DET-TRONICS®

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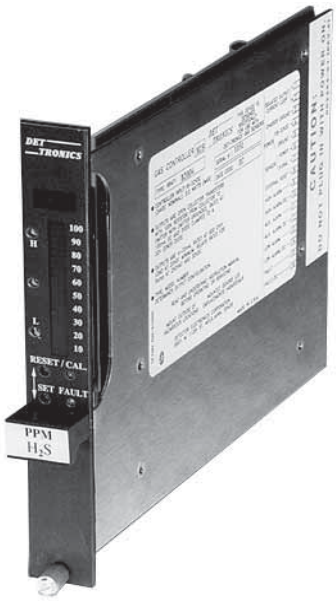
Instructions 95-8401

H_2S Controller
R8471B



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INSTRUCTIONS

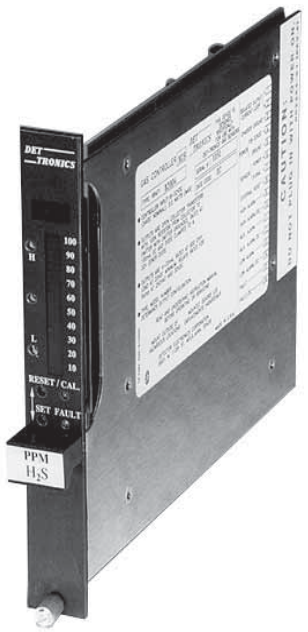
H_2S Controller

R8471B

Section I
General Information

DESCRIPTION

The R8471B Hydrogen Sulfide (H_2S) Controller is a single channel, rack mounted device that operates in the ranges of 0 to 100, 0 to 50 or 0 to 20 parts per million (ppm). The controller provides continuous monitoring of a Det-Tronics electrochemical H_2S sensor or any H_2S sensor/transmitter assembly capable of generating a 4 to 20 ma dc signal. Controller response includes actuation of solid state or optional relay outputs for direct control of field response devices, a full array of faceplate indicators, as well as an optional 4 to 20 milliampere output for transmitting system information to other devices.



FEATURES

- Controller accepts a 4 to 20 ma input, ensuring compatibility with a Det-Tronics electrochemical H_2S sensor or a variety of H_2S sensor/transmitter assemblies.
- Digital display, bar graph display, and high intensity LEDs indicate important system status information.
- AutoCal feature provides easy and accurate calibration.
- Microprocessor based controller is easily field programmable.
- Base model is furnished with solid state alarm and fault outputs.
- Premium model is furnished with relay outputs and a 4 to 20 ma dc output.
- Current output is selectable for isolated/non-isolated operation.
- Rack compatible with Det-Tronics R7400 series flame controllers.
- Variety of racks available in 4U or 3U height configuration.

APPLICATION INFORMATION

Hydrogen sulfide is a colorless, highly toxic gas. It is frequently found in oil and natural gas, sewage disposal or treatment systems, as well as a variety of industrial processes. Typical operations that encounter H_2S include:

- Oil and natural gas exploration and production
- Refineries
- Sewers
- Sewage treatment plants
- Chemical plants
- Paper mills.

The ability to electronically monitor the level of H_2S is essential in many potentially hazardous environments. In low concentrations hydrogen sulfide has the odor of rotten eggs. However, at higher concentrations or after prolonged exposure, it deadens the sense of smell. Therefore, depending on human senses alone to estimate the concentration of H_2S is totally unreliable.

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The actual effect of H_2S on an individual depends on several factors:

1. Concentration level of the exposure
2. Length of time exposed
3. Exposure frequency
4. Ability to tolerate H_2S.

Table 1 shows some of the effects of breathing H_2S gas.

SPECIFICATIONS

CONTROLLER

OPERATING VOLTAGE—
24 vdc. Can operate in the range of 18 to 32 vdc.

NOTE

When an I.S. barrier is used, the input voltage (measured at the controller) must be between 23 and 26.6 vdc to ensure proper operation of the sensor and barrier.

POWER CONSUMPTION (controller only)—
Base model: 0.7 watt nominal, 1.3 watts maximum (25 ma nominal, 50 ma maximum at 24 vdc).

Premium model: 1.2 watts nominal, 3.5 watts maximum (50 ma nominal, 145 ma maximum at 24 vdc).

Table 1—Effects of H_2S

Concentration	Effect
1 ppm	Detectable by odor.
10 ppm	Allowable for 8 hours exposure (OSHA).
Over 20 ppm	**Protective equipment required.**
100 ppm	Kills smell in 3 to 15 minutes. May burn eyes and throat.
200 ppm	Kills smell rapidly. Burns eyes and throat.
500 ppm	Victim loses sense of reasoning and balance. Respiratory disturbances in 2 to 15 minutes. Prompt artificial resuscitation needed.
700 ppm	Victim becomes unconscious quickly. Breathing will stop and death will result if not rescued promptly. Immediate artificial resuscitation required.
1,000 ppm	Unconscious at once. Permanent brain damage or death will result unless rescued promptly.

Maximum startup current is 0.6 ampere for 10 milliseconds. Power supplies with fold back current limiting are not recommended.

MAXIMUM RIPPLE—
Ripple should not exceed 5 volts peak-to-peak. The sum of dc plus ripple must be ≥18 vdc and ≤ 32 vdc.

TEMPERATURE RANGE—
Operating: +32°F to +140°F (0°C to +60°C)
Storage: –49°F to +185°F (–45°C to +85°C).

HUMIDITY RANGE—
5 TO 99% R.H., non-condensing.

OPERATING RANGE—
0 to 100, 0 to 50 or 0 to 20 ppm.

ACCURACY—
±3% of full scale over specified temperature range.

SOLID STATE OUTPUTS (Base model only)—
The outputs are open collector transistors with a 100K resistor from the collector to emitter with the emitter grounded, rated 100 milliamperes at 32 volts dc maximum.

RELAY CONTACTS (Premium model only)—
Selectable normally open/normally closed contacts rated 5 amperes at 30 vdc/250 vac.

CURRENT OUTPUT (Premium model only)—
4 to 20 milliamperes dc current, with a maximum external loop resistance of 600 ohms at 20 to 32 vdc.

DIMENSIONS—
See Figure 1.

SHIPPING WEIGHT (approximate)—
2.0 pounds (0.9 kilogram).

SYSTEM APPROVAL—
The R8471B Controller, base and premium model in 3U and 4U height, has been tested and approved by FMA. It can be used with any FMA approved sensing device capable of generating a 4 to 20 ma input. FMA approval of the R8471B Controller, however, does not include or imply approval of input devices such as sensors or transmitters, or devices connected to the controller outputs. To maintain FMA system approval, **all equipment** connected to the controller must be FMA approved.

NOTE

Ensure sensor hazardous (classified) location rating is applicable for the intended use.

SENSOR

OPERATING RANGE—
0 to 100 ppm.

TEMPERATURE RANGE—
Continuous operation: –40°F to +105°F (–40°C to +40°C).
Intermittent operation: –40°F to +130°F (–40°C to +55°C).
Recommended storage: +32°F to +68°F (0°C to +20°C).

HUMIDITY RANGE—
Continuous: 15 to 90% RH.
Intermittent: 0 to 99% RH.

ACCURACY—
±10 percent of applied gas concentration or ±3 ppm, whichever is greater.

RESPONSE TIME—
20 percent full range within 12 seconds, 50 percent full range within 30 seconds when H_2S concentration equal to full scale is applied.

DRIFT—
Less than 2 ppm per month.

ENCLOSURE MATERIAL—
316 stainless steel.

SENSOR RATINGS—
The C7064E (explosion proof) is CSA certified and designed to meet FM requirements for Class I, Division 1, Groups C and D.

The C7064C (intrinsically safe) is CSA certified and FM approved for Class I, Division 1, Groups A, B, C and D.

DIMENSIONS—
See Figure 2 for dimensions of the C7064E Sensor and Figure 3 for dimensions of the junction box.

SHIPPING WEIGHT (Approximate)—
2.5 pounds (1.1 kilograms).

SYSTEM OPERATION

SENSOR

The C7064C (intrinsically safe) and C7064E (explosion proof) H_2S Sensors use an electrochemical sensing element to detect the presence of hydrogen sulfide gas. The electrochemical sensing element provides improved accuracy and reliability, and also extended calibration intervals when compared

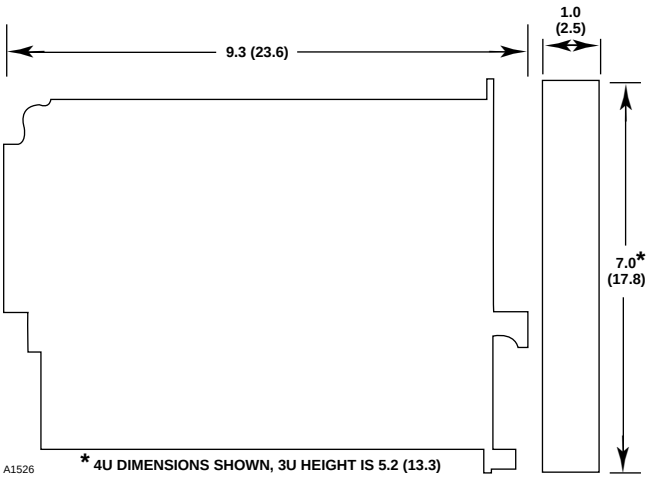

Figure 1—Controller Dimensions in Inches (Centimeters)

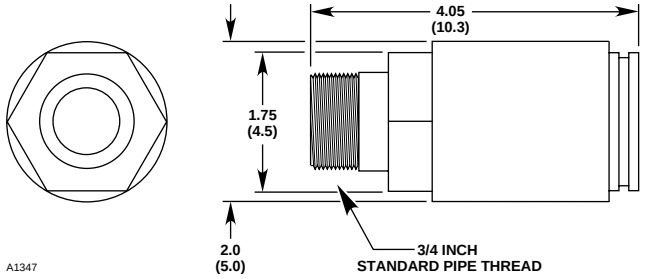

Figure 2—Sensor Dimensions in Inches (Centimeters)

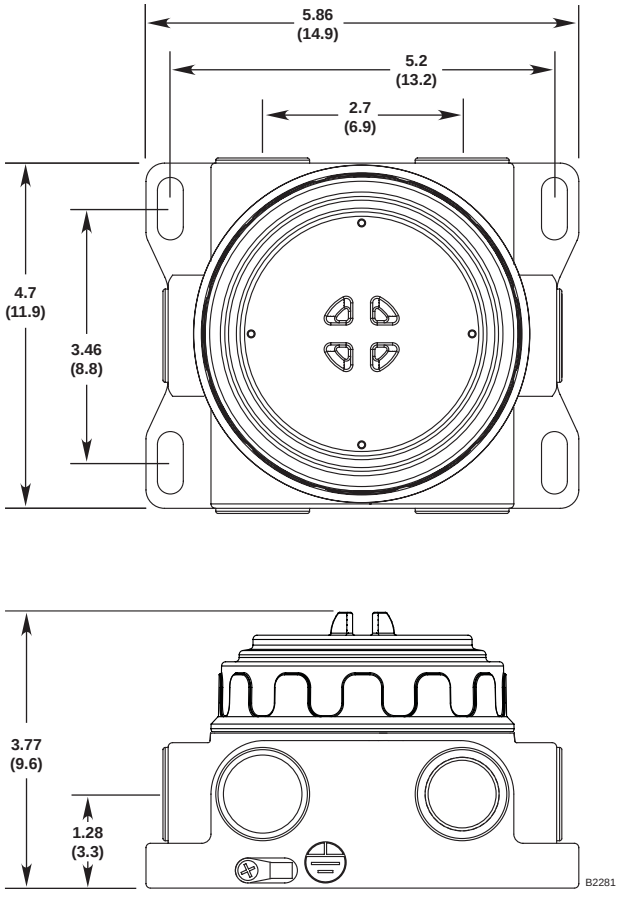

Figure 3—Junction Box Dimensions in Inches (Centimeters)

to ordinary solid state type sensors. A significant property of the sensing element is its highly specific response to H_2S. Since many commonly encountered gases have little if any effect on the electrical response of the sensor, false indications caused by the presence of these gases are greatly reduced. In addition, high concentrations of H_2S do not adversely affect the sensor.

The sensor housing contains the transmitter circuitry for generating a linear 4 to 20 milliampere dc output signal, corresponding to levels of H_2S from 0 to full scale.

The sensor uses a hydrophobic filter to protect the electrochemical sensing element from contamination by dirt and moisture. Unlike metal filters that significantly restrict the passage of H_2S gas to the sensing element when the surface is coated with water, the hydrophobic filter sheds water and will not inhibit the flow of H_2S gas to the sensing element. As with any filter, the hydrophobic filter must be kept free of contaminants to allow H_2S gas to reach the sensing element.

The hydrophobic filter and electrochemical sensing element can be replaced quickly and conveniently in the field.

NOTE

If an intrinsically safe sensor is used with the R8471B, it must be powered through an approved barrier in order to maintain its intrinsically safe rating.

Sensor Cross Sensitivity

Table 2 shows the response of a typical electrochemical H_2S sensor when exposed to 100 ppm concentrations of various commonly encountered substances. Note that 100 ppm concentrations of some substances are not normally present in most applications involving H_2S detection systems.

OPTIONAL TRANSMITTERS

The sensor contains the transmitter circuitry for generating a 4 to 20 ma signal, eliminating the need for a separate transmitter. If the application requires calibration at the sensor location or various other special transmitter features such as relay contacts or visible annunciators, a variety of Det-Tronics transmitters are available for use with either electrochemical or solid state H_2S sensors. Refer to the “Ordering Information” section of this manual for more information.

Table 2—Cross Sensitivity of Electrochemical Sensor to 100 ppm Concentrations

0 ppm	<1 ppm	<15 ppm	<–30 ppm	–20 ppm
HCN C_2H_4	CO NO H_2 HCl	SO_2	NO_2	Cl_2

CONTROLLER

Faceplate Description

The controller faceplate provides LEDs for identifying status conditions, a digital display and bar graph display for indicating the sensor input, and pushbuttons for programming, calibrating and resetting the system. See Figure 4 for the location of indicators and pushbuttons.

1. **Digital Display** – The digital display provides a continuous reading (in ppm) of the sensor input in both the Normal and Calibrate modes. In the event of a fault, it identifies the nature of the fault using an alpha-numeric code. In other operating modes it shows the alarm setpoints and programmed calibration gas concentration. A negative zero drift condition is indicated by a minus (–) sign in the left hand digit. Since this display is always lit, it also functions as a power indicator (except during the power-up time delay, when the FAULT LED is on and the digital display is off).

   NOTE

   In the event of an over-range condition, the digital display flashes and the highest reading latches on until reset. The user must exercise caution if an over-range reading is indicated, since a dangerous condition could exist. The hazardous area should be checked with a portable detection instrument to determine the actual level of H_2S gas present.

2. **Bar Graph Display** – The 20 segment bar graph display provides a reading of sensor input in increments of 5% of full scale.

3. **High Alarm LED** – Flashes in response to a sensor signal that exceeds the high setpoint.

4. **Auxiliary Alarm LED** – Flashes in response to a sensor signal that exceeds the auxiliary setpoint.

5. **Low Alarm LED** – Flashes in response to a sensor signal that exceeds the low setpoint.

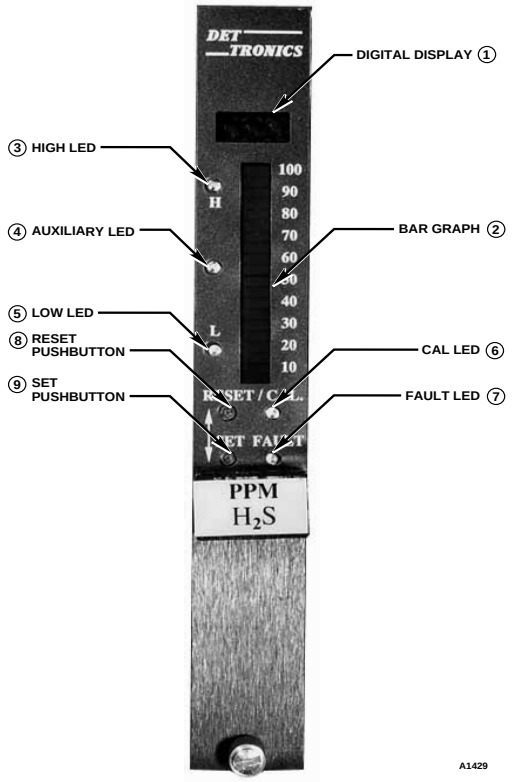

Figure 4—Controller Front Panel

NOTE

The alarm LEDs flash when the setpoint is exceeded and are on steady (until reset) when the H_2S level drops below the setpoint, whether the corresponding alarm output is latching or non-latching.

6. **CAL LED** – Illuminated while the controller is in the calibrate mode.

NOTE

In the Setpoint Display or Setpoint Adjust mode, a flashing alarm LED identifies the particular setpoint currently being indicated on the digital display. A flashing CAL LED indicates that the programmed calibration gas concentration in ppm is currently being shown on the digital display.

7. **FAULT LED** – Flashes upon detection of a system fault and is on steady during the power-up time delay.

8. **RESET Pushbutton** – Used for various system programming and calibration functions as well as for resetting the controller.

9. **SET Pushbutton** – Used for various system programming and calibration functions.

Setpoints

The R8471B Controller has independent Low, High, and Auxiliary alarm setpoints, with corresponding outputs.

The programmed calibration gas concentration in ppm is also displayed and adjusted with the alarm setpoints. This value must be equal to the ppm concentration of the calibration mixture that is used for the span adjustment.

The adjustment range in ppm is:

Range:	0 to 100	0 to 50	0 to 20
Low alarm:	5 to 40	1 to 25	0.5 to 10
High alarm:	10 to 60	2 to 45	1 to 18
Aux. alarm:	5 to 99	1 to 45	0.5 to 18
Cal. gas:	30 to 99	15 to 45	6 to 18

The alarm setpoints and calibration gas concentration can be checked by pressing the RESET pushbutton located on the front panel of the controller. See “Setpoint Adjustment” and “Calibration” sections of this manual for additional information.

Outputs

The R8471B Controller is available in a Base version and a Premium version. The differences between the two models are the output configuration and programming options.

BASE MODEL

The base controller is furnished with open collector transistor outputs (rated 100 milliamperes at 32 volts dc) for the Low alarm, High alarm, Auxiliary alarm, and Fault circuits. The normally de-energized alarm outputs are energized when their corresponding setpoints are exceeded. The fault output is normally energized and becomes de-energized upon detection of a system fault. The low alarm, auxiliary alarm, and fault outputs are non-latching. The high alarm output is latching.

PREMIUM MODEL

The premium model is furnished with a set of four relays in place of the four solid state outputs. The relays have SPST contacts rated 5 amperes at 30 vdc or 250 vac.

This model also includes a selectable isolated/non-isolated 4 to 20 ma dc current output for transmitting system information to other devices. The linear 4

to 20 ma output corresponds to levels from 0 to full scale. If a system fault is detected, the output drops to less than 1.0 ma. The current output can be calibrated in the field to ensure maximum accuracy. (Refer to the "Calibration" section of this manual for details.)

PROGRAMMING OPTIONS
(PREMIUM MODEL ONLY)

Each of the four relays is field selectable for either normally open or normally closed contacts using jumper plugs located on the printed circuit board inside the controller. (See Table 3.)

The alarm relays are also switch programmable for either normally energized or normally de-energized operation (programmable as a group only, not individually) . The fault relay is normally energized.

The low and auxiliary alarm relays are programmable for either latching or non-latching operation. The high alarm relay is always latching and the Fault relay is non-latching. Latching relays are reset using either the RESET pushbutton on the front panel of the controller or an external reset switch.

The 4 to 20 ma circuit is selectable for isolated or non-isolated operation.

Automatic Diagnostics and Fault Identification

The microprocessor based controller features self-testing circuitry that continuously checks for problems that could prevent proper system response. When power is applied, the microprocessor automatically tests memory. In the Normal operating mode, it continuously monitors the input signal from the sensor/transmitter to ensure proper functioning. In addition, a "watchdog" timer is maintained to ensure that the program is running correctly. If a fault should occur:

Table 3—Selectable Relay Options

Relay	Selectable Normally Open/Closed	Selectable Normally Energized/ De-Energized	Selectable Latch/ Non-Latch
Low	Y	Y[1]	Y[1]
High	Y	Y[1]	N[2]
Auxiliary	Y	Y[1]	Y[1]
Fault	Y	N[3]	N[4]

Y = Yes N = No
[1]Selectable as a group, not individually [2]Latching only
[3]Normally energized only [4]No latching option

— The FAULT LED flashes.

— The digital display identifies the nature of the fault using an alpha-numeric code. Refer to Table 4 for an interpretation of the codes.

— The normally energized Fault output is de-energized.

— The dc current output drops to less than 1 ma.

NOTE

The fault code will be shown for about 2 seconds out of every 5 seconds. The gas concentration at the sensor will be displayed during the remaining time. If more than one fault should occur, the highest priority fault will be displayed. (Table 4 lists the faults in order of priority.)

Table 4—System Status Codes

Status	Condition
F9X	Initialization failure. (Subcodes are as follows.)
F91	EPROM sumcheck failure.
F92	System failure during startup - current too high or too low.
F93	Watchdog timer failure.
F94	RAM failure.
F95	Internal 5 volt power supply failure during startup.
F96	External 24 volt power supply failure during startup.
F97	Controller type invalid. Error in data from RAM.
F98	Watchdog timer reset the controller.
F70	External reset button has been activated for 15 seconds or longer. Self-clearing when button is released.
F60	External 24 vdc power input is not in the 18 to 32 vdc range.
F50	Internal 5 volt power supply is not in the 4.75 to 5.25 volt range.
F40	Sensor fault (after startup). Input is above 35 ma or below 2 ma.
F30	Negative zero drift. Sensor input is –9% full scale or lower.
F2X	Calibration error. (Subcodes are as follows.)
F20	General calibration fault, or calibration aborted due to a higher priority fault.
F21	Time ran out while waiting for the user to apply gas to the sensor.
F22	Sensor input is too low. The sensor cannot generate enough offset to get an accurate calibration. Replace sensor.
F23	Sensor is too sensitive for the controller to read 100% full scale. Replace sensor.
F24	Zero gas level too high, or sensor zero input over limit.
F10	Sensor reaching end of life. Consider replacing the sensor within the next two calibration periods.

An alarm condition will normally over-ride a fault condition unless the fault condition occurred first. F10 and F2X will not over-ride an alarm. Faults that affect the actual function of the controller (F50, F60, F70, F9X) can impair the ability of the controller to maintain an alarm output.

All faults automatically reset except the F9X, F20, and F10 faults. After the fault condition has been corrected, the fault output automatically switches to the normal (energized) state, the dc current output returns to normal, and the FAULT LED turns off. Clearing F9X faults requires removing operating power from the controller for approximately one second.

CAUTION

The fault detection circuitry does not monitor the operation of external response equipment or the external wiring to these devices. It is important that these devices be checked periodically to ensure that they are operational.

Operating Modes

NOTE

The following section is intended to acquaint the operator with the basic operation of the controller. For complete step-by-step programming and calibration procedures, refer to the corresponding sections in this manual.

The controller can operate in any of the following modes. Operating modes other than Normal are selected by pressing the appropriate pushbutton(s) located on the controller front panel. See Figure 5.

NORMAL

In the Normal operating mode with no alarm condition:

— Digital display is on and indicates the sensor input in ppm.

— Bar graph display reads the same as the digital display.

— All LEDs are off.

— Alarm outputs are in their normal state (energized or de-energized as programmed).

— DC current output signal level corresponds to sensor input.

— Fault output is energized.

In the Normal operating mode with a low and/or auxiliary alarm condition occurring:

— Digital display and bar graph display indicate the sensor input in ppm.

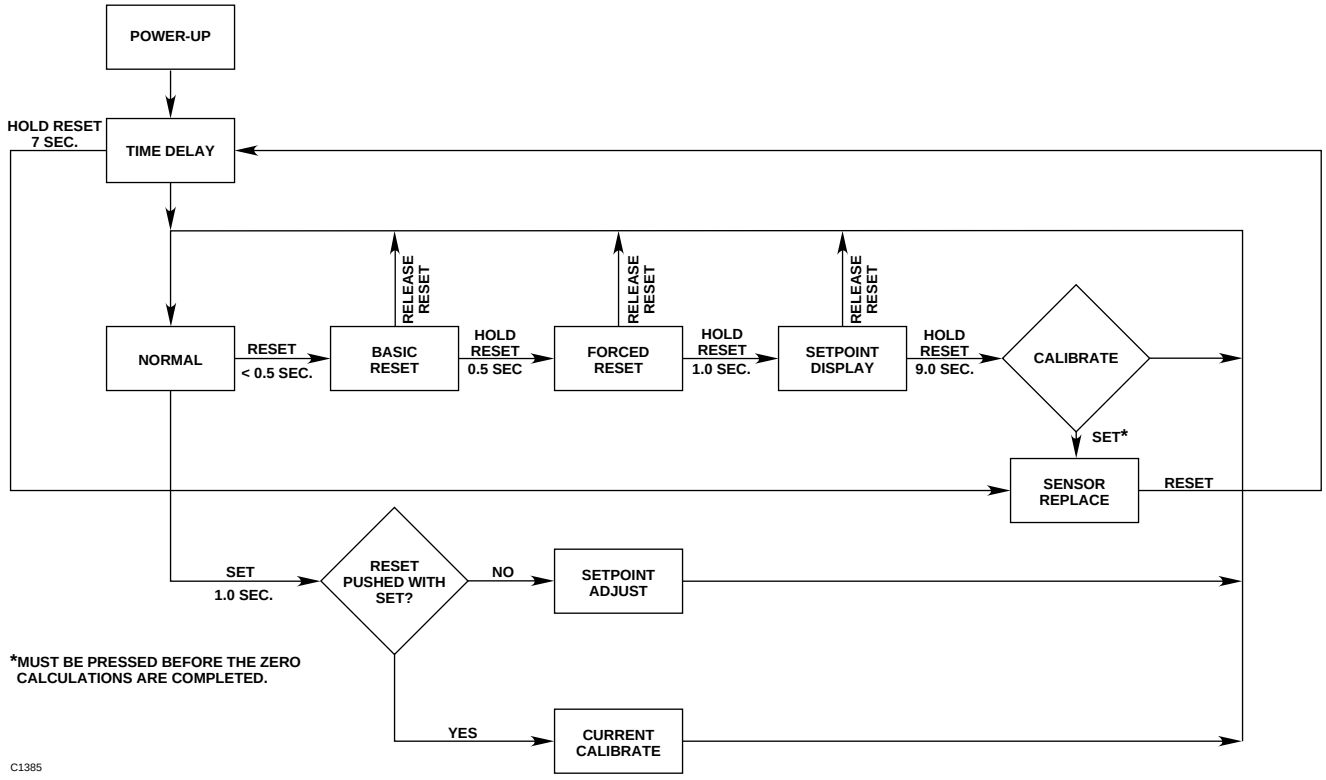

Figure 5—R8471B Controller Flow Chart

— Low and/or Auxiliary LED flashes.

— Low and/or Auxiliary alarm output changes state.

— DC current output signal level corresponds to sensor input.

— Fault output energized and LED off.

When the signal decreases below the low or auxiliary setpoint:

— Digital display, bar graph display, and 4 to 20 ma output continue to track the sensor input.

— With latching operation programmed: No change to alarm outputs.

— With non-latching operation programmed: Alarm outputs return to their normal state.

— Low and Auxiliary LEDs are on steady until reset.

In the Normal operating mode and a high alarm condition occurring:

— Same as a low or auxiliary alarm condition, but High LED and high alarm output are affected.

When the signal decreases below the high alarm setpoint:

— The high alarm is always latching and unaffected by the latching/non-latching programming for the low and auxiliary alarms. High LED is on steady until reset.

In the event of a system fault:

— The normally energized Fault output is de-energized and the FAULT LED is illuminated.

RESET

The Reset mode is entered by pressing the RESET button located on the front panel of the controller. (See Figure 5.) When the RESET button is **momentarily depressed**, all LEDs turn off and all outputs return to their normal condition if no alarms or faults are occurring (basic reset). When the RESET button is **held for 0.5 second**, the LEDs turn off and the outputs return to their normal condition even if an alarm or fault condition still exists (forced reset). Remote reset capability is also provided. (Remote reset performs a forced reset.)

NOTE

The remote reset performs a reset function only. It cannot be used for entering other controller operating modes.

SETPOINT DISPLAY MODE

If the RESET button is held for approximately one second, the controller enters the Setpoint Display mode. In this mode, the digital display sequentially shows the programmed alarm setpoints and calibration gas concentration. Each value is displayed for approximately 2 seconds. After completing the sequence, the controller automatically returns to the Normal operating mode if the RESET button is no longer being depressed.

This mode is used only for displaying the setpoints. Use the “Setpoint Adjust” mode for changing setpoint and calibration gas values.

CALIBRATE

The R8471B Controller uses a fully automatic calibration procedure that requires no adjustments by the operator. The Calibrate mode is entered by pressing and holding the RESET button until completion of the “Setpoint Display” sequence described above (approximately 9 seconds). The controller performs the Zero adjustments, then signals the operator when to apply and also when to remove the calibration gas. Upon completion of a successful calibration, the controller automatically returns to the Normal operating mode.

If the operator fails to complete the calibration procedure, if an error in calibrating occurs, or if a successful calibration cannot be completed, the microprocessor will automatically return to the Normal mode (after 10 minutes or when the gas level drops below the lowest setpoint) and continue to use the previous calibration data. A fault indication (“F2X” status) will be displayed until a reset occurs. If the microprocessor determines that the sensing element is approaching the end of its useful life, “F10” will be indicated on the digital display. Refer to the “Calibration” section of this manual for complete information regarding calibration.

While in the Calibrate mode, all controller outputs are inhibited, the CAL LED is illuminated, and the dc current output goes to a preset level (adjustable from 0 to 20 ma).

SENSOR REPLACEMENT

This mode inhibits all controller outputs to allow replacement of the sensing element without removing power from the controller. In addition, this mode automatically sets the factory default values for sensor calibration. Alarm setpoints and calibration gas concentration are not affected.

CAUTION

Upon entering the Sensor Replacement mode, all previously entered sensor calibration information is lost. Sensor ***calibration must be performed****, even if the sensing element was not replaced.*

To enter the Sensor Replacement mode, either enter the Calibrate mode as described above and press the SET button, or hold the RESET button for 7 seconds while in the power-up time delay. To exit this mode, press the RESET button. Upon exiting the Sensor Replacement mode, the controller returns to normal operation after a time delay (five minutes or as soon as no alarm setpoints are exceeded).

SETPOINT ADJUST

The Setpoint Adjust mode is entered by depressing the SET button for approximately one second. In this mode the alarm setpoints and calibration gas level are sequentially displayed on the digital display for approximately five seconds and the corresponding LED flashes. To change the setpoint, depress the RESET button to increase the displayed value or the SET button to decrease the value. If no changes are made for 5 seconds, the microprocessor automatically advances to the next setpoint. At the end of the sequence, the microprocessor automatically returns to the Normal operating mode.

DC CURRENT OUTPUT CALIBRATION

This mode is used to calibrate the 4 to 20 ma dc output. To enter this mode, hold the SET button, then press RESET. First the 0 ppm value (4 ma) is generated for approximately 7 seconds while the Low LED flashes. Then the full scale value (20 ma) is generated while the High LED flashes. Finally the current output level during calibration is generated while the CAL LED flashes. The microprocessor automatically returns to the normal operating mode at the end of the sequence. Adjustments to the current output level are made by pressing the RESET (increase) or SET (decrease) button. This procedure requires a dc current meter to monitor the actual controller dc milliampere output.

Section II
System Installation

INSTALLATION

NOTE

The C7064E Sensor is not included in the FMRC approval.

NOTE

Refer to the sensor manual for complete information regarding sensor installation.

SENSOR LOCATION

Proper location of the sensor is essential for providing maximum protection. The formula for determining the most effective number and placement of sensors varies depending on the conditions at the job site. The individual performing the installation must rely on experience and common sense to determine the number of sensors needed and the best sensor locations to adequately protect the area.

The following factors are important and should be considered for every installation:

1. Since hydrogen sulfide is heavier than air, it will normally tend to settle near the floor or ground, unless it is heated, mixed with other gases that are lighter than air, or prevented from doing so by air movement.

2. How rapidly will the H_2S gas diffuse into the air? Select a location for the sensor as close as practical to an anticipated source.

3. Ventilation characteristics of the immediate area must also be considered. Air movement will cause the gas to accumulate more heavily in one area than another. Sensors should be placed where the most concentrated accumulation of hydrogen sulfide gas is anticipated. Also consider the fact that some ventilation systems do not operate continuously.

4. The sensor should be located where it is safe from potential sources of contamination.

5. The sensor should be pointed down to prevent the buildup of contaminants on the filter.

6. The sensor must be accessible for testing and calibration.

7. Exposure to excessive heat or vibration can cause premature failure of electronic devices, and should be avoided if possible. Shielding the device from intense sunlight will reduce solar heating and can increase the life of the unit.

Remember, the finest detection system is of little value if the H_2S gas cannot readily come into contact with the sensor.

GENERAL WIRING REQUIREMENTS

NOTE

The wiring procedures in this manual are intended to ensure proper functioning of the device under normal conditions. However, because of the many variations in wiring codes and regulations, total compliance to these ordinances cannot be guaranteed. Be certain that all wiring complies with applicable regulations that relate to the installation of electrical equipment in a hazardous area. If in doubt, consult a qualified official before wiring the system.

The use of shielded cable is highly recommended for wiring the H_2S detection system to protect against interference caused be extraneous electrical "noise". In applications where the wiring cable is installed in conduit, the conduit **must not** be used for wiring to other electrical equipment.

Since moisture can be detrimental to electronic devices, it is important that moisture not be allowed to come in contact with the electrical connections of the system. Moisture in the air can become trapped within sections of conduit. Therefore, the use of conduit seals is required to prevent damage to electrical connections caused by condensation within the conduit.

These seals must be watertight and explosion-proof and are to be installed even if they are not required by local wiring codes. A seal must be located as close to the device as possible. In no case should this seal be located more than 18 inches (46 cm) from the device. When an explosion-proof installation is required, an additional seal may be needed at any point where the conduit enters a non-hazardous area. Always observe the requirements of local codes.

When pouring a seal, a fiber filler is required to assure proper formation of the seal. The seals should never be poured in temperatures that are below freezing, since the water in the sealing compound will freeze and the compound will not dry properly. Contamination problems can then result when temperatures rise above the freezing point and the compound thaws.

The shielding of the cable should be stripped back to permit the seal to form around the individual leads, rather than around the outside of the shield. This will prevent any siphoning action that can occur through the inside of the shield.

It is recommended that conduit breathers also be used. In some applications, alternate changes in temperature and barometric pressure can cause "breathing", which allows the entry and circulation of moist air throughout the conduit. Joints in the conduit system and its components are seldom tight enough to prevent this "breathing." Moisture in the air can condense at the base of vertical conduit runs and equipment enclosures, and can build up over a period of time. This can be detrimental to electronic devices. To eliminate this condition, explosion-proof drains and breathers should be installed to automatically bleed off accumulated water.

Two wire cable is used for connecting the sensor to the controller. Two conductor cable with a foil shield is recommended. The shield of the cable should be open at the sensor junction box and connected to earth ground at the controller.

The maximum distance between the sensor and controller is limited by the resistance of the connecting wiring, which is a function of the gauge of the wire being used. Table 5 shows the maximum wiring distance allowed for a given wire size. **If a sensor/ transmitter assembly is being used, refer to the transmitter manual for specific instructions**.

SENSOR WIRING

1. Determine the best mounting locations for the sensors by following the previously discussed guidelines for locating sensors. Whenever practical, sensors should be placed where they are easily accessible for calibration.

2. The sensor junction box can be mounted to a wall or post, or it can be suspended by the conduit. The junction boxes should be electrically connected to earth ground.

Table 5—Maximum Wiring Distances – Controller to Sensor

Wire Size (AWG)	Maximum Sensor to Controller Distance	
	Feet	Meters
18	5700	1750
16	9000	2800

The sensor must be oriented with the filter pointing down. Position the junction box with the conduit connected to the upper opening. The sensor will be installed in the lower opening on the junction box.

3. Remove the cover from the junction box.

NOTE

Do not apply power to the system with the junction box cover removed unless the area has been declassified.

4. Remove the cap from the sensor housing. See Figure 6.

5. Remove the sensing element assembly from its packaging. Determine proper orientation for the assembly, then **carefully** plug it into the sensor housing.

NOTE

Handle the sensing element assembly carefully. To avoid possible damage, observe the normally accepted procedures for handling electrostatic sensitive devices. See form 75-1005 for additional information.

6. Place the cap back on the sensor housing. Tighten only until snug. **Do not over tighten**.

7. Attach the sensor to the junction box. The sensor should be tight to ensure an explosion-proof installation, however, do **not** over tighten.

NOTE

Coat the sensor threads with an appropriate grease to ease installation, and also lubricate the junction box cover threads to ensure a water-tight enclosure. The recommended lubricant is a silicone free polyalphaolefin grease, part number 005003-001, available from Detector Electronics.

8. Connect the sensor wires to the terminal block marked “to sensor.” (See Figure 7.) Connect the controller wiring to the terminal block marked “to controller.” Connect the shield to earth ground at the controller. Under normal conditions, the other end of the shield should not be connected at the sensor junction box unless such a connection is required by local wiring codes.

The wiring code is:

Red lead = “+”
Black lead = “–”
Green lead = Chassis (earth) ground.

In order to maintain the intrinsically safe rating of the C7064C Sensor, it must be wired through an approved I.S. barrier. See Figure 8.

NOTE

When an I.S. barrier is used, the input voltage (measured at the controller) must be between 23 and 26.6 vdc to ensure proper operation of the sensor and barrier.

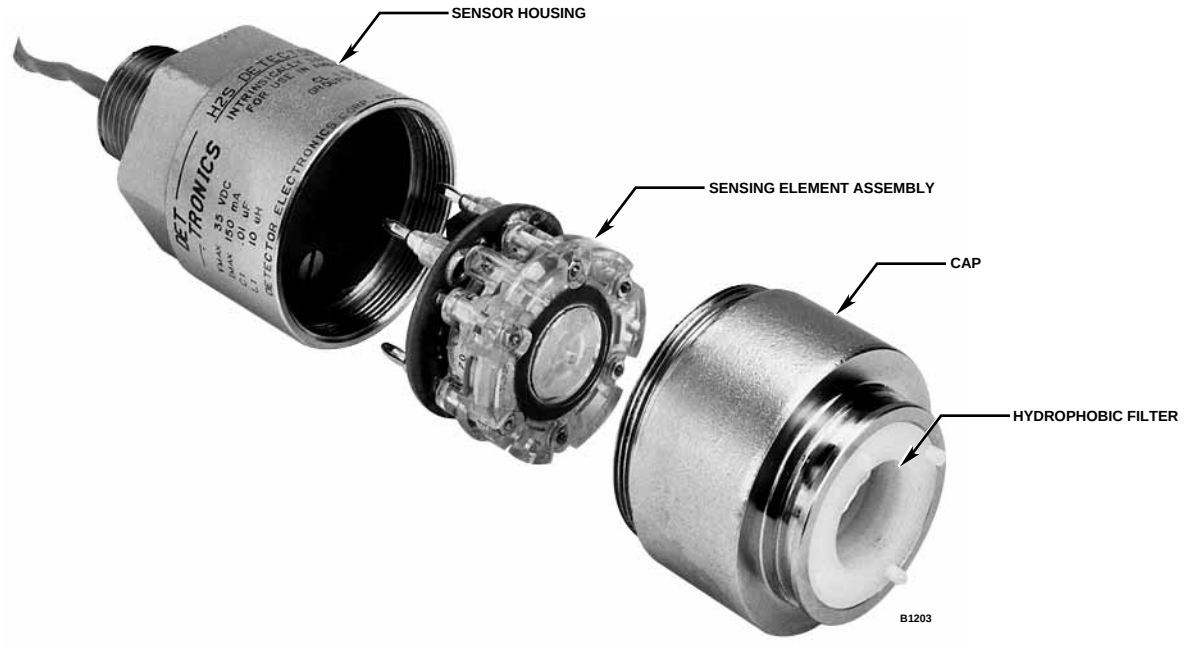

Figure 6—Exploded View of Sensor

9. Check the sensor wiring to ensure proper connections, then pour the conduit seals and allow them to dry (if conduit is being used).

10. Place the cover back on the junction box.

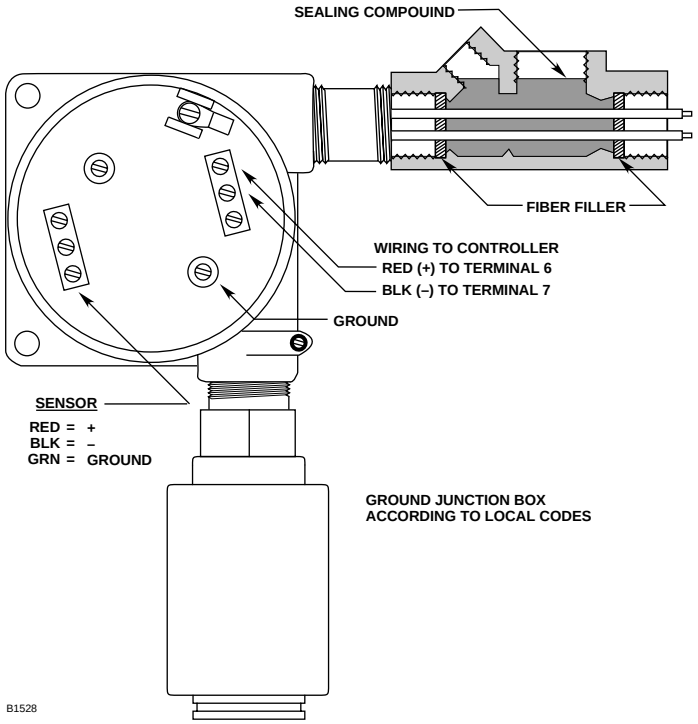

Figure 7—Sensor Wiring

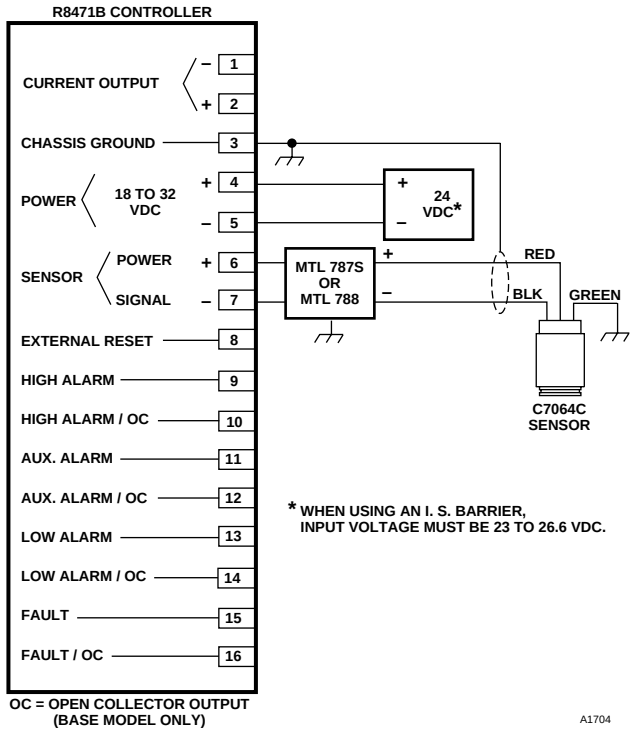

Figure 8—R8471B Controller and C7064C Sensor Used with I.S. Barrier

CONTROLLER WIRING

NOTE

The controller contains semiconductor devices that are susceptible to damage by electrostatic discharge. An electrostatic charge can build up on the skin and discharge when an object is touched. Therefore, use caution when handling, taking care not to touch the terminals or electronic components. For more information on proper handling, refer to Service Memo form 75-1005.

Field Wiring Connector

The controller is furnished with a field wiring connector backplate that incorporates pressure type screw terminals for connecting the external wiring and a circuit board edge connector for attaching to the controller. The use of a mounting rack is recommended for mounting the controller. The backplate is attached to the back of the rack to allow easy removal of the controller without disturbing the wiring. See Figures 9 and 10.

The controller is designed for installation in a non-hazardous area.

Figure 11 shows the terminal configuration for the R8471B H_2S Controller.

Terminals 1 and 2 – 4 to 20 ma dc output.

Non-Isolated Current Output - If the 4 to 20 ma current loop is to be non-isolated, wire the current loop as shown in Figure 12. Note that terminal 2 is not used with a non-isolated current loop. Program the controller for a non-isolated current loop as described in the "Controller Programming" section of this manual.

Isolated Current Output - If an isolated current loop is desired, wire the current loop as shown in Figure 13 and program the controller for an isolated current loop as described in the "Controller Programming" section of this manual. Note that this wiring scheme requires an external power source for the isolated current output.

CONTROLLER POSITIONS FOR:		HT:	DIM. (A)		DIM. (B)		DIM. (C)		DIM. (D)		DIM. (E)	
FIRE	GAS		INCH	MM	INCH	MM	INCH	MM	INCH	MM	INCH	MM
8	16	4U	19.00	482.6	18.30	464.8	17.36	440.9	4.00	101.6	6.97	177.1
6	12	4U	15.06	382.6	14.36	364.7	13.42	340.9				
4	8	4U	11.13	282.6	10.43	264.9	9.49	241.1				
3	6	4U	9.16	232.7	8.46	214.9	7.52	191.0				
2	4	4U	7.19	182.7	6.49	164.9	5.55	141.0				
1	2	4U	5.22	132.6	4.52	114.8	3.58	90.9				
	16	3U	19.00	482.6	18.30	464.8	17.36	440.9	2.25	57.15	5.22	132.6
	12	3U	15.06	382.6	14.36	364.7	13.42	340.9				
	8	3U	11.13	282.6	10.43	264.9	9.49	241.1				
	6	3U	9.16	232.7	8.46	214.9	7.52	191.0				
	4	3U	7.19	182.7	6.49	164.9	5.55	141.0				
	2	3U	5.22	132.6	4.52	114.8	3.58	90.9				

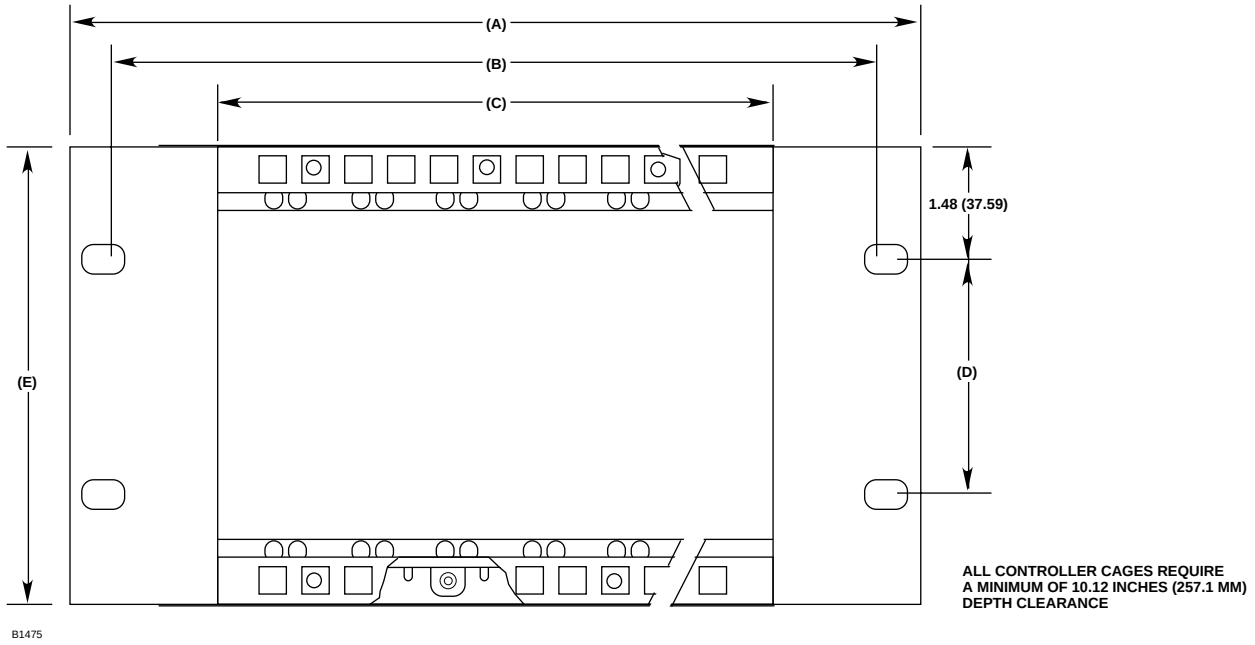

Figure 9—Dimensions of the Q4003 and Q4004 Mounting Racks

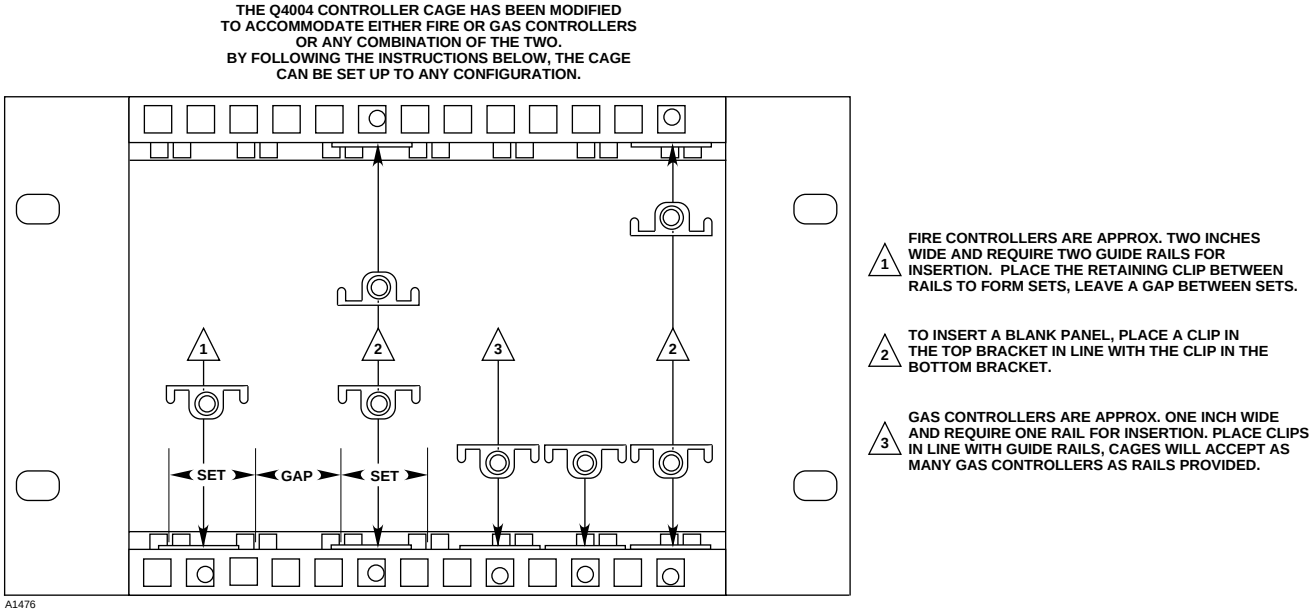

Figure 10—Clip Positioning for Q4003 and Q4004 Mounting Racks

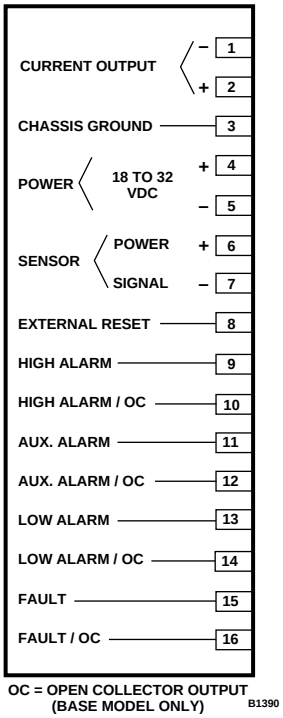

Figure 11—Terminal Configuration for the R8471B H_2S Controller

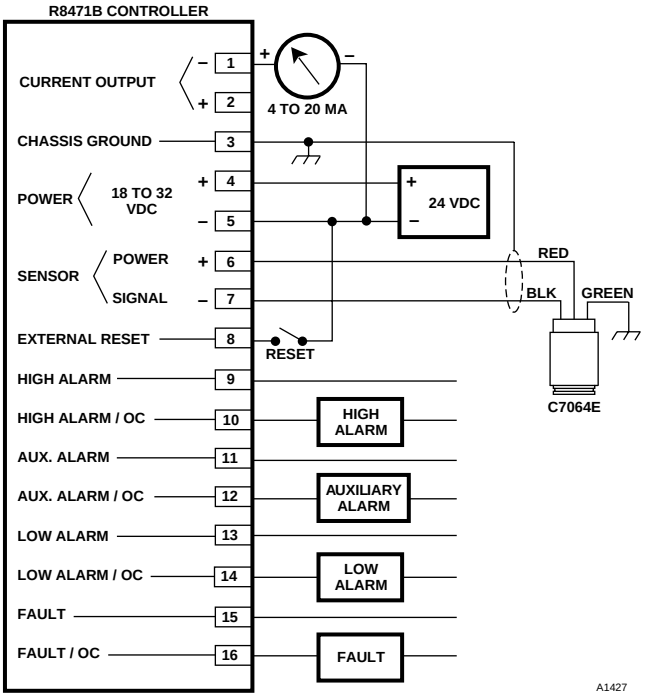

Figure 12—A Typical System – R8471B with Relay Outputs, Non-Isolated Current Output and C7064E Sensor

Terminal 3 – Chassis ground. Ground the cable shield at this terminal.

NOTE

If local wiring codes permit and if a ground fault monitoring system is not being used, the minus side of the dc power source can be connected to chassis (earth) ground. Alternatively, a 0.47 microfarad, 100 volt capacitor can be installed (terminal 5 to ground) for best immunity against electromagnetic interference.

Terminal 4 – Connect to the positive (+) side of the 18 to 32 vdc power source.

Terminal 5 – Connect to the negative (–) side of the dc power source.

Terminal 6 – Connect to the red (+) lead of the sensor. If a separate transmitter is used, no connections are made to this terminal.

Terminal 7 – Connect to the black (–) lead of the sensor or the 4 to 20 ma dc signal input from the transmitter/ sensor assembly.

Terminal 8 – A normally open momentary closure switch can be connected between this terminal and the negative (–) side of the power source for remote reset.

Terminals 9 and 10 – High Alarm Output.

Terminals 11 and 12 – Auxiliary Alarm Output.

Terminals 13 and 14 – Low Alarm Output.

Terminals 15 and 16 – Fault Output.

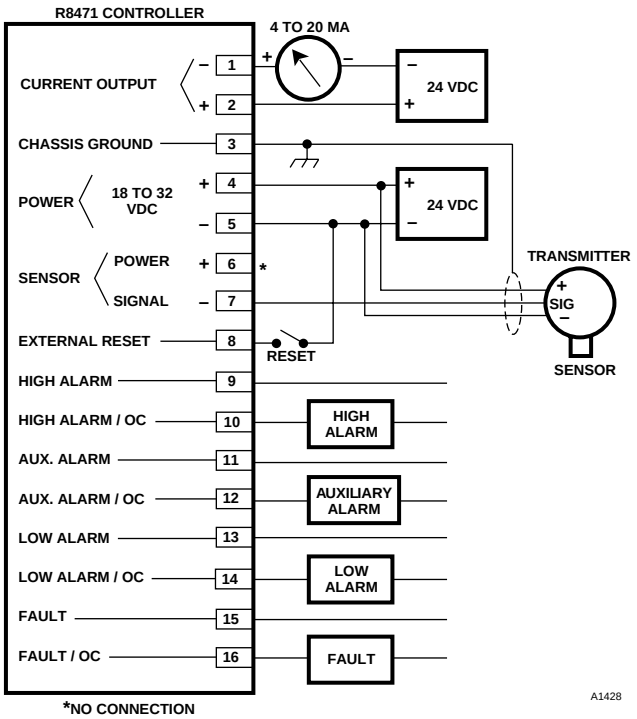

Figure 13—A Typical System - R8471B with Relay Outputs, Isolated Current Output and Optional Transmitter

PREMIUM CONTROLLER

The relay outputs (terminals 9 to 16) are programmed for the desired operation using the procedure described in the “Controller Programming” section of this manual.

BASE CONTROLLER

Connections to open collector transistor outputs are made at terminals 10, 12, 14, and 16. Terminals 9, 11, 13, and 15 are not used. See Figure 14 for an example of a typical connection to an open collector transistor output.

NOTE

External equipment that can generate transients when switching (such as relays) ***must have a transient suppression device*** *(diode) properly connected across the coil at the time of installation. This will safeguard the output transistors of the controller against possible damage. Figure 14 illustrates an inductive load with a diode used for transient suppression.*

CONTROLLER PROGRAMMING

Refer to Figure 15 to determine the location of programming jumpers and switches. Table 3 shows the selectable options for each relay.

NOTE

All jumper plugs ***must be installed****. The controller outputs will not function properly if a jumper plug is missing.*

Normally Open/Closed Relays

The four SPST relays are individually programmed for either normally open or normally closed contacts. This is accomplished by placing a jumper plug on the appropriate pair of pins. Each relay has a set of three pins. For normally open operation, place the plug on the NO and center pins. For normally closed operation, place it on the NC and center pins. The pin groups are identified as follows:

J2 – High Alarm
J3 – Auxiliary Alarm
J4 – Low Alarm
J5 – Fault

The controller is programmed at the factory for normally open relay contacts.

NOTE

“Normally Open” or “Normally Closed” refers to the condition of the relay contacts when “Normally de-energized” operation is selected. (Refer to the setting of SW1-2 below.) If the relays are “Normally Energized,” the condition of the relay contacts will be reversed.

Latching/Non-Latching Relays

The Low and Auxiliary alarm relays are programmable for latching or non-latching operation. The High alarm relay is always latching. Latching relay operation is programmed using rocker switch 1 at SW1 (SW1-1). For latching operation, place the switch in the closed position. For non-latching operation, place it in the open position. This switch is set at the factory for non-latching relay operation.

Normally Energized/De-Energized Relays

The three alarm relays are also programmable for normally energized (fail-safe) or normally de-energized operation. This is accomplished by setting rocker switch 2 at SW1 (SW1-2). For normally energized alarm relays, place the switch in the closed position. For normally de-energized operation, place it in the open position. This switch is set at the factory for normally de-energized operation.

The Fault relay is always normally energized, regardless of the setting of SW1-2.

NOTE

If the switch positions of SW1 are changed while power is applied, power must be cycled for the change to take effect.

4 to 20 ma Output

Isolated or non-isolated operation of the 4 to 20 ma output is selected using a jumper plug at J1. For non-isolated operation, as illustrated in Figure 12, place the jumper plug in the INT (**int**ernal power source) position. Place the plug in the EXT position for an isolated circuit, as illustrated in Figure 13. The jumper is set at the factory for non-isolated operation.

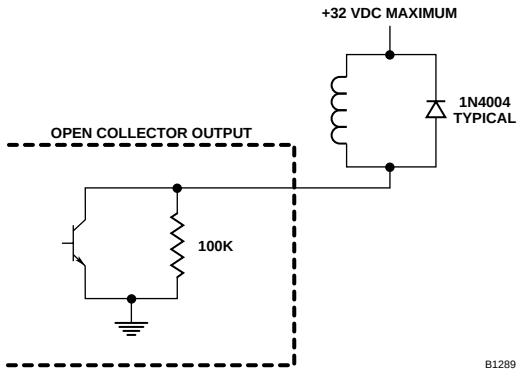

Figure 14—Open Collector Output with Inductive Load and Transient Suppression Device

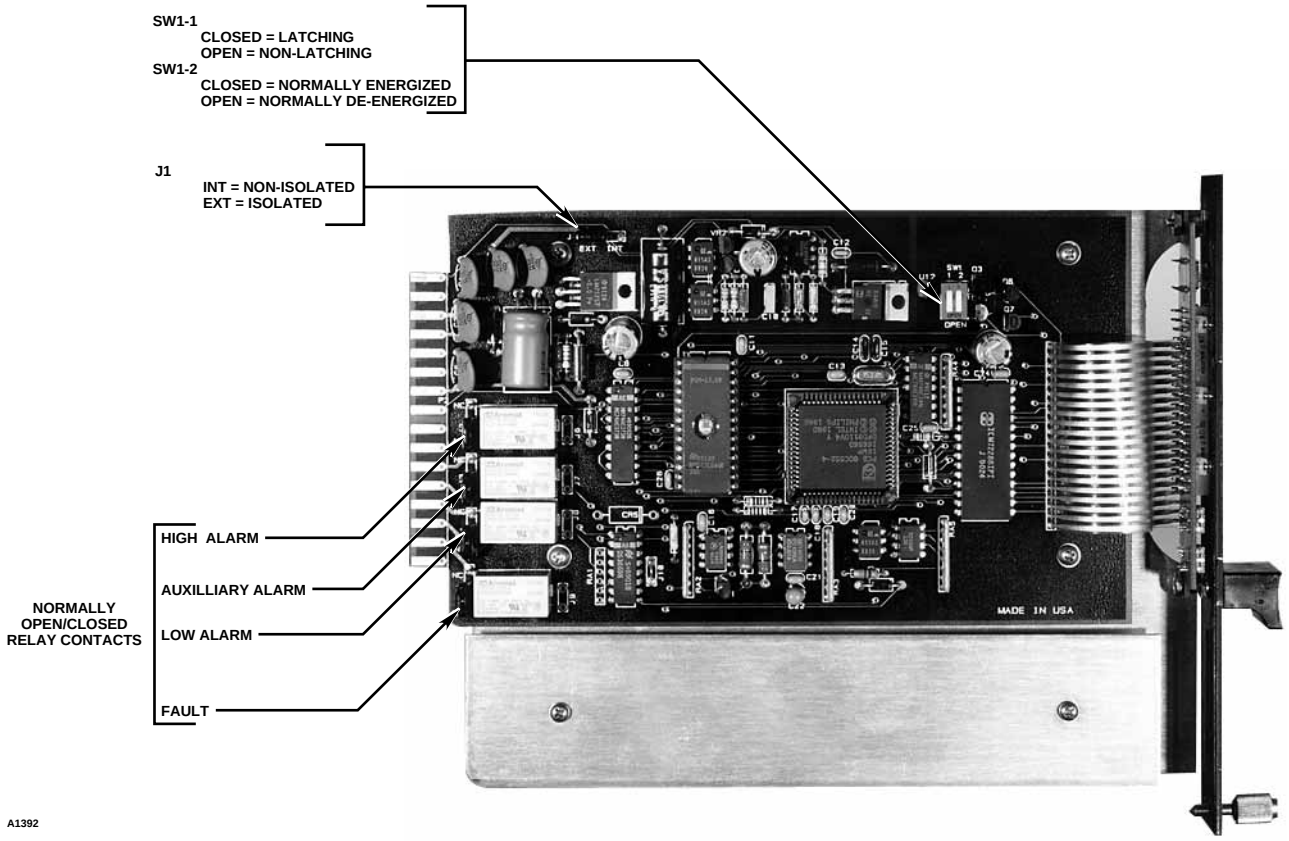

Figure 15—Programming Jumper Plugs and Switches

INSTALLATION CHECKLIST

The following checklist is provided as a means of double checking the system to be sure that all phases of system installation are complete and have been performed correctly.

1. Sensors are pointing down and junction boxes are securely mounted.

2. All cable shields are properly grounded.

3. All junction box covers are tightly installed.

4. Explosion-proof conduit seals have been installed at all junction box entries (if conduit is being used).

5. Sensor to controller wiring is correct.

6. Power wiring to the controller is installed and power source is operational.

7. External loads are properly connected to the controller.

8. Controller is programmed as desired. Record this information for future reference.

9. Controller is properly installed in the mounting rack.

10. Proper ventilation is provided to prevent overheating of the controller.

Proceed to System Startup, Setpoint Adjustment, and Calibration.

Section III
System Startup

STARTUP PROCEDURE

1. Output loads that are normally actuated by the system should be secured (remove power from all output devices) to prevent undesired activation.

2. Check all external wiring for proper connection. Be sure that the sensor has been wired properly.

3. Before installing the controller in the mounting rack, inspect it to verify that it has not been physically damaged in shipment. Check the jumper plugs and rocker switches on the controller for proper programming, then slide the controller fully into the mounting rack.

4. Apply power to the system.

NOTE

The controller has a power-up time delay to allow the sensor output to stabilize before beginning normal operation. During this time the outputs are inhibited, the FAULT LED is illuminated, and the current output indicates a fault condition. The controller automatically exits the time delay mode after 5 minutes have elapsed or as soon as the sensor output no longer exceeds any alarm setpoints.

5. Put the controller in the Setpoint Display mode to determine the present alarm setpoints and calibration gas concentration. If changes are required, perform the Setpoint Adjustment procedure.

6. Perform the calibration procedure.

7. Check the 4 to 20 ma current loop for proper calibration and adjust as required.

8. Remove mechanical blocking devices (if used) and restore power to the output loads.

SETPOINT ADJUSTMENT

The adjustment range in ppm for the alarm setpoints and calibration gas concentration is as follows:

Range:	0 to 100	0 to 50	0 to 20
Low alarm:	5 to 40	1 to 25	0.5 to 10
High alarm:	10 to 60	2 to 45	1 to 18
Aux. alarm:	5 to 99	1 to 45	0.5 to 18
Cal. gas:	30 to 99	15 to 45	6 to 18

The factory settings in ppm are:

Range:	0 to 100	0 to 50	0 to 20
Low alarm:	10	5	2
High alarm:	20	10	4
Aux. alarm:	20	10	4
Cal. gas:	50	25	10

To **check** the present levels, use the "Setpoint Display Mode" described below. To **change** the values, use the "Setpoint Adjustment Procedure."

SETPOINT DISPLAY MODE

1. To enter the Setpoint Display mode, press and hold the RESET button until the Low LED begins to blink (approximately one second). Release the RESET button. The low alarm setpoint will be shown for two seconds on the digital display.

NOTE

The RESET button should be released as soon as the controller has entered the Setpoint Display mode (after one second). If the button is still depressed at the end of the Setpoint Display mode (9 seconds), the controller will automatically enter the Calibrate mode. If the operator is not prepared to perform a calibration, a calibration fault will occur. Recycle power to the controller to exit the Calibrate mode without affecting the calibration settings.

2. At the end of the two second interval, the Low LED goes out, the High LED begins to blink, and the digital display shows the high alarm setpoint.

3. Two seconds later the High LED goes out and the Auxiliary LED blinks. The digital display now shows the programmed auxiliary alarm setpoint.

4. Two seconds later the Auxiliary LED goes out and the CAL LED blinks. The digital display now shows the programmed calibration gas concentration.

5. After displaying the calibration gas concentration for two seconds, the controller automatically leaves the Setpoint Display mode and returns to the Normal operating mode.

6. If adjustments to the setpoints are required, perform the Setpoint Adjustment procedure. When the setpoint levels are acceptable, record this information for future reference and perform the Calibration procedure.

SETPOINT ADJUSTMENT PROCEDURE

1. Determine the required alarm setpoint levels and calibration gas concentration.

2. Press and hold the SET button for one second. The digital display indicates the present low alarm setpoint and the Low LED blinks. Press the RESET button to increase the reading or the SET button to decrease the reading. (Holding the button will cause the reading to change rapidly.)

3. When no changes to the setpoint level have been made for 5 seconds, the Low LED goes out, the High LED blinks, and the digital display shows the high alarm setpoint. Press the appropriate button (detailed in step 2 above) to obtain the desired reading on the digital display.

4. When no changes to the setpoint level have been made for 5 seconds, the High LED goes out, the Auxiliary LED blinks, and the digital display shows

the auxiliary alarm setpoint. Press the appropriate button to obtain the desired reading on the digital display.

5. When no changes have been made for 5 seconds, the Auxiliary LED goes out, the CAL LED blinks, and the digital display indicates the calibration gas concentration. Press the appropriate button to change the calibration gas concentration as required.

6. When no changes have been made for 5 seconds, the controller automatically returns to the Normal operating mode.

7. Record the new values for future reference.

NOTE

The alarm setpoints, calibration gas concentration, and calibration data are stored in non-volatile memory and are retained in the event of a power loss. However, if power is interrupted while performing the Setpoint Adjustment or Calibration procedure, the entire procedure must be repeated when power is restored.

CALIBRATION

Various factors affect the time interval between periodic recalibrations. Exposure to certain contaminants in the air, accumulation of contaminants on the filter, or an extended period of normal operation can cause changes in sensitivity. Since each application is different, the length of time between regularly scheduled recalibrations can vary from one installation to the next. In general, the more frequently a system is checked, the greater the reliability. Calibration must be performed:

— When a new system is initially put into service

— When the sensing element is replaced

— If a transmitter or controller used in conjunction with the sensor is replaced

— When the hydrophobic filter is cleaned or replaced.

The following calibration schedule is recommended when placing a new sensor into operation and will ensure reliable operation in most applications:

1. One hour after power-up

2. One week later

3. Every 30 days thereafter, or as determined by the needs of the specific application.

IMPORTANT

To ensure adequate protection, ***the H_2S detection system must be calibrated on a regularly scheduled basis****.*

Loss of sensitivity can be caused by various factors. One common cause is by clogging of the hydrophobic filter by dirt, oil, paint, etc. Problems of this nature will not be detected by the system's diagnostic circuitry. While performing detector calibration, the operator should examine the hydrophobic filter of the sensor. If it cannot be properly cleaned, it should be replaced.

The detector must be calibrated using hydrogen sulfide mixed with either air or nitrogen. For best results, a calibration gas concentration equal to the high alarm setpoint or 50% of full scale is recommended.

NOTE

If the sensing element is being replaced, refer to the "Sensing Element Replacement" section (under "Maintenance") in this manual for information regarding replacement and calibration of the sensor.

CALIBRATION PROCEDURE

The H_2S detection system can be calibrated using either of two methods:

1. **Transmitter calibration (if a transmitter is used)**. This method of calibration can be performed by one person. All adjustments are made at the transmitter. Calibration of certain transmitter models requires removing the enclosure cover, therefore, the hazardous area must be de-classified.

   When transmitter calibration is performed, an initial calibration of the controller must be performed in addition to the transmitter calibration. This calibration of the controller is not the same as "2. Controller Calibration" described below. It involves setting factory default calibration values in the controller that will ensure accuracy when used in conjunction with a properly calibrated transmitter. Since these default values do not change, the procedure does not need to be repeated with subsequent transmitter recalibrations. This controller calibration is accomplished by momentarily entering the Sensor Replacement mode. Upon entering the Sensor Replacement mode, the controller automatically sets the factory default controller calibration values. (Follow the procedure described in the "Setting Controller Default Values" section.)

2. **Controller calibration**. This method of calibration typically requires two people, one person at the controller and another at the sensor. All adjustments are made automatically by the controller.
   The controller calibration procedure is typically used when the system involves a sensor that generates an uncalibrated output signal (no transmitter calibration is possible).

   However, if the controller calibration procedure will be used with a transmitter that can be calibrated, the transmitter must be calibrated first, followed by the controller calibration. (The controller calibration compensates for errors in sensor/transmitter output. If the transmitter is calibrated following a controller calibration, the controller must be recalibrated.)

In most cases, the controller calibration procedure can be used for all subsequent recalibrations, with no need to repeat the transmitter calibration.

NOTE

If the controller calibration method is used for calibrating a new sensor in a system using a transmitter that can be calibrated, the most accurate calibration for the new sensor will be achieved if a transmitter calibration is performed initially (the controller must be placed into the Sensor Replacement mode to set the controller default calibration values), followed by a controller calibration (24 hours later for maximum accuracy). The controller calibration procedure can then be used for all subsequent calibrations.

Setting Controller Default Values
(Required for Transmitter Calibration)

IMPORTANT

*This procedure **must** be performed in addition to transmitter calibration.*

When calibration adjustments are made at the transmitter, the controller must be set for the factory default calibration values by momentarily entering the Sensor Replacement mode.

1. Press and hold the RESET button for approximately 9 seconds until the digital display begins flashing and the CAL LED is illuminated. Release the RESET button.

2. Press the SET button. The FAULT LED comes on and the digital display stops flashing. The controller is now set for the factory default values.

3. To exit the Sensor Replacement mode, press the RESET button. The controller returns to the normal operating mode after a time delay.

The above procedure does not need to be performed with each recalibration unless a controller calibration (described below) is performed.

For information regarding calibration of the transmitter, refer to the transmitter manual.

Controller Calibration Procedure

1. Be certain that the controller is properly programmed for the ppm concentration being used for calibration. (See “Setpoint Adjustment” section.) Reprogram the controller if required. Failure to do so will greatly impair system response.

2. Be sure that only clean air (0 ppm) is present at the sensor. (The microprocessor begins taking Zero readings immediately upon entering the Calibrate mode.) If the possibility of background gases exists, purge the sensor with clean air to assure accurate calibration.

3. Depress and hold the RESET button until the CAL LED is illuminated and the digital display starts to flash (approximately 9 seconds).

4. When the Zero calculations are complete (30 seconds minimum), the digital display stops flashing and reads “00.”

5. Apply the calibration gas to the sensor. The digital display starts to flash, and the value indicated on the display rises. The bar graph display also indicates the level of gas at the sensor, but does not flash.

6. When the microprocessor has completed the Span adjustments (30 seconds minimum), the digital display stops flashing.

7. Remove the calibration gas. When the gas level falls below the lowest alarm setpoint, the controller automatically exits the Calibrate mode. All outputs and indicators return to normal operation.

If the operator fails to complete the calibration procedure or if the sensitivity of the sensor has deteriorated to the extent that calibration cannot be successfully completed, a calibration fault (“F2X” status) will be generated and the system will automatically revert back to the former calibration settings (after 10 minutes or when the gas level drops below the lowest set-

point). If a successful calibration cannot be accomplished, replace the sensing element and recalibrate.

If the microprocessor determines that the sensing element is approaching the end of its useful life, “F10” will be indicated on the digital display. This does not indicate a system malfunction, but is intended to notify the operator of this condition. A successful calibration can still be performed. Press RESET after completing calibration to clear the display.

CURRENT OUTPUT CALIBRATION

The 4 to 20 milliampere output is calibrated at the factory to provide a degree of accuracy that is satisfactory for most applications. However, the highest level of accuracy can be obtained by performing the following procedure.

1. A dc current meter capable of measuring 4 to 20 milliamperes must be connected to the current loop output. This can be accomplished by connecting a dc ammeter in series with the load or by connecting a digital dc voltmeter across a known load resistance and calculating the current flow using the formula:

   I = voltage/load resistance.

2. Press and hold the SET button, then immediately press the RESET button. (The RESET button must be pressed within one second of pressing the SET button.) Release both buttons. The Low LED should flash slowly. The flashing Low LED indicates that the system is now generating a 4 ma output.

3. Press the RESET (increase) or SET (decrease) button to obtain a 4.0 ma reading on the meter. (Holding the button will cause the output to change rapidly.)

4. When no adjustments have been made for 7 seconds, the controller automatically switches to a 20 ma output. This is indicated by a flashing High LED. Press the appropriate button to obtain a 20.0 ma reading.

5. When no adjustments have been made for 7 seconds, the controller generates the current output level for the calibrate mode. This is indicated by a flashing CAL LED. Press the appropriate button to obtain the desired current output level for the calibrate mode. (The default level is 4.0 ma.)

6. When no changes have been made for 7 seconds, the system automatically returns to the Normal operating mode and saves the data in non-volatile memory.

7. Remove the meter from the system output and reconnect the outputs for normal operating conditions.

Section IV
System Maintenance

ROUTINE MAINTENANCE

To ensure reliable protection, it is important to check and calibrate the H_2S detection system on a regularly scheduled basis. The frequency of these checks is determined by the requirements of the particular installation.

MANUAL CHECK OF OUTPUT DEVICES

Fault detection circuitry continuously monitors for problems that could prevent proper system response. It does not monitor external response equipment or the wiring to these devices. It is important that these devices be checked initially when the system is installed, as well as periodically during the ongoing maintenance program.

CHECKOUT IN NORMAL MODE

The system must be checked periodically in the Normal mode to ensure that those items not checked by the controller diagnostic circuitry (such as output relays) are functioning properly.

CAUTION

Be sure to secure all output devices that are actuated by the system to prevent unwanted activation of this equipment, and remember to place these same output devices back into service when the checkout is complete.

HYDROPHOBIC FILTER

The hydrophobic filter on the front of the sensor housing protects the sensing element from contaminants in the environment. The operator should frequently inspect the hydrophobic filter for cleanliness. A dirty filter can significantly reduce the amount of H_2S gas that is able to reach the sensing element, thereby impairing the ability of the system to respond to a hazardous condition. If the filter becomes dirty and cannot be properly cleaned or if it is damaged, it must be replaced. Do not use solvents to clean the filter. DO NOT operate the detector if the hydrophobic filter is damaged or missing.

To replace the hydrophobic filter, simply unscrew the

existing filter from the housing, then replace it with a new filter. Use care not to over tighten.

NOTE

A dirty hydrophobic filter can adversely affect the response of the sensor by blocking the flow of gas to the sensing element. If the detector cannot be calibrated or responds slowly to the calibration gas, check the condition of the hydrophobic filter before replacing the sensing element assembly. The hydrophobic filter should be clean and squarely seated in the housing.

SENSING ELEMENT REPLACEMENT

The area must be de-classified or power to the sensor must be removed prior to replacing the sensing element in a hazardous area.

To replace the sensing element:

1. If the controller will remain powered during sensor replacement, enter the sensor replacement mode by pressing and holding the RESET button for approximately 9 seconds until the digital display begins flashing and the CAL LED is illuminated. Release the RESET button.

2. Press the SET button. The FAULT LED also comes on. The controller is now in the Sensor Replacement mode.

3. Remove the cap from the sensor housing. See Figure 6. (There is no need to remove the sensor housing from the junction box.)

4. Remove and discard the old sensing element assembly. Check for corrosion or contamination on the terminals inside the sensor enclosure, and clean if necessary.

5. Determine proper orientation for the new assembly, then **carefully** plug it in.

NOTE

Handle the sensing element assembly carefully. To avoid possible damage, observe the normally accepted procedures for handling electrostatic sensitive devices. See form 75-1005 for additional information.

6. Place the cap back on the sensor housing. Tighten only until snug. **Do not over tighten**.

7. Re-apply power. Allow time for the unit to warm up and stabilize (approximately one hour for best results), then calibrate.

NOTE

If power was removed from the controller during the sensing element replacement procedure, the controller will automatically return to the Normal mode when power is restored (after a time delay). To prevent the possibility of alarms, allow the system to warm up in the sensor replacement mode. The sensor replacement mode can be entered during the power-up time delay by holding the RESET button for 7 seconds.

If performing a transmitter calibration, leaving the controller in the Sensor Replacement mode until after the calibration is complete will prevent any alarms. If using the controller calibration method, exit the Sensor Replacement mode and calibrate.

Press RESET to exit the Sensor Replacement mode. The controller will enter the Normal mode after a time delay.

An adequate supply of spare sensing element assemblies should be kept on hand for field replacement. For maximum protection against contamination and deterioration, they should not be removed from the original protective packaging until the time of installation. To ensure maximum storage life, sensing elements should be stored at a temperature between 32° and 68°F (0 to 20°C) and a relative humidity between 15 and 90 percent.

NOTE

The sensing element assembly contains an acid that occasionally can leak. If leakage should occur, gloves should be worn when handling the assembly. If acid comes in contact with the skin, wash the affected area thoroughly with soap and water. Dispose of all old sensing elements properly, even if leakage is not detected. Never attempt to open the sensing element assembly.

Controller Calibration

If transmitters are being used and the system is being calibrated using the “Controller Calibration” method, the most accurate calibration for a new sensor will be achieved if a transmitter calibration is performed first (as soon as the sensor output has stabilized). Then perform the “Controller Calibration” procedure described in the “Calibration” section of this manual (24 hours later for maximum accuracy). The controller calibration procedure can then be used for all subsequent calibrations.

Refer to the “Calibration” section of this manual for the recommended calibration schedule for a new sensor. A Recommended Test Form is supplied at the back of this manual for recording maintenance performed on

the system.

TROUBLESHOOTING

Table 6 is intended to serve as an aid in locating the cause of a system malfunction.

NOTE

Record all faults on the Fault Record Sheet at the back of this manual.

REPLACEMENT PARTS

The R8471B Controller is not designed to be repaired by the customer in the field. If a problem should develop, first carefully check for proper wiring, programming and calibration. If it is determined that the problem is caused by an electronic defect, the device must be returned to the factory for repair.

NOTE

When replacing a controller, be sure that the jumper plugs and rocker switches of the replacement are the same as the original. Remove power before removing the device from the mounting cage or plugging in the replacement unit.

The sensing element assembly is not intended to be repaired. When calibration can no longer be properly performed, the assembly must be replaced. The frequency of replacement will be determined by the amount and type of contamination present at the particular installation.

An adequate supply of spare sensing element assemblies should be kept on hand for field replacement. For maximum protection against contamination and deterioration of the sensing element, they should not be removed from the original protective packaging until the time of installation. Sensing elements should be stored at a temperature

Table 6—Troubleshooting Guide

Problem	Possible Cause
No faceplate indicators illuminated.	1. Wiring to external power source. 2. Input power failure.
FAULT LED on, digital display blank.	1. Power-up time delay (up to 5 minutes). 2. If condition continues after 5 minutes, repeat power-up. If problem continues, replace controller.
F91 to F98 Status	1. Initialization failure. Repeat power-up. If successful, re-program and re-calibrate. If not, replace controller.
F92 Status	1. Sensor failure (during startup). Current is over 35 ma or below 2 ma.
F94 Status	1. RAM failure. Return controller to factory for repair.
F96 Status	1. Input power problem (should be 18 to 32 volts). Check operation of power source and power wiring.
F97 Status	1. Controller type invalid. Error in data from RAM. Return controller to factory for repair.
F70 Status	1. External reset activated for over 15 seconds. Check external switch and wiring.
F60 Status	1. Input power out of tolerance. Check operation of power source and power wiring.
F50 Status	1. Internal power supply problem. Replace controller.
F40 Status	1. Sensor output (after startup) is over 35 ma or below 2 ma. Check sensor/transmitter wiring and calibration. 2. Faulty sensor. Replace and calibrate. 3. Faulty transmitter. Replace and calibrate.
F30 Status	1. Negative zero drift. Calibrate sensor. 2. Faulty sensor. Replace and calibrate. 3. Faulty transmitter. Replace and calibrate.
F20, F21 Status	1. Calibration error. Re-calibrate.
F22, F23 Status	1. Sensor sensitivity out of tolerance. Calibrate transmitter. If problem continues, replace sensor and calibrate.
F24 Status	1. Wrong gas for zero calibration. 2. Background gas affecting the zero calibration. 3. Sensor zero input over limit, re-calibrate transmitter.
F10 Status	1. Sensor reaching end of life - no problem at present time. Be prepared to replace sensor at next calibration (calibration attempt might fail).

between 32°F and 68°F (0° to 20°C) and a relative humidity between 15 and 90 percent.

Always calibrate after replacing the sensing element.

Refer to the “Ordering Information” section of this manual for a list of part numbers.

DEVICE REPAIR AND RETURN

Prior to returning devices or components, contact the nearest local Detector Electronics office so that a Service Order number can be assigned. A written statement describing the malfunction must accompany the returned device or component to expedite finding the cause of the failure.

Pack the unit or component properly. Use sufficient packing material in addition to an anti-static bag or aluminum-backed cardboard as protection from electrostatic discharge.

Return all equipment transportation prepaid to the factory in Minneapolis.

ORDERING INFORMATION

Sensors and transmitters must be ordered separately from the controller. When ordering please specify:

R8471B H_2S Controller
Specify base or premium model, 3U or 4U height, and 0 to 100, 0 to 50 or 0 to 20 ppm range.

MOUNTING RACKS
A mounting rack is required for controller installation. 3U racks are used with gas controllers only. 4U racks can house gas or flame controllers in any combination. See Figures 9 and 10. Rack sizes are available to handle up to 8 flame controllers or up to 16 gas controllers.

SENSOR
C7064C Sensor Housing
C7064E Sensor Housing
Electrochemical Sensing Element
Sensor Junction Box

ACCESSORIES

Silicone Free Grease
Open Frame Power Supply - 3.6 amperes at 24 vdc
Open Frame Power Supply - 12 amperes at 24 vdc
W4810 Power Supply mounted in explosion-proof enclosure, 24 vdc.

CALIBRATION EQUIPMENT

H_2S Calibration Kit (for use with electrochemical sensors only) includes regulator, hose, calibration cup, and two cylinders of calibration gas.
Ampoule Calibration Kit (includes six 10 ppm ampoules and six 40 ppm ampoules). Used with small systems.
H_2S Air Dilution Calibration System (not certified for use in hazardous locations). Used with large systems.

REPLACEMENT PARTS

Electrochemical Sensing Element
Hydrophobic Filter
Gas Bottle for Calibration Kit - 50 ppm

APPLICATION ASSISTANCE

For assistance in ordering a system to fit your application, please contact:

Detector Electronics Corporation
6901 West 110th Street
Minneapolis, Minnesota 55438 USA
Operator: (952) 941-5665 or (800) 765-FIRE
Customer Service: (952) 946-6491
Fax: (952) 829-8750
Web site: www.det-tronics.com
E-mail: detronics@detronics.com

Recommended Test Form

Detector Number	Detector Location	Date Installed	Date Checked	Date Calibrated	Remarks

Fault Record Sheet

Date	Time	Detector Affected	System Status	Operator	Comments

DECLARATION OF CONFORMITY

Manufacturers' Name & Address

Detector Electronics Corporation
6901 West 110th Street
Minneapolis, MN 55438
USA

Application of Council Directive(s):	Standard(s) to which conformity is declared:
89/336/EEC	EN 50081-1:1992 EN 50082-1:1992

Type of Equipment:	Model Number/Assembly Number:
Gas Controller	R8471XXXXX/005479-001 thru 005479-028 R8471XXXXX/005478-001 thru 005478-027

We, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s).

Kevin Keefe, Sales Support Manager
Detector Electronics UK Ltd.

Scott Dodge, Quality Manager
Detector Electronics Corporation

European contact: Detector Electronics UK Ltd., Riverside Park, Poyle Road, Colnbrook Slough, Berkshire SL3 9HB England
Phone: +44 (1) 753 683059 Fax: +44 (1) 753 684540

X3301 Multispectrum
IR Flame Detector

PointWatch Eclipse®
IR Combustible Gas Detector

Eagle Quantum Premier®
Safety System

Eagle Logic Solver
Safety System

Detector Electronics Corporation
6901 West 110th Street
Minneapolis, MN 55438 USA

T: 952.941.5665 or 800.765.3473
F: 952.829.8750
W: http://www.det-tronics.com
E: detronics@detronics.com

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