INSTRUCTION MANUAL

Model 700 Series
Remote Sensor/Alarm Relay Module

detcon inc.

DETCON, Inc.
3200 Research Forest Dr.,
The Woodlands, Texas 77387
Ph.281.367.4100 / Fax 281.298.2868
www.detcon.com

January 25, 2007• Document #3220• Revision 0.1

This page left intentionally blank

Table of Contents

1. Introduction 1
1.1 Description 1
1.2 Installation 1
1.3 Field Wiring 3
2. Operator Interface 5
3. Set-up and Normal Operation 6
3.1 View Sensor Status 7
3.2 Set AutoSpan Level 8
3.3 Set Serial ID 8
3.4 Set-up for Relay Outputs 9
3.5 Signal Output Check 10
4. RS-485 Modbus™ Protocol 10
5. RAM Electronics Warranty 11
6. Appendix 11
6.1 Specifications 11
6.2 Spare Parts 12

Table of Figures

Figure 1 700 RAM 1
Figure 2 RAM Mounting 2
Figure 3 Mounting RAM with 700 Sensor 2
Figure 4 Exploded View of Assembly 3
Figure 5 Remote Alarm Connector PCB 3
Figure 6 Installation with 700 Series Gas Sensor 4
Figure 7 Remote 700 Series Gas Sensor with RAM 4
Figure 8 RAM Software Flowchart 6

This page left intentionally blank

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, 281.367.4100 • Fax: 281.292.2860 • www.detcon.com • sales@detcon.com

1. Introduction

1.1 Description

The Model 700 Remote Sensor/Alarm Relay Module (known as the Remote Alarm Module or 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 RAM is provided in an explosion-proof junction box constructed of either epoxy-painted aluminum or 316 stainless steel.

Figure 1 700 RAM

The RAM has two main functions. The first function is used to set gas alarm levels and to configure the three local relay contacts. The second function is used to operate a 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 provides the 4-20mA output directly from the Model 700 Gas Sensor. The RAM acts as a Modbus™ master to the Model 700 Gas Sensor in order to display the reading and execute the remote control functions. It acts as a Modbus™ slave to any master control device and simply repeats the Modbus™ output from the 700 Gas Sensor it is connected to.

1.2 Installation

The RAM can be installed as wall pipe mounted 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 RAM, the user should use 0.5” spacers underneath the mounting holes to provide access clearance for the 700 Gas Sensor (Figure 3).

NOTE: Block any unused ¾” NPT holes with the proper Plug. (Detcon P/N 8522-750)

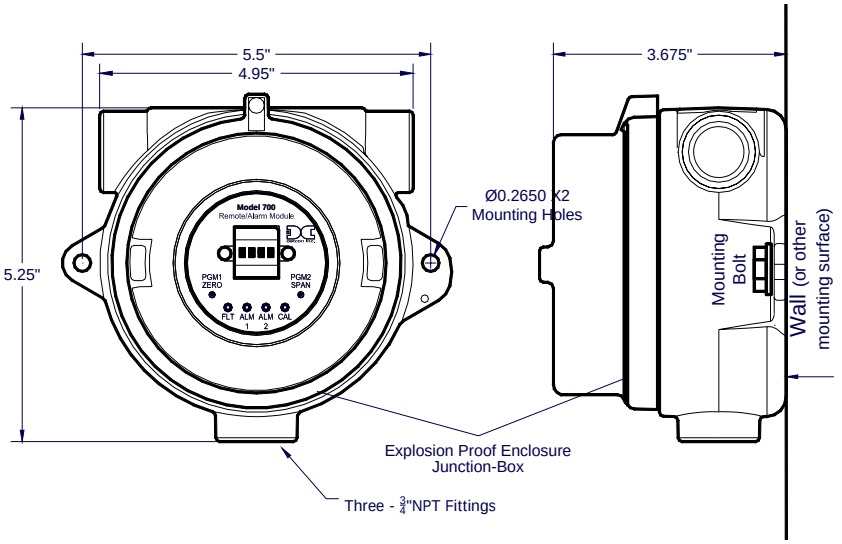


Figure 2 RAM Mounting

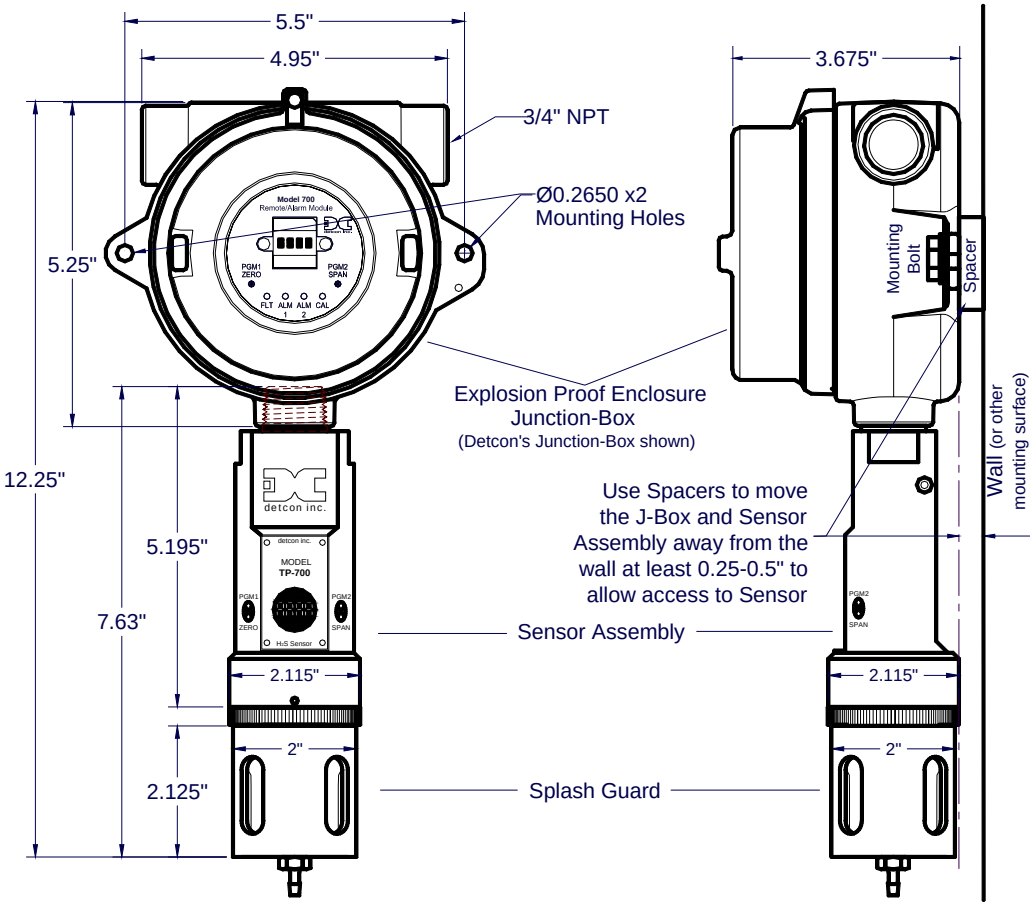


Figure 3 Mounting RAM with 700 Sensor

The 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 at the bottom of the junction box. The two stand-offs protrude through two clearance holes in the bottom PCB. To install, properly align the stand-offs with the clearance holes and push the RAM in until the stand-offs make contact with the top PCB. The RAM faceplate will be even with the top of the junction box when installed properly. The RAM top should be flush with the top of the enclosure before screwing down the junction box cover.

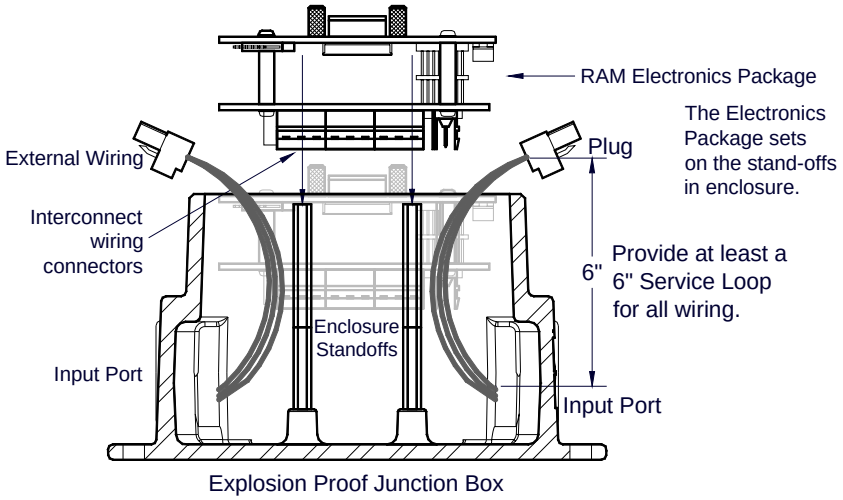


Figure 4 Exploded View of Assembly

1.3 Field Wiring

The field wiring connections are made on the backside of the RAM using a series of removable connector blocks. There is a 6-pin terminal 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), and a 7-pin terminal block for connection of power and signal outputs (labeled Host).

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

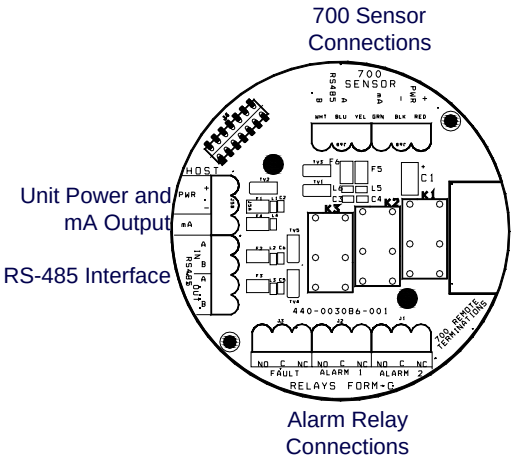


Figure 5 Remote Alarm Connector PCB

Typically, the 700 Gas Sensor is connected directly to the RAM if there is no requirement for remote sensor separation (Figure 6). In this case, the 700 series sensor will not require its own junction box and it is not necessary to install or use the Transient Protection Module shipped with the 700 sensor. The 700 series sensor may arrive from the factory pre-assembled with the 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 RAM terminals labeled “700 Sensor”.

NOTE: If the 700 series sensor and RAM are directly connected, it is not necessary to install/use the Transient Protection Module that is shipped with the 700 Series Gas Sensors.

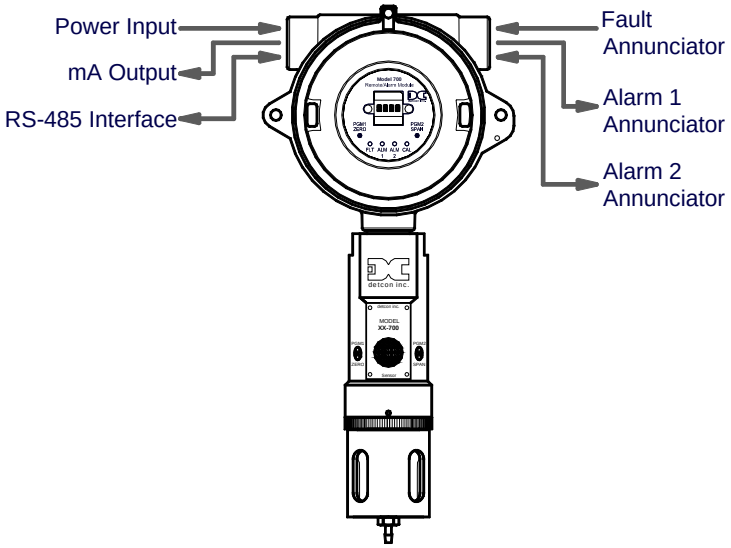


Figure 6 Installation with 700 Series Gas Sensor

If the remote sensor separation is required, the RAM will be separated from the 700 series 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 EM and RF interference.

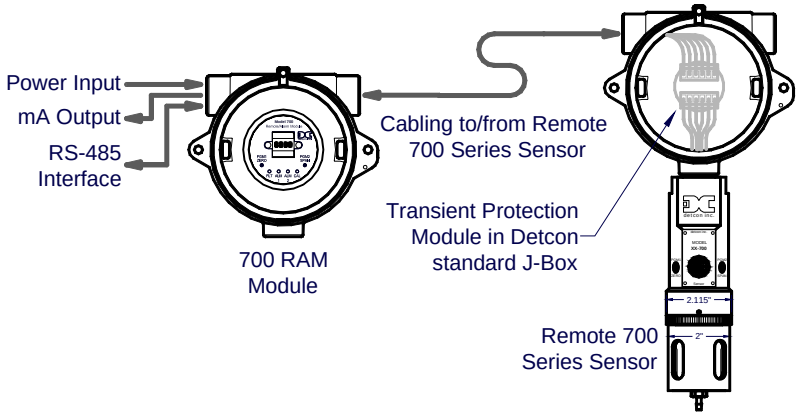


Figure 7 Remote 700 Series Gas Sensor with RAM

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.

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 RAM and the 700 Gas Sensor.

NOTE 3: The same recommended cables should be used for the connection between the master control device and the 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.

2. Operator Interface

The operator interface of the 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 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 or being polled serially by a master control device.

The gas reading, gas units, and fault status reported by the RAM mimic that of the 700 Gas Sensor. The Modbus™ output from the RAM repeats the Modbus™ output from the 700 Gas Sensor.

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

The operating interface is menu-driven via the two magnetic program switches located under the target marks on the 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

The user interface of the 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. The 5 menu functions that are available for the remote control of the 700 Gas Sensor are:

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

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

Software Flowchart

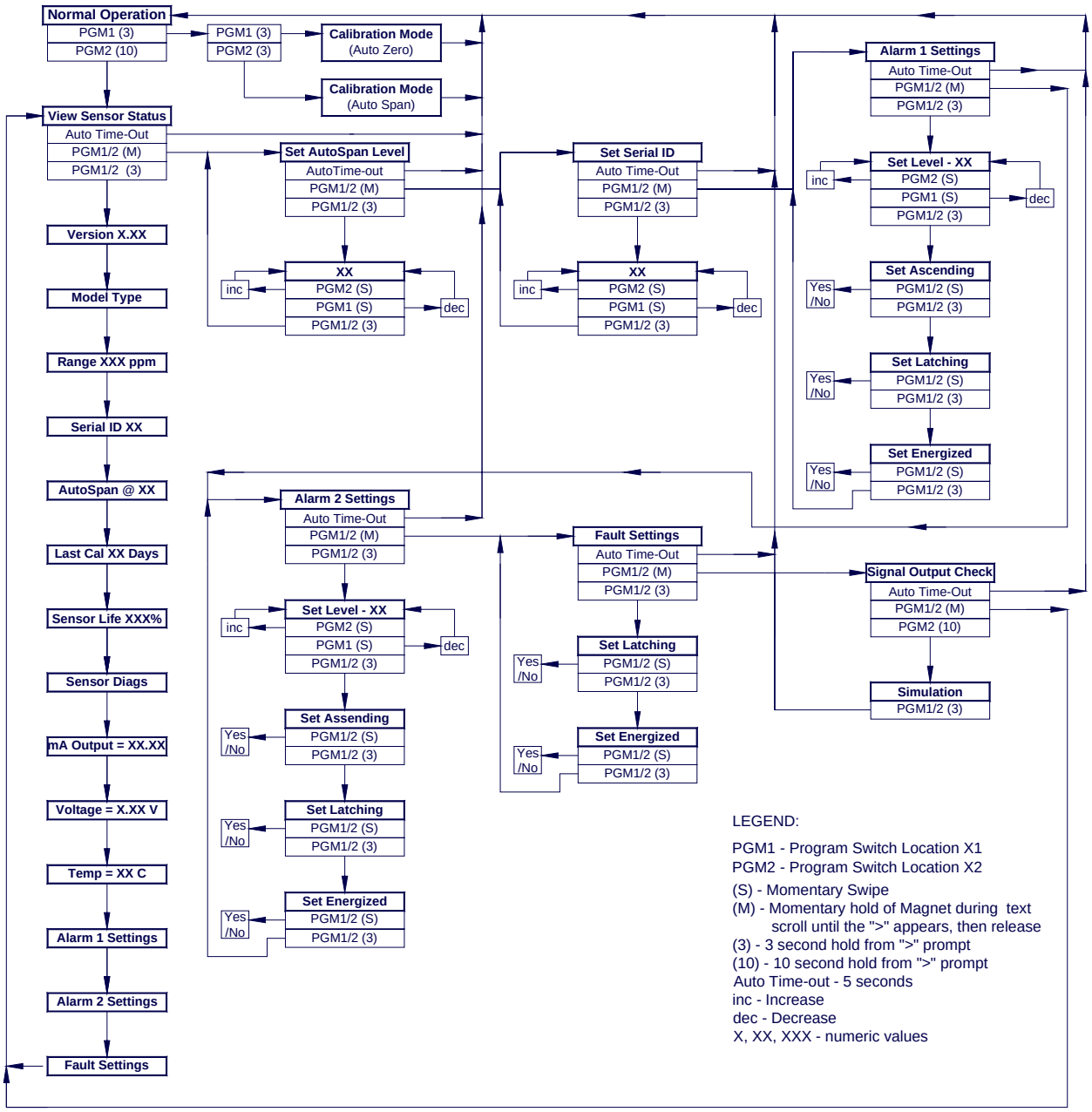


Figure 8 RAM Software Flowchart

3. Set-up and Normal Operation

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

In normal operation, the 4-20 mA current output from the RAM corresponds with the present gas concentration and full-scale range. The RS-485 Modbus™ serial output provides the current gas reading and fault status on a continuous basis when polled. Successful Modbus™ communications between the RAM and an RS-485 Master Controller will be indicated by a blinking 'CAL' LED.

If the Modbus™ communication between the RAM and the 700 Gas Sensor is not functioning, the RAM will display "**COMM**" and the 'FLT' LED will be illuminated.

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

3.1 View Sensor Status

View Sensor Status displays the current configuration 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 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 RAM can be polled serially via RS-485 Modbus™ RTU. It repeats the Modbus™ output from the 700 Gas Sensor it is connected to. The RAM Serial ID ## should be set as a slave device to a master polling

device. Refer to the Modbus™ section of the Model 700 Gas Sensor Instruction Manual for the details on using the Modbus™ output feature.

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

Set Serial ID is used to set the Modbus™ serial ID address of the RAM. It is adjustable from 01 to 256 in hexadecimal format (01-FF 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 configurational 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).

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

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

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.

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

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.

4. RS-485 Modbus™ Protocol

The RAM module provides a Modbus™ compatible communications protocol and is addressable via the program mode. This Modbus™ output is exactly repeated from the specific Model 700 sensor that is attached. Communication is two wire, half duplex RS-485, 9600 baud, 8 data bits, 1 stop bit, no parity, with the sensor set up as a slave device. An RS-485 Master Controller up to 4000 feet away can theoretically poll up to 256 different RAM's. This number may not be realistic in harsh environments where noise and/or wiring conditions would make it impractical to place so many devices on the same pair of wires. If a multi-point

system is being utilized, each RAM must be set for a different address. Typical address settings are: 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B, 0C, 0D, 0E, 0F, 10, 11…etc.

Successful Modbus™ communications between the RAM and an RS-485 Master Controller is indicated by a blinking 'CAL' LED.

If the Modbus™ communication between the RAM and the 700 Gas Sensor is not functioning, the RAM will display "**COMM**" and the 'FLT' LED will be illuminated.

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

RS-485 ID numbers are factory default to 01. These can be changed in the field via the Operator Interface described in Section 3.3, Set Serial ID.

NOTE: Refer to the Model 700 Gas Sensor Instruction Manual for details on the Modbus™ protocol registers.

5. RAM Electronics Warranty

Detcon Inc. warrants, under intended normal use, each new Model 700 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 RAM replacement.

6. Appendix

6.1 Specifications

Inputs
Any Model 700 Gas Sensor

Outputs
4-20mA signal
RS 485 Modbus™
Relay Contacts - Three Form C contacts rated for 5Amps at 30VDC/250VAC

Input Voltage
11-30VDC

Power Consumption (excluding 700 Gas Sensor)
< 0.5 Watts at 24VDC (Nominal)
<1.0 watt at 24VDC (Maximum)

Operating Temperature
-40C to 75C

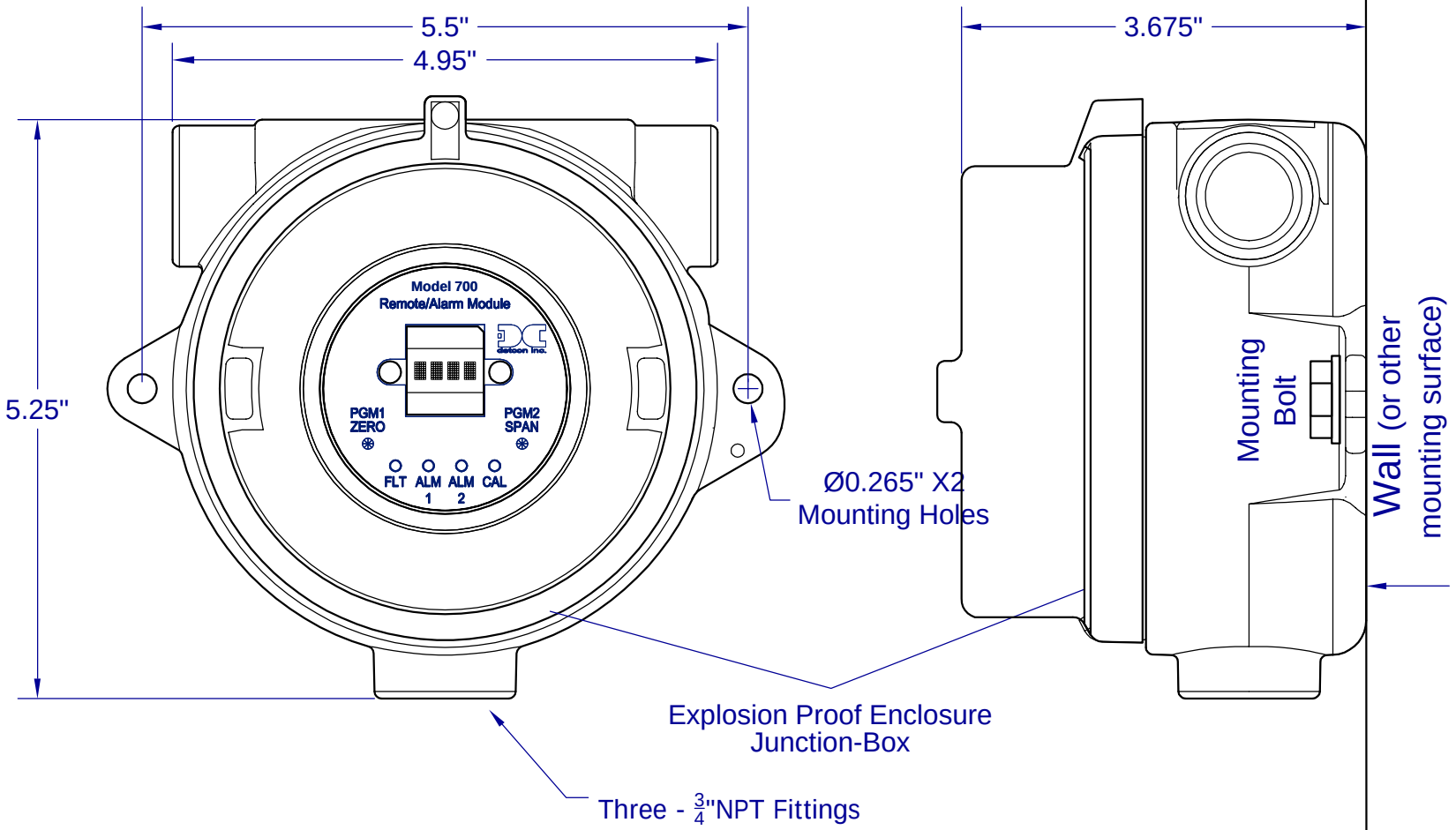
Electrical Classification
Class 1, Division 1 Groups BCD
Class 1, Zone 1, Group IIC

Enclosure Classification
Nema 7 and Nema 4X

6.2 Spare Parts

Part Number	Spare Parts
927-70000A-000	**RAM Electronics Package**
8522-750	¾" NPT Plug
960-202200-000	Condensation Prevention Packet

JOB NO.	SIZE	DRAWING NO.	REV
NA	A	3220-1	1



NOTES:

P.O. NO.	NA
REQ. NO.	NA
PROJECT NO.	NA
CLIENT'S SERIAL NO.	NA
PLANT:	NA

Rev	DATE	DESCRIPTION	DRN	CHKD	APPD	DWG NO.	SUBJECT
1	04/26/06	Changes and updates	RH	EM	BM	3220	Changes

REVISION HISTORY — REF. DWGS

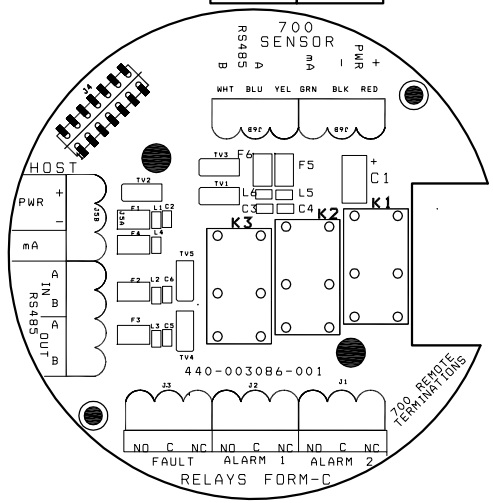
DETCON INC.
3200 Research Forest Dr. A-1 * The Woodlands Texas 77381 * www.detcon.com

CLIENT: NA		700 RAM Deminsional P/N 975-70000A-00A	
PROJECT: NA			
DRAWN BY: R HUTSKO	SCALE: NTS	SALES ORDER NO.: NA	DRAWING NO.: 3220-1
FIRST ISSUE: 01/27/06		DETCON PRPOSAL #: NA	SIZE: A / REV: 1

JOB NO.	SIZE	DRAWING NO.	REV
NA	A	3220-2	1

(Wht) A
(Blu) B
(Yel) Reserve
(Grn) mA Out
(Blk) -
(Red) +
RS-485
Power Input
700 Gas Sensor

700 Gas Sensor Connector

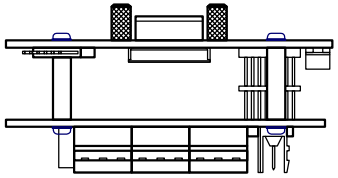


Power Input 11.5-30VDC
Ground
mA Output
RS-485 A In
B In
A Out
B Out
Host Controller Connections

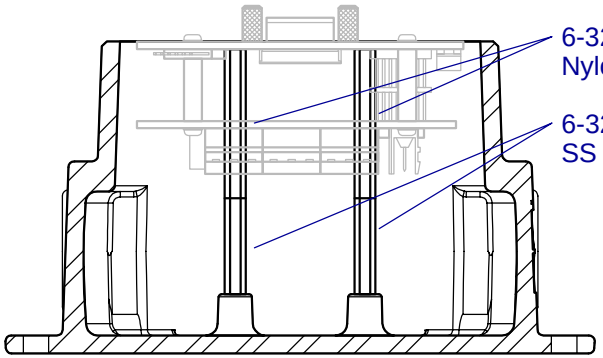
Relay Output Connections

Fault Relay: NO, COM, NC
Alarm 1 Relay: NO, COM, NC
Alarm 2 Relay: NO, COM, NC

The recommended cables for remote sensor separation are Belden 8770 (18AWG 3 twisted pair Shielded) for 3 wire connection of power and mA signal return, and Belden 9841 for the 2 wire serial Modbus™ communications.



927-70000A-000
Ram Electronics Package



6-32 X 3/16 X 1 5/8"
Nylon Standoff

6-32 X 3/16 X 1"
SS Standoff

897-850800-000 - Alm. Enclosure Housing

Note 1:
If the mA Output is ***NOT*** to be utilized place a 250? resistor between mA Output and Ground to avoid causing a 4-20mA Fault on the 700 Sensor.

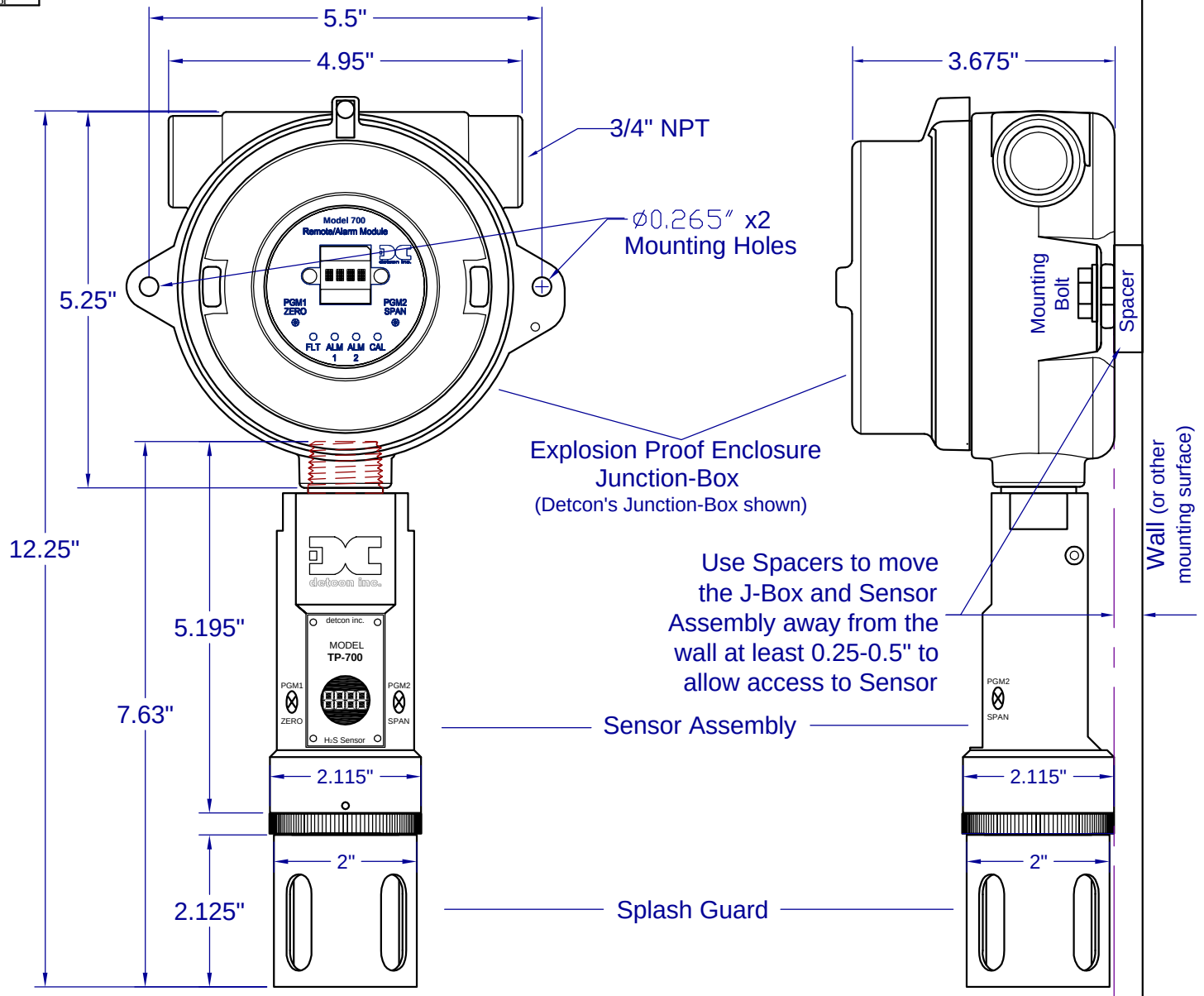
P.O. NO.	NA
REQ. NO.	NA
PROJECT NO.	NA
CLIENT'S SERIAL NO.	NA
PLANT:	NA

Rev	DATE	DESCRIPTION	DRN	CHKD	APPD	DWG NO.	SUBJECT
1	04/26/06	Changes and updates	RH	EM	BM	3220	Changes

REVISION HISTORY — REF. DWGS

DETCON INC.
3200 Research Forest Dr. A-1 * The Woodlands Texas 77381 * www.detcon.com

CLIENT: NA		700 RAM Interconnect Wiring P/N 975-70000A-00A	
PROJECT: NA			
DRAWN BY: R HUTSKO	SCALE: NTS	SALES ORDER NO.: NA	DRAWING NO.: 3220-2
FIRST ISSUE: 01/27/06		DETCON PRPOSAL #: NA	SIZE: A / REV: 1



NOTES:

P.O. NO.	NA
REQ. NO.	NA
PROJECT NO.	NA
CLIENT'S SERIAL NO.	NA
PLANT:	NA

Rev	DATE	DESCRIPTION	DRN	CHKD	APPD	DWG NO.	SUBJECT
1	04/26/06	Changes and updates	RH	EM	BM	3220	Changes

REVISION HISTORY — REF. DWGS

DETCON INC.
3200 Research Forest Dr. A-1 * The Woodlands Texas 77381 * www.detcon.com

CLIENT: NA		700 RAM with Sensor Deminsional	
PROJECT: NA			
DRAWN BY: R HUTSKO	SCALE: NTS	SALES ORDER NO.: NA	DRAWING NO.: 3220-3
FIRST ISSUE: 01/27/06		DETCON PRPOSAL #: NA	SIZE: A / REV: 1

JOB NO.	SIZE	DRAWING NO.	REV
NA	A	3220-3	1