



Orion[®] plus MultiGas Detector

Operating Manual



In North America, to contact your nearest stocking location, dial toll-free 1-800-MSA-2222
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Manufactured by

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WARNING

THIS MANUAL MUST BE CAREFULLY READ BY ALL INDIVIDUALS WHO HAVE OR WILL HAVE THE RESPONSIBILITY FOR USING OR SERVICING THE PRODUCT. Like any piece of complex equipment, this instrument will perform as designed only if it is used and serviced in accordance with the manufacturer's instructions. OTHERWISE, IT COULD FAIL TO PERFORM AS DESIGNED AND PERSONS WHO RELY ON THIS PRODUCT FOR THEIR SAFETY COULD SUSTAIN SEVERE PERSONAL INJURY OR DEATH.

The warranties made by Mine Safety Appliances Company with respect to the product are voided if the product is not used and serviced in accordance with the instructions in this manual. Please protect yourself and others by following them. We encourage our customers to write or call regarding this equipment prior to use or for any additional information relative to use or repairs.

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Chapter 1, Instrument Safety and Certifications

The Orion plus Multigas Detector is for use by trained and qualified personnel. It is designed to be used in air when performing a hazard assessment.

The Orion plus Multigas Detector can be equipped to detect:

- Combustible gases and certain combustible vapors
- Oxygen-deficient or oxygen-rich atmospheres
- Specific toxic gases for which a sensor is installed.

WARNING

Safety Limitations and Precautions

Carefully review the following warnings, safety limitations and precautions before placing this instrument in service:

- The Orion plus Multigas Detector is designed to detect (in air only) combustible gases and vapors and specified toxic gases for which a sensor is installed.
- Perform the following checks before each day's use to verify proper instrument operation:
 - Gas response check (see Calibration section)
 - Calibrate if the readings are not within the specified limits.
 - Check pump for proper operation (see "Verifying Pump Operation" section). Have pump serviced if necessary.
- Check calibration more frequently if the unit is subjected to physical shock or high levels of contaminants. Also, check calibration more frequently if the tested atmosphere contains the following materials, which may desensitize the combustible gas sensor and reduce its readings:
 - Organic silicones
 - Silicates
 - Lead-containing compounds
 - Hydrogen sulfide exposures over 200 ppm or exposures over 50 ppm for one minute.
- A combustible gas reading of "100" indicates the atmosphere is

above 100% LEL and an explosion hazard exists. In such cases, the instrument LockAlarm feature activates. Move away from contaminated area immediately.

- Do not use the Orion plus Multigas Detector to detect combustible dusts or mists.
- Do not use the Orion plus Multigas Detector to test for combustible or toxic gases in the following atmospheres as this may result in erroneous readings:
 - Oxygen-deficient or oxygen-rich atmospheres
 - Reducing atmospheres
 - Furnace stacks
 - Inert environments
 - Atmospheres containing combustible airborne mists or dusts.
- Do not use the Orion plus Multigas Detector to test for combustible gases in atmospheres containing vapors from liquids with a high flash point (above 100°F) as this may result in erroneously low readings.
- Do not block pump inlet as this may cause inaccurate readings. Do not press on the face of the sensors, as this may damage them and cause erroneous readings. Do not use compressed air to clean the sensor holes, as the pressure may damage the sensors.
- Allow sufficient time for unit to display an accurate reading. Response times vary based on the type of sensor being used (see Chapter 7, "Performance Specifications"). Additionally, when using a sampling pump, allow a minimum of 0.7 seconds per foot of sample line to allow the sample to be drawn through to the sensors.
- Keep the probe tip above liquid surfaces; otherwise, liquid may enter the system and block the sample flow, causing inaccurate readings and/or internal damage.
- All instrument readings and information must be interpreted by someone trained and qualified in interpreting instrument readings in relation to the specific environment, industrial practice and exposure limitations.
- Replace alkaline cells or recharge NiMH battery-pack in non-hazardous areas only. Use only battery chargers listed in this manual; other chargers may damage the battery pack and the unit. Dispose of batteries in accordance with local health and safety regulations.

- Do not alter this instrument or make any repairs beyond those specified in this manual. Only MSA-authorized personnel may repair this unit; otherwise, damage may result.

Certifications

Tests completed by MSA verify that the Orion plus Multigas Detector meets applicable industry and government standards as of the date of manufacture.

Electronic Interference

- This instrument generates, uses, and can radiate radio frequency energy. Operation of this instrument may cause interference, in which case, the user may be required to correct.
- This device is test equipment and is not subject to FCC technical regulations. However, it has been tested and found to comply with the limits for a Class A digital device specified in Part 15 of the FCC regulations.
- This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the CRTC.
- There is no guarantee that interference will not occur. If this instrument is determined to cause interference to radio or television reception, try the following corrective measures:
 - Reorient or relocate the receiving antenna
 - Increase separation between the instrument and the radio/TV receiver
 - Consult an experienced radio/TV technician for help.

Chapter 2, Quick Start

It is your responsibility to know how to use the Orion plus Multigas Detector. When used properly, this unit will alert you to the presence of:

- combustible gases and vapors
- atmospheres that are rich or deficient in oxygen
- specific toxic gases if equipped with the appropriate sensor.

These conditions are displayed clearly and simultaneously on the face of the instrument. See Chapter 3, FIGURE 3-3 for an explanation of the flags, numbers and button operation of the Orion plus Multigas Detector.

Turning ON the Orion plus Multigas Detector

1. Push the ON-OFF button to turn ON the Orion plus Multigas Detector with an installed battery pack:
 - The instrument then performs a Self-test where the:
 - instrument details are displayed
 - audible alarm sounds
 - alarm lights illuminate
 - display backlight illuminates.

Once the Self-test is complete, the instrument:

- requests that a Fresh Air Setup be performed
- is ready for use after this Fresh Air Setup procedure is performed or rejected.

Moving Through the Orion plus Multigas Detector Pages

To access instrument features and informational pages:

- Push the PAGE button (See Chapter 3, FIGURE 3-3).

The Pages appear in the following order:

- **Minimum**
Shows minimum value recorded since last instrument turn-ON for the oxygen sensor only.

- **Maximum**
Shows peak value recorded since last instrument turn-ON.
- **TWA**
Shows Time Weighted Average for installed toxic gas sensors.
- **STEL**
Shows Short Term Exposure Limit for installed toxic gas sensors.

To return the instrument to the Measure page:

- Push the RESET button.
 - The instrument automatically returns to the Measure page after a 20-second delay on any page.

Turning OFF the Orion plus Multigas Detector

To turn OFF the Orion plus Multigas Detector:

- Push and hold the ON-OFF button for five seconds.
 - Hourglass displays to indicate instrument turn-OFF.

Chapter 3, Using the Orion plus Multigas Detector

Turning ON the Orion plus Multigas Detector

Installing the Battery Pack (FIGURE 3-1)

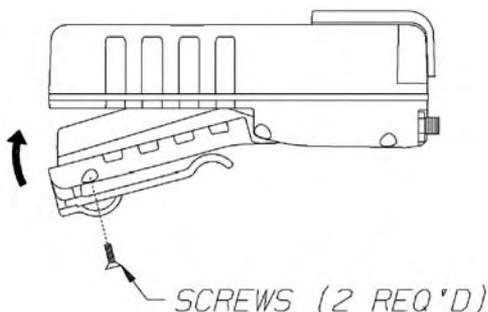


Figure 3-1. Battery Pack Installation

1. Slide the battery pack toward the top of the instrument.
2. Swing the battery pack up and into the body of the instrument.
3. Secure the battery pack by installing the two screws in the bottom two corners of the battery pack and instrument.

NOTE: The screws must be snug to ensure that the battery pack properly seals to the instrument. Do not over-tighten.

4. Once the battery pack is installed, the Orion plus Multigas Detector turns ON.

▲ WARNING

A calibration check must be performed after switching battery packs to assure accuracy of readings.

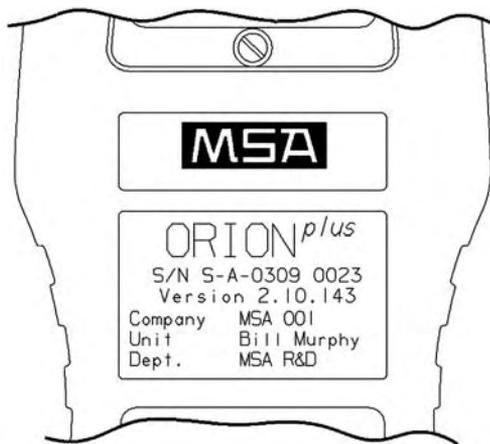


Figure 3-2 Startup Screen

The instrument now performs the following Self-test where the:

- Instrument details are displayed
- Audible alarm sounds
- Alarm lights illuminate
- Display backlight illuminates
- Internal instrument diagnostic occurs (any detected internal errors appear on the display) and all pre-set alarms are displayed.

When the Self-test ends:

- The instrument offers the FAS option to zero the instrument
 - If the FAS is declined or no buttons are pressed, the instrument enters the Measure mode
- Gas concentrations appear on the display.

Fresh Air Setup Option

(for automatic zero adjustment of the Orion plus Multigas Detector sensors)

NOTE: The Fresh Air Setup (FAS) has limits. If a hazardous level of gas is present, the Orion plus Multigas Detector ignores the

FAS command and goes into alarm.

⚠ WARNING

Do not activate the Fresh Air Setup unless you are certain you are in fresh, uncontaminated air; otherwise, inaccurate readings can occur which can falsely indicate that a hazardous atmosphere is safe. If you have any doubts as to the quality of the surrounding air, do not use the Fresh Air Setup feature. Do not use the Fresh Air Setup as a substitute for daily calibration checks. The calibration check is required to verify span accuracy. Failure to follow this warning can result in serious personal injury or death.

Persons responsible for the use of the Orion plus Multigas Detector must determine whether or not the Fresh Air Setup option should be used. The user's abilities, training and normal work practices must be considered when making this decision.

1. Turn ON the Orion plus Multigas Detector.
 - Once the instrument self check is complete, the instrument offers a Fresh Air Setup option.
2. To perform a Fresh Air Setup, push the display indication YES (RESET) button.
3. To immediately skip the FAS, push the NO (PAGE) button.
 - If no buttons are pushed, the Orion plus Multigas Detector enters the Measuring mode.

Understanding the Display (see FIGURE 3-3)



Figure 3-3. Heartbeat, Time & Date, and Battery Life Indicator

- The Heartbeat Indicator circles continuously to notify the user the instrument is ON and operating when Heartbeat is activated.

Time & Date indicator (see FIGURE 3-3)

- The current time (24-hour format) and date (MM/DD/YEAR) continuously displays in the upper portion of the screen.

Battery Life Indicator (see FIGURE 3-3)

- The battery condition icon continuously displays in the upper portion of the screen, regardless of the selected page.
- As the battery charge dissipates, segments of the battery icon go blank until only the outline of the icon remains.

Battery Warning

- A Battery Warning indicates that a nominal 20 minutes of operation remain before instrument batteries are completely depleted.

NOTE: Duration of remaining instrument operation during Battery Warning depends on:

- Ambient temperatures (The battery warning is likely to be shorter in colder temperatures, particularly with alkaline batteries)
- Whether the battery warning is reset (it comes ON again every five minutes).
- When the Orion plus Multigas Detector goes into Battery Warning:
 - Battery Life indicator flashes
 - Alarm sounds
 - Alarm lights flash.
- To silence the Battery Warning, push the RESET button.
- The Orion plus Multigas Detector continues to operate until the instrument is turned OFF or battery shutdown occurs.

Battery Shutdown

When the batteries can no longer operate the instrument, the instrument goes into Battery Shutdown mode:

- Battery Indicator remains ON

- Alarm sounds continuously
- Alarm lights flash
- No other pages can be viewed
- After approximately five minutes, the unit automatically turns OFF.

⚠ WARNING

When Battery Shutdown condition sounds, stop using the instrument; it can no longer alert you of potential hazards since it does not have enough power to operate properly. You must:

- 1. Leave the area immediately.**
- 2. Turn OFF the instrument if it is ON.**
- 3. Report to the person responsible for maintenance.**
- 4. Replace or recharge the battery pack.**

Failure to follow this procedure, could result in serious personal injury or death.

For Alkaline Battery packs, replace batteries when the "Battery Low" or "Battery Shutdown" alarms occur. When replacing alkaline batteries, replace ALL batteries with fresh ones at the same time. Do not mix new and partially-discharged batteries. If the batteries are improperly replaced or improperly mixed, the "Battery Low" and "Battery Shutdown" alarms may fail to function, which could result in serious personal injury or death.

Do not use rechargeable batteries in Alkaline Battery Packs. The Alkaline battery warning and alarm setpoints are not optimized for rechargeable batteries. The low battery warning and alarm could occur too quickly to be noticed. Using rechargeable batteries in the Alkaline battery pack could result in serious personal injury or death.

NOTE: The instrument recognizes the type of installed battery pack (rechargeable NiMH or alkaline) and automatically adjusts the low battery warning and alarm setpoints.

⚠ CAUTION

During "Battery Low" condition, prepare to exit the work area since the instrument could go into "Battery Shutdown" at any time, resulting in loss of sensor function. Depending on the age of the batteries, ambient temperature and other conditions, the instrument "Battery Low" and "Battery Shutdown" times could be shorter than anticipated.

⚠ WARNING

Recharge or replace the batteries when the "Battery Low" or "Battery Shutdown" conditions occur.

Do not reuse a NiMH battery without recharging, even if the battery regains some charge after a period of non-use.

Verifying Pump Operation

1. Turn ON the Orion plus Multigas Detector.
 - The pump motor starts fast and then slows down as the instrument adjusts the power to run the pump.
2. Once gas readings are displayed, plug the free end of the sampling line or probe.
 - The pump motor shuts down and an alarm sounds.
 - The 'Heartbeat' stops circling and displays a "P" in the circle
 - A clear message appears in the display with 'on-line' instructions
 - The readings on the display may change.
3. When the pump inlet, sample line or probe is blocked, the pump alarm must activate. If the alarm does not activate:
 - a. Check the pump, sample line, and probe for leaks.
 - b. Once leak is fixed, recheck pump alarm by blocking the flow.
4. Check the pump before each day's use.

⚠ WARNING

Do not use the pump, sample line, or probe unless the pump alarm activates when the flow is blocked. Lack of an alarm is an indication that a sample may not be drawn to the sensors, which could cause inaccurate readings. Failure to follow the above can result in serious personal injury or death.

⚠ WARNING

Never let the end of the sampling line touch or go under any liquid surface. If liquid is sucked into the instrument, readings will be inaccurate and the instrument could be damaged.

5. Press the RESET button to reset the alarm and restart the pump.

During operation, a pump alarm may occur when the:

- Flow system is blocked
- Pump is inoperative
- Sample lines are attached or removed.

To Clear an Alarm

1. Correct any flow blockage.
2. Press the RESET button.
 - The Pump will now restart.

Response Check

The gas response check is simple and should complete in about one minute.

- Perform this response check before each day's use.
1. Turn ON the Orion plus Multigas Detector in clean, fresh air.
 2. Verify that readings indicate no gas is present.
 3. Attach the regulator to the cylinder.
 4. Connect the tubing to the regulator.
 5. Open the regulator valve.
 - The flow rate of the regulator is 0.25 lpm.
 6. Attach the other end of tubing to the Orion plus pump inlet fitting.
 - The reading on the Orion plus Multigas Detector display should be within the limits stated on the calibration cylinder or limits determined by your company.
 - If necessary, change the cylinder to introduce other calibration gases.
- The Orion plus Multigas Detector also offers an option for a 'silent' response check with no audible and visual alarms triggered. For the 'silent' check, enter the 'Setup' mode (see Chapter 4, "Changing Instrument Settings") and, in the 'Calibration' menu, select the 'Calibration check' option.

Measuring Gas Concentrations

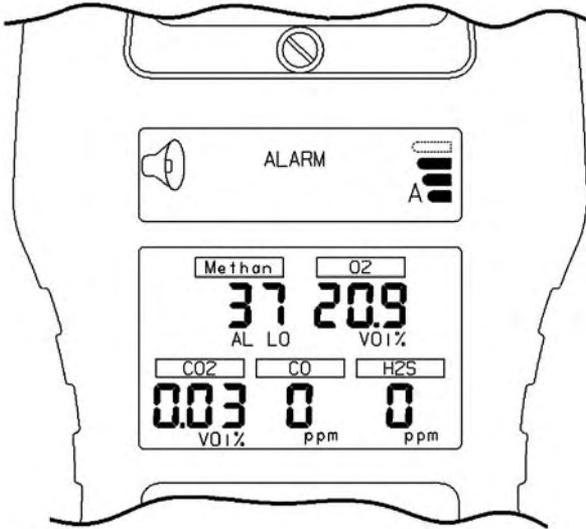


Figure 3-4. Instrument in LEL Alarm

The Orion plus Multigas Detector can be equipped to detect combustible gases in the atmosphere.

- Alarms sound when concentrations reach:
 - Low Alarm Setpoint, High Alarm Setpoint or
 - 100% LEL (Lower Explosive Limit).
- When the combustible gas indication reaches the Low Alarm Setpoint, the:
 - Alarm sounds and Alarm lights flash
 - Lo Alarm indication and % LEL label (located above the concentration) flashes; all other non-alarming gas readings move to the background.
- To silence the alarm, press the RESET button.

NOTE: The alarm will stay silent if the alarm condition has cleared.

- When the combustible gas indication reaches the High Alarm Setpoint, the:
 - Alarm sounds and Alarm lights flash at a higher frequency

- High Alarm indication and % LEL label (located above the concentration) flashes; all other non-alarming gas readings move to the background.
- To silence the alarm, press the RESET button.

NOTE: This alarm cannot be reset with RESET button until the condition is cleared.

- When the combustible gas indication reaches 125% LEL, the:
 - LockAlarm circuit locks the combustible gas reading and alarm
 - Alarm sounds
 - Alarm lights flash
 - Overrange message appears on the display.
- This alarm cannot be reset with the CHANGE/RESET button.

▲ WARNING

If the overrange LEL alarm condition is reached, you may be in a life-threatening situation; there is enough gas in the atmosphere for an explosion to occur. In addition, any rapid up-scale reading followed by a declining or erratic reading can also be an indication that there is enough gas for an explosion. If either of these indications occur, leave and move away from the contaminated area immediately. Failure to follow this warning can result in serious personal injury or death.

- After moving to a safe, fresh-air environment, reset the alarm by turning OFF the instrument and turning it ON again.

Oxygen Measurements

The Orion plus Multigas Detector can be equipped to detect the amount of oxygen in the atmosphere.

- Two conditions, depending on setpoints, can trigger the alarm:
 - Too little oxygen (deficient)
 - Too much oxygen (enriched).
- When the alarm setpoint is reached for either of the above:
 - Alarm sounds and Alarm lights flash
 - Hi or Lo Alarm indication and % O₂ label above the concentration flashes; all other non-alarming gas readings move to the background.

Toxic Gas Measurements

The Orion plus Multigas Detector can be equipped to detect specific toxic gases.

When the Low alarm setpoint is reached for any toxic gas:

- Alarm sounds and Alarm lights flash
- Lo Alarm indication and gas label above the concentration flashes; all other non-alarming gas readings move to the background.

To silence the alarm, press the RESET button.

NOTE: The alarm will stay silent if the alarm condition has cleared.

When the toxic gas indication reaches the High Alarm Setpoint, the:

- Alarm sounds and Alarm lights flash at higher frequency
- Hi Alarm indication and gas label (located above the concentration) flashes; all other non-alarming gas readings move to the background.

NOTE: This alarm cannot be reset with the RESET button until the condition is cleared.

WARNING

If the Oxygen or Toxic Gas alarm condition is reached while using the instrument as a personal or area monitor, leave the area immediately; the ambient condition has reached a pre-set alarm level. If using the instrument as an inspection device, do not enter the area without proper protection. Failure to follow this warning will cause over-exposure to toxic gases, which can result in serious personal injury or death.

Viewing Optional Displays

- Press the PAGE button to move to Minimum Readings (MINIMUM).
 - This page shows the lowest level of oxygen recorded by the Orion plus Multigas Detector since Turn-ON.

Peak Readings (MAXIMUM)

- The Maximum flag appears in the upper portion of the display to show the highest levels of gas recorded by the Orion plus Multigas Detector since:
 - Turn-ON
 - Short Term Exposure Limits (STEL)
 - The STEL flag appears in the upper portion of the display to show the average exposure over a 15-minute period.
- When the amount of gas detected by the Orion plus Multigas Detector is greater than the STEL limit, the:
 - Alarm sounds and Alarm lights flash
 - STEL flag flashes.
- The STEL alarm is calculated over a 15-minute exposure. Calculation examples are as follows:

Assume the Orion plus Multigas Detector has been running for at least 15 minutes.

- 10-minute exposure of 35 PPM
5-minute exposure of 5 PPM:

$$\frac{(10 \text{ minutes} \times 35 \text{ PPM}) + (5 \text{ minutes} \times 5 \text{ PPM})}{15 \text{ minutes}} = 25 \text{ PPM}$$

Assume the Orion plus Multigas Detector was turned on five minutes ago.

- 5-minute exposure of 15 PPM:

$$\frac{(5 \text{ minutes} \times 15 \text{ PPM}) + (10 \text{ minutes} \times 0 \text{ PPM})}{15 \text{ minutes}} = 5 \text{ PPM}$$

Time Weighted Average (TWA)

- The TWA flag appears in the upper portion of the display to show the average exposure since the TWA reading was reset.
- When the amount of gas detected by the Orion plus Multigas Detector is greater than the eight-hour TWA limit, the:
 - Alarm Sounds and Alarm Lights Flash
 - TWA flag flashes.

The TWA alarm is calculated over an eight-hour exposure. Calculation examples are as follows:

- 1-hour exposure of 50 PPM:

$$\frac{(1 \text{ hour} \times 50 \text{ PPM}) + (7 \text{ hours} \times 0 \text{ PPM})}{8 \text{ hours}} = 6.25 \text{ PPM}$$

- 12-hour exposure of 100 PPM:

$$\frac{(12 \text{ hours} \times 100 \text{ PPM})}{8 \text{ hours}} = 150 \text{ PPM}$$

NOTE: The accumulated reading is always divided by eight hours.

WARNING

If the STEL or TWA alarm condition is reached while using the instrument as a personal or area monitor, leave the contaminated area immediately; the ambient gas concentration has reached the preset STEL or TWA alarm level. Failure to follow this warning will cause over-exposure to toxic gases, which can result in serious personal injury or death.

Turning OFF the Orion plus Multigas Detector

Push and Hold the ON-OFF button for five seconds.

- Gas readings end and the Hourglass displays.

NOTE: Releasing the ON-OFF/PAGE button before the five seconds elapse returns the instrument to the Measure page.

Chapter 4, Setting up the Multigas Detector

Power Systems

- The Orion plus Multigas Detector is supplied with a NiMH battery pack or an optional replaceable cell, alkaline battery pack.
- See TABLE 4-1 for nominal run times by battery type.

Table 4-1.
Approximate Battery Run Times (20°C)

BATTERY TYPE	HOURS (WITH PUMP)
NiMH	10
Alkaline	6

In colder temperatures, battery output may be severely reduced. See TABLE 4-2 for capacity reductions expected for alkaline batteries at these temperatures.

Table 4-2.
**Capacity Reductions
Expected for Batteries at Colder Temperatures**

TEMPERATURE	AA ALKALINE
21°C (70°F)	None
0°C (32°F)	25%
-10°C (14°F)	60%

Battery Pack Removal

To remove the battery pack from the Orion plus Multigas Detector:

1. Remove the two screws from the bottom corner of the battery pack.
2. Gently pull out the pack by lifting the bottom out of its recess; then, slide it down.

Battery Charging (NiMH Battery Pack Only)

Charge the Orion plus Multigas Detector NiMH battery packs by using the Orion plus Fast Charger supplied with the instrument.

CAUTION

Use of any charger, other than the Fast Charger supplied with the instrument, may damage or improperly charge the batteries.

- The Orion plus Multigas Detector must be turned OFF, or the battery pack must be removed from the instrument, prior to charging.
- The charger is capable of charging a completely depleted pack in two hours in normal, room-temperature environments.

NOTE: Allow very cold battery packs to stabilize for 1/2-hour at room temperature before attempting to charge.

To Charge the Battery Pack

- Align and connect the charger cable plug and battery pack charging jack using the white alignment markers located on the charger plug and the back of the battery pack or use the charger cradle.
- Charger status is indicated by the LED color:
 - **Amber**
The charge is pending; LED remains amber until the pack is ready to be charged.
 - **Red**
Charging is in process.
 - **Green**
Charging is complete; the pack is fully charged and ready for use.

- **Red Flashing**
Failure mode; remove battery pack from charger.
- **LED OFF**
No battery pack is connected.

To Charge the Battery Pack (Vehicle Charger P/N 10034276)

- Connect the:
 - input cable assembly to the automobile lighter and
 - input to the charger assembly.
- Align and connect the charger cable plug and battery pack charging jack by using the white alignment markers located on the charger plug and the back of the battery pack.
- Charger status is indicated by the LED color:
 - **Yellow**
Charge pending/Fault
 - **Solid Red**
Charging is in process
 - **Solid Green**
Charge complete.

Once battery pack is charged, it:

- Can be disconnected from the charger
- Is ready for immediate use.

Alkaline Battery Pack

- The Orion plus Multigas Detector Replaceable battery pack can be used as a:
 - Full-time battery pack or
 - Backup power source.
- See TABLE 4-3 for batteries approved for use in the Orion plus alkaline battery pack.

Table 4-3.
Batteries Approved for use in the Orion plus Alkaline Battery Pack

BATTERY	UL	EUROPE	AUSTRALIA
DURACELL MN1500	●	●	●
VARTA 4006	●	●	
Energizer E91	●		●

To Replace the Batteries

1. Remove battery pack from the instrument by removing the two screws located in the bottom corners of the battery pack.
2. Gently lift the pack out of its recess and pull it out.
3. Using the supplied hex key, loosen the single screw that holds the plastic battery cover to the battery pack.
4. Remove the plastic cover, exposing the replaceable batteries.
5. Remove the depleted batteries.

NOTE: Follow local regulations regarding battery disposal.

6. Install the new batteries, observing the direction of the positive (+) battery terminal. The instrument will not operate if cells are reversed.
7. Replace the plastic battery cover and tighten the screw.
8. Re-install the battery pack on the instrument.

Changing Instrument Settings

- Many of the Orion plus Multigas Detector options can be set using the buttons on the front of the instrument.
 - The MSA Orion plus LINK software can be used to set most of the instrument selections, including some that cannot be changed from the instrument's front panel buttons.
1. To access instrument Setup mode, simultaneously press the PAGE and RESET buttons until "Password" appears on the display.
 2. Enter the following sequence:
 - PAGE, ON/OFF, RESET, ON/OFF, PAGE
 - You are now in the Setup menu, on the top menu "calibration"; there are five top menus which can be accessed using the scroll (PAGE/RESET) and OK (ON/OFF) buttons

- See TABLE 4-4 for available selections and methods for changing these selections.

**Table 4-4.
Available Instrument Selections and Methods
for Changing Selections**

OPTION	Orion plus FRONT-PANEL BUTTONS	ORION PLUS LINK
Viewing alarm set-points	●	●
Changing alarm set-points	●	●
Setting Datalog Intervals	●	
Setting calibration	●	
Password Change		●
Setting Date/Time	●	
Set Contrast	●	
Set Language (English/German)	●	●
Add Remote Sensors		●

Chapter 5, Instrument Setup and Calibration

WARNING

Attention! Special conditions with toxic gases!

If the instrument is to be checked or calibrated for toxic gases, prerequisites are required; otherwise, incorrect calibration would result in incorrect instrument operation.

Toxic gases (e.g., chlorine, ammonia, ozone) have the property of diffusing into rubber and plastic tubes so the volume of test gas available in the instrument would no longer be sufficient to correctly perform instrument calibration.

For this reason, when calibrating the instrument with toxic gases, certain prerequisites are required:

- a special pressure reducer
- short connection tubes between the pressure reducer and the instrument (approximately one inch)
- connection tubes made from a material which does not absorb the test gases (e.g., Teflon).

NOTE: If using normal tubes and pressure reducers, expose them to the relevant test gas for an extended time period.

For example:

for chlorine, allow the entire contents of a test gas cylinder to flow through the tubes and the pressure reducer.

Calibrating the Orion plus Multigas Detector

The Orion plus Multigas Detector is equipped with a password-accessible autocalibration feature to prevent unauthorized access to calibration. This autocalibration function will only operate with configurations shown in TABLE 5-1.

The Autocalibration sequence resets, instrument zeroes, and adjusts sensor calibration for known concentrations of calibration gases.

Table 5-1. Autocalibration and Required Calibration Cylinders

SENSORS	EXPECTED GAS CONCENTRATION	FIVE GAS CYLINDER	FOUR GAS CYLINDER
	58 Liters	P/N 10050744	P/N 804770
	34 Liters	P/N 10058022	P/N 711058
Combustible	58% LEL	●	●
Oxygen	15%	●	●
Carbon Monoxide	300 ppm	●	●
Hydrogen Sulfide	10 ppm	●	●
Carbon Dioxide	2.5% Vol	●	

To Calibrate the Orion plus Multigas Detector

1. Turn ON instrument and verify that battery is sufficiently charged.
2. To access Instrument Setup mode, simultaneously press the PAGE and RESET buttons until "Password" appears on the display.

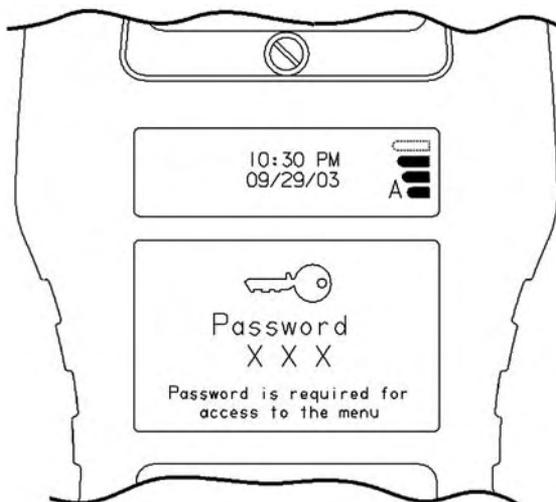


Figure 5-1. Password Screen

3. Enter the following sequence:
 - PAGE, ON/OFF, RESET, ON/OFF, PAGE.
 - User is now:
 - in the Setup menu
 - at the top Menu,"calibration".
 - There are five top menus accessible by using the:
 - Scroll (PAGE, RESET) and
 - OK (ON/OFF) buttons.
 - The five top menus in the Setup menu are:
 - Calibration
 - Alarm Setup
 - Instrument Setup
 - Turn Off Instrument
 - Go Back to Measurement.

Calibration Mode

4. To enter this page, press OK by scrolling with the PAGE and RESET buttons.
5. It is now possible to access the following sub-menus:
 - Calibration Multiple Sensors
 - 5 sensor calibration (see TABLE 5-1)
 - 4 sensor calibration (see TABLE 5-1)
 - Calibration Single Sensor
 - Fresh Air Setup
 - Calibration Check
 - Go Back to Previous Menu.

NOTE: The procedure is similar for all menus.

- The following describe the 4 sensor calibration procedure.

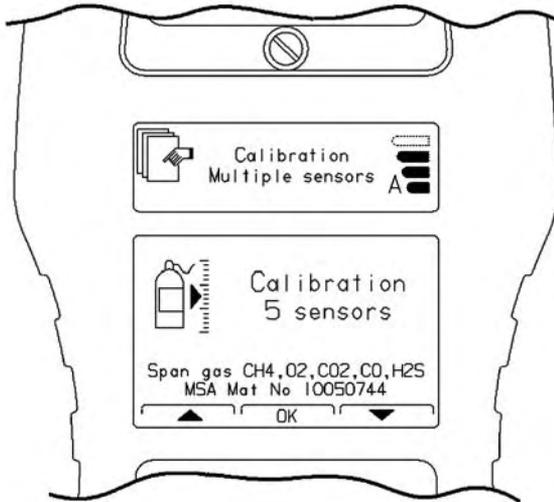


Figure 5-2. Multi Sensor Calibration Screen

Calibration Multiple Sensors

1. Access with OK; choose (PAGE, RESET) for:
 - 5 sensor calibration (see TABLE 5-1) or
 - 4 sensor calibration (see TABLE 5-1)
2. Access with OK.
 - Instrument displays list of required gases and concentrations.
3. Press NEXT for zero Calibration.
 - Instrument displays 'Apply Fresh Air'.

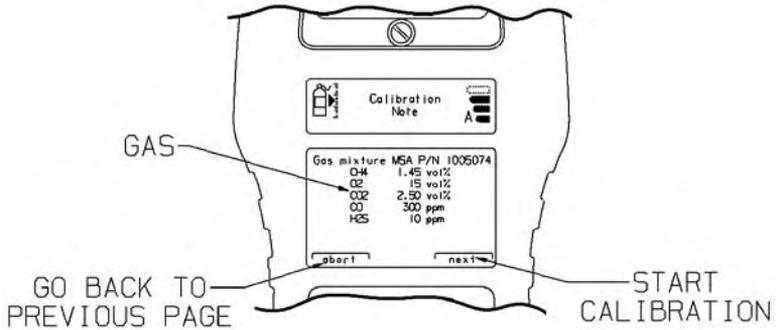


Figure 5-3. Gas Mixture Screen

4. Press:
 - ABORT to cancel
 - MEASURE to return to Measure mode
 - REPEAT to start FAS again
 - MENU to return to 4 sensor calibration
 - NEXT to perform FAS.
5. Press:
 - VALUE to see gas Value instead of gas Flag
 - ABORT to cancel FAS.
6. Press:
 - MEASURE to return to Measure mode
 - REPEAT to start FAS again
 - MENU to return to 4 sensor calibration.
 - If FAS is successful, instrument displays "Apply Span gas".
- 7 Press:
 - ABORT to cancel.
8. Press:
 - MEASURE to return to Measure mode
 - REPEAT to return to "Apply Span Gas"

- MENU to return to 4 sensor calibration
- NEXT to perform Calibration.

9. Press:

- VALUE to see gas Value instead of gas Flag
- ABORT to cancel Calibration.

10. Press:

- MEASURE to return to Measure mode
- REPEAT to start 4 sensor Calibration again
- MENU to return to 4 sensor calibration.
 - If Calibration is successful, the instrument asks for confirmation.
 - If Calibration is not successful, user can:
 - REPEAT or
 - ABORT.

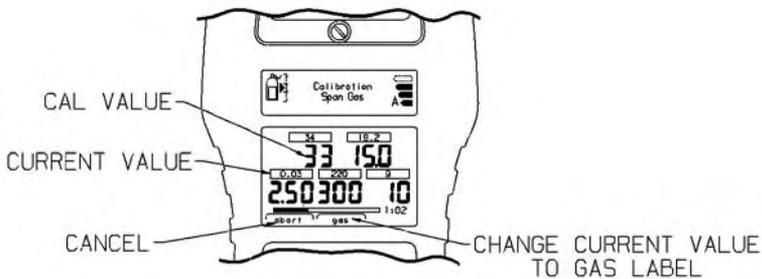


Figure 5-4. Calibration Page

Calibration Single Sensor

1. Access with OK.
2. Press NEXT and follow a procedure similar to that previously given under "Calibration Multiple Sensors".

NOTE: After performing FAS, the unit will ask for Span gas; the calibration value can be adjusted in this mode.

Calibration Table

DRION Plus Echém sensor Calibration				Zero gas: Clean Fresh Air	
Sensor	Range	Time Zero gas	Time Span gas	Cal gas Concentration	Display Read out
O2 Oxygen	0-25 Vol%	-	90 s	Clean Fresh Air (20.9 Vol % O2)	20.9 Vol%
CO Carbon Monoxide	0-300 ppm	60 s	90 s	10058022 / 1005823 (58L) 300 ppm CO	300 ppm
H2S Hydrogen Sulphide	0-200 ppm	60 s	90 s	10058022 / 1005823 (58L) 10 ppm H2S	10 ppm
NH3 Ammonia	0-100 ppm	60 s	240 s	711078 (34L) 25 ppm NH3 in N2	25 ppm
Cl2 Chlorine	0-10 ppm	60 s	180 s	805740 (58L) 10 ppm Cl2 in N2	10 ppm
SO2 Sulfur Dioxide	0-20 ppm	60 s	120 s	711070 (34L) 10 ppm SO2 in N2	10 ppm
NO2 Nitrogen Dioxide	0-20 ppm	60 s	180 s	711068 (34L) 10 ppm NO2 in Air	10 ppm
PH3 Phosphine	0-5 ppm	60 s	90 s	711088 (34L) 0.5 ppm PH3 in N2	0.5 ppm
ClO2 Chlorine Dioxide	0-1 ppm	60 s	180 s	711082 (34L) 2 ppm Cl2 / N2	0.6 ppm
O3 Ozone	0-1 ppm	60 s	240 s	711082 (34L) 2 ppm Cl2 / N2	2.4 ppm
HCN Hydrogen Cyanide	0-30 ppm	60 s	180 s	711072 (34L) 10 ppm HCN / N2	10 ppm
COCl2 Phosgene	0-1 ppm	60 s	240 s	711082 (34L) 2 ppm Cl2 / N2	0.8 ppm

DRION Plus IR sensor Calibration				Zero gas: Clean Fresh Air	
Sensor	Range	Time Zero gas	Time Span gas	Cal gas Concentration	Display Read out
CO2 Carbon dioxide	0 - 10 Vol%	60 s	90 s	10058022 / 1005823 (58L) 2.5 Vol % CO2	2.5 Vol%
CO2 Carbon dioxide	0 - 50 Vol%	60 s	90 s	10061803 10% CO2 in N2	10 Vol%
C3H8 Propane	0 - 100 % LEL	60 s	90 s	493579 100L 0.6 Vol % C3H8 in Air	29% LEL
C3H8 Propane	0 - 25 Vol %	60 s	90 s	10081605 / 15% Propane in N2 10075802 / 8Vol% C4H10 -> 11	15% 11.0 Vol%
C3H8 Propane	0 - 100 Vol %	60 s	90 s	10075803 / 8Vol % C3H8 -> 8 10075802 / 8Vol% C4H10 -> 11	8.0 Vol% 11.0 Vol%
C4H10 n-Butane	0 - 25 Vol %	60 s	90 s	10075802 / 8 Vol% C4H10 in N2	8.0 Vol%
C4H10 n-Butane	0 - 100 Vol %	60 s	90 s	10061604 / 15% Butane in N2	15 Vol%
CH4 Methane	0 - 25 Vol %	60 s	90 s	2.5 % Vol CH4	2.5% Vol
CH4 Methane	0 - 100 Vol %	60 s	90 s	711014 (58L) 100 Vol % CH4 in N2	100 Vol%

Alarm Setup Mode

NOTE: Accessing the Instrument Setup mode leads you to the main Calibration mode page.

1. To access the 'Alarm Setup' page:
 - Press the scroll buttons (PAGE, RESET).
 - Press OK.
 - User is now in the 'Setup Alarm Lo' page.

'Setup Alarm Lo' Page

2. Press:
 - ABORT to cancel setup
 - REPEAT to return to 'Setup Alarm Lo' page
 - NEXT to access the main 'Alarm Setup' page
3. CHANGE setpoints with the PAGE and RESET buttons.
4. Confirm settings with the ON/OFF button.
 - NEXT will lead you to 'Setup Alarm Hi' page.

'Setup Alarm Hi' Page

5. In the 'Setup Alarm Hi' page, press:
 - ABORT to cancel setup
 - REPEAT to return to 'Setup Alarm Lo' page
 - NEXT to access the main 'Setup TWA Alarms' page
6. CHANGE setpoints with the PAGE and RESET buttons.
7. Confirm settings with the ON/OFF button.
 - NEXT leads to 'Setup TWA Alarms' page.

'Setup TWA Alarms' Page

- In 'Setup TWA Alarms', display asks 'Activate TWA Alarms?'
8. Press:
 - ABORT to cancel setup
 - REPEAT to return to 'Setup Alarm Lo' page

- NEXT to access the main 'Alarm Setup' page
 - NO to Deactivate STEL and TWA Alarms
 - YES to save this setting and move to 'Alarm Setup' page.
9. In 'Alarm Setup' page press:
- NO to cancel
 - REPEAT to return to 'Setup Alarm Lo' again
 - NEXT to access the main 'Alarm Setup' page
 - YES to activate and move to 'Setup Alarm STEL' page.

'Setup Alarm STEL' Page

10. In 'Setup Alarm STEL', press:

- NO to cancel
- REPEAT to return to 'Setup Alarm Lo' again
- NEXT to access the main 'Alarm Setup' page

11. CHANGE the STEL setpoints with the PAGE and RESET buttons.

12. Confirm the settings with the ON/OFF button.

- NEXT will lead you to the 'Setup TWA Alarms' page.

13. In the 'Setup Alarm TWA', press:

- ABORT to cancel setup
- REPEAT to return to 'Setup Alarm Lo' page
- NEXT to access the main 'Alarm Setup' page

14. CHANGE the TWA setpoints with the PAGE and RESET buttons.

15. Confirm the settings with the ON/OFF button.

- NEXT leads to the question 'Save alarm setup?'

16. Press:

- YES to save
- NEXT to access the main 'Alarm Setup' page
- NO to cancel the setup
- REPEAT to restart 'Setup Alarm Lo'
- NEXT to access the main 'Alarm Setup' page.

Instrument Setup Menu

NOTE: Accessing the Instrument Setup mode leads you to the main Calibration mode page.

1. To access the Instrument Setup page:
 - Press the scroll buttons (PAGE, RESET).
 - Press OK.
 - User is now in the 'Instrument setup' page.
 - the instrument displays the 'Time Setup' sub-menu

'Time Setup' Sub-Menu

2. Press:
 - OK to enter the Time Setup page
 - display asks, 'change time?'
3. Press:
 - NO to cancel and return to 'time Setup' page
 - YES to change
 - OK to confirm setting.
 - Display asks 'Save new time?'
4. Press:
 - YES to save and return to the 'Time setup' page
 - NO to cancel and return to the 'Time Setup' page
 - REPEAT to change time and date again.
 - 'Language' is the next sub-menu under 'instrument Setup'

'Language' Sub-Menu

5. Press OK to enter the Language sub-menu.
 - The display shows 'English'.
6. Press:
 - ABORT to return to the 'English' page
 - STORE to save and return to the 'Calibration' page
 - CHANGE to change to the 'Deutsche' page.

7. Press:

- 'SPEICHERN' to store
- 'ANDERN' to go back to 'English'
- 'ABBRUCH' to return to 'Language'
 - 'Heartbeat' is the next sub-menu under 'Instrument Setup'.

'Heartbeat' Sub-Menu

7. Press:

- OK to enter the Heartbeat sub-menu
 - The display shows 'Heartbeat ON'
- OFF to:
 - Turn OFF the confidence beep and
 - Flash every 60 seconds
- NEXT to return to 'Heartbeat' page
- ABORT to return to 'Heartbeat' page
 - 'Contrast Setup' is the next sub-menu under Instrument Setup'.

'Contrast Setup' Sub-Menu

8. Press:

- OK to enter the Contrast Setup sub-menu.

NOTE: Contrast automatically adjusts with temperature changes. However, low temperatures may cause poor display contrast; this can be manually adjusted in the Setup mode.

'Data Logging Interval' Sub-Menu

9. Press OK to enter the 'Data Logging Interval' sub menu

10. To change the interval to a setting between 15 seconds and 10 minutes, use the (PAGE, RESET) scroll buttons.

11. Press OK to confirm setting.

- 'Data Logging Interval' is the next sub-menu under 'Instrument Setup'.
- Use arrows to change settings; press OK to confirm settings

between 15 seconds, 30 seconds, 60 seconds, two minutes, five minutes, and 10 minutes.

- 'Go back to Previous Menu' is the next sub-menu under 'instrument Setup'.

'Go back to Previous Menu'

13. To return to the previous menu:

- Press OK to confirm or
- Scroll with PAGE, RESET between previous sub-menus.

Turn OFF Instrument (Main Menu)

- Press OK to turn OFF the instrument
- Scroll with PAGE, RESET between other menus.

Go Back to Measurement (Main Menu)

- Press OK to return to the Measuring page
- Scroll with PAGE, RESET between other menus.

Setting the Instrument Using the ORION Link Software

NOTE: The computer must be fitted with an Infrared Adaptor IrDA RS 232 (e.g. iFoundry IFSYS-8001A) and the corresponding software.

1. If not already done, connect the infrared adaptor to the computer and install the driver (see drivers and installation instructions for the infrared adaptor).

NOTE: .NET-Framework by Microsoft® software must be installed on the computer.

2. If not already done, install the .NET-Framework by Microsoft software on the computer (software and installation instructions are on the supplied CD-ROM).
3. Install the ORION Link software on the computer (software and installation instructions are on the supplied CD-ROM).

Connecting Instrument to the PC

1. Turn ON the computer and open the ORION Link software.
2. Turn ON the instrument and wait until it is in the Measuring mode.
3. Locate the instrument about 1 inch away from the infrared adaptor (with input spigot pointing toward the infrared sensor when viewing the instrument from the rear).



Figure 5-5. Attaching the Infrared Adaptor to the Instrument

4. On the Start screen of the ORION Link software, select CONNECT INSTRUMENT.
5. On the window that opens, select the:
 - interface (COM1, COM2 or others) connected to the infrared adaptor (FIGURE 5-6)
 - scope of information:
 - Instrument information
 - Sensor data and settings
 - Stored event data (over a specific time period)
 - Stored measured values (over a specific time period)

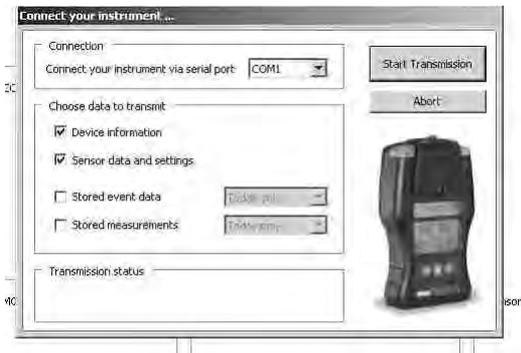


Figure 5-6. Connecting the instrument

6. Connect the instrument by clicking on the CONNECT INSTRUMENT button.

- The following Welcome screen appears:

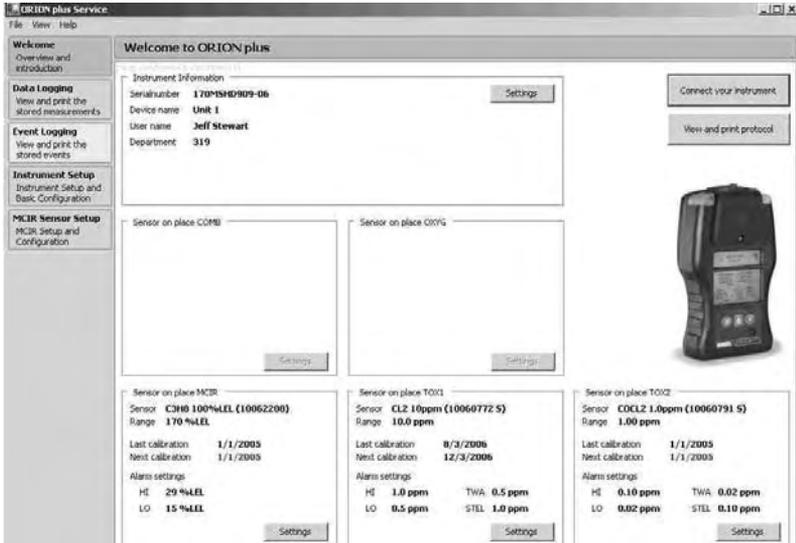


Figure 5-7. Welcome to ORION plus

- The CONNECT INSTRUMENT button can be used to reestablish an interrupted connection.
- The CREATE PROTOCOL button can be used to store all the instrument data.
- FIGURE 5-7 displays the:
 - instrument data
 - information concerning individual sensors.
- After pressing the SETTINGS button, the user can change:
 - settings for each sensor individually (if the required areas are adjustable)
 - alarm settings for installed sensors.

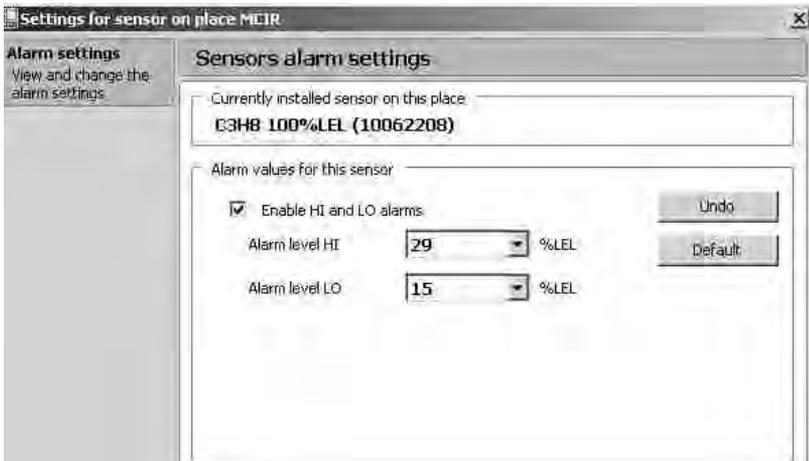


Figure 5-8. Alarm Settings

- The FIGURE 5-8 screen shows the:
 - sensors
 - alarm thresholds for these sensors.
- By selecting the options you can activate or deactivate the alarm.
 - This can only be done for *both* alarm thresholds *together*.
- The alarm thresholds:
 - can be changed to suit the user's requirements and
 - transmitted to the instrument by closing the window.
- By clicking on the relevant button the user can:
 - cancel the changes made or
 - set the values to a standard setting.
- By using the buttons in the navigation bar (FIGURE 5-7) the user can access other program areas, such as:
 - Data storage – display and store the instrument data
 - Event storage – display and store the event data
 - Instrument settings – instrument settings and configuration
 - MCIR settings – MCIR settings and configuration.

NOTE: The program areas, instrument settings and MCIR settings are only accessible with valid authorization. For access to the area MCIR settings, the corresponding sensor must be installed.

Data Log

- In this window, the user can:
 - view all stored measurement data for the selected time period
 - view instrument data
 - convert and store the measurement data as a table by clicking on the STORE TABLE button
 - delete all the stored measurement data by clicking on the DELETE DATA button

NOTE: It is not possible to delete selected individual data.

 - re-establish an interrupted connection to the instrument by pressing the CONNECT INSTRUMENT button.

Event Log

- In this window, the user can:
 - view all stored measurement data for the selected time period
 - view instrument data
 - convert and store the measurement data as a table by clicking on the STORE TABLE button
 - re-establish an interrupted connection to the instrument by pressing the CONNECT INSTRUMENT button.

Area Instrument Settings

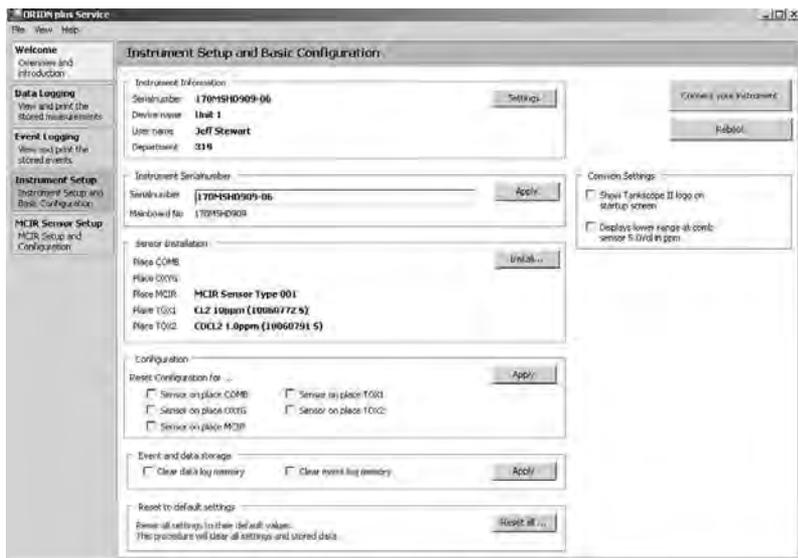


Figure 5-9. Instrument Settings and Configuration

- This window provides extended instrument settings and configuration.
- Certain functions are only accessible by the group of persons authorized by MSA.
- The available options are:
 - Display and modify the instrument information
 - Display the instrument serial number
 - Install the sensors
 - Reset the sensors
 - Delete the data and event storage .
- To reset all instrument data to the factory setting, click on the RESET button.

- By clicking on the SETTINGS button in the area instrument information (FIGURE 5-11), the "Instrument Settings" window appears:

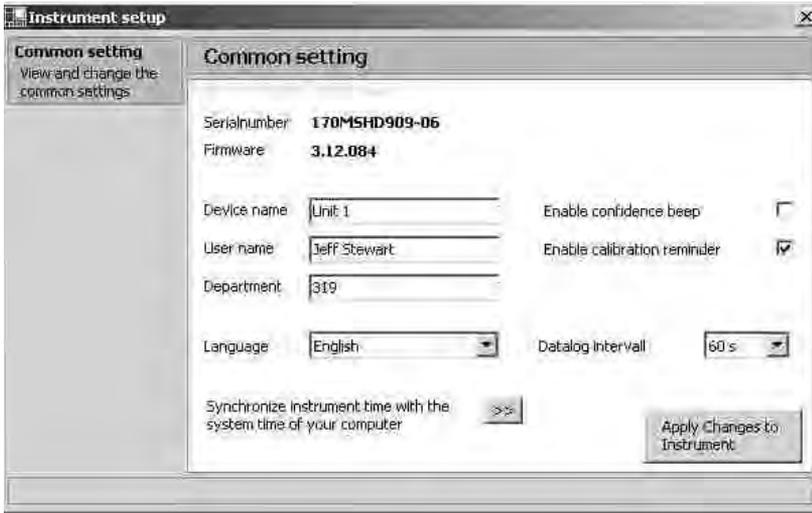


Figure 5-10. Instrument Settings

- This window displays the instrument serial number and additional information applicable to the instrument:
 - Instrument name
 - User, Department
 - Language and
 - Data storage interval.
- The user can:
 - change the information on the input masks provided for this purpose.
 - activate or be reminded by a sound when instrument calibration is required.
- All data is transmitted to the instrument by clicking on the TRANSMIT CHANGES button, .
- After the changes are transmitted, the instrument performs a REBOOT (automatically switches OFF and ON again).

Chapter 6, Warranty, Maintenance, and Troubleshooting

MSA Portable Instrument Warranty

1. Warranty-

ITEM	WARRANTY PERIOD
Chassis and electronics	Two years (MSA will support product for five years after production ends)
Sensors	Varies (see TABLE 7-2)
Pump and drive unit	Two years
Rechargeable batteries	Two years

This warranty does not cover fuses. Certain other accessories not specifically listed here may have different warranty periods. This warranty is valid only if the product is maintained and used in accordance with Seller's instructions and/or recommendations. The Seller shall be released from all obligations under this warranty in the event repairs or modifications are made by persons other than its own or authorized service personnel or if the warranty claim results from physical abuse or misuse of the product. No agent, employee or representative of the Seller has any authority to bind the Seller to any affirmation, representation or warranty concerning this product. Seller makes no warranty concerning components or accessories not manufactured by the Seller, but will pass on to the Purchaser all warranties of manufacturers of such components.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY, AND IS STRICTLY LIMITED TO THE TERMS HEREOF. SELLER SPECIFICALLY DISCLAIMS ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.

- 2. Exclusive Remedy-** It is expressly agreed that Purchaser's sole and exclusive remedy for breach of the above warranty, for any tortious conduct of Seller, or for any other cause of action, shall be the repair and/or replacement at Seller's option, of any equipment or parts thereof, which after examination by Seller is proven to be defective. Replacement equipment and/or parts will be provided at no cost to Purchaser, F.O.B. Seller's Plant. Failure of Seller to successfully repair any nonconforming product shall not cause the remedy established hereby to fail of its essential purpose.

3. **Exclusion of Consequential Damages-** Purchaser specifically understands and agrees that under no circumstances will seller be liable to purchaser for economic, special, incidental or consequential damages or losses of any kind whatsoever, including but not limited to, loss of anticipated profits and any other loss caused by reason of nonoperation of the goods. This exclusion is applicable to claims for breach of warranty, tortious conduct or any other cause of action against seller.

Cleaning and Periodic Checks

As with all electronic equipment, the Orion plus Multigas Detector will operate only if it is properly maintained.

⚠ WARNING

Repair or alteration of the Orion plus Multigas Detector, beyond the procedures described in this manual or by anyone other than a person authorized by MSA, could cause the instrument to fail to perform properly. Use only genuine MSA replacement parts when performing any maintenance procedures described in this manual. Substitution of components can seriously impair instrument performance, alter intrinsic safety characteristics or void agency approvals.

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

Cleaning and Routine Care

Periodically clean the Orion plus Multigas Detector case with a soft damp cloth.

1. Remove the sensor cover plate, sensor membrane, and sensor cover gasket (see Chapter 8, FIGURE 8-1)
2. Clean sensor plate holes with a paper clip, wire, or similar device. The holes may also be cleaned with oil-free compressed air.
3. Replace sensor membrane with a new one.

⚠ WARNING

Do not attempt to clean the sensor cover plate while it is in place; sensor damage may occur. The tops of sensors are very fragile; do not touch or apply pressure to the tops of any sensors. If a sensor is damaged, it can cause the unit to give false readings. The sensor cover plate contains

holes for four sensors. In instruments with less than four sensors, some of the holes are permanently blocked with special sealing membranes. Do not puncture these membranes; erroneous gas readings can result.

Checking The Pump Inlet Filter

Orion plus Multigas Detectors ordered with the internal pump contain a filtering system to protect the pump from particles and water in the sample air. If the filter becomes clogged, the sample flow may be blocked, or an extra load may be placed on the pump; therefore, check the filter regularly.

The frequency of checks should depend on amount of pump usage and concentration of particles allowed to enter the pump. In dirty applications, replace the dust filter every 200 hours.

Replacing the Filters

▲ CAUTION

When replacing external dust and water filters, prevent any dust or dirt around the filter housing from entering the pump housing. Dust or dirt in the pump unit may impede pump operation.

Dust and Water Filter (see FIGURE 8-2 and TABLE 8-2)

1. Remove the four screws (24) from the clear filter housing (23) on the back of the instrument.
2. Remove fibrous filter (21) from the recess on filter housing.
3. Carefully install the new filter in the filter housing recess.
4. Re-install the filter housing.

NOTE: When replacing filter, carefully handle new filter by the edges only, as it is easily torn. Install filters in correct order.

4. Replace the O-ring, being sure to press gently down on top of the water filter.
5. Replace the cover and screws.

Probe Filter

- The MSA sampling probe contains a filter to:
 - block dust and dirt
 - block the passage of water.
- If the probe tip is accidentally submerged in water, the filter prevents the water from reaching the internal pump. The filter is not designed to stop other liquids, such as gasoline or alcohols.

To Replace the Probe Filter

1. Grasp the probe handle by the base and guard.
2. Push the cap section toward the other two and turn clockwise. The spring pushes the sections apart.
3. Grasp and spin the wand clockwise while pulling to disengage.
4. Remove the water trap filter (P/N 801582) and replace.

Storage

- When not in use, store your Orion plus Multigas Detector in a safe, dry place between -5° and 40°C (23° and 104 °F).
- The Orion plus Multigas Detector with the NiMH rechargeable battery pack can be stored on charge indefinitely.

WARNING

After storage, always recheck instrument calibration before use. During storage, sensors may drift or become inoperative and may not provide warnings of dangers to the health and lives of users.

Shipment

1. Remove battery pack before shipment. When returning the Orion plus Multigas Detector for repairs, disconnect the normally used battery pack from unit, and include it in the container.

2. Pack the Orion plus Multigas Detector in its original shipping container with suitable padding. If the original container is unavailable, an equivalent container may be substituted. Seal instrument in a plastic bag to protect it from moisture. Use sufficient padding to protect it from the rigors of handling. Damage due to improper packaging or damage in shipment is not covered by the instrument's warranty.

Troubleshooting

The Orion plus Multigas Detector will operate reliably for years when cared for and maintained properly. If the instrument becomes inoperative, it typically displays the error message with corrective action in clear language. You may return nonoperative instruments to MSA for repair.

- **Instrument Division
Repair and Service Department
1000 Cranberry Woods Drive
Cranberry Township, PA 16066-5207
1-800-MSA-INST**

To contact MSA International, please call:

- **1-412-967-3000 or 1-800-MSA-7777.**

Table 6-1. Troubleshooting Guidelines

PROBLEM	ACTION
Does not turn ON	Recharge (if applicable) or replace battery. See Chapter 6
Battery pack does not hold charge	Replace battery. See Chapter 6
Sensor does not calibrate	Replace sensor. See Chapter 6
IR Sensor Error	If temperature too cold, allow instrument to stabilize within normal temperature range before turning ON. If Error remains, contact the MSA Repair Center
Pump alarm	Check for leaks/blocks, replace dust and water filters. See Chapter 3
Sensor missing	Check installation of sensor/replace sensor. See Chapter 6
RAM Error	Contact MSA
ROM Error	Contact MSA
Memory Error	Contact MSA
Battery type not recognized	Change the battery pack or have the instrument checked by MSA
Device restarts automatically	If this occurs repeatedly, arrange for service by MSA
▲ or ▼ next to the measurement unit	Measurement above or below measuring range; calibration required
Fresh Air Setup error	Supply fresh air (not measuring gas) and repeat; if error recurs, calibration is required
Test gas error	Check the gauge on test gas regulator. Set the correct test gas concentration; if message recurs, replace the sensor
In all of the above cases and for any other problems, the Orion plus Multigas Detector may be returned to MSA for repairs.	

Repair Procedures

Battery Pack Replacement

Remove the Battery Pack

1. Remove the two battery mounting screws on the back of the instrument.
2. Pull out the battery pack by gripping it at the edge of the battery pack case and pulling it away from the unit.

Replace the Battery Pack

3. Insert the front of the battery pack under the lip on the case and snap the bottom of the battery pack into the case.

4. Install and tighten the battery mounting screws.

Sensor Replacement

1. Verify that the instrument is turned OFF; remove battery pack.
2. Remove pump cover by removing the screw with a 1/16" hex key.
3. Remove the sensor cover screws and cover.
4. Gently lift out sensor to be replaced; properly dispose of sensor.

NOTE: Sensor positions cannot be changed. Each sensor location is identified by a label in the bottom of each sensor well.

When replacing a sensor, ensure that the gas type printed on the sensor label matches the sensor identification label in the instrument.

5. If replacement sensor is equipped with a shorting plate, clip or wire attached to its pins, remove plate, clip or wire before inserting the replacement sensor.
6. Carefully align the new sensor contact pins with the sockets on the printed circuit board.
7. Press the new sensor into place.
8. Replace the sensor gasket and sensor cover.
9. Re-install the screws to hold down the sensor cover.

NOTE: Any repair beyond this manual (IR sensor, Main board, etc.) requires special training and can only be performed by qualified and authorized repair centers.

WARNING

Verification of calibration response is required (some toxic sensors require more than five hours to stabilize); otherwise, the instrument will not perform as required, and persons relying on this product for their safety could sustain serious personal injury or death.

Chapter 7, Performance Specifications

Table 7-1. Certifications

HAZARDOUS LOCATIONS	US	UL 913 for Class 1, Div. 1, Groups A, B, C, and D
	CANADA	CSA C22.2 No. 157 for Class 1, Div. 1, Groups A, B, C, and D
	EUROPE	EN 50 014/ EN 50 018/EN 50 019/ EN 50 020 EEx ia d e IIC T4 (T3 Varta Alkaline AA) -20 °C to +50°C
	AUSTRALIA	AS/NZS 60079-11 ExiasIIC -20°C to +50°C
EMC/RFI	US	47 CFR, part 15
	EUROPE	EN 50270 Type 2 EN 61000-6-3
	AUSTRALIA	C-tick emissions (CSPR11)
PERFORMANCE	CANADA	CSA C22.2 No. 152 for Methane only
	EUROPE	IEC 529 IP54 min., EN 50 271/ EN 50 054 EN 50 057/ EN 50 104 EN 45 544
	AUSTRALIA	AS/NZS 61779 -1/61779-4
SAFETY	EUROPE	CE: LVD (low voltage directive), EN61010-1 for chargers and accessories requiring greater than 50 VAC or 75 VDC
ATEX	EUROPE	EEx ia d e IIC T4 (T3 Varta Alkaline AA) -20 °C to +50°C Directive 94/9/CE
		BVS 03 ATEX E 27OX II2G EEx ia d e IIC T4 (T3 Varta Alkaline AA) -20 °C to +50°C

Table 7-2. Instrument Specifications

TEMPERATURE RANGE	Normal	0 to 40°C
	Extended*	-20 to 50°C
WARM-UP TIME	two minutes	
*NOTE: Extended temperature range indicates that gas readings may vary slightly if calibrated at room temperature. For optimal performance, it is recommended that the instrument be calibrated at temperature of use.		
MEASUREMENT METHODS	COMBUSTIBLE GAS	Catalytic Sensor
	OXYGEN	Electrochemical Sensor
	TOXIC GASES	Electrochemical Sensors/IR Sensor
WEIGHT	410 g (instrument with battery pack)	
DIMENSIONS	165 x 92 x 66 mm (L x B x H)	
BATTERY TYPE	Rechargeable NiMH battery pack	
BATTERY LIFE	NiMH: 11 h	
CHARGING TIME	≤ 3 h with the MSA Fast Charger (100-250 VAC)	
WARM UP TIME	2 minutes	
TEMPERATURE RANGE	-20°C to +50°C, Storage from -5°C to +40°C	
HUMIDITY RANGE	15 - 90% rel. humidity, non condensing, short term 5% - 95% rel. humidity	
ATMOSPHERIC PRESSURE RANGE	800 to 1200 HPa	
FLOW RATE	0.2 to 0.5 l/min	
DUST AND SPRAY PROTECTION	IP 54	
WARRANTY	2 years for housing, electronics, rechargeable batteries and pump 2 years for IR, LEL, O ₂ , H ₂ S, CO, HCN, SO ₂ , CL ₂ sensors; 1 year for NH ₃ , NO ₂ and PH ₃ sensors; 6 months for ClO ₂ , COCl ₂ , and O ₃	

**Table 7-3.
Measurable Gases, Displays and Resolution**

MEASURABLE GASES*	DISPLAY	RESOLUTION	RESPONSE TIME AT 20°C
20 mm SENSORS			
Combustible gases	0 - 100% LEL	1% LEL	$t_{50} \leq 10$ s methane ≤ 15 s propane $t_{90} \leq 26$ s methane ≤ 35 s propane
O ₂	0 - 25 % Vol.	0.1 % Vol.	≤ 10 s
CO	0 - 999 ppm	1 ppm	= 45 s
H ₂ S	0 - 200 ppm	1 ppm	= 20 s
HCN	0 - 50 ppm	1 ppm	$t_{50} < 30$ s
Cl ₂	0 - 10 ppm	0.1 ppm	$t_{50} < 10$ s / $t_{90} < 30$ s
NH ₃	0 - 100 ppm	1 ppm	$t_{50} < 20$ s / $t_{90} < 60$ s
SO ₂	0 - 20 ppm	0.1 ppm	$t_{90} \leq 35$ s
NO ₂	0 - 20 ppm	0.1 ppm	$t_{90} \leq 25$ s
ClO ₂	0 - 1 ppm	0.02 ppm	$t_{50} < 20$ s / $t_{90} < 120$ s
PH ₃	0 - 5 ppm	< 0.05 ppm	t_{90} 30 s
O ₃	0 - 1 ppm	0.02 ppm	$t_{50} < 30$ s / $t_{90} < 60$ s
COCl ₂	0 - 1 ppm	0.02 ppm	$t_{50} < 60$ s / $t_{90} < 120$ s
IR SENSORS			
HC, Butane	0-25 % Vol.	0.1 % Vol.	
HC, Propane	0-25 % Vol.	0.1 % Vol.	
CH ₄ , Methane	0-100 % Vol.	1 % Vol.	
C ₃ H ₈ , Propane	0-100 % Vol.	1 % Vol.	
C ₃ H ₈ , Propane	0-100 % LEL	1 % LEL	
CO ₂	0 - 10 % Vol.	0.01 % Vol.	
CO ₂	0 - 5 % Vol.	0.01 % Vol.	
CO ₂	0 - 50 % Vol.	0.1 % Vol.	

* The gases can only be measured when the appropriate sensors are used.

**Table 7-4.
Sensor Cross-Sensitivity**

INPUT→ OUTPUT↓	20.9 % Vol O₂	300 ppm CO	20 ppm H₂S	5 % Vol CO₂	33 % LEL CH₄	20 ppm Cl₂	50 ppm NH₃
O ₂ / 30 % Vol	20.9 % Vol	20.9 % Vol	20.9 % Vol	20.9 % Vol	20.9 % Vol	20.9 % Vol	20.9 % Vol
CO/ 300 ppm	0 ppm	300 ppm	0 ppm	0 ppm	0 ppm	2 ppm	23 ppm
H ₂ S/ 200 ppm	0 ppm	0 ppm	20 ppm	0 ppm	0 ppm	9 ppm	0 ppm
CO ₂ / 5% Vol	0 % Vol	0 ppm	0 ppm	5 % Vol	0 ppm	0 ppm	0 ppm
Comb/ 100 LEL	0 LEL	0 LEL	0 LEL	0 LEL	33 % LEL	0 LEL	0 LEL
Cl ₂ / 20 ppm	0 ppm	0 ppm	0 ppm	0 ppm	0 ppm	20 ppm	0 ppm
NH ₃ / 100 ppm	0 ppm	0 ppm	2 ppm	0 ppm	0 ppm		50 ppm
SO ₂ / 20 ppm	0 ppm	4 ppm	0 ppm Fi (200 ppmh)	0 ppm	0 ppm	-140 ppm*	0.25 ppm
NO ₂ / 100 ppm	0 ppm	≤ 0.1 ppm	≤ 40 ppm	0 ppm	0 ppm	200 ppm	≤ 0.25 ppm
PH ₃ / 5 ppm	0 ppm	1.5 ppm	0 ppm	0 ppm			
ClO ₂ / 1 ppm	0 ppm	0 ppm	0 ppm	0 ppm	0 ppm	6 ppm	
O ₃ / 1 ppm	0 ppm	0 ppm	0 ppm	0 ppm	0 ppm	24 ppm	-1.5 ppm
HCN/ 50 ppm	0 ppm	0 ppm	0 ppm	0 ppm	0 ppm	0 ppm	0 ppm
COCl ₂ / 1 ppm	0 ppm	0 ppm	0 ppm	0 ppm	0 ppm	8 ppm	0.15 ppm

* This sensor combination should not be selected.

INPUT → OUTPUT ↓	20 ppm SO ₂	100 ppm NO ₂	5 ppm PH ₃	1 ppm ClO ₂	1 ppm O ₃	50 ppm HCN	1 ppm COCl ₂
O ₂ / 30% Vol	20.9 % Vol	20.9 % Vol	20.9 % Vol	20.9 % Vol	20.9 % Vol	20.9 % Vol	20.9 % Vol
CO/ 300 ppm	1 ppm	-6 ppm				0.5 ppm	
H ₂ S/ 200 ppm	0.2 ppm	-7 ppm				0.5 ppm	
CO ₂ / 5% Vol	0 ppm	0 ppm	0 ppm	0 ppm	0 ppm	0 ppm	0 ppm
Comb/ 100 LEL	0 LEL	0 LEL	0 LEL	0 LEL	0 LEL	0 LEL	0 LEL
Cl ₂ / 20 ppm	-2.5 ppm	20 ppm		0.5 ppm	0.12 ppm	-0.5 ppm	
NH ₃ / 100 ppm							
SO ₂ / 20 ppm	20 ppm	-500 ppm					
NO ₂ / 100 ppm	≤ -2.5 ppm	100 ppm					
PH ₃ / 5 ppm	4 ppm		5 ppm				
ClO ₂ / 1 ppm		37 ppm		1 ppm	0.06 ppm	-2.1 ppm	
O ₃ / 1 ppm	-0.2 ppm	60 ppm		1.5 ppm	1 ppm		
HCN/ 50 ppm	0 ppm Fi	-7.3 ppm		-2 ppm	-0.04 ppm	50 ppm	
COCl ₂ / 1 ppm	0 ppm	10 ppm		-3 ppm	0 ppm	0 ppm Fi	1 ppm

IR X- Sensitivity Table

IR Sensor 0-25 Vol % Methan		
Test Gas	% LEL	% VOL CH4 Display
12.5 Vol % Methane	NA	12.5
Propane	50	25.2
Butane	50	25.8
Nonane	50	26.0
Hexane	50	32.8
Pentan	50	Over Range
Methanol	50	Over Range
Benzene 65/95	50	Over Range
JP8	20	1.5
Ethanol	50	24.3
Toluene	50	2.0
Aceton	50	2.1
Ethylacetat	50	5.6

IR Sensor / 0-100 % LEL Propane		
Test Gas	% LEL	% LEL C3H8 Display
20 Vol % Methane	NA	44.0
Propane	50	50.0
Butane	50	54.0
Nonane	50	48.0
Hexane	50	53.0
Pentan	50	62.0
Methanol	50	61.0
Benzene 65/95	50	66.0
JP8	20	7.0
Ethanol	50	55.0
Toluene	50	13.0
Aceton	50	10.0
Ethylacetat	50	21.0

IR Sensor / 0 - 100 % LEL Butane		
Test Gas	% LEL	% LEL C4H10 Display
20 Vol % Methane	NA	66.0
Propane	50	52.0
Butane	50	50.0
Nonane	50	36.0
Hexane	50	45.0
Pentan	50	55.0
Methanol	50	62.0
Benzene 65/95	50	55.0
JP8	20	6.0
Ethanol	50	55.0
Toluene	50	11.0
Aceton	50	12.0
Ethylacetat	50	27.0

Environment and Oxygen Sensor Readings

A number of environmental factors may affect the oxygen sensor readings, including changes in pressure, humidity and temperature. Pressure and humidity changes affect the amount of oxygen actually present in the atmosphere.

Pressure Changes

The Orion plus oxygen sensor is designed to compensate for ambient pressure changes in the area of instrument operation. If pressure changes rapidly (e.g., stepping through airlock) the oxygen sensor reading may temporarily shift, and possibly cause the detector to go into alarm. While the percentage of oxygen may remain at or near 20.8%, the total amount of oxygen present in the atmosphere available for respiration may become a hazard if the overall pressure is reduced to a significant degree.

Humidity Changes

If humidity changes to any significant degree (e.g., going from a dry, air conditioned environment to outdoor, moisture laden air), oxygen levels can change up to 0.5%. This is due to water vapor in the air displacing oxygen, thus reducing oxygen readings as humidity increases. The oxygen sensor has a special filter to reduce the affects of humidity changes on oxygen readings. This effect will not be noticed immediately, but slowly impacts oxygen readings over several hours.

Temperature Changes

The oxygen sensor has built-in temperature compensation. However, if temperature shifts dramatically, the oxygen sensor reading may shift. Zero the instrument to within 30°C of the temperature-of-use for the least effect.

Chapter 8, Replacement and Accessory Parts

Table 8.1. Accessory Parts List

PART	PART NO.
Protective Jacket, Orange Nylon	10020486
Protective Rubber Boot, Black	10022036
Protective Rubber Boot, Red (North American-approved instrument only)	10025665
Leather Carrying Case	10020485
Calibration Kit Model RP with 0.25 lpm Regulator	477149
Calibration Gas - 100 Liters, 58% LEL pentane simulant / 15% O ₂ ; 300 ppm CO / 2.5% Vol. CO ₂	10059149
Calibration Gas - 58 Liters, 58% LEL pentane simulant / 15% O ₂ ; 300 ppm CO and 10 ppm H ₂ S / 2.5% Vol. CO ₂	10050744
Econocal, 34 Liters, 58% LEL pentane simulant / 300 ppm CO/15% O ₂ /2.5% Vol. CO ₂	10058023
Econocal, 34 Liters, 58% LEL pentane simulant / 300 ppm CO/15% O ₂ /10 ppm H ₂ S/2.5% Vol. CO ₂	10058022
Gas Miser Regulator, Model RP	710288
Regulator, .25 LPM, Model RP	467895
Regulator, Combination, .25 LPM, Model RP	711175
Battery Charger, NiMH, A.C.	10020551
Battery Charger, NiMH, Vehicle	10034276
Battery Pack, NiMH (10031091 Pack with Charging Adapter)	10073663
Battery Pack, Alkaline	10031092
Belt Clip	10025664
Sampling Line, 1.5 m Teflon, PTFE conductive	10074535
Sampling Line 5 m Teflon, PTFE conductive	10021927
Calibration Gas - 58 Liters, 58% LEL pentane simulant / 15% O ₂ ; 300 ppm CO and 10 ppm H ₂ S	804770
Calibration Gas, 34 Liters, 58% LEL pentane simulant / 300 ppm CO/15% O ₂ and 10 ppm H ₂ S	711058
Calibration Gas, 34L, 300 ppm CO, 1.45% CH ₄ , 15% O ₂ , 10 ppm H ₂ S, 2.5% CO ₂ , N ₂ Balance	10058022
Calibration Gas, 34L, 300 ppm CO, 1.45% CH ₄ , 15% O ₂ , 2.5% CO ₂ , N ₂ Balance	10058023
Calibration Gas, 34L, 10 ppm HCN, N ₂ Balance	711072
Calibration Gas, 58L, 10 ppm Cl ₂ , N ₂ Balance (to calibrate Cl ₂ sensor)	806740
Calibration Gas, 34L, 2 ppm Cl ₂ , N ₂ Balance (to calibrate O ₃ /COCl ₂ /ClO ₂ sensor)	711082
Calibration Gas, 34L, 25 ppm NH ₃ , N ₂ Balance	711078
Calibration Gas, 34L, 10 ppm SO ₂ , air Balance	711070
Calibration Gas, 34L, 10 ppm NO ₂ , air Balance	711068

PART	PART NO.
Calibration Gas, 34L, 0.5 ppm PH ₃ , N ₂ Balance	711088
Calibration Gas, 10% CO in N ₂	10081603
Calibration Gas, 15% Butane in N ₂	10081604
Calibration Gas, 15% Propane in N ₂	10081605
Calibration Gas, 58L, 50% Vol Methane, N ₂ Balance	10075804
Calibration Gas, 58L, 100% Vol Methane	711014
Calibration Gas, 100L, 0.6% Vol Propane	493579
NiMH Battery with PCBA connector	10073663
Connector, PCBA and nut	10074534
Charger and Cradle	10073666
Upgrade Kit (Cradle, PCBA connector and nut)	10073664
Charging Cradle	10073668
Alkaline Battery pack	10031092
Vehicle Battery Charger	10034276
Assembly Kit for IR Sensor	10080043

Table 8-2. Replacement Parts List

FIGURE 8-1 OR 8-2 ITEM NO.	PART/COMPONENT	PART NO.
1	Pump Cap Assembly, includes screw P/N10025551	10025539
2	Pump Cap Screw	10025551
3	Case Screws	10022921
4	Sensor Cover	10022105
6	Sensor Cover Gasket, Coated	10061454
7	Oxygen Sensor	10025940
8	Toxic Sensor 1	
9	Combustible Sensor	10024247
10	Toxic Sensor 2	
11	Sensor Gasket	10022331
12	Front Case Assembly Keypad	10046364
13	Pump Cap Assembly, includes gasket P/N 10022102	10025539
14	Pump Cap Gasket	10022102
15	Display Assembly	10046366
16	Printed Circuit Board Assembly, Main	10045993
17	IR Sensor	
18	Case Gasket	10022100
19	Pump and Drive Replacement Kit	10031093
21	PTFE filter and Water filter, package of five	10064531

FIGURE 8-1 OR 8-2
8-1 OR 8-2 PART/COMPONENT
ITEM NO.

PART NO.

22	Inlet Fitting	497187
23	Filter Cover	811722
24	Filter Cover Screws	10022922
25	Case Rear, Pumped	(non-saleable)
26	Filter Cover O-ring	637009
27	Internal backup filter (not shown)	634261

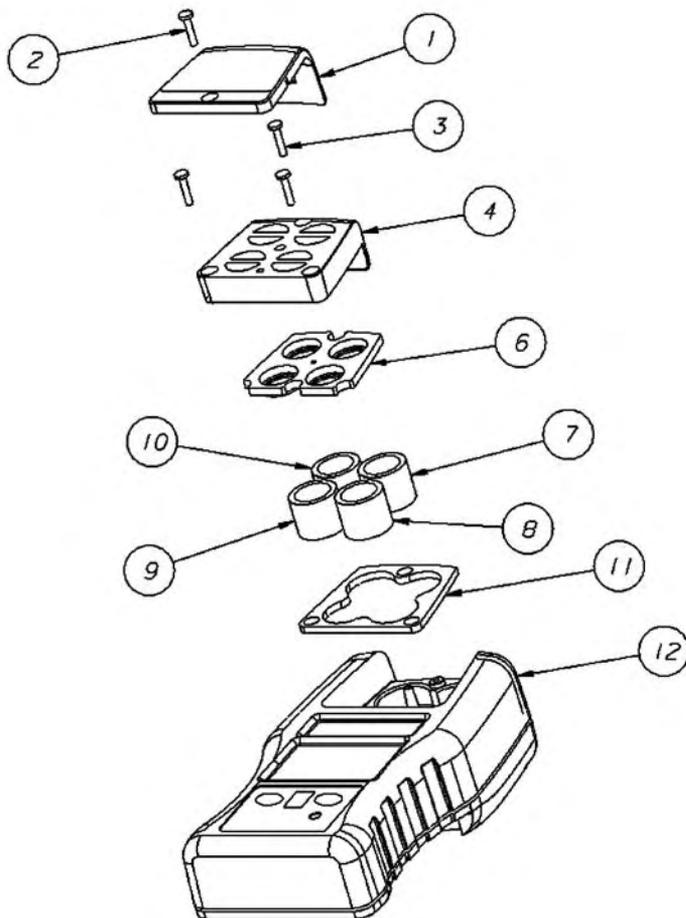


Figure 8-1. Replacement Parts (see TABLE 8-2)

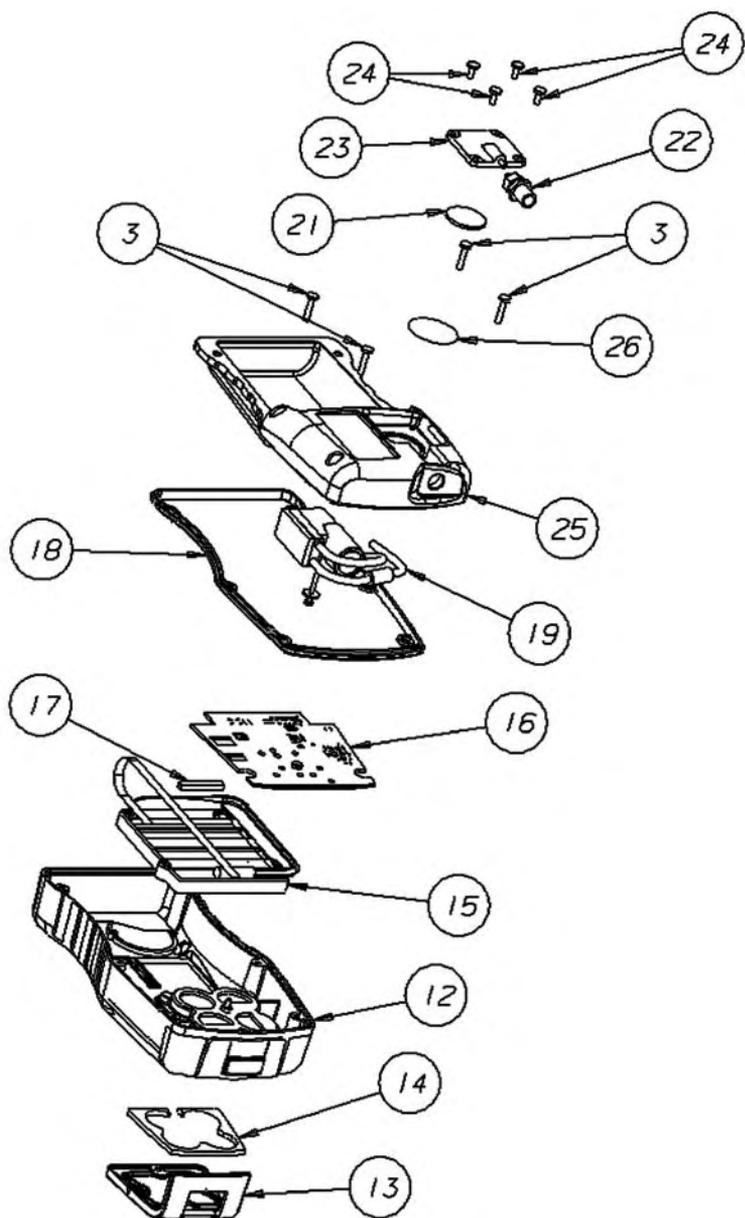


Figure 8-2. Replacement Parts (see TABLE 8-2)

Table 8.3 Sensor Replacement Parts

PART/COMPONENT	PART NO.
SENSORS	
LEL sensor	10024247
O ₂ sensor	10025940
CO sensor	711306
H ₂ S sensor	711307
HCN sensor	10073949
Cl ₂ sensor	10073945
NH ₃ sensor	10073948
SO ₂ sensor	10073944
NO ₂ sensor	10073947
ClO ₂ sensor	10073951
PH ₃ sensor	10073952
O ₃ sensor	10073946
COCl ₂ sensor	10073950
IR SENSORS	
ORION plus, IR sensor HC 0-25 % Vol Butane	10062201
ORION plus, IR sensor HC 0-25 % Vol Propane	10062202
ORION plus, IR sensor CH ₄ 0-100 % Vol	10062205
ORION plus, IR sensor C ₃ H ₈ 0-100 % Vol	10062207
ORION plus, IR sensor C ₃ H ₈ 0-100 % LEL	10062208
ORION plus, IR sensor CO ₂ 0-10% Vol.	10062209
ORION plus, IR sensor CO ₂ 0-50% Vol.	10070757
ORION plus, IR sensor CH ₄ 0-25 % Vol	10070759
ORION plus, IR sensor C ₄ H ₁₀ 0-100% LEL	10071381
ORION plus, IR sensor C ₄ H ₁₀ 0-100% Vol.	10070756