconds. To mute a warning level, press the RESET button. This silences the audible tone, but the visual indicator remains.

If a warning condition remains, the tone will only be temporarily silenced. The default setting for the "W" alarm is 22% O_2.

The low alarm, indicating oxygen deficiency, is high-rate intermittent and latching. This is indicated by an "A" on the display and a beep approximately every 1/2-second. It is not possible to mute the alarm level while the deficiency persists. The alarm level can only be reset once the oxygen concentration rises above the alarm level. The default setting for the "A" alarm is 19.5% O_2.

Low Battery Alarm

The low battery alarm occurs when a minimum of 24 hours of battery life remains. This is indicated by a "B" on the display and a beep approximately every 40 seconds.

Vibrating Alarms

Certain Responders are equipped with vibrating alarms that cause the unit to vibrate each time any alarm is activated.

Backlight

Briefly pressing the Power Peak button turns ON the backlight for approximately 30 seconds.

Peak Readings

Press the Power Peak button briefly to turn ON the backlight. Anytime the backlight is ON, briefly press the Power Peak button again. The Peak (lowest) concentration of that sampling period will be displayed along with a "P" for three seconds. The Peak can be reset by turning the instrument OFF or by performing a calibration.

Calibration Check

While the instrument is turned ON, press and hold both the Zero and Reset buttons; then, press the Power Peak button. The instrument beeps once and the descriptor "↑SET↓" appears on the display. The monitor then spans the instrument. When calibration is complete, the instrument beeps three times. Within the next five seconds, if you press and hold the Power Peak button for two seconds, you will be able to change the alarm settings.

Setting Alarm Setpoints

If alarm setpoints have been engaged (see "Calibration Check"), the descriptor "↑SET↓" appears at the bottom of the display, the "W" lights and the previous warning level displays. Press the ↓ (Zero) and ↑ (Reset) to adjust the reading to the new desired levels. Once the reading shows this number, press the Power Peak button to accept the reading. The descriptor "↑SET↓" and an "A" are displayed. The alarm level is entered by the same method. After accepting the alarm level, the monitor returns to the concentration reading display.

Installing/Replacing the Battery

Remove the belt clip by pressing the two tabs near the top and releasing from the back. Remove the two slotted head screws on the back of the case, located under the clip. Remove the 9-V battery from the snap connector and replace with a fresh 9-V battery or install a fresh 9-V battery for first-time use. Replace the battery cover and the two slotted screws and snap the belt clip back. Wait one minute before turning the instrument ON and zeroing it. The instrument will not turn ON for 45 seconds. The backlight is ON and **---** is displayed during this period.

Replacing Sensor Assembly

Remove the remote oxygen sensor and cable assembly from the instrument by unscrewing the jack assembly counterclockwise and removing jack from the top of the sensor cap. Replace the new oxygen sensor and cable assembly by reversing the above procedure. It will be necessary to re-span the instrument to 20.8% Oxygen.

Specifications	
RANGE	0-100% oxygen, over range indicated by - - -
RESPONSE TIME	30 seconds or less to 90% of final reading
TEMPERATURE RANGE (COMPENSATED)	-10°C to 40°C (14°F to 104°F)
HUMIDITY	15 - 90% (non-condensing)
BATTERY LIFE	60 days with five minutes of alarm per day
	90 days with no alarm
WARM-UP TIME	Less than five minutes when a new sensor or battery is installed
ALARM RANGE	0 to 25%
DIMENSIONS	4-1/8"(L) x 2-1/4"(W) x 1-3/4" (H)
WEIGHT	7 oz.
ACCURACY	±0.5% O_2 at constant temperature; at -10°C and 50°C, the reading shall not change by more than 1.0% O_2 than at ambient temperature

Replacement Parts	
COMPONENT/ASSEMBLY	**PART NO.**
Remote Oxygen Sensor Assembly with Cable	458169
9-V Battery	628817
Battery Cover Door with slotted screws	710493
Slotted Screwdriver	632655
Belt Clip	710489
Extension Cable, 50-foot	458226
Cable, 10-foot, for Sensor P/N 458169	485103

Section 5
MiniCl$_2$™ Responder Chlorine Detector (P/Ns 10020744 and 10020747)

Instructions for Use and Maintenance

⚠ WARNINGS

FAILURE TO FOLLOW CAN RESULT IN SERIOUS PERSONAL INJURY OR DEATH.

1. **The MiniCl$_2$ Responder is designed to measure Chlorine in air only. Do not use this monitor to sample for Cl$_2$ in gases other than air.**
2. **Alarm functions must be checked and a response check must be performed daily. If the instrument fails the response check and cannot be calibrated, either the sensor must be replaced, the battery must be replaced, or the instrument must be serviced.**
3. **Calibration must be checked if the sensor is replaced, if the battery is replaced, or if the instrument is dropped or subjected to severe physical shock.**
4. **The Cl$_2$ sensor is a sealed unit containing sulfuric acid electrolyte. If a sensor develops a leak, dispose of it properly. Should contact occur with skin or clothing, rinse area with large quantities of water. In case of eye contact, immediately flush eyes for at least 15 minutes, holding eyes open; call a physician.**
5. **Do not change battery in hazardous locations.**
6. **Substitution of components may impair intrinsic safety.**
7. **Once a high alarm condition is detected and the alarms latch, the displayed reading may not fall within the specified accuracy range for the instrument.**

⚠ CAUTIONS

1. To prevent sensor damage, store the instrument under the following conditions:

INTERMITTENT TEMPERATURE	OPTIMAL STORAGE TEMPERATURE
-30°C to 50°C (-20°F to 120°F)	4°C to 32°C (40°F to 90°F)

Turning ON/OFF

When unit is delivered, the battery is not connected. See "Installing/Replacing the Battery" later in this section prior to use. To turn the instrument ON, press the Power/Peak button on the left-hand side of the display. All segments of the display light upon turn-ON. To turn OFF the monitor, press and hold the Power/Peak button for five seconds. After a series of beeps, the display turns OFF.

FAS (Fresh Air Setup)

Upon instrument turn-ON, the display flashes "Zero." While the "Zero" is flashing, pressing the Zero button zeroes the instrument. The monitor will not zero out background concentrations greater than 0.5 ppm. If a concentration higher than this is detected, the instrument will display the actual concentration and not zero out the background.

Gas Alarms

There are two levels of audible and visual alarms. The warning level alarms are low rate intermittent and non-latching. This is indicated by a "W" on the display and a beep approximately every five seconds. The high level alarms are high rate intermittent and latching. This is indicated by an "A" on the display and a beep approximately every 1/2-second.

To mute a Warning level, press the RESET button. This silences the audible tone, but the visual indicator remains. If a warning condition remains, the tone will only be temporarily silenced. It is not possible to mute the alarm level while it persists. The alarm level can only be reset once the concentration falls below the alarm level.

Low Battery Alarm

The low battery alarm occurs when a minimum of 24 hours of battery life remains. This is indicated by a "B" on the display and a beep approximately every 40 seconds.

Vibrating Alarms

Certain Responders are equipped with vibrating alarms that cause the unit to vibrate each time any alarm is activated.

Backlight

Pressing the Power Peak button briefly turns ON the backlight for approximately 30 seconds.

Peak Readings

Press the Power Peak button briefly to turn ON the backlight. The backlight will light. Anytime the backlight is ON, briefly press the Power Peak button again. The Peak (highest) concentration of that sampling period will be displayed along with a "P" for three seconds. The Peak can be reset by turning the instrument OFF or performing a calibration.

Calibration Check

While the instrument is turned ON, press and hold both the Zero and Reset; then, press the Power Peak button. The descriptor "↑SET↓" will appear on the display. The monitor then automatically zeroes out the background concentration (display shows "Zero"). When this is complete, the calibration gas can be added.

Connect the calibration cap to the sensor cap. Attach the calibration gas to the cal cap. Turn ON the gas. Wait for the display reading to stabilize; then, adjust the concentration on the display by pressing the ↓ (labeled Zero) or ↑ (labeled Reset) to read the same as the concentration of the cylinder of gas attached. Once the display is reading the same as the attached cylinder, press the Power Peak button briefly to accept the reading. (Pressing and holding the Power Peak at this point enables setting of alarm setpoints; see "Setting Alarm Setpoints.") Calibration is now complete and the gas may be turned OFF and removed. If you will be using the Peak function, turn the instrument OFF; the Peak value will be reset.

Setting Alarm Setpoints

If alarm setpoints have been engaged (see above), the descriptor "↑SET↓" appears at the bottom of the display and the "W" lights. The previous warning level displays. Press the ↓ (Zero) and ↑ (Reset) to adjust the reading to the new desired level; once the reading shows this number, press the Power Peak button to accept the reading. The descriptor "↑SET↓" displays along with an "A." The alarm level is entered by the same method. After accepting the alarm level, the monitor returns to displaying the concentration reading.

Installing/Replacing the Battery

Remove belt clip by pressing the two tabs near the top and releasing from the back. Remove the two slotted head screws on the back of the case, located under the clip. Remove the 9-V battery from the snap connector and replace with a fresh 9-V battery or install a fresh 9-V battery for first-time use. Replace the battery cover and the two slotted screws; snap the belt clip back. Wait one minute before turning the instrument ON and zeroing it. If the instrument

has been out of service or the battery has been out of the instrument for more than one day, it is recommended that the instrument not be used or zeroed for a period of 12 hours. This allows the sensor time to equilibrate. The instrument will not turn ON for 45 seconds. The backlight is ON and **---** is displayed during this period.

Replacing Sensor Assembly

Remove phillips screw from sensor assembly. Rotate approximately 15^{o} clockwise. Pull assembly out. Remove the shorting bar from the new assembly. Place the assembly in the instrument and rotate approximately 15^{o} counterclockwise; insert the phillips screw and tighten.

It is recommended that the instrument not be used or calibrated for a period of 12 hours once the sensor has been installed. This allows the sensor time to equilibrate.

Specifications	
RANGE	0-15 ppm, over range indicated by - - -
RESPONSE TIME	90 seconds or less to 90% of final reading
TEMPERATURE RANGE (COMPENSATED)	-10^{o}C to 40^{o}C (14^{o}F to 104^{o}F)
	40^{o}C to 50^{o}C if calibrated at temperature of use and recalibrated again if temperature drops within the compensated range
HUMIDITY LIMITS	15 - 90% (non-condensing)
BATTERY LIFE	60 days with five minutes of alarm per day
	90 days with no alarm
WARM-UP TIME	As much as 12 hours when a new sensor or battery is installed
ALARM RANGE	0.2 to 4.9 ppm

Specifications	
DIMENSIONS	4-1/8"(L) x 2-1/4"(W) x 1-3/4" (H)
WEIGHT	7 oz.
ACCURACY	$\pm$0.1 ppm Cl_2 at constant temperature; at -10°C and 50°C, the reading shall not change by more than 0.2 ppm than at ambient temperatures
dB LEVEL OF ALARMS	93 dB at one foot typical

Interferant Data

This data is presented as the indicated output in ppm, which would result from the application of 2 ppm of the test gas.

TEST GAS	CONCEN-TRATION	READING
Methane (CH_4)	1.50%	0.0
Carbon Monoxide (CO)	300 ppm	0.0
Hydrogen Sulfide (H_2S)	10 ppm	0.0
Sulfur Dioxide (SO_2)	10 ppm	0.0
Nitrogen Dioxide (NO_2)	10 ppm	4.0
Nitric Oxide (NO)	50 ppm	5.1
Phosphine (PH_3)	0.5 ppm	0.0
Ammonia (NH_3)	25 ppm	DOWN

Replacement Parts	
COMPONENT/ASSEMBLY	**PART NO.**
Cl_2 Sensor Assembly	10021355
9-V Battery	628817
Calibration Cap	10028451
Battery Cover Door with slotted screws	710493
Slotted Screwdriver	632655
Belt Clip	710489
Calibration Gas	710331
Calibration Regulator	465895
Calibration Tubing, 30-inch	485030

Special Instructions

Due to the high reactivity of Chlorine gas, ambient humidity and sample line material can react with Chlorine to cause the Chlorine concentration reading to be lower than actual concentrations. It is therefore necessary when sampling for Chlorine to use dry sample lines.

1. If condensation in the sample line is suspected, dry the sample line by drawing a sample with the sample line attached in a low humidity atmosphere.
2. To verify operation of a MiniCl_2 Responder equipped with a Chlorine sensor, perform response check with the sample line in place.
3. Since shorter sample lines will reduce the reaction with Chlorine gas, calibrate and operate the instrument using the shortest possible tubing to connect to the calibration cylinder. Use no more than 10 feet of sample line for best results.

NOTE: Use only regulator (P/N 809945) with calibration cylinder (P/N 806740).

Section 6
MiniClO$_2$™ Responder
Chlorine Dioxide Detector
(P/Ns 10020745 and 10020749)

Instructions for Use and Maintenance

⚠ WARNINGS

FAILURE TO FOLLOW CAN RESULT IN SERIOUS PERSONAL INJURY OR DEATH.

1. **The MiniClO$_2$ Responder is designed to measure Chlorine Dioxide in air only. Do not use this monitor to sample for ClO$_2$ in gases other than air.**
2. **Alarm functions must be checked and a response check must be performed daily. If the instrument fails the response check and cannot be calibrated, either the sensor must be replaced, the battery must be replaced, or the instrument must be serviced.**
3. **Calibration must be checked if the sensor is replaced, if the battery is replaced, or if the instrument is dropped or subjected to severe physical shock.**
4. **The ClO$_2$ sensor is a sealed unit containing sulfuric acid electrolyte. If a sensor develops a leak, dispose of it properly. Should contact occur with skin or Clothing, rinse area with large quantities of water. In case of eye contact, immediately flush eyes for at least 15 minutes, holding eyes open; call a physician.**
5. **Do not change battery in hazardous locations.**
6. **Substitution of components may impair intrinsic safety.**
7. **Once a high alarm condition is detected and the alarms latch, the displayed reading may not fall within the specified accuracy range for the instrument.**

⚠ CAUTIONS

1. To prevent sensor damage, store the instrument under the following conditions:

INTERMITTENT TEMPERATURE	OPTIMAL STORAGE TEMPERATURE
-30°C to 50°C (-20°F to 120°F)	4°C to 32°C (40°F to 90°F)

Turning ON/OFF

When unit is delivered, the battery is not connected. See "Installing/Replacing the Battery" later in this section prior to use. To turn the instrument ON, press the Power/Peak button on the left-hand side of the display. All segments of the display light upon turn-ON. To turn OFF the monitor, press and hold the Power/Peak button for five seconds. After a series of beeps, the display turns OFF.

FAS (Fresh Air Setup)

Upon instrument turn-ON, the display flashes "Zero." While the "Zero" is flashing, pressing the Zero button zeroes the instrument. The monitor will not zero out background concentrations greater than 0.5 ppm. If a concentration higher than this is detected, the instrument will display the actual concentration and not zero out the background.

Gas Alarms

There are two levels of audible and visual alarms. The warning level alarms are low rate intermittent and non-latching. This is indicated by a "W" on the display and a beep approximately every five seconds. The high level alarms are high rate intermittent and latching. This is indicated by an "A" on the display and a beep approximately every 1/2-second.

To mute a Warning level, press the RESET button. This silences the audible tone, but the visual indicator remains. If a warning condition remains, the tone will only be temporarily silenced. It is not possible to mute the alarm level while it persists. The alarm level can only be reset once the concentration falls below the alarm level.

Low Battery Alarm

The low battery alarm occurs when a minimum of 24 hours of battery life remains. This is indicated by a "B" on the display and a beep approximately every 40 seconds.

Vibrating Alarms

Certain Responders are equipped with vibrating alarms that cause the unit to vibrate each time any alarm is activated.

Backlight

Pressing the Power Peak button briefly turns ON the backlight for approximately 30 seconds.

Peak Readings

Press the Power Peak button briefly to turn ON the backlight. The backlight will light. Anytime the backlight is ON, briefly press the Power Peak button again. The Peak (highest) concentration of that sampling period will be displayed along with a "P" for three seconds. The Peak can be reset by turning the instrument OFF or performing a calibration.

Calibration Check

While the instrument is turned ON, press and hold both the Zero and Reset; then, press the Power Peak button. The descriptor "↑SET↓" will appear on the display. The monitor then automatically zeroes out the background concentration (display shows "Zero"). When this is complete, the calibration gas can be added.

Connect the calibration cap to the sensor cap. Attach the calibration gas to the cal cap. Turn ON the gas. Wait for the display reading to stabilize; then, adjust the concentration on the display by pressing the ↓ (labeled Zero) or ↑ (labeled Reset) to read the same as the concentration of the cylinder of gas attached. Once the display is reading the same as the attached cylinder, press the Power Peak button briefly to accept the reading. (Pressing and holding the Power Peak at this point enables setting of alarm setpoints; see "Setting Alarm Setpoints.") Calibration is now complete and the gas may be turned OFF and removed. If you will be using the Peak function, turn the instrument OFF; the Peak value will be reset.

NOTE: For ease of calibration, the Chlorine Dioxide Responder can be calibrated by using Chlorine.

If calibrating with a Chlorine cylinder, the instrument should be set to 50% of the Chlorine concentration shown on the cylinder.

Example:

To calibrate the Chlorine Dioxide Responder using a 2 ppm Chlorine cylinder, the reading should be set to 50% of the Chlorine concentration shown on the cylinder, or 1.0 ppm.

Setting Alarm Setpoints

If alarm setpoints have been engaged (see above), the descriptor "↑SET↓" appears at the bottom of the display and the "W" lights. The previous warning level displays. Press the ↓ (Zero) and ↑ (Reset) to adjust the reading to the new desired level; once the reading shows this number, press the Power Peak button to accept the reading. The descriptor "↑SET↓" displays along with an "A." The alarm level is

entered by the same method. After accepting the alarm level, the monitor returns to displaying the concentration reading.

Installing/Replacing the Battery

Remove belt clip by pressing the two tabs near the top and releasing from the back. Remove the two slotted head screws on the back of the case, located under the clip. Remove the 9-V battery from the snap connector and replace with a fresh 9-V battery or install a fresh 9-V battery for first-time use. Replace the battery cover and the two slotted screws; snap the belt clip back. Wait one minute before turning the instrument ON and zeroing it. If the instrument has been out of service or the battery has been out of the instrument for more than one day, it is recommended that the instrument not be used or zeroed for a period of 12 hours. This allows the sensor time to equilibrate. The instrument will not turn ON for 45 seconds. The backlight is ON and **---** is displayed during this period.

Replacing Sensor Assembly

Remove phillips screw from sensor assembly. Rotate approximately 15^0 clockwise. Pull assembly out. Remove the shorting bar from the new assembly. Place the assembly in the instrument and rotate approximately 15^0 counterclockwise; insert the phillips screw and tighten.

It is recommended that the instrument not be used or calibrated for a period of 12 hours once the sensor has been installed. This allows the sensor time to equilibrate.

Specifications	
RANGE	0-6 ppm, over range indicated by - - -
RESPONSE TIME	90 seconds or less to 90% of final reading
TEMPERATURE RANGE	-10°C to 40°C (14°F to 104°F)
	40°C to 50°C if calibrated at temperature of use and recalibrated again if temperature drops within the compensated range
HUMIDITY LIMITS	15 - 90% (non-condensing)
BATTERY LIFE	60 days with five minutes of alarm per day
	90 days with no alarm
WARM-UP TIME	As much as 12 hours when a new sensor or battery is installed
ALARM RANGE	0.2 to 2.9 ppm
DIMENSIONS	4-1/8"(L) x 2-1/4"(W) x 1-3/4" (H)
WEIGHT	7 oz.
ACCURACY	±0.1 ppm Cl_2 at constant temperature; at -10°C and 50°C, the reading shall no change by more than 0.2 ppm than at ambient temperatures
dB LEVEL OF ALARMS	93 dB at one foot typical

Interferant Data		
This data is presented as the indicated output in ppm, which would result from the application of 2 ppm of the test gas.		
TEST GAS	**CONCEN-TRATION**	**READ-ING**
Methane (CH_4)	1.50%	0.0
Carbon monoxide (CO)	300 ppm	0.0
Hydrogen Sulfide (H_2S)	10 ppm	0.0
Sulfur Dioxide (SO_2)	10 ppm	0.0
Nitrogen Dioxide (NO_2)	10 ppm	4.0
Nitric Oxide (NO)	50 ppm	5.1
Phosphine (PH_3)	0.5 ppm	0.0
Ammonia (NH_3)	25 ppm	DOWN

Replacement Parts	
COMPONENT/ASSEMBLY	**PART NO.**
ClO_2 Sensor Assembly	10021356
9-V Battery	628817
Calibration Cap	10028451
Battery Cover Door with slotted screws	710493
Slotted Screwdriver	632655
Belt Clip	710489
Calibration Gas	710331
Calibration Regulator	465895
Calibration Tubing, 30-inch	485030

Special instructions

Due to the high reactivity of Chlorine gas, ambient humidity and sample line material can react with Chlorine to cause the Chlorine concentration reading to be lower than actual concentrations. It is therefore necessary when sampling for Chlorine Dioxide to use dry sample lines.

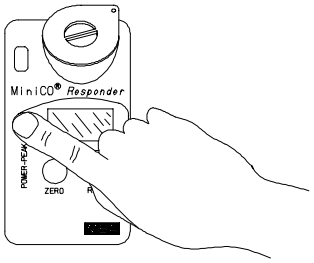
1. If condensation in the sample line is suspected, dry the sample line by drawing a sample with the sample line attached in a low humidity atmosphere.
2. To verify operation of a MiniClO_2 Responder equipped with a Chlorine Dioxide sensor, perform response check with the sample line in place.
3. Since shorter sample lines will reduce the reaction with Chlorine gas, calibrate and operate the instrument using the shortest possible tubing to connect to the calibration cylinder. Use no more than 10 feet of sample line for best results.

NOTE: Use only regulator (P/N 809945) with calibration cylinder (P/N 806740).

Section 7
Suggested Daily Use for All Units (MiniCO unit shown)

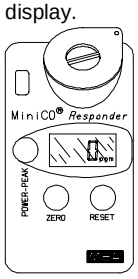
1.

Turn ON the MiniCO Responder.



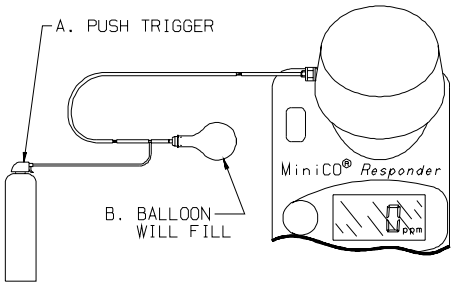
2.

The instrument can be zeroed in fresh air by pressing the ZERO button while "zero" flashes on the display.



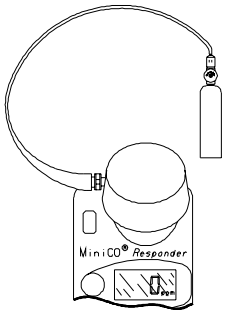
3.

Test the instrument's response to gas:
Bump check with Squirt® Bump Test Gas
OR (see step 4):



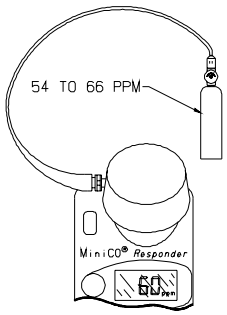
4.

OR: Test the instrument's response to gas with a calibration gas cylinder.



5.

The instrument should read within the tolerance printed on the cylinder or can.



6.

If not, calibration is required.
See "Calibration Check Adjustment."