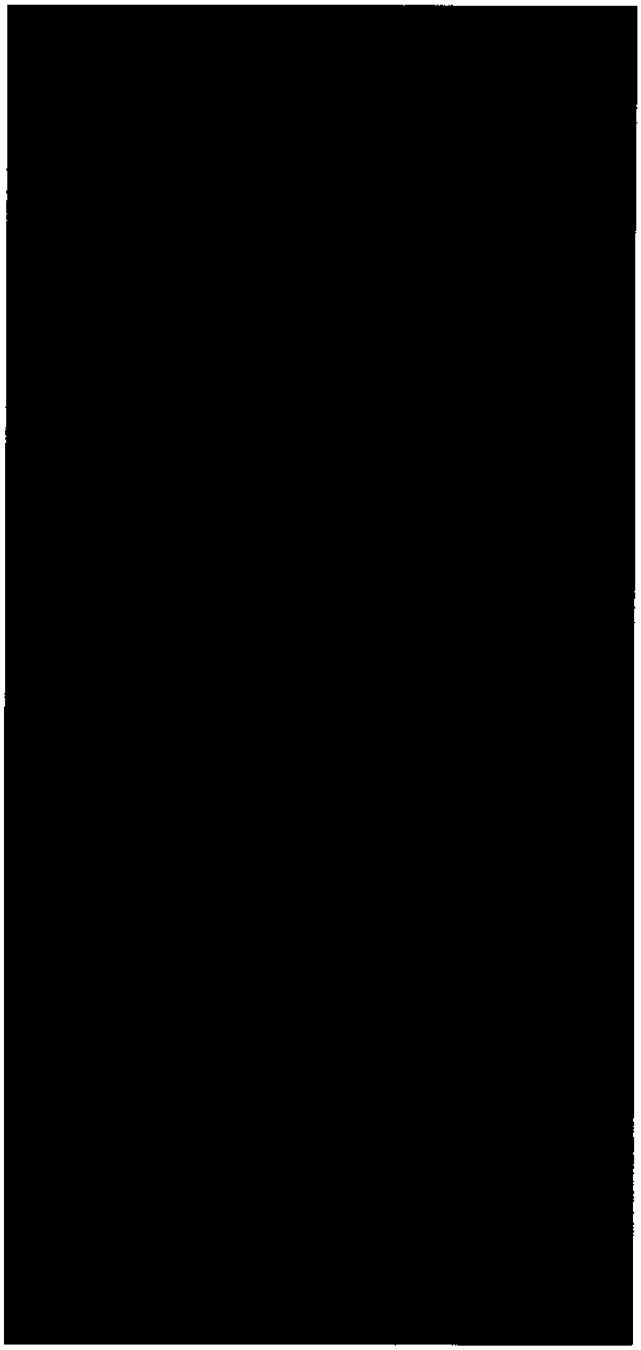
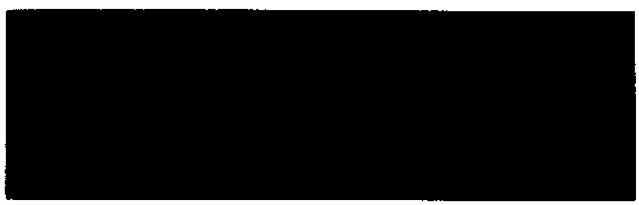
DET TRONICS



INSTRUCTIONS

Combustible Gas Detection System

Model 8000



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DET TRONICS

INSTRUCTIONS

Combustible Gas Controller

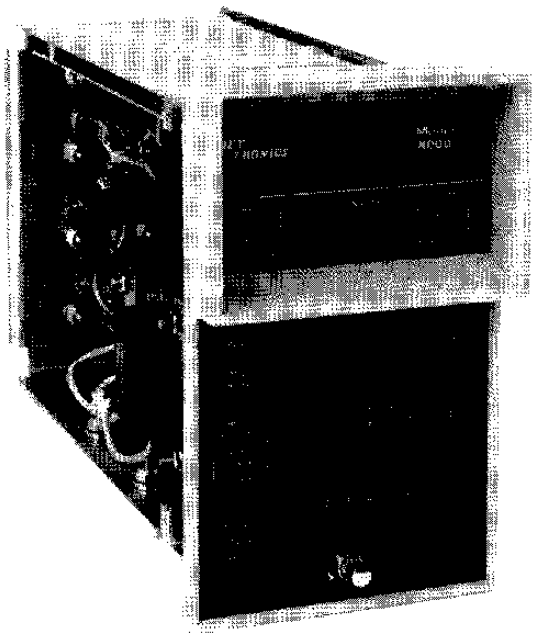
Model 8000

APPLICATION

The Model 8000 is a rack mounted controller capable of monitoring up to eight combustible gas sensors. The input to the controller consists of a 4 to 20 milliampere dc signal, which is generated by a Det-Tronics sensor/transmitter combination. The Model 8000 is designed for use with K Series transmitters, but it can also be used with Model 400 or U8700 transmitters. The gas detection system operates in the range of 0 to 100% LFL (lower flammable limit).

The controller continuously monitors the outputs of all sensor/transmitter assemblies connected to it. If the pre-set low or high alarm threshold is exceeded, the corresponding alarm relay is energized. The channel number and LFL percentage for each channel are displayed on the digital readout, which scans through the channels at a rate of one channel per second. If desired, the readout can be advanced to or stopped on any channel. Digital displays and LEDs display the level of gas being detected and indicate system status.

In addition to continuously monitoring sensor output, the controller simultaneously checks for various problems that could prevent proper system response to a hazardous condition. If a fault should occur in the system, the Trouble relay is de-energized and a faceplate LED is illuminated.



FEATURES

- Continuous monitoring of up to eight sensors.
- With proper calibration, the sensor will detect a wide variety of combustible gases.
- Field selectable high and low alarm setpoint levels.
- Relays respond to trouble, low alarm, or high alarm signals.
- LEDs provide visual indication of system status.
- Digital display indicates level of gas being detected.
- Front touch panel allows channel freeze or advance for ease of channel selection.
- Calibration can be performed by one person.
- Calibration meter enables the operator to determine remaining sensor life.
- 24 vdc or 120/240 vac operating power.
- Low power consumption - less than 4 watts per channel.
- Power interruption time delay de-activates alarm circuit on startup, power interruption, or sensor/transmitter replacement.
- Linear 4 to 20 milliampere dc output for each channel (optional).
- Independent high and low alarm relay for each channel (optional).

GENERAL APPLICATION INFORMATION

A combustible gas is one that will burn when mixed with air (or oxygen) and ignited.

The lower explosive limit (LEL) or lower flammable limit (LFL) of a combustible gas is defined as the smallest amount of the gas that will support a self-propagating flame when mixed with air (or oxygen) and ignited. In gas detection systems, the amount of gas present is specified in terms of % LFL, 0% LFL being a gas-free atmosphere and 100% LFL being an atmosphere in which the gas concentration is at its lower flammable limit. The relationship between % LFL and % by volume differs from gas to gas.

Hydrogen (H_2), 100% LFL = 4.0% by volume in air
Methane (CH_4), 100% LFL = 5.0% by volume in air
Ethane (C_2H_6), 100% LFL = 3.0% by volume in air
Ethylene (C_2H_4), 100% LFL = 2.7% by volume in air
Pentane (C_5H_{12}), 100% LFL = 1.5% by volume in air
Propane (C_3H_8), 100% LFL = 2.2% by volume in air

For data on other gases, refer to NFPA 325M. Typical settings for the alarm setpoints are 20% LFL for the low alarm and 40% LFL for the high alarm.

The LFL of a gas is affected by temperature and pressure. As the temperature increases, the LFL decreases and hence the explosion hazard increases. The relationship between LFL and pressure is fairly complex, however, a pressure increase usually lowers the LFL. The LFL of a gas is not significantly affected by the humidity fluctuations normally found in the operation of a gas detection system.

SYSTEM DESCRIPTION

NOTE

The Model 8000 Controller is designed for use with K Series Transmitters, however, the controller can also be used with Model 400 or U8700 Transmitters. This manual covers the use of the Model 8000 Controller with K Series Transmitters. If other transmitter models are being used, refer to the instruction manual supplied with the transmitter for specific information regarding the transmitter.

SENSOR

The sensing element used in the Det-Tronics combustible gas sensor consists of a pair of elements. The pair is matched to have the same electrical resistance. One is an active catalytic sensing element, and the other is inactive and acts as a temperature compensating reference element. Both elements are composed of a platinum alloy wire coil encased in ceramic. The active element has a catalytic coating applied to its surface, however, the reference element is glazed so that it does not react to the presence of a combustible gas/air mixture.

In the presence of a combustible gas/air mixture, the resistance of the active sensing element increases in proportion to the concentration of gas at the sensor. The change in resistance of the active sensing element, relative to that of the reference element, is used by the controller to determine the actual level of combustible gas present at the sensor.

Both elements operate at a high temperature and are enclosed by a porous stainless steel cup, which functions as a flame arrester. See Figure 1. This cup allows the diffusion of gas to and from the sensing element, but prevents the ignition of the atmosphere outside the sensor should the combustible gas concentration exceed its LFL.

A barrier is placed between the element pair to prevent thermal interaction and to prevent the transfer of catalytic material from the active element to the surface of the reference element.

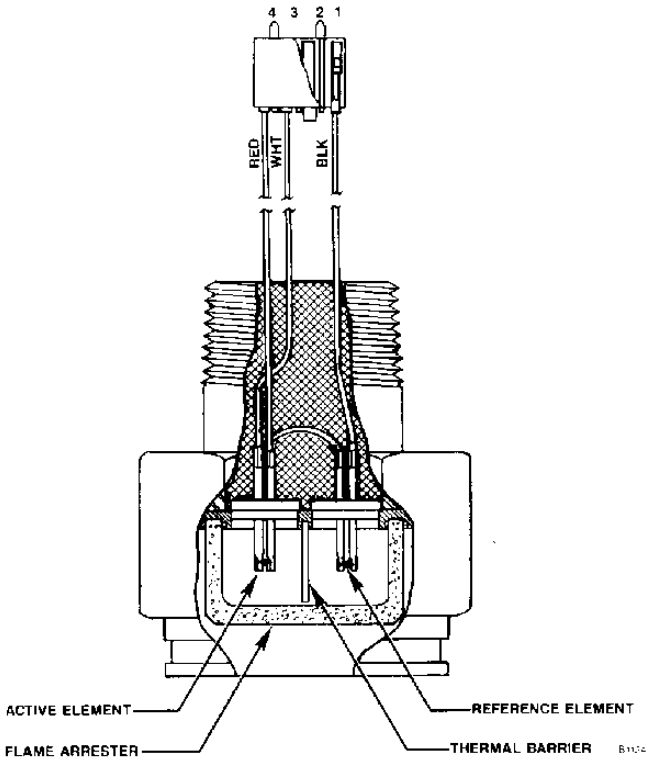


Figure 1—Cutaway View of Sensor

Figure 2 shows the response of a typical sensor to various levels of combustible gas. Note that a reading of 40% LFL will be given at 2.0% methane and also at 80.0% methane, well above the upper flammable limit of methane. Although gas levels above the upper flammable limit will not propagate a flame, it stands to reason that somewhere between the leak and clear air there will be a flammable mixture.

CAUTION

It is possible for the display to drop to a low % LFL reading after going into high alarm and still have an unsafe level of combustible gas present. Therefore, precautions should be taken to ensure that the combustible gas has been cleared before classifying the area as safe.

All catalytic type sensors require oxygen to detect combustible gases. The sensor response will decrease if enough combustible gas displaces the normal oxygen present in air. Figure 3 shows the effect of oxygen enriched and oxygen deficient atmospheres on the response of a typical combustible gas sensor. The sensor should not be used where the oxygen level is less than 10%.

SENSOR JUNCTION BOX

An explosion-proof metal junction box houses the sensor, transmitter, and connector board. A removable cover allows access to the wiring terminals and calibration potentiometers. Two 3/4 inch NPT threaded conduit entries are provided. One is used for mounting the sensor, and the other serves as the conduit wiring entrance. If the application involves installation of the sensor in a poorly accessible location, the sensor and transmitter can be mounted separately using a sensor separation kit available from Detector Electronics.

TRANSMITTER

The transmitter functions as the interface between the sensor and the controller. It contains a voltage regulator circuit to convert the transmitter supply voltage to a constant 3.3 vdc at the sensor. The transmitter generates a linear 4 to 20 milliampere output signal, which is proportional to the level of flammable gas at the sensor. It is calibrated so that a 4 milliampere signal is sent when 0% LFL is present at the sensor, and a 20 milliampere signal is sent when the sensor detects 100% LFL.

A transmitter output signal of less than four milliamperes is displayed as a negative % LFL reading by the controller and also by the calibration meter. A signal of less than four milliamperes indicates that calibration is needed or that a problem has been detected.

CALIBRATION METER

One person can calibrate the system using the Det-Tronics calibration meter. See Figure 4. When the calibration meter is plugged into the transmitter module, the signal to the controller is limited to a maxi-

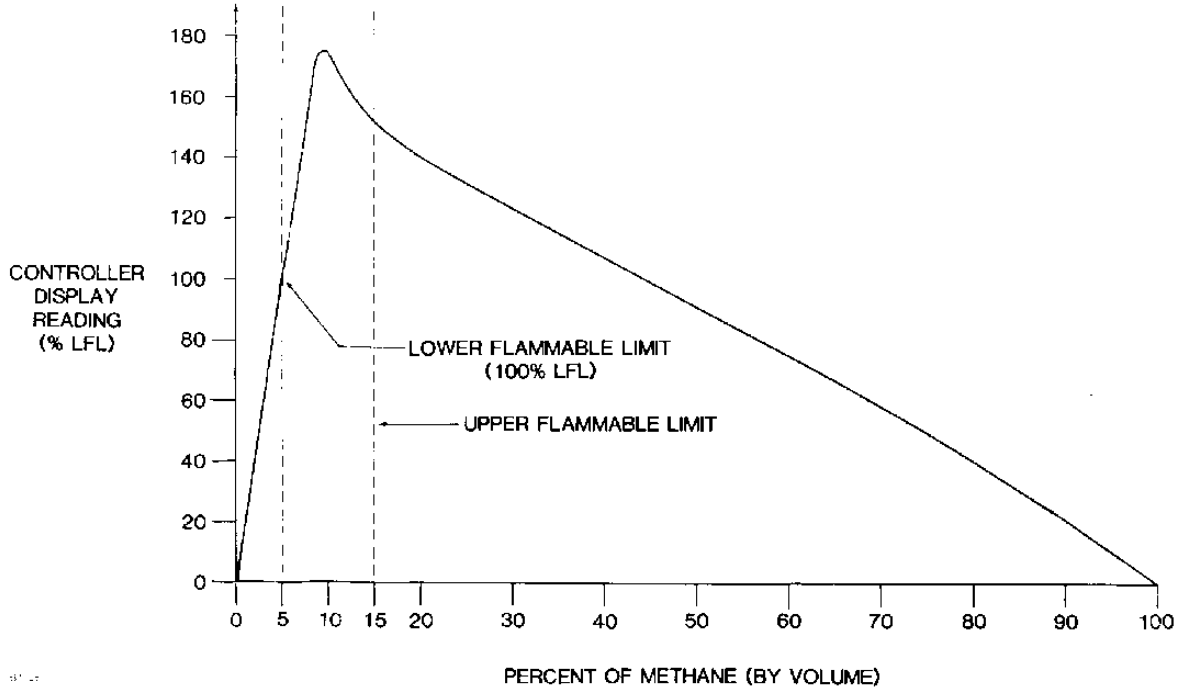


Figure 2—Response of a Typical Sensor to all Possible Mixtures of Methane and Air

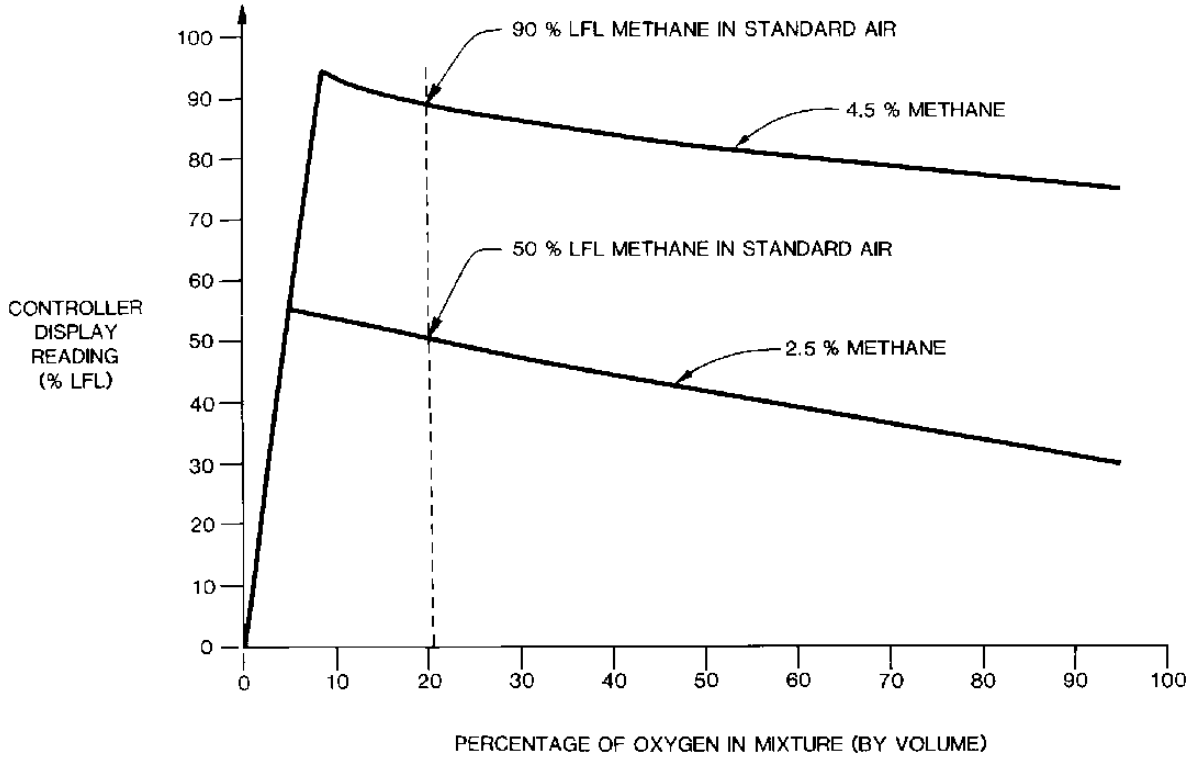


Figure 3—Effect of Oxygen Enriched and Deficient Atmospheres

mum of +4% LFL to prevent unwanted alarms. The calibration meter uses a liquid crystal display (LCD) to indicate response to the gas that is present at the sensor. When the sensitivity test button is pressed, the actual sensor signal voltage is displayed.

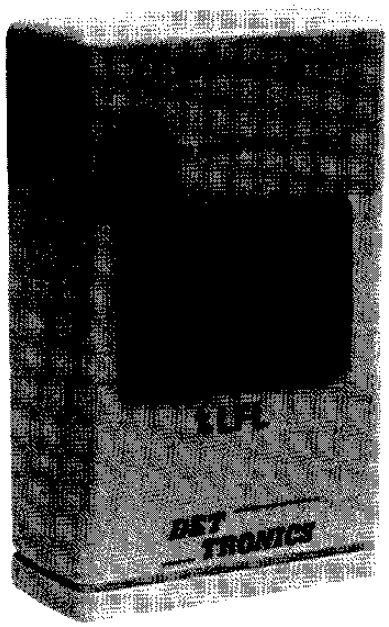


Figure 4—Calibration Meter

CONTROLLER

The Model 8000 Controller monitors up to eight sensor/transmitter units.

NOTE

The Model 400 and U8700 are compatible with the Model 8000, however, the power requirements of these devices can exceed the capacity of the power supply in the controller. When using transmitters other than K Series with a Model 8000 Controller, an external power source must be used for the transmitters to ensure proper operation.

Alarm Setpoints

The controller has a switch selectable Low and High alarm setpoint.

Outputs

The controller is furnished with a low and a high alarm relay and a trouble relay. The alarm relays are normally de-energized and energize upon alarm. The trouble relay is normally energized and drops out in the event of a malfunction.

Circuit Boards

The controller contains two printed circuit boards. The Control board contains the three output relays, a

switch for selecting the number of channels being used (1 to 8), and 3 programming jumpers. The A/D-MUX board contains the channel select switch, the low and high alarm setpoint switches, 5 programming jumpers, a zero potentiometer, and a span potentiometer. Two optional circuit boards are also available.

IAO Board (Optional) — The Individual Alarm Option (IAO) relay board provides relay outputs for the low and high alarms for each of the eight channels.

4 to 20 MA Board (Optional) — The 4 to 20 milliampere current output board provides a dc current output for each of the eight channels. These outputs are routed to the backplate through either a blank or a fully operational IAO board.

Faceplate

The faceplate of the controller provides red LEDs for indicating status conditions, digital displays for indicating the channel selected and the level of gas being detected, and pushbuttons for acknowledging an alarm condition and resetting the system. See Figure 5 for the location of pushbuttons and indicators.

- **%LFL Display** indicates the LFL percentage of gas being detected at the selected sensor.
- **Over 100 Indicator** is illuminated to indicate a gas level over 100% LFL.
- **Low Signal Indicator (Low Sig)** indicates a low sensor signal. This can be caused by a calibration error or by an open or shorted sensor signal leadwire.
- **Channel Number** identifies the channel selected for display of output on the %LFL display.
- **Low Power Indicator (Low Pwr)** indicates that the controller input voltage is below the minimum voltage needed for proper circuit operation.
- **Hold Switch/LED** is used with the Manual Select switch to select a specific channel for continuous display. To select a channel, press the Hold button until the LED comes on, then press the Manual Select button to display the desired channel, then release.
- **Manual Select Switch** is used with the Hold switch to select a particular channel for continuous display.
- **High Alarm LEDs** are illuminated when the level of gas at the corresponding sensor exceeds the high alarm setpoint. The LED latches on and can only be reset when the sensor signal is below the high alarm setpoint and the high alarm reset switch is pressed.

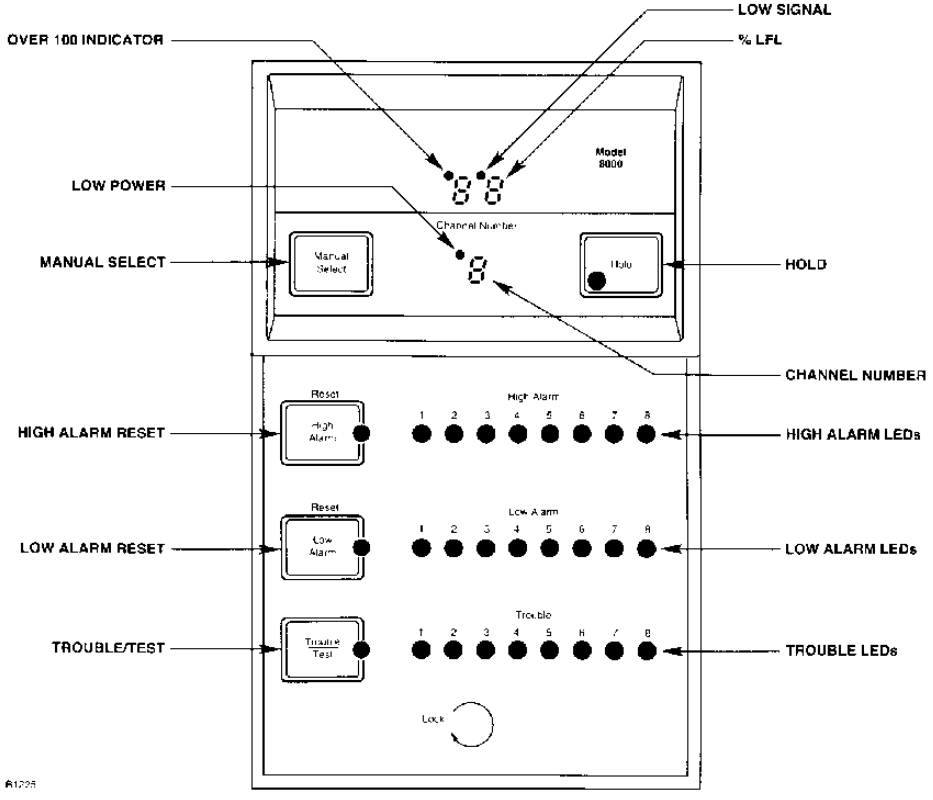


Figure 5—Controller Faceplate

- **High Alarm Reset Switch** acknowledges a high alarm and resets the high alarm relay. The LED flashes while any channel is in a high alarm state. The LED is on continuously while the switch is being pressed and goes out upon release of the switch.

- **Low Alarm LEDs** are illuminated when the level of gas at the corresponding sensor exceeds the low alarm setpoint. The LED latches on and can only be reset when the sensor signal is below the low alarm setpoint and the Low Alarm Reset switch is pressed.

- **Low Alarm Reset Switch** acknowledges a low alarm and resets the low alarm relay. The LED flashes while any channel is in a low alarm state. The LED is on continuously while the switch is being pressed and goes out upon release of the switch.

- **Trouble LEDs** indicate a problem at the corresponding sensor such as an open sensor or a shorted or open transmitter wire.

- **Trouble/Test Switch** acknowledges a trouble condition. The LED flashes when the input power to the controller is low and during the trouble relay timeout period. The LED is on continuously while the switch is being pressed, when the output signal from any sensor is –10% LFL or less, when the signal wire of any sensor is open or shorted, or when any transmitter power wires are open or shorted.

Diagnostics and Fault Identification

The controller features self-testing circuitry that continuously checks for shorts, opens, low input voltage, or other problems that could prevent proper response to gas. If a malfunction should occur, the Trouble LED is illuminated and the Trouble relay is de-energized. All alarm outputs are inhibited during a trouble condition.

To acknowledge a trouble condition, press the Trouble/Test switch. The Trouble/Test switch has no effect on the operation of the trouble relay. Approximately twenty seconds after the trouble condition has been corrected, the trouble relay automatically switches to the normal (energized) state and the Trouble LED turns off. This time delay allows the sensor to thermally stabilize before re-enabling the alarm circuitry.

The Trouble/Test switch is also used to sequentially test the digital displays and LEDs (except the over 100 indicator, Low Signal indicator, and Low Power indicator).

SPECIFICATIONS

CONTROLLER

OPERATING RANGE—
0 to 99% LFL, with under/over range indication.

INPUT VOLTAGE—
Standard: 120 vac (105 to 130 vac),
24 vdc (20 to 28 vdc, measured at the controller).
Optional: 220 vac (210 to 245 vac).

POWER CONSUMPTION (with sensors connected and without IAO board installed)—
120 vac: 3.5 watts per channel in Normal mode with no alarms; 6.9 watts per channel maximum.
24 vdc: 2.7 watts per channel in Normal mode with no alarms; 5.8 watts per channel maximum.

OUTPUT RELAYS—
Three SPDT relays, contacts rated 10 amperes at 24 vdc, 115/250 vac.

DISPLAY SCAN RATE—
1 second per channel.

CURRENT OUTPUT LOOP RESISTANCE—
33 ohms maximum from controller to K Series transmitter.

TEMPERATURE RANGE—
Operating: +32°F to +158°F (0°C to 70°C).
Storage: –49°F to +185°F (–45°C to +85°C).

HUMIDITY RANGE—
0 to 90% RH (non-condensing).

CONTROLLER INPUT SIGNAL—
4 to 20 milliamperes (0 to 25 milliampere range).

CONTROLLER SIGNAL INPUT RESISTANCE—
100 ohms (nominal).

DIMENSIONS—
See Figure 6.

APPROVALS—
FM approved and CSA certified.

K SERIES TRANSMITTER

INPUT VOLTAGE—
24 vdc (10 to 28 vdc range).

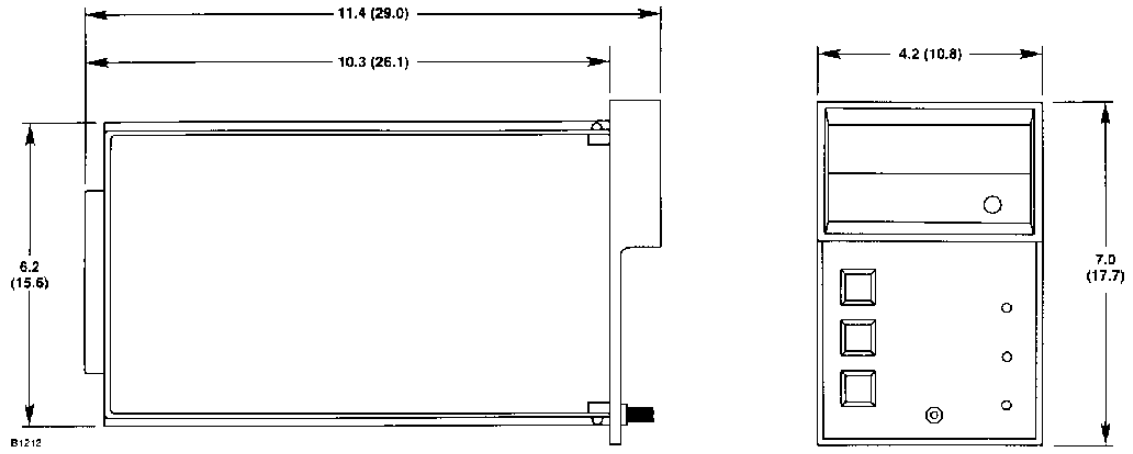


Figure 6—Controller Dimensions in Inches (Centimeters)

POWER CONSUMPTION—
1.5 watts with sensor.

OUTPUT CURRENT—
Linear 4 to 20 milliamperes.

ZERO SHIFT WITH TEMPERATURE—
0.02% LFL/°C at maximum gain.

GAIN SHIFT WITH TEMPERATURE—
0.01% LFL/°C at maximum gain.

TEMPERATURE RANGE—
Operating: –40°F to +167°F (–40°C to +75°C).
Storage: –49°F to +185°F (–45°C to +85°C).

APPROVALS—
FM approved and CSA certified for Class I, Div. 1, Groups C and D. (A junction box that is suitable for Group B locations is available as an option.)

SENSOR

RESPONSE TIME—
50% of full scale reading within 10 seconds, 90% of full scale reading within 30 seconds.

RECOVERY TIME—
Less than 30 seconds after exposure to pure methane.

SENSOR LIFE—
2 to 3 years.

CALIBRATION CYCLE—
60 to 90 days.

LINEARITY—
±5% of full scale.

STORAGE LIFE—
Indefinite if sensor remains in unopened original packaging.

TEMPERATURE RANGE—
Operating: –40°F to +185°F (–40°C to + 85°C).
Storage: –67°F to +257°F (–55°C to +125°C).

HUMIDITY RANGE—
0 to 100% RH.

SENSOR DIMENSIONS—
See Figure 7.

JUNCTION BOX DIMENSIONS—
See Figure 8.

APPROVALS—
FM approved and CSA certified for Class I, Division 1, Groups A, B, C, and D.

CALIBRATION METER

TEMPERATURE RANGE—
Operating: –4°F to +130°F (–20°C to +55°C).
Storage: –40°F to +130°F (–40°C to +55°C).

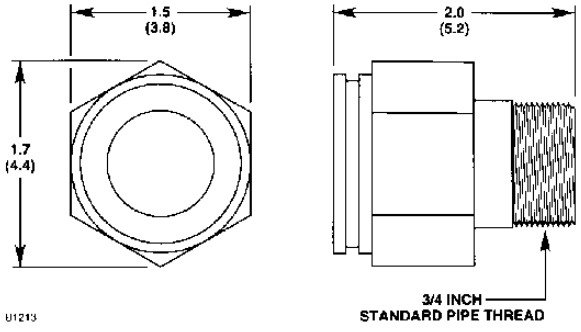


Figure 7 Sensor Dimensions in Inches (Centimeters)

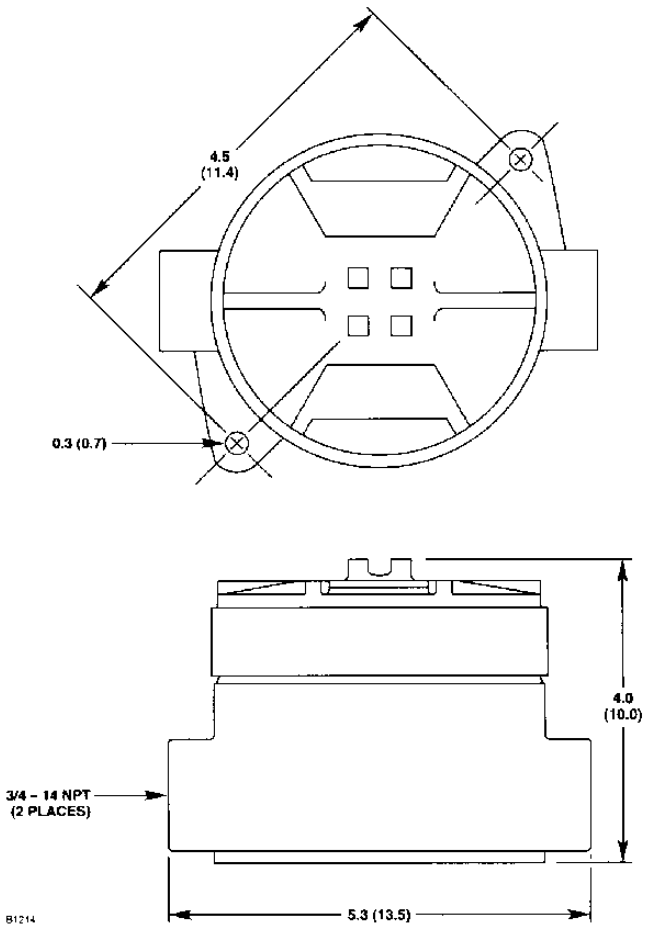


Figure 8—Junction Box Dimensions in Inches (Centimeters)

BATTERY LIFE—
200 hours (approximately 2000 calibrations).

INSTALLATION

SENSOR POSITIONING

It is essential that the sensor be properly located to enable it to provide maximum protection. Unfortunately, there is no fool-proof formula for determining the most effective number and placement of detectors. Therefore, the individual who is responsible for the installation must rely on experience and common sense to determine the best sensor locations for the area to be protected.

The following factors should be considered for every installation:

1. What kind of gas is to be detected? If it is lighter than air (Acetylene, Hydrogen, Methane, etc.), place the sensor above the potential gas leak. Place it close to the floor for gases that are heavier than air (Benzene, Butane, Butylene, Propane, Hexane, Pentane, etc.) or for vapors resulting from flammable liquid spills.

2. How rapidly will the gas diffuse into the air? Locate the sensor as close as practical to the anticipated source of a gas leak.

3. Ventilation characteristics of the immediate area must also be considered. Movement of air will cause the gas to accumulate more heavily in one area than another. The sensors should be placed in the areas where the most concentrated accumulation of gas is anticipated. Also take into consideration the fact that some ventilation systems do not operate continuously.

4. The sensor should be pointed down to prevent the buildup of moisture or contaminants on the gas inlet.

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

6. The sensor should be located in an area where it is safe from potential sources of contamination that could poison the sensing element.

7. Exposure to excessive heat or vibration can result in premature failure of any electronic device and, therefore, should be avoided if possible. Shielding the transmitter 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 gas cannot readily come into contact with the sensors.

In a typical installation, the sensor will be mounted on the same junction box as the transmitter. In some cases this is impractical, since the transmitter must be accessible for routine calibration. A Sensor Separation Kit is available from Detector Electronics and is recommended for use in these applications. This kit contains the essential components for separating the sensor from the transmitter.

SPECIAL APPLICATIONS

Sample Draw System — If the probable gas leak is in an environment that is hostile to the system, a sample draw system can be used to bring a sample of the gas to the sensor.

Outdoors — For outdoor applications, a sensor rain shield can be used to prevent the sensor flame arrestor from becoming wet or plugged.

Dust — A clip-on dust cover is available for use in dusty locations.

WIRING REQUIREMENTS

The transmitter is connected to the controller using a three wire cable. The use of shielded cable is required 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. The maximum distance between the transmitter and power source (controller) is determined by the wire size. Refer to Table 1 to determine the proper size wire and/or maximum wiring distance allowed.

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 in the conduit. These seals must be water-tight 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 transmitter junction box as possible. In no case should this seal be located more than 18 inches (46 cm) from the sensor. When an explosion-proof installation is required, an additional seal is also required at any point where the conduit enters a non-hazardous area. When pouring a seal, the use of a fiberdam 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 might occur through the inside of the shield.

Table 1—Controller to Transmitter Distance

Wire Size		Maximum Controller to Transmitter Distance	
AWG No.	Diameter (millimeters)	(feet)	(meters)
18	1.024	1,800	548.64
16	1.291	2,900	883.92
14	1.628	4,600	1,402.08
12	2.053	7,300	2,225.05

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.

CONTROLLER INSTALLATION

There are seven standard enclosures for mounting the Model 8000 Controller. Refer to the "Ordering Information" section of this manual for part numbers.

SINGLE UNIT PANEL MOUNT — See Figure 9 for dimensions and Figure 10 for connection diagram.

FOUR UNIT RACK MOUNT — See Figure 11 for dimensions and Figure 10 for connection diagram.

FOUR UNIT PANEL MOUNT — See Figure 12 for dimensions and Figure 10 for connection diagram.

SINGLE UNIT NEMA 3 — See Figure 13 for dimensions and Figure 14 for connection diagram. No IAO option is available with this enclosure.

FOUR OR EIGHT UNIT NEMA 3 — See Figure 15 for dimensions and Figure 14 for connection diagram. The IAO option is not available for the 8 unit enclosure.

NEMA 4 — See Figure 16 for enclosure dimensions.

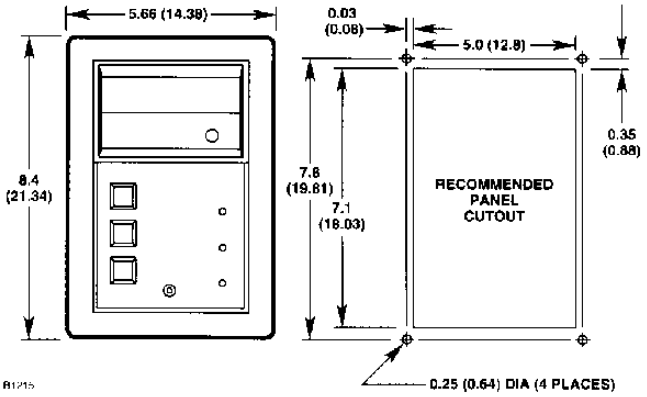


Figure 9—Single Unit Panel Mount Rack Dimensions in Inches (Centimeters)

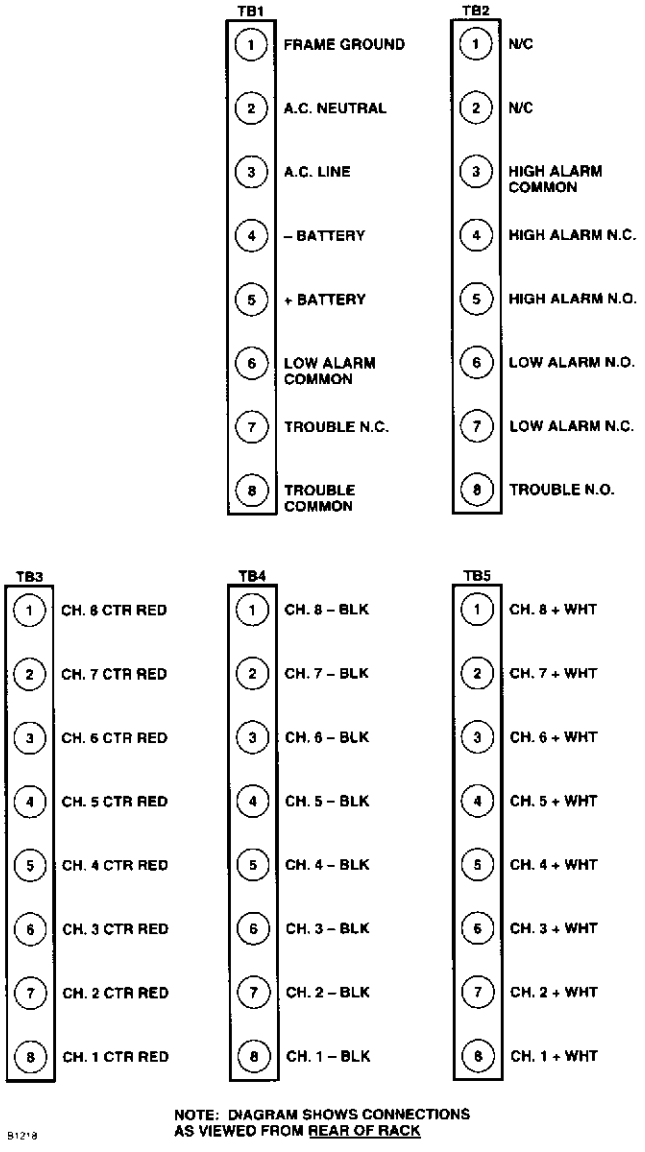


Figure 10—Single Unit and 19 Inch Rack Interconnection Diagram

NEMA 7 — Explosion-proof housing with external reset and channel select capability. See Figure 17 for dimensions and Figure 18 for connection diagram. No IAO option is available with this enclosure.

When installing rack and panel mounts, allow three to four inches of air space vertically between units to allow for convection cooling. When mounting units in a non-explosion proof enclosure, allow an opening for air cooling at the top and bottom of the cabinet.

Purging NEMA enclosures with dry instrument or compressed air is recommended for high humidity environments.

CONTROLLER WIRING

All external wiring is connected to the screw terminals on the back side of the terminal board.

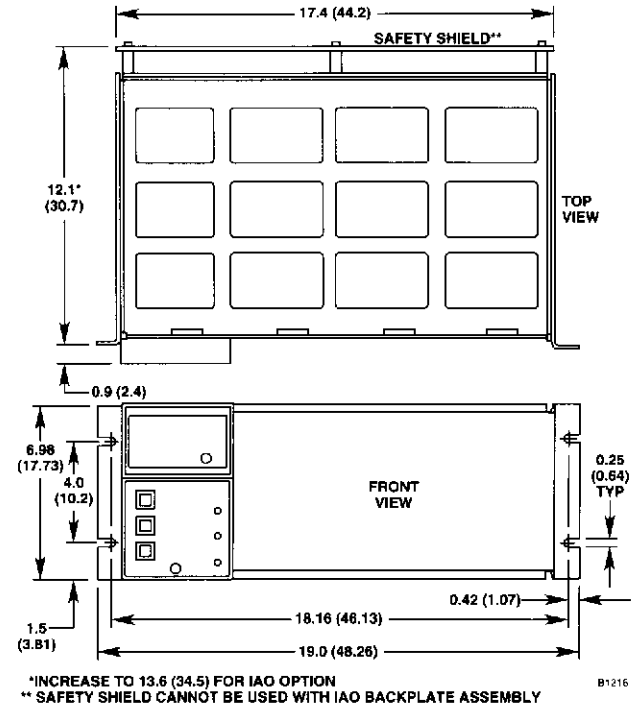


Figure 11—Four Unit 19 Inch Mounting Rack Dimensions in Inches (Centimeters)

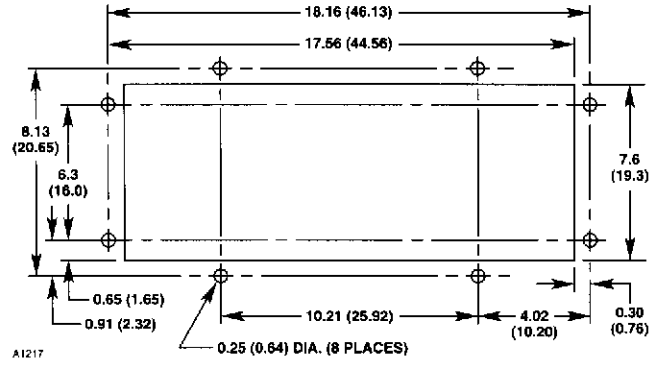


Figure 12—Four Unit 19 Inch Panel Mount Cutout Dimensions in Inches (Centimeters)

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 the controller, taking care not to touch the terminals or electronic components. For more information on proper handling, refer to Service Memo form 75-1005, at the front of this manual.

The standard controller can operate from two power sources: +24 vdc (20 to 28 vdc) or 110 vac (105 to 130 vac). The use of a 24 vdc battery backup is recommended to assure continuous operation in the event of a power failure. Controllers that operate on 220 vac (210 to 245 vac) are available as an option. See Figure 19.

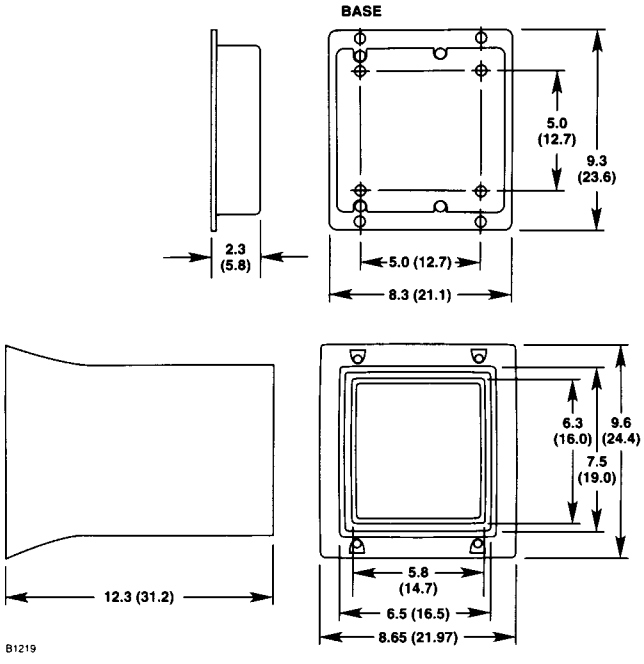


Figure 13—Single Unit NEMA 3 Wall Mount Housing Dimensions in Inches (Centimeters)

NOTE

Model 8000 Controllers are designed for use with K Series transmitters. Other transmitters can also be used with Model 8000 Controllers, however, it is important to note that power requirements of other transmitters are normally greater than K Series transmitters. While the power supply circuitry in the Model 8000 Controller is adequate for powering the K Series transmitters, operating problems can result if other transmitter models are wired to receive operating power directly from the controller. If transmitters other than K Series are used with Model 8000 Controllers, they should be wired directly to a 24 vdc power supply of adequate size. See Figure 20.

Long wiring distances (greater than 100 feet) will normally require larger diameter wire in order to minimize the voltage drop between the controller and power source. The connections should be made using conductors of adequate diameter to assure the proper voltage level when measured **at the controller**. The

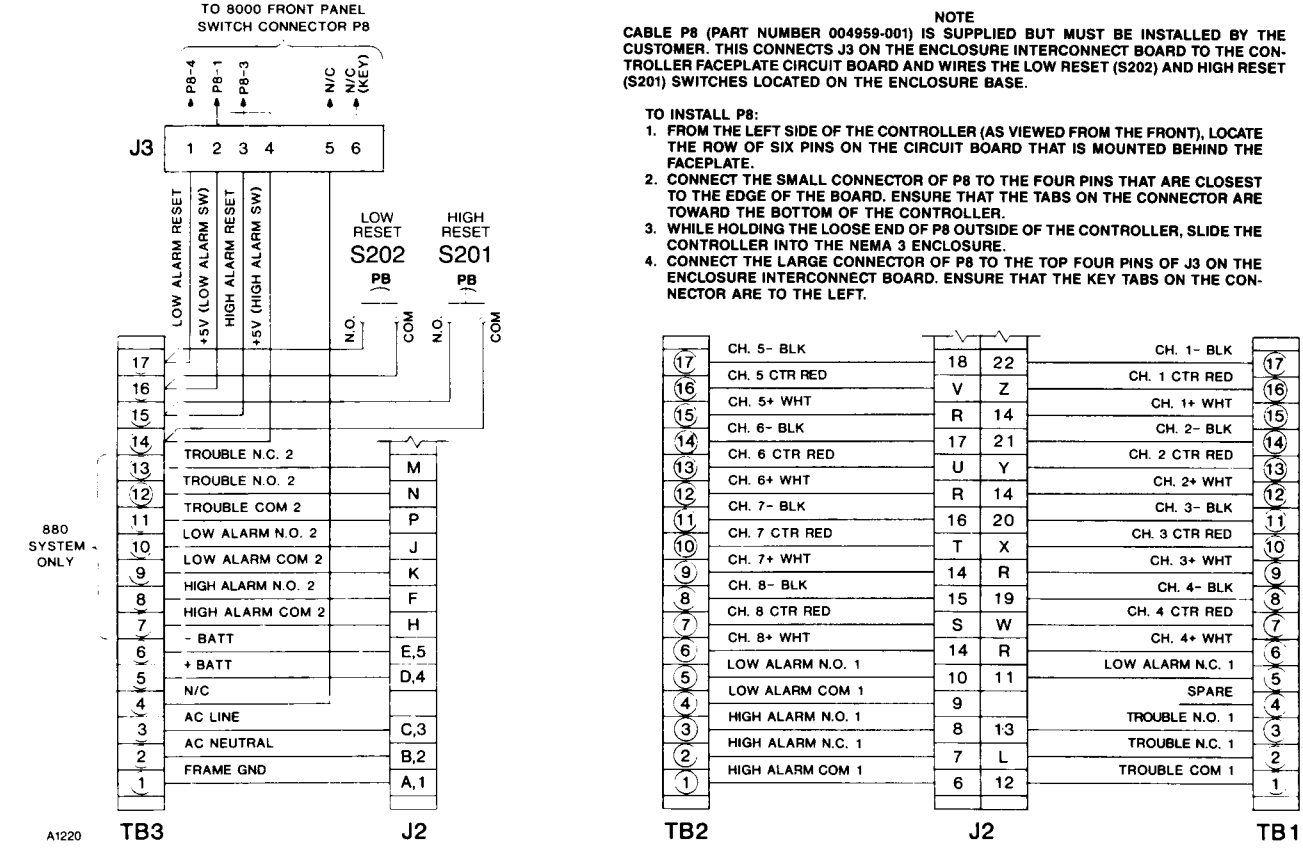


Figure 14—NEMA 3 Single Unit Interconnection Diagram

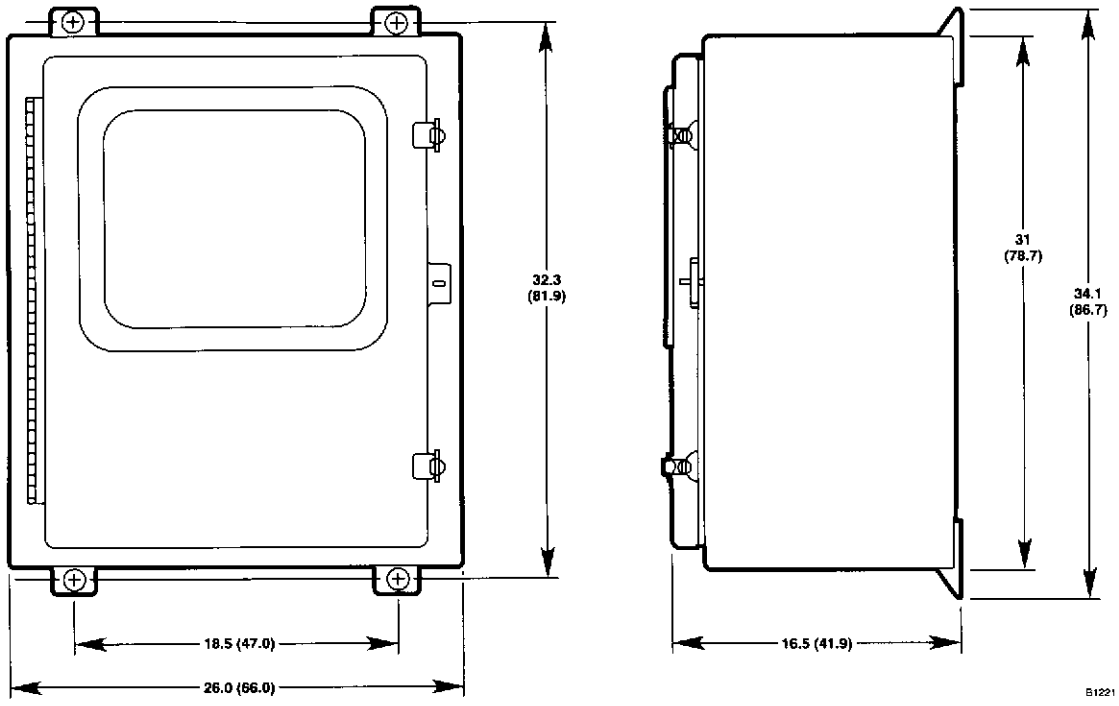


Figure 15—NEMA 3 Multi-Unit Wall Mount Housing Dimensions in Inches (Centimeters)

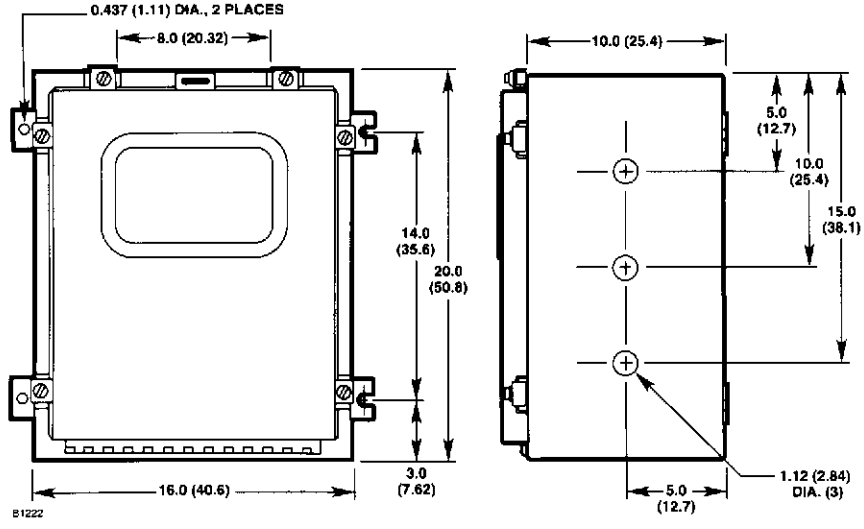


Figure 16—NEMA 4 Multi-Unit Wall Mount Housing Dimensions in Inches (Centimeters)

use of shielded cable is recommended to eliminate the possibility of interference caused by extraneous electrical "noise."

Figure 21 shows the maximum wiring distances for several popular wire sizes between the dc power supply and a Model 8000 Controller using K Series Transmitters. The graphs are valid for standard annealed copper wire at a temperature of 185°F (85°C) or less.

CONTROLLER PROGRAMMING

Before the controller is installed in the mounting enclosure, it must be programmed to provide the desired output in response to the input conditions. Controller programming is accomplished using switches and jumpers that are located on the Control circuit board and the A/D-mux circuit board in the controller.

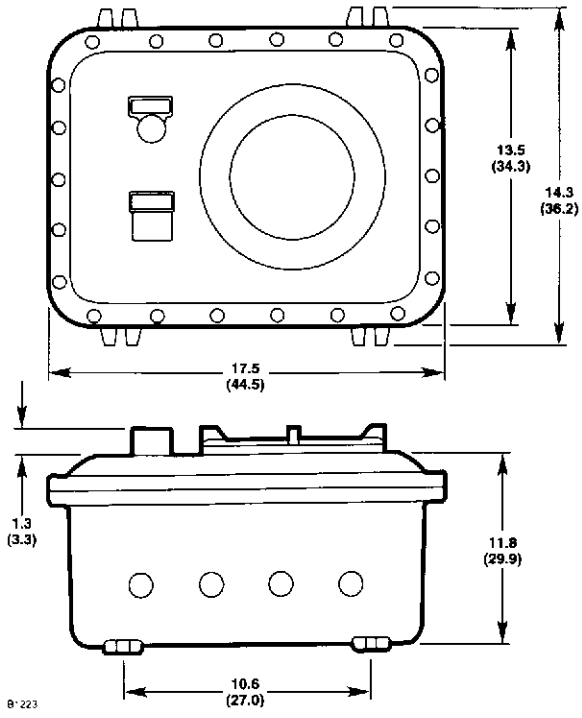


Figure 17—NEMA 7 Explosion-Proof Housing Dimensions in Inches (Centimeters)

IMPORTANT

All jumpers and switches must be set exactly as specified. Any deviation can have a serious detrimental effect on system performance. It is also important to note that if certain jumpers are installed, their installation automatically requires the installation of other specified jumpers to assure proper system operation. (See W20 and W21 below.)

Control Circuit Board

The following switches and jumpers are located on the control circuit board. Refer to Figure 22 for location.

TROUBLE DISABLE SWITCH (S1)

Any channel that has a sensor connected should have its corresponding switch in the "off" position. However, any channel with no sensor connected must have its switch in the "on" position. This will disable the trouble signal and turn off the trouble LED for that channel. Switch position 1 corresponds to channel 1, switch position 2 corresponds to channel 2, etc.

NOTE

If fewer than eight sensors are installed, the highest numbered channels must be the unused channels. For example, if only five sensors are installed, they must be connected to channels one to five, with channels six to eight unused.

TROUBLE ALARM (W10/11)

W11 INSTALLED (standard) — A Trouble signal is generated when any one channel is in a trouble state.

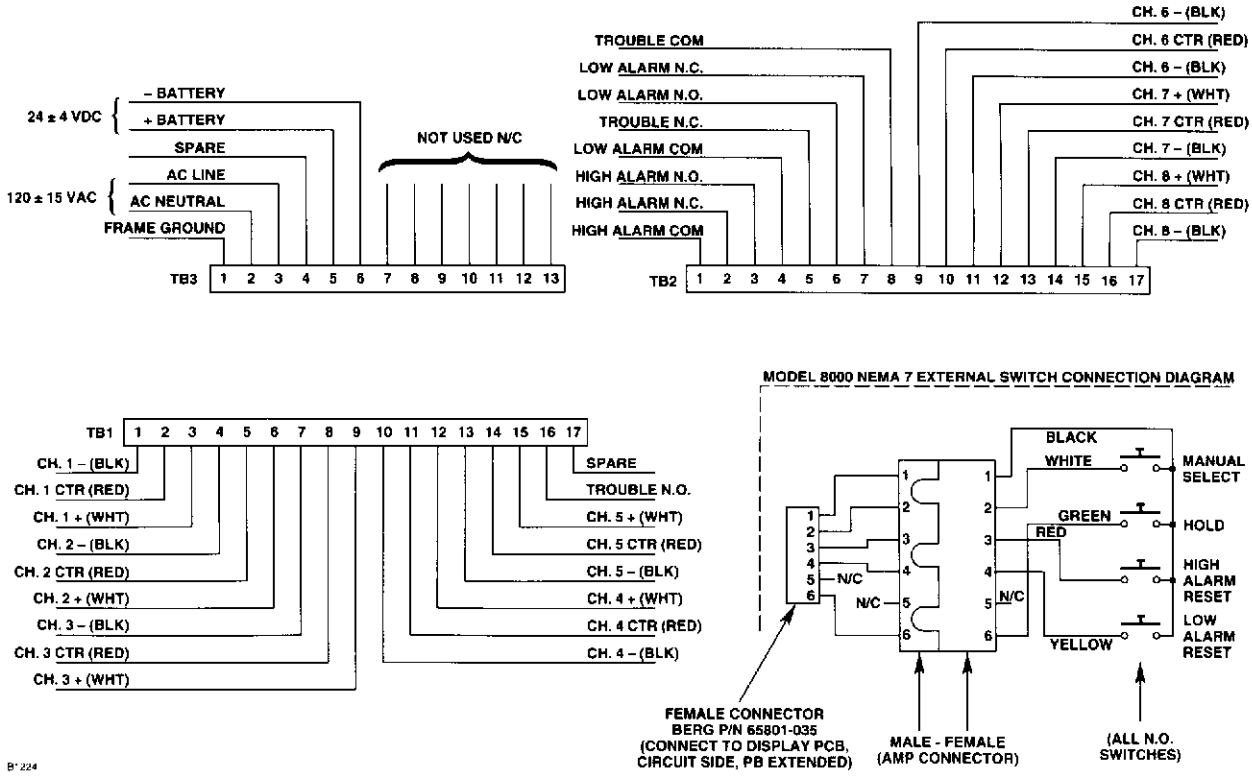


Figure 18—NEMA 7 Explosion-Proof Housing Interconnection Diagram

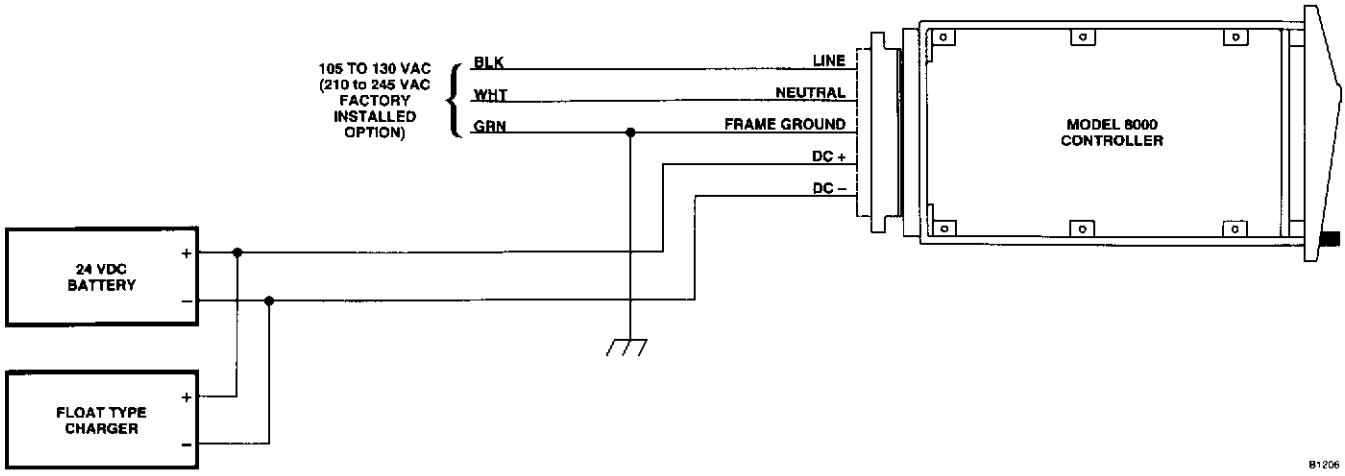


Figure 19—Controller Power Connections

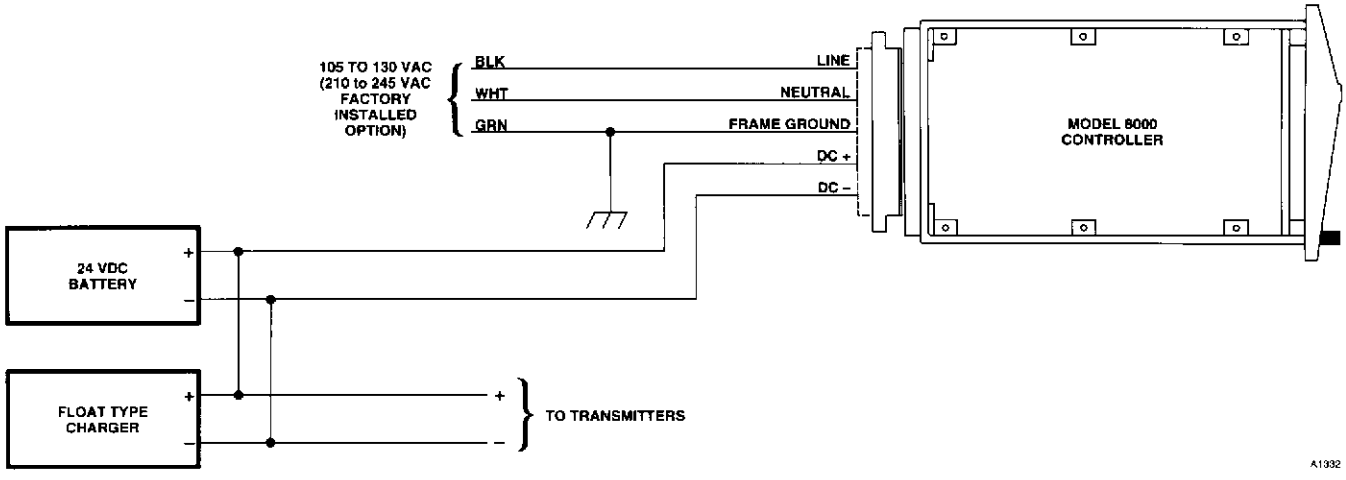


Figure 20—Transmitters Wired Directly to Power Source

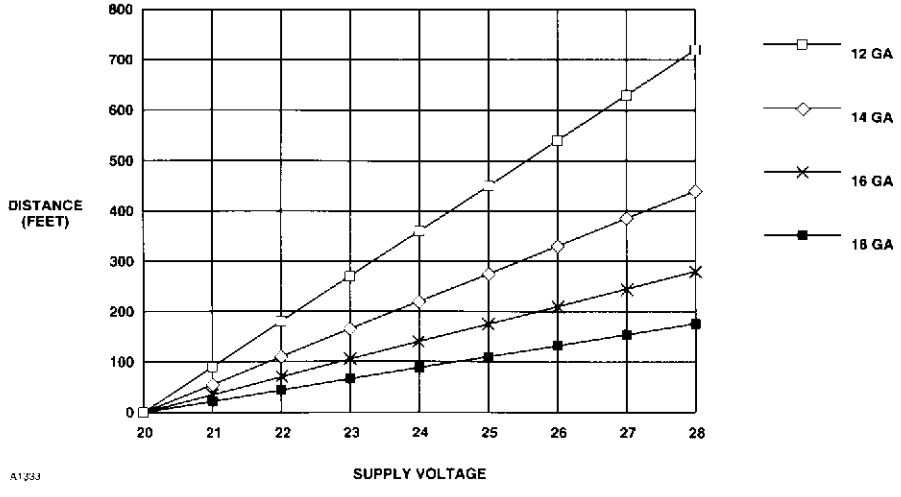


Figure 21—Power Supply Ratings and Distances for Several Wire Sizes

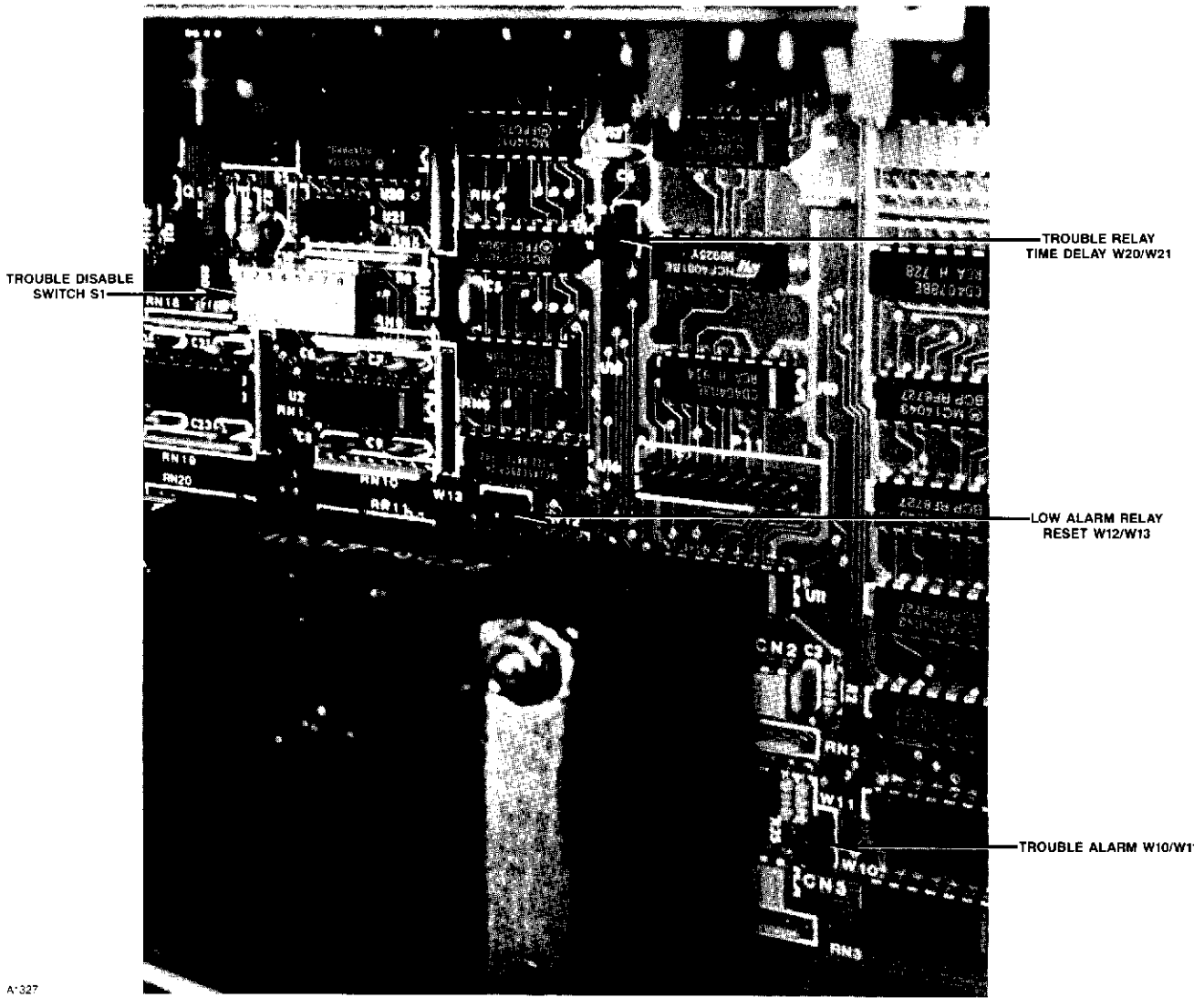


Figure 22—Control Circuit Board

W10 INSTALLED (not a recommended option) — All eight channels must be in a trouble state for a Trouble signal to occur. If fewer than eight sensors are installed, the S1 Trouble Disable Switch positions for the unused channels must be in the "off" position (the Trouble LEDs will remain on).

LOW ALARM RELAY RESET (W12/W13)

W12 INSTALLED (standard) — The low alarm relay and the corresponding low alarm LED can be reset if the level of gas at the sensor is below the low alarm setpoint (refer to S2 on the A/D-mux circuit board) by pressing the Low Alarm Reset button.

W13 INSTALLED — The low alarm relay can be reset even if the level of gas at the sensor is above the low alarm setpoint by pressing the Low Alarm Reset button, however, the corresponding LED cannot be reset until the alarm level is below the low alarm setpoint.

TROUBLE RELAY TIME DELAY (W20/W21)

W20 INSTALLED (standard) — The trouble relay will become energized 20 seconds after the problem is corrected. W11 on the A/D-mux circuit board must also be installed to enable this function.

W21 INSTALLED — The trouble relay is energized immediately upon correction of the problem. Jumpers W2, W4, W8, and W10 on the A/D-mux circuit board must also be installed.

A/D-mux Circuit Board

The following switches and jumpers are located on the A/D-mux circuit board. Refer to Figure 23.

ALARM SETPOINT RANGE (W6/W7)

W6 INSTALLED (standard) — Both the low and high alarm setpoint levels are limited to a maximum of 60% LFL.

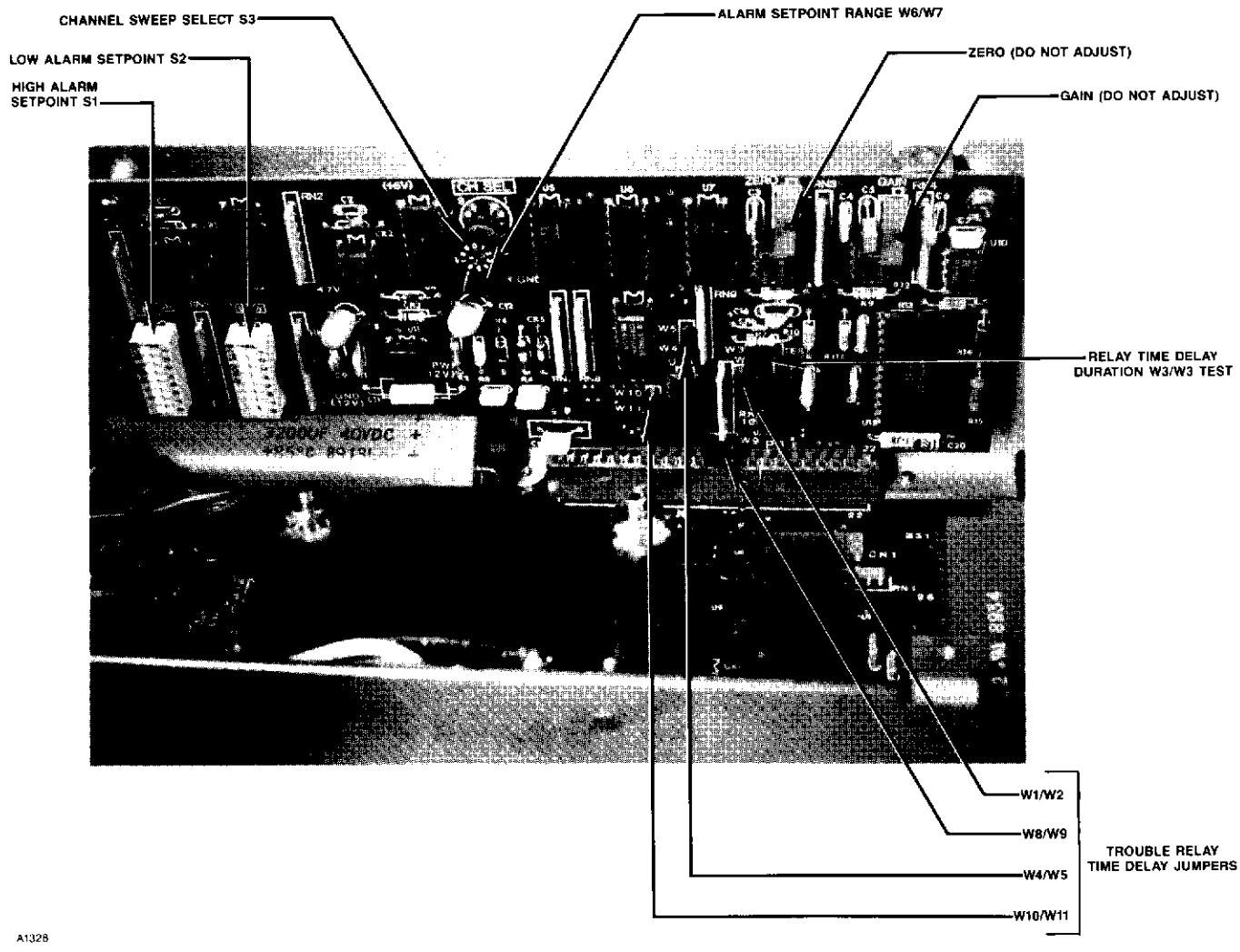


Figure 23—A/D-mux Circuit Board

W7 INSTALLED — The alarm setpoint level can exceed 60% LFL.

WARNING

This special option is provided at customer risk and violates FM and CSA regulations. This is not a recommended option.

HIGH (S1) AND LOW (S2) ALARM SETPOINTS

The high and low alarm setpoints are programmed using DIP switch assemblies S1 and S2 on the A/D-mux circuit board. Each of these switch assemblies has eight switches. Refer to Tables 2 and 3 to determine the proper switch positions. Use Table 2 if W6 on the A/D-mux board is installed (setpoints limited to 60% LFL). Use Table 3 if W7 on the A/D-mux board is installed (setpoints limited to 90% LFL).

WARNING

FM and CSA approval standards require that the high alarm operate at or below 60% LFL.

CHANNEL SWEEP SELECT (S3)

Set this switch for the total number of channels that have a sensor connected. This switch selects the number of channels that will be displayed on the front panel of the controller (1 to 8). All unused channels will be bypassed. When the Hold LED is off, the channel sweep rate is typically one channel per second.

RELAY TIME DELAY DURATION (W3/W3 TEST)

W3 INSTALLED (standard) — Upon application of operating power to the controller or when a trouble condition has been corrected, the alarm relays and LEDs are inhibited for 20 seconds to prevent false alarms. When power is initially applied, the reading on the %LFL display on the controller front panel will typically exceed the alarm setpoints, but will then return to less than 10% LFL in approximately 10 seconds. This is caused by changes in the resistance of the sensor as the temperature of the sensing element rises to its operating temperature.

Table 2—Alarm Setpoint DIP Switch Positions with W6 Installed

% LFL •	1 •	2 •	3 •	4 •	5 •	6 •	7 •	8 •
5	on	—	on	—	on	—	on	—
10	on	on	—	—	—	on	on	—
15	—	on	—	—	on	on	on	—
20	—	—	—	—	—	—	—	on
25	—	on	on	on	—	—	—	on
30	—	—	on	on	on	—	—	on
35	—	on	—	on	—	on	—	on
40	—	—	—	on	on	on	—	on
45	on	on	on	—	—	—	on	on
50	on	—	on	—	on	—	on	on
55	on	on	—	—	—	on	on	on
60	on	—	—	—	on	on	on	on

"on" signifies switch is ON, "—" signifies switch if OFF

W3 TEST — Do not use this setting. This option is provided for testing and troubleshooting purposes only and will cause false alarms upon application of operating power to the controller.

TROUBLE RELAY TIME DELAY

The Trouble relay can operate in either of two ways upon correction of a fault.

1. The Trouble relay will energize 20 seconds after the fault is corrected.

2. The Trouble relay energizes immediately upon correction of a fault.

20 SECOND DELAY — Install W20 on the Control circuit board and W1, W5, W9, and W11 on the A/D-mux circuit board. The Trouble relay will energize 20 seconds after the fault is corrected.

NO TIME DELAY — Install W2, W4, W8, and W10 on the A/D-mux circuit board and W21 on the Control circuit board. The Trouble relay will energize immediately upon correction of the fault. The alarm relays will still be inhibited for the 20 second time delay upon power-up or correction of an open or short fault to prevent the possibility of a false alarm.

ZERO ADJUST/GAIN ADJUST

The Zero and Gain adjustment potentiometers have been set at the factory and do not normally require further adjustment in the field. **Do not** adjust these potentiometers. All zero and gain adjustments are made at the transmitter during routine calibration. Refer to the "Calibration" section of this manual for details.

CONTROLLER INSTALLATION PROCEDURE

Before installing the controller in the enclosure, inspect the unit to verify that it has not been physically damaged in shipment. Then examine the unit to be sure that the alarm setpoints and other programming options have been set for the desired system operation. Before applying power:

1. Check the power connections and system ground.

2. Check for proper connections and for shorts between transmitter wires.

3. When using rack mounted and NEMA 3 enclosures, examine the connector board to ensure that the plastic guides at the top and at the bottom of the connector are present. Serious damage to the controller can result if these guides are not present or if they have been misaligned.

Table 3—Alarm Setpoint DIP Switch Positions with W7 Installed

% LFL •	1 •	2 •	3 •	4 •	5 •	6 •	7 •	8 •
5	—	—	—	—	on	on	—	—
10	—	—	—	on	on	on	—	—
15	on	—	—	—	—	—	on	—
20	on	—	—	on	—	—	on	—
25	on	—	—	—	on	—	on	—
30	on	—	—	on	on	—	on	—
35	on	—	—	—	—	on	on	—
40	—	on	—	on	—	on	on	—
45	—	on	—	—	on	on	on	—
50	—	on	—	on	on	on	on	—
55	—	on	—	—	—	—	—	on
60	—	on	—	on	—	—	—	on
65	on	on	—	—	on	—	—	on
70	on	on	—	on	on	on	—	on
75	on	on	—	—	—	on	—	on
80	on	on	—	on	—	on	—	on
85	on	on	—	—	on	on	—	on
90	on	on	—	on	on	on	—	on

"on" signifies switch is ON, "—" signifies switch if OFF

CAUTION

Do not install the controller in the enclosure or rack with power applied.

4. Upon application of system power, the Trouble/Test LED will flash. If all sensors and transmitters are properly connected and voltages are within acceptable limits, the LED will go out after 20 seconds. If the LED continues to flash:

   —check system supply voltage
   —check all transmitter connections.

NOTE

To quickly troubleshoot the system, use a DVM to measure the voltage at terminals "CH-BLK" of each sensor (on the controller backplate) with respect to "–Battery". The readings should be 50 to 85 millivolts dc. If the reading is lower than 45 millivolts dc or if the reading is 0, the problem could be an open power wire, open sensor, faulty transmitter, or a shorted transmitter wire. A higher voltage could indicate excess sensor voltage. Refer to the "Sensor Voltage Adjustment" section of this manual.

SENSOR/TRANSMITTER WIRING

The sensor should be installed in the 3/4-inch NPT opening on the bottom side of the junction box and the conduit should be connected to the 3/4-inch NPT opening on the top of the box, with a conduit seal installed between the conduit and the junction box. The junction box can be mounted to a wall or post or it can be suspended by the conduit. The boxes should be electrically connected to an earth ground.

NOTE

A spacer (approximately 1/4 inch) may be needed between the junction box and the wall or post to allow adequate room for the sensor and calibration cup.

Table 1 shows the maximum separation distance between the transmitter and controller for several wire sizes. The maximum distances between a transmitter

and controller for a given wire size are valid over the entire operating temperature range of the system. The system has been designed so that changes in the resistance of the copper wire will have no significant effect on the operation.

The following procedure should be used for mounting and wiring the sensor/transmitter.

CAUTION

Do not remove the junction box cover while power is applied unless the area has been declassified.

1. Sensors should be installed in locations that are best suited for covering the area to be protected, following the previously discussed guidelines. Whenever practical, they should be placed where they are easily accessible for calibration. For proper operation, the sensor should be oriented with the sintered metal opening pointing down.

2. Remove the cover from the junction box.

3. Remove the electronic transmitter module from the junction box.

4. Connect the junction box to the conduit. The junction box should be electrically connected to earth ground.

5. Attach the sensor to the junction box. The sensor should be tight to ensure an explosion-proof installation, however, do **not** overtighten. Attach the wiring plug at the appropriate terminal location. (See Figure 24.)

NOTE

The sensor threads can be coated with an appropriate grease to ease both the initial installation and future replacement of the sensor. Also lubricate the cover threads. The recommended lubricant is a silicone free polyalphaolefin grease, part number 005143-001, available from Detector Electronics. The use of other lubricants is not recommended, since some materials can cause irreversible damage to the sensing element. ***Silicone*** *based lubricants must* ***never*** *be used.*

6. Connect the power and current output leadwires to the appropriate screw terminals inside the junction box. It is recommended that the shield be connected to earth ground at the controller end only. See Figure 25.

7. Check all field wiring to ensure that the proper connections have been made, then pour the conduit seals and allow them to dry (if conduit is being used).

NOTE

The transmitter wiring can be checked before installation of any transmitter modules by applying power and measuring the voltage between the +WHT and –BLK terminals inside the junction box. This voltage should measure 21 to 30 vdc with 105 to 135 vac applied to the controller

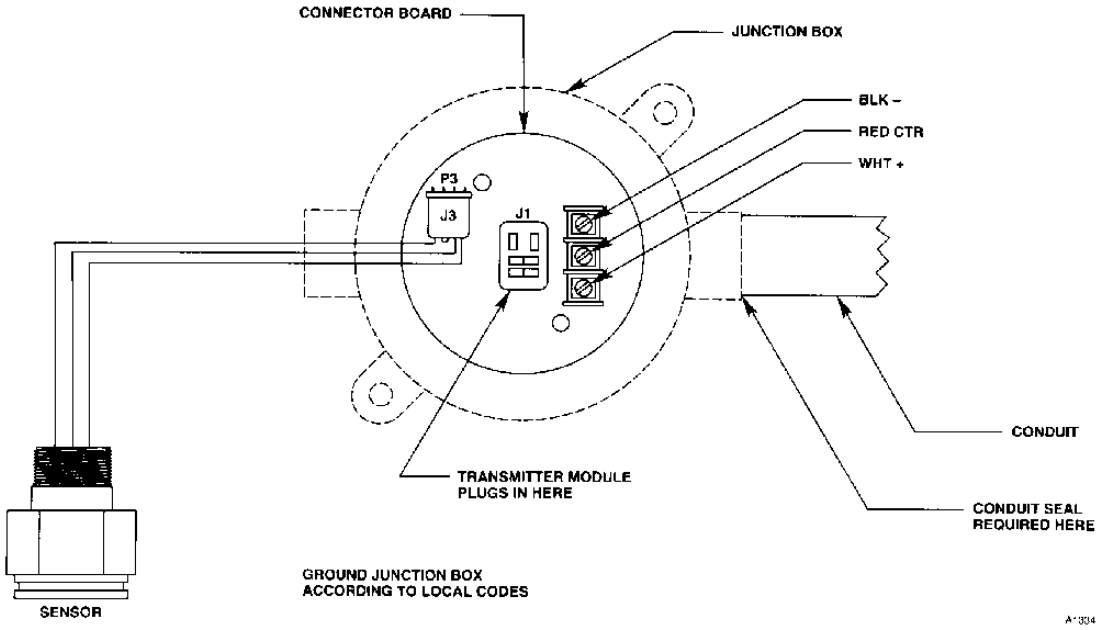


Figure 24—Transmitter Wiring

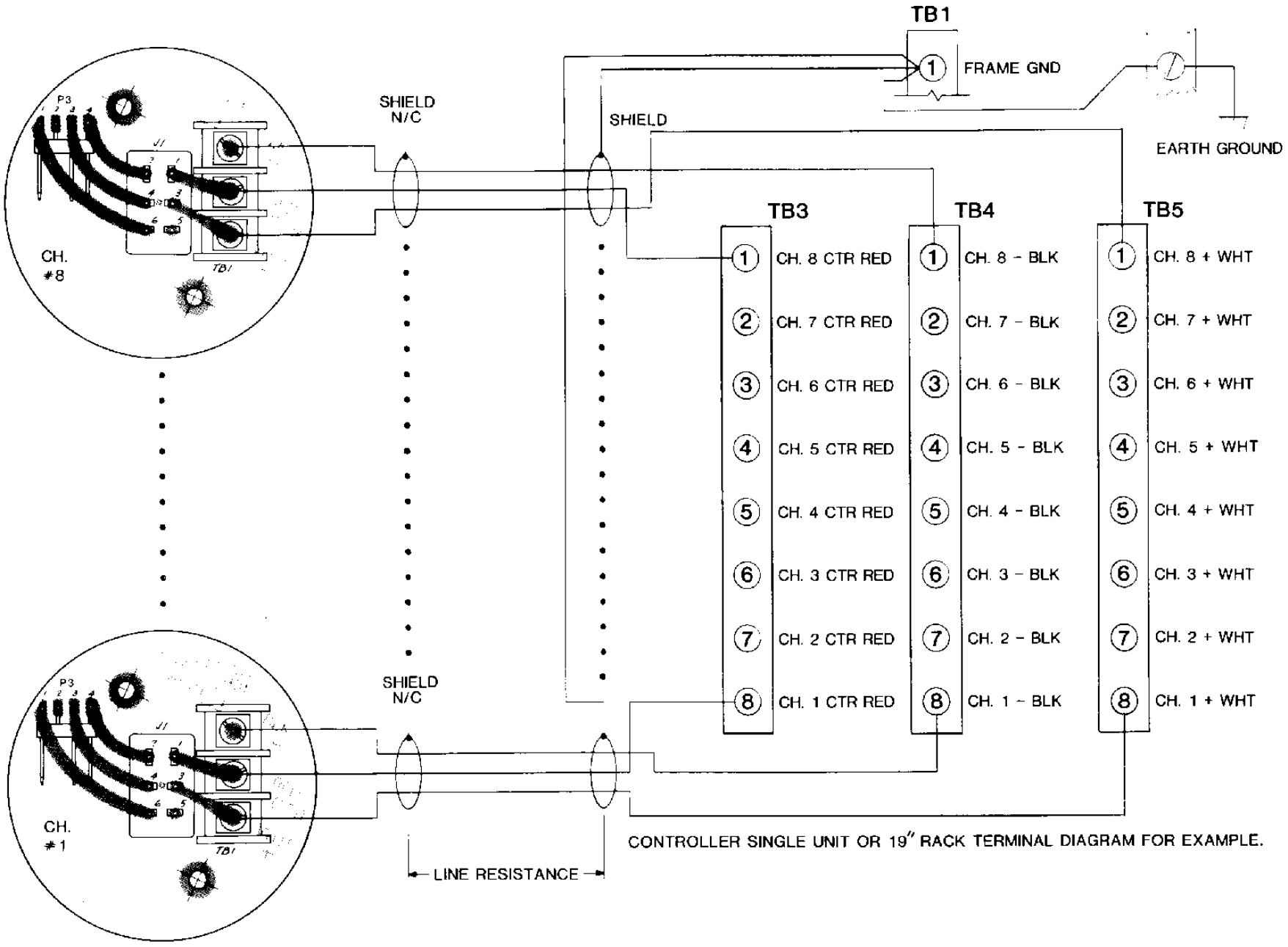


Figure 25—Typical Controller to K Series Transmitter Connection

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and no transmitters installed. The signal wire (RED CTR) can be checked by installing a 6 kilohm 1% resistor between the +WHT and RED CTR terminals inside the junction box. This will result in an indication at the controller of from –4% LFL to +6% LFL at a total loop resistance of 0 to 30 ohms. Be sure to remove the resistors after the test is complete.

8. Install the transmitter module inside the junction box.

9. Place the cover back on the junction box.

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 with 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 electrician before wiring the system.

SENSOR/TRANSMITTER SEPARATION

It is preferable to mount the sensor on the same junction box as the transmitter. In some cases this is impractical, since the transmitter must be accessible for routine calibration. The Sensor Separation Kit, available from Detector Electronics, contains the essential components for separating the sensor from the transmitter. (When the Sensor Separation Kit is used with K Series transmitters, a field adjustment to the sensor operating voltage is normally required. This procedure requires the use of the Transmitter Extender Plug, which is available from Detector Electronics.)

The maximum distance between the sensor and transmitter is limited by the resistance of the connecting wiring, which is a function of the diameter of the wire being used. The maximum separation distance allowed for a given wire size can be determined from Table 4. An adjustment to the sensor voltage is required to assure proper operation.

Three conductor cable with a foil shield is recommended. Please note that the shield lead should be open at the sensor junction box and connected to earth ground at the transmitter junction box.

Refer to the manual supplied with the sensor separation kit for additional information.

Table 4—Maximum Sensor Separation Distances

Wire (AWG)	Recommended Maximum Transmitter to Sensor Distance*	
	Feet	Meters
18	50	15
16	75	23
14	125	38

*Sensor voltage adjustment is required.

SENSOR VOLTAGE ADJUSTMENT (K Series transmitters only)

The combustible gas sensor is designed to operate at 3.3 volts dc. Voltages greater than this will shorten sensor life and voltages less than this will reduce sensitivity to certain gases. The sensor supply voltage is factory adjusted. However, re-adjustment is necessary if the sensor and transmitter are located separately. To adjust sensor voltage, connect a digital voltmeter across +WHT and –BLK on the connector board inside the **sensor separation kit junction box** (see Figure 26). Install the transmitter extender plug between the transmitter module and the connector board in the **transmitter junction box** to allow access to potentiometer R18 on the transmitter module. Adjust R18 to obtain a reading of 3.3 volts on the voltmeter.

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. Conduit seals have been installed at all junction box entries (if conduit is being used).

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

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

4. External loads are properly connected to the controller.

5. Response equipment is operational.

6. Controllers are properly installed in the mounting enclosure.

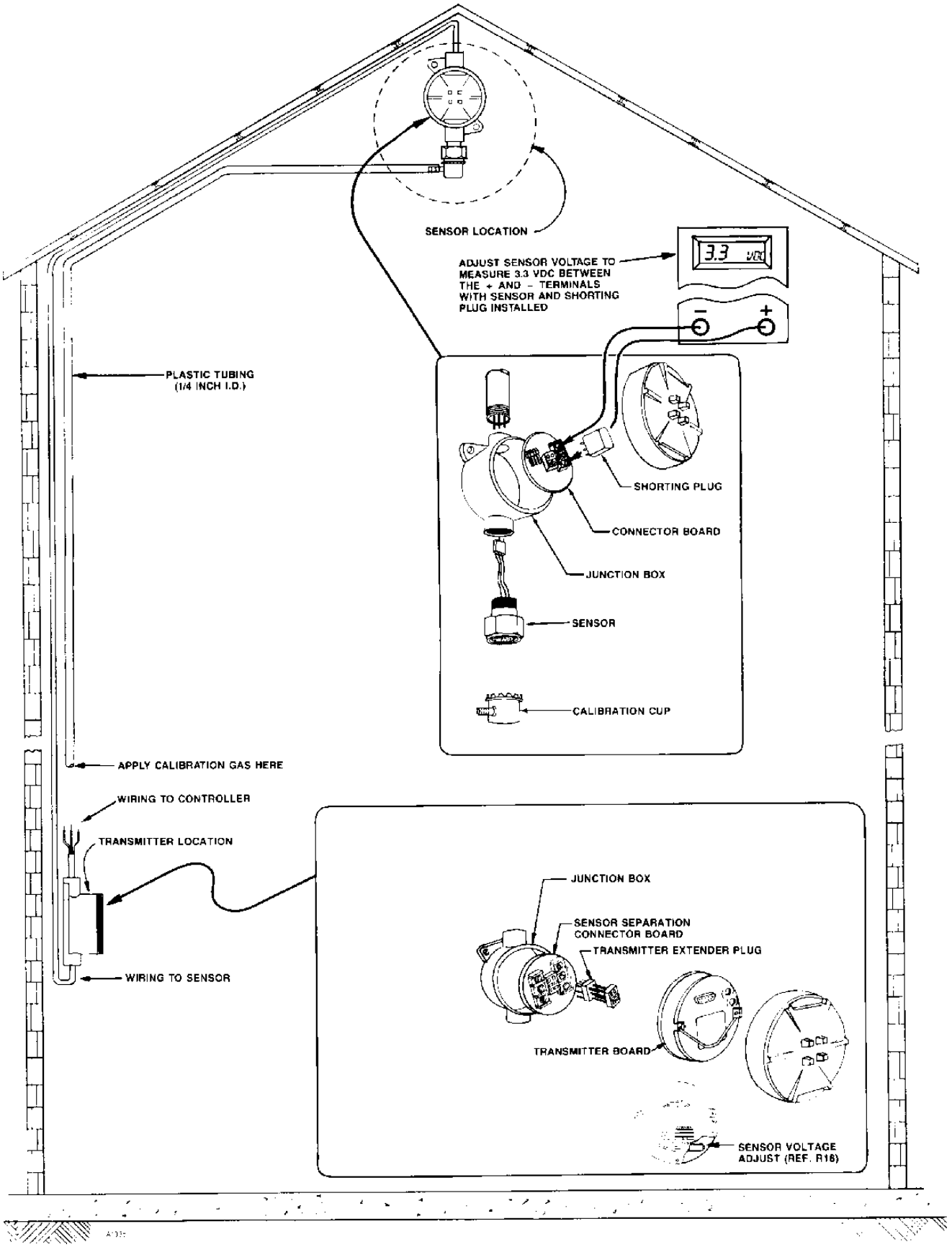


Figure 26—Sensor and Transmitter Separation

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

8. Sensors are pointing down and sensor junction boxes are securely mounted.

9. Optional sensor accessories (dust/splash guards, sample draw devices, etc.) are installed, clean, and in good condition.

10. Sensor to transmitter wiring is correct. If a sensor separation kit is used, check the sensor voltage (should measure 3.3 vdc) and adjust as required.

11. Transmitter to controller wiring is correct. (If using other than K Series transmitters, also check the wiring to the external power source.)

12. All transmitter modules are properly installed in their junction boxes.

13. All junction box covers are tightly installed.

Follow the instructions in the "Startup Procedure" and "Calibration" sections.

TYPICAL SYSTEM

Various alarm indicators and response devices can be connected to the alarm and fault relays in the controller. Figure 27 is an example only and illustrates typical connections. For assistance in adapting a system to meet your individual requirements, contact the Field Support Group at Detector Electronics.

STARTUP PROCEDURE

This procedure requires removal of the junction box cover, therefore, the hazardous area must be de-classified.

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

2. Ensure that the alarm setpoints are set for desired controller operation. Double check to be sure that all external wiring has been installed properly and that the sensors and transmitters have been connected properly.

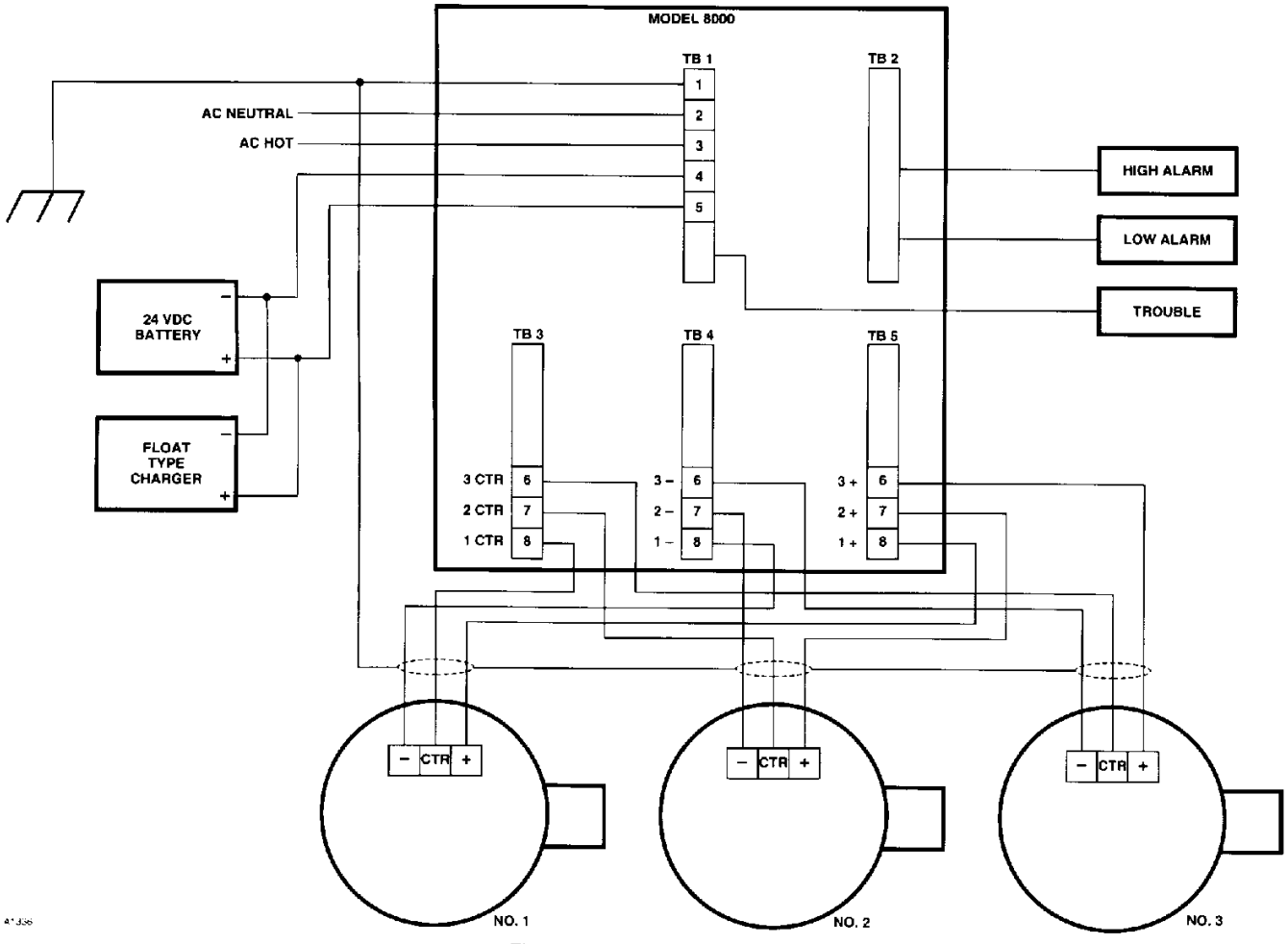


Figure 27—A Typical System

3. Be sure that power is not applied to the terminal board, then slide the controller fully into the mounting enclosure.

4. Apply power to the system.

5. Allow a minimum of 15 seconds for the sensors to stabilize. The alarm relays can now be tested by adjusting the transmitter Zero control until an alarm level is reached. (The transmitter Span adjustment may have to be increased (clockwise) to obtain a full scale reading on the controller.)

NOTE

The calibration meter must be unplugged to get a low or high alarm at the controller.

6. After testing the system, calibrate the transmitters using the Calibration procedure described below.

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

CALIBRATION

The transmitter must be adjusted periodically to match the characteristics of the sensor to which it is connected. Various factors affect the time interval between periodic calibrations (typically 30, 60, or 90 day intervals, depending on the conditions). Since each application is different, the length of time between regularly scheduled calibrations can vary from one installation to the next. In general, the more frequently a system is checked, the greater the reliability. The transmitter **must** be calibrated:

—Before a new system is initially put into service
If the sensor is replaced
—If the transmitter module is replaced.

For maximum calibration accuracy, allow a new sensor to operate for several hours to ensure a stable output before performing calibration. For the highest degree of accuracy, perform a second calibration after 24 hours.

When a sensor is exposed to a different or new environment, calibration should be checked frequently (approximately twice in the first month) to determine the proper interval between periodic calibrations.

NOTE

Under ideal conditions, some systems can go for extended periods of time without a serious loss of sensitivity. However, it must be noted that only during calibration can the system be tested to assure total function. Loss of sensitivity can be caused by various factors. One common cause is by clogging of the sintered metal filter by water, dirt, oil, paint, etc. Problems of this nature are capable of totally incapacitating the sensor, but it is only during calibration that the problem will be discovered. To assure the greatest level of reliability, calibration should be performed at regularly scheduled intervals.

The Span (gain) control adjusts the % LFL reading to match the LFL percentage of the applied calibration gas. The gain setting will vary for different combustible gases. Therefore, calibration should always be performed using the same gas as the one to be detected. If several different combustible gases can be present, calibrate to the most volatile gas.

Before performing calibration, the operator should also examine the sintered metal cover of the sensor to be sure that it is not missing or damaged. If the cover is defective or missing, the sensor **must not** be operated, since the exposed sensing element can act as an ignition source. It should also be noted that a dirty cover can significantly reduce the sensitivity of the sensor.

CALIBRATION METER

The calibration meter (see Figure 28) allows one person to accurately calibrate the sensor without setting off any alarms at the controller. Its secondary function is to indicate the rate of sensor sensitivity loss and to indicate when sensor replacement is recommended. A third function of the calibration meter is to

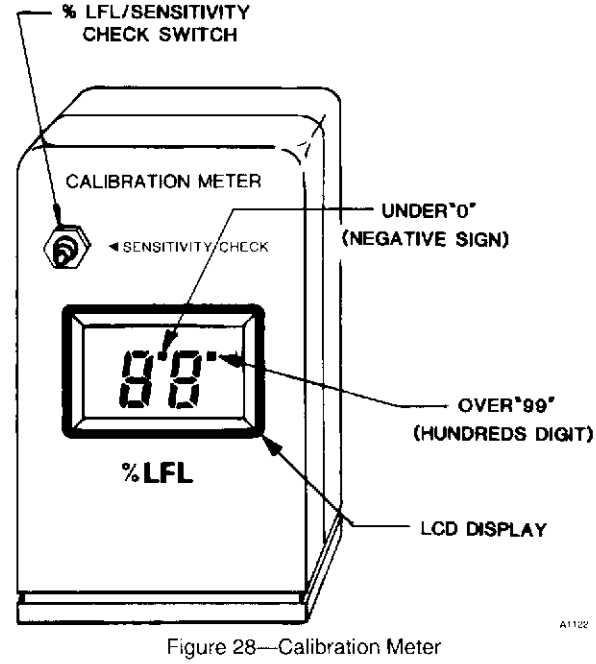


Figure 28—Calibration Meter

aid in troubleshooting sensor and transmitter problems.

When the calibration meter is plugged into the transmitter module, the signal current to the controller is limited to a maximum of 4.6 milliamperes (equivalent to 4% LFL on the controller display). This prevents the controller from going into an alarm condition during calibration. The calibration meter does not limit the minimum signal current, therefore, caution should be taken so that the zero is not set below –10% LFL or the controller will generate a trouble alarm. (The controller will leave the trouble mode sixteen seconds after the 4 milliampere (0% LFL) signal is restored.)

The two digit LCD display normally indicates what the controller display would read if the calibration meter were unplugged. When the calibration gas is applied to the sensor and the sensitivity check switch is pressed, the relative sensitivity of the sensor is shown on the LCD display. The meter reads sensitivity in millivolts. A typical sensitivity reading with 50% LFL gas applied to the sensor is 35 to 50 millivolts for a new sensor. Sensor replacement is recommended when the sensitivity reading is less than 15 millivolts.

The dot on the LCD display labeled "Under Zero" is used as a negative sign. When adjusting the zero setting, the zero control should be turned counter-clockwise (CCW) until the display reads "0°0," and then turned slowly clockwise (CW) until the dot just disappears ("00" displayed).

The dot on the LCD display labeled "Over 99" is used as a hundreds digit (a reading of "10°" is actually 110% LFL). During normal calibration this dot should not appear. If the dot appears with 50% LFL gas applied, turn the span control CCW until the dot disappears and continue turning until the display reads 50% LFL.

CAUTION

If the LCD display digits do not appear or both dots appear simultaneously, there is a problem with the system. DO NOT apply calibration gas or the controller may go into alarm. Refer to the "Troubleshooting" section for more information.

CALIBRATION PROCEDURE

Calibrate the system using the following procedure.

1. Verify that the area is safe for entry (no dangerous levels of either toxic or combustible gas are present).

CAUTION

A portable instrument should be used to ensure that the area is clear of any combustible gases. If there is any indication of the presence of combustible gas at the sensor, calibration or maintenance should not be performed.

The location must be declassified prior to calibration.

2. Remove the junction box cover and plug the calibration meter into the socket on the transmitter. If the meter does not display a two digit number, refer to the "Troubleshooting" section.

3. Adjust the Zero control with a screwdriver until the meter displays 0% LFL (see Figure 29). If the possibility of background gases exists, purge the sensor with clean air to assure accurate calibration.

NOTE

If a dust cover or splash shield is used, it should be checked to ensure that it is not dirty or plugged. A plugged dust cover can restrict the flow of gas to the sensing element, seriously reducing its effectiveness. For optimum performance, sensor covers/filters should be replaced at each calibration to ensure that they have not been degraded or plugged.

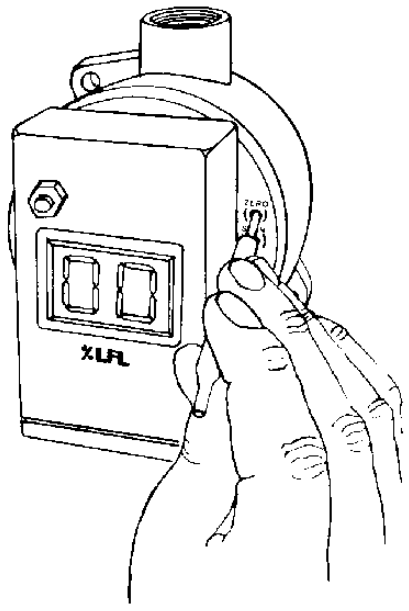
4. Apply the calibration gas to the sensor. (Be sure that the pressure gauge indicates that there is enough gas in the tank to complete the calibration.)

5. When the meter displays a stable output level, press the sensitivity check button. If the display reads less than 15, sensor replacement is recommended. If the sensor must be replaced, refer to the "Sensor Replacement" section of this manual.

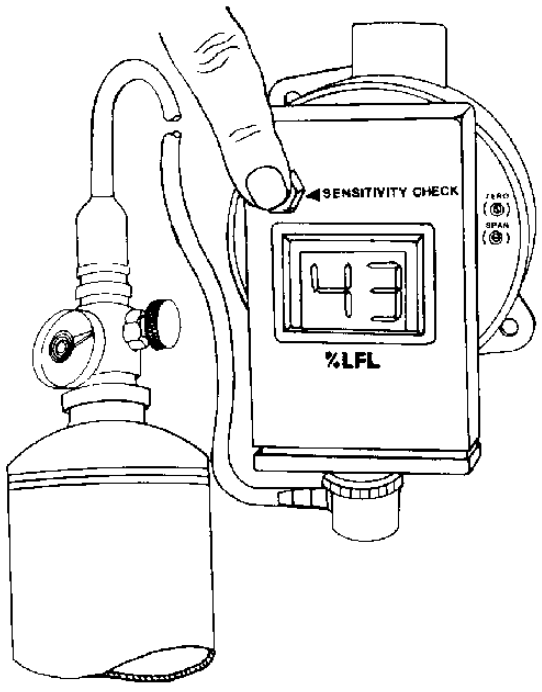
6. When the display shows a stable reading, adjust the Span control until the meter displays the same % LFL as indicated on the calibration tank (typically 50%).

7. Remove the calibration gas from the sensor. DO NOT REMOVE THE CALIBRATION METER until the reading on the calibration meter returns below the low alarm setpoint level (or 5% LFL).

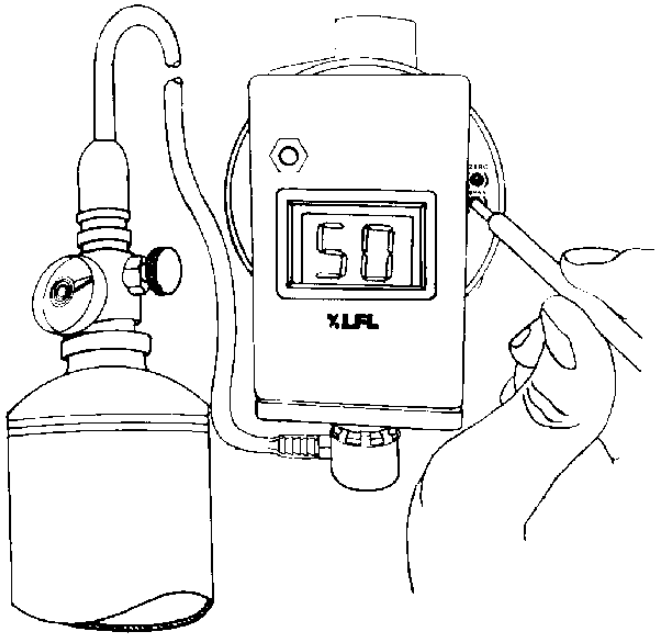
8. Unplug the calibration meter and replace the junction box cover.



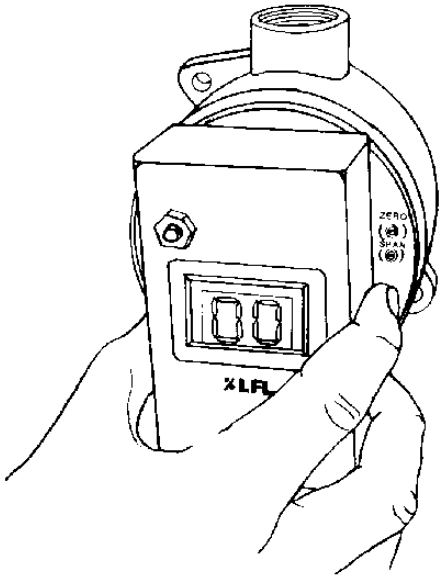
1. Set zero.



2. Apply calibration gas. Check Sensor Sensitivity.



3. Set span.



4. Remove calibration gas. When % LFL reading is below alarm level, calibration meter may be removed.

A1123

Figure 29—Calibration Sequence

MAINTENANCE

The gas detection system requires virtually no routine maintenance, except for periodic checks to assure proper system function and calibration. 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 various problems that could prevent proper system response, however, it does not monitor external equipment that is actuated by the system. 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 entire system should be checked periodically to ensure that the presence of gas at the sensor will result in the proper system response.

CAUTION

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

SENSOR REPLACEMENT

The area must be de-classified or power must be removed prior to replacing the sensor. To replace the sensor:

1. Remove the cover from the junction box.

2. Remove the transmitter module, then unplug the sensor from the connector board and unscrew it from the junction box.

NOTE

When either the sensor or transmitter is unplugged, the controller will generate a Trouble signal (if W11 on the Control board is installed).

3. Coat the threads of the sensor with the appropriate grease (part number 005143-001), then screw the sensor into the junction box and plug it into the connector board.

4. Plug the calibration meter into the transmitter, **then** plug the transmitter into the connector board. The calibration meter will prevent a false alarm signal at the controller.

5. Allow the sensor output to stabilize (several hours for maximum calibration accuracy), then perform the calibration procedure as described in the "Calibration" section of this manual.

6. When the calibration is complete, remove the calibration meter and replace the junction box cover.

7. For the highest degree of calibration accuracy, perform a second calibration after 24 hours.

A Recommended Test Form is supplied at the back of this manual for recording maintenance performed on the system.

TROUBLESHOOTING

Table 5 is intended to serve as an aid in locating the cause of a system malfunction.

The combustible gas detection system 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 electrical malfunction, the unit must be returned to the factory for repair.

NOTE

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

LOSS OF SENSOR SENSITIVITY

There are a variety of factors that can cause a decrease in the sensitivity of catalytic type combustible gas sensors. The following information is intended to aid the user of the combustible gas detection system in identifying those substances that can have a detrimental effect on the gas sensor. Under no circumstances should these lists be considered to be complete. Interfering or contaminating substances that can adversely affect the response of the sensor to combustible gases are as follows:

A. Materials that can clog the pores of the sintered metal flame arrestor and reduce the gas diffusion rate to the sensor include:

   1. Dirt and oil.

      — A dust cover should be installed to protect the flame arrestor whenever these conditions exist.

      — The dust cover can be cleaned as part of routine maintenance. Use an organic solvent and an ultrasonic bath.

Table 5—Troubleshooting

Symptom	Probable Cause	Recommended Action
• No LEDs on.	Lack of power.	Check power connections.
• Low Power LED on.	AC and DC power voltages below minimum.	Check power supplies (Line 105 to 135 vac and/or 20 to 28 vdc).
• Trouble Switch LED on, "Low Signal" LED on, and/or "Low Pwr" LED on.	Shorted XMTR+ and XMTR– wires.	Unplug controller, check for shorts with ohmmeter.
• Channel trouble LED on, Trouble Switch LED on when on particular channel, "Low Signal" LED on	Transmitter not plugged in.	Plug in transmitter and calibrate.
—and transmitter calibrates properly.	Signal wire (CTR) shorted to XMTR– wire.	Check with ohmmeter.
• Over 100 indicator on and %LFL display reading any number.	Over 100% LFL gas to sensor.	Take appropriate safety measures, **USE EXTREME CAUTION.**
	Transmitter not calibrated.	Calibrate transmitter.
	XMTR+ wire shorted to CTR wire.	Unplug controller/test wire with ohmmeter.
• "Low Signal" LED on and Trouble switch LED on.	Transmitter not calibrated.	Calibrate transmitter.
	Shunt resistance between CTR wire and XMTR–.	Check wires with ohmmeter, check for water in conduit box, etc.
• Calibration meter LCD display blank.	Meter not fully plugged into transmitter.	Check connectors for obstructions or bad contacts.
	Controller not supplying power to transmitter.	Check voltage across XMTR+ and XMTR– terminals of controller motherboard. Voltage should be greater than 19 volts.
	Broken or disconnected power wire to transmitter.	Check XMTR+ and XMTR– wires.
• Calibration meter reads –25% LFL, transmitter Zero adjustment has no effect on reading.	Sensor not connected or sensor element damaged.	Check sensor connections, replace sensor if damaged.
• Calibration meter display digits are blank and dot is displayed.	Meter not fully plugged into transmitter.	Make sure meter is plugged in properly.
• Calibration meter drifts or erratic jumps occur during calibration.	Terminal wire connections (TB1) on J-box interconnect PCB loose.	Align wires and tighten screws.
	Transmitter, sensor or calibrater connectors dirty, loose, or pins missing.	Clean with safe spray cleaner and medium bristled brush. Replace transmitter, interconnect PCB, or hand calibrater if connector pins are loose or missing.
	Erratic jumps in calibration meter %LFL reading when adjusting span potentiometer.	Replace transmitter.
	Large undershoot ≥ –3% LFL when calibration gas is removed and/or does not recover to 0% within 60 seconds.	Sensor probably defective, replace sensor.

2. Corrosion products.

   — This occurs when substances such as Cl_2 (Chlorine) or HCl are present. A dust cover provides some protection. The dust cover should be replaced as part of routine maintenance.

3. Flame arrestor clogged as a result of painting or house cleaning.

   — The routine maintenance procedure should include covering the sensor with a plastic bag when painting or cleaning. The bag should be removed as soon as possible when the procedure is complete.

4. Polymer formation in the flame arrestor.

   — This can occur where monomeric vapors such as 1-3 butadiene, styrene, isoprene, etc. are present.

B. Substances that cover or tie up the active sites on the catalytic surface of the active sensing element.

This occurs in the presence of volatile metal organics, gases, or vapors of hydrides, and volatile compounds containing phosphorous, boron, silicon, etc.

Examples:
- Tetraethyl lead
- Phosphine
- Diborane
- Silane
- Trimethyl chlorsilane
- Hydrogen fluoride
- Boron trifluoride
- Phosphate esters
- Silicone oils and greases
- RTV silicone sealants

Longer sensor life can be obtained by using the Det-Tronics poison resistant sensor.

C. Materials that remove the catalytic metals from the active element of the sensor.

Some substances react with the catalytic metal, forming a volatile compound. This erodes the metal from the surface. With sufficient exposure, most or all of the metal catalyst can be removed from the surface of the active element of the sensor.

Halogens and compounds that contain halogens are materials of this nature.

Examples:
- Chlorine
- Bromine
- Iodine
- Hydrogen Chloride, Bromide or Iodide
- Organic halides
  - Trichloroethylene
  - Dichlorobenzene
  - Vinyl chloride
  - Freons
  - Halon 1301 (Bromotrifluoromethane)

A brief exposure to one of these materials can increase the sensitivity of the sensor. This is usually a temporary effect due to etching of the catalytic surface. This is sometimes used as a means of activating a sensor that has a degraded signal. **This practice is not recommended, since it is unreliable and may give a false sense of security.**

Longer sensor life can be obtained by using the Det-Tronics poison resistant sensor.

D. Exposure to high concentrations of combustible gases.

Exposure of the sensor to high concentrations of combustible gases for extended periods of time can introduce stress to the sensing element and seriously affect its performance. After exposure to a high concentration of combustible gas, recalibration should be performed and, if necessary, the sensor should be replaced.

The degree of damage to the sensor is determined by a combination of the type of contaminant, its concentration in the atmosphere, and the length of time the sensor is exposed. When a sensor has been exposed to a contaminant or to a high level of combustible gas, it should be calibrated at the time, followed by an additional calibration a few days later to determine whether a significant shift in sensitivity has occurred.

DEVICE REPAIR AND RETURN

Prior to returning devices or components, contact the nearest local Detector Electronics office so that an RMI (Return Material Identification) 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, thereby reducing the time and cost of the repair to the customer.

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 Minneapolis location.

Office Locations

Detector Electronics Corporation
6901 West 110th Street
Minneapolis, Minnesota 55438 USA
Telephone (612) 941-5665 or (800) 765-FIRE
Telex 6879043 DETEL UW
Cable DETRONICS
Facsimile (612) 829-8750

Detector Electronics Corporation
3000 Wilcrest
Suite 145
Houston, Texas 77042 USA
Telephone (713) 782-2172

Detector Electronics Corporation
466 Conchester Highway
Aston, Pennsylvania 19014 USA
Telephone (215) 497-5593
Facsimile (215) 485-2078

Detector Electronics Corporation
P. O. Box 13227
Shawnee Mission, Kansas 66212-3227 USA
Telephone (913) 451-4878
Facsimile (913) 451-1115

Detector Electronics (UK) Limited
Riverside Park, Poyle Road
Colnbrook
Slough, Berkshire
SL3 OHB
ENGLAND
Telephone 0753 683059
Telex 848124 GRAVIN G
Facsimile 0753 684540

Detronics Scandinavia AB
Box 81
S-260 83 Vejbystrand
SWEDEN
Telephone 431-53002/53240
Facsimile 431-52236

Detector Electronics Graviner S.r.l.
Milano I-20143 Via Carlo D'Adda, 5
ITALY
Telephone 39 2 58100401
Facsimile 39 2 89407638

Detronics AB
Rochussenstraat 49A
3015 Ec Rotterdam
HOLLAND
Telephone 010-436-2777
Facsimile 010-436-0296

Detectomatic S.A.
AV17 Con Calle 72, No. 71-92
Apartado 10055
Maracaibo, Venezuela

Det-Tronics Asia Pacific Office
10 Coleman Street
Unit No. 05-02
SINGAPORE 0617
Telephone (65) 334-1255
Facsimile (65) 334-1607

REPLACEMENT PARTS

An adequate supply of spare sensors 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. Refer to the "Ordering Information" section of this manual for sensor model numbers.

Always calibrate the system after replacing either an electronic transmitter module or a sensor.

ORDERING INFORMATION

When ordering please specify:

CONTROLLER

Model 8000	Eight Channel Controller
226408-XXX*	IAO Board
226745-001*	4 to 20 ma Board with IAO
226420-006*	4 to 20 ma Board without IAO

*Refer to form 95-8389 for details.

SENSOR

225006-002	Standard sensor with aluminum housing
225957-001	Standard sensor with stainless steel housing
226530-001	Poison resistant sensor with aluminum housing
226531-001	Poison resistant sensor with stainless steel housing

226931-001 High temperature sensor with aluminum housing

226931-002 High temperature sensor with stainless steel housing

TRANSMITTER

226585-001 K Series Transmitter

226555-001 Junction Box with Connector Board

226365-002 Sensor Separation Kit for K Series

226365-003 Sensor Separation Kit for Model 400 and U8700G/H

226616-001 Calibration Meter

226367-001 Transmitter Extender Plug (for use with sensor separation kit)

CALIBRATION KITS

225130-001 Methane 50% LFL

225130-002 Ethane 50% LFL

225130-003 Ethylene 50% LFL

225130-004 Propane 50% LFL

225130-005 Hydrogen 50% LFL

225130-006 Methane 20% LFL

225130-007 Methane 25% LFL

225130-008 Methane 35% LFL

REPLACEMENT CYLINDERS

226166-001 Methane 50% LFL

226166-002 Ethane 50% LFL

226166-003 Ethylene 50% LFL

226166-004 Propane 50% LFL

226166-005 Hydrogen 50% LFL

226166-006 100% Air

226166-007 Methane 20% LFL

226166-008 Methane 25% LFL

226166-009 Methane 35% LFL

CONTROLLER MOUNTING ENCLOSURES

225451-001 Single Unit Panel Mount

226463-001 Single Unit Panel Mount with IAO

225736-001 Four Unit Panel Mount

225476-001 Four Unit Rack Mount

226466-001 Four Unit Panel Mount with IAO

226465-001 Four Unit Rack Mount with IAO

226085-003 Single Unit NEMA 7

226480-003 Single Unit NEMA 4 with IAO

225450-004 Single Unit NEMA 3

226191-001 Eight unit NEMA 3

226191-002 Four unit NEMA 3

226191-003 Four unit NEMA 3 with IAO

225477-002 Blank Panel

ACCESSORIES

226349-001 Sensor Rain Shield

225312-001 Sensor Dust Cover (Stainless Steel)

226190-001 Sensor Dust Cover (Porex)

226846-001 Duct Mount Assembly

225775-001 Sample Draw Assembly (one "T" fitting)

226053-001 Sample Draw Assembly (two "T" fittings)

005143-001 Silicone Free Grease

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

Detector Electronics Corporation
Field Support Group
6901 West 110th Street
Minneapolis, Minnesota 55438 USA
Telephone (612) 941-5665 or (800) 765-FIRE
Telex 6879043 DETEL UW
Cable Detronics
Facsimile (612) 829-8750