# Operation & Maintenance Manual

# Catalytic Bead
# Combustible Gas Sensor

For Detection of Hydrocarbon / Combustible Gases

**Important: Read and understand contents prior to first use. Improper use or operation could result in instrument malfunction or serious injury.**

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# SECTION 1 – SAFETY INFORMATION

## *1.1 Safety Information – Read Before Installation & Applying Power*

**IMPORTANT**

Users should have a detailed understanding of GDS-Catalytic Bead operating and maintenance instructions. Use the GDS-Catalytic Bead only as specified in this manual or detection of gases and the resulting protection provided may be impaired. Read the following **WARNINGS** prior to use.

**WARNINGS**

- Do not paint the sensor assembly.
- Do not use the GDS Catalytic Bead sensor if its enclosure is damaged or cracked or has missing components.
- Make sure the cover and field wiring are securely in place before operation.
- Periodically test for correct operation of the system's alarm events by exposing the monitor / sensor system to a targeted gas concentration above the High Alarm setpoint.
- Do not expose the GDS Catalytic Bead sensor to electrical shock or continuous severe mechanical shock.
- Protect the GDS Catalytic Bead sensor from dripping liquids and high power sprays.
- Use only for applications described within this manual.

**CAUTION: FOR SAFETY REASONS THIS EQUIPMENT MUST BE OPERATED AND SERVICED BY QUALIFIED PERSONNEL ONLY. READ AND UNDERSTAND INSTRUCTION MANUAL COMPLETELY BEFORE OPERATING OR SERVICING.**

**ATTENTION: POUR DES RAISONS DE SÉCURITÉ, CET ÉQUIPEMENT DOIT ÊTRE UTILISÉ, ENTRETENU ET RÉPARÉ UNIQUEMENT PAR UN PERSONNEL QUALIFIÉ. ÉTUDIER LE MANUE D'INSTRUCTIONS EN ENTIER AVANT D'UTILISER, D'ENTRETENIR OU DE RÉPARER L'ÉQUIPEMENT.**

## *1.2 Contacting Global Detection Systems Corp.*

To contact Global Detection Systems Corp, please call 409-927-2980, FAX 409-927-4180 or visit us on the web at www.gdscorp.com For sales information, send email to sales@gdscorp.com or for technical support email us at tech@gdscorp.com Our headquarters are located at 2513 Hwy 6 in Santa Fe, Texas 77510.

# SECTION 2 – CATALYTIC BEAD SENSOR SPECIFICATIONS

| | |
|---|---|
| **Model:** | Global Detection Systems Corp. Catalytic Bead Combustible Gas Sensor |
| **Available gases:** | Methane: 0-100% LEL<br>Propane 0-100% LEL<br>Acetylene 0-100% LEL<br>Hydrogen 0-100% LEL<br>**NOTE:** This list is not all-inclusive. The GDS Catalytic Bead sensor can be calibrated for other hydrocarbons; please contact GDS Corp for more information. |
| **Detection Method:** | Diffusion |
| **Output (analog):** | Installed in GDS-48 Universal Sensor Head: Traditional catalytic bead bridge output<br>Installed in GASMAX II Gas Monitor: 4-20 mA (Source type) max. 600 Ohm load at 24 VDC supply voltage |
| **Response Time:** | $T_{50}$ < 3 seconds at 20°C ambient<br>$T_{90}$ < 8 seconds at 20°C ambient |
| **Operating Temperature Rating:** | Remote installation using GDS-48 Universal Sensor:<br>-20°C to +70°C<br>Local installation with GASMAX II Gas Monitor (Arctic Monitor option):<br>-40°C to +70°C |
| **Operating Voltage:** | Installed in GDS-48 Universal Sensor Head: 2.0 VDC (+/- 0.1VDC) as measured at the detector head<br>Installed in GASMAX II Gas Monitor:<br>See GASMAX manual |
| **Power Consumption:** | Sensor only: 300mA (+/- 20mA) |
| **Hazardous Environment Certification** | Installed in GDS-48 Universal Sensor Head:<br>CSA Certified Class 1, Division 1, Groups B, C, D<br>Installed in GASMAX II Gas Monitor:<br>CSA Certified Class 1, Division 1 Groups B, C, D<br>CSA Certified Class 1, Division 1 Groups A, B, C, D available for acetylene. Contact factory. |
| **Warranty:** | Electronics (GASMAX II) – Two years from date of purchase<br>Sensor: One year from date of purchase |

# SECTION 3 - GENERAL DESCRIPTION

### *3.1 GDS Catalytic Bead Sensor for Combustibles*

The GDS Catalytic Bead sensor is a permanently-mounted sensor that continuously monitors for a wide range of combustible gases. The GDS Catalytic Bead sensor can be connected to a GDS Corp **C1** ***Protector*** sixteen-channel controller, a GDS Corp **C2** ***Protector*** two-channel controller, a single or dual channel **GASMAX II** Gas Monitor, or other instrumentation device that supports a standard Whetstone bridge input that can provide 2.0 VDC (+/- 0.1V) excitation voltage. When used locally with the GASMAX II monitor, a standard 4-20mA output, an isolated 4-20mA output, a MODBUS digital output and local alarm relay contacts are available.

### *3.2 Features (Installed in GDS-48 Remote Sensor Housing)*

- Output compatible with standard 3-wire catalytic bead bridge-type circuit (~2.0VDC excitation)
- Contains active and reference beads
- Ranges available: 0-100% LEL
- Can be factory-calibrated to other gases – contact GDS Corp for more details.

### *3.3 Features (Installed with GASMAX II Gas Monitor or C2 Two-Channel Controller)*

- All above features plus the following:
- Smart Sensor records serial number, born-on date and other information (GASMAX only)
- Graphic alphanumeric display in engineering units with alarm LEDs
- Calculated sensor life display after each calibration
- Optional isolated 4-20mA output, MODBUS digital serial output
- Optional alarm relay contacts (3 separate levels + Fault)
- Magnetic interface allows setup without declassifying hazardous area
- Second GASMAX channel supports simultaneous monitoring of toxic gas using electrochemical sensor

### *3.4 Catalytic Bead Detection Technology*

Catalytic bead sensors are made from two separate elements. The “detector” element is made by winding a small coil of wire, sealing it in a ceramic substance and then coating it with a catalyst. The “compensator” element is made in a similar fashion except in place of the catalyst, an inert substance is used. The compensator bead allows the pair to minimize changes due to ambient temperature, humidity and pressure variations.

Catalytic bead sensors operate above a threshold or "turn-on" voltage corresponding to the bead temperature which can, in the presence of the catalyst and oxygen, first ignite the gas. When a mixture of combustible gas or vapor in air diffuses through the sensor, it oxidizes on the catalytically treated detector bead. Since this oxidation reaction is exothermic, it causes an increase in the temperature of the detector bead, resulting in an increase in the electrical resistance of the coil embedded in this bead. The change in resistance in the embedded platinum coil is proportional to the amount of chemical energy released by the oxidation reaction. Electronic circuitry in the controller or gas monitor detects this change in resistance (as compared to the compensator bead) and reports the output as an increase it the ambient combustible gas level.

As the sensor ages, the catalyst slowly deactivates on the detector bead. The voltage at which the sensor detects gas gradually increases, and the sensor sensitivity decreases. At the same time, changes in the wire coil cause increased zero drift and noise. As a result, catalytic bead sensors must be replaced periodically to ensure accurate gas detection.

# SECTION 4 - OPERATION

## *4.1 Installation and Startup*

**WARNING:** *THE USER SHALL BE MADE AWARE THAT IF THE EQUIPMENT IS USED IN A MANNER NOT SPECIFIED BY THE MANUFACTURER, THE PROTECTION PROVIDED BY THE EQUIPMENT MAY BE IMPAIRED.*

The first step in the installation process is to establish a mounting location for the GDS Catalytic Bead sensor. Select a location that is typical of the atmosphere to be monitored or close to the anticipated source of a target gas.

It is very important that the GDS Catalytic Bead sensor be properly located to enable it to provide maximum protection. The most effective number and placement of sensors vary depending on the conditions of the application. When determining where to locate sensors the following factors should be considered.

- What are the characteristics of the gas that is to be detected? Is it lighter or heavier than air? If it is lighter than air the sensor should be placed above the potential gas leak. Place the sensor close to the floor for gases that are heavier than air or for vapors resulting from flammable liquid spills. Note that air currents can cause a gas that is heavier than air to rise. In addition, if the temperature of the gas is hotter than ambient air or mixed with gases that are lighter than air, it could also rise.

- How rapidly will the gas diffuse into the ambient air? Select a location for the sensor that is close to the anticipated source of a gas leak.

- Wind or ventilation characteristics of the immediate area must also be considered. Movement of air may cause gas to accumulate more heavily in one area than in another. The detector should be placed in the areas where the most concentrated accumulation of gas is anticipated. For outdoor applications with strong wind conditions, it may require the sensors to be mounted closer together and on the down wind side, to the anticipated area of a gas leak. Also take into consideration for indoor applications, the fact that many ventilation systems do not operate continuously.

- The sensor should be accessible for maintenance.

- Excessive heat or vibration can cause premature failure of any electronic device and should be avoided if possible.

- Follow all national and local installation codes and practices**.**

Both the GDS-48 Universal Sensor housing and GASMAX II Gas Monitor provide a ¾" NPT threaded connector for installation with conduit or shielded cable. **Shielded cable is recommended.** Wiring should be installed in metal conduit with no other cabling in the same conduit.

## *4.2 Start-Up*

**CAUTION:** NEVER EXCEED 2.2 VDC AS MEASURED ACROSS THE CATALYTIC BEAD SENSOR. THE SENSOR ELEMENT CAN BE DESTROYED IF THE VOLTAGE EXCEEDS 2.2 VDC.

**NOTE:** SEE THE GASMAX MONITOR, C1 CONTROLLER AND C2 CONTROLLER MANUALS FOR DETAILED INSTRUCTIONS REGARDING THE INSTALLATION AND SETUP OF CATALYTIC BEAD SENSORS WITH THESE PRODUCTS.

In general, catalytic bead sensors are easy to install and very reliable over time. When installing a catalytic bead sensor, always check the excitation voltage at the sensor wiring terminals BEFORE installing the sensor element. Adjust the excitation voltage at the controller or gas monitor such that the voltage as measured across the junction box terminal strip is 2.0VDC WITHOUT the sensor in place. Disconnect the power, install the sensor and measure the excitation voltage with the sensor in place. If the voltage (with the sensor in place) is lower than 2.0VDC, carefully adjust the excitation voltage at the controller or monitor until the actual sensor excitation voltage reads 2.0VDC +/- 0.1VDC. DO NOT EXCEED 2.2VDC.

After installation, allow the sensor to stabilize for a minimum of eight hours (overnight is best).

## *4.3 Normal Operation*

The operation of any gas sensor should be checked periodically to ensure proper operation. When first installed, the GDS Catalytic Bead sensor should be challenged with a calibration gas (50% LEL Methane preferred) to make certain that the detector and any associated alarm systems are functional. Periodically thereafter, the GDS Catalytic Bead sensor should be tested and/or recalibrated as necessary. Normally, initial calibration tests should be done at least monthly, and may be done on a more extended basis once some experience with the sensor and surrounding environment is obtained.

# SECTION 5 - CALIBRATION

## *5.1 Calibration*

The GDS Catalytic Bead sensors are available factory-programmed for 0-100% LEL Methane (p/n 10-9070 Smart Sensor, p/n 10-8070 Simple Sensor). Sensors are also available for Propane and Acetylene (contact GDS Corp for more details). The GDS Corp Catalytic Bead should be calibrated for best accuracy as described in the appropriate controller manual using clean ambient air (or 'zero air' if hydrocarbons are present) for zero calibration and the appropriate reference gas for span calibration.

After installation, allow the GDS Catalytic Bead to stabilize for a period of 8 hours or more, preferably overnight. After stabilization, re-balance and calibrate the unit. During the first several weeks of operation, periodically calibrate the sensor to ensure there are no localized sources of contamination or environmental effects that may block cause the unit to drift or become inaccurate. It is recommended that the eventual period between calibrations be no longer than 60 days.

A reference table of Lower Explosive Limit (LEL) values is included in Appendix A along with a table of Relative Response Factors that allows the user to estimate the concentration of combustible gases other than Methane (if components of the gas mixture are known).

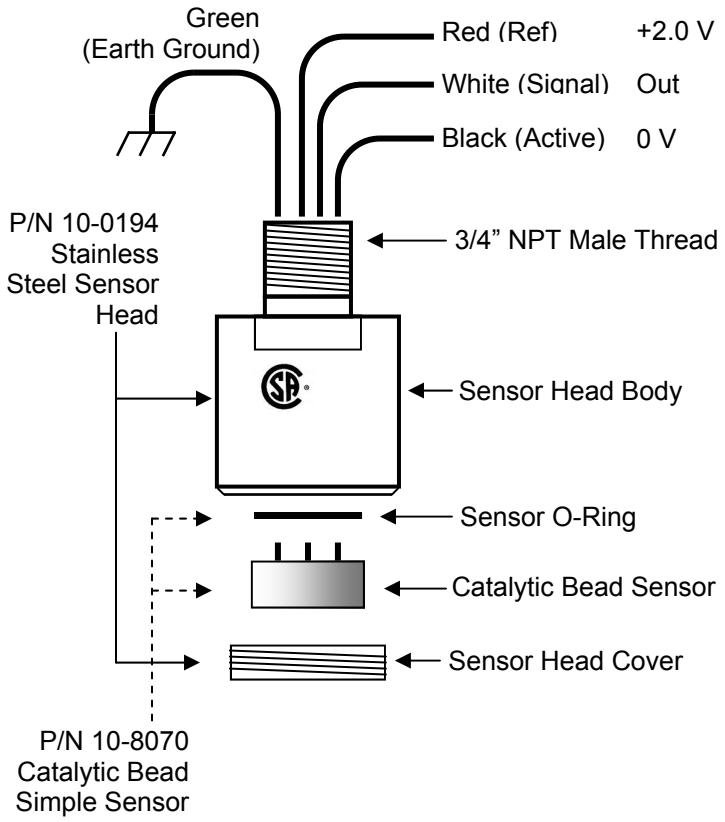
# SECTION 6 – SENSOR MAINTENANCE

## *6.1 GDS Catalytic Bead Sensor Maintenance*

The GDS Catalytic Bead sensor is a highly reliable, self-contained detector that requires very little maintenance other than periodic calibration and/or replacement. There are no user-serviceable parts.

**Cleaning** – During the course of normal operation, contaminants in the ambient air can cause a reduction in sensitivity due to a build-up of film on the sensor's beads. Periodic calibration will compensate for this effect. In the event that the sensor's sensitivity drops excessively, the sensor should be replaced.

# SECTION 7 – DRAWINGS AND PARTS LIST (#10-0194)

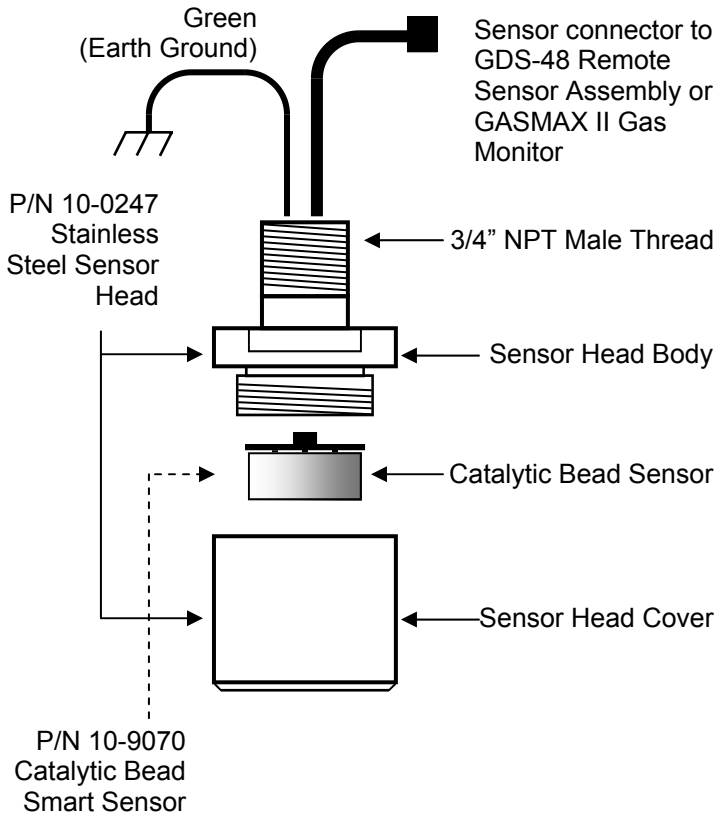



**GDS Catalytic Bead Sensor Assembly**

### Part Number Description

| | |
|---|---|
| 10-0194 | Stainless Steel Sensor Head |
| 10-8070 | Catalytic Bead 0-100% LEL Methane (Simple) |
| 10-0198 | Sensor splash guard |
| 10-0205 | Sensor flow cell for process monitoring |
| 10-0187 | Sensor replacement tool kit |
| 1000-0078 | Large black magnet for GASMAX II |

# SECTION 8 – DRAWINGS AND PARTS LIST (#10-0247)




**GDS Catalytic Bead Sensor Assembly**

**Part Number Description**

| | |
|---|---|
| 10-0247 | Stainless Steel Sensor Head |
| 10-9070 | Catalytic Bead 0-100% LEL Methane (Smart) |
| 10-0198 | Sensor splash guard |
| 10-0205 | Sensor flow cell for process monitoring |
| 10-0187 | Sensor replacement tool kit |
| 1000-0078 | Large black magnet for GASMAX II |

# Appendix A – LEL Levels & Relative Response Factors

| Gas / Vapor | LEL (CENELEC Standards) | Relative Response (with respect to Methane) | Gain Adjustment / Multiplier |
|---|---|---|---|
| Acetic Acid | 5.4% | 0.20 | 5.00 |
| Acetone | 2.6% | 0.35 | 2.86 |
| Ammonia | 15% | 0.65 | 1.54 |
| Benzene | 1.3% | 0.35 | 2.86 |
| Butyl Acetate | 1.4% | 0.30 | 3.33 |
| Cyclo-hexane | 1.3% | 0.45 | 2.22 |
| Cyclo-pentane | 1.4% | 0.50 | 2.00 |
| Decane | 0.75% | 0.20 | 5.00 |
| Dioxane | 2.0% | 0.50 | 2.00 |
| Ethane | 3.0% | 0.85 | 1.18 |
| Ethanol | 3.3% | 0.45 | 2.22 |
| Ethyl Acetate | 2.2% | 0.35 | 2.86 |
| Ethylene | 2.7% | 0.65 | 1.54 |
| Hydrogen | 4.0% | 0.95 | 1.05 |
| Iso-Butane | 1.8% | 0.55 | 1.82 |
| Iso-Butyl Alcohol | 1.7% | 0.30 | 3.33 |
| Iso-Butyl Methyl Ketone | 1.2% | 0.25 | 4.00 |
| Iso-Octane | 0.95% | 0.35 | 2.86 |
| Iso-Pentane | 1.4% | 0.45 | 2.22 |
| Iso-Propyl Alcohol | 2.2% | 0.35 | 2.86 |
| Methane | 5.0% | 1.00 | 1.00 |
| Methanol | 6.7% | 0.70 | 1.43 |
| Methyl Ethyl Ketone (MEK) | 1.9% | 0.35 | 2.86 |
| n-Butane | 1.8% | 0.55 | 1.82 |
| n-Heptane | 1.05% | 0.40 | 2.50 |
| n-Hexane | 1.02% | 0.45 | 2.22 |
| Nonane | 0.85% | 0.25 | 4.00 |
| n-Pentane | 1.4% | 0.50 | 2.00 |
| n-Propanol | 2.2% | 0.40 | 2.50 |
| n-Propyl Alcohol | 2.2% | 0.40 | 2.50 |
| Propane | 2.1% | 0.60 | 1.67 |
| Propylene | 2.4% | 0.70 | 1.43 |
| Styrene Monomer | 1.1% | 0.30 | 3.33 |
| Toluene | 1.2% | 0.40 | 2.50 |