MODEL 5000

S E N T R Y

GAS MONITORING SYSTEM

Version 6

FM

APPROVED

APPLICABILITY & EFFECTIVITY

Effective for all Sentry systems manufactured after September 1, 1995.

Instruction Manual Part Number T12001-A1

FMRC APPROVAL

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

Sentry Model 5000 Gas Monitoring System

Controllers

Model 5000-02	Two Channel Controller
Model 5000-04	Four Channel Controller
Model 5000-08	Eight Channel Controller

Controller Options:

Model 5380-00	Rack Mount Configuration
Model 5383-00	NEMA-4X Configuration
Model 5387-00	Printer Output Software
Model 5392-00	Individual Alarm Relays

Sensor Module

Model 5100-02	Combustible Gas Sensor Module
Model 5100-05	Hydrogen Sulfide Sensor Module - EC Cell

Calibration Equipment

Model 1200-26	Calibration Gas Delivery System
Model 1290-02	Combustible Gas Cylinder
Model 5358-00	Calibration Head, Magnetic
Model 5358-01	Calibration Head, Standard
Model 5360-00	Calibration Gas Delivery Fitting

Notes:

1) FMRC Approval applies only to conventional (one cable run per sensor module) or multiplexed (multiple sensor modules per cable) installations. Apparatus must be installed in accordance with National Electrical Code.

2) FMRC Approval of the RS232C Data Output option applies only if used as a printer port and the apparatus connected to the controller does not use or generate greater than 250 Vrms.

3) FMRC Approval for Hydrogen Sulfide Sensor Module applies to Model 5100-05 electrochemical cell only. Model 5100-01 solid state sensor is not approved.

4) FMRC Approval allows the presence of MODBUS firmware in the Sentry controller but does not cover the operation of the MODBUS firmware itself.

*FMRC: Factory Mutual Research Corporation

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1. PRODUCT DESCRIPTION

1.1 GENERAL

The Sentry 5000 is a fixed installation gas monitoring system designed for continuous operation in open or confined areas. The system is comprised of a controller and up to eight sensor modules. The sensor modules are supplied for detection of combustible gas, oxygen deficiency or various toxic gases and can be mixed within one system as required.

1.2 CONTROLLER

The Sentry controller is a microprocessor computer which performs functions including management of the sensor modules, management of alarm relays and interface with the user via the front panel which includes a concentration display, an alphanumeric display, keypad and status indicators. The microprocessor functions are permanently installed in the controller. They cannot be changed or damaged by the user and will not be altered by loss of power.

Configuration variables, such as alarm levels, can be changed via a simple keypad sequence. Information provided to the controller in this manner is retained even when the power is interrupted. This information can be protected by a "user code" to avoid unauthorized modification.

Sentry continually scans all modules for alarm conditions. No sequence of key presses can prevent the scanning except specific actions during calibration or deliberate disabling of the sensor module.

The Sentry controller is provided in a rack or panel mount version for control rooms, an environmental enclosure for outdoor, stand alone applications, or other packages for specialty applications.

1.2.1 ENHANCEMENT PACKAGE

Various factory installed firmware enhancements are available for the Sentry controller. These are selected at the time of purchase or subsequent upgrade. The enhancements, which are described in detail in the appropriate sections of this manual, include:

- Addition of printer output firmware for models 5000-04 or 5000-02. Printer output is standard on model 5000-08.
- Replace printer output firmware with **MODBUS** data address protocol for host computer or DCS interface. **MODBUS** is an industry standard communication protocol which allows bi-directional communication via the controller RS-232C serial port.
- High Alarm Acknowledge function for alarm reset.
- Low Alarm Acknowledge function for alarm reset
- Emergency Alarm function adds a third alarm level.
- Zone and Voting assignment of individual alarm relays.
- Analog Output software driver for use with Model 4314-01 output module.
- Custom default Gas Tags and Engineering Units Tags for up to eight input devices.
- Custom default Module Tags for up to eight module addresses.
- Configure alarm relays to be normally energized in the safe condition.

1.3 SENSOR MODULES

Each sensor module ("module") is labeled internally to identify the type of gas it is designed to detect. For each gas group, the sensor and the electronics board in the explosion proof housing is different. During installation, switches in the electronics are set by the user to give the module an address (module number) to make it unique from others in the same system. Sentry then "communicates" with each module to determine its number, the type of gas it detects, the gas concentration and other information.

Inside the module housing is an electronic assembly consisting of two printed circuit board assemblies mounted under a metal top plate. The address switches and adjustment potentiometers are accessible through the plate and electrical test points (test lead jacks) are installed in the plate. Connectors for wiring from the controller and the sensor are located on the bottom of the electronic assembly. The sensor is installed in one hub of the enclosure.

1.4 INTERCONNECT WIRING

Not supplied with Sentry, but necessary to the installation and operation is the three conductor wiring which connects the controller to the modules. Before this wiring is installed it is important to read and understand the installation instructions (Chapter 3) because significant economies can be realized by connecting more than one module onto a common wiring run. This standard feature is accomplished by multiplexing the signals from the modules to the controller.

1.5 DATA TRANSMISSION

Transparent to the user is the data transfer which occurs on the installed interconnect wiring. Two of the conductors are used to pass direct current (DC) from the controller to the modules. The third wire transfers a series of very rapid pulses between the controller and the sensor modules. This digital transfer of information is an important feature of the system which significantly reduces RFI and EMI problems.

1.6 POWER REQUIREMENTS

The standard system requires 120 VAC, 60 Hz, at 0.5 Amp electrical supply. A factory option can be ordered for 220 VAC operation. DC voltage (12 to 28 VDC) can be used for standby power. The system will automatically switch to supplied DC operation at any time the AC voltage is interrupted.

The system includes a lithium battery for RAM memory retention during power interruptions. To ensure continuous trouble free operation, however, the primary power source must be one which is continuous and reliable, preferably dedicated to this equipment. Battery back-up or emergency power is recommended to insure continuous operation.

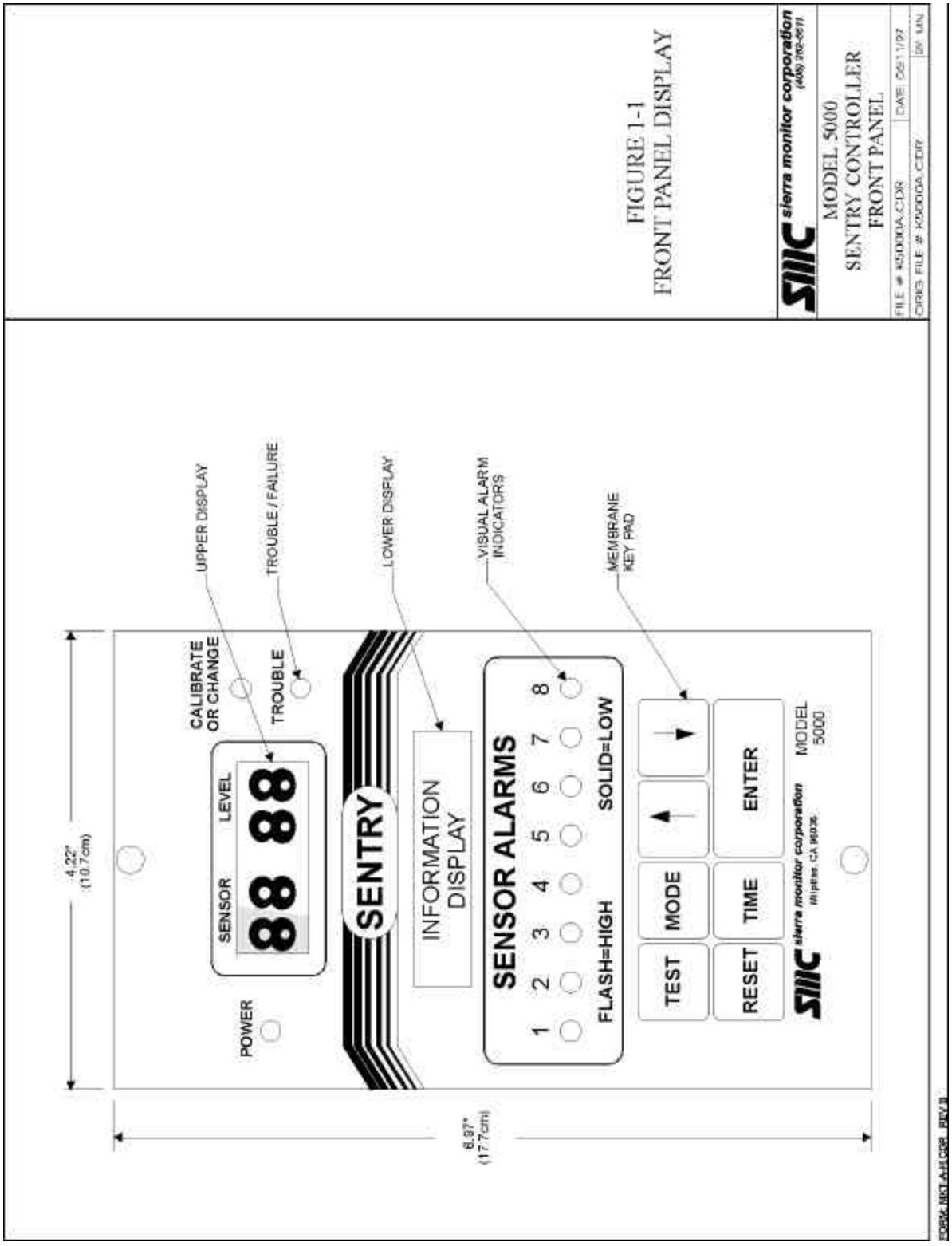


Figure 1-1
Front Panel Display

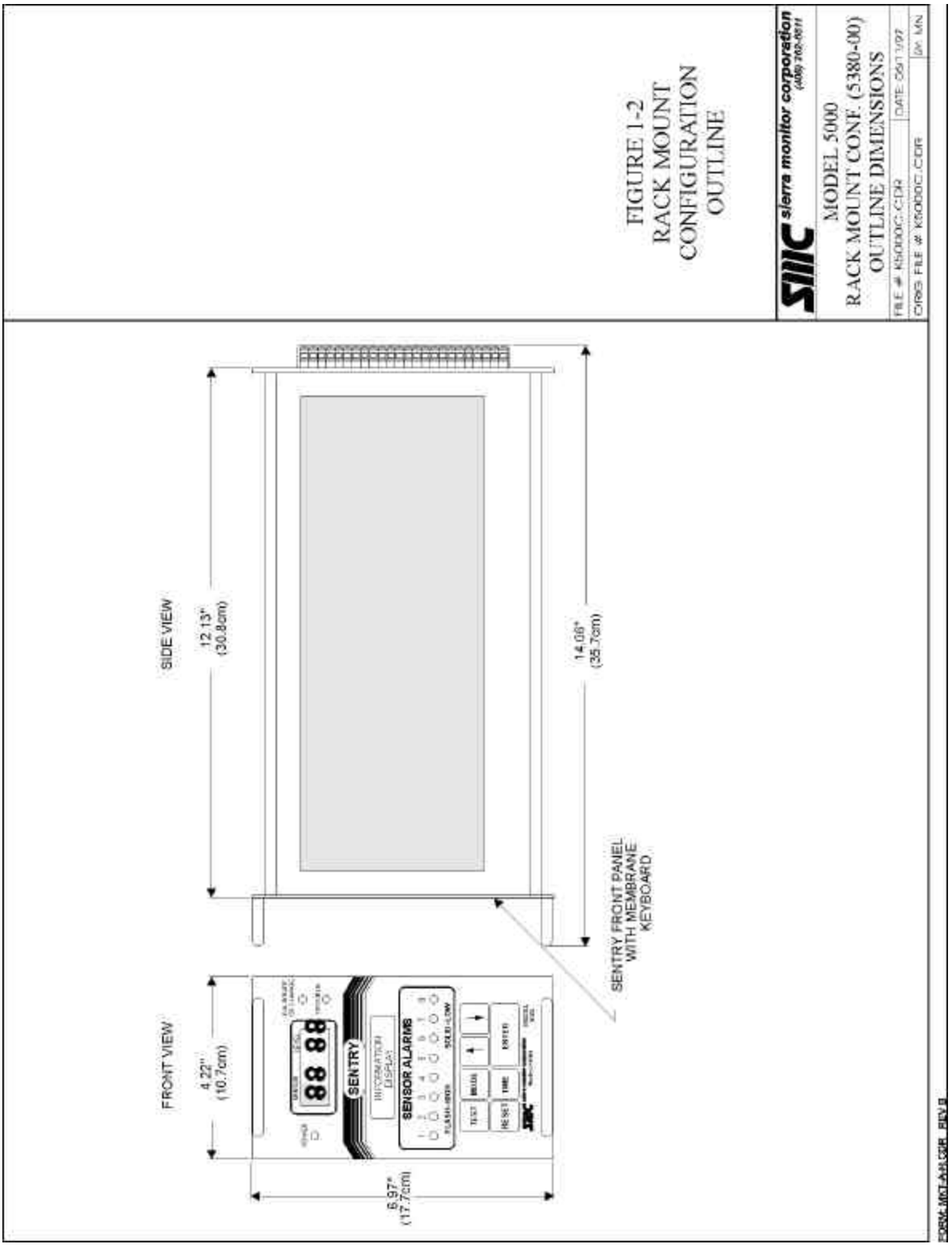


Figure 1-2
Rack Mount Configuration - Outline

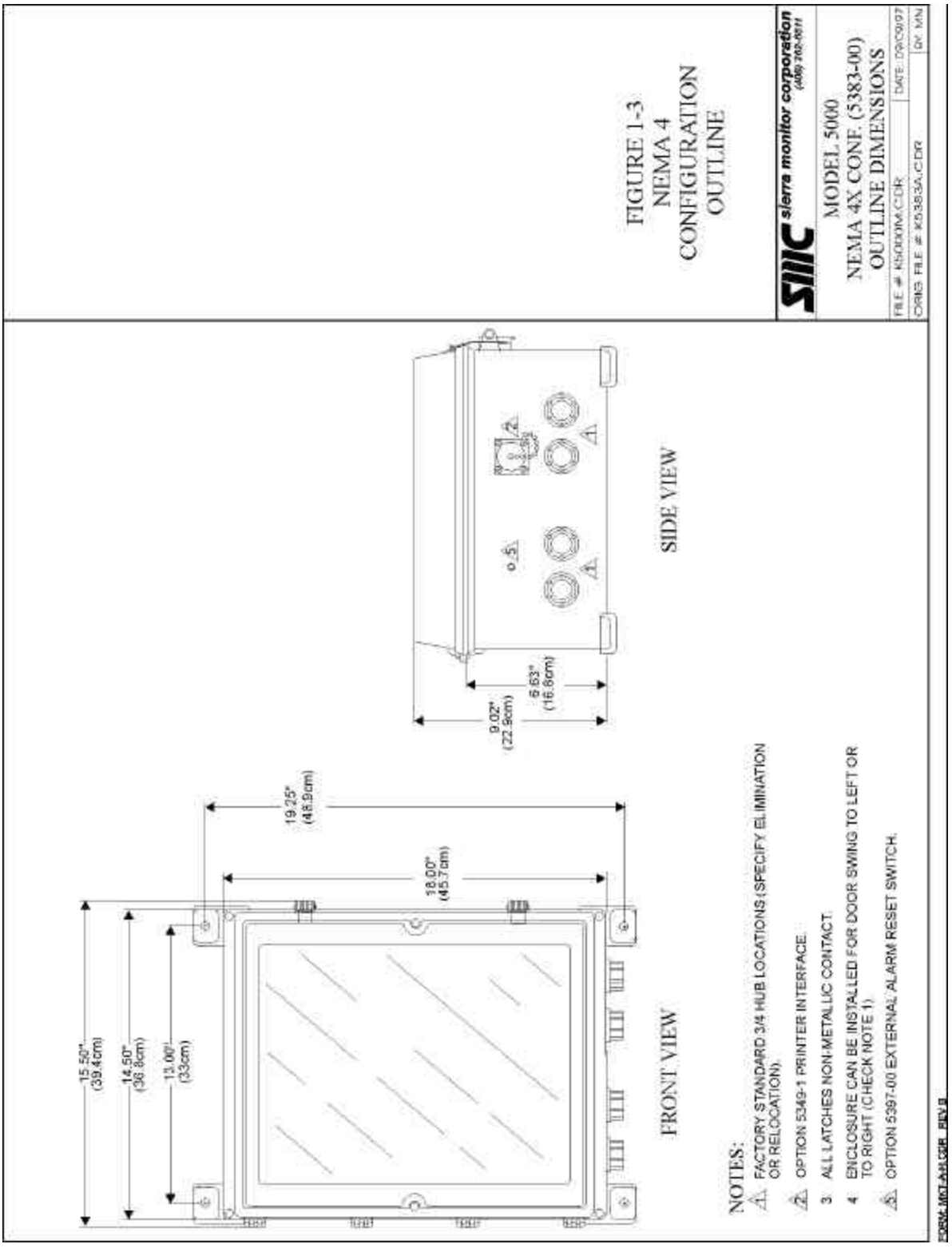


Figure 1-3
NEMA-4 Configuration - Outline

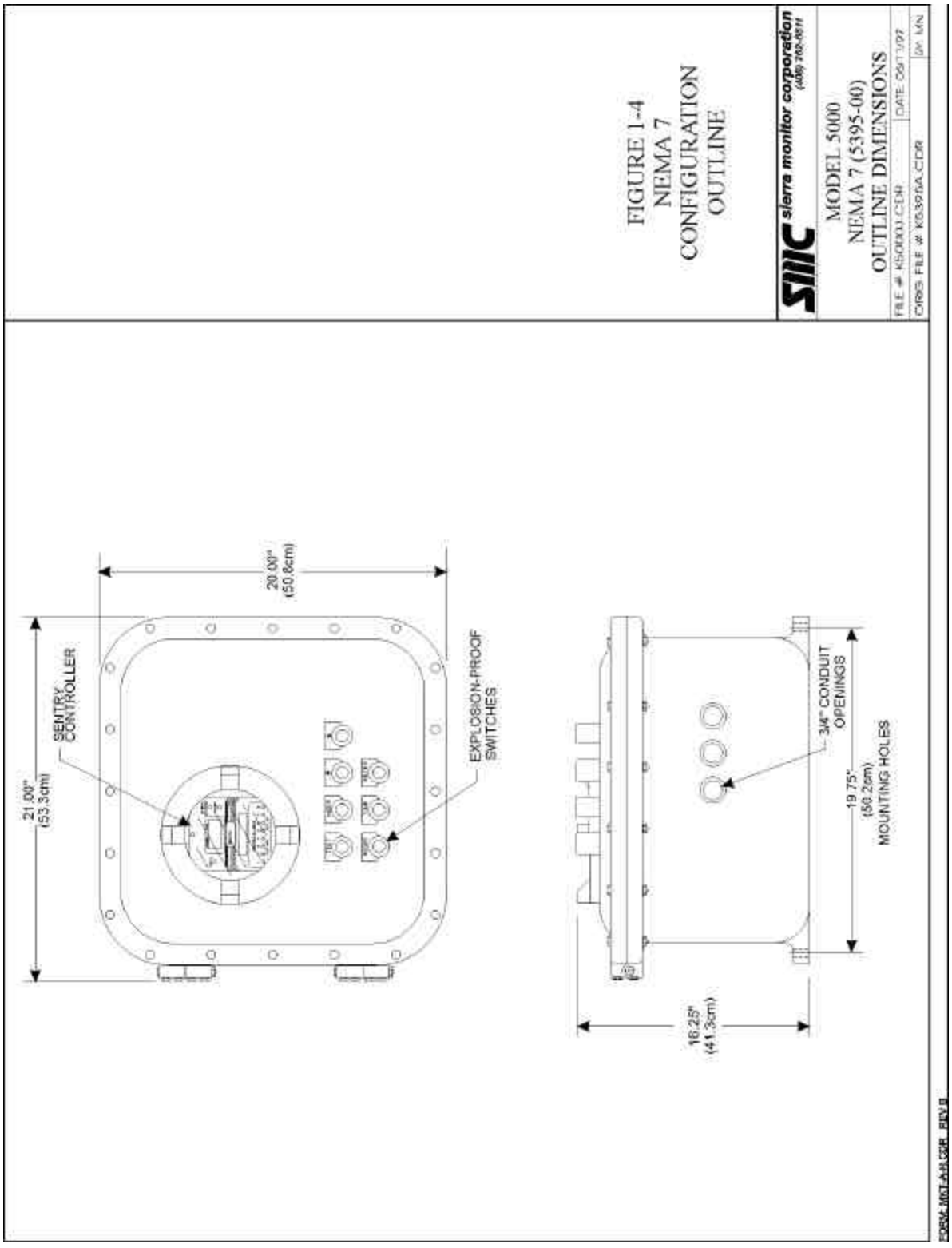


Figure 1-4
NEMA-7 Configuration - Outline

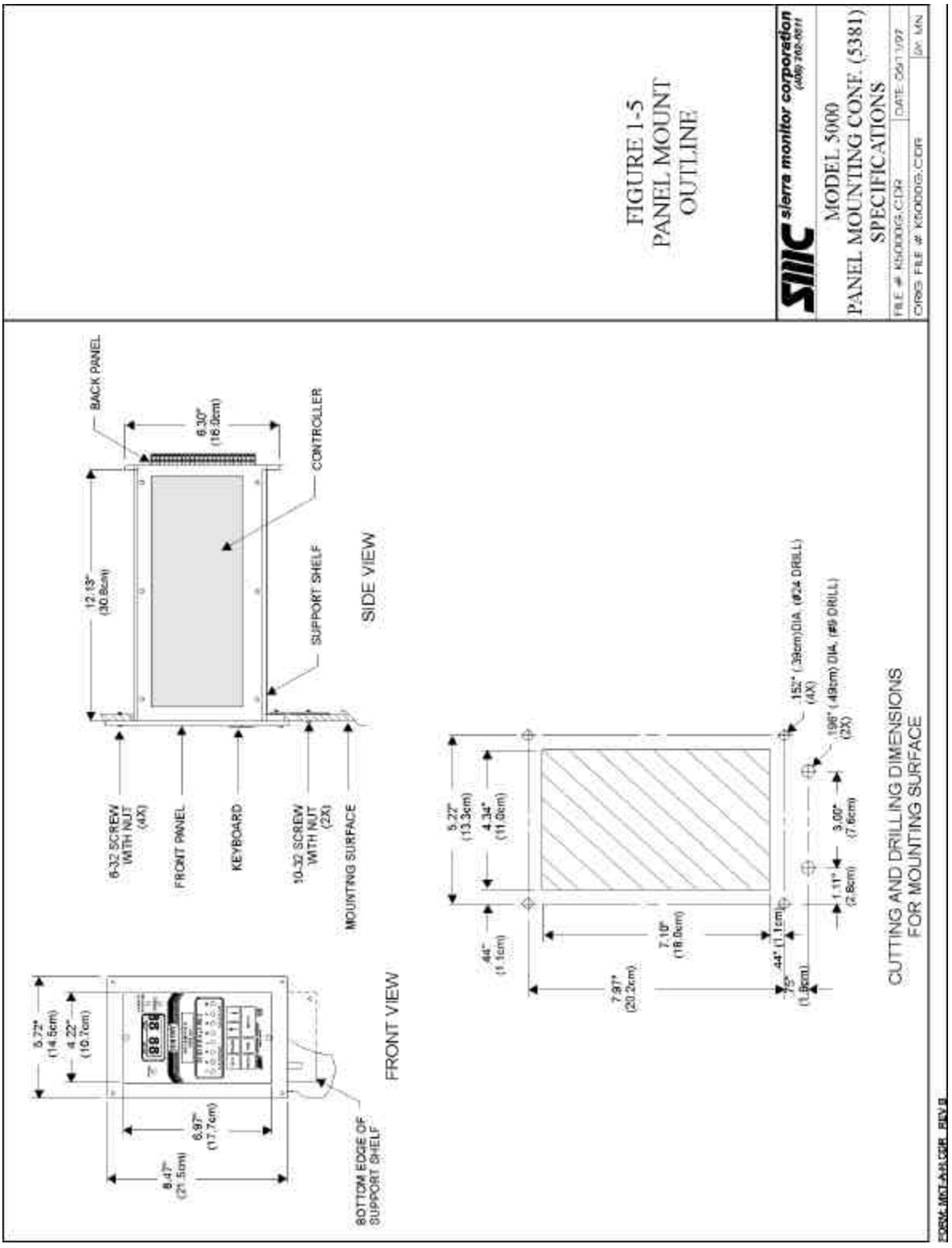


Figure 1-5
Panel Mount Configuration Outline

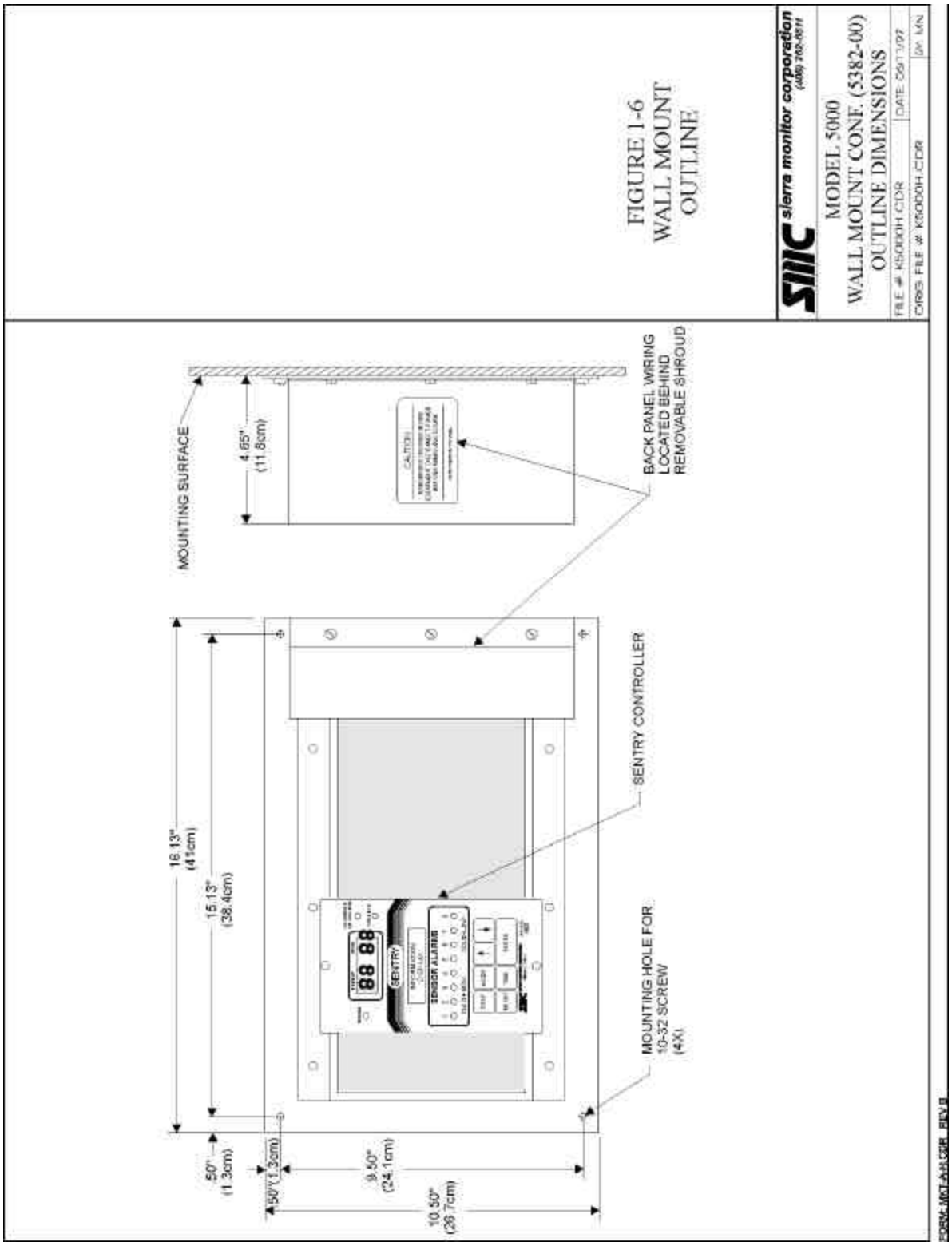


Figure 1-6
Wall Mount Configuration Outline

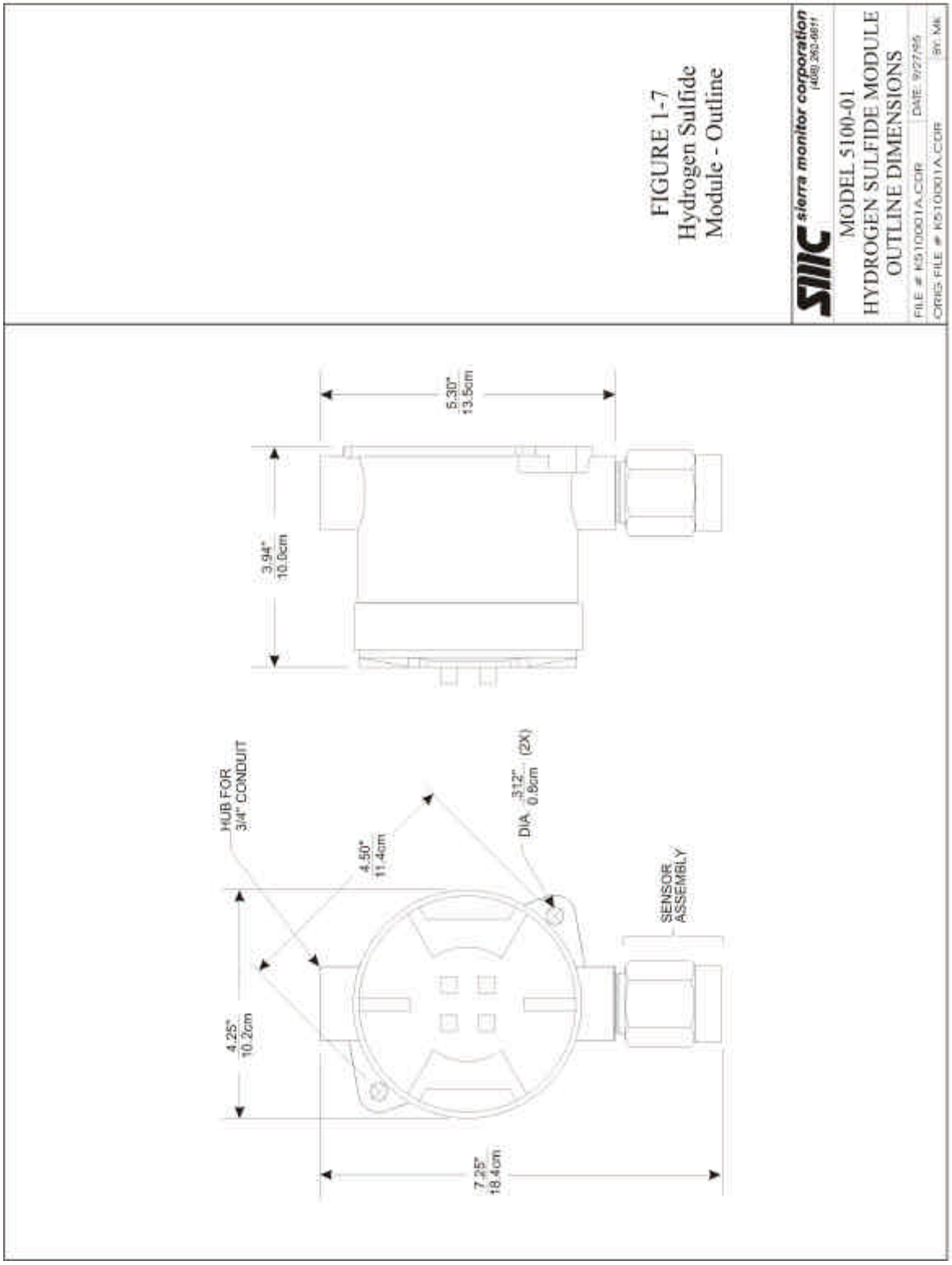


Figure 1-7
Hydrogen Sulfide Module - Outline

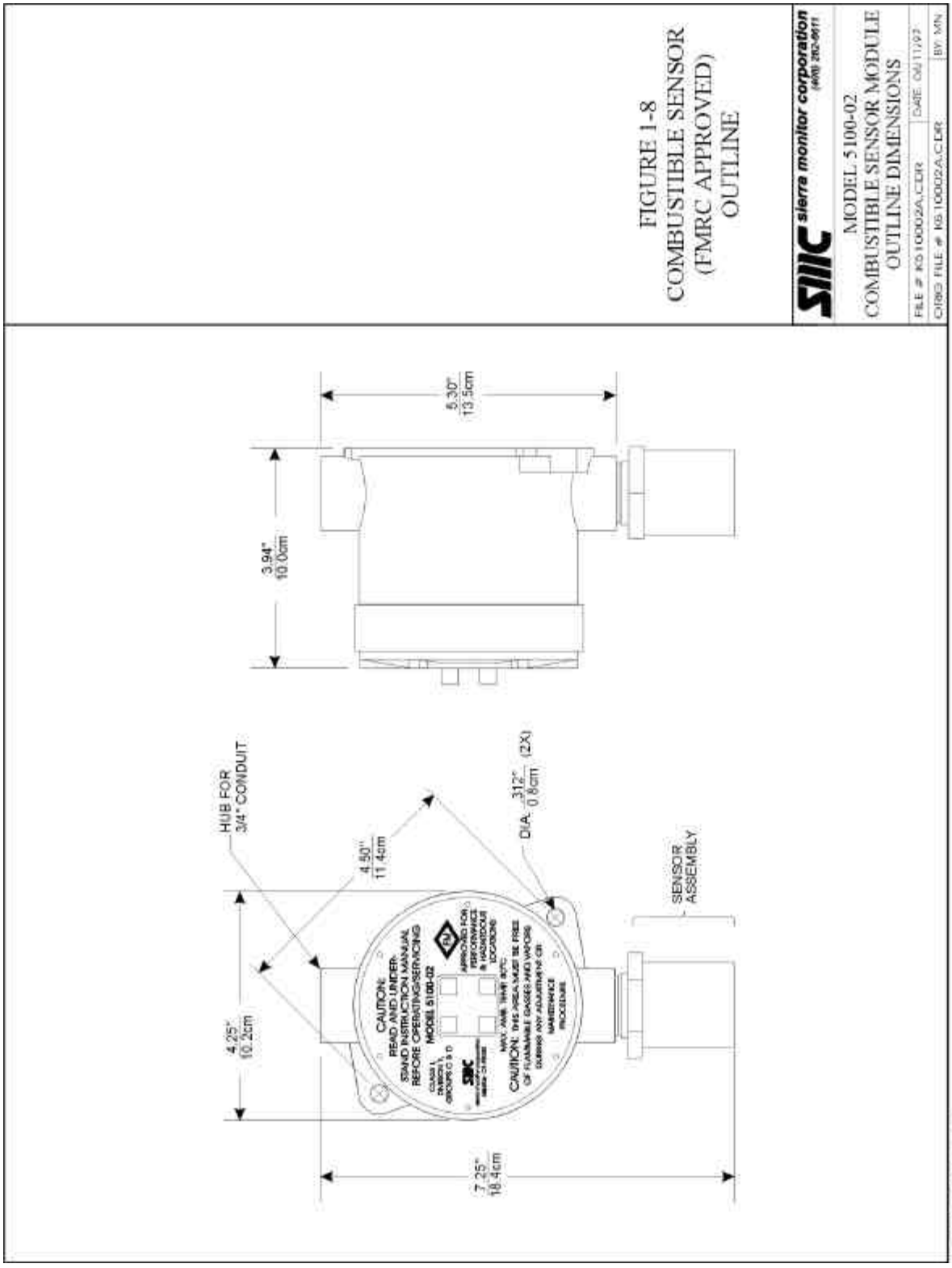


Figure 1-8
Combustible Sensor - Outline

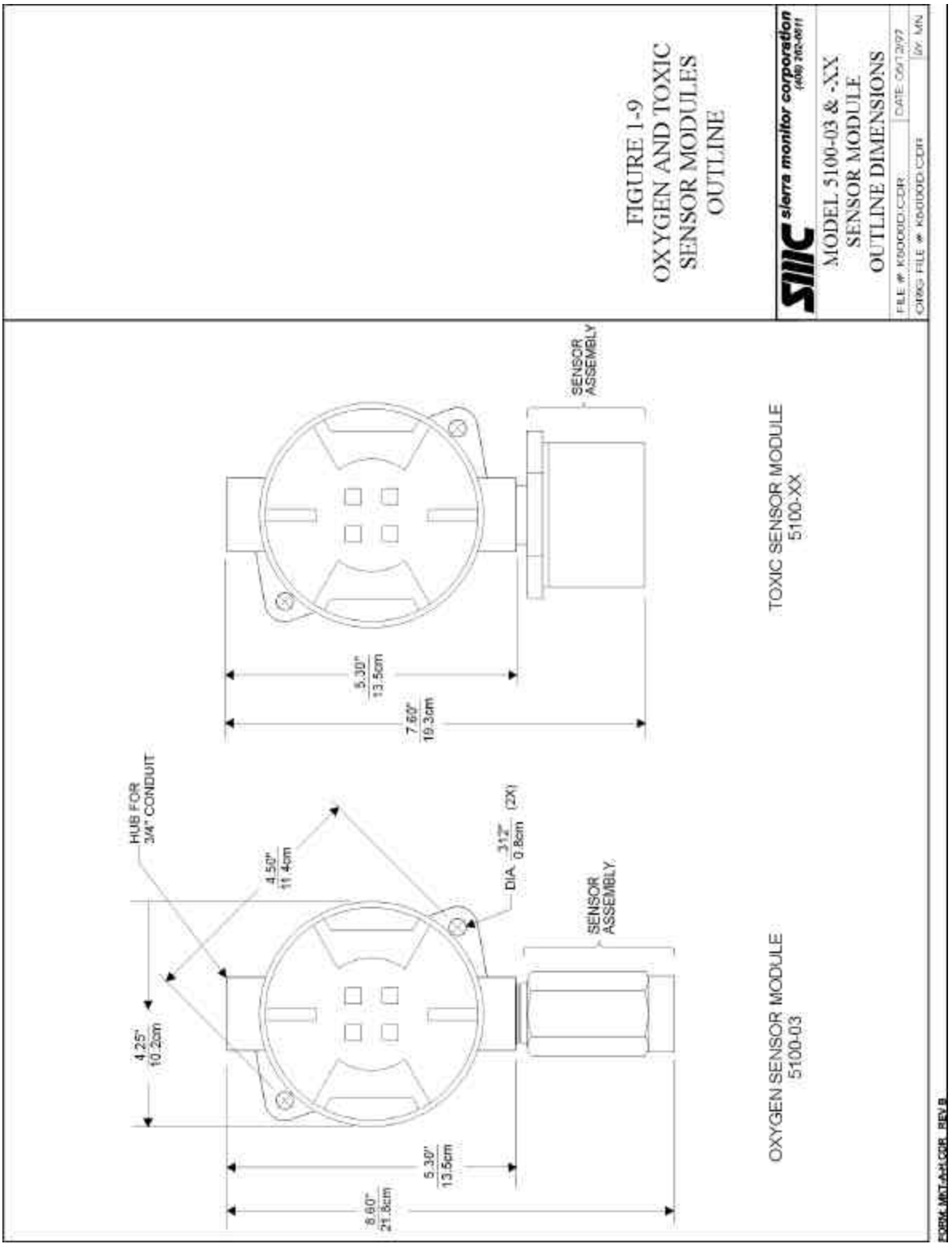


Figure 1-9
Oxygen and Toxic Sensor Modules - Outline

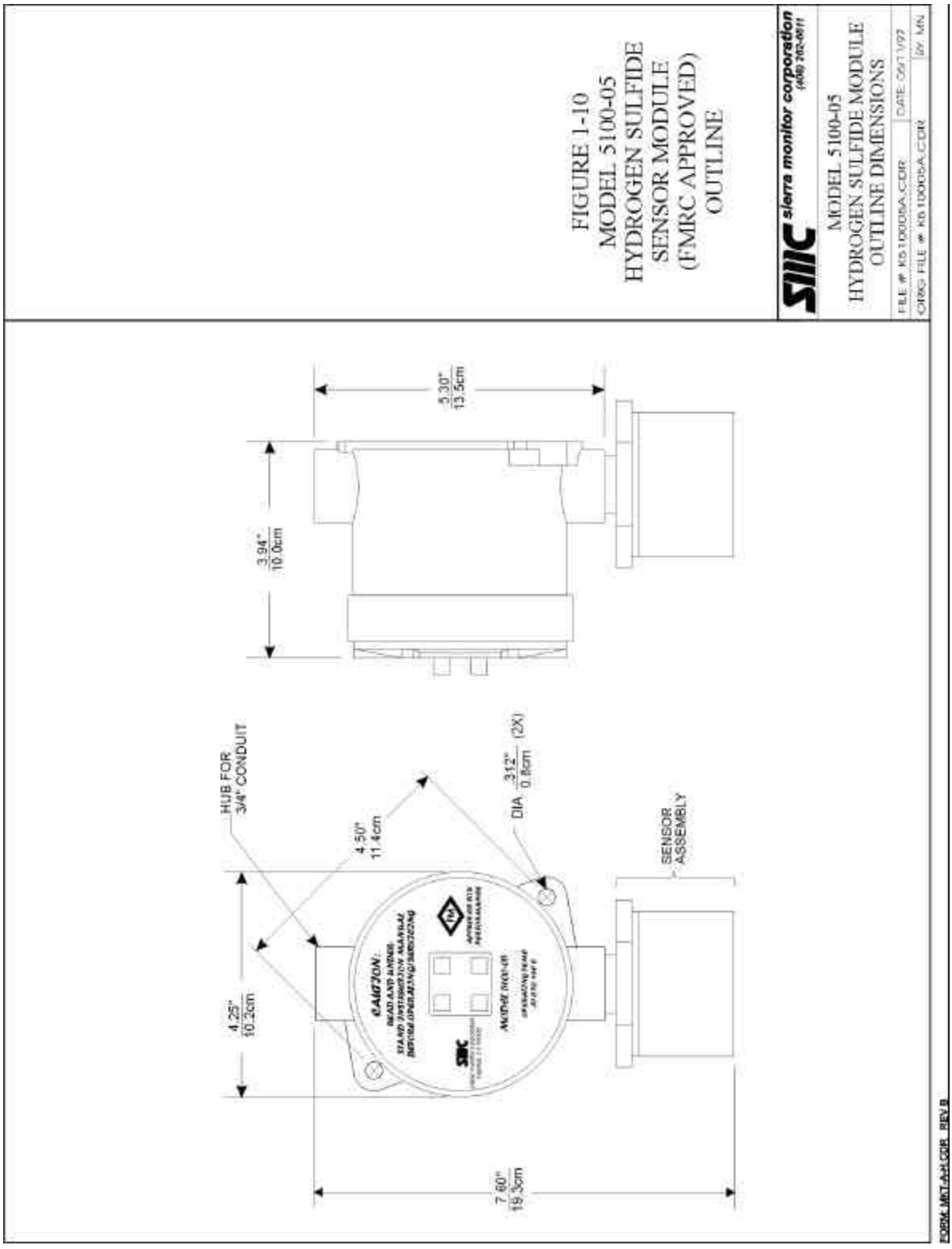


Figure 1-10
Model 5100-05 Hydrogen Sulfide Sensor Module (FMRC Approved) - Outline

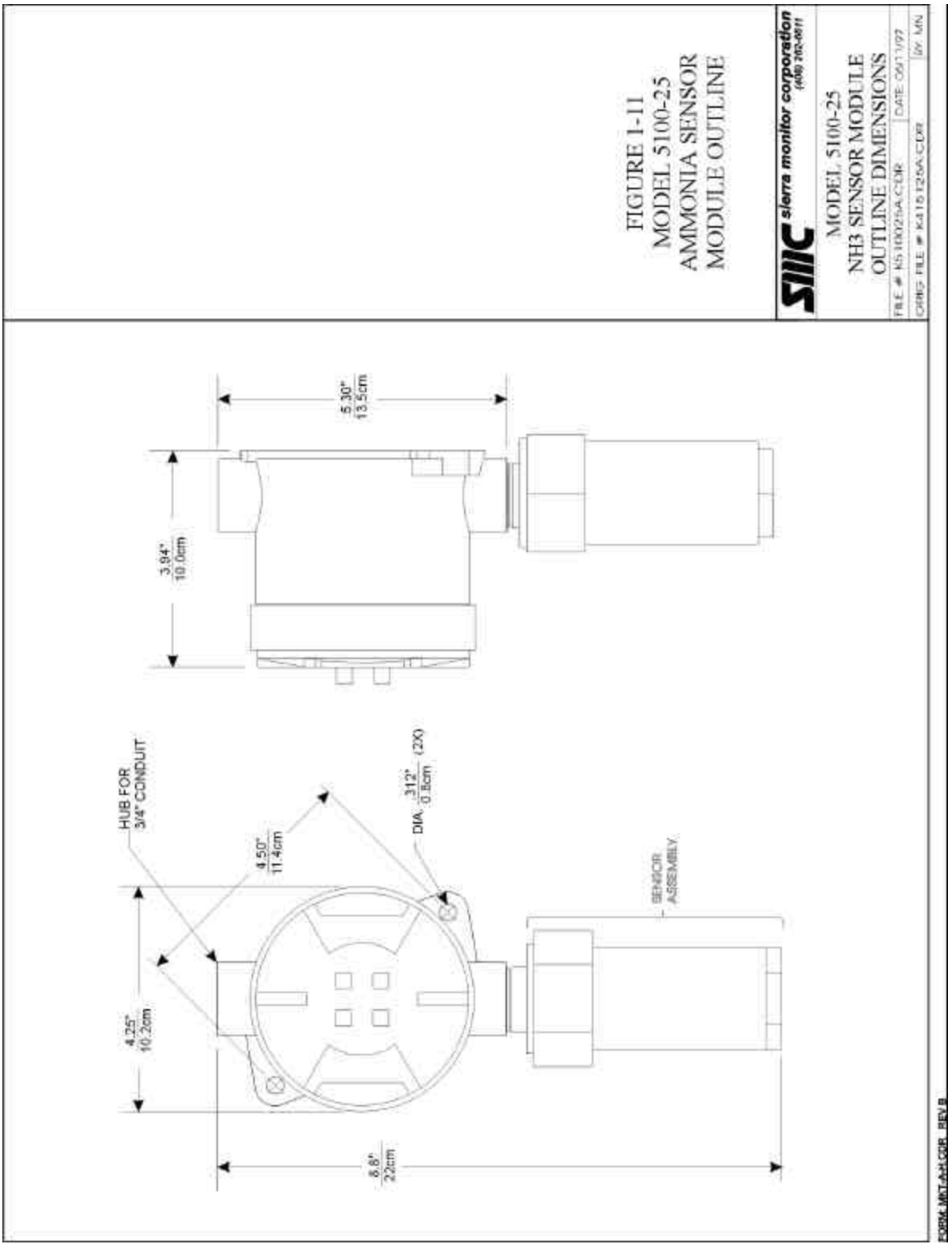


Figure 1-11
Model 5100-25 Ammonia Sensor Module - Outline

2. CAUTIONS & WARNINGS

2.1 INTRODUCTION

Although the Sentry system 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 CONTROLLER

The controller should be installed in a location which is safely accessible during a gas alarm.

Avoid installing the controller where it will be unnecessarily exposed to wind, dust, shock or vibration or direct sun. Observe temperature range limitations.

Adhere to standard electrical installation procedures. The chassis ground on the controller must be connected to earth ground.

2.3 WIRING

While the digital communication method used between the controller and modules will greatly reduce problems associated with electromagnetic and radio frequency interference the manufacturer recommends that extra caution be taken where the installation is near any sources of these interferences:

- 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.
- When the risk of interference is present use shielded cables. In conduit installations the shield should be connected to the conduit. In cable applications the shield should be connected to the cable connector.
- All splices must be via either a lug and terminal 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

2.4 SENSOR MODULES - GENERAL

Avoid installing sensor modules where they will be unnecessarily exposed to wind, dust, water (esp. 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), silicones, acid vapors, caustic liquids or mists.

Care has been taken by the manufacturer to ship your modules in protective packaging to avoid contamination prior to installation. It is recommended that the sensors 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 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**".

When sensors are replaced the thread must be Teflon taped to avoid metal to metal binding which will damage the housing threads.

2.4.1 COMBUSTIBLE SENSOR MODULES

Catalytic type combustible gas sensors may be poisoned by exposure to silicones. Sierra Monitor Corporation supplies resistant sensors, but care should be taken to avoid exposure to silicones. No Silicone caulking (RTV) should be used near the sensors. No other silicone based compounds should be used near the sensors unless they are fully protected during the entire cure cycle. If the sensors will be exposed to silicone during normal operation the manufacturer's sensor warranty is void.

3. INSTALLATION

NOTE
All systems are factory are pre-configured and calibrated. All sensors are tagged to indicate the controller (alpha) and the sensor module number (1 - 8). Identify all components of the system during unpacking and install using the factory configuration. The system will power up in a calibrated and fully functional condition.

3.1 CONTROLLER LOCATION

Rack mounted controllers should be installed in a control room environment where they will be relatively free from dust and temperature extremes. For ease of operation select a rack window space at approximately eye level. Four controllers can be installed side by side in a 19" instrument shelf.

Enclosed controllers for outdoor applications should be located in the most protected location available with consideration for easy access for installation and calibration. The enclosures should be mounted on a vertical surface with the key board at approximately eye level. The enclosure should not face directly into the sun.

3.2 SENSOR MODULE LOCATIONS

Select locations for each of the sensor modules based on the following:

- Consider the density, relative to dry air, of the gas to determine height of module above floor or ground level:

Gas	Density (Air = 1.00)
Air	**1.00**
Ammonia	0.60
Carbon Monoxide	0.97
Chlorine	2.49
Ethylene Oxide	1.52
Hydrogen	0.07
Hydrogen Chloride	1.27
Hydrogen Cyanide	0.94
Hydrogen Sulfide	1.19
Methane	0.55
Nitrogen Dioxide	1.58
Oxygen (Air)	1.10
Sulfur Dioxide	2.26

Table 3-1
Specific Gravity of Selected Gases

- Modules should be placed close to the potential source of gas.
- Modules should be placed in areas accessible for calibration.
- Sensors should be pointed down and the conduit should include an inverse trap to reduce moisture (condensation) from accumulating in the electronics enclosure Figure 3-3.

3.3 WIRING

Plan the wiring arrangement to minimize installation expense but with redundancy for critical locations. Wire shall be Belden (or equivalent) 949X (where X = 2, 3, 4, or 5 depending on wire gauge). If high RFI or EMI levels exist wiring should be protected by conduit or shield. Shielded wire shall be Belden (or equivalent) 936X.

NOTE
In no case should the drain wire of shielded cable be used as one of the conductors.

- Any modules which are located in a common geographical area a long distance from the controller can be connected to the same three conductor wire run installed from the controller to that area. Table 3-2, Figure 3-4.
- The remote auxiliary power supply option can be used for installation of one or more modules a long distance from the controller location. The connection from the controller to the remote power supply is via a two conductor "data link" Figure 3-4.

Number of modules	Maximum length of wire run (feet)				
	500	1,000	2,000	3,000	5,000
1	20	20	18	16	14
2	20	18	14	12	xx
3	18	16	12	xx	xx
4	16	14	12	xx	xx

Table 3-2
Minimum Wire Gauges

Install conduit as required. Provide for splice boxes where multiple modules will be wired to a single run. Pull 3 (typical: white, black, green) conductors of the correct gauge wire from the controller to each splice box and from the respective splice box to each planned module location. See Figure 3-5 for proper wire termination in the splice box. Twisted wire secured with wire nuts is not an acceptable splice.

NOTE
Installation and wiring must be in accordance with the National Electrical Code

In installations where redundancy of module locations is a requirement do not install multiple modules on one cabling run as any damage to the primary wiring will disable all the modules.

NOTE
Temperature rating of cable wire insulation must be above 75^{o}C (85^{o}C or greater rating wiring is recommended). If cable runs through higher temperature environments, it should be specified for that environment.

3.4 SENSOR MODULE INSTALLATION

Note: Remove spring from the electromechanical sensor (5100-04 through 5100-23) prior to installation. See technical note provided with sensor module.

1. Remove the electronics from the module housing by:
   - Unscrew the two captive panel screws in the top plate.
   - Lift the electronics out of the housing.
   - Unplug the sensor harness from the bottom electronics board.
2. Install the module housing onto the end of the supply conduit and/or bolt into position as required.

Note
If housing grounding is required for the installation a grounding lug is located under the two printed circuit assemblies in the housing. Install the ground wire under the green lug. Figure 3-5

3. Connect the three wires which run from the controller to the three position terminal strip on the bottom of the electronics assembly. See Table 3-3 for terminal markings and normal wiring color code conventions. Figure 3-7 shows the correct wiring connections and the operation of the connector mechanism.

Controller Marking	Function	Module Marking	Color
1	+VDC	P	White
2	Signal	S	Black
3	DC Return	G	Green

Table 3-3
Sensor Module Wiring

4. Reconnect the sensor harness to the sensor connector on the bottom of the electronic assembly. Figure 3-7.
5. Twist the assembly 180^{o} to take up the service loop on both the incoming wire and the sensor harness. With the sensor facing down the wording on the cover plate will be correctly oriented.
6. Carefully fit the electronics over the two posts in the housing and tighten the captive panel screws.

Module	Switch Positions		
#	1	2	3
1	ON	ON	ON
2	OFF	ON	ON
3	ON	OFF	ON
4	OFF	OFF	ON
5	ON	ON	OFF
6	OFF	ON	OFF
7	ON	OFF	OFF
8	OFF	OFF	OFF

Table 3-4
Sensor Module Binary Switch Positions

7. Set the dip switch Figure 3-8 on each module to indicate the module number (Table 3-4). Each of the modules connected to one controller must have a different address. (Note: Switch position 4 is not used.)

3.5 CONTROLLER INSTALLATION

3.5.1 CONTROLLER CONFIGURATIONS

Table 3-5 lists the number of sensor modules which can be operated on each controller model.

Model	Controller Capacity
5000-02	2 Sensor Modules
5000-04	4 Sensor Modules
5000-08	8 Sensor Modules

Table 3-5
Sentry Controller Capacity

Table 3-6 lists and describes Sentry controller enclosure options.

Model	Description
5380-00	Standard configuration, controller intended for installation in instrument rack. Wiring to back connector panel.
5381-00	Controller supplied with bezel for panel or chassis installation. Wiring to back connector panel.
5382-00	Wall mount configuration includes a mounting panel and brackets, display is side mounted. Wiring to side facing panel.
5383-00	NEMA-4X Enclosure with latching front door and window for viewing display. Wiring to front facing terminal strips.
5395-00	NEMA-7 Explosion Proof Enclosure with screw in window for viewing of display and external switches for operation of keypad. Wiring to side facing panel.

Table 3-6
Sentry Enclosure Options

3.5.2 CONTROLLER MOUNTING

3.5.2.1 RACK MOUNTED CONTROLLER

The instrument rack should be installed in a 19" electronic cabinet at eye level. Care should be taken to avoid heat from other instruments under the controller.

3.5.2.2 CHASSIS MOUNTED CONTROLLER

The chassis mounted controller is provided with a pre-installed bezel and a template for the chassis cut-out. An angle bracket is also provided to support the cantilever of the controller. Select an appropriate location at approximately eye level providing rear access for the module and alarm wiring.

3.5.2.3 WALL MOUNTED CONTROLLER

The wall mounted controller is provided on a sheet metal panel containing brackets which allow for removal of the controller. Select a location, where module and alarm wiring can be run up or down the wall for distribution, and bolt the panel to the wall.

3.5.2.4 NEMA ENCLOSED CONTROLLER

Mount the NEMA enclosed controller on a vertical surface with the display at approximately eye level. Mounting feet are supplied with the enclosure for external mounting bolts. Figure 1-3. Although the enclosure is designed for exposure to weather, normal measures to protect the system from harsh conditions are recommended. It is particularly important to avoid exposure of the display to direct sunlight as this can cause fading of the display during very hot weather.

3.5.2.5 WIRING CONNECTIONS

Channel wiring connections at the controller (except NEMA-4X) and at the module are made using a quick connect terminal strip. Figure 3-7. The terminal can be operated using an actuator (supplied in the system accessory bag) or by pressing a small screwdriver into the actuator slot.

It is important to understand that, because of multiplexed communication, there is a difference between "channel" numbers and "module" numbers. Channels are the physical connectors at the controller. Module numbers are the switched addresses on each module. More than one module number may be installed on a channel, up to a maximum of four modules.

NOTE
Installation and wiring must be in accordance with the National Electrical Code

Make the following connections at the controller.:

- Attach the three wires for each channel to separate channel connectors on the terminal strip marked CH1 through CH8. The sequence should exactly match that at the sensor assembly. (Typical: White 1, Black 2, Green 3.)

- Connect the necessary remote audible and visual alarms or other process control equipment to the "**HIGH**", "**LOW**" and "**TROUBLE**" dry contact relays on the connector panel.

  The Double Pole/Double Throw **(DPDT)** relay connections are marked to indicate Normally Open **(N/O)** , Normally Closed **(N/C)** and Common **(COM)** terminals for each pole. No voltage is applied to the terminals internally.

  Typical wiring configuration is described in Figure 3-11. The trouble relay is fail safe so that it will switch from Normally Closed to Normally Open if all system power is lost.

NOTE
It may be preferably to delay wiring the alarms, or delay powering them, until the detection system has been fully activated, tested and calibrated.

Connect 120 volts AC wiring to the terminals marked Hot (black), Neutral (white), and Ground (Green).

If a 12-28 VDC supply is to be used as either back-up or as the primary operating voltage make the necessary connections to the terminal marked "DC INPUT 12 - 28V" "+" (Red) & "-" (Black).

NOTE
When a battery is to be used for back-up DC supply only, a Sentry feature provides protection against battery damage by shutting off the battery before complete discharge. When this feature is used, the Sentry controller can only be restarted by AC voltage.

To implement the battery protection feature, two red jumper wires located on the power supply board must be cut. See Figure 7-3.

If splice boxes are used to combine multiple modules on a channel the splice connections should be made using a terminal block/wire lug assembly or all wires should be soldered and insulated. Figure 3-5.

3.5.3 ALARM DEVICE INSTALLATION

Alarm devices must be installed according to the manufacturer's instructions for the particular device. Sentry dry contact relays provide switching capability as rated in the specifications. (See Appendix A.)

NOTE
Certain warning strobes have a very high peak current which is dependent upon the phase angle of the AC line at the precise moment the strobe is switched on. A high current at the time of switching may cause the relay contacts to stick together.

The corrective action to avoid contacts sticking together is to install a 10 Ohm, 5 Watt resistor in series with the strobe power, preferably close to the relay.

3.5.4 RELAY OUTPUTS

Three relays on the standard Sentry controller are for: high alarm, low alarm and trouble. The trouble relay is normally energized (power applied to coil). The gas alarm relays (high and low) are normally not energized. Individual low and high alarm relays are optional hardware.

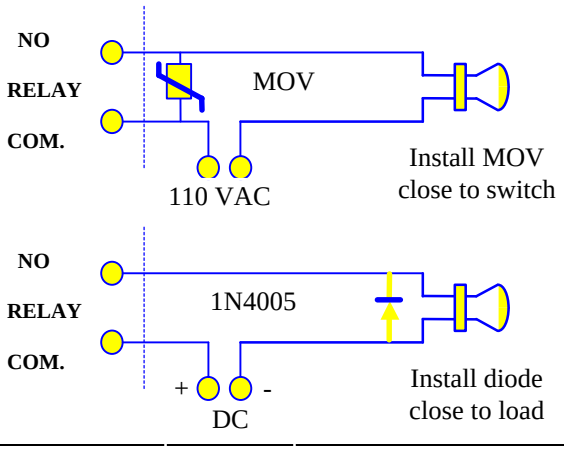


Figure 3-1
Typical Protection Circuit

The relays are dry contact and may be used to actuate bells, lights, sirens, solenoid valves, or contactors as required. It is recommended that for 120 VAC circuits a metal oxide varistor (MOV) rated for 150 Vrms be place across the load (Figure 3-1). (General Electric V150LA20A or equivalent). For DC circuits a general purpose rectifier diode should be placed across the load (1N4005).

3.5.5 DC POWER LOAD

Table 3-7 is provided to allow correct sizing of battery back-up. To determine total load add the applicable individual loads. (All measurements are at 12 VDC.)

Test Condition	Amps	Watts
Controller, No Sensors, No Alarms	0.560	6.7
Controller, No Sensors, All Alarms	0.660	8.0
Controller, 8 Combust, All Alarms	4.000	48.0
Individual Relay Board	0.750	9.3
Hydrogen Sulfide (Type 1) Module	0.260	3.1
Combustible (Type 2) Module	0.420	5.0
Electrochemical Sensor (typical)	0.050	0.6

Table 3-7
Sentry Power Load

3.5.6 POWER UP

Systems shipped complete from the factory are pre-configured and calibrated. When power is turned on the power light will start flashing and the alpha-numeric display will indicate **"SYSTEM WARM-UP" "PLEASE WAIT MM:SS"** (where MM:SS is a five minute count-down clock). When the warm-up ends the two displays will begin functioning in the "continuous scan" mode which is described in the next chapter. The large display will cycle through each module number for any modules which have been installed.

If modules have been added to the system since it was factory configured, those modules will have a blank ("—") concentration display and the lower display will show the module type and units with **"FACTOR MISSING"** or **"UNCALIBRATED"** messages.

If the display indicates module numbers which match the numbers used in installation, the wiring is correct and module configuration can begin. If any number is omitted the controller is not recognizing that module and the wiring should be checked for errors (the system will display **"NO MODULE"** when any attempt is made to obtain information on that module).

If the controller does not recognize any modules the display will read **"NO MODULES INSTALLED".**

NOTE
On 2 and 4 Channel systems any module set with a number higher than four will cause the lower display to indicate "MODULE # MUST BE 1 THROUGH 4" and the upper display to display "#E --" (where # = the erroneous module number).

3.5.7 POWER DOWN

If it is necessary to remove the power all operator configured data and parameters will be saved by Sentry. (It is important to turn off the main power prior to disconnection of any module wiring because while under power Sentry will interpret certain changes as errors.)

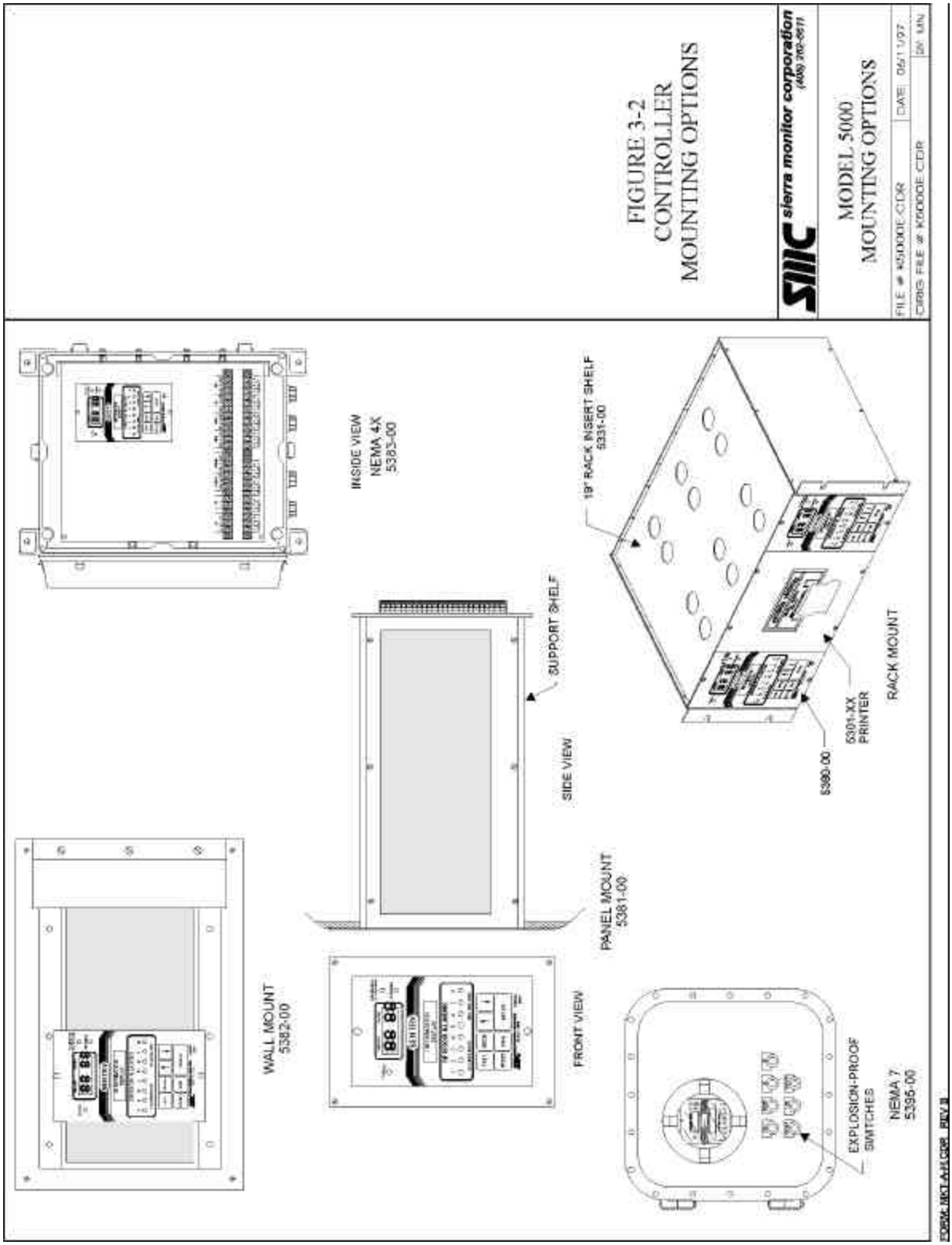


Figure 3-2
Controller Mounting Options

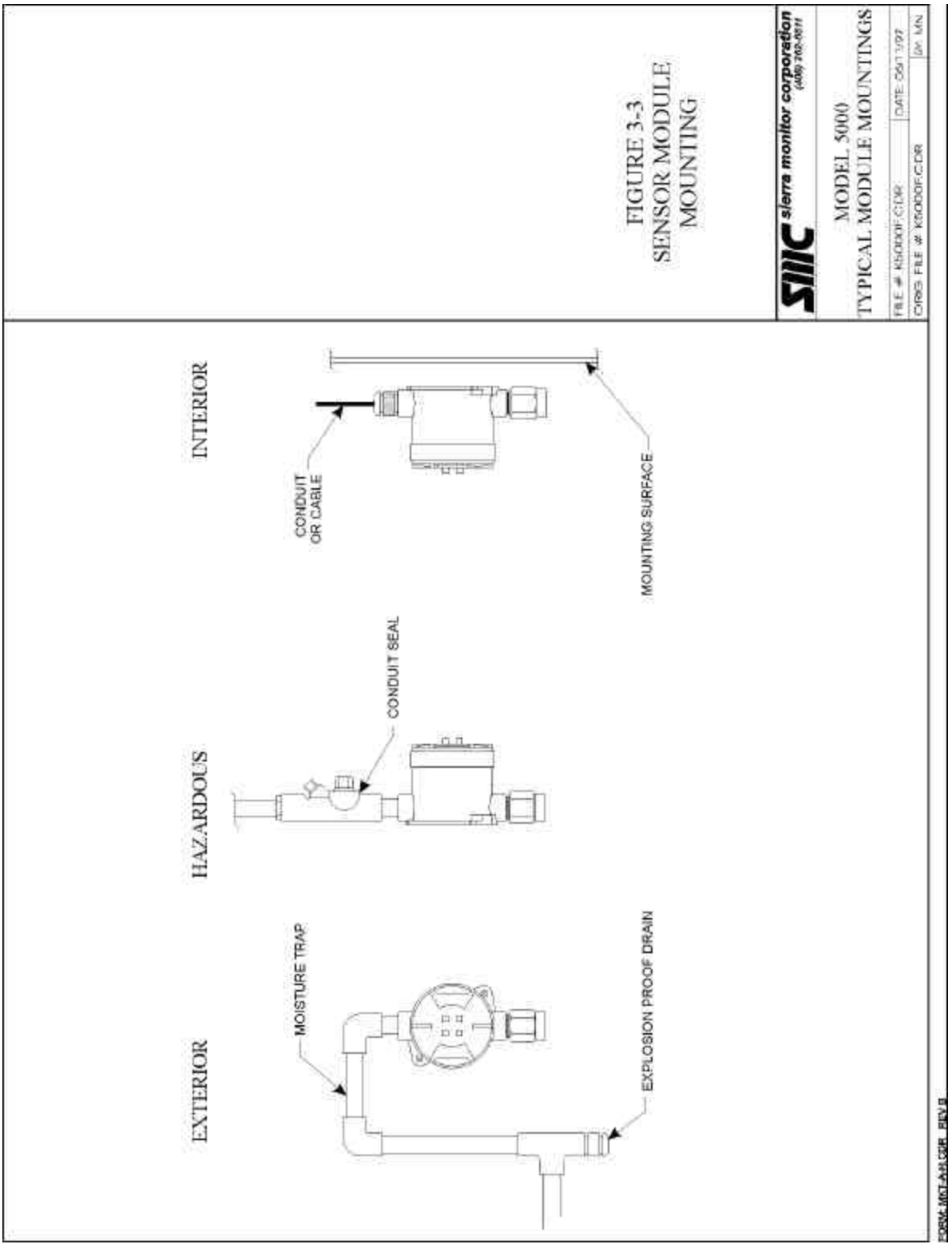


Figure 3-3
Sensor Module Mounting

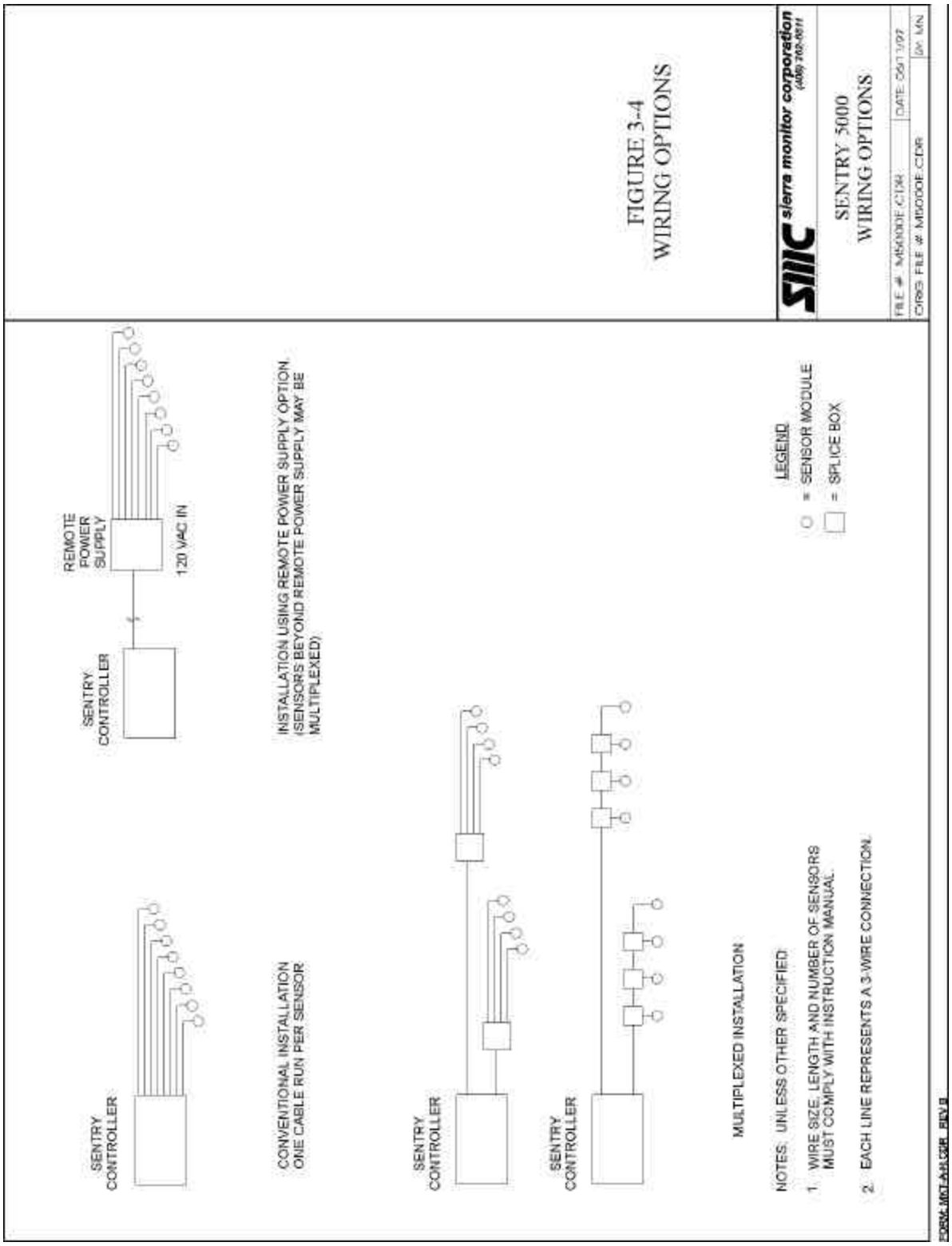


Figure 3-4
Wiring Options

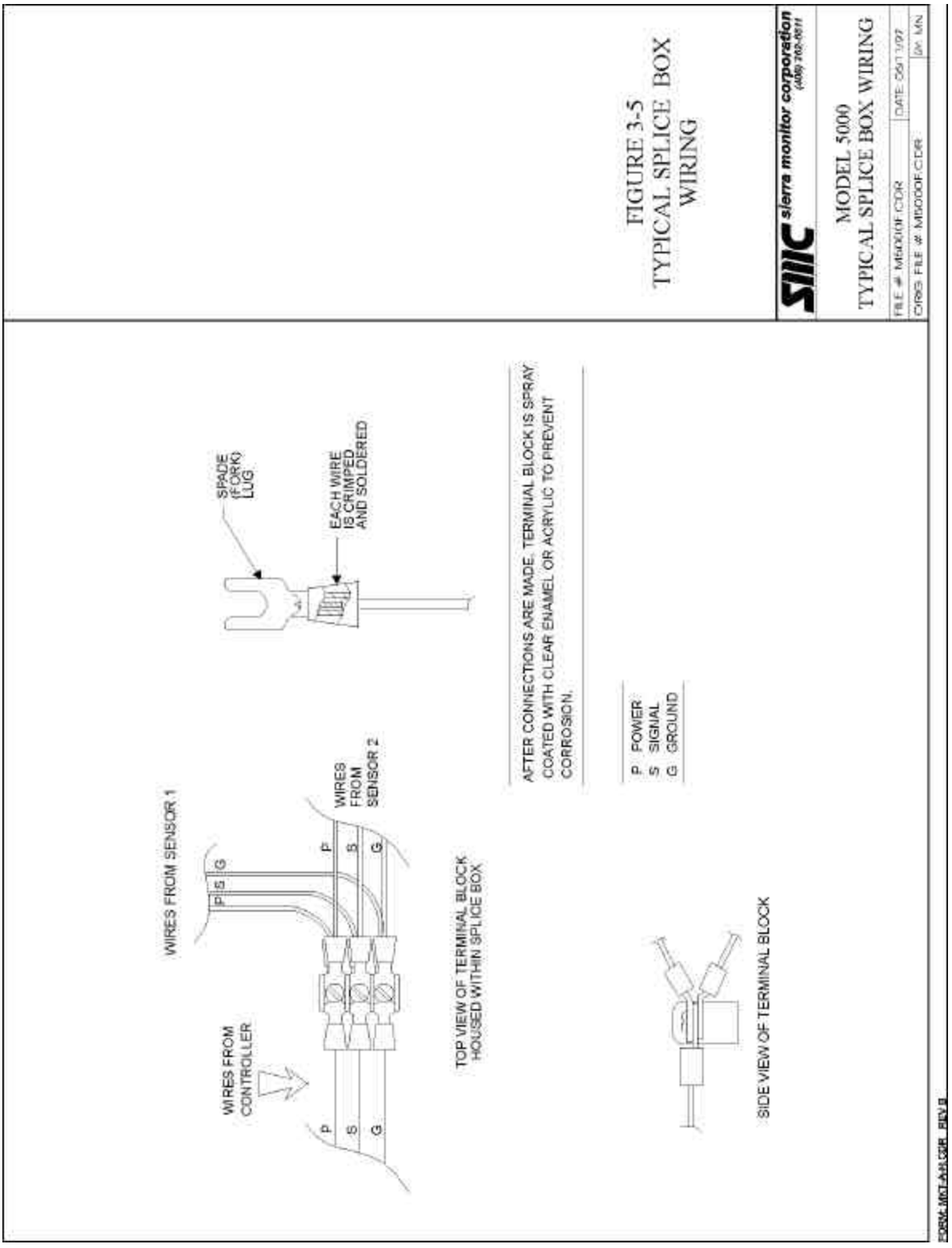


Figure 3-5
Typical Splice Box Wiring

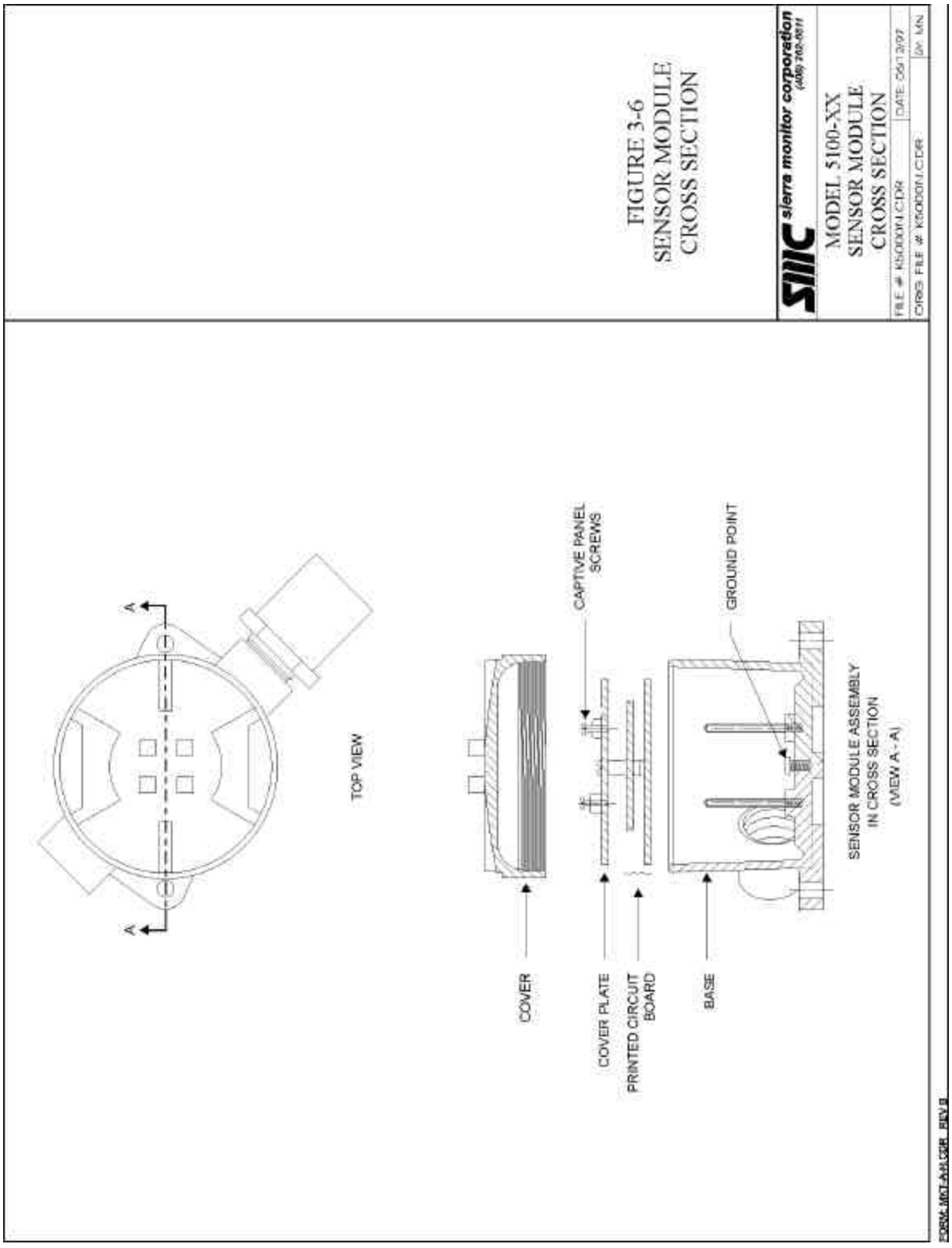


Figure 3-6
Sensor Module Cross Section

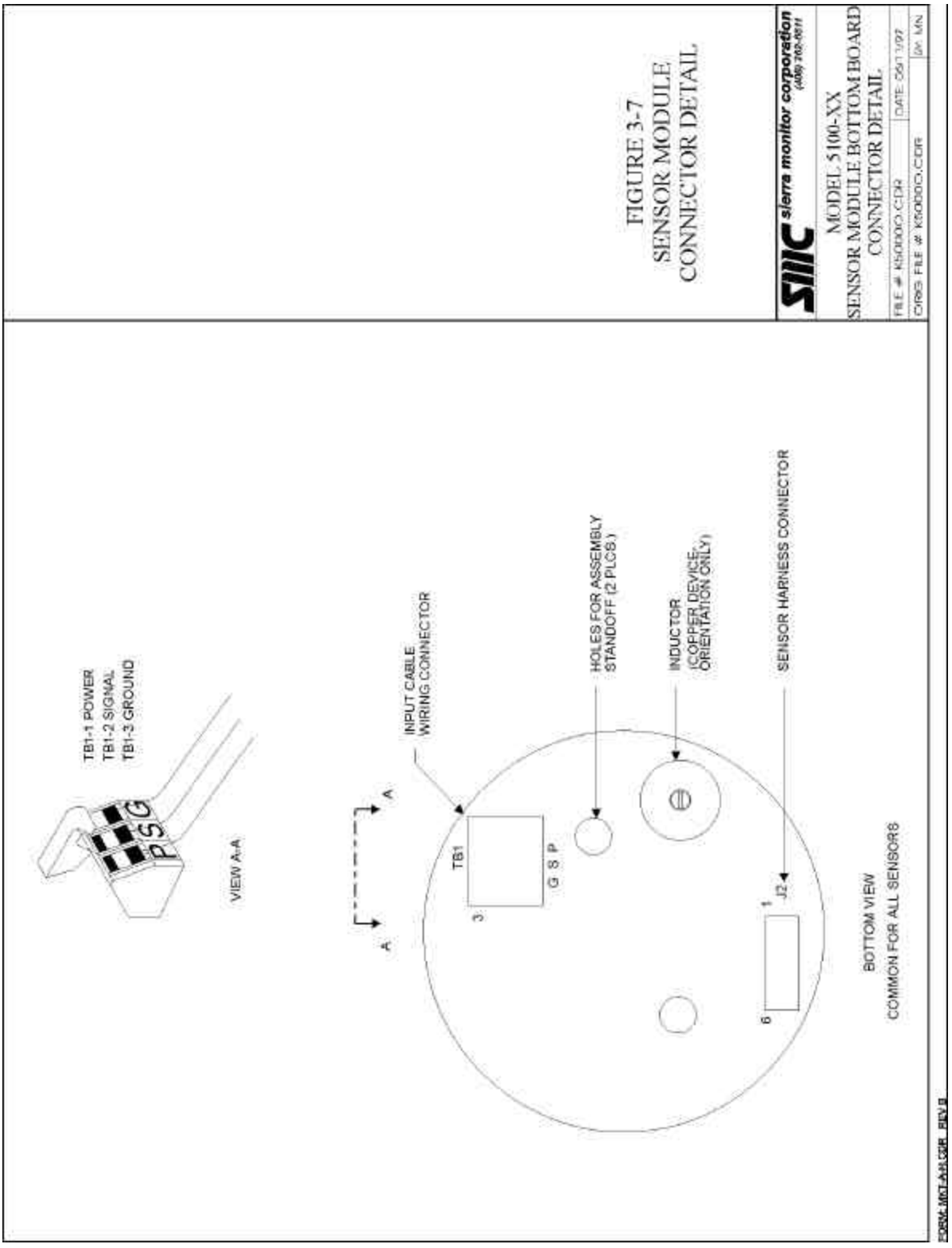


Figure 3-7
Sensor Module Connector Detail

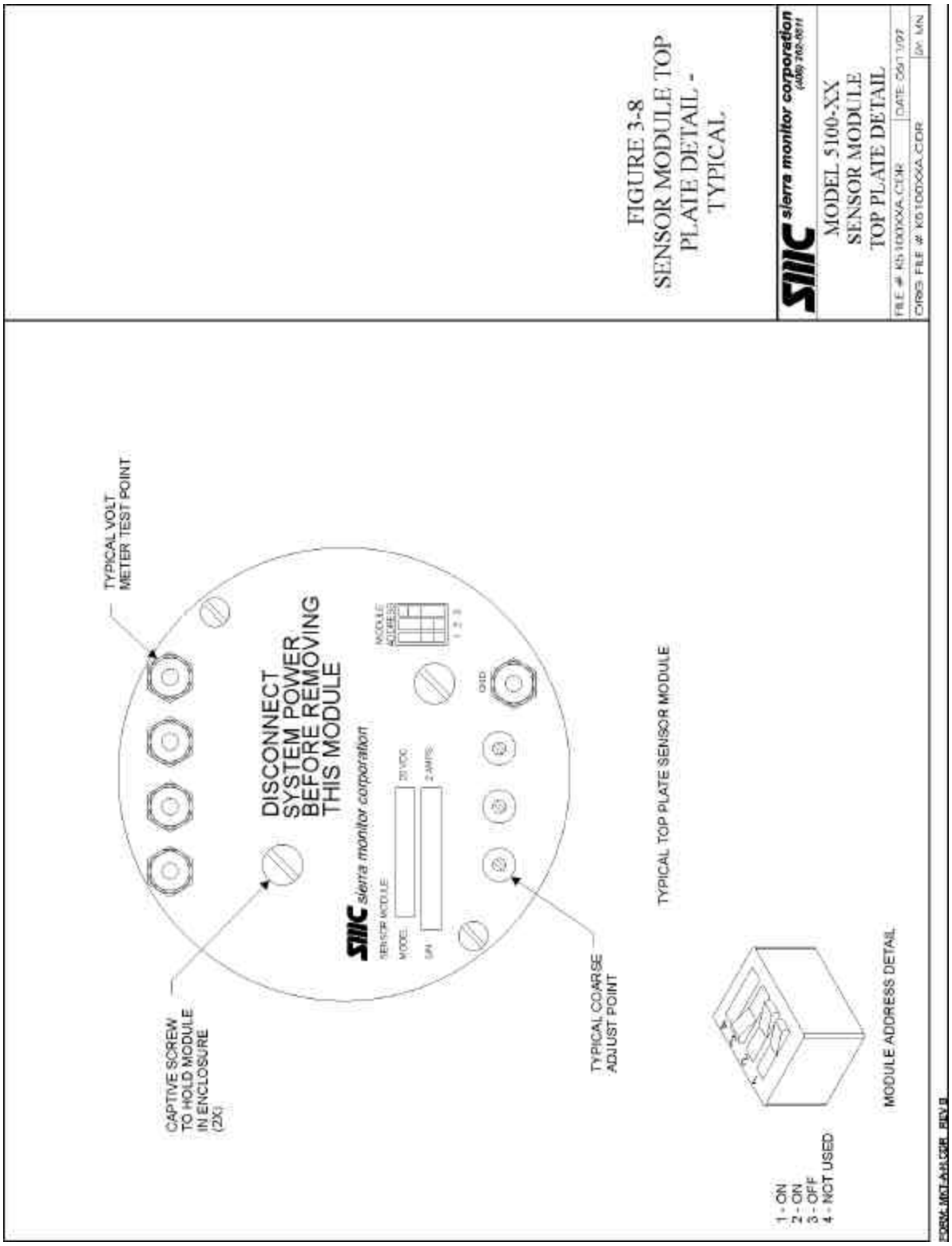


Figure 3-8
Sensor Module Top Plate Detail - Typical

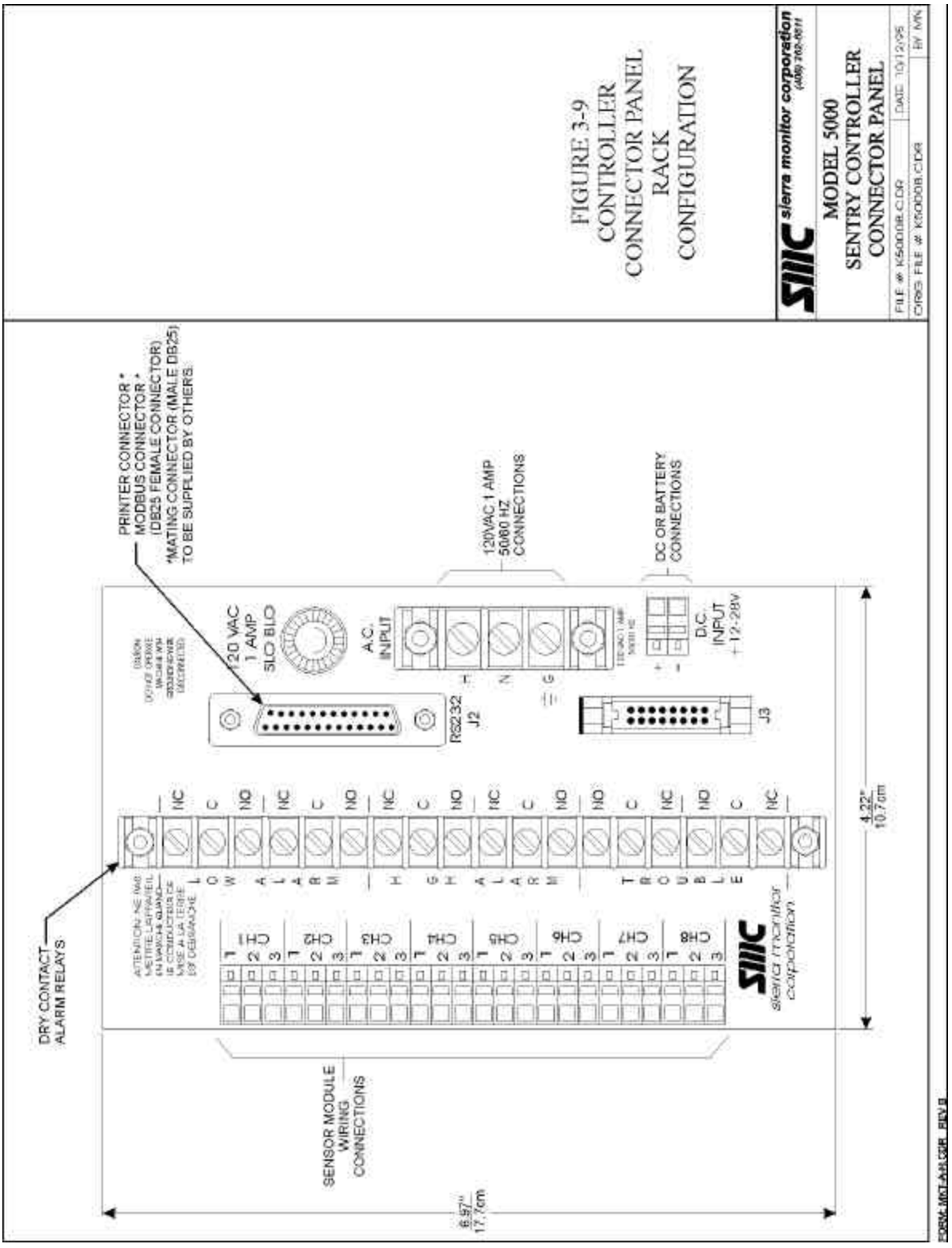


Figure 3-9
Controller Connector Panel - Rack Configuration

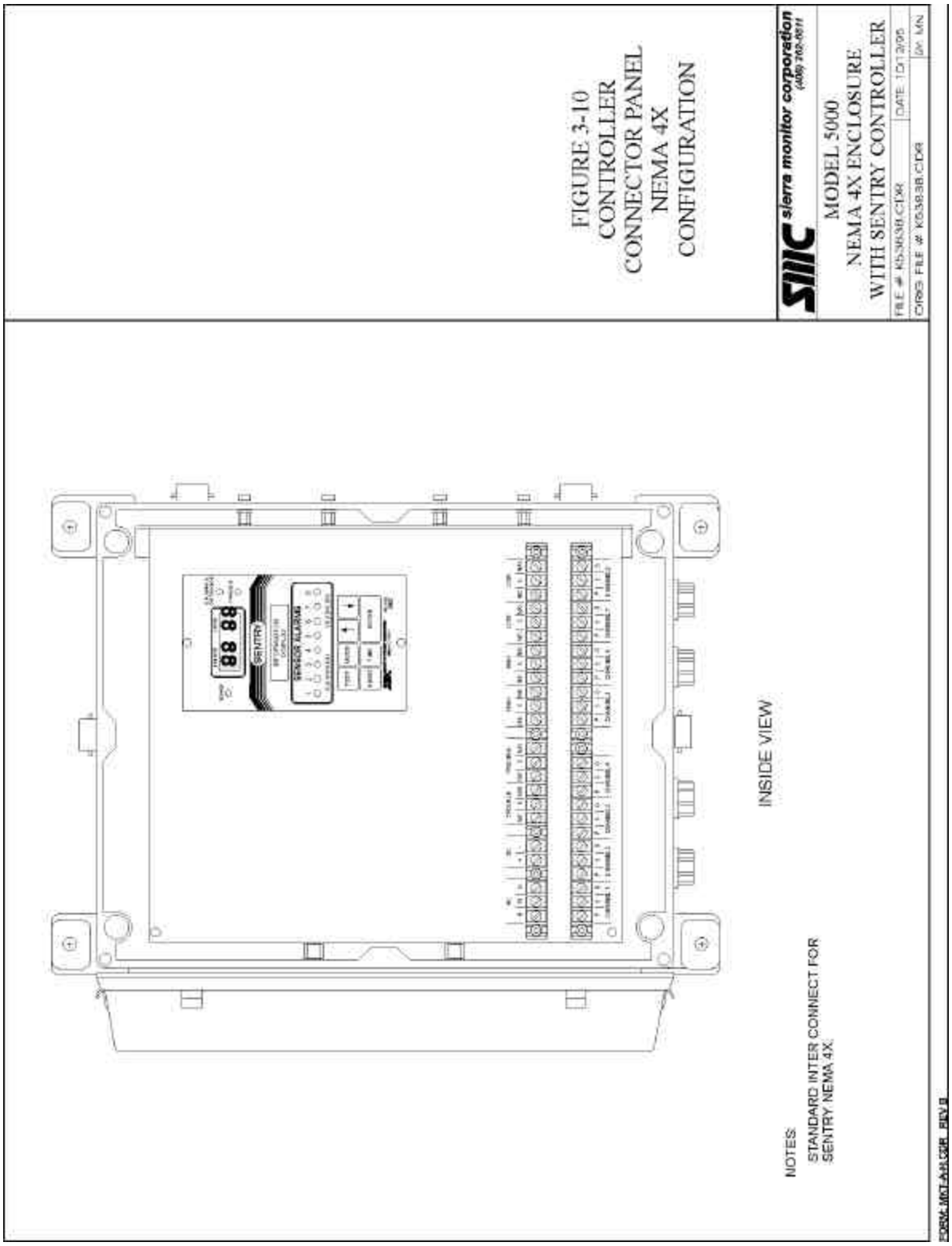


Figure 3-10
Controller Connector Panel - NEMA-4X Configuration

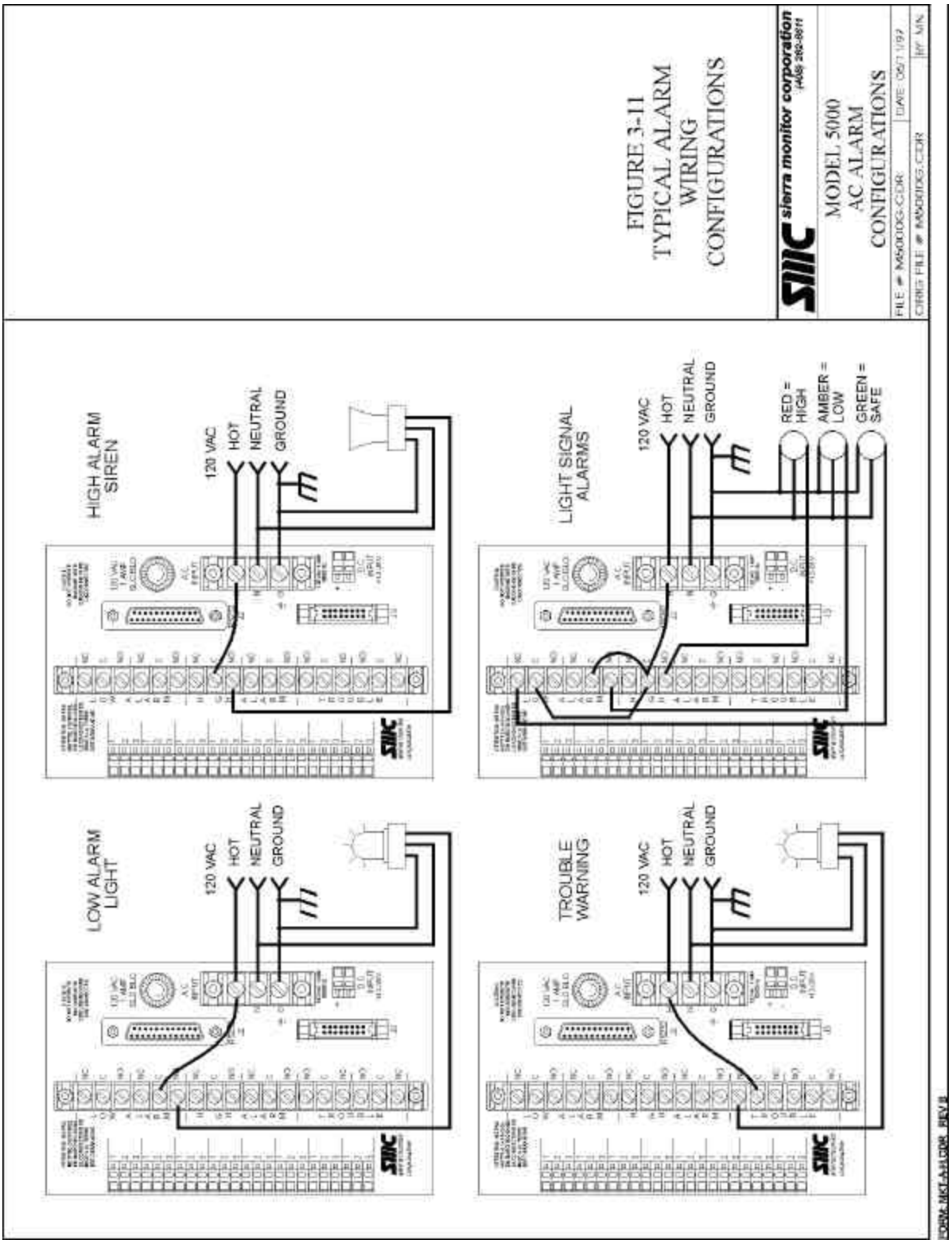


Figure 3-11
Typical Alarm Wiring Configuration

4. CONFIGURATION PROCEDURE

4.1 INTRODUCTION

Sentry is operated via the seven keys on the front panel. Operation includes initial set-up, periodic calibration, recall of history, and changes to configuration.

Certain procedure and message conventions are used to provide consistency. A knowledge of these conventions will aid in understanding of the set-up and operation steps.

The **UP** and **DOWN** arrow keys change information displayed on the alpha-numeric (lower) display. Changes made by using the arrows are not "implemented" until the **ENTER** key is pressed.

The **ENTER** key is used to access the selected activity or to enter selected data or status information into the controller memory.

When any of the four activity keys **TEST**, **RESET**, **TIME**, **MODE** are depressed the **SENSOR/LEVEL** display is cleared and the activity information is displayed on the alpha-numeric display.

The messages **PRESS ENTER TO** or **ENTER TO** indicate that the selected activity can be accessed via the **ENTER** key.

The message **USE ARROWS/ENTER** indicates that module numbers or other variables can be changed with the arrows prior to entering the activity with the **ENTER** key.

The message **PRESENT CONFIG** is used in system responses during **CHECK** activities. Variables displayed as **PRESENT CONFIG** can be changed via the **CHANGE** mode.

Positive response messages such as **SYSTEM RESET COMPLETE** are displayed for 1.5 seconds to confirm that the activity has been completed.

Activity names are displayed bracketed by "<" and ">" signs.

Normal operation is the condition where the change and calibrate light is off and the display cycles continuously between all active module numbers.

If the **ENTER** key is pressed once during normal operation the display locks onto the current module number and can be advanced using the **UP** and **DOWN** arrow keys. When the display is locked onto one module number the gas type and units display is shown in round parenthesis "( )".

If any module is force calibrated, the gas type and units display for that module number is shown in square parenthesis "[ ]".

The message **USE ARROWS/ENTER** indicates that the arrows can be used to change the module number or other data on the second line and the **ENTER** can be used to access the selected activity or module number.

Successive presses of any one of the four activity keys will cycle through each option available and will return the system to the normal operating mode..

When any activity key cycle has been started and not completed the remaining activity keys are disabled except that the **RESET** key can be used to return the system to normal **OPERATE** mode.

When the system is in the **CHANGE** mode the **CALIBRATE OR CHANGE** light is ON.

4.2 START-UP PREPARATION

The worksheet, Figure 4-1, will aid in understanding the type of information required to set-up the system, it should be completed prior to system power-up.

MODULE ADDRESS	LOCATION	SENTRY CHANNEL	GAS TYPE	LOW	HIGH	LATCH	SCALING FACTORS	SENSOR SERIAL #
1								
2								
3								
4								
5								
6								
7								
8								

Figure 4-1
System Configuration Worksheet

NOTES

1	Module Address	Dip switch setting for each sensor module
2	Location	Describe the physical location of the module
3	Sentry Channel	Log the channel number to which the module is wired
4	Gas	Log the name of the gas which is to be detected
5	Low Alarm	Enter the value for the low alarm Default values are: H_2S: 10 PPM, Combustible 20% LEL, Oxygen 19.5%, Toxic 10 PPM
6	High Alarm	Enter the value for the high alarm Default values are: H_2S: 20 PPM, Combustible 60% LEL, Oxygen 16.5%, Toxic 20 PPM **Note: Combustible Alarms cannot be set greater than 60% LEL.**
7.	Latch L?/H?	Determine if any module will require a latching alarm and write "Y" in the appropriate position (e.g.: N/Y indicates a non-latching low alarm and latching high alarm, Y/Y indicates both relays will be latching). The system "defaults are N/Y. **Note: Combustible High Alarms are Latching Only**
8	Factors	For H_2S (5100-01): Record the three (three digit) numbers which are written on the sensor connector on each sensor. For Combustibles: If the gas to be detected and the gas to be used for calibration are the same write "100". If the calibration gas is methane and a different gas is to be detected select the correct factor from XXXXX. **Note: Combustible Gas Scaling Factors are not FMRC approved.** No factors are required for Oxygen or Toxic sensors.
9	Sensor Serial Number	Record the serial number from the label on the connector of each sensor

4.3 CONFIGURATION INSTRUCTIONS

Sentry controllers which are components of complete systems are factory configured and generally do not require changes prior to being placed in service.

Sentry controllers which have not been factory configured can be placed into operation with default values for all configuration parameters by using the diagnostic code "0021" described in Section 8.3 of this manual.

The following are step-by-step configuration instructions which can be used to customize the operation of the controller for specific applications. After initial configuration the controller can be placed in service or used for training as described in the this section.

If an error is made, or suspected, press the **RESET** key until the display reads <**RESET SYSTEM**> and then press the **ENTER** key, the system will reset and the set-up routine can be re-started.

STEP	KEY	LOWER DISPLAY
1	RESET	<RESET ALARMS>
2	RESET	<RESET SYSTEM>
3	ENTER	SYSTEM RESET COMPLETE
		<UNCALIBRATED>
		Displays continue cycling through each module number. Power light changes from flashing to solid.
4	MODE	<CALIB/CHANGE>
5	ENTER	CHANGE MODE SELECTED Note that if a user entry code has been initiated it must be input here. Change/Calibrate light turns on.
		READ INSTRUCTION MANUAL FIRST
		PRESS ENTER TO CALIB ALL [GGGG] Where GGGG is the gas type.
6	MODE	<CHANGE CALIB>
7	MODE	<CHANGE MODULE>
8	ENTER	USE ARROWS/ENTER
		MODULE # = 1
9	ENTER	GAS TYPE : GGGG
10	ENTER	# 1 GGGG IS: ON
11	ENTER	LO ALM: NONLATCH Use arrows to change.
12	ENTER	HI ALM: LATCH Use arrows to change.
13	ENTER	HIGH ALARM = XX Use arrows to change each digit.
14	ENTER	LOW ALARM = XX Use arrows to change each digit.
15	ENTER	FACTOR = 100 Linearizing factors are required for sensor modules 5100-01 (H_2S) . Scaling factors can be used for sensor module 5100-02 (Combustibles)
16	ENTER	MODULE # = 2 Repeat steps 9 through 15 for each module.
17	MODE	<SET USER CODE>
18	MODE	<CHANGE PRINTER> or <CHANGE MODBUS> Displays only if printer or MODBUS option is installed.
19	MODE	CHANGE GAS TAG
20	MODE	CHANGE MOD TAG
21	MODE	CHANGE ENG UNITS
22	MODE	<OPERATE MODE>
23	ENTER	OPERATE MODE SELECTED
24	TIME	<CHECK HISTORY>
25	TIME	<HISTORY REPORT> For printer option only.
26	TIME	<SYSTEM REPORT> For printer option only.
27	TIME	<STATUS REPORT> For printer option only.
28	TIME	<SET DATE & TIME>
29	ENTER	D&T MM/DD HH:MM Set each digit using the arrows, then ENTER to advance to the next digit.
28	RESET	H2S PPM Display will scan through all active gas sensor modules.

4.4 SENTRY TRAINING

After the controller is configured use this section in conjunction with the Sentry **MENU**, Table 4-2, and Sentry **FLOWCHARTS**, Figure 4-3 through Figure 4-7 to develop an understanding of keyboard operation.

To begin, press the **RESET** key until the lower display reads **PRESS ENTER TO RESET SYSTEM** then press **ENTER**. The system is now in "normal operate mode". The Sensor/Level display will cycle through each of the module numbers (**CONTINUOUS SCAN**). If any module is indicated as **MODULE OFF** use steps 9 through 15 of Section 4.3 to turn that module **ON**.

In **NORMAL OPERATE** mode Sentry scans all modules in sequence and displays their current readings. For any modules which are not correctly initiated and calibrated the status will be indicated. This scanning sequence is by module number by type. (Type 1 = H_2S solid state, Type 2 = Combustible, Type 3 = Oxygen and Type 4 = all others)

For H2S, Combustible and Toxic modules the upper (Sensor/Level) display indicates the module number and the concentration. The lower display shows the gas tag and the engineering unit.

For Oxygen the upper display indicates the module number and its deficiency status. The lower display will read the oxygen concentration (e.g.: 20.9%).

Table 4-1 indicates display conditions for each module type.

Type	Gas/Status	Upper	Lower
1	**H_2S Normal**	**00**	**H2S PPM%**
2	**Combustible Normal**	**00**	**COMB* %LEL**
3	**Oxygen Normal**	**00**	**OXY 20.9%**
3	**Oxygen Below Normal**	**LO**	**OXY <20.7%**
3	**Oxygen Above Normal**	**HI**	**OXY >21.1%**
4	**Toxic Normal**	**00**	**TOXIC* PPM**

* "COMB" and "TOXIC" gas tags can be modified to any six character tag using CHANGE GAS TAGS.

Table 4-1
Display Conditions

CONTINUOUS SCAN is Sentry's default display mode. To "lock" the display onto one module wait till that module is displayed and press **ENTER**. While the "lock" is in effect the arrows can be used to change to other module numbers. The lock is indicated by "( )" around the top line of the lower display. To return to **CONTINUOUS SCAN** press **ENTER**.

Other user selectable display modes are described later in this manual.

Press the **TEST** button, read the display, then press the **TEST** button again. Repeat until the system returns to the continuous scan display. The two test conditions which are displayed are: <**TEST SYSTEM**> and <**TEST ALARMS**>. Neither of these tests were implemented because the **ENTER** key was not pressed.

To implement the tests, press the **TEST** key once; display will read <**TEST SYSTEM**>. Press the **ENTER** key. Sentry will then step through the following series of displays:

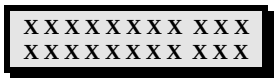
Model number, software level, and traceability descriptors.

Low Alarm Test with relays inactive.

High Alarm Test with relays inactive.

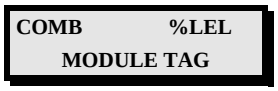
Trouble Alarm Test with relays inactive.

Full Display Test with all display segments and LED's on.



Warm-up Time-out.

Return to normal scan.



Press the **TEST** key twice and the display will read **TEST ALARMS**. Press the **ENTER** key and Sentry will execute **LOW, HIGH & TROUBLE** alarms and then return to the operate mode. During this test the respective alarm relays will throw. The user code described later in this manual can be used to protect against unauthorized activation of the alarm relays.

Read the Sentry menu, Table 4-2 to find the **TEST** key. It should now be easy to understand that each step in the menu can be implemented by using the enter key or bypassed by continuing to press the activity key. This process is further described in the flowcharts. Figure 4-3 through Figure 4-7.

4.5 SENTRY MENU

Table 4-2 describes the primary activities that can be accessed via the Sentry keyboard. Each activity which involves sub-menu selection is identified by an asterisk Menu selections which refer to printer are standard in eight channel systems, optional in two and four channel systems. The MODBUS option replaces Printer software.

Menu selections are further described in the following paragraphs. Press the respective key to select the sub-routines and press the **ENTER** key to access them. Follow the sequence in the flow charts.

MENU KEYS			
TEST	**RESET**	**TIME**	**MODE**
SYSTEM	**ALARMS**	**HISTORY**	**CALIBRATE/ CHANGE**
ALARMS	**SYSTEM**	**PRINT HISTORY**	**SELECT SCAN**
	HISTORY	**PRINT SYSTEM REPORT**	**CHECK CALIB**
		PRINT STATUS REPORT	**CHECK MODULE**
		SET DATE & TIME	**CHECK PRINTER**

Table 4-2
Sentry Primary Menu Selection

4.5.1 TEST KEY

The **TEST KEY** activities are described in the training exercise in Section 4.4.

4.5.2 TIME KEY

4.5.2.1 CHECK HISTORY

PRESS ENTER TO CHECK HISTORY

The first display in the **CHECK HISTORY** menu shows the system clock date and time **D/T** on the first line. The second line shows the date and time at which the history information was last cleared **HR.**

The second display indicates the last time the power was interrupted. **PD** is the Power Down time and **PU** is the Power Up time. After any interruption of power to the controller the **POWER** light will flash until the system is reset.

The third display begins the sequence in which the history for any module can be recalled. The display will indicate **MODULE NUMBER 1.** Successive presses of the **ENTER** key will result in display of:

- Date and time of the last low alarm **LA** and high alarm **HA**
- Highest concentration **HC** with date and time
- Lowest concentration **LC** with date and time
- Last Calibration with date and time.
- Last logged error with date and time (if applicable).

At the end of the sequence the display will indicate the next module number and will continue to automatically increment as the data is recalled. If the data from a particular module is not required press the **UP** arrow to manually increment the number. As this recall sequence is a continuous "loop", press the **RESET** key at any time to return to the **OPERATE MODE**.

The history information may be collected on a continuous basis without clearing the data because only the last occurrence of each level will be retained. History data can be cleared by using the **RESET HISTORY** menu selection. Error messages are cleared by using the **RESET SYSTEM** menu selection.

4.5.2.2 PRINT HISTORY

PRESS ENTER TO PRINT HISTORY

When the printer option is installed in Sentry this menu choice can be used to print all the module history.

4.5.2.3 PRINT SYSTEM

PRESS ENTER TO PRINT SYSTEM

When the printer option is installed in Sentry this menu choice can be used to print a complete system configuration report.

4.5.2.4 PRINT STATUS

PRESS ENTER TO PRINT STATUS

When the printer option is installed in Sentry this menu choice can be used to print a status report which indicates the present status and concentration for each module.

4.5.2.5 SET DATE/TIME

PRESS ENTER TO
SET DATE & TIME

Set the Sentry clock in the same manner as any digital clock is set. The format is **MM/DD HH:MM**, with the hours set in military time (24 hours). If a user code has been set-up it will be required prior to changing the clock. The cursor is initially under the month **MM,** set the correct month with the arrow and press **ENTER** to advance to the day **DD.** Repeat the process to set day, hour and minute. When the time is correct, press **RESET** to exit.

4.5.3 RESET KEY

4.5.3.1 RESET ALARMS

PRESS ENTER TO
RESET ALARMS

The **RESET ALARMS** activity will reset any latched alarm relay when the condition which caused the alarm has been corrected. If **RESET ALARMS** is selected before the correction has been made, the respective LED and relay will remain in the alarm condition.

4.5.3.2 RESET SYSTEM

PRESS ENTER TO
RESET SYSTEM

The **RESET SYSTEM** activity will reset all trouble conditions. If the trouble still exists the condition will re-display immediately. **RESET SYSTEM** can be used at any time to return the system to normal operation and clear all error messages.

4.5.3.3 RESET HISTORY

PRESS ENTER TO
RESET HISTORY

The **RESET HISTORY** activity clears all module history information which is normally accessed via the **TIME** key. The highest concentration is set to **00** and the lowest concentration is set to **HI**. The history reset date/time is set to the current system date/time. Sentry will immediately begin collecting new history information. When a user code has been installed the code will be required before the history can be reset.

4.5.3.4 OTHER USE OF RESET KEY

During **CHANGE** activity if the **RESET** key is pressed once the display will return to its normal scan operation but the **CHANGE/CALIBRATE** light will remain on. The **MODE** key can then be used to return to configuration activities without re-entering a user code. This action is helpful if module scan information is required during a configuration step.

4.5.3.5 EXTERNAL RESET KEY

The external **RESET** key on NEMA units implements **RESET ALARMS** and eliminates the need to open the enclosure for this purpose.

4.5.4 MODE KEY - CALIB/CHANGE

The first menu choice under the **MODE** key is **CALIB/CHANGE** when the **ENTER** key is pressed the "Calibrate or Change" light will turn on and the display will indicate **ENTER TO CALIB (GAS TYPE) (SPAN VALUE).** After initial system set-up the **CALIBRATE OR CHANGE** activity should be protected via the user access code described in Section 7.3.4. When the user code has been installed only authorized operators may access this activity.

4.5.4.1 CALIBRATE

ENTER TO CALIB
COMB 50% LEL

The calibration activity is described in detail in the next chapter.

4.5.4.2 CHANGE CALIB

PRESS ENTER TO
CHANGE CALIB

The change calibration activity is described in detail in the next chapter.

4.5.4.3 CHANGE MODULE

PRESS ENTER TO
CHANGE MODULE

Each module in the installation must be initialized via the change module activity. The **CHANGE MODULE** activity is detailed in step by step form in Section 4.3 steps 6 through 18. The **CHANGE MODULE** activity should also be used after any sensor or module has been replaced to insure that the correct alarm limits and factors have been established.

4.6 SET USER CODE

PRESS ENTER TO SET USER CODE

To avoid unauthorized access to the configuration activity the **USER CODE** should be set as soon as the Sentry has been put on line. User codes are described in Section 8.3. Special diagnostic routines, also accessible via the user code, are describe in the same section.

4.6.1.1 CHANGE PRINTER / MODBUS

PRESS ENTER TO CHANGE PRINTER CHANGE MODBUS

The **CHANGE PRINTER** or **CHANGE MODBUS** sub menu will appear if printer or MODBUS software is installed on the Sentry. Printer and MODBUS software is described in Section 8.5.

4.6.1.2 CHANGE GAS TAG

PRESS ENTER TO CHANGE GAS TAG

The system default **GAS TAG** list contains eight common toxic gas names. (CO, H_2S, CL_2, SO_2, NO_2, HCL, H_2, NH_3). The gas tag names, and their corresponding engineering units can be changed. At the menu prompt press **ENTER** and the first gas tag will appear. Press **ENTER** to begin edit, or press **ARROW** to select a different gas tag.

Edit the tag by pressing the **ARROW** unit the correct character is selected, then **ENTER** to advance to the next character. The gas tag allows six characters, the engineering units allow four characters.

4.6.1.3 CHANGE MODULE TAG

PRESS ENTER TO: CHANGE MOD TAG

The system default **MODULE TAGS** are blank for all modules unless changes have been ordered through the enhancement package. Module tags can be changed or edited.. At the menu prompt press **ENTER** and the first module number will display. Press **ENTER** to begin edit, or press **ARROW** to select a different module number.

Edit the tag by pressing the **ARROW** unit the correct character is selected, then **ENTER** to advance to the next character. The module tag allows sixteen characters,. It is recommended that shorter tags be centered by leaving leading blank.

4.6.1.4 OPERATE MODE

PRESS ENTER TO: OPERATE MODE

When the **OPERATE MODE** is selected by pressing **ENTER** the Change/Calibrate light turns off and Sentry returns to the pre-selected scanning mode.

4.6.2 MODE KEY - OTHER

If the first **MODE** key activity **CALIB/CHANGE** is not required the following menu selections can be accessed by successive presses of the **MODE** key:

4.6.2.1 SELECT SCAN

PRESS ENTER TO SELECT SCAN

Select the controller scan mode during normal operation. This selection only affects the display and does not change the alarm or relay activity. The scan mode can be selected by successive presses of the **ARROW** key. and implemented by implemented by pressing the **ENTER** key.

1. **HIGHEST MODULE**: Sentry will find the highest reading module and will display only that module until another module exceeds the first level. Under certain conditions the display will cycle from one module to another in this mode, those conditions are:
   - More than one module at the same level.
   - More than one module type in use (when two types are in use the highest of each type will display alternately.
   - All modules in alarm condition will display.
   - Any module which is uncalibrated, off, or in trouble.
2. **CONTINUOUS**: The display continuously cycles through all modules. When two types of module are in use all "Type 1" (H_2S) will be displayed, followed by all "Type 2" (CH_4) etc..
3. **SAFE SCAN**: When all modules are below their respective alarm level Sentry will display a "- -" on the upper display and **CONDITION SAFE** on the lower display. When any module(s) exceeds it's alarm level that module's information will display. Modules which are uncalibrated, off or in trouble will also display.

4.6.2.2 CHECK CALIB

```
PRESS ENTER T O:
CHECK CALIB
```

The present calibration parameters can be check by successive presses of the **ENTER** key. These include the gas type, full scale, concentration of calibration gas, the number of days between calibrations and the status of global calibrate.

4.6.2.3 CHECK MODULE

```
PRESS ENTER TO:
CHECK MODULE
```

Any module number can be selected and configuration information for that module recalled. Select the module number using **ARROWS**, then step through the configuration information using the **ENTER** key.

> ***NOTE***
> ***MEASUREMENT OVERRANGE - When Combustible concentration exceeds the 99% LEL range of the instrument, the controller displays "HI".***

4.6.2.4 CHECK PRINTER

```
PRESS ENTER T O:
CHECK PRINTER
```

Press **ENTER** to review printer configuration.

SENTRY KEY BOARD

Ts = TEST R = RESET M = MODE T = TIME ^ = ARROWS E = ENTER

RESET KEY	
Reset Alarms	R E
Reset System	R R E
Reset History	R R R E

TIME KEY	
Check History	T E
Printer History	T T E
Print System	T T T E
Print Status	T T T T E
Set Date & Time	T T T T T E

TEST KEY	
Test System	Ts E
Test Alarms	Ts Ts E

MODE KEY - PASSIVE	
Change/Calib	M E
Select Scan	M M E
Check Calib	M M M E
Check Module	M M M M E

MODE KEY - ACTIVE	
Change/Calib	M E
Calibrate □	E
Change Calibrate □	M E
Change Module □	M M E
Set User Code □	M M M E
Change Printer □	M M M M E
Change Gas Tag	M M M M M E
Change Module Tag	M M M M M M E

□ CHANGE CALIB	
Gas Type	^^ E
Full Scale	^^ E ^^ E ^^ E
Calib Concentration	^^ E ^^ E ^^ E
Calib Frequency	^^ E
Global Calib	^ E

□ GLOBAL CALIBRATION	
Gas Type (Concentration)	^ E
Enter to Span	E
Apply Zero Gas	E
Enter to Span	E
Apply Span Gas	E
Operate Mode (After timer)	E

□ LOCAL CALIBRATION	
Gas Type (Concentration)	^ E
Apply Zero & Span	E
Operate Mode (After timer)	E

□ CHANGE MODULE	
Module #	^ E
Gas Type	^ E
Module On/Off	^ E
Low Alarm Latch/Non	^ E
High Alarm Latch/Non	^ E
High Alarm Value	^ E ^ E ^ E
Low Alarm Value	^ E ^ E ^ E
Scaling Factors	^ E ^ E ^ E

□ SET USER CODE	
User Number	^ E
Entry Code	^E ^E ^E ^E

□ CHANGE PRINTER	
Printer On/Off	^ E
Controller ID	^^ E
Status Frequency	^^ E
Print History	^ E
Gas Type	^^ E
Min. Conc.	^^ E
Conc. Change	^^ E
Gas Type	^ E
Exit	R

Figure 4-2
Sentry Keyboard - Quick Help

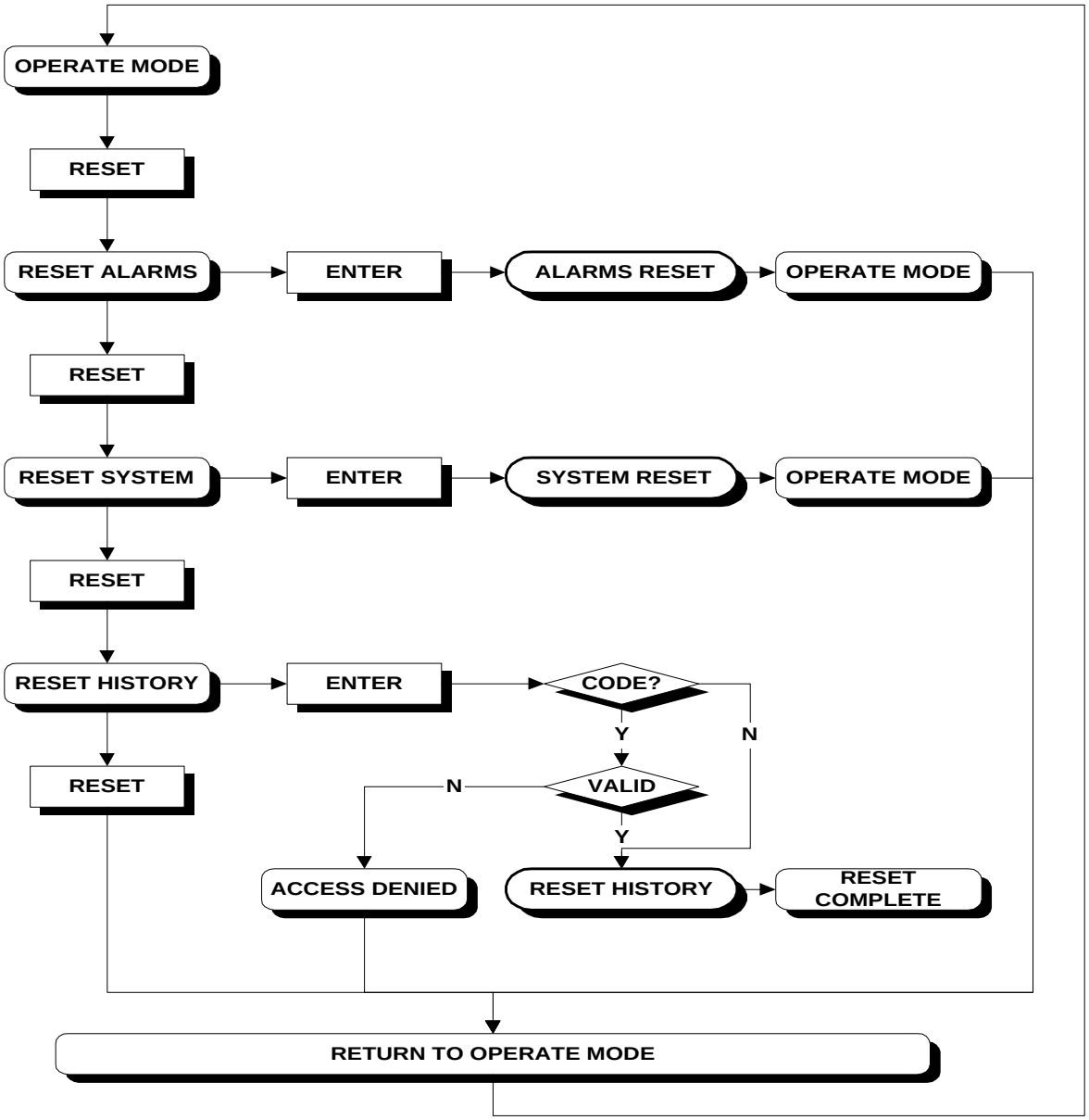


Figure 4-3
Sentry Reset Key Flow Chart

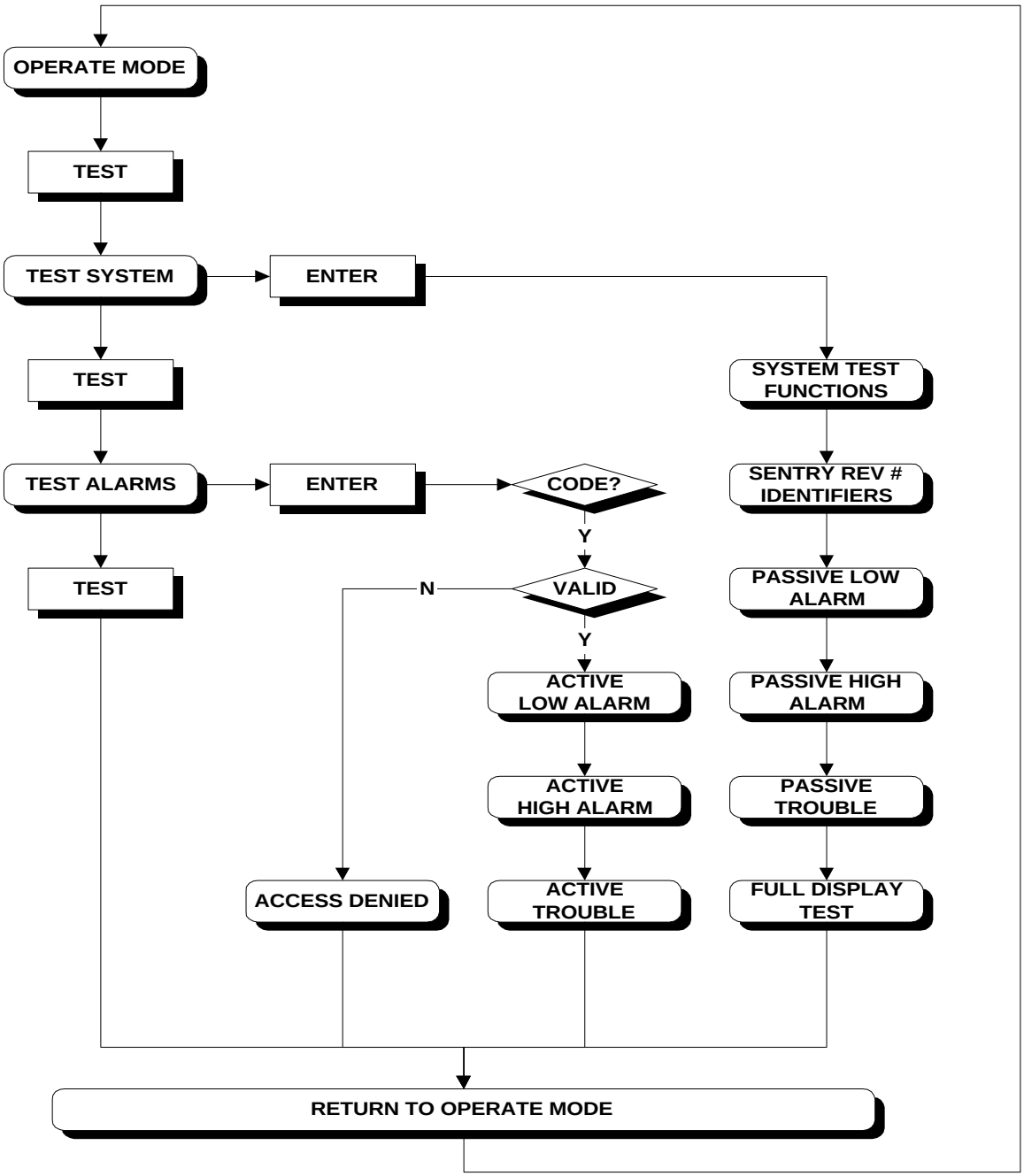


Figure 4-4
Sentry Test Key Flow Chart

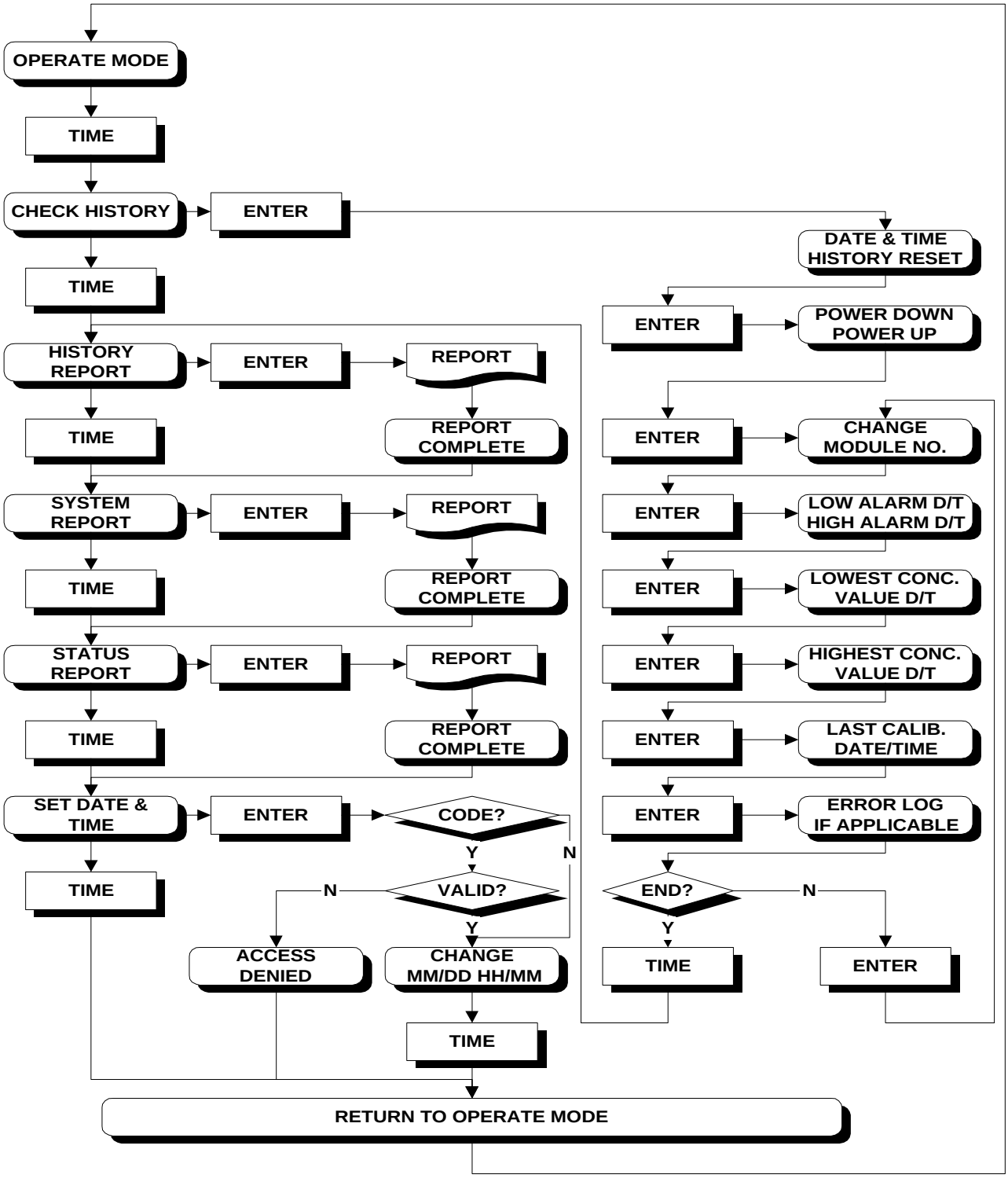


Figure 4-5
Sentry Time Key Flow Chart

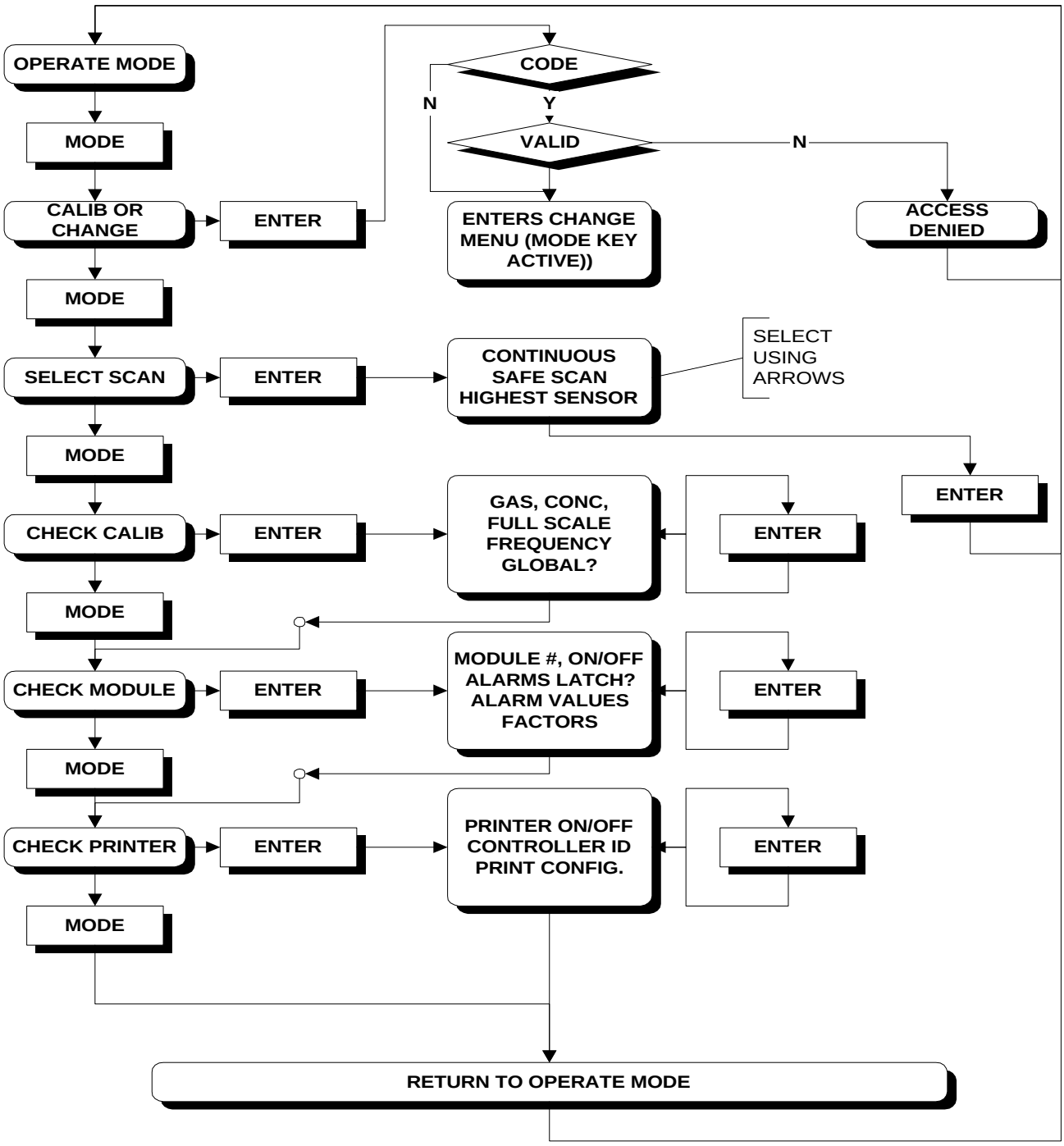


Figure 4-6
Sentry Mode Key (Passive) Flow Chart

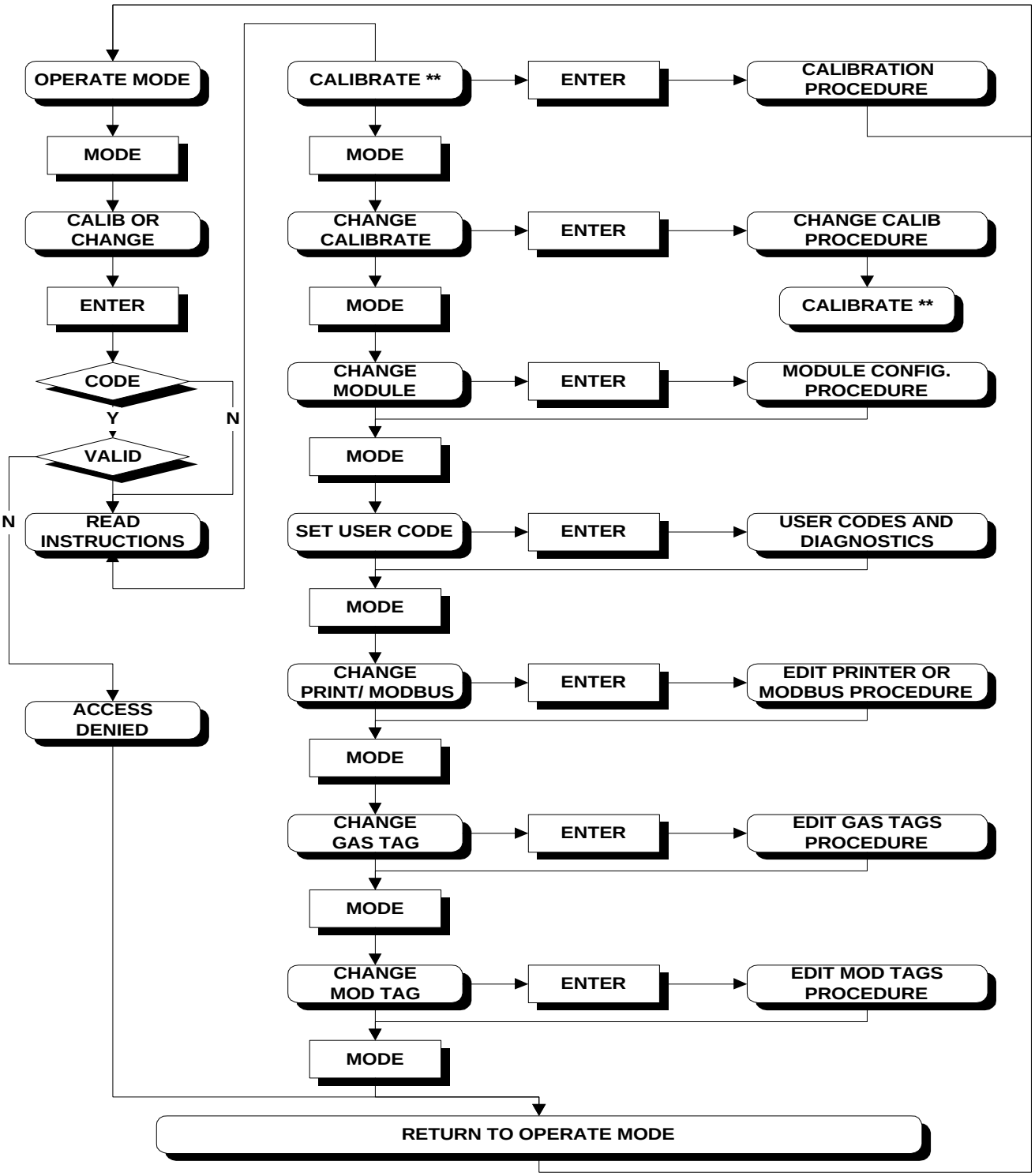


Figure 4-7
Sentry Mode Key (Active) Flow Chart

5. CALIBRATION

5.1 SENTRY CALIBRATION - AN OVERVIEW

Calibration is a simple three step process:

1. Initiate calibration via the controller keyboard.
2. Apply zero gas (if required) and then span gas to the sensors.
3. Close the calibration via the controller keyboard.

Calibration parameters are configured via the **CHANGE CALIB** activity and are saved by Sentry for future calibrations.

During calibration Sentry "peak holds" the sensor signal output for zero and span gas and then uses those values to construct a curve for continuous reference during normal gas monitoring.

There are two alternative calibration methods, Global Calibration and Local Calibration.

5.1.1 GLOBAL CALIBRATION

When Global Calibration is selected, the Sentry controller collects zero and span value data from all sensor modules eligible for calibration based on a global keyboard command. It is not necessary to calibrate all the sensors, those which do not receive span gas will be rejected automatically.

The operator presses the **ENTER** key to initiate, and complete, collection of the zero value and then the span value. Calibration gas may be delivered to the sensor module in a variety of methods dependent upon the accessibility of the sensor.

The benefits of Global Calibration are:

- Magnetic calibration head not required.
- All "zero's" can be set at one time.

Global Calibration is particularly useful when:

- The sensor is in a position which is difficult to access, because a calibration gas delivery tube can be installed to a more accessible location.
- The magnetic head is not available or the magnetic switch in one of the sensors is not functioning.

5.1.2 LOCAL CALIBRATION

When Global Calibration is turned off, the Sentry controller collects zero and span value data from each sensor module eligible for calibration based on a local command at the module.

Calibration gas is delivered through a magnetic fitting which causes a switch in the sensor to command the controller to remember the module output. The procedure calls for the magnetic cap to be applied twice (zero first, span second) except that the magnet is applied only once for oxygen modules.

The benefits of Local Calibration are:

- Individual modules can be calibrated while others remain on line.
- Time savings when sensors must be exposed to zero air due to the environment.

Local Calibration is particularly useful when:

- Plant operating procedures demand that some modules remain on line while others are being calibrated.

5.2 CALIBRATION INITIALIZATION

5.2.1 MODULES

Before any module can be calibrated it must be initialized via the **CHANGE MODULE** activity. Initialization includes turning the module on, setting the alarm levels and setting the factor(s). This activity is described in step by step form in Section 4.3 steps 6 through 18. If a module is not initialized, an error prompt **INITIALIZE MODULES FIRST** will display when calibration is attempted.

NOTE
The following calibration instructions are applicable to controllers with version 6.xx firmware. For earlier version firmware (example 4.2) refer to the Instruction Manual furnished with that controller. To determine the firmware version installed in any Sentry controller, press TEST, ENTER and observe the firmware version number on the lower LCD screen.

NOTE
If any sensors are not previously calibrated use Diagnostic Code 0020 or 0021 to force calibration prior to performing the normal calibration procedure. See Section 8.3.5.

5.2.2 CALIBRATION PARAMETERS

Use the **CHANGE CALIB** menu to configure calibration parameters as follows: Calibration parameters remain in Sentry memory until changed by the operator, they do not require initiation at every calibration

Step	Activity	Display
1	Select **CHANGE CALIB** menu	**PRESS ENTER TO <CHANGE CALIB>**
	Use **MODE** key to select **CHANGE CALIB**	
2	Select Gas Type	**USE ARROWS/ENTER GAS TYPE: COMB**
	Sentry displays the last gas type which was calibrated. Use the arrow keys to change the type. Press **ENTER** to continue to the next parameter	
3	Edit Full Scale	**USE ARROWS/ENTER FULL SCALE = 100**
	If the full scale value is set above 999, the display will default percent full scale (%FS). (Alarm values must be set using PPM, not %FS.) Press **ENTER** to continue to the next parameter.	
4	Edit Span Gas Concentration	**USE ARROWS/ENTER CALIB CONC = 050**
	Use arrow keys to set the span gas concentration to match the concentration of gas to which the sensors will be exposed. Press **ENTER** to continue to the next parameter	
5	Edit Calibration Frequency	**USE ARROW/ENTER CAL FREQ =30 DAYS**
	Use the arrow keys to set the number of days till the next calibration. Sentry will use this number to count down to the next calibration and display "**CALIBRATION OVERDUE**". Press **ENTER** to continue to the next parameter. The calibration overdue message is a notification only and does not cause the module to go out of service. The message can be suppressed by setting the calibration frequency to "00" days at the time of calibration	
6	Select Calibration Method	**USE ARROWS/ENTER GLOBAL CAL ON**
	Use the arrow keys to turn Global Calibration ON for Global Calibration or OFF for Local Calibration.	

5.3 CALIBRATION PROCEDURE

5.3.1 CONTROLLER SET-UP

Use the **CALIB** menu to initiate the calibration session at the controller.

Step	Activity	Display
1	Select **CALIBRATION** activity	**PRESS ENTER TO <CHANGE CALIB>**
	From normal operate mode, press **MODE** and **ENTER** to access the calibration activity.. (If a user code has been set in the system it must be input to access the CALIB/CHANGE activity. See Section 8.3.3).	
	Successive Displays.	**CALIB/CHANGE SELECTED**
	Successive Displays	**READ INSTRUCTION MANUAL FIRST**
	Select Gas Type	**ENTER TO CALIB COMB 50% LEL**
	If the gas type is not correct press the **ARROW** until the correct gas type and concentration is displayed. Use **CHANGE CALIB** menu selection to change span gas concentration. (See Section: 5.2)	
3A	Initiate Calibration (Global)	**ENTER TO ZERO 1 2 3 4 5 6 7 8**
	If the display is similar to this example, the controller is configured for Global Calibration. Continue to Section 5.3.1.1.	
3B	Initiate Calibration (Local)	**APPLY 0 & 50% LEL 1 2 3 4 5 6 7 8**
	If the display is similar to this example, the controller is configured for Local Calibration. Continue to Section 5.3.1.2.	

NOTE
In all calibration examples, the responses for combustible gas are used as an example. Other gases will provide appropriate similar displays.)

5.3.1.1 GLOBAL CALIBRATION

Proceed with the following steps to perform Global Calibration.

Step	Activity	Display
1	Begin **ZERO** value read.	**ENTER TO ZERO** **1 2 3 4 5 6 7 8**
	Press **ENTER** to start the controller recording the zero signal value for all modules of the selected gas type.	
2	Complete **ZERO** value read.	**APPLY ZERO GAS** **ENTER WHEN DONE**
	The upper display will cycle through all the applicable module numbers with "**00**" displayed as the level. • Example "1. 00", "2 00" etc. • If any module has not been previously calibrated the "00" will be replaced by a "--". • If any sensor is not known to be in clean air at this time, go to each such sensor which is to be calibrated and deliver clean air at 100 cc/min for three minutes using the apparatus in Section 5.3.2. Wait until the display cycles through all module numbers. Press **ENTER** to complete the zero read and the display will advance to the span prompt.	
3	Begin **SPAN** value read	**ENTER TO SPAN** **1 2 3 4 5 6 7 8**
	Press **ENTER** to begin the span process. The top display begins to cycle through all sensor module numbers which are configured for the selected calibration gas. Each module number will show a "period" immediately after the number and a numerical concentration display as in the following example. **[1. 00] [2. 00].**	
4	Apply **SPAN** gas.	**APPLY 50% LEL** **ENTER WHEN DONE**
	Apply calibration gas to each sensor which is to be calibrated using the apparatus in Section 5.3.2. Use magnetic or non magnetic calibration gas delivery fitting. During the time calibration gas is being delivered the upper display on the controller will continue to cycle through all applicable module numbers. The module responding to gas will generally show an increasing reading on each pass.	
5	Complete **SPAN** gas	**CALIB COMPLETE**
	application - no errors	**PLEASE WAIT 3:00**
	When all modules have received calibration gas press **ENTER** to indicate completion of the span process. If all modules have been successfully calibrated the controller will begin the three minute time delay before placing modules back on line	
6	Error Conditions - Low Sensitivity	**LOW SENSITIVITY** **1 2 3 4 5 6 7 8**
	If any modules were missed, or if any sensors failed to respond correctly to the calibration gas the low sensitivity message will identify those sensor module numbers. If calibration of the module was attempted, note the number and plan corrective action as described in Section 7.	
7	Error conditions - Not Calibrated	**NOT CALIBRATED** **1 2 3 4 5 6 7 8**
	Press **ENTER** again. If all modules have been successfully calibrated the controller will begin the three minute time delay before placing modules back on line. If any modules were displayed as **LOW SENSITIVITY**, they will be displayed again as **NOT CALIBRATED**. Press **ENTER** to acknowledge	
8	Return to Operate Mode	**PRESS ENTER TO OPERATE MODE**
	When the time delay is complete the display will read **PRESS ENTER TO OPERATE MODE** Press **ENTER** and the procedure is complete. Repeat the process as necessary to recalibrate modules or to calibrate other gases. Remove all calibration apparatus from sensors.	

5.3.1.2 LOCAL CALIBRATION

Proceed with the following steps to perform Local Calibration

Step	Activity	Display
1	Apply **ZERO** and **SPAN** gas to each sensor.	**APPLY 0 & 50% LEL** **1 2 3 4 5 6 7 8**
	Apply zero and span calibration gas to each sensor for which calibration is required. (Sensors which are not exposed will be reported as "Not Calibrated" and will retain their prior calibration status). The calibration gas must be applied via the magnetic delivery head supplied with the Sentry system. 1. Remove the rainshield (where applicable). 2. Using the apparatus in Section XXX, thread the calibration head into the sensor assembly. At this time the controller top display will lock onto this module number. If the ambient environment is one which has been determined to be clean at the time of calibration, leave the magnetic head in place for 30 seconds and then remove. If the ambient environment is potentially contaminated, bleed clean air through the calibration head for two minutes at 100 cc/min and then remove the air and the calibration head. 3. Wait thirty seconds after the magnet is removed. During this period the controller will stop displaying the module number and will show dashes "- -" on the upper display. 4. Thread the calibration head into the sensor assembly a second time. The controller will again lock onto the number for that module but will add a period immediately following the number. Bleed calibration span gas through the magnetic head at 100 cc (or as required for permeation tube calibrator). The controller will display the concentration which would be determined based on the prior calibration of the module 5. Remove the gas and the calibration head, replace the rainshield and repeat the process for the next module. As each sensor is correctly exposed to calibration gas the respective module number will disappear from the display making it possible, at any time, to read which modules have not been exposed to calibration gas.	
2	Gas application complete - no errors	**CALIB COMPLETE** **PLEASE WAIT 3:00**
	When all modules have received calibration gas press **ENTER** to indicate completion of the span process. (Required only if module numbers remain on the display) Press **ENTER** again. (Required only if error messages appear.) If all modules have been successfully calibrated the controller will begin the three minute time delay before placing sensor modules back on line.	
3	Error Conditions - Low Sensitivity	**LOW SENSITIVITY** **1 2 3 4 5 6 7 8**
	If any sensors failed to respond correctly to the calibration gas the low sensitivity message will identify those sensor module numbers. Note the number and plan corrective action as described in Section 7.	
4	Error Conditions - Not Calibrated	**NOT CALIBRATED** **1 2 3 4 5 6 7 8**
	Press **ENTER** again. Modules which were not attempted, and any modules which were displayed as "LOW SENSITIVITY", will be displayed as "NOT CALIBRATED". Press ENTER to acknowledge Press **ENTER** to acknowledge	
5	Return to Operate Mode	**PRESS ENTER TO OPERATE MODE**
	When the time delay is complete the display will read **PRESS ENTER TO OPERATE MODE** Press **ENTER** and the procedure is complete. Repeat the process as necessary to recalibrate modules or to calibrate other gases. Remove all calibration apparatus from sensors.	

5.3.2 CALIBRATION GAS DELIVERY METHODS

Calibration gas is can be delivered to the sensors via the following delivery devices:

Model 5358-00: Calibration Adapter - used with portable calibrators. - See Figure 5-1

Model 5360-00: Calibration Gas Delivery fitting - permanently installed fitting which allows tubing to be run to a convenient delivery location

5.3.3 SENSOR EXPOSURE TO GAS

Calibration gas must be delivered to the sensor using the flow rate and duration listed in Table 5-1

Model	Gas	Flow	Period
5100-01	H_2S	300 cc/min	3 minutes
5100-02	Combustible	100 cc/min	3 minutes
5100-03	O_2	200 cc/min	3 minutes
5100-04	CO	150 cc/min	3 minutes
5100-05	H_2S	300 cc/min	3 minutes
5100-06	CL_2	300 cc/min	3 minutes
5100-07	H_2	300 cc/min	3 minutes
5100-10	SO_2	300 cc/min	3 minutes
5100-12	NO_2	300 cc/min	3 minutes
5100-13	CO	300 cc/min	3 minutes
5100-16	CO	300 cc/min	3 minutes
5100-19	NO	300 cc/min	3 minutes
5100-21	HCL	1,000 cc/min	10 minutes
5100-22	HCN	300 cc/min	3 minutes
5100-25	NH_3	300 cc/min	3 minutes
5100-26	HF	300 cc/min	3 minutes
5100-27	ETO	1,000 cc/min	3 minutes

Table 5-1
Calibration Gas Flow Rates

5.3.3.1 HYDROGEN SULFIDE

Hydrogen Sulfide gas must be supplied from a permeation tube device or from Sierra Monitor Model 9200 series calibrator.

5.3.3.2 COMBUSTIBLE

For compliance with factory Mutual (FMRC) Approval, the Sierra Monitor Model 1200-26 is the only Approved calibration gas delivery device. Apply 50% LEL methane in air or the calibration concentration of the gas to be monitored at 100 cc/min using Model 5358-00 or 5358-01 Calibration Adapter and Model 5360-00 Gas Delivery Fitting. For calibration with a standard gas and cross reference to a secondary gas, see Appendix D.

NOTE
Cross reference factors are not FMRC approved.

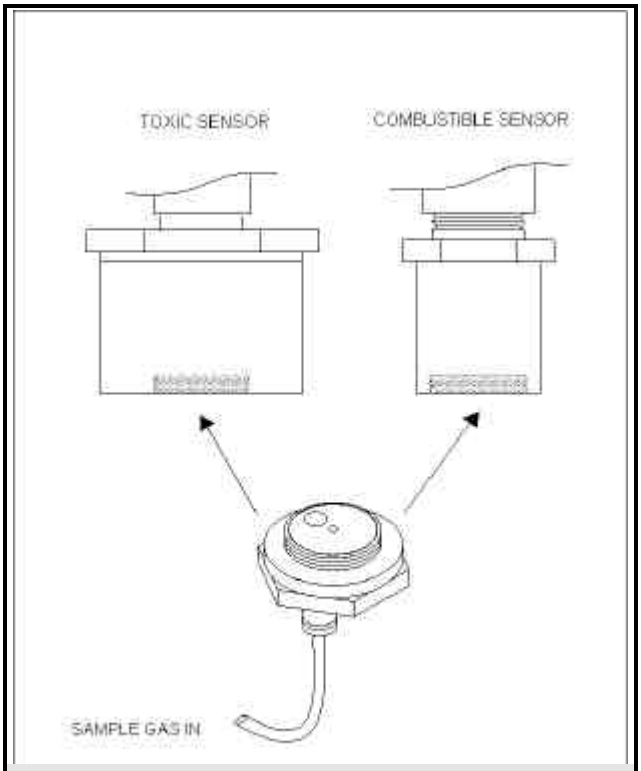


Figure 5-1
Model 5358-00 Calibration Adapter

5.3.3.3 OXYGEN

The calibration procedure is different for Oxygen because zero gas is not required and the sensor will be exposed only to span gas. This is a single point calibration.

- **Either**: Deliver calibration gas (clean air - 20.9% Oxygen through the magnetic head at 100 cc/min for one minute and then remove the air and the calibration head.
- **Or**: If the local air is known to be clean leave the magnetic head in place for one minute and then remove.

5.3.3.4 TOXIC GAS

Toxic Gas for may be delivered from Sierra Monitor Model 9200 series calibrator or from appropriate permeation devices.

6. MAINTENANCE

6.1 MAINTENANCE REQUIREMENTS

The following are the manufacturer's recommendations for periodic maintenance of the Sentry system:

1 **CALIBRATION**: All sensors should be calibrated at a minimum of every 90 days.

> ***NOTE***
> ***FMRC approved combustible gas sensors are required to be calibrated every 90 days.***

2 **BATTERY REPLACEMENT**: The lithium battery for memory retention should be replaced every two years. (See Service)

3 **DUST AND DIRT CONTROL**: When calibration is performed the controller and the modules should be checked visually to determine if dust or dirt build up needs to be removed. This cleaning should be done with dry instruments such as compressed air, cloth wipes or whisk broom.

4 **WIRING OR CABLE CONDITIONS**: Any wiring or cables which are not conduited should be checked once a year for damage to insulation or corrosion of splice or terminal points.

5 **LUBRICATION**: Lubricate metal to metal parts (module lid) periodically.

6 **INSPECTION**: Inspect modules, periodically, for moisture or water accumulation.

7. SERVICE

7.1 OVERVIEW

7.1.1 GENERAL

This section provides service information for Sentry systems which have software version 6.0 and above The section is intended for use by a qualified field technician. Sierra Monitor sales and technical staff are available to assist by telephone at (408) 262-6611, during normal west coast working hours.

7.1.2 INSTALLATION INSPECTION

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

7.1.2.1 CONTROLLER INSTALLATION

- Controller installed in conformance to instruction manual recommendations.
- AC power is correctly grounded.
- Hot AC and relay connections have safety covers installed.
- RS232C cable connection to printer correctly seated and retaining screws tight.

7.1.2.2 CABLING INSTALLATION

- All splices are soldered or via terminal block.
- Cabling is away from sources of electrical noise where possible.
- Terminals P, S, G (or 1,2,3) on channel connector match terminals P, S, G on module. Trace color codes to confirm correct wiring.

7.1.2.3 SENSOR MODULE INSTALLATION

- Module installation in conformance with instruction manual recommendations.
- Modules accessible for calibration.
- Terminations to electronics card clean and correct.

7.1.2.4 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
- Rainshields installed where applicable.

7.1.2.5 STANDARD VOLTAGES

- AC Voltage on AC terminal on connector panel of controller should be 120 VAC (or 220 VAC option) +10%, -15%, 50-60 Hz.
- DC Voltage on DC terminal on connector panel (if used) should be (12 VDC Nominal), 10 to 29 VDC.
- Channel Voltage (power to ground) should be approximately 20 VDC on open channel and approx. 18 VDC on used channel.
- Signal Oscillation on an “in use” channel (signal to ground) can usually be read with a voltmeter at approx. 0 - 6 VDC.

7.1.3 DATA COLLECTION

Sentry can provide a large amount of data which will be helpful during problem solving. If the system has a printer use the **TIME KEY** to select **HISTORY REPORT** and press **ENTER**. When the report is complete **SYSTEM REPORT** will display on the controller, press **ENTER** to print. Diagnostic reporting capability is discussed in Section 7.3.5.

If a printer is not in use, key information can be read and manually recorded by selection of the **HISTORY (TIME KEY), CHECK MODULE** and **CHECK SYSTEM (MODE KEY)** menu choices

7.1.4 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.

Instructions:

1. Take the action described in the "Operator Action" column.
2. If the “CORRECT” result occurs, proceed to the next Operator Action.
3. If the “Incorrect” result occurs find the probable cause and corrective action in the “Reason/ Correction” column.

INSPECTION GUIDE		
OPERATOR ACTION	RESULT CORRECT, Incorrect	*Reason/Correction*
TURN SYSTEM ON	POWER LIGHT FLASHING Power light solid Power light off	 *Turn off & restart* *Check fuse & line voltage* *Check power supply 5v fuse*
RESET/RESET/ENTER	POWER LIGHT SOLID Power light flashing & Top Display = "----" Top display = E1 Top display = E2 Top display blank BOTTOM DISPLAY = "SYSTEM WARM-UP "PLEASE WAIT MM:SS" Random Blank CLOCK COUNTS DOWN TO ZERO No count down ALARM LED'S BLANK Random LED's ON or flashing CALIB LIGHT OFF Calib light on	 *System is re-setting, check for channel cable short* *EPROM error (fatal)* *RAM error (fatal)* *Check +15 & -12V on power supply* *Check display ribbon cable, cold start* *Check line: must be >90 VAC, Check EPROM* *Check ribbon cable to display* *Check -12v on power supply* *Check lithium battery for 2.5V, Check U15* *Reset alarms, If not fixed cold start.* *Reset system*
MODE/ENTER	CALIB LIGHT ON Calib light off	 *Procedure error: retry*
RESET	UPPER DISPLAY CYCLES ALL MODULE NUMBERS Lower display = "No modules installed Not all installed module #'s displayed Lower display shows "Module numbers must be 1-2" or "1-4" TROUBLE LIGHT OFF Trouble light on	 *Check module channel wiring* *Check connector panel seating to controller* *Check +20V between channel pins 1 and 3* *Check +15 & -12V supply* *Check for oscillation on channel pin 2* *Correct above items, replace analog multiplexor* *Check respective cabling including cross-wiring, opens, shorts, leakage* *Check cable length & size versus instruction manual* *Check # of modules on cable run (Max. 4)* *Check modules for correct digital address* *Test modules by swapping working for non-working* *Test modules on short cables at controller to eliminate cable doubts. Modules will only be recognized when controller is in Change/Calib mode* *Controller has 2 or 4 channel software, but module numbers have been set >2 or >4* *Read lower display for error message and check upper display for module # (See specific error message instructions in this manual)*
RESET/RESET/ENTER	TOP DISPLAY CYCLES ALL MODULES WITH "00" CONCENTRATION Some/all modules indicate "no factors" Some/all modules indicate "uncalibrated Lower display reads: "Replace Battery" Lower display reads: "Calib Switch On" Lower display reads: "Diagnostic Scan" Lower display reads: "Fast Error Check" Lower display reads: "Module Off" Lower display reads: "Module Warm-up"	 *Input factors via Change Module and calibrate* *Calibrate* *Check/Replace lithium battery* *Magnetic switch in sensor head is on* *Exit Scan with code "0009* *Exit Scan with code "0009* *Turn module "on" in "Change Module" mode* *Wait for clock to zero*

TROUBLE SHOOTING GUIDE		
Symptom	Cause	*Fix*
CONTROLLER **Top Display: wrong characters displaying 8888 or Blank** **Bottom Display blank** **Diagnostic voltages displayed are more than 10% different from manual** **Keyboard: Wrong action based on key press** **Alarms intermittent or false** **AC fuse blows** **Modules not recognized**	 PROM failure; microprocessor failure; other major component failure; AC brown out -12 VDC failure on power supply; Component failure Respective module PCB (digital board) bad Component failure +15 OR -12 VDC failure or out of adjustment Wiring error or Power Supply or Transformer failure Component failure; wiring defect; power to modules may be low	 *Replace components or send to SMC; Power up and down for brown-outs* *Replace power supply board or factory repair* *Replace module electronics or factory repair* *Factory repair* *Replace power supply board or factory repair* *Check wiring; replace power supply and/or transformer; or factory repair* *Check channel wiring for breaks/opens; move to another channel; multiplexors may be bad on main PCB; replace multiplexors; clear RAM*
MODULES **Module not recognized** **Module recognized as wrong type** **Sensor failure** **Multiplexing problem**	 Component failure; wrong address; reversed wiring Component failure; controller RAM initialized incorrectly; wire gauge too small Sensor Module electronics failure Signal voltage misadjusted; environmental deterioration DC ground wire not connected at one module; Wire AWG is wrong; wire connections faulty	 *Set address correctly; check wiring; check all voltages including sensor; turn on "calibrate or change" light by pressing MODE, ENTER, RESET factory repair* *Check wiring against manual spec; clear RAM for 1 address; clear system RAM factory repair* *Replace module electronics assembly* *Adjust per service instructions, replace sensor if necessary* *Test individual modules on single channel; check all DC ground connections; verify AWG; solder all splices; replace module*
PRINTER **Not Printing** **Printing garbage**	 AC power glitch DIP switches set wrong Corrupted printer buffer Failed component in Sentry controller Ribbon cable damaged Paper out light is on Paper misaligned	 *Power down and power up complete system at one time* *Set printer for 1200 baud* *Clear printer buffer (Diagnostic 0006)* *Replace printer drivers* *Check/replace printer cable* *Replace paper or fix paper to route past paper sensor* *Fix alignment*
MODBUS **Not Communicating**	 Incorrect Configuration Hardware Problem	 *Use "Change MODBUS" in Mode menu to turn MODBUS on and set controller address and baud rate to match host.* *Check for correct interface cable, RS485 configuration and host computer port configuration.*

7.2 CONTROLLER

7.2.1 MECHANICAL/FUNCTIONAL DESCRIPTION

The controller consists of four sub assemblies. Figure 7-1.

7.2.1.1 CONNECTOR PANEL

The Back Panel contains all the connectors for providing system power, powering and communicating with the modules, operating alarm devices and communicating with a printer. The panel also contains the AC fuse.

The connector panel contains, internally, an edge card connector which connects the main control card.

To remove the panel from the controller unscrew the four corner screws and gently slide the edge connector apart. This procedure allows the controller to be removed for repair without disconnecting all the wiring from the connector panel.

Except for the AC fuse there are no field repairable components on the connector panel.

7.2.1.2 POWER SUPPLY ASSEMBLY:

The power supply assembly includes the transformer which is installed on the bottom plate of the controller and the power supply board which is "piggy backed" to the main control board. To gain access to the power supply board remove the six screws which hold the perforated side panel on the left side of the controller and slide the panel off toward the connector panel.

The power supply board provides various DC voltages for system operation and is described in Section 7.2.2

To remove the power supply board unplug the large in-line harness connector, remove the four nuts from the corners of the board, and lift the board off the multi-pin connectors which interface the power supply to the main control board.

7.2.1.3 MAIN CONTROL BOARD

The main control board assembly is a printed circuit board which connects to the connector panel and the power supply as described above and to the front panel via a ribbon cable. To access the component side of the board remove the perforated side panel on the right side of the controller.

Field repairs to the main control board involve socketed component replacement only. Board removal is not required for these repairs.

7.2.1.4 FRONT PANEL

he front panel assembly contains the membrane panel, the two displays and the indicator lights (LED's). A ribbon cable connection to the main control card is the only electrical connection to the panel.

Access to the lower display angle adjustment is by removal of the left side panel.

7.2.2 ELECTRICAL DESCRIPTION

7.2.2.1 POWER SUPPLY DESCRIPTION

The controller power supply is configured to accept 120 VAC and/or 12 VDC. See specifications Section 8.1 for specific requirements.

The controller can also accept +10 to +29 VDC. If both AC and DC supplies are connected and the AC drops below 90 VAC the system will operate on DC until that supply drops below 10.5 VDC. At that time the controller will reset.

The power supply provides a regulated +24 to +26 volts for the channel regulators, +5 volts for the main control card and front panel board, and +15 & -12 volts for the main control card. A 1 Amp (120 VAC) or .5 Amp (220 VAC) slo-blow fuse protects the AC input power. Check the fuse on the connector panel if the power light is off. - Figure 3-9

The power supply is protected by an over-voltage transient protector (MOV), an EMI/RFI line filter and Zener transient protectors.

The following are symptoms of power supply failure. Figure 7-3.

1. No +24 volts: no modules recognized by the system.

Action: check the fuse on the connector panel, check that the 9 pin in-line connector is fully seated. If the +24 volts is still absent, replace the power supply board. (The failed board can be factory repaired.)

2. No +5 volts: no lights or displays on the front panel.

Action: check fuse F1 on power supply board.

3. No +15 volts: no modules recognized by the system & no bottom display.

Action: replace power supply board.

4. No -12 volts: no lower display and/or no modules recognized, no printing and no alarm functions.

Action: replace power supply board.

5. No +12 volts with battery back-up: no lights on front panel.

Action: check fuse F2 on power supply board. If power supply jumpers have been cut, cold start requires 110 VAC.

7.2.2.2 POWER SUPPLY ADJUSTMENTS

The +24 volts can be measured at TP1 or TP2 (Test Point 1 or 2) with respect to ground (GT1). Figure 7-3. If there is no +24 volts and replace fuse F1

The +5 volts can be measured at TP4 If there is no +5 volts check and replace fuse F3.

The +15 volts can be measured at TP5.

The -12 volts can be measured at TP7

7.2.2.3 LITHIUM BATTERY

The lithium battery which is located on the main control board, Figure 7-2, looks like a large coin and is mounted in a round battery holder with a metal retaining clip. Typical battery voltage should be 3.0 volts and can be measured by connecting the negative lead of the meter to Ground Test 1 (GT1) on the main control board, and the positive lead to the shoulder of the battery holder arm. The voltage should be greater than +2.2 volts or the battery should be replaced. To remove the battery (use Panasonic BR2325 or equal) use a nonmetallic probe to carefully lift the metal clip and push the battery to one side.

It is advisable to increase the tension on both the positive and negative contacts before installing the new battery. To do this slide an insulator between the contacts and use a small screwdriver to lift the lower contact up and push the upper contact down. Install the new battery with the positive terminal ("+") facing up. The insulator is important to avoid shorting the two terminals as this will erase the data accumulated in RAM.

Battery replacement is necessary when the **REPLACE BATTERY** message appears on the lower display during normal operation. The controller memory of factors, calibration and history will be retained for a period of several minutes during battery replacement.

7.2.2.4 EPROM'S

There is one EPROM located on the main control board. Figure 7-2. The EPROM can be identified by the white label on the window. The EPROM stores all the software for Sentry. The EPROM needs replacement when the user wishes to upgrade to additional options or when a factory upgrade is issued for the system. The following precautions must be exercised when replacing the EPROM:

- EPROM'S are sensitive to static discharge and extreme care must be used in their handling. The technician should be grounded before picking up or installing EPROM'S.
- Always remove power to the controller before removing or installing EPROM'S.
- Before installing check each EPROM for bent pins.
- Insure that pin orientation is correct, pin 1 toward center of controller.
- After installation clear RAM using diagnostic code 0099. (See Section 8.3.5)
- If there is a problem with the EPROM, the display will read an "**E-01**" error. This is usually a result of an improperly installed EPROM.

7.2.2.5 CHANNEL VOLTAGE

There are eight regulated power supplies on the main control board. The regulators supply power to the module channels. The voltages which can be measured between the power and ground connectors of any channel should be between +20.5 and +19.0 volts with no sensor modules connected to any channel. If the channel voltage is greater than +21 volts that channel should not be used.

7.2.2.6 ALPHANUMERIC DISPLAY ANGLE ADJUSTMENT

The alphanumeric display is the lower display on the front panel. The viewing angle can be altered via the display angle adjustment potentiometer located on the side of the display panel. To access the adjustment slide the left panel back and use a small screwdriver on the only visible potentiometer on the front panel assembly.

7.2.2.7 RELAY REPLACEMENT

The three socketed DPDT 3 Amp dry contact relays are on the main control board Figure 7-2. The relay function can be tested using the **TEST ALARMS** function of the controller which causes each relay to throw during the time the respective display is indicated on the front panel.

It is important that replacement relays be installed in the same orientation; pin 1 of the relay must line up with pin 1 of the socket.

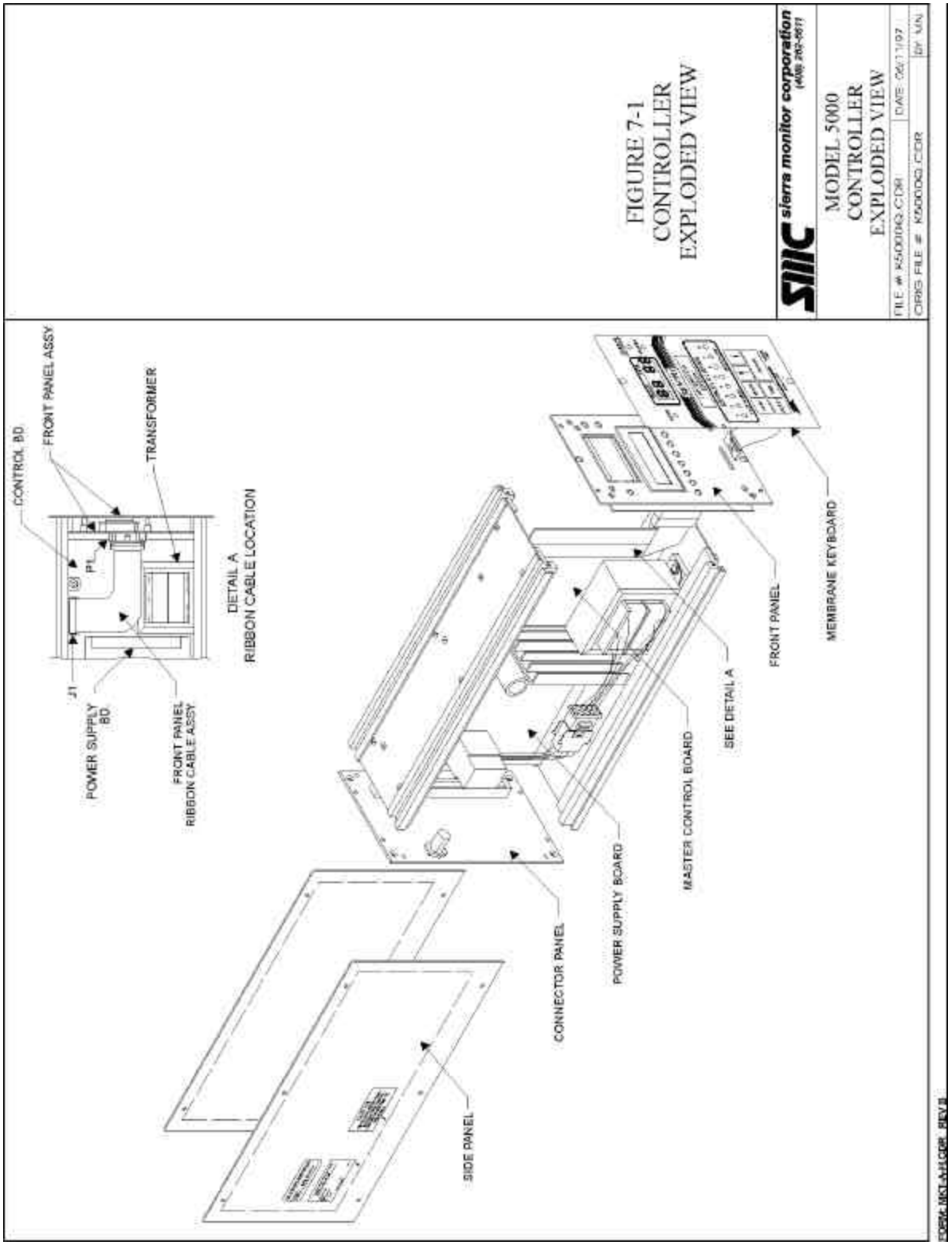


Figure 7-1
Controller Exploded View

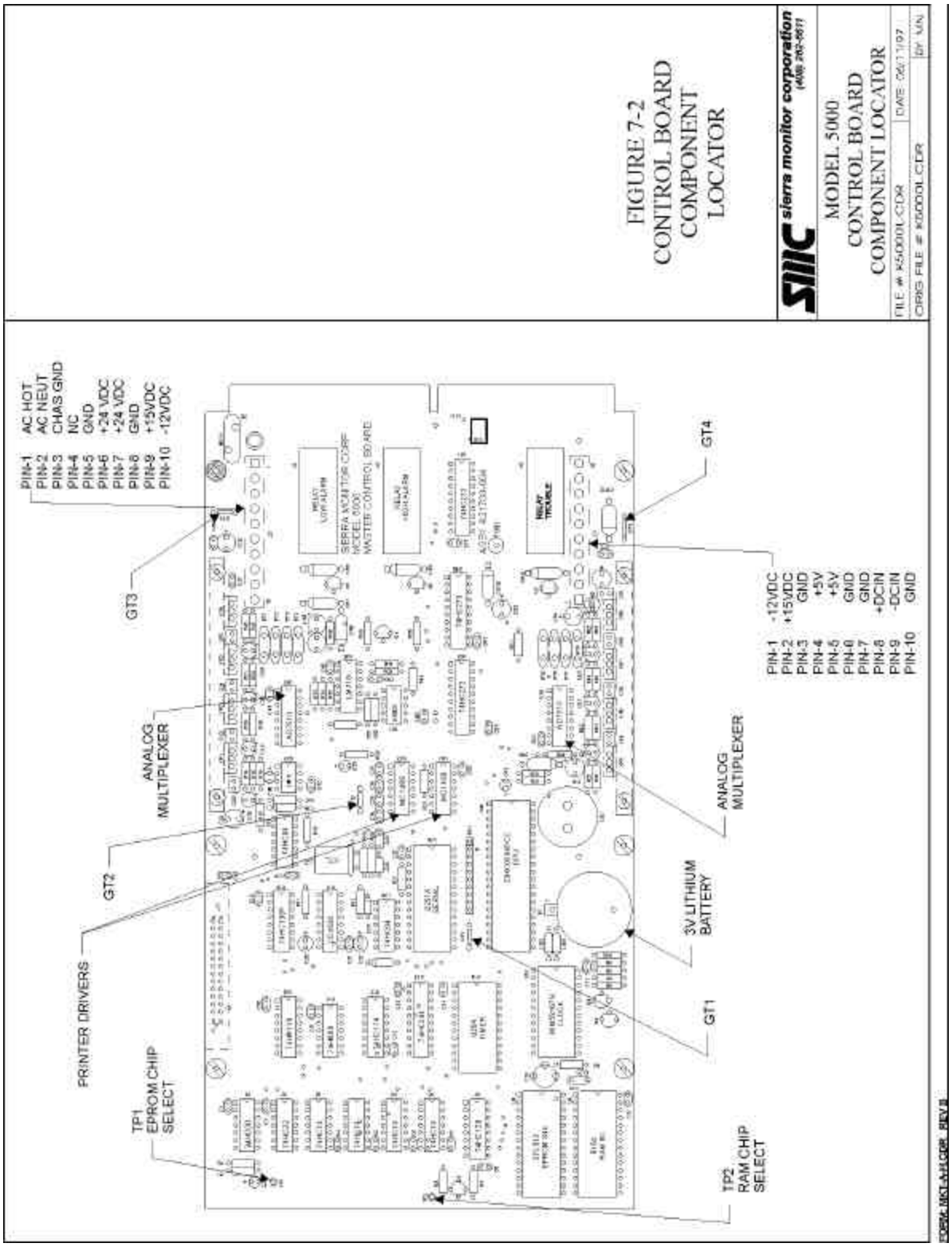


Figure 7-2
Control Board Component Locator

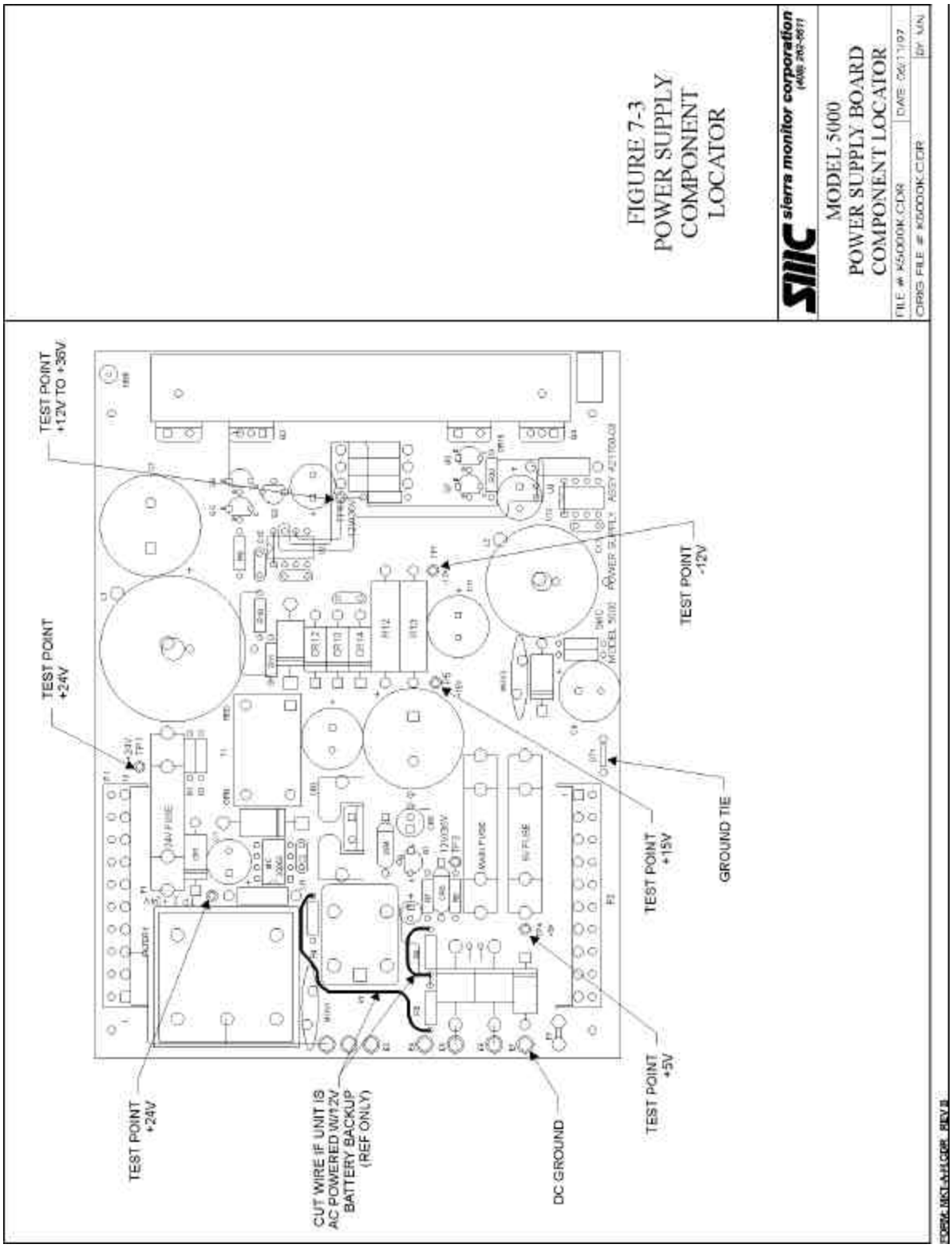


Figure 7-3
Power Supply Component Locator

7.3 COMMUNICATIONS

7.3.1 DESCRIPTION OF COMMUNICATIONS

The Sentry controller scans each channel in turn taking less than one second to scan all channels. At each channel:

1. A "reset" signal is sent out to clear all module communications.
2. An address (which is a module number) is sent out and the controller waits for a response. The response is a digital frequency which is proportional to the first of eight parameters which are interrogated by the controller.
3. Because the controller received an answer and knows that the particular module is on that channel it continues to interrogate that module to retrieve the remaining seven parameters before moving to the next module number.

The eight (total) signals are:

- Value of Ground.
- Value of sensor signal (relates to gas concentration).
- Heater voltage (Type 1 Module) or Bridge Voltage (Type 2 Module).
- Heater current (Type 1 Module) or Bridge Current (Type 2 Module).
- Sensor type (Type 1 through 4 Modules).
- Calibration switch condition on/off.
- Module voltage (tests line drop from controller to module).
- Reference voltage (used together with ground to ratiometrically compensate for any temperature drift in module components)

The controller interprets the information received during the polling and takes actions as necessary. (Any deviation from normal is rapidly validated to avoid errors due to electrical noise.) The information, combined with continual system diagnostics allows the controller to accurately determine abnormal conditions. Table 7-1 provides a categorized listing of Sentry messages.

SYSTEM ERRORS	MODULE ERRORS	WARNING/STATUS MESSAGES
E-01 (ROM Check Failed)	DISCONNECTED	NO MODULE
E-02 (RAM Check Failed)	CHECK POWER ADJ	MODULE OFF
TIMER FAILURE	MODULE VOLTAGE LOW	WARM-UP WAIT - 00:00
CLOCK FAILURE	SENSOR FAILURE	FACTOR MISSING
	DUPLICATE MODULE	UNCALIBRATED
	CHK BRIDGE VOLTAGE	REPLACE SENSOR
	TYPE ERROR	CALIBRATION OVERDUE
		REPLACE BATTERY
		CALIBRATION SWITCH ON
		DIAGNOSTIC SCAN
		FAST ERROR CHECK
		LOW SENSITIVITY
		NOT CALIBRATED
		CALIBRATION ABORTED

Table 7-1
Sentry Error and Diagnostic Messages

7.3.2 WARNING AND ERROR MESSAGES

7.3.2.1 SYSTEM ERRORS

If Sentry cannot operate the basic computer functions one of the System Errors listed in Table 7-1 will display.

These failures indicate internal controller problems which are most likely to require board level repairs by the factory.

7.3.2.2 TROUBLE CONDITIONS

The following "Trouble Conditions" require operator corrective action.

DISCONNECTED:	The controller is not able to communicate with the module
CHECK POWER ADJ	A hydrogen sulfide sensor heater is not functioning. Current drops to zero or voltage increases to maximum.
MODULE VOLT LOW	The module voltage is too low (<11.5V). This indicates there is an excessive drop in the line from the controller to the module.
SENSOR FAILURE	Sensor signal voltage is out of limits.
DUPLICATE MODULE	A response to one address number has been received on two channels.
CHK BRIDGE VOLTAGE	The bridge voltage on a combustible sensor is out of limits.
TYPE ERROR	The module which responded is a different type than previous response.

When any of these conditions are identified the controller:

- activates the trouble relay and trouble light
- displays an "**E** --" beside the corresponding module number (i.e.: "**1E** --")
- describes the error condition on the lower display, and
- logs the error in history memory for later recall via the keyboard or printer.

> ***NOTE***
> ***Trouble conditions logged into memory are erased by the Reset System command. All other erasable History is cleared by the Reset History command.***

All other modules on the channel and modules on other channels remain in full operation and continue to be scanned by the controller. If the problem is corrected, the trouble light and relay will turn off and the module will be brought back on line after a warm-up period.

7.3.2.3 WARNING AND STATUS

The warning and status messages are displayed when valid and do not log to history.

7.3.3 WARM-UP TIMERS

Three “timers” are used by Sentry to delay bringing the system or parts of the system on-line during a stabilization period. These timers can be cleared via the diagnostic code “0000” described in Appendix C.

- **SYSTEM WARM-UP:** After any loss of power (AC & DC) Sentry will count down a five minute system warm-up. During this period the modules will be under power but will not be displayed, nor will their output be used to determine a gas concentration.
- **MODULE WARM-UP:** Any module which has been disconnected, or has just been “recognized” by the controller will be held in a module warm-up delay for a period of five minutes before being displayed as “on line”.
- **CALIBRATION DELAY:** Immediately after calibration each module is held in a calibration delay which is similar to the module warm-up. Although the controller display indicates **CALIBRATION COMPLETE/PLEASE WAIT** if the system is reset, each applicable module will be indicated as **MODULE WARM-UP.**

7.3.4 ACCESS CODES

Sentry software allows users to establish user codes which restrict access by unauthorized users to critical parameters or functions. (See Section 8.3).

7.3.5 DIAGNOSTIC CODES

Diagnostic codes allow the technician to use the system software to collect diagnostic data for use in system check-out. Diagnostic code assignment is described in Section 8.3.5.

7.3.6 DIAGNOSTIC REPORT

A Diagnostic report can be printed using diagnostic codes 0008 or 0010. Figure 7-4 is a typical report..

```
ID:A 11/20 15:16
S1= +0.376    BV= +2.021    BI= 0.323     SP= 0653
              ST= +0.284    MV= +19.0     CS= +0.000
S2= +1.20     HV= +0.920    HI= +0.975    SP= 400
              ST= +0.009    MV= +19.4     CS= +0.000
```

Figure 7-4
Typical Diagnostic Report

Table 7-2 is a description of the information contained in a typical diagnostic report

Report		Description
ID:A		Controller Identification
11/20 15:16		Time report was generated
S1	+0.376	Data that follows is for Module 1 Sensor Signal is +0.376 VDC
BV	+2.021	Bridge Voltage 2.021 VDC
BI	+0.322	Bridge Current 323 mA
SP	0653	Sensor Power 653 mW
ST	+0.284	Sensor Type (Where: .2 -.3 VDC: Combustible)
MV	+19.0	Module Voltage = 19 VDC
CS	+0.000	Calibration Switch Off 0.000, On = 2.5 VDC
S2	+1.20	Data that follows is for Module Sensor Signal is + 1.20 VDC
HV	+0.920	Heater Voltage Signal
HI	+0.975	Heater Current Signal
SP	400	Sensor Power 400 mW
ST	+0.009	Module Type (Where: .11-.1 VDC: H2S)

Table 7-2
Diagnostic Report Description

7.4 HYDROGEN SULFIDE MODULE (5100-01)

7.4.1 DESCRIPTION

The Hydrogen Sulfide Sensor Module includes the sensor and electronic assembly installed in an explosion proof housing. The sensor screws into one hub of the enclosure and plugs into the bottom electronics card via a six pin connector. Cabling to the controller connects to a three pin spring loaded terminal strip.

When a sensor is changed it is important that the factors for the new sensor are keyed into the controller and that a 24 hour stabilization period elapses prior to voltage adjustments and calibration. The three factors, each three digits are written on the sensor connector label.

7.4.2 TROUBLE ANALYSIS

Electrical adjustment, or replacement of the sensor will be necessary under the following conditions:

- Controller displays the error messages:
  CHECK POWER ADJ
  SENSOR FAILURE
  LOW SENSITIVITY

- False readings or alarms are received due to sensor inaccuracy.

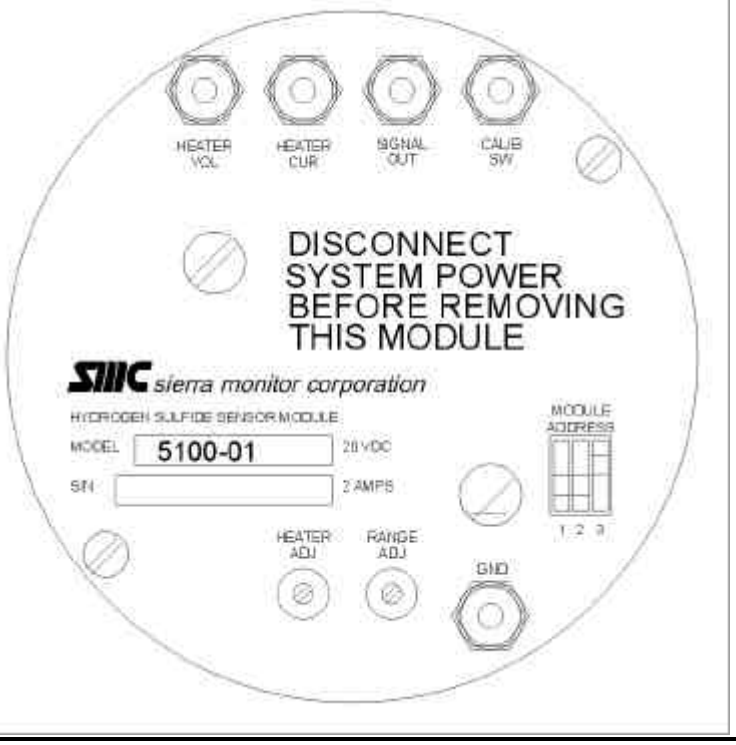


Figure 7-5
Cover Plate - Hydrogen Sulfide Sensor Module

Warning: During sensor adjustments the concentration reading on the controller will be inaccurate and alarm level concentrations may be displayed. If false activation of the alarm relays will cause a problem disconnect the relay wiring prior to adjustment or turn the module off using the **CHANGE MODULE** mode.

> ***Note:***
> ***Although all the necessary data can be collected with a voltmeter at the sensor module, some helpful information can be displayed or printed. See diagnostic codes 0004 and 0008, Appendix C.***

7.4.3 ADJUSTMENT PROCEDURE

Prior to reading voltages and making adjustments perform a visual inspection to confirm that there are no physical problems such as water in the electronics enclosure, wiring damage or corrosion.

Use Figure 7-5 to locate test points during the following procedures.

7.4.3.1 POWER ADJUSTMENT

Comparing to the **GND** (ground) test point measure the **HEATER VOL** (heater voltage) and the **HEATER CUR** (heater current) values in VDC. Calculate the power by the formula: **(HEATER CUR - HEATER VOL) * HEATER VOL / 5.1.** The correct value is 400Mw +/- 5 Mw. (Note that this calculation is performed by the controller and displayed using diagnostic code 0004.) See Table 7-4 for corresponding voltage and current settings.

Adjust the heater power using **HEATER ADJ** potentiometer, turn clockwise to decrease, counter-clockwise to increase the power. Make the adjustments 1/4 turn at a time and wait for the values to stabilize before making successive adjustments.

7.4.3.2 MODULE ADJUSTMENT

Compare ground to **SIGNAL OUT** to read the module voltage. The beginning (no gas) value must be above 1.2 VDC and can be up to 7.5 VDC. If the no gas voltage is lower than 1.2 VDC adjust using **RANGE ADJ** potentiometer.

To adjust the sensitivity apply 20 ppm hydrogen sulfide for five minutes for full stabilization. (Check that the voltage drops by at least .3 volts during this time.) Adjust the signal out value to .6 VDC using the range adjust potentiometer. Remove gas and verify that the voltage climbs to above 1.0 VDC in five minutes.

7.4.4 SENSOR REPLACEMENT

If either of the above adjustments cannot be completed successfully the sensor and/or electronics will require replacement. To check the sensor unplug it from the electronics and remove from the housing so that continuity and resistance tests can be made. Table 7-3 provides the pin out for the sensor assembly.

PIN	FUNCTION	WIRE COLOR
1	SENSOR FILM	GREY
2	HEATER	RED
3	HEATER	RED
4	SENSOR FILM	GREY
5	CALIB. SW.	GREEN
6	CALIB. SW.	GREEN

Table 7-3
Hydrogen Sulfide Sensor
Wiring Pin-Out

1. Sensor Film resistance (grey wires) should be above 10K ohms.
2. Heater resistance (red wires) should be between 20 and 35 ohms.
3. Calibration switch (green wires) should be open in normal operation and should close when the calibration magnet is applied.

If the sensor fails any of these tests it should be replaced. If the sensor passes these tests the electronics are suspect and BOTH the sensor and electronics should be replaced. (The failed components should be returned to the factory for evaluation).

When a new sensor is installed the following actions should be taken:

1. Input new factors into controller. The factors are written onto the sensor connector label. (Three numbers: ###-###-###)
2. Make a preliminary power adjustment to insure heater is below 400 mW.
3. Force calibrate the sensor module.
4. Wait 24 hours for stabilization of the sensor film.
5. Make the power and sensitivity adjustments as described above.
6. Calibrate the sensor.

7.4.4.1 H_2S MODULE HEATER VOLTAGES

Table 7-4 may be used during adjustment of Hydrogen Sulfide sensor heater voltages. Make small adjustments to the Heater Adjust potentiometer until the corresponding Heater Voltage and Heater Current readings are obtained. Both values are read as voltages.

Heater Voltage	Heater Current	Heater Voltage	Heater Current	Heater Voltage	Heater Current	Heater Voltage	Heater Current
2.50	3.32.	2.90	3.60	3.30	3.92	3.70	4.25
2.51	3.32	2.91	3.61	3.31	3.93	3.71	4.26
2.52	3.33	2.92	3.62	3.32	3.93	3.72	4.27
2.53	3.34	2.93	3.63	3.33	3.94	3.73	4.28
2.54	3.34	2.94	3.63	3.34	3.95	3.74	4.29
2.55	3.35	2.95	3.64	3.35	3.96	3.75	4.29
2.56	3.36	2.96	3.65	3.36	3.97	3.76	4.30
2.57	3.36	2.97	3.66	3.37	3.98	3.77	4.31
2.58	3.37	2.98	3.66	3.38	3.98	3.78	4.32
2.59	3.38	2.99	3.67	3.39	3.99	3.79	4.33
2.60	3.38	3.00	3.68	3.40	4.00	3.80	4.34
2.61	3.39	3.01	3.69	3.41	4.01	3.81	4.35
2.62	3.40	3.02	3.70	3.42	4.02	3.82	4.35
2.63	3.41	3.03	3.70	3.43	4.03	3.83	4.36
2.64	3.41	3.04	3.71	3.44	4.04	3.84	4.37
2.65	3.42	3.05	3.72	3.45	4.05	3.85	4.38
2.66	3.43	3.06	3.73	3.46	4.06	3.86	4.39
2.67	3.43	3.07	3.73	3.47	4.07	3.87	4.40
2.68	3.44	3.08	3.74	3.48	4.07	3.88	4.41
2.69	3.45	3.09	3.75	3.49	4.08	3.89	4.41
2.70	3.46	3.10	3.76	3.50	4.08	3.90	4.42
2.71	3.46	3.11	3.77	3.51	4.09	3.91	4.43
2.72	3.47	3.12	3.77	3.52	4.10	3.92	4.44
2.73	3.48	3.13	3.78	3.53	4.11	3.93	4.45
2.74	3.48	3.14	3.79	3.54	4.12	3.94	4.46
2.75	3.49	3.15	3.80	3.55	4.12	3.95	4.47
2.76	3.50	3.16	3.81	3.56	4.13	3.96	4.48
2.77	3.51	3.17	3.81	3.57	4.14	3.97	4.48
2.78	3.51	3.18	3.82	3.58	4.15	3.98	4.49
2.79	3.52	3.19	3.83	3.59	4.16	3.99	4.50
2.80	3.53	3.20	3.84	3.60	4.17	4.00	4.51
2.81	3.54	3.21	3.85	3.61	4.18	4.01	4.52
2.82	3.54	3.22	3.85	3.62	4.18	4.02	4.53
2.83	3.55	3.23	3.86	3.63	4.19	4.03	4.54
2.84	3.56	3.24	3.87	3.64	4.20	4.04	4.54
2.85	3.57	3.25	3.88	3.65	4.21	4.05	4.55
2.86	3.57	3.26	3.89	3.66	4.22	4.06	4.56
2.87	3.58	3.27	3.89	3.67	4.23	4.07	4.57
2.88	3.59	3.28	3.90	3.68	4.23	4.08	4.58
2.89	3.60	3.29	3.91	3.69	4.24	4.09	4.59

Table 7-4
Heater Voltage and Current Settings

7.5 COMBUSTIBLE GAS SENSOR MODULE (5100-02)

7.5.1 DESCRIPTION

The Combustible Gas Module includes the sensor and electronic assembly installed in an explosion proof housing. The sensor screws into one hub of the enclosure and plugs into the bottom electronics card via a six pin connector. Cabling to the controller connects to a three pin spring loaded terminal strip.

7.5.2 TROUBLE ANALYSIS

Electrical adjustment, or replacement of the sensor will be necessary under the following conditions:

- Controller displays the following error messages:

  CHK BRIDGE VOLT
  SENSOR FAILURE
  LOW SENSITIVITY

- False readings or alarms are received due to sensor inaccuracy.

Warning: : During sensor adjustments the concentration reading on the controller will be inaccurate and alarm level concentrations may be displayed. If false activation of the alarm relays will cause a problem disconnect the relay wiring prior to adjustment or turn the module off using the **CHANGE MODULE** mode.

> ***NOTE***
> ***Although all the necessary data can be collected with a voltmeter at the sensor module, some helpful information can be displayed or printed. See diagnostic codes 0004 and 0008 in Appendix C.***

7.5.3 ADJUSTMENT PROCEDURE

Prior to reading voltages and making adjustments perform a visual inspection to confirm that there are no physical problems such as water in the electronics enclosure, wiring damage or corrosion.

Use Figure 7-6 to locate test points during the following procedures:

Caution: The area must be free of flammable vapors or gases during any adjustments or maintenance procedures.

7.5.3.1 BRIDGE VOLTAGE ADJUSTMENT

Confirm that no combustible gas is present and remove sensor module cover.

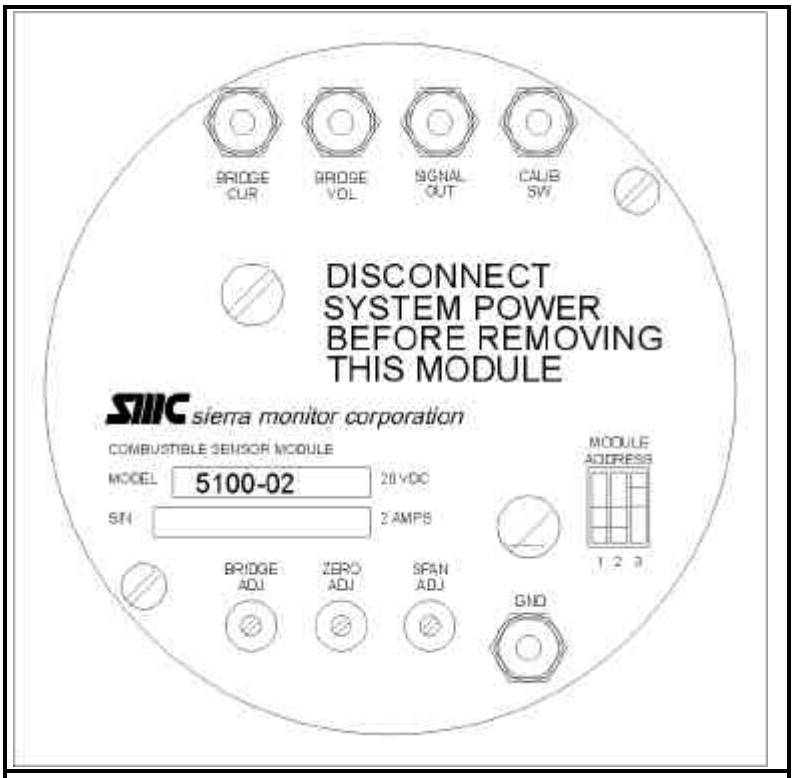


Figure 7-6
Cover Plate - Combustible Gas Module

Comparing to the "GND" (ground) test point measure "BRIDGE VOL" (bridge voltage) and adjust to 2.00 VDC using "BRIDGE ADJ" potentiometer. Turn counter-clockwise to increase.

7.5.3.2 ZERO ADJUSTMENT

Comparing to ground measure **SIGNAL OUT** and adjust to 0.18 VDC by turning **ZERO ADJ** potentiometer. Turn counter clock-wise to increase.

7.5.3.3 SPAN ADJUSTMENT

1. Determine the concentration of the calibration gas (CG) in % LEL.
2. Use the following formula to determine the response to the calibration gas at **SIGNAL OUT**.

   Voltage (Signal Out) = (CG+12)/60

   For Example:

   If CG = 50% L.E.L

   Signal Out= (50+12)/60

   = 1.03 volts

3. Using a Sierra Monitor Model 1200-26 Gas Calibrator with a Sierra Monitor Model 5358-00 calibration adapter, or Model 5360 Gas Delivery Fitting. Apply the calibration gas at a flow rate of 100 cc/min. until the signal out voltage stops changing (approx. 2 minutes). Then adjust span adj. potentiometer to the calculated value.
4. Remove the calibration gas and wait for the voltage to drop. If the voltage is below 0.30 VDC the procedure is complete. If the voltage is above 0.30 VDC repeat the zero and span adjustments.
5. Calibrate the sensor using the instruction manual procedure.
    - A **LOW SENSITIVITY** message during calibration indicates one of the two conditions for a combustible sensor:
        - The zero gas voltage must be less than .3 volts.
        - The new span change (span voltage less zero voltage) must exceed 30% of the calculated span change.

          For Example:

          Zero gas voltage = .20 VDC

          Span voltage = .43 VDC

          Span change is .43-.2 = .23 VDC

          As the calculated span value (from step 5 above) is 1.03, the calculated span change is: 1.03-.2 = .87

          By calculation: 30% of .87 = .26

          The new span change (.23) is less than 30% of the calculated span change so a **LOW SENSITIVITY** message will be displayed.

The **LOW SENSITIVITY** calculation is made to insure that the calibration does not adjust the electronics so that the "gain" is large enough to cause false alarms due to minor drift or due to minimal electronic noise.

7.5.4 SENSOR REPLACEMENT

If any of the above adjustments cannot be completed successfully the sensor and/or electronics will require replacement. To check the sensor unplug it from the electronics and remove from the housing so that continuity and resistance tests can be made. Table 7-4 provides the pin out for the sensor assembly.

PIN	FUNCTION	WIRE COLOR
1	DETECTOR	WHITE
2	COMPENSATOR	BROWN
3	CALIB. SW.	RED
4	DETECTOR	BLACK
5	DRAIN	BARE
6	CALIB. SW.	GREEN

Table 7-5
Combustible Gas Sensor
Wiring Pin Out

1. Detector element resistance should be between 1.5 to 2 ohms.
2. Compensator element resistance should be between 1.5 to 2 ohms.
3. Calibration switch should be open in normal operation and should close when the calibration magnet is applied.

If the sensor fails any of these tests it should be replaced. If the sensor passes these tests the electronics are suspect and BOTH the sensor and electronics should be replaced. (The electronics and sensor which are removed should be returned to the factory for evaluation).

When a new sensor is installed the following actions must be taken:

- Make the bridge voltage adjustment immediately to avoid over-voltage damage to the sensor.
- Use diagnostic code 0020 to establish nominal value calibration.
- Allow 24 hours for full stabilization of the sensor, recheck the zero and span adjustments and calibrate the sensor module.

7.5.5 COMBUSTIBLE GAS SCALING FACTORS

For combustible gas monitoring, a calibration standard of Methane or Propane my be used in conjunction with scaling factors to cause Sentry concentration display and alarm function in %LEL scale of another gas as follows:

GAS	METHANE FACTOR	PROPANE FACTOR
Acetaldehyde	60	109
Acetic Acid	54	98
Acetic Anhydride	46	83
Acetone	52	94
Acetylene	57	103
Alkyl Alcohol	51	92
Ammonia	126	229
n-Amyl Alcohol	33	59
Aniline	39	71
Benzene	41	74
Biphenyl	25	45
1,3-Butadiene	56	101
n-Butane	58	106
iso-Butane	52	94
Butene-1	45	82
cis-Butene-2	48	88
trans-Butene-2	51	92
n-Butyl Alcohol	34	62
iso-Butyl Alcohol	53	96
tert-Butyl-Alcohol	74	134
n-Butyl Benzene	31	57
iso-Butyl Benzene	32	58
n-Butyric Acid	38	69
Carbon Disulfide	18	32
Carbon Monoxide	75	137
Carbon Oxysulphide	93	169
Chlorobenzene	34	62
Cyanogen	89	162
Cyclohexane	41	74
Cyclopropane	62	113
n-Decane	33	59
Diethylamine	49	88
Dimethylamine	58	105
2,3-Dimethylpentane	40	72
2,3-Dimethylpropane	40	72
Dimethylsulphide	43	79
1,4-Dioxane	45	81
Epichlorohydrin	45	82
Ethane	68	123
Ethyl Acetate	51	93
Ethyl Alcohol	73	132
Ethylamine	53	95
Ethyl Benzene	36	65
Ethyl Bromide	91	165
Ethyl Chloride	57	103
Ethylcyclopentane	40	72
Ethylene	71	128
Ethylenedichloride	66	120
Ethyleneoxide	52	94

GAS	METHANE FACTOR	PROPANE FACTOR
Diethyl Ether	46	84
Dimethoxyethane	42	75
Dimethyl Ether	63	113
Dimethylformamide	46	83
Ethyl Formate	44	80
Ethylmercaptan	56	102
n-Heptane	39	70
n-Hexane	37	67
Hydrazine	45	82
Hydrogencyanide	48	86
Hydrogen	77	139
Hydrogen Sulfide	41	74
Methane	100	181
Methyl Actetate	50	90
Methyl Alcohol	86	156
Methylamine	77	140
Methyl Bromide	90	162
Methyl Chloride	102	186
Methylcyclohexane	44	80
Methylenedichloride	93	168
Methylethylether	44	80
Methylethylketone	41	75
Methyl Formate	67	121
Methylmercaptan	61	110
Methylpropionate	51	93
Methyl n-propylketone	40	73
Napthalene	34	62
Nitromethane	34	62
n-Nonane	31	57
n-Octane	37	68
n-Pentane	46	83
i-Pentane	46	84
Propane	55	100
n-Propyl Alcohol	47	85
n-Propylamine	48	88
n-Propylchloride	50	90
Propylene	52	93
Propyleneoxide	46	83
iso-Propylether	44	79
Propyne	42	75
Toluene	40	73
Triethylamine	40	72
Trimethylamine	48	88
Vinylethylether	42	76
o-Xylene	36	65
m-Xylene	39	71
p-Xylene	39	71
JP-4 (Jet Fuel)	41	73

NOTES:

1. Scaling factors are not FMRC approved.
2. Base data source: EEV sensor specification catalog. (EEV claims some data is the result of specific tests, other data is empirically derived.)

7.6 OXYGEN MODULE (5100-03)

7.6.1 DESCRIPTION

The Oxygen Module includes the electronic assembly installed in an explosion proof housing and the electrochemical sensor connected to one hub of the enclosure. Cabling from the controller connects to a three pin spring loaded terminal strip.

7.6.2 TROUBLE ANALYSIS

Electrical adjustment, or replacement of the sensor will be necessary under the following conditions:

- Controller displays the following error messages:

  CHANGE SENSOR
  SENSOR FAILURE
  REPLACE SENSOR

- False readings or alarms are received due to sensor inaccuracy.

Warning: During sensor adjustments the concentration reading on the controller will be inaccurate and alarm level concentrations may be displayed. If false activation of the alarm relays will cause a problem disconnect the relay wiring prior to adjustment or turn the module off using the "Change Module" mode.

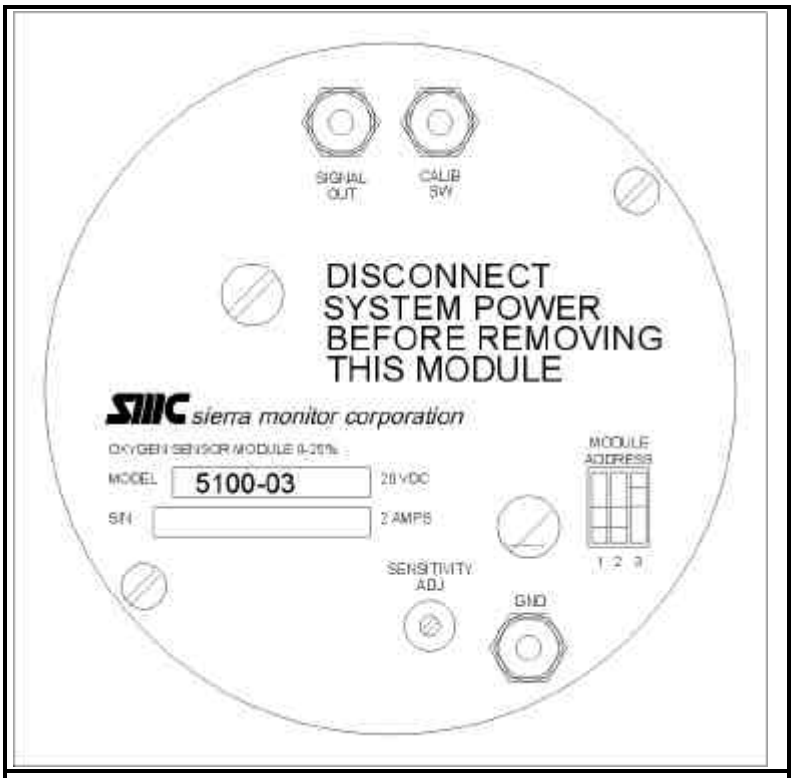


Figure 7-7
Cover Plate - Oxygen Module

> ***NOTE***
> ***Although all the necessary data can be collected with a voltmeter at the sensor module, some helpful information can be displayed on the controller or printed. See diagnostic codes 0004 and 0008 in Appendix C.***

7.6.3 ADJUSTMENT PROCEDURE

Prior to reading voltages and making adjustments perform a visual inspection to confirm that there are no physical problems such as water in the electronics enclosure, wiring damage or corrosion.

Use Figure 7-7 to locate test points during the following procedures.

7.6.3.1 SIGNAL ADJUSTMENT

It is unlikely that any electrical adjustment will be required except when a new sensor is installed.

To make the electrical adjustment connect a voltmeter to **SIGNAL OUT** (pos) and **GND** (ground) and use **SENSITIVITY ADJ** potentiometer to set the voltage equal to 1/10 of the actual oxygen concentration. In clean air the concentration is 20.9% so the voltage should be set at 2.09 VDC.

7.6.4 SENSOR REPLACEMENT

The oxygen sensor should be replaced when it can no longer be calibrated correctly or when the signal output drops to zero. Generally this is every twelve to eighteen months. The Sentry clock keeps track of the age of the sensor if it is correctly initialized in the "change module" mode.

When a new sensor is installed use the **CHANGE MODULE** menu selection to answer yes to the "new sensor?" question. After nine months the **CHANGE SENSOR** message will be displayed to warn that a new sensor should be installed.

The **SENSOR FAILURE** message for Oxygen sensors does not indicate a specific failure of the sensor but indicates that the sensor is not correctly connected to the electronics. If this message appears check that the sensor harness is correctly installed to the connector on the bottom electronics board.

When sensor replacement is required, open the cover of the sensor module, remove the transmitter and disconnect the sensor wiring harness from the back of the transmitter.

Unscrew the old sensor from the conduit hub, screw in the new sensor and connect the wiring harness to the transmitter electronics. Replace the transmitter into the enclosure, make signal adjustments as described above, and replace the enclosure cover.

After the sensor is installed:

- Update "new sensor" status in the change module mode.
- Allow one hour of stabilization of the new sensor.
- Make the electrical sensitivity adjustment as described above.
- Calibrate the sensor module.

7.7 CARBON MONOXIDE MODULE (5100-04)

7.7.1 DESCRIPTION

The Carbon Monoxide Module includes the sensor and electronic assembly installed in an explosion proof housing.

The sensor screws into one hub of the enclosure and plugs into the bottom electronics card via a six pin connector. Cabling from the controller connects to a three pin spring loaded terminal strip.

7.7.2 TROUBLE ANALYSIS

Electrical adjustment, or replacement of the sensor will be necessary under the following conditions:

- Controller displays the following error messages

  SENSOR FAILURE
  LOW SENSITIVITY

- False readings or alarms are received due to sensor inaccuracy.

Warning: During sensor adjustments the concentration reading on the controller will be inaccurate and alarm level concentrations may be displayed. If false activation of the alarm relays will cause a problem disconnect the relay wiring prior to adjustment or turn the module off using the "Change Module" mode.

> ***Note***
> ***Although all the necessary data can be collected with a voltmeter at the sensor module, some helpful information can be displayed on the controller or printed. See diagnostic codes 0004 and 0008 in Appendix C.***

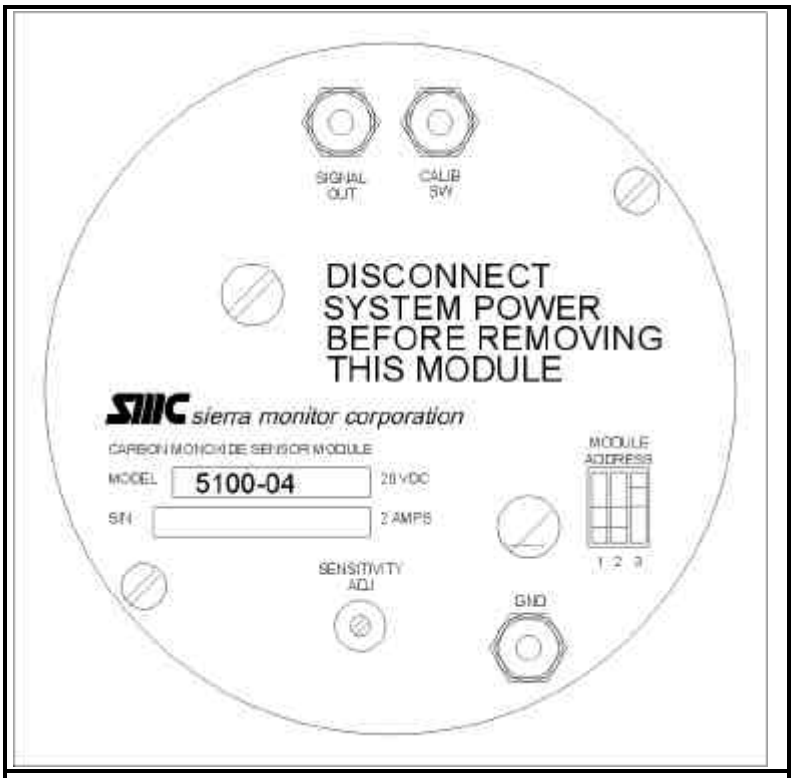


Figure 7-8
Cover Plate - Carbon Monoxide Module

7.7.3 ADJUSTMENT PROCEDURE

Prior to reading voltages and making adjustments perform a visual inspection to confirm that there are no physical problems such as water in the electronics enclosure, wiring damage or corrosion.

Use Figure 7-8 to locate test points during the following procedures.

7.7.3.1 SIGNAL ADJUSTMENT

It is unlikely that any electrical adjustment will be required except when a new sensor is installed.

To make the electrical adjustment connect a voltmeter to **SIGNAL OUT** (pos) and **GND** (ground) and use **SENSITIVITY ADJ** potentiometer to adjust the voltage based on the following:

- 1 ppm CO = 0.004 VDC.
- 100 ppm CO = 0.40 VDC.
- 250 ppm CO = 1.00 VDC.

7.7.3.2 SENSOR REPLACEMENT

The carbon monoxide sensor should be replaced when it can no longer be calibrated correctly. Generally this is every twenty four to thirty months.

The "SENSOR FAILURE" message for Carbon Monoxide sensors does not indicate a specific failure of the sensor but indicates that the sensor is not correctly connected to the electronics. If this message appears check that the sensor harness is correctly installed to the connector on the bottom electronics board.

If sensor replacement is necessary remove the electronics from the housing and unplug the old sensor from the bottom board, remove it from the enclosure hub and reverse the procedure to install the new sensor.

After the sensor is installed:

- Allow one hour of stabilization of the new sensor.
- Make the electrical sensitivity adjustment as described above.
- Calibrate the sensor using the instruction manual procedure.

7.8 HYDROGEN SULFIDE MODULE (5100-05)

7.8.1 DESCRIPTION

Model 5100-05 Hydrogen Sulfide Sensor Module includes a sensor assembly and electronic assembly installed in an explosion proof housing.

The sensor assembly includes a reuseable housing and disposable electrochemical sensor. The assembly screws into one hub of the sensor module enclosure and plugs into the bottom electronics card via a six pin connector.

Cabling from the controller connects to a three pin spring loaded terminal strip on the electronics assembly.

7.8.2 TROUBLE ANALYSIS

Electrical adjustment, or replacement of the sensor will be necessary under the following conditions:

- Controller displays the following error messages

  SENSOR FAILURE
  LOW SENSITIVITY

- False readings or alarms are received due to sensor inaccuracy.

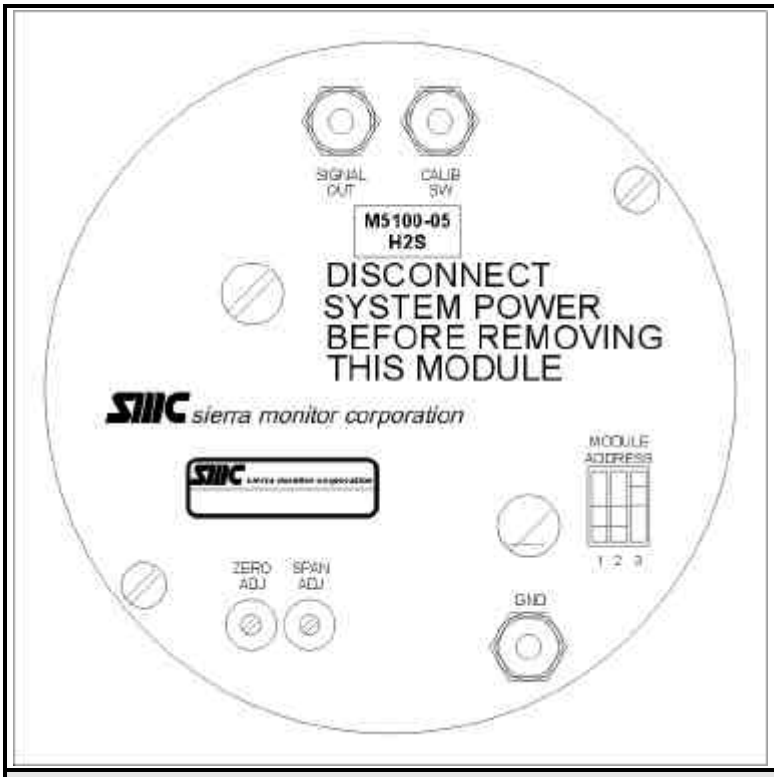


Figure 7-9
Cover Plate - Hydrogen Sulfide Module

Warning: During sensor adjustments the concentration reading on the controller will be inaccurate and alarm level concentrations may be displayed. If false activation of the alarm relays will cause a problem disconnect the relay wiring prior to adjustment or turn the module off using the "Change Module" mode.

> ***NOTE***
> ***Although all the necessary data can be collected with a voltmeter at the sensor module, some helpful information can be displayed on the controller or printed. See diagnostic codes 0004 and 0008 in Appendix C.***

7.8.3 ADJUSTMENT PROCEDURE

Prior to reading voltages and making adjustments perform a visual inspection to confirm that there are no physical problems such as water in the electronics enclosure, wiring damage or corrosion.

Use Figure 7-9 to locate test points during the following procedures.

7.8.3.1 SIGNAL ADJUSTMENT

It is unlikely that any electrical adjustment will be required except when a new sensor is installed.

To make the electrical adjustment connect a voltmeter to **SIGNAL OUT** (pos) and **GND** (ground) and use **SPAN ADJ** potentiometer to adjust the voltage based on the following:

- 1 ppm H_2S = 0.02 VDC.
- 100 ppm H_2S = 2.00 VDC.

7.8.3.2 SENSOR REPLACEMENT

The Hydrogen Sulfide sensor should be replaced when it can no longer be calibrated correctly. Generally this is every twenty four to thirty months.

The **SENSOR FAILURE** message for Hydrogen Sulfide sensors does not indicate a specific failure of the sensor but indicates that the sensor is not correctly connected to the electronics. If this message appears check that the sensor harness is correctly installed to the connector on the bottom electronics board.

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

1. Confirm that system power has been removed.
2. Remove the transmitter electronics board from the main housing and unplug the sensor harness from the transmitter electronics.
3. Unscrew the sensor housing from the bottom of the enclosure
4. Hold the sensor assembly so that the harness faces down and the sensor faces up. Unscrew and remove the round section of the housing from the hex section. Be careful not to lose the spacer washer which will be sitting on top of the exposed sensor.
5. Carefully pull the old sensor straight up from the socket.
6. Orient the new sensor so that the sensor pin labeled **"C"** faces the socket labeled **"C"** which is on the far side of the board from the vertical reed switch. The reed switch will slide into a hole on the side of the new sensor. Press the new sensor's pins into the three sockets.
7. Carefully replace the cover on the sensor assembly including the spacer washer.
8. Install the sensor assembly into the enclosure and tighten firmly.
9. Reconnect the sensor harness to the transmitter, install the transmitter into the housing and restore power.
10. Allow one hour for the sensor to stabilize prior to recalibration.
11. Recalibrate the sensor module.

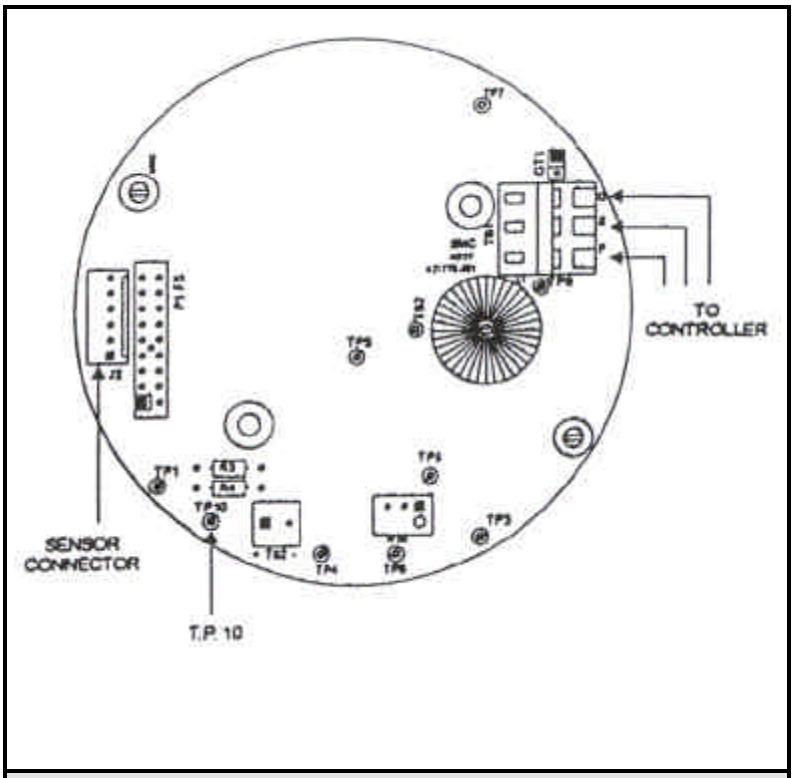


Figure 7-10
Hydrogen Sulfide Transmitter Component Locator

7.8.3.3 SENSOR OUTPUT ADJUSTMENT

The following procedure is to be used when, during normal calibration of a new sensor, the span voltage cannot be adjusted to a high enough level.

1. Adjust the span potentiometer so that it is approximately mid range. (Twenty turns clockwise and tens turns counter-clockwise).
2. Remove system power and remove both the transmitter and the sensor assembly from the enclosure. Remove the sensor assembly cover so that the sensor is visible.
3. Plug the sensor harness into the transmitter assembly and check that no components are touching the enclosure. Restore power and allow a minimum of 30 minutes for stabilization before adjustment.
4. Connect a DVM across TP10 and GT1 on the transmitter assembly. Figure 7-10
5. Locate the gain potentiometer which is on the sensor electronics directly behind one of the holes in the sensor body. The potentiometer is accessible by inserting a jewelers screwdriver through the hole in the sensor.
6. Determine the correct value to be read at TP10 based on the following formula:

$V_{TP10} = 2(C/R)$, where C = concentration of span gas, and R = range of detection (100 PPM).

7. Apply span gas. Adjust the gain potentiometer until TP10 = correct value as described above. To increase voltage at TP10 turn the gain potentiometer counter clockwise.
8. Remove system power and re-install the sensor and transmitter in the enclosure. Restore power and calibrate.

7.9 TOXIC GAS SENSOR MODULE

7.9.1 DESCRIPTION

Toxic Gas Sensor Modules include the following models and default ranges:

5100-06	Chlorine -10 PPM
5100-07	Hydrogen - 2000 PPM
5100-12	Nitrogen Dioxide - 20 PPM
5100-13	Carbon Monoxide, High Range - 1,000 PPM
5100-10	Sulfur Dioxide - 100 PPM
5100-16	Carbon Monoxide, H2 Tolerant - 2,000 PPM
5100-19	Nitric Oxide - 20 PPM
5100-21	Hydrogen Chloride - 20 PPM
5100-22	Hydrogen Cyanide - 20 PPM
5100-27	Ethylene Oxide - 20 PPM

The Toxic Sensor Module includes a sensor assembly and electronic assembly installed in an explosion proof housing.

The sensor assembly includes a reuseable housing and disposable electrochemical sensor. The assembly screws into one hub of the sensor module enclosure and plugs into the bottom electronics card via a six pin connector.

Cabling from the controller connects to a three pin spring loaded terminal strip on the electronics assembly.

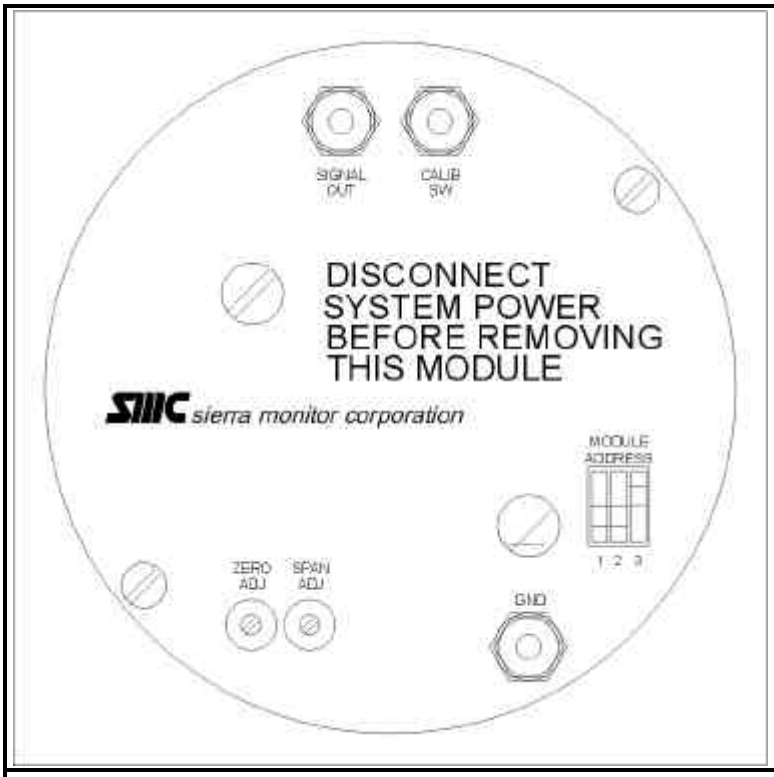


Figure 7-11
Cover Plate - Toxic Gas Module

7.9.2 TROUBLE ANALYSIS

Electrical adjustment, or replacement of the sensor will be necessary under the following conditions:

- Controller displays the following error messages

  SENSOR FAILURE
  LOW SENSITIVITY

- False readings or alarms are received due to sensor inaccuracy.

Warning: During sensor adjustments the concentration reading on the controller will be inaccurate and alarm level concentrations may be displayed. If false activation of the alarm relays will cause a problem disconnect the relay wiring prior to adjustment or turn the module off using the "Change Module" mode.

> ***NOTE***
> ***Although all the necessary data can be collected with a voltmeter at the sensor module, some helpful information can be displayed on the controller or printed. See diagnostic codes 0004 and 0008 in Appendix C.***

7.9.3 ADJUSTMENT PROCEDURE

Prior to reading voltages and making adjustments perform a visual inspection to confirm that there are no physical problems such as water in the electronics enclosure, wiring damage or corrosion.

Use Figure 7-11 to locate test points during the following procedures.

7.9.3.1 SIGNAL ADJUSTMENT

It is unlikely that any electrical adjustment will be required except when a new sensor is installed.

To make the electrical adjustment connect a voltmeter to **SIGNAL OUT** (pos) and **GND** (ground) and use **SPAN ADJ** potentiometer to adjust the voltage based on the following:

- 1% of full scale = 0.02 VDC.
- 100% of full scale = 2.00 VDC.

7.9.3.2 SENSOR REPLACEMENT

The toxic gas sensor should be replaced when it can no longer be calibrated correctly. Generally this is every twenty four to thirty months.

The **SENSOR FAILURE** message for toxic gas sensors does not indicate a specific failure of the sensor but indicates that the sensor is not correctly connected to the electronics. If this message appears check that the sensor harness is correctly installed to the connector on the bottom electronics board.

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

1. Confirm that system power has been removed.
2. Remove the transmitter electronics board from the main housing and unplug the sensor harness from the transmitter electronics.
3. Unscrew the sensor housing from the bottom of the enclosure
4. Hold the sensor assembly so that the harness faces down and the sensor faces up. Unscrew and remove the round section of the housing from the hex section. Be careful not to lose the spacer washer which will be sitting on top of the exposed sensor.
5. Carefully pull the old sensor straight up from the socket.
6. Orient the new sensor so that the sensor pin labeled "**C**" faces the socket labeled "**C**" which is on the far side of the board from the vertical reed switch. The reed switch will slide into a hole on the side of the new sensor. Press the new sensor's pins into the three sockets.
7. Carefully replace the cover on the sensor assembly including the spacer washer.
8. Install the sensor assembly into the enclosure and tighten firmly.
9. Reconnect the sensor harness to the transmitter, install the transmitter into the housing and restore power.
10. Allow one hour for the sensor to stabilize prior to recalibration.
11. Recalibrate the sensor module.

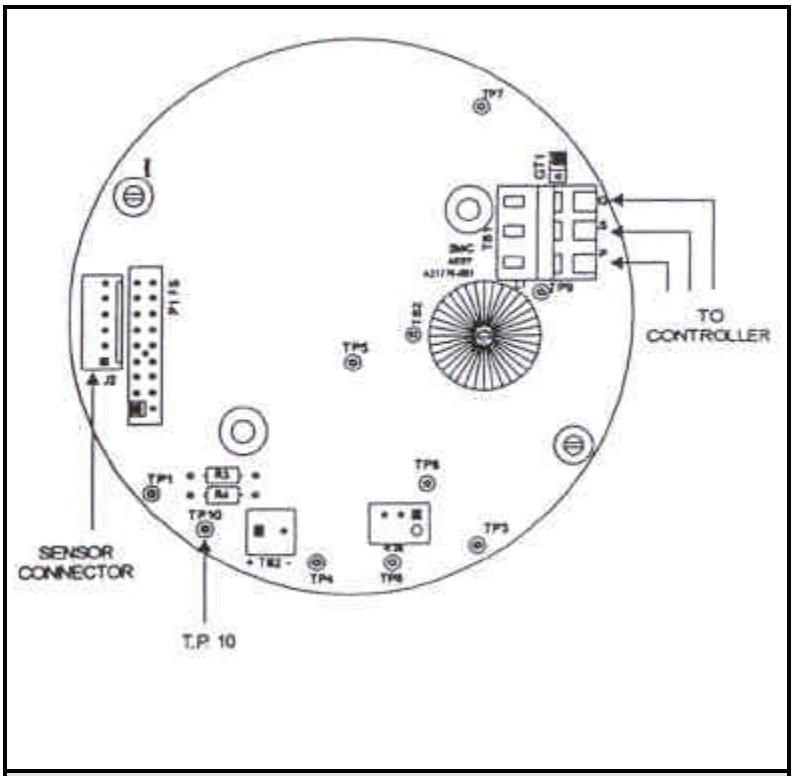


Figure 7-12
Toxic Gas Transmitter Component Locator

7.9.3.3 SENSOR OUTPUT ADJUSTMENT

The following procedure is to be used when, during normal calibration of a new sensor, the span voltage cannot be adjusted to a high enough level.

1. Adjust the span potentiometer so that it is approximately mid range. (Twenty turns clockwise and tens turns counter-clockwise).
2. Remove system power and remove both the transmitter and the sensor assembly from the enclosure. Remove the sensor assembly cover so that the sensor is visible.
3. Plug the sensor harness into the transmitter assembly and check that no components are touching the enclosure. Restore power and allow a minimum of 30 minutes for stabilization before adjustment.
4. Connect a DVM across TP10 and GT1 on the transmitter assembly. Figure 7-12
5. Locate the gain potentiometer which is on the sensor electronics directly behind one of the holes in the sensor body. The potentiometer is accessible by inserting a jewelers screwdriver through the hole in the sensor.
6. Determine the correct value to be read at TP10 based on the following formula:

$V_{TP10} = 2(C/R)$, where C = concentration of span gas, and R = range of detection (100 PPM). The value is negative for all models except 5100-06, and 5100-19.

7. Apply span gas. Adjust the gain potentiometer until TP10 = correct value as described above. To increase voltage at TP10 turn the gain potentiometer counter clockwise.
8. Remove system power and re-install the sensor and transmitter in the enclosure. Restore power and calibrate.

7.10 AMMONIA SENSOR MODULE (5100-25)

7.10.1 DESCRIPTION

The Ammonia Sensor Module includes a sensor assembly and electronic assembly installed in an explosion proof housing.

The sensor assembly includes a rechargeable electrochemical sensor. The assembly screws into one hub of the sensor module enclosure and plugs into the bottom electronics card via a six pin connector.

Cabling from the controller connects to a three pin spring loaded terminal strip on the electronics assembly.

7.10.2 TROUBLE ANALYSIS

Electrical adjustment, recharge, or replacement of the sensor will be necessary under the following conditions:

- Controller displays the following error messages

  SENSOR FAILURE
  LOW SENSITIVITY

- False readings or alarms are received due to sensor inaccuracy.

Warning: During sensor adjustments the concentration reading on the controller will be inaccurate and alarm level concentrations may be displayed. If false activation of the alarm relays will cause a problem disconnect the relay wiring prior to adjustment or turn the module off using the "Change Module" mode.

> ***NOTE***
> ***Although all the necessary data can be collected with a voltmeter at the sensor module, some helpful information can be displayed on the controller or printed. See diagnostic codes 0004 and 0008 in Appendix C.***

7.10.3 ADJUSTMENT PROCEDURE

Prior to reading voltages and making adjustments perform a visual inspection to confirm that there are no physical problems such as water in the electronics enclosure, wiring damage or corrosion.

Use Figure 7-13 to locate test points during the following procedures.

7.10.3.1 SIGNAL ADJUSTMENT

It is unlikely that any electrical adjustment will be required except when a new sensor is installed.

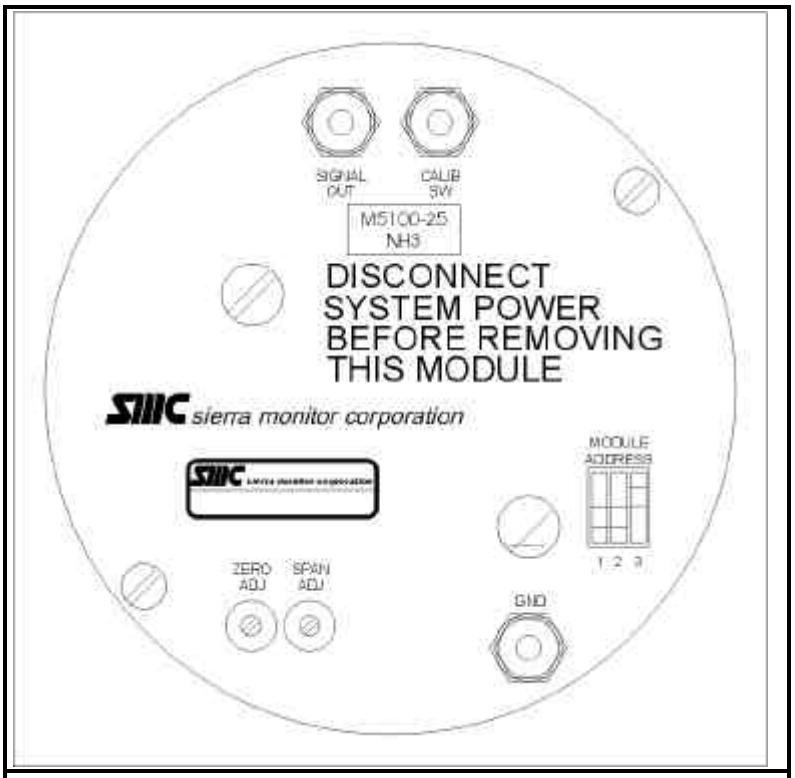


Figure 7-13
Cover Plate - Ammonia Module

To make the electrical adjustment connect a voltmeter to **SIGNAL OUT** (pos) and **GND** (ground) and use **SPAN ADJ** potentiometer to adjust the voltage based on the following:

- 1% of full scale = 0.02 VDC.
- 100% of full scale = 2.00 VDC.

7.10.3.2 SENSOR RECHARGE

The Ammonia sensor can be recharged by removing it from service, draining electrolyte, cleaning electrodes and replacing the electrolyte and membrane.

Step by step instructions for sensor recharge are supplied with the recharge kit.

7.10.3.3 SENSOR REPLACEMENT

The Ammonia sensor assembly should be replaced when it can no longer be recharged and calibrated correctly.

The **SENSOR FAILURE** message for ammonia sensors does not indicate a specific failure of the sensor but indicates that the sensor is not correctly connected to the electronics. If this message appears check that the sensor harness is correctly installed to the connector on the bottom electronics board.

To replace the sensor assembly:

1. Confirm that system power has been removed.
2. Remove the transmitter electronics board from the main housing and unplug the sensor harness from the transmitter electronics.
3. Unscrew the sensor housing from the bottom of the enclosure
4. Install the new sensor assembly into the enclosure and tighten firmly.
5. Reconnect the sensor harness to the transmitter, install the transmitter into the housing and restore power.
6. Allow one hour for the sensor to stabilize prior to recalibration.
7. Recalibrate the sensor module.

8. APPENDICES

8.1 APPENDIX A - SPECIFICATIONS

A. OPERATING

OPERATING TEMPERATURE

Controller	32 to 122^{O}F (0 to 50^{O}C)

STORAGE TEMPERATURE

Controller:	-40 to 130^{O}F (-40 to 55^{O}C)

HUMIDITY

Controller:	10% to 95% RH

POWER

Standard	120 VAC +10%/-15%, 60 Hz 12 VDC Nom; 10 to 29 VDC
Optional	220 VAC +10%/-15%, 50 Hz 12 VDC Nom; 10 to 29 VDC
Consumption	48 Watts max. (eight modules)

RELAYS

Three DPDT 3A, 115 VAC (Low, High, Trouble)
Sixteen SPDT 6A, 115 VAC (Model 5392-00)
Sixteen SPDT 6A, 115 VAC (Model 4314-01)

ANALOG OUTPUTS

Eight 4-20 mA, channel value (Model 4314-01)
Loop Resistance max. 800 Ohms

NUMBER OF CHANNELS

5000-02: Two channels, upgradeable to four or eight
5000-04: Four channels, upgradeable to eight
5000-08: Eight channels

PRINTER INTERFACE

Standard on 5000-08, option on -02 & -04

RS232 Port	1200 Baud 8 bits, no parity 1 start bit, 2 stop bits

MODBUS INTERFACE (Replaces printer interface)

Optional MODBUS communication protocol
Honeywell Multivendor Approved for TDC 3000 Gateway

COMPONENTS

Microprocessor	Z84 (4 MHz - 8 bit CPU)
Memory	64K bytes EPROM 8K bytes Static RAM (battery backed-up)
Displays	4 digit 1/2" LCD 32 character (2X16) dot matrix alphanumeric LCD 11 LED indicators
Battery	Hi energy lithium 3 year retention
Keypad	7 key sealed membrane
Power Supply	Integral High efficiency AC/DC with line filter

TRANSMISSION

Digital, pulse width modulated - RFI, EMI immune

B. PHYSICAL

DIMENSIONS

Controller

Rack Mount	7" X 4.5" X 12" (H W D) 17.5cm X 11.25cm X 30cm
NEMA 4X Enclosure	17.5" X 16.2" X 6.35" (H W D) 44.5cm X 41.1cm X 16cm
NEMA 7 Enclosure	22.0" X 21.5" X 14" (H W D) 55.9cm X 54.6cm X 35.6cm

Module Housing

Environment	NEMA 7 (NEMA 4X Optional)
5100-01, 5100-02	7.5" X 4" X 4" (H W D) 19cm X 10cm X 10cm
5100-03	8.5" X 4" X 4" (H W D) 19cm X 10cm X 10cm
5100-04 : -24, -27	7.5" X 4" X 4" (H W D) 19cm X 10cm X 10cm
5100-25	10" X 4" X 4" (H W D) 19cm X 10cm X 10cm

WEIGHT

Controller

Rack Mount	7 pounds (3.2 kg)
NEMA 4X Enclosure	25 pounds (11.3 kg)
NEMA 7 Enclosure	143 pounds (65.0 kg)
Module	2 pounds (0.9 kg)

MOUNTING

Controller	Instrument Rack Chassis Mount Panel Wall Mount Bracket NEMA 4X Enclosure NEMA 7 Enclosure
Module	Conduit or flexible cable

MODULE CABLE

Typical: three conductor 18 AWG,
See installation instructions for alternative wire sizes

SENSOR TYPES

Hydrogen Sulfide	Thin film, solid state (5100-01)
Combustible	Catalytically bead (5100-02)
Oxygen	Electrochemical (5100-03).
Carbon Monoxide (CO)	Electrochemical (5100-04)
Hydrogen Sulfide	Electrochemical (5100-05)
Chlorine	Electrochemical (5100-06)
Hydrogen	Electrochemical (5100-07)
Sulfur Dioxide	Electrochemical (5100-10)
Nitrogen Dioxide	Electrochemical (5100-12)
CO High Range	Electrochemical (5100-13)
CO - Hydrogen Tolerant	Electrochemical (5100-16)
Nitric Oxide	electrochemical (5100-19)
Hydrogen Chloride	Electrochemical (5100-21)
Hydrogen Cyanide	Electrochemical (5100-22)
Ammonia	Electrochemical.(5100-25)
Ethylene Oxide	Electrochemical (5100-27)

C. PERFORMANCE

Combustible Gas (5100-02)

Range:	0 - 99% Lower Explosive Limit.
Operating Temperature	-40°F to 158°F (-40°C to 70°C)
Relative Humidity	5 - 99% RH
Accuracy:	+/- 3% of Full Scale or +/- 10% of Applied Concentration
Response:	Step to 50% within 10 seconds Recover to 10% within 45 seconds
Calibration Frequency	Monthly, Recommended
Zero Drift:	Less than 5% per year.
Typical Life:	3 years in normal service.
Warranty:	1 year.

Hydrogen Sulfide (5100-05)

Range:	0 - 100 PPM
Operating Temperature	-40°F to 122°F (-40°C to +50°C)
Relative Humidity	10 - 99% RH
Accuracy:	+/- 2 PPM
Response:	<30 seconds to 50% indication
Calibration Frequency	90 Days, Recommended
Zero Drift:	Less than 1% per month
Typical Life:	3 years in normal service
Warranty:	1 year

Note: Only Combustible Gas (5100-02) and Electrochemical sensor Hydrogen Sulfide (5100-05) are FMRC Approved

Hydrogen Sulfide (5100-01)

Range:	Factory 100 PPM, Max. 100 PPM
Operating Temperature	-40°F to 158°F (-40°C to 70°C)
Relative Humidity	5 - 99% RH
Response:	<60 seconds to 90% indication
Calibration Frequency	Monthly, Recommended
Zero Drift:	Less than 5% per year.
Typical Life:	3 years in normal service.
Warranty:	1 year.

Oxygen (5100-03)

Range:	Factory 25% O_2, Max. 25% O_2
Operating Temperature	-19°F to 122°F (-7°C to 50°C)
Relative Humidity	5 - 99% RH
Response:	10 seconds to 90% indication.
Calibration Frequency	90 Days, Recommended
Zero Drift:	Less than 5% per year.
Typical Life:	1 year in normal service.
Warranty:	1 year

Carbon Monoxide (5100-04)

Range:	Factory 500 PPM, Max. 2,000 PPM
Operating Temperature	4°F to 122°F (-20°C to 50°C)
Relative Humidity	15 - 99% RH
Response:	<25 seconds to 90% indication
Calibration Frequency	90 Days, Recommended
Zero Drift:	Less than 1% per month
Typical Life:	2 years in normal service
Warranty:	1 year

Chlorine (5100-06)

Range:	Factory 10 PPM, Max. 100 PPM
Operating Temperature	4°F to 122°F (-20°C to 50°C)
Relative Humidity	15 - 99% RH
Response:	<60 seconds to 90% indication
Calibration Frequency	90 Days, Recommended
Zero Drift:	Less than 1% per month
Typical Life:	2 years in normal service
Warranty:	1 year

Hydrogen (5100-07)

Range:	Factory 1,000 PPM, Max 2,000 PPM
Operating Temperature	4°F to 122°F (-20°C to 50°C)
Relative Humidity	15 - 99% RH
Response:	<30 seconds to 90% indication
Calibration Frequency	90 Days, Recommended
Zero Drift:	Less than 1% per month
Typical Life:	2 years in normal service
Warranty:	1 year

Sulfur Dioxide (5100-10)

Range:	Factory 100 PPM, Max 100 PPM
Operating Temperature	4°F to 122°F (-20°C to 50°C)
Relative Humidity	15 - 99% RH
Response:	<20 seconds to 90% indication
Calibration Frequency	90 Days, Recommended
Zero Drift:	Less than 1% per month
Typical Life:	2 years in normal service
Warranty:	1 year

Nitrogen Dioxide (5100-12)

Range:	Factory 20 PPM, Max 100 PPM
Operating Temperature	4°F to 122°F (-20°C to 50°C)
Relative Humidity	15 - 99% RH
Response:	<35 seconds to 90% indication
Calibration Frequency	90 Days, Recommended
Zero Drift:	Less than 1% per month
Typical Life:	2 years in normal service
Warranty:	1 year

Carbon Monoxide (5100-13)

Range:	Factory 1,000 PPM, Max 2,000 PPM
Operating Temperature	4°F to 122°F (-20°C to 50°C)
Relative Humidity	15 - 99% RH
Response:	<25 seconds to 90% indication
Calibration Frequency	90 Days, Recommended
Zero Drift:	Less than 2% per month
Typical Life:	3 years in normal service
Warranty:	1 year

Carbon Monoxide (5100-16)

Range:	Factory 2,00 PPM, Max 4,000 PPM Tolerates Hydrogen to 2,000 PPM
Operating Temperature	4°F to 122°F (-20°C to 50°C)
Relative Humidity	15 - 99% RH
Response:	<35 seconds to 90% indication
Calibration Frequency	90 Days, Recommended
Zero Drift:	Less than 1% per month
Typical Life:	2 years in normal service
Warranty:	1 year

Nitric Oxide (5100-19)

Range:	Factory 20 PPM, Max 100 PPM
Operating Temperature	4°F to 122°F (-20°C to 50°C)
Relative Humidity	15 - 99% RH
Response:	<15 seconds to 90% indication
Calibration Frequency	90 Days, Recommended
Zero Drift:	Less than 2% per month
Typical Life:	3 years in normal service
Warranty:	1 year

Hydrogen Chloride (5100-21)

Range:	Factory 20 PPM, Max 100 PPM
Operating Temperature	4°F to 122°F (-20°C to 50°C)
Relative Humidity	15 - 99% RH
Response:	<100 seconds to 90% indication
Calibration Frequency	90 Days, Recommended
Zero Drift:	Less than 1% per month
Typical Life:	2 years in normal service
Warranty:	1 year

Hydrogen Cyanide (5100-22)

Range:	Factory 20 PPM, Max 200 PPM
Operating Temperature	4°F to 122°F (-20°C to 50°C)
Relative Humidity	15 - 99% RH
Response:	<70 seconds to 90% indication
Calibration Frequency	90 Days, Recommended
Zero Drift:	Less than 1% per month
Typical Life:	2 years in normal service
Warranty:	1 year

Ammonia (5100-25)

Range:	Factory 50 PPM, Max 50 PPM
Relative Humidity	20 - 90% RH
Operating Temperature	14°F to 113°F (-10°C to 45°C)
Response:	<30 seconds to 90% indication
Calibration Frequency	90 Days, Recommended
Zero Drift:	Less than 2% per month
Typical Life:	2 - 3 years in normal service
Warranty:	1 year

Ethylene Oxide (5100-27)

Range:	Factory 20 PPM, Max 100 PPM
Relative Humidity	5 - 99% RH
Operating Temperature	4°F to 122°F (-20°C to 50°C)
Response:	<90 seconds to 90% indication
Calibration Frequency	90 Days, Recommended
Zero Drift:	Less than 2% per month
Typical Life:	2 years in normal service
Warranty:	1 year

Model	**Gas**	**Reading from 100 PPM of interfering gas**									
Number	**Type**	**CO**	**H_2S**	**Cl_2**	**H_2**	**SO_2**	**NO_2**	**NO**	**HCl**	**HCN**	**C_2H_4**
5100-04	CO	100	315	-15	<40	50	-55	30	2	40	<50
5100-05	H_2S	<0.5	100	-20	<0.1	<15	-15	0	0	0	0
5100-06	Cl_2	0	<-10	100	0	0	105	0	0	0	0
5100-07	H_2	<1	<20	0	100	3	0	35	3	35	85
5100-10	SO_2	<1	0	-40	0	100	-100	0	0	15	0
5100-12	NO_2	0	-20	90	0	0	100	0	0	-3	0
5100-13	CO	100	350	-40	<60	65	-60	25	5	40	90
5100-16	CO	100	0	0	0	0	0	0	0	0	35
5100-19	NO	0	35	0	0	5	25	100	15	0	0
5100-20	HCl	0	75	-10	0	35	-2	0	100	-8	0
5100-22	HCN	<0.5		-50	0	160	-190	-5	30	100	<1
		Ethanol		Toluene		Methyl-ethyl-ketone			Carbon Monoxide		
5100-27	C_2H_4O	55		20		10			40		

Table 8-1
Toxic Sensor Cross Sensitivity

8.2 APPENDIX B - 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 , 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.

8.3 APPENDIX C - ACCESS CONTROL BY USER CODE

8.3.1 INTRODUCTION

Certain critical activities which can be accessed from the keypad are initially unrestricted. Entry codes can be initiated at any time so that these activities are protected from unauthorized access.

8.3.2 DEFINITIONS

USER NUMBER: Single digit number between 1 and 8. This number is used to establish different authorized users and is printed on reports generated by each user. User number 1 must be established before the other numbers can be used.

ENTRY CODE: Four digit code between 0001 and 9999. This is the access code which is assigned to each user and is required to access critical menu items which result in changes to the system.

SPECIAL USER NUMBER: The special user number 9 is reserved for access to the diagnostic mode of operation.

DIAGNOSTIC CODES: When the user number 9 is used to access diagnostics, four digit entry code numbers are used to select various diagnostic activity.

8.3.3 USER CODE INSTALLATION

1. Select the **"SET USER CODE"** activity via the **MODE** key and press **ENTER**. Sentry will display **"USE ARROWS/ENTER" "USER # 1".**
2. To establish an entry code for user number "1" press **ENTER** and Sentry will display **"USE ARROWS/ENTER" "ENTRY CODE = 0"**
3. Use the arrow to change the first digit as required, press **ENTER** to move to the second digit.
4. Set the second, third and fourth digits in the same manner.
5. When an entry code has been established that code must be used to access the controlled sections of the menu.
6. User numbers 1 through 5 have access to all Sentry functions. Users 6 through 8 are restricted to calibration activities only.

8.3.4 USER CODE REMOVAL

1. Change user number 1 entry code to "0000".

8.3.5 DIAGNOSTIC CODES:

Select the **"SET USER CODE"** activity, input user number "9" and press **ENTER.** The display will indicate **"WARNING: DIAGNOSTIC MODE"** and will then ask for the **ENTRY CODE**. The following are the codes and their Function:

Code	Function
0000	Clears all warm-up timers.
0002	Disables error filtering and reduces all warm-up times.
0003	Not used.
0004	Displays critical module electrical measurements during normal operation. (H2S: Sensor signal & Heater Power in mW, Combustible: Sensor signal & Bridge Power in mW, O2 & CO: Sensor signal.)
0006	Clears printer buffer.
0007	Clear module X: Asks for the module number and clears that module's information from the system memory.
0008	Prints a periodic diagnostic report. The period is selected in the subsequent menu selection. (1, 5, 10 , 30 minutes, 1, 8, 12, 24 hours.)
0009	Reset of all diagnostic modes
0010	Prints a single diagnostic report
0012	Forces all Analog Outputs (Model 4314-01) to 4 mA.
0013	Forces all Analog Outputs (Model 4314-01) to 20 Ma
0020	Force Calibrates one sensor module. Asks for the module number after the code is input.
0021	Force Calibrates all uncalibrated sensor modules.
0022	Disables alarm suppression during calibration.
0023	Restores alarm suppression during calibration
0099	Clears all system RAM including configuration, calibration and history data.

8.3.6 LOST ENTRY CODE

If the Entry code is misplaced it will be necessary to **ENTER** the "**CALIB/CHANGE**" activity and delete all codes as described above. To enter the "**CALIB/CHANGE**" activity:

1. Turn Sentry off and then on to start the warm-up.
2. Press **RESET** key three times to "**RESET HISTORY**"
3. Press **ENTER** to display "**USE ARROWS/ENTER**" "**ENTRY CODE=0**"
4. Press **TEST** key **THREE** times. No changes will be apparent.
5. Enter the entry code: 9999.
6. The "**CALIB/CHANGE**" light will turn on and the "**SET USER CODE**" activity can be selected so that the entry code can be changed.

8.4 APPENDIX D: - MODEL NUMBERS & PARTS LIST

8.4.1 CONTROLLER ITEMS

Controllers	
5000-02	Sentry 2 Channel Controller
5000-04	Sentry 4 Channel Controller
5000-08	Sentry 8 Channel Controller
5389-50	Sentry Software Enhancement Package
Output Options	
4314-01	Output Expansion Module (16 Relays, 8 Analog)
5392-00	Individual Relay Panel (16 Relays)
Mounting Options	
4304-03	Cabinet, NEMA 12 Enclosure, 1 shelf
4304-04	Cabinet, NEMA 12 Enclosure, 2 shelf
5331-00	Shelf, 19" Rack Insert
5380-00	Standard (Rack) Configuration (use with 5331-00)
5381-00	Hardware, Panel Mount
5382-00	Hardware, Wall Mount
5383-00	Enclosure, NEMA-4X Weatherproof
5395-00	Enclosure, NEMA-7 Explosion Proof
Controller Accessories	
4301-10	Converter RS232-RS485
5332-00	Remote Power Supply - 8 Channel
5346-03	Battery Back-Up System - 3 Hr. (In 5383-00 Encl.)
5346-04	Battery Back-Up System - 5 Hr. (In separate NEMA-12 Encl.)
5346-05	Battery Charger (Mounts in 5331-00)
5346-06	Battery Back-Up System - 24 Hr. (In separate NEMA-4 Encl.)
Printer Options	
5301-51	Printer Package, Single Controller, Rack
5301-52	Printer Package, 2-Controller, Rack
5301-53	Printer Package, 3-Controller, Rack
5301-54	Printer Package, 4-Controller, Rack
5301-61	Printer Package, Single Controller, NEMA-4
Controller Upgrades	
5357-00	Software, 8 Channel Upgrade from 4 Channel
5357-10	Software, 4-Channel Upgrade from 2-Channel
5357-20	Software, 8-Channel Upgrade from 2-Channel
5389-51	Sentry Software Enhancement Package, Field Upgrade
Sentry Controller Spare/Replacement Parts	
5301-00	Printer, 40 Column, Dot Matrix
5301-01	Printer, In 5383-00
5349-00	Connector, On 5383-00 for Printer
5350-00	Printer Cable, RS232C, 15'
5355-00	Printer Network Master Board
5356-00	Printer Network Sub Board
5359-00	Cable, Printer, 6' (use w/5349-00)
SPL21701	Sentry Back Panel
SPL21703-4	Assy, Master Board
SPL21713	Assy, Transformer
SPL21714	Cable, Ribbon, Front Panel
SPL21714-1	Cable, Ribbon, NEMA Front Panel
SPL21760	Assy, Power Supply
SPL21768	Assy, Front Panel w/ Label
SPL21718	Module, Zone Configuration
SPL35079	Panel, Membrane, Keyboard / Label
SPL39050	Cover Plate, (Unused Rack Position)
SPL49093	Cover, Safety for Alarm Terminal
SPL49094	Cover, Safety for AC Terminal Strip
SPL49111	Fuse, 1 AMP Slo-Blo (AC)
SPL49117	Fuse, 4 AMP Slo-Blo (P/S F1,3)

SPL49121	Varistor (AC)
SPL49142	Fuse, 10 AMP (P/S F2)
SPL52094	Connector Release Arm (10 Pack)
SPL69017	Relay, DPDT
SPL69121	Battery, Lithium, Sentry
SPL69145	Battery, 12 VDC 20 AH (for 5346-04)
SPL69146	Printer Ribbon, Sentry (EA)
SPL69148	Printer Paper, Sentry (Roll)
SPL69150	Battery, 12 VDC 6.5 AH (for 5346-03)

8.4.2 SENSOR MODULE ITEMS

Sensor Modules

5100-01	Sensor Module - Hydrogen Sulfide, H2S, solid state, 0-100 ppm
5100-02	Sensor Module - Combustible Gas, 0-100% L.E.L.
5100-03	Sensor Module - Oxygen, O2, 0-25%
5100-04	Sensor Module - Carbon Monoxide, CO, 0-200 ppm
5100-05	Sensor Module - Hydrogen Sulfide, H2S, electrochemical, 0-100 ppm
5100-06	Sensor Module - Chlorine, Cl2, 0-10 ppm
5100-07	Sensor Module - Hydrogen, H2, 0-1000 ppm
5100-10	Sensor Module - Sulfur Dioxide, SO2, 0-100 ppm
5100-12	Sensor Module - Nitrogen Dioxide, NO2, 0-100 ppm
5100-16	Sensor Module - Carbon Monoxide, CO, H2 Tolerant, 0-2000 ppm
5100-21	Sensor Module - Hydrogen Chloride, HCl, 0-20 ppm
5100-22	Sensor Module - Hydrogen Cyanide, HCN, 0-20 ppm
5100-25	Sensor Module - Ammonia, NH3, 0-50 ppm
5100-90	Input Module - Analog/Digital - 8 channel
5100-99	Input Module - Analog/Digital - 1 channel

Sensor Module Accessories

5311-00	Rainshield
5394-00	Duct Mount Fitting
5398-01	Sample Draw Assembly
5398-02	Sample Draw/Dilution Assembly
5398-24	Sample Draw System - 4 channel
5399-01	Sample Draw Fitting
SPL21776	Enclosure, NEMA 4, Group. B, Transmitter Upgrade
SPX39128-1	Tag, Stainless Steel

Gas Sensor Modules Spare Parts

5200-01	Sensor, Sentry Hydrogen Sulfide, H2S (Solid State)
5200-02	Sensor, Sentry Combustible (%LEL)
5200-03	Sensor, Sentry Oxygen, O2 (%)
5200-04	Sensor, Sentry, Carbon Monoxide, CO ppm
5200-05	Sensor, Sentry Hydrogen Sulfide, H2S, ppm
5200-06	Sensor, Sentry Chlorine,CL2, ppm
5200-07	Sensor, Sentry Hydrogen, H2, ppm
5200-10	Sensor, Sentry Sulfur Dioxide, SO2, ppm
5200-12	Sensor, Sentry Nitrogen Dioxide, NO2, ppm
5200-16	Sensor, Sentry Carbon Monoxide, CO, H2 Tolerant, ppm
5200-21	Sensor, Sentry Hydrogen Chloride, HCL, ppm
5200-22	Sensor, Sentry Hydrogen Cyanide, HCN, ppm
5200-25	Sensor, Sentry Ammonia, NH3, ppm
SPL21756	Assy,. Transmitter, Carbon Monoxide, CO
SPL21756-1	Assy, Transmitter, Hydrogen, H2
SPL21757	Assy, Transmitter, Combustibles
SPL21758	Assy, Transmitter, Hydrogen Sulfide, H2S
SPL21759	Assy, Transmitter, Oxygen, O2
SPL21767	Enclosure, Transmitter
SPL21774	Remote Sensor Ext. Kit, H2S
SPL21775	Remote Sensor Ext. Kit , Combustible
SPL21776-1	Enclosure, Transmitter NEMA-4X
SPL21780	Assy, Transmitter - Toxic
SPL21781-XX	Assy, Sensor - Toxic

SPL63036	Stand Off (for Transmitter)
SPX27057	Kit, Sensor Recharge, for 5100-25

8.4.3 CALIBRATION EQUIPMENT

Calibrators

1200-26	Gas Sensor Calibrator w/2 Gas Cylinders (Specify Gas Type/Conc.)
1290-01	Gas Cylinder - Air
1290-02	Gas Cylinder - Methane, CH4, 50% L.E.L.
1290-03	Gas Cylinder - Methane, CH4, 5000 ppm
1290-04	Gas Cylinder - Methane, CH4, 1000 ppm
1290-05	Gas Cylinder - Carbon Monoxide, CO, 100 ppm
1290-06	Gas Cylinder - Hydrogen, H2, 50% L.E.L.
1290-07	Gas Cylinder - Hydrogen, H2, 500 ppm
1290-08	Gas Cylinder - Carbon Monoxide, CO, 25 ppm
1290-09	Gas Cylinder - Carbon Dioxide, CO2, 2000 ppm
1290-98	Gas Cylinder - Non-Standard Mixture
1290-99	Gas Cylinder - Non-Standard Gas Type
9210-00	Calibrator, Permeation Type (Requires Permeation Tube)
9211-01	Permeation Tube, Hydrogen Sulfide, H2S
9211-02	Permeation Tube, Chlorine, CI2
9211-03	Permeation Tube, Sulfur Dioxide, SO2
9211-04	Permeation Tube, Nitric Oxide, NO
9211-05	Permeation Tube, Nitrogen Dioxide, NO2
9211-06	Permeation Tube, Carbon Dioxide, CO2
9211-07	Permeation Tube, Hydrogen Chloride, HCI
9211-08	Permeation Tube, Hydrogen Cyanide, HCN
9211-09	Permeation Tube, Ammonia, NH3,
9220-00	Calibrator Kit, Toxic Gas w/o cylinders
9221-01	Gas Cylinder (9220) Hydrogen Sulfide, H2S, 20 ppm
9221-02	Gas Cylinder (9220), Chlorine, Cl2, 5 ppm
9221-03	Gas Cylinder (9220) Sulfur Dioxide, SO2, 50 ppm
9221-04	Gas Cylinder (9220) Nitric Oxide, NO, 20 ppm
9221-05	Gas Cylinder (9220) Nitrogen Dioxide, NO2, 50 ppm
9221-07	Gas Cylinder (9220) Hydrogen Chloride, HCl, 10 ppm
9221-10	Gas Cylinder (9220) Hydrogen Sulfide H2S in Air, 20 ppm
9221-11	Gas Cylinder (9220) Methane (CH4), 50% LEL
9221-12	Gas Cylinder (9220) Carbon Monoxide (CO) 25 PPM
9221-13	Gas Cylinder (9220) Air Zero Grade
9221-98	Gas Cylinder (9220), Non-Standard Mixture
9221-99	Gas Cylinder (9220), Non-Standard Gas Type

Calibration Options & Accessories

5358-00	Calibration Adapter - Direct, Magnetic
5358-01	Calibration Adapter - Direct, Standard
5360-00	Calibration Gas Delivery Fitting - Fixed
SPB69159	Sample Pump

Calibration Equipment Spare Parts

9225-01	Case, Calibrator Kit (9220)
9225-02	Regulator 300 cm (9220)
9225-03	Calibration Adapter (9220)
9225-04	Calibration Tubing TFE 3 Foot
SPB22048	Delivery Tube / Fitting for 1200-26
SPB64011	Delivery Tube for 9210-00, 3 Foot
SPB69036	O-Ring for 1200-26 (5 Pack)

8.5 APPENDIX E - INSTRUCTIONS FOR PRINTER SOFTWARE OPTION

8.5.1 IDENTIFICATION

Sentry systems configured with printer software (5387-00) or printer network software (5388-00) can be identified by pressing the **TIME** key twice. Printer software is installed if the display reads **PRINT HISTORY**.

8.5.2 CAPABILITY

Pre-formatted reports can be printed, via the RS232 port on the Sentry connector panel, directly from one controller to a printer or, via the Sentry Master (5355-00) & Subordinate (5356-00) network system, from several controllers to one printer

8.5.3 REPORTS

8.5.3.1 DEMAND REPORTING

HISTORY REPORT: Selected via the **TIME** key. The History Report lists the last time each significant event has occurred. This includes system power interruption, history reset, alarm and concentration information for each sensor, calibration time for each sensor and an error log.

SYSTEM REPORT: Selected via the **TIME** key. The System Report lists all the system parameters including the software configuration of the system and for each module: on/off condition, calibration status, relay latching configuration, alarm levels, module type, the controller channel to which it is connected, and calibration conditions and factors. The System Report also lists the printer configuration.

STATUS REPORT: Selected via the **TIME** key. The Status Report lists the module numbers with a letter indicating if a low alarm (L) or high alarm (H) condition exists. In addition to module number, the report lists the gas type and present concentration.

DIAGNOSTIC REPORT: Selected via the **MODE** key. The diagnostic report is part of the package of diagnostics described in 7.3.5 and Appendix B. The report lists the critical voltage conditions for each module and can be printed by selecting **SET USER CODE** and answering with user number **9** and entry code number **0010**.

8.5.3.2 OPERATIONAL REPORTING

CALIBRATION REPORT: The calibration report prints automatically when a calibration has been completed. The report indicates which gas type was calibrated, the gas concentration and the planned frequency of calibration. For each module the report lists the percent change during calibration, the peak concentration and the zero and span sensor voltages.

WARM START REPORT: At any time the system is warm started due to a power failure a report is generated to show the system software configuration, the result of an internal diagnostic sequence and the power down and power up dates and times.

8.5.3.3 PERIODIC REPORTING

Sentry can be configured to generate periodic reports to provide closed loop confirmation that the system is operating.

STATUS REPORT: Status report can be printed periodically from 1 to 23 hours or from 1 to 7 days. To configure the status report use the **MODE** key menu item **SET PRINTER**. Turn the printer **ON** and set the period for the Status Report.

HISTORY REPORTS: At the time a periodic Status Report is printed, a History Report can also be printed. The History report is described above in Demand Reporting. In the **SET PRINTER** routine answer the question "Print History" **Y** to cause the report to be generated immediately following every Status Report. If the question is answered "yes" all history data will be reset each period.

DIAGNOSTIC REPORTS: The Diagnostic Report in Demand Reporting can be selected to print periodically (from 1 to 90 minutes). The user code for this selection is "0008".

8.5.3.4 EVENT REPORTING:

EVENT REPORT: When any sensor reading exceeds a preset minimum level an event report is generated. After the sensor is above the minimum level any change greater than a preset change concentration will cause another Event Report to print. The Event Report prints all module numbers and their present reading. Event Report parameters are set in the **CHANGE PRINTER** activity selection in the **MODE** key menu.

8.5.3.5 REPORT FORMAT:

All printer reports begin with the controller ID# which is a single alpha identification set in the **CHANGE PRINTER** activity. The reports also begin with the present system date and time.

All printer reports end with a line across the page. This allows the user to confirm that the entire report has printed and helps with differentiation when more than one controller is printing to the same printer.

The periodic **STATUS, KEY EVENT,** and **HISTORY** reports are printed only when the printer is turned **ON** in the **CHANGE PRINTER** activity. All other reports can be generated without setting the printer to **ON**.

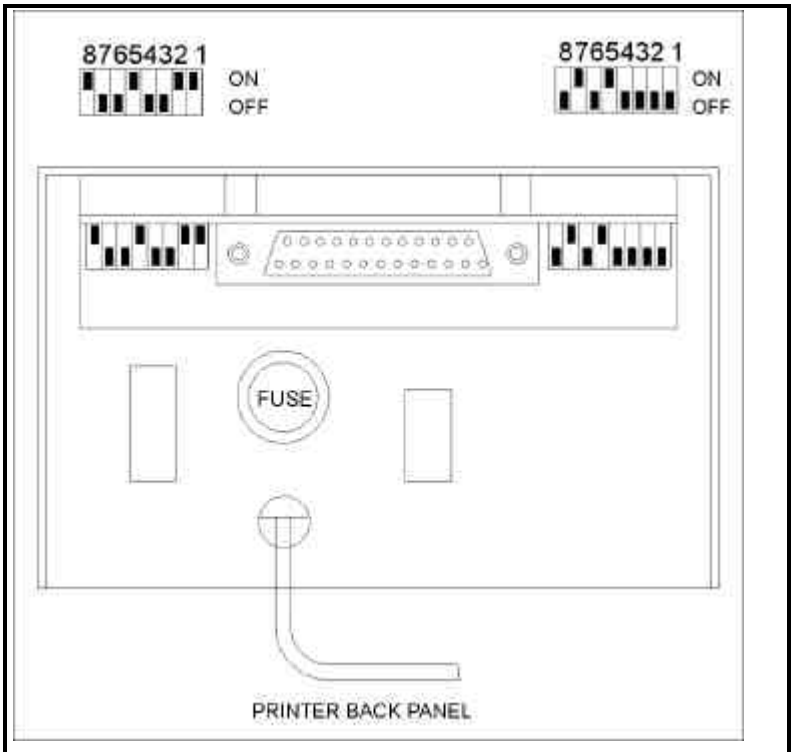


Figure 8-1
Printer Settings

8.6 APPENDIX F - MODEL 5392 INDIVIDUAL RELAY

8.6.1 RELAY PANEL DESCRIPTION

Model 5392-00 Individual Relay Panel extends Sentry low alarm and high alarm capability by providing individual single pole double throw (SPDT) dry contacts for each alarm level for each module. The panel is designed to be installed as follows:

- Rack or Chassis Controllers: Mounted on stand-offs on the connector panel of the controller, or installed on the back of spare slots in 19” instrument shelf Model 5331-00.
- Wall Mount: Supplied pre-installed on a separate wall mounting panel
- NEMA 4X Enclosure: Mounted on swinging connector panel beside the display panel. (When other options are installed in the enclosure, the Individual Relay panel may be installed inside the swinging panel)

The panel connects to the Sentry controller via a ribbon cable.

8.6.2 RELAY PANEL ASSEMBLY

Individual Relay Panels supplied with original Sentry shipments are factory pre-assembled with the controller. For NEMA enclosures, the panel is fully installed prior to shipment. For other controllers minor final assembly is described below.

Individual Relay Panels supplied as add-on to original Sentry controllers require that the connector panel of the controller be removed so that threaded stand-offs (supplied) can be installed onto the four corners of the panel.

8.6.3 INSTALLATION

The following are instructions for final installation and wiring of the Individual Relay panel:

1. Perform normal installation of the Sentry controller and modules and perform function checks of the basic system.
2. Power down the system.
3. Plug the Individual Relay Panel ribbon cable into the connector on the controller.
4. Mount the panel on the four stand-offs on the connector panel of the controller [not required for NEMA enclosures].
5. Make the necessary connections to the high and low relays for each of the modules as required for the particular application. Note that these are dry contact relays and that power must be connected from an external source.

8.6.4 OPERATION

Figure 8-2 shows the location of the sixteen relays which are marked as "high" and "low" alarms for the respective modules.

When any module connected to the controller is in alarm it's respective relay will be energized.

To operate alarms or other auxiliary equipment connect to the required relays according to the module number.

Several logic configurations are available:

- The user can configure each alarm as latching or non-latching via the **CHANGE MODULE** menu activity.
- A factory option available with the Enhancement Package allows all high, or all low alarms, or both, to be configured for alarm acknowledge when latched.
- A factory option available with the Enhancement Package allows alarm states to be combined into zones and voting groups for activation of individual relays.

Table 8-2 is helpful for determining the relay actions which will occur under various alarm conditions based on the user’s configuration.

To use the table:

1. Select one of the nine possible combinations of high and low alarm relay configurations in the top two lines across the table.
2. Select one main block of the three alarm status scenarios from the left column.
3. Trace the relay and LED status conditions for each change in alarm status.
4. Where there are secondary columns, move to the secondary columns at any point by pressing Alarm Reset, Enter.

8.6.5 INDIVIDUAL RELAY SPECIFICATIONS

- Dimensions 6.97” X 4.2” X 1.5” (HWD)
- Number of Relays 16 SPDT
- Contact Rating 6A
- Wire Terminals Screw Terminals

LOW RELAY:		**NON-LATCH**			**LATCH**			**ACKNOWLEDGE**		
HIGH RELAY:		**NON**	**LATCH**	**ACKN**	**NON**	**LATCH**	**ACKN**	**NON**	**LATCH**	**ACKN**
Status	**Outputs**	**Status conditions are indicted as "0" = Off, "1" = On, "F" = Flashing**								
No Alarm	**Low Relay**	0	0	0	0	0	0	0	0	0
	High Relay	0	0	0	0	0	0	0	0	0
	LED	0	0	0	0	0	0	0	0	0
Low Alarm	**Low Relay**	1	1	1	1	1	1	1-0	1-0	1.0
	High Relay	0	0	0	0	0	0	0-0	0-0	0-0
	LED	1	1	1	1	1	1	1-1	1-1	1-1
No Alarm	**Low Relay**	0	0	0	1-0	1-0	1-0	1-0	1-0	1-0
	High Relay	0	0	0	0-0	0-0	0-0	0-0	0-0	0-0
	LED	0	0	0	1-0	1-0	1-0	0-0	0-0	0-0
No Alarm	**Low Relay**	0	0	0	0	0	0	0	0	0
	High Relay	0	0	0	0	0	0	0	0	0
	LED	0	0	0	0	0	0	0	0	0
Low Alarm	**Low Relay**	1	1	1	1	1	1	1-0	1-0	1-0
	High Relay	0	0	0	0	0	0	0-0	0-0	0-0
	LED	1	1	1	1	1	1	1-1	1-1	1-1
High Alarm	**Low Relay**	1	1	1-1	1	1	1-1	1-0	1-0	1-0-0
	High Relay	1	1	1-0	1	1	1-1	1-1	1-1	1-1-0
	LED	F	F	F-F	F	F	F-F	F-F	F-F	F-F-F
Low Alarm	**Low Relay**	1	1-1	1-1	1	1-1	1-1	1-0	1-0-0	1-0-0
	High Relay	0	1-0	1-0	0	1-0	1-0	0-0	1-1-0	1-1-0
	LED	1	F-1	F-1	1	F-1	F-1	1-1	F-F-1	F-F-1
No Alarm	**Low Relay**	0	0-0	0-0	1-0	1-1-0	1-1-0	1-0	1-0-0	1-0-0
	High Relay	0	1-0	1-0	0-0	1-0-0	1-0-0	0-0	1-1-0	1-1-0
	LED	0	F-0	F-0	1-0	F-1-0	F-1-0	1-0	F-F-0	F-F-0
No Alarm	**Low Relay**	0	0	0	0	0	0	0	0	0
	High Relay	0	0	0	0	0	0	0	0	0
	LED	0	0	0	0	0	0	0	0	0
Low Alarm	**Low Relay**	1	1	1	1	1	1	1-0	1-0	1-0
	High Relay	0	0	0	0	0	0	0-0	0-0	0-0
	LED	1	1	1	1	1	1	1-1	1-1	1-1
High Alarm	**Low Relay**	1	1	1-1	1	1	1-1	1-0	1-0	1-0-0
	High Relay	1	1	1-0	1	1	1-1	1-1	1-1	1-1-0
	LED	F	F	F-F	F	F	F-F	F-F	F-F	F-F-F
Low Alarm	**Low Relay**	1	1-1	1-1	1	1-1	1-1	1-0	1-0-0	1-0-0
	High Relay	0	1-0	1-0	0	1-0	1-0	0-0	1-1-0	1-1-0
	LED	1	F-1	F-1	1	F-1	F-1	1-1	F-F-1	F-F-1
High Alarm	**Low Relay**	1	1-1	1-1-1	1	1-1	1-1-1	1-0	1-0-0	1-0-0-0
	High Relay	1	1-1	1-1-0	0	1-1	1-1-0	1-1	1-1-1	1-1-1-0
	LED	F	F-F	F-F-F	1	F-F	F-F-F	F-F	F-F-F	F-F-F-F
Low Alarm	**Low Relay**	1	1-1-1	1-1-1	1	1-1-1	1-1-1	1-0	1-0-0-0	1-0-0-0
	High Relay	0	1-1-0	1-1-0	0	1-1-0	1-1-0	0-0	1-1-1-0	1-1-1-0
	LED	1	F-F-1	F-F-1	1	F-F-1	F-F-1	1-1	F-F-F-1	F-F-F-1
No Alarm	**Low Relay**	0	0-0-0	0-0-0	1-0	1-1-1-0	1-1-1-0	1-0	1-0-0-0	1-0-0-0
	High Relay	0	1-1-0	1-1-0	0-0	1-1-0-0	1-1-0-0	0-0	1-1-1-0	1-1-1-0
	LED	0	F-F-0	F-F-0	1-0	F-F-1-0	F-F-1-0	1-0	F-F-F-0	F-F-F-0

Table 8-2
Individual Alarm Relay Logic

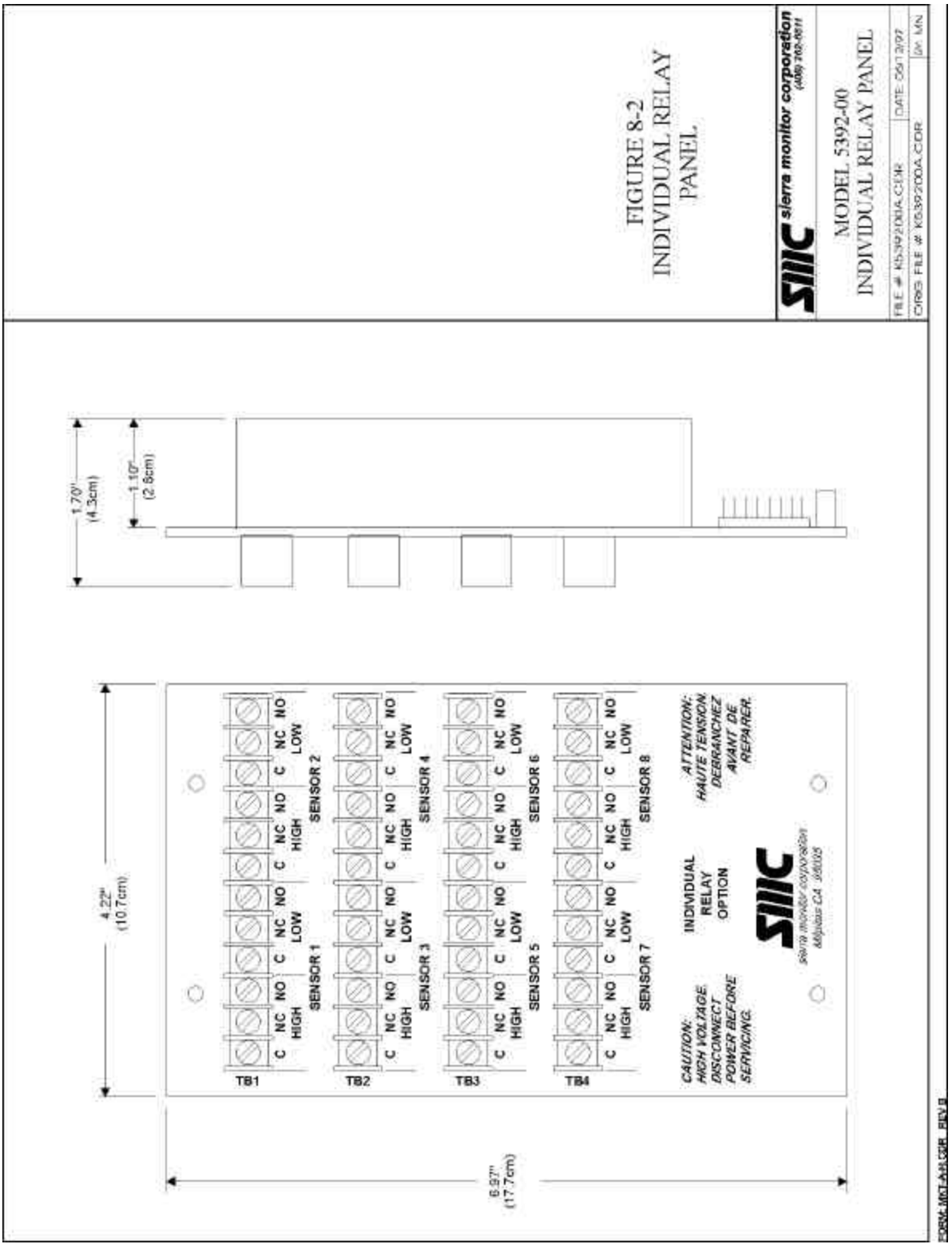


Figure 8-2
Individual Relay Panel

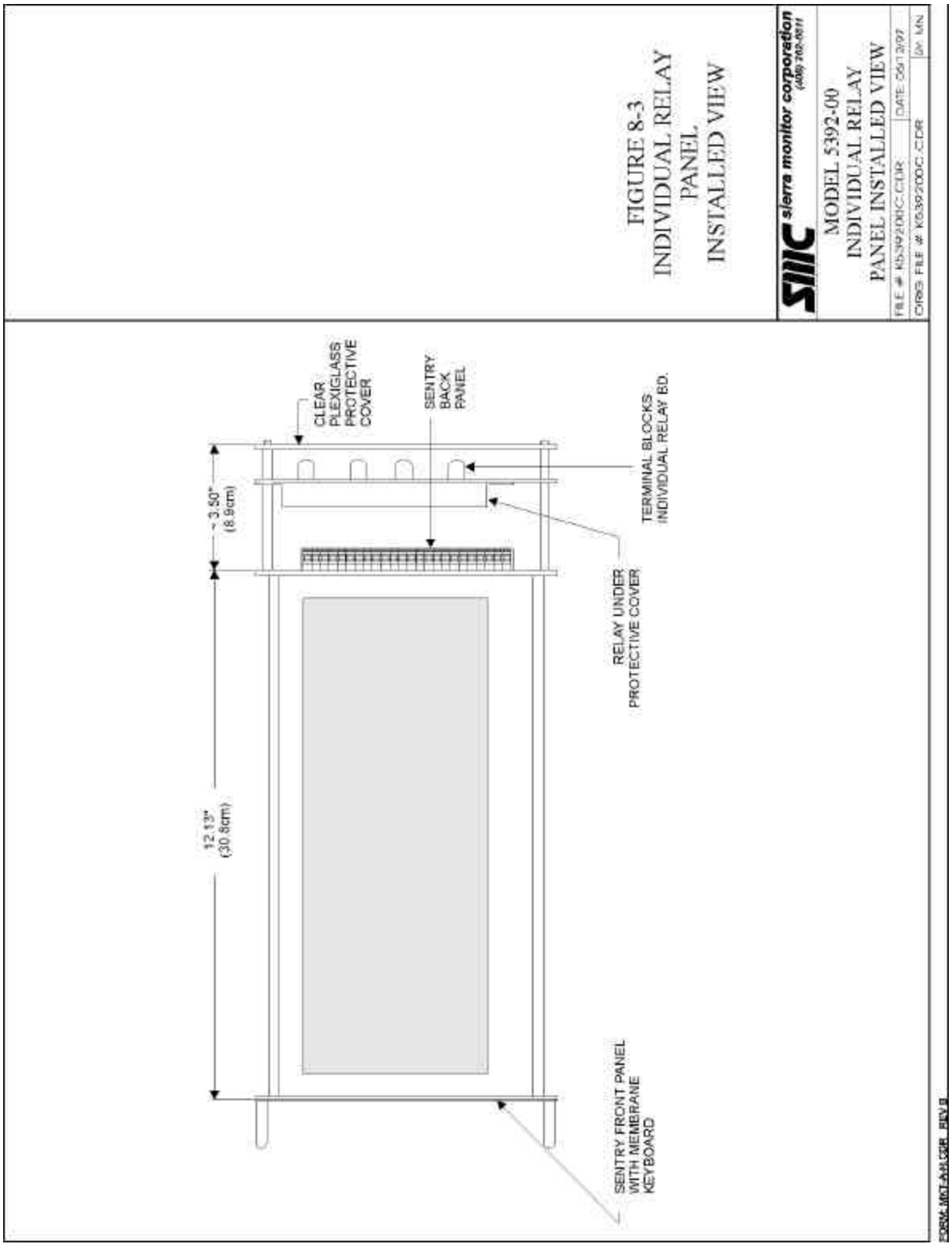


Figure 8-3
Individual Relay Panel - Installed View

8.7 APPENDIX G - MODEL 4314 OUTPUT EXPANSION PANEL

8.7.1 EXPANSION PANEL DESCRIPTION

The Model 4314-01 Output Expansion Panel extends Sentry low and high alarm capability by providing individual single pole double throw (SPDT) dry contacts for each alarm level for each module, and also provides eight analog outputs for retransmission of the gas concentration values for each sensor. Model 4314-01 is an alternative option to Model 5392 and requires the firmware enhancement. The panel is designed to be installed as follows:

- Rack, Chassis and Wall Mount Controllers: Mounted on stand-offs on the connector panel of the controller, or installed on the back of spare slots in 19" instrument shelf Model 5331-00.
- NEMA 4X Enclosure: Mounted on swinging connector panel beside the display panel.

The panel connects to the Sentry controller via a ribbon cable and a two conductor wire harness.

8.7.2 EXPANSION PANEL ASSEMBLY

Expansion Panels supplied with original Sentry shipments are factory pre-assembled with the controller. For NEMA enclosures, the panel is fully installed prior to shipment. For other controllers minor final assembly is described below.

Expansion Panels supplied as add-on to original Sentry controllers require that the connector panel of the controller be removed so that threaded stand-offs (supplied) can be installed onto the four corners of the panel.

8.7.3 INSTALLATION

The following are instructions for final installation and wiring of the Output Panel:

1. Perform normal installation of the Sentry controller and modules and perform function checks of the basic system.
2. Power down the system.
3. Plug the Output Expansion Panel connector cable into the connector panel of the controller. See J3 Figure 8-4 not required for NEMA enclosures].
4. Connect the two position DC power connector to Power (P) and Ground (G) on any channel of the Sentry controller.
5. Mount the panel on the four stand-offs on the connector panel of the controller [not required for NEMA enclosures].
6. Make the necessary connections to the HIGH and LOW relays for each of the Modules as required for the particular application. Note that these are dry contact relays and that power must be connected from an external source.
7. Make the necessary connections to the analog output terminals located across the lower side of the panel. The outputs are preconfigured for 4-20 mA proportional to the full scale of the corresponding input sensor module. The outputs can be forced high or low for test purposes by using diagnostic codes. See Section 7.3.5

8.7.4 OPERATION

Figure 8-4 shows the location of the sixteen relays which are (marked as "high" and "low" alarms for the respective modules) and the eight analog outputs marked.

The analog outputs are always active except during calibration when they are locked at 4 mA.

When any module connected to the controller is in alarm it's respective relay will be energized.

To operate alarms or other auxiliary equipment connect to the required relays according to the module number.

Several logic configurations are available:

- The user can configure each alarm as latching or non-latching via the **CHANGE MODULE** menu activity.
- A factory option available with the Enhancement Package allows all high, or all low alarms, or both, to be configured for alarm acknowledge when latched.
- A factory option available with the Enhancement Package allows alarm states to be combined into zones and voting groups for activation of individual relays.

Table 8-2 is helpful for determining the relay actions which will occur under various alarm conditions based on the user's configuration.

8.7.5 OUTPUT EXPANSION PANEL TESTING

The relay outputs can be forced to the energized state by using the front panel **TEST ALARMS** function.

The analog outputs can be forced to 4 mA by using diagnostic code 0012.

The analog outputs can be forced to 20 mA by using diagnostic code 0013.

The analog outputs can be returned to normal operation by using diagnostic code 0000.

8.7.6 INDIVIDUAL RELAY SPECIFICATIONS

- Dimensions 7.0" X 4.2" X 1.2" (HWD)
- Relays

Number of Relays	16 SPDT
Contact Rating	6A
Wire Terminals	Screw Terminals

- Analog Outputs

Number of Outputs	8
Scale	4-20 mA
Loop Resistance (max.)	800 Ohms
Wire Terminals	Compression

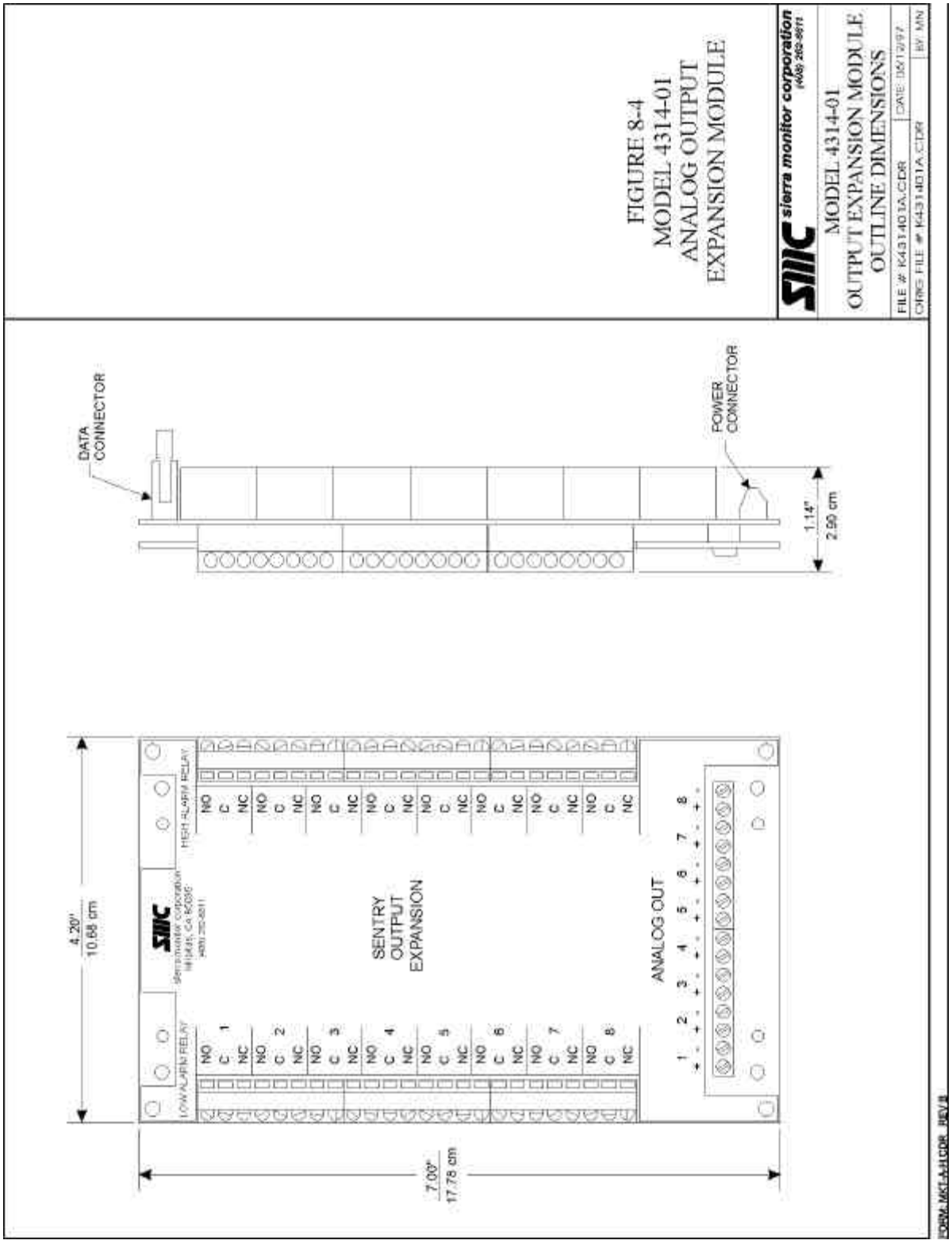


Figure 8-4
Model 4314-01 Output Expansion Module

8.8 APPENDIX H - MODEL 5100-99 ANALOG INPUT MODULE

8.8.1 DESCRIPTION

The Analog Input Module is used to allow input to Sentry by a 4-20 mA analog device, such as an analog gas sensor or other type of sensing device.

The module has the same physical form as other Sentry gas modules except that the sensor assembly in the lower hub is replaced by the user's analog input device.

8.8.2 INSTALLATION

Figure 8-5 shows the terminal connections for the analog input module.

- Connect channel wiring (P S G) from the Sentry controller to TB1 in the same manner as other sensor modules.
- For three wire analog input device:
  - ⇒ Double up the power (P) on TB1 connection to provide 19 - 21 VDC to the analog input device.
  - ⇒ Connect ground (G) and signal (S) on TB2 to the corresponding terminals on the analog input device.
- For two wire analog input device:
  - ⇒ Double up the power (P) on TB1 connection to provide 19 - 21 VDC to the analog input device.
  - ⇒ Connect signal (S) on TB2 to the corresponding terminal on the analog input device.

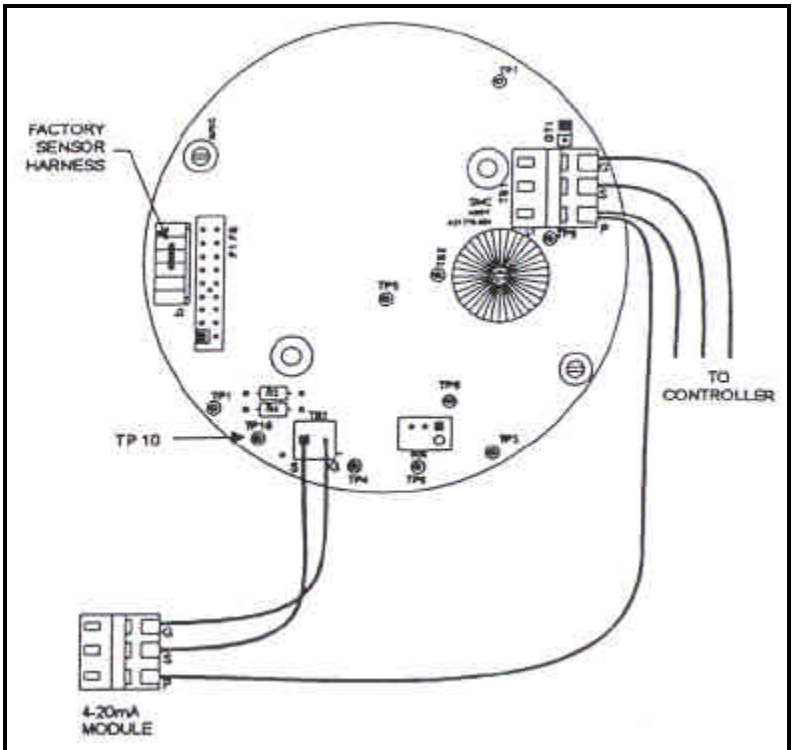


Figure 8-5
Model 5100-99 Analog Input Component Locator

8.8.3 ADJUSTMENT PROCEDURE

Prior to reading voltages and making adjustments perform a visual inspection to confirm that there are no physical problems such as water in the electronics enclosure, wiring damage or corrosion.

8.8.3.1 SIGNAL ADJUSTMENT

The Model 5100-99 transmitter must be adjusted when a new analog input is connected. It is not necessary to perform periodic adjustment of the tranmitter, but normal calibration of the input should be perfomred according to manufacturer instructions.

To adjust the tranmitter:

1. Connect DVM to Signal Out and Ground test points on the cover plate.
2. Supply 4 mA from the sensor device and adjust "Zero Adj" potentiometer until DVM reads 0.0 VDC.
3. Supply 20 mA from the sensor device and adjust "Span Adj" potentiometer until DVM reads 2.0 VDC.
4. Repeat steps 2 and 3 on an iteration basis until step 2 requires no further adjustment.

8.8.3.2 CALIBRATION

To calibrate the combined Model 5100-99 and analog sensor input, follow the standard Sentry Global Calibration instructions. See 5.3.1.1

8.9 APPENDIX I - MODEL 5100-90 8-CHANNEL ANALOG-DIGITAL CONVERTER

8.9.1 DESCRIPTION

The 8-Channel Analog-Digital Converter can be used to connect up to eight 4-20 mA sensor devices from Sierra Monitor or other manufacturers to the Sentry controller.

8.9.2 INSTALLATION

1. Power down the system
2. Figure 8-6 shows the terminal connections for the 8-Channel Analog-Digital Converter.
3. Connect 4-20 mA sensor inputs for each of the sensors (up to 8) to channels 1 through 8 as indicated
   - 3-wire connections should be P (Power), S (Signal), G (Ground)
   - 2-wire connections should be P (Power) and S (Signal)
4. The channel number indicated by the connection on the 5100-90 becomes the Sentry module address number
   - **NOTE**: Sentry digital input sensor modules on the same controller must not have addresses which duplicate addresses used on the 5100-90
5. Set select switches on the right side of the converter to identify the sensor module type as follows:

Type	Switch 1	Switch 2
Combustible	OFF	ON
Oxygen	ON	OFF
Toxic	OFF	OFF
Not Active	ON	ON

6. The Power/Comm Bus is located at the bottom of the converter. Connect Power/Comm Bus to the Sentry or an external 20-24 VDC Power Supply as follows:

Converter	Sentry	External 20-24VDC Power Supply
P1	Terminal 1 Channel 8	Power Supply +VDC
S1	Terminal 2 Channel 8	Terminal 2 Channel 8
G1	Terminal 3 Channel 8	Terminal 3 Channel 8K
P2	Terminal 1 Channel 7	Power Supply +VDC
G2	Terminal 3 Channel 7	Power Supply Common

   - **NOTE**: Converter terminals P1, S1 and G1 connect to one channel and P2, G2 connect to a second channel. When an external power supply is used, connect S1 and G1 to any single channel on the Sentry

8.9.3 SERVICE

There are no serviceable components on the Analog-Digital Converter. Contact Sierra Monitor for factory service.

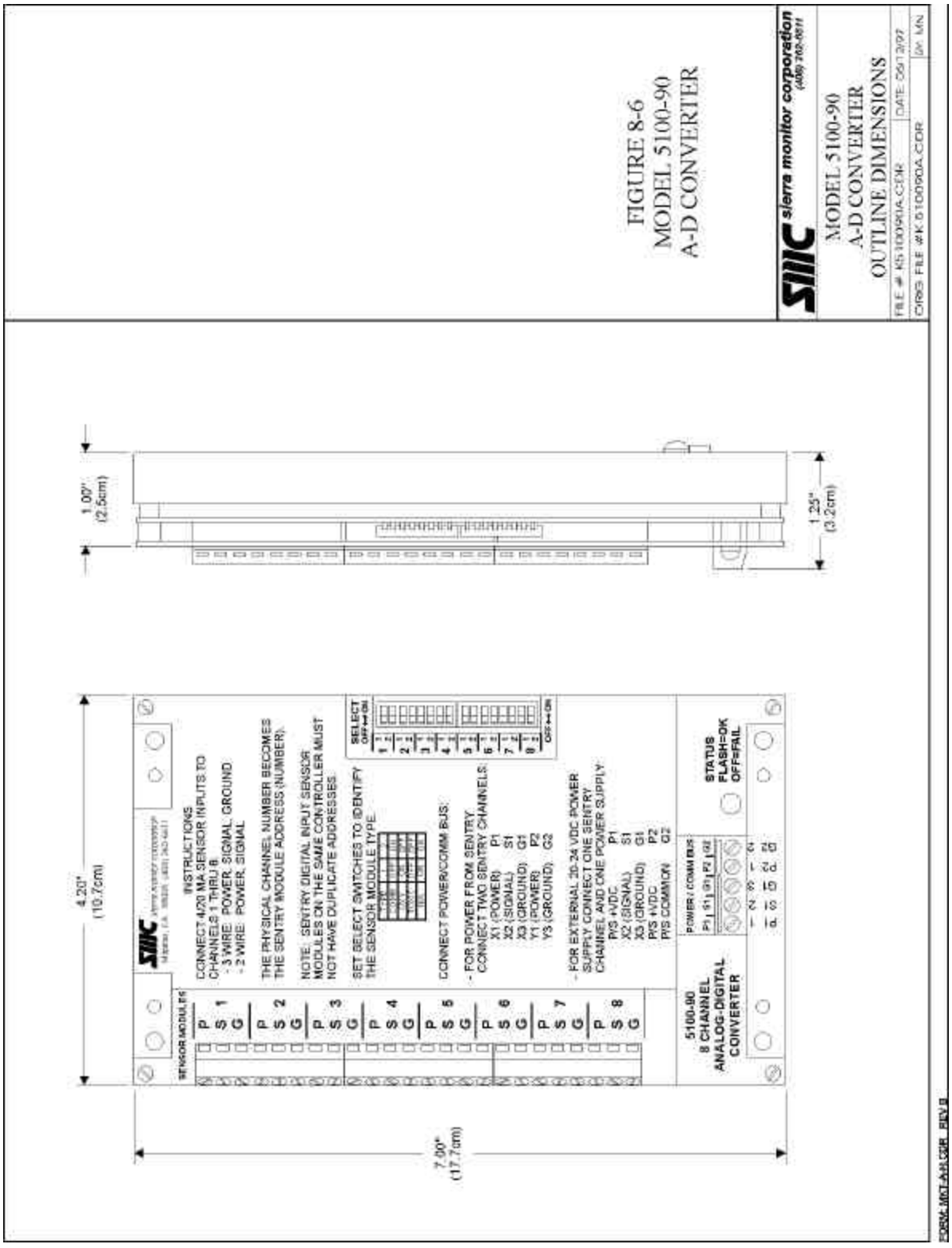


Figure 8-6
Model 5100-90 Analog Input Multiplexor

8.10 APPENDIX J - REFERENCE DRAWINGS

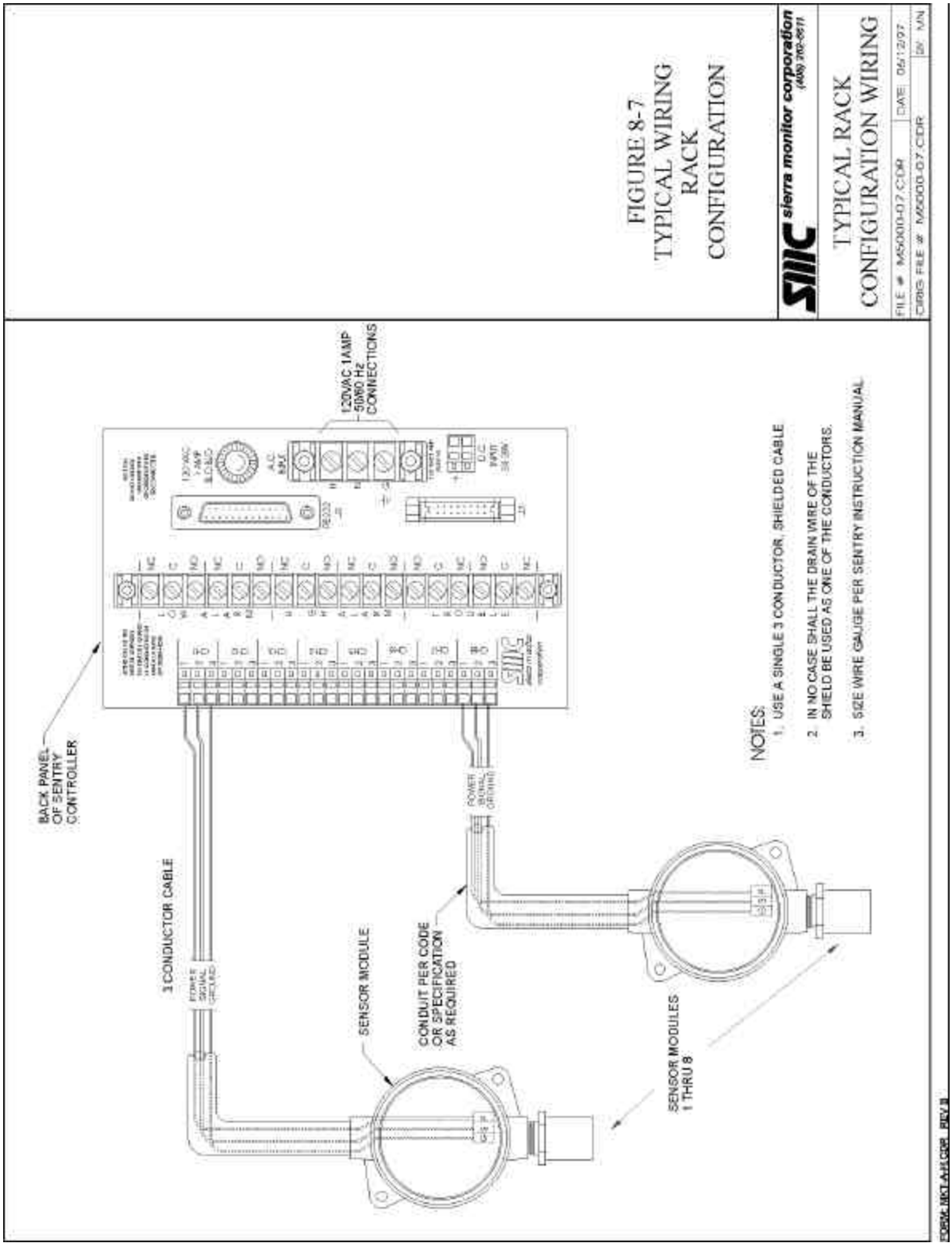


Figure 8-7
Typical Rack Configuration Wiring

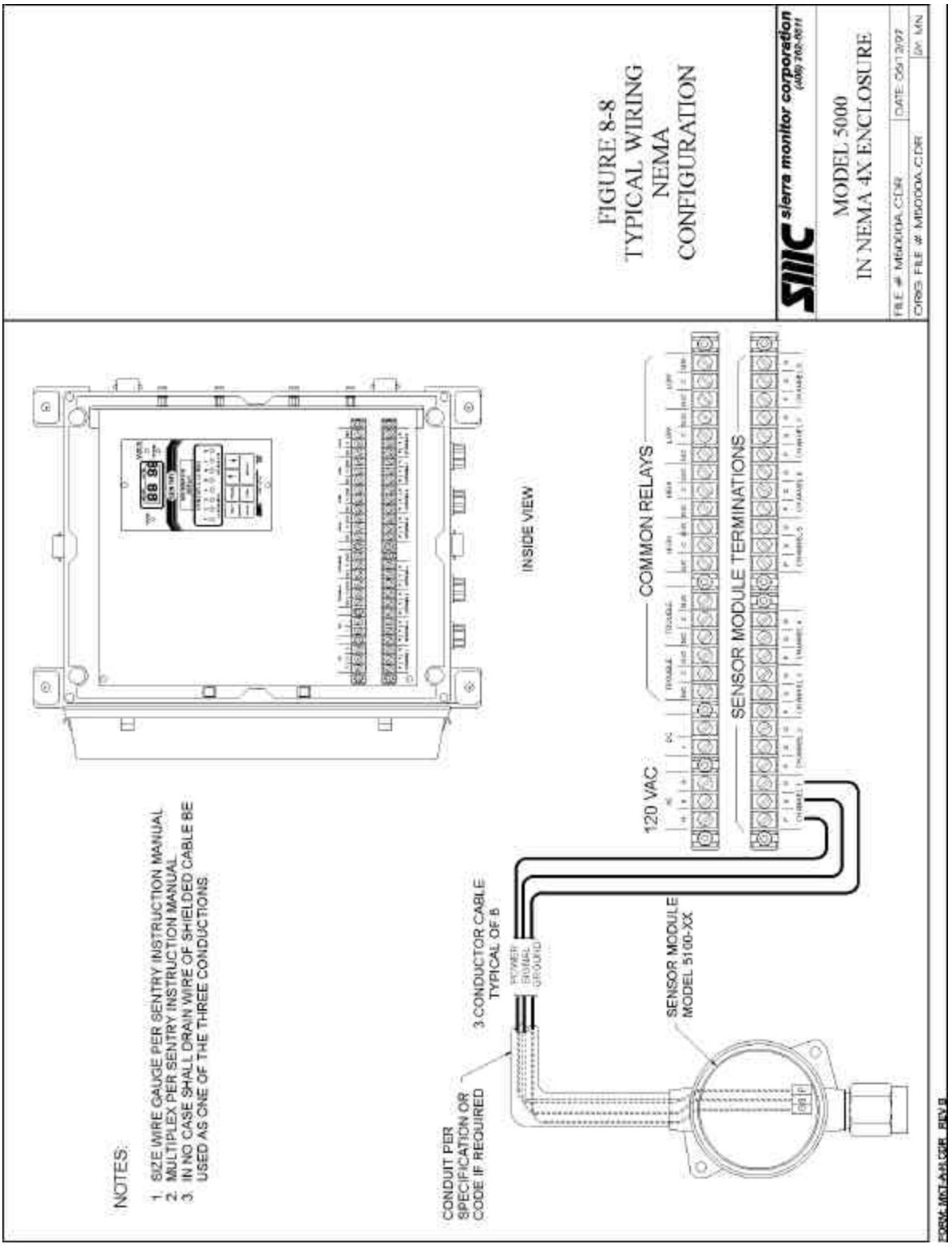


Figure 8-8
Typical NEMA-4X Wiring

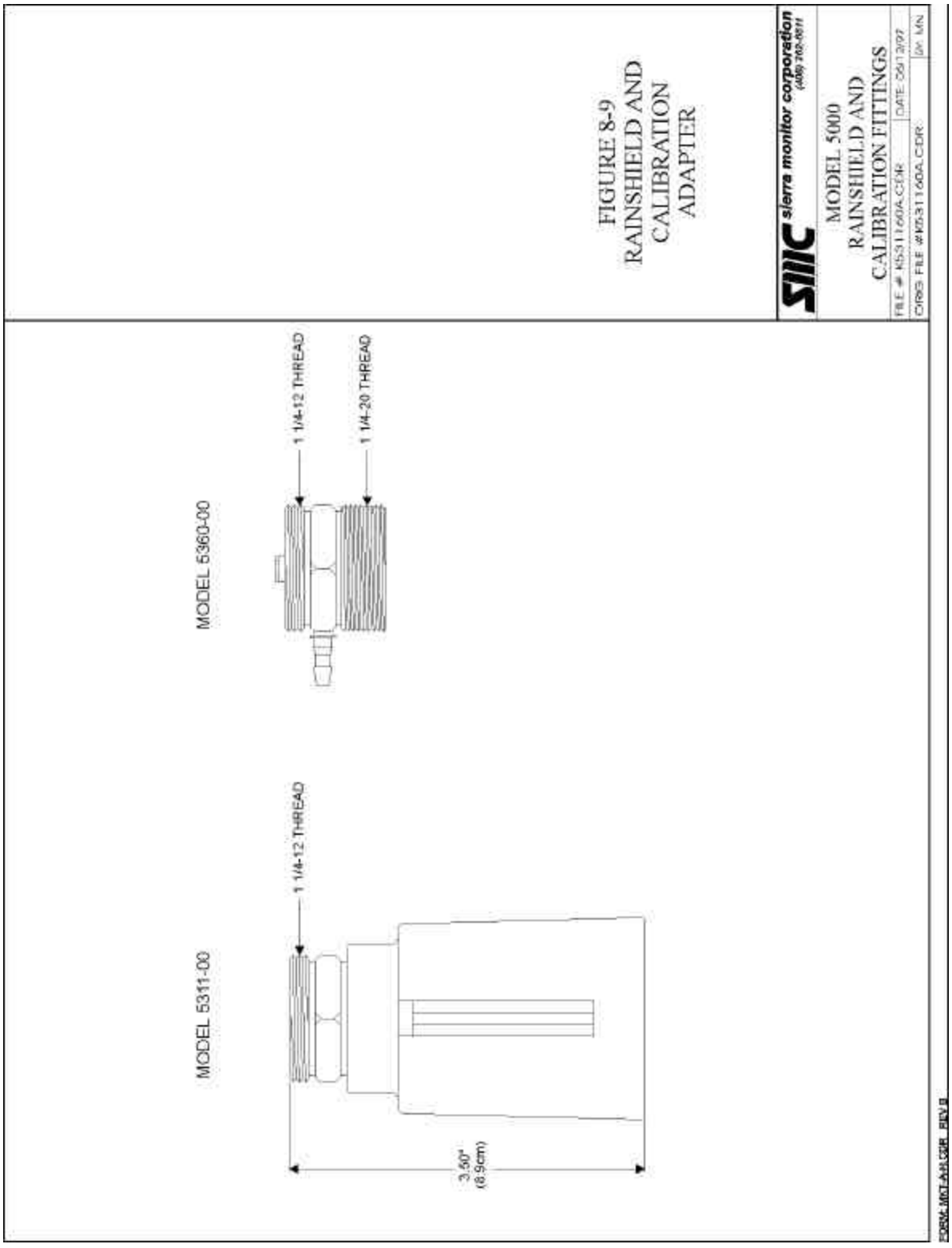


Figure 8-9
Rainshield and Calibration Adapter

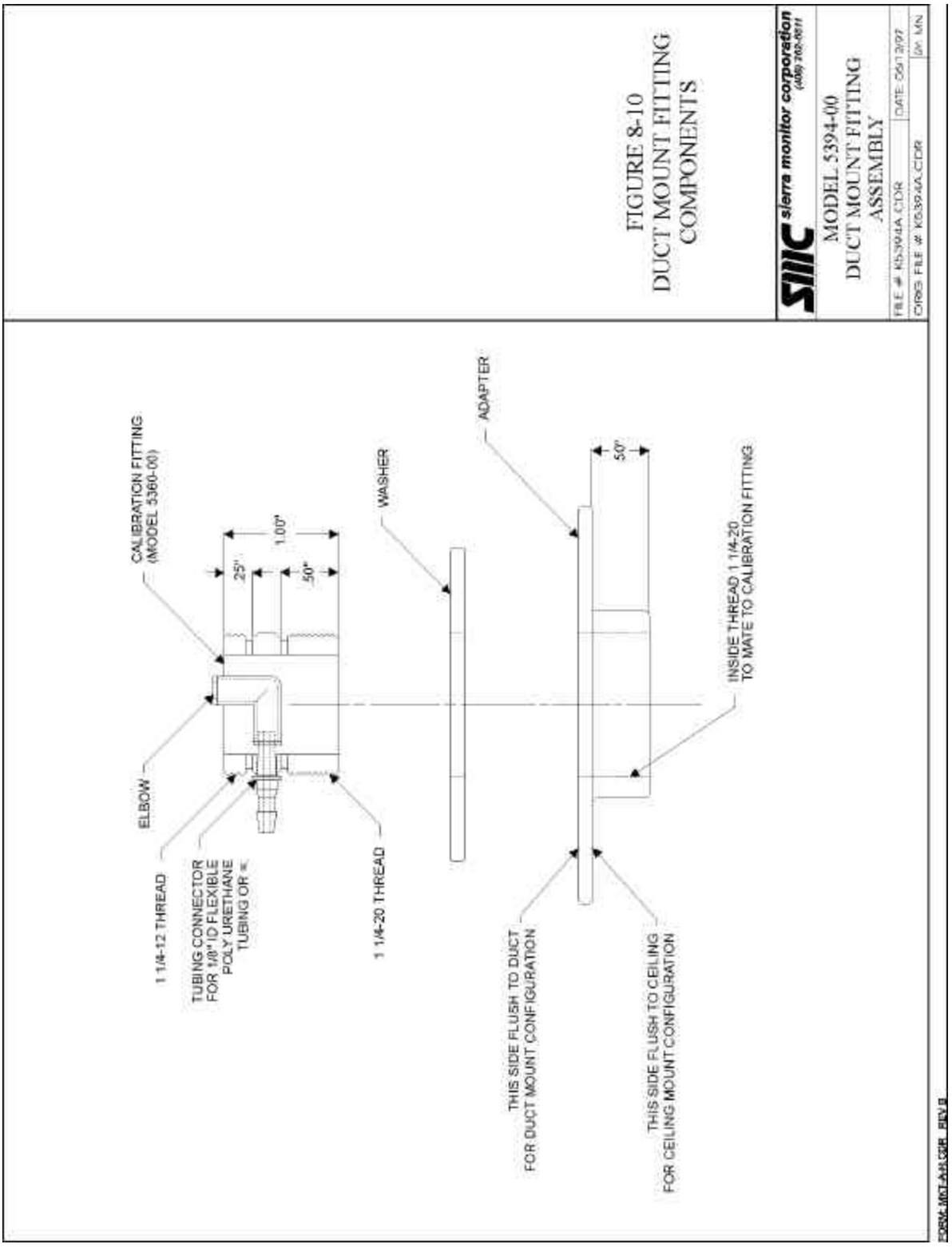


Figure 8-10
Duct Mount Fitting Components

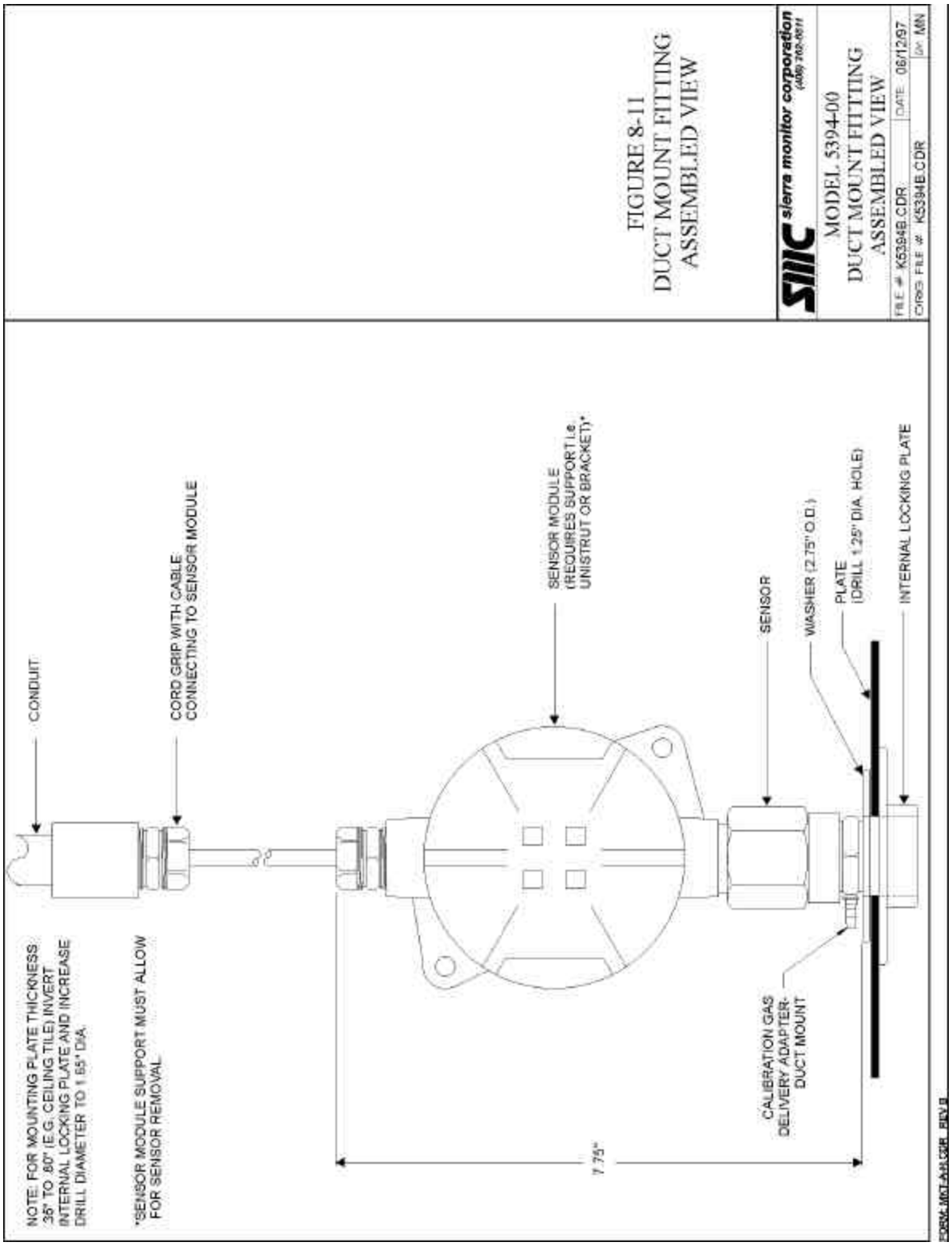


Figure 8-11
Duct Mount Fitting - Assembled View

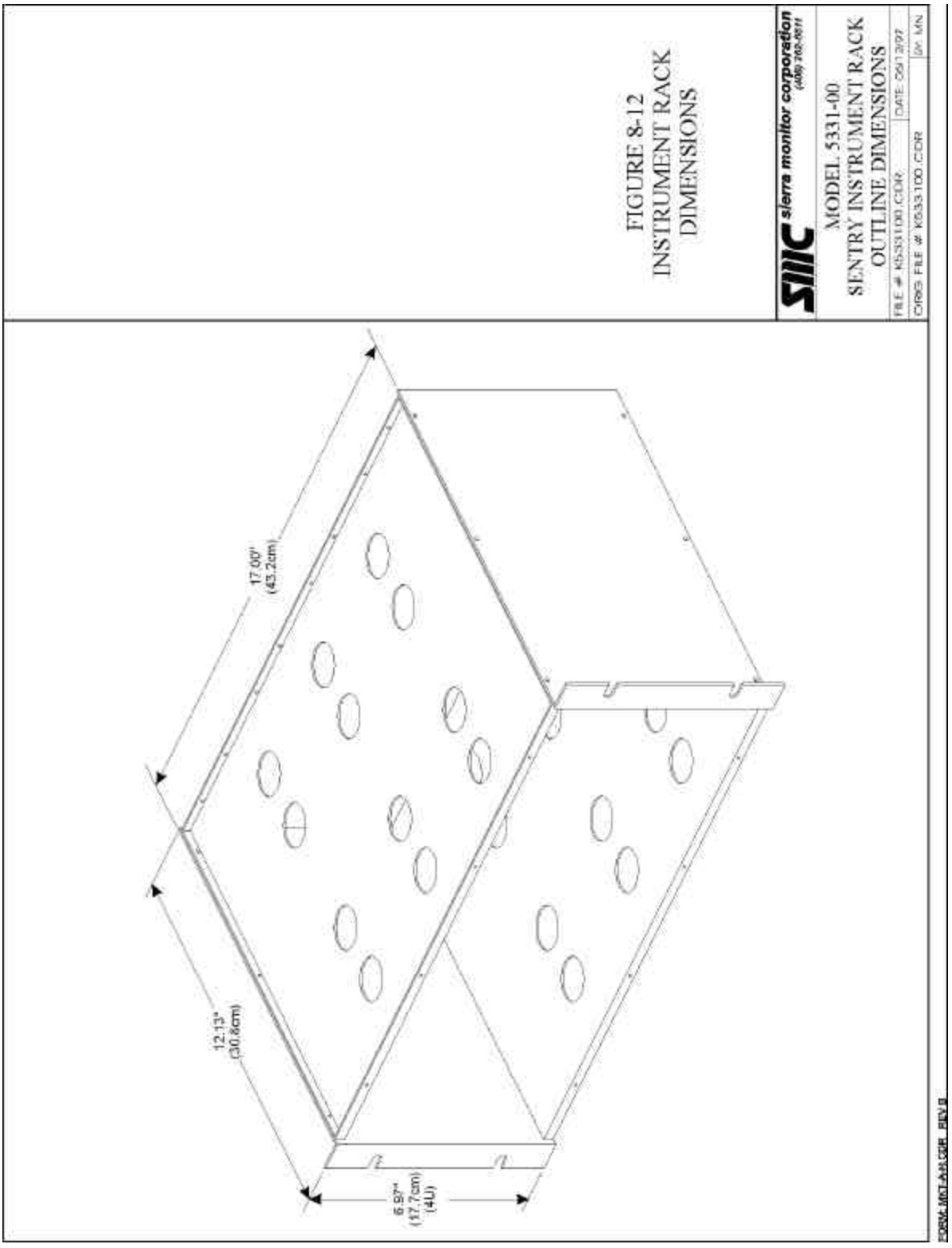


Figure 8-12
Instrument Rack Dimensions

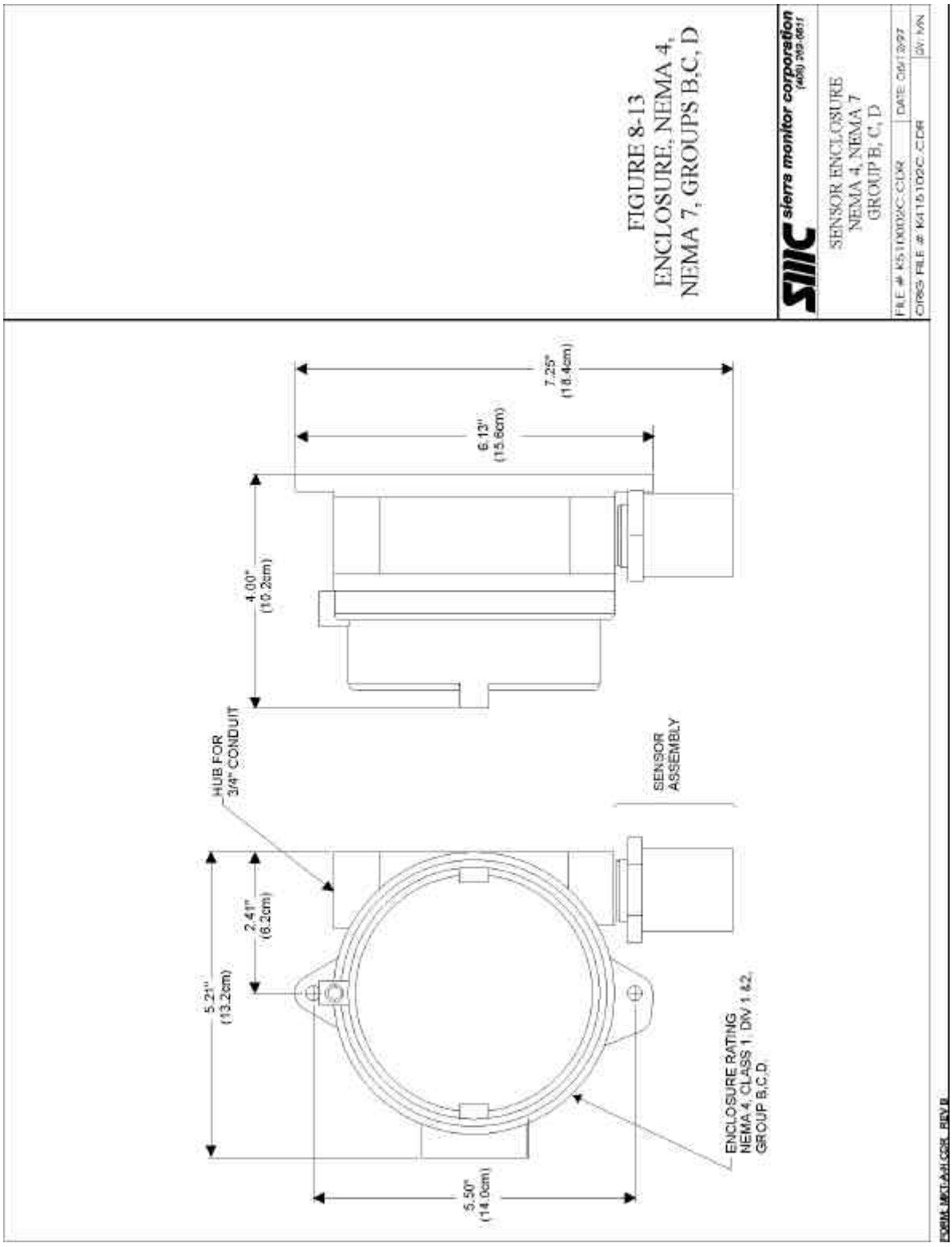


Figure 8-13
Enclosure, NEMA 4, NEMA 7, Groups B, C, D

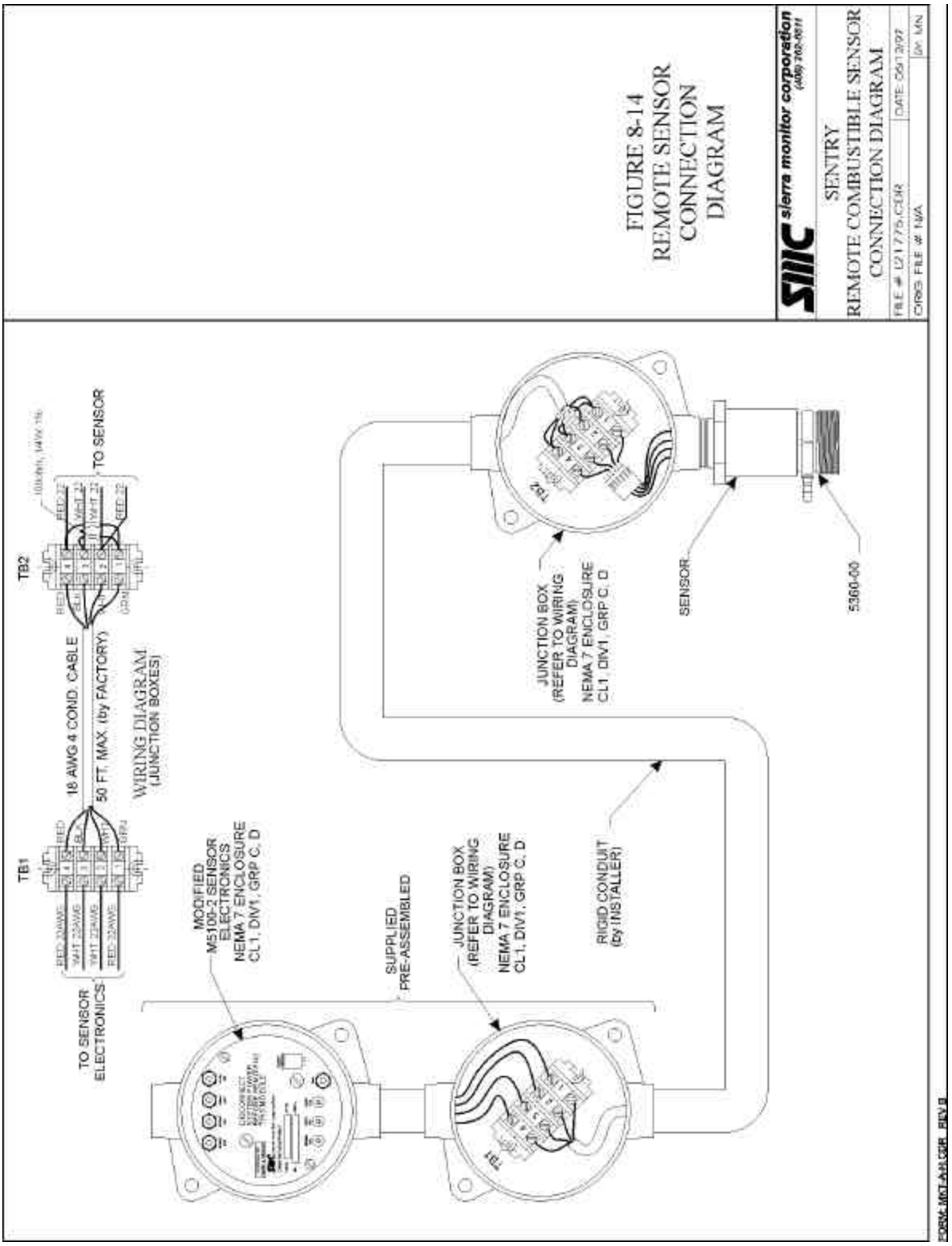


Figure 8-14
Remote Sensor Connection Diagram

9. INDEX

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10. LIST OF FIGURES

11. LIST OF TABLES

INTERNAL NOTES FOR THIS MANUAL

Author:

1. Gordon Arnold - July 1992
2. Gordon Arnold - November 1995

General:

1. This manual is a re-write of the Version 4.0 Instruction and Service manuals for Sentry systems. Changes implemented are to comply with FM approval requirements and to update or correct sections which have been obsoleted by time.
2. This manual is updated (1995) to incorporate changes due to Version 6.X

Publishing:

1. Formatting is for HPDWNB2P
2. Format is for double side printing for 3 hole binders or spiral bind.
3. All appendices are to be included in all copies of the manual.
4. WARNING: WORD 6.0 AND ORIGINAL RELEASE OF WORD 7.0 HAVE A BUG WHICH WILL CAUSE SHRINKING OF FIGURE CROSS REFERENCES. USE ONLY WORD 6.0a (UPDATED ON GORDON ARNOLD'S COMPUTER 11/95) OR USE AN UPDATED 7.0 SYSTEM.

ALWAYS CHECK CONTENT, INDEX AND LISTS FOR ACCURATE PAGE NUMBERS BEFORE RUNNING COPIES.

PHYSICAL CUT AND PASTE REQUIRED TO COMPLETE SMALL FIGURES.

FOR FULL PAGE FIGURES OBTAIN ORIGINAL SUBMITTAL DRAWINGS FROM DRAFTING, THEN USE UPDATED FILE FIGRTAGS.DOC TO PRINT LABELS INTO LEGEND BLOCK.

Changes:

1. July 13, 1992 - First distributed draft.
2. August 1992 - Final FM approval changes including FM Logo
3. NOTE: No further changes unless approved by FM
4. Update for FM approval 5/95 THRU 11/95
5. FM approval 11/95 uses draft of Version 6 manual.
6. Final Version 6 Manual to be submitted to FM in December 1995.
7. Added drawings to electronic version in 2001.
8. Figures captions were corrupted.

Manual Writing Notes:

1. In Version 6.0 all specifications were correlated with sales latest literature.

APPLICABILITY & EFFECTIVITY

Effective for all Sentry **systems manufactured after September 1, 1995.**

Effective for FM approved systems after FM contract is signed.

Sierra Monitor Corporation
1991 Tarob Court, Milpitas, CA 95035
(408) 262-6611