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Warnings and Cautionary Statements

### General

⚠️ **IMPORTANT**
Failure to perform certain procedures or note certain conditions may impair the performance of this product. For maximum safety and optimal performance, please read and understand the Ventis LS Product Manual available online at the Ventis LS Resource Center at www.indsci.com/VentisLSresources.

### Personnel

⚠️ **CAUTION:** For safety reasons, this equipment must be operated and serviced by qualified personnel only. Read and understand the product manual completely before operating or servicing.

ATTENTION: Pour des raisons de sécurité, cet équipement doit être utilisé, entretenu et réparé uniquement par un personnel qualifié. Étudier le manuel d'instructions en entier avant d'utiliser, d'entretenir ou de réparer l'équipement.

### Hazardous Conditions, Poisons, and Contaminants

⚠️ **WARNING:** Servicing the unit, replacing or charging battery packs, or using the communications port must only be done in an area known to be nonhazardous. Not for use in oxygen-enriched atmospheres.

⚠️ **WARNING:** Power-off the monitor before servicing the unit or replacing the battery.

⚠️ **WARNING:** Substitution of components may impair intrinsic safety and may cause an unsafe condition.

AVERTISSEMENT: La substitution de composants peut compromettre la sécurité intrinsèque.

⚠️ **CAUTION:** High off-scale readings may indicate explosive gas concentration(s).

ATTENTION: Des lectures supérieures à l'échelle peuvent indiquer des concentrations explosives.

⚠️ **CAUTION:** Any rapid up-scale reading followed by a declining or erratic reading may indicate gas concentration(s) beyond the upper scale limit which may be hazardous.

⚠️ Silicone compound vapors or other known contaminants may affect the combustible gas sensor and cause readings of combustible gas to be lower than actual gas concentrations. If the monitor has been used in an area where silicone vapors were present, always calibrate the monitor before next use to ensure accurate measurements.
Factors that Affect Monitor Performance

- Oxygen-deficient atmospheres may cause combustible gas readings to be lower than actual concentrations.
- Oxygen-enriched atmospheres may cause combustible gas readings to be higher than actual concentrations.
- Sudden changes in atmospheric pressure may cause temporary fluctuations in the oxygen reading.
- Verify the calibration of the combustible gas sensor after any incident where the combustible gas content has caused the monitor to display an over-range condition.
- Sensor openings and water barriers must be kept clean. Obstruction of the sensor openings and/or contamination of the water barriers may cause readings to be lower than actual gas concentrations.
- Do not use the ISC Alkaline battery pack (P/N:17150608) with the Ventis LS monitor.
- The Ventis LS is CSA certified according to the Canadian Electrical Code for use in Class I, Division 1 and Class I, Zone 1 Hazardous Locations within an ambient temperature range of $T_{\text{amb}}$: -20°C to +50°C. CSA has assessed only the %LEL combustible gas detection portion of this instrument for performance according to CSA Standard C22.2 No. 152. This is applicable only when the monitor has been calibrated to 50% LEL CH₄.
- CAUTION: CSA C22.2 No. 152 requires before each day’s usage, sensitivity must be tested on a known concentration of pentane or methane equivalent to 25% or 50% of full scale concentration. Accuracy must be within -0% to +20% of actual concentration. Accuracy may be corrected by referring to the zero/calibration section of the Product Manual.

Certifications

- The EC type examination certificate is DEMKO 11 ATEX 1104473 with marking code Ex d ia I Mb/Ex d ia IIC T4 Gb for equipment category II 2G and I M2.
- The IECEx examination certificate is IECEx UL11.0023 with marking code Ex d ia IIC T4 Gb.
- The model Ventis LS complies with relevant provisions of European ATEX directive 94/9/EC and EMC directive 2004/108/EC.
- The Ventis LS Multi-gas monitor is constructed with reference to published standards of directive 2006/95/EC, to eliminate electrical risks and fulfill 1.2.7 of ANNEX II of directive 94/9/EC.
- These detectors have been investigated for risk of explosion, fire, and electric shock only. They have not been investigated for performance relative to their ability to detect gases or vapors.

Recommended Practices

- Industrial Scientific Corporation recommends the monitor be charged, configured, and calibrated before first time use.
- Industrial Scientific Corporation recommends a full monitor calibration be performed monthly (at a minimum), using a certified concentration(s) of Industrial Scientific calibration gas(es) to help ensure monitor accuracy.
- Industrial Scientific Corporation recommends the monitor be zeroed and bump tested before each use with a certified concentration(s) of Industrial Scientific calibration gas(es).
- Battery contacts are exposed on battery packs when they are removed from the monitor. Do not touch the battery contacts and do not stack battery packs on top of one another.
- Contact your service representative immediately if you suspect that the Ventis LS is working abnormally.
Ventis LS Resources

The Ventis LS Product Manual is the primary resource, within a full suite of learning tools, developed for the monitor user. Its step-by-step “walk through” format covers everything from unpacking to set-up, operation, and service. All Ventis LS users should read and understand the Product Manual prior to unpacking or using the monitor.

A companion to the manual, the Ventis LS Reference Guide ships with the monitor. It serves to announce all warnings and cautionary statements relevant to general monitor use. The guide also features process charts that provide an overview of four fundamental tasks: operation/start-up, configuration, calibration, and functional “bump” testing. These charts are tools for the user who is both familiar with the manual and proficient in the performance of the given task.

A collection of audio-visual learning tools is also available online at the Ventis LS Resource Center. Here the user can watch fully narrated step-by-step demonstrations of instruction sets outlined in the manual. These training modules allow the user to view the full presentation of a process, such as calibration, or to access a particular segment within that process. These Ventis LS product-specific resources are part of the organization’s broader training line-up, featuring face-to-face classroom programs for technicians, operators, first responders, trainers, and distributors. Courses combine theory with hands-on learning, and can be tailored to the customer’s unique requirements and gas monitoring applications.

The organization’s customer and technical support call centers provide product and order information, how-to product assistance, and guidance for in-depth technical applications. Its service centers offer comprehensive factory repair and maintenance services.

Industrial Scientific Corporation provides a full suite of resources to aid customers in the competent and safe use of its products and services. With manufacturing, support, and service centers and hundreds of distributors worldwide, Industrial Scientific serves the globe’s gas detection needs.

Ventis LS Capabilities

The Ventis LS is a portable multi-gas monitor. It detects and measures gas(es) present in open space. Its wireless feature continuously communicates gas readings and alarm events to a control center. Based on the customer’s monitor order, up to four sensors are factory installed enabling the monitor to continuously and simultaneously detect and measure the presence of up to four specific gases.

<table>
<thead>
<tr>
<th>Sensor Category</th>
<th>Number available per monitor</th>
<th>Gases Monitored</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>1</td>
<td>O₂ (Oxygen) only</td>
</tr>
<tr>
<td>Combustible</td>
<td>1</td>
<td>Monitor can be configured for sensor to measure ONE of the following:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• LEL (Pentane)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• LEL (Methane)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• CH₄ (0%-5%)</td>
</tr>
<tr>
<td>Toxic</td>
<td>2</td>
<td>Each sensor detects and measures only ONE of the following:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• CO (Carbon Monoxide)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• H₂S (Hydrogen Sulfide)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• NO₂ (Nitrogen Dioxide)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• SO₂ (Sulfur Dioxide)</td>
</tr>
</tbody>
</table>

Equipped with a multi-mode (audible, visual, and vibration) and multi-level alarm system, the Ventis LS monitor is capable of notifying its user of potentially hazardous gas concentrations. It is also equipped with motion alarms and a panic alarm.

The monitor performs continuous data logging at 10 second intervals. It can store approximately 90 days of data for a four-sensor configuration. Its date- and time-stamped event log records and stores data for 24 alarm events and a minimum of 15 error events. The memory, when full, overwrites the oldest data as the newest readings and events are logged.
The Ventis LS monitor functions as an independent device to monitor the environment for hazardous gas concentrations. It is also part of the Ventis System including products that charge, calibrate, bump test, datalink, protect, and otherwise enable or enhance use of the monitor and its data. (Datalink refers to capabilities that enable access to the download and use of monitor datalogs, reports, and other information.)

Unpacking the Monitor

Contents
The monitor box contains the following items including, when ordered, those marked optional. Each item ordered should be accounted for in the unpacking process.

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 as ordered</td>
<td>Ventis LS Portable Multi-gas Monitor</td>
<td>--</td>
</tr>
<tr>
<td>1 installed as ordered</td>
<td>Battery Pack</td>
<td>One of two battery types is factory installed as indicated on the box label. Options: Rechargeable Lithium-ion Rechargeable Extended Range Lithium-ion</td>
</tr>
<tr>
<td>1 as ordered</td>
<td>Charger</td>
<td>Universal power cord. AC charger products include interchangeable plugs (US, UK, EU, and AUS).</td>
</tr>
<tr>
<td>0 or 1</td>
<td>Calibration Cup</td>
<td>--</td>
</tr>
<tr>
<td>1</td>
<td>Calibration and Bump Test Tubing</td>
<td>Two feet of clear tubing</td>
</tr>
<tr>
<td>1</td>
<td>Final Inspection &amp; Test Report</td>
<td>Contains the following factory set* information:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Monitor Set-up Date</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Monitor Part Number (P/N)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Monitor Serial Number (S/N)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- For Each Sensor*:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- P/N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- S/N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Type</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Location</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Alarm level values</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Span gas values</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Span reserve values</td>
</tr>
</tbody>
</table>

*Some factory set sensor values subject to user changes.

| 1                      | Service Tool                               | Tool includes two screw heads; a #1 Phillips head and a T10 Torx bit are stored inside the handle. |
| 1                      | Warranty Card                              | --                                                                   |

Reporting a Problem
After unpacking, if any item is missing or appears to have been damaged, contact a local distributor of Industrial Scientific products or Industrial Scientific Corporation (for contact information, please see the manual's last page).
Monitor Overview

Hardware Features and Functions

<table>
<thead>
<tr>
<th>Number</th>
<th>Feature</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Visual alarm indicator</td>
<td>Signals an alarm or warning; frequency varies by alarm level. Also used as a confidence indicator.</td>
</tr>
<tr>
<td>2</td>
<td>Sensor ports</td>
<td>Air intake; calibration and bump test gas intake.</td>
</tr>
<tr>
<td>3</td>
<td>Panic button</td>
<td>Used to signal an alarm on the instrument and wirelessly to the communications center.</td>
</tr>
<tr>
<td>4</td>
<td>LCD display</td>
<td>User interface; backlight flashes when monitor is in system, high, or low alarm states.</td>
</tr>
<tr>
<td>5</td>
<td>Audible alarm ports</td>
<td>On when monitor is in system, high, or low alarm states; frequency and tone vary by alarm level. Also used for warnings and as confidence indicator.</td>
</tr>
<tr>
<td>6</td>
<td>On/Off/Mode button</td>
<td>Used to power-on and power-off. Also used to bypass a process/step or advance to a next screen in both gas monitoring and configuration modes. Sets values in configuration mode.</td>
</tr>
<tr>
<td>7</td>
<td>Enter button</td>
<td>Used to begin a process/step in a process. Edits values in configuration mode.</td>
</tr>
<tr>
<td>8</td>
<td>IrDA interface</td>
<td>Indicates infrared light data exchange in-progress.</td>
</tr>
<tr>
<td>9</td>
<td>Charging contacts</td>
<td>Battery charging.</td>
</tr>
</tbody>
</table>
Display Screen
The Ventis LS Boot-up Screen, as shown below, serves to introduce all icons and the alpha-numeric items (e.g., 8.8.8) that can appear on the display when the monitor is in use, docked, or charging. Each display item is stationary, communicates unique information, and appears only when relevant to the task being performed.

A sample Gas Monitoring Screen is also shown below, next to the boot-up screen. This illustrates how the icons and the alpha-numeric characters work together to communicate several points of information to the monitor user.

<table>
<thead>
<tr>
<th>Boot-Up Screen</th>
<th>Gas Monitoring Screen</th>
</tr>
</thead>
<tbody>
<tr>
<td>All possible screen images.</td>
<td>Sample screen in gas monitoring mode.</td>
</tr>
</tbody>
</table>

It is helpful to view the boot-up screen in sections. The top and bottom rows each contain icons. The main function of the middle section, in gas monitoring mode, is to communicate gas concentration readings. Definitions for all icons, gas name abbreviations, gas measurement units, and other indicators are provided below. Where applicable, display variations are noted.

### Top Row Icons
<table>
<thead>
<tr>
<th>Icon</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔</td>
<td>Status: indicates no monitor or sensor faults.</td>
</tr>
<tr>
<td>❗</td>
<td>Warning: indicates monitor or sensor fault.</td>
</tr>
<tr>
<td>Ø</td>
<td>Zero: communicates zero status (e.g., zero results, zero in-progress, etc.).</td>
</tr>
<tr>
<td><em>gas_cylinder_icon</em></td>
<td>Gas Cylinder: communicates calibration related information (calibration due, calibration apply gas, etc.).</td>
</tr>
<tr>
<td><em>clock_icon</em></td>
<td>Clock: indicates a process is in-progress.</td>
</tr>
<tr>
<td><em>calendar_icon</em></td>
<td>Calendar: communicates overdue warnings for service items (calibration, bump testing, etc.).</td>
</tr>
<tr>
<td><em>alarm_icon</em></td>
<td>Alarm: indicates an alarm causing condition.</td>
</tr>
<tr>
<td>low_audio_alarm_icon_</td>
<td>Low level audio alarm is on.</td>
</tr>
<tr>
<td>high_audio_alarm_icon_</td>
<td>High level audio alarm is on.</td>
</tr>
<tr>
<td>peak_icon_</td>
<td>Peak: displayed when peak detection values are viewed.</td>
</tr>
</tbody>
</table>

### Alpha-numeric display values
<table>
<thead>
<tr>
<th>Icon</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>Carbon Monoxide (CO)</td>
</tr>
<tr>
<td>CH4</td>
<td>Methane (CH4)</td>
</tr>
<tr>
<td>SO2</td>
<td>Sulfur Dioxide (SO2)</td>
</tr>
<tr>
<td>LEL</td>
<td>Lower Explosive Limit. Display variations: “LEL” (English) “LIE” (French) “UEG” (German)</td>
</tr>
<tr>
<td>Symbol</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
<td>-------------</td>
</tr>
<tr>
<td><strong>O₂</strong></td>
<td>Oxygen (O₂)</td>
</tr>
<tr>
<td><strong>NO₂</strong></td>
<td>Nitrogen Dioxide (NO₂)</td>
</tr>
<tr>
<td><strong>H₂S</strong></td>
<td>Hydrogen Sulfide (H₂S)</td>
</tr>
<tr>
<td><strong>%VOL</strong></td>
<td>Percentage Volume: O₂ and CH₄ measurement unit</td>
</tr>
<tr>
<td><strong>% LEL</strong></td>
<td>Percentage unit for combustible gases; display variations: “% LEL” (English) “% LIE” (French) “% UEG” (German)</td>
</tr>
<tr>
<td><strong>PPM</strong></td>
<td>Parts Per Million: H₂S, CO, SO₂ and NO₂ measurement unit.</td>
</tr>
<tr>
<td><strong>Or</strong></td>
<td>Over-range: for any sensor in over-range, indicates the measured gas concentration is greater than the measurement range of the sensor. Display variations: “Or” (English and German) “Sup” (French)</td>
</tr>
<tr>
<td><strong>-Or</strong></td>
<td>Negative Over-range: for any sensor in negative over-range indicates the measured gas concentration is less than the negative measurement range of the sensor. Display variations: “-Or” (English and German) “InF” (French)</td>
</tr>
</tbody>
</table>

**Bottom Row Icons**

- **Battery level indicator**: display variations: 1 bar < 33% charge remaining 2 bars = 34% - 66% charge remaining 3 bars = 67% – 100% charge remaining
- **Security Code**: indicates code is set or to be entered.
- **Indicates IrDA communication is in-progress when the monitor is docked.** Indicates wireless communication is active when the monitor is NOT docked.
- **STEL**: Short Term Exposure Limit: communicates STEL values. Display variations: “STEL” (English and German) “VLE” (French)
- **TWA**: Time Weighted Average: communicates TWA values. Display variations: “TWA” (English and German) “VME” (French)
Alarms

NOTICE
→ All monitor alarms and warnings should be taken seriously and responded to as stated in company safety standards.

It is practical for the monitor user to be aware of the possible alarms prior to monitor set-up and use. The Ventis LS has multiple alarm and warning signals. A “system level” alarm generates the highest frequency tone and highest level visual and vibration signals. It is used to indicate such events as a sensor failure. Compared to the system alarm, gas alarms are of lower intensity, and a quick repetitive burst of signals is used to indicate a panic or motion alarm. The lowest level indicator is a warning with low-level beep patterns to indicate service needs (e.g., low battery or calibration due). The beep is also used as a confidence indicator when enabled.

Alarm types and their alarm generating conditions are described below.

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Over-range Alarm Screen" /></td>
<td>An over-range condition occurs when the gas concentration value sensed is above the sensor’s measuring range. After any over-range alarm, the monitor should be calibrated. <strong>NOTE</strong>: The O₂ and toxic sensor values normally reset when the gas sensed reaches an acceptable range. If the LEL sensor reads over-range, the alarm “latches” or remains on until the monitor is powered-off.</td>
</tr>
<tr>
<td><img src="image" alt="Negative Over-range Alarm Screen" /></td>
<td>A negative over-range condition occurs when the gas concentration value sensed is less than the sensor’s measuring range. After any negative over-range alarm, the monitor should be calibrated.</td>
</tr>
<tr>
<td><img src="image" alt="High Alarm Screen" /></td>
<td>A high alarm condition occurs when the concentration of gas sensed reaches a level greater than the monitor’s high alarm value setting for a sensor(s).</td>
</tr>
<tr>
<td><img src="image" alt="Low Alarm Screen" /></td>
<td>A low alarm condition occurs when the concentration of gas sensed reaches the monitor’s low alarm value setting for a sensor(s).</td>
</tr>
</tbody>
</table>

Display Description:
- **Over-range Alarm Screen**: The “Or” message indicates which sensor(s) is reading an over-range condition(s). All other sensors show their current gas concentration readings on a numeric display (left) or gas names on a text display (right). The high level alarms turn on and the alarm icon displays.
- **Negative Over-range Alarm Screen**: The “-Or” message indicates which sensor is reading a negative over-range condition. All other sensors display their current gas concentration readings*. The high level alarms turn on and the alarm icon displays.
- **High Alarm Screen**: A flashing gas concentration value* indicates which sensor(s) reading(s) is the cause for alarm. The high level alarms turn on and the up arrow icon displays.
- **Low Alarm Screen**: A flashing gas concentration value* indicates which sensor(s) reading(s) is the cause for alarm. The low level alarms turn on and the down arrow icon displays.
TWA Alarm Screen
A flashing gas concentration value* indicates which sensor(s) reading(s) is the cause for alarm. The low level alarms turn on and the TWA icon flashes.

A TWA alarm occurs when the calculated time weighted average reaches the monitor’s hazardous value for the set time frame.

STEL Alarm Screen
A flashing gas concentration value* indicates which sensor(s) reading(s) is the cause for alarm. The low level alarms turn on and the STEL icon flashes.

The STEL alarm occurs when the short term exposure value exceeds the acceptable limit.

No Sensor Installed Screen
The system level alarms turn on and the error icon displays.

Alarm occurs when the monitor registers no sensors installed.

Sensor Data Fail Screen
A flashing “F” indicates which sensor is the cause for alarm. The audio alarm turns on and the error icon displays.

Alarm occurs when any installed sensor’s data-related operations fail and the sensor is not operational.

Motion 1 Alarm Screen
The panic-motion alarm signals turn on.

The Motion 1 alarm occurs when the instrument has not moved for 1 minute (default setting; subject to change). To turn off the alarm, the user can move the monitor or press the ENTER button.

Motion 2 Alarm Screen
The panic-motion alarm signals turn on.

The Motion 2 alarm occurs when the Motion 1 alarm has not been cleared. The user can clear the Motion 2 alarm by pressing the ENTER button for one second.
Panic Alarm Screen
The panic-motion alarm signals turn on.

Low Battery Warning Screen
A beep sounds every 30 seconds and the empty battery icon flashes.

Bump Overdue Screen
A “b” indicates which sensor(s) is overdue for bump testing. Two beeps sound every 30 seconds and the calendar and alarm icons display.

Calibration Due Alarm Screen
The gas value flashes for each sensor overdue for calibration. Three beeps sound every 30 seconds and the calendar and alarm icons display. The gas cylinder icon flashes.

* The numeric mode display shows gas concentration values; the text mode display shows gas type names in place of gas values.

Monitor Set-up
Preparing the monitor for first time use is a “3-C” process: charge (if equipped with a lithium-ion battery pack), configure, and calibrate. This manual section covers charging and configuration for set-up purposes and can be consulted for ongoing instruction thereafter. Immediately following this section, calibration is covered in the manual section, Use and Service.
Battery Properties
Based on the customer order, the Ventis LS comes equipped with one of two factory installed batteries: rechargeable Lithium-ion (Li-ion) or the rechargeable Extended Range Lithium-ion (extended range Li-ion). The factory installed battery pack type is stated on the label affixed to the monitor box. Basic battery properties are shown below.

<table>
<thead>
<tr>
<th>Properties</th>
<th>Battery Pack</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rechargeable Li-ion</td>
</tr>
<tr>
<td></td>
<td>Rechargeable Extended Range Li-ion</td>
</tr>
<tr>
<td>Battery lifetime</td>
<td>300 charge cycles</td>
</tr>
<tr>
<td>Battery re-charge time</td>
<td>3-5 hours</td>
</tr>
<tr>
<td>Ambient temperature required for charging</td>
<td>0–50 °C (32–122 °F)</td>
</tr>
<tr>
<td>Nominal run time (when fully charged and operating at room temperature)</td>
<td>12 hours</td>
</tr>
<tr>
<td></td>
<td>20 hours</td>
</tr>
</tbody>
</table>

Charging the Lithium-ion Battery Packs
The lithium-ion battery packs are charged at the factory. As some or all of the charge may deplete before the monitor arrives or is unpacked, it is recommended that the monitor be fully charged before first time use. Ventis LS can be charged with any of the products listed below.

- DS2 Docking Station™ for Ventis LS
- Single Unit Charger
- Single Unit Charger/Datalink
- Single Unit Automotive Charger, 12 VDC
- Single Unit Truck-Mount Charger, 12 VDC, with Cigarette Adapter
- Single Unit Truck-Mount Charger, 12 VDC, Hard Wired

NOTE: The above products are all equipped with a yellow LED “presence” indicator. This LED confirms that the monitor is properly seated in the cradle such that the monitor can charge; however, it is NOT intended to be used as a charging indicator.

This LED indicator may go out intermittently during normal charging functions and will not light if the unit is fully charged when placed in the cradle. Always refer to the monitor display’s battery level indicator to confirm the battery charge level.

The Single Unit Charger is generally shipped with the monitor and is equipped with a movable partition which fits in each of two dedicated slots. Place the partition in the front slot to charge a monitor with a battery pack. Place the partition in the back slot to charge and instrument with an extended range battery.

Instructions

NOTICES
- Charge the monitor in an area known to be nonhazardous.
- When using the charger and adjusting its partition, take care NOT to touch the battery contacts located at the front of the cradle bottom.

- The single unit charger has a universal power cord; change the plug insert, if needed, and plug into the appropriate outlet.
- To properly adjust the partition, if needed, complete and observe the following.
  - Lift up to remove from slot.
  - Push down to place in the desired slot.
  - When partition is inserted correctly, a click sounds.

Recommended Practice: To prevent the loss of the partition, it should always reside in the cradle in one of its two dedicated slots. Choose the most used slot. Do not place the partition in the forward most compartment of the charger where the battery contacts are located.

- To properly place the monitor in the charger, complete or observe the following.
The monitor’s display side faces the user.
- The charging contacts on the monitor bottom meet the contact pins inside the charger’s cradle.
- Refer to the monitor’s battery icon to confirm the battery charge level.
  - If the battery is less than fully charged, the monitor displays the battery icon (flashing empty to full, repeatedly).
  - If the battery is fully charged, the monitor displays a full battery icon.

### Power-On and -Off
To power-on the Ventis LS, press ON/OFF/MODE and hold for three to five seconds. During the first ten to fifteen seconds the monitor is on, its firmware completes internal tests and the user sees or hears what is described and shown below. Following this initialization phase, a countdown screen displays. During this 20-second countdown, the monitor user can enter configuration mode to manually adjust monitor settings.

<table>
<thead>
<tr>
<th>Display and Options</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image.png" alt="Image" /></td>
<td>No user action required.</td>
</tr>
</tbody>
</table>

#### Visual Test Screen
Displays for up to five seconds as the monitor completes a sensor and alarm check. Visual, vibration, and audio alarms turn on briefly, then off.

![Image](image.png)

#### Software Version Screen
The Software Version Screen message displays for five seconds.

![Image](image.png)

**Countdown Screen**
Displays the 20 second countdown, one second at a time, from 20 to one.

**Options**
- Enter gas monitoring mode
- Enter configuration mode

Press ON/OFF/MODE, hold for the full five second countdown to zero, and release to power-off the monitor.

*To enter gas monitoring mode:*
Allow the countdown to complete and advance to the Gas Monitoring Screen. Proceed to the manual section, Monitor Use and Service.

*To enter configuration mode:*
Simultaneously press ON/OFF/MODE and ENTER, hold for three seconds, and release.
Configuration

INTRODUCTION
Before first time use of the monitor, its settings should be reviewed and, if needed, be adjusted. Qualified safety personnel should complete the following tasks.

- Review the monitor settings for compliance with company policy and any applicable regulations, laws, and observed guidelines as issued by regulatory agencies and government or industry groups.
- Determine which settings, if any, require adjustment.
- Make the adjustments or supervise other qualified personnel in the process.

Monitor settings should be reviewed regularly and adjusted as needed. The following settings are adjustable or "configurable" for the Ventis LS:

- LEL Type
- Calibration Mode Setting
- Low Alarm Settings
- High Alarm Settings
- TWA Alarm Settings
- TWA Interval Settings
- STEL Alarm Setting
- Calibration Gas Settings
- Clock Settings
- Date Settings
- Display Mode Setting
- Confidence Indicator (on/off)
- Confidence Indicator (type)
- Bump Test In-field
- Bump Test Due Warning
- Bump Test Time Set-point
- Bump Test Percentage
- Bump Test Response Time
- Alarm Latch Set
- Zero In-field
- Calibration In-field
- Calibration Due Alarm
- Calibration Due Set-point
- Security Code
- Language Selection

The Ventis LS can be configured manually as instructed below. Any changes made take effect immediately upon exiting the configuration mode.

Configuration can also be completed through Industrial Scientific Accessory Software (ISAS) or the Docking Station Server Administrative Console (DSSAC), software tools for users of iNET, DS2 Docking Station for Ventis, V-Cal Calibration Station, and the Single-Unit Charger/Datalink. For instruction on the use of these software tools, please consult the respective manual.

When the monitor is part of a fleet maintained by DS2, any manual changes made to the monitor's settings are overridden by the DS2 settings when the monitor is next docked.

INSTRUCTIONS

NOTICES
- The configuration mode should be accessed only by safety personnel authorized to change monitor settings based on company policy.
- Read ALL requirements and instructions outlined below, including the screen-by-screen process description, before beginning the configuration process.

The configuration mode can be entered during the 20-second countdown of the power-on process. During the countdown, simultaneously press ON/OFF/MODE and ENTER, hold for three seconds, and release to enter configuration mode. (While in the configuration mode, the same button presses cause the monitor to exit configuration). Each configuration screen times out after 30 seconds and the monitor enters gas monitoring mode. To re-enter the configuration mode, power-off the monitor, then power-on and repeat the entry process.

Throughout the configuration process, the main functions of the two buttons are as follows.
- The ENTER button is used to edit values. It is also used, where noted, to begin a process or a step in a process.
- The ON/OFF/MODE button is used to set the value. Where noted, it is also used to bypass a process or step in a process, or to advance to the next configuration screen.

The first screen to display in configuration mode depends on three things:
- security code setting,
- the presence or absence of the China MA feature,
- and the presence or absence of an LEL sensor.
If the security code setting is 000, the security feature is disabled and the Enter Security Code Screen does NOT appear. If the security code is NOT 000, the security feature is enabled and the monitor displays the Enter Security Code Screen.

The monitor next checks for the presence of a China MA mining feature. If this feature is operational, the monitor displays the Zero Initiate Screen.

If the China MA mining feature is NOT operational, the monitor then checks for an installed LEL sensor. If installed, the monitor displays the LEL Type Screen. If no LEL sensor is installed, the monitor displays the Zero Initiate Screen.

<table>
<thead>
<tr>
<th>Configuration Process</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NOTE:</strong> To view a fully narrated step-by-step audio visual demonstration of the configuration process, visit the online Ventis LS Resource Center at <a href="http://www.indsci.com/VentisLSresources">www.indsci.com/VentisLSresources</a>.</td>
<td></td>
</tr>
<tr>
<td><strong>Display and Options</strong></td>
<td></td>
</tr>
<tr>
<td>Check Enter Security Code Screen</td>
<td>Press ENTER to edit the value, if needed; press repeatedly or hold down to speed the increment pace to reach the valid security code. Press ON/OFF/MODE to enter configuration mode and arrive at the next applicable screen.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Enter Security Code Screen</strong></td>
<td></td>
</tr>
<tr>
<td>The presence of this screen indicates an enabled security feature.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Check LEL Type Set Screen</td>
<td>Press ENTER to edit the value, if needed. Press ON/OFF/MODE to set the value and advance to the Zero Initiate Screen.</td>
</tr>
<tr>
<td>Options</td>
<td><strong>NOTE:</strong> If the LEL type is changed, the sensor goes into calibration fail mode. A full calibration is required before the monitor can be used and is accessible from the next screen in the configuration process, the Zero Initiate Screen. For complete calibration instructions, proceed to the manual section, Zero, Calibration, and Bump Testing.</td>
</tr>
<tr>
<td>LEL</td>
<td></td>
</tr>
<tr>
<td>CH₄</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Zero Initiate Screen</td>
<td>Press ON/OFF/MODE to bypass the zero and calibration processes and advance to one of two screens.</td>
</tr>
<tr>
<td>Options</td>
<td></td>
</tr>
<tr>
<td>Bypass zero and calibration process.</td>
<td></td>
</tr>
<tr>
<td>Begin zero and calibration process.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>If the installed sensor set includes H₂S and NO₂, OR, SO₂ and NO₂, the monitor is pre-set for standard calibration mode and the Low Alarm Set-point Screen displays. For all others installed sensor combinations, the Calibration Mode Selection Screen displays.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Press ENTER to begin the zero and calibration process. Proceed to the manual section, Zero, Calibration, and Bump Testing</td>
<td></td>
</tr>
</tbody>
</table>
Calibration Mode Selection

Does not display if the installed sensor combination includes H₂S and NO₂, or SO₂ and NO₂.

Options
0 = Standard Calibration
1 = Quick Calibration

NOTE: The user can edit the values for four alarm types in configuration mode. The monitor presents these options in the order shown below.
1. Low alarm
2. High alarm
3. TWA (if toxic sensors installed)
4. STEL (if toxic sensors installed)

For each alarm type (e.g., low alarm), the user can edit the alarm settings for each installed sensor, one sensor at a time. The order in which the sensors are subject to change is as follows.
1. Toxic sensor 1
2. LEL sensor
3. Toxic sensor 2
4. O₂ sensor

Low Alarm Set-point Screen
Displays the existing low alarm value for each installed sensor. If any one of the sensors is NOT installed, its position on the display is blank.

High Alarm Set-point Screen
Displays the existing high alarm value for each installed sensor. If any one of the sensors is not installed, its position on the display is blank.

The quick calibration option sets the monitor to calibrate all four sensors simultaneously. The standard calibration option sets the monitor to calibrate each sensor independently.

Press ENTER to edit the value, if needed.
Press ON/OFF/MODE to set the value and advance to the Low Alarm Set Screen.

Press ON/OFF/MODE to bypass the low alarm value set process and advance to the High Alarm Set-point Screen.
Press ENTER to begin the low alarm value set process.
On the display, the first sensor subject to change flashes.
Press ENTER to edit the value, if needed; press repeatedly or hold down to speed the increment pace.
Press ON/OFF/MODE to set the value.

The next sensor subject to change flashes. Continue to use the ENTER and ON/OFF/MODE buttons, respectively, to edit and set each sensor's low alarm value.

After the alarm value is set for each installed sensor, press ON/OFF/MODE to advance to the High Alarm Set-point Screen.

Press ON/OFF/MODE to bypass high alarm value set process and advance to one of two screens as noted below.
Press ENTER to begin the high alarm value set process.
On the display, the first sensor subject to change flashes.
Press ENTER to edit the value, if needed; press repeatedly or hold down to speed the increment pace.
Press ON/OFF/MODE to set the value.

The next sensor subject to change flashes. Continue to use the ENTER and ON/OFF/MODE buttons, respectively, to edit and set each sensor's high alarm value.

After the alarm value is set for each installed sensor, press ON/OFF/MODE and advance to one of two screens.

If at least one toxic sensor is installed, the TWA...
### Alarm Set Screen displays.
If NO toxic sensors are installed, the Calibration Gas Set Screen displays.

<table>
<thead>
<tr>
<th>Alarm Se Display</th>
<th>TWA Alarm Set-point Screen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displays the existing TWA values for the toxic sensors installed. No other sensor readings appear.</td>
<td>Press <strong>ON/OFF/MODE</strong> to bypass the TWA alarm value set process and advance to the TWA Interval Set-point Screen. Press <strong>ENTER</strong> to begin the TWA alarm value set process. On the display, the first sensor subject to change flashes. Press <strong>ENTER</strong> to edit the value, if needed; press repeatedly or hold down to speed the increment pace. Press <strong>ON/OFF/MODE</strong> to set the value. The next sensor subject to change flashes. Continue to use the <strong>ENTER</strong> and <strong>ON/OFF/MODE</strong> buttons, respectively, to edit and set each alarm value. After the alarm value is set for each installed sensor, press <strong>ON/OFF/MODE</strong> to advance to the TWA Interval Set Screen.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TWA Interval Set-point Screen</th>
<th>STEL Alarm Set-point Screen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displays the existing TWA interval. The value can be set from one to 40 hours, in increments of one.</td>
<td>Press <strong>ON/OFF/MODE</strong> to bypass the STEL alarm value set process and advance to the Calibration Gas Set Screen. Press <strong>ENTER</strong> to begin the STEL alarm value set process. On the display, the first sensor subject to change flashes. Press <strong>ENTER</strong> to edit the value, if needed; press repeatedly or hold down to speed the increment pace. Press <strong>ON/OFF/MODE</strong> to set the value. The next sensor subject to change flashes. Continue to use the <strong>ENTER</strong> and <strong>ON/OFF/MODE</strong> buttons, respectively, to edit and set each sensor's STEL alarm value. After the alarm value is set for each installed sensor, press <strong>ON/OFF/MODE</strong> to advance to the Calibration Gas Set Screen.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Calibration Gas Set Screen</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Displays the existing calibration gas value for each installed sensor. If any one of the sensors is not installed, its position on the display is blank.</td>
<td>Press <strong>ON/OFF/MODE</strong> to bypass the calibration gas set process and advance to the Clock Set Screen. Press <strong>ENTER</strong> to begin the calibration gas value set process. On the display, the first sensor subject to change flashes. Press <strong>ENTER</strong> to edit the value, if needed; press repeatedly or hold down to speed the increment pace. Press <strong>ON/OFF/MODE</strong> to set the value. The next sensor subject to change flashes. Continue to use the <strong>ENTER</strong> and <strong>ON/OFF/MODE</strong> buttons, respectively, to edit and set each sensor's calibration gas value. After calibration gas value is set for each installed sensor, press <strong>ON/OFF/MODE</strong> to advance to the Clock Set Screen.</td>
</tr>
</tbody>
</table>
**Clock Set Screen**
Displays the existing time values using a 24-hour time format.

Press **ON/OFF/MODE to bypass** the clock set process and advance to the Date Set Screen.
Press **ENTER to begin** the clock set process.

On the display, the first time value subject to change flashes.
Press ENTER to edit the value, if needed; press repeatedly or hold down to speed the increment pace.
Press ON/OFF/MODE to set the value.

The next value subject to change flashes. Use the ENTER and ON/OFF/MODE buttons, respectively, to edit the value.

**After all values are set,** press **ON/OFF/MODE** and advance to the Date Set Screen.

**Date Set Screen**
Displays the existing date. The value displayed on the far left is the month and to its right the day. The year is displayed beneath the day.

Press **ON/OFF/MODE to bypass** the date set process and advance to the Display Mode Set Screen.
Press **ENTER to begin** the date set process.

On the display, the first date value subject to change flashes.
Press ENTER to edit the value, if needed; press repeatedly or hold down to speed the increment pace. Press ON/OFF/MODE to set the value.

The next date value subject to change flashes. Continue to use the ENTER and ON/OFF/MODE buttons, respectively, to edit and set each value.

**After all values are set,** press **ON/OFF/MODE** and advance to the Display Mode Set Screen.

**Display Mode Set Screen**
The display mode selected determines whether the monitor user will see a numeric or text display (including alarm displays) when the monitor is in the gas monitoring mode.

Press **ENTER to edit** the value, if needed.
Press **ON/OFF/MODE to set** the value and advance to the Confidence Indicator Set Screen.

**Confidence Indicator Set Screen**
Options
0 = Disable/off
1 = Enable/on

With an enabled confidence indicator, the monitor will emit a signal, every 90 seconds in gas monitoring mode, to inform the user it is operational.

Press **ENTER to edit** the value, if needed.
Press **ON/OFF/MODE to set** the value and advance to one of two screens.

If the confidence indicator is enabled, the Confidence Indicator Type Set Screen displays.

If the confidence indicator is disabled, the Bump Test In-field Option Screen displays.
Confidence Indicator Type Set Screen

<table>
<thead>
<tr>
<th>Options</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 = Audible/beep</td>
<td>The confidence indicator can be set as an audible or visual signal, to beep or flash LEDs, respectively. Press ENTER to edit the value, if needed. Press ON/OFF/MODE to set the value and advance to the Bump Test In-field Option Screen.</td>
</tr>
<tr>
<td>1 = Visual/LEDs flash</td>
<td></td>
</tr>
</tbody>
</table>

Bump Test In-field Option Screen

<table>
<thead>
<tr>
<th>Options</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 = Disable/off</td>
<td>When enabled, permits all monitor users to bump test the monitor from the gas monitoring mode. Press ENTER to edit the value, if needed. Press ON/OFF/MODE to set the value and advance to one of two screens.</td>
</tr>
<tr>
<td>1 = Enable/on</td>
<td></td>
</tr>
</tbody>
</table>

Bump Due Warning Option Screen

<table>
<thead>
<tr>
<th>Options</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 = Disable/off</td>
<td>When enabled, the monitor will sound two beeps every 30 seconds and its display icons will indicate a bump test is due. Press ENTER to edit the value, if needed. Press ON/OFF/MODE to set the value and advance to the Bump Test Time Set-point Screen.</td>
</tr>
<tr>
<td>1 = Enable/on</td>
<td></td>
</tr>
</tbody>
</table>

Bump Test Time Set-point Screen

| Value range: .5 days to 7.0 days | Sets the elapsed time allowed between bump tests. Press ENTER to edit the value, if needed; press repeatedly or hold down to speed the increment pace. Press ON/OFF/MODE to set the value and advance to the Bump Test Percentage Requirement Screen. |
| Value increment: .5 days |

Bump Test Percentage Requirement Screen

| Value range: 50% to 99% | Sets the percentage of calibration gas the monitor expects to be exposed to. Press ENTER to edit the value, if needed; press repeatedly or hold down to speed the increment pace. Press ON/OFF/MODE to set the value and advance to the Bump Test Response Time Screen. |
| Value increment: one percent |
### Bump Test Response Time Screen

Value range: 30 to 300 seconds  
Value increment: five seconds

Sets the bump test response time period.  
Press **ENTER** to edit the value, if needed; press repeatedly or hold down to speed the increment pace.  
Press **ON/OFF/MODE to set** the value and advance to the Latch Alarm Set Screen.

### Latch Alarm Set Screen

Options  
0 = Normal mode  
1 = Latching mode

When enabled, if the monitor goes into alarm, it will remain in alarm until after the gas concentration is less than the low alarm value, and the monitor user presses the **ENTER** button for one second.  
Press **ENTER** to edit the value, if needed.  
Press **ON/OFF/MODE to set** the value and advance to the Zero In-field Screen.

### Zero In-field Screen

Options  
0 = Disable/off  
1 = Enable/on

When enabled, all monitor users are permitted to zero the monitor from the gas monitoring mode.  
Press **ENTER** to edit the value, if needed.  
Press **ON/OFF/MODE to set** the value and advance to one of two screens.  
If Zero In-field is enabled, the Calibration In-field Option screen displays.  
If Zero In-field is disabled, the Calibration Due Alarm screen displays.

### Calibration In-field Option Screen

Options  
0 = Disable/off  
1 = Enable/on

When enabled, all monitor users are permitted to calibrate the monitor from the gas monitoring mode.  
Press **ENTER** to edit the value, if needed.  
Press **ON/OFF/MODE to set** the value and advance to the Calibration Due Alarm Option.

### Calibration Due Alarm Option Screen

Options  
0 = Disable/off  
1 = Enable/on

When enabled, the monitor will activate the calibration due alarm, in gas monitoring mode, when any sensor is due for calibration. A flashing gas cylinder and gas type will appear on the display and three beeps will sound every 30 seconds.  
Press **ENTER** to edit the value, if needed.  
Press **ON/OFF/MODE to set** the value and advance to the Calibration Due Set-point screen.
Calibration Due Set-point Screen
Value range: one to 365 days
Value increment: one day

Sets the elapsed time allowed between calibrations.
Press ENTER to edit the value, if needed.
Press ON/OFF/MODE to set the value and advance to the Security Code Set Screen.

Security Code Set Screen
Valid values: 000 to 999.
Increment value: one

An A security code value of 000 permits all monitor users to enter configuration mode and gain access to change the monitor’s settings. A value other than 000 will restrict access to the configuration mode.
Press ENTER to edit the value, if needed; press repeatedly or hold down to speed the increment pace.
Press ON/OFF/MODE to set the value and advance to the Language Selection Screen.

Language Selection Screen
Options
E = English
F = French
d = German

Allows the choice of display languages as applied to select screens.
Press ENTER to edit the value, if needed.
Press ON/OFF/MODE to set the value and return to the LEL Type Set Screen.

Monitor Use and Service
Proper monitor use and service includes everything from bump testing and calibration to keeping the monitor clean, proper air sampling, and the replacement of parts and components. Beginning with calibration and bump testing, the following sections provide information and instruction on all use and service tasks.

Zero, Calibration, and Bump Testing

INTRODUCTION
All sensors gradually degrade over time. Without regular calibrations, sensor readings during monitor use will not accurately display true gas concentrations. During the calibration process, the monitor self-adjusts so that the sensors retain their ability to correctly measure and accurately display gas concentration values. When a sensor has degraded beyond an acceptable level, it has reached its end of life and will no longer pass a calibration.

Zeroing is the first step in the calibration process. When zeroing, the monitor is exposed to the ambient air (or zero grade air) and each toxic and LEL sensor registers to zero; the O2 sensor is calibrated (when set to the default value of 20.9% or 21%). After a successful zero, the calibration process begins for the installed toxic and combustible sensors. Each sensor expects to be exposed to a known concentration of gas. As each sensor calibrates, the monitor self-adjusts, if needed, to ensure the gas concentration values are accurately registered and displayed.

A bump test is defined as a brief exposure of each sensor to an expected concentration of gas greater than the sensor’s low alarm set-point. It is a functional test to verify sensor and alarm operation only. It is not a measure of monitor accuracy; no adjustments are made to the monitor during a bump test. If a monitor fails a bump test, a full calibration is recommended.
The zero, calibration, and bump testing tasks are in-field enabled or in-field disabled in the configuration process. This permits or denies access to these functions from the gas monitoring mode. When any of these options is enabled, it is accessible to all monitor users. In gas monitoring mode, a series of presses on the ON/OFF/MODE button gives the user access to the following screens and processes in the order shown:

- Gas Monitoring Screen
- Days Since Calibration
- Zero Initiate (if in-field enabled)
  - Calibration Apply Gas Screen (if in-field enabled)
- Bump Test Initiate (if in-field enabled)
- Peak Readings
- TWA Readings
- STEL Readings

The monitor is capable of performing two types of calibration, and this option is set in configuration mode. The calibration type selected also determines the monitor’s bump test type. With a “quick” calibration, the monitor is set to calibrate and bump test all installed sensors simultaneously. With a “standard” calibration setting, these tasks are completed independently for each installed sensor in the order shown below.

1. Oxygen sensor*
2. Toxic sensor 1
3. LEL sensor
4. Toxic sensor 2

*If set to the default value of 20.9% or 21%, the Oxygen sensor calibrates during the zero process and toxic 1 is the first to calibrate in the calibration process.

The Ventis LS monitor can be calibrated with any of the accessories listed.

- Calibration cup and/or tubing shipped with the monitor (see instructions below)
- DS2 Docking Station for Ventis LS (consult the docking station manual for instruction)

Instructions

**Calibration and Bump Testing with Calibration Cup and/or Tubing**

Read all instructions before beginning: notices, supply check-list, gas cylinder preparation, and the complete screen-by-screen walk-through of the zero, calibrate, and bump test processes. Each process is presented in the order in which it is accessible from gas monitoring mode.

**NOTICES**

→ Industrial Scientific recommends that full monitor calibration be performed, using a known certified concentration(s) of Industrial Scientific calibration gas(es), to prepare the monitor for first time use, and monthly (at a minimum) thereafter, to help ensure monitor accuracy.

→ Industrial Scientific also recommends that each monitor be zeroed and bump tested before each use with a known certified concentration(s) of Industrial Scientific calibration gas(es).

→ Read ALL requirements and instructions outlined below, including the screen-by-screen process description, before beginning the zero, calibration, or bump testing processes.

→ Only qualified personnel should zero, calibrate, or bump test a monitor.

→ Zero, calibration, and bump testing functions should be performed in a fresh air environment known to be nonhazardous.

→ After calibration or bump testing, or after terminating either process, stop the flow of gas.

**Supplies**

✔ Calibration cup*
✔ Calibration tubing 2 feet in length*
✔ Calibration gas cylinder and regulator** (customer supplied)

*Shipped with monitor.
**Industrial Scientific recommends 1) the use of regulators with a flow rate of .5 LPM, and 2) the monitor be calibrated or bump tested using a positive flow regulator, NOT a demand flow regulator.
PREPARE THE GAS CYLINDER FOR USE

1. Attach the correct regulator to the gas cylinder and turn clockwise to tighten.
2. Attach either end of the tubing to the cylinder’s nipple.
3. Attach the other end of the tubing to the calibration cup’s nipple.

DO NOT ATTACH THE CALIBRATION CUP TO THE MONITOR OR APPLY THE GAS BEFORE REACHING THE “APPLY GAS SCREEN”. If gas is applied before that point, the monitor will go into alarm and a failure will be logged.
### Zero and Quick Calibration Process

**NOTE:** To view a fully narrated step-by-step audio visual demonstration of the zero, calibration, or bump test processes, visit the online Ventis LS Resource Center at www.indsci.com/VentisLSresources.

<table>
<thead>
<tr>
<th>Display and Options</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Gas Monitoring Screen" /></td>
<td>Press ON/OFF/MODE to advance to the Days since Calibration Screen.</td>
</tr>
</tbody>
</table>

#### Gas Monitoring Screen

Numeric mode display (left)
Text mode display (right)
Displays the gas concentration readings (or gas names in text mode) for all installed sensors. If a sensor is NOT installed, its position on the LCD is blank.

<table>
<thead>
<tr>
<th>Days Since Calibration Screen</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Days Since Calibration Screen" /></td>
<td>Press ON/OFF/MODE to advance to one of three screens.</td>
</tr>
</tbody>
</table>

If zero in-field is enabled, the user advances to the Zero Initiate Screen.
If zero in-field is disabled and bump test in-field is enabled, the user advances to the Bump Test Initiate Screen.
If zero in-field and bump test in-field are both disabled, the user advances to the Peak Readings Screen.

**NOTE:** When zero, calibration, and bump test are ALL in-field enabled, and the user has entered zero from the gas monitoring mode, the monitor expects to be calibrated following a successful zero.

If the desired task, after zero, is bump testing (or clearing the peaks) and NOT calibration, follow the instructions at the Calibration Apply Gas Screen to terminate calibration.

<table>
<thead>
<tr>
<th>Zero Initiate Screen</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Zero Initiate Screen" /></td>
<td>Press ENTER to begin the zero process and advance to the Zero In-process Screen. Press ON/OFF/MODE to bypass zero and calibration and advance to one of two screens.</td>
</tr>
</tbody>
</table>

If bump test in-field is enabled, the user advances to the Bump Test Initiate Screen.
If bump test in-field is disabled, the user advances to the Peak Readings Screen.

<table>
<thead>
<tr>
<th>Zero In-process Screen</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Zero In-process Screen" /></td>
<td>Allow the zero process to complete and advance to the Zero Results (Pass or Fail) Screen. After the zero process, press ON/OFF/MODE to bypass calibration of the installed toxic and combustible sensors. The user returns to the mode from which the calibration process was entered (configuration or gas monitoring).</td>
</tr>
</tbody>
</table>

**NOTE:** during the zero process, the O₂ sensor is calibrated (when set to default gas volume of 20.9%).
NOTE: The “span reserve” of a sensor measures its sensitivity. The displayed span value divided by the calibration gas value equals the span reserve percentage. A span reserve percentage of greater than 70% indicates a “good” sensor; 50%-70% indicates “marginal” sensitivity. When the span reserve percentage is less than 50%, the sensor will not pass calibration.

Within Ten Seconds
Press ENTER to repeat the zero process. Press ON/OFF/MODE to advance to one of two screens.

If zero was entered from...

...configuration mode, the user advances to the Calibration Apply Gas Screen.

...gas monitoring mode and the calibration in-field option is enabled, the user advances to the Calibration Apply Gas Screen.

...gas monitoring mode and the calibration in-field option is disabled, the user advances to the Gas Monitoring Screen in the gas monitoring mode.

If neither ENTER nor ON/OFF/MODE is pressed, within ten seconds, the user advances to the Gas Monitoring Screen in the gas monitoring mode.

Press ON/OFF/MODE (or wait ten seconds) to return to the Zero Initiate Screen and repeat the zero process.

Zero Results (Pass) Screen
The check mark displays to indicate a successful zero and a short beep sounds. Each sensor’s numerical values display at zero except O₂.

Options:
Repeat zero
Begin calibration
Enter gas monitoring mode

Press ON/OFF/MODE (or wait ten seconds) to return to the Zero Initiate Screen and repeat the zero process.

Zero Results (Fail) Screen
Displays an “F” or “P”, respectively, for each failed or passed sensor. For O₂, if the sensor passed its calibration, the sensor reading displays.

Calibration Apply Gas Screen*
The gas cylinder icon flashes. Each sensor’s display shows the calibration gas concentration to be applied. (The O₂ display is blank as the sensor was calibrated during zeroing.) The monitor waits up to five minutes to successfully sense the gas.

Calibration In-progress Screen*
If gas is sensed, the gas values for the LEL and toxic sensors increase and the O₂ value decreases.

To Calibrate
- Place the calibration cup over the upper portion of the monitor’s case top (front of monitor). To attach properly, complete or observe the following:
  o The cup fully covers the sensor ports.
  o The monitor’s display and buttons are NOT covered.
  o The cup’s side arms fit securely in the grooves on the sides of the monitor.
  o The cup’s nipple points up and away from the monitor.
- Turn (counterclockwise) the regulator’s knob.

If gas is NOT sensed, a failed calibration registers and the Calibration Failed Screen displays.

To Terminate
Press ON/OFF/MODE while the gas cylinder icon flashes to terminate the quick calibration process (or to skip a sensor’s calibration in standard calibration) and return to the gas monitoring mode.
Sensor Results Screen*
Pass (top) or Fail (bottom) Screen
The display alternately shows a “P” for pass (or “F” for fail) and the final span value reading for each sensor. A check mark displays and a single beep sounds.

NOTE: The “span reserve” of a sensor measures its sensitivity. The displayed span value divided by the calibration gas value equals the span reserve percentage. A span reserve percentage of greater than 70% indicates a “good” sensor; 50%-70% indicates “marginal” sensitivity. When the span reserve percentage is less than 50%, the sensor will not pass calibration.

Calibration Failed Screen*
Gas readings display for all successfully calibrated sensors and an “F” displays for any failed sensors. A system level alarm turns on. The warning icon and gas cylinder display to indicate a sensor calibration failure.

STOP THE FLOW OF GAS.
After calibration, or if calibration is terminated at anytime during the process, stop the flow of gas.

All Sensors Pass
The user returns to the mode from which the calibration process was entered (configuration or gas monitoring).

Sensor Fail
If one or more sensors fail calibration, the Calibration Fail Screen displays and a system level alarm turns on.

Any failed sensor stays in alarm until it passes a calibration or is replaced.

Press ON/OFF/MODE to repeat calibration.

* During the standard calibration or standard bump test process, a series of apply gas, in-progress, and results screens show for EACH sensor as it is calibrated or tested.
Quick Bump Test Process

NOTE: To view a fully narrated step-by-step audio visual demonstration of the zero, calibration, or bump test processes, visit the online Ventis LS Resource Center at www.indsci.com/VentisLSresources.

<table>
<thead>
<tr>
<th>Display and Options</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Bump Test Initiate Screen" /></td>
<td>Press ON/OFF/MODE to bypass the bump test process and advance to the Peak Readings Screen. Press ENTER to begin the bump test process.</td>
</tr>
</tbody>
</table>
| **Bump Test Initiate Screen**
- Options
  - Begin process
  - Bypass process |

<table>
<thead>
<tr>
<th><img src="image" alt="Bump Test Apply Gas Screen*" /></th>
<th><img src="image" alt="Bump Test In-progress Screen*" /></th>
</tr>
</thead>
</table>
| **Bump Test Apply Gas Screen**
Displays the bump test gas concentrations the monitor is expecting to receive. The monitor waits up to five minutes to successfully sense the gas. | **As the bump test progresses**, observe the display activity (left). **STOP THE FLOW OF GAS.** |
  - If gas is sensed, the user advances to the Bump Test In-progress Screen. |
  - If gas is NOT sensed, a failed bump test occurs and the user advances to the Bump Test Results Screen displays. |
  - **To Bump Test**
    - Place the calibration cup over the upper portion of the monitor’s case top (front of monitor). To attach properly, complete or observe the following:
      - The cup fully covers the sensor ports.
      - The monitor’s display and buttons are not covered.
      - The cup’s side arms fit securely in the grooves on the sides of the monitor.
      - The cup’s nipple points up and away from the monitor.
      - Turn (counterclockwise) the regulator’s knob. |
| **Bump Test In-progress Screen**
Displays when gas is sensed within five minutes. The clock icon flashes to indicate the test is in-progress. The sensor reading(s) display. The LEL and toxic sensor readings increase and the O₂ reading decreases. | **After** the bump test, the Bump Test Results Screen displays. **STOP THE FLOW OF GAS.** After bump testing, or if bump testing is terminated at anytime during the process, **stop the flow of gas** from the cylinder. |
### Bump Test Results (Pass) Screen *
The above displays an all sensor pass result. If one or more sensors fail, the “F” shows in place of the “P”. The pass/fail screen (left) and the final sensor reading screen (right) display alternately three times. A single beep sounds to indicate the bump test is completed.

### Bump Test Results (Fail) Screen *
The “bF” displays under each gas type to indicate a bump test failure. The system level alarm turns on and the gas cylinder icon flashes.

### Peak Readings Screen
Displays the peak icon and peak gas concentrations for each installed sensor since the last time the peak readings were cleared. (For O₂, the lowest reading is shown.)

### TWA Readings Screen
Displays the TWA (time weighted average) icon and calculated readings for each toxic sensor installed; all other sensor values are blank.

**No User Action Required**
After a **passed bump test**, the monitor goes into gas monitoring mode.

After a **failed bump test**, the Bump Test Fail Screen displays and a **low level audio alarm turns on**.

The monitor should be fully calibrated after a failed bump test.

**NOTE**: After a full calibration, the O₂ sensor must pass a bump test to clear the bump test fail status.
**STEL Readings Screen**
Displays the STEL (short term exposure limit) icon and STEL values for each toxic sensor installed; all other sensor values are blank. The STEL value is the running average over the last 15 minutes.

* During the standard calibration or standard bump test process, a series of apply gas, in-progress, and results screens show for EACH sensor as it is calibrated or tested.

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**Recommended Practices for In-field Air Sampling**
When worn, the monitor should be fastened securely and attached to ensure the sensor portals are exposed to the air. The monitor should be in full view. No part of the monitor should be covered by any garment or part of a garment.

**Cleaning**
- NEVER use solvents or cleaning solutions of any type.
- When necessary, wipe the outside of the Ventis LS with a soft, clean cloth.
- Make sure the sensor diffusion membrane, inside and out, is free of debris; wipe gently with a cloth or brush that is soft, clean, and dry.

**Service**
Instructions are provided for battery, sensor, sensor barrier, and LCD service. Refer to the three-dimensional view diagram to identify the parts referenced in the instruction sets, and for screw torque values.

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**NOTICES**
→ Before beginning any service tasks, power-off the monitor.
→ Only qualified staff should perform monitor service and should take the following precautions.
   → Take care not to touch battery contacts on the monitor or the battery itself.
   → Perform work in a clean air environment that is known to be nonhazardous.
   → Perform work on a nonconductive work surface.
   → Wear grounding straps.

**Battery Packs**
Battery service instruction sets are provided below for each allowable monitor/battery pack combination. Please choose, read, and then follow the appropriate instruction set.

**Battery Pack Replacement.**

<table>
<thead>
<tr>
<th>Step</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power-off the monitor.</td>
</tr>
<tr>
<td>2</td>
<td>Loosen the four captive screws on the lower portion of the case bottom (or the battery cover if the Extended Range Li-ion battery pack is attached).</td>
</tr>
<tr>
<td>3</td>
<td>Lift and remove the Li-ion battery pack or (Extended Range battery and cover); set aside.</td>
</tr>
</tbody>
</table>

**Battery Attachment.**
*If attaching the Li-ion battery pack, start with step 4.*
*If inserting the Extended Range Li-ion battery, follow steps 5-7 ONLY.*
To properly attach the new Li-ion battery pack to the monitor, align its exterior charging contacts with the monitor’s bottom. *Skip to step 6.*

To properly place the Extended Range battery pack inside the battery cover ensure:
- The battery circuitry is exposed and faces the user.
- A small groove at the back of the battery bottom fits over the small rib in the battery cover.
- Ensure the battery contacts are showing at the bottom of the monitor.

Tighten the four captive screws to secure the battery pack or battery cover to the monitor.

Dispose of any spent batteries according to company policy, or properly store any battery packs that have a remaining life.

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**Sensor, Sensor Barrier, LCD, and Vibrating Motor Replacement**

Please choose, read, and then follow the appropriate instruction set using the service tool packed with the monitor. Within each set of instructions, follow those relevant to the desired task(s) and note the following.
- The monitor has a two-part circuit board assembly, the main board and a smaller sensor board. They are attached to one another with a connector at the center of the sensor board. At its top, the main board is also attached to the wireless “tag”.
- The sensor barrier can be replaced as an assembly that fits in the monitor’s case top, or the full case top can be replaced. NOTE: When a sensor is replaced, it is recommended that the sensor barrier/case top also be replaced. After reassembling the monitor, a full calibration should be completed.

### Disassembling the Monitor.

<table>
<thead>
<tr>
<th>Step</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power-off the monitor.</td>
</tr>
<tr>
<td>2</td>
<td>Loosen the four captive screws on the lower portion of the case bottom (back of the monitor) to remove the battery pack. Set aside the battery (and battery cover if applicable).</td>
</tr>
<tr>
<td>3</td>
<td>Loosen the four captive screws on the upper portion of the case bottom.</td>
</tr>
<tr>
<td>4</td>
<td>Lift and remove the case bottom; set aside for later reassembly.</td>
</tr>
<tr>
<td>5</td>
<td>Lift and remove the circuit board assembly.</td>
</tr>
<tr>
<td>6</td>
<td>Separate the main circuit board from the sensor board (if needed).</td>
</tr>
</tbody>
</table>

### Replacing the LCD (if needed).

<table>
<thead>
<tr>
<th>Step</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Grasp the sides of the LCD and lift straight up to remove.</td>
</tr>
<tr>
<td>2</td>
<td>To properly position the new LCD, align the pins on the LCD with their receptacles on the main circuit board.</td>
</tr>
<tr>
<td>3</td>
<td>Gently press straight down and into place.</td>
</tr>
</tbody>
</table>

### Replacing the Sensor(s) (if needed).

<table>
<thead>
<tr>
<th>Step</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Identify the sensor to be removed.</td>
</tr>
<tr>
<td>2</td>
<td>Gently lift and remove the sensor.</td>
</tr>
<tr>
<td>3</td>
<td>To add the new sensor, align its pins or connector(s), with the respective receptacles on the board.</td>
</tr>
<tr>
<td>4</td>
<td>Press down. A slight click indicates the sensor is securely in place.</td>
</tr>
</tbody>
</table>

### Replacing the Sensor Barrier (if needed).

To replace the sensor barrier assembly, follow instruction 1-4 below. To replace the entire case top, including its sensor barrier, skip to the instruction set, “Reassembling the Circuit Board Assembly and Monitor.”

<table>
<thead>
<tr>
<th>Step</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Observe the placement of the existing water barrier inside the case top. Note that each cut-out is shaped to match the sensor it protects.</td>
</tr>
<tr>
<td>2</td>
<td>Lift and remove the sensor barrier and gasket from inside the monitor case top. Ensure the entire case top is free of adhesive; gently scrape, if needed. Wipe with a clean, dry, soft cloth or brush.</td>
</tr>
</tbody>
</table>
3 Lift the backing from the new sensor barrier to reveal the adhesive.

4 Carefully position the new barrier. Each shaped opening matches the shape of the sensor it protects. Press to attach to the inside of the case top.

**Replacing the Vibrating Motor (if needed).**

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Place the monitor’s case top face down.</td>
</tr>
<tr>
<td>2</td>
<td>Lift the vibrating motor from its partition. The partition has two sections divided by a ridge. Discard the used motor.</td>
</tr>
<tr>
<td>3</td>
<td>To properly place the new vibrating motor, its contact pins face the user and align with the left edge of the partition. (The motor’s movable component fits within the small section of the partition.)</td>
</tr>
<tr>
<td>4</td>
<td>Press into place.</td>
</tr>
</tbody>
</table>

**Reassembling the Circuit Board Assembly and Monitor.**

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Re-attach the main board to the sensor board, aligning their connectors. Press; a slight click indicates the boards are securely attached.</td>
</tr>
<tr>
<td>2</td>
<td>Re-place the circuit board assembly into the monitor’s case top.</td>
</tr>
<tr>
<td>3</td>
<td>Re-place the monitor’s case bottom.</td>
</tr>
<tr>
<td>4</td>
<td>Tighten the four captive screws on the upper portion of the case bottom.</td>
</tr>
<tr>
<td>5</td>
<td>Re-place the battery pack onto the case bottom and tighten the four captive screws.</td>
</tr>
<tr>
<td>6</td>
<td>Dispose of the used sensor(s) according to company policy.</td>
</tr>
<tr>
<td>7</td>
<td>Perform a full calibration following the addition or replacement of any sensor, or the replacement of the sensor water barrier or the monitor case top.</td>
</tr>
</tbody>
</table>
### Key for Ventis LS Monitor three-Dimensional Diagram

<table>
<thead>
<tr>
<th>Number/Symbol</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>*</td>
<td>17134495</td>
<td>SENSOR, MX4, 4B-LEL</td>
</tr>
<tr>
<td>*</td>
<td>17134487</td>
<td>SENSOR, 6A-CO, MX4</td>
</tr>
<tr>
<td>*</td>
<td>17134479</td>
<td>SENSOR, 6A-H2S, MX4</td>
</tr>
<tr>
<td>*</td>
<td>17134461</td>
<td>SENSOR, O2, MX4</td>
</tr>
<tr>
<td>*</td>
<td>17134503</td>
<td>SENSOR, 6A-NO2, MX4</td>
</tr>
<tr>
<td>*</td>
<td>17143595</td>
<td>SENSOR, 6A-SO2, MX4</td>
</tr>
<tr>
<td>10</td>
<td>17153421</td>
<td>PCBA, MAIN, VENTIS LS</td>
</tr>
<tr>
<td>11</td>
<td>17134982</td>
<td>PCB, ANALOG, MX4</td>
</tr>
<tr>
<td>12</td>
<td>17153423</td>
<td>ASSY, CASE, BOTTOM, VENTIS LS</td>
</tr>
<tr>
<td>13</td>
<td>17153424</td>
<td>ASSY, CASE, TOP, VENTIS LS</td>
</tr>
<tr>
<td>14**</td>
<td>17153520</td>
<td>MODULE, RF, T3 TAG, VENTIS LS</td>
</tr>
<tr>
<td>19</td>
<td>17150772</td>
<td>ASSY, LCD, ASP, MX4</td>
</tr>
<tr>
<td>20</td>
<td>17147174</td>
<td>PAD, PCB, ANALOG, MX4</td>
</tr>
<tr>
<td>25</td>
<td>17151028</td>
<td>SCR, CAPT, M2.5 X 29MM, TORX</td>
</tr>
</tbody>
</table>
Key for Ventis LS Monitor three-Dimensional Diagram

<table>
<thead>
<tr>
<th>Number/Symbol</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>17147281</td>
<td>SCR, CAPT, M2.5 X 16.5MM, TORX</td>
</tr>
<tr>
<td>27</td>
<td>17147273</td>
<td>SCR, CAPT, M2.5 X 16.5MM, PH, CR</td>
</tr>
<tr>
<td>28</td>
<td>17151002</td>
<td>SCR, CAPT, M2.5 X 29MM, PH, CR</td>
</tr>
<tr>
<td>30</td>
<td>17120528</td>
<td>SUSPENDER CLIP; SINGLE GAS</td>
</tr>
<tr>
<td>31</td>
<td>17139262</td>
<td>SCREW, SEMS, M2.5 X 6.0, PHCR</td>
</tr>
<tr>
<td>36</td>
<td>17134453-X1</td>
<td>BATT PACK, LI-ION, MX4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>X=battery cover color, where 0=black and 1=orange</td>
</tr>
<tr>
<td>37</td>
<td>17148313</td>
<td>BATTERY PACK, LI-ION, EXT, VENTIS MX4</td>
</tr>
<tr>
<td>42</td>
<td>17151184-X1</td>
<td>ASSY, COVER, BATT, EXT, VENTIS MX4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>X=battery cover color, where 0=black and 1=orange</td>
</tr>
</tbody>
</table>

** Item is not field-replaceable.

Specifications and Certifications

Monitor Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>Backlit Liquid Crystal Display (LCD)</td>
</tr>
<tr>
<td>Buttons</td>
<td>Three (ON/OFF/MODE, ENTER, and PANIC)</td>
</tr>
<tr>
<td>Monitor case</td>
<td>Polycarbonate with ESD protective rubber overmold</td>
</tr>
<tr>
<td>Alarms</td>
<td>Ultra-bright LEDs, loud audible alarm (95dB at 30 cm), and vibrating alarm</td>
</tr>
<tr>
<td>Size</td>
<td>131.5 mm x 72.0 mm x 56.0 mm (5.1” x 2.8” x 2.2”)</td>
</tr>
<tr>
<td>Weight</td>
<td>With Extended Range Lithium Battery: 303.50 grams (10.70 oz)</td>
</tr>
<tr>
<td></td>
<td>With Lithium Battery: 258.10 grams (9.10 oz)</td>
</tr>
</tbody>
</table>

Sensor Specifications

<table>
<thead>
<tr>
<th>Gas Name</th>
<th>Abbr.</th>
<th>Measuring Range</th>
<th>Resolution</th>
<th>Accuracy at Time and Temperature of Calibration</th>
<th>Response Time (Max) T50</th>
<th>Response Time (Max) T90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>O₂</td>
<td>0 – 30% vol</td>
<td>0.1% vol</td>
<td>± 0.5% vol</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>CO</td>
<td>0 – 1000 ppm</td>
<td>1 ppm</td>
<td>± 5%</td>
<td>15</td>
<td>50</td>
</tr>
<tr>
<td>Hydrogen Sulfide</td>
<td>H₂S</td>
<td>0 – 500 ppm</td>
<td>0.1 ppm</td>
<td>± 5%</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>Nitrogen Dioxide</td>
<td>NO₂</td>
<td>0 – 150 ppm</td>
<td>0.1 ppm</td>
<td>10%</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>Sulfur Dioxide</td>
<td>SO₂</td>
<td>0 – 150 ppm</td>
<td>0.1 ppm</td>
<td>10%</td>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>Combustible</td>
<td>LEL</td>
<td>0 – 100% LEL</td>
<td>1% LEL</td>
<td>± 5%</td>
<td>15</td>
<td>35</td>
</tr>
<tr>
<td>Methane</td>
<td>CH₄</td>
<td>0 – 5% vol</td>
<td>0.01% vol</td>
<td>± 5%</td>
<td>15</td>
<td>35</td>
</tr>
</tbody>
</table>
### Certifications

<table>
<thead>
<tr>
<th>Directive/Code</th>
<th>Certification Marking</th>
<th>Standard</th>
</tr>
</thead>
</table>
| ATEX           | Ex d ia I Mb / Ex d ia IIC T4 Gb  
Equipment Group and Category: I M2 and II 2G | EN 60079-0: 2009  
EN 60079-1: 2007  
EN 60079-11: 2007 |
| CSA            | Class I, Group A B C D T4  
C22.2 No. 152  
Ex ia d IIC T4 | CSA C22.2 No. 152  
CSA C22.2 No. 157  
CSA C22.2 No. 60079-0  
CSA C22.2 No. 60079-1  
CSA C22.2 No. E60079-11 |
| IECEx          | Ex d ia IIC T4 Gb | IEC 60079-0: 2007  
IEC 60079-1: 2007  
IEC 60079-11: 2006 |
| UL             | Class I, Group A B C D T4  
Class II, Group F G  
Class I, Zone 0, AEx d ia IIC T4 | UL 913 7th Ed.  
UL 60079-0 5th Ed.  
UL 60079-11 5th Ed. |

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Industrial Scientific Corporation's Ventis LS portable gas monitors are warranted to be free from defects in material and workmanship for a period of two years after purchase. This warranty includes the sensors, and the lithium-ion battery pack as shipped with the Ventis LS.

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