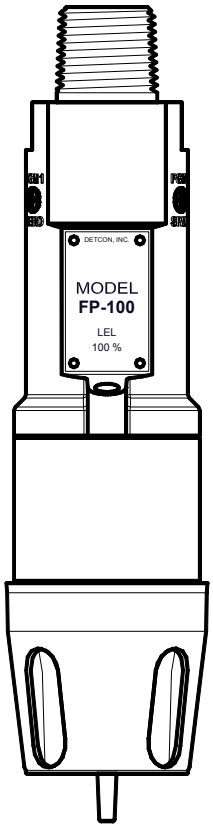
Model FP-100

FP-100 Combustible Gas Sensors



Operator's Installation and Instruction Manual

Covers all Model FP-100 Sensors

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1. Introduction

1.1 Description

Detcon Model FP-100 combustible gas sensors are non-intrusive 4-20mA output sensors designed to detect and monitor combustible gases in air. Range of detection is 0-100% LEL. The basic sensor assembly consists of a set of catalytic beads mounted in a stainless steel housing and includes a stainless steel Splash Guard Adapter. Optionally, the sensor may be installed on an explosion proof junction box and may include a Model 100 Series Display. Other options are available, contact Detcon for more information.

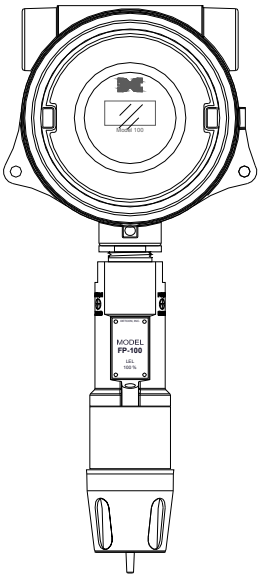

Figure 1 Sensor Assembly with Optional J-Box and LED Display

Catalytic Bead (Pellistor) Sensor Technology

The sensor technology is a poison-resistant catalytic bead type. Catalytic bead sensors show a strong response to a long list of combustible gases. The sensor is supplied as a matched-pair of detector elements mounted in a plug-in replaceable module. One bead is a catalytically active detector and the other is a non-active reference detector. Each detector consists of a fine platinum wire coil embedded in aluminum oxide. A catalytic mixture is applied to the active detector while the reference detector is treated so that oxidation of the gas does not occur. The technique is referred to as non-selective and may be used to monitor most any combustible gas. Detcon catalytic bead sensors are specifically designed to be resistant to poisons such as sulfides, chlorides, and silicones. The sensors are characteristically stable and capable of providing reliable performance for periods exceeding 5 years in most industrial environments.

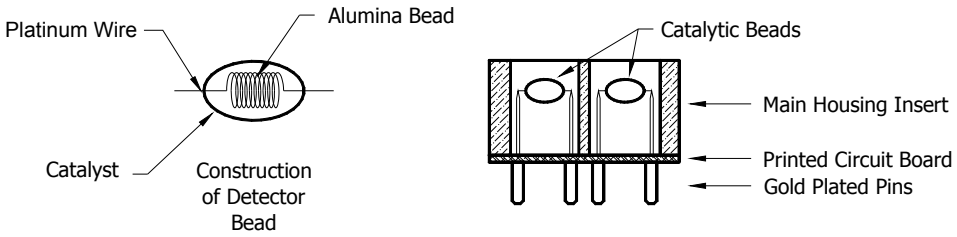

Figure 2 Sensor Cell Construction

Principle of Operation

Method of detection is by diffusion/adsorption. Air and combustible gases pass through a sintered stainless steel filter and contact the heated surface of both the active and reference detectors. The surface of the active detector promotes oxidation of the combustible gas molecules while the reference detector has been treated not to support this oxidation. The reference detector serves as a means to maintain zero stability over a wide range of temperature and humidity.

When combustible gas molecules oxidize on the surface of the active detector, heat is generated, and the resistance of the detector changes. Electronically, the detectors form part of a balanced bridge circuit. As the active detector changes in resistance, the bridge circuit unbalances. This change in output is conditioned by the amplifier circuitry, which is an integral part of the sensor design. The response and clearing characteristics of the sensor are rapid and provide for the continuous and accurate monitoring of ambient air conditions.

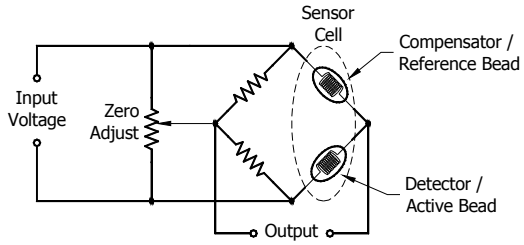

Figure 3 Wheatstone Bridge

Performance Characteristics

The detector elements maintain good sensitivity to combustible gas concentrations in the Lower Explosive Limit (LEL) range, as shown in the response curves in Figure 4. However, for gas concentrations significantly above the LEL range (100% LEL = 5% by volume Methane), the bridge output begins to decrease. Ambiguous readings above the LEL range dictate that alarm control logic be of the latching type, wherein alarms are held in the "ON" position until reset by operations personnel.

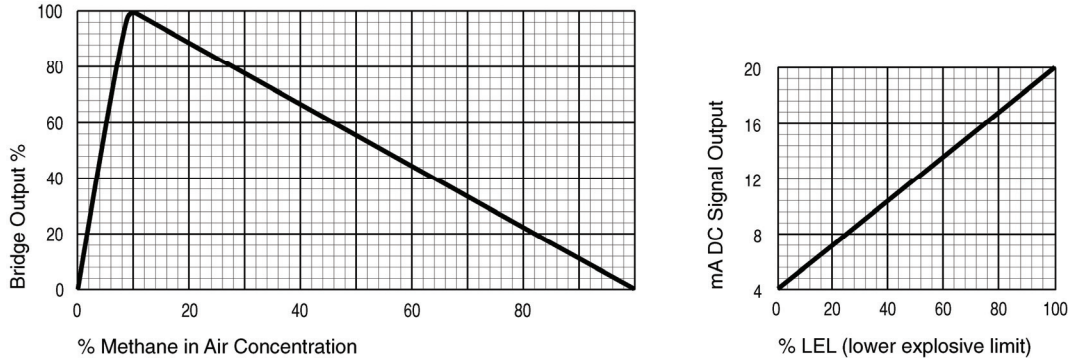

Figure 4 Response Curves

1.2 Modular Mechanical Design

The Model FP-100 Sensor Assembly is completely modular and is made up of four parts (See Figure 5 for Assembly Breakaway):

1) FP-100 Intelligent Transmitter Module (ITM)
2) Intelligent Plug-in Sensor (varies by detector type)
3) 100 Series Bottom Housing Assembly
4) Splash Guard.

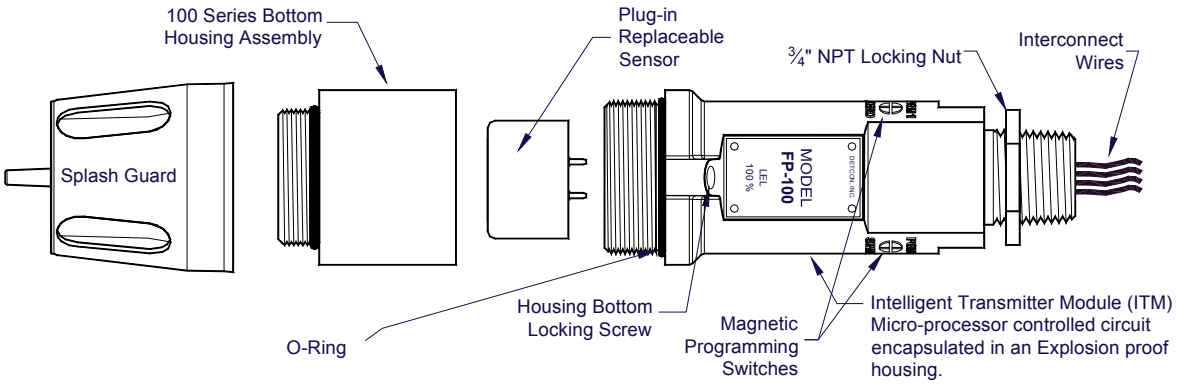

Figure 5 Sensor Assembly Breakaway

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

FP-100 Intelligent Transmitter Module

The Transmitter Module is a microprocessor-based package that can be attached to an explosion proof junction box. Circuit functions include bridge drive circuitry, 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 via a hand-held magnetic programming tool, allowing non-intrusive operator interface with the Transmitter Module. Electrical classifications are Class I, Division 1, Groups A, B, C, and D.

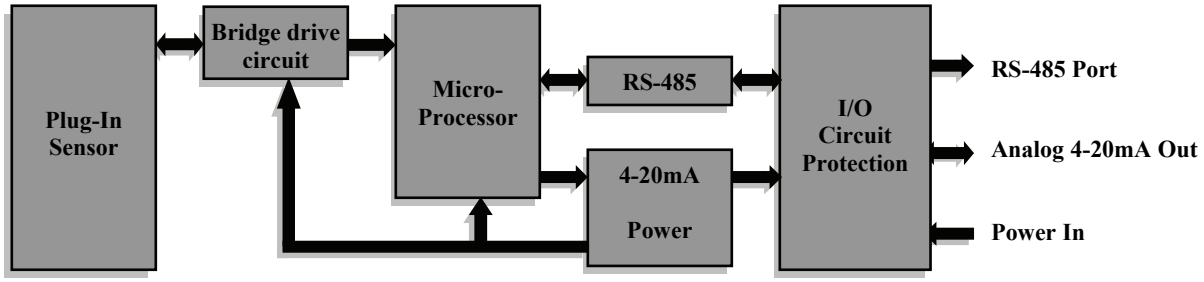

Figure 6 Functional Block Diagram

Field Replaceable Plug-in Sensor

The Detcon family of catalytic bead gas sensors are field proven, plug-in sensors with over-sized gold-plated connections that eliminate corrosion problems. The sensor can be accessed and replaced in the field easily by releasing the locking screw and unthreading the Bottom Housing. Detcon's family of catalytic bead sensors have a long shelf life and are supported by an industry-leading warranty.

Figure 7 Plug-in Sensor

1.3 Model 100 Standard Terminal Board (Optional)

If the sensor is ordered with an explosion proof condulet/junction box, the sensor will come with the Model 100 Standard Terminal Board mounted in the J-Box (see Figure 8). This terminal board affords the user easy plug in connectors for use in wiring the unit during installation, and convenient test points for measuring the milliamp (mA) output.

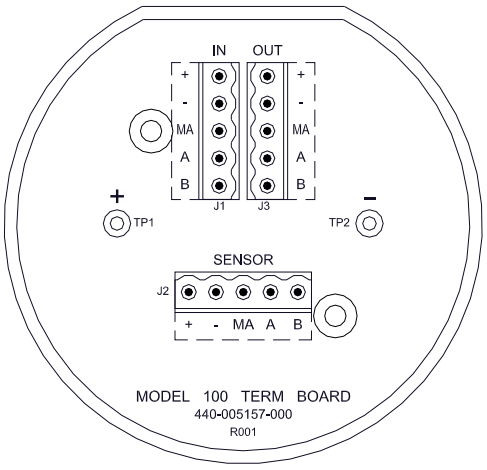

Figure 8. Standard Terminal Board

This terminal board provides an easy Digital Volt Meter (DVM) connection for reading the mA output from the sensor. Two test points (TP1 and TP2) provide a connection across a 10Ω resistor that develops a 10mV voltage drop per 1mA output. Thus a reading of 40mV on a DVM equals 4mA of current. This is an alternative method to reading the mA output of the sensor for assemblies that do not include the 100 Series Display option. Refer to section 2.6 Field Wiring for more information about the setup of the Model 100 Terminal Board.

1.4 Model 100 Display Terminal Board (Optional)

If the unit is ordered with the optional display or a battery pack (as used in wireless configurations) the unit comes with the Model 100 Display Terminal Board mounted in the J-Box (See Figure 9).

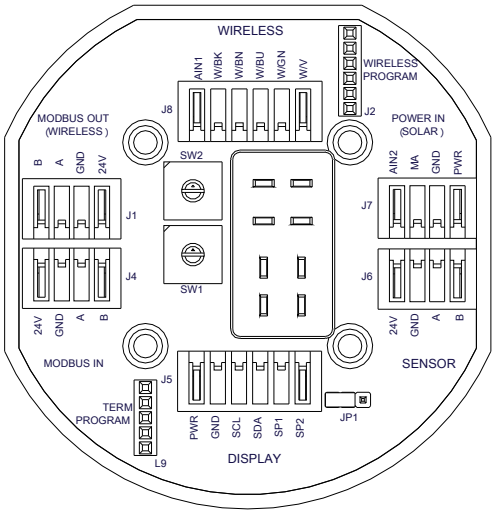

Figure 9 Model 100 Display Terminal Board

This terminal board includes connectors for the following:

J1 4-Pin Connector – Modbus Out (Wireless Transceiver Option)
J2 6-Pin Header – Wireless Transceiver Programming Header
J3 8-Pin Beau Connector – used for battery operation or display interface dependant on sensor configuration
J4 4-Pin Connector – Modbus In
J5 6-Pin Connector – used for Display interface with battery/wireless configurations
J6 4-Pin Connector – Sensor connections
J7 4-Pin Connector – Auxiliary power in and mA out.
J8 6-Pin Connector – Wireless Transceiver
J9 5-Pin Header – Terminal Board Programming

The Model 100 Display Terminal Board does not provide test points for measuring the milliamp (mA) output. The mA output is available at J7.

1.5 Model 100 Series Display (Optional)

The Model 100 Series Display is a 4-digit LED display that provides a direct display of the sensor readings. In units that are ordered with the optional display, the display is mounted directly onto the J3 Beau connector of the Display Terminal Board so the display can be easily seen through the J-box window. The display automatically identifies the ITM, the sensor type, and range. This factory installed option must be ordered along with the sensor assembly.

Figure 10 Model 100 Series Display

Fault Codes are generated by the 100 series sensors, but these fault codes cannot be visualized unless the sensor incorporates a display. With the display option, fault codes are displayed as “Fxx” where xx is the code. Fault Codes are described more in depth in Section 5 Troubleshooting Guide.

1.6 Wireless Transceiver and Battery Pack (Optional)

The FP-100 has the option to operate on a wireless network with the addition of a wireless transceiver and battery pack. These options allow the sensor to be remotely mounted without the need for external wiring. These options are factory installed. Contact Detcon for more information on these options.

2. Installation

2.1 Hazardous Locations Installation Guidelines for Safe Use

1. Install sensor only in areas with classifications matching with those described on the approval label. Follow all warnings listed on the label.

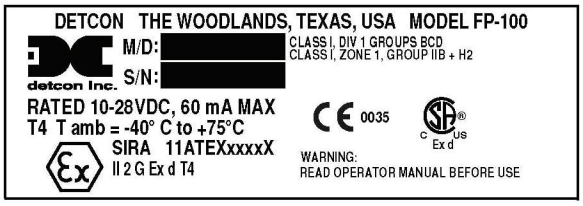

Figure 11 Approvals Label

2. For Ex d installations, ensure that the sensor is properly threaded into a suitable explosion-proof rated junction box with a downward pointing female ¾" NPT threaded connection. The sensor should be threaded up at least 5 full turns until tight, with the LED display facing forward. Avoid use of Teflon Tape, or any type of non-conductive pipe thread coating on the NPT threaded connection.

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. Also verify a good ground connection between the junction box and earth ground.

4. Proper precautions should be taken during installation and maintenance to avoid the build-up of static charge on the plastic components of the sensor. These include the Splash Guard.

5. Do not operate the sensor outside of the stated operating temperature limits.

6. Do not operate the sensor outside the stated operating limits for voltage supply.

7. These sensors meet ATEX standards EN60079-0, EN60079-18 and EN60079-11.

8. These sensors pass dielectric strength of 500VRMS between circuit and enclosure for a minimum of 1 minute at a maximum test current of 5mA.

2.2 Sensor Placement

Selection of sensor location is critical to the overall safe performance of the product. Five factors play an important role in selection of sensor locations:

(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

Placement of sensors relative to the density of the target gas is such that sensors for the detection of heavier than air gases should be located within 4 feet of grade as these heavy gases will tend to settle in low lying areas. For gases lighter than air, sensor placement should be 4-8 feet above grade in open areas or in pitched areas of enclosed spaces.

Leak Sources

The most probable leak sources within an industrial process include flanges, valves, and tubing connections of the sealed type 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 migration 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. A more general and applicable thought toward selecting sensor location is combining leak source and perimeter protection in the best possible configuration.

Maintenance Access

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

NOTE: In all installations the gas sensor should point straight down (refer to Figure 13). Improper sensor orientation may result in false readings and permanent sensor damage.

Additional Placement Considerations

The sensor should not be positioned where it may 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, or splashing from hose spray, direct steam releases, and continuous vibration. If the sensor cannot be mounted away from these conditions then make sure the Detcon Harsh Location Dust Guard accessory is used.

Do not mount in locations where temperatures will exceed the operating temperature limits of the sensor. Where direct sunlight leads to exceeding the high temperature-operating limit, use a sunshade to help reduce temperature.

2.3 Sensor Contaminants and Interference

Detcon combustible gas sensors may be adversely affected by exposure to certain airborne substances. Loss of sensitivity or corrosion may be gradual if such materials are present in sufficient concentrations.

The performance of the detector elements may be temporarily impaired during operation in the presence of substances described as inhibitors. Inhibitors are usually volatile substances containing halogen compounds. Inhibitors include halide compounds such as Cl_2, ClO_2, F_2, HF, HCl, Br_2, vinyl chloride, and methyl chloride.

Inhibition is typically a temporary effect and the detectors generally recover after short periods of operation back in clean air.

Some background gases may act as poisoning agents and have a more damaging effect on the sensor. Although the sensor is designed to be poison resistant, it does have physical limits. Poisoning gases deactivate the active detector's catalytic ability and cause a permanent reduction in the span sensitivity. Examples of typical poisons are: silicone oils and greases, siloxanes (HMDS), H_2S, anti-knock petrol additives, and phosphate esters. Activated carbon filters can be used to provide additional protection from poisoning in most cases.

The presence of such inhibitors and poisons in an area does not preclude the use of this sensor technology, although it is likely that the sensor lifetime will be shorter as a result. Use of this sensor in these environments may require more frequent calibration checks to ensure safe system performance.

2.4 Sensor Mounting

The FP-100 should be vertically oriented so that the sensor points straight downward. The explosion-proof enclosure or junction box is typically mounted on a wall or pole (See Figure 12). Detcon provides a selection of standard junction boxes in both Aluminum and Stainless Steel.

NOTE: If wall mounting without a mounting plate, make sure to use at least 0.5" spacers underneath the J-Box's 1/4" mounting holes to move the sensor assembly away from the wall and allow access clearance to the sensor assembly.

NOTE: Do not use Teflon Tape or any other type of Pipe Thread material on the ¾" threads unless the sensor is mounted in a severe or harsh environment. Metal-on-metal contact must be maintained to provide a solid electrical ground path. 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 Detcon Junction Box's are available separately.)

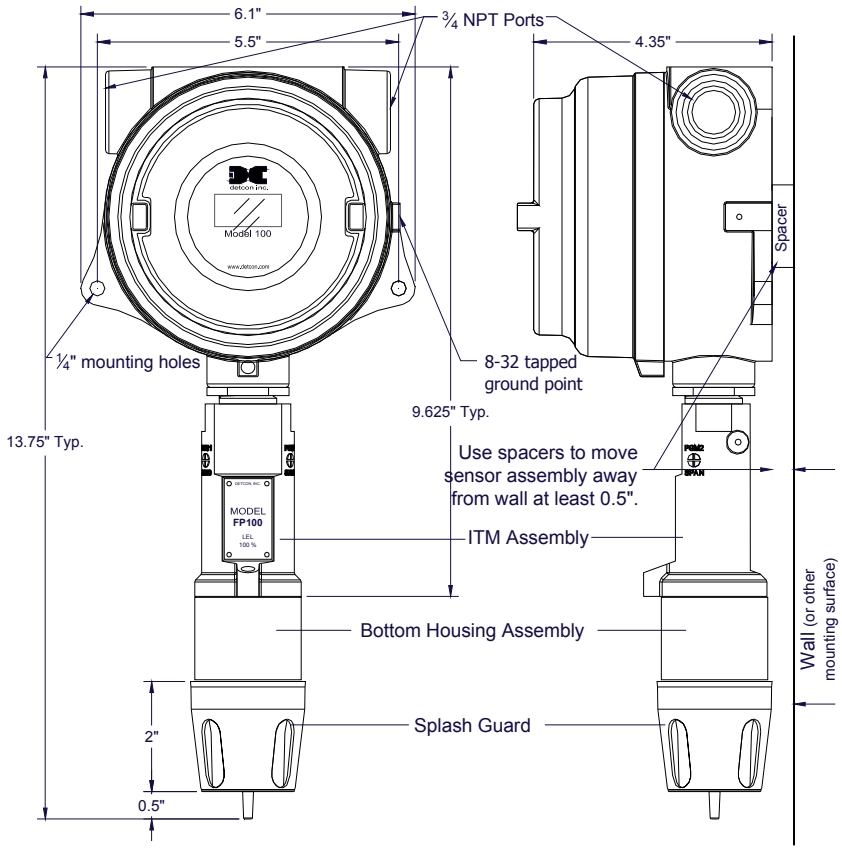

Figure 12 Typical FP-100 Sensor Assembly and Mounting Dimensions

2.5 Electrical Installation

The Sensor Assembly should be installed in accordance with local electrical codes. The sensor assemblies are CSA/NRTL approved (US and Canada) for Class I, Division 1, Groups B, C, & D area classifications, and are also ATEX Approved for Class I, Zone 1, Group IIB+H_2 area classifications.

Proper electrical installation of the gas sensor is critical for conformance to Electrical Codes and to avoid damage due to water leakage. Refer to Figure 9 and Figure 13 for proper electrical installation.

NOTE: If a conduit run exits the secondary port, repeat the installation technique shown in Figure 13.

In Figure 13, the drain allows H_2O condensation inside the conduit run to safely drain away from the sensor assembly. 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. Electrical seals also act as a secondary seal to prevent water from entering the wiring terminal enclosure. However, they are not designed to provide an absolute watertight seal, especially when used in the vertical orientation.

NOTE: A conduit seal is typically required to be located within 18" of the J-Box and Sensor Assembly. Crouse Hinds type EYS2, EYD2 or equivalent are suitable for this purpose.

NOTE: The Detcon Warranty does not cover water damage resulting from water leaking into the enclosure.

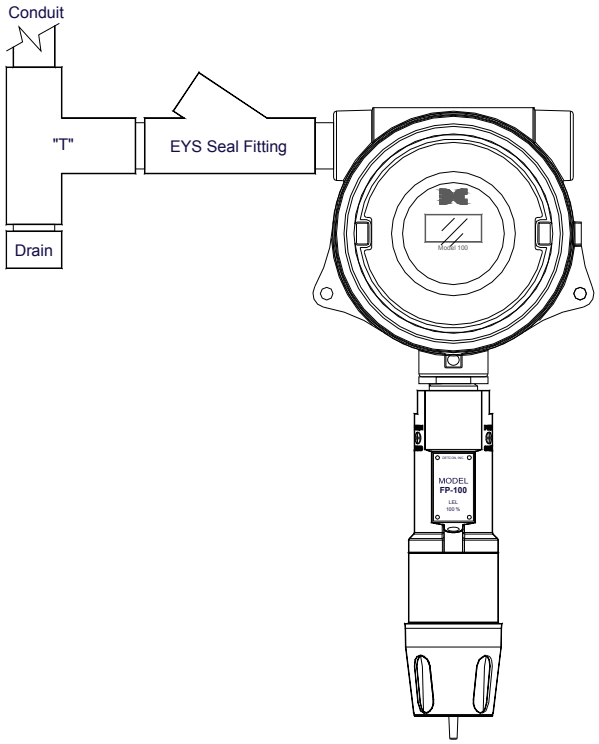

Figure 13 Typical Installation

NOTE: Any unused ports should be blocked with suitable ¾" male NPT plugs. Detcon supplies one ¾" NPT male plug with each J-box enclosure. If connections are other than ¾" NPT, use an appropriate male plug of like construction material.

2.6 Field Wiring

Detcon Model FP-100 sensor assemblies are designed to connect to a host electronic controller's 4-20mA input. Wiring designations are 'PWR', 'GND' and 'MA' (sensor signal). The maximum wire size for termination in the Junction Box is 14 AWG.

NOTE 1: 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 2: The supply of power should be from an isolated source with over-current protection.

Terminal Connections – with Junction Box Option

CAUTION*:* Do not apply System power to the sensor until all wiring is properly terminated. Refer to Section **2.7** Initial Start Up

1. Remove the junction box cover.

2. If the sensor has the 100 Series Display option installed, unplug the display from the terminal board by pulling the display out of the junction box. The display option plugs directly into the terminal board's Beau Connector.

3. Observing correct polarity, terminate the 3-conductor power and 4-20mA field wiring ('+' '-' and 'mA') at the terminal board connector J1 (4-20mA Out) on the Standard Terminal Board shown in Figure 8, or J7 (PWR GND and MA) on the Display Terminal Board shown in Figure 9.

> **NOTE:** Connections on the Display Terminal Board are clamp type, and require a small screwdriver or insertion tool to actuate the clamp that holds the wire.

4. Trim and cap all exposed wire leads if they are not permanently landed in the terminal board.

5. The sensor should be connected to J2, labeled "SENSOR", on the Standard Terminal Board, and J6, labeled "SENSOR", on the Display Terminal Board. On the Standard Terminal Board, the wiring from the sensor should match the silkscreen on the terminal board: R–Red, BK–Black, GN-Green, BU–Blue, and W–White. On the Display Terminal Board the wiring should be: Red-PWR, Black-GND, White-A, Blue-B (Green is not connected).

6. On the Display Terminal Board other connectors are provided for factory installed options. The options ordered will dictate if, and what connectors are used. The display option is plugged into the Beau connector (J3) for a FP-100 with just the display option added. Other options are covered in the associated manual for those options.

7. If a display was removed in step 2, re-install the display by plugging it back into the terminal board.

8. Replace the junction box cover after Initial Start Up.

> **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.

2.6.1 Model 100 Display Terminal Board Settings

The Model 100 Display Terminal Board contains a jumper that must be configured properly for the board to operate properly. The jumper is normally configured at the factory and should not be changed. Misplacement of the jumper may cause the sensor to become inoperative.

Table 1 Model 100 Terminal Board Jumper

JP1	1-2 – Battery installed	2-3 – Display only

2.7 Initial Start Up

2.7.1 Combustible Gas Sensors

Upon completion of all mechanical mounting and termination of all field wiring, apply system power in the range of 11-26VDC (24VDC typical) and observe the following normal conditions:

1. If the 100 Series Display option is installed, the display should read 0.0 upon power up. If a Display is not installed, set a DVM to measure millivolts, and connect it between TP1 and TP2 on the standard terminal board. The DVM will read the voltage drop across a 10Ω resistor. The resistor develops a 10mV voltage drop per 1mA of current. Thus a reading of 40mV on a DVM equals 4mA of current.

2. A temporary upscale reading may occur as the sensor stabilizes. This upscale reading will decrease to "0" ppm (40mV on the DVM) within 1-2 minutes of power-up, assuming there is no gas in the area of the sensor.

NOTE: The 4-20mA signal is held constant at 4mA for the first two minutes after power up.

Initial Operational Tests

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

Material Requirements

-Detcon PN 613-120000-700 700 Series Splash Guard with integral Cal Port, with Wind Guard -OR-
-Detcon PN 943-000006-132 Threaded Calibration Adapter.
-Detcon PN 942-520124-050 Span Gas; 50% LEL methane/balance Air at fixed flow rate of 200-500cc/min.
-DVM (if a 100 Series Display is not installed)

NOTE: Do not use calibration gases in Nitrogen background gas mixtures. This will cause significant reading inaccuracies.

1. If the sensor has a loop power display installed, the display should read "0". If a DVM is used to measure the 4-20mA output, set the DVM to measure millivolts and connect the leads across TP1 and TP2 on the terminal board. The DVM will read the voltage drop across a 10Ω resistor. The resistor develops a 10mV voltage drop per 1mA of current. Thus a reading of 40mV on a DVM equals 4mA of current. The DVM should read 40±2mV.

2. Attach the calibration adapter to the Bottom Housing or connect tubing to integral cal port. It is recommended that the Wind Guard (Detcon P/N 943-000000-000) in installed over the Splash Guard during calibration. Apply the test gas at a controlled flow rate of 200 - 500cc/min (500cc/min is the recommended flow). If the sensor has a display, the reading should increase to 50% of full range. Observe that the DVM increases to a level near that of the applied calibration gas value. Typically this would be 50% of full range, a reading of 120±2mV (12mA)

3. Remove test gas and observe that, if the sensor has a loop power display installed, the display decreases to "0.0". If a DVM is used the DVM reading should decrease back to 40mV (4mA).

4. If a calibration adapter was used during these tests, remove them from the unit, and re-install the Splash Guard. If a wind guard was used, remove the wind guard.

Initial operational tests are complete. FP-100 combustible gas 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 3.2 Calibration.

3. Operation

The Operator Interface of the Model 100 Series gas sensors is accomplished via two internal magnetic switches located on the left and the right of the sensor (Figure 15). The two switches, labeled "PGM1" and "PGM2", allow for complete calibration of the sensor. The addition of the 100 Series Display allows the ability to calibrate the sensor without the need to de-classify the area or the use of hot permits.

Figure 14 Magnetic Programming Tool

The magnetic programming tool (Figure 14) is used to operate the magnetic switches. Switch action is defined as momentary contact and 3-second hold. Hold time is defined as the time from the point when the magnet is placed in close proximity with the switch. For momentary contact the programming magnet is briefly held over a switch location. The location of "PGM1" and "PGM2" are shown in Figure 15.

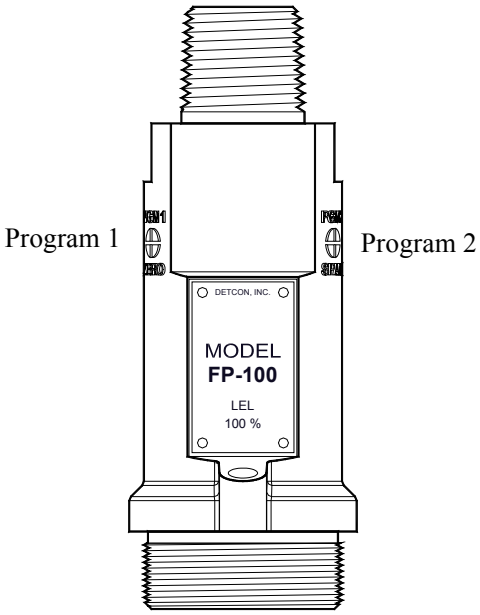

Figure 15 Magnetic Programming Switches

3.1 Normal Operation

In normal operation, the mA output will be the current sensor reading. The 4-20mA current output linearity corresponds with the full-scale range. If the 100 Series Display option is added to the sensor, the display continuously shows the current sensor reading in 0~100% LEL (Lower Explosion Level), which will normally appear as "0". If the sensor is actively experiencing any diagnostic faults, the mA output will be taken to 0mA to designate a fault to the controller. The 100 Series Display will display an error code to signify a fault. Error codes are noted by Fxx, where F is Fault and xx is an error code. Error codes are defined is section 5 Troubleshooting Guide.

3.2 Calibration

Zero and span calibration should be performed on a routine basis (quarterly minimum) 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.

3.2.1 Zero Calibration

Zero Calibration is used to zero the sensor. Local ambient air can be used to zero calibrate the sensor as long as it can be confirmed that it contains no combustible gases. If this cannot be confirmed then a zero air cylinder should be used.

Material Requirements:

-Detcon PN 327-000000-000 MicroSafe™ Programming Magnet
-Detcon PN 613-120000-700 Splash Guard with integral Cal Port with a Wind Guard -OR-
-Detcon PN 943-000006-132 Threaded Calibration Adapter.
v-Detcon PN 942-001123-000 Zero Air cal gas or use ambient air if no combustible gas is present.

NOTE: The cover of the junction box will need to be removed if there is not a 100 Series Display. The area may need to be de-classified.

NOTE: The zero gas source should have a normal background concentration of 20.9% O2. Pure Nitrogen gas standards should not be used or errors may result.

1. If a 100 Series Display is ***not*** installed on the sensor, set a DVM to measure millivolts, and connect it across TP1 and TP2 on the Standard Terminal Board. The DVM will read the voltage drop across a 10Ω resistor. The resistor develops a 10mV voltage drop per 1mA of current. Thus a reading of 40mV on a DVM equals 4mA of current. If the sensor has a display, a DVM is not required.

2. If the ambient air is known to contain no target gas content, then it 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 (200cc/min is the recommended flow rate) and let sensor purge for 1-2 minutes before zeroing the sensor.

3. From Normal Operation, hold the programming magnet over PGM1 for 3 seconds. The display (if connected) will display will flash “CAL” three times and then should display ‘0.0’ and will flash at a rate of once per second. If a meter is attached, the reading will dip momentarily to 2mA (20mV on the meter). The reading will then return to 4ma. The ideal reading for zero is 4.03mA (40.3mV on a DVM).

4. Observe the reading for a minute or so to ensure that the reading does not drift. IF a display is connected, the display will flash “CAL” three times when it leaves calibration.

5. If zero gas was used, remove the gas from the sensor.

3.2.2 Span Calibration

Span Calibration is used to adjust the span of the sensor. Span calibration should be performed periodically or as required. Span calibration should be considered after periods of over-range target gas exposure. Unless otherwise specified, span adjustment is recommended at 50% of range.

Material Requirements:

-Detcon PN 327-000000-000 MicroSafe™ Programming Magnet
-Detcon PN 613-120000-700 Splash Guard with integral Cal Port with a Wind Guard -OR-
-Detcon PN 943-000006-132 Threaded Calibration Adapter.
-Detcon PN 942-520124-050 50% LEL Methane in balance air (recommended) or other suitable span gas containing a certified level of % LEL concentration of combustible gas in air balance. A flow fixed rate of 200-500cc/min is recommended.
-DVM (if a 100 Series Display is not installed)

NOTE: The cover of the junction box will need to be removed if there is not a 100 Series Display. The area may need to be de-classified.

NOTE: Contact Detcon for Ordering Information on Span Gas cylinders.

NOTE: The span gas source must have a normal background concentration of 20.9% O2. Pure Nitrogen background mixtures are not acceptable! Significant span calibration inaccuracies will result.

Span consists of applying the correct gas concentration at the correct flow rate, and adjusting the sensor for the proper output. The 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 10% and 100% of range.

1. If a 100 Series Display is **not** installed on the sensor, set a DVM up to measure millivolts, and connect it across TP1 and TP2 on the terminal board. The DVM will read the voltage drop across a 10Ω resistor. The resistor develops a 10mV voltage drop per 1mA of current. Thus a reading of 40mV on the DVM equals 4mA of current. If the sensor has a display, a DVM is not required.

2. Install the Calibration Wind Guard, or the appropriate calibration adapter.

3. From Normal Operation, hold the programming magnet over PGM2 for greater than three seconds. The display (if connected) will display will flash “CAL” three times and then should display ‘0.0’ and will flash at a rate of once per second. If a meter is attached, the reading will dip to 2mA (20mV on the meter).

4. Apply the span calibration test gas for toxic gas sensors at a flow rate of 200-500cc/min (200cc/min is the recommended flow rate). The DVM reading or display will remain at 2mA for 2 minutes. The display (if connected) will display the current gas concentration reading.

5. When the 2 minute wait is complete, the mA output will increase to a level that corresponds to the level of gas the plug-in sensor is detecting. The display (if connected) will flash “ADJ” three times to indicate the span reading can be adjusted. There is a 30 second period to decide if the reading needs to be adjusted. If the reading matches the level of gas applied skip to step 7.

6. To adjust the reading, swipe or hold the programming magnet over PGM1 or PGM2. PGM1 is used to decrease the displayed reading, while PGM2 is used to increase the reading. Short swipes (less than 1

second) of the magnet over PGM1 and PGM2 will change the reading slowly. Holding the magnet over PGM1 or PGM2 will change the reading more quickly. Use PGM1 and PGM2 to adjust the output to match the target gas set-point. Assuming 50% of full range was applied adjust the reading to 12mA (120mV on the DVM, or 50% of full range on the display.

NOTE: 12mA and 50% of full range are based on the use of a span gas concentration of 50%. If a different concentration of span gas is used, the mA reading will need to be calculated. I.E. if a 25% concentration span gas is used the reading would be 8mA and the display would be 25% of full range. Use the magnetic tool to adjust the mA reading to the target set-point.

7. When the correct adjustment has been made, wait 15 seconds without holding the programming magnet over either PGM1 or PGM2. The display (if connected) will flash "CAL" three times then return to the target reading. If a meter is attached, the reading will momentarily decrease about 20% and then return to the target reading. This indicates that the span calibration point has been successfully saved. If a lack of proper signal level change is internally detected the sensor will immediately go into fault. The display (if connected) will show "Fxx" (where xx is the error code). If a meter is attached, the reading will go to 0ma. Only a successful re-calibration will clear this fault. (Refer to section 5 Troubleshooting Guide.)

8. Remove the span gas and calibration adapter (or calibration wind guard). If a display is installed the display will report a live reading as the sensor clears toward "0". On the DVM, the reading will fall from the reported span level to 4mA (40mV). The sensor now allows 5 minutes for the reading to clear below 10% of full scale range (5.6mA). If the reading does not meet the clearing test criteria the sensor will go into fault. The display (if connected) will show "Fxx" (where xx is the error code). If a meter is attached, the reading will go to 0ma. Only a successful re-calibration will clear this fault. (Refer to section 5 Troubleshooting Guide).

9. Span calibration is complete. If the Splash Guard was removed for calibration, re-install the Splash Guard.

3.3 Gas Calibration Factor

Because of the catalytic bead sensor's almost universal response to combustible gases, the FP-100 sensor can be calibrated to specifically detect any of the combustible gases listed in Table 2. This gas is referred to as the "target gas". In addition, the sensor can also be configured so that it can be calibrated with any of the listed gases regardless of which target gas is selected. This gas is referred to as the "cal gas". These two features, allow a significant degree of flexibility in the detection and span calibration process.

When calibrating with one gas (Cal Gas) and scale sensitivity is required for a different gas (Target Gas) use the following calculation to determine calibration adjustment requirements: Target Gas Cal Factor ÷ Cal Gas Cal Factor * Cal Gas concentration = Required adjustment level. For example, calibrating with 50%LEL methane when propane is the target gas: 1.81(Propane) ÷ 1.00(Methane) * 0.5 = 90.5%. The sensor response is lower for propane than it is for methane. Therefore, the scale sensitivity should be adjusted higher when methane is used as the Cal Gas.

The Gas/Cal Factor Table shows the Gas Factors for most combustible gases that can be measured. Locate the target gas and use the corresponding value as the Gas Factor. For example, if butane were the target gas, the correct gas factor would be 1.71. If there is a mixture of target gases, use a weighted approach to determine the correct Gas Factor. For example, if the target gas was 50% butane and 50% methane, the correct gas factor would be calculated and entered as 0.5 * 1.71(Butane) + 0.5 * 1.0(Methane) = 1.35.

When a sensor has been calibrated with one gas and another gas occurs in the area of that sensor, the scale response is calculated as: Cal Gas K-Factor/Target Gas K-Factor. For example, when a sensor has been

calibrated with methane and propane occurs in the area: 1.00(Methane) ÷ 1.81(Propane) = 55%. If 40% LEL propane occurred the sensor output would equal 22.0%.

In all cases remember that these Cal Factor ratios are theoretical. Actual response may vary from sensor to sensor. Always use the Target Gas as the Cal Gas whenever possible.

Table 2 Gas/Cal Factors

Gas	Factor	Gas	Factor	Gas	Factor
Acetaldehyde	1.66	Decane	3.05	Dimethyl Ether	1.60
Acetic Acid	1.84	Diethylamine	2.05	Methylethyl Ether	2.27
Acetic Anhydride	2.17	Dimethylamine	1.73	Methylethyl Ketone	2.42
Acetone	1.93	2,3-Dimethylpentane	2.51	Methyl Formate	1.49
Acetylene	1.76	2,2-Dimethylpropane	2.52	Methyl Mercaptan	1.64
Alkyl Alcohol	1.96	Dimethyl Sulphide	2.30	Methyl propionate	1.95
Ammonia	0.79	1,4-Dioxane	2.24	Methyl n-propyl Ketone	2.46
n-Amyl Alcohol	3.06	Ethane	1.47	Naphtha	3.03
Aniline	2.54	Ethyl Acetate	1.95	Naphthalene	2.94
Benzene	2.45	Ethyl Alcohol	1.37	Nitromethane	1.72
Biphenyl	4.00	Ethylamine	1.90	n-Nonane	3.18
1,3-Butadiene	1.79	Ethyl Benzene	2.80	n-Octane	2.67
Butane	1.71	Ethylcyclopentane	2.52	n-Pentane	2.18
iso-Butane	1.93	Ethylene	1.41	iso-Pentane	2.15
Butene-1	2.20	Ethylene Oxide	1.93	Propane	1.81
cis-Butene-2	2.06	Diethyl Ether	2.16	n-Propyl Alcohol	2.12
trans-Butene-2	1.97	Ethyl Formate	2.26	n-Propylamine	2.07
n-Butyl Alcohol	2.91	Ethyl Mercaptan	1.78	Propylene	1.95
iso-Butyl Alcohol	1.89	n-Heptane	2.59	Propylene Oxide	2.18
tert-Butyl-Alcohol	1.34	n-Hexane	2.71	iso-Propyl Ether	2.29
n-Butyl Benzene	3.18	Hydrazine	2.22	Propyne	2.40
iso-Butyl Benzene	3.12	Hydrogen Cyanide	2.09	Toluene	2.47
n-Butyric Acid	2.63	Hydrogen	1.30	Triethylamine	2.51
Carbon Disulphide	5.65	Hydrogen Sulphide	2.54	Trimethylamine	2.06
Carbon Monoxide	1.32	Methane	1.00	Vinyl Chloride	2.32
Carbon Oxysulphide	1.07	Methyl Acetate	2.01	Vinyl Ethyl Ether	2.38
Cyanogen	1.12	Methyl Alcohol	1.16	o-Xylene	2.79
Cyclohexane	2.43	Methylamine	1.29	m-Xylene	2.55
Cyclopropane	1.60	Methylcyclohexane	2.26	p-Xylene	2.55

3.4 Fault Diagnostic/Failsafe Feature

If the ITM should incur a fault, the ITM will drop the mA output to 0mA. This can occur if the ITM detects a problem with the sensor, detects that there is no sensor connected, or if the ITM has an internal fault. The ITM will hold this 0mA output until the problem is resolved. If the 100 Series Display is installed, the display will show an eror code. The error codes are defined in section 5 Troubleshooting Guide.

4. Service and Maintenance

Calibration Frequency

In most applications, quarterly to biannual zero and span calibration intervals will assure reliable detection. However, industrial environments differ. Upon 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:

- 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.
- Inspect the flame arrestor on the Bottom Housing for corrosion or blockage.
- 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 moisture condensation prevention 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. Detcon's PN is 960-202200-000.

4.1 Replacement of Plug-in Sensor

NOTE: It is necessary to remove power while changing the plug-in sensor in order to maintain area classification, since the Plug-In Sensor is **not** intrinsically safe.

NOTE: Only replace the FP-100 plug-in sensor with an authorized FP-100 plug-in Sensor.

1. Use a 1/8" Allen wrench to release the locking cap head screw that locks the ITM and Bottom Housing together (One turn will suffice - Do not remove cap head screw completely).

2. Unthread and remove the Bottom Housing and Splash Guard from the ITM.

3. Gently pull the plug-in sensor out of the ITM. Orient the new plug-in sensor so that it matches with the female connector pins. Use the alignment marks provided to assure alignment is correct. When properly aligned, press the sensor in firmly to make the proper connection.

4. Thread the Bottom Housing onto the ITM to a snug fit and tighten the locking cap head screw using the 1/8" Allen wrench. Reinstall the Splash Guard.

5. Check and perform zero calibration and span calibration as per Section 3.2 Calibration.

4.2 Replacement of ITM

1. If the sensor has the 100 Series Display option installed, unplug the display from the terminal board by pulling the display out of the junction box. The display option plugs directly into the terminal board's Beau Connector.

2. 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: Connections on the Display Terminal Board are clamp type, and require a small screwdriver or insertion tool to actuate the clamp that holds the wire.

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

3. Use a wrench and the wrench flats provided at the top section of the ITM and unthread the ITM until it can be removed.

4. Use a 1/8" Allen wrench to release the locking cap head screw that locks the ITM and Bottom Housing together (One turn will suffice - Do not remove cap head screw completely).

5. Unthread and remove the Bottom Housing and Splash Guard from the ITM. These will be re-used with the new ITM.

6. Gently remove the plug-in sensor from the old ITM and install it in the new ITM. Orient the plug-in sensor so that it matches the female connector pins on the new ITM and press the sensor in firmly to make proper connection.

7. Thread the Bottom Housing onto the new ITM until snug, tighten the locking cap head screw and reinstall Splash Guard.

8. Feed the sensor assembly wires through the ¾" female NPT mounting hole 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. Connect the sensor assembly wires to the terminal board inside the Junction Box (Refer to Section 2.6).

9. Check and/or perform Zero Calibration and Span Calibration per sections 3.2 Calibration.

4.3 Replacement of the Model 100 Terminal Board

There are two terminal boards used with the 100 series sensors. Although the boards are physically different the procedure is basically the same. These terminal boards are not interchangeable, and the terminal board being replaced should be replaced with the same type of terminal board.

1. Remove the power source to the sensor assembly.

NOTE: It is necessary to remove power to the Junction Box while changing the Model 100 Terminal Board in order to maintain area classification.

2. Remove the junction box cover and remove the 100 Series Display, if one is installed. (The 100 series display unplugs from the Model 100 Display Terminal Board

3. Remove the power connector from the terminal board.

4. Unplug all other connectors from the terminal board, noting where they are plugged in.

5. Remove the four 6-32 screws holding the terminal board to the base of the junction box and remove the terminal board.

6. Install the new terminal board using the four 6-32 screws removed in step 5.

7. If the unit has the Model 100 Display Terminal Board, ensure that the jumper on the Display Terminal Board is set properly (Refer to section 2.6.1 Model 100 Display Terminal Board Settings).

8. Re-connect the sensor connector to the terminal board and all other connections removed in step 4.

9. Reconnect the power connector to the terminal board.

10. Re-install the 100 Series Display, if one was installed.

11. Reinstall the junction box cover, and restore power to the sensor.

12. Check operation of sensor assembly. (see section 2.7 Initial Start Up)

5. Troubleshooting Guide

5.1 Fault Codes

If the ITM detects any functional errors the ITM will bring the mA output to 0mA and hold it there until the problem has been resolved. If the unit has a Display, the display will show an error code. Error codes are displayed as "Fxx" where xx is the actual error code.

The Display Error Codes are:

F01 Span Fault
F02 Temperature Fault
F03 4-20mA Fault
F04 Input Voltage Fault
F05 ITM Memory Fault
F06 Processor Fault
F07 Clearing Fault
F08 Stability Fault
F09 Range Fault
F10 Sensor Fault
F11 Zero Fault
F12 Sensor Fault 2
CF Communication Fault

F01 – Auto Span Fault

If the sensor fails the minimum signal change criteria during a span calibration an "Span Fault" is declared, and 'F01' will be displayed. This is normally a calibration error. The sensor should be considered "Out-of-Service" until a successful span calibration is performed.

F02 – Temperature Fault

If the detector is currently reporting an ambient temperature that is outside of the –40C to +75C range, a "Temperature Fault" is declared, and the display will change to 'F02'. If a Temperature Fault occurs, the 4-20mA signal remains operational.

F03 – 4-20mA Fault

If the sensor detects a condition where the 4-20mA output loop is not functional (high loop resistance or failed circuit function) a "4-20mA Fault" is declared, and 'F03 will be displayed. If a 4-20mA Fault occurs, the 4-20mA signal will be set to 0mA until the fault condition is resolved.

F04 – Input Voltage Fault

If the detector is currently receiving an input voltage that is outside of the 10-28VDC range, an "Input Voltage Fault" is declared, and 'F04' will be displayed. If an Input Voltage Fault occurs, the 4-20mA signal will be set to 0mA until the fault condition is resolved.

F05 – ITM Memory Fault

If the detector has a failure in saving new data to memory, a "Memory Fault" is declared, and 'F05' will be displayed. If a Memory Fault occurs, the 4-20mA signal will be set to 0mA until the fault condition is resolved.

F06 – Processor Fault

If the detector has any unrecoverable run-time errors, a "Processor Fault" is declared, and F06 will de displayed. If a Processor Fault occurs, the 4-20mA signal will be set to 0mA until the fault condition is resolved.

F07 – Clearing Fault
If the sensor fails the clearing criteria during span calibration, a "Clearing Fault" will be declared, and 'F07' will be displayed. The sensor should be considered as "Out-of-Service" until a successful span calibration is performed.

F08 – Stability Fault
If the sensor fails the signal stability criteria during span calibration, a "Stability Fault" will be declared and the display will change to F08. The sensor should be considered as "Out-of-Service" until a successful span calibration is performed.

F09 – Range Fault
If the sensor fails the minimum signal change criteria during span calibration a "Range Fault" will be declared, and 'F09' will be displayed. The sensor should be considered "Out-of-Service" until a successful span calibration is performed.

F10 – Sensor Current Fault
If the current flowing through the sensor cell is outside of acceptable levels, a "Sensor Current Fault" will be declared, and the display will change to 'F10'. If a Sensor Fault occurs, the 4-20mA signal will be set to 0mA until the fault condition is resolved.

F11 – Zero Fault
If the sensor drifts below –10% LEL, a "Zero Fault" will be declared, and 'F11' will be displayed. If a Zero Fault occurs, the 4-20mA signal will be set to 0mA until the fault condition is resolved. The sensor should be considered "Out-of-Service" until a successful zero calibration is performed.

F12 – Sensor Voltage Fault
If the voltage applied to the sensor cell is outside of acceptable levels, a "Sensor Voltage Fault" will be declared, and the display will change to 'F12'. If a Sensor Fault occurs, the 4-20mA signal will be set to 0mA until the fault condition is resolved.

CF – Communication Fault
This fault is displayed if the Display or Display Terminal PCA cannot communicate with the sensor assembly. The 4-20mA signal will be set to 0mA until the fault condition is resolved.

5.2 Troubleshooting

Under-Range problems (F11)

Probable Cause: Sensor Baseline drifted lower, Interference gases,
Perform Zero Calibration. (Section 3.2.1 Zero Calibration)
Execute successful Span Calibration. (Section 3.2.2 Span Calibration)
Replace plug-in combustible sensor if error continues.

Stability problems (F08)

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).
Check for obstructions affecting cal gas hitting sensor face (including being wet, blocked, or corroded). Combustible sensors assemblies use a bottom housing assembly with an integral sinter/flame arrestor. Clean or replace bottom housing assembly as necessary.
Replace the plug-in combustible sensor.

Clearing problem (F07)

Probable Causes: Failed Sensor, Cal Gas not removed at appropriate time, problems with cal gas and delivery.
The sensor must recover to < 5% of range in < 5 min after Span calibration is complete, use bottled air if there is a known continuous background level of combustible gas.
Check validity of span gas using pull tube or other means (check MFG date on cal gas cylinder).
Check for obstructions affecting cal gas hitting sensor face (including being wet, blocked, or corroded). Combustible sensors assemblies use a bottom housing assembly with an integral sinter/flame arrestor. Clean or replace bottom housing assembly as necessary.
Replace the plug-in combustible sensor.

Poor Calibration Repeatability (F09)

Probable Causes: Failed Sensor, use of wrong Cal Gas or problems with cal gas and delivery.
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).
Check for obstructions affecting cal gas hitting sensor face (including being wet, blocked, or corroded). Combustible sensors assemblies use a bottom housing assembly with an integral sinter/flame arrestor. Clean or replace bottom housing assembly as necessary.
Replace the plug-in combustible sensor.

Unstable Output/ sudden spiking (F03, F04)

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 Detcon to optimize shielding and grounding.
Add Detcon's RFI Protection Circuit accessory if problem is proven RFI induced.

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 Detcon's Condensation Prevention Packet P/N 960-202200-000.
Determine if cause is RFI induced.

Unreadable Display (if a 100 Series Display is installed)

If due to excessive sunlight, install a sunshade to reduce glare.
Replace Display Assembly
Replace 100 Series Display.

Blank or incorrect reading on Display (if a 100 Series Display is installed)

ITM has an internal fault, problem with display.
Swap with a known-good ITM to determine if ITM is faulty.
Swap Model 100 Display Terminal Board with known good board
Swap Model 100 Display with known good display.

Transmitter not responding (F05, F06)

Verify condulet has no accumulated water or abnormal corrosion.
Verify required DC power is applied to correct terminals.
Swap with a known-good ITM to determine if ITM is faulty.

Faulty 4-20mA Output (F03)

Check that wiring is properly connected at terminal board and through to controller inputs.
The 4-20 output loop must be closed (resistance of < 750 ohms).
If the 4-20mA signal output is 0mA to 2mA, there is an ITM fault.
Swap with new ITM to determine if the ITM is faulty.

6. Customer Support and Service Policy

Detcon Headquarters
Shipping Address: 3200 A-1 Research Forest Dr., The Woodlands Texas 77381
Mailing Address: P.O. Box 8067, The Woodlands Texas 77387-8067
Phone: 888.367.4286, or 281.367.4100
Fax: 281.292.2860

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

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

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

Warranty Notice

Detcon Inc. warrants the Model FP-100 gas sensor to be free from defects in workmanship of material under normal use and service for two years from the date of shipment on the transmitter electronics. See Warranty details in section 7 FP-100 Sensor Warranty.

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 Detcon Inc. personnel.

Defective or damaged equipment must be shipped to the 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 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 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, 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 Detcon Inc. for damages including, but not limited to, consequential damages arising out of, or in connection with, the performance of the product.

7. FP-100 Sensor Warranty

Plug-in Sensor Warranty

Detcon Inc. warrants, under normal intended use, each new plug-in combustible gas sensor. The warranty period begins on the date of shipment to the original purchaser and ends 2 years thereafter. The sensor element is warranted 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 Detcon, Inc., 3200 A-1 Research Forest Dr., The Woodlands, Texas 77381, for necessary repairs or replacement.

Terms & Conditions

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

ITM Electronics Warranty

Detcon Inc. warrants, under intended normal use, each new Model 100 ITM to be free from defects in material and workmanship for a period of two years from the date of shipment to the original purchaser. All warranties and service policies are FOB the Detcon facility located in The Woodlands, Texas.

Terms & Conditions

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

8. Appendix

8.1 Specifications

System Specifications

Sensor Type:	Continuous diffusion/adsorption type Matched-Pair Catalytic Bead type Plug-in Replaceable Type
Sensor Life:	3-5 years typical
Measuring Ranges:	0-100% LEL
Accuracy/ Repeatability:	± 3% LEL in 0-50% LEL range, ± 5% LEL in 51-100% LEL range
Response Time:	T50 < 10 seconds, T90 < 30 seconds
Electrical Classification:	CSA and US (NRTL) Class I, Division 1, Groups A, B, C, D ATEX Class I, Zone 1, Group IIB+H_2 Ex d IIB+H_2, T4
Approvals:	$_C$CSA$_{US}$, ATEX, CE Marking
Warranty:	Electronics – 2 years Plug in Sensor – 2 years

Environmental Specifications

Operating Temperature:	-40°C to +75°C typical
Storage Temperature:	-35°C to +55°C typical
Operating Humidity:	0-100% RH non-condensing
Operating Pressure:	Ambient ± 10%

Electrical Specifications

Input Voltage:	10-28 VDC
Power Consumption:	Normal operation = 37 mA (0.89 watts @ 24VDC); Maximum = 56 mA (1.35 watts @ 24VDC)
RFI/EMI Protection:	Complies with EN61326
Analog Output:	Linear 4-20mA DC current 750 ohms maximum loop load @ 24VDC 0 mA All Fault Diagnostics 4-20 mA 0-100% full-scale 22 mA Over-range condition

Cable Requirements: Power/Analog: 3-wire shielded cable
Maximum distance is 13,300 feet with 14 AWG

Mechanical Specifications

Length: 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: four 18 gauge wire leads - 5.5" long

8.2 Spare Parts, Sensor Accessories, Calibration Equipment

Part Number	Spare Parts
921-515400-100	Low Power FP-100 Intelligent Transmitter Module (ITM for Combustible Gas Sensors is universal design for all gas types and ranges via label inscription.)
921-525400-100	FP-100 Intelligent Transmitter Module
371-510000-100	Low Power Replacement Plug-in catalytic bead gas sensor
371-520000-100	Replacement Plug-in catalytic bead gas sensor
500-005143-100	Model 100 Standard Terminal Board
500-005168-100	Model 100 Display Terminal Board (used with display option)
500-005168-200	Model 100 Display Terminal Board (used with battery option)
303-734231-000	Insertion Tool for Display Terminal Board connectors
345-005160-100	Plug in Display assembly, 100 series
Part Number	**Sensor Accessories**
613-120000-700	Sensor Splash Guard with integral Cal Port
602-003581-000	100 Series 316 SS Bottom Housing Assembly (includes, O-Rings, Gasket and Sinter/Flame Arrestor)
943-002273-000	Harsh Environment Sensor Guard
327-000000-000	Programming Magnet
Part Number	**Calibration Accessories**
943-000006-132	Threaded Calibration Adapter
943-000000-000	Calibration Wind Guard
943-020000-000	Span Gas Kit: Includes calibration adapter, span gas humidifier, 200cc/min fixed flow regulator, and carrying case. (Not including gas).
943-090005-502	200cc/min Fixed Flow Regulator for span gas bottle
Part Number	**Optional Accessories**
897-850800-010	NEMA 7 Aluminum Condulet Base
897-850400-010	NEMA 7 Aluminum Condulet Solid Cover
897-850500-010	NEMA 7 Aluminum Condulet w/Window Cover
897-850801-316	NEMA 7 316SS Condulet Base
897-850401-316	NEMA 7 316SS Condulet Solid Cover
897-850701-316	NEMA 7 316SS Condulet w/Window Cover
960-202200-000	Condensation prevention packet (For condulet, replace annually)

943-004221-000	Mounting Plate (other mounting plates available)
943-004223-000	Mounting Plate with Sun Shade (other mounting plates available)
500-005143-100	Model 100 Standard Terminal Board
500-005168-100	Model 100 Display Terminal Board (used with display option)
500-005168-200	Model 100 Display Terminal Board (used with battery option)
345-005160-100	Plug in Display assembly, 100 series

8.3 Revision Log

Revision	Date	Changes made	Approval
0.0	10/12/11	Initial Release	LU