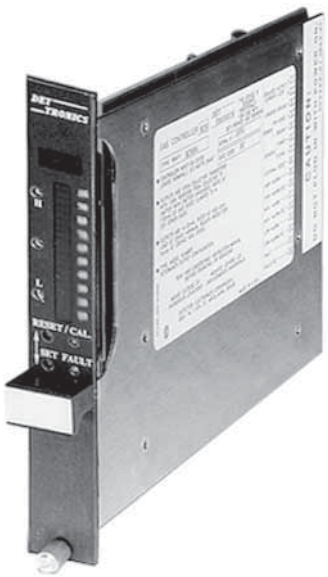
DET-TRONICS®

A UTC Fire & Security Company

# Instructions 95-8410

Carbon Monoxide Controller
R8471E



# Table of Contents

## Section I - General Information



## Section II - System Installation



## Section III - System Startup



## Section IV - System Maintenance

DET-TRONICS®
A UTC Fire & Security Company

# INSTRUCTIONS
## Carbon Monoxide Controller
## R8471E

## Section I
## General Information

Carbon monoxide (CO) is a colorless, odorless gas that is toxic to human life at low concentrations. Figure 1 shows the effects of various concentrations of CO on the human body.

## DESCRIPTION

The R8471E is a single channel, rack mounted controller that provides continuous monitoring of a Det-Tronics electrochemical CO sensor or any other CO 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 ma output for transmitting system information to other devices.

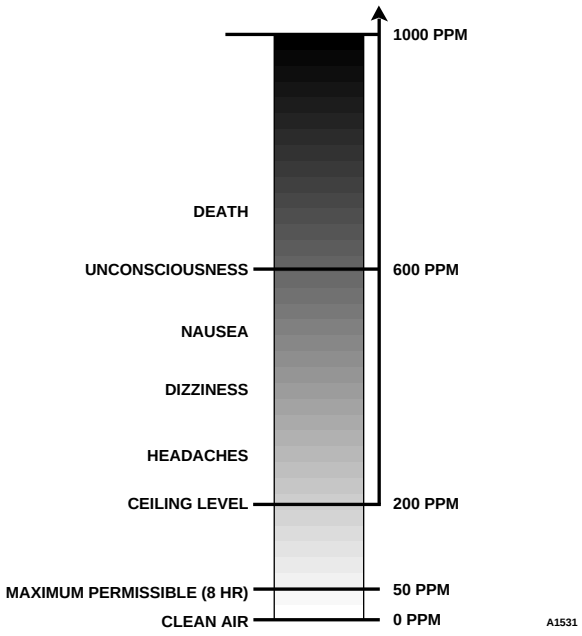
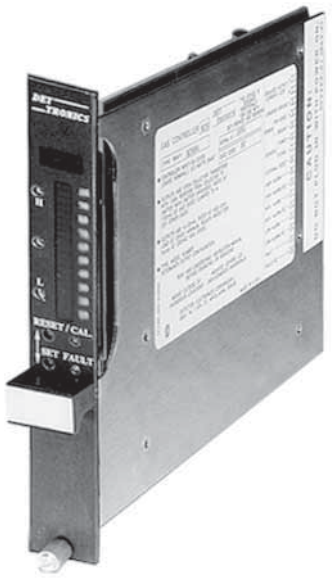



Figure 1—Effects of CO on the Human Body



## FEATURES

- Controller accepts a 4 to 20 ma input.
- 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.
- Three independent alarm outputs with field selectable setpoints.
- 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.
- Available operating ranges are 0 to 100, 0 to 500 and 0 to 1000 ppm.
- Rack compatible with Det-Tronics R7400 series flame controllers.

# SPECIFICATIONS

## CONTROLLER

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

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.)

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

MAXIMUM RIPPLE—
Not to exceed 5 volts peak-to-peak.

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

OPERATING RANGES (not programmable)—
0 to 100 ppm, 0 to 500 ppm, or 0 to 1000 ppm.

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 ma at 32 volts dc maximum.

RELAY CONTACTS (Premium model only)—
SPST relays with selectable normally open/normally closed contacts, rated 5 amperes at 30 vdc.

CURRENT OUTPUT (Premium model only)—
4 to 20 ma, with a maximum external loop resistance of 600 ohms at 20 vdc and 1100 ohms at 32 vdc.

DIMENSIONS—
See Figure 2.

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

SYSTEM APPROVAL—
The R8471E 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 R8471E 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 (not programmable)—
0 to 100 ppm, 0 to 500 ppm, or 0 to 1000 ppm. Sensor operating range **must** match that of controller.

TEMPERATURE RANGE—
+23°F to +105°F (–5°C to +40°C). Recommended storage: +32°F to +68°F (0°C to +20°C).

TEMPERATURE RESPONSE—
Less than ±10% of gas concentration or ±3% full scale, whichever is greater, from –5°C to +40°C.

HUMIDITY RANGE—
15 to 90% RH, non-condensing.

PRESSURE RANGE—
Ambient pressure ±10%.

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

REPEATABILITY—
±2% of applied gas concentration or ±1% full scale, whichever is greater.

RESPONSE TIME—
20 percent full range within 18 seconds, 50 percent full range within 30 seconds when CO concentration equal to full scale is applied.

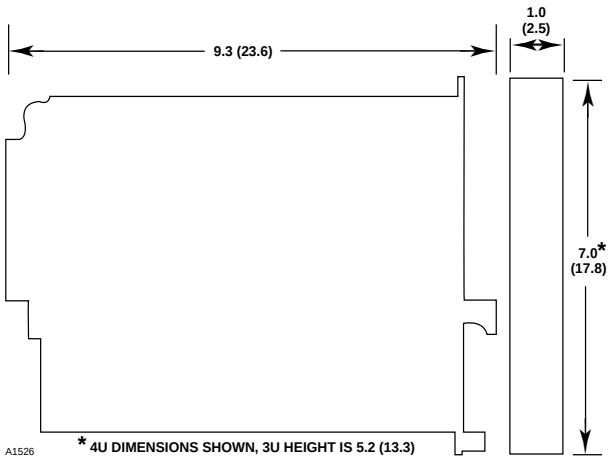



Figure 2—Controller Dimensions in Inches (Centimeters)

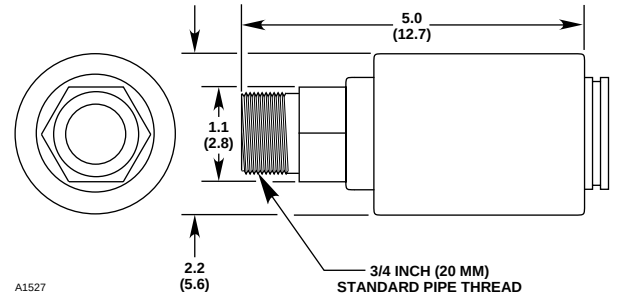



Figure 3—C7066E Sensor Dimensions in Inches (Centimeters)

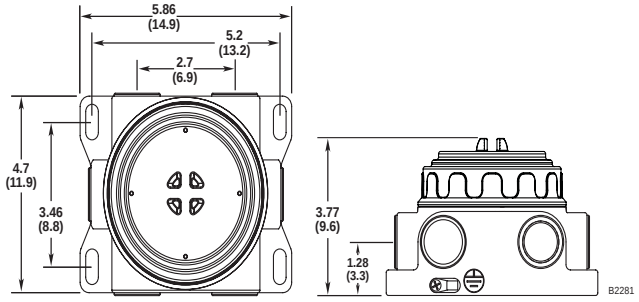



Figure 4—Junction Box Dimensions in Inches (Centimeters)

ENCLOSURE MATERIAL—
Aluminum.

DETECTOR RATINGS—
The C7066E is designed to meet FM and CSA requirements for Class I, Division 1, Groups C and D.

DIMENSIONS—
See Figures 3 and 4.

SHIPPING WEIGHT (Approximate) —
1.0 pound (0.5 kilogram).

WARRANTY—
Limited warranty 12 months on hardware, 24 months on sensor cell.

Table 1—Cross Sensitivity of Electrochemical CO Sensor

| Gas | Concentration | Signal |
|---|---|---|
| Carbon Dioxide | 25% | 0 |
| Chlorine | 10 ppm | 0 |
| Ethylene | 100 ppm | <50 |
| Hydrogen | 100 ppm | <60 ppm |
| Hydrogen Chloride | 100 ppm | 0 |
| Hydrogen Cyanide | 100 ppm | 0 |
| Hydrogen Sulfide | 100 ppm | <5 ppm |
| Methane | 5% | 0 |
| Nitric Oxide | 100 ppm | <5 ppm |
| Nitrogen Dioxide | 100 ppm | <5 ppm |
| Sulfur Dioxide | 100 ppm | <5 ppm |

# SYSTEM OPERATION

## SENSOR

The C7066E CO Sensor consists of an explosion-proof aluminum housing with a field replaceable electrochemical sensor cell. The transmitter circuitry for generating a 4 to 20 ma output signal is contained within the sensor housing, eliminating the need for a separate transmitter.

The sensor is designed for use in Class I, Division 1, Groups C and D hazardous locations.

The C7066E uses a hydrophobic filter to protect the electrochemical sensor cell from contamination by dirt and moisture. Unlike metal filters that significantly restrict the passage of gases to the sensor cell when the surface is coated with water, the hydrophobic filter sheds water and will not inhibit the flow of CO gas to the sensor cell. As with any filter, the hydrophobic filter must be kept free of contaminants to allow CO gas to reach the sensor cell.

The hydrophobic filter and electrochemical sensor cell can be replaced quickly and conveniently in the field.

### Sensor Cross Sensitivity

Table 1 shows the response of a typical electrochemical CO sensor when exposed to various commonly encountered substances.

## CONTROLLER

### Faceplate Description

The controller faceplate provides LEDs for identifying system status conditions, a digital display and a bar graph display for indicating the sensor input, and pushbuttons for programming, calibrating and resetting the system. See Figure 5 for the location of indicators and pushbuttons.

1. **Digital Display** - The digital display provides a continuous reading in parts per million (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 on, 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).

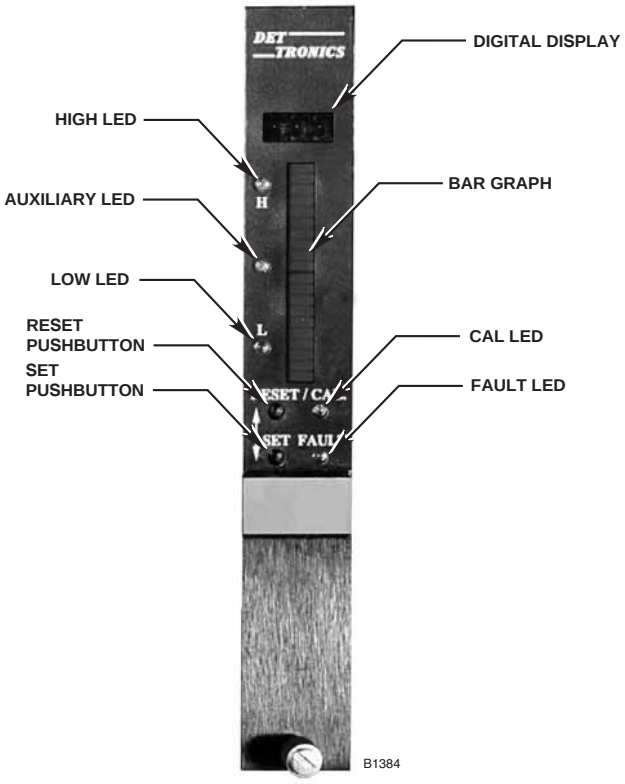



Figure 5—Controller Front Panel

*NOTE*

*In the event of an over-range condition, the digital display flashes as long as the over-range condition exists. 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 CO gas present.*

2. **Bar Graph Display** - The 20 segment bar graph display provides a reading of sensor input.

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.

*NOTE*

*Alarm LEDs flash when the setpoint is reached and are on steady (until reset) when the CO 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.

**Operating Ranges**

The R8471E is available in three operating ranges:

- 0 to 100 ppm
- 0 to 500 ppm
- 0 to 1000 ppm.

The operating range is not field programmable and must be specified when ordering.

It is essential for the operating range of the sensor to match the operating range of the controller to which it is connected. Note that three sensor housings and three electrochemical cells are offered. Be sure that all equipment is compatible when installing the new system and when replacing sensor cells. Refer to the “Ordering Information” section.

**Setpoints**

The R8471E CO Controller has three independent alarm outputs (low, high and auxiliary), with field selectable setpoints.

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.

Refer to Table 2 for a list of setpoint adjustment ranges.

Alarm setpoints and calibration gas concentration can be checked and/or changed using pushbuttons

Table 2—Setpoint Adjustment Ranges in PPM

| Range | Low Alarm | High Alarm | Auxiliary Alarm | Calibration Gas |
|---|---|---|---|---|
| 0 to 100 | 5 to 50 | 10 to 90 | 5 to 90 | 30 to 90 |
| Default | 10 | 20 | 20 | 50 |
| 0 to 500 | 25 to 250 | 50 to 450 | 25 to 450 | 150 to 450 |
| Default | 50 | 100 | 100 | 250 |
| 0 to 1000 | 50 to 500 | 100 to 900 | 50 to 900 | 300 to 900 |
| Default | 100 | 200 | 200 | 500 |

located on the front panel of the controller. See the "Set-point Adjustment" section for complete information.

**Outputs**

The R8471E 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 ma 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 reached. 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. Relays have SPST contacts rated 5 amperes at 30 vdc.

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 CO levels from 0 ppm to 100% full scale (0 to 100, 0 to 500 or 0 to 1000 ppm, depending on controller model). 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.

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 to ensure proper functioning. In addition, a "watchdog" timer is maintained to ensure that the program is running correctly. If a fault should occur:

— 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.

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 normally energized Fault output is de-energized.
— The dc current output drops to less than 1.0 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.)*

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 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 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 6.

POWER-UP TIME DELAY

When power is applied to the controller, it enters a time delay mode 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 (less than 1.0 ma). At the end of the time delay, the controller automatically enters the Normal operating mode.

NORMAL

In Normal operating mode with no alarm condition:

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

Table 4—System Status Codes

| Status | Condition |
|---|---|
| F9X | Initialization failure. (Subcodes are as follows.) |
| F91 | EPROM sumcheck failure. |
| F92 | Sensor 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 calibration gas to be applied 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. |

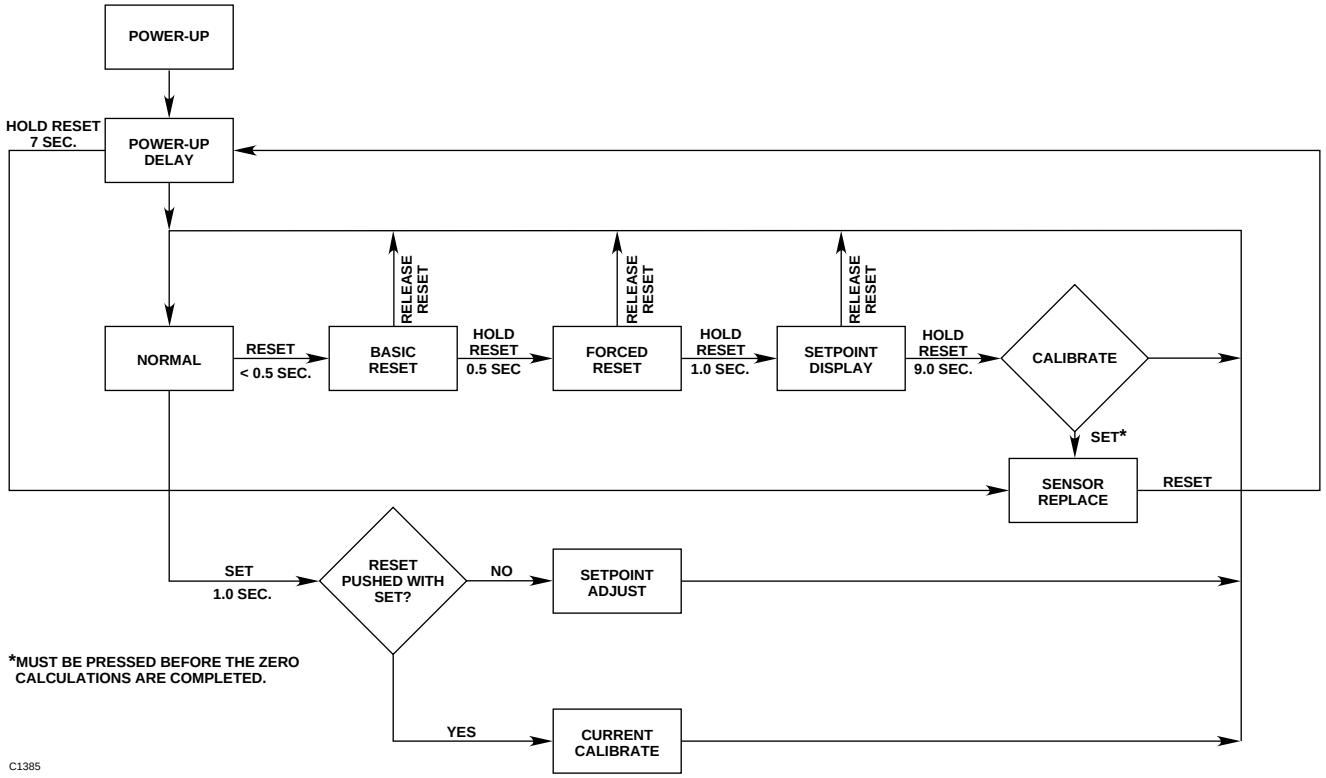



Figure 6—R8471E Controller Flow Chart

— 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).
— 4 to 20 ma 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.
— Low and/or Auxiliary LED flashes.
— Low and/or Auxiliary alarm output changes state.
— 4 to 20 ma 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.
— 4 to 20 ma output drops to less than 1.0 ma.

RESET

The Reset mode is entered by pressing the RESET button located on the front panel of the controller. (See Figure 6.) 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 R8471E 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 and continue to use the previous calibration data (after 10 minutes or when the gas level drops below the lowest setpoint). A fault indication ("F2X" status) will be displayed until a reset occurs. If the microprocessor determines that the sensor cell is approaching the end of its useful life, "F10" will be indicated on the digital display.

See "Calibration" section for complete information.

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, with a default value of 4.0 ma).

SENSOR REPLACEMENT

This mode inhibits all controller outputs to allow replacement of the sensor cell 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 sensor cell 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 automatically returns to normal operation.

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. Initially, a 4 ma output is generated for approximately 7 seconds while the Low LED flashes. Then 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

### 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. Select a location for the sensor as close as practical to an anticipated source of CO gas.

2. 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 carbon monoxide gas is anticipated. Also consider the fact that some ventilation systems do not operate continuously.

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

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

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

6. 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.

### GENERAL WIRING REQULREMENTS

*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 CO detection system to protect against interference caused by 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 junction box as possible. In no case should this seal be located more than 18 inches (46 cm) from the junction box. 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, the use of a fiber dam 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 through the inside of the shield. The shield should not be cut.

Conduit breathers are also recommended. 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.

## SENSOR WIRING

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.

1. Determine the best mounting locations for the 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.

   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 de-classified.*

4. Remove the cap from the sensor base. See Figure 7.

5. Remove the sensor cell from its packaging. Determine proper orientation, then **carefully** plug it into the sensor base.

Table 5—Maximum Wiring Distances – Controller to Sensor

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

*NOTE*

*Handle the sensor cell carefully. To avoid possible damage, observe the normally accepted procedures for handling electrostatic sensitive devices. See form 75-1005 for more information.*

6. Be sure that the O-ring is in good condition, then place the cap back on the sensor base. 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. Also lubricate the junction box cover threads. The recommended lubricant is a silicone free polyalphaolefin grease available from Det-Tronics.*

8. Connect the sensor wires to the sensor terminal block inside the junction box. (See Figure 8.) Connect the controller wiring to the controller terminal block inside the junction box.

Connect the shield to earth ground at the controller end only. Under normal conditions, the other

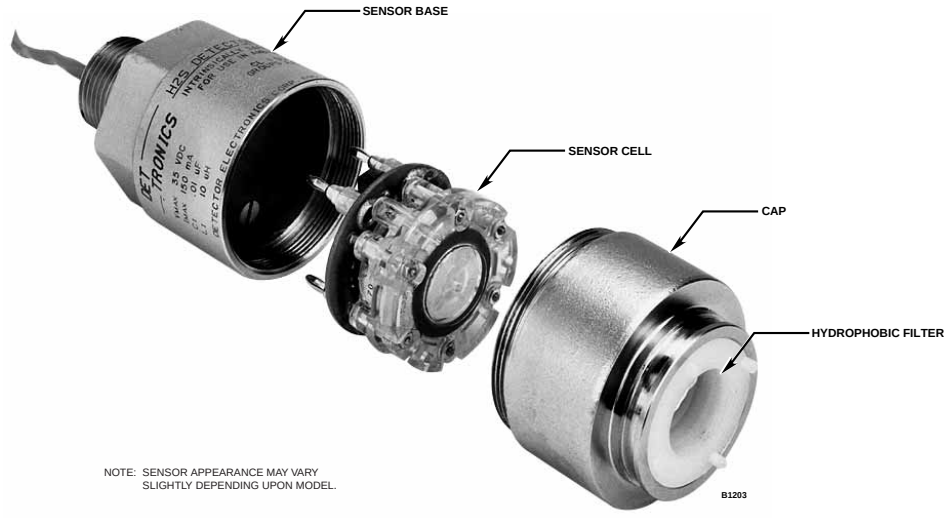



Figure 7—Exploded View of Sensor

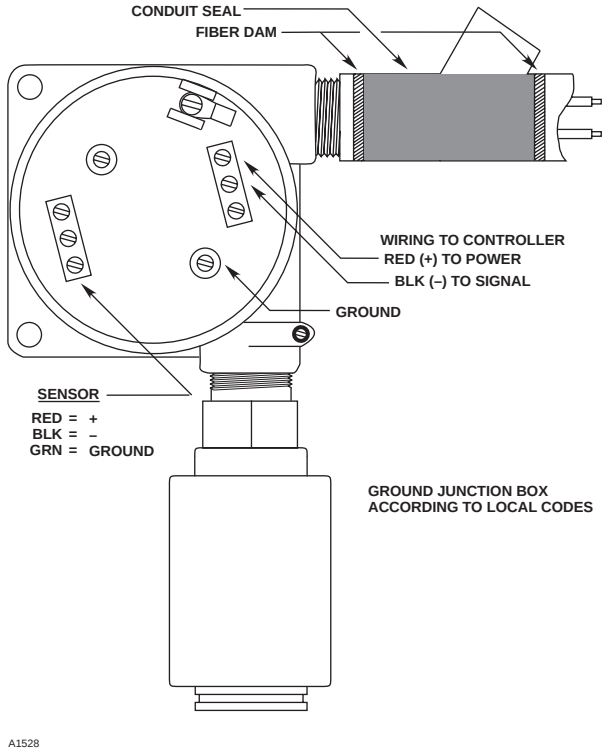



Figure 8—Sensor Wiring

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 | = | "+/power" |
| Black lead | = | "–/signal" |
| Green lead | = | Chassis (earth) ground |

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.

## 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 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 required 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 R8471E CO 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.

**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.

Terminal 3 – Connect to chassis (earth) ground. Ground the cable shield at this terminal.

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.

*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.*

| 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 | | | | |

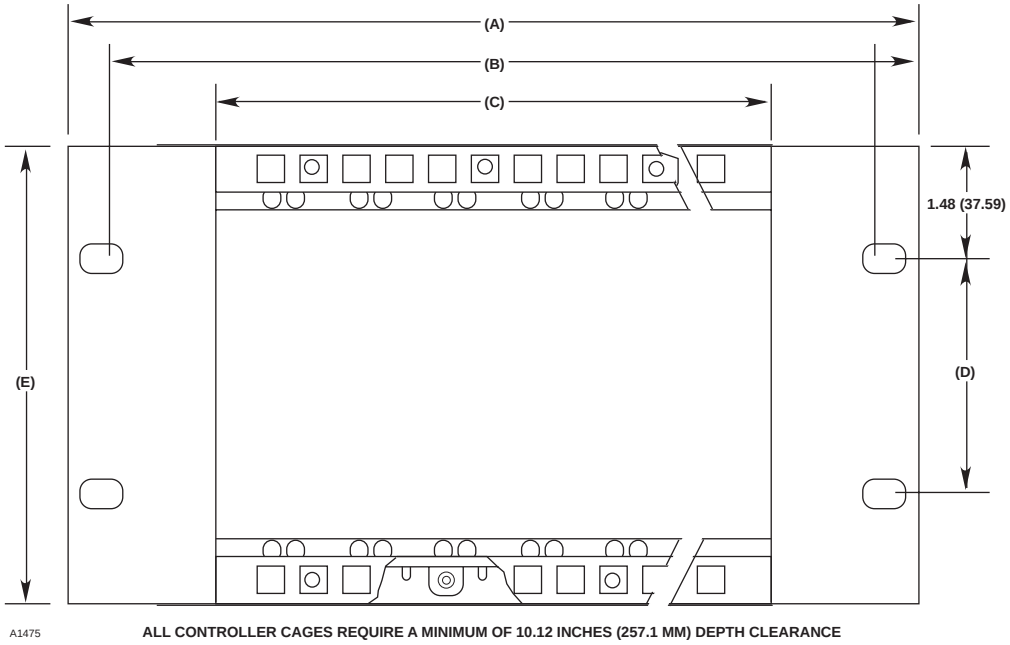
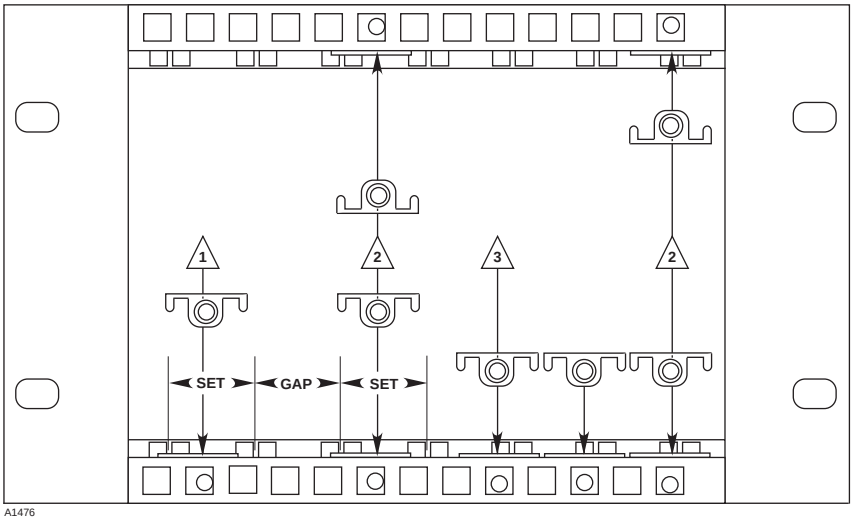



Figure 9—Dimensions of Mounting Rack

**THE Q4004 CONTROLLER CAGE HAS BEEN MODIFIED TO ACCOMMODATE EITHER FIRE OR GAS CONTROLLERS OR ANY COMBINATION OF THE TWO. BY FOLLOWING THE INSTRUCTIONS BELOW, THE CAGE CAN BE SET UP TO ANY CONFIGURATION.**




1. FIRE CONTROLLERS ARE APPROX. TWO INCHES WIDE AND REQUIRE TWO GUIDE RAILS FOR INSERTION. PLACE THE RETAINING CLIP BETWEEN RAILS TO FORM SETS, LEAVE A GAP BETWEEN SETS.
2. TO INSERT A BLANK PANEL, PLACE A CLIP IN THE TOP BRACKET IN LINE WITH THE CLIP IN THE BOTTOM BRACKET.
3. GAS CONTROLLERS ARE APPROX. ONE INCH WIDE AND REQUIRE ONE RAIL FOR INSERTION. PLACE CLIPS IN LINE WITH GUIDE RAILS, CAGES WILL ACCEPT AS MANY GAS CONTROLLERS AS RAILS PROVIDED.

Figure 10—Clip Positioning for Mounting Racks

Terminal 6 – Connect to the red (+) lead of the C7066E Sensor.

Terminal 7 – Connect to the black (–) lead of the C7066E Sensor.

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.

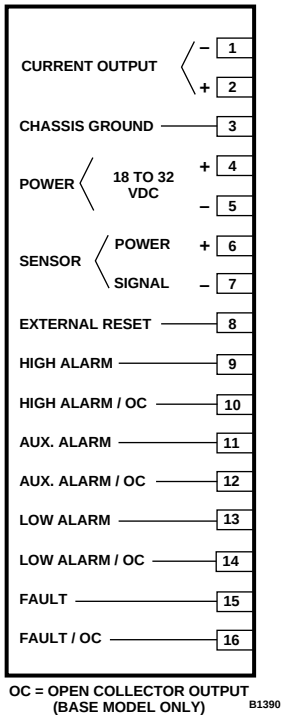



Figure 11—Terminal Configuration for R8471E CO Controller

## 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) connected across the coil at the time of installation. (Note proper polarity of the diode.) 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.*

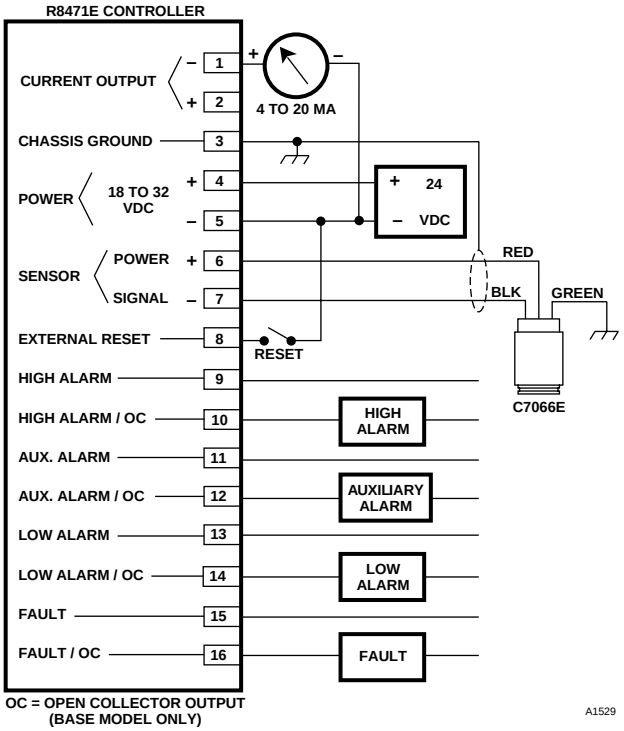



Figure 12—A Typical System – R8471E with Relay Outputs, Non-Isolated Current Output and C7066E Sensor

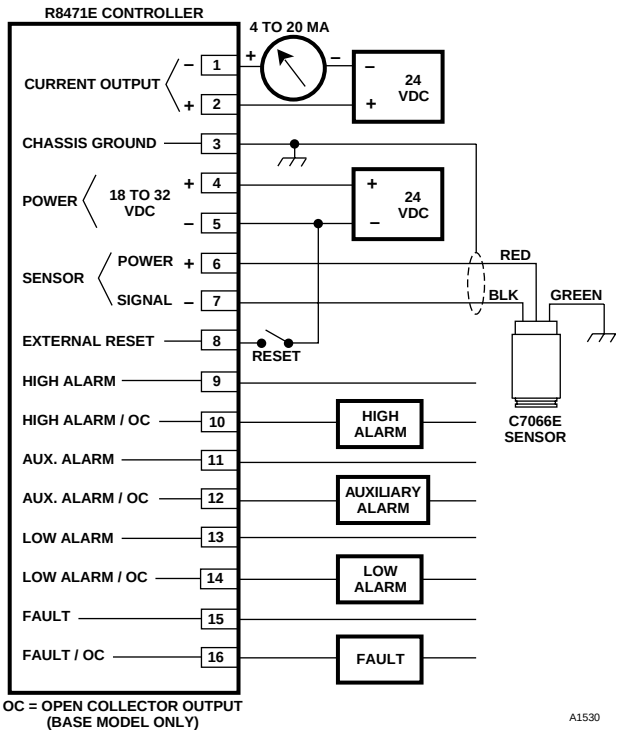



Figure 13—A Typical System - R8471E with Isolated Current Output

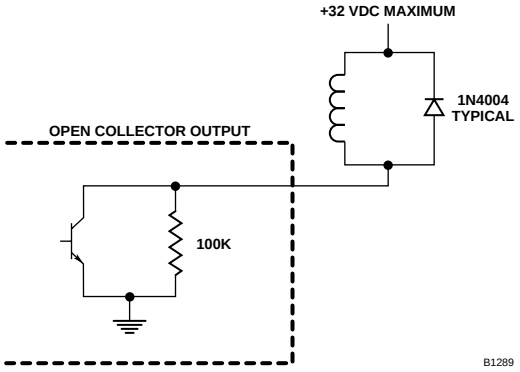



Figure 14—Open Collector Output with Inductive Load and Transient Suppression Device

PREMIUM CONTROLLER

The relay outputs (terminals 9 to 16) are programmed for the desired operation using the procedure described in the "Controller Programming" section.

## CONTROLLER PROGRAMMING

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

***IMPORTANT***

*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 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.

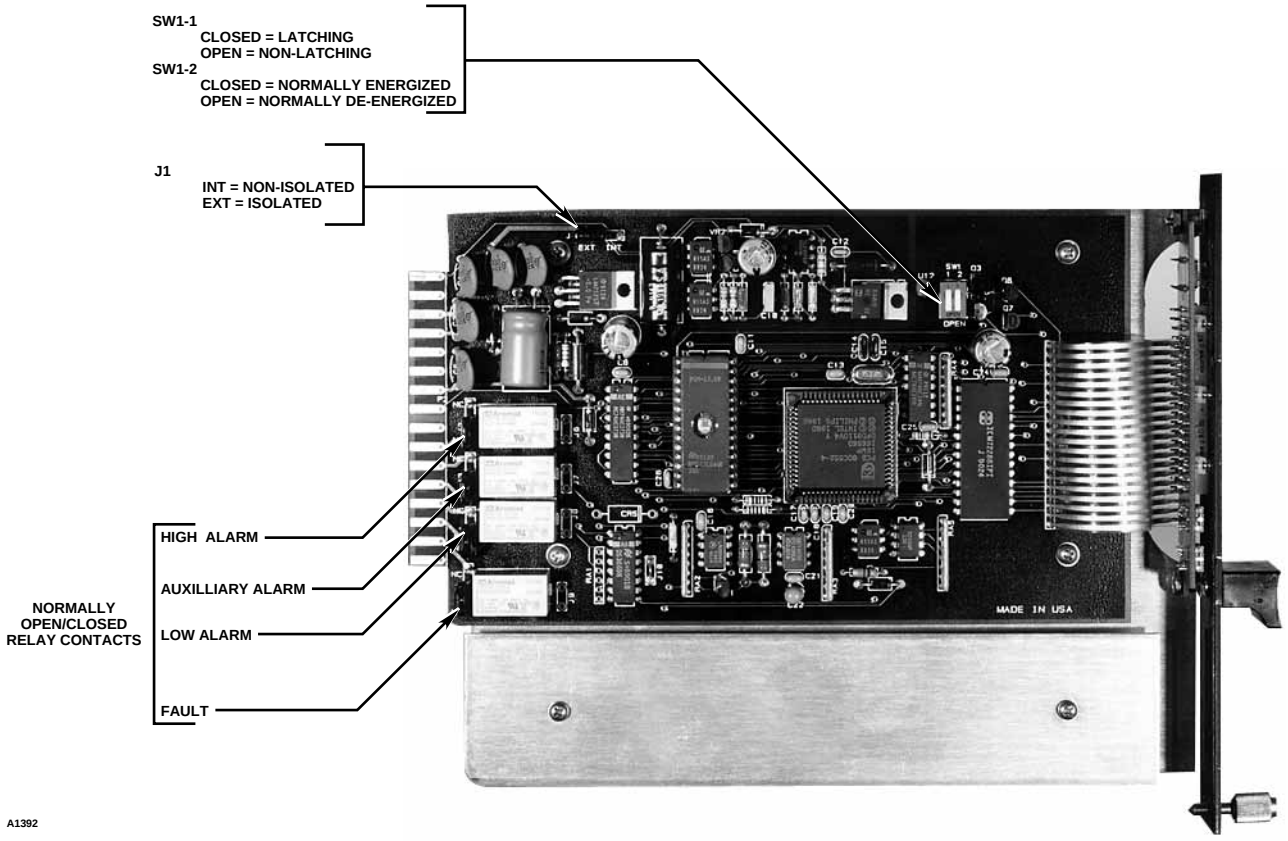



Figure 15—Programming Jumper Plugs and Switches

**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 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 (internal power source) position. Place the plug in the EXT position for an isolated circuit (external power source), as illustrated in Figure 13. The jumper is set at the factory for non-isolated operation.

## 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. Junction boxes are mounted securely and sensors are pointing down.
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 controlled by the system should be secured (remove power from all output devices) to prevent actuation.
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*

*When power is applied to the system, the controller enters a time delay mode before beginning normal operation. During this time the outputs are inhibited, the FAULT LED is illuminated and the current output indicates a fault condition. This delay allows time for the sensor output to stabilize before normal operation is begun. 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

Refer to Table 2 to determine the adjustment ranges for the alarm setpoints and calibration gas concentration for the controller model being used.

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 blinks 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 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, then release. 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 value to match the actual gas concentration used for sensor calibration.

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

To ensure optimum protection, the CO detection system must be calibrated on a regularly scheduled basis. 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 sensor cell 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 CO 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 controller's diagnostic circuitry. While performing calibration, the operator should examine the hydrophobic filter of the sensor. If it cannot be cleaned properly, it should be replaced.

For best results, a calibration gas concentration equal to the high alarm setpoint or 50% full scale is recommended.

*NOTE*

*If the sensor cell is being replaced, refer to the "Sensor Cell Replacement" section (under "Maintenance") for information regarding cell replacement and sensor calibration.*

### CALIBRATION PROCEDURE

Calibration typically requires two people, one person at the controller and another at the sensor. All adjustments are made automatically by the controller.

1. Be certain that the controller is properly programmed for the ppm concentration being used for calibration. (See the "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 CO) 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 ensure 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 setpoint). If a successful calibration cannot be accomplished, replace the sensor cell and recalibrate.

If the microprocessor determines that the sensor cell 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 simply to make the operator aware 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 ma 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 ma 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 flashes slowly while the system generates 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 CO 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 sensor cell from contaminants in the environment. The operator should frequently inspect the hydrophobic filter for cleanliness. A dirty filter can significantly reduce the amount of CO gas that is able to reach the sensor cell, 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.

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 sensor cell. If the detector cannot be*

*calibrated or responds slowly to the calibration gas, check the condition of the hydrophobic filter before replacing the sensor cell. The hydrophobic filter should be clean and squarely seated in the housing.*

## SENSOR CELL REPLACEMENT

The area must be de-classified or remove power to the sensor prior to replacing the sensor cell in a hazardous area. To replace the sensor cell:

1. If the controller will remain powered during sensor cell replacement, enter the sensor replacement mode before replacing the cell. To enter the sensor replacement mode, 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 also comes on. The controller is now in the Sensor Replacement mode.

3. Remove the cap from the sensor base. See Figure 7. (There is no need to remove the sensor housing from the junction box.)

4. Remove and discard the old sensor cell. Check for corrosion or contamination on the terminals of the sensor base, and clean if necessary.

*NOTE*

*Compare part numbers to be sure that the correct replacement cell is being used.*

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

*NOTE*

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

6. Be sure that the O-ring on the sensor housing is in good condition, then place the cap back on the sensor base. Tighten only until snug. **Do not over tighten**.

7. If power was removed prior to replacing the sensor cell, 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 sensor cell 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.*

Press RESET to exit the Sensor Replacement mode. The controller will automatically enter the Normal mode.

An adequate supply of spare sensor cell 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, sensor cells should be stored at a temperature between 32°F and 68°F (0 to 20°C) and a relative humidity between 15 and 90 percent.

A Recommended Test Form is supplied at the back 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 R8471E Controller is not designed to be repaired 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 controller from the mounting cage or plugging in the replacement unit.*

The sensor cell is not intended to be repaired. When calibration can no longer be properly performed, the assembly must be replaced.

An adequate supply of spare sensor cells should be kept on hand for field replacement. For maximum protection against contamination and deterioration of the sensor cell, it should not be removed from the original protective packaging until the time of installation.

Table 6—Troubleshooting Guide

| Problem | Possible Cause |
|---|---|
| No faceplate indicators illuminated. | 1. Wiring to external power source.<br>2. Input power failure. |
| FAULT LED on, digital display blank. | 1. Power-up time delay (up to 5 minutes).<br>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 be18 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.<br>2. Faulty sensor. Replace and calibrate.<br>3. Faulty transmitter. Replace and calibrate. |
| F30 Status | 1. Negative zero drift. Calibrate sensor.<br>2. Faulty sensor. Replace and calibrate.<br>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.<br>2. Background gas affecting the zero calibration.<br>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 may fail). |

Sensor cells should be stored at a temperature between 32°F and 68°F (0° to 20°C) and a relative humidity between 15 and 90 percent.

Always calibrate after replacing the sensor cell. Refer to the “Ordering Information” section for a list of replacement parts.

## DEVICE REPAIR AND RETURN

Prior to returning devices, 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 properly. Use sufficient packing material in addition to an antistatic bag as protection from electrostatic discharge.

Return all equipment transportation prepaid to the factory in Minneapolis.

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

## ORDERING INFORMATION

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

**CONTROLLERS**

**R8471E CO Controller:**

Base model
Premium model

**Operating range:**

0 to 100 ppm
0 to 500 ppm
0 to 1000 ppm

**Controller height:**

3U
4U

**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 to accommodate 2, 4, 6, 8, 12 or 16 gas controllers are available. (Flame controllers require two rack positions per controller.)

**SENSORS**

Each detection point requires a sensor consisting of one sensor housing, one sensor cell and one sensor junction box.

**Sensor housing:**

3/4 inch NPT
20 mm

**Sensor range:**

0 to 100 ppm
0 to 500 ppm
0 to 1000 ppm

**Sensor Cell:**

0 to 100 ppm
0 to 500 ppm
0 to 1000 ppm

**Sensor Junction Box**

**ACCESSORIES**

Silicone Free Grease
Open Frame Power Supply, 24 vdc at 3.6 amperes
Open Frame Power Supply, 24 vdc at 12 amperes
W4810 Power Supply mounted in explosion-proof enclosure, 24 vdc at 1.0 ampere

**CALIBRATION EQUIPMENT**

CO Calibration Kit includes regulator, hose, calibration cup and two cylinders of calibration gas.

50 ppm
250 ppm
500 ppm

**REPLACEMENT PARTS**

Hydrophobic filter for sensor housing
Sensor O-Ring (2 per sensor)
Bottle of Calibration Gas - 50, 250 or 500 ppm

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 |
|---|---|---|---|---|---|
| | | | | | |

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

DET-TRONICS®
A UTC Fire & Security Company