

MODEL 5000
S E N T R Y
GAS MONITORING SYSTEM

Version 6

Installation



APPLICABILITY & EFFECTIVITY

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

Instruction Manual Part Number T12001-A1

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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 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°C (85°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° 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.)

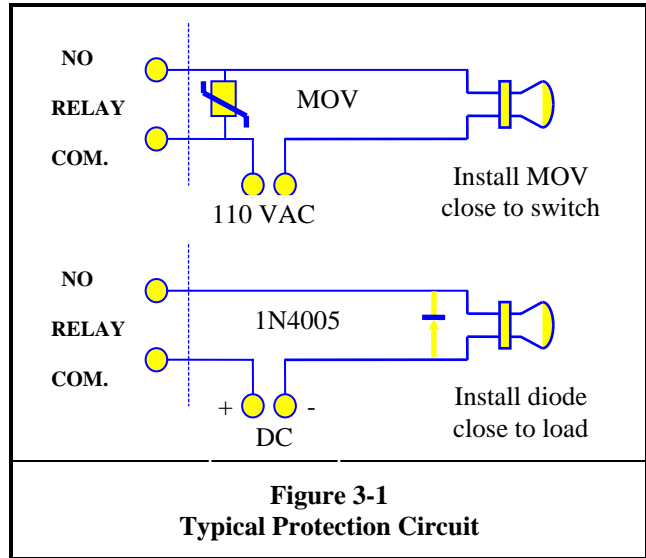
NOTE

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 placed 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).

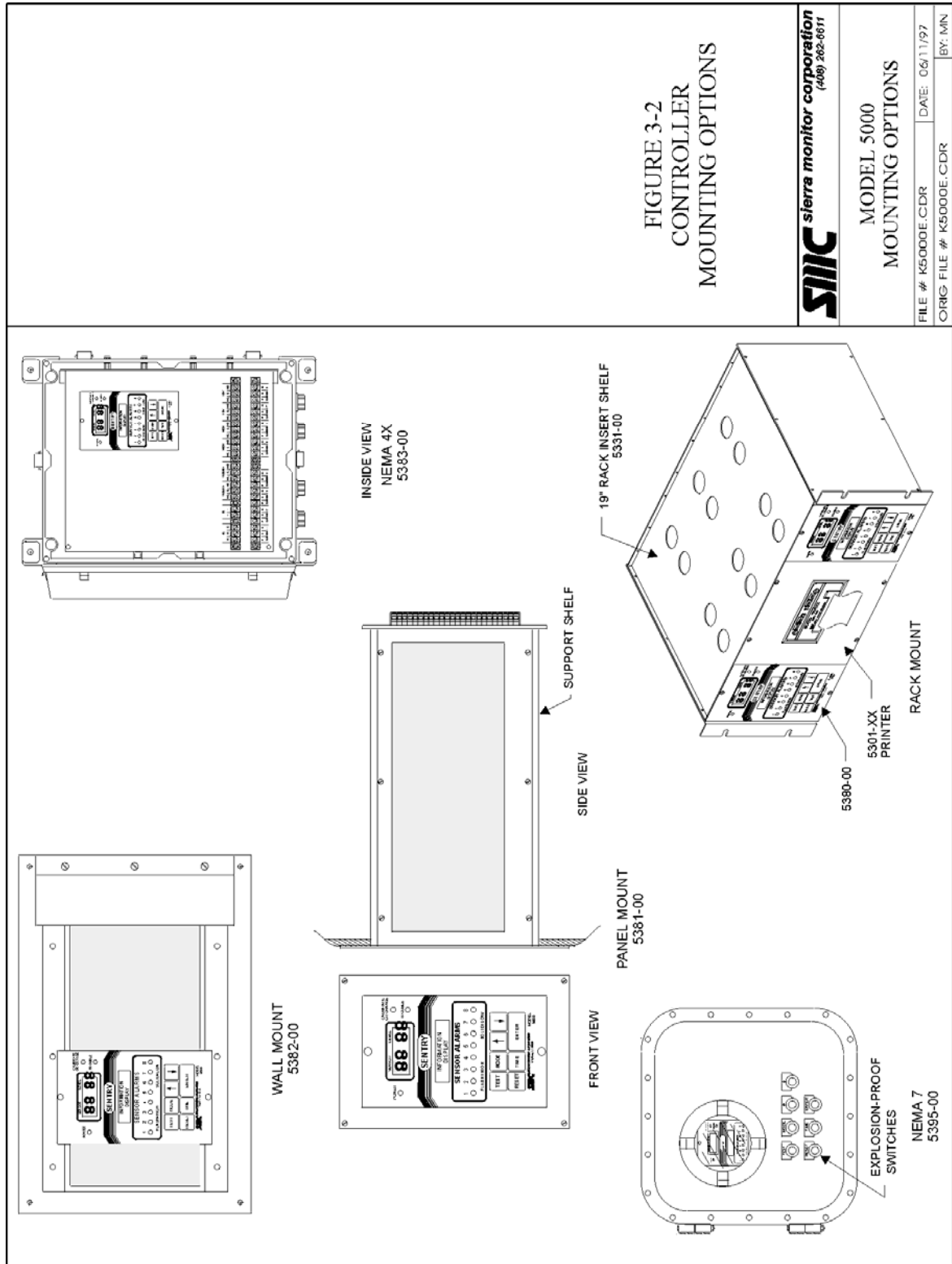
If the controller does not recognize any modules the display will read "NO MODULES INSTALLED".

NOTE

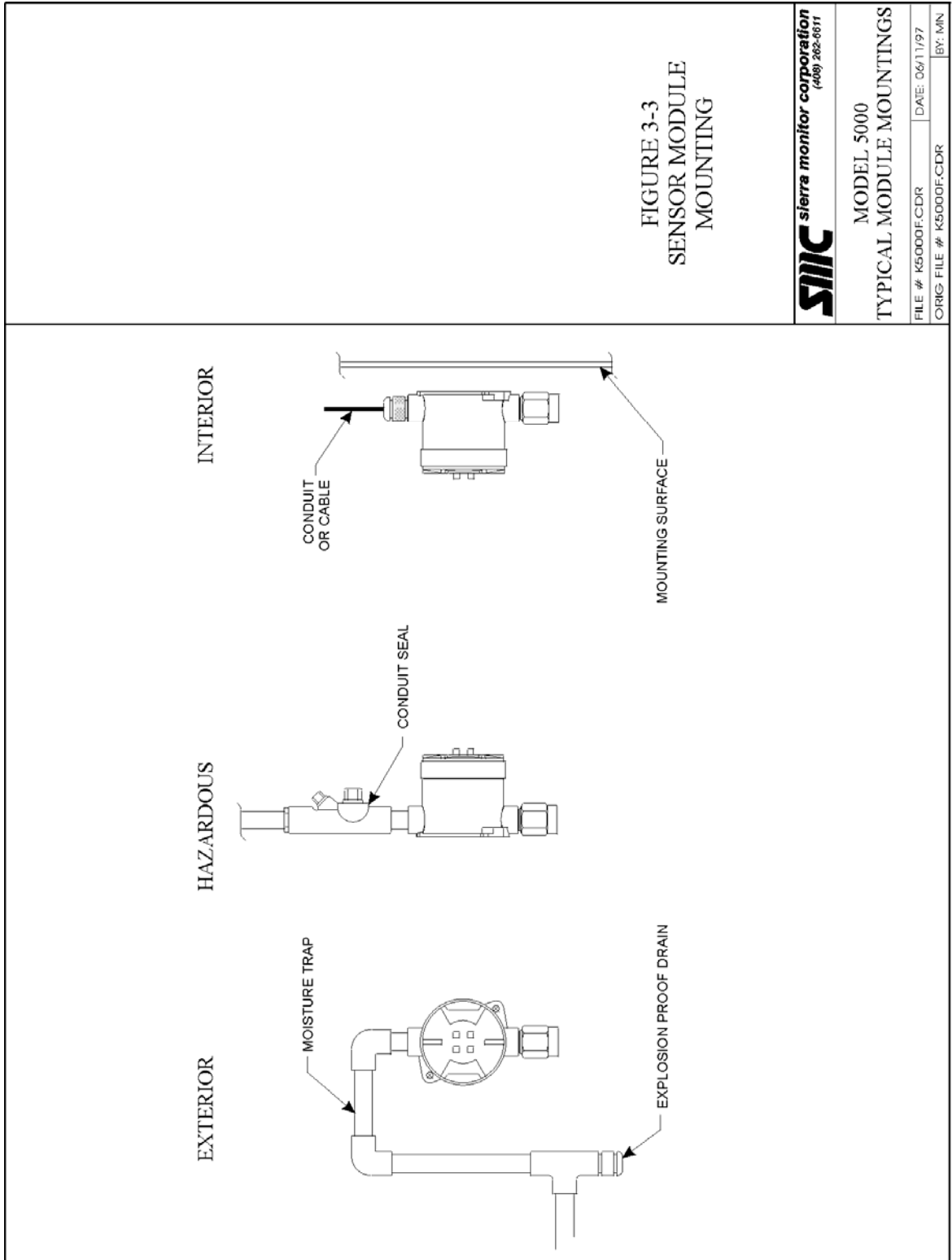
On 2 and 4 Channel systems any module set with a number higher than four will cause the lower display to indicate "MODULE # MUST BE 1 THROUGH 4" and the upper display to display "#E --" (where # = the erroneous module number).

3.5.7 POWER DOWN

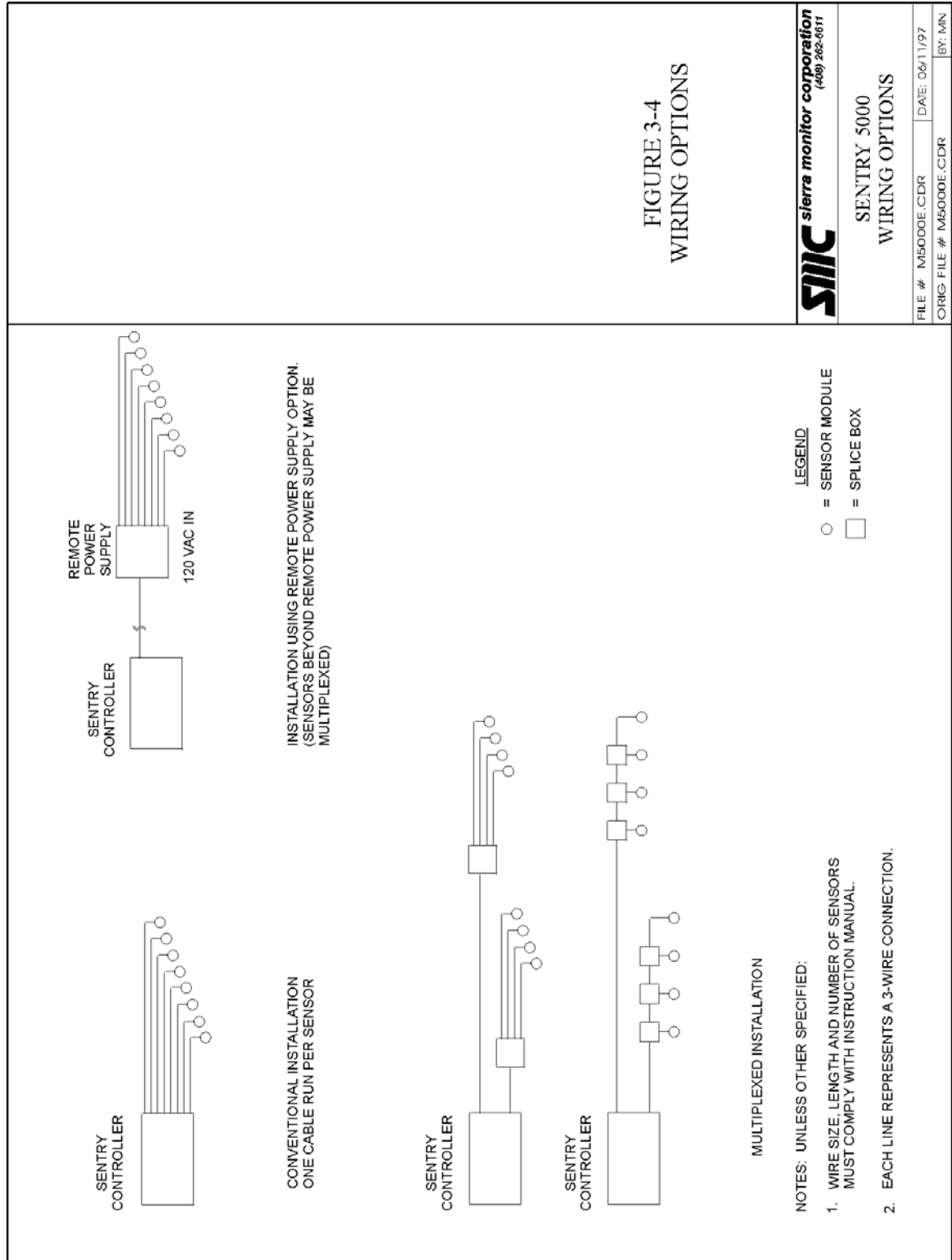
If it is necessary to remove the power all operator configured data and parameters will be saved by Sentry. (It is important to turn off the main power prior to disconnection of any module wiring because while under power Sentry will interpret certain changes as errors.)



**Figure 3-2
Controller Mounting Options**



**Figure 3-3
Sensor Module Mounting**



**Figure 3-4
Wiring Options**

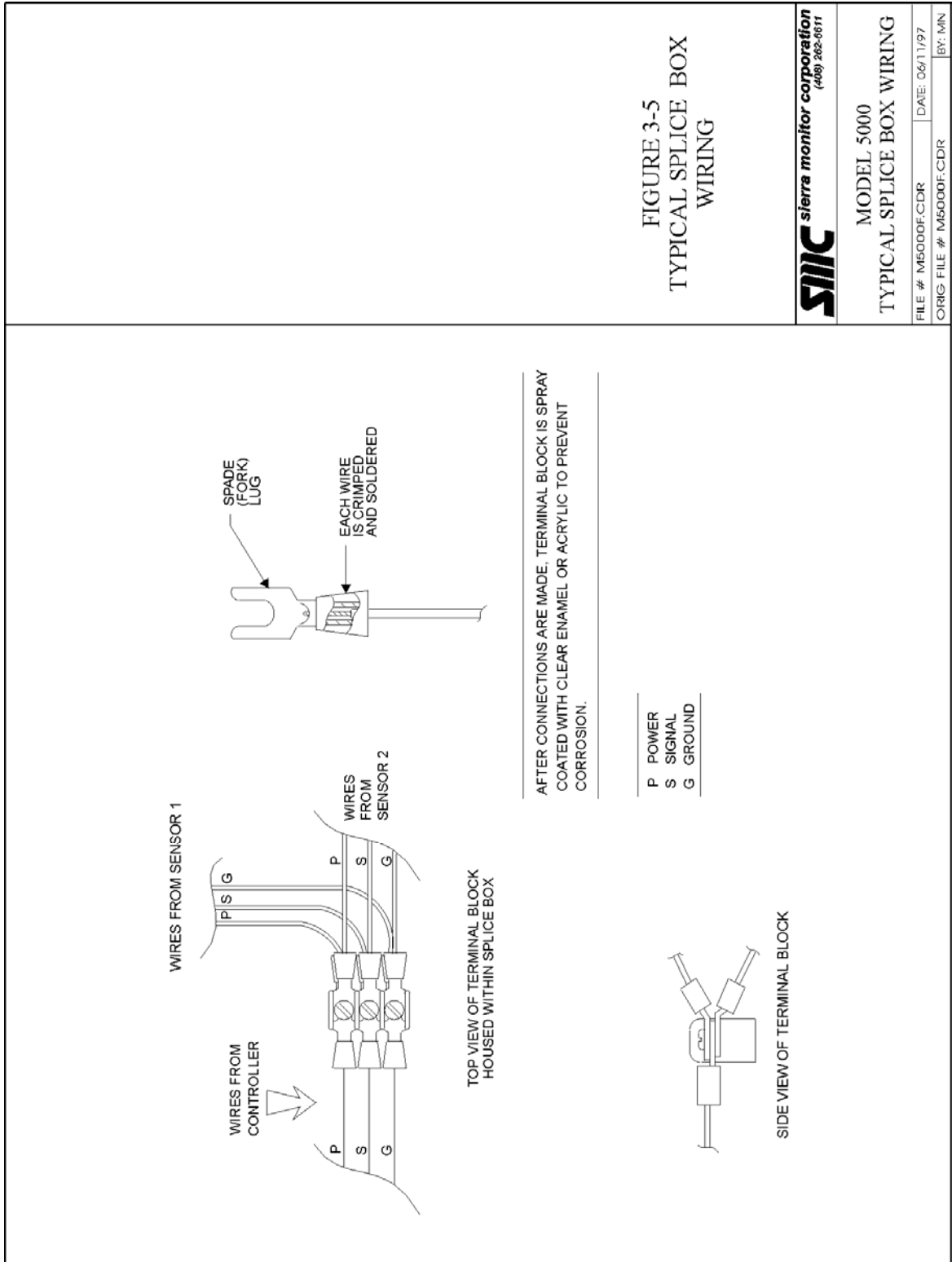


Figure 3-5
Typical Splice Box Wiring

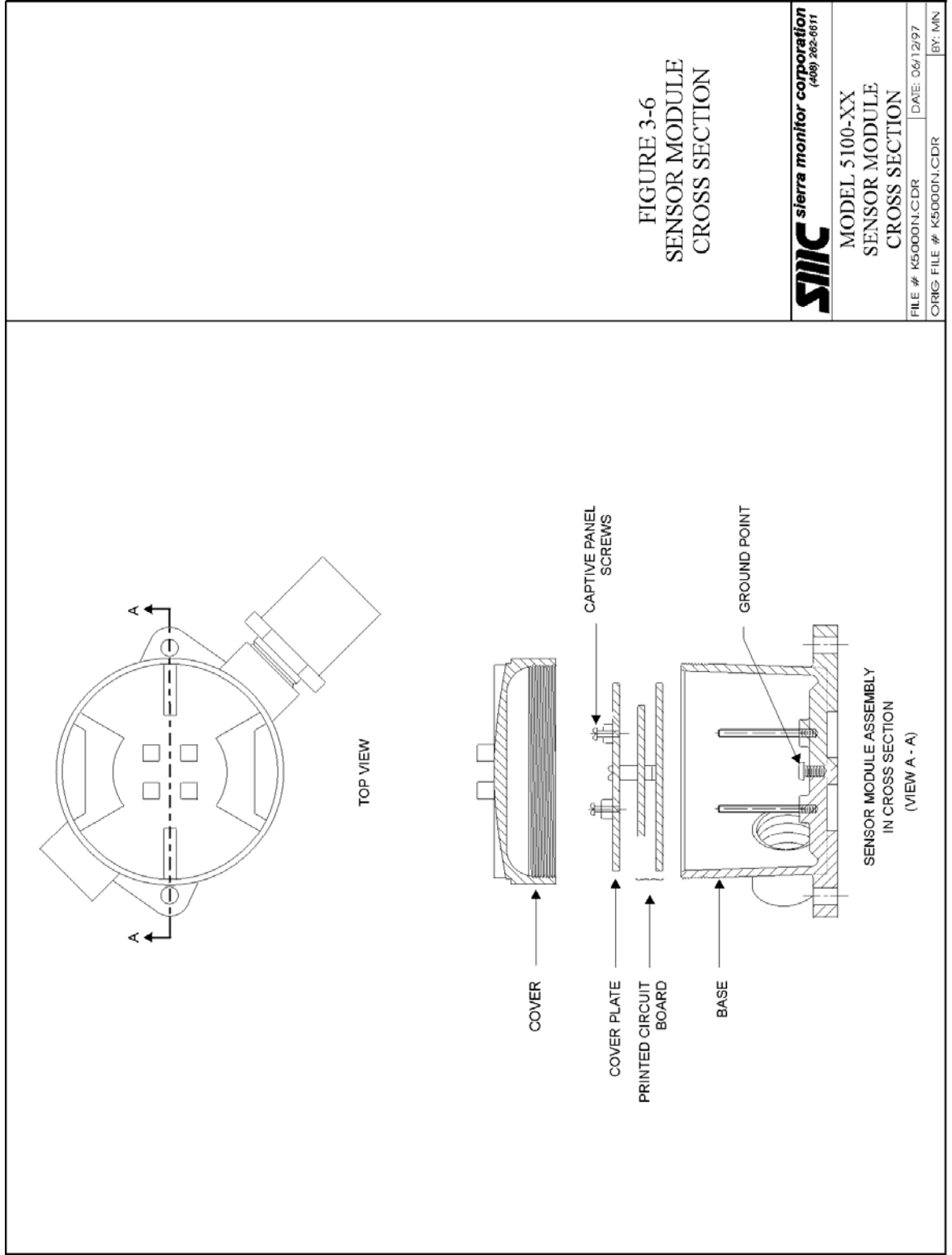
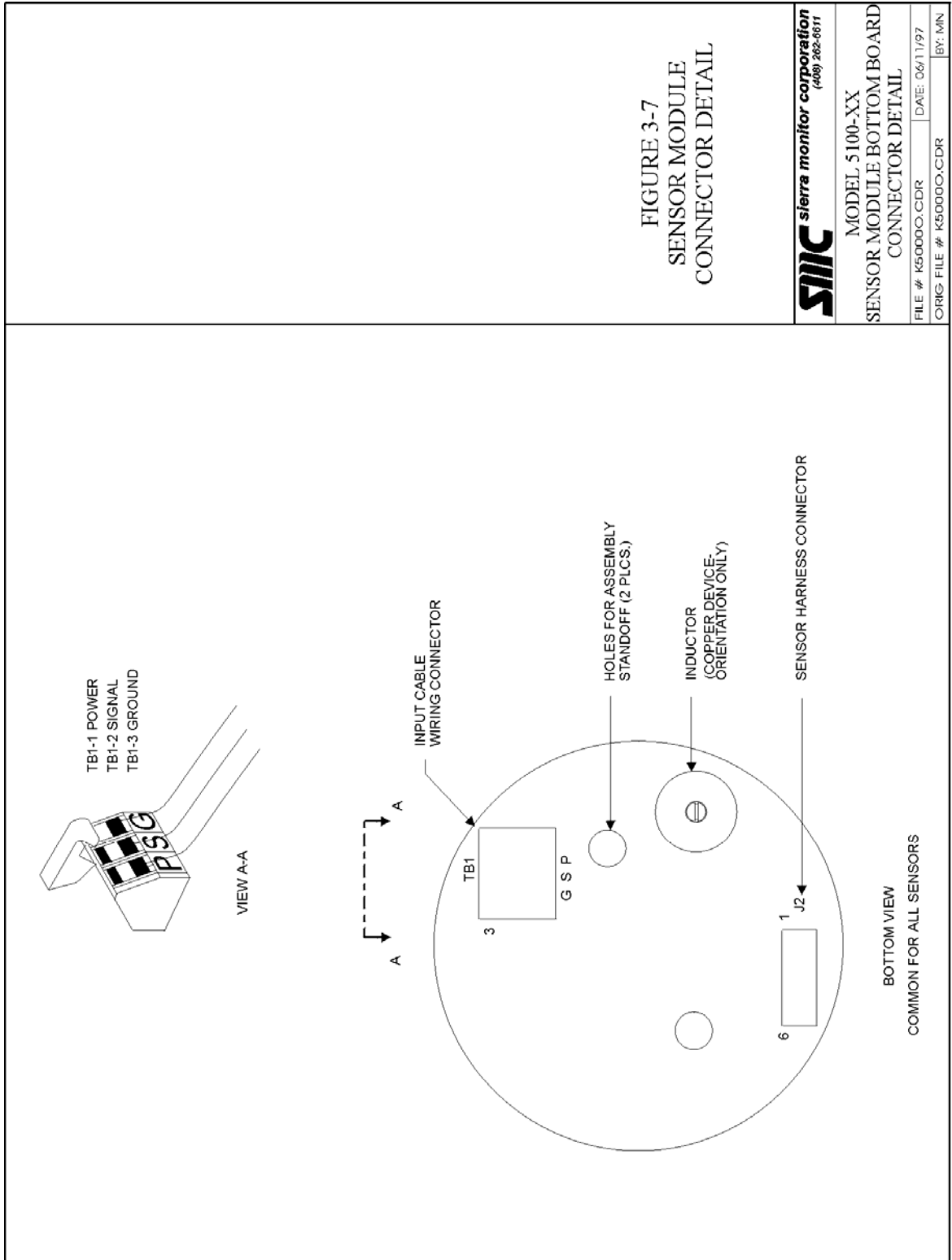


Figure 3-6
Sensor Module Cross Section



FORM: MKT-A-H.CDR REV B

Figure 3-7
Sensor Module Connector Detail

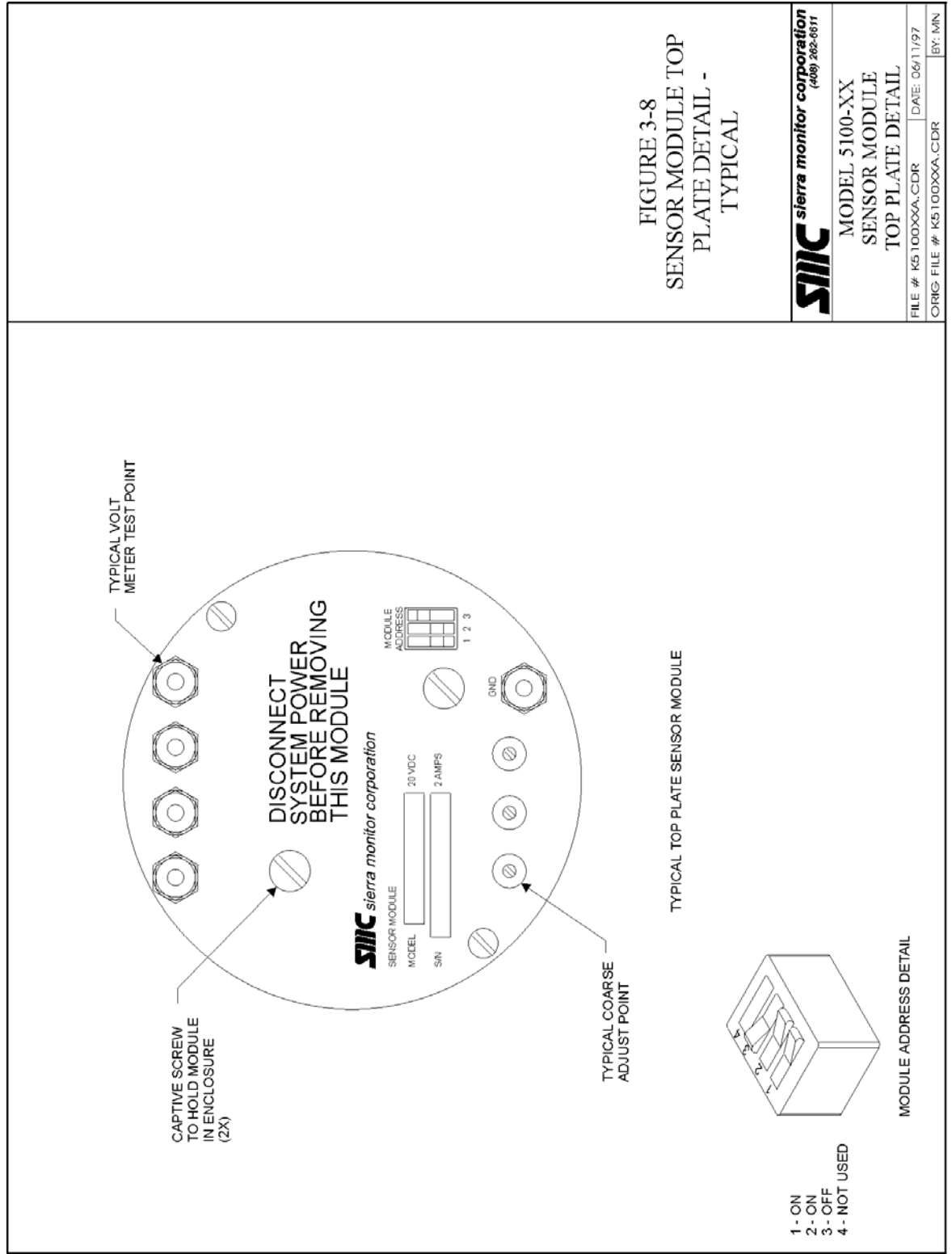
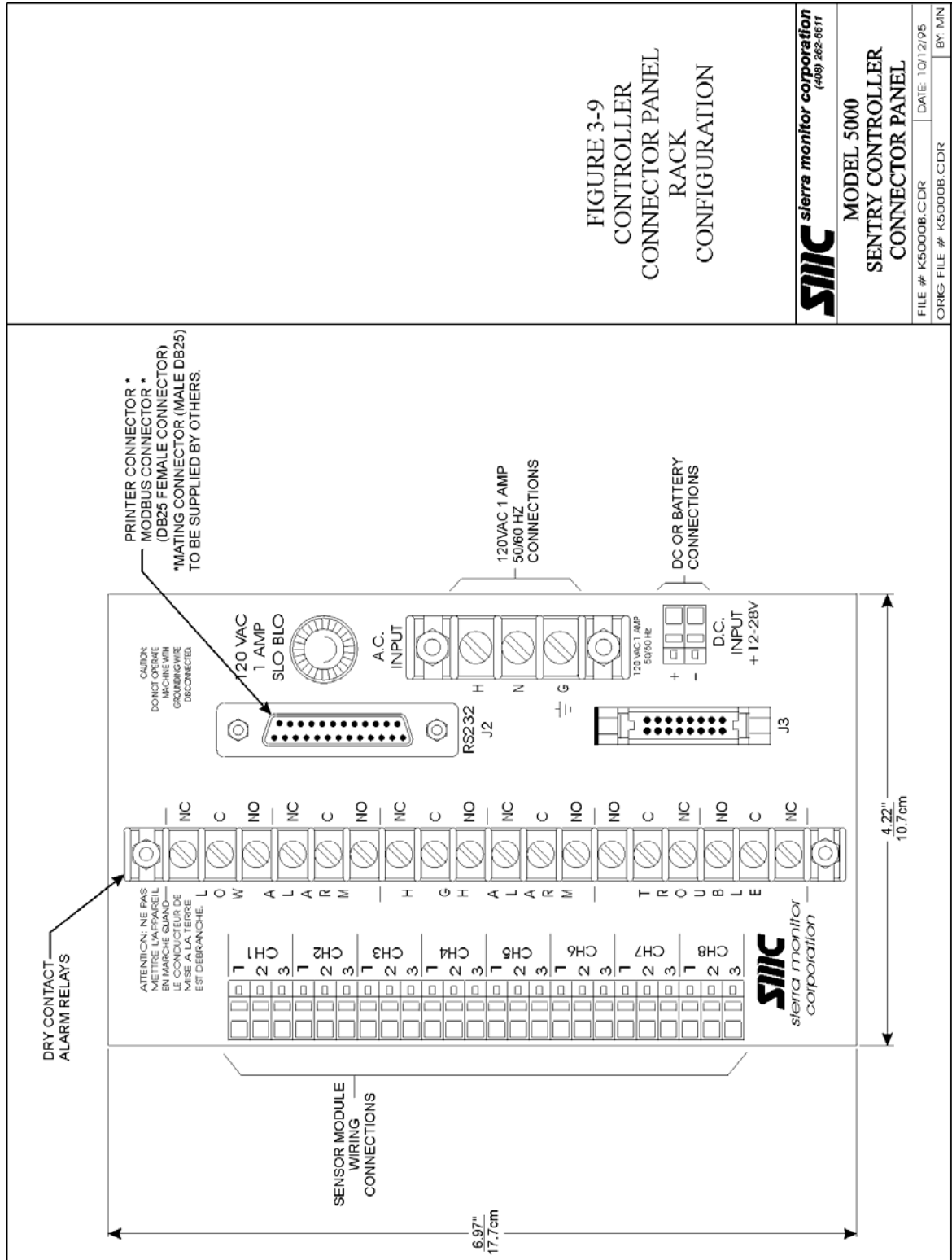
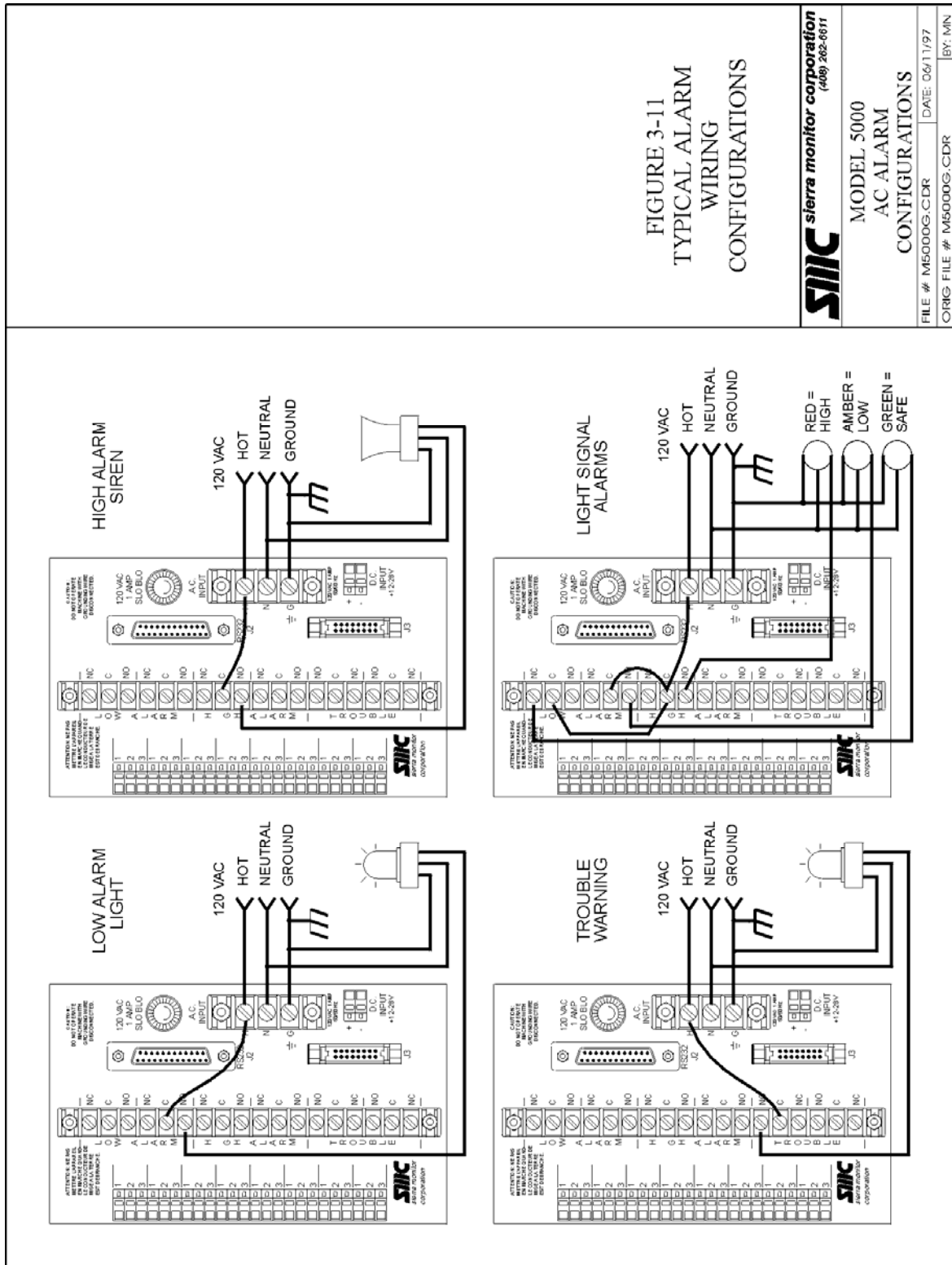


Figure 3-8
Sensor Module Top Plate Detail - Typical



**Figure 3-9
Controller Connector Panel - Rack Configuration**



**Figure 3-11
Typical Alarm Wiring Configuration**