



Gas Monitor 1A1 with DSI

One Channel Gas Monitor with
Optional Display

Installation and Operation Instructions

IMPORTANT:

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

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1 GENERAL INFORMATION

1.1 WARRANTY

The Gas Monitor 1A1 with DSI one channel monitor is warranted against defects in material and workmanship for a period of two years from date of delivery. 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). Site visits by Armstrong personnel, to evaluate/repair equipment, are not covered by this warranty. AMC is not liable for auxiliary interfaced equipment, nor for 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 failure is due to misuse or conditions of use.

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

1.2 LIABILITY

All AMC products must be installed and maintained according to instructions. Only qualified personnel 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>CHECK TO ASSURE THE WORKING AREA IS FREE FROM HAZARDS DURING INSTALLATION OR WHEN PERFORMING MAINTENANCE, AND USE PROPER PRECAUTIONS.</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 or through email directly at 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

Alarm	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.
Calibration	Calibration is the procedure used to adjust the instrument for proper response.
Calibration Gas	Calibration Gas is a gas of known concentration(s) used to set the instrument span or alarm level(s).
DSI	Dual Sensor Interface card is an integrated circuit board that adds sensor/transmitter/VFD capabilities to the 1A Gas Monitor
Gas Concentration	Gas Concentration is measured: <ul style="list-style-type: none">• PPM• %LEL (lower Explosive Limit)
PPM	Parts Per Million (1% volume = 10,000PPM)
LEL	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).
Percent by volume	Concentration of gas in a mixture expressed as a percentage of total volume.
Span	Full range of a sensor i.e. a CO sensor with a full scale of 0-100 PPM has a 100 PPM span.
T90	Response Time in seconds to achieve 90% gas concentration reading. This a typical calibration point that allows for sensor aging, but tends to be less accurate than a T99 calibration,
T99	Response Time in seconds to achieve 99% gas concentration reading. This is a more accurate calibration point.
VFD	variable-frequency drive is a system for controlling the rotational speed of an alternating current (AC) electric motor by controlling the frequency of the electrical power supplied to the motor.
Zero Buffering	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.



Zero Gas	Zero gas is a gas which is devoid of the target gas.
-----------------	---



TORQUE SPECIFICATIONS:

POWER SUPPLY:

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

RELAY:

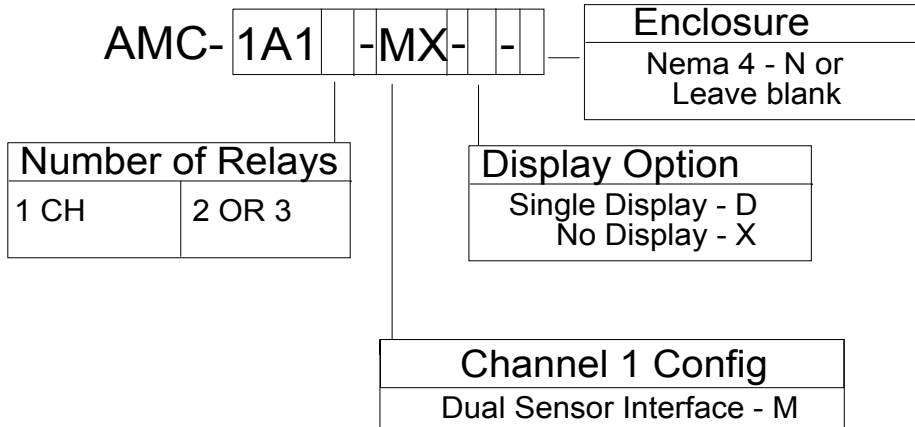
Relay socket terminal screws 7 pound-inches.

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. Other Products this Manual supports are:

AMC-1ACOs Standalone CO Series
 AMC-1AD1v Single Zone Monitor with Variable Output

Products that follow format 1 or 2 but append with -LV or -LVAC will use this manual with an addendum.



3 PRODUCT DESCRIPTION

3.1 GENERAL DESCRIPTION

The Gas Monitor 1A1 with DSI is a one 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 DSI (Dual Sensor Interface) permits three choices for the one channel input including:

- A 4-20mA transmitter input
- An on-board electrochemical sensor
- A sensor module input for either Voltage Mode or Current Mode Sensor Modules. (Multidrop)

An on board electrochemical sensor is employed where local monitoring at the monitor is sufficient. A 4-20mA transmitter is used to monitor gas in a remote location. Eight sensor modules can be daisy chained for the one channel input allowing larger area or zone 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.
Warning concentrations are indicated in Section 2
3. ALARM INDICATOR: Alarm levels of gas are indicated by a red LED. 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/transmitters at low voltages. Optional secondary transformer, used in specific VFD options, may be installed. Transformer(s) located underneath the PCB.
6. INTERNAL WIRING HEADER: Provides wiring connection points as follows:
1,2,3,4 - Relay coils
5,6,7,8 - Reserved
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 cadence for each one
8. RELAY SETUP JUMPERS: Used to independently configure the Warning and Alarm 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. TRIP POINT ADJUSTMENT: Sets the Signal adjust, Alarm and Warning
11. 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
12. RELAYS: 2 alarm and 1 optional Fault DPDT relays are provided
13. DSI (Dual Sensor Interface): Dual sensor interface: allows an on board sensor or a remote transmitter signal in and a 4-20mA signal out
14. ON-BOARD SENSOR(S): Optional sensor allows local detection of gas
15. SIGNAL INPUT/OUTPUT TERMINAL BLOCK:
- Allows connection to transmitter input and output
- | | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 |
- 1 - Signal Ground, “-“
2 - 4-20mA Current Output
3 - Power, V+, “+”
4 - 4-20mA Current Input
5 - Chassis Ground
6 - Signal Ground, “-“
16. OPTIONAL GAS CONCENTRATION DISPLAY: A visual indication of the gas concentration for channel 1



Gas Monitor 1A1 with DSI One Channel Monitor

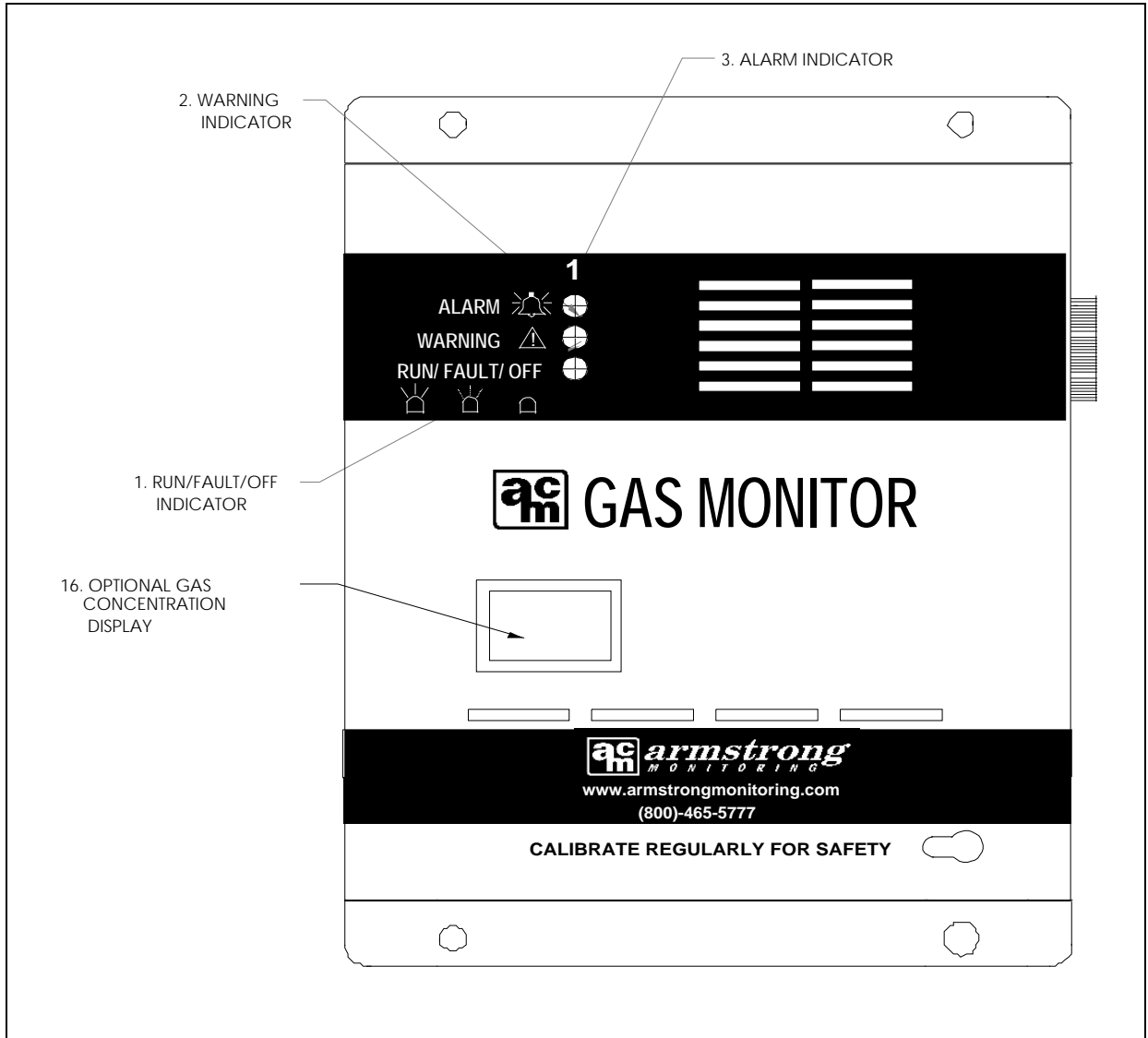


Figure 3-1: Gas Monitor 1A1 with DSI, Front Cover

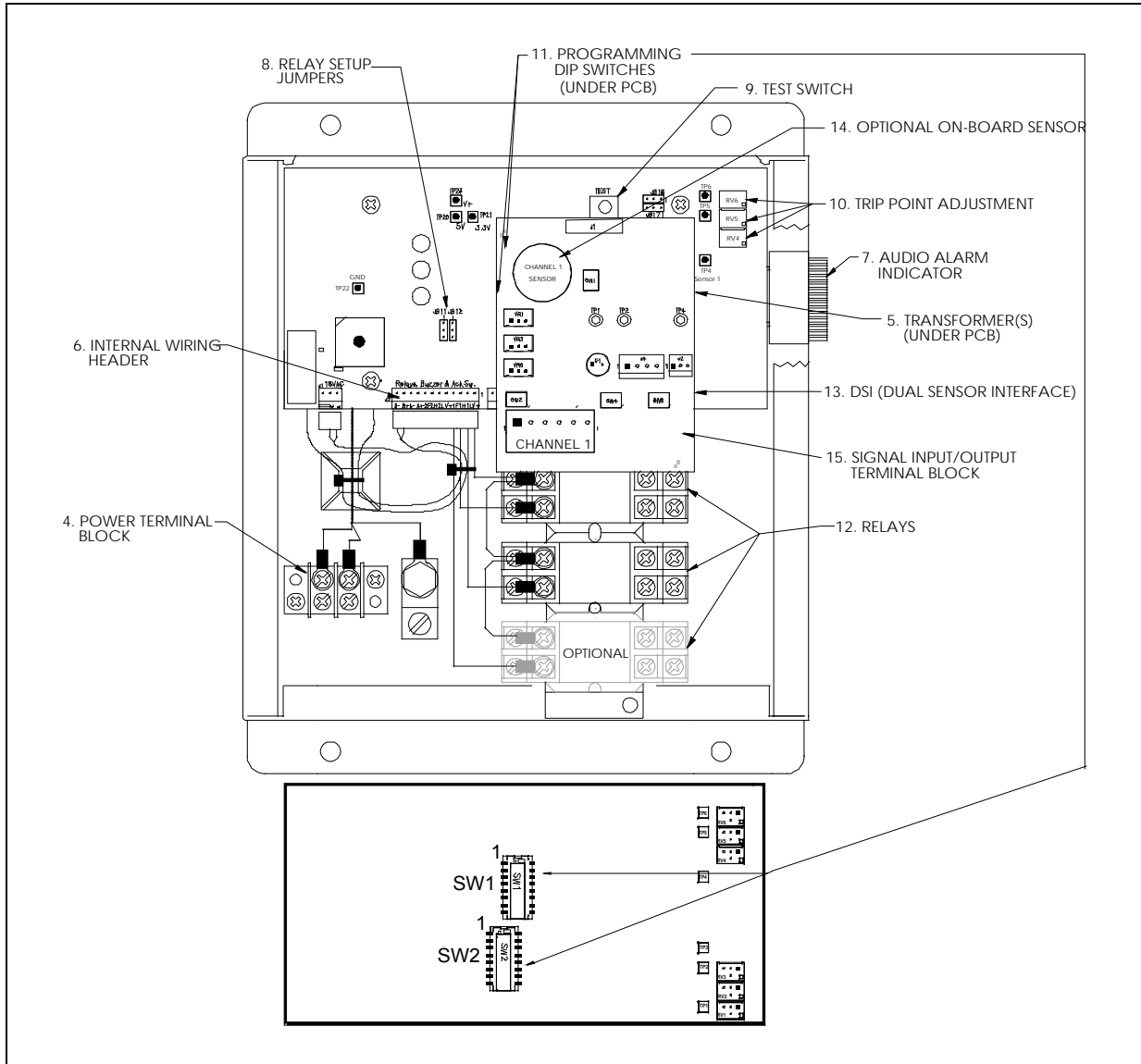


Figure 3-2: Internal Features of the Gas Monitor 1A1 with DSI.

4 INSTALLATION

Follow the guidelines in this section for proper locations and installation of the Gas Monitor 1A1 with DSI. 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 1A1 with DSI.

4.1 MOUNTING INSTRUCTIONS

4.1.1 MONITOR MOUNTING

Securely fasten the Gas Monitor 1A1 with DSI 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.

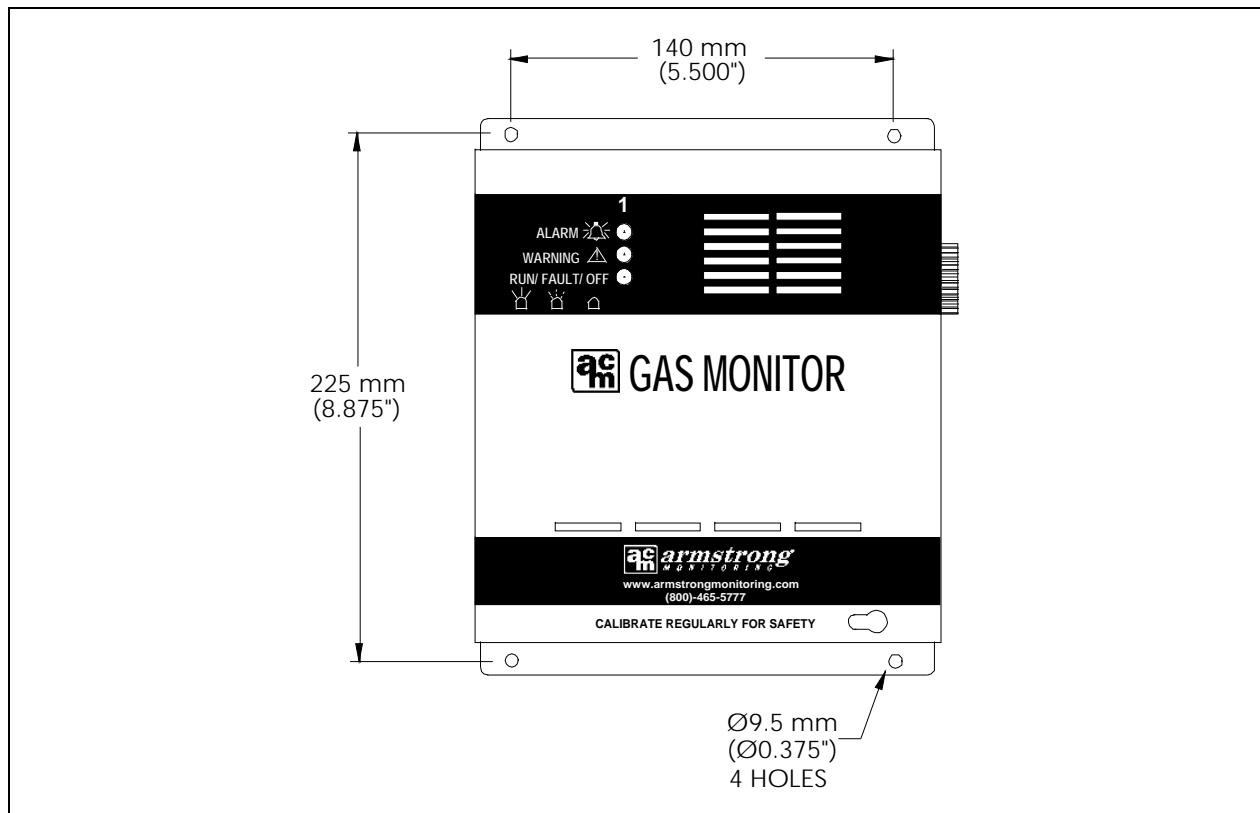


Figure 4-1: Locations of Mounting Holes.



4.1.2 REMOTE TRANSMITTER or SENSOR MODULE MOUNTING

Mount the remote transmitter or sensor module 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 manual(s) or sensor module manual(s) for additional instructions for proper mounting.

Table 4-1 Remote Transmitter or Sensor Module Mounting Locations

Gas	Application	Location
CO, NO ₂	Vehicle exhaust monitoring	1.2 – 1.5 m (4-5 ft.) from floor
O ₂ , NH ₃	Ambient TLV 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: **CAUTION:** Ensure to take all proper precautions when handling high voltage power sources.

The monitor operates on 120 VAC, 60 Hz. A step down transformer powers the internal circuitry and remote sensor/transmitters 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 optional third relay is a Fault relay. The contacts are rated for 10Amps@240VAC resistive. For relay contact arrangement, see Figure 4-3.

The Gas Monitor 1A1 with DSI is shipped with relays factory configured per customer order, typically as 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 Fault relay is in the normally energized (failsafe) mode, and is not programmable by the end user.

All settings are factory configured, as per original customer order, for use with the installed sensor. 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).

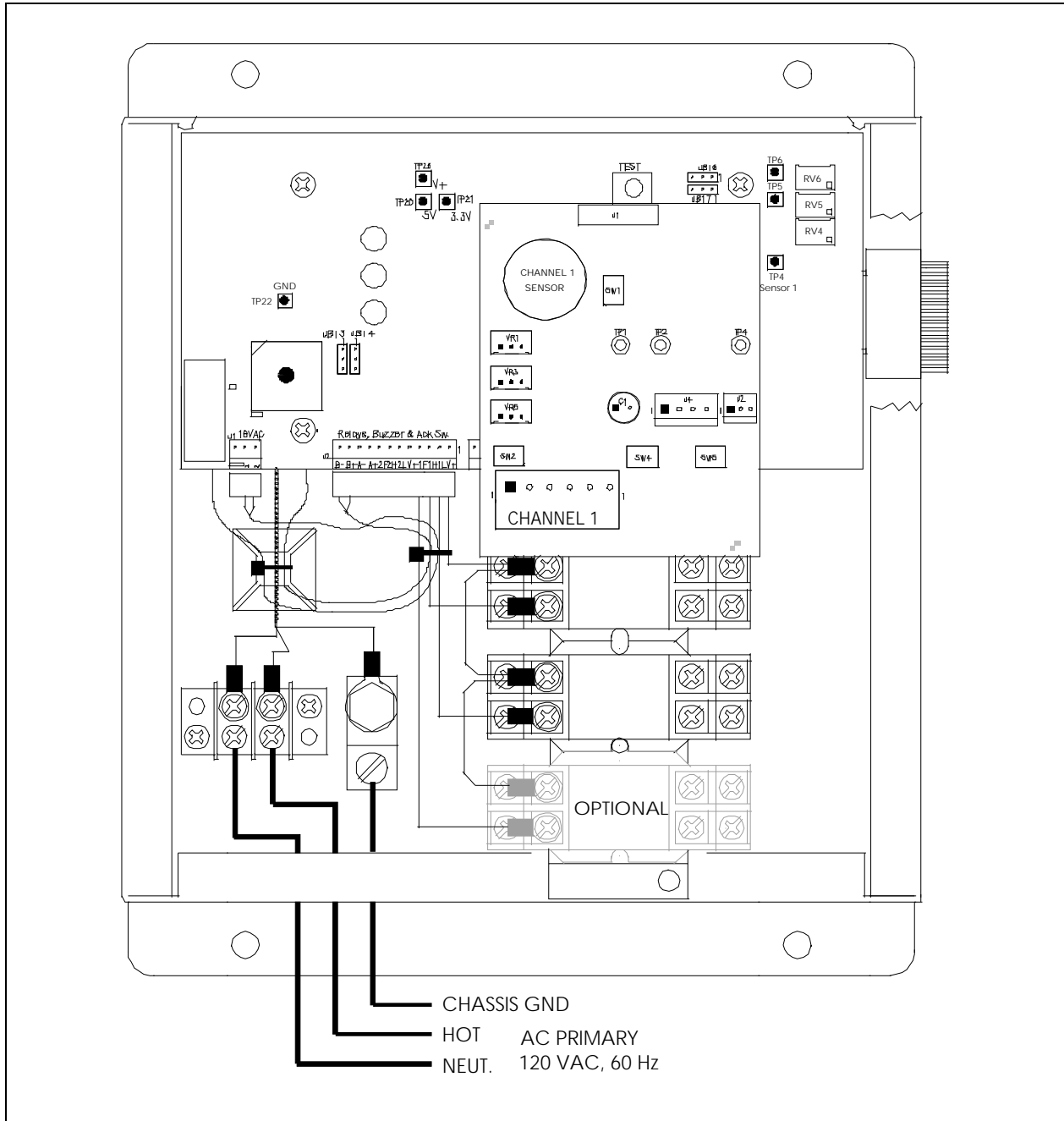


Figure 4-2: Location of Power Supply Connections.

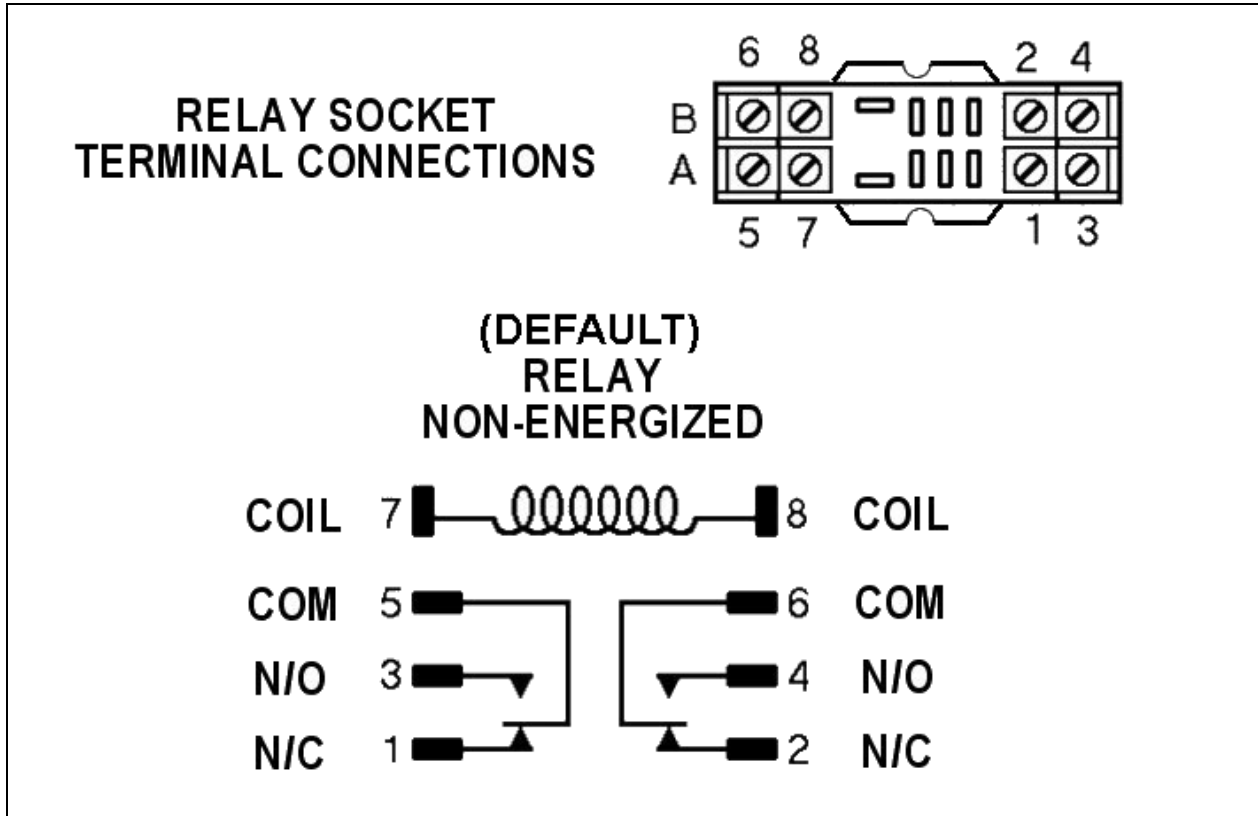


Figure 4-3: Relay Contact Arrangement for 2 or 3 Relays.

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

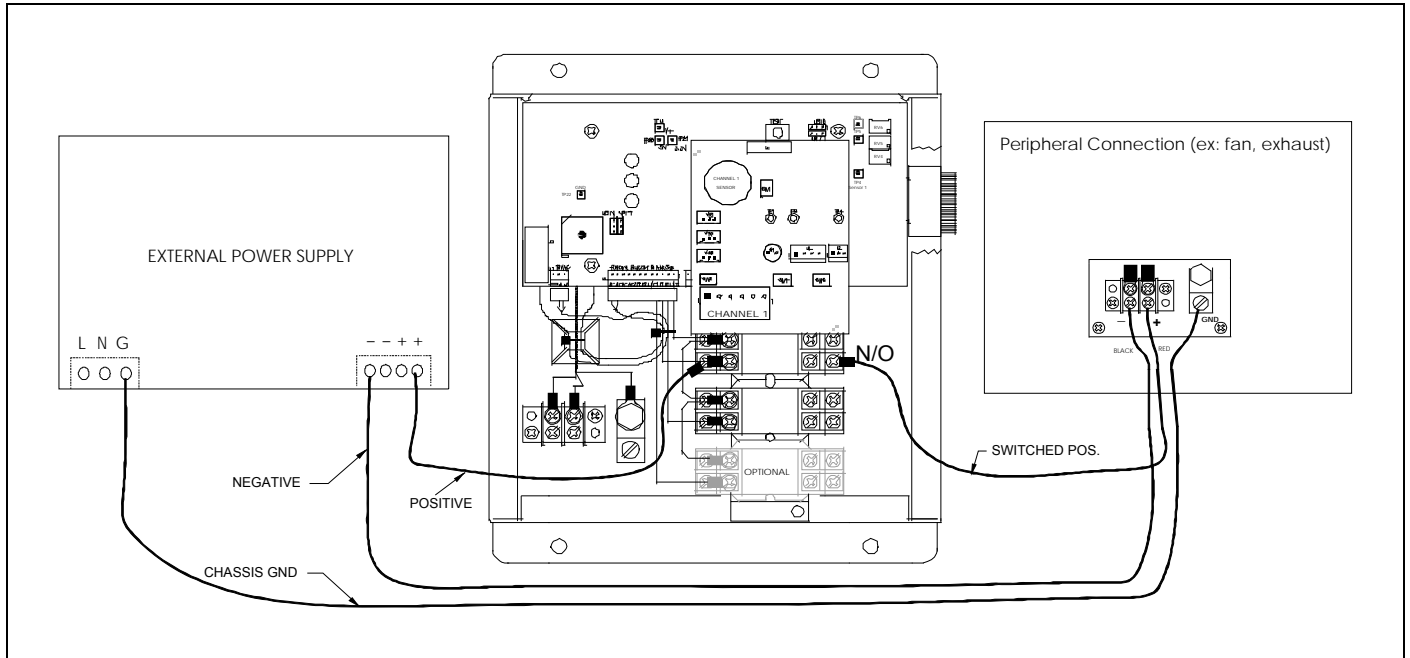


Figure 4-4 Connection when Relays programmed as De-Energized in Non Alarm State

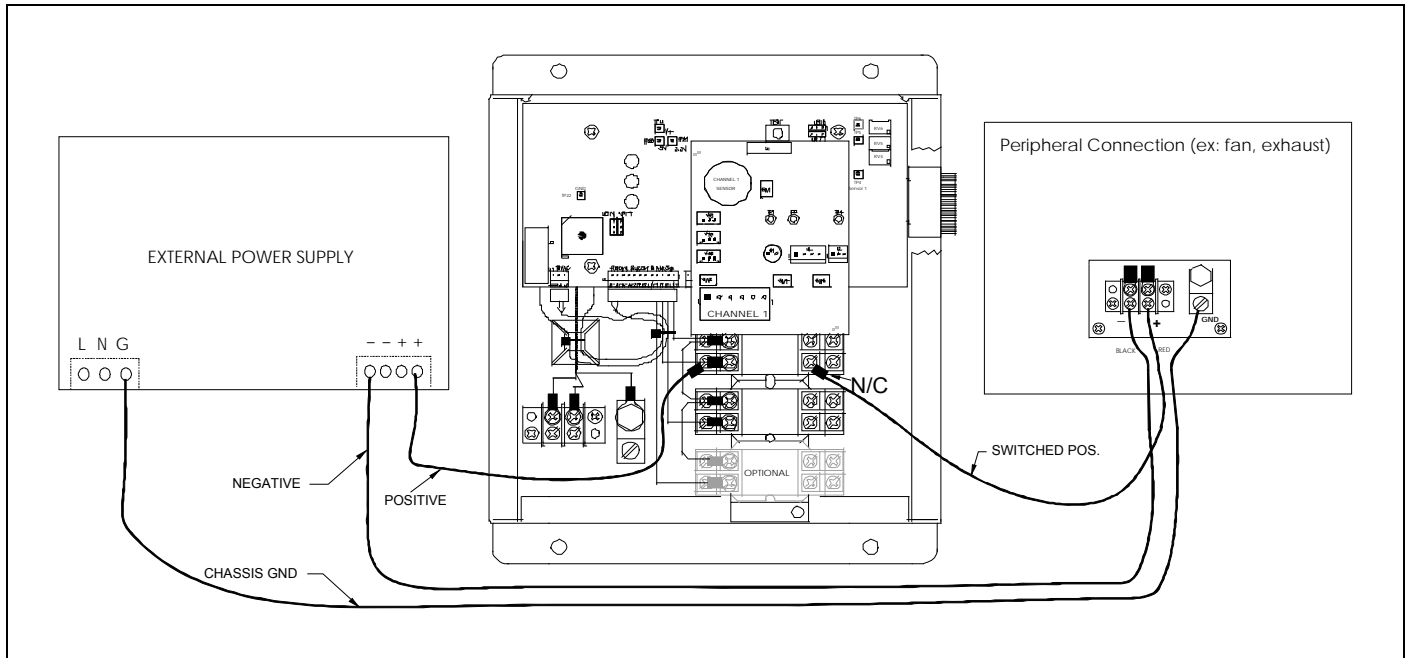


Figure 4-5 Connection when Relays Programmed as Energized in Non Alarm State

4.2.2 CABLE SELECTION

Connections from the monitor to sensor modules should be made using shielded, 3-conductor cable. Connections from monitor to transmitter should be made using shielded, 2 or 3-conductor cable (depending on type of transmitter used). For best signal transmission and maximum noise rejection, run cable through steel conduit (cable shield must be grounded at the monitor). For basic selection of cable size and length (between monitor and transmitter), refer to the cable selection chart in the appropriate transmitter manual(s).

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 DSI WIRING

On the DSI board, the signal input/output terminal block (see Figure 3-2, item 15) allows for wiring. Figure 4-6 shows a detailed depiction of a signal input/output terminal block. A 4-20mA signal output is always present with either an on-board sensor or remote transmitter. If an on-board sensor is not employed, the DSI can be configured to accept the input for a remote transmitter, typically a 4-20mA current signal. Refer to Figure 5-2 for DSI layout. Table 5-7 defines the current output the DSI will supply on the 4-20mA signal when connected to a Sensor Module which utilizes a voltage signal out (AMC Multidrop Sensor Module). The following subsections detail transmitter, building automation, and VFD wiring.

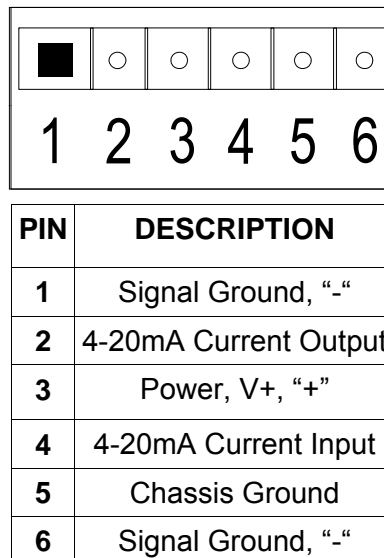


Figure 4-6: Signal Input/Output Terminal Block.



See specific transmitter 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.

4.2.3.1 On-Board Sensor Connection

The on-board sensor has a socket connection to the DSI board for easy sensor replacement in the field. For removal, unplug the sensor from the DSI when the main power supply is turned off. For installation, hold the sensor in such a way that the sensing area is not covered. Align the sensor pins with pin sockets on the DSI and lightly push the sensor on to the DSI. Sensors need to be calibrated at regular intervals, see 5.2.4 AMC-DSI CALIBRATION for procedure. Sensor replacement is needed when the sensor life has expired; see 6.3 SENSOR REPLACEMENT for details.

CAUTION

TURN OFF THE MAIN POWER SUPPLY BEFORE REMOVING OR INSTALLING THE SENSOR.

4.2.3.2 2-wire Transmitter Wiring

The 2 wire transmitter is wired to the Gas Monitor through the signal input/output terminal block on the DSI board. The wiring is conveyed in Table 4-2.

Table 4-2: 2-Wire Transmitter Wiring

Gas Monitor (DSI)		4-20 Transmitter, 2 wire
Negative	-	→ Not applicable
4-20mA signal output	4-20mA out	→ Not applicable
Positive	+	→ Positive +
4-20mA signal input	4-20mA in	→ Negative -
Chassis ground CGND	Connect to shield of cable	→
Signal ground	-	→ Not applicable

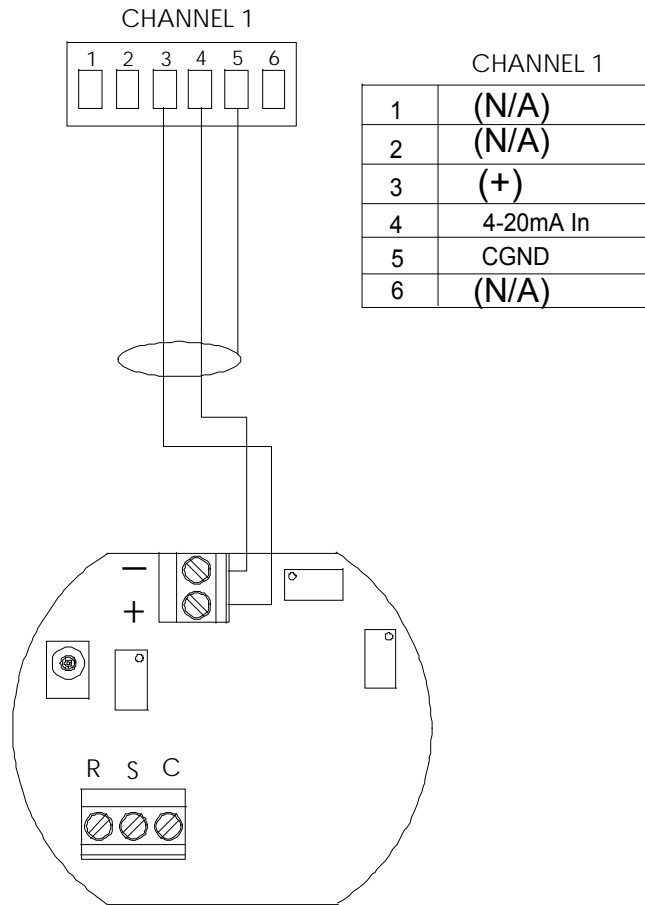


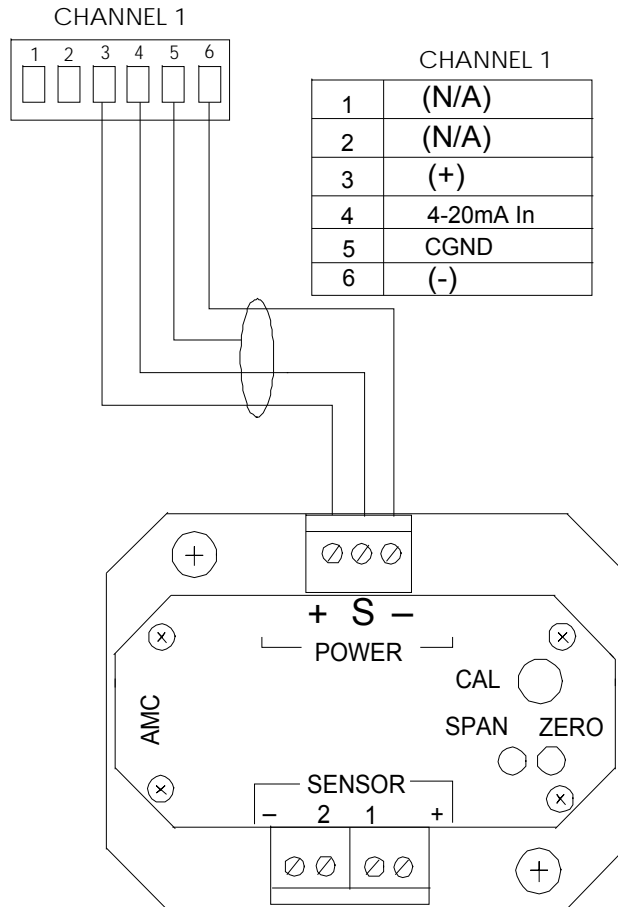
Figure 4-7: 2-wire Transmitter Wiring.

4.2.3.3 3-wire Transmitter Wiring

The 3 wire transmitter is wired to the Gas Monitor through the signal input/output terminal block on the DSI board. This wiring is still true if the 3-wire transmitter is a multidrop (AMC-122X). The wiring is conveyed in Table 4-3.

Table 4-3: 3-Wire Transmitter Wiring

	Gas Monitor (DSI)		4-20 Transmitter, 3 wire
Negative	-	→	Not applicable
4-20mA signal output	4-20mA out	→	Not applicable
Positive	+	→	Positive +
4-20mA signal input	4-20mA in	→	Signal S
Chassis ground CGND	Connect to shield of cable	→	
Signal ground	-	→	Negative -



EXAMPLE OF CHANNEL 1 CONNECTION

Figure 4-8: 3-wire Transmitter Wiring.

4.2.3.4 Sensor Module (Multidrop) Wiring

The Sensor module is wired to the Gas Monitor through the signal input terminal block. The wiring is conveyed in Table 4-4.

Table 4-4: Sensor Module Wiring

Gas Monitor (DSI)		Sensor Module	
Negative	-	→	Not applicable
4-20mA signal output	4-20mA out	→	Not applicable
Positive	+	→	Positive +
4-20mA signal input	4-20mA in	→	Remote Transmitter Signal Input S
Chassis ground CGND	Connect to shield of cable	→	
Signal ground	-	→	Negative -

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

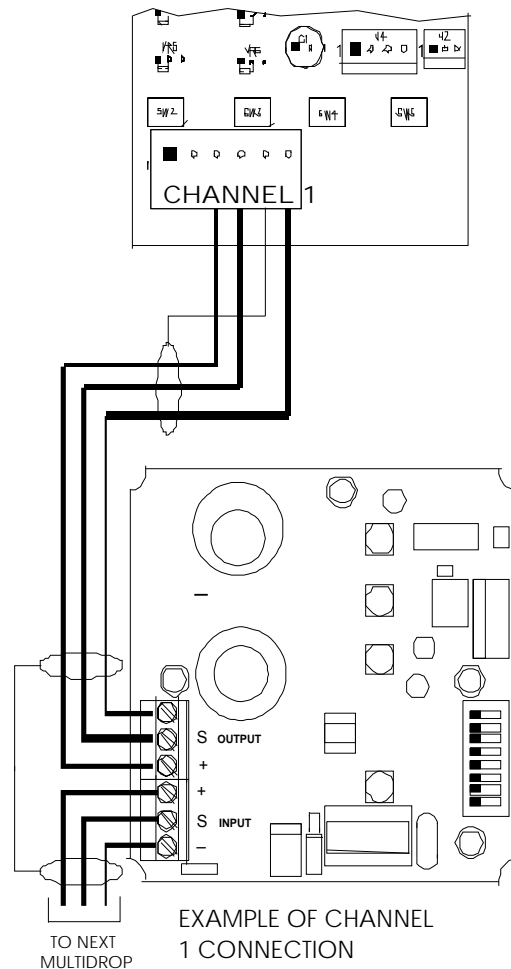


Figure 4-9: Multidrop Sensor Module Wiring

4.2.3.5 Building Automation Wiring

The building automation system is wired to the Gas Monitor through the signal input/output terminal block on the DSI board. The wiring is conveyed in the following table.

Table 4-5: Building Automation Wiring

Gas Monitor (DSI)			Building Automation System	
Negative	-	→	Negative	-
4-20mA signal output	4-20mA out	→	4-20mA signal input	4-20mA in
Positive	+	→	Not applicable	
4-20mA signal input	4-20mA in	→	Not applicable	
Chassis ground	CGND	→	Connect to shield of cable	CGND
Signal ground	-	→	Not applicable	

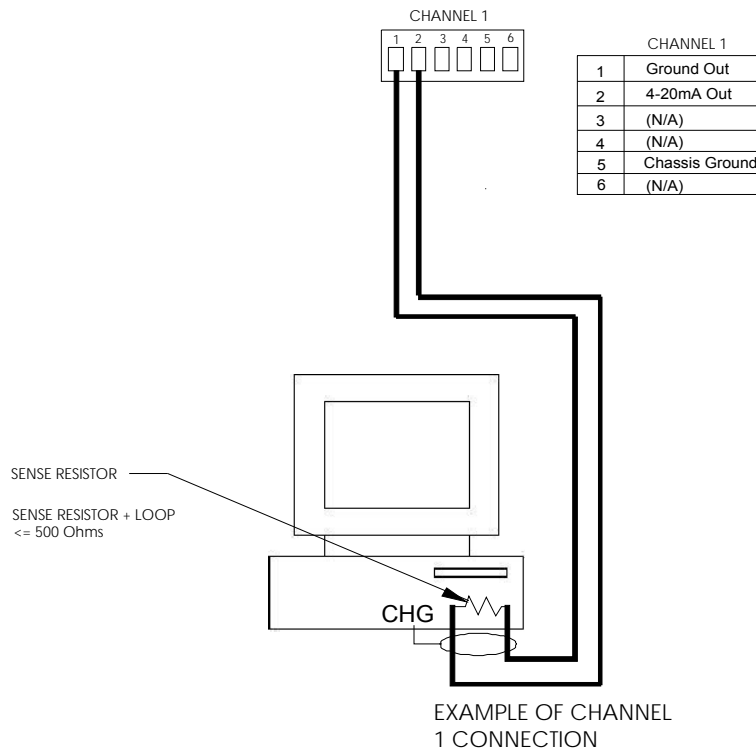


Figure 4-10: Building Automation Wiring.

NOTE

MAXIMUM LOAD RESISTANCE IS 500 OHMS

4.2.3.6 VFD Wiring

When a DSI board is equipped with the VFD option, connectors J4 and J2 are installed. Refer to Section 5.1.5 for the layout of a DSI board with VFD option. The VFD signal and external power is wired through J4; while the optional additional transformer is factory installed through J2. Figure 4-11 shows a detail description of the VFD connector (J4). When the additional transformer is not employed there will not be a 24VAC voltage on pin 1 of J4.

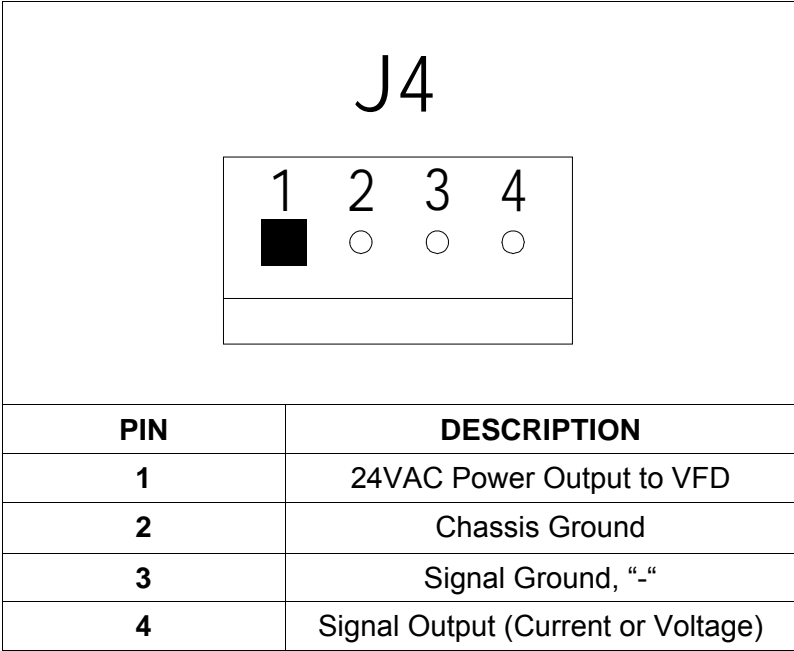


Figure 4-11: VFD Connector (J4)



Gas Monitor 1A1 with DSI One Channel Monitor

Switch	Feature	Position	Description
SW1-6	Number of Sensors	OFF	Channel 1 and 2 are enabled.
		ON	Only channel 1 enabled.
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"> ▪ Signals exceeding thresholds on channel 1 activate group 1 relays ▪ Signals exceeding thresholds on channel 2 activate group 2 relays ▪ Fault relay is activated as a result of fault detection on either channel ▪ Alarm relay may be activated as a result of fault detection on either channel (see SW2-1)
		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"> ▪ Signals exceeding thresholds on either channel will result in relays being activated
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"> ▪ 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 ▪ 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.
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	OFF	Sensor Fault thresholds set at 0.4mA into 250R or 100 mV.



Switch	Feature	Position	Description
		ON	Sensor Fault thresholds set at 1.4mA into 250R or 350mV.
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
Warning	JB11	1-2	2-3
Alarm	JB12	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

TABLE: Audio alarm operation <i>Sensor Status</i>	<i>Output</i>
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 GAS MONITOR INTERFACE CONFIGURATION

The input interface is factory pre-configured for proper operation of the DSI board. Figure 5-1 is included as a guide for troubleshooting purposes as the jumpers must be strapped as indicated in Table 5-4. Note V+ equals 19 - 24 volts DC depending on the load.

Table 5-4: Signal Input Configuration Jumper Selection

SIGNAL INPUT CONFIGURATION	SENSOR 1	
	JB 8 TERMINATION	JB10 POWER SUPPLY
DSI	4-20mA	V+

Note:

The signal input configuration jumpers are under the DSI board. Turn off the main power supply of the monitor before removing the DSI board to configure the jumpers.

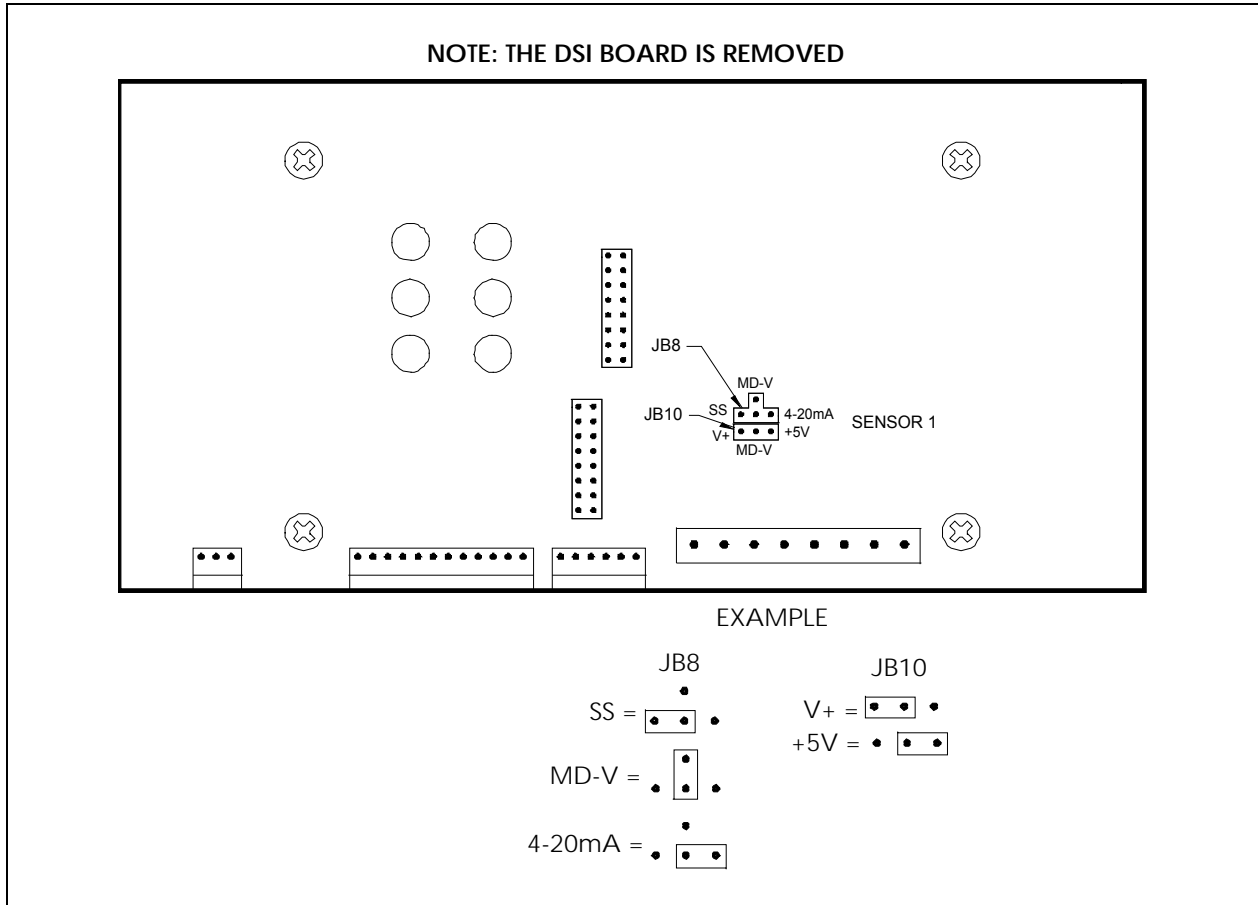


Figure 5-1: Gas Monitor Signal Input Configuration Jumpers

5.1.5 DSI INTERFACE CONFIGURATION

With the signal input configuration as shown in Table 5-4, the Gas Monitor board is correctly configured for the DSI board. The AMC-DSI is factory pre-configured as per order; the required interface is configured by dip switch settings found in Table 5-5, **bold** positions indicate defaults. Figure 5-2 illustrates the layout of the DSI board, while Table 5-6 gives detailed descriptions of the dip switch settings found in Table 5-5.

Note : The settings for SW4 and SW5 are critical in the setup for either a current input 4-20mA transmitter or 4-20mA current mode Sensor Module (AMC Multidrop) or a voltage input from a voltage mode Sensor Module (AMC Multidrop).

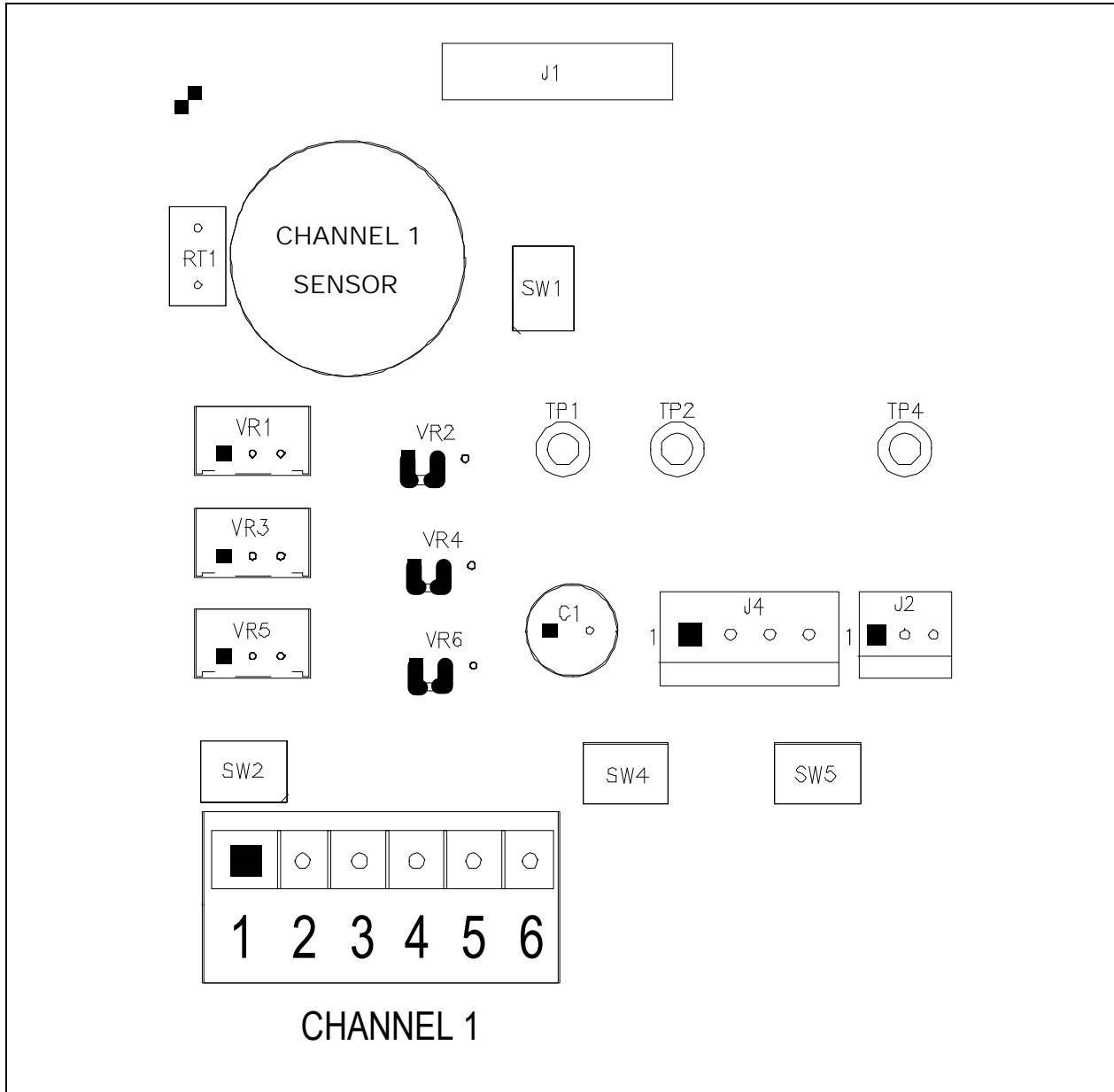


Figure 5-2: A 1CH DSI board with VFD Option and One Onboard Sensor

Table 5-5: Dip Switch Setting for DSI Board

Switch	Title	Position
SW1-1 Upper	Channel 2 Service Mode	Left – CH 2 Service Right – CH 2 Normal
SW1-2 Lower	Channel 1 Service Mode	Left – CH 1 Service Right – CH 1 Normal
SW2-1 Left	VFD Selector for Voltage or Current	Up – Current Down – Voltage



Switch	Title	Position
SW2-1 Right	VFD Selector for 0 or Offset (2V/4mA)	Up – 2V/4mA offset Down – No offset
SW4-1 Left	CH 1 Selector External or On Board Electro-chemical Sensor	Up – On Board Sensor Down – External
SW4-2 Right	CH 1 Selector External Input Resistor 10K or 100R	Up – 100R Input Resistor Down – 10K Input Resistor
SW5-1 Left	CH 2 Input Selector for Voltage or current	Up – CH 2 Input Voltage Down – CH 2 Input Current
SW5-2 Right	CH 1 Input Selector for Voltage or current	Up – CH1 Input Current Down – CH 1 Input Voltage

Table 5-6: Detailed Descriptions of Dip Switch Settings

Service Mode	Default setting is normal, this mode must be selected for regular operation. Service mode is used by trained technicians to simulate a full scale gas reading on the available channel. Proper precautions must be taken for resulting alarms.
External or On Board Electro-chemical Sensor	Sets the operation of an external transmitter or on board sensor. The on board or external operation is factory set per order. Please consult Armstrong Monitoring for available configurations.
External Input Resistor Selector: 10K or 100R	Selects the input resistance required. This setting is dependant if the input is voltage or current driven When a external 4-20mA transmitter or a sensor module configured for current mode is employed the setting must be set for a 100R input resistance. If a sensor module is configured for a voltage mode (voltage output) the 10K input resistance setting is required.
Input Selector for Voltage or current	Configures the input required to interpret the signal from the external transmitter employed. For an on board sensor or a 4-20mA transmitter, or sensor module in current mode select current input for the appropriate channel. If an AMC Sensor Module (Multidrop) set in Voltage Mode is used, select voltage input for the appropriate channel. Table 5-7 indicates the cross reference for current out when a voltage driven device is used.
VFD Voltage or Current Selector	Selects the output mode for the VFD signal. Voltage (0-10VDC) or current (4-20mA). Refer to VFD Offset Selector for setting the minimum VFD signal output.
VFD Offset Selector for 0 or (2V/4mA)	Sets an offset, if desired, for a zero reading from the sensor/transmitter input. In voltage mode the VFD offset is 2V, for current mode the offset is 4mA. Having an offset is ideal as the offset will help indicated sensor/transmitter connectivity, i.e. with no connectivity the VFD output signal will drop to read 0V or 0mA. This unique feature is lost with no offset as the 0 (V or mA) indicates everything is fine.

Table 5-7: Remote Transmitter Voltage In/Current Out Cross Reference

Transmitter Output Voltage (V) (Same as AMC122X Signaling Levels)	State	Output Current (mA)
0	FAULT	0
1	NORMAL	4
2	WARNING	8
3	ALARM	12

5.1.5.1 VFD Configuration

The DSI board is also capable of providing a variable-frequency drive (VFD) option. Figure 5-3 shows the layout of a DSI board with VFD option configured for remote transmitter input.

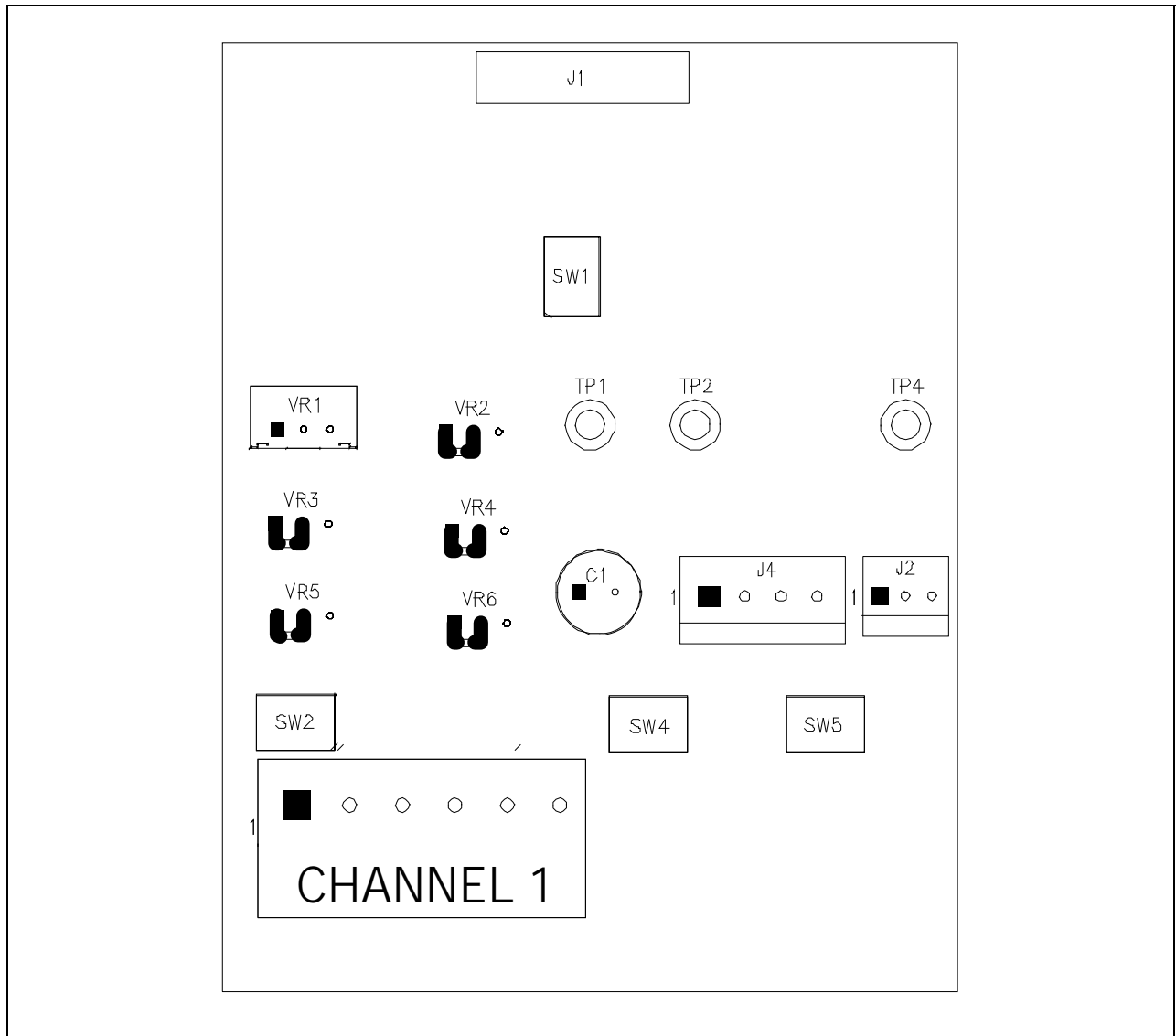


Figure 5-3: A 1CH DSI Board with VFD Option Configured for External Inputs



5.1.6 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 shows 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.

5.1.7 TEST SWITCH FUNCTION

While pressed, the on-board test switch will cause continuous activation of the available 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.

This test switch differs from the service mode setting on the DSI, service mode will output a full scale gas reading on the signal output of the available channels.

5.1.8 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.

5.1.9 ALARM/WARNING RELAY ACTIVATION DELAYS

The Gas Monitor 1A1 with DSI has a user configurable option of 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.

5.1.10 RELAY OUTPUTS

A WARNING condition on the sensor will result in activation of the WARNING relay output. An ALARM condition on the sensor will result in activation of both the WARNING and ALARM relay outputs.

Each alarm relay (WARNING, ALARM) may be selected as either energized when alarm active, or de-energized when alarm active, using on-board jumpers JB11 and JB12, 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

Gas sensors need to be calibrated and periodically checked to ensure sensor accuracy and system integrity.

Calibration of transmitters or sensor modules is performed at their respective sensor electronics, only trip point settings are made at the monitor. See the transmitter or sensor module manual for calibration instructions.

The Gas Monitor 1A1 with DSI series system comes factory calibrated and does not need to be adjusted as part of installation. Testing of all peripherals and/or relays should be checked twice a year The AMC-DSI is part of the EZ Cal Sensor Replacement Program, for further information please contact the factory. Direct service enquiries to The Armstrong Monitoring Corp at (800)465-5777 or 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.

5.2.1 GAS MONITOR TRIP THRESHOLD ADJUSTMENT

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

It does not matter what type of input the DSI receives it always supplies a linear 4 to 20 mA signal to the monitor. This translates to a 0.4 to 2.0 volt DC signal at TP4 (Sensor 1) see Figure 5-1: Gas Monitor Signal Input Configuration Jumpers. The alarms are set to correspond to some fraction of the transmitters full scale calibration, see section 2 PRODUCT INFORMATION.

Table 5-8 and Figure 5-4 below are provided to identify key components used in trip threshold adjustment.

- RV5 is used to set a threshold at which the WARNING is triggered. TP5 is used to monitor these WARNING levels.
- RV6 is used to set a threshold at which the ALARM is triggered. TP6 is used to monitor these ALARM levels.

Table 5-8: Test Points and Trimpots Allocation

	Reference Points	Sensor/Channel 1
Test Points	Signal	TP4
	WARNING	TP5
	ALARM	TP6
	Ground	TP22 (or TP4 on DSI card)
Trimpots	WARNING	RV5
	ALARM	RV6

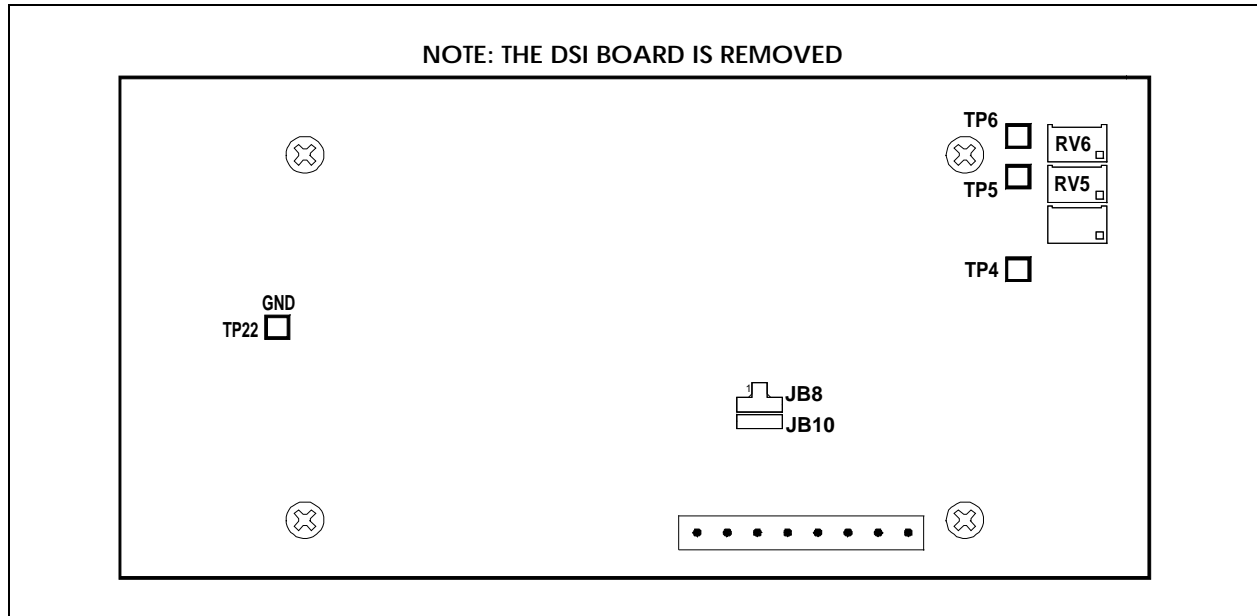


Figure 5-4: Gas Monitor 1A1 Test Points and Trimpots

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 for 4-20mA transmitters

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_{alarm} – The voltage measured at the alarm test point while adjusting the alarm trimpot.
- C_{alarm} - The target gas concentration for the alarm
- $C_{\text{full scale}}$ - The gas concentration corresponding to full scale (20mA)
- I_{Range} – Calibrated at transmitter, typically 16mA for full range.
 - $I_{\text{Range}} + I_{\text{base}}$ typically add to 20mA.
- I_{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_{alarm} : 100 PPM
- $C_{\text{full scale}}$: 100 PPM
- I_{Range} : 20mA – 4mA = 16mA
- $V_{\text{alarm}} = (((100 \text{ PPM} / 100 \text{ PPM}) * 16\text{mA}) + 4\text{mA}) * 250 * 0.4$
= 2.0V
- 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_{alarm} : 25 PPM
- $C_{\text{full scale}}$: 100 PPM
- I_{Range} : 20mA – 4mA = 16mA
- $V_{\text{alarm}} = (((\mathbf{25 \text{ PPM}} / 100 \text{ PPM}) * 16\text{mA}) + 4\text{mA}) * 250 * 0.4$
= 0.8V
- RV5 would be adjusted so that 0.8V is measured at TP5.

5.2.1.3 Trip Threshold Adjustment for Sensor Modules

The warning output from a DSI connected to a sensor modules is 8mA and the alarm output is 12mA. The factory thresholds are set to .706V (Warning) at TP5 and 1.073V (Alarm) at TP6 to ensure the Monitor will detect these conditions. Trip threshold adjustment is to verify these correct voltages are set up and adjust if required.

5.2.2 2-WIRE AND 3-WIRE TRANSMITTERS CALIBRATION

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

5.2.3 SENSOR MODULE CALIBRATION

The calibration procedure of the sensor module is specified in the corresponding sensor module manual.

5.2.4 AMC-DSI CALIBRATION

Every AMC-DSI sensor/transmitter is factory calibrated, so each unit should be ready for operation after installation and a 30 minute stabilization time.

Periodic calibration is required as a part of regular maintenance. Calibration is recommended two times per year. When the sensor life has expired, sensor replacement is needed, see section 6.3 SENSOR REPLACEMENT.

Caution:

- Only qualified personnel should perform the actual calibration.
- Users new to gas calibration are advised to consult with Armstrong Monitoring

The Armstrong Monitoring Corporation offers the following plans:

1. On site installation and calibration by Armstrong Monitoring
2. On site calibration by Armstrong Monitoring
3. Training by Armstrong Monitoring
4. Extended warranty calibration program
5. EZ Cal Sensor Replacement Program

Figure 5-5 illustrates the test points used to calibrate the on board sensors and VFD. Table 5-9 details the function of the test points.

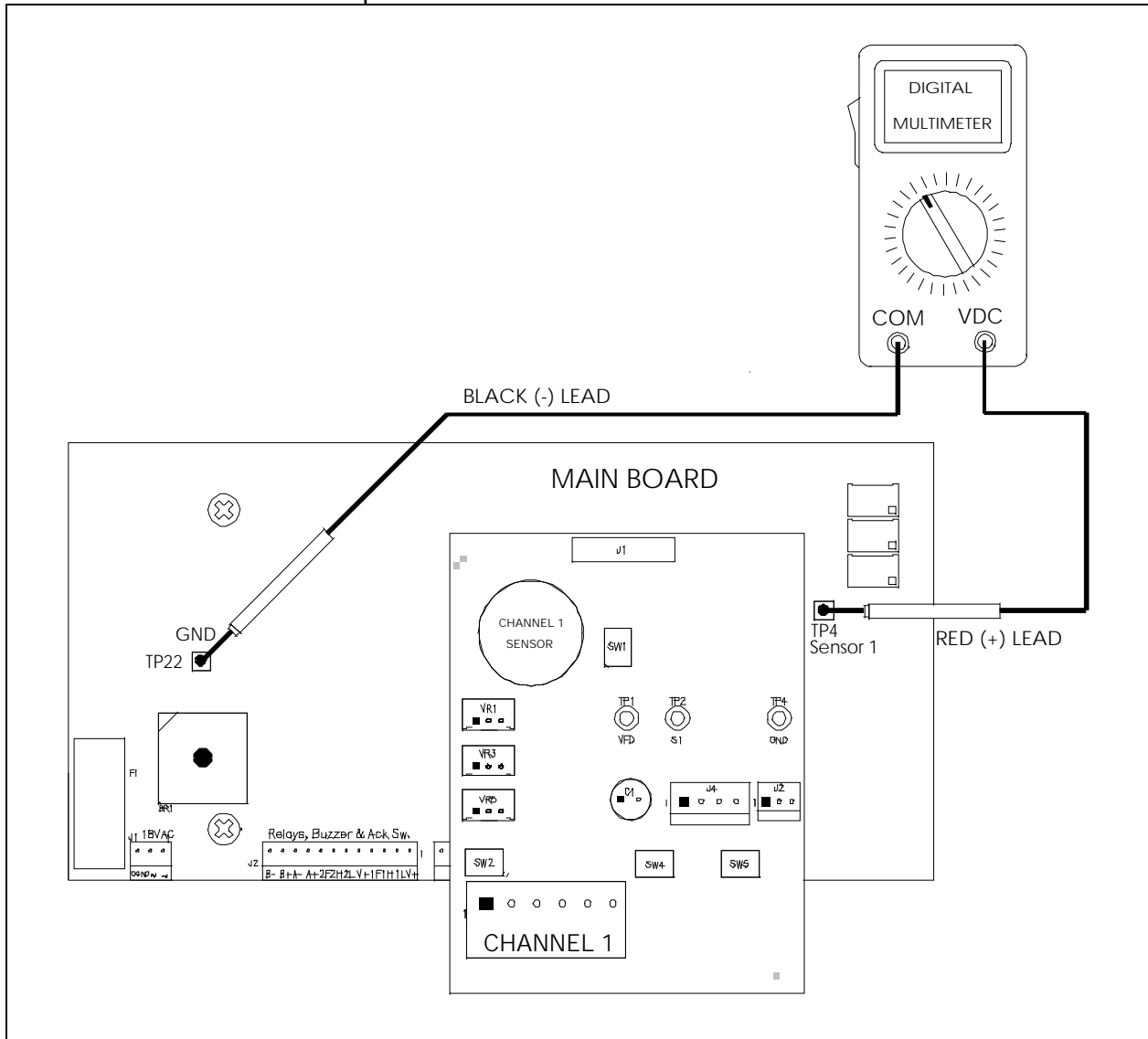


Figure 5-5: AMC-DSI Test Points and Trimpots.



Table 5-9: DSI board Test Points(use a voltmeter with greater than 100k input resistance)

TP #	Title	Usage
1	VFD	Provides a voltage representation of the VFD output Measure between GND (TP4) and VFD (TP1) Range: Minimum 0 or 2V based upon SW2-2 No target (0 ppm) gas measured Range: Maximum 10V High gas concentration measured
2	S1	Provides a voltage representation of the gas concentration reported on channel 1 Measure between GND (TP4) and S1 (TP2) Range: Minimum 0.4V No target (0 ppm) gas measured, 4mA on 4-20mA input Range: Maximum 2V High gas concentration measured, 20mA on 4-20mA input
4	GND	Reference ground, used with VFD (TP1), S1 (TP2) and S2 (TP3)

5.2.4.1 On Site Calibration Equipment Required

- Digital multi-meter with a minimum display range of 0 to 10.0 VDC.
- Miniature screwdriver or trimmer adjustment tool.
- Calibration adapter, available from AMC
- Zero and Span gases (Contact AMC for information)

5.2.4.2 Calibration Procedure

5.2.4.2.1 On Board Sensor

Calibration of the gas sensor involves two steps. First the “zero” must be set and then the “span” must be calibrated.

Note:

The calibration procedure will cause false alarms and or fail signal. Appropriate precautions may be required.

Refer to the Figure 5-5 for DSI Layout, to perform the following calibration procedure:

1. Open the front cover on the Gas Monitor 1A1 enclosure.
2. Attach the multi-meter as shown in Figure 5-5.
 - Connect negative (black) lead to TP22 (main board)
 - Connect positive (red) lead to TP4 (main board)
 - Alternatively the measurements can be taken on the DSI board by connecting negative (black) lead to TP4 (GND) and connecting positive (red) lead to TP2
 - Measurements through the Gas Monitor 1A1 main board is preferred
3. Apply a Zero gas sample, with a calibration adapter cup firmly and completely over the sensor on the AMC-DSI for 2 minutes with a flow rate of .5 liters per minute.
4. At 2 minutes adjust the Zero trimmer VR5 (DSI board) for a reading of 0.4 V +/- 5mV.



5. Apply the Span gas sample, with a calibration adapter cup firmly and completely over the sensor on the AMC-DSI for 2 minutes with a flow rate of .5 liters per minute. Since the output range is 0.4 to 2.0 V, a full-scale concentration should register 2.0 V after a 2 minute exposure. Proportionately, a half-scale concentration of gas should register 1.2 V, and so on.
$$V \text{ span adjust} = ((\text{Gas used} / \text{Full scale}) \times 1.6\text{VDC}) + 0.4 \text{ VDC.}$$
6. At 2 minutes adjust the Span trimmer VR3 (DSI board) for the appropriate the Span voltage reading.
7. Make sure alarm indicators (see Figure 3-1, item 1) turn on when meter reading passes the WARNING and/or ALARM thresholds.
8. Let sensor recover in air.

5.2.4.2.2 VFD Calibration

A VFD adjust trimpot is provided for each channel, this allows for independent scaling of the VFD output for different gas concentrations.

An example of this unique usage would be to provide the fullscale, 20mA output current at the channel output ie. 100PPM, then have the VFD output adjusted to full scale (10V) on a partial channel scale ie 50PPM.

Refer to Figure 5-2 to perform the following calibration procedure:

1. Open the front cover on the Gas Monitor 1A2 enclosure.
2. Measurements are taken on the DSI board by connecting negative (black) lead to TP4 (GND) and connecting positive (red) lead to TP1 (VFD).
3. Apply the desired gas concentration, with a calibration adapter cup firmly and completely over the sensor on the AMC-DSI for 2 minutes with a flow rate of .5 liters per minute.
4. At 2 minutes adjust the VFD trimmer VR1 (DSI board) for the appropriate VFD voltage reading. Full scale is 10V.
5. Make sure VFD activates appropriately for given voltage.
6. Let sensor recover in air.

5.2.4.3 Recalibration

Calibration is recommended two times per year. Refer to section 5.2 for contacting factory.

5.3 GAS CONCENTRATION DISPLAY (OPTIONAL)

The digital display on the Gas Monitor 1A1 series monitor shows the current gas concentration of the on-board or remote sensor/transmitter. The display is completely user configurable and is designed to be able to work with the most common gas concentration ranges. For proper setup, refer to the next section.



5.3.1 OPTIONAL GAS CONCENTRATION DISPLAY SETUP

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 5-10 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 15 below 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 section 4.2.3. 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 .

Table 5-10: Display DIP Switch Settings

Range ppm	1	2	3	4	Decimal Point
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 ₂)	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

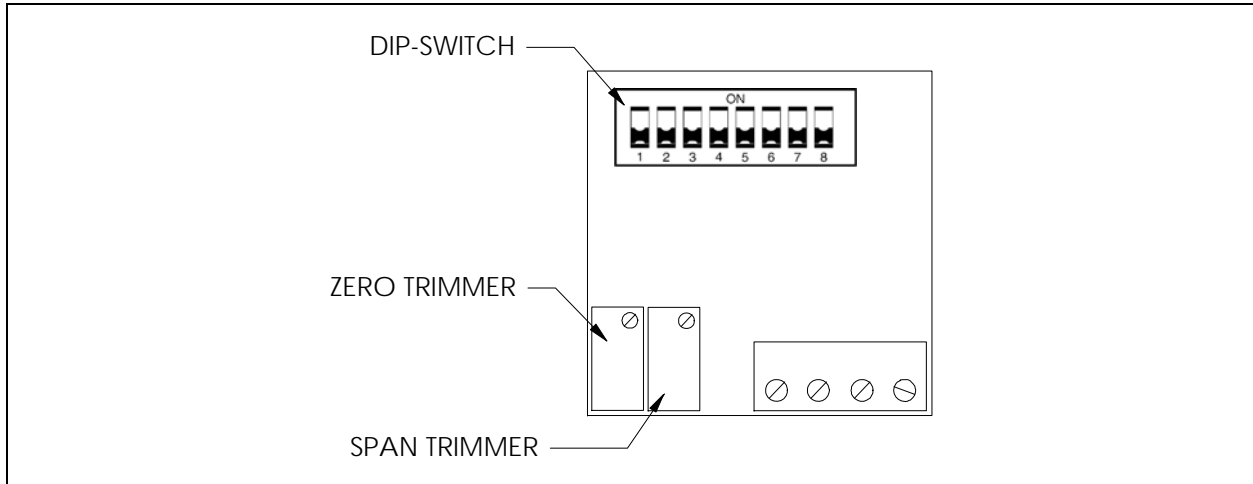


Figure 5-6 Back view of Gas Concentration Display



6 PREVENTIVE MAINTENANCE

This section covers all aspects of the Gas Monitor 1A1 with DSI. 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 must be prevented.

6.2 VERIFICATION OF OPERATION

Verification of operation should be performed at least once every 6 months. For highly demanding applications more frequent verification is recommended.

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

TURN OFF THE MAIN POWER SUPPLY BEFORE ATTEMPTING THE FOLLOWING PROCEDURE.
--

ON-BOARD SENSOR:

The on-board sensor has a socket connection to the DSI board for easy sensor replacement in the field. For removal, unplug the sensor from the DSI when the main power supply is turned off. For installation, hold the sensor in such a way that the sensing area is not covered. Align the sensor pins with pin sockets on the DSI and lightly push the sensor on to the DSI. Sensors need to be calibrated at regular intervals, see 5.2.4 AMC-DSI CALIBRATION for procedure. Sensor replacement is needed when the sensor life has expired. New sensor elements may require calibration.

The AMC-DSI is part of the Armstrong EZ Cal Sensor Replacement Program which allows a replacement with a complete calibrated AMC-DSI with onboard Sensor.

TRANSMITTER or SENSOR MODULE:

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

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.
- Another thing to watch is that a sensor module run should be either set to all voltage mode or all current mode. Note the AMC-1225 or AMC-1228 Sensor Modules work **only** in voltage mode but the AMC-1222 or AMC-1228s can work in either current or voltage mode. To avoid conflicts it is best to configure all of a run in current or voltage mode. See sensor module manual for configuring voltage or current mode. Ensure switches on DSI (Table 5-5) are setup to function in correct mode. (Table 5-6)

8.1 1222 WIRING AND TERMINATION

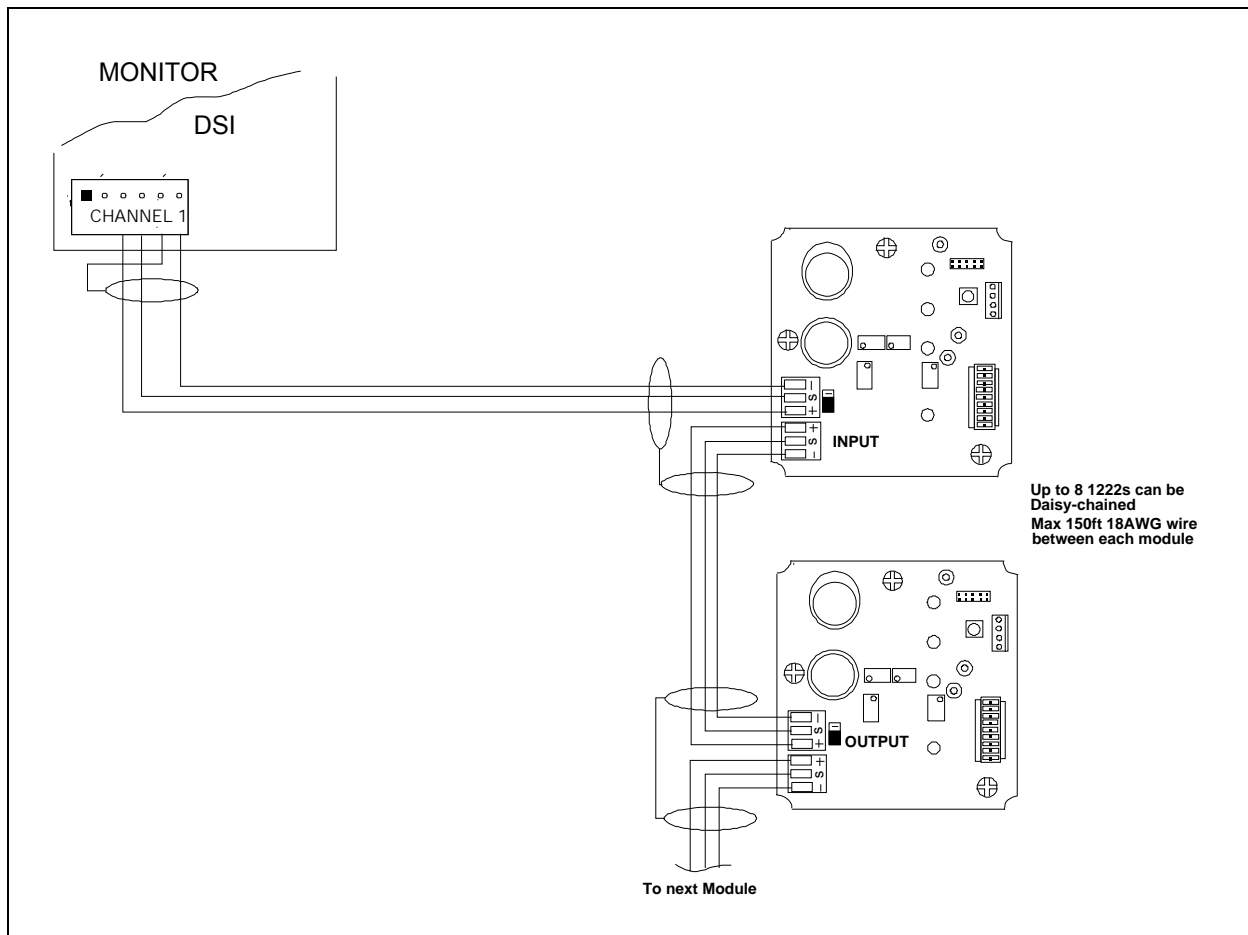


Figure 8-1: 1222 Sensor Module Wiring

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.

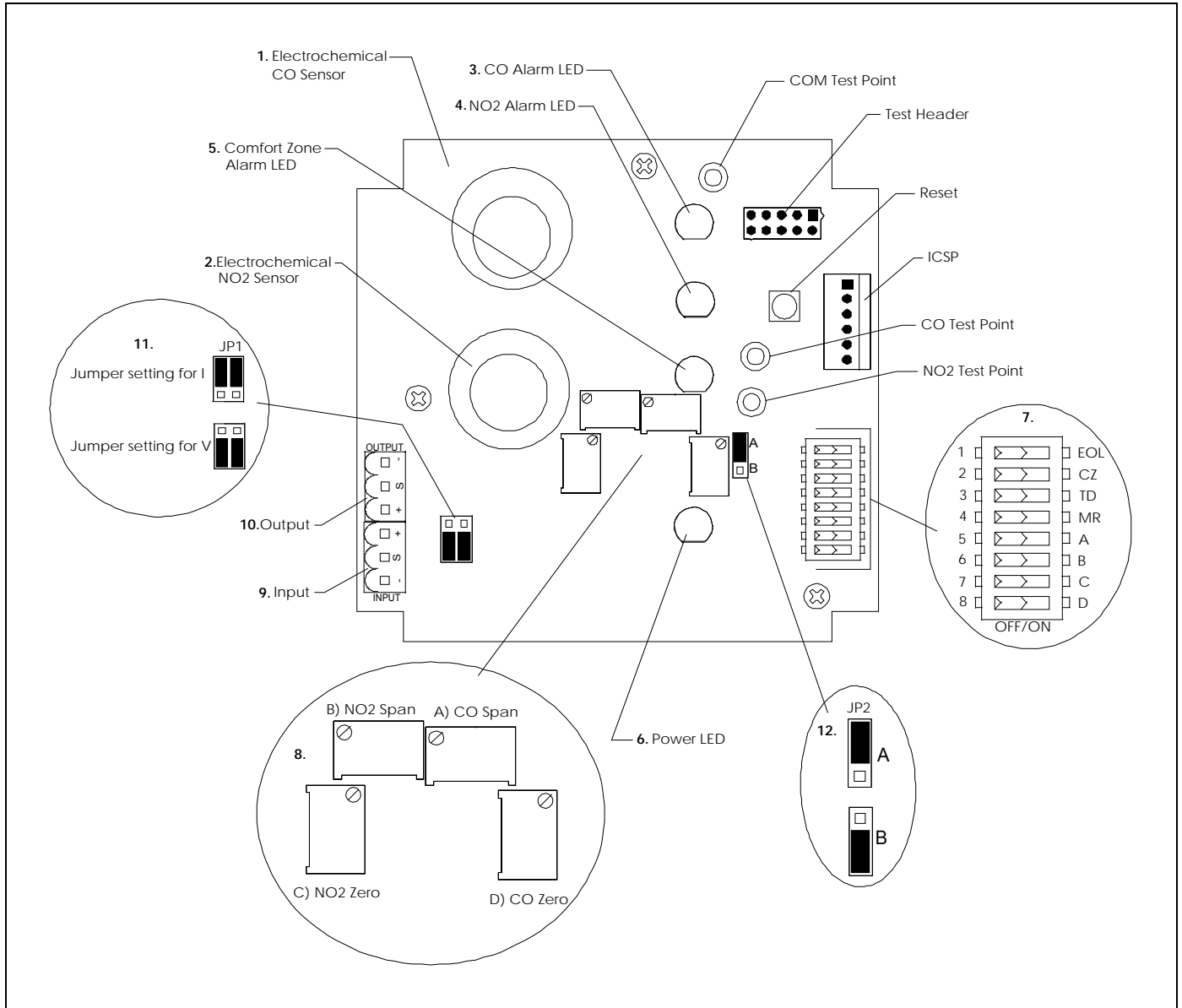


Figure 8-2: 1222 Sensor Module Termination

8.2 1228s WIRING AND TERMINATION

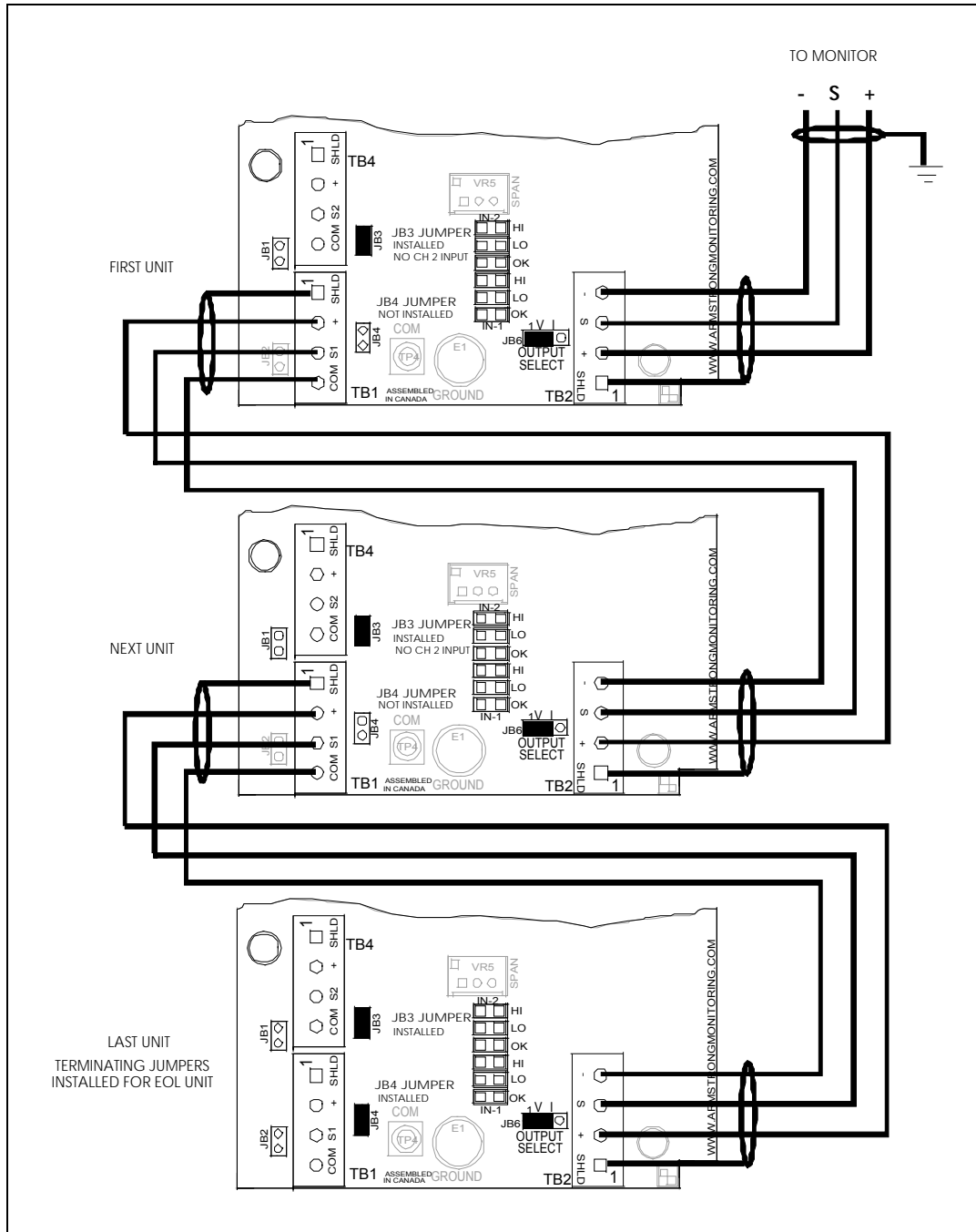


Figure 8-3: 1228s Sensor Module Wiring and Termination

JB3 jumper is installed if input TB4 is not used. JB4 jumper is installed if input TB1 is not used. JB1 and JB2 jumpers are only installed if set for current output.

8.3 1225 WIRING AND TERMINATION

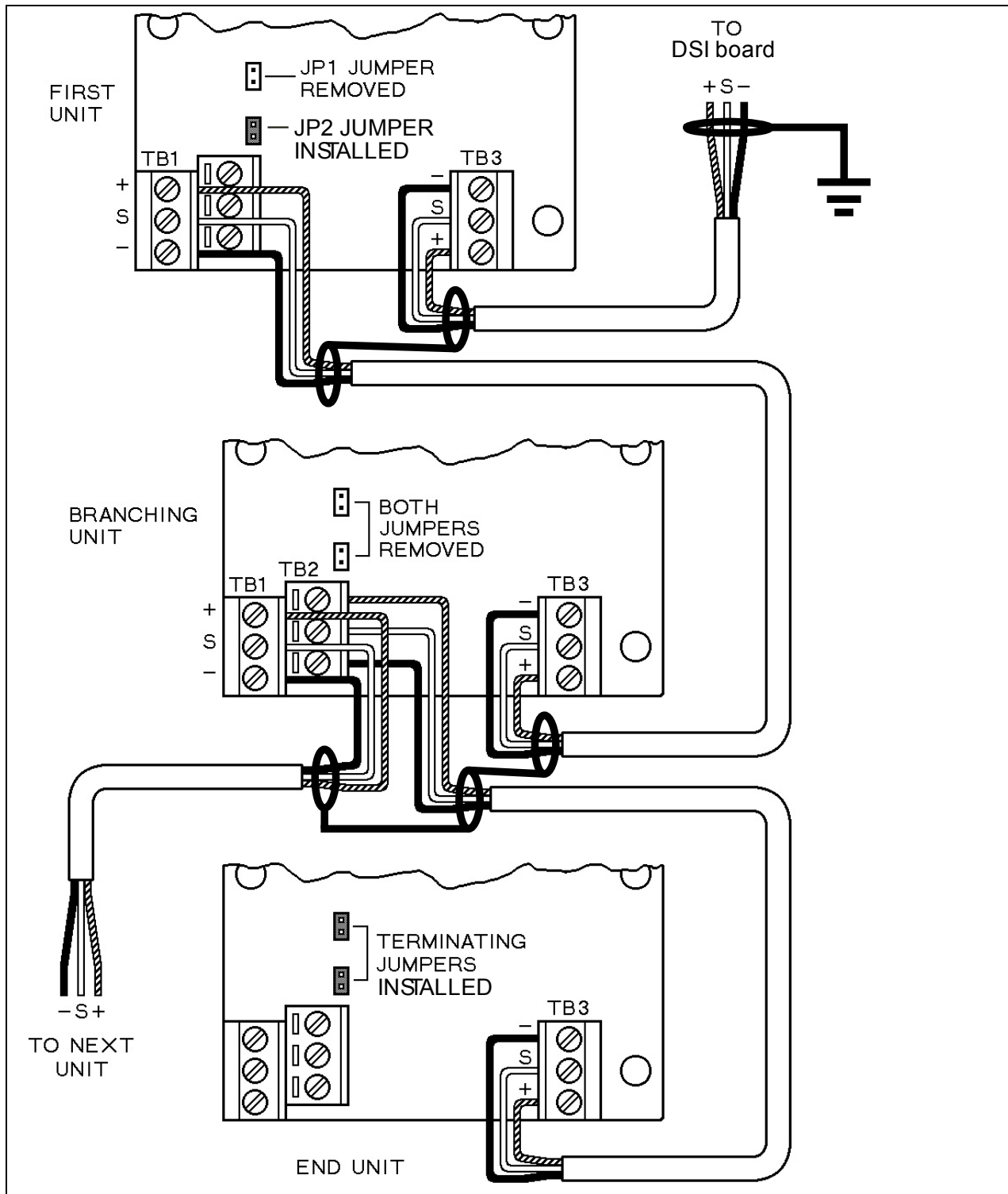


Figure 8-4: 1225 Sensor Module Wiring and Termination

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