



# Gas Monitor 1A2 Series

Two-Channel Monitor with  
optional display/s

## Installation and Operation Instructions

**IMPORTANT:**

**Please read these installation and operating instructions completely and carefully before starting.**

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## TABLE OF CONTENTS

Section Title	Page
<b>1 GENERAL INFORMATION.....</b>	<b>1</b>
1.1 WARRANTY .....	1
1.2 LIABILITY .....	1
1.3 PRODUCT RETURN.....	2
1.4 CONTACT INFORMATION .....	2
1.5 MODIFICATIONS AND SUBSTITUTIONS.....	2
1.6 GLOSSARY .....	2
<b>2 PRODUCT INFORMATION.....</b>	<b>3</b>
2.1 Products covered by this Manual .....	4
<b>3 PRODUCT DESCRIPTION .....</b>	<b>5</b>
3.1 GENERAL DESCRIPTION.....	5
3.1.1 MONITOR FEATURES .....	5
<b>4 INSTALLATION .....</b>	<b>9</b>
4.1 MOUNTING INSTRUCTIONS .....	9
4.1.1 MONITOR MOUNTING.....	9
4.1.2 TRANSMITTER, SENSOR MODULE OR REMOTE SENSOR MOUNTING.....	10
4.2 WIRING .....	10
4.2.1 MONITOR WIRING .....	10
4.2.2 CABLE SELECTION .....	14
4.2.3 INTERFACE CONFIGURATION.....	14
4.2.3.1 On-Board Sensor Connection .....	15
4.2.3.1.1 Solid State Sensor .....	15
4.2.3.2 Transmitter, Sensor Module or Remote Sensor Wiring.....	17
4.2.3.2.1 Transmitter, 2 Wire .....	18
4.2.3.2.2 Transmitter, 3 Wire .....	19
4.2.3.2.3 AMC-122X Sensor Modules (Voltage Mode).....	20
4.2.3.2.4 AMC-3700 Remote Sensor.....	21
4.2.3.2.5 AMC-3705 Remote Sensor.....	22
<b>5 OPERATION AND CALIBRATION.....</b>	<b>23</b>
5.1 OPERATION .....	23
5.1.1 DIP SWITCH PROGRAMMING .....	23
5.1.2 ALARM RELAY PROGRAMMING .....	25
5.1.3 AUDIO ALARMS .....	26
5.1.4 POWER-ON DELAY .....	27
5.1.5 TEST SWITCH FUNCTION .....	27
5.1.6 ACKNOWLEDGE FUNCTION .....	27
5.1.7 ALARM/WARNING RELAY ACTIVATION DELAYS .....	27
5.1.8 RELAY OUTPUTS .....	27
5.2 CALIBRATION/SERVICE.....	28
5.2.1 2-WIRE AND 3-WIRE TRANSMITTERS.....	29
5.2.1.1 Equipment Required .....	29
5.2.1.2 Trip Threshold Adjustment.....	30
5.2.1.3 Recalibration .....	30
5.2.2 SOLID STATE, ON-BOARD, AND REMOTE SENSORS .....	31
5.2.2.1 Setting Up Chamber and Applying Gas .....	31



- 5.2.2.2 Adjustments ..... 33
- 5.2.3 AMC122X FAMILY OF SENSOR MODULES (VOLTAGE MODE)..... 36
  - 5.2.3.1 Equipment Required ..... 37
  - 5.2.3.2 Trip Threshold Adjustment ..... 37
- 5.3 GAS CONCENTRATION DISPLAY (OPTIONAL)..... 37
  - 5.3.1 GAS CONCENTRATION DISPLAY SETUP ..... 38
- 6 PREVENTIVE MAINTENANCE ..... 40**
  - 6.1 GENERAL ..... 40
  - 6.2 VERIFICATION OF OPERATION ..... 40
  - 6.3 SENSOR REPLACEMENT ..... 40
- 7 INSTALLATION TIPS AND TRICKS ..... 41**
- 8 TROUBLE SHOOTING ..... 42**
  - 8.1 1222 WIRING AND TERMINATION ..... 42
  - 8.2 1228s WIRING AND TERMINATION ..... 44
  - 8.3 1225 WIRING AND TERMINATION ..... 45

**LIST OF FIGURES**

- Figure 3-1 Gas Monitor 1A2, Front Cover..... 7
- Figure 3-2 Internal Features of the Gas Monitor 1A2 ..... 8
- Figure 4-1 Locations of Mounting Holes ..... 9
- Figure 4-2 Location of Power Supply Connections ..... 11
- Figure 4-3: Relay Contact Arrangement for 2 or 3 Relays..... 12
- Figure 4-4 : Relay Contact Arrangement for 4 or 5 Relays..... 12
- Figure 4-5 Connection when Relays programmed as De-Energized in Non Alarm State..... 13
- Figure 4-6 Connection when Relays programmed as Energized in Non Alarm State ..... 13
- Figure 4-7 Signal Input Configuration Jumpers ..... 15
- Figure 4-8 Solid State Sensor connection ..... 16
- Figure 4-9 Signal Input Terminal Block..... 17
- Figure 4-10 Transmitter. 2 Wire Wiring..... 18
- Figure 4-11 Transmitter. 3 Wire Wiring..... 19
- Figure 4-12 122x Sensor Module Wiring ..... 20
- Figure 4-13 AMC-3700 Remote Sensor Wiring ..... 22
- Figure 4-14 AMC-3705 Remote Sensor Wiring ..... 23
- Figure 5-1 Gas Monitor 1A2 Test Points and Trimpots..... 29
- Figure 5-2 Calibration Chamber Set-Up Procedure ..... 32
- Figure 5-3 Taking Gas Sample ..... 34
- Figure 5-4 Injecting Gas Sample for Calibration ..... 35
- Figure 5-5 Trimmer Adjustment and Test Point Locations..... 36
- Figure 5-6 Back View of Gas Concentration Display ..... 39
- Figure 8-1 1222 Sensor Module Wiring ..... 42
- Figure 8-2 1222 Sensor Module Termination ..... 43
- Figure 8-3 1228s Sensor Module Wiring and Termination ..... 44
- Figure 8-4 1225 Sensor Module Wiring and Termination ..... 45

**LIST OF TABLES**

- Table 4-1 Transmitter, Sensor Module and Remote Sensor Mounting Locations ..... 10
- Table 4-2 Signal Input Configuration Jumper Selection..... 14
- Table 5-1 DIP-Switch Programming Chart..... 23
- Table 5-2 WARNING and ALARM Relay Active State..... 25



Table 5-3 Audio Alarm Operation .....26  
Table 5-4 Test Points and Trimpots Allocation .....28  
Table 5-5 Equivalent Concentration of Pure Gas Volume in 2L Plastic Mixing Chamber.....32  
Table 5-6 State Versus Voltage .....36  
Table 5-7 Display DIP-Switch Settings .....38



## 1 GENERAL INFORMATION

### 1.1 WARRANTY

The Gas Monitor 1A2 Series Two-Channel Monitor is warranted against defects in material and workmanship for a period of two (2) years from date of shipment (For on-board and remote sensors see below. For sensor/transmitter see corresponding sensor/transmitter manual). Maintenance items are not warranted During the warranty period, The Armstrong Monitoring Corporation will repair or replace components that prove to be defective in the opinion of AMC. Any equipment deemed to be defective by the user should be returned to The Armstrong Monitoring Corporation for evaluation (see product return below), We are not liable for auxiliary interfaced equipment, or consequential damage. This warranty shall not apply to any product, which has been modified in any way, which has been repaired by any other party other than a qualified technician or authorized AMC representative, or when such failure is due to misuse or conditions of use.

**Note:** extended warranty mail in calibration programs are available (please call 1-800-465-5777).

#### **Sensor Only Configuration Warranty**

S.S. sensor: \_\_\_\_\_

AMC-3705: \_\_\_\_\_

### 1.2 LIABILITY

All AMC products must be installed and maintained according to instructions. Only qualified technicians should install and maintain the equipment. AMC shall have no liability arising from auxiliary interfaced equipment, for consequential damage, or the installation and operation of this equipment. AMC shall have no liability for labour or freight costs, or any other costs or charges in excess of the amount of the invoice for the products.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, AND SPECIFICALLY THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THERE ARE NO WARRANTIES THAT EXTEND BEYOND THE DESCRIPTION ON THE FACE THEREOF.

### **WARNING**

<p><b>CHECK TO ASSURE THE WORKING AREA IS FREE FROM HAZARDS DURING INSTALLATION OR WHEN PERFORMING MAINTENANCE, AND USE PROPER PRECAUTIONS.</b></p>
---



### 1.3 PRODUCT RETURN

All products returned for warranty or service should be shipped by prepaid freight. Please obtain a Return Material Authorization (RMA) number from AMC prior to shipping and ensure this RMA number is clearly visible on the outside of the shipping container. Material shipped without RMA will be rejected and returned. All products returned to the client will be shipped by freight collect.

### 1.4 CONTACT INFORMATION

For information please call 1-800-465-5777 or through contacts at [www.armstrongmonitoring.com](http://www.armstrongmonitoring.com) or through email directly at [support@armstrongmonitoring.com](mailto:support@armstrongmonitoring.com).

### 1.5 MODIFICATIONS AND SUBSTITUTIONS

Due to an ongoing development program, AMC reserves the right to substitute components and change specifications at any time without incurring any obligations.

### 1.6 GLOSSARY

<b>Alarm</b>	<b>Alarm is an audible, visual, or physical presentation designed to warn the instrument user that a specific level of a dangerous gas/vapor concentration has been reached or exceeded.</b>
<b>Calibration</b>	<b>Calibration is the procedure used to adjust the instrument for proper response.</b>
<b>Calibration Gas</b>	<b>Calibration Gas is a gas of known concentration(s) used to set the instrument span or alarm level(s).</b>
<b>Gas Concentration</b>	<b>Gas Concentration is measured:</b> <ul style="list-style-type: none"><li>• PPM</li><li>• %LEL (lower Explosive Limit)</li></ul>
<b>PPM</b>	<b>Parts Per Million (1% volume = 10,000PPM)</b>
<b>LEL</b>	<b>Lower explosive limit is the lowest concentration (percentage) of a gas or a vapor in air capable of combusting in the presence of an ignition source (arc, flame, heat).</b>
<b>Span</b>	<b>Full range of a sensor i.e. a CO sensor with a full scale of 0-100 PPM has a 100 PPM span.</b>
<b>Zero Buffering</b>	<b>Zero buffering is transmitter function which forces the gas concentration reading to zero when sensor is exposed to low concentration of a gas. The zero buffers is provided in the sensor specification.</b>
<b>Zero Gas</b>	<b>Zero gas is a gas which is devoid of the target gas.</b>



## 2 PRODUCT INFORMATION

Monitor Part Number. ....	AMC-
Monitor Serial Number. ....	_____
Monitor Warranty Period. ....	2 years
Power Supply Requirement. ....	120 VAC, 60 Hz, 30 VA
Operating Temperature No Displays.....	-20°C to +40°C (-4°F to +104°F)
Operating Temperature with Displays .....	0°C to +40°C (32°F to +104°F)
Operating Pressure.....	Ambient atmospheric pressure
Operating Pressure.....	35 – 85% non-condensing
Output Voltage (depending on load).....	19-24VDC

Signal Input Configuration		Part No.	Serial No.	Type of Gas	Alarm Trip Points		Full Scale
					Warning	Alarm	
S.S. sensor	CH1						
	CH2						
2 wire trans	CH1						
	CH2						
3 wire trans	CH1						
	CH2						
AMC-122X	1	CH1					
		CH2					
	2	CH1					
		CH2					
	3	CH1					
		CH2					
	4	CH1					
		CH2					
	5	CH1					
		CH2					
	6	CH1					
		CH2					
	7	CH1					
		CH2					
	8	CH1					
		CH2					
AMC-3700	CH1						
	CH2						
AMC-3705	CH1						
	CH2						





**TORQUE SPECIFICATIONS:**

**POWER SUPPLY:**

- Neutral terminal screw ..... 7 pound-inches.
- Hot terminal screw ..... 7 pound-inches.
- Ground Lug screw. .... 15 pound-inches.

**RELAY:**

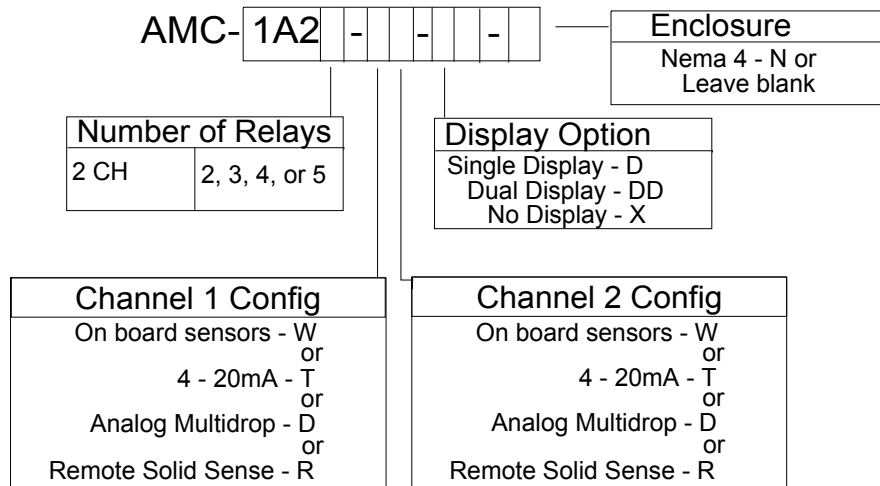
- Relay socket terminal screws ..... 7 pound-inches.

**Note:**

All Armstrong Monitoring systems must be installed and maintained according to instructions, to ensure proper operation. Only qualified technicians should install and maintain the equipment.

**2.1 Products covered by this Manual**

1. All Products that are derived from the following Order Code



2. Products that follow this format but append with -LV or -LVAC will use this manual with an addendum.
3. Other Product this Manual supports are:

AMC-1AD2 Series Gas Monitor



## 3 PRODUCT DESCRIPTION

### 3.1 GENERAL DESCRIPTION

The Gas Monitor 1A2 series monitor is a two channel gas monitoring system incorporating state of the art sensing technology using micro-controller based design to provide continuous, reliable surveillance of surrounding air for traces of hazardous gases (listed in Section 2). The 1A2 Monitor permits three choices for the two channel inputs including:

- Up to two 4-20mA transmitter inputs
- Two sensor module inputs for Voltage Mode Sensor Modules.
- One onboard Solid State Sensor for local monitoring.

The 4-20mA transmitters are used to monitor gases in up to two remote locations. Eight sensor modules can be daisy chained per each of the two channel inputs allowing larger areas or zones to be effectively monitored. The monitor comes with the following features, see Figure 3-1 and Figure 3-2.

#### 3.1.1 MONITOR FEATURES

1. RUN/FAULT/OFF INDICATOR: A green LED for each channel.  
RUN: LED on  
FAULT: LED flashing  
OFF: LED off
2. WARNING INDICATOR: Warning levels of gas are indicated by a yellow LED for each channel. Warning concentrations are indicated in Section 2
3. ALARM INDICATOR: Alarm levels of gas are indicated by a red LED for each channel. Alarm concentrations are indicated in Section 2
4. POWER TERMINAL BLOCK: For line voltage connections of 120 VAC, 60 Hz
5. TRANSFORMER: A Class II, step down transformer powers the internal circuitry and remote sensor at low voltages. Located underneath the PCB
6. INTERNAL WIRING HEADER: Provides wiring connection points as follows:  
**1,2,3,4** - Relay group 1 & Fault relay  
**5,6,7,8** - Relay group 2  
**9,10** - Acknowledge switch  
**11,12** - Audio alarm indicator
7. AUDIO ALARM INDICATOR: The buzzer will activate for Alarm, Warning (configurable) and fault conditions, with a distinct tone for each one
8. RELAY SETUP JUMPERS: Used to independently configure the Warning/Ch1 and Alarm/Ch2 relays as Normally Energized or Non-



- Energized
9. TEST SWITCH: The test switch is provided to electronically simulate alarms in order to test audio and relay functions
10. CHANNEL 1 ADJUSTMENT: Sets the Signal adjust (for solid state only), Alarm and Warning for channel 1
11. CHANNEL 2 ADJUSTMENT: Sets the Signal adjust (for solid state only), Alarm and Warning for channel 2
12. PROGRAMMING DIP SWITCHES: Allows user to configure the alarm delay and timer circuits, audio alarm activation, sensor mode selection, fault threshold, and acknowledge switch function
13. RELAYS: 2 or 4 alarm and 1 optional Fault DPDT relays are provided
14. ON-BOARD SENSOR: Optional sensor allows local detection of gas
15. SIGNAL INPUT TERMINAL BLOCK: Allows connection to signal input: transmitter, sensor module (Multidrop) or remote sensor  
**1, 8** - Chassis ground  
**2, 5** - Power  
**3, 6** - Signal  
**4, 7** - Negative
16. OPTIONAL GAS CONCENTRATION DISPLAYS: A visual indication of the gas concentration for channel 1 and 2



# Gas Monitor 1A2 Series Two Channel Monitor

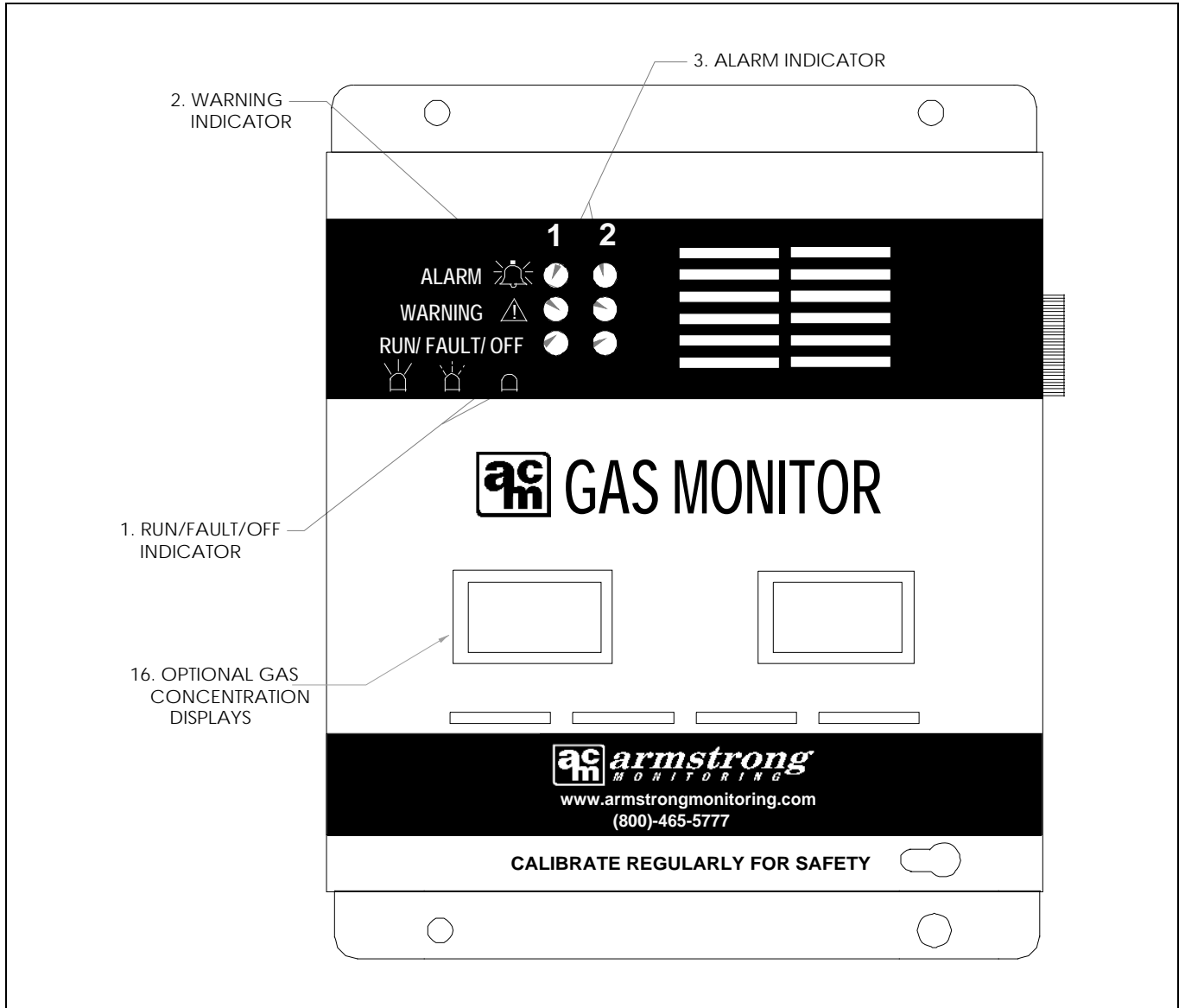


Figure 3-1 Gas Monitor 1A2, Front Cover



# Gas Monitor 1A2 Series Two Channel Monitor

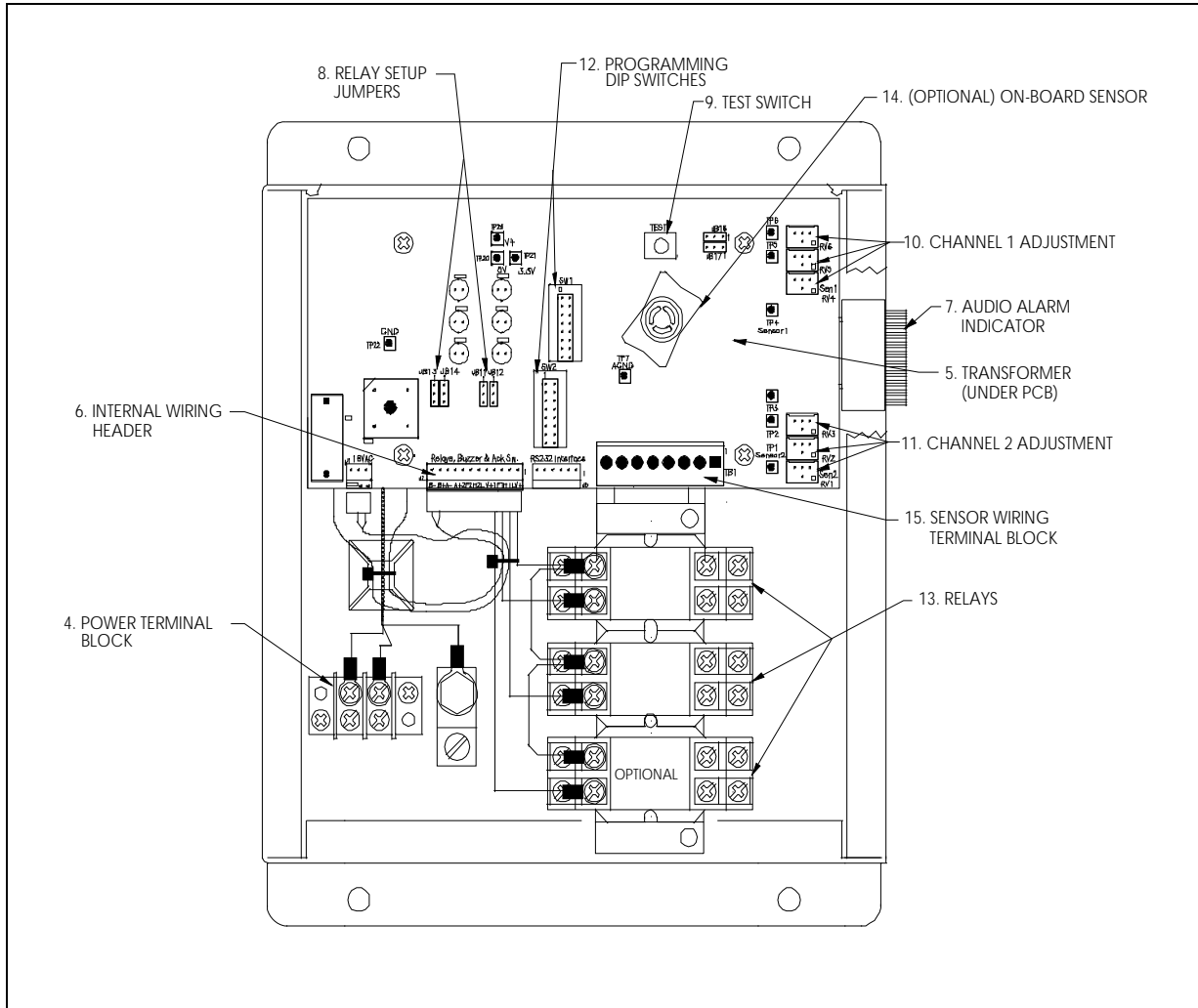


Figure 3-2 Internal Features of the Gas Monitor 1A2



## 4 INSTALLATION

Follow the guidelines in this section for proper locations and installation of the Gas Monitor 1A2 series monitor. In addition to these instructions, ensure installation is compliant with local building and electrical codes. This section covers topics related to installation location, mounting, cable selection, wiring instructions and monitor function programming for the Gas Monitor 1A2 series monitor.

### 4.1 MOUNTING INSTRUCTIONS

#### 4.1.1 MONITOR MOUNTING

Securely fasten the Gas Monitor 1A2 series monitor unit on a solid, non-vibrating surface or structure. Install the unit where it is not exposed to rain or water spray. If equipped with an onboard sensor Install in an area where the local concentration of gas is unaffected by the presence of ventilation systems and away from sources of interference gases. Mount the monitor where the unit can be observed periodically. For most applications the monitor should be mounted 1.2 -1.8 m (4-6 ft) from the floor. See Figure 4-1 for mounting hole locations.

**CAUTION: All cable entry MUST BE through the BOTTOM of the monitor enclosure only. Other entry locations will allow foreign materials to enter the enclosure, causing possible damage to the internal components.**

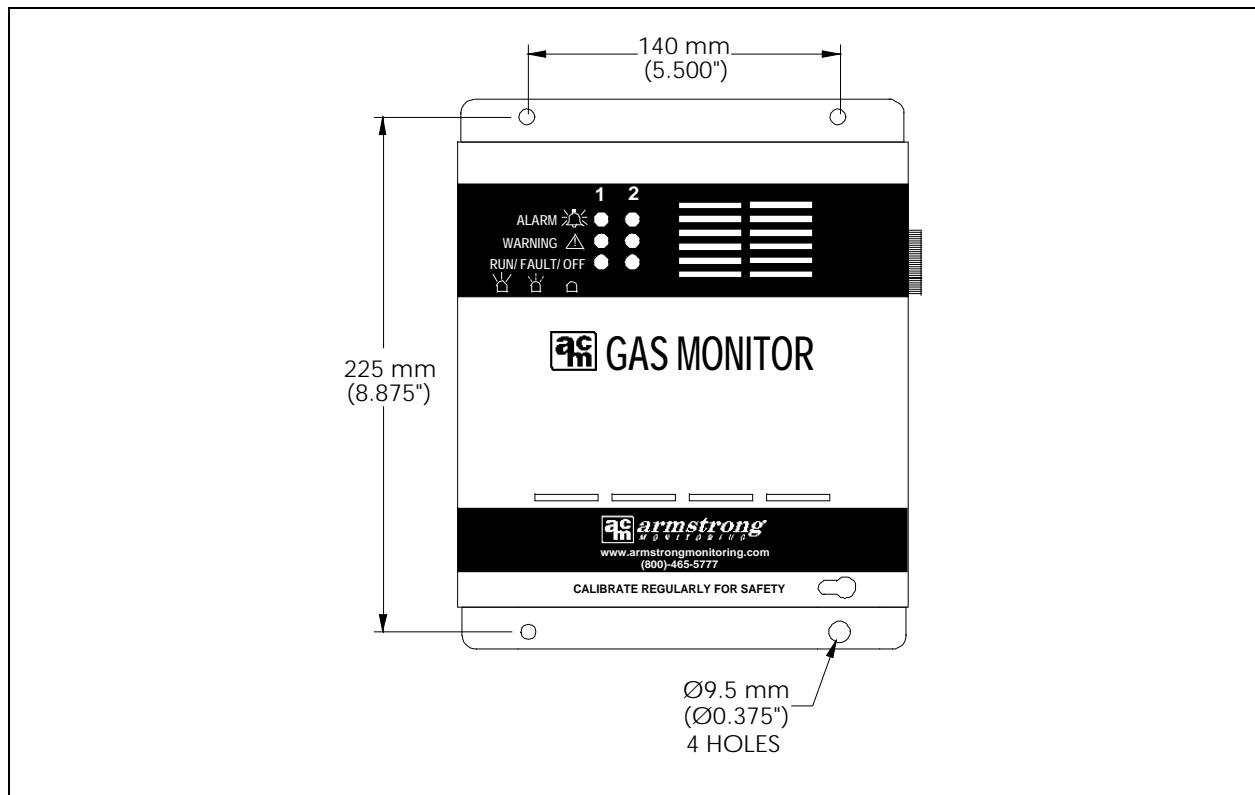


Figure 4-1 Locations of Mounting Holes



### 4.1.2 TRANSMITTER, SENSOR MODULE OR REMOTE SENSOR MOUNTING

Mount the transmitter, sensor module or remote sensor on a solid, non-vibrating surface or structure in an area where the local concentration of gas is unaffected by the presence of ventilation systems and away from sources of interference gases. Mounting heights and location vary depending on application and target gas properties. Refer to local building codes and regulations to determine if location is specified or contact the factory for consultation. If applicable, see the associated transmitter, sensor module or remote sensor manual(s) for additional instructions for proper mounting.

**Table 4-1 Transmitter, Sensor Module and Remote Sensor Mounting Locations**

Gas	Application	Location
CO	Vehicle exhaust monitoring	1.2 – 1.5 m (4-5 ft.) from floor
NO <sub>2</sub>	Vehicle exhaust monitoring	1.2 – 1.5 m (4-5 ft.) from floor
LPG	Vehicle fuel leaks	30 cm (12”) from floor

## 4.2 WIRING

### 4.2.1 MONITOR WIRING

**POWER SUPPLY:** The monitor operates on 120 VAC, 60 Hz. A Class II step down transformer runs the internal circuitry at low voltages. The power supply connections are made at the power terminal block located inside the monitor, see Figure 4-2.

**2 or 3 RELAYS:** When 2 or 3 relays are included with the monitor, “Ice Cube” DPDT relays are used. Two of the relays are set for different alarm conditions and the third relay is an optional Fault relay. The contacts are rated for 10Amps@250VAC resistive. For relay contact arrangement, see Figure 4-3.

**4 or 5 RELAYS:** When 4 or 5 relays are included with the monitor, Miniature DPDT relays are used. Four of the relays are set for different alarm conditions (2 per channel) and the fifth relay is an optional Fault relays (shared Fault condition between channel 1 and 2). The contacts are rated for 10Amps@250VAC resistive. For relay contact arrangement, see Figure 4-4.

The Gas Monitor 1A2 series monitor is shipped with channel 1 and 2 relays factory configured to be de-energized in the non-alarm state. If the user prefers to have relays in a normally energized (failsafe) state see section 5.1.2 for jumper configuration.

The optional fault relay is in the normally energized (failsafe) mode, and is not programmable by the end user.



# Gas Monitor 1A2 Series Two Channel Monitor

All programmable settings are factory configured for use with sensor options provided on original order. Certain user options however may be set according to preferences in the field. Be certain to observe appropriate interconnection of sensors to specified monitor inputs (see Section 2).

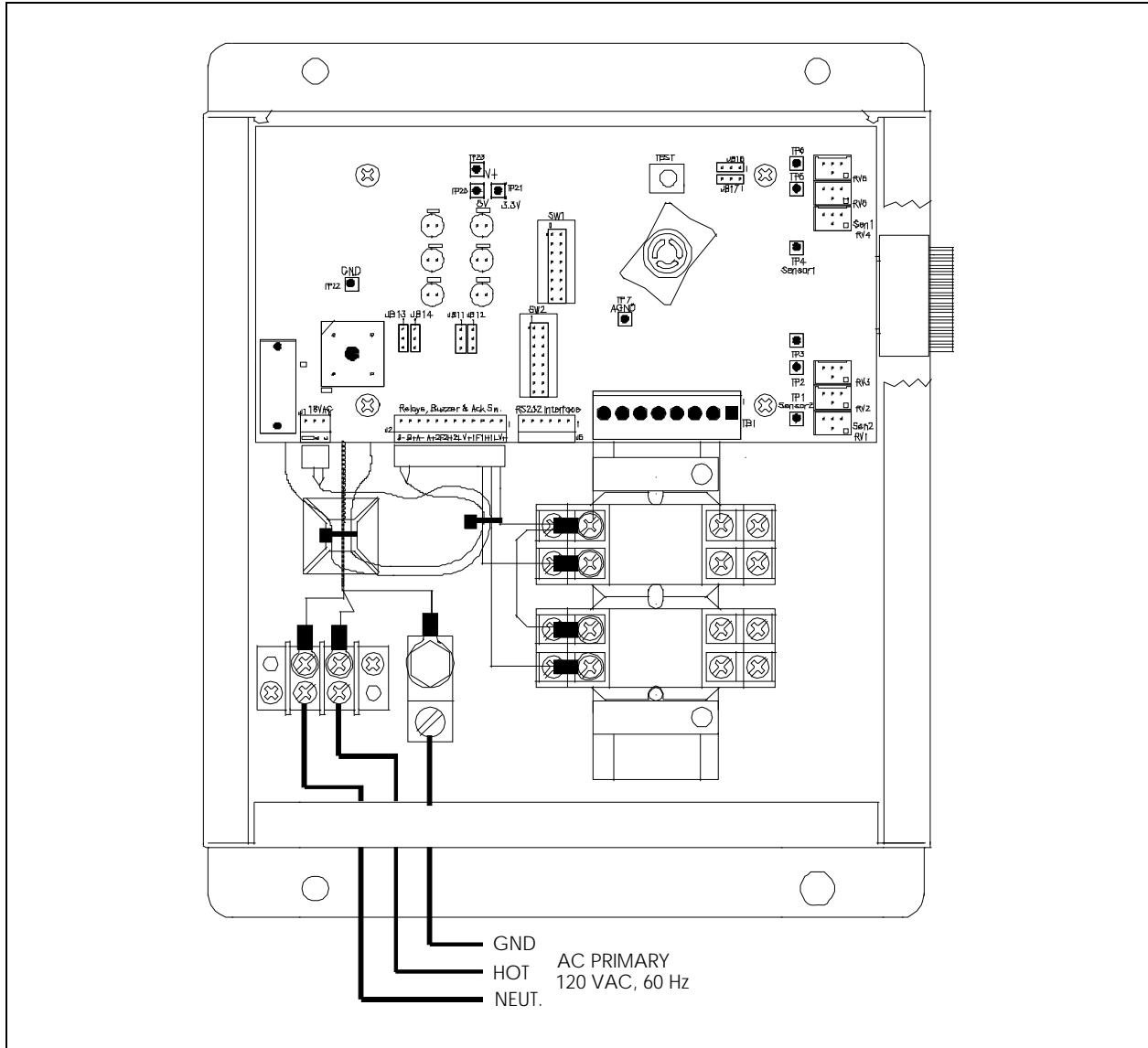
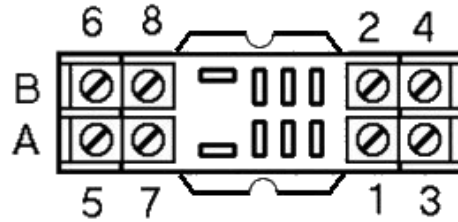


Figure 4-2 Location of Power Supply Connections



**RELAY SOCKET  
TERMINAL CONNECTIONS**



**(DEFAULT)  
RELAY  
NON-ENERGIZED**

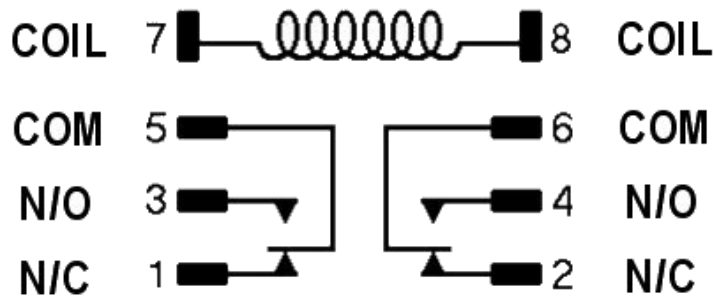


Figure 4-3: Relay Contact Arrangement for 2 or 3 Relays

**RELAY SOCKET TERMINAL CONNECTIONS**

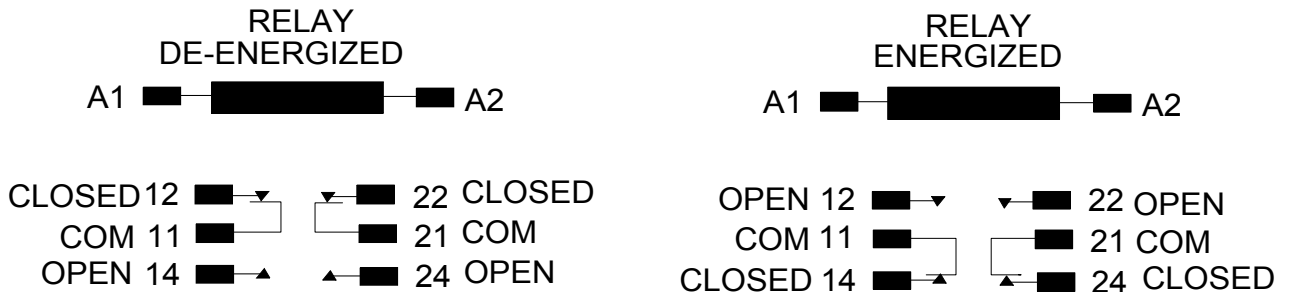
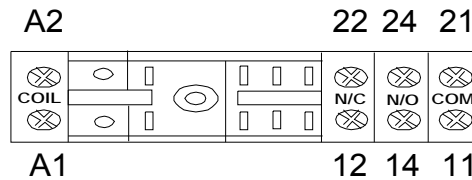


Figure 4-4 : Relay Contact Arrangement for 4 or 5 Relays.

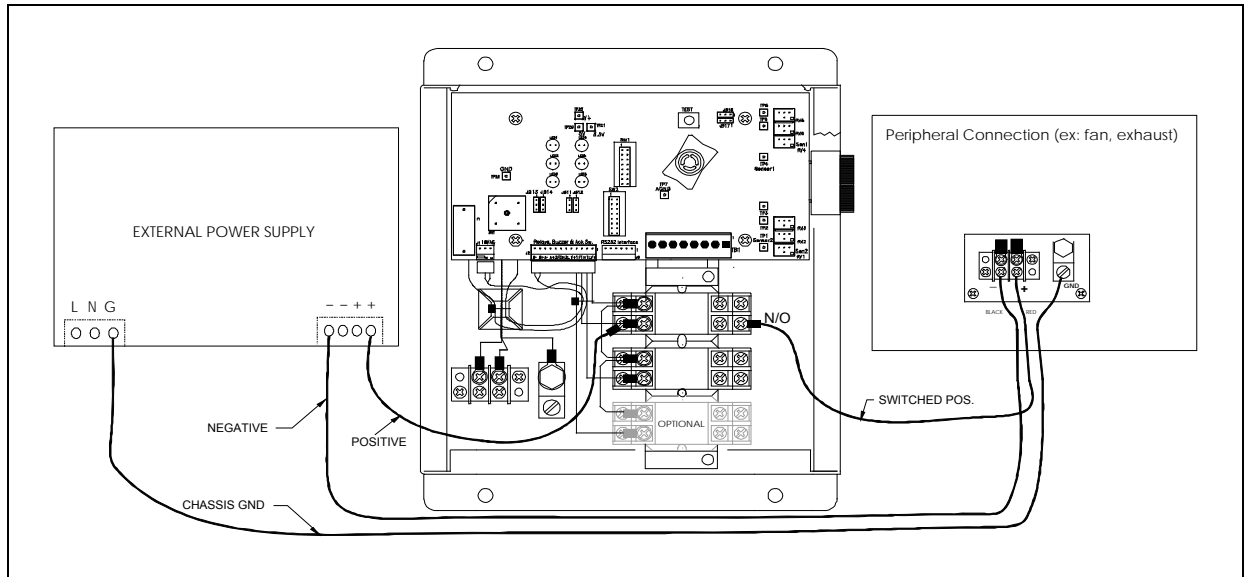


## Gas Monitor 1A2 Series Two Channel Monitor

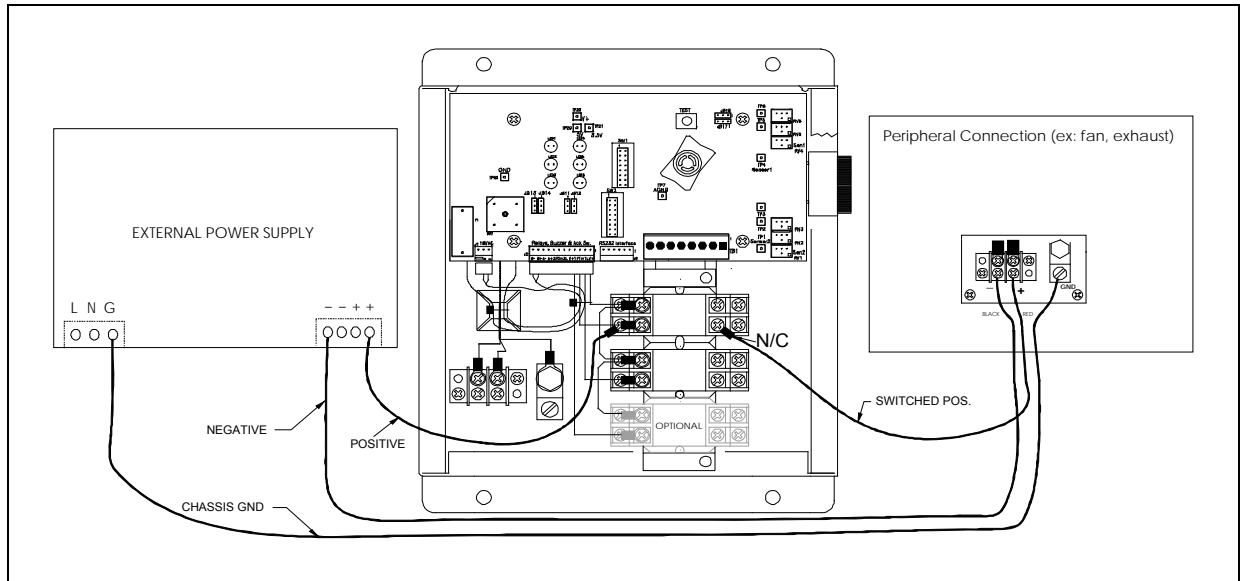
The default relay programming configuration that is shipped is de-energized in the non-alarm state. See section 5.1.2 ALARM RELAY PROGRAMMING. The Figure 4-3 drawing above shows the schematic for the de-energized relay state. Note that N/O or normally open define the contact state for a specific relay pin or pins when the coil is not energized. N/C or normally closed also define the contact state for a specific relay pin or pins when the relay coil is not energized.

If the user prefers to have relays programmed in the normally energized (failsafe) state then contact pin 3 and pin 4 are closed and contact pin 1 and 2 are open.

See Figure 4-5 and Figure 4-6 for connection examples.



**Figure 4-5 Connection when Relays programmed as De-Energized in Non Alarm State**



**Figure 4-6 Connection when Relays programmed as Energized in Non Alarm State**



### 4.2.2 CABLE SELECTION

Connections from the monitor to sensor modules should be made using shielded, 3-conductor cable. Connections from the monitor to transmitters should be made using shielded, 2 or 3-conductor cable (depending on type of transmitter used). Connections from monitor to remote sensor should be made using shielded, 3-conductor cable. For best signal transmission and maximum noise rejection, run cable through steel conduit (cable shield must be grounded at the monitor except for AMC-3705). For basic selection of cable size and length (between monitor and transmitter, sensor module or remote sensor), refer to the cable selection chart in the appropriate transmitter, sensor module or remote sensor manual(s). The monitor has two field wiring power supplies; 5 volts and 19-24 volts. The configuration for each signal input is shown in Table 4-2.

### WARNING FOR REMOTE TRANSMITTER INSTALLED IN HAZ-LOC

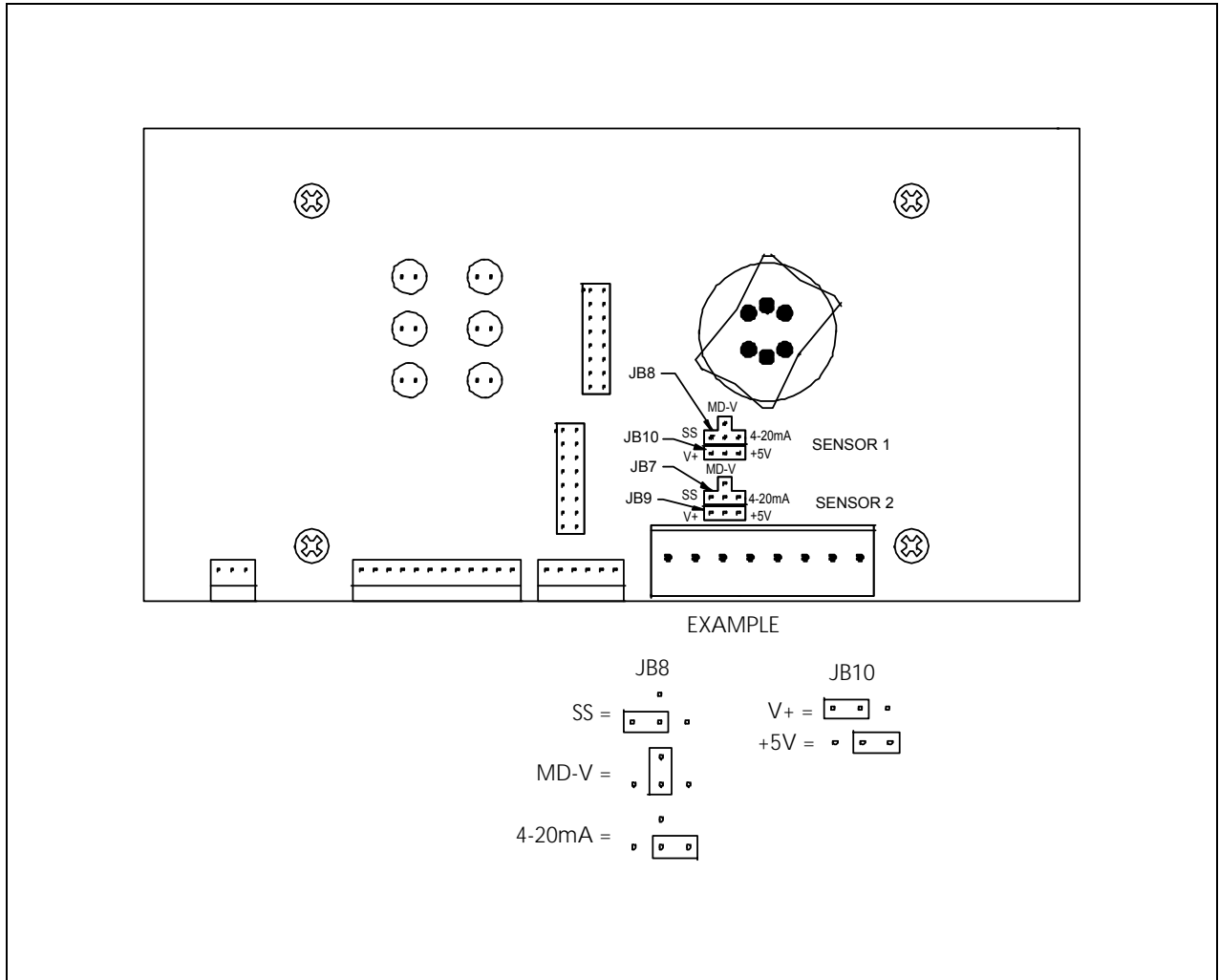
- ALL cables MUST pass through conduit seals installed between the hazardous (Class I, Division 1 or 2) and non-hazardous areas, for safety reasons and to comply with the local municipal, provincial, state, or federal electrical regulations.
- For UL only (U.S.) follow the National Electrical Code (NFPA 70) and the automotive & Marine Service Station Code (NFPA 30A).

### 4.2.3 INTERFACE CONFIGURATION

The input interface is configured by strapping the jumpers shown in the following table and figure, note V+ equals 19-24 volts DC depending on the load. A detailed description of each signal input configuration is in the following sub-sections.

Table 4-2 Signal Input Configuration Jumper Selection

SIGNAL INPUT CONFIGURATION	SENSOR 1		SENSOR 2	
	JB 8 TERMINATION	JB10 POWER SUPPLY	JB7 TERMINATION	JB9 POWER SUPPLY
On-board Solid State	SS	N/A	N/A	N/A
Transmitter, 2 wire Transmitter, 3 wire	4-20mA	V+	4-20mA	V+
AMC-122X Sensor Module	MD-V	V+	MD-V	V+
AMC-3700 Sensor with SS sensor	SS	V+	SS	V+
AMC-3705 Sensor with SS sensor	SS	+5V	SS	+5V



**Figure 4-7 Signal Input Configuration Jumpers**

Signal inputs are categorized into two main groups; On-board sensor connection and Transmitter, sensor module or remote sensor wiring.

### 4.2.3.1 On-Board Sensor Connection

There is currently only one on-board sensor option which is with a solid state sensor. The wiring as described in the following sections.

#### 4.2.3.1.1 Solid State Sensor

The solid state sensor plugs directly into the sensor socket located on the PCB. There is no polarity on the sensor, so the sensor will function properly in any orientation, see Figure 4-8 Solid State Sensor connection. Ensure all sensor pins are fully engaged.

### CAUTION

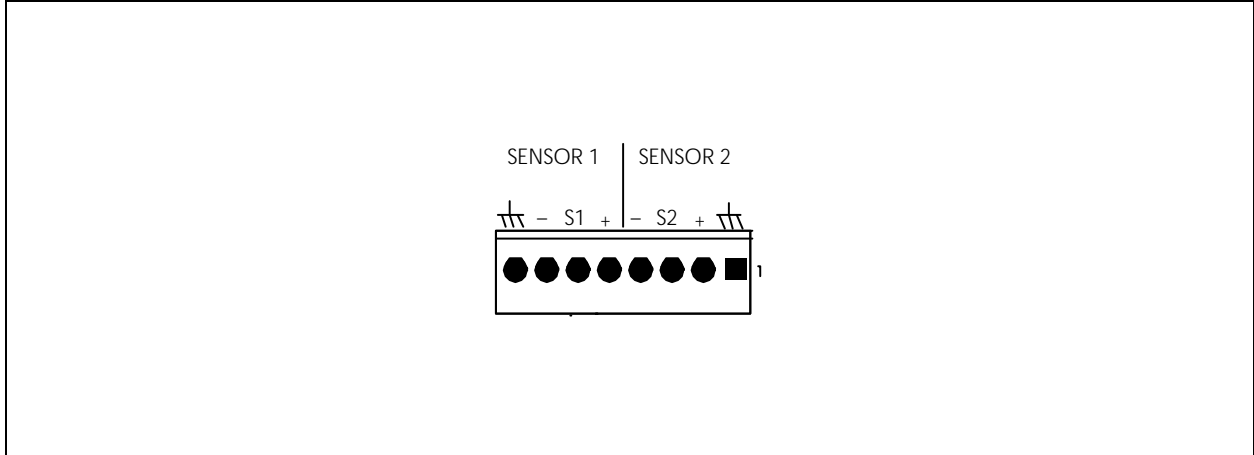
**TURN OFF THE MAIN POWER SUPPLY BEFORE REMOVING OR INSTALLING THE SENSOR(S).**





### 4.2.3.2 Transmitter, Sensor Module or Remote Sensor Wiring

Each transmitter, sensor module or remote sensor connects to a set of sensor terminals (-, S#, +) on the signal input terminal block located on the circuit board, see Figure 3-2, item 15. The signal input terminal block is located in the bottom right corner of the PCB and is capable of wiring two channels of inputs as shown in Figure 4-9. The following sections detail each of the remote transmitter or sensor wiring.



**Figure 4-9 Signal Input Terminal Block**

See specific transmitter, sensor module or remote sensor manual for wire gauge recommendations, based upon installation distance from the monitor. Be certain to observe appropriate wire connection to specified monitor signal input channel to retain correct operation or factory set alarm functions.

#### **Note:**

**Use Copper Conductors Only. Be sure to use shielded cable where specified.**



## Gas Monitor 1A2 Series Two Channel Monitor

### 4.2.3.2.1 Transmitter, 2 Wire

The 2 wire transmitter is wired to the Gas Monitor through the signal input terminal block. The wiring for channel 1 and 2 is conveyed in the following table.

Gas Monitor		Transmitter, 2 wire	
Chassis ground		→	Connect to shield of cable
Negative	-	→	Not applicable
Signal	S	→	Negative -
Positive	+	→	Positive +

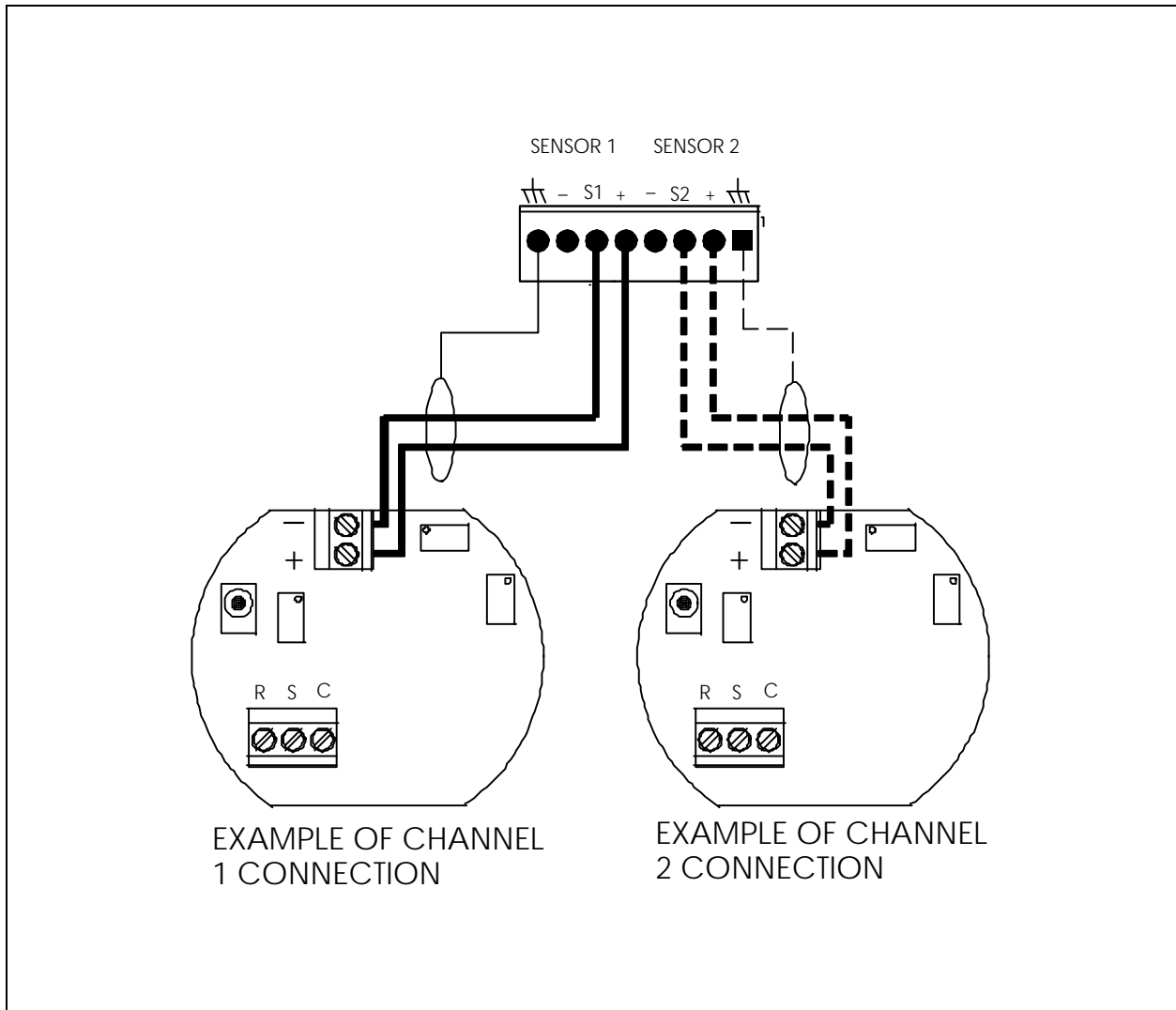


Figure 4-10 Transmitter. 2 Wire Wiring.



# Gas Monitor 1A2 Series Two Channel Monitor

## 4.2.3.2.2 Transmitter, 3 Wire

The 3 wire transmitter is wired to the Gas Monitor through the signal input terminal block. The wiring for channel 1 and 2 is conveyed in the following table.

Gas Monitor		Transmitter, 3 wire	
Chassis ground		→	Connect to shield of cable
Negative	-	→	Negative -
Signal	S	→	Signal S
Positive	+	→	Positive +

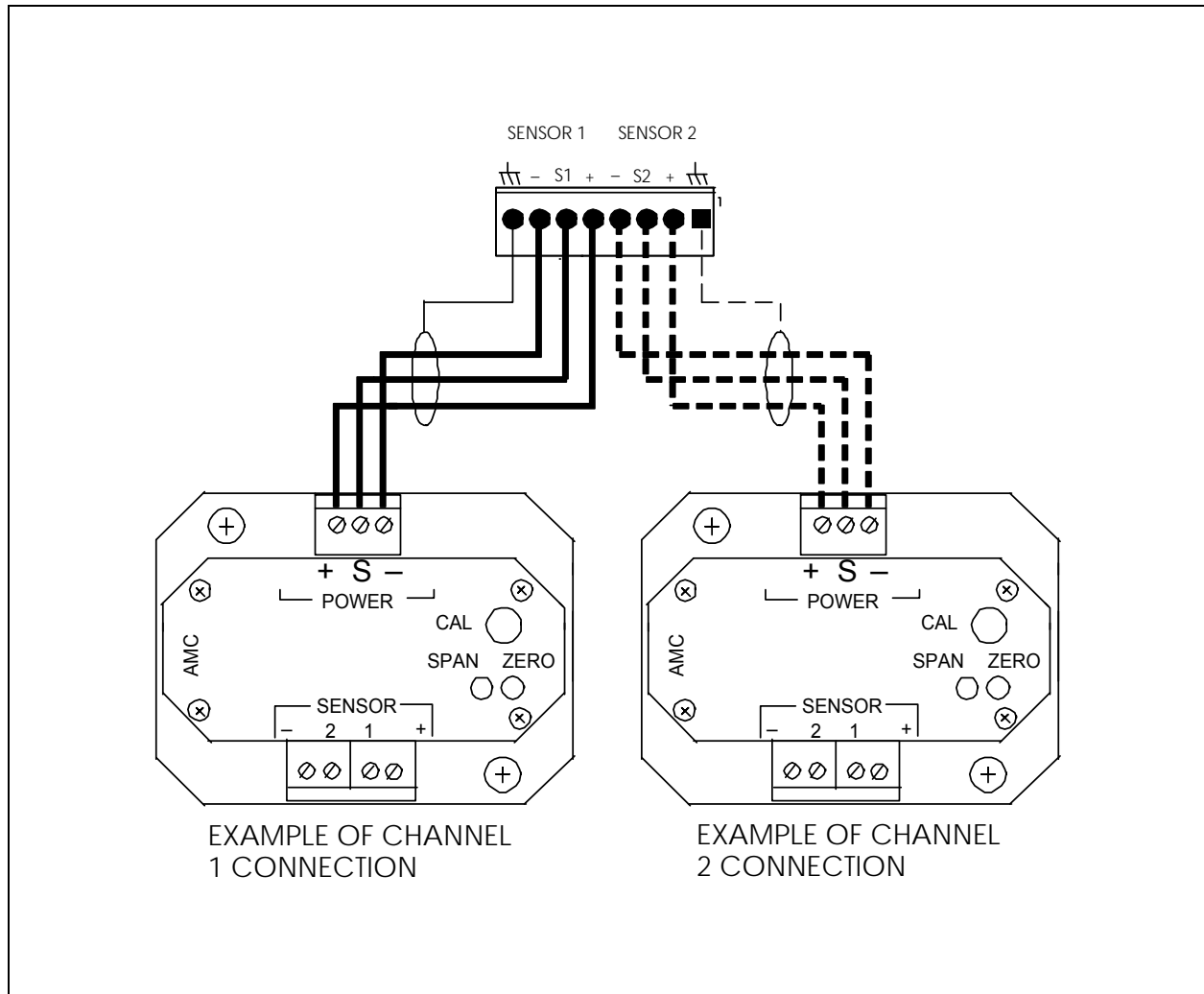


Figure 4-11 Transmitter. 3 Wire Wiring





# Gas Monitor 1A2 Series Two Channel Monitor

## 4.2.3.2.3 AMC-122X Sensor Modules (Voltage Mode)

The 122X sensor module is wired to the Gas Monitor through the signal input terminal block. The wiring for channel 1 and 2 is conveyed in the following table.

Gas Monitor		122X Sensor Module	
Chassis ground		→	Connect to shield of cable
Negative	-	→	negative
Signal	S	→	signal
Positive	+	→	positive

For further detailed wiring instructions for multiple sensor modules on one channel (up to 8) see the corresponding sensor module manual.

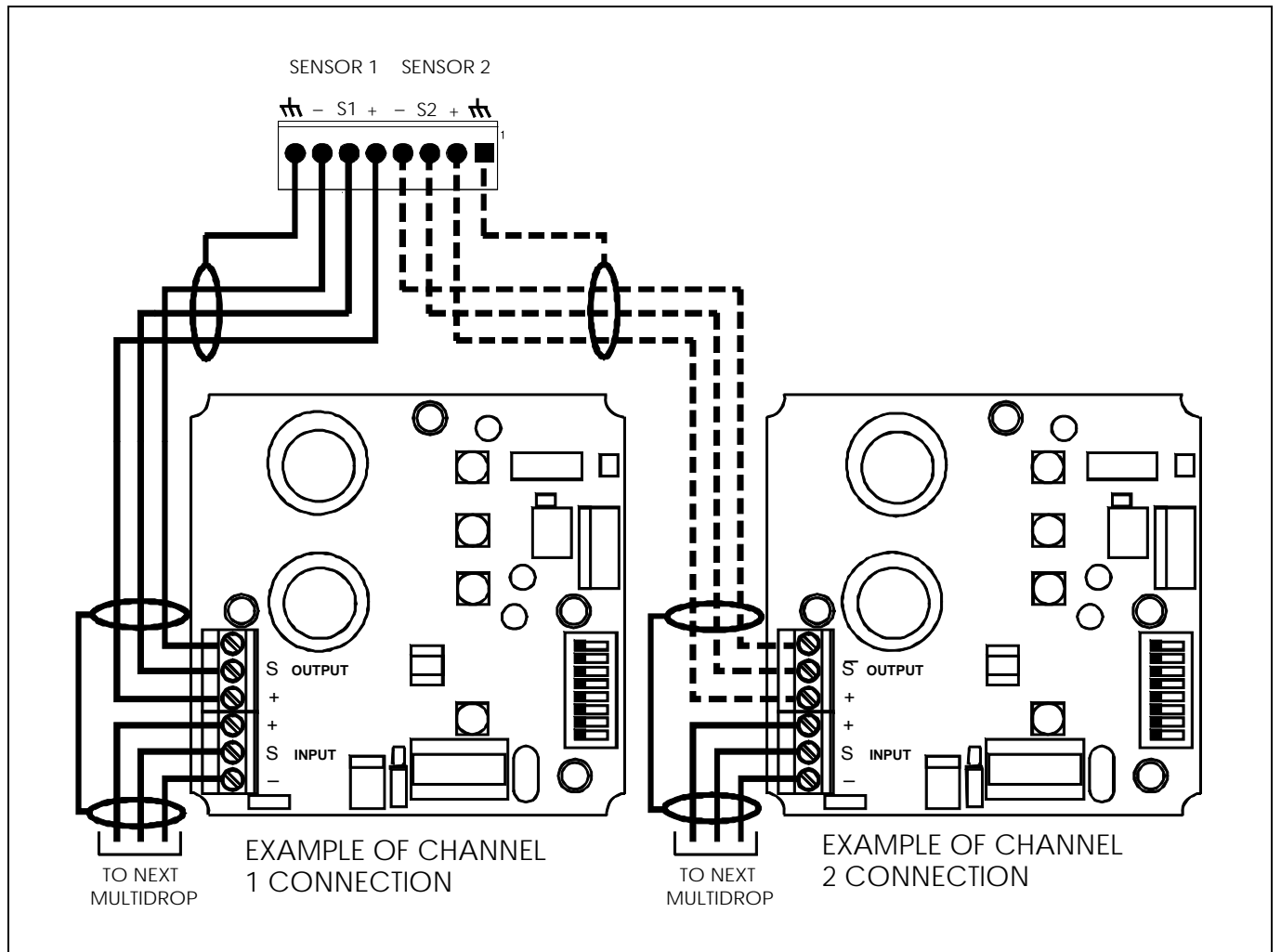


Figure 4-12 122x Sensor Module Wiring

## 4.2.3.2.4 AMC-3700 Remote Sensor

The 3700 remote sensor is wired to the Gas Monitor through the signal input terminal block. The wiring for channel 1 and 2 is conveyed in the following table.

Gas Monitor		3700 Remote Sensor	
Chassis ground		→	Connect to shield of cable
Negative	-	→	negative
Signal	S	→	signal
Positive	+	→	positive

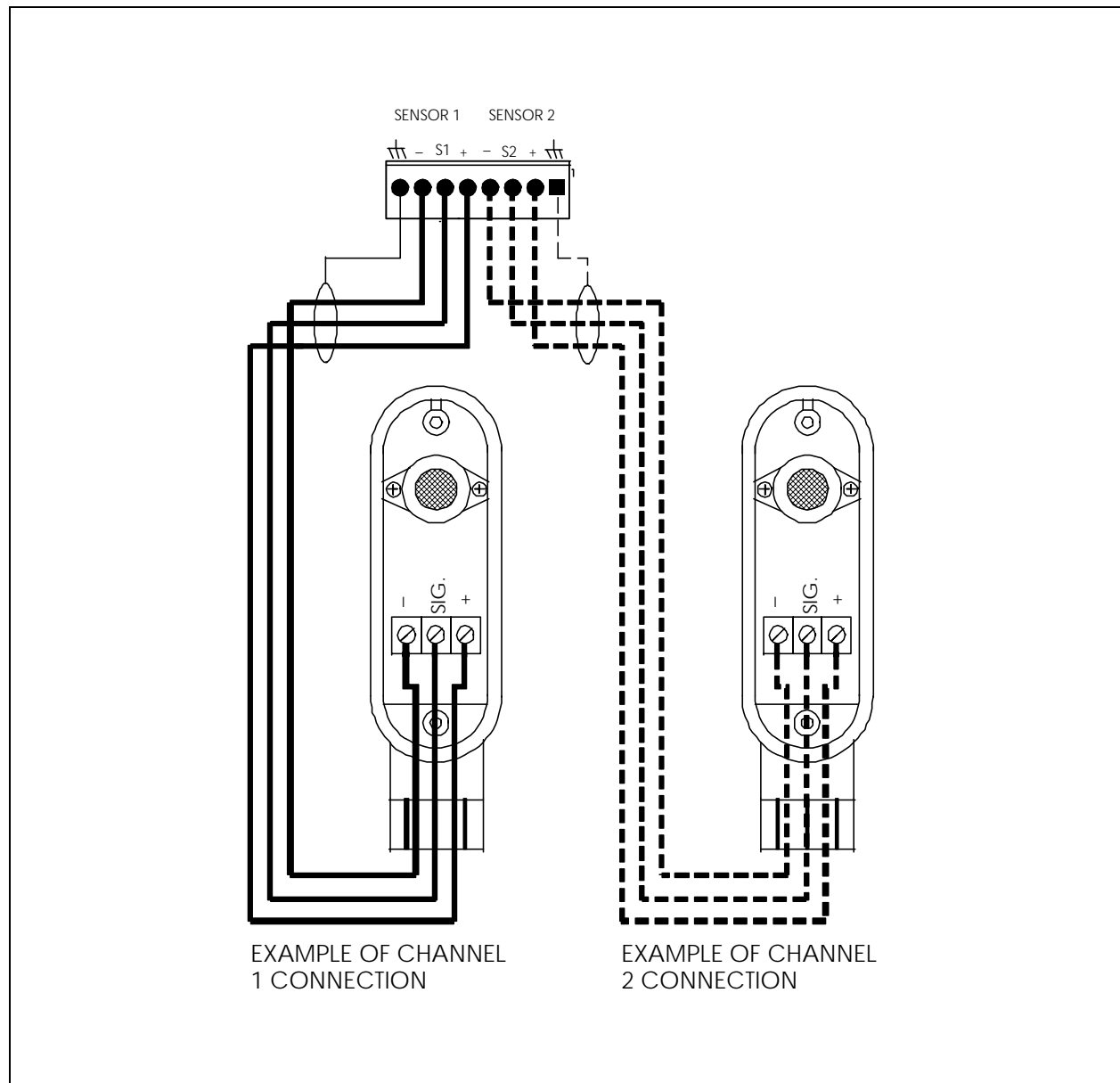
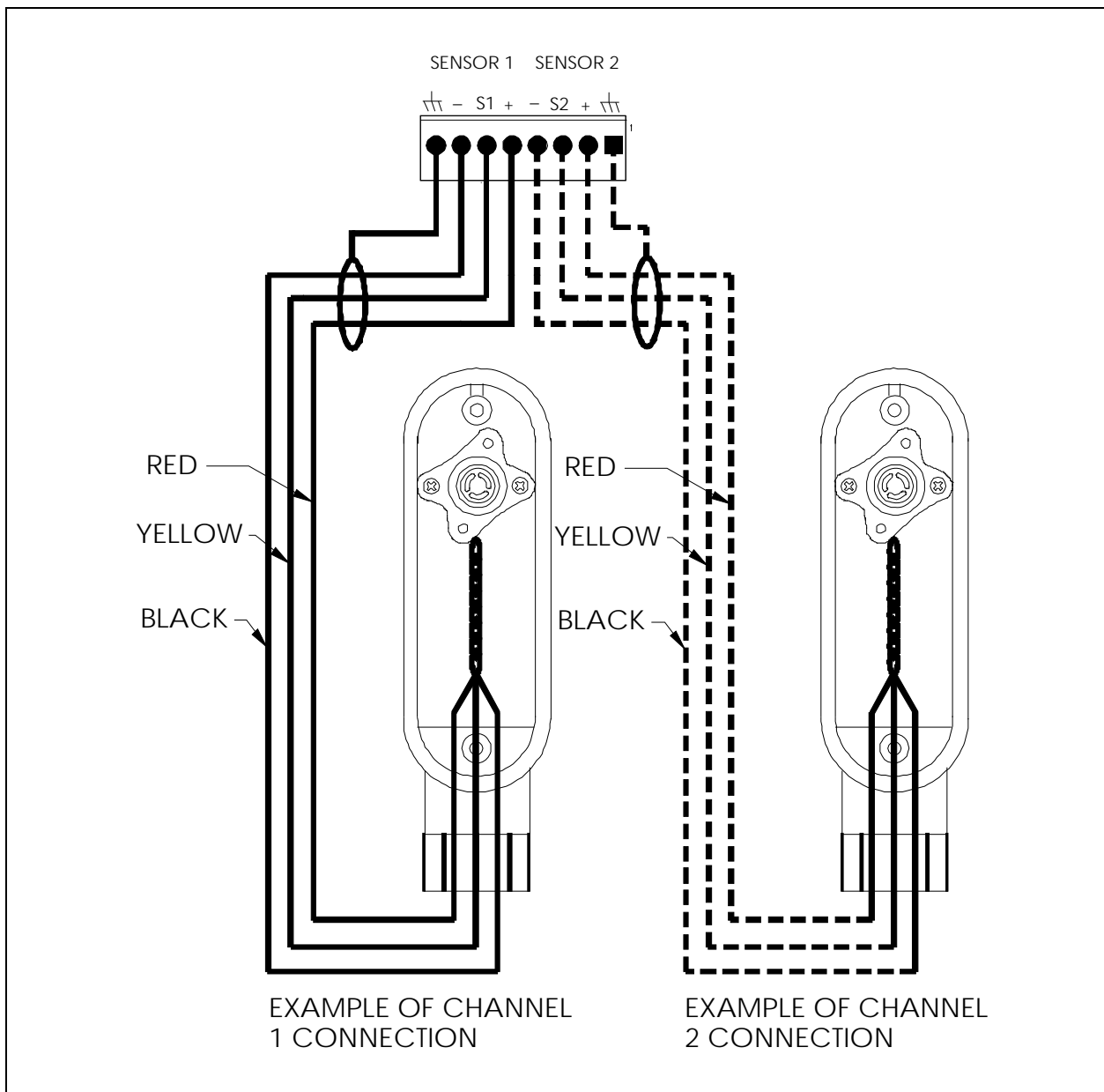


Figure 4-13 AMC-3700 Remote Sensor Wiring

4.2.3.2.5 AMC-3705 Remote Sensor

The 3705 remote sensor is wired to the Gas Monitor through the signal input terminal block. The wiring for channel 1 and 2 is conveyed in the following table.

Gas Monitor		3705 Remote Sensor
Chassis ground	⏏ →	Not applicable
Negative	- →	Black wire
Signal	S →	Yellow wire
Positive	+ →	Red wire







## Gas Monitor 1A2 Series Two Channel Monitor

Switch	Feature	Position	Description
SW1-7	Two Zone Enabled		With two sensor/channels (SW1-6 Off) and one group of relays (SW1-8 On), this dipswitch configures the two relays of group 1 to function as warning and alarm for a single zone, or each relay acts as the Alarm relay for each sensor/channel (Sensor/channel 1 with group 1 warning and Sensor/Channel 2 with group 1 Alarm). The Alarm Relay Activated when Fail is detected (SW2-1) applies to both relays when two zone is configured.
		OFF	One zone.
		ON	Two zones.
SW1-8	Enable One group of Relays	OFF	Two groups of relays (group1: Warning/J2-2 and Alarm/J2-3 and group2: Warning/J2-6 and Alarm/J2-7) and Fault/J2-4 are enabled. <ul style="list-style-type: none"><li>▪ Signals exceeding thresholds on channel 1 activate group 1 relays</li><li>▪ Signals exceeding thresholds on channel 2 activate group 2 relays</li><li>▪ Fault relay is activated as a result of fault detection on either channel</li><li>▪ Alarm relay may be activated as a result of fault detection on either channel (see SW2-1)</li></ul>
		ON	Only the first group of relays (Warning/J2-2 and Alarm/J2-3) and Fault/J2-4 are enabled. See SW2-1 for double duty Alarm and Fault. <ul style="list-style-type: none"><li>▪ Signals exceeding thresholds on either channel will result in relays being activated</li></ul>
SW2-1	Alarm Relay Activated when Fault is Detected	OFF	The Alarm relay is not activated when fault is detected.
		ON	When fault is detected, the Alarm relay is activated. <ul style="list-style-type: none"><li>▪ When only one group of relays is selected (see SW1-8), if fail is detected on a channel which is enabled (see SW1-6) then the Alarm relay is activated</li><li>▪ When two groups of relays are selected (see SW1-8), if fail is detected on a channel which is enabled (see SW1-6) then the Alarm relay associated with the channel is activated.</li></ul>
SW2-3	Audio Enable for Warning	OFF	Audio alarm is disabled for Warning conditions (2-threshold sensor modes only).
		ON	Audio alarm is activated in conjunction with Warning (2-threshold sensor modes only).
SW2-4	Sensor Fault Threshold	ON	Sensor Fault thresholds set at 0.4mA into 250R or 100 mV. Off if using 300 Series transmitters including AMC-360 transmitters or AMC-3701 transmitters.



Switch	Feature	Position	Description
		OFF	Sensor Fault thresholds set at 1.4mA into 250R or 350mV. ON if using 300 Series transmitters including AMC-360 transmitters or AMC-3701 transmitters.
SW2-5	Activation Delay, Warning or Sensor 1	OFF	No activation delay of Warning / S1 alarm conditions.
		ON	Five minute delay on activation of Warning (2-threshold) or Sensor 1 (1-threshold) alarm conditions following sensor exceeding alarm threshold.
SW2-6	Activation Delay, Alarm or Sensor 2	OFF	No activation delay of Alarm / S2 alarm conditions.
		ON	Delay on activation of Alarm (2-threshold) or Sensor 2 (1-threshold) alarm conditions following sensor exceeding alarm threshold.
SW2-7	Audio Alarm Enable	OFF	Audio alarm (buzzer) disabled.
		ON	Audio alarm (buzzer) enabled.
SW2-8	None	Either	Not used.

### 5.1.2 ALARM RELAY PROGRAMMING

The WARNING and ALARM relays may be configured as normally energized or normally de-energized with the jumper straps identified in Table 5-2 WARNING and ALARM Relay Active State and shown in Figure 3-2, item 8. Typically the “normally de-energized” position is employed, activating the relay when an alarm condition is detected.

The “normally energized” position is selected when failsafe operation is required. For example, the requirement is that when power to the Gas Monitor is lost, the load connects to a power source via contacts of this, normally energized relay.

Table 5-2 WARNING and ALARM Relay Active State

Relay	Jumper	Normally De-Energized	Normally Energized
Group 1, Warning	JB11	1-2	2-3
Group 1, Alarm	JB12	1-2	2-3
Group 2, Warning	JB13	1-2	2-3
Group 2, Alarm	JB14	1-2	2-3



### 5.1.3 AUDIO ALARMS

An audio alarm output is provided, which produces various alarm sounds, as shown in the chart below. The audio alarm can be disabled by turning OFF the DIP-switch SW2-7.

Table 5-3 Audio Alarm Operation

<b>Sensor Status</b>	<b>Output</b>
Normal	off
Warning (SW2-3 OFF, 2-threshold modes only)	off
Warning (SW2-3 ON, 2-threshold modes only)	two long, slow beeps. followed by short pause
Any Sensor (1-threshold modes), or Alarm (2-threshold modes)	four fast beeps, followed by short pause
Any Sensor Fault (with no unacknowledged alarms on opposite sensor)	short, slow beeps
Notes: 1) Micro-controller operation ensures that Warning, Alarm and Fault conditions will not occur simultaneously on the same sensor.  2) An Alarm or Warning condition on either sensor overrides a Fault condition on the opposite sensor.	



### 5.1.4 POWER-ON DELAY

Following successful completion of all self-tests, detection of sensor WARNING, ALARM and FAULT conditions is disabled for 30 seconds. This delay is provided to allow the sensors to stabilize. During this delay, the status LEDs show the “sensor normal” condition (only the green LED on). The audio alarm is silent, and the alarm relay outputs are held in the non-alarm condition.

### 5.1.5 TEST SWITCH FUNCTION

While pressed, the on-board test switch will cause continuous activation of the alarm relay outputs (energized or de-energized, depending on configuration), continuous activation of the audio alarm, and all status LEDs will be illuminated. Sensor processing and updating of internal status and timers continues. When released, the outputs and LEDs return to normal operation.

### 5.1.6 ACKNOWLEDGE FUNCTION

An option exists for an Acknowledge pushbutton switch. When pressed, any present WARNING, ALARM or FAULT condition, including those previously acknowledged, will be silenced (audio alarm off) for 30 minutes. If any WARNING, ALARM or FAULT condition remains after 30 minutes, the audio alarm will again be activated. Any WARNING, ALARM or FAULT condition returning to normal and then reactivating, or any new WARNING, ALARM or FAULT condition will cause an immediate audio alarm.

If the Activate Alarms Until Acknowledge (latching relays) (SW1-1 ON) feature is enabled, the alarm outputs will not automatically return to normal, but will remain in alarm until the acknowledge button has been pressed. While a relay remains latched, the audio alarm remains active.

### 5.1.7 ALARM/WARNING RELAY ACTIVATION DELAYS

The Gas Monitor 1A2 series monitor comes standard with 5 min activation time delays for the WARNING and ALARM relay contacts. The activation time delays can help prevent short cycling WARNING/ALARM in some applications. The delays can be enabled by turning ON switches SW2-5 and SW2-6, for WARNING/ALARM respectively.

### 5.1.8 RELAY OUTPUTS

In single relay group, single zone, a WARNING condition on either sensor will result in activation of the WARNING/1 relay output. An ALARM condition on either sensor will result in activation of both the WARNING/1 and ALARM/2 relay outputs.

In single-relay group, dual zone, a Sensor 1 Alarm condition will result in activation of the WARNING/1 relay output, and independently, a Sensor 2 Alarm condition will result in activation of the ALARM/2 relay output.

With two sensors enabled, the option exists to use two groups of relays; a WARNING and ALARM relay with sensor 1, and a WARNING and ALARM relay with sensor 2.





Each alarm relay (WARNING/1, ALARM/1, WARNING/2 and ALARM/2) may be selected as either energized when alarm active, or de-energized when alarm active, using on-board jumpers JB11, JB12, JB13 and JB14, respectively. This option is provided to allow configuration flexibility. If configured to energize the relay when alarm becomes active (jumpers set to “normally de-energized”), a controller failure or controller power failure will prevent an alarm condition from being produced. The opposite setting of jumpers (relay “normally energized”) will result in an alarm condition produced on reaching the gas threshold level, controller failure or controller power failure.

### 5.2 CALIBRATION/SERVICE

For transmitters and sensor modules calibration is done at their respective sensor electronics only trip point settings are made at the monitor. See transmitter or sensor module manual for calibration instructions. For AMC-3700, AMC-3705 and on-board sensors, calibration is done at the monitor.

The Gas Monitor 1A2 series system comes factory calibrated and does not need to be adjusted as part of installation. Periodic calibration is required on the Gas Monitor 1A2 series system; please contact the factory for recommended calibration intervals for your application. Direct service enquiries to The Armstrong Monitoring Corp at (800)465-5777 or [service@armstrongmonitoring.com](mailto:service@armstrongmonitoring.com). The monitor should not need re-calibration when first installed and powered up, but a test for correct operation is recommended after a stabilization period.

The table and figure below are provided to identify key components used in calibration.

- RV4 (Sensor1) and RV1 (sensor2) are used with solid state sensors to condition the signal from the sensor so that it is in a usable range. TP4 (Sensor1) and TP1 (sensor 2) are used to monitor the signal from the sensors/channels.
- RV5 (Sensor1) and RV2 (sensor2) are used to set a threshold at which the WARNING is triggered. TP5 (Sensor1) and TP2 (sensor2) are used to monitor these WARNING levels.
- RV6 (Sensor1) and RV3 (sensor2) are used to set a threshold at which the ALARM is triggered. TP6 (Sensor1) and TP3 (sensor2) are used to monitor these ALARM levels.

Table 5-4 Test Points and Trimpots Allocation

	Reference Points	Sensor/Channel 1	Sensor/Channel 2
Test Points	Signal	TP4	TP1
	WARNING	TP5	TP2
	ALARM	TP6	TP3
	Ground	TP7	
Trimpots	Solid State Signal Termination	RV4	RV1
	WARNING	RV5	RV2
	ALARM	RV6	RV3

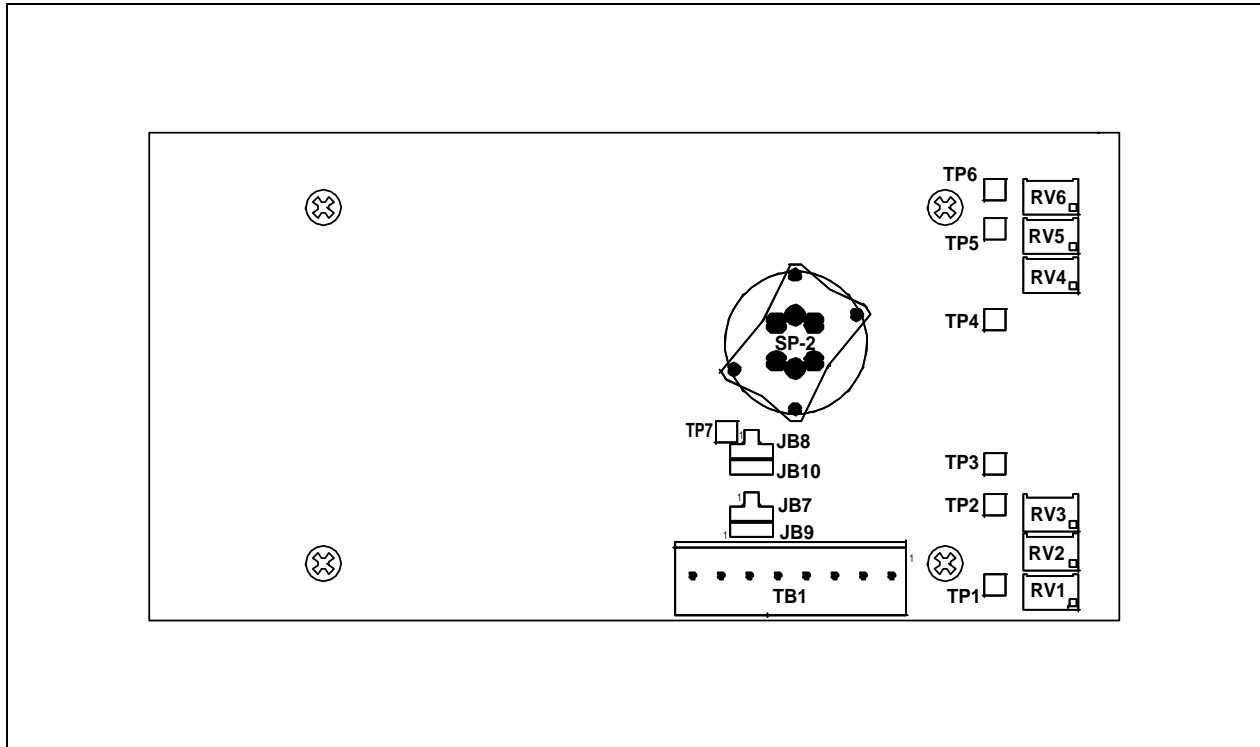


Figure 5-1 Gas Monitor 1A2 Test Points and Trimpots

## 5.2.1 2-WIRE AND 3-WIRE TRANSMITTERS

This section discusses the adjustment of the WARNING and ALARM thresholds on the Gas Monitor when connected to a 2 or 3-wire transmitter.

These transmitters supply a linear 4 to 20mA DC signal to the monitor. This translates to a 0.4 to 2.0 volt DC signal at TP4 (Sensor 1) and TP1 (Sensor 2). The alarms are set to correspond to some fraction of the transmitters full scale calibration. The WARNING threshold is set using trimpot RV5 (Sensor 1) and RV2 (Sensor 2). The ALARM threshold is set using trimpot RV6 (Sensor 1) and RV3 (Sensor 2).

The calibration of the two or three wire transmitters is specified in the transmitter specific manual.

See sections 4.2.3.2.1 Transmitter, 2 Wire and 4.2.3.2.2 Transmitter, 3 Wire for connecting the transmitters to the Gas Monitor.

### 5.2.1.1 Equipment Required

- Digital multimeter with a minimum display range of 0 to 10.0 VDC.
- Miniature screwdriver or trimmer adjustment tool.



### 5.2.1.2 Trip Threshold Adjustment

Ensure that the interface is configured for 4-20mA transmitters.

The formula below is used to determine the voltages the thresholds are adjusted to with the trimpots.

$$V_{\text{alarm}} = ((C_{\text{alarm}} / C_{\text{full scale}} * I_{\text{Range}}) + I_{\text{base}}) * R_{\text{termination}} * K_{\text{Gas Monitor 1A}}$$

Where

- $V_{\text{alarm}}$  – The voltage measured at the alarm test point while adjusting the alarm trimpot.
- $C_{\text{alarm}}$  - The target gas concentration for the alarm
- $C_{\text{full scale}}$  - The gas concentration corresponding to full scale (20mA)
- $I_{\text{Range}}$  – Calibrated at transmitter, typically 16mA for full range.
  - $I_{\text{Range}} + I_{\text{base}}$  typically add to 20mA.
- $I_{\text{base}}$  – fixed at 4.0mA
- $R_{\text{termination}}$  – fixed internally on Gas Monitor at 250 ohms
- $K_{\text{Gas Monitor 1A}}$  – constant which describes the scaling used within the Gas Monitor, fixed at 0.4

EXAMPLE 1: To set an ALARM threshold of 100 PPM for a 4-20mA transmitter calibrated for 20mA for a concentration of 100 PPM;

- $C_{\text{alarm}}$ : 100 PPM
- $C_{\text{full scale}}$ : 100 PPM
- $I_{\text{Range}}$ : 20mA – 4mA = 16mA
- $V_{\text{alarm}} = (((100 \text{ PPM} / 100 \text{ PPM}) * 16\text{mA}) + 4\text{mA}) * 250 * 0.4$   
 $= 2.0\text{V}$
- For sensor 1, RV6 would be adjusted so that 2.0V is measured at TP6.

EXAMPLE 2: Using the same transmitter as example 1, set a WARNING threshold of 25 PPM;

- $C_{\text{alarm}}$ : 25 PPM
- $C_{\text{full scale}}$ : 100 PPM
- $I_{\text{Range}}$ : 20mA – 4mA = 16mA
- $V_{\text{alarm}} = (((25 \text{ PPM} / 100 \text{ PPM}) * 16\text{mA}) + 4\text{mA}) * 250 * 0.4$   
 $= 0.8\text{V}$
- For sensor 1, RV5 would be adjusted so that 0.8V is measured at TP5.

### 5.2.1.3 Recalibration

Refer to the transmitter manual for recommended recalibration & replacement periods. Whenever the transmitter is recalibrated or replaced, the Gas Monitor should also be recalibrated.



## 5.2.2 SOLID STATE, ON-BOARD, AND REMOTE SENSORS

The Gas Monitor is factory calibrated at levels based on set standards. Calibration of the monitor should be performed every 6 months unless the alarm trip point settings need to be changed. The monitor operates with a standard sensor assembly and all on site adjustments are made at the monitor. Recalibration is necessary when replacing the sensor. Use Armstrong's calibration chamber AMC-MXXXX series. For additional reference see the AMC-MXXXX series mixing chamber manual.

See sections 4.2.3.1.1 Solid State Sensor, 4.2.3.2.4 AMC-3700 Remote Sensor and 4.2.3.2.5 AMC-3705 Remote Sensor for connecting the solid state sensor to the Gas Monitor.

### 5.2.2.1 Setting Up Chamber and Applying Gas

Prior to applying gas to the sensor, follow the procedure shown in Figure 5-2 to set up the calibration chamber. Once the calibration chamber is set up, a gas sample may be taken and injected into the chamber following the procedures shown in Figure 5-3 and Figure 5-4. Measure the gas sample in the 1cc syringe to obtain the desired concentration. Please refer to the following gas concentration chart.

Table 5-5 Equivalent Concentration of Pure Gas Volume in 2L Plastic Mixing Chamber

Volume of Pure Gas	* Volume of Pure CO	Equivalent of Concentration
0.1 cc	0.4 cc	50 ppm
0.2 cc	0.8 cc	100 ppm
0.4 cc	1.6 cc	200 ppm
0.8 cc	3.2 cc	400 ppm
** 20 cc		1 %

CHAMBER MUST BE PURGED WITH FRESH OUTSIDE AIR PRIOR TO EACH CALIBRATION FUNCTION.

Allow 5 minutes warm-up for sensor to stabilize before injecting gas sample.

\* For CO in ventilation or parking applications, measure Volume x 4 to obtain desired concentration (i.e.: 0.1 cc x 4 = 0.4 cc for 50 ppm).

\*\* To measure a large volume of gas as in the case of combustibles, the larger 20-cc syringe is recommended.

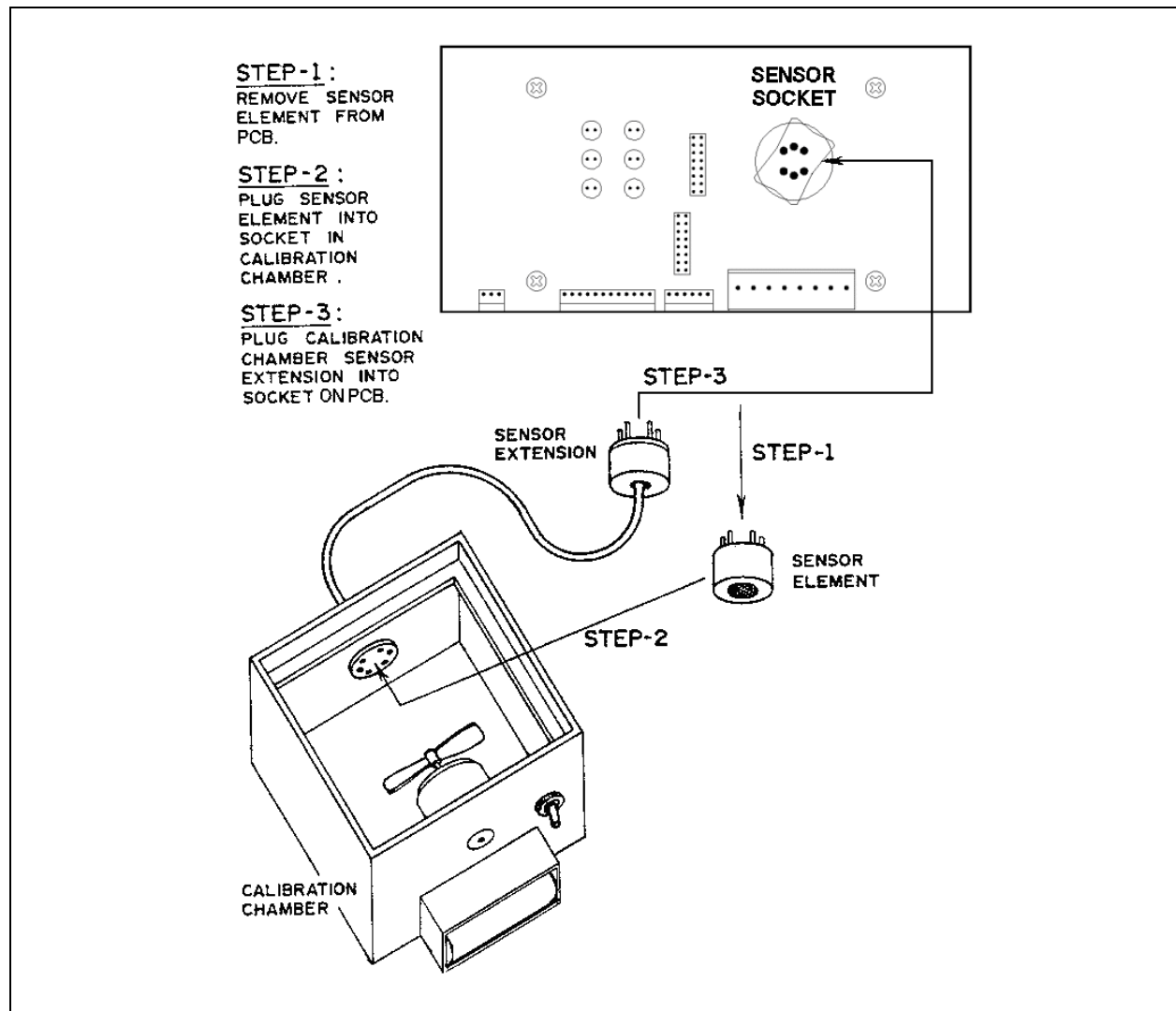


Figure 5-2 Calibration Chamber Set-Up Procedure



### 5.2.2.2 Adjustments

To observe immediate reaction during calibration, the low and high alarm time delays should be disabled. All calibration is made using the trimmers along the right side edge of the circuit board as shown in Figure 5-1.

Trimpot RV5 (Sensor 1) and RV2 (Sensor 2) are used to establish the WARNING trip point. This is done by exposing the sensor to the WARNING gas concentration and adjusting the trimmer clockwise until the YELLOW LED just lights.

Trimpot RV6 (Sensor 1) and RV3 (Sensor 2) are used to establish the ALARM trip point. This is done by exposing the sensor to the ALARM gas concentration and adjusting the trimmer clockwise until the RED LED just lights.

#### **Note:**

**IF THE SENSOR HAS BEEN REPLACED, ADJUST THE SIGNAL FIRST THEN PROCEED WITH WARNING AND ALARM ADJUSTMENTS. SIGNAL CALIBRATION IS PERFORMED USING A DIGITAL MULTIMETER SET TO MEASURE DC VOLTAGES TO TWO DECIMAL PLACES.**

Trimpots RV4 (Sensor 1) and RV1 (Sensor 2) are used to set the sensitivity of the sensor. This is done by exposing the sensor to the WARNING concentration of gas. The voltage associated with the signal can be measured at the test points TP4 (Sensor 1) and TP1 (Sensor 2), see Figure 5-5. The voltage measured at the signal test point should be approximately 1.2 Volts.

When the calibrations are complete remove the calibration chamber and replace the sensor element as shown in Figure 5-1.

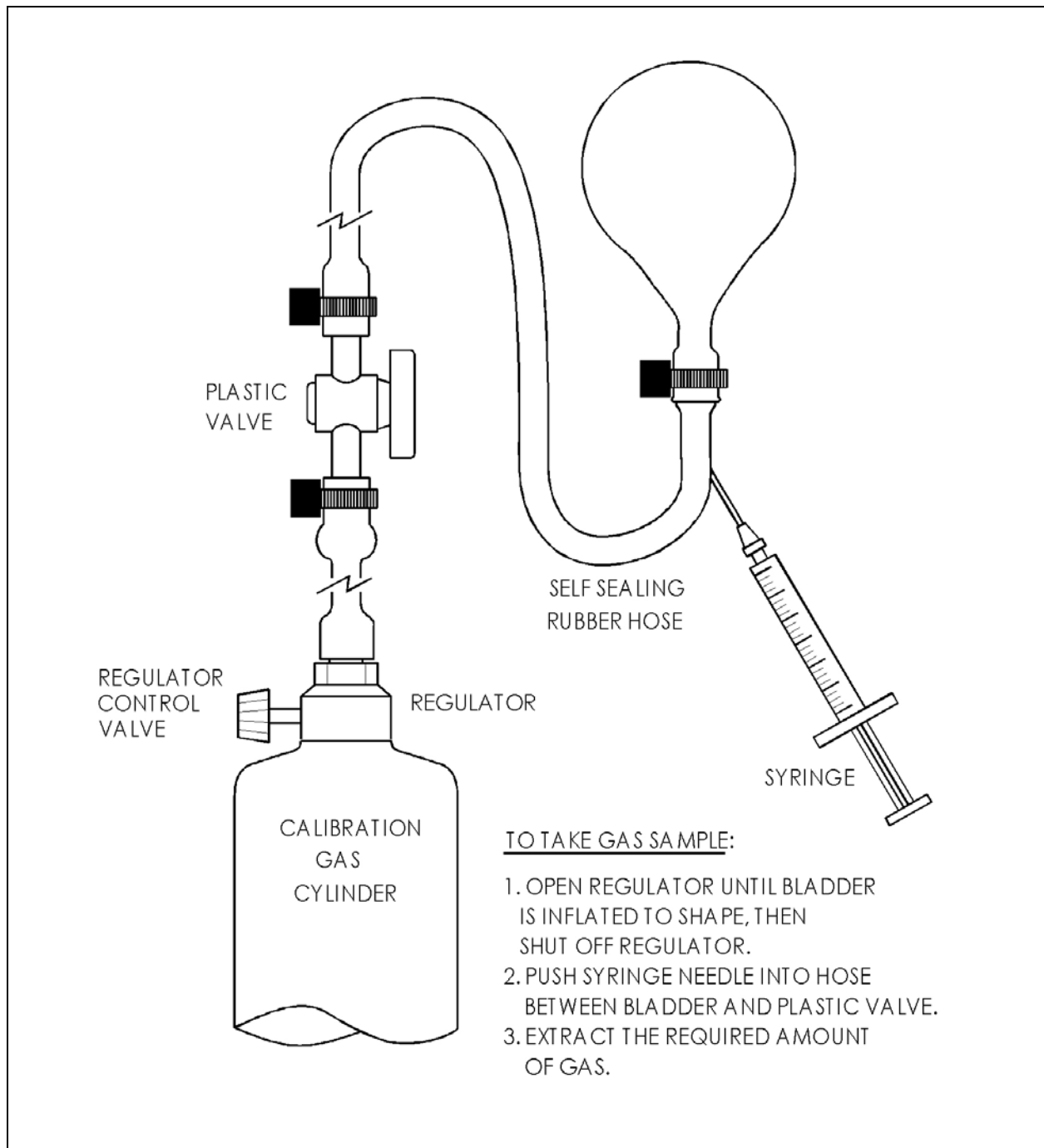


Figure 5-3 Taking Gas Sample

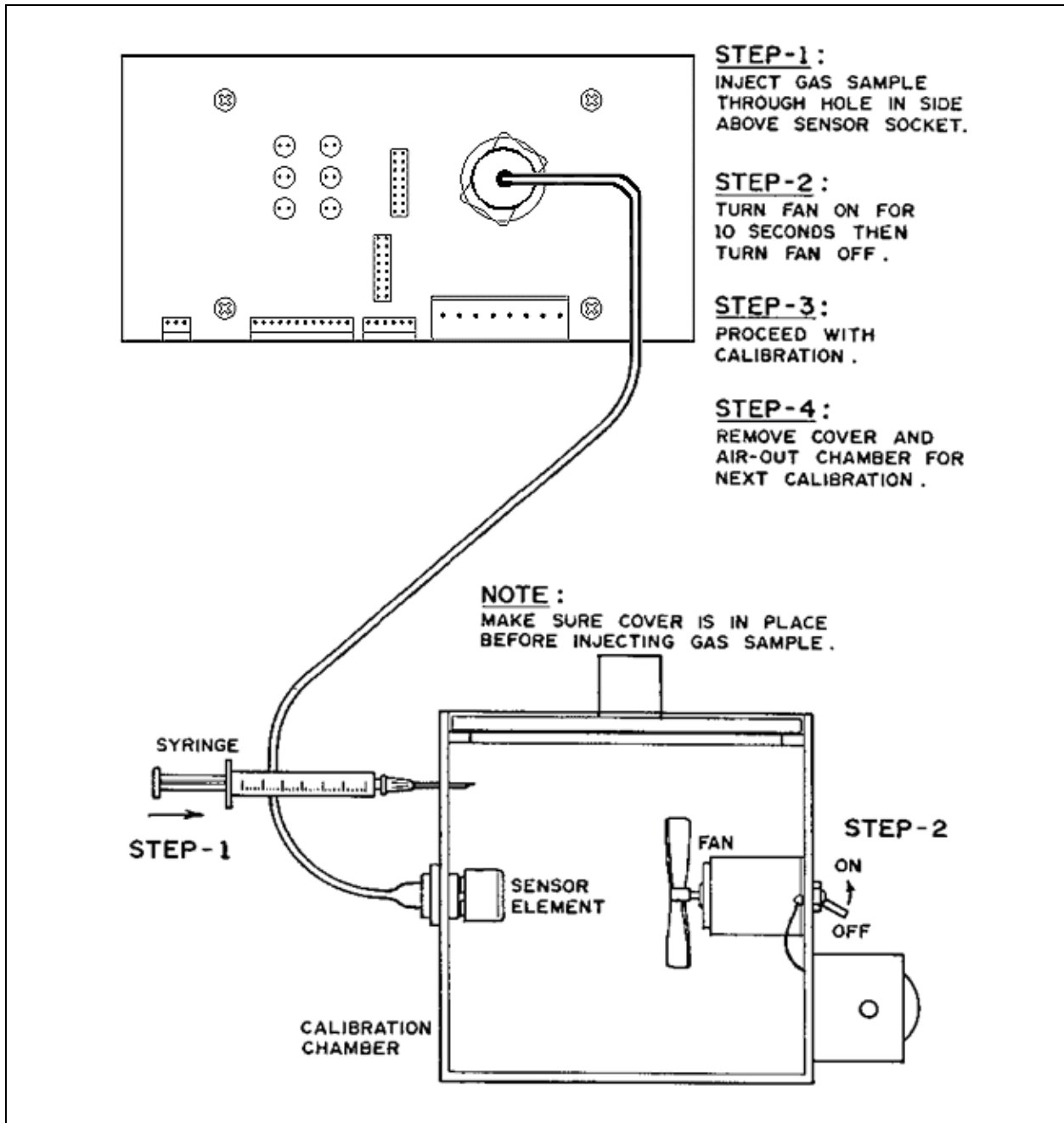


Figure 5-4 Injecting Gas Sample for Calibration



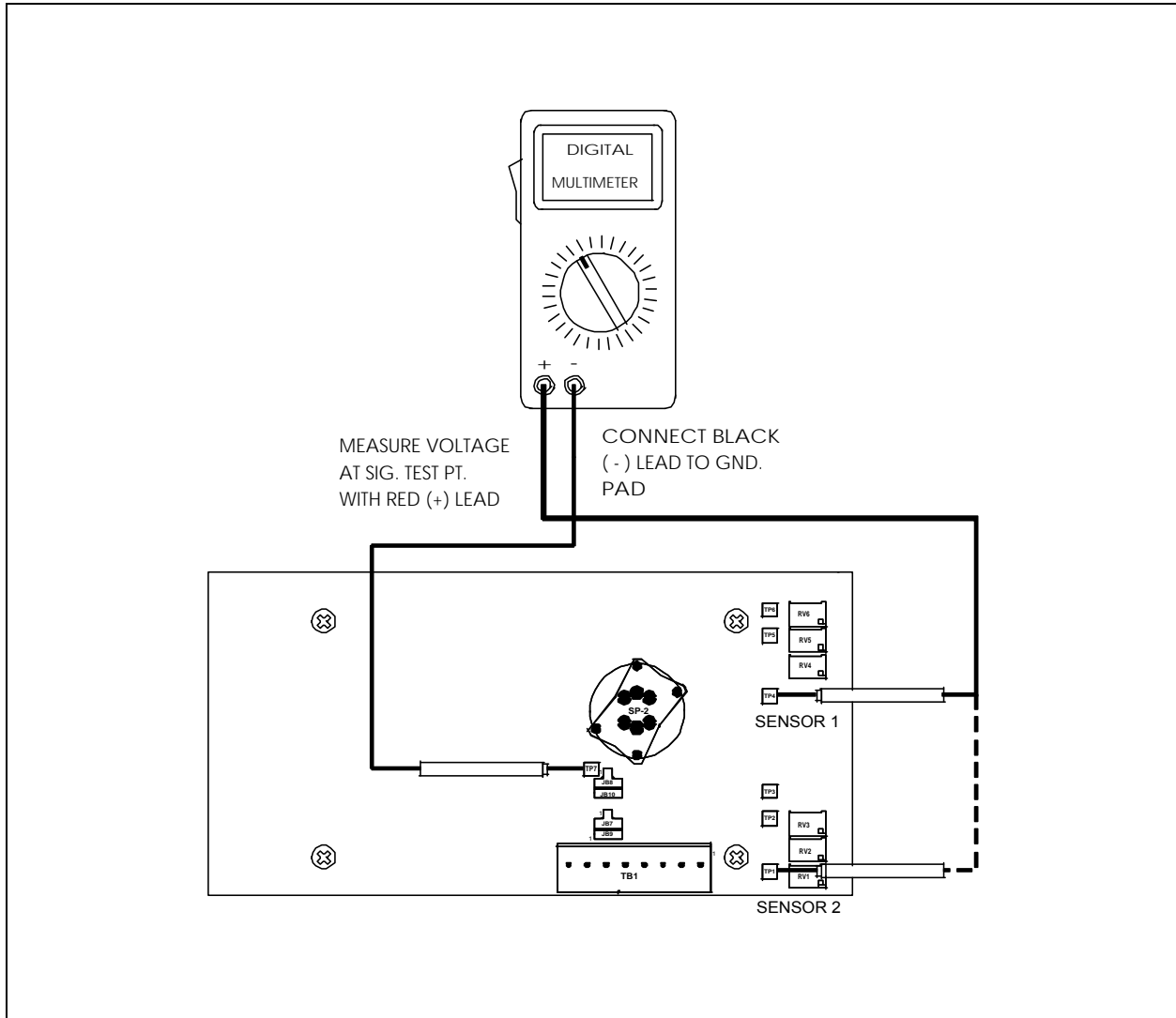


Figure 5-5 Trimmer Adjustment and Test Point Locations

### 5.2.3 AMC122X FAMILY OF SENSOR MODULES (VOLTAGE MODE)

This section discusses the principle of the WARNING and ALARM thresholds on the Gas Monitor when connected to a voltage mode sensor module (i.e. AMC122X). These modules drive a multi-level voltage signal to the monitor to indicate their current state. The following table provides a general indication of state versus voltage.

Table 5-6 State Versus Voltage

State	Signal Voltage (V) On Signal Wire
Fail / Fault	0
Normal	1
Warning	2
Alarm	3



Since alarms are processed at the sensor module, the monitor is factory set to simply recognize their settings; therefore, no user adjustments reside in the monitor.

Calibration is performed at the sensor module as specified in the module specific manual.

See section 4.2.3.2.3 AMC-122X Sensor Module for connecting the module to the Gas Monitor.

5.2.3.1 Equipment Required

- Digital multimeter with a minimum display range of 0 to 2.00 VDC.
- Miniature screwdriver or trimmer adjustment tool.

5.2.3.2 Trip Threshold Adjustment

Ensure that the interface is configured for AMC-122X Sensor Module.

Connect the negative lead of the multimeter to TP7 AGND.

To adjust the WARNING threshold;

- Connect the positive lead of the multimeter to TP5 (channel 1) or TP2 (Channel 2).
- Using the miniature screwdriver, adjust RV5 (channel 1) or RV2 (channel 2) until 0.703V DC is measured on the multimeter.

To adjust the ALARM threshold;

- Connect the positive lead of the multimeter to TP6 (channel 1) or TP3 (channel 2).
- Using the miniature screwdriver, adjust RV6 (channel 1) or RV3 (channel 2) until 1.073V DC is measured on the multimeter.

Monitor Calibration is complete.

The following table summarizes the keypoints of the calibration.

	Channel 1		Channel 2		Threshold
	Test Point	Trimpot	Test Point	Trimpot	
WARNING	TP5	RV5	TP2	RV2	0.703
ALARM	TP6	RV6	TP3	RV3	1.073

5.3 GAS CONCENTRATION DISPLAY (OPTIONAL)

The optional digital display on the Gas Monitor 1A2 series monitor shows the current gas concentration of the remote sensor/transmitter that measure in PPM. The displays are completely user configurable and are designed to be able to work with the most common gas concentration ranges. They are not designed to be used with the solid state gas sensors which have outputs not based on PPM. For proper setup, refer to next section.



### 5.3.1 GAS CONCENTRATION DISPLAY SETUP

There are two gas concentration displays; looking from the front of the enclosure, channel 1 is left and channel 2 display is right. The following setup is common for both displays.

The display needs to be configured to the required gas range. On the back side of the display, there are 8 DIP-switches (Figure 5-6). The first 4 switches control the range and 6, 7 and 8 controls the placement of the decimal point (switch 5 is not used). In Table 5-7 below, common gas ranges are listed with the corresponding DIP-switch selection. For decimal point placement, only one of the switches (6, 7 and 8) can be ON at once. The selected gas range must be calibrated to display accurate values by adjusting the Zero and Span trimmers (Figure 5-6). A test transmitter with 4-20mA output is required to simulate zero and full scale outputs. Follow the steps below for proper setup.

1. Refer to Table 5-7 to select the desired gas range, change DIP-switch accordingly
2. Set Zero and Span trimmers fully clockwise, refer to Figure 5-6
3. Connect the test transmitter to the Gas Monitor 1A; refer to 4.2.3.2. Remove field wiring if required
4. Adjust transmitter to output 4.0mA and adjust the display Zero trimmer so the display reads 0
5. Adjust transmitter to output 20.0mA and adjust the display Span trimmer so the display reads the selected full scale
6. Repeat steps 4 and 5 to make sure the adjustments do not affect one another
7. Remove the transmitter and reconnect the field wiring if required

Table 5-7 Display DIP-Switch Settings

<b>Range ppm</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>Decimal Point</b>
1.000	ON	OFF	OFF	OFF	6
3.00	OFF	OFF	ON	OFF	7
10.00	ON	OFF	OFF	OFF	7
25.0 (% for O <sub>2</sub> )	OFF	ON	ON	OFF	8
50.0	OFF	ON	OFF	OFF	8
100.0	ON	OFF	OFF	OFF	8
200	OFF	ON	ON	OFF	None
300	OFF	OFF	ON	OFF	None
400	OFF	ON	OFF	OFF	None
500	OFF	ON	OFF	OFF	None
1000	ON	OFF	OFF	OFF	None

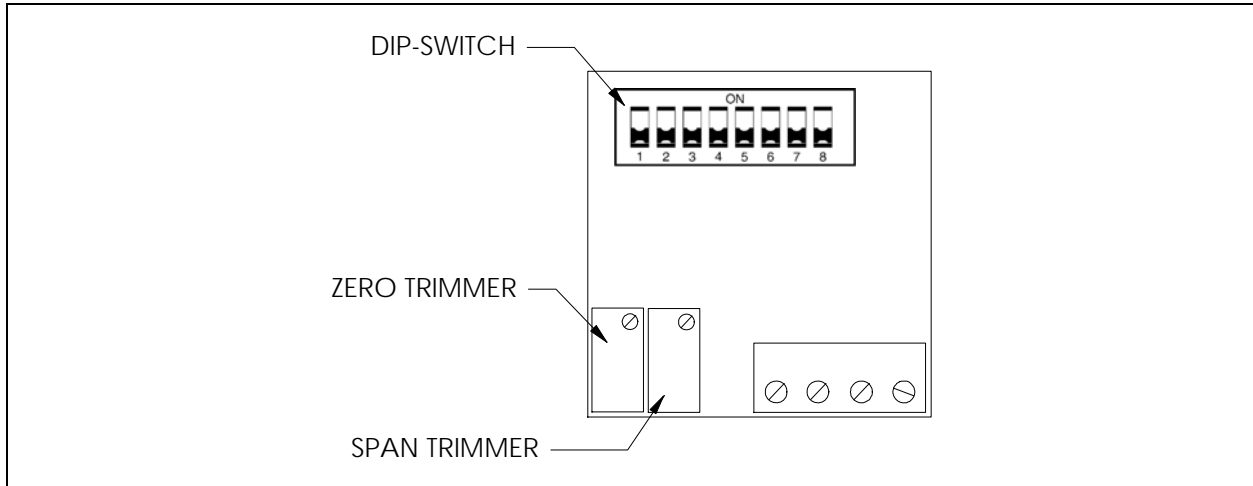


Figure 5-6 Back View of Gas Concentration Display



## 6 PREVENTIVE MAINTENANCE

This section covers all aspects of the Gas Monitor 1A2 series monitor. First, a description of general maintenance is given followed by a verification of operation and sensor replacements.

### 6.1 GENERAL

The monitor unit should be brushed or wiped clean, once a year or more, of any dust or dirt that settles on it, depending on the accumulation.

The unit SHOULD NOT be submerged in water or other liquids. Also, hosing and other conditions that could cause a liquid to enter the enclosure should be avoided.

### 6.2 VERIFICATION OF OPERATION

To verify the operation of the system, make sure that the green power LED indicator is on steady state. Push and hold the test button to verify the audio and WARNING and ALARM relays are operational.

### 6.3 SENSOR REPLACEMENT

The sensor should be replaced when the sensor no longer adequately responds to test gas. Refer to the corresponding calibration section and follow the calibration steps to apply the test gas to the sensor.

#### CAUTION

<b>TURN OFF THE MAIN POWER SUPPLY BEFORE ATTEMPTING THE FOLLOWING PROCEDURE.</b>
--

#### ON-BOARD AND REMOTE SENSOR:

Refer to the corresponding installation section; 4.2.3.1.1 Solid State Sensor for proper removal and installation of the sensor. New sensor elements may require calibration; see one of following calibration sections for details: 5.6.2 Solid State; On-Board and Remote Sensors.

#### TRANSMITTER OR SENSOR MODULE:

For a transmitter or sensor module, follow the sensor replacement procedure described in the appropriate transmitter or sensor module material.

## 7 INSTALLATION TIPS AND TRICKS

### **CABLING**

- Cabling – use 2 conductor cable with 2 wire transmitter and 3 conductor cable with everything else. Generally, 18 gauge conductors are used (not true in all cases). Shielded wires are used to connect all gas sensors.
- Route cabling in conduit to avoid damage to cabling.
- Cable shielding must be grounded at the monitor end only. For Sensor modules ensure grounding continuity by tying grounding shields together see Figure 8-1. The cable shield at the end of a cable where the grounding is not propagated or tied to a landing point must be clipped short and wrapped with electrical tape to avoid electrical contact with any components in the housing.
- Route cabling away from AC power cabling and any source of electro-magnetic interference (EMI) or radio frequency interference (RFI) such as power transformers, electric motors, etc.
- EMT (Electrical Metal Tube) conduit also adds an added degree of electrical shielding against EMI (Electro-Magnetic Interference) from devices such as RF (i.e. radio) sources.
- All cabling must enter the sensors and monitors from the bottom to ensure protection against water damage due to water inside the conduit from condensation or leaks.
- Ensure that there are no short or open circuits in the sensor cabling.
- Verify that there is no AC or DC voltage present on the sensor cabling prior to connecting the cabling to either the sensor or the monitor.

### **EQUIPMENT LOCATION**

- Mount all equipment away from any source of electro-magnetic interference (EMI) or radio frequency interference (RFI) such as power transformers, electric motors, etc.
- Mount sensors in accordance with the installation guidelines for the specific species of gas to be detected; i.e. CO sensors should be mounted at breathing height etc.
- Equipment must be positioned such that the chance of water damage is minimized; i.e. away from fire suppression sprinkler heads, away from wet or damp locations where there would be a risk of water damage.
- Ensure a balanced layout of sensors to cover the intended area.
- Ensure that sensors are not in close proximity to clean air sources.
- Ensure only appropriate equipment is installed in hazardous locations. Proper procedures are to be followed for this equipment.

### **POWER AND GROUNDING**

- All power and grounding connections to equipment must be made in accordance with applicable electrical and building codes.
- A separate, dedicated, noise free, 15 amp power circuit, with an appropriately labeled circuit breaker.

## 8 TROUBLE SHOOTING

- If you have connected 122X Sensor Modules to the monitor and are experiencing a fault you will need to check the inputs and output wiring and either the end of line termination jumpers or dipswitch settings. See Figure 8-1 to Figure 8-4.

### 8.1 1222 WIRING AND TERMINATION

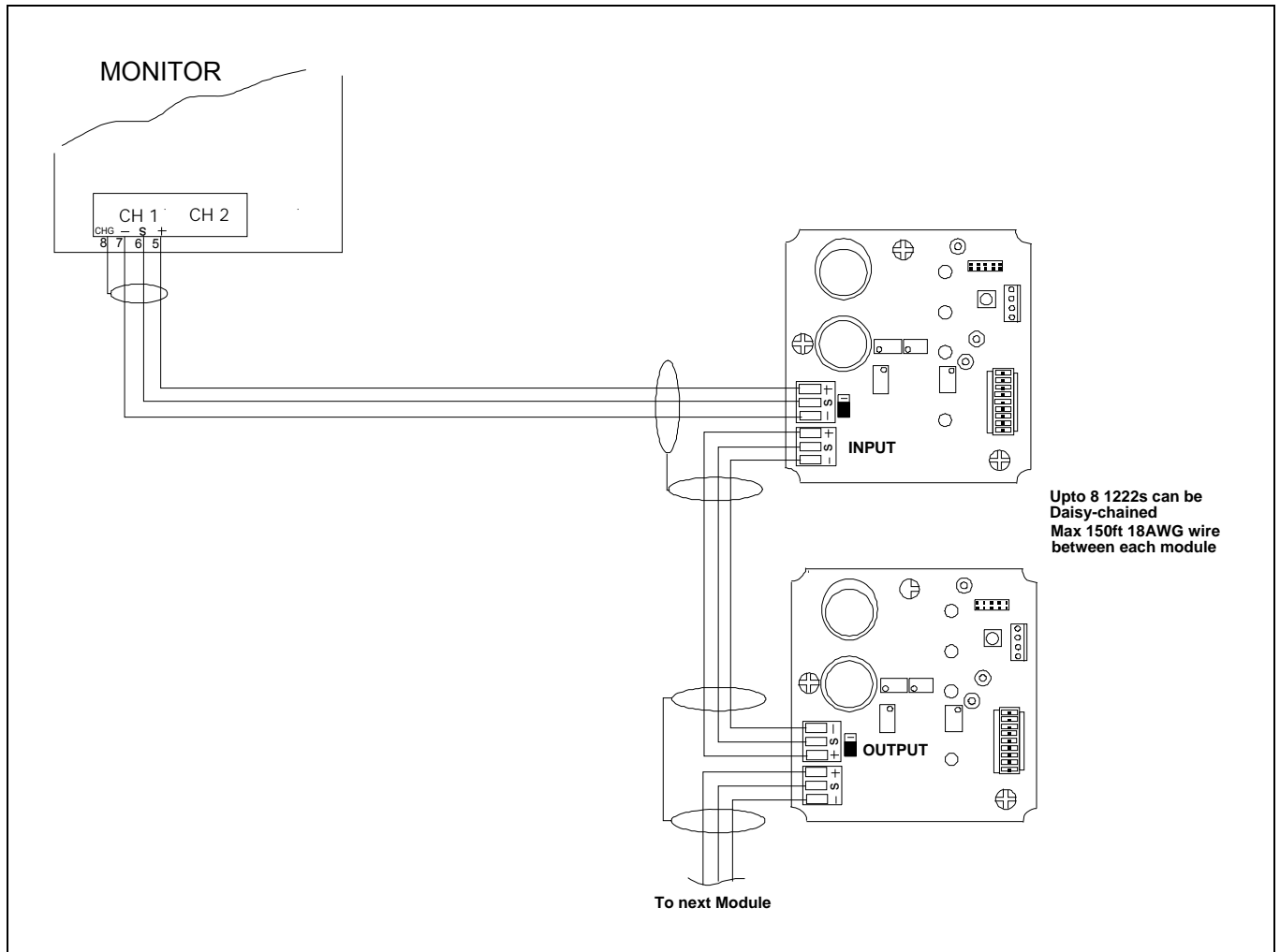
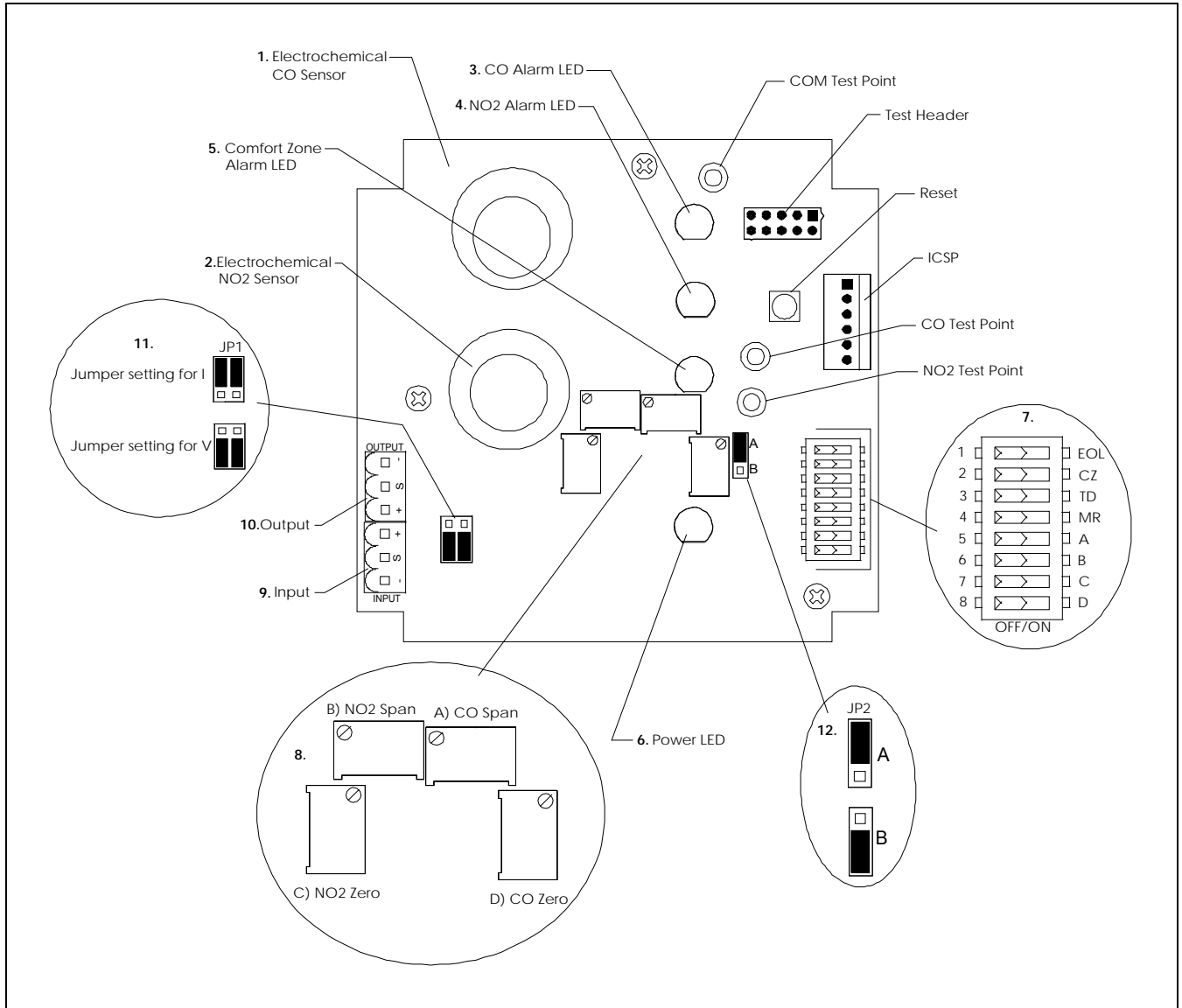


Figure 8-1 1222 Sensor Module Wiring

The input terminal block for the last module in the chain will be empty and the EOL (end of line) DIP switch is switched on. See Figure 8-2.



**Figure 8-2 1222 Sensor Module Termination**



## 8.2 1228s WIRING AND TERMINATION

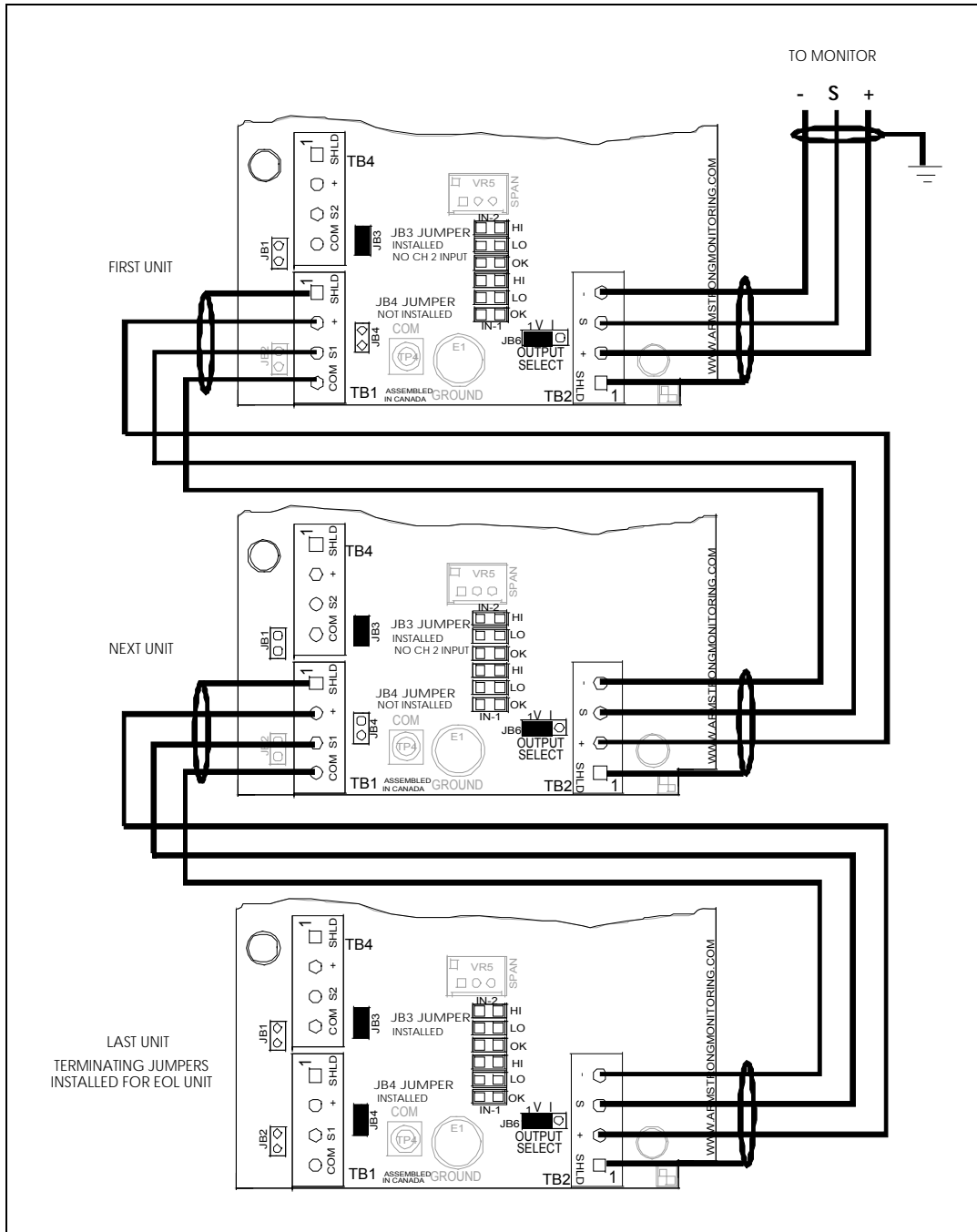


Figure 8-3 1228s Sensor Module Wiring and Termination

JB3 jumper is installed if input TB4 is not used. JB4 jumper is installed if input TB1 is not used.

### 8.3 1225 WIRING AND TERMINATION

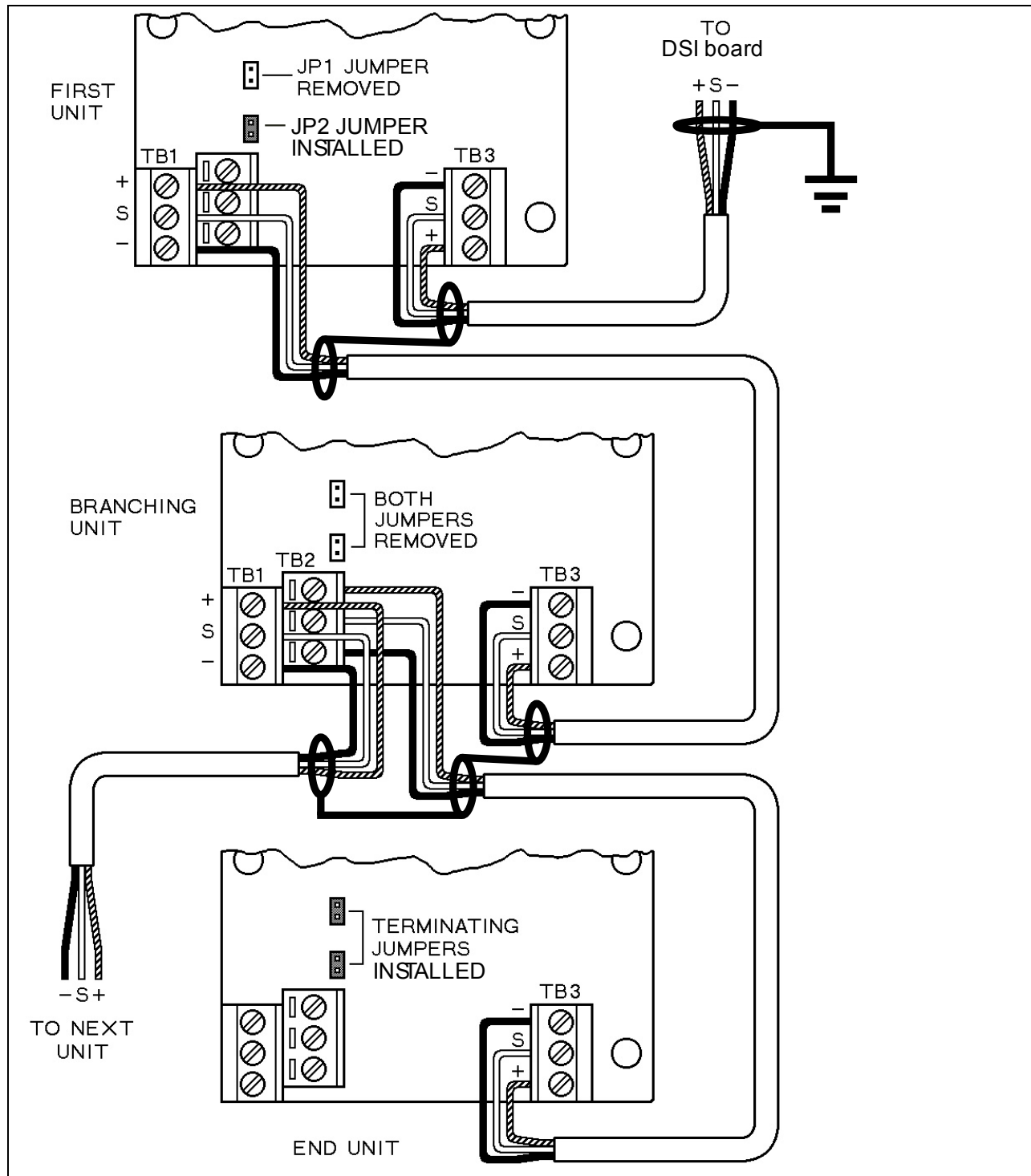


Figure 8-4 1225 Sensor Module Wiring and Termination

JP1 jumper is installed if input TB1 is not used. JP2 jumper is installed if input TB2 is not used.