sierra monitor corporation

# MODEL 5100-02-IT

## *IT Series*

## COMBUSTIBLE GAS SENSOR MODULE

**Version 2.00a**

FM APPROVED

**APPLICABILITY & EFFECTIVITY**

**Effective for all Model 5100-02-IT Modules manufactured after February 15, 2008.**

**Instruction Manual Part Number T12019**
**Rev. B1**

**FM APPROVAL**

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

## Model 5100-02-IT Combustible Gas Sensor Module

### Sensor Module

| | |
|---|---|
| Model 5100-02-IT | Combustible Gas Sensor Module |
| Model 5100-02-IT-SS | Combustible Gas Sensor Module, 316SS |

### Calibration Equipment

| | |
|---|---|
| Model 1200-26 | Calibration Gas Delivery System |
| Model 1290-02 | Combustible Gas Cylinder |
| Model 5358-01 | Calibration Head, Standard |
| Model 5360-00 | Calibration Gas Delivery Fitting |
| Model 1260-02 | Combustible 50% LEL Gas Cylinder |
| Model 1260-42 | Cylinder H2 50% LEL Type A |
| Model 1250-01 | Gas Sensor Calibrator Kit, Type A |
| Model 1256-01 | Regulator Type A Calibrator |
| Model 5394-61 | Auxiliary Connection Option |
| Model 5394-62 | Auxiliary Relay Option |
| Model 5394-64 | RS-485 Multidrop Option |
| Model 5394-51 | Remote Sensor Option – 5100-02-IT |

Notes:

1) FM 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) FM Comments

   *FM Approvals, a subsidiary of FM Global

   - Project# 3021050

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# 1. PRODUCT DESCRIPTION

## 1.1 GENERAL

The Model 5100-02-IT Catalytic Bead Combustible Gas Sensor Module is a member of the ***Sentry Information Technology "IT"*** family of gas sensor transmitter modules. ***IT*** modules offer a broad array of features including:

- Integral Alphanumeric display
- 180 day calibration frequency
- Integral alarm relays (3)
- 4-20 mA output
- Modbus® RTU interface
- SMC Sentry interface
- 316 Stainless steel enclosure option
- Remote alarm reset
- Auxiliary relay option
- Remote sensor option
- Auxiliary connector option

***IT*** modules are designed, and approved for installation and operation in hazardous locations.

## 1.2 PRODUCT CONFIGURATION

Various module configuration options are available. Where applicable, these options are factory configured prior to shipment.

## 1.3 THEORY OF OPERATION

Catalytic bead gas sensors detect gas by comparing the resistance of two heated elements. One element is catalytic to enhance the burning of combustible gases, the other element is passive. Electronic circuits are used to compare the change in the catalytic bead resistance relative to the passive bead. The relative change is calibrated to determine the concentration of the gas of interest.

## 1.4 MODES OF OPERATION

### 1.4.1 SENTRY INTERFACE

All ***IT*** gas sensor modules can be installed on Sierra Monitor Sentry Model 5000 controllers. Catalytic bead modules communicate as a combustible gas sensor module (Type 2 communication) and are automatically detected by the Sentry controller. When it is installed in a Sentry system the ***IT*** module must have a unique address which can be established by setting an address between 1 and 8 on the rotary switch accessible from the cover plate as illustrated in Figure 3-1. Figure 3-4 in this manual provides the wiring terminations for connections to the Sentry controller.

When the module is operated in conjunction with a Sentry controller, the alarm relay setup (See section 4.3) should be set to "Sentry", allowing the Sentry controller to manage alarm relay action rather than the 5100-02-IT Gas Sensor Module.

An available option, applicable only to Sentry installations, is a connector card which allows daisy chain installation using the Sentry multiplex capability. Use of the connector card reduces costs by avoiding the requirement for wiring junction boxes. The connector card has two sets of connections, allowing for a continuous run to the next module.

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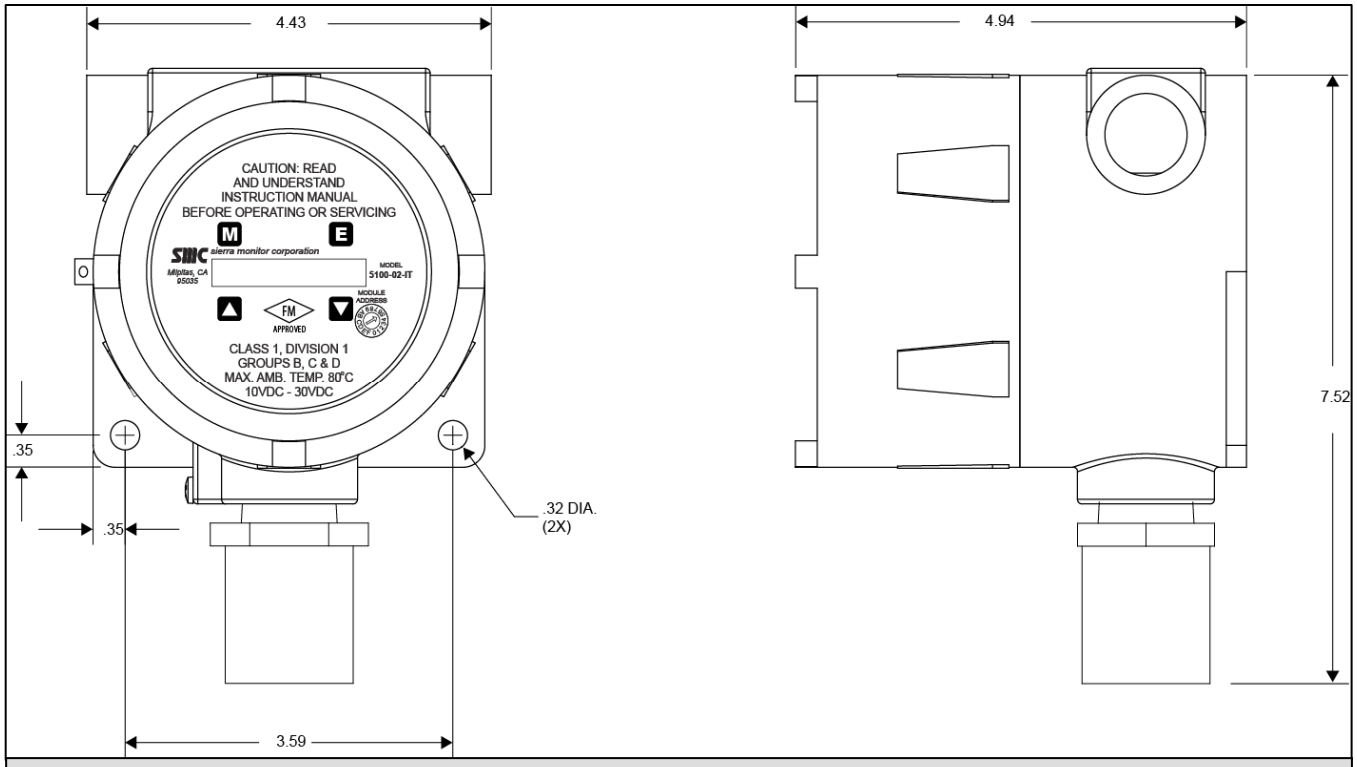



**Figure 1-1**
**Model 5100-02-IT Combustible Gas Sensor Module Stainless Steel – Dimensions**

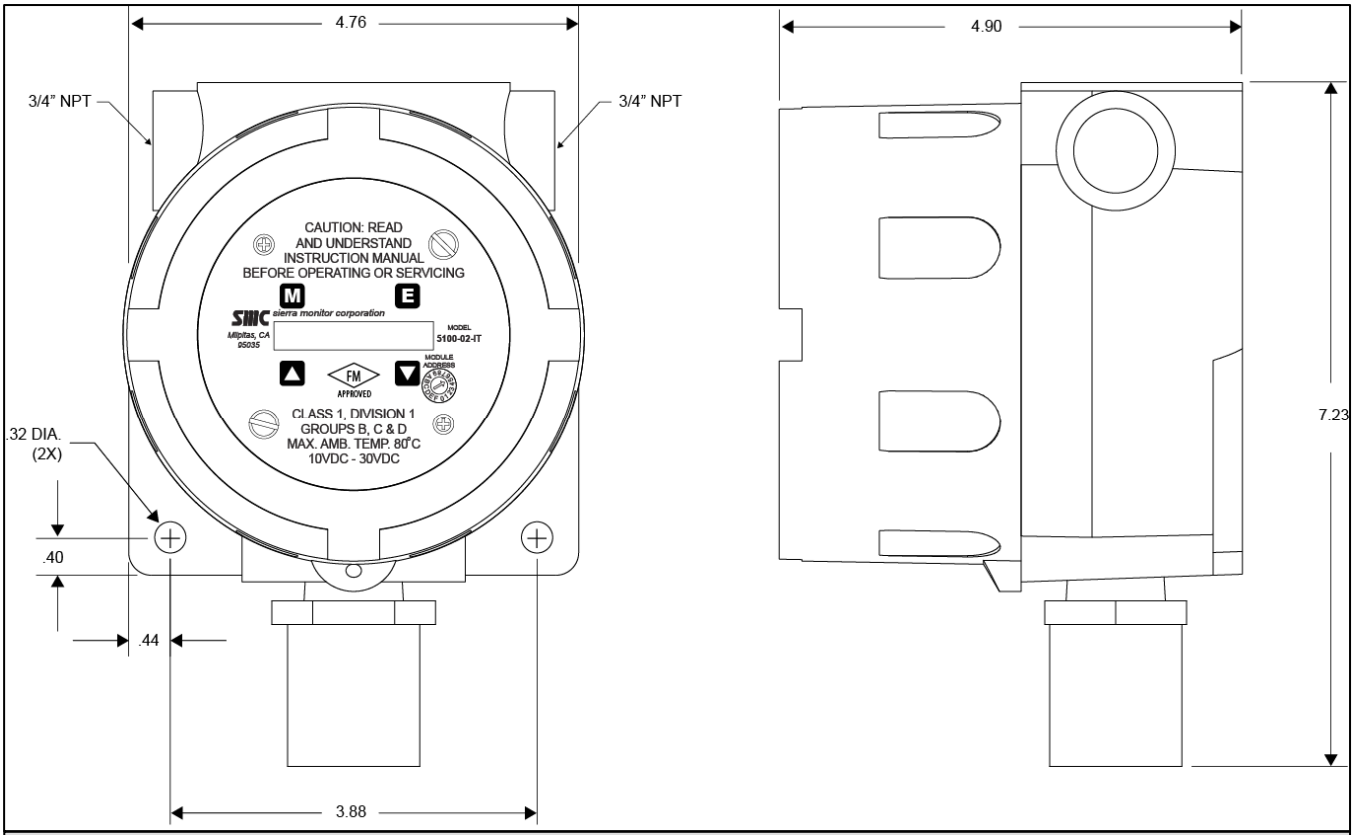



**Figure 1-2**
**Model 5100-02-IT Combustible Gas Sensor Module Aluminum – Dimensions**

#### 1.4.2 MODBUS OPERATION

All ***IT*** gas sensor modules have a Modbus RTU RS-485 serial interface to allow direct connection to any standard PLC or DCS. The Module Address Switch (section 3.5) allows the user to select Modbus addresses 1 thru 15. Switch position "0" allows the user to set addresses up to 254 using the s Menu (See Table 4-3). Figure 3-4 provides the wiring terminations for Modbus connections.

#### 1.4.3 ANALOG OPERATION

All ***IT*** gas sensor modules have a 4-20 mA interface to allow direct connection to standard analog indicators or PLCs. The standard Model 5100-02-IT provides a 4-20 mA analog interface which allows power and loop connections. When ***IT*** modules are to be operated with analog interface, each module requires individual home run wiring and no unique address is required. Figure 3-3 provides the wiring terminations for 4-20 mA connections.

#### 1.4.4 AUXILIARY RELAY OPERATION (APPENDIX E)

While the 5100-02-IT has three internal 0.25 amp relays (high alarm, low alarm and trouble) as standard, an available option is an Auxiliary Relay Assembly, Part Number 5394-62, which provides 8 amp alarm relays for each of the two conditions, low alarm and high alarm.

#### 1.4.5 ENHANCED CONNECTION (APPENDIX F)

An Auxiliary Connection Assembly, Part Number 5394-61, applicable to Sentry and RS-485 installations only, provides connections capable of accepting 12 AWG wire. Additionally, the enhancement acts as a junction box providing connections for the next module in the run, when utilizing the Sentry multiplexing capability.

#### 1.4.6 AUXILIARY RS-485 MULTIDROP (APPENDIX G)

The Auxiliary RS-485 Multidrop Connection Assembly, Part Number 5394-64, provides the additional terminal connectors to enable the user to connect the In/Out terminations of a RS-485 connection.

#### 1.4.7 REMOTE SENSOR (APPENDIX D)

Extension kit 5394-51 can be used to remotely mount the sensor up to 50' from the transmitter.

#### 1.4.8 REMOTE ALARM RESET

An input is available for connection of remote alarm reset/acknowledge. Figure 3-5 provides the wiring termination for connecting the remote alarm reset.

### 1.5 MECHANICAL

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

#### 1.5.1 ENCLOSURE

Standard on the 5100-02-IT is an explosion-proof, rain-tight cast aluminum electrical housing with three ¾" FNPT conduit hubs. The 5100-02-IT-SS has a 316 Stainless Steel enclosure. Both enclosure covers have a viewing window. The design of the enclosure allows 3-way mounting choices as shown in figure 1-3. .

#### 1.5.2 TRANSMITTER ELECTRONICS

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

#### 1.5.3 SENSOR ASSEMBLY

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

## 1.6 INTERCONNECT WIRING

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

## 1.7 POWER REQUIREMENTS

***IT*** modules operate on DC power between 10 VDC and 30 VDC. Regulated DC power must be supplied from a separate source, or from an approved Sentry or ***IT*** Controller.

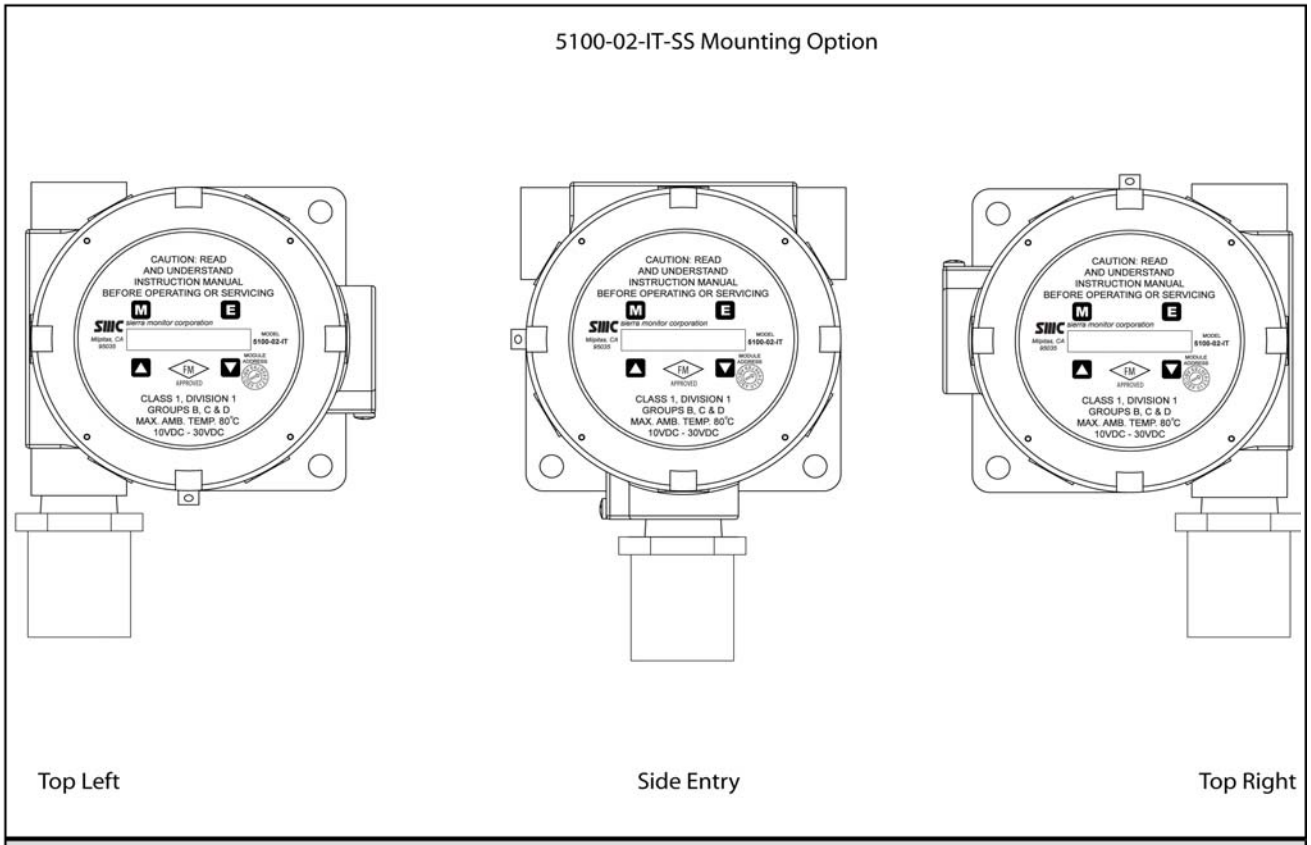



**Figure 1-3**
**Model 5100-02-IT Combustible Sensor – Mounting Options**

# 2. CAUTIONS & WARNINGS

## 2.1 INTRODUCTION

Although ***IT*** Transmitter Modules are 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 IT MODULES - GENERAL

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

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

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

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

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

## 2.3 WIRING

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

- Avoid running sensor module cable close to high power cables, radio transmission lines, or cables subject to pulses of high current.
- Avoid running cables near large electric motors or generators.
- When the sensor module is to be operated in analog (4-20mA output) mode shielded cable is required.
- 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 instrument ground.
- All splices must be via either a termination hardware system or soldered. Improperly spliced cable can result in corrosion, resistance changes and system errors.

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

### 2.3.1 CATALYTIC BEAD SENSOR MODULES

Model 5100-02-IT Gas Sensor Modules are FM performance approved for detection of Combustible gas (methane and hydrogen). The sensor is cross sensitive to the combustible gases indicated in Table 2-1. Risk management planning should take into consideration the potential for the presence of other gases in the monitored area.

Note that the 5100-02-IT has a gas factor scaling feature in which a calibration standard of Methane or Propane may be used in conjunction with scaling factors to cause alarm function in %LEL scale of another gas. See Appendix I.

| | | |
|---|---|---|
| Acetaldehyde | 2,3-Dimethylpentane | Methyl Chloride |
| Acetic Acid | 2,3-Dimethylpropane | Methylcyclohexane |
| Acetic Anhydride | Dimethylsulphide | Methylenedichloride |
| Acetone | 1,4-Dioxane | Methylethylether |
| Acetylene | Epichlorohydrin | Methylethylketone |
| Alkyl Alcohol | Ethane | Methyl Formate |
| Ammonia | Ethyl Acetate | Methylmercaptan |
| n-Amyl Alcohol | Ethyl Alcohol | Methylpropionate |
| Aniline | Ethylamine | Methyl n-propylketone |
| Benzene | Ethyl Benzene | Napthalene |
| Biphenyl | Ethyl Bromide | Nitromethane |
| 1,3-Butadiene | Ethyl Chloride | n-Nonane |
| n-Butane | Ethylcyclopentane | n-Octane |
| iso-Butane | Ethylene | n-Pentane |
| Butene-1 | Ethylenedichloride | i-Pentane |
| cis-Butene-2 | Ethyleneoxide | Propane |
| trans-Butene-2 | Diethyl Ether | n-Propyl Alcohol |
| n-Butyl Alcohol | Dimethoxyethane | n-Propylamine |
| iso-Butyl Alcohol | Dimethyl Ether | n-Propylchloride |
| tert-Butyl-Alcohol | Dimethylformamide | Propylene |
| n-Butyl Benzene | Ethyl Formate | Propyleneoxide |
| iso-Butyl Benzene | Ethylmercaptan | iso-Propylether |
| n-Butyric Acid | n-Heptane | Propyne |
| Carbon Disulfide | n-Hexane | Toluene |
| Carbon Monoxide | Hydrazine | Triethylamine |
| Carbon Oxysulphide | Hydrogencyanide | Trimethylamine |
| Chlorobenzene | Hydrogen | Vinylethylether |
| Cyanogen | Hydrogen Sulfide | o-Xylene |
| Cyclohexane | Methane | m-Xylene |
| Cyclopropane | Methyl Actetate | p-Xylene |
| n-Decane | Methyl Alcohol | JP-4 (Jet Fuel) |
| Diethylamine | Methylamine | |
| Dimethylamine | Methyl Bromide | |

**Table 2-1**

**Combustible gases detected by Model 5100-02-IT Combustible Gas Sensor Module**

# 3. INSTALLATION

***NOTE***
***All IT modules are factory pre-configured and calibrated.***
***All modules are tagged to indicate the configuration including the sensor module number.***
***Identify all components during unpacking and install using the factory configuration.***

## 3.1 SENSOR MODULE LOCATIONS

Select locations for each sensor module based on the following:

- 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.
- Remote calibration fitting (5360-00) can be used to facilitate calibration gas delivery. Run polyurethane tubing (1/4" O.D. x 1/8" I.D.) from fitting to an accessible location.

## 3.2 WIRING

### 3.2.1 ANALOG 4-20 MA OPERATION

The 4-20 mA output for the 5100-02-IT can be either 3-wire (using the 5394-61 Connector Board) or 4-wire operation. If using 3-wire operation, use a minimum of 18 AWG, shielded, 3-conductor cable up to 2000'. For 4-wire operation, use a minimum of 2 each, 18 AWG, twisted, shielded, pair up to 2000'.

### 3.2.2 MODBUS OPERATION USING RS-485 CONNECTION

Use a minimum of 18 AWG, 2 conductor for DC power connection. No shield required. In addition use a minimum of 24 AWG, low capacitance, shielded data cable for RS-485 half duplex communication. The installation may be planned in a manner which provides up to 32 sensor modules on a single home run.

### 3.2.3 SENTRY OPERATION USING SMC SENTRY CONNECTION

Use a minimum of 18 AWG, 3-conductor cable up to 2000'. The cable may or may not be shielded. We recommend shielded cable in circumstances that there could be RF or EM interference present. Shield to be terminated and grounded only at the Sentry controller. Shield must be cut and dressed at the module end so that no part of it comes in contact with the conduit or ground.

***NOTE:***
***Be sure to follow all local electric code and safety requirements when installing the 5100-02-IT Gas Sensor Module***

### 3.2.4 GENERAL

Install conduit as required by local code or construction specifications. When sensor modules are to be multiplexed for Sentry or RS-485 communication two alternatives may be planned:

- Install splice boxes above each sensor module. Use multi-position positive contact terminals to connect daisy chain wiring and provide a pigtail to connect to the sensor module transmitter board.
- Use Auxiliary Connection Assembly, Model 5394-61. The Auxiliary Connection Assembly plugs into the sensor module transmitter and provides daisy chain wiring.

***NOTE***
***The drain wire of shielded cable must NOT be used as one of the conductors. Installation and wiring must be in accordance with the National Electrical Code. Temperature rating of cable wire must be at least 75°C. If cable runs through higher temperature environments, it must be specified for that environment.***

## 3.3 ENCLOSURE INSTALLATION

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

Prior to installation and wiring.

1. Remove the transmitter from the module housing by:
   - Unscrew the two captive panel screws on the face plate.
   - Lift the transmitter out of the housing.
   - Unplug the sensor cable from transmitter connector J2.
   - Remove the sensor assembly from the enclosure hub.
2. Install the module housing onto the end of the supply conduit and/or bolt into position as required.

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

## 3.4 TRANSMITTER AND SENSOR INSTALLATION

When all pre-wire is complete:

1. Install sensor assembly in the open hub on the module enclosure. The sensor assembly thread must be fully seated into the hub and tightened to maintain explosion proof assembly.
2. Connect the wires which return to the controller to transmitter connectors P1 and P2 (Figure 3-2) according to Figures 3-3 (Analog Output), 3-4 (Digital Interface), 3-5 (Remote Alarm Reset).
3. Connect the sensor assembly cable to transmitter connector J2.
4. Reconnect any required auxiliary wiring to the applicable terminals according to project requirements and Table 3-2.
5. Connectors P1 and P2 are removable to facilitate wiring termination. When reinstalling the connectors pay attention to the connector orientation. See Figures 3-2, 3-3, 3-4, 3-5, etc.

***NOTE***
***Connectors P1 and P2 are removable for easy wiring termination.***

6. Carefully return the transmitter to the enclosure installing it over the two standoffs. Tighten the retaining screws into the standoffs.

| P1 | FUNCTION | P2 | FUNCTION |
|---|---|---|---|
| 1 | High Alarm Relay NC | 1 | Power |
| 2 | High Alarm Relay NO | 2 | Signal |
| 3 | High Alarm Relay COM | 3 | Ground |
| 4 | Low Alarm Relay NC | 4 | N/A |
| 5 | Low Alarm Relay NO | 5 | N/A |
| 6 | Low Alarm Relay COM | 6 | 4-20 mA output - |
| 7 | Trouble Relay NC* | 7 | 4-20 mA output + |
| 8 | Trouble Relay NO* | 8 | RS-485 Ground |
| 9 | Trouble Relay COM | 9 | RS-485 (-) (B) |
| 10 | Digital Input SW+ | 10 | RS-485 (+) (A) |
| 11 | Digital Input SW- | | |
| *Trouble relay is fail safe so it is energized for normal operation. Functions are labeled for normal operation. | | | |

**Table 3-1**
**Sensor Module External Interfaces**

7. Establish the module address according to section 3.5.

***NOTE***
***The warm-up period is 3 minutes from power on.***

## 3.5 INSTALLATION CONFIGURATION

Table 3-3 and Figures 3-1 through 3-4 provide location and installation details.

| POSITION | ADDRESS | POSITION | ADDRESS |
|---|---|---|---|
| 1 | Sensor 1 | 9 | Sensor 09 |
| 2 | Sensor 2 | A | Sensor 10 |
| 3 | Sensor 3 | B | Sensor 11 |
| 4 | Sensor 4 | C | Sensor 12 |
| 5 | Sensor 5 | D | Sensor 13 |
| 6 | Sensor 6 | E | Sensor 14 |
| 7 | Sensor 7 | F | Sensor 15 |
| 8 | Sensor 8 | 0 | Select |

**Table 3-2**
**Sensor Module Rotary Switch Positions**

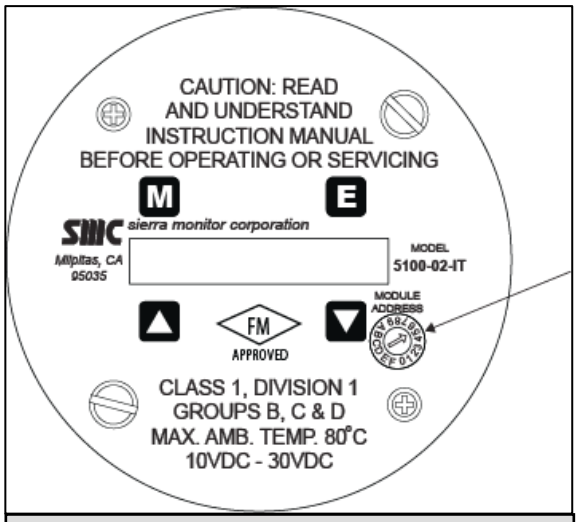



**Figure 3-1**
**Module Address Rotary Switch**

***NOTE***
***For Sentry applications only sensor addresses 1-8 are allowed. If using Modbus output sensor addresses 1-15 are available. Position 0 allows the Modbus or Sentry address to be set by software menu, in the range 16-254.***

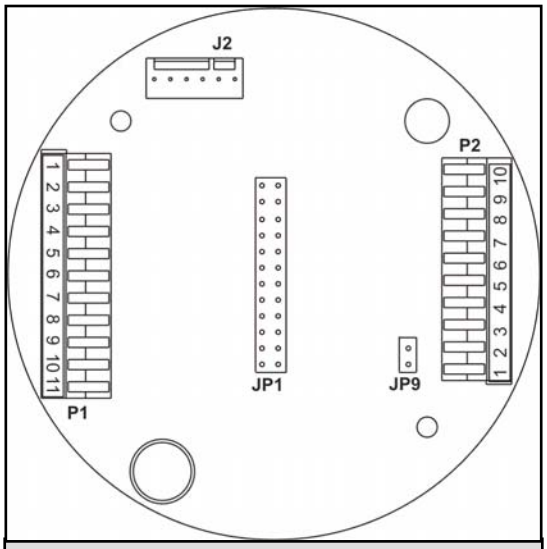



**Figure 3-2**
**Connector Locations**

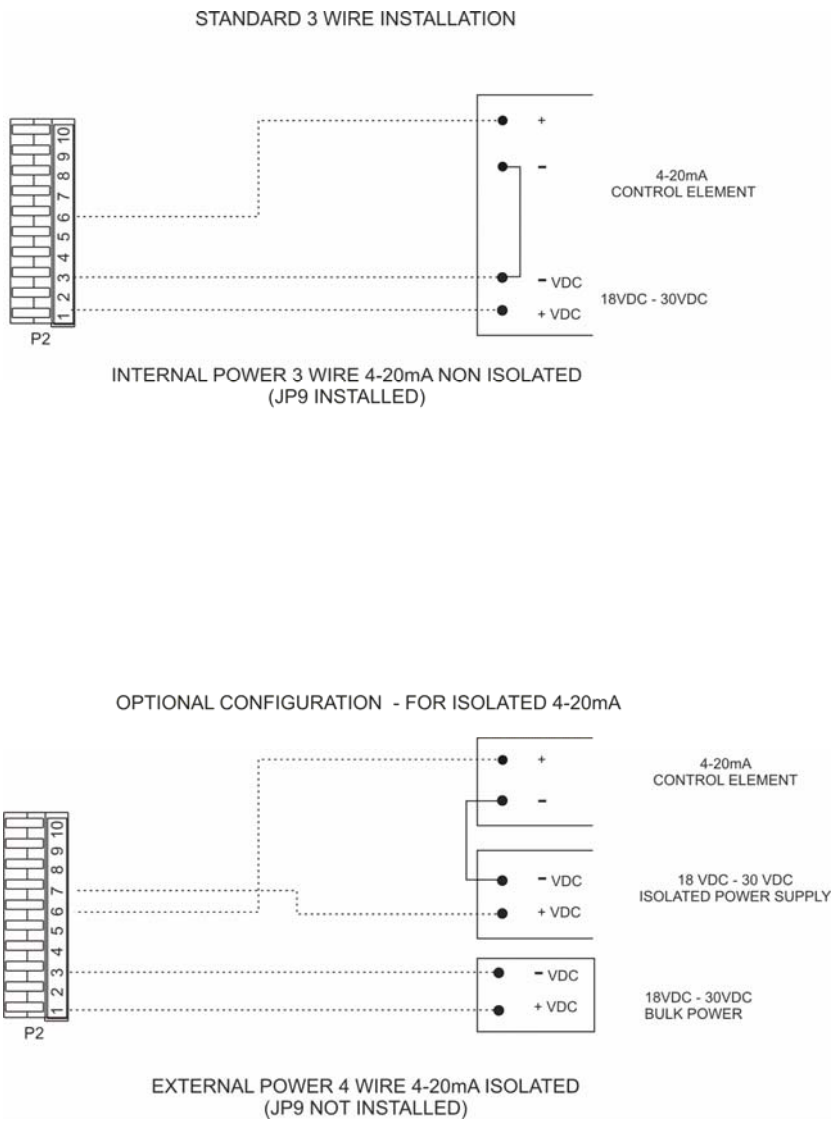



**Figure 3-3**
**4-20 mA Connection**

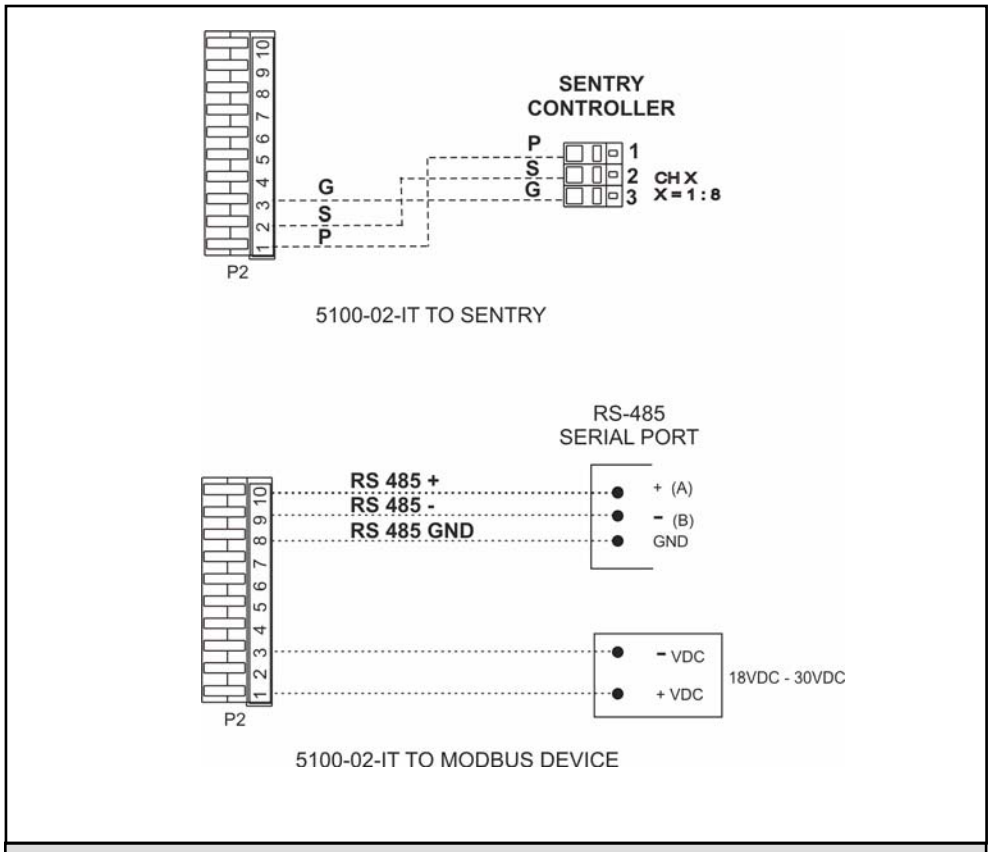



**Figure 3-4**
**Digital Interface Connections**

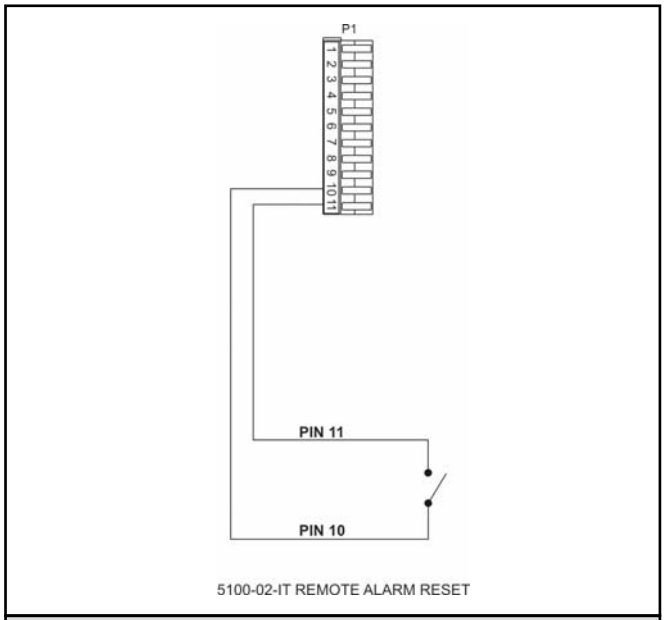



**Figure 3-5**
**Remote Alarm Reset**

# 4. INTRODUCTION – HUMAN-MACHINE INTERFACE SYSTEM

The Combustible Gas Sensor utilizes a visual menu system operated by means of a magnet. A magnet stick is supplied for this purpose. The menu system is used to configure alarm set-points, calibrate the sensor module, and for maintenance procedures and alarms acknowledge.

## 4.1 HUMAN-MACHINE INTERFACE

The module menu system is operated by means of directing the magnet stick toward each of four independent hall-effect magnetic switches. Each switch functions as if it is a manually activated panel key. The keys are located above and below the faceplate display and are labeled [M], [E], [▲], and [▼] as shown in Figure 4-6.

- Key [M]: **MODE**
- Key [E]: **ENTER**
- Key [▲]: **UP** (+)
- Key [▼]: **DOWN** (-)

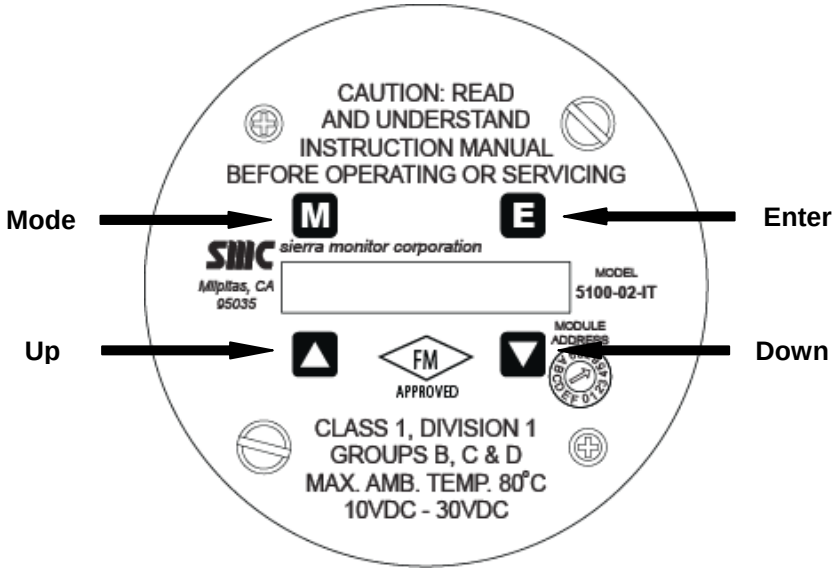



**Figure 4-6**
**HMI Switch Locations**

## 4.2 MAIN MENU

Table 4-1 describes the primary human-machine interface operation.

| Key | Function | Display | Description | Reference |
|---|---|---|---|---|
| M E ▲ ▼ | Mode | | Switch [M] | |
| M E ▲ ▼ | Enter | | Switch [E] | |
| M E ▲ ▼ | Up | | Switch [▲] Previous Menu | |
| M E ▲ ▼ | Down | | Switch [▼] Next Menu | |
| | | 5100-02 | First screen at power up-model | |
| | 1.Xxa | VX.Xxx | Second screen at power up-version | |
| | | Warm.XXX | Third screen at start up-warm up | |
| | | 0%LEL | Normal condition - default display | |
| M E ▲ ▼ | Mode | ALMRSET: | Mode Function -Alarms Acknowledge | |
| | | SSSSSSSS | Banner: Use <M> switch for different menu items. Select <E> to enter menu item. | |
| | | 0%LEL | Default Display | |
| M E ▲ ▼ | Mode | ALMRSET: | Mode Function - Alarms Reset | |
| M E ▲ ▼ | Mode | CALIB: | Mode Function - Calibrate | Table 5-1 |
| M E ▲ ▼ | Mode | SETUP: | Mode Function - Set Point Adjustments | Table 4-3 |
| M E ▲ ▼ | Mode | MAINT: | Mode Function - Maintenance | Table 4-4 |
| M E ▲ ▼ | Mode | EXIT-? | Exit Mode | |
| M E ▲ ▼ | Enter | 0%LEL | Apply Selected Mode (Exit) | |
| | | 0%LEL | Default Display | |

**Table 4-1**
**Master Menu**

Table 4-2 describes the operational display values of the human-machine interface system.

| Display | Description |
|---|---|
| STARTING | Warm-up at start-up |
| ##%LEL | Concentration |
| L ##%LEL | Low Alarm |
| H ##%LEL | High Alarm |
| HIGH | >100% Full Scale |
| NO SENSR | Sensor Failure |
| C ##%LEL | Calibration Mode |
| ACK | Acknowledged Function |

**Table 4-2**
**Operation Display Values**

*ID THE DISPLAY SHOWS "START" INSTEAD OF "STARTING, THE MODULE MUST BE CALIBRATED BEFORE USING IT.*

## 4.3 CONFIGURE SET-POINTS

The sensor module set-points menu is used to initially set-up the alarm set points, relay actions, gas type and range, 4-20 mA action and RS-485/Sentry address and baud rates (See Menu Key in Appendix J).

- **Alarm Set-points:** Once the Set-up menu is selected, press [E] to activate the Alarm Set-point screen. Use the [▲] or [▼] keys to select Low Alarm or High Alarm menu. Key [▲] will adjust the setpoint upwards and Key [▼] will adjust the value downwards. Once it reaches the desired setpoint, Key [E] will accept it and ACK will appear. Set-points can be configured using this menu to values between 0 and 60.

- **Alarm Relay Set-up:** Once the Set-up menu is selected, press key [▼] once and press [E] to activate the Relay Set-up menu. Use the [▲] or [▼] keys to select High Alarm or Low Alarm relay menu and press [E]. Use the [▲] or [▼] keys to select the correct alarm relay action for the application, Latch, Sentry or Non-Latch. Selecting "Sentry" enables the Sentry controller to make all alarm action decisions. * indicates the current selection.

- **Gas Factor:** A calibration standard of Methane or Propane may be used in conjunction with scaling factors to cause alarm function in %LEL scale of another gas. See Appendix I for a list of the scaling factors. Note that if the 5100-02-IT is interfaced to a Sentry controller that the gas factor can be set in the Sentry or the Gas Sensor Module but NOT IN BOTH. It is recommended that the gas factor be adjusted in the Gas Sensor Module so that the display values on both the Gas Sensor Module and the Sentry are matched. Note that gas factors are not applicable during calibration.

- **4-20mA:** Once the Set-up menu is selected, press key [▼] three times and press [E] to activate the 4-20mA Set-up menu. Use the [▲] or [▼] keys to select Calib, or CalibOut TblOut menu and press [E]. The "Calib" section of the menu allows the user to calibrate the 4 mA and 20 mA outputs. To calibrate the 4 mA and 20 mA outputs it is necessary to have an amp meter connected to the 5100-28-IT and upon selecting the 4 mA output calibration then the [▲] or [▼] keys can be used to adjust the 4 mA reading on the amp meter until it reads 4 mA. Similar steps can then be performed for the 20 mA output. The CalibOut section allows the user to select the 4-20 mA output action desired during calibration. * indicates the current selected value. Available selections include:

  - **Track –** the 4-20mA value tracks the calibration gas exposed to the gas sensor module
  - **Zero –** the 4-20mA value is held at 0mA during calibration
  - **C1.50mA** – the 4-20mA value is held at 1.50mA during calibration
  - **C4.00mA** – the 4-20mA value is held at 4.0mA during calibration.

  The Tbl Out menu enables the user to select the mA output value for the Trouble Alarm. Select "T2.5mA" to choose the 2.5mA default valve. Or select "User mA" and use the [▲] or [▼] keys to select any valve between 0.5mA and 3.7mA.

- **RS-485** - Once the Set-up menu is selected, press key [▼] four times and press [E] to activate the RS-485/Sentry Set-up menu. Use the [▲] or [▼] keys to select Address or Baud rate menu and press [E]. Note that the 5100-28-IT has a rotary switch on the faceplate and it is used to select addresses 1-15. When connected to Sentry the user can select 1-8 and using Modbus RS-485 the user can select addresses 1-15. For Modbus addresses above 15, set the rotary switch to 0 and then use the "Address" menu to select any address between 16 and 254. The Baud rate menu allows the user to select a baud rate of 38400, 19200, 9600, 4800 or 2400. * indicates current selection.

| Key | Function | Display | Description | Reference |
|---|---|---|---|---|
| | | --0%LEL- | Default Display | |
| M E ▲ ▼ | Mode | ALMRSET: | Mode Function - Alarm Reset | |
| M E ▲ ▼ | Mode | CALIB:-- | Mode Function - Calibrate | |
| M E ▲ ▼ | Mode | SETUP:--- | Mode Function - Set Point Adjustments | |
| M E ▲ ▼ | Enter | Alarms | S.P. Function - Alarm Adjust | * A Below |
| M E ▲ ▼ | Down | Relays | S.P. Function - Relays Adjust | * B Below |
| M E ▲ ▼ | Down | GasFactr | S.P. Function - Gas Factor Adjust | * C pg. 19 |
| M E ▲ ▼ | Down | 4-20mA | S.P. Function - 4-20 mA Adjust | * D pg. 19 |
| M E ▲ ▼ | Down | RS-485 | S.P. Function - RS-485/Sentry Output Adjust | * E pg. 19 |
| **High Alarm Set Point Adjustment Example** | | | | |
| M E ▲ ▼ | Enter | H.Alarm | S.P. Function - High Alarm Adjust | *A |
| M E ▲ ▼ | Enter | HASP:60- | High Alarm Set Point: current = 60 | |
| | | | Use ▲ or ▼ keys to adjust to new set point | |
| M E ▲ ▼ | Down (x5) | HASP:55- | High Alarm Set Point: new = 55 | |
| M E ▲ ▼ | Enter | ACK | Momentary Acknowledge of new Set Point | |
| | | H.Alarm | S.P. Function - High Alarm Adjust | |
| **Relays Set Point Adjustment Example** | | | | |
| M E ▲ ▼ | Enter | H. Relay | S.P. Function - High Alarm Relay Adjust | *B |
| M E ▲ ▼ | Down | L.Relay | S.P. Function - Low Alarm Relay Adjust | |
| M E ▲ ▼ | Enter | Latch | Use ▲ or ▼ keys to adjust to new relay action (Latch, Sentry, NonLatc) * indicates current | |
| M E ▲ ▼ | Down | Sentry | NOTE: Sentry indicates that Sentry controls relay action and not the IT Sensor Module | |
| M E ▲ ▼ | Down | *Sentry | High Alarm Relay set to Sentry | |

**Table 4-3A Set-Up Configuration**

| | | | | |
|---|---|---|---|---|
| **Gas Factor Example** | | | | |
| M E ▲ ▼ | Enter | GasFactr | S.P. Function - Gas Factor Adjust | *C |
| M E ▲ ▼ | Enter | Factr100 | Select [E] to select or ▲ or ▼ to adjust factor number and press [E] | |
| M E ▲ ▼ | Enter | ACK | Acknowledgement of new Gas Factor Value | |
| **4-20 mA Adjustment Example** | | | | |
| M E ▲ ▼ | Enter | Calib | S.P. Function - Calib Adjust | *D |
| M E ▲ ▼ | Enter | Out: 4mA | Use ▲ or ▼ keys to select 4 mA or 20mA | |
| M E ▲ ▼ | Enter | 4mA | Selects 4 mA | |
| M E ▲ ▼ | Enter | ACK | Momentary Acknowledge of new Set Point | |
| M E ▲ ▼ | Mode | Calib | S.P. Function - Calib Adjust | |
| M E ▲ ▼ | Down | CalibOut | S.P. Function - Output during Calibration Adjust | |
| M E ▲ ▼ | Enter | Track | Use ▲ or ▼ keys to select Track, Zero, C1.50mA, C4.00mA | |
| | | | Track = Output during calibration tracks the calibration gas, Zero = Output is Zero during calibration, C1.50mA = Output during calibration is 1.50 mA, C4.00mA = Output during calibration is 4.0 mA | |
| M E ▲ ▼ | Enter | *Track | * = Current selection | |
| M E ▲ ▼ | Mode | Calib | S.P. Function - Calib Adjust | |
| M E ▲ ▼ | Down | Tbl Out | S.P. Function - output during Trouble Alarm | |
| M E ▲ ▼ | Enter | *T2.50mA | Current Valve 2.5mA for Trouble | |
| M E ▲ ▼ | Down | User mA | S.P. Function - User Selectable mA Valve | |
| M E ▲ ▼ | Enter | *T2.50mA | Use ▲ or ▼ keys to select mA Valve between 0.5 and 0.7mA | |
| M E ▲ ▼ | Enter | *T1.75mA | Selctd 1.75mA for volume during trouble | |
| **RS-485 Adjustment Example** | | | | |
| M E ▲ ▼ | Enter | Address | S.P. Function - RS-485 Address Adjust | *E |
| M E ▲ ▼ | Enter | Addr:016 | Use ▲ or ▼ keys to enter new address | |
| M E ▲ ▼ | Enter | ACK | New address selected | |
| M E ▲ ▼ | Enter | Address | S.P. Function - RS-485 Address Adjust | |
| M E ▲ ▼ | Down | Baud | S.P. Function - RS-485 Baud Rate Adjust | |
| M E ▲ ▼ | Enter | *38400 | Press [E] to select or [▲] or [▼] to select another | |

**Table 4-3B**
**Set-Up Configuration**

## 4.4 MAINTENANCE FUNCTIONS

The maintenance menu allows the operator to monitor certain Sensor values, and select the required analog or digital communication interface. The maintenance menu operation is described in Table 4-4.

| Key | Function | Display | Description | Reference |
|---|---|---|---|---|
| | | 0%LEL | Default Display | |
| M E ▲ ▼ | Mode | ALMRSET: | Mode Function - Alarm Reset | |
| M E ▲ ▼ | Mode | CALIB: | Mode Function - Calibration | |
| M E ▲ ▼ | Mode | SETUP: | Mode Function - Set Point Adjustments | |
| M E ▲ ▼ | Mode | MAINT: | Mode Function - Maintenance | |
| M E ▲ ▼ | Enter | V2.00aA | Module Version | |

**Table 4-4**
**Maintenance Menu**

# 5. CALIBRATION

## 5.1 CALIBRATION FREQUENCY

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

The sensor module microprocessor software includes high level self checking algorithms which provide continuous sensor diagnostic and self adjustment. Users may elect to increase calibration periods based on low drift experience during the first two calibration periods.

## 5.2 CALIBRATION PREPARATION

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

***NOTE***
***If an error is made during any stage of the calibration process, hold the magnet stick at the Switch 1 for 10 seconds. A scrolling display will indicate "Operate Mode" and the sensor module will exit the calibration activity and return to normal operating mode. The calibration procedure can then be restarted.***

Calibration must be performed only when the area is known to be clear of combustible gas. If necessary, use a portable instrument to confirm that there is no background combustible gas.

For compliance with Factory Mutual (FM) Approvals, the Sierra Monitor Model 1200-26, 1250-01, 1256-01, 1260 - 02 and 1260-42 are the FM Approved calibration gas delivery devices. Use Model 5358-01 Calibration Adapter or Model 5360-00 Gas Delivery Fitting.

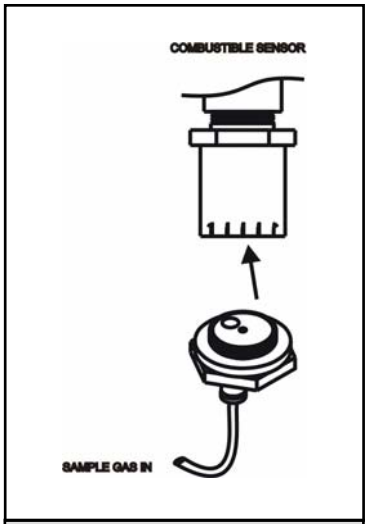



**Figure 5-1**
**Model 5358-01 Calibration Adapter**

### 5.2.1 CALIBRATION GAS DELIVERY METHODS

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

Model 5358-01: Calibration Adapter - use with portable calibrators. See Fig 5-1.

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

### 5.2.2 CALIBRATION PROCEDURE

Table 5-1 shows the step by step process of the calibration procedure.

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

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

### 5.2.3 SENSOR EXPOSURE TO GAS

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

| Model | Gas | Flow | Period |
|---|---|---|---|
| 5100-02-IT | Combustible | 100-300 cc/min | Until Stable (minimum 3 minutes.) |

***NOTE:***
***Following calibration, the module counts down for 300 seconds. During this time the module is updating its internal memory and it is very important that its power not be interrupted***

| Key | Function | Display | Description | Reference |
|---|---|---|---|---|
| | | 0%LEL | Default Display | |
| M E ▲ ▼ | Mode | ALMRSET: | Mode Function - Alarms Reset | |
| M E ▲ ▼ | Mode | CALIB: | Mode Function - Calibrate | or Sub Routine A |
| M E ▲ ▼ | Enter | CAL-0% | Banner: Apply zero gas, enter <E> when done | |
| | | | *Operation: Confirm area clear of gas, or apply zero air to sensor.* | |
| M E ▲ ▼ | Enter | ACK | Zero gas setting acknowledged | |
| | | 50%-SPAN | Banner: Select span, enter <E> when done | use Sub Routine B |
| M E ▲ ▼ | Enter | CAL-50% | Banner: Apply 50% gas, then enter <E> to calibrate gas sensor | |
| | | C 0%LEL | *Operation: Apply calibration gas.* | |
| | | CXX%LEL | *Operation: As gas is applied the reading will increase - wait 3 minutes* | use Sub Routine C |
| M E ▲ ▼ | Enter | CAL-OK | Calibration Passed - now remove gas | |
| | | WAIT-300 | *Operation: Five minute time out before sensor is returned to service.* | |
| **Sub-Routine A - Abort Calibration** | | | | |
| M E ▲ ▼ | Mode | (Any) | *Operation: Hold magnet over Mode <SW1> for ten seconds to abort calibration* | |
| | | | Banner: Operate mode | |
| | | 0%LEL | Default Display | |
| **Sub-Routine B - Select Span** | | | | |
| | | 50%-SPAN | Banner: Select span, enter <E> when done | |
| M E ▲ ▼ | Down | 25%-SPAN | *Operation: Change Span Gas Value to 25%* | |
| M E ▲ ▼ | Down | Adj-SPAN | *Operation: User adjustable value* | |
| M E ▲ ▼ | Enter | 25%-SPAN | *Operation: Ready for user adjustment* | |
| M E ▲ ▼ | Up (x5) | 30%-SPAN | *Operation: User adjustment to new value 30%* | |
| **Sub-Routine C - Calibration Fail** | | | | |
| M E ▲ ▼ | Enter | CAL-FAIL | *Operation: No calibration gas applied, or sensor did not respond correctly.* | |
| | | WAIT-300 | *Operation: Five minute time out before sensor is returned to service.* | |

**Table 5-1**
**Calibration**

# 6. SERVICE

## 6.1 SENSOR MODULE CONFIGURATION

The gas sensor module is comprised of the following sub-assemblies (Figure 6-1):

| | |
|---|---|
| 5100-02-IT | Gas Sensor Module |
| SPL21810 | Alluminum Enclosure (SPL32178 316SS Enclosure) |
| SPL21813 | Transmitter Assembly |
| 5200-02 | Sensor Assembly |

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

## 6.2 ENCLOSURE REPLACEMENT

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

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

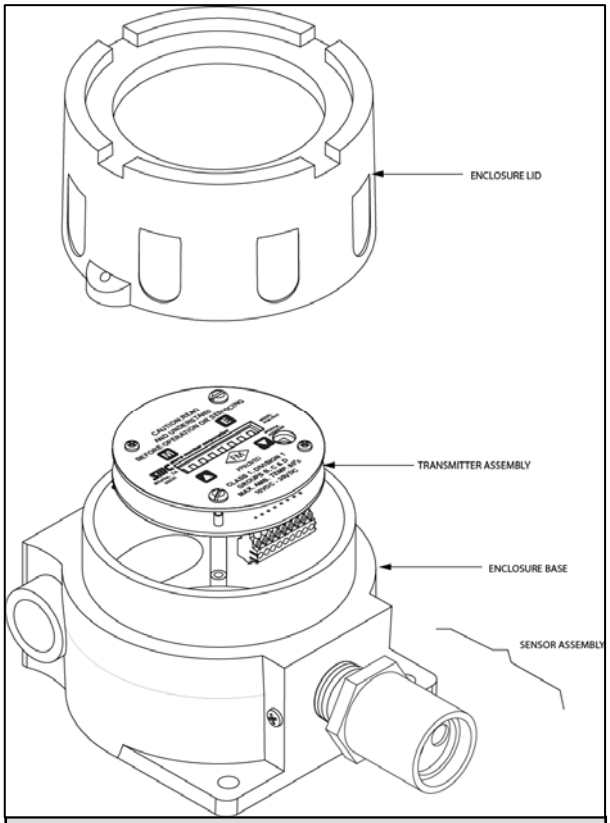



**Figure 5-1**
**Module Components**

### 6.3 TRANSMITTER REPLACEMENT

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

To replace the transmitter assembly:

a. Remove the cover of the main enclosure
b. Unscrew the two thumb screws in the top of the cover plate, lift the assembly and rotate 90° to relieve the wiring service loop
c. Unplug the sensor connector from the transmitter
d. Plug connector into new transmitter (be sure to match numbers between connector and socket).
e. Restore power and allow a minimum of 3 hours for stabilization before re-calibration

### 6.4 SENSOR REPLACEMENT

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

- The "CAL-FAIL" message appears after calibration
- The sensor output signal is noisy, causing erroneous gas level readings

To replace the sensor:

a. Confirm that system power has been removed
b. Remove the gas sensor module enclosure cover,
c. Unscrew the two thumb screws in the top of the faceplate, lift the transmitter assembly and rotate 90° to relieve the wiring service loop.
d. Unplug the sensor connector from the transmitter
e. Unscrew the old sensor assembly from the enclosure conduit hub. Remove the sensor assembly with its harness
f. Unscrew sensor housing cover from the sensor (be sure to loosen the set screw first)
g. Carefully pull the old sensor straight up from the socket
h. Press the new sensor into the socket.
i. Reverse the preceding steps to install the sensor assembly.
j. Allow the new sensor to stabilize for a minimum of 3 hours and then calibrate using the procedure in Section 5.

### 6.5 INSTALLATION INSPECTION

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

#### 6.5.1 CONTROLLER INSTALLATION

- Controller installed in conformance to instruction manual recommendations.
- AC power is correctly grounded.
- Hot AC and relay connections have safety covers installed.

#### 6.5.2 CABLING INSTALLATION

- All splices are soldered or via terminal block.
- Cabling is away from sources of electrical noise where possible.
- Connector P2, terminals P2 1, 2, 3 on sensor module are connected to Sentry controller as Power, Signal, Ground, respectively.

#### 6.5.3 SENSOR MODULE INSTALLATION

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

- Wiring terminations clean and correct.

#### 6.5.4 MOISTURE TRAPS AND RAINSHIELDS

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

#### 6.5.5 STANDARD VOLTAGES

- Regulated DC Voltage to be applied to the sensor module must be between 10 VDC and 30 VDC.

#### 6.5.6 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.

#### 6.5.7 IF MODULE DOES NOT RESPOND TO GAS

1. Repeat calibration procedure.
2. Remove the gas and wait for the timer to completely count down.
3. Apply 50%LEL and verify that the sensor sees 50% LEL gas after calibration.
4. If the sensor still does not see gas, power cycle the unit and repeat calibration.

#### 6.5.8 IF THE MODULE DOES NOT COME OUT OF WARM UP

1. Make sure the sensor is placed in an ambient room temperature environment.
2. Power cycle the sensor.
3. Ensure that the sensor is not exposed to combustible gas during warm-up.

#### 6.5.9 IF THE MODULE DOES NOT DISPLAY THE CORRECT %LEL

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

#### 6.5.10 IF THE DISPLAY SHOWS 'NO SENSR' –SENSOR FAILING

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

#### 6.5.11 IF THE MODULE SHOWS "***CALIBRATION REQUIRED***"

1. Calibrate the module

#### 6.5.12 IF THE MODULE SHOWS "***UNCALIB***"

1. Hold magnet to any key to acknowledge message
2. Calibrate the module

#### 6.5.13 IF THE DISPLAY SHOWS 'H' (OR L) THEN THE LOCAL HIGH OR LOW ALARM IS ACTIVE

#### 6.5.14 IF THE DISPLAY SHOWS 'W' – RADIO FREQUENCY INTERFERENCE

1. Remove source of interference.

#### 6.5.15 IF THE DISPLAY SHOWS "C" – CALIBRATION MODE

1. Complete calibration or exit to operating mode.

#### 6.5.16 OTHER ERROR MESSAGES – CALL FACTORY

1. E: OSC F1 Oscillator Fail

# 7. APPENDICES

## 7.1 APPENDIX A: SPECIFICATIONS

### Specifications:

| | | |
|---|---|---|
| **Sensor:** | | |
| | Type: | Catalytic Bead |
| | Range: | 0-100% LEL Combustible |
| | Repeatability: | +/-1% LEL |
| | Response time: | < 12 sec to 60% full scale |
| | Accuracy: | +/- 1% for 0-50% LEL range<br>+/- 2% for 51-100% LEL range |
| | Sensor Life: | Typically >3 years |
| **Output:** | | |
| | Display: | Fixed and Scrolling LED |
| | Relays (Standard): | High Alarm, Low Alarm, Trouble (SPDT Form C, 0.25 Amp@ 250VAC)<br>Signal Output: Sentry Digital Bus |
| | Relays (Option): | High Alarm, Low Alarm (8 Amp, 250VAC) |
| | 420 mA: | 3-wire sensor powered analog 4-20 mA or optically isolated (Calibration: 4.0 mA (default) or 1.5 mA. or Normal) |
| | RS485: | Serial RS-485 Modbus RTU |
| **Input:** | | |
| | Remote Alarm Reset: | Normally open digital input |
| **Electrical Data:** | | |
| | Power consumption: | 3 watts |
| | Connection type: | 3 wire |
| | Input voltage: | 24 VDC nominal: 10-30VDC |
| | RFI/EMI Protection: | EN50081-2, EN50082-2 |
| **Operating Range:** | | |
| | Ambient Temperature Range: | -40$^{O}$ to 176 $^{O}$F(-40$^{O}$ to 80$^{O}$C) |
| | Relative Humidity: | 0-99% |
| **Enclosure:** | | |
| | Dimensions: | 7.5 x 5.0 x 4.8 inches (H x W x D)<br>(21.6 x 12.7 x 12.2 cm) |
| | Weight: | 2.7 lb. (1.3 Kg) |
| | Housing: | NEMA 4X |
| **Electrical Classification:** | | |
| | Performance: | Explosion proof, Class 1, Div. I, Groups B, C, D<br>Class 1, Zone 1, Group IIB+H2 IP66 |
| **Approvals:** | | |
| | FM Approved: | Approval Standards: 6320, 3600 |
| **Modbus:** | | |
| | Baud: | 38400 (Adjustable 2400 to 38400 baud) |
| | Parity: | None |
| | Stop bit: | 1 |
| | Data bits: | 8 |
| | Flow Control: | None |
| | Memory map: | Available upon request |
| **Warranty:** | | |
| | Limited warranty: | 2 years |

Specifications subject to change without notice

## 7.2 APPENDIX B: MODEL NUMBERS & PARTS LIST

**Sensor Module**

| | |
|---|---|
| 5100-02-IT-AL | Sensor Module, Combustible, Aluminum housing |
| 5100-02-IT-SS | Sensor Module, Combustible, 316SS housing |

**Options**

| | |
|---|---|
| 5311-00 | Rainshield |
| 5394-51 | Remote Sensor/Display Option |
| 5394-61 | Auxiliary Connection Assembly |
| 5394-62 | Auxiliary Relay Assembly |

**Calibration Items**

| | |
|---|---|
| 1200-26 | Gas Sensor Calibrator w/2 Gas Cylinders |
| 1250-01 | Gas Sensor Calibrator Kit |
| 1256-01 | Regulator Type A Calibrator |
| 1260-00 | Gas Cylinder – Air (Type A), 105 liters |
| 1260-02 | Gas Cylinder – Methane 50% LEL, (type A), 105 liters |
| 1260-42 | Gas Cylinder - Hydrogen, 50% LEL, (Type A), 105 liters |
| 1290-02 | Gas Cylinder - Combustible, CH4, 50% L.E.L. |
| 5358-01 | Calibration Adapter - Direct, Standard |
| 5358-50 | Calibration/Configuration Magnetic Tool |

**Spare Parts**

| | |
|---|---|
| SPL21813 | Transmitter for 5100-02-IT |
| 5200-02-IT | Sensor Assy for 5100-02-IT |

## 7.3 APPENDIX C: LIMITED WARRANTY

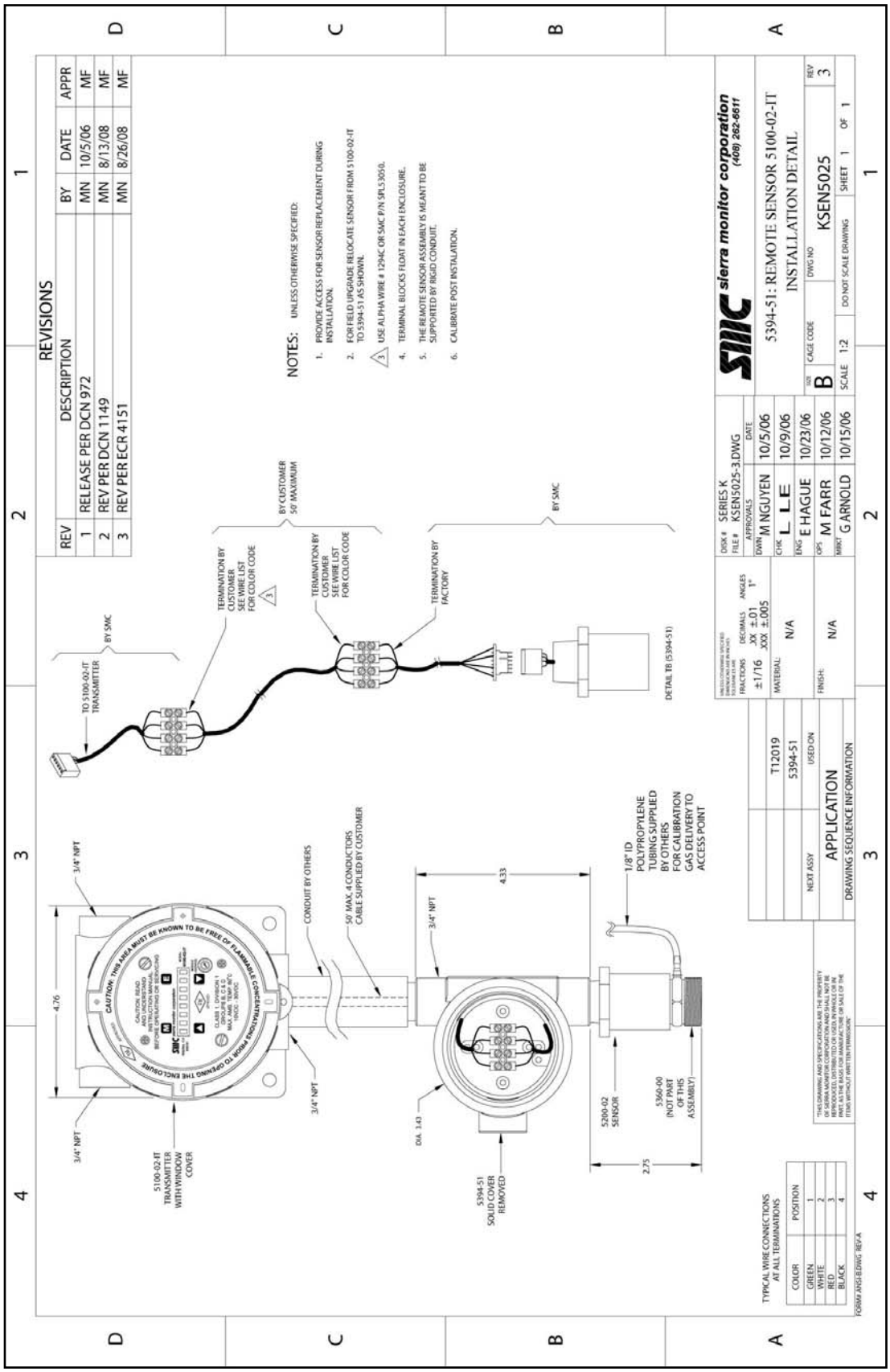
SIERRA MONITOR CORPORATION warrants its products to be free from defects in workmanship or material under normal use and service for two years after date of shipment. SMC will repair or replace without charge any equipment found to be defective during the warranty period. Final determination of the nature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

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

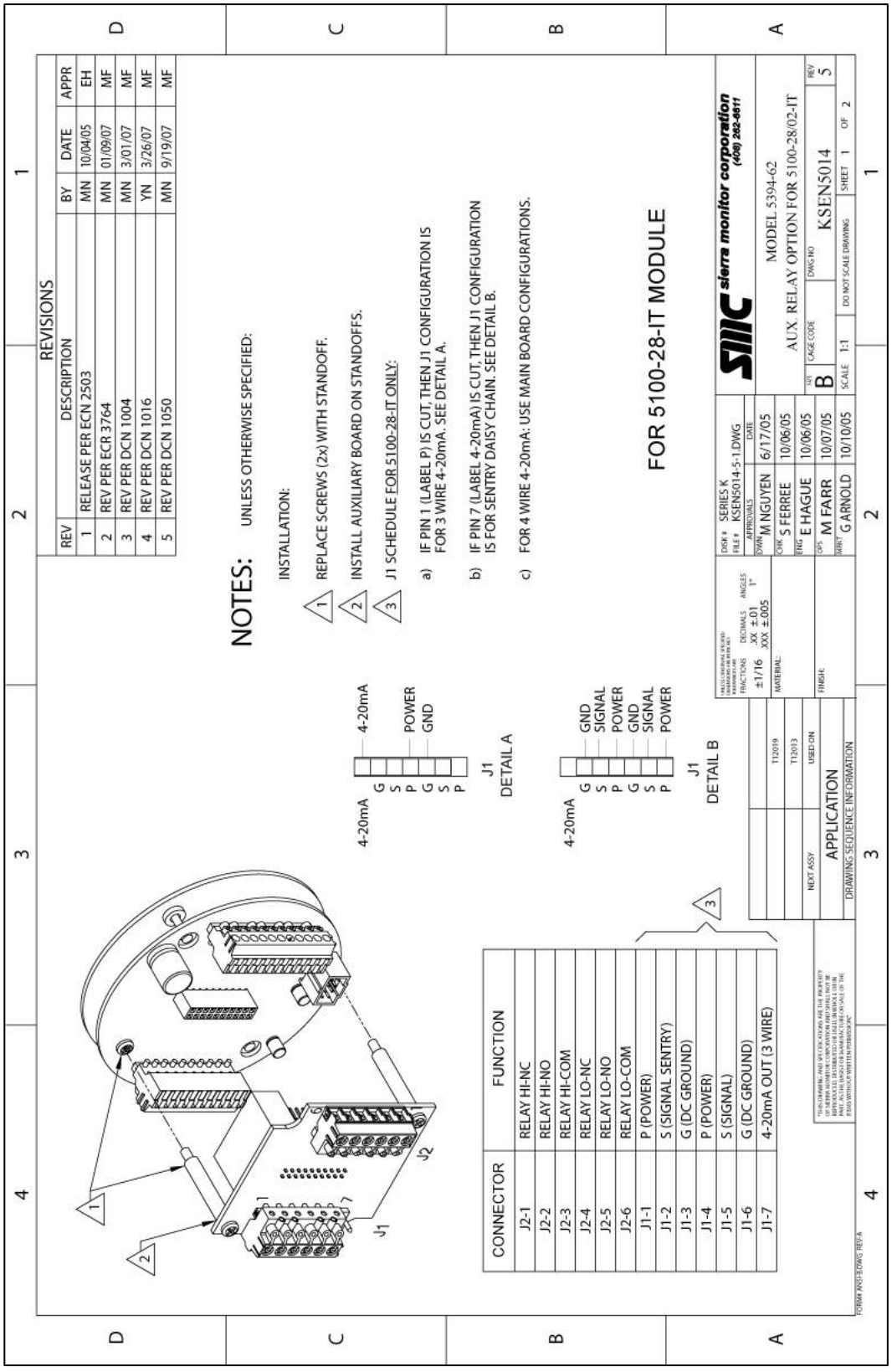
In all cases SMC's responsibility and liability under this warranty shall be limited to the cost of the equipment. The purchaser must obtain shipping instructions for the prepaid return of any item under this warranty provision and compliance with such instruction shall be a condition of this warranty.

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

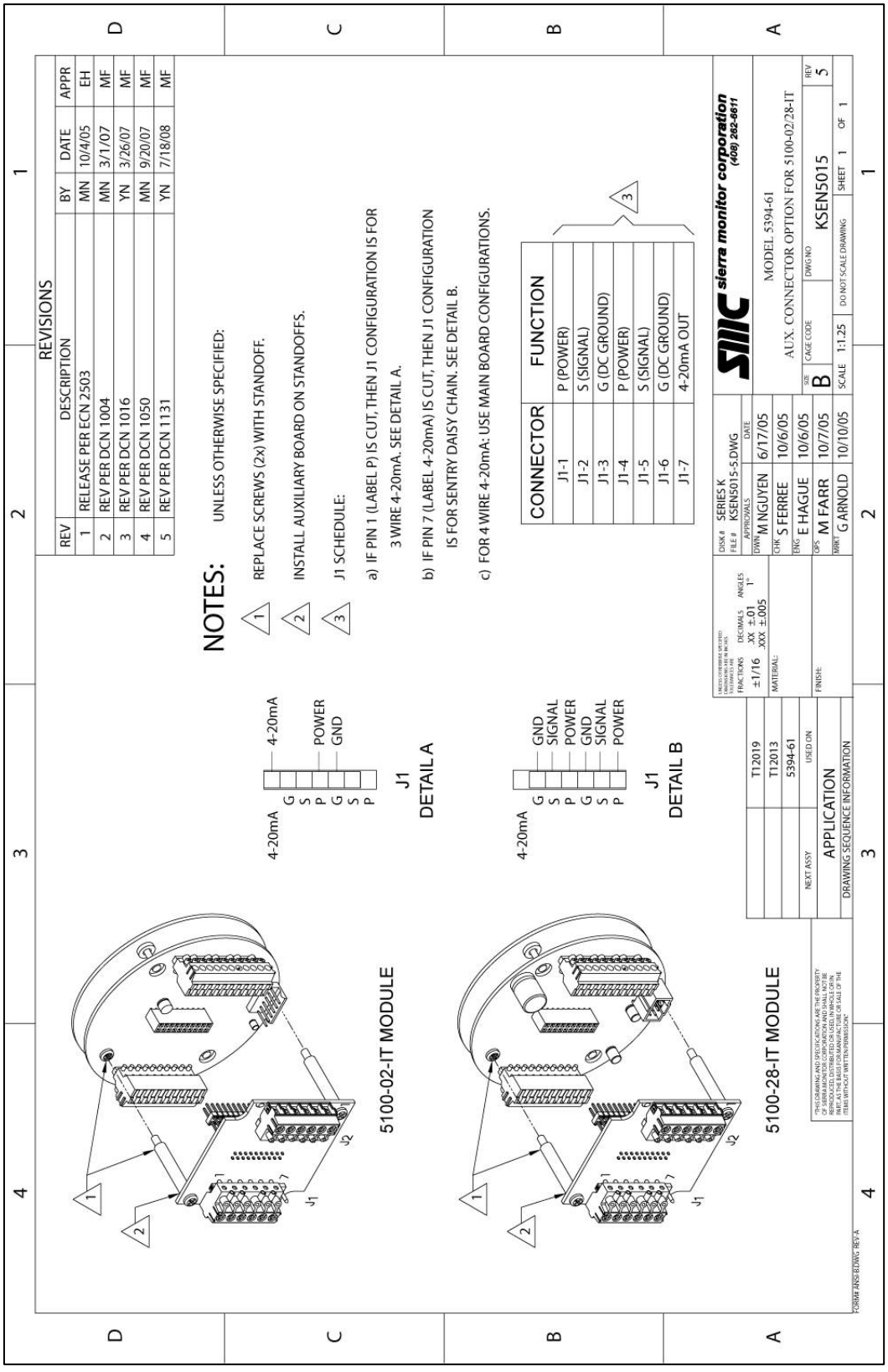
## 7.4 APPENDIX D: REMOTE SENSOR DRAWING 5394-50



## 7.5 APPENDIX E: AUXILIARY RELAY ASSEMBLY 5394-62

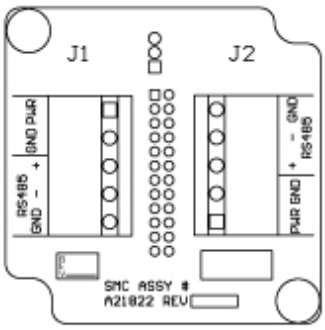


## 7.6 APPENDIX F: AUXILIARY CONNECTION ASSEMBLY 5394-61



## 7.7 APPENDIX G: AUXILIARY RS-485 MULTIDROP ASSEMBLY 5394-64

| REVISIONS | | | | |
|---|---|---|---|---|
| REV | DESCRIPTION | BY | DATE | APPR |
| 1 | RELEASE PER DCN 976 | MN | 11/10/06 | MF |
| 2 | REV PER ECR 3492 | YN | 12/18/06 | MF |
| 3 | REV PER ECR 3958 | MN | 11/27/07 | MF |



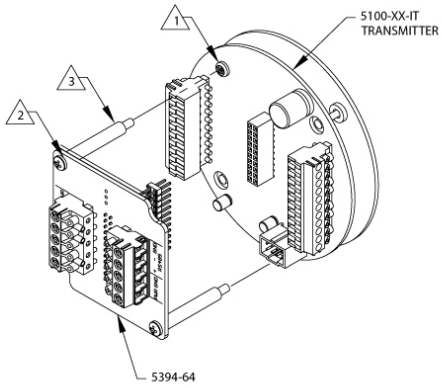

CONNECTIONS

| CONNECTOR | FUNCTION |
|---|---|
| J1-1 | PWR (POWER) |
| J1-2 | GND (GROUND) |
| J1-3 | RS485 + |
| J1-4 | RS485 - |
| J1-5 | RS485 GND |
| J2-1 | PWR (POWER) |
| J2-2 | GND (GROUND) |
| J2-3 | RS485 + |
| J2-4 | RS485 - |
| J2-5 | RS485 GND |

| | |
|---|---|
| T32899 | |
| T32853 | |
| 5394-64 | |
| APPLICATION | |

| | | |
|---|---|---|
| DRN | M.NGUYEN | 11/10/06 |
| CHK | M. FARR | 11/13/06 |
| ENG | E HAGUE | 11/17/06 |
| QA | M. FARR | 11/13/06 |
| MFG | G.ARNOLD | 11/24/06 |

sierra monitor corporation (408) 262-6611
MODEL 5394-64
RS485 MULTIDROP
B | KSEN5027 | 3
SCALE 2/1 | DO NOT SCALE DRAWING | SHEET 1 OF 4




NOTES: UNLESS OTHERWISE SPECIFIED:

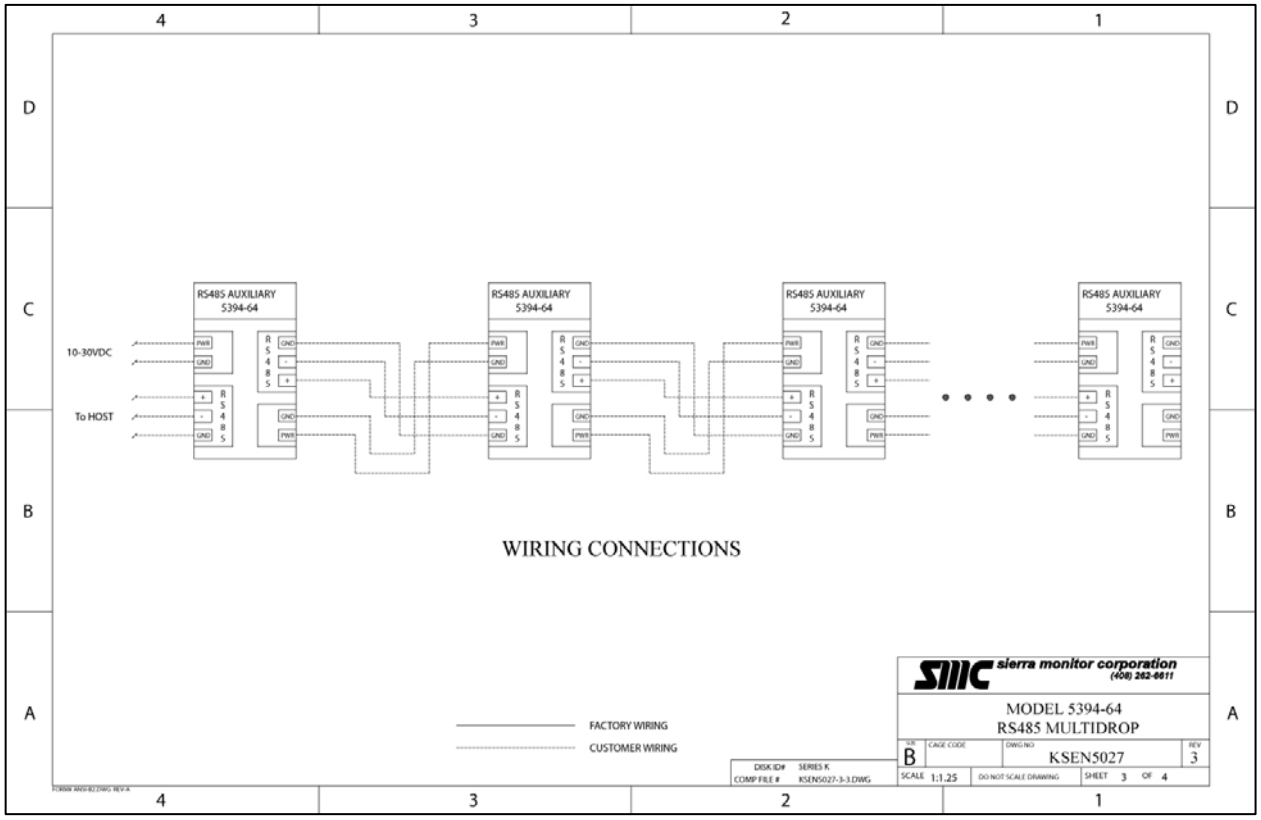
IF INSTALLATION IS REQUIRED:

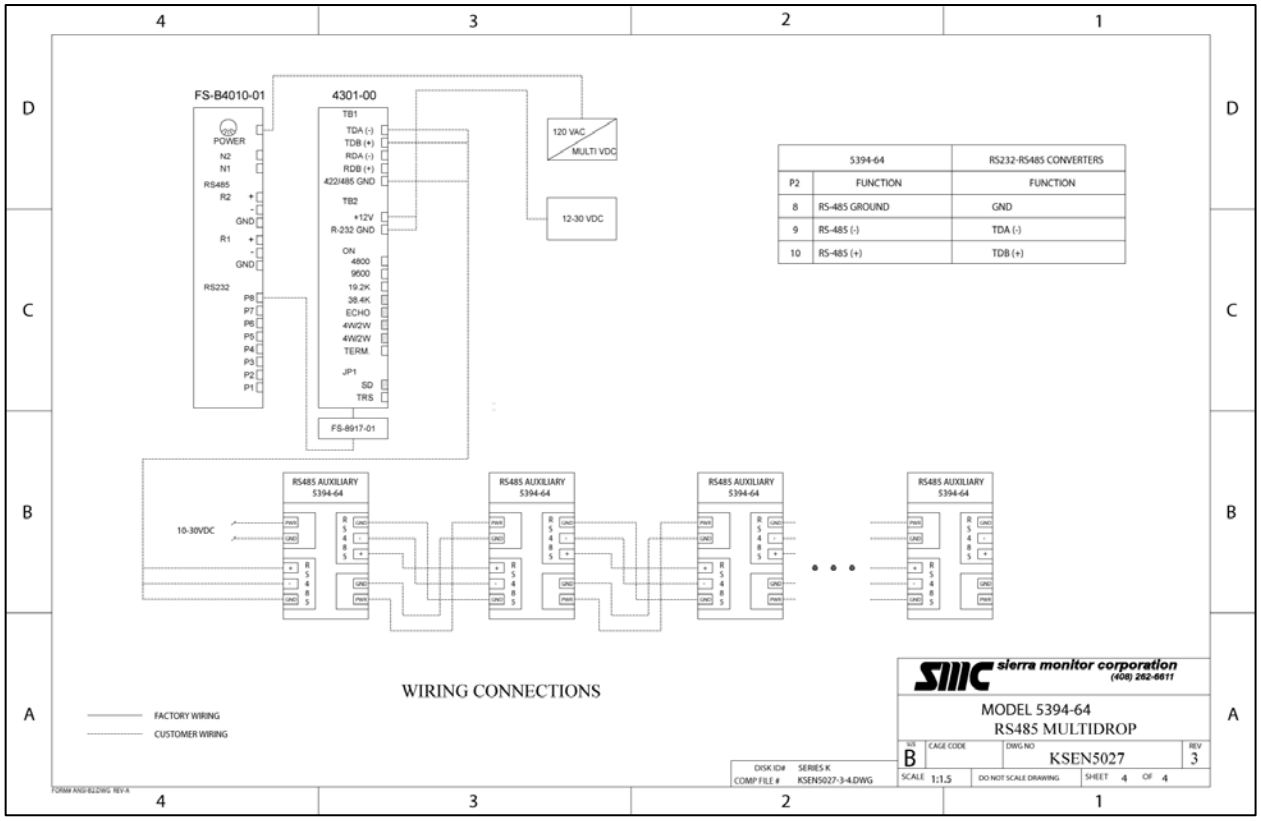
1. REMOVE SCREWS (2x) AS SHOWN.
2. LOOSEN SCREWS.
3. THREAD STANDOFF INTO LOCATION WHERE SCREWS WERE REMOVED.
4. SECURE ALL SCREWS.

MECHANICAL ASSEMBLY

sierra monitor corporation (408) 262-6611
MODEL 5394-64
RS485 MULTIDROP
B | KSEN5027 | 3
SCALE 1:1 | DO NOT SCALE DRAWING | SHEET 2 OF 4

DISK ID# SERIES K
COMP FILE # KSEN5027-3-2.DWG


RS485 AUXILIARY
5394-64
10-30VDC
To HOST
WIRING CONNECTIONS
FACTORY WIRING
CUSTOMER WIRING
sierra monitor corporation
(408) 262-6611
MODEL 5394-64
RS485 MULTIDROP
KSEN5027
SCALE 1:1.25
DO NOT SCALE DRAWING
SHEET 3 OF 4
DISK ID# SERIES K
COMP FILE # KSEN5027-3-3.DWG


FS-B4010-01
4301-00
POWER
TB1
TDA (-)
TDB (+)
RDA (-)
RDB (+)
422/485 GND
TB2
+12V
R-232 GND
120 VAC
MULTI VDC
12-30 VDC
FS-8917-01
RS485 AUXILIARY
5394-64
10-30VDC
WIRING CONNECTIONS
FACTORY WIRING
CUSTOMER WIRING
5394-64
RS232-RS485 CONVERTERS
P2 FUNCTION
FUNCTION
8 RS-485 GROUND
GND
9 RS-485 (-)
TDA (-)
10 RS-485 (+)
TDB (+)
sierra monitor corporation
(408) 262-6611
MODEL 5394-64
RS485 MULTIDROP
KSEN5027
SCALE 1:1.5
DO NOT SCALE DRAWING
SHEET 4 OF 4
DISK ID# SERIES K
COMP FILE # KSEN5027-3-4.DWG

## 7.8 APPENDIX H: MODBUS MEMORY MAP

**Read Register Table**

| Register | Description | Comments |
|---|---|---|
| 40001 | Concentration | Gas Concentration multiplied by 100 |
| 40002 | Temperature | Temperature in degrees Celsius scalled by a factor of 100 |
| 40003 | High Alarm Relay | Boolean indicating the High Alarm Status, 0 No Alarm, 1 High Alarm |
| 40004 | Low Alarm Relay | Boolean indicating the Low Alarm Status, 0 No Alarm, 1 Low Alarm |
| 40005 | Low Alarm Value | Low alarm set point, used for activating Alarms |
| 40006 | High Alarm Value | High alarm set point, used for activating High Alarms |
| 40007 | Reserved | |
| 40008 | Reserved | |
| 40009 | Reserved | |
| 40010 | Reserved | |
| 40011 | Trouble Bits | 0 for no trouble |
| 40012 | Trouble | 1 for any trouble, 0 for no trouble |
| 40013 | High Alarm Immediate | Like 40003. but never latched |
| 40014 | Low Alarm Immediate | Like 40004, but never latched |
| 40015 | Random ID | Randomly generated permanent ID of sensor |
| 40016 | Restart Count | |
| 40017 | Run time – high | In minutes |
| 40018 | Run time – low | In minutes |
| 40019 | Max. gas value | *scale ((see 40024) |
| 40020 | Model | 51002 |
| 40021 | Range | *scale (see 40024) |
| 40022 | Units | 1 is %LEL |
| 40023 | Temperature Units | 0 is C, 1 is F |
| 40024 | Gas Scale | Value like 1 or 100 |
| 40025 | Temperature Scale | Value like 1 or 100 |

## 7.9 APPENDIX I: COMBUSTIBLE GAS SCALING FACTORS

For combustible gas monitoring, a calibration standard of Methane may 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 |
|---|---|
| Acetaldehyde | 60 |
| Acetic Acid | 54 |
| Acetic Anhydride | 46 |
| Acetone | 52 |
| Acetylene | 57 |
| Alkyl Alcohol | 51 |
| Ammonia | 126 |
| n-Amyl Alcohol | 33 |
| Aniline | 39 |
| Benzene | 41 |
| Biphenyl | 25 |
| 1,3-Butadiene | 56 |
| n-Butane | 58 |
| iso-Butane | 52 |
| Butene-1 | 45 |
| cis-Butene-2 | 48 |
| trans-Butene-2 | 51 |
| n-Butyl Alcohol | 34 |
| iso-Butyl Alcohol | 53 |
| tert-Butyl-Alcohol | 74 |
| n-Butyl Benzene | 31 |
| iso-Butyl Benzene | 32 |
| n-Butyric Acid | 38 |
| Carbon Disulfide | 18 |
| Carbon Monoxide | 75 |
| Carbon Oxysulphide | 93 |
| Chlorobenzene | 34 |
| Cyanogen | 89 |
| Cyclohexane | 41 |
| Cyclopropane | 62 |
| n-Decane | 33 |
| Diethylamine | 49 |
| Dimethylamine | 58 |
| 2,3-Dimethylpentane | 40 |
| 2,3-Dimethylpropane | 40 |
| Dimethylsulphide | 43 |
| 1,4-Dioxane | 45 |
| Epichlorohydrin | 45 |
| Ethane | 68 |
| Ethyl Acetate | 51 |
| Ethyl Alcohol | 73 |
| Ethylamine | 53 |
| Ethyl Benzene | 36 |
| Ethyl Bromide | 91 |
| Ethyl Chloride | 57 |
| Ethylcyclopentane | 40 |
| Ethylene | 71 |
| Ethylenedichloride | 66 |
| Ethyleneoxide | 52 |

| GAS | METHANE FACTOR |
|---|---|
| Diethyl Ether | 46 |
| Dimethoxyethane | 42 |
| Dimethyl Ether | 63 |
| Dimethylformamide | 46 |
| Ethyl Formate | 44 |
| Ethylmercaptan | 56 |
| n-Heptane | 39 |
| n-Hexane | 37 |
| Hydrazine | 45 |
| Hydrogencyanide | 48 |
| Hydrogen | 77 |
| Hydrogen Sulfide | 41 |
| Methane | 100 |
| Methyl Actetate | 50 |
| Methyl Alcohol | 86 |
| Methylamine | 77 |
| Methyl Bromide | 90 |
| Methyl Chloride | 102 |
| Methylcyclohexane | 44 |
| Methylenedichloride | 93 |
| Methylethylether | 44 |
| Methylethylketone | 41 |
| Methyl Formate | 67 |
| Methylmercaptan | 61 |
| Methylpropionate | 51 |
| Methyl n-propylketone | 40 |
| Napthalene | 34 |
| Nitromethane | 34 |
| n-Nonane | 31 |
| n-Octane | 37 |
| n-Pentane | 46 |
| i-Pentane | 46 |
| Propane | 55 |
| n-Propyl Alcohol | 47 |
| n-Propylamine | 48 |
| n-Propylchloride | 50 |
| Propylene | 52 |
| Propyleneoxide | 46 |
| iso-Propylether | 44 |
| Propyne | 42 |
| Toluene | 40 |
| Triethylamine | 40 |
| Trimethylamine | 48 |
| Vinylethylether | 42 |
| o-Xylene | 36 |
| m-Xylene | 39 |
| p-Xylene | 39 |
| JP-4 (Jet Fuel) | 41 |

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).

## 7.10 APPENDIX J: Menu Key for 5100-02-IT Gas Sensor Module

- Key **M** : **MODE**
- Key **E** : **ENTER**
- Key **▲ UP** (+)
- Key **▼ DOWN** (-)

**MAIN MENU**

Use the **M** key to access each of the 4 main sections of the menu.

```
M              M              M              M              M
|              |              |              |              |
|- ALMRSET:    |- CALIB:      |- SETUP:      |- MAINT:      |- EXIT?
```

**ALARM RESET MENU**

```
ALMRSET:
|
E– RESET (Resets current alarm)
```

**CALIB MENU**

```
CALIB:
|
E – CAL-0% (Calibrate Zero)
    |
    E – Ack (Acknowledges Zero)
        |
        *50%-SPAN (Last  span gas used – initially set at 50%)
        |    |
        |    ▲ 25%-SPAN
        |    ▲ 50%-SPAN (Select Span gas value from below)
        |    ▲ 75%-SPAN
        |    ▲ Adj-SPAN (To select an alternate span gas value)
        |         |
        |         E 50%-SPAN
        |              |
        |              ▲ 51%-SPAN (Change span value to desired, once completed E starts calibration)
        |
        E  C XX%LEL (Reading the value of the calibration gas being applied)
        |
        |- CAL-OK (if successful) or CAL-FAIL (if unsuccessful)
```

## SETUP MENU

Once in the SETUP menu use the ▲ or ▼ keys to access each of the 5 main sections of the SETUP menu.

▼ ▼ ▼ ▼ ▼
| | | | |
|- **Alarms**: |- **Relays**: |- **GasFactr**: |- **4-20mA**: |- **RS-485**

**SETUP:**
|
**E** – Alarms (Alarms Set-Point Adjustment)
| |
| **E** – H.Alarm (High Alarm Setup)
| |
| **E** ---------- OR----------▼
| | |
| |- HASP: 60 (Current Hi Alarm set-point |- L. ALARM (Low Alarm Setup)
| | |
| ▲ or ▼ (To adjust to desired set-point) **E** LASP:20 (Current Lo Alarm Set-point)
| | |
| **E**– Ack (Accepts set-point) ▲ or ▼ (To adjust to desired set-point)
| |
| **E** – Ack (Accepts set-point)
|
|
|----▼ Relays (Relay Set Point Adjustment)
| |
| **E** ---------- OR----------▼:
| | |
| |- H. Relay (High Relay Setup) |- L. Relay (Low Relay Setup)
| | |
| **E** – Latch **E** – Latch
| | |
| ▲ or ▼ (To adjust to desired condition) ▲ or ▼ (To adjust to desired condition)
| (Selections are Latch, NonLatc, or Senty)
| (* indicates current status, Sentry = Sentry controller controls alarm relay action)
|
|----▼ Gas Factr (Gas Factor Adjustment)
| |
| **E** *Factr100 (* = current selection)
| |
| ▲ or ▼ (To adjust to desired factor)
| If USER is selected use the ▲ or ▼ keys to change to desired value
|

```
|
|----▼  4-20mA (Verifies 4mA or 20mA output and selects condition of output during calibration)
|          |
|          ▼ -------or---------- E Calib
|          |                                  |
|          |                                  |- Out:  4mA
|          |                                     |
|          |                                     ▼ --or—E (To calibrate analog output 4mA, |▲ or ▼ to adjust level,
|          |                                     |                                  then E t o accept)
|          |                                     |- Out: 20mA
|          |                                     ▼ --or--E (To calibrate analog output 20mA, |▲ or ▼ to adjust level,
|          |                                     |                                  then E  to accept)
|          |                                     |- In: 4mA
|          |                                     ▼ --or—E (To calibrate analog input 4mA, |▲ or ▼ to adjust level,
|          |                                     |                                  then E to accept)
|          |                                     |- In: 20mA
|          |                                     ▼--or--E  (To calibrate analog input 20mA, |▲ or ▼ to adjust level,
|          |                                                                        then E to accept)
|          |
|          ▼ -------or---------- E CalibOut (Adjust 4-20mA output during Calibration)
|          |                                  |
|          |                                  |- Track: (▲ or ▼ (To adjust action/mA value during calibration
|          |                                        Track = mA value tracks Gas value
|          |                                     Hold = holds mA value existing prior to calibration
|          |                                     C1.50mA = 1.50 mA during calibration
|          |                                     C4.00 mA = 4.00 mA during calibration
|          |                                     User mA = |▲ or ▼ to adjust to desired mA value
|          |
|          ▼ -------or----------|E Tbl Out (Adjust 4-20mA output during Trouble condition)
|          |                                  |
|          |                                  |- T2.50mA: (▲ or ▼ (To select 2.50mA or User mA, * = current value)
|          |                                     User mA = |▲ or ▼ to adjust to desired mA value
|          |
|          |
|----▼  RS-485 (Select RS-485 address and baud rate)
|          |
|          | - Address
|          |
|          ▼ | -------or----------|E Addr:016 (Use (▲ or ▼ and E| to select module address – 016 to 254)
|          |
|          |- Baud   ----------|E  *38400 (Use |▲ or ▼ and E| to select baud rate, * = current selection)
```

**MAINT MENU**

**MAINT::**

```
|
E|– V2.00aB (Software version installed on module)
    |
    E – CCC001 (Configuration number)
```

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