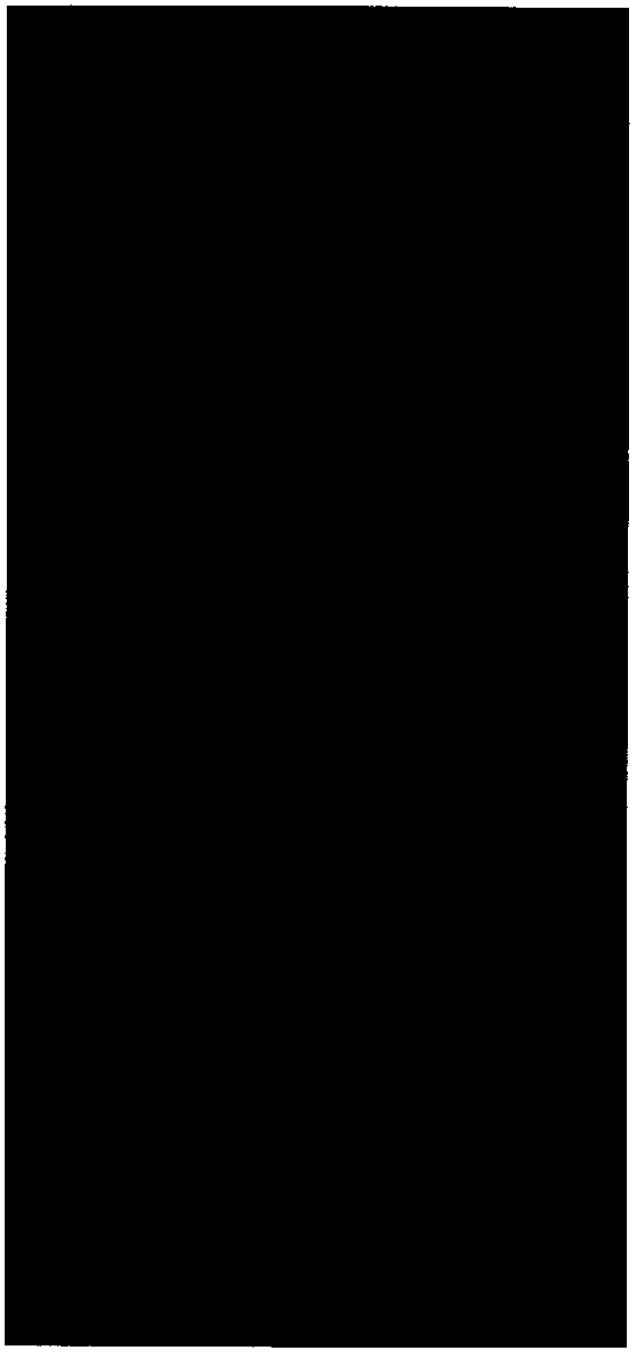
DET TRONICS



INSTRUCTIONS

H_2S Transmitter

Model 415

8/92 Form 95-8375

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DET TRONICS

INSTRUCTIONS

H_2S Transmitter

Model 415

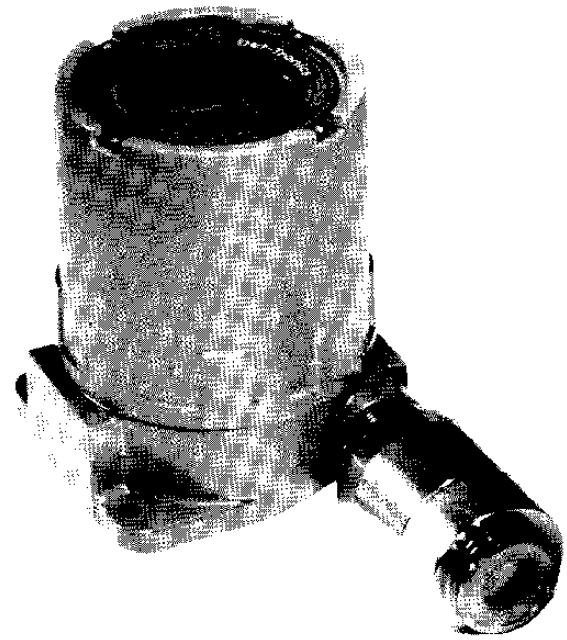
APPLICATION

The Model 415 H_2S Transmitter is designed to interface directly with a computer, programmable logic controller, or various other monitoring devices such as Det-Tronics Model 1100, 2100, or 8100 Controller. The unitized device uses microprocessor based circuitry to monitor the output of a C7064E Electrochemical Hydrogen Sulfide (H_2S) Sensor. The output signal consists of a linear 4 to 20 ma dc current output that corresponds to H_2S levels from 0 to 100 parts per million (ppm). An optional relay board is available to enable the Model 415 to function as an independent single channel detection system. All electronic circuitry of both the sensor and transmitter is housed in explosion-proof metal enclosures and is located at the point of detection. If desired, the sensor and transmitter can be mounted separately using the Det-Tronics Sensor Separation Kit.

In addition to continuously monitoring the output of the sensor, the Model 415 simultaneously checks continuity of external wiring and functioning of electronic circuitry to assure proper response to the presence of hydrogen sulfide. If a fault should occur in the system, it is indicated by a dc current output level of 0 ma.

Calibration is performed with the Det-Tronics Optical Calibration Meter attached to the glass window on the transmitter housing. The transmitter and calibration meter exchange information through an optical coupling arrangement. The digital readout on the calibration meter displays essential information to enable the operator to make zero and span adjustments. In addition, it allows the operator to determine remaining sensor life.

This method of calibration is easily performed by one person without removing the enclosure cover. The calibration meter automatically takes the detector under calibration off line, allowing the remainder of the detection system to function normally. The meter also inhibits the transmitter output signal during the calibration procedure to prevent an unwanted alarm.



FEATURES

- Electrochemical sensor for increased accuracy and reliability.
- High specificity to H_2S reduces the chance of false alarms resulting from the presence of other gases.
- Linear 4 to 20 ma output corresponds to H_2S concentration of 0 to 100 ppm.
- Calibration can be performed by one person without opening the housing.
- Digital display on calibration meter provides important calibration information.
- Non-volatile memory retains calibration and setpoint data during loss of input power.
- Optional relay board provides two SPDT relays for controlling alarm response devices.

GENERAL APPLICATION INFORMATION

Hydrogen sulfide is a colorless, highly toxic gas. It is frequently found in oil and natural gas, sewage dis-

posal or treatment systems, as well as a variety of industrial processes. Typical operations that encounter H_2S include:

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

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

The actual effects of H_2S on an individual depend on several factors:

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

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

Table 1—Effects of H_2S

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

DESCRIPTION

The Model 415 Transmitter functions as the interface between the H_2S sensor and the control device. The sensor detects the presence of H_2S gas. The transmitter monitors the output from the sensor and generates a linear 4 to 20 milliampere dc signal that corresponds to H_2S concentrations from 0 to 100 ppm. (Operating ranges of 0 to 25 ppm and 0 to 50 ppm are field selectable.) If the transmitter is equipped with the optional relay board, it can independently control alarm response devices.

SENSOR

The C7064E uses an electrochemical sensing element to detect the presence of hydrogen sulfide gas. The electrochemical sensing element provides improved accuracy and reliability, and also extended calibration intervals when compared to ordinary solid state type sensors. A significant property of the sensing element is its highly specific response to H_2S. Since many commonly encountered gases have little if any effect on the electrical response of the sensor, false indications caused by the presence of these gases are greatly reduced. In addition, high concentrations of H_2S do not adversely affect the sensor.

The C7064E uses a revolutionary hydrophobic filter to protect the electrochemical sensing element from contamination by dirt and moisture. Unlike a sintered metal filter that can restrict the passage of H_2S to the sensing element when its surface is covered with water, the hydrophobic filter sheds water, allowing an uninhibited flow of H_2S gas to the sensing element. As with any filter, the hydrophobic filter must be kept free of contaminants to allow H_2S gas to reach the sensing element. The filter can be replaced quickly and conveniently in the field.

Interfering Gases

Interfering gases are those which, when mixed with hydrogen sulfide, enhance, attenuate, or inhibit the sensor response to H_2S. The following are commonly encountered substances that can affect sensor response. By no means should this list be considered complete. ethylene, hydrogen, methylmercaptan, and chlorine increase the sensor response to H_2S, while sulfur dioxide and ammonia have an attenuating effect on the sensor. At concentrations above 1 ppm, nitrogen dioxide temporarily desensitizes the sensor to H_2S.

Sensor Separation (Optional)

The sensor separation kit is designed for use in applications where the sensor and transmitter must be

installed in different locations. In a standard installation, the sensor and transmitter share the same junction box. When using the sensor separation kit, the sensor and transmitter are mounted with separate junction boxes. This allows the sensor to be mounted in a location that will assure effective gas detection, while allowing the transmitter to be located where it is most convenient for calibration. The maximum separation distance depends on the gauge of the wire connecting the sensor and transmitter.

The sensor separation kit consists of a metal junction box containing a factory-installed connector board assembly. The junction box is designed for use in hazardous areas, and when properly installed will provide an explosion-proof detector installation. The connector board assembly contains screw-type terminals for connecting the external wiring.

TRANSMITTER

The Model 415 Transmitter functions as the interface between the sensor and the monitoring device. The transmitter generates a linear 4 to 20 milliampere output signal, which is proportional to the level of H_2S at the sensor. This dc current output is calibrated so that the output is 4 ma when no H_2S is detected and 20 ma when 100 ppm H_2S is present. The maximum output of the transmitter is 26 ma. A signal below 4 ma indicates a negative zero drift condition (up to –9 ppm) or calibration mode (the actual current output during calibration is user selectable.) If any of the connecting wires should break or become disconnected, the current output signal will be 0 ma.

Relay Board (Optional)

If the application requires the use of relay contacts, a relay board with two alarm relays is available as an option. Two relay status LEDs are provided to signal actuation of their corresponding relay. The relays have SPDT contacts that are rated at 2 amperes and can be programmed for either normally energized or normally de-energized operation. Each relay has separate set and reset setpoints, which are adjustable in one ppm increments. The relays are automatically reset when power is first applied to the transmitter and when a trouble signal is being generated. Latching and reset options for the alarm relays are programmed at the time of installation using the calibration meter. See "Operating the Calibration Meter" section of this manual for details.

CALIBRATION METER

The calibration meter enables one person to perform a system calibration without opening the transmitter enclosure. (See Figure 1.) When the calibration meter is communicating with the transmitter, the signal to the controller is set to a user selectable level (typically –2 ppm/3.68 ma) to indicate that the transmitter is being calibrated and to prevent unwanted alarms. The calibration meter uses a liquid crystal display (LCD) to allow the user to see the actual response of the sensor to the calibration gas mixture. In addition to routine calibration of the sensor, the calibration meter can also be used to select various options and to aid in identifying system problems.

Refer to the "Calibration" and "Operating the Calibration Meter" sections of this manual for complete information regarding the use of the calibration meter.

SPECIFICATIONS

TRANSMITTER

OPERATING VOLTAGE—
24 vdc nominal, total range 18 to 30 vdc, measured at the transmitter.

OPERATING CURRENT—
50 milliamperes nominal, 225 milliamperes with both relays energized, 350 milliamperes during power-up.

OPERATING RANGE—
0 to 100 ppm.

TEMPERATURE RANGE—
Operating: –40°F to +167°F (–40°C to +75°C).
Storage: –67°F to +185°F (–55°C to +85°C).

RELAY BOARD TEMPERATURE RANGE—
Operating: –40°F to +167°F (–40°C to +75°C).

CURRENT LOOP OUTPUT—
4 to 20 milliamperes dc nominal, 0 to 26 milliamperes total range, capable of driving a 600 ohm load at 24 vdc input voltage.

RELAY CONTACT RATINGS—
2.0 amperes at 24 vdc.

RATINGS—
Designed to meet FM and CSA explosion-proof requirements for Class I, Division 1, Groups C and D.

DIMENSIONS—
See Figure 2.

SHIPPING WEIGHT (Approximate)—
6.0 pounds (2.7 kilograms).

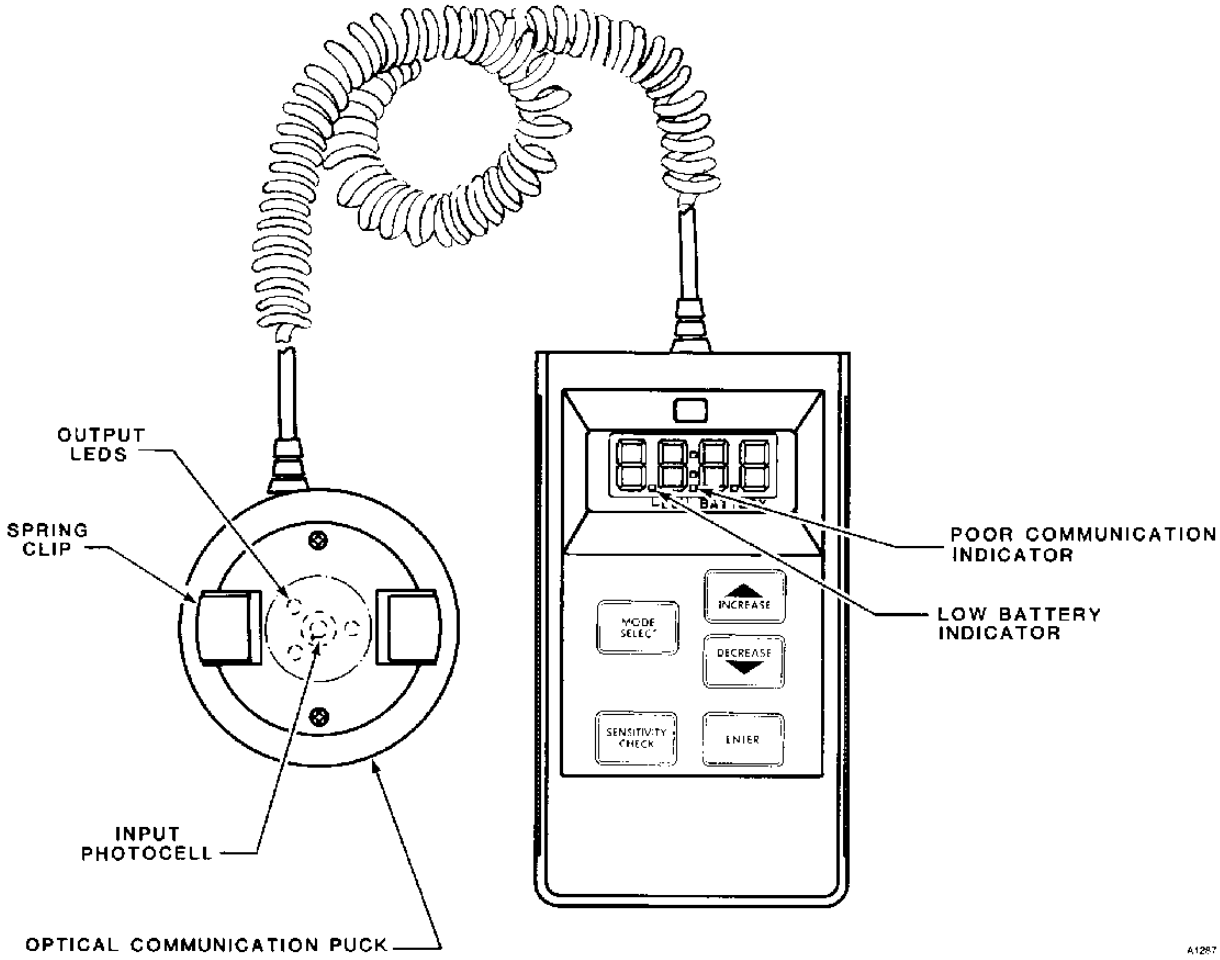


Figure 1—Optical Calibration Meter

SENSOR

OPERATING RANGE—
0 to 100 ppm.

TEMPERATURE RANGE—

Continuous operation:	–40°F to +105°F (–40°C to +40°C).
Intermittent operation:	–40°F to +130°F (–40°C to +55°C).
Storage:	+32°F to +68°F (0°C to +20°C).

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

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

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

ENCLOSURE MATERIAL—
316 stainless steel.

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

DIMENSIONS—
See Figure 3.

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

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).

CALIBRATION METER BATTERY—
Eveready No. 522. Approximate life: 200 hours or 2000 calibrations.

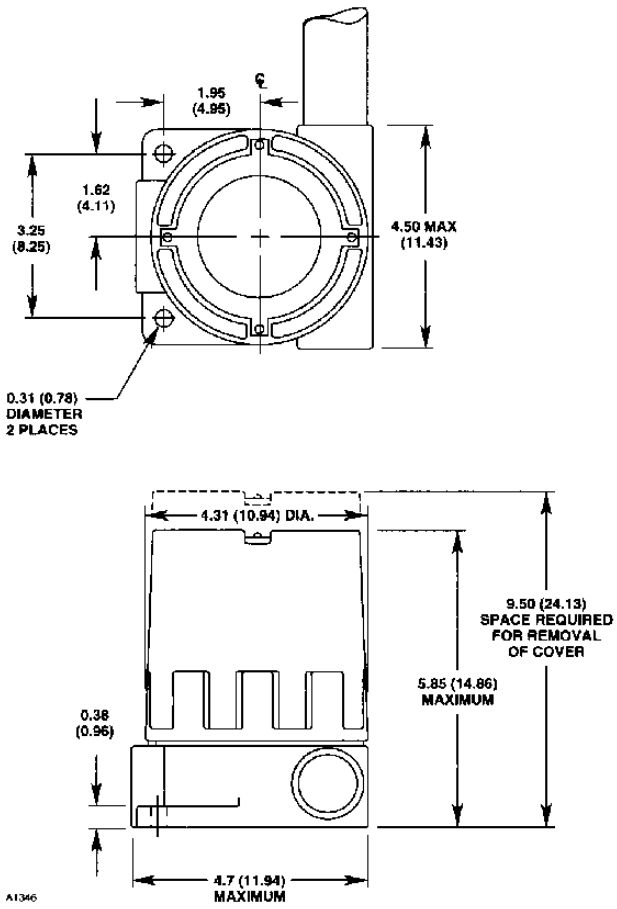


Figure 2—Transmitter Dimensions in Inches (Centimeters)

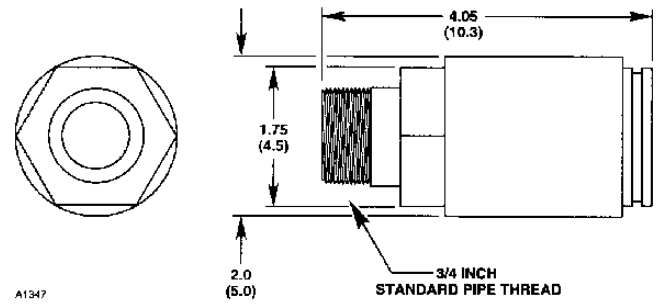


Figure 3—Sensor Dimensions in Inches (Centimeters)

RATINGS—
CSA certified intrinsically safe for Class I, Division 1, Groups A, B, C and D. Designed to meet FM intrinsic safety requirements for Class I, Division 1, Groups A, B, C and D.

INSTALLATION

SENSOR POSITIONING

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

2. Since H_2S has a density greater than air, it will normally tend to settle near the floor or ground, unless it is heated, mixed with gases that are lighter than air, or prevented from doing so by air movement.

3. Ventilation characteristics of the immediate area must also be considered. Movement of air will cause the H_2S gas to accumulate more heavily in one area than another. The sensors should be placed in the areas where the most concentrated accumulation of hydrogen sulfide gas is anticipated. Also take into consideration the fact that some ventilation systems do not operate continuously.

4. The sensor opening should be pointed down to prevent the buildup of moisture or contaminants and to ensure proper operation.

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.

7. Exposure to excessive heat or vibration can result in pre-mature failure of any electronic device and, therefore, should be avoided if possible.

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

WIRING REQUIREMENTS

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. To assure proper operation of the transmitter, the resistance of the connecting wire must be within the specified limits. The maximum distance between the transmitter and

power source (controller) is determined by the minimum supply voltage and wire size. See Figure 4 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 be 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 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 enclosure as possible. In no case should this seal be located more than 18 inches (46 cm) from the detector. 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.

SENSOR SEPARATION

A sensor separation kit is available from Detector Electronics and is recommended in applications that involve installation of the sensor in a poorly accessible location. The sensor separation kit allows the sensor to be mounted apart from the transmitter, thereby permitting the transmitter to be mounted in a location that is convenient for performing calibration.

The kit consists of an aluminum junction box, which is designed for use in hazardous areas. When properly installed, it will provide an explosion-proof installation. A terminal board assembly, mounted inside the junction box, contains a plug-in terminal for connecting the sensor and a screw type terminal block for connecting the external wiring. The kit also includes a shorting plug as well as a special calibration plug that can remain on the sensor after calibration without interfering with normal operation. By connecting a length of tubing from the calibration plug back to the transmitter, the operator can make calibration adjust-

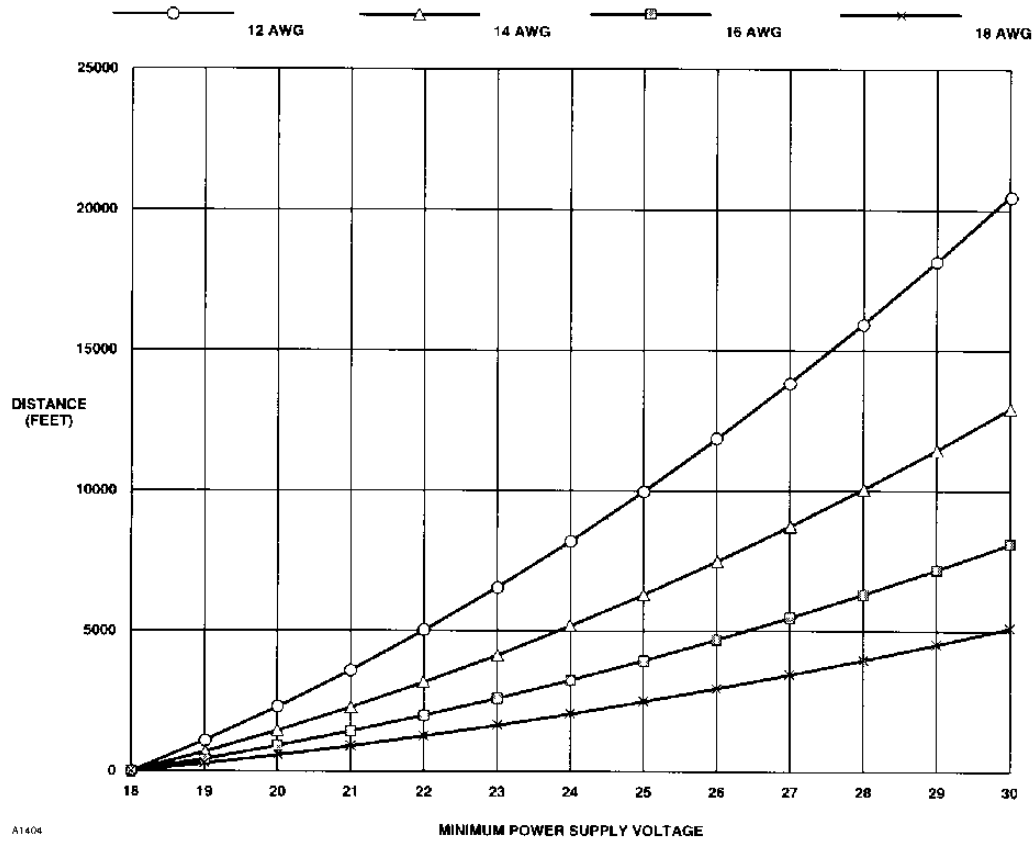


Figure 4—Transmitter Wiring Requirements

ments and also control the flow of calibration gas from the same location.

NOTE

The use of long lengths of tubing for delivering the calibration gas to the H_2S sensor is not recommended, since H_2S gas can be absorbed as it passes through the tubing, resulting in a decreased level of gas at the sensor. In general, the longer the tubing length, the lower the gas concentration at the sensor. To ensure proper operation, the detector should be tested by applying a known concentration of H_2S to the sensor to verify that a proper calibration has been performed.

The sensor is connected directly to the junction box. A two wire shielded cable is used for connecting the sensor to the transmitter. Refer to Table 2 to determine the maximum separation distance for a given wire size.

Table 2—Maximum Sensor Separation Distances

Wire Size (AWG)	Maximum Transmitter to Sensor Distance	
	Feet	Meters
18	5735	1748
16	9130	2783

WIRING PROCEDURE

The following procedure should be used for mounting and wiring the Model 415 Transmitter.

NOTE

Do not remove the cover from the sensor or transmitter while power is applied.

1. The unit should be installed in a location that is best suited for covering the area to be protected, following the previously discussed guidelines. Whenever practical, it should be placed where it is easily accessible for calibration. For proper operation, the sensor should be pointing down. See Figure 2 for mounting dimensions.

   NOTE

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

2. Remove the cover from the enclosure.

3. Connect the enclosure to the conduit so that the external wiring can be installed and trimmed. The enclosure should be electrically connected to earth ground.

4. If the optional relay board is used, plug the ribbon cable on the relay board into terminal J2 on the transmitter module. Attach the relay board to the side of the transmitter module using the five screws provided.

5. Loosen the three mounting screws on the transmitter module, then install the module in the mounting bracket inside the enclosure and tighten the screws. See Figure 5.

6. Attach the sensor to the conduit entry on the transmitter enclosure as shown in Figure 5. The sensor should be tight to ensure an explosion-proof installation, however, do **not** overtighten. Route the wires as shown. Attach the sensor plug to the transmitter module.

   If a sensor separation kit is being used, screw the sensor into the conduit entry of the separation kit junction box and connect the plug to the sensor terminal inside the junction box. Connect the leadwires of the shielded cable coming from the transmitter to the appropriate screw terminals inside the sensor junction box. **Do not** ground the shield at the sensor junction box. Ground the sensor wire shield at the transmitter end only.

   NOTE

   Coat the sensor threads with an appropriate grease to ease installation and ensure a watertight enclosure. The recommended lubricant is a silicone free polyalphaolefin grease (part number 005003-001), which is available from Detector Electronics.

   The wiring code for the sensor is:

   Red lead = "+"
   Black lead = "–"
   Green lead = Chassis (earth) ground

7. Connect the power and current output leadwires to the screw terminals on the plug that is provided. Proper wire locations are indicated on the sideplate of the transmitter and also in Figure 6. See Figure 5 for proper wire length and routing. Connect the shield to earth ground at the power supply. Under normal conditions, the other end of the shield should not be connected at the

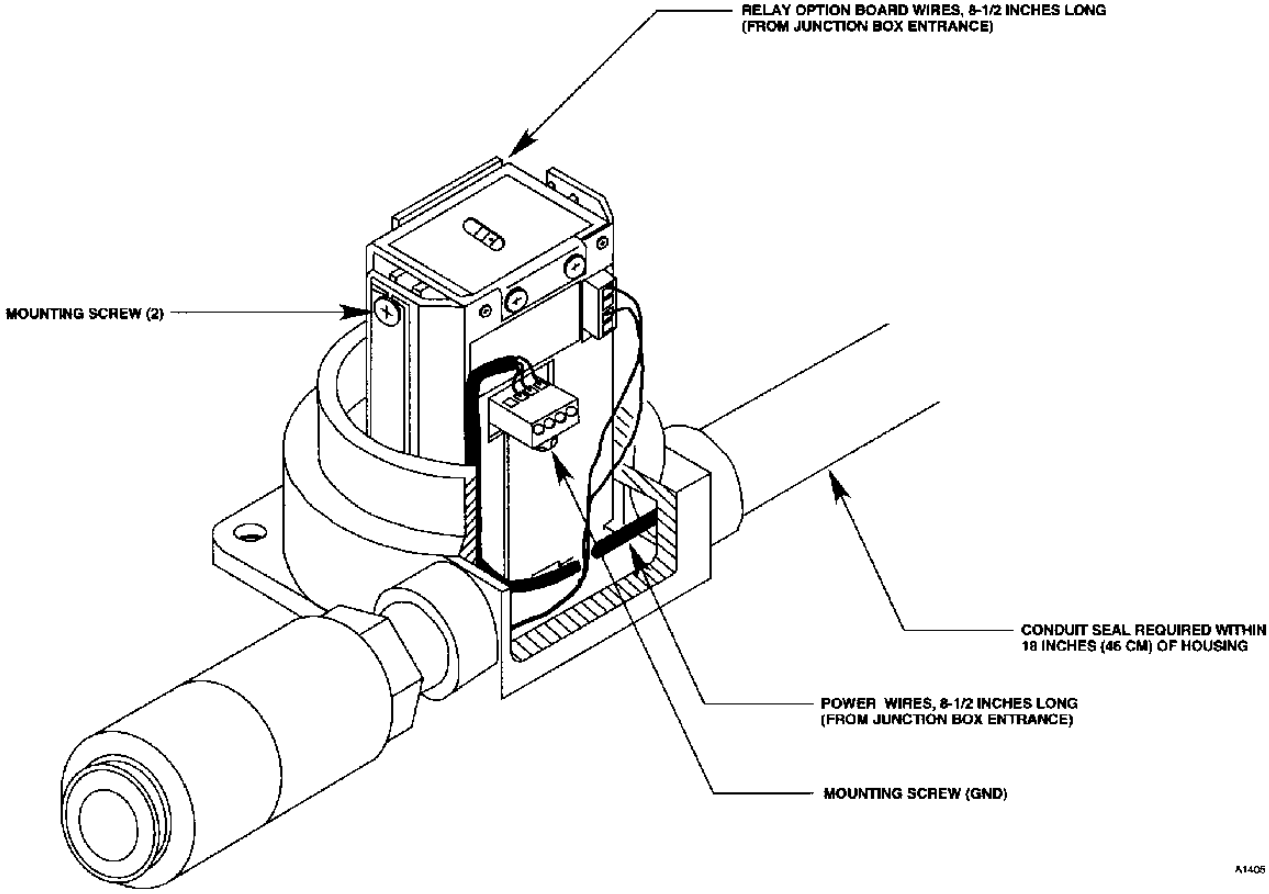


Figure 5—Transmitter Module Installation

transmitter unless such a connection is required by local wiring codes.

8. If an optional relay board is being used, continue with steps 9 to 11. If a relay board is not used, go to step 12.

9. See Figure 7 for connecting external loads to the relay outputs.

NOTE

Direct connection of 120/240 vac to the relay terminals inside the transmitter enclosure is not recommended, since switching relay contacts can induce electrical noise into the electronic circuitry, possibly resulting in a false alarm or other system malfunction. If the application requires that ac powered equipment be controlled by the Model 415 Transmitter, the use of externally located relays is recommended.

External relays, solenoids, motors, or other devices that can cause inductive transients should be transient suppressed. Place a MOV across the coil for ac devices. Place a diode across the coil for dc devices. See Figure 8.

10. If the optional relay board is being installed, a remotely located relay reset switch can be wired as shown in Figure 6. (The relays can also be reset using the calibration meter.) The transmitter resets the relays when the switch changes from open to closed, therefore, the switch can have either normally open or normally closed contacts. The switch must be held for approximately one second before the transmitter resets the relays.

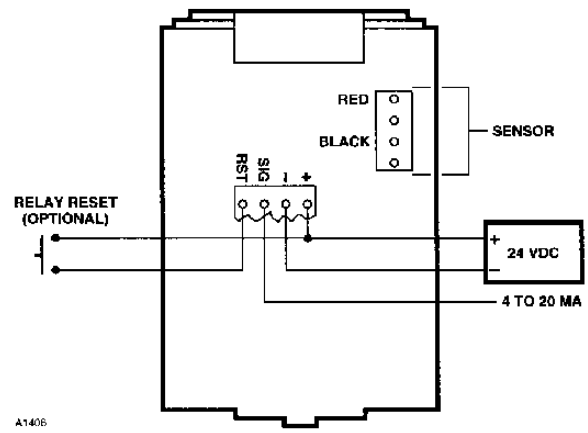


Figure 6—Transmitter Wiring

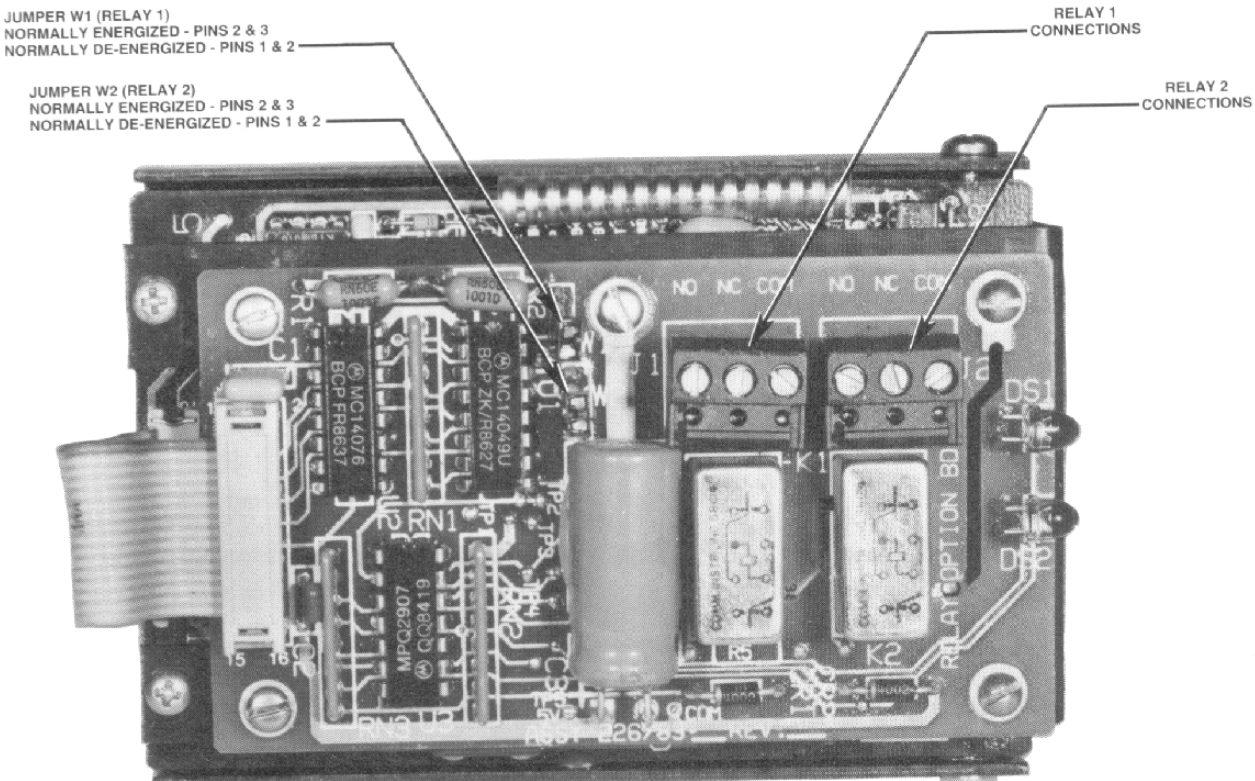


Figure 7—Relay Wiring Terminals and Programming Jumpers

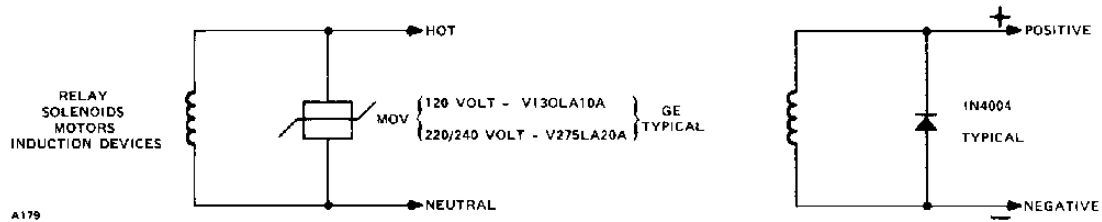


Figure 8—Transient Suppression for Inductive Loads

11. The relays are programmed for normally energized or de-energized operation by placing jumper plugs on the appropriate pins at locations W1 and W2 on the relay board. W1 controls Relay no. 1 and W2 controls Relay no. 2. For normally de-energized operation, place the jumper across pins 1 and 2. For normally energized operation, place the jumper across pins 2 and 3. See Figure 7.

12. Check all field wiring to ensure that the proper connections have been made, then install explosion-proof conduit seals at the conduit entries of all junction boxes.

13. Place the cover back on the enclosure.

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.

TYPICAL APPLICATIONS

Various alarm indicators and response devices can be connected to the optional alarm relays. Recorders, computers, programmable logic controllers, etc. are typically connected to the 4 to 20 ma

current output. Figure 9 shows an example of typical user connections.

Refer to Figure 10 for an illustration of a typical system using a Model 415 Transmitter with either a Model 1100 or 2100 Controller. The controller can be powered by either 24 volts dc or 120 volts ac. The Model 415 receives power by direct connection to the controller.

Figure 11 shows a typical system using three Model 415 Transmitters connected to a Model 8100 Controller. (A Model 8100 Controller can accommodate up to eight transmitters.) The controller is powered by an external ac input source. The transmitters are powered by connection to the controller.

For assistance in adapting a system to your individual requirements, contact the Field Support Group at Detector Electronics.

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. Enclosure is securely mounted and sensor is pointing down.
2. Explosion-proof seals have been installed at all junction box entries.
3. Power wiring is installed and power source is operational.
4. Wiring to external loads and/or monitoring devices is properly connected.
5. If a sensor separation kit is used, interconnecting wiring is correct.
6. All cable shields are properly grounded.
7. Device is programmed as desired. Record this information for future reference.
8. Optional sensor accessories (dust/splash guards, sample draw devices, etc.) are installed, clean, and in good condition.
9. Electronic module is properly installed.
10. Cover is tightly installed and gasket is in good condition.
11. Monitoring devices and/or response equipment is operational.

Proceed to System Startup and Calibration.

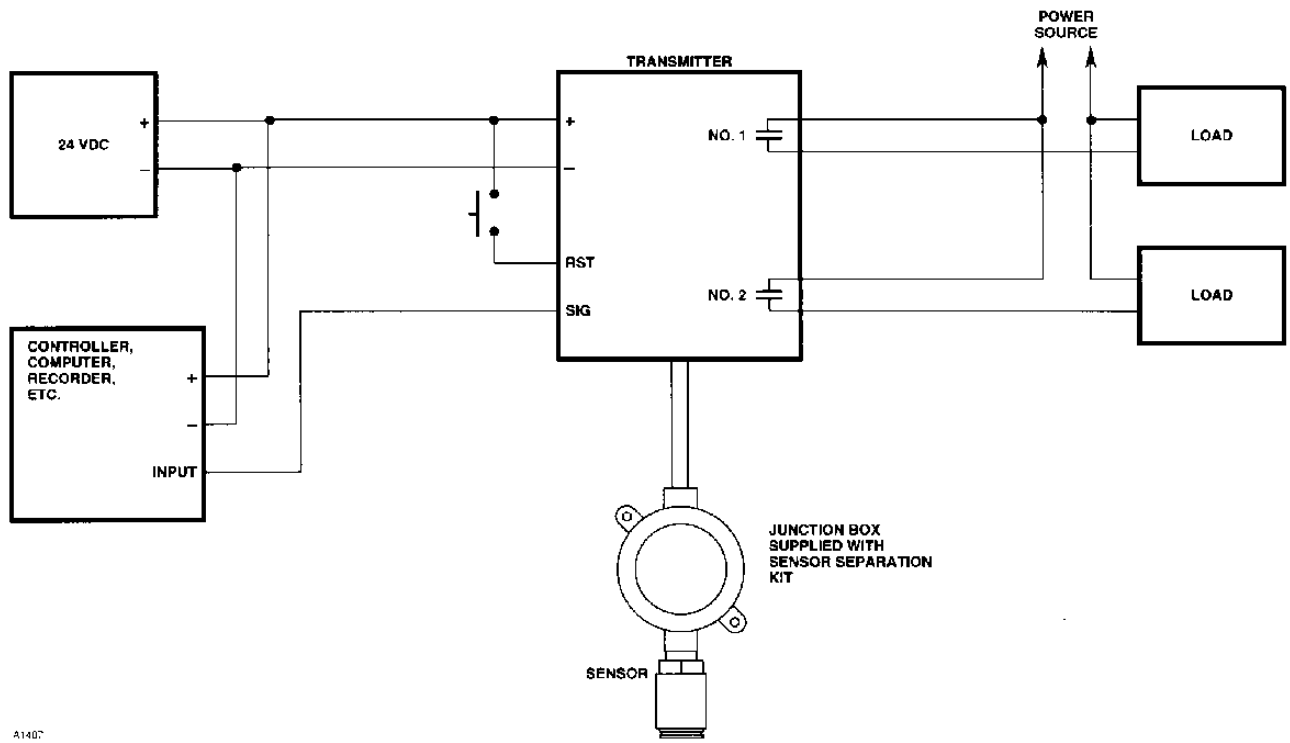


Figure 9—A Typical System Showing Transmitter Equipped with Optional Relays and Sensor Separation Kit

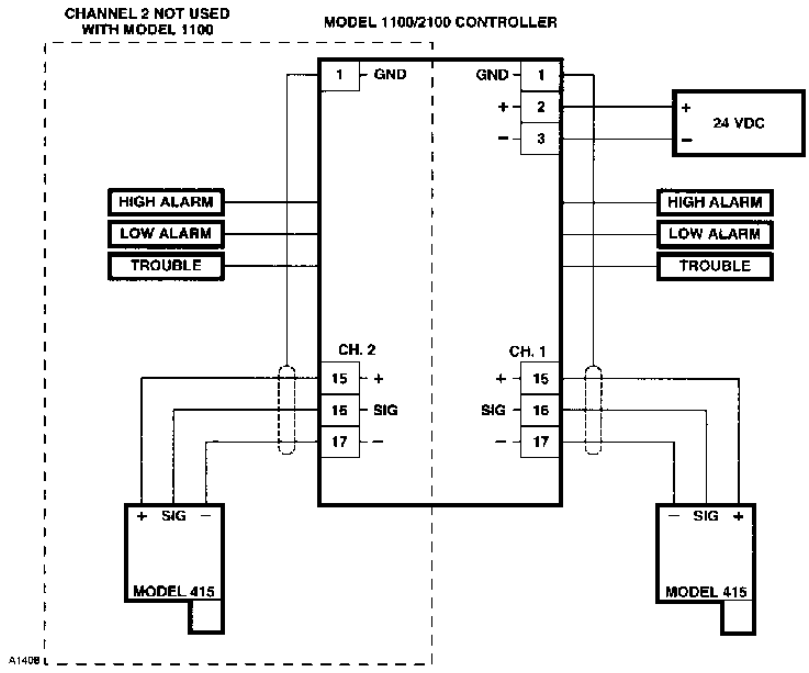


Figure 10—Model 415 with 1100/2100 Controller

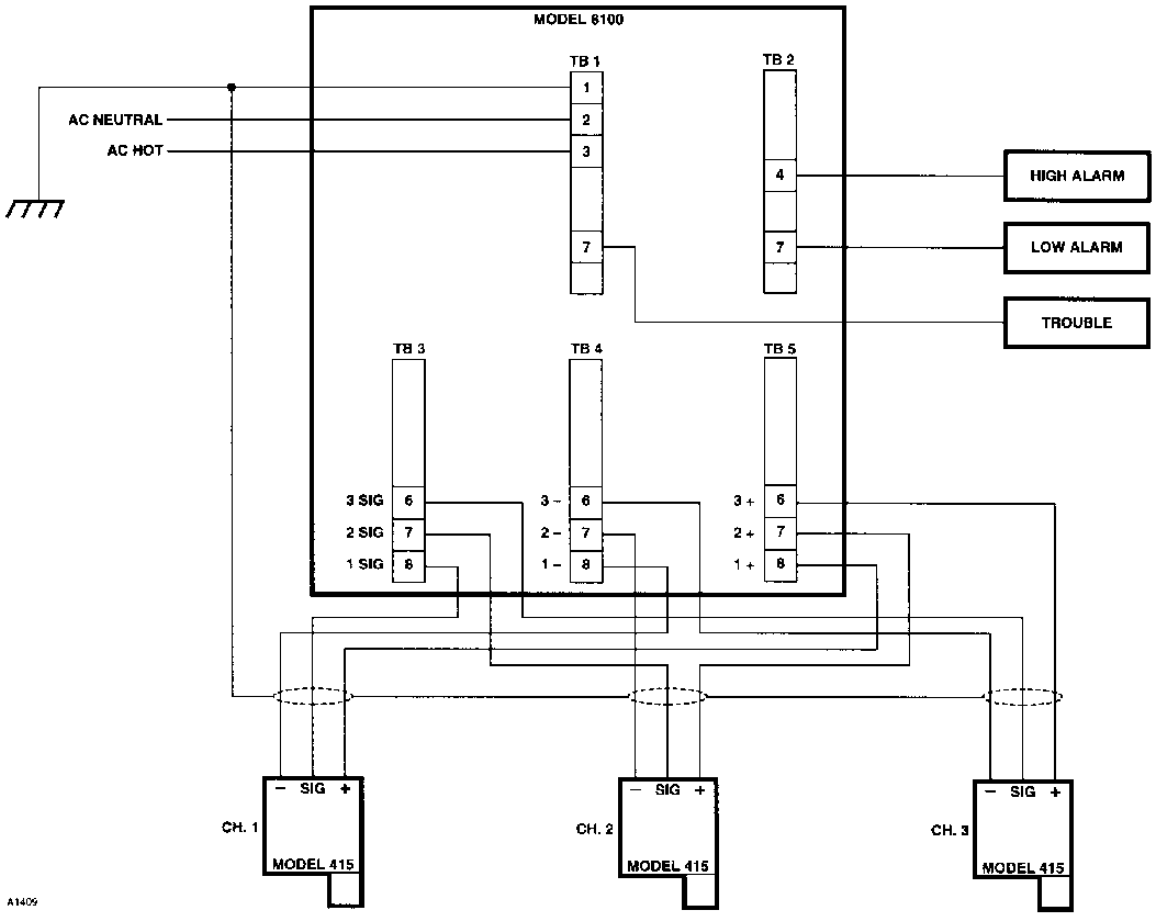


Figure 11—Model 415 with 8100 Controller

STARTUP PROCEDURE

1. Since the transmitter has not been calibrated, it is possible for a controller or other output device that is connected to it to generate an alarm output when power is applied. Therefore, 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. Double check to be sure that all external wiring has been installed properly and that the sensor has been connected properly. Be sure that the transmitter has been properly mounted inside the enclosure.

3. Apply power. The LED on the transmitter will flash as the transmitter performs its initialization procedure. After a 100 second time delay, the transmitter will begin normal operation.

4. Allow the sensor to operate for about an hour, then perform the calibration procedure. Refer to the "Calibration" section of this manual for a recommended calibration schedule.

5. If the optional relay board is being used, the desired relay operation must be programmed into the transmitter using the procedure described in the "Transmitter Programming" section of this manual.

NOTE

The operator can use the calibration meter to test the transmitter output signal and/or the optional relay board and reset switch functions by performing tests T4 and T2, respectively. The relays are unsupervised and should be tested periodically to ensure proper operation. Refer to the "Transmitter Programming" section of this manual for details regarding these tests.

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

CALIBRATION

Various factors affect the time interval between periodic calibrations. 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. Calibration **must** be performed:

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

NOTE

To ensure adequate protection, the H_2S detection system must be calibrated on a regular basis. *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 hydrophobic filter by dirt, oil, paint, etc. Problems of this nature will not be detected by the system's diagnostic circuitry. Therefore, it is imperative that calibration be performed regularly. As a general rule, calibration should be performed every 30 days.*

While performing detector calibration, the operator should also examine the hydrophobic filter of the sensor. It should also be noted that a dirty filter can significantly reduce sensor sensitivity and speed of response.

To ensure accurate calibration, the detector must be calibrated using 30 to 90 ppm hydrogen sulfide mixed with either air or nitrogen. The transmitter will accept values outside this range, however, calibration accuracy can be adversely affected.

Calibrate the system using the following procedure.

NOTE

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

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

2. Hold the calibration meter puck by the spring clip and squeeze to compress the spring. Place the puck on the window of the transmitter and release the spring clip. It should grip the cover behind the red label.

3. Turn on the calibration meter by pressing the MODE SELECT button. See Figure 12. The display should show OFF. (If the display shows "Er:X" press ENTER to clear it. See Table 3 for interpretation of error codes. If a proper display does not appear, try cleaning the window or adjusting the position of the puck.)

4. Press the MODE SELECT button. The display will show CAL.

5. Press the ENTER button. The meter will show "SET LO, C0:XX". "XX" is the present sensor reading.

6. Be sure that no H_2S is present at the sensor. When a stable reading is displayed, press ENTER. The display should now show "SET SPAn C1:XX".

NOTE

If background H_2S is present, it may be necessary to purge the sensor with clean air to assure accurate calibration. If the level of background H_2S exceeds 5 ppm or if the sensor output drifts to greater than 5 ppm or less than –5 ppm, the transmitter will not accept the sensor output for the zero value. The calibration meter will indicate "bad" and the calibration procedure will automatically be ended.

7. Apply the calibration gas mixture.

8. When the reading on the calibration meter stabilizes (typically within 2 to 3 minutes), press the INCREASE or DECREASE button to adjust the reading on the display to match the level of the applied calibration gas.

Table 3—Error Codes

Display	Possible Cause	Corrective Action
ER:0	Power is interrupted.	Press ENTER or MODE SELECT
ER:1	Calibration was attempted and not completed. (The transmitter will return to normal operation using the previous calibration data after 10 minutes.)	Press ENTER or MODE SELECT to clear, then calibrate.
	Puck removed without exiting.	Press ENTER or MODE SELECT to clear.
ER:2	Noise interference problem.	Press ENTER or MODE SELECT. Locate and remove source of noise, use shielded cable.
	Communication problem between the transmitter and Calibration Meter.	Clean window on detector cover and adjust the position of the puck on the window.
ER:3	Component or software failure.	Press ENTER or MODE SELECT.
ER:4	EEPROM failure	Simultaneously press ENTER and MODE SELECT. If normal operation is restored, the transmitter must be recalibrated and all programming options must be checked.
ER:5	Non-recoverable PROM/RAM failure.	Remove power and try a restart. If the failure persists, the unit must be returned to the factory for repair.
ER:6	Sensor zero drift exceeds –10 ppm or sensor is unplugged.	Recalibrate. Replace sensor, then recalibrate. Check sensor wiring.

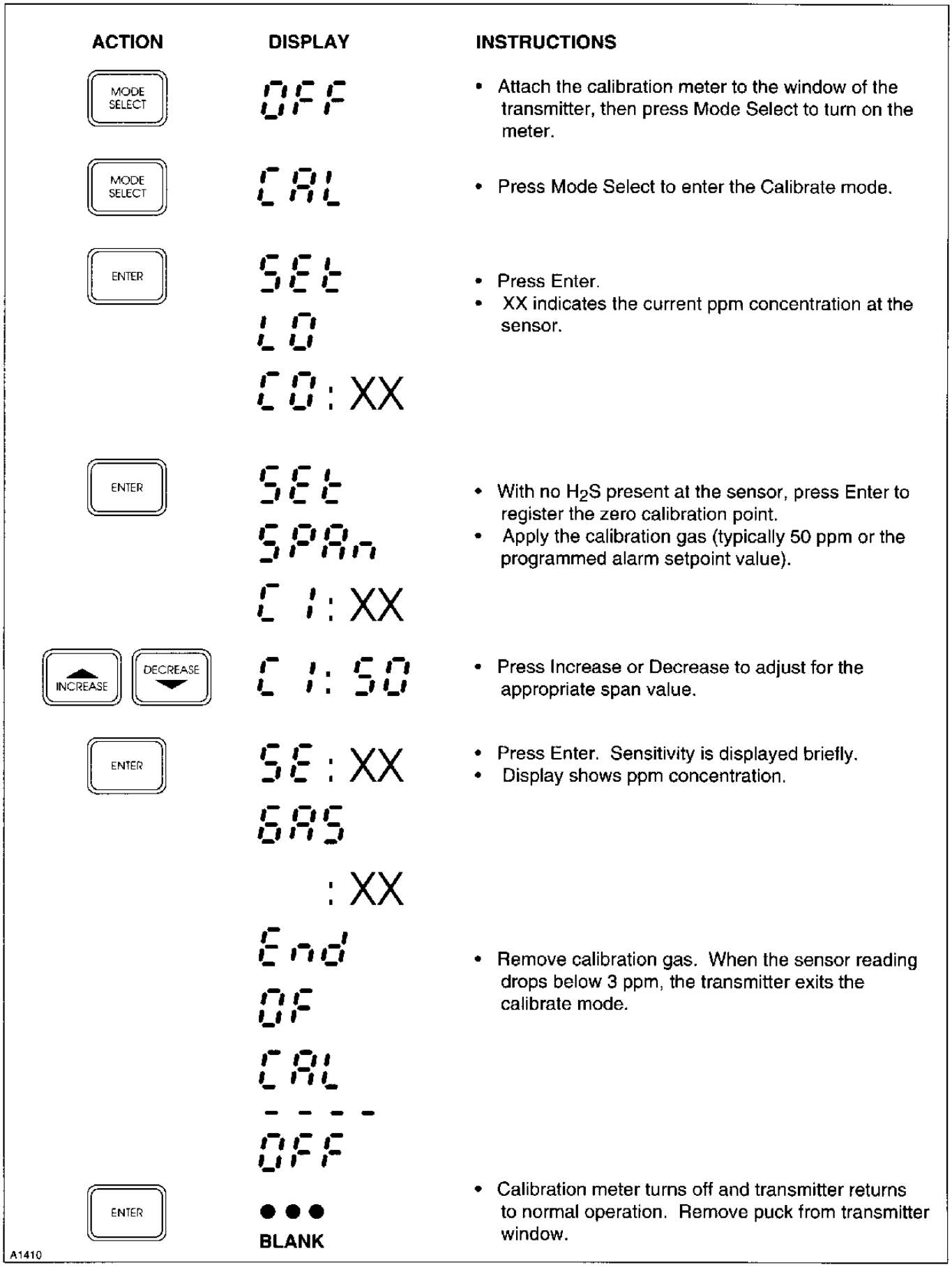


Figure 12—Transmitter Calibration

NOTE

The calibration meter will indicate "Lo Sen" (low sensor sensitivity) when the sensor is approaching the end of its useful life.

9. Press ENTER to save the calibration data and end the calibration procedure. The sensor sensitivity will be displayed briefly, then the meter will alternately display "GAS" and the ppm level of the gas present at the sensor. If the display should indicate "bad", the sensing element must be replaced and the calibration procedure must be repeated. If the display shows "bad" or "Lo Sen", press and hold ENTER to exit.

NOTE

Sensor sensitivity is displayed as a two-digit number (0 to 99). The larger this number, the greater the sensitivity of the sensor. Some sensors with a sensitivity reading near 0 can still provide reliable service and in some cases can still be successfully calibrated. In general, a sensitivity reading below 10 for a sensor that has been in service for awhile indicates that the sensor is approaching the end of its useful life. Sensor replacement may be needed at the next scheduled calibration.

10. Shut off the gas flow and remove the cup from the sensor. The "GAS" message will continue until the gas level drops below 3 ppm or 90 seconds go by.

NOTE

If power was interrupted during the previous calibration procedure, the transmitter will automatically return to the normal mode 90 seconds after the "GAS" message appears. If the gas level at the sensor is above an alarm setpoint at this time, an alarm output will be generated.

11. The meter will display "END OF CAL" followed by "OFF." Press ENTER to turn off the calibration meter and return the transmitter to normal operation.

12. Remove the calibration meter from the transmitter.

NOTE

If the calibration meter is removed prematurely, the transmitter will automatically return to the normal operating mode after a ten minute period.

13. 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. To ensure accuracy, calibration should be performed with filters in place whenever possible.

NOTE

If power to the transmitter is interrupted during the calibration procedure, the transmitter will automatically return to the beginning of the calibration procedure when power is restored and the calibration meter is connected.

NOTE

To safely exit the calibrate mode at any point without affecting calibration (no gas can be present at the sensor and the calibration meter must read 0 ppm), press ENTER (one or more times, depending on the point in the procedure) until the display shows OFF. Disregard any response messages from the calibration meter. Press ENTER once more to turn off the meter. Do not apply gas to the sensor. The transmitter will return to the normal operating mode and use the previous calibration data.

CALIBRATION METER OPERATION

The calibration meter allows the operator to calibrate and program the transmitter without opening the transmitter enclosure or triggering an alarm at the controller. It can also indicate the relative sensitivity of the sensor, enabling the operator to determine when replacement of the sensor is needed. In addition, the calibration meter can be used to aid in troubleshooting sensor and transmitter problems.

The calibration meter and transmitter communicate with each other by sending and receiving a coded light signal. Message signals are generated by LEDs that are located on the "puck" of the calibration meter and on the faceplate of the transmitter. The messages are received and interpreted using photocells, along with amplifying and decoding circuitry.

The calibration meter is turned on by pressing the MODE SELECT button. It automatically turns off approximately six seconds after it stops receiving data from the transmitter.

If the light signal is weak or is blocked by dirt or other contamination on the transmitter window, the display on the calibration meter will flicker or become difficult to read. The "Poor Communication" indicator (center decimal point located below the colon on the display) will be on.

Several operating modes are available for testing and programming the transmitter using the calibration meter. See Flow Chart, Figure 13. Once a mode has

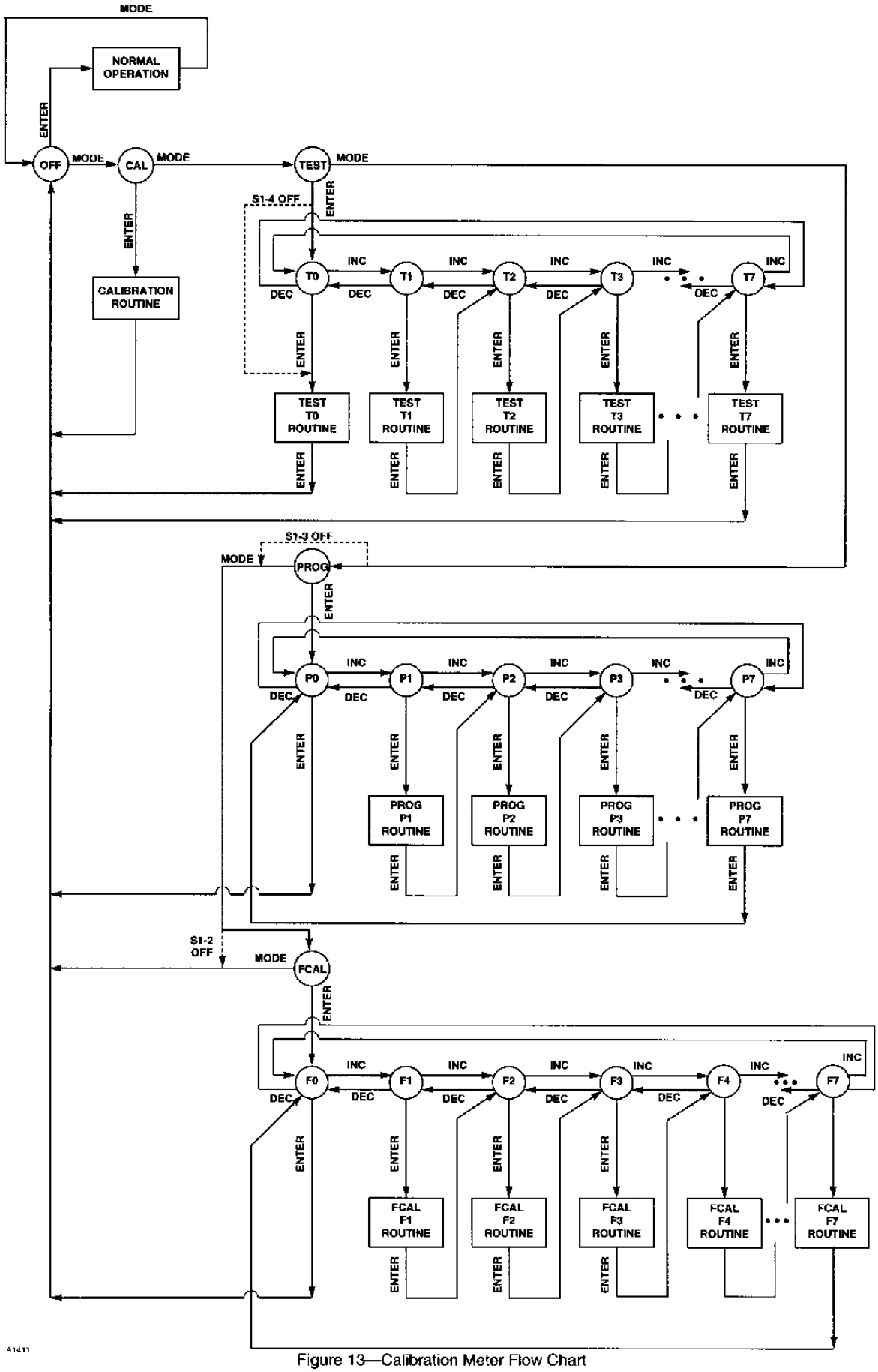


Figure 13—Calibration Meter Flow Chart

been entered, a number of routines can be performed before exiting that mode. The INCREASE and DECREASE buttons are used to alter the operation of the transmitter. If these buttons are not pressed, the operator can step through all the routines (except P3, F3, F4 and CAL) without affecting the operation of the system. (The P3, F3 and F4 routines reset the unit to the factory programmed settings. Pressing ENTER in any of these modes automatically executes the function.) The ENTER button is used to end a routine and return the unit to normal operation.

All data changes are stored in permanent memory as each routine is completed. If power is interrupted before a routine is completed, the new data is lost and the old data is retained. If the calibration meter is removed before the ENTER button is pressed for the final time to exit the last routine, the transmitter will automatically restore the old data and return to normal operation (after a 10 minute waiting period).

MODE DISABLE SWITCHES

A set of four switches is provided to prevent accidental alarms or changes to the programmable features. These switches are located on the printed circuit board inside the calibration meter as illustrated in Figure 14. All switches are set in the "off" position and must be switched on to enable the desired function.

S1-1 is not used and should remain off.
S1-2 must be on to calibrate the 4 to 20 ma output (FCAL routines).
S1-3 must be on to allow adjustments to the relay setpoints or other user programmable options.
S1-4 must be on to enable various system tests.

LOW BATTERY INDICATOR

The decimal point on the left side of the digital display flashes when the battery in the calibration meter needs to be replaced. The meter will continue to operate until the output of the LED is too low for the transmitter to detect.

CAUTION

The battery must never be replaced in a hazardous area.

ERROR MESSAGES

Error codes are displayed on the calibration meter to identify various system problems. See Table 3.

Press ENTER or MODE SELECT to clear the error message and resume normal operations. All error messages except "ER:0" will be lost if power is removed.

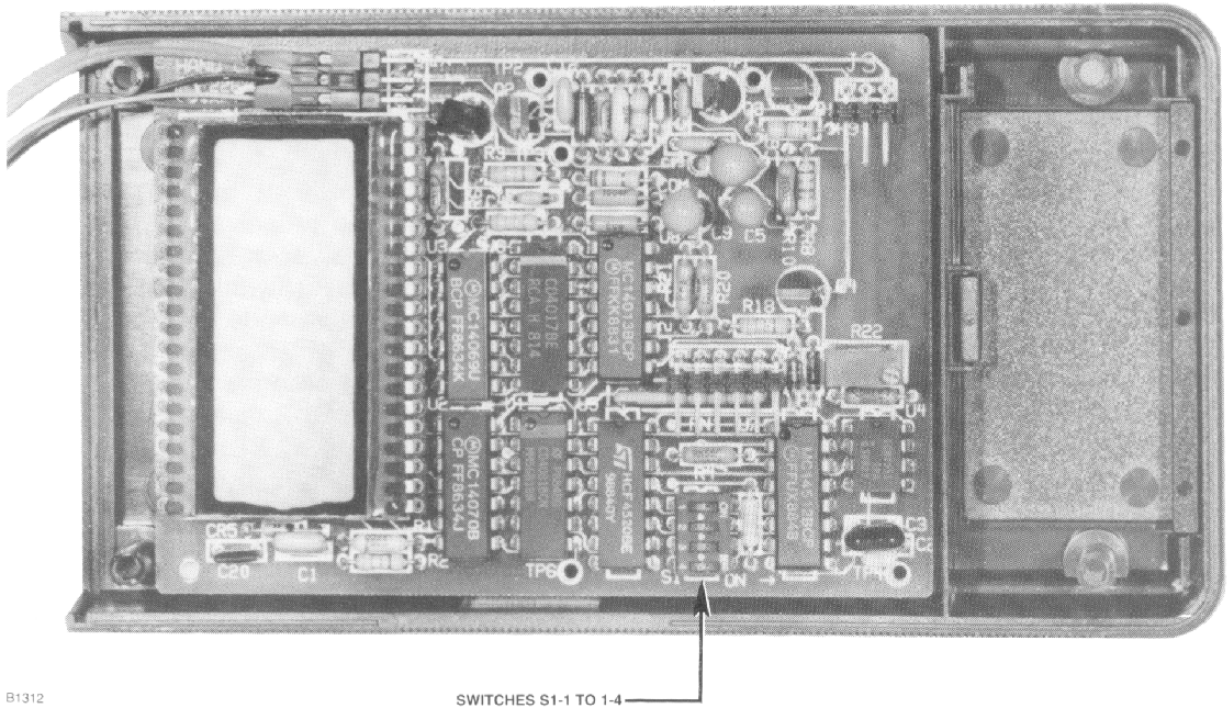


Figure 14—Mode Disable Switches

TRANSMITTER PROGRAMMING

If the transmitter is equipped with the optional relay board, it must be programmed before being placed in service. Each relay must be programmed for the ppm level at which it will set (change state upon reaching the alarm setpoint level) and reset (return to its non-alarm state). In addition, four different operating modes are available for each relay to provide the set/reset characteristics required for the specific installation. The following operating modes are available:

1. **Non-Latching, Remote Reset Switch Disabled**— The relay is set when the gas concentration at the sensor reaches the alarm setpoint level and automatically resets when the gas concentration drops below the programmed reset level. The remote reset switch has no effect on relay operation in this mode.

2. **Latching, Switch Reset *Below* Reset Level**— The relay is set when the gas concentration at the sensor reaches the alarm setpoint level. The relay can be reset using the external reset switch when the level of gas goes ***below*** the programmed reset level.

3. **Latching, Switch Reset at *Any* Level**— The relay is set when the gas concentration at the sensor reaches the alarm setpoint level. The relay is reset using the external reset switch at any time, even if the gas level is above the reset level. However, after the relay is reset, it cannot be set again until the gas concentration at the sensor drops below the reset level and then rises to the programmed set level.

4. **Latching, Calibration Meter Reset**— The relay is set when the gas concentration at the sensor reaches the alarm setpoint level and must be reset using the calibration meter.

CALIBRATION METER RESET

When resetting the relays with the calibration meter, the gas concentration at the sensor must be below the programmed reset level for the relays to remain reset. If the gas concentration is above the reset level, the relay will return to the alarm condition when the calibration meter is removed. To reset the relays, attach the calibration meter to the transmitter enclosure and turn on the meter by pressing the MODE SELECT button. The relays will reset. The meter can be turned off by pressing MODE SELECT until "OFF" is displayed, and then pressing ENTER.

FACTORY SETTINGS

The factory settings for the transmitter are as follows. (To return the transmitter to the factory settings, perform routine P3 or F3.)

Relay 1 Set level = 10 ppm
Reset level = 8 ppm
Operating mode = Auto Reset with Reset Switch Input Disabled
(Use routine P1 for changes.)

Relay 2 Set level = 20 ppm
Reset level = 18 ppm
Operating mode = Auto Reset with Reset Switch Input Disabled
(Use routine P2 for changes.)

Signal Output During Calibration = –2 ppm
Alternating Signal Feature = Off
(Use routine P4 for changes.)

Operating Range = 0 to 100 ppm full scale.
(Use routine P5 for changes.)

MODE SELECTION

The calibration meter operates in any of the following modes.

Calibrate— used to calibrate the system.

Off— used to terminate communication between the calibration meter and transmitter.

Test— used to perform various system tests (switch S1-4 must be on to enable this mode.)

Program— used to select setpoints, relay reset options, and various other system options. (Switch S1-3 must be on to enable this mode.)

FCAL— used to calibrate the 4 to 20 ma output. (Switch S1-2 must be on to enable this mode.)

To turn the calibration meter on, press the MODE SELECT button. See Figure 13. The meter displays "OFF." To exit and return to the Normal operating mode press "ENTER." To enter one of the other modes, press the MODE SELECT button until the desired mode is indicated on the display, then press "ENTER" to enter that mode.

After exiting a mode, the unit will return to the "OFF" mode. The operator can then select and enter another mode, or **turn the calibration meter off** by pressing ENTER.

NOTE

If the calibration meter is removed before selecting "OFF", the transmitter will automatically return to the normal operating mode after a 10 minute waiting period.

PROGRAMMING PROCEDURES

Programming changes are made to the Model 415 Transmitter by performing the following routines using the Program mode. (Switch S1-3 inside the calibration meter must be on.)

P0

The P0 routine is used to exit the Program mode. With "P0" displayed on the calibration meter, press ENTER. The meter will show "OFF". Press MODE SELECT to select the desired mode, or press ENTER to turn the calibration meter off.

P1

The P1 routine allows the operator to program the set and reset levels for relay number 1 and also determines the method of resetting the relay.

1. Press the MODE SELECT button to show "prog" on the display. See Figure 15.
2. Press ENTER. The display shows "P0."
3. Press INCREASE to advance to "P1."
4. Press ENTER. The display shows "relay.1," "St:XX." "XX" is the present alarm setpoint. Press INCREASE or DECREASE to display the desired relay set level.
5. Press ENTER. The display shows "rt:XX." "XX" is the relay reset point.
6. Press INCREASE or DECREASE to display the desired relay reset level.
7. Press ENTER. The display shows "r1:XX."
8. Program the relay operating mode by pressing INCREASE or DECREASE to achieve the desired reading.
9. Press ENTER. The display shows four dashes and then "P2."
10. To continue with routine P2, press ENTER (step 4 below). To exit, press DECREASE to show "P0" on the display. (The display must show "P0" to exit this operating mode.) Press ENTER. The display shows "OFF." Press ENTER to return to normal operation. (See "Mode Selection" section for information regarding selection of a different operating mode or turning off the calibration meter.)

P2

The P2 routine allows the operator to program the set and reset levels for relay number 2 and also determines the method of resetting the relay.

1. Press the MODE SELECT button to show "prog" on the display. See Figure 16.
2. Press ENTER. The display shows "P0."
3. Press INCREASE to advance to "P2."
4. Press ENTER. The display shows "relay.2," "St:XX." "XX" is the present alarm setpoint. Press INCREASE or DECREASE to display the desired relay set level.
5. Press ENTER. The display shows "rt:XX." "XX" is the relay reset point.
6. Press INCREASE or DECREASE to display the desired relay reset level.
7. Press ENTER. The display shows "r2:XX."
8. Program the relay operating mode by pressing INCREASE or DECREASE to achieve the desired reading.
9. Press ENTER. The display shows four dashes and then "P3."
10. To continue with P3, press ENTER (step 4 below). To exit, press DECREASE to show "P0" on the display. Press ENTER. The display shows "OFF." Press ENTER to return to normal operation.

P3

The P3 routine is used to program the transmitter to the factory settings.

CAUTION

Pressing ENTER while P3 is displayed on the meter will restore the factory default settings for the alarm relays.

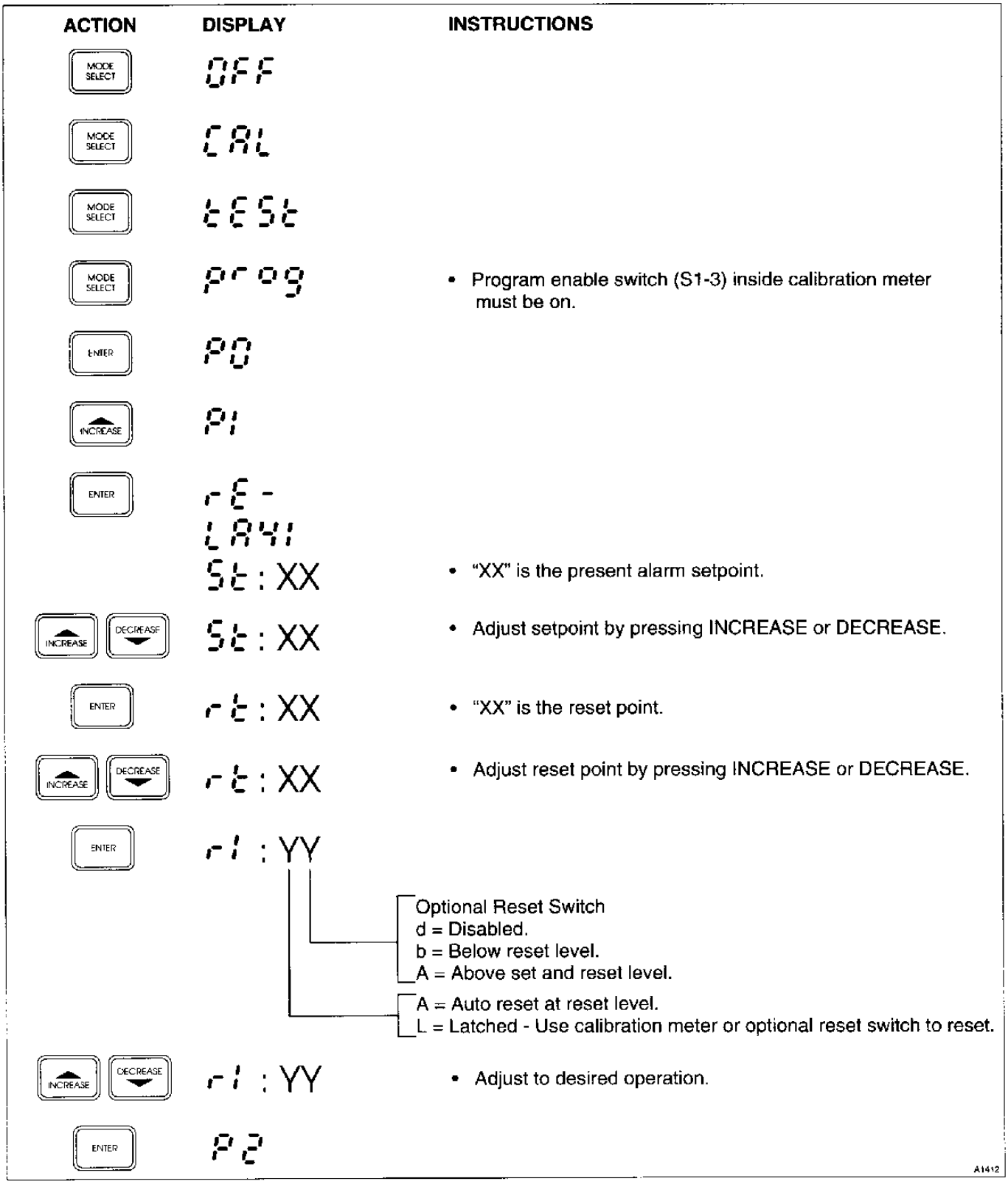


Figure 15—P1 Routine

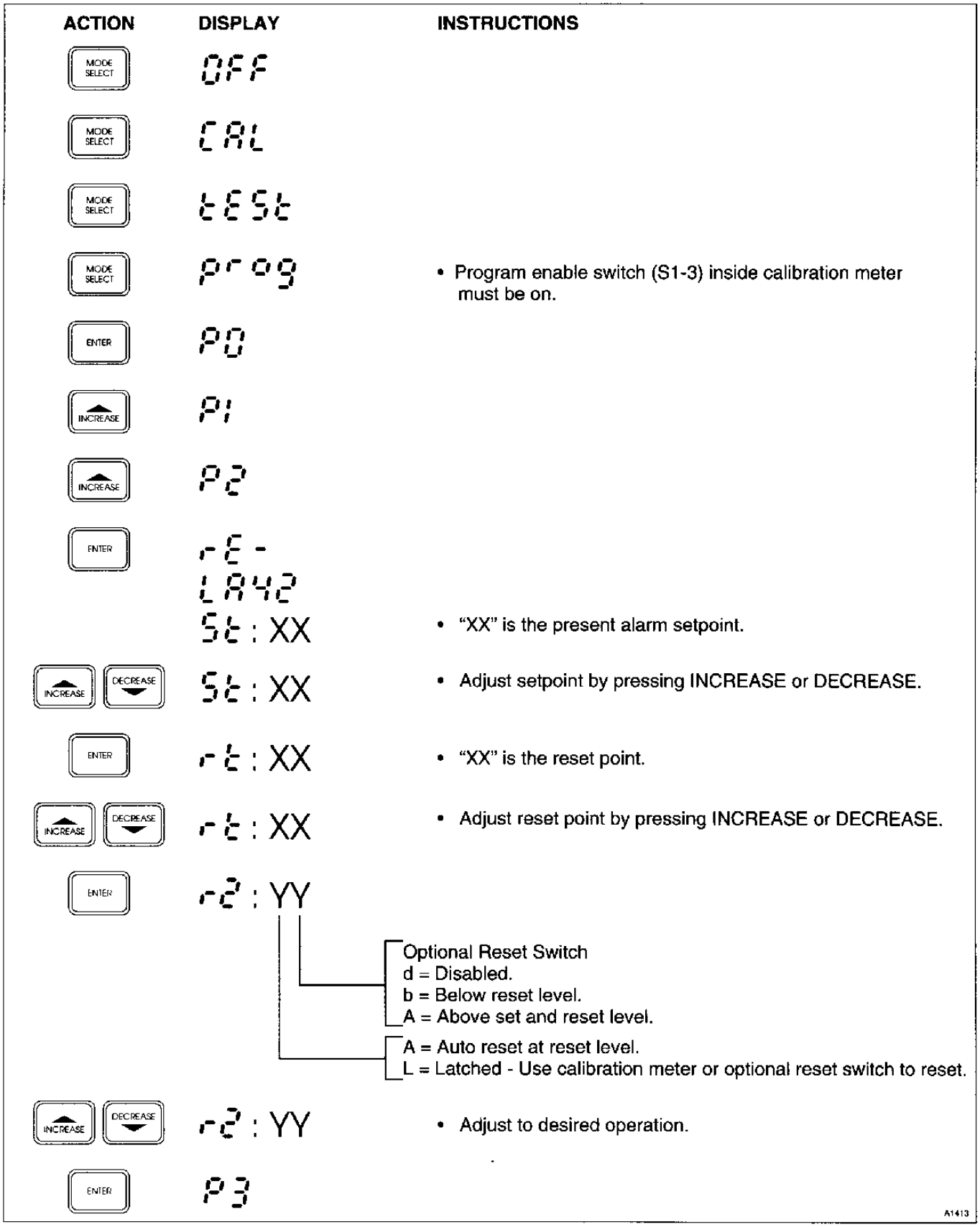


Figure 16—P2 Routine

1. Press the MODE SELECT button to show "Prog" on the display. See Figure 17.

2. Press ENTER. The display shows "P0."

3. Press INCREASE to advance to "P3."

4. Press ENTER. The display shows four dashes followed by "Std OPt SEt," followed by "P4."

5. To continue with P4, press ENTER (step 4 below). To exit press DECREASE to show "P0" on the display. Press ENTER. The display shows "OFF." Press ENTER to return to normal operation.

P4

The P4 routine allows the operator to program the current output level that will be generated while the transmitter is in the calibrate mode. Two adjustments are possible:

OUTPUT AMPLITUDE. The adjustment range is from –25 to +100 ppm (0 to 20 milliamperes).

FLASHING OPTION. The transmitter offers the option of alternating this signal level with 4.0 milliamperes (0 ppm) to achieve a unique "flashing" signal during calibration.

1. Press the MODE SELECT button to show "prog" on the display. See Figure 18.

2. Press ENTER. The display shows "P0."

3. Press INCREASE to show "P4" on the display.

4. Press ENTER. The display shows "P4:XX." "XX" is the calibration output signal level in ppm. Note that the signal output changes as this value is adjusted.

5. Press INCREASE or DECREASE to select the desired level.

6. Press ENTER. The display shows "F:OFF." Press INCREASE or DECREASE to switch the flashing feature on or off.

   OFF—Transmitter generates a steady signal (amplitude selected in step 4 above) during calibration.

   ON— Two different signal levels (4 ma and the value programmed in step 4 above) are alternately generated during calibration.

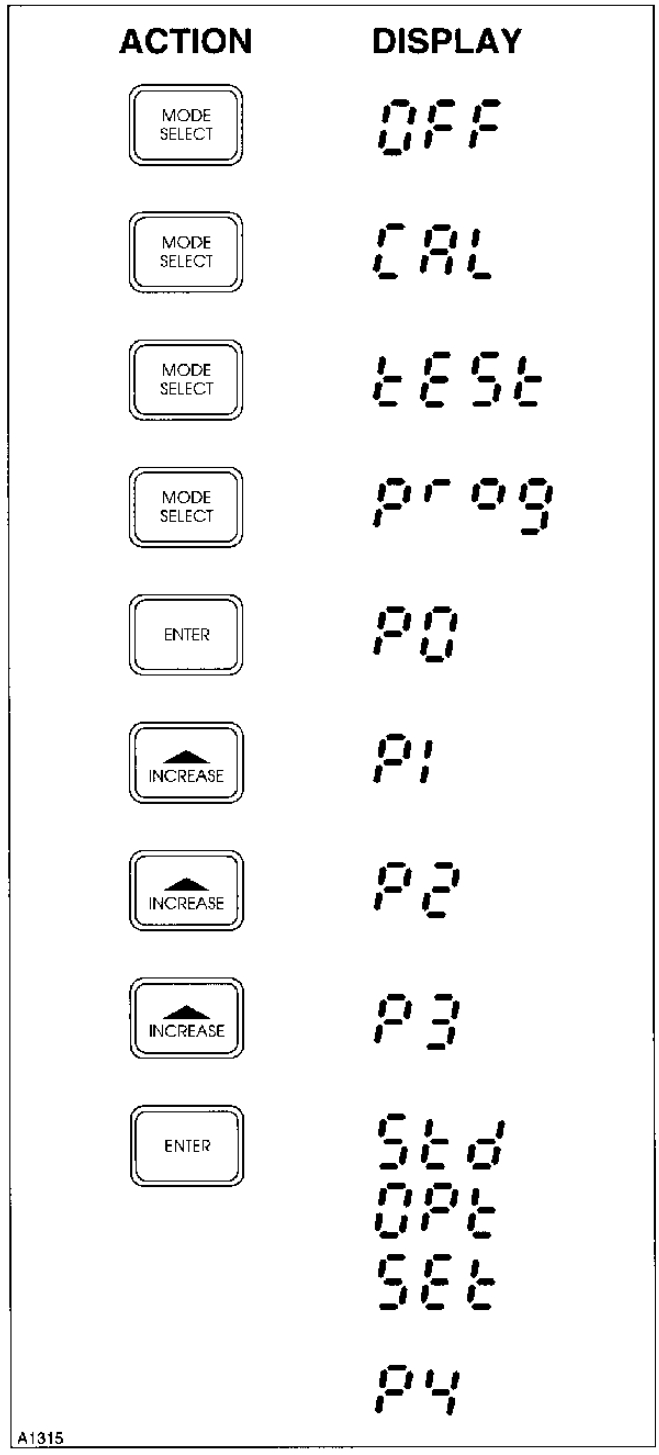


Figure 17—P3 Routine

7. Press ENTER. The display shows four dashes followed by "P5."

8. To continue with P5, press ENTER (step 4 below). To exit press DECREASE to show "P0" on the display. Press ENTER. The display shows "OFF." Press ENTER to return to normal operation.

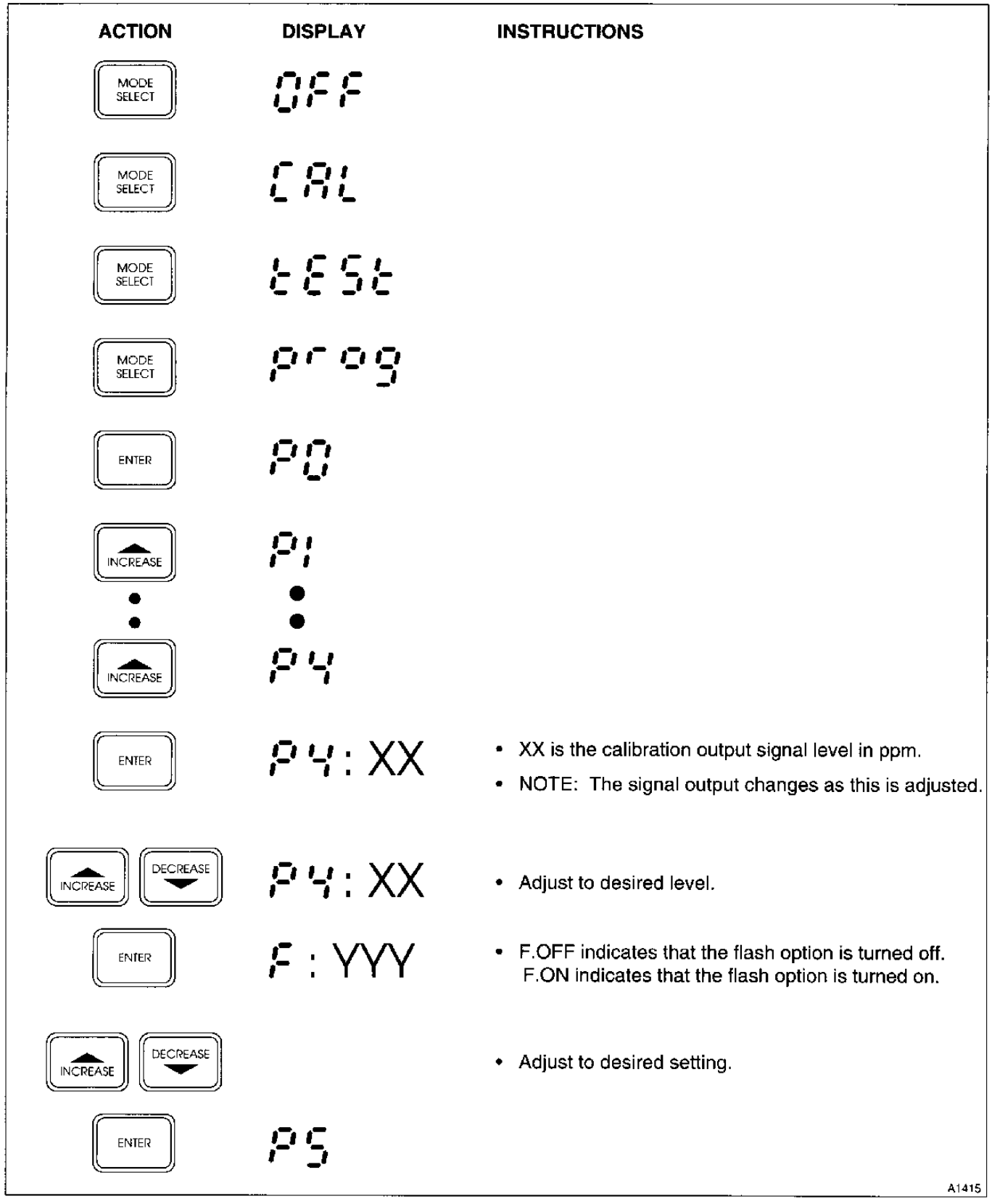


Figure 18—P4 Routine

P5

The P5 routine allows the operator to select a full scale range of 0 to 25 ppm, 0 to 50 ppm, or 0 to 100 ppm. (Select the 0 to 100 range when using Det-Tronics Model 1100, 2100, or 8100 Controllers.)

NOTE

Changing the full scale range using the P5 routine will result in a change in the current output level that was selected in the P4 routine. If a change is made in P5, return to P4 - step 4 to verify/program the desired value.

1. Press the MODE SELECT button to show "prog" on the display. See Figure 19.
2. Press ENTER. The display shows "P0."
3. Press INCREASE to advance to "P5."
4. Press ENTER. The display shows "Full SCL At: XXX." XXX is the full scale level in ppm.
5. Press INCREASE or DECREASE to select the desired operating range.
6. Press ENTER. The display shows four dashes followed by "P6."
7. To exit press DECREASE to show "P0."
8. Press ENTER. The display shows "OFF." Press ENTER to return to normal operation.

P6 and P7

Do not use.

FCAL

FCAL is a mode that is used to calibrate the 4 to 20 milliampere output signal. (Switch S1-2 inside the calibration meter must be on.)

F0

The F0 routine is used to exit the FCAL mode. With "F0" displayed on the calibration meter, press ENTER. The meter will show "OFF." Press MODE SELECT to select the desired mode, or press ENTER to turn off the calibration meter.

F1

The F1 routine allows the operator to fine tune the transmitter output signal for precisely 4.0 ma with 0 PPM at the sensor.

NOTE

If an alarm setpoint of a monitoring device is exceeded, an alarm output will be generated. It should also be noted that an adjustment to the current output can affect the calibration current level (refer to routine P4).

1. Press the MODE SELECT button to show "FCAL" on the display.
2. Press ENTER. The display shows "F0."
3. Press INCREASE to advance to "F1."
4. Press ENTER. While monitoring the current output, press INCREASE or DECREASE to adjust the output to 4.0 ma, ±0.02 ma. (The display will show an increasing or decreasing reference number.)

NOTE

Holding the Increase or Decrease button for 3 seconds will cause the output to change at a rapid rate.

5. Press ENTER. The display shows four dashes followed by "F2."
6. To continue with the F2 routine, press ENTER (step 4 below). To exit, press DECREASE to show "F0" on the display. (The display must show "F0" to exit this operating mode.) Press ENTER. The display shows "OFF." Press ENTER to return to normal operation. (See "Mode Selection" section for information regarding selection of a different operating mode or turning off the calibration meter.)

F2

The F2 routine allows the operator to fine tune the transmitter output signal for precisely 20.0 ma with 100 PPM at the sensor.

NOTE

If an alarm setpoint of a monitoring device is exceeded, an alarm output will be generated. It should also be noted that an adjustment to the current output can affect the calibration current level (refer to routine P4).

1. Press the MODE SELECT button to show "FCAL" on the display.
2. Press ENTER. The display shows "F0."
3. Press INCREASE to advance to "F2."

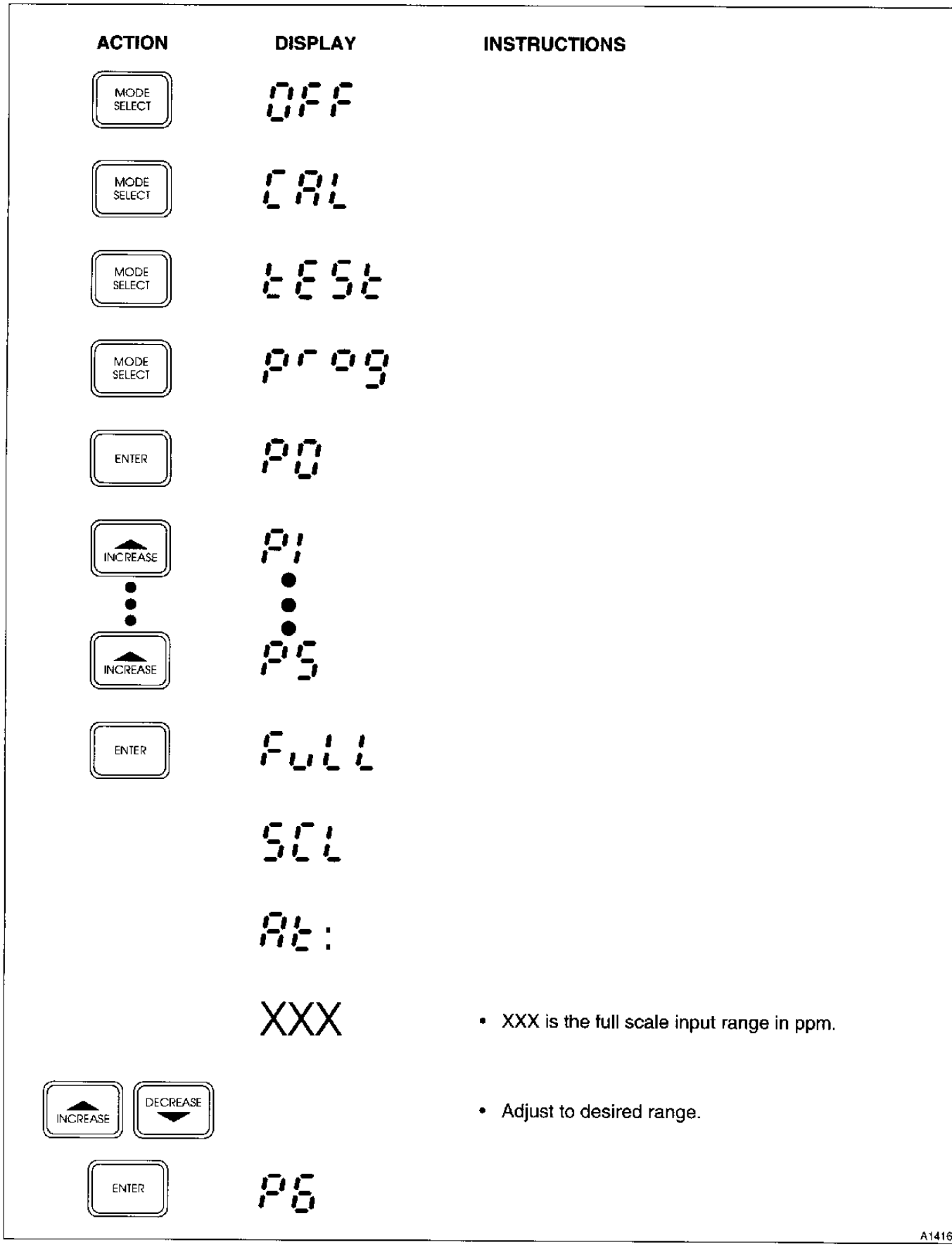


Figure 19—P5 Routine

4. Press ENTER. While monitoring the current output, press INCREASE or DECREASE to adjust the output to 20.0 ma, ±0.02 ma. (The display will show an increasing or decreasing reference number.)

NOTE

Holding the Increase or Decrease button for 3 seconds will cause the output to change at a rapid rate.

5. Press ENTER. The display shows four dashes followed by "F3."

6. To continue with F3 (F3 programs the transmitter to the factory settings), press ENTER (step 4 below). To exit, press DECREASE to show "F0" on the display. Press ENTER. The display shows "OFF." Press ENTER to return to normal operation.

F3

The F3 routine is used to reset the transmitter to the factory settings (same as P3).

1. Press the MODE SELECT button to show "FCAL" on the display.

2. Press ENTER. The display shows "F0."

3. Press INCREASE to advance to "F3."

4. Press ENTER. The display shows 4 dashes followed by "Std Opt Set," followed by F4. To exit press DECREASE to show "F0" on the display. Press ENTER. The display shows "OFF." Press ENTER to return to normal operation.

F4

The F4 routine (calibration options reset) is used to reset the 4 to 20 ma current loop and the sensor calibration values to the factory default settings.

CAUTION

Pressing ENTER with F4 displayed on the calibration meter restores the factory default calibration settings, which will invalidate any previous sensor and current loop calibrations.

1. Press the MODE SELECT button to show "FCAL" on the display.

2. Press ENTER. The display shows "F0."

3. Press INCREASE to advance to "F4."

4. Press ENTER. The calibration meter display reads "CAL opt rset," followed by F5. To exit press DECREASE to show "F0" on the display. Press ENTER. The display shows "OFF." Press ENTER to return to normal operation.

F5 to F7

Not used.

SYSTEM TESTS

The following system tests are performed using the Test mode. (Switch S1-4 should be on at this time.)

T0

T0 is used to exit the Test mode. To exit, with T0 displayed, press and hold the ENTER button until the display shows four dashes. Release ENTER. The display shows "OFF." Press MODE SELECT to select the desired operating mode or press ENTER to turn off the calibration meter.

T0 is also used to display the position of the calibration meter switches.

1. Press the MODE SELECT button to display "test" on the digital display. See Figure 20.

2. Press ENTER. The display shows "t0."

3. Press ENTER. The display shows the switch positions using the pattern illustrated in Figure 20.

4. To exit, press and hold ENTER until the display shows 4 dashes. Release ENTER; the display shows "OFF." Press ENTER to return to normal operation.

Test T1

Test T1 gives a direct ppm reading on the calibration meter and is useful for verifying proper operation of the entire system from the sensor to the controller. The dc current output and the optional relays are **not** disabled during this test.

1. Press the MODE SELECT button to display "test" on the digital display. See Figure 21.

2. Press ENTER. The display shows "t0."

3. Press INCREASE to advance to "t1."

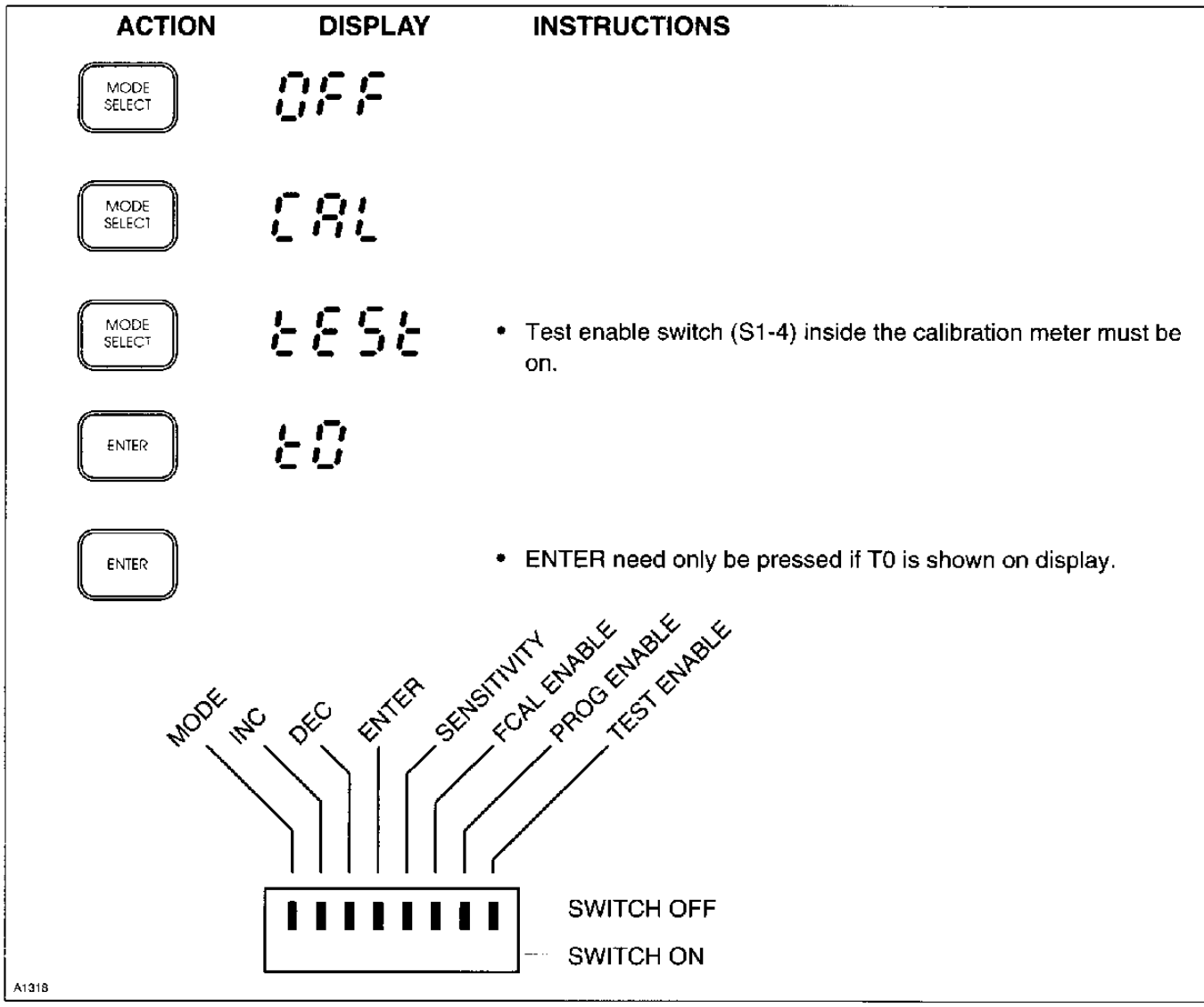


Figure 20—T0 Routine

4. Press ENTER. The display shows "t1:XX." XX is the ppm level of H_2S gas currently being detected at the sensor.

5. Press ENTER. The display shows "t2."

6. To continue with T2, press ENTER (step 4 below). To exit press DECREASE to show "t0." (The display must show "t0" to exit the test mode.) Press and hold ENTER until the display shows 4 dashes. Release ENTER; the display shows "OFF." Press ENTER to return to normal operation. (See "Mode Selection" section for information regarding selection of a different operating mode or turning off the calibration meter.)

Test T2

Test T2 allows the operator to actuate the relays on the relay board. It also indicates a signal from the optional external reset switch. Since the relays are unsupervised, this test should be performed regularly to ensure proper system operation.

CAUTION

This routine causes actuation of the alarm relays. Response devices that are connected to the relays should be disabled to prevent unwanted activation.

1. Press the MODE SELECT button to show "test" on the digital display. See Figure 22.

2. Press ENTER. The display shows "t0."

3. Press INCREASE to advance to "t2."

4. Press ENTER. The display shows the pattern illustrated in Figure 22. An "on" indication means that the relay is in its alarm state. The reset

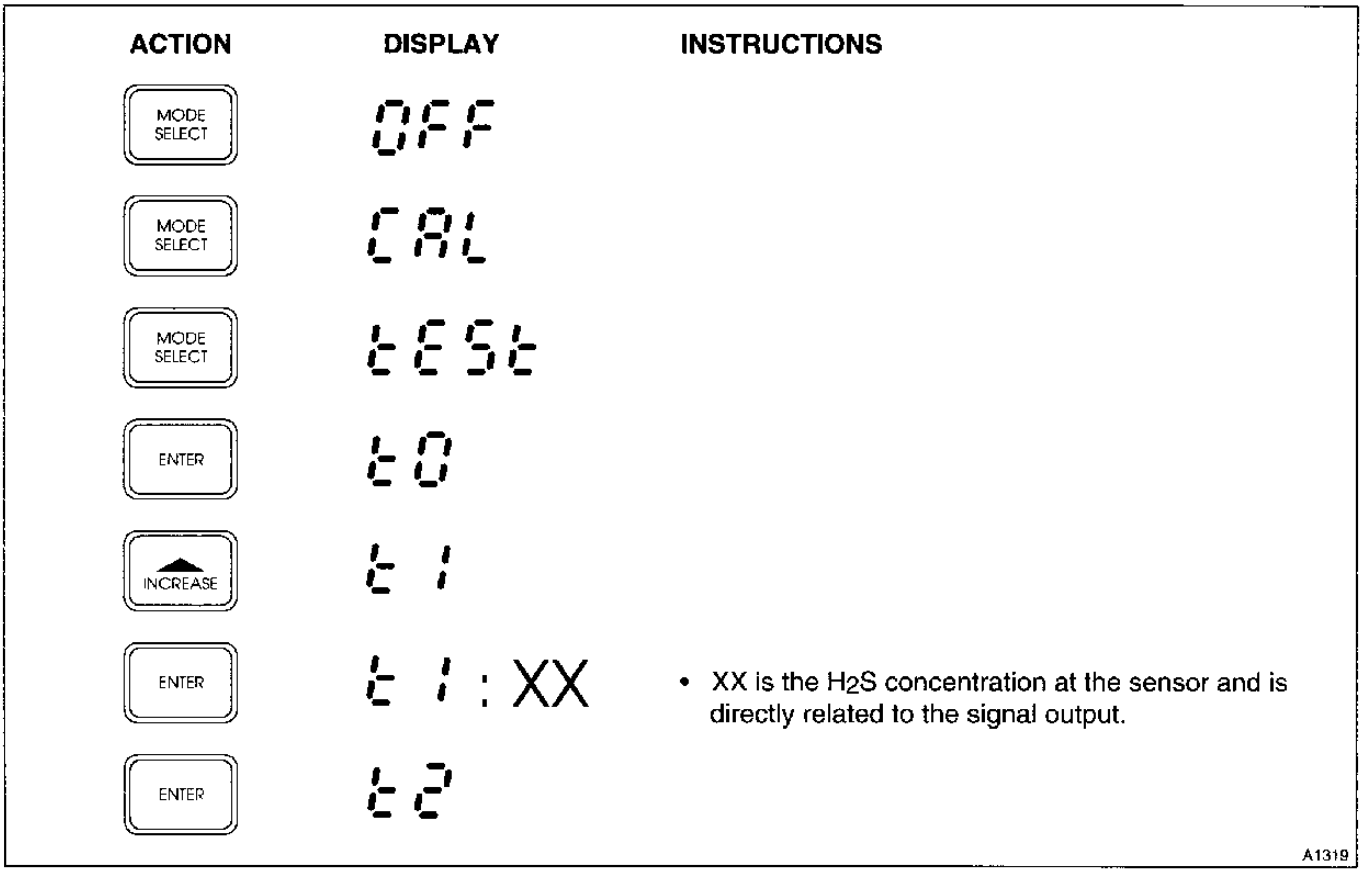


Figure 21—T1 Routine

switch indicator goes to the "on" position when the reset switch contacts are closed.

5. Press INCREASE or DECREASE to change the relay states.

6. Press ENTER. The display shows "t3."

7. To exit press DECREASE to show "t0." Press and hold ENTER until the display shows 4 dashes. Release ENTER; the display shows "OFF." Press ENTER to return to normal operation.

Test T3

A factory test.

Test T4

Test T4 allows the operator to vary the output signal from the transmitter. The corresponding ppm level is shown on the digital display.

CAUTION

This routine causes an increase in the dc current output signal. Alarm response devices should be disabled to prevent unwanted actuation.

1. Press the MODE SELECT button to show "test." See Figure 23.

2. Press ENTER. The display shows "t0."

3. Press INCREASE to show "t4."

4. Press ENTER. The display shows "t4:XX." XX is the ppm level of the output signal.

5. Press INCREASE or DECREASE to test controller response to the varying output signal from the transmitter.

6. Press ENTER. The display shows "t5."

7. To exit press DECREASE to show "t0" on the display.

8. Press and hold ENTER until the display shows 4 dashes. Release ENTER; the display shows "OFF." Press ENTER to return to normal operation.

Tests T5 to T7

Factory tests. Do not use.

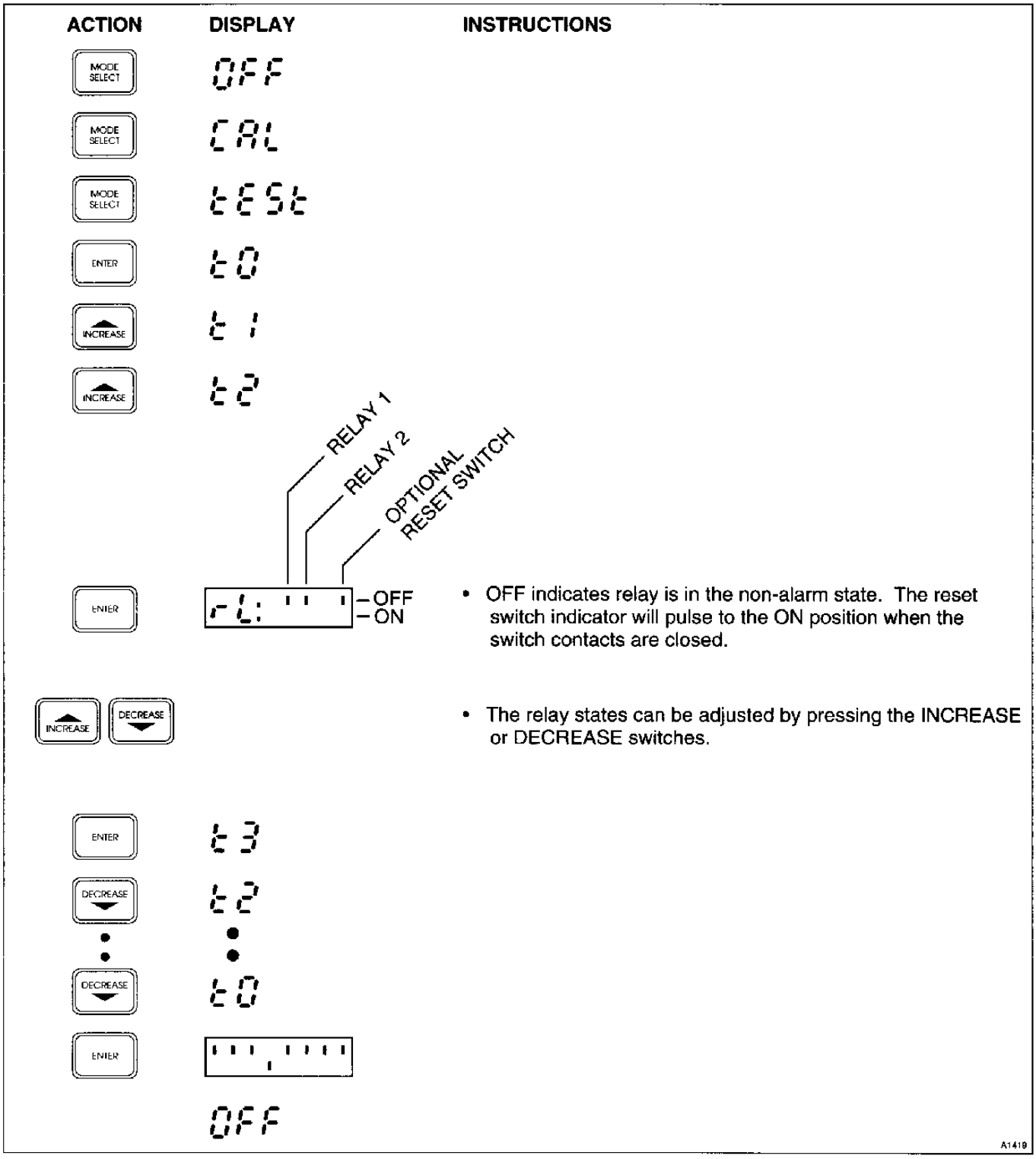


Figure 22—T2 Routine

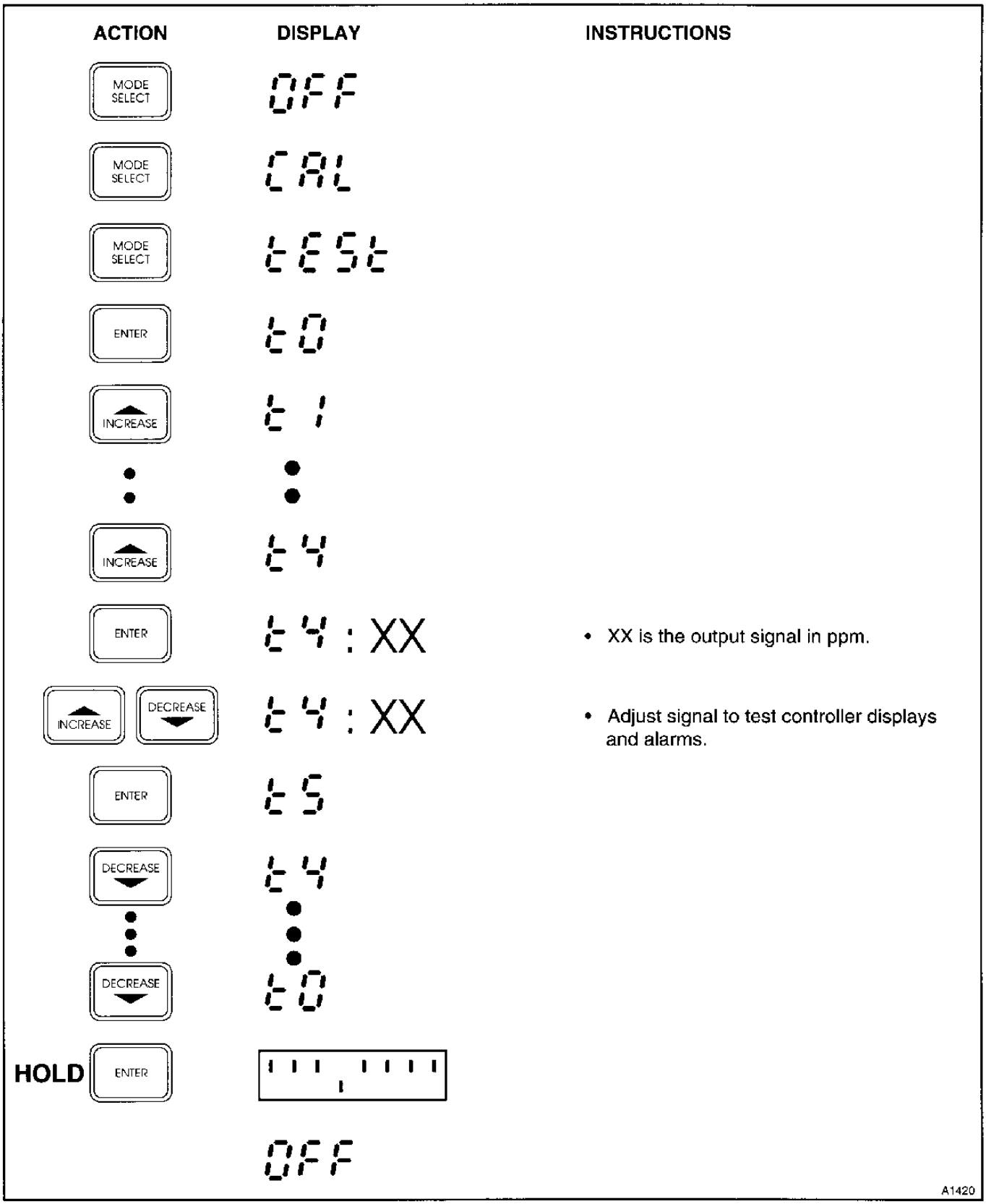


Figure 23—T4 Routine

MAINTENANCE

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

VISUAL INSPECTION

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

To replace the hydrophobic filter, simply unscrew the existing filter from the housing, then replace it with a new filter. Use care not to overtighten.

NOTE

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

MANUAL CHECK OF OUTPUT DEVICES

Fault detection circuitry continuously monitors for various problems that could prevent proper response to a dangerous level of H_2S, however, it does not monitor external equipment that is actuated by the detection 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 H_2S at the sensor will result in the proper system response. Refer to the "Operating the Calibration Meter" section for information regarding system tests using the calibration meter.

CAUTION

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

SENSING ELEMENT REPLACEMENT

To replace the sensing element in the C7064E Sensor:

1. De-classify the area prior to replacing the sensor.
2. Begin the normal calibration procedure as described in the "Calibration" section of this manual. Stop after completion of step 5 when the display shows C0:XX. (With the transmitter in the calibrate mode, the controller cannot generate either a fault or an alarm output.)
3. Remove power from the transmitter. (When power is restored, the transmitter will return to the calibrate mode.)
4. Remove the cap from the sensor housing. See Figure 24. (There is no need to remove the C7064E from the transmitter junction box.)
5. Remove and discard the old sensing element assembly. Check for corrosion or contamination on the terminals inside the sensor enclosure and clean if necessary.
6. Determine proper orientation for the new assembly, then **carefully** plug it in.

NOTE

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

7. Place the cap back on the sensor housing. Tighten only until snug. **Do not overtighten.**
8. Connect the calibration meter and re-apply power to the transmitter.

NOTE

If power to the transmitter is interrupted during the calibration procedure, the transmitter will automatically return to the beginning of the calibration procedure when power is restored and the calibration meter is connected.

9. Press MODE SELECT to turn on the calibration meter and return to the calibrate mode. The display shows "Er: 0." Press ENTER. The display shows " Set LO C0:XX."

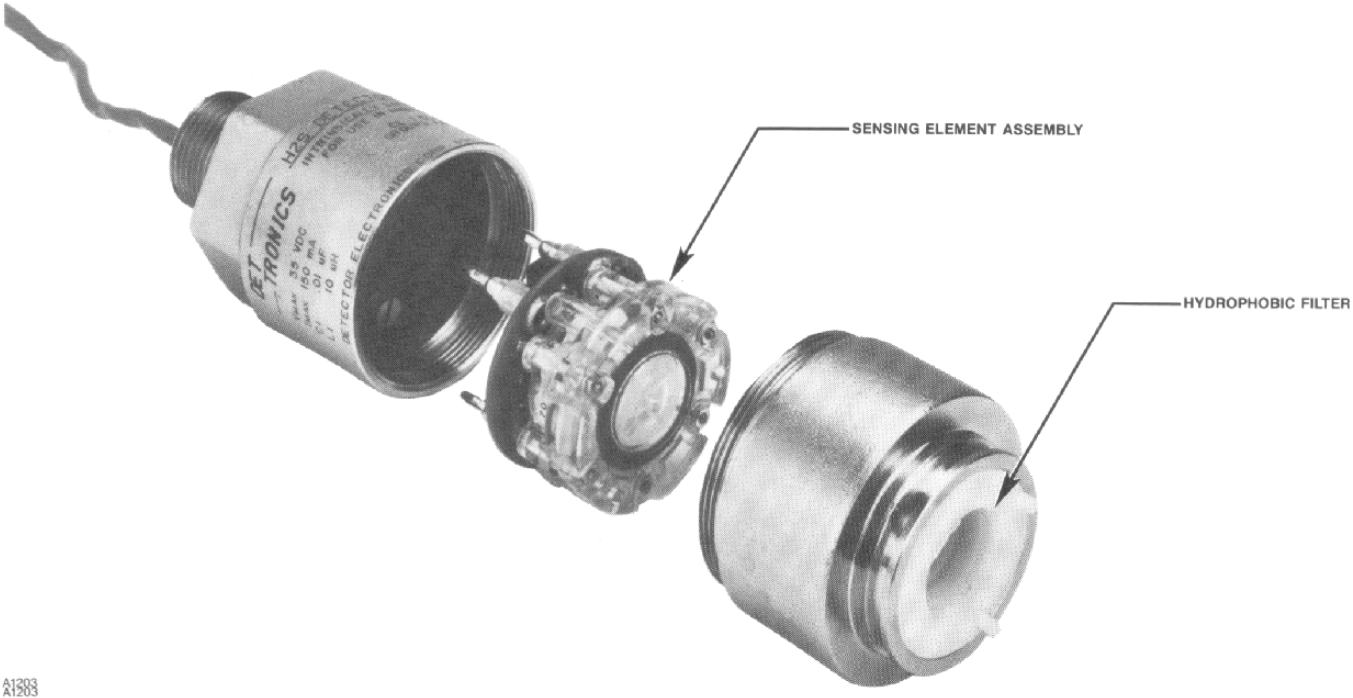


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Figure 24—C7064E Sensor

10. Be sure that no H_2S is present at the sensor. When a stable reading is displayed, press ENTER. The display should now show "SET SPAn C1:XX."

11. Apply the calibration gas mixture.

12. When the reading on the calibration meter stabilizes (typically within 2 to 3 minutes), press the INCREASE or DECREASE button to adjust the reading on the display to match the level of the applied calibration gas.

13. Press ENTER to save the calibration data and end the calibration procedure. The sensor sensitivity will be displayed briefly, then the meter will alternately display "GAS" and the ppm level of the gas present at the sensor. If the display should indicate "bad," the sensing element must be replaced and the calibration procedure must be repeated. If the display shows "bad" or "Lo Sen," press and hold ENTER to exit.

14. Shut off the gas flow and remove the cup from the sensor. The "GAS" message will continue until the gas level drops below 3 ppm or 90 seconds go by.

NOTE

If power was interrupted during the calibration procedure, the transmitter will automatically return to the normal mode 90 seconds after the "GAS" message appears. If the gas level at the sensor is above an alarm setpoint at this time, an alarm output will be generated.

15. The meter will display "END OF CAL" followed by "OFF." Press ENTER to turn off the calibration meter and return the transmitter to normal operation.

16. Remove the calibration meter from the transmitter.

17. 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.

Refer to the "Calibration" section of this manual for the recommended calibration schedule for a new sensor.

A test form is supplied at the rear of this manual for recording maintenance performed on the system.

An adequate supply of spare sensing element assemblies should be kept on hand for field replacement. For maximum protection against contamination and deterioration, they should not be removed from the original protective packaging until the time of installation. To ensure maximum storage life, sensing ele-

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

CAUTION

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

TROUBLESHOOTING

Table 4 is intended to serve as an aid in locating the cause of a system malfunction. If an error code is displayed on the calibration meter, refer to Table 3 in the "Operating the Calibration Meter" section of this manual.

NOTE

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

REPLACEMENT PARTS

The Model 415 is not designed to be repaired by the customer in the field. If a problem should develop, first carefully check for proper wiring, programming, and calibration. If it is determined that the problem is caused by a defect within the electronic module, it should be returned to the factory for repairs.

The plug-in sensing element assembly is not intended to be repaired. When calibration can no longer be properly performed, the sensing element assembly must be replaced. An adequate supply of spare sensors should be kept on hand for field replacement.

NOTE

For maximum protection against contamination and deterioration, the sensor should not be removed from the original protective packaging until the time of installation.

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

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

DEVICE REPAIR AND RETURN

Prior to returning devices or components, contact the nearest local Detector Electronics office so that 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.

Table 4—Troubleshooting Chart

Symptom	Possible Cause
Calibration meter display blank	Meter not properly attached to transmitter.
Calibration meter or controller reads –25 ppm	Bad sensor or sensor not connected. No power to transmitter. Open or shorted transmitter wiring.
Transmitter LED does not light briefly when power is applied.	No power, low power, or wrong polarity.
Transmitter LED flashes rapidly and calibration meter does not show valid display.	Low power to transmitter. Excessive transmitter power wire resistance. Large ac ripple on power wires.
Calibration meter displays improper output or does not respond to pressed switches.	Dirty window on puck or transmitter. Poor alignment of LED and photocell.
Controller displays full scale reading.	High level of H_2S at sensor. Calibration error. Sensor wire shorted.

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 (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

Det-Tronics Deutschland
Walter Kidde GmbH
Postfach 1457
Harkortstrasse 3
D-4030 Ratingen 1
GERMANY
Telephone 49 2102 4050
Direct 49 2102 405152
Facsimile 49 2102 405109
Telex 8589029

Detectomatic S.A.
AV17 Con Calle 72, No. 71-92
Apartado 10055
Maracaibo, Venezuela
Telephone 58-61-521274, -529154, -529749
Facsimile 58-61-529144
Telex 61331

Detector Electronics Corporation
C/O Walter Kidde Aerospace
The ADELPHI
No. 1 Coleman Street #05-02
SINGAPORE 0167
Telephone (65) 334-1255
Facsimile (65) 334-1607

ORDERING INFORMATION

The sensor must be ordered separately from the Model 415 Transmitter. When ordering please specify:

226908-003	Model 415 Transmitter Module*
226905-001	Junction Box with Mounting Bracket*
004539-004	Electrochemical H_2S Sensor Housing, 3/4 inch NPT*
004539-005	Electrochemical H_2S Sensor Housing, 25 mm*
005434-001	Electrochemical Sensing Element for C7064E*
226906-001	Calibration Meter**
226783-001	Alarm Relay Board***
226365-007	Sensor Separation Kit***

*One required per transmitter assembly.
**One required per system.
***Optional.

CALIBRATION EQUIPMENT (SELECT ONE)

225798-001	Ampoule Calibration Kit (includes six 10 ppm ampoules and six 40 ppm ampoules)
226515-001	H_2S Air Dilution Calibration System (not certified for use in hazardous locations)
227115-001	H_2S Calibration Kit (for use with electrochemical sensors only)

ACCESSORIES

000507-005	Open Frame Power Supply, 24 vdc at 3.6 amperes
000507-006	Open Frame Power Supply, 24 vdc at 12 amperes
005003-001	Silicone-free grease

REPLACEMENT PARTS

005434-001	Sensing element assembly for C7064E
004532-002	Hydrophobic filter for C7064E
227117-001	Gas bottle for 227115-001 Calibration Kit, 50 ppm
227117-002	Gas Bottle for 227115-001 Calibration Kit, 20 ppm

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 (952 941-5665 or (800) 765-FIRE
Telex 6879043 DETEL UW
Cable Detronics
Facsimile (612) 829-8750