

# INSTRUCTION MANUAL



## Model 700 Series Remote Sensor/Alarm Relay Module With Profibus DP Interface



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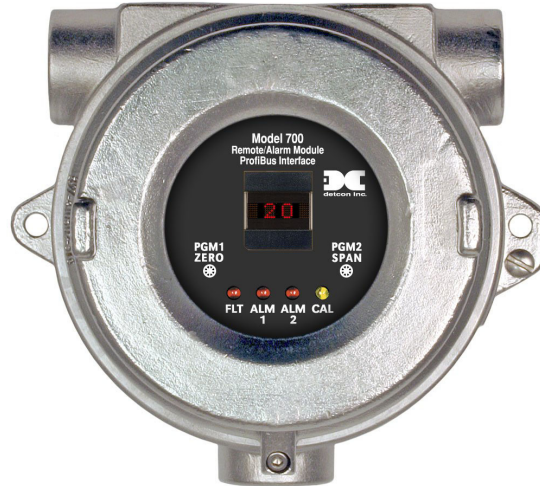
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# 1. Introduction

## 1.1 Description

The Model 700 Remote Sensor/Alarm Relay Module with Profibus Interface (known as the Profibus Remote Alarm Module or Profi-RAM) is sold separately as an accessory for Model 700 Series Gas Sensors. It is a universal design and can be used with any of the Model 700 Gas Sensors. The Profi-RAM is provided in an explosion-proof junction box constructed of either epoxy-painted aluminum or 316 stainless steel.



**Figure 1** 700 Profi-RAM

The Profi-RAM performs three functions. The first function is used to set gas alarm levels and to configure the three local relay contacts. The second function is to provide a Profibus Interface for the Model 700 Gas Sensor and the third is to operate the Model 700 Gas Sensor remotely. The remote sensor function is typically used when the sensor must be mounted in a position where it cannot be viewed or accessed readily. Both functions can be used at the same time.

The RAM Module provides a bridge for a Model 700 gas sensor to a PROFIBUS-DP Network. The Profi-RAM functions as an intelligent PROFIBUS-DP Slave on the Network. The Profi-RAM also provides connection directly to the 4-20mA output of the Model 700 Gas Sensor.

## 1.2 Installation

The Profi-RAM can be installed as a wall mount or pipe mount using the mounting holes of the explosion-proof junction box. It should be oriented such that the LED display is horizontal. If the 700 Gas Sensor is mounted directly to the Profi-RAM, use 0.5" spacers underneath the mounting holes to provide access clearance for the 700 Gas Sensor (Figure 3).

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**NOTE:** Block any unused 3/4" NPT holes with the proper Plug. (Detcon P/N 8522-750)

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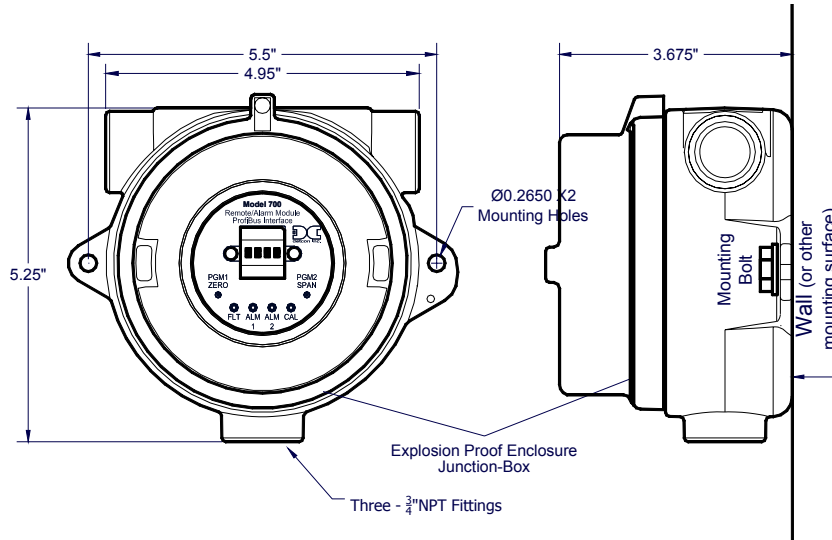


Figure 2 Profi-RAM Mounting

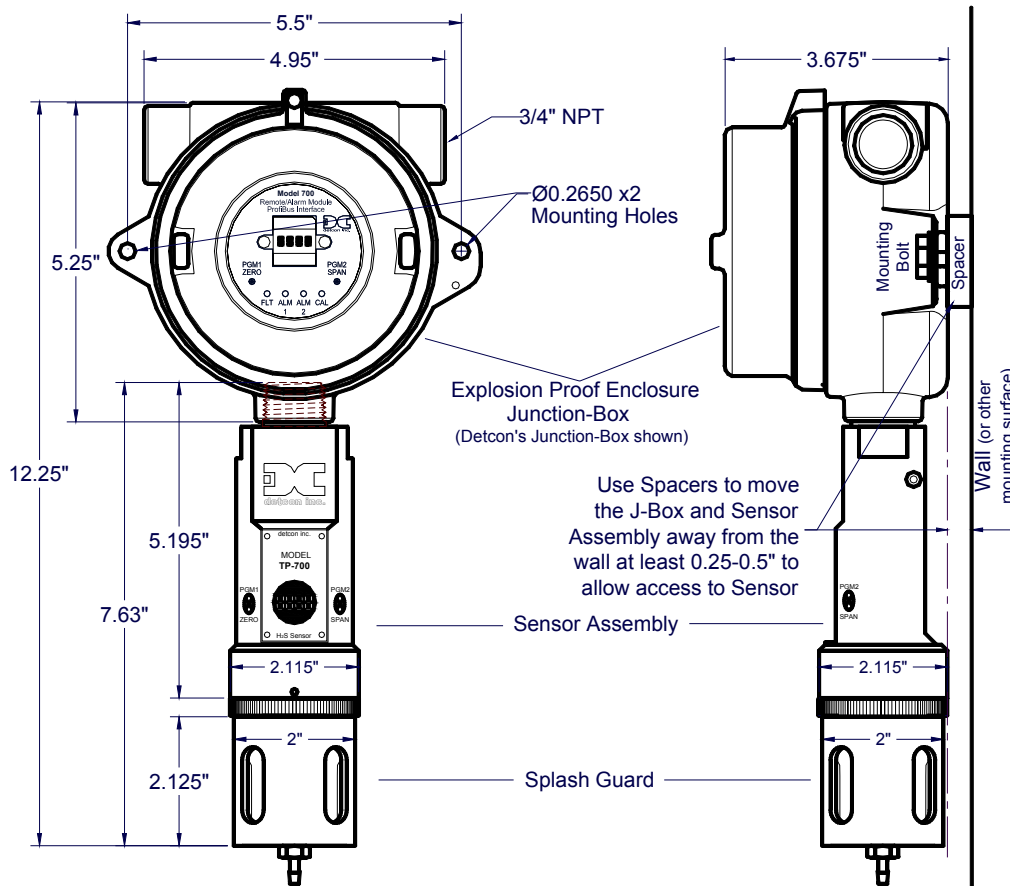


Figure 3 Mounting Profi-RAM with 700 Sensor

The Profi-RAM Electronics package is accessed by removing the junction box cover, grabbing the brass pull knobs, and pulling the package directly out of the enclosure. The module is mounted in the junction box via a slip-fit over two long stand-offs attached to the bottom of the junction box. The two stand-offs protrude through two clearance holes in the bottom two PCB's. To install the electronics package, properly align the stand-offs with the clearance holes and gently push the Profi-RAM in until the stand-offs make contact with the top PCB. The Profi-RAM faceplate will be even with the top of the junction box when installed properly. The Profi-RAM top should be about flush with the top of the enclosure before screwing down the junction box cover.

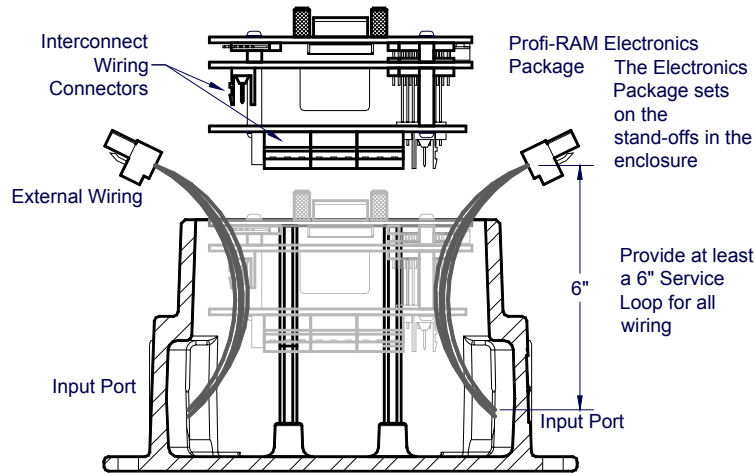


Figure 4 Exploded View of Assembly

### 1.3 Field Wiring

The field wiring connections are made on the backside of the Profi-RAM using a series of removable connector blocks. There is 6-pin terminals block for connection to the 700 Gas Sensor (labeled 700 Sensor), a 9-pin terminal block for connection to the 3 relay contacts (labeled Relays), a 3-pin terminal block for connection of power and mA output (labeled Host) and a 5-pin terminal block for the Profibus Connection.

**NOTE:** It is critical to provide 5-7 inches of service loop wiring on customer wiring connections, such that the Profi-RAM can be removed from the stand-offs and the connector blocks can be accessed.

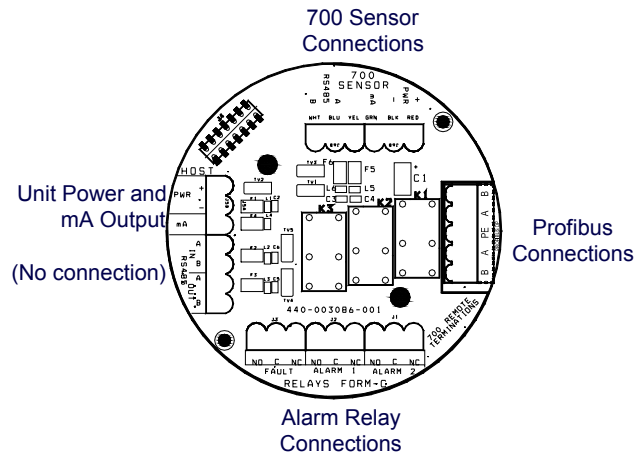
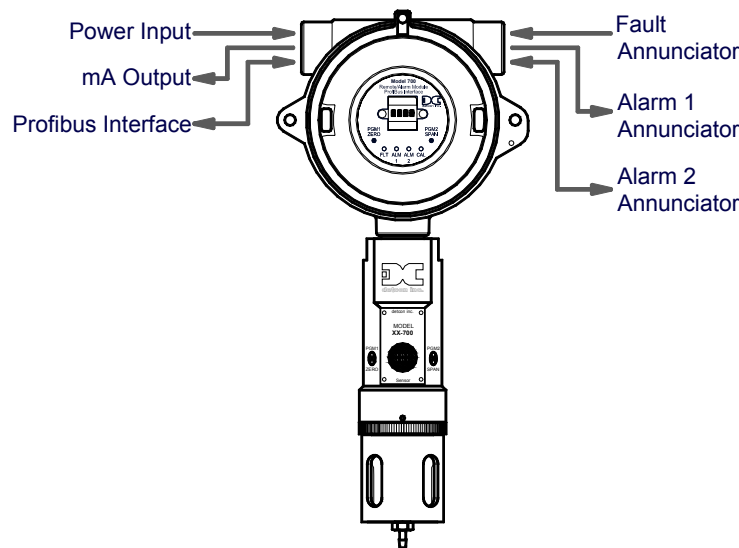


Figure 5 Interface connections

Typically the 700 Gas Sensor is connected directly to the Profi-RAM if there is no requirement for remote sensor separation (Figure 6). In this case, the 700 sensor will not require its own junction box and it is not necessary to install/use the transient protection module shipped with the 700 sensor. The 700 series sensor may arrive from the factory pre-assembled with the Profi-RAM in the j-box, but only if it is ordered in this configuration. In this configuration, the wires from the 700 series sensor will be directly connected to the Profi-RAM terminals labeled “700 Sensor”. It is recommended to Use Belden 3079A for the Profibus communications.

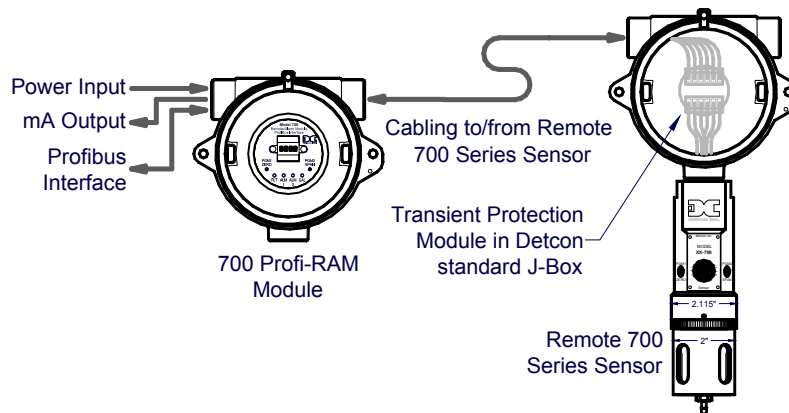
**NOTE:** If the 700 sensor and Profi-RAM are directly connected, it is not necessary to install/use the transient protection module that is shipped with every 700 Gas Sensor.



**Figure 6** Installation with 700 Gas Sensor

If remote sensor separation is required, the Profi-RAM will be separated from the 700 sensor. Remote separation distances of up to 1000 feet are possible with the recommended cables.

**NOTE:** It is highly recommended to install the interconnecting cabling inside rigid metal conduit to eliminate potential EMI and RFI interference.



**Figure 7** Remote 700 Gas Sensor with Profi-RAM

The recommended cables for remote sensor separation are Belden 8770 (18AWG three wire, Shielded cable) for connection of power and mA signal return, and Belden 9841 for serial Modbus™ communications. Use Belden 3079A for the Profibus communications.

**NOTE 1:** The yellow (reserved wire) does not need to be connected in the remote sensor configuration.

**NOTE 2:** Both the 3 wire power/mA cable and the 2 wire Modbus™ serial communications cable are required when remote wiring between the Profi-RAM and the 700 Gas Sensor.



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**NOTE 3:** The same recommended cables should be used for the connection between the master control device and the Profi-RAM. However, if only the 4-20 mA signal is being used by the master/host controller then only the 3 wire cable is required.

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## 2. Operator Interface

The operator interface of the Profi-RAM is very similar to the Model 700 Gas Sensor. It uses the identical LED display, same programming magnet, and has the same magnetic programming switches (PGM1/ZERO and PGM2/SPAN). The main difference is that the 700 Profi-RAM has LED indicators for the 3 relays (ALM1, ALM2, and FAULT) and a CAL LED to indicate when the 700 sensor is in calibration.

The gas reading, gas units, and fault status reported by the Profi-RAM will mimic that of the 700 Gas Sensor.

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**NOTE:** If the Model 700 Gas Sensor is directly connected to the Profi-RAM and junction box, then the gas sensor operation should be exercised through the 700 Gas Sensor (and not the Profi-RAM). This is the recommended practice since the Profi-RAM contains a limited number of sensor operational control functions. If the Profi-RAM and 700 Gas Sensor are separated, normal remote gas sensor operation should be exercised through the Profi-RAM.

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The operating interface is menu-driven via the two magnetic program switches located under the target marks on the Profi-RAM faceplate. The two switches are referred to as “PGM1” and “PGM2”. The menu list consists of three major items that include sub-menus as indicated below. (Refer to the complete Software Flow Chart.)

### Normal Operation

Current Reading and Fault Status

### Calibration Mode

AutoZero (if applicable)  
AutoSpan

### Program Mode

View Sensor Status (representative of whichever Model 700 Gas Sensor is attached)  
Set AutoSpan Level  
Set Serial ID  
Alarm 1 Settings  
Alarm 2 Settings  
Fault Settings  
Signal Output Check  
PDP Diagnostics

The user interface of the Profi-RAM is designed to mimic that of the Model 700 Gas Sensor. However, only the functions deemed critical for normal remote sensor operation are available. These are the 6 menu functions that are available for the remote control of the 700 Gas Sensor:

**AutoZero** – used to perform AutoZero remotely

**AutoSpan** – used to perform AutoSpan remotely, user is required to apply span gas flow to remote gas sensor

**View Program Status** – displays the complete list of sensor status and diagnostic indicators

**Set AutoSpan Level** – used to change the span gas concentration

**Signal Output Check** – used to generate simulated outputs from the sensor for system diagnostic purposes.

**PDP Diagnostics** – Displays the Profibus DP slave’s status.

**NOTE:** For any other required operational changes, the 700 Gas Sensor must be accessed directly.

### Software Flowchart

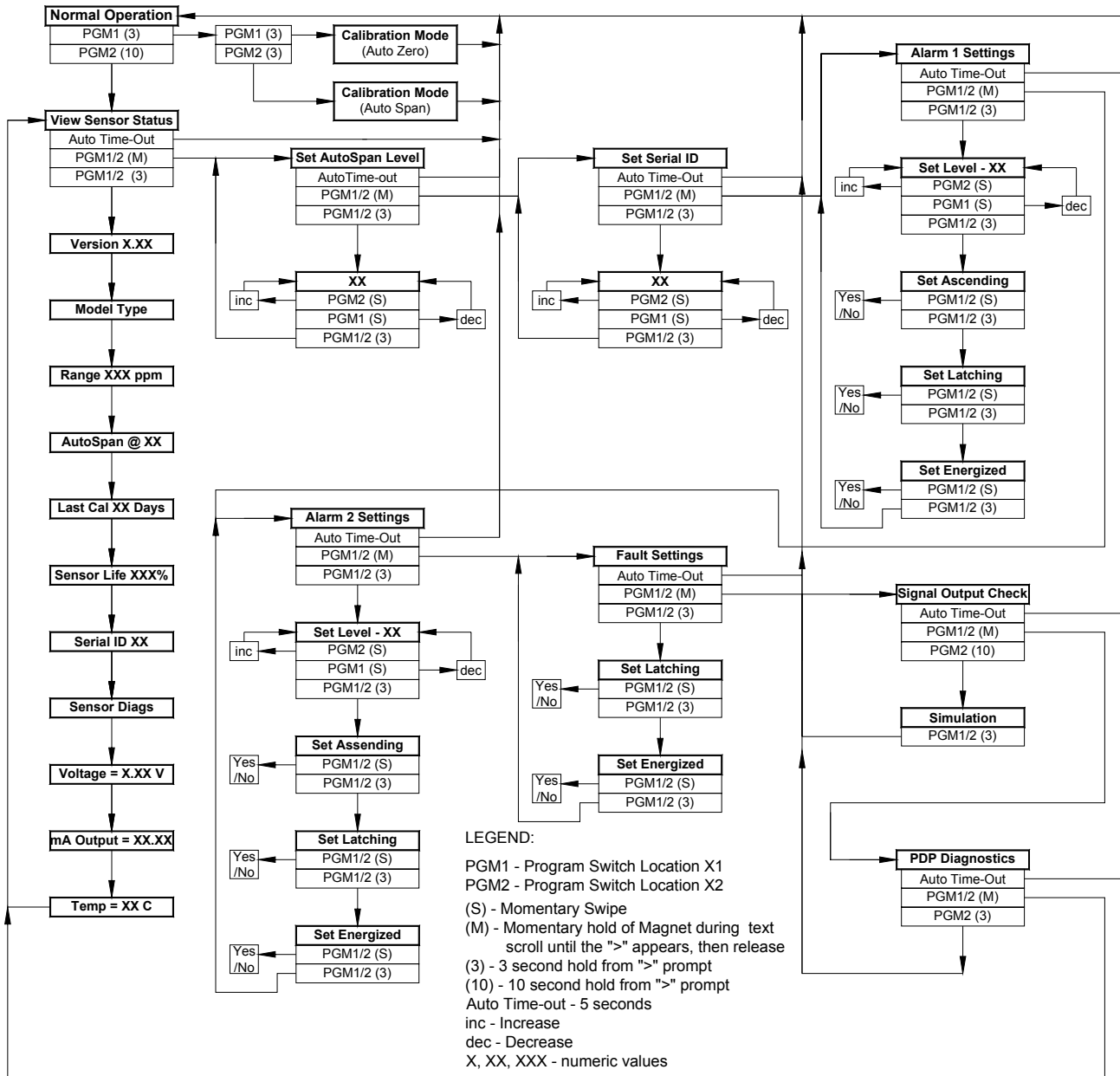


Figure 8 Profi-RAM Software Flowchart

## 3. Set-up and Normal Operation

In normal operation, the Profi-RAM display continuously shows the current sensor reading, which will typically appear as “ 0 ”. Once every 1 minute the LED display will flash the sensor’s measurement units and gas type (i.e. % LEL). If the 700 Gas Sensor or Profi-RAM is actively experiencing any diagnostic faults, a “Fault Detected” message will flash on the display once every minute. When the unit is in “Fault Detected” mode with the red Fault LED on, PGM1 or PGM2 can be swiped to invoke a display of the active faults.

In normal operation, the 4-20 mA current output from the Profi-RAM corresponds with the present gas concentration and full-scale range. The Profibus serial output provides the current gas reading and fault status on a continuous basis when polled.

If the Modbus™ communication between the Profi-RAM and the 700 Gas Sensor is not functioning, the Profi-RAM will display “COMM” and the ‘FLT’ LED will be illuminated.

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**NOTE:** The 700 Gas Sensor must be set to Serial ID = 01 for proper communications set-up with the Profi-RAM.

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### 3.1 View Sensor Status

**View Sensor Status** displays all current configurational and operational parameters from the 700 Gas Sensor attached to it. These typically include sensor type, software version number, detection range, AutoSpan level, days since last AutoSpan, estimated remaining sensor life, sensor diagnostics, input voltage, 4-20mA output, and sensor ambient temperature.

From the **View Sensor Status** text scroll, hold the magnet over PGM1 or PGM2 until the “▶” prompt appears and then hold continuously for an additional 3 seconds. The display will scroll the complete list of sensor status parameters sequentially:

#### **Current Software Version**

Item appears as: “700 RAM VX.XXX”

#### **Sensor Model Type**

Item appears as: “Model XX-700”

#### **Range of Detection.**

Item appears as: “Range XXX”

#### **Serial ID address.**

Item appears as: “Serial ID XX”

#### **AutoSpan Level.**

Item appears as: “AutoSpan Level XX”

#### **Days Since Last AutoSpan.**

Items appears as: “Last Cal XX days”

#### **Remaining Sensor Life.**

Item appears as: “Sensor Life 100%”

#### **Sensor Diagnostics**

(Varies by sensor type)

### **mA Output**

Item appears as: “mA Output XX.XX”

### **Input Voltage Supply**

Item appears as: “Voltage XX.XXVDC”

### **Sensor Temperature**

Item appears as: “Temp XXC”

### **Alarm 1 Settings**

Items appear as:

- “Alarm1 Level = X.X”
- “Alarm1 Ascending / Descending”
- “Alarm1 Latching / Non-latching”
- “Alarm1 Energized / Non-energized”

### **Alarm 2 Settings**

Items appear as:

- “Alarm2 Level = X.X”
- “Alarm2 Ascending / Descending”
- “Alarm2 Latching / Non-latching”
- “Alarm2 Energized / Non-energized”

### **Fault Settings**

Items appear as:

- “Fault Latching / Non-latching”
- “Fault Energized / Non-energized”

When the status list sequence is complete, the Profi-RAM will revert to the “View Sensor Status” text scroll. The user can either: 1) review list again by executing another 3-4 second hold, 2) move to another menu item by executing a momentary hold over PGM1 or PGM2, or 3) return to Normal Operation via automatic timeout of about 15 seconds (the display will scroll “**View Sensor Status**” 4 times and then return to Normal Operation).

## **3.2 Set AutoSpan Level**

**Set AutoSpan Level** is used to set the span gas concentration level that is being used to calibrate the sensor. This level is adjustable from 10% to 100% of range. The current setting can be viewed in View Sensor Status.

The menu item appears as: “**Set AutoSpan Level**”

From the **Set AutoSpan Level** text scroll, hold the magnet over PGM1 or PGM2 until the “▶” prompt appears and then hold continuously for an additional 3 seconds. The display will then switch to “XX”(where XX is the current gas level). Swipe the magnet momentarily over PGM2 to increase or PGM1 to decrease the AutoSpan Level until the correct level is displayed. Hold the magnet over PGM1 or PGM2 for 3 seconds to accept the new value. The display will scroll “AutoSpan Level Saved”, and revert to “Set AutoSpan Level” text scroll.

The user can then choose to either: 1) move to another menu item by executing a momentary hold, or 2) return to Normal Operation via 5 second automatic timeout.

### 3.3 Set Serial ID

The Profi-RAM can be polled serially via the Profibus. The Profi-RAM Serial ID # should be set as a slave device to a master polling device.

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**NOTE:** The Serial ID of the Model 700 Gas Sensor connected to the Profi-RAM must be set to ID = 01 for proper communication between the two devices.

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**Set Serial ID** is used to set the Profibus serial ID address. It is adjustable from 01 to 127 in hexadecimal format (01-7F hex). The current serial ID can be viewed in View Sensor Status using the instruction given in Section 3.1 View Sensor Status.

The menu item appears as: “**Set Serial ID**”

From the “**Set Serial ID**” text scroll, hold the programming magnet over PGM1 or PGM2 until the “**◆**” prompt appears and continue to hold the magnet in place for an additional 3-4 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 momentarily over PGM2 to increase or PGM1 to decrease the hexadecimal number until the desired ID is displayed. Hold the magnet over PGM1 or PGM2 for 3-4 seconds to accept the new value. The display will scroll “**ID Saved**”, and revert to “**Set Serial ID**” text scroll.

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

### 3.4 Set-up for Relay Outputs

The user interface allows setting the configuration of the three relay contacts of the RAM. The three relays can be optionally configured as follows:

Alarm 1: 1) gas level, 2) ascending/descending, 3) latching/non-latching, and 4) energized/non-energized  
Alarm 2: 1) gas level, 2) ascending/descending, 3) latching/non-latching, and 4) energized/non-energized  
Fault: 1) latching/non-latching and 2) energized/non-energized

The three menu items for relay output set-up are **Alarm1 Settings**, **Alarm2 Settings**, and **Fault Settings**. They are used to set the gas alarm levels and relay status for ascending/descending, latching/non-latching, and energized/de-energized. The gas concentration level for alarms can be set between 5-100% of the full-scale range of the 700 Gas Sensor. The current relay configuration settings can be viewed in View Sensor Status menu.

The menu item appears as: “**Alarm1 Settings**”

From the “**Alarm1 Settings**” text scroll, hold the magnet over PGM1 or PGM2 until the “**◆**” prompt appears and then hold continuously for an additional 3 seconds. The display will switch to “**Set Level**“followed by **XX** (where XX is the current set-point level). Swipe the magnet momentarily over PGM2 to increase or PGM1 to decrease until the correct level is displayed. To save the level, hold the magnet over PGM1 or PGM2 until the LCD scrolls, “Level Saved” (about 3 seconds).

The display will scroll “**Set Ascending**” and show “**Yes**” or “**No**”. Momentarily swipe PGM1 to select the desired choice (yes = ascending and no = descending). Hold the magnet over PGM1 until the LCD scrolls, “**Saved**” (about 3 seconds).

The display will scroll “**Set Latching**” and then show “**Yes**” or “**No**”. Use a swipe of PGM1 to select choice (yes = latching and no = non-latching). Hold the magnet over PGM1 until the LCD scrolls, “**Saved**” (about 3 seconds).

The display will scroll “**Set Energized**” and then show “**Yes**” or “**No**”. Use a swipe of PGM1 to select choice (yes = energized and no = non-energized). Hold the magnet over PGM1 until the LCD scrolls, “**Saved**” (about 3 seconds).

Move to another menu item by executing a momentary hold, or, return to Normal Operation via automatic timeout of about 15 seconds (the display will scroll “**Alarm1 Settings**” 4 times and then return to Normal Operation).

Follow the identical instructional sequence for the menu function “**Alarm2 Settings**”. The menu function for “**Fault Settings**” is similar except that it does not have a selection for gas level and ascending/descending. It only has selections for latching/non-latching and energized/non-energized).

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**NOTE:** The Fault relay is typically set as ‘energized’ so that it will change states during an unexpected power loss.

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**NOTE:** The relay contacts can be wired at the RAM’s Connector PCB for either Normally Open or Normally Closed.

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### 3.5 Signal Output Check

**Signal Output Check** provides a simulated 4-20mA output and RS-485 Modbus™ output. This simulation allows the user to conveniently perform a functional system check of their entire safety system. This signal output simulation also aids the user in performing troubleshooting of signal wiring problems.

The menu item appears as: “**Signal Output Check**”.

From the “**Signal Output Check**” text scroll, hold the magnet over PGM1 or PGM2 until the “**▶**” prompt appears and then hold continuously for an additional 10 seconds. Once initiated, the display will scroll “**Simulation Active**” until the function is stopped. During simulation mode, the 4-20mA value will be increased from 4.0mA to 20.0mA (in 1% of range increments at about a 1 second update rate) and then decreased from 20.0mA to 4.0mA. The same simulation sequence is applied to the Modbus™ output gas reading.

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**NOTE:** Signal Output Check will stay active indefinitely, until the user stops the function. There is no automatic timeout for this feature.

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To end simulation mode, hold magnet over PGM1 or PGM2 for 3 seconds. The display will either move to the prior menu item or move to the next menu item respectively.

Move to another menu item by executing a momentary hold, or, return to Normal Operation via automatic timeout of about 15 seconds.

### 3.6 PDP Diagnostics

**PDP Diagnostics** displays the current status of the AnyBus Profibus connection to the network. This information is useful for verifying the connection properties and status between the ProfiRam and the AnyBus IC and, also between the AnyBus IC and the Profibus network.

From the **PDP Diagnostics** text scroll, hold the magnet over PGM2 until the “▶” prompt appears and then hold continuously for an additional 3 seconds. The display will scroll the list of diagnostic parameters sequentially:

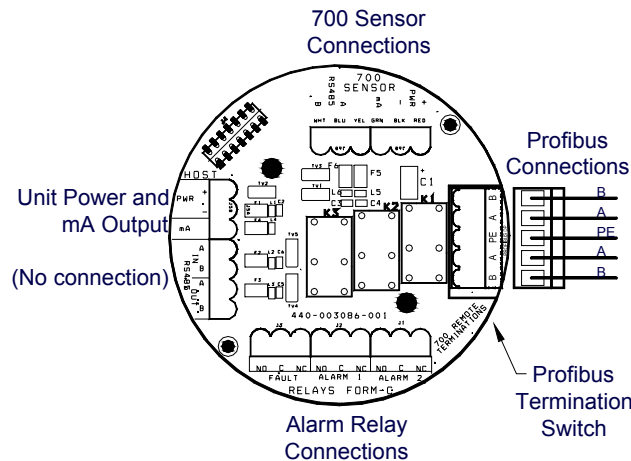
- AnyBusIC Mode
- FB I/O Config Status
- SCI I/O Config Status
- Node Online Status
- Node in Clear Status
- Node Address
- Baud Rate

When the diagnostics status list sequence is complete, the Profi-RAM will revert to the “PDP Diagnostics” text scroll. Move to another menu item by executing a momentary hold, or, return to Normal Operation via automatic timeout of about 15 seconds.

## 4. 700 Profibus

The Profi-RAM module provides a bridge for a Model 700 gas sensor to a PROFIBUS-DP Network. This allows a PROFIBUS Master, such as a PLC, to monitor the operation of the Profi-RAM, and the Model 700 sensor attached to it. The Profi-RAM functions as an intelligent PROFIBUS-DP Slave on the Network.

The PROFIBUS-DP Network connects through the 5-pin removable header located on the backside of the Profi-RAM assembly (Figure 9). The PROFIBUS-DP Network is electrically isolated from the RAM and Model 700 electronics. If the Profibus Module is located physically at the end of the Profibus Network, the termination switch on the Profibus PCA should be ‘ON’.



**Figure 9** Profibus Connections

The Profi-RAM interface supports Automatic Baud Rate Detection, with an operating range of 9600 baud up to 12M baud. The station address is set via the Profi-RAM Operator interface. Data exchange with the master device is accomplished by cyclic data transmission.

The PROFIBUS-DP Protocol is implemented using the HMS Industrial Networks, Inc. AnyBus-IC for PROFIBUS. The Profibus National Organization (PNO) Identifier for this IC is 0x1810. The AnyBus-IC GSD file and bitmaps must be downloaded from the HMS Industrial Networks, Inc website at <http://www.anybus.com>. The GSD file is used to configure the Profibus Master to recognize the Profi-RAM.

The Profi-RAM implements the following function of the AnyBus IC:

INPUT: 16 Byte (8 word).

All data is in 16 bit integer format. The following shows the data contents of these 8 words.

Word 1: Gas Type.

This is implemented on the Model 700 IR sensor only.

1= LEL CH4

2= LEL Heavy Hydrocarbons

3= CO2

Word 2: Detectable Range.

Minimum value: 1

Maximum value: 10000

i.e.: 100 for 0-100 ppm H2S, 50 for 0-50% LEL.

Word 3: Current Gas Reading.

Minimum value: -10% of Detectable Range

Maximum value: 10000

This is the gas level currently being detected. This number should be divided by the value in word 8 to give an accurate reading.

Word 4: Auto Span Level.

Minimum value: 1% of Detectable Range

Maximum value: 95% of Detectable Range

This number is the gas concentration expected to be used during an auto span calibration. This number should be divided by the value in word 8 to give an accurate number.

Word 5: Sensor Life.

Minimum value: 25%

Maximum value: 100%

This is an estimated remaining use of the plug-in sensor.

Word 6: Fault Codes.

Bit 15: Comm Fault between the Profi-RAM and the Model 700 Sensor.

Bits 14 thru 8 are Sensor dependant. See the Modbus section of the appropriate Model 700 instruction manual for the designation of these bits.

Bit 7: Sensor Fault.

Bit 6: Processor Fault.

Bit 5: Memory Fault.

Bit 4: Input Voltage Fault.

Bit 3: 4-20ma Fault.

Bit 2: Temperature Fault.

Bit 1: Auto Span Fault.

Bit 0: Global Fault bit.



Word 7: Sensor Temperature.  
Minimum value: -40  
Maximum value: 75

Word 8: Range Divisor.

This setting is determined by which sensor is connected to the ProfiRAM.  
For a FP-700 or TP-700, this setting will be 1.  
For an IR-700, the gas reading will be divided by this number.  
For a DM-700:

- If range is 0-9, setting is 2 decimal places (divide by 100);
- If range is 10-25, setting is 1 decimal place (divide by 10);
- If range is 26+, setting is 0 (no decimal places).

## 5. RAM Electronics Warranty

Detcon Inc. warrants, under intended normal use, each new Model 700 Profi-RAM module 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:

- 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 Profi-RAM replacement.

## 6. Appendix

### 6.1 Specifications

#### Inputs

Any Model 700 Gas Sensor

#### Outputs

4-20mA signal

Profibus-DP Interface

Relay Contacts - Three Form C contacts rated for 2Amps at 30 VDC/120 VAC

#### Input Voltage

11.5-30VDC

#### Power Consumption (excluding 700 Gas Sensor)

< 2.5 Watts at 24VDC (Nominal)

<4.0 watt at 24VDC (Maximum)

#### Operating Temperature

-40°C to 70°C

#### Electrical Classification

Class 1, Division 1 Groups BCD

Class 1, Zone 1, Group IIC

**Enclosure Classification**

Nema 7 and Nema 4X

**6.2 Spare Parts**

| Part Number    | Spare Parts                            |
|----------------|--|
| 927-70000P-000 | <b>Profibus-RAM Electronics Module</b> |
| 8522-750       | 3/4" NPT Plug                          |
| 960-202200-000 | Condensation Prevention Packet         |

**6.3 Revision Log**

| Revision | Date       | Changes made  |
|----------|------------|---|
| 0.2      | 08/13/2009 | Specifications: Corrected lower operating temperature. Revised information on relay contact rating to match CSA/UL labeling. Added revision log |
| 0.03     | 11/20/2009 | Description of Word 8: Range Divisor. (Section 4)   |