



INSTRUMENTS

Eagle 3

Operator's Manual

Part Number: 71-0590

Revision: DRAFT

Released: 5/2/24

WARNING

Read and understand this instruction manual before operating instrument. Improper use of the gas monitor could result in bodily harm or death.

Maintenance of the gas monitor is essential for proper operation and correct readings.

Bump test the instrument before each day's use with a known concentration of each target gas. A bump test can be done in User Mode's BUMP item or by applying gas in Measuring Mode. The instrument does not need to be calibrated unless it does not pass the User Mode bump test or does not respond appropriately, as defined by the user, in Measuring Mode. For more information about bump test and calibration requirements, see IEC 60079-29-2.

Table of Contents

Chapter 1: Introduction	13
About the Eagle 3	13
Specifications	14
About this Manual	14
 Chapter 2: Description	 17
Instrument Description	17
<i>LCD</i>	19
<i>Case</i>	19
<i>Control Buttons</i>	19
<i>Alarm LEDs</i>	20
<i>Buzzer</i>	20
<i>Sensors</i>	20
<i>Filters</i>	21
<i>Printed Circuit Boards (PCBs)</i>	23
<i>Flow System</i>	24
<i>Battery Pack</i>	25
Standard Accessories	26
<i>Shoulder Strap</i>	26
<i>Hose and Probe</i>	26
<i>AC Charger</i>	27
Optional Accessories	27
<i>Optional Probes</i>	27
<i>External Dilution Fittings</i>	29
 Chapter 3: Operation.....	 30
Start Up	30
<i>Turning On the Eagle 3</i>	30
<i>Performing a Demand Zero</i>	40
<i>Turning Off the Eagle 3</i>	41

Normal Mode Operation	42
<i>Monitoring an Area</i>	43
<i>Using Optional Sample Hoses</i>	44
<i>Using Exhaust Tubing</i>	44
<i>Combustible Gas Detection</i>	44
<i>Monitoring Combustible Gas in the PPM or % volume Ranges</i>	46
Alarms	50
<i>Alarm Indicators</i>	50
<i>Responding to Alarms</i>	52
Data Logging	56
Chapter 4: Display Mode.....	58
Tips for Using Display Mode	59
Peak Screen	59
Battery Voltage Screen	60
Catalytic (LEL) Sensor Screen	60
Methane Elimination Mode Screen	61
Relative Response Screen	62
STEL Screen	64
TWA Screen	64
View Alarm Settings Screen	65
Viewing and Selecting the User ID	67
Viewing and Selecting the Station ID	68
View Snap Log Data Screen	71
Time in Operation Screen	74
Date/Time Screen	74
Data Logging Screen	75
Chapter 5: Calibration Mode	77
Overview	77
Entering Calibration Mode	77
Performing a Bump Test	78
CO ₂ Zero Calibration	85
Performing a TE Zero Calibration	85

Auto Calibration Method	85
<i>Preparing for a Calibration</i>	85
<i>Calibration Supplies and Equipment</i>	85
<i>Performing an Air Calibration</i>	86
<i>Performing an Auto Calibration</i>	87
Single Calibration Method	88
<i>Preparing for a Calibration</i>	88
<i>Calibration Supplies and Equipment</i>	89
<i>Performing an Air Calibration</i>	90
<i>Performing a Single Calibration</i>	90
Setting Auto Calibration Values	92
Making Cylinder Selections	93
Entering Normal Mode	95
Chapter 6: Maintenance	96
Overview	96
Troubleshooting	96
Recharging the Eagle 3	97
Replacing the Hydrophobic Probe's Particle Filter and Hydrophobic Filter Disk	99
Replacing the Hydrophobic Filter	100
Replacing the Sensor Filters	102
Checking the Combustible Gas Sensor's Condition	103
Sensor Replacement	103
<i>Replacing an O₂, CO, or H₂S Sensor</i>	103
<i>Replacing an LEL Sensor</i>	106
<i>Replacing an F-Sensor</i>	106
Chapter 7: General Parts List	107
Appendix A: Calibrating with a Sample Bag	109
Overview	109
Calibration Supplies and Equipment	109
Entering Calibration Mode	110

Calibrating Using the Auto Calibration Method	111
<i>Setting the Fresh Air Reading</i>	111
<i>Performing a Span Adjustment in Auto Calibration</i>	112
Calibrating Using the Single Calibration Method	116
<i>Setting the Fresh Air Reading</i>	117
<i>Performing a Span Adjustment in Single Calibration</i>	118
Parts List	122

Appendix B: Setup Mode 123

Overview	123
Tips for Using Setup Mode	129
Entering Setup Mode	130
Setting the Date and Time (Set Date/Time)	131
Setting the Date Format (Set Date Format)	132
Configuring the Channels (Configure Channels)	133
Configuring the Gases (Configure Gases)	135
<i>Adjusting Channels for Catalytic Sensors</i>	136
<i>Adjusting Channels for Non-Catalytic Sensors</i>	140
Setting the Catalytic Detection Units	140
Setting the Carbon Dioxide Units	141
Selecting HC or CH4 Units (HC Or CH4 Units)	142
Setting the LEL Standard	143
Adjusting the Relative Response Setting	144
Updating the Alarm Settings.....	145
<i>Changing Alarm Points</i>	145
<i>Changing the Alarm Latching Setting</i>	148
Turning the User and Station ID On or Off	154
Turning Demand Zero On or Off (Demand Zero)	155
Turning Auto Zero On or Off (Auto Zero)	156
Turning CO2 Air Zero On or Off	157
Adjusting the Data Log Settings.....	158
Selecting the Backlight Time	160
Adjusting the LCD Contrast	161
Turning the Key Tone On/Off.....	162

Calibration Settings.	163
<i>Turning the Calibration Reminder On or Off</i>	163
<i>Selecting the Calibration Past Due Action Setting</i>	164
<i>Adjusting the Calibration Interval</i>	165
<i>Turning Min/Max Span On or Off</i>	166
<i>Turning Calibration Auto Start On or Off</i>	167
Bump Test Settings	168
<i>Turning Bump Reminder On or Off</i>	168
<i>Selecting the Bump Past Due Action</i>	169
<i>Adjusting the Bump Test Interval</i>	170
<i>Turning Bump Test Auto Start On or Off</i>	171
<i>Selecting the GasTime</i>	172
<i>Adjusting the Tolerance</i>	173
<i>Selecting the Calibration Time</i>	174
<i>Turning Auto Calibration On or Off</i>	165
Setting the Mode Select	178
Setting the Bar Hole Measurement Time	179
Adjusting the CO Display in Leak Check	181
Adjusting the Zero Follower Settings	182
Adjusting the Zero Suppression Settings	184
Adjusting the Confirmation Alert Setting	186
Turning Stealth Mode On or Off.	189
Turning Lunch Break On or Off	189
Adjusting the Language Setting	191
Turning the Setup Password Function On or Off	192
Turning the Setup Password Function On or Off	193
Low Flow Fail Calibration	195
Viewing the ROM/SUM Details	197
Adjusting the Radio Standard.	198
Saving the User Configuration	199
Restoring the User Configuration.	200
Restoring the Four Gas Defaults.	201
Restoring the Factory Defaults	202
Exiting Setup Mode (Normal Operation)	204

Appendix C: PID Sensors	205
Overview	205
Description	205
<i>PID Sensor and Sensor Adapter</i>	206
<i>PID Sub PCB</i>	206
<i>PID Probe</i>	207
Start Up and Normal Operation	208
PID Relative Response Feature	210
<i>PID Sensor Relative Response Screen in Display Mode</i>	210
PID Calibration	213
<i>Calibrating with a 4-Gas Cylinder and a PID Cylinder</i>	213
<i>Calibrating with a 5-Gas Cylinder</i>	222
Maintenance	230
<i>Troubleshooting</i>	231
<i>Cleaning the PID Sensor's Lamp</i>	231
<i>Replacing PID Sensor's Lamp</i>	235
<i>Replacing Electrode Stack</i>	239
<i>Replacing the PID Sensor</i>	242
Configuring the PID Gas in Setup Mode	243
PID Parts List	249
 Appendix D: ESM-01 Toxic Sensors	 251
Overview	251
Description	251
<i>ESM-01 Sensor</i>	252
<i>ESM-01 Sub PCB</i>	253
Start Up and Normal Operation	253
ESM-01 Calibration	253
<i>Calibrating with a 4-Gas Cylinder and an ESM-01 Cylinder</i>	254
<i>Calibrating with a 5-Gas Cylinder</i>	261
Maintenance	270
<i>Replacing the ESM-01 Sensor</i>	270
<i>Replacing the H₂S Scrubber in the SO₂ and HCN Sensors</i>	271
Parts List	274

Appendix E: TC Sensors	275
Overview	275
Description	275
<i>TC Sensor</i>	276
<i>TC Sub PCB</i>	276
Start Up and Normal Operation	277
Catalytic (LEL) Sensor Screen	277
TC Calibration	278
Maintenance	286
<i>Replacing the TC Sensor.</i>	287
Configuring the TC Gas in Setup Mode	288
Parts List	293
 Appendix F: Infrared Carbon Dioxide Sensors.	 294
Overview	294
Description	294
<i>Infrared Carbon Dioxide Sensor.</i>	295
<i>Infrared Sub PCB</i>	295
<i>CO₂ Scrubber</i>	296
Start Up and Normal Operation	296
<i>Performing a Demand Zero for Carbon Dioxide Sensors</i>	297
Infrared Carbon Dioxide Calibration	298
Maintenance	307
<i>Replacing the IR CO₂ Sensor or Changing Sensor Type</i>	307
Parts List	308
 Appendix G: Infrared Methane Sensor	 309
Overview	309
<i>Target Gases</i>	309
Description	310
<i>Infrared Methane Sensor</i>	311
<i>Infrared Sub PCB</i>	311
Start Up and Normal Operation	311
<i>Detection Ranges</i>	311
Catalytic (LEL) Sensor Screen	312

Infrared Methane Calibration	312
Maintenance	320
<i>Replacing the IR Methane Sensor</i>	321
Parts List	322
Appendix H: Infrared Hydrocarbon Sensor	323
Overview	323
<i>Target Gases</i>	323
Description	323
<i>Infrared Hydrocarbon Sensor</i>	324
<i>Infrared Sub PCB</i>	324
Start Up and Normal Operation	325
<i>0-100% LEL/2.0-30.0% vol Autoranging</i>	325
Catalytic (LEL) Sensor Screen	325
Infrared Hydrocarbon Calibration	326
Maintenance	334
<i>Replacing the IR Hydrocarbon Sensor</i>	335
Parts List	336
Appendix I: Methane Elimination Mode	337
Overview	337
Monitoring in Methane Elimination Mode	337
Calibration	340
Appendix J: Using the Eagle 3 in Bar Hole Mode	341
Overview	341
Start Up, Bar Hole Mode	341
<i>Turning on Eagle 3, Bar Hole Mode</i>	341
<i>Performing a Demand Zero, Bar Hole Mode</i>	345
Bar Hole Testing	346
<i>Performing a Bar Hole Test</i>	346
<i>Turning off the Eagle 3, Bar Hole Mode</i>	348
Appendix K: Using the Eagle 3 in Leak Check Mode	349
Overview	349

Start Up, Leak Check Mode	349
<i>Turning On the Eagle 3, Leak Check Mode</i>	349
<i>Performing a Demand Zero, Leak Check Mode</i>	354
Leak Testing	354
<i>Locating a Leak</i>	354
<i>Turning the Buzzer On and Off In Leak Check Mode</i>	355
<i>Turning Off the Eagle 3, Leak Check Mode</i>	355
Appendix L: Tank Tester Model	356
Description	356
<i>Float Probe Assembly</i>	357
<i>Dilution Fitting (1:1)</i>	357
Start Up	358
Alarms	360
Calibration	360
Parts List	360
Appendix M: Using the Eagle 3 in Inert Mode	361
Description	361
Alarms	361
Start Up	364
Operation	367
Appendix N: Eagle 3 Transformer Gas Tester Model	367
Description	367
Operation	367
Alarms	368
Parts List	368
Appendix O: Internal Dilution Models	369
Description	369
Calibration	369

WARNING: *Understand manual before operating. Substitution of components may impair intrinsic safety. To prevent ignition of a hazardous atmosphere, batteries must only be changed or charged in an area known to be nonhazardous. Not tested in oxygen enriched atmospheres (above 21%).*

NOTE: RKI Instruments, Inc. recommends that you refer to ISA-RP12.13, Part II-1987 or an equivalent international recommended practice for guidance in the use of combustible gas detection instruments.

Chapter 1: Introduction

About the Eagle 3

Using an advanced detection system consisting of up to six gas sensors, the Eagle 3 sample draw gas monitor can detect the presence of combustible gas, oxygen (O₂), carbon monoxide (CO), hydrogen sulfide (H₂S), and toxic gases simultaneously.

The Eagle 3's rugged, reliable, and easy-to-use design makes it suited for a wide range of applications, including sewage treatment plants, utility manholes, tunnels, hazardous waste sites, power stations, petrochemical refineries, mines, paper mills, drilling rigs, and fire fighting stations. The Eagle 3's full range of features is included below:

- Simultaneous monitoring of one to six gases. The standard configuration includes four sensors for combustible gas (% LEL, ppm, and % volume), oxygen, carbon monoxide (CO), and hydrogen sulfide (H₂S).
- Choice of three operating modes:
 - Normal Mode for typical confined spaces or area monitoring (standard factory setting)
 - Bar Hole Mode for checking of bar holes when searching for underground gas leaks
 - Leak Check Mode for locating leaks in valves and piping
- Sample-drawing pump with a range of up to 125 feet
- Liquid crystal display (LCD) for complete and understandable information at a glance
- Ultrabright alarm LEDs
- Distinctive audible alarm for dangerous gas conditions or unit malfunction
- Microprocessor control for reliability, ease of use, and advanced capabilities
- Data logging functions (when used in Normal Mode)
- Alarm trend data (when used in Normal Mode)
- STEL and TWA (when used in Normal Mode) and over range alarms
- Peak readings (when used in Normal Mode)
- Built-in time function
- Lunch break feature
- RF shielded high-impact plastic case
- CSA classified for Class I, Division I, Groups A, B, C, and D hazardous atmospheres

WARNING: The Model Eagle 3 detects oxygen deficiency, elevated levels of oxygen, combustible gases, carbon monoxide, and hydrogen sulfide, all of which can be dangerous or life threatening. When using the Eagle 3, you must follow the instructions and warnings in this manual to ensure proper and safe operation of the unit and to minimize the risk of personal injury. Be sure to maintain and periodically calibrate the Eagle 3 as described in this manual.

NOTE: ONLY THE COMBUSTIBLE GAS DETECTION PORTION OF THIS INSTRUMENT HAS BEEN ASSESSED FOR PERFORMANCE.

Specifications

Table 1: Standard Sensor Specifications

	Detection Range	Lower Detectable Limit (LDL)	Reading Increment	Alarm 1 Setpoint	Alarm 2 Setpoint	STEL Setpoint	TWA Setpoint
Combustible Gas*	0 - 100% LEL	n/a	1% LEL	10% LEL**	50% LEL	n/a	n/a
Oxygen (O₂)	0 - 40.0% vol	n/a	0.1% vol	19.5% vol**	23.5% vol	n/a	n/a
Hydrogen (H₂S)	0 - 200.0 ppm	0.5 ppm	0.5 ppm	5.0 ppm**	30.0 ppm	5.0 ppm	1.0 ppm
Carbon Monoxide (CO)	0 - 2,000 ppm	3 ppm	1 ppm	25 ppm**	50 ppm	200 ppm	25 ppm
<p>* Methane Calibration Standard</p> <p>** When calibrating the Eagle 3 with the Auto Calibration or the Single Calibration method, the calibration gas value must be equal to or higher than the alarm 1 setting. See page 145 for instructions to change the alarm points if necessary for the desired calibration gas value.</p>							

Table 2: IR Sensor Specifications

	Detection Range	Lower Detectable Limit (LDL)	Reading Increment	Warning Setpoint	Alarm Setpoint	STEL Setpoint	TWA Setpoint
Carbon Dioxide (CO₂)	0 - 10.00% vol	0.05% vol	0.01% vol	0.05% vol	3.00% vol	3.00% vol	0.50% vol
	0 - 10,000 ppm	300 ppm	20 ppm	5,000 ppm	5,000 ppm	n/a	5,000 ppm

Table 3: EC Sensor Specifications

	Detection Range	Lower Detectable Limit (LDL)	Reading Increment	Warning Setpoint	Alarm Setpoint	STEL Setpoint	TWA Setpoint
Ammonia (NH₃)	0 - 400.0 ppm	4.0 ppm	0.5 ppm	25.0 ppm	35.0 ppm	35.0 ppm	25.0 ppm
Hydrogen Cyanide (HCN)	0 - 30.0 ppm	1.0 ppm	0.1 ppm	5.0 ppm	10.0 ppm	10.0 ppm	4.7 ppm
Nitrogen Dioxide (NO₂)	0 - 20.00 ppm	0.30 ppm	0.05 ppm	2.00 ppm	4.00 ppm	1.00 ppm	0.50 ppm
Phosphine (PH₃)	0 - 20.00 ppm	0.02 ppm	0.01 ppm	0.30 ppm	0.60 ppm	1.00 ppm	0.30 ppm
Sulfur Dioxide (SO₂)	0 - 100.0 ppm	0.20 ppm	0.05 ppm	2.00 ppm	5.00 ppm	5.00 ppm	2.00 ppm

Table 4: Eagle 3 Specifications


Sampling Method	Sample Draw	
Response Time	T90 Within 30 Seconds	
Display	Graphics LCD Display	
Operating Temperature(s)	All sensors with target gases except those listed below:	-20°C to 50°C
	<ul style="list-style-type: none"> Hydrogen Bromide (HBr) Hydrogen Chloride (HCl) Fluorine (F2) Hydrogen Fluoride (HF) Chlorine Trifluoride (ClF3) 	0°C to 40°C
	• Chlorine (Cl2)	0°C to 50°C
	• Ozone (O3)	10°C to 40°C
Humidity	Below 85% RH (Non-Condensing)	
Indicator Accuracy	<u>Combustible Gas (LEL), Catalytic Type Sensor</u> <ul style="list-style-type: none"> -10°C to 40°C: 5% of full scale -20°C to 50°C: 6% of full scale 	
Safety/Regulatory	<p>ATEX Pending</p> <div style="text-align: center;">  C US 186718 </div> <p>CSA classified as Intrinsically Safe. Exia. Class I, Groups A, B, C, & D. Temperature Code T3C.</p>	
Power Supply	Lithium-ion battery pack	
Continuous Operating Hours @ 25 °C	TBD	
Battery Charger Ratings	TBD	
Case	High-impact Plastic, RF-shielded, Dust and Weather Proof	
Standard Accessories	<ul style="list-style-type: none"> AC charger 5-foot hose Hydrophobic probe Shoulder Strap 	
Optional Accessories	<ul style="list-style-type: none"> 12 VDC Charger Hoses of Various Lengths, see “Chapter 7: General Parts List” on page 107. Dilution Fitting (1:1 and 3:1) Various Probes, see “Chapter 7: General Parts List” on page 107 Communication cable 	

Table 4: Eagle 3 Specifications

Dimensions and Weight	Approximately 171(H) x 65(W) x 39(D) mm (5.6”H x 2.5”W x 1.5”D) Approximately 310 g (11 oz.)
------------------------------	---

About this Manual

The Eagle 3 Operator’s Manual uses the following conventions for notes, cautions, and warnings.

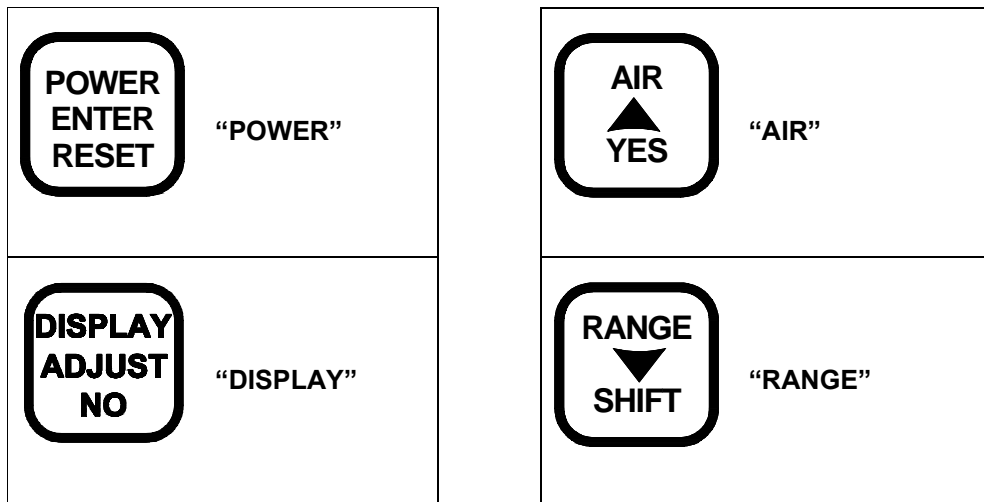
NOTE: Describes additional or critical information.

CAUTION: *Describes potential damage to equipment.*

WARNING: *Describes potential danger that can result in injury or death.*

Button Labels

Throughout this manual, the Eagle 3’s control buttons are referenced in the following ways:



Chapter 2: Description

Instrument Description

The Eagle 3 includes the case, LCD, control buttons, alarm LEDs, buzzer, sensors, printed circuit boards, communication port, flow system, and rechargeable battery pack.

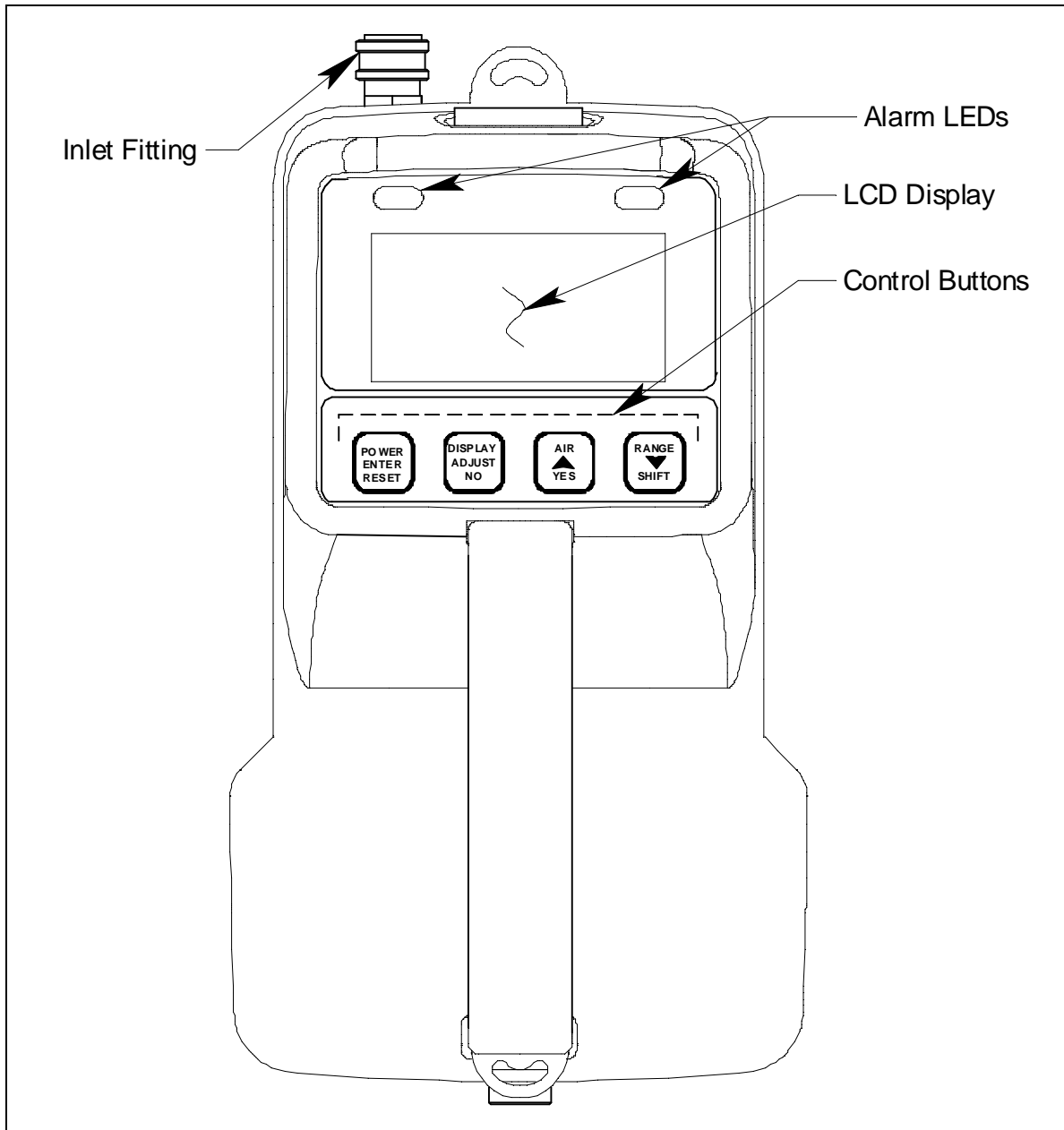


Figure 1: Component Location, Top View

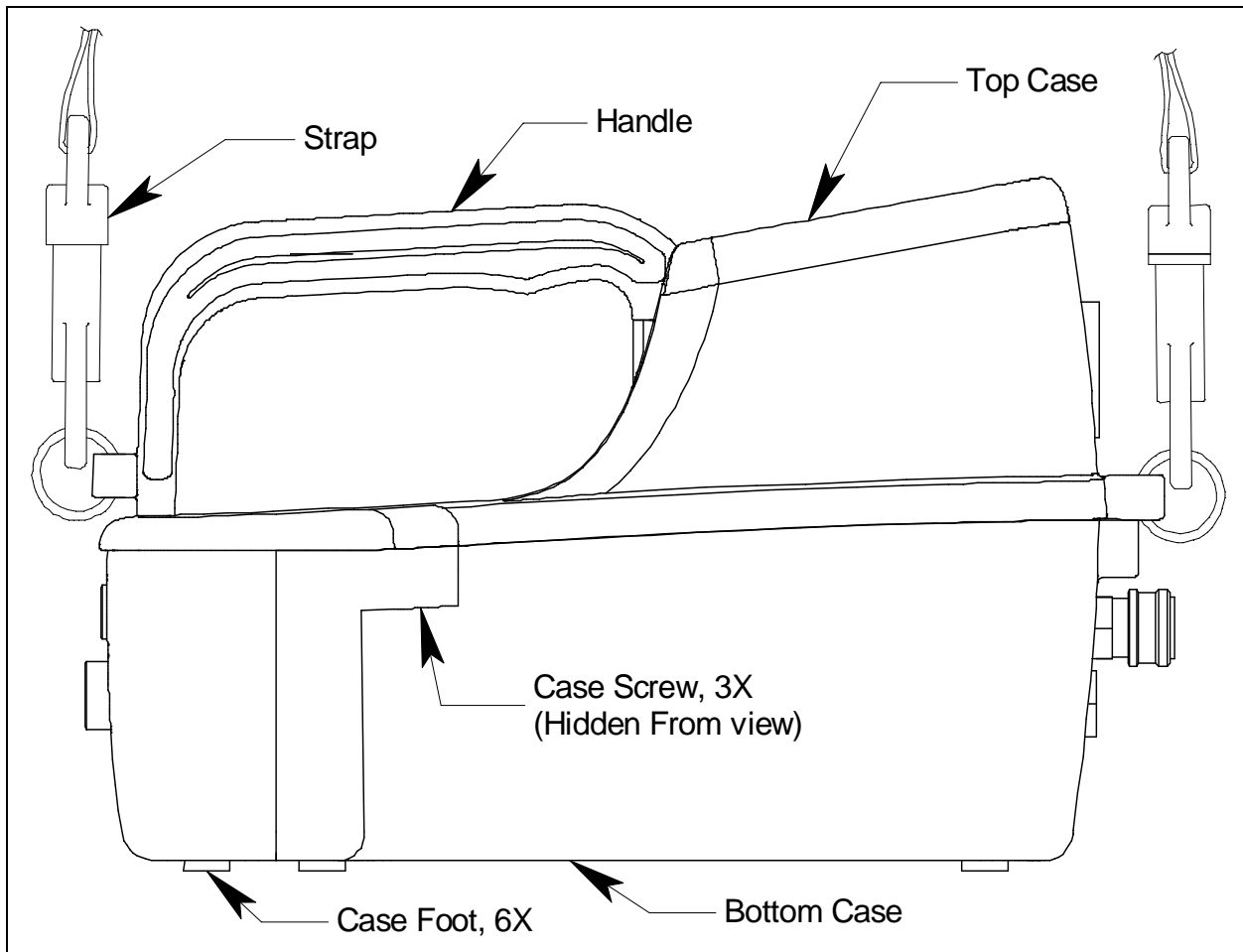


Figure 2: Component Location, Side View

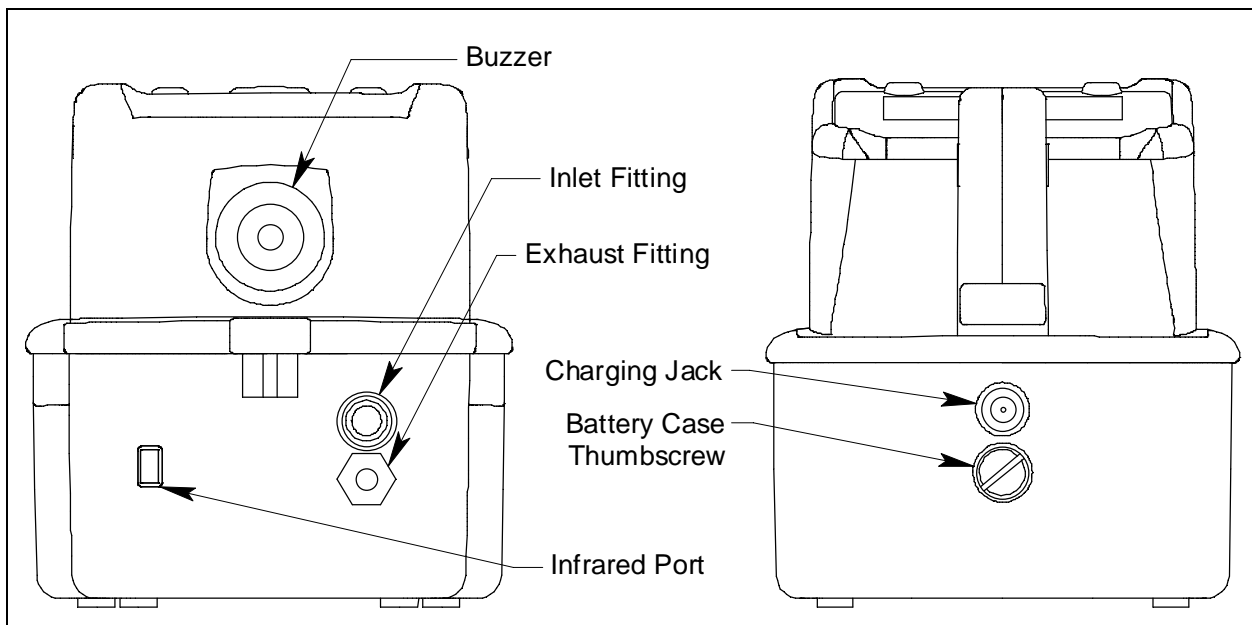


Figure 3: Component Location, Front & Back Views

Case

The Eagle 3's high-impact, conductive plastic case is radio frequency (RF) resistant and suitable for many indoor and outdoor conditions. The case is dust-proof and water-resistant. Its two main components, the top case and bottom case, are held together with three screws located on the bottom case. The interface between the top case and bottom case is gasketed. A sturdy, well-balanced handle on the top case makes the instrument comfortable to hold. A clear plastic window for viewing the LCD is located above the black handle on the top case.

There are four, raised feet on the bottom of the bottom case. These slightly elevate the Eagle 3 from the surface on which it rests.

LCD

A digital LCD (liquid crystal display) is visible through a clear plastic window in the top case. The LCD simultaneously shows the gas readings for all installed sensors. The LCD also shows information for each of the Eagle 3's operating modes.



A backlight allows the LCD to remain visible in low-light situations. The backlight is set on a timer to switch off after a certain period to prolong battery life. This setting can be adjusted from 0 seconds to 10 minutes using the **Backlight Time** parameter in **Setup Mode** (see page 160).



NOTE: If **Stealth** is set to **On**, the backlight remains off regardless of the **Backlight Time** setting.

WARNING: *A thin protective film covers the display to prevent scratches during shipping. Remove this film before use. Leaving the film installed voids the intrinsically safe certification.*

Control Buttons

From left to right, the four control buttons below the LCD are POWER (ENTER RESET), DISPLAY (ADJUST NO), AIR (▲YES), and RANGE (▼SHIFT).

Button	Function(s)
	<ul style="list-style-type: none">• turns the Eagle 3 on and off• silences and resets alarm condition if Alarm Latching is set to Alarm Latching and Alarm Silence is set to On• enters instructions, values, and settings into the Eagle 3's microprocessor
	<ul style="list-style-type: none">• enters and scrolls through Display Mode• silences and resets alarm condition if Alarm Latching is set to Alarm Latching and Alarm Silence is set to On• enters instructions into the Eagle 3's microprocessor

Button	Function(s)
	<ul style="list-style-type: none"> • activates the demand zero function (adjusts the Eagle 3's fresh air reading) • silences and resets alarm condition if Alarm Latching is set to Alarm Latching and Alarm Silence is set to On • enters instructions into the Eagle 3's microprocessor • moves the cursor on the LCD up the screen • increases the value of a parameter available for adjustment • scrolls through parameter options
	<ul style="list-style-type: none"> • changes the detection units of the combustible gas channel (when Catalytic Units is set to CHANGE OK in Setup Mode) • silences and resets alarm condition if Alarm Latching is set to Alarm Latching and Alarm Silence is set to On • enters instructions into the Eagle 3's microprocessor • moves the cursor on the LCD down the screen • decreases the value of a parameter available for adjustment • scrolls through parameter options

Alarm LEDs

Five sets of red alarm LEDs (light emitting diodes) around the edge of the case act as visual indicators for gas, low battery, and failure alarms.

Charging Indicator LED

One LED located above the LCD lights up orange when a power cable is plugged into the instrument. When charging is complete, the LED turns green until the Eagle 3 is disconnected from power.

Buzzer

One solid-state electronic buzzer is located inside the case. Sound exits the case through a hole in the middle front of the case. The buzzer sounds for gas alarms, malfunctions, low battery voltage, and as a general indicator while the Eagle 3 is in use.

Sensors

The Eagle 3 can use up to six sensors to simultaneously monitor combustible gas, oxygen (O₂), carbon monoxide (CO), hydrogen sulfide (H₂S), and other toxic gases. The sensors are located inside the Eagle 3's bottom case, installed in the flow chamber. The O₂, CO, and H₂S sensors are housed within a flow block mounted to the main board. F-sensors and the LEL sensor are installed into individual flow blocks that get mounted to the bottom plate of the unit.

The sensors for the four standard gases (LEL, oxygen, H₂S, and CO) are described in the sections below:

- For PID sensors, see page 205.

- For ESF toxic sensors, see page 251.
- For TC sensors, see page 275.
- For IR CO₂ sensors, see page 294.
- For IR methane sensors, see page 309.
- For IR hydrocarbon sensors, see page 323.

Catalytic Combustible Gas Sensor (LEL Sensor)

The catalytic combustible gas (LEL) sensor detects combustible gas in the % LEL range. It uses a catalytic element for detection. The reaction of gas with oxygen on the catalyst causes a change in the element's resistance, changing the current flowing through it. The current is amplified by the Eagle 3's circuitry, converted to a measurement of combustible gas concentration, and displayed on the LCD.

The LEL sensor housing includes a sintered metal flame arrestor on one end that allows gas to diffuse into the sensor. On the other end, five pins extend from the sensor. The pins plug into a connector in the LEL sensor chamber. The LEL sensor chamber is mounted to the bottom plate of the unit and has pins that fit in a socket on the main PCB (see Figure 5 on page 24).

O₂/CO/H₂S Sensors

The O₂, CO, and H₂S sensors are electrochemical cells that consist of two precious metal electrodes in a dilute acid electrolyte. A gas permeable membrane covers the sensor face and allows gas to diffuse into the electrolyte. The gas reacts in the sensor and produces a current proportional to the concentration of the target gas. The Eagle 3's circuitry amplifies the current, converts the current to a gas concentration, and displays the concentration on the LCD.

There are 4 different types of CO and H₂S sensors available:

- CO-only (ESR-A13P-CO): A single electrochemical cell that detects CO. Instruments with this sensor can only detect H₂S if an H₂S F-sensor is installed.
- H₂-compensated CO (ESR-A1CP-CO-H): A single electrochemical cell that detects CO. This sensor does not respond to or responds minimally to hydrogen (displays H₂ RICH once H₂ concentration reaches 2000 ppm). Instruments with this sensor can only detect H₂S if an H₂S F-sensor is installed.
- H₂S only (ESR-A13i-H₂S): A single electrochemical cell that detects H₂S. Instruments with this sensor cannot detect CO.
- CO/H₂S (ESR-A1DR-COHS): A combination electrochemical cell that detects both CO and H₂S.

Filters

CO/H₂S Sensor Dual Filter (Black and White)

A dual filter is placed into a recess in the filter gasket over the dual CO/H₂S sensor. The black half is a charcoal filter for the CO sensor. The white half is a humidity filter for the H₂S sensor.

Replace the filter if you notice:

- Unexplained CO readings
- For users with a 1 ppm H₂S alarm setpoint: A drift on the H₂S zero reading, unexplained H₂S readings, the filter appears dirty, or every 6 months (whichever is sooner)

CO Sensor Charcoal Filter (Black)

A black charcoal filter is placed into a recess in the filter gasket over the CO sensor. The charcoal filter disk scrubs H₂S and certain hydrocarbons out of the sample to avoid false CO readings. If false or elevated CO readings are noticed, especially in the presence of H₂S, change the charcoal filter.

H₂S Sensors Humidity Filter (White)

A white humidity filter is placed into a recess in the filter gasket over the H₂S sensor (if an H₂S sensor is installed). The filter absorbs humidity in the sampling environment to prevent unstable readings around 0 ppm. “H₂S” is printed on the side of the filter.

- H₂S: For users with a 1 ppm H₂S alarm setpoint, the filter should be replaced every 6 months, if you notice a drift on the zero reading, or if the filter appears dirty (whichever is sooner). For users with a 2 ppm or higher H₂S alarm setpoint, the filter does not necessarily ever need to be replaced.

Printed Circuit Boards (PCBs)

The Eagle 3's PCBs analyze, record, control, store, and display the information collected. The R sensor board is mounted to the main PCB which is installed in the bottom case. The display PCB is installed in the top case and is not involved in any user-performed maintenance. Smaller interface PCBs are installed in the flow blocks for the pump, LEL, PID, IR, and TC sensors as described in Figure 5.

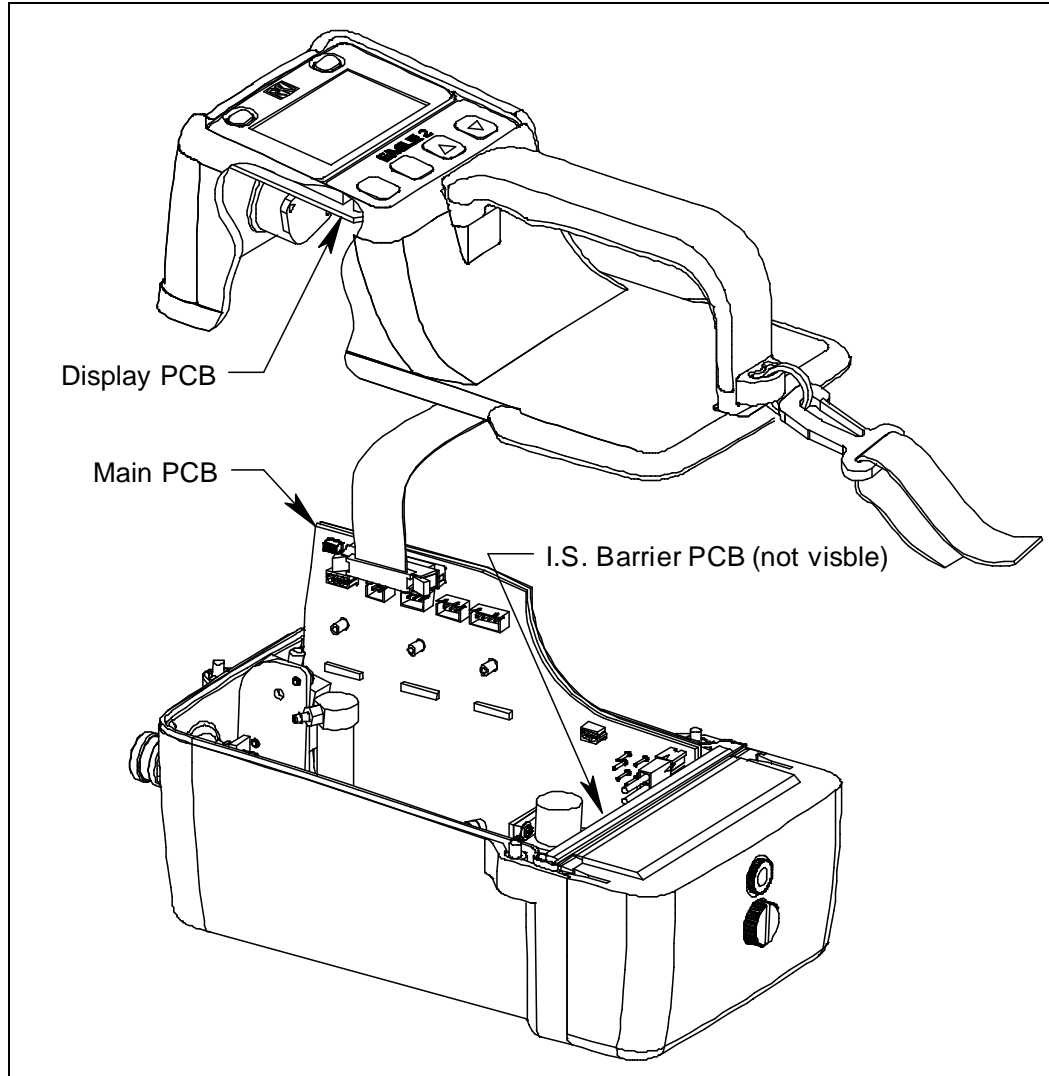


Figure 4: PCBs

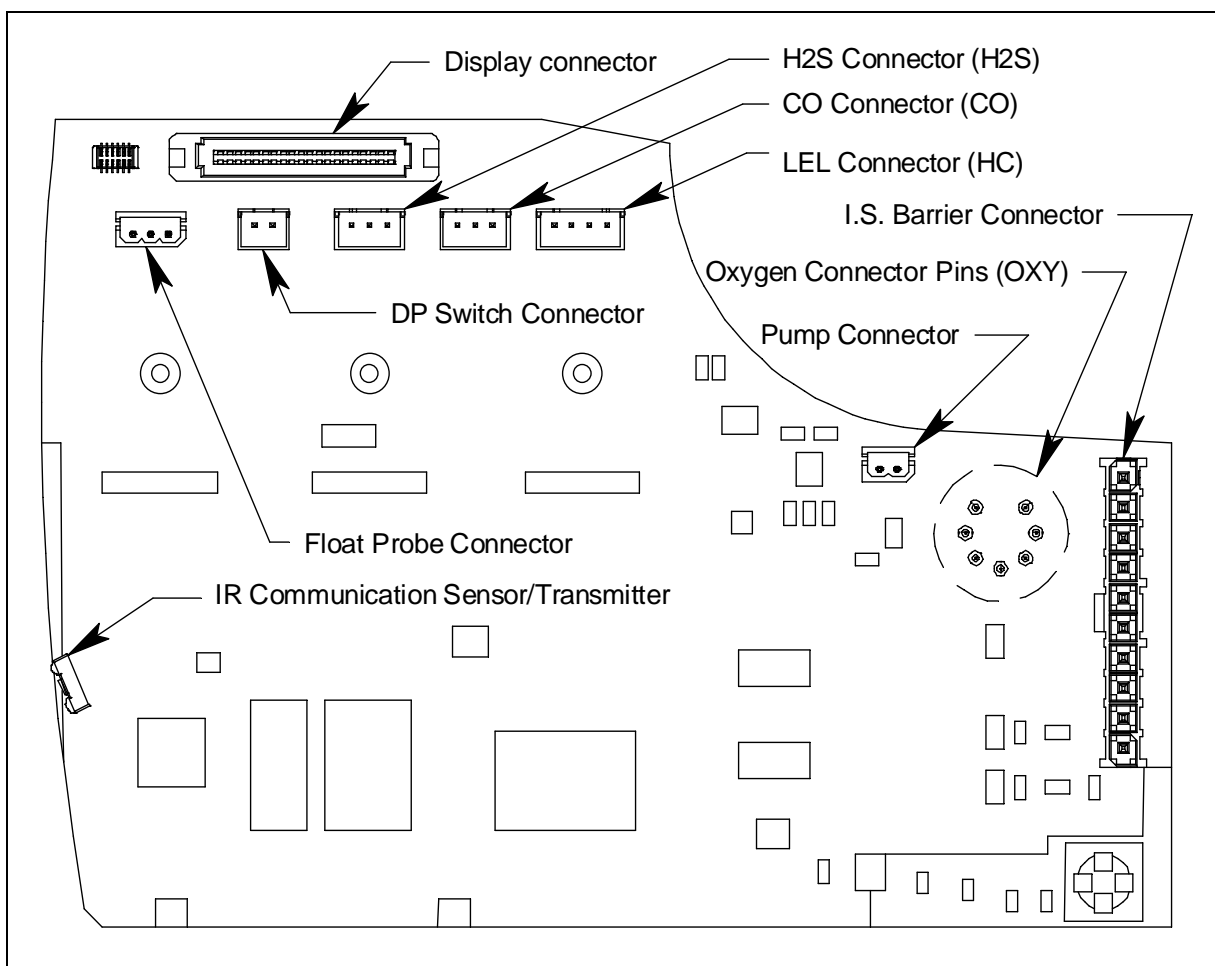


Figure 5: Main PCB

The main PCB is located on the right side of the bottom case. It slides into grooves in the bottom case. Connectors for the sensors, pump, display PCB, charger/communication PCB, and battery pack are located on the main PCB.

Communication/Charging Port

The Eagle 3's charging and communication port is on the right side of the bottom case. The AC charger and optional USB cable have compatible sliding connectors that fit securely into the port to allow for charging and optional data downloading.

Flow System

The Eagle 3 flow system consists of the inlet fitting, hydrophobic filter, pump, internal tubing, pressure switch, sensor chambers, and exhaust fitting.

Inlet Fitting

When viewed from the front, the inlet fitting is on the right side of the bottom case. It is a nickel-plated brass quick connect fitting. It mates with either the sample hose or with the hydrophobic probe.

Hydrophobic Filter

The hydrophobic filter is located in the bottom case above the sensors. Normally, the hydrophobic probe accessory (see page 26) will prevent water and particulate matter from entering the flow system. However, if the probe is not used, the hydrophobic filter will stop water and particulates from penetrating further into the flow system. If the filter becomes dirty or water logged, replace it (see page 100).

Pump

A diaphragm pump is located at the front of the bottom case and draws the sample to the sensors. It can draw sample from as far as 125 feet from the Eagle 3.

CAUTION: *Sample hose lengths of more than 125 feet are not recommended for the Eagle 3 because of flow rate reduction and increased response time. Consult with RKI Instruments, Inc. for sample hose lengths longer than 125 feet.*

Internal Tubing

The flow system includes polyurethane tubing to route the sample between the various components of the flow system. The internal sample tubing is not user-serviceable.

Pressure Switch

The pressure switch is installed on the main PCB. It senses the Eagle 3's flowrate by monitoring the pressure at one point in the flow system. When the flowrate becomes too low for safe operation of the Eagle 3, the instrument indicates a low flow alarm.

Sensor Chambers

The O₂, CO, and H₂S sensors are installed in an R-sensor flow block that is mounted to the main PCB. The LEL sensor and any installed IR, PID, TC, or super-toxic sensors are installed in individual F-sensor flow blocks that connect to the main PCB.

Exhaust Fitting

The exhaust fitting is located below the inlet fitting. It routes the gas sample out of the Eagle 3. It includes a female 10-32 thread that can be used for the installation of a hose barb or other type of fitting that has a male 10-32 thread so that the exhaust can be routed to a particular location with flexible tubing if desired.

Battery Pack

A battery pack is installed at the back of the bottom case. A fully-charged battery pack can power the Eagle 3 for 16 hours of non-alarm operation. The current battery voltage is viewable in Display Mode (see page 58).

When the Eagle 3 detects low battery voltage, a low battery warning is activated. When battery voltage is too low for operation, the Eagle 3 sounds a dead battery alarm.

The battery pack can be recharged by using the Eagle 3 charger (see page 97).

NOTE: Use of the battery pack or charger not specified by RKI Instruments, Inc. will void the CSA classification and may void the warranty.

WARNING: *To prevent ignition of a hazardous atmosphere, batteries must only be charged in an area known to be nonhazardous.*

Standard Accessories

Standard accessories include the shoulder strap, the sample hose, the hydrophobic probe, and the AC charger.

Shoulder Strap

A comfortable elastic shoulder strap clips to the Eagle 3 at the front and rear of the top case. It clips to stainless steel rings that are installed in features on the top case. It can be removed from the Eagle 3 by opening the clip at each end of the strap and removing it from both strap rings.

Hose and Probe

A 5 foot polyurethane sample hose and a 10 inch hydrophobic probe are included as standard. The hose has a male quick connect fitting on one end and a female quick connect fitting on the other end. The probe has a male quick connect fitting. Normally, the male end of sample hose is installed in the Eagle 3 inlet fitting, and the probe is installed in the female end of the hose. However, if the sample hose is not needed for monitoring a particular area, the probe may be installed directly to the inlet fitting. Sample hose lengths are available from 5 feet (standard length) to 125 feet (see “Chapter 7: General Parts List” on page 107). A Teflon-lined hose is provided with all units that contain a PID sensor. This hose must be used when operating a PID Eagle 3 (see page 205).

CAUTION: *Sample hose lengths of more than 125 feet are not recommended for the Eagle 3 because of flow rate reduction and increased response time. Consult with RKI Instruments, Inc. for hose lengths longer than 125 feet.*

The probe includes a replaceable particle filter and hydrophobic filter disk that prevent particulates and water from entering the Eagle 3's flow system. See page 99 for instructions to replace the particle filter and hydrophobic filter disk.

NOTE: When using the probe with a PID Eagle 3, be sure that the particle filter is not installed.

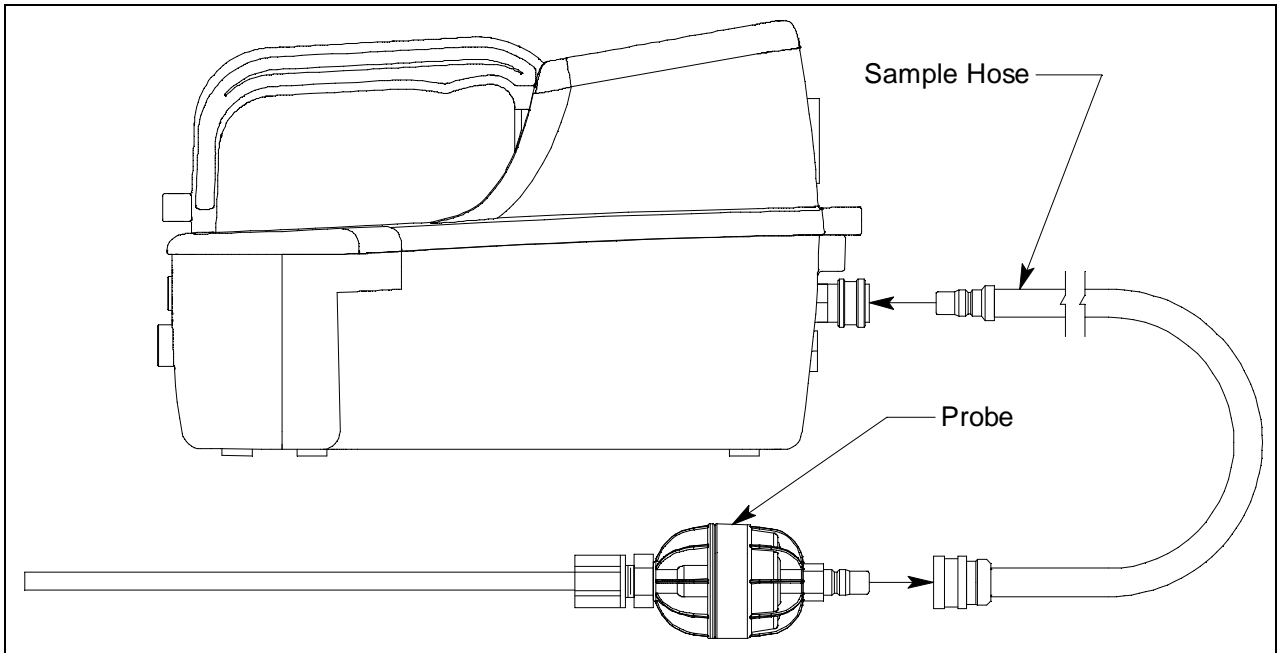


Figure 6: Sample Hose and Hydrophobic Probe

AC Charger

A 3-foot AC charger is included as a standard accessory. The charger has a custom fitting on the end that mates with the communication/charger connection port on the side of the Eagle 3.

Optional Accessories

Several optional accessories are available for the Eagle 3, including various special probes and dilution fittings. Detailed instructions regarding the use of these and other available accessories are included in other parts of this manual. For information on data logging accessories, see page 56.

Optional Probes

The following probes are each designed for specific applications and are available for the Eagle 3. See page 107 for probe ordering information.

30 inch aluminum probe

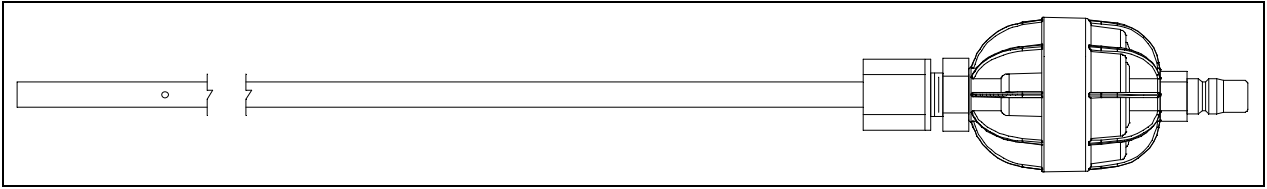


Figure 7: 30 Inch Aluminum Probe

This probe is designed for use where it is necessary to put the probe tip in areas that are out of reach with the standard probe. A small breather hole near the end of the probe tube prevents interruption of sampling and emits a low flow alarm if the probe tip is blocked.

30 inch stainless steel probe

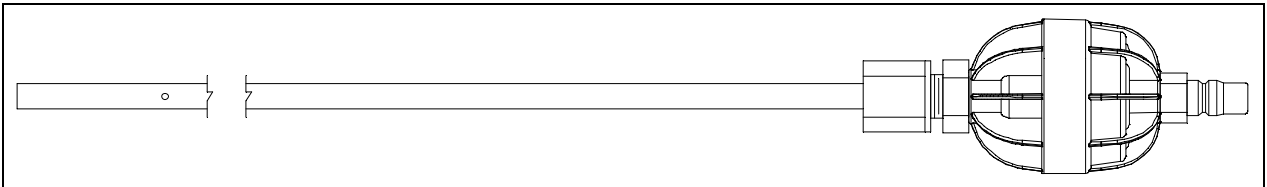


Figure 8: 30 Inch Stainless Steel Probe

This probe is physically the same as the 30 inch aluminum probe and is intended for use where a high level of corrosion resistance is required in the long probe tube.

4 foot stainless steel probe

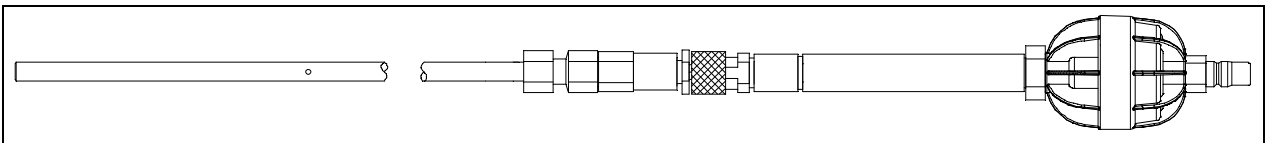


Figure 9: 4 Foot Stainless Steel Probe

This probe is designed for use where it is necessary to put the probe tip in areas that are out of reach for even the 30 inch probes. Because the length of the probe tube requires a high degree of rigidity, a stainless steel probe tube is used. A small breather hole near the end of the probe tube prevents interruption of sampling and emits a low flow alarm if the probe tip is blocked.

Barhole probe

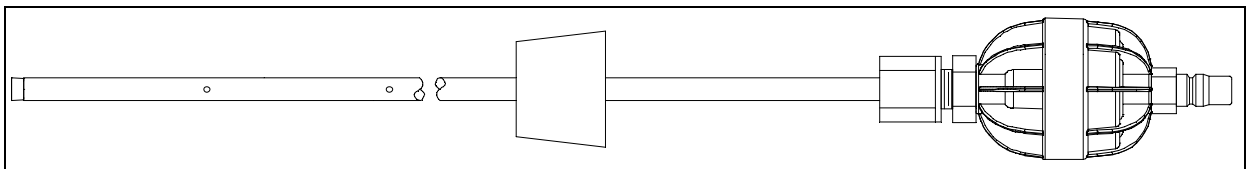


Figure 10: Barhole Probe

This probe is designed specifically for barhole testing. See Appendix J: Using the Eagle 3 in Bar Hole Mode for an in-depth discussion of using the Eagle 3 in Bar Hole Mode.

10 inch probe with dust filter

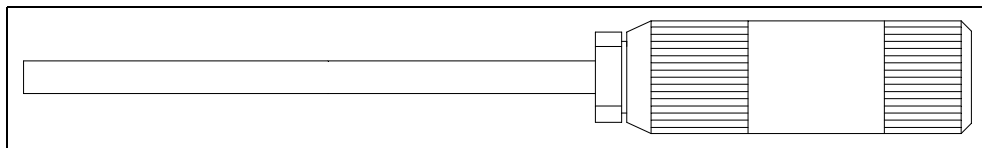


Figure 11: 10 Inch Probe with Dust Filter

This probe is designed for use where drawing water or moisture into the Eagle 3 is not a concern. Instead of a hydrophobic filter, a cotton dust filter is used.

32 inch telescoping probe with dust filter

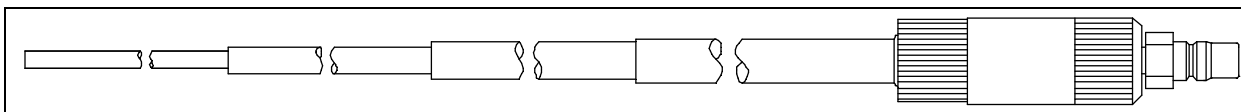


Figure 12: 32 Inch Telescoping Probe with Dust Filter

This probe is designed for use where it is necessary to put the probe tip in areas not accessible with the 10 inch probe with dust filter and applications where the probe tube must be collapsible for storage.

7 foot telescoping probe with dust filter

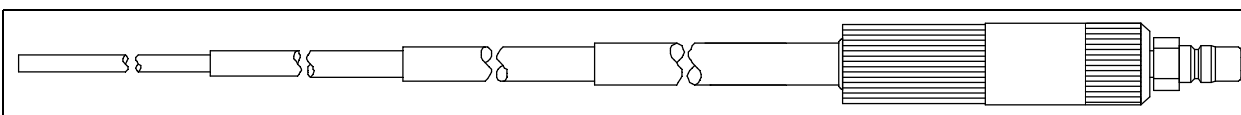


Figure 13: 7 Foot Telescoping Probe with Dust Filter

This probe is designed for use where it is necessary to put the probe tip in areas not accessible with the 32 inch telescoping probe with dust filter and applications where the probe tube must be collapsible for storage.

External Dilution Fittings

Two external dilution fittings are available for the Eagle 3: a 1:1 dilution fitting and a 3:1 dilution fitting. They are designed to mate with the inlet fitting and accept a sample hose or probe. The fittings are made with brass and nickel plated brass and are appropriate for use with the four standard gases. The 1:1 fitting is normally used when it is necessary to introduce air into a sample that has no oxygen or a very low level of oxygen, such as a nitrogen-purged sample. Both the 1:1 and 3:1 fittings can also be used when one of the target gas levels in the sample area will likely be present in a concentration above the detection range for that gas. Since the fittings partially consist of unplated brass, they are not appropriate for detection of elevated levels of H₂S or easily absorbed gases, such as Cl₂ or SO₂.

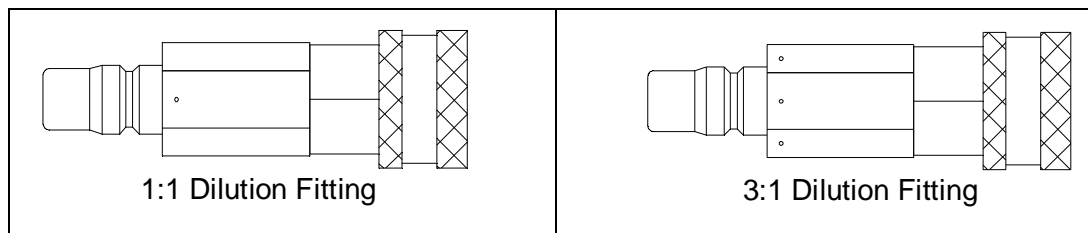


Figure 14: 1:1 and 3:1 Dilution Fittings

Chapter 3: Operation

This chapter explains how to use the Eagle 3 to perform confined space entry monitoring or general area monitoring in Normal Mode. Special versions of the Eagle 3 can also operate in Leak Check Mode and Bar Hole Mode. See page 341 and page 349 for operating instructions for Bar Hole and Leak Check Mode, respectively.

Start Up

This section explains how to start up the Eagle 3, prepare it for operation, and turn it off.

WARNING: *A thin protective film covers the display to prevent scratches during shipping. Remove this film before use. Leaving the film installed voids the intrinsically safe certification.*

NOTE: The screens illustrated in this section are for a 4-gas/PID/SO₂ unit.

Turning On the Eagle 3

The Eagle 3 may be used with a sample hose or with the probe installed directly to the inlet fitting. Determine which configuration works best for the situation before starting up the Eagle 3.

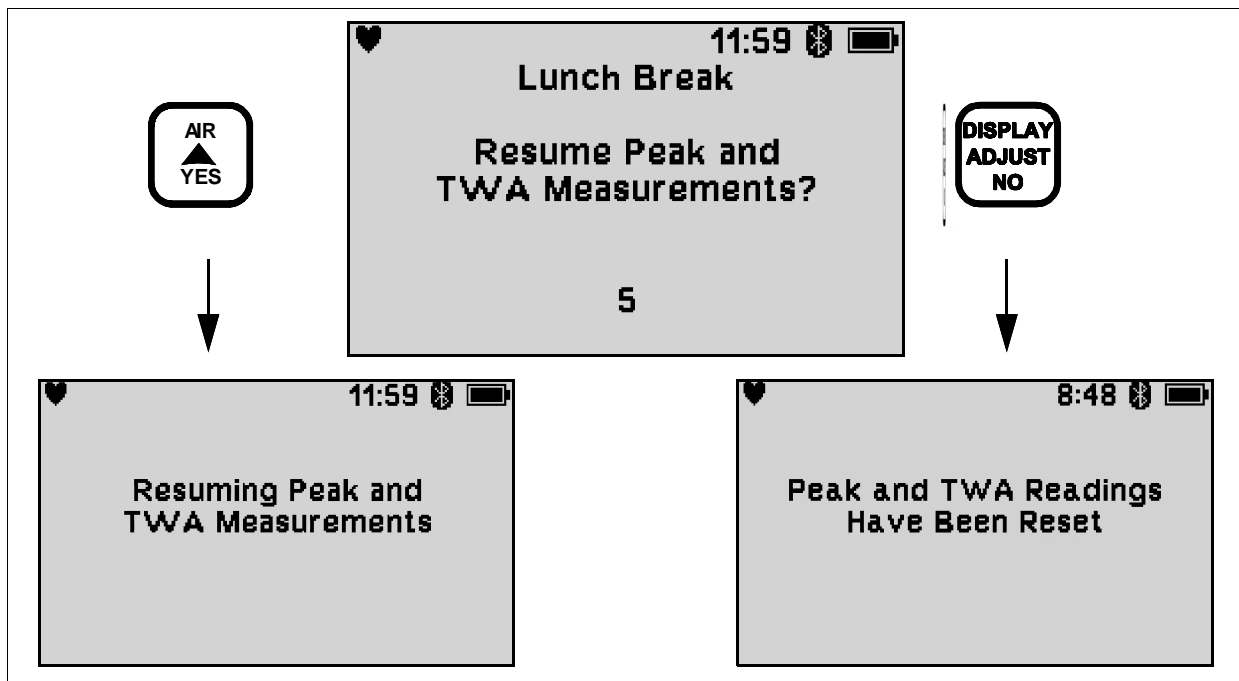
1. Connect the sample hose or probe to the Eagle 3's quick connect inlet fitting.
2. If a sample hose is being used, connect the probe to the sample hose's quick connect fitting.
3. Press and hold **POWER** for a few seconds. Confirm that the LCD turns on, the LEDs flash, and the buzzer sounds before continuing with operation.
4. Release **POWER** after the instrument beeps once.
5. The LCD displays the name of the instrument and the RKI Instruments logo for a few seconds.



6. If **Lunch Break** is set to **On** (see page 190), the **Resume Measurement?** screen will appear. The LCD displays a 5-second countdown in the lower middle of the screen.

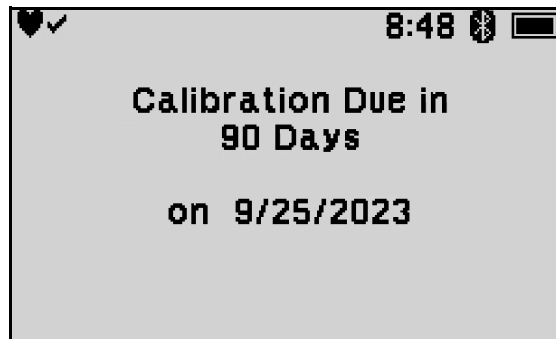
NOTE: By default, this feature is disabled, and the unit will instead display the Calibration Reminder.

- Continue Accumulating: To continue accumulating peak and time-weighted average (TWA) readings from the last time the Eagle 3 was used, press **AIR** or allow the countdown to reach 0.
 - The unit will resume tracking time in operation from the last time the Eagle 3 was used. See page 74 for more information. The short-term exposure limit (STEL) reading is reset each time the Eagle 3 is turned on.
- Reset Accumulation: To reset the accumulation of peak and time-weighted average (TWA) readings and time in operation, press **DISPLAY** before the countdown reaches 0.



7. By default, the **Calibration Reminder** screen will appear. To disable this setting, see page 163 for turning the reminder **On** and **Off**.

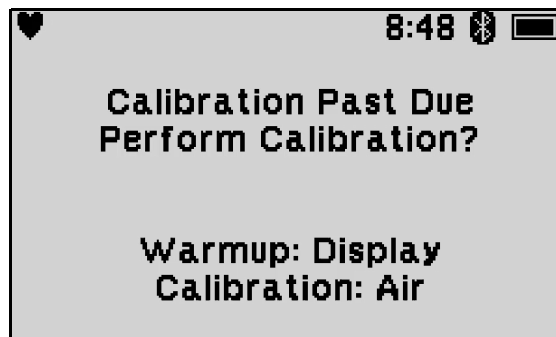
If no calibration is due, the Eagle 3 displays the days remaining until the next calibration date as shown below.



If a calibration is due, the screen appearance depends on the setting of the **Calibration Past Due Action** parameter and a calibration may be required. See page 164 for changing this parameter.

- **Calibration Past Due Action: Confirm to Use**

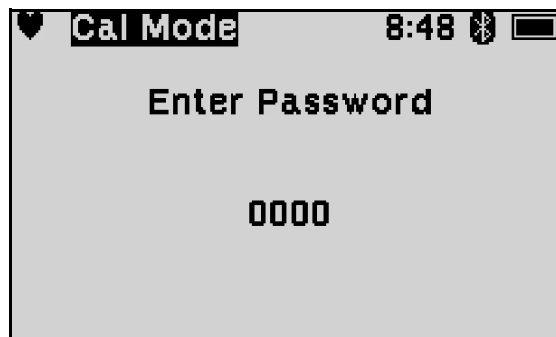
If **Calibration Past Due Action** is set to **Confirm**, the instrument can either be calibrated or resume warmup without calibration.



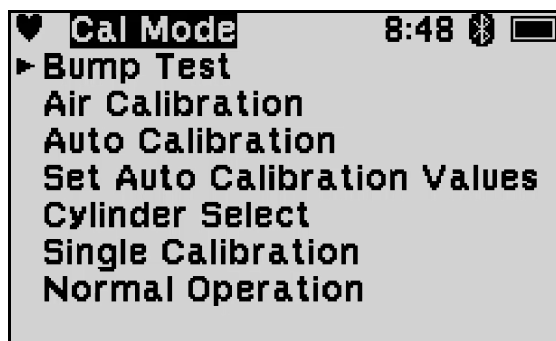
To confirm and resume warmup without performing a calibration, press **DISPLAY**. Proceed to Step 8.

To perform a calibration, press **AIR**.

- a. If **Calibration Password** is set to **On** (factory setting is **Off**), a password screen appears.



- b. After the password is entered correctly, the instrument enters **Calibration Mode**. Press **AIR** or **RANGE** to scroll to the **Auto Calibration** menu item. Press **POWER** to select it.



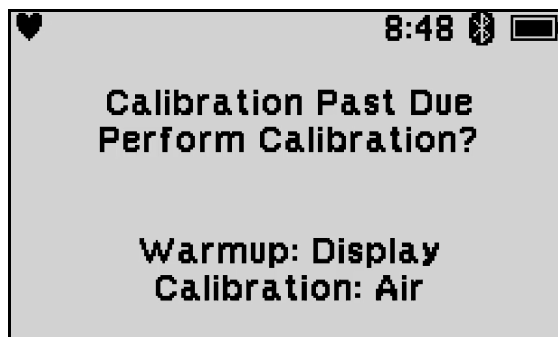
- c. The **Auto Calibration** screen appears. See page 85 for calibration instructions.

♥ Cal Mode 8:48 [icons]		
CH ₄ %LEL	O ₂ %	CO ppm
50	12.0	50
H ₂ S ppm		
25.0		
Auto Calibration		Cylinder A

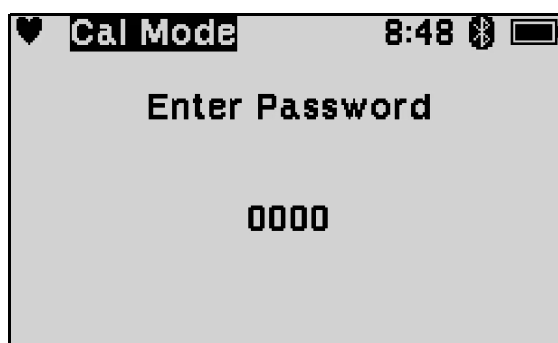
- If the calibration is successful, the **Calibration Past Due** screen won't appear until the next calibration date. Proceed to Step 8.
- If the calibration is unsuccessful, the instrument indicates which channels failed. Press **POWER** to acknowledge the failure. The warmup sequence will resume.

- **Calibration Past Due Action: Can't Use**

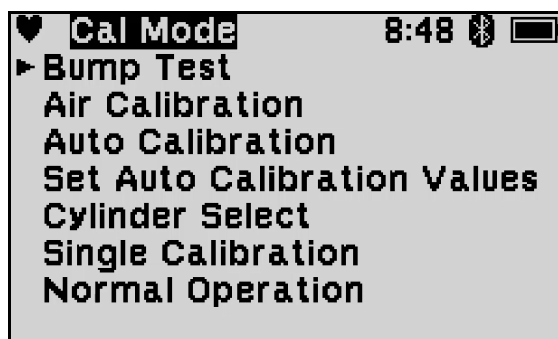
If **Calibration Past Due Action** is set to **Cannot Use**, the instrument must be calibrated before it can proceed with warmup.



- If **Calibration Password** is set to **On** (factory setting is **Off**), a password screen appears.



- After the password is entered correctly, the instrument enters **Calibration Mode**. Press **AIR** or **RANGE** to scroll to the **Auto Calibration** menu item. Press **POWER** to select it.



- The **Auto Calibration** screen appears. See page 85 for calibration instructions.

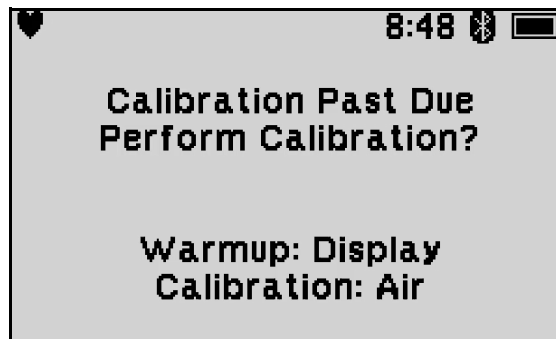
Cal Mode			8:48		
CH ₄ %LEL	O ₂ %	CO ppm			
50	12.0	50			
H ₂ S ppm					
25.0					
Auto Calibration		Cylinder A			

- If the calibration is successful, the **Calibration Past Due** screen won't appear until the next calibration date. Proceed to Step 8.
- If the calibration is unsuccessful, the instrument indicates which channels failed. Press **POWER** to acknowledge the failure. The instrument cannot be used until a successful calibration is performed.

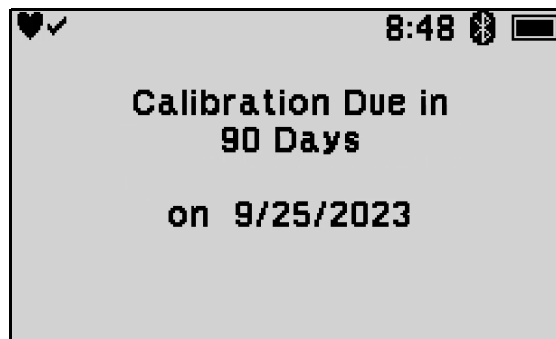
- **Calibration Past Due Action: None**

If the **Calibration Past Due Action** setting is set to **None**, the calibration reminder is displayed for a few seconds before the warmup sequence resumes.

If desired, press **POWER** to perform a calibration but is not necessary to acknowledge the calibration indication. The warmup sequence will continue on its own.



8. If **Bump Reminder** is set to **On** (see page 168), the **Bump Test Reminder** screen will appear.
9. If no bump test is due, the Eagle 3 displays the days remaining until the next bump test date as shown below.

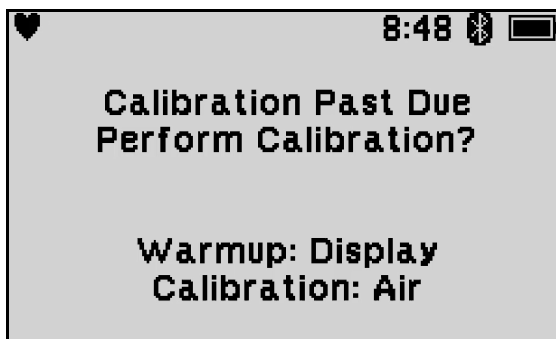


If a bump test is due, the screen appearance depends on the setting of the **Bump Test Past Due Action** parameter and a bump test may be required. See page 169 for changing this parameter.

- **Bump Test Past Due Action: Confirm to Use**

If **Bump Test Past Due Action** is set to **Confirm to Use**, the instrument can either be calibrated or resume warmup without calibration.

Press **AIR** to continue without bump testing, or press **POWER** to perform a bump test.

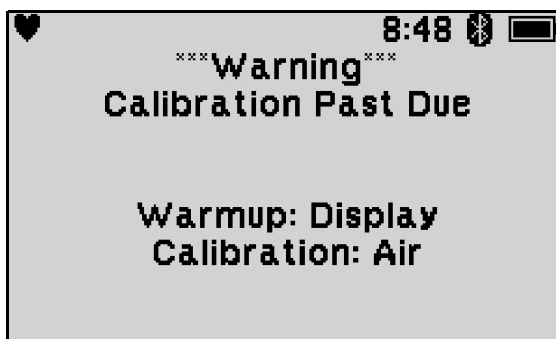


To confirm and resume warmup without performing a bump test, press **DISPLAY**. Proceed to Step 8. If the bump test is successful, the **Bump Test Past Due** screen won't appear until the next calibration date. Proceed to Step 8.

- If the bump test is not successful, the instrument indicates which channels failed. Press **POWER** to acknowledge the failure. The warmup sequence will resume.

- **Bump Test Past Due Action: Cannot Use**

If **Bump Test Past Due Action** is set to **Cannot Use**, the instrument must be bump tested before it can proceed with warmup.

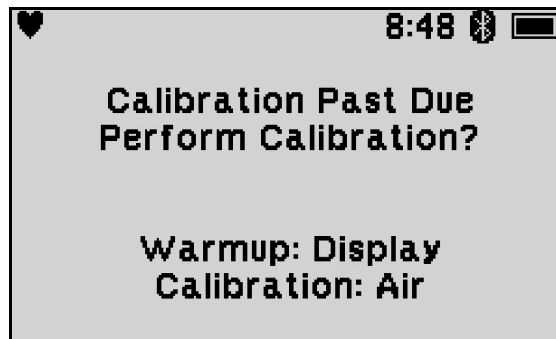


The auto calibration screen appears. See page 78 for calibration instructions.

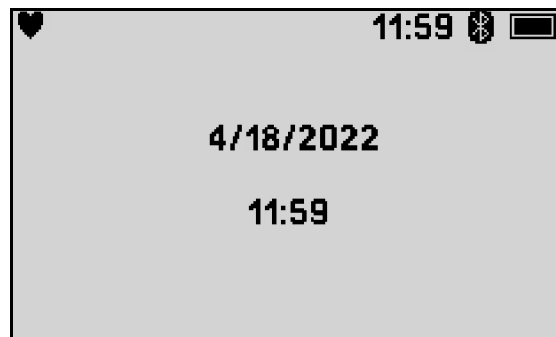
Cal Mode		8:48	
CH ₄ %LEL	O ₂ %	CO ppm	
50	12.0	50	
H ₂ S ppm			
25.0			
Auto Calibration		Cylinder A	

- If the bump test is successful, the **Calibration Past Due** screen won't appear until the next bump test date. Proceed to Step 8.

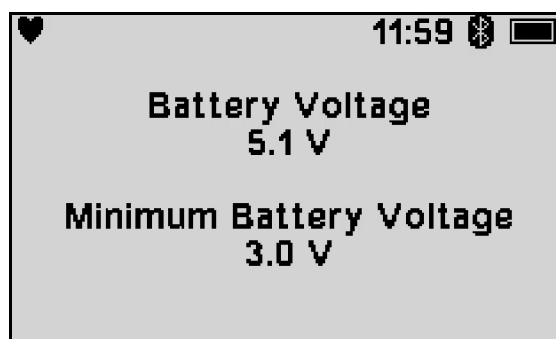
- If the bump test is unsuccessful, the instrument indicates which channels failed. Press **POWER** to acknowledge the failure. The instrument cannot be used until a successful bump test is performed.
- **Bump Test Past Due Action: None**
If the **Bump Test Past Due Action** setting is set to **None**, the bump test reminder is displayed for a few seconds before the warmup sequence resumes.
If desired, press **POWER** to perform a bump test but is not necessary to acknowledge the bump test due indication. The warmup sequence will continue on its own.






10. The **Date/Time** screen appears for a few seconds.



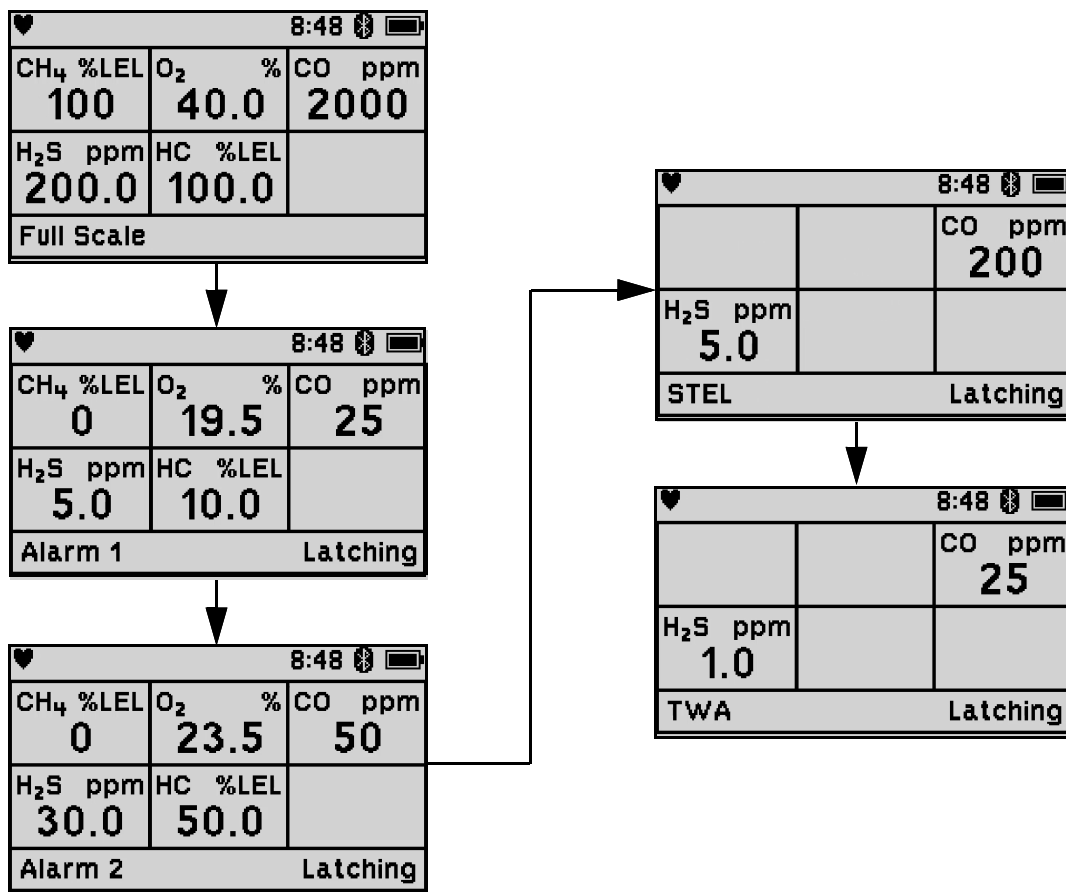
11. The **Battery Voltage** screen appears for a few seconds.



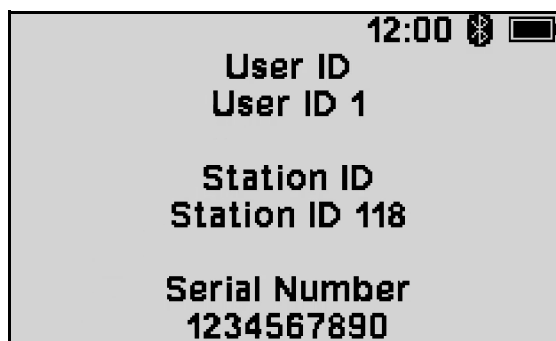
12. The **Gas Names** screen appears for three seconds, indicating which channels are active and their target gases.

<div>  8:48   </div>		
CH ₄ %LEL CH₄	O ₂ % O₂	CO ppm CO
H ₂ S ppm H₂S	HC %LEL HC	
Gas Names		

13. The alarm setpoint screens appear in the following sequence: **Full Scale**, **Alarm 1**, **Alarm 2**, **STEL**, and **TWA**. The LCD displays each screen for three seconds.



14. If the **User and Station ID** option is set to **On** (see page 154), the **ID Screen** will display the assigned IDs for three seconds.



If **User and Station ID** is **Off**, only the instrument's serial number appears.

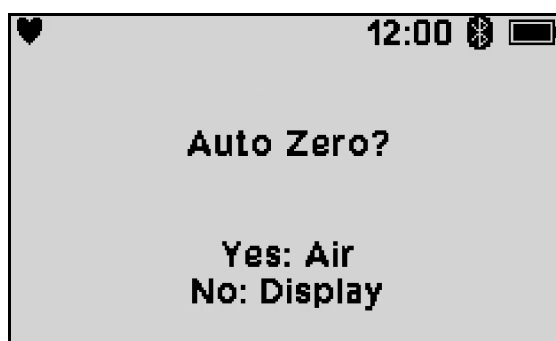
15. If the Eagle 3 experiences a sensor failure during the warmup sequence, the LCD indicates which sensor failed and the buzzer sounds a pulsing tone twice per second.

In the example below, the H₂S sensor has failed.

♥ 8:48 [Signal Tower] [Battery]		
CH ₄ %LEL 0	O ₂ % 20.9	CO ppm 0
H ₂ S ppm Fail	HC %LEL 0.0	

Press **POWER** to acknowledge the failure. “- - -” replaces the failed sensor's gas reading. Replace the failed sensor as soon as possible (see page 113).

16. If **Auto Zero** is set to **On** (factory setting is **Off**, see page 156), the instrument prompts you to do an auto zero.



WARNING: *Make sure that the instrument is in a known fresh air environment (an environment free of combustible or toxic gases and of normal oxygen content, 20.9%) before performing an auto zero operation. If you perform an auto zero operation in an area with gases present, the adjustment will not be accurate.*

- a. An auto zero operation sets the combustible gas, H₂S, CO, and super toxic channels to 0 and the O₂ channel to 20.9%.
 - b. If the instrument has a CO₂ sensor installed and **CO₂ Air Zero** is set to **On** in Setup Mode, the CO₂ channel gets set to 400 ppm (0.04% volume) during an auto zero. If **CO₂ Air Zero** in Setup Mode is set to **Off**, the CO₂ channel is not adjusted during the auto zero. See “Turning CO₂ Air Zero On or Off” on page 157.
 - c. You must press POWER to perform an auto zero function. If no key is pressed after 15 seconds, the instrument enters Normal Mode without performing an auto zero.
17. The Normal Mode screen appears, showing the current gas reading for each target gas. See “Normal Mode Operation” on page 42 for descriptions of on-screen icons and features.

♥		12:00		📶 🔋	
%VOL	%VOL	CO	ppm		
fnp	fnp	0			
H ₂ S ppm	CH ₄ %LEL	O ₂	%		
0.0	0	20.9			

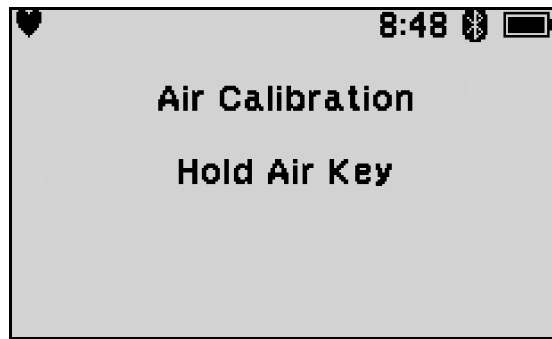
Performing a Demand Zero

Before using the Eagle 3, perform a demand zero to set the fresh air readings for the target gases. This will set the CH₄, H₂S, CO, and IR combustible, TC, or PID channels to zero and the OXY channel to 20.9%.

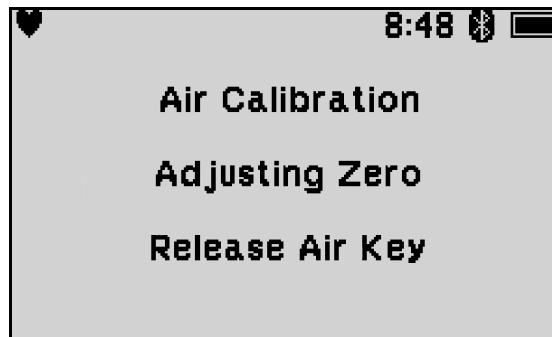
If the instrument has a CO₂ sensor installed and the **CO₂ Air Zero** setting is set to **On** in Setup Mode, the CO₂ channel gets set to 400 ppm (0.04% volume). If **CO₂ Air Zero** in Setup Mode is set to **Off**, the CO₂ channel is not adjusted during the demand zero. See “Turning CO₂ Air Zero On or Off” on page 157.

1. Find a fresh-air environment. This is an environment free of toxic or combustible gases and of normal oxygen content (20.9%).
2. Turn on the unit as described in “Turning On the Eagle 3” on page 30.

- After the Eagle 3 finishes its warmup sequence, press and hold **AIR**. The LCD displays a “Hold Air Key” prompt and the buzzer pulses while you hold **AIR**.



- Continue holding **AIR** until the LCD displays a prompt to release it.



- The Eagle 3 will set the fresh air reading for all channels. Start up is complete and the unit is now ready for monitoring.

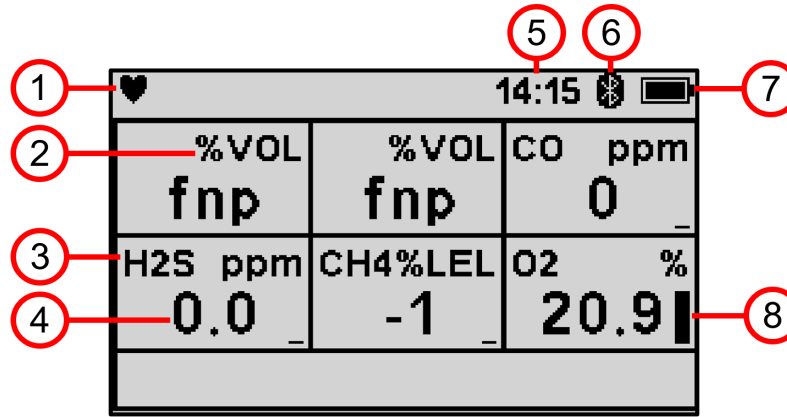
♥		12:00		Bluetooth	Battery
%VOL	%VOL	CO	ppm		
fnp	fnp	0			
H2S ppm	CH4%LEL	O2	%		
0.0	0	20.9			

Turning Off the Eagle 3

- Press and hold **POWER**. The LCD displays “Turn Off”.
- The buzzer will pulse for five seconds.
- Release **POWER** when “Goodbye” appears on the LCD. When “Goodbye” disappears and the backlight turns off, the unit is off.

Normal Mode Operation

After completing its warmup sequence, the Eagle 3 enters Normal Mode. In Normal Mode, the Eagle 3 continuously monitors the sampled atmosphere and displays the target gas concentrations. The Eagle 3 is considered to be in Normal Operation if there are no alarm indicators.



1. Heart Symbol: The heart symbol in the upper left corner of the LCD indicates the operation status and blinks when normal. A microprocessor error causes the heart symbol to stop flashing or disappear.
2. Unit of Measurement: Each channel's unit of measurement is displayed in the top right corner of each channel's section.
3. Target Gas Name: Each channel's target gas is displayed in the top left corner of each channel's section.
4. Concentration Reading: Each channel reading is displayed in the center of each channel's section.
5. Time: Displays the time in a 24-hour format
6. Bluetooth Icon: The Bluetooth icon flashes when the instrument is trying to pair to a phone. The Bluetooth icon is steadily on when the instrument is paired to a phone. The Bluetooth icon is off when the instrument is not paired and is not trying to pair to a phone.
7. Battery Icon: Displays the battery's life
8. Peak Bar: If the Peak Bar setting in Display Mode is set to **On**, each channel will display a peak bar corresponding to the current Peak readings saved to the instrument.
9. Check Mark: If **Bump Reminder** is set to **ON** and if a bump test is not due, a check mark appears in the upper left corner of the LCD.
10. "S": If the instrument is operating in Stealth Mode, an "S" appears at the top of the LCD.
11. Buzzer Icon: The buzzer icon indicates the buzzer volume. Lines in front of the icon indicate a high buzzer volume. No lines in front of the icon indicates a low buzzer volume.

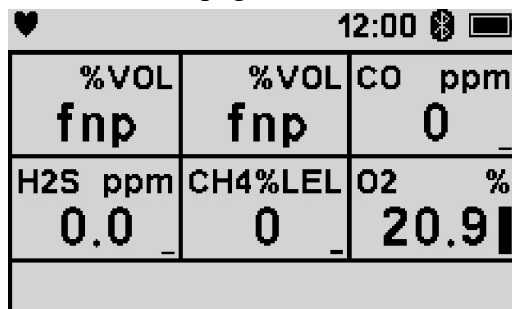
12. **Backlight:** In a low-light environment, press either button to turn on the display backlight. See page 160 to set the backlight time.

Confirmation/Non-Compliance Indicator

If the **Beep Select** menu item in Setup Mode is set to anything other than **OFF**, the Eagle 3 gives periodic indicators to confirm that it's operating or to indicate a non-compliance (see page 186 for instructions).

Monitoring an Area

1. Start up the Eagle 3 as described on page 30. It is now in Normal Mode.



The screenshot shows the Eagle 3 display in Normal Mode. At the top, there is a status bar with a heart icon, the time 12:00, and icons for Bluetooth and battery. Below this is a table of gas readings:

%VOL	%VOL	CO ppm
fnp	fnp	0
H2S ppm	CH4%LEL	O2 %
0.0	0	20.9

2. Take the Eagle 3 to the monitoring area.
3. Put the probe tip in the area to be monitored.

NOTE: If the particle filter or hydrophobic filter become dirty or clogged, replace them. See page 99 for instructions to replace the particle filter and the hydrophobic filter.

4. Wait 10 - 15 seconds and monitor the display for gas readings. Allow any readings to stabilize to determine the gas concentrations present.

NOTE: Response times increase with the length of the sample hose. Long sample hoses will require more time to show a response from the Eagle 3.

The maximum sample hose length recommended for the Eagle 3 is 125 feet. Consult with RKI Instruments, Inc. for longer sample hose lengths.

5. If a gas alarm occurs, see page 52 for information on responding to alarms.

Using Optional Sample Hoses

The standard sample hose for the Eagle 3 is 5 feet long. Optional hoses are available up to 125 feet long. If you are considering using a longer hose, keep in mind that a longer hose will increase the Eagle 3's response time and the flowrate may decrease close to the low flow alarm point.

CAUTION: *Sample hose lengths of more than 125 feet are not recommended for the Eagle 3 because of flow rate reduction and increased response time. Consult with RKI Instruments, Inc. for hose lengths longer than 125 feet.*

Table 5 illustrates how response time is affected by the sample hose length.

Table 5: Eagle 3 Response Time vs. Sample Hose Length

Hose Used	Typical Time to 90% of Response (T90)
Probe Only	12 seconds
Probe & 5 Foot Hose	15 seconds
Probe & 25 Foot Hose	25 seconds
Probe & 50 Foot Hose	35 seconds
Probe & 75 Foot Hose	45 seconds
Probe & 100 Foot Hose	60 seconds
Probe & 125 Foot Hose	75 seconds

Using Exhaust Tubing

The Eagle 3's exhaust fitting has a female 10-32 thread to allow for the installation of a hose barb fitting with a 10-32 thread to which a flexible exhaust tube can be connected. To utilize this feature, the tubing used must have a minimum internal diameter of 1/8 inch. RKI Instruments, Inc. recommends using flexible polyurethane tubing with a maximum exhaust tube length of 20 feet. Consult with RKI Instruments, Inc. for exhaust tubing lengths longer than 20 feet.

Combustible Gas Detection

When monitoring for combustible gas, the catalytic sensor's target gas calibration, overscale protection, and contaminating gases can all affect the sensor's readings and function.

Response

The catalytic combustible gas sensor responds to any combustible gas. The standard calibrated target gas for the combustible gas channel is methane (CH₄). If the instrument is setup for and calibrated to a different combustible gas, such as hexane or propane, the gas name above the readings displays as "HC".

- **Automatic Conversion**

The Eagle 3 can automatically display converted target gas readings if the instrument's calibrated target gas is methane or isobutane. See "Combustible Sensor Target Gas Conversion (HC GAS LIST)" on page 50.

- **Manual Conversion**

You can manually calculate a converted target gas reading using the table below if the instrument's calibrated target gas is methane. Table 6 lists the conversion factors for several hydrocarbon gases if the Eagle 3 is calibrated to methane.

To use this table, multiply the display reading on the combustible gas channel by the factor in the appropriate row to obtain the actual gas concentration. For example, if you are detecting pentane and the display reads 10% LEL for the catalytic combustible channel, you actually have $10\% \text{ LEL} \times 1.95 = 19.5\% \text{ LEL}$ pentane present.

Table 6: Response Factors of Common Hydrocarbons

Target Gas	LEL Factor	PPM Factor	Target Gas	LEL Factor	PPM Factor
Acetone	1.40	0.70	Isobutane	1.61	0.58
Benzene	1.75	0.42	Isopropanol	2.22	0.89
Butyl Acrylate	3.95	1.34	Methane	1.00	1.00
Butyl Acetate	3.38	0.88	Methanol	1.23	1.48
2-Butyl Alcohol	1.94	0.66	Methyl Acetate	1.37	0.85
1-Butyl Alcohol	2.65	0.74	Methyl Acrylate	1.10	0.62
Cyclohexane	1.82	0.47	Methyl Ethyl Ketone	2.53	0.71
Cumene	3.90	0.70	Methyl Isobutyl Ketone	2.53	0.61
Ethylene Dichloride	2.75	3.41	Mixed Xylenes	2.36	0.52
Ethyl Alcohol	1.38	0.91	Nonane	2.87	0.46
Ethyl Chloride	1.26	0.96	Pentane	1.95	0.59
Ethyl Acrylate	2.45	0.69	Propane	1.50	0.63
Hexane	2.44	0.54	Styrene	2.94	0.53
Hydrogen	1.16	0.93	Toluene	2.16	0.48
			Vinyl Acetate Monomer	1.48	0.77

* Vapor pressure too low for significant LEL reading

Overscale Protection

The Eagle 3 protects the combustible gas sensor by temporarily turning off the sensor power if levels exceeding 100% LEL are detected. Nevertheless, combustible gas concentrations above 100% LEL can still affect the zero level or calibration of the combustible gas sensor.

CAUTION: *Do not expose the catalytic combustible sensor to high concentrations of combustible gas such as that from a butane lighter. Exposure to high concentrations of combustible gas may adversely affect the performance of the sensor.*

CAUTION: *Any rapid increase in the combustible gas reading on the catalytic combustible channel followed by a declining or erratic reading may indicate a gas concentration above the LEL which may be hazardous.*

Damaging Gases

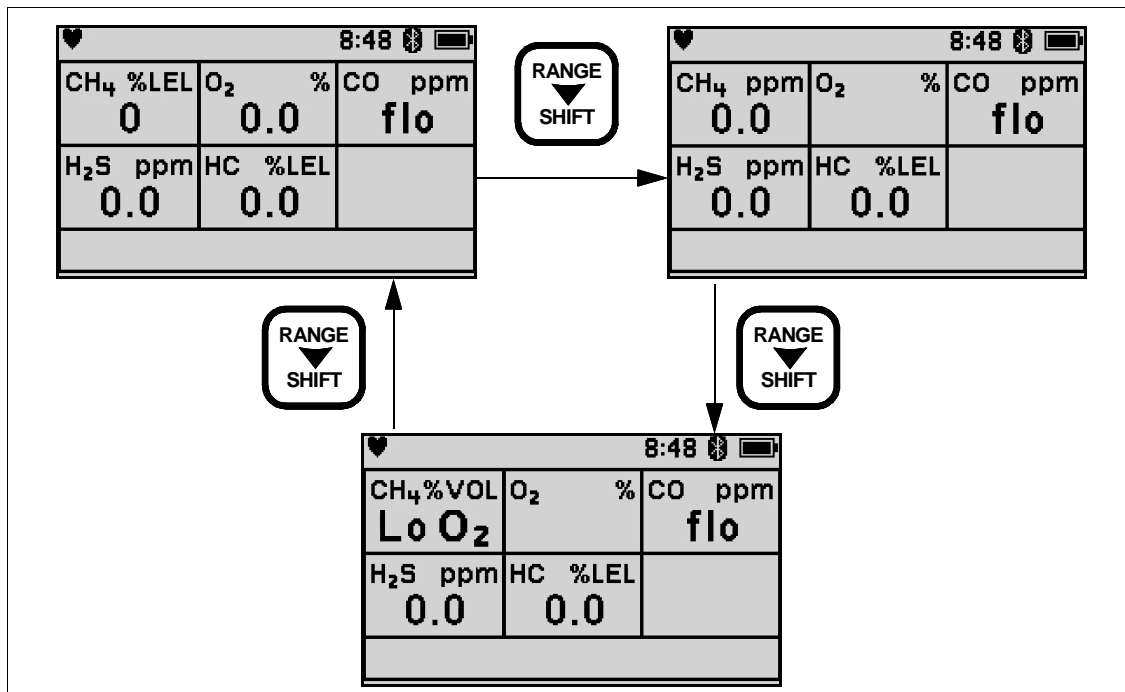
Some gases such as silicone vapors, chlorinated hydrocarbons, and sulfur compounds can contaminate the sensor's detection elements. This causes sensor damage and/or a reduced response to combustible gas. Make every effort to avoid these gases.

Monitoring Combustible Gas in the PPM or % volume Range

The standard factory configuration for the Eagle 3 allows the user to use the RANGE ▼ SHIFT button to change the displayed detection units of the catalytic combustible channel between % LEL, ppm, and % volume. To disable this capability and set the Eagle 3 to display only one of the detection units, use the Catalytic Units menu item in Setup Mode. See page 172 for instructions to set this Setup Mode Menu item.

The detection range of the combustible catalytic channel when set for ppm or % volume will correspond to 0 - 100% LEL for the configured gas. For example, the LEL for methane (CH₄) is 5% volume, or 50,000 ppm. So if the catalytic combustible channel is displayed in terms of % volume, then the full scale is 5.00%, and if it is displayed in terms of ppm, then the full scale is 50,000 ppm.

If the **Catalytic Units** menu item in Setup Mode is set to **Change OK**, the standard factory setting, then the catalytic combustible channel's units can be changed by pressing and releasing **RANGE**.



Monitoring Combustible Gas in the PPM Range

• Stabilization Period

Because of the Eagle 3's high sensitivity in the lower part of the ppm range, the catalytic combustible channel needs more time than the instrument's warm-up period to stabilize after the Eagle 3 is turned on if it is used for ppm level detection.

• PPM Increments

The reading increments in the ppm range are smallest in the lower part of the range and increase as the reading increases:

- 5 ppm increments from 0 ppm to 200 ppm
- 10 ppm increments from 200 ppm to 1,000 ppm
- 50 ppm increments from 1,000 ppm to 10,000 ppm
- 250 ppm increments from 10,000 ppm to 50,000 ppm

• User-Defined Ratios

If the catalytic combustible channel is configured for a user-defined gas in Setup Mode (see "Configuring the Gases (Configure Gases)" on page 135), then the gas' ppm ratio must be considered.

For example, if the ppm ratio of a user-defined gas is set higher than 50,000 ppm, then when the display units are set as ppm the reading will not go above 50,000 ppm (equivalent to 33% LEL and 5% volume).

If the gas reading is higher than 50,000 ppm, the ppm unit reading will indicate 50,000 ppm and also indicate an overscale condition. The % LEL and % volume unit readings will still increase up to 100% LEL and 15% volume respectively, (equivalent to 150,000 ppm).

- **Humidity**

The catalytic combustible sensor is slightly affected by humidity. This is not apparent when the Eagle 3 is used for % LEL or % volume detection, but because of the high sensitivity in the ppm range, significant humidity changes can affect the ppm reading, especially in the lower part of the range. Take care to allow the unit to acclimate to a new environment for about a minute and perform a demand zero in a fresh air location when you move between areas of different humidity.

CAUTION: *If the catalytic combustible channel is being calibrated with a gas concentration of 1000 ppm or lower, a 24 inch humidifier must be used for accurate calibration. See page 77 for more explanation and instructions for calibration.*

To monitor for combustible gas in the ppm range:

1. Start up the Eagle 3 as described on page 30.
2. After warmup, allow the Eagle 3 to run for 3 - 5 minutes in Normal Mode. This allows the catalytic combustible sensor to stabilize sufficiently for ppm monitoring.

NOTE: This extra stabilization period is not necessary for monitoring in % LEL or % volume ranges.

3. Press RANGE until the catalytic combustible channel's units are set to ppm.
4. Perform a demand zero as described on page 40.
5. Proceed to monitor for gas as described on page 43.

Oxygen-Enriched Atmospheres

The Eagle 3 is not intended for use in oxygen-enriched atmospheres.

WARNING: *Do not use the Eagle 3 in an environment whose oxygen concentration is above 21%.*

H₂-Compensated CO Detection

- Eagle 3 displays CO readings.
- H₂ reading is not displayed but "H₂ RICH" appears once the H₂ concentration rises above 2000 ppm.

NOTE: The H₂-compensated CO sensor may not effectively compensate for high levels of H₂ if exposed to temperatures above 40°C for longer than 15 minutes. Under these conditions, it can appear to the instrument that the H₂ concentration has exceeded 2000 ppm, the max concentration that can be compensated for, resulting in a CO reading higher than the actual CO level.

Interference Information

Some gases interfere with CO, H₂S, and super toxic sensors. For a complete list of these gases, see page 271.

Although the Eagle 3 can support up to two ESS-03 sensors, many combinations are impractical for various reasons including sensor cross sensitivity to other gases.

The table below indicates some of the gases that will cause an increased gas reading for the affected sensor. For example, if you are attempting to detect HCN but H₂ is also present, the instrument's HCN reading will be higher than the environment's actual HCN level.

Table 7: Positive Interference

Sensor	Affected By:
Cl ₂	<ul style="list-style-type: none">• HCl• SO₂
HCN	<ul style="list-style-type: none">• H₂• SO₂
PH ₃	<ul style="list-style-type: none">• H₂S• SO₂
SO ₂	<ul style="list-style-type: none">• H₂

Table 8 indicates some of the gases that will cause a negative response and a decreased reading for the affected sensor. For example, if you are attempting to detect SO₂ but NO₂ is also present, the instrument's SO₂ reading will be lower than the environment's actual SO₂ level.

Table 8: Negative Interference

Sensor	Affected By:
Cl ₂	<ul style="list-style-type: none">• H₂S <p><i>NOTE: Cl₂ sensors exposed to H₂S will have their responses suppressed even after exposure. The suppression's amount and duration depend on how much H₂S the sensor is exposed to and for how long. For example, exposure to 25 ppm of H₂S for 3 minutes can suppress the Cl₂ response by 50% for several hours.</i></p>
HCN	<ul style="list-style-type: none">• NO₂
NH ₃	<ul style="list-style-type: none">• HCl• NO₂
NO ₂	<ul style="list-style-type: none">• CO• SO₂
PH ₃	<ul style="list-style-type: none">• NO₂
SO ₂	<ul style="list-style-type: none">• NO₂

CO₂ Detection

- A background level of CO₂ exists in fresh air. Table 9 below indicates a typical gas reading in fresh air.

Table 9: Carbon Dioxide Fresh Air Readings

Sensor Range	Approximate Fresh Air Reading
0 - 10.00% volume	0.04% volume
0 - 10,000 ppm	400 ppm

- Performing a demand zero, an auto zero, or an AIR CAL will either set the CO₂ channel to 400 ppm (0.04% volume) or exclude the CO₂ channel based on the setting of the **CO₂ Air Zero** parameter in Setup Mode parameter (see page 157).
- Monitor the readings and note if any alarms occur. The readings will peak shortly after the last squeeze and may decrease before all the channels can be checked. Use the Peak screen in Display Mode to see the maximum readings for each channel (see page 59).

NOTE: The peak readings for each channel are saved until a higher peak is recorded, the peak readings are reset, or the instrument is turned off. If a gas is present but the level does not exceed the previous peak level, the previous peak will be displayed on the Peak Screen.

Alarms

This section covers alarm types and their indicators while in Normal Mode. It also describes how to reset the Eagle 3 after an alarm has occurred and how to respond to an alarm condition.

NOTE: False alarms may be caused by radio frequency (RF) or electromagnetic (EMI) interference. Keep the Eagle 3 away from RF and EMI sources such as radio transmitters and large motors.

Alarm Indicators

When any alarm condition or failure occurs, the Eagle 3 buzzer sounds an alarm and the LEDs flash. If the Eagle 3 is operating in Stealth Mode, the buzzer does not sound (see page 189).

The Eagle 3 will sound an alarm and flash the LED arrays when one of the target gas concentrations rises above the Low Alarm level or falls below a Low Alarm level for O₂.

The Eagle 3 also sounds an alarm and flashes the LED arrays when one of the target gas concentrations rises above the High Alarm level and when the STEL and TWA alarm levels are reached for CO, H₂S, or other toxic gases.

NOTE: If an alarm condition occurs while in Display Mode, the Eagle 3's LCD immediately displays the alarm screen instead.

The following table summarizes the types of alarms produced by the Eagle 3 and their indicators.

Table 10: Alarm Types and Indicators

Alarm Type	Visual Indicators	Audible Indicator
<u>Low Alarm</u> Concentration of gas rises above the Low Alarm setting or falls below the Low Alarm setting for O ₂ .	<ul style="list-style-type: none"> • ALRM1 alternately flashes with the channel's unit of measurement • The channel in alarm flashes its gas reading • Alarm LED arrays flash once per second • Backlight turns on 	Pulsing tone once per second
<u>High Alarm</u> Concentration of gas rises above the High Alarm setting.	<ul style="list-style-type: none"> • ALRM2 alternately flashes with the channel's unit of measurement • The channel in alarm flashes its gas reading • Alarm LED arrays flash twice per second • Backlight turns on 	Pulsing tone twice per second
<u>TWA or STEL</u> Concentration of CO, H ₂ S, or other toxic gases rises above the TWA or STEL alarm setting.	<ul style="list-style-type: none"> • Alarm LED arrays flash once per second • Backlight turns on • TWA or STEL appears next to gas reading 	Pulsing tone once per second
<u>Over Range</u>	<ul style="list-style-type: none"> • OVER appears next to gas reading • Gas reading indicates full scale • Alarm LED arrays flash twice per second • Backlight turns on 	Pulsing tone twice per second
<u>Low Flow</u>	<ul style="list-style-type: none"> • The display indicates FAIL LOW FLOW LEVEL • Alarm LED arrays flash in a double pulsing pattern once per second • Backlight turns on 	Double pulsing tone once per second

Table 10: Alarm Types and Indicators

Alarm Type	Visual Indicators	Audible Indicator
<u>Low Battery Warning</u>	<ul style="list-style-type: none"> • BATT appears vertically along the left side of LCD 	None
<u>Sensor Failure</u>	<ul style="list-style-type: none"> • FAILED SENSOR(S) appears at the top of the display and the failed sensor(s) are indicated • Alarm LED arrays flash in a double pulsing pattern once per second 	Double pulsing tone once per second
<u>Clock Failure</u>	<ul style="list-style-type: none"> • FAIL CLOCK appears at the bottom of the LCD • Alarm LEDs flash once per second 	Double pulsing tone once per second
<u>System Failure</u>	<ul style="list-style-type: none"> • FAIL SYSTEM appears at the bottom of the LCD and an error code displays in the middle of the LCD • Alarm LEDs flash once per second 	Double pulsing tone once per second

Responding to Alarms

This section describes response to gas, over range, battery, and sensor failure alarms.

Responding to Gas Alarms

1. Determine which gas alarm has been activated.
2. Follow your established procedure for an increasing gas condition or a decreasing oxygen condition.
3. If necessary, press **POWER** to reset the alarm once the alarm condition has passed.
 - a. If **Alarm Latching** is set to **On** (factory setting) in Setup Mode, the gas reading must fall below (or rise above for an oxygen low alarm) an alarm setting before the alarm can be reset.
 - b. If **Alarm Latching** is set to **Off** in Setup Mode, the alarm condition automatically resets when the gas reading falls below (or rises above for an oxygen low alarm) an alarm setpoint.

Responding to Over Range Alarms

WARNING: *An over range condition may indicate an extreme combustible gas, toxic gas, or oxygen concentration. Confirm a normal condition with a different Eagle 3 or with another gas detecting device.*

CAUTION: *High off-scale readings may indicate an explosive concentration.*

PRUDENCE: *Des lectures élevées hors échelle peuvent indiquer une concentration explosive.*

1. Determine which channel is in alarm.
2. Follow your established procedure for an extreme gas condition.
3. Press **POWER** to reset the alarm once the alarm condition has cleared.
4. Calibrate the Eagle 3 as described on page 77.
5. If the over range condition continues or if you are not able to successfully calibrate the unit, the sensor that has triggered the over range alarm may need to be replaced.
6. If the over range condition continues after sensor replacement, contact RKI Instruments, Inc. for further instructions.

Responding to Battery Alarms

WARNING: *The Eagle 3 is not operational as a gas monitoring device during a dead battery alarm. Take the Eagle 3 to a non-hazardous area and replace or recharge the batteries as described in “Recharging the Eagle 3” on page 97.*

The Eagle 3 is fully functional during a low battery warning. However, only a limited amount of operating time remains, approximately 1 - 2 hours. The amount of time depends on how often the LCD backlight is used and how often the unit is responding to alarm conditions. Recharge the lithium-ion battery pack as soon as possible as described on page 97.

NOTE: Alarms and the LCD back light consume battery power and reduce the amount of operating time remaining.

Responding to Clock Failure Alarms

A clock failure alarm occurs if the unit's internal clock malfunctions. A clock failure alarm might also occur if the battery becomes too drained during storage. See page 158 for storage information.



1. Press POWER to enter Normal Mode.

CAUTION: *If you operate the instrument after a clock failure, data will still be logged but the date/time will be incorrect. Set the date/time as described on page 132 as soon as possible to ensure logged data uses the correct date/time.*

2. Try to set the date using the Date/Time in Setup Mode as described on page 131.
3. If the date cannot be set correctly, contact RKI Instruments, Inc. as soon as possible.

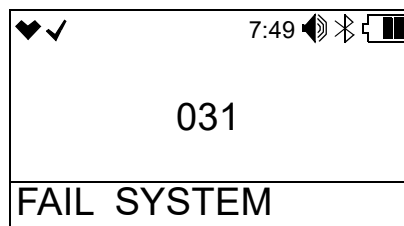
Responding to Sensor Failure Alarms

1. Determine which sensor has triggered the sensor failure alarm.
2. Try calibrating the sensor as described on page 77.
 - a. If the sensor failure continues, replace the sensor as described on page 113.

CAUTION: *If the sensor failure continues after sensor replacement, contact RKI Instruments, Inc. for further instructions.*

Responding to System Failure Alarms

1. If a system failure occurs, an error code displays as shown below.



2. The error code meanings are shown in the table below.

Error Code	Explanation
000	ROM failure
010	RAM failure
021	FRAM failure

Error Code	Explanation
031	FLASH memory failure
080	Acceleration sensor failure
081	PCB failure
082	Temperature sensor failure
083	Bluetooth failure

3. If the error code is anything but 031, the instrument cannot be used. Contact RKI Instruments, Inc. as soon as possible.

If the error code is 031, press **POWER** to continue into Normal Mode if the instrument must be used temporarily.

CAUTION: *There will be no datalogging function if you operate the instrument after a 031 system failure. Contact RKI Instruments, Inc. as soon as possible.*

Alarm Silence

Alarm silence can be turned on or off through **Alarm Silence** located in Setup Mode via the **Alarm Settings** menu (see page 148).

Table 11 summarizes resetting and silencing alarms for all **Alarm Latching** and **Alarm Silence** setting combinations.

Table 11: Resetting and Silencing Alarms

	Alarm Latching: On (factory setting)	Alarm Latching: Off
Alarm Silence: On	<ul style="list-style-type: none"> Press POWER or AIR to silence the buzzer. If the gas concentration was still above the alarm level when the button was pressed, the LED arrays continue to flash, the vibrator continues to pulse, and the Eagle 3 continues to display the current alarm level. The gas reading must fall below (or rise above for an oxygen low alarm) an alarm setting before you can reset the alarm, the LEDs, and the vibrator using the POWER or AIR buttons. 	<ul style="list-style-type: none"> Press POWER or AIR buttons to silence the buzzer. The POWER or AIR buttons will not reset the alarm. The alarm, LEDs, and vibrator will automatically reset when gas reading falls below (or rises above for an oxygen low alarm) an alarm setpoint.

Table 11: Resetting and Silencing Alarms

Alarm Silence: Off (factory setting)	<ul style="list-style-type: none">• Pressing POWER or AIR will not silence buzzer.• The gas reading must fall below (or rise above for an oxygen low alarm) an alarm setting before you can reset the alarm condition using the POWER or AIR buttons.	<ul style="list-style-type: none">• Pressing POWER or AIR will not silence buzzer.• The alarm condition will automatically reset when the gas reading falls below (or rises above for an oxygen low alarm) an alarm setpoint.
--	--	--

Data Logging

NOTE: The Eagle 3 only logs data while in Normal Mode and will not log data while in Leak Check Mode or Bar Hole Mode.

The Eagle 3 features the ability to log gas readings during normal operation in addition to alarm data and calibration data. This data can be downloaded to a computer via the communications/charging port on the side of the unit.

To download data from the Eagle 3, the following are required:

- a USB-adaptor communication cable
- the Eagle 3 Data Logger Management Program
- a computer with a USB port running one of the following operating systems: Windows 8, Windows 10, or Windows 11.

The Eagle 3 Data Logger Management Program is available for installation at www.rkiinstruments.com/eagle3.

The data logging capacity depends on how often the Eagle 3 stores data, how many channels are active, and how often the Eagle 3 is turned on and off. Table 12 illustrates how much data logging time is available for each interval of time. It assumes that the unit is setup with four sensors, is only turned on once, and there are no alarm occurrences. See page 151 for instructions on setting the data logging interval time.

Table 12: Interval/Data Logging Time

Interval Time	Data Logging Time
5 seconds	239 hours (10 days)
10 seconds	479 hours (20 days)
20 seconds	959 hours (40 days)
30 seconds	1439 hours (60 days)
1 minute	2879 hours (120 days)
3 minutes	8639 hours (360 days)
5 minutes	14,399 hours (600 days)
10 minutes	28,798 hours (2,000 days)

For a complete description of the Data Logger Management Program and procedures for downloading Eagle 3 data to a computer, see the Eagle 3 Data Logger Management Program Operator's Manual.

Chapter 4: Display Mode

This section describes the features of Display Mode. To enter this mode, press **DISPLAY** while in Normal Mode. The **Display Mode** marker appears in the top portion of the screen.

See Table 13 for a list of Display Mode's menu items, a short description of each item, and the page number for further description.

Table 13: Display Mode Menu Items

Display Screen Name	Function
Peak (page 59)	Displays each sensor's peak readings
Battery Voltage (page 60)	Displays the minimum operating and current battery voltage
CAT Sensor Protection (page 60)	Enables or disables the catalytic LEL sensor (if there is a TC or infrared combustible IR channel with a catalytic combustible channel)
Methane Elimination Mode (page 61)	Enables or disables Methane Elimination Mode (if the catalytic combustible gas channel is configured appropriately in the Configure Gases menu item in Setup Mode)
Relative Response (page 62)	Displays current combustible gas response factor that is applied to the catalytic sensors channel
STEL (page 64)	Displays the STEL readings (CO, H2S, and CO2/super toxic only)
TWA (page 64)	Displays the TWA readings (CO, H2S, and CO2/super toxic only)
View Alarm Settings (page 65)	Displays all current alarm setpoints
Change User ID? (page 67)	Displays the current User ID and allows selection of a different User ID
Change Station ID? (page 68)	Displays the current Station ID and allows selection of a different Station ID
View Calibration Dates? (page 69)	Displays the most recent calibration date for each installed sensor
View Bump Test Dates? (page 70)	Displays the most recent bump test date for each installed sensor
View Snap Log Data? (page 71)	Displays each snap log recorded (up to 5 logs)
Peak Bar (page 72)	Enables or disables the Peak Bar in Normal Mode
Bluetooth (page 73)	Enables or disables Bluetooth
GPS (page 73)	Enables or disables GPS
Time In Operation (page 74)	Displays time in operation
Date/Time (page 74)	Displays date and time
Data Logging (page 75)	Displays the current snap log data saved to the instrument

Tips for Using Display Mode

- To scroll from one menu item to the next or skip an item when a question is asked, press or hold **DISPLAY**.
- To change a flashing parameter or move the on-screen cursor, press either **AIR** or **RANGE**.
- To select an option when a question is asked, press **POWER**.
- To exit Display Mode, press **DISPLAY** until the **Display Mode** marker disappears.

NOTE: Each Display Mode menu item displays for 20 seconds. If you do not press a button within 20 seconds while in Display Mode, the Eagle 3 returns to Normal Mode

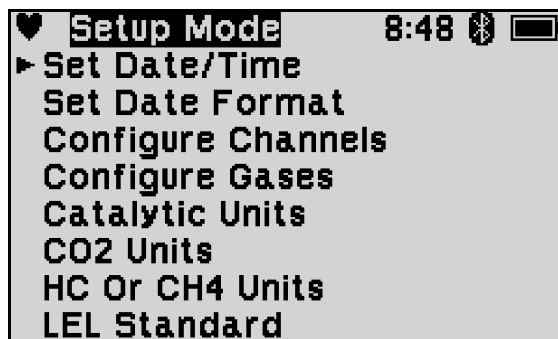
Viewing the Peak Screen

The Peak screen displays the highest (lowest for oxygen) concentrations detected since the Eagle 3 was turned on. Peak readings are stored in the Eagle 3's memory until a higher level is detected (lower for oxygen), the peak reading is cleared, or the Eagle 3 is turned off.

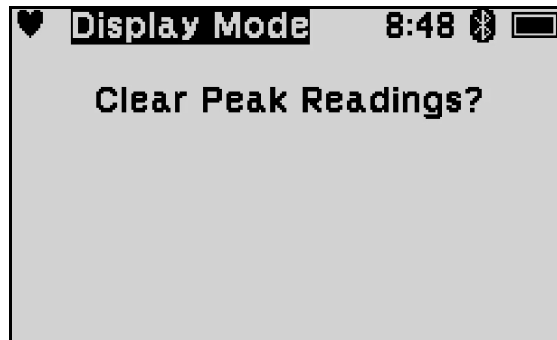
NOTE: The **Lunch Break** feature allows the Eagle 3 to save peak readings when it is turned off and continue to use these readings after it is turned back on. See page 190 for turning **Lunch Break** on and off.

To clear the peak readings, perform the following:

1. While in Normal Mode, press **DISPLAY** to scroll to the **Peak** screen.



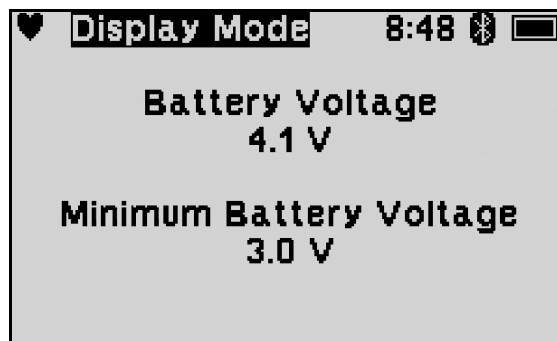
2. Press **POWER**. The following prompt appears.



3. Press **AIR** to clear the peak readings and proceed to the next screen in Display Mode.
To return to the **Peak** screen without clearing the peak readings, press **DISPLAY**.

Viewing the Battery Voltage

The **Battery Voltage** screen displays the minimum operating voltage and the current battery voltage. When the unit's battery pack is fully charged, the screen will typically indicate 4.2 volts. This screen also displays during the warmup sequence.



Catalytic (LEL) Sensor Protection

NOTE: This screen appears only when either a TC sensor or an infrared combustible sensor is installed in an Eagle 3 with a catalytic combustible LEL sensor.

If the instrument is going to be exposed to known high-levels of combustible gas or operated in areas with known catalytic sensor poisons such as silicone vapors, the catalytic combustible sensor should be turned off. Even though this sensor has its own protective shut off, exposure to high levels of combustible gas can still stress the catalytic LEL sensor.

See Appendix E: TC Sensors, Appendix G: Infrared Methane Sensor, or Appendix H: Infrared Hydrocarbon Sensor for more information about this screen and instructions to use it.

The catalytic LEL sensor can be enabled or disabled in the Catalytic (LEL) Sensor screen in Display Mode. The factory setting is **Enabled**.

1. While in Normal Mode, press **DISPLAY** until the Catalytic (LEL) Sensor screen appears.



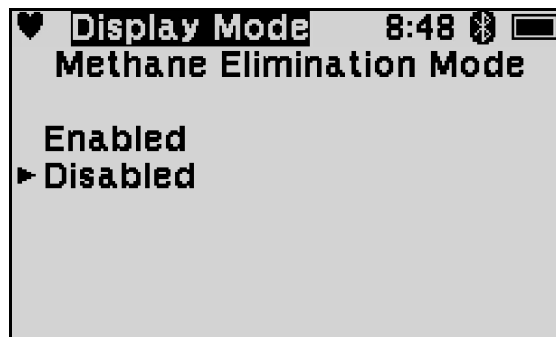
2. Press **AIR** or **RANGE** to select the desired setting.
3. To save the setting, press the **POWER** button. The unit will save the setting and proceed to the next menu item.

To continue to the next menu item without changing the setting, press **DISPLAY**.

Adjusting the Methane Elimination Mode

The standard setup for methane (CH_4) does not support methane elimination. When applicable, use this screen to enable and disable the methane elimination feature. See page 337 for more information.

1. While in Normal Mode, press **DISPLAY** until the Methane Elimination screen appears.



2. Press **AIR** or **RANGE** to scroll to the desired setting.
3. To save the setting, press the **POWER** button. The unit will save the setting and proceed to the next menu item.

To continue to the next menu item without changing the setting, press **DISPLAY**.

Catalytic Sensor Relative Response

NOTE: This screen displays only if **Relative Response** in Setup Mode is set to **On** (see page 136). Use this screen to temporarily change the gas configuration of the catalytic combustible channel.

NOTE: If Methane Elimination Mode is enabled, the **Catalytic Sensor Relative Response** screen does not appear.

A list of gases with responses relative to the configured gas, normally methane, is programmed into the Eagle 3's memory. This includes several pre-defined gases and 5 gases that can be entered into the Eagle 3 in the field. In order to program a field-defined gas into the Eagle 3, gas testing must be performed to determine the gases' response factor relative to methane.

The following is the complete list of factory-defined gases:

- | | | | | |
|-------------------|-----------------------|-------------------|--------------------------|---------------------|
| • Acetone | • Cumene | • Isobutane | • Methyl Isobutyl Ketone | • Mixed Xylenes |
| • Benzene | • Ethylene Dichloride | • Isopropanol | • Nonane | • Field Defined Gas |
| • Butyl Acrylate | • Ethyl Alcohol | • Methane | • Pentane | • Field Defined Gas |
| • Butyl Acetate | • Ethyl Chloride | • Methanol | • Propane | • Field Defined Gas |
| • 2-Butyl Alcohol | • Ethyl Acrylate | • Methyl Acetate | • Styrene | • Field Defined Gas |
| • 1-Butyl Alcohol | • Hexane | • Methyl Acrylate | • Toluene | • Field Defined Gas |
| • Cyclohexane | • Hydrogen | • Methyl Ketone | • Vinyl Acetate | |

See the *Eagle 3 Maintenance Data Loader Program Operator's* manual for details regarding the gas testing and programming of user-defined gases into the Eagle 3's relative response list. The last five items in the gas list are reserved for field-defined gases.

The relative response feature enables the instrument to temporarily monitor for the selected gas without needing recalibration. The Eagle 3 will clear the gas configuration change when it is turned off and will return to the programmed configuration when it is turned on again.

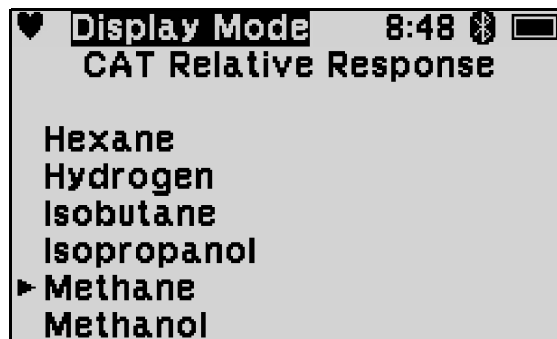
Because of normal variation between sensors, these relative response factors are typical factors. If you use this feature, the response to the selected gas will not be as accurate as it would be if you configured and calibrated the catalytic combustible channel to the target gas.

NOTE: For maximum accuracy, configure and calibrate the Eagle 3's catalytic combustible channel to the desired target gas.

1. While in Normal Mode, press **DISPLAY** to scroll to the **Relative Response** screen.



2. Press **AIR** to select the menu item. A list of gases will appear on the screen. There are multiple screens of gases.



3. Press **AIR** or **RANGE** to scroll to the desired gas.
4. Press **POWER** to select the desired gas. The catalytic combustible channel will be configured to the selected gas and the Eagle 3 will proceed to the STEL Screen.

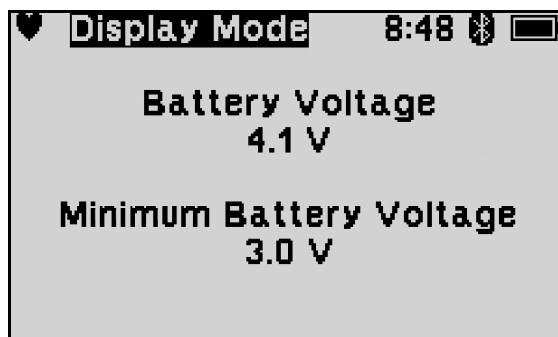
This configuration will be in force until a different gas is selected in Display Mode or the unit is turned off.

**SELECT
RELATIVE RESPONSE
TO CALIBRATED GAS
FOR PID SENSOR**

NOTE: The **PID Sensor Relative Response** screen only appears if a PID sensor is installed in the Eagle 3. See “PID Relative Response Feature” on page 210 for more information.

Viewing the Short-Term-Exposure-Limit (STEL)

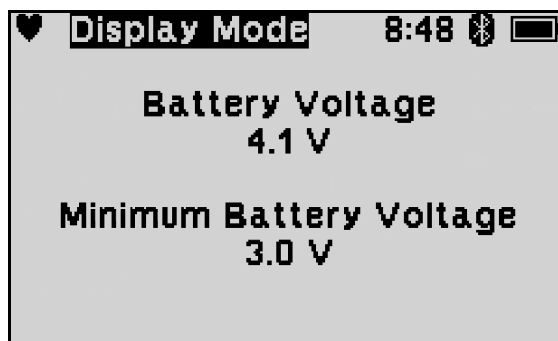
The STEL Screen displays the short term exposure limit (STEL) readings for H_2S , CO , CO_2 , and *super toxic channels only*. The STEL reading is the average reading over the last 15 minutes.



Viewing the Time-Weighted-Average (TWA)

NOTE: If **Lunch Break** is set to **On**, the Eagle 3 will remember TWA readings when it is turned off so it can continue them when it is turned on again. See page 190 for instructions to turn the lunch break feature on.

The TWA Screen displays the time weighted average (TWA) readings for H_2S , CO , CO_2 , and *super toxic channels only*.



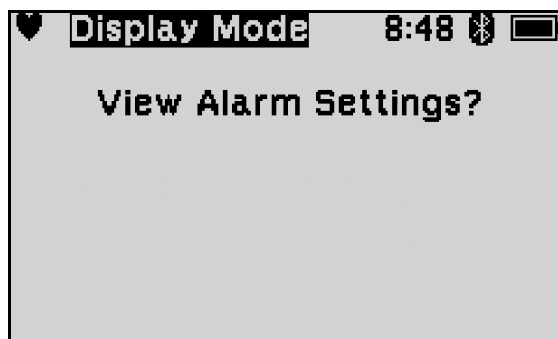
The TWA reading is the average reading *over the last 8 hours*. If 8 hours have not elapsed since the last time the TWA reading was cleared, the average is still calculated over 8 hours. The missing readings are assigned a 0 value. If **Lunch Break** is set to **Off** (factory setting), the TWA is cleared when the Eagle 3 is turned off.

Viewing the Alarm Settings

The View Alarm Settings screen shows the gas alarm points for all active channels.

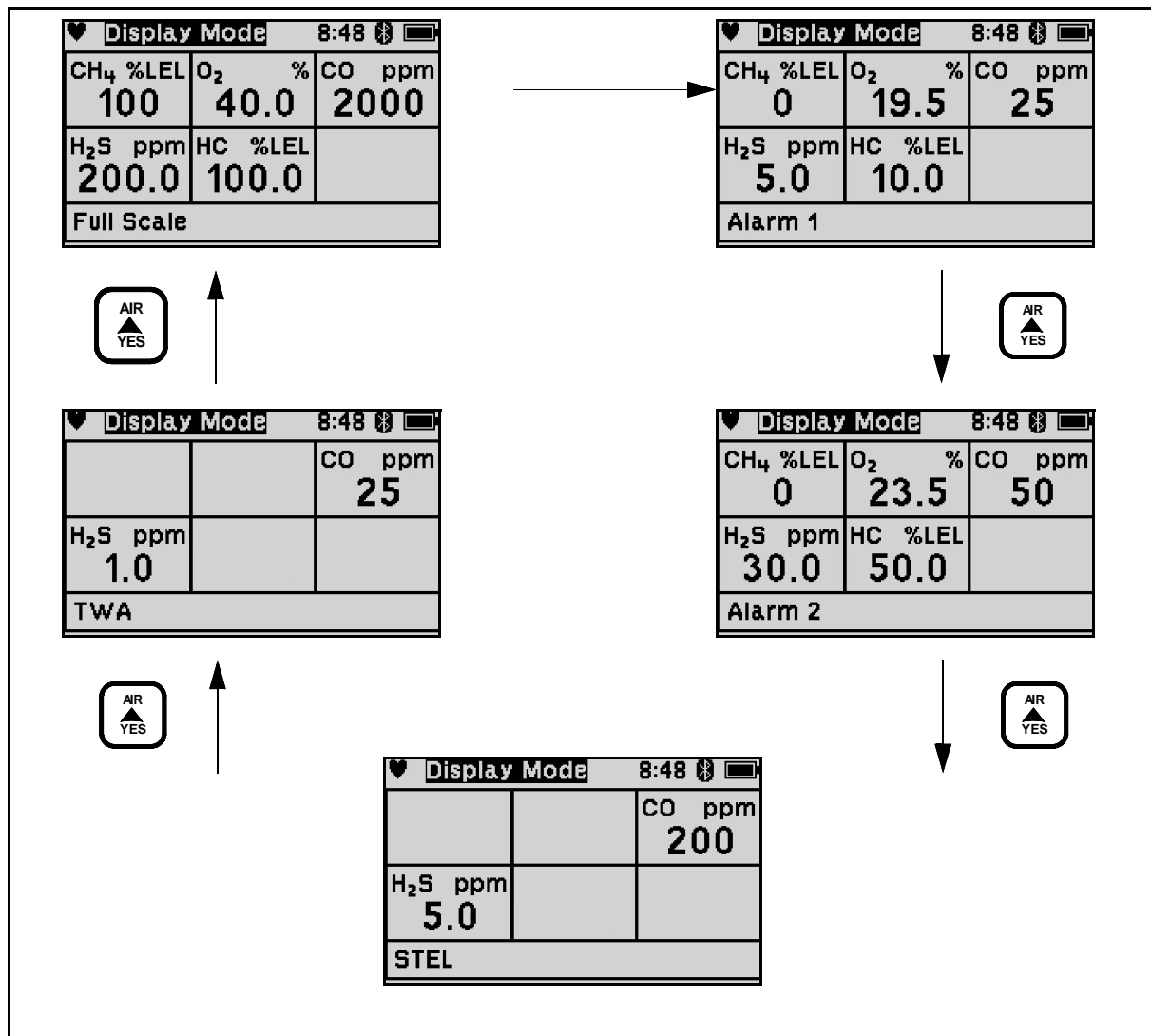
To view the gas alarm settings, perform the following:

1. While in Normal Mode, press DISPLAY to scroll to the **Alarm Settings** screen.



2. Press AIR to enter the **View Alarm Settings** menu. The **Full Scale** alarm settings screen appears.

3. Press **AIR** to scroll through the Alarm Settings screens. The screens appear in the order shown below: **Full Scale**, **Alarm 1**, **Alarm 2**, **STEL**, and **TWA**.



While viewing the alarm settings for a particular alarm point, press AIR and POWER at the same time to simulate the alarm conditions. The buzzer will sound and the LEDs will flash just as it would if the displayed condition was actually happening.

4. To return to the **View Alarm Settings?** menu item, press DISPLAY on any alarm settings screen.

Viewing and Changing the User ID

NOTE: The **Change User ID?** screen displays only if **User and Station ID** in the Setup Mode menu is set to ON (see page 154).

A user ID is a way to identify different users and their saved data logs on the instrument.

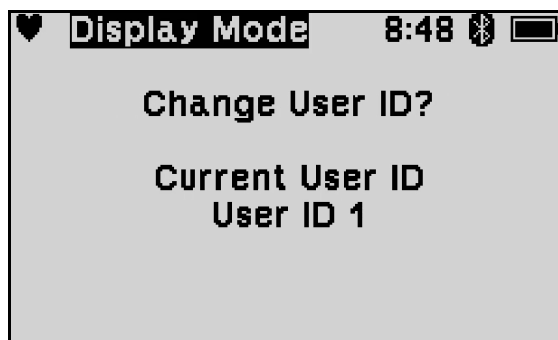
Use this screen to select a user ID from the 128 user IDs stored in the Eagle 3's memory. Before a user ID is selected on a brand new instrument, the instrument's user ID is "-----". Factory-installed user IDs have a "**User ID XXX**" format.

User IDs can only be selected in this menu item. The Eagle 3 Datalogging Program is required to edit the user IDs.

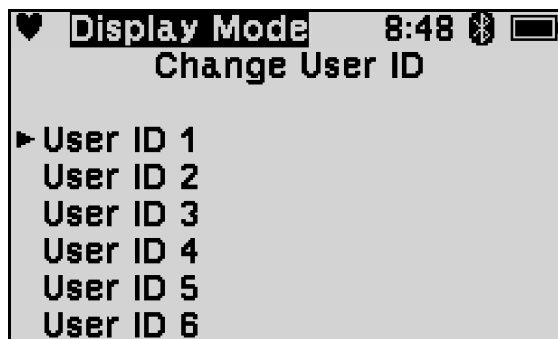
NOTE: For a detailed description of data logging and editing user IDs, see the Eagle 3 Data Logger Management Program Operator's Manual.

To select a different user ID, perform the following:

1. While in Normal Mode, press DISPLAY to scroll to the **Change User ID?** screen.



2. Press AIR to enter the **Change User ID** menu. The **Change User ID** screen appears with the cursor next to the current user ID in use.



3. Press AIR or RANGE to scroll through the list of user IDs until the cursor is next to the desired user ID.

4. Press **POWER** to save the desired user ID and proceed to the Select Station ID screen.
To return to the **Change User ID?** screen without changing the user ID, press **DISPLAY**.

Viewing and Changing the Station ID

NOTE: The **Change Station ID?** screen displays only if **User and Station ID** in the Setup Mode menu is set to **ON** (see page 154).

A station ID provides a way to identify the Eagle 3's location during a data logging session.

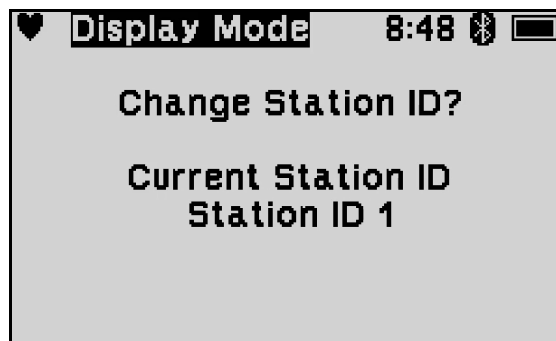
Use this screen to select a station ID from the 128 station IDs stored in the Eagle 3's memory. Before a station ID is selected on a brand new instrument, the instrument's station ID is "-----". Factory-installed station IDs have a "Station ID XXX" format.

Station IDs can only be selected in this menu item. The Eagle 3 Datalogging Program is required to edit the station IDs.

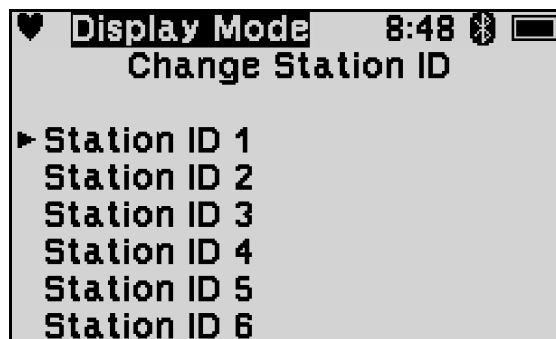
NOTE: For a detailed description of data logging and station IDs, see the Eagle 3 Data Logger Management Program Operator's Manual.

To select a different station ID, perform the following:

1. While in Normal Mode, press **DISPLAY** to scroll to the **Change Station ID?** screen appears.



2. Press **AIR** to enter the **Change Station ID** menu. The **Change Station ID** screen appears with the cursor next to the current station ID in use.

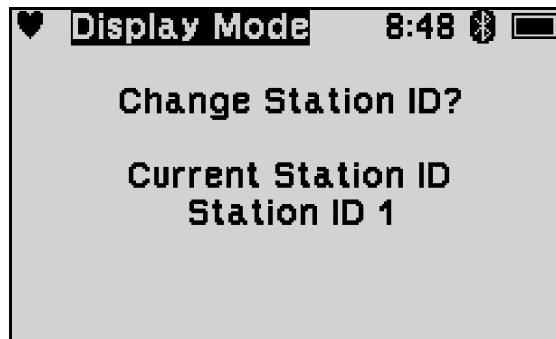


3. Press **AIR** or **RANGE** to scroll through the list of station IDs until the cursor is next to the desired station ID.
4. Press **POWER** to save the desired station ID and proceed to the next Display Mode screen.
To return to the **Change Station ID?** screen without changing the station ID, press **DISPLAY**.

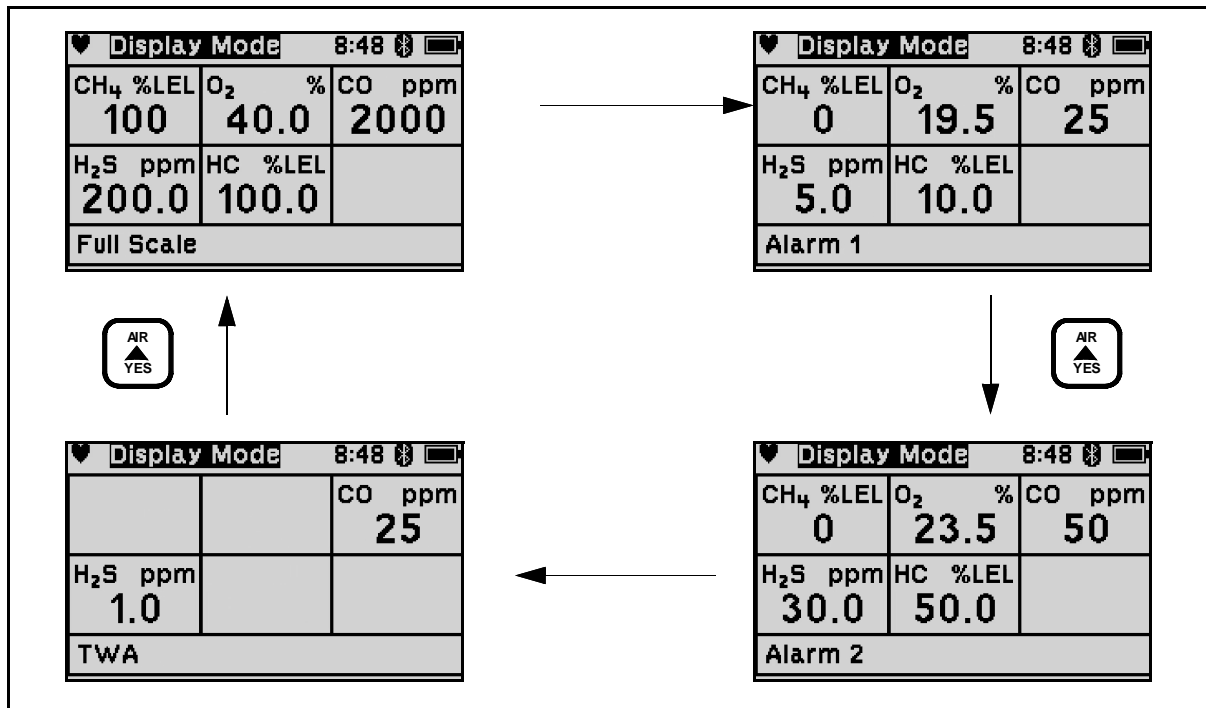
View Calibration Dates

Use this menu to view each sensor's most recent calibration date.

1. While in Normal Mode, press **DISPLAY** to scroll to the **View Calibration Dates?** screen.



2. Press **AIR** to scroll to the desired sensor's **Calibration Date** screen. Each screen shows a different sensor's recorded calibration dates.

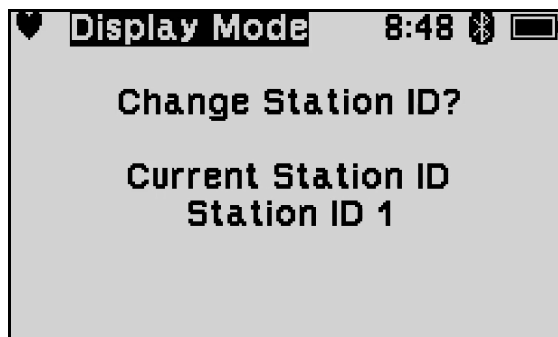


3. Press **DISPLAY** to return to the **View Calibration Dates?** screen in Display Mode.

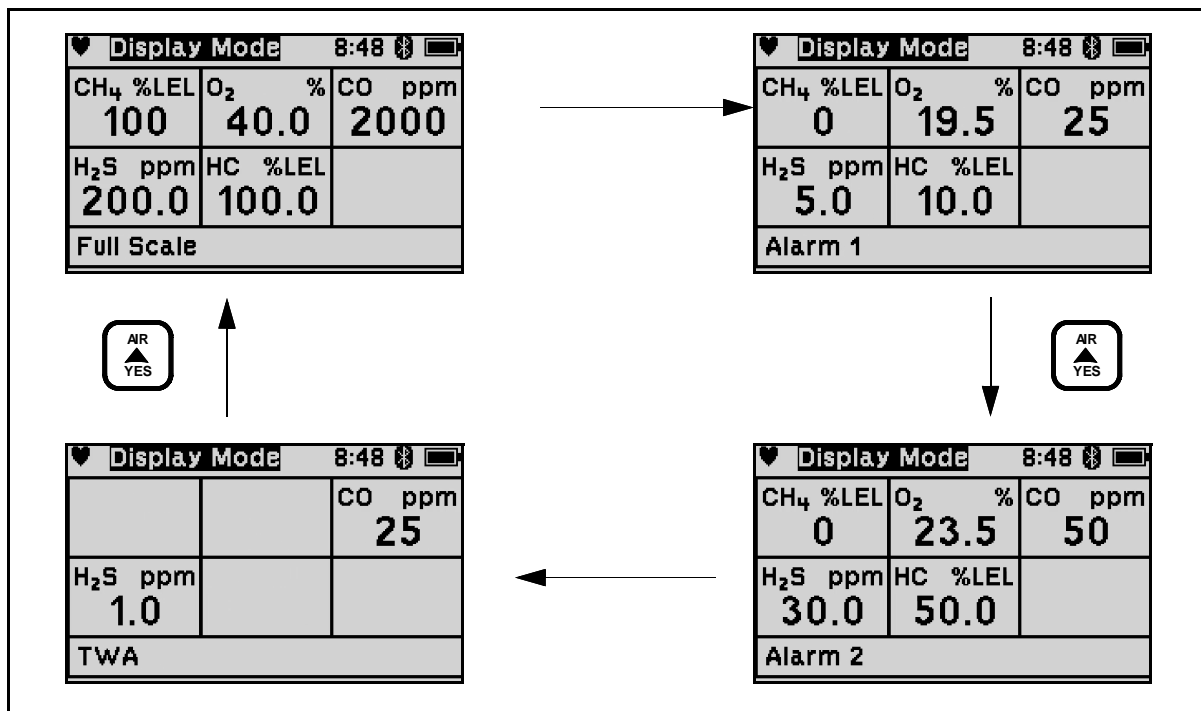
View Bump Test Dates

Use this menu to view each sensor's most recent bump test date.

1. While in Normal Mode, press **DISPLAY** to scroll to the **View Bump Test Dates?** screen.



2. Press **AIR** to scroll to the desired sensor's **Bump Test Date** screen. Each screen shows a different sensor's recorded bump test dates.



3. Press **DISPLAY** to return to the **View Calibration Dates?** screen in Display Mode.

View Snap Log Data



The Eagle 3 is capable of logging all channel readings at a given moment. The Eagle 3 can store up to 256 snap logs at one time. If Data Log Overwrite (page 159) is set to On, the oldest log will be overwritten by the newest snap log.

To view a snap log, perform the following:

1. While in Normal Mode, press **DISPLAY** until the View Snap Log Data Screen appears.

Display Mode		13:06		
%VOL	%VOL	CO	ppm	
fnp	fnp		0	
H2S ppm	CH4%LEL	O2	%	
0.0	0	20.9		
View Snap Log Data				

2. Press the **POWER** or **AIR** buttons. The following screen appears.

Display Mode		13:06		
Snap Log Data				
▶	Snap Log Number 1			
	Snap Log Number 2			
	Snap Log Number 3			
	Snap Log Number 4			
	Snap Log Number 5			

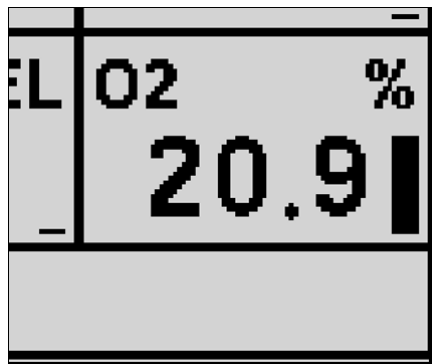
3. Press the RANGE button to cycle through list of recorded Snap Logs. Press POWER or AIR buttons to select one of the Snap Log Numbers to view.

To return to the Snap Log Data list, press **POWER**. To return to Display Mode, press **DISPLAY**.

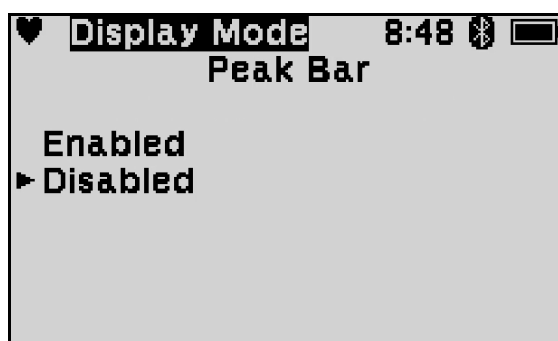
Display Mode		9:42		
%VOL	%VOL	CO	ppm	
0	0		0	
H2S ppm	CH4%LEL	O2	%	
0.0	0	0.0		
View Snap Log Data				

Peak Bar

The Peak Bar screen enables or disables the peak bar. If the function is turned on, the peak bar appears along the right side of each current gas reading in Normal Mode, representing the peak of each channel.



1. While in Normal Mode, press **DISPLAY** until the Peak Bar screen appears. The cursor is next to the current setting.



2. Press **AIR** or **RANGE** to scroll to the desired setting.
3. To save the setting, press the **POWER** button. The unit will save the setting and proceed to the next menu item.

To continue to the next menu item without changing the setting, press **DISPLAY**.

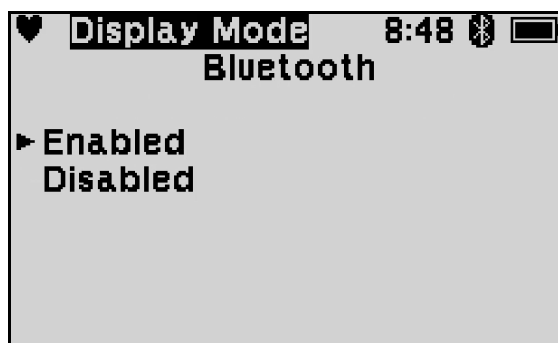
Turning Bluetooth On/Off (Bluetooth)

The **Bluetooth** screen allows the Eagle 3's Bluetooth functionality to be enabled and disabled.

On: Turns Bluetooth functionality on, allowing for connection to the RK Link phone application.

Off (factory setting): Turns Bluetooth functionality off.

1. While in Normal Mode, press **DISPLAY** to scroll to the Bluetooth screen. The cursor is next to the current setting.



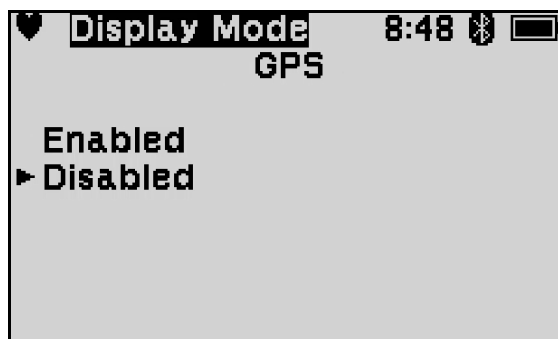
2. Press **AIR** or **RANGE** to scroll to the desired setting.
3. Press **POWER** to save the setting. The unit will save the setting and proceed to the next Display Mode menu item.

To continue to the next menu item without changing the setting, press **DISPLAY**.

Turning the GPS On/Off

The GPS screen allows the Eagle 3's GPS functionality to be enabled and disabled.

1. While in Normal Mode, press **DISPLAY** until Bluetooth appears. The cursor is next to the current setting.

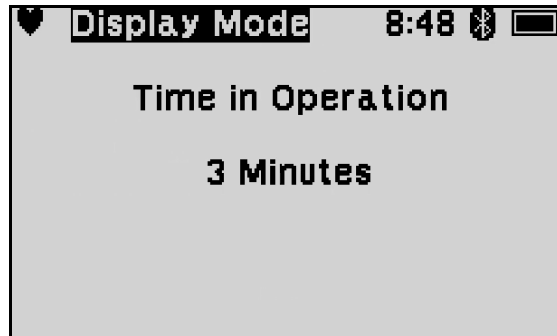


2. Press **AIR** or **RANGE** to scroll to the desired setting.
3. Press **POWER** to save the setting. The unit will save the setting and proceed to the next Display Mode menu item.

To continue to the next menu item without changing the setting, press **DISPLAY**.

Time in Operation Screen

The Time In Operation Screen displays the length of time since the Eagle 3 was turned on if the Lunch Break is turned off.



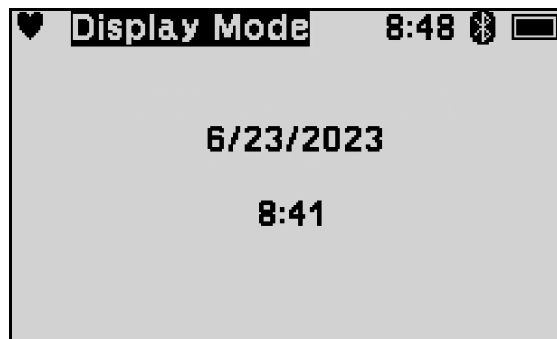
If the lunch break feature is turned on, the time in operation will only be reset if you do not choose to resume the peak and TWA measurements when the Eagle 3 is turned on in the Resume Measurement Screen described in Step 6 on page 31.

If you choose to resume the peak and TWA measurements during warmup, the Eagle 3 will include the time in operation when the unit was last turned off in the current time in operation.

See page 159 for a description of the lunch break feature.

Date/Time Screen

The Date/Time Screen displays the current date and time.



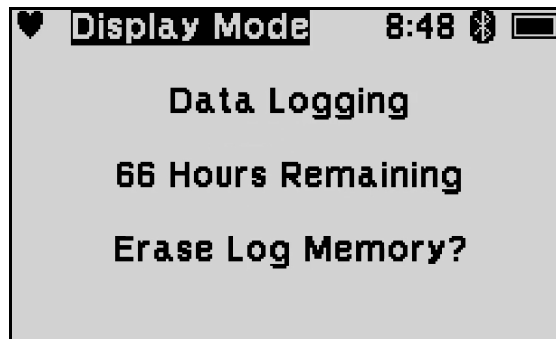
Data Logging Screen

CAUTION: *Once you clear the data logger, you cannot retrieve any data previously stored in the data logger.*

The Data Logging screen displays the time remaining until the data logger memory is full and asks if you want to clear the data logger memory.

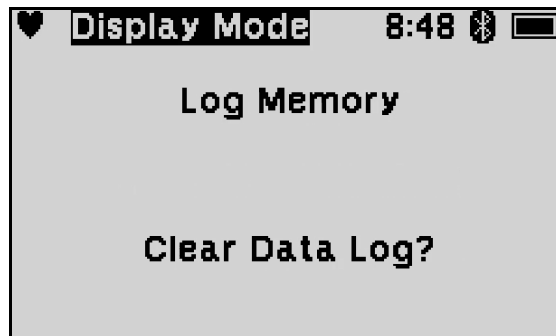
To clear the data logger memory, do the following:

1. While in Normal Mode, press **DISPLAY** until the Data Logging screen appears.



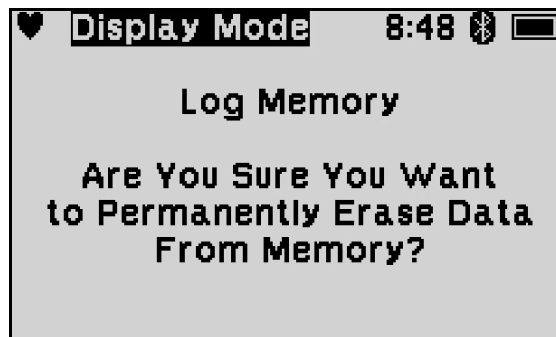
2. Press **AIR** to proceed to the confirmation screen.

To continue return to Normal Mode without erasing the stored data, press **DISPLAY**.

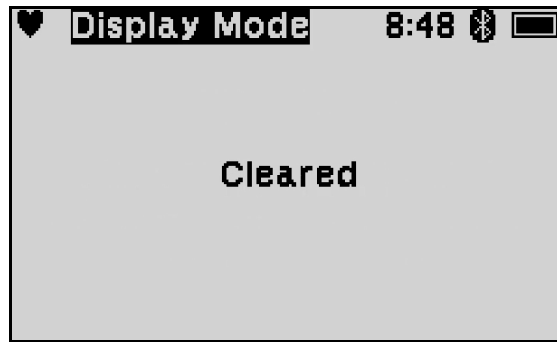


3. The confirmation screen appears. Press **AIR** to erase all stored data saved to the Eagle 3.

To return to the Data Logging screen, press **DISPLAY**.



4. The screen displays the “**Cleared**” text before returning to Normal Mode.



Chapter 5: Calibration Mode

Overview

This section describes the Eagle 3 in Calibration Mode. See Table 14 for a list of the items found in Calibration Mode, the page that each menu item's instructions can be found on, and a short description of each menu item.

Table 14: Calibration Mode Menu Items

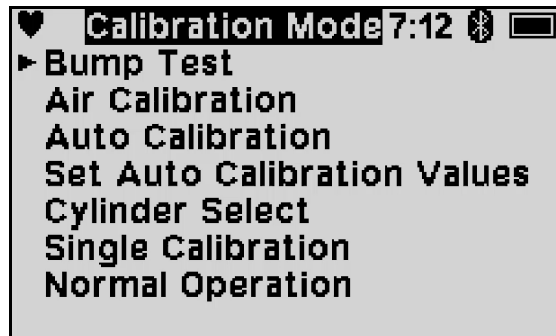
Calibration Mode Menu Item	Function
Bump Test (page 78)	Perform a bump test.
Air Calibration (page 85)	Perform a fresh air adjustment on all channels.
CO2 Zero Calibration (page 86)	Perform a zero adjustment on the CO ₂ sensor. <i>NOTE: This menu item only appears if a CO₂ sensor is installed.</i>
TE Zero Calibration (page 86)	Perform a zero adjustment on the TE sensor. <i>NOTE: This menu item only appears if a TE sensor is installed.</i>
Auto Calibration (page 87)	Perform a span adjustment for all channels.
Single Calibration (page 90)	Perform a span adjustment on one channel.
Set Auto Calibration Values (page 92)	Adjust each channel's auto calibration values.
Cylinder Select (page 93)	Assign a cylinder (A-E) to each gas (all 4 gases set to Cylinder A is the default).
Normal Operation (page 95)	Begin the warmup sequence and enter Normal Mode.

Entering Calibration Mode

1. Find a fresh-air environment. This is an environment free of toxic or combustible gases and of normal oxygen content (20.9%).
2. While in Normal Mode, press and hold **RANGE** then press **DISPLAY**.

3. If the unit prompts you for the password, enter it by using **AIR** and **RANGE** to scroll through each digit and then press **POWER** to enter the number and move to the next one.

Press **DISPLAY** to return to the previous number entered.



4. The Calibration Mode Screen displays with the cursor next to **Bump Test**.

Performing a Bump Test

Bump test the instrument before each day's use with a known concentration of each target gas. The instrument does not need to be calibrated unless it does not pass the bump test.

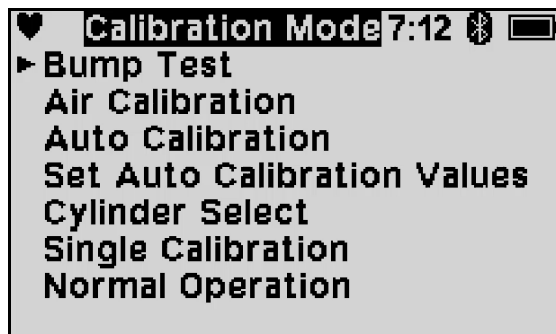
To bump test the Eagle 3, you will need:

- Known calibrating samples of the gases being detected.



Channel	Min. Cal. Gas Concentration	Max. Cal. Gas Concentration
Combustible Gas	1% LEL	75% LEL
Oxygen	0.0%	17.0%
Carbon Monoxide	0 ppm	2,000 ppm
Hydrogen Sulfide	0 ppm	200.0 ppm

- Demand flow regulator
 - Non-absorbent tubing
 - Sample hose and probe
1. Confirm that the Eagle 3's calibration gas values match the concentrations listed on the calibration gas cylinder(s) as described on page 90.
 2. Confirm that your cylinder selections are appropriate as described on page 93.
 3. Install the demand flow regulator onto the calibration cylinder.
 4. Connect the sample tubing to the demand flow regulator.

5. Install the sample hose and probe onto the Eagle 3 inlet fitting. Make sure the probe is complete with internal O-ring and membrane and that the two halves of the probe are tightened firmly together to avoid leaks that can affect the calibration. See Figure 17 on page 99 for an illustration of the internal parts of the probe.
6. While in Calibration Mode, press **AIR** or **RANGE** to scroll to **Bump Test**.



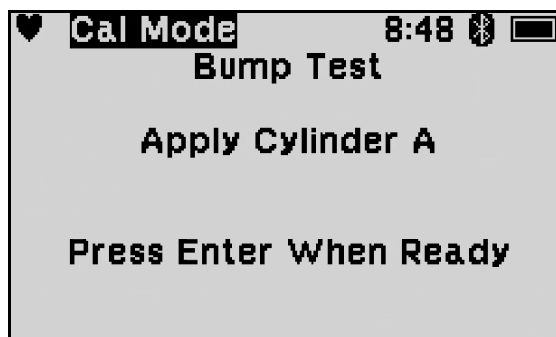
7. Press **POWER**. The **Bump Test** screen shows the gases assigned to Cylinder A and their assigned calibration values (see page 92 if the bump test values do not match the calibration gas cylinder's concentrations).

♥ Cal Mode		8:48		
CH ₄ %LEL	O ₂ %	CO ppm		
50	12.0	50		
H ₂ S ppm				
25.0				
Bump Test		Cylinder A		

8. If necessary, use **AIR** to scroll to a different cylinder screen for the gas(es) you want to bump test. As shipped from the factory, the standard 4 gases (combustible gas, O₂, CO, and H₂S) are assigned to Cylinder A.



NOTE: If a H₂-compensated CO sensor is installed, H₂ is assigned to Cylinder D but there is no reason to bump test the H₂ response. Toxic sensors are assigned to Cylinder D or Cylinder E.

9. Press **POWER**. The **Apply Cylinder A** prompt appears.



10. Make sure the Eagle 3 has been turned on for at least 45 seconds before continuing.
11. Connect the sample tubing from the demand flow regulator to the Eagle 3's connected probe then quickly press **POWER** to begin the bump test countdown.
12. The gas readings flash and the bottom of the screen displays **Bump Test, Apply Gas**, and a countdown defined by the **GasTime** menu item in **Setup Mode** (see page 172).

NOTE: To return to the **Calibration Mode** menu without performing the bump test, press **AIR** and **POWER** together.

♥ Cal Mode		8:48	 
CH ₄ %LEL	O ₂ %	CO ppm	
0	0.0	-400	
H ₂ S ppm	HC %LEL		
0.0			
Bump Test		Apply Gas	29

13. At the end of the countdown, the instrument analyzes the results. Follow the flow chart to determine the bump test outcome.

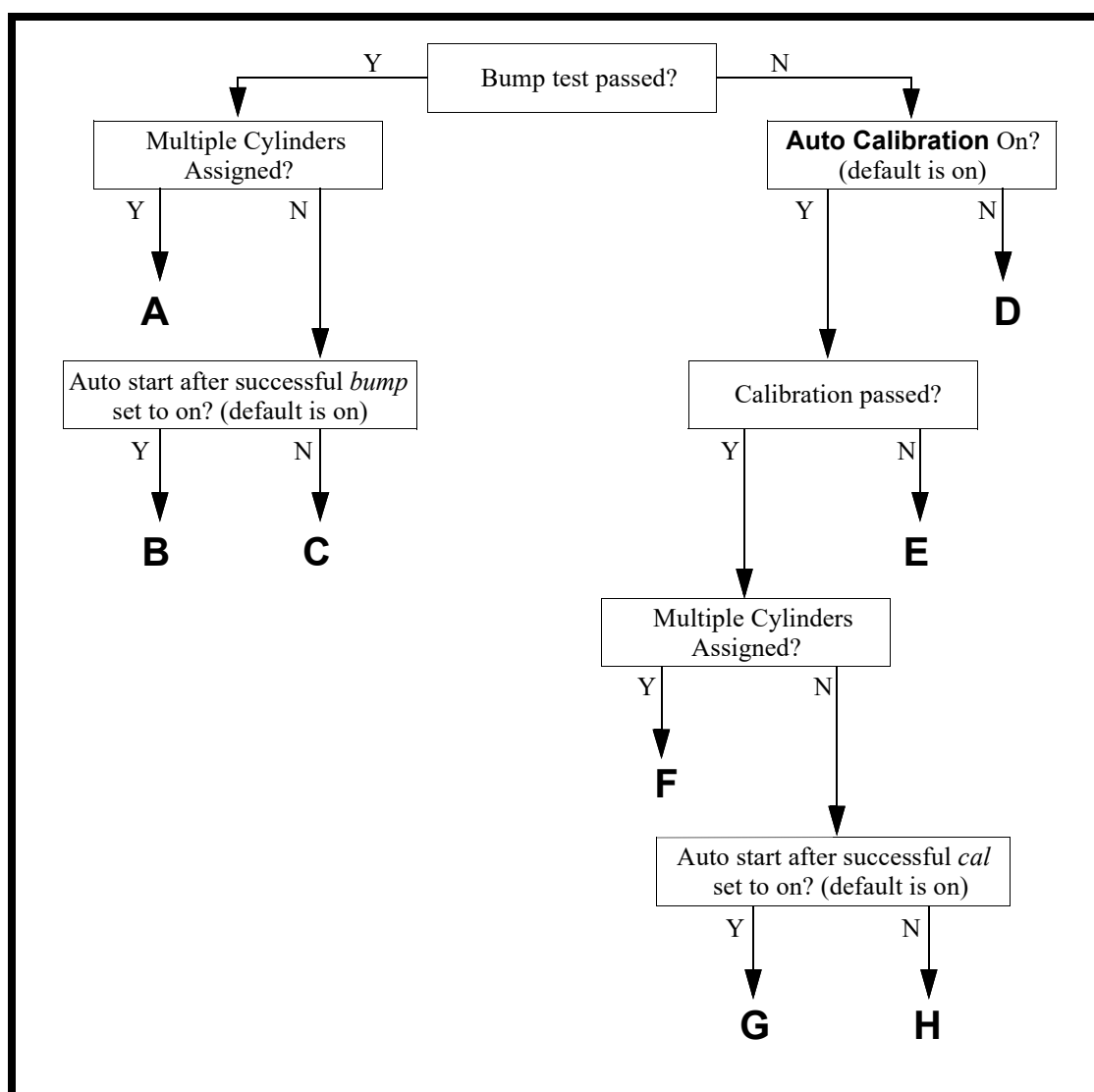


Figure 15: Bump Test Flow Chart

Option A from Flow Chart	Option B from Flow Chart	Option C from Flow Chart
<ul style="list-style-type: none"> • Bump test passed • Multiple cylinders assigned 	<ul style="list-style-type: none"> • Bump test passed • One cylinder assigned • Bump Auto Start set to On (factory setting) 	<ul style="list-style-type: none"> • Bump test passed • One cylinder assigned • Bump Auto Start set to Off (factory setting is On)
<p>1. The instrument indicates that all channels passed the bump test. Press AIR or RANGE to scroll between the bump test results and the bump test gas readings.</p> <div> <p>The diagram illustrates the navigation between two screens. The top screen, titled 'Cal Mode' with a time of 8:48 and a battery icon, displays 'Bump Test Result' with 'P' for all channels (CH4 %LEL, O2 %, CO ppm, H2S ppm, HC %LEL). A double-headed vertical arrow indicates scrolling, with a button labeled 'AIR YES' pointing upwards. The bottom screen, also titled 'Cal Mode' with 8:48 and a battery icon, displays 'Bump Test Readings' with numerical values: CH4 %LEL 36, O2 % 0.0, CO ppm 0, H2S ppm 0.0, and HC %LEL blank.</p> </div> <ol style="list-style-type: none"> 2. Disconnect the tubing from the probe. 3. Press POWER to move to the Bump Test Cylinder X screen for the next cylinder. 4. Unscrew the regulator from the first cylinder and screw it into the next cylinder. 5. Repeat Step 11 through Step 13. 6. Disconnect the sample tubing from the probe. 7. Press POWER to enter Normal Mode. 	<p>1. The instrument indicates that all channels passed the bump test. Press AIR or RANGE to scroll between the bump test results and the bump test gas readings.</p> <div> <p>The diagram illustrates the navigation between two screens. The top screen, titled 'Cal Mode' with a time of 8:48 and a battery icon, displays 'Bump Test Result' with 'P' for all channels (CH4 %LEL, O2 %, CO ppm, H2S ppm, HC %LEL). A double-headed vertical arrow indicates scrolling, with a button labeled 'AIR YES' pointing upwards. The bottom screen, also titled 'Cal Mode' with 8:48 and a battery icon, displays 'Bump Test Readings' with numerical values: CH4 %LEL 36, O2 % 0.0, CO ppm 0, H2S ppm 0.0, and HC %LEL blank.</p> </div> <ol style="list-style-type: none"> 2. Disconnect the tubing from the probe. 3. Unscrew the regulator from the calibration cylinder. 4. Press POWER to enter Normal Mode. 	<p>1. The instrument indicates that all channels passed the bump test. Press AIR or RANGE to scroll between the bump test results and the bump test gas readings.</p> <div> <p>The diagram illustrates the navigation between two screens. The top screen, titled 'Cal Mode' with a time of 8:48 and a battery icon, displays 'Bump Test Result' with 'P' for all channels (CH4 %LEL, O2 %, CO ppm, H2S ppm, HC %LEL). A double-headed vertical arrow indicates scrolling, with a button labeled 'AIR YES' pointing upwards. The bottom screen, also titled 'Cal Mode' with 8:48 and a battery icon, displays 'Bump Test Readings' with numerical values: CH4 %LEL 36, O2 % 0.0, CO ppm 0, H2S ppm 0.0, and HC %LEL blank.</p> </div> <ol style="list-style-type: none"> 2. Disconnect the tubing from the probe. 3. Unscrew the regulator from the calibration cylinder. 4. Press POWER to move to the Normal Operation screen in the Bump Test menu. 5. Press POWER to enter Normal Mode.

Option D from Flow Chart	Option E from Flow Chart	Option F from Flow Chart
<ul style="list-style-type: none">Bump test failedAuto Calibration set to Off (factory setting is On)	<ul style="list-style-type: none">Bump test failedAuto Calibration set to On (factory setting)Calibration failed	<ul style="list-style-type: none">Bump test failedAuto Calibration set to On (factory setting)Calibration passedMultiple cylinders assigned
<p>1. The instrument shows which channels passed or failed the bump test. The LEDs flash and the buzzer sounds. Press AIR or RANGE to scroll between the results and the readings.</p> <div><div><div>Cal Mode8:48</div><div>CH₄ %LEL O₂ % CO ppm</div><div>P F F F</div><div>H₂S ppm HC %LEL</div><div>F</div><div>Bump TestResult</div></div><div><div>AIR YES</div><div>RANGE SHIFT</div></div><div><div>Cal Mode8:48</div><div>CH₄ %LEL O₂ % CO ppm</div><div>36 0.0 0</div><div>H₂S ppm HC %LEL</div><div>0.0</div><div>Bump TestReadings</div></div></div> <p>2. Disconnect the tubing from the probe.</p> <p>3. Unscrew the regulator from the calibration cylinder.</p> <p>4. Press POWER to return to the Bump Test Cylinder X screen.</p> <p>5. Press POWER to return to the Bump Test menu.</p> <p>6. Press RANGE to scroll to Normal Operation and press POWER to enter Normal Mode.</p> <p>7. Calibrate the Eagle 3 as soon as possible.</p>	<p>1. A calibration immediately and automatically starts. Continue to apply the calibration gas.</p> <p>2. The calibration time is the difference between the GasTime and the Cal Time values defined in the Bump Settings menu item in Setup Mode.</p> <div><div><div>MAINT60</div><div>CH₄ %LEL H₂S ppm</div><div>30 2.0</div><div>AUTO CALAPPLY GAS</div></div></div> <p>3. The instrument shows which channels passed or failed the bump test/ calibration. The LEDs flash and the buzzer sounds. Press AIR or RANGE to scroll between the results and the readings.</p> <div><div><div>Cal Mode8:48</div><div>CH₄ %LEL O₂ % CO ppm</div><div>P F F F F F</div><div>H₂S ppm HC %LEL</div><div>F F</div><div>Bump/Auto Calibration Result</div></div><div><div>AIR YES</div><div>RANGE SHIFT</div></div><div><div><div>MAINT7:49</div><div>CH₄ %LEL CO ppm H₂S ppm</div><div>30 47 2.0</div><div>O₂ %</div><div>11.9</div><div>BUMP TEST</div></div><div><div>AIR YES</div></div><div><div><div>MAINT7:49</div><div>CH₄ %LEL H₂S ppm</div><div>47 2.5</div><div>AUTO CAL</div></div></div></div><p>4. Disconnect the tubing from the probe.</p><p>5. Unscrew the regulator from the calibration cylinder.</p><p>6. Press POWER to return to the Bump Test menu.</p><p>7. Press RANGE to scroll to Normal Operation and press POWER to enter Normal Mode.</p></div>	<p>1. A calibration immediately and automatically starts. Continue to apply the calibration gas.</p> <p>2. The calibration time is the difference between the GasTime and the Cal Time values defined in the Bump Settings menu item in Setup Mode.</p> <div><div><div>MAINT60</div><div>CH₄ %LEL H₂S ppm</div><div>30 2.0</div><div>AUTO CALAPPLY GAS</div></div></div> <p>3. The instrument shows which channels passed or failed the bump test/ calibration. Press AIR or RANGE to scroll between the results and the readings.</p> <div><div><div>Cal Mode8:48</div><div>CH₄ %LEL O₂ % CO ppm</div><div>P P F P</div><div>H₂S ppm HC %LEL</div><div>F P</div><div>Bump/Auto Calibration Result</div></div><div><div>AIR YES</div></div><div><div><div>MAINT7:49</div><div>CH₄ %LEL CO ppm H₂S ppm</div><div>30 47 12.0</div><div>O₂ %</div><div>11.9</div><div>BUMP TEST</div></div><div><div>AIR YES</div></div><div><div><div>MAINT7:49</div><div>CH₄ %LEL H₂S ppm</div><div>47 20.5</div><div>AUTO CAL</div></div></div></div><p>4. Disconnect the tubing from the probe.</p><p>5. Press POWER to move to the Bump Test Cylinder X screen for the next cylinder.</p><p>6. Unscrew the regulator from the first cylinder and screw it into the next cylinder.</p><p>7. Repeat Step 11 through Step 13.</p><p>8. Press AIR to scroll to Normal Operation screen and press POWER to enter Normal Mode.</p></div>

Option G from Flow Chart	Option H from Flow Chart
<ul style="list-style-type: none"> • Bump test failed • Auto Calibration set to On (factory setting) • Calibration passed • One cylinder assigned • Bump Auto Start set to On (factory setting) 	<ul style="list-style-type: none"> • Bump test failed • Auto Calibration set to On (factory setting) • Calibration passed • One cylinder assigned • Bump Auto Start set to Off (factory setting is On)
<ol style="list-style-type: none"> 1. A calibration immediately and automatically starts. Continue to apply the calibration gas. 2. The calibration time is the difference between the GasTime and the Cal Time values defined in the Bump Settings menu item in Setup Mode. <div> </div> 3. The instrument shows which channels passed or failed the bump test/calibration. Press AIR or RANGE to scroll between the results and the readings. <div> </div> <div> <p>↑ AIR ↓</p> </div> <div> </div> <div> <p>↑ AIR ↓</p> </div> <div> </div> 4. Disconnect the tubing from the probe. 5. Unscrew the regulator from the calibration cylinder. 6. Press POWER to enter Normal Mode. 	<ol style="list-style-type: none"> 1. A calibration immediately and automatically starts. Continue to apply the calibration gas. 2. The calibration time is the difference between the GasTime and the Cal Time values defined in the Bump Settings menu item in Setup Mode. <div> </div> 3. The instrument shows which channels passed or failed the bump test/calibration. Press AIR or RANGE to scroll between the results and the readings. <div> </div> <div> <p>↑ AIR ↓</p> </div> <div> </div> <div> <p>↑ AIR ↓</p> </div> <div> </div> 4. Disconnect the tubing from the probe. 5. Unscrew the regulator from the calibration cylinder. 6. Press POWER to return to the Bump Settings menu. Scroll to the Normal Mode menu item. 7. Press POWER to enter Normal Mode.

Performing a Calibration

CO₂ Zero Calibration

Should note when this appears (only with instruments that have a CO₂ sensor installed)

Performing a TE Zero Calibration

Should note when this appears (only with instruments that have a TE sensor installed)

Auto Calibration Method

Preparing for a Calibration

- To fully calibrate the sensors, you must do a fresh air adjustment (**Air Calibration**) and a span adjustment (**Auto Calibration**).
- Bump test the instrument before each day's use with a known concentration of each target gas. A bump test can be done in Calibration Mode's **Bump Test** item or by applying gas in Normal Mode. The instrument does not need to be calibrated unless it does not pass the User Mode bump test or does not respond appropriately, as defined by the user, in Normal Mode.
- The hydrogen response for the H₂-compensated CO sensor needs to be calibrated both monthly and when the sensor is replaced.

Calibration Supplies and Equipment

To calibrate the Eagle 3, the following items are required:

- Known calibrating samples of the gases being detected

Channel	Min. Cal. Gas Concentration	Max. Cal. Gas Concentration
Combustible Gas	1% LEL	75% LEL
Oxygen	0.0%	17.0%
Carbon Monoxide	0 ppm	2,000 ppm
Hydrogen Sulfide	0.0 ppm	200.0 ppm

- Demand flow regulator

WARNING: For instruments with chlorine (Cl₂) sensors, RKI Instruments, Inc. recommends using a dedicated regulator for Cl₂ gas only and not using it with any other gases, particularly hydrogen sulfide (H₂S).

- Non-absorbent tubing

NOTE: The catalytic combustible channel can be set up for and calibrated to a number of different combustible gases. See page 135 for instructions. Be sure to use an appropriate calibration cylinder for the target gas of the catalytic combustible channel.

CAUTION: *When using auto calibration with the standard 4-gas Eagle 3, although the Eagle 3 can be calibrated with an oxygen concentration of up to 17.0%, RKI Instruments, Inc. recommends that the multi-gas cylinder have an oxygen concentration in the range of 10% - 16% oxygen.*

- A 24-inch humidifier tube if you are calibrating the catalytic combustible channel with a gas concentration of 1000 ppm or lower



WARNING: *If you are using a calibration kit that includes a gas bag and a fixed flow regulator or dispensing valve, do not apply gas directly to the Eagle 3 with the regulator or dispensing valve or damage to the pump will result. See “Appendix A: Calibrating with a Sample Bag” on page 109 for instructions to properly use a gas bag kit.*

Performing an Air Calibration

NOTE: For calibration of CO₂ sensors, proceed to “CO₂ Zero Calibration” on page 85 for zero adjustment.

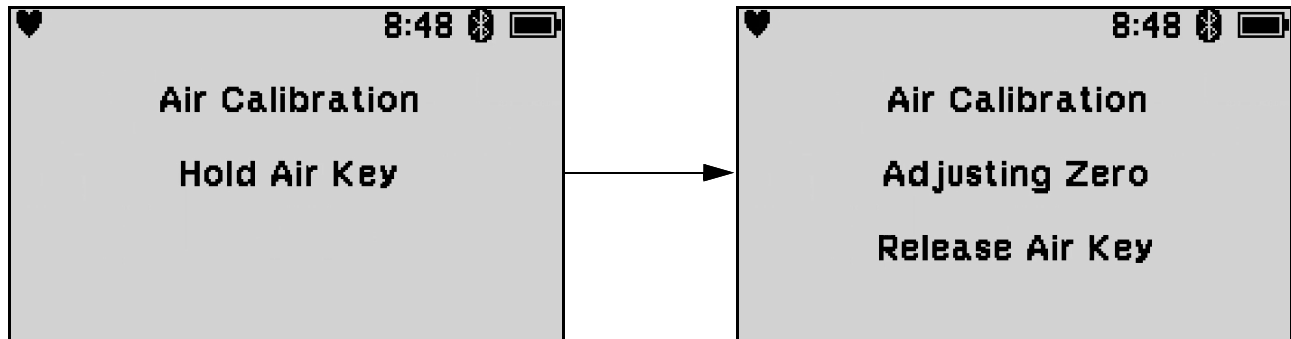
NOTE: For calibration of TE sensors, proceed to “Performing a TE Zero Calibration” on page 85 for zero adjustment.

1. Find a fresh air environment, an environment of normal oxygen content (20.9%) that is free of toxic and combustible gases.
2. While in Calibration Mode, press **AIR** or **RANGE** to scroll to **Air Calibration**.
3. Press **POWER**. The **Air Calibration** screen appears.

♥ Cal Mode		8:48		
CH ₄ %LEL	O ₂ %	CO ppm		
17	0.0	-400		
H ₂ S ppm	HC %LEL			
0.0	0.0			
Air Calibration				

4. Make sure the Eagle 3 has been turned on for at least 45 seconds before continuing.

5. Press **POWER** to begin the fresh air adjustment.
6. Press and hold **AIR** until the screen prompts you to release it.

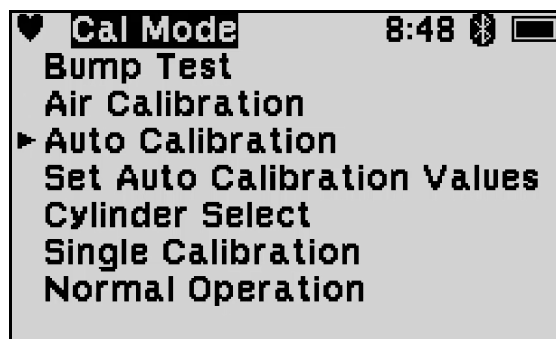


7. If all channels pass the fresh air adjustment, the instrument returns to the **Calibration Mode** menu.



If the fresh air adjustment fails, “**Fail**” displays for the channel(s) that failed. Press **POWER** to acknowledge the failure. See “Troubleshooting” on page 96.

Performing an Auto Calibration

1. Find a fresh air environment, an environment of normal oxygen content (20.9%) that is free of toxic and combustible gases.
2. Install the demand flow regulator onto the calibration cylinder.
3. Connect the sample tubing to the demand flow regulator.
4. Install the probe on the Eagle 3 inlet fitting. Make sure the probe is complete with internal O-ring and membrane and that the two halves of the probe are tightened firmly together to avoid leaks that can affect the calibration. See Figure 17 on page 99 for an illustration of the internal parts of the probe.
5. While in Calibration Mode, press **AIR** or **RANGE** to scroll to **Auto Calibration**.





- Press **POWER**. The **Auto Calibration** screen shows the gases assigned to Cylinder A and their assigned calibration values (see page 90 if the calibration values do not match the calibration gas cylinder's concentrations).

♥ Cal Mode 8:48  		
CH ₄ %LEL 50	O ₂ % 12.0	CO ppm 50
H ₂ S ppm 25.0		
Auto Calibration Cylinder A		

- If necessary, use **AIR** to scroll to the Auto Calibration screen for the gas(es) you want to calibrate. As shipped from the factory, the standard 4 gases (combustible gas, O₂, CO, and H₂S) are assigned to Cylinder A.

NOTE: If an H₂-compensated CO sensor is installed, H₂ is assigned to Cylinder D. Toxic sensors are assigned to Cylinder D or Cylinder E.

- Make sure the Eagle 3 has been turned on for at least 45 seconds before continuing.
- Press **POWER** and connect probe to the sample tubing.

♥ 8:48  		
CH ₄ %LEL -1	O ₂ % Fail	CO ppm 0
H ₂ S ppm 0.0	HC %LEL	
Auto Calibration Apply Gas		

- If the fresh air adjustment passes, “**Pass**” appears on screen, then the instrument displays the **MIN** and **MAX SPAN** screens for 2 seconds each.

If the fresh air adjustment fails, “**Fail**” flashes for the channel(s) that failed. Press **POWER** to acknowledge the failure and view the reading(s) that failed. See “Troubleshooting” on page 96.

Single Calibration Method

Single Calibration allows one channel to be calibrated at a time. This is useful if you only want to calibrate one or two channels.

Preparing for a Calibration

- To fully calibrate the sensors, you must do a fresh air adjustment (**Air Calibration**) and a span adjustment (**Auto Calibration**).

- Bump test the instrument before each day's use with a known concentration of each target gas. A bump test can be done in Calibration Mode's **Bump Test** item or by applying gas in Normal Mode. The instrument does not need to be calibrated unless it does not pass the User Mode bump test or does not respond appropriately, as defined by the user, in Normal Mode.
- The hydrogen response for the H₂-compensated CO sensor needs to be calibrated both monthly and when the sensor is replaced.

Calibration Supplies and Equipment

To calibrate the Eagle 3, the following items are required:

- Known calibrating samples of the gases being detected

Channel	Min. Cal. Gas Concentration	Max. Cal. Gas Concentration
Combustible Gas	1% LEL	75% LEL
Oxygen	0.0%	17.0%
Carbon Monoxide	0 ppm	2,000 ppm
Hydrogen Sulfide	0.0 ppm	200.0 ppm

- Demand flow regulator

WARNING: *For instruments with chlorine (Cl₂) sensors, RKI Instruments, Inc. recommends using a dedicated regulator for Cl₂ gas only and not using it with any other gases, particularly hydrogen sulfide (H₂S).*

- Non-absorbent tubing

NOTE: The catalytic combustible channel can be set up for and calibrated to a number of different combustible gases. See page 135 for instructions. Be sure to use an appropriate calibration cylinder for the target gas of the catalytic combustible channel.

CAUTION: *When using auto calibration with the standard 4-gas Eagle 3, although the Eagle 3 can be calibrated with an oxygen concentration of up to 17.0%, RKI Instruments, Inc. recommends that the multi-gas cylinder have an oxygen concentration in the range of 10% - 16% oxygen.*

- A 24-inch humidifier tube if you are calibrating the catalytic combustible channel with a gas concentration of 1000 ppm or lower

WARNING: *If you are using a calibration kit that includes a gas bag and a fixed flow regulator or dispensing valve, do not apply gas directly to the Eagle 3 with the regulator or dispensing valve or damage to the pump will result. See "Appendix A: Calibrating with a Sample Bag" on page 109 for instructions to properly use a gas bag kit.*

Performing an Air Calibration

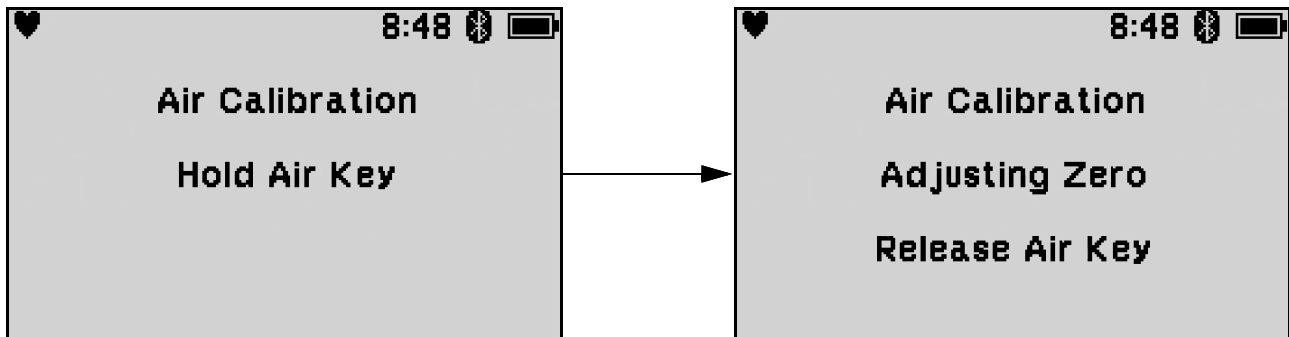
NOTE: For calibration of CO₂ sensors, proceed to “” for zero adjustment.

NOTE: For calibration of TE sensors, proceed to “” for zero adjustment.

1. Find a fresh air environment, an environment of normal oxygen content (20.9%) that is free of toxic and combustible gases.
2. While in Calibration Mode, press **AIR** or **RANGE** to scroll to **Air Calibration**.
3. Press **POWER**. The **Air Calibration** screen appears.

♥ Cal Mode 8:48		
CH ₄ %LEL	O ₂ %	CO ppm
17	0.0	-400
H ₂ S ppm	HC %LEL	
0.0	0.0	
Air Calibration		

4. Make sure the Eagle 3 has been turned on for at least 45 seconds before continuing.
5. Press **POWER** to begin the fresh air adjustment.
6. Press and hold **AIR** until the screen prompts you to release it.



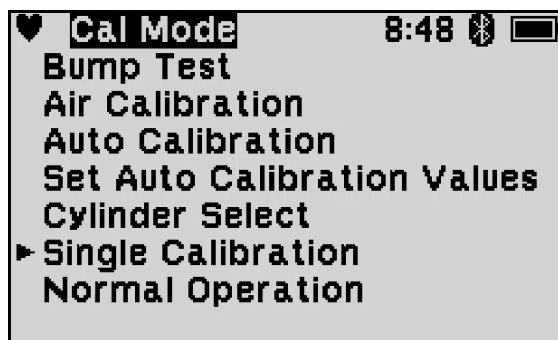
7. If the fresh air adjustment passes, the instrument returns to the **Calibration Mode** menu.

If the fresh air adjustment fails, “**Fail**” displays for the channel(s) that failed. Press **POWER** to acknowledge the failure. See “Troubleshooting” on page 96.

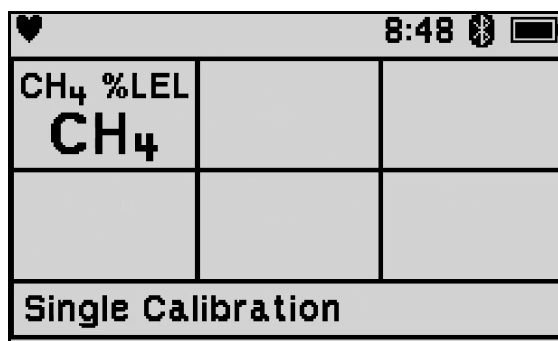
Performing a Single Calibration

1. Find a fresh air environment, an environment of normal oxygen content (20.9%) that is free of toxic and combustible gases.
2. Install the demand flow regulator onto the calibration cylinder.
3. Connect the sample tubing to the demand flow regulator.

- While in Calibration Mode, press **AIR** or **RANGE** to scroll to **Single Calibration** menu item.



- Press **POWER**. The **Single Calibration** screen shows the first channel's target gas (see page 92 if the calibration values do not match the calibration gas cylinder's concentrations).

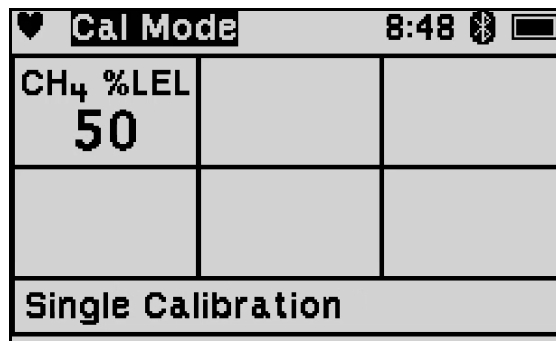


- If necessary, use **AIR** to scroll to the gas you want to bump test.

NOTE: If a H₂-compensated CO sensor is installed, H₂ is assigned to Cylinder D but there is no reason to bump test the H₂ response. Toxic sensors are assigned to Cylinder D or Cylinder E.

- Make sure the Eagle 3 has been turned on for at least 45 seconds before continuing.
- Install the probe on the Eagle 3 inlet fitting. Make sure the probe is complete with internal O-ring and membrane and that the two halves of the probe are tightened firmly together to avoid leaks that can affect the calibration. See Figure 17 on page 99 for an illustration of the internal parts of the probe.

9. Allow the calibration gas to flow until the reading stabilizes, then press **POWER** to confirm the reading.



10. If the single calibration passes, “**Pass**” appears on screen, then the instrument displays the **MIN** and **MAX SPAN** screens for 2 seconds each.

If the fresh air adjustment fails, “**Fail**” flashes for the channel that failed. Press **POWER** to acknowledge the failure. See “Troubleshooting” on page 96.

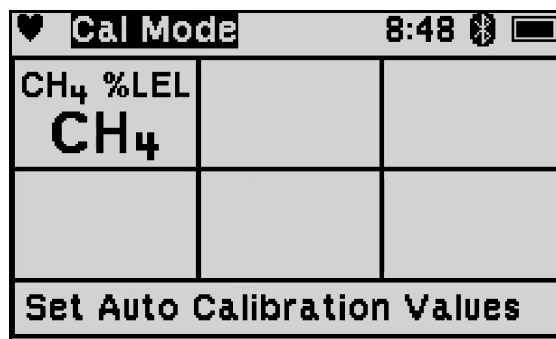
NOTE: The **MIN/MAX SPAN** parameter in **Setup Mode** must be enabled (factory setting is **OFF**) to have the adjustment range display after a span adjustment. See page 166 for changing this parameter.

Setting Auto Calibration Values

Use this menu to adjust the calibration values that are used during bump test and calibrations.

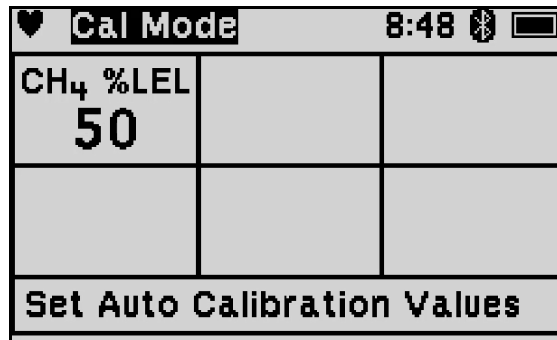
You can also update auto calibration settings in **Setup Mode**. Updating the auto calibration gas values in Calibration Mode is normally done when performing a calibration. Updating these settings in Setup Mode allows you to update the settings without performing a calibration.

1. While in Calibration Mode, press **AIR** or **RANGE** to scroll to **Set Auto Calibration Values**.
2. Press **POWER**. The **Set Auto Calibration Values** screen appears.



3. Press **AIR** or **RANGE** to scroll to the desired channel.

4. Press **POWER**. The channel's auto calibration value flashes, indicating it can be adjusted.



5. Use **AIR** and **RANGE** to adjust the auto calibration value to the desired value.
6. Press **POWER** button to save the value.
7. Repeat Step 3 - Step 6 for each auto calibration value you want to change.
If you want to return to the main menu at any time without saving any changes, press the **DISPLAY** button until you return to the main menu.
8. To exit the **Set Auto Calibration Values** screen:
 - a. Press **RANGE** to scroll to **Escape**.
 - b. Press **POWER** to return to the Calibration Mode menu.
9. To exit Calibration Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Making Cylinder Selections

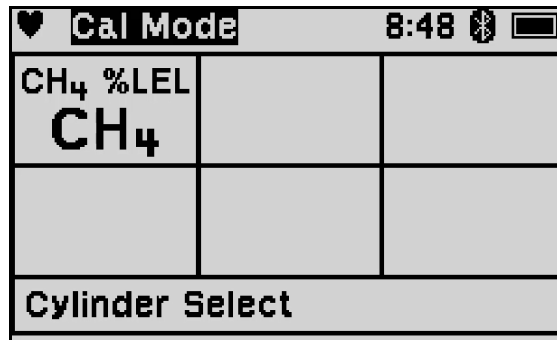
The **Cylinder Select** menu item allows you to group channels together for calibration. As shipped from the factory, the standard 4 channels (combustible gas, O₂, H₂S, and CO) are assigned to Cylinder A.

There are 5 cylinder assignments available: A, B, C, D, and E. To automatically calibrate each channel separately, assign each channel to a different cylinder (ie. Cylinder A: combustible gas, Cylinder B: O₂, Cylinder C: H₂S, Cylinder D: CO).

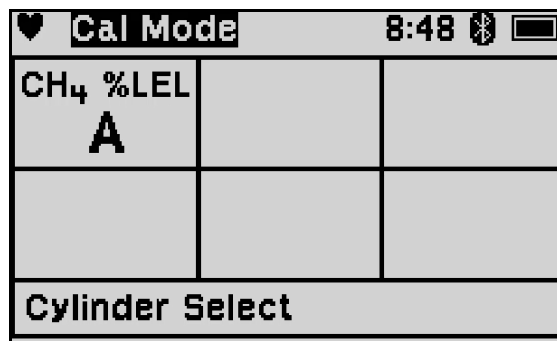
NOTE: As shipped from the factory, the H₂ response for the H₂-compensated CO sensor is assigned to Cylinder D.

1. While in Calibration Mode, press **AIR** or **RANGE** to scroll to **Cylinder Select**.

2. Press **POWER** mode to select the menu item. The **Cylinder Select** screen appears.



3. Press **POWER** mode to select the menu item. The channel's cylinder assignment is displayed and flashes.

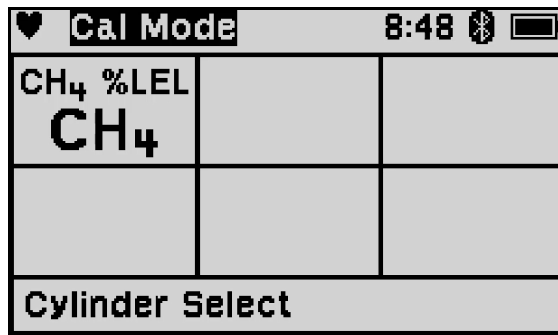


4. Press **AIR** or **RANGE** to scroll between cylinder assignments A - E.
5. Press **POWER** mode to save the setting and displays the channel that was to the **Cylinder Select** screen.
6. To exit the **Cylinder Select** screen:
- Press **RANGE** to scroll to **Escape**.
 - Press **POWER** to return to the Calibration Mode menu.
7. To exit Calibration Mode:
- Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - Press **POWER** to enter Normal Mode and begin the warmup sequence.

Entering Normal Mode

The **Normal Operation** menu item allows you to return to Normal Mode if the instrument was in use before calibration or begin the warmup sequence if it was turned on just before calibration.

1. While in Calibration Mode, press **AIR** or **RANGE** to scroll to **Normal Operation**.



2. Press **POWER** mode to select the menu item. The instrument begins the warmup sequence or returns to Normal Mode if used prior to entering **Calibration Mode**.

Chapter 6: Maintenance

Overview

This chapter describes troubleshooting procedures for the Eagle 3. It also includes procedures for replacing and recharging the batteries as well as replacing other consumable parts.

WARNING: *RKI Instruments, Inc. recommends that service, calibration, and repair of RKI instruments be performed by personnel properly trained for this work. Replacing sensors and other parts with original equipment does not affect the intrinsic safety of the instrument.*

Troubleshooting

The troubleshooting table describes error messages, symptoms, probable causes, and recommended actions for problems that may arise when using the Eagle 3.

Table 15: Troubleshooting

Symptoms	Probable Causes	Recommended Action
<ul style="list-style-type: none">The LCD is blank.	<ul style="list-style-type: none">The unit may have been turned off.The lithium-ion battery pack needs to be recharged.	<ol style="list-style-type: none">To turn on the unit, press and briefly hold POWER.If the unit does not turn on, recharge the lithium-ion battery pack.If the difficulties continue, contact RKI Instruments, Inc. for further instruction.
<ul style="list-style-type: none">The LCD shows abnormally high or low readings but other gas detection instruments do not.	<ul style="list-style-type: none">The Eagle 3 may need to be recalibrated.The sensor for the affected channel(s) may need replacement.	<ol style="list-style-type: none">Recalibrate the unit.If the difficulties continue, replace the sensor for the affected channel(s) and calibrate the affected channel(s).If the difficulties continue, contact RKI Instruments, Inc. for further instruction.
<ul style="list-style-type: none">The unit indicates flow failure and does not recover when POWER is pressed.	<ul style="list-style-type: none">The probe tube is clogged.The hydrophobic filter disk in the probe is dirty.The sample hose has a kink or obstruction.The internal hydrophobic filter is dirty.The pump is malfunctioning.	<ol style="list-style-type: none">Inspect the probe tube for any obstructions.Inspect the hydrophobic filter disk in the probe and replace if necessary.Inspect the sample hose for kinks or obstructions and replace if necessary.Inspect the internal hydrophobic filter and replace if necessary.If difficulties continue, contact RKI Instruments, Inc. for further instruction.

Table 15: Troubleshooting

Symptoms	Probable Causes	Recommended Action
<ul style="list-style-type: none"> Auto or Single Calibration fails. 	<ul style="list-style-type: none"> The auto calibration values may not match the cylinder gas concentrations (auto calibration only). The charcoal filter is saturated causing an elevated CO reading. The sample gas is not reaching the sensors because of a bad connection. The calibration cylinder may be out of gas or is outdated. The sensor for the affected channel(s) may need replacement. 	<ol style="list-style-type: none"> 1. Check all calibration tubing for leaks or for any bad connections. 2. Make sure the Eagle 3 has been properly set up for calibration. 3. Change the charcoal filter. 4. Verify that the calibration cylinder contains an adequate supply of fresh test sample. 5. If the fail condition continues, replace the sensor(s). 6. If the difficulties continue, contact RKI Instruments, Inc. for further instruction.
<ul style="list-style-type: none"> Display indicates “SYSTEM FAIL 12” during warmup. 	<ul style="list-style-type: none"> A memory error has occurred. 	<ol style="list-style-type: none"> 1. Press and hold the RANGE button, then press DISPLAY. The Enter Password Screen will appear. 2. Enter the password, “1994”, to proceed to the Set Default Screen. 3. Press AIR twice to restore the defaults. See page 203 for a description of issues to consider when restoring the defaults. 4. If difficulties continue, contact RKI Instruments, Inc. for further instruction.

Recharging the Eagle 3

WARNING: To prevent ignition of a hazardous atmosphere, batteries must only be charged in an area known to be nonhazardous.

Charge the batteries when the Eagle 3 indicates that it is in low battery warning. When in low battery warning, BATT appears vertically along the left side the LCD.

CH4	0% LEL
B OXY	20.9vol%
A H2S	0.0ppm
T CO	0ppm
T	

CAUTION: Use with Li-ion battery p/n 49-1631. Charge only with RKI charger model 49-2175RK, 49-2176RK, or 49-2177RK. Use of other rechargeable batteries or chargers or charging of other rechargeable batteries in the Eagle 3 will void the warranty.

1. Plug the power adapter into either an AC outlet.
2. Make sure the Eagle 3 is off.
3. Make sure the adapter and module are connected.
4. Insert and slide the power connector along the grooves of the Eagle 3's external charging contacts located on the right side of the bottom case.



Figure 16: Connecting the Charger to the Eagle 3

5. While the batteries are charging, the LED indicator will be amber.
6. The charging module has an internal timeout feature set at 9.5 hours. A full charge should be reached in less than 9.5 hours. When a full charge has been reached, the LED indicator will be green.
7. If charging should fail, the green indicator LED will be off and the amber one will be blinking.

Replacing the Hydrophobic Probe's Particle Filter and Hydrophobic Filter Disk

Inspect the probe's internal components if you notice that the Eagle 3's pump sounds bogged down or if an unexplained low flow alarm occurs. Replace the particle filter if it appears to be dirty. Replace the hydrophobic filter disk if it appears dirty or saturated with liquid. Replace the O-rings in the probe if either of them appears damaged.

1. Grasp each end of the clear probe body firmly and unscrew the two halves from each other. One half includes a plastic tube fitting and the probe tube. The other half includes a metal fitting that mates with the Eagle 3 inlet fitting.

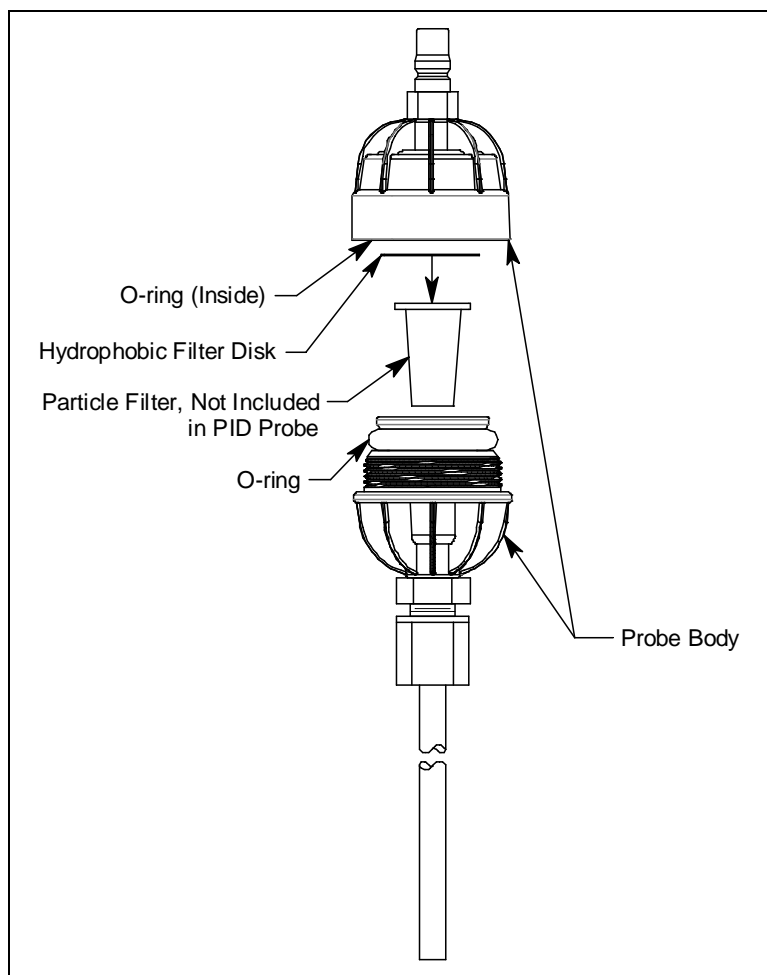


Figure 17: Replacing the Probe's Filters

2. Remove the white hydrophobic filter disk from the top of the particle filter or from the probe body.
3. Remove the particle filter from the probe body.
4. Clean the inside of the probe body if necessary.

5. Hold the probe half that has the plastic tube fitting and the probe tube with the fitting and tube facing down.
6. Place the new cone-shaped particle filter into the probe body so that the wide part of the filter is facing up.

NOTE: Do not install the particle filter into a probe intended to be used with a PID Eagle 3.

7. Place the new filter disk flat on top of the particle filter. Make sure it is centered over the particle filter.
8. Carefully screw the other half of the probe body onto the half with the particle filter and filter disk while keeping the probe oriented vertically to keep the disk centered.
9. When you feel the O-ring being compressed, grasp both ends of the probe and tighten them together very firmly to ensure a seal.

Testing the Probe Filter Seal

To test the probe's seal, do the following:

1. Install the probe on the Eagle 3.
2. Warmup the Eagle 3.
3. Confirm that a low flow alarm occurs when you cover the end of the probe tube with your finger.
4. If a low flow alarm does not occur, hand tighten the probe further.
If a low flow alarm still does not occur when you cover the probe tube with your finger, disassemble the probe, inspect the placement of the O-rings and filter disk, reassemble the probe, and re-test it.

Replacing the Hydrophobic Filter

Replace the hydrophobic filter inside the bottom case when it becomes dirty or clogged. An unexplained low flow alarm may indicate that the hydrophobic filter is dirty and needs to be replaced.

1. Verify that the Eagle 3 is off.
2. Place the Eagle 3 upside down on a flat surface or hold it upside down.
3. Unscrew the three case screws until they disengage from the top case. They are captive screws so they will not fall off of the bottom case.
4. Turn the Eagle 3 right side up and carefully lift the top case away from the bottom case. Be careful not to lift it so far that it pulls on the main PCB with the cable that connects the top case to the main PCB.

5. Lay the top case down next to the bottom case to allow access to the flow system.
6. Locate the hydrophobic filter. It is over the oxygen sensor. Note which side of the hydrophobic filter has the RKI logo and part number. This is the inlet side and should be facing toward the front of the Eagle 3.

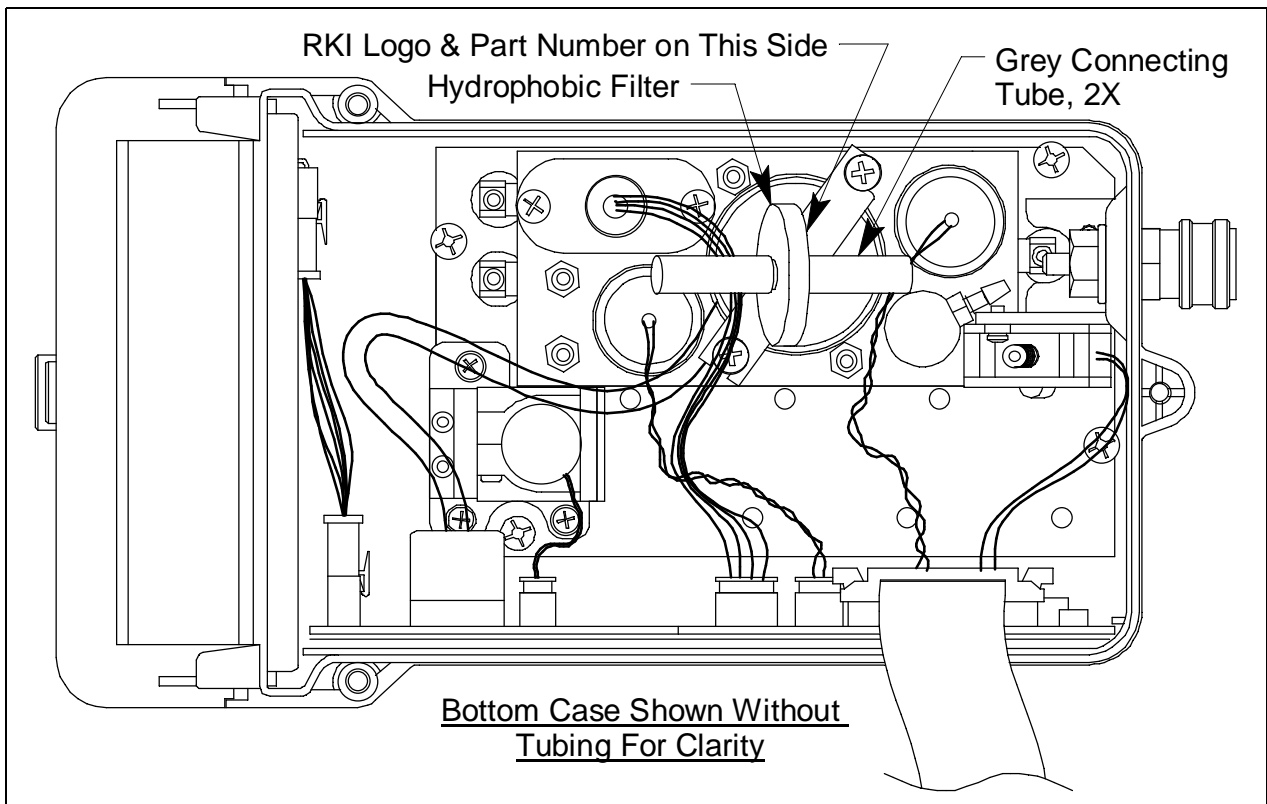


Figure 18: Replacing the Hydrophobic Filter

7. Pull the gray connecting tubes off of each end of the filter and remove it.
8. Install the new filter with the red RKI logo and part number on the inlet side of the flow chamber, facing the front of the Eagle 3. Make sure to push the grey connection tubes all the way onto the filter's hose barbs.
9. Confirm that the main PCB is seated in its slots and that its bottom edge is resting on the bottom of the bottom case. If the main PCB is not seated properly, then it may be damaged when the top case is re-installed.
10. Make sure that the top case gasket is fully seated in its groove and carefully put the top case back on the bottom case. If you have any difficulty mating the top and bottom cases, inspect the placement of the main PCB and the placement of the top case gasket.
11. Turn the Eagle 3 upside down and tighten the three case screws to secure the top case to the bottom case.

Replacing the Sensor Filters

CAUTION: *The sensors and filters are the only user-serviceable parts in the Eagle 3. Do not replace or modify any other part.*

Dual CO/H₂S Sensor Filter

The dual CO/H₂S sensor has a half black/half white filter installed over it. The filter should be replaced if you notice either 1) unexplained CO readings or 2) For users with a 1 ppm H₂S alarm setpoint: a drift on the H₂S channel's zero reading, unexplained H₂S readings, the filter appears dirty, or every 6 months (whichever is sooner).

CO-Only Sensor Filter

A black charcoal filter is installed over CO-only sensors. The filter should be replaced if you notice unexplained CO readings.

H₂S-Only Sensor Filter

A white humidity filter is installed over H₂S-only sensors. The filter absorbs humidity in the sampling environment to prevent unstable readings around 0 ppm H₂S. For users with a 1 ppm H₂S alarm setpoint, the filter should be replaced if you notice: a drift on the H₂S channel's zero reading, unexplained H₂S readings, the filter appears dirty, or every 6 months (whichever is sooner). For users with a 2 ppm or higher H₂S alarm setpoint, the filter does not necessarily ever need to be replaced.

Replacement Procedure

1. Verify that the Eagle 3 is off.
2. Turn the Eagle 3 upside down.
3. Use a small Phillips screwdriver to unscrew the three captive screws holding the bottom case to the top case.
4. Turn the Eagle 3 right side up and gently lift the top case from the rest of the instrument. Lay the top case down next to the bottom case to allow access to the flow system.
5. Locate the R sensor flow chamber mounted on the main PCB.
6. Unscrew the flow chamber's four screws and gently pull away from the main PCB.
7. Remove the filter gasket/sensor retainer assembly.
8. Remove the filter gasket/hydrophobic dust filter assembly.
9. Gently pry out the filter you want to replace.

10. Install the new filters.
 - a. Black and white combo filter for CO/H₂S dual sensor: The red side of the filter case should face toward the Eagle 3. The black filter material should face the edge of the Eagle 3 while the white filter material should face the H₂S scrubber disk.
 - b. Black filter for CO-only sensor: The red side of the filter case should face toward the Eagle 3.
 - c. White filter for H₂S-only sensor: The white side of the filter case should face toward the Eagle 3.
11. Reinstall the filter gasket/hydrophobic dust filter assembly onto the sensor retainer.
12. Screw the flow chamber screws into the main PCB.
13. Place the top case back over the bottom case and screw the case screws.
14. Perform a bump test as described on page 78 to confirm good operation.

Checking the Combustible Gas Sensor's Condition

If you suspect that the combustible sensor has been contaminated or may be reaching the end of its operational life, do the following to confirm it is still operating properly:

1. Perform a calibration using single calibration as described in “Single Calibration Method” on page 88.
2. When performing a span adjustment, note the adjustment range on the **MIN** and **MAX SPAN** result screens as described in Step 10 on page 92.

NOTE: The **MIN/MAX SPAN** parameter in **Setup Mode** must be enabled (factory setting is **OFF**) to have the adjustment range display after a span adjustment. See page 166 for changing this parameter.

3. A new sensor can typically be adjusted to more than twice the calibration gas concentration. If the result screen indicates that the Eagle 3 could not adjust the combustible gas reading to be at least 10% higher than the calibration gas concentration, then the sensor should be replaced as soon as possible.

Sensor Replacement

Replacing an O₂, CO, or H₂S Sensor

1. Verify that the Eagle 3 is off.
2. Place the Eagle 3 upside down on a flat surface or hold it upside down.

3. Unscrew the three case screws until they disengage from the top case. They are captive screws so they will not fall off of the bottom case.
4. Turn the Eagle 3 right side up and carefully lift the top case away from the bottom case. Be careful not to lift it so far that it pulls on the main PCB with the cable that connects the top case to the main PCB.
5. Lay the top case down next to the bottom case to allow access to the flow system.
6. Locate the sensor you want to replace and remove it from the flow chamber.

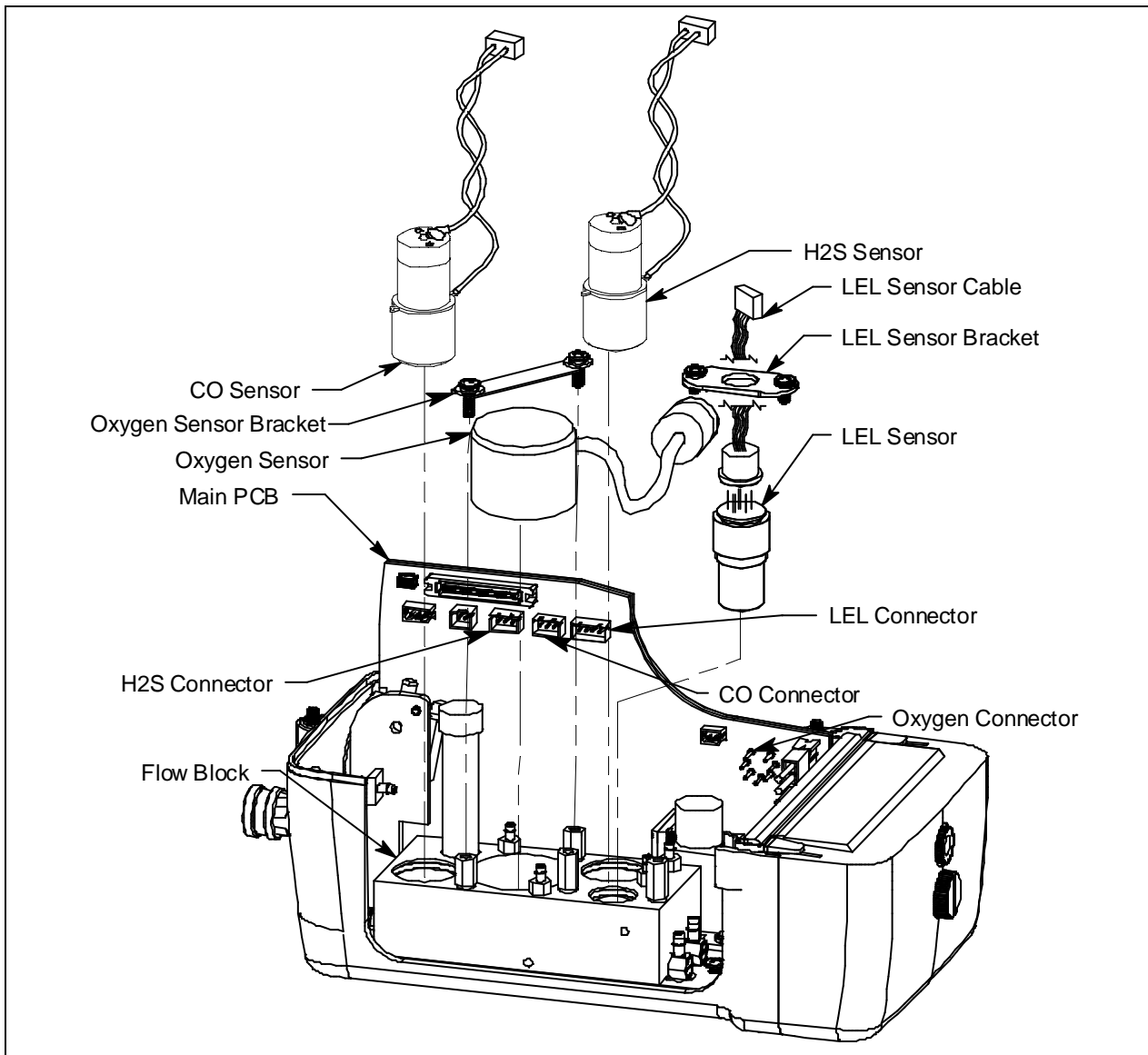


Figure 19: Replacing a Sensor

7. Removing the LEL Sensor

- a. Unscrew and remove the two screws that hold down the LEL sensor bracket.
- b. Grasp the LEL sensor connector and gently pull it up until it either disengages from the LEL sensor or the LEL sensor comes out of the flow chamber with the connector.
- c. If the sensor came out with the connector, remove the sensor from the connector.
- d. If the sensor stayed in the flow chamber, grasp the sensor and pull it out of the flow chamber.

8. To remove the oxygen sensor:

- a. Unscrew the two screws that hold the oxygen sensor bracket a few turns so that you can rotate and remove the oxygen sensor bracket. Make sure to note the routing of the oxygen sensor cable to the main PCB so that you can route the replacement sensor cable the same way. Also make sure that the O-ring in the bottom of the flow chamber does not come out with the sensor.
- b. Move the hydrophobic filter towards the bottom case side wall and pull the oxygen sensor out of the flow chamber.
- c. Hold the main PCB to support it where the oxygen sensor cable connects to it.
- d. Grasp the connector on the end of the sensor cable and pull the connector away from the main PCB to disconnect it from the main PCB.

9. To remove the H₂S and CO sensors:

- a. Grasp the sensor firmly and rock it back and forth slightly while pulling on it. Make sure to note the routing of the sensor cable to the main PCB so that you can route the replacement sensor cable the same way.
- b. If the sensor does not come out of the flow chamber easily enough using this method, grasp it with a pair of pliers and rock it back and forth slightly while pulling on it.

CAUTION: *If you are using pliers to remove a sensor, be careful not to damage the sensor in case you find that the sensor is still functional and does not need to be replaced.*

- c. Hold the main PCB to support it where the sensor cable connects to it.
- d. Grasp the connector on the end of the sensor cable and pull the connector away from the main PCB to disconnect it from the main PCB.

10. Install the new sensor.

11. To install the LEL sensor:

- a. Plug the replacement sensor into the sensor connector on the LEL sensor cable.
- b. Insert the LEL sensor into the LEL sensor chamber in the flow chamber.
- c. Line up the holes in the LEL sensor bracket with the two standoffs on either side of the LEL sensor chamber.
- d. Install the two sensor bracket screws tightening them a little at a time alternately to push the sensor into its chamber evenly.

12. To install the oxygen sensor:
 - a. Confirm that the sealing O-ring is still in the bottom of the oxygen sensor chamber in the flow chamber and insert the oxygen sensor face down into the chamber.
 - b. Route the sensor cable the same way the old sensor cable was routed and connect it to the main PCB. Make sure to support the main PCB when making the connection.
 - c. Reinstall the oxygen sensor bracket and tighten both bracket screws firmly.
13. To install the H₂S and CO sensors:
 - a. Insert the sensor face down into the sensor chamber in the flow chamber.
 - b. Push the sensor in until it bottoms out.
 - c. Route the sensor cable the same way the old sensor cable was routed and connect it to the main PCB. Make sure to support the main PCB when making the connection.
14. Confirm that the main PCB is seated in its slots and that its bottom edge is resting on the bottom of the bottom case. If the main PCB is not seated properly, then it may be damaged when the top case is re-installed.
15. Make sure that the top case gasket is fully seated in its groove and carefully put the top case back on the bottom case. If you have any difficulty mating the top and bottom cases, inspect the placement of the main PCB and the placement of the top case gasket.
16. Turn the Eagle 3 upside down and tighten the three case screws to secure the top case to the bottom case.
17. Calibrate the new sensors as described in “Chapter 5: Calibration Mode” on page 77.

Replacing an LEL Sensor

Replacing an F-Sensor

Chapter 7: General Parts List

Table 16: General Parts List

Part Number	Description
06-1248RK-03	Calibration kit tubing, 3 foot length
07-7210RK	O-ring for inlet fitting half of probe
07-7304RK	O-ring for tube half of probe
13-1061RK	Panel screw, captive, 6-32 x 1/2 inch, for bottom case
13-1081RK	Thumbscrew, captive, 10-32 x 2 inches, for battery case
30-0600RK-01	Pump
33-0156RK-01	Filter element, hydrophobic disk, for standard 80-0131RK-10 probe, pack of 5
33-0173RK	Internal hydrophobic filter
33-1200RK	Particle filter for standard 80-0131RK-10 probe
33-2002RK-01	Humidifier, 24 inch, for calibration of catalytic combustible channel with gas concentrations of 1000 ppm or lower
33-6090RK	Charcoal filter
33-7130	Charcoal filter/humidity filter disk (black and white), for dual CO/H ₂ S sensor, 5 pack
33-7132	Charcoal filter disk (black), for CO and H ₂ -compensated CO sensors, 5 pack
33-7133	Humidity filter (white), for H ₂ S sensor, 5 pack
35-0112RK	Dummy sensor, LEL sensor position
47-1016RK	Vehicle plug 12 VDC adapter cable for charger
49-0115RK	AC adapter
49-1631	Li-ion battery pack
49-2176RK	12 VDC charger
61-0155RK	LEL combustible sensor, catalytic, hydrogen specific, no shrink tubing (for H ₂ specific units sold before 3/6/2019)
61-0155-01	LEL combustible sensor, catalytic, hydrogen specific, with shrink tubing (for H ₂ specific units sold after 3/6/2019)
65-7004	Dummy sensor, CO, H ₂ S, and O ₂ sensor position
71-0590	Operator's Manual, Eagle 3 (this document)
71-0170RK	Operator's Manual, Eagle 3 Data Logger Management Program
80-0131RK-10	10 inch hydrophobic probe (standard probe)
80-0133RK-10	30 inch aluminum probe
80-0134RK-10	4 foot stainless steel hydrophobic probe

Table 16: General Parts List

Part Number	Description
80-0135RK-10	30 inch stainless steel hydrophobic probe
80-0136RK	32 inch telescoping fiberglass probe w/dust filter
80-0137RK	10 inch probe w/dust filter
80-0143RK	7 foot telescoping fiberglass probe w/dust filter
80-0156RK-10	30 inch fiberglass hydrophobic probe
80-0160RK-12	12 foot extendable probe
80-0160RK-18	18 foot extendable probe
80-0405RK	Dilution fitting, 1:1
80-0406RK	Dilution fitting, 3:1
80-05XXRK	Sample hose. Replace “XX” with length in feet. 5 foot hose is standard. Available lengths for the Eagle 3 are 3, 4, 5, 6, 10, 15, 20, 25, 30, 35, 40, 50, 75, 100, and 125 feet.
81-0090RK-01	Calibration cylinder, 34 liter steel, three-gas (CH ₄ /O ₂ /CO)
81-0090RK-03	Calibration cylinder, 103 liter, three-gas (CH ₄ /O ₂ /CO)
81-0154RK-02	Calibration cylinder, 58 liter; four-gas (CH ₄ /O ₂ / H ₂ S/CO)
81-0154RK-04	Calibration cylinder, 34 liter aluminum; four-gas (CH ₄ /O ₂ / H ₂ S/CO)
81-1054RK	Regulator, demand-flow type, for 34 liter aluminum/58 liter/103 liter calibration cylinders (cylinders with internal threads)
81-1055RK	Regulator, demand-flow type, for 17 liter and 34 liter steel calibration cylinders (cylinders with external threads)
81-5302RK	Calibration kit, for LEL/Oxy/CO unit, w/demand flow regulator, 103 liter cylinder
81-5401RK	Calibration kit, for LEL/Oxy/H ₂ S/CO unit, w/demand flow regulator, 58 liter cylinder
ESR-A13i-H2S	Hydrogen sulfide (H ₂ S) sensor
ESR-A13P-CO	Carbon monoxide (CO) sensor
ESR-A1CP-CO-H	Hydrogen-compensated carbon monoxide (CO) sensor
ESR-A1DP-COHS	Dual carbon monoxide (CO) and hydrogen sulfide (H ₂ S) sensor
NC-6260B	LEL combustible sensor, catalytic

Appendix A: Calibrating with a Sample Bag

Overview

The Eagle 3 can be calibrated with a gas bag calibration kit instead of a demand flow regulator kit. This appendix describes how to use a sample bag calibration kit to calibrate the Eagle 3. A parts list at the end of this appendix lists spare parts for the calibration kit.

Calibration Supplies and Equipment

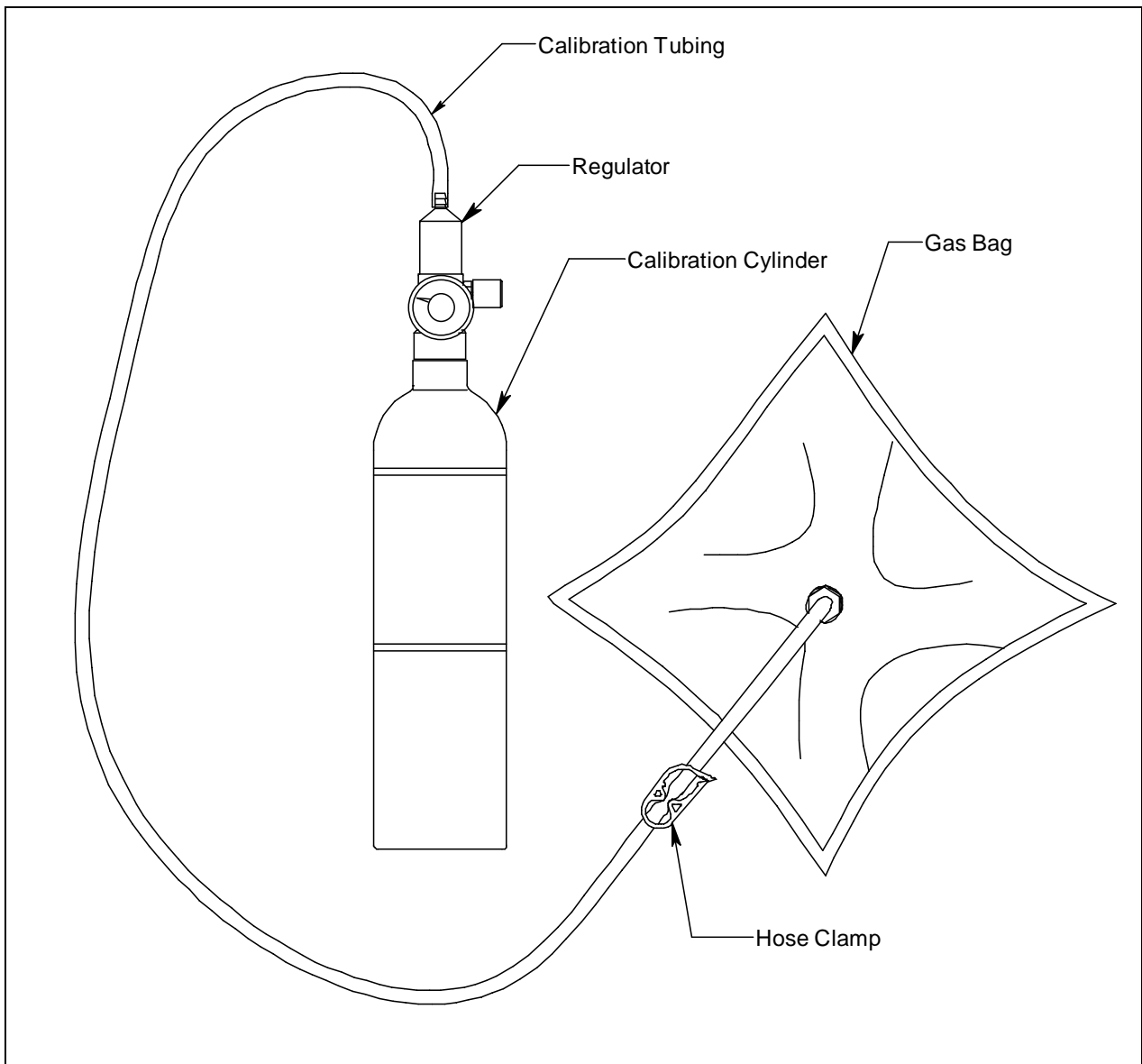


Figure 20: Gas Bag Calibration Kit

To calibrate the Eagle 3, you will need:

- Known calibrating samples of the gases being detected. The combustible and toxic gas samples should have concentrations between 10 and 50% of the full scale value. For example, if you are calibrating the catalytic combustible gas channel, your calibration cylinder should have a combustible gas concentration between 10% LEL and 50% LEL. An oxygen-free source, such as 100% nitrogen is recommended for setting the oxygen zero.

NOTE: The catalytic combustible channel can be set up for and calibrated to a number of different combustible gases. See “Configuring the Gases (Configure Gases)” on page 135 for instructions. Be sure that you are using an appropriate calibration cylinder for the target gas of the catalytic combustible channel.

CAUTION: *When using auto calibration with the standard 4-gas Eagle 3, although the Eagle 3 can be calibrated with an oxygen concentration of up to 19.5%, RKI Instruments, Inc. recommends that the multi-gas cylinder have an oxygen concentration in the range of 10% - 16% oxygen.*

- A gas collection bag with hose clamp
- A 6 LPM fixed-flow regulator or a dispensing valve

WARNING: *RKI Instruments, Inc. recommends that you dedicate a regulator for use with chlorine (Cl₂) gas and that you do not use that dedicated regulator for any other gases, particularly hydrogen sulfide (H₂S).*

- Calibration tubing

To calibrate the combustible gas, oxygen, CO, and H₂S sensors at the same time, automatically, with no need for a zero-oxygen source, you can use the auto calibration feature with a 4-gas cylinder. If the H₂S channel is not active, then a 3-gas cylinder may be used for auto calibration. This document includes instructions for auto calibration with a fixed flow regulator or dispensing valve, a sample bag, and a 4-gas cylinder. This document also includes instructions for calibrating one channel at a time using single calibration.

Entering Calibration Mode

To enter Calibration Mode, do the following:

1. Find a fresh-air environment. This is an environment free of toxic or combustible gases and of normal oxygen content (20.9%).
2. While in Normal Mode, press and hold the RANGE ▼ SHIFT button, then press the DISPLAY ADJUST NO button both buttons.
3. If the unit prompts you for the password, enter it by using the AIR ▲YES and RANGE ▼ SHIFT buttons to select each password number and then pressing and releasing POWER ENTER RESET to enter the number and move on to the next one.

4. The Calibration Mode Screen displays with the cursor next to **AUTO CALIBRATION**.

CALIBRATION MODE

> AUTO CALIBRATION
SINGLE CALIBRATION
PERFORM AIR ADJUST
NORMAL OPERATION

NOTE: The following screens illustrate a 4-gas Eagle 3 for detection of CH₄ (% LEL using catalytic sensor), oxygen, H₂S, and CO. Your Eagle 3 may display slightly different screens.

Calibrating Using the Auto Calibration Method

This method allows you to calibrate the CH₄ (% LEL catalytic combustible sensor), oxygen, H₂S, and CO sensors simultaneously. It is designed for use with the RKI 4-gas calibration cylinder and is the quickest and most convenient method to calibrate the Eagle 3.

Setting the Fresh Air Reading

1. While in the Calibration Mode Screen, move the cursor to the **PERFORM AIR ADJUST** menu item by using the RANGE ▼ SHIFT button.

CALIBRATION MODE

AUTO CALIBRATION
SINGLE CALIBRATION
> PERFORM AIR ADJUST
NORMAL OPERATION

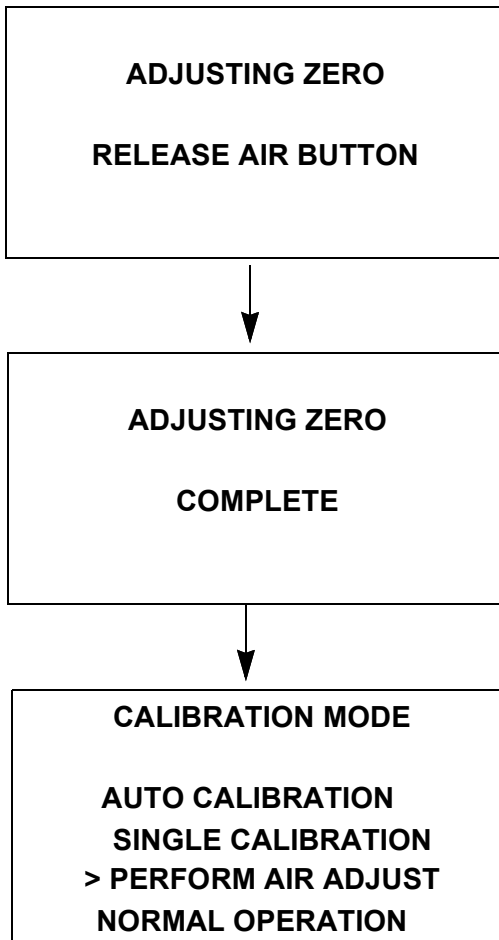
2. Press the POWER ENTER RESET button. The following screen appears.

PERFORM

AIR ADJUST?

3. Press the AIR ▲YES button to continue.
If you do not want to continue, press the DISPLAY ADJUST NO button and the unit will return to the Calibration Mode Screen.

4. The Eagle 3 will indicate that it is adjusting the zero reading for a few seconds, then indicate that the operation is complete before returning to the Calibration Mode Screen.



Performing a Span Adjustment in Auto Calibration

1. Slide the tubing clamp onto the tubing and connect the tubing to the sample bag's inlet fitting. Leave the clamp unclamped for now.
2. Install the probe on the Eagle 3 inlet fitting. Make sure the probe is complete with internal O-ring and membrane and that the two halves of the probe are tightened firmly together to avoid leaks that can affect the calibration. See Figure 17 on page 99 for an illustration of the internal parts of the probe.

3. Move the cursor next to the **AUTO CALIBRATION** menu item by using the AIR ▲YES button.

<p>CALIBRATION MODE</p> <p>> AUTO CALIBRATION</p> <p>SINGLE CALIBRATION</p> <p>PERFORM AIR ADJUST</p> <p>NORMAL OPERATION</p>

4. Press the POWER ENTER RESET button to display the Calibration Gas Values Screen.

<p>CAL GAS VALUES</p> <p>CH4 50 % LEL</p> <p>OXY 12.0 vol%</p> <p>H2S 25.0 ppm</p> <p>CO 50 ppm</p> <p>ENTER TO BEGIN CAL</p>

The gas concentrations displayed in the Calibration Gas Values Screen must match the gas concentrations listed on the 4-gas calibration cylinder.

If *all* concentrations match, go to Step 14.

If *one or more* concentrations *do not* match, continue with Step .

If you do not want to continue with the calibration, press the DISPLAY ADJUST NO button to return to the Calibration Mode Screen.

NOTE: The RKI 4-gas cylinder typically contains 12% O₂ by volume. When using the auto calibration method, be sure to set the “OXY” auto calibration gas value to agree with the concentration listed on the cylinder’s label, not zero.

5. To adjust the values on the screen, hold down the RANGE ▼ SHIFT button, then press the DISPLAY ADJUST NO button both. The following screen appears with the cursor next to **CH4**.

<p>ADJUST AUTO</p> <p>CALIBRATION VALUES</p> <p>> CH4 50 % LEL</p> <p>OXY 12.0 vol%</p> <p>H2S 25.0 ppm</p> <p>CO 50 ppm ▼</p>

6. Place the cursor next to the channel whose gas value you want to change using the AIR ▲ YES and RANGE ▼ SHIFT buttons.
7. Press the POWER ENTER RESET button to select the channel. The calibration gas value begins to flash.

8. Use the AIR ▲YES and RANGE ▼ SHIFT buttons to adjust the calibration gas setting to the desired value.

NOTE: The calibration gas value cannot be set lower than the low alarm setting. If the calibration gas value listed on the calibration cylinder is lower than the current low alarm setting, enter Setup Mode and change the low alarm setting. See page 145 for instructions. If you need to change the alarm point setting only to perform a calibration, make sure that you change the alarm point setting back to its original value once the calibration has been performed.

9. Press the POWER ENTER RESET button to save the change. The calibration gas value stops flashing.
10. Repeat Step 5 through Step 8 for any other channels that need to be changed.
11. When you are done adjusting the calibration gas values, move the cursor down past the bottom of the screen next to **END**.

**ADJUST AUTO
CALIBRATION VALUES
> END**

12. Press the POWER ENTER RESET button. The following screen appears.

**DO YOU WANT TO
STORE NEW VALUE(S)
IN MEMORY FOR
FUTURE CALIBRATIONS?**

PRESS YES OR NO

13. If you select YES by pressing and releasing the AIR ▲YES button, the changes that you made will be saved in the Eagle 3's memory as the new auto calibration gas values.

If you select NO by pressing and releasing the DISPLAY ADJUST NO button, the changes you made will be used for any calibrations performed during the current operating session only. The Eagle 3 will delete the changes when the unit is turned off and will load the previous set of auto calibration values when it is turned on again.

14. When you make your selection and press the desired button, the unit returns to the Calibration Gas Values Screen.

CAL GAS VALUES		
CH4	50	% LEL
OXY	12.0	vol%
H2S	25.0	ppm
CO	50	ppm
ENTER TO BEGIN CAL		

15. Press the POWER ENTER RESET button to proceed to the Calibration In Process Screen. **CAL IN PROCESS** is flashing.

CAL IN PROCESS		
CH4	0	% LEL
OXY	20.9	vol%
H2S	0.0	ppm
CO	0	ppm
ENTER WHEN DONE		

If you do not want to proceed with the calibration, press the DISPLAY ADJUST NO button to return to the Calibration Gas Values Screen.

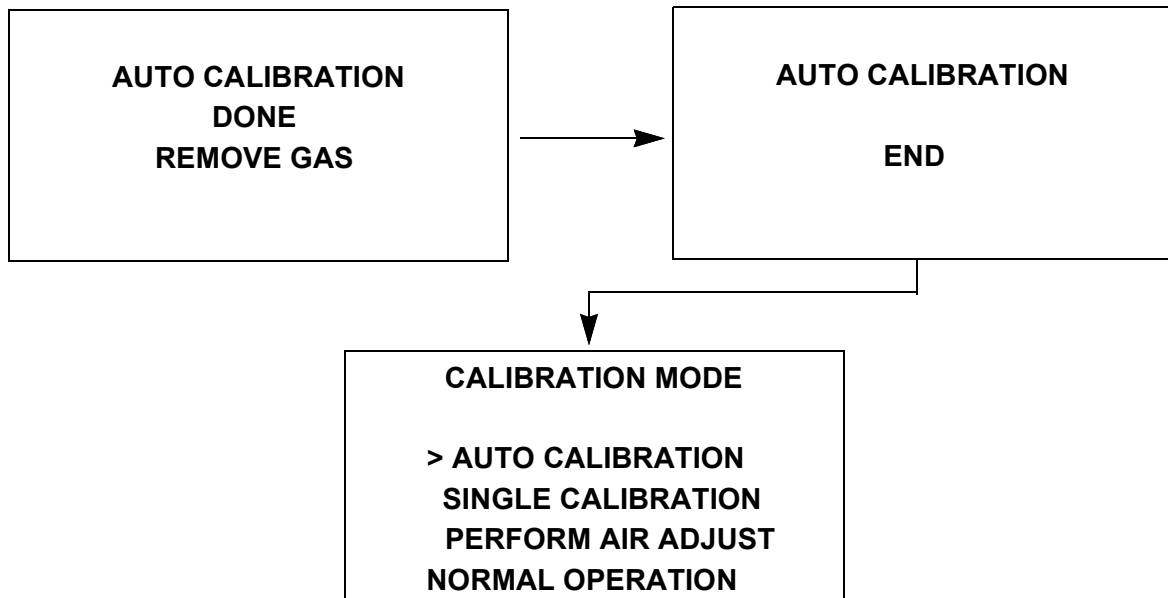
If you do want to continue with the calibration, proceed to the next step.

16. Connect the gas bag tubing to the regulator's or dispensing valve's hose barb fitting.
17. Fill the gas collection bag by screwing the fixed flow regulator or dispensing valve onto the calibration cylinder and turning the knob counterclockwise.
18. Allow the gas to dispense until the gas collection bag is a little over half full.
19. Turn the knob clockwise to stop the gas flow, clamp down the hose clamp and remove the regulator or dispensing valve from the cylinder.
20. Disconnect the tubing from the regulator or dispensing valve.
21. Open the hose clamp on the gas bag tubing.
22. Connect the tubing from the gas bag to the rigid tube on the probe. Allow the gas to flow for one minute.

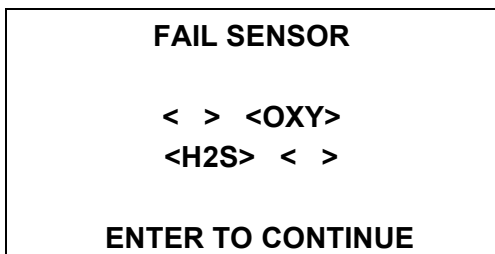
NOTE: If you are calibrating the catalytic combustible channel with a gas concentration of 1000 ppm or lower, you must use a 24 inch humidifier tube to connect the gas bag to the rigid tube on the probe.

23. Press the POWER ENTER RESET button to set the span adjustment to the programmed values.

24. If all channels passed calibration the following screen sequence occurs.



If any of the sensors cannot be adjusted to the proper value, a screen displays that indicates a calibration failure and lists the sensor(s) that failed to calibrate. In the example below, the oxygen and H₂S channels failed calibration. The other sensors calibrated normally.



The buzzer and LED arrays activate in a double pulsing pattern. Press the POWER ENTER RESET button to reset the alarm and return to the Calibration Mode Screen. Attempt to calibrate again. If the failure continues, investigate the cause. See “Troubleshooting” on page 96..

25. Disconnect the tubing from the probe.

26. Use the RANGE ▼ SHIFT button to place the cursor next to the **NORMAL OPERATION** menu option, then press the POWER ENTER RESET button to return to Normal Mode.

Calibrating Using the Single Calibration Method

Single Calibration allows you to calibrate one channel at a time. This is useful if you only want to calibrate one or two channels.

Setting the Fresh Air Reading

1. While in the Calibration Mode Screen, move the cursor to the **PERFORM AIR ADJUST** menu item by using the RANGE ▼ SHIFT button.

CALIBRATION MODE

AUTO CALIBRATION

SINGLE CALIBRATION

> PERFORM AIR ADJUST

NORMAL OPERATION

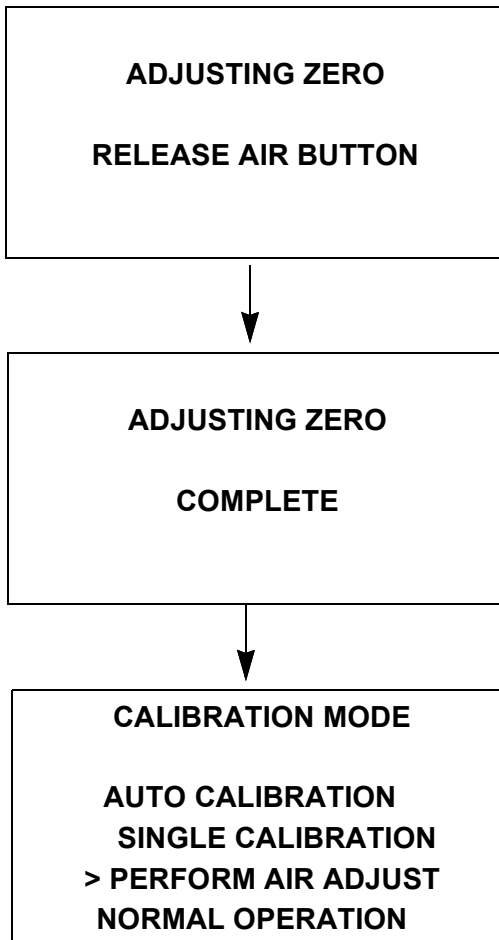
2. Press the POWER ENTER RESET button. The following screen appears.

PERFORM

AIR ADJUST?

3. Press the AIR ▲YES button to continue.
If you do not want to continue, press the DISPLAY ADJUST NO button and the unit will return to the Calibration Mode Screen.

4. The Eagle 3 will indicate that it is adjusting the zero reading for a few seconds, then indicate that the operation is complete before returning to the Calibration Mode Screen.



Performing a Span Adjustment in Single Calibration

1. Slide the tubing clamp onto the tubing and connect the tubing to the sample bag's inlet. Leave the clamp unclamped for now.
2. Connect the other end of the tubing to the regulator's or dispensing valve's hose barb fitting.
3. Install the probe on the Eagle 3 inlet fitting. Make sure the probe is complete with internal O-ring and membrane and that the two halves of the probe are tightened firmly together to avoid leaks that can affect the calibration. See Figure 17 on page 99 for an illustration of the internal parts of the probe.

4. Move the cursor next to the **SINGLE CALIBRATION** menu item by using the AIR ▲YES button.

CALIBRATION MODE

AUTO CALIBRATION
> SINGLE CALIBRATION
PERFORM AIR ADJUST
NORMAL OPERATION

5. Press the POWER ENTER RESET button. The Select Sensor Screen appears with the cursor flashing.

**SELECT SENSOR
TO CALIBRATE**
>ESCAPE
CH4 OXY
H2S CO

6. Move the cursor next to the sensor you want to calibrate with the AIR ▲YES and RANGE ▼ SHIFT buttons. In the example below, the CH₄ sensor is selected for span adjustment.

**SELECT SENSOR
TO CALIBRATE**
ESCAPE
>CH4 OXY
H2S CO

If you do not want to proceed with the span adjustment, press the DISPLAY ADJUST NO button or place the cursor next to **ESCAPE** and press POWER ENTER RESET to return to the Calibration Mode Screen.

If you do want to continue with the calibration, proceed with the next step.

7. Press the POWER ENTER RESET button to proceed to the Single Calibration Gas Value Screen for the selected channel. The calibration gas value is flashing.

SINGLE CALIBRATION

CH4 50 % LEL
AIR/RANGE TO ADJUST
CALIBRATION VALUE
ENTER WHEN DONE

8. If necessary, adjust the calibration gas value to match the cylinder concentration using the AIR ▲YES and RANGE ▼ SHIFT buttons. For this example, the calibration gas value is entered as 50% LEL.

NOTE: The calibration gas value cannot be set lower than the low alarm setting. If the calibration gas value listed on the calibration cylinder is lower than the current low alarm setting, enter Setup Mode and change the low alarm setting. See page 145 for instructions. If you need to change the alarm point setting only to perform a calibration, make sure that you change the alarm point setting back to its original value once the calibration has been performed.

9. Press the POWER ENTER RESET button to proceed to the Single Calibration Apply Gas Screen. **CAL IN PROCESS** is flashing.

SINGLE CALIBRATION
APPLY GAS
CH4 0 % LEL

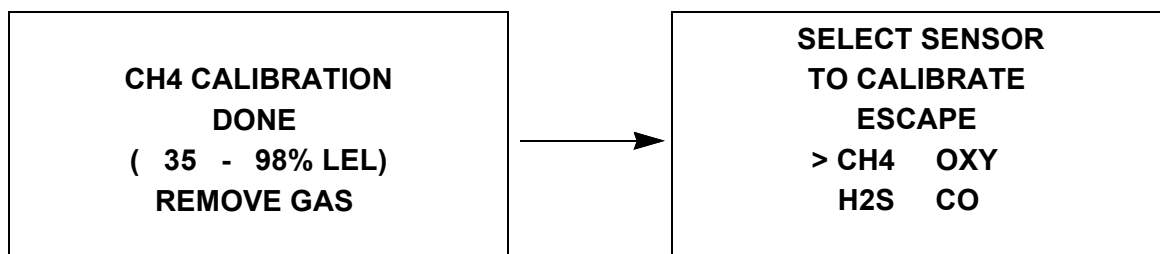
CAL IN PROCESS
ENTER WHEN DONE

10. Fill the gas collection bag by screwing the fixed flow regulator or dispensing valve onto the calibration cylinder and turning the knob counterclockwise.
11. Allow the gas to dispense until the gas collection bag is a little over half full.
12. Turn the knob clockwise to stop the gas flow, clamp down the hose clamp and remove the regulator or dispensing valve from the cylinder.
13. Disconnect the tubing from the regulator or dispensing valve.
14. Open the hose clamp on the gas bag tubing.
15. Connect the tubing from the gas bag to the rigid tube on the probe. Allow the gas to flow for one minute.

NOTE: If you are calibrating the catalytic combustible channel with a gas concentration of 1000 ppm or lower, you must use a 24 inch humidifier tube to connect the gas bag to the rigid tube on the probe.

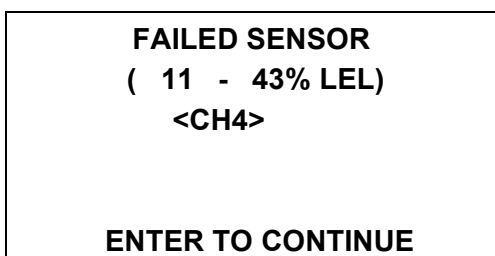
16. Press the POWER ENTER RESET button to make the span adjustment.

17. When the span adjustment is made, the Eagle 3 calculates the range of adjustment, minimum and maximum, it could have made based on its response level to the applied gas. This calculated range is independent of the calibration gas value that was entered in Step 8 and Step 9 above. The adjustment range is included on the result screen to indicate the condition of the sensor. If the calibration gas value is in the adjustment range, the span adjustment will pass. If the calibration gas value is out of the adjustment range, the span adjustment will fail.
18. If the span adjustment is successful, the following screens display.



In the example above, the Eagle 3 could have adjusted the reading as low as 35% LEL and as high as 98% LEL.

If the span adjustment is not successful, a screen displays that indicates a calibration failure.



In the example above, the Eagle 3 could have adjusted the reading as low as 11% LEL and as high as 43% LEL. Since the calibration gas value entered was 50% LEL, the unit failed the span adjustment. The buzzer and alarm LED arrays activate in a double pulsing pattern. Press the POWER ENTER RESET button to reset the alarm and return to the Select Sensor Screen. Attempt to calibrate again. If the failure continues, investigate the cause. See “Troubleshooting” on page 96..

NOTE: The adjustment range will only appear in the calibration results screen if the Span Factor item in Setup Mode is set to ON. If the Span Factor is set to OFF, the adjustment range will not appear.

19. Disconnect the tubing from the Eagle 3’s probe.
20. Repeat Step 6 through Step 19 for any other channels you want to calibrate. Make sure you use an appropriate calibration cylinder for each channel.

CAUTION: When calibrating the oxygen channel, verify the concentration of oxygen listed on the cylinder's label. For oxygen-free samples (100% nitrogen for example), set the oxygen zero setting to 0.0%.

21. After the last channel is calibrated, disconnect the calibration tubing from the probe.
22. With the Select Sensor Screen displayed, place the cursor next to **ESCAPE** using the AIR ▲ YES button.

**SELECT SENSOR
TO CALIBRATE**

>ESCAPE

CH4 OXY

H2S CO

23. Press the POWER ENTER RESET button to return to the Calibration Mode Screen.
24. Use the RANGE ▼ SHIFT button to place the cursor next to the **NORMAL OPERATION** menu item, then press the POWER ENTER RESET button to return to Normal Mode.

Sample Bag Calibration Parts List

Table 17: Sample Bag Calibration Parts List

Part Number	Description
06-1248RK-03	Calibration kit tubing, 3 foot length
81-0090RK-01	Calibration cylinder, 3-gas mix, LEL/Oxygen/CO, 34 liter steel
81-0154RK-04	Calibration cylinder, 4-gas mix, LEL/Oxygen/CO/H ₂ S, 34 liter aluminum
81-1001RK	Dispensing valve, for 17/34 liter steel cylinders (cylinders with external threads)
81-1051RK-60	Regulator with gauge and knob, 6 LPM, for 34 liter aluminum/58 liter/103 liter cylinders (cylinders with internal threads)
81-1126RK	Gas bag with clamp and hose barb, 9" x 9", 2 liter
81-5302RK-LV	Calibration kit, for LEL/Oxy/CO unit, w/gas bag, 34 Liter
81-5401RK-LV	Calibration kit, for LEL/Oxy/H ₂ S/CO unit, w/gas bag, 34 Liter

Appendix B: Setup Mode

Overview

The Eagle 3 is factory-set to suit most applications. Update settings in Setup Mode only if required for a specific application. The description of each item below indicates the factory setting for each item.

Setup Mode Menu Item		Description
Set Date/Time (page 131)		Set the current date and time.
Set Date Format (page 132)		MM/DD/YYYY (factory setting): month/day/year YYYY/MM/DD : year/month/day DD/MM/YYYY : day/month/year
Configure Channels (page 133)		Turn channels on or off.
Configure Gases (page 135)		Turn gases on or off and change target gas for each channel.
Catalytic Units (page 140)		Select the units of measurement used by catalytic channel.
CO2 Units (page 141)		Select the units of measurement used by the CO2 sensor.
HC Or CH4 Units (page 141)		On: Off:
LEL Standard (page 143)		Standard (factory setting): Apply standard settings for the LEL's ppm level. IEC : Apply IEC settings for the LEL's ppm level. ISO : Apply ISO settings for the LEL's ppm level.
Relative Response (page 144)		On : The Relative Response screen appears in Display Mode. Off : The Relative Response screen does not appear in Display Mode.
Alarm Settings (page 145)	Alarm Points (page 145)	Update one or more alarm points. See Table 1 for alarm point factory settings.
	Alarm Latching (page 148)	Latching (factory setting): The Eagle 3 remains in alarm condition until the alarm condition passes and the RESET button is pressed. Self Resetting : The Eagle 3 automatically resets an alarm when the alarm condition passes.

Setup Mode Menu Item		Description
Alarm Set-tings (page 145) cont.	Alarm Silence (page 148)	On (factory setting): During an alarm condition, pressing the RESET button silences the buzzer. Off : During an alarm condition, the buzzer cannot be silenced and the LEDs will continue to flash.
	Sensor Life Alert (page 149)	On : Enable several indicators for sensors that are nearing expiration. Off (factory setting): Disable sensor expiration indicators.
	Save User Alarm (page 150)	Save all current, user-set alarm settings.
	Restore User Alarm (page 151)	Restore all current alarm settings to the user adjusted settings.
	Restore Four Gas Alarm (page 152)	Restore the current alarm settings to the Four Gas alarm settings.
	Restore Factory Alarm (page 153)	Restore all current alarm settings to the factory default alarm settings.
	Escape	Return to the Setup Mode menu.
User and Station ID (page 154)		On : The User ID and Station ID screens appear in startup sequence. IDs can be selected in Display Mode. See page 67 and page 68 for information about this feature. Off (factory setting): The User ID and Station ID screens do not appear in startup sequence. IDs cannot be selected in Display Mode.
Demand Zero (page 155)		On (factory setting): Fresh air adjustments can be performed while in Normal Mode by pressing AIR. Off : Fresh air adjustments cannot be performed while in Normal Mode.
Auto Zero (page 156)		On : The option to perform a fresh air adjustment appears at the end of the startup sequence. Off (factory setting): The option to perform a fresh air adjustment does not appears at the end of the startup sequence.
CO2 Air Zero (page 157)		On : The CO ₂ channel is set to 400 ppm (0.04% volume) during a demand zero, auto zero, or Air Calibration . Off (factory setting): The CO ₂ channel is not adjusted during a demand zero, auto zero, or Air Calibration .
Disable Air Calibration (page 158)		

Setup Mode Menu Item		Description
Data Log Settings (page 158)	Data Log Interval (page 158)	Select how often the Eagle 3 saves readings to the data logger. The following interval times can be selected: Options: 10 minutes, 5 minutes (factory setting), 3 minutes, 2 minutes, 1 minute, 30 seconds, 20 seconds, or 10 seconds
	Data Log Overwrite (page 159)	On (factory setting): The Eagle 3 writes over the oldest data with new data when the data logger memory is full. Off : The Eagle 3 stops saving data to the data logger when the data logger memory is full.
	Escape	Return to the Setup Mode menu.
Backlight Time (page 160)		How long the back light stays on after one button press. Options: 0 seconds, 5 seconds, 10 seconds, 20 seconds, 30 seconds, 1 minute, 3 minutes, 5 minutes (factory setting), 10 minutes
LCD Contrast (page 161)		On (factory setting): Buzzer sounds when a button is pressed. Off : Buzzer does not sound when a button is pressed.
Key Tone (page 162)		On (factory setting): The instrument will beep every time a button is pressed. Off : The instrument will not beep when a button is pressed.
Calibration Settings (page 163)	Calibration Reminder (page 163)	On (factory setting): The Eagle 3 will give an indication at start up if it is due for calibration. The type of indication will depend on the Calibration Past Due Reminder setting. Off : The Eagle 3 will not give an indication at start up if it is due for calibration.
	Calibration Past Due Reminder (page 164)	Defines what action must be taken if a calibration is due upon startup. Confirm to Use (factory setting): Press DISPLAY to acknowledge that a calibration is past due and continue to Normal Mode. Cannot Use : Cannot enter Normal Mode until a successful calibration is performed. No Effect : A screen indicates that a calibration is past due but the warmup sequence continues.
	Calibration Interval (page 165)	Define the amount of time between calibrations. Options: 0 (factory setting) - 90 days

Setup Mode Menu Item		Description
Calibration Settings (page 163) cont.	Min/Max Span (page 166)	On: After a passed calibration, the Eagle 3 displays the maximum possible adjustment it could have made to the response reading. Off (factory setting): There is no maximum span indication at the end of a calibration.
	Calibration Auto Start (page 167)	On (factory setting): The instrument automatically begins the warmup sequence after passing calibration. Off: The instrument remains in Calibration Mode after passing calibration.
	Escape	Return to the Setup Mode menu.
Bump Settings (page 168)	Bump Reminder (page 168)	On: The instrument notifies the user upon startup when a bump test is due. The notification type depends on Bump Past Due Reminder setting. Off (factory setting): No notification upon startup when a bump test is due.
	Bump Past Due Reminder (page 169)	Define what action must be taken if a bump test is due upon startup. Confirm to Use (factory setting): Press DISPLAY to acknowledge that a bump test is past due and continue to Normal Mode. Cannot Use: Cannot enter Normal Mode until a successful bump test is performed. No Effect: A screen indicates that a bump test is past due but the warmup sequence continues.
	Bump Interval (page 170)	Define the amount of time between bump tests. Options: 0 - 60 days, 30 days (factory setting)
	Bump Auto Start (page 171)	On (factory setting): The instrument automatically enters begins the warmup sequence after passing a bump test. Off: The instrument remains in Calibration Mode after a bump test passes.
	GasTime (page 172)	Define how long gas is applied during a bump test. Options: 30 (factory setting), 45, 60, 90 seconds
	Tolerance (page 173)	Percentage of calibration gas concentration that the bump test reading must be within in order to pass bump Options: 10%, 20%, 30%, 40%, and 50% (factory setting)
	Calibration Time (page 174)	Define how long gas is applied for auto calibration if the bump test fails. The GasTime setting is deducted from this time. Options: 90 (factory setting) and 120 seconds

Setup Mode Menu Item		Description
Bump Set-tings (page 168) cont.	Auto Calibration (page 174)	On (factory setting): If a bump test fails, the unit will automatically begin a calibration. Off : If a bump test fails, a calibration does not automatically start.
	Escape	Return to the Setup Mode menu
Gas Test (page 176)		Test sensor response and observe alarm indications without an alarm event being recorded.
Sensor Date (page 177)		View and/or set the battery and sensor replacement dates.
Mode Select (page 178)		Leak Check Mode/Bar Hole Mode : The Mode Select Screen appears when the unit is turned on. You are able to select from Normal Mode, Leak Check Mode, and Bar Hole Mode. Bar Hole Mode : The Mode Select Screen appears when the unit is turned on. You are able to select from Normal Mode and Bar Hole Mode. Leak Check Mode : The Mode Select Screen appears when the unit is turned on. You are able to select from Normal Mode and Leak Check Mode. Off (factory setting): The Mode Select Screen does not appear when the unit is turned on, and the unit goes into Normal Mode after the start up sequence.
Bar Hole Time (page 179)		This setting indicates the length of time the unit will sample when a bar hole measurement is initiated in Bar Hole Mode. Options: 30 (factory setting), 45, and 60 seconds
CO Display in Leak Check (page 181)		Off (factory setting): The CO channel is not displayed in Leak Check Mode. This setting has no effect on Normal Mode. On : The CO channel will be displayed in Leak Check Mode, but there will be no CO alarms.
Zero Follower (page 182)		Not intended for field adjustment. Oxygen channel does not support zero follower functionality. Factory setting for all other channels is On .

Setup Mode Menu Item		Description
Zero Suppression (page 184)		<p>On (factory setting): Not intended for field adjustment. The following are the available suppression values:</p> <ul style="list-style-type: none"> • Combustible gas: 2% LEL • O2: 0.5% volume • H2S: 0.3 ppm • CO: 2 ppm • CO2: 0 ppm • HCN: 0.5 ppm • NH3: 4 ppm • NO2: 0.30 ppm • PH3: 0.02 ppm • SO2: 0.20 ppm
Confirmation Alert (page 186)	Beep Select (page 186)	<p>Off (factory setting): The Eagle 3 does not sound a confirmation alert.</p> <p>LED: The Eagle 3 flashes the LED arrays after a user-defined period to verify that it is operating.</p> <p>Buzzer: The Eagle 3 beeps after a user-defined period to verify that it is operating.</p> <p>LED and Buzzer: The Eagle 3 beeps and flashes the LED arrays after a user-defined period to verify that it is operating.</p>
	Beep Interval (page 188)	Select the amount of time between each confirmation alert. Options: 5 seconds, 10 seconds, 20 seconds, 30 seconds, 1 minute, 3 minutes, 5 minutes (factory setting), 10 minutes, 20 minutes, 30 minutes
	Escape	Return to the Setup Mode menu.
Stealth (page 186)		<p>On: The backlight, LED, or buzzer are disabled regardless of alarm conditions or Backlight Time settings.</p> <p>Off (factory setting): The backlight, LED, and buzzer operate normally.</p>
Lunch Break (page 190)		<p>On: At startup, the instrument allows the user to resume TWA and PEAK readings from the last time it was used.</p> <p>Off (factory setting): The instrument resets TWA and PEAK readings every time it is turned on.</p>
Language (page 191)		<p>Set the instrument language.</p> <p>Options: English (factory setting), Japanese, Italian, Spanish, German, French, Portuguese, Russian, Korean, Chinese (TC)</p>
Calibration Mode Password (page 192)		<p>On (factory setting): A password is required to enter Calibration Mode. The factory set password is 0006.</p> <p>Off: No password is required to enter Calibration Mode.</p>

Setup Mode Menu Item	Description
Setup Password (page 193)	On (factory setting): A password is required to enter Setup Mode. The factory set password is 0000. Off : No password is required to enter Setup Mode.
Low Flow Fail Calibration (page 195)	This calibration is performed if an instrument repeatedly goes into low flow alarm and all of the recommendations in “Troubleshooting” on page 96 have been followed.
ROM/Sum (page 197)	View the firmware information for the Eagle 3’s sensor board(s), main board, gas list, and Bluetooth version.
Radio Standard (page 198)	View the IC and FCC ID standards.
Save User Configuration (page 199)	Save all current User Configurations.
Restore User Configuration (page 200)	Restore the User Configuration to its factory defaults.
Restore Four Gas Defaults (page 201)	Restore all Four Gas settings to their factory defaults.
Restore Factory Defaults (page 202)	Restore all settings to their factory defaults.
Normal Mode (page 204)	Begin the warmup sequence and enter Normal Mode.

Tips for Using Setup Mode

- When in the main menu, the cursor (►) points to the first menu item.
- Press **RANGE** to move the cursor down through the menus, to decrease values, or to change the setting in a specific option.
- Press **AIR** to move the cursor up through the main menu and submenu items, to raise values, or change the setting in a specific option.
- Flashing parameters can be adjusted by pressing **AIR** or **RANGE**. Holding either button down increases scroll speed.
- Press **POWER** to enter the menu the cursor is pointing to or to save a selected setting and return to the Setup Mode menu.
- Press **DISPLAY** while in a settings menu to exit the screen without saving any changes.

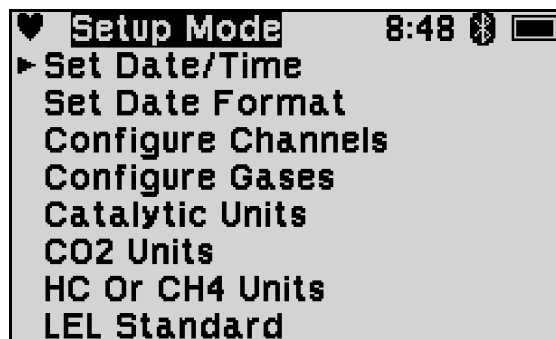
Entering Setup Mode

WARNING: *The Eagle 3 is not in operation as a gas detector while in Setup Mode.*

1. Take the Eagle 3 to a non-hazardous location and turn it off if it is on.
2. Press and hold **AIR** and **RANGE**, then press and hold **POWER**. When you hear a beep, release both buttons.
3. The screen that appears depends on the **Setup Password** setting in Setup Mode.
If **Setup Password** is set to **On** (factory setting), continue with Step 4.
If **Setup Password** is set to **Off**, continue with Step 6.
4. If **Setup Password** is set to **On**, a password screen appears. The factory-set password is **0000**, but it can be changed if desired.



5. Press **AIR** to select each password number then press **POWER** to save it and move to the next number.
To return to a previous digit, press and hold **AIR** and **POWER** for a few seconds.
6. The Setup Mode menu appears. Press **AIR** or **RANGE** to move the cursor up or down and to view additional menu items.

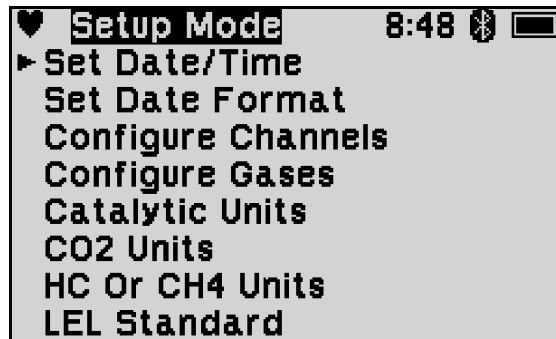


7. Press **POWER** to select the desired menu item.

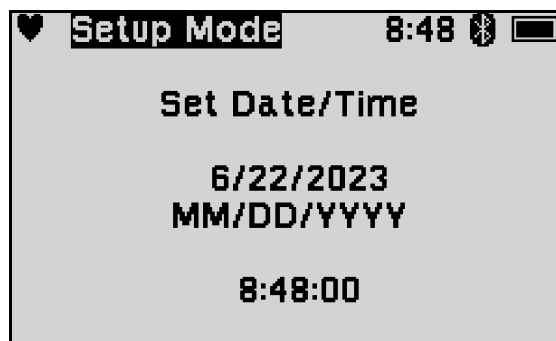
8. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Setting the Date and Time (Set Date/Time)

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Set Date/Time**.



2. Press **POWER** to select the menu item. The **Set Date/Time** screen appears with the year value flashing.



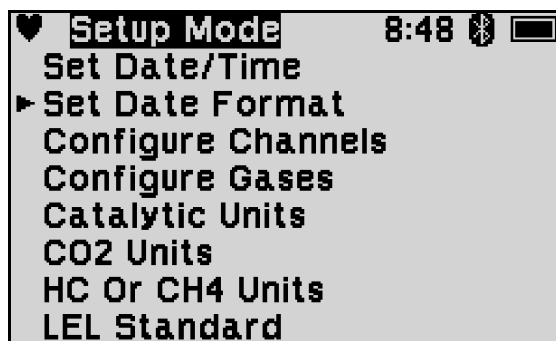
3. Press **AIR** or **RANGE** to scroll to the desired value.
4. Press **POWER** to enter the setting and move to the next value.
5. Repeat Step 3 to enter the month, day, hours, minutes, and seconds values. After the seconds value has been entered, the unit returns to the Setup Mode menu.
6. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Setting the Date Format (Set Date Format)

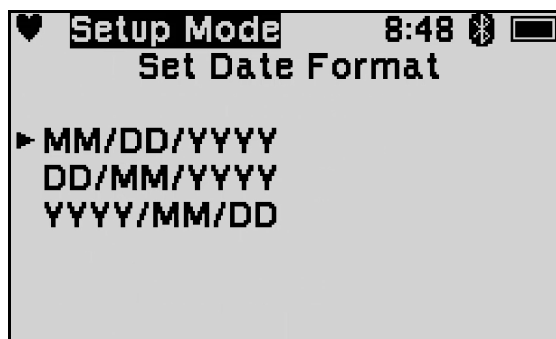
Use this menu to select one of the following date formats:

- **MM/DD/YYYY** (factory setting)
- **YYYY/MM/DD**
- **DD/MM/YYYY**

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Set Date Format**.



2. Press **POWER** to select the menu item. The **Set Date Format** screen appears with the cursor next to the current setting.



3. Press **AIR** or **RANGE** to scroll to the desired setting.
4. Press **POWER** to save the setting and return to the Setup Mode menu.
5. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Configuring the Channels (Configure Channels)

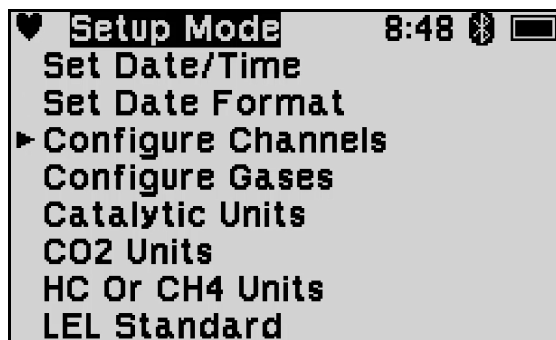
Use this menu to turn channels on and off and change each channel's target gas. The standard Eagle 3 is factory configured for the following four channels: combustible gas (catalytic sensor), oxygen, H₂S, and CO (channels 5 and 6 are turned off).

However, the Eagle 3 can be factory and field configured for a variety of active channels and detector types.

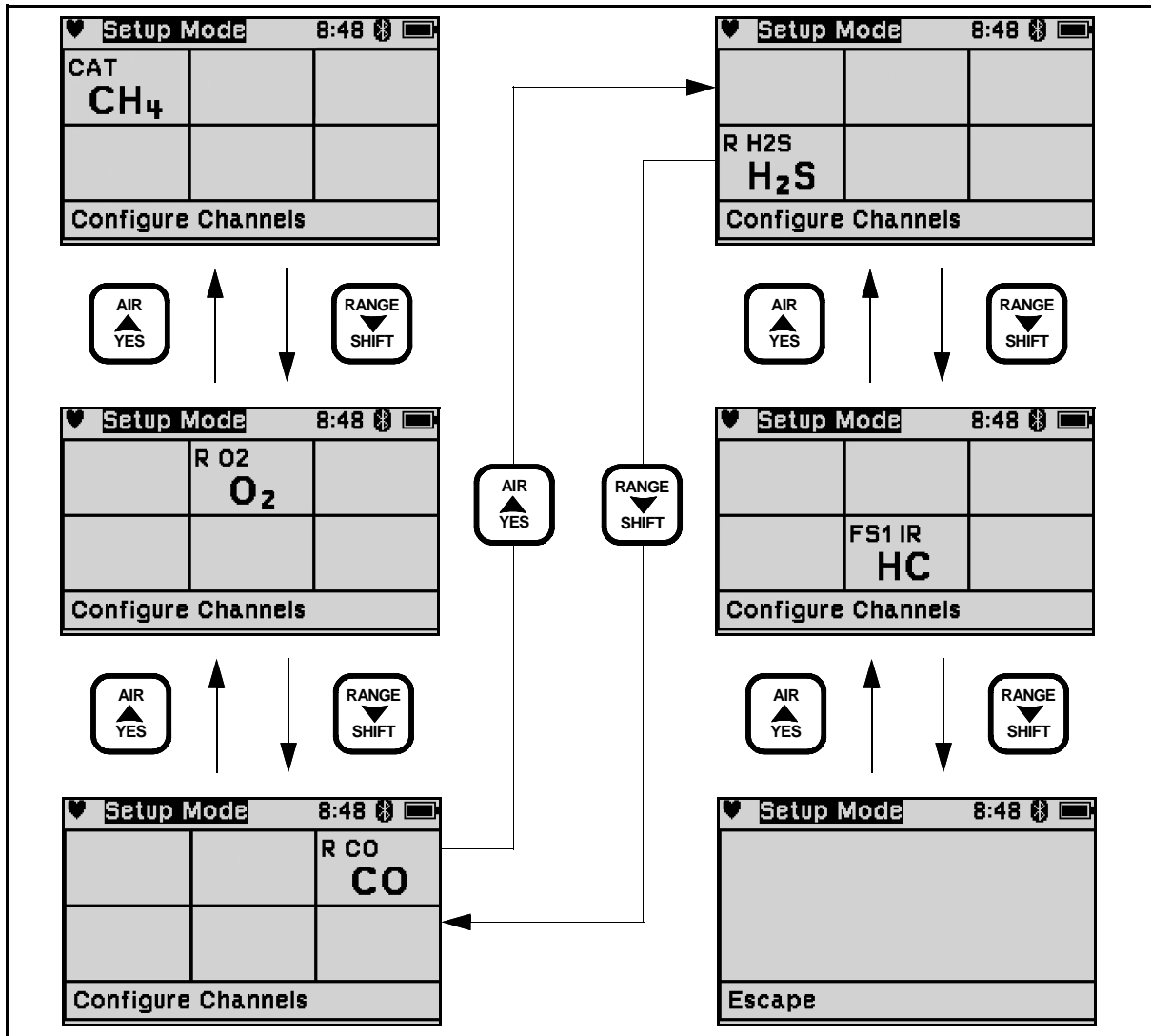
To set the combustible channel's calibration gas, select that target gas here and then calibrate to it in Calibration Mode (see page 68).

CAUTION: *Before changing the channel configuration, confirm that the correct sensors and electronic hardware are installed in the Eagle 3 and that its construction and flow system are appropriate for the installed sensors. Operation of the Eagle 3 with a flow system or construction not compatible with the installed sensors will result in inaccurate readings. Consult with RKI Instruments, Inc. if you cannot confirm either of these items.*

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Configure Channels**.



- Press **POWER** to select the menu item. The **Configure Channels** screen appears with the first channel and target gas in the top left corner of the display.



- Press **AIR** or **RANGE** until the desired channel appears.
- Press **POWER** to select the channel. The channel's target gas flashes, indicating it can be changed.

NOTE: The FS1, FS2, and FS3 options are not defined in a standard 4-gas Eagle 3. These options are only defined when optional sensors are installed.

- Press **AIR** or **RANGE** until the desired target gas appears. If **OFF** is selected, this just makes the channel inactive.
- Press **POWER** to save the target gas type.
- Press **RANGE** to move to the next channel. Press **AIR** to move to the previous channel. Repeat Step 2 through Step 5 for all other channels if desired.

8. To return to the Setup Mode menu:
 - a. Press **RANGE** until the **Escape** screen appears.
 - b. Press **POWER** to select the menu item.
9. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Configuring the Gases (Configure Gases)

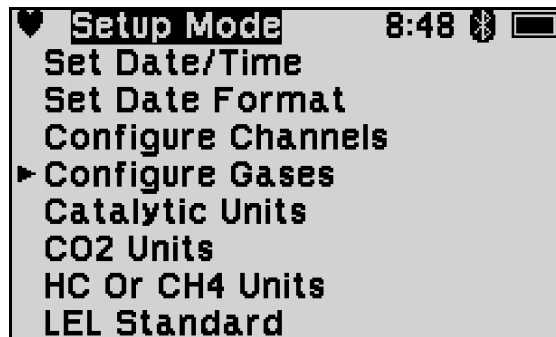
Use this menu to configure catalytic, TC (thermal conductivity), or PID (photo ionization detector) sensors. In a standard Eagle 3, only the catalytic sensor can be configured. PID or TC sensors can only be configured if those sensors are installed.

For each of the catalytic sensor's gas choices, the LEL (lower explosive limit) and gas name are displayed. The LEL is shown in terms of ppm. The available choices are on two screens.

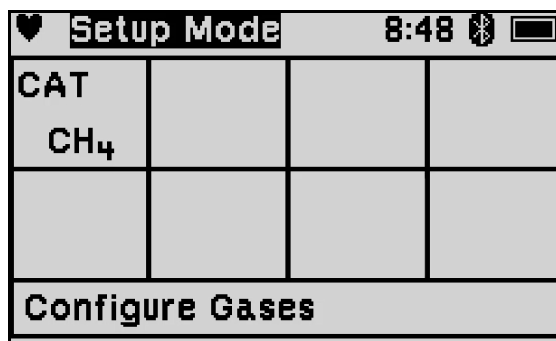
Some catalytic channel gas choices have pre-defined settings for methane elimination. See "Adjusting the Methane Elimination Mode" on page 61 for a description of the Methane Elimination Mode screen in Display Mode. See Appendix I: Methane Elimination Mode for a description of Methane Elimination Mode.

WARNING: Do not configure the catalytic sensor gas to hydrogen when monitoring for general hydrocarbons. Only use this configuration when monitoring exclusively for hydrogen or to prevent a significant response to other combustible gases.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Configure Gases**.



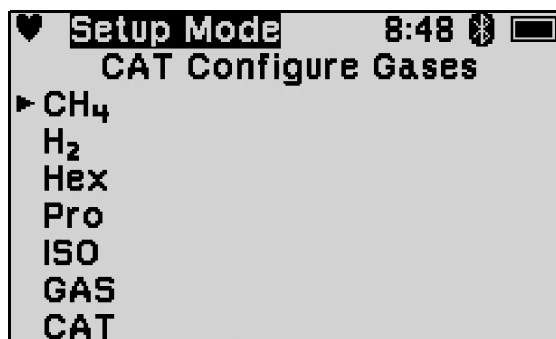
2. Press **POWER** to select the menu item. The **Configure Gases** screen appears with the catalytic channel's setting displayed, indicating that it can be adjusted.



3. Press **AIR** or **RANGE** to scroll to the desired channel.
 - To adjust the **CAT** channel, press **POWER** to select the channel and proceed to “Adjusting Channels for Catalytic Sensors”.
 - To adjust a non-**CAT** channel, press **POWER** to select the channel and proceed to “Adjusting Channels for Non-Catalytic Sensors” on page 140.

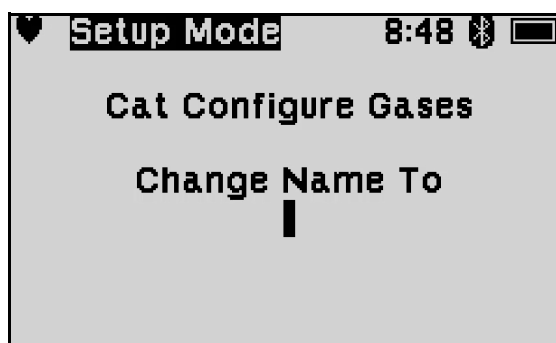
Adjusting Channels for Catalytic Sensors

1. After selecting the catalytic sensor's channel, the **Catalytic Configure Gases** screen appears. Press **AIR** or **RANGE** to scroll to the desired gas.



2. Press **POWER** to select the desired gas.
 - If the user-defined **GAS**, **CAT**, or “- -” choice is selected, proceed to Step 3.
 - If another gas is selected, proceed to Step 5.
 - If **Off** is selected, the instrument returns to the **Configure Gases** screen. Proceed to “Adjusting Channels for Non-Catalytic Sensors” to configure the other channels.

3. The user-defined gas **Change Name** screen appears with the first character flashing. Press **AIR** or **RANGE** to scroll to the desired value.

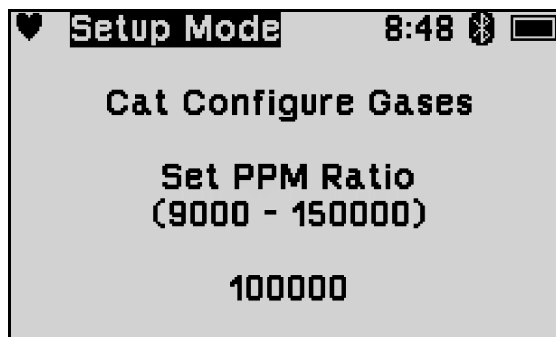


4. Press **POWER** to enter the value and move to the next value. Repeat until all three characters are entered.
5. The **Set PPM Ratio** screen appears. Gases that are not user-defined will display the fixed ppm ratio programmed into the instrument.

Refer to Table 19 for each combustible gas and their configurations.

Target Gas Name (Screen Name)	PPM Ratio: %vol / ppm	Sensor Voltage	CH ₄ Elimination	CH ₄ Elimination in Display Mode
Methane (CH ₄) (factory setting)	5% vol / 50,000 ppm	2.4v	Inactive	Unavailable
Hydrogen (H ₂)	4% vol / 40,000 ppm	1.1v	Inactive	Unavailable
Hexane (HEX)	1.1% vol / 11,000 ppm	2.4v	Active	Available
Propane (PRO)	TBD	TBD	TBD	TBD
Isobutane (IBU)	1.8% vol / 18,000 ppm	2.4v	Inactive	Unavailable
User-Adjustable Gas Configurations				
Generic Combustible Configuration (GAS)*	50,000 ppm	2.4v	Active	Unavailable
Factory Catalytic Channel (CAT)	50,000 ppm	2.4v	Inactive	Unavailable
“_ _ _”**	10,000 ppm	2.4v	Active	Accessible
<p>* The 50,000 ppm GAS gas configuration is normally set at the factory for very specific applications. Consult with RKI Instruments, Inc. before configuring the gas for 50,000 ppm GAS.</p> <p>** This option is entirely user-defined. The user will be prompted to enter a three-character gas name, the LEL value (ppm), the response factor to methane, and the detector voltage.</p>				

For user-adjustable gas configurations, use the **Set PPM Ratio** setting to enter the LEL of the channel's target gas. For example, if ethane is being defined, the LEL for ethane is 30,000 ppm (3.0% volume), so 30,000 ppm must be entered.



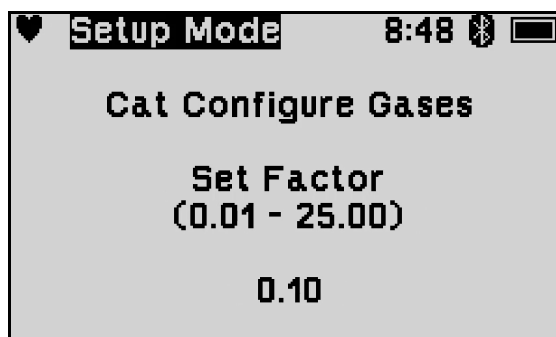
NOTE: If a user-defined gas has an LEL above 50,000 ppm, the %LEL reading in Normal Mode will reflect the defined ppm ratio, but the ppm reading in Normal Mode will not indicate above 50,000 ppm.

For example, if you set the ratio to be 150,000 ppm and set the catalytic combustible channel to display the reading in ppm, the gas reading will not indicate higher than 50,000 ppm, the equivalent of 33% LEL and 5% volume for this ratio, but will continue to indicate %LEL readings up to 100% LEL and %vol readings up to 15% volume, the equivalent of 150,000 ppm, if the display units are changed to %LEL or %vol. In addition, all adjustable ppm parameters cannot be set higher than 50,000 ppm.

6. Press **AIR** or **RANGE** until the desired value appears.
7. Press **POWER** to save the desired value.
 - If the user-defined **GAS**, **CAT**, or “- - -” choice is being adjusted, proceed to the next step.
 - If another combustible gas is selected, the instrument returns to the **Configure Gases** screen. Proceed to “Adjusting Channels for Non-Catalytic Sensors” on page 140 to configure the other channels.

NOTE: Be sure to perform a calibration on the catalytic combustible channel using an appropriate calibration cylinder for the target gas.

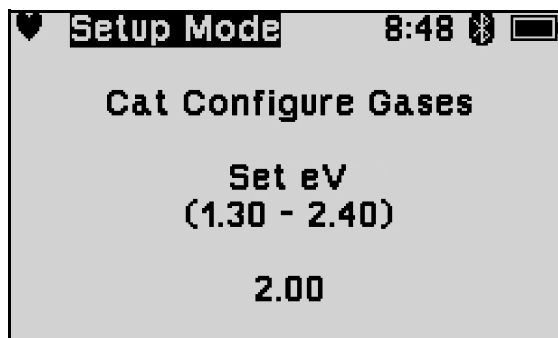
8. The **Set Factor** screen appears with the response factor range and current setting displayed.



Use this setting to adjust the response factor for the user-defined gas relative to methane. The response factor must be obtained by testing the user-defined gas and comparing its response to methane.

See “Catalytic Sensor Relative Response” on page 62 for a description of the relative response feature and how to use it. See page 44 for a list of response factors for several common hydrocarbon gases that have already been tested.

9. Press **AIR** or **RANGE** until the desired value appears.
10. Press **POWER** to save the desired value. The **Set EV** screen appears with the sensor voltage range and current setting displayed.



Use this setting to adjust whether the catalytic sensor voltage is set for full response, 2.40 volts, or methane elimination, 1.30 volts. If the sensor voltage is set to 2.40 volts, the unit will default to Full Response Mode when turned on, but the methane elimination feature can be turned on in the Methane Elimination Mode Screen in Display Mode.

If the sensor voltage is set to 1.3 volts, the unit will default to Methane Elimination Mode when turned on, but the methane elimination feature can be turned off in the Methane Elimination Mode Screen in Display Mode.

11. Press **AIR** or **RANGE** until the desired value appears.
12. Press **POWER** to save the desired value and return to the **Configure Gases** screen.
13. To exit the **Configure Gases** screen:
 - a. Press **RANGE** to scroll to **Escape**.
 - b. Press **POWER** to return to the Setup Mode menu.
14. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Adjusting Channels for Non-Catalytic Sensors

1. After selecting a non-catalytic sensor's channel from the **Configure Gases** screen, the channel's **Configure Gases** screen appears with the cursor next to the current setting.



2. Press **AIR** or **RANGE** to scroll to the desired setting.
3. Press **POWER** to save the desired setting and return to the **Configure Gases** screen.
4. To exit the **Configure Gases** screen:
 - a. Press **RANGE** to scroll to **Escape**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.
5. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Selecting the Catalytic Detection Units (Catalytic Units)

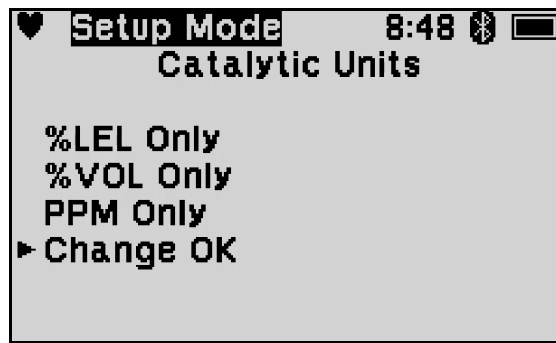
Use this menu to select one of the following measurement units for the catalytic sensor channel: **ppm**, **%LEL**, **%VOL**, or **Change OK** (factory setting).

Change OK allows units to be manually changed while in Normal Mode by pressing **RANGE**.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Catalytic Units**.



2. Press **POWER** to select the menu item. The **Catalytic Units** screen appears with the cursor next to the current setting.

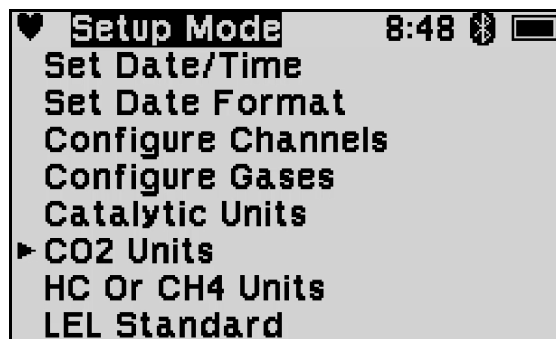


3. Press **AIR** or **RANGE** to scroll to the desired setting.
4. Press **POWER** to save the setting and return to the Setup Mode menu.
5. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

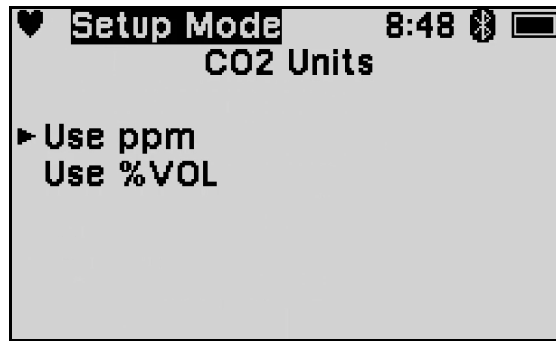
Selecting the CO₂ Detection Units (CO₂ Units)

Use this menu to select one of the following measurement units for the CO₂ channel: **ppm** (factory setting) or **%VOL**.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **CO₂ Units**.



2. Press **POWER** to select the menu item. The **CO2 Units** screen appears with the cursor next to the current setting.



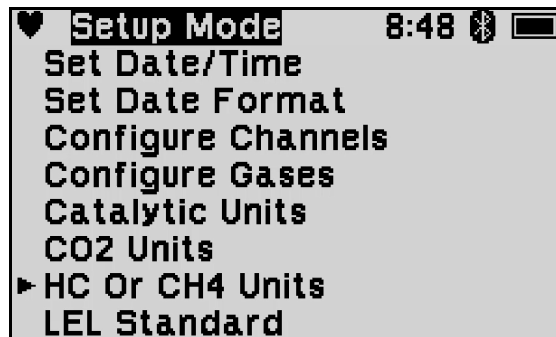
3. Press **AIR** or **RANGE** to scroll to the desired setting.
4. Press **POWER** to save the setting and return to the Setup Mode menu.
5. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Selecting HC or CH4 Units (HC Or CH4 Units)

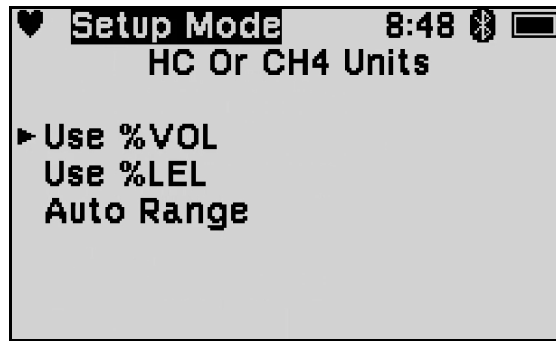
Use this menu to select one of the following measurement units for the IR channel: **Use %LEL**, **Use %VOL**, or **Auto Range** (factory setting).

Auto Range displays readings in %LEL until the gas level reaches 100% LEL, or 5.0% vol for methane. Once the gas reading is above 100% LEL, the reading is displayed in %vol. Alarm points exist for the %LEL range but do not exist for the %vol range.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **HC Or CH4 Units**.



2. Press **POWER** to select the menu item. The **HC Or CH4 Units** screen appears with the cursor next to the current setting.



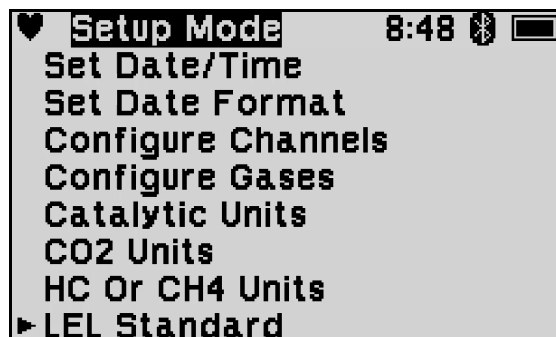
3. Press **AIR** or **RANGE** to scroll to the desired setting.
4. Press **POWER** to save the setting and return to the Setup Mode menu.
5. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Selecting the LEL Standard

Use this menu to select one of the following standards that the instrument uses to determine the LEL (lower explosive limit) for the combustible channel's target gas.

- **Standard** (factory setting) applies the standard settings for the lower explosive limit's ppm level
- **IEC** applies the IEC settings (per IEC 60079-20-1 2010[ed1.0]) for the lower explosive limit's ppm level.
- **ISO** applies the ISO settings (per ISO 10156 2017) for the lower explosive limit's ppm level.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **LEL Standard**.



2. Press **POWER** to select the menu item. The **LEL Standard** screen appears with the cursor next to the current setting.



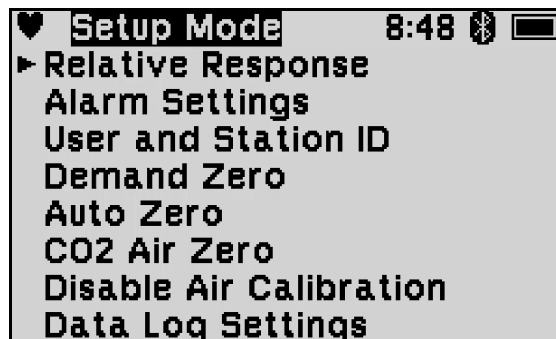
3. Press **AIR** or **RANGE** to scroll to the desired setting.
4. Press **POWER** to save the setting and return to the Setup Mode menu.
5. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Turning the Catalytic Sensor Relative Response On or Off (Relative Response)

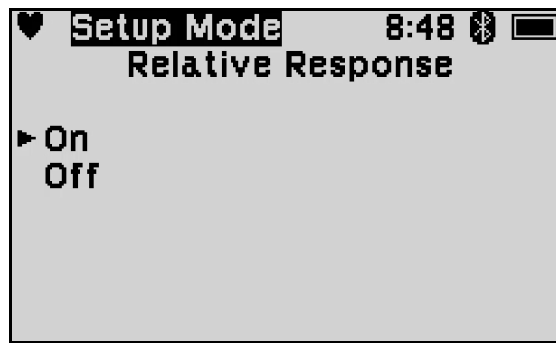
The relative response feature allows the catalytic sensor's response to be changed on the fly so that the catalytic channel is roughly calibrated to an alternate gas.

If the catalytic channel is setup for and calibrated to methane, another combustible gas can be selected from the gas list accessible from the **Catalytic Sensor Relative Response** in Display Mode (if the **Relative Response** setting is **On**). The channel will then respond to gas as if it were calibrated to the selected gas. For more information about using this feature, see page 62.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Relative Response**.



2. Press **POWER** to select the menu item. The **Relative Response** screen appears with the cursor next to the current setting.



3. Press **AIR** or **RANGE** to scroll to the desired setting.
4. Press **POWER** to save the setting and return to the Setup Mode menu.
5. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Updating the Alarm Settings

Changing Alarm Points

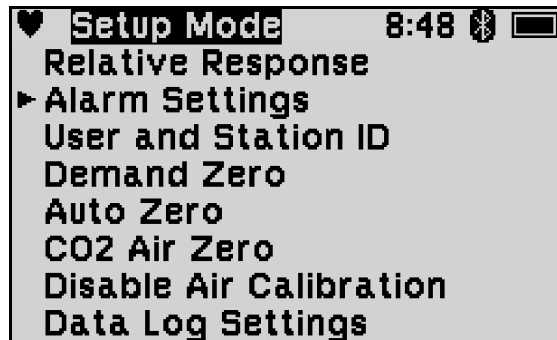
Use this menu to update one or more alarm points (the reading at which the Eagle 3 recognizes the alarm condition).

Channel	Alarm Point Limitations
Combustible Gas	5% LEL ≤ Alarm 1 ≤ Alarm 2 ≤ 60% LEL
Oxygen (O ₂)	<ul style="list-style-type: none"> • 0.0% ≤ Alarm L ≤ 21.8% • 20.0% ≤ Alarm H ≤ 40.0%
Hydrogen Sulfide (H ₂ S)	1.0 ppm ≤ Alarm 1 ≤ Alarm 2 ≤ 200.0 ppm
Carbon Monoxide (CO)	15 ppm ≤ Alarm 1 ≤ Alarm 2 ≤ 2000 ppm

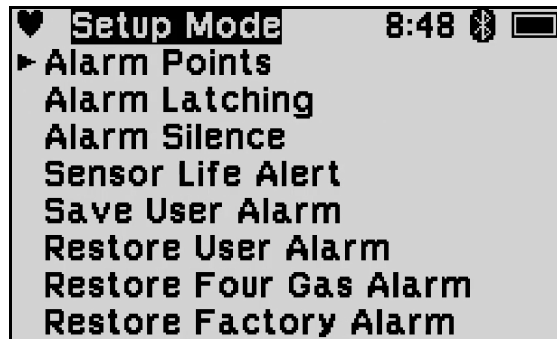
When setting the alarm points, keep the following in mind:

- The low alarm cannot be set higher than the high alarm, and the high alarm cannot be set lower than the low alarm.
- In addition to setting the oxygen alarm points, you can also select one of the following operation modes: low alarm decreasing and high alarm increasing (**L-H**); low and high alarm decreasing (**L-L**); low and high alarm increasing (**H-H**). The factory setting is **L-H**.

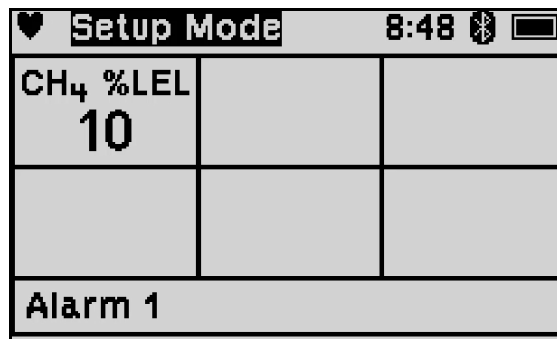
1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Alarm Settings**.



2. Press **POWER** to select the menu item. The **Alarm Settings** menu appears.

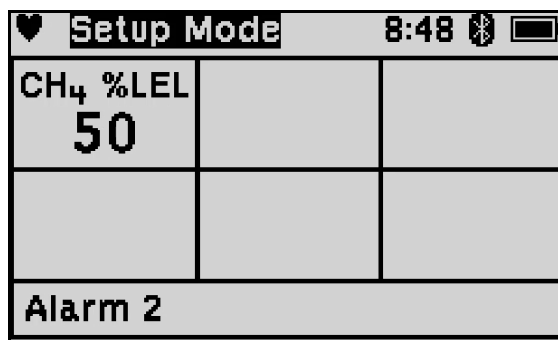


3. Press **AIR** or **RANGE** to scroll to **Alarm Points**.
4. Press **POWER** to select the menu item. The **Alarm Points** screen appears, displaying the first channel.
5. Press **AIR** or **RANGE** to scroll to the desired channel.
6. Press **POWER** to select the desired channel and begin editing the **Alarm 1** setting.



7. Press **AIR** or **RANGE** to scroll to the desired value.

8. Press **POWER** to confirm and repeat Step 7 for the **Alarm 2** setting.



9. Press **POWER** to confirm and move to the next alarm setting. Refer to the following table for each type of channel:

Catalytic Channel	<ul style="list-style-type: none"> • Alarm 1 (%LEL) • Alarm 2 (%LEL) • Alarm 1 ppm • Alarm 2 ppm 	<ul style="list-style-type: none"> • Alarm 1 %vol • Alarm 2 %vol • Alarm 1 ME (ppm) • Alarm 2 ME (ppm) 	<ul style="list-style-type: none"> • Alarm 1 ME LEL • Alarm 2 ME LEL • Alarm 1 ME VOL • Alarm 2 ME VOL
Toxic Gas Channels	<ul style="list-style-type: none"> • Alarm 1 • Alarm 2 • STEL • TWA 		
O₂ Channel	<ul style="list-style-type: none"> • Alarm 1 • Alarm 2 <p><u>Alarm Types:</u></p> <ul style="list-style-type: none"> • L-H (factory setting): Alarm 1 decreasing, Alarm 2 increasing • L-L: Both alarms decreasing • H-H: Both alarms increasing 		

10. When all settings for a channel have been saved, the instrument returns to the **Alarm Points** screen. Press **RANGE** to move to the next channel. Press **AIR** to move to the previous channel.
11. To return to the Alarm Settings menu:
- Press **RANGE** until the **Escape** screen appears
 - Press **POWER** to select the menu item.
12. To return to the Setup Mode menu:
- Press **AIR** or **RANGE** to scroll to the **Escape** menu item.
 - Press **POWER** to select the menu item.
13. To exit Setup Mode:
- Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - Press **POWER** to enter Normal Mode and begin the warmup sequence.

Changing the Alarm Latching Setting

Latching (factory setting): The instrument remains in alarm condition until the alarm condition passes and **POWER** is pressed.

Self-Resetting: The instrument automatically resets an alarm when the alarm condition passes.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Alarm Settings**.
2. Press **POWER** to select the menu item. The **Alarm Settings** menu appears.
3. Press **AIR** or **RANGE** to scroll to **Alarm Latching**.
4. Press **POWER** to select the menu item. The **Alarm Latching** menu appears with the cursor next to the current setting.



5. Press **AIR** or **RANGE** to scroll to the desired setting.
6. Press **POWER** to save the setting and return to the Alarm Settings menu.
7. To return to the Setup Mode menu:
 - a. Press **AIR** or **RANGE** to scroll to the **Escape** menu item.
 - b. Press **POWER** to select the menu item.
8. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

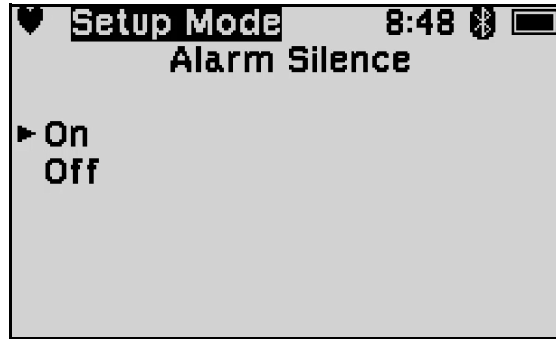
Turning the Alarm Silence Setting On or Off

On (factory setting): Pressing and releasing any button silences the buzzer when the Eagle 3 is in alarm. The LEDs continue to flash and the display continues to show the alarm.

- When the gas concentration falls below the alarm level, pressing and releasing **POWER** clears all alarm indicators for that alarm.
- To enter Display Mode during an alarm condition, press **DISPLAY**. The buzzer will be silenced, but the LEDs will continue to flash.
- If you return to Normal Mode and there is still an alarm condition, the LEDs will continue to flash and the buzzer will remain off. Once the condition clears, press **POWER** to clear the alarm indicators.

Off: The buzzer cannot be silenced. If an alarm condition occurs, and you enter Display Mode, the buzzer will not be silenced and the LEDs will continue to flash. Upon returning to Normal Mode, if there is still an alarm condition, you must wait until it clears before you can press **POWER** to clear the alarm indicators.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Alarm Settings**.
2. Press **POWER** to select the menu item. The **Alarm Settings** menu appears.
3. Press **AIR** or **RANGE** to scroll to **Alarm Silence**.
4. Press **POWER** to select the menu item. The **Alarm Silence** menu appears with the cursor next to the current setting.



5. Press **AIR** or **RANGE** to scroll to the desired setting.
6. Press **POWER** to save the setting and return to the Alarm Settings menu.
7. To return to the Setup Mode menu:
 - a. Press **AIR** or **RANGE** to scroll to the **Escape** menu item.
 - b. Press **POWER** to select the menu item.
8. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Turning the Sensor Life Alert On or Off

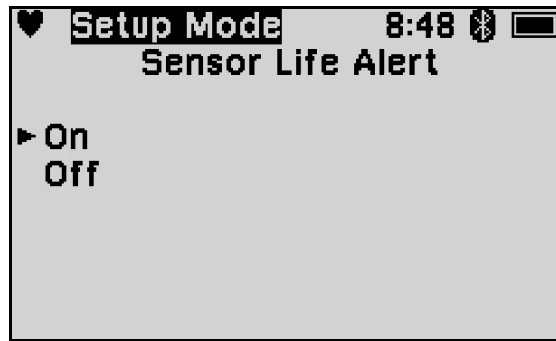
On: The instrument indicates that a sensor is nearing expiration in the following ways:

- Gas name flashes during normal operation.
- Sensor life warning screen (LEDs flash, buzzer sounds) during calibration. Press **POWER** to acknowledge.

Off (factory setting): The instrument does not indicate when a sensor is nearing its expiration.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Alarm Settings**.
2. Press **POWER** to select the menu item. The **Alarm Settings** menu appears.
3. Press **AIR** or **RANGE** to scroll to **Sensor Life Alert**.

4. Press **POWER** to select the menu item. The **Sensor Life Alert** menu appears with the cursor next to the current setting.

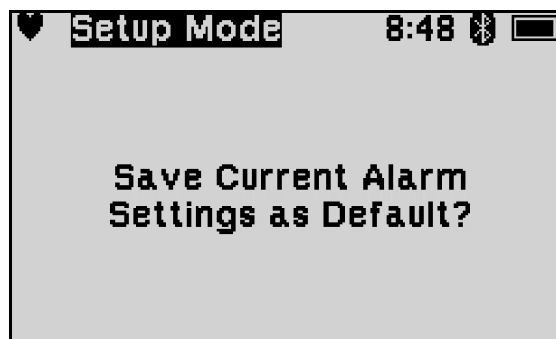


5. Press **AIR** or **RANGE** to scroll to the desired setting.
6. Press **POWER** to save the setting and return to the Alarm Settings menu.
7. To return to the Setup Mode menu:
 - a. Press **AIR** or **RANGE** to scroll to the **Escape** menu item.
 - b. Press **POWER** to select the menu item.
8. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Saving the User Alarm Settings

Use this menu to save the current alarm settings as the instruments default alarm settings.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Alarm Settings**.
2. Press **POWER** to select the menu item. The **Alarm Settings** menu appears.
3. Press **AIR** or **RANGE** to scroll to **Save User Alarm**.
4. Press **POWER** to select the menu item. The following prompt appears.



5. Press **POWER** to save the alarm points setting as the default alarm settings and return to the Alarm Settings menu.

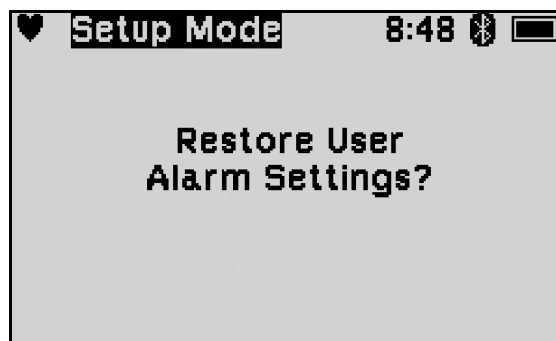
To return to the Alarm Settings menu without saving the current user alarm points, press **DISPLAY**.

6. To return to the Setup Mode menu:
 - a. Press **AIR** or **RANGE** to scroll to the **Escape** menu item.
 - b. Press **POWER** to select the menu item.
7. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

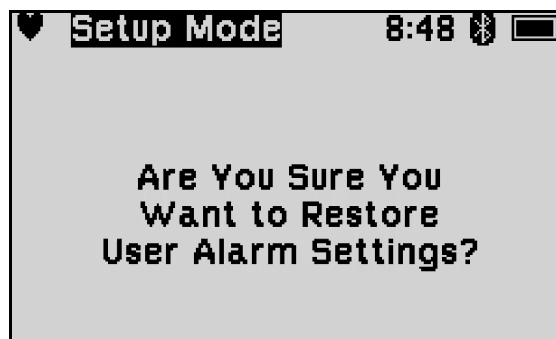
Restoring the User Alarm Settings

Use this menu to restore the current alarm points to the user alarm settings saved in the **Save User Alarm** menu item (if performed).

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Alarm Settings**.
2. Press **POWER** to select the menu item. The **Alarm Settings** menu appears.
3. Press **AIR** or **RANGE** to scroll to **Restore User Alarm**.
4. Press **POWER** to select the menu item. The following prompt appears.



5. Press **POWER** to proceed to the confirmation screen.
To return to the Alarm Settings menu without restoring the user alarm settings, press **DISPLAY**.



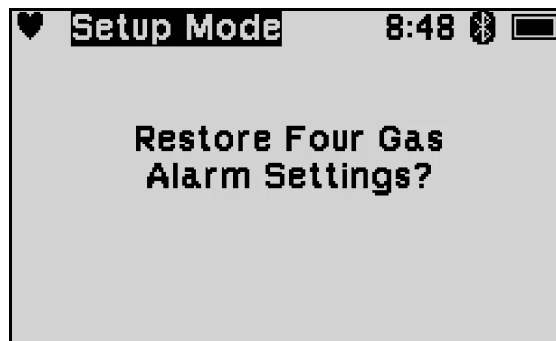
6. Press **POWER** to restore the alarm settings to the currently saved user alarm settings and return to the Alarm Settings menu.
To return to the Alarm Settings menu without restoring the user alarm settings, press **DISPLAY**.

7. To return to the Setup Mode menu:
 - a. Press **AIR** or **RANGE** to scroll to the **Escape** menu item.
 - b. Press **POWER** to select the menu item.
8. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

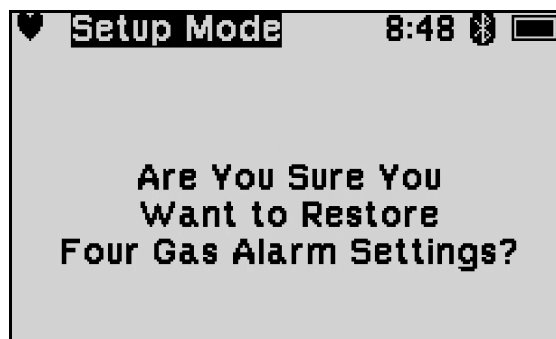
Restoring the Four Gas Alarm Settings

Use this menu to restore alarm settings for the following four gases: CH₄, O₂, CO, and H₂S. See Table 1 all four gases' default alarm points.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Alarm Settings**.
2. Press **POWER** to select the menu item. The **Alarm Settings** menu appears.
3. Press **AIR** or **RANGE** to scroll to **Restore Four Gas Alarm**.
4. Press **POWER** to select the menu item. The following prompt appears.



5. Press **POWER** to proceed to the confirmation screen.
To return to the Alarm Settings menu without restoring the four gas default alarm settings, press **DISPLAY**.



6. Press **POWER** to restore the alarm points to the four gas alarm settings and return to the Alarm Settings menu.
To return to the Alarm Settings menu without restoring the four gas alarm settings, press **DISPLAY**.

7. To return to the Setup Mode menu:
 - a. Press **AIR** or **RANGE** to scroll to the **Escape** menu item.
 - b. Press **POWER** to select the menu item.
8. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

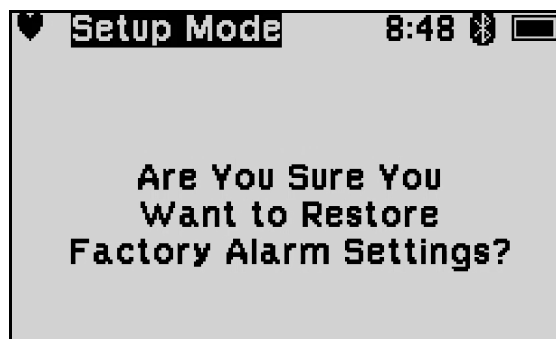
Restoring the Factory Alarm Settings

Use this menu to restore all current alarm settings to the factory default alarm settings (see “Specifications” on page 14).

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Alarm Settings**.
2. Press **POWER** to select the menu item. The **Alarm Settings** menu appears.
3. Press **AIR** or **RANGE** to scroll to **Restore Factory Alarm**.
4. Press **POWER** to select the menu item. The following prompt appears.



5. Press **POWER** to proceed to the confirmation screen.
To return to the Alarm Settings menu without restoring the factory alarm settings, press **DISPLAY**.



6. Press **POWER** to restore the current alarm settings to the factory alarm settings and return to the Alarm Settings menu.
To return to the Alarm Settings menu without restoring the factory alarm settings, press **DISPLAY**.

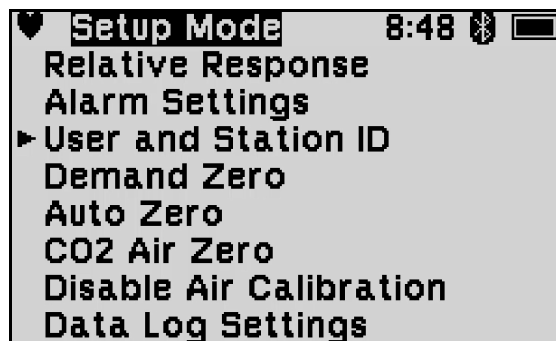
7. To return to the Setup Mode menu:
 - a. Press **AIR** or **RANGE** to scroll to the **Escape** menu item.
 - b. Press **POWER** to select the menu item.
8. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Turning the User and Station ID On or Off

On: The ID Screen displays during start up and the **Select User ID?** screen and **Select Station ID?** screens appear in Display Mode. To select a new user ID, see page 67. To select a new station ID, see page 68.

Off (factory setting): The ID Screen does not display during start up and the **Select User ID?** screen and **Select Station ID?** screen do not appear in Display Mode.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **User and Station ID**.



2. Press **POWER** to select the menu item. The **User and Station ID** screen appears with the cursor next to the current setting.



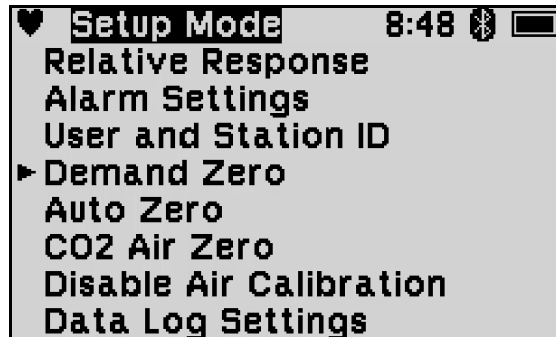
3. Press **AIR** or **RANGE** to scroll to the desired setting.
4. Press **POWER** to save the setting and return to the Setup Mode menu.
5. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Turning Demand Zero On or Off (Demand Zero)

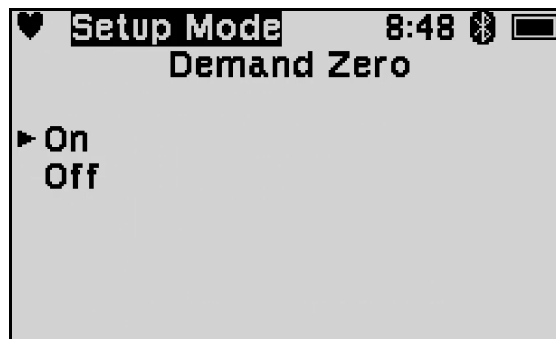
On (factory setting): Fresh air adjustments can be performed while in Normal Mode by pressing AIR.

Off: Fresh air adjustments cannot be performed while in Normal Mode.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Demand Zero**.



2. Press **POWER** to select the menu item. The **Demand Zero** screen appears with the cursor next to the current setting.



3. Press **AIR** or **RANGE** to scroll to the desired setting.
4. Press **POWER** to save the setting and return to the Setup Mode menu.
5. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

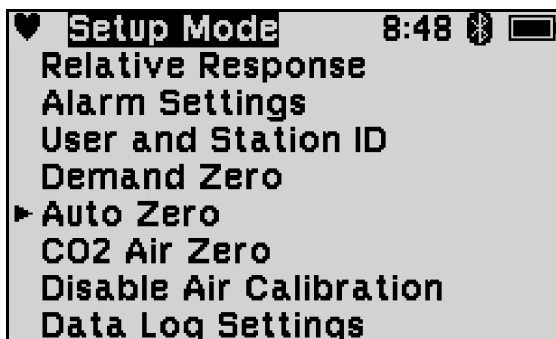
Turning Auto Zero On or Off (Auto Zero)

On: The Eagle 3 asks if you want to perform a fresh air adjustment at the end of the warmup sequence.

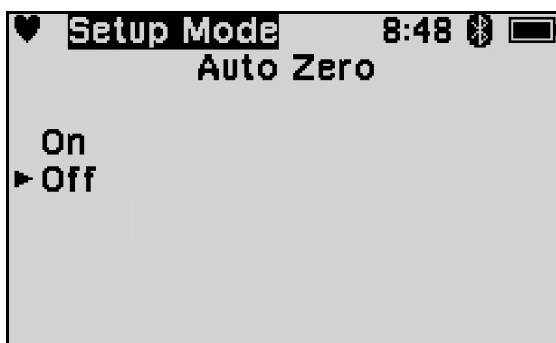
Off (factory setting): The Eagle 3 does not ask if you want to perform a fresh air adjustment at the end of the warmup sequence.

WARNING: *If the automatic fresh air feature is turned on, you must start up the Eagle 3 in a known fresh air environment, an environment free of toxic or combustible gases and of normal oxygen content (20.9%). If this feature is on and the Eagle 3 is started up in the presence of a target gas, the readings and alarms will not be accurate or reliable.*

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Auto Zero**.



2. Press **POWER** to select the menu item. The **Auto Zero** screen appears with the cursor next to the current setting.



3. Press **AIR** or **RANGE** to scroll to the desired setting.
4. Press **POWER** to save the setting and return to the Setup Mode menu.
5. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

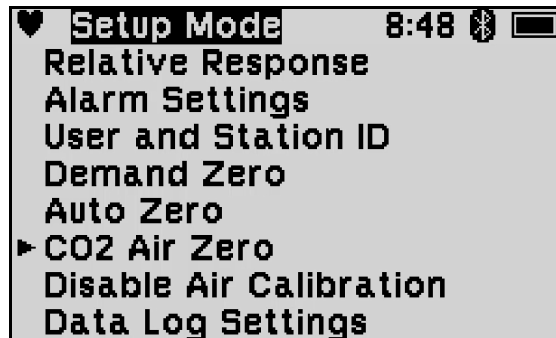
Turning CO₂ Air Zero On or Off

This menu item only appears if a CO₂ sensor is installed.

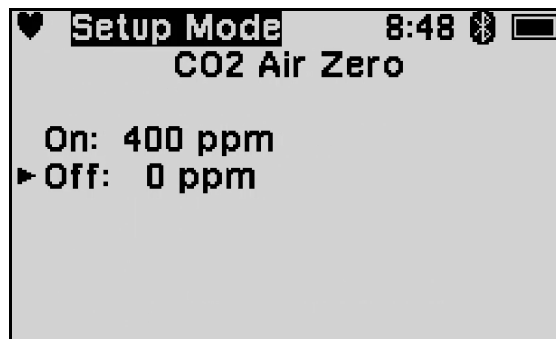
ON: CO₂ channel is set to 400 ppm (0.04% volume) during a demand zero, auto zero, or **Air Calibration**.

OFF (factory setting): CO₂ channel is not adjusted during a demand zero, auto zero, or **Air Calibration**.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **CO₂ Air Zero**.



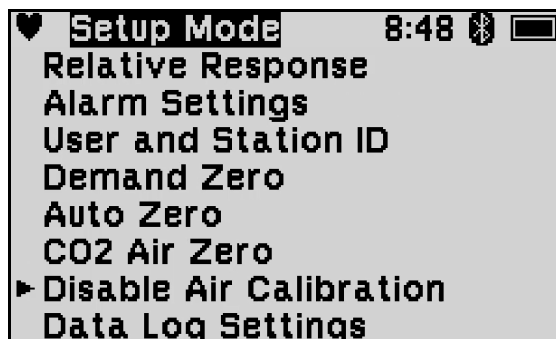
2. Press **POWER** to select the menu item. The **CO₂ Air Zero** screen appears with the cursor next to the current setting.



3. Press **AIR** or **RANGE** to scroll to the desired setting.
4. Press **POWER** to save the setting and return to the Setup Mode menu.
5. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Disabling Air Calibration

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Disable Air Calibration**.

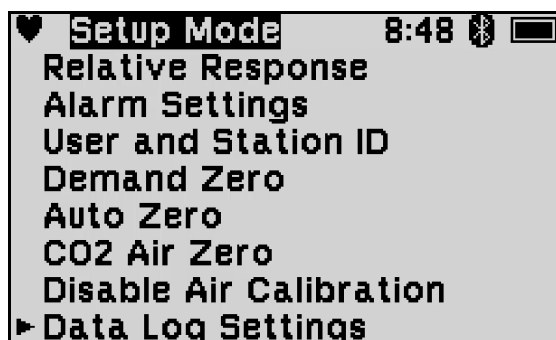


Adjusting the Data Log Settings

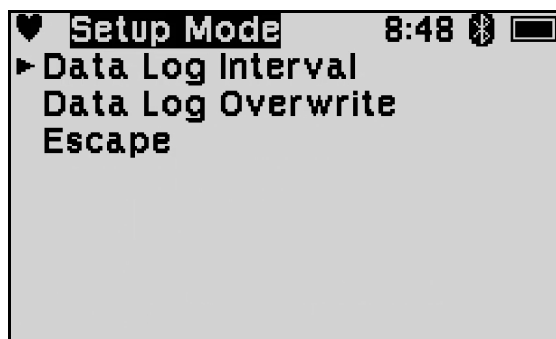
Selecting the Data Log Interval

This setting controls how often the Eagle 3 saves readings to the data logger. The following interval times can be selected: 10 minutes, 5 minutes (factory setting), 3 minutes, 1 minute, 30 seconds, 20 seconds, 10 seconds, 5 seconds, 4 seconds, 3 seconds, 2 seconds, and 1 second.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Data Log Settings**.

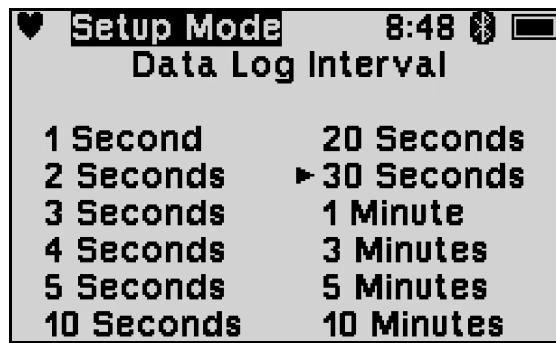


2. Press **POWER** to select the menu item. The Data Log Settings menu appears.



3. Press **AIR** or **RANGE** to scroll to the **Data Log Interval** menu item.

4. Press **POWER** to select the menu item. The **Data Log Interval** screen appears with the cursor next to the current setting.



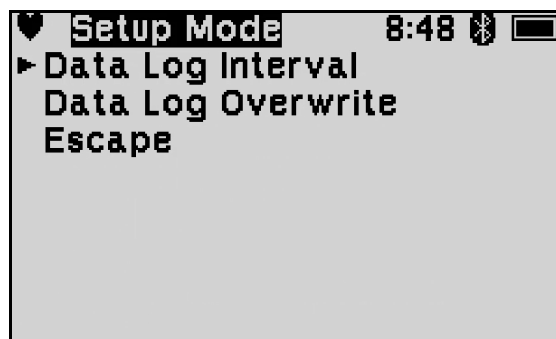
5. Press **AIR** or **RANGE** to scroll to the desired setting.
6. Press **POWER** to save the setting and return to the Data Log Settings menu.
7. To return to the Setup Mode menu:
 - a. Press **AIR** or **RANGE** to scroll to the **Escape** menu item.
 - b. Press **POWER** to select the menu item.
8. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Turning Data Log Overwrite On or Off

On (factory setting): When the Eagle 3's data log memory is full, it overwrites the oldest data logs with the most recent data logs.

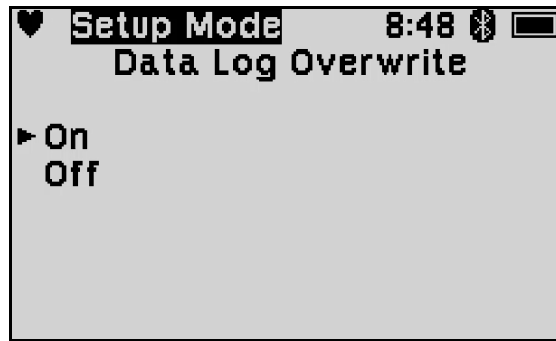
Off: The Eagle 3 stops saving data to the data logger when the data logger memory is full.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Data Log Settings**.
2. Press **POWER** to select the menu item. The Data Log Settings menu appears.



3. Press **AIR** or **RANGE** to scroll to the **Data Log Overwrite** menu item.

4. Press **POWER** to select the menu item. The **Data Log Overwrite** screen appears with the cursor next to the current setting.

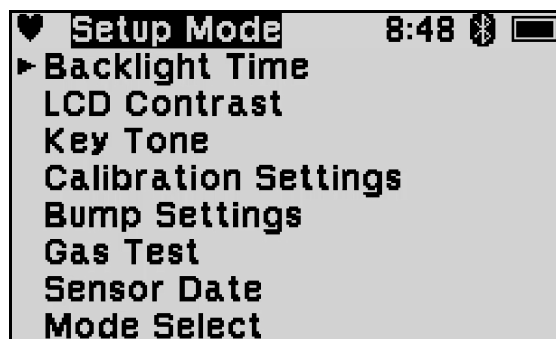


5. Press **AIR** or **RANGE** to scroll to the desired setting.
6. Press **POWER** to save the setting and return to Data Log Settings menu.
7. To return to the Setup Mode menu:
 - a. Press **AIR** or **RANGE** to scroll to the **Escape** menu item.
 - b. Press **POWER** to select the menu item.
8. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

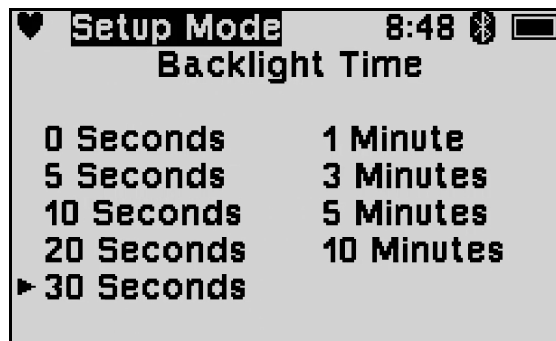
Selecting the Backlight Time

This setting defines how long the LCD backlight stays on when you press any button. The minimum setting is 0 seconds; the maximum setting is 10 minutes. The factory setting is **30 seconds**.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Backlight Time**.



2. Press **POWER** to select the menu item. The **Backlight Time** screen appears with the cursor next to the current setting.



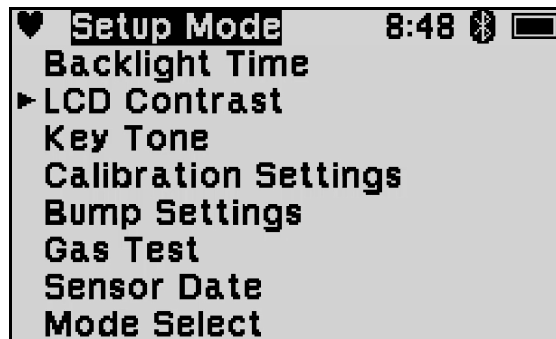
3. Press **AIR** or **RANGE** to scroll to the desired setting.
4. Press **POWER** to save the setting and return to Setup Mode menu.
5. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Adjusting the LCD Contrast

Use this setting to adjust the LCD contrast. Select the setting so the characters on the display are easy to see. Increasing the contrast darkens the characters and LCD background.

The LCD contrast can be set from 1 to 15. The factory setting is **8**.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **LCD Contrast**.



2. Press **POWER** to select the menu item. The **LCD Contrast** screen appears with the current contrast value displayed above a solid bar representing the contrast level.



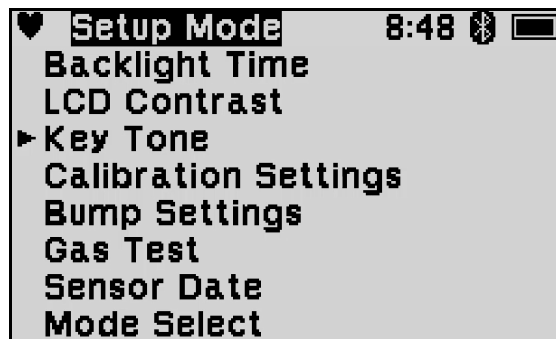
3. Press **AIR** or **RANGE** to adjust the setting so that the characters on the LCD are easily visible.
4. Press **POWER** to save the desired setting and return to Setup Mode.
5. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Turning the Key Tone On/Off

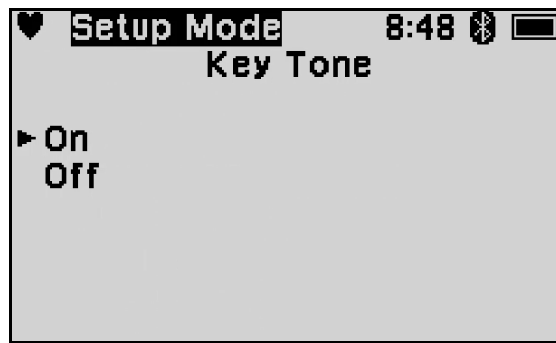
On (factory setting): The instrument beeps when a button is pressed.

Off: The instrument does not beep when a button is pressed.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Key Tone**.



2. Press **POWER** to select the menu item. The **Key Tone** screen appears with the cursor next to the current setting.



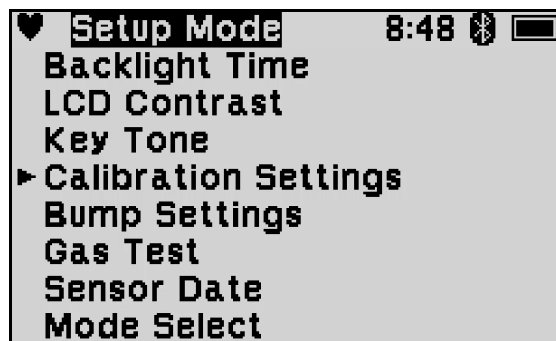
3. Press **AIR** or **RANGE** to scroll to the desired setting.
4. Press **POWER** to save the setting and return to Setup Mode menu.
5. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Calibration Settings

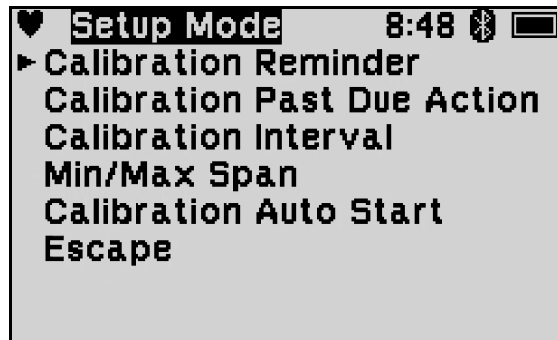
Turning the Calibration Reminder On or Off

Use this menu to turn the Calibration Reminder feature **On** (factory setting) or **Off**. When this feature is enabled, the Eagle 3 will indicate at start up if it is due for calibration. The type of indicator will depend on the **Calibration Past Due Action** setting (see page 164).

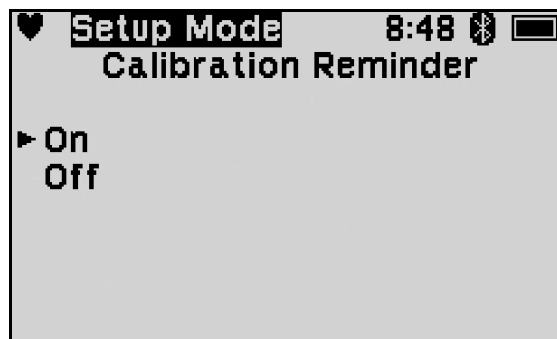
1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Calibration Settings**.



2. Press **POWER** to select the menu item. The **Calibration Settings** menu appears.



3. Press **AIR** or **RANGE** to scroll to the **Calibration Reminder** menu item.
4. Press **POWER** to select the menu item. The **Calibration Reminder** menu appears with the cursor next to the current setting.



5. Press **AIR** or **RANGE** to scroll to the desired setting.
6. Press **POWER** to save the setting and return to Setup Mode menu.
7. To return to the Setup Mode menu:
 - a. Press **AIR** or **RANGE** to scroll to the **Escape** menu item.
 - b. Press **POWER** to select the menu item.
8. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Selecting the Calibration Past Due Action Setting

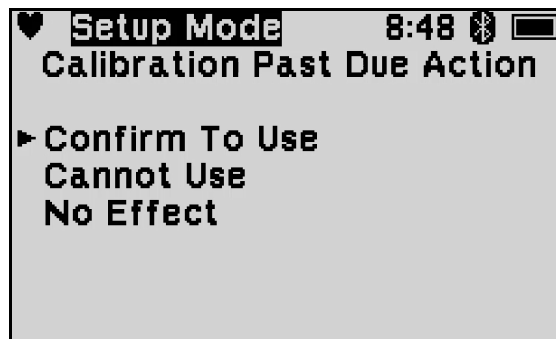
Use this menu to select the Calibration Past Due Action for when **Calibration Reminder** is set to **On** and a calibration is past due. The following options are detailed below: **Confirm to Use**, **Cannot Use**, and **No Effect**.

Confirm to Use (factory setting): If the unit is due for a calibration, the Eagle 3 displays a prompt to continue with the warm up sequence or perform a calibration. To acknowledge the reminder, skip the calibration, and resume warmup, press **DISPLAY**.

Cannot Use: If the unit is due for a calibration, the buzzer will pulse twice a second and the Eagle 3 displays a prompt to begin a calibration. Press **AIR** to proceed. If **AIR** is not pressed after five seconds, the unit enters Calibration Mode. See page 85 for performing a calibration.

No Effect: If the unit is due for a calibration, the buzzer will pulse twice a second and the Eagle 3 displays a reminder to calibration the instrument and the option to resume with the warm up sequence or perform a calibration. After a few seconds, the unit resumes the warmup sequence.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Calibration Settings**.
2. Press **POWER** to select the menu item. The **Calibration Settings** menu appears.
3. Press **AIR** or **RANGE** to scroll to the **Calibration Past Due Action** menu item.
4. Press **POWER** to select the menu item. The **Calibration Past Due Action** menu appears with the cursor next to the current setting.



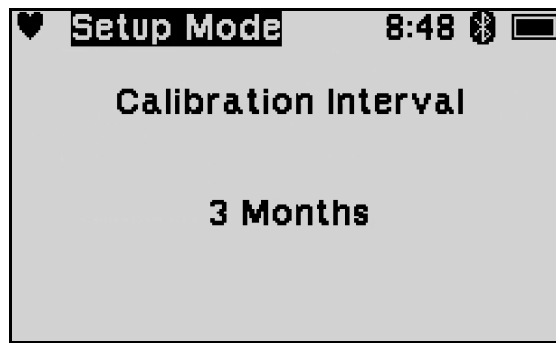
5. Press **AIR** or **RANGE** to scroll to the desired setting.
6. Press **POWER** to save the setting and return to the Calibration Settings menu.
7. To return to the Setup Mode menu:
 - a. Press **AIR** or **RANGE** to scroll to the **Escape** menu item.
 - b. Press **POWER** to select the menu item.
8. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Adjusting the Calibration Interval

Use this menu to adjust the time between calibrations. The available intervals are **0 - 30 days** and **2 - 12 months**. The factory setting is **3 months**.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Calibration Settings**.
2. Press **POWER** to select the menu item. The **Calibration Settings** menu appears.
3. Press **AIR** or **RANGE** to scroll to the **Calibration Interval** menu item.

4. Press **POWER** to select the menu item. The **Calibration Interval** menu appears with the current interval displayed.



5. Press **AIR** or **RANGE** until the desired number of days is displayed.
6. Press **POWER** to save the setting and return to the **Calibration Settings** menu.
7. To return to the Setup Mode menu:
 - a. Press **AIR** or **RANGE** to scroll to the **Escape** menu item.
 - b. Press **POWER** to select the menu item.
8. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Turning Min/Max Span On or Off

Use this menu to turn the Min/Max Span feature **On** (factory setting) and **Off**. When this feature is enabled, the Eagle 3 will display the span adjustment range for a sensor in the calibration results screen. The span adjustment shows how low and how high the reading could have been adjusted.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Calibration Settings**.
2. Press **POWER** to select the menu item. The **Calibration Settings** menu appears.
3. Press **AIR** or **RANGE** to scroll to the **Min/Max Span** menu item.
4. Press **POWER** to select the menu item. The **Min/Max Span** screen appears with the cursor next to the current setting.



5. Press **AIR** or **RANGE** to move the cursor next to the desired setting.

6. Press **POWER** to save the setting and return to the **Calibration Settings** menu.
7. To return to the Setup Mode menu:
 - a. Press **AIR** or **RANGE** to scroll to the **Escape** menu item.
 - b. Press **POWER** to select the menu item.
8. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Turning Calibration Auto Start On or Off

Use this menu to select whether the instrument automatically begins the warmup sequence if it passes calibration. The factory setting is **On**.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Calibration Settings**.
2. Press **POWER** to select the menu item. The **Calibration Settings** menu appears.
3. Press **AIR** or **RANGE** to scroll to the **Calibration Auto Start** menu item.
4. Press **POWER** to select the menu item. The **Calibration Auto Start** screen appears with the cursor next to the current setting.



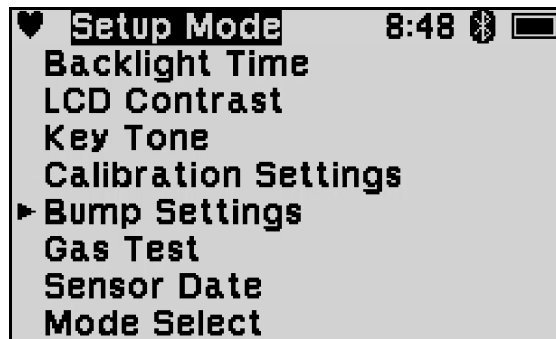
5. Press **AIR** or **RANGE** to move the cursor next to the desired setting.
6. Press **POWER** to save the setting and return to the **Calibration Settings** menu.
7. To return to the Setup Mode menu:
 - a. Press **AIR** or **RANGE** to scroll to the **Escape** menu item.
 - b. Press **POWER** to select the menu item.
8. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Bump Settings

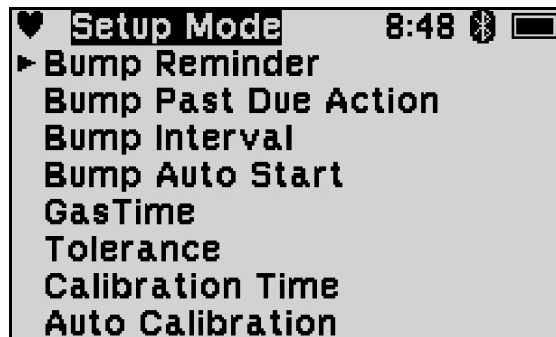
Turning Bump Reminder On or Off

Use this menu to turn the Bump Reminder feature on and off (factory setting). When this feature is enabled, the Eagle 3 will indicate at start up if it is due for a bump test. The type of indicator will depend on the **Bump Past Due Action** setting (see page 169).

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Bump Settings**.



2. Press **POWER** to select the menu item. The Bump Settings screen appears.



3. Press **AIR** or **RANGE** to scroll to the **Bump Reminder** menu item.
4. Press **POWER** to select the menu item. The **Bump Reminder** screen appears with the cursor next to the current setting.



5. Press **AIR** or **RANGE** to move the cursor next to the desired setting.

6. Press **POWER** to save the setting and return to the Bump Settings menu.
7. To return to the Setup Mode menu, press **AIR** or **RANGE** to scroll to the **Escape** menu item. Press **POWER** to select the menu item.
8. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Selecting the Bump Past Due Action

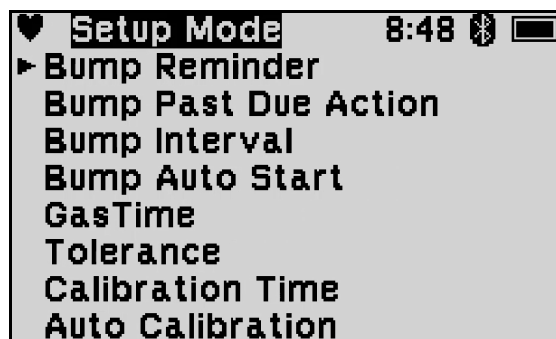
Use this menu to select the Bump Past Due Action for when **Bump Test Reminder** is set to **On** and a bump test is past due. The following options are detailed below: **Confirm to Use**, **Cannot Use**, and **No Effect**.

Confirm to Use (factory setting): If the unit is due for a bump test, the Eagle 3 displays a prompt to continue with the warm up sequence or perform a bump test. To acknowledge the reminder, skip the bump test, and resume warmup, press **DISPLAY**.

Cannot Use: If the unit is due for a bump test, the buzzer will pulse twice a second and the Eagle 3 displays a prompt to begin a bump test. Press **AIR** to proceed. If **AIR** is not pressed after five seconds, the unit enters Calibration Mode. See page 78 for performing a bump test.

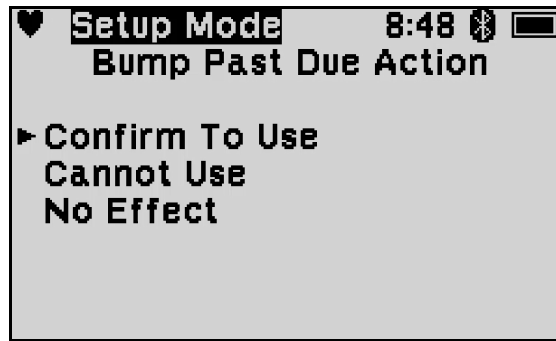
No Effect: If the unit is due for a bump test, the buzzer will pulse twice a second and the Eagle 3 displays a reminder to bump test the instrument and the option to resume with the warm up sequence or perform a bump test. After a few seconds, the unit resumes the warmup sequence.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Bump Settings**.
2. Press **POWER** to select the menu item. The Bump Settings menu appears.



3. Press **AIR** or **RANGE** to scroll to the **Bump Past Due Action** menu item.

4. Press **POWER** to select the menu item. The **Bump Past Due Action** screen appears with the cursor next to the current setting.

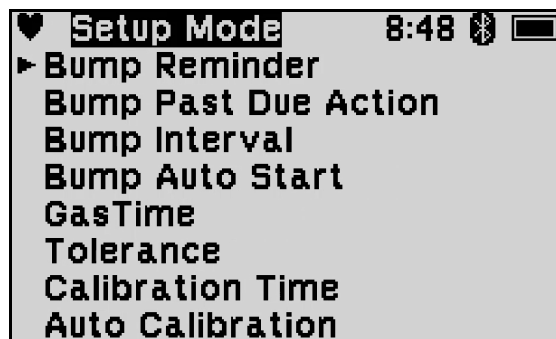


5. Press **AIR** or **RANGE** to scroll to the desired setting.
6. Press **POWER** to save the setting and return to the Bump Settings menu.
7. To return to the Setup Mode menu:
 - a. Press **AIR** or **RANGE** to scroll to the **Escape** menu item.
 - b. Press **POWER** to select the menu item.
8. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Adjusting the Bump Test Interval

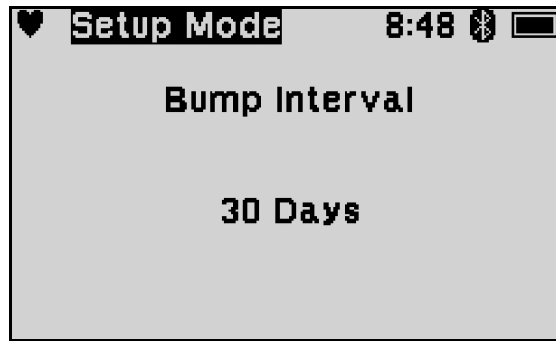
Use this menu to adjust how often a bump test should be performed. The time can be set in 1 day increments. The minimum setting is 0 day and the maximum setting is 60 days. The factory setting is **30 days**.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Bump Settings**.
2. Press **POWER** to select the menu item. The Bump Settings menu appears.



3. Press **AIR** or **RANGE** to scroll to the **Bump Interval** menu item.

4. Press **POWER** to select the menu item. The **Bump Interval** screen appears with the current interval setting displayed.



5. Press **AIR** or **RANGE** until the desired number of days is displayed.

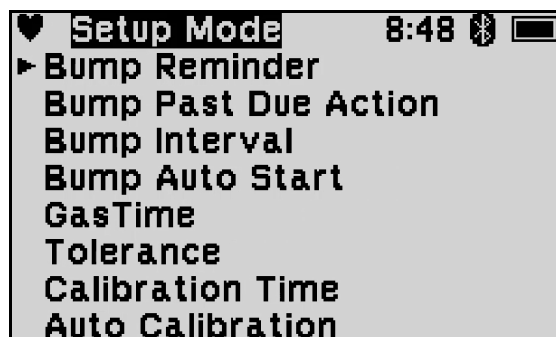
NOTE: The **AIR** or **RANGE** buttons can be held down to increase the scroll speed.

6. Press **POWER** to save the setting and return to the Bump Settings menu.
7. To return to the Setup Mode menu:
 - a. Press **AIR** or **RANGE** to scroll to the **Escape** menu item.
 - b. Press **POWER** to select the menu item.
8. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Turning Bump Test Auto Start On or Off

Use this menu to select whether the instrument automatically begins the warmup sequence after passing a bump test. The factory setting is **On**.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Bump Settings**.
2. Press **POWER** to select the menu item. The Bump Settings menu appears.



3. Press **AIR** or **RANGE** to scroll to the **Bump Auto Start** menu item.

4. Press **POWER** to select the menu item. The Bump Auto Start screen appears with the cursor next to the current setting.



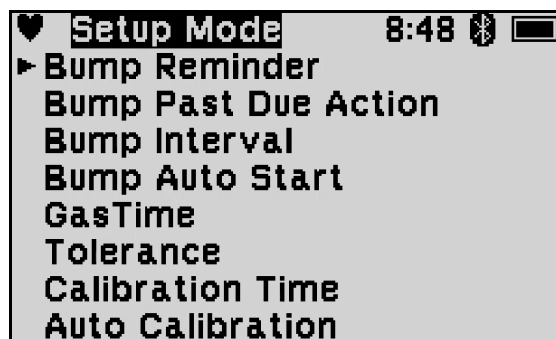
5. Press **AIR** or **RANGE** to scroll to the desired setting.
6. Press **POWER** to save the setting and return to the Bump Settings menu.
7. To return to the Setup Mode menu:
 - a. Press **AIR** or **RANGE** to scroll to the **Escape** menu item.
 - b. Press **POWER** to select the menu item.
8. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Selecting the GasTime

Use this menu to select the length of time the Eagle 3 draws calibration gas during a bump test.

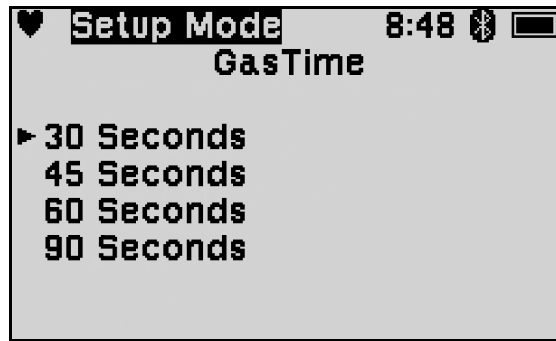
Options: **30 seconds** (factory setting), 45 seconds, 60 seconds, and 90 seconds.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Bump Settings**.
2. Press **POWER** to select the menu item. The Bump Settings menu appears.



3. Press **AIR** or **RANGE** to scroll to the **GasTime** menu item.

4. Press **POWER** to select the menu item. The **GasTime** screen appears with the cursor next to the current setting.



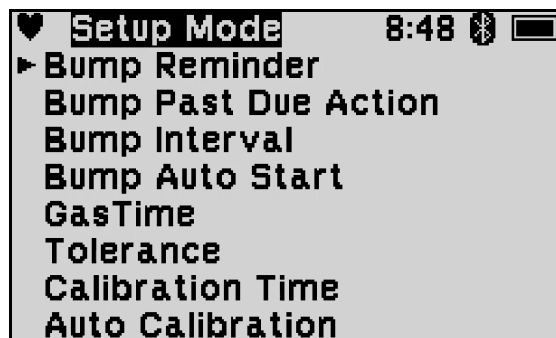
5. Press **AIR** or **RANGE** to scroll to the desired setting.
6. Press **POWER** to save the setting and return to the Bump Settings menu.
7. To return to the Setup Mode menu:
 - a. Press **AIR** or **RANGE** to scroll to the **Escape** menu item.
 - b. Press **POWER** to select the menu item.
8. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Adjusting the Tolerance

Use this menu to adjust how close the gas reading has to be to the calibration gas value to pass the bump test. For example, if the tolerance is set to 50%, and the %LEL calibration gas concentration is 50% LEL, then the bump test gas reading for the LEL channel on the Eagle 3 must be 50% LEL \pm 25% LEL.

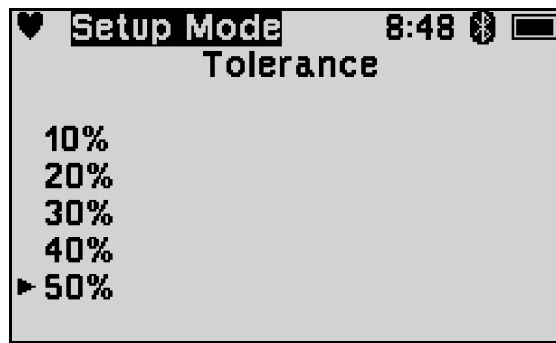
Options: 10, 20, 30, 40, **50%** (factory setting)

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Bump Settings**.
2. Press **POWER** to select the menu item. The Bump Settings menu appears.



3. Press **AIR** or **RANGE** to scroll to the **Tolerance** menu item.

4. Press **POWER** to select the menu item. The **Tolerance** screen appears with the cursor next to the current setting.



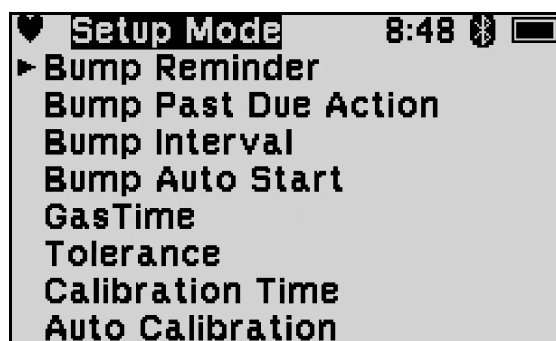
5. Press **AIR** or **RANGE** to scroll to the desired setting.
6. Press **POWER** to save the setting and return to the Bump Settings menu.
7. To return to the Setup Mode menu:
 - a. Press **AIR** or **RANGE** to scroll to the **Escape** menu item.
 - b. Press **POWER** to select the menu item.
8. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Selecting the Calibration Time

Use this menu to select the the total time that the instrument is exposed to calibration gas when a bump test fails and **Auto Calibration** is set to **On**. The bump test time is deducted from the calibration time.

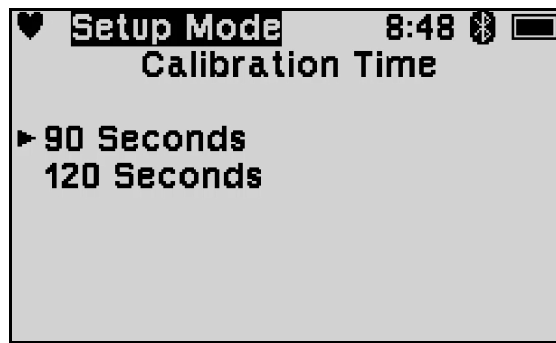
For example, if the **Calibration Time** is set to 90 seconds, the **GasTime** is set to 30 seconds, and the bump test fails, the Eagle 3 will only be exposed to gas for an additional 60 seconds. The available values are **90 seconds** (factory setting), and **120 seconds**.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Bump Settings**.
2. Press **POWER** to select the menu item. The Bump Settings menu appears.



3. Press **AIR** or **RANGE** to scroll to the **Calibration Time** menu item.

4. Press **POWER** to select the menu item. The **Calibration Time** screen appears with the cursor next to the current setting.

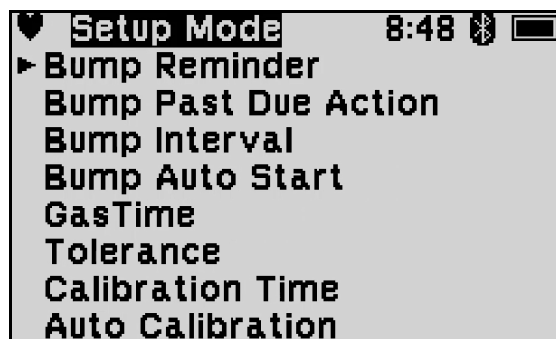


5. Press **AIR** or **RANGE** to turn the setting on or off.
6. Press **POWER** to save the setting and return to the Bump Settings menu.
7. To return to the Setup Mode menu:
 - a. Press **AIR** or **RANGE** to scroll to the **Escape** menu item.
 - b. Press **POWER** to select the menu item.
8. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Turning Auto Calibration On or Off

Use this menu to control whether or not the instrument automatically starts a calibration if the bump test fails. Factory setting is **On**.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Bump Settings**.
2. Press **POWER** to select the menu item. The Bump Settings menu appears.



3. Press **AIR** or **RANGE** to scroll to the **Auto Calibration** menu item.

4. Press **POWER** to select the menu item. The **Auto Calibration** screen appears with the cursor next to the current setting.

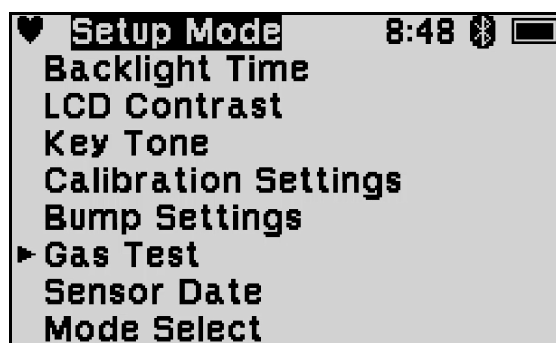


5. Press **AIR** or **RANGE** to turn the setting on or off.
6. Press **POWER** to save the setting and return to the Bump Settings menu.
7. To return to the Setup Mode menu:
 - a. Press **AIR** or **RANGE** to scroll to the **Escape** menu item.
 - b. Press **POWER** to select the menu item.
8. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Performing a Gas Test

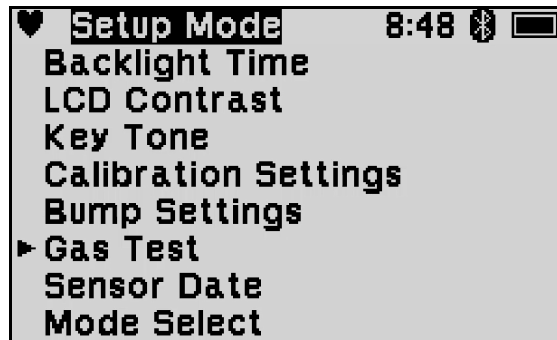
Use this menu item to confirm that the Eagle 3 is responding to gas without recording a bump test or an alarm condition.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Gas Test**.



2. Press **POWER** to begin alarm testing.

3. On screen, all channels will flash at once. The buzzer will sound if it has been enabled.



4. To return to Setup Mode, press **POWER**.
5. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

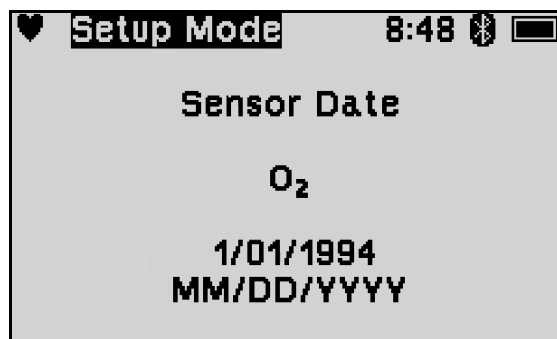
Setting the Sensor Replacement Date (Sensor Date)

Use this menu item to enter and save the sensor replacement date for each sensor.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Sensor Date**.



2. Press **POWER**. The **Sensor Date** screen appears with the first channel and a date placeholder.



3. Press **AIR** or **RANGE** until the year matches the year of the sensor's replacement date.

NOTE: The **AIR** or **RANGE** buttons can be held down to increase the scroll speed.

4. Press **POWER** to save the year and move to the month.
5. Repeat Step 2 through Step 4 to enter the month and day.
6. Press **POWER** to save the day value and the **Sensor Date** and return the unit to the Setup Mode menu.
7. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Selecting the Mode Setting (Mode Select)

Use this menu to configure the **Mode Select** screen and the available options. The options are detailed below.

See page 341 and page 349 for discussions of Bar Hole Mode and Leak Check Mode, respectively.

Off (factory setting): The Mode Select Screen does not appear when the unit is turned on and the unit goes into Normal Mode after the start up sequence. **Off** is the factory setting unless the instrument is ordered for bar hole measurement or leak checking use.

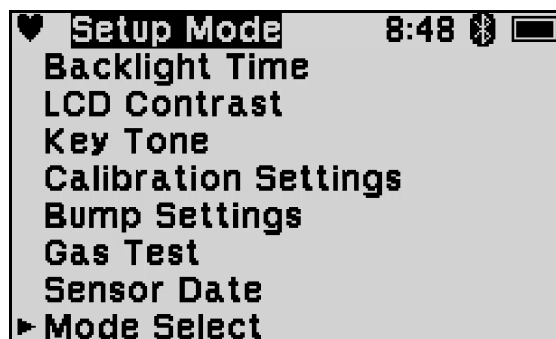
Leak Check Only: The Mode Select Screen appears when the unit is turned on. The available options are Normal Mode and Leak Check Mode.

Bar Hole Only: The Mode Select Screen appears when the unit is turned on. The available options are Normal Mode and Bar Hole Mode.

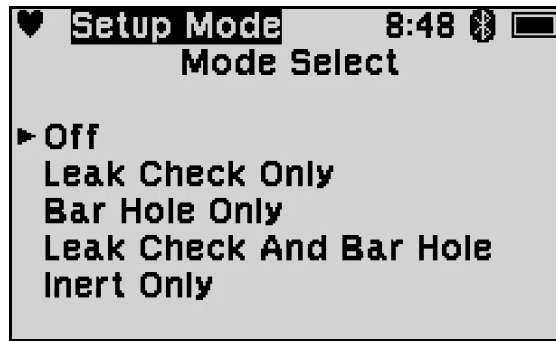
Leak Check And Bar Hole: The Mode Select Screen appears when the unit is turned on. The available options are Normal Mode, Leak Check Mode, and Bar Hole Mode.

Inert Only: The Mode Select Screen appears when the unit is turned on. The available options are Normal Mode, Leak Check Mode, and Bar Hole Mode.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Mode Select**.



2. Press **POWER** to select the menu item. The **Mode Select** screen appears with the cursor next to the current setting.

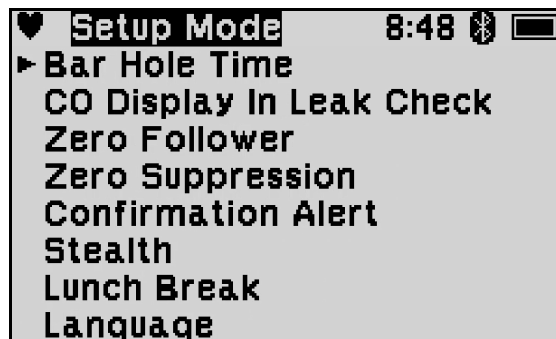


3. Press **AIR** or **RANGE** to scroll to the desired mode.
4. Press **POWER** to save the setting and return to the Setup Mode menu.
5. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Selecting the Bar Hole Measurement Time

Use this menu to select the length of time the unit will sample when a bar hole measurement is initiated in Bar Hole Mode. It can be set to **30** (factory setting), 45, or 60 seconds.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Bar Hole Time**.



2. Press **POWER** to select the menu item. The **Bar Hole Time** screen appears with the cursor next to the current setting.



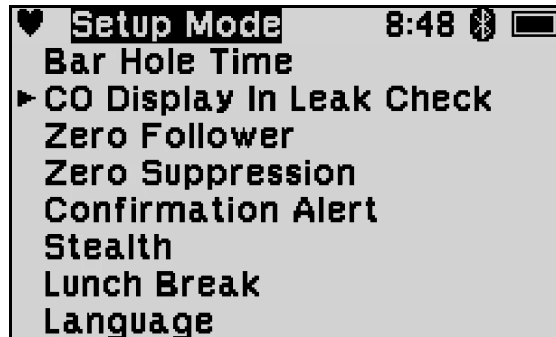
3. Press **AIR** or **RANGE** to scroll to the desired setting.
4. Press **POWER** to save the setting and return to the Setup Mode menu.
5. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Turning CO Display in Leak Check On or Off

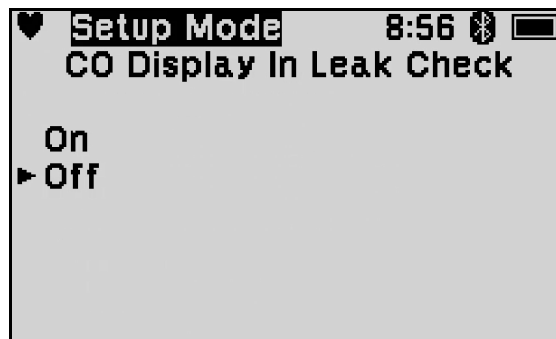
On: The CO channel will be displayed in Leak Check Mode, but there will be no CO alarms.

Off (factory setting): The CO channel is not displayed in Leak Check Mode. This setting has no effect on Normal Mode.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **CO Display in Leak Check**.



2. Press **POWER** to select the menu item. The **CO Display in Leak Check** screen appears with the cursor next to the current setting.

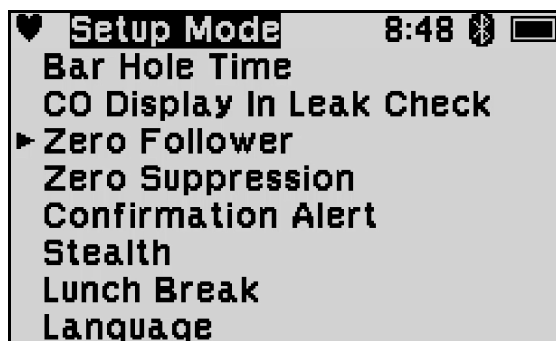


3. Press **AIR** or **RANGE** to scroll to the desired setting.
4. Press **POWER** to save the setting and return to the Setup Mode menu.
5. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

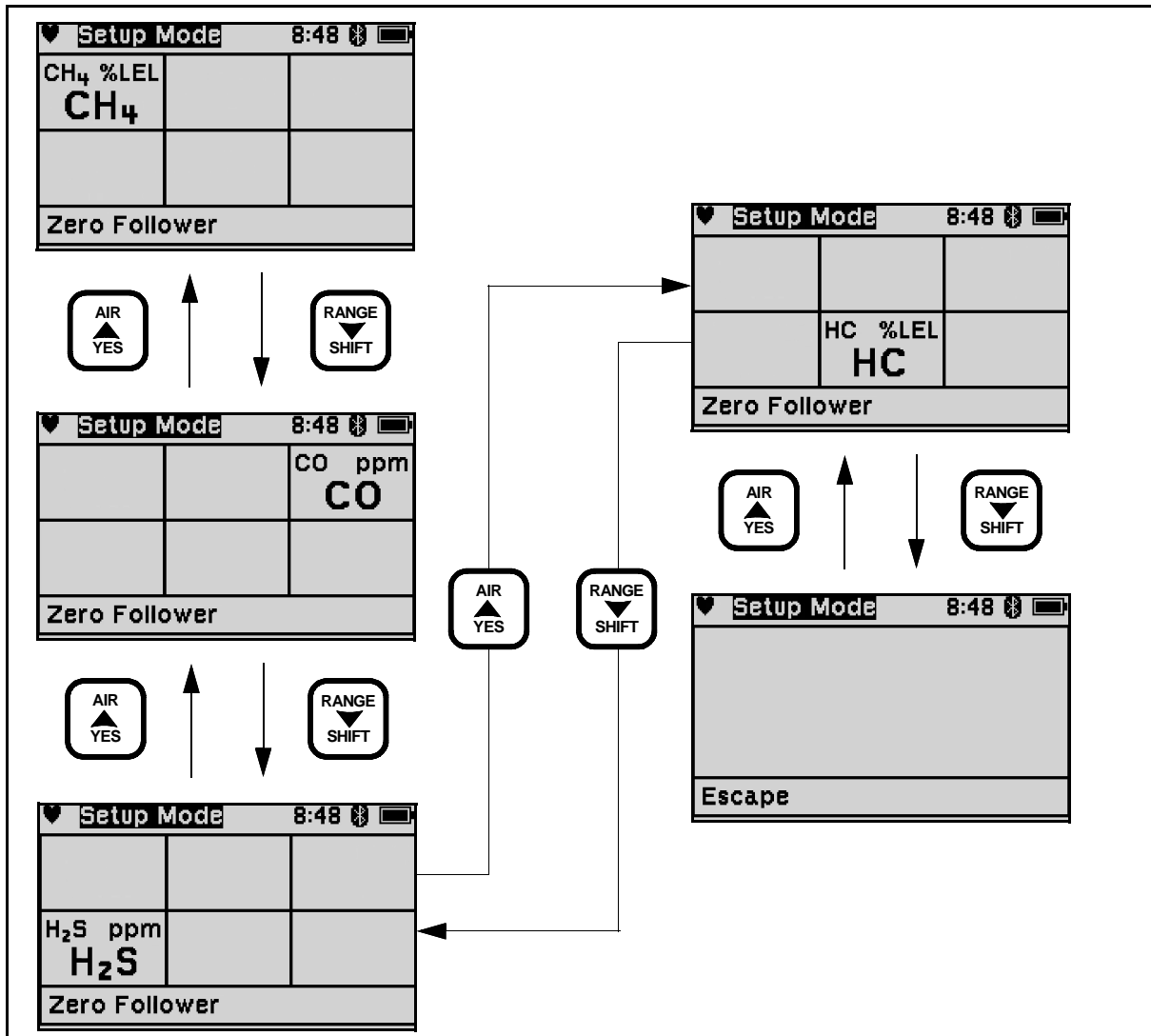
Turning Zero Follower On or Off

The **Zero Follower** setting is not intended for field adjustment. The default setting for most target gases is **ON**. The default setting for carbon dioxide channels and some configurations of non-standard toxic gas channels is **OFF**. The oxygen channel does not support this feature.

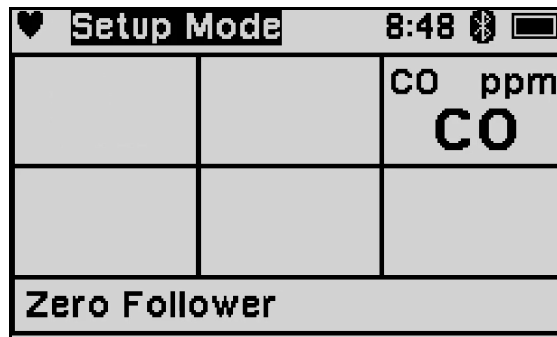
1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Zero Follower**.



- Press **POWER** to select the menu item. The **Zero Follower** screen appears with only the first channel displayed.



- Press **AIR** or **RANGE** to scroll to the desired channel.
- Press **POWER** to select the desired channel.



- Press **AIR** or **RANGE** to scroll to the desired setting.
- Press **POWER** to save the setting.

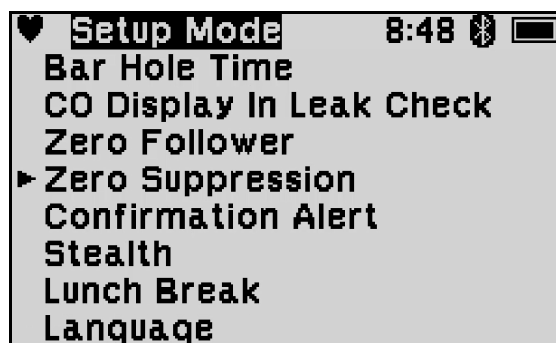
7. To return to the Setup Mode menu, press **RANGE** until the **Escape** screen appears. Press **POWER** to select the menu item.
8. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Turning Zero Suppression On or Off

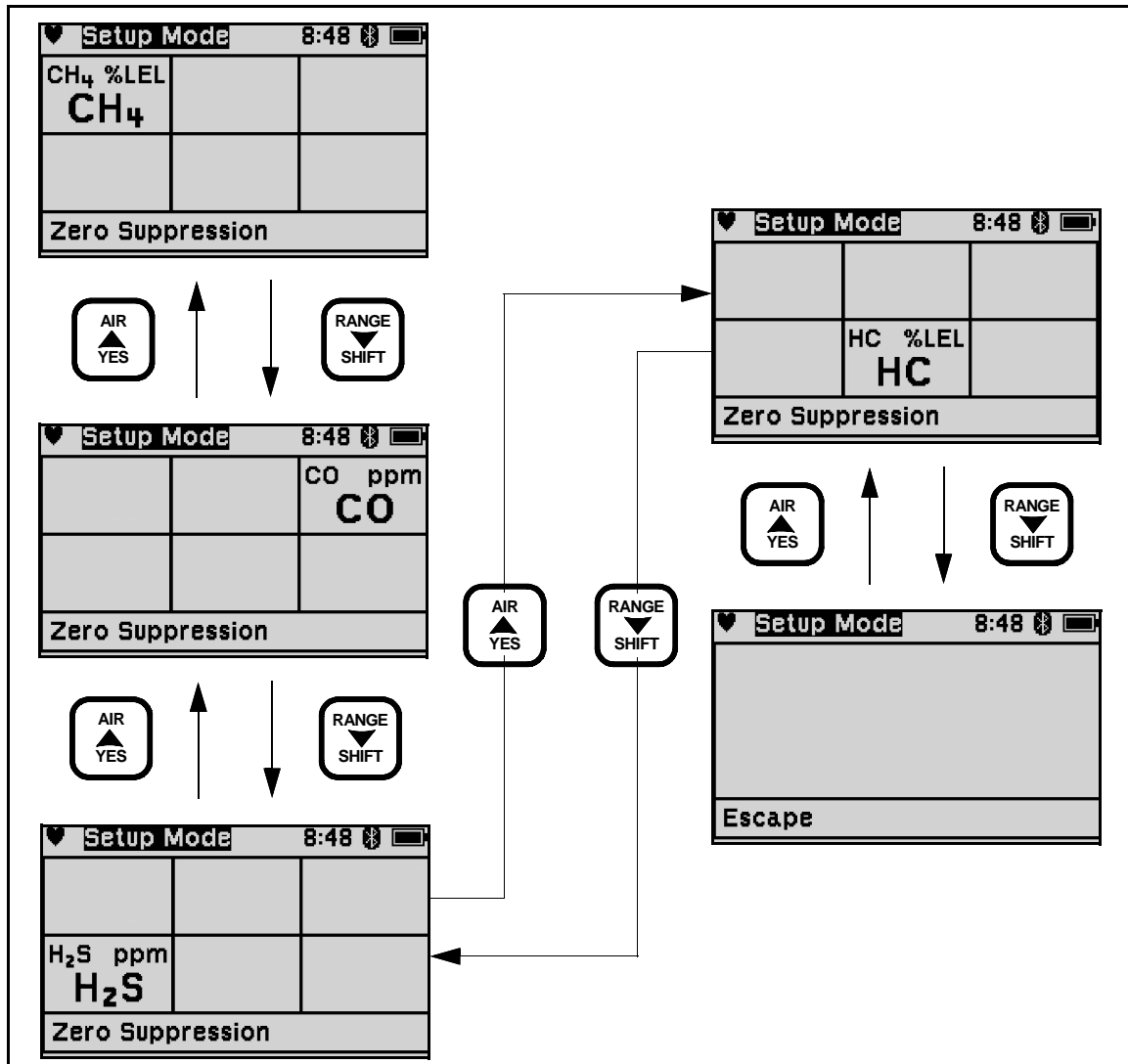
The **Zero Suppression** setting is not intended for field adjustment. The default setting for each sensor is **On**. The following table lists the suppression value for each channel.

Sensor	Zero Suppression Value
Combustible Gas	2% LEL
O ₂	0.5% volume
H ₂ S	0.3 ppm
CO	2 ppm
CO ₂	0 ppm
HCN	0.5 ppm
NH ₃	4 ppm
NO ₂	0.30 ppm
PH ₃	0.02 ppm
SO ₂	0.20 ppm

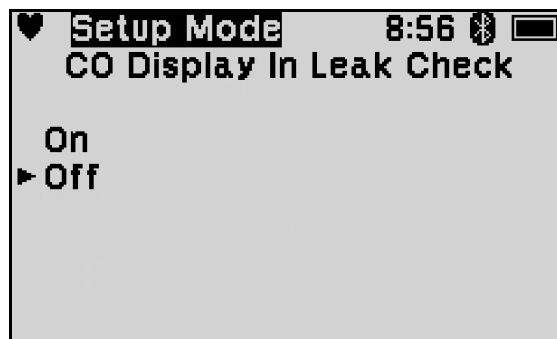
1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Zero Suppression**.



- Press **POWER** to select the menu item. The **Zero Suppression** screen appears with the first channel and target gas displayed.



- To view a different channel, press **RANGE** until the desired channel appears.
- To change a channel's zero follower setting, press **POWER**. The channel's current setting will flash. Press **AIR** or **RANGE** to switch the Zero Suppression setting from **On** to **Off**. Press **POWER** to save the setting.



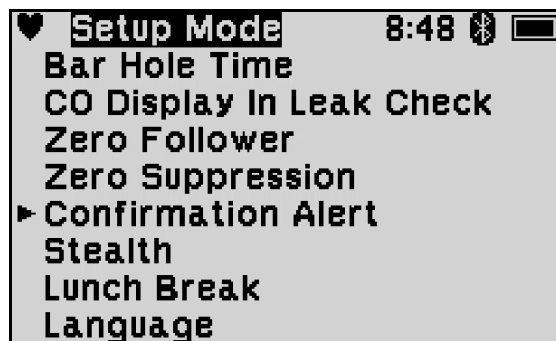
5. To return to the Setup Mode menu, press **RANGE** until the **Escape** screen appears. Press **POWER** to select the menu item.
6. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Adjusting the Confirmation Alert Settings

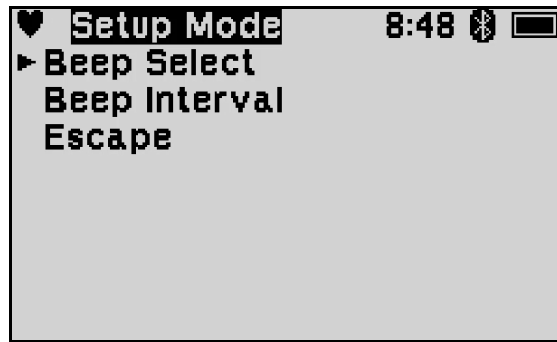
Selecting the Beep Select Setting

Use this menu to select the confirmation alert setting. The options are detailed below.

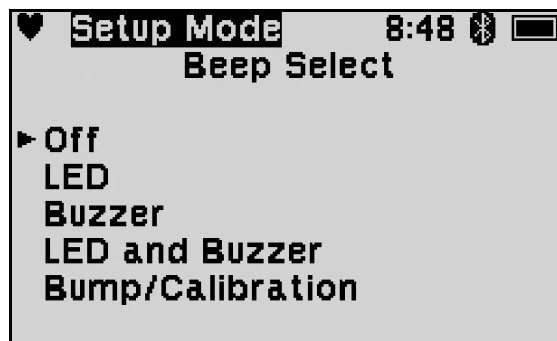
- **Off** (factory setting): With this setting enabled, the Eagle 3 does not sound a confirmation alert.
 - **LED**: With this setting enabled, the Eagle 3 flashes the LED arrays as often as defined by the **Beep Interval** parameter to verify that it is operating.
 - **Buzzer**: With this setting enabled, the Eagle 3 beeps as often as defined by the **Beep Interval** parameter to verify that it is operating.
 - **LED and Buzzer**: With this setting enabled, the Eagle 3 beeps and flashes the LED arrays as often as defined by the **Beep Interval** parameter to verify that the unit is operating.
 - **Bump/Calibration**: If a bump test or a calibration is due and if **Bump Past Due Action** or **Calibration Past Due Action** is set to **Confirm** or **None**, the Eagle 3's LEDs double flash as often as defined by the **Beep Interval** parameter to indicate a non-compliance. Once a bump test or calibration (depending on which is due) is done, the LEDs stop flashing.
1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Confirmation Alert**.



2. Press **POWER** to select the menu item. The Confirmation Alert menu appears.



3. Press **AIR** or **RANGE** to scroll to **Beep Select**.
4. Press **POWER** to select the menu item. The **Beep Select** screen appears with the cursor next to the current setting.

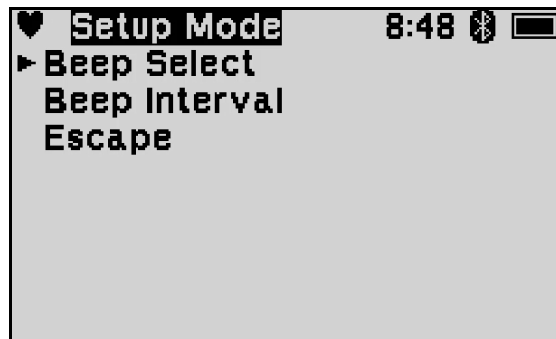


5. Press **AIR** or **RANGE** to scroll to the desired setting.
6. Press **POWER** to save the setting and return to the Confirmation Alert menu.
7. To return to the Confirmation Alert menu:
 - a. Press **AIR** or **RANGE** to scroll to the **Escape** menu item.
 - b. Press **POWER** to select the menu item.
8. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

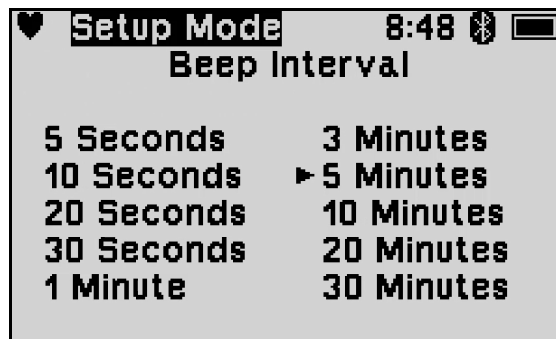
Selecting the Beep Interval Setting

Use this menu to select one of the following beep intervals: 5 seconds, 10 seconds, 20 seconds, 30 seconds, 1 minute, 3 minutes, 5 minutes (factory setting), 10 minutes, 20 minutes, and 30 minutes.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Confirmation Alert**.
2. Press **POWER** to select the menu item. The Confirmation Alert screen appears.



3. Press **AIR** or **RANGE** to scroll to **Beep Interval**.
4. Press **POWER** to select the menu item. The **Beep Interval** screen appears with the cursor next to the current setting.



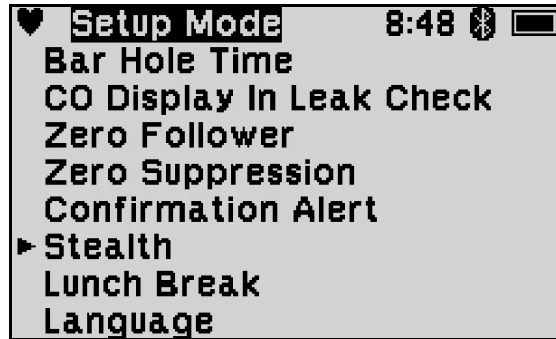
5. Press **AIR** or **RANGE** to scroll to the desired setting.
6. Press **POWER** to save the setting and return to the Confirmation Alert menu.
7. To return to the Confirmation Alert menu:
 - a. Press **AIR** or **RANGE** to scroll to the **Escape** menu item.
 - b. Press **POWER** to select the menu item.
8. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Turning Stealth On or Off

On: The instrument's backlight, LEDs, and buzzer are disabled regardless of any alarm condition or the **Backlight Time** setting. An **S** appears at the top of the LCD to indicate when the unit's Stealth feature is active.

Off (factory setting): The instrument's backlight and LEDs operate normally.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to the **Stealth** menu item.



2. Press **POWER** to select the menu item. The **Stealth** screen appears with the cursor next to the current setting.



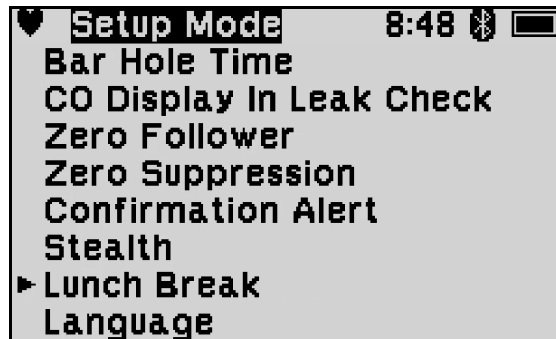
3. Press **AIR** or **RANGE** to move the cursor to the desired setting.
4. Press **POWER** to save the desired setting and return to Setup Mode.
5. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Turning Lunch Break On or Off

On: The Resume Measurements Screen displays during warmup. From this screen, you can choose to continue accumulating TWA and PEAK readings and the time in operation from the last time the Eagle 3 was used or start collecting new readings and reset the time in operation.

Off (factory setting): The Eagle 3 automatically starts new TWA and PEAK reading collection and resets the time in operation at warmup.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to the **Lunch Break** menu item.



2. Press **POWER** to select the menu item. The **Lunch Break Screen** appears with the cursor next to the current setting.



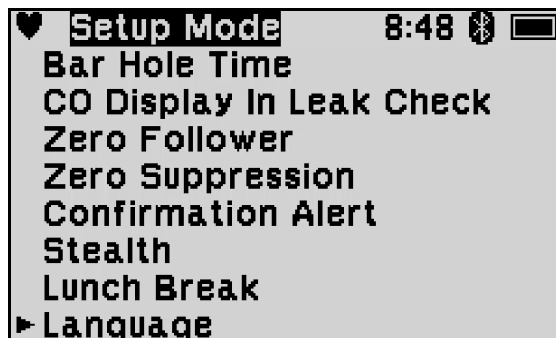
3. Press **AIR** or **RANGE** to move the cursor to the desired setting.
4. Press **POWER** to save the desired setting and return to Setup Mode.
5. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Selecting the Language Setting

Use this menu to select the language for the Eagle 3's. The available choices are **English** (factory setting), Japanese, Spanish, Italian, German, French, Portuguese, Russian, and Korean.

NOTE: If a language other than English is selected, a prompt will appear during warmup to change the language back to English if desired.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to the **Language** menu item.



2. Press **POWER** to select the menu item. The **Language** screen appears with the cursor next to the current setting.



3. Press **AIR** or **RANGE** to scroll to the desired setting.
4. Press **POWER** to save the desired setting and return to Setup Mode.
5. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

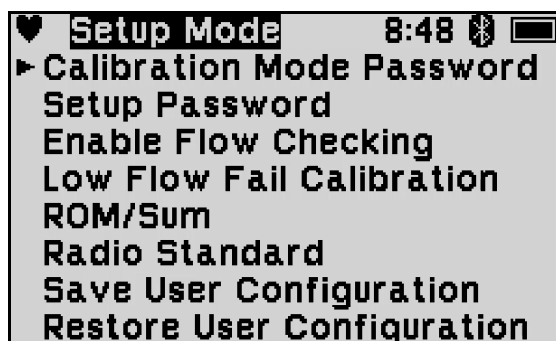
Setting the Calibration Mode Password

On (factory setting): The Eagle 3 prompts you for a password when you enter Calibration Mode.

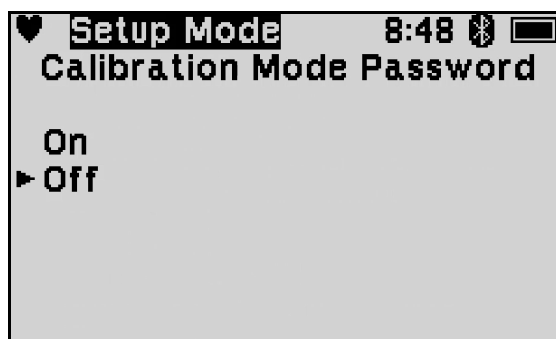
NOTE: If a calibration is past due, **Calibration Reminder** is set to **On**, and **Calibration Past Due Action** is set to **Must Calibrate**, a password will not be required to perform a calibration during warmup.

Off: No password is required to enter Calibration Mode.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Calibration Mode Password**.



2. Press **POWER** to select the menu item. The **Calibration Mode Password** screen appears with the cursor next to the current setting.



3. Press **AIR** or **RANGE** to scroll to the desired setting.

4. Press **POWER** to save the desired setting and proceed to the Password screen. The **Calibration Mode Password** screen appears, displaying the current password (factory set to **0000**) with the first number flashing.



5. Press **AIR** or **RANGE** to increase or decrease the first number.
6. Press **POWER** to save the current number and advance to the next number.
7. Repeat Step 5 to select the remaining numbers. After entering the last number, the password is saved and the instrument returns to the Setup Mode.
8. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

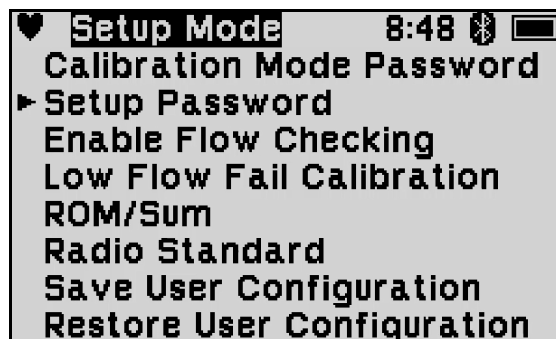
Setting the Setup Password

Use the Setup Password menu to enable and save a password or to disable the setting.

On: A password will be required to enter Setup Mode.

Off (factory setting): No password is required to enter Setup Mode.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Setup Password**.



2. Press **POWER** to select the menu item. The **Setup Password** screen appears with the cursor next to the current setting.



3. Press **POWER** to save the desired setting and proceed to the Setup Mode Password screen.
4. The **Setup Password** screen appears, displaying the current password (factory set to **0000**) with the first number flashing. Press **AIR** or **RANGE** to increase or decrease the first number. Press **POWER** to save the current number and advance to the next number.

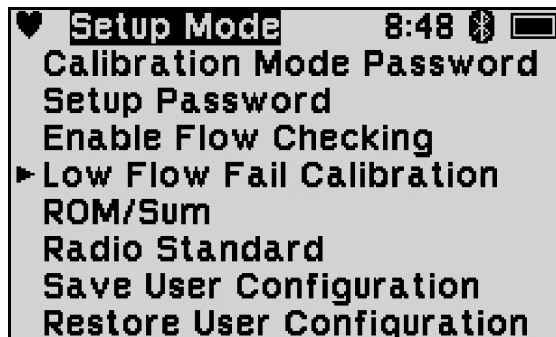


5. Repeat Step 4 to select the remaining numbers. After entering the last number, the password is saved and the instrument returns to the Setup Mode.
6. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

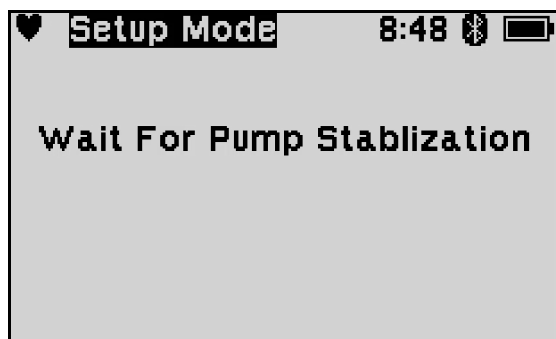
Performing a Low Flow Fail Calibration

Use **Low Flow Fail Calibration** if the instrument repeatedly goes into low flow alarm and all other recommendations in the Troubleshooting section have been attempted.

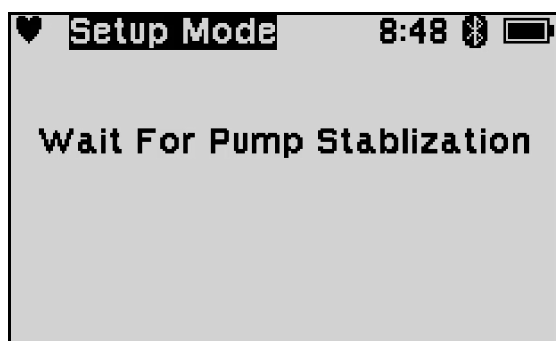
1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Low Flow Fail Calibration**.



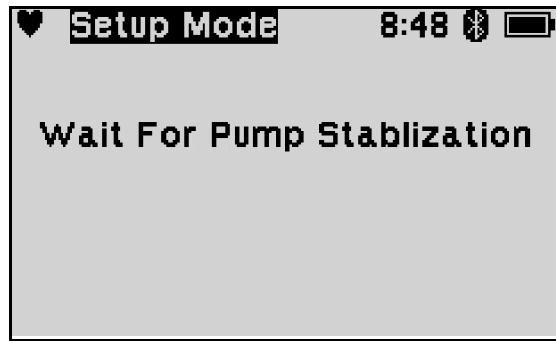
2. Press **POWER** to select the menu item. The following screen appears.



3. Press **POWER** to begin calibration.
4. Press the **POWER** button. The pump will turn off and the screen will display values that reflect the pump's current draw.
5. Press **AIR** or **RANGE** to get a reading of approximately 1500 on the bottom value. When you have adjusted the value as close as you can, press the **POWER** button.



6. The pump will turn on and two new values will be displayed. The top will be a reference value and the bottom will reflect the pump's current draw.

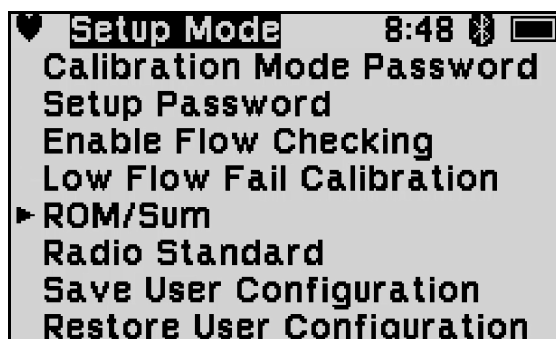


7. Connect a flow meter with a valve to the inlet of the instrument and adjust it to $0.2 \text{ LPM} \pm 0.1 \text{ LPM}$. This will be the low flow setpoint. You do not need to adjust anything at the instrument.
8. Press the **POWER** button to confirm the calibration and return to Setup Mode.
9. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

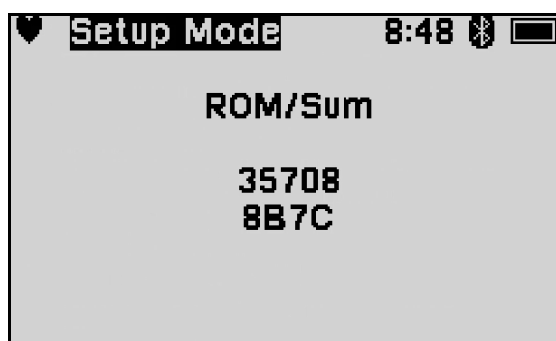
Viewing the ROM/Sum Details

Use this menu item to view the instrument's firmware version and the firmware checksum.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **ROM/SUM**.



2. Press **POWER** to select the menu item. The **ROM/Sum** screen appears.

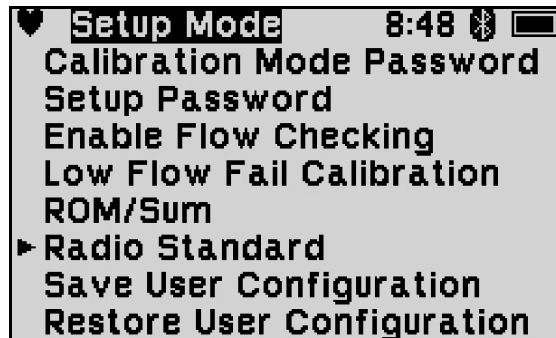


3. Press **POWER** to return to the Setup Mode menu.
4. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

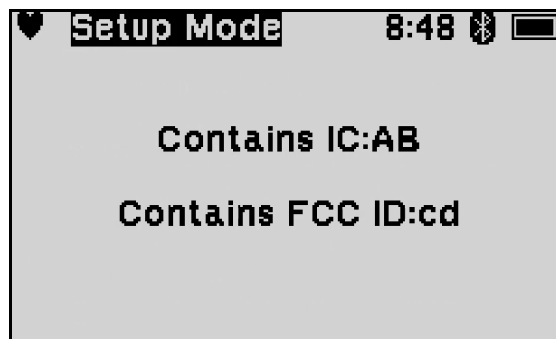
Viewing the Radio Standard

Use this menu to view the Radio Standard.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Radio Standard**.



2. Press **POWER** to select the menu item. The **Radio Standard** screen appears.



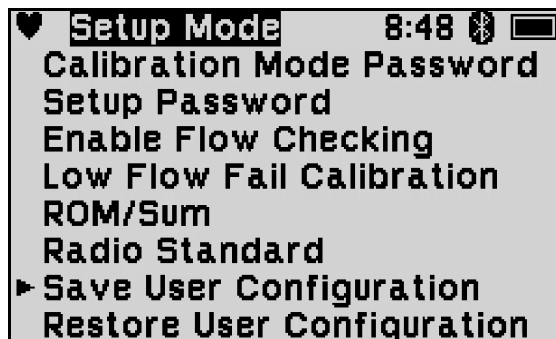
3. Press **POWER** to return to the Setup Mode menu.
4. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Saving User Configuration

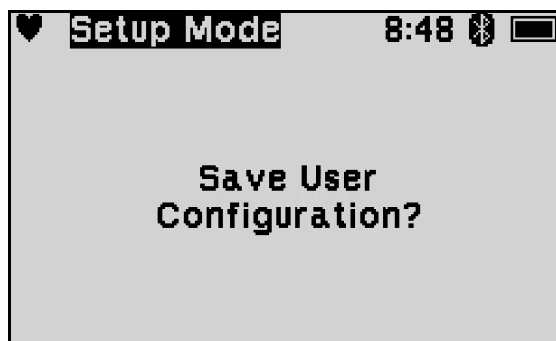
Use this menu to save the current configuration as the default user configuration. Saving a new configuration will overwrite any previously saved user configuration.

Saved user configurations can be restored using the **Restore User Configuration** function described in the next section.

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Save User Configuration**.

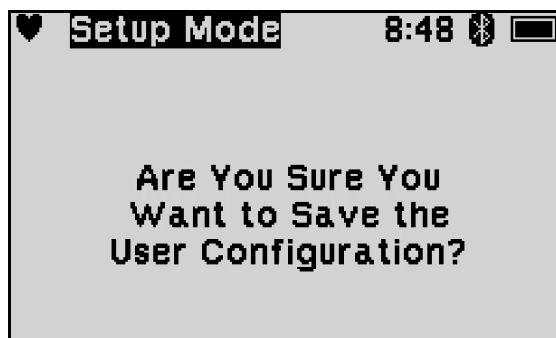


2. Press **POWER** to select the menu item. The following screen appears.



3. Press **POWER** or **YES** to proceed to the confirmation screen.

To return to the Setup Mode menu without saving the current configuration as the default user configuration, press **DISPLAY**.



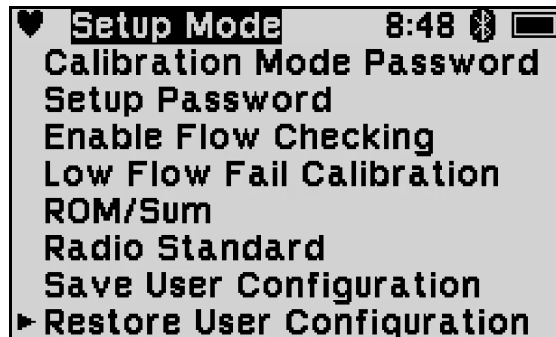
4. Press **POWER** or **YES** to save user configuration and return to the Setup Mode menu.
To return to the Setup Mode menu without saving the user configuration, press **DISPLAY**.

5. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

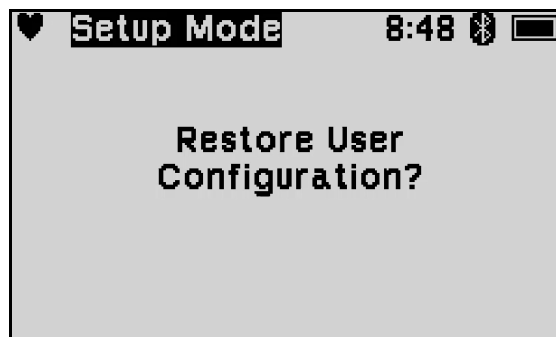
Restoring User Configuration

Use this menu to restore the current settings to the saved user configuration (saved in the previous menu item, **Save User Configuration**).

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Restore User Configuration**.

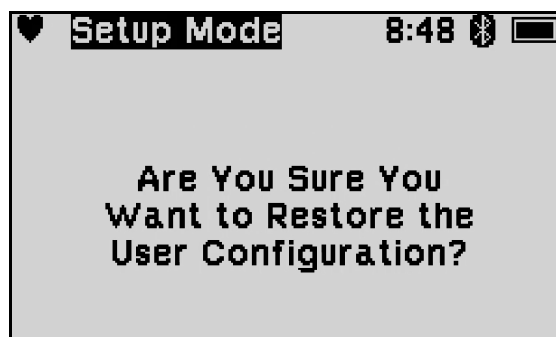


2. Press **POWER** to select the menu item. The following screen appears.



3. Press **POWER** or **YES** to proceed to the confirmation screen.

To return to the Setup Mode menu without restoring the four gas default alarm settings, press **DISPLAY**.



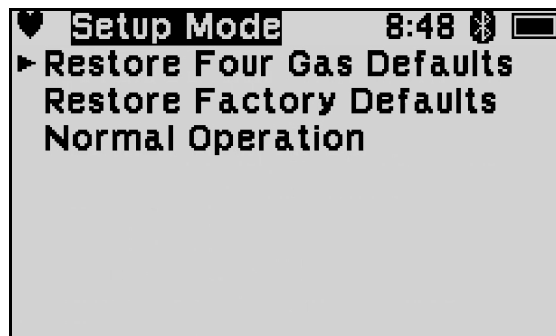
4. Press **POWER** or **YES** to restore the current configuration to the saved user configuration and return to the Setup Mode menu.
To return to the Setup Mode menu without restoring the current configuration, press **DISPLAY**.
5. To exit Setup Mode:
 - a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
 - b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Restoring Four Gas Defaults

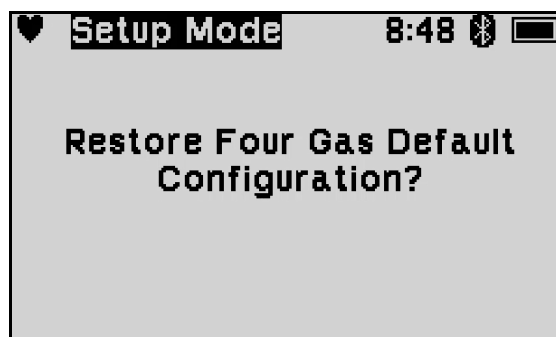
Use this menu to restore the current settings to the four gas default configuration. This reverts all channel settings, alarm points, and other target-gas specific parameters to their four gas default settings.

WARNING: *When the Eagle 3 is restored to its default configuration, the zero and span values for each channel are reset. All active channels must be recalibrated if the Eagle 3 is restored to its default configuration.*

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Restore Four Gas Defaults**.

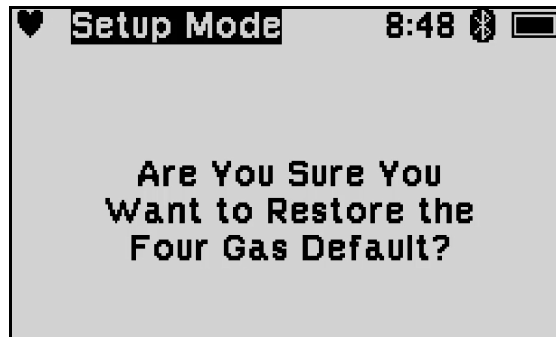


2. Press **POWER** to select the menu item. The following screen appears.



3. Press **POWER** or **YES** to proceed to the confirmation screen.

To return to the Setup Mode menu without restoring the current configuration, press **DISPLAY**.



4. Press **POWER** or **YES** to restore the current configuration to the four gas default configuration and return to the Setup Mode menu.

To return to the Setup Mode menu without restoring the current configuration, press **DISPLAY**.

5. To exit Setup Mode:

- a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
- b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

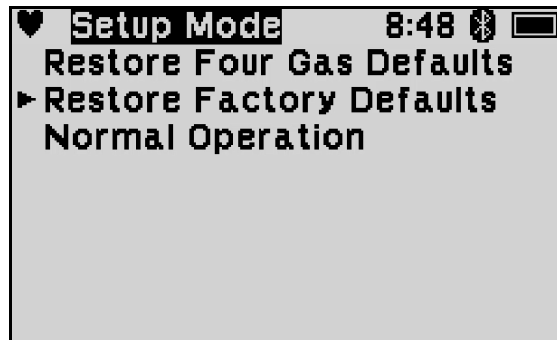
Restoring Factory Defaults

Each of the Eagle 3 setup parameters, such as the auto calibration values or parameters in Setup Mode, has a factory default setting. The **Restore Factory Defaults** menu item in Setup Mode can be used to return all setup parameters to their default settings. Restoring all setup parameters to their default settings can be useful if settings selected produce unintended issues and returning the Eagle 3 to its original configuration would help with troubleshooting.

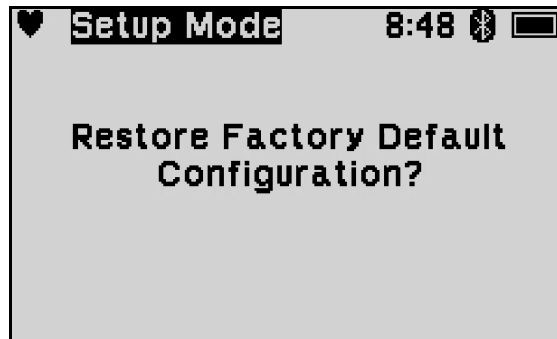
The standard default gas configuration is LEL/oxygen/H₂S/CO. If any channels have been turned off or added to the Eagle 3, the unit must be re-setup to the desired gas combination after it is restored to its default configuration.

WARNING: *When the Eagle 3 is restored to its default configuration, the zero and span values for each channel are reset. All active channels must be recalibrated if the Eagle 3 is restored to its default configuration.*

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Restore Factory Defaults**.

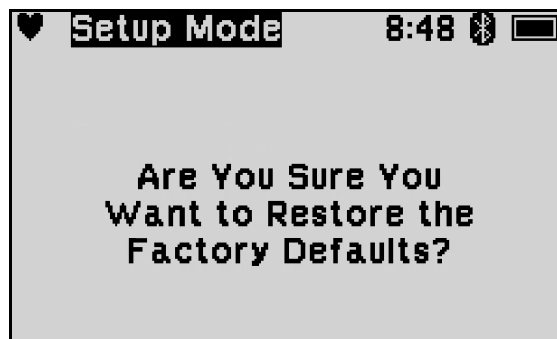


2. Press **POWER** to select the menu item. The following screen appears.



3. Press **POWER** or **YES** to proceed to the confirmation screen.

To return to the Setup Mode menu without restoring the factory defaults, press **DISPLAY**.



4. Press **POWER** or **YES** to restore the current configuration to the factory configuration and return to the Setup Mode menu.

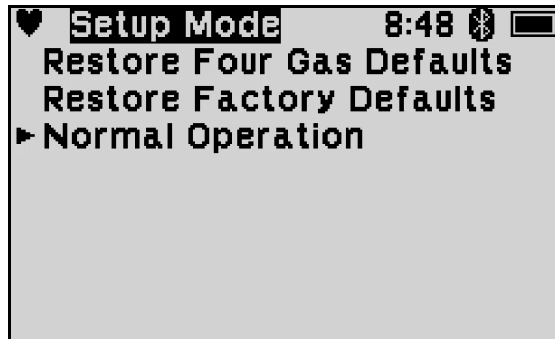
To return to the Setup Mode menu without restoring the current configuration, press **DISPLAY**.

5. To exit Setup Mode:

- a. Press **AIR** or **RANGE** to scroll to **Normal Operation**.
- b. Press **POWER** to enter Normal Mode and begin the warmup sequence.

Exiting Setup Mode (Normal Operation)

1. While in Setup Mode, press **AIR** or **RANGE** to scroll to **Normal Operation**.



2. Press **POWER** to enter **Normal Operation** and begin the warmup sequence.

Appendix C: PID Sensors

Overview

The PID (photo ionization detector) sensors are used for applications where high sensitivity is needed to monitor ppm levels of VOCs (volatile organic compounds). This appendix describes the Eagle 3's PID sensors and includes instructions to use an Eagle 3 that has a PID sensor installed. It also includes instructions to maintain and replace a PID sensor.

Table 18: Eagle 3 PID Sensor Specifications

Target Gas	Sensor Type	Detection Range	Reading Increment	Alarm 1 Factory Setting	Alarm 2 Factory Setting
VOCs, Isobutylene Calibration Standard	Low Range	0 - 50.00 ppm	0.02 ppm	5.00 ppm	10.00 ppm
	High Range	0 - 2000 ppm	1 ppm	400 ppm	1000 ppm

Description

Two types of PID sensors can be used with the Eagle 3, a low range (high sensitivity) sensor and a high range (low sensitivity) sensor. The PID sensor is installed in a single sensor flow chamber which is located in the area next to the standard 4-sensor flow chamber. This area can accommodate up to three single sensor flow chambers. Figure 21 below illustrates a typical PID sensor location in front of the pump. The PID flow chamber may also be installed in one of the other two sensor chamber locations depending on the particular version of the Eagle 3. Some PID instrument configurations do not include the 4-sensor flow chamber.

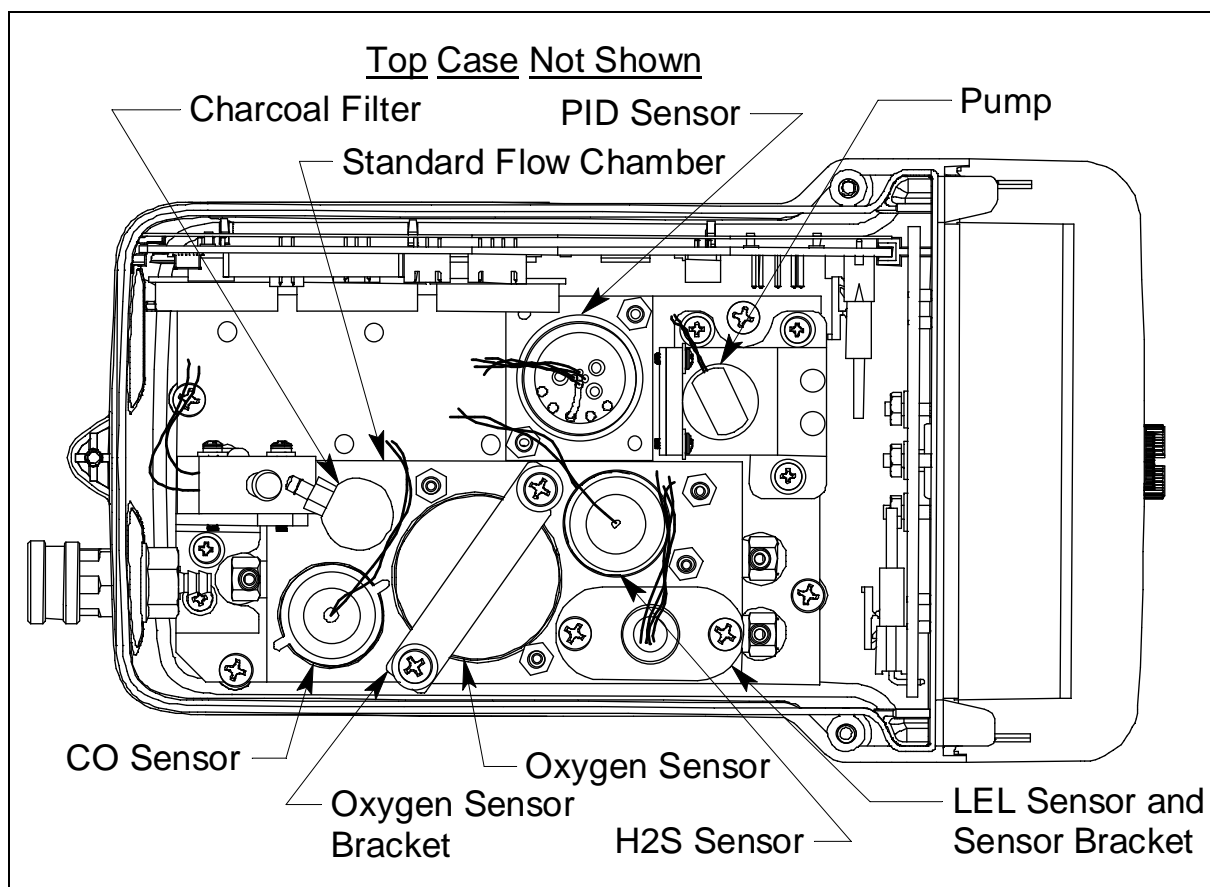


Figure 21: Typical PID Sensor Location

PID Sensor & Sensor Adapter

The PID sensor is a cylindrical sensor with a diffusion opening on the front and 3 pins on the back. It is plugged into a sensor adapter with a 5 wire cable that terminates in a 5-position connector. The connector plugs into a PID sub PCB (see description below) that is installed on the main PCB. The sensor adapter allows installation of the PID sensor into the PID flow chamber. The sensor adapter is held in the PID flow chamber with two O-rings which also seal around the sensor adapter.

PID Sub PCB

The PID sub PCB is a circuit board that is installed on the main PCB in one of the 3 sub PCB positions when a PID sensor is used with the Eagle 3. The PID sensor adapter connects to the sub PCB with a 5-position connector. The sub PCB plugs into the main PCB and is held in place with a screw/flat washer/lock washer. There are no user-serviceable parts on the PID sub PCB.

PID Probe

Several of the gases that can be monitored with a PID are easily absorbed in the Eagle 3's standard sample hose and standard probe. One example of this is styrene. Because of this, RKI Instruments, Inc. recommends that you use the probe intended for PID use that does not have a particle filter installed and that you install the probe directly to the inlet fitting when monitoring for gas with the PID sensor. The figure below shows an exploded drawing of the PID probe.

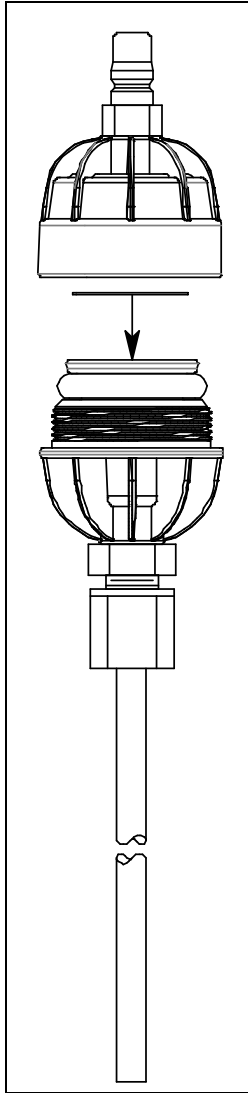


Figure 22: PID Probe

VOC Zero Filter

A VOC zero filter is included as standard with Eagle 3s that include a low range PID sensor.

The VOC zero filter scrubs out low levels of VOC gases using charcoal. Use the VOC zero filter when performing an air adjust on a PID sensor in an area that may have a low-level VOC background.

The filter comes with a tubing stub and plug on each end. Both plugs must be removed before using the filter and must be reinstalled for storage. The filter does not have a preferred flow direction.

When used with a CO₂ scrubber, the VOC zero filter gets connected to the probe and the CO₂ scrubber gets connected to the VOC zero filter. See “Performing a Demand Zero for Carbon Dioxide Sensors” on page 297 for more instructions.

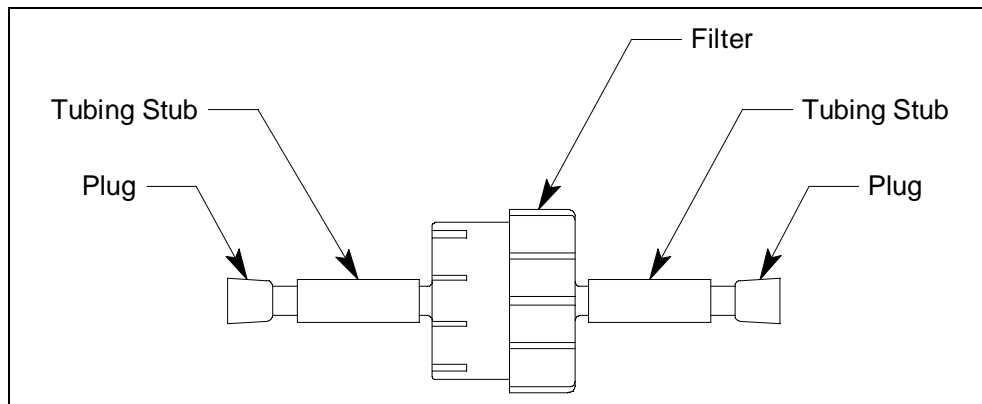


Figure 23: VOC Zero Filter

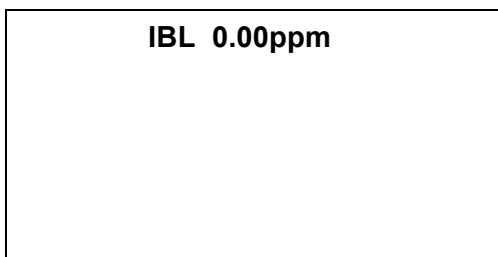
Start Up and Normal Operation

For instructions to warmup and use an Eagle 3 that includes a PID sensor, reference “Start Up” on page 30, “Normal Mode Operation” on page 42, and “Alarms” on page 50. Follow these instructions keeping the following special considerations in mind:

- After the instrument’s warms up and the gas readings are displayed on the screen, if the PID sensor is still in its warm up state, the gas reading for the PID channel will scroll through -200, -100, and 0 for a high range sensor and -2.00, -1.00, and 0.00 for a low range sensor. Allow the sensor to continue warming up for 5 minutes. If it exits its warm up state, the alternating numbers will be replaced by a gas reading. If the sensor doesn’t exit its warm up state after 5 minutes, see “Troubleshooting” on page 231.
- If using a probe, be sure to use the PID probe that does not have a particle filter installed. If it is necessary to use a sample hose for any reason, you must use the Teflon-lined hose that is supplied with the PID instrument. A 5 foot hose is supplied as standard. 10, 15, and 20 foot hoses are also available. See page 249 for ordering information.
- If your Eagle 3 is a multigas unit that is used for monitoring of combustible gases in the % LEL range, the PID channel will indicate an upscale reading if one of a variety of combustible gases is present. If % LEL concentrations of one of these combustible gases is present, the PID channel may indicate an overscale reading.
- If concentrations of methane greater than 10% LEL are present in the monitoring environment, the PID channel’s reading will be suppressed.
- The PID sensor will also respond to H₂S, so if H₂S is present, the PID channel may indicate an upscale reading depending on the concentration present.

The standard calibration for a PID channel is to isobutylene. A PID channel can be factory setup for and calibrated to other gases. Consult with RKI Instruments, Inc. for other available PID configurations and to specify the desired PID configuration when a unit is ordered.

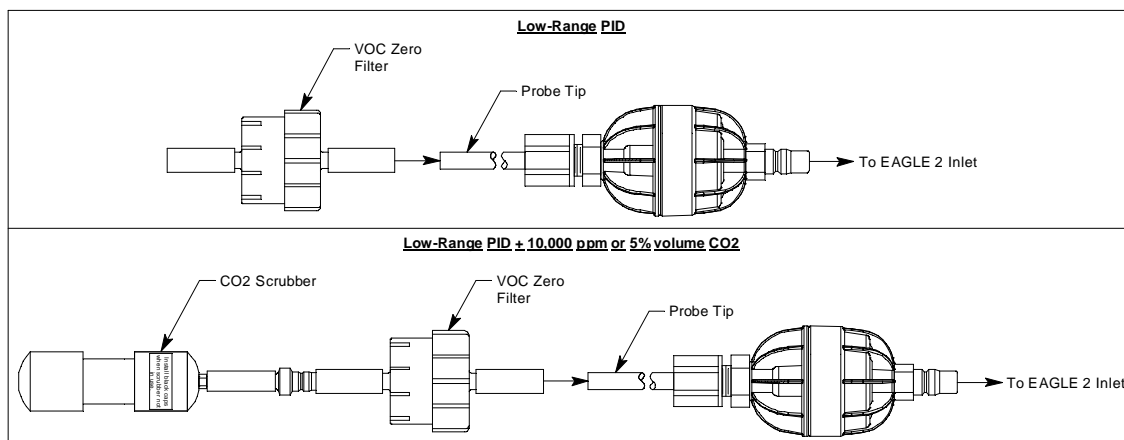
The display screen below illustrates an Eagle 3 with a low range PID sensor installed.



It is possible to temporarily configure a PID channel for a target gas other than the factory setting in Display Mode. See the next section, PID Relative Response Feature, for instructions to use this feature.

Performing a Demand Zero for Low Range PID Sensors

1. If you suspect any low-level VOC background in the area, you must install the VOC zero filter before performing a demand zero.
 - a. Remove the plug from each end of the VOC zero filter.
 - b. Attach the VOC zero filter to the probe. The filter does not have a preferred flow direction.
 - c. If your instrument also has a 0-10,000 ppm or 0-5 %vol CO₂ sensor, remove the black caps from the CO₂ scrubber and connect its fitting to the VOC zero filter.



- d. Let the instrument draw through the filter(s) for 1 minute.
2. Press and hold the AIR ▲YES button. The LCD prompts you to continue holding the AIR ▲YES button and the buzzer will pulse.
3. Continue to hold the AIR ▲YES button until the LCD prompts you to release it.
4. If you used a CO₂ scrubber, remove it from the VOC filter and reinstall the black caps.
5. Remove the VOC zero filter from the probe and reinstall the plugs.

PID Relative Response Feature

The relative response feature enables you to change the PID sensor's response to gas on the fly so that the PID channel is roughly calibrated to an alternate gas. This is done by temporarily changing the gas configuration of the PID channel. You can select from a list of gases whose response relative to the configured gas, normally isobutylene, is programmed into the Eagle 3's memory. For example, if the PID channel is setup for and calibrated to isobutylene (IBL), you can select isopropyl alcohol (IPA) from a gas list accessible from the PID Relative Response Screen in Display Mode so that the PID channel responds to gas as if it were calibrated to isopropyl alcohol. The Eagle 3 will clear the gas configuration change when it is turned off and will return to the programmed configuration when it is turned on again.

The gas list for the relative response feature includes several pre-defined gases and 1 gas that can be entered into the Eagle 3 in the field using the Eagle 3 Maintenance Data Loader Program. The Eagle 3 Maintenance Data Loader Program Operator's Manual contains a chart of response factors relative to isobutylene for many gases. If the desired gas is not in this chart, gas testing must be performed to determine the gas' response factor relative to isobutylene. See the Eagle 3 Maintenance Data Loader Program Operator's manual for details regarding the gas testing and programming user defined gases into the Eagle 3's relative response list.

Because of normal variation between sensors, these relative response factors are typical factors. If you use this feature, the response to the selected gas will not be as accurate as it would be if you configured and calibrated the PID channel to the target gas.

For maximum accuracy, configure and calibrate the Eagle 3's PID channel to the desired target gas.

PID Sensor Relative Response Screen in Display Mode

To use the relative response feature for the PID sensor, enter display mode and select the desired gas as described below:

1. With the Eagle 3 in Normal Mode, press the DISPLAY ADJUST NO button repeatedly until you arrive at the PID Sensor Relative Response Screen.

**SELECT
RELATIVE RESPONSE
TO CALIBRATED GAS
FOR PID SENSOR**

2. With the PID Sensor Relative Response Screen displayed, press AIR ▲YES. A list of gases will appear on the screen with **EXIT** at the top of the list.

>EXIT
ACETONE
BENZENE
DIESEL FUEL NO 1
ETHANOL
GASOLINE

There are multiple screens of gases. The following is the complete list of factory defined gases along with their detection ranges, low alarm, high alarm, STEL, and TWA settings. Table 19 is a list of the low range values and Table 20 is a list of the high range values.

Table 19: Low Range Relative Response Gas List

Target Gas	Detection Range (ppm)	Alarm 1 Factory Setting (ppm)	Alarm 2 Factory Setting (ppm)	STEL (ppm)	TWA (ppm)
Acetone	0-30.00	5.00	7.50	OFF	OFF
Benzene	0-25.00	0.50	2.50	2.50	0.50
Diesel Fuel NO 1	0-40.00	2.00	3.00	OFF	OFF
Ethanol	0-400.00	10.0	15.0	OFF	OFF
Gasoline	0-50.00	3.00	5.00	OFF	OFF
Isobutylene	0-50.00	4.30	6.00	OFF	OFF
Isopropanol	0-200.00	2.0	4.0	OFF	OFF
JP-5 Fuel	0-30.00	1.40	2.10	OFF	OFF
Methyl Ethyl Ketone	0-40.00	2.00	3.00	OFF	OFF
Toluene	0-25.00	0.50	1.50	OFF	OFF
N-Hexane	0-200.00	5.0	10.0	OFF	OFF
Propylene	0-50.00	5.00	7.50	OFF	OFF
Styrene	0-20.00	0.20	0.40	OFF	OFF
Tetrachloro-ethylene	0-30.00	0.24	1.00	OFF	OFF
Trichloro-ethylene	0-30.00	0.50	1.00	OFF	OFF
Vinyl Chloride	0-100.00	1.0	5.0	5.0	1.0
PID	0-50.00	OFF	OFF	OFF	OFF

Table 20: High Range Relative Response Gas List

Target Gas	Detection Range (ppm)	Alarm 1 Factory Setting (ppm)	Alarm 2 Factory Setting (ppm)	STEL (ppm)	TWA (ppm)
Acetone	0-1000	500	750	750	500
Benzene	0-1000	50	250	OFF	OFF
Diesel Fuel NO 1	0-1500	200	300	OFF	200
Ethanol	0-15000	1000	1500	OFF	1000
Gasoline	0-2000	300	500	500	300
Isobutylene	0-2000	400	600	60	42
Isopropanol	0-5000	200	400	400	200
JP-5 Fuel	0-1000	140	210	OFF	14
Methyl Ethyl Ketone	0-1500	200	300	300	200
Toluene	0-1000	50	150	150	50
N-Hexane	0-5000	500	1000	1000	500
Propylene	0-2500	500	750	OFF	500
Styrene	0-500	20	40	40	20
Tetrachloro-ethylene	0-1000	25	100	100	25
Trichloro-ethylene	0-1000	50	100	100	50
Vinyl Chloride	0-4000	100	500	OFF	OFF
PID	0-2000	OFF	OFF	OFF	OFF

The last choice in each list, PID, can be defined by the user and loaded in the Eagle 3 using the Eagle 3 Maintenance Data Loader Program. See the Eagle 3 Maintenance Data Loader Program Operator's Manual.

3. Use the AIR ▲YES or RANGE ▼ SHIFT button to move the cursor next to the desired gas.
4. Press POWER ENTER RESET. The PID channel will be configured to the selected gas and the Eagle 3 will proceed to the STEL Screen. This configuration will be in force until either a different gas is selected in Display Mode or the unit is turned off.

PID Calibration

A PID channel can be calibrated using the auto calibration method or the single calibration method. To calibrate a PID channel using the single calibration method, see page 88 and follow the instructions for calibrating a single channel.

NOTE: The factory setting for the Span Factor menu item in Setup Mode is OFF for an Eagle 3 with a PID channel. So the range of adjustment is not displayed when a single calibration is performed for any channel if a PID sensor is installed.

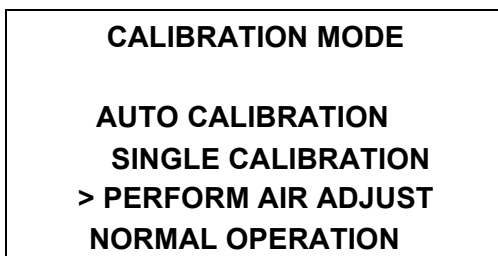
If your instrument is a multi-channel instrument that includes a high range PID channel, RKI Instruments, Inc. recommends using the auto calibration method for convenience. The calibration instructions below show a 5 channel instrument which has the four standard channels, LEL/oxygen/H₂S/CO, and a high range PID channel calibrated to and setup for isobutylene (IBL). There are two ways to calibrate an Eagle 3 with a PID channel installed. The first way, described below in “Calibrating with a 4-Gas Cylinder and a PID Cylinder” on page 213, uses a 4-gas cylinder and an appropriate PID cylinder. The second way, described below in “Calibrating with a 5-Gas Cylinder” on page 222, uses a multi-gas cylinder that contains the target gas for all installed sensors. Follow the set of instructions appropriate for your cylinder configuration.

Calibrating with a 4-Gas Cylinder and a PID Cylinder

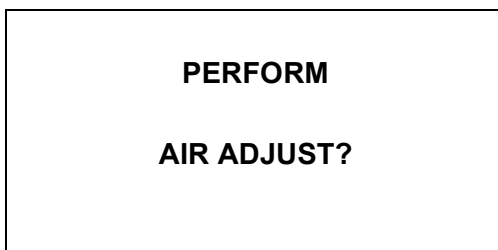
1. See “Entering Calibration Mode” on page 77 for a description of the necessary calibration supplies. In addition to an appropriate multi-gas cylinder that is used to calibrate any active standard channels, you will also need a cylinder to calibrate the PID channel. See page 249 for available cylinders. Make sure your calibration cylinder is appropriate for the PID detection range.
2. Find a fresh-air environment. This is an environment free of toxic or combustible gases and of normal oxygen content (20.9%).
3. While in Normal Mode, press and hold the RANGE ▼ SHIFT button, then press the DISPLAY ADJUST NO button both buttons.
4. If the unit prompts you for the password, enter it by using the AIR ▲YES and RANGE ▼ SHIFT buttons to select each password number and then pressing and releasing POWER ENTER RESET to enter the number and move on to the next one.
5. The Calibration Mode Screen displays with the cursor next to **AUTO CALIBRATION**.

<p>CALIBRATION MODE</p>
<p>> AUTO CALIBRATION</p>
<p>SINGLE CALIBRATION</p>
<p>PERFORM AIR ADJUST</p>
<p>NORMAL OPERATION</p>

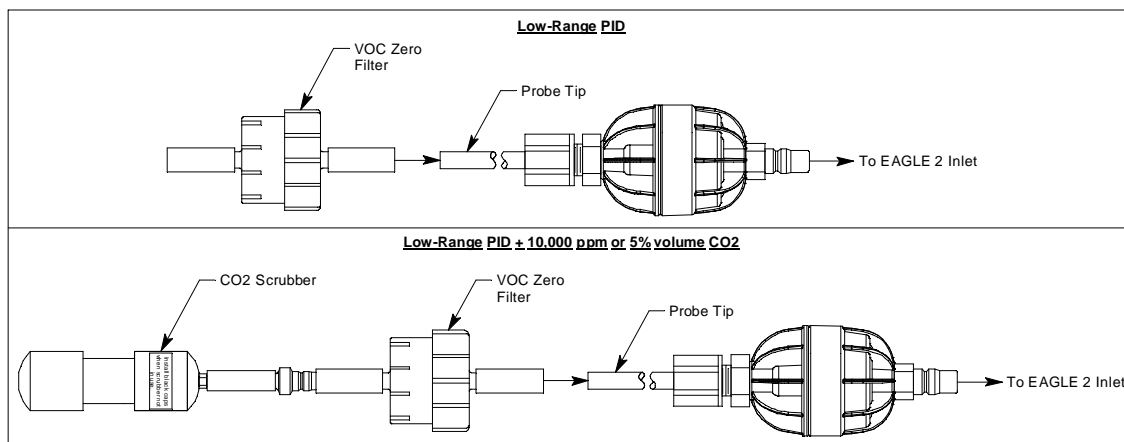
6. Move the cursor to the **PERFORM AIR ADJUST** menu item by using the RANGE ▼ SHIFT button.



7. Press the POWER ENTER RESET button. The following screen appears.

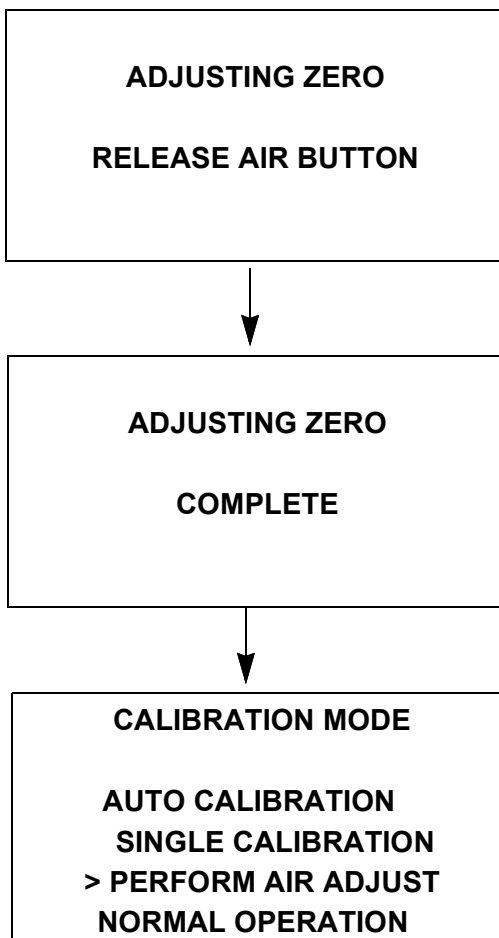


8. If you suspect any low-level VOC background in the area, you must install the VOC zero filter before performing a demand zero.
- Remove the plug from each end of the VOC zero filter.
 - Attach the VOC zero filter to the probe. The filter does not have a preferred flow direction.
 - If your instrument also has a 0-10,000 ppm or 0-5 %vol CO₂ sensor, remove the black caps from the CO₂ scrubber and connect its fitting to the VOC zero filter.



9. Let the instrument draw through the filter(s) for 1 minute.
10. Press the AIR ▲YES button to continue.
- If you do not want to continue, press the DISPLAY ADJUST NO button and the unit will return to the Calibration Mode Screen.

11. The Eagle 3 will indicate that it is adjusting the zero reading for a few seconds, then indicate that the operation is complete before returning to the Calibration Mode Screen.



12. If you used a CO₂ scrubber, remove it from the VOC filter and reinstall the black caps.
13. Remove the VOC zero filter from the probe and reinstall the plugs.
14. Install the demand flow regulator onto the multi-gas calibration cylinder.
15. Connect the sample tubing to the demand flow regulator.
16. Install the probe on the Eagle 3 inlet fitting. Make sure the probe is complete with internal O-ring and membrane and that the two halves of the probe are tightened firmly together to avoid leaks that can affect the calibration. See Figure 17 on page 99 for an illustration of the internal parts of the probe.

17. Move the cursor next to the **AUTO CALIBRATION** menu item by using the AIR ▲YES button.

<p>CALIBRATION MODE</p> <p>> AUTO CALIBRATION</p> <p>SINGLE CALIBRATION</p> <p>PERFORM AIR ADJUST</p> <p>NORMAL OPERATION</p>

18. Press the POWER ENTER RESET button to display the Calibration Gas Values Screen.

<p>CAL GAS VALUES</p> <p>CH4 50 % LEL</p> <p>OXY 12.0 vol%</p> <p>H2S 25.0 ppm</p> <p>CO 50 ppm</p> <p>ENTER TO BEGIN CAL</p>

The gas concentrations displayed in the Calibration Gas Values Screen must match the gas concentrations listed on the 4-gas calibration cylinder.

If *all* concentrations match, go to Step 29.

If *one or more* concentrations *do not* match, continue with Step 19.

If you do not want to continue with the calibration, press the DISPLAY ADJUST NO button to return to the Calibration Mode Screen.

NOTE: The RKI 4-gas cylinder typically contains 12% O₂ by volume. When using the auto calibration method, be sure to set the “OXY” auto calibration value to agree with the concentration listed on the cylinder’s label, not zero.

19. To adjust the values on the screen, press and hold the RANGE ▼ SHIFT button, then press the DISPLAY ADJUST NO button both. The following screen appears with the cursor next to **CH4**.

<p>ADJUST AUTO</p> <p>CALIBRATION VALUES</p> <p>> CH4 50 % LEL</p> <p>OXY 12.0 vol%</p> <p>H2S 25.0 ppm</p> <p>CO 50 ppm ▼</p>

20. Place the cursor next to the channel whose gas value you want to change using the AIR ▲ YES and RANGE ▼ SHIFT buttons.
21. Press the POWER ENTER RESET button to select the channel. The calibration gas value begins to flash.

22. Use the AIR ▲YES and RANGE ▼ SHIFT buttons to adjust the calibration gas setting to the desired value.

NOTE: The calibration gas value cannot be set lower than the low alarm setting. If the calibration gas value listed on the calibration cylinder is lower than the current low alarm setting, enter Setup Mode and change the low alarm setting. See page 145 for instructions. If you need to change the alarm point setting only to perform a calibration, make sure that you change the alarm point setting back to its original value once the calibration has been performed.

23. Press the POWER ENTER RESET button to save the change. The calibration gas value stops flashing.
24. Repeat Step 19 through Step 23 for any other channels that need to be changed.
25. When you are done adjusting the calibration gas values, move the cursor down past the bottom of the screen next to **END**.

**ADJUST AUTO
CALIBRATION VALUES
> END ▲**

26. Press the POWER ENTER RESET button. The following screen appears.

**DO YOU WANT TO
STORE NEW VALUE(S)
IN MEMORY FOR
FUTURE CALIBRATIONS?

PRESS YES OR NO**

27. If you select YES by pressing and releasing the AIR ▲YES button, the changes that you made will be saved in the Eagle 3's memory as the new auto calibration gas values.

If you select NO by pressing and releasing the DISPLAY ADJUST NO button, the changes you made will be used for any calibrations performed during the current operating session only. The Eagle 3 will delete the changes when the unit is turned off and will load the previous set of auto calibration values when it is turned on again.

28. When you make your selection and press the desired button, the unit returns to the Calibration Gas Values Screen.

CAL GAS VALUES		
CH4	50	% LEL
OXY	12.0	vol%
H2S	25.0	ppm
CO	50	ppm
ENTER TO BEGIN CAL		

29. Press the POWER ENTER RESET button to proceed to the Calibration In Process Screen with **CAL IN PROCESS** flashing.

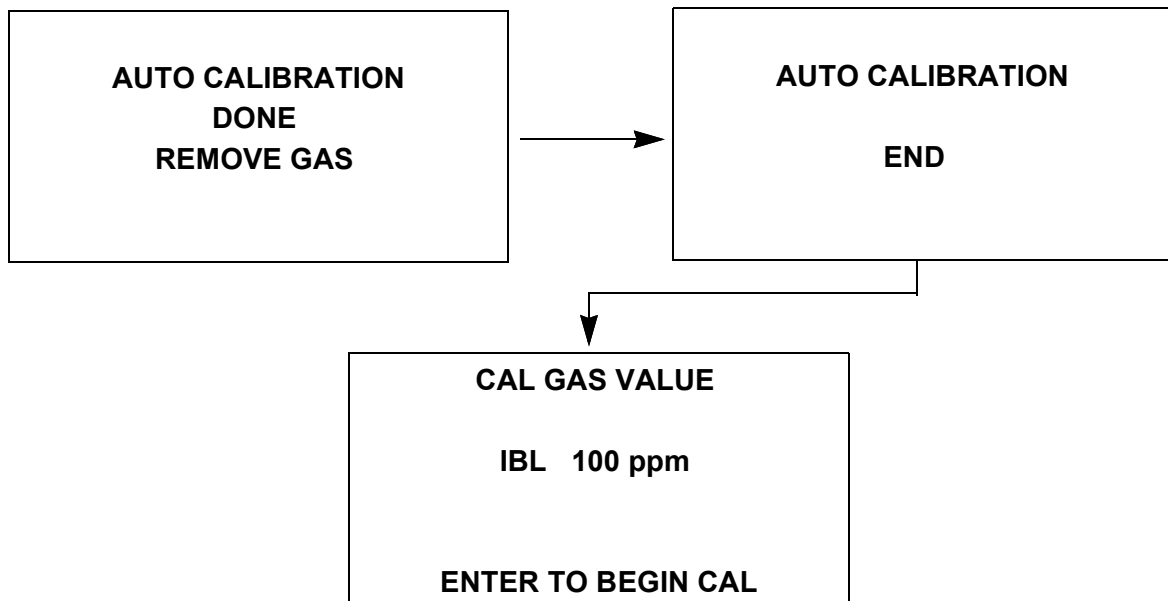
CAL IN PROCESS		
CH4	0	% LEL
OXY	20.9	vol%
H2S	0.0	ppm
CO	0	ppm
ENTER WHEN DONE		

If you do not want to proceed with the calibration, press the DISPLAY ADJUST NO button to return to the Cal Gas Values Screen.

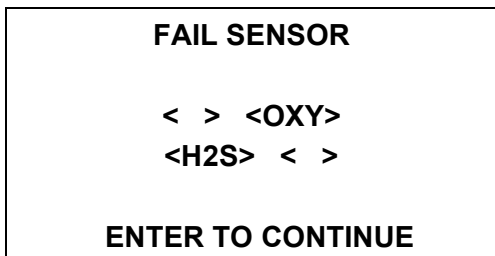
If you do want to continue with the calibration, proceed to the next step.

30. Connect the tubing from the demand flow regulator to the rigid tube on the probe. Allow the Eagle 3 to draw gas for one minute.
31. Press the POWER ENTER RESET button to set the span adjustment for each channel to the programmed values.

32. If all channels passed calibration, the following screen sequence occurs.



If any of the sensors cannot be adjusted to the proper value, a screen displays that indicates a calibration failure and lists the sensor(s) that failed to calibrate. In the example below, the oxygen and H₂S channels failed calibration. The other sensors calibrated normally.



The buzzer and alarm LEDs activate in a double pulsing pattern. Press the POWER ENTER RESET button to reset the alarm and continue to the Calibration Value Screen for the PID channel. After calibrating the PID channel by following the instructions below, attempt to calibrate the standard channels again. If the failure continues, investigate the cause. See "Troubleshooting" on page 96..

33. Remove the tubing from the rigid tube on the probe.

34. Unscrew the 4-gas cylinder from the regulator.

35. If you want to change the PID channel's calibration gas value, follow Step 5 - Step 28 above beginning with the PID Calibration Gas Value Screen below instead of the standard channel Calibration Gas Value Screen.

<p>CAL GAS VALUE</p> <p>IBL 100 ppm</p> <p>ENTER TO BEGIN CAL</p>
--

36. With the PID Calibration Gas Value Screen displayed, press the POWER ENTER RESET button to proceed to the Calibration In Process Screen for the PID channel with **CAL IN PROCESS** flashing.

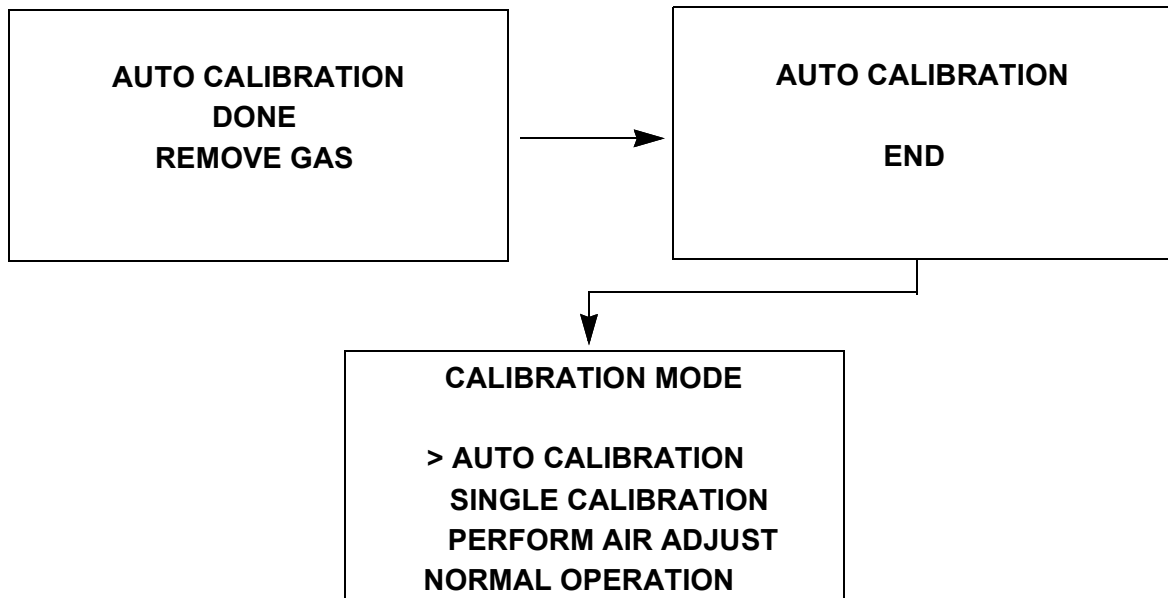
<p>CAL IN PROCESS</p> <p>IBL 0 ppm</p> <p>ENTER WHEN DONE</p>
--

If you do not want to proceed with the calibration, press the DISPLAY ADJUST NO button to return to the PID Cal Gas Values Screen.

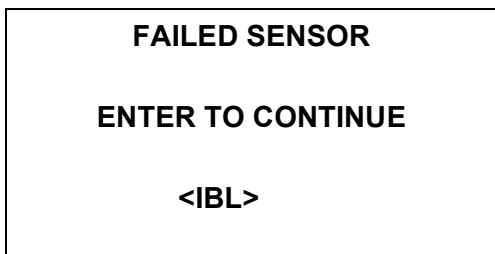
If you do want to continue with the calibration, proceed to the next step.

37. Screw the PID calibration cylinder onto the demand flow regulator.
38. Connect the tubing from the regulator to the rigid tube on the probe. Allow the Eagle 3 to draw gas for one minute.
39. Press the POWER ENTER RESET button to set the span adjustment for the PID channel to the programmed value.

40. If the PID channel passed calibration, the following screen sequence occurs.



If the PID channel cannot be adjusted to the proper value, a screen displays that indicates a calibration failure and indicates that the PID sensor failed to calibrate.



The buzzer and alarm LEDs activate in a double pulsing pattern. Press the POWER ENTER RESET button to reset the alarm and continue to the Calibration Mode Screen. Attempt to calibrate the PID channel again. If the failure continues, investigate the cause. See "Troubleshooting" on page 96..

41. Disconnect the tubing from the probe.
42. Unscrew the demand flow regulator from the calibration cylinder.
43. Use the RANGE ▼ SHIFT button to place the cursor next to the **NORMAL OPERATION** menu option, then press the POWER ENTER RESET button to return to Normal Mode.

Calibrating with a 5-Gas Cylinder

1. See “Entering Calibration Mode” on page 77 for a description of the necessary calibration supplies. See page 249 for available cylinders. Make sure your calibration cylinder is appropriate for the PID detection range.

NOTE: The 5-gas calibration cylinder that includes LEL CH₄/O₂/CO/H₂S/isobutylene is a proprietary gas mix developed by RKI Instruments, Inc. for calibrating a PID sensor in the presence of the other gases during an auto calibration. It can also be used for a single calibration of a PID sensor. Do not use a similar gas mix provided by any other manufacturer when calibrating a PID channel. Use of a gas mix from another manufacturer that includes isobutylene and these other gases will result in an inaccurate calibration.

2. Find a fresh-air environment. This is an environment free of toxic or combustible gases and of normal oxygen content (20.9%).
3. While in Normal Mode, press and hold the RANGE ▼ SHIFT button, then press the DISPLAY ADJUST NO button both buttons.
4. If the unit prompts you for the password, enter it by using the AIR ▲YES and RANGE ▼ SHIFT buttons to select each password number and then pressing and releasing POWER ENTER RESET to enter the number and move on to the next one.
5. The Calibration Mode Screen displays with the cursor next to **AUTO CALIBRATION**.

CALIBRATION MODE

> AUTO CALIBRATION

SINGLE CALIBRATION

PERFORM AIR ADJUST

NORMAL OPERATION

6. Move the cursor to the **PERFORM AIR ADJUST** menu item by using the RANGE ▼ SHIFT button.

CALIBRATION MODE

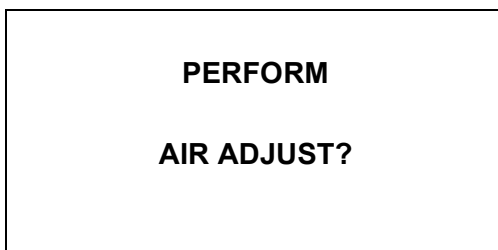
AUTO CALIBRATION

SINGLE CALIBRATION

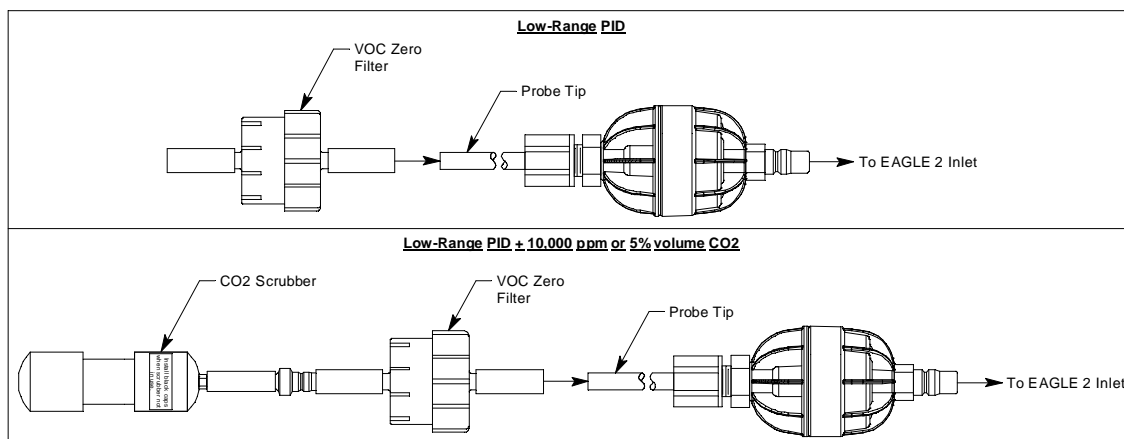
> PERFORM AIR ADJUST

NORMAL OPERATION

7. Press the POWER ENTER RESET button. The following screen appears.

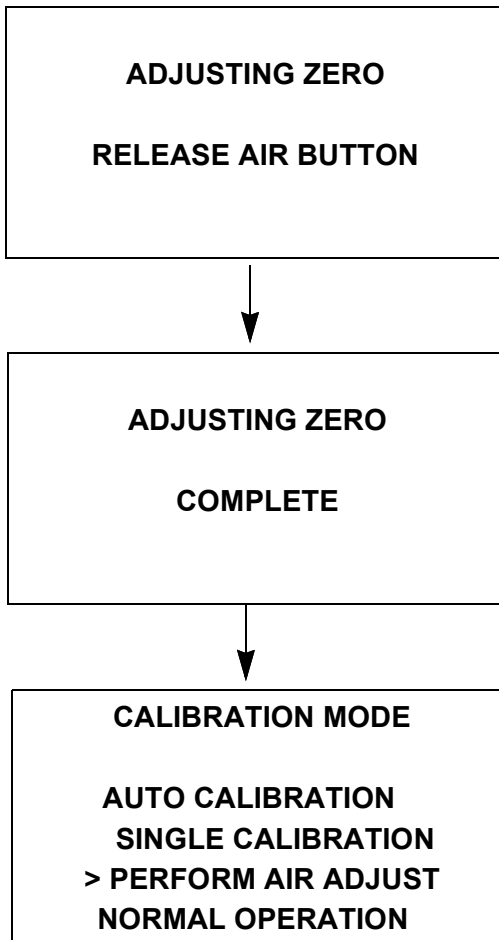


8. If you suspect any low-level VOC background in the area, you must install the VOC zero filter before performing a demand zero.
- Remove the plug from each end of the VOC zero filter.
 - Attach the VOC zero filter to the probe. The filter does not have a preferred flow direction.
 - If your instrument also has a 0-10,000 ppm or 0-5 %vol CO₂ sensor, remove the black caps from the CO₂ scrubber and connect its fitting to the VOC zero filter.



9. Let the instrument draw through the filter(s) for 1 minute.
10. Press the AIR ▲YES button to continue.
- If you do not want to continue, press the DISPLAY ADJUST NO button and the unit will return to the Calibration Mode Screen.

11. The Eagle 3 will indicate that it is adjusting the zero reading for a few seconds, then indicate that the operation is complete before returning to the Calibration Mode Screen.



12. If you used a CO₂ scrubber, remove it from the VOC filter and reinstall the black caps.
13. Remove the VOC zero filter from the probe and reinstall the plugs.
14. Install the demand flow regulator onto the multi-gas calibration cylinder.
15. Connect the sample tubing to the demand flow regulator.
16. Install the probe on the Eagle 3 inlet fitting. Make sure the probe is complete with internal O-ring and membrane and that the two halves of the probe are tightened firmly together to avoid leaks that can affect the calibration. See Figure 17 on page 99 for an illustration of the internal parts of the probe.

17. Move the cursor next to the **AUTO CALIBRATION** menu item by using the AIR ▲YES button.

<p>CALIBRATION MODE</p> <p>> AUTO CALIBRATION</p> <p>SINGLE CALIBRATION</p> <p>PERFORM AIR ADJUST</p> <p>NORMAL OPERATION</p>

18. Press the POWER ENTER RESET button to display the Calibration Gas Values Screen.

<p>CAL GAS VALUES</p> <p>CH4 50 % LEL</p> <p>OXY 12.0 vol%</p> <p>H2S 25.0 ppm</p> <p>CO 50 ppm</p> <p>ENTER TO BEGIN CAL</p>

The gas concentrations displayed in the Calibration Gas Values Screen must match the gas concentrations listed on the 4-gas calibration cylinder.

If *all* concentrations match, go to Step 29.

If *one or more* concentrations *do not* match, continue with Step 19.

If you do not want to continue with the calibration, press the DISPLAY ADJUST NO button to return to the Calibration Mode Screen.

NOTE: The RKI 4-gas cylinder typically contains 12% O₂ by volume. When using the auto calibration method, be sure to set the “OXY” auto calibration value to agree with the concentration listed on the cylinder’s label, not zero.

19. To adjust the values on the screen, press and hold the RANGE ▼ SHIFT button, then press the DISPLAY ADJUST NO button both. The following screen appears with the cursor next to **CH4**.

<p>ADJUST AUTO</p> <p>CALIBRATION VALUES</p> <p>> CH4 50 % LEL</p> <p>OXY 12.0 vol%</p> <p>H2S 25.0 ppm</p> <p>CO 50 ppm ▼</p>

20. Place the cursor next to the channel whose gas value you want to change using the AIR ▲ YES and RANGE ▼ SHIFT buttons.
21. Press the POWER ENTER RESET button to select the channel. The calibration gas value begins to flash.

22. Use the AIR ▲YES and RANGE ▼ SHIFT buttons to adjust the calibration gas setting to the desired value.

NOTE: The calibration gas value cannot be set lower than the low alarm setting. If the calibration gas value listed on the calibration cylinder is lower than the current low alarm setting, enter Setup Mode and change the low alarm setting. See “Updating the Alarm Settings” on page 145 for instructions. If you need to change the alarm point setting only to perform a calibration, make sure that you change the alarm point setting back to its original value once the calibration has been performed.

23. Press the POWER ENTER RESET button to save the change. The calibration gas value stops flashing.
24. Repeat Step 19 through Step 23 for any other channels that need to be changed.
25. When you are done adjusting the calibration gas values, move the cursor down past the bottom of the screen next to **END**.

**ADJUST AUTO
CALIBRATION VALUES
> END ▲**

26. Press the POWER ENTER RESET button. The following screen appears.

**DO YOU WANT TO
STORE NEW VALUE(S)
IN MEMORY FOR
FUTURE CALIBRATIONS?

PRESS YES OR NO**

27. If you select YES by pressing and releasing the AIR ▲YES button, the changes that you made will be saved in the Eagle 3’s memory as the new auto calibration gas values.

If you select NO by pressing and releasing the DISPLAY ADJUST NO button, the changes you made will be used for any calibrations performed during the current operating session only. The Eagle 3 will delete the changes when the unit is turned off and will load the previous set of auto calibration values when it is turned on again.

28. When you make your selection and press the desired button, the unit returns to the Calibration Gas Values Screen.

CAL GAS VALUES		
CH4	50	% LEL
OXY	12.0	vol%
H2S	25.0	ppm
CO	50	ppm
ENTER TO BEGIN CAL		

29. Press the POWER ENTER RESET button to proceed to the Calibration In Process Screen with **CAL IN PROCESS** flashing.

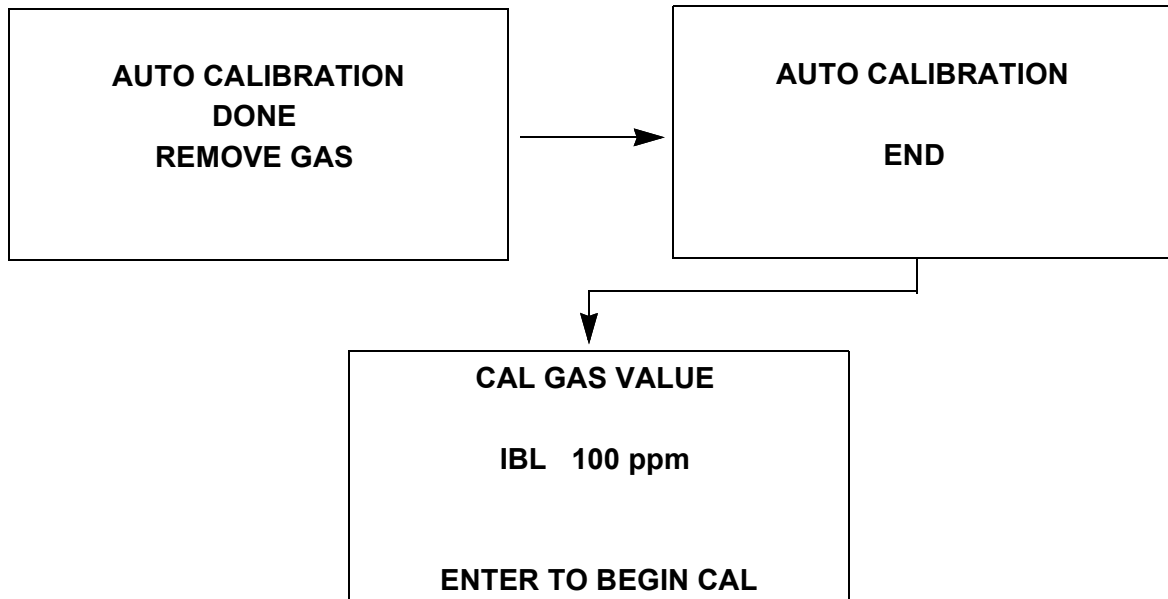
CAL IN PROCESS		
CH4	0	% LEL
OXY	20.9	vol%
H2S	0.0	ppm
CO	0	ppm
ENTER WHEN DONE		

If you do not want to proceed with the calibration, press the DISPLAY ADJUST NO button to return to the Cal Gas Values Screen.

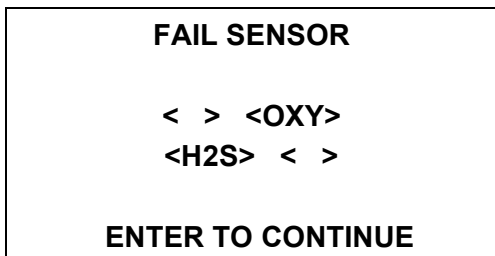
If you do want to continue with the calibration, proceed to the next step.

30. Connect the tubing from the demand flow regulator to the rigid tube on the probe. Allow the Eagle 3 to draw gas for one minute.
31. Press the POWER ENTER RESET button to set the span adjustment for each channel to the programmed values.

32. If all channels passed calibration, the following screen sequence occurs.

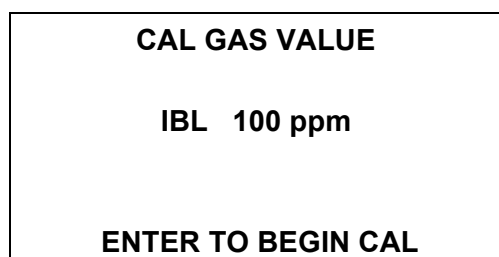


If any of the sensors cannot be adjusted to the proper value, a screen displays that indicates a calibration failure and lists the sensor(s) that failed to calibrate. In the example below, the oxygen and H₂S channels failed calibration. The other sensors calibrated normally.

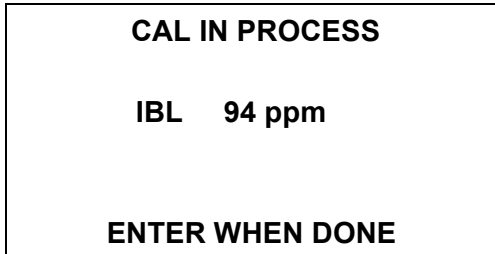


The buzzer and alarm LEDs activate in a double pulsing pattern. Press the POWER ENTER RESET button to reset the alarm and continue to the Calibration Value Screen for the PID channel. After calibrating the PID channel by following the instructions below, attempt to calibrate the standard channels again. If the failure continues, investigate the cause. See “Troubleshooting” on page 96.

33. If you want to change the PID channel’s calibration gas value, follow Step 5 - Step 28 above beginning with the PID Calibration Gas Value Screen below instead of the standard channel Calibration Gas Value Screen.



34. With the PID Calibration Gas Value Screen displayed, press the POWER ENTER RESET button to proceed to the Calibration In Process Screen for the PID channel with **CAL IN PROCESS** flashing.

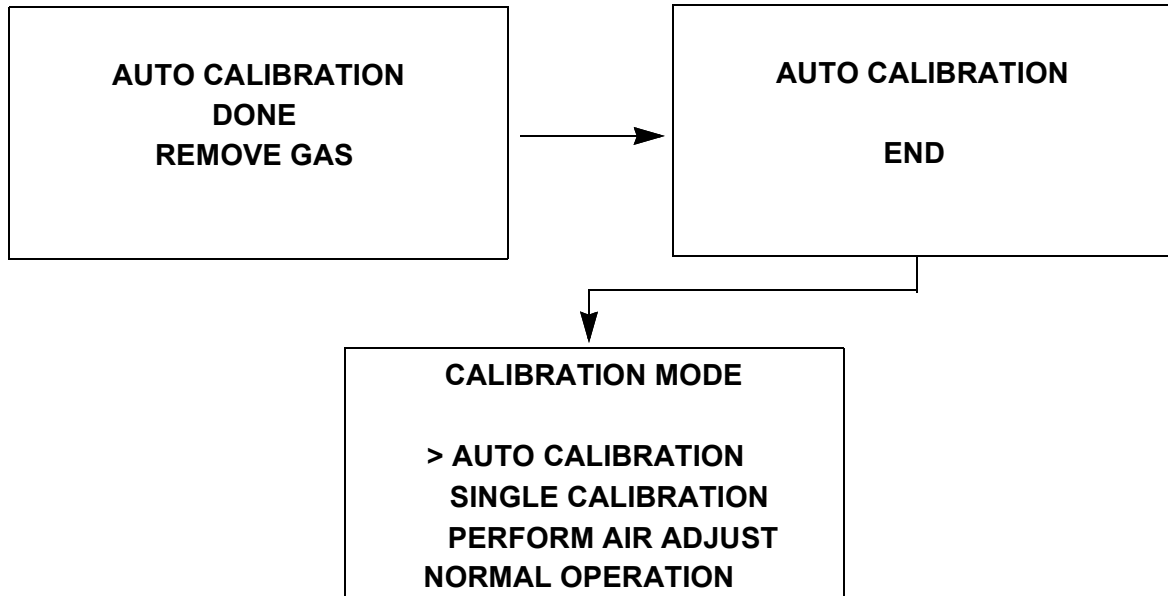


If you do not want to proceed with the calibration, press the DISPLAY ADJUST NO button to return to the PID Cal Gas Values Screen.

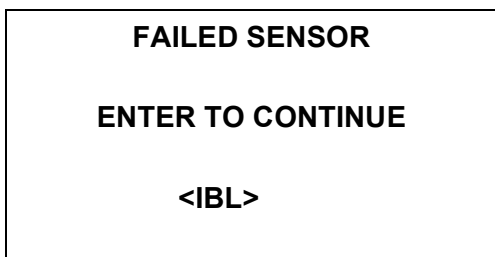
If you do want to continue with the calibration, proceed to the next step.

35. Since calibration gas has already been flowing to the PID sensor while the other channels were being calibrated, the PID sensor reading should be stable and ready for adjustment.
36. Press the POWER ENTER RESET button to set the span adjustment for the PID channel to the programmed value.

37. If the PID channel passed calibration, the following screen sequence occurs.



If the PID channel cannot be adjusted to the proper value, a screen displays that indicates a calibration failure and indicates that the PID sensor failed to calibrate.



The buzzer and alarm LEDs activate in a double pulsing pattern. Press the POWER ENTER RESET button to reset the alarm and continue to the Calibration Mode Screen. Attempt to calibrate the PID channel again. If the failure continues, investigate the cause. See "Troubleshooting" on page 96..

38. Disconnect the tubing from the probe.

39. Unscrew the demand flow regulator from the calibration cylinder.

40. Use the RANGE ▼ SHIFT button to place the cursor next to the **NORMAL OPERATION** menu option, then press the POWER ENTER RESET button to return to Normal Mode.

Maintenance

The PID sensor includes user-serviceable parts. They are the lamp and the electrode stack. The following sections include troubleshooting instructions as well as procedures for cleaning the lamp, replacing the lamp, replacing the electrode stack, and replacing the PID sensor.

Troubleshooting

The troubleshooting table describes symptoms, probable causes, and recommended action for problems you may encounter with the PID sensor.

Table 21:

Symptoms	Probable Causes	Recommended Action
<ul style="list-style-type: none">• PID channel doesn't exit its warm up state and the reading continues to scroll through -200, -100, and 0 for a high range sensor and -2.00, -1.00, and 0.00 for a low range sensor.	<ul style="list-style-type: none">• The PID sensor has not come out of its warm up state.	<ol style="list-style-type: none">1. Clean the lamp.2. Replace the lamp.3. Replace the electrode stack.4. If the difficulties continue, contact RKI Instruments, Inc. for further instruction.
<ul style="list-style-type: none">• The PID sensor fails to calibrate.	<ul style="list-style-type: none">• The auto calibration values may not match the cylinder gas concentration (auto calibration only).• The sample gas is not reaching the sensor because of a bad connection.• The calibration cylinder may be out of gas or is outdated.• The lamp may need to be cleaned.• The electrode stack may need to be replaced.	<ol style="list-style-type: none">1. Make sure the Eagle 3 has been properly set up for calibration.2. Check all calibration tubing for leaks or for any bad connections.3. Verify that the calibration cylinder contains an adequate supply of sample.4. Clean the lamp.5. Replace the electrode stack.6. If the difficulties continue, contact RKI Instruments, Inc. for further instruction.

Cleaning the PID Sensor's Lamp

Clean the lamp if you notice a significant drop in sensitivity from one scheduled calibration to another or if you are not able to calibrate the PID channel. See the page 249 for lamp cleaning kit ordering information. The lamp cleaning kit includes the following items:

- an electrode stack removal tool
- a small vial of aluminum oxide powder
- 40 cotton swabs
- 10 finger cots

Perform the following procedure to clean the PID lamp:

1. Verify that the Eagle 3 is off.
2. Place the Eagle 3 upside down on a flat surface or hold it upside down.
3. Unscrew the three case screws until they disengage from the top case. They are captive screws so they will not fall off of the bottom case.

4. Turn the Eagle 3 right side up and carefully lift the top case away from the bottom case. Be careful not to lift it so far that it pulls on the main PCB with the cable that connects the top case to the main PCB.
5. Lay the top case down next to the bottom case to allow access to the flow system.
6. Locate the PID sensor adapter. It has a five wire cable and is normally located next to the pump. The cable has a connector that mates to a PID sub PCB that is installed on the main PCB. Figure 21 on page 206 shows a PID sensor in a typical location.
7. Grasp the sensor adapter firmly and pull it out of the PID flow chamber. Rock it back and forth gently if necessary to pull it out. Take care not to pull the cable connector from the PID sub PCB.
8. The PID sensor protrudes from one end of the sensor adapter. Grasp the PID sensor firmly and pull it out of the sensor adapter.
9. Place the PID sensor face down on a flat clean working surface.

NOTE: Do not touch the lamp window with your fingers as this may contaminate the window with finger oil. At this point it is recommended that the finger cots be used on the fingers handling the lamp. Finger cots are included with the lamp cleaning kit.

10. Hold the PID sensor steady on the working surface with one hand and using the other hand, locate the tabs on the electrode stack removal tool and insert them into the slots on the side of the PID sensor near the face.

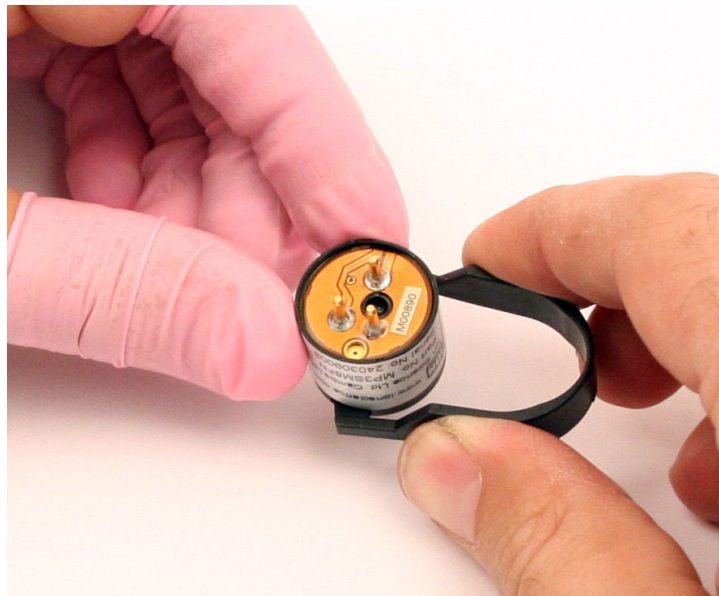


Figure 24: Using Removal Tool

11. Squeeze the removal tool to push the tabs into the sensor slots until the electrode stack and lamp are released.

12. Carefully lift the PID sensor body away from the electrode stack and lamp. Take care not to touch the lamp window, the flat end of the lamp, with your fingers. If the lamp remains lodged in the sensor body, carefully remove it with tweezers.

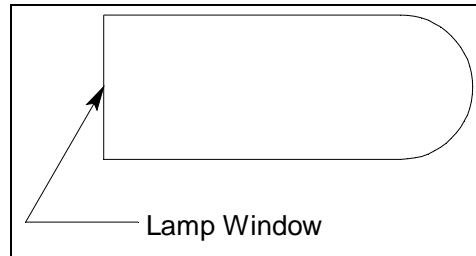


Figure 25: Lamp Window Location

13. If the spring in the lamp cavity comes out, place it back into the lamp cavity.
14. Hold the lamp in one hand being careful not to touch the lamp window with your fingers.
15. With the other hand collect a small amount of aluminum oxide powder on a cotton swab.
16. Use this cotton swab to polish the PID lamp window. Use a circular motion, applying light pressure to clean the lamp window. Do not touch the lamp window with your fingers.

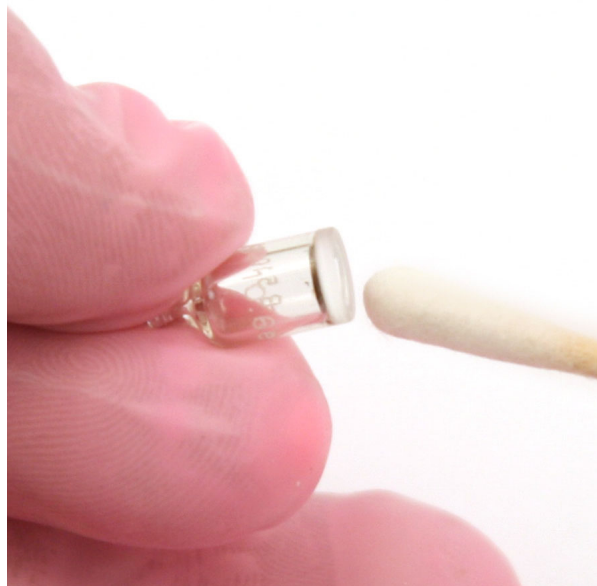


Figure 26: Polishing the Electrode Lamp Window

17. Continue polishing until you can hear a squeaking sound made by the cotton swab moving over the window surface. This usually occurs after about 15 seconds of polishing.
18. Remove the residual powder from the lamp window with a clean cotton swab. Take care not to touch the tip of the cotton swab that is used to clean the lamp as this may contaminate it with finger oil.
19. Ensure the lamp is completely dry and any visible signs of contamination are removed before reinstalling.

20. Hold the electrode stack between the thumb and forefinger of one hand and place the window end of the lamp inside the O-ring seal in the electrode stack with the other hand as shown below.

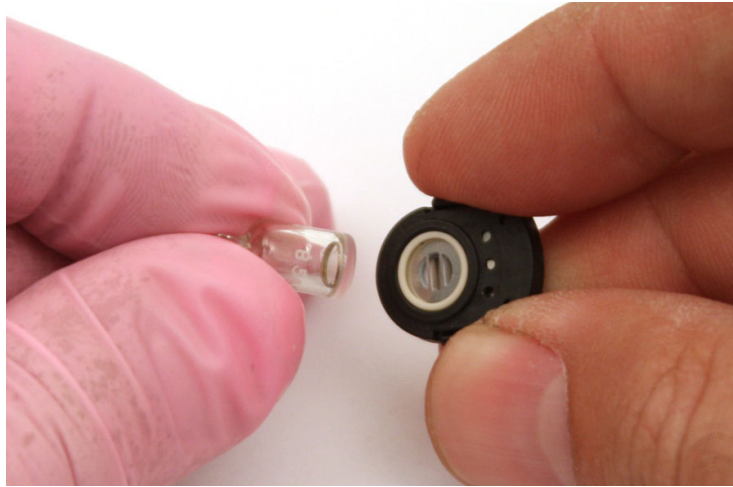


Figure 27: Reinstalling the Electrode Lamp

21. Twisting the lamp slightly during insertion will help to ensure the lamp window is snug against the stack's front electrode. The lamp should be supported by the O-ring.
22. Continuing to hold the electrode stack between your forefinger and thumb, carefully insert the lamp into the lamp cavity in the sensor ensuring that the lamp remains in position.
23. Press in the electrode stack firmly to ensure that the stack wing clips are engaged and the faces of the stack and sensor body are flush.
24. Carefully line up the PID sensor's pins with the sockets in the bottom of the sensor adapter and gently lower the sensor into the adapter until you feel it contact the bottom.
25. Do not attempt to push the sensor in farther once it makes contact with the bottom of the adapter until you are sure that the sensor's pins are engaged with the sockets. If you feel that the pins did not engage the sockets, slightly rotate the sensor back and forth without putting pressure on it until you feel the pins engage the sockets.
26. Push the sensor into the sockets until it bottoms out.
27. Insert the sensor adapter into the PID flow chamber and push it in until it bottoms out.
28. Confirm that the main PCB is seated in its slots and that its bottom edge is resting on the bottom of the bottom case. If the main PCB is not seated properly, it may be damaged when the top case is re-installed.
29. Make sure that the top case gasket is fully seated in its groove and carefully put the top case back on the bottom case. If you have any difficulty mating the top and bottom cases, inspect the placement of the main PCB and the placement of the top case gasket.
30. Turn the Eagle 3 upside down and tighten the three case screws to secure the top case to the bottom case.

31. Calibrate the PID channel as described on page 213.

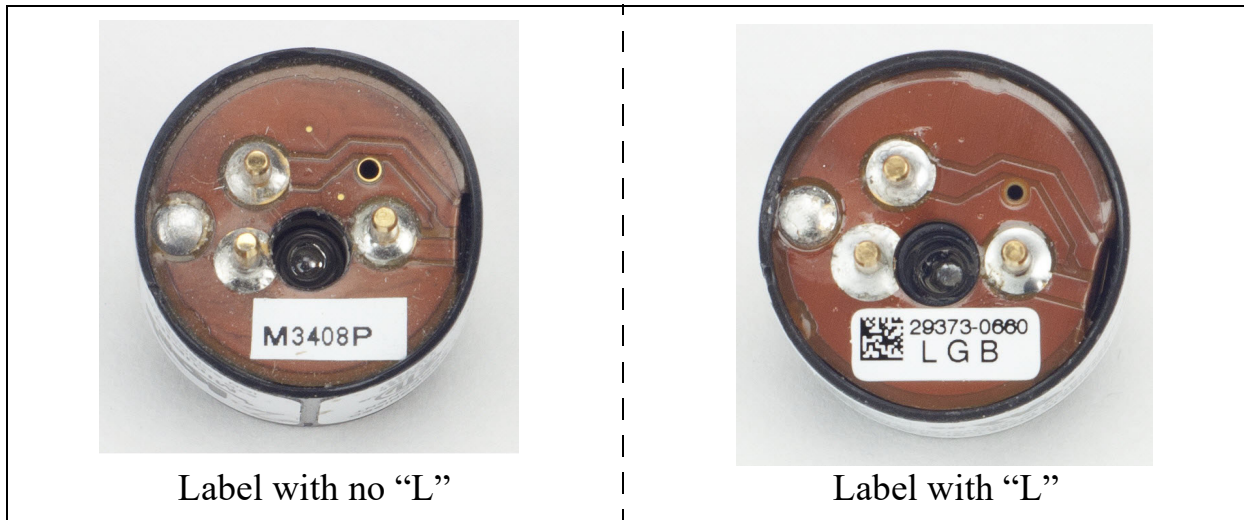
Replacing the PID Sensor's Lamp

If cleaning the PID lamp does not resolve any calibration problems you may be having, the lamp may need to be replaced.

Ordering the Correct Replacement Lamp

It's important to order the correct replacement lamp for your PID sensor.

1. If you have a 61-0300RK-01 or a 61-0301-02 sensor, you need to:
 - a. Pull the PID sensor out of the socket and look at the pins on the underside of the sensor.
 - b. Look at the label near the pins. Some sensors have an "L" in the lower lefthand corner of this label. Other sensors do not.



- c. See the table below for replacement lamp part numbers based on your sensor part number and the presence of the "L" on the pin label.
2. If you have a 61-0302 or 61-0303 sensor, see the table below for replacement lamp part numbers.

Table 22:

PID Sensor Part Number		Replacement Lamp Part Number
61-0300RK-01	No "L"	51-1500RK
	"L"	51-1503
61-0301-02	No "L"	51-1502
	"L"	51-1503
61-0302		51-1503
61-0303		51-1503

Steps to Replace the Lamp

Perform the following procedure to replace the PID lamp:

NOTE: Do not touch the new lamp window (the flat end) with your fingers as this may contaminate the window with finger oil.

1. Verify that the Eagle 3 is off.
2. Place the Eagle 3 upside down on a flat surface or hold it upside down.
3. Unscrew the three case screws until they disengage from the top case. They are captive screws so they will not fall off of the bottom case.
4. Turn the Eagle 3 right side up and carefully lift the top case away from the bottom case. Be careful not to lift it so far that it pulls on the main PCB with the cable that connects the top case to the main PCB.
5. Lay the top case down next to the bottom case to allow access to the flow system.
6. Locate the PID sensor adapter. It has a five wire cable and is normally located next to the pump. The cable has a connector that mates to a PID sub PCB that is installed on the main PCB. Figure 21 on page 206 shows a PID sensor in a typical location.
7. Grasp the sensor adapter firmly and pull it out of the PID flow chamber. Rock it back and forth gently if necessary to pull it out. Take care not to pull the cable connector from the PID sub PCB.
8. The PID sensor protrudes from one end of the sensor adapter. Grasp the PID sensor firmly and pull it out of the sensor adapter.
9. Place the PID sensor face down on a flat clean working surface.

10. Hold the PID sensor steady on the working surface with one hand and using the other hand, locate the tabs on the electrode stack removal tool and insert them into the slots on the side of the PID sensor near the face.

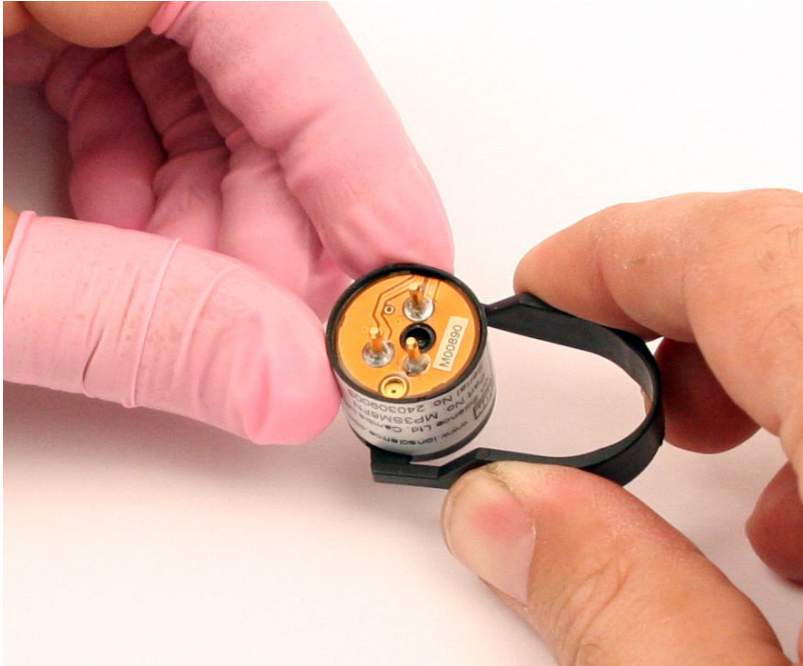


Figure 28: Using Removal Tool

11. Squeeze the removal tool to push the tabs into the sensor slots until the electrode stack and lamp are released.
12. Carefully lift the PID sensor body away from the electrode stack and lamp. If the lamp remains lodged in the sensor body, carefully remove it with tweezers.
13. If the spring in the lamp cavity comes out, place it back into the lamp cavity.
14. Discard the old PID lamp.

NOTE: At this point it is recommended that the finger cots be used on the fingers handling the lamp. Finger cots are included with the lamp cleaning kit.

15. Hold the electrode stack between the thumb and forefinger of one hand and place the window end of the new lamp inside the O-ring seal in the electrode stack with the other hand as shown below. Take care not to touch the lamp window.

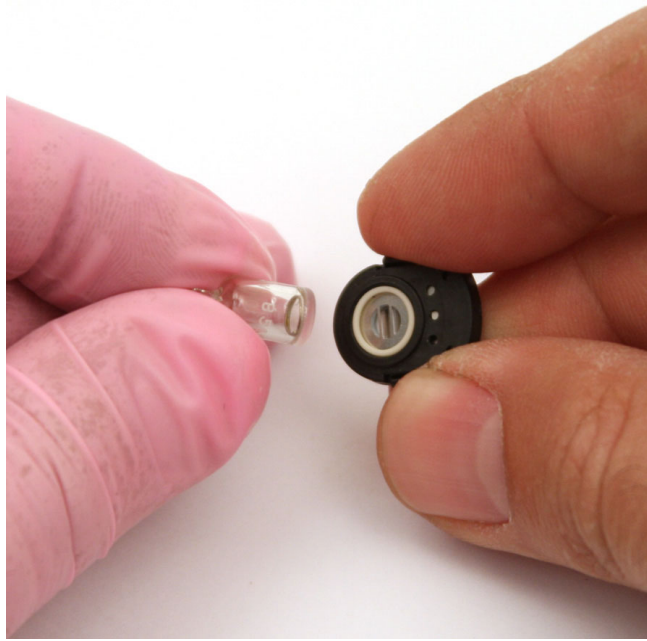


Figure 29: Reinstalling the Electrode Lamp

16. Twisting the lamp slightly during insertion will help to ensure the lamp window is snug against the stack's front electrode. The lamp should be supported by the O-ring.
17. Continuing to hold the electrode stack between your forefinger and thumb, carefully insert the lamp into the lamp cavity in the sensor ensuring that the lamp remains in position.
18. Press in the electrode stack firmly to ensure that the stack wing clips are engaged and the faces of the stack and sensor body are flush.
19. Carefully line up the PID sensor's pins with the sockets in the bottom of the sensor adapter and gently lower the sensor into the adapter until you feel it contact the bottom.
20. Do not attempt to push the sensor in farther once it makes contact with the bottom of the adapter until you are sure that the sensor's pins are engaged with the sockets. If you feel that the pins did not engage the sockets, slightly rotate the sensor back and forth without putting pressure on it until you feel the pins engage the sockets.
21. Push the sensor into the sockets until it bottoms out.
22. Insert the sensor adapter into the PID flow chamber and push it in until it bottoms out.
23. Confirm that the main PCB is seated in its slots and that its bottom edge is resting on the bottom of the bottom case. If the main PCB is not seated properly, it may be damaged when the top case is re-installed.
24. Make sure that the top case gasket is fully seated in its groove and carefully put the top case back on the bottom case. If you have any difficulty mating the top and bottom cases, inspect the placement of the main PCB and the placement of the top case gasket.

25. Turn the Eagle 3 upside down and tighten the three case screws to secure the top case to the bottom case.
26. Calibrate the PID channel as described on page 213.

Replacing the Electrode Stack

The electrode stack can last for the life of the PID sensor if the Eagle 3 is used in a very clean, controlled environment. When used in a heavily contaminated or dirty environment, the electrode stack may only last a month. A contaminated electrode stack will cause a drop in sensitivity which can cause problems calibrating the PID channel. The electrode stack should be replaced if the PID sensor shows signs of contamination even after cleaning or replacing the lamp.

NOTE: Do not touch the new lamp window (the flat end) with your fingers as this may contaminate the window with finger oil.

1. Verify that the Eagle 3 is off.
2. Place the Eagle 3 upside down on a flat surface or hold it upside down.
3. Unscrew the three case screws until they disengage from the top case. They are captive screws so they will not fall off of the bottom case.
4. Turn the Eagle 3 right side up and carefully lift the top case away from the bottom case. Be careful not to lift it so far that it pulls on the main PCB with the cable that connects the top case to the main PCB.
5. Lay the top case down next to the bottom case to allow access to the flow system.
6. Locate the PID sensor adapter. It has a five wire cable and is normally located next to the pump. The cable has a connector that mates to a PID sub PCB that is installed on the main PCB. Figure 21 on page 206 shows a PID sensor in a typical location.
7. Grasp the sensor adapter firmly and pull it out of the PID flow chamber. Rock it back and forth gently if necessary to pull it out. Take care not to pull the cable connector from the PID sub PCB.
8. The PID sensor protrudes from one end of the sensor adapter. Grasp the PID sensor firmly and pull it out of the sensor adapter.
9. Place the PID sensor face down on a flat clean working surface.

NOTE: At this point it is recommended that the finger cots be used on the fingers handling the lamp. Finger cots are included with the lamp cleaning kit.

10. Hold the PID sensor steady on the working surface with one hand and using the other hand, locate the tabs on the electrode stack removal tool and insert them into the slots on the side of the PID sensor near the face.

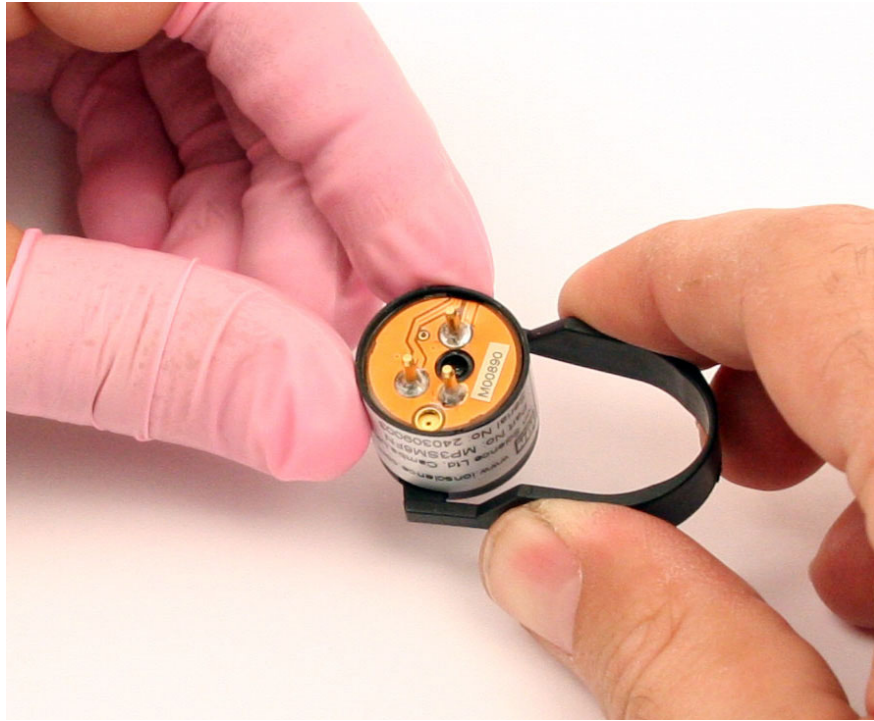


Figure 30: Using Removal Tool

11. Squeeze the removal tool to push the tabs into the sensor slots until the electrode stack and lamp are released.
12. Carefully lift the PID sensor body away from the electrode stack and lamp. If the lamp remains lodged in the sensor body, carefully remove it with tweezers.
13. If the spring in the lamp cavity comes out, place it back into the lamp cavity.
14. Discard the old electrode stack.
15. Hold the new electrode stack between the thumb and forefinger of one hand and place the window end of the lamp inside the O-ring seal in the new electrode stack with the other hand as shown below. Take care not to touch the lamp window.

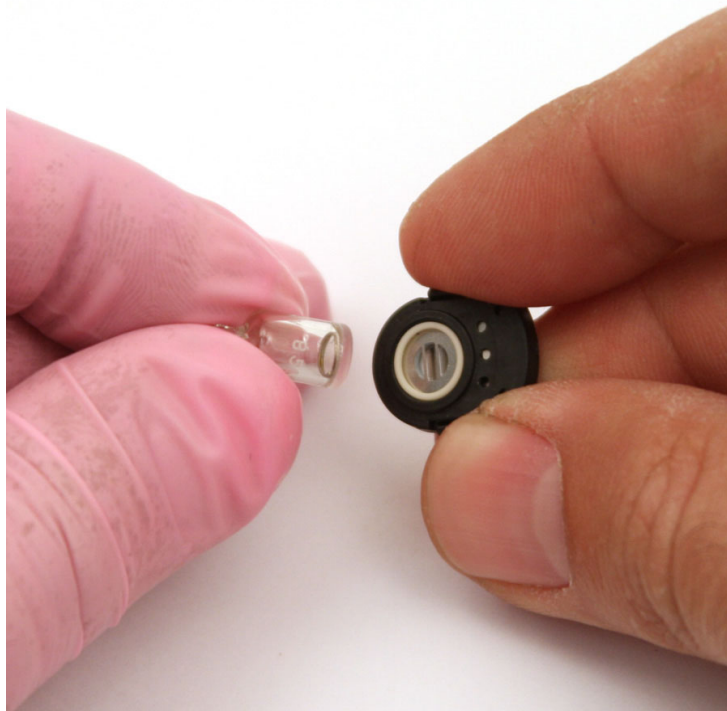


Figure 31: Reinstalling Electrode Lamp

16. Twisting the lamp slightly during insertion will help to ensure the lamp window is snug against the stack's front electrode. The lamp should be supported by the O-ring.
17. Continuing to hold the electrode stack between your forefinger and thumb, carefully insert the lamp into the lamp cavity in the sensor ensuring that the lamp remains in position.
18. Press in the electrode stack firmly to ensure that the stack wing clips are engaged and the faces of the stack and sensor body are flush.
19. Carefully line up the PID sensor's pins with the sockets in the bottom of the sensor adapter and gently lower the sensor into the adapter until you feel it contact the bottom.
20. Do not attempt to push the sensor in farther once it makes contact with the bottom of the adapter until you are sure that the sensor's pins are engaged with the sockets. If you feel that the pins did not engage the sockets, slightly rotate the sensor back and forth without putting pressure on it until you feel the pins engage the sockets.
21. Push the sensor into the sockets until it bottoms out.
22. Insert the sensor adapter into the PID flow chamber and push it in until it bottoms out.
23. Confirm that the main PCB is seated in its slots and that its bottom edge is resting on the bottom of the bottom case. If the main PCB is not seated properly, it may be damaged when the top case is re-installed.

24. Make sure that the top case gasket is fully seated in its groove and carefully put the top case back on the bottom case. If you have any difficulty mating the top and bottom cases, inspect the placement of the main PCB and the placement of the top case gasket.
25. Turn the Eagle 3 upside down and tighten the three case screws to secure the top case to the bottom case.
26. Calibrate the PID channel as described on page 213.

Replacing the PID Sensor

1. Verify that the Eagle 3 is off.
2. Place the Eagle 3 upside down on a flat surface or hold it upside down.
3. Unscrew the three case screws until they disengage from the top case. They are captive screws so they will not fall off of the bottom case.
4. Turn the Eagle 3 right side up and carefully lift the top case away from the bottom case. Be careful not to lift it so far that it pulls on the main PCB with the cable that connects the top case to the main PCB.
5. Lay the top case down next to the bottom case to allow access to the flow system.
6. Locate the PID sensor adapter. It has a five wire cable and is normally located next to the pump. The cable has a connector that mates to a PID sub PCB that is installed on the main PCB. Figure 21 on page 206 shows a PID sensor in a typical location.
7. Grasp the sensor adapter firmly and pull it out of the PID flow chamber. Rock it back and forth gently if necessary to pull it out. Take care not to pull the cable connector from the PID sub PCB.
8. The PID sensor protrudes from one end of the sensor adapter. Grasp the old PID sensor firmly and pull it out of the sensor adapter.
9. Carefully line up the new PID sensor's pins with the sockets in the bottom of the sensor adapter and gently lower the sensor into the adapter until you feel it contact the bottom.
10. Do not attempt to push the sensor in farther once it makes contact with the bottom of the adapter until you are sure that the sensor's pins are engaged with the sockets. If you feel that the pins did not engage the sockets, slightly rotate the sensor back and forth without putting pressure on it until you feel the pins engage the sockets.
11. Push the sensor into the sockets until it bottoms out.
12. Insert the sensor adapter into the PID flow chamber and push it in until it bottoms out.
13. Plug the PID cable connector into the PID sub PCB on the main PCB.
14. Confirm that the main PCB is seated in its slots and that its bottom edge is resting on the bottom of the bottom case. If the main PCB is not seated properly, it may be damaged when the top case is re-installed.

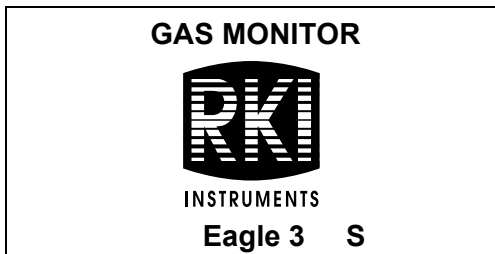
15. Make sure that the top case gasket is fully seated in its groove and carefully put the top case back on the bottom case. If you have any difficulty mating the top and bottom cases, inspect the placement of the main PCB and the placement of the top case gasket.
16. Turn the Eagle 3 upside down and tighten the three case screws to secure the top case to the bottom case.
17. Calibrate the PID channel as described on page 213.

Configuring the PID Gas in Setup Mode

The standard PID channel is configured for and calibrated to isobutylene. If calibration to a different gas is required for an application, the PID channel can also be configured for other gases in the CONFIGURE GASES menu item in Setup Mode. To change the gas configuration of the PID channel in Setup Mode, do the following:

WARNING: The Eagle 3 is not in operation as a gas detector while in Setup Mode.

1. Take the Eagle 3 to a non-hazardous location and turn it off if it is on.
2. Press and hold AIR ▲YES and RANGE ▼ SHIFT, then press and hold POWER ENTER RESET. When you hear a beep, release the buttons.
3. The LCD will show the following screen for a few seconds with the “S” in the lower right corner indicating the unit is entering Setup Mode.



4. The “S” will then disappear and the following screen will appear for a few seconds.



5. If the unit prompts you for the password, enter it by using AIR ▲YES and RANGE ▼ SHIFT to select each password number and then pressing and releasing the POWER ENTER RESET button to enter it and move on to the next number until all of the numbers are entered. The main menu displays. It displays six menu items at a time.

```
>SET DATE & TIME
SET DATE FORMAT
SET BATTERY TYPE
CONFIGURE CHANNELS
CONFIGURE GASES
CATALYTIC UNITS ▼
```

6. Use the RANGE ▼ SHIFT button to move the cursor down the menu to CONFIGURE GASES.
7. Press POWER ENTER RESET. The Configure Gases Screen appears with the cursor flashing next to CAT, the catalytic sensor. If an Eagle 3 has a PID sensor installed, one of the three optional sensor types, OP1, OP2, or OP3 will indicate it is a PID. In the example below, OP1 is shown as a PID sensor.

```
CONFIGURE GASES

> CAT : CH4 (CAT)
  OP1 : IBL (PID)
  OP2 : --- (---)
  OP3 : --- (---) ▼
```

8. Use RANGE ▼ SHIFT to move the cursor down the menu to the PID sensor.

```
CONFIGURE GASES

CAT : CH4 (CAT)
> OP1 : IBL (PID)
  OP2 : --- (---)
  OP3 : --- (---) ▼
```

9. To change the PID sensor gas configuration, press POWER ENTER RESET.

10. A screen appears that indicates the PID type, low range or high range (flashing), and the detection range for the currently configured gas. In the example below, the PID sensor is currently configured as a high range sensor for 0 - 2,000 ppm isobutylene.

PID(0- 2000ppm IBL)

AIR/RANGE THEN ENTER

HIGH RANGE

11. Use AIR ▲YES and RANGE ▼ SHIFT to set the correct range, low or high, for the sensor that is installed.

Press POWER ENTER RESET. A screen appears with gas configuration choices for the PID sensor. The screen below illustrates the first four choices for a high range PID.

PID(0- 2000ppm IBL)

> 1000 ppm ACT

1000 ppm BNZ

1500 ppm DSL

15000 ppm ETA ▼

There are 17 gas configuration choices, shown below, that can be viewed on five screens.

Table 23:

Gas Name (LCD Abbreviation)	Detection Range Full Scale Low Range/High Range
Acetone (ACT)	30.00 ppm/1000 ppm
Benzene (BNZ)	25.00 ppm/1000 ppm
Diesel Fuel No. 1 (DSL)	40.00 ppm/1500 ppm
Ethanol (ETA)	400.0 ppm/15000 ppm
Gasoline (GSL)	50.00 ppm/2000 ppm
Isobutylene (IBL) Standard Factory Gas Configuration	50.00 ppm/2000 ppm
Isopropanol (IPA)	200.0 ppm/5000 ppm
JP-5 Fuel (JP5)	30.00 ppm/1000 ppm
Methyl Ethyl Ketone (MEK)	40.00 ppm/1500 ppm
Toluene (TOL)	25.00 ppm/1000 ppm
N-Hexane (HEX)	200.0 ppm/5000 ppm

Table 23:

Gas Name (LCD Abbreviation)	Detection Range Full Scale Low Range/High Range
Propylene (PRL)	50.00 ppm/2500 ppm
Styrene (STY)	20.00 ppm/500 ppm
Tetrachloroethylene (PCE)	30.00 ppm/1000 ppm
Trichloroethylene (TCE)	30.00 ppm/1000 ppm
Vinyl Chloride (VCM)	100.0 ppm/4000 ppm
PID (PID) User Defined Gas Loaded with Maintenance Program	50.0 ppm/2000 ppm

12. Use AIR ▲YES and RANGE ▼ SHIFT to place the cursor next to the desired gas. In the example below, the cursor is placed next to isopropanol (IPA).

PID(0- 2000ppm IBL)

2000 ppm GSL

2000 ppm IBL

> 5000 ppm IPA

1000 ppm JP5 ▼

13. Press the POWER ENTER RESET button. The LCD will ask for confirmation that you want to change the configured gas.

CHANGE TO IPA ?

PRESS YES OR NO

14. To change the gas configuration, press AIR ▲YES. The unit will return to the Configure Gases Screen reflecting the new gas configuration.

CONFIGURE GASES

CAT : CH4 (CAT)

> OP1 : IPA (PID)

OP2 : --- (---)

OP3 : --- (---) ▼

If you do not want to change the gas configuration, press DISPLAY ADJUST NO. The unit will return to the first gas configuration choice screen with the gas configuration unchanged.

PID(0- 2000ppm IBL)

> 1000 ppm ACT

1000 ppm BNZ

1500 ppm DSL

15000 ppm ETA ▼

Select a different gas and go to Step 13 or press DISPLAY ADJUST NO to return to the Gas Configuration screen.

15. Use RANGE ▼ SHIFT to place the cursor next to **END**.
16. Press POWER ENTER RESET to return to the main menu.
17. Use RANGE ▼ SHIFT to place the cursor in front of **NORMAL OPERATION** at the bottom of the main menu.
18. Press POWER ENTER RESET.
19. A screen appears that asks if you want to save the changes you have made.

SAVE ALL CHANGES

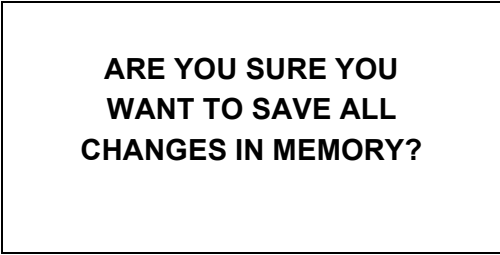
IN MEMORY?

NOTE: If you entered Setup Mode and did not make any changes, the above screen will still appear. In this case, press DISPLAY ADJUST NO to proceed to exit Setup Mode and begin the Eagle 3's warmup sequence.

20. If you do not want to save the changes, press DISPLAY ADJUST NO. The unit will begin its warmup sequence without saving the changes.

If you do want to save the changes, press AIR ▲YES and continue with the next step.

21. A confirmation screen appears asking if you are sure you want to save the changes.



**ARE YOU SURE YOU
WANT TO SAVE ALL
CHANGES IN MEMORY?**

22. If you want to save the changes, press AIR ▲YES to save the changes. A screen will appear for a few seconds indicating that the changes have been saved and the unit will begin its warmup sequence.

If you do not want to save the changes, press DISPLAY ADJUST NO to proceed to the unit's warmup sequence without saving changes.

PID Eagle 3 Parts List

Table 24:

Part Number	Description
33-0560RK	Electrode stack, 0 - 50 ppm, 2 pack
33-0562	Electrode stack, 0 - 2,000 ppm, HPPM type
33-6092	VOC zero filter, for zeroing low range PID sensors
51-1500RK	Replacement lamp, 0 - 50 ppm <ul style="list-style-type: none"> • for 61-0300RK-01 sensor without “L” on label
51-1502	Replacement lamp, 0 - 2,000 ppm, HPPM type <ul style="list-style-type: none"> • for 61-0301-02 sensor without “L” on label
51-1502-01	Electrode stack/lamp set, 0 - 2,000 ppm, HPPM type <ul style="list-style-type: none"> • for 61-0301-02 sensor without “L” on label
51-1503	Replacement lamp <ul style="list-style-type: none"> • for 61-0300RK-01 sensor with “L” on label • for 61-0301-02 sensor with “L” on label • for 61-0302 sensor • for 61-0303 sensor
57-2005RK	Adapter assembly, for PID sensor
61-0302	PID sensor, 0 - 50 ppm VOC, improved type
61-0303	PID sensor, 0 - 2,000 ppm VOC, improved type
80-0131RK-20	PID probe, particle filter removed
80-0605RK	Teflon-lined sample hose, 5 feet
80-0610RK	Teflon-lined sample hose, 10 feet
80-0615RK	Teflon-lined sample hose, 15 feet
80-0620RK	Teflon-lined sample hose, 20 feet
81-0103RK-01	Calibration cylinder, isobutylene, 100 ppm in air, 34 liter steel
81-0103RK-03	Calibration cylinder, isobutylene, 100 ppm in air, 103 liter
81-0103RK-04	Calibration cylinder, isobutylene, 100 ppm in air, 34 liter aluminum
81-0104RK-01	Calibration cylinder, isobutylene, 10 ppm in air, 34 liter steel
81-0104RK-03	Calibration cylinder, isobutylene, 10 ppm in air, 103 liter
81-0104RK-04	Calibration cylinder, isobutylene, 10 ppm in air, 34 liter aluminum
81-0143RK-02	Calibration cylinder, 5-gas (Proprietary blend of IBL, CH ₄ , O ₂ , H ₂ S, CO), 58-liter aluminum

Table 24:

Part Number	Description
81-0143RK-04	Calibration cylinder, 5-gas (Proprietary blend of IBL, CH ₄ , O ₂ , H ₂ S, CO), 34-liter aluminum
81-1054RK	Regulator, demand-flow type (for 58- and 103-liter aluminum or steel, and 34-liter aluminum cylinder)
81-1055RK	Regulator, demand-flow type (for 17- and 34-liter steel cylinder)
82-0003RK	Electrode stack removal tool
82-0300RK	Lamp cleaning kit with electrode stack removal tool

Appendix D: ESM-01 Toxic Sensors

Overview

The ESM-01 sensors are used to monitor levels of a variety of toxic gases. This appendix describes the Eagle 3's ESM-01 sensors and includes instructions to use an Eagle 3 that has one or more ESM-01 sensors installed. It also includes instructions to replace an ESM-01 sensor.

Table 25: ESM-01 Sensor Specifications

Target Gas	Detection Range (ppm)	Reading Increment	Alarm 1 Factory Setting	Alarm 2 Factory Setting	STEL (ppm)	TWA (ppm)
Ammonia (NH ₃)	0 - 75.0	0.5 ppm	12.0 ppm	25.0 ppm	35	25
Arsine (AsH ₃)	0 - 1.50	0.01 ppm	0.20 ppm	0.50 ppm	OFF	OFF
Chlorine (Cl ₂)	0-3.00	0.02 ppm	0.50 ppm	1.50 ppm	1.00	0.50
Hydrogen Cyanide (HCN)	0 - 15.0	0.1 ppm	3.00 ppm	5.00 ppm	4.7	OFF
Phosphine (PH ₃)	0 - 1.00	0.01 ppm	0.10 ppm	0.30 ppm	1.00	0.30
Sulfur Dioxide (SO ₂)	0 - 6.00	0.05 ppm	1.00 ppm	2.00 ppm	1.00	0.50

Description

The ESM-01 is a smart sensor that stores sensor parameters including the target gas, detection range, alarm points, and calibration settings in its memory. So a sensor can be calibrated at the factory and shipped as a replacement sensor without the need to calibrate the sensor when it is installed as long as it is installed during the sensor's valid calibration period which is typically 3 months. In addition, you can change an existing ESM-01 channel from one type of ESM-01 sensor to another and the Eagle 3 will automatically load all the sensor parameters and configure the ESM-01 channel for the new sensor without the need to enter CONFIGURE CHANNELS or CONFIGURE GASES in Setup Mode. See page 270 for instructions to replace or change an ESM-01 sensor.

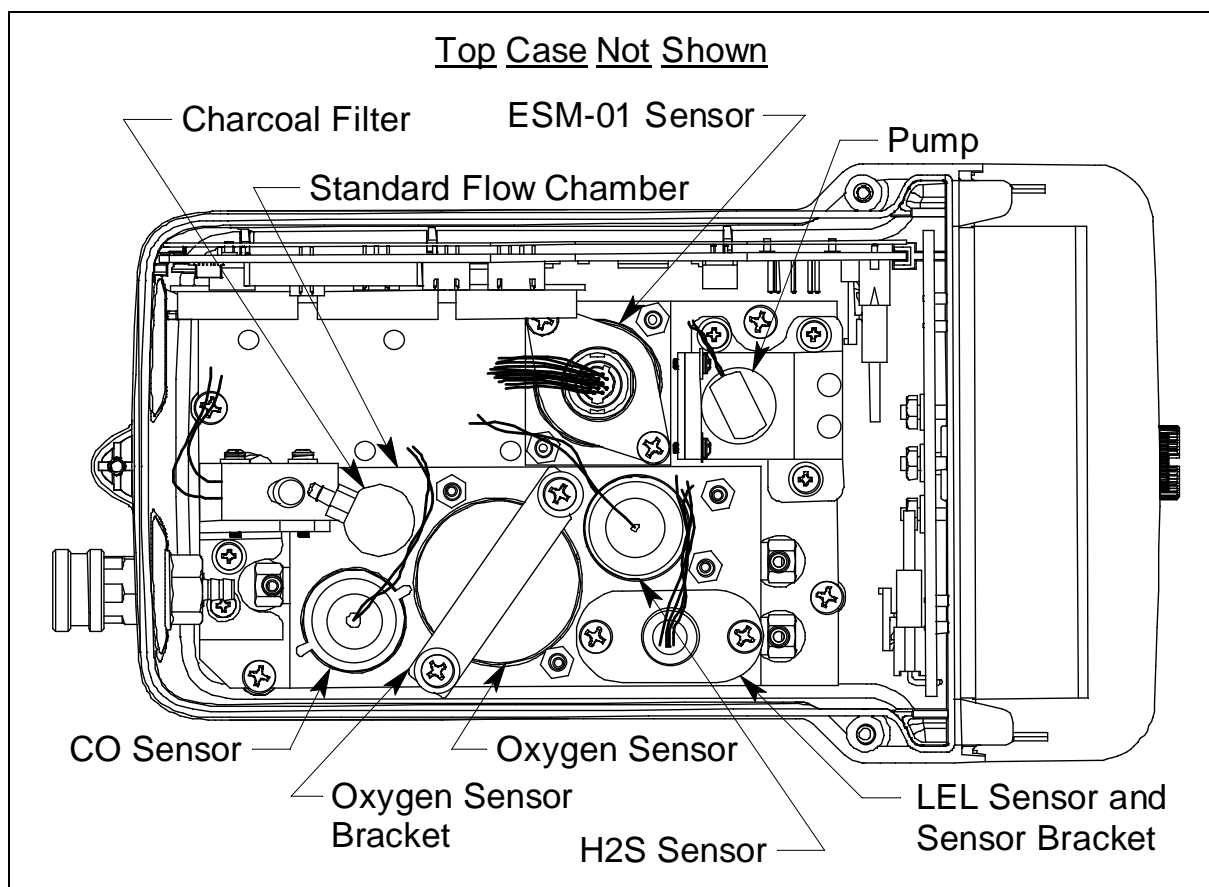


Figure 32: Typical ESM-01 Sensor Location

The ESM-01 sensor is installed in a single sensor flow chamber which is located in the area next to the standard 4-sensor flow chamber. This area can accommodate up to three single sensor flow chambers. Although the Eagle 3 can support up to three ESM-01 sensors, many combinations are impractical for various reasons including sensor cross sensitivity to other gases. Consult with RKI Instruments, Inc. for practical combinations. Figure 32 above illustrates a typical ESM-01 sensor location in front of the pump. The ESM-01 flow chamber may also be installed in one of the other two sensor chamber locations depending on the particular version of the Eagle 3. Some ESM-01 instrument configurations do not include the 4-sensor flow chamber.

ESM-01 Sensor

The ESM-01 sensor is a cylindrical sensor with a diffusion opening on the front and a 12 pin circular connector on the back. A 12 wire cable plugs into the back of the ESM-01 sensor with a circular connector that includes a locking lever. The other end of the cable plugs into an ESM-01 sub PCB (see description below) that is installed on the main PCB. The sensor is held in the ESM-01 flow chamber by a bracket on standoffs.

ESM-01 Sub PCB

The ESM-01 sub PCB is a circuit board that is installed on the main PCB in one of the 3 sub PCB positions when an ESM-01 sensor is used with the Eagle 3. The ESM-01 sensor connects to the sub PCB with a 12-position connector. The sub PCB plugs into the main PCB and is held in place with a screw/flat washer/lock washer. There are no user-serviceable parts on the ESM-01 sub PCB.

Start Up and Normal Operation

For instructions to warmup and use an Eagle 3 that includes an ESM-01 sensor, reference “Start Up” on page 30, “Normal Mode Operation” on page 42, and “Alarms” on page 50. Follow these instructions keeping the following special considerations in mind:

- Several of the gases that can be monitored with an ESM-01 are absorbed in the longer Eagle 3 sample hoses. Do not use sample hoses that are longer than the standard 5 foot hose without consulting RKI Instruments, Inc.
- If your Eagle 3 has more than one ESM-01 sensor installed, it is possible that both sensors will respond to some of the same gases at varying levels. Make sure you understand any issues like this that may exist in your particular instrument.
- The SO₂ and HCN ESM-01 sensors include a replaceable H₂S scrubber disk inside the sensor face. The SO₂ and HCN sensors respond to H₂S, so the H₂S scrubber disk removes H₂S from the sample to avoid false SO₂ and HCN readings. See page 271 for instructions to replace the H₂S scrubber.

ESM-01 Calibration

An ESM-01 channel can be calibrated using the auto calibration method or the single calibration method. To calibrate an ESM-01 channel using the single calibration method, see page 88 and follow the instructions for calibrating a single channel. If your instrument is a multi-channel instrument that includes one or more ESM-01 channels, RKI Instruments, Inc. recommends using the auto calibration method for convenience. There are two ways to calibrate an Eagle 3 with an ESM-01 channel installed. The first way, described below in “Calibrating with a 4-Gas Cylinder and an ESM-01 Cylinder” on page 254, uses a 4-gas cylinder and an IBL cylinder. The second way, described below in “Calibrating with a 5-Gas Cylinder” on page 261, uses a multi-gas cylinder that contains the target gas for all installed sensors. Follow the set of instructions appropriate for your cylinder configuration.

NOTE: If your instrument has more than one ESM-01 sensor, you will need a calibration cylinder for each sensor and follow the instructions on page 254.

Calibrating with a 4-Gas Cylinder and an ESM-01 Cylinder

The calibration instructions below show a 5 channel instrument which has the four standard channels, LEL/oxygen/H₂S/CO, and an ESM-01 channel for ammonia (NH₃).

1. See “Entering Calibration Mode” on page 77 for a description of the necessary calibration supplies. In addition to an appropriate multi-gas cylinder that is used to calibrate any active standard channels, you will also need a cylinder to calibrate the ESM-01 channel. See page 274 for available cylinders. Make sure your calibration cylinder is appropriate for the ESM-01 detection range.

WARNING: *RKI Instruments, Inc. recommends that you dedicate a regulator for use with chlorine (Cl₂) gas and that you do not use that dedicated regulator for any other gases, particularly hydrogen sulfide (H₂S).*

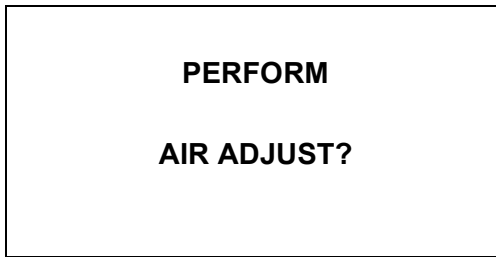
2. Find a fresh-air environment. This is an environment free of toxic or combustible gases and of normal oxygen content (20.9%).
3. While in Normal Mode, press and hold the RANGE ▼ SHIFT button, then press the DISPLAY ADJUST NO button both buttons.
4. If the unit prompts you for the password, enter it by using the AIR ▲YES and RANGE ▼ SHIFT buttons to select each password number and then pressing and releasing POWER ENTER RESET to enter the number and move on to the next one.
5. The Calibration Mode Screen displays with the cursor next to **AUTO CALIBRATION**.

<p>CALIBRATION MODE</p> <p>> AUTO CALIBRATION</p> <p>SINGLE CALIBRATION</p> <p>PERFORM AIR ADJUST</p> <p>NORMAL OPERATION</p>

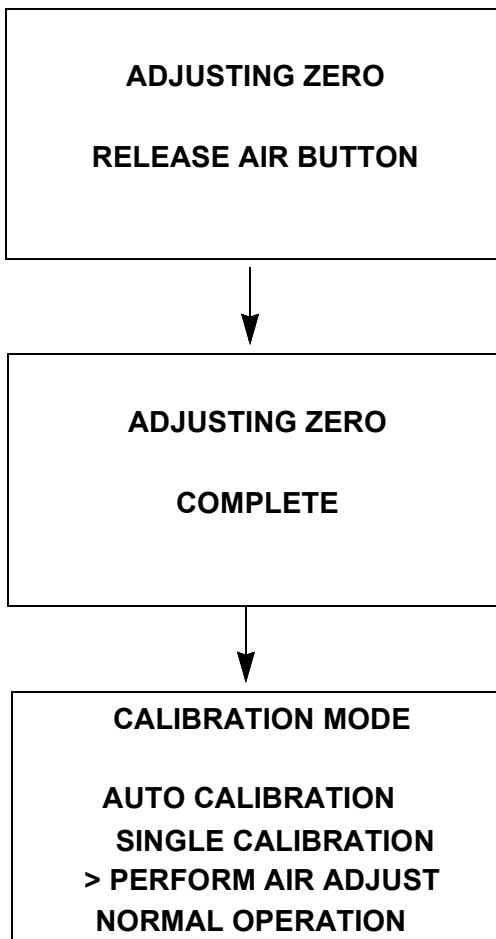
6. Move the cursor to the **PERFORM AIR ADJUST** menu item by using the RANGE ▼ SHIFT button.

<p>CALIBRATION MODE</p> <p>AUTO CALIBRATION</p> <p>SINGLE CALIBRATION</p> <p>> PERFORM AIR ADJUST</p> <p>NORMAL OPERATION</p>

7. Press the POWER ENTER RESET button. The following screen appears.



8. Press the AIR ▲YES button to continue.
If you do not want to continue, press the DISPLAY ADJUST NO button and the unit will return to the Calibration Mode Screen.
9. The Eagle 3 will indicate that it is adjusting the zero reading for a few seconds, then indicate that the operation is complete before returning to the Calibration Mode Screen.



10. Install the demand flow regulator onto the multi-gas calibration cylinder.
11. Connect the sample tubing to the demand flow regulator.

12. Install the probe on the Eagle 3 inlet fitting. Make sure the probe is complete with internal O-ring and membrane and that the two halves of the probe are tightened firmly together to avoid leaks that can affect the calibration. See Figure 17 on page 99 for an illustration of the internal parts of the probe.
13. Move the cursor next to the **AUTO CALIBRATION** menu item by using the AIR ▲YES button.

<p>CALIBRATION MODE</p> <p>> AUTO CALIBRATION</p> <p>SINGLE CALIBRATION</p> <p>PERFORM AIR ADJUST</p> <p>NORMAL OPERATION</p>

14. Press the POWER ENTER RESET button to display the Calibration Gas Values Screen.

<p>CAL GAS VALUES</p> <p>CH4 50 % LEL</p> <p>OXY 12.0 vol%</p> <p>H2S 25.0 ppm</p> <p>CO 50 ppm</p> <p>ENTER TO BEGIN CAL</p>

The gas concentrations displayed in the Calibration Gas Values Screen must match the gas concentrations listed on the 4-gas calibration cylinder.

If *all* concentrations match, go to Step 25.

If *one or more* concentrations *do not* match, continue with Step 15.

If you do not want to continue with the calibration, press the DISPLAY ADJUST NO button to return to the Calibration Mode Screen.

NOTE: The RKI 4-gas cylinder typically contains 12% O₂ by volume. When using the auto calibration method, be sure to set the “OXY” auto calibration value to agree with the concentration listed on the cylinder’s label, not zero.

15. To adjust the values on the screen, press and hold the RANGE ▼ SHIFT button, then press the DISPLAY ADJUST NO button both. The following screen appears with the cursor next to **CH4**.

<p>ADJUST AUTO</p> <p>CALIBRATION VALUES</p> <p>> CH4 50 % LEL</p> <p>OXY 12.0 vol%</p> <p>H2S 25.0 ppm</p> <p>CO 50 ppm ▼</p>

16. Place the cursor next to the channel whose gas value you want to change using the AIR ▲ YES and RANGE ▼ SHIFT buttons.
17. Press the POWER ENTER RESET button to select the channel. The calibration gas value begins to flash.
18. Use the AIR ▲ YES and RANGE ▼ SHIFT buttons to adjust the calibration gas setting to the desired value.

NOTE: The calibration gas value cannot be set lower than the low alarm setting. If the calibration gas value listed on the calibration cylinder is lower than the current low alarm setting, enter Setup Mode and change the low alarm setting. See page 145 for instructions. If you need to change the alarm point setting only to perform a calibration, make sure that you change the alarm point setting back to its original value once the calibration has been performed.

19. Press the POWER ENTER RESET button to save the change. The calibration gas value stops flashing.
20. Repeat Step 16 through Step 19 for any other channels that need to be changed.
21. When you are done adjusting the calibration gas values, move the cursor down past the bottom of the screen next to **END**.

**ADJUST AUTO
CALIBRATION VALUES
> END**

22. Press the POWER ENTER RESET button. The following screen appears.

**DO YOU WANT TO
STORE NEW VALUE(S)
IN MEMORY FOR
FUTURE CALIBRATIONS?**

PRESS YES OR NO

23. If you select YES by pressing and releasing the AIR ▲ YES button, the changes that you made will be saved in the Eagle 3's memory as the new auto calibration gas values.
If you select NO by pressing and releasing the DISPLAY ADJUST NO button, the changes you made will be used for any calibrations performed during the current operating session only. The Eagle 3 will delete the changes when the unit is turned off and will load the previous set of auto calibration values when it is turned on again.

24. When you make your selection and press the desired button, the unit returns to the Calibration Gas Values Screen.

CAL GAS VALUES		
CH4	50	% LEL
OXY	12.0	vol%
H2S	25.0	ppm
CO	50	ppm
ENTER TO BEGIN CAL		

25. Press the POWER ENTER RESET button to proceed to the Calibration In Process Screen with **CAL IN PROCESS** flashing.

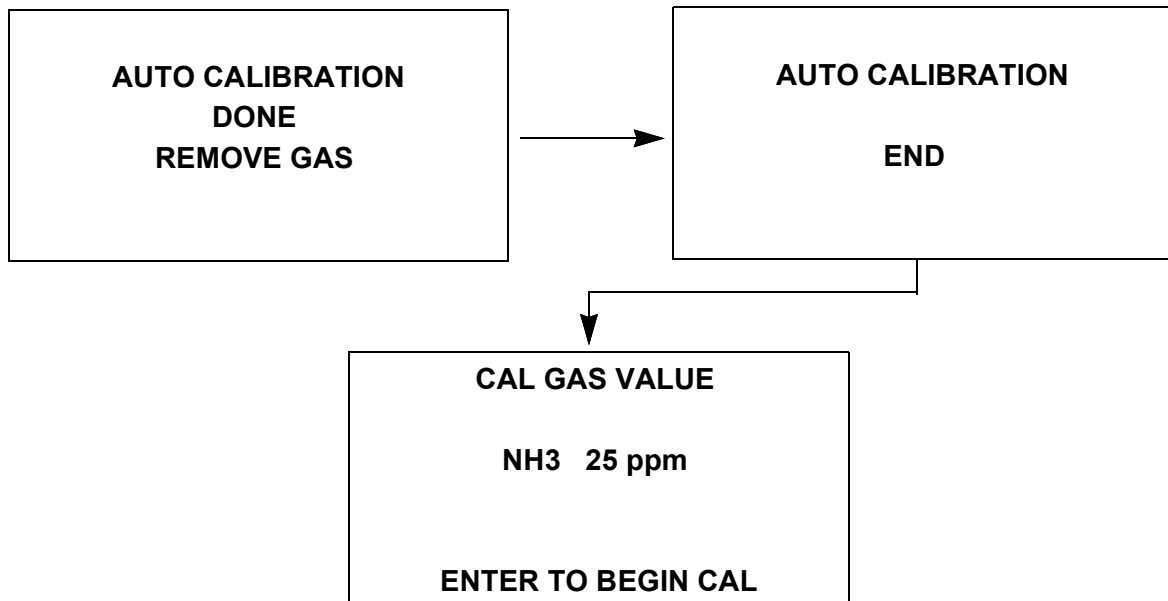
CAL IN PROCESS		
CH4	0	% LEL
OXY	20.9	vol%
H2S	0.0	ppm
CO	0	ppm
ENTER WHEN DONE		

If you do not want to proceed with the calibration, press the DISPLAY ADJUST NO button to return to the Cal Gas Values Screen.

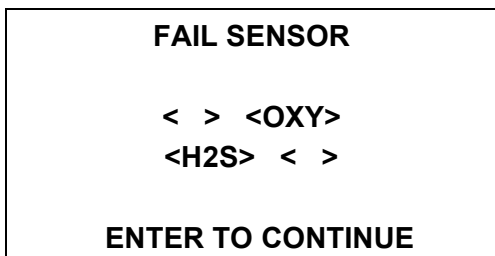
If you do want to continue with the calibration, proceed to the next step.

26. Connect the tubing from the demand flow regulator to the rigid tube on the probe. Allow the Eagle 3 to draw gas for one minute.
27. Press the POWER ENTER RESET button to set the span adjustment for each channel to the programmed values.

28. If all channels passed calibration, the following screen sequence occurs.



If any of the sensors cannot be adjusted to the proper value, a screen displays that indicates a calibration failure and lists the sensor(s) that failed to calibrate. In the example below, the oxygen and H₂S channels failed calibration. The other sensors calibrated normally.



The buzzer and alarm LEDs activate in a double pulsing pattern. Press the POWER ENTER RESET button to reset the alarm and continue to the Calibration Value Screen for the ESM-01 channel. After calibrating the ESM-01 channel by following the instructions below, attempt to calibrate the standard channels again. If the failure continues, investigate the cause. See "Troubleshooting" on page 96..

29. Remove the tubing from the rigid tube on the probe.

30. Unscrew the 4-gas cylinder from the demand flow regulator.

31. If you want to change the ESM-01 channel's calibration gas value, follow Step 19 - Step 28 above beginning with the ESM-01 Calibration Gas Value Screen below instead of the standard channel Calibration Gas Value Screen.

<p>CAL GAS VALUE</p> <p>NH3 25 ppm</p> <p>ENTER TO BEGIN CAL</p>

32. With the ESM-01 Calibration Gas Value Screen displayed, press the POWER ENTER RESET button to proceed to the Calibration In Process Screen for the ESM-01 channel with **CAL IN PROCESS** flashing.

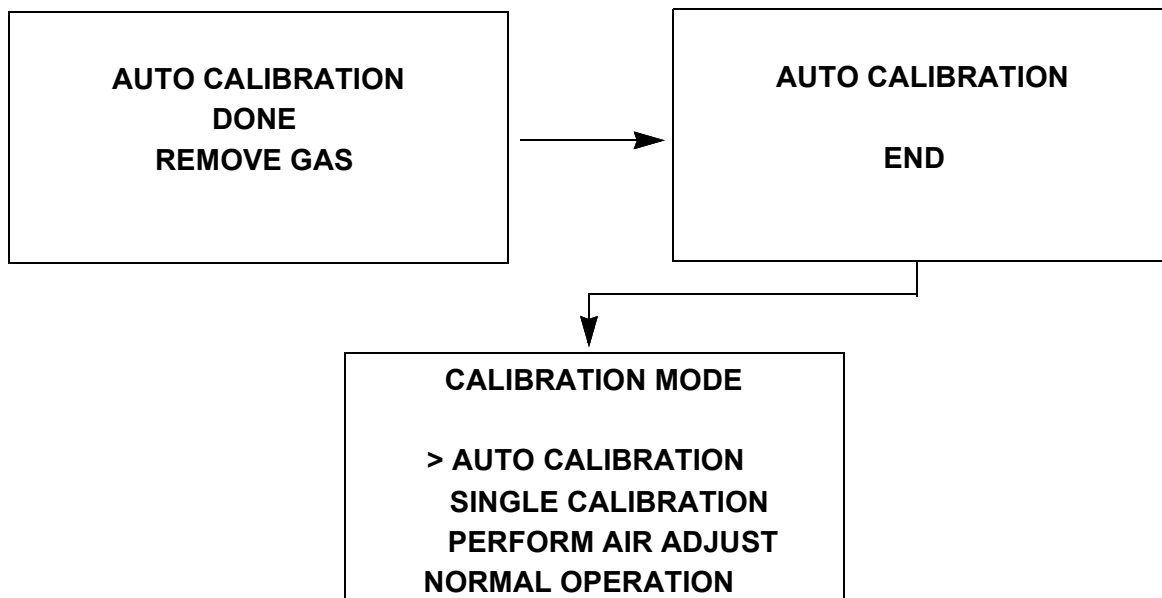
<p>CAL IN PROCESS</p> <p>NH3 0 ppm</p> <p>ENTER WHEN DONE</p>
--

If you do not want to proceed with the calibration, press the DISPLAY ADJUST NO button to return to the ESM-01 Cal Gas Values Screen.

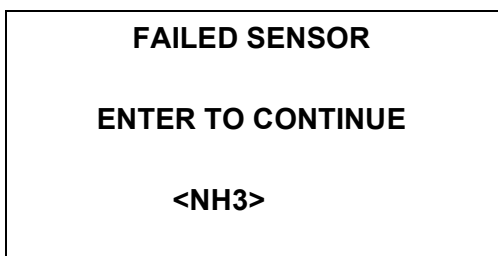
If you do want to continue with the calibration, proceed to the next step.

33. Screw the ESM-01 calibration cylinder onto the demand flow regulator.
34. Connect the tubing from the regulator to the rigid tube on the probe. Allow the Eagle 3 to draw gas for two minutes. If you notice that the gas reading stabilizes sooner, you can reduce the gas application time to the time it takes the gas reading to stabilize.
35. Press the POWER ENTER RESET button to set the span adjustment for the ESM-01 channel to the programmed value.

36. If the ESM-01 channel passed calibration, the following screen sequence occurs.



If the ESM-01 channel cannot be adjusted to the proper value, a screen displays that indicates a calibration failure and indicates that the ESM-01 sensor failed to calibrate.



The buzzer and alarm LEDs activate in a double pulsing pattern. Press the POWER ENTER RESET button to reset the alarm and continue to the Calibration Mode Screen. Attempt to calibrate the ESM-01 channel again. If the failure continues, investigate the cause. See "Troubleshooting" on page 96..

37. Disconnect the tubing from the probe.

38. Unscrew the demand flow regulator from the calibration cylinder.

39. Use the RANGE ▼ SHIFT button to place the cursor next to the **NORMAL OPERATION** menu option, then press the POWER ENTER RESET button to return to Normal Mode.

Calibrating with a 5-Gas Cylinder

The calibration instructions below show a 5 channel instrument which has the four standard channels, LEL/oxygen/H₂S/CO, and an ESM-01 channel for sulfur dioxide (SO₂).

1. See "Entering Calibration Mode" on page 77 for a description of the necessary calibration supplies. See page 274 for available cylinders. Make sure your calibration cylinder is appropriate for the ESM-01 detection range.

WARNING: *RKI Instruments, Inc. recommends that you dedicate a regulator for use with chlorine (Cl₂) gas and that you do not use that dedicated regulator for any other gases, particularly hydrogen sulfide (H₂S).*

2. Find a fresh-air environment. This is an environment free of toxic or combustible gases and of normal oxygen content (20.9%).
3. While in Normal Mode, press and hold the RANGE ▼ SHIFT button, then press the DISPLAY ADJUST NO button both buttons.
4. If the unit prompts you for the password, enter it by using the AIR ▲YES and RANGE ▼ SHIFT buttons to select each password number and then pressing and releasing POWER ENTER RESET to enter the number and move on to the next one.
5. The Calibration Mode Screen displays with the cursor next to **AUTO CALIBRATION**.

CALIBRATION MODE

> AUTO CALIBRATION

SINGLE CALIBRATION

PERFORM AIR ADJUST

NORMAL OPERATION

6. Move the cursor to the **PERFORM AIR ADJUST** menu item by using the RANGE ▼ SHIFT button.

CALIBRATION MODE

AUTO CALIBRATION

SINGLE CALIBRATION

> PERFORM AIR ADJUST

NORMAL OPERATION

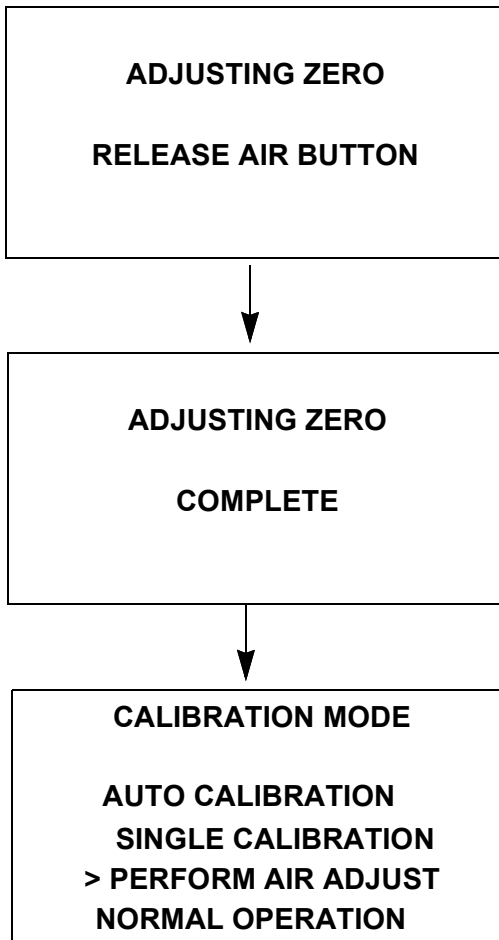
7. Press the POWER ENTER RESET button. The following screen appears.

PERFORM

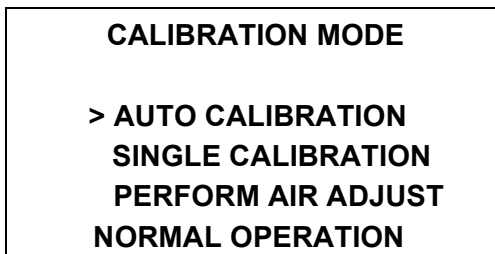
AIR ADJUST?

8. Press the AIR ▲YES button to continue.
If you do not want to continue, press the DISPLAY ADJUST NO button and the unit will return to the Calibration Mode Screen.

9. The Eagle 3 will indicate that it is adjusting the zero reading for a few seconds, then indicate that the operation is complete before returning to the Calibration Mode Screen.



10. Install the demand flow regulator onto the multi-gas calibration cylinder.
11. Connect the sample tubing to the demand flow regulator.
12. Install the probe on the Eagle 3 inlet fitting. Make sure the probe is complete with internal O-ring and membrane and that the two halves of the probe are tightened firmly together to avoid leaks that can affect the calibration. See Figure 17 on page 99 for an illustration of the internal parts of the probe.
13. Move the cursor next to the **AUTO CALIBRATION** menu item by using the AIR ▲YES button.



14. Press the POWER ENTER RESET button to display the Calibration Gas Values Screen.

CAL GAS VALUES		
CH4	50	% LEL
OXY	12.0	vol%
H2S	25.0	ppm
CO	50	ppm
ENTER TO BEGIN CAL		

The gas concentrations displayed in the Calibration Gas Values Screen must match the gas concentrations listed on the 4-gas calibration cylinder.

If *all* concentrations match, go to Step 25.

If *one or more* concentrations *do not* match, continue with Step 15.

If you do not want to continue with the calibration, press the DISPLAY ADJUST NO button to return to the Calibration Mode Screen.

NOTE: The RKI 4-gas cylinder typically contains 12% O₂ by volume. When using the auto calibration method, be sure to set the “OXY” auto calibration value to agree with the concentration listed on the cylinder’s label, not zero.

15. To adjust the values on the screen, press and hold the RANGE ▼ SHIFT button, then press the DISPLAY ADJUST NO button both. The following screen appears with the cursor next to CH4.

ADJUST AUTO		
CALIBRATION VALUES		
> CH4	50	% LEL
OXY	12.0	vol%
H2S	25.0	ppm
CO	50	ppm
		▼

16. Place the cursor next to the channel whose gas value you want to change using the AIR ▲ YES and RANGE ▼ SHIFT buttons.
17. Press the POWER ENTER RESET button to select the channel. The calibration gas value begins to flash.
18. Use the AIR ▲ YES and RANGE ▼ SHIFT buttons to adjust the calibration gas setting to the desired value.

NOTE: The calibration gas value cannot be set lower than the low alarm setting. If the calibration gas value listed on the calibration cylinder is lower than the current low alarm setting, enter Setup Mode and change the low alarm setting. See page 145 for instructions. If you need to change the alarm point setting only to perform a calibration, make sure that you change the alarm point setting back to its original value once the calibration has been performed.

19. Press the POWER ENTER RESET button to save the change. The calibration gas value stops flashing.
20. Repeat Step 16 through Step 19 for any other channels that need to be changed.
21. When you are done adjusting the calibration gas values, move the cursor down past the bottom of the screen next to **END**.

**ADJUST AUTO
CALIBRATION VALUES
> END ▲**

22. Press the POWER ENTER RESET button. The following screen appears.

**DO YOU WANT TO
STORE NEW VALUE(S)
IN MEMORY FOR
FUTURE CALIBRATIONS?

PRESS YES OR NO**

23. If you select YES by pressing and releasing the AIR ▲YES button, the changes that you made will be saved in the Eagle 3's memory as the new auto calibration gas values.

If you select NO by pressing and releasing the DISPLAY ADJUST NO button, the changes you made will be used for any calibrations performed during the current operating session only. The Eagle 3 will delete the changes when the unit is turned off and will load the previous set of auto calibration values when it is turned on again.
24. When you make your selection and press the desired button, the unit returns to the Calibration Gas Values Screen.

CAL GAS VALUES
CH4 50 % LEL
OXY 12.0 vol%
H2S 25.0 ppm
CO 50 ppm
ENTER TO BEGIN CAL

25. Press the POWER ENTER RESET button to proceed to the Calibration In Process Screen with **CAL IN PROCESS** flashing.

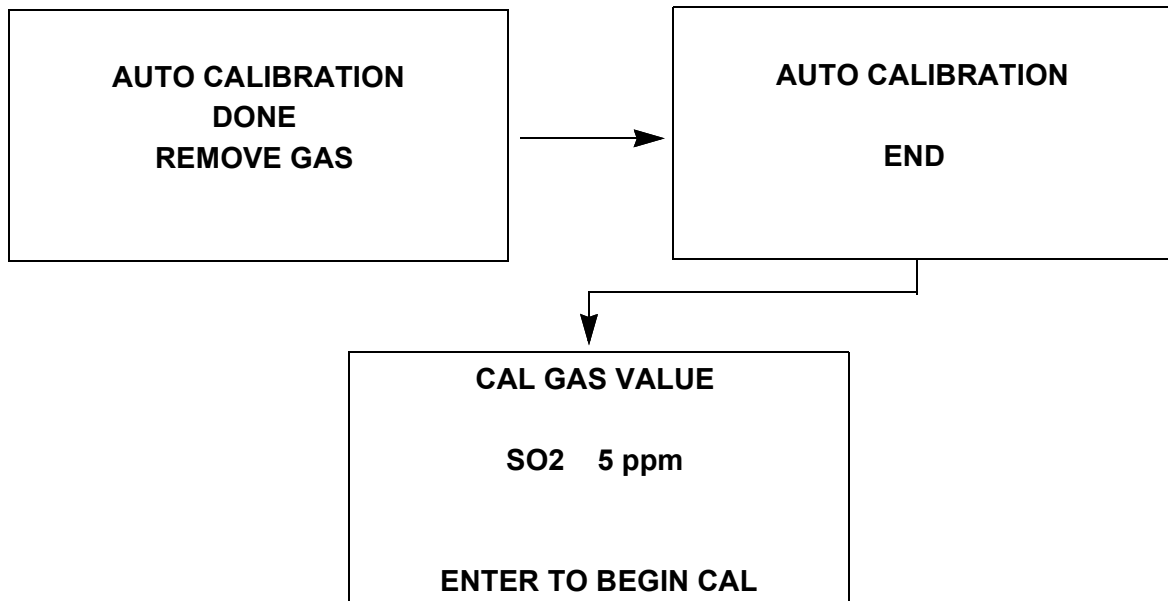
CAL IN PROCESS		
CH4	0	% LEL
OXY	20.9	vol%
H2S	0.0	ppm
CO	0	ppm
ENTER WHEN DONE		

If you do not want to proceed with the calibration, press the DISPLAY ADJUST NO button to return to the Cal Gas Values Screen.

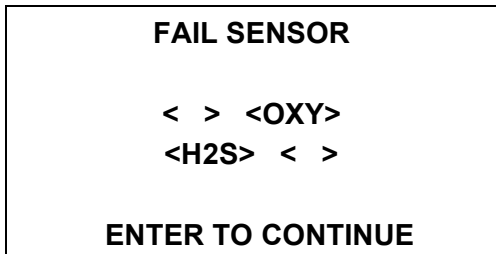
If you do want to continue with the calibration, proceed to the next step.

26. Connect the tubing from the demand flow regulator to the rigid tube on the probe. Allow the Eagle 3 to draw gas for one minute.
27. Press the POWER ENTER RESET button to set the span adjustment for each channel to the programmed values.

28. If all channels passed calibration, the following screen sequence occurs.

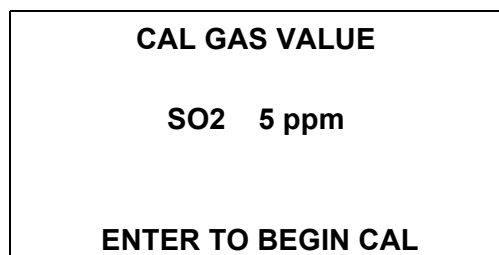


If any of the sensors cannot be adjusted to the proper value, a screen displays that indicates a calibration failure and lists the sensor(s) that failed to calibrate. In the example below, the oxygen and H₂S channels failed calibration. The other sensors calibrated normally.

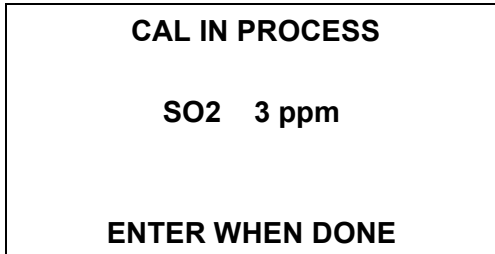


The buzzer and alarm LEDs activate in a double pulsing pattern. Press the POWER ENTER RESET button to reset the alarm and continue to the Calibration Value Screen for the ESM-01 channel. After calibrating the ESM-01 channel by following the instructions below, attempt to calibrate the standard channels again. If the failure continues, investigate the cause. See "Troubleshooting" on page 96..

29. If you want to change the ESM-01 channel's calibration gas value, follow Step 19 - Step 28 above beginning with the ESM-01 Calibration Gas Value Screen below instead of the standard channel Calibration Gas Value Screen.



30. With the ESM-01 Calibration Gas Value Screen displayed, press the POWER ENTER RESET button to proceed to the Calibration In Process Screen for the ESM-01 channel with **CAL IN PROCESS** flashing.

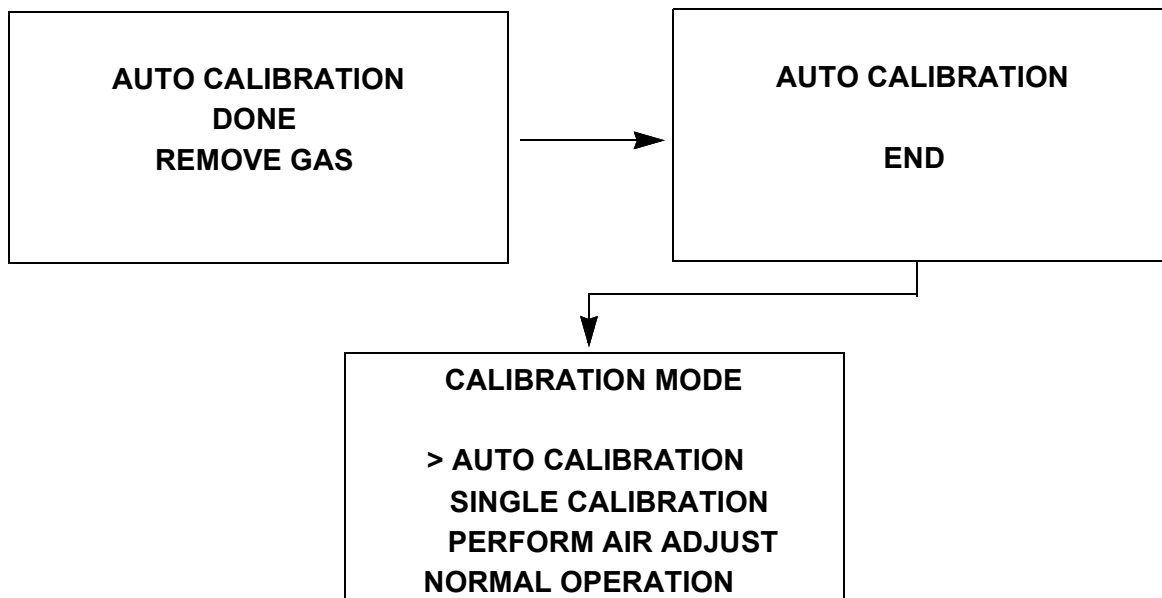


If you do not want to proceed with the calibration, press the DISPLAY ADJUST NO button to return to the ESM-01 Cal Gas Values Screen.

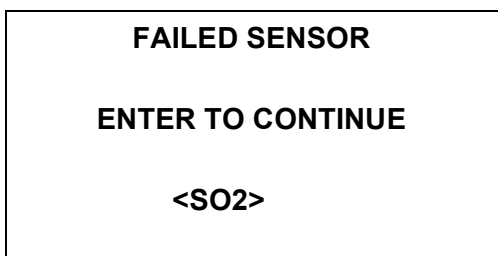
If you do want to continue with the calibration, proceed to the next step.

31. Since calibration gas has already been flowing to the ESM-01 sensor while the other channels were being calibrated, the ESM-01 sensor reading should be stable and ready for adjustment.
32. Press the POWER ENTER RESET button to set the span adjustment for the ESM-01 channel to the programmed value.

33. If the ESM-01 channel passed calibration, the following screen sequence occurs.



If the ESM-01 channel cannot be adjusted to the proper value, a screen displays that indicates a calibration failure and indicates that the ESM-01 sensor failed to calibrate.



The buzzer and alarm LEDs activate in a double pulsing pattern. Press the POWER ENTER RESET button to reset the alarm and continue to the Calibration Mode Screen. Attempt to calibrate the ESM-01 channel again. If the failure continues, investigate the cause. See "Troubleshooting" on page 96..

34. Disconnect the tubing from the probe.
35. Unscrew the demand flow regulator from the calibration cylinder.
36. Use the RANGE ▼ SHIFT button to place the cursor next to the **NORMAL OPERATION** menu option, then press the POWER ENTER RESET button to return to Normal Mode.

Maintenance

The SO₂ and HCN ESM-01 sensors are the only ESM-01 sensors that include user-serviceable parts. This section includes a procedure for replacing an ESM-01 sensor and for replacing the H₂S scrubber in the SO₂ and HCN sensors. When replacing a sensor, you may either replace it with another of the same sensor or you may install a different ESM-01 sensor. If a different one is installed, the Eagle 3 will load the sensor parameters and configure the ESM-01 channel for the new sensor.

Replacing the ESM-01 Sensor or Changing Sensor Type

1. Verify that the Eagle 3 is off.
2. Place the Eagle 3 upside down on a flat surface or hold it upside down.
3. Unscrew the three case screws until they disengage from the top case. They are captive screws so they will not fall off of the bottom case.
4. Turn the Eagle 3 right side up and carefully lift the top case away from the bottom case. Be careful not to lift it so far that it pulls on the main PCB with the cable that connects the top case to the main PCB.
5. Lay the top case down next to the bottom case to allow access to the flow system.
6. Locate the ESM-01 sensor. It has a twelve wire cable with a connector that mates to an ESM-01 sub PCB that is installed on the main PCB and is normally located next to the pump. Figure 32 on page 252 shows an ESM-01 sensor in a typical location.
7. Unscrew and remove the two screws that hold down the ESM-01 sensor bracket.
8. Grasp the sensor firmly and pull it out of the ESM-01 flow chamber. Rock it back and forth gently if necessary to pull it out. Take care not to pull the cable from the sub PCB.
9. Rotate the locking lever counterclockwise on the cable connector that mates to the ESM-01 sensor to unlock it.
10. Unplug the old ESM-01 sensor from the cable.
11. Connect the new ESM-01 sensor to the sensor cable and rotate the locking lever clockwise to lock the connector.
12. Insert the sensor into the ESM-01 flow chamber and push it in until it bottoms out.
13. Line up the holes in the ESM-01 sensor bracket with the two standoffs on the ESM-01 chamber.
14. Install the two sensor bracket screws.

15. Confirm that the main PCB is seated in its slots and that its bottom edge is resting on the bottom of the bottom case. If the main PCB is not seated properly, it may be damaged when the top case is re-installed.
16. Make sure that the top case gasket is fully seated in its groove and carefully put the top case back on the bottom case. If you have any difficulty mating the top and bottom cases, inspect the placement of the main PCB and the placement of the top case gasket.
17. Turn the Eagle 3 upside down and tighten the three case screws to secure the top case to the bottom case.
18. Calibrate the ESM-01 channel as described in “ESM-01 Calibration” on page 253.

Replacing the H₂S Scrubber in the SO₂ and HCN Sensors

1. Verify that the Eagle 3 is off.
2. Place the Eagle 3 upside down on a flat surface or hold it upside down.
3. Unscrew the three case screws until they disengage from the top case. They are captive screws so they will not fall off of the bottom case.
4. Turn the Eagle 3 right side up and carefully lift the top case away from the bottom case. Be careful not to lift it so far that it pulls on the main PCB with the cable that connects the top case to the main PCB.
5. Lay the top case down next to the bottom case to allow access to the flow system.
6. Locate the ESM-01 sensor. It has a twelve wire cable with a connector that mates to an ESM-01 sub PCB that is installed on the main PCB and is normally located next to the pump. Figure 32 on page 252 shows an ESM-01 sensor in a typical location.
7. Unscrew and remove the two screws that hold down the ESM-01 sensor bracket.
8. Grasp the sensor firmly and pull it out of the ESM-01 flow chamber. Rock it back and forth gently if necessary to pull it out. Take care not to pull the cable from the sub PCB.
9. Rotate the locking lever counterclockwise on the cable connector that mates to the ESM-01 sensor to unlock it.
10. Unplug the ESM-01 sensor from the cable.

11. The ESM-01 sensor consists of an electrolyte reservoir assembly retained in the sensor body by a threaded collar on the connector end of the sensor. Unscrew the collar from the sensor body.

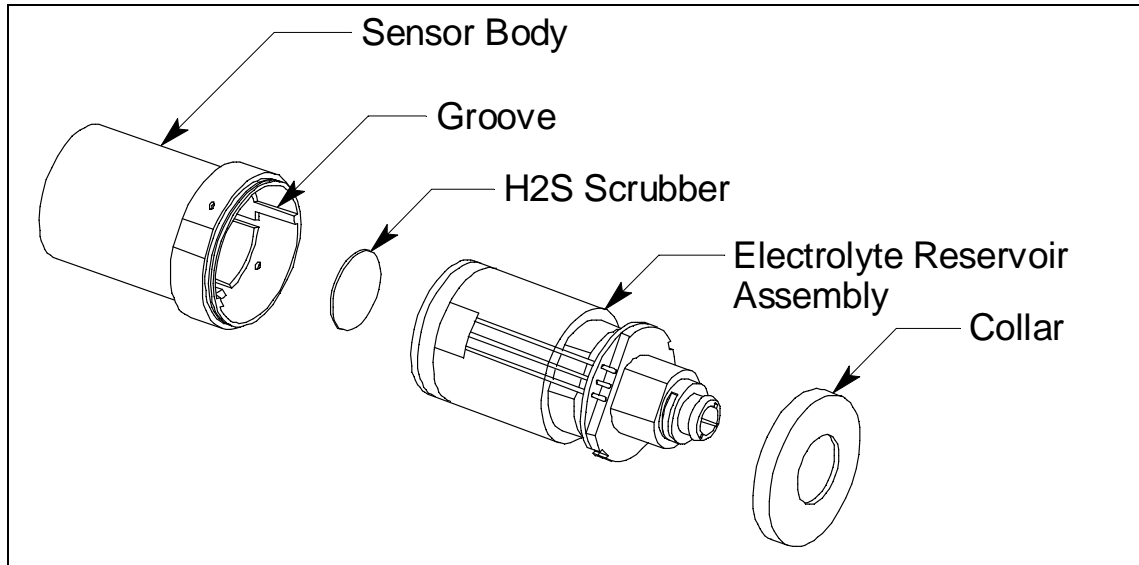


Figure 33: ESM-01 Sensor Component Location

12. Grasp the connector and lift the electrolyte reservoir assembly out of the sensor body.
13. Turn the body upside down to remove the H₂S scrubber. If it does not come out, push on it from the top of the upside down body.
14. Discard the old H₂S scrubber.
15. Carefully place the new H₂S scrubber in the end of the sensor body. If the O-ring came out, place it back in making sure it is seated in its groove.
16. Place the electrolyte reservoir assembly back in the sensor body making sure that the ridges on the electrolyte reservoir assembly line up with the grooves inside the sensor body.

CAUTION: *Verify that the electrolyte reservoir assembly is properly aligned before inserting it into the sensor body. Forcing an electrolyte reservoir assembly into its sensor body may damage the electrolyte reservoir assembly or the sensor body.*

17. Screw the collar of the ESM-01 sensor back on.
18. Plug the ESM-01 sensor back into the cable.
19. Insert the sensor into the ESM-01 flow chamber and push it in until it bottoms out.
20. Line up the holes in the ESM-01 sensor bracket with the two standoffs on the ESM-01 chamber.
21. Install the two sensor bracket screws.

22. Confirm that the main PCB is seated in its slots and that its bottom edge is resting on the bottom of the bottom case. If the main PCB is not seated properly, it may be damaged when the top case is re-installed.
23. Make sure that the top case gasket is fully seated in its groove and carefully put the top case back on the bottom case. If you have any difficulty mating the top and bottom cases, inspect the placement of the main PCB and the placement of the top case gasket.
24. Turn the Eagle 3 upside down and tighten the three case screws to secure the top case to the bottom case.
25. Calibrate the ESM-01 channel as described in “ESM-01 Calibration” on page 253.

ESM-01 Eagle 3 Parts List

Table 26:

Part Number	Description
33-7120RK	H ₂ S scrubber disk, for ESM-01DH-D-HCN sensor
33-7121RK	H ₂ S scrubber disk, for ESM-01DH-F-SO ₂ sensor
47-5015RK	ESM-01 sensor cable
ESM-01DH-ASH3	Arsine sensor, 0-1.50 ppm
ESM-01R-NH ₃	Ammonia sensor, 0-75.0 ppm
ESM-01DH-D-HCN	Hydrogen cyanide sensor, 0-15.0 ppm
ESM-01DH-PH ₃	Phosphine sensor, 0-1.00 ppm
ESM-01DH-F-SO ₂	Sulfur dioxide sensor, 0-6.00 ppm
ESM-K01-CL ₂	Chlorine sensor, 0-3.00 ppm
81-0142RK-02	Calibration cylinder, 5-gas (SO ₂ , CH ₄ , O ₂ , H ₂ S, CO), 58-liter aluminum
81-0142RK-04	Calibration cylinder, 5-gas (SO ₂ , CH ₄ , O ₂ , H ₂ S, CO), 34-liter aluminum
81-0170RK-02	Calibration cylinder, 5 ppm SO ₂ in nitrogen, 58 liter
81-0170RK-04	Calibration cylinder, 5 ppm SO ₂ in nitrogen, 34 liter aluminum
81-0176RK-02	Calibration cylinder, 25 ppm NH ₃ in nitrogen, 58 liter
81-0176RK-04	Calibration cylinder, 25 ppm NH ₃ in nitrogen, 34 liter aluminum
81-0185RK-02	Calibration cylinder, 0.5 ppm PH ₃ in nitrogen, 58 liter
81-0192RK-02	Calibration cylinder, 2 ppm Cl ₂ in nitrogen, 58 liter
81-0192RK-04	Calibration cylinder, 2 ppm Cl ₂ in nitrogen, 34 liter aluminum
81-0196RK-02	Calibration cylinder, 10 ppm HCN in nitrogen, 58 liter
81-0196RK-04	Calibration cylinder, 10 ppm HCN in nitrogen, 34 liter

Appendix E: TC Sensors

Overview

The TC sensors are used to monitor high levels of combustible gas. This appendix describes the Eagle 3's TC sensor and includes instructions to use an Eagle 3 that has a TC sensor installed. It also includes instructions to calibrate and replace a TC sensor.

Table 27: TC Sensor Specifications

Target Gas	Detection Range	Reading Increment	Alarm 1 Factory Setting	Alarm 2 Factory Setting	STEL	TWA
Methane (CH ₄)	0 - 100.0 %vol	0.5 %vol	OFF	OFF	OFF	OFF
Hydrogen (H ₂)	0 - 100.0 %vol	0.5 %vol	10.0 %vol	50.0 %vol	OFF	OFF
Hydrogen (H ₂)	0 - 10.0 %vol	0.1 %vol	1.0 %vol	5.0 %vol	OFF	OFF

Description

The TC sensor is installed in a single sensor flow chamber which is located in the area next to the standard 4-sensor flow chamber. This area can accommodate up to three single sensor flow chambers. Figure 34 below illustrates a typical TC sensor location in front of the pump. The TC flow chamber may also be installed in one of the other two sensor chamber locations depending on the particular version of the Eagle 3. Some TC sensor instrument configurations do not include the 4-sensor flow chamber.

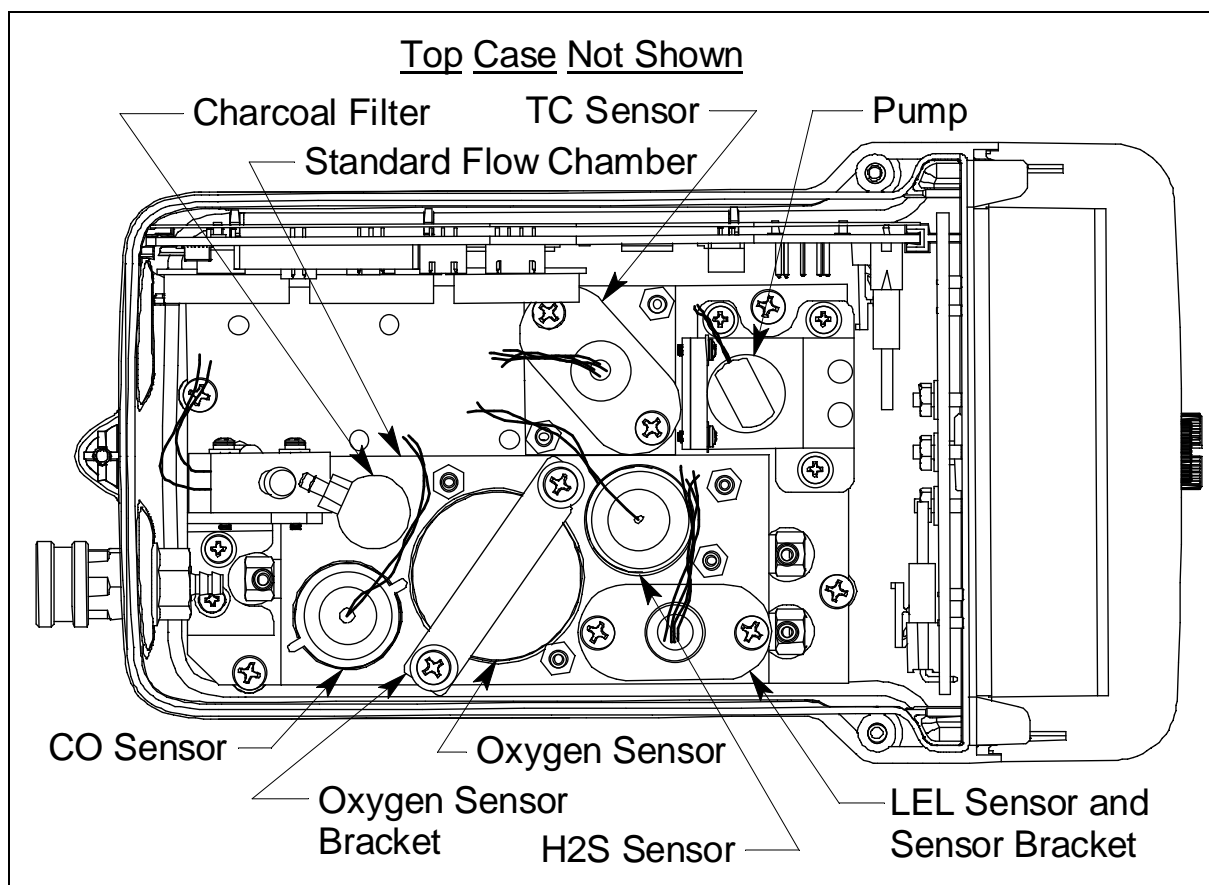


Figure 34: Typical TC Sensor Location

TC Sensor

The TC sensor's appearance is exactly the same as that of the LEL sensor. Its housing includes a sintered metal flame arrestor on one end that allows gas to diffuse into the sensor. On the other end, five pins extend from the sensor. The TC sensor can be distinguished from the LEL sensor by the part number imprinted on it. The TC sensor part number is TE-7568 while the LEL part number is NC-6260B. The sensor cable connects to pins on one end and terminates in a four-position connector on the other end which plugs into the TC sub PCB (see description below). The sensor bracket is installed over the TC sensor to keep it seated in place.

NOTE: The LEL and TC sensors and sensor cables are identical in appearance. Take care not to plug the LEL sensor cable into the port on the TC sub PCB and not to plug the TC sensor cable into the LEL port on the main PCB.

TC Sub PCB

The TC sub PCB is a circuit board that is installed on the main PCB in one of the 3 sub PCB positions when a TC sensor is used with the Eagle 3. The TC sensor cable connects to the sub PCB. The sub PCB plugs into the main PCB and is held in place with a screw/flat washer/lock washer. There are no user-serviceable parts on the TC sub PCB.

Start Up and Normal Operation

For instructions to warmup and use an Eagle 3 that includes a TC sensor, reference “Start Up” on page 30, “Normal Mode Operation” on page 42, and “Alarms” on page 50. Follow these instructions keeping the following in mind:

- The TC sensor is used to monitor combustible gases above their LEL (lower explosive limit). When monitoring the target gas in % volume, be aware that you may be monitoring gas levels that are potentially explosive.

Catalytic (LEL) Sensor Screen

When either a TC sensor or an infrared combustible sensor is installed in an Eagle 3 along with a catalytic combustible LEL sensor, the user has the option of turning off the catalytic combustible LEL sensor in Display Mode. If the unit is going to be used for sampling known high-levels of combustible gas or in areas with known catalytic sensor poisons such as silicone vapors, the catalytic combustible sensor should be turned off. Even though this sensor has its own protective shut off, exposure to high levels of combustible gas can still stress the catalytic LEL sensor. The catalytic LEL sensor can be enabled or disabled in the Catalytic (LEL) Sensor screen in Display Mode. The default setting is enabled. To change the setting, do the following:

NOTE: The Catalytic (LEL) Sensor setting is reset when the Eagle 3 is turned off. When the Eagle 3 is turned on, this setting is always ENABLED.

1. Use the DISPLAY ADJUST NO button to enter Display Mode and scroll to the Catalytic (LEL) Sensor screen. The current setting will be flashing. The screen below indicates the warning that appears when a TC sensor and a catalytic LEL sensor are both installed. Since the TC sensor only reads in % volume, if the catalytic LEL sensor is disabled, there will be no alarms for the LEL range.

CAT (LEL) SENSOR
***** WARNING *****
NO LEL ALARMS IF
CAT (LEL) IS DISABLED

ENABLED

2. Use the AIR ▲YES or RANGE ▼ SHIFT button to toggle to the desired setting.
If set to DISABLED, the gas reading for the catalytic LEL channel will be replaced by dashes (---).
3. Press POWER ENTER RESET to save the setting and return to the main menu.
4. Use the DISPLAY ADJUST NO button to scroll through the rest of Display Mode and enter Normal Operation.

TC Calibration

A TC channel can be calibrated using the auto calibration method or the single calibration method. To calibrate a TC channel using the single calibration method, see page 88 and follow the instructions for calibrating a single channel. If your instrument is a multi-channel instrument that includes one or more TC channels, RKI Instruments, Inc. recommends using the auto calibration method for convenience. The calibration instructions below show a 5 channel instrument which has the four standard channels, LEL/oxygen/H₂S/CO, and a TC channel configured for 0-100 %vol CH₄. To use the auto calibration method to calibrate a multi-channel instrument that includes a TC channel, do the following:

1. See “Entering Calibration Mode” on page 77 for a description of the necessary calibration supplies. In addition to an appropriate multi-gas cylinder that is used to calibrate any active standard channels, you will also need a cylinder to calibrate the TC channel. See page 293 for available cylinders. Make sure your calibration cylinder is appropriate for the TC detection range.

If the Eagle 3 is intended for use in a landfill, RKI Instruments, Inc. recommends using the carbon dioxide/methane mix calibration cylinder because it is representative of gases present in a landfill.

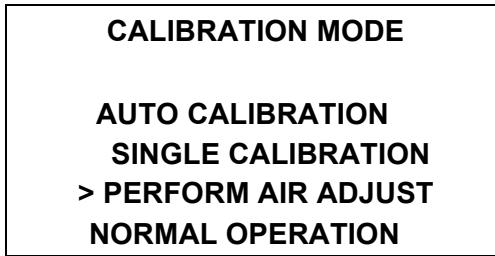
NOTE: If your instrument has more than one TC sensor, you will need a calibration cylinder for each sensor.

2. Find a fresh-air environment. This is an environment free of toxic or combustible gases and of normal oxygen content (20.9%).
3. While in Normal Mode, press and hold the RANGE ▼ SHIFT button, then press the DISPLAY ADJUST NO button both buttons.
4. If the unit prompts you for the password, enter it by using the AIR ▲YES and RANGE ▼ SHIFT buttons to select each password number and then pressing and releasing POWER ENTER RESET to enter the number and move on to the next one.
5. The Calibration Mode Screen displays with the cursor next to **AUTO CALIBRATION**.

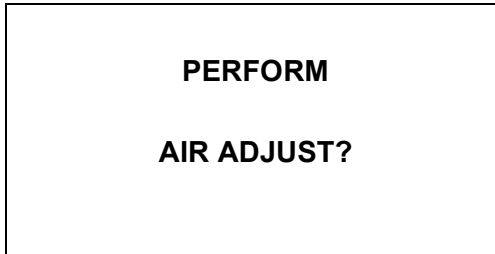
CALIBRATION MODE

> AUTO CALIBRATION
SINGLE CALIBRATION
PERFORM AIR ADJUST
NORMAL OPERATION

6. Move the cursor to the **PERFORM AIR ADJUST** menu item by using the RANGE ▼ SHIFT button.

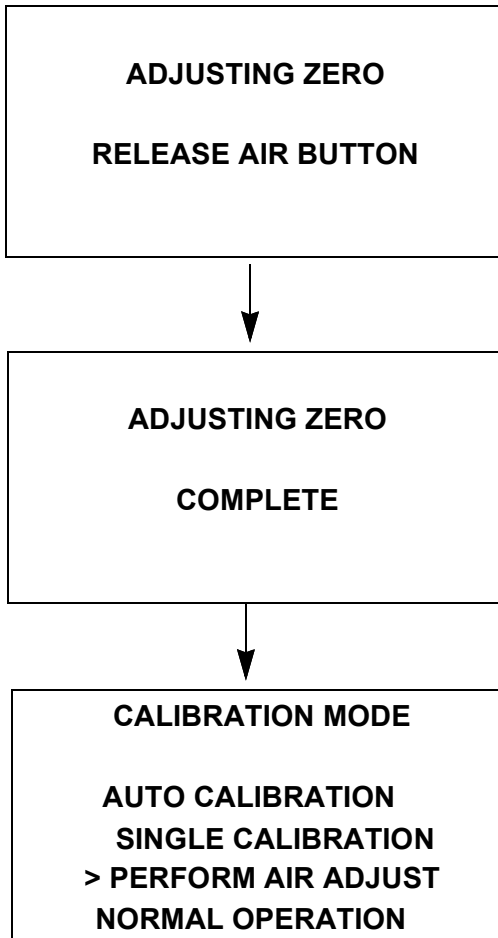


7. Press the POWER ENTER RESET button. The following screen appears.

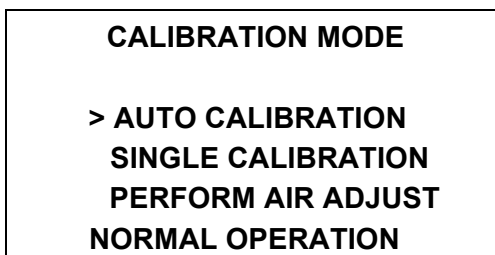


8. Press the AIR ▲YES button to continue.
If you do not want to continue, press the DISPLAY ADJUST NO button and the unit will return to the Calibration Mode Screen.

9. The Eagle 3 will indicate that it is adjusting the zero reading for a few seconds, then indicate that the operation is complete before returning to the Calibration Mode Screen.



10. Install the demand flow regulator onto the multi-gas calibration cylinder.
11. Connect the sample tubing to the demand flow regulator.
12. Install the probe on the Eagle 3 inlet fitting. Make sure the probe is complete with internal O-ring and membrane and that the two halves of the probe are tightened firmly together to avoid leaks that can affect the calibration. See Figure 17 on page 99 for an illustration of the internal parts of the probe.
13. Move the cursor next to the **AUTO CALIBRATION** menu item by using the AIR ▲YES button.



14. Press the POWER ENTER RESET button to display the Calibration Gas Values Screen.

CAL GAS VALUES		
CH4	50	% LEL
OXY	12.0	vol%
H2S	25.0	ppm
CO	50	ppm
ENTER TO BEGIN CAL		

The gas concentrations displayed in the Calibration Gas Values Screen must match the gas concentrations listed on the 4-gas calibration cylinder.

If *all* concentrations match, go to Step 25.

If *one or more* concentrations *do not* match, continue with Step 15.

If you do not want to continue with the calibration, press the DISPLAY ADJUST NO button to return to the Calibration Mode Screen.

NOTE: The RKI 4-gas cylinder typically contains 12% O₂ by volume. When using the auto calibration method, be sure to set the “OXY” auto calibration value to agree with the concentration listed on the cylinder’s label, not zero.

15. To adjust the values on the screen, press and hold the RANGE ▼ SHIFT button, then press the DISPLAY ADJUST NO button both. The following screen appears with the cursor next to CH4.

ADJUST AUTO		
CALIBRATION VALUES		
> CH4	50	% LEL
OXY	12.0	vol%
H2S	25.0	ppm
CO	50	ppm
		▼

16. Place the cursor next to the channel whose gas value you want to change using the AIR ▲ YES and RANGE ▼ SHIFT buttons.
17. Press the POWER ENTER RESET button to select the channel. The calibration gas value begins to flash.
18. Use the AIR ▲ YES and RANGE ▼ SHIFT buttons to adjust the calibration gas setting to the desired value.

NOTE: The calibration gas setting value be set lower than the low alarm setting. If the calibration gas value listed on the calibration cylinder is lower than the current low alarm setting, enter Setup Mode and change the low alarm setting. See page 145 for instructions. If you need to change the alarm point setting only to perform a calibration, make sure that you change the alarm point setting back to its original value once the calibration has been performed.

19. Press the POWER ENTER RESET button to save the change. The calibration gas value stops flashing.
20. Repeat Step 16 through Step 19 for any other channels that need to be changed.
21. When you are done adjusting the calibration gas values, move the cursor down past the bottom of the screen next to **END**.

**ADJUST AUTO
CALIBRATION VALUES
> END ▲**

22. Press the POWER ENTER RESET button. The following screen appears.

**DO YOU WANT TO
STORE NEW VALUE(S)
IN MEMORY FOR
FUTURE CALIBRATIONS?

PRESS YES OR NO**

23. If you select YES by pressing and releasing the AIR ▲YES button, the changes that you made will be saved in the Eagle 3's memory as the new auto calibration gas values.

If you select NO by pressing and releasing the DISPLAY ADJUST NO button, the changes you made will be used for any calibrations performed during the current operating session only. The Eagle 3 will delete the changes when the unit is turned off and will load the previous set of auto calibration values when it is turned on again.
24. When you make your selection and press the desired button, the unit returns to the Calibration Gas Values Screen.

CAL GAS VALUES
CH4 50 % LEL
OXY 12.0 vol%
H2S 25.0 ppm
CO 50 ppm
ENTER TO BEGIN CAL

25. Press the POWER ENTER RESET button to proceed to the Calibration In Process Screen with **CAL IN PROCESS** flashing.

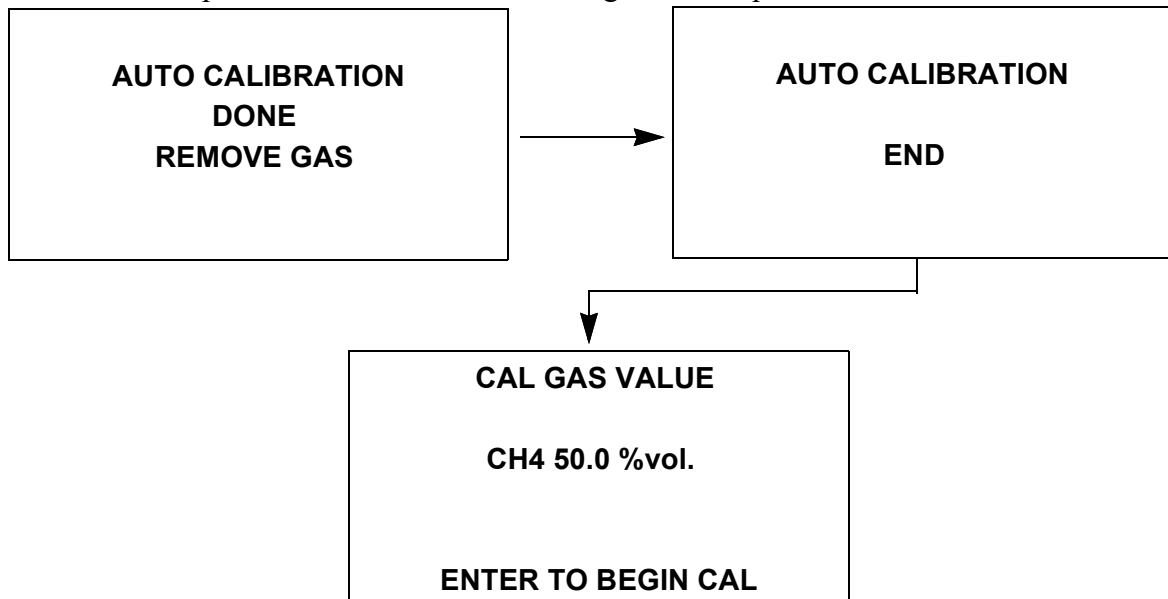
CAL IN PROCESS		
CH4	0	% LEL
OXY	20.9	vol%
H2S	0.0	ppm
CO	0	ppm
ENTER WHEN DONE		

If you do not want to proceed with the calibration, press the DISPLAY ADJUST NO button to return to the Cal Gas Values Screen.

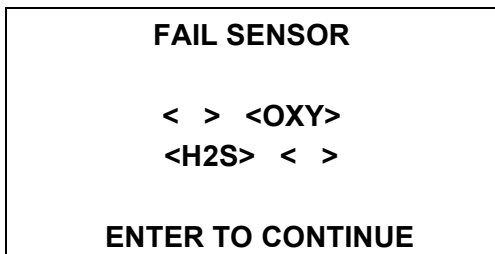
If you do want to continue with the calibration, proceed to the next step.

26. Connect the tubing from the demand flow regulator to the rigid tube on the probe. Allow the Eagle 3 to draw gas for one minute.
27. Press the POWER ENTER RESET button to set the span adjustment for each channel to the programmed values.

28. If all channels passed calibration, the following screen sequence occurs.



If any of the sensors cannot be adjusted to the proper value, a screen displays that indicates a calibration failure and lists the sensor(s) that failed to calibrate. In the example below, the oxygen and H₂S channels failed calibration. The other sensors calibrated normally.



The buzzer and alarm LEDs activate in a double pulsing pattern. Press the POWER ENTER RESET button to reset the alarm and continue to the Calibration Value Screen for the TC channel. After calibrating the TC channel by following the instructions below, attempt to calibrate the standard channels again. If the failure continues, investigate the cause. See "Troubleshooting" on page 96..

29. Remove the tubing from the rigid tube on the probe.

30. Unscrew the 4-gas cylinder from the demand flow regulator.

31. If you want to change the TC channel's calibration gas value, follow Step 19 - Step 28 above beginning with the TC Calibration Gas Value Screen below instead of the standard channel Calibration Gas Value Screen.

<p>CAL GAS VALUE</p> <p>CH4 50.0 %vol.</p> <p>ENTER TO BEGIN CAL</p>

32. With the TC Calibration Gas Value Screen displayed, press the POWER ENTER RESET button to proceed to the Calibration In Process Screen for the TC channel with **CAL IN PROCESS** flashing.

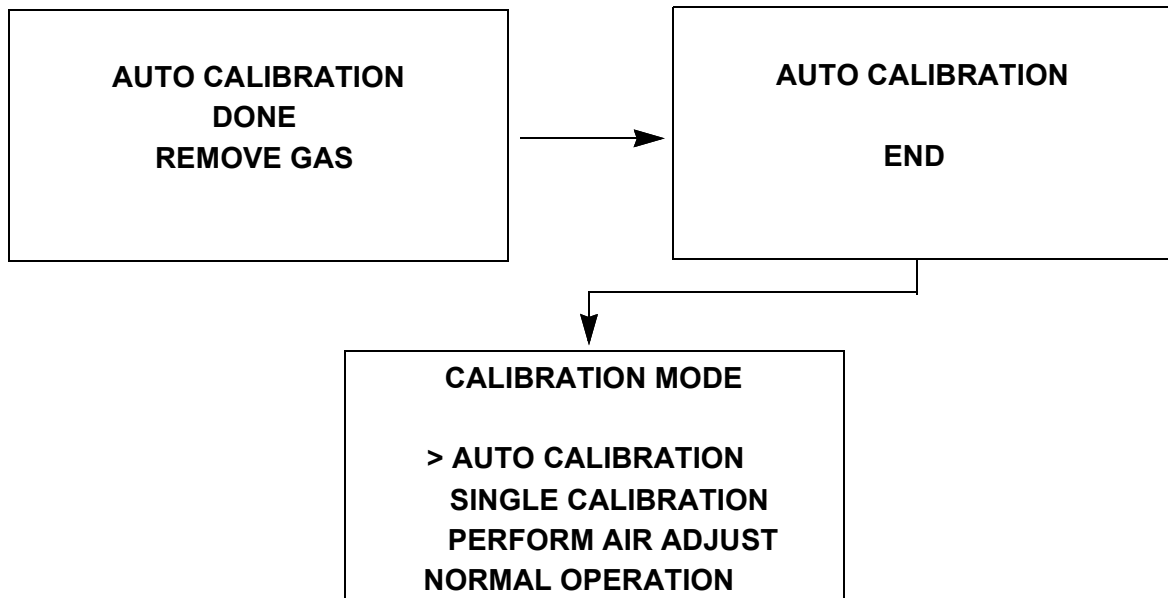
<p>CAL IN PROCESS</p> <p>CH4 0.0 %vol.</p> <p>ENTER WHEN DONE</p>
--

If you do not want to proceed with the calibration, press the DISPLAY ADJUST NO button to return to the TC Cal Gas Values Screen.

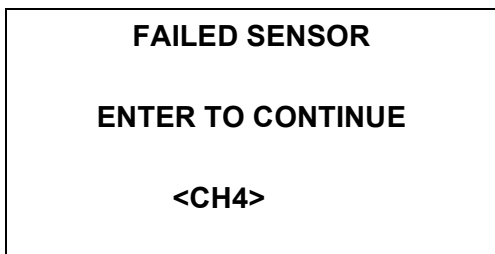
If you do want to continue with the calibration, proceed to the next step.

33. Screw the new TC calibration cylinder onto the demand flow regulator.
34. Connect the tubing from the regulator to the rigid tube on the probe. Allow the Eagle 3 to draw gas for one minute.
35. Press the POWER ENTER RESET button to set the span adjustment for the TC channel to the programmed value.

36. If the TC channel passed calibration, the following screen sequence occurs.



If the TC channel cannot be adjusted to the proper value, a screen displays that indicates a calibration failure and indicates that the TC sensor failed to calibrate.



The buzzer and alarm LEDs activate in a double pulsing pattern. Press the POWER ENTER RESET button to reset the alarm and continue to the Calibration Mode Screen. Attempt to calibrate the TC channel again. If the failure continues, investigate the cause. See "Troubleshooting" on page 96..

37. Disconnect the tubing from the probe.

38. Unscrew the demand flow regulator from the calibration cylinder.

39. Use the RANGE ▼ SHIFT button to place the cursor next to the **NORMAL OPERATION** menu option, then press the POWER ENTER RESET button to return to Normal Mode.

Maintenance

The TC sensor does not include any user-serviceable parts. This section includes a procedure for replacing the TC sensor.

Replacing the TC Sensor

1. Verify that the Eagle 3 is off.
2. Place the Eagle 3 upside down on a flat surface or hold it upside down.
3. Unscrew the three case screws until they disengage from the top case. They are captive screws so they will not fall off of the bottom case.
4. Turn the Eagle 3 right side up and carefully lift the top case away from the bottom case. Be careful not to lift it so far that it pulls on the main PCB with the cable that connects the top case to the main PCB.
5. Lay the top case down next to the bottom case to allow access to the flow system.
6. Locate the TC sensor. It has a five wire cable with a connector that mates to a TC sub PCB that is installed on the main PCB and is normally located in a single sensor flow chamber next to the pump. Figure 34 on page 276 shows a TC sensor in a typical location.
7. Unscrew and remove the two screws that hold down the TC sensor bracket.
8. Grasp the TC sensor connector and gently pull it up until it either disengages from the TC sensor or the TC sensor comes out of the flow chamber with the connector.
9. If the sensor came out with the connector, remove the sensor from the connector.
10. If the sensor stayed in the flow chamber, grasp the sensor and pull it out of the flow chamber.
11. Plug the replacement sensor into the sensor connector on the TC sensor cable.
12. Insert the TC sensor into the TC sensor chamber in the flow chamber.
13. Line up the holes in the TC sensor retaining bracket with the two standoffs on either side of the TC sensor chamber.
14. Install the two sensor retaining screws tightening them a little at a time alternately to push the sensor into its chamber evenly.
15. Confirm that the main PCB is seated in its slots and that its bottom edge is resting on the bottom of the bottom case. If the main PCB is not seated properly, it may be damaged when the top case is reinstalled.
16. Make sure that the top case gasket is fully seated in its groove and carefully put the top case back on the bottom case. If you have any difficulty mating the top and bottom cases, inspect the placement of the main PCB and the placement of the top case gasket.
17. Turn the Eagle 3 upside down and tighten the three case screws to secure the top case to the bottom case.
18. Calibrate the TC channel as described on page 278.

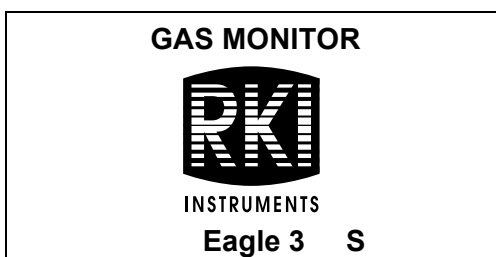
Configuring the TC Gas in Setup Mode

The TC channel can be configured for 3 different pre-defined gases and 1 user-defined gas in the CONFIGURE GASES menu item in Setup Mode. To change the gas configuration of the TC channel in Setup Mode, do the following:

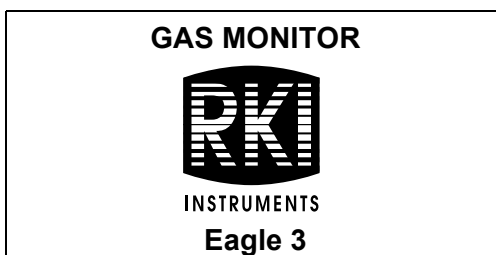
WARNING: Do not use the user defined gas configuration without consulting RKI Instruments, Inc.

WARNING: The Eagle 3 is not in operation as a gas detector while in Setup Mode.

1. Take the Eagle 3 to a non-hazardous location and turn it off if it is on.
2. Press and hold AIR ▲YES and RANGE ▼ SHIFT, then press and hold POWER ENTER RESET. When you hear a beep, release the buttons.
3. The LCD will show the following screen for a few seconds with the “S” in the lower right corner indicating the unit is entering Setup Mode.



4. The “S” will then disappear and the following screen will appear for a few seconds.



5. If the unit prompts you for the password, enter it by using AIR ▲YES and RANGE ▼ SHIFT to select each password number and then pressing and releasing the POWER ENTER RESET button to enter it and move on to the next number until all of the numbers are entered. The main menu displays. It displays six menu items at a time.

>SET DATE & TIME
SET DATE FORMAT
SET BATTERY TYPE
CONFIGURE CHANNELS
CONFIGURE GASES
CATALYTIC UNITS ▼

6. Use the RANGE ▼ SHIFT button to move the cursor down the menu to CONFIGURE GASES.
7. Press POWER ENTER RESET. The Configure Gases Screen appears with the cursor flashing next to CAT, the catalytic sensor. If an Eagle 3 has a TC sensor installed, one of the three optional sensor types, OP1, OP2, or OP3 will indicate it is a TC. In the example below, OP1 is shown as a TC sensor.

CONFIGURE GASES

> CAT : CH4 (CAT)
OP1 : CH4 (TC)
OP2 : --- (---)
OP3 : --- (---) ▼

8. Use RANGE ▼ SHIFT to move the cursor down the menu to the TC sensor.

CONFIGURE GASES

CAT : CH4 (CAT)
> OP1 : CH4 (TC)
OP2 : --- (---)
OP3 : --- (---) ▼

9. To change the TC sensor gas configuration, press POWER ENTER RESET.

10. A screen appears that indicates the detection range for the currently configured gas. In the example below, the TC sensor is currently configured for 0 - 100 % volume CH₄. The screen also shows the gas configuration choices for the TC sensor. There are 3 pre-defined options and 1 user-defined option. The user-defined option will always have an asterisk next to it.

TC (0-100.0vol%CH4)

> 100.0 vol% CH4

100.0 vol% H2

10.0 vol% H2

10.0 vol% TC * ▼

11. Use AIR ▲YES and RANGE ▼ SHIFT to move the cursor next to the desired gas.

If you placed the cursor next to one of the pre-defined gases, press POWER ENTER RESET to select the gas and proceed to Step 16.

If you placed the cursor next to the user defined gas with the asterisk (*), press POWER ENTER RESET and proceed with Step 12.

12. The user defined gas setup screen appears with the first character of the gas name flashing. The current gas name and range are shown on the top line of the screen.

TC (0-100.0vol%CH4)

CHANGE TO NAME

TC

FULL_SCALE 10.0

WARNING: Do not use the user defined gas configuration without consulting RKI Instruments, Inc.

13. Enter the gas name. There are 3 characters available for the gas name. The factory setting of TC uses only 2 characters. Use AIR ▲YES and RANGE ▼ SHIFT to display the desired character, then press POWER ENTER RESET to enter the displayed character and move to the next character. Repeat until all three characters are entered. When the last character is entered, the full scale value will be flashing.
14. Use AIR ▲YES and RANGE ▼ SHIFT to display the desired full scale value. It may be any value from 10 to 100 in increments of 10.

15. Press **POWER ENTER RESET** to enter the full scale value. The confirmation screen appears. In the example below, the user defined gas has been selected and defined as propane with the gas name set to **PRO**.

CHANGE TO PRO ?

PRESS YES OR NO

16. If you want to accept the gas configuration change, press **AIR ▲YES**. The unit will return to the **Configure Gases** screen.

CONFIGURE GASES

> CAT : CH4 (CAT)

OP1 : PRO (TC)

OP2 : --- (---)

OP3 : --- (---) ▼

If you do not want to accept the gas configuration change, press **DISPLAY ADJUST NO** to return to the screen with the gas choices shown in Step 10 on page 290. You can either scroll down to **END** and press **POWER ENTER RESET** to return to the **Configure Gases** screen or continue from Step 10 on page 290 to select a new gas.

17. Use **RANGE ▼ SHIFT** to place the cursor next to **END**.
18. Press **POWER ENTER RESET** to return to the main menu.
19. Use **RANGE ▼ SHIFT** to place the cursor in front of **NORMAL OPERATION** at the bottom of the main menu.
20. Press **POWER ENTER RESET**.
21. A screen appears that asks if you want to save the changes you have made.

SAVE ALL CHANGES

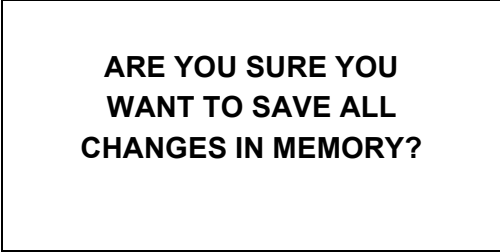
IN MEMORY?

NOTE: If you entered Setup Mode and did not make any changes, the above screen will still appear. In this case, press **DISPLAY ADJUST NO** to proceed to exit Setup Mode and begin the Eagle 3's warmup sequence.

22. If you do not want to save the changes, press DISPLAY ADJUST NO. The unit will begin its warmup sequence without saving the changes.

If you do want to save the changes, press AIR ▲YES and continue with the next step.

23. A confirmation screen appears asking if you are sure you want to save the changes.



**ARE YOU SURE YOU
WANT TO SAVE ALL
CHANGES IN MEMORY?**

24. If you want to save the changes, press AIR ▲YES to save the changes. A screen will appear for a few seconds indicating that the changes have been saved and the unit will begin its warmup sequence.

If you do not want to save the changes, press DISPLAY ADJUST NO to proceed to the unit's warmup sequence without saving changes.

TC Eagle 3 Parts List

Table 28:

Part Number	Description
47-5010RK	TC/LEL sensor cable
TE-7568	TC sensor
81-0013RK-01	Calibration cylinder, 50% vol CH ₄ in N ₂ , 34 liter steel
81-0013RK-05	Calibration cylinder, 50% vol CH ₄ in N ₂ , 58 liter
81-0023RK-01	Calibration cylinder, H ₂ , 8% volume in nitrogen, 34 liter steel
81-0024RK-01	Calibration cylinder, H ₂ , 100% volume, 34 liter steel
81-0025RK-01	Calibration cylinder, 35% CO ₂ /50% CH ₄ , balance N ₂ , 34 liter steel, intended for landfill applications

Appendix F: Infrared Carbon Dioxide Sensors

Overview

The infrared CO₂ sensors are used to monitor levels of carbon dioxide. This appendix describes the Eagle 3's infrared CO₂ sensors and includes instructions to use an Eagle 3 that has one or more infrared CO₂ sensors installed. It also includes instructions to replace an infrared CO₂ sensor.

Table 29: Infrared CO₂ Sensor Specifications

Range	Increment	Alarm 1 Factory Setting	Alarm 2 Factory Setting	STEL (ppm)	TWA (ppm)
0-5.00 %vol	0.02 %vol	0.5 %vol	3.0 %vol	3.0	0.5
0-10,000 ppm	25 ppm	5,000 ppm	OFF	5,000	OFF
0-60.0 %vol	0.2 %vol	OFF	OFF	OFF	OFF

Description

The infrared CO₂ sensor is a smart sensor that stores sensor parameters including the target gas and detection range. So you can change an existing infrared CO₂ channel from one range to another and the Eagle 3 will automatically load all the sensor parameters and configure the infrared CO₂ channel for the new sensor without the need to enter CONFIGURE CHANNELS or CONFIGURE GASES in Setup Mode. See page 307 for instructions to replace or change an infrared CO₂ sensor.

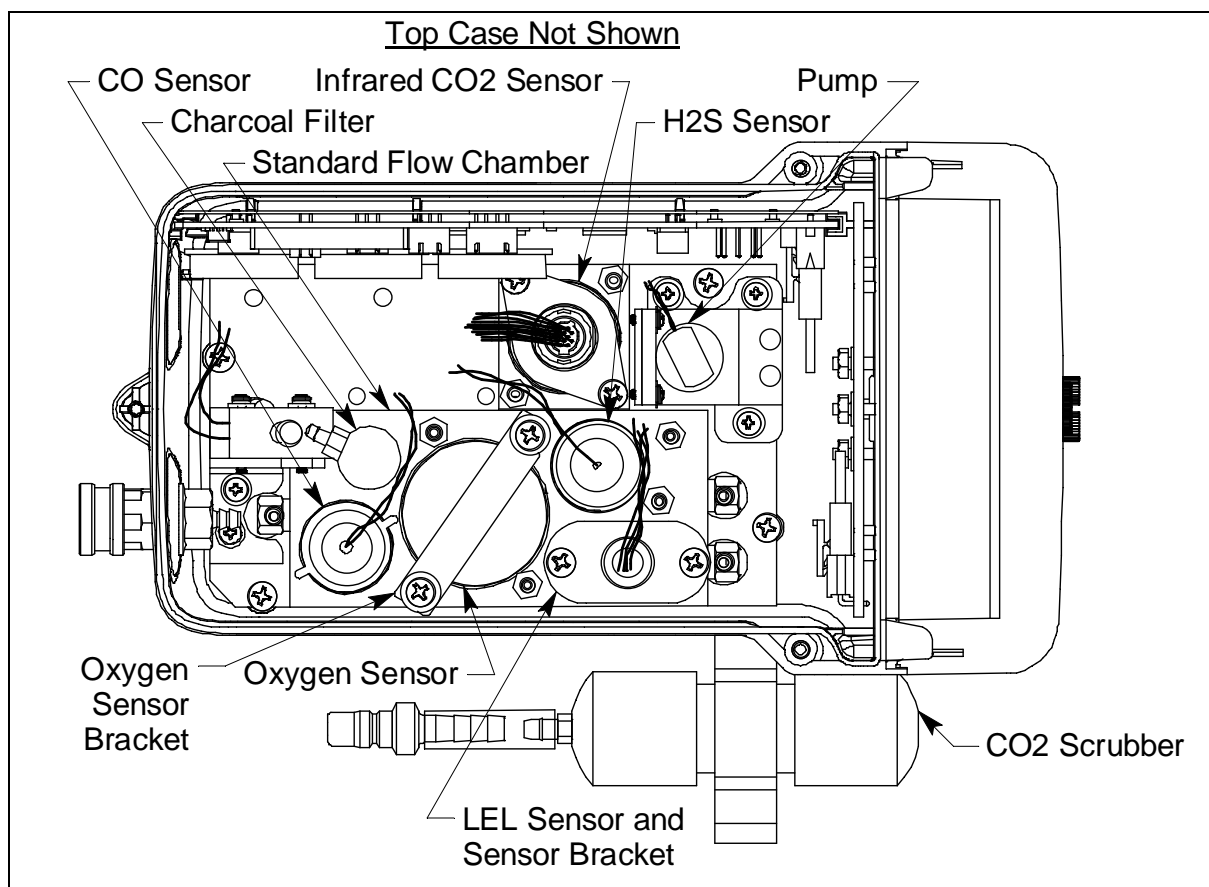


Figure 35: Typical IR CO₂ Sensor Location

The infrared CO₂ sensor is installed in a single sensor flow chamber which is located in the area next to the standard 4-sensor flow chamber. This area can accommodate up to three single sensor flow chambers. Figure 35 above illustrates a typical infrared CO₂ sensor location in front of the pump. The infrared CO₂ flow chamber may also be installed in one of the other two sensor chamber locations depending on the particular version of the Eagle 3. Some infrared CO₂ instrument configurations do not include the 4-sensor flow chamber.

Infrared CO₂ Sensor

The infrared CO₂ sensor is a cylindrical sensor with a diffusion opening on the front and a 12 pin circular connector on the back. A 12 wire cable plugs into the back of the infrared CO₂ sensor with a circular connector that includes a locking lever. The other end of the cable plugs into an infrared sub PCB (see description below) that is installed on the main PCB. The sensor is held in the infrared flow chamber by a bracket on standoffs.

Infrared Sub PCB

The infrared sub PCB is a circuit board that is installed on the main PCB in one of the 3 sub PCB positions when an infrared CO₂ sensor is used with the Eagle 3. The infrared CO₂ sensor connects to the sub PCB with a 12-position connector. The sub PCB plugs into the main PCB and is held in place with a screw/flat washer/lock washer. There are no user-serviceable parts on the infrared sub PCB.

CO₂ Scrubber

A carbon dioxide scrubber is mounted to the exterior side of Eagle 3s that are factory-shipped with carbon dioxide sensors for the ranges of 0-5 %vol and 0-10,000 ppm.

NOTE: Eagle 3s with a range of 0-60 %vol CO₂ do not include a scrubber since the normal background of CO₂ in air is negligible when compared to the full scale of these units.

This scrubber is for use when setting the carbon dioxide sensor's zero reading only. Two black vinyl caps cover either end of the carbon dioxide scrubber. To prolong the life of the scrubber, be sure the caps are installed while the scrubber is not in use or while it is being stored. Replace the scrubber when it turns from white to a violet color.

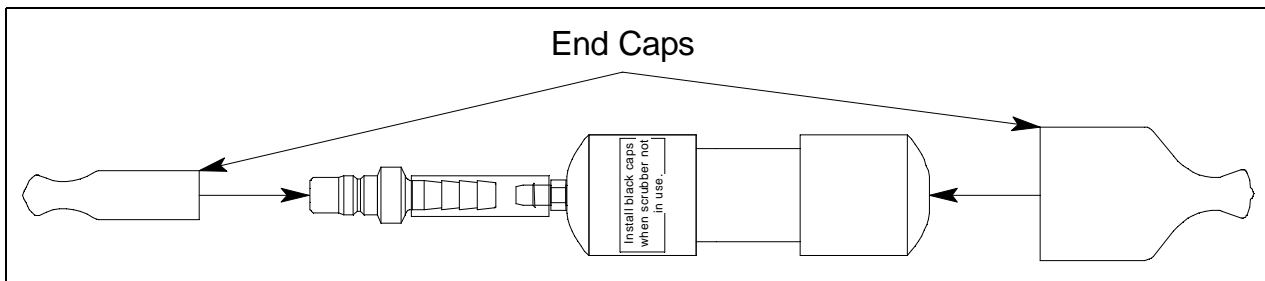


Figure 36: Carbon Dioxide Scrubber

Start Up and Normal Operation

For instructions to warmup and use an Eagle 3 that includes an infrared CO₂ sensor, reference “Start Up” on page 30, “Normal Mode Operation” on page 42, and “Alarms” on page 50.

Follow these instructions keeping the following special considerations in mind:

- A background level of CO₂ exists in fresh air. The low range sensors will display a reading in fresh air. Table 30 below indicates typical gas readings in fresh air.

Table 30: Carbon Dioxide Fresh Air Readings

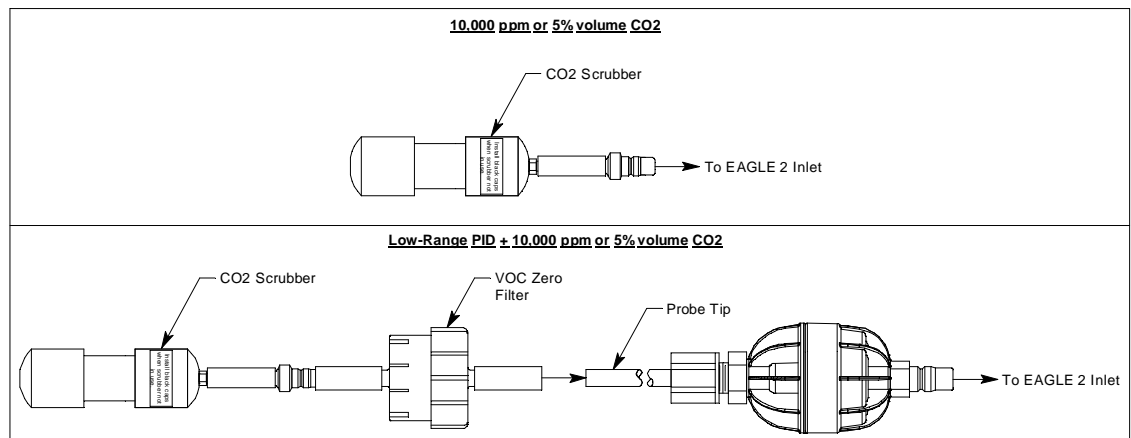
Sensor Range	Approximate Fresh Air Reading
0-5 %vol	0.04 %vol
0-10,000 ppm	400 ppm
0-60 %vol	0.0 %vol

- When you perform a demand zero during start up, operation, or calibration of a 0-10,000 ppm or 0-5 %vol CO₂ instrument, you must use the CO₂ scrubber provided with the instrument to remove background CO₂ from the air being sampled. See Performing a Demand Zero for Carbon Dioxide Sensors below.
- Since there is a background of CO₂ in air, do not use the AUTO FRESH AIR ADJ feature that can be turned on and off in Setup Mode. The factory setting for the feature is off.

Performing a Demand Zero for Carbon Dioxide Sensors

When setting the zero reading, the carbon dioxide scrubber mounted to the side of the Eagle 3 allows you to eliminate carbon dioxide normally found in fresh air. To perform a demand zero, do the following:

1. Remove the black caps from the ends of the carbon dioxide scrubber. Be sure to grab the scrubber by the Eagle 3 fitting so that the fitting and tubing do not come off.
2. Connect the carbon dioxide scrubber directly to the Eagle 3's inlet fitting.
3. If you also have a low-range PID sensor installed and suspect any low-level VOC background in the area, you must install the VOC zero filter before performing a demand zero.
 - a. Remove the plug from each end of the VOC zero filter.
 - b. Attach the VOC zero filter to the probe. The filter does not have a preferred flow direction.
 - c. Connect the CO₂ scrubber's fitting to the VOC zero filter.



4. Wait one minute, then press AIR ▲YES to set the zero reading.
5. Remove the scrubber from the inlet fitting or from the VOC zero filter if you used one.
6. Put the caps back on the scrubber.
7. If you used a VOC zero filter, remove it from the probe and reinstall the plugs.

Infrared CO₂ Calibration

An infrared CO₂ channel can be calibrated using the auto calibration method or the single calibration method. To calibrate an infrared CO₂ channel using the single calibration method, see page 94 and follow the instructions for calibrating a single channel. If your instrument is a multi-channel instrument that includes one or more infrared CO₂ channels, RKI Instruments, Inc. recommends using the auto calibration method for convenience. The calibration instructions below show a 5 channel instrument which has the four standard channels, LEL/oxygen/H₂S/CO, and an infrared CO₂ channel for 0-5 %vol. To use the auto calibration method to calibrate a multi-channel instrument that includes an infrared CO₂ channel, do the following:

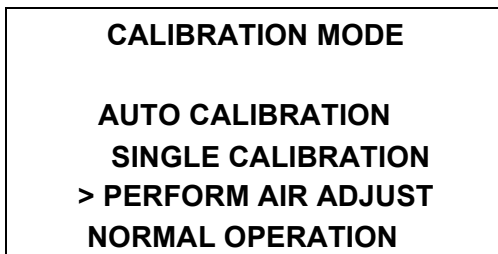
NOTE: If your instrument has more than one infrared CO₂ sensor, you will need a calibration cylinder for each sensor.

1. See “Entering Calibration Mode” on page 77 for a description of the necessary calibration supplies. In addition to an appropriate multi-gas cylinder that is used to calibrate any active standard channels, you will also need a cylinder to calibrate the infrared CO₂ channel. See page 308 for available cylinders. Make sure your calibration cylinder is appropriate for the infrared CO₂ detection range.
2. Find a fresh-air environment. This is an environment free of toxic or combustible gases and of normal oxygen content (20.9%).
3. While in Normal Mode, press and hold the RANGE ▼ SHIFT button, then press the DISPLAY ADJUST NO button both buttons.
4. If the unit prompts you for the password, enter it by using the AIR ▲YES and RANGE ▼ SHIFT buttons to select each password number and then pressing and releasing POWER ENTER RESET to enter the number and move on to the next one.
5. The Calibration Mode Screen displays with the cursor next to **AUTO CALIBRATION**.

CALIBRATION MODE

> AUTO CALIBRATION
SINGLE CALIBRATION
PERFORM AIR ADJUST
NORMAL OPERATION

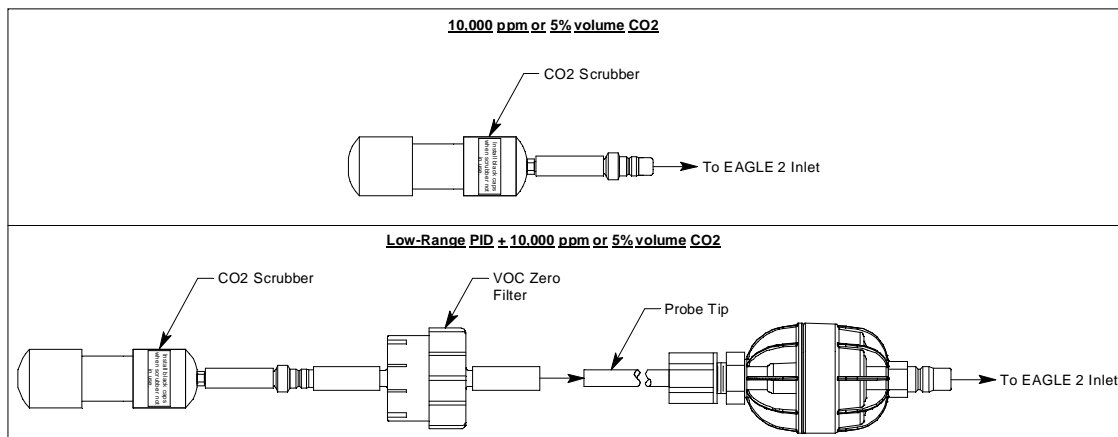
6. Move the cursor to the **PERFORM AIR ADJUST** menu item by using the RANGE ▼ SHIFT button.



7. Remove the black caps from the ends of the carbon dioxide scrubber. Be sure to grab the scrubber by the Eagle 3 fitting so that the fitting and tubing do not come off.
8. Attach the CO₂ scrubber to the inlet fitting of the Eagle 3.

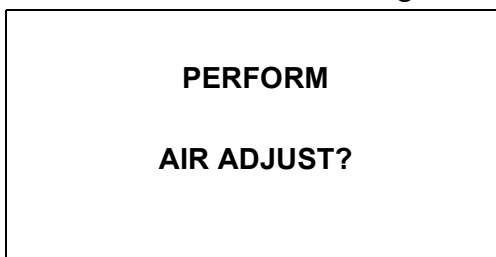
NOTE: Attaching the CO₂ scrubber to the inlet fitting eliminates the background CO₂ found in fresh air and allows the Eagle 3 to obtain an accurate zero reading.

9. If you also have a low-range PID sensor installed and suspect any low-level VOC background in the area, you must install the VOC zero filter before performing a demand zero.
 - a. Remove the plug from each end of the VOC zero filter.
 - b. Attach the VOC zero filter to the probe. The filter does not have a preferred flow direction.
 - c. Connect the CO₂ scrubber's fitting to the VOC zero filter.



10. Allow the instrument to draw fresh air for 1 minute before performing an air adjust.

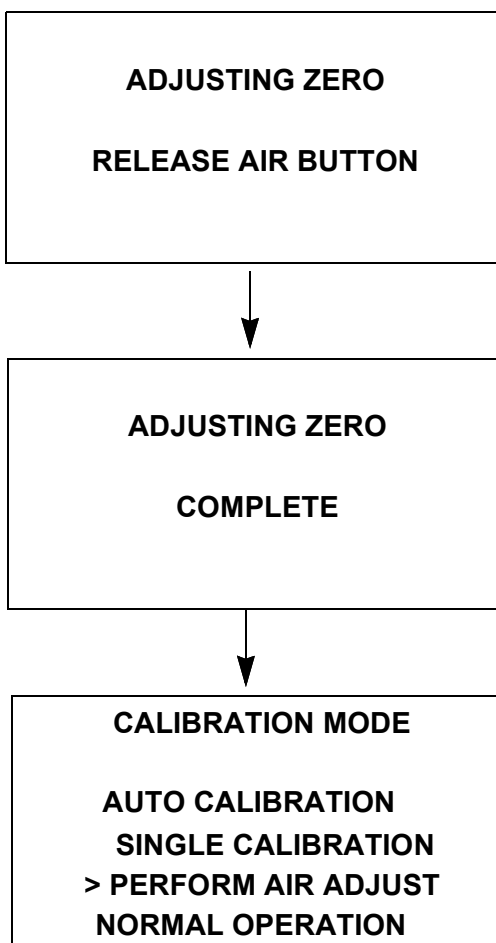
11. Press the POWER ENTER RESET button. The following screen appears.



12. Press the AIR ▲YES button to continue.

If you do not want to continue, press the DISPLAY ADJUST NO button and the unit will return to the Calibration Mode Screen.

13. The Eagle 3 will indicate that it is adjusting the zero reading for a few seconds, then indicate that the operation is complete before returning to the Calibration Mode Screen.



14. Remove the CO₂ scrubber from the Eagle 3 inlet fitting.

15. Put the caps back on the scrubber.

16. If you used a VOC zero filter, remove it from the probe and reinstall the plugs.

17. Install the demand flow regulator onto the multi-gas calibration cylinder.

18. Connect the sample tubing to the demand flow regulator.
19. Install the probe on the Eagle 3 inlet fitting. Make sure the probe is complete with internal O-ring and membrane and that the two halves of the probe are tightened firmly together to avoid leaks that can affect the calibration. See Figure 17 on page 99 for an illustration of the internal parts of the probe.
20. Move the cursor next to the **AUTO CALIBRATION** menu item by using the AIR ▲YES button.

<p>CALIBRATION MODE</p> <p>> AUTO CALIBRATION</p> <p>SINGLE CALIBRATION</p> <p>PERFORM AIR ADJUST</p> <p>NORMAL OPERATION</p>

21. Press the POWER ENTER RESET button to display the Calibration Gas Values Screen.

<p>CAL GAS VALUES</p> <p>CH4 50 % LEL</p> <p>OXY 12.0 vol%</p> <p>H2S 25.0 ppm</p> <p>CO 50 ppm</p> <p>ENTER TO BEGIN CAL</p>

The gas concentrations displayed in the Calibration Gas Values Screen must match the gas concentrations listed on the 4-gas calibration cylinder.

If *all* concentrations match, go to Step 27.

If *one or more* concentrations *do not* match, continue with Step 17.

If you do not want to continue with the calibration, press the DISPLAY ADJUST NO button to return to the Calibration Mode Screen.

NOTE: The RKI 4-gas cylinder typically contains 12% O₂ by volume. When using the auto calibration method, be sure to set the “OXY” auto calibration value to agree with the concentration listed on the cylinder’s label, not zero.

22. To adjust the values on the screen, press and hold the RANGE ▼ SHIFT button, then press the DISPLAY ADJUST NO button both. The following screen appears with the cursor next to **CH4**.

<p>ADJUST AUTO</p> <p>CALIBRATION VALUES</p> <p>> CH4 50 % LEL</p> <p>OXY 12.0 vol%</p> <p>H2S 25.0 ppm</p> <p>CO 50 ppm ▼</p>

23. Place the cursor next to the channel whose gas value you want to change using the AIR ▲ YES and RANGE ▼ SHIFT buttons.
24. Press the POWER ENTER RESET button to select the channel. The calibration gas value begins to flash.
25. Use the AIR ▲ YES and RANGE ▼ SHIFT buttons to adjust the calibration gas setting to the desired value.

NOTE: The calibration gas value cannot be set lower than the low alarm setting. If the calibration gas value listed on the calibration cylinder is lower than the current low alarm setting, enter Setup Mode and change the low alarm setting. See page 145 for instructions. If you need to change the alarm point setting only to perform a calibration, make sure that you change the alarm point setting back to its original value once the calibration has been performed.

26. Press the POWER ENTER RESET button to save the change. The calibration gas value stops flashing.
27. Repeat Step 17 through Step 21 for any other channels that need to be changed.
28. When you are done adjusting the calibration gas values, move the cursor down past the bottom of the screen next to **END**.

**ADJUST AUTO
CALIBRATION VALUES
> END**

29. Press the POWER ENTER RESET button. The following screen appears.

**DO YOU WANT TO
STORE NEW VALUE(S)
IN MEMORY FOR
FUTURE CALIBRATIONS?**

PRESS YES OR NO

30. If you select YES by pressing and releasing the AIR ▲ YES button, the changes that you made will be saved in the Eagle 3's memory as the new auto calibration gas values.

If you select NO by pressing and releasing the DISPLAY ADJUST NO button, the changes you made will be used for any calibrations performed during the current operating session only. The Eagle 3 will delete the changes when the unit is turned off and will load the previous set of auto calibration values when it is turned on again.

31. When you make your selection and press the desired button, the unit returns to the Calibration Gas Values Screen.

CAL GAS VALUES	
CH4	50 % LEL
OXY	12.0 vol%
H2S	25.0 ppm
CO	50 ppm
ENTER TO BEGIN CAL	

32. Press the POWER ENTER RESET button to proceed to the Calibration In Process Screen with **CAL IN PROCESS** flashing.

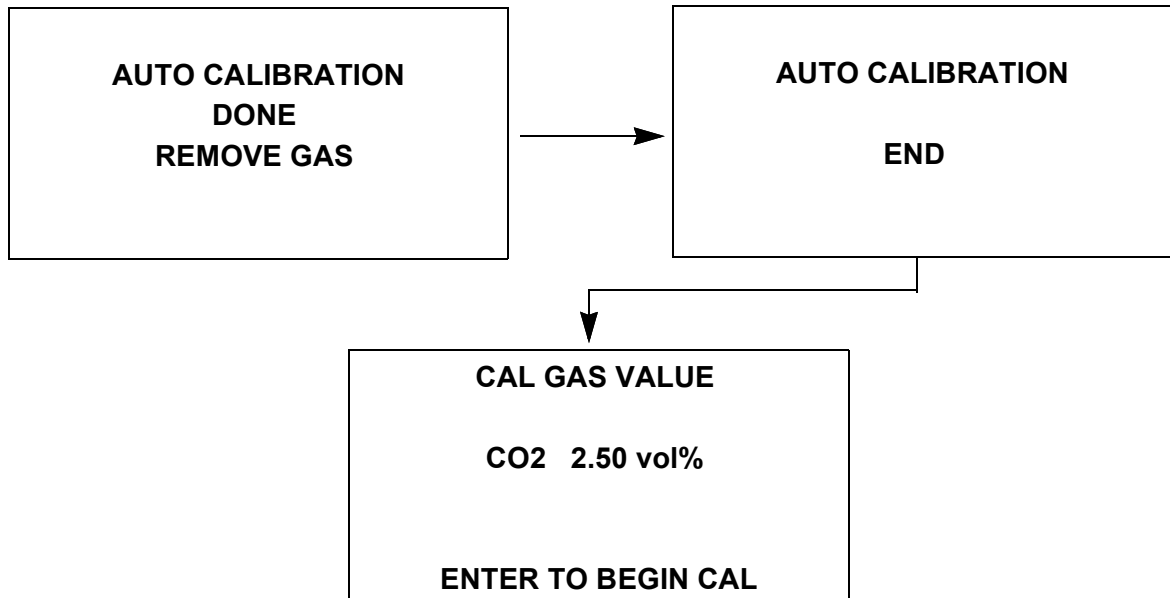
CAL IN PROCESS	
CH4	0 % LEL
OXY	20.9 vol%
H2S	0.0 ppm
CO	0 ppm
ENTER WHEN DONE	

If you do not want to proceed with the calibration, press the DISPLAY ADJUST NO button to return to the Cal Gas Values Screen.

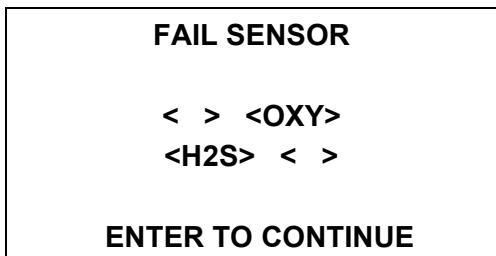
If you do want to continue with the calibration, proceed to the next step.

33. Connect the tubing from the demand flow regulator to the rigid tube on the probe. Allow the Eagle 3 to draw gas for one minute.
34. Press the POWER ENTER RESET button to set the span adjustment for each channel to the programmed values.

35. If all channels passed calibration, the following screen sequence occurs.



If any of the sensors cannot be adjusted to the proper value, a screen displays that indicates a calibration failure and lists the sensor(s) that failed to calibrate. In the example below, the oxygen and H₂S channels failed calibration. The other sensors calibrated normally.



The buzzer and alarm LEDs activate in a double pulsing pattern. Press the POWER ENTER RESET button to reset the alarm and continue to the Calibration Value Screen for the infrared CO₂ channel. After calibrating the infrared CO₂ channel by following the instructions below, attempt to calibrate the standard channels again. If the failure continues, investigate the cause. See "Troubleshooting" on page 96..

36. Remove the tubing from the rigid tube on the probe.

37. Unscrew the 4-gas cylinder from the demand flow regulator.

38. If you want to change the infrared CO₂ channel's calibration gas value, follow Step 21 - Step 30 above beginning with the infrared CO₂ Calibration Gas Value Screen below instead of the standard channel Calibration Gas Value Screen.

<p>CAL GAS VALUE</p> <p>CO2 2.50 vol%</p> <p>ENTER TO BEGIN CAL</p>
--

39. With the infrared CO₂ Calibration Gas Value Screen displayed, press the POWER ENTER RESET button to proceed to the Calibration In Process Screen for the infrared CO₂ channel with **CAL IN PROCESS** flashing.

<p>CAL IN PROCESS</p> <p>CO2 0.00 vol%</p> <p>ENTER WHEN DONE</p>
--

If you do not want to proceed with the calibration, press the DISPLAY ADJUST NO button to return to the infrared CO₂ Cal Gas Values Screen.

If you do want to continue with the calibration, proceed to the next step.

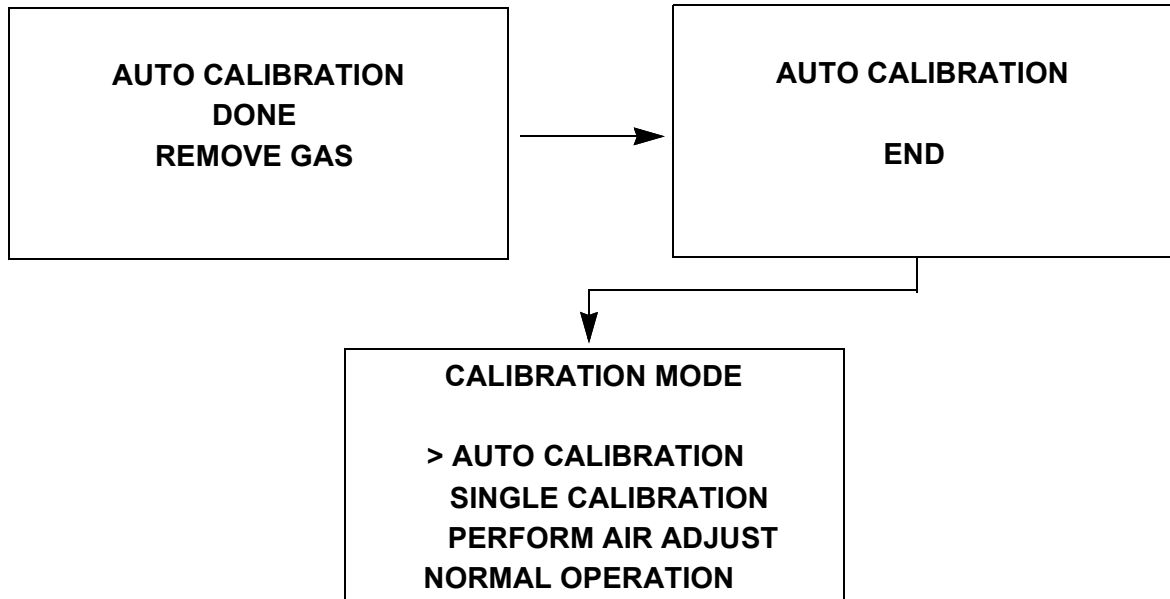
40. Screw the infrared CO₂ calibration cylinder onto the demand flow regulator.
41. Connect the tubing from the regulator to the rigid tube on the probe. Allow the Eagle 3 to draw gas for the appropriate time shown in the table below.

Table 31: IR CO₂ Sensor Calibration Times

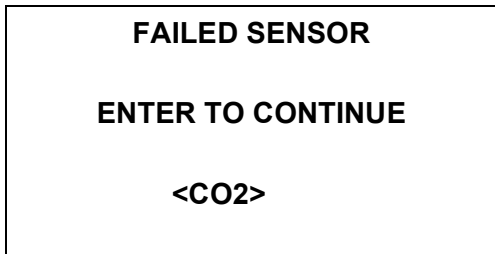
Range	Calibration Time
0-5.00 %vol	1 minute
0-10,000 ppm	90 seconds
0-60.0 %vol	90 seconds

42. Press the POWER ENTER RESET button to set the span adjustment for the infrared CO₂ channel to the programmed value.

43. If the infrared CO₂ channel passed calibration, the following screen sequence occurs.



If the infrared CO₂ channel cannot be adjusted to the proper value, a screen displays that indicates a calibration failure and indicates that the infrared CO₂ sensor failed to calibrate.



The buzzer and alarm LEDs activate in a double pulsing pattern. Press the POWER ENTER RESET button to reset the alarm and continue to the Calibration Mode Screen. Attempt to calibrate the infrared CO₂ channel again. If the failure continues, investigate the cause. See "Troubleshooting" on page 96..

44. Disconnect the tubing from the probe.

45. Unscrew the demand flow regulator from the calibration cylinder.

46. Use the RANGE ▼ SHIFT button to place the cursor next to the **NORMAL OPERATION** menu option, then press the POWER ENTER RESET button to return to Normal Mode.

Maintenance

This section includes a procedure for replacing an infrared CO₂ sensor.

Replacing the IR CO₂ Sensor or Changing Sensor Type

1. Verify that the Eagle 3 is off.
2. Place the Eagle 3 upside down on a flat surface or hold it upside down.
3. Unscrew the three case screws until they disengage from the top case. They are captive screws so they will not fall off of the bottom case.
4. Turn the Eagle 3 right side up and carefully lift the top case away from the bottom case. Be careful not to lift it so far that it pulls on the main PCB with the cable that connects the top case to the main PCB.
5. Lay the top case down next to the bottom case to allow access to the flow system.
6. Locate the infrared CO₂ sensor. It has a twelve wire cable with a connector that mates to an infrared sub PCB that is installed on the main PCB and is normally located next to the pump. Figure 35 on page 295 shows an infrared CO₂ sensor in a typical location.
7. Unscrew and remove the two screws that hold down the infrared CO₂ sensor bracket.
8. Grasp the sensor firmly and pull it out of the infrared CO₂ flow chamber. Rock it back and forth gently if necessary to pull it out. Take care not to pull the cable from the sub PCB.
9. Rotate the locking lever counterclockwise on the cable connector that mates to the infrared CO₂ sensor to unlock it.
10. Unplug the old infrared CO₂ sensor from the cable.
11. Connect the new infrared CO₂ sensor to the sensor cable and rotate the locking lever clockwise to lock the connector.
12. Insert the sensor into the infrared CO₂ flow chamber and push it in until it bottoms out.
13. Line up the holes in the infrared CO₂ sensor bracket with the two standoffs on the infrared CO₂ chamber.
14. Install the two sensor bracket screws.
15. Confirm that the main PCB is seated in its slots and that its bottom edge is resting on the bottom of the bottom case. If the main PCB is not seated properly, it may be damaged when the top case is re-installed.
16. Make sure that the top case gasket is fully seated in its groove and carefully put the top case back on the bottom case. If you have any difficulty mating the top and bottom cases, inspect the placement of the main PCB and the placement of the top case gasket.

17. Turn the Eagle 3 upside down and tighten the three case screws to secure the top case to the bottom case.
18. Calibrate the infrared CO₂ channel as described on page 298.

IR CO₂ Eagle 3 Parts List

Table 32:

Part Number	Description
33-6010RK-01	CO ₂ scrubber
47-5051RK	Infrared CO ₂ sensor cable
DEM-3313-1	Infrared CO ₂ sensor, 0-5 %vol
DEM-3313-4	Infrared CO ₂ sensor, 0-10,000 ppm
DEM-3313-5	Infrared CO ₂ sensor, 0-60 %vol
81-0071RK-01	Calibration cylinder, 5000 ppm CO ₂ in nitrogen, 34 liter steel
81-0071RK-03	Calibration cylinder, 5000 ppm CO ₂ in nitrogen, 103 liter
81-0072RK-01	Calibration cylinder, 2.5 %vol CO ₂ in nitrogen, 34 liter steel
81-0072RK-03	Calibration cylinder, 2.5 %vol CO ₂ in nitrogen, 103 liter
81-0073RK-01	Calibration cylinder, 15 %vol CO ₂ in nitrogen, 34 liter steel
81-0073RK-03	Calibration cylinder, 15 %vol CO ₂ in nitrogen, 103 liter

Appendix G: Infrared Methane Sensor

Overview

This appendix describes the Eagle 3's infrared methane sensors and includes instructions to use an Eagle 3 that has an infrared methane sensor installed. It also includes instructions to replace an infrared methane sensor.

Table 33: Infrared Methane Sensor Specifications, % LEL Configuration

Range	Increment	Alarm 1	Alarm 2	STEL	TWA
0-100 % LEL CH ₄	1 % LEL	10 % LEL	50 % LEL	N/A	N/A

Table 34: Infrared Methane Sensor Specifications, Autoranging Configuration

Range	Increment	Alarm 1	Alarm 2	STEL	TWA
0-100 % LEL CH ₄	1 % LEL	10 % LEL	50 % LEL	N/A	N/A
5.0-100.0 %vol CH ₄	0.5 %vol	OFF	OFF	N/A	N/A

Table 35: Infrared Methane Sensor Specification, % volume Configuration

Range	Increment	Alarm 1	Alarm 2	STEL	TWA
0-100.0 %vol CH ₄	0.5 %vol	OFF	OFF	N/A	N/A

Target Gases

The infrared methane sensor is setup for and factory-calibrated to methane. There are gases that the sensor will still detect and respond to. There are also gases that the methane sensor will not detect or respond to. Lists of the gases falling in each of these respective categories can be found below. Consult with RKI Instruments, Inc. for combustible gases not listed below.

The infrared methane sensor is known to respond to the following combustible gases:

- ethane
- hexane
- IPA
- isobutane
- MEK
- propane
- styrene
- toluene

The infrared methane sensor is known to not or to poorly respond to the following combustible gases:

- acetylene
- benzene
- hydrogen

Description

Table 33 and Table above list the available infrared methane sensor configurations. The infrared methane sensor is a smart sensor that stores the target gas.

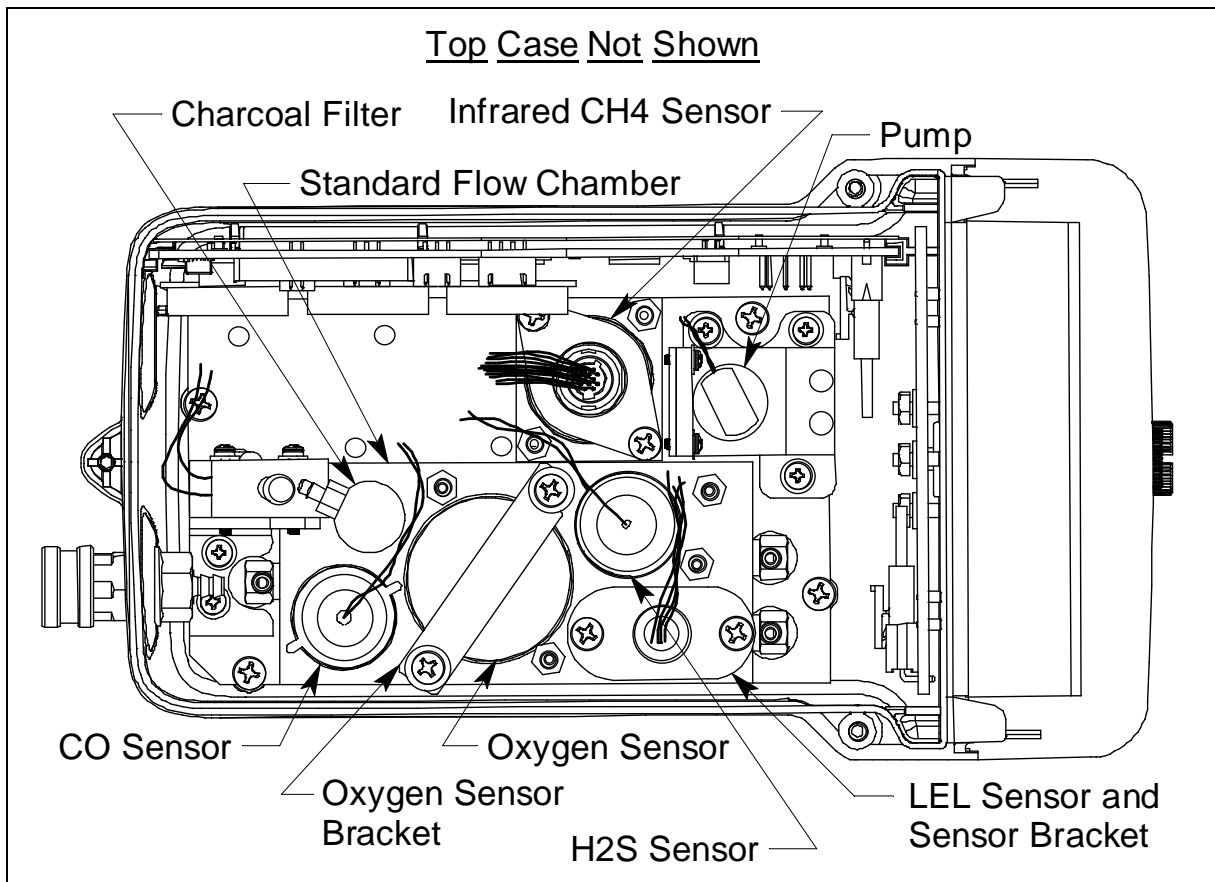


Figure 37: Typical IR Methane Sensor Location

The infrared methane sensor is installed in a single sensor flow chamber which is located in the area next to the standard 4-sensor flow chamber. This area can accommodate up to three single sensor flow chambers. Figure 37 above illustrates a typical infrared methane sensor location in front of the pump. The infrared methane flow chamber may also be installed in one of the other two sensor chamber locations depending on the particular version of the Eagle 3. Some infrared methane instrument configurations do not include the 4-sensor flow chamber.

Infrared Methane Sensor

The infrared methane sensor is a cylindrical sensor with a diffusion opening on the front and a 12 pin circular connector on the back. A 12 wire cable plugs into the back of the infrared methane sensor with a circular connector that includes a locking lever. The other end of the cable plugs into an infrared sub PCB (see description below) that is installed on the main PCB. The sensor is held in the infrared flow chamber by a bracket on standoffs.

Infrared Sub PCB

The infrared sub PCB is a circuit board that is installed on the main PCB in one of the 3 sub PCB positions when an infrared methane sensor is used with the Eagle 3. The infrared methane sensor connects to the sub PCB with a 12-position connector. The sub PCB plugs into the main PCB and is held in place with a screw/flat washer/lock washer. There are no user-serviceable parts on the infrared sub PCB.

Start Up and Normal Operation

For instructions to warmup and use an Eagle 3 that includes an infrared methane sensor, reference “Start Up” on page 30, “Normal Mode Operation” on page 42, and “Alarms” on page 50.

Detection Ranges

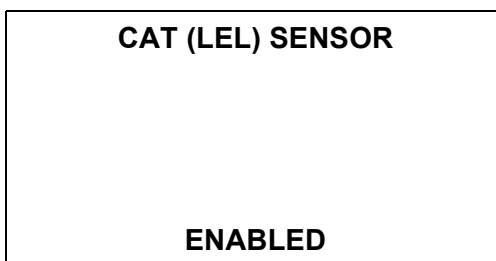
The infrared methane sensor can be factory set to detect gas in a 0-100 % LEL configuration, an autoranging configuration, or a 0 - 100.0 % volume configuration. The autoranging configuration detects gas on a 0-100 % LEL and a 5.0-100.0 %vol scale. The gas reading will be displayed in % LEL until the gas level reaches 100 % LEL, or 5.0 %vol for methane. Once the gas reading is above 100 % LEL, it is displayed in %vol. Alarm points exist for the % LEL range but do not exist for the %vol range.

Catalytic (LEL) Sensor Screen

When either a TC sensor or an infrared combustible sensor is installed in an Eagle 3 along with a catalytic combustible LEL sensor, the user has the option of turning off the catalytic combustible LEL sensor in Display Mode. If the unit is going to be used for sampling known high-levels of combustible gas or in areas with known catalytic sensor poisons such as silicone vapors, the catalytic combustible sensor should be turned off. Even though this sensor has its own protective shut off, exposure to high levels of combustible gas can still stress the catalytic LEL sensor. The catalytic LEL sensor can be enabled or disabled in the Catalytic (LEL) Sensor screen in Display Mode. The default setting is enabled. To change the setting, do the following:

NOTE: The Catalytic (LEL) Sensor setting is reset when the Eagle 3 is turned off. When the Eagle 3 is turned on, this setting is always ENABLED.

1. Use the DISPLAY ADJUST NO button to enter Display Mode and scroll to the Catalytic (LEL) Sensor screen. The current setting will be flashing.



2. Use the AIR ▲YES or RANGE ▼ SHIFT button to toggle to the desired setting.
If set to DISABLED, the gas readings for the catalytic LEL channel will be replaced by dashes (---).
3. Press POWER ENTER RESET to save the setting and return to the main menu.
4. Use the DISPLAY ADJUST NO button to scroll through the rest of Display Mode and enter Normal Operation.

Infrared Methane Calibration

An infrared methane channel can be calibrated using the auto calibration method or the single calibration method. To calibrate an infrared methane channel using the single calibration method, see page 94 and follow the instructions for calibrating a single channel. If your instrument is a multi-channel instrument that includes an infrared methane channel, RKI Instruments, Inc. recommends using the auto calibration method for convenience. The calibration instructions below show a 5 channel instrument which has the four standard channels, LEL/oxygen/H₂S/CO, and an infrared methane channel configured for autoranging.

The standard factory calibration for the autoranging infrared methane sensor is to 50 % LEL. If your instrument is configured for autoranging and you need maximum accuracy in the %vol range, the sensor may be calibrated to 50 %vol.

To use the auto calibration method to calibrate a multi-channel instrument that includes an infrared methane channel, do the following:

1. See “Entering Calibration Mode” on page 77 for a description of the necessary calibration supplies. In addition to an appropriate multi-gas cylinder that is used to calibrate any active standard channels, you will also need a cylinder to calibrate the infrared methane channel. See page 322 for available cylinders. Make sure your calibration cylinder is appropriate for the infrared methane detection range.
2. Find a fresh-air environment. This is an environment free of toxic or combustible gases and of normal oxygen content (20.9%).
3. While in Normal Mode, press and hold the RANGE ▼ SHIFT button, then press the DISPLAY ADJUST NO button both buttons.
4. If the unit prompts you for the password, enter it by using the AIR ▲YES and RANGE ▼ SHIFT buttons to select each password number and then pressing and releasing POWER ENTER RESET to enter the number and move on to the next one.
5. The Calibration Mode Screen displays with the cursor next to **AUTO CALIBRATION**.

<p>CALIBRATION MODE</p> <p>> AUTO CALIBRATION</p> <p>SINGLE CALIBRATION</p> <p>PERFORM AIR ADJUST</p> <p>NORMAL OPERATION</p>

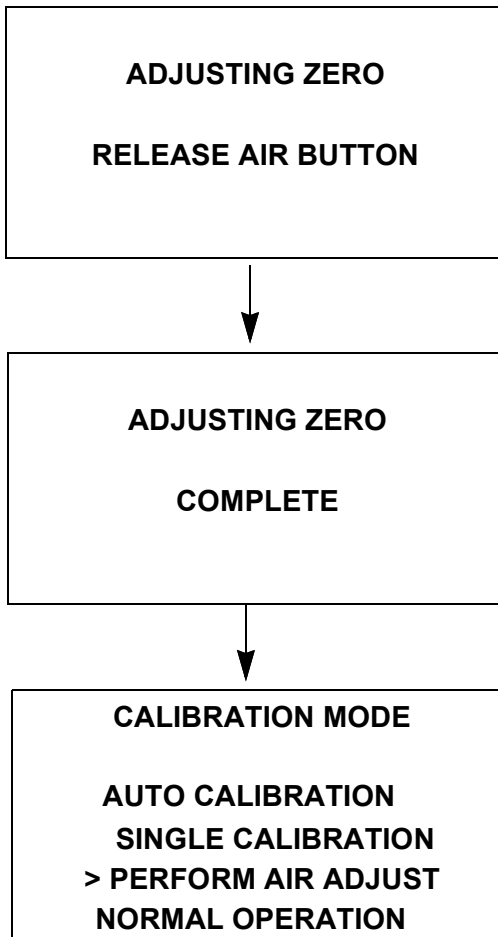
6. Move the cursor to the **PERFORM AIR ADJUST** menu item by using the RANGE ▼ SHIFT button.

<p>CALIBRATION MODE</p> <p>AUTO CALIBRATION</p> <p>SINGLE CALIBRATION</p> <p>> PERFORM AIR ADJUST</p> <p>NORMAL OPERATION</p>

7. Press the POWER ENTER RESET button. The following screen appears.

<p>PERFORM</p> <p>AIR ADJUST?</p>

8. Press the AIR ▲YES button to continue.
If you do not want to continue, press the DISPLAY ADJUST NO button and the unit will return to the Calibration Mode Screen.
9. The Eagle 3 will indicate that it is adjusting the zero reading for a few seconds, then indicate that the operation is complete before returning to the Calibration Mode Screen.



10. Install the demand flow regulator onto the multi-gas calibration cylinder.
11. Connect the sample tubing to the demand flow regulator.
12. Install the probe on the Eagle 3 inlet fitting. Make sure the probe is complete with internal O-ring and membrane and that the two halves of the probe are tightened firmly together to avoid leaks that can affect the calibration. See Figure 17 on page 99 for an illustration of the internal parts of the probe.

13. Move the cursor next to the **AUTO CALIBRATION** menu item by using the AIR ▲YES button.

<p>CALIBRATION MODE</p> <p>> AUTO CALIBRATION</p> <p>SINGLE CALIBRATION</p> <p>PERFORM AIR ADJUST</p> <p>NORMAL OPERATION</p>

14. Press the POWER ENTER RESET button to display the Calibration Gas Values Screen.

<p>CAL GAS VALUES</p> <p>CH4 50 % LEL</p> <p>OXY 12.0 vol%</p> <p>H2S 25.0 ppm</p> <p>CO 50 ppm</p> <p>ENTER TO BEGIN CAL</p>

The gas concentrations displayed in the Calibration Gas Values Screen must match the gas concentrations listed on the 4-gas calibration cylinder.

If *all* concentrations match, go to Step 25.

If *one or more* concentrations *do not* match, continue with Step 15.

If you do not want to continue with the calibration, press the DISPLAY ADJUST NO button to return to the Calibration Mode Screen.

NOTE: The RKI 4-gas cylinder typically contains 12% O₂ by volume. When using the auto calibration method, be sure to set the “OXY” auto calibration value to agree with the concentration listed on the cylinder’s label, not zero.

15. To adjust the values on the screen, press and hold the RANGE ▼ SHIFT button, then press the DISPLAY ADJUST NO button both. The following screen appears with the cursor next to **CH4**.

<p>ADJUST AUTO</p> <p>CALIBRATION VALUES</p> <p>> CH4 50 % LEL</p> <p>OXY 12.0 vol%</p> <p>H2S 25.0 ppm</p> <p>CO 50 ppm ▼</p>

16. Place the cursor next to the channel whose gas value you want to change using the AIR ▲ YES and RANGE ▼ SHIFT buttons.
17. Press the POWER ENTER RESET button to select the channel. The calibration gas value begins to flash.

18. Use the AIR ▲YES and RANGE ▼ SHIFT buttons to adjust the calibration gas setting to the desired value.

NOTE: The calibration gas value cannot be set lower than the low alarm setting. If the calibration gas value listed on the calibration cylinder is lower than the current low alarm setting, enter Setup Mode and change the low alarm setting. See page 145 for instructions. If you need to change the alarm point setting only to perform a calibration, make sure that you change the alarm point setting back to its original value once the calibration has been performed.

19. Press the POWER ENTER RESET button to save the change. The calibration gas value stops flashing.
20. Repeat Step 16 through Step 19 for any other channels that need to be changed.
21. When you are done adjusting the calibration gas values, move the cursor down past the bottom of the screen next to **END**.

**ADJUST AUTO
CALIBRATION VALUES
> END**

22. Press the POWER ENTER RESET button. The following screen appears.

**DO YOU WANT TO
STORE NEW VALUE(S)
IN MEMORY FOR
FUTURE CALIBRATIONS?**

PRESS YES OR NO

23. If you select YES by pressing and releasing the AIR ▲YES button, the changes that you made will be saved in the Eagle 3's memory as the new auto calibration gas values.

If you select NO by pressing and releasing the DISPLAY ADJUST NO button, the changes you made will be used for any calibrations performed during the current operating session only. The Eagle 3 will delete the changes when the unit is turned off and will load the previous set of auto calibration values when it is turned on again.

24. When you make your selection and press the desired button, the unit returns to the Calibration Gas Values Screen.

CAL GAS VALUES	
CH4	50 % LEL
OXY	12.0 vol%
H2S	25.0 ppm
CO	50 ppm
ENTER TO BEGIN CAL	

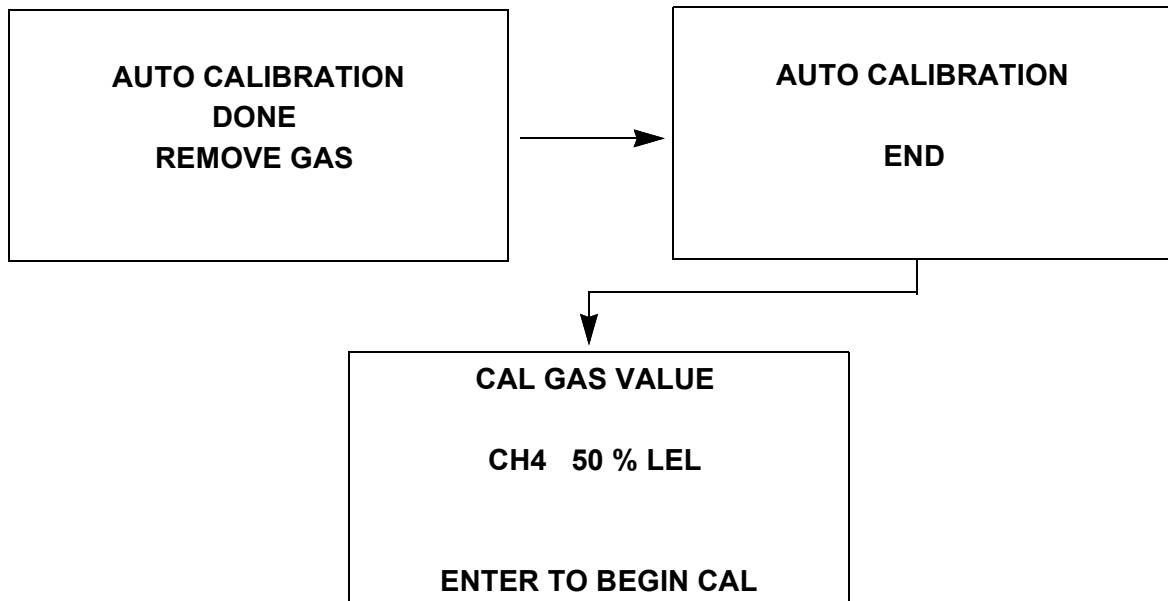
25. Press the POWER ENTER RESET button to proceed to the Calibration In Process Screen with **CAL IN PROCESS** flashing.

CAL IN PROCESS	
CH4	0 % LEL
OXY	20.9 vol%
H2S	0.0 ppm
CO	0 ppm
ENTER WHEN DONE	

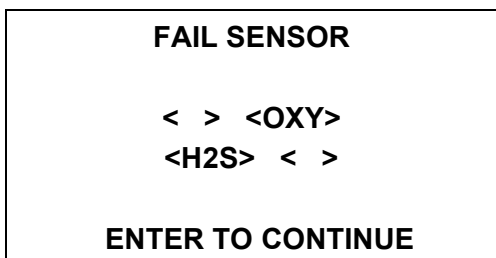
If you do not want to proceed with the calibration, press the DISPLAY ADJUST NO button to return to the Cal Gas Values Screen. If you do want to continue with the calibration, proceed to the next step.

26. Connect the tubing from the demand flow regulator to the rigid tube on the probe. Allow the Eagle 3 to draw gas for one minute.
27. Press the POWER ENTER RESET button to set the span adjustment for each channel to the programmed values.

28. If all channels passed calibration, the following screen sequence occurs.



If any of the sensors cannot be adjusted to the proper value, a screen displays that indicates a calibration failure and lists the sensor(s) that failed to calibrate. In the example below, the oxygen and H₂S channels failed calibration. The other sensors calibrated normally.



The buzzer and alarm LEDs activate in a double pulsing pattern. Press the POWER ENTER RESET button to reset the alarm and continue to the Calibration Value Screen for the infrared methane channel. After calibrating the infrared methane channel by following the instructions below, attempt to calibrate the standard channels again. If the failure continues, investigate the cause. See “Troubleshooting” on page 96..

29. Remove the tubing from the rigid tube on the probe.

30. Unscrew the 4-gas cylinder from the demand flow regulator.

31. If you want to change the infrared methane channel's calibration gas value, follow Step 19 - Step 28 above beginning with the infrared methane Calibration Gas Value Screen below instead of the standard channel Calibration Gas Value Screen.

CAL GAS VALUE

CH4 50 % LEL

ENTER TO BEGIN CAL

32. With the infrared methane Calibration Gas Value Screen displayed, press the POWER ENTER RESET button to proceed to the Calibration In Process Screen for the infrared methane channel with **CAL IN PROCESS** flashing.

CAL IN PROCESS

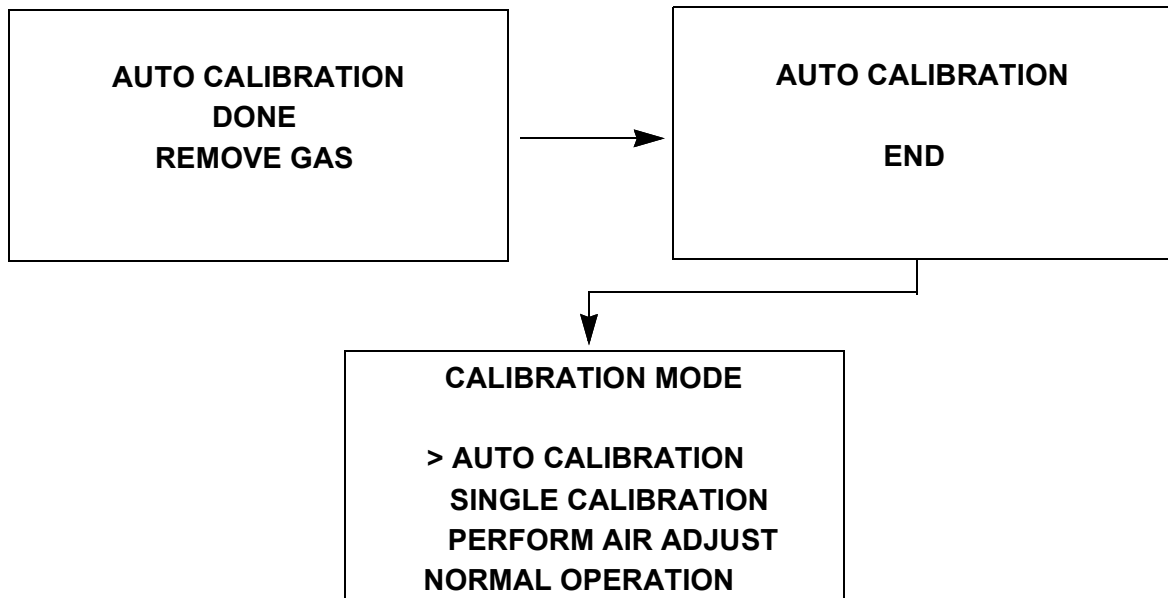
CH4 0 % LEL

ENTER WHEN DONE

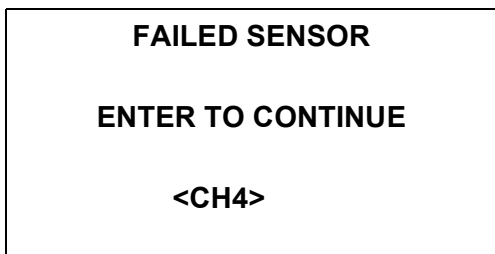
If you do not want to proceed with the calibration, press the DISPLAY ADJUST NO button to return to the infrared methane Cal Gas Values Screen. If you do want to continue with the calibration, proceed to the next step.

33. Screw the infrared methane calibration cylinder onto the demand flow regulator.
34. Connect the tubing from the regulator to the rigid tube on the probe. Allow the Eagle 3 to draw gas for 90 seconds.
35. Press the POWER ENTER RESET button to set the span adjustment for the infrared methane channel to the programmed value.

36. If the infrared methane channel passed calibration, the following screen sequence occurs.



If the infrared methane channel cannot be adjusted to the proper value, a screen displays that indicates a calibration failure and indicates that the infrared methane sensor failed to calibrate.



The buzzer and alarm LEDs activate in a double pulsing pattern. Press the POWER ENTER RESET button to reset the alarm and continue to the Calibration Mode Screen. Attempt to calibrate the infrared methane channel again. If the failure continues, investigate the cause. See "Troubleshooting" on page 96..

37. Disconnect the tubing from the probe.
38. Unscrew the demand flow regulator from the calibration cylinder.
39. Use the RANGE ▼ SHIFT button to place the cursor next to the **NORMAL OPERATION** menu option, then press the POWER ENTER RESET button to return to Normal Mode.

Maintenance

This section includes a procedure to replace an infrared methane sensor.

Replacing the IR Methane Sensor

1. Verify that the Eagle 3 is off.
2. Place the Eagle 3 upside down on a flat surface or hold it upside down.
3. Unscrew the three case screws until they disengage from the top case. They are captive screws so they will not fall off of the bottom case.
4. Turn the Eagle 3 right side up and carefully lift the top case away from the bottom case. Be careful not to lift it so far that it pulls on the main PCB with the cable that connects the top case to the main PCB.
5. Lay the top case down next to the bottom case to allow access to the flow system.
6. Locate the infrared methane sensor. It has a twelve wire cable with a connector that mates to an infrared sub PCB that is installed on the main PCB and is normally located next to the pump. Figure 37 on page 310 shows an infrared methane sensor in a typical location.
7. Unscrew and remove the two screws that hold down the infrared methane sensor bracket.
8. Grasp the sensor firmly and pull it out of the infrared methane flow chamber. Rock it back and forth gently if necessary to pull it out. Take care not to pull the cable from the sub PCB.
9. Rotate the locking lever counterclockwise on the cable connector that mates to the infrared methane sensor to unlock it.
10. Unplug the old infrared methane sensor from the cable.
11. Connect the new infrared methane sensor to the sensor cable and rotate the locking lever clockwise to lock the connector.
12. Insert the sensor into the infrared methane flow chamber and push it in until it bottoms out.
13. Line up the holes in the infrared methane sensor bracket with the two standoffs on the infrared methane chamber.
14. Install the two sensor bracket screws.
15. Confirm that the main PCB is seated in its slots and that its bottom edge is resting on the bottom of the bottom case. If the main PCB is not seated properly, it may be damaged when the top case is re-installed.
16. Make sure that the top case gasket is fully seated in its groove and carefully put the top case back on the bottom case. If you have any difficulty mating the top and bottom cases, inspect the placement of the main PCB and the placement of the top case gasket.
17. Turn the Eagle 3 upside down and tighten the three case screws to secure the top case to the bottom case.
18. Calibrate the infrared methane channel as described on page 312.

IR CH₄ Eagle 3 Parts List

Table 36:

Part Number	Description
47-5051RK	Infrared CH ₄ sensor cable
DEM-3313-3	Infrared CH ₄ sensor, 0-100 % LEL or 0-100 % LEL/5.0-100.0 %vol autoranging
81-0012RK-01	Calibration cylinder, 50 % LEL CH ₄ in air, 34 liter steel
81-0012RK-03	Calibration cylinder, 50 % LEL CH ₄ in air, 103 liter
81-0013RK-01	Calibration cylinder, 50 %vol CH ₄ in N ₂ , 34 liter steel
81-0013RK-05	Calibration cylinder, 50 %vol CH ₄ in N ₂ , 58 liter

Appendix H: Infrared Hydrocarbon Sensor

Overview

This appendix describes the Eagle 3's infrared hydrocarbon sensor and includes instructions to use an Eagle 3 that has an infrared hydrocarbon sensor installed. It also includes instructions to replace an infrared hydrocarbon sensor.

Table 37: Infrared Hydrocarbon Sensor Specifications, % LEL Configuration

Range	Increment	Alarm 1	Alarm 2	STEL	TWA
0-100 % LEL HC	1 % LEL	10 % LEL	50 % LEL	N/A	N/A

Table 38: Infrared Hydrocarbon Sensor Specifications, Autoranging Configuration

Range	Increment	Alarm 1	Alarm 2	STEL	TWA
0-100 % LEL HC	1 % LEL	10 % LEL	50 % LEL	N/A	N/A
2.0-30.0 %vol HC	0.5 %vol	N/A	N/A	N/A	N/A

NOTE: The gas name on the infrared hydrocarbon channel will normally read "HC". However, depending on the instrument's shipment date and any special requirements, your instrument may read "IBU" or some other gas name.

Target Gases

The infrared HC sensor is a general hydrocarbon sensor. It is setup for and factory-calibrated to isobutane.

Description

The infrared hydrocarbon sensor is a smart sensor that stores the target gas. The infrared hydrocarbon sensor is installed in a single sensor flow chamber which is located in the area next to the standard 4-sensor flow chamber. This area can accommodate up to three single sensor flow chambers. Figure 38 above illustrates a typical infrared hydrocarbon sensor location in front of the pump. The infrared hydrocarbon flow chamber may also be installed in one of the other two sensor chamber locations depending on the particular version of the Eagle 3. Some infrared hydrocarbon instrument configurations do not include the 4-sensor flow chamber.

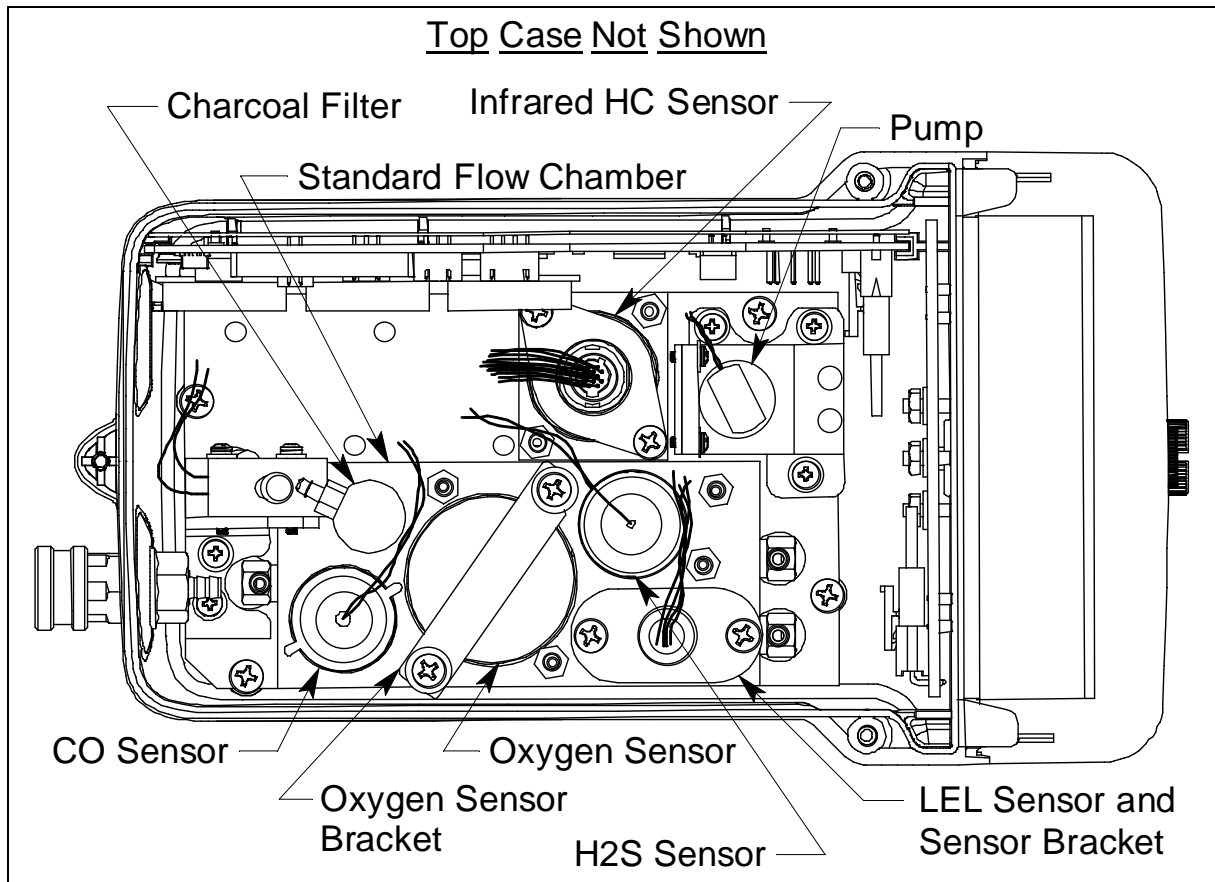


Figure 38: Typical IR HC Sensor Location

Infrared Hydrocarbon Sensor

The infrared hydrocarbon sensor is a cylindrical sensor with a diffusion opening on the front and a 12 pin circular connector on the back. A 12 wire cable plugs into the back of the infrared hydrocarbon sensor with a circular connector that includes a locking lever. The other end of the cable plugs into an infrared sub PCB (see description below) that is installed on the main PCB. The sensor is held in the infrared flow chamber by a bracket on standoffs.

Infrared Sub PCB

The infrared sub PCB is a circuit board that is installed on the main PCB in one of the 3 sub PCB positions when an infrared hydrocarbon sensor is used with the Eagle 3. The infrared hydrocarbon sensor connects to the sub PCB with a 12-position connector. The sub PCB plugs into the main PCB and is held in place with a screw/flat washer/lock washer. There are no user-serviceable parts on the infrared sub PCB.

Start Up and Normal Operation

For instructions to warmup and use an Eagle 3 that includes an infrared hydrocarbon sensor, reference “Start Up” on page 30, “Normal Mode Operation” on page 42, and “Alarms” on page 50.

0-100 % LEL/2.0-30.0 %vol Autoranging

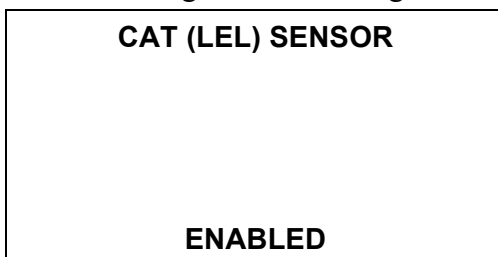
The infrared hydrocarbon sensor can be factory set to detect gas in a 0-100 % LEL configuration or an autoranging configuration. The autoranging configuration detects gas on a 0-100 % LEL and a 2.0-30.0 %vol scale. The gas reading will be displayed in % LEL until the gas level reaches 100 % LEL, or 2.0 %vol for isobutane. Once the gas reading is above 100 % LEL, it is displayed in %vol. Alarm points exist for the % LEL range but do not exist for the %vol range.

Catalytic (LEL) Sensor Screen

When either a TC sensor or an infrared combustible sensor is installed in an Eagle 3 along with a catalytic combustible LEL sensor, the user has the option of turning off the catalytic combustible LEL sensor in Display Mode. If the unit is going to be used for sampling known high-levels of combustible gas or in areas with known catalytic sensor poisons such as silicone vapors, the catalytic combustible sensor should be turned off. Even though this sensor has its own protective shut off, exposure to high levels of combustible gas can still stress the catalytic LEL sensor. The catalytic LEL sensor can be enabled or disabled in the Catalytic (LEL) Sensor screen in Display Mode. The default setting is enabled. To change the setting, do the following:

NOTE: The Catalytic (LEL) Sensor setting is reset when the Eagle 3 is turned off. When the Eagle 3 is turned on, this setting is always ENABLED.

1. Use the DISPLAY ADJUST NO button to enter Display Mode and scroll to the Catalytic (LEL) Sensor screen. The current setting will be flashing.



2. Use the AIR ▲YES or RANGE ▼ SHIFT button to toggle to the desired setting.
If set to DISABLED, the gas reading for the catalytic LEL channel will be replaced by dashes (---).
3. Press POWER ENTER RESET to save the setting and return to the main menu.
4. Use the DISPLAY ADJUST NO button to scroll through the rest of Display Mode and enter Normal Operation.

Infrared Hydrocarbon Calibration

An infrared hydrocarbon channel can be calibrated using the auto calibration method or the single calibration method. To calibrate an infrared hydrocarbon channel using the single calibration method, see page 94 and follow the instructions for calibrating a single channel. If your instrument is a multi-channel instrument that includes an infrared hydrocarbon channel, RKI Instruments, Inc. recommends using the auto calibration method for convenience. The calibration instructions below show a 5 channel instrument which has the four standard channels, LEL/oxygen/H₂S/CO, and an infrared hydrocarbon channel.

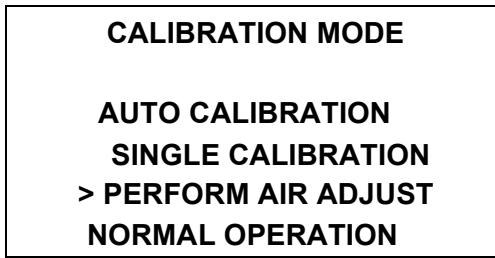
The standard factory calibration for the autoranging infrared hydrocarbon sensor is to 50 % LEL isobutane. If you need maximum accuracy in the %vol range, the sensor may be calibrated to 10 %vol isobutane.

To use the auto calibration method to calibrate a multi-channel instrument that includes an infrared hydrocarbon channel, do the following:

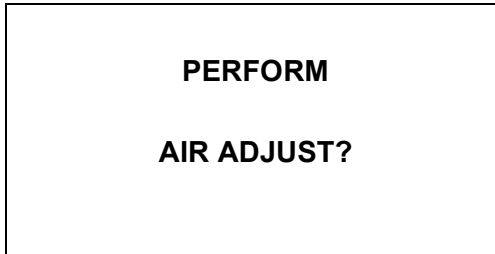
1. See “Entering Calibration Mode” on page 77 for a description of the necessary calibration supplies. In addition to an appropriate multi-gas cylinder that is used to calibrate any active standard channels, you will also need a cylinder to calibrate the infrared hydrocarbon channel. See page 336 for available cylinders. Make sure your calibration cylinder is appropriate for the infrared hydrocarbon detection range.
2. Find a fresh-air environment. This is an environment free of toxic or combustible gases and of normal oxygen content (20.9%).
3. While in Normal Mode, press and hold the RANGE ▼ SHIFT button, then press the DISPLAY ADJUST NO button both buttons.
4. If the unit prompts you for the password, enter it by using the AIR ▲YES and RANGE ▼ SHIFT buttons to select each password number and then pressing and releasing POWER ENTER RESET to enter the number and move on to the next one.
5. The Calibration Mode Screen displays with the cursor next to **AUTO CALIBRATION**.

<p>CALIBRATION MODE</p> <p>> AUTO CALIBRATION</p> <p>SINGLE CALIBRATION</p> <p>PERFORM AIR ADJUST</p> <p>NORMAL OPERATION</p>

6. Move the cursor to the **PERFORM AIR ADJUST** menu item by using the RANGE ▼ SHIFT button.

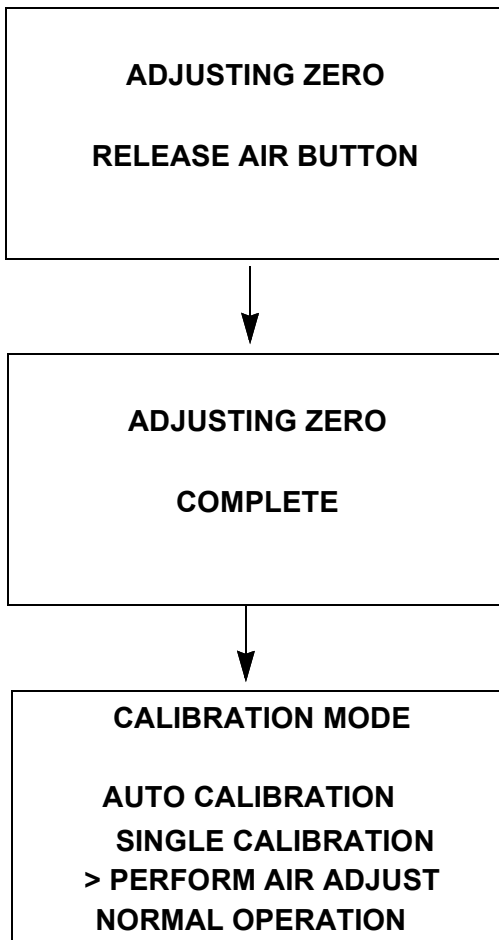


7. Press the POWER ENTER RESET button. The following screen appears.

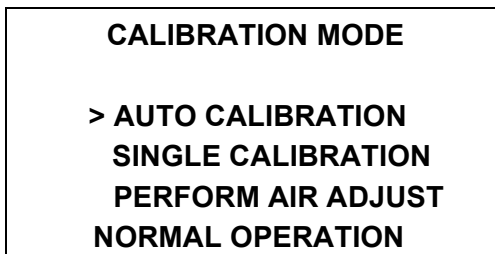


8. Press the AIR ▲YES button to continue.
If you do not want to continue, press the DISPLAY ADJUST NO button and the unit will return to the Calibration Mode Screen.

9. The Eagle 3 will indicate that it is adjusting the zero reading for a few seconds, then indicate that the operation is complete before returning to the Calibration Mode Screen.



10. Install the demand flow regulator onto the multi-gas calibration cylinder.
11. Connect the sample tubing to the demand flow regulator.
12. Install the probe on the Eagle 3 inlet fitting. Make sure the probe is complete with internal O-ring and membrane and that the two halves of the probe are tightened firmly together to avoid leaks that can affect the calibration. See Figure 17 on page 99 for an illustration of the internal parts of the probe.
13. Move the cursor next to the **AUTO CALIBRATION** menu item by using the AIR ▲YES button.



14. Press the POWER ENTER RESET button to display the Calibration Gas Values Screen.

CAL GAS VALUES		
CH4	50	% LEL
OXY	12.0	vol%
H2S	25.0	ppm
CO	50	ppm
ENTER TO BEGIN CAL		

The gas concentrations displayed in the Calibration Gas Values Screen must match the gas concentrations listed on the 4-gas calibration cylinder.

If *all* concentrations match, go to Step 25.

If *one or more* concentrations *do not* match, continue with Step 15.

If you do not want to continue with the calibration, press the DISPLAY ADJUST NO button to return to the Calibration Mode Screen.

NOTE: The RKI 4-gas cylinder typically contains 12% O₂ by volume. When using the auto calibration method, be sure to set the “OXY” auto calibration value to agree with the concentration listed on the cylinder’s label, not zero.

15. To adjust the values on the screen, press and hold the RANGE ▼ SHIFT button, then press the DISPLAY ADJUST NO button both. The following screen appears with the cursor next to **CH4**.

ADJUST AUTO		
CALIBRATION VALUES		
> CH4	50	% LEL
OXY	12.0	vol%
H2S	25.0	ppm
CO	50	ppm ▼

16. Place the cursor next to the channel whose gas value you want to change using the AIR ▲ YES and RANGE ▼ SHIFT buttons.
17. Press the POWER ENTER RESET button to select the channel. The calibration gas value begins to flash.
18. Use the AIR ▲ YES and RANGE ▼ SHIFT buttons to adjust the calibration gas setting to the desired value.

NOTE: The calibration gas value cannot be set lower than the low alarm setting. If the calibration gas value listed on the calibration cylinder is lower than the current low alarm setting, enter Setup Mode and change the low alarm setting. See page 145 for instructions. If you need to change the alarm point setting only to perform a calibration, make sure that you change the alarm point setting back to its original value once the calibration has been performed.

19. Press the POWER ENTER RESET button to save the change. The calibration gas value stops flashing.
20. Repeat Step 16 through Step 19 for any other channels that need to be changed.
21. When you are done adjusting the calibration gas values, move the cursor down past the bottom of the screen next to **END**.

**ADJUST AUTO
CALIBRATION VALUES
> END ▲**

22. Press the POWER ENTER RESET button. The following screen appears.

**DO YOU WANT TO
STORE NEW VALUE(S)
IN MEMORY FOR
FUTURE CALIBRATIONS?

PRESS YES OR NO**

23. If you select YES by pressing and releasing the AIR ▲YES button, the changes that you made will be saved in the Eagle 3's memory as the new auto calibration gas values.
If you select NO by pressing and releasing the DISPLAY ADJUST NO button, the changes you made will be used for any calibrations performed during the current operating session only. The Eagle 3 will delete the changes when the unit is turned off and will load the previous set of auto calibration values when it is turned on again.
24. When you make your selection and press the desired button, the unit returns to the Calibration Gas Values Screen.

CAL GAS VALUES
CH4 50 % LEL
OXY 12.0 vol%
H2S 25.0 ppm
CO 50 ppm
ENTER TO BEGIN CAL

25. Press the POWER ENTER RESET button to proceed to the Calibration In Process Screen with **CAL IN PROCESS** flashing.

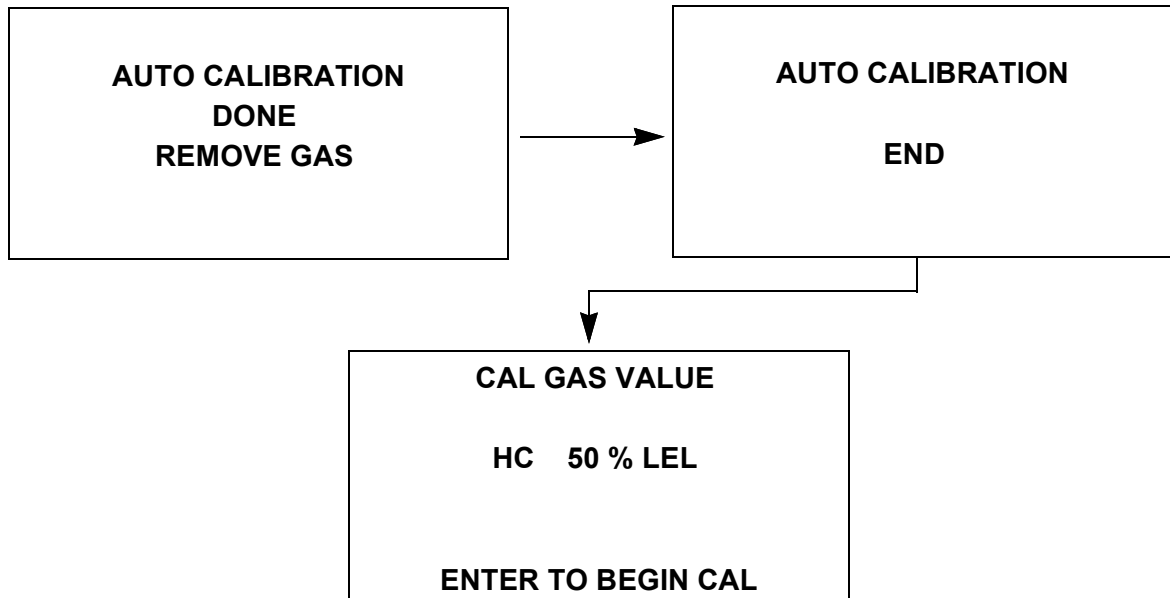
CAL IN PROCESS	
CH4	0 % LEL
OXY	20.9 vol%
H2S	0.0 ppm
CO	0 ppm
ENTER WHEN DONE	

If you do not want to proceed with the calibration, press the DISPLAY ADJUST NO button to return to the Cal Gas Values Screen.

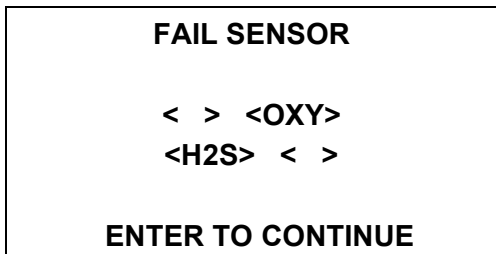
If you do want to continue with the calibration, proceed to the next step.

26. Connect the tubing from the demand flow regulator to the rigid tube on the probe. Allow the Eagle 3 to draw gas for one minute.
27. Press the POWER ENTER RESET button to set the span adjustment for each channel to the programmed values.

28. If all channels passed calibration, the following screen sequence occurs.



If any of the sensors cannot be adjusted to the proper value, a screen displays that indicates a calibration failure and lists the sensor(s) that failed to calibrate. In the example below, the oxygen and H₂S channels failed calibration. The other sensors calibrated normally.

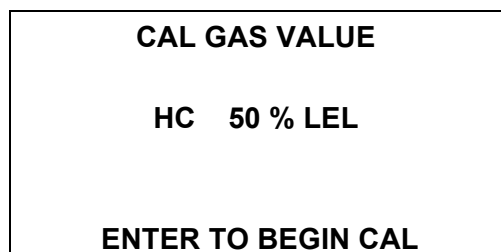


The buzzer and alarm LEDs activate in a double pulsing pattern. Press the POWER ENTER RESET button to reset the alarm and continue to the Calibration Value Screen for the infrared hydrocarbon channel. After calibrating the infrared hydrocarbon channel by following the instructions below, attempt to calibrate the standard channels again. If the failure continues, investigate the cause. See “Troubleshooting” on page 96..

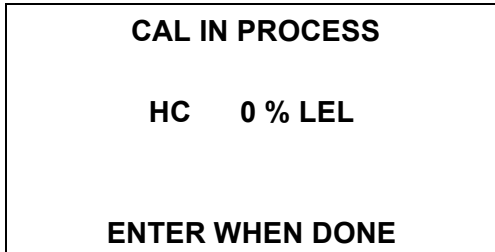
29. Remove the tubing from the rigid tube on the probe.

30. Unscrew the 4-gas cylinder from the demand flow regulator.

31. If you want to change the infrared hydrocarbon channel’s calibration gas value, follow Step 19 - Step 28 above beginning with the infrared hydrocarbon Calibration Gas Value Screen below instead of the standard channel Calibration Gas Value Screen.



32. With the infrared hydrocarbon Calibration Gas Value Screen displayed, press the POWER ENTER RESET button to proceed to the Calibration In Process Screen for the infrared hydrocarbon channel with **CAL IN PROCESS** flashing.

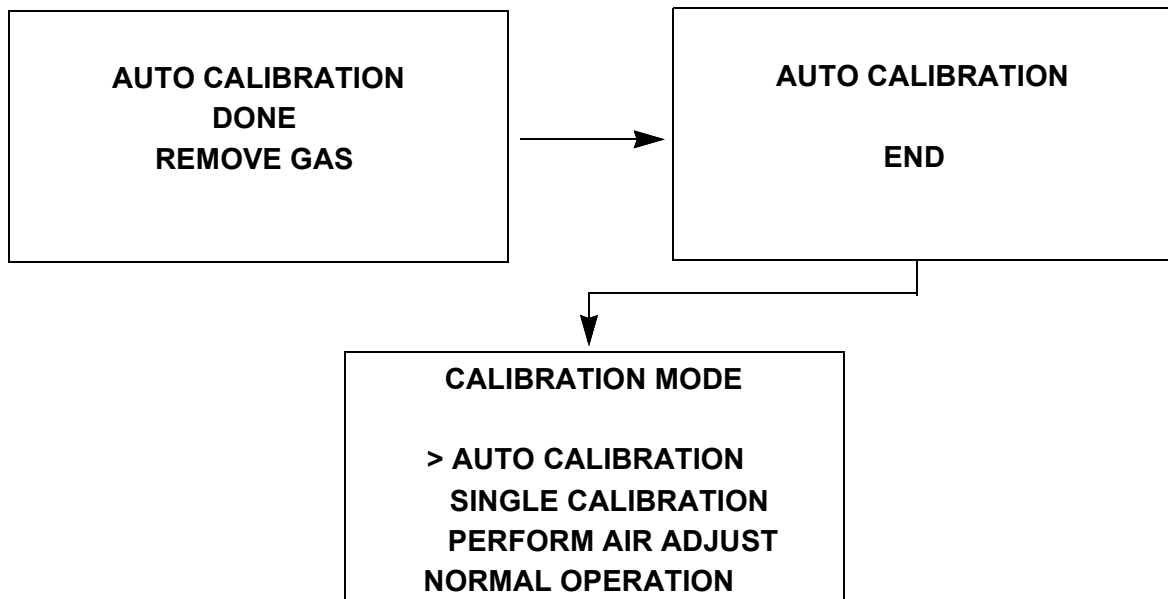


If you do not want to proceed with the calibration, press the DISPLAY ADJUST NO button to return to the infrared hydrocarbon Cal Gas Values Screen.

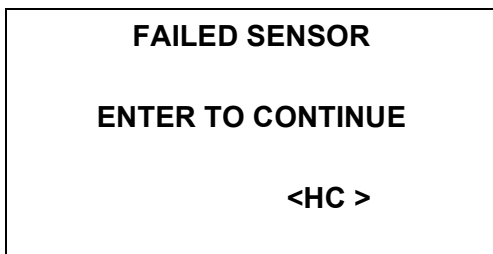
If you do want to continue with the calibration, proceed to the next step.

33. Screw the infrared hydrocarbon calibration cylinder onto the demand flow regulator.
34. Connect the tubing from the regulator to the rigid tube on the probe. Allow the Eagle 3 to draw gas for one minute.
35. Press the POWER ENTER RESET button to set the span adjustment for the infrared hydrocarbon channel to the programmed value.

36. If the infrared hydrocarbon channel passed calibration, the following screen sequence occurs.



If the infrared hydrocarbon channel cannot be adjusted to the proper value, a screen displays that indicates a calibration failure and indicates that the infrared hydrocarbon sensor failed to calibrate.



The buzzer and alarm LEDs activate in a double pulsing pattern. Press the POWER ENTER RESET button to reset the alarm and continue to the Calibration Mode Screen. Attempt to calibrate the infrared hydrocarbon channel again. If the failure continues, investigate the cause. See “Troubleshooting” on page 96..

37. Disconnect the tubing from the probe.

38. Unscrew the demand flow regulator from the calibration cylinder.

39. Use the RANGE ▼ SHIFT button to place the cursor next to the **NORMAL OPERATION** menu option, then press the POWER ENTER RESET button to return to Normal Mode.

Maintenance

This section includes a procedure to replace an infrared hydrocarbon sensor.

Replacing the IR Hydrocarbon Sensor

1. Verify that the Eagle 3 is off.
2. Place the Eagle 3 upside down on a flat surface or hold it upside down.
3. Unscrew the three case screws until they disengage from the top case. They are captive screws so they will not fall off of the bottom case.
4. Turn the Eagle 3 right side up and carefully lift the top case away from the bottom case. Be careful not to lift it so far that it pulls on the main PCB with the cable that connects the top case to the main PCB.
5. Lay the top case down next to the bottom case to allow access to the flow system.
6. Locate the infrared hydrocarbon sensor. It has a twelve wire cable with a connector that mates to an infrared sub PCB that is installed on the main PCB and is normally located next to the pump. Figure 38 on page 324 shows an infrared hydrocarbon sensor in a typical location.
7. Unscrew and remove the two screws that hold down the infrared hydrocarbon sensor bracket.
8. Grasp the sensor firmly and pull it out of the infrared hydrocarbon flow chamber. Rock it back and forth gently if necessary to pull it out. Take care not to pull the cable from the sub PCB.
9. Rotate the locking lever counterclockwise on the cable connector that mates to the infrared hydrocarbon sensor to unlock it.
10. Unplug the old infrared hydrocarbon sensor from the cable.
11. Connect the new infrared hydrocarbon sensor to the sensor cable and rotate the locking lever clockwise to lock the connector.
12. Insert the sensor into the infrared hydrocarbon flow chamber and push it in until it bottoms out.
13. Line up the holes in the infrared hydrocarbon sensor bracket with the two standoffs on the infrared hydrocarbon chamber.
14. Install the two sensor bracket screws.
15. Confirm that the main PCB is seated in its slots and that its bottom edge is resting on the bottom of the bottom case. If the main PCB is not seated properly, it may be damaged when the top case is re-installed.
16. Make sure that the top case gasket is fully seated in its groove and carefully put the top case back on the bottom case. If you have any difficulty mating the top and bottom cases, inspect the placement of the main PCB and the placement of the top case gasket.
17. Turn the Eagle 3 upside down and tighten the three case screws to secure the top case to the bottom case.
18. Calibrate the infrared hydrocarbon channel as described on page 326.

IR HC Eagle 3 Parts List

Table 39: IR HC Parts List

Part Number	Description
47-5051RK	Infrared HC sensor cable
DEM-3313-2	Infrared HC sensor, 0-100 % LEL/2.0-30.0 %vol autoranging
81-0018RK-01	Calibration cylinder, 50 % LEL isobutane in air, 34 liter steel
81-0018RK-03	Calibration cylinder, 50 % LEL isobutane in air, 103 liter
81-0019RK	Calibration cylinder, 10 % volume isobutane in nitrogen, 17 liter

Appendix I: Methane Elimination Mode

Overview

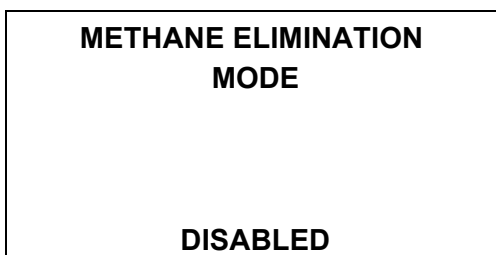
For applications where methane is an interfering gas, you can set the Eagle 3 to eliminate most response to methane using methane elimination mode.

CAUTION: *The Eagle 3 catalytic combustible sensor experiences a significant gas response drop when it is changed from full response mode to methane elimination mode. The Eagle 3 must be calibrated in both full response mode and in methane elimination mode to account for this. See “Calibration” on page 340. for further instructions.*

Monitoring in Methane Elimination Mode

To monitor an area using methane elimination mode, do the following:

1. Turn on the Eagle 3 as described in “Start Up” on page 30.
2. Make sure that the Eagle 3 catalytic combustible channel is set to monitor a gas in which methane elimination is an option. For a list of these gases and a procedure to select one, see page 135. A common target gas is hexane. Once a gas that allows for methane elimination is selected for the catalytic combustible channel, the methane elimination mode screen becomes part of Display Mode.
3. Press **DISPLAY** to enter Display Mode and to scroll through the screens until you reach the Methane Elimination Mode screen. The current setting is displayed.



4. Press the AIR ▲YES or RANGE ▼ SHIFT button to toggle the setting to ENABLED.
5. Press the POWER ENTER RESET button. The unit will save the setting and proceed to the next menu item.
6. You will note that if methane elimination is enabled, the Catalytic Sensor Relative Response screen no longer appears even if the relative response feature in Setup Mode is turned on. While methane elimination is enabled, the Catalytic Sensor Relative Response screen will not appear in Display Mode even if the relative response feature in Setup Mode is enabled.

7. Continue to press **DISPLAY** until the Normal Mode screen appears.

HEX	0% LEL	ME
OXY	20.9vol%	
H2S	0.0ppm	
CO	0ppm	

When the instrument is reading in methane elimination, an ME appears in line with the catalytic combustible channel reading.

8. Allow 2 minutes for the combustible sensor to stabilize.
9. Perform a demand zero. See page 40 for instructions.
10. Monitor for the target gas.
11. If you wish to monitor for any other gas while in methane elimination mode, a conversion factor must be taken into consideration. With the Eagle 3 calibrated to hexane, use Table 40 below to determine the concentrations of other target gases. Multiply the display reading by the factor in the appropriate column to determine the actual reading for that gas. For example, if you are using the Eagle 3 in methane elimination mode to detect isobutane and the display reads 10% LEL, the actual isobutane reading is $10\% \times 0.59 = 5.9\%$ LEL isobutane.

Table 40: Methane Elimination Mode Conversion Factors (Hexane Calibration)

Target Gas	LEL Factor	PPM Factor	Target Gas	LEL Factor	PPM Factor
Acetone	0.58	1.32	Isobutane	0.59	0.97
Benzene	1.01	1.10	Isopropanol	0.85	1.55
Butyl Acrylate	*	1.52	Methane	No response	No response
Butyl Acetate	1.34	1.58	Methanol	0.58	3.16
2-Butyl Alcohol	0.84	1.30	Methyl Acetate	0.55	1.55
1-Butyl Alcohol	1.71	2.18	Methyl Acrylate	0.83	2.11
Cyclohexane	1.06	1.25	Methyl Ethyl Key-tone	1.04	1.32
Cumene	1.74	1.42	Methyl Isobutyl Keytone	1.30	1.42
Ethylene Dichloride	2.04	11.50	Mixed Xylenes	1.36	1.36
Ethyl Alcohol	0.57	1.71	Nonane	1.66	1.21
Ethyl Chloride	0.59	2.04	Pentane	0.54	0.74
Ethyl Acrylate	1.32	1.68	Propane	Low response	Low response
Hexane	1.00	1.00	Styrene	1.74	1.42

Table 40: Methane Elimination Mode Conversion Factors (Hexane Calibration)

Target Gas	LEL Factor	PPM Factor	Target Gas	LEL Factor	PPM Factor
Hydrogen	0.48	1.75	Toluene	1.25	1.25
			Vinyl Acetate Monomer	0.92	2.17
* Vapor pressure too low for significant LEL reading					

WARNING: The Eagle 3's alarms are initiated by the display reading, not the factored reading. If you are monitoring for isobutane as in the above example and the low alarm is set for 10% LEL, the Eagle 3 will initiate a low alarm at 5.9% LEL isobutane (display reading of 10% LEL).

12. To return to full response mode, return to the Methane Elimination Mode screen in Display Mode and press the AIR ▲YES or RANGE ▼ SHIFT button to toggle the setting to DISABLED.
13. Press the POWER ENTER RESET button. The unit will save the setting and proceed to the next menu item.
14. Continue to press the DISPLAY button until the Normal Mode screen appears.

HEX	0% LEL
OXY	20.9vol%
H2S	0.0ppm
CO	0ppm

The ME is no longer next to the catalytic combustible channel reading indicating that the unit is measuring in full response mode.

15. Allow 2 minutes for the combustible sensor to stabilize before monitoring the target gas.
16. Perform a demand zero. See “Performing a Demand Zero” on page 40 for instructions.
17. Monitor for the target gas.

NOTE: The Eagle 3 retains the methane elimination mode setting when it is turned off. The methane elimination mode setting, ENABLED or DISABLED, will remain in effect until it is changed in Display Mode. So if methane elimination mode is enabled when you turn off the Eagle 3, it will remain enabled when you turn the Eagle 3 on again.

Calibration

The Eagle 3 stores calibration data for the instrument both in methane elimination mode and in full response mode. When using the instrument for applications where methane elimination mode is used, it is most common to calibrate to hexane. If you are planning to use the Eagle 3 in methane elimination mode, RKI Instruments, Inc. recommends that you setup and calibrate the instrument to hexane in both full response and methane elimination mode unless your application requires a different setup and calibration. See “Configuring the Gases (Configure Gases)” on page 135 for instructions to setup the catalytic combustible channel gas.

CAUTION: *The Eagle 3 catalytic combustible sensor experiences a significant gas response drop when it is changed from full response mode to methane elimination mode. The Eagle 3 must be calibrated in both full response mode and in methane elimination mode to account for this.*

To properly calibrate the instrument, do the following:

1. With the Eagle 3 catalytic combustible channel set up for hexane, perform a demand zero and a calibration while in full response. See “Chapter 5: Calibration Mode” on page 77 for instructions.
2. Enable methane elimination in Display Mode.
3. Allow the unit to stabilize for 2 minutes.
4. Perform a demand zero and a calibration while in methane elimination mode. See page 77 for instructions.

Appendix J: Using the Eagle 3 in Bar Hole Mode

Overview

This chapter explains how to operate the Eagle 3 in Bar Hole Mode. Bar Hole Mode is used to perform consistent checks of bar holes when tracking down underground gas leaks. When the Eagle 3 is in Bar Hole Mode, only the combustible and oxygen sensors are displayed.

If an Eagle 3 is intended for bar hole testing, it is shipped with Bar Hole Mode or both Bar Hole Mode and Leak Check Mode enabled so that the operator must choose which operational mode to use when the unit is turned on (see page 194).

Start Up, Bar Hole Mode

This section explains how to start up the Eagle 3 in Bar Hole Mode and get it ready for operation.

Turning On the Eagle 3, Bar Hole Mode

WARNING: *If one or more sensors other than a catalytic LEL, TC, or oxygen sensor is installed, these sensors will not be active while the Eagle 3 is in Bar Hole Mode.*

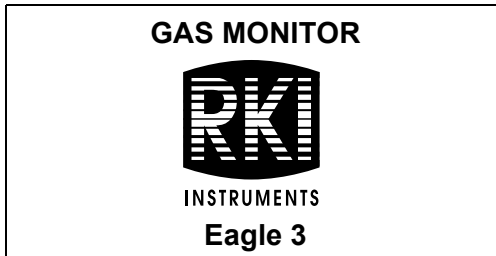
WARNING: *Gas alarms are not active when the Eagle 3 is in Bar Hole Mode.*

The following description of the Eagle 3 start up sequence assumes that the following menu items in Setup Mode are turned on: CAL REMINDER and USER/STATION ID. If either of these items is turned off, then the corresponding screen will not appear.

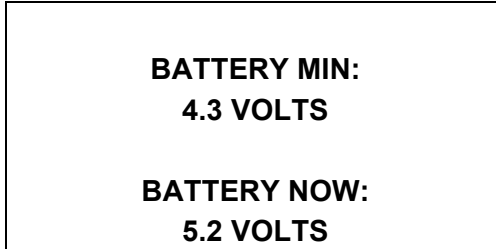
NOTE: In order for **BAR HOLE MODE** to appear as a selection in the Mode Select Screen in Step 3 below, the Eagle 3 must have both a catalytic LEL sensor and a TC sensor installed. In addition, both the catalytic LEL and TC channels must be configured for methane, CH₄, in the CONFIGURE GASES menu item in Setup Mode. If an Eagle 3 has only the catalytic LEL sensor installed or if the TC channel is configured for a gas other than CH₄, then **BAR HOLE MODE** will not appear as a choice as shown in Step 3 below and **NORMAL MODE** and **LEAK CHECK MODE** will be the only choices displayed. In this case, see “Turning On the Eagle 3” on page 30 or “Turning On the Eagle 3, Leak Check Mode” on page 349.

1. Connect the sample hose to the Eagle 3’s quick connect inlet fitting.
2. Connect the bar hole probe to the sample hose’s quick connect fitting.
3. Press and briefly hold down the POWER ENTER RESET button. Release the button when you hear a beep.

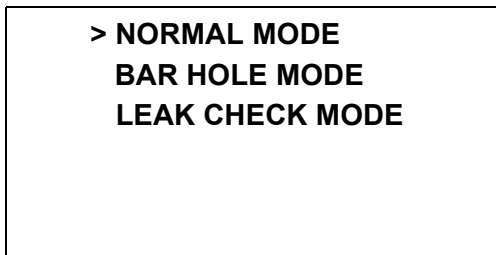
4. The LCD will show the following screen for about ten seconds.



5. The Battery Voltage Screen appears for a few seconds.



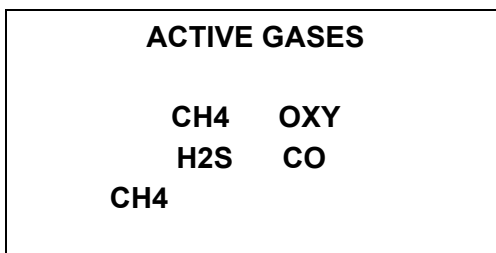
6. The Mode Select Screen displays.



7. The cursor will flash in front of **NORMAL MODE**. Use the RANGE ▼ SHIFT button to move the cursor next to **BAR HOLE MODE**.
8. With Bar Hole Mode selected, press the POWER ENTER RESET button to begin the Bar Hole Mode warmup sequence.

NOTE: If no button is pressed for 20 seconds, the unit will proceed into whichever mode has the cursor in front of it.

9. The Active Gases Screen appears for a few seconds indicating which channels are active and their target gas.



10. The gas alarm setpoints are displayed by three screens in sequence: the Low Alarm Screen, High Alarm Screen, and STEL/TWA Alarm Screen. Each screen remains on the LCD for three seconds.

**A CH4 10 % LEL
L L OXY 19.5 vol%
O A H2S 10.0 ppm
WR CO 25 ppm
CH4 M0 vol%
S**

**A CH4 50 % LEL
HL OXY 23.5 vol%
I A H2S 30.0 ppm
GR CO 50 ppm
CH4 HM0 vol%
S**

**ALARMS STEL & TWA
H2S(ppm) 15.0 10.0
CO (ppm) 200 25
CH4(vol%) OFF OFF**

11. After the alarm screens, if CAL REMINDER is turned on, the screen that appears next depends on how CAL PAST DUE ACT is set in the Setup Mode Menu (see page 192).

- If the unit is due for calibration and CAL PAST DUE ACT is set to CONFIRM TO CAL, then the following screen displays and the buzzer sounds in a double pulsing pattern.

**CALIBRATION DATE
IS PAST DUE

PERFORM
CALIBRATION?**

- To perform a calibration, press the AIR ▲YES button. The Eagle 3 will enter Calibration Mode and the LCD will show the Calibration Mode main menu. See page 77 for instructions to calibrate the Eagle 3. When you are done with the calibration and exit Calibration Mode, the unit will begin the warmup sequence. If the calibration was successful, the screen above will not appear again until the unit is due for calibration. If the calibration was not successful, the screen above will again appear in the warmup sequence.
- To continue without performing a calibration, press the DISPLAY ADJUST NO button.

- If the unit is due for calibration and CAL PAST DUE ACT is set to MUST CALIBRATE, then the following screen displays and the buzzer sounds in a double pulsing pattern.

**CALIBRATION DATE
IS PAST DUE**

**ENTER TO PERFORM
CALIBRATION**

- The Eagle 3 cannot be used until a successful calibration has been performed. Press the ENTER button to enter Calibration Mode. See page 77 for instructions to calibrate the Eagle 3. When you are done with the calibration and exit Calibration Mode, the unit will begin the warmup sequence. If the calibration was successful, the screen above will not appear again until the unit is due for calibration. If the calibration was not successful, the screen above will again appear in the warmup sequence.
- If the unit is due for calibration and CAL PAST DUE ACT is set to NOTIFICATION ONLY, then the following alert screen displays and the buzzer sounds in a double pulsing pattern.

**CALIBRATION DATE
IS PAST DUE**

Press the POWER ENTER RESET button to acknowledge the alert and continue with the warmup sequence.

12. The Date/Time Screen appears for a few seconds.

9/12/2008

15:00:00

13. If USER/STATION ID is turned on (see page 154), the ID Screen appears for a few seconds.

**USER ID
MIKE
STATION ID
PUMP 1
SERIAL NUMBER
E2A515**

If USER/STATION ID is turned off, only the serial number is shown.

14. If the Eagle 3 experiences a sensor failure during start up, a screen indicating which sensor failed appears and the buzzer sounds a pulsing tone twice per second. In the example below, the TC % volume CH₄ sensor has failed.

FAILED SENSOR(S)

< > < >

< > < >

<CH4>

ENTER TO CONTINUE

If one of the combustible sensors, LEL or TC, fails, it is not possible to enter Bar Hole Mode. Press the POWER ENTER RESET button to acknowledge the failure and return to the Mode Select Screen. Replace the failed sensor as soon as possible.

If the oxygen sensor fails, press the POWER ENTER RESET button to acknowledge the failure and continue to Bar Hole Mode. The gas reading for the oxygen sensor will be replaced by “XXX”. Replace the failed sensor as soon as possible.

If any other sensor that is installed fails, press the POWER ENTER RESET button to acknowledge the failure and continue to Bar Hole Mode. Replace the failed sensor(s) as soon as possible for use in Normal Mode.

The Eagle 3 is now operating in Bar Hole Mode. The pump is off and the following screen appears. Only the methane and oxygen channels are displayed.

BAR HOLE MODE

CH4 0 % LEL

OXY 20.9 vol%

ENTER: MEASURE

ADJUST: PURGE

NOTE: The units for the methane channel can be changed using the RANGE ▼ SHIFT button. Press the RANGE ▼ SHIFT button until the desired units, ppm, LEL, or vol%, are displayed.

NOTE: If measuring the combustible gas in ppm units, for maximum sensor stability, allow 3-5 minutes for the sensor to warm up. The small increment size in the lower range of a ppm measurement can cause instability if the unit is not properly warmed up.

Performing a Demand Zero, Bar Hole Mode

Before using the Eagle 3, it is recommended to set the fresh air readings for the target gases by performing a demand zero. This will set the CH₄ channel to zero and the OXY channel to 20.9%.

1. Find a fresh-air environment. This is an environment free of toxic or combustible gases and of normal oxygen content (20.9%).

2. Turn on the unit as described above in “Turning On the Eagle 3, Bar Hole Mode” on page 341.
3. Press and hold the AIR ▲YES button. The display will indicate that a demand zero is taking place and prompt you to hold the AIR ▲YES button.
4. Continue to hold the AIR ▲YES button until the display prompts you to release it. The Eagle 3 will set the fresh air reading for the CH₄ and oxygen channels. Start up is complete and the unit is now ready for bar hole testing.

Bar Hole Testing

In Bar Hole Mode, you can initiate sampling for a fixed time period to monitor for methane and oxygen in a bar hole. The factory set time is 30 seconds. At the end of the sample period, the pump will shut off and the peak methane and minimum oxygen levels monitored during the sample period will be displayed. Bar Hole Mode also allows you to initiate an air purge cycle to purge gas from the Eagle 3 after a sample is taken. See “Setting the Bar Hole Measurement Time (BH MEASURING TIME)” on page 172 to change the bar hole sample time.

In a low-light environment, press the RANGE ▼SHIFT button to turn on the display backlight. Although the backlight will turn on when any button is pressed, other buttons may initiate an undesired operation sequence. See “Updating the Backlight Delay Setting (BACKLIGHT DELAY)” on page 153 to program backlight duration. If CONFIRMATION ALERT is turned on in the Setup Mode menu, the Eagle 3 will alert you based on the setting you choose once every 15 minutes to confirm that it’s operating.

Performing a Bar Hole Test

1. Start up the Eagle 3 as described on page 341.
2. Take the Eagle 3 to the bar hole that will be tested.
3. Insert the probe into the bar hole and press the ENTER button. The pump will turn on, the display will indicate “MEASURING...” below the oxygen reading, and the sample period will begin with the sample period counting down in seconds in the lower right corner of the display. The CH₄ channel will be displayed in vol%.

BAR HOLE MODE	
CH4	0 vol%
OXY	20.9 vol%
MEASURING...	
30 SEC	

4. After 15 seconds of sampling, if the CH₄ reading is less than 5 vol%, the CH₄ channel will automatically begin displaying in the units you selected earlier. If you selected the methane channel to be displayed in vol%, then after 15 seconds, the reading will remain in vol%.

5. At the end of the sample period, the pump will shut off and the audible alarm will sound, then the peak methane reading and the minimum oxygen reading for the sample period will be displayed.

BAR HOLE MODE		
P		
E	CH4	0 vol%
A	OXY	20.9 vol%
K	ENTER: MEASURE	
	ADJUST: PURGE	

6. If a high concentration of methane is encountered, a fresh air purge can be performed to purge the hose, probe and Eagle 3 of gas before the next bar hole test. To perform a purge, do the following:

- Remove the probe from the barhole so the instrument will draw fresh air.
- Press the DISPLAY ADJUST NO button. The display will now indicate “FRESH AIR PURGE . . .” below the oxygen reading and the purge time will begin counting down from 30 seconds in the lower right corner of the display.

BAR HOLE MODE		
	CH4	0 vol%
	OXY	20.9 vol%
	FRESH AIR PURGE...	
		30 SEC

- After 15 seconds of sampling, if the CH₄ reading is less than 5 vol%, the CH₄ channel will automatically begin displaying in the units you selected earlier. Since performing a fresh air purge draws fresh air, the display units should always switch to the previously selected units. If you selected the methane channel to be displayed in vol%, then after 15 seconds, the reading will remain in vol%.
- When the purge is complete, the screen will return to the initial Bar Hole Mode screen.

BAR HOLE MODE		
	CH4	0 vol%
	OXY	20.9 vol%
	ENTER: MEASURE	
	ADJUST: PURGE	

7. If other bar holes will be tested, proceed to the next bar hole and repeat Step 3 - Step 6.
8. To cancel a bar hole measurement or fresh air purge that is in progress, press the DISPLAY ADJUST NO button.
9. To exit Bar Hole Mode and return to the Mode Select Screen at any time, press and hold the RANGE ▼ SHIFT button for 5 seconds.

Turning Off the Eagle 3, Bar Hole Mode

1. Press and hold the POWER ENTER button.
2. The unit will initiate a bar hole measurement. Keep holding the POWER ENTER button. The buzzer will sound and the LCD back light will flash for about five seconds.
3. Release the button when GOODBYE appears on the display. When GOODBYE disappears and the backlight turns off, the unit is off.

Appendix K: Using the Eagle 3 in Leak Check Mode

Overview

This chapter explains how to operate the Eagle 3 in Leak Check Mode. Leak Check Mode is used to pinpoint small leaks of combustible gas from valves, flanges, connections, and other potential leak points. When the Eagle 3 is in Leak Check Mode, only the catalytic combustible sensor is active.

If an Eagle 3 is intended for tracking down leaks, it is shipped with Leak Check Mode or both Leak Check Mode and Bar Hole Mode enabled so that the operator must choose which operational mode to use when the unit is turned on (see page 194).

Start Up, Leak Check Mode

This section explains how to start up the Eagle 3 in Leak Check Mode and get it ready for operation.

Turning On the Eagle 3, Leak Check Mode

CAUTION: *If one or more sensors other than a catalytic combustible sensor is installed, these sensors will not be active while the Eagle 3 is in Leak Check Mode.*

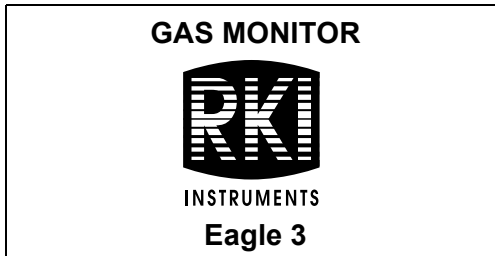
The following description of the Eagle 3 start up sequence assumes that the following menu items in Setup Mode are turned on: CAL REMINDER and USER/STATION ID. If either of these items is turned off, then the corresponding screen will not appear.

1. Connect the standard probe to the Eagle 3's quick connect inlet fitting.

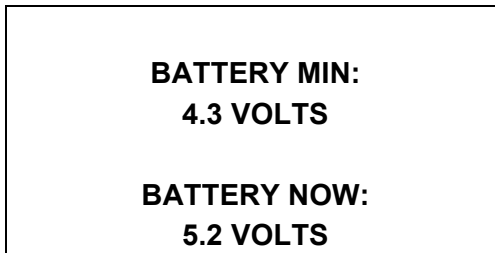
NOTE: Use the standard probe, not the bar hole probe, when using the Eagle 3 in Leak Check Mode.

2. If a sample hose is used, connect the sample hose to the Eagle 3's quick connect inlet fitting and connect the probe to the sample hose's quick connect fitting.
3. Press and briefly hold down the POWER ENTER RESET button. Release the button when you hear a beep.

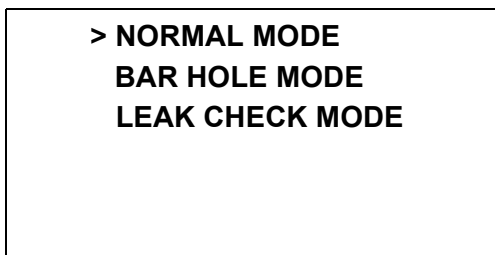
4. The LCD will show the following screen for about ten seconds.



5. The Battery Voltage Screen appears for a few seconds.



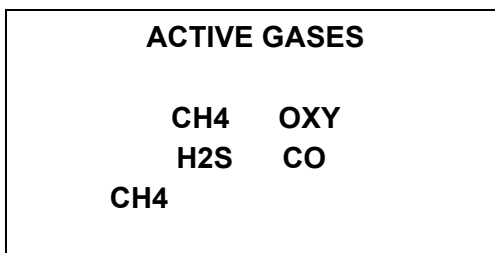
6. The Mode Select Screen displays.



7. The cursor will flash in front of **NORMAL MODE**. Use the RANGE ▼ SHIFT button to move the cursor next to **LEAK CHECK MODE**.
8. With Leak Check Mode selected, press the POWER ENTER RESET button to begin the Leak Check Mode warmup sequence.

NOTE: If no button is pressed for 20 seconds, the unit will proceed into whichever mode has the cursor in front of it.

9. The Active Gases Screen appears for a few seconds indicating which channels are active and their target gas.



10. The gas alarm setpoints are displayed by three screens in sequence: the Low Alarm Screen, High Alarm Screen, and STEL/TWA Alarm Screen. Each screen remains on the LCD for three seconds.

A	CH4	50 % LEL
H L	OXY	23.5 vol%
I A	H2S	30.0 ppm
G R	CO	50 ppm
H M	CH4	50 vol%
S		

ALARMS STEL & TWA		
H2S(ppm)	15.0	10.0
CO (ppm)	200	25
CH4(vol%)	OFF	OFF

A	CH4	10 % LEL
L L	OXY	19.5 vol%
O A	H2S	10.0 ppm
WR	CO	25 ppm
	CH4	10 vol%
S		

11. After the alarm screens, if CAL REMINDER is turned on, the screen that appears next depends on how CAL PAST DUE ACT is set in the Setup Mode Menu (see page 192).
- If the unit is due for calibration and CAL PAST DUE ACT is set to CONFIRM TO CAL, then the following screen displays and the buzzer sounds in a double pulsing pattern.

CALIBRATION DATE IS PAST DUE
PERFORM CALIBRATION?

To perform a calibration, press the AIR ▲YES button. The Eagle 3 will enter Calibration Mode and the LCD will show the Calibration Mode main menu. See page 77 for instructions to calibrate the Eagle 3. When you are done with the calibration and exit Calibration Mode, the unit will begin the warmup sequence. If the calibration was successful, the screen above will not appear again until the unit is due for calibration. If the calibration was not successful, the screen above will again appear in the warmup sequence.

To continue without performing a calibration, press the DISPLAY ADJUST NO

button.

- If the unit is due for calibration and CAL PAST DUE ACT is set to MUST CALIBRATE, then the following screen displays and the buzzer sounds in a double pulsing pattern.

**CALIBRATION DATE
IS PAST DUE**

**ENTER TO PERFORM
CALIBRATION**

The Eagle 3 cannot be used until a successful calibration has been performed. Press the ENTER button to enter Calibration Mode. See page 77 for instructions to calibrate the Eagle 3.

NOTE: In this situation, even if the password function has been turned on, no password is required to perform a calibration.

When you are done with the calibration and exit Calibration Mode, the unit will begin the warmup sequence. If the calibration was successful, the screen above will not appear again until the unit is due for calibration. If the calibration was not successful, the screen above will again appear in the warmup sequence.

- If the unit is due for calibration and CAL PAST DUE ACT is set to NOTIFICATION ONLY, then the following alert screen displays and the buzzer sounds in a double pulsing pattern.

**CALIBRATION DATE
IS PAST DUE**

Press the POWER ENTER RESET button to acknowledge the alert and continue with the warmup sequence.

12. The Date/Time Screen appears for a few seconds.

9/12/2008

15:00:00

- USER ID
MIKE
STATION ID
PUMP 1
SERIAL NUMBER
E2A515

14. If the Eagle 3 experiences a catalytic combustible sensor failure during start up, a screen indicating which sensor failed appears and the buzzer sounds a pulsing tone twice per second. In the example below, the H₂S sensor has failed.

If the catalytic combustible sensor fails, it is not possible to enter Leak Check Mode. Press the POWER ENTER RESET button to acknowledge the failure and return to the Mode Select Screen. Replace the failed sensor.

If any other sensor that is installed fails, press the POWER ENTER RESET button to acknowledge the failure and continue to Leak Check Mode. Change the failed sensor(s) as soon as possible for use in Normal Mode.

- ```

LEAK CHECK MODE
CH4 0 ppm
0 5000
[]
BUZZER ON
```

Appendix K: Using the Eagle 3 in Leak Check Mode • 353

## ***Performing a Demand Zero, Leak Check Mode***

Before using the Eagle 3, it is recommended to set the fresh air reading for the target gas by performing a demand zero. This will set the CH<sub>4</sub> channel to zero.

1. Find a fresh-air environment. This is an environment free of toxic or combustible gases and of normal oxygen content (20.9%).
2. Turn on the unit as described above in Turning On the Eagle 3, Leak Check Mode.
3. Press and hold the AIR ▲YES button. The display prompts you to hold the AIR ▲YES button.
4. Continue to hold the AIR ▲YES button until the display prompts you to release it. The Eagle 3 will set the fresh air reading for the CH<sub>4</sub> channel. Start up is complete and the unit is now ready for monitoring.

---

## **Leak Testing**

In Leak Check Mode, the Eagle 3 only displays combustible gas readings. The readings are displayed in both numerical and bar graph form. The bar graph displays readings up to 5,000 ppm while the numerical indicator displays readings up to 50,000 ppm in the following increments:

- 5 ppm increments from 0 ppm to 200 ppm
- 10 ppm increments from 200 ppm to 1,000 ppm
- 50 ppm increments from 1,000 ppm to 10,000 ppm
- 250 ppm increments from 10,000 ppm to 50,000 ppm

As the gas concentration increases from 0 ppm, the alarm LEDs begin to blink in unison with the buzzer's pulsing. The blinking/pulsing rate increases as the gas reading increases. If desired the buzzer can be turned off in Leak Check Mode.

In a low-light environment, press any of the buttons to turn on the display backlight. See "Updating the Backlight Delay Setting (BACKLIGHT DELAY)" on page 153 to program backlight duration. If CONFIRMATION BEEP is turned on in the Setup Mode menu, the Eagle 3 beeps once every 15 minutes to confirm that it's operating.

## ***Locating a Leak***

1. Start up the Eagle 3 as described above on page 349.
2. Move the probe tip back and forth along the area where a leak is suspected.
3. Observe the display reading. If the gas level increases, the numerical reading will increase, the bar graph level will increase to the right, and the beeping and buzzer pulsing frequency will increase.
4. Use the increasing and decreasing of the reading to locate the leak point.
5. To exit Leak Check Mode and return to the Mode Select Screen at any time, press and hold the RANGE ▼ SHIFT button for 5 seconds.

## ***Turning the Buzzer On and Off in Leak Check Mode***

The alarm buzzer can be turned off and on when the Eagle 3 is in Leak Check Mode. This setting only applies to Leak Check Mode and does not affect buzzer operation in Normal or Bar Hole Mode. The buzzer setting is displayed in the lower left corner as BUZZER ON when the buzzer is on or BUZZER OFF when the buzzer is off. When the Eagle 3 is turned off or you exit Leak Check Mode, it remembers the buzzer setting. So when the Eagle 3 is turned on again or you return to Leak Check Mode after operating in Normal Mode or Bar Hole Mode, the buzzer has the same setting it did the last time it was in Leak Check Mode.

To turn the buzzer off or on while in Leak Check Mode, press the DISPLAY ADJUST NO button.

## ***Turning Off the Eagle 3, Leak Check Mode***

1. Press and hold the POWER button.
2. The buzzer will sound and the LCD back light will flash for about five seconds.
3. Release the button when GOODBYE appears on the display. When GOODBYE disappears and the backlight turns off, the unit is off.

# Appendix L: Tank Tester Model

The Eagle 3 Tank Tester model is intended for checking tanks or vessels that may contain residual hydrocarbon vapors or water or may have been purged of oxygen. It is supplied as an LEL (catalytic) only unit or an LEL (catalytic)/oxygen unit. You can also use this model as a standard Eagle 3 gas monitor by connecting the standard hose and probe and selection Normal Mode in the Inert Mode Selection Screen.

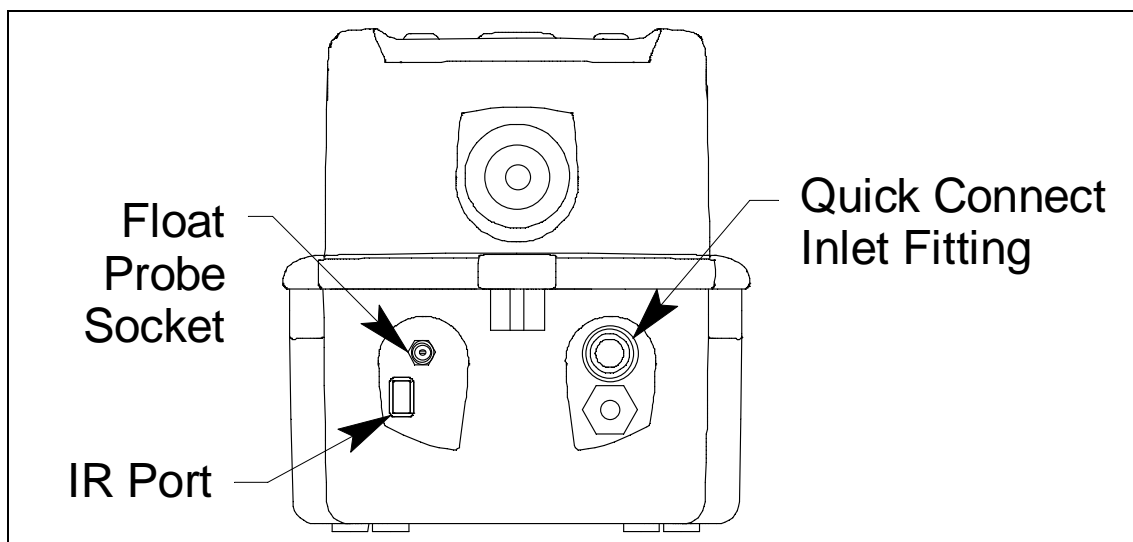
**Table 41:**

|                           | <b>Alarm 1</b>      | <b>Alarm 2</b>      |
|---------------------------|---------------------|---------------------|
| <b>LEL</b>                | 10% LEL<br>1100 ppm | 50% LEL<br>5500 ppm |
| <b>Normal Mode Oxygen</b> | Oxy: 19.5% falling  | Oxy: 23.5% rising   |
| <b>Inert Mode Oxygen</b>  | Oxy: 5.0% rising    | Oxy: 10.0% rising   |

---

## Description

The tank tester model has an additional socket on the front on the housing to accommodate connection of the float probe assembly.



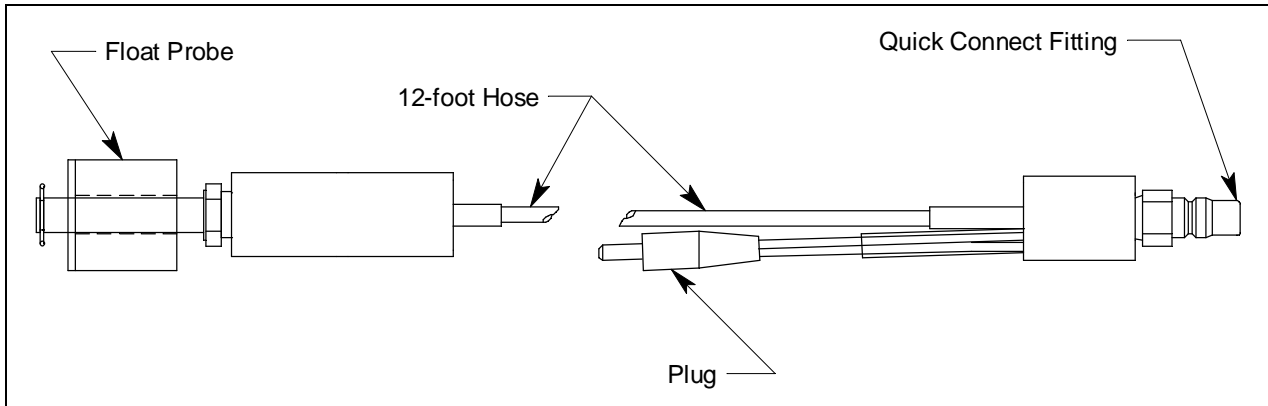
**Figure 39: Eagle 3 Tank Tester Version**

This model includes the following non-standard components.



## Float Probe Assembly

The float probe assembly helps prevent liquid from being drawn into the Eagle 3. The float probe assembly is 12-feet long. The hose between both ends of the float probe has an integral cable that connects a switch in the float end to the plug at the other end. This plug connects to the float probe socket that is adjacent to the Eagle 3's IR port. A quick connect fitting at the same end of the assembly connects to the Eagle 3's inlet fitting. The float probe switch at the opposite end of the 12-foot hose shuts off the pump if the probe begins to be submerged into a liquid.



**Figure 40: Float Probe Assembly**

To use the float probe assembly, perform the following:

---

**CAUTION:** *Drawing water, gasoline, or other liquids into the Eagle 3 will cause damage.*

---

1. Attach the quick connect fitting to the Eagle 3's inlet fitting.
2. Insert the plug into the socket that is adjacent to the IR port.
3. Lower the probe into the tank or vessel. Lower the probe *very slowly*, keeping the float switch vertical, to allow the float switch to activate if necessary.

## Dilution Fitting (1:1)

---

**CAUTION:** *When measuring oxygen readings, remove the dilution fitting or use your finger to seal the small dilution hole on the side of the dilution fitting.*

---

The catalytic combustible gas sensor requires oxygen to operate. In environments where there is not enough oxygen to operate the combustible gas sensor, (for example a tank purged with an inerting gas), the 1:1 dilution fitting adds sufficient oxygen by blending ambient air with the incoming sample. The standard dilution fitting dilutes at a ratio of 1:1 (one part air to one part sample). The dilution fitting is not an integral part of the float probe assembly and must be installed on the Eagle 3 inlet fitting before installing the float probe assembly when measuring gas in an inert atmosphere.

To attach the dilution fitting:

1. Attach the dilution fitting's male quick connect fitting to the Eagle 3's inlet fitting.

2. Attach the float probe assembly to the opposite end of the dilution fitting.

---

**NOTE:** When using the dilution fitting, multiply the combustible gas reading (LEL or PPM) by 2 to determine the actual combustible gas concentration. Always remove the dilution fitting or seal the dilution hole with your finger to measure for oxygen.

---

---

## Start Up and Operation

1. Press and briefly hold down the POWER ENTER RESET button. Release the button when you hear a beep.
2. The LCD will show the following screen for about ten seconds.

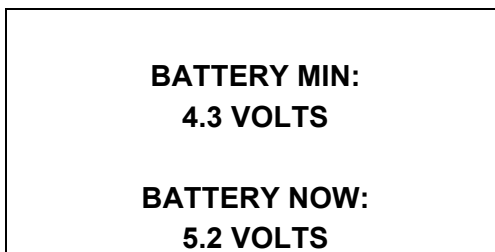


3. The Connect Float Probe Screen appears for a few seconds, prompting you to confirm that the float probe's quick connect fitting is connected to the inlet fitting and that the float probe's plug is connected to the Eagle 3.



Make sure that the float probe assembly is hanging vertically and that the float device is located at the bottom of the probe.

4. The Battery Voltage Screen appears for a few seconds.



5. The Inert Mode Selection Screen will then be displayed.

**MODE SELECT**

**AIR/RANGE THEN ENTER**

**NORMAL MODE**

Use the AIR ▲YES or RANGE ▼ SHIFT button to display the mode you wish to enter. To use the Eagle 3 for tank tester applications, ensure that the float probe is connected and select Inert Mode. To use the Eagle 3 in Normal Mode, select Normal Mode and refer to “Normal Mode Operation” on page 42. If you have not made a selection after 20 seconds, the instrument will begin to beep and the LEDs will begin to flash. They will continue until you make a selection.

---

***WARNING: The Eagle 3 is not a gas monitoring device until you select a mode and enter it.***

---

6. The warm up sequence will continue as described in “Start Up” on page 30. The oxygen alarms in the alarm point screens will be the alarm points for Inert Mode and not for Normal Mode.
7. When the warm up is complete and the instrument is operating in Inert Mode, the screen will appear as shown below if the instrument is sampling a fresh air environment. The screen is shown with % LEL and oxygen channels. Your unit may only have % LEL.

**I CH4     0% LEL**

**N OXY 20.9vol%ALRM2**

**E**

**R**

If the instrument is sampling a fresh air environment, the oxygen channel will be in alarm. For more information about Inert Mode, see page 361.

8. When monitoring for combustible gas in an inerted tank, be sure the dilution fitting is installed and multiply the combustible gas reading by 2.

When monitoring for oxygen in an inerted tank, remove the dilution fitting or seal the dilution hole with your finger.

---

## Alarms

The Eagle 3 Tank Tester model has two sets of oxygen alarm settings: one for Normal Mode and one for Inert Mode. The Inert Mode oxygen alarms are factory-set at 5.0% by volume (rising) and 10.0% by volume (rising). Normal Mode oxygen alarm setpoints also exist and take effect when you select Normal Mode at start up.

The rising Inert Mode alarms are used to monitor a purged vessel to alert you to a rising oxygen condition.

The oxygen level in a fresh air environment is above both Inert Mode oxygen alarm points so the Eagle 3 Tank Tester version will go into alarm when turned on in Inert Mode in a fresh air environment. To silence the alarm, press the RESET button. The audible alarm silences, but the alarm lights continue to flash and the display screen continues to indicate an oxygen alarm. If one of the alarm levels is newly exceeded, the audible alarm sounds again.

For information about viewing and changing the standard alarms used in Normal Mode, see “Updating the Alarm Settings” on page 145. For information about viewing and changing Inert Mode oxygen alarms, see “Appendix M: Using the Eagle 3 in Inert Mode” on page 361.

---

## Calibration

Use a hexane calibrating source to calibrate the combustible gas LEL range. Use a 100% nitrogen calibrating source to set the zero reading for the oxygen channel. RKI Instruments, Inc. recommends using the Single Calibration method to calibrate the Eagle 3 Tank Tester model. See “Chapter 5: Calibration Mode” on page 77.. The instructions in that section call for calibrating the Eagle 3 with methane. When following these instructions, be sure to calibrate with hexane rather than methane.

---

**NOTE:** Do not calibrate the Eagle 3 Tank Tester model with the dilution fitting attached to the inlet fitting.

---

---

## Tank Tester Eagle 3 Parts List

Table 42:

| Part Number | Description            |
|-------------|------------------------|
| 80-0405RK   | Dilution fitting (1:1) |
| 80-0802RK   | Float probe (12-foot)  |

# Appendix M: Using the Eagle 3 in Inert Mode

Inert Mode is used to measure the combustible gas and/or oxygen level in a purged environment. The oxygen alarms in this mode are both increasing and are generally set at 5.0% and 10.0%.

---

## Description

Inert Mode is factory activated for instruments that require it. The instrument can still be used in Normal Mode for other applications.

It is recommended that either an IR CH<sub>4</sub> or an IR HC sensor be installed in a unit that is used to monitor combustible gas in Inert Mode since it does not require oxygen to work properly. The catalytic LEL sensor does not operate at oxygen concentrations below 10% volume. If it is necessary to use the catalytic LEL sensor in Inert Mode, a dilution fitting must be installed. Installing a dilution fitting will affect the oxygen reading since you're introducing oxygen into the sample.

---

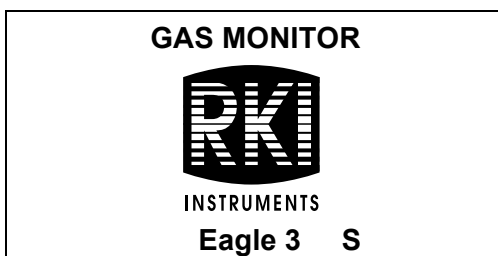
## Alarms

The oxygen channel alarm points in Inert Mode are different from those in Normal Mode. All other alarm point settings remain unchanged.

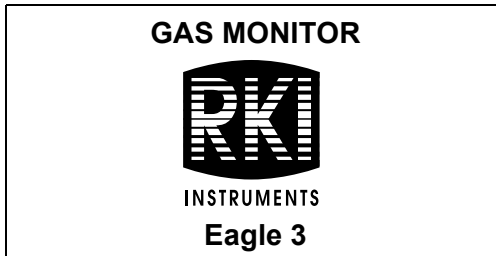
Since the application for Inert Mode is to detect a rising oxygen level in purged environments, both oxygen alarms are set to rising. The factory set alarm point is 5.0% volume for the low alarm and 10.0% volume for the high alarm. These alarm points are user adjustable in Setup Mode. See page 145 for instructions to set the alarm points for channels other than oxygen or to set the Normal Mode oxygen alarm points.

Below are instructions to set the Inert Mode oxygen alarms.

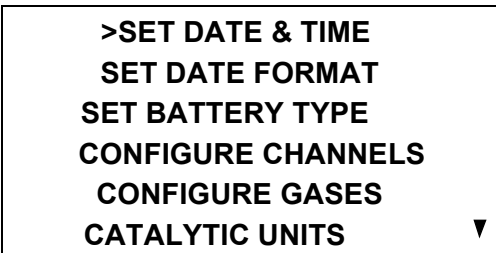
1. Take the Eagle 3 to a non-hazardous location and turn it off if it is on.
2. Press and hold the AIR ▲YES or RANGE ▼ SHIFT buttons, then press and hold the POWER ENTER RESET button. When you hear a beep, release the buttons.
3. The LCD will show the following screen for a few seconds with the "S" in the lower right corner indicating the unit is entering Setup Mode.



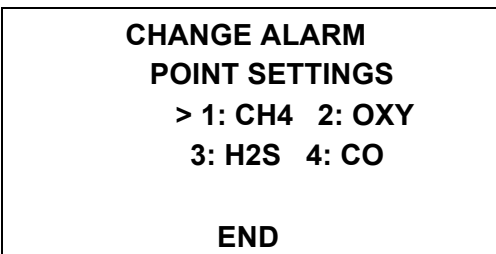
4. The “S” will then disappear and the following screen will appear for a few seconds.



5. If the unit prompts you for the password, enter it by using the AIR ▲YES or RANGE ▼ SHIFT buttons to select each password number and then pressing and releasing the POWER ENTER RESET button to enter it and move on to the next number until all of the numbers are entered. The main menu displays. It displays six menu items at a time.



6. Use the AIR ▲YES or RANGE ▼ SHIFT button to move the cursor to the **ALARM POINTS** menu item.
7. Press POWER ENTER RESET. The Change Alarm Point Settings Screen appears and all detection channels are displayed.



8. Move the cursor next to the oxygen channel. Press POWER ENTER RESET.

9. A mode select screen will appear and prompt you to choose between Normal Mode and Inert Mode. Use the AIR ▲YES or RANGE ▼ SHIFT button to display Inert Mode and press POWER ENTER RESET.

**MODE SELECT**

**AIR/RANGE THEN ENTER**

**NORMAL MODE**

---

**NOTE:** To change the Normal Mode oxygen other alarm points, select Normal Mode and see “Updating the Alarm Settings” on page 145.

---

**OXY 0- 40.0 vol%**

**INERT ALARM**

**>LO : 5.0 vol%**

**HI : 10.0 vol%**

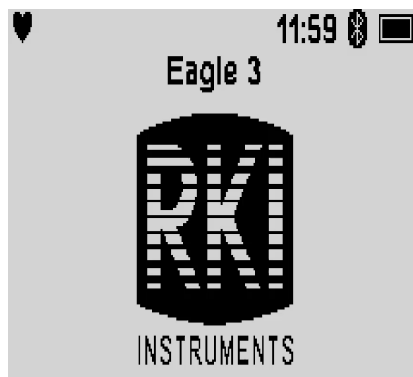
**END**

10. Press POWER ENTER RESET. The alarm point or alarm operation (oxygen only) will begin to flash.
11. Use AIR ▲YES and RANGE ▼ SHIFT to adjust the alarm point to the desired setting. Keep the following in mind:
- The low alarm cannot be set higher than the high alarm, and the high alarm cannot be set lower than the low alarm.
  - Any alarm setting can be turned off by adjusting it to its lowest setting. The setting will be displayed as **OFF**.
12. If you want to continue with the change, press POWER ENTER RESET to accept the setting.
- If you want to exit this screen without saving any change to the alarms, press DISPLAY ADJUST NO until you return to the Change Alarm Point Settings Screen.
13. When you are done making changes, use RANGE ▼ SHIFT to move the cursor next to **END**.
14. Press POWER ENTER RESET to save the new settings and return to the Change Alarm Point Settings Screen.
15. Use RANGE ▼ SHIFT to move the cursor next to **END**.
16. Press POWER ENTER RESET to return to the main menu.

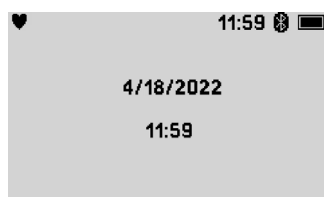
---

## Start Up

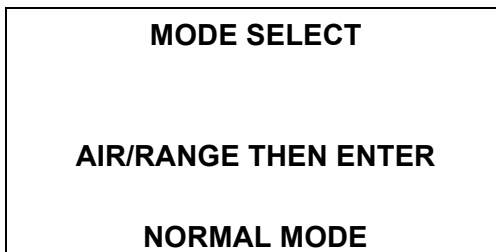
1. Press and briefly hold down the POWER ENTER RESET button. Release the button when you hear a beep.
2. The LCD will show the following screen for about ten seconds.



3. The Battery Voltage Screen appears for a few seconds.



4. The Inert Mode Selection Screen will then be displayed.



Use the AIR ▲YES or RANGE ▼ SHIFT button to display the mode you wish to enter. If you have not made a selection after 20 seconds, the instrument will begin to beep and the LEDs will begin to flash. They will continue until you make a selection.



---

**WARNING:** *The Eagle 3 is not a gas monitoring device until you select a mode and enter it.*

---

5. If you select Normal Mode, the warm up sequence will continue as described in “Start Up” on page 30 unless Leak Check or Bar Hole Mode is active. If Leak Check or Bar Hole Mode is active, the Leak Check/Bar Hole Mode Select Screen will appear immediately after the Normal Mode selection.

**> NORMAL MODE  
BAR HOLE MODE  
LEAK CHECK MODE**

Use the AIR ▲YES or RANGE ▼ SHIFT button to display the mode you wish to enter.

6. If you select **Inert Mode**, the warm up sequence will continue as described in “Start Up” on page 30. The oxygen alarms in the alarm point screens will be the alarm points for Inert Mode and not for Normal Mode.
7. When the warm up is complete and the instrument is operating in Inert Mode, the screen will appear as shown below if the instrument is sampling a fresh air environment.

**I CH4     0% LEL  
N OXY 20.9vol%ALRM2  
E H2S     0.0ppm  
R CO       0ppm**

If the instrument is sampling a fresh air environment, the oxygen channel will be in alarm.

---

## Operation

See “Normal Mode Operation” on page 42 for operating instructions keeping in mind that the Inert Mode oxygen alarm settings are different.

You can access the Inert Mode Selection Screen while in Inert Mode or Normal Mode by pressing and holding the RANGE ▼SHIFT button.

**MODE SELECT**

**AIR/RANGE THEN ENTER**

**NORMAL MODE**

Use the AIR ▲ YES or RANGE ▼SHIFT button to display the mode you wish to enter and press the POWER ENTER RESET button.

# Appendix N: Eagle 3 Transformer Gas Tester Model

This Eagle 3 Transformer Gas Tester Model is specially set up for electrical transformer gas testing. Large electrical transformers are filled with oil which surrounds the transformer coils, and they have an inert gas head space above the oil. When a transformer begins to fail, electrical arcing between the conductors of the coils can cause flammable gases to form in the head space. By testing the head space for these gases and recording trends of the readings, an early warning of transformer failure can be detected, and the transformer can be removed from service before it explodes.

---

## Description

The standard setup and calibration for the catalytic combustible channel on a Transformer Gas Tester Model setup is for hydrogen with a range of 0 - 5.00% volume. When set up this way, the catalytic sensor will not respond to or will respond only slightly to the presence of methane.

Since the head space being tested is filled with nitrogen, there is no oxygen in the test sample. The catalytic sensor requires oxygen in order to operate, so the instrument is supplied with a snap-on dilution fitting with a dilution ratio of 1:1 (one part air to one part sample). This fitting blends the sample with ambient air before entering the instrument, which provides sufficient oxygen for the sensor to work.

The instrument is also supplied with a sample bag.

---

## Operation

1. Turn the instrument on and allow it to warm up.
2. Attach the dilution fitting directly to the front of the instrument. Attach the probe to the dilution fitting.
3. Press the AIR ▲YES button in fresh air to zero the instrument.
4. Connect the deflated sample bag to the sample valve on the transformer and open the valve slightly to fill the sample bag. Close off the sample bag and remove it from the transformer valve.

5. Attach the sample bag to the probe and open the sample bag.

The sample will now be drawn into the instrument. After about 45 seconds note and record the display reading. Compare this reading to historical data to determine the condition of the transformer.

---

**NOTE:** The Eagle 3 can be calibrated either with or without the dilution fitting in place. If calibrated without the dilution fitting in place, then display readings must be doubled to determine the actual gas concentration. If calibrated with the dilution fitting in place, then the sample bag must be used during calibration, and the display readings will be the actual gas concentrations.

---

---

**CAUTION:** *If the dilution fitting is in place for calibration, do not use a demand flow regulator. Use a sample bag. The use of a demand flow regulator with a dilution fitting when calibrating will result in an inaccurate calibration.*

---

---

## Alarms

All the gas alarms on the Transformer Gas Tester are set to OFF.

---

## Transformer Tester Eagle 3 Parts List

Table 43:

| Part Number | Description                 |
|-------------|-----------------------------|
| 80-0405RK   | Dilution fitting (1:1)      |
| 81-1126RK   | Sample bag, 9" x 9", tedlar |

# Appendix O: Internal Dilution Models

This appendix describes versions of the Eagle 3 that contain an internal dilution fitting.

---

## Description

Internal dilution versions of the Eagle 3 have a 1:1 dilution fitting installed in the bottom case. The dilution fitting blends ambient air into the incoming sample to provide sufficient oxygen for the catalytic LEL sensor to function properly. The flow system is arranged to allow the LEL sensor to see diluted sample while all other installed sensors see normal, undiluted sample.

A vent is installed on the right side of the bottom case when viewing the instrument from the front. This equalizes the pressure inside the Eagle 3 as the instrument draws air from inside the case through the dilution fitting's hole.

---

## Calibration

The instrument must be calibrated with a sample bag. See “Appendix A: Calibrating with a Sample Bag” for instructions.

---

# Warranty

RKI Instruments, Inc. warrants the Eagle 3 sold by us to be free from defects in materials, workmanship, and performance for a period of two years from the date of shipment from RKI Instruments, Inc. This includes the instrument and the original sensors. Replacement parts are warranted for 1 year from the date of their shipment from RKI Instruments, Inc. PID sensors are warranted for 1 year from date of shipment from RKI Instruments, Inc. whether they are new or a replacement part. Any parts found defective within their warranty period will be repaired or replaced, at our option, free of charge. This warranty does not apply to those items which by their nature are subject to deterioration or consumption in normal service, and which must be cleaned, repaired, or replaced on a routine basis. Examples of such items are:

- Absorbent cartridges
- Filter elements, disks, or sheets
- Pump diaphragms and valves
- PID sensor electrode stacks

Warranty is voided by abuse including mechanical damage, alteration, rough handling, or repair procedures not in accordance with the instruction manual. This warranty indicates the full extent of our liability, and we are not responsible for removal or replacement costs, local repair costs, transportation costs, or contingent expenses incurred without our prior approval.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY AND ALL OTHER WARRANTIES AND REPRESENTATIONS, EXPRESSED OR IMPLIED, AND ALL OTHER OBLIGATIONS OR LIABILITIES ON THE PART OF RKI INSTRUMENTS, INC. INCLUDING BUT NOT LIMITED TO THE WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL RKI INSTRUMENTS, INC. BE LIABLE FOR INDIRECT, INCIDENTAL, OR CONSEQUENTIAL LOSS OR DAMAGE OF ANY KIND CONNECTED WITH THE USE OF ITS PRODUCTS OR FAILURE OF ITS PRODUCTS TO FUNCTION OR OPERATE PROPERLY.

This warranty covers instruments and parts sold to users only by authorized distributors, dealers, and representatives as appointed by RKI Instruments, Inc.

We do not assume indemnification for any accident or damage caused by the operation of this gas monitor and our warranty is limited to replacement of parts or our complete goods.











