

SIRIUS®

[MultiGas Detector]



Instruction Manual

Manufactured by:

MSA INSTRUMENT DIVISION

P.O.Box 427, Pittsburgh, Pennsylvania 15230

[Europe] Rev.03 / 11 2010 10092677 Y-HLS / GB

Warranty and Liability Disclaimer

🔍 Safety Advice

The SIRIUS Multigas Detector is a product supporting life and health!

- This manual must be carefully read, understood and followed by all individuals who have or will have the responsibility for selecting, using, servicing or maintaining this product.
- This manual contains instructions for the optimal use of the product as well as important safety information.
- Before use, the acting persons have to decide in accordance with this manual, whether the product is suitable for the intended application.

🔍 Liability Information

- The liability of MSA is excluded if the product is not used appropriately and for the intended purpose. Choice and use are in the sole responsibility of the acting persons.
- Warranties also as guarantees made by MSA with respect to the product are voided, if it is not used, serviced or maintained in accordance with the instructions in this manual.
- The above corresponds to the terms and conditions of sale regarding the warranty and liability of MSA. It does not alter them.

🔍 Maintenance Advice

- This product must be inspected and maintained in regular intervals by trained specialists, records are to be kept. For service and repairs original MSA spare must be used only. Inspections and maintenance must be made exclusively by authorised service shops or MSA. The authorised service shops are responsible for procurement of valid technical information for the product, components thereof and maintenance instructions. Modifications to the product or components thereof are not permissible and violate the approvals.
- The liability of MSA extends exclusively to service and maintenance made by MSA.



Observe handling instructions Subassemblies sensitive to electrostatic discharge

This instrument consists of subassemblies which are electrostatically sensitive. Opening of the instrument for maintenance or repair is to be carried out by authorized personnel only. Avoid unprotected touching of the subassemblies causing electrostatic discharge. Guarantee is voided if damages to subassemblies are caused by electrostatic discharge.

Table of Content

1. Instrument Safety and Certifications.	5
1.1 Safety Limitations and Precautions.	6
1.2 Date of Instrument Manufacture.	7
1.3 Marking, Certificates and Approvals according to the Directive 94/9/EC (ATEX).	8
2. Quick Start.	10
2.1 Turning ON the SIRIUS Multigas Detector.	11
2.2 Moving through the SIRIUS Multigas Detector Pages.	12
2.3 Turning Off the SIRIUS Multigas Detector.	12
3. Using the SIRIUS Multigas Detector.	13
3.1 Power Systems.	13
3.2 Battery Pack Removal and Replacement.	13
3.3 Battery Charging (Lithium-Ion Battery Pack Only).	14
3.3.1 To Charge the Instrument.	15
3.4 Last Cal Date.	15
3.5 Fresh Air Set Up Option (for automatic zero adjustment).	16
3.6 Battery Life Indicator.	16
3.6.1 Battery Warning.	16
3.6.2 Battery Shutdown.	17
3.7 Sensor Missing Alarm.	17
3.8 PID Alarms.	17
3.8.1 PID Bulb - Cal Now.	18
3.9 Verifying Pump Operation.	18
3.10 To Clear Pump Alarm.	19
3.11 Confidence Flash.	19
3.11.1 Safe LED.	20
3.11.2 Operating Beep.	20
3.12 Calibration Check.	20
4. Measuring Gas Concentrations.	21
4.1 Combustible Gases (% LEL).	21
4.1.1 Oxygen Measurements (% O ₂).	22
4.1.2 Toxic Gas and VOC Measurements.	22
4.2 Viewing Optional Displays.	23
4.2.1 Peak Readings (PEAK).	23
4.2.2 Minimum Readings (MIN).	24
4.2.3 Short Term Exposure Limits (STEL).	24
4.2.4 Time Weighted Average (TWA).	25
4.2.5 Time and Date Display.	25
4.3 PID Setup.	26
4.3.1 Displaying Current Response Factor.	26
4.3.2 Changing Response Factor.	26
4.3.3 Selecting a Custom Response Factor.	26
4.3.4 Changing PID Bulb Selection.	27

Table of Content

5. Setting up the SIRIUS Multigas Detector	28
5.1 Changing Instrument Settings.	28
5.2 Accessing the Instrument Setup Mode.	28
5.3 Instrument Alarm Bypass Options.	30
6. Calibration	33
6.1 Calibrating the SIRIUS Multigas Detector.	33
6.2 Calibration Flow Chart.	34
6.3 Autocalibration Failure.	36
7. Warranty, Maintenance, and Troubleshooting	37
7.1 MSA Portable Instrument Warranty.	37
7.2 Cleaning and Periodic Checks.	37
7.3 Removing and Cleaning the PID Bulb.	38
7.3.1 Cleaning Steps.	38
7.4 Replacing the Ion Chamber.	40
7.5 Replacing the Filters.	43
7.6 Storage.	45
7.7 Shipment.	45
7.8 Troubleshooting.	45
7.9 Sensor Replacement.	47
7.10 Replacement of the Electronics Boards, the Display Assembly, the Horn Assembly, and the Pump.	48
8. Performance Specifications	49
9. Replacement and Accessory Parts	60

1. Instrument Safety and Certifications

The SIRIUS Multigas Detector is for use by trained and qualified personnel. It is designed to be used when performing a hazard assessment to:

- Assess potential worker exposure to combustible and toxic gases and vapours
- Determine the appropriate gas and vapor monitoring needed for a workplace.

The SIRIUS Multigas Detector can be equipped to detect:

- Combustible gases and certain combustible vapours
- Volatile organic compounds (VOCs)
- Oxygen-deficient or oxygen-rich atmospheres
- Specific toxic gases for which a sensor is installed.

ATTENTION:

- Read and follow all instructions carefully.
- Check calibration before each day's use and adjust if necessary.
- Check calibration more frequently if exposed to silicone, silicates, lead-containing compounds, hydrogen sulfide, or high contaminant levels.
- Recheck calibration if unit is subjected to physical shock.
- Use only to detect gases/vapours for which a sensor is installed.
- Do not use to detect combustible dusts or mists.
- Make sure adequate oxygen is present.
- Do not block pump sample inlet and sensors.
- Use only Teflon sampling lines for reactive gases such as Cl_2 , PH_3 , NH_3 , HCN and for semivolatile organic compounds such as gasoline and jet fuels.
- Do not place end of sampling line in liquids.
- Use only MSA-approved sampling lines.
- Do not use silicone tubing or sampling lines.
- Wait for accurate reading; response times vary, based on gas/vapor and length of sampling line.
- Have a trained and qualified person interpret instrument readings.
- Account for sensor reproducibility.
- Properly identify the VOC gas being measured before using VOC response factors or setting alarm values (exposures, STEL, TWA).
- Recognize that the VOC Auto-range displays readings in increments of 100 ppb.
- Ensure installed PID bulb corresponds to the PID bulb setting on the instrument display.
- Do not recharge Lithium Ion battery or change Alkaline batteries in a combustible atmosphere.
- Do not alter or modify instrument.



1.1 Safety Limitations and Precautions

It is very important to have an understanding of PID basics when changing your PID settings. Failure to properly identify the VOC gas being measured and/or failure to select the correct Response Factor alarm values (exposure, STEL, TWA) that match your desired Response Factor and/or the correct bulb, will result in erroneous readings.

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

The SIRIUS Multigas Detector is designed to:

- Detect gases and vapours in air only
- Detect only specified toxic gases for which a sensor is installed.

Perform the following check before each day's use to verify proper instrument operation:

- Calibration check (see 3.12 Calibration Check). Adjust calibration if the readings are not within the specified limits.

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/or VOC sensor (PID) and reduce its readings:

- Organic silicones
- Silicates
- Lead-containing compounds
- Hydrogen sulfide exposures over 200 ppm or exposures over 50 ppm for one minute.

The minimum concentration of a combustible gas in air that can ignite is defined as the Lower Explosive Limit (LEL). A combustible gas reading of "100" (in LEL mode) or "4.4" (in CH₄ mode) indicates the atmosphere is at 100% LEL or 4.4% CH₄ (by volume), respectively, and an explosion hazard exists. In such cases, the instrument LockAlarm feature activates. Move away from contaminated area immediately.

Do not use the SIRIUS 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/dusts
- Ambient pressures other than one atmosphere.

Do not use the SIRIUS Multigas Detector to test for combustible gases in atmospheres containing vapours from liquids with a high flash point (above 38 °C, 100 °F) as this may result in erroneously low readings.

Allow sufficient time for unit to display accurate reading. Response times vary based on the type of sensor being utilized (see **8. Performance Specifications**). Additionally, when using a sampling line, allow a minimum of 3 seconds per meter of sampling line to allow the sample to be drawn through 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 Li-Ion 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.

1.2 Date of Instrument Manufacture

The date of manufacture of your SIRIUS Multigas Detector is coded into the instrument serial number.

- The last three digits represent the month (the letter) and the year (the two-digit number).
- The letter corresponds to the month starting with A for January, B for February, etc.

1.3 Marking, Certificates and Approvals according to the Directive 94/9/EC (ATEX)

Manufacturer:	Mine Safety Appliances Company 1000 Cranberry Woods Drive Cranberry Township, PA 16066 USA	
Product:	MSA SIRIUS	
EC-Type Examination Certificate:	BVS 05 ATEX E 025X FTZU 05 ATEX 0003X	
Marking:	 II 2G EEx ia d IIC T3/T4 -20 °C ≤ Ta ≤ +50 °C	
Battery:	Alkaline	T4: Duracell MN 15000 T3: Varta 4006, 4106, 4906, Energizer E91
	Lithium Ion	T4
	Um = 6,54V	
Type of protection:	EN 50 014: 1997, EN 50 018: 2000, EN 50 020: 2002 The revised standards are compared to the standards used for the certification and there are no changes in the "state of the art" applied to the Sirius.	
Performance:	EN 60 079-29-1: 2007, EN 50 104: 2004, EN 50 271: 2001	
Gas:	Methane, Pentane, Oxygen	
Quality Assurance Notification:	0080	
Year of Manufacture:	see Label	
Serial Nr.:	see Label	

EMC Conformance according to the Directive 2004/108 EC

EN 50270: 2007 Type 2, EN 61000-6-3: 2007



Declaration of Conformity

MANUFACTURED BY: Mine Safety Appliances Company
1000 Cranberry Woods Drive
Cranberry Township, PA 16066 USA

The manufacturer or the European Authorized Representative
MSA AUER GmbH, Thiemannstraße 1, D-12059 Berlin

declares that the product: **SIRIUS**

based on the EC-Type Examination Certificate:

BVS 05 ATEX E 025X
FTZU 05 ATEX 0003X

complies with the ATEX directive 94/9/EC, Annex III. Quality Assurance Notification complying with Annex IV of the ATEX Directive 94/9/EC has been issued by Ineris, Notified Body number: 0080.

The product is in conformance with the directive 2004/108/EC, (EMC):
EN 50270: 2007 Type 2, EN 61000-6-3: 2007

The product is in conformance with the directive 2008/67/EC, (MarED):
EC-Type Examination Certification: **213.037** Notified Body number: 0736

A handwritten signature in black ink that reads 'Dr. A. Schubert'. The signature is written in a cursive, flowing style.

MSA AUER GmbH
Dr. Axel Schubert
R & D Instruments

Berlin, March 2010

2. Quick Start

It is your responsibility to know how to use the SIRIUS Multigas Detector. When used properly the SIRIUS Multigas Detector will alert you to presence of VOC, combustible gases and vapours, atmospheres that are rich or deficient in oxygen. It will also alert you to presence of carbon monoxide and hydrogen sulphide, if it is equipped with sensors for those gases. The conditions are displayed clearly and simultaneously on face of the instrument, See Figure 1 for an explanation of the flags, numbers and button operation on the SIRIUS Multigas Detector.

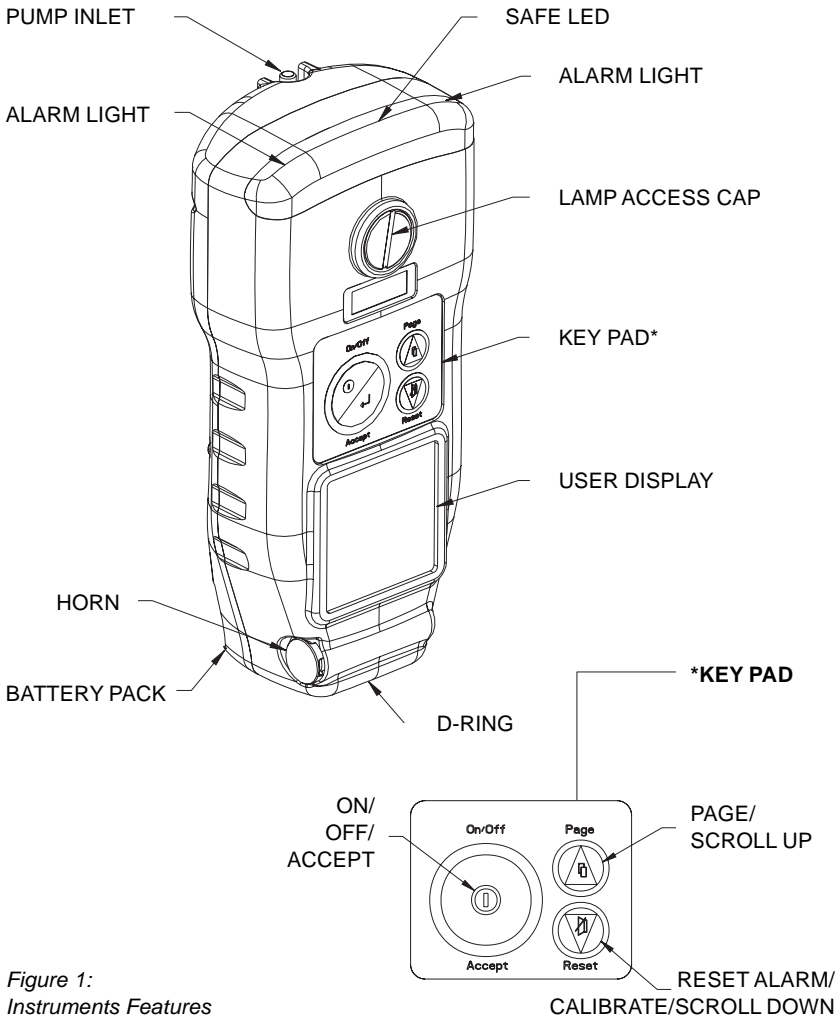


Figure 1:
Instruments Features

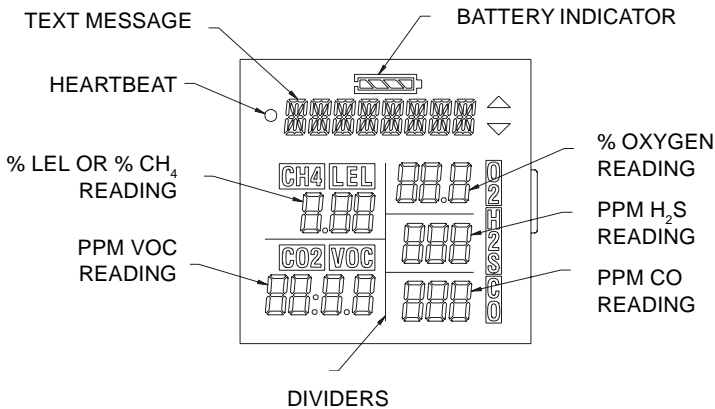


Figure 2:
Understanding the Display

2.1 Turning ON the SIRIUS Multigas Detector

Install the alkaline battery pack Lithium-Ion battery pack or if already intalled press the ON-OFF/ACCEPT button. The instrument then performs a Self-test and displays:

- All segments display
- Audible alarm sounds
- Alarm LEDs illuminate
- Display backlight illuminates
- Pump activates
- Software version displays
- Internal diagnostics

Alarm setpoints:

- Low
- High
- STEL (if activated)
- TWA (if activated)
- **Calibration gas** (expected calibration gas values)
- **Time and date** (if data logging option installed)
- **Last CAL date** (if data logging option installed)
- **Instrument warm-up period**
- **Fresh Air Setup option**
- **Last Cal Date**

Once the Self-test is complete, the instrument enters the Measure mode and is ready for use.

2.2 Moving through the SIRIUS Multigas Detector Pages

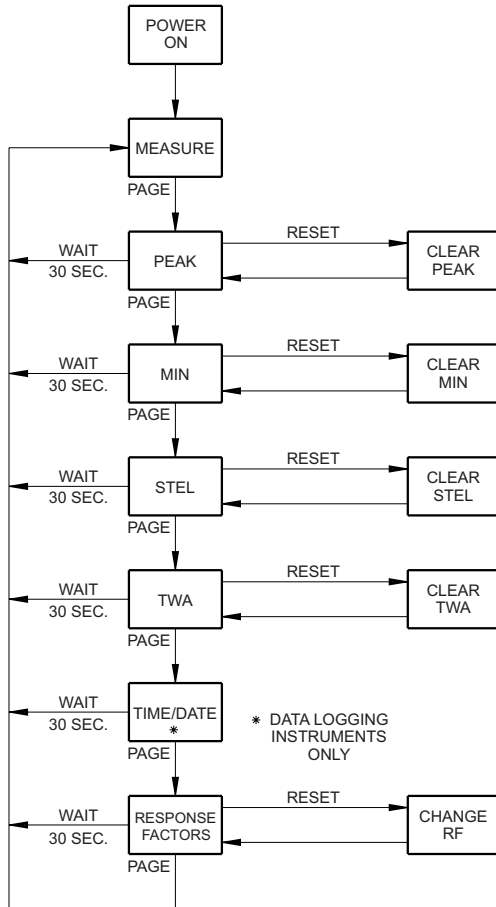


Figure 3:
Flow diagram showing the operation of the instrument.

2.3 Turning Off the SIRIUS Multigas Detector

To turn OFF the SIRIUS Multigas Detector:

- Push and hold the ON-OFF/ACCEPT button for three seconds.
- Four audible beeps will be heard during the turn-off sequence.

3. Using the SIRIUS Multigas Detector

3.1 Power Systems

The SIRIUS Multigas Detector is supplied with a rechargeable Lithium-Ion battery pack or a replaceable cell, alkaline battery pack.

NOTE:

For both types of battery packs, always remove the battery pack from the instrument if the instrument is not to be used for 30 days.

See Table 1 for nominal run times by battery type. Note that there is a severe reduction in run time for instruments operated at colder temperatures.

Table 1. Battery Type/Temperature/Approximate Run Time (Hours)

Battery Type	23 °C	0 °C	-20 °C
Alkaline	6	4	1
Lithium-Ion	11	9	6

3.2 Battery Pack Removal and Replacement (Figure 4)

To remove the battery pack from the SIRIUS Multigas Detector:

1. Unscrew the captive screw from the bottom of the battery door.

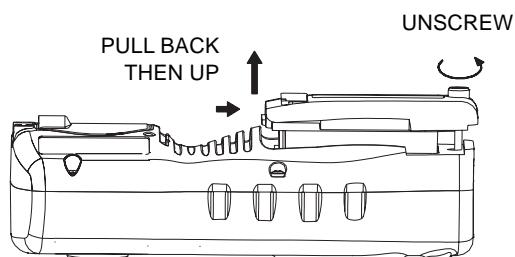


Figure 4: Battery Pack Removal

2. Pull the battery pack out of the instrument by gripping the sides of the battery pack door and lifting it up and away from the unit.

For Alkaline battery packs (Figure 5):

- a. Pull the battery pack from the clip.
- b. Unscrew the captive thumbscrew and lift the lid.
 - The lid will remain on the thumbscrew.
- c. Replace the batteries, using only batteries listed on the approval label T3: Varta 4006/ Energizer E91, T4: Duracell MN1500 (see also chapter 1.3), and replace the lid; tighten the thumbscrew.
- d. Slide the battery pack into the clip and reinstall the door.



Change batteries in non-hazardous areas only!

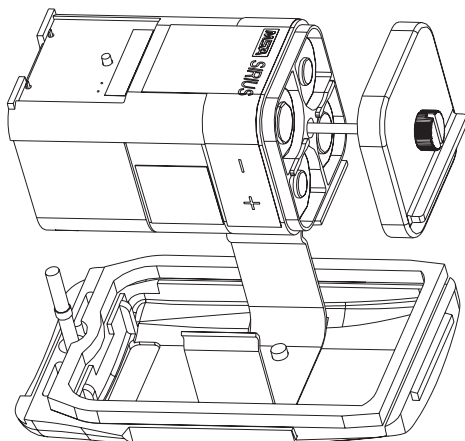


Figure 5: Changing Alkaline Batteries

3.3 Accumulator Charging (Lithium-Ion Battery Pack Only)

Charge the SIRIUS Multigas Detector Lithium-Ion battery pack by using the SIRIUS Charger supplied with the instrument. The Lithium-Ion battery pack can be charged while on or off the instrument.

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



Charge Accumulator in non-hazardous areas only!

- The SIRIUS Multigas Detector must be turned OFF, or the battery pack may be removed from the instrument, prior to charging.

NOTE:

If the instrument is not turned OFF, the charger connection will turn OFF the instrument without warning.

- The charger is capable of charging a completely depleted pack in less than six hours in normal, room-temperature environments.

Allow very cold battery packs to stabilize for one hour at room temperature before attempting to charge.

- Minimum and maximum ambient temperature to charge the instrument: 10 °C (50 °F) to 35 °C (95 °F). Charging outside of this range may not be successful.
- For best results, charge the instrument at room temperature (23 °C)



3.3.1 To Charge the Instrument

- Snap the charger onto the instrument.
- Do not restrict or block the ventilation openings on either side of the charger.
- Charge status is indicated by the LED on the charger.
 - **Red:** Charging in process
 - **Green:** Charging complete
 - **Yellow:** Failure Mode.
- If the red LED does not light and remain ON when the charger is attached, it is possible:
 - an incomplete electrical connection exists between the charger and the Lithium Ion battery pack contact points or
 - the temperature of the battery pack is outside of the previously indicated range.
- During recharge, the red LED turning OFF and green LED not lighting is an indication of an improper charging process. This is most likely caused by a battery pack temperature being outside of the previously-indicated range.
 - Restart the charging process with the battery pack in a different temperature environment.
- Failure mode, indicated by the yellow LED, will occur if either:
 - the battery pack has been deeply depleted beyond the point where it will accept a charge
 - an internal charger fault has been detected, which would result in an erroneous charging condition.
- Charger may be left on the instrument when charge is complete.

3.4 Last Cal Date

The SIRIUS Multigas Detector is equipped with a “last successful calibration date” feature. The date shown is the last date at that all installed sensors were successfully calibrated. “**LAST CAL**” is displayed with this date in the following format:

MM/DD/YY

3.5 Fresh Air Set Up Option (for automatic zero adjustment)



NOTE:

The Fresh Air Setup (FAS) has limits. If a hazardous level of gas is present, the SIRIUS Multigas Detector ignores the FAS command and goes into alarm. Persons responsible for the use of the SIRIUS 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.

- Turn ON the SIRIUS Multigas Detector.
- Once the instrument self check is complete, **ZERO?** flashes for 10 seconds.
- To perform a Fresh Air Setup, push the ON/OFF button while **ZERO?** is flashing.
- To immediately skip the FAS, push the RESET/▼ button.
- If no buttons are pushed, the option of performing a Fresh Air Set Up stops flashing after the 10 seconds have expired.

3.6 Battery Life Indicator (see Figure 2)

- 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 battery icon remains.

3.6.1 Battery Warning

A Battery Warning indicates that a nominal 15 minutes of operation remain before instrument batteries are completely depleted.



NOTE:

Duration of remaining instrument operation during Battery Warning depends on ambient temperatures.

When the SIRIUS Multigas Detector goes into Battery Warning:

- Battery Life indicator flashes
- "BATT WRN" flashes every 15 seconds
- Alarm sounds
- Lights flash every 15 seconds
- The SIRIUS Multigas Detector continues to operate until the instrument is turned OFF or battery shutdown occurs.

3.6.2 Battery Shutdown

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

- **LOW** and **BATTERY** flash on the display
- Alarm sounds and lights flash
- Alarm can be silenced by pressing the RESET/▼ button
- No other pages can be viewed
- After approximately one minute, the instrument 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:

1. Leave the area immediately.
2. Turn OFF the instrument if it is ON.
3. Report to the person responsible for maintenance.

Recharging or replacing batteries must be done in a non-hazardous location only.



3.7 Sensor Missing Alarm

The SIRIUS Multigas Detector will enter the Sensor Missing alarm if the instrument detects that an enabled sensor is not properly installed in the instrument. For O₂, CO, and H₂S sensors, the Sensor Missing feature is checked when the instrument is turned ON and when leaving the Setup mode. The combustible Sensor Missing feature is continually monitored. If a sensor is detected as missing, the following occurs:

- **SENSOR** and **MISSING** flash on the display
- The flag above the sensor detected as missing flashes on the display
- Alarm sounds and lights flash
- Alarm can be silenced by pressing the RESET/▼ button
- No other pages can be viewed
- After approximately one minute, the unit automatically turns OFF.

3.8 PID Alarms

The SIRIUS Multigas Detector will enter the Ion Error, PID Error or the PID Comm Error if the instrument detects that the PID is not functioning properly. These errors are continually monitored. The PID Failed Span Cal is monitored during calibration only. If one of these errors is detected, the following occurs:

- The error name flashes on the display
- Alarm sounds and lights flash
- Alarm can be silenced by pressing the RESET/▼ button
- No other pages can be viewed
- After approximately one minute, the unit automatically turns OFF.

3.8.1 PID Bulb – Cal Now

This message may appear in the event that the instrument detects a potential problem with the output of the PID sensor. When this occurs, the best course of action is to clean the PID bulb (see **7.3 Removing and Cleaning the PID Bulb**). This message is not a replacement for daily bump checks.



WARNING!

If a Sensor Missing, PID Error, Ion Error, PID Failed Span Cal, or PID Comm condition occurs, stop using the instrument; it can no longer alert you of potential hazards.

1. Leave the area immediately.
2. Turn OFF the instrument if it is ON.
3. Report to the person responsible for maintenance.

3.9 Verifying Pump Operation

1. Turn ON the SIRIUS 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
 - PUMP ALARM will flash on the display
 - The readings on the display may change.



Figure 6:
PUMP/ALARM
flashing on the display

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 sample line and probe for leaks.
 - b. Once leak is fixed, recheck pump alarm by blocking the flow.

NOTICE

Perform a blocked flow test before each day's use. 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.

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 instrument could be damaged.

4. 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.

3.10 To Clear Pump Alarm

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

NOTE:

When the instrument is in a gas alarm, the pump alarm may not display until gas alarm is cleared.

3.11 Confidence Flash

In addition to the audible (brief horn sounding) and visual tests (all display segments light and all alarm lights flash) that occur when the instrument turns on, this instrument is equipped with a confidence heartbeat on the display that flashes periodically. This informs the user that the display is functioning normally (see Figure 7).



Figure 7: Heartbeat Indicator

3.11.1 Safe LED

The SIRIUS Multigas Detector is equipped with an optional green “SAFE” LED which flashes every 15 seconds under the following conditions

- The green SAFE LED is enabled
- Instrument is on the normal Measure Gases page
- Combustible reading is 0% LEL or 0% CH₄
- Oxygen (O₂) reading is 20.8%
- Carbon Monoxide (CO) reading is 0 ppm
- Hydrogen Sulfide (H₂S) reading is 0 ppm
- VOC reading is 0 ppm
- No gas alarms are present (low or high)
- Instrument is not in Low Battery warning or alarm
- CO, H₂S, VOC, STEL and TWA readings are 0 ppm.

3.11.2 Operating Beep

The SIRIUS Multigas Detector is equipped with an optional operating beep. This operating beep activates every 30 seconds by momentarily beeping the horn and flashing the alarm LEDs under the following conditions:

- Operating beep is enabled
- Instrument is on normal Measure Gases page
- Instrument is not in Battery warning
- Instrument is not in Gas alarm.

3.12 Calibration Check

The calibration check is simple and should only take about one minute. Perform this calibration check before each day's use for each installed sensor.

1. Turn ON the SIRIUS Multigas Detector in clean, fresh air.
2. Verify that readings indicate no gas is present.
3. Attach regulator (supplied with calibration kit) to the cylinder.
4. Connect tubing (supplied with calibration kit) to the regulator.
5. Attach other end of tubing to the instrument.
6. Open the valve on the regulator, if so equipped.
 - The reading on the SIRIUS Multigas Detector display should be within the limits stated on the calibration cylinder or limits determined by your company.
 - If necessary, change cylinder to introduce other calibration gases.
 - If readings are not within these limits, the SIRIUS Multigas Detector requires recalibration. See **6. Calibration**.



NOTE:

The presence of other calibration gases may cause the PID to indicate measuring error by dashes for the displayed VOC reading.

4. Measuring Gas Concentrations

4.1 Combustible Gases (% LEL) (Figure 8)

The SIRIUS Multigas Detector can be equipped to detect combustible gases in the atmosphere. Alarms sound when concentrations reach:

- Alarm Setpoint or
- 100% LEL (Lower Explosive Limit), 4.4% CH₄

When the combustible gas indication reaches the Alarm Set point:

- Alarm sounds
- Alarm lights flash
- % LEL or CH₄ flag above the concentration flashes

To silence the alarm, press the RESET/▼ button.

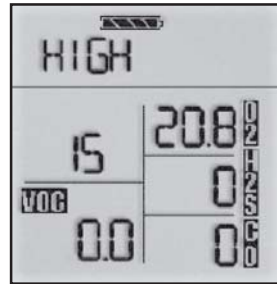


Figure 8:
Instrument in LEL Alarm

NOTE:

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

When the combustible gas indication reaches 100% LEL or 4.4% CH₄, the LockAlarm™ circuit locks the combustible gas reading and alarm and:

- Alarm sounds
- Alarm lights flash
- 100 (or 4.4 in CH₄ mode) appears on the display and flashes.
- This alarm cannot be reset with the RESET/▼ button.

WARNING!

If the 100% LEL or 4.4 vol.% CH₄ 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.

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

4.1.1 Oxygen Measurements (% O₂) (Figure 9)

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

Alarms can be set to trigger on two different conditions:

- Deficiency/too little oxygen (setpoints less than 20.8)
- Enriched/too much oxygen (setpoints greater than 20.8).

When the alarm setpoint is reached for either of the above:

- Alarm sounds
- Alarm lights flash
- % O₂ flag next to the concentration flashes.



Figure 9:
Instrument in
Oxygen alarm



WARNING!

If the Oxygen alarm condition is reached while using the instrument as a personal or area monitor, leave the area immediately; the ambient condition has reached a preset alarm level. If using the instrument as an inspection device, do not enter the area without proper protection.

4.1.2 Toxic Gas and VOC Measurements (Figure 10)

The SIRIUS Multigas Detector can be equipped to detect:

- Carbon Monoxide (CO) and/or
- Hydrogen Sulfide (H₂S) and/or
- Volatile Organic Compounds (VOCs) in the atmosphere.

When the alarm set point is reached for Carbon Monoxide (CO) and/or Hydrogen Sulfide (H₂S) and/or VOC:

- Alarm Sounds
- Alarm Lights flash
- PPM CO or PPM H₂S or VOC flag flashes.

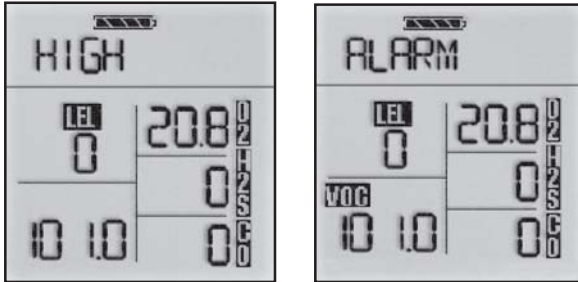


Figure 10:
Instrument in
VOC Gas Alarm

WARNING!

If an alarm condition is reached while using the instrument as a personal or area monitor, leave the area immediately; the ambient condition has reached a preset alarm level. If using the instrument as an inspection device, do not enter the area without proper protection.



4.2 Viewing Optional Displays

See **2.2 Moving through the SIRIUS Multigas Detector Pages** which shows the flow diagram for optional displays.

Press the PAGE/▲ button to move to the various screens.

NOTE:

The page will default back to the Measure page within 30 seconds.



4.2.1 Peak Readings (PEAK) (Figure 11)

PEAK appears in the upper portion of the display to show the highest levels of gas recorded by the SIRIUS Detector since:

- Turn-ON or
- Peak readings were reset.
- To Reset the Peak Readings:
 1. Access the Peak page.
 2. Press the RESET/▼ button.

4.2.2 Minimum Readings (MIN) (Figure 11)

This page shows the lowest level of oxygen recorded by the SIRIUS Multigas Detector since:

- Turn-ON or
- MIN reading was reset.
- MIN appears in the upper portion of the display.

To reset the MIN Reading:

1. Access the Min page.
2. Press the RESET/▼ button.



Figure 11:
Peak Readings
and Minimum Readings
for Oxygen on Display

4.2.3 Short Term Exposure Limits (STEL) (Figure 12)

The STEL flag appear 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 SIRIUS Multigas Detector is greater than the STEL limit:

- Alarm sounds
- Alarm lights flash
- STEL flashes.

To Reset the STEL:

1. Access the STEL page.
2. Press the RESET/▼ button.



WARNING!

If the STEL 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 alarm level.

4.2.4 Time Weighted Average (TWA) (Figure 12)

The TWA flag will appear in the upper portion of the display to show the average exposure since the instrument was turned ON or the TWA reading was reset. When the amount of gas detected by the SIRIUS Multigas Detector is greater than the eight-hour TWA limit:

- Alarm Sounds
- Alarm Lights Flash
- TWA flashes.

To Reset the TWA:

1. Access the TWA page.
2. Press the RESET/▼ button.

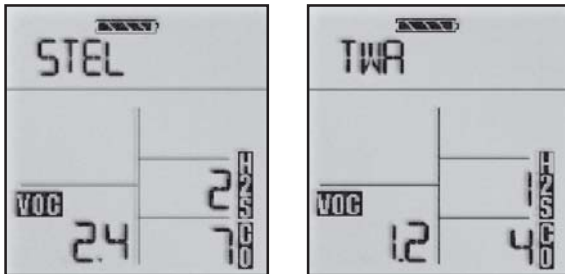


Figure 12:
Exposure Page
with STEL or TWA Alarm

WARNING!

If the 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 TWA alarm level.



4.2.5 Time and Date Display (Figure 13)

The time appears on the display to show the current time of day in a 24-hour format. The **date** appears on the display with the current date displayed in the following format:

MM:DD:YY

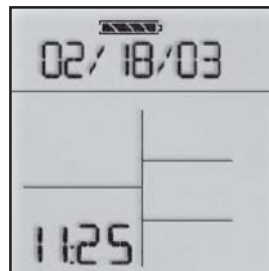


Figure 13:
Time and Date Display

4.3 PID Setup



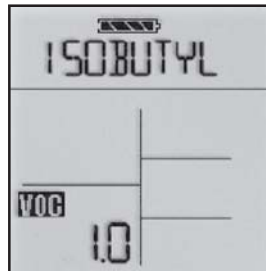
WARNING!

It is very important to have an understanding of PID basics when changing your PID settings. Failure to properly identify the VOC gas being measured, and failure to select the correct Response Factor alarm values (exposure, STEL, TWA) that match your desired Response Factor, and/or the correct bulb, will result in erroneous readings.

4.3.1 Displaying Current Response Factor

To display and/or change your current VOC response factor, press PAGE/▲ until you see the Response Factor Page (Figure 14). This shows the eight-character identifier and multiplier for the current gas of interest. A complete list and reference table for the eight-character identifiers of all available gases is shown in **8. Performance Specification**, Table 15.

Figure 14: PID RF Page



4.3.2 Changing Response Factor

To change your current Response Factor, press RESET/▼ on the Response Factor Page.

- Up and down arrows appear on the display.
- User can now scroll, using the PAGE/▲ and RESET/▼ buttons.
- At any time, user can select the option display by pressing the ON-OFF/ACCEPT button.
- The first five Response Factors in the list are called favourites (these can be set using our MSA LINK program).
- The user has the option to turn OFF the PID (VOC detection), if desired.
- If the gas of interest isn't in the favorites list, select -MORE- to scroll through the entire list of pre-programmed Response Factors in alphabetical order.

4.3.3 Selecting a Custom Response Factor

If the gas of interest is not in the pre-programmed list, the user can use a Custom Response Factor if the multiplier is known for the gas compared to the Isobutylene calibration gas. To do this:

1. Go to the Response Factor page and press RESET/▼ button.
2. Scroll to and select -CUSTOM-.
3. Enter your desired eight-character identifier and multiplier.
4. Use the RESET/▼ button to scroll through the alphabet or numbers, and use the ON-OFF/ACCEPT button to select the letter and move on to the next letter.

4.3.4 Changing PID Bulb Selection

Several PID bulb options are available for this instrument. The two bulb options currently available (with their associated colour codes) are:

- 10.6 eV (GREEN)
- 9.8 eV (RED).

Changing to a different type bulb involves two steps:

- physically installing the bulb (see **7.3 Removing and Cleaning the PID Bulb** for instructions on physically removing and installing the bulb)
- then updating the software to use the correct parameters for the new bulb.

To update the software:

1. Go to the Response Factor page; press the RESET/▼ button.
2. Scroll to and select -BULB- (Figure 15)
3. Select the electron voltage of the desired bulb.
 - If instrument is setup for use with a bulb other than the default 10.6 (GREEN) one, current bulb voltage will be displayed at turn ON.



Figure 15:
Changing PID Bulb Selection

WARNING!

It is very important to have an understanding of PID basics when changing your PID settings. Failure to select the correct Response Factor alarm values (exposure, STEL, TWA) that match your desired Response Factor, and/or the correct bulb, will result in erroneous readings.



5. Setting up the SIRIUS Multigas Detector

5.1 Changing Instrument Settings

- Many options can be set using the instrument buttons.
- If the SIRIUS Multigas Detector was ordered with the optional datalogging, the MSA 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.

5.2 Accessing the Instrument Setup Mode

- Press and hold the RESET/▼ button while turning the instrument ON. **SETUP** displays.



NOTE:

In all of the following selections in this Set-up mode:

- Press ON/OFF to enter chosen value/go to the next page.
 - Press the ON/OFF button to store the chosen value.
 - Press RESET/▼ to decrement by one or toggle ON/OFF.
 - Press and hold RESET/▼ to decrement by 10.
 - Press PAGE/▲ to increment by one or toggle ON/OFF.
 - Press and hold PAGE/▲ to increment by 10.
-
- **Enter password default "672".**
 - Press ON/OFF to enter password.
 - Correct Password: instrument continues/beeps three times.
 - Incorrect Password: instrument enters the Measure mode.
 - Password ON/OFF (turns the password protection ON or OFF)
 - New Password Setup (changes the password)

Figure 16 shows how to enter the Set-up mode.

SIRIUS FLOW DIAGRAM TO ENTER SETUP MODE

To start setup mode the instrument must be turned off

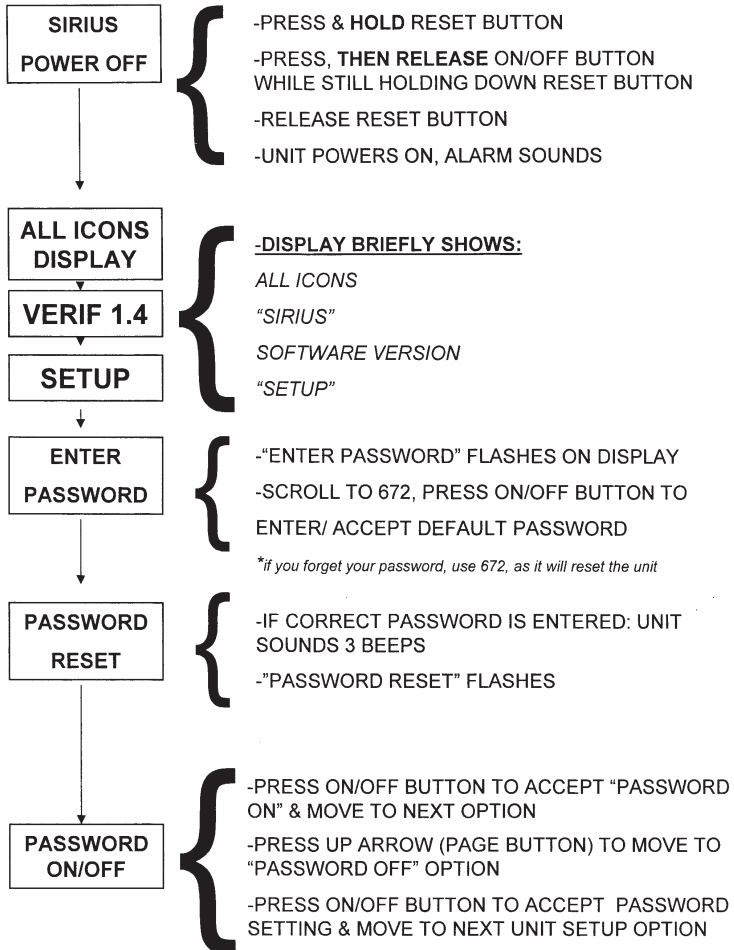


Figure 16: Entering the setup mode

5.3 Instrument Alarm Bypass Options

The SIRIUS Multigas Detector (with software version 1.1 or higher) is equipped with a feature to disable or silence the visual, backlight, and audible options. If any of these options are disabled during instrument start up, the SIRIUS Detector displays:

- “VISUAL OFF” if the red LEDs are disabled
- “AUDIBLE OFF” if the audible buzzer is disabled
- “BACKLITE OFF” if the backlight is disabled
- “BACKLITE TIME”

If the visual or audible options are disabled, “ALARM OFF” flashes on the LCD during Normal Measure mode.

1. Instrument Options Setup

- Safe LED ON/OFF
- Operating beep ON/OFF
- STEL/TWA ON/OFF

2. CAL Lockout Enable

- To disable calibration in the user mode, set CAL LOCK MODE to ON
- When ON, calibration is only accessible via the Setup mode and password (if enabled)

3. CAL DUE Alert

- To disable CAL Due messages, turn this feature OFF.
- When ON, the number of days (1 to 180) between calibrations can be set. User will be required to acknowledge an overdue calibration at turn ON.

4. Warm Up Info

- Turning this selection OFF causes the instrument NOT to display alarm set points at power-ON
- Time (if data logging option installed)
- Date (if data logging option installed)

5. LEL/CH₄ Setup

- Sensor ON/OFF (turns the sensor ON or OFF)
- Display Combustible Gas Type?
 - Methane
 - Pentane
 - Hydrogen
 - Propane
- LEL or CH₄ mode displays % LEL (for any gas) or % CH₄ (for Methane only)
- Low Alarm (sets the low combustible alarm)
- High Alarm (sets the high combustible alarm)
- Cal Gas (sets the expected combustible calibration gas)

6. O₂ Setup

- Sensor ON/OFF (turns the sensor ON or OFF)
- Low Alarm
- High Alarm

7. CO Setup

- Sensor ON/OFF (turns the sensor ON or OFF)
- Low Alarm (sets the low CO alarm)
- High Alarm (sets the high CO alarm)
- STEL Alarm (if enabled) (sets the STEL CO alarm)
- TWA Alarm (if enabled) (sets the TWA CO alarm)
- Cal Gas (sets the expected CO calibration gas)

8. H₂S Setup

- Sensor ON/OFF (sets H₂S sensor ON or OFF)
- Low Alarm (sets the low H₂S alarm)
- High Alarm (sets the high H₂S alarm)
- STEL Alarm (if enabled) (sets the STEL H₂S alarm)
- TWA Alarm (if enabled) (sets the TWA H₂S alarm)
- Cal Gas (sets the expected H₂S calibration gas)

9. VOC Setup

- Sensor ON/OFF (sets VOC sensor ON or OFF)
- Low Alarm (sets the low VOC alarm)
- High Alarm (sets the high VOC alarm)
- STEL Alarm (if enabled) (sets the STEL VOC alarm)
- TWA Alarm (if enabled) (sets the TWA VOC alarm)
 - VOC Auto-range (if enabled) (sets the display to read in 100 ppb increments when below 10 ppm)
Select ON for PPB:
 - This mode allows for improved signal stability at low concentrations and can be used to determine if the low level VOC concentration is increasing or decreasing. Response times are longer (see **8. Performance Specifications, Table 14**).

NOTE:

In VOC Auto-range, the response time will increase by approximately 10 seconds. Failure to wait the appropriate time can result in an incorrect reading.

- Display will read in increments of 100 ppb from 0 to 9900 ppb (9.9 ppm); (100 ppb = 0.1 ppm); then, it switches to ppm readings at readings >10 ppm.

NOTE:

After set-up, the instrument will display:

“Warning - 100 ppb increments - see manual”.

Press the ON/OFF button to acknowledge the warning and to continue.

- Display reading will flash between the reading and “ppb” for readings less than 9900 ppb (9.9 ppm).
- Select OFF for PPM
- Response Factor Page (turns the RF Page ON or OFF)
- Response Factor Save (if OFF, instrument always returns to Isobutylene at turn-ON)
- Response Factor Favorites:
Select the five favorite VOC gases for quick selection when changing response factors (See **4.3 PID Setup**)
- Response Factor Change (see **4.3 PID Setup**).

**NOTE:**

Alarm values for PID have limits based on sensor performance. The Low alarm, STEL, and TWA cannot be set below 2.0 ppm and High alarm cannot be set below 10 ppm.

**WARNING:**

It is very important to have an understanding of PID basics when changing your PID settings. Failure to properly identify the VOC gas being measured and/or failure to select the correct Response Factor alarm values (exposure, STEL, TWA) that match your desired Response Factor and/or the correct bulb, will result in erroneous readings.

6. Calibration

6.1 Calibrating the SIRIUS Multigas Detector

Each SIRIUS Multigas Detector is equipped with an Autocalibration feature to make unit calibration as easy as possible. The Autocalibration sequence resets instrument zeroes and adjusts sensor calibration for known concentrations of calibration gases.

Table 2. Autocalibration and Required Calibration Cylinders

SENSORS	EXPECTED GAS CONCENTRATION*	FOUR-GAS CYLINDER (P/N 10053022)	ISOBUTYLENE (P/N D0715896)
Combustible	1.45 vol% CH ₄	x	
Oxygen	15 vol%	x	
Carbon Monoxide	60 ppm	x	
Hydrogen Sulfide	20 ppm	x	
VOC	100 ppm Isobutylene		x

* *Factory Default*

NOTE:

Refer to **5. Setting up the Multigas Detector**, for instructions on changing the Autocalibration expected gas concentrations if calibration gas with concentrations other than those listed above will be used to calibrate the instrument.

The expected gas concentrations must match the gas concentrations listed on the calibration cylinder(s). Failure to follow this warning will cause an incorrect calibration, which will result in erroneous readings.



6.2 Calibration Flow Chart

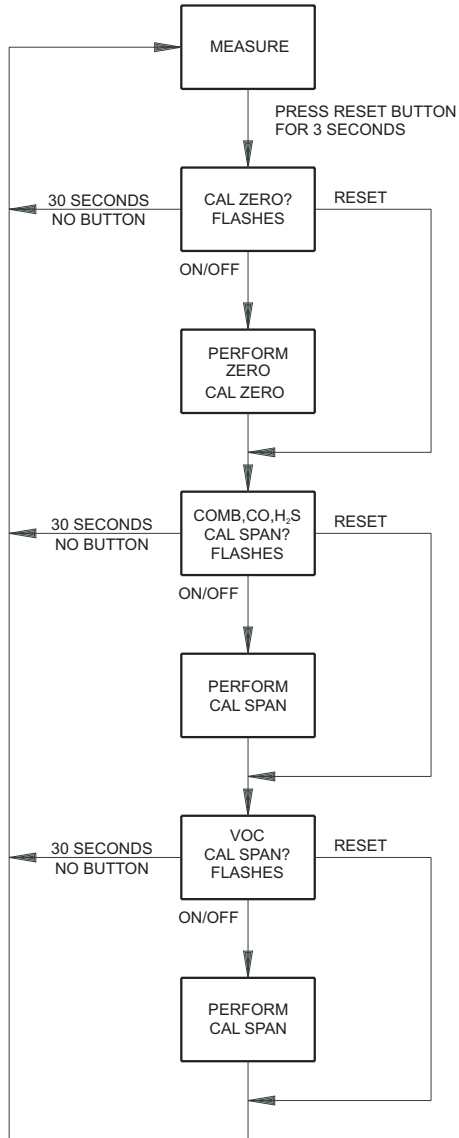


Figure 17: Calibration Flow Chart

1. Turn ON the instrument and verify that battery has sufficient life.
2. Wait until the Measure Gases page appears.
3. Push and hold the RESET/▼ button until **CAL ZERO?** flashes on the display (Figure 18).

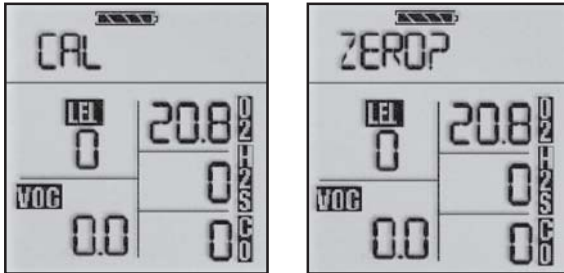


Figure 18: Zero Flag

4. Push the ON-OFF/ACCEPT button to zero the instrument.
 - Instrument must be in fresh air to perform the zero.
 - **CAL ZERO** flashes.

NOTE:

To skip the Zero procedure and move directly to the calibration span procedure, push the RESET/▼ button. If no button is pushed for 30 seconds, the instrument returns to the Measure mode.

- Once the zeros are set, **CAL SPAN?** flashes (Figure 19).



Figure 19: CAL Flag

5. Connect the appropriate calibration gas to the instrument by connecting one end of the tubing to the pump inlet on the instrument and the other end of tubing to the cylinder regulator (supplied in the calibration kit).
6. Open the valve on the regulator, if so equipped.

7. Push the ON-OFF/ACCEPT button to calibrate (span) the instrument.
 - **CAL SPAN** flashes for approximately 90 seconds.
 - If autocalibration sequence passes, the instrument beeps three times and returns to the Measure mode.

**NOTE:**

To skip calibration and return to the Measure mode, push the RESET/▼ button. If no button is pushed for 30 seconds, it will return to the Measure page.

8. Remove the tubing from the instrument.
9. Close the valve on the regulator, if so equipped.
10. Repeat steps 5 through 8 for the PID.

**NOTE:**

The Autocalibration procedure adjusts the span value for any sensor that passes the test; sensors that fail autocalibration are left unchanged. Since residual gas may be present, the instrument may briefly go into an exposure alarm after the calibration sequence is completed.

6.3 Autocalibration Failure

If the SIRIUS Multigas Detector cannot calibrate one or more sensor(s), the instrument goes into the Autocalibration Failure Page and remains in alarm until the RESET/▼ button is pushed. Sensors that could not be calibrated are indicated by dashed lines on the concentration display.

Check the calibration cylinder for:

- accuracy
- calibration setpoints

Replace failed sensor or, if a VOC, clean the PID bulb and/or replace the ion chamber.

7. Warranty, Maintenance, and Troubleshooting

7.1 MSA Portable Instrument Warranty

Table 3. Warranty Periodes

ITEM	WARRANTY PERIODE
Chassis and electronics	Two years
All sensors, unless otherwise specified	Two years
PID bulbs 10.6 eV and 9.6 eV	One year
PID ion chamber	One year

This warranty does not cover filters, fuses, etc. 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.

7.2 Cleaning and Periodic Checks

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

All maintenance and service only in non-hazorous areas !

NOTE:

Repair or alteration of the SIRIUS 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.



7.3 Removing and Cleaning the PID Bulb



WARNING!

Do not attempt to clean the PID bulb in a hazardous area. The SIRIUS Multigas Detector must be turned OFF before cleaning or replacing the bulb and ion chamber.

Using a bulb that is contaminated with dust, dirt or oily residue can impair the performance of the instrument. Failure to clean the PID bulb can cause inaccurate readings, jeopardizing monitoring functions. For the best performance, clean the PID bulb when:

- the monitor does not respond acceptably to a calibration check
- the PID Failed Span Cal occurs (to indicate low output)
- the PID Bulb/Cal Now error occurs
- the PID shows increased sensitivity to humidity
- the displayed PID reading is erratic.

If you are operating the monitor in a high temperature, high humidity, or dirty environment, you may need to clean the lamp more frequently to maintain optimal performance.



NOTES:

- Perform this procedure using methanol only.
- After cleaning, if the instrument still fails to calibrate, replace the bulb.
- All cleaning must be done in a clean, non-hazardous environment.

7.3.1 Cleaning Steps

1. Turn OFF the instrument.
2. While in a non-hazardous and non-combustible area, remove the battery pack.
3. Use a coin to gently unscrew the bulb access cap; set the cap on a clean surface.



NOTE:

If the alternate tamper-resistant bulb access cap is installed, the special tool provided with the cap must be used.

4. Gently grasp the tapered end of the rubber bulb holder attached to the tip of the bulb and firmly pull the bulb holder straight out until the bulb comes free from the assembly.



NOTE:

Do not touch the bulb lens with your hands. The oily residue from your fingers will damage the window surface. Inspect the bulb window for scratches. Minor scratches should not affect bulb performance. If severe scratches and chips are present, replace the bulb.

Be careful not to allow dirt or particulates to fall into the bulb hole in the instrument.

5. Remove the rubber bulb holder from the end of the bulb and set the bulb holder on a clean surface.
6. Open the Bulb Cleaning Kit, consisting of cleaning implements and laboratory-grade methanol.
7. Moisten a clean cotton swab with methanol.
8. Hold the middle of the bulb body securely in your thumb and forefinger.
9. Using light pressure, rub the side of the swab in a circular motion over the surface of the window for 60 seconds.
10. Dispose of the swab.
11. Take a fresh swab and repeat steps 7 through 10.
12. Using a clean, dry swab, use light pressure and move the side of the swab over the window for 30 seconds.
13. Dispose of the swab.
14. Allow the bulb to dry for a minimum of 30 minutes before proceeding.

NOTE:

Methanol can give a delayed, high response on the CO channel. When cleaning the bulb, it is important to ensure that all of the methanol cleaning compound has evaporated from the bulb before re-installation into the instrument.



15. Once the bulb is cleaned, inspect the bulb window for any dust or fibers.

NOTE:

The bulb window and entire body of the bulb must be dust and lint-free before re-assembly into the instrument.

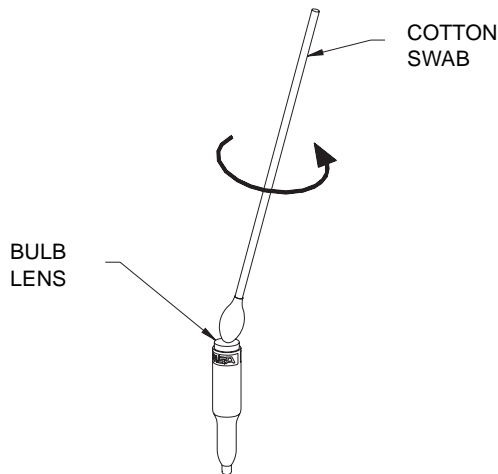


Figure 20:
Cleaning the PID Bulb

16. Never touch the lens surface with your fingers. If contact occurs, repeat steps 6 through 13.
17. Gently insert the clean bulb, window first into the bulb sleeve of the instrument.



Do not apply excessive pressure when seating the bulb. Too much pressure may damage the detector and/or the bulb.

18. Push the open end of the rubber bulb holder onto the tip of the bulb. Gently push it on until it is fully seated.
19. Before replacing the bulb access cap, ensure the o-ring that goes around the bulb sleeve is in place. Replace the bulb access cap and tighten with a coin until it completely bottoms (no longer turns).
 - If using the tamper-resistant bulb access cap, the special tool provided with the cap must be used.



NOTE:

Failure to tighten the bulb access cap fully may result in leakage in the flow system, causing inaccurate readings.

20. Turn ON the instrument and check the system for leaks by plugging the inlet with your finger.
 - The pump alarm should sound immediately. See **3.9 Verifying Pump Operation**.
21. In a clean air environment, do a fresh air setup.
22. Allow the instrument to run for at least 15 minutes for the bulb to stabilize.
23. Recalibrate the instrument according to **6. Calibration**.



NOTE:

If a PID Failed Span Cal still occurs or an acceptable calibration cannot be performed, replace the PID bulb with a new one.

7.4 Replacing the Ion Chamber

Replace the ion chamber:

- when Changes in RH (wet to dry and dry to wet) cause erratic VOC readings with no analyte present
- if a PID Failed Span Cal still occurs after bulb replacement.

Use the Ion Chamber Replacement Kit (P/N 10050783).



NOTE:

Remove and re-install the ion chamber in a clean, non-hazardous environment.

1. Turn OFF the instrument and, while in a non-hazardous and non combustible area, remove the battery pack.
2. Unscrew the captive screw from the clear filter housing on the back of the instrument and remove the filter housing.
3. Gently remove the ion chamber cover assembly (see Figure 21) from the instrument and set the assembly on a clean, lint-free surface.
4. Using a small, flat-blade screwdriver, gently remove the ion chamber from the cell holder and discard (Figure 21).

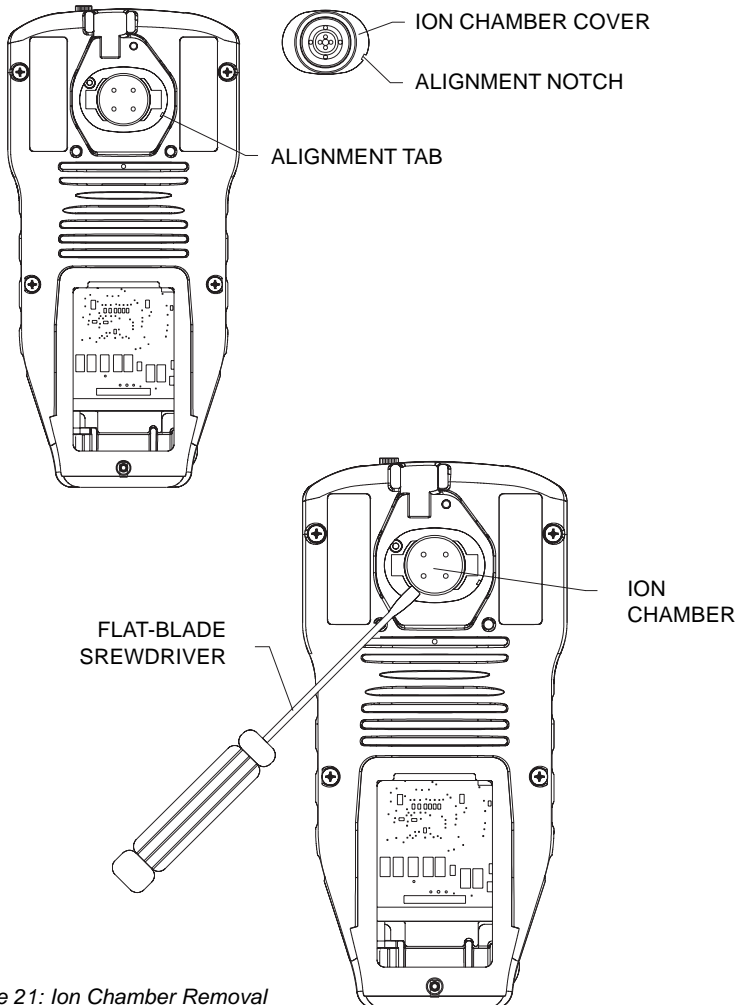


Figure 21: Ion Chamber Removal

5. Remove the new ion chamber from its package.
6. Snap the ion chamber into the cell holder, with the four small, round holes facing up as shown in Figure 22.

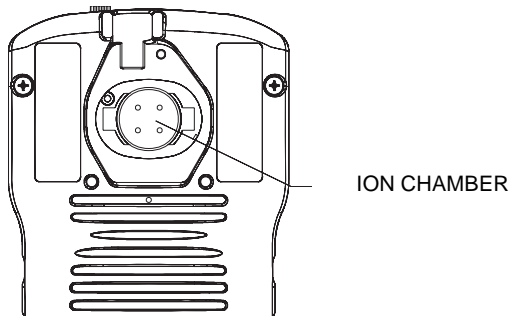


Figure 22: Ion Chamber Installation

7. Replace the ion chamber cover, aligning the notch to ensure proper orientation.
8. Check that the o-rings are seated in their proper locations (see **7.5 Replacing the Filters**).
9. Replace the filter housing and tighten the screw.
10. Place the used ion chamber in the reclosable package and discard.
11. Turn ON the instrument and check the system for leaks by plugging the inlet with a finger.
 - The pump alarm must sound. See **3.9 Verifying Pump Operation**.



Do not use the pump, sample line, or probe unless the pump alarm activates when the flow is blocked. Lack of an alarm is at a sample may not be drawn to the sensors, which could cause inaccurate readings.

7.5 Replacing the Filters

NOTE:

When replacing external dust and water filters, prevent any dust or dirt around the filter housing from entering the PID sensor. Dust or dirt entering the PID sensor may impede or degrade PID sensor performance, especially in humid environments. Also, dust or dirt that gets pulled into the pump unit may impede pump operation.



DUST AND WATER FILTER

1. Turn OFF the instrument and, while in a non-hazardous and non combustible area, remove the battery pack.
2. Unscrew the captive screw from the clear filter housing on the back of the instrument to access the filters.
3. Carefully lift out the O-ring, the water filter, and the fibrous dust filter from the recess on the filter housing.
4. Carefully install the new dust filter in the filter housing recess.
5. Install the new water filter in the filter housing recess (see Figure 23).

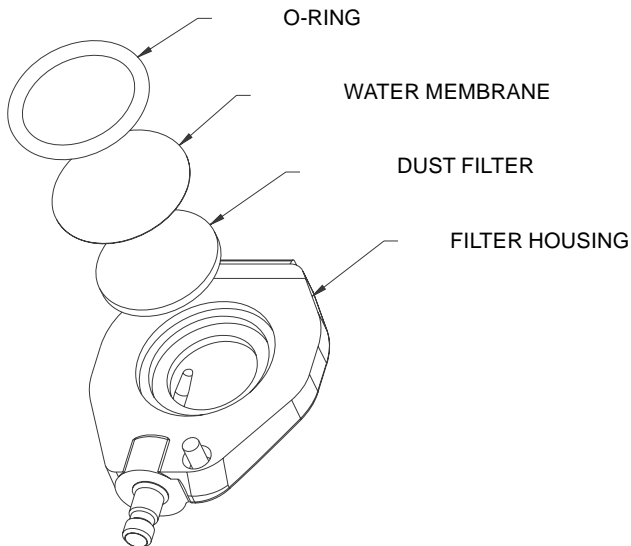


Figure 23:
Filter Installation

- Replace the O-ring, being sure to press gently down on top of the water filter.

NOTE:

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

- If the case oval-shaped O-ring comes out inadvertently when changing the filters replace it in the oval-shaped groove in the back case before replacing the filter housing (see Figure 24).

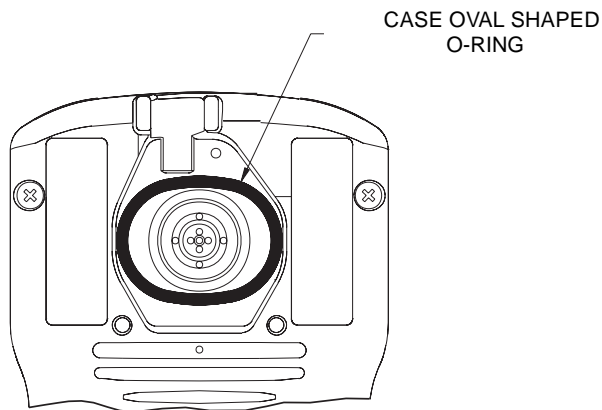


Figure 24:
Case Oval-shaped O-ring

- Re-install the filter housing and tighten the screw.
- Check the system for leaks by plugging the inlet with a finger.
 - A pump alarm must sound. See **3.9 Verifying Pump Operation**.

**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.

7.6 Storage

When not in use, store your SIRIUS Multigas Detector in a safe, dry place between 0 and 40 °C (32 and 104 °F).

WARNING!

After storage, always recheck instrument calibration before use. During storage, sensors may drift or become inoperative.



7.7 Shipment

Pack the SIRIUS 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.

7.8 Troubleshooting

The SIRIUS Multigas Detector will operate reliably for years when cared for and maintained properly. If the instrument becomes inoperative, follow the Troubleshooting Guidelines in Table 4; these represent the most likely causes of a problem. You may return inoperative instruments to MSA for repair.

To contact MSA, please call your supplier.

The instrument displays an error code if it detects a problem during startup or operation. See Table 4 for a brief description of the error and proper corrective action.

When an inoperative component is located by using the guidelines, it may be replaced by using one of the following **Repair Procedures**.

Table 4. Troubleshooting Guidelines

PROBLEM	ACTION
Does not turn ON	Recharge (if applicable) or replace battery. See 3.1 Power Systems
Battery does not hold charge	See 3.1 Power Systems
Combustible sensor does not calibrate	See 6. Calibration
Oxygen sensor does not calibrate	See 6. Calibration
Toxic sensors does not calibrate	See 6. Calibration
Ion Error	Check that the ion chamber is not installed upside down. See 7.4 Replacing Ion Chamber
PID Error	Check that ion chamber is installed. Clean or replace bulb if within normal temperature range. If temperature too cold, allow instrument to stabilize within normal temperature range before turning ON.
Failed Span Cal Error (on PID)	Clean or replace bulb. See 7.3 Removing and Cleaning the PID Bulb
PID Comm Error	Send instrument to authorized service center for repair.
PID bulb/Cal now	Clean or replace bulb and recalibrate instrument. See 7.3 Removing and Cleaning the PID Bulb
PID sensitivity to humidity	Clean or replace bulb/replace ion chamber. See 7.3 Removing and Cleaning PID Bulb/ 7.4 Replacing Ion Chamber
Noisy PID Reading	Clean or replace bulb/replace ion chamber. See 7.3 Removing and Cleaning PID Bulb/ 7.4 Replacing Ion Chamber
CO sensor spurious signal at high temperature	Over exposure to isobutylene or other interferent gases. Allow sensor to clear for 24 hours or replace CO sensor. See 7.9 Sensor Replacement
Pump Alarm	Check for leaks/blocks, replace dust and water filters. See 7.5 Replacing Filters
Sensor missing	Check installation of sensor/replace sensor. See 7.9 Sensor Replacement
In all of the above cases and for any other problems, The SIRIUS Multigas Detector may be returned to MSA for repairs.	

7.9 Sensor Replacement

1. Verify the instrument is turned OFF.
2. Remove the battery pack.
3. Remove the four case mounting screws from the back of the case.
4. Remove the back case.
5. Gently lift out and properly discard the sensor to be replaced.
 - Use a flat-blade screwdriver to pry the CO and/or H₂S sensors from their holders.
6. For the combustible and/or O₂ sensor, carefully align the new sensor pins with the appropriate sockets on the (lower) printed circuit board. Press gently into position.
 - If a combustible and/or an O₂ sensor is not to be installed, ensure that the appropriate opening in the sensor gasket is sealed with a sensor cover label (tape disc) (P/N 710487).
7. For the CO and/or H₂S sensors, carefully press them into their appropriate socket.
 - The CO sensor has a filter disc attached to it. Be careful not to damage the filter disc during handling and installation. Be sure the filter disc is facing upward when installed.
 - The H₂S sensor is marked "H₂S" on its top side; ensure that the "H₂S" mark and gas inlet hole face upward when installed.
 - If a CO and/or an H₂S sensor is not to be installed, ensure that an "inactive sensor plug" (P/N 10046292) is installed properly in its place.

NOTE:

The CO and H₂S sensor positions must not be swapped. Verify that they are in the proper holder as indicated on the (upper) printed circuit board.

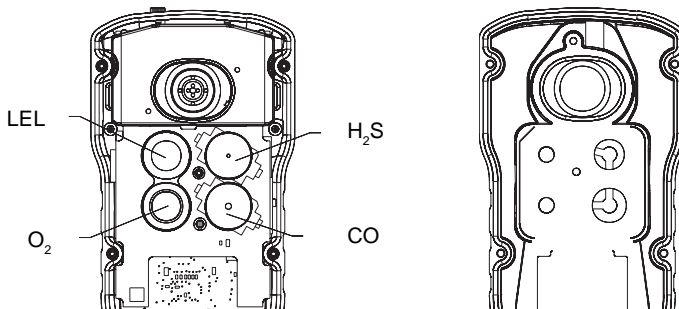


Figure 25: Sensor Locations

8. Re-install the back case.
9. Tighten the four captive case screws.
10. Re-install the battery pack.
11. Turn ON the instrument and allow the new sensor(s) to equilibrate with the environment temperature for approximately five minutes.
12. Check the system for leaks by plugging the inlet with a clean finger.
 - A pump alarm must sound. See Chapter **3.9 Verifying Pump Operation**.
13. The sensors must be professionally disposed.

**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.

Verification of calibration response is required; otherwise, the instrument will not perform as required.

7.10 Replacement of the Electronics Boards, the Display Assembly, the Horn Assembly, and the Pump

These parts must be replaced at an authorized factory service center.

8. Performance Specifications

Table 5. Instrument Specifications

TEMPERATURE RANGE	NORMAL	0 to 40 °C
	EXTENDED*	-20 to 0 °C, 40 to 50 °C
INGRESS PROTECTION RATING (IP)		IP54
MEASUREMENT METHOD	COMBUSTIBLE GAS	Catalytic Sensor
	OXYGEN	Electrochemical Sensor
	TOXIC GASES	Electrochemical Sensors
	VOC	Photoionization Detector

*** NOTE:**

Extended temperature range indicates gas readings may vary slightly if calibrated at room temperature. For optimal performance, calibrate instrument at temperature of use.

Table 6. FACTORY-SET

ALARM SET POINTS	LOW ALARM	HIGH ALARM	STEL	TWA
CO	35 PPM	100 PPM	400	35
H ₂ S	10 PPM	15 PPM	15	10
LEL	10%	20%		
O ₂	19.5%	23.0%	-	-
VOC	50	100	25	10

Table 7. COMBUSTIBLE GAS – Typical Performance Specifications

RANGE	0 to 100% LEL or 0 to 4.4% CH ₄
RESOLUTION	1% LEL or 0.04% CH ₄
REPRODUCIBILITY**	±3% LEL, 0% to 50% LEL reading or ±0.15% CH ₄ 0.0% to 2.2% CH ₄ (normal temperature range*)
	±5% LEL, 50% to 100% LEL reading or ±0.25% CH ₄ 2.2% to 4.4% CH ₄ (normal temperature range*)
	±5% LEL, 0% to 50% LEL reading or ±0.25% CH ₄ 0.0% to 2.2% CH ₄ (extended temperature range*)
	±8% LEL, 50% to 100% LEL reading or ±0.40% CH ₄ 2.2% to 4.4% CH ₄ (extended temperature range*)
RESPONSE TIME	90% of final reading in 30 seconds with sampling line and probe (normal temperature range*)

* See Table 5. Instrument specification, NOTE

** See Table 14. PID Typical Performance Specifications NOTE

Table 8. COMBUSTIBLE GAS – Cross Reference Factors for SIRIUS General-Purpose Calibration using Calibration Cylinder (P/N 10053022)

Calibration set to	US			EU	
	Pentan	Propan	Methan	Propan	Methan
	58	57	33	46	29
	multiply %LEL reading by				
Acetone	1,1	1,1	1,9	1,4	2,2
Acetylene	0,7	0,7	1,2	0,9	1,4
Acrylonitrile*	0,8	0,8	1,4	1,0	1,6
Benzene	1,1	1,1	1,9	1,4	2,2
Butane	1	1,0	1,8	1,3	2,0
1.3- Butadiene	0,9	0,9	1,6	1,1	1,8
n-Butanol	1,8	1,8	3,2	2,3	3,6
Carbon Disulfide*	2,2	2,2	3,9	2,8	4,4
Cyclohexane	1,1	1,1	1,9	1,4	2,2
2.2- Dimethylbutane	1,2	1,2	2,1	1,5	2,4
2.3- Dimethylpentane	1,2	1,2	2,1	1,5	2,4
Ethane	0,7	0,7	1,2	0,9	1,4
Ethyl Acetate	1,2	1,2	2,1	1,5	2,4
Ethyl Alcohol	0,8	0,8	1,4	1,0	1,6
Ethylene	0,7	0,7	1,2	0,9	1,4
Formaldehyde*	0,5	0,5	0,9	0,6	1,0
Gasoline (unleaded)	1,3	1,3	2,3	1,6	2,6
Heptane	1,3	1,3	2,3	1,6	2,6
Hydrogen	0,6	0,6	1,1	0,8	1,2
n-Hexane	1,3	1,3	2,3	1,6	2,6
Isobutane	0,9	0,9	1,6	1,1	1,8
Isobutyl Acetate	1,5	1,5	2,6	1,9	3,0
Isopropyl Alcohol	1,1	1,1	1,9	1,4	2,2
Methane	0,5	0,5	0,9	0,6	1,0
Methanol	0,6	0,6	1,1	0,8	1,2
Methyl Isobutyl Ketone	1,1	1,1	1,9	1,4	2,2
Methylcyclohexane	1,1	1,1	1,9	1,4	2,2
Methyl Ethyl Ketone	1,1	1,1	1,9	1,4	2,2
Methyl Tertiary Butyl Ether	1	1,0	1,8	1,3	2,0
Mineral Spirits	1,1	1,1	1,9	1,4	2,2
iso-Octane	1,1	1,1	1,9	1,4	2,2
n-Pentane	1	1,0	1,8	1,3	2,0
Propane	0,8	0,8	1,4	1,0	1,6
Propylene	0,8	0,8	1,4	1,0	1,6
Styrene*	1,9	1,9	3,3	2,4	3,8
Tetrahydrofuran	0,9	0,9	1,6	1,1	1,8
Toluene	1,2	1,2	2,1	1,5	2,4
Vinyl Acetate	0,9	0,9	1,6	1,1	1,8
VM&P Naphta	1,6	1,6	2,8	2,0	3,2
O-Xylene	1,2	1,2	2,1	1,5	2,4

RESPONSE NOTES:

* *Some compounds may reduce the sensitivity of the combustible gas sensor by poisoning or inhibiting the catalytic action or by polymerizing on the catalytic surface.*

For an instrument calibrated on Pentane, multiply the displayed %LEL value by the conversion factor above to get the true %LEL.

These conversion factors should be used only if the combustible gas is known.

These conversion factors are typical for a SIRIUS Multigas Detector. Individual units may vary by $\pm 25\%$ from these values.

Table 9. OXYGEN – Typical Performance Specifications

RANGE	0 to 25% O ₂	
RESOLUTION	0.1% O ₂	
REPRODUCIBILITY**	0.7% O ₂ for 0 to 25% O ₂	
RESPONSE TIME	90% of final reading	30 seconds with sample line and probe (normal temperature range*) 3 minutes with sample line and probe (extended temperature range*)

* See Table 5. Instrument specification, NOTE

** See Table 14. PID Typical Performance Specifications. NOTE

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

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 at a temperature within 30 °C of the temperature-of use for the least effect.

Table 10. CARBON MONOXIDE (appropriate models only) – Typical Performance Specifications

RANGE	500 ppm CO
RESOLUTION	1 ppm CO for 5 to 500 ppm CO
REPRODUCIBILITY**	± 5 ppm CO or 10% of reading, whichever is greater 0 to 150 ppm CO ±15% >150 ppm CO (normal temperature range*)
	±10 ppm CO or 20% of reading, whichever is greater (extended temperature range*)
RESPONSE TIME	90% of final reading in 50 seconds with sample line and probe (normal temperature range*)

* See Table 5. Instrument specification, NOTE

** See Table 14. PID Typical Performance Specifications, NOTE

Table 11. CARBON MONOXIDE – Cross Reference Factors for SIRIUS Calibration Using Calibration Cylinder (P/N 10053022)

NOTE:

Data is presented as the indicated output in ppm, which would result from the application of 100 ppm of the test gas.

TEST GAS (100 PPM)	EQUIVALENT PPM
Carbon Monoxide (CO)	100 ± 9
Hydrogen Sulfide (H ₂ S)	4 ± 4
Sulfur Dioxide (SO ₂)	0 ± 1
Nitrogen Dioxide (NO ₂)	2 ± 6
Nitric Oxide (NO)	70 ± 10
Chlorine (Cl ₂)	1 ± 8
Ammonia (NH ₃)	2 ± 4
Hydrogen Chloride (HCl)	3 ± 2
Ethylene (C ₂ H ₄)	76 ± 9
Hydrogen Cyanide (HCN)	0 ± 1
Methane (CH ₄)	0 ± 0
Ethanol (EtOH)	0
Hydrogen (H ₂)	70 ± 26

The carbon monoxide channel in the SIRIUS instrument is equipped with internal and external filters. The purpose of these filters is to protect the CO sensor from acid gases (H₂S, SO₂, etc.) and from the hydrocarbons that the instrument is intended to measure, including the calibration gas, isobutylene. In normal use, an interferent signal for calibration or bump checking the instrument should not be observed on the CO channel. However, exposure to large amounts of certain hydrocarbons (either long exposure times or high concentrations) can overwhelm the filter and appear as signals on the CO channel. In normal operation, after the hydrocarbon exposure is ended, the filter is designed to outgas absorbed hydrocarbons at a rate that will not cause a signal on the CO channel. However, if the unit is exposed to high temperature (>40 °C), this desorption rate increases and spurious signals may be observed on the CO channel due to gassing of previously absorbed hydrocarbons. If this occurs, it may be necessary to replace the CO sensor.

Table 12. HYDROGEN SULFIDE (appropriate models only) – Typical Performance Specifications

RANGE	200 ppm H ₂ S
RESOLUTION	1 ppm H ₂ S for 3 to 200 ppm H ₂ S
REPRODUCIBILITY**	± 2 ppm H ₂ S or 10% of reading, whichever is greater 0 to 100 ppm H ₂ S ±15% > 100 ppm H ₂ S (normal temperature range*)
	± 5 ppm H ₂ S or 20% of reading, whichever is greater (extended temperatur range*)
RESPONSE TIME	90% of final reading in 50 seconds with sample line and probe (normal temperature range*)

* See Table 5. Instrument specification, NOTE

** See Table 14. PID Typical Performance Specifications NOTE

Table 13. HYDROGEN SULFIDE – Cross Reference Factors for SIRIUS Calibration Using Calibration Cylinder (P/N10053022)**NOTE:**

Data is presented as the indicated output in ppm, which would result from the application of 100 ppm of the test gas.

TEST GAS (100 PPM)	EQUIVALENT PPM
Hydrogen Sulfide (H ₂ S)	100 ± 10
Ethylene (C ₂ H ₄)	0 ± 0
Methane (CH ₄)	0 ± 0
Hydrogen (H ₂)	0 ± 0
Ammonia (NH ₃)	0 ± 0
Chlorine (Cl ₂)	0 ± 0
Nitrogen Dioxide (NO ₂)	-20 ± 2
Nitric Oxide (NO)	1 ± 1
Carbon Monoxide (CO)	4 ± 4
Hydrogen Chloride (HCl)	0 ± 0
Hydrogen Cyanide (HCN)	1 ± 1
Sulfur Dioxide (SO ₂)	10 ± 3
Ethanol (EtOH)	0 ± 0
Toluene	0 ± 0

Table 14. PID (appropriate models only) – Typical Performance Specifications

RANGE	0 to 2000 ppm
DISPLAY RESOLUTION	0,1 ppm (100 ppb) from 0 to 2000 ppm 1 ppm from 200 to 2000 ppm
REPRODUCIBILITY**	± 2 ppm (± 2000 ppb) or ± 10% which ever is greater (normal temperature range*)
RESPONSE TIME	90% of final reading in 20 seconds (normal mode) 90% of final reading in 30 seconds (VOC ppb autorange)

* See Table 5. Instrument specification, NOTE

** Assumes proper calibration and constant ambient conditions. Represents the range of possible variation between the displayed value and the actual concentration in a properly-calibrated instrument.

Table 15. PID Response Factor Table

Analyte Name	CAS no. ¹	Chemical Formula	SIRIUS Displayed Name	IP, eV	Lamp Response Factors [eV]		
					9.8	10.6	11.7
1,2,3-trimethylbenzene	526-73-8	C ₉ H ₁₂	123MEBNZ	8.42	0.53	0.58	
1,2,4-trimethylbenzene	95-63-6	C ₉ H ₁₂	124MEBNZ	8.27	0.51	0.48	
1,2-dibromoethane	106-93-4	C ₂ H ₄ Br ₂	12BRETHN	10.35	N/A2	12.20	
1,2-dichlorobenzene	95-50-1	C ₆ H ₄ Cl ₂	12CLBNZ	9.06	0.57	0.43	
1,3,5-trimethylbenzene	108-67-8	C ₉ H ₁₂	135MEBNZ	8.40	0.43	0.37	
1,4-butanediol	110-63-4	C ₄ H ₁₀ O ₂	BUTNDIOL	10.70	N/A	N/A	
1,4-dioxane	123-91-1	C ₄ H ₈ O ₂	DIOXANE	9.19	1.35	1.06	
1-butanol	71-36-3	C ₄ H ₁₀ O	BUTANOL	9.99	N/A	2.30	
1-methoxy-2-propanol	107-98-2	C ₄ H ₁₀ O ₂	MEOXPROP	9.54	1.89	0.89	
1-propanol	71-23-8	C ₃ H ₈ O	PROPANOL	10.22	N/A	4.74	
2-butanone	78-93-3	C ₄ H ₈ O	BUTANONE	9.52	0.76	0.70	
2-methoxyethanol	109-86-4	C ₃ H ₈ O ₂	MEOXETOH	10.13	N/A	1.45	
2-pentanone	107-87-9	C ₅ H ₁₀ O	2PENTANO	9.38	0.80	0.68	
2-picoline	109-06-8	C ₆ H ₇ N	2PICOLIN	9.40	0.59	0.41	
2-propanol	67-63-0	C ₃ H ₈ O	IPROPNOL	10.17	N/A	2.72	
3-picoline	108-99-6	C ₆ H ₇ N	3PICOLIN	9.00	0.42	0.45	
4-hydroxy-4-methyl-2-pentanone	123-42-2	C ₆ H ₁₂ O ₂	PYRATON	9.50	0.42	0.36	
acetaldehyde	75-07-0	C ₂ H ₄ O	ETHANAL	10.23	N/A	4.57	
acetone	67-64-1	C ₃ H ₆ O	ACETONE	9.70	0.96	1.12	
acetophenone	98-86-2	C ₈ H ₈ O	ETANONE	9.28	1.36	0.78	
acrolein	107-02-8	C ₃ H ₄ O	ACROLEIN	10.11	N/A	3.82	
acrylic acid	79-10-7	C ₃ H ₄ O ₂	ACRLCADC	10.60	N/A	7.63	
allyl alcohol	107-18-6	C ₃ H ₆ O	PROPENOL	9.67	6.04	1.81	
amyl acetate	628-63-7	C ₇ H ₁₄ O ₂	AMYLACET	?	5.32	1.65	
arsine	7784-42-1	AsH ₃	ARSINE	10.18	N/A	2.71	
benzene	71-43-2	C ₆ H ₆	BENZENE	9.24	0.56	0.53	
bromomethane	74-83-9	CH ₃ Br	BRMETHAN	10.54	N/A	1.40	
butadiene	106-99-0	C ₄ H ₆	BUTADIEN	9.07	0.65	0.63	
butoxyethanol	111-76-2	C ₆ H ₁₄ O ₂	BTOXETOH	8.68	1.46	0.80	
butyl acetate	123-86-4	C ₆ H ₁₂ O ₂	BTYLACET	10.00	N/A	2.22	
carbon tetrachloride	56-23-5	CCl ₄	CARBONT	11.47	N/A	N/A	
chlorobenzene	108-90-7	C ₆ H ₅ Cl	CLBNZE	9.07	0.34	0.36	
cumene	98-82-8	C ₉ H ₁₂	CUMENE	8.73	0.54	0.54	
cyclohexane	110-82-7	C ₆ H ₁₂	CYCHEXAN	9.88	2.88	1.17	
cyclohexanone	108-94-1	C ₆ H ₁₀ O	CYCHEXON	9.16	0.26	0.27	
decane	124-18-5	C ₁₀ H ₂₂	DECANE	9.65	2.67	0.87	
dichloroethane	107-06-2	C ₂ H ₄ Cl ₂	DICLETHAN	11.07	N/A	N/A	
Diesel #2	68476-34-6	mixture	DIESEL2		1.46	0.80	
Diesel #4, Marine Diesel	77650-28-3	mixture	DIESEL4		1.46	0.80	
Diesel Oil, Diesel Fuel	68334-30-5	mixture	DIESEL		1.46	0.80	

Analyte Name	CAS no. ¹	Chemical Formula	SIRIUS Displayed Name	IP, eV	Lamp Response Factors [eV]		
					9.8	10.6	11.7
diethylamine	109-89-7	C ₄ H ₁₁ N	DIETAMNE	8.01	0.30	0.31	
dimethoxymethane	109-87-5	C ₃ H ₈ O ₂	DIMEOXME	10.00	N/A	1.63	
dimethylacetamide	127-19-5	C ₆ H ₁₃ NO	DMA	8.81	0.63	0.47	
dimethylformamide	68-12-2	C ₃ H ₇ NO	DMF	9.13	0.60	0.46	
epichlorohydrin	106-89-8	C ₃ H ₅ ClO	ECL2HYDN	10.64	N/A	N/A	
ethanol	64-17-5	C ₂ H ₆ O	ETHANOL	10.48	N/A	9.25	
ethyl acetate	141-78-6	C ₄ H ₈ O ₂	ETACET	10.01	N/A	2.85	
ethyl acetoacetate	141-97-9	C ₆ H ₁₀ O ₃	EAA	?	1.02	0.66	
ethylbenzene	100-41-4	C ₈ H ₁₀	ETBNZE	8.77	0.46	0.43	
ethylene	74-85-1	C ₂ H ₄	ETHYLENE	10.51	N/A	6.30	
ethylene glycol	107-21-1	C ₂ H ₆ O ₂	ETGLYCOL	10.50	N/A	N/A	
ethylene oxide	75-21-8	C ₂ H ₄ O	ETOXIDE	10.56	N/A	34.3	
Fuel Oil #2	68476-30-2	mixture	FUELOIL2		1.46	0.80	
α -butyrolactone	96-48-0	C ₄ H ₆ O ₂	GBUTRLCN	10.26	N/A	3.78	
gasoline (unleaded)	8006-61-9	mixture	GASOLINE		2.27	1.21	
heptane	142-82-5	C ₇ H ₁₆	HEPTANE	9.93	N/A	2.01	
hexane	110-54-3	C ₆ H ₁₄	HEXANE	10.13	N/A	2.88	
hydrazine	302-01-2	H ₂ N ₂	HYDRAZINE	8.10	7.78	3.23	
isoamyl acetate	123-92-2	C ₇ H ₁₄ O ₂	IAMYACET	9.90	N/A	1.65	
isobutanol	78-83-1	C ₄ H ₁₀ O	IBUTANOL	10.02	N/A	5.24	
isobutylene	115-11-7	C ₄ H ₈	ISOBUTYL	9.22	1.00	1.00	1.00
isooctane	540-84-1	C ₈ H ₁₈	IOCTANE	9.89	2.75	0.91	
isophorone	78-59-1	C ₉ H ₁₈ O	IPHORNE	9.07	0.21	0.20	
isopropylamine	75-31-0	C ₃ H ₉ N	2PROPAME	8.60	0.61	0.51	
isopropyl ether	108-20-3	C ₆ H ₁₄ O	IPTROETHR	9.20	0.72	0.62	
Jet A(A1)	8008-20-6	mixture	JETA(A1)		1.04	0.36	
JP 4, jet B	8008-20-6	mixture	JP4		1.57	1.03	
JP 5	8008-20-6	mixture	JP5		1.04	0.36	
JP 8	8008-20-6	mixture	JP8		1.04	0.36	
kerosene	8008-20-6	mixture	KEROSENE		1.04	0.36	
mesityl oxide	141-79-7	C ₆ H ₁₀ O	MSTYLOXD	9.10	0.48	0.40	
m-xylene	108-38-3	C ₈ H ₁₀	MXYLENE	8.55	0.80	0.80	
methanol	67-56-1	CH ₄ O	MEOH	10.84	N/A	N/A	
methyl acetate	79-20-9	C ₃ H ₆ O ₂	MEACET	10.25	N/A	5.47	
methyl acetoacetate	105-45-3	C ₅ H ₈ O ₃	MEACACET	9.82	1.23	0.87	
methyl acrylate	96-33-3	C ₄ H ₆ O ₂	MEACRYLT	10.70	N/A	3.09	
methyl benzoate	93-58-3	C ₈ H ₈ O ₂	MEBNZOTE	9.32	6.50	1.88	
methylbenzyl alcohol	589-18-4	C ₈ H ₁₀ O	MEBNZOL	?	1.49	0.81	
methyl ethyl ketone	78-93-3	C ₄ H ₈ O	MEK	9.52	0.76	0.65	
methyl isobutyl ketone	108-10-1	C ₆ H ₁₂ O	MIBK	9.30	0.76	0.65	
methyl methacrylate	80-62-6	C ₅ H ₈ O ₂	MEMEACRY	10.06	N/A	0.94	
methyl tert-butylether	1634-04-4	C ₅ H ₁₂ O	MTBE	9.41	0.84	0.74	
methylene chloride	75-09-2	CH ₂ Cl ₂	METYLCL2	11.33	N/A	N/A	
monomethylamine	74-89-5	CH ₃ N	MEAMINE	8.90	0.85	0.76	
n-methylpyrrolidone	872-50-4	C ₅ H ₉ NO	MEPRYLDN	9.17	1.22	0.58	

Analyte Name	CAS no. ¹	Chemical Formula	SIRIUS Displayed Name	IP, eV	Lamp Response Factors [eV]		
					9.8	10.6	11.7
octane	111-65-9	C ₈ H ₁₈	OCTANE	9.80	11.7	1.61	
o-xylene	95-47-6	C ₈ H ₁₀	OXYLENE	8.56	0.51	0.46	
p-xylene	106-42-3	C ₈ H ₁₀	PXYLENE	8.44	0.41	0.50	
phenol	108-95-2	C ₆ H ₆ O	PHENOL	8.49	N/A	N/A	
phenylethyl alcohol	60-12-8	C ₈ H ₁₀ O	BNZETOH	10.00	N/A	N/A	
phosphine	7803-51-2	PH ₃	PHOSPHIN	9.87	N/A	2.64	
propylene	115-07-1	C ₃ H ₆	PROPENE	9.73	1.25	1.06	
propylene oxide	75-56-9	C ₃ H ₆ O	PROPLYOX	10.22	N/A	4.84	
pyridine	110-86-1	C ₅ H ₅ N	PYRIDINE	9.26	0.60	0.53	
quinoline	91-22-5	C ₈ H ₇ N	QUNOLINE	8.63	14.2	0.47	
styrene	100-42-5	C ₈ H ₈	STYRENE	8.46	0.40	0.32	
tert-butyl alcohol	75-65-0	C ₄ H ₁₀ O	TBUOH	9.90	23.7	2.27	
tert-butylamine	75-64-9	C ₄ H ₁₁ N	TBUAMINE	8.50	0.42	0.41	
tert-butylmercaptan	75-66-1	C ₄ H ₁₀ S	TBUMRCAP	9.03	0.45	0.36	
tetrachloroethylene	127-18-4	C ₂ Cl ₄	(CL)4ET	9.33	0.64	0.49	
tetrahydrofuran	109-99-9	C ₄ H ₈ O	THF	9.40	1.66	1.47	
thiophene	110-02-1	C ₄ H ₄ S	THIOLE	8.86	0.41	0.52	
toluene	108-88-3	C ₇ H ₈	TOLUENE	8.83	0.62	0.56	
trans-dichloroethene	156-60-5	C ₂ H ₂ Cl ₂	CL2ETHN	9.64	0.42	0.37	
trichloroethylene	79-01-6	C ₂ HCl ₃	(CL)3ETL	9.46	0.44	0.36	
turpentine - pure gum spirits	8006-64-2	mixture	TURPS		0.12	0.17	
vinyl acetate	108-05-4	C ₄ H ₆ O ₂	VNYLACET	9.20	1.36	0.94	
vinyl chloride	75-01-4	C ₂ H ₃ Cl	VNLYCLDE	9.99	N/A	1.47	
vinylcyclohexane	695-12-5	C ₈ H ₁₄	VYLCYHEX	9.51	0.73	1.38	

¹ CAS no. or Chemical Abstract Service No. – An internationally recognized unique identifier of chemical compounds. The CAS no. is listed on Material Safety Data Sheets (MDS).

² N/A – Not applicable: This lamp cannot be used to detect this analyte because the ionization energy of the compound is greater than the energy of the lamp.

NOTE:

VOC Response factors apply in the 0-500 ppm range. The values in this table were obtained using dry bottled gases at 25 °C. The response factors may change at higher concentrations, different temperature and humidity conditions, or with cleanliness of lamp. For increased accuracy at different ambient conditions or concentrations, determine a custom response factor and enter it via the Response Factor page; see **4.3.3 Selecting a Custom Response Factor**. These response factors are specific to the energy of the lamp designated in the table. They are not valid for instruments using PID bulbs at any other energy. Using these response factors with a lamp at any other energy may critically compromise the instrument's ability to detect organic compounds.

Use of SIRIUS PID for detection of extremely toxic gases:

The system resolution limit of the SIRIUS PID in normal mode (with a new, clean lamp) is approximately 0.1 ppm isobutylene equivalent. Users must be aware of exposure limit guidelines, such as TLV, for the target analyte. Do not use the SIRIUS PID Detector if the exposure limit for the target analyte is below 0.1 ppm.

For any analyte, its exposure limit guideline can be recalculated in terms of equivalent ppm isobutylene by dividing the exposure limit guideline by the appropriate response factor.

Example: For butadiene (CAS 106-99-0), the recommended threshold limit value (as TWA) is 1 ppm. Its response factor (10.6 eV lamp) is 0.69. The TLV for butadiene, in terms of equivalent ppm isobutylene is:

$$\text{ppm} \div 0.69 = 1.4 \text{ ppm isobutylene equivalent.}$$

The SIRIUS PID Detector has a reproducibility of ± 2 ppm (± 2000 ppb) or 10%, whichever is greater (see Table 14). The user must account for this potential variation between the displayed value and the actual concentration when setting alarms and interpreting readings.

Gases with very high response factors (RF):

The SIRIUS PID is a very versatile solution for monitoring many different gases and vapors. In addition to the pre-programmed list provided in the SIRIUS instrument, users can determine response factors for many other compounds (see 4.3). The maximum response factor value that will be accepted by the SIRIUS instrument is 39.99. Following the procedure in Chapter 4, if a response factor of greater than 39.99 is experimentally determined, the user must use the next higher energy lamp (9.6, 10.6, or 11.7 eV) to monitor that compound. If a response factor of greater than 39.99 is experimentally determined when using the 11.7 eV lamp, the compound of interest has an ionization potential too high to be detected reliably using the SIRIUS instrument.

Use the correct bulb when determining the response factor.

Failure to apply the appropriate response factors can result in inaccurate readings.

These additional response factors were determined by MSA Chemists using the SIRIUS Multigas Detector. The listing consists of response factors for several common industrial chemicals that are not preprogrammed into the instrument. Using your IBM compatible PC with the Data Logging Software and Data Docking Module, you can add a response factor from this list to the monitor's internal gas table. Consult the Data Logging Software User's Manual for specific instruction. MSA is continually developing new Response Factors; contact MSA if your compound of interest is not listed.

Table 16. Known Interference Data for listed VOCs

CHEMICAL	CONCENTRATION	SENSOR CHANNEL			
		LEL	O ₂	H ₂ S	CO
ethylene oxide	2297 ppm				43 (5)
arsine	186 ppm			176 (5)	
phosphine	303 ppm			172 (5)	
propylene	151.6 ppm				19 (5)
ethylene	101 ppm				76 (5)
methanol	994 ppm				*

* Methanol can give a delayed, high response on the CO channel. When cleaning the bulb, it is important to ensure that all of the methanol cleaning compound has evaporated from the bulb before re-installation into the instrument.

9. Replacement and Accessory Parts

Table 17. Accessory Parts List

PART	PART NO.
Calibration gas cylinder 58 l [4 gas mixture] 1.45 Vol% CH ₄ , 15 Vol% O ₂ , 60 ppm CO, 20 ppm H ₂ S	10053022
Calibration gas cylinder [Isobutylene 100 ppm]	D0715896
Zero gas 100% synth. air	10029511
Pressure reducer 0.5 l/min	D0715890
Pressure reducer 0.25 l/min	478359
PID Calibration T-connector	10045650
Sampling probe, flexible 30 cm	D620373
Sampling line, 3 m (10 ft)	10040665
Sampling line, 7,5 m	10040664
Sampling line 1.5 m Teflon, conductive (hazardous areas)	10021925
Sampling line 3 m Teflon, conductive (hazardous areas)	10021926
Field Case , black, with foam insert	10052515
Rubber Boot, black, (includes shoulder strap)	10052514
Rubber Boot, red (non hazardous areas only)	10050124
Protective Jacket, orange (non hazardous areas only)	10050122
Power Supply, global	10065716
Battery Charger Stand (ATEX version)	10066628
Charger Stand with Power Supply, ATEX	10068655
Vehicle charger [12 V DC]	10049410
Battery Assembly, Alkaline	10051980
Alkaline battery pack (less door)	10064569
Li-ion battery pack	10052296
DATA Docker IR-Link Kit	710946
JetEye IR-Link	D655505
Link Software	710988

Replacement Parts List

Table 18. Replacement Parts List

PART	PART NO.
Sensor COVER Label	710487
LEL Sensor	10047947
O ₂ Sensor	10046946
CO Sensor	10049804
H ₂ S Sensor	10046945
Inactive Sensor Plug	10046292
Chamber Replacement Kit	10050783
PID Bulb 10.6 eV (green)	10049692
Lamp Access Cap	10050841
Lamp Access Cap O-Ring	10050855
Ion Chamber	10049768
Screw Replacement Kit	10051537
Water Membrane, package of five	10051250
Dust filter package of five	808935
Filter Cover O-ring	10049892
Horn, Protective Insert	10046042

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