PureAire Monitoring Systems
Explosion Proof Universal (EPU) Gas Monitors

Instruction Manual

For models/series
EPU-MPS (980--)
EPU-EC (981--)
EPU-PEL (982--)
EPU-NDIR (983--)
EPU-PID (984--)

PureAire Monitoring Systems, Inc.
1140 Ensell Road
Lake Zurich, Illinois 60047
Phone: +1 (847) 726-6000
Fax: +1 (847) 726-6051
Toll-Free: +1 (888) 788-8050
24/7 Emergency: +1 (847) 541-1968
Pureairemonitoring.com
Rev 1.03, June 2025

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Welcome to PureAire Monitoring Systems

I would like to thank you for investing in our continuous life safety and process control toxic gas monitoring systems.

PureAire offers an unbeatable combination of experience and innovation in solving the safety and environmental needs of our customers. We can provide small systems of a few points, to a total multi-point turnkey computerized package.

PureAire's proprietary sensor cell technology and state-of-the-art electronics are designed to interface with the latest distributive or PLC based control systems. We believe that our experience, innovative products, and commitment to service will satisfy your specific monitoring needs now, and in the future.

Our growth is a result of our total commitment to supporting our customers. We are available 24 hours a day, 7 days a week to help you when you need us. Our 24-hour Emergency phone number is +1 (847) 541-1968. We can provide field service recommendations, preventative maintenance programs and training to your technicians in the operation of our equipment. Our goal is to provide the best after-sales service and support in the industry. That is just one way PureAire takes that extra step to ensure your complete satisfaction.

Thank you again for investing in PureAire Monitoring Systems for your monitoring needs and I am proud to welcome you to our family of valued and satisfied customers.

Sincerely,

Albert A. Carrino
President

Notices

1140 Ensell Road
Lake Zurich, Illinois 60047

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PLEASE READ BEFORE INSTALLATION

The following environmental conditions **WILL DAMAGE** the Monitor

1. The PureAire Monitor requires **24 VDC regulated power ONLY**. **DO NOT** connect the monitor to >24 VDC, or **ANY AC Voltage**.

2. **DO NOT power** the monitor **without the sensor attached** to the main assembly. **DO NOT disconnect/reconnect sensor** while monitor is powered.

3. Protect the monitor from physical impact and vibrations that exceed the specified limits.

4. Ensure installation complies with local safety regulations and standards. **INSTALLATION SHOULD ONLY BE PERFORMED BY QUALIFIED PERSONNEL**.

5. To prevent ignition of hazardous atmospheres, **DO NOT REMOVE COVER WHILE CIRCUITS ARE ALIVE**. Keep assembly **TIGHTLY CLOSED** when in operation. **Conduit seals** are required within **18”**.

The Password for entering the menus is 557.

1: Introduction

The PureAire Explosion Proof Universal (EPU) Gas Monitors are advanced, durable instruments engineered for the continuous monitoring of flammable gases, toxic gases, refrigerants, volatile organic compounds (VOCs), and other hazardous substances. Designed for use in areas classified as hazardous or potentially explosive, the EPU series ensures reliable performance even in challenging and harsh environmental conditions. Each monitor is enclosed in a robust, explosion-proof housing compliant with stringent safety standards, including Class I Division 1&2 Groups B, C, D, Class II Groups E, F, G, Class III, NEMA 4X, and IP66 protection levels.

All EPU models feature common state-of-the-art electronics and a user-friendly, non-intrusive magnetic wand (Hall-effect) interface, enabling safe access to menus and settings without the need to open the explosion-proof enclosure. This approach significantly enhances user safety in explosion-risk environments.

PureAire's EPU series provides flexibility through its universal design, allowing multiple sensor technologies to be incorporated into a standardized platform. Sensor selection is based on application specific needs, and each sensor offers distinct performance characteristics, lifespan, calibration requirements, and operational features.

1.1 Universal Features of EPU Gas Monitors

The Explosion Proof Universal (EPU) Gas Monitor is designed with an array of innovative features that facilitate ease of use and efficient operation. These unique characteristics have been thoughtfully incorporated to streamline the installation process, optimize daily functionality, and minimize maintenance needs. By fusing cutting-edge technology with user-centric design, the monitor delivers reliable performance while ensuring a simplified user experience.

1.1.1 Explosion-Proof Enclosure

Heavy-duty, explosion-proof construction compliant with Class I Div 1&2 Groups B, C, D, Class II Groups E, F, G, Class III, and NEMA 4X standards ensures safe operation in hazardous environments.

1.1.2 Smart Electronics

Advanced electronic circuitry continuously monitors the status of the sensor cell and associated electronics, promptly identifying sensor degradation or failure and communicating faults via relay outputs and signal outputs.

1.1.3 Flexible Integration

The common electronic architecture allows easy integration with a variety of sensor technologies, providing tailored solutions for diverse gas detection requirements.

1.1.4 Reliable Signal Outputs

Includes standard 4-20 mA analog output, dual-level user-configurable alarm relays, and fault relay outputs. Standard RS-485 communication ensures easy integration into existing safety management systems.

1.1.5 Factory Calibration & Minimal Maintenance

All monitors ship factory calibrated, and feature streamlined maintenance routines, enhancing uptime and reducing lifecycle costs. Sensor-specific calibration and verification requirements vary and are detailed in subsequent sections.

Further details about the factory reset and all specifications will be provided later in the manual.

1.2 Overview of Sensor Technologies in EPU Series

1.2.1 MPS (Molecular Property Spectrometry) Sensor (99214/980--)

- **Application:** Flammable gases detection with TrueLEL™ accuracy, ideal for safety-critical applications.
- **Technology:** Advanced MEMS-based molecular property spectrometry by NevadaNano.
- **Lifespan & Calibration:** 15+ years lifespan, calibration-free operation over the entire lifetime, built-in environmental compensation ensures reliability across varying temperature, humidity, and pressure ranges.

1.2.2 EC (Electrochemical) Sensor (981--)

- **Application:** Detection of toxic gases in the PPM/PPB ranges, suitable for process monitoring and non-oxygen environments.
- **Technology:** Electrochemical cells from Alphasense.
- **Lifespan & Calibration:** 3-5 years lifespan depending on environmental conditions; annual calibration recommended. Sensors are field-replaceable.

1.2.3 PEL (Pellistor) Sensor (982--)

- **Application:** Traditional industry-standard for %LEL detection of combustible gases in environments where MPS may not be optimal.
- **Technology:** Catalytic bead sensor from N.E.T. Sensors, Italy.
- **Lifespan & Calibration:** 3-5 years lifespan; annual calibration recommended; accuracy depended on cross-factor calibration.

1.2.4 NDIR (Non-Dispersive Infrared) Sensor (983--)

- **Application:** Monitoring refrigerants (R- gases), toxic gases such as SF6, and others requiring infrared detection methods.
- **Technology:** Infrared gas sensing for stable, long-term operation.
- **Lifespan & Calibration:** 5+ years typical lifespan, recommended yearly calibration.

1.2.5 PID (Photoionization Detector) Sensor (984--)

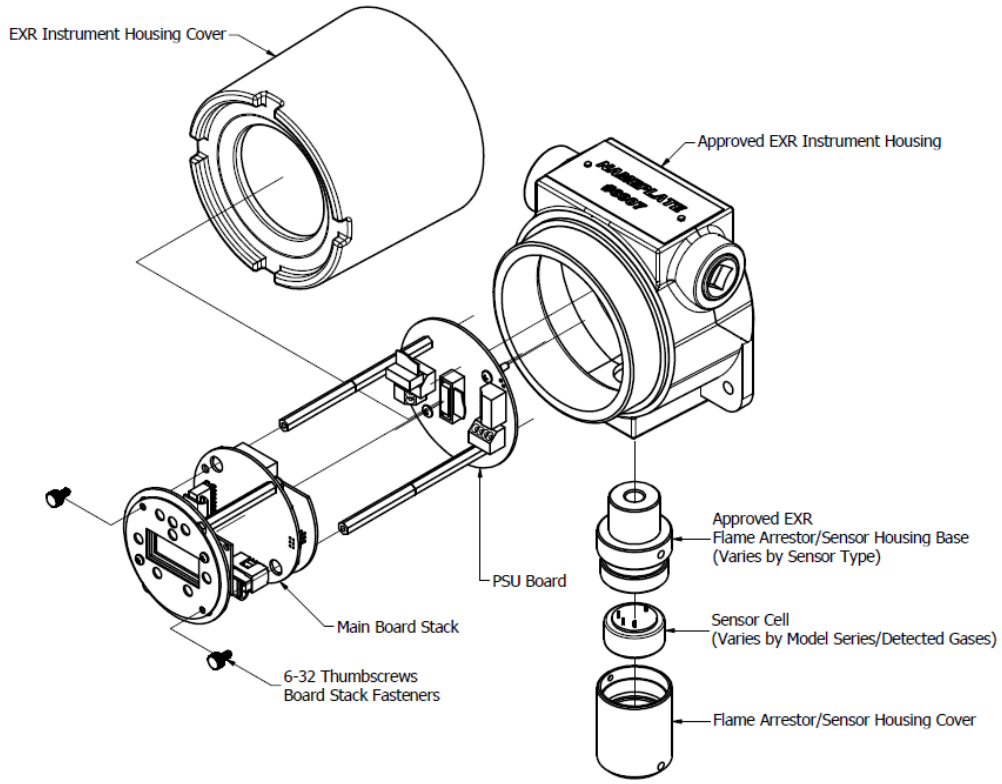
- **Application:** Detection of volatile organic compounds (VOCs) and certain particulate hazards.
- **Technology:** PID sensors provide rapid response and sensitivity to VOC presence.
- **Lifespan & Calibration:** 5+ year lifespan, yearly calibration is recommended.

1.3 Purpose of This Manual

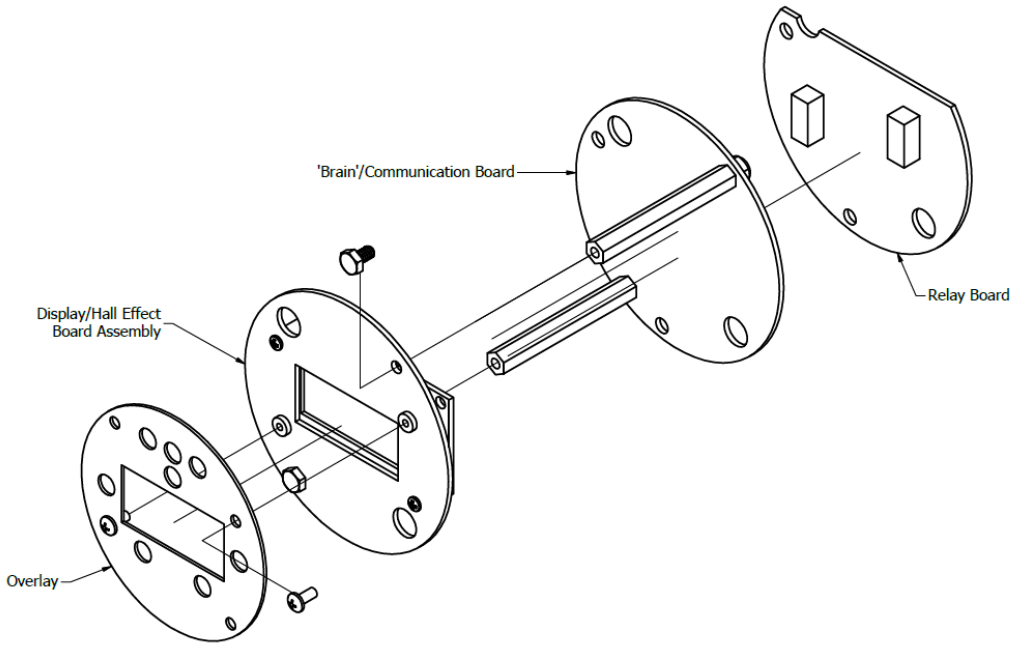
This manual provides comprehensive guidance for installing, operating, and maintaining the PureAire Explosion Proof Universal Gas Monitors across various sensor technologies. It covers general guidelines, sensor-specific details, and specifications. For optimal monitor performance, ensure you carefully follow instructions regarding sensor-specific calibration, maintenance intervals, and operating procedures provided in the corresponding sections.

1.4 Component Identification

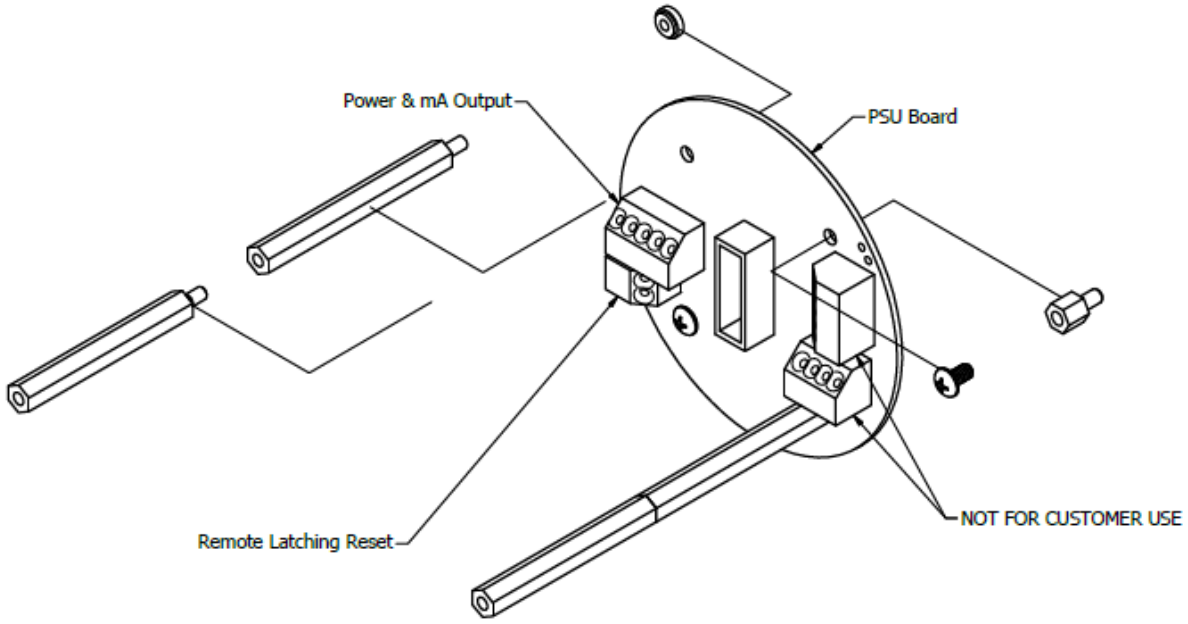
1.4.1 Major Component Overview



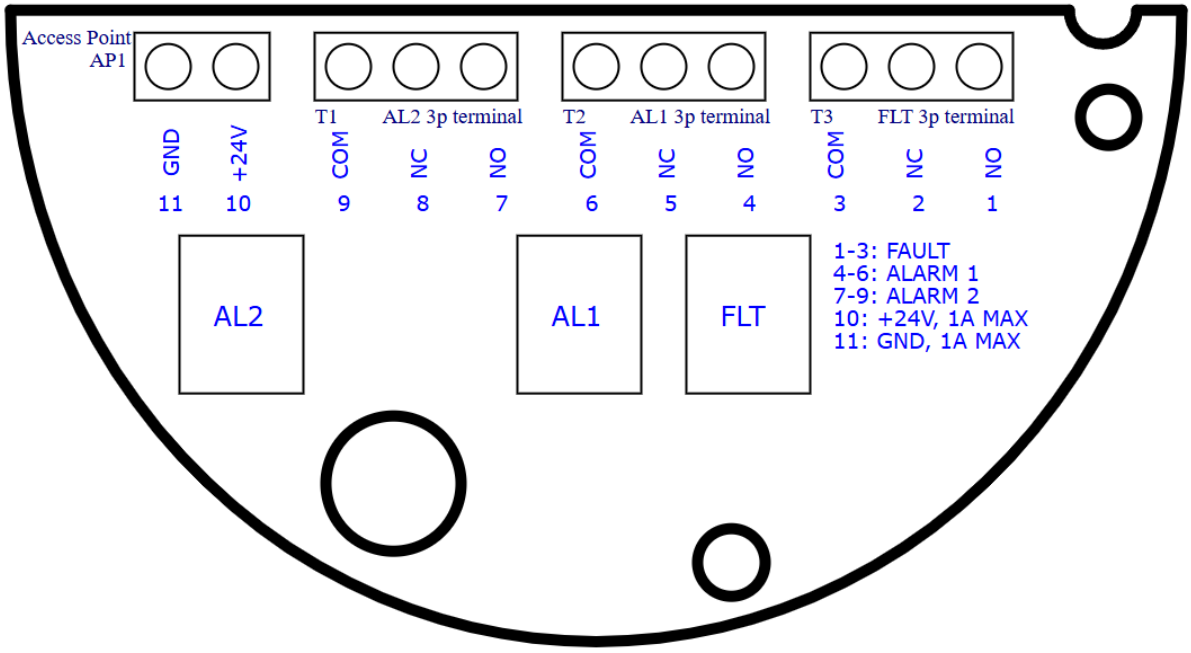
1.4.2 Main Board Stack Overview



1.4.3 Power Supply (PSU) Board Assembly



1.4.4 Relay Board



COM: Common
NC: Normally Closed
NO: Normally Open

2: Specifications

NOTE: *For our continual product improvement, all specifications are subject to change without notice*

2.1 Performance Specifications

Sensor Type:	Molecular Property Spectrometry (MPS) Sensor.	0-100% TrueLEL™
Response Time:	< 20 seconds (T90)	
Accuracy:	Methane (CH_4): ±3% LEL Hydrogen (H_2): ±5% LEL Other gases: Varies (see specific gas accuracy in datasheet)	
Fault Indicators:	Loss of VDC power (analog signal drops to 0 mA). Sensor cell failure: Fault relay activated.	
Operating Cond.:	-40° to +167°F (-40° to +75°C) 0 to 100% RH	
Sensor Type:	Electrochemical (EC) Sensor.	PPM/PPB Ranges
Response Time:	< 60 seconds (T50)	
Accuracy:	Varies (see specific gas accuracy in datasheet)	
Operating Cond.:	-4°F to +122°F (-20° to +50°C) 80 to 120 kPa 15 to 90% RH	
Storage Period:	6 months @ 3 to 20°C (stored in sealed pot)	
Sensor Type:	Pellistor (PEL) Sensor.	Linear: 0-60% LEL, Nonlinear: 60-100% LEL
Response Time:	< 20 seconds (T90)	
Accuracy:	±1% LEL (CH4); Varies by gas (see specific gas accuracy in datasheet)	
Operating Cond.:	+40°F to +302°F (-40°C to +150°C) 0 to 95% RH noncondensing	
Sensor Type:	Non-Dispersive Infrared (NDIR) Sensor.	Various Ranges
Response Time:	< 30 seconds (T50); < 60 seconds (T90)	
Accuracy:	Varies (see specific gas accuracy in datasheet)	
Operating Cond.:	+32°F to +122°F (0° to +50°C) 80 to 120 kPa 0 to 95% RH noncondensing	
Sensor Type:	Photoionization Detector (PID) Sensor.	Various Ranges
Response Time:	< 10 seconds (T50); < 30 seconds (T90)	
Accuracy:	Varies (see specific gas accuracy in datasheet)	
Operating Cond.:	-40° to +131°F (-40° to +55°C) 80 to 120 kPa 15 to 95% RH noncondensing	

2.2 Certifications and Standards

2.2.1 Explosion Proof Enclosure Certifications

Manufacturer:	Adalet/Scott Fetzer Co.
Catalog Number:	XIHMX Series
Temperature Range:	-34°C to +100°C
IP Rating:	IP66

2.2.1.1 IECEx

Test Standard:	IEC 60079-0:2017, IEC 60079-11:2011
Protection Categories:	Ex db IIC Gb, Ex tb IIIC Db IP66
Certificate:	UL 08.0005U

2.2.1.2 ATEX

Test Standard:	EN 60079-0:2018, EN 60079-11:2012, EN 60079-31:2014
Protection Categories:	II 2 G Ex db IIC Gb, II 2 D Ex tb IIIC Db IP66
Certification:	DEMKO 07 ATEX 0622294U Rev. 4

2.2.1.3 UL

Test Standard:	FM 3600:2018, FM 3610:2018, ANSI/UL 913:2019
Protection Categories:	Class I, Division 1, Group A,B,C,D; Class II, Division 1, Group E,F,G; Class III; Class I, Zone 1 AEx d IIC, Ex d IIC
Certificate:	Classified UL C US 34H4

2.2.1.4 Routine Tests

Routine tests according to EN 60079-1 clause 16 are not required, as the enclosures have been successfully tested at four times the reference pressure, 62.6 bar.

2.2.2 Flame Arrestor Certifications

Manufacturer:	Dynament LTD, Mansfield, UK
Model:	GSH-Series housing
Temperature:	-20°C to +60°C

2.2.2.1 IECEx

Test Standard:	IEC 60079-0:2011 Edition 6.0, IEC 60079-1:2014-06 Edition 7
Protection Categories:	Ex db IIC T4 Gb
Certificate:	IECEx SIR 10.0184X

2.2.2.2 ATEX

Test Standard:	EN 60079-0:2012+A11:2013, EN 60079-1:2014
Protection Categories:	II 2 G Ex db IIC T4 Gb
Certificate:	SIRA 10ATEX1358X

2.2.2.3 EU Declaration of Conformity

Directives:	2014/34/EU: Harmonisation of the laws of Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres (ATEX) 2012/19/EU: Waste Electrical and Electronic Equipment (WEEE) 2011/65/EU: Restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)
Harmonised Standards:	EN 60079-0:2012+A11:2013: General requirements for electrical apparatus for potentially explosive atmospheres EN 60079-1:2014: Flameproof enclosure 'd'
Notified Body for Hazardous Area Certification:	CSA Group Netherlands B.V., Notified Body Number 2813
Notified Body for ATEX QA Notif.:	SGS Fimko Oy, Notified Body Number: 0598

2.3 Signal Outputs

Local Display:	Offers a digital display, which can be accessed and managed via the included magnet wand. In measurement mode, selecting ‘down’ will toggle between scrolling the description and just the gas.
Standard Analog:	Provides DC 4-20 mA output. RS-485 Standard.
Relay Output:	Includes dual-level user-selectable alarm relays and one fault relay, all rated at ≤ 2amps @ ≤ 24VDC.

2.4 Electrical Requirements

Power:	24VDC external power. A regulated 24VDC power supply is required.
Consumptions:	Approx. 250mA

2.5 Physical Characteristics

Dimensions:	5.125 (W) x 8.00 (H) x 6.40 (D) inches; 130 x 200 x 160 mm (Max w/ feet)
Weight:	6.5 pounds (3 kg)
Enclosure Type:	Approved Instrument Housing; For use in Hazard locations as to **Explosion and Fire Hazard ONLY**.

2.6 Default Factory Settings

The PureAire Explosion Proof Universal (EPU) Gas Monitor is shipped with factory defaults that are saved to the memory of the unit. Factory resettable functions are denoted by †.

Menu	Factory Default	Definition
Set 4-20mA Loop†	mA output is individually set at the factory using a calibrated Fluke meter.	Use this function to adjust the PureAire monitor's 4 mA (Zero), and 20 mA (Span) analog output
Set Formats†	Alarm 1 = Normal Alarm 2 = Normal Fault = Normal	When alarm activates, the relays should energize (Normal), or de-energize (Inverted)
Set Polarity†	Alarm 1 = Normal Alarm 2 = Normal	Alarm should activate above specified concentration (Normal), or when lower (Inverted) than the alarm thresholds
Set Latching†	Alarm 1 = Non-latching Alarm 2 = Non-latching Fault = Non-latching	Automatic alarm reset (non-latching), or manual alarm reset (latching)
Alarm Delay†	Alarm = 5 Seconds	Delay until alarm is activated
Set Alarm Thresholds†	Alarm 1 = 20% Alarm 2 = 40%	Alarm levels
Set Alarm Hysteresis†	Alarm 1 = 0.0% Alarm 2 = 0.0%	Deadzone setting, more information in Section 5
Manage Passwords	Factory Default is **557**	For changing the password from factory default to a new password

The LED indicators on the front panel are connected directly to the alarm relays.

3: Installation

3.1 Site Requirements

The PureAire Explosion Proof Universal (EPU) Gas Monitor should ideally be placed in an area free from excessive vibration and electrical noise or interference. Areas with high temperatures or high humidity should be avoided. When installed on a wall, the monitor effectively covers an area of about 692 ft^2. This coverage is approximately a circle with a radius of around 15 ft, assuming an ideal and uniform gas dispersion in an open space.

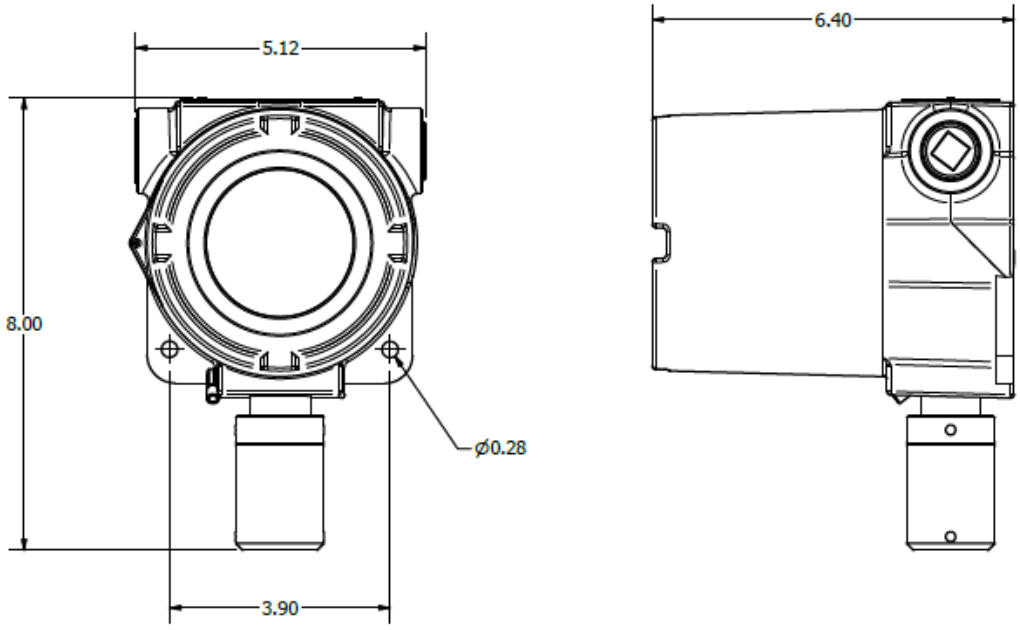
For optimal safety and effectiveness, the EPU Gas Monitor should ideally be situated as close as possible to potential leak sources, such as gas lines, gas cylinders, or other areas prone to gas leaks. While the monitor should not be placed more than 21 ft away from these potential leak points, positioning it closer enhances its ability to promptly detect changes in gas levels. When considering placement, various factors may have to be examined such as expected gas dispersion patterns, the monitor's sensitivity, and required safety margins. Therefore, the closer the monitor is to the potential source of a leak, the more effective it will be in providing timely alerts.

Furthermore, if multiple monitors are installed on the same wall, the maximum distance between two units should not exceed 30 ft for optimal safety and monitoring efficiency. However, actual coverage could be influenced by many environmental factors.

3.2 Mounting

3.2.1 EXR Enclosure Dimensions

The following is a drawing of the mounting dimensions for the monitor housing.



3.2.2 Installation Guidance

The EPU monitor is designed primarily for wall mounting and should be installed at a height convenient for operation, maintenance, and viewing of the instrument's digital display.

Choose a location for the transmitter and sensor where potential gas leaks could occur or where any released gases might tend to gather. The installation should not be less than 12 inches above the floor level. **Consider factors such as air circulation patterns within the area to be monitored, the properties of the gas (whether it's lighter or heavier than air), and the placement of workstations and staff when deciding on the optimal installation site.**

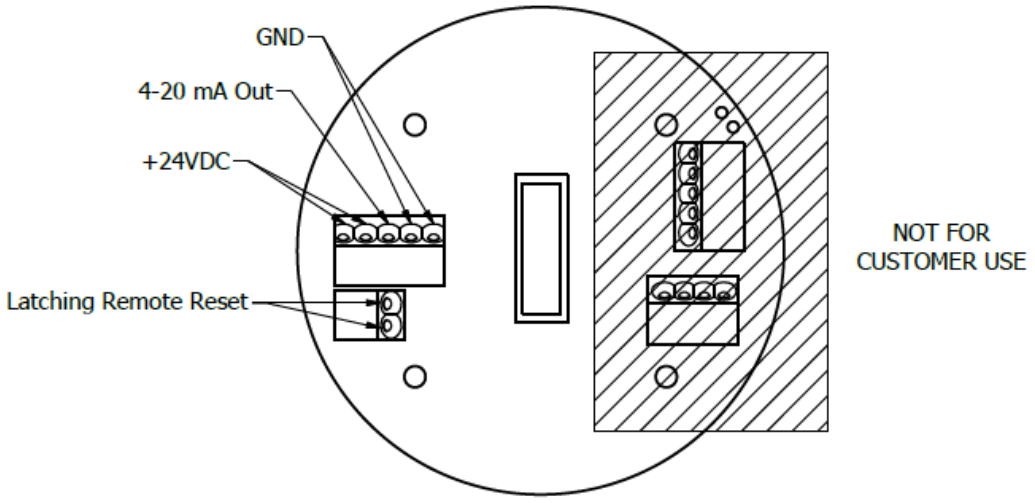
3.3 Wiring

The EPU monitor necessitates a singular, triple-conductor shielded cable for the purpose of analog output and 24 VDC power input. It's recommended to employ a three-wire shielded cable, ideally of 18 AWG stranded, such as the General Cable E2203S.30.860 or an equivalent. The connections for analog output and VDC power input are to be made on the internal terminal block located within the transmitter housing.

Note that all PureAire monitors, except for explosion proof monitors, come with a pre-installed plug-in power supply.

THIS MONITOR REQUIRES CUSTOMER SUPPLIED POWER.

3.3.1 Power to Monitor



Caution: DO NOT connect to a powered current loop receiver. The PureAire monitor supplies the current loop power.

DO NOT disconnect or reconnect the sensor when the monitor is powered on.

4: Normal Operation

The EPU monitor is a single point monitor designed for the continuous detection and measurement of flammable and toxic gas concentration levels in ambient air.

4.1 Signal Outputs

The EPU monitor consistently outputs an analog signal ranging from 4-20 mA, corresponding directly to the measured flammable or toxic gas concentration. A 4-mA output signifies 0% of the full range, while a 20-mA output denotes 100% of the maximum value, representing the full operational range of the monitor. If a system fault occurs, a specific factory-designated code will appear on the local digital display, which will help identify the exact issue with the system, while the analog signal will be locked to 2mA.

CAUTION: DO NOT connect to a powered current loop receiver.
The PureAire monitor supplies the current loop power.

4.2 Instrument Faults

The EPU monitor incorporates several self-checking features to ensure reliable operation. If a fault condition is detected, the analog signal output is altered. Common error codes are displayed in the following table.

Condition	Error Code
Sensor Communication Error	1
EEPROM Fault	8
Supply Voltage Out of Range†	16

When the monitor is in a Fault state, the analog output will be locked to 2 mA.

† When using a non-PureAire power supply, please ensure that the voltage is regulated to 24±0.5VDC. If the voltage is outside the acceptable range, the “Supply Voltage Out of Range” fault will be activated and will disable the monitor.

*If a Fault condition clears itself, (Yellow LED is no longer illuminated) the Fault message will continue to scroll until manually cleared. To clear the fault message, select/toggle **down** ↓.*

4.3 Routine Maintenance Schedule

Continuous gas detection systems, crucial for identifying hazardous gas leaks in various environments, require routine maintenance to ensure proper functioning. The frequency of this maintenance largely hinges on the specific environmental conditions. However, as a general guideline, it is recommended to conduct visual inspections **every 1 year** to verify the physical integrity of the system. Similarly, testing the system with the target gas every 12 months is advisable to confirm the sensor's responsiveness. Please remember that your organization's maintenance policies, along with the unique conditions of your application, may necessitate adjustments to this recommended maintenance schedule.

During normal operation, the unit should be outputting a 4-mA signal when the flammable gas level is at 0% of the full scale. The LCD digital display should also indicate ‘00’ when there is no flammable gas detected.

4.4 Loss of Power Indication

In the event the PureAire monitor loses 24VDC power, the analog output signal will drop to 0mA, and the LCD display will be blank.

4.5 Alarm Reset

The PureAire EPU monitor comes equipped with alarm relays. When the monitor’s alarms are triggered, the built-in alarm relays, and panel-mounted LEDs will activate simultaneously. Depending on the relay settings, the alarm systems will either automatically reset (non-latching settings) or require manual reset (latching settings) upon coming out of alarm state.

To manually reset the alarms, you can use the user-interface or the remote reset function:

1. **User-Interface:** To use the user-interface for reset, you first need to enter the designated password to access the reset function. Once the password is accepted, you can toggle enter using the provided magnetic wand to reset the alarms.
2. **Remote Reset:** The alarm relay board includes a two-pin connector for wiring to a remote switch. When a switch is connected, this remote reset function allows you to reset the alarms without using the user-interface or needing to enter a password.

Please note: Before you can reset the alarms using either the remote reset switch or the user-interface, the measured gas levels must return to under alarm thresholds.

5: Monitor Programming

Only qualified personnel should perform programming, maintenance, and sensor verification.

The PureAire EPU monitor comes with customizable settings, allowing users to modify alarm settings, 4 and 20mA output, and minor sensor adjustments. These settings are organized within menus that can be navigated using the user-interface and the provided magnetic wand. Access to these menus is secured with a factory-set password.

Please note: Even while adjusting settings within these menus, the PureAire EPU monitor will keep monitoring gas levels. **The alarm, fault relays, and mA output remain active and online during any changes made within the menus.**

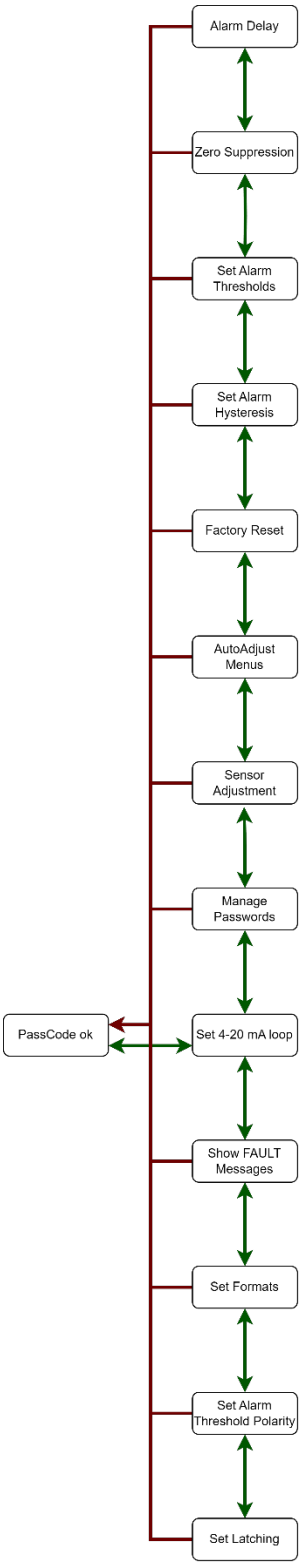
5.1 User-Interface Operation

The PureAire EPU monitor uses a magnetic user-interface for selecting menus and changing values. The user-interface is programmed to standard protocol as follows:

Up – Increases the value
Down – Decreases the value
Right – Next level of menu hierarchy
Previous – Returns to previous level of menu hierarchy
Enter – Enters information into the microprocessor

NOTE: The interface has a built-in delay to prevent accidental tampering of the menus.

5.2 Overall Program Flowchart



5.2.1 Top Level Menu Navigation

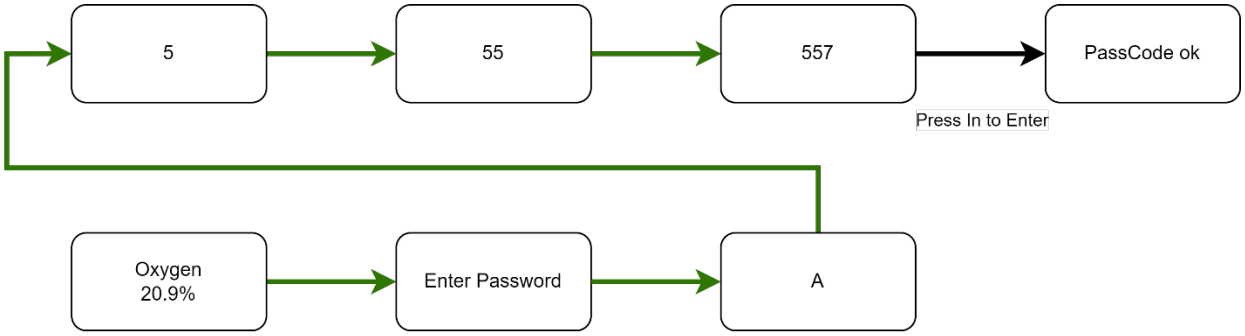
After entering the correct password, the monitor will display “PassCode ok”. To exit the password menu and return to the default screen, input ‘left’ on the user interface.

To access the internal settings, input ‘right’ to enter the ‘Set 4-20 mA loop’ top-level menu state.

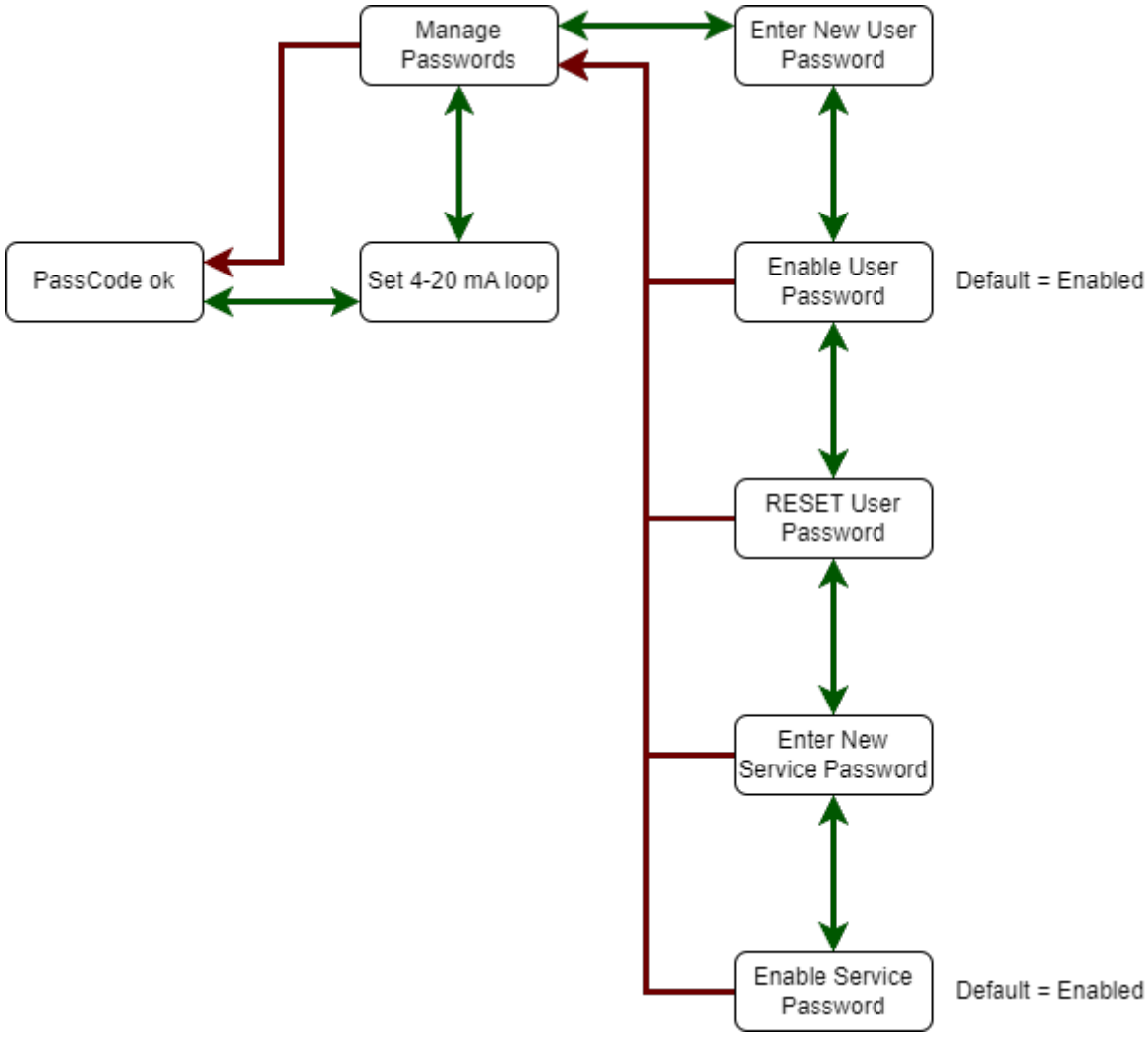
Once in this menu state, you can navigate through other top-level internal menus by inputting ‘up’ or ‘down’.

To return to the “PassCode ok” screen from any top-level internal menu, input ‘left’ on the user-interface. From sub-menus, toggle left until the “PassCode ok” menu state is reached.

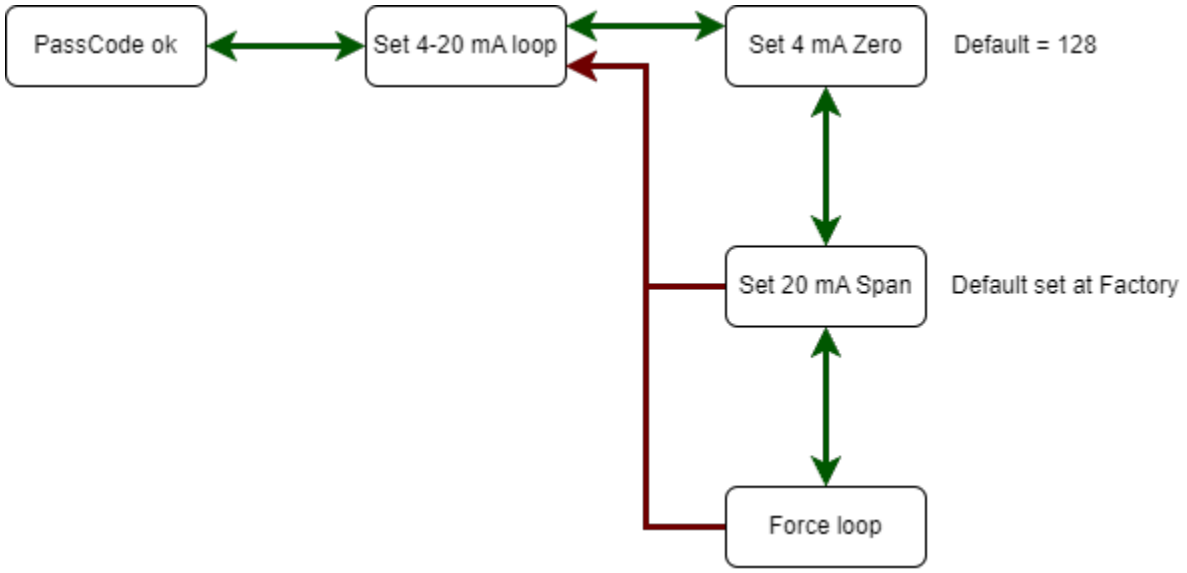
5.3 Entering Password



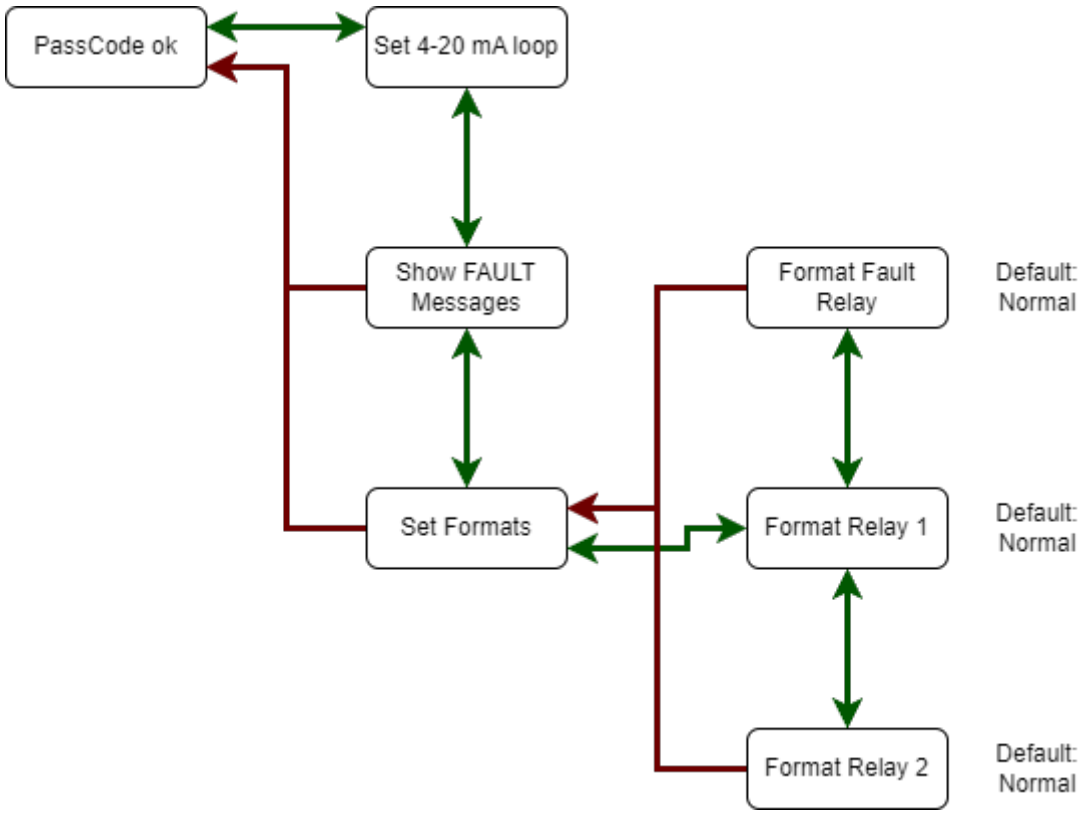
5.4 Changing the User Password



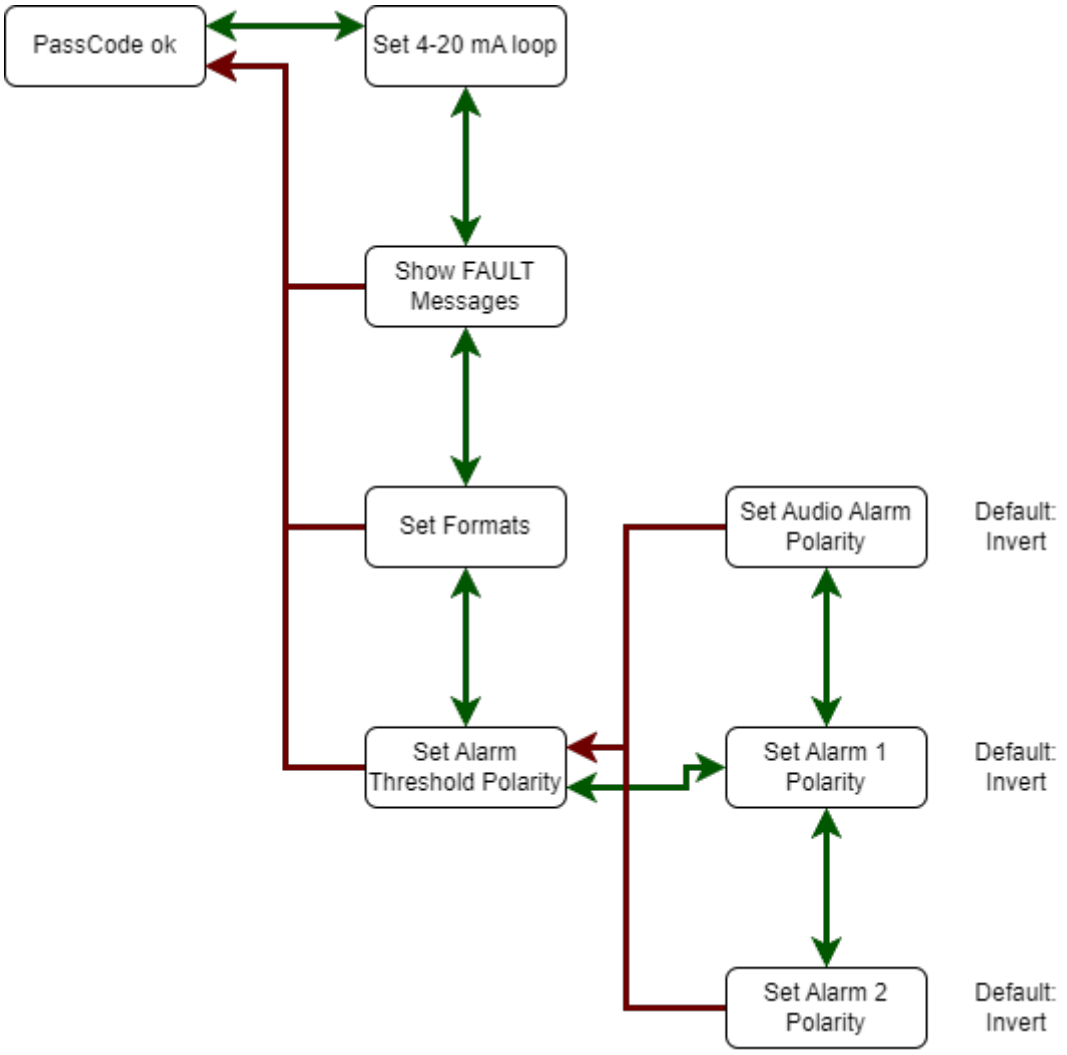
5.5 Setting 4-20mA Loop



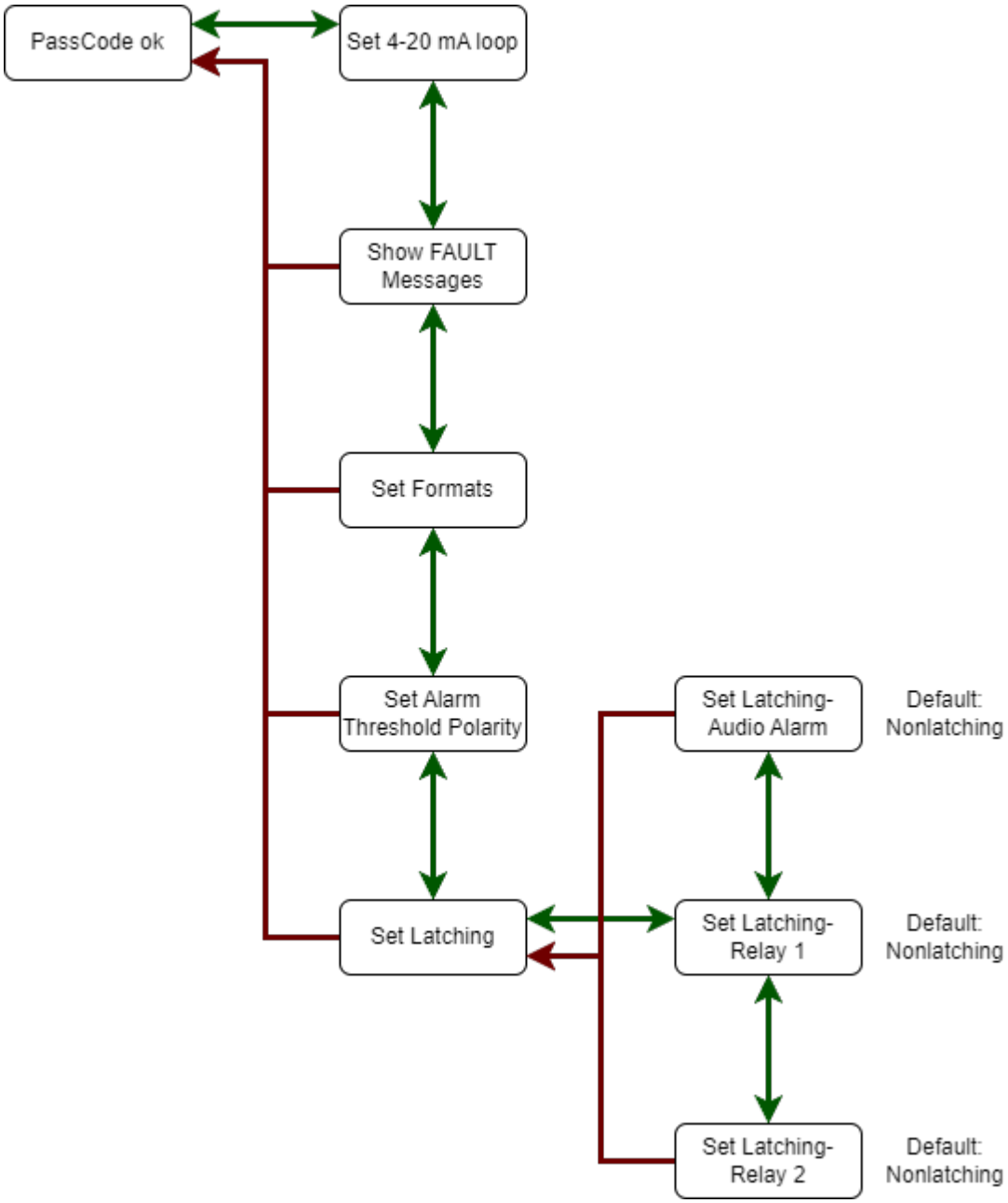
5.6 Setting Relay Formats



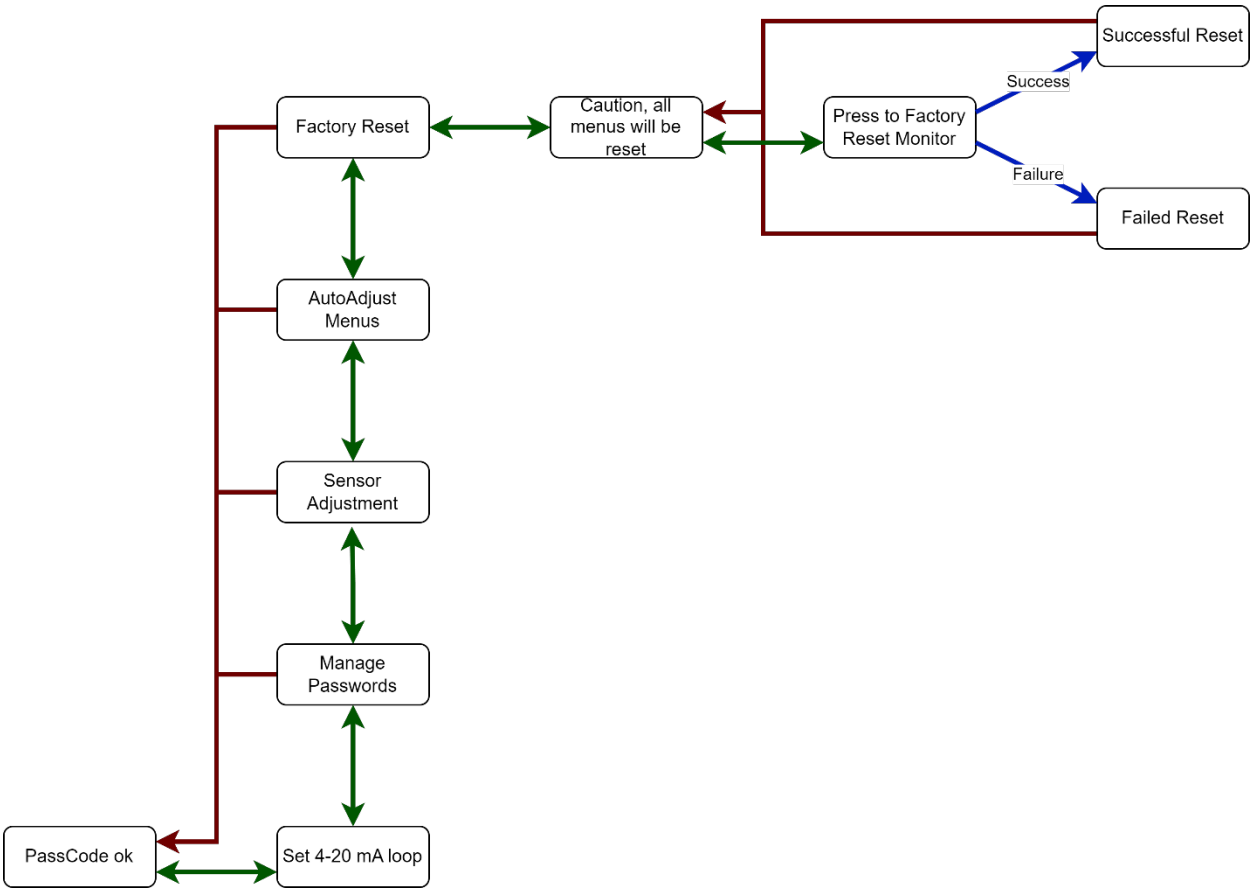
5.7 Setting Alarm Polarity



5.8 Setting Alarm Latching

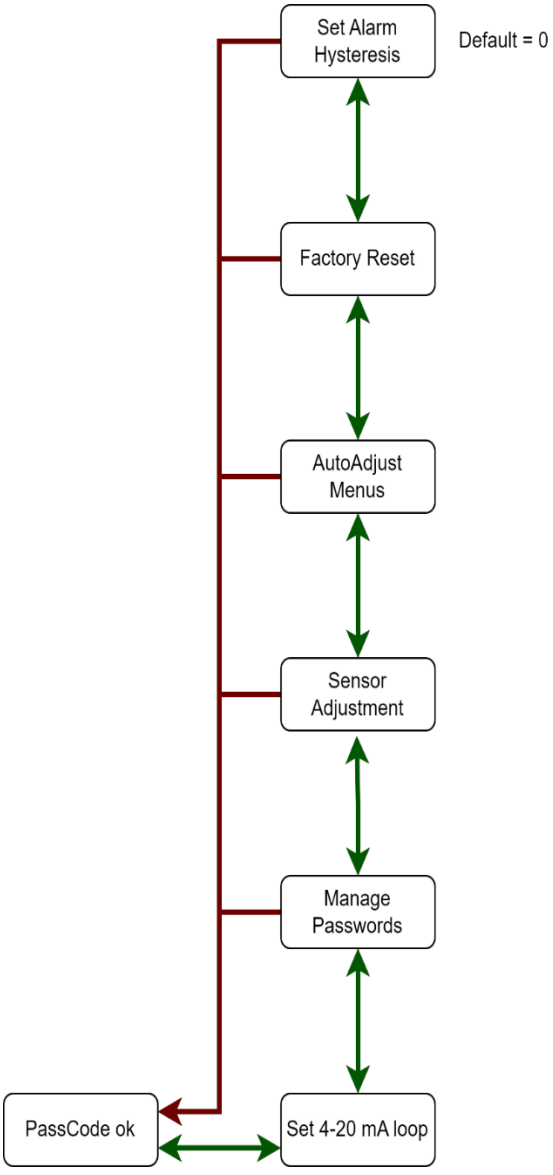


5.9 Factory Reset Menus



Please refer to Section 2.7 for Default Factory Settings and resettable settings.

5.10 Setting Alarm Hysteresis



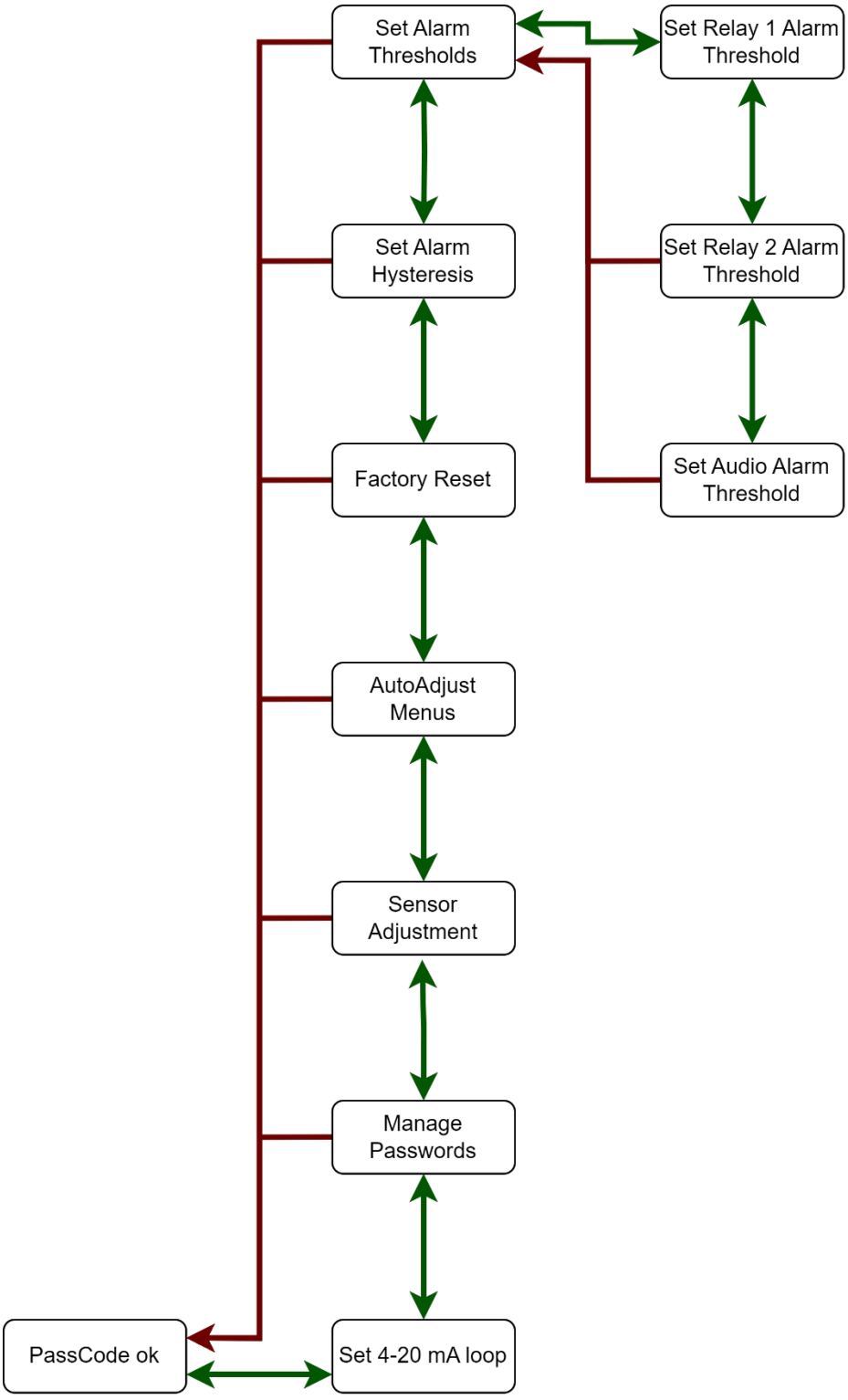
5.10.1 Hysteresis

Hysteresis refers to a system's dependency not just on its current input, but also on its past history of inputs. It's a fundamental concept employed in various scientific and engineering fields, often used to stabilize systems and prevent them from rapid fluctuations in response to minor changes in input, a phenomenon commonly referred to as "chatter". The application of hysteresis, thus, can provide more consistent and reliable system operation.

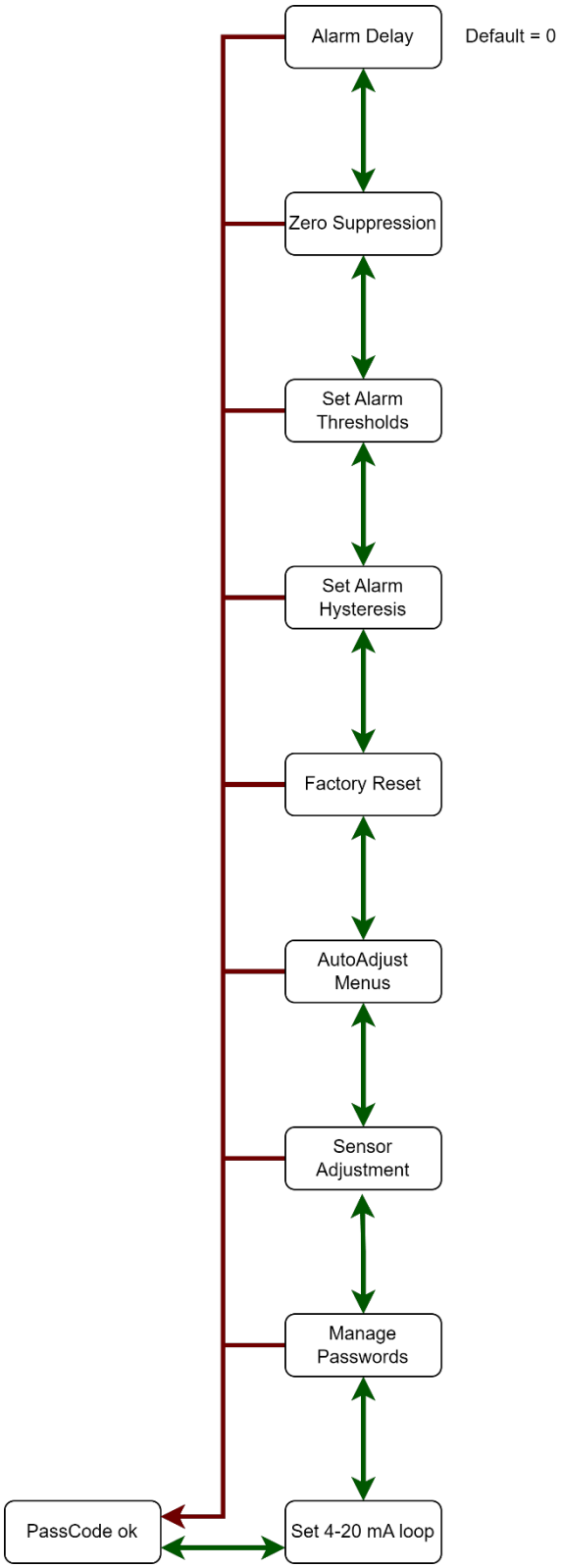
In control systems or sensors, hysteresis introduces a buffer zone of sorts, within which the system maintains its current state even as the input varies. This has the practical effect of preventing a system from overreacting to small or brief changes in the inputs.

Consider an example in an oxygen monitoring and control system where we want a valve to close when the flammable gas level drops to 14.9% and reopen when it reaches 15.5%. The implementation of hysteresis allows us to set the alarm threshold at 15.2%, with a hysteresis value of 0.3%. This means that when the oxygen level falls to 15.2%, the system will trigger the alarm, and the valve will close. However, the valve will not reopen immediately when the oxygen level rises back to 15.2%. Instead, it will wait until the oxygen level reaches the upper hysteresis limit of 15.5% (15.2% + 0.3%). This strategy prevents the valve from frequently opening and closing due to small fluctuations around the 15.2% level, ensuring more stable operation

5.11 Setting Alarm Thresholds



5.12 Setting Alarm Delay



6: Maintenance & Sensor Verification

Only qualified personnel should perform maintenance and sensor verification.

6.1 General Guidelines

All Explosion Proof Universal (EPU) Gas Monitors are designed for high reliability, but periodic verification of sensor functionality is recommended to ensure continuous optimal performance and safety compliance.

While the EPU Gas Monitor's electronics require minimal maintenance, sensor cells have different lifespans, calibration intervals, and verification requirements. Please refer to your specific sensor type listed below for guidance.

6.1.1 EPU-MPS Sensor

The Molecular Property Spectrometry (MPS) sensor is designed for long-term operation (15+ years) without routine calibration. Periodic sensor verification every 12 months is recommended to ensure continued responsiveness.

- Verification Gas: Standard butane lighter or 50% LEL hydrogen or methane mixture.
- Equipment Required: Standard butane lighter or regulated gas supply (e.g., 50% LEL hydrogen mixture), regulator, and tubing.
- Recommended Gas Flow Rate: 500cc/min (0.5LPM).

6.1.2 EPU-EC Sensor

Electrochemical (EC) sensors require periodic calibration, typically annually. Verification involves applying a known concentration of the target toxic gas (ppm/ppb range).

- Required Equipment: Certified gas cylinder specific to the gas monitored, compatible regulator, and tubing.
- Recommended Gas Flow Rate: Refer to sensor datasheet (typically 250cc/min).

6.1.3 EPU-PEL Sensor

The Pellistor (PEL) sensor typically has a 3–5-year lifespan depending on usage conditions. Annual calibration is required using specific calibration gases with cross-factors clearly indicated in the sensor datasheet.

- Recommended Gas Flow Rate: 500cc/min (0.5LPM).

6.1.4 EPU-NDIR Sensor

The Non-Dispersive Infrared (NDIR) sensors have a lifespan of approximately 5+ years. Annual calibration is recommended using a known reference gas for the specific refrigerant or toxic gas being detected.

- Recommended Gas Flow Rate: Refer to sensor datasheet (typically 500cc/min).

6.1.5 EPU-PID Sensor

The Photoionization Detector (PID) sensor typically has a 5+ year lifespan and detects volatile organic compounds (VOCs). Calibration is recommended annually or more frequently based on environmental conditions, using certified calibration gases specific to the VOCs of concern.

- Recommended Gas Flow Rate: Refer to sensor datasheet (typically 500cc/min).

6.2 General Sensor Functionality Verification Procedure

CAUTION: Always adhere strictly to all safety protocols when handling hazardous, toxic, or flammable gases.

Sensor functionality verification generally involves applying a known concentration of the target gas or using a verification gas to confirm sensor responsiveness:

1. Introduce the verification gas at the recommended flow rate.
2. Observe that the monitor reading appropriately increases in response to the introduced gas.
3. Ensure the sensor reading returns to baseline after removal of the verification gas.
4. Verify optional features such as analog outputs, alarm relays, and any attached components trigger during alarm states and reset upon returning to safe conditions.

If the sensor reading deviates beyond acceptable limits (typically ±5%), recalibration or cell replacement may be necessary. If issues persist, consult PureAire for detailed servicing instructions

CAUTION: Always adhere strictly to safety protocols when handling calibration gases or hazardous materials.

For sensor-specific details, calibration gases, and exact procedures, please refer to the appendices and related documents dedicated to each sensor technology.

NOTE: It is recommended to warm up the PureAire Explosion Proof Universal Gas Monitor for at least two hours before making any adjustments to the sensor.

Appendix A — EPU-MPS

The Molecular Property Spectrometer (MPS™) Flammable Gas Sensor is an advanced sensor designed with built-in environmental compensation to accurately detect and quantify over a dozen different flammable gases, as well as gas mixtures. It is designed to be robust, and highly resistant to poisoning, making it extremely reliable for long-term use in various environments.

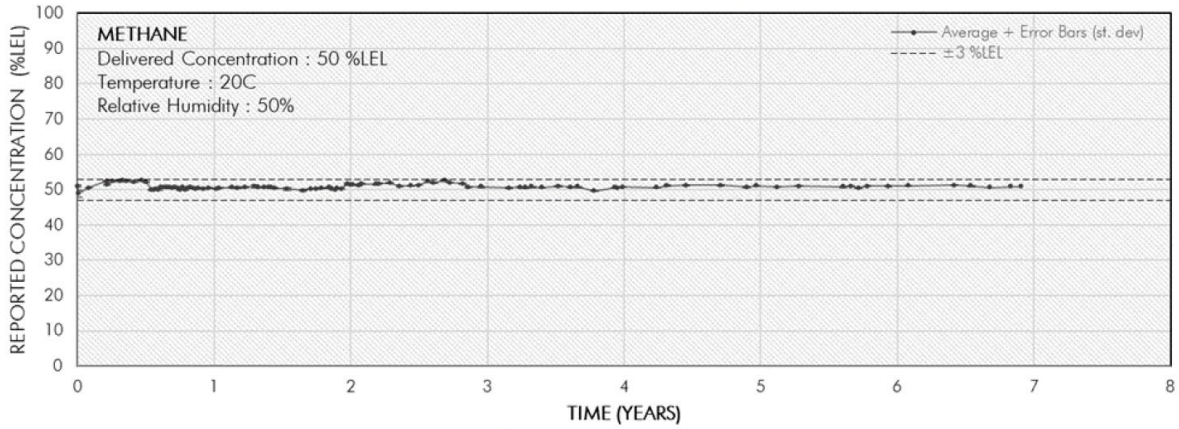
Unlike traditional sensing technologies such as catalytic beads or NDIR sensors, which require manual selection of a "k-factor" to adjust sensitivity to specific gases, the MPS sensor applies a real-time conversion factor automatically. This conversion factor is determined using the most recent thermal properties of the ambient air/gas mixture, as well as environmental conditions. This ensures that the %LEL (Lower Explosive Limit) values reported are accurate even in complex gas mixtures, maintaining a high level of accuracy across all detected gases.

A.1 MPS — Detected Gases, Displayed Classes, & Verified Accuracy

Class	**PureAire Displayed Text**	Class Description	No. of Carbons	Gas	Formula	% Volume of gas at 100%LEL (ISO 10156)	Accuracy (0-50%LEL)
0	SENSING.	No Gas					
1	H2	Hydrogen	0	Hydrogen	H2	4.0 %Vol	±5 %LEL
2	H2 MIX	Hydrogen Mixture	Varies	Hydrogen + Flam	H2 + CxHxOx	—	—
3	CH4	Methane/Natural Gas	0-2	Methane	CH4	5.0 %Vol	±3 %LEL
4	LITE GAS	Light Gas	1-4	Ethylene	C2H4	2.7 %Vol	-12 %LEL
				Ethane	C2H6	3.0 %Vol	±5 %LEL
				Propylene	C3H6	2.4 %Vol	±5 %LEL
				Propane	C3H8	2.1 %Vol	±7 %LEL
				Isopropanol	C3H8O	2.0 %Vol	±10 %LEL
				Isobutylene	C4H8	1.8 %Vol	±5 %LEL
				Isobutane	HC(CH3)3	1.8 %Vol	±5 %LEL
				Butane	C4H10	1.8 %Vol	±5 %LEL
5	MED. GAS	Medium Gas	2-8	Acetone	C3H6O	2.5 %Vol	±20 %LEL
				Methyl Ethyl Ketone (MEK)	C4H8O	1.4 %Vol	±5 %LEL
				Pentane	C5H12	1.5 %Vol	±7 %LEL
				Heptane	C7H16	1.1 %Vol	±12 %LEL
6	HVY. GAS	Heavy Gas	6+	Toluene	C7H8	1.2 %Vol	±12 %LEL
				Styrene	C8H8	1.1 %Vol	-20 %LEL
				Xylene	C8H10	1.1 %Vol	±12 %LEL
				Octane	C8H18	1.0 %Vol	±12 %LEL
-	OVR. RNG	>100% LEL					

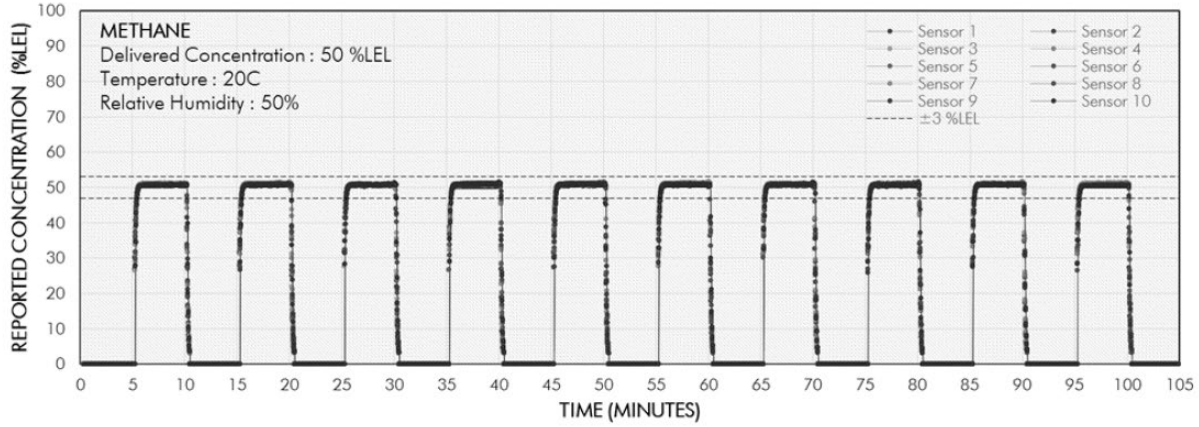
A.2 MPS — Typical Gas Performance Characteristics

A.2.1 Long-Term Accuracy/Stability



Average concentration reported to repeated exposures of 50 %LEL methane vs. time. Between exposures, all sensors operated continuously in clean air. During exposures, all sensors were placed in an environmental chamber set at standard conditions (20 °C, 50 %RH) where gas was delivered from a cylinder. Accuracy has remained within ±3 %LEL to date. The test is ongoing.

A.2.2 Repeatability



Sensor #	Average [%LEL]	Standard Deviation [%LEL]
Sensor 1	50.8	0.15
Sensor 2	50.5	0.18
Sensor 3	50.9	0.13
Sensor 4	50.7	0.22
Sensor 5	50.7	0.14
Sensor 6	50.7	0.13
Sensor 7	50.7	0.14
Sensor 8	50.6	0.18
Sensor 9	50.7	0.10
Sensor 10	50.6	0.17

A.3 MPS — All Detectable Gases

The table below outlines all gases detectable by the Molecular Property Spectrometer (MPS™). Although the MPS sensor can detect a broad range of flammable gases, not all exhibit the consistent accuracy across various environmental conditions required for inclusion in the primary verified accuracy list (Section A.1).

Gases listed under "Variable Accuracy" have varying degrees of accuracy based on environmental factors and specific gas properties. Users should note the classification symbols accompanying each gas to understand the level of testing and the expected performance:

- * = Tested with good results
- † = Tested; approximate accuracy (sniffer-level detection)
- ‡ = Tested; accuracy unknown
- ‡‡ = Tested; demonstrated poor performance

Consider these accuracy variations carefully when selecting the MPS sensor for monitoring specific gases, particularly in environments with fluctuating conditions.

Gas Class	Verified Accuracy, Measurable Gases		Variable Accuracy, Detectable Gases	
Class I	Hydrogen			
Class II	Hydrogen + Flam			
Class III	Methane		Acetylene†	Ammonia‡‡
Class IV	Ethylene	Isopropanol	1-Butene*	Hexamethyldisilazane (HMDS)†
	Ethane	Isobutylene		
	Propylene	Isobutane		
	Propane	Butane		
Class V	Acetone	Pentane	Hexane*	
	Methyl Ethyl Ketone (MEK)	Heptane		
Class VI	Toluene	Xylene	Hexane*	Hexamethyldisiloxane (HMDSO)†
	Styrene	Octane	n-Nonane*	Dimethyl Carbonate (DMC)†
Varies by Environment			Cyclohexane*	Unleaded Petrol*
			Ethanol†	Fuel oil, diesel‡
			Methanol†	n-Decane†

Appendix B — EPU-EC

PureAire EPU-EC monitors use electrochemical (EC) cells highly specific to their target gas through selective chemical reactions. These EC cells are durable, offering strong resistance to variations in humidity and temperature; however, prolonged exposure and environmental conditions eventually affect their lifespan.

Typical sensor life ranges from 3 to 5 years, but extreme exposure can reduce it to as little as 6 months. Due to their consumable nature and limited shelf life, we recommend performing functional checks and testing every 6 months to ensure reliable performance.

B.1 EC — Detectable Toxic Gases

Detectable Toxic Gases (PPM/PPT), EPU-EC 981##	
Ethylene Oxide (EtO)	Carbon Monoxide (CO)
Sulfur Dioxide (SO2)	Nitric Oxide (NO)
Hydrogen Sulfide (H2S)	Ammonia (NH3)
Hydrogen Cyanide (HCN)	Hydrogen (H2)
Nitrogen Dioxide (NO2)	Chlorine (CL2)
Phosphine (PH3)	Hydrogen Peroxide (H2O2)
Hydrogen Chloride (HCL)	Volatile Organic Compounds (VOCs)

Appendix C — EPU-PEL

Pelistor (catalytic bead) sensors reliably detect combustible gases through catalytic oxidation and are robust against environmental factors such as humidity, providing consistent performance under vary conditions.

However, these sensors require calibration adjustments similar to selecting a “k-factor,” limiting accurate detection to a single target gas, potentially causing under- or over-reporting. Additionally, pelistor sensors are susceptible to poisoning, notably by hydrogen sulfide (H_2S). Due to these limitations, PureAire recommends the MPS sensor technology for flammable gas monitoring unless the target gas is not listed as detectable by the MPS.

C.1 PEL — Detectable Flammable Gases, Alphabetical

Detectable Flammable Gases (%LEL), EPU-PEL 982##	
Acetone	Heptane
Acetic Acid	Iso-Butane
Acetonitrile	Iso-Butanol
Acetylene	Iso-Octane
Ammonia	Iso-Pentane
Benzene	Iso-Propanol
Butane	Methane
Butyl Acetate	Methanol
Cyclohexane	Methyl Ethyl Ketone
Cyclopentane	Octane
Carbon Monoxide	Pentane
Dichloromethane	Propane
Dodecane	Propanol
Diethyl Ether	Propylene
Ethane	Styrene
Ethanol	Tetrahydrofuran
Ethyl Acetate	Tert-Butanol
Ethylene	Toluene
Hydrogen	Vinyl Chloride
Hexane	Xylene

C.2 PEL — Detectable Flammable Gases, Calibration Ratio

Gas	Calibration Ratio	
Acetylene	1:1	100%
Carbon Monoxide		
Hydrogen		
Methane		
Methanol	~1:1	96%
Ammonia		92%
Acetonitrile		90%
Ethylene		80%
Cyclopentane	~2:3	70%
Ethane		
Ethanol		
Isobutane		
Propane		
Tert-Butanol		68%
Dichloromethane		66%
Iso-Pentane		
Isopropanol		
Pentane		
Acetone	~3:5	64%
Butane		
Cyclohexane		
Hexane		
Benzene		60%
Propylene		
Ethyl Acetate		56%
Heptane		
Octane	~1:2	54%
Toluene		52%
Diethyl Ether		50%
Tetrahydrofuran		
Xylene		
Iso-Butanol		48%
Iso-Octane	~2:5	40%
Propanol		
Vinyl Chloride		
Styrene		38%
Butyl Acetate	~1:3	32%
Methyl Ethyl Ketone		28%
Dodecane	1:5	20%
Acetic Acid	1:10	10%

C.3 PEL — Selecting Target Gas & Number of Units

The table provided in Section C.2 categorizes gases detectable by pelistor sensors into distinct groups based on calibration ratios. Gases with calibration ratios near 1:1, such as carbon monoxide and ammonia, deliver optimal performance due to minimal cross-sensitivity with other gases. As calibration ratios diverge from 1:1 (moving downward in the table), the sensor's sensitivity must be increased, amplifying cross-sensitivity and potentially causing significant over-reporting of gases higher in the table.

Consequently, careful consideration is required when selecting target gases for monitoring. Calibrating sensors for gases with markedly different calibration ratios in the same location (e.g., acetylene and dodecane) is not advisable; one sensor will frequently trigger alarms due to over-reporting, while the other might rarely alert, depending on the actual gas present.

This challenge underscores why PureAire recommends the Molecular Property Spectrometer technology, EPU-MPS, which incorporates environmental factors and molecular weight into its calculations, providing a more accurate %LEL measurement for diverse environments. However, pelistor sensors remain suitable and effective when monitoring environments with a limited number of target gases or when the target gases are not reliably detected by the MPS.

Appendix D — EPU-NDIR

The Non-Dispersive Infrared (NDIR) sensors accurately detect and quantify refrigerant gases and carbon dioxide (CO_2) using infrared absorption technology. Optimized for reliable monitoring in HVAC, refrigeration, and environmental applications, these sensors offer precise measurement, minimal maintenance, and robust long-term performance. Their inherent stability and immunity to common environmental contaminants make them ideal for continuous monitoring in demanding conditions.

NDIR sensors have no defined shelf life and typically provide reliable service for over five years. However, their accuracy can be affected by high humidity, and they cannot detect hydrogen in flammable gas mixtures. Although less selective than electrochemical sensors (EC), NDIR sensors offer significantly longer lifespans. For precise monitoring of flammable gases, PureAire recommends Molecular Property Spectrometer (MPS™) or catalytic bead (pelistor) sensors over NDIR technology due to their superior selectivity and performance.

D.1 NDIR — Detectable Refrigerant Gases

Detectable Refrigerants, EPU-NDIR 983##	
SF6 (0-1000ppm, 0-2000ppm)	R-410 (0-2000ppm)
R-1233zd (0-5000ppm)	R-417a (0-2000ppm)
R-1234yf (0-6.2%vol, 0-2000ppm)	R-422d (0-2000ppm)
R-1234ze (0-6.5%vol, 0-2000ppm)	R-448a (0-2000ppm)
R-125 (0-2000ppm)	R-449a (0-2000ppm)
R-134a (0-2000ppm)	R-450a (0-2000ppm)
R-143a (0-2000ppm)	R-452a (0-2000ppm)
R-22 (0-2000ppm)	R-452b (0-11.9%, 0-2000ppm)
R-227ea (0-2000ppm)	R-454a (0-6.3%vol)
R-32 (0-14%vol, 0-2000ppm)	R-454b (0-7.7%vol, 0-2000ppm)
R-404a (0-2000ppm)	R-454c (0-6.2%vol)
R-407a (0-2000ppm)	R-455a (0-11.8%vol)
R-407f (0-2000ppm)	R-507 (0-2000ppm)
Ethylene (0-2.3%vol)	R-513a (0-2000ppm)
Detectable Refrigerants through Cross Factors, EPU-NDIR 983##	
R-22	R-452a
R-407c	R-454b (ppm)
R-422a	R-454c (ppm)
R-424a	R-455a (ppm)
R-427a	R-453a
R-434a	R-422a
R-438a	R-123

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