Instruction Manual

Model CX-DM

CX-DM Toxic Gas Sensors
CX-DM O2 Deficiency Sensors

This manual covers all CX-DM Sensors

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1. Introduction

1.1 Description

Teledyne Detcon's CX-DM sensor for toxic gas and O_2 deficiency are non-intrusive sensors designed to detect and monitor a wide range of toxic gases in air. Detection ranges for toxic gases are 0-1ppm up to 0-10,000ppm (typical ranges of detection are 0-10ppm, 0-25ppm, 0-50ppm and 0-100ppm). Ranges for O_2 deficiency are 0-1% up to 0-25% by volume. The basic sensor assembly consists of an electrochemical sensor mounted in an intrinsically safe stainless steel housing and includes a Splash Guard Cal Adapter.

Electrochemical Sensor Technology

The toxic gas sensors are based on electrochemical cells. Each cell consists of three electrodes embedded in an electrolyte solution and housed beneath a diffusion membrane. Sensitivity to target gases is achieved by varying composition of any combination of the sensor components. The cells are diffusion limited by way of small capillary barriers resulting in a long service life of three or more years. The electrochemical cell is packaged as a field replaceable plug-in sensor.

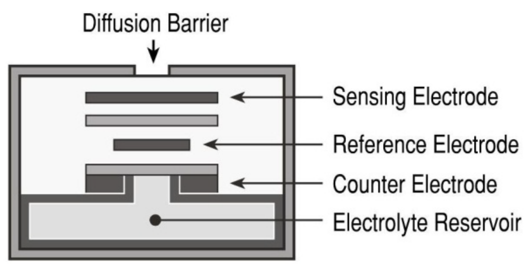

Figure 1 Construction of Electrochemical Toxic Sensor

Principle of Operation

The O_2 deficiency sensor technology is a two electrode galvanic metal air battery type cell housed as a field replaceable intelligent plug-in sensor. The cell is diffusion limited and functions as a direct current generator proportional to the amount of oxygen adsorption. The sensors are temperature compensated and show good accuracy and stability over the operating temperature range of -20°C to 50°C (-4°F to +122°F). The sensor is warranted for two years with an expected service life of up to 2.5 years in ambient air at 20.9% oxygen.

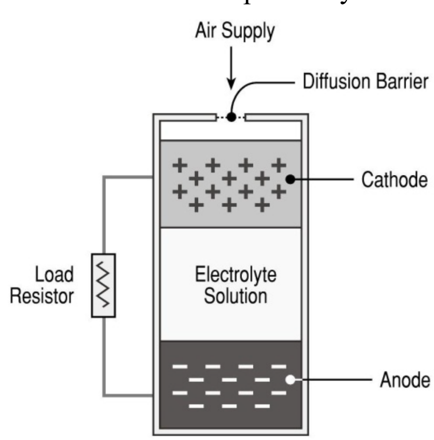

Figure 2 Construction of Galvanic Cell

1.2 Modular Mechanical Design

The Model CX-DM Sensor Assembly is completely modular and is made up of four parts (Figure 3).

1) CXT-DM Intelligent Transmitter Module (ITM)
2) Plug-in Electrochemical Sensor (varies by gas type and range)
3) CXT Series Bottom Housing
4) Splash Guard.

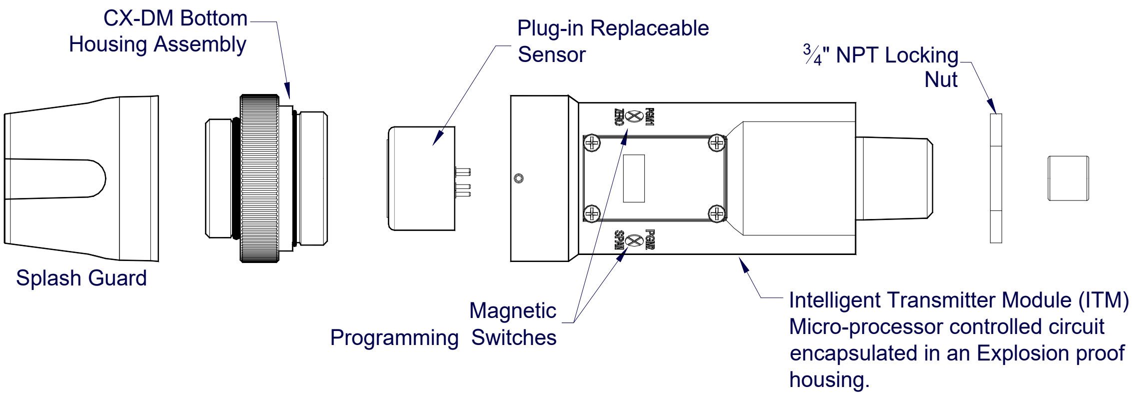

Figure 3 Sensor Assembly Breakaway

NOTE: All metal components are constructed from electro polished 316 Stainless Steel in order to maximize corrosion resistance in harsh environments.

1.2.1 CX-DM Intelligent Transmitter Module

The transmitter module is microprocessor-based and attached to the explosion proof junction box. Circuit functions include an intrinsically safe barrier, on-board power supply, microprocessor, magnetic programming switches, and a linear 4-20mA DC output. Magnetic program switches (located on either side of the ITM) are activated by a hand-held magnetic programming tool, allowing non-intrusive operator interface with the transmitter module. Electrical classifications are Class I, Div 1, Groups C, and D.

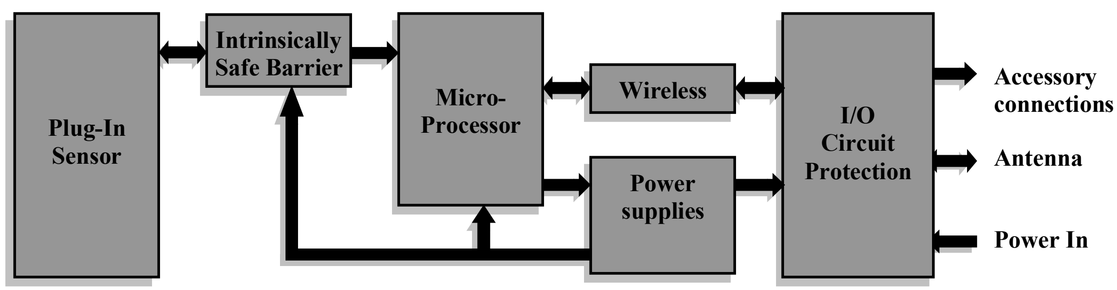

Figure 4 Functional Block Diagram

1.2.2 Field Replaceable Sensor

Teledyne Detcon's electrochemical gas sensors are field proven, plug-in sensors with over-sized gold-plated connections that eliminate corrosion problems. The sensor can be easily accessed and replaced in the field by releasing the locking screw and unthreading the splashguard adapter assembly. Teledyne Detcon's toxic sensors have a long shelf life and supported by an industry-leading warranty.

Figure 5 Plug-in Sensor

2. Installation

2.1 Hazardous Locations Installation Guidelines for Safe Use

1. Install the sensor only in areas with classifications matching the approval label. Follow all warnings listed on the label.
2. Do not remove the junction box cover while in the classified are unless it is conformed the there is no explosive gas levels in the area.
3. A good ground connection should be verified between the sensor's metal enclosure and the junction box. If a good ground connection is not made, the sensor can be grounded to the junction box using the sensor's external ground lug. Verify a good ground connection between the junction box and earth ground.
4. Proper precautions should be taken during installing and maintenance to avoid the build-up of static charge on the plastic components of the sensor (Splash Guard) Wipe with damp cloth on plastic components to avoid static discharge.
5. Do not substitute components. Substitution of components may impair the intrinsic safety rating.
6. Do not operate the sensor outside of the stated operating temperature limits.
7. Do not operate the sensor outside the stated operating limits for voltage supply.
8. These sensors meet ATEX standards EN IEC 60079-0:2018, EN 60079-1:2014, EN 60079-11:2012.
9. These sensors have a maximum safe location voltage of Um=30V.
10. The CX-DM apparatus is not capable of withstanding the 500V insulation test required by clause 6.3.12 of IEC/EN 60079-11:2007 (and by clause 6.8.1 of CSA Std. 142); thus, the enclosure must be grounded.
11. The CXT-DM may be used as an oxygen deficiency sensor; the CXT-DM must not be used for detecting oxygen concentrations expected to be greater than 21%
12. The CXT-DM must only use gas sensor cell model 371-xxxx00-yyy. No other gas sensor shall be used.

2.2 Sensor Placement

Sensor location is critical to the overall safe performance of the product. Confirm that the following five factors are verified during sensor placement.

1. Density of the gas to be detected
2. Most probable leak sources within the industrial process
3. Ventilation or prevailing wind conditions
4. Personnel exposure
5. Maintenance access

Density

Sensor placement should be relative to the density of the target gas. For the detection of heavier than air gases, sensors should be located within 4 feet of grade since heavy gases typically settle in low lying areas. For gases lighter than air, sensor placement should be 4 to 8 feet above grade in open areas or in pitched areas of enclosed spaces.

Leak Sources

The most leak sources in an industrial process are flanges, valves, and tubing connections where seals may either fail or wear. Other leak sources are best determined by facility engineers with experience in similar processes.

Ventilation

Normal ventilation or prevailing wind conditions can dictate efficient location of gas sensors in a manner where the movement of gas clouds is quickly detected.

Personnel Exposure

The undetected migration of gas clouds should not be allowed to approach concentrated personnel areas such as control rooms, maintenance or warehouse buildings. Selecting sensor location should combine leak source and perimeter protection in the best possible configuration.

Maintenance Access

Consideration should be given to providing easy access for maintenance personnel and the consequences of close proximity to contaminants that may cause the sensor to wear prematurely.

NOTE: In all installations, the gas sensor should point straight down. Improper sensor orientation may result in false readings and permanent sensor damage.

Additional Placement Considerations

The sensor should not be positioned where it might be sprayed or coated with surface contaminating substances. Painting sensor assemblies is prohibited.

Although the sensor is designed to be RFI resistant, it should not be mounted in close proximity to high-powered radio transmitters or similar RFI generating equipment.

When possible mount in an area void of high wind, accumulating dust, rain, splashing from hose spray, direct steam releases, and continuous vibration. If the sensor cannot be mounted away from potentially damaging conditions then use the Teledyne Detcon's Harsh Location Dust Guard accessory.

Do not mount in locations where temperatures will exceed the operating temperature limits of the sensor. Use a sunshade to maintain correct operating temperature if mounted in direct sun light.

2.3 Sensor Contaminants and Interference

Electrochemical toxic gas may be adversely affected by exposure to other airborne gases. Depending on the cross-sensitivity relationship, there may be a false high or false low reading. The most common gases that may cause interference are referenced in Section 8.3 (Table 4 and Table 5).

Cross-Interference Data Table

Gases typically found in industrial environments that may cause interference with Teledyne Detcon's toxic gas sensors are listed in Section 8.3, Table 5. To effectively reference the table; locate the chosen gas, scan across the row for possible interference gases, and then determine the magnitude of cross-interference that may occur.

2.4 Sensor Mounting

Vertically position the CX-DM so the sensor points straight down. The explosion-proof enclosure or junction box is typically mounted on a wall or pole. Teledyne Detcon provides a selection of standard junction boxes in aluminum and stainless steel.

NOTE: If wall mounting without a mounting plate, make sure to use at least $^1/_2$" spacers underneath the aluminum junction boxes $^1/_4$" mounting holes to move the sensor assembly away from the wall and to allow access to the sensor assembly.

NOTE: Metal-on-metal contact must be maintained to provide a solid electrical ground path. Only use Teflon Tape or other pipe thread material on the $^3/_4$" threads if the sensor is mounted in a severe or harsh environment. If Teflon Tape is used the Sensor ***must*** be externally grounded using a ground strap.

When mounting on a pole, secure the junction box to a suitable mounting plate and attach the mounting plate to the pole using U-Bolts. (Pole-Mounting brackets for Teledyne Detcon junction boxes are available separately.)

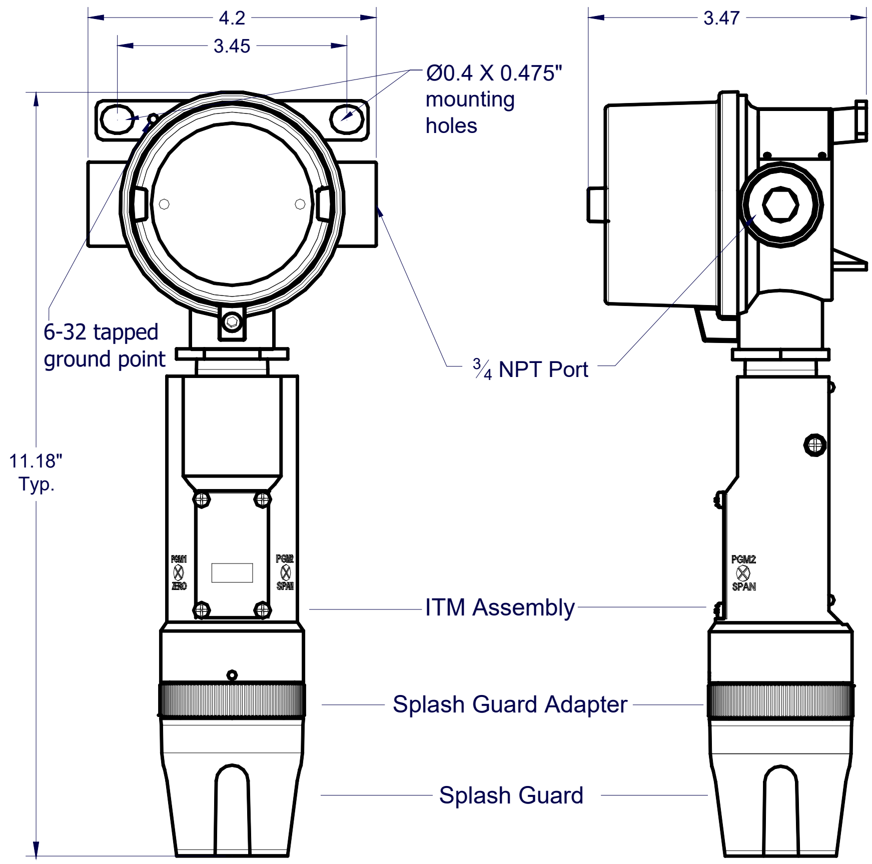

Figure 6 CX-DM Sensor with Mini-Condulet

2.5 Electrical Installation

The sensor assembly wiring should be installed in accordance with local electrical codes. Proper electrical installation of the gas sensor is critical for conformance to electrical codes and to avoid damage due to water leakage.

If a conduit run exists, a drain should be incorporated. The drain allows condensation inside the conduit run to drain safely away from the sensor assembly. Electrical seals act as a secondary seal to prevent water from entering the wiring enclosure. However, electrical seals are not designed to provide an absolute watertight seal, especially when used in the vertical orientation. The electrical seal fitting is required to meet the National Electrical Code per NEC Article 500-3d (or Canadian Electrical Code Handbook Part 1 Section 18-154). Requirements for locations of electrical seals are covered under NEC Article 501-5.

NOTE: For products utilizing the aluminum junction box option, the conduit seal shall be placed at the entry to the junction box (see Figure 8 as an example). For products utilizing the stainless steel junction box option, the conduit seal shall be placed within 18” of the enclosure. Crouse Hinds type EYS2, EYD2 or equivalent are suitable for this purpose.

NOTE: Water damage from water leaking into the enclosure is not covered by the Teledyne Detcon warranty.

NOTE: Unused ports should be blocked with suitable $^{3}/_{4}$" male NPT plug. Teledyne Detcon supplies one $^{3}/_{4}$" NPT male plug with each J-box enclosure. If connections are other than $^{3}/_{4}$" NPT, use an appropriate male plug of like construction material.

CAUTION: Do not apply system power to the sensor until all wiring is properly terminated (Section 2.7).

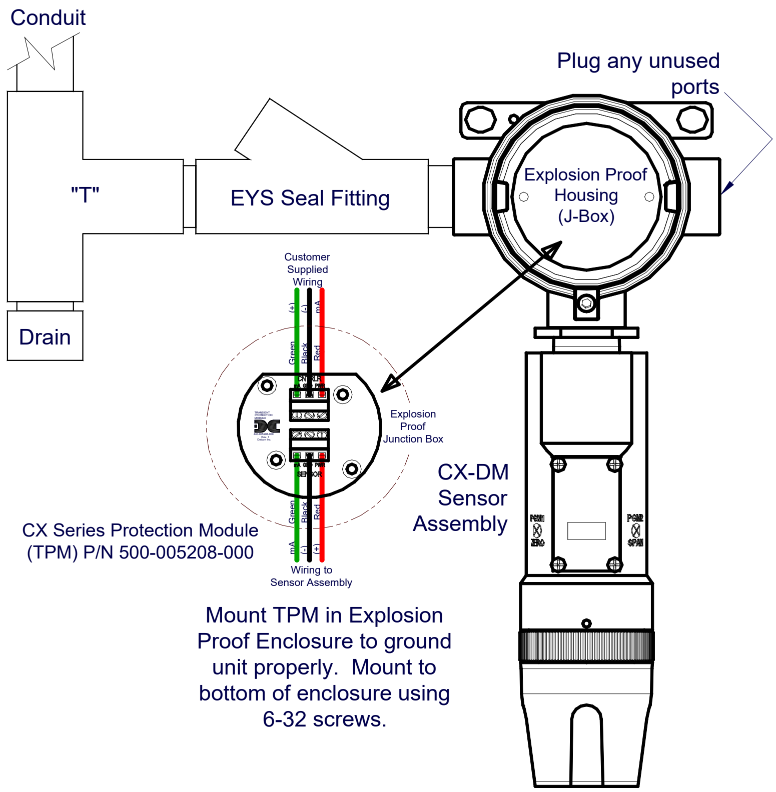

Figure 7 Typical Installation

2.6 Initial Start Up

Teledyne Detcon Model CX-IR sensor assemblies require three conductor connections between power supplies and host electronic controller's 4-20mA output. Wiring designations are + (DC), – (DC), and mA (sensor signal. Maximum wire ohmic resistance between sensor and 24VDC source is defined below. Maximum wire size for termination in the Teledyne Detcon J-Box accessory is 14 gauge.

Max Resistance drop on red and black wire is 10 ohms. This considers wire diameter, wire length and maximum operation temperature.

Max loop load resistance between green and black wire is 500 ohms. Minimum loop load resistance between green and black wire is 100 ohms. This is considers wire diameter, wire length, max operating temperature and selected termination resistor.

Table 1 Protection vs. Wire Gauge

AWG	Wire Dia.	Over-Current Protection
22	0.723mm	3A
20	0.812mm	5A
18	1.024mm	7A
16	1.291mm	10A
14	1.628mm	20A

NOTE: Wiring table is based on stranded tinned copper wire and is designed to serve as a reference only.

NOTE: Shielded cable is required for installations where cable trays or conduit runs include high voltage lines or other possible sources of induced interference. Separate conduit runs are highly recommended in these cases.

NOTE: The supply of power should be from an isolated source with over-current protection as stipulated in table.

2.6.1 Terminal Connections 3-Wire 4-20mA

CAUTION: Do not apply System power to the sensor until all wiring is properly terminated. Refer to Section 2.5 Initial Start Up.

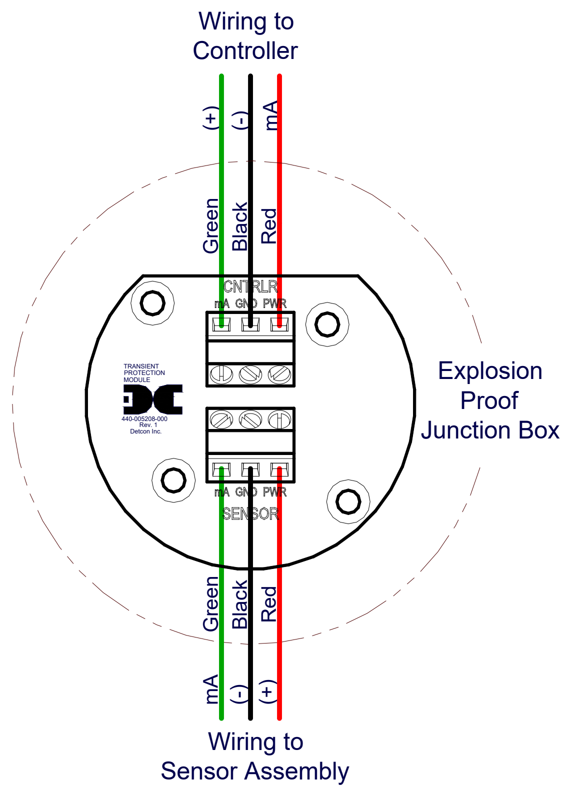

Figure 8 Sensor Wire Connections

a) Remove the junction box cover. Identify the terminal blocks for customer wire connections.

b) Observing correct polarity, terminate the 3-conductor 4-20mA field wiring (+, -, mA) to the sensor assembly wiring in accordance with the detail shown in **Figure 9**.

c) Replace the junction box cover.

2.6.2 Terminal Connections 4-20mA and RS-485

1. Remove the junction box cover.
2. Connect the incoming 24V to the terminal labeled "+" and 24V return to the terminal labeled "–". Connect the mA output to the “mA” terminal and the Modbus signals (if used) to the “A” and “B” terminals. Note: the “Y” terminal is not used.
3. Replace the junction box cover after Initial Start Up (Section 2.7).

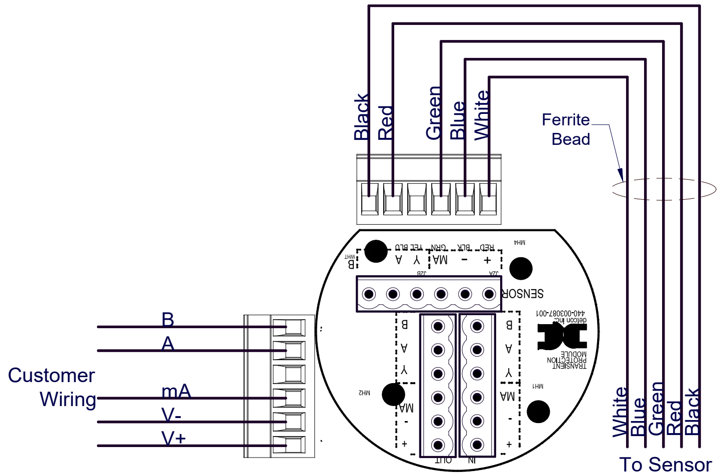

Figure 9 Terminal Interconnect

NOTE: A 6-32 or 8-32 threaded exterior ground point is provided on most junction boxes for an external ground. If the sensor assembly is not mechanically grounded, an external ground strap ***must*** be used to ensure that the sensor is electrically grounded.

2.7 Initial Start Up

Toxic Gas Sensors

Upon completion of all mechanical mounting, apply power to the sensor. Observe the following normal conditions:

1. Upon power up, the sensor will scroll "CX-DM V##.##" and will then display the current reading for about 5 seconds. A temporary upscale reading may occur as the sensor stabilizes. This upscale reading will decrease to "0" ppm within 1 to 2 minutes of power-up, assuming there is no gas in the area of the sensor. Sensors cells that use a bias voltage require a longer time to stabilize. This can vary between 1 and 24 hours depending on the sensor type and range. Biased sensors include NH_3, NO, HCl, and VOC gases (ethylene oxide, ethylene, methanol, formaldehyde….etc.).
2. After the initial power up, the sensor display will turn off. Thereafter the display will come on once every 10 seconds, display the current reading for 2 seconds, and then return to a blank display.

Initial Operational Tests

After a warm up period of 1 hour (or when zero has stabilized), verify that the sensor has sensitivity to the target gas.

Material Requirements

- Splash Guard with integral Cal Port and Wind Guard (Teledyne Detcon PN 613-120000-700) - *or* -
- Threaded Calibration Adapter (Teledyne Detcon PN 943-000006-132) - *or* -
- Teflon Calibration Adapter for highly reactive gases (Teledyne Detcon PN 943-01747-T05)
- Teledyne Detcon Span Gas; 50% of range target gas in balance N_2 or Air at fixed flow rate between 200-500cc/min (500cc/min is preferred)

NOTE: Calibration gas generators using perm tubes or electrochemical sources may be used in place of span gas cylinders.

1. Attach the calibration adapter to the splashguard adapter assembly or connect tubing to integral cal port. It is recommended that the wind guard is installed over the splash guard during calibration.
2. Apply the test gas at a controlled flow rate of 200 - 500cc/min (500cc/min is the recommended flow). Observe that the ITM display increases to a level near that of the applied calibration gas value.

NOTE: The wind guard must be used during calibration with the integral cal port to ensure proper calibration.

3. Remove the test gas and ensure that the display decreases to "0".
4. If a calibration adapter was used during these tests, remove them from the unit, and re-install the Splash Guard. If used, remove the wind guard.

Initial operational tests are complete. CX-DM toxic gas sensors are factory calibrated prior to shipment and should not require significant adjustment upon start up. However, it is recommended that a complete calibration test and adjustment be performed 16 to 24 hours after power-up. Refer to zero and span calibration instructions in Section 3.3.

2.7.1 O_2 Deficiency Sensors

1. When first powered up, the CX-DM display should read close to 20.9%.
2. The reading should stabilize within 1 to 2 minutes of power-up (assuming a normal ambient O_2 concentration).

Initial Operational Tests

After a warm-up period of 5 minutes, verify that the sensor responded to the O_2 deficiency.

Material Requirements

- 700 Series Splash Guard with integral Cal Port and with Wind Guard
- (Teledyne Detcon PN 613-120000-700) *-or-*
- Threaded Calibration Adapter (Teledyne Detcon PN 943-000006-132)
- Teledyne Detcon Zero Gas: 100% N2 at fixed flow rate of 200-500cc/min

1. Attach the calibration adapter to the threaded sensor housing or connect tubing to the integral cal port. Apply the test gas at a controlled flow rate of 200-500cc/min (500cc/min is the recommended flow). Observe that the ITM display decreases to a level near zero.

NOTE: The wind guard must be used during calibration with the integral cal port to ensure proper calibration.

2. Remove test gas and calibration adapter. The ITM display should return to a reading of 20.9%.

Initial operational tests are complete. CX-DM O_2 deficiency sensors are factory calibrated prior to shipment, and should not require significant adjustment on start up. However, it is recommended that a complete calibration test and adjustment be performed 16 to 24 hours after power-up. Refer to zero and span calibration instructions in Section 3.3.

3. Operation

The operator interface of the CX Series gas sensors is accomplished with two internal magnetic switches located to either side of the LED display (Figure 12). The two switches, labeled **PGM1** and **PGM2**, allow for complete calibration and configuration, eliminating the need for area de-classification or the use of hot permits.

Figure 10 Magnetic Programming Tool

The magnetic programming tool (Figure 11) is used to operate the magnetic switches. Switch action is defined as momentary contact (a swipe), a 3-second hold, and a 10-second hold. (Hold times are defined as the time from the point when the arrow prompt appears. Swiping the magnet does not display the arrow prompt.) For momentary contact use, the programming magnet is briefly held over a switch location, or swiped. For 3-second hold, the programming magnet is held in place over the switch location for three seconds. For 10-second hold, the programming magnet is held in place over the switch location for 10 seconds. The 3 and 10 second holds are generally used to enter calibration/program menus and save new data. The momentary contact is generally used to move between menu items and to modify set-point values. Arrows (◄ and ►) are used on the LED display to indicate when the magnetic switches are activated. The location of **PGM1** and **PGM2** are shown in Figure 12.

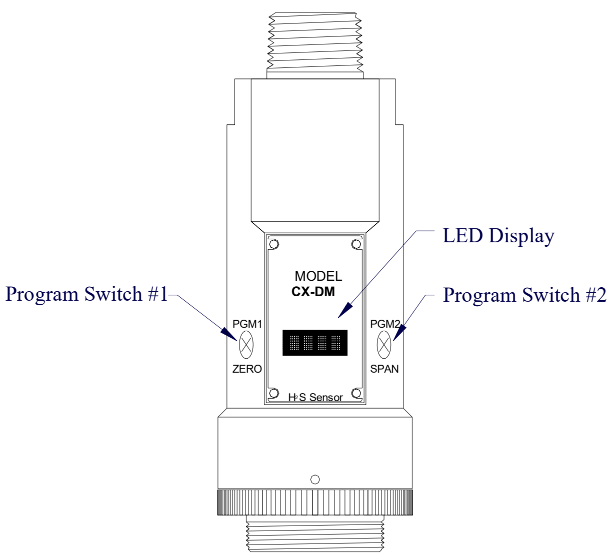

Figure 11 Magnetic Programming Switches

NOTE: While in Program Mode, if there is no magnetic switch interaction after 4 consecutive menu scrolls, the sensor will automatically revert to normal operating condition. While changing values inside menu items, **if there is no magnet activity after 3 to 4 seconds the sensor will revert to the menu scroll.** If the sensor is in Bump Test mode, the display will remain active.

3.1 Operator Interface

The operating interface is menu-driven via the two magnetic program switches located under the target marks of the sensor housing. The two switches are referred to as **PGM1** and **PGM2**. The menu list consists of three menu items that include sub-menus:

Normal Operation

Concentration reading is displayed once every 10 seconds.

Calibration Mode

AutoZero
AutoSpan

Program Mode

View Sensor Status
CX-DM ##.##
Range ###
Autospan Level ##
Modbus ID ##
Tempcomp Level ##
Last Cal ## Days
Sensor Life ###%
Temperature ##C

Set Detection Range
Set Autospan Level
Set Modbus ID
Bump Test
Restore Defaults

Software Flowchart

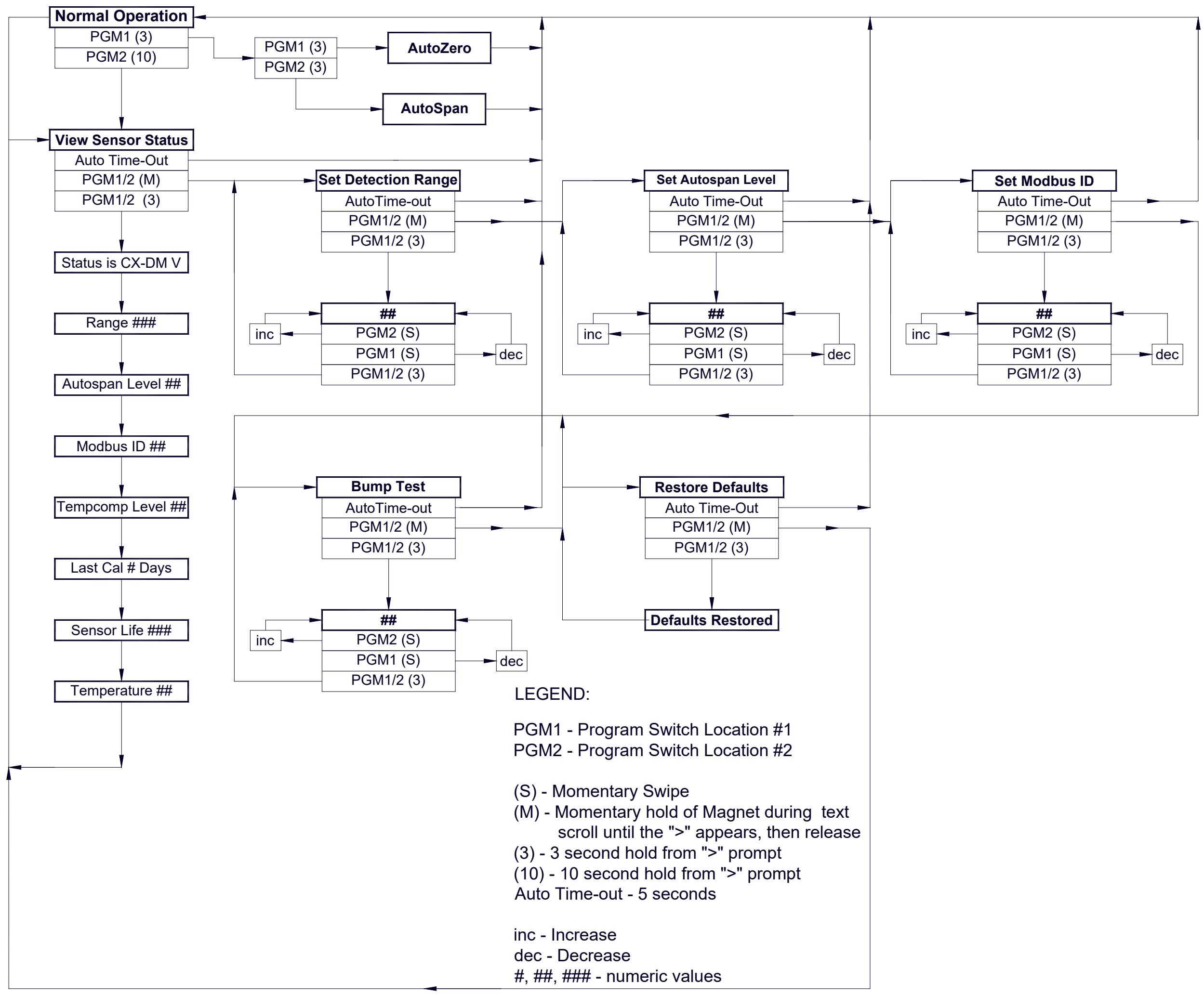

Figure 12 Software flow chart

3.2 Normal Operation

In normal operation, the Intelligent Transmitter Module (ITM) display will be blank and will display the gas reading once every 10 seconds for about 2 seconds (normally appear as "0"). At any time, swiping a magnet across either **PGM1** or **PGM2** will cause the ITM to display the range and gas type (i.e. "ppm H2S"). If the sensor is actively experiencing any diagnostic faults, a swipe of the magnet will cause the display to scroll the fault condition. Refer to Section 5 Service and Maintenance for more information on fault conditions.

3.3 Calibration Mode

Zero and span calibration should be performed on a routine basis (quarterly minimum is advised) to ensure reliable performance. If a sensor has been exposed to any de-sensitizing gases, or to very high over-range combustible gas levels, re-calibration should be considered. Unless otherwise specified, span adjustment is recommended at 50% of the full scale range.

To enter calibration mode hold the magnet over **PGM1** for 3 seconds. If the sensor is experiencing a fault condition the "►" prompt will not appear until the fault(s) have been displayed. When the ITM enters calibration mode the display will scroll **Pgm1=Zero Pgm2=Span** twice before returning to normal mode (about 5 seconds).

NOTE: Upon entering calibration mode, the Modbus™ status register bit 14 is set to signify the sensor is in-calibration mode. This bit will remain set until the program returns to normal operation.

3.3.1 AutoZero

The AutoZero function will zero the sensor. AutoZero should be performed periodically or as required. AutoZero should be considered after periods of over-range target gas exposure. Local ambient air can be used to zero calibrate a toxic gas sensor as long as it can be confirmed that it contains no target or interference gasses. If this cannot be confirmed then a zero air or N_2 cylinder should be used. Pure N_2 must be used for zero calibration of the O_2 deficiency sensors.

Material Requirements:

- MicroSafe™ Programming Magnet (Teledyne Detcon PN 327-000000-000)
- Splash Guard with integral Cal Port (Teledyne Detcon P/N 613-120000-700) and Calibration Wind Guard (Teledyne Detcon PN 613-120000-700) *-or-*
- Threaded Calibration Adapter (Teledyne Detcon PN 943-000006-132)
- Zero Air cal gas (or use ambient air if no target gas is present) (Teledyne Detcon PN 942-001123-000)
- Nitrogen 99.99% (Teledyne Detcon P/N 942-640023-100)

NOTE: The zero gas source may be zero air or N_2 for toxic sensors, but must be pure N_2 (99.99%) for O_2 deficiency sensors.

NOTE: The Calibration Wind Guard must be used when the Splashguard Adapter with integral Cal Port is used. Failure to use the Calibration Wind Guard may result in an inaccurate AutoZero calibration.

1. Toxic sensors, if the ambient air is known to contain no target gas content, can be used for zero calibration. If a zero gas cal cylinder is going to be used, attach the calibration adapter and set flow rate of 200-500cc/min (500cc/min is the recommended flow rate) and let sensor purge for 1 to 2 minutes before executing the AutoZero. For O_2 deficiency sensors, apply N_2 at a set flow rate of 500cc/min for 3 to 5 minutes before executing AutoZero.
2. From Normal Operation, enter Calibration Mode by holding the programming magnet over **PGM1** for 3 seconds. The "◄" prompt will show that the magnetic switch is activated during the 3 second hold period. The display will then scroll **Pgm1=Zero Pgm2=Span**. Hold the programming magnet over **PGM1** for 3 seconds once the "◄" prompt appears to execute AutoZero (or allow to timeout in 5 seconds if AutoZero is not desired).

NOTE: The "◄" prompt will show that the magnetic switch is activated during the 3 second hold period.

NOTE: Upon entering calibration mode, the Modbus™ status register bit 14 is set to signify the sensor is in-calibration mode. This bit will remain set until the program returns to normal operation.

3. The ITM will display the following sequence of text messages as it proceeds through the AutoZero sequence:

   Zero Cal. . . Setting Zero. . . Zero Saved (each will scroll twice)
4. Remove the zero gas and calibration adapter, if applicable.

3.3.2 AutoSpan

The AutoSpan function is used to span calibrate the sensor. AutoSpan should be performed periodically or as required. AutoSpan should be considered after periods of over-range target gas exposure. Unless otherwise specified, span adjustment is recommended at 50% of range. This function is called "AUTO SPAN".

NOTE: Before performing AutoSpan Calibration, verify that the AutoSpan level matches the span calibration gas concentration as described in Section 3.4.3.

Material Requirements:

- MicroSafe™ Programming Magnet (Teledyne Detcon PN 327-000000-000)
- Splash Guard with integral Cal Port (Teledyne Detcon P/N 613-120000-700) and Calibration Wind Guard (Teledyne Detcon PN 613-120000-700) *-or-*
- Threaded Calibration Adapter (Teledyne Detcon PN 943-000006-132)

- Teledyne Detcon Span Gas (See Teledyne Detcon for Ordering Information). Recommended span gas is 50% of range with target gas. Other suitable span gas sources containing the target gas in air or N_2 balance are acceptable.

NOTE: Contact Teledyne Detcon for ordering information on span gas cylinders.

NOTE: A target gas concentration of 50% of range is strongly recommended. This should be supplied at a controlled flow rate of 200 to 500cc/min, with 500cc/min being the recommended flow rate. Other concentrations can be used if they fall within allowable levels of 5% to 100% of range.

NOTE: The Calibration Wind Guard must be used when the Splashguard Adapter with integral Cal Port is used. Failure to use the Calibration Wind Guard may result in an inaccurate AutoSpan calibration.

NOTE: Ambient air should be used to calibrate O_2 deficiency sensors as long as the oxygen concentration is confirmed to be 20.9%.

NOTE: It is generally not advised to use other gasses to cross-calibrate for span. Cross-calibration by use of other gasses should be confirmed by Teledyne Detcon.

CAUTION: Verification that the calibration gas level setting matches the calibration span gas concentration is required before executing "AUTOSPAN" calibration. These two numbers must be equal.

AutoSpan consists of entering Calibration Mode and following the displayed instructions. The display will ask for the application of span gas in a specific concentration. The applied gas concentration must be equal to the calibration gas level setting. The factory default setting and recommendation for span gas concentration is 50% of range. If a span gas containing the recommended concentration is not available, other concentrations may be used as long as they fall between 5% and 100% of range. However, any alternate span gas concentration value must be programmed via the **Set AutoSpan Level** menu before proceeding with AutoSpan calibration.

1. Verify that the AutoSpan Level is equal to the Calibration Span Gas Concentration. (View Sensor Status in Section 3.4.1.) If the AutoSpan Level is not equal to the Calibration span gas concentration, adjust the AutoSpan level as instructed in Section 3.4.3.
2. From normal operation, enter Calibration Mode by holding the programming magnet over **PGM1** for 3 seconds.

NOTE: The "◄" prompt will show that the magnetic switch is activated during the 3 second hold period.

3. The display will scroll **'PGM1=Zero PGM2=Span'**. Hold the programming magnet over **PGM2** for 3 seconds to execute AutoSpan (or allow to timeout in 5 seconds if AutoSpan is not intended). The ITM will scroll '**Apply XX ppm Gas'**.
4. Apply the span calibration test gas for toxic gas sensors at a flow rate of 200-500cc/min (500cc/min is the recommended flow rate). As the sensor signal begins to increase the display will switch to flashing **XX** reading as the ITM shows the sensor's "as found" response to the span gas presented. If it fails to meet the minimum in-range signal change criteria within 2 minutes, the display will report **Range Fault** twice and the ITM will return to normal operation, aborting the AutoSpan sequence. The ITM will continue to report a "Range Fault" for 1 minute.

NOTE: Ambient air should be used to calibrate O_2 deficiency sensors as long as the oxygen concentration is confirmed to be 20.9%. There is no need to apply a flow of gas.

5. Assuming acceptable sensor signal change, after 1 minute the reading will auto-adjust to the programmed AutoSpan level. The ITM then reports the following messages: **'Remove Gas'.**
6. Remove the span gas source and calibration adapter. The ITM will report a live reading as it clears toward "0". When the reading clears below 10% of range, the ITM will display **'Span Complete'** and will revert to normal operation. If the sensor fails to clear to less than 10% in less than 5 minutes, a **'Clearing Fault'** will be reported twice and the ITM will return to normal operation, aborting the AutoSpan sequence. The ITM will continue to report a **Clearing Fault** until a successful calibration is completed.

NOTE: When calibrating O2 deficiency sensors, there is no requirement to clear to <5% of range. The sensor will return to normal operation immediately after span adjustment.

7. AutoSpan calibration is complete.

NOTE: If the sensor fails the minimum signal change criteria, a **Range Fault** will be declared and the Range Fault bit will be set on the Modbus™ output.

NOTE: If the sensor fails the clearing time criteria, a **Clearing Fault** will be declared and the Clearing fault bit will be set on the Modbus™ output.

3.4 Program Mode

Program Mode provides menus to check and set operational and configuration parameters of the sensor. Program Mode provides for adjustment of the AutoSpan Level, configuration parameters, detection range adjustment, and AutoSpan Level. Program mode includes the diagnostic function bump test and restores defaults.

The program mode menu items appear in the order presented below:

View Sensor Status
Set Detection Range
Set Autospan Level
Set Modbus ID
Bump Test
Restore Defaults

Navigating Program Mode

From normal operation, enter program mode by holding the magnet over **PGM2** for 3 seconds. The "►" prompt will verify that the magnetic switch is activated. If the sensor is experiencing a fault condition the "►" prompt will not appear until the fault(s) have been displayed.

NOTE: The arrow prompts (◄ and ►) will show that the magnetic switch is activated during the 3 second hold period.

The ITM will enter program mode and the first menu item **View Sensor Status** will be displayed. Hold the magnet over **PGM1** or **PGM2** while the current menu text is scrolling to advance to the next menu item.

At the conclusion of the text scroll the arrow prompt ("►" for PGM2 or "◄" for PGM1) will appear, immediately remove the magnet. The ITM will advance to the next menu item. Repeat this process until the desired menu item is displayed.

NOTE: PGM1 moves the menu items from right to left and PGM2 moves the menu items from left to right.

To enter a menu item, hold the magnet over **PGM1** or **PGM2** while the menu item is scrolling. At the conclusion of the text scroll the "►"prompt ("►" for PGM2 or "◄" for PGM1) will appear, continue to hold the magnet over **PGM1** or **PGM2** for an additional 3 to 4 seconds to enter the selected menu item. If there is no magnet activity while the menu item text is scrolling (typically 4 repeated text scrolls), the ITM will automatically revert to Normal Operation.

3.4.1

View Sensor Status displays all current configuration and operational parameters including: sensor type, software version number, gas type, detection range, AutoSpan level, days since last AutoSpan, estimated remaining sensor life, raw sensor current, mA output, input voltage and sensor ambient temperature.

- CX-DM ##.##
- Range ###
- Autospan Level ##
- Modbus ID ##
- Tempcomp Level ##

- Last Cal ## Days
- Sensor Life ###%
- Temperature ##C

From the **View Sensor Status** text scroll, hold the magnet over **PGM1** or **PGM2** until the "►" prompt appears and continue to hold the magnet in place for an additional 3 to 4 seconds (until the display starts to scroll **Status Is**). The display will scroll the complete list of sensor status parameters sequentially:

When the status list sequence is complete, the ITM will revert to the **View Sensor Status** text scroll. The user can either:

- review the list again by executing another 3 to 4 second hold, or
- move to another menu item by swiping over PGM1 or PGM2, or
- return to normal operation by the automatic timeout of about 15 seconds (the display will scroll **View Sensor Status** four times before returning to normal operation).

3.4.2 Set Detection Range

The CX-DM sensor is calibrated at the factory for the range specified by the customer. Field adjustments to the predetermined range should only be made under direct supervision of Teledyne Detcon.

NOTE: The sensor range should not be changed in the field unless directed to do so by Teledyne Detcon.

3.4.3 Set AutoSpan Level

Set AutoSpan Level is used to set the span gas concentration level used to calibrate the sensor. This level is adjustable from 1% to approximately 75% or 95% depending on the full-scale range. The current setting can be viewed in **View Program Status**.

The menu will display **Set AutoSpan Level**.

From the **Set AutoSpan Level** text scroll, hold the magnet over **PGM1** or **PGM2** until the "►" prompt appears and continue to hold the magnet in place for an additional 3 to 4 seconds (until the display starts to scroll **Set Level**). The display will switch to **XX** (where **XX** is the current AutoSpan level).

Swipe the magnet momentarily over **PGM2** to increase or **PGM1** to decrease the AutoSpan Level until the correct level is displayed. When the correct level is achieved, hold the magnet over **PGM2** for 3 to 4 seconds to accept the new value. The display will scroll **Level Saved**, and revert to **Set AutoSpan Level** text scroll.

Move to another menu item by executing a momentary hold, or return to normal operation by the automatic timeout of about 15 seconds (the display will scroll **Set AutoSpan Level** four times before returning to normal operation).

3.4.4 Bump Test

Bump test checks the response of the sensor with the indication of response limited to the display only. The bump test mode allows the performance of the sensor to be checked without firing the alarms of any attached control systems. The results of the bump test will not affect the reading register on the Modbus™ output.

The menu item appears as: **Bump Test**.

From the **Bump Test** scroll, hold the magnet over **PGM1** or **PGM2** until the "►" prompt appears and continue to hold the magnet in place for an additional 3 to 4 seconds (until the display starts to scroll **Bump Test Started**).

Apply span gas to the sensor in accordance with Section 0. The sensor will respond to the gas testing the sensor response while the current Modbus gas reading (Modbus register 0002) remains unchanged. Remove the gas before the bump test time expires (2 minutes).

The display will return to normal operation and alternate between showing the live gas reading, and showing "Bump" for 2 minutes, or the execution of a momentary hold over PGM1 or PGM2, when the display will scroll **Bump Test Ended**.

3.4.5 Restore Defaults

Restore Factory Defaults clears the current user configuration and calibration data from memory and reverts back to factory default values. Returning to a factory default is common when settings have been configured improperly and a known reference point needs to be re-established to correct the problem.

This menu item appears as: **Restore Defaults**.

NOTE: Restoring factory defaults should only be used when absolutely necessary. All previously existing configuration inputs will have to be re-entered if this function is executed. A full 10 second magnet hold on PGM2 is required to execute this function.

From the **Restore Defaults** scroll, hold the programming magnet over **PGM2** until the "►" prompt appears and continue to hold for 3 to 4 seconds. The display will scroll **Defaults Restored**, and revert to **Restore Defaults** text scroll.

Move to another menu item by executing a momentary hold or, return to normal operation by the automatic timeout of about 15 seconds (the display will scroll **Restore Defaults** 4 times and return to normal operation).

Following the execution of **Restore Defaults**, the CX-DM will revert to its factory default settings. The default settings are as follows:

NOTE: The following must be performed in order before the sensor can be placed in operation.

- **AutoSpan Level** = 50% of range. AutoSpan level must be set appropriately by the operator (Section 3.4.3).
- **Range**: Defaults to range of intelligent plug-in sensor, must be set to the appropriate level by the operator (Section 3.4.2).
- **Modbus ID** = 01. The Modbus ID must be set appropriately by the user (Section 3.4.6).
- **AutoZero**: AutoZero Settings are lost and the user must perform new AutoZero (Section 3.3.1).

AutoSpan: AutoSpan Settings are lost and user must perform new AutoSpan (Section 3.3.2).

3.4.6 Set Modbus™ ID

Teledyne Detcon's CX sensor can be polled serially via Modbus™ RTU. Refer to Section 4 for details on using the Modbus™ output feature. The Modbus™ is adjustable from 01 to 256 in hexadecimal format (01-FF) hex. Each sensor must have a unique Modbus address to operate correctly on the network. The current serial ID can be viewed in View Sensor Status.

The menu item appears as: **Set Serial ID**.

From the **Set Modbus ID** scroll, hold the programming magnet over **PGM1** or **PGM2** until the "►" prompt appears and continue to hold the magnet in place for an additional 3 to 4 seconds (until the display starts to scroll **Set ID**). The display will then switch to **XX** (where **XX** is the current ID address).

Swipe the magnet over **PGM2** to increase or **PGM1** to decrease the hexadecimal number until the desired ID is displayed. Hold the magnet over **PGM2** for 3 to 4 seconds to accept the new value. The display will scroll **ID Saved**, and revert to **Set Modbus ID** text scroll.

Move to another menu item by executing a momentary hold or, return to normal operation by automatic timeout of about 15 seconds (the display will scroll **Set Serial ID** 5 times and return to normal operation).

3.5 Fault Diagnostic/Failsafe Feature

If the ITM should incur a fault, the Global Fault bit will be set on the Modbus™ output. This can occur if the ITM detects a problem with the sensor, detects that there is no sensor connected, if the ITM has an internal fault, or other fault condition. The Global Fault bit will be set on the Modbus™ output until the problem is resolved. The display will show the fault when a magnetic programming tool is swiped across either PGM1 or PGM2. The error codes are defined in the Troubleshooting Guide (Section 6).

4. Modbus™ Communications

Model CX-DM sensors feature Modbus™ compatible communications protocol and are addressable via the operator interface. Communication is two wire, half duplex 485, 9600 baud, 8 data bits, 1 stop bit, and no parity. If a multi-point system is being utilized, each sensor should be set for a different address. Typical address settings are: 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B, 0C, 0D, 0E, 0F, 10, 11…etc.

Sensor RS-485 ID numbers are factory default to 01 and can be changed in the field using the operator interface (Section 3.5.5).

4.1 General Modbus™ Description

The Modbus™ communication uses the RTU transmission mode per the Modbus™ specification. The basic frame format for Modbus™ consists of a Modbus™ address, function code, data and CRC.

Address Field	Function Code	Data	CRC

Figure 13 Modbus™ Frame Format

The Modbus ID Field is the unique Modbus™ address of each device on the network. The Function Code is the function to be performed. The Data contains read or write data and is formatted according to the function being performed. The CRC (Cyclic Redundancy Code) is used to detect errors in the frame. Frames with errors are invalid and ignored.

Modbus™ transactions consist of a request by the controller and response from the device being addressed so there are two frames transferred for every transaction. Every request is evaluated by the CX-DM to determine if it is addressed, and if it falls within the register address range. If these two conditions are true, the CX-DM will then verify a valid Function Code. Function Codes supported by the CX-DM are as follows:

- Function Code 03 (03h) – Read Holding Registers
- Function Code 06 (06h) – Write Single Register
- Function Code 16 (10h) – Write Multiple Registers

If an invalid function code is performed, the CX-DM will ignore the request.

4.2 Modbus™ Register Map & Description

When the CX-DM is assigned a Modbus™ address, the following registers become available to the controller for access. All CX-DM sensors implement this register set. Some registers are Read Only (R) and others are Read/Write (R/W) as shown by the R/W column. This equates to specific function codes where Read is function code 03 and Write is function code 06 or 16.

NOTE: A write to a Read Only register is allowed and returns a response, but it does not change the value of the register.

Table 2 is the register map for the CX-DM sensor and gives a brief description each register or register set. This information is only meant as a reference. For a more detailed description of the Register Map please contact Teledyne Detcon.

Table 2 CX-DM Register Map

Register	Name	R/W	Meaning	Units
40000	CX-DM-100 Device Type	R	= 42	
40001	Range	R/W	Detectable Range	ppm or %(O_2)
40002	Reading	R	Current Gas Reading	ppm or %(O_2)
40003	Calibration Level	R/W	Auto Span Level	ppm or %(O_2)
40004	Life	R	Sensor Life	%
40005	Sensor Faults	R	See Section 4.2.1	
40006	Sensor Model	R	DM (set to 1)	
40007	Days since Calibration	R		days
40008	Reserved	R		
40009	Reserved	R		
40010	Sensor Temperature	R		°C
40011	Decimal Places	R/W	# of decimal places in reading, range, and AutoSpan level values	
40012	Temperature Compensation	R/W	See Section 4.2.2	
40013	Reserved	R		
40014	Sensor Counts	R/W		
40015	Calibration Enable/Status	R/W		
40016	Gas Type/Units String	R	ASCII Text (set at factory)	
40017	Gas Type/Units String	R	ASCII Text (set at factory)	
40018	Gas Type/Units String	R	ASCII Text (set at factory)	
40019	Gas Type/Units String	R	ASCII Text (set at factory)	
40020	Gas Type/Units String	R	ASCII Text (set at factory)	
40021	Gas Type/Units String	R	ASCII Text (set at factory)	

4.2.1 Sensor Faults – Register 40005

The sensor fault status register consists of High and Low Status Bits. These bits are set/reset as faults occur or are cleared. Each Bit has a particular meaning and displayed as follows:

Register # 0005	High Byte Status Bits	Low Byte Status Bits

NOTE: Bits read as 0 are FALSE, bits read as 1 are TRUE.

Status Bits High Byte:
Bit 15 – Reserved
Bit 14 – Calibration Mode
Bit 13 – Reserved
Bit 12 – Zero Fault
Bit 11 – Range Fault
Bit 10 – Reserved
Bit 9 – Clearing Fault
Bit 8 – Reserved

Status Bits Low Byte:
Bit 7 – Sensor Fault
Bit 6 – Processor Fault
Bit 5 – Memory Fault
Bit 4 – Reserved
Bit 3 – Reserved
Bit 2 – Temperature Fault
Bit 1 – Auto Span Fault
Bit 0 – Global Fault

4.2.2 Temperature Compensation – Register 40012

The CX-DM implements temperature compensation for certain gas types. The possible values for this register are as follows:

0 = No temperature compensation
1 = CO - temperature compensation
2 = H_2 - temperature compensation
3 = NH_3 - temperature compensation
4 = ETO - temperature compensation
5 = ETHYLENE - temperature compensation
6 = VINYL CHLORIDE - temperature compensation
7 = METHANOL - temperature compensation
8 = ETHANOL - temperature compensation
9 = ACRYLONITRILE - temperature compensation
10 = ACETALDEHYDE - temperature compensation
11 = CL_2 - temperature compensation

5. Service and Maintenance

Calibration Frequency

In most applications, monthly to quarterly span calibration intervals will assure reliable detection. With industrial environments varying, after initial installation and commissioning close frequency tests should be performed, weekly to monthly. Test results should be recorded and reviewed to determine a suitable calibration interval.

Visual Inspection

The Sensor should be inspected annually for the following:

- Inspect the sensor for signs of corrosion, pitting, and water damage.
- Remove the Splash Guard and inspected it for blockage, broken, cracked, or missing pieces.
- For H2S Sensor assemblies, inspect CX-DM Series Splashguard Adapter Assembly with integral filter (P/N 602-003803-200) for blockage of filter material.
- Inspect inside of the Junction Box for signs of water accumulation, signs of corrosion.
- Check wiring to ensure there are no loose or pinched wires and all connections are clean and tight.

Condensation Prevention Packet

A moisture condensation packet should be installed in every explosion proof junction box. The packet will prevent the internal volume of the J-Box from condensing and accumulating moisture due to day-night humidity changes. This packet provides a critical function and should be replaced annually.

5.1 Replacement of Plug-in Sensor

NOTE: It is not necessary to remove power while changing the plug-in toxic gas sensor in order to maintain area classification. The sensor is intrinsically safe.

NOTE: Only replace the plug-in sensor with an authorized CX-DM family of gas sensors.

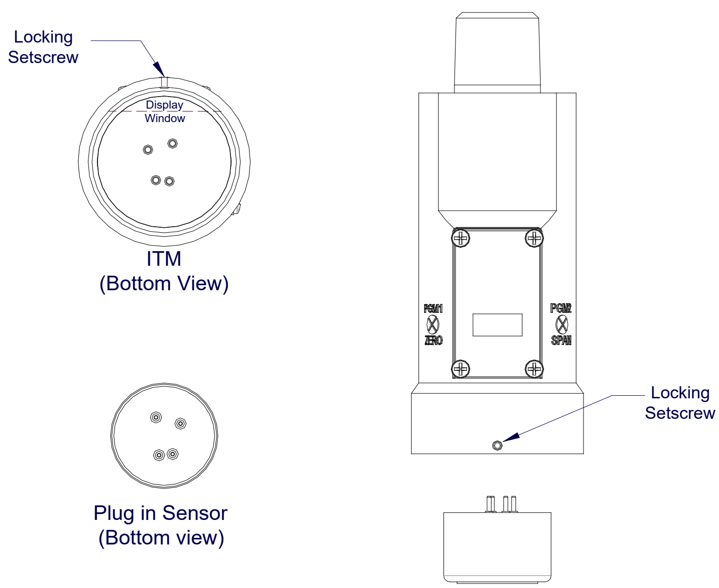

Figure 14 Sensor Cell and ITM Mating

1. Use a $^{1}/_{16}$" Allen wrench to release the locking setscrew that locks the ITM and splashguard adapter assembly together.

NOTE: One turn of the setscrew will suffice - Do not remove setscrew completely.

2. Remove the splashguard. Unthread and remove the splashguard adapter assembly from the ITM.
3. Gently pull the plug-in sensor out of the ITM. Verify that the gas type and range of the new sensor cell is correct. Orient the new plug-in sensor so that it matches with the female connector pins. When properly aligned, press the sensor in firmly to make the proper connection.

4. Thread the splashguard adapter assembly onto the ITM to a snug fit and tighten the locking setscrew using the $^{1}/_{16}$" Allen wrench. Reinstall the splashguard.
5. Check and perform zero calibration and span calibration in accordance with Section 3.3.

5.2 Replacement of ITM – Aluminum J-box

1. Remove the power source to the sensor assembly. Disconnect all sensor wire connections at the junction box terminal board, taking note of the wire connections.

NOTE: It is necessary to remove power to the junction box while changing the ITM in order to maintain area classification.

2. Use a wrench at the top section of the ITM and unthread the ITM until it can be removed.
3. Use a $^{1}/_{8}$" Allen wrench to release the locking cap head screw that locks the ITM and splashguard adapter assembly together.

NOTE: One turn of the setscrew will suffice - Do not remove setscrew completely.

4. Unthread and remove the splashguard adapter assembly and splash guard from the ITM. These will be re-used with the new ITM.
5. Gently remove the plug-in toxic gas sensor from the old ITM and install the sensor in the new ITM. Orient the plug-in sensor so it matches the female connector pins on the new ITM and press the sensor in firmly to make proper connection.
6. Thread the splashguard adapter assembly onto the new ITM until snug, tighten the locking cap head screw and reinstall splash guard.
7. Feed the sensor assembly wires through the $^{3}/_{4}$" female NPT port and thread the assembly into the J-box until tight and the ITM faces toward the front access point. Use the locking nut to secure the ITM in this position. Re-connect the sensor assembly wires to the terminal board inside the junction box.
8. Check and/or perform Zero Calibration and Span Calibration in accordance with Section 3.3.

5.3 Replacement of ITM – Stainless Steel Mini Condulet

NOTE: It is necessary to remove power to the Junction box while changing the ITM in order to maintain area classification.

1. Disconnect the sensor wire connections from the terminal board, taking note of the wire connections.
2. Use a wrench at the top section of the ITM and unthread the ITM until it can be removed.
3. Use a $^{1}/_{8}$" Allen wrench to release the locking cap head screw that locks the ITM and splashguard adapter assembly together.

NOTE: One turn of the setscrew will suffice - Do not remove setscrew completely.

4. Unthread and remove the splashguard adapter assembly and splash guard from the ITM. These will be re-used with the new ITM.
5. Gently remove the plug-in toxic gas sensor from the old ITM and install it in the new ITM. Orient the plug-in sensor so it matches the female connector pins on the new ITM and press the sensor in firmly to make proper connection.
6. Thread the splashguard adapter assembly onto the new ITM until snug, tighten the locking cap head screw and reinstall splash guard.
7. Feed the sensor assembly wires through the $^{3}/_{4}$" female NPT port and thread the assembly into the J-box until tight and the ITM faces toward the front access point. Use the locking nut to secure the ITM in this position.
8. Re-connect the sensor assembly wires to the terminal board inside the junction box.
9. Check and/or perform Zero Calibration and Span Calibration in accordance with Section 3.3.

6. Troubleshooting Guide

If the ITM detects any functional errors the ITM will display the fault. If the sensor is experiencing a fault condition a momentary swipe of the magnet will cause the ITM to scroll the fault condition(s) across the display before the "◄" or "►" prompt will appear.

The Display Error Codes are:
Auto Span Fault
Temperature Fault
Memory Fault
Processor Fault
Clearing Fault
Range Fault
Sensor Fault
Zero Fault
Sensor Fault 2

Some faults are self-explanatory, and if these faults occur and cannot be cleared the ITM should be replaced first to see if the fault will clear. Other faults may need further investigation. Some of the sensor problems, associated error codes, and resolutions are listed below.

Under-Range Problems

Probable Cause: Sensor Baseline drifted lower, Interference gases,

- Perform Zero Calibration. Use Zero Air or N_2 source. (Section3.3.1 AutoZero)
- Allow more time for zero stabilization if this is a biased sensor type.
- If using Splashguard with Integral Cal Port, must use Calibration Wind Guard or air movement can compromise span gas delivery.
- Execute successful Span Calibration. (Section 3.3.2 AutoSpan)
- Replace plug-in toxic sensor if error continues.

Stability Problems

Probable Causes: Failed Sensor, empty or close to empty Cal Gas Cylinder, problems with cal gas and delivery

- Check validity of span gas using pull tube or other means (check MFG date on cal gas cylinder).
- Use proper cal gas regulators and tubing for highly corrosive gases
- If using Splashguard with Integral Cal Port, must use Calibration Wind Guard or air movement can compromise span gas delivery.
- Check for obstructions affecting cal gas hitting sensor face (including being wet, blocked, or corroded). H2S sensors assemblies use CX-DM Series Splashguard Adapter Assembly with integral filter. Clean or replace if necessary.
- Replace the plug-in toxic sensor

Clearing Problems

Probable Causes: Failed Sensor, Cal Gas not removed at appropriate time, problems with cal gas and delivery, Background of Target Gas.

- The sensor must recover to < 5% of range in < 5 min after Span calibration is complete
- Use bottled air (zero air or N_2) if there is a known continuous background level.
- Check validity of span gas using pull tube or other means (check MFG date on cal gas cylinder).
- Use proper cal gas regulators and tubing for highly corrosive gases
- Check for obstructions affecting cal gas hitting sensor face (including being wet, blocked, or corroded). H2S sensors assemblies use CX_DM Series Splashguard Adapter Assembly with integral filter. Clean or replace if necessary.
- Replace the plug-in toxic sensor.

Poor Calibration Repeatability

Probable Causes: Failed Sensor, use of wrong Cal Gas or problems w/ cal gas and delivery, Interference Gases

- Check validity of span gas with regulator and sample tubing in place using pull tube or other means (check MFG date on cal gas cylinder).
- Use proper cal gas regulators and tubing for highly corrosive gases (HF, HCI, Cl2, NH3, HBR, F2, etc.)
- Check for obstructions affecting cal gas hitting sensor face (including being wet, blocked, or corroded). H2S sensors assemblies use CX-DM Series Splashguard Adapter Assembly with integral filter. Clean or replace if necessary.
- Replace the plug-in toxic sensor.

Unstable Output/ sudden spiking

Possible Causes: Unstable power supply, inadequate grounding, or inadequate RFI protection.

- Verify Power source is stable.
- Verify field wiring is properly shielded and grounded.
- Contact Teledyne Detcon to optimize shielding and grounding.

Nuisance Alarms

- Check condulet for accumulated water and abnormal corrosion on terminal board.
- If nuisance alarms are happening at night, suspect condensation in condulet.
- Add or replace Teledyne Detcon’s Condensation Prevention Packet P/N 960-202200-000.
- Investigate the presence of other target gases that are causing cross-interference signals.
- Determine if cause is RFI induced.

Intelligent Transmitter Module (ITM) not responding

- Verify condulet has no accumulated water or abnormal corrosion.
- Verify required batteries are installed and have enough charge to power the sensor.
- Swap with a known-good ITM to determine if ITM is faulty.

Contact the Teledyne Detcon Service Department for further troubleshooting assistance at 713-559-9200.

7. Customer Support and Services Policy

Teledyne Detcon Headquarters
Shipping Address: 14880 Skinner Road, Cypress, Texas 77429
Phone: 713.559.9200

- www.teledynegasandflamedetection.com
- detcon-service@teledyne.com
- detcon-sales@teledyne.com

All Technical Service and Repair activities should be handled by the Teledyne Detcon Service Department via phone or email (contact information given above). RMA numbers should be obtained from the Teledyne Detcon Service Department prior to equipment being returned. For on-line technical service, have the model number, part number, and serial number of product(s) in question available.

All Sales activities (including spare parts purchase) should be handled by the Teledyne Detcon Sales Department via phone or email (contact information given above).

NOTE: All additional parts must be supplied by Teledyne Detcon. Use of parts from a third party will void warranty and safety approvals.

NOTE: CX-DM should only be repaired by Teledyne Detcon personnel or a Teledyne Detcon trained representative.

Warranty Notice

Teledyne Detcon Inc. warrants the Model CX-DM gas sensor to be free from defects in workmanship of material under normal use and service for one year from the date of shipment on the transmitter electronics. See Warranty details in the CX-DM Sensor Warranty (Section 7.2).

Teledyne Detcon Inc. will repair or replace without charge any such equipment found to be defective during the warranty period. Full determination of the nature of, and responsibility for, defective or damaged equipment will be made by Teledyne Detcon Inc. personnel.

Defective or damaged equipment must be shipped to the Teledyne Detcon Inc. factory or representative from which the original shipment was made. In all cases, this warranty is limited to the cost of the equipment supplied by Teledyne Detcon Inc. The customer will assume all liability for the misuse of this equipment by its employees or other contracted personnel.

All warranties are contingent upon the proper use in the application for which the product was intended and does not cover products which have been modified or repaired without Teledyne Detcon Inc. approval, or which have been subjected to neglect, accident, improper installation or application, or on which the original identification marks have been removed or altered.

Except for the express warranty stated above, Teledyne Detcon Inc. disclaims all warranties with regard to the products sold. Including all implied warranties of merchantability and fitness and the express warranties stated herein are in lieu of all obligations or liabilities on the part of Teledyne Detcon Inc. for damages including, but not limited to, consequential damages arising out of, or in connection with, the performance of the product.

8. CX-DM Sensor Warranty

Plug-in Sensor Warranty

Teledyne Detcon Inc. warrants, under normal intended use, each new plug-in sensor per the period specified in the Warranty column of Table 3 Sensor Specific Data (Section 8.2) and under the conditions described as follows: The warranty period begins on the date of shipment to the original purchaser. The sensor element is warranted to be free of defects in material and workmanship. Should any sensor fail to perform in accordance with published specifications within the warranty period, return the defective part to Teledyne Detcon, Inc., 14880 Skinner Road, Cypress, Texas 77429, for necessary repairs or replacement.

Terms & Conditions

- The original serial number must be legible on each sensor element base.
- Shipping point is FOB the Teledyne Detcon factory.
- Net payment is due within 30 days of invoice.
- Teledyne Detcon, Inc. reserves the right to refund the original purchase price in lieu of sensor replacement.

ITM Electronics Warranty

Teledyne Detcon Inc. warrants, under intended normal use, each new CX-DM Sensor ITM to be free from defects in material and workmanship for a period of one year from the date of shipment to the original purchaser. All warranties and service policies are FOB the Teledyne Detcon facility located in Cypress, Texas.

Terms & Conditions

- The original serial number must be legible on each ITM.
- Shipping point is FOB the Teledyne Detcon factory.
- Net payment is due within 30 days of invoice.
- Teledyne Detcon, Inc. reserves the right to refund the original purchase price in lieu of ITM replacement.

9. Appendix

9.1 Specifications

System Specifications

Sensor Type:	Continuous diffusion/adsorption type 3-Electrode Electrochemical Sensor (2-Electrode for O_2) Plug-in Replaceable Type
Sensor Life:	2 years typical
Measuring Ranges:	0-1ppm up to 0-10,000ppm (Toxic Gases) 0-1% up to 0-25% volume (O_2)
Accuracy/ Repeatability:	±2% of full-range (Toxic Gases) ±1% of full-range (O_2)
Response Time:	T90 < 30 seconds typical (See Sensor Table)
Warranty:	Electronics – 1 year Sensor – See Table 3 Sensor Specific Data

Environmental Specifications

Operating Temperature:	-40°C to +50°C typical (See Table 3 Sensor Specific Data)
Storage Temperature:	-35°C to +55°C typical
Operating Humidity:	10-95% RH Continuous Duty (See Table 3 Sensor Specific Data) 0-100% RH Short-Term Duration Only
Operating Pressure:	Ambient ± 10%
Air Velocity:	0-5 meters/second

Electrical Specifications

Input Voltage:	7-30 VDC
Power Consumption:	20mW (Low Power Mode) 100mW (Typical) 500mW (Max)
RFI/EMI Protection:	Complies with EN61326
Cable Requirements:	Power/Analog: 3-wire shielded cable Maximum distance is 4000 feet with 14 AWG Power/RS-485: 4-wire two twisted pair shielded cable

Mechanical Specifications

Length:	ITM - 5.165 inches (131 mm), 8.5 inches (215mm) with Splash Guard
Width:	2.2 inches (55 mm)
Weight:	2.5 lbs (1.2 Kg)
Mechanical Connection:	¾” Male NPT threaded connection with locking nut
Electrical Connection:	five 18 gauge wire leads - 5.5” long

9.2 Sensor Specific Data

Table 3 Sensor Specific Data

Gas	GasName	Part Number[1]	Response Time (seconds)	SpanDrift	Temperature Range °C	Humidity Range%	Warranty
O_2	Oxygen	371-343400-025	T95<30	<5%signal loss/year	-20 to+50	15 to 90	2 years
C_2H_3O	Acetaldehyde	371-12EA00-100	T90<140	<5%signal loss/year	-20 to+50	15 to 90	2 years
C_2H_2	Acetylene	371-12EG00-100	T90<140	<5%signal loss/year	-20 to+50	15 to 90	2 years
NH_3	Ammonia	371-171700-100	T90<90	<2%signal loss/month	-20 to+50	15 to 90	2 years
AsH_3	Arsine	371-191900-001	T90<60	<5%signal loss/month	-20 to+40	20 to 95	1.5 years
Br_2	Bromine	371-747500-005	T90<60	<2%signal loss/month	-20 to+50	15 to 90	2 years
C_4H_6	Butadiene	371-12EB00-100	T90<140	<5%signal loss/year	-20 to+50	15 to 90	2 years
CO	Carbon Monoxide	371-444400-100	T90=30	<5%signal loss/year	-40 to+50	15 to 90	3 years
Cl_2	Chlorine	371-747400-010	T90<60	<2%signal loss/month	-20 to+50	15 to 90	2 years
ClO_2 (>10ppm)	Chlorine Dioxide	371-777700-001	T90<60	<2%signal loss/month	-20 to+50	15 to 90	2 years
ClO_2 (<=10ppm)	Chlorine Dioxide	371-282800-050	T90<120	<1%signal loss/month	-20 to+40	10 to 95	2 years
B_2H_6	Diborane	371-192100-005	T90<60	<5%signal loss/month	-20 to+40	20 to 95	1.5 years
C_2H_5OH	Ethanol	371-12EO00-100	T90<140	<5%signal loss/year	-20 to+50	15 to 90	2 years
C_2H_5SH	Ethyl Mercaptan	371-24EZ00-100	T90<45	<2%signal loss/month	-40 to+50	15 to 90	2 years
C_2H_4	Ethylene	371-12ED00-100	T90<140	<5%signal loss/year	-20 to+50	15 to 90	2 years
C_2H_4O	Ethylene Oxide	371-12EJ00-100	T90<140	<5%signal loss/year	-20 to+50	15 to 90	2 years
F_2	Fluorine	371-272700-001	T90<80	<5%signal loss/year	-10 to+40	10 to 95	1.5 years
CH_2O	Formaldehyde	371-12EP00-100	T90<140	<5%signal loss/year	-20 to+50	15 to 90	2 years
GeH_4	Germane	371-232500-002	T90<60	<1%signal loss/month	-20 to+40	20 to 95	1.5 years
N_2H_4	Hydrazine	371-262600-001	T90<120	<5%signal loss/month	-10 to+40	10 to 95	1 year
H_2 (ppm)	Hydrogen	371-848400-100	T90=30	<2%signal loss/month	-20 to+50	15 to 90	2 years
H_2 (LEL)*	Hydrogen	371-050500-04P	T90<60	<2%signal loss/month	-40 to+40	5 to 95	2 years
HBr	Hydrogen Bromide	371-090800-030	T90<70	<3%signal loss/month	-20 to+40	10 to 95	1.5 years
HCl	Hydrogen Chloride	371-090900-030	T90<70	<2%signal loss/month	-20 to+40	10 to 95	1.5 years
HCN	Hydrogen Cyanide	371-131300-030	T90<40	<5%signal loss/month	-40 to+40	5 to 95	2 years
HF	Hydrogen Fluoride	371-333300-010	T90<90	<10%signal loss/month	-20 to+35	10 to 80	1.5 years
H_2S	Hydrogen Sulfide	371-242400-100	T80<30	<2%signal loss/month	-40 to+50	15 to 90	2 years
CH_3OH	Methanol	371-12EE00-100	T90<140	<5%signal loss/year	-20 to+50	15 to 90	2 years
CH_3SH	Methyl Mercaptan	371-24EK00-100	T90<45	<2%signal loss/month	-40 to+50	15 to 90	2 years
NO	Nitric Oxide	371-949400-100	T90=10	<2%signal loss/month	-20 to+50	15 to 90	3 years
NO_2	Nitrogen Dioxide	371-646400-010	T90<40	<2%signal loss/month	-20 to+50	15 to 90	2 years

[1] The last three digits of the Part Number are the range of the sensor cell. I.E. "-100" is a 100ppm range.

Gas	GasName	Part Number[1]	Response Time (seconds)	SpanDrift	Temperature Range °C	Humidity Range%	Warranty
O_3	Ozone	371-999900-001	T90<120	<1%signal loss/month	-10 to+40	10 to 95	2 years
$COCl_2$	Phosgene	371-414100-001	T90<120	<1%signal loss/month	-20 to+40	10 to 95	1.5 years
PH3	Phosphine	371-192000-005	T90<30	<1%signal loss/month	-20 to+40	20 to 95	1.5 years
SiH_4	Silane	371-232300-050	T90<60	<1%signal loss/month	-20 to+40	20 to 95	1.5 years
SO_2	Sulfur Dioxide	371-555500-020	T90=20	<2%signal loss/month	-20 to+50	15 to 90	2 years

9.3 Interference Table

Interference Table Reference Table 4 Interfering Gases to match the interfering gas symbol with the gas name. Then refer to Table 5 Cross Interference Table which extends for 5 pages, with each sensor specific gas repeated in each section of the table, for a column listing of 40 gases. The list is followed by a row of 14 possible interfering gases per page. Review each page for the applicable sensor gas and then scan across the row for possible interference gases.

Table 4 Interfering Gases

Acetaldehyde	C_2H_3O	Dimethyl Sulfide	C_2H_6S	Methane	CH_4
Acetylene	C_2H_2	Disilane	Si_2H_6	Methanol	CH_3OH
Acrylonitrile	C_3H_3N	Epichlorohydrin	C_3H_5OCl	Methyl-ethyl-ketone	C_4H_8O
Alcohols	Alcohols	Ethanol	C_2H_5OH	Methyl Mercaptan	CH_3SH
Amines	Amines	Ethyl Mercaptan	C_2H_5SH	Nitric Oxide	NO
Ammonia	NH_3	Ethylene	C_2H_4	Nitrogen	N_2
Arsenic Trifluoride	AsF_3	Ethylene Oxide	C_2H_4O	Nitrogen Dioxide	NO_2
Arsenic Pentafluoride	AsF_5	Fluorine	F_2	Ozone	O_3
Arsine	AsH_3	Formaldehyde	CH_2O	Phosgene	$COCl_2$
Boron Trifluoride	BF_3	Germane	GeH_4	Phosphine	PH_3
Bromine	Br_2	Hydrazine	N_2H_4	Phosphorous Trifluoride	PF_3
Butadiene	C_4H_6	Hydrocarbons	C-H's	Silane	SiH_4
Buten-1	Buten-1	Hydrocarbons (unsaturated)	C-H's (μ)	Silicon	Si
Carbon Dioxide	CO_2	Hydrogen	H_2	Silicon Tetra Fluoride	SiF_4
Carbon Disulfide	CS_2	Hydrogen Bromide	HBr	Sulfur Dioxide	SO_2
Carbon Oxide Sulfide	COS	Hydrogen Chloride	HCl	Tetrahydrothiophene	C_4H_8S
Carbon Monoxide	CO	Hydrogen Cyanide	HCN	Thiophane	C_4H_4S
Carbonyl Sulfide	CS	Hydrogen Fluoride	HF	Toluene	$C_6H_5CH_3$
Chlorine	Cl_2	Hydrogen Selenide	HSe	Tungsten Hexafluoride	WF_6
Chlorine Dioxide	ClO_2	Hydrogen Sulfide	H_2S	Vinyl Acetate	$C_4H_6O_2$
Chlorine Trifluoride	ClF_3	Dimethyl Sulfide	C_2H_6S	Vinyl Chloride	C_2H_3Cl
Diborane	B_2H_6				

Table 5 Cross Interference Table

Gas	C_2H_3O	C_2H_2	C_3H_3N	Alcohols	Amines	NH_3	AsF_3	AsF_5	AsH_3	BF_3	Br_2	C_4H_6	Buten-1
C_2H_3O	n/a	40=340	40=75	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	40=170	n/d
C_2H_2	340=40	n/a	340=75	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	340=170	n/d
C_3H_3N	75=40	75=340	n/a	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	75=170	n/d
NH_3	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
AsH_3	n/d	n/d	n/d	n/d	n/d	100=0.01	n/d	n/d	n/a	n/d	n/d	n/d	n/d
Br_2	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/a	n/d	n/d
C_4H_6	170=40	170=340	170=75	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/a	n/d
CS_2	140=40	140=340	140=75	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	140=170	n/d
CO	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
Cl_2	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	1=0.55	n/d	n/d
ClO_2 (>10ppm)	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	1=0.18	n/d	n/d
ClO_2 (=10ppm)	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
B_2H_6	n/d	n/d	n/d	n/d	n/d	100=0.013	n/d	n/d	0.15=0.2	n/d	n/d	n/d	n/d
C_3H_5OCl	50=40	50=340	50=75	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	50=170	n/d
C_2H_5OH	180=40	180=340	180=75	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	180=170	n/d
C_2H_5SH	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
C_2H_4	220=40	220=340	220=75	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	220=170	n/d
C_2H_4O	275=40	275=340	275=75	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	275=170	n/d
F_2	n/d	n/d	n/d	1000=0	n/d	n/d	n/d	n/d	0.1=0	n/d	yes n/d	n/d	n/d
CH_2O	330=40	330=340	330=75	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	330=170	n/d
GeH_4	n/d	n/d	n/d	n/d	n/d	100=<1	n/d	n/d	0.2=0.14	n/d	n/d	n/d	n/d
N_2H_4	n/d	n/d	n/d	1000=0	n/d	200=0.04	n/d	n/d	0.1=0.1	n/d	n/d	n/d	n/d
H_2 (ppm)	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
H_2 (LEL)	n/d	n/d	n/d	n/d	n/d	100=0	n/d	n/d	n/d	n/d	n/d	n/d	n/d
HBr	n/d	n/d	n/d	1000=0	no	n/d	n/d	n/d	0.1=0.3	n/d	n/d	n/d	n/d
HCl	n/d	n/d	n/d	1000=0	no	n/d	n/d	n/d	0.1=0.3	n/d	n/d	n/d	n/d
HCN	n/d	n/d	n/d	1000=0	n/d	n/d	n/d	n/d	0.1=0	n/d	yes n/d	n/d	n/d
HF	n/d	n/d	n/d	1000=0	n/d	n/d	yes n/d	yes n/d	0.1=0	yes n/d	n/d	n/d	n/d
H_2S	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
CH_3OH	415=40	415=340	415=75	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	415=170	n/d
CH_3SH	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	275=170	n/d
NO	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
NO_2	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
O_3	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	0.1=0.05	n/d	yes n/d	n/d	n/d
$COCl_2$	n/d	n/d	n/d	1000=0	n/d	50=0.5	n/d	n/d	n/d	n/d	n/d	n/d	n/d
PH_3	n/d	n/d	n/d	n/d	n/d	100=0.01	n/d	n/d	1=1	n/d	n/d	n/d	n/d
SiH_4	n/d	n/d	n/d	n/d	n/d	100=<1	n/d	n/d	0.2=0.14	n/d	n/d	n/d	n/d
SO_2	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
$C_4H_6O_2$	200=40	200=340	200=75	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	200=170	n/d
C_2H_3Cl	200=40	200=340	200=75	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	200=170	n/d

n/a – not applicable
n/d – no data

Table 5 Cross Interference Table (pg.2)

Gas	**CO_2**	**CS_2**	**CO**	**COS**	**CL_2**	**CLO_2**	**CLF_3**	**B_2H_6**	**C_2H_6S**	**Si_2H_6**	**C_3H_5OCL**	**C_2H_5OH**	**F_2**
C_2H_3O	n/d	40=140	40=100	40=135	n/d	n/d	n/d	n/d	40=150	n/d	40=50	40=180	n/d
C_2H_2	n/d	340=140	340=100	340=135	n/d	n/d	n/d	n/d	340=150	n/d	340=50	340=180	n/d
C_3H_3N	n/d	75=140	75=100	75=135	n/d	n/d	n/d	n/d	75=150	n/d	75=50	75=180	n/d
NH_3	n/d	n/d	300=8	n/d	1=-1	10%=-15	n/d	n/d	n/d	n/d	n/d	n/d	n/d
AsH_3	5000=0	n/d	300=0	n/d	0.5=-0.04	n/d	n/d	0.2=0.15	n/d	5=yes n/d	n/d	n/d	n/d
Br_2	n/d	n/d	300=0	n/d	1=2	1=6	n/d	n/d	n/d	n/d	n/d	n/d	n/d
C_4H_6	n/d	170=140	170=100	170=135	n/d	n/d	n/d	n/d	170=150	n/d	170=50	170=180	n/d
CS_2	n/d	n/a	140=100	140=135	n/d	n/d	n/d	n/d	140=150	n/d	140=50	140=180	n/d
CO	n/d	n/d	n/a	n/d	1=0	n/d	n/d	n/d	n/d	n/d	n/d	200=0	n/d
Cl_2	n/d	n/d	300=0	n/d	n/a	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
ClO_2 (>10ppm)	n/d	n/d	300=0	n/d	3=1	n/a	n/d	n/d	n/d	n/d	n/d	n/d	n/d
ClO_2 (=10ppm)	5000=0	n/d	1000=0	n/d	1=0.9	n/a	yes n/d	0.1=0	n/d	n/d	n/d	n/d	yes n/d
B_2H_6	5000=0	n/d	300=0	n/d	0.5=-0.05	n/d	n/d	n/a	n/d	5=yes n/d	n/d	n/d	n/d
C_3H_5OCl	n/d	50=140	50=100	50=135	n/d	n/d	n/d	n/d	50=150	n/d	n/a	50=180	n/d
C_2H_5OH	n/d	180=140	180=100	180=135	n/d	n/d	n/d	n/d	180=150	n/d	180=50	n/a	n/d
C_2H_5SH	n/d	n/d	300=5	n/d	1=-0.6	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
C_2H_4	n/d	220=140	220=100	220=135	n/d	n/d	n/d	n/d	220=150	n/d	220=50	220=180	n/d
C_2H_4O	n/d	275=140	275=100	275=135	n/d	n/d	n/d	n/d	275=150	n/d	275=50	275=180	n/d
F_2	5000=0	n/d	1000=0	n/d	1=1.3	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/a
CH_2O	n/d	330=140	330=100	330=135	n/d	n/d	n/d	n/d	330=150	n/d	330=50	330=180	n/d
GeH_4	5000=0	n/d	300=0	n/d	0.5=-0.04	n/d	n/d	0.2=0.11	n/d	5=yes n/d	n/d	n/d	n/d
N_2H_4	5000=0	n/d	1000=0	n/d	1=0	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
H_2 (ppm)	n/d	n/d	300=<30	n/d	1=0	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
H_2 (LEL)	1000=0	n/d	50=6	n/d	5=0	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
HBr	5000=0	n/d	1000=0	n/d	5=1	n/d	yes n/d	n/d	n/d	n/d	n/d	n/d	n/d
HCl	5000=0	n/d	1000=0	n/d	5=1	n/d	1=yes n/d	n/d	n/d	n/d	n/d	n/d	n/d
HCN	5000=0	n/d	1000=0	n/d	5=-1	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
HF	5000=0	n/d	1000=0	n/d	1=0.4	n/d	yes n/d	0.1=0	n/d	n/d	n/d	n/d	yes n/d
H_2S	n/d	n/d	300==1.5	n/d	1=˜-0.2	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
CH_3OH	n/d	415=140	415=100	415=135	n/d	n/d	n/d	n/d	415=150	n/d	415=50	415=180	n/d
CH_3SH	n/d	n/d	300=3	n/d	1=-0.4	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
NO	n/d	n/d	300=0	n/d	1=0	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
NO_2	n/d	n/d	300=0	n/d	1=˜1	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
O_3	5000=0	n/d	300=0	n/d	1=1.4	0.1=0.12	1=1(theory	n/d	n/d	n/d	n/d	n/d	0.1=0.07
$COCl_2$	5000=0	n/d	1000=0	n/d	1=0	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
PH_3	5000=0	n/d	300=0	n/d	0.5=-0.04	n/d	n/d	0.2=0.15	n/d	5=yes n/d	n/d	n/d	n/d
SiH_4	5000=0	n/d	300=0	n/d	0.5=-0.04	n/d	n/d	0.2=0.11	n/d	5=yes n/d	n/d	n/d	n/d
SO_2	n/d	n/d	300=<5	n/d	1=<0.5	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
$C_4H_6O_2$	n/d	200=140	200=100	200=135	n/d	n/d	n/d	n/d	200=150	n/d	200=50	200=180	n/d
C_2H_3Cl	n/d	200=140	200=100	200=135	n/d	n/d	n/d	n/d	200=150	n/d	200=50	200=180	n/d

n/a – not applicable
n/d – no data

Table 5 Cross Interference Table (pg.3)

Gas	C_2H_4	C_2H_4O	CH_2O	GeH_4	N_2H_4	C-H's	C-H's (U)	H_2	HBr	HCL	HCN	HF	I_2
C_2H_3O	40=220	40=275	40=330	N/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
C_2H_2	340=220	340=275	340=330	N/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
C_3H_3N	75=220	75=275	75=330	N/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
NH_3	100=0	n/d	n/d	N/d	n/d	n/d	n/d	200=4	n/d	5=-3	10=0	n/d	n/d
AsH_3	n/d	n/d	n/d	1=0.4	n/d	%range=0	n/d	3000=0	n/d	5=0	10=0.1	4=0	n/d
Br_2	100=0	n/d	n/d	N/d	n/d	n/d	n/d	100=0	n/d	5=0	10=0	n/d	n/d
C_4H_6	170=220	170=275	170=330	N/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
CS_2	140=220	140=275	140=330	N/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
CO	100=<100	n/d	n/d	N/d	n/d	n/d	n/d	100=<60	n/d	5=0	10=<2	n/d	n/d
Cl_2	100=0	n/d	n/d	N/d	n/d	n/d	n/d	100=0	n/d	5=0	10=0	n/d	n/d
ClO_2 (>10ppm)	100=0	n/d	n/d	N/d	n/d	n/d	n/d	100=0	n/d	5=0	10=0	n/d	n/d
ClO_2 (=10ppm)	n/d	n/d	n/d	1=0	n/d	%range=0	n/d	1%=0	n/d	n/d	n/d	n/d	n/d
B_2H_6	n/d	n/d	n/d	1=0.53	n/d	%range=0	n/d	3000=0	n/d	5=0	10=0.13	4=0	n/d
C_3H_5OCl	50=220	50=275	50=330	N/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
C_2H_5OH	180=220	180=275	180=330	N/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
C_2H_5SH	100=0	n/d	n/d	N/d	n/d	n/d	n/d	1%=<15	n/d	5=0	10=0	n/d	n/d
C_2H_4	n/a	220=275	220=330	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
C_2H_4O	275=220	n/a	275=330	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
F_2	n/d	n/d	n/d	n/d	n/d	%range=0	n/d	1%=0	n/d	5=0	1=-3	3=0	n/d
CH_2O	330=220	330=275	n/a	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
GeH_4	n/d	n/d	n/d	n/a	n/d	%range=0	n/d	3000=0	n/d	5=0	10=1	4=0	n/d
N_2H_4	n/d	n/d	n/d	n/d	n/a	%range=0	n/d	1000=0	n/d	5=0.1	n/d	3=0	n/d
H_2 (ppm)	100=ˉ80	n/d	n/d	n/d	n/d	n/d	n/d	n/a	n/d	5=0	10=ˉ3	n/d	n/d
H_2 (LEL)	yes n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/a	n/d	n/d	10=0	n/d	n/d
HBr	n/d	n/d	n/d	n/d	n/d	%range=0	n/d	1%=0	n/a	1=1	15=1	3=0	n/d
HCl	n/d	n/d	n/d	1=n/d	n/d	%range=0	n/d	1%=0	1=1	n/a	15=1	3=0	n/d
HCN	n/d	n/d	n/d	n/d	n/d	%range=0	n/d	1000=0	n/d	5=0	n/a	3=0	n/d
HF	n/d	n/d	n/d	1=0	n/d	%range=0	n/d	1%=0	n/d	5=3.3	n/d	n/a	n/d
H_2S	100=0	n/d	n/d	n/d	n/d	n/d	n/d	1%=<5	n/d	5=0	10=0	n/d	n/d
CH_3OH	415=220	415=275	415=330	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
CH_3SH	100=0	n/d	n/d	n/d	n/d	n/d	n/d	1%=<10	n/d	5=0	10=0	n/d	n/d
NO	100=0	n/d	n/d	n/d	n/d	n/d	n/d	100=0	n/d	5=<1	10=0	n/d	n/d
NO_2	100=0	n/d	n/d	n/d	n/d	n/d	n/d	100=0	n/d	5=0	10=0	n/d	n/d
O_3	n/d	n/d	n/d	n/d	n/d	n/d	n/d	1%=0.003	n/d	10=0	10=0.03	5=0	yes n/d
$COCl_2$	n/d	n/d	n/d	n/d	n/d	%range=0	n/d	1%=0	n/d	5=0	5=0	3=0	n/d
PH_3	n/d	n/d	n/d	1=0.4	n/d	%range=0	n/d	3000=0	n/d	5=0	10=0.1	4=0	n/d
SiH_4	n/d	n/d	n/d	1=1.0	n/d	%range=0	n/d	3000-=0	n/d	5=0	10=1	4=0	n/d
SO_2	100=0	n/d	n/d	n/d	n/d	n/d	n/d	100=0	n/d	5=0	10=<5	n/d	n/d
$C_4H_6O_2$	200=220	200=275	200=330	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
C_2H_3Cl	200=220	200=275	200=330	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d

n/a – not applicable
n/d – no data

Table 5 Cross Interference Table (pg.4)

Gas	HSe	H_2S	C_3H_8O	CH_4	CH_3OH	C_4H_8O	CH_3SH	NO	N_2	NO_2	O_3	$COCL_2$	PH_3
C_2H_3O	n/d	n/d	n/d	n/d	40=415	n/d	40=275	n/d	n/d	n/d	n/d	n/d	n/d
C_2H_2	n/d	n/d	n/d	n/d	340=415	n/d	340=275	n/d	n/d	n/d	n/d	n/d	n/d
C_3H_3N	n/d	n/d	n/d	n/d	75=415	n/d	75=275	n/d	n/d	n/d	n/d	n/d	n/d
NH_3	n/d	15=30	n/d	n/d	n/d	n/d	n/d	35=6	n/d	5=-1	n/d	n/d	n/d
AsH_3	0.05=0.005	1=0	n/d	n/d	n/d	n/d	n/d	n/d	100%=0	n/d	n/d	n/d	0.1=0.11
Br_2	n/d	15=-1.5	n/d	n/d	n/d	n/d	n/d	35=0	n/d	5=˜10	n/d	n/d	n/d
C_4H_6	n/d	n/d	n/d	n/d	170=415	n/d	170=275	n/d	n/d	n/d	n/d	n/d	n/d
CS_2	n/d	n/d	n/d	n/d	140=415	n/d	140=275	n/d	n/d	n/d	n/d	n/d	n/d
CO	n/d	15=<0.3	n/d	n/d	n/d	n/d	n/d	35==7	n/d	5=0.5	n/d	n/d	n/d
Cl_2	n/d	15=-0.75	n/d	n/d	n/d	n/d	n/d	35=0	n/d	5=˜5	n/d	n/d	n/d
ClO_2 (>10ppm)	n/d	15=0.25	n/d	n/d	n/d	n/d	n/d	35=0	n/d	5=1.66	n/d	n/d	n/d
ClO_2 (=10ppm)	n/d	10=-0.015	n/d	n/d	n/d	n/d	n/d	n/d	n/d	yes n/d	yes n/d	n/d	n/d
B_2H_6	0.05=0.006	1=0	n/d	n/d	n/d	n/d	n/d	n/d	100%=0	n/d	n/d	n/d	0.1=0.14
C_3H_5OCl	n/d	n/d	n/d	n/d	50=415	n/d	50=275	n/d	n/d	n/d	n/d	n/d	n/d
C_2H_5OH	n/d	n/d	n/d	n/d	180=415	n/d	180=275	n/d	n/d	n/d	n/d	n/d	n/d
C_2H_5SH	n/d	1:03	n/d	n/d	n/d	n/d	5=8	35=<6	n/d	5=-1.5	n/d	n/d	n/d
C_2H_4	n/d	n/d	n/d	n/d	220=415	n/d	220=275	n/d	n/d	n/d	n/d	n/d	n/d
C_2H_4O	n/d	n/d	n/d	n/d	275=415	n/d	275=275	n/d	n/d	n/d	n/d	n/d	n/d
F_2	n/d	1=-1.5	n/d	n/d	n/d	n/d	n/d	n/d	100%=0	1=0.05	0.1=0.2	n/d	n/d
CH_2O	n/d	n/d	n/d	n/d	330=415	n/d	330=275	n/d	n/d	n/d	n/d	n/d	n/d
GeH_4	0.05=0.005	1=0	n/d	n/d	n/d	n/d	n/d	n/d	100%=0	n/d	n/d	n/d	0.1=0.13
N_2H_4	n/d	1=0.1	n/d	n/d	n/d	n/d	n/d	n/d	100%=0	1=-0.25	0.1=-0.1	n/d	0.3=0.1
H_2 (ppm)	n/d	15=<3	n/d	n/d	n/d	n/d	n/d	35=˜10	n/d	5=0	n/d	n/d	n/d
H_2 (LEL)	n/d	n/d	yes n/d	1%=0	n/d	n/d	n/d	yes n/d	n/d	10=0	n/d	n/d	n/d
HBr	0.1=0	10=2.75	n/d	n/d	n/d	n/d	n/d	n/d	100%=0	n/d	n/d	0.1=0	0.1=0.3
HCl	0.1=0	10=2.75	n/d	n/d	n/d	n/d	n/d	n/d	100%=0	n/d	n/d	0.1=0	0.1=0.3
HCN	n/d	10=0	n/d	n/d	n/d	n/d	n/d	n/d	100%=0	10=-12	0.1=0	n/d	0.3=0
HF	n/d	10=0	n/d	n/d	n/d	n/d	n/d	n/d	100%=0	10˜0.1	n/d	n/d	0.1=0
H_2S	n/d	n/a	n/d	n/d	n/d	n/d	2:01	35=<2	n/d	5=-0.5	n/d	n/d	n/d
CH_3OH	n/d	n/d	n/d	n/d	n/a	n/d	415=275	n/d	n/d	n/d	n/d	n/d	n/d
CH_3SH	n/d	1:02	n/d	n/d	n/d	n/d	n/a	35=<4	n/d	5=-1.0	n/d	n/d	n/d
NO	n/d	15=˜5	n/d	n/d	n/d	n/d	n/d	100=0	n/d	5=<1.5	n/d	n/d	n/d
NO_2	n/d	15=-0.75	n/d	n/d	n/d	n/d	n/d	35=0	n/d	n/a	n/d	n/d	n/d
O_3	n/d	1=-.015	n/d	n/d	n/d	n/d	n/d	10=0	100%=0	1=0.7	n/a	n/d	0.3=0.03
$COCl_2$	n/d	1=0	n/d	n/d	n/d	n/d	n/d	n/d	100%=0	n/d	n/d	n/a	0.3=0
PH_3	0.05=0.005	1=0	n/d	n/d	n/d	n/d	n/d	n/d	100%=0	n/d	n/d	n/d	n/a
SiH_4	0.05=0.005	1=0	n/d	n/d	n/d	n/d	n/d	n/d	100%=0	n/d	n/d	n/d	0.1=0.13
SO_2	n/d	15=0	n/d	n/d	n/d	n/d	n/d	35=0	n/d	5=˜-5	n/d	n/d	n/d
$C_4H_6O_2$	n/d	n/d	n/d	n/d	200=415	n/d	200=275	n/d	n/d	n/d	n/d	n/d	n/d
C_2H_3Cl	n/d	n/d	n/d	n/d	200=415	n/d	200=275	n/d	n/d	n/d	n/d	n/d	n/d

n/a – not applicable
n/d – no data

Table 5 Cross Interference Table (pg.5)

Gas	PF_3	SiH_4	Si	SiF_4	SO_2	C_4H_8S	C_4H_4S	C_6H5CH_3	WF_6	$C_4H_6O_2$	C_2H_3CL	C_2H_5SH	$C_6H_5CH_3$
C_2H_3O	n/d	n/d	n/d	n/d	n/d	n/d	40=45	n/d	n/d	40=200	40=200	n/d	40=55
C_2H_2	n/d	n/d	n/d	n/d	n/d	n/d	340=45	n/d	n/d	340=200	340=200	n/d	340=55
C_3H_3N	n/d	n/d	n/d	n/d	n/d	n/d	75=45	n/d	n/d	75=200	75=200	n/d	75=55
NH_3	n/d	n/d	n/d	n/d	5=-0.5	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
AsH_3	n/d	1=0.56	n/d	n/d	2=0	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
Br_2	n/d	n/d	n/d	n/d	5=-0.1	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
C_4H_6	n/d	n/d	n/d	n/d	n/d	n/d	170=45	n/d	n/d	170=200	170=200	n/d	170=55
CS_2	n/d	n/d	n/d	n/d	n/d	n/d	140=45	n/d	n/d	140=200	140=200	n/d	140=55
CO	n/d	n/d	n/d	n/d	5=0	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
Cl_2	n/d	n/d	n/d	n/d	5=-0.05	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
ClO_2 (>10ppm)	n/d	n/d	n/d	n/d	5=-0.016	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
ClO_2 (=10ppm)	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
B_2H_6	n/d	1=0.72	n/d	n/d	2=0	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
C_3H_5OCl	n/d	n/d	n/d	n/d	n/d	n/d	50=45	n/d	n/d	50=200	50=200	n/d	50=55
C_2H_5OH	n/d	n/d	n/d	n/d	n/d	n/d	180=45	n/d	n/d	180=200	180=200	n/d	180=55
C_2H_5SH	n/d	n/d	n/d	n/d	5=<3	n/d	n/d	n/d	n/d	n/d	n/d	n/a	n/d
C_2H_4	n/d	n/d	n/d	n/d	n/d	n/d	220=45	n/d	n/d	220=200	220=200	n/d	220=55
C_2H_4O	n/d	n/d	n/d	n/d	n/d	n/d	275=45	n/d	n/d	275=200	275=200	n/d	275=55
F_2	n/d	n/d	n/d	n/d	2=0	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
CH_2O	n/d	n/d	n/d	n/d	n/d	n/d	330=45	n/d	n/d	330=200	330=200	n/d	330=55
GeH_4	n/d	1=1	n/d	n/d	2=0	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
N_2H_4	n/d	n/d	n/d	n/d	2=0	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
H_2 (ppm)	n/d	n/d	n/d	n/d	5=0	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
H_2 (LEL)	n/d	n/d	n/d	n/d	2=0	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
HBr	n/d	n/d	n/d	n/d	5=2.5	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
HCl	n/d	n/d	n/d	n/d	5=2.5	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
HCN	n/d	n/d	n/d	n/d	2=0	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
HF	yes n/d	n/d	n/d	3=4(theory)	yes n/d	n/d	n/d	n/d	yes n/d	n/d	n/d	n/d	n/d
H_2S	n/d	n/d	n/d	n/d	5=<1	n/d	n/d	n/d	n/d	n/d	n/d	3=1	n/d
CH_3OH	n/d	n/d	n/d	n/d	n/d	n/d	415=45	n/d	n/d	415=200	415=200	n/d	413=55
CH_3SH	n/d	n/d	n/d	n/d	5=<2	n/d	n/d	n/d	n/d	n/d	n/d	2=1	n/d
NO	n/d	n/d	n/d	n/d	5=0	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
NO_2	n/d	n/d	n/d	n/d	5=-0.025	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
O_3	n/d	1=0.015	n/d	n/d	2=0	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
$COCl_2$	n/d	n/d	n/d	n/d	2=0	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
PH_3	n/d	1=0.56	n/d	n/d	2=0	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
SiH_4	n/d	n/a	n/d	n/d	2=0	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
SO_2	n/d	n/d	n/d	n/d	n/a	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
$C_4H_6O_2$	n/d	n/d	n/d	n/d	n/d	n/d	200=45	n/d	n/d	n/a	200=200	n/d	200=55
C_2H_3Cl	n/d	n/d	n/d	n/d	n/d	n/d	200=45	n/d	n/d	200=200	n/a	n/d	200=55

n/a – not applicable
n/d – no data

9.4 Spare Parts, Sensor Accessories, Calibration Equipment

Part Number	Spare Parts
92C-240400-000	CX-DM-H2S Intelligent Transmitter Module
92C-XX0400-YYY	CX-DM Intelligent Transmitter Module for Toxic Gas Sensors (where xx=Gas Code, and YYY=Range)
371-XXXX00-XXX	Replacement Plug-in toxic gas sensor (Refer to Table 3 Sensor Specific Data)
Sensor Accessories	
613-120000-700	Sensor Splash Guard with integral Cal Port
602-003803-000	CX-DM Splashguard Adapter Assembly
602-003803-200	CX-DM H2S Splashguard Adapter Assembly
943-002273-000	Harsh Environment Sensor Guard
327-000000-000	Programming Magnet
Calibration Accessories	
943-000000-000	Calibration Wind Guard
943-000006-132	Threaded Calibration Adapter
943-01747-T05	Calibration Adapter for highly reactive gases
943-050000-132	Span Gas Kit: Includes calibration adapter, span gas humidifier, 500cc/min fixed flow regulator, and carrying case. (Not including gas).
943-050000-HRG	Highly Reactive Gas Span Gas Kit (Used for NH3, Cl2, HCl, HBr, etc.)
See Detcon	Span Gases – various
943-05AM00-000	500 cc/min Fixed Flow Regulator for span gas bottle
Optional Accessories	
897-860000-316	316SS Mini Condulet w/Solid Cover
960-202200-000	Condensation prevention packet (For condulet, replace annually)

10.Revision Log

Revision	Date	Changes made	Approval
1.0	03/20/13	Release	LBU
1.1	01/29/14	Update wiring, calibration and other corrections	LBU
1.2	04/09/14	Wiring Correction	LBU
1.3	05/29/14	Added Section 2.1, Updated Approvals Label	BM
1.4	09/08/14	Added Section 2.1, Updated Approvals Label	BM
1.5	06/06/18	Added conduit seal in Section 2.5	MM
1.6	01/21/20	Updated Company Information	MM
1.7	10/26/20	Updated approvals label, updated company address	KM
1.8	03/15/22	Removed approvals label	KM

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