VENTIS™
PRO SERIES

Product Manual

The Essential Guide for

Safety Teams and

Instrument Operators

Edition: 9
September 15, 2017
Part Number: 17156830-1

INDUSTRIAL SCIENTIFIC

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Revision 6

www.indsci.com/ventispro

Contents

Tables and Figures

1

General Information

Certifications

Warnings and Cautionary Statements

Recommended Practices

Certifications

Certifications for the Ventis™ Pro4 Multi-Gas Monitor and Ventis™ Pro5 Multi-Gas Monitor, at the time of this document's publication, are listed below in Tables 1.1 and 1.2. To determine the hazardous-area classifications for which an instrument is certified, refer to its label or the instrument order.

Table 1.1 Hazardous-area certifications

Certifying Body (CB)	Area Classifications	Approved Temperature Range
ANZEx	Ex ia I Ma / Ex ia IIC T4 Ga	-40 °C to +50 °C (-40 °F to +122 °F)
	Ex d ia I Mb / Ex d ia IIC T4 Gb with IR Sensor	-20 °C to +50 °C (-4 °F to +122 °F)
ATEX[a]	Equipment Group and Category II 1G, Ex ia IIC, equipment protection level Ga, Temperature Class T4	-40 °C to +50 °C (-40 °F to +122 °F)
	Equipment Group and Category II 2G, Ex d ia IIC, equipment protection level Gb, Temperature Class T4, with IR sensor	
	Equipment Group and Category I M1, Ex ia I, equipment protection level Ma, Temperature Class T4	
	Equipment Group and Category I M1, Ex d ia I, equipment protection level Ma, Temperature Class T4, with IR sensor	
CSA[b]	Class I, Division 1, Groups A, B, C, and D, Temperature Class T4	-40 °C to +50 °C (-40 °F to +122 °F)
	Class I, Zone 1, Ex d ia IIC, Temperature Class T4	
	C22.2 No. 152 applies to %LEL reading for the sensor Part Number 17155304-K only	-20 °C to +50 °C (-4 °F to +122 °F)
IECEx[a]	Class I, Zone 0, Ex ia IIC, equipment protection level Ga, Temperature Class T4	-40 °C to +50 °C (-40 °F to +122 °F)

Table 1.1 Hazardous-area certifications

Certifying Body (CB)	Area Classifications	Approved Temperature Range
	Class I, Zone 1, Ex d ia IIC, , equipment protection level Gb, Temperature Class T4, with IR sensor	
INMETRO	Class I, Zone 0, Ex ia IIC, equipment protection level Ga, Temperature Class T4	-40 °C to +50 °C (-40 °F to +122 °F)
	Class I, Zone 1, Ex d ia IIC, equipment protection level Gb, Temperature Class T4, with IR sensor	
MSHA[C]	Permissible for Underground Mines	-40 °C to +50 °C (-40 °F to +122 °F)
UL	Class I, Division 1, Groups A, B, C, and D, Temperature Class T4	-40 °C to +50 °C (-40 °F to +122 °F)
	Class II, Division 1, Groups E, F, and G, Temperature Class T4	
	Class I, Zone 0, AEx ia IIC, Temperature Class T4	
	Class I, Zone 1, AEx d ia II C, Temperature Class T4, with IR sensor	

[a]Marking requirements are reproduced in Appendix B.

[b]The following apply to instruments that are to be used in compliance with the CSA certification: Ventis Pro4 and Ventis Pro5 instruments are 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_{amb}: -40 °C to +50 °C.

- CSA has assessed only the %LEL combustible gas detection portion of this instrument (the sensor part number 17155304-K only) for performance according to CSA Standard C22.2 No. 152. Within an ambient temperature range of T_{amb}: 0 °C to +50 °C, the accuracy is ±3%. Within an ambient temperature range of T_{amb}: -20°C up to 0°C, the accuracy is ±5%. This is applicable only when the monitor has been calibrated to 50% LEL CH_4.
  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 and calibration section of the Product Manual.
  ATTENTION : CSA C22.2 N°152 exige que la sensibilité de l'instrument soit testée avant l'utilisation quotidienne de l'instrument sur une concentration connue de pentane ou de méthane équivalente à 25 % ou 50 % de la concentration totale. L'exactitude doit être entre -0 % et +20 % de la concentration réelle. L'exactitude peut être corrigée en se référant à la partie concernant la mise à zéro et l'étalonnage dans le Manuel du produit.

[C]MSHA requires the monitor be calibrated according to the procedures in the Product Manual only. MSHA also requires the monitor display methane in the percent-by-volume mode (0-5%) for compliance determinations required by 30 CFR Part 75, subpart D.

Table 1.2 Wireless certifications

Agency or authority	Identification number or registration number	Country or region
FCC	PHH-VPX	USA
IC	20727-VPX	Canada

Warnings and Cautionary Statements

Read and understand this Product Manual before operating or servicing the instrument. Failure to perform certain procedures or note certain conditions—provided below and throughout the manual—may impair the performance of the product, cause unsafe conditions, or both.

Table 1.3 Warnings and cautionary statements

⚠	If it appears that the instrument is not working correctly, immediately contact Industrial Scientific.
⚠	Only qualified personnel should operate, maintain, and service the instrument.
⚠	Substitution of components may impair intrinsic safety, which may cause an unsafe condition. Substituer des composants peut compromettre la sécurité intrinsèque, ce qui peut résulter en une situation dangereuse.
⚠	Do not use in oxygen-enriched atmospheres. If the atmosphere becomes oxygen enriched, it may cause inaccurate readings.
⚠	Oxygen-deficient atmospheres may cause inaccurate readings.
⚠	A rapid increase in a gas reading that is followed by a declining or erratic reading may indicate an over-range condition, which may be hazardous.
⚠	Sudden changes in atmospheric pressure may cause temporary fluctuations in gas readings.
⚠	Temperatures below -20 °C (-4 °F) are likely to cause decreased functionality in the instrument's display screen and man-down feature.
⚠	Sudden changes in ambient-air temperature will cause a form of sensor drift in the Carbon Monoxide/Hydrogen Sulfide (CO/H_2S) sensor (part number 17155306-J) that will produce temporary variations in the sensor's readings: • If the temperature suddenly *increases*, the CO reading will temporarily decrease and the H_2S reading may temporarily increase. • If the temperature suddenly *decreases*, the CO reading will temporarily increase and the H_2S reading may temporarily decrease. The readings will stabilize when the sensor has acclimated to the change in temperature. For example, if the ambient-air temperatures changes from a "room temperature" of 20 °C (68 °F) to an outdoor temperature of 0 °C (32 °F), the stabilization time is approximately 15 minutes; with smaller or larger changes in temperature, stabilization time will be shorter or longer, respectively. *Note:* If the sensor is to be zeroed after a sudden change in ambient-air temperature, allow the sensor and its readings to stabilize before zeroing.
⚠	The Long-life O2 sensor (part number 17155304-Y) is a biased sensor, requiring continuous power to operate to specification. Continuous power is provided by a charged battery, regardless if the instrument is powered on. If no power is provided to the sensor, it will experience sensor drift and generate erroneous readings. If an instrument containing this sensor experiences a state of no charge, sensor drift will likely occur. If so, Industrial Scientific recommends that the instrument be installed on a compatible charger or docking station. If installed on a docking station, the instrument may fail calibration, but can remain docked to charge. After charging*, undock the instrument; then, redock the instrument or zero it manually. If the instrument does not pass zero, repeat the zero. *If the sensor has been in a no-power state for seven days, it may require a charge period of up to three hours. Charge time will vary based on how long the sensor has been in a no-charge state.

Table 1.3 Warnings and cautionary statements

⚠ To avoid potentially inaccurate readings for some applications—monitoring for gases other than O_2, CO, CO_2, H_2S, and combustible gases [LEL/CH_4]—*only* use a leather case as a carrying case. Do not power on, operate, or power off the instrument while it is in a leather case.

⚠ Silicone and other known contaminants may damage the instrument's combustible gas sensors, which can cause inaccurate gas readings.

⚠ To support accurate readings, keep clean and unobstructed all filters, sensor ports, water barriers, and pump inlet.

⚠ Charge the instrument's battery only in nonhazardous locations. Chargez la batterie de l'instrument uniquement dans des lieux sans danger.

⚠ Charge the instrument's battery using only compatible accessories from Industrial Scientific, including the chargers listed below.

Part Number	*Description*
18108191	Ventis Single-Unit Charger
18108209	Ventis Single-Unit Charger/Datalink
18108651	Ventis Single-Unit Automotive Charger,12VDC
18108652	Ventis Single-Unit Truck-Mount Charger, 12VDC, with Cigarette Adapter
18108653	Ventis Single-Unit Truck-Mount Charger, 12VDC, Hard Wired

⚠ Perform all instrument service tasks and maintenance procedures in nonhazardous locations only. This includes the removal, replacement, or adjustment of any part on or inside the instrument or its pump.

Exécutez toutes les procédures de service les tâches de service sur l'instrument uniquement dans des lieux sans danger. Ceci comprend la dépose d'une pièce positionnée sur l'instrument ou à l'intérieur de celui-ci, ou bien la rechange ou le réglage d'une telle pièce.

⚠ Battery contacts are exposed on batteries when they are removed from the instrument. Do not touch the battery contacts and do not stack batteries on top of each other.

⚠ Do not use solvents or cleaning solutions on the instrument or its components.

⚠ The radios in the Industrial Scientific Ventis Pro 4 and Ventis Pro 5 Portable Multi Gas monitors have been assessed to and found to be below limits as defined in FCC; Innovation, Science and Economic Development Canada; and European Council recommendation 1995/519/EC requirements for human exposure to electromagnetic fields.

⚠ This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

The instrument complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

Changes or modification made that are not expressly approved by the manufacturer could void the user's authority to operate the equipment.

Table 1.3 Warnings and cautionary statements

⚠ This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

⚠ The Ventis Pro 4 and Ventis Pro 5 Portable Multi Gas Monitors contain 3 radio communication modules that generate radio frequency energy. They frequencies and output powers are listed below:

		Maximum Transmit Power
NFC	13.56 MHz	-43.2 dBm (0.000048 mW)
Bluetooth Low Energy	2402 to 2480 MHz	0 dBm (1 mW)
LENS Wireless	2405 to 2480 MHz	3 dBm (2 mW)

⚠ Industrial Scientific recommends persons with a pacemaker or implantable cardio defibrillator (ICD) should maintain a minimum separation distance of 15 cm (6 ") between the pacemaker or ICD and a wireless-enabled instrument. Please consult your physician or pacemaker or ICD manufacturer for additional guidance and recommendations.

MSHA Conditions of Safe Use

⚠ The diffusion versions of the Ventis Pro 4 and Pro 5 are approved for use with either the rechargeable P/N 17134453-X2, or P/N 17148313-2 (extended) 3.7 volt, lithium-ion batteries only.

⚠ The batteries are not user-replaceable.

⚠ The aspirated version of the Ventis Pro 4 and Pro 5 is approved for use with the P/N 17148313-2 extended battery only.

⚠ To be charged on the surface or underground in accordance with 30 CFR 75.340 (the applicable regulations pertaining to battery-charging stations) and MSHA Program Information Bulletin PIB P11-12.

⚠ Charge monitors with an Industrial Scientific Corporation charger designed for use with this monitor.

⚠ Calibrate according to the procedures in the Product Manual, Document No. 17156830-1.

⚠ The monitor must display methane in the percent-by-volume mode (0-5%) for compliance determinations required by 30 CFR Part 75, Subpart D.

⚠ The respective minimum distances that shall be maintained between the Ventis Pro 4 or Pro 5 monitors and any blasting circuits, explosives and detonators for MSHA and the PA Department of Environmental Protection are:

MSHA - 6 inches (15.2 cm)

PA DEP - 30 inches (76 cm)

Recommended Practices

Instrument Maintenance

The procedures defined below help to maintain instrument functionality and support operator safety.

Industrial Scientific minimum-frequency recommendations for these procedures are summarized below in Table 1.4. These recommendations are provided to help support worker safety and are based on field data, safe work procedures, industry best practices, and regulatory standards. Industrial Scientific is not responsible for determining a company's safety practices or establishing its safety policies, which may be affected by the directives and recommendations of regulatory groups, environmental conditions, operating conditions, instrument use patterns and exposure to gas, and other factors.

Settings

Settings control how an instrument will perform. They are used to help ensure the instrument is in compliance with company safety policy and applicable regulations, laws, and guidelines as issued by regulatory agencies and government or industry groups.

Utilities

Maintenance procedures are known as "utilities". Utilities are primarily used to test the instrument or its components for functionality or performance. Each utility is defined below.

Self-test.

The self-test is used to test the functionality of the instrument's memory operations, battery, display screen, and each alarm signal type (audible, visual, and vibration).

Bump Test (or "functional test").

Bump testing is a functional test in which an instrument's installed sensors are to be briefly exposed to (or "bumped" by) calibration gases in concentrations that are greater than the sensors' low-alarm setpoints. This will cause the instrument to go into low alarm and will indicate which sensors pass or fail this basic test for response to gas.

Zero.

Zeroing adjusts the sensors' "baseline" readings, which become the points of comparison for subsequent gas readings. It is a prerequisite for calibration. During zeroing, the installed sensors are to be exposed to an air sample from a zero-grade-air cylinder or ambient air that is known to be clean air. If there are gases in the air sample that are below the lowest alarm level, the instrument will read them as zero; its task is to read the air sample as clean air. The user's task is to ensure the air is clean.

Calibration.

Regular calibrations promote the accurate measurement of gas concentration values. During calibration, an instrument's installed sensors are to be exposed to their set concentrations of calibration gases. Based on the sensors' responses, the instrument will self-adjust to compensate for declining sensor sensitivity, which naturally occurs as the installed sensors are used or "consumed".

Note: During calibration, the span reserve percentage value for each sensor is displayed. An indicator of a sensor's remaining life, when the value is less than 50%, the sensor will no longer pass calibration

Docking.

When docked, instruments that are supported by iNet® Control or DSSAC (Docking Station Software Admin Console) will be maintained for all scheduled bump tests and calibrations, synchronized for any changes to settings, and upgraded for improvements from Industrial Scientific.

Other Maintenance.

The time-weighted average (TWA), short-term exposure limit (STEL), and peak readings can each be "cleared". When any summary reading is cleared, its value is reset to zero and its time-related setting is also reset to zero.

Table 1.4 Recommended frequencies for instrument maintenance

Procedure	Recommended minimum frequency
Settings	Before first use, when an installed sensor is replaced, and as needed.
Calibration[a]	Before first use and monthly thereafter.
Bump test[b]	Before first use and prior to each day's use thereafter.
Self-test[c]	As needed.

[a]Between regular calibrations, Industrial Scientific also recommends a calibration be performed immediately following each of these incidences: the unit falls, is dropped, or experiences another significant impact; is exposed to water; fails a bump test; or has been exposed to an over-range (positive or negative) gas concentration. A calibration is also recommended after the installation of a new (or replacement) sensor.

[b]If conditions do not permit daily bump testing, the procedure may be done less frequently based on instrument use, potential exposure to gas, and environmental conditions as determined by company policy and local regulatory standards.

[b]When redundant sensors are operating on DualSense® technology, bump testing these sensors may be done less frequently based on company safety policy.

[c]The instrument performs a self-test during power on. For an instrument that is set for always-on, the instrument will automatically perform a self-test every 24 hours. The self-test can also be completed on demand by the instrument user.

Note: The use of calibration gases not provided by Industrial Scientific may void product warranties and limit potential liability claims.

First Use

To prepare the Ventis Pro Series instrument for first use, qualified personnel should ensure the following are completed:

- Charge the battery.
- Review instrument settings and adjust them as needed.
- Calibrate the instrument.
- Complete a bump test.

Wearing the Instrument

Based on the U.S. Department of Labor's Occupational Safety and Health Administration (OSHA) definition of the breathing zone, it is recommended that the instrument be worn within a 25.4 cm (10") radius of the nose and mouth. Refer to OSHA and to other agencies or groups as needed for additional information.

LENS™ Wireless Considerations

LENS™ Wireless (Linked Equipment Network for Safety) from Industrial Scientific is used to form wirelessly connected instrument "groups". It allows the communication of gas readings, alarms, and other data among LENS-connected "peer" instruments.

- LENS data travel in a nonlinear manner. With the locations of peer instruments A through F as shown below in Figure 1.1, messages travel among instruments that may be separated by distance or by a structure (gray bar). For example, if instrument "E" experiences an alarm, the other instruments in the group will experience a peer alarm, which will include details about the instrument that is in alarm.
- As a guideline, a line-of-sight distance up to 100 m (109 yd), between two Ventis Pro instruments that are facing each other, allows an instrument to maintain membership in its group.

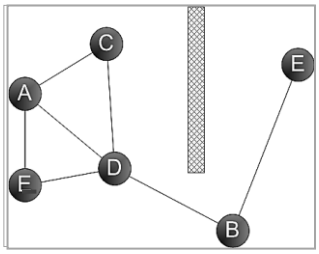


Figure 1.1 Snapshot of LENS Wireless peer-instrument locations

iNet Now Considerations

iNet Now is a live-monitoring software solution from Industrial Scientific. Using Bluetooth technology, gas-detection instruments, and smart devices, it delivers to safety team members instrument gas readings, alarms, and other data—in real time.

When iNet Now is in use, the following apply.

- An in-range smart device must be running the *iNet Now Sync app*.
- A line-of-sight distance of up to 30 m (32 yd)—between the Ventis Pro and the smart device—generally serves to maintain the Bluetooth connection.
- If a Ventis Pro has lost its connection to the smart device, its data upload to iNet Now can be maintained *only when* it is part of a LENS group that includes no more than six instruments, and at least one instrument in the group is communicating with any smart device that is running the iNet Now Sync app.

Remote Sampling

When sampling with a motorized pump and sampling line, Industrial Scientific recommends the following:

- Choose the tubing type based on the target gases. If the target gases are *known*, use Teflon-lined tubing when sampling for these gases: chlorine (Cl_2), chlorine dioxide (ClO_2), hydrogen chloride (HCl), and volatile organic compounds (VOCs). For other *known* target gases, urethane tubing or Teflon-lined tubing may be used.

  When the target gases are *unknown*, use Teflon-lined tubing.
- Know the length of the sample line as it is a factor in determining sampling time. A sample line may consist of tubing, a probe, or a probe and tubing. It should also have a dust filter–water stop installed at the line's end that will extend into the sample area. Sample-line length is defined as the distance from

the dust filter–water stop opening to the point where the line connects to the pump's inlet. Ensure sample-line length does not exceed the pump's maximum draw.

- Before and after each air sample, perform a test of the full sampling line.
    - Use a thumb to block the end of the sampling line at the water-stop opening. This should cause a pump-fault alarm.
    - Remove the thumb from the water-stop opening. After the alarm cycle completes, the pump should resume normal operation.

  Note: If a pump fault does *not* occur, check and correct for cracks or other damage, debris, and proper installation in these areas: the sampling line and its connections, the pump's inlet cap and inlet barrel, and the dust filter-water stop items at the end of the sampling line and inside the pump inlet barrel.

- Based on sample-line length, calculate the *minimum time* recommended for the air sample to reach the instrument's sensors. As shown below, use a base time of 2 minutes, and add 2 seconds for each 30 cm (1 ') of line length. Watch the display screen for gas readings and, if present, allow them to stabilize to determine the reading.

Table 1.5 Minimum sample time for common sample-line lengths

Sample-line length	Base time (minutes)	+	Sample-line-length factor	=	Minimum sample time (mm:ss)
3.05 m (10 ')	2 min	+	(10 ' x 2 s)	=	02:20
6.10 m (20 ')	2 min	+	(20 ' x 2 s)	=	02:40
9.14 m (30 ')	2 min	+	(30 ' x 2 s)	=	03:00
12.10 m (40 ')	2 min	+	(40 ' x 2 s)	=	03:20
15.24 m (50 ')	2 min	+	(50 ' x 2 s)	=	03:40
18.29 m (60 ')	2 min	+	(60 ' x 2 s)	=	04:00
21.34 m (70 ')	2 min	+	(70 ' x 2 s)	=	04:20
24.38 m (80 ')	2 min	+	(80 ' x 2 s)	=	04:40
27.43 m (90 ')	2 min	+	(90 ' x 2 s)	=	05:00
30.48 m (100 ')	2 min	+	(100 ' x 2 s)	=	05:20

Cold-weather Operation

Use caution when operating the instrument in temperatures below -20 °C (-4 °F), which can diminish display-screen legibility and man-down functionality. To help support functionality and available battery power, the following practices are recommended.

- Do not operate the instrument in temperatures that are not within the temperature ranges of the installed sensors (see "Table 2.6, Sensor specifications").
- Use a compatible, fully charged extended range battery.
- Before using the instrument in the cold-weather environment, power it on a warm-up environment (approximately 20 °C [68 °F]).
- Alternately operate the instrument in the cold-weather and warm-up environments.
- Do not operate the instrument unmanned.

2

Product Information

Overview

The Ventis™ Pro Series portable gas monitors are used for personal protection to monitor for oxygen and a variety of toxic gases and combustible gases.

Twelve compatible sensors are available for use with the Ventis™ Pro4 Multi-Gas Monitor, which can provide readings for up to four gases. These sensors are among the 19 available for use with the Ventis™ Pro5 Multi-Gas Monitor, which can provide readings for up to five gases.

The instruments take gas readings every second and record readings-related data every ten seconds. Data are stored in the instrument data log, which has these characteristics:

- Capacity for approximately three months of readings for a unit that is on 10 hours a day and has four installed, operational sensors
- Data storage for up to 60 alarm events, 30 error events, and 250 manual calibrations and bump tests
- Downloadable using compatible accessories that are supported by iNet® Control, DSSAC, or Accessory Software from Industrial Scientific.

Ventis™ Pro Series instruments use a multisensory alarm-warning-indicator system comprising audible, visual, and vibration signals.

The instrument's display-screen language can be set to one of several available language options.

Key Features

LENS™ Wireless

Ventis Pro instruments are equipped with LENS™ Wireless (Linked Equipment Network for Safety), a long-range, power-efficient wireless mesh network from Industrial Scientific. LENS Wireless functionality is available when an instrument is ordered or can be later activated by the customer.

LENS functionality enables instrument-to-instrument communication of data through wirelessly connected, ad-hoc-formed "instrument groups" or "peer groups". A LENS group can accommodate from 2 to 25 peer

instruments. Each LENS group can include Ventis Pro Series instruments, Radius™ BZ1 Area Monitors, or both.

As groups are formed, if instrument "A" belongs to a LENS group and instrument "X" connects to instrument "A", instrument "X" will be connected to all peer instruments in the group. When any peer-group gas-detection instrument is within range of any other instrument in the group, they share their alarms, gas readings, and other data. This allows in-field personnel to learn of and respond to hazardous events or conditions that originate with any instrument that is operating in a LENS group.

Data communicated using LENS Wireless can be secured with the default encryption key from Industrial Scientific. LENS allows for the customer to optionally use its own custom key*. When an encryption key is used, data are encrypted during the instrument-joining process.

LENS functionality requires no central controller, network configuration, or infrastructure.

*Requires iNet Control or DSSAC (Docking Station Software Admin Console) from Industrial Scientific.

iAssign™

Programmed iAssign™ tags can be used by the instrument operator to assign an instrument to the user-site data on his or her tag. This can help promote a sense of ownership among instrument operators, encouraging their responsible use of the equipment. User and site values are also associated with alarm events and other instrument data that are important to users of Industrial Scientific software products.

The iAssign Beacon is used to change an instrument's site assignment as the instrument enters or leaves the Beacon's range. It is also used to help restrict access to an area: an instrument's "proximity alarm" will be activated when the access level for its current user assignment is lower than the Beacon's access setting.

Panic and man-down features

The panic button provides instrument operators with the ability to turn on the instrument’s high-level alarm. This can signal others who are nearby that the instrument operator is in distress, someone else is in distress, or there is some concern about in-field circumstances.

The man-down feature allows the instrument to sense when *it* has not moved. A man-down warning or alarm may indicate the instrument operator is unable to move or press the panic button, or that the instrument has become separated from its operator. Both the warning and alarm can be turned off by the user.

Gas-alert and -alarm features

The optional "acknowledgeable gas alert" feature warns the instrument operator of the presence of gas in concentrations that may be approaching the instrument’s alarm setpoints. This can prompt the instrument operator to check the display screen for gas readings and for an optional instructional message; the instrument operator can reset the alert.

The safety team can provide instrument operators with up to 26 customized, instructional messages*. The opportunities include a message that displays during the start-up sequence and those that display during gas events. A unique "alarm action message" (e.g., "EVACUATE") can be set for each of these events for each installed sensor: gas present (alert, low alarm, and high alarm), STEL, and TWA.

The optional "full screen alarm" setting is used to display easy-to-read alarm details in large type.

The alarm-latch feature is used to keep an alarm on after the alarm-causing condition no longer exists. This serves to sustain alarm signals, which can encourage the instrument operator to check the display screen for gas readings and an instructional message, and to optionally release the alarm latch.

*Requires iNet Control, DSSAC (Docking Station Software Admin Console), or Accessory Software,

iNet Now

Part of the iNet® Integrated Solution for Gas Detection, *iNet Now* provides the opportunity for its users to learn of and respond to unsafe conditions *as they occur*.

Using Bluetooth technology, iNet Now happens in the *iNet Cloud Platform* where data from gas-detection instruments are used to provide safety team members with real-time information and alerts about what is happening in-field—everything from instrument gas readings to gas alarms, man-down events, panic alarms, and more. iNet Now users can:

- View instrument status summaries.
- View a live-monitoring map.
- Receive (via SMS text, e-mail, or both), detailed, subscription-based alerts that notify of gas-detection and worker events.

Gas-information access

Optional gas-information displays are used to provide the instrument operator with the setpoints for gas events and calibration gas concentrations. The information can be set to display during the start-up sequence, be accessible during operation, or both.

Other key features

When used in combination with the security code feature, the instrument's always-on option can help prevent the instrument from being powered off during operation.

When the instrument is powered-off, the quick-status feature allows users to view this instrument information: installed sensors, available battery power, and instrument serial number.

These hardware features help protect and reduce damage to the instrument:

- The instrument's raised ridges help shield the sensor ports from dirt and damage when an instrument falls or is dropped.
- The display screen is recessed to protect it from scratches and other damage.
- Rails help reduce wear from docking.

Compatibility

Sensors

Each instrument's compatible sensors can be installed in one or more specific locations as depicted in Figures 2.1.A and 2.1.B for Ventis Pro4 and Ventis Pro5, respectively. Table 2.1 provides the same information but in list format, which is helpful for distinguishing among sensors of the same type. For example, there are two H_2S sensors that do not share installation locations or part numbers.

Locations 1 or 2

Hydrogen Sulfide (H_2S); 17155304-2

Oxygen (O_2); 17155304-3

Oxygen, Long-life (O_2); 17155304-Y

Location 2 *only*

LEL (Pentane); 17155304-K

LEL (Methane); 17155304-L

Methane, 0-5% vol; 17155304-M

Locations 3 or 4

Carbon Monoxide (CO); 17155306-1

Carbon Monoxide with low Hydrogen cross-sensitivity (CO/H_2 Low); 17155306-G

Hydrogen Cyanide (HCN); 17155306-B

Hydrogen Sulfide (H_2S); 17155306-2

Nitrogen Dioxide (NO_2); 17155306-4

Sulfur Dioxide (SO_2); 17155306-5

Figure 2.1.A Sensor compatibility and installation locations for the Ventis Pro4

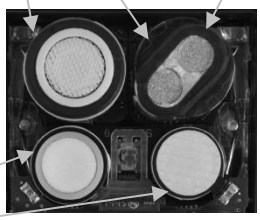


Figure 2.1.B Sensor compatibility and installation locations for the Ventis Pro5

Table 2.1 Sensor compatibility and installation locations

	Ventis Pro4	Ventis Pro5	Installation locations	Part number
Sensor				
Ammonia (NH_3)	No	Yes	3 or 4	17155306-6
Carbon Dioxide/LEL (Propane), IR (CO_2/LEL)	No	Yes	2	17155304-U
Carbon Dioxide/Methane (CO_2/CH_4)	No	Yes	2	17155304-V
Carbon Monoxide (CO)	Yes	Yes	3 or 4	17155306-1
Carbon Monoxide/Hydrogen Sulfide (CO/H_2S)	No	Yes	1 or 2	17155304-J
Carbon Monoxide/Hydrogen Sulfide (CO/H_2S)*	No	Yes	3 or 4	17155306-J
Carbon Monoxide with low Hydrogen cross-sensitivity (CO/H_2 Low)	Yes	Yes	3 or 4	17155306-G
Hydrogen Cyanide (HCN)	Yes	Yes	3 or 4	17155306-B

Table 2.1 Sensor compatibility and installation locations

	Ventis Pro4	Ventis Pro5	Installation locations	Part number
Hydrogen Sulfide (H_2S)	Yes	Yes	1 or 2	17155304-2
Hydrogen Sulfide (H_2S)	Yes	Yes	3 or 4	17155306-2
LEL (Methane)	Yes	Yes	2	17155304-L
LEL (Pentane)	Yes	Yes	2	17155304-K
Methane, IR, (CH_4)	No	Yes	2	17155304-N
Methane, 0-5% vol	Yes	Yes	2	17155304-M
Nitrogen Dioxide (NO_2)	Yes	Yes	3 or 4	17155306-4
Oxygen (O_2)*	Yes	Yes	1 or 2	17155304-3
Oxygen, Long-life (O_2)	Yes	Yes	1 or 2	17155304-Y
Phosphine (PH_3)	No	Yes	3 or 4	17155306-9
Sulfur Dioxide (SO_2)	Yes	Yes	3 or 4	17155306-5

*DualSense® technology capable.

Batteries

As shown below, the lithium-ion and slim extended lithium-ion batteries are compatible with the diffusion instrument only. The extended range battery can be installed for use with a diffusion or aspirated instrument. The part number shown below is stated on the battery's label. The battery's orderable part numbers are supplied in Table 8.2, Battery parts list.

Table 2.2 Battery compatibility

	Rechargeable batteries (part number*)		
	Lithium-ion battery	Slim extended lithium-ion battery	Extended range lithium-ion battery
	(17134453-XY*)	(17157350-XY*)	(17148313-Y*)
Compatibility			
Ventis Pro Series diffusion	Yes	Yes	Yes
Ventis Pro Series aspirated	No	No	Yes

*X indicates color and Y indicates approvals.

Equipment and software

Listed below are some of the Industrial Scientific offerings that are available for use with Ventis Pro Series instruments. To learn more about these and other offerings or to check on the compatibilities of specific part numbers, visit the Industrial Scientific website, or contact Industrial Scientific or a distributor of its products.

Ventis Pro instruments are compatible with the DSX™ Docking Stations supported by iNet® Control or DSSAC; the Charger-Datalink supported by Accessory Software from Industrial Scientific; the V-Cal calibration station and a variety of Ventis chargers; iNet Now offerings; and the iAssign app.

iAssign accessories

Ventis Pro instruments are compatible with iAssign accessories, which can be used to assign an instrument to the accessory's user-site data. Using a smart device and the iAssign app, an accessory can be programmed to contain user data, site data, or both as described below in Table 2.3.

Table 2.3 iAssign accessories compatibility

Item	Properties	Assignment options
Standard tag	A lightweight, adhesive tag suitable for attachment to a badge or other clean, flat surface.	User, site, or both
Waterproof tag	A lightweight, adhesive tag with a waterproof coating that can be attached to a badge or other clean, flat surface.	User, site, or both
Keychain tag	Suitable for use as a key chain.	User, site, or both
All-weather outdoor tag	A durable plastic tag with a center screw hole; suitable for permanent installation indoors or outdoors.	User, site, or both
iAssign™ Beacon	Suitable for permanent installation indoors or outdoors, or for general use.	Site only

When using the iAssign app to program user and site names, follow the app's on-screen instruction to "write" a tag. When using the app's "write bulk" option, the source-file format is shown below; the words “User” and “Site” must be have an initial capital letter.

User:Sean Cooper# for Sean Cooper

Site:Storage Tank# for Strorage Tank

Specifications

Instrument

The Ventis Pro Series’ instrument specifications are provided below in Table 2.4.

Table 2.4 Instrument and pump specifications

Item	Description
Display	Monochrome LCD with automatic backlight
User interface buttons	Three (power button, enter button, and panic button)
Case materials	Polycarbonate with static-dissipative protective rubber overmold
Alarm signals	Visual (two red and two blue lights); audible (95 dB at a distance of 10 cm [3.94 "], typical[a]); and vibration
Dimensions	104 x 58 x 36 mm (4.09 x 2.28 x 1.42 ")
Weight	200 g (7.05 oz.), typical[b]

Table 2.4 Instrument and pump specifications

Item	Description
Ingress protection	IP68 at 1.5 m (4.9 ') for one hour
Pump	With 0.3175 cm (0.125 ") inside diameter sample tubing, sustains a continuous sample draw for up to 30.48 m (100 ').
Temperature range[c and d]	-40°C to + 50 °C (-40 °F to + 122 °F)
Humidity range[d]	15−95 % relative humidity (RH) noncondensing (continuous)

[a]May vary based on in-field conditions.

[b]May vary based on installed components.

[c]Temperatures below -20 °C (-4 °F), can diminish display-screen legibility and man-down functionality. See also "Cold-weather Operation" (Chapter 1, "Recommended Practices") and Table 1.1, "Certifications".

[d]Sensor temperature and humidity ranges may differ from those of the instrument (see "Table 2.6, Sensor specifications").

Battery Specifications

Table 2.5 provides battery specifications, which include run time, charge time, charging temperature requirements, and expected lifetime. The part number shown below is stated on the battery's label. The battery's orderable part numbers are supplied in Table 8.2, Battery parts list.

Table 2.5 Battery specifications

	Rechargeable batteries (part number)		
	Lithium-ion battery (17134453-XY[c])	Slim extended lithium-ion battery (17157350[c])	Extended range lithium-ion battery (17148313[c])
Run time[a]	12 hours	18 hours	23 hours
Charge time[b]	up to 4 hours	up to 7.5 hours	up to 7.5 hours
Ambient temperature required for charging	0 − 40 °C (32 − 104 °F)	0 − 40 °C (32 − 104 °F)	0 − 40 °C (32 − 104 °F)

[a]Approximate run time for a diffusion unit when the battery is fully charged, using LENS Wireless with up to 24 peer instruments, and operating at room temperature.

[b]When a lithium-ion battery becomes deeply discharged and the instrument is docked, it can take up to an hour for the instrument display to indicate that the battery is charging.

[c]X indicates color and Y indicates approvals.

Note: Batteries can withstand 300 charge cycles over their lifetime.

Sensor Specifications

Table 2.6 provides specifications for each sensor, which include properties, installation locations, operating conditions, and performance data.

Table 2.6 Sensor specifications

	Gas type (abbreviation) Part number		
	Ammonia (NH_3) 17155306-6	Carbon Dioxide/LEL (Propane), IR (CO_2/LEL) 17155304-U[c]	
Properties			
Category	Toxic	Toxic/Combustible	
Technology	Electrochemical	Infrared	
DualSense™ capable	No	No	
Installation location			
Ventis Pro4	None	None	
Ventis Pro5	3 or 4	2	
Operating conditions			
Temperature range[a]	-20 to +40 °C (-4 to +104 °F)	-20 to +50 °C (-4 to +122 °F)	
RH range[a]	15-95%	0-95%	
Performance		CO_2	LEL
Sensitivity			
Measurement range	0−500 ppm	0-5% vol	0-100% LEL
Measurement resolution	1 ppm	0.01% vol	0.01% LEL
Accuracy[b]			
Calibration gas and concentration	50 ppm NH_3	2.5% vol CO_2	25% LEL (Propane)
Accuracy at time and temperature of calibration	± 15% (0-100 ppm) 0 to 25% (101−500 ppm)	±10% or 0.1%	±5%
Accuracy over sensor's full temperature range	± 15%	±15%	±15%
Response Time			
T50	30 s	17 s	17 s
T90	84 s	32 s	35 s

Table 2.6 Sensor specifications

	Gas type (abbreviation)		
	Part number		
	Carbon Dioxide/Methane (CO_2/CH_4)		
	17155304-V[c]		
Properties			
Category	Toxic and Combustible		
Technology	Infrared		
DualSense™ capable	No		
Installation location			
Ventis Pro4	None		
Ventis Pro5	2		
Operating conditions			
Temperature range[a]	-20 to +50 °C (-4 to +122 °F)		
RH range[a]	0-95%		
Performance	CO_2	CH_4	
Sensitivity			
Measurement range	0−5% vol	0−5% vol	5.01-100% vol
Measurement resolution	0.01% vol	0.01% vol	0.1% vol
Accuracy[b]			
Calibration gas and concentration	2.5% vol CO_2	2.5% vol	99% vol
Accuracy at time and temperature of calibration	± 10%	± 10%	± 10%
Accuracy over sensor's full temperature range	± 15%	± 15%	—
Response Time			
T50	17 s	15 s	15 s
T90	32 s	30 s	30 s

Table 2.6 Sensor specifications

	Gas type (abbreviation) Part number				
	Carbon Monoxide (CO) 17155306-1	Carbon Monoxide and Hydrogen Sulfide (CO/H_2S) 17155306-J		Carbon Monoxide and Hydrogen Sulfide (CO/H_2S) 17155304-J	
Properties					
Category	Toxic	Toxic		Toxic	
Technology	Electrochemical	Electrochemical		Electrochemical	
DualSense™ capable	No	Yes		No	
Installation location					
Ventis Pro4	3 or 4	None		None	
Ventis Pro5	3 or 4	3 or 4		1 or 2	
Operating conditions					
Temperature range[a]	-40 to +50 °C (-40 to +122 °F)	-20 to +50 °C (-4 to +122 °F)		-20 to +50 °C (-4 to +122 °F)	
RH range[a]	15-95%	15-95%		15-95%	
Performance		CO	H_2S	CO	H_2S
Sensitivity					
Measurement range	0-2000 ppm	0-1500 ppm	0−500 ppm	0-1500 ppm	0−500 ppm
Measurement resolution	1 ppm	1 ppm	0.1 ppm	1 ppm	0.1 ppm
Accuracy[b]					
Calibration gas and concentration	100 ppm CO	100 ppm CO	25 ppm H_2S	100 ppm CO	25 ppm H_2S
Accuracy at time and temperature of calibration	± 5%	± 7%	± 10 %	± 5%	0 to 7%
Accuracy over sensor's full temperature range	± 10%	± 5%	± 10%	± 5%	± 10%
Response Time					
T50	10 s	15 s	10 s	15 s	10 s
T90	20 s	35 s	20 s	35 s	20 s

Table 2.6 Sensor specifications

	Gas type (abbreviation) Part number	
	Carbon Monoxide with low Hydrogen cross-sensitivity (CO/H_2 Low) 17155306-G	Hydrogen Cyanide (HCN) 17155306-B
Properties		
Category	Toxic	Toxic
Technology	Electrochemical	Electrochemical
DualSense™ capable	No	No
Installation location		
Ventis Pro4	3 or 4	3 or 4
Ventis Pro5	3 or 4	3 or 4
Operating conditions		
Temperature range[a]	-20 to +50 °C (-4 to +122 °F)	-30 to +40 °C (-22 to +104 °F)
RH range[a]	15-95%	15-95%
Performance		
Sensitivity		
Measurement range	0−1000 ppm	0−30 ppm
Measurement resolution	1 ppm	0.1 ppm
Accuracy[b]		
Calibration gas and concentration	100 ppm CO	10 ppm HCN
Accuracy at time and temperature of calibration	± 5% (0-300 ppm) ± 15% (301-1000 ppm)	0 to10%
Accuracy over sensor's full temperature range	± 15%	± 15%
Response Time		
T50	8 s	18 s
T90	12 s	65 s

Table 2.6 Sensor specifications

	Gas type (abbreviation) Part number	
	Hydrogen Sulfide (H_2S) 17155304-2	Hydrogen Sulfide (H_2S) 17155306-2
Properties		
Category	Toxic	Toxic
Technology	Electrochemical	Electrochemical
DualSense™ capable	No	No
Installation location		
Ventis Pro4	1 or 2	3 or 4
Ventis Pro5	1 or 2	3 or 4
Operating conditions		
Temperature range[a]	-40 to +50 °C (-40 to +122°F)	-40 to +50 °C (-40 to +122°F)
RH range[a]	15-95%	15-95%
Performance		
Sensitivity		
Measurement range	0−500 ppm	0−500 ppm
Measurement resolution	0.1 ppm	0.1 ppm
Accuracy[b]		
Calibration gas and concentration	25 ppm	25 ppm
Accuracy at time and temperature of calibration	± 5% (0-400 ppm) ± 7% (401-500 ppm)	± 7%
Accuracy over sensor's full temperature range	± 15%	± 15%
Response Time		
T50	10 s	10 s
T90	25 s	25 s

Table 2.6 Sensor specifications

	Gas type (abbreviation) Part number	
	LEL (Methane) 17155304-L	LEL (Pentane) 17155304-K[c]
Properties		
Category	Combustible	Combustible
Technology	Catalytic bead	Catalytic bead
DualSense™ capable	No	No
Installation location		
Ventis Pro4	2	2
Ventis Pro5	2	2
Operating conditions		
Temperature range[a]	-20 to +55 °C (-4 to +131 °F)	-20 to +55 °C (-4 to +131 °F)
RH range[a]	15-95%	15-95%
Performance		
Sensitivity		
Measurement range	0−100% LEL	0−100% LEL
Measurement resolution	1% LEL	1 % LEL
Accuracy[b]		
Calibration gas and concentration	50% LEL methane	25% LEL pentane
Accuracy at time and temperature of calibration	± 3% LEL (0-50% LEL) ± 5% LEL (51-100% LEL)	± 5% LEL
Accuracy over sensor's full temperature range	± 15%	± 15%
Response Time		
T50	7 s	10 s
T90	10 s	16 s

Table 2.6 Sensor specifications

	Gas type (abbreviation) Part number		
	Methane, IR (CH_4)		Methane, 0-5% vol
	17155304-N		17155304-M[c]
Properties			
Category	Combustible		Combustible
Technology	Infrared		Catalytic bead
DualSense™ capable	No		No
Installation location			
Ventis Pro4	None		2
Ventis Pro5	2		2
Operating conditions			
Temperature range[a]	-20 to +50 °C (-4 to +122 °F)		-20 to +55 °C (-4 to +131 °F)
RH range[a]	0−95%		15-95%
Performance			
Sensitivity			
Measurement range	0−5% vol	5.1-100% vol	0-5% vol
Measurement resolution	.01% vol	0.1% vol	0.01% vol
Accuracy[b]			
Calibration gas and concentration	2.5% vol methane	99% vol methane[d]	2.5% vol
Accuracy at time and temperature of calibration	± 5%	± 15%	± 10%
Accuracy over sensor's full temperature range	± 10%	± 10%	± 15%
Response Time			
T50	15s	15s	7 s
T90	25s	25s	10 s

Table 2.6 Sensor specifications

	Gas type (abbreviation) Part number		
	Nitrogen Dioxide (NO_2) 17155306-4	Oxygen (O_2) 17155304-3	Oxygen, Long-life (O_2) 17155304-Y[e]
Properties			
Category	Toxic	Oxygen	Oxygen
Technology	Electrochemical	Electrochemical	Electrochemical
DualSense™ capable	No	Yes	Yes
Installation location			
Ventis Pro4	3 or 4	1 or 2	1 or 2
Ventis Pro5	3 or 4	1 or 2	1 or 2
Operating conditions			
Temperature range[a]	-20 to +50 °C (-4 to +122 °F)	-20 to +55 °C (-4 to +131 °F)	-20 to +50 °C (-4 to +122 °F)
RH range[a]	15-95%	5-95%	15-90%
Performance			
Sensitivity			
Measurement range	0-150 ppm	0-30% vol	0-30% vol
Measurement resolution	0.1 ppm	0.1% vol	0.1% vol
Accuracy[b]			
Calibration gas and concentration	25 ppm NO_2	20.9% vol O_2	20.9% vol O_2
Accuracy at time and temperature of calibration	± 5%	± 0.3% vol	± 0.5% vol
Accuracy over sensor's full temperature range	± 15%	± 0.8% vol	± 0.8% vol
Response Time			
T50	10 s	5 s	10s
T90	20 s	15 s	15s

Table 2.6 Sensor specifications

	Gas type (abbreviation) Part number	
	Phosphine (PH_3) 17155306-9	Sulfur Dioxide (SO_2) 17155306-5
Properties		
Category	Toxic	Toxic
Technology	Electrochemical	Electrochemical
DualSense™ capable	No	No
Installation location		
Ventis Pro4	3 or 4	3 or 4
Ventis Pro5	3 or 4	3 or 4
Operating conditions		
Temperature range[a]	-20 to +50 °C (-4 to +122 °F)	-20 to +50 °C (-4 to +122 °F)
RH range[a]	15-90%	15-90%
Performance		
Sensitivity		
Measurement range	0-10 ppm	0-150 ppm
Measurement resolution	0.01 ppm	0.1 ppm
Accuracy[b]		
Calibration gas and concentration	1 ppm PH_3	10 ppm SO_2
Accuracy at time and temperature of calibration	± 5%	± 5% (0-20 ppm) 0 to 11% (21-150 ppm)
Accuracy over sensor's full temperature range	± 15%	± 10%
Response Time		
T50	10s	10 s
T90	20s	25 s

[a]During continuous operation.

[b]Apply when the instrument is calibrated using the stated calibration gas and concentration; accuracy is equal to the stated percentage or one unit of resolution, whichever is greater.

[c]The sensor part number 17155304-K *is* CSA-assessed for %LEL combustible gas detection. The following sensors are *not* CSA-assessed for combustible gas detection: part numbers 17155304-M and 17155304-U.

[d]Requires manual calibration.

[e]Not approved for use in MSHA-certified instruments.

"—" indicates no available data.

3

Getting Started

Unpacking the Instrument

The items that are shipped with the instrument are listed below in Table 3.1. Each item should be accounted for during the unpacking process. If any item is missing or appears to have been damaged, contact Industrial Scientific (see back cover) or an authorized distributor of Industrial Scientific products.

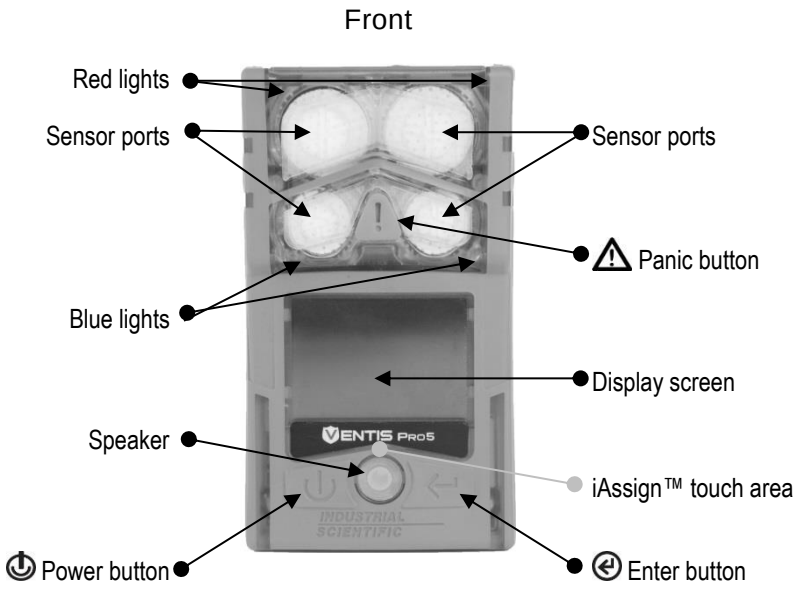
Table 3.1 Package contents

Quantity	Item	Notes
1 as ordered	Ventis Pro Series instrument	Ventis Pro4 or Ventis Pro5.
1 as ordered	Battery (factory installed)	Rechargeable lithium-ion, rechargeable slim extended lithium-ion, or rechargeable extended range ithium-ion.
1	Suspender clip (factory installed)	—
1	*Final Inspection & Test Report*	Includes information[a] about the instrument and its installed sensors and factory calibration.
1	*Quick Start*	—
As ordered	Ventis Charger	The universal power cord has four available plugs, one each for use with US, UK, EU, and AUS receptacles.
1	Calibration cup	—
1	Calibration tubing	60.96 cm (2 ') of urethane tubing; 4.762 mm (3/16 ") ID.

[a]At the time of shipment.

Hardware Overview

The instrument's main hardware components are identified below in Figures 3.1.A and 3.1.B for the diffusion and aspirated instruments, respectively (Ventis Pro5 shown).



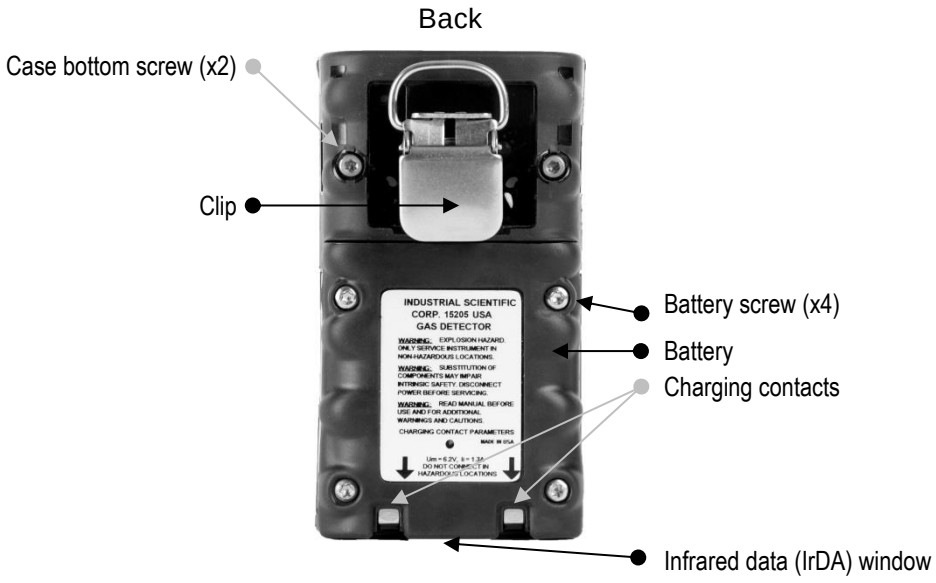
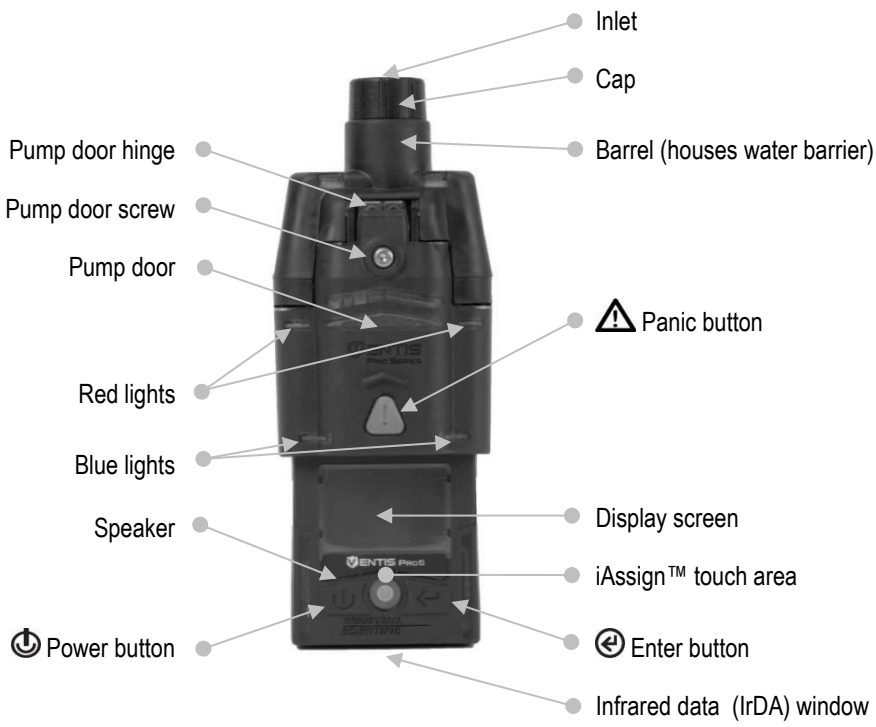


Figure 3.1.A Hardware overview diffusion instrument

Front



Back

Figure 3.1.B Hardware overview aspirated instrument

Display Overview

The instrument's easy-to-read display screen has three main horizontal segments. From top to bottom, they are:

- Status bar
- Gas readings area
- Navigation bar

The instrument uses these areas to display symbols, numbers, abbreviations, and text in combinations that allow it to clearly communicate with its user: the instrument operator in the field or the safety team members who are responsible for maintaining the instrument.

See Figures 3.2.A through 3.2.D to become familiar with the display screen layout and content items the user can expect to see at these times:

- During operation
- In the event of a warning or alarm
- During maintenance
- While working in settings

Status bar

During operation, the display screen's status bar communicates basic information to the instrument operator: instrument and battery status (shown), ambient-air temperature, and the time of day. When the instrument is in a LENS group, the number of peer instruments is shown along with the group's signal quality. Cloud symbols are used to indicate iNet Now status.

Instrument status symbol

✓	The status bar checkmark indicates the instrument is operational.

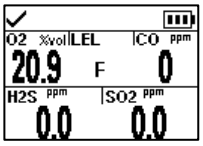
Other symbols

5 and	Indicates the LENS Wireless group peer count and the group's signal quality.
, , , and	Group signal quality is shown here in order from weakest to strongest.
	The wireless radio is not functioning and LENS Wireless features are not available.
	LENS Wireless is set to "off" and LENS Wireless features are not available.
no cloud	iNet Now is *not* enabled.
	iNet Now is enabled, but no signal is available.
	iNet Now is enabled, but the signal is weak.
	iNet Now is enabled and the signal is strong.
Name	User name assigned to peer instrument readings.

	Pump installed.
	The battery's level of charge is between 67and 100%.
	The battery's level of charge is between 34 and 66%.
	The battery's level of charge is less than or equal to 33%.
	The battery's level of charge is approaching a critically low level.
11:34a	The time of day (12-hour format shown).
76 F	The ambient-air temperature reading (Fahrenheit shown).

Gas readings area

In addition to the display of current gas readings, this area communicates status information about the installed sensors.



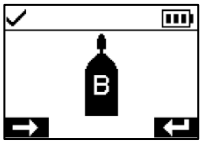
Gas reading

Gas, unit of measure, and current reading.

Other symbols

F	The indicated sensor is in a general state of failure.
ØF	The indicated sensor failed zeroing.
CAL	The indicated sensor failed calibration.
BUMP	The indicated sensor failed bump testing.
ERR	The indicated sensor is installed in the wrong location.

Navigation Bar



During operation, there may be information screens or maintenance utilities available to the instrument operator. If so, the bottom area of the display screen will feature the *navigation bar*. The action displayed on the left is controlled by the button underneath it, the power button ⏻; the action on the right is controlled by the enter button ↵.

Instructional symbols and text

	Start the option (bump test utility shown above).
	Skip the option and go to the next display screen.
	Clear values.

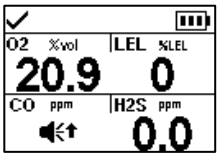
Figure 3.2.A Reading the display during operation

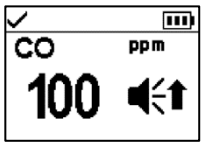
Status bar

Gas readings area

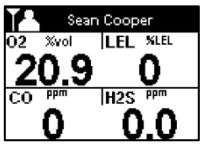
In the event of an instrument warning or alarm, the gas readings area communicates the event type, details about the alarm, and gas readings for all sensors.

Peer events use symbols that are similar to instrument-event symbols. When shown in the status bar, they are generally white on a black background; when shown in the gas readings area, the word "peer" will display.





Full-screen alarm format



Peer alarm

Event symbols (gas-related)

and OR	Gas present, over-range alarm
and	Gas present, high-alarm
and	Gas present, low-alarm
	Gas present, alert (warning)
STEL	Short-term exposure limit (STEL) alarm
TWA	Time-weighted average (TWA) alarm
	Alarm is latched

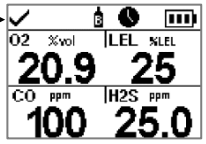
Other symbols (nongas-related, full-screen symbol)

	Critical low battery
	Indicates the in-alarm instrument is a Ventis Pro Series monitor.
	Indicates the in-alarm peer instrument is a Radius BZ1 Area Monitor.
Panic Alarm ;	Panic alarm; peer panic alarm
MAN DOWN ;	Man-down alarm; peer man-down alarm
Peer Name	A peer instrument has lost its wireless connection to the LENS Wireless group.
Group Lost	The instrument is no longer wirelessly connected to any LENS peer-group instruments.
Last Peer	The instrument is the only one remaining in the group; all former peer instruments have left the group.
ERROR 408	System error (408 shown)

Figure 3.2.B Reading the display during an event (warning or alarm)

Status bar

The display screen's status bar indicates which maintenance procedure is in progress (bump test utility shown here).

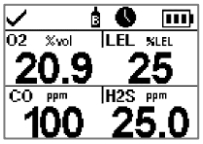


Utility symbols

B	Bump test utility
	Zero utility
C	Calibration utility
	Process in progress

Gas readings area

The gas readings area communicates information about the process and results for any maintenance procedures (bump test utility shown here).

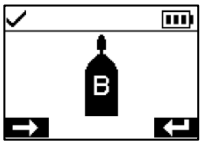


Other symbols

H2S ppm 25.0	Calibration gas type, unit of measure, and concentration
LEL	Results
✓	Passed
✗	Failed

Navigation Bar

The navigation bar provides instruction. The action displayed on the left is controlled by the button underneath it, the power button ⏻; the action on the right is controlled by the enter button ↵.



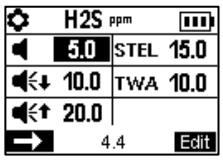
Instructional symbols

→	Cancel the utility (bump test shown here).
↵	Start the utility.
▶▶	Apply the calibration gas.

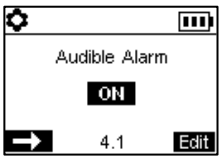
Figure 3.2.C Reading the display during maintenance

Status bar

When working in settings, the status bar may indicate the setting name (H_2S settings shown here).



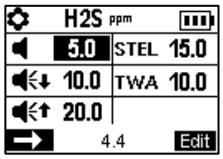
Multi-item setting



Single-item setting

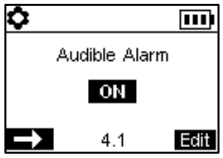
Editing area

The editing area displays the settings' values. The highlight bar indicates which setting is being edited (gas-alert value shown here).



Navigation bar

The navigation bar provides instruction for navigating settings. The action displayed on the left is controlled by the button underneath it, the power button ⏻; the action on the right is controlled by the enter button ↵.



Status bar symbol

⚙	Settings.

Other symbols

ON	Current setting.
→	Go to the next setting.
↵	Edit the setting.
Edit	Edit the setting.
▼	Scroll an options list.
⎋	Exit.
X.Y	"X" indicates the display screen's menu number; "Y" indicates its setting number.

Figure 3.2.D Reading the display while working in settings

In addition to the items described above, the Ventis Pro Series' display will also feature, when relevant, the gas names, units of measure, and other symbols shown below.

Gas names

CH4	CH_4 (Methane)
CO	Carbon Monoxide
CO2	CO_2 (Carbon Dioxide)
H2S	H_2S (Hydrogen Sulfide)
HCN	Hydrogen Cyanide

LEL	Combustible gases
NH3	NH_3 (Ammonia)
NO2	NO_2 (Nitrogen Dioxide)
O2	O_2 (Oxygen)
SO2	SO_2 (Sulfur dioxide)

Units of measure

ppm	Parts per million.
mg/m3	Milligrams per cubic meter.
% LEL	The lower explosive limit (LEL) is the minimum concentration of a gas, which, if given an ignition source, is capable of producing a flash of fire.
% vol	Percent by volume refers to a defined amount of the gas in 100 parts of air. For example, normal air contains 21% vol oxygen, or 21 parts oxygen in every 100 parts of air.

Other symbols

	Yes.
	No.
	Maintenance due (calibration shown).
	The down arrow indicates the number of *days since* the maintenance procedure was last completed. The up arrow indicates the number of *days until* the maintenance procedure is next due.
	Peak readings.
	Used with peer messages to indicate the peer instrument is a Radius BZ1.
	Used to identify an instrument's assigned (or available) user name. Also used with peer messages to indicate the peer instrument is a Ventis Pro Series instrument.
	Used to identify an instrument's assigned site name.
	Return the instrument to Industrial Scientific.
	Security code is required.
	Data exchange or synchronization may be in progress.
	Indicates that the sensor is operating on DualSense technology.
	A sensor that was operating on DualSense has failed.
	A sensor operating on DualSense is due for maintenance (sensor 1 shown here).

Power On

If a pump is installed, complete the following pump preparation steps before powering on the instrument.

If the use of the integrated pump is desired, but has not been installed, see Figure 8.2 Service Tasks for pump installation instruction.

Attach one end of the sample tubing to the pump inlet's nipple (left); attach the other end to a compatible water stop (right).

At each end, push on the tubing to ensure the connecting part is fully inserted into the tubing (approximately .635 cm [.25 "]). To test for a firm connection, gently pull on the tubing.

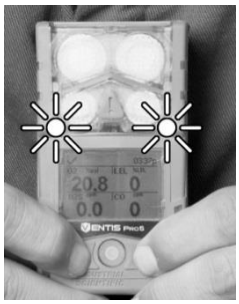
To power on the instrument, press and hold the power button ⏻ for approximately three seconds, until the blue lights flash. The instrument will perform a *self-test*; its operator should observe the instrument and its display screen to verify the unit is operating as expected (see Figure 3.3 below).

Immediately following the self-test is the *start-up sequence*, which will provide information and may prompt the instrument operator to prepare the instrument for use. Preparation and utility options included in the start-up sequence may vary from those shown below depending on instrument settings and whether or not a pump is installed.

At the end of the power-on process, the home screen will display.

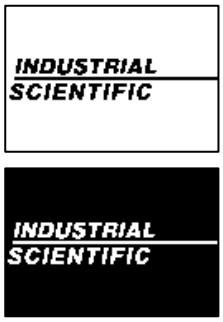
Self-test

Light test



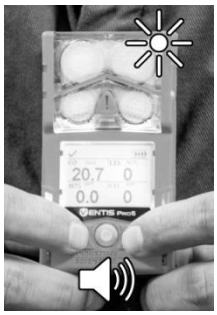
The blue lights will flash followed by the red lights. Verify that all lights are functional.

Display test



Observe the display screen to verify that all pixels are functional.

Audible and vibration test



The instrument will vibrate and then emit a loud beep. Verify that both signal types are functional.

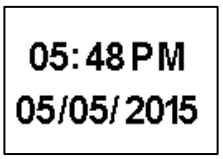
Sample error message

If the instrument fails any part of its self-test, an error message will display. If the instrument or its operator detect problems, contact Industrial Scientific for assistance.

Start-up sequence

Information

Date and time



If the battery has been reinstalled or replaced, the instrument operator may be prompted to set the date and time, which can be done manually or by docking the instrument.

Tap iAssign tag

Tap the instrument to the desired iAssign tag.

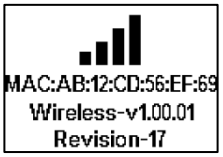
Radio firmware update

The instrument is installing improvements.

Instrument information

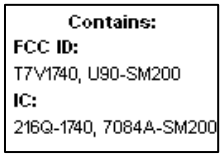
—

Wireless information



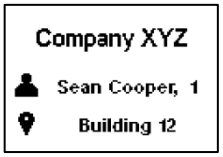
—

Regulatory information



—

Instrument assignments



Indicates the company, person (user), and location (site) to which the instrument is currently assigned.

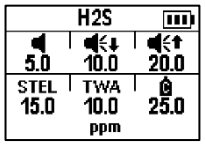
Note: When a ", X" displays next to the user name, it indicates the access level for the instrument's current user, which applies to Beacon-restricted areas.

Maintenance information

The dock information (above left) indicates maintenance is due in the future ("days until").

The calibration information (above right) indicates when the maintenance was last performed ("days since"). Calibration information can also appear as due in the future.

Gas information



—

A series of information screens provide the setpoints for each sensor (H_2S shown). The values from left to right are:

Top row: gas present alert, low alarm, and high alarm.
Bottom row: STEL alarm, TWA alarm, and calibration gas concentration. Verify that the settings are appropriate.

Preparation and utilities

Start-up message

Read and understand the message.

Acknowl-edge message.

Compliance check

(German-language instruments only)

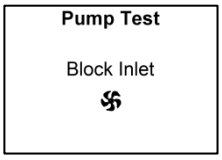
Answer "no".

Answer "yes".

If a pump has been installed, the instrument will prompt its operator to complete the following pump test.

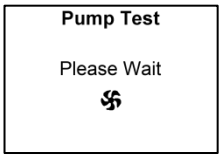
Pump test

Block inlet



When prompted, use a thumb to block the end of the sampling line, the water-stop opening.

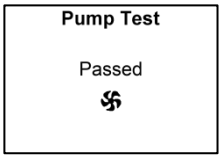
Wait

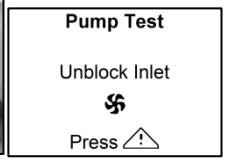


—

While the test is in progress, the display screen will ask the instrument operator to wait. Next, the test results will be displayed as "Passed" or "Failed".

Test results: Passed





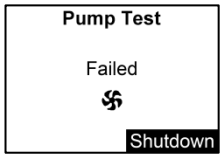
Remove thumb from the water-stop opening.

Restart the pump: Press ⚠.

It may take several seconds for the pump to restart.

Test results: Failed*

Remove thumb from the water-stop opening.

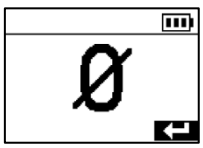


—

Power off the instrument.

*Note: A failed pump test may indicate a problem somewhere in the sampling line. Check and correct for cracks or other damage, debris, and improper installation in these areas: all sampling line connections and the pump's inlet cap, inlet barrel, and dust filter.

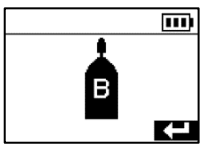
Zero utility



Skip the utility: wait 15 seconds.

Start the utility.

Bump test utility



Skip the utility: wait 15 seconds.

Start the utility.

—

Home

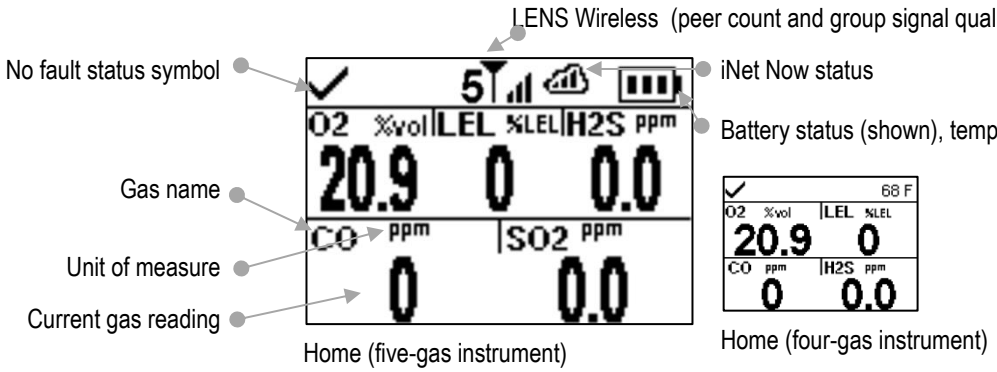


Figure 3.3 Power on

Power Off

If the instrument is set to remain on, power off may require the entry of the unit's security code.

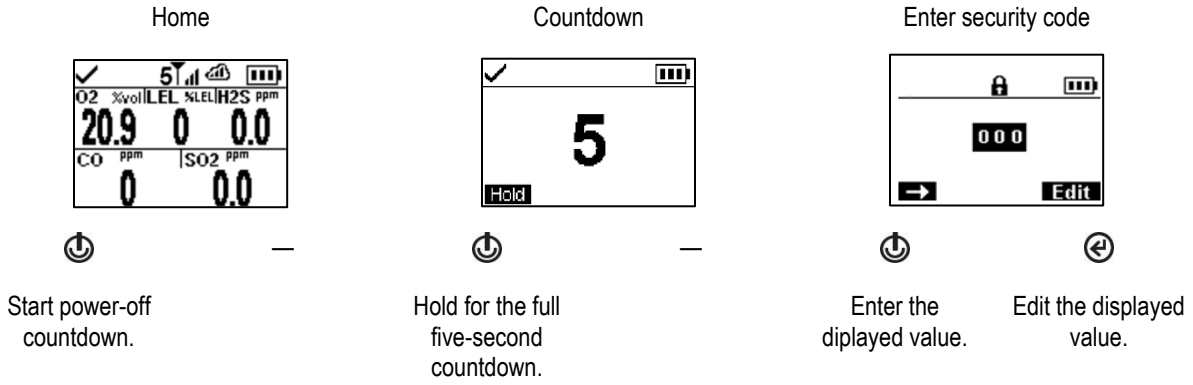
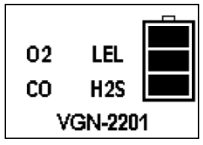


Figure 3.4 Power off

Quick-status information

When the instrument is powered off, the installed sensors, available battery power, and instrument serial number can be viewed without powering on the instrument: simultaneously press and hold ⏻ and ↵ for two seconds.



4

Settings

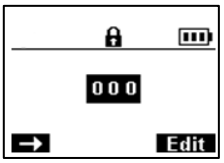
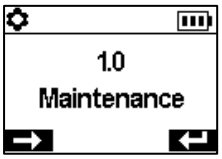
Guidelines

Settings that can be adjusted manually through the instrument are described in this Product Manual. These and other settings can also be adjusted through compatible Industrial Scientific docking stations and accessories supported by iNet Control, DSSAC, and Accessory Software; *any changes made manually to the instrument will be overridden when the instrument is docked*.

Only qualified personnel should access and adjust instrument settings; this person is referred to below as the "safety specialist". To help guard against unintended access by nonqualified personnel, settings can be security-code protected.

Accessing Settings

Settings can be accessed while the instrument is powering on—any time during the start-up sequence—by simultaneously pressing then releasing ⏻ and ↵. If the security-code screen is activated, settings are protected and the instrument's security code must be entered. If the entered value matches the instrument's security code, the first settings menu (1.0 Maintenance) will display; otherwise, access to settings will be denied and the instrument will resume start-up.

				—	—
Press ⏻	Press ↵	Press ⏻	Press ↵		
Enter the displayed value.	Edit the value.	Next menu	Start maintenance		

Settings Menus

A menu system is used to organize instrument settings by topic. This allows the safety specialist to first choose the menu (topic) of interest, such as alarms, then review and optionally "edit" (adjust) each available setting within that menu. Table 4.1 summarizes the settings that are available in each menu.

Table 4.1 Settings menus

Menu number and topic		Settings summary
1.0	Maintenance	A primary purpose of the maintenance menu is to provide the safety specialist with access to maintenance procedures (utilities). Menu options also include NFC and Bluetooth settings, which are needed for an instrument that will use iAssign accessories or will send instrument data to the iNet Now Sync App, respectively.
2.0	Start-up	Start-up settings allow the safety specialist to permit or prohibit all-user access—from the start-up sequence—to some utilities and maintenance status information (e.g., number of days until calibration is due).
3.0	Operation	The operation menu allows the safety specialist to permit or prohibit—during instrument operation—all-user access to utilities and maintenance status information. Access is set separately for each item. For example, the option to clear the peak readings may be permitted for all-user access, but access to calibration may be prohibited. From here, the specialist can also permit or prohibit the use of iAssign tags during instrument operation.
4.0	Alarm	Alarm settings allow the safety specialist to set the values for each gas event that will cause the instrument to alarm. The specialist can also permit or prohibit instrument power off during alarms and make other choices about alarm- and warning-related instrument behavior.
5.0	Sensor	Sensor settings allow the safety specialist to view basic information about the installed sensors and control settings related to calibration and bump test utilities.
6.0	Admin (Administration)	Admin settings allow the safety specialist to control important aspects about how the instrument communicates with its operator. For example, a security code can be set to help restrict all-user access to settings. The safety specialist can also set the display-screen language, maintenance-related warnings, and other items.
7.0	Wireless	Wireless settings allow the safety specialist to turn on or off LENS Wireless and to choose settings for LENS' group-related warnings and data encryption. The specialist can also set the instrument to sync-while-charging with iNet Now.

Examples for Working in Settings

Two examples are provided below to illustrate how to navigate in and adjust settings.

Each example includes a goal, a target setting that is to be changed; the navigation path that leads to the target setting; and instruction to change the target setting.

Example 1 features a single-item setting—a setting that has a value of “on” or “off”.

Example 2 features a multi-item setting where the value for each of several items can be changed—one item at a time.

Example 1. Editing a single-item setting

Goal: Latch the instrument's alarms

- From the 1.0 Maintenance menu, navigation leads to the 4.0 Alarm menu where the alarm-latch setting resides. Along the way, the navigation bypasses menus 1.0, 2.0, and 3.0.
- From the 4.0 Alarm menu, navigation leads to the setting, “Alarm Latch”. Along the way, other alarm settings are bypassed and their values remain unchanged.
- At the alarm-latch setting, the value is changed from “off” to “on”.

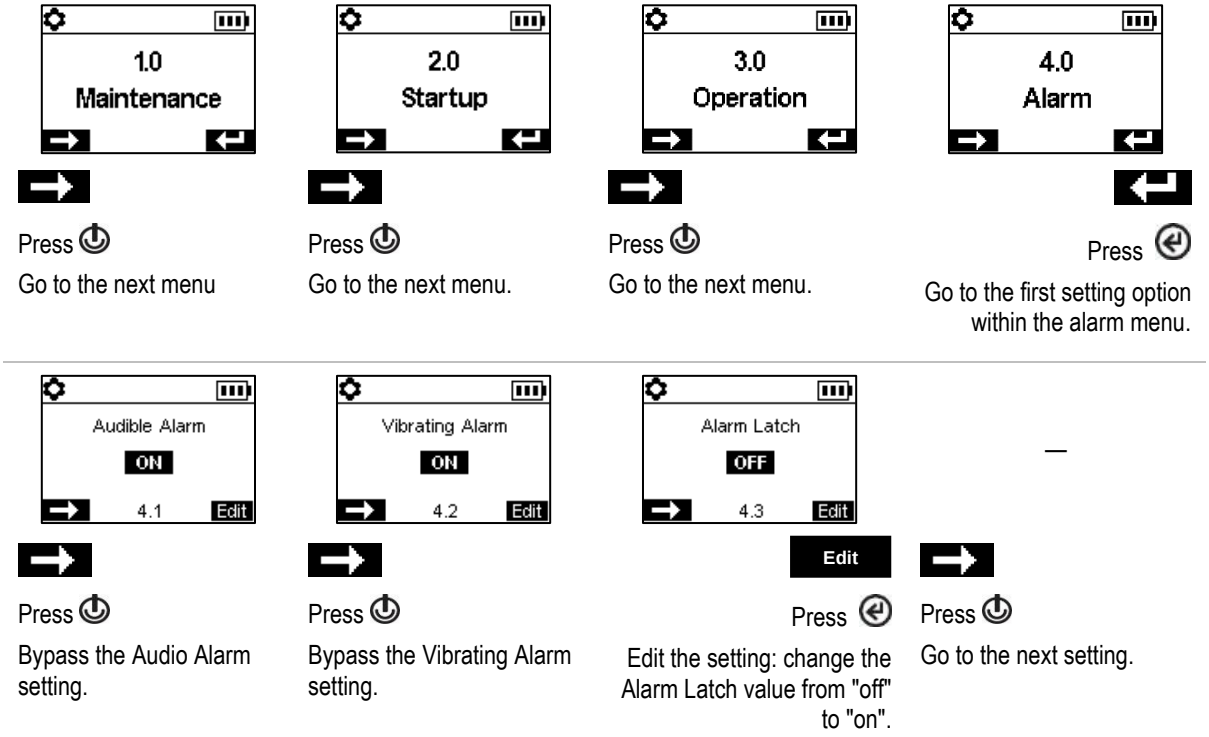


Figure 4.1.A Example for editing a single-item setting

Example 2. Editing a multi-item setting

Goal: Change the high-alarm setpoint for H2S.

- Follow the navigation from *Example 1* above.
- The navigation shown below then bypasses setpoints for the O_2, LEL, and CO sensors are bypassed; their values remain unchanged.
- The H_2S event setpoint screen is a five-item setting. The navigation bypasses the first two settings, the gas-alert and low-alarm setpoints; their values remain unchanged.
- The H_2S high-alarm setpoint is then highlighted for editing. Its value is changed from 20.0 ppm to 19.0 ppm.

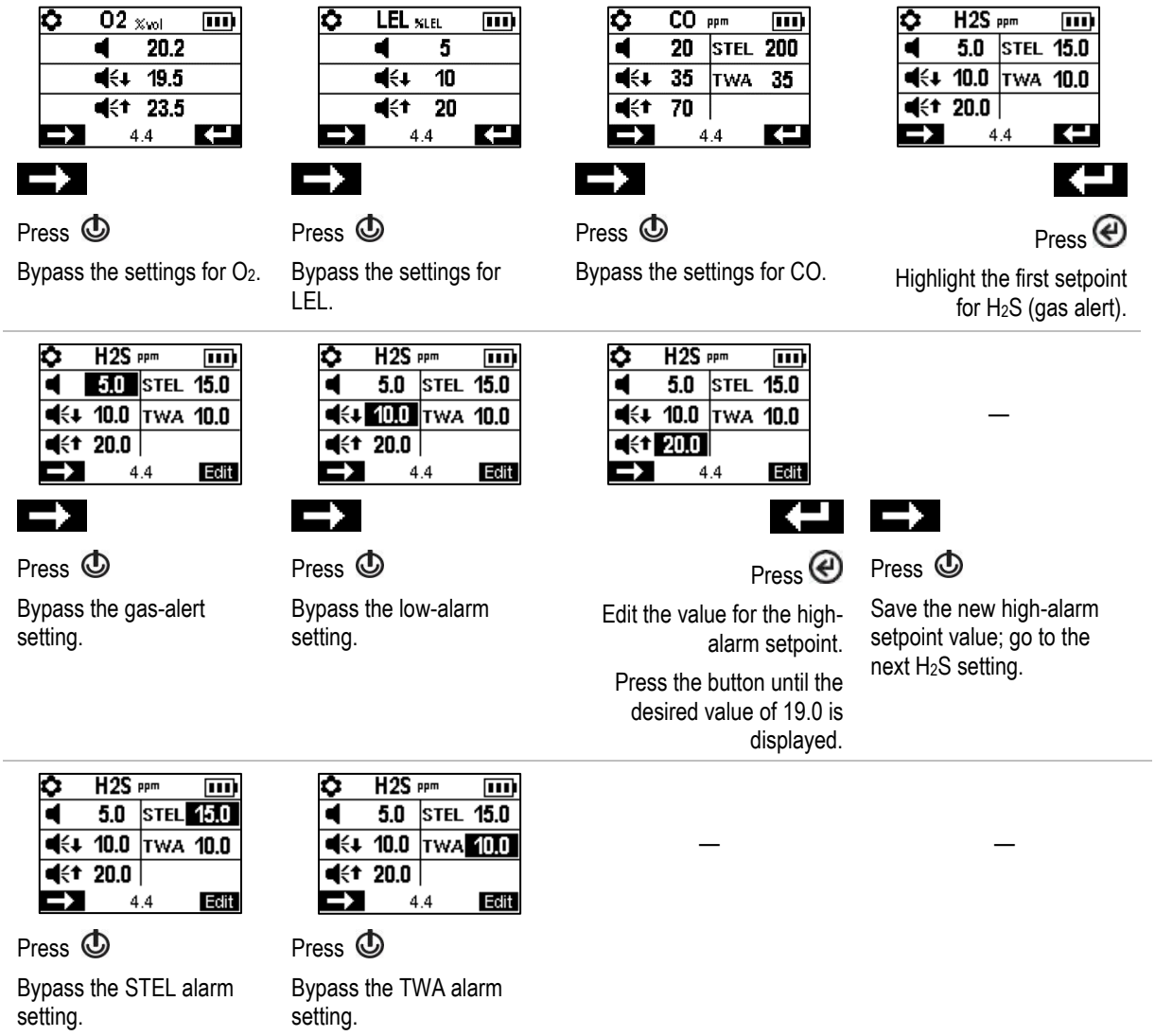


Figure 4.1.B Example for editing a multi-item setting

Reviewing and Editing Settings

The rest of this chapter describes in detail the settings and options available within each menu. Instruction is provided for navigating each menu and adjusting its settings.

When navigating and editing settings, the instrument will wait approximately 60 seconds between button presses; when no button is pressed, it will exit settings and re-enter start-up. To return to settings from start-up, simultaneously press and hold, then release ⏻ and ↵.

Maintenance menu

The maintenance menu options related to these topics:

- Utilities and instrument information
- User-site assignments, iAssign, and iNet Now

Utilities and instrument information

Perform any of these utilities:

- Zero the installed sensors.
- Calibrate the instrument.
- Bump test the installed sensors.
- View and optionally reset to zero each summary reading (peak, TWA, or STEL reading). When any summary reading is reset to zero, its time-related setting is also reset to zero.

Locate this basic instrument information:

- View the model, serial number, firmware version, and boot loader version.
- View regulatory and wireless information.
- Learn when the instrument is next due for docking or calibration or when it was last calibrated.

User-site assignments, iAssign, and iNet Now

View the instrument's user and site assignments, and optionally change those assignments from the list of available values. If the desired user or site is not listed, use iNet Control or an iAssign accessory to complete the assignment.

Note: When a user or site assignment is made to the instrument using iNet Control, DSSAC, or Accessory Software, the instrument classifies the entered user or site as a recurring assignment. When an assignment is made to the instrument using an iAssign accessory, the instrument treats it as a temporary assignment.

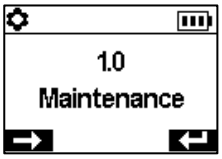
Set iAssign functionality using these settings, plus the Bluetooth setting:

- Set NFC on to allow the use of iAssign accessories.
- Use the "Clear iAssign" setting to control how current user and current site assignments are to be cleared. Choose from these options:
    - Select "Overwrite" to allow iAssign accessories to overwrite the instrument's current user-site assignments. This setting is suitable for applications where instrument operators are to use iAssign accessories in the field to change the instrument's current assignments.
    - Select "Restart" or "Charging" to allow the instrument's current user-site assignments to be cleared only when the instrument experiences a restart or charging event, respectively; the *recurring* user and site will then become the instrument's current assignments.

Set iNet Now and iAssign Beacon functionality using the Bluetooth setting.

- If the facility uses, iAssign Beacons, choose a setting option that includes *local*.
- If the instrument is to be monitored by iNet Now, choose an option that includes *iNet Now.*
- An *off* option is available if Bluethooth will not be used.

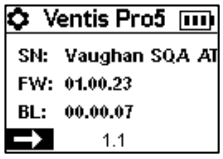
Maintenance menu



Next menu

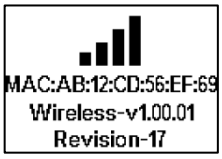
Go to first maintenance option

Instrument information



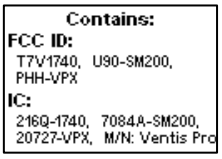
Next option

Wireless information



Next option

Regulatory information



Next option

Dock status

Next option

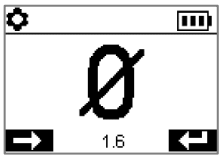
View span values

Calibration status

Next option

View span values

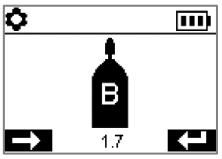
Zero and calibration utilities



Next option

Start utility

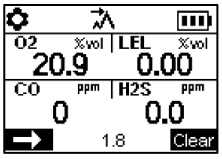
Bump test utility



Next option

Start utility

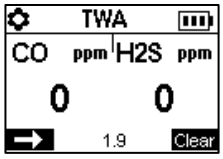
Peak readings



Next option

Clear peak readings

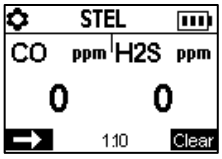
TWA readings



Next option

Clear TWA readings

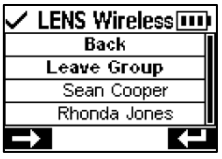
STEL readings



Next option

Clear STEL readings

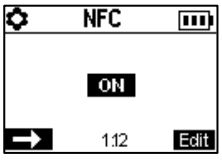
LENS Peer list



Next option

Access list

Near-field communications (NFC; required for iAssign tags)

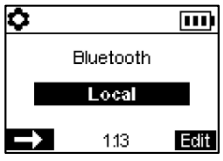


Next option

Turn on or off

Bluetooth

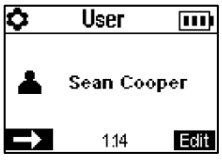
If the facility uses, iAssign Beacons, choose an option that includes "local" if the instrument is to be monitored by iNet Now, choose an option that includes "iNet Now"



Next option

Choose connection type

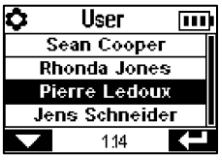
User assignment



Next option

Edit current user

User assignment options (current user highlighted)



Scroll user list

Set user

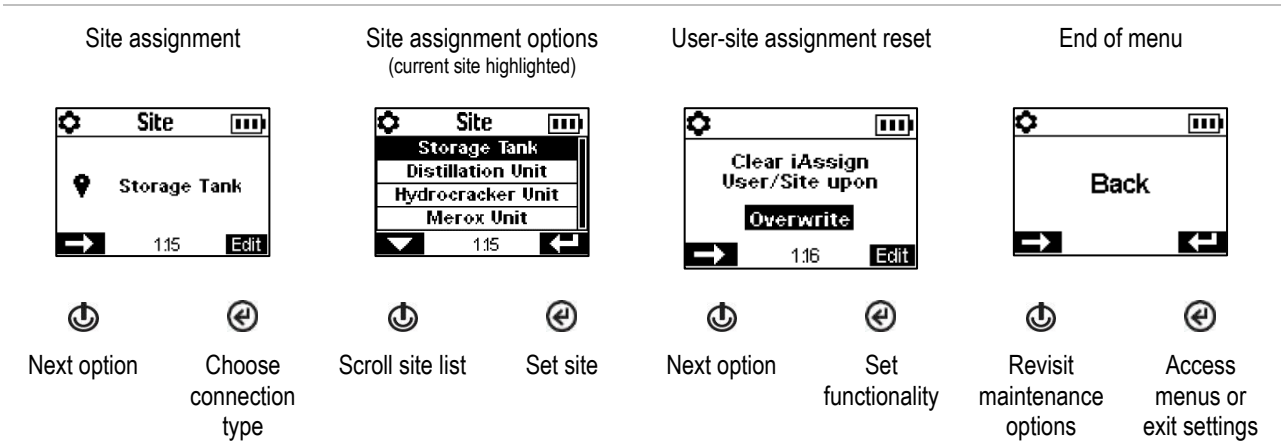


Figure 4.2.A Navigating and using maintenance options

Start-up menu

Control how the instrument will interact with its operator during start-up.

Prompt or don't prompt for the use of an iAssign tag.

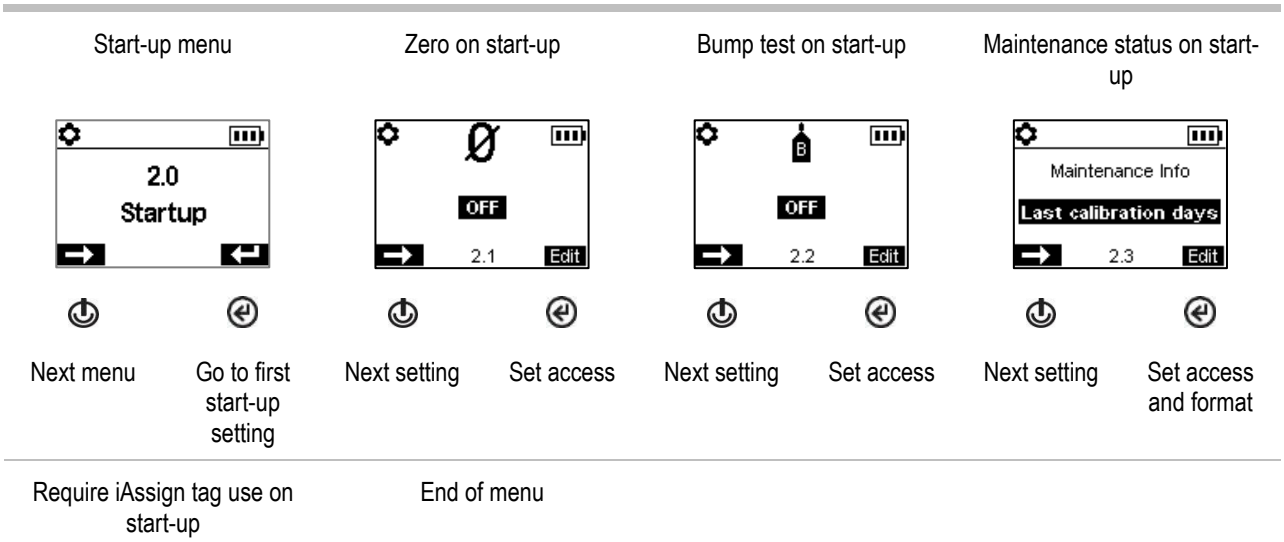
Permit or prohibit all-user access to each item listed below.

Maintenance utilities:

- Zero the installed sensors.
- Bump test the installed sensors.

Maintenance status message:

- No message
- The number of days until the next dock is due
- The number of days until the next calibration is due
- The number of days since calibration was last performed



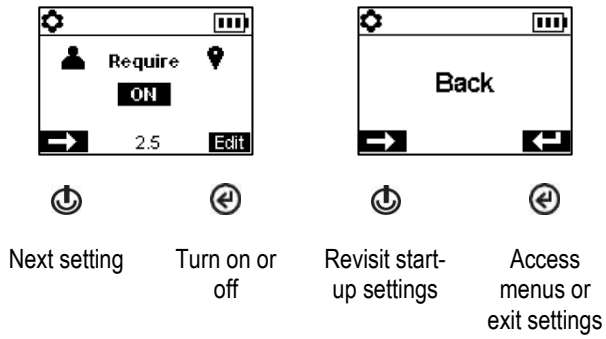


Figure 4.2.B Navigating and editing start-up settings

Operation menu

Control how the instrument will behave during operation.

Permit or prohibit all-user access, during operation, to each of the items listed below.

Utilities:

- Zero the installed sensors.
- Calibrate the instrument.
- Bump test the installed sensors.
- View and optionally clear each summary reading (peak, TWA, or STEL). *Note*: When an instrument operator clears any summary reading, the value is reset to zero and its time-related setting is also reset to zero.
  Note: If a CO_2 sensor is installed, it will be zeroed along with any other installed sensors *only if* the "Zero CO_2" setting is on.

Information:

- The instrument's current assignments for user, site, or both
- A maintenance message about scheduled docking or calibration activities
- The gas information for all installed sensors: the values for the gas alert and alarm setpoints, and the calibration gas and concentration

Set this functionality

- Permit or prohibit all-user access to the instrument's LENS Wireless peer list.
- Permit or prohibit the use of iAssign accessories during operation.
- Permit all-user power off or set the instrument for "always-on" operation*.
- Set the instrument to display the ambient air temperature in Celsius or Fahrenheit.

*Always-on functionality also requires a valid security code setting (see the settings menu 6.0 Admin).

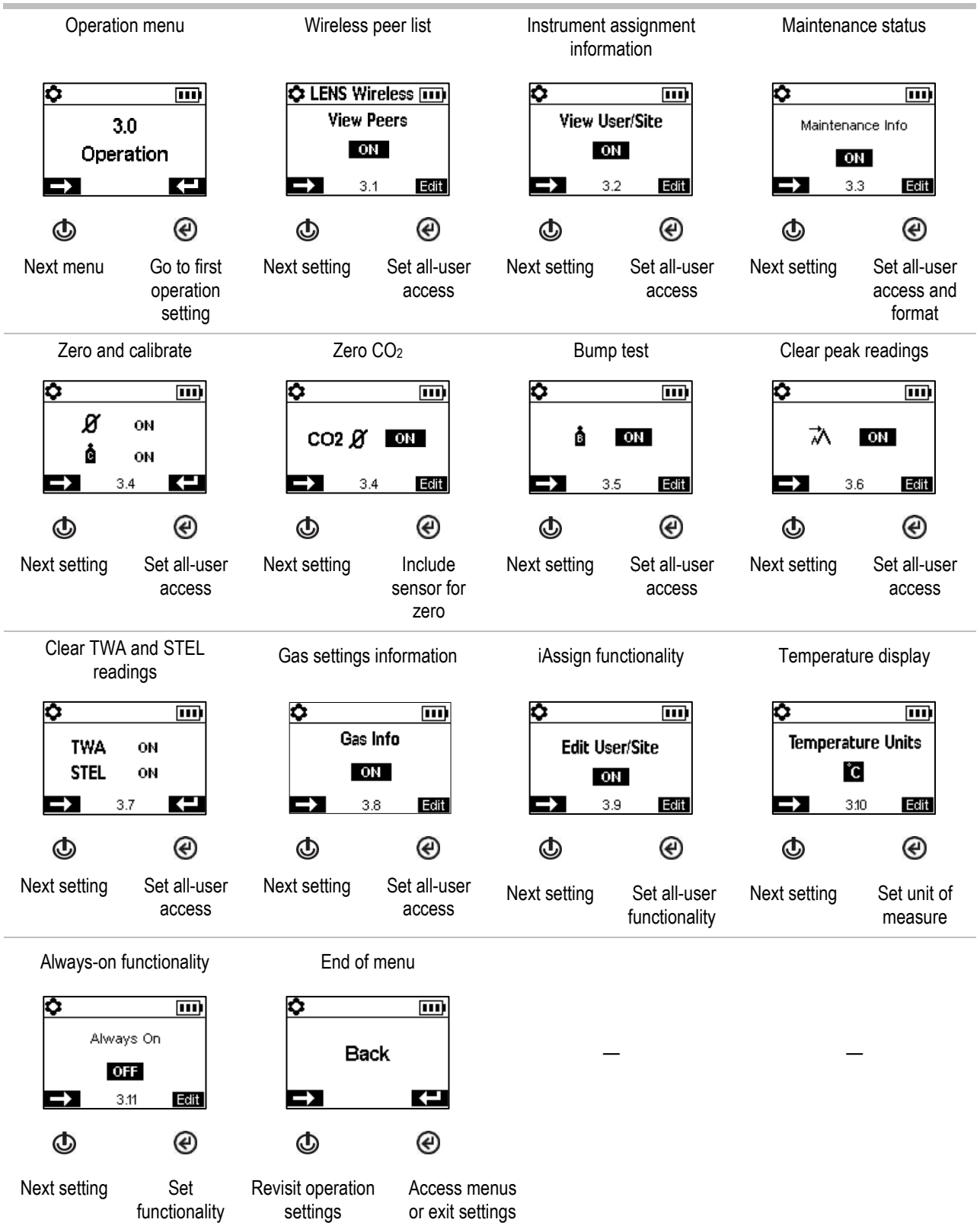


Figure 4.2.C Navigating and editing operation settings

Alarm menu

Control how the instrument will behave during alarms and some warnings.

Set for each sensor, the concentration of gas that will cause each possible gas event listed below.

- gas present, alert
- gas present, low alarm
- gas present, high alarm
- TWA
- STEL

  Note: The navigation will start with the first event setpoint for the *first sensor*; then the second event setpoint for that same sensor, and so on through the last setpoint for the sensor. The navigation will then go through the same pattern for the *next sensor*.

Set the TWA time interval for toxic sensor readings.

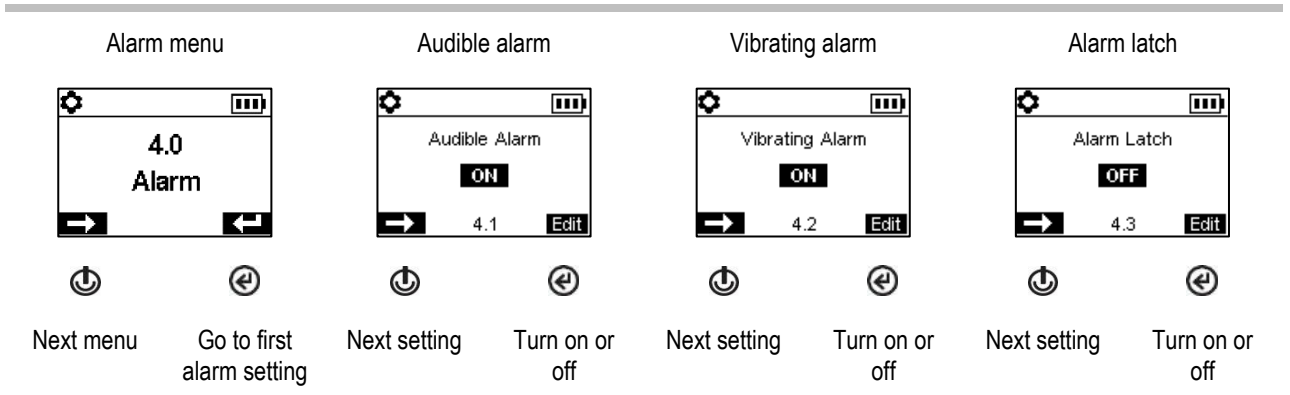
Permit or prohibit instrument power off during alarms.

Set the on-off functionality for the man-down feature; set the amount of time that will lapse between the man-down warning and its alarm.

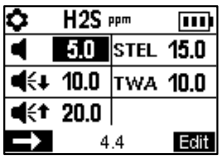
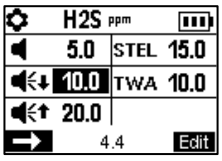
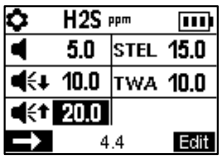
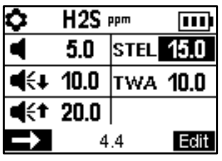
Set the on-off functionality for the proximity alarm. When set to on, the proximity alarm is activated when the instrument enters an iAssign Beacon restricted-access area where the Beacon's access level is higher than that of the current user's access level.

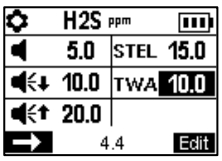
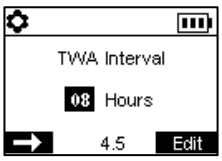
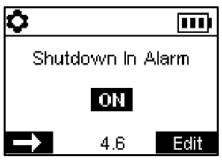
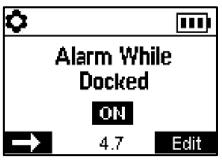
Set the on-off functionality for each option listed below.

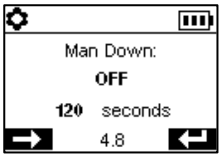
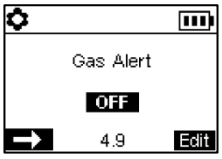
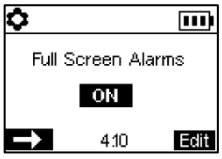
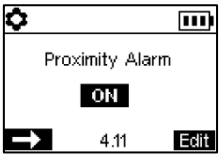
- audible alarm
- vibrating alarm
- full-screen alarms
- gas-present alert
- alarm latch
- alarms while docked



Alert and alarm setpoints (H2S shown)

Gas present, alert	Gas present, low alarm	Gas present, high alarm	STEL alarm
			
Next setting / Edit value	Next setting / Edit value	Next setting / Edit value	Next setting / Edit value

TWA alarm	TWA interval	Shutdown in alarm	Alarm while docked
			
Next setting / Edit value	Next setting / Edit value	Next setting / Turn on or off	Next setting / Turn on or off

Man-down warning and alarm	Gas-present alert	Full-screen alarms	Proximity alarm
			
Next setting / Turn on or off; edit delay value	Next setting / Turn on or off	Next setting / Turn on or off	Next setting / Turn on or off

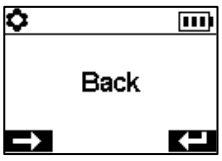
End of alarm settings			
	—	—	—
Revisit alarm settings / Access menus or exit settings			

Figure 4.2.D Navigating and editing alarm settings

Sensor menu

Depending on the installed sensors, display screens may vary.

Control settings related to calibration and bump testing:

- Choose the "quick" or "standard" process for calibration and bump testing.
  Quick process. This process allows for only one application of gas. It is well suited for installed sensor combinations that use a calibration gas cylinder of the "blended" type—one that contains the gas types and concentrations required for *all* installed sensors.
  Standard process. This process allows for more than one application of gas. It provides time—between sensors—for the change of cylinders. It is well suited for installed sensor combinations that require more than one calibration gas cylinder.
- Set calibration gas concentrations for each sensor and the correlation factor for an LEL sensor. View the location of each installed sensor and its span reserve percentages. *Note*: An indicator of a sensor's remaining life, the span reserve percentage will decline over time; when its value is less than 50%, the sensor will no longer pass calibration.

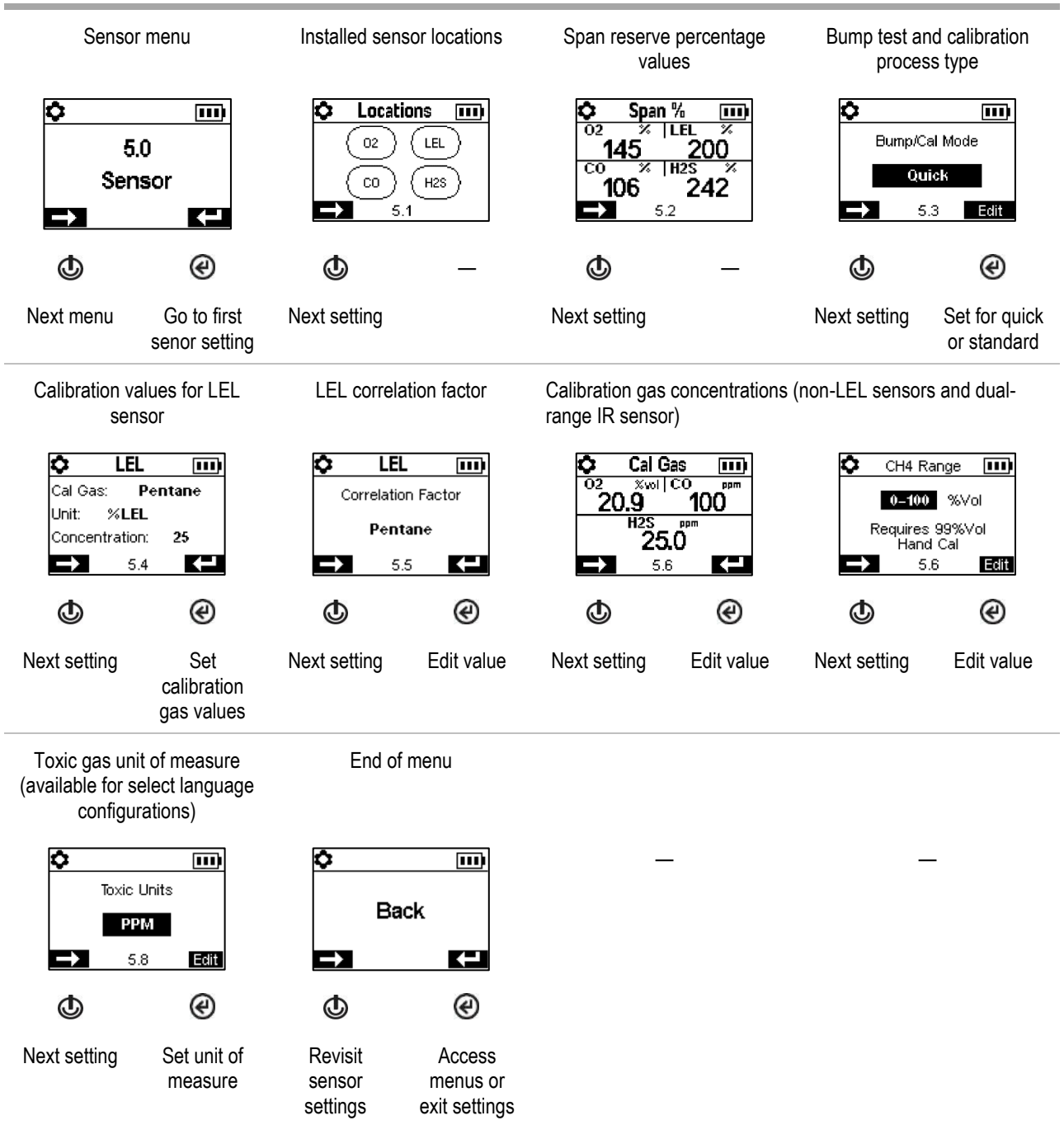


Figure 4.2.E Navigating and editing sensor settings

Admin menu

Control the ways in which an instrument will interact with its user and set time-based values that are related to the data-log entries and bump testing.

To help protect access to settings, set the instrument's security code value to any three-digit number from 001 to 999. A value of 000 will leave settings *unprotected* and potentially accessible all instrument users.

A security code of 001-999 is also required for the use of always-on functionality; if set to 000, an always-on unit can be powered off without a security code.

Sensors pass a bump test when they sense the specified percentage of calibration gas (or "pass limit") within the specified response-time setting. Set the bump test criteria for these two values:

- a pass limit value from 50 to 99%
- a response-time value from 30 to 120 seconds

Note: For calibration gas recommendations, see "Table 2.6, Sensor specifications".

Turn on or off each of these warnings: scheduled bump test due, scheduled calibration due, and scheduled dock (or "synch") due. For each warning that is set for on, set these two values:

- a warning type of audible only, visual only, or both audible and visual
- the maintenance interval (set in one-day increments for dock and calibration and half-day increments for bump test)

The confidence indicator emits a signal every 90 seconds to indicate to the user and others who are nearby that the instrument is powered on. If the indicator is set for on, choose a warning type of audible only, visual only, or both audible and visual.

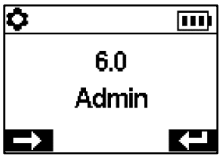
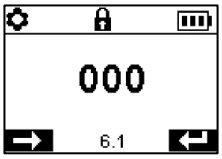
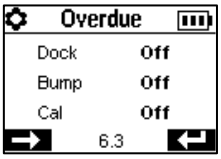
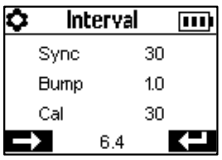
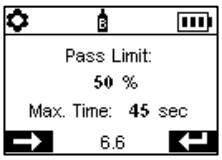
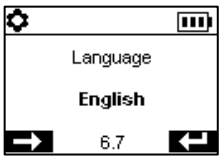
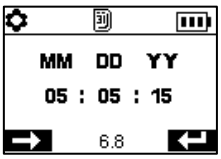
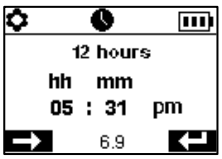
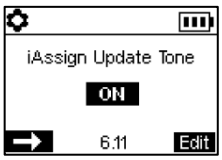
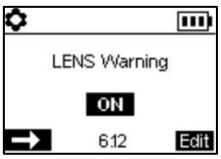
Set the LENS Warning to off or to on. When set to on, the instrument will warn its operator that it is not part of LENS group.

Set the iAssign warning to off or to on for user only, site only, or user and site. When set to on, the instrument will warn its operator of missing assignments.

Set the iAssign update to on or off. When set to on, the instrument notifies its user when iAssign user-site settings are changed.

Set the instrument's display language.

To support data-log integrity, set the date and time; these values are associated with gas-readings and event data that are saved to the data log.

Admin menu	Security code	Confidence indicator	Scheduled maintenance warnings
			
Next menu Go to first admin setting	Next setting Edit value	Next setting Turn off warning or set warning type	Next setting Turn off warnings or set warning types
Maintenance intervals	**Bump test criteria**	**Display-screen language**	**Current date**
			
Next setting Set interval (days)	Next setting Edit percentage and time	Next setting Choose display-screen language	Next setting Edit values
Current time	**iAssign warning**	**IAssign update tone**	**LENS warning**
			
Next setting Edit values	Next setting Turn off warning or set warning type	Next setting Turn on or off	Next setting Turn on or off

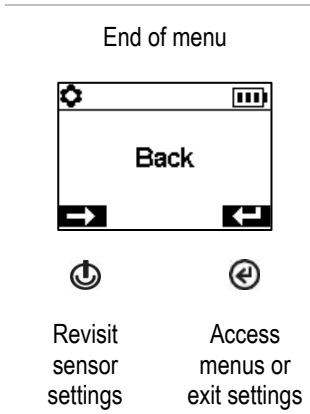


Figure 4.2.F Navigating and editing admin settings

Wireless menu

Control the instrument's LENS Wireless features.

- Set LENS Wireless to on or off.
- Determine whether or not the instrument will warn its user of peer-lost and last-peer occurrences.
- Set LENS Wireless data encryption to the default data-encryption key from Industrial Scientific or to a custom key*.

  Note: When any group has or gains a peer instrument that has a custom encryption key, all peer instruments will learn and use that custom key, until one of these things happens: the peer instrument is powered off, leaves the group, or its LENS Wireless is turned off.
- Set iNet Now to sync or not sync while the instrument is charging.

*Requires iNet Control or DSSAC from Industrial Scientific.

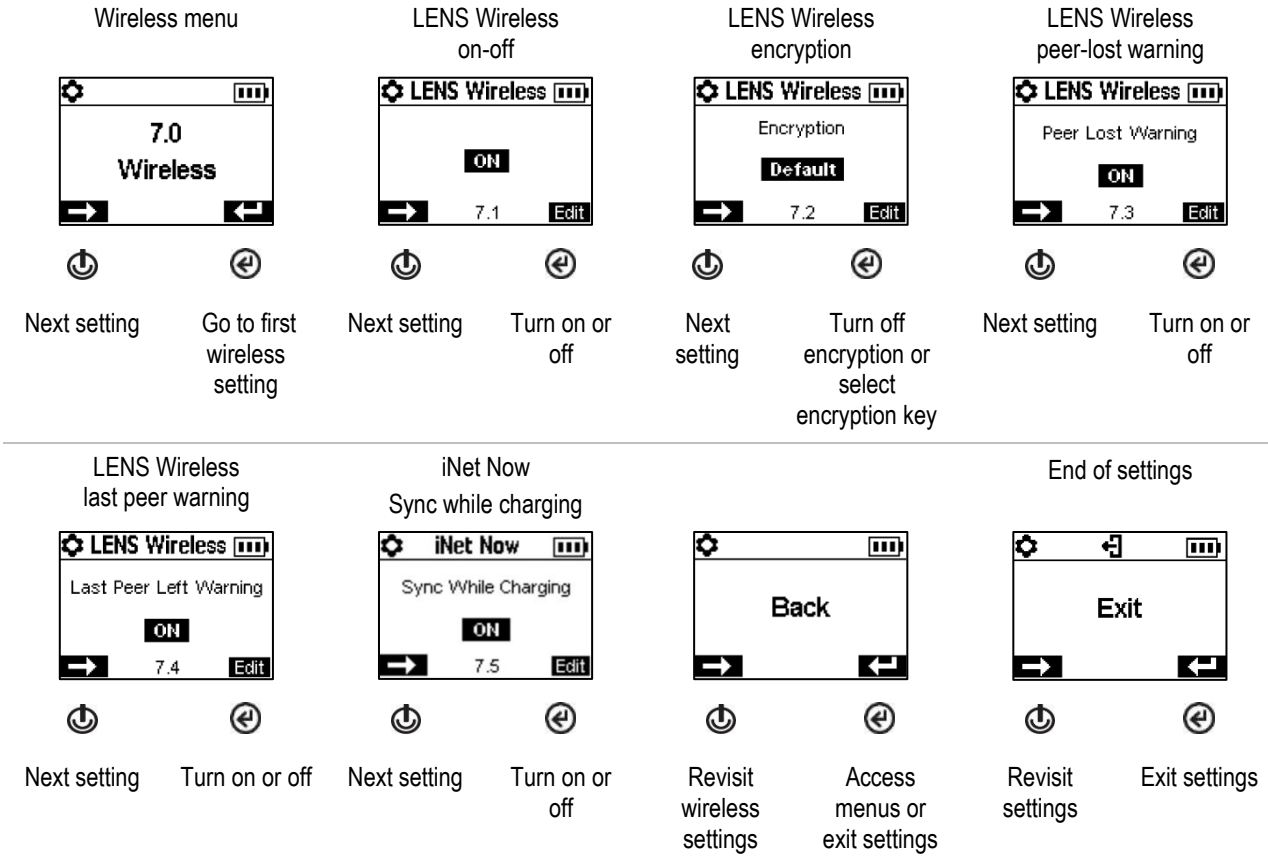


Figure 4.2.G Navigating and editing wireless settings

5

Operation

The Instrument Buttons

Ventis Pro Series instruments have three buttons, the power button, the enter button, and the panic button. During operation, the buttons are used as described below in Figure 5.1

Panic ⚠

Press and hold to turn on (or off) the instrument's high-level alarm.

The panic alarm can help alert others nearby of distress. For example, the instrument operator has tripped, fallen, been otherwise injured, another person has been injured, or there is some concern about in-field circumstances.

Power ⏻

Press to view information and access utilities.

Press and hold to power on or off the instrument.

Enter ↵

Press and hold to reset a latched alarm.

Press to start a utility.

⏻ + ↵

To complete an instrument self-test, simultaneously press and hold, then release both buttons.

Figure 5.1 Using the buttons during operation

The Instrument Display

After a unit has been powered on—its self-test and start-up sequence successfully completed—the gas readings should display. This display screen is referred to as “Home”, which will generally look like the samples shown below for a five-gas instrument (enlarged for detail) and a four-gas instrument. During operation, the home screen will display unless the instrument is using the display to provide information about an alarm, warning, indicator, or status item, or the instrument operator has accessed another option.

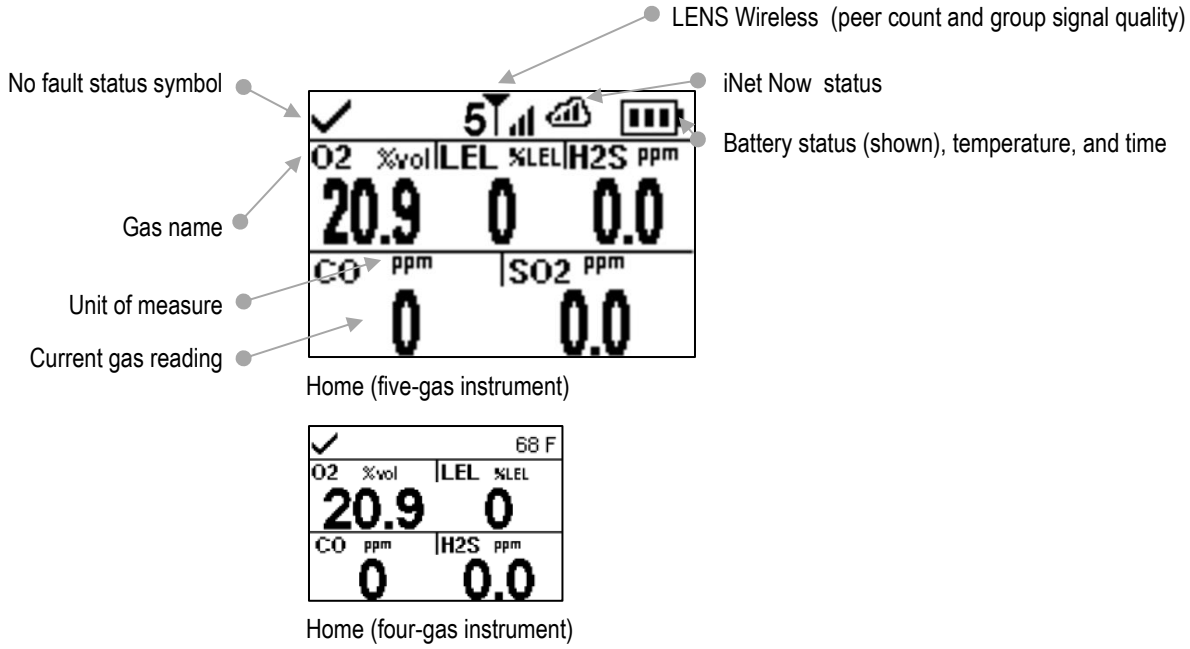


Figure 5.2 Home

Operating the Instrument

From the home screen, a series of display screens may be accessible depending on the unit’s settings, and may include any or all of the options listed below.

Information and LENS Wireless

The LENS Wireless peer list provides access to:

- The list of peer instruments* in the group.
- The gas readings for any peer instrument.
- The option to leave the existing group.

*If a peer instrument is not assigned to a user name, the instrument's serial number or MAC address will be shown in the peer list.

Other available information may include the following:

- Number of days until the instrument is due to be docked.
- Number of days until the instrument is due for calibration or the number of days since its last calibration.

- Gas-settings information (alert and alarm setpoints and calibration gas concentrations for the installed sensors).
- Assignment information (the company, user, and site assigned to the instrument).

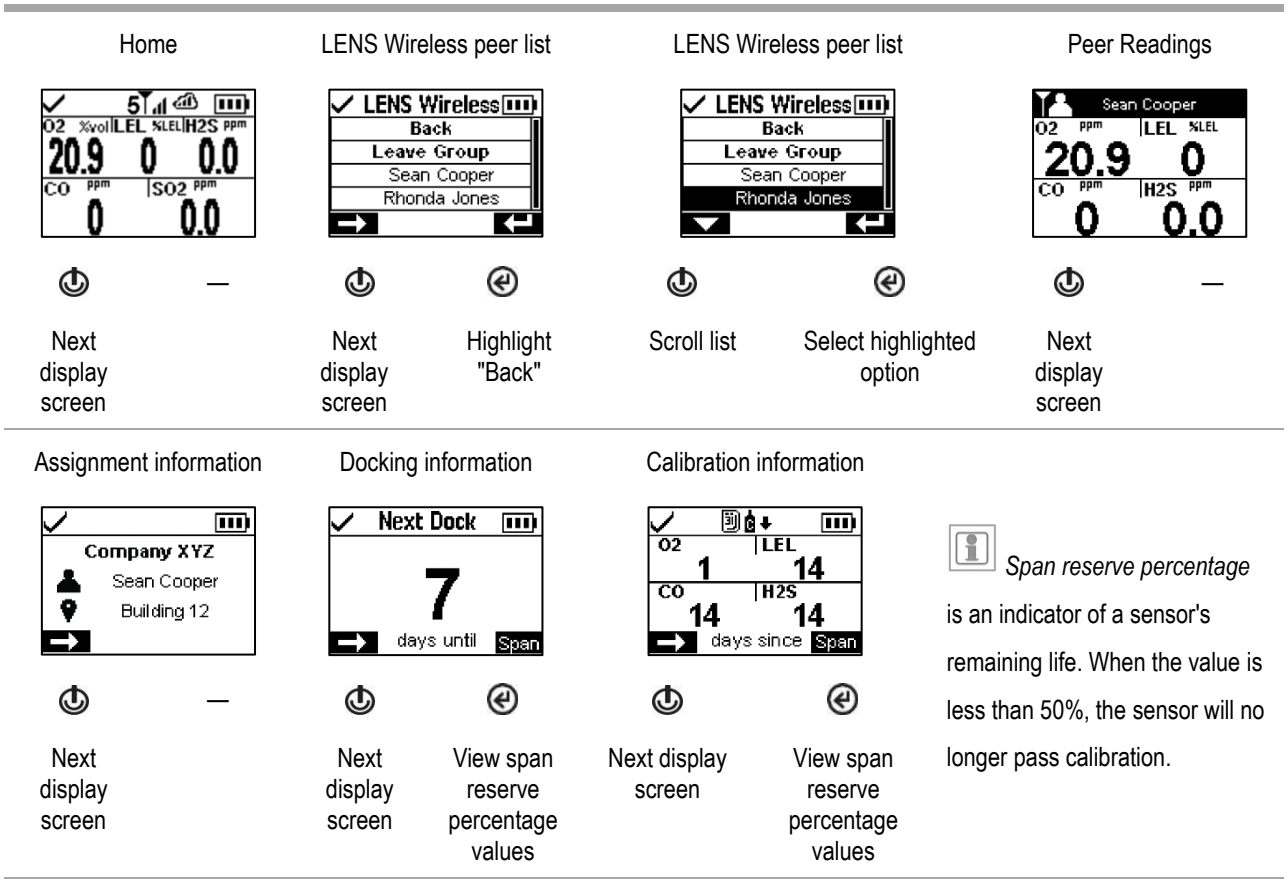
Utilities

Utilities give the instrument operator opportunities to complete maintenance procedures, which may include:

- Zero the installed sensors and optionally calibrate the instrument.
- Bump test the installed sensors.
- View and optionally clear the peak readings.
- View and optionally clear the TWA readings.
- View and optionally clear the STEL readings.

Note: When a reading is cleared, its value is reset to zero and its time-related setting is also reset to zero.

Figure 5.3 (below) describes and illustrates how to access information and utilities. Available options will vary based on instrument settings. The sample display screens shown here feature 3-, 4-, and 5-gas formats.



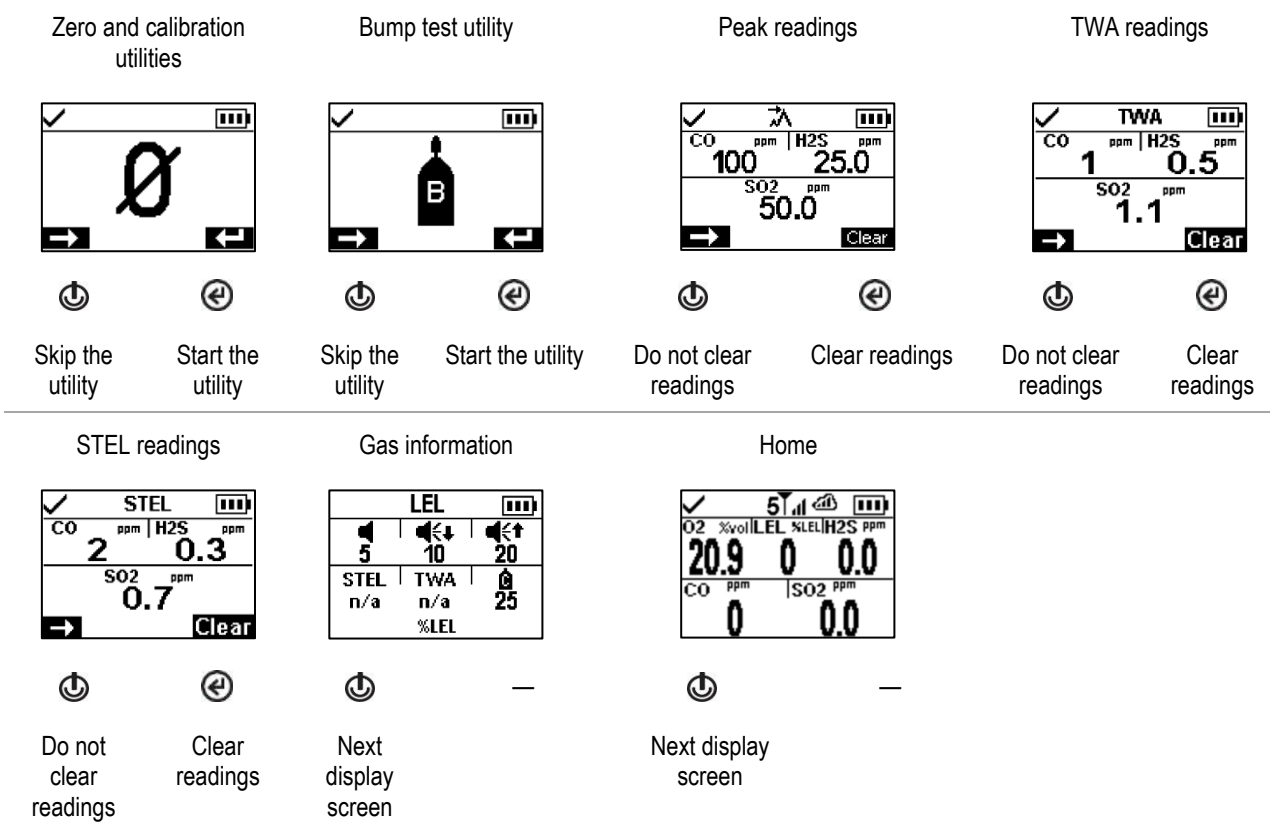


Figure 5.3 Operation instruction

Wearing the Instrument

The instrument may be worn with its factory-installed clip, which is solely intended for attachment to a garment.

As shown below, the clip should be securely fastened and attached in a manner that ensures the instrument's sensor ports are fully exposed to the air. No part of the instrument should be covered by any garment, part of a garment, or other item that would restrict the flow of air to the sensors or impair the operator's access to the audible, visual, or vibration alarms.

Suspender clip

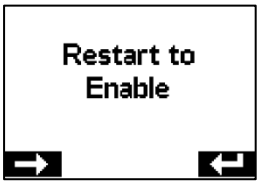
Lift the clip cover.

Position the garment between the clip's upper and lower teeth.

Press down on the clip cover to secure the clip in place.

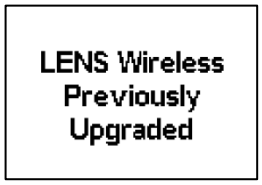
Using Upgrade Cards

Upgrade cards can be used to add the instrument functionality needed for LENS Wireless. Simply touch the card to the front of the instrument. Then, follow the on-screen instructions and look for one of these results.



The upgrade was successful. Power off the instrument, then power it on. The feature-related symbol should now appear on the display screen; otherwise, see a supervisor.

The upgrade was not successful because the card's upgrades have all been used. Retry the upgrade with another card.



The instrument is equipped with the functionality. The instrument's related settings should be reviewed to ensure they are correct (e.g., LENS is set to "on").

Using an iNet Now connected instrument

If the instrument in use is set to send data to iNet Now, periodically check the instrument's status bar for the cloud status symbol. If none appears or if the cloud is shown with a line through it, see a supervisor.

User-site Assignments

iAssign™ tags can be used to change the instrument's user-site assignments. Each tag can contain a user name, site name, or both.

Note: An instrument's settings may or may not permit the use of iAssign technology.

iAssign tag

iAssign tap area

To assign the instrument to the user-site data that is on an iAssign tag, touch the tag once to the instrument's iAssign tap area.

To remove the assignment, use any one of these options:

- Touch the same tag to the instrument's iAssign tap area.
- Touch a different tag to the instrument's iAssign tap area.
- Power off the instrument.
- Dock the instrument to synchronize instrument settings with their current values from iNet Control, DSSAC, or Accessory Software.

Results (success and failure shown)

Watch and listen for success or failure indicators.

Success

- 
- blue lights
- current user and site

Failure

- 
- red lights
- "Invalid Tag" message

If the assignment failed, retry the assignment.

Figure 5.4 Using iAssign tags

Using LENS Wireless

Overview

LENS™ Wireless (Linked Equipment Network for Safety) is used to form wirelessly connected instrument "groups". A LENS group can include Ventis Pro Series instruments, Radius™ BZ1 Area Monitors, or both. Instruments that are connected through a LENS group are known as "peer instruments". Peer instruments share alarms, allowing instrument operators to learn of nearby hazardous conditions and the identities* of colleagues whose instruments are in alarm. LENS also allows instrument operators to view peer-instrument gas readings on demand.

Instruments in a LENS group communicate in a nonlinear manner. With the location of units A through F as shown below in Figure 5.5, messages can travel among instruments that may be separated by distance or a structure (gray bar). The following also apply to Ventis Pro instruments that are in a LENS group:

- To maintain membership in the group, use this guideline to assess potential signal reach: a line-of-sight distance up to 100 m (109 yd) between two Ventis Pro instruments that are facing each other.
- Check the home screen to assess the group's signal quality. From lowest to highest signal quality, the symbols are: , , , and .
- If an instrument becomes separated from its group, its display screen will feature a "Group Lost" message; its peer instruments, a "Peer Lost" message (if settings permit). When lost from its group, the instrument will make multiple attempts over five minutes to rejoin the group.

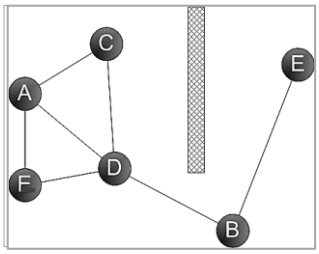


Figure 5.5 LENS group peer-instrument locations

*Requires valid current user assignment; otherwise, the peer instrument's serial number or MAC address will display.

How to form, join, or leave a LENS Wireless group

Forming and joining a group

Among LENS-enabled instruments that have the LENS setting turned on, peer-instrument groups can be formed or joined in the field in the ad hoc manner described below in Figure 5.6.

When an instrument is already in a LENS group, but tries to join another, the instrument will prompt its user to confirm the change; otherwise, it will simply signal its user of the joining-attempt result.

Result	LED color	Tone	Message	Information and options
Successful	Blue		—	Check the home screen for the peer count and signal quality symbol.
Pending	Blue		Leave Existing Group?	If "yes" is selected, the instrument will disconnect from its current group, then, attempt to join the new group.
Not successful	Red		Binding Failed	Retry.
Not successful	Red		Network Full	The group has reached the maximum number of peers. See a supervisor for assistance.
Not successful	None	None	—	Try again. If unsuccessful, at least one of the instruments is not upgraded to LENS Wireless or has LENS set to off. See a supervisor for assistance.

Start

To join together Ventis Pro Series instruments, hold two instruments together—speaker to speaker—for approximately five seconds or until the instrument emits an ascending tone to indicate success.

To join a Ventis Pro Series instrument to a Radius BZ1 instrument, choose the "Join new peer" option on the Radius; this is accessible from the Wireless menu's Wireless Peer options.

Then, point the Ventis Pro IrDA window at Radius IrDA window. Hold the Ventis Pro very close to the Radius for approximately five seconds or until the Ventis Pro emits an ascending tone to indicate success.

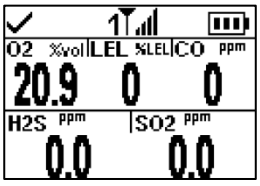
—

Joining in progress

The joining process requires up to 30 seconds. During that time, the Ventis Pro will periodically display its gas readings.

Leave group confirmation

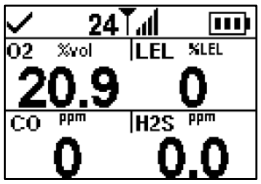
If the Ventis Pro is in an existing group, it will require confirmation from its user to leave that group. This allows the instrument to join the new group.



Once connected, the instrument's home screen will indicate the number of peer instrumentsand group signal quality.

Home

Repeat



Add peers to the group as needed. The number of peers displayed will increase and decrease as instruments join or leave the group. The total number of peers that can show on an instrument's display is 24, which means the group has the maximum number of peer instruments: 25. If iNet Now will be used, limit group size to a total of six instruments.

Figure 5.6 Form or join a LENS Wireless group

Leaving a group

There are three ways for an instrument to *intentionally* leave a group without activating group-related warnings.

- The operator accesses the instrument's LENS Wireless options and chooses the "Leave Group" option (see Figure 5.7).
- The instrument joins another group.
- The instrument is docked or powered off.

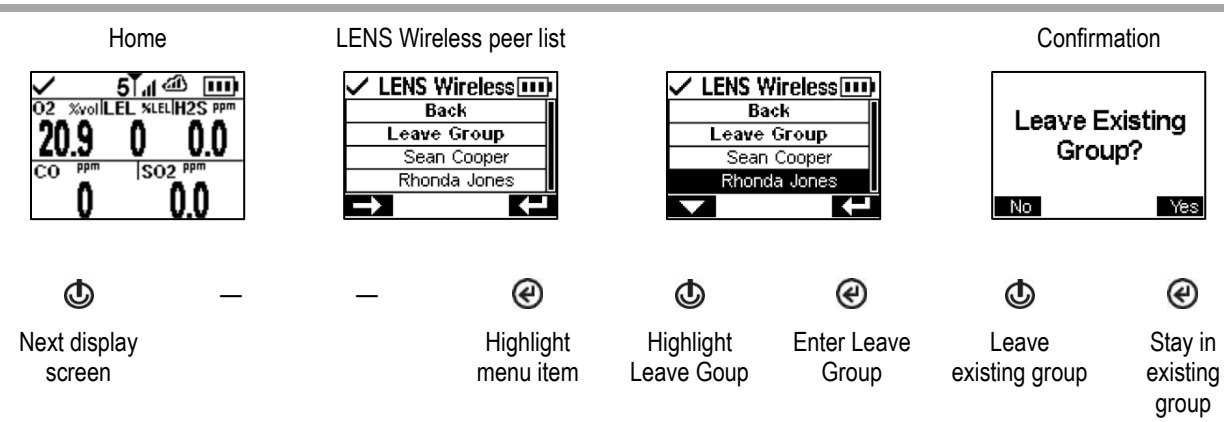


Figure 5.7 Leave a LENS Wireless group

Peer gas readings

Figure 5.8 describes how to access the gas readings of a peer instrument.

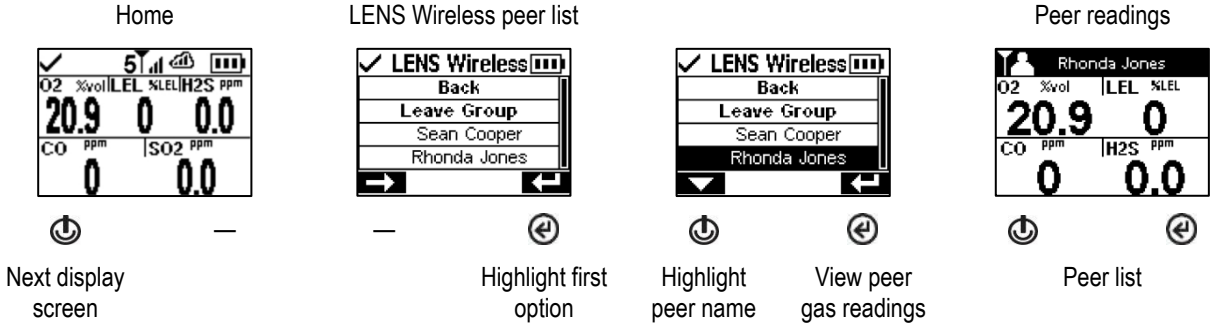


Figure 5.8 Access peer gas readings

Alarms and Warnings At-a-glance

Alarms

Alarms notify the instrument operator of danger.

The Ventis Pro Series instruments have alarms of four intensities, high, low, peer high, and peer low. Alarms are persistent. They turn off when the alarm-causing event is no longer detected, unless they are

latched. A latched alarm can be turned off by pressing . LENS peer-alarm signals can be turned off by pressing ; details will remain visible on the display screen.

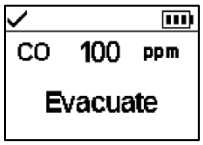
When all alarm signals* are on:

- The *high* alarm is bright red in color; it uses two different sounds and a vibration. It is fast-paced.
- The *low* alarm is similar to the high alarm, but includes blue as well as bright red light. It is medium-paced.
- *Peer alarms* are similar to the low alarm, but are slower in pace.

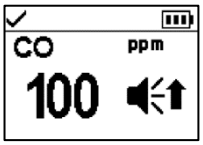
*Signals (visual, audible, and vibration) vary based on instrument settings.

Information about gas alarms is presented in different formats on the display screen. In addition to the "readings" and "event type" formats, an instrument user may also see "alarm action" (instructional) or "full-screen" alarm messages. Sample display screens are shown below for instrument alarms and peer alarms.

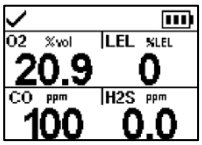
Alarms (sample display screens for 100 ppm CO)



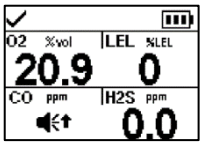
Alarm action format (Evacuate shown)



Full screen alarm format



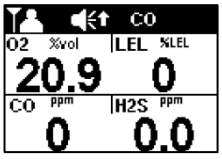
Readings



Event type

LENS peer alarms (sample display screens)

Peer alarm (panic shown)



Peer alarm (gas present, high shown)

and indicate the in-alarm instrument is a Ventis Pro Series monitor or a Radius BZ1 Area Monitor, respectively.

When an instrument is in alarm, its display will feature a symbol that indicates the event type. LENS peer alarms use the same or similar symbols; samples are shown below.

High alarm	Event
OR, -OR	Gas present (over-range event)
	Gas present (high-alarm event)
STEL	STEL event
ERROR 408	System error
	Critical low battery
; MAN DOWN	Man down; Peer man down

 PANIC ALARM	Panic; Peer panic
Low alarm	
	Gas present (low-alarm event); Peer gas present (low-alarm event)
TWA	TWA event

Warnings

Warnings notify the instrument operator of a condition that needs attention.

Warnings turn on and off repeatedly. The more urgent the warning, the shorter the time between on-off occurrences: a warning that repeats every two seconds is more urgent than a warning that repeats every thirty seconds. Warnings persist until the issue is resolved.

When all signals* are on, a warning appears as a short burst of red and blue light mixed with sound and vibration.

Sample display screens are shown below for instrument warnings and peer warnings.

*Signals (visual, audible, and vibration) vary based on instrument settings.

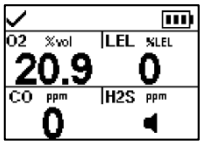
Warnings (sample display screens)

Instrument warnings

Man-down warning

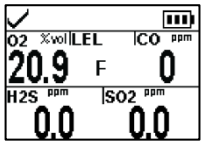
120-second pre-alarm countdown.

Gas-present alert



H_2S gas-present alert.

Instrument issue

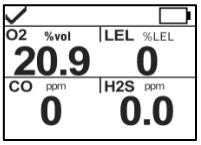


LEL sensor failure.

Maintenance required

Bump test due for CO and H_2S.

Low battery

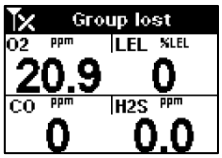


Other Warnings

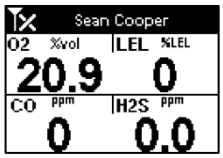
iAssign warning

LENS Wireless warnings

Group lost



Peer lost



No peers

iNet Now connection lost

6

Alarms, Warnings, and Notifications

Overview

This chapter provides in-depth information about alarms, warnings, and notifications; portions of this text appear in abbreviated form elsewhere within this product manual.

Alarms notify the instrument operator of danger.

Warnings notify of a condition that needs attention.

Indicators notify of a status (e.g., confidence indicator).

Take seriously all alarms, warnings, and indicators, and respond to each according to company policy.

Alarms

Alarms notify instrument operators of danger. Alarm intensity is based on the event type and its source. Ventis Pro instrument have alarms of four intensities; from highest to lowest they are:

- High alarm
- Low alarm
- Peer high alarm (LENS Wireless)
- Peer low alarm (LENS Wireless)

When all signals* are on, the following apply:

- The *high alarm* features only red light and is fast-paced.
- The *low alarm* is similar to the high alarm, but includes blue as well as red light. It is medium-paced.
- *Peer alarms* are similar to the low alarm, but are slower in pace.

*Signals (visual, audible, and vibration) vary based on instrument settings.

Alarms are persistent: they turn off when the alarm-causing event is no longer detected; however, if the instrument's alarm latch setting is on, an alarm will remain on until the user presses ⏎ to turn it off. A peer

alarm can be acknowledged by pressing ⏎, which turns off alarm signals, but preserves details on the display; if two or more peer alarms are active, they will *all* be acknowledged with a single press of the enter button, ⏎.

When the instrument has more than one active alarm (or active peer alarm), the display will cycle through messages for each event; however, when the instrument is in alarm, it will not display peer alarms.

Instrument alarm events are distinguished from one another through the use of symbols (see Table 6.1) that appear on the display screen. Peer events use the same or similar symbols within peer-alarm messages.

Table 6.1 Alarm events (list)

Alarm symbol	Alarm level	Alarm event	Description
Instrument events			
OR, -OR	High	Gas present (over-range)	The detected gas concentration is outside the sensor's measuring range.
	High	Gas present (high-alarm)	The detected gas concentration exceeds the high-alarm setpoint.
STEL	High	STEL	The cumulative measure of a detected gas exceeds the STEL setpoint.
	High	Man down	The instrument has been stationary for the set period of time. To turn off the alarm, press and hold ⏎.
	High	Panic	The user has pressed the instrument's panic button and held it long enough (approximately 3 seconds) to turn on the panic alarm. To turn off the alarm, press and hold ⏎.
ERROR 408	High	System	The instrument is in failure (error code 408 shown here) and is not operational.
	High	Critical low battery	The instrument has shut down and is not operational.
Access Denied	High	Proximity	The instrument has entered an iAssign Beacon-restricted area where the Beacon's access level is higher than that of the current user's access level.
	Low	Gas present (low-alarm)	The detected gas concentration exceeds the low-alarm setpoint.
TWA	Low	TWA	The cumulative measure of detected gas exceeds the TWA setpoint.
LENS peer events			
	Peer high	Peer gas present (high-alarm)	
STEL	Peer high	Peer STEL	
	Peer high	Peer man down	
	Peer high	Peer panic	For any peer alarm, turn off alarm signals by pressing and briefly holding ⏎; the alarm message will remain on display in the status bar.

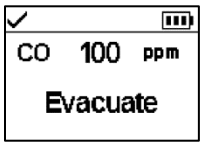
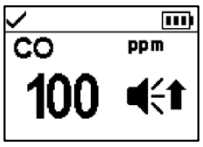
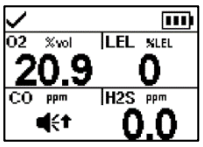
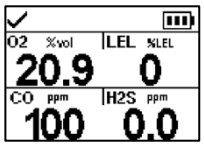
Table 6.1 Alarm events (list)

Alarm symbol	Alarm level	Alarm event	Description
	Peer low	Peer gas present (low-alarm)	
TWA	Peer low	TWA	

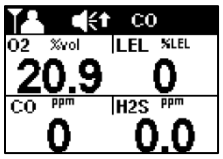
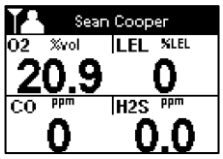
For some instrument alarms, the display screen provides alarm details in multiple formats, which alternate during the event. For example, a high-alarm gas event has three possible display formats as described and shown below for an instrument that is in high alarm caused by the CO sensor reading, which is now at 100 ppm. A peer alarm caused by the same event is also featured below.

Display screen formats

Instrument alarms

Instruction	Full-screen alarm	Event	Readings
			
If the instrument is set to provide the user with instruction, the instruction format will be displayed ("Evacuate" shown here); otherwise, the full-screen alarm format will be shown.		The symbol indicates the event type and identifies the in-alarm sensor. Current readings are provided for all other installed sensors.	Provides the current reading for the in-alarm sensor and all other installed sensors.

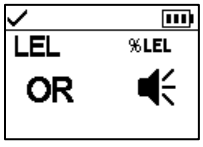
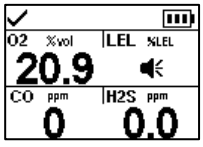
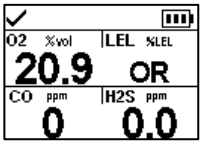
LENS peer alarms

Event	User		
		—	—

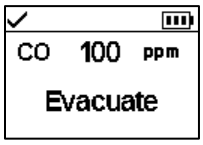
Sample display screens are reproduced below for each event that can cause an alarm. For any event that can feature multiple display formats, each format is shown here; they will alternate on the display screen during the alarm event.

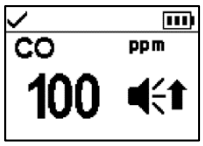
Alarm level: High

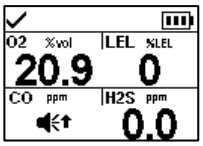
Gas present, over-range alarm

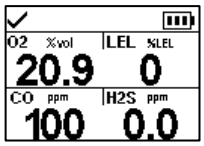
			—

Gas present, high alarm

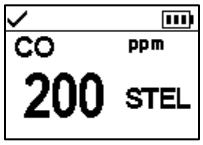


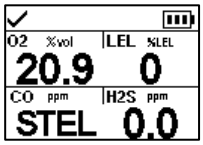


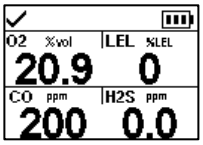




STEL alarm







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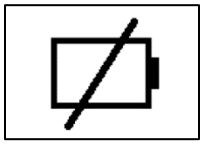
Critical low battery alarm



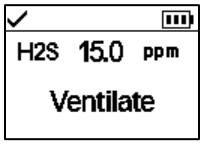
System alarm

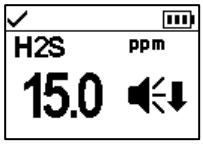
Man-down alarm

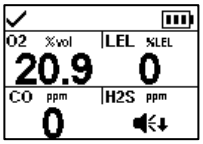
Panic alarm

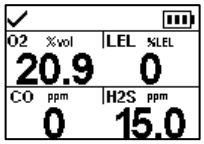
Alarm level: Low

Gas present, low alarm

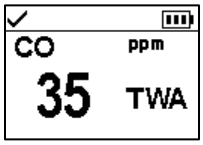


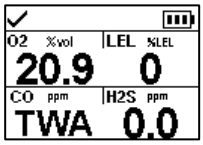


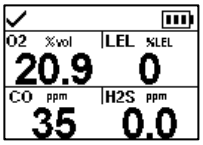




TWA alarm



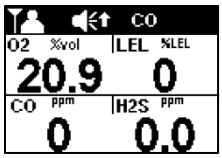




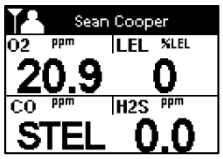
—

Alarm level: LENS peer high

Peer gas present, high alarm



Peer STEL



Peer panic alarm

Peer man down

Alarm level: LENS peer low

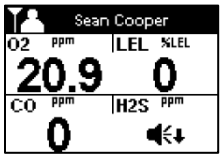
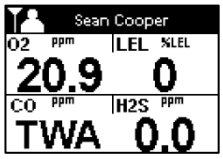
Peer gas present, low alarm	Peer TWA		
		—	—

Figure 6.1 Alarm events (display screens)

Warnings

Warnings turn on and off repeatedly. The more urgent the warning, the shorter the time between on-off occurrences: a warning that repeats every two seconds is more urgent than a warning that repeats every thirty seconds.

Warnings persist until the event is resolved. In some cases, an unresolved warning will cause an alarm. For example, if the man-down warning turns on and the instrument operator does not turn it off, the instrument and its signals will change from warning status to alarm status. Similarly, a low-battery warning that is not resolved will change to alarm status indicating a critical low-battery condition.

When all signal* settings are on, warnings appear as a short burst of blue and red light mixed with sound and a vibration.

As with alarm events, warnings are distinguished from one another on the instrument display (see Table 6.2 below).

For LENS-group peer instruments, when an instrument can no longer connect with any instrument in its group, it is said to be "lost"—not within range of any peer-instrument. These warnings will occur:

- The instrument will activate its "group lost" warning to indicate to its operator that he or she is no longer connected to the group. It will continually attempt to rejoin the group for five minutes.
- The peer instruments will activate the "peer lost" warning, which will identify the name** of the lost peer, the instrument user who has lost his or her connection to the group.

*Signals (visual, audible, and vibration) vary based on instrument settings.

**Requires valid user assignment.

Table 6.2 Warnings (list)

Symbol	Warning	Description
⚠ MAN DOWN	Man-down	The instrument has not moved for the set period of time. To turn off the warning, move the instrument.
🔊	Gas alert	A detected gas concentration may be approaching alarm levels. To turn off the warning, press and hold ⏎.
↓O2	LEL-Low O_2	LEL and O_2 sensors are installed and the concentration of O_2 is insufficient for LEL sensor functionality.
F	Sensor failure	One or more sensors is not working.

Table 6.2 Warnings (list)

Symbol	Warning	Description
	Instrument maintenance required (bump test shown)	The instrument is in need of some form of maintenance (calibration, bump test, etc.).
	Low battery	The instrument's battery is low; replace or charge the battery.
	iNet Now connection lost	The instrument is set to send data to iNet Now, but cannot do so because no wireless signal is available.
	Peer lost	A peer instrument has become disconnected from the LENS group without using the "Leave Group" option.
	Group lost	The user has *not* used the "Leave Group" option, but has become disconnected from the LENS group; the instrument may be out of range from all other instruments in the group.
	No peers	The instrument is not connected to a LENS group.
	Last peer	All peer instruments have used the "Leave Group" option. The instrument is no longer connected to any LENS-group peer instruments.

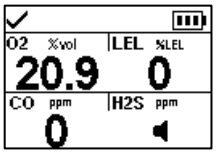
Display-screen reproductions are shown below for each condition that can cause a warning. For any warning that features multiple display formats, each format is shown; they will alternate on the display screen during the event.

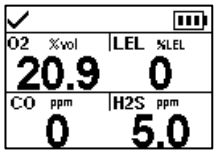
Man-down warning

(120 second countdown to alarm shown here)

Gas alert

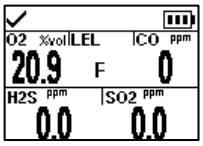
(5.0 ppm H_2S shown here)





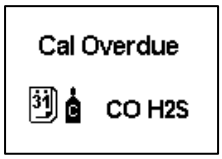
Sensor failure warning

(LEL shown here)

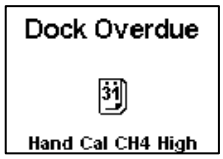


Maintenance required warnings

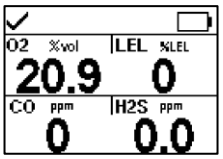
(Calibration due for CO and H_2S)

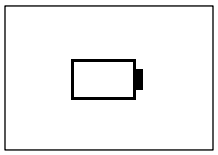


(Dock overdue; manual calibration required for CH_4 High)



Low battery warning





Other Warnings

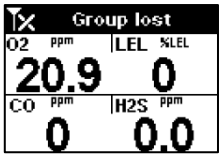
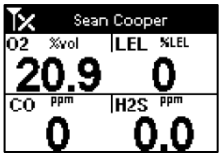
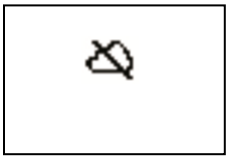
iAssign warning	Group lost (LENS Wireless)	Peer lost (LENS Wireless)	No peers (LENS Wireless)	iNet Now connection lost
				

Figure 6.2 Warnings (display screens)

Indicators

Most indicators turn on once, then off; only the confidence indicator persists, repeating every 90 seconds. If all signal* settings are on, indicators will look and sound like this:

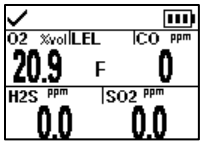
Indicator	Status	Color	Sound
User or site assignment, calibration, or bump test	Success	Blue	♪♪♪
User or site assignment, calibration, or bump test	Failure	Red	♪♪♪
Confidence indicator	Instrument on	Blue	Beep

*Signals (visual, audible, and vibration) vary based on instrument settings.

Failures and Errors

Some failures and errors are easily resolved by qualified personnel (see Table 6.3 below). For other errors or failures, contact Industrial Scientific for assistance.

Table 6.3 Failures and errors



The sample display screen (left) indicates a sensor failure. The position of the "F" means it is the LEL sensor that is in failure. As noted below, different abbreviations or symbols are used to indicate other failures and errors.

Symbols	Cause	Recommended actions
F only	The sensor is in a general state of failure and is not operational.	Power off the instrument, then power it back on. If the failure persists, check the sensor for proper installation.
ERR	The sensor is installed in the wrong location.	Install the sensor in its correct location.
ØF	The sensor failed the zero process.	Repeat the zero process.
BUMP and **F**	The sensor failed bump testing.	Calibrate the instrument, then complete a bump test.
CAL and **F**	The sensor failed calibration.	Calibration results indicate the sensor's span reserve percentages. When that value is less than 50%, the sensor will not pass calibration and is due for replacement. If the span reserve percentage indicates the sensor is greater than

Table 6.3 Failures and errors

			50% check for the following possible causes for the failure. • Ensure the calibration cup is compatible with the instrument and is correctly and securely placed on the instrument. • Check the tubing for splits, blockages, or damage. • Ensure the tubing is secured to the calibration cup and the cylinder's regulator. • Ensure the cylinder is not empty and contains the required gas concentrations. If desired, repeat the calibration process.
	! and gas reading	A sensor that was operating in DualSense has failed.	The remaining sensor is operating as a single sensor. Respond according to company safety policy.

When a failure is caused by conditions other than those listed above, an error code will display. Some indicate a possible installation error or compatibility issue; qualified personnel may attempt to resolve these and other errors (see Table 6.4 below). For all other error codes, contact Industrial Scientific for assistance.

Table 6.4 Critical errors

The display screen reproduction shown here (left) is an example of a critical error. The instrument is put into a state of failure until the error is resolved. The 408 code indicates a specific issue; different codes are used to indicate various failures.

Error code	Cause	Possible resolution
406	A sensor is installed in the wrong location.	Check the sensor type and install it in its correct location.
408	No sensors are installed or the installed sensors are not detected by the instrument.	Check the installed sensor for proper installation, correct location, and compatibility.
490	A sensor may have become disconnected from the circuit board.	Check for a loose or dislodged sensor, and for damage to the sensor pins and their board receptors.
470	An incompatible battery is installed.	Check the installed battery's part number for compatibility; install a compatible battery if needed.

7

Maintenance

Guidelines

This chapter provides instruction for manually completing these utilities: bump testing, zeroing, and calibration. These procedures can also be completed using compatible Industrial Scientific docking stations and accessories that are supported by iNet Control, DSSAC, or Accessory Software. Elsewhere in this product manual (Chapter 1), are the definitions and recommended practices for each procedure.

Use these guidelines to prepare for manually completing a zero, calibration, or bump test.

- Work in an area known to be nonhazardous.
- Use certified Industrial Scientific calibration gas.
- Choose calibration gas cylinders that are suitable for the installed sensors and their calibration gas settings, and for the instrument's process-type setting ("quick" vs. "standard").

  When instruments are set to the "quick" process type, one application of gas is permitted. This setting is usually the choice for applications in which one calibration gas cylinder contains all the required gases.

  When set to the or "standard" process type, it is often because more than one gas cylinder is required to calibrate or bump test all the installed sensor types. For example, a cylinder that contains more than one gas may be suitable for three of the installed sensors while the fourth sensor may require a gas that is not contained in that cylinder. During the standard process, the instrument will prompt its user for the application of each gas and, between gases, will allow time for a change of cylinders.

Process At-a-glance

Whether bump testing or calibrating manually, the basic steps are:

- Gather the needed supplies.
- Prepare the gas cylinder for use.
- Access the utility on the instrument.
- Connect the calibration cup to the instrument.
- Turn on the gas cylinder.

- View the results.
- Remove the calibration cup.
- *Turn off the gas cylinder.*

Supplies and Preparation

Use Figure 7.1 as a guide to gathering supplies and preparing the calibration gas cylinders.

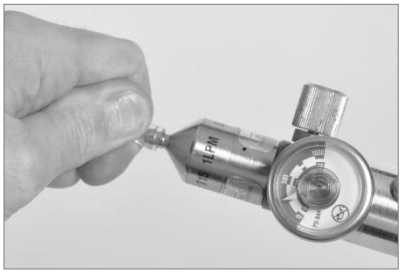
Supplies

- Calibration gas cylinder or cylinders
- Positive flow regulator suitable for the calibration gas cylinders
- Calibration cup (shipped with the instrument)
- Calibration tubing (shipped with the instrument)

Preparation

Holding the regulator, turn the calibration gas cylinder in a clockwise direction to tighten.

If a change in cylinders will be needed for a standard calibration or bump test, this preparation step can be completed for each cylinder.



Connect either end of the calibration tubing to the regulator's nipple.

Connect the other end of the tubing to the calibration cup.

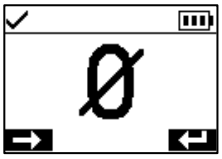
Figure 7.1 Maintenance supplies and preparation

Instruction

Figure 7.2.A through 7.2.C provide maintenance instruction in this order: zeroing, calibration, and bump testing. The standard process is shown for calibration and the quick process is shown for bump testing. When a process varies from those shown below, the instrument will supply instruction on its display screen.

Zeroing

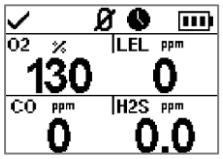
Zero utility



Cancel

Start zero process

Zero Progress



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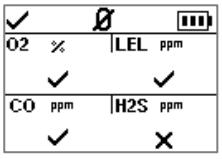
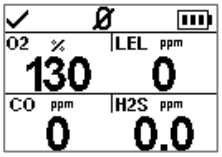
Zero Results

When the zero is completed, the instrument will emit an audible indicator and display results as follows:



✓ Passed

✗ Failed



If any sensor failed, press ⏻ to access the zero utility and repeat the zero process.

Figure 7.2.A Zeroing instruction

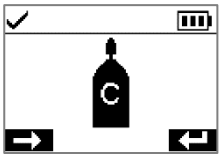
Calibration (standard process shown)

Place the prepared calibration cup over the instrument case top.

Press down to secure the cup in place; a click will sound.

Visually inspect the calibration cup to ensure its edges along the top and sides align with the instrument case top edges.

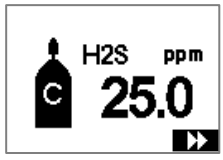
Calibration utility



Cancel calibration

Start calibration

Calibration apply gas

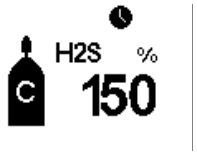


—

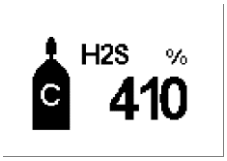
If desired, skip calibration for the displayed gas

Apply calibration gas of the type and concentration stated on the instrument's display screen. To start the flow of gas, turn the regulator's knob in a counterclockwise direction.

Calibration progress	Calibration results



When the calibration is completed, the instrument will display a calibration results of passed or failed, along with the sensor's span reserve percentage.



— Cancel calibration

✓ Passed

✗ Failed

The span reserve percentage is an indicator of the sensor's remaining life. When that value is less than 50%, the sensor will no longer pass calibration.

After the first sensor is calibrated and the results displayed, the instrument will activate the calibration process for the next gas type starting with the "Apply gas" request. The instrument will wait a few minutes to receive the requested calibration gas. This is the opportunity to change cylinders if needed, then continue the calibration process (in the same manner as described above for H_2S) until all calibration gases have been applied.

After the installed sensors have been calibrated (or skipped), the instrument's display screen will state the calibration results for all installed sensors.

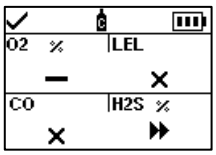
All-sensor calibration results	End

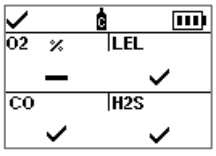
✓ Passed

✗ Failed

►► Skipped

— Not relevant to the procedure.





Remove the calibration cup: lift up from the cup's tabs.

Stop the flow of gas: turn the regulator knob in a clockwise direction and tighten.

Use Table 7.1 as a guide to help determine the probable cause for calibration failure and find recommendations for resolution.

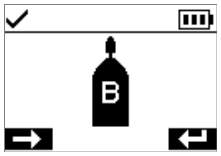
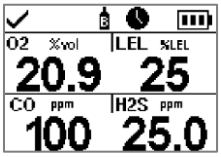
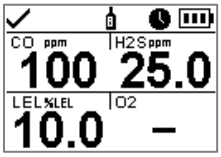
Figure 7.2.B Calibration instruction

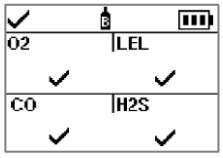
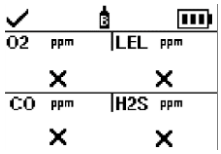
Bump testing (quick process shown)

Place the prepared calibration cup over the instrument case top.

Press down to secure the cup in place; a click will sound.

Visually inspect the calibration cup to ensure its edges along the top and sides align with the instrument case top edges.

Bump test utility	Apply gas	Bump test progress
	 	
Cancel bump test / Start bump test	Apply calibration gases of the type and concentration stated on the instrument's display screen: turn the cylinder's regulator knob in a counterclockwise direction.	— / Cancel bump test

All-sensor bump test results	End
 	 
After the bump test is completed, summary results are shown. If any sensors fail the bump test, the calibration required warning will turn on. Complete a calibration for any failed sensor, then repeat the bump test.	Remove the calibration cup: lift up from the cup's tabs.	*Stop the flow of gas*: turn the regulator knob in a clockwise direction and tighten.

✓ Passed

✗ Failed

►► Skipped

— Not relevant to the procedure

Figure 7.2.C Bump testing instruction

Table 7.1 Calibration failure: possible causes and recommendations

Possible causes for calibration failure	Recommendations
The sensor's span reserve percentage is less than 50%.	The sensor is due for replacement.
The gas cylinder did not contain the calibration gas in the concentration needed.	Repeat the calibration with a suitable gas cylinder.
When all sensors fail, this may indicate the calibration gas did not reach the sensors.	Check for the following. • Ensure the calibration cup is compatible with the instrument. • Ensure the calibration cup is correctly and securely placed on the instrument. • Check the tubing for splits, blockages, or damage. • Ensure the tubing is secured to the calibration cup and the cylinder's regulator. • Ensure the cylinder is not empty and contains the required gas concentrations. • Be sure the cylinder is turned on when the apply-gas screen displays and remains on until the calibration is completed. Repeat the calibration.

8

Service and Warranty

Service

Guidelines

Service tasks that can be completed by Industrial Scientific customers are described in this Product Manual. Table 8.1 indicates which parts and components are customer replaceable. All other service tasks should be performed only by Industrial Scientific or an authorized service center.

- Service tasks should be performed only by qualified personnel.
- Use only approved Industrial Scientific parts and accessories.
- Perform service tasks in a nonhazardous location.
- Work on a nonconductive surface in a well-lit area.
- Wear grounding straps to prevent electrostatic discharge (ESD), which can cause damage to the instrument's electronics.
- Before removing the instrument’s battery, dock the instrument to synchronize it with iNet Control, Accessory Software, or DSSAC.

Use care when working with the adhesive-backed filters and gaskets.

- Be careful not to pierce or tear these items.
- When using tweezers, apply gentle pressure.
- Once the adhesive touches a surface, any attempt to remove or reposition the item may cause it damage.

Use care when working with sensors and water barriers.

- Do not touch the sensors' white membranes as this can contaminate the sensors.
- Do not separate the sensor from its membrane.
- Do not damage or tear the membranes or water barriers.

Supplies

- ✓ T10 torx screwdriver
- ✓ Needle-nose tweezers (for barrier and filter replacement)

Instruction

Figures 8.1 and 8.2 provide disassembled views of the instrument and its pump module, respectively, identifying their parts and components. Use Table 8.1 to determine which items are customer replaceable and identify their part names and part numbers.

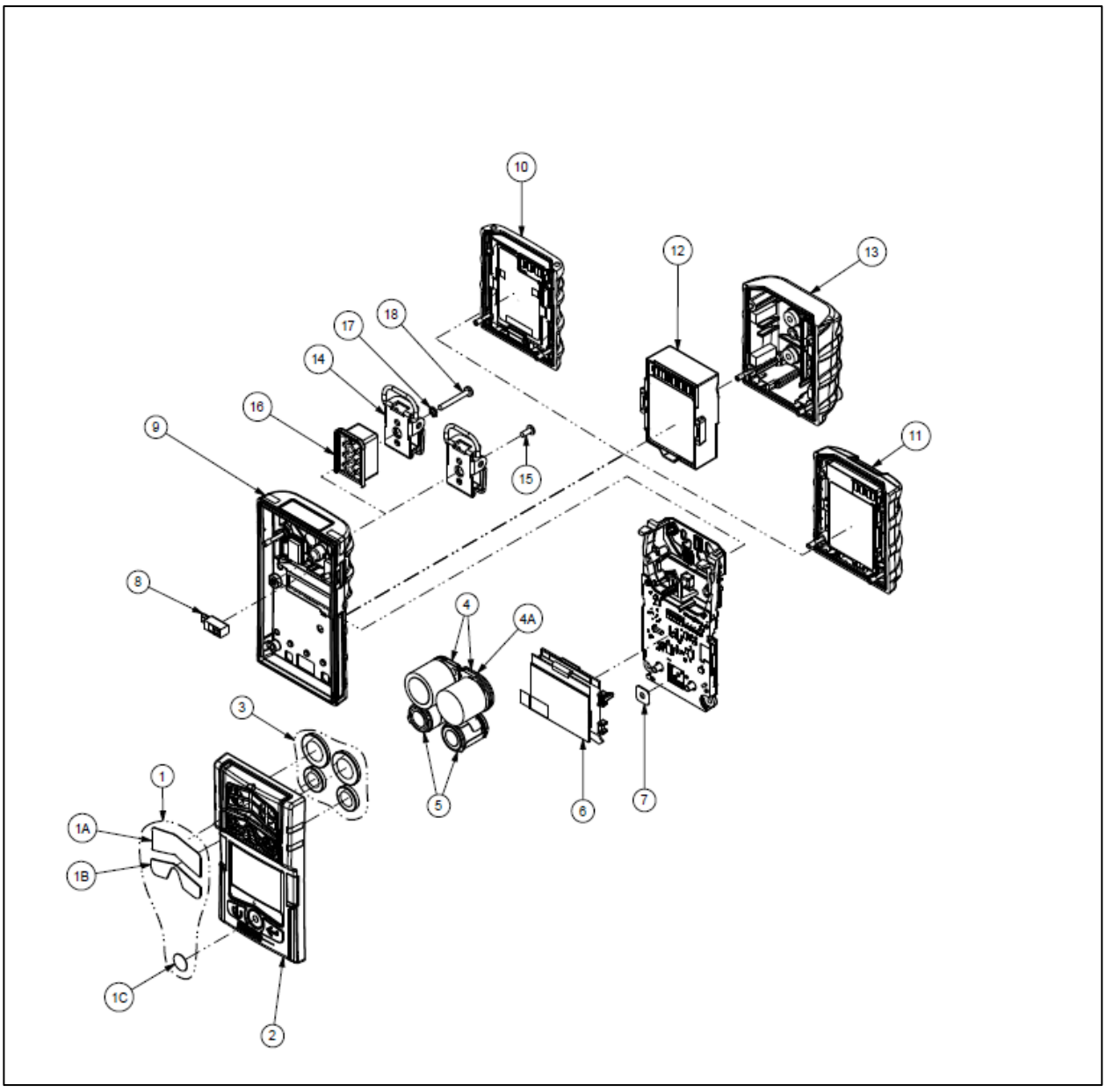


Figure 8.1 Instrument diagram

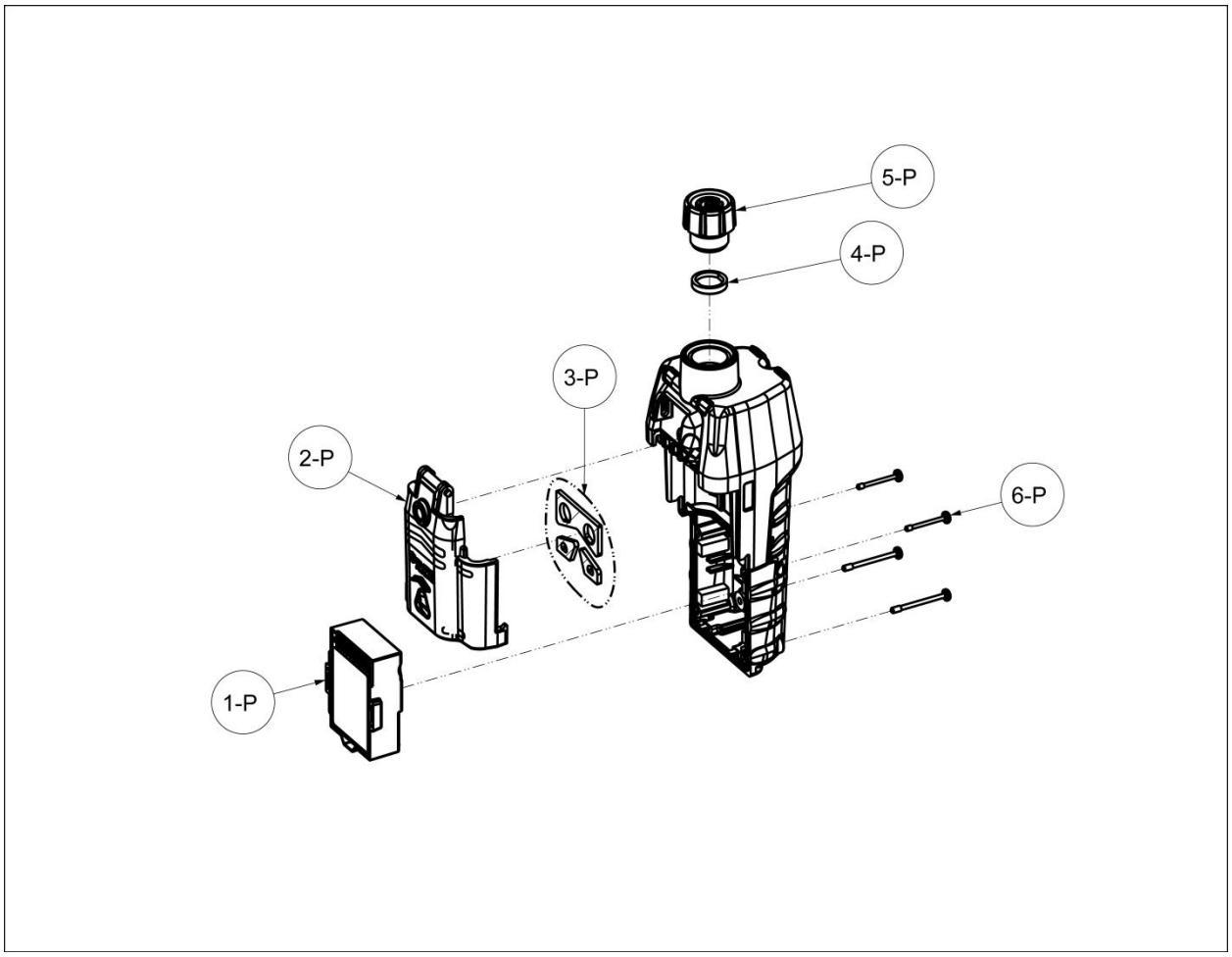


Figure 8.2 Pump module diagram

Table 8.1 Instrument and pump module parts list

Diagram number	Part name	Customer replaceable	Part number	Notes
Instrument				
1 (includes 1A, 1B, and 1C)	Dust barrier kit	Yes	18109435	Includes ten of each sensor dust barrier and ten speaker dust barriers.
2 (includes 1A, 1B, 1C, and 3)	Case top assembly	Yes	17156049-XY	Assembly includes case top, dust barriers, and water barriers X indicates case-cover color, where 0 = Black and 1 = Orange. Y indicates name plate, where 1 = Ventis Pro4 and 2 = Ventis Pro5.

Table 8.1 Instrument and pump module parts list

Diagram number	Part name	Customer replaceable	Part number	Notes
3	Sensor water barrier kit	Yes	18109436	Includes one water barrier for each sensor port.
4, 4a, and 5				See "Table 2.6 Sensor specifications" for details about sensor compatibility and permitted installation locations.
	Ammonia (NH_3)	Yes	17155306-6	Ventis Pro5 only.
	Carbon Dioxide/LEL (Propane), IR (CO_2/LEL)	Yes	17155304-U	Ventis Pro5 only.
	Carbon Dioxide/Methane (CO_2/CH_4)	Yes	17155304-V	Ventis Pro5 only.
	Carbon Monoxide (CO)	Yes	17155306-1	
	Carbon Monoxide/Hydrogen Sulfide (CO/H_2S)	Yes	17155304-J	Ventis Pro5 only.
	Carbon Monoxide/Hydrogen Sulfide (CO/H_2S)	Yes	17155306-J	Ventis Pro5 only.
	Carbon Monoxide with low Hydrogen cross-sensitivity (CO/H_2 Low)	Yes	17155306-G	—
	Hydrogen Cyanide (HCN)	Yes	17155306-B	—
	Hydrogen Sulfide (H_2S)	Yes	17155306-2	—
	Hydrogen Sulfide (H_2S)	Yes	17155304-2	—
	LEL (Methane)	Yes	17155304-L	—
	LEL (Pentane)	Yes	17155304-K	—
	Methane, 0-5% vol.	Yes	17155304-M	—
	Methane, IR, (CH_4)	Yes	17155304-N	—
	Nitrogen Dioxide (NO_2)	Yes	17155306-4	—
	Oxygen (O_2)	Yes	17155304-3	—
	Oxygen, Long-life (O_2)	Yes	17155304-Y	—
	Phosphine (PH_3)	Yes	17155306-9	—
	Sulfur Dioxide (SO_2)	Yes	17155306-5	—
6	LCD assembly	No*	—	—
7	Audible alarm speaker	No*	—	—
8	Vibration alarm motor	Yes	17120080	—
9	Case bottom	No*	—	Screw torque: .39 newton m (55 ounce-force inch)

Table 8.1 Instrument and pump module parts list

Diagram number	Part name	Customer replaceable	Part number	Notes
Batteries				
10	Rechargeable lithium-ion battery	Yes	See Table 8.2	Screw torque: 0.39 newton m (55 ounce-force inch)
11	Rechargeable slim extended lithium-ion battery	Yes		
12	Rechargeable extended range lithium-ion battery	Yes		
13	Battery cover (for use with rechargeable extended range, lithium-ion battery)	Yes		
14	Suspender clip	Yes	17120528	—
15	Screw with locking washer	Yes	17139262	Torque: .88 newton m (125 ounce-force inch)
16	Suspender clip spacer	Yes	17152506	—
17	Locking washer	Yes	17153137	—
18	Screw (for use with suspender clip spacer)	Yes	17152507	Torque: .88 newton m (125 ounce-force inch)
Pump				
1P - 6P	Pump module	Yes	VPP-ABCD	A indicates battery, where 0 = no battery and 2 = extended range rechargeable lithium-ion battery B indicates color, where 0 = black and 1 = orange C indicates approvals, where 1=UL and CSA, 2 = ATEX and IECEx, 3 = MSHA, and 9=INMETRO D indicates language, where 1 = English, 2 = French, 3 = Spanish, 4 = German, C=Chinese, and -7 = Brazilian Portuguese
	Pump module parts			
1P	Extended range rechargeable lithium-ion battery	Yes	See Table 8.2	Screw torque: 0.39 newton m (55 ounce-force inch)
2P (includes 3P)	Door assembly	Yes	17156945-X	X indicates color, where 0 = black and 1 = orange.
3P	Gaskets	No*	—	—
4P	Inlet water barrier	Yes	17152395	—
5P	Inlet cap	Yes	17129909	—

*For items that are *not* customer replaceable, contact Industrial Scientific or an authorized service center.

Battery parts

The base part number that appears on the *label* of a Ventis battery item uses an eight-digit numeric format (XXXXXXXX). The corresponding *orderable* part numbers use the four-letter base reference "VTSB", which is followed by a three character suffix. The first suffix character is a number that designates the battery type; the second and third are used to indicate color and approval options, respectively. For example, as shown below in Table 8.2, a rechargeable slim extended lithium-ion battery kit that is black and has a UL approval would have an orderable part number of VTSB-401 and its label would state a part number of 17157350-X1.

Table 8.2 Battery parts list

Diagram number	Item	Part numbers		Options[a] (X and Y)
		Label	Orderable kit	
10	Rechargeable lithium-ion battery	17134453-XY	VTSB-10Y	X indicates color*: 0 for black; 1 for orange (battery cover only) Y indicates approvals*: 1 for UL, CSA, ATEX, and IECEx; 2 for MSHA; 3 for China EX; 4 for ANZEx; and 5 for INMETRO
11	Rechargeable slim extended lithium-ion battery	17157350-XY	VTSB-40Y	
12 and 13	Rechargeable extended-range lithium-ion battery (includes battery and cover)	17148313-Y (battery) 17151184-XY (cover)	VTSB-20Y (kit)[b]	

[a]Color and approval options may vary for each battery item. For more information, contact Industrial Scientific or an authorized distributor of its products.

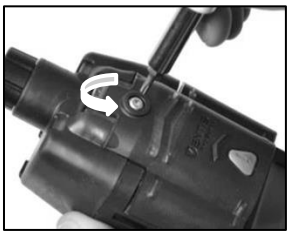
[b]The battery and cover may be ordered separately using these part numbers 17148313-Y (battery) 17151184-XY (cover).

⚠ Power off the instrument before disassembling it or performing any service task.

Pump installation

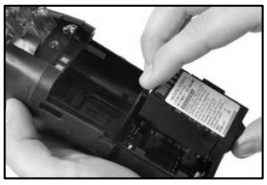
Unscrew and remove the belt clip. Store the clip, screw, and washer for future use.

Unscrew, lift, and remove the battery from the diffusion instrument; store it for future use.



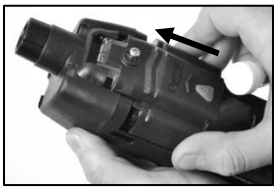
Loosen the pump door screw.

Slide the pump door down; lift it to open.



Install a compatible extended range battery—label side up—into the lower receptacle of the pump case.

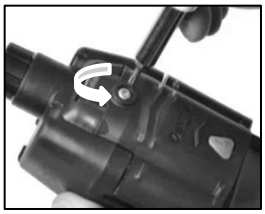
Place the instrument in the pump case; tighten the four torx screws on the back of the pump.



Lower the pump door. Slide it into its fully closed, clicked-shut position.

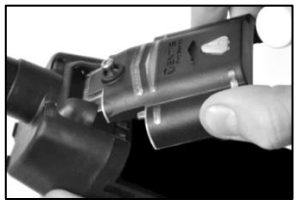
Tighten the pump door screw.

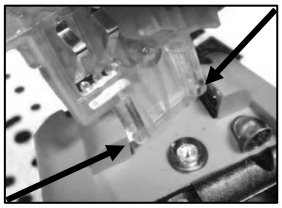
Pump door replacement



Loosen the pump door screw.

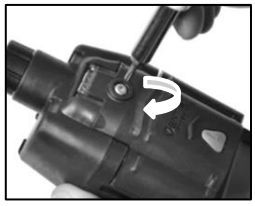
Slide the pump door down; lift it to open.





The door is hinged to the pump module with two pegs that slide into grooves. Angle the door so that one peg moves to the bottom of its groove and the other moves the top of its groove. Lift the door to remove it.

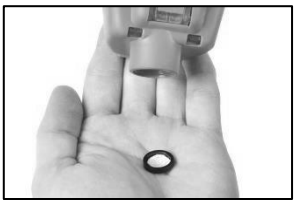
Install the new door in the same manner the door was removed.



Lower the pump door. Slide it into its fully closed, clicked-shut position. Tighten the pump door screw.

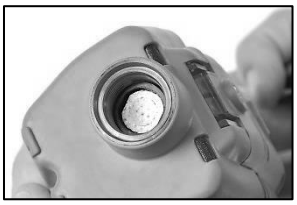
Pump cap and water barrier replacement

To unscrew and remove the pump cap, turn it in a counterclockwise direction.



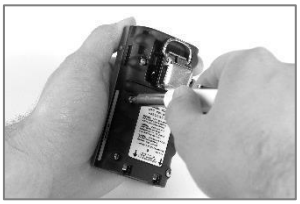
Remove the water barrier from the inlet barrel.

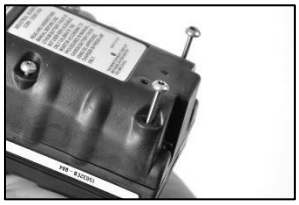
Place the new water barrier inside the inlet barrel; the side with the larger filter surface should face the user.



Secure the pump cap to the inlet barrel: turn it in a clockwise direction to tighten.

Battery replacement

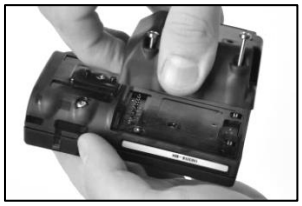




Using a torx screwdriver, loosen all four screws from the battery (left) or the battery cover (right).

Lift the battery (left) or battery cover and extended- range battery (right) away from the instrument.

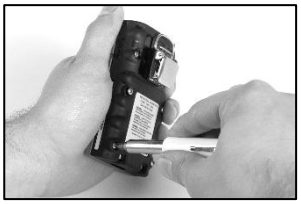
Note: If the instrument is without a battery for more than 40 minutes, the instrument date and time settings will be deleted. The next time the instrument is powered on, it will prompt its operator to set the date and time to support data-log integrity; this can be done manually or by docking the instrument.



To install the extended range battery, first place the battery in the battery cover. When placed correctly, the battery's label will show.

Next, align the battery cover with the instrument.

To install the battery, align it with the instrument.



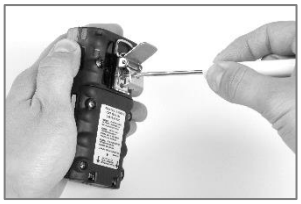
Using a torx screwdriver, tighten each of the four screws to secure the battery (shown) or battery cover to the instrument.

Refer to Table 8.1 for torque value.

Clip replacement

Clip only (use with lithium-ion battery or slim extended lithium-ion battery)

Lift the clip's cover.



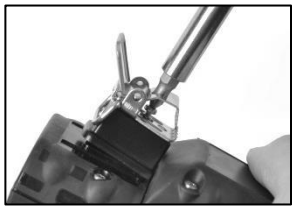
To remove the clip, use a torx screwdriver to access the clip's screw. Turn counterclockwise to loosen the screw.

Remove the screw, washer, and clip; set aside or store for future use.

To attach the clip, put the washer onto the screw and place the screw in the clip's middle hole.

Turn the screw clockwise to tighten; refer to Table 8.1 for torque value.

Clip with spacer (use with extended range battery and battery cover)

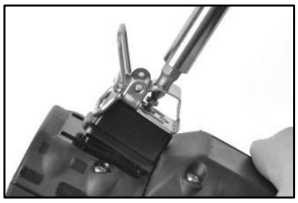


To remove the clip, use a torx screwdriver to access the clip's screw. Turn counterclockwise to loosen the screw.

Remove the washer, screw, clip, and spacer; set aside or store for future use.

To attach the clip and spacer, cover the case bottom's platform with the spacer.

Put the washer onto the screw and place the screw in the clip's middle hole.

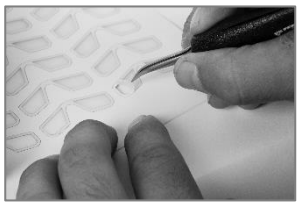


Guide the screw into the spacer's hole and into the instrument case bottom..

Turn clockwise to tighten; refer to Table 8.1 for torque value.

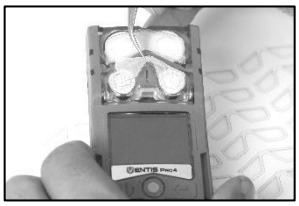
Dust barrier replacement (sensor port dust-barrier shown)

Using a finger or needle-nose tweezers, peel off the dust barrier and discard.



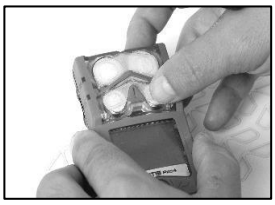
Place the barrier sheet on the work surface.

Scrape lightly across the paper to the barrier's edge. Gently lift to expose a portion of its adhesive back. Peel the barrier from the sheet.



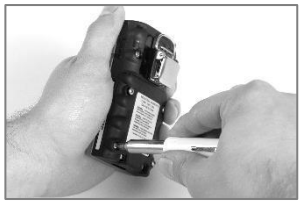
Guide the new barrier—adhesive side down—onto the case top.

Press and hold to support adhesion.



Instrument disassembly

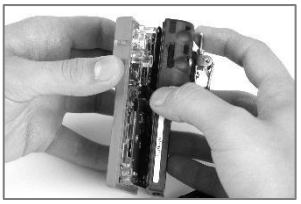
Instrument disassembly and reassembly is required for the service tasks described below, sensor water barrier replacement and sensor replacement. Optionally charge the instrument after reassembly.



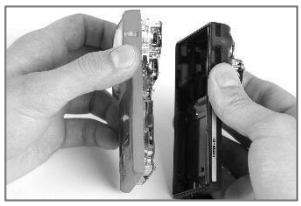
Using a torx screwdriver, loosen all four captive screws on the battery.

Lift the battery away from the instrument.

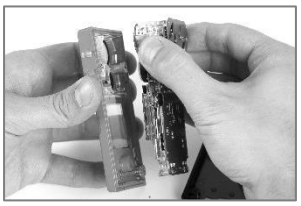
Using a torx screwdriver, loosen the case bottom's remaining two screws.



Hold the case bottom near the upper screws. Lift the case top slightly to separate it from the case bottom.

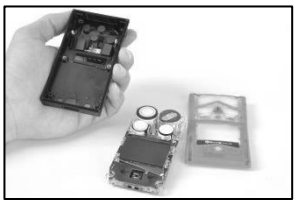


Continue to lift the case top straight up to remove it.



Near the top of the circuit board assembly, hold the plastic sides that border the sensors.

Gently lift the circuit board assembly straight up and away to separate it from the case top.



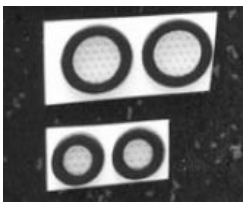
—

Sensor water-barrier replacement

Inside the case top, grip the sensor water barrier with the needle-nose tweezers. Peel to remove.

Remove any remnants of the adhesive or water barrier.

Clear away any dirt, dust, or debris.



Place the water-barrier sheets on the work surface.

Using the tweezers, scrape lightly across the paper to the barrier's edge; gently lift to expose a portion of the adhesive back.

Grip the barrier lightly with the tweezers and peel it from the packet.

Guide the new water barrier—adhesive side down—into the case top.

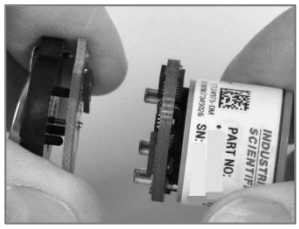
For proper placement, take care to ensure the barrier edge meets the inner edge of the case top's sensor opening.

Using care not to touch the filter's white membrane, press on the filter edge to support adhesion.

—

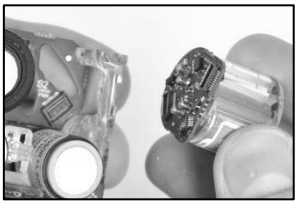
Sensor setup and replacement

Sensor setup



If a battery is attached to a sensor, separate the battery from the sensor where the two circuit boards meet. Dispose of the battery according to company policy.

Sensor replacement (LEL sensor shown)

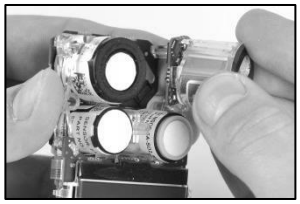


Hold the sides of the sensor firmly then pull it straight up and away from the instrument.

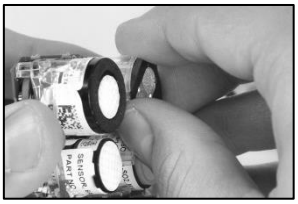
Some sensors, such as the LEL sensor shown here, include a small circuit board that should detach from the instrument board when the sensor is removed. If it does not detach, remove the sensor's board from the instrument board.

Store the sensor for future use or dispose of it according to company policy.

Note: When two sensors of the same type are operating on DualSense, replace both sensors at the same time.



Position the new sensor to align its connectors with their receptacles on the instrument's circuit board assembly.

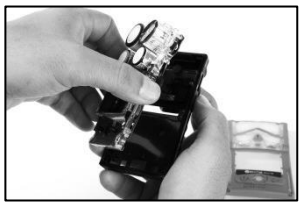


Secure the sensor in place by applying gentle pressure to the sides of the sensor case. *Do not touch the sensor's membrane*.

A slight connection impact can be felt when the sensor is secured into place.

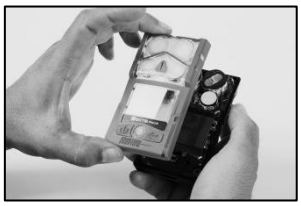
Note: After reassembling the instrument, calibrate for any newly installed sensors.

Instrument assembly and charging



Near the top of circuit board assembly, hold the plastic sides that border the sensors.

Place the circuit board assembly into the instrument's case bottom.



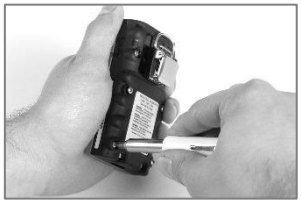
Lower the case top assembly onto the case bottom.

Press to secure the case top to the case bottom.

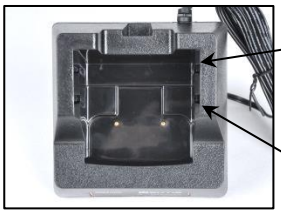
Using a torx screwdriver, tighten the top two screws. See Table 8.1 for torque value.

Charging

Place the battery against the case bottom.



Using a torx screwdriver, tighten the screws. See Table 8.1 for torque value.



If the charger includes an insert, adjust the insert to ensure the battery contacts touch the charging contacts. Once the insert is placed into the desired position, a firm push down will secure it in place.

To prevent losing the insert, keep it in the cradle in the most often used position.

Insert position: forward

Insert side: 1

Lithium-ion battery

Insert position: forward

Insert side: 1

Slim extended lithium-ion battery

Insert position: forward

Insert side: 2

Extended range lithium-ion battery (aspirated shown)

Insert position: rear

Insert side: 1

NOTE: Do NOT touch the charger's battery contacts as contaminants and damage will inhibit charging.

Figure 8.3 Service Tasks

Warranty

Industrial Scientific Corporation's Ventis™ Pro Series portable gas monitors are warranted to be free from defects in material and workmanship under normal and proper use and service for as long as the instrument is supported by Industrial Scientific (excludes sensors, batteries, filters, and pumps). O2, LEL, CO (excluding COSH or CO/H2 Low), and H2S sensors are warranted for three years from date of shipment. All other sensors, pumps, filters and battery packs are warranted for two years from date of shipment, except where otherwise stated in writing in the literature accompanying the product.

Limitation of Liability

THE WARRANTY SET FORTH ABOVE IS STRICTLY LIMITED TO ITS TERMS AND IS IN LIEU OF ALL OTHER WARRANTIES, GUARANTEES, EXPRESS OR IMPLIED, ARISING BY OPERATION OF LAW, COURSE OF DEALING, USAGE OF TRADE OR OTHERWISE. INDUSTRIAL SCIENTIFIC MAKES NO OTHER WARRANTIES, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE.

SHOULD THE PRODUCT FAIL TO CONFORM TO THE ABOVE WARRANTY, BUYER'S ONLY REMEDY AND INDUSTRIAL SCIENTIFIC'S ONLY OBLIGATION SHALL BE, AT INDUSTRIAL SCIENTIFIC'S SOLE

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Buyer acknowledges that it alone has determined the intended purpose and suitability of the goods purchased. It is expressly agreed by the parties that any technical or other advice given by Industrial Scientific with respect to the use of the goods or services is given without charge and at Buyer's risk; therefore, Industrial Scientific assumes no obligations or liability for the advice given or results obtained.

Appendix A

Supplemental Information about Gases and Sensors

Toxic Gases

A sensor is designed to detect for and measure the presence of a particular gas, the "target gas"; however, it may also respond to other gases. When this is the case, the sensor is said to have "cross-sensitivity" to another gas, which will interfere with the target-gas readings. Table A.1 provide insight to the levels of cross sensitivity that can exist and whether a nontarget gas will have the effect of adding to or subtracting from the target-gas readings.

For example, a site is being monitored for H_2S; the air also contains NO_2. According to table A.1, the H_2S sensor will respond to NO_2, so the H_2S readings will account for both gases. Because the NO_2 cross-sensitivity value is negative (-25%), its presence will *subtract from* the H_2S readings, which will generate an H_2S reading that is *lower* than the actual concentration of H_2S contained in the air sample.

When a cross-sensitivity value is positive, the opposite will happen. When a gas has a positive cross-sensitivity value, it will add to a sensor's target gas reading, which will generate a reading that is higher than the actual concentration of the target gas contained in the air sample.

Table A.1 Cross-sensitivity guidelines (%)

	Sensor						
Target Gas	CO	CO/H_2 Low	H_2S	SO_2	NO_2	HCN	NH_3
CO	100	100	1	1	0	0	0
H_2S	5	5	100	1	-40	10	25
SO_2	0	5	5	100	0	—	-40
NO_2	-5	5	-25	-165	100	-70	-10
Cl2	-10	0	-20	-25	10	-20	-50
ClO_2	—	—	—	—	—	—	—
HCN	15	—	—	50	1	100	5
HCl	3	—	—	5	0	0	0
PH_3	—	—	—	—	—	425	—
NO	25	40	-0.2	1	5	-5	0
H2	22	3	0.08	0.5	0	0	0
NH_3	0	0	0	0	0	0	100

The values supplied above are estimates. They generally apply only to new sensors used for monitoring gases in these environmental conditions: 20 °C (68 °F), 50% RH, and 1 atm. Values are subject to change.

"—" indicates no available data.

Combustible Gases

Tables A.2 and A.3 provide the LEL for select combustible gases as they apply to specific sensors. These tables also provide correlation factors that can help determine the percentage LEL when the actual gas differs from the gas that was used to calibrate the instrument.

For example, if the instrument reads 10% LEL in a pentane atmosphere, and was calibrated to methane, the actual percentage LEL is determined as follows:

1. Locate the table cell where the sample gas (pentane) intersects with the calibration gas (methane).
2. Multiply the cell's value (2.02) by the unit's LEL reading (10%) to calculate the actual concentration of 20.2% LEL.

Table A.2 LEL correlation factors for the sensors 17155304-K, -L, and -M

		Calibration gas					
Sample gas	LEL (% vol)	Butane	Hexane	Hydrogen	Methane	Pentane	Propane
Acetone	2.5%	1.00	0.70	1.70	1.70	0.90	1.10
Acetylene	2.5%	0.70	0.60	1.30	1.30	0.70	0.80
Benzene	1.2%	1.10	0.80	1.90	1.90	1.00	1.20
Butane	1.9%	1.00	0.58	1.78	1.67	0.83	1.03
Ethane	3.0%	0.80	0.60	1.30	1.30	0.70	0.80
Ethanol	3.3%	0.89	0.52	1.59	1.49	0.74	0.92
Ethylene	2.7%	0.80	0.60	1.40	1.30	0.70	0.90
Hexane	1.1%	1.71	1.00	3.04	2.86	1.42	1.77
Hydrogen	4.0%	0.56	0.33	1.00	0.94	0.47	0.58
Isopropanol	2.0%	1.10	0.90	2.00	1.90	1.00	1.20
Methane	5.0%	0.60	0.35	1.06	1.00	0.50	0.62
Methanol	6.0%	0.60	0.50	1.10	1.10	0.60	0.70
Nonane	0.8%	2.22	1.30	3.95	3.71	1.84	2.29
Pentane	1.4%	1.21	0.71	2.15	2.02	1.00	1.25
Propane	2.1%	0.97	0.57	1.72	1.62	0.80	1.00
Styrene	0.9%	1.30	1.00	2.20	2.20	1.10	1.40
Toluene	1.1%	1.53	0.89	2.71	2.55	1.26	1.57
Xylene	1.1%	1.50	1.10	2.60	2.50	1.30	1.60
JP-4	—	—	—	—	—	1.20	—
JP-5	—	—	—	—	—	0.90	—
JP-8	—	—	—	—	—	1.50	—

Table A.3 LEL correlation factors[a] for the sensor 17155304-U

Sample gas	LEL (% vol)	Calibration gas: Propane
Acetone	2.5	3.28
Butane	1.9	0.97
Chloromethane	8.1	0.966
Cyclopentane	1.1	1.62
Dichloroethane	5.4	8.57
Ethane	3.0	1.01
Ethanol	3.5	1.65
Ethyl Acetate	2.0	1.69
Ethylene	2.7	3.43
Ethylene Oxide	3.0	0.845
Hexane	1.1	0.8
Isopropanol	2.0	1.43
Methane	5.0	3
Methanol	6.0	2.22
Methyl ethyl ketone	1.4	1.87
Pentane	1.4	0.89
Propylene	2.4	1.69
Toluene	1.1	1.18
Xylene	1.1	1.51

[a]These factors only apply to gas concentrations expressed in % volume terms and up to 2.5%vol. These factors may vary from sensor to sensor with tolerance of ± 25% deviation.

Note: LEL correlation-factor accuracy may change without notice and is impacted by exposure to sensor inhibitors or poisons, sensor aging, the gas-detection applications and environment, and other factors. Calibrate instruments using the intended target gas when feasible and validate correlation factors as needed.

Appendix B

Marking Requirements

ATEX Markings

Industrial Scientific Corp.
15205 USA
VENTIS Pro SERIES
DEMKO 15 ATEX 1571
Ex da ia IIC T4 Ga
Ex db ia IIC T4 Gb with IR sensor installed
Ex da ia I Ma
Ex db ia I Ma with IR sensor installed
-40°C 1 Ta 1 +50°C
-20°C 1 Ta 1 +50°C with IR sensor installed
IP 64

Aspirated Configuration
Use only replaceable battery pack P/N 17148313-1.
Do Not Recharge or Replace battery in Hazardous Locations.
Charging contact parameters: Um = 6.2V
[Serial Number] [Month/Year of Production]

Diffusion Configuration
Use only replaceable battery pack P/N 17148313-1, 17157350-X1, or 17134453-X1
Do Not Recharge or Replace battery in Hazardous Locations.
Charging contact parameters: Um = 6.2V
[Serial Number] [Month/Year of Production]

IECEx Markings

Industrial Scientific Corp.
15205 USA
VENTIS PRO SERIES
IECEx UL15.0114
Ex da ia IIC T4 Ga Ex db ia IIC T4 Gb with IR sensor installed
-40°C 1 Ta 1 +50°C
-20oC 1 Ta 1 +50oC with IR sensor installed -20ₒC 1 Ta 1 +50ₒC
IP 64

Aspirated Configuration
Use only replaceable battery pack P/N 17148313-1.
Do Not Recharge or Replace battery in Hazardous Locations.
Charging contact parameters: Um = 6.2V
[Serial Number] [Month/Year of Production]

Diffusion Configuration
Use only replaceable battery pack P/N 17148313-1, 17157350-X1, or 17134453-X1
Do Not Recharge or Replace battery in Hazardous Locations.
Charging contact parameters: Um = 6.2V
[Serial Number] [Month/Year of Production]

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