

MACURCO

GAS DETECTION

Macurco™ Single-Gas Monitor Series, CM-1 Carbon Monoxide (CO),
HS-1 Hydrogen Sulfide (H₂S), OX-1 Oxygen (O₂)
User Instructions



Important: Keep these User Instructions for reference

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GENERAL SAFETY INFORMATION

Intended Use

The Macurco™ Single-Gas Monitor Series is designed to continuously monitor the ambient environment and notify the user if the level of the target gas reaches the alarm set point for the monitor. The Macurco™ Single-Gas Monitor is designed to operate for 2 years and then be disposed of according to local regulations. The Macurco Single-Gas Monitor is a single gas detector that is available in three versions to monitor either Carbon Monoxide (CO), Hydrogen Sulfide (H₂S) or Oxygen (O₂).

List of Warnings and Cautions within these User Instructions



- Each person using this equipment must read and understand the information in these User Instructions before use. Use of this equipment by untrained or unqualified persons, or use that is not in accordance with these User Instructions, may adversely affect product performance and result in sickness or death.

- This instrument helps monitor for the presence and concentration level of certain specified airborne gases. Misuse may produce an inaccurate reading, which means that higher levels of the gas being monitored may be present and could result in overexposure and cause sickness or death. With oxygen sensor installed, misuse may produce an inaccurate reading where lower or higher levels of oxygen may be present and cause sickness or death. For proper use, see supervisor or User Instructions, or call Macurco Technical Service at 1-877-367-7891.
- Use only for monitoring the gas which the sensor and instrument are designed to monitor. Failure to do so may result in exposures to gases not detectable and cause sickness or death. For proper use, see supervisor or User Instructions, or call Macurco Technical Service at 1-877-367-7891.
- Each time a self-test is performed, it activates the audible, vibratory and visual alarms. If the self-test fails, or all the alarms do not activate, do not use. Failure to do so may adversely affect product performance and result in sickness or death.
- Immediately exit any environment that causes an alarm condition on the monitor. Failure to do so may result in sickness or death.
- Do not cover or obstruct display, audible alarm opening or visual alarm cover. Doing so may adversely affect product performance and result in sickness or death.
- Vibrator and LCD may not function effectively below -4°F (-20°C). Using the instrument below this temperature may adversely affect product performance and result in sickness or death.
- The following steps must be performed when performing a calibration (O_2 model) or calibration verification test (CO and H_2S models) to ensure proper performance of the detector. Failure to do so may adversely affect product performance and result in sickness or death.
 - When performing a calibration or calibration verification test (bump test) only use certified calibration gas at the required concentration level. Do not use expired calibration gas.
 - A calibration verification test (bump test) should be performed before initial and each use.
 - If the instrument cannot be calibrated (O_2 model) or calibration verification test (CO and H_2S models) is not within $\pm 15\%$ of the calibration gas concentration, do not use until the reason can be determined and corrected.
 - Do not cover or obstruct display, audible alarm opening or visual alarm cover.
 - Ensure sensor inlet is unobstructed and is free of debris.

- Insure calibration hood is removed prior to use.
- Do not attempt to clean the instrument by rubbing with a dry cloth. Cleaning with a dry cloth may generate a static charge and result in an explosion if located in a hazardous environment.
- Do not disassemble unit or attempt to repair or modify any component of this instrument. This instrument contains no user serviceable parts, and substitution of components may impair intrinsic safety which may adversely affect product performance and result in sickness or death.

USE INSTRUCTIONS AND LIMITATIONS



Each person using this equipment must read and understand the information in these User Instructions before use. Use of this equipment by untrained or unqualified persons, or use that is not in accordance with these User Instructions, may adversely affect product performance and result in sickness or death.

Use For

Monitoring for, either Carbon Monoxide (CO), Hydrogen Sulfide (H₂S) or Oxygen (O₂).

Do Not Use For

Monitoring for gases other than those which the instrument was designed to monitor, or in atmospheres where oxygen concentrations are below 12 % when equipped with Carbon monoxide (CO) or Hydrogen Sulfide (H₂S) sensors. Prolonged exposure to high levels of target gas may prematurely degrade sensor performance.

General Description

These User Instructions apply to the Macurco Single-Gas Series. It is designed to provide continuous monitoring of the ambient environment for Carbon Monoxide (CO), Hydrogen Sulfide (H₂S) or Oxygen (O₂), depending on which sensor is installed in the instrument. The gas detected by the sensor installed in the instrument is identified on the label located on the front of the unit and the sensor symbol on the LCD display.

Accuracy of the instrument's gas sensor readings can vary up to $\pm 25\%$ depending on the accuracy of the calibration gas, how often a calibration (O₂) or calibration verification test (CO, H₂S) is performed, environmental conditions (temperature, atmospheric pressure, humidity, air velocity), cross interference gases or time of exposure to the target gas (see SPECIFICATIONS section).

Calibrating (O₂) prior to use in the same environmental conditions as the instrument will be used will increase the accuracy of the instrument's gas concentration reading (see Calibration Verification Test and Calibration section).

An internal microprocessor controls the indication and alarm functions in response to the signals received from an electrochemical sensor permanently mounted inside the unit. When turned on, it continuously monitors the ambient air that enters the sensor through the sensor inlet opening by the process of passive diffusion. If the level of the target gas detected by the sensor reaches a factory preset alarm point, the unit will alarm (see SPECIFICATIONS section).

The Macurco Single-Gas Monitor is a battery powered unit utilizing a permanently mounted, non-rechargeable 3.6-volt Lithium battery. It is designed to be intrinsically safe. The Macurco Single-Gas Monitor is UL Classified intrinsically safe for Class I, Div. I, Groups A, B, C, & D Hazardous Locations.

The components of the Macurco Single-Gas Monitor are assembled in an ABS/PC plastic housing 3.2 x 2 x 1.2 in. (8.1 x 5.1 x 3.1 cm). Located on the front face of the unit is an ON/MENU button, the display (LCD), sensor inlet, audio alarm opening, visual alarm LED. On the back of the instrument is an alligator pocket/belt clip and a label containing the intrinsic safety information and serial number.

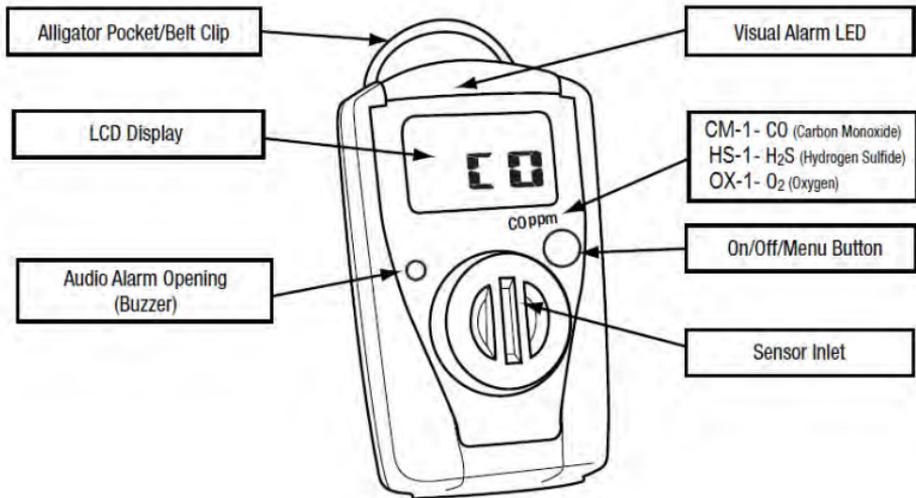


Fig.1

Sensor Symbol	Gas Read by Sensor	Display Range	Reading Resolution	Recommended Certified Gas Concentration (Cal. Ver. Test)	Factory Set Low Alarm	Factory Set High Alarm	Temperature Range
CO	Carbon Monoxide	0-995 ppm	5 ppm	35 ppm	35 ppm	200 ppm	-4 to 122 °F (-20 to 50 °C)
HS	Hydrogen Sulfide	0-200 ppm	5 ppm	10 ppm	10 ppm	15 ppm	-4 to 122 °F (-20 to 50 °C)
OX	Oxygen	0-25% v/v	0.5% v/v	Clean Air	19.5%	23%	-4 to 122 °F (-20 to 50 °C)

Specifications

- Size: 3.2 x 2.0 x 1.2 in. (8.1 x 5.1 x 3.1 cm)
- Weight: 4.1 oz. (115 g)
- Ingress Protection Rating: IP54
- Sensor: Electrochemical
- Operating Humidity: 15 – 90% (non-condensing)
- Readout: Direct read LCD
- Range: 0-995 ppm (CO), 0-200 ppm (H₂S), 0-25% v/v (O₂)
- Alarm Indicators Visual: Flashing LCD display and Red LED, Audio: 85 dBA @ 1 foot (30.5 cm) buzzer, Tactile: Internal vibrator
- Alarm Readings: Low, High Alarms, Low Battery, Over Range
- Alarm Settings: See alarm settings in the table below
- Reading Resolution: 5 ppm – Carbon Monoxide (Reading start at 20 ppm or greater), 5 ppm – Hydrogen Sulfide (Reading start at 10 ppm or greater), 0.5% v/v - Oxygen (Increment/decrement from 21.0%)
- Test Function: Self-test on circuitry, battery and alarms.
- Operating Life: 2 years from activation (maximum 36.5 alarm hours – 3 minutes/day)
- Sensor Replacement: Not replaceable
- Intrinsic Safety: UL Classified - Class I, Div. I, Group A, B, C & D, T4
- Power: Permanently mounted, non-rechargeable 3.6-volt Lithium battery
- Radio Frequency Protection: <10% deviation of alarm level when subjected to 450MHz, 5 Watt Radio @ 2ft (61cm)
- Keypad: One button operation

- Operating Temperature Range: -4 to 122°F (-20°C to 50°C)
- Sensor Accuracy: (After calibration) Carbon Monoxide (CO) - Less than $\pm 25\%$ of the displayed reading or 5 ppm, whichever is greater. Oxygen (O₂) - Less than $\pm 0.5\%$ vol/vol from 17% to 24% Oxygen. Hydrogen Sulfide (H₂S) - Less than $\pm 25\%$ of the displayed reading or 2 ppm, whichever is greater
- Non-contaminated environment: An environment containing less than 0.1 ppm of hydrocarbons, 0.5 ppm of CO, 0.2 ppm of H₂S, 0.2 ppm of Ammonia, 0.5 ppm of Hydrogen and 0.2 ppm of other gasses not normally found in the air.
- Certified calibration gas: Refers to a calibration gas sold by Macurco* or produced by an ISO 9001:2000 certified calibration gas manufacturer. The certified accuracy of the calibration gas components must be listed on the calibration gas container and traceable to National Institute of Standards and Technology (NIST) or a national measurement institute standard reference material.
- Warranty: 2 years for sensor and electronics (see WARRANTY section)
 - * A gas analysis certificate of the calibration gas is available if requested.

Display Menu Sequence

Press On/Menu Button (number of times)	Result
1	Unit performs a self-test
2	Display peak value
3	Display detector remaining life (months)
4	Display low alarm set points
5	Display high alarm set points

OPERATING INSTRUCTIONS

The following instructions are intended to serve as a guideline for the use of the Macurco™ Single-Gas Monitor Series. It is not to be considered all-inclusive, nor is it intended to replace the policy and procedures for each facility.



Each person using this equipment must read and understand the information in these User Instructions before use. Use of this equipment by untrained or unqualified persons, or use that is not in accordance with these User Instructions, may adversely affect product performance and result in sickness or death.

This instrument helps monitor for the presence and concentration level of certain specified airborne gases. Misuse may produce an inaccurate reading, which means that higher levels of the gas being monitored may be present and could result in overexposure and cause sickness or death. With oxygen sensor installed, misuse may produce an inaccurate reading where lower or higher levels of oxygen may be present and cause sickness or death. For proper use, see supervisor or User Instructions, or call Macurco Technical Service at 1-877-367-7891.

Use only for monitoring the gas which the sensor and instrument are designed to monitor. Failure to do so may result in exposures to gases not detectable and cause sickness or death. For proper use, see supervisor or User Instructions, or call Macurco Technical Service at 1-877-367-7891.

If you have any doubts about the applicability of the equipment to your job situation, consult an industrial hygienist or call Macurco Technical Service at 1-877-367-7891.

Activating the Detector

Press and hold the ON/MENU button for 3 seconds until the LCD displays “RLS”. The instrument will go through a test sequence (test sequence may take up to 15 minutes on O₂ models). Once the check icon is displayed, the instrument will remain on for two years.

Display Readings



Fig. 2

Normal Operating Mode

CO and H₂S Models

The LCD will display "CO" or "HS" until the unit is exposed to detected gas levels at or above 20 ppm for CO models or 10 ppm for H₂S models (Fig. 3 and 4). The gas readings will change in increments at or above 5 ppm as the CO or H₂S gas levels change.



Fig. 3



Fig. 4

O₂ Model

The LCD should display 20.9% once activated in an environment containing normal oxygen levels. It will change in increments of 0.5% above or below 21.0% if oxygen levels change (e.g. 20.5%, 21.5% etc.).

Performing Self-test



Each time a self-test is performed, it activates the audible, vibratory and visual alarms. If the self-test fails, or all the alarms do not activate, do not use. Failure to do so may adversely affect product performance and result in sickness or death.

A self-test can be performed at any time by pressing the ON/MENU button once from the normal operating mode. This will test the battery, electronic circuitry and alarm functions to insure they are working properly. The self-test does not test the performance of the sensor. This must be done through a calibration (O₂ model) or calibration verification test (CO and H₂S models). See Calibration Verification Test and Calibration section of these User Instructions.

The self-test will be indicated by the "TEST" icon being displayed on the LCD for about 5 seconds and the buzzer, LED and vibrator will activate (Fig. 5). After successful completion of a self-test, the "check" icon (Fig. 6) will appear on the display for 24 hours and the unit will return to normal operating mode. If a self-test fails, the LCD will display "Err" (Fig. 7). Press ON/MENU button to clear. **Do not use the instrument until the reason for the "Err" message has been determined and corrected.**



Fig. 5



Fig. 6



Fig. 7

Viewing Peak Levels

From normal mode, press the ON/MENU button twice and the peak reading will be displayed. To clear the peak reading, wait 5 seconds; "Clr" will be displayed. Press the

ON/MENU button once to clear and the value will be set to zero so long as the unit is in a non-contaminated environment (Fig. 8). The instrument will go back to normal operating mode after 5 seconds.

Time Remaining Indicator

To display time remaining until the monitor becomes deactivated, press the ON/MENU button three times from normal mode (or once from peak mode). The time will be displayed in months (Fig. 9). When less than 2 months of life remains, the time will display in days. The instrument will go back to normal operating mode after 5 seconds.



Fig. 8



Fig. 9



Fig. 10

End of Life Indicator

The LCD will display "EOL" at the end of the instruments two-year life (Fig. 10). Press ON/MENU button to clear. Discard monitor according to local regulations.

Alarms



WARNING

Immediately exit any environment that causes an alarm condition on the monitor. Failure to do so may result in sickness or death. Do not cover or obstruct display, audible alarm opening or visual alarm cover. Doing so may adversely affect product performance and result in sickness or death. Vibrator and LCD may not function effectively below -4°F (-20°C). Using the instrument below this temperature may adversely affect product performance and result in sickness or death.

Viewing Alarm Set Points

To display alarm set-points, press the ON/MENU button 4 times from the normal operating mode (Fig. 11). The low alarm will be displayed followed by the high alarm.

Low Alarm

A low alarm is activated once the low alarm set-point has been reached or exceeded. A low alarm is indicated by a slow alarm sequence of buzzer, red LED, "ALARM LOW" display and vibrator actuated every 2.5 seconds (Fig. 12).

High Alarm

A high alarm is activated once the high alarm set-point has been reached or exceeded. A high alarm is indicated by a fast alarm sequence of buzzer, red LED, "ALARM HIGH" display and vibrator actuated every 1.25 seconds (Fig. 13).

Over Range Alarm

An over range alarm is indicated by a flashing display showing the highest value in the range of the sensor: 995 ppm for CO, 200 ppm for H₂S, or 25.0% for O₂ (Fig. 14). The alarm indicators are the same as those for the high alarm.

Low Battery Alarm

If battery capacity reaches a point where it is no longer sufficient to maintain operation of the unit, the LCD will display "bAt" (Fig. 15). Press ON/MENU button to acknowledge and silence the alarm. Discard and replace the unit.



Fig. 11



Fig. 12



Fig. 13



Fig. 14



Fig. 15

Alarm Mode table

Alarm Mode	Display	Alarm Sequence
Low	Gas Concentration and "ALARM LOW"	Repeating Alarm Cycle: Three 2.5 sec. alarm sequences (vibrate, double beep/double flash) followed by five 2.5 sec. alarm sequences (double beep/double flash). Repeats cycle.
High	Gas Concentration and "ALARM HIGH"	Repeating Alarm Cycle: Three 1.25 sec. alarm sequences (vibrate, double beep/double flash) followed by five 1.25 sec. alarm sequences (double beep/double flash). Repeats cycle.
Over Range	"ALARM HIGH" and flashing of highest value in the range of sensor (995 ppm CO, 200 ppm H ₂ S, 25% O ₂)	Repeating Alarm Cycle: Three 1.25 sec. alarm sequences (vibrate, double beep/double flash) followed by five 1.25 sec. alarm sequences (double beep/double flash). Repeats cycle.
Error	Err	Double beep/double flash every 40 seconds
End of Life	EOL	Double beep/double flash every 40 seconds
Low Battery	bAt	Double beep/double flash every 40 seconds

Calibration Verification Test and Calibration



The following steps must be performed when performing a calibration (O₂ model) or calibration verification test (CO and H₂S models) to ensure proper performance of the detector. Failure to do so may adversely affect product performance and result in sickness or death.

- When performing a calibration or calibration verification test (bump test) only use certified calibration gas at the required concentration level. Do not use expired calibration gas.
 - A calibration verification test (bump test) should be performed before initial and each use.
 - If the instrument cannot be calibrated (O₂ model) or calibration verification test (CO and H₂S models) is not within $\pm 15\%$ of the calibration gas concentration do not use until the reason can be determined and corrected.
 - Do not cover or obstruct display, audible alarm opening or visual alarm cover.
 - Ensure sensor inlet is unobstructed and is free of debris.
 - Insure calibration hood is removed prior to use.
-

A calibration verification test (Bump Test) should be performed before every use for CO and H₂S sensors. This is done by checking the monitor's response to a known concentration of certified calibration gas. Sensors used beyond the warranty period or exposed to very high concentrations of gas may require more frequent testing.

Note: The instrument has been calibrated prior to being shipped from the factory. However, to ensure it is performing correctly, a calibration verification test must be performed prior to initial use.

Performing a Calibration Verification Test (Bump Test) (CO and H₂S Models Only)

A calibration verification test (bump test) should be conducted every time you use the monitor. This is the only way to effectively confirm that all characteristics of the monitor and the sensors are working correctly.

Ensure that you are in a non-contaminated environment before performing a calibration verification test. To conduct the test, attach the calibration (cal) hood on top of the sensor inlet (Fig. 16). Ensure the calibration gas matches the sensor installed in the instrument. Connect the hose from the gas regulator of the calibration gas bottle to the cal hood. Turn on the gas. Compare the displayed values with those of your reference calibration gas source. Apply the calibration gas for a period of at least 2 - 3 minutes to ensure sufficient

response time and steady state readings. If the measurement displayed is within $\pm 15\%$ of the calibration gas concentration, turn off the calibration gas and remove the cal hood. The unit is now ready for use. Otherwise do not use the instrument until the reason for the discrepancy with the calibration gas concentration has been determined and corrected.

Performing a Calibration (Oxygen Model Only)

First perform a self-test. Upon completion of a successful self-test, the "CAL" message will appear on the LCD (Fig. 17). To start a self-calibration sequence, ensure the instrument is in non-contaminated environment and press the ON/MENU button before the "CAL" message disappears. A successful calibration will be indicated by 20.9% being displayed on the LCD. If calibration fails, the "Err" message will appear on the LCD indicating the unit needs to be replaced (Fig. 18). **Do not use the instrument until the reason for the "Err" message has been determined and corrected.**



Fig. 16



Fig. 17

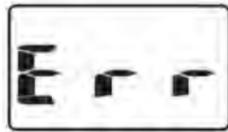


Fig. 18

MAINTENANCE



Do not attempt to clean the instrument by rubbing with a dry cloth. Cleaning with a dry cloth may generate a static charge and result in an explosion if located in a hazardous environment.

Do not disassemble unit or attempt to repair or modify any component of this instrument. This instrument contains no user serviceable parts, and substitution of components may impair intrinsic safety which may adversely affect product performance and result in sickness or death.

CAUTION

This instrument contains a lithium battery. Dispose of in accordance with local regulations. Avoid the use of harsh cleaning materials, abrasives and other organic solvents. Such materials may permanently scratch the surfaces and damage the display window, labels, or instrument housing.

Cleaning

Cleaning of the external surfaces is best carried out using a damp cloth with a mild detergent or soap.

Disposal

The Macurco™ Single-Gas Monitor is designed to be discarded 2 years after activation. To properly dispose of the instrument, follow local solid waste disposal regulations.

MACURCO GAS DETECTION PRODUCTS LIMITED WARRANTY

Macurco warrants the Macurco™ Single-Gas Monitor Series detector will be free from defective materials and workmanship for a period of two (2) years from date of manufacture (indicated on the cover of the device), provided it is maintained and used in accordance with Macurco instructions and/or recommendations. If any component becomes defective during the warranty period, it will be replaced or repaired free of charge, if the unit is returned in accordance with the instructions below. This warranty does not apply to units that have been altered or had repair attempted, or that have been subjected to abuse, accidental or otherwise. The above warranty is in lieu of all other express warranties, obligations or liabilities. THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE ARE LIMITED TO A PERIOD OF TWO (2) YEARS FROM THE PURCHASE DATE. Macurco shall not be liable for any incidental or consequential damages for breach of this or any other warranty, express or implied, arising out of or related to the use of said gas detector. Manufacturer or its agent's liability shall be limited to replacement or repair as set forth above. Buyer's sole and exclusive remedies are return of the goods and repayment of the price, or repair and replacement of non-conforming goods or parts.

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