



MODEL 4501-XX

2-Wire Series

TOXIC GAS SENSOR MODULE



APPLICABILITY & EFFECTIVITY

Effective for all Model 4501-XX Modules manufactured after September 1, 2006.

4501-04 FM Pending

4501-05 FM Approved

4501-06 FM Pending

**Instruction Manual Part Number T13022
Rev. A**

FM PERFORMANCE APPROVAL

ONLY THE FOLLOWING ITEMS, FUNCTIONS AND OPTIONS ARE FM* APPROVED

Model 4501-05 Hydrogen Sulfide Gas Sensor Module**Sensor Module**

Model 4501-05 Sensor Module - Hydrogen Sulfide

Calibration Equipment

Model 1250-01	Gas Sensor Calibration Kit, Type A
Model 1260-05	Hydrogen Sulfide in N2, 25 ppm Gas Cylinder
Model 1260-45	Hydrogen Sulfide in N2, 10 ppm Gas Cylinder
Model 5358-01	Calibration Adapter

Notes:

- 1) Apparatus must be installed in accordance with National Electrical Code.
- 2) FM Comments

*FM Approvals, a subsidiary of FM Global

- ◆ Project# 3028099

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1. PRODUCT DESCRIPTION

1.1 GENERAL

The Model 4501-XX Toxic Gas Sensor Module is a 2-wire transmitter with 4-20 mA output and it offers a broad array of features including:

- 2-wire loop powered
- 180 day calibration interval
- Selectable ranges
- Non-intrusive one-person calibration
- Integral LCD 2-line, 20-character display
- Stainless steel enclosure and sensor housing
- 4-20 mA output
- Long sensor life
- Rotatable faceplate enables multi-directional installation attitudes.

The 4501-XX is designed and approved for installation and operation in hazardous locations.

Members of the 4501-XX Two-Wire Toxic Gas family include:

- 4501-04 Carbon Monoxide Gas Sensor Module
- 4501-05 Hydrogen Sulfide Gas Sensor Module
- 4501-06 Chlorine Gas Sensor Module



1.2 MOUNTING CONFIGURATION

Various module mounting configurations can be implemented without special fixtures. Where applicable, these options are factory configured prior to shipment. Mounting configuration can be selected by the installer or field technician and are fully described in this manual.

1.3 THEORY OF OPERATION

Electrochemical sensors are fuel cell-like devices consisting of an anode, cathode, and electrolyte. The components of the cell are selected so a subject gas, allowed to diffuse into the cell, will cause a chemical reaction and generate a current. The cells are diffusion limited so the rate the gas enters the cell is solely dependent on the gas concentration. The current generated is proportional to the rate of consumption of the subject gas in the cell.

Sierra Monitor electrochemical sensors provide improved reliability by allowing the gas to diffuse into the sensor through a capillary port, rather than diffusing through membranes. The result is an extremely stable sensor with very low temperature and pressure coefficients and the capability to monitor gas as ppm.

1.4 MECHANICAL

The sensor module is comprised of the following three primary components:

1.4.1 ENCLOSURE

Explosion proof, rain-tight stainless steel electrical housing with three ¾" FNPT conduit hubs. The enclosure cover has a viewing window. The 3 conduit hubs combined with the rotatable faceplate enable the user to mount the module in a variety of configurations. See Figure 1-2 for details.

1.4.2 TRANSMITTER ELECTRONICS

Electronic Assembly consisting of one printed circuit board assembly mounted under a cover plate. Wiring connections for power and signal interface are located on the back side of the display.

1.4.3 SENSOR ASSEMBLY

The sensor assembly includes a stainless steel, explosion proof, housing containing the gas sensor and a wiring harness for connection to the transmitter. The sensor assembly threads into one hub of the enclosure. The exposed end of the sensor assembly is threaded to allow connection of a rain-shield or calibration gas delivery fitting.

1.5 INTERCONNECT WIRING

Not supplied with the sensor module, but necessary to the installation and operation is the two conductor wiring which connects the module to its power source and controller. Before this wiring is installed it is important to read and understand the control system installation instructions to determine wiring requirements and alternatives.

1.6 POWER REQUIREMENTS

The 4501-XX module operates on DC power between 14 VDC and 30 VDC. The DC power must be supplied by the loop controller.

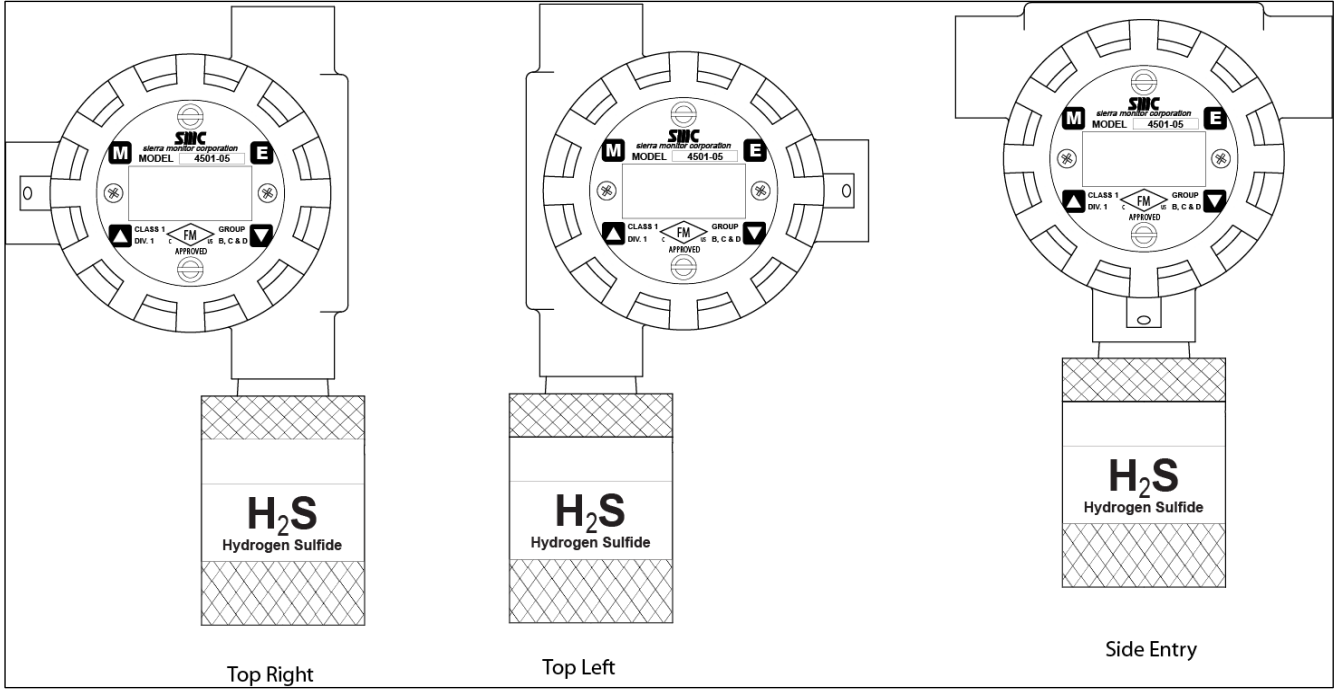


Figure 1-1
Model 4501-05 Hydrogen Sulfide Gas Sensor Module– Dimensions

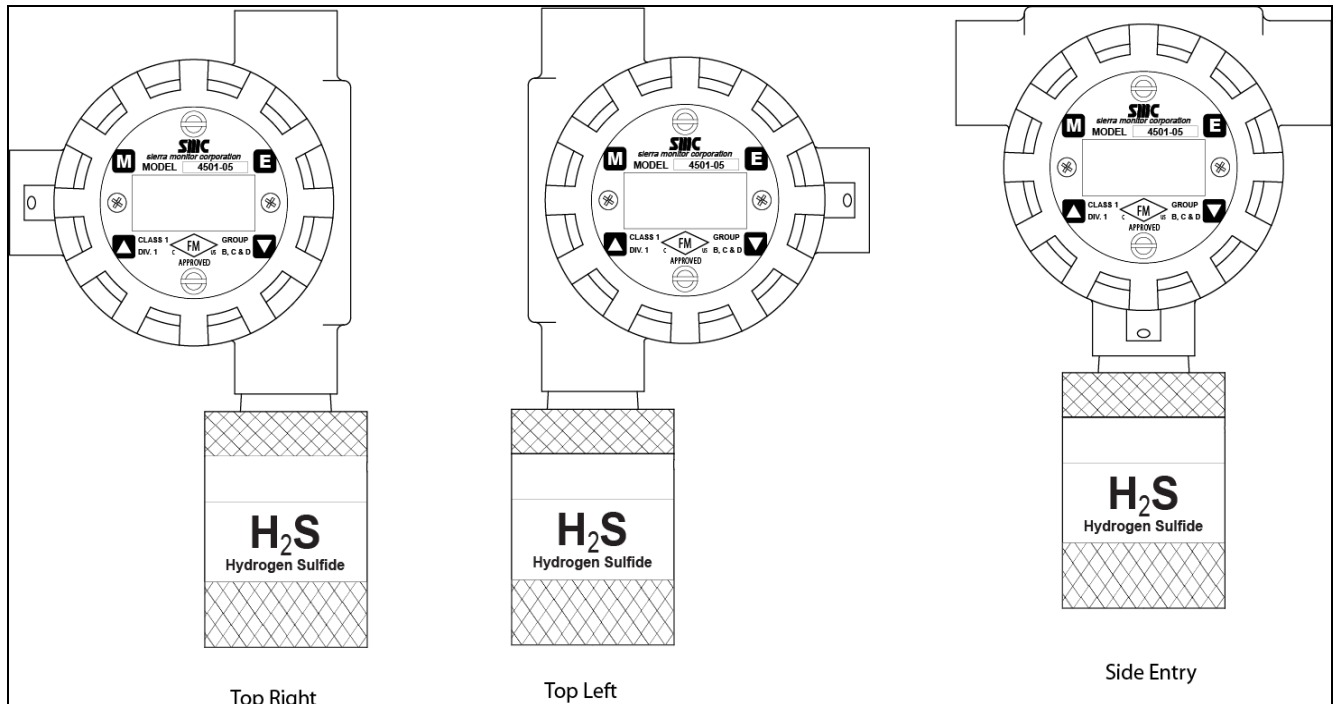


Figure 1-2
Model 4501-05 Hydrogen Sulfide Gas Sensor Module– Orientation Options

2. CAUTIONS & WARNINGS

2.1 INTRODUCTION

Although the 4501-XX Gas Sensor Module is designed and constructed for installation and operation in industrial applications including hostile environments, caution should be taken to insure that the installation is made in compliance with this instruction manual and that certain procedures and conditions are avoided. This chapter discusses the necessary cautions. **Read the entire chapter prior to installation of the equipment.**

2.2 GAS SENSOR MODULES - GENERAL

Avoid installing sensor modules where they will be unnecessarily exposed to wind, dust, water (i.e. direct hose down), shock, or vibration. Observe temperature range limitations.

Sensors may be adversely affected by prolonged exposure to certain materials. Loss of sensitivity, or corrosion, may be gradual if such materials are present in low concentrations. These materials include: Halides (compounds containing chlorine, fluorine, bromine, iodine), acid vapors, caustic liquids or mists.

Care has been taken by the manufacturer to ship modules in protective packaging to avoid contamination prior to installation. It is recommended that the modules remain protected during installation and that the covering be removed immediately prior to system start-up.

During normal use the sensor is protected from dirt and oil contamination by a sintered metal cover. If this cover becomes clogged, the response of the sensor will be reduced. Protect the sensor from contamination by careful placement, or by use of rain shields and dust shields.

Sensor modules must not be painted. Paint may contain compounds which will contaminate the sensor. Paint will cause clogging of the sintered metal cover and will cause difficulties during attachment of the calibration head or other maintenance activity. It is recommended that the module be tagged "DO NOT PAINT".

2.3 WIRING

The manufacturer recommends that extra caution be taken where the installation is near any sources of electromagnetic or radio frequency interference. Precautions include:

- Avoid running sensor module cable close to high power cables, radio transmission lines, or cables subject to pulses of high current.
- Avoid running cables near large electric motors or generators.
- Analog devices require shielded cable.
- In conduit installations and cable applications the shield should be connected to instrument ground.
- All splices must be via either a termination hardware system or soldered. Improperly spliced cable can result in corrosion, resistance changes and system errors.

NOTE

Installation and wiring must be in accordance with the National Electrical Code. Voltage AC conductors are not to be run in the same conduit as voltage DC conductors.

2.4 CALIBRATION FREQUENCY

The 4501-XX calibration frequency is six months (180 days). However, prudent gas detector maintenance practices normally suggest a simple recalibration following incidences of exposure to high levels of H₂S that would lead to alarm activation within any system utilizing the output of the 4501-05.

3. QUICK START

3.1 OVERVIEW

The gas sensor module has been supplied factory calibrated and ready for immediate installation and operation. An installer familiar with installation and operation of gas detection products can use this section to begin immediate use of the module.

3.2 WIRING

Provide two conductor shielded wiring from the power supply/control device to the sensor module location. Use wire that is 16 AWG or larger.

3.3 MODULE INSTALLATION

The 4501-XX can be mounted in a variety of configurations supported by the conduit. See figure 1-2 to determine which configuration is best for your specific application. The default configuration enables the modules to be put in line with other modules with the sensor element below the transmitter. To change the configuration simply remove the transmitter and rotate to the appropriate configuration and remount the standoffs and transmitter.

The module is designed to be installed on a 3/4" conduit. Two important warnings:

- **The installation must meet any hazardous environment codes for electrical equipment**
- **The sensor module enclosure mounting must be spaced far enough from any vertical surface to allow removal and replacement of the sensor assembly which is threaded into one 3/4" conduit entry.**

3.4 TRANSMITTER INSTALLATION

To install the transmitter printed circuit assembly into the housing, carefully turn the faceplate so that the printing is in the correct horizontal position for the mounting configuration and slide the assembly over the two stand-offs in the enclosure.

Hand tighten the two captive panel thumb screws into the stand-offs. Replace the enclosure cover prior to providing power to the transmitter

- **If the transmitter is installed in a classified hazardous area, replace the threaded cover prior to providing power.**

3.5 START-UP & OPERATION

To begin operation of the sensor module activate the instrument loop with 14-30 VDC. Each time the sensor module is powered up it will perform a warm-up for approximately 2.5 minutes (148 seconds). During this time the display will read "Warm. 148" and count down. The loop output will be held at 4 mA.

After the warm-up period has expired, the display will indicate the gas concentration. Also, the instrument loop will be released to output current in the range of 4 to 20 mA. The actual current is linear with the gas concentration and depends on the selected range. For instance, when the range of 0 to 50 PPM has been selected, a current of 4 mA corresponds to 0 PPM and a current of 20 mA corresponds to 50 PPM.

3.6 ZERO STABILIZATION

All electrochemical sensors require at least 30 minutes on power prior to calibration. This allows the electrode potentials to equilibrate, resulting in a stable zero signal level.

4. INSTALLATION

4.1 SENSOR MODULE LOCATIONS

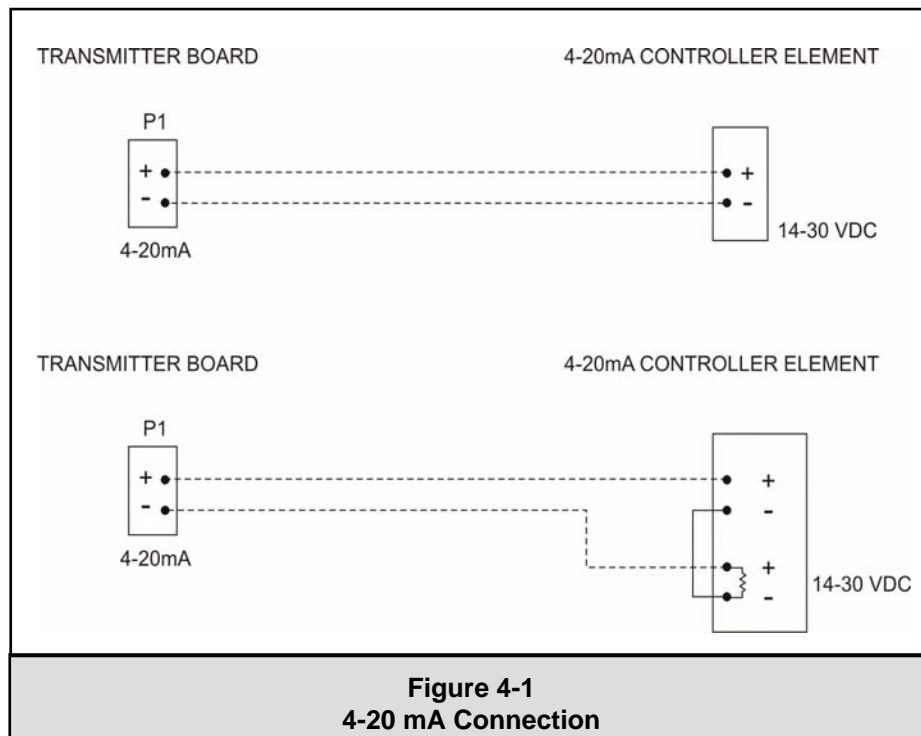
The gas sensor module utilizes a diffusion type sensor which should be located close to either the expected source or destination of the gas hazard. If the gas is heavier than air, the sensor module should be installed within 24 inches of the ground or floor. If it is lighter than air, move it above 6'.

After optimum locations are determined based on the above recommendations, consideration should be given to placing the sensor modules in locations which are accessible for calibration service. Slight adjustments to the location of the sensor module may have little impact on effectiveness but major effect on accessibility.

- Modules should be placed in areas accessible for calibration.
- The cover should face out from the wall for easy access.
- Sensors should be pointed down and the conduit should include an inverse trap to reduce moisture (condensation) from accumulating in the electronics enclosure.

4.2 WIRING

- Wire should be 16 AWG minimum at a maximum distance is 5,000 feet. Install conduit as required by local code or construction specifications.
- See figure 4-1 for typical 2 terminal and 4 terminal connections.



4.3 ENCLOSURE INSTALLATION

To protect the transmitter and sensor assembly they should be removed from the enclosure and preserved until final installation and wiring termination.

Prior to installation and wiring:

1. Remove the transmitter from the module housing by:
 - Unscrew the two captive panel screws on the faceplate.
 - Lift the transmitter out of the enclosure.
 - Unplug the sensor cable from transmitter connector J1.
 - Remove the sensor assembly from the enclosure hub.
2. Install the module enclosure onto the end of the supply conduit and/or bolt into position as required.

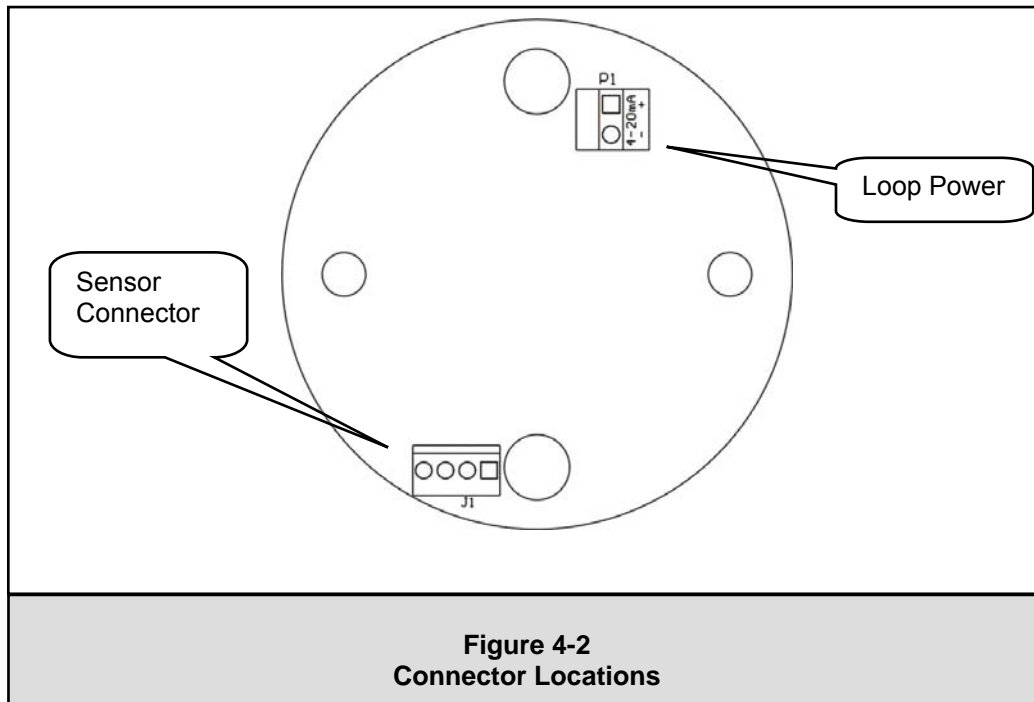
NOTE

When enclosure earth grounding is required for the installation a grounding lug is located in the base of the enclosure. Install the earth ground under the green ground screw.

4.4 TRANSMITTER AND SENSOR INSTALLATION

When all pre-wiring is complete:

1. Install sensor assembly in the open hub on the module enclosure. The sensor assembly thread must be fully seated into the hub and tightened to maintain explosion proof assembly.
2. Connect the loop wires (Loop + and Loop -) to transmitter connector P1, pins 1 and 2 (Figure 4-2)
3. Connect the sensor assembly cable to transmitter connector J1. (Figure 4.2)
4. Carefully return the transmitter to the enclosure installing it over the two standoffs. Finger tighten the retaining screws into the standoffs.



5. OPERATION

5.1 INTRODUCTION

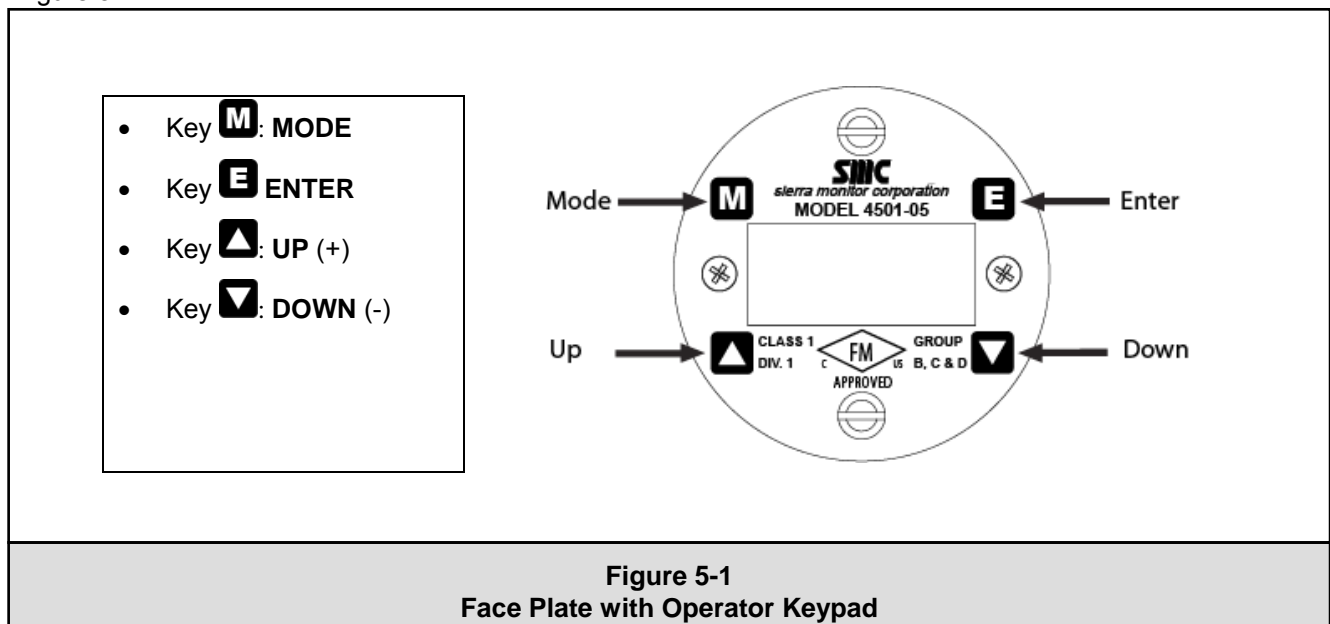
The 4501-XX Toxic Gas Sensor Module utilizes a visual menu system operated by means of a magnet. A magnet stick is supplied for this purpose. The menu system is used to calibrate the sensor module, and for maintenance and diagnostic procedures.

The following adjustments can be made to the sensor module:

- ◆ Range adjustments (see section 5.4)
- ◆ 4mA and 20mA calibration adjustments (see section 5.4)
- ◆ Span adjustment (see section 6.3.1)

5.2 DATA ENTRY KEYPAD

The module menu system is operated by means of directing the magnet stick toward each of four independent hall-effect magnetic switches. Each switch functions as if it is a manually activated panel key. The keys are located under the faceplate above and below the LCD and are labeled **M**, **E**, **▲** and **▼** as shown in Figure 5-1.



5.3 MAIN MENU

Key	Function	Display	Description	Reference
M E	Mode		Switch [M]	
▲ ▼	Enter		Switch [E]	
M E	Up		Switch [▲] Previous Menu	
▲ ▼	Down		Switch [▼] Next Menu	
		4501-XX XX.XXaA	First screen at power-up, Model and Version	
		Warm 148 XX.XXaA	Second screen at start-up, count down of Warm-up	
		H2S XXX.PPM	Default Display (example 4501-05)	
M E	Mode	H2S CALIB:	Mode Function: Calibration (example 4501-05)	Table 6-1
▲ ▼	Down	H2S MAINT:	Mode Function: Maintenance (example 4501-05)	Table 5-3
M E	Down	H2S DIAG:	Mode Function: Diagnostics (example 4501-05)	Table 5-4
▲ ▼	Down	H2S Exit-?	Exit Mode (example 4501-05)	
Table 5-1 Master Menu				

Table 5-2 defines the key operational displays on the operator interface.

Display	Description
H2S WARM XXX	Warm-up at start-up (example 4501-05)
SENSOR FAIL	Sensor failure
NO SENSOR	Sensor not found or plugged in
C.## PPM	Calibration Mode
XXX DONE	Finished with step
Figure 5-2 Key Operational Display	

5.4 MAINTENANCE SUB-MENU

Key	Function	Display	Description	Reference
		H2S XX PPM	Default Display (example 4501-05)	
M ▲▼	E Mode	H2S CALIB:		
M ▲▼	E Down	H2S MAINT:		
M ▲▼	E Enter	Cal: 4mA	Enter Calibration 4 mA Menu Banner: Use [▲] or [▼] to change 4mA output, [E] when done	
			A multi-meter should be inserted into the current loop to measure the loop current between the power and the sensor module No gas is required for this step	
M ▲▼	E Enter	4mA DONE	Acknowledges 4mA calibration	or Sub-Routine A
M ▲▼	E Down	H2S MAINT:		
M ▲▼	E Enter	MAINT CAL:20mA	Enter Calibration 20 mA Menu Banner: Use [▲] or [▼] to change 20mA output, [E] when done	
			A multi-meter should be inserted into the current loop to measure the loop current between the power and the sensor module No gas is required for this step	
M ▲▼	E Enter	20mA DONE	Acknowledges 20mA calibration	or Sub-Routine A
		H2S MAINT:		
M ▲▼	E Down	MAINT: 4mA		
M ▲▼	E Down	MAINT: 20mA		
M ▲▼	E Enter	H2S Range	Enter Range Menu	
		M- Range 100 PPM	Enter Calibration Range Menu Banner: Use [▲] or [▼] to change range, [E] when done	
M ▲▼	E Enter	Range DONE	Acknowledge range selection	
Sub-Routine A				
		CAL: XmA ERROR!	The expected range of the 4mA and 20mA is limited to factory defined values. If the actual signal is outside of this predefined range, an error is displayed indicating a hardware or installation problem. Contact technical support.	
Table 5-3 Maintenance Sub Menu				

5.5 DIAGNOSTICS SUB-MENU

Key	Function	Display	Description	Reference
M ▲▼ ▲▼	Mode	H2S XXX PPM	Default Display(example 4501-05)	
M ▲▼ ▲▼	Enter	H2S CALIB	Go to previous maintenance menu item	
M ▲▼ ▲▼	Down	H2S MAINT:		
M ▲▼ ▲▼	Down	H2S DIAG:		
M ▲▼ ▲▼	Enter	DIAG: RawSig	Enter diagnostics sub-menu	
M ▲▼ ▲▼	Enter	D-RawSig XXXXmV	Voltage reading of the output of the sensor element	
M ▲▼ ▲▼	Mode	DIAG: RawSig	Return to diagnostic menu	
M ▲▼ ▲▼	Down	DIAG: Ref		
M ▲▼ ▲▼	Enter	D-Ref XXXXmV	Voltage reading of the output of the reference	
M ▲▼ ▲▼	Mode	DIAG: Ref		
M ▲▼ ▲▼	Down	DIAG: Temp		
M ▲▼ ▲▼	Enter	TEMP XXXC	Temperature of sensor use [▲] or [▼] to switch between Celsius and Fahrenheit	
M ▲▼ ▲▼	Mode	DIAG: Temp		
M ▲▼ ▲▼	Down	DIAG: 4-20 mA		
M ▲▼ ▲▼	Enter	D-4-20 mA Normal	Enter 4-20 mA output sub-menu	Sub-Routine A
M ▲▼ ▲▼	Mode	DIAG: 4-20mA		
M ▲▼ ▲▼	Down	DIAG: Version		
M ▲▼ ▲▼	Enter	D-Ver VX.XX	Version number of firmware	
M ▲▼ ▲▼	Mode	DIAG: Version		
M ▲▼ ▲▼	Down	DIAG: FactInit		
M ▲▼ ▲▼	Enter	Accept? N NO Y	Banner: Use [▲] or [▼] to change, [E] to accept	Sub-Routine B
Sub-Routine A				
		D-4-20mA Normal		
M ▲▼ ▲▼	Down	D-4-20mA 3.6 mA	Press [E] to send 3.6 mA signal	
M ▲▼ ▲▼	Down	D-4-20mA 4.0 mA	Press [E] to send 4.0 mA signal	
M ▲▼ ▲▼	Down	D-4-20mA 10.0 mA	Press [E] to send 10.0 mA signal	
M ▲▼ ▲▼	Down	D-4-20mA 20.0 mA	Press [E] to send 20.0 mA signal	
Sub-Routine B				
M ▲▼ ▲▼	Down	Accept? N YES Y	If accepting [▼] to change to yes and [E] to accept	Sub-Routine C
M ▲▼ ▲▼	Enter	Accept? N YES Y		
		FactInit Done	Factory initialization completed	
Sub-Routine C				
M ▲▼ ▲▼	Enter	Accept? N NO Y	If not accepting, [E] to accept NO	Sub-Routine C
		FactInit Aborted	Factory initialization not done	

**Table 5-4
Diagnostics Sub Menu**

5.5.1 NOTES

When selecting the output current requested, an acknowledge message will appear on the screen. Select [E] to accept this message.

Whenever a message appears on the screen, select [E] to accept the message. No other action can be taken with messages.

Except for the FactNit Menu, the sub-menus in the diagnostics section only provide information and do not cause action.

6. CALIBRATION

6.1 CALIBRATION FREQUENCY

The sensor module must be calibrated every 180 days. Periodic functional tests are advisable for critical applications and hostile environments.

The sensor module microprocessor software includes high-level self checking algorithms which provide continuous sensor diagnostic and self adjustment.

6.2 CALIBRATION PREPARATION

Calibration of the sensor is accomplished by simple menu based steps and application of span gas.

NOTE
If an error is made during any stage of the calibration process, hold the magnet stick at the [M] for 10 seconds. A scrolling display will indicate "Operate Mode" and the sensor module will exit the calibration activity and return to normal operating mode. The calibration procedure can then be restarted.

Calibration must be performed only when the area is known to be clear of Hydrogen Sulfide gas. When in doubt, use a portable instrument to confirm that there is no background Hydrogen Sulfide gas.

For compliance with Factory Mutual (FM) Approvals, the Sierra Monitor Model 1250-01, 1260 -05 and 1260-45 are the FM Approved calibration gas delivery devices. Use the Model 5358-01 Calibration Adapter delivery fitting.

6.2.1 CALIBRATION GAS DELIVERY METHODS

Calibration gas can be delivered to the sensors via the Model 5358-01: Calibration Adapter (Figure 6-1) - used with portable calibrators.

CALIBRATION PROCEDURE

The Calibration Menu is described on Table 6-1:

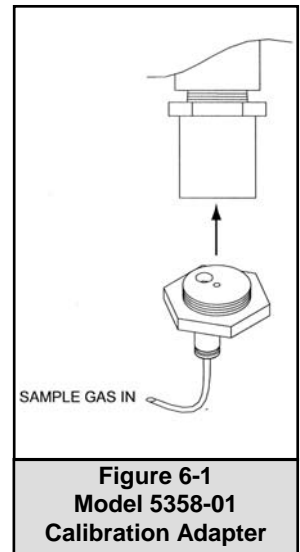
The procedure requires that the menu "keys" be activated using the magnet stick. Each key press steps through the process of setting the zero value for clean air and then setting the span value.

At each of these steps, apply calibration gas of the value corresponding to the setting accepted on the sensor module display.

6.2.2 SENSOR EXPOSURE TO GAS

Calibration gas must be delivered to the sensor using the flow rate and duration listed in below:

Model	Gas	Flow	Period
4501-04	Carbon Monoxide	300 cc/min	Until Stable (minimum 3 minutes)
4501-05	Hydrogen Sulfide	300 cc/min	Until Stable (minimum 3 minutes)
4501-06	Chlorine	300 cc/min	Until Stable (minimum 3 minutes)



6.3 DIAGNOSTICS SUB-MENU

Key	Function	Display	Description	Reference
M E ▲ ▼	Mode	H2S CALIB:	Default Display (example 4501-05)	or Sub-Routine A
M E ▲ ▼	Enter	CAL 0 PPM	Banner: Apply zero gas, [E] when done	
			<i>Operation: Confirm area clear of gas, or apply zero air to sensor.</i>	
M E ▲ ▼	Enter	Cal0PPM Wait.XXX	There is a minimum time to calibrate at 0PPM. If [E] is hit prior to this time has elapsed, a countdown screen will appear.	
		ZERO DONE	Zero gas setting completed (Message will appear on the screen and after 3 seconds will go to the next menu - 25PPM Span)	
		XXPPM	Banner: [▲] or [▼] to change span value, [E] when done	Sub-Routine B
		H2S WAIT-148	<i>Operation: 148 second time out before sensor is returned to service.</i>	
M E ▲ ▼	Enter	H2S CAL-OK	Banner: Remove gas from sensor	Sub-Routine C
Sub-Routine A - Abort Calibration				
M E ▲ ▼	Mode	CALIB ABORTED	<i>Operation: Hold magnet over [M] for 10 seconds to abort calibration</i>	
		H2S XXX PPM	Default Display	
Sub-Routine B - Select Span				
		25PPM SPAN	Banner: [▲] or [▼] to change span value, [E] when done	
M E ▲ ▼	Down	C##PPM	Banner: Apply xx-PPM gas, [E] when stable	Should be stable after 3 minutes of gas exposure
M E ▲ ▼	Enter	H2S REMOVE GAS	<i>Operation: Remove gas from sensor</i>	If calibration failed, then Sub-Routine C
		H2S CAL-OK	<i>Calibration successful</i>	
Sub-Routine C - Calibration Fail				
M E ▲ ▼	Enter	READ MANUAL	<i>Operation: Remove gas from sensor read manual, particularly section 6.3 and 7.6, to check calibration procedures.</i>	
		H2S CAL-FAIL	<i>Calibration Failed</i>	
Table 6-1 Calibration Sub-Menu				

7. SERVICE

7.1 SENSOR MODULE CONFIGURATION

The gas sensor module is comprised of the following sub-assemblies (Figure 7-1):

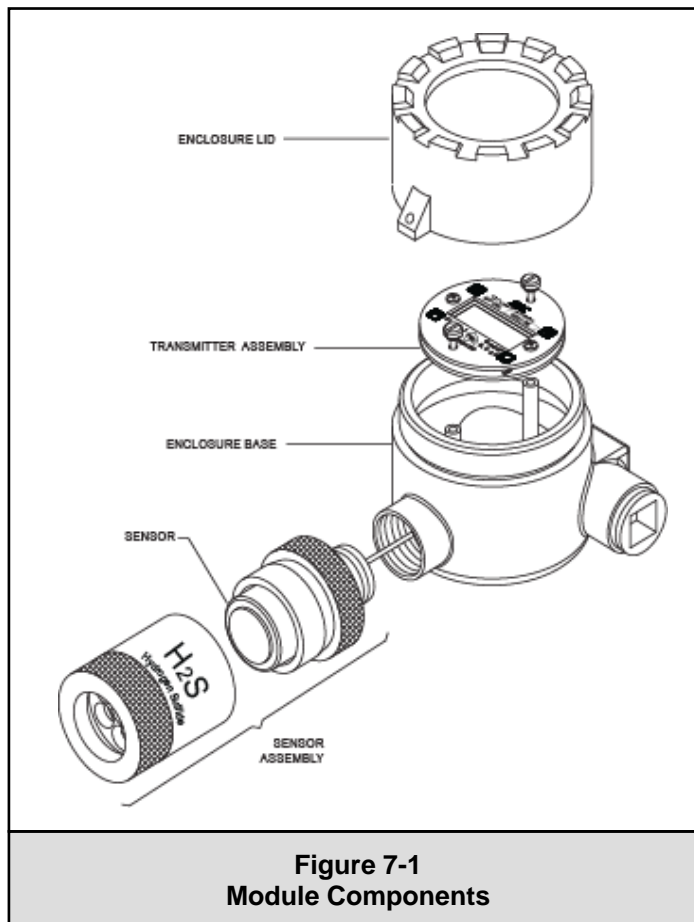
4501-XX	Gas Sensor Module
SPL27077	Enclosure
SPM27071	Transmitter Assembly
XXXXXXX	Sensor Assembly (see Appendix B)
XXXXXXX	Sensor (see Appendix B)

There are no field serviceable components below the sub assembly level.

ENCLOSURE REPLACEMENT

The enclosure should be replaced if the cover threads or conduit threads have been damaged, or if the enclosure has been damaged sufficiently that it no longer meets the required NEMA classification.

To replace the enclosure follow the transmitter and sensor assembly removal instructions, remove the damaged enclosure from its conduit, install a new enclosure and continue the transmitter and sensor assembly replacement instructions.



TRANSMITTER REPLACEMENT

The transmitter assembly should be replaced when it is determined that it is unreliable, noisy or cannot be adjusted for calibration. This may occur due to age, corrosion or failed components.

To replace the transmitter assembly:

- a. Remove the cover of the main enclosure
- b. Unscrew the two thumb screws in the top of the cover plate, lift the assembly and rotate 90° to relieve the wiring service loop
- c. Unplug the sensor connector from the transmitter
- d. Remove the two wires from J1 terminals (see figure 4-2)
- e. Reverse the preceding steps to install the new transmitter
- f. Restore power and allow a minimum of 30 minutes for stabilization before re-calibration

SENSOR REPLACEMENT

The gas sensor which is located inside the sensor assembly housing can be replaced without replacement of the housing. The gas sensor needs replacement when:

- ◆ It is no longer possible to obtain correct Zero and Span values
- ◆ The “LOW SENS” message appears after calibration
- ◆ The sensor output signal is noisy, causing erroneous gas level readings

To replace the sensor:

- a. Confirm that system power has been removed
- b. Remove the gas sensor module enclosure cover,
- c. Unscrew the two thumb screws in the top of the faceplate, lift the transmitter assembly and rotate 90° to relieve the wiring service loop.
- d. Unplug the sensor connector from the transmitter
- e. Unscrew the old sensor assembly from the enclosure conduit hub. Remove the sensor assembly with its harness
- f. Unscrew sensor housing cover from the sensor
- g. Carefully pull the old sensor straight up from the socket
- h. Press the new sensor into the socket.
- i. Reverse the preceding steps to install the sensor assembly.
- j. Allow the new sensor to stabilize for a minimum of 30 minutes and then calibrate using the procedure in Section 6.

INSTALLATION INSPECTION

Prior to system start-up or trouble shooting, the entire system should be visually inspected. The following are guidelines for that inspection:

7.1.1 CONTROLLER INSTALLATION

- Controller installed in conformance to manufacturer’s instruction manual recommendations.

7.1.2 CABLING INSTALLATION

- All splices are soldered or via terminal block.
- Cabling is away from sources of electrical noise or RFI where possible.

7.1.3 SENSOR MODULE INSTALLATION

- Module installation in conformance with this manual.
- Modules accessible for calibration.

- Wiring terminations clean and correct.

7.1.4 MOISTURE TRAPS AND RAINSHIELDS

- Conduit seals and drains installed to avoid moisture build up in electronics enclosure. Water accumulation in sensor module enclosures is a major cause of damage and system failures - take precautions to seal electrical conduits and provide moisture traps and drains to avoid water damage
- Rain-shields installed where applicable.

7.1.5 STANDARD VOLTAGES

- Loop voltage to be applied to the sensor module must be between 14 VDC and 30 VDC.

7.2 INSPECTION AND TROUBLESHOOTING GUIDE

The inspection and troubleshooting guide can be used to step through the system start-up and to determine the corrective action if a fault occurs.

7.2.1 IF MODULE DOES NOT DISPLAY THE CORRECT PPM GAS

1. Repeat calibration procedure.
2. Remove the gas and wait for the timer to completely count down.
3. Apply Span Gas and verify that the sensor sees the correct value of the span gas after calibration.
4. If the sensor still does not respond to gas, power cycle the unit and repeat calibration.

7.2.2 IF THE MODULE DOES NOT DISPLAY THE CORRECT PPM

1. Power cycle the module.
2. Recalibrate the sensor.

7.2.3 IF THE DISPLAY SHOWS 'NO SENSOR' – SENSOR FAILING

1. Power down the unit
2. Open the enclosure and unplug the sensor from the transmitter board.
3. Plug the sensor back into the transmitter board carefully and ensure a secure fit.
4. Power up the unit.

7.2.4 IF THE DISPLAY SHOWS "C" – CALIBRATION MODE

1. Complete calibration or exit to operating mode.

7.2.5 IF THE DISPLAY SHOWS "▼" – DOWNSCALE INDICATOR

1. The reaction of the sensor to gas may, for a short period of time, result in a downscale indicator being shown on the display.
2. If this indicator remains for a longer period of time, the sensor may need re-calibration.

7.2.6 IF THE DISPLAY SHOWS "HIGH" – UPSCALE INDICATOR

1. The concentration of the gas is outside the calibrated range.

8. APPENDICES

APPENDIX A: SPECIFICATIONS
Specifications:
Sensor:

	4501-04	4501-05	4501-06
Max. Range (1)	0-1200 PPM	0-100 PPM	0-10 PPM
Zero Drift	+/- 1 PPM	+/- 0.5 PPM	+/- 0.5 PPM
Repeatability	+/- 1 PPM	+/- 1 PPM	+/- 0.5 PPM
Linearity	+/- 1 PPM	+/- 1 PPM	+/- 0.5 PPM
Resolution	0.5 PPM	0.1 PPM	0.1 PPM
Response Time (2)	<25 sec.	<30 sec.	<60 sec
Sensor Life (3)	2 years	2 years	2 years

- (1) Optional ranges available
- (2) Response time to 90% full signal value for applied concentration
- (3) Sensor life typical for use at standard temperature and pressure with occasional exposure to gas of interest

Output:

Display:	LCD, 2-line, 20-characters
Signal Output:	2-wire sensor powered analog 4-20 mA (Trouble: 3.6 mA)
Loop Resistance	800 ohm

Electrical Data:

Power consumption:	<160 milliwatts
Connection type:	2 wire
Input voltage:	24 VDC nominal: 14-30VDC, 2-wire loop powered
RFI/EMI Protection:	EN50081-2, EN50082-2

Operating Range:

	4501-04 CO	4501-05 H2S	4501-06 Cl2
Ambient Temp (°F)	-4 to 122 °F	-40 to 122 °F	-4 to 122 °F
Ambient Temp (°C)	-20 to 50 °C	-40 to 50 °C	-20 to 50 °C
Relative Humidity	5 – 99%	5 – 99%	5 – 99%

Extended Range Operation	Sensor and 4-20 mA will continue to operate to -40°F (-40°C) but the LCD display will decay over time if exposed to temperatures below -4° (-20° C) for significant time
Storage Temperature:	-4° to 122 °F (-20° to 50°C)

Enclosure:

Dimensions:	7.0 x 3.6 x 4.0 inches (H x W x D) (17.8 x 9.1 x 11.2 cm)
Weight:	4.4 lb. (2.0 Kg)
Material of Construction:	316 Stainless Steel
Enclosure:	NEMA 4X

Electrical Classification:

FM Approved:	Explosion proof, Class 1, Div. I, Groups B, C, D Class 1, Zone 1, Group IIB+H2 IP66
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Approvals:

FM Performance Approval: (4501-05 only)	Approval Standards: ISA-92.0.01, Part I-1998 and FM 3600
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Remote Sensor Option:

Distance Sensor to Transmitter:	4501-04	25 feet
	4501-05	25 feet
	4501-06	15 feet

Warranty:

Limited warranty: 2 year specifications subject to change without notice

Model Number	Gas Type	CO	H ₂ S	Cl ₂	H ₂	SO ₂	NO ₂	NO	HCl	HCN	C ₂ H ₄
4501-04-IT	CO	100	5	0	<20	0	0	6	0	0	<50
4501-05-IT	H ₂ S	<2	100	-20	<0.1	<15	-15	0	0	0	0
4501-06-IT	C ₁ ₂	0	<-10	100	0	0	105	0	0	0	0

APPENDIX B: MODEL NUMBERS & PARTS LIST**Sensor Module**

4501-04	Sensor Module 2-wire, CO
4501-05	Sensor Module 2-wire, H ₂ S
4501-06	Sensor Module 2-wire, Cl ₂

Options

5394-52	Remote Sensor/Display Option
5311-00	Rainshield

Calibration Items

1250-01	Gas Sensor Calibration Kit, Type A (CO, H ₂ S)
1250-03	Gas Sensor Calibration Kit, Type C (Cl ₂)
1260-00	Gas Cylinder, Air, (Type A), 105 litres
1260-04	Gas Cylinder, CO 100 PPM, (Type A) 57 litres
1260-05	Gas Cylinder, H ₂ S in N ₂ , 25 PPM, (Type A) 57 litres
1260-06	Gas Cylinder, Cl ₂ , 5 PPM, (Type C) 104 litres
1260-13	Gas Cylinder, CO, 1000 PPM, (Type A), 105 liters
5360-00	Calibrator Head Standard
1256-01	Regulator Type A Calibrator
1265-03	Regulator Type C Calibrator
5358-01	Calibration Adapter - Direct, Standard
5358-51	Calibration/Configuration Magnetic Tool, 4501-XX

Spare Parts

SPM21830	Sensor Assy, Aluminum, 4501-05/5100-05-IT
SPM21832	Sensor Assy, Aluminum, 4501-04/5100-04-IT
SPM21833	Sensor Assy, Aluminum, 4501-06/5100-06-IT
SPM27071	Transmitter for 4501-XX
SPM27074	Sensor Assy, 316SS, 4501-05/5100-05-IT
SPM27083	Sensor Assy, 316SS, 4501-04/5100-04-IT
SPM27084	Sensor Assy, 316SS, 4501-06/5100-06-IT
SPM33030	Sensor for 4501-04
SPM33041	Sensor for 4501-05
SPM33050	Sensor for 4501-06

APPENDIX C: LIMITED WARRANTY

SIERRA MONITOR CORPORATION warrants its products to be free from defects in workmanship or material under normal use and service for two years after date of shipment. SMC will repair or replace without charge any equipment found to be defective during the warranty period. Final determination of the nature and responsibility for defective or damaged equipment will be made by SMC personnel.

All warranties hereunder are contingent upon proper use in the application for which the product was intended and do not cover products which have been modified or repaired without SMC approval or which have been subjected to accident, improper maintenance, installation or application, or on which original identification marks have been removed or altered. This Limited Warranty also will not apply to interconnecting cables or wires, consumables (i.e. calibration gases, batteries, sensors), nor to any damage resulting from battery leakage.

In all cases SMC's responsibility and liability under this warranty shall be limited to the cost of the equipment. The purchaser must obtain shipping instructions for the prepaid return of any item under this warranty provision and compliance with such instruction shall be a condition of this warranty.

Except for the express warranty stated above, SMC disclaims all warranties with regard to the products sold hereunder including all implied warranties of merchantability and fitness and the express warranties stated herein are in lieu of all obligations or liabilities on the part of SMC for damages including, but not limited to, consequential damages arising out of/or in connection with the use or performance of the product.