



SafeTest 90

Portable Single Gas Monitor

Operator's Manual

Note: Due to the new ATEX Directive in Europe, all references in this document to "Ex" or "EEx" for intrinsic safety approvals should be disregarded effective 7/1/03 within the member countries of the European Union (EU). At this time, this product is not approved in accordance with the new ATEX Directive and is not sold for use in hazardous atmospheres or explosive zones by customers within the EU. Outside of the EU, all references to intrinsic safety continue without change.



Thank you for choosing Quest Technologies to meet your personal gas monitoring needs. The SafeTest 90 is an extremely rugged, lightweight personal single-gas monitor for oxygen and one of five toxic gases. It is our goal to make your decision to buy Quest products the right one, and to provide support for any questions or concerns that might arise.

The purpose of this manual is to provide the user with the necessary information to operate the SafeTest 90. The entire manual should be read to fully understand the many features this instrument offers.

This manual is not all inclusive and cannot cover all unique situations. In addition, no warranties are contained in this manual except as described under the warranty policy section.

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**SafeTest 90 SINGLE GAS MONITOR
QUICK START REFERENCE GUIDE**

- Turn On:**
1. **Press & hold the I/O button** through the ON count to 3 until all items are shown in the display.
 2. **Release the I/O button** and the display will show revision number, which sensor is installed, Confidence Chirp "CC" setting, Latching Alarm "LA" setting, remaining battery voltage, and finally "ZERO".
- Zero:**
1. Be sure the unit is in a fresh air environment! After turning the unit on, **press & release the I/O button** during the 5 seconds that "ZERO" is in the display.
- Run Mode:**
1. After turning the ST-90 on the unit will enter the Run mode.
- OR**
2. To enter the Run mode from the Setup menu, **press & hold the down arrow for two seconds** until "LEVL" and the current concentration of gas are displayed.
- Setup:**
1. Turn the ST-90 on and enter the Run mode (see above section).
 2. **Press and hold the up arrow** for 4 second SE countdown until display shows "PAS". Then release the up arrow. Enter the password "157".
 3. **Press the down arrow** to display CAL, HI LEVL, LO LEVL, STEL, and TWA alarm levels.
 4. To change an alarm level:
 - a. **Press I/O** and the current alarm level will begin to flash.
 - b. **Use the arrow buttons** to adjust the level displayed.
 - c. When the level desired is displayed, **press the I/O button**.
- Calibrate:**
1. Turn the ST-90 on and enter the Run mode (see above section).
 2. **Press and hold the up arrow** for 4 second SE countdown until display shows "PAS", then release the up arrow. Enter the password "157".
 3. Be sure the unit is in a fresh air environment! With "ZERO CAL" in the display **press the I/O button** to zero the instrument.
 4. **Press the down arrow** to display "CAL" and press the I/O button. The display will now be flashing.
 5. Turn the calibration gas on. When the value in the display stops rising and stabilizes, **press the up or down arrows** until the displayed value matches the calibration gas concentration.
 6. When the displayed value matches the calibration gas concentration, **press the I/O button**. The display will stop flashing and the unit is calibrated.
- Turn Off:**
1. The ST-90 must be in Run mode to be turned off (see above).
 2. While in Run mode, **press & hold the I/O button** for the 5 second countdown, then the ST-90 will return to the RUN mode.

1. GENERAL DESCRIPTION

The SafeTest 90 is an extremely rugged, lightweight personal single gas monitor. Designed for today's demanding work environment, the unit features compact design, long battery life, and a loud pulsating alarm.

WARNING: *The SafeTest 90 is a safety device intended for measurement of gases that may be hazardous to human health. It is very important that all users read and understand the operating manual and calibration procedures before using the instrument. The SafeTest 90, like all gas detection instruments, should not be relied upon for use in potentially hazardous environments unless it has been both operationally checked and the calibration accuracy verified by using good quality test gas in accordance with the calibration instructions.*

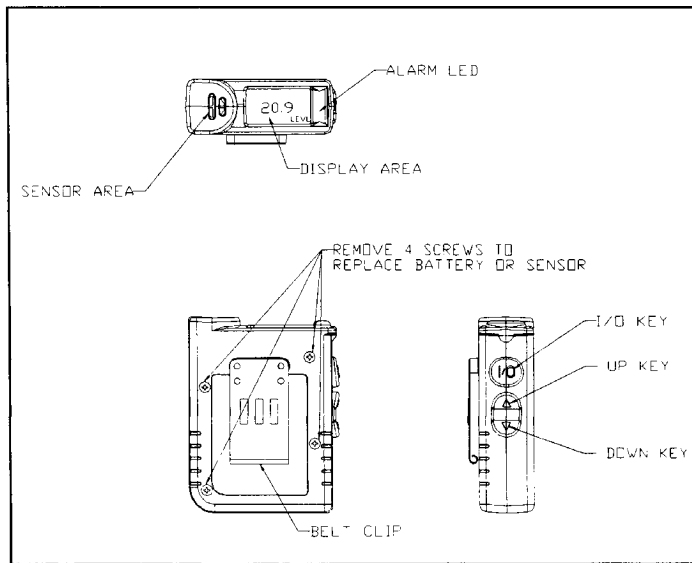


Figure 1. Unit Overview

2. DISPLAY ANNUNCIATORS

2.1 LEVL

This annunciator appears whenever the level measured by the sensor is shown, and when the HI, LO, STEL, and TWA alarm levels are being viewed in SETUP.

2.2 TWA

This annunciator, which stands for Time Weighted Average, is used when the unit contains a toxic gas sensor. The unit calculates the TWA by summing the one-second sensor readings, and then dividing this sum by the number of seconds in eight hours (28,800). It then compares the TWA to its alarm level, which is typically set to the maximum average concentration that an unprotected worker can be exposed to over an eight hour period. If this level is exceeded, the alarm activates and the TWA annunciator turns on.

2.3 STEL

The STEL (Short Term Exposure Limit) is the maximum average concentration of a toxic gas to which an unprotected worker may be exposed over any fifteen minute interval during a work period. The unit calculates the STEL by compiling fifteen one minute averages, and updates that average each minute after the initial fifteen minute exposure. If the STEL is reached or exceeded, the alarm activates, and the STEL annunciator turns on.

2.4 PEAK

The highest level of toxic gas or oxygen reached while the unit is on.

2.5 CAL

This annunciator appears during the setup mode when calibrating.

2.6 ZERO

This annunciator appears when in the ZEROing mode, after the unit is first turned on or when in the setup zero mode. YOUR UNIT MUST BE ZEROED IN A CLEAN AIR ENVIRONMENT PRIOR TO CALIBRATION.

2.7 HI

This annunciator appears when the high level alarm of a toxic gas or O₂ is reached.

2.8 LO

This annunciator appears when the low level alarm point of O₂ or the low (pre-alarm) point of a toxic gas is reached.

2.8 BAT

This annunciator appears whenever the battery voltage is displayed and when the unit goes into a low battery condition.

3. OPERATION

3.1 Turning the Unit ON

Press and hold the I/O button. It will display On and count up for 3 seconds beeping once per second. After these 3 seconds all display segments and the alarm lights will light at which time the I/O button can be released.

Note: If the I/O button is released before completion of the 3 second count up the startup procedure will be terminated and the unit will shut off.

1. **Firmware Revision:** The current version of firmware that runs the unit is displayed.
2. **Sensor Type:** The chemical symbol for the type of sensor currently installed in the unit is displayed next.
3. **Confidence Chirp:** The state (ON/OFF) of the confidence chirp is displayed as CC1 or CC0. The confidence chirp beeps once every 30 seconds. During this startup screen, the buzzer will sound.
4. **Latching Alarm:** The state (ON/OFF) of the latching alarm is displayed as LA1 or LA0. With the latching alarm set to 1 the unit requires the press of any key to silence the alarm after the hazards go away. With the latching alarm set to 0 the alarm silences as soon as the hazard goes away. During this startup screen, the vibrating motor (if present) will pulse once.

5. **Battery Voltage:** The battery voltage is displayed.

Display BackLight: The SafeTest90 is equipped with a backlight that will turn on for 5 seconds when any key is pressed or when the unit goes into alarm.

3.2 Turning the Unit OFF

To turn off the SafeTest90, it must be in the Run Mode. Press and hold the I/O key until "oF5" appears. Keep depressing the key until the unit counts down to 0. The display will turn off, at which time you can release the key. If you release the key at any time during this countdown it will return to the Run Mode.

3.3 Setup Mode

Access to the Setup Mode is protected by a fixed three-digit password. This password is 157.

To access Setup, the SafeTest90 must be in the Run Mode. Press and hold the UP key. The display will count down from 5 seconds until PAS is displayed.

Note: If the UP key is released before completion of the 5 second count is complete the unit will return to the Run Mode.

At that point release the key and the display will change to "-00". Use the DOWN key to scroll through the numbers from 9 down to 0. Once you reach the number you want, press I/O and the dash will move to the next digit. Repeat this process until the entire 3-digit password appears on the screen. Then when you press the I/O key, you will be in the Setup Mode and the display will change to the Calibration Zero screen

Entering the wrong password or pressing the UP key anytime while in the password input screen would return the unit to the RUN Mode.

In the Setup Mode the alarms can be set, the confidence chirp and latching alarm turned on or off, the unit can be calibrated and the sensor can be calibration zeroed (zeroed without any limits).

The UP/DOWN keys are used to access the different settings. To exit the Setup Mode and go to the Run Mode, press and hold the DOWN key for about 2 seconds until the alarm LED's flash, the alarm sounds, and the display reads LEVL.

3.3.1 Alarm Set

Use the UP/DOWN keys to move to the desired alarm value that you wish to change. Press the I/O key to access that alarm value. The display will now flash. Use the UP/DOWN keys to change the value and the I/O key to accept the change. With an O2 sensor installed, the alarm points are HI and LO LEVL. With a toxic sensor installed, the alarm points are HI LEVL, LO LEVL, STEL, and TWA.

3.3.2 Confidence Chirp Set

Use the UP/DOWN keys to access the confidence chirp setting. Then use the I/O key to change the setting, with CC1 meaning ON, and CC0 meaning OFF.

3.3.3 Latching Alarm Set

Use the UP/DOWN keys to access the latching alarm setting. Then use the I/O key to change the setting, with LA1 meaning ON, and LA0 meaning OFF.

3.3.4 Calibration Zero

Use the UP/DOWN keys to access ZERO CAL and the I/O key to zero the unit. Because there are no limits on this ZERO function it is important to be in a clean air environment prior to doing a calibration zero. NOTE: With an O2 sensor installed, pressing the I/O key in the ZERO CAL mode will assume the unit is being zeroed in a 20.9% oxygen environment.

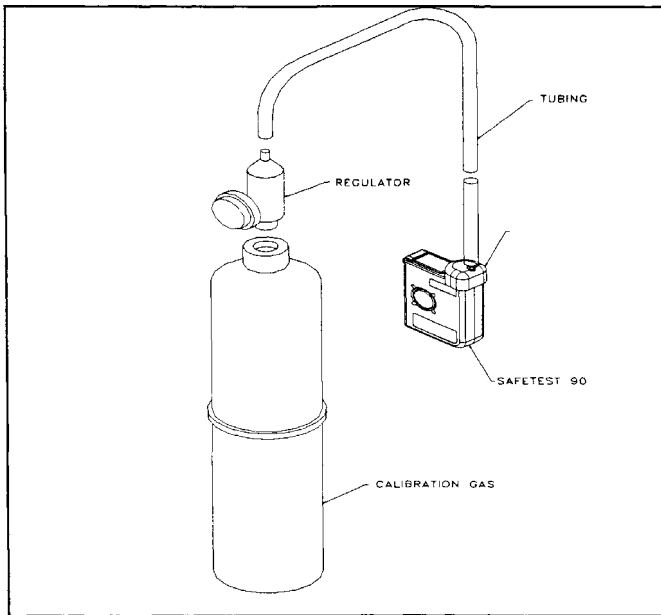


Figure 2. Calibration

3.3.5 Calibration

Use the UP/DOWN keys to move to the screen where CAL is the only annunciator that is on. Press the I/O key to access calibration. The display will now flash. Apply calibration gas. When the displayed value stops rising and then stabilizes, use the UP/DOWN keys to raise or lower the displayed value to match the concentration stated on the calibration cylinder. Then press the I/O key to accept the change. (See figure 2)

To exit the Setup Mode and go to the Run Mode, press and hold the DOWN key for about 2 seconds until the alarm LED's flash, the alarm sounds, and the display reads LEVL.

3.4 Fresh Air Zero Mode

This mode is only accessible during unit startup. The ZERO annunciator is on while the unit goes through a 6 second fresh air zero countdown. The display alternates between the countdown value and the reading from the sensor. A press on the I/O key during this countdown will zero out the unit and then automatically enter the Run Mode. If the I/O key is not pressed during the countdown, the unit will enter the Run Mode at the completion of the countdown.

A safety feature in this mode prevents zeroing of the unit in either a high background level of toxic gas or an improper level of oxygen. The unit will display Err before entering the Run Mode if zeroing is attempted at incorrect gas levels.

3.5 Run Mode

In the RUN mode, the current LEVL, sensor type, and battery voltage can be viewed along with the following readings:

Oxygen: PEAK LEVL and LO LEVL

Toxic: PEAK LEVL, STEL, and TWA

To view these items, use the I/O key. The first press of this key turns on the backlight for 5 seconds. Then, while the backlight is on, each press of the key will change the display to the next item to be viewed.

In the RUN mode the HI and LO alarm conditions will be checked every second. STEL, TWA alarm conditions and battery voltage are checked every minute. If any HI, STEL, TWA, or LO (O2 only) alarm is reached the alarm will sound continuously and the alarm lights flash on every other second alternating with the internal vibratory alarm, (if present). A LO alarm in the case of a toxic gas is a pre-alarm warning and if reached the alarm will sound once every three seconds.

The battery is checked while in the RUN mode. If the battery voltage drops below 6.7 volts the LO and BAT annunciators come on and the display flashes. At this point you have about 20 hours of battery life left before the unit will turn itself off. When the battery voltage drops below 6.5 volts, in addition to the above, the light will flash and the alarm will sound once every 15 seconds. At this point you have about 10 hours of battery life left before the unit will turn itself off. Quest recommends that you change the battery as soon as this indicator appears. If the battery voltage drops below 6.3 volts, the unit begins a five second count down and then turns itself off.

3.6 Error Codes

ER1: Indicates there is no sensor present in the unit, or the unit does not recognize the sensor that is present. This is checked at unit startup. If the unit finds no sensor it will shutoff after approximately 10 seconds.

3.7 Sensor and Battery Replacement

Separate the two halves of the unit by loosening the four captive screws that hold the unit together providing access to both battery and sensor. The sensor mounts to the bottom board with a six pin connector. The battery is held in place by a standard 9V-battery clip.

4. SPECIFICATIONS

Size:	1.3" x 3.0" x 3.9" (3.3 cm x 7.6 cm x 9.9 cm)
Weight:	6.3 ounces (180 grams)
Power:	Single 9 Volt Alkaline or Lithium Battery
Battery Life:	5000 hours with the Alkaline Battery. 10000 hours with the Lithium Battery
Sensors:	O ₂ , CO, H ₂ S, SO ₂ , NO ₂ , CL ₂ (City Technology Electrochemical Cells)
Measurement:	Continuous (1 sample/second)
Display:	3 1/2 Digit LCD, with 5 second backlight
Alarms:	Pulsating audio tone and flashing visual. Optional: Vibratory
Alarm Thresholds:	High level, Low level, STEL, TWA, Low battery
Operating Indicator:	Periodic confidence chirp and visual flash every 30 seconds (if enabled)
Temperature Range:	-10 to 40°C (14 to 104°F) operating -15 to 60°C (5 to 140°F) storage

Humidity Range: 0 to 99% relative humidity, non-continuous, non-condensing 15 to 90% relative humidity, continuous, non-condensing

Warranty: Sensors 1 year, electronics 1 year

Intrinsic Safety: ETL, CENELEC (DEMKO), Class I, II, III, Division 1, Groups A, B, C, D, E, F, G

RFI Protection: ANSI Standard C95.1-1982, Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields 300 kHz to 100 Ghz

Ingress Protection Rating: IP54

5 GAS SPECIFIC DATA

Gas	Range	Resolution	Accuracy	Drift**	Alarm High***	Alarm STEL***	Alarm TWA***
Oxygen O ₂	0-30%	0.1%	±5%	<1%	23.5%	19.5%	
Carbon Monoxide CO	0-1500 ppm	1 ppm	±5%	<2%	200 ppm	100 ppm	35 ppm
Hydrogen Sulfide H ₂ S	0-500 ppm	1 ppm	±5%	<2%	20 ppm	15 ppm	10 ppm
Chlorine CL ₂	0-20 ppm	0.1 ppm	±5%	<2%	1 ppm	1 ppm	0.5 ppm
Sulphur Dioxide SO ₂	0-50 ppm	0.1 ppm	±5%	<2%	10 ppm	5 ppm	2 ppm
Nitrogen Dioxide NO ₂	0-50 ppm	0.1 ppm	±5%	<2%	8 ppm	5 ppm	2 ppm

* Sensor accuracy, listed by City Technology, as a percentage of the reading.

** Long term output drift listed as percentage of signal loss per month

*** Factory default settings. Recommended for normal use.

6. ACCESSORIES

54-733 Vibratory Alarm

6.1 Replacement Sensor Modules

54-734 Oxygen (O₂)
54-735 Carbon Monoxide (CO)
54-736 Hydrogen Sulfide (H₂S)
54-741 Chlorine (CL₂)
54-742 Sulphur Dioxide (SO₂)
54-743 Nitrogen Dioxide (NO₂)

6.2 Calibration Accessories

54-737 Calibration Adapter
54-974 Two Cylinder Calibration Kit: Includes two
cylinder calibration case, regulator, and tubing
54-971 0.5 lpm Regulator with 2' (.050 I.D.) tubing
54-141 100% Nitrogen
54-142 50 PPM Carbon Monoxide in Air
54-143 200 PPM Carbon Monoxide in Air
54-144 50 PPM Carbon Monoxide in Nitrogen
54-146 25 PPM Hydrogen Sulphide in Air
54-147 10 PPM Chlorine in Nitrogen
54-148 10 PPM Sulphur Dioxide in Air
54-150 5 PPM Nitrogen Dioxide in Nitrogen

QUEST WARRANTY POLICY

Warranty Policy

Quest Technologies warrants our instruments to be free from defects in materials and workmanship for one year under normal conditions of use and service. For U.S.A. customers we will replace or repair (our option) defective instruments at no charge, excluding batteries, abuse, misuse, alterations, physical damage, or instruments previously repaired by other than Quest Technologies. Microphones, sensors, and printers may have shorter warranty periods. This warranty states our total obligation in place of any other warranties expressed or implied. Our warranty does not include any liability or obligation directly resulting from any defective instrument or product or any associated damages, injuries, or property loss, including loss of use or measurement data.

For warranty outside the U.S.A., a minimum one year warranty applies to the same limitation and exceptions as above with service provided or arranged through the authorized Quest distributor or our Quest European Service Laboratory. Foreign purchasers should contact the local Quest distributor for details.

QUEST SERVICE POLICY

Service Policy

The Quest product you have purchased is one of the finest gas detection instruments available. It is backed by our full one year warranty which seeks complete customer satisfaction. This is your assurance that you can expect prompt courteous service for your equipment from the entire Quest service organization.

Should your Quest equipment need to be returned for repair or recalibration, please contact the Service Department at (800) 245-0779 (USA) or Fax (262) 567-4047 for a Return Authorization Number. The RA number is valid for 30 days, and must be shown on the shipping label and purchase order/cover letter. If you are unable to return instruments in that time call for a new RA number. Send it prepaid and properly packed in the original shipping carton directly to Quest Technologies, 1060 Corporate Center Drive, Oconomowoc, WI 53066 U.S.A.

Repair or replacement work done under warranty will be performed free of charge, and the instrument will be returned to you prepaid. Your copy or a photocopy of the Quest Registration Card will serve as proof of warranty should the factory require this information.

If for any reason you should find it necessary to contact the factory regarding service or shipping damage, please direct your calls or letters to the attention of the Service Manager, Quest Technologies, (262) 567-9157 or (800) 245-0779. Office hours are from 7 AM to 6 PM (Central Standard Time) Monday through Friday.

For service or recalibration outside the U.S.A., please contact your local Quest Dealer or fax Quest U.S.A. at (262) 567-4047.



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