



MILLENNIUM 2-Channel Rack Mount Controller

User Manual

Model:

RM2-ARD

covering

FIRE (F)/TOXIC (T)/COMBUSTIBLE (C)

combinations

ISO 9001:2000



Part number: MAN-0096 Rev 0
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IMPORTANT INFORMATION

This manual is for informational purposes only. Although every effort has been made to ensure the correctness of the information, technical inaccuracies may occur and periodic changes may be made without notice. Net Safety Monitoring Inc., assumes no responsibility for any errors contained within this manual.

If the products or procedures are used for purposes other than as described in the manual, without receiving prior confirmation of validity or suitability, Net Safety Monitoring Inc., does not guarantee the results and assumes no obligation or liability.

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Net Safety Monitoring Inc., products are carefully designed and manufactured from high quality components and can be expected to provide many years of trouble free service. Each product is thoroughly tested, inspected and calibrated prior to shipment. Failures can occur which are beyond the control of the manufacturer. Failures can be minimized by adhering to the operating and maintenance instructions herein. Where the absolute greatest of reliability is required, redundancy should be designed into the system.

Warranty

Net Safety Monitoring Inc., warrants its electronic assemblies for 36 months from date of purchase.

No other warranties or liability, expressed or implied, will be honoured by Net Safety Monitoring Inc.

Contact Net Safety Monitoring Inc., or an authorized representative for details.

We welcome your input at Net Safety Monitoring. If you have any comments please contact us at the phone/address below or visit our web site and complete our on-line customer survey: www.net-safety.com.

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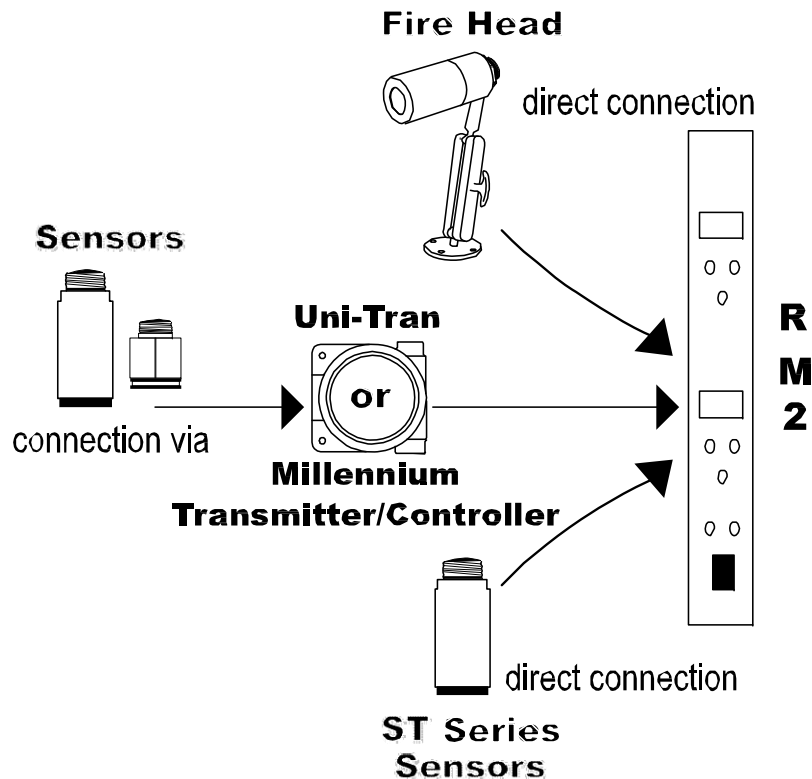
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INTRODUCTION

RM2 SYSTEM

The **RM2-ARD** is a 2-channel, 4-20 mA input monitor for use with a variety of Net Safety's monitoring devices. Channel #1 and Channel #2 function independently and can be used for any combination of Net Safety's fire detectors, toxic gas sensors or combustible sensor with transmitters. The available outputs from this device are: 4-20 mA **analog** signal, **relay** and **digital** for Modbus applications. For Modbus setup see pages 17-20.

Note: All three (3) outputs can be utilized at the same time.



Fire Head

Net Safety's UV/IRS, UVS, IRS, UVU-120-H2 and Phoenix IR3S fire detector heads can be used in conjunction with the RM2.

ST Series Sensors

A variety of Net Safety's ST Series 4-20 mA Toxic gas sensors can be connected to the RM2.

Combustible Sensors and Transmitters / Controllers

Net Safety's Uni-Tran and Millennium Combustible Gas Controllers or Transmitters can be used in conjunction with the RM2. Combustible sensors should always be connected to transmitter or controller. The 4-20 output from this combination then connected to the RM2.

Manual

The manual has been designed to make installation of the RM2 System easy. To ensure proper installation and usage follow the simple steps outlined in the following pages. Consult the manual provided with the detector device(s) being connected to the RM2 for specific information.

If you encounter any problems, consult the troubleshooting section or contact your sales representative.

Step 1 — INSTALL

Step 2 — WIRE

Step 3 — OPERATE

Step 4 — MONITOR

Step 5 — MAINTAIN

STEP 1 — INSTALL

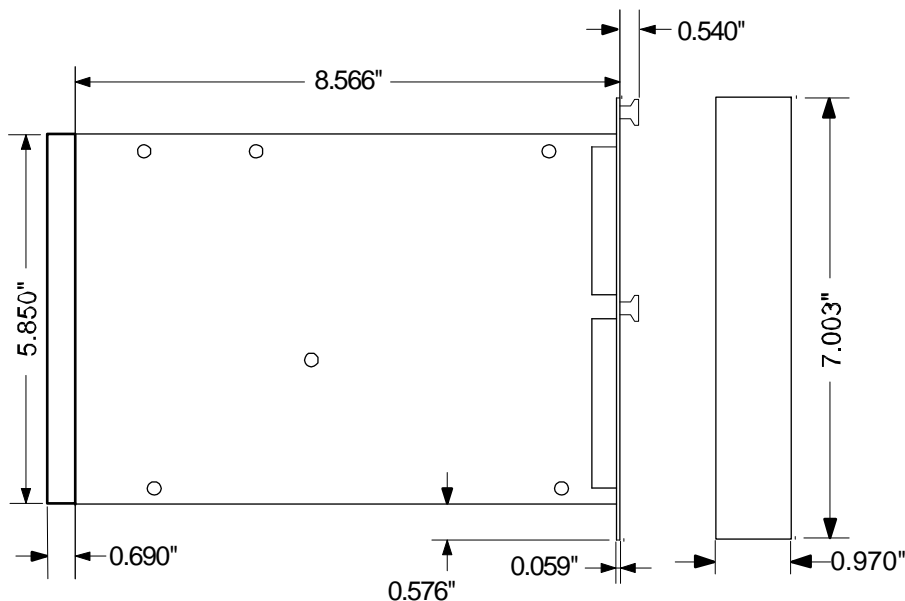
UNPACK

Carefully remove all components from the packaging. Check components against the enclosed packing list and inspect all components for obvious damage such as broken or loose parts. If you find any components missing or damaged, notify your representative or Net Safety Monitoring immediately.

Locate

Locate Fire Heads, Sensors, Controllers or Transmitters as per the manual provided with the specific product.

Figure 1: Dimensional Drawings



Mount

The RM2 can be fitted into a cage and located in a Class 1, Division 2 location.

STEP 2 — WIRE

FIELD INSTALLATION

WARNING: Wiring codes and regulations may vary. Wiring must comply with applicable regulations relating to the installation of electrical equipment and is the responsibility of the installer. If in doubt, consult a qualified official before wiring the system.

The following figures illustrate the basic connections for a Fire Head, Sensor, Controller or Transmitter as well as information for external equipment. Consult the manual for the specific Fire Head, Controller or Transmitter regarding further wiring information.

Configuration

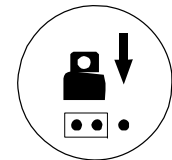
Two Analog Input channels with Current Loop and Relay and Digital Output. Refer to Figure 2, "Analog/Relay/Digital RM2 System Board—Wiring", on page 3 for illustration.

SETTINGS

Once field wiring is complete, the Relay Contacts and the Isolated/Non-isolated analog outputs should be configured.

Using Jumpers

Place Jumper(s) over appropriate pins in order to set Relays Contacts as Open or Closed, and set Isolated or Non-isolated analog output. See Figure 2 on page 3.



Relay Outputs

The relay outputs have SPDT, form C, normally open/normally closed contacts rated for 5 Amps @ 30 V dc or 250 V ac. Each channel has two dedicated alarm relays and a fifth relay is a Common Fault relay.

Current Outputs

A 4-20 mA dc analog current output (isolated/non-isolated) transmits information to other devices.

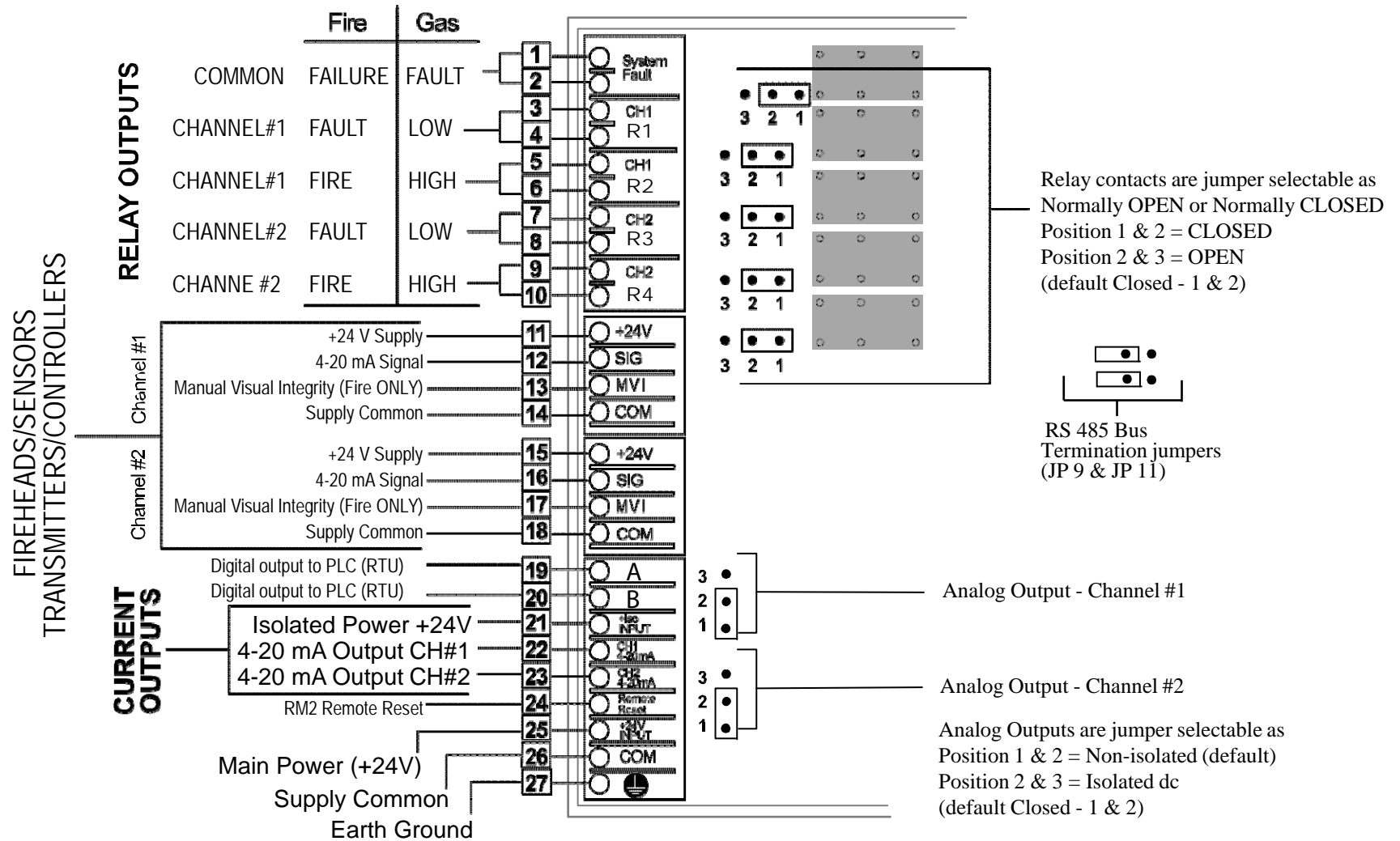
Digital Outputs

For digital output, connections to PLC (RTU) are made via terminals 19 and 20 (A and B) for Modbus communications. See page 3 and pages 17-20.

RS 485 Bus Terminator Jumpers (JP9 and JP11) should be placed over jumper pins for Modbus communication. The user should wire the system according to RS 485 convention and local Electrical codes.

Figure 2: Analog/Relay/ Digital RM2 System Board—Wiring

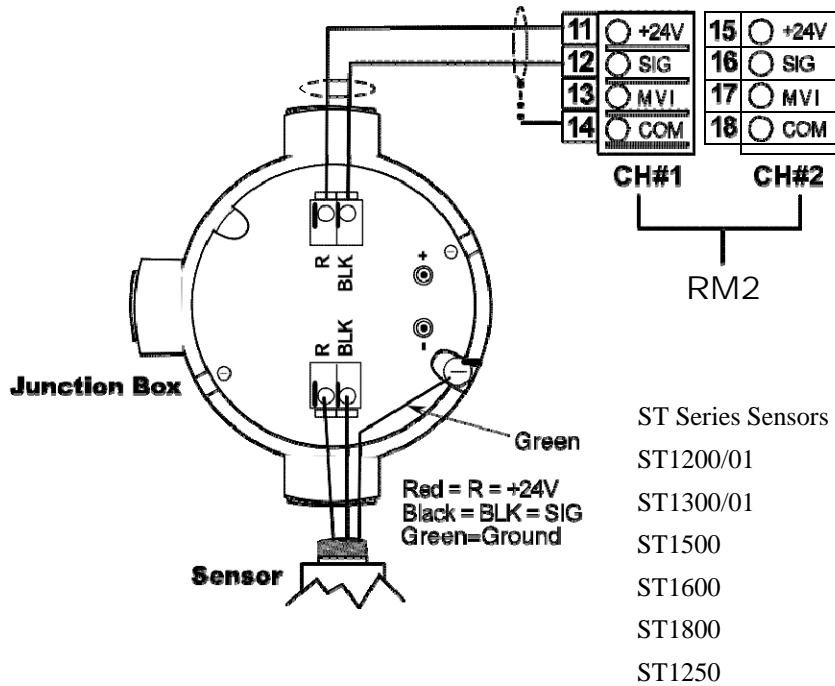
Note: The Common System Fault Relay is fixed as Energized/Non-latching.
 Refer to Table 2 on page 13, Table 4 on page 15 and Table 5 on page 16 for status indicators.



Note: Connect Shield to Supply Common (COM). Refer to "Remote Reset—Wiring" on page 4 for instructions on wiring a Remote Reset button.

Note: For **FIRE HEAD** and **CONTROLLER/TRANSMITTER** wiring, consult the manual provided with the fire or gas product for specific wiring instructions.

Figure 3: ST Series Toxic SENSOR—Wiring

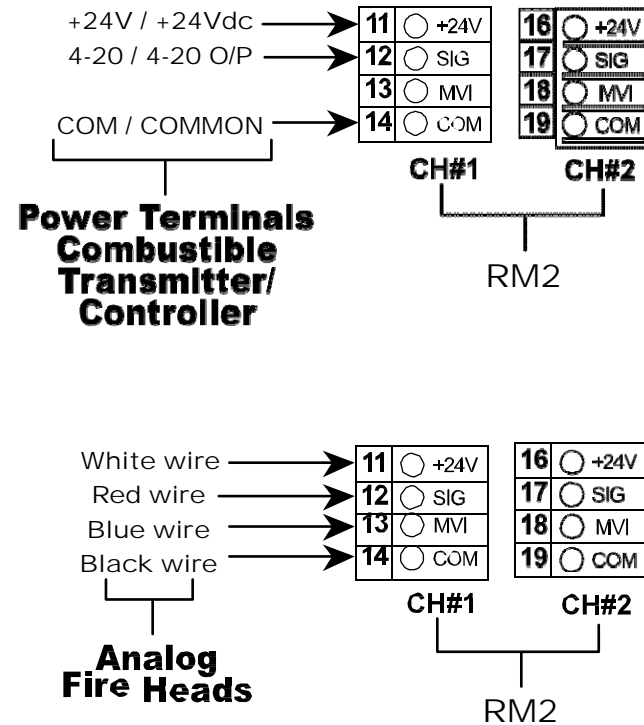


Note: Refer to MAN-0081 for terminal designations if the Net Safety multi-purpose junction box is being used.

Note: For ST Series Toxic sensors, use shielded copper instrument wire (minimum 18 AWG) for separations up to 500 feet; use 16 AWG for separations of 500 to 2000 feet. Consult the factory if greater distance required.

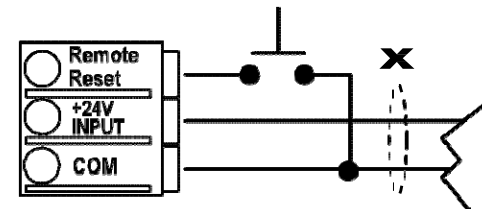
Note: To compensate for distance when remotely calibrating (sensor wired for separation), decrease the tubing diameter or increase the calibration gas flow rate. Always confirm calibration at the sensor.

Figure 4: FIRE HEAD and CONTROLLER/TRANSMITTER—Wiring



Note: Refer to the FIRE HEAD or CONTROLLER/TRANSMITTER manual for more detailed wiring instructions.

Figure 5: Remote Reset—Wiring



Note: Clears latched alarms for both RM2 channels.

STEP 3 — OPERATE

START UP

Once all terminal wiring and Jumper settings are complete, the RM2 may be powered up.

The time it takes the RM2 to power up is dependent on whether it is connected to a Fire head , a transmitter/controller with sensor or directly to ST series sensor. For **CONTROLLERS** with sensor and **FIRE Heads** , a 90 seconds routine will begin after the system has been powered up; the System Status LED blips green and current output is 3.0 mA. The unit will power up immediately when a ST series sensor is directly connected to it.

Note: Channel types are defined at purchase and factory set.

Normal Operation

Once the warm-up routine has ended, normal operation begins as indicated in Table 1.

Table 1: Normal Operation Indicators

Type	System Status LED	Channel 1 or 2 Display Message	Current Output
Fire Head	Green Blip	N O R M	4.0 mA
ST Series Sensors		0 0	
Controllers/ Transmitters		0 0	

Operational Test

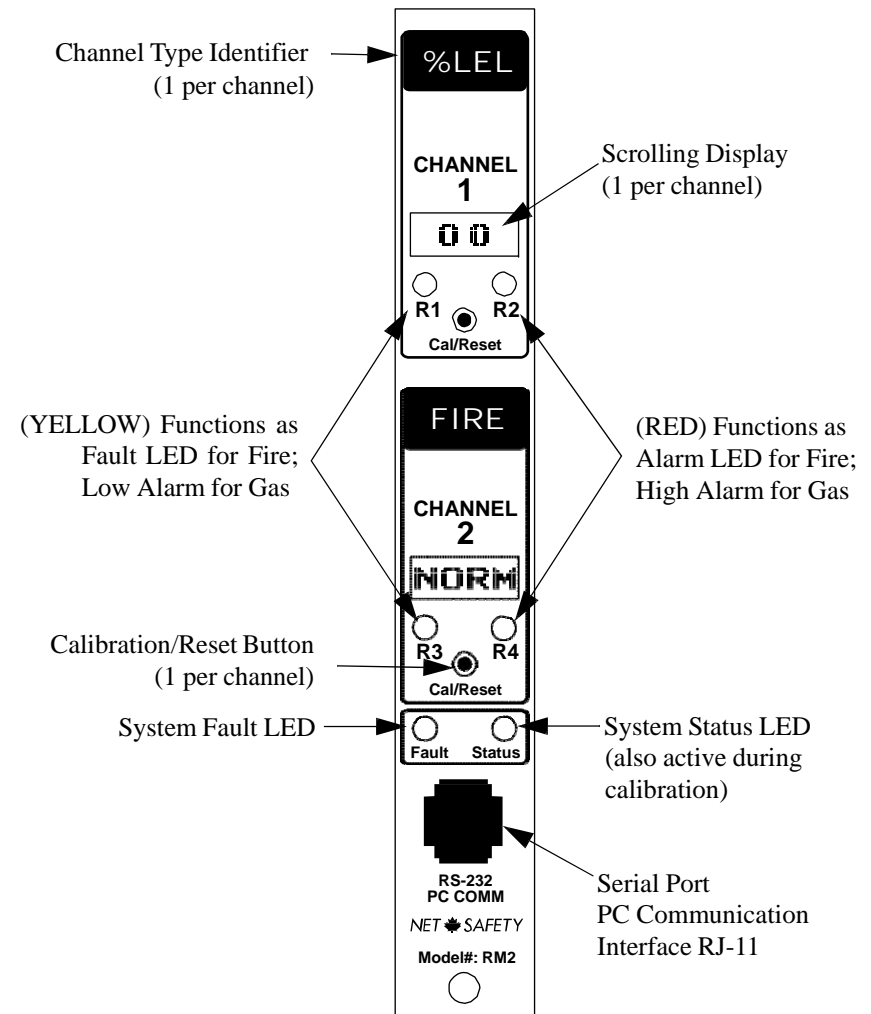
Once normal operation has been established, consult the manual provided with the Fire Head, Sensor, Controller or Transmitter for instructions on operational testing.

Ensure that all safety precautions and regulatory requirements for the application are met.

FRONT PANEL

The RM2 Front Panel contains convenient LEDs and displays to provide information regarding the RM2 status; the push button facilitates various settings/activities; and the RS-232 port supports communication with a PC.

Figure 6: RM2 Front Panel Functionality



LEDs

There are two LEDs dedicated to each channel and two additional System LEDs. The LEDs will turn solid or flash depending upon the status of the RM2.

Refer to the section titled "Monitor" on page 12 and review the tables listing the various devices, LEDs and states.

Channel LEDs

Two LEDs are dedicated to each channel and, depending on the type of detector connected (fire or gas), the LED indicates which relay has been tripped.

LED MARKED	GAS CONNECTED	FIRE CONNECTED	LED COLOUR
R1 or R3	LOW alarm	FAULT alarm	yellow
R2 or R4	HIGH alarm	FIRE alarm	red

Common System LEDs

A Fault and Status LED are provided and are common to both channels. The Status LED is also active during calibration.

Display

Each channel has a separate, 4-character scrolling display visible in most lighting conditions.

Cal/Reset Button

Each channel has a push button for calibration (ST SENSORS only), setting relay options, clearing latched alarms, turning channels on or off and bypassing channels.

RS-232 PC COMM port

The COMM port is an RJ-11 compatible, RS-232 suitable PC communications port for interfacing with the RM2 at the Front Panel (refer to "Communication" on page 6 for details).

Using the Front Panel

1. Ensure that the RM2 has been turned on and no fault is present.
2. Press and hold the Cal/Reset button until the message `S w i t c h O n` displays and the countdown 10 to 1 finishes.
3. An option will scroll across the display followed by the prompt `Y E S ?`
4. To select an option, momentarily press the Cal/Reset button at the `Y E S ?` prompt.
5. If you do not wish to select that option wait until the next option appears and then select `Y E S ?`
6. A selection is acknowledged with a flashing `Y E S .`
7. If no option is selected, the RM2 returns to normal operation.

COMMUNICATION

RS-232 Communications Port

The RS-232 is compatible with standard terminal software which must be used to communicate with the RM2. The terminal software can be used to modify various options, set parameters and view the Event Log.

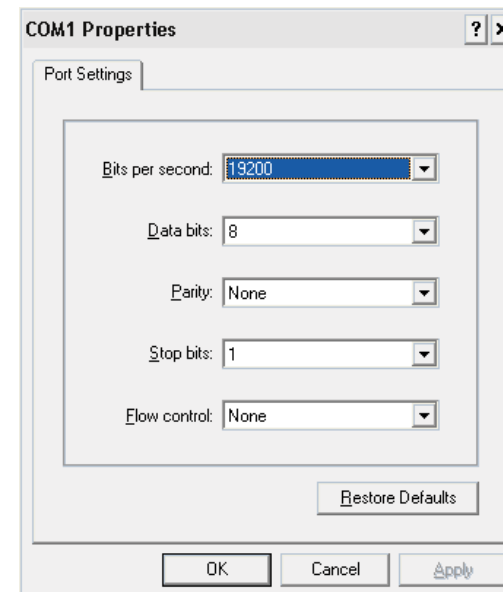
A RJ-11 compatible cable and DB9 connector are required to connect the RM2 serial port (refer to "Part Numbering" on page 18) to an interface device such as PDA or computer loaded with standard Terminal software.

WARNING: The Alarm System connected to the RM2 must be in Bypass.

Terminal Software

RS-232 compatible terminal software must be installed on the device communicating with the RM2 (i.e., computer, PDA, etc.). When creating a new connection definition, the appropriate COM port must be defined for proper communication to be established. The Properties for that port must be set as shown in Figure 7, "Terminal Software—Setup Properties", on page 6.

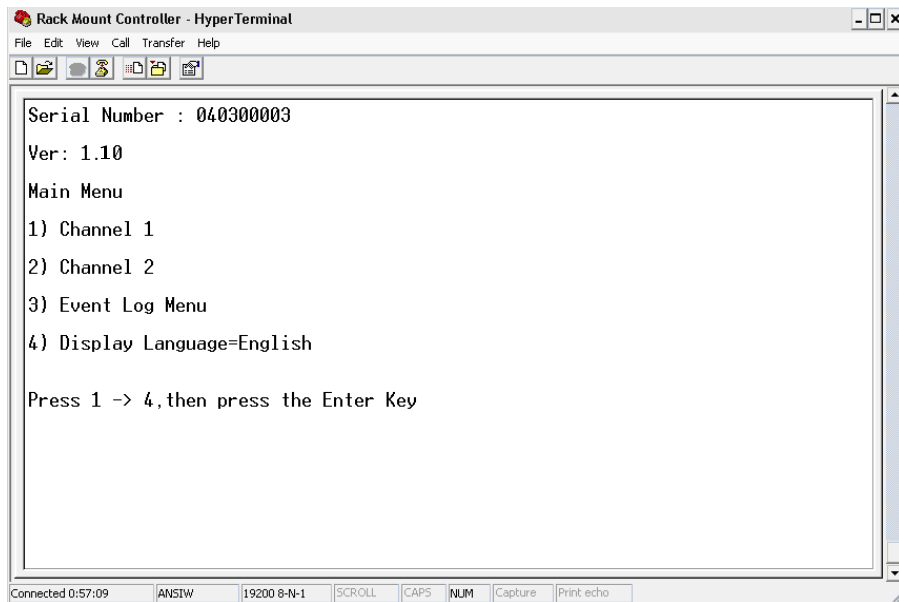
Figure 7: Terminal Software—Setup Properties



Using Terminal Software

1. Open terminal software and establish a connection.
2. Once connected, press Enter for Main Menu.
3. The Main Menu will display an entry for each channel plus Event Logging and Display Language as well as a serial and version number.
4. Enter a number 1, 2, 3, etc., and press Enter to make a selection from any menu.
5. Press Enter twice to return to the Main Menu.

Figure 8: Terminal Software—Main Menu



SETTING OPTIONS

Options can be set from the Front Panel, the RS-232 Terminal interface or, in some cases, both.

WARNING: DO NOT interrupt setup from Front Panel by using Terminal software.

Front Panel / Terminal Functionality

	Front Panel	Terminal
Calibrate SENSOR*	*	
Set and Review Relay settings	*	*
Set Sensor Range		*
Set Display Language		*
Reset Channel	*	
Power Down mode per channel	*	
Momentary BYPASS** mode per channel	*	
Channel Permanent OFF		*
Define Channel Type		*
Event Logging - setup and review		*
Current Firmware version		*
* ST Series Sensors only; otherwise calibrate from Uni-Tran/Millennium controller/transmitter.		
** BYPASS mode is only available when both channel types are FIRE.		

Power Down Mode

Each channel can be individually turned off from the Front Panel for maintenance.

WARNING: When in power down mode, the RM2 channel will neither alarm nor transmit current output.

1. Press and hold the Cal/Reset button on the Front Panel. Wait for the `Switch On` message and countdown (10-0) to complete.
2. When `Power Down Channel YES?` displays press the Cal/Reset Button.
3. The message `Are you sure? YES?` displays. At the `YES?` prompt, press the Cal/Reset button to select. The RM2 channel is now powered down.
4. The message `Off` will continue to scroll on the display while the channel is in power down mode.
5. To return to normal channel operation, press the Cal/Reset button. Channels defined as **FIRE** have a 90 second start delay prior to returning to normal operation.

BYPASS Mode—FIRE only

When both Channels are defined as **FIRE**, each channel can be individually placed into Bypass mode from the Front Panel for testing and detector replacement. When in Bypass mode, the channel relays will not trip nor will an output signal be transmitted.

Bypass mode is momentary; pressing the Cal/Reset Button will return the Channel to normal operation.

1. Press and hold the Cal/Reset button on the Front Panel. Wait for the `Switch On` message and countdown (10-0) to complete.
2. When `Channel Bypass YES?` displays press the Cal/Reset Button.
3. The message `Are you sure?` displays. At the `YES?` prompt, press the Cal/Reset button to select.
4. The message `Bypass Channel` will continue to scroll and the Yellow System Fault LED will turn Solid. Press the Cal/Reset Button at any time to return channel to `NORM`.

Permanent OFF

If a channel is not required, it can be permanently turned OFF using the Terminal Software.

1. Open terminal software and establish a connection.
2. Once connected, press Enter for Main Menu.
3. Select the Channel number to be turned off.
4. Enter 1 (sensor type) until `=OFF` is displayed.

Note: The Terminal Software must also be used to turn the Channel ON.

RELAY OPTIONS

Review Relay Settings

The current relay settings can be viewed using either the Terminal Software or the Front Panel. Use Cal/Reset button for either channel and select `Review Relay Settings` when using Front Panel; enter a channel number and review displayed settings using Terminal Software.

Figure 9: Terminal Software—Relay Settings

Current Setting for Channel #1

1) Sensor type=Fire

Fault Relay=Energized, Non Latching

High Alarm

2) Coil Status=De-Energized

3) Latch Status=Non Latching

Press 1->3, then press the Enter key

default settings (fixed)

Refer to "FIRE" on page 9 for details regarding these relay settings.

Current Setting for Channel #2

1) Sensor type=ST Series

Fault Relay: Energized, Non Latching

High Alarm

2) Coil Status=De-Energized

3) Latch Status=Non Latching

4) High Alarm Level=40

Low Alarm

5) Coil Status=De-Energized

6) Latch Status=Non Latching

7) Low Alarm Level=20

8) Sensor Range=100

Press 1->8, then press the Enter key

or Unitran/Millennium

default settings (fixed)

Refer to "ST SERIES SENSORS/ CONTROLLERS" on page 9 for details regarding these relay settings.

Selectable 10, 20, 25, 50, 100, 200, 250, 500, 1000

Note: When switching Sensor Type, establish a new connection and reset all options.

WARNING: Do not attempt to setup the RM2 using the Terminal Software if setup has already begun at Front Panel.

Setting Relays—Terminal Software

Set the Low and High Alarm relays for Gas as well as Sensor range. Set the High Alarm for Fire. The Fault Relay is fixed as Energized/Non-latching and cannot be changed.

WARNING: The scale (PPM) of the sensor connected, with or without a controller, must match the scale entered in the field Sensor Range.

1. Open terminal software and establish a connection.
2. Once connected, press Enter twice for Main Menu.
3. Enter a number 1 or 2 for the required Channel.
4. Enter the number for a setting. In most cases, entering a number will toggle between setting options; for alarm levels and range, a prompt will appear at the bottom of the screen. Enter level/range and press Enter again to confirm entry.
5. Press Enter twice to return to the Main Menu.

Setting Relays—Front Panel

FIRE

The High Alarm (Fire relay) can be set to Energized or De-Energized and Latching or Non-latching. The Fault Relay is fixed as Energized/Non-latching.

- Step 1:** Press and hold the Cal/Reset button on the Front Panel. Wait for the Switch On message and countdown (10-0) to complete.
- Step 2:** When Set Relay Options YES? displays press the Cal/Reset Button.
- Step 3:** The message High Alarm---Coil Status displays. The display then shows Energized YES? and then De-Energized YES?. Press the Cal/Reset Button to select the setting when it displays. The flashing YES confirms the selection. If no selection is made, the next option displayed.
- Step 4:** The message Latch Status displays. The display then shows Latching YES? and then Non Latching YES?. Press the Cal/Reset Button to select the setting when it displays. The flashing YES confirms the selection.
- Step 5:** Once set, the RM2 will return to NORM.

ST SERIES SENSORS/CONTROLLERS

There are two settings for the Alarm Relays: Low and High. The Coil Status, Latch Status and Alarm Level for the Low alarm are set first, followed by the High. The Fault Relay is fixed as Energized/Non-latching and cannot be changed.

- Step 1:** Press the Cal/Reset button, wait for countdown to finish and when Set Relay Options YES? displays press the Cal/Reset Button again to select. The flashing YES confirms the selection.
- Step 2:** The message Low Alarm---Coil Status displays. The display then shows Energized YES? and then De-Energized YES?. Press the Cal/Reset Button to select the setting when it displays. The flashing YES confirms the selection.
- Step 3:** The message Latch Status displays. The display then shows Latching YES? and then Non Latching YES?. Press the Cal/Reset Button to select. The flashing YES confirms the selection.
- Step 4:** The message Set Low displays. Low alarm set-points are then displayed in varying increments (increment dependant upon defined sensor range). When the required level displays, press the Cal/Reset Button to select. The level chosen will flash to confirm the selection.
- Step 5:** The message High Alarm---Coil Status displays. The display then shows Energized YES? and then De-Energized YES?. Press the Cal/Reset Button to select. The flashing YES confirms the selection.
- Step 6:** The message Latch Status displays. The display then shows Latching YES? and then Non Latching YES?. Press the Cal/Reset Button to select. The flashing YES confirms the selection.
- Step 7:** The message Set High displays. High alarm set-points are then displayed in varying increments (increment dependant upon defined sensor range). The high alarm set-point is always higher than the low alarm level. When the required level displays, press the Cal/Reset Button to select. The level chosen will flash to confirm the selection.
- Step 8:** Once set, the RM2 will return to 00.

SELECT DISPLAY LANGUAGE

The display language can only be set using the Terminal interface.

1. Open terminal software and establish a connection.
2. Once connected, press Enter twice for Main Menu.
3. The Main Menu will display.
4. Enter the number 4 to select 4) Display Language.
5. The language will change to Espanol then Francais and back to English each time 4 is entered.
6. Press Enter twice for Main Menu.

Note: The factory default is English.

CALIBRATION

WARNING: When using a combustible sensor with the RM2, the sensor has to be connected to a transmitter or controller. The 4-20 output from this configuration is then connected to the RM2 as signal. Calibration must be performed transmitter or controller NOT the RM2. Refer to the Uni-Tran or Millennium transmitter manuals for calibration instructions.

Use the **CONTROLLERS /TRANSMITTERS** to monitor display messages. Not all messages will appear at RM2.

Calibration Procedure—ST Series SENSORS

WARNING: The calibration procedure requires approximately 5 minutes to complete. If gas is not applied at the appropriate time, a calibration failure may occur (refer to "Calibration Failure/Interruption" on page 11 for specific information).

For accurate performance, calibrate sensors using 50% span of the specific gas of concern. The concentration of gas, corresponding to 100% of full scale, is converted to a linear 4 to 20 mA output signal which can be powered from the primary dc supply of the instrument. Power up the unit for at least 4 hours BEFORE first calibration.

The following calibration procedure should be followed to ensure an accurate correlation between the 4 to 20 mA output signal and the gas concentration.

Note: The ST Series SENSORS must be calibrated from the RM2 Front Panel.

1. Confirm successful power up of RM2—Status LED Green Blip; no fault indicated.
2. Press and Hold Cal/Reset Button until S w i t c h O N and countdown completes.
3. When C a l i b r a t e S e n s o r Y E S ? displays, press the Cal/Reset Button to select Y E S ? Selection will be confirmed by a flashing Y E S .
4. When A p p l y C l e a n A i r displays apply clean air.
5. Wait for A p p l y 5 0 % S p a n G a s to display and apply specific gas at a rate of 0.5 litres per minute.
6. The display will show the actual gas value at last calibration.
7. Remove span gas when the message R e m o v e G a s displays.
8. The message C a l C o m p l e t e will display when calibration is complete.
9. Apply zero gas (clean air) again to purge system.

Note: Always apply test gas after calibration to verify operation.

Figure 10: Calibration Procedure

Display Shows	Action	Status LED and Current Output
Calibrate Sensor YES ?	Select YES ?	
Apply Clean Air	Apply clean (zero air)	Status LED Solid Green / 3.0 mA
Apply 50 % Span Gas	Apply specific gas	Status LED Fast Flash Red / 3.3 mA
Calibrating Gas Value @ last calibration	Wait	Status LED Fast Flash Red / 3.3 mA
Remove Gas	Remove gas	Status LED Solid Green / 3.6 mA
Cal Complete	Apply clean air to purge system	Status LED Solid Green / 3.6 mA
00	Normal Operation	Status LED Blip / Green 4.0 mA

Abort Calibration

The Calibration procedure may be aborted. When the display shows Apply 50 % Span Gas, press and hold the Cal/Reset button until the abort calibration countdown 10-0 completes and the display returns to 00.

Calibration Failure/Interruption

If the calibration procedure fails, the Status LED alternates between Green and Red and the analog output changes back and forth from 3.0 to 3.3 mA. The message Fail Zero is displayed if span gas is not applied or recognized; the message Fail Span will display if the calibration process is interrupted.

The unit remains in a failed state until manually reset. After the Manual Reset, the unit will return to normal operation based on previous calibration values. See "Manual Reset" on page 11 for instructions.

RESET

Manual Reset

A Manual Reset is required to clear a latched relay alarm for individual channels. Simply press the specific Channel's Cal/Reset Button, on the Front Panel of the RM2, to clear a latched alarm.

Remote Reset

The RM2 can be wired to an external device (refer to illustration "Remote Reset—Wiring" on page 4) so latched alarms for both channels may be remotely cleared.

STEP 4 — MONITOR

EVENT LOGGING

The Event Logging feature securely stores in protected RAM up to 1000 events. The time and date of each occurrence is recorded along with the channel, detector type and the associated alarm, fault or calibration event. A maximum of 1000 events are stored although as few as 10 events may be viewed at a time. When the 1000th event is reached, the first event stored will be removed.

In order to accurately track events, the time and date must first be set.

Setting Time and Date

- Step 1:** Open terminal software and establish a connection.
- Step 2:** Press Enter for Main Menu.
- Step 3:** Type 3 and press Enter to select 3) Event Log Menu.
- Step 4:** Type 1 and press Enter to select 1) Time.
- Step 5:** Enter the hour (24 hours) and then minutes.
Use 2-digits for hour/minutes and separate with a space.
- Step 6:** Type 2 and press enter to select 2) Date.
- Step 7:** Enter the day/month/year using 2-digits for each and separate with a space.
- Step 8:** Press Enter to confirm entry.

Figure 11: Event Logging Menu

```
Event Logging Menu
1) Time (HH:MM)=14/04
2) Date (DD/MM/YY)=03/12/03
3) Display last 10 Events
4) Display All Events

Enter 1->4, then press the Enter key
```

Once the time and date have been set the RM2 will automatically and accurately track the alarm and fault conditions as well as other events such as sensor calibration.

Figure 12: Event Logging Display Menu

```
Time (HH:MM) :14.12 - Date (DD/MM/YY) :03/12/03 - Ch:02 Event: vi fault
Time (HH:MM) :14.12 - Date (DD/MM/YY) :03/12/03 - Ch:02 Event: Warning!!
Time (HH:MM) :14.12 - Date (DD/MM/YY) :03/12/03 - Ch:01 Event: high alarm
Time (HH:MM) :03.11 - Date (DD/MM/YY) :03/17/03 - Ch:02 Event: fire
Time (HH:MM) :19.12 - Date (DD/MM/YY) :05/02/03 - Ch:02 Event: fault
Time (HH:MM) :22.09 - Date (DD/MM/YY) :06/22/03 - Ch:01 Event: high alarm
Time (HH:MM) :06.01 - Date (DD/MM/YY) :08/11/03 - Ch:01 Event: calibrate

Press Enter Key to exit
```

Note: Press Enter at any time to stop the scroll through all events.

FIRE

Table 2: FIRE—Current Output, LEDs and Display Messages

Status	Current O/P	Channel 1 and 2 LEDs		System LEDs			Scrolled Display Messages
		R1 & R3 Fault (yellow)	R2 & R4 Fire (red)	Fault (yellow)	Status (red)	Status (green)	
Power Down Mode	0 mA	off	off	off	-	Blip	Off
RM2 System failure	0 mA	-	-	Solid	-	-	last message*
Fire Head Electronic failure	0-0.5 mA	Solid	off	off	-	Blip	Sensor Fault
Internal Power Fault or system power out of range	1.0 mA	Solid	off	off	-	Blip	Sensor Fault
Automatic VI Test Failure	2.0 mA	Solid	off	off	-	Blip	VI Fault
Start Delay (90 seconds)	3.0 mA	off	off	off	-	Blip	Start Delay Millennium
Normal Operation	4.0 mA	off	off	off	-	Blip	NORM
Bypass mode	4.0 mA	off	off	Solid	-	Blip	Channel Bypass
Background radiation source UV	6.0 mA	off	off	off	-	Blip	UV Present
Background radiation source IR	8.0 mA	off	off	off	-	Blip	IR Present
Early Warning - Intermittent radiation detected	16.0 mA	off	off	off	-	Blip	Warning!!
Fire confirmed	20.0 mA	off	Solid	off	-	Blip	FIRE (flashes)

* The last message displayed prior to the failure will remain on the display.

FIRE ONLY—Manual Visual Integrity (VI) Testing

The RM2 can be wired (using Terminal 13 for Channel 1 and Terminal 17 for Channel 2) so **FIRE HEAD** Visual Integrity test results can be displayed and monitored by the RM2.

WARNING: Both Channels must be set to **FIRE** for VI Testing and the connected alarm system placed in bypass. The Phoenix IR3S cannot be wired for VI testing.

- Step 1:** Press and hold Channel #1 or #2 Cal/Reset button on the Front Panel. Wait for the `S w i t c h O n` message and countdown (10-0) to complete.
- Step 2:** When `M a n u a l V I T e s t Y E S ?` displays press the Cal/Reset Button.
- Step 3:** After 5 seconds, the test lamp turns on for 30 seconds and analog output drops to 3 mA.
- Step 4:** Refer to Table 3 below for the list of possible status messages for the Visual Integrity Test.
- Step 5:** The VI Test message is displayed for 30 seconds or press and hold the Cal/Reset Button until the VI display message flashes (approximately 10 seconds) to return to `N O R M` before the 30 seconds.

Table 3: Manual Visual Integrity Testing—**FIRE only**

Status	Display Message
VI Fault	F A I L
Optical surfaces require cleaning	P A S S
Optical surfaces clean	G O O D
Optical surfaces perfectly clean	B E S T

FIRE ONLY—Force Alarm Output Test

The Force Alarm Output tests Relay contacts by switching relays for 2 seconds and stepping Analog output through the primary alarm levels. Tests are initiated from the RM2.

WARNING: The connected alarm system must be placed in bypass during the Force Alarm Output test.

- Step 1:** Press and hold Channel #1 or #2 Cal/Reset button on the Front Panel. Wait for the `S w i t c h O n` message and countdown (10-0) to complete.
- Step 2:** When `F o r c e A l a r m O u t p u t Y E S ?` displays press the Cal/Reset Button.
- Step 3:** When `I s i t S a f e t o A c t i v a t e A l a r m s ? Y E S ?` displays, press the Cal/Reset Button.
- Note:** If you do not press `Y E S ?` as this prompt, the RM2 will return to normal operation.
- Step 4:** When `R e l a y s Y E S ?` displays, press the Cal/Reset Button. The flashing `Y E S` confirms the selection. The message `O n` will flash 4 times during the Relay test and then return to `N O R M`. If `Y E S ?` is not selected, the next option is displayed.
- Step 5:** When `A n a l o g O P ? Y E S ?` displays, press the Cal/Reset Button. The RM2 will then test primary analog output responses and then return to `N O R M`.

ST SERIES SENSORS

When calibrating a sensor, status is reflected by the System LEDs.

Table 4: ST SERIES SENSORS—Current Output, LEDs and Display Messages

Status	Current O/P	Channel 1 and 2 LEDs		System LEDs			Scrolled Display Messages
		R1 & R3 Low (yellow)	R2 & R4 High (red)	Fault (yellow)	Status (red)	Status (green)	
Start Delay (few seconds)	3.0 mA	off	off	off	-	Blip	Start Delay Millennium
Normal operation	4.0 mA	off	off	off	-	Blip	00
Power Down Mode	0 mA	off	off	off	-	Blip	Off
RM2 System failure	0 mA	-	-	Solid	-	-	last message*
Sensor Fault	<2.5 mA	off	off	Solid	-	Blip	Sensor Fault
Excess drift (>10%)	2.5 mA	off	off	Solid	-	Blip	Neg Drift
Calibrate Sensor	3.0 mA	off	off	off	-	Solid	Calibrate Sensor
Apply clean air	3.0 mA	off	off	off		Solid	Apply Clean Air
Apply calibration gas - 50% span	3.3 mA	off	off	off	Fast Flash	-	Apply 50% Span Gas (gas value)
Span is set, remove gas	3.6 mA	off	off	off	-	Solid	Remove gas
Return to normal operation	3.6 mA	off	off	off	-	Solid	Cal. complete
Calibration procedure failed/interrupted	3.0 / 3.3 mA	off	off	off	Alternate		Fail Zero Fail Span
Gas present	>4.0-20.0 mA	ON (when set point reached)	ON (when set point reached)	off	-	Blip	1 to 100% full Scale (gas value)

* The last message displayed prior to the failure will remain on the display.

CONTROLLERS/TRANSMITTERS

The RM2 receives and interprets the 4-20 current output sent by the Uni-Tran or the Millennium. Not all visual alerts will appear at the RM2.

Table 5: CONTROLLERS/TRANSMITTERS—Current Output, LEDs and Display Messages

Status	Current O/P	Channel 1 and 2 LEDs		System LEDs			Scrolled Display Messages
		R1 & R3 Low (yellow)	R2 & R4 High (red)	Fault (yellow)	Status (red) (green)		
Start Delay (90 seconds) Message will also appear when calibrating from the CONTROLLER/TRANSMITTER	3.0 mA	off	off	off	off	Blip	Start Delay Millennium
Normal operation Message will also appear when calibrating from the CONTROLLER/TRANSMITTER	4.0 mA	off	off	off	off	Blip	00
Power Down Mode	0 mA	off	off	off	off	Blip	Off
RM2 System failure	0 mA	off	off	Solid	off	off	last message*
Sensor Fault	2.5 mA	off	off	Solid	off	Blip	Sensor Fault
Gas present	>4.0-20.0 mA	ON (when set point reached)	ON (when set point reached)	off	off	Blip	1 to 100% full Scale

* The last message displayed prior to the failure will remain on the display.

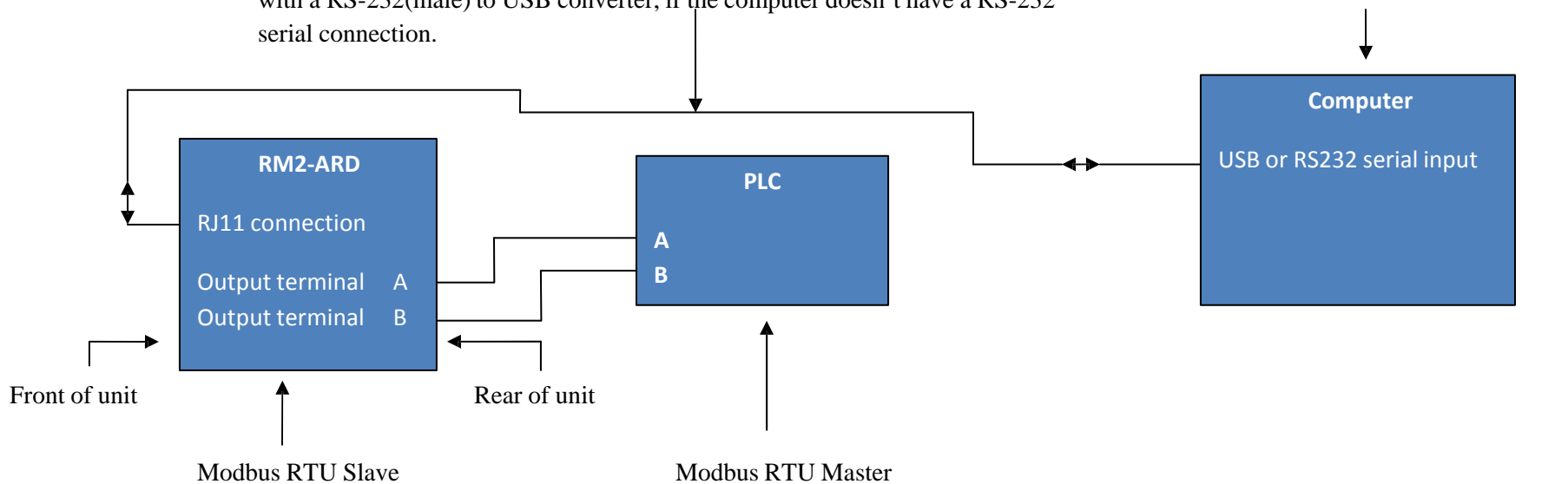
Digital output from Modbus Set-up:

The RM2-ARD also allows digital output to be monitored by the user. Ensure that the proper connections are made when connecting the RM2-ARD output terminals 19 and 20 (marked 'A' and 'B') to PLC (RTU). For output bit assignments for Combustible and Toxic sensor see table 7 and table 8. For output bit assignment for Fire head see table 9.

Hardware Setup

Figure 13: User interface for Modbus setup

For Hyper Terminal connection: An RJ11 cable with DB9 (female) connector is used for RS-232 serial connection. Use the RJ 11 and DB9 (female) connector with a RS-232(male) to USB converter, if the computer doesn't have a RS-232 serial connection.



Note: For Modbus communication, the user should wire the system according to RS 485 conventions and adhere to local electrical codes.

Software Setup

Connect the Modbus output using baud rates of 4800, 9600, 14.4 K, 19.2K, 28.8 K, 38.4K or 57.6 K bps. Parity is none and stop bit is 1. Addresses are assigned by the user.

Modbus Register definitions

Four Modbus registers are utilized when setting up for digital output. They are as follows:

40001 Scaled sensor output channel 1 40003 Status Bits channel 1(binary)

40002 Scaled sensor output channel 2 40004 Status Bits channel 2(binary)

Binary values of Registers 40003 and 40004 are used indicate the type of sensor /detector being used. With 16 bits(2 byte) assigned to each register , only bits # 's 0, 1, 2 and 3 are utilized at this time. Table 1 below shows the bits assigned for combustible sensor setup, toxic sensor and Flame detector.

Table 6: Status bit assignment for sensor type (Combustible, Toxic and Fire)

Assigned Registers & Channel #	Channel is inactive(turned off)	Status bits for Combustible set-up	Status bits for Toxic sensor(ST series)	Status bits for Fire heads
Register 40003 (Channel 1)	xxxx xxxx 0000 0000	xxxx xxxx 0000 0001	xxxx xxxx 0000 0010	xxxx xxxx 0000 0011
Register 40004 (Channel 2)	xxxx xxxx 0000 0000	xxxx xxxx 0000 0001	xxxx xxxx 0000 0010	xxxx xxxx 0000 0011

Note: The Status bits for **Oxygen** (to be released soon) will be xxxx xxxx 0000 **0100**

GAS: Modbus Registers and Status bit assignment

Combustible gas detection: The table below shows the status registers and bit assignments for various outputs when Combustible gas sensor (with transmitter) is connected to the RM2-ARD unit.

Table 7: Status bit assignment for Combustible (signal from LEL sensor and transmitter) output conditions

Assigned Registers & Channel #	Combustible Power up	Combustible Sensor fault	Combustible Low Alarm activated	Combustible High Alarm activated
Register 4003 (Channel 1)	xxxx xxxx 0001 0001	xxxx xxxx 0010 0001	xxxx xxxx 0100 0001	xxxx xxxx 1000 0001
Register 4004 (Channel 2)	xxxx xxxx 0001 0001	xxxx xxxx 0010 0001	xxxx xxxx 0100 0001	xxxx xxxx 1000 0001

Toxic gas detection: The table below shows the status register and bit assignments for various outputs when a Toxic (ST series) gas sensor is connected to the RM2-ARD unit.

Table 8: Status bit assignment for Toxic sensor (ST series) output conditions

Assigned Registers & Channel #	Toxic Power up	Toxic (ST series) Sensor fault	Toxic Low Alarm activated	Toxic High Alarm activated
Register 4003 (Channel 1)	xxxx xxxx 0001 0010	xxxx xxxx 0010 0010	xxxx xxxx 0100 0010	xxxx xxxx 1000 0010
Register 4004 (Channel 2)	xxxx xxxx 0001 0010	xxxx xxxx 0010 0010	xxxx xxxx 0100 0010	xxxx xxxx 1000 0010

FIRE: Modbus Registers and Status bit assignment

Fire detection: The table below shows the status registers and bit assignments for various outputs when a Fire head is connected to the RM2-ARD unit. Outputs are indicated by address of 40001 and 40002 registers.

Table 9: Status bit assignment for Fire head output conditions

Assigned Registers & Channel #	Fire head Power up	Normal operation	Fire head fault	Background IR Energy(8.0 mA)	Background UV Energy(6.0 mA)
Register 40001 (Channel 1)	xxxx 0000 0000 0001	xxxx 0000 0000 0100	xxxx 0000 0000 1000	xxxx 0000 0001 0000	xxxx 0000 0010 0000
Register 40002 (Channel 2)	xxxx 0000 0000 0001	xxxx 0000 0000 0100	xxxx 0000 0000 1000	xxxx 0000 0001 0000	xxxx 0000 0010 0000

Note: Status bits for output due to Self- test failure (not yet used) will be xxxx xxxx 0000 0010

Table 9 (cont'd): Status bit assignment for Fire head output conditions

Assigned Registers & Channel #	Instant fire warning	Fire present	Channel bypassed, (available only if both channel are set for fire)	Sensor power OFF (loss of power from Fire head)
Register 40001 (Channel 1)	xxxx 0000 0100 0000	xxxx 0000 1000 0000	xxxx 0001 0000 0000	xxxx 0010 0000 0000
Register 40002 (Channel 2)	xxxx 0000 0100 0000	xxxx 0000 1000 0000	xxxx 0001 0000 0000	xxxx 0010 0000 0000

Note: Channel bypass is only available if both channels are set for fire.

STEP 5 — MAINTAIN

SENSORS—Periodic Response Test

We recommend the sensors be verified or calibrated every 3 months. A typical response check involves the application of calibration gas to the sensor, then the observation of the response LEDs, analog output, display and external monitoring equipment. Be sure to prevent unwanted response of external monitoring devices and equipment during this procedure. If the response to calibration gas is within its specified accuracy then it is not necessary to perform a calibration. For example, when 50% of full scale is applied, the response is expected to be between 11.5 mA (47% of full scale) and 12.5 mA (53% of full scale). An additional consideration is the accuracy tolerance of the calibration gas which may be + or - a few percent. If the calibration gas is + or - 10% of full scale then the reading may be from 10.7 mA (42% of full scale) to 13.3 mA (58% of full scale).

TROUBLESHOOT

- Response to the input should be checked and, if necessary, calibration should be performed whenever any of the following occur. Refer to "Calibration" on page 10 for calibration instructions.
 - Excess negative drift is indicated by 2.5 mA current output
 - Sensor or controller/transmitter is connected or disconnected
 - Long term or high concentration exposure to gas
- The RM2 is not designed to be repaired in the field. If a problem should develop, first calibrate the device and carefully check for faulty wiring. If it is determined that the problem is caused by an electronic failure, the device must be returned to the factory for repair. Refer "How to Return Equipment" on page 18 for detailed instructions.
- Apparent sensor failure (see "Calibration Failure/Interruption" on page 11) may occur if calibration process has begun but span gas is not applied when prompted or if span gas is removed during calibration process. Perform a manual reset (refer to "Manual Reset" on page 11) and re-calibrate sensor.
- If Front Panel buttons appear non-responsive—recycle power. (Can occur when set up at Front Panel is interrupted by an attempt to also set up using Terminal). DOES NOT affect detection functionality.
- Consult the manual supplied with the Fire Head, Millennium or Uni-Tran for further troubleshooting information.

HOW TO RETURN EQUIPMENT

A Material Return Authorization number is required in order to return equipment. Please contact Net Safety Monitoring at **(403) 219-0688** before returning equipment or consult our Service Department to possibly avoid returning equipment.

If you are required to return equipment, include the following information:

1. A Material Return Authorization number (provided over the phone to you by Net Safety).
2. A detailed description of the problem. The more specific you are regarding the problem, the quicker our Service department can determine and correct the problem.
3. A company name, contact name and telephone number.
4. A Purchase Order, from your company, authorizing repairs or request for quote.
5. Ship all equipment, prepaid to:

Net Safety Monitoring Inc
2721 Hopewell Place NE
Calgary, Alberta, Canada
T1Y 7J7

6. Mark all packages: **RETURN for REPAIR**

Waybills, for shipments from outside Canada, must state:

Equipment being returned for repair
All charges to be billed to the sender

Also, please ensure a duplicate copy of the packing slip is enclosed inside the box indicating item 1-4 along with the courier and account number for returning the goods.

All Equipment must be Shipped prepaid. Collect shipments will not be accepted.

Pack items to protect them from damage and use anti-static bags or aluminum-backed cardboard as protection from electrostatic discharge.

SPARE PARTS/ACCESSORIES

Table 10: Part Numbering

Description	Net Safety Part Number
Communications Kit	RM2-COM-KIT
Wall mount Controller Box	WM2-HSG-ASSY
Solar Shield, 2-channel Analog/Relay Output for Toxic and Combustible sensors or Fire Detectors	SS2-AR
Solar Shield, 2-channel Controller/Terminal Box	SS2-HSG-ASSY-12V or 24V
Solar Shield 2-Battery Enclosure	SS-2BAT-ASSY
Solar Shield Pole Installation Assembly	SS-POLE-ASSY
Solar Shield 50 Ft Power Cable Extension	CAB-0035
Solar Shield Battery Box Interconnect cable	CAB-0041

Appendix A:

ELECTROSTATIC SENSITIVE DEVICE (ESD)

Electrostatic discharge (ESD) is the transfer, between bodies, of an electrostatic charge caused by direct contact or induced by an electrostatic field.

The most common cause of ESD is physical contact. Touching an object can cause a discharge of electrostatic energy—ESD! If the charge is sufficient and occurs near electronic components, it can damage or destroy those components.

In some cases, damage is instantaneous and an immediate malfunction occurs. However, symptoms are not always immediate—performance may be marginal or seemingly normal for an indefinite period of time, followed by a sudden failure.

To eliminate potential ESD damage, review the following guidelines:

- Handle boards by metal shields—taking care not to touch electronic components
- Wear grounded wrist or foot straps, or ESD shoes or heel grounders to dissipate unwanted static energy
- Prior to handling boards, dispel any charge in your body or equipment
- Ensure components are transported and stored in static safe packaging
- When returning boards, carefully package in the original carton and static protective wrapping
- Ensure ALL personnel are educated and trained in ESD Control Procedures

In general, exercise accepted and proven precautions normally observed when handling electrostatic sensitive devices.

A warning label is placed on the packaging, identifying product using electrostatic sensitive semiconductor devices.



Appendix B: RESISTANCE TABLE (Ohms)

Distance (Feet)	AWG #20	AWG #18	AWG #16	AWG #14	AWG #12	AWG #10	AWG #8
100	1.02	0.64	0.40	0.25	0.16	0.10	0.06
200	2.03	1.28	0.80	0.51	0.32	0.20	0.13
300	3.05	1.92	1.20	0.76	0.48	0.30	0.19
400	4.06	2.55	1.61	1.01	0.64	0.40	0.25
500	5.08	3.20	2.01	1.26	0.79	0.50	0.31
600	6.09	3.83	2.41	1.52	0.95	0.60	0.38
700	7.11	4.47	2.81	1.77	1.11	0.70	0.44
800	8.12	5.11	3.21	2.02	1.27	0.80	0.50
900	9.14	5.75	3.61	2.27	1.43	0.90	0.57
1000	10.20	6.39	4.02	2.53	1.59	1.09	0.63
1250	12.70	7.99	5.03	3.16	1.99	1.25	0.79
1500	15.20	9.58	6.02	3.79	2.38	1.50	0.94
1750	17.80	11.20	7.03	4.42	2.78	1.75	1.10
2000	20.30	12.80	8.03	5.05	3.18	2.00	1.26
2250	22.80	14.40	9.03	5.68	3.57	2.25	1.41
2500	25.40	16.00	10.00	6.31	3.97	2.50	1.57
3000	30.50	19.20	12.00	7.58	4.76	3.00	1.88
3500	35.50	22.40	14.10	8.84	5.56	3.50	2.21
4000	40.60	25.50	16.10	10.00	6.35	4.00	2.51
4500	45.70	28.70	18.10	11.40	7.15	4.50	2.82
5000	50.10	32.00	20.10	12.60	7.94	5.00	3.14
5500	55.80	35.10	22.10	13.91	8.73	5.50	3.46
6000	61.00	38.30	24.10	15.20	9.53	6.00	3.77
6500	66.00	41.50	26.10	16.40	10.30	6.50	4.08
7000	71.10	44.70	28.10	17.70	11.10	7.00	4.40
7500	76.10	47.90	30.10	19.00	12.00	7.49	4.71
8000	81.20	51.10	33.10	20.20	12.70	7.99	5.03
9000	91.40	57.50	36.10	22.70	14.30	8.99	5.65
10 000	102.00	63.90	40.20	25.30	15.90	9.99	6.28

Note: Resistance shown is one way. This figure should be doubled when determining closed loop resistance.

Appendix C: RM2 SPECIFICATIONS

MILLENNIUM	RM2-ARD (ANALOG / RELAY / DIGITAL)
Operating Voltage	10.5 V dc to 32 V dc
Power Consumption 12 V dc	nominal 150 mA/250 mA (1.8 W/3.0 W) de-energized/energized maximum 290 mA/3.48 W
Power Consumption 24 V dc	nominal 80 mA/130 mA (1.92 W/3.12 W) de-energized/energized maximum 160 mA/3.84 W
Operating Temperature	-40°C to +80°C (-40F to +176F)
Humidity Range	0-100% relative humidity, non-condensing
Chassis Material	16 gauge steel / powder coated or chromatic
Weight	2 lbs (0.9 kilograms)
Certifications	CSA and NRTL/C for hazardous locations. Class 1, Division 2, Groups A, B, C and D
Current Outputs-2 channel	4 to 20 mA - Into a maximum loop impedance of 800 Ohms at 32 V dc or 150 Ohms at 10.5 V dc. Isolated or non-isolated loop supply.
Relay Output-5 relays	Form C contacts rated 5 Amps at 30 V dc / 250 V ac. Selectable energized/de-energized, latching/non-latching Fire Relay. Fault relay is factory set as energized, non-latching and cannot be modified.
Digital Output	Digital output available via terminals 19 and 20 (A and B) for Modbus communication.

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