DIXELL *Installing and operating instructions* EMERSON


# MRLDS-450

## IP41 & IP66 Refrigerant Gas Detection

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# 1 Introduction

## 1.1 About this Manual

Thank you for investing in a MRLDS-400 series gas detector. To ensure operator safety and the proper use of the gas detector, please read the contents of this manual for important information on the operation and maintenance of the instrument.

## 1.2 Conventions

### 1.2.1 Short Form Instructions

This document uses a short form for describing steps *(e.g. executing a command)*.

**Example:**

Accessing sensor calibration.

**Short Form Instructions:**

To select access sensor calibration: Home Tab → Calibrate → enter Unlock Code

**Steps Required:**

1. Open the Home Tab.
2. Select Calibrate.
3. When prompted, enter the Unlock Code to access calibration screen.

### 1.2.2 Iconography

| Alert | Icon | Description |
|---|---|---|
| Danger |  | Imminently hazardous situation which, if not avoided, will result in death or serious injury. |
| Warning |  | Potentially hazardous situation which, if not avoided, could result in death or serious injury. |
| Warning |  | Potential electrical shock hazard which, if not avoided, could result in death or serious injury. |
| Caution |  | Potentially hazardous situation which, if not avoided, could result in physical injury or damage to the product or environment. It may also be used to alert against unsafe practices. |
| Important |  | Additional information on how to use the product. |

## 1.3 General Safety Statements

| | |
|---|---|
|  | **IMPORTANT:** Before using this product, carefully read and strictly follow the instructions in the manual. Ensure that all product documentation is retained and available to anyone operating the instrument. |
|  | **DANGER:** This instrument is neither certified nor approved for operation in oxygen-enriched atmospheres. Failure to comply may result in personal injury or death. |
|  | **WARNING:** Use this product only for the purposes specified in this document and under the conditions listed. |
|  | **WARNING:** This instrument has not been designed to be intrinsically safe for use in areas classified as being hazardous locations. For your safety, DO NOT use it in hazardous *(classified)* locations. |
|  | **WARNING:** In the event of an alarm or over-range condition, the sensor must be recalibrated to ensure continued accuracy. |
|  | **WARNING:** This product must be recalibrated if installed in a non-room condition environment *(i.e. temperature or humidity extremes)*. |
|  | **WARNING:** The gas diffusion path can become occluded *(moisture, dust, debris, frozen condensation)* over time resulting in reduced or complete lack of gas detection and alarming function. Routine visual inspection of the gas detector and bump testing are suggested to ensure proper gas detection and alarm function. |
|  | **CAUTION:** Except for maintenance detailed in this manual, these products should only be opened and / or serviced by authorized technical personnel. Failure to comply may void the warrant. |
|  | **CAUTION:** Operator assumes responsibility for complying with all laws, rules and regulations governing the use of this product. |
|  | **CAUTION:** Use only genuine parts and accessories. Failure to comply may impair the operation of the product and / or void the warranty. |
|  | **CAUTION:** Only operate the product within the framework of a risk-based alarm signaling concept. |

## 1.4 Safe Connection of Electrical Devices

**WARNING:** Before connecting this instrument to electrical devices, consult the manufacturer or a qualified professional. Failure to comply may result in injury and / or damage to the product.

# 2 Product Description

## 2.1 Intended Uses / Applications

MRLDS-400 gas detectors are to be installed in non-classified, non-hazardous, permanent locations for the purpose of continuously monitoring ambient air *(indoor or outdoor)* for the following gas types:

- Refrigerants
- Oxygen
- Toxic and combustible gases

**WARNING:** This instrument is neither certified nor approved for operation in oxygen-enriched atmospheres. Failure to comply may result in EXPLOSION.

**WARNING:** This instrument has not been designed to be intrinsically safe for use in areas classified as being hazardous locations. For your safety, DO NOT use it in hazardous *(classified)* locations.

**WARNING:** It is possible to identify this instrument as a safety device only evaluating the final application and location, which defines the relevant local laws, applicable standards and required technical characteristics; therefore, the evaluation of the MRLDS-450 as a safety device will be ultimately assessed by the customer / installer.

## 2.2 Transmitter Construction

MRLDS-400 gas detectors may be purchased in the following configurations:

| |  |  |
|---|---|---|
| **Enclosure** | IP41 | IP66 |
| **Relays** | 3 | 3 |
| **Communication** | Modbus | Modbus |
| **Output** | Analog | Analog |
| **Sensor** | Integrated | Integrated |

## 2.3 Power Options

MRLDS-400 gas detectors may use the following power options:

- 24 VAC
- 19.5 to 28.5 VDC

## 2.4 Diagnostic / Status LED

MRLDS-400 gas detectors feature a three-color LED *(green, orange and red)* which are used, in combination with an audible alarm, to communicate the status of the instrument.

## 2.5 Configurable Output Signals

MRLDS-400 gas detectors may be connected to a Dixell controller or a third-party device capable of accepting digital and/or analog outputs from the gas detectors, such as a Building Management System *(BMS)* or Programmable Logic Controller *(PLC)*. With the integrated audio-visual alarm indication, an instrument can be operated as a stand-alone unit *(with additional local alarm signaling as required)*. Configurable output signal options include the following:

- Digital Output *(Modbus RTU signal)*
- 3× Relays *(high alarm / low alarm / fault)*
- 1× Analog Output *(4 to 20 mA, 0 to 5 V, 0 to 10 V, 1 to 5 V, 2 to 10 V)*

## 2.6 User Interface

MRLDS-400 gas detectors allow users to interface directly with the instrument via the following:

- Bluetooth® Communication *(*MRLDS*-400 App allows users to configure the gas detector, initiate calibration, bump test / functional test modes and view status information.)*
- Tactile / Magnetic Switches *(A non-intrusive magnetic wand allows users to initiate calibration of the device.)*

## 2.7 Technical Specifications

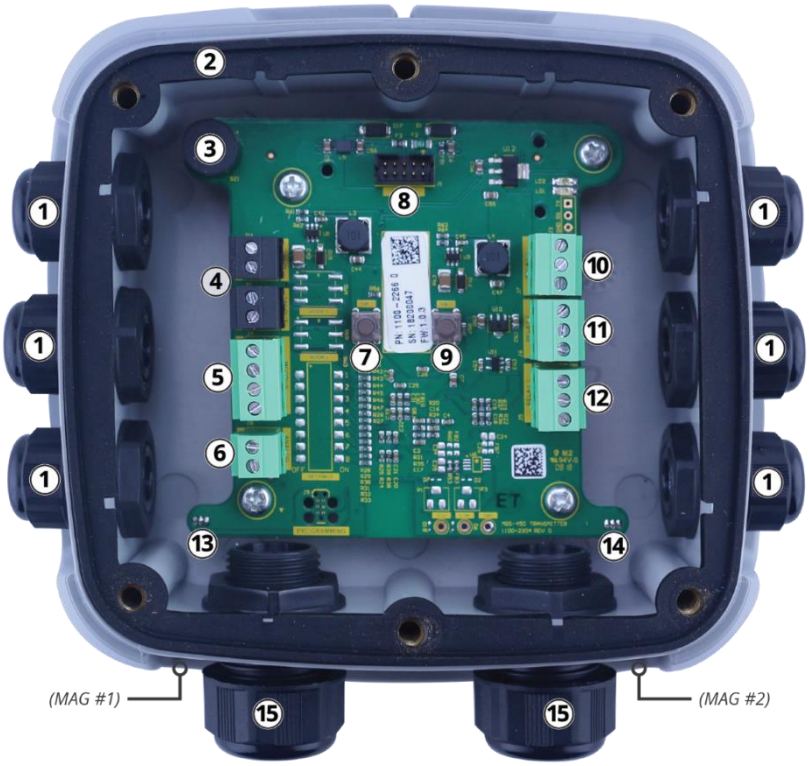
| Category | | Specifications |
|---|---|---|
| Signal to Central Controller | Analog Current | Normal operation:..... 4 to 20 mA |
| | | Drift below zero:..... 3.8 mA |
| | | Measuring range exceeded:..... 20.5 mA |
| | | Instrument fault:..... ≤ 1.2 mA |
| | | Fault on analog interface:..... > 21 mA |
| | | Offline mode/Maintenance signal:..... 3 mA steady signal |
| | Analog Voltage | 0 to 5V; 1 to 5V; 0 to 10V; 2 to 10V *(selectable)*. During fault condition, 1 to 5V and 2 to 10V outputs are 0V. |
| | Modbus RTU over RS-485 | Baud rate:..... 9,600 or 19,200 *(selectable)* |
| | | Start bits:..... 1 |
| | | Data bits:..... 8 |
| | | Parity:..... None, odd, even *(selectable)* |
| | | Stop bits:..... 1 or 2 *(selectable)* |
| | | Retry time:..... 500 ms, min time between retries |
| | | End of message:..... Silent 3.5 characters |
| Power Supply and Relays | Operating Voltage | 19.5 to 28.5 VDC; 24 VAC ± 20%, 50/60 Hz |
| | Inrush Current | 1.5 A |
| | Operating Current, Max. | 4W, 170mA @ 24VDC |
| | Relay Rating | 3 SPDT<br>1A at 30 VAC/VDC, resistive load |
| | Audible Alarm | Internal Buzzer ≥72 dB at 4” *(10 cm)* |
| | Alarm Delay | 0 to 15 minutes *(selectable)* |

| | | |
|---|---|---|
| Wiring | Power and Analog Signal | 2-core shielded cable, 16 to 20 AWG *(0.5 to 1.5 $mm^2$)* |
| | Modbus Network | 3-core, 2 twisted pair + ground, shielded cable with 120 Ω characteristic impedance, 16 to 24 AWG *(0.2 to 1.5 $mm^2$)*. |
| | Cable Gland | M20, 10-14mm cable outer diameter<br>M16, 4-8mm cable outer diameter |
| Physical Specifications | Enclosure Protection | IP41 / IP66 |
| | Enclosure Size *(W×H×D) (Approx.)* | MRLDS-450 IP41: 6.5× 6.5×3.0” *(165×165×77 mm)*<br>MRLDS-450 IP66: 6.5×6.5×3.4” *(165×165×87 mm)* |
| | Weight (Approx.) | 1lb, 1oz *(480 g)* |
| Environmental | Temperature | - 40 to 120 ºF *(-40 to 50 ºC)* |
| | Storage Temperature | - 5 to 100 ºF *(-20 to 40 ºC)* |
| | Humidity | 5 to 90 %RH, non-condensing<br>*(15 to 90 %RH, non-condensing, EC sensors excl. O2)* |
| | Sensors | See paragraph Sensor Specifications for detailed information. |
| | Influences | For influences on the measurement performance and restrictions of a particular sensor see sensor data sheet. |
| Agency Approvals | CE, EN 50270:2015, UL/CSA/IEC/EN 61010-1 | |

## 2.8 Components

**CAUTION:** This product uses semiconductors which can be damaged by electrostatic discharge *(ESD)*. When handling the printed circuit boards *(PCBs)*, observe proper ESD precautions so that the electronics are not damaged.

### 2.8.1 MRLDS-450 Components




| # | Component Description |
|---|---|
| **1** | M16 Cable Glands *(×6)* |
| **2** | Rubber Gasket *(IP66 Version Only)* |
| **3** | Internal Alarm Buzzer |
| **4** | Power Connections *(×2)* |
| **5** | Digital Connection *(Modbus)* |
| **6** | Analog Connection *(with Jumper)* |
| **7** | Tactile Switch #1 |
| **8** | Ribbon Cable Connection *(To Sensor)* |

| # | Component Description |
|---|---|
| **9** | Tactile Switch #2 |
| **10** | Relay 3 Connection *(FAULT)* |
| **11** | Relay 2 Connection *(HIGH)* |
| **12** | Relay 1 Connection *(LOW)* |
| **13** | Magnetic Switch #1 |
| **14** | Magnetic Switch #2 |
| **15** | M20 Cable Glands *(×2)* |

# 3 Installation

**IMPORTANT:** The manufacturer of this product requires that a bump test or calibration be performed following installation to verify instrument functionality.

## 3.1 General Information

Installation site selection is critical to ensuring system performance and effectiveness. Strict compliance and considerable thought must be given to every detail of the installation process, including, but not limited to the following:

- Regulations as well as local, state, and national codes that govern the installation of gas monitoring equipment
- Electrical codes that govern the routing and connection of electrical power and signal cables to gas monitoring equipment
- The full range of environmental conditions to which the instruments will be exposed
- The physical characteristics of the gas or vapor to be detected
- The specifics of the application *(e.g., possible leaks, air movement/draft, etc.)*
- The degree of accessibility required for maintenance purposes
- The types of optional equipment and accessories that will be used with the system
- Any limiting factors or regulations that would affect system performance or installations
- Wiring details, including:

| | **MRLDS-450** |
|---|---|
| M16 Cable Glands (4-8mm cable diameter) | 6 |
| M20 Cable Glands (10-14mm cable diameter) | 2 |

- Secondary circuit must be supplied from an isolating source
- The wiring for the relays must be selected and fused according to the rated voltages, currents, and environmental conditions
- If stranded conductors are used, a ferrule should be used
- To comply with RFI immunity regulations, it is necessary to ground the shield of the communications cable at the PLC, GDA controller, front-end controller, or Building Management System *(e.g., the chassis, the ground bus-bar, etc.).*

## 3.2 Restrictions

The installation location must have appropriate supply power available for the instrument *(i.e., 19.5 to 28.5 VDC or 24 VAC)*. This ultimately determines the distance the instrument can be mounted from the controller or power supply.

## 3.3 Mechanical Installation

**WARNING:** DO NOT allow the lid / sensor to hang from the ribbon cable. Failure to comply may result in damage to the product.

1. Using the provided hardware, securely mount the MRLDS-400 gas detector according to the product dimensions, maximum wiring lengths and following considerations:
    a. Environment: the full range of environmental conditions when selecting a location.
    b. Application: the specifics of the application *(possible leaks, air movement / draft, etc.)* when selecting a location.
    c. Accessibility: the degree of accessibility required for maintenance purposes when selecting a location.
    d. Target Gas: the specific gravity of the target gas when selecting the height of the instrument.
2. Using a 5/32″ *(4 mm)* hex key / allen wrench *(not included)* remove the lid and disconnect the ribbon cable from the base.
3. Set the lid and rubber gasket *(IP66-rated enclosures only)* aside to be reinstalled later.

## 3.4 Electrical Installation

### 3.4.1 Preparations

**IMPORTANT:** Analog output is configured for 4 to 20 mA output by default. The MRLDS-450 have a jumper on the analog connection. This jumper MUST be removed to use the analog 4 to 20mA output signal. If the jumper is removed AND the 4 to 20mA signal is not used, the unit will go into fault. The analog output is designed as sourcing.

**CAUTION:** Ensure wiring for relays and connections for sensor*(s)* are made before applying power.

**CAUTION:** This product uses semiconductors which can be damaged by electrostatic discharge *(ESD)*. When handling the printed circuit boards *(PCBs)*, observe proper ESD precautions so that the electronics are not damaged.

### 3.4.2 Power & Signal Wiring

1. Locate the relevant connections *(Power, Analog, Modbus)* and remove the terminal block from the PCBA. *(The PCB terminal blocks are pluggable type and may be removed to aid termination.)*

| Connection | Description | Label | Wiring Termination |
|---|---|---|---|
| Power | 24 VDC/VAC IN | 24V IN: - | 24 VDC/VAC neutral / ground |
| | | 24V IN: + | 24 VDC positive / VAC live |
| | 24 VDC/VAC OUT *(power daisy chain terminal)* | 24V OUT: - | 24 VDC/VAC neutral / ground |
| | | 24V OUT: + | 24 VDC positive / VAC live |
| Digital Output | Modbus Network Communications | MODBUS: B | RS-485 “B” *(inverted)* |
| | | MODBUS: A | RS-485 “A” *(non-inverted)* |
| | | MODBUS: GND | RS-485 GND |
| | | MODBUS: SH | RS-485 Shield |
| Analog Output | Voltage or Current Output | ANALOG: - | Analog output ground |
| | | ANALOG: + | Analog output signal *(+)* |

2. Remove plugs from the corresponding M16 cable glands.
    - The product comes with cable glands and plugs pre-installed. *(The power entry cable gland is shipped from the factory without a plug.)*
3. Using the appropriate cable glands, insert wires into the enclosure.
4. Secure the wires in each terminal block and, pressing firmly, reinstall the terminal block into the PCBA.
    - Polarity must not be reversed.
    - For 24 VAC installations in a daisy-chain configuration, the neutral polarity must be maintained for all instruments.
5. Remove all excess cable from the housing before securing the cable glands.

### 3.4.3 Relay Wiring

**WARNING:** Relays are rated for 0 to 30V AC/DC. DO NOT apply mains power onto these relays.

1. Locate the relevant connections *(Relay 1, Relay 2, Relay 3)* and remove the terminal block from the PCBA.

| Relay | Function |
|---|---|
| 1 | Low Alarm |
| 2 | High Alarm |
| 3 | Fault Alarm |

2. Remove plugs from the corresponding M16 cable glands.
3. Using the appropriate cable glands, insert wires into the enclosure.
4. Secure the wires in each terminal block and, pressing firmly, reinstall the terminal block into the PCBA.
5. Remove all excess cable from the housing before securing the cable glands.

When configured according to the factory default settings, the relays are de-energized during normal operation *(not fail-safe)*. Fail-safe mode can be configured. When configured for fail-safe operation, relays are energized during normal operation. Fail-safe operation ensures relays are triggered in cases of power failure at the instrument. In failsafe operation normally open and normally closed terminals are reversed as indicated by the following table:

| Terminal | Normal operation | Failsafe Operation |
|---|---|---|
| NC | Normally Closed | Normally Open |
| COM | Common | Common |
| NO | Normally Open | Normally Closed |

### 3.4.4 Modbus RTU RS-485 Interface

For the Modbus RS-485 network use a 16 to 24 AWG *(0.2 to 1.5 $mm^2$)* 3-core, 2 twisted pair + ground, shielded cable with 120 Ω characteristic impedance. *(Recommended: Belden 3106A or equivalent.)*

The Modbus address, baud rate, stop bit, parity and slave termination is configured through the setup menu. No jumpers or hardware switch settings are required.

Ensure that the communication parameters within the network, including the Building Management System, are configured identically.

To ensure optimal performance of the Modbus network, ensure the following guidelines are implemented:

- Instruments are configured in a single bus topology, connecting multiple buses in parallel or branching multiple units from the main bus, may introduce impedance mismatches, reflections and/or signal distortions.
- Avoid long stubs when connecting instruments to the bus *(stubs should be less than 1 meter in length)*.
- Instruments at end of bus have 120Ω terminating resistor enabled. Terminating resistors may be enabled via the MRLDS-400 App *(refer to Section 4.2.3.6 for more information)*.
- A/B signal polarity is maintained throughout RS-485 network.
- Connect cable shield drain to physical earth or ground at the controller only.
- Connect cable shield drain to *(SH)* terminal at instrument.
- Cable shield integrity is maintained throughout RS-485 network.
- Do not use shield connection for signal ground. Use cable that provides dedicated ground conductor for signal ground. Connect signal ground to *(GND)* terminal of instrument.

### 3.4.5 Confirming Instrument Functionality

After all wiring has been completed, power the transmitter and perform a calibration / bump test to verify instrument functionality:

1. Switch power on.
2. Allowing the instrument to complete its start-up sequence and the sensor to stabilize.
3. Perform a calibration or bump test to confirm instrument functionality. *(For instructions on performing a calibration or bump test, see Section 5.2.)*
4. After verifying instrument functionality, reinstall the enclosure lid.
    - Reinstall the rubber gasket in the transmitter and / or remote sensor. Ensure that it is seated correctly before replacing lid. *(Note that the IP41-rated configurations do not include a rubber gasket.)*
    - Using a 5/32″ *(4 mm)* hex key / allen wrench *(not included)* tighten the lid screws in an “X” tightening pattern. *(Tightening torque should be limited to hand tight, and should be uniform.)*

# 4 Operation

## 4.1 Overview of Normal Operation

**WARNING:** Before leaving the instrument for normal operation, check the configuration for proper settings and check calibration.

### 4.1.1 Applying Power & the Start-up Sequence

After applying power, the instrument will go through a start-up sequence *(initialization, audible/visual test and self-test sequence).* After start-up sequence completes, the instrument will enter a warm-up period to allow the sensor element to stabilize before reporting a valid output.

1. Switch power on.
2. Observe the start-up sequence and warm-up phase:
    - Green LED will blink at 0.5 HZ for about 5 minutes.
    - Modbus flag for warm-up is set.
    - Buzzer is off.
    - Relay state is “no alarm.”
    - Gas reading is invalid.
3. Observe normal operation:
    - Green LED is steady on.
    - Modbus flag for warm-up is cleared.
    - Buzzer is off.
    - Relay state is “no alarm.”
    - Gas reading is valid.

### 4.1.2 Verifying Analog Signals

MRLDS-450 gas detectors feature a single configurable analog output. During normal operation, the analog output of the instrument is proportional to the detected gas concentration. Output level is proportional to the gas level as shown below:

| Gas Concentration | 1-5V | 0-5V | 2-10V | 0-10V | 4-20mA |
|---|---|---|---|---|---|
| 0% | 1V | 0V | 2V | 0V | 4 mA |
| 50% | 3V | 2.5V | 6V | 5V | 12 mA |
| 100% | 5V | 5V | 10V | 10V | 20 mA |

The instrument may also enter several special states, these are indicated by the specific analog output levels indicated below:

| Mode of Operation | 1-5V | 0-5V | 2-10V | 0-10V | 4-20mA |
|---|---|---|---|---|---|
| Instrument Fault | ≤ 0.3V | N/A | ≤ 0.6V | N/A | ≤ 1.2 mA |
| Offline Mode / Maintenance | 0.75V | N/A | 1.5V | N/A | 3 mA |
| Drift Below Zero | 0.95V | N/A | 1.9V | N/A | 3.8 mA |
| Normal Operation | 1-5V | 0-5V | 2-10V | 0-10V | 4-20 mA |
| Measuring Range Exceeded | 5.12V | 5.12V | 10.25V | 10.25V | 20.5 mA |
| Fault on Analog Interface | > 5.25V | > 5.25V | > 10.5V | > 10.5V | > 21mA |

### 4.1.3 Verifying the Modbus Signal

The MRLDS-400 gas detectors provide a Modbus RTU digital interface. All status messages and most parameters can be accessed and / or configured via the MRLDS-400 App *(Bluetooth® communications)* or via a Building Management *(Modbus network)*.

### 4.1.4 Status Indication

The MRLDS-400 gas detectors provide external indication of their current operational state via audible and visual feedback. *(MRLDS-450 gas detectors also provide relays outputs.)* Visual indication of the instrument status is provided by a single tri-color LED *(Green / Red / Orange)* as indicated below:

| State | LED | Buzzer | Relay 1 *(LOW)* | Relay 2 *(HIGH)* | Relay 3 *(Fault)* |
|---|---|---|---|---|---|
| Warm-up | | | OFF | OFF | OFF |
| Normal | | | OFF | OFF | OFF |
| Low Alarm | | | ON | OFF | OFF |
| High Alarm | | | ON | ON | OFF |
| Offline | | | OFF | OFF | OFF |
| Fault | | | OFF | OFF | ON |
| Negative Gas Fault | | | OFF | OFF | ON |
| Zero Cal. Fault | | | OFF | OFF | OFF |
| Span Cal. Fault | | | OFF | OFF | OFF |

### 4.1.5 Switch Functions

User interaction with the MRLDS-400 gas detector is accomplished through the use of two magnetic switches located on the bottom of each unit. To actuate a magnetic switch *(referred to as MAG#1 or MAG#2)*, apply the supplied magnetic wand to the relevant switch location as indicated below:

Depending on the duration the switch is held, a short “TAP” or long “HOLD” will be detected:

- To carry out a tap function, tap the relevant switch location for 1 second, until a single “chirp” is heard, remove wand to confirm a “TAP.”
- To carry out a hold function, do not remove the magnetic wand after the first chirp but continue to hold for >5 seconds, until a double “chirp” is heard, remove wand to confirm a “HOLD.”
- If either switch is held for >30s, a stuck switch fault will be indicated.

To interact with the instrument without use of the magnetic wand, two internal push button tactile switches may be used. Remove lid without removing ribbon cable to access. Internal switches TACT#1 and TACT#2 mirror the functions of MAG#1 and MAG#2.

The function of each switch depends on the current state of the instrument as indicated in the following table:

| State | Switch 1 (Tap) | Switch 1 (Hold) | Switch 2 (Tap) | Switch 2 (Hold) |
|---|---|---|---|---|
| Warm-up | Enable Bluetooth® Connectivity | - | Disable Bluetooth® Connectivity | - |
| Normal | | Start Zero Calibration | | Start Span Calibration |
| Low Alarm | | Mute Buzzer | | Ack. Latched Alarm |
| High Alarm | | Mute Buzzer | | Ack. Latched Alarm |
| Offline | | - | | - |
| Fault | | Mute Buzzer | | Ack. Latched Fault |
| Negative Gas Fault | | Mute Buzzer | | Start Zero Calibration |
| Zero Cal. Fault | | Acknowledge Fault | | - |
| Span Cal. Fault | | - | | Acknowledge Fault |

### 4.1.6 Reset System to Factory Default Settings

To reset system to factory defaults, remove lid and hold TACT#1 and TACT#2 simultaneously for 30 seconds. Instrument will restart to confirm factory reset. Alternatively, see Section 4.2.3.4 “Reset to Factory Defaults”, for instructions on resetting instrument configuration via the MRLDS-400 App.

## 4.2 MRLDS-400 Smartphone Application

To download the MRLDS-400 App, visit either the App Store or Google Play.
The companion smartphone application allows users to perform a variety of functions to configure and interact with the MRLDS-400 gas detector, including:

- View real-time measurements
- Configure instrument
- Test outputs
- Calibrate / bump test instrument
- Generate customizable calibration certificates

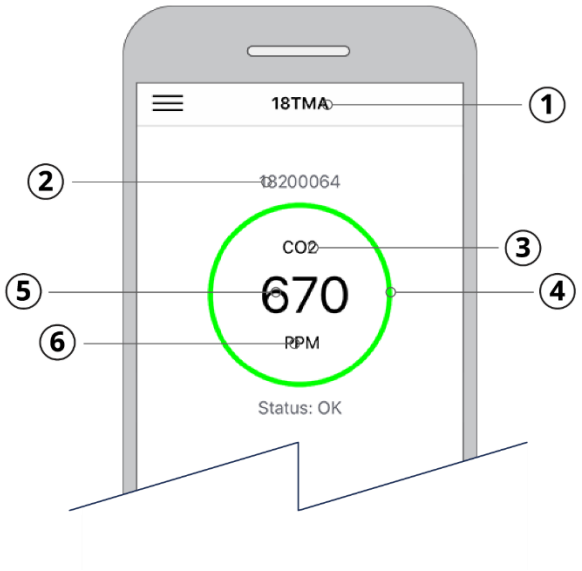
### 4.2.1 Enable Bluetooth® Connection

1. Enable Bluetooth® discovery by tapping MAG#1 for 1-second. *(After 10-seconds, device will indicate that it is discoverable with audible heartbeat until it has been paired, discovery has timed-out or has been cancelled.)*
2. Launch the MRLDS-400 App and click the Bluetooth® icon at the bottom of the screen to initiate a scan.
3. Select the instrument from the list of available gas detectors.
    - MRLDS-450 default alias is “18TMAE”
4. When prompted, enter the passkey *(default is “123456”).*

**WARNING:** Default alias, passkey and unlock code can be changed via the MRLDS-400 App’s configuration menu. Default values should be changed after instrument installation for security purposes.

### 4.2.2 Checking Status

Current instrument status can be viewed from the Home tab, including the following:




| # | Description |
|---|---|
| 1 | **Alias** - user configured instrument name |
| 2 | **Serial Number** - instrument 8 digit serial number |
| 3 | **Gas** - gas type currently detected by instrument |
| 4 | **Status Ring** - provides visual indication of various instrument states *(expanded on below)* |
| 5 | **Live Measurement** - current measurement in given measurement units |
| 6 | **Measurement Unit** - displayed measurement unit *(PPM / PPB / %LEL / %VOL)* |

| State | Status Ring | Description |
|---|---|---|
| Warm-up | Green | Gas detector stabilizing after power on or restart |
| Normal | Green | Normal operation |
| Low Alarm | Yellow | Gas measurement has exceeded low alarm setpoint |
| High Alarm | Red | Gas measurement has exceeded high alarm setpoint |
| Offline | Orange | Gas Detector in maintenance mode and is not actively monitoring gas |
| Fault | Orange | A fault has been detected |
| Negative Gas Fault | Orange | Gas detector calibration has drifted below zero, requires zero calibration |
| Zero Cal. Fault | Orange | Error occurred during zero calibration. Zero calibration has not be updated. Zero calibration required. |
| Span Cal. Fault | Orange | Error occurred during span calibration. Span calibration has not be updated. Span calibration required. |

### 4.2.3 Instrument Configuration

For security, access to configuration and calibration options are restricted to authorized users only. Access to these functions require use of an unlock code. To unlock instrument configuration:

- Configure Tab → When prompted, enter unlock code to access device configuration. *(The instrument's default code is "1234")*. Instrument will remain unlocked until Bluetooth® connection has ended.

**WARNING:** Default alias, passkey and unlock code can be changed via the MRLDS-400 App's configuration menu. Default values should be changed after instrument installation for security purposes.

#### 4.2.3.1 Change Alias

To allow easy identification of a given instrument, an alias can be assigned to each instrument. This alias is displayed when searching for an instrument via Bluetooth®, on calibration certificate and in home tab. To set alias:

- Configure Tab → Alias, enter required alias for instrument, select OK.
- Instrument must be restarted for change to take effect. Home Tab → Restart, will reboot device.
- Reconnect to instrument to confirm alias has been updated.

#### 4.2.3.2 Change Unlock Code

To prevent unauthorized access to instrument configuration and calibration, default instrument unlock code should be changed during commissioning. To change unlock code:

- Configure Tab → Modbus Unlock Code, enter new 4-digit unlock code for instrument, select OK.
- Instrument must be restarted for change to take effect. Home Tab → Restart, will reboot device.
- Reconnect to instrument to confirm unlock code has been updated.

**IMPORTANT:** If custom unlock code is forgotten, unlock code may be reset to default value (1234) by resetting system to factory defaults. Refer to section 4.1.6 for system reset procedure. Note system reset will return all custom system configurations to defaults

#### 4.2.3.3 Change Bluetooth Passcode

To prevent unauthorized access to instrument status, default instrument Bluetooth® passcode code should be changed during commissioning. To change Bluetooth® passcode:

- Configure Tab → Bluetooth Passcode, enter new 6-digit passcode for instrument, select OK.
- Instrument must be restarted for change to take effect. Home Tab → Restart, will reboot device.

- Reconnect to instrument to confirm unlock code has been updated.

**IMPORTANT:** If custom passcode is forgotten, unlock code may be reset to default value *(123456)* by resetting system to factory defaults. Refer to section 4.1.6 for system reset procedure. Note system reset will return all custom system configurations to defaults.

#### 4.2.3.4 Reset to factory defaults

Instrument configuration may be reset to factory defaults via the smartphone application:

- Configure Tab → Reset to factory default, select OK to confirm.
- Instrument will automatically restart and disconnect from smartphone application.

**WARNING:** Resetting system to factory defaults will remove all custom system configuration including unlock code and Bluetooth passcode. After system reset custom unlock and Bluetooth passcodes should be configured to prevent unauthorized access and reconfiguration of instrument.

#### 4.2.3.5 Alarm Configuration

**Low Alarm Setpoint**

Value above which a low alarm condition occurs. Low alarm setpoint must be less than the high alarm setpoint and greater than the low alarm limit. The low alarm limit is the fixed minimum limit that is sensor–specific and not editable.

Range of acceptable setpoints is displayed when updating parameter. To update setpoint:

- Configure Tab → Alarm → Low Alarm Setpoint, enter new setpoint, select OK to confirm.

**IMPORTANT:** In instruments with an oxygen sensor installed, low alarm behavior operates in a depletion mode where gas measurements BELOW the low alarm setpoint initiate a low alarm. This allows monitoring of oxygen displacement and enrichment scenarios.

**IMPORTANT:** To prevent intermittent alarm operation at the setpoint due to measurement noise this instrument implements hysteresis at the setpoint. Once the alarm level is exceeded, the gas measurement must return a fixed percentage below the alarm threshold before the alarm is disabled. Typical hysteresis value is set at 5% of full scale however this is sensor specific and non-editable.

**High alarm Setpoint**

Value above which a high alarm condition occurs. High alarm setpoint must be less than the sensor full scale range and greater than the low alarm setpoint.

Range of acceptable setpoints is displayed when updating parameter. To update setpoint:

- Configure Tab → Alarm → High Alarm Setpoint, enter new setpoint, select OK to confirm.

**IMPORTANT:** To prevent intermittent alarm operation at the setpoint due to measurement noise this instrument implements hysteresis at the setpoint. Once the alarm level is exceeded, the gas measurement must return a fixed percentage below the alarm threshold before the alarm is disabled. Typical hysteresis value is set at 5% of full scale however this is sensor specific and non-editable.

**Alarm Latching**

Enabling alarm latching will maintain alarm or fault condition even after the alarm or fault condition is no longer active. When latched, the alarm or fault condition must be manually acknowledged before the condition will be cleared. This allows transient alarm or fault conditions to be identified.

If an alarm is latched, i.e. the condition has occurred but is no longer active, an acknowledgement button will appear on the home screen. Select this button to acknowledge the latched condition and clear the alarm or fault.

When disabled the alarm or fault status clears automatically as soon as the condition is no longer active. To configure:

- Configure Tab → Alarm → Alarm Latching, select enable/disable, select OK to confirm

#### 4.2.3.6 Modbus Configuration

**Address**

Sets instrument address for connection to RS-485 Modbus interface. *(Default: 1)*.

To set address:

- Configure Tab → Modbus → Address, select 1-247, select OK to confirm

**IMPORTANT:** Ensure all instruments on RS-485 bus have been configured with unique node addresses. If two instruments have been configured with same address, bus contention will occur preventing communications with these instruments via the RS-485 interface.

**Baud Rate**

Sets instrument baud rate for connection to RS-485 Modbus interface. *(Default: 9600 baud)* To set baud rate:

- Configure Tab → Modbus → Baud Rate, select 9600/19200, select OK to confirm

**Stop Bits**

Sets instrument stop bits for connection to RS-485 Modbus interface. *(Default: 1 stop bits)* To set number of stop bits:

- Configure Tab → Modbus → Stop Bits, select 1 or 2, select OK to confirm

**Parity**

Sets instrument parity for connection to RS-485 Modbus interface. *(Default: None)* To set parity:

- Configure Tab → Modbus → Parity, select None/Odd/Even, select OK to confirm

**IMPORTANT:** Stop bits must be set to 1 where parity is odd or even.

**Enable 120Ω Termination**

For optimal communication reliability, in RS-485 Modbus networks the last instrument physically connected to the RS-485 bus must include a 120Ω termination resistor. This is to reduce the potential for electrical signal reflection on long buses due to impedance mismatches.

Typically, this requires a physical resistor with the same characteristic impedance of the bus cable to be installed on the bus.

MRLDS-400 instruments include this termination resistor on all instruments and allow this termination to be enabled via this configuration setting without the need for an external physical resistors. To enable this termination resistor:

- Configure Tab → Modbus → Enable 120Ω Termination, select enable/disable, select OK to confirm

**IMPORTANT:** Termination resistor should only be enabled on last instrument physically connected to RS-485 bus. An external resistor should not be connected where this is enabled on the instrument.

#### 4.2.3.7 Output Configuration

**Analog Output Range**

Sets instrument analog output range. Available ranges: 4-20mA (Default), 1-5V, 0-5V, 0-10V, 2-10V. To set range:

- Configure Tab → Outputs → Analog Output Range, select desired range, select OK to confirm

**Buzzer**

Enable or disable buzzer. Buzzer provides local audible alarm/fault indication. Buzzer is enabled by default. To enable/disable buzzer:

- Configure Tab → Outputs → Buzzer, select enable/disable, select OK to confirm

**Relay Failsafe**

Enable or disable Relay Failsafe operation. When configured for fail-safe operation, relays are energized during normal operation. Fail-safe operation ensures relays are triggered in cases of power failure at the instrument. In failsafe operation normally open and normally closed terminals are reversed as indicated in Section 3.4.3.

Relays are configured as non-failsafe by default. To enable/disable relay failsafe:

- Configure Tab → Outputs → Relay Failsafe, select enable/disable, select OK to confirm

**Alarm Delay**

Sets delay in minutes before instrument will indicate an alarm condition after low or high alarm threshold has been exceeded. May be used to prevent short transient alarm conditions from activating alarms. Alarm delays may be set for 0-15 minutes. Alarm delay is configured as 0 minutes by default. To set alarm delay:

- Configure Tab → Outputs → Alarm Delay, enter desired delay in minutes *(0-15)*, select OK to confirm.

**Analog Zero Adjust**

Analog zero adjust applies a fixed offset to the analog output. This allows removal of small errors in the output between the gas detection instrument and the measurement at the controller due to cable resistance when using voltage outputs.

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**NOTE:** Not used for digital interface. The analog adjustment may be adopted when using controllers with analog interface for gas concentration and status monitoring.

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To apply adjustment ensure instrument is outputting fixed voltage (default 1V at zero ppm or use output test function to set specific voltage value), monitor remote measurement and adjust zero offset until remote measurement matches expected voltage output.

Adjustment is limited to ±10% full scale. To set analog zero adjustment:

- Configure Tab → Outputs → Analog Zero Adjust, use slider to set desired offset adjustment.
- Alternatively, tap “Analog Zero Adjust (X.X%)” text and enter specific offset required *(-10 to 10)*

**Analog Span Range**

Analog span range scales the FSD *(full-scale deflection)* of the analog output. The selected range determines the equivalent gas measurement at the analog output maximum range.

Example: R134A 1000 ppm, 0-5V analog output. If Analog Span Range is set to 20%, the full analog output range only covers the first 20% of the gas measurement range, i.e. 0-200 ppm will output 0-5V, above 200 ppm the output will be truncated to 5V.

Note, sensor resolution stays at the value for the max range.

Adjustment is limited to between 20%-100% FSD, Default is set to 100%. To set analog span range:

- Configure Tab → Outputs → Analog Span Range, use slider to set desired range
- Alternatively, tap “Analog Span Range (X.X%)” text and enter specific range required.

# 5 Care & Maintenance

## 5.1 Maintenance Intervals

| Interval | Function |
|---|---|
| During Commissioning | Check calibration. |
| | Check LEDs for proper operation.* |
| | Check for proper buzzer and relay operation.* |
| | Check signal transmission to the BMS/BAS *(central controller)* if connected.* |
| Every 6-12 Months** | Inspection by trained service personnel. |
| | Check LEDs for proper operation.* |
| | Check for proper buzzer and relay operation.* |
| | Check signal transmission to the BMS/BAS *(central controller)* if connected.* |
| | Calibrate the sensor or contact Dixell for sensor exchange with factory-calibrated sensor. |
| As Required | Replace sensor module*(s)* |

* Feature may be activated via Modbus commands or MRLDS-400 App.

** Typical maintenance frequency may vary by sensor type.

| Sensor Type | Maintenance Interval | Typical Sensor Lifetime |
|---|---|---|
| Electrochemical * | 12 months | 2-3 years |
| Catalytic Bead | Zero calibration -1-3 months<br>Span calibration - 6 months | 5-7 years |
| Semiconductor* | 6 months after commissioning<br>12 months thereafter | 4-6 years |
| Infrared | 12 months | 5-7 years |

* Sensors should be checked after exposure to significant concentrations of gas, which can shorten the sensor lifetime and/or reduce its sensitivity.

## 5.2 Adjustments

### 5.2.1 Introduction

Adjustment of the detector must be performed at regular intervals as required by national standards or regulations *(e.g. EN 378, ASHRAE 15, BREEAM, etc.)*.

**Breathing Hazard:** Calibration gas MUST NOT be inhaled! See appropriate Safety Data Sheets. Calibration gas should be vented into a fume hood or to the outside of the building.

**Zero First, Then Span:** For proper operation, never adjust the span *before* completing a zero adjustment. Performing these operations out of order will cause faulty calibration.

**IMPORTANT:** Emerson recommends calibrating detectors within the application-specific condition and with target gas. This method of zeroing the detector in the application environment and performing a target gas calibration is more accurate. A surrogate gas calibration may only be performed as an alternative if a target gas calibration is not possible.

**IMPORTANT:** The sensor should be fully stabilized *(at least 2 hours, preferably 24 hours).*

**IMPORTANT:** When entering the functions for zero or span adjustment, the detector will automatically enter OFFLINE mode, and will remain OFFLINE until either the OFFLINE mode is canceled by tapping the respective magnetic switch, or the OFFLINE mode times out within 6 minutes *(typical)* after the adjustment has ended.

### 5.2.2 General Calibration Procedure

**WARNING:** The MRLDS-400 Gas Detector MAY NOT be in an alarm or fault condition during calibration. Acknowledge any alarms or faults BEFORE attempting to begin the calibration process.

**WARNING:** Except for $CO_2$ or $O_2$ sensors, calibration gas must be in a balance of air, not nitrogen *($N_2$)*.

**IMPORTANT:** Calibration and / or bump testing requires the MRLDS-400 calibration adapter kit.

**IMPORTANT:** At elevations higher than 6,560' *(2,000 m)*, calibration will result in a lower reading. Above 6,560', the instrument should be calibrated in the environment of operation.

1. Fit calibration adapter to the gas detector lid.
2. If using a variable flow regulator, adjust the gas flow to approximately 0.3 L/min.

### 5.2.3 Zero Adjustment

Ambient air can be used to zero the sensor instead of synthetic air only if the area is known to be free of the target gas or any gas to which the sensor may be cross-sensitive. In this case, no cylinder or calibration adapter is needed for the zero adjustment.

**WARNING:** The MRLDS-450 MAY NOT be in an alarm or fault condition during calibration. Acknowledge any alarms or faults BEFORE attempting to begin the calibration process.

**WARNING:** Except for $CO_2$ or $O_2$ sensors, ambient air may be used instead of zero gas if the area is know to be free of the target gas or any gases to which the sensor may be cross-sensitive.

**IMPORTANT:** Calibration and / or bump testing requires the MRLDS-400 calibration adapter kit.

1. Begin zero adjustment:
    a. MRLDS-400 App: Home Tab → Calibrate → scan barcode on gas cylinder or manually enter values for zero gas.
    b. Manual: hold MAG#1 for >5-seconds. The LED will blink green-green-red when the instrument is ready.
2. Apply zero gas *(or ambient air per warning above)*.
3. Confirm the start of calibration:
    a. MRLDS-400 App: press the Start Zero button.

b. Manual: tap MAG#1 within 30-seconds or the instrument will time-out and return to normal operation.

4. Complete zero adjustment:
   a. MRLDS-400 App: app will countdown to completion. If calibration is successful, proceed to Step 5. If calibration is unsuccessful, return to the Home screen and press the Acknowledge button to clear the zero calibration fault.
   b. Manual: the LED will blink green-red, green-red-red, green-red-red-red, etc. until calibration is complete. To abort, hold MAG#1 for >5-seconds, turn off gas flow and remove the calibration adapter. If calibration is successful *(green LED)*, proceed to Step 5. If calibration is unsuccessful *(LED blinks orange @ 2 Hz)*, tap MAG#1 to discard the calibration attempt.
5. Turn off gas flow from zero gas.
6. Replace zero gas with calibration gas in preparation for span adjustment.

### 5.2.4 Span Adjustment

**WARNING:** Except for $CO_2$ or $O_2$ sensors, calibration gas must be in a balance of air, not nitrogen *($N_2$)*.

**IMPORTANT:** At elevations higher than 6,560' *(2,000 m)*, calibration will result in a lower reading. Above 6,560', the instrument should be calibrated in the environment of operation.

1. Begin span adjustment:
   a. MRLDS-400 App: scan barcode on gas cylinder or manually enter values for calibration gas.
   b. Manual: hold MAG#2 for >5-seconds. The LED will blink green-green-orange when the instrument is ready.
2. Apply calibration gas at the concentration listed on the calibration gas concentration label *(located on top of the instrument)*.
   - Part Number
   - Serial Number
   - Sensor Type
   - Maximum Range
3. Confirm the start of calibration:
   a. MRLDS-400 App: press the Start Span button.
   b. Manual: tap MAG#2 within 30-seconds or the instrument will time-out and return to normal operation.
4. Complete span adjustment:
   a. MRLDS-400 App: app will countdown to completion. If calibration is successful, proceed to Step 5. If calibration is unsuccessful, return to the Home screen and press the Acknowledge button to clear the span calibration fault.

b. Manual: the LED will blink green-orange, green-orange-orange, green-orange-orange-orange, etc. until calibration is complete. To abort, hold MAG#2 for >5-seconds, turn off gas flow and remove the calibration adapter. If calibration is successful *(LED blinks green-orange-red)*, proceed to Step 5. If calibration is unsuccessful *(LED blinks orange @ 2 Hz)*, tap MAG#2 to discard the calibration attempt.

5. Turn off gas flow from calibration gas and remove the calibration adapter.
6. Allow sensor to recover / stabilize before the instrument returns to normal operation *(green LED).*

### 5.2.5 System Bump Test

**IMPORTANT:** The manufacturer of this product requires that a bump test or calibration be performed following installation to verify instrument functionality.

A bump test is a live test of the system to verify that the detector responds to gas and all connected alarm devices, BMS, etc. are operating accordingly. It is recommended that all involved persons are informed about the test and certain alarms might have to be inhibited *(e.g., shutdown valves, notification of authorities, etc.).*

1. Connect adapter and gas cylinder according to the instructions in the General Calibration Procedure.
2. If desired, disable / silence external annunciators *(e.g., shutdown valves, notification of authorities, etc.)*:
    a. MRLDS-400 App: Home Tab → Calibrate → Bump → toggle TAKE OFFLINE to disable communications to external devices.
    b. Manual: Inform building personnel of test so that external devices can be disabled / silenced.
3. Apply a sufficiently high concentration of the target gas to trigger alarms, but NOT pure refrigerant or hydrocarbons *(e.g., do not use a butane lighter)*.
4. Once thresholds have been exceeded, relays should activate, digital outputs should transmit the gas concentration and:
    a. MRLDS-400 App: gas concentration should be displayed, the instrument status should be “LOW ALARM” or “HIGH ALARM” and alarms states should be “ON.”
    b. Manual: LED status should display “LOW ALARM” or “HIGH ALARM.”
5. Turn off gas flow and remove the calibration adapter.
6. Allow sensor to recover / stabilize before the instrument returns to normal operation *(green LED).*

## 5.3 Sensor Maintenance

**CAUTION:** This product uses semiconductors which can be damaged by electrostatic discharge *(ESD)*. When handling the PCB, care must be taken so that the electronics is not damaged.

### 5.3.1 Replacing the Sensor Module

MRLDS-400 gas detectors are compatible with pre-calibrated sensor modules which maintain the sensor's gas type and calibration information. To replace the gas detector's sensor module:

1. Power-down the gas detector.
2. Using a 5/32" *(4mm)* hex key / allen wrench *(not included)*, remove the lid and disconnect the ribbon cable from the sensor module.
3. Remove installed sensor module from lid by holding onto the housing and turning counter-clockwise 90°. Take care not to apply excessive force to the sensor module's circuit board. When the square tab of the sensor housing is aligned with the lock icon, firmly pull the module to remove it from the housing.
4. Install the new sensor module by aligning the square tab with the lock icon before firmly pressing it into the enclosure. Taking care not to apply excessive force to the sensor module's circuit board, rotate the sensor module clockwise 90° *(or until the triangle icon aligns with the lock icon on the lid).*
5. Connect the ribbon cable as shown *(to the sensor module and transmitter)* and close the lid.

6. Ensure gasket is aligned correctly *(IP66 versions only)* and tighten the lid using the supplied hardware in an "X" pattern. Tightening torque should be limited to hand tight and should be uniform.
7. Power-up the gas detector.
8. After start-up sequence has finished, check sensor response *(bump test)*.

## 5.4 Cleaning the Instrument

Clean the detector with a soft cloth using water and a mild detergent. Rinse with water. Do not use any alcohols, cleaning agents, sprays, polishes, detergents, etc.

# 6 Additional Information

## 6.1 Sensor Principle

### 6.1.1 Electrochemical Sensors

Electrochemical sensors measure the partial pressure of gases under atmospheric conditions. The monitored ambient air diffuses through a membrane into the liquid electrolyte in the sensor. The electrolyte contains a measuring electrode, a counter-electrode and a reference electrode. An electronic “potentiostat” circuit ensures a constant electrical voltage between measuring electrode and reference electrode. Voltage, electrolyte, and electrode material are selected to suit the gas being monitored so that it is transformed electrochemically on the measuring electrode and a current flows through the sensor. This current is proportional to the gas concentration. At the same time, oxygen from the ambient air reacts at the counter electrode electrochemically. The current flowing through the sensor is amplified electronically, digitized and corrected for several parameters *(e.g., the ambient temperature)*.

### 6.1.2 Catalytic Bead Sensors

A catalytic bead sensor measures the partial pressure of combustible gases and vapors in ambient air. It uses the heat-of-combustion principle.

The monitored air diffuses through the sintered metal disc into the sensor. The mixture of combustible gases, vapors, and air are catalytically combusted at a heated detector element (called a *pellistor*). The oxygen content in the air must be greater than 12 Vol%. Due to the resulting heat-of-combustion, the temperature of the detector element rises. This increase in temperature causes a change of resistance in the detector element, which is proportional to the concentration of the mixture of combustible gases and vapors in the monitored air. In addition to the catalytically active detector element, there is a compensator element. Both elements are parts of a Wheatstone bridge. Thus environmental effects like changes in ambient temperature or humidity are almost entirely compensated.

**IMPORTANT:** Certain substances in the atmosphere to be monitored may impair the sensitivity of the sensors. Such substances include, but are not limited to:

- Polymerizing substances such as acrylonitrile, butadiene and styrene.
- Corrosive compounds such as halogenated hydrocarbons *(releasing halogens such as bromine, chlorine or fluorine when oxidized)* and halogen hydride acids as well as acidic gaseous compounds such as sulfur dioxide and nitrogen oxides.
- Catalyst poisons such as sulfurous and phosphorous compounds, silicon compounds *(especially silicones)*, and metal-organic vapors.

It may be necessary to check the calibration if the sensor has been exposed for a long time to a high concentration of flammable gases, vapors, or the above-mentioned contaminating substances.

The nature of catalytic bead sensor technology means that sensor drift may typically be up to ±5% LEL per month. Instruments using these sensors should be zeroed regularly following the instructions in section 5 of this manual.

### 6.1.3 Semiconductor Sensors

Semiconductor or metallic oxide sensors *(MOSs)* are among the most versatile of all broad-range sensors. They can be used to detect a variety of gases and vapors in low ppm or even combustible ranges. The sensor is made up of a mixture of metallic oxides. They are heated to a temperature between 150º and 300º C depending on the gas*(es)* to be detected. The temperature of operation as well as the "recipe" of mixed oxides determines the sensor selectivity to various toxic gases, vapors, and refrigerants. Electrical conductivity greatly increases as soon as a diffusion process allows the gas or vapor molecules to come in contact with the sensor surface. Water vapor, high ambient humidity, temperature fluctuations, and low oxygen levels can result in higher readings.

**IMPORTANT:** Certain substances in the environment to be monitored may impair the sensitivity of the sensors:

- Materials containing silicone or silicone rubber/putty
- Corrosive gases such as hydrogen sulfide, sulfur oxide, chlorine, hydrogen chloride, etc.
- Alkaline metals, salt water spray.

### 6.1.4 Infrared Sensors

The infrared *(IR)* gas sensor is designed to measure the concentration of combustible gases and vapors in the ambient air. The sensor principle is based on the concentration-dependent absorption of infrared radiation in measured gases.

The monitored ambient air diffuses through a sintered metal material into the enclosure of an optical "bench". The broadband light emitted by an IR source passes through the gas in the optical bench and is reflected by the walls from where it is directed towards a dual-element detector. One channel of the detector measures the gas-dependent light transmission, while the other channel is used as a reference. The ratio between measurement and reference signal is used to determine the gas concentration. Internal electronics and software calculate the concentration and produce an output signal.

## 6.2 Disposing of the Instrument

### 6.2.1 Disposing of the Electrical & Electronic Equipment

EU-wide regulations governing the disposal of electrical and electronic appliances which have been defined in the EU Directive 2012/19/EU and in national laws have been effective since August 2012 and apply to this device.

Common household appliances can be disposed of using special collecting and recycling facilities. However, this device has not been registered for household usage. Therefore it must not be disposed of through these channels.

### 6.2.2 Disposing of Sensors

Dispose of sensors in accordance with local laws.

**DANGER:** Do not dispose of sensors in fire due to the risk of explosion and resulting chemical burns.

**WARNING:** Do not force open electrochemical sensors.

**WARNING:** Observe the applicable local waste disposal regulations. For information, consult your local environmental agency, local government offices or appropriate waste disposal companies.

## 6.3 Sensor Specifications

| Sensor Information | Electro-Chemical (EC) | Semi-Conductor (SC) | Catalytic Bead (CAT) | Infrared (IR) |
|---|---|---|---|---|
| Sensor Life (Typical) | 2 to 3 years | 5 to 8 years | 5 years | 5 years |
| Temperature Range | • **$NH_3$ 100 / 1,000 ppm: -40 to 40° C**<br>• **$NH_3$ 5,000 ppm: -20 to 40° C**<br>• **CO 500 ppm: -40 to 50° C**<br>• **$NO_2$ 20 ppm: -20 to 40° C**<br>• **$O_2$ 30% Volume: -20 to 50° C** | -40º to 50º C | | |
| | • **$NH_3$ 100 / 1,000 ppm: -40 to 104° F**<br>• **$NH_3$ 5,000 ppm: -4 to 104° F**<br>• **CO 500 ppm: -40 to 122° F**<br>• **$NO_2$ 20 ppm: -4 to 104° F**<br>• **$O_2$ 30% Volume: -4 to 50° F** | -40º to 122º F | | |

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