Gas Monitor 1A1 Series

One-Channel Gas Monitor

INSTRUCTIONS

Installation and Operation of the Gas Monitor 1A1 One-Channel Monitor

IMPORTANT:

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

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1 WARRANTY

The Gas Monitor 1A1 Series One-Channel Monitor is warranted against defects in material and workmanship for a period of two (2) years from date of shipment. During the warranty period, The Armstrong Monitoring Corporation will repair or replace components that prove to be defective in the opinion of AMC. 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.

1.1 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.

1.2 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.

1.3 PRODUCT RETURN

All products returned for warranty service will be by prepaid freight and they will only be accepted with an R.M.A. number issued by AMC. All products returned to the client will be freight collect.

Service Department contact information:
Web: www.armstrongmonitoring.com
North America toll free: 1 (800) 465-5777

2 PRODUCT INFORMATION

Monitor Serial Number.	_____
Monitor Warranty Period.	2 year
Power Supply Requirement.	120 VAC, 60 Hz, 30 VA
Operating Temperature.....	-20°C to +40°C (-4°F to +104°F)
Operating Pressure.....	Ambient atmospheric pressure
Relative Humidity.....	35 – 85% non-condensing.

Signal Input Configuration	Sensor		Type of Gas	Alarm Trip Points	
	Part No.	Serial No.		Warning	Alarm
S.S. sensor					
AMC-S2e					
2 wire trans					
3 wire trans					
AMC-122X					
AMC-3700					
AMC-3705					

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.

3 PRODUCT DESCRIPTION

3.1 GENERAL DESCRIPTION

The Gas Monitor 1A1 series monitor 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 monitor comes with the following features, see Figures 1 and 2.

3.1.1 MONITOR FEATURES

1. RUN/FAULT/OFF INDICATOR: A green LED
   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 at low voltages. Located underneath the PCB

6. INTERNAL WIRING HEADER: Provides wiring connection points as follows:
   1,2,3,4 - Channel 1 input
   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 tone 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 (for solid state only), 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. ON-BOARD SENSOR:	Optional sensor allows local detection of gas
14. SIGNAL INPUT TERMINAL BLOCK:	Allows connection to signal input: transmitter, multidrop or remote sensor **5** - Power **6** - Signal **7** - Negative **8** - Chassis ground

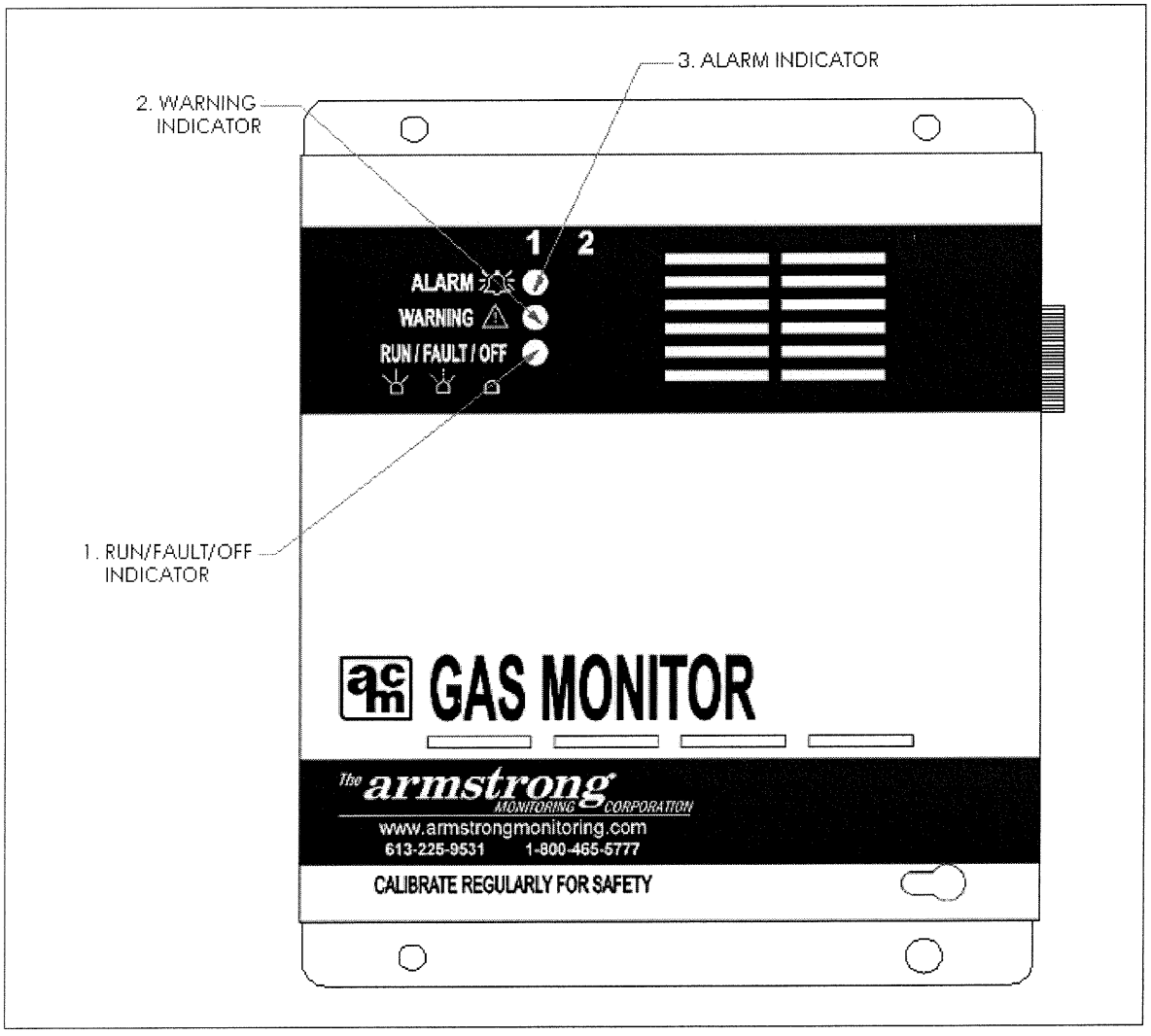

FIGURE 1: Gas Monitor 1A1, Front Cover.

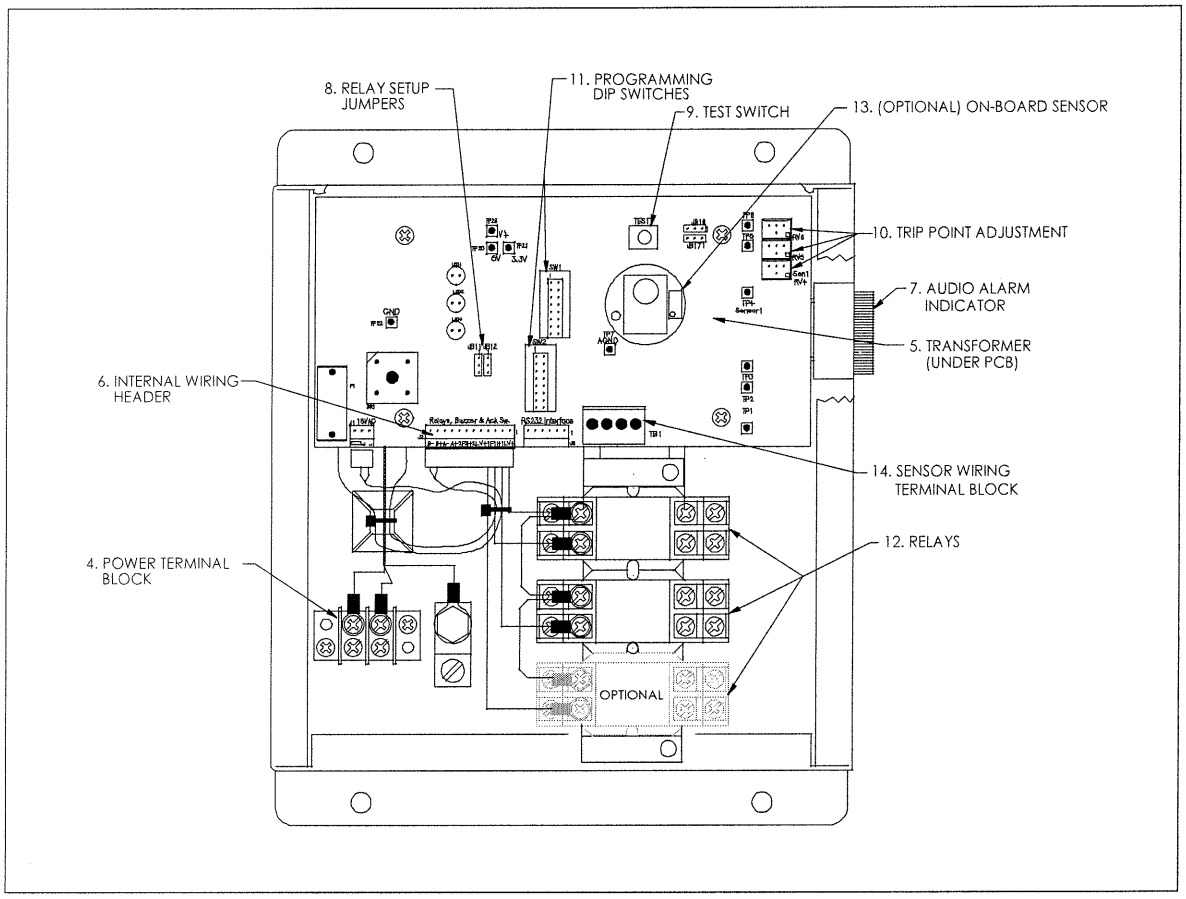

FIGURE 2: Internal Features of the Gas Monitor 1A1.

4 INSTALLATION

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

4.1 MOUNTING INSTRUCTIONS

4.1.1 MONITOR MOUNTING

Securely fasten the Gas Monitor 1A1 series monitor unit on a solid, non-vibrating surface or structure. Install the unit where it is not exposed to rain or water spray. 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 1.5 -1.8 m (5-6 ft) from the floor. See Figure 3 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.

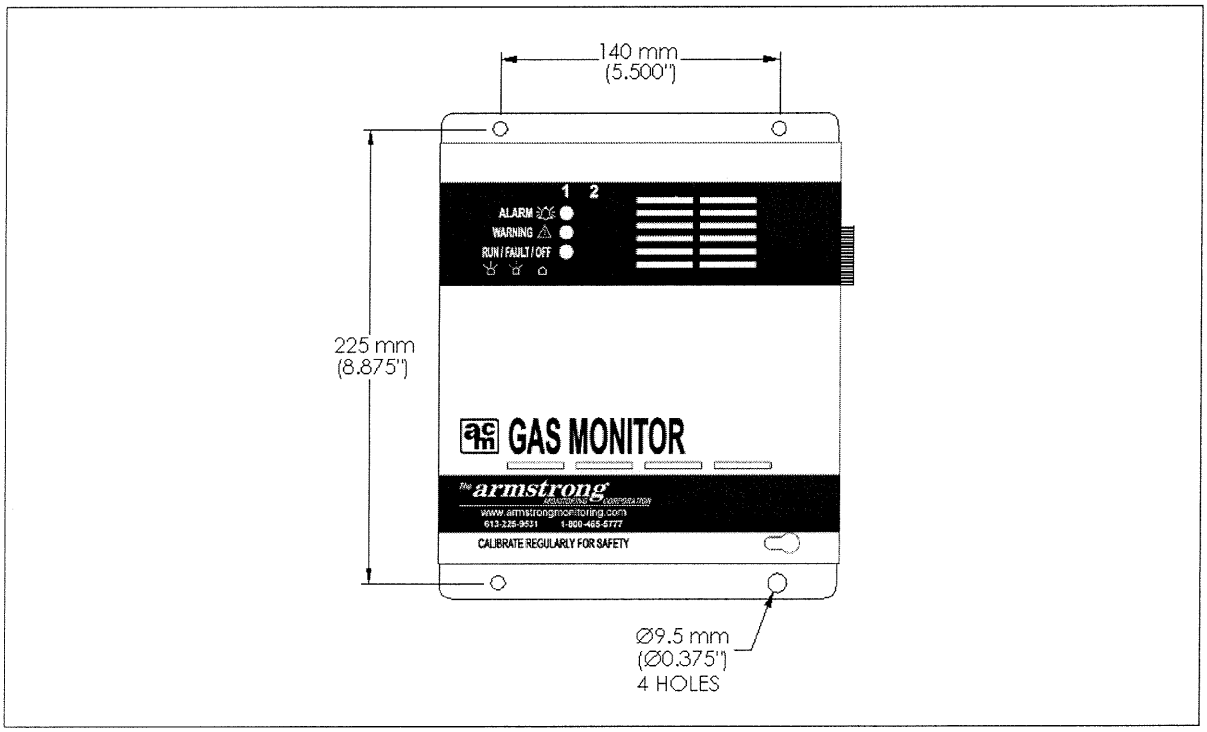

FIGURE 3: Locations of Mounting Holes.

4.1.2 TRANSMITTER, MULTIDROP OR REMOTE SENSOR MOUNTING

Mount the transmitter, multidrop 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, multidrop or remote sensor manual for additional instructions for proper mounting.

Table 1: Transmitter, multidrop and remote sensor mounting locations

Gas	Application	Location
CO	Vehicle exhaust monitoring	1.2 – 1.5 m (4-5 ft.) from floor
NO_2	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.

RELAYS: Relays are included with the monitor, 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 5.

The Gas Monitor 1A1 series monitor is shipped 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 4.4 for jumper configuration.

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

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

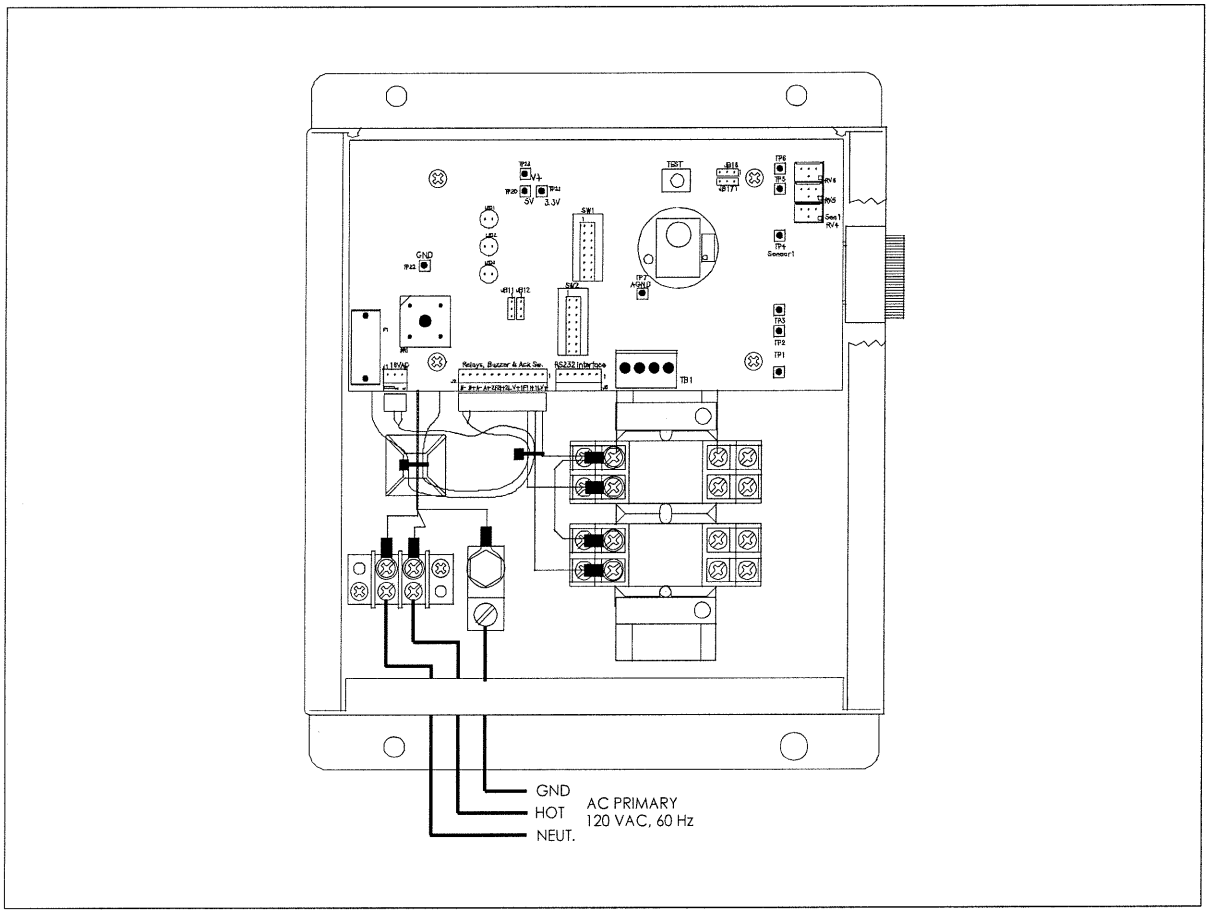

FIGURE 4: Location of Power Supply Connections.

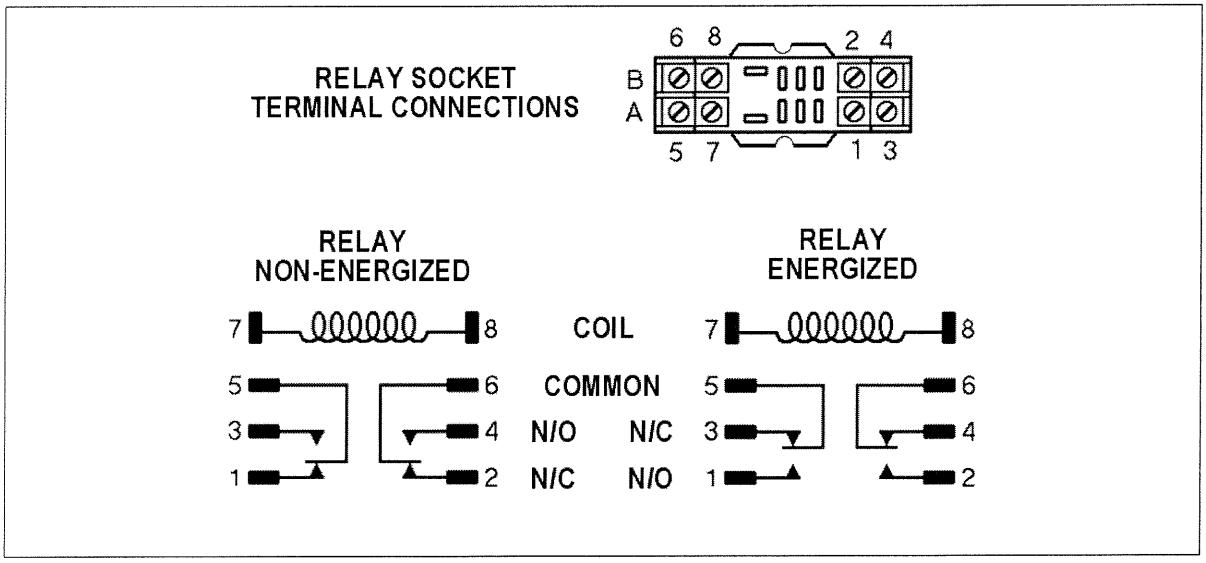

FIGURE 5: Relay Contact Arrangement.

4.2.2 CABLE SELECTION

Connections from monitor to transmitter, multidrop or remote sensor should be made using shielded, 2 or 3-conductor cable (depending on type of remote sensor or transmitter used). 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, multidrop or remote sensor), refer to the cable selection chart in the appropriate transmitter, multidrop or remote sensor manual. The monitor has two field wiring power supplies; 5 volts and 18-22 volts. The configuration for each signal input is shown in Table 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 18-22 volts. A detailed description of each signal input configuration is in the following sub-sections.

Table 2: Signal input configuration jumper selection

SIGNAL INPUT CONFIGURATION	JB 8 TERMINATION	JB10 POWER SUPPLY
On-board Solid State	SS	N/A
On-board S2e	MD-V	N/A
Transmitter, 2 wire Transmitter, 3 wire	4-20 mA	V+
AMC-122X Multidrop	MD-V	V+
AMC-3700 Remote Sensor	SS	V+
AMC-3705 Remote Sensor	SS	+5V

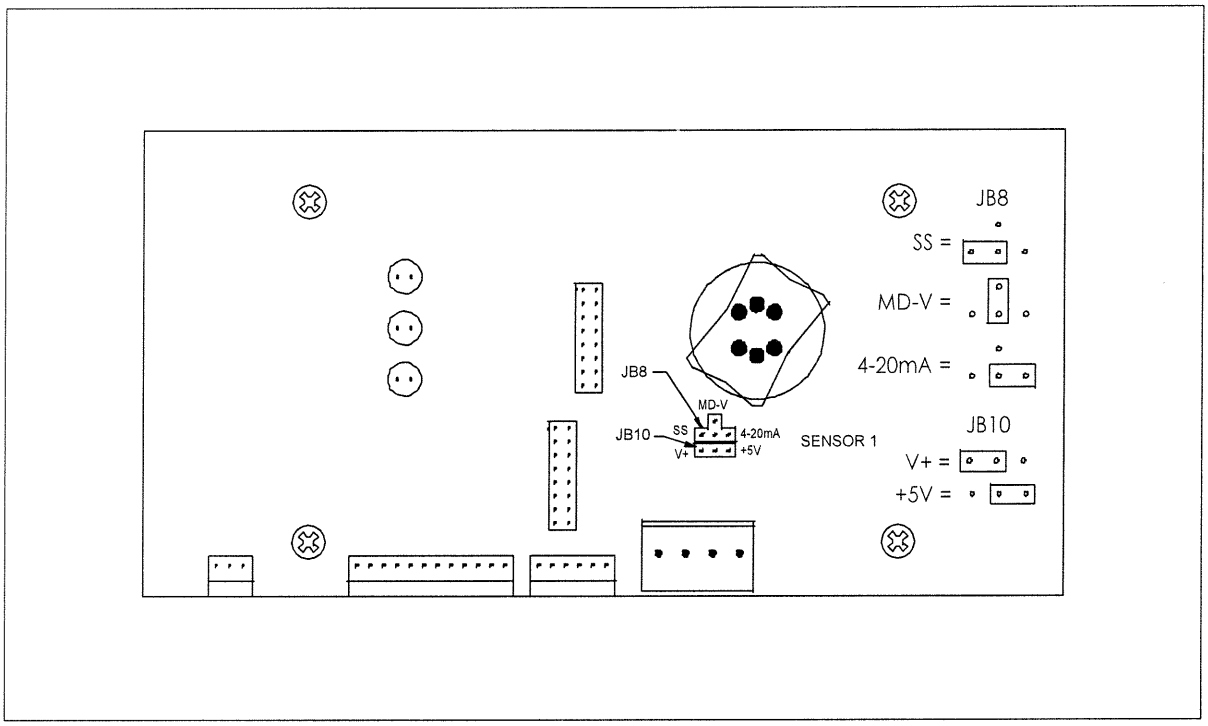

FIGURE 6: Signal input configuration jumpers.

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

4.2.3.1 On-Board Sensor Connection

There are two on-board sensor options; solid state and AMC-S2e sensor. Each has their own 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 7. Ensure all sensor pins are fully engaged.

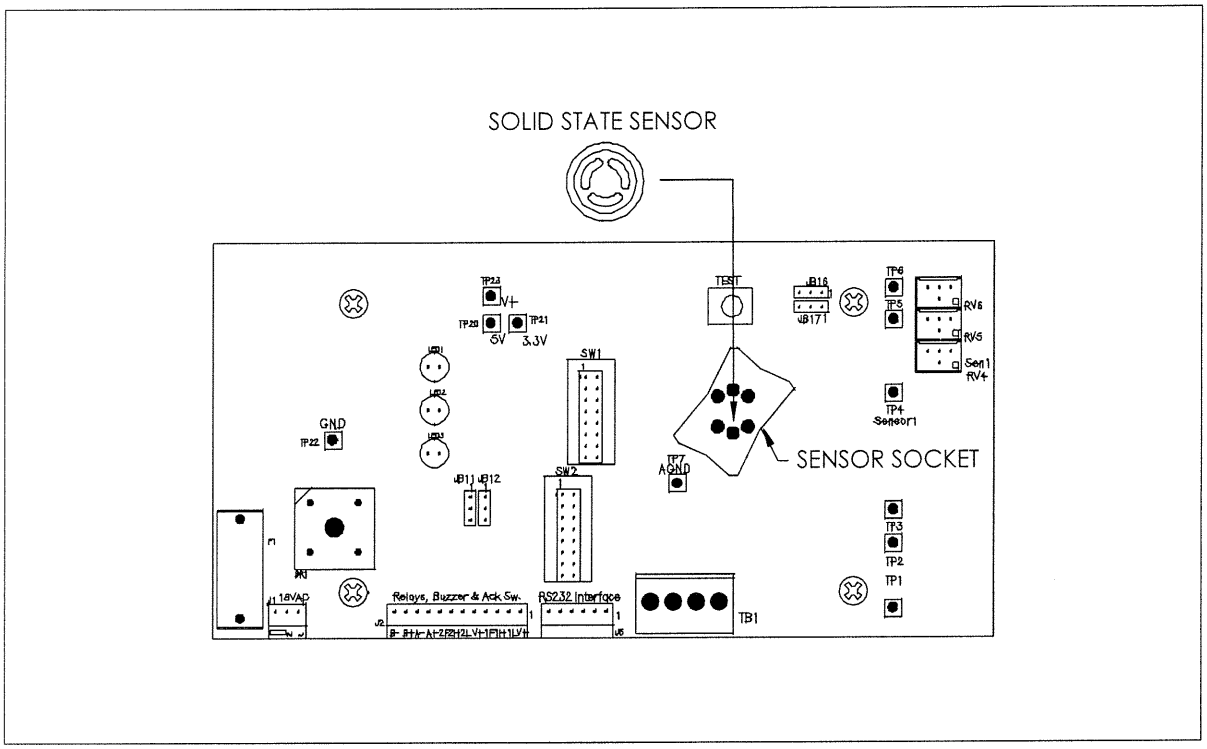

FIGURE 7: Solid state sensor connection.

4.2.3.1.2 AMC-S2e Sensor

The AMC-S2e sensor is designed to plug into the same socket as the solid state sensor. Plug the sensor into the socket and ensure the green LED on the AMC-S2e illuminates. If the green LED does not illuminate, unplug and rotate AMC-S2e 180°.

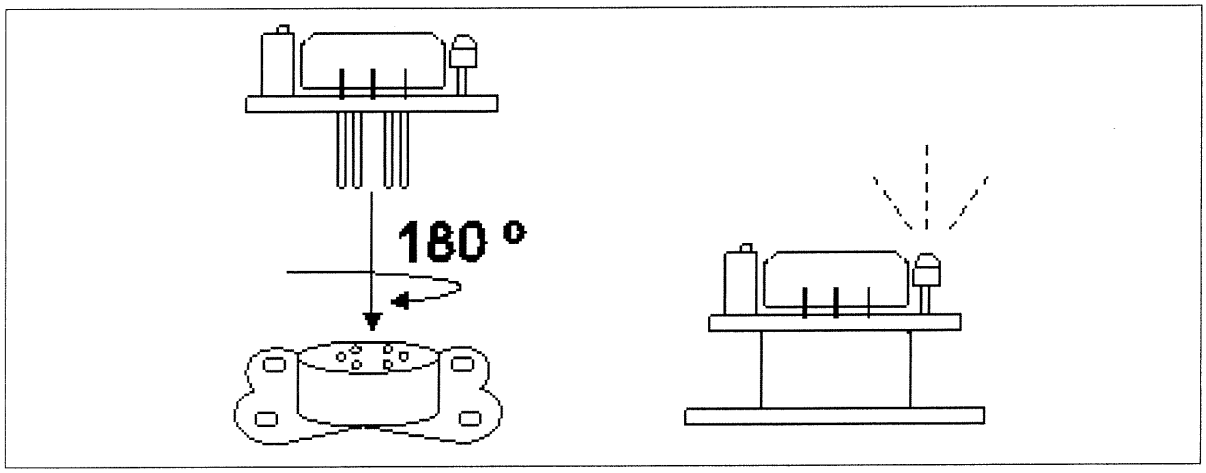

FIGURE 8: S2e sensor connection.

4.2.3.2 Transmitter, Multidrop or Remote Sensor Wiring

Each transmitter, multidrop or remote sensor connects to a set of sensor terminals (-, S1, +) on the sensor wiring terminal block located on the circuit card, see Figure 2, item 14. The sensor wiring terminal block is located in the bottom right corner of the PCB and is capable of wiring inputs as shown in Figure 9. The following sections detail each of the remote transmitter or sensor wiring.

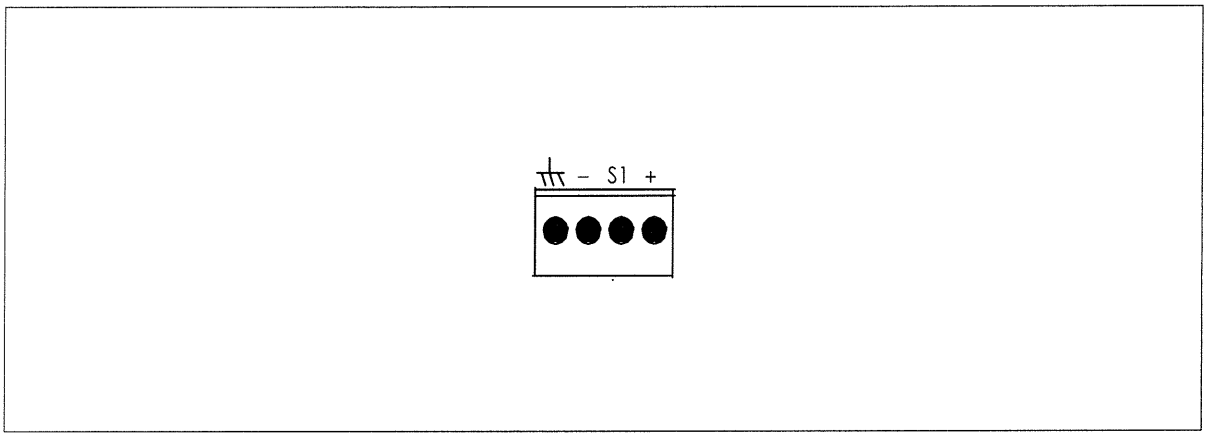

FIGURE 9: Sensor wiring terminal block.

See specific transmitter, multidrop or remote sensor manual for wire gauge recommendations, based upon instillation 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.

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 is conveyed in the following table.

Gas Monitor			Transmitter, 2 wire	
chassis ground	⏚	→	No connect at transmitter	
negative	-	→	Not applicable	
signal	S	→	Negative	-
positive	+	→	Positive	+

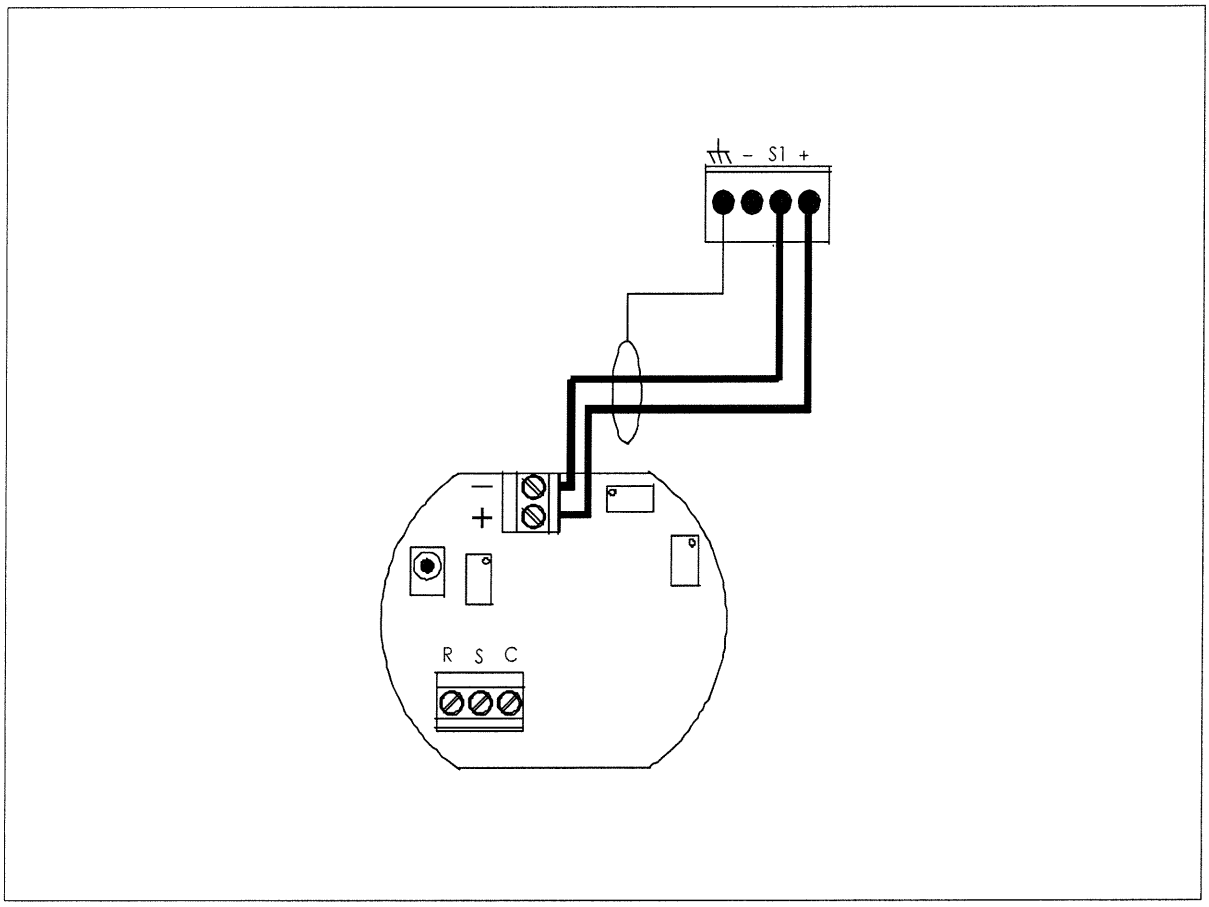

FIGURE 10: Transmitter, 2 wire wiring.

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 is conveyed in the following table.

Gas Monitor			Transmitter, 3 wire	
chassis ground	⏚	→	No connect at transmitter	
negative	-	→	Negative	-
signal	S	→	Signal	S
positive	+	→	Positive	+

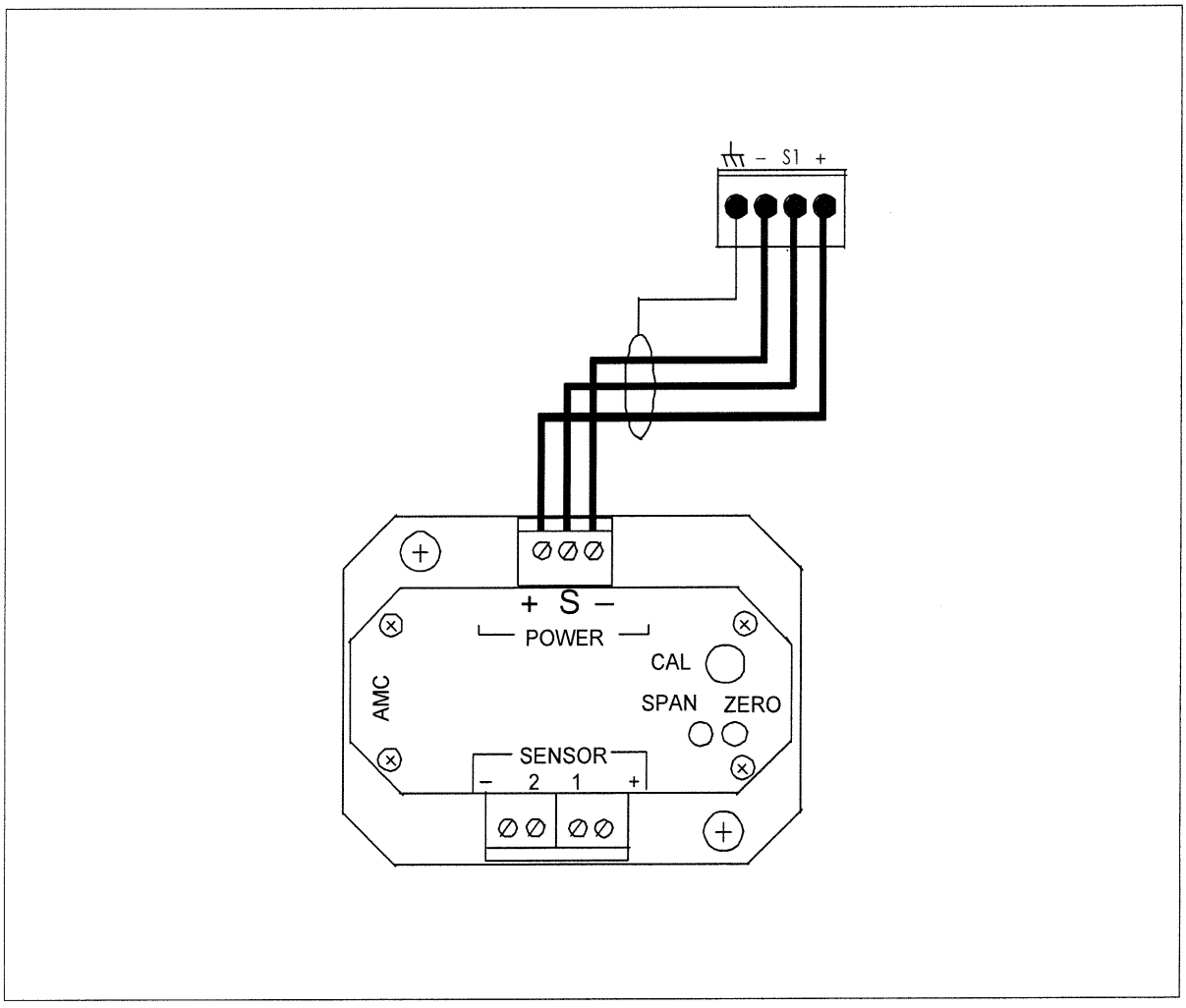

FIGURE 11: Transmitter, 3 wire wiring.

4.2.3.2.3 AMC-122X Multidrop

The 122X multidrop is wired to the Gas Monitor through the signal input terminal block. The wiring is conveyed in the following table.

Gas Monitor			122X Multidrop	
chassis ground	⏚	→	No connect at module	
negative	-	→	negative	-
signal	S	→	signal	S
positive	+	→	positive	+

For further detailed wiring instructions for multiple multidrops (up to 8) see the corresponding multidrop manual.

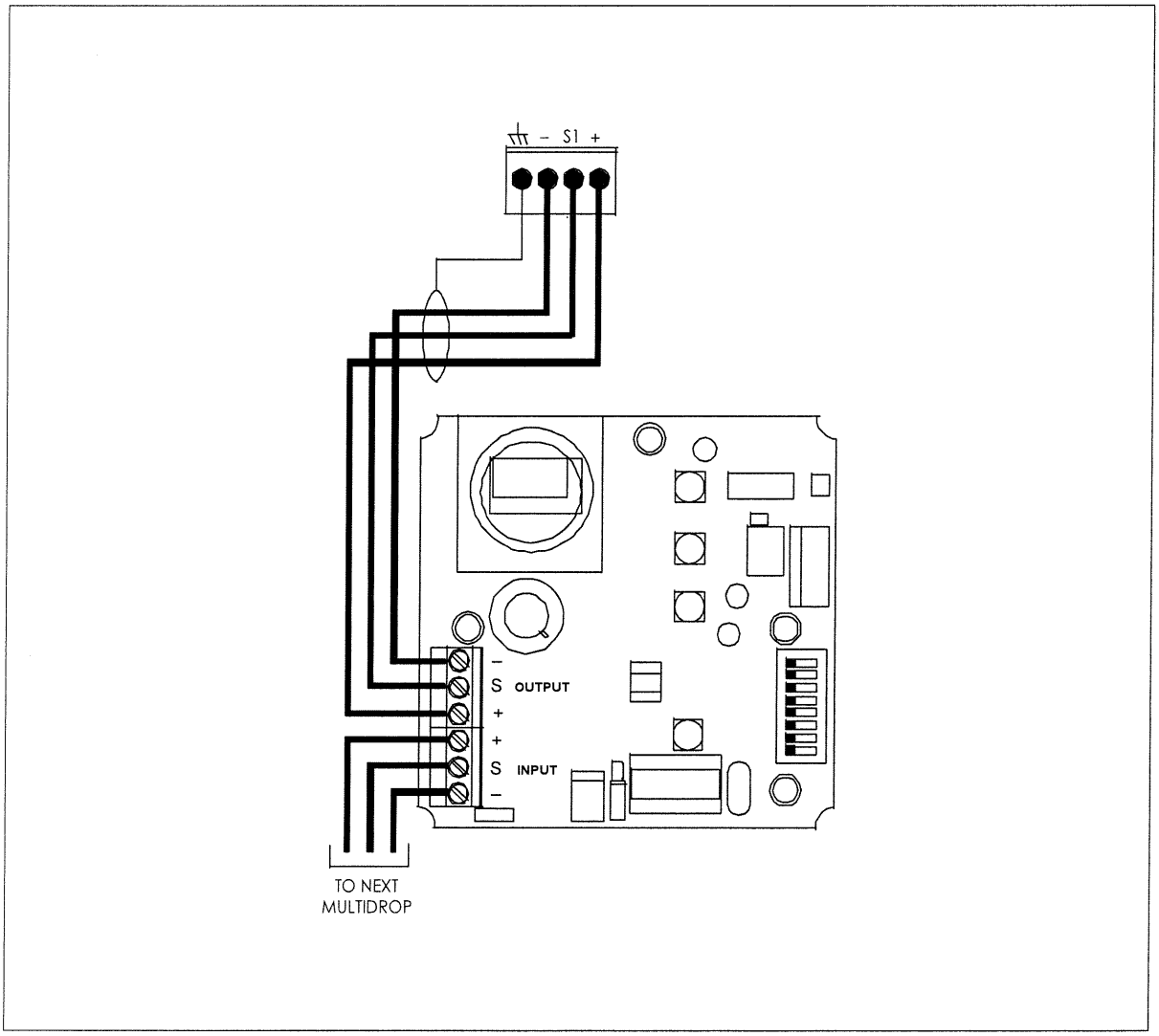

FIGURE 12: 122X Multidrop wiring.

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 is conveyed in the following table.

Gas Monitor			3700 Remote Sensor	
chassis ground	⏚	→	No connect at sensor	
negative	-	→	negative	-
signal	S	→	signal	S
positive	+	→	positive	+

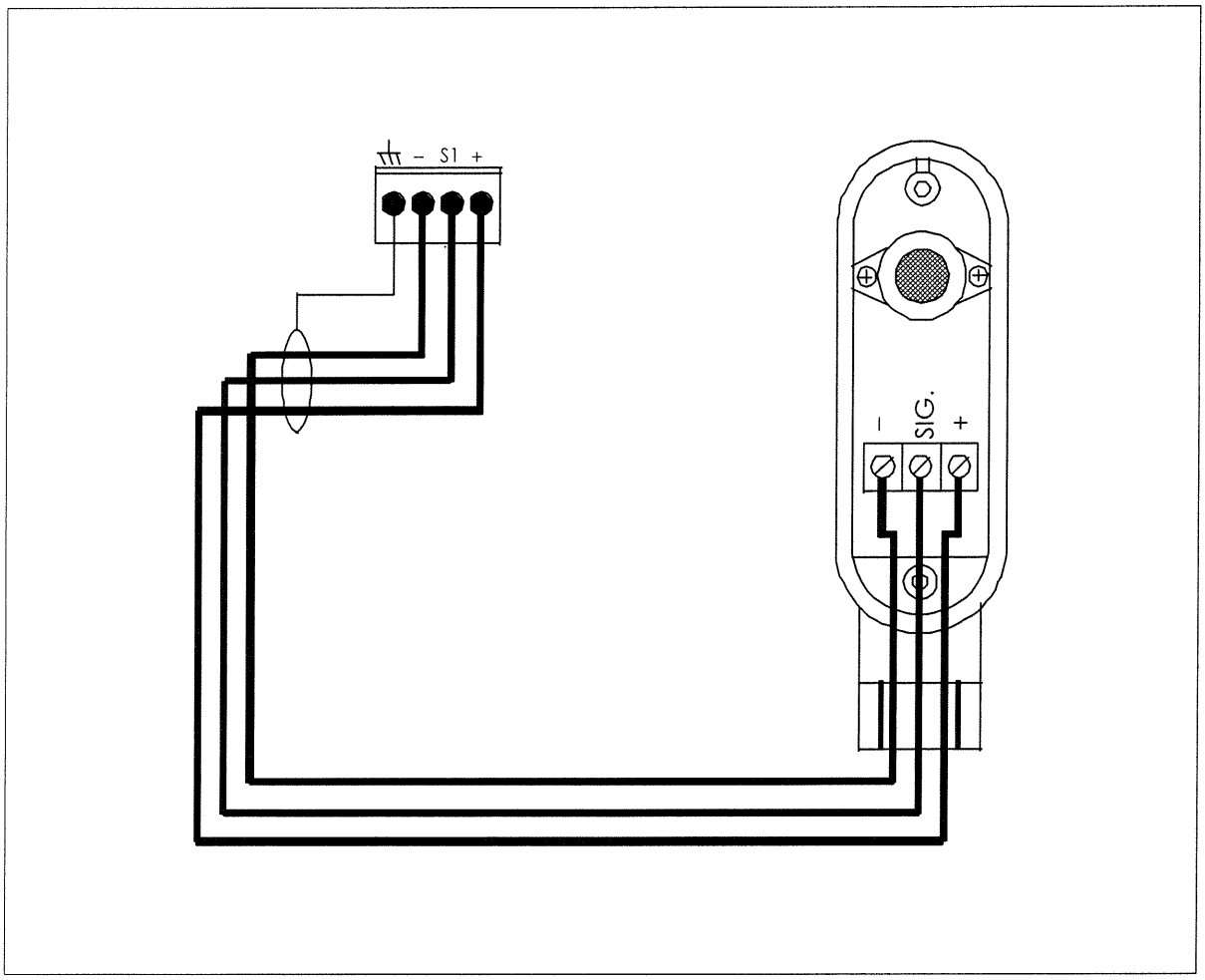

FIGURE 13: AMC-3700 Remote sensor wiring.

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 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

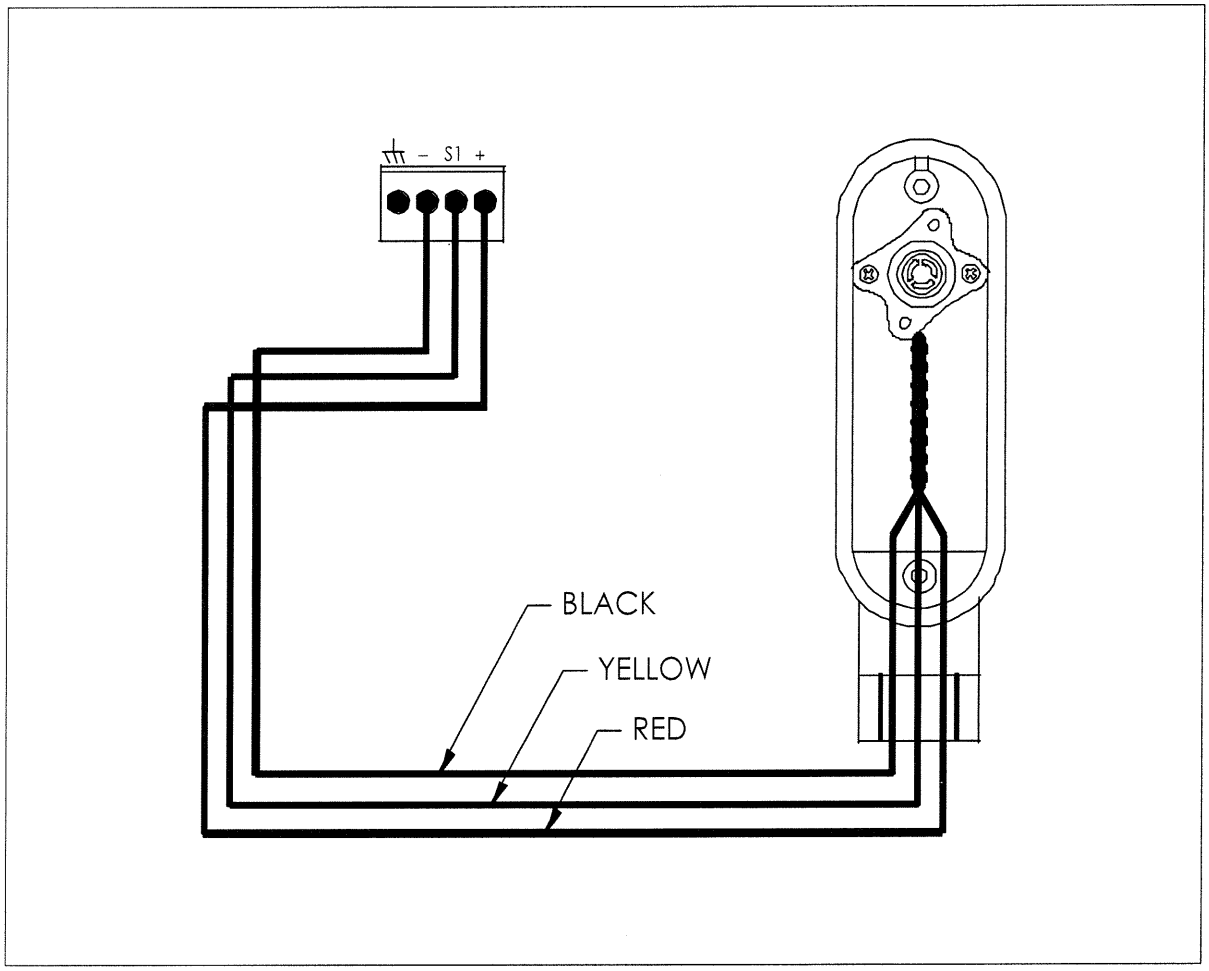

FIGURE 14: AMC-3705 Remote sensor wiring.

4.3 DIP SWITCH PROGRAMMING

The circuit card has two blocks of DIP-switches for configuring the various functions; see Figure 2, item 11. Each DIP-switch can be set to OFF (left position) or ON (right position) depending on functions required.

Table 3: DIP-switch programming chart

Switch	Feature	Position	Description
SW1-1	Activate Alarms until Acknowledge (Latching Relays)	**OFF**	Warning and alarm relays are automatically de-activated once activating condition has been removed and minimum run timer has expired.
		ON	Once activated, warning and alarm relays remain activated (latched) until activation condition has been removed, minimum run timer has expired and the Acknowledge button has been pressed.
SW1-2, SW2-2	Minimum Run Timer	See Description	Warning and alarm relays are maintained in alarm state for a minimum time interval following alarm activation, as follows: SW1-2 SW2-2 Minimum Run Time **OFF** **OFF** 0 minutes ON OFF 5 minutes OFF ON 10 minutes ON ON 30 minutes Note that a sensor level falling below the alarm threshold and then re-occurring during this time resets the alarm timer for the associated alarm.
SW1-3, SW1-4	Sensor Type (Mode Select)	See Description	Sensor type (threshold mode) is selected as follows: SW1-3 SW1-4 Sensor Type (Mode) **OFF** **OFF** Increasing ON OFF Decreasing OFF ON Reserved ON ON Reserved
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.
SW2-3	Audio Enable for Warning	OFF	Audio alarm is disabled for Warning conditions.
		ON	Audio alarm is activated in conjunction with Warning.
SW2-4	Sensor Fault Threshold	OFF	Sensor Fault thresholds set at 0.4 mA into 250R or 100 mV.
		ON	Sensor Fault thresholds set at 1.4 mA into 250R or 350mV.

Switch	Feature	Position	Description
SW2-5	Activation Delay, Warning	**OFF**	No activation delay of Warning conditions.
		ON	Five minute delay on activation of Warning conditions following sensor exceeding alarm threshold.
SW2-6	Activation Delay, Alarm	**OFF**	No activation delay of Alarm conditions.
		ON	Delay on activation of Alarm conditions following sensor exceeding alarm threshold.
SW2-7	Audio Alarm Enable	OFF	Audio alarm (buzzer) disabled.
		ON	Audio alarm (buzzer) enabled.

4.4 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 4 WARNING and ALARM Relay Active State and shown in Figure 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 if the requirement is that the relay falls to the closed condition when power is lost.

Table 4: 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

4.5 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: Audio alarm operation

Sensor Status	***Output***
Normal	off
Warning (SW2-3 OFF)	off
Warning (SW2-3 ON)	two long, slow beeps. followed by short pause
Alarm	four fast beeps, followed by short pause
Any Sensor Fault	short, slow beeps
Notes: 1) Micro-controller operation ensures that Warning, Alarm and Fault conditions will not occur simultaneously on the same sensor.	

5 OPERATION AND CALIBRATION

This section covers the operation and calibration procedures pertaining to the Gas Monitor 1A1 series monitor.

5.1 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.

5.2 TEST SWITCH FUNCTION

While pressed, the on-card 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.

5.3 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.

5.4 ALARM/WARNING RELAY ACTIVATION DELAYS

The Gas Monitor 1A1 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.

5.5 RELAY OUTPUTS

A WARNING condition on either sensor will result in activation of the WARNING relay output. An ALARM condition on either 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-card jumpers JB11, JB12, respectively. This option is provided to allow configuration flexibility. When selected to energize when alarm active, a controller or power failure will prevent an alarm condition from being produced, while the opposite setting will result is an alarm signal on failure.

5.6 CALIBRATION/SERVICE

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

The Gas Monitor 1A1 series system comes factory calibrated and does not need to be adjusted as part of installation. Periodic calibration is required on the Gas Monitor 1A1 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. 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 is used with solid state sensors to condition the signal from the sensor so that it is in a usable range. TP4 is used to monitor the signal from the sensor.
- 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 6: Test points and trimpots allocation

Reference Points		Sensor
Test Points	Signal	TP4
	WARNING	TP5
	ALARM	TP6
	Ground	TP7
Trimpots	Solid State Signal Termination	RV4
	WARNING	RV5
	ALARM	RV6

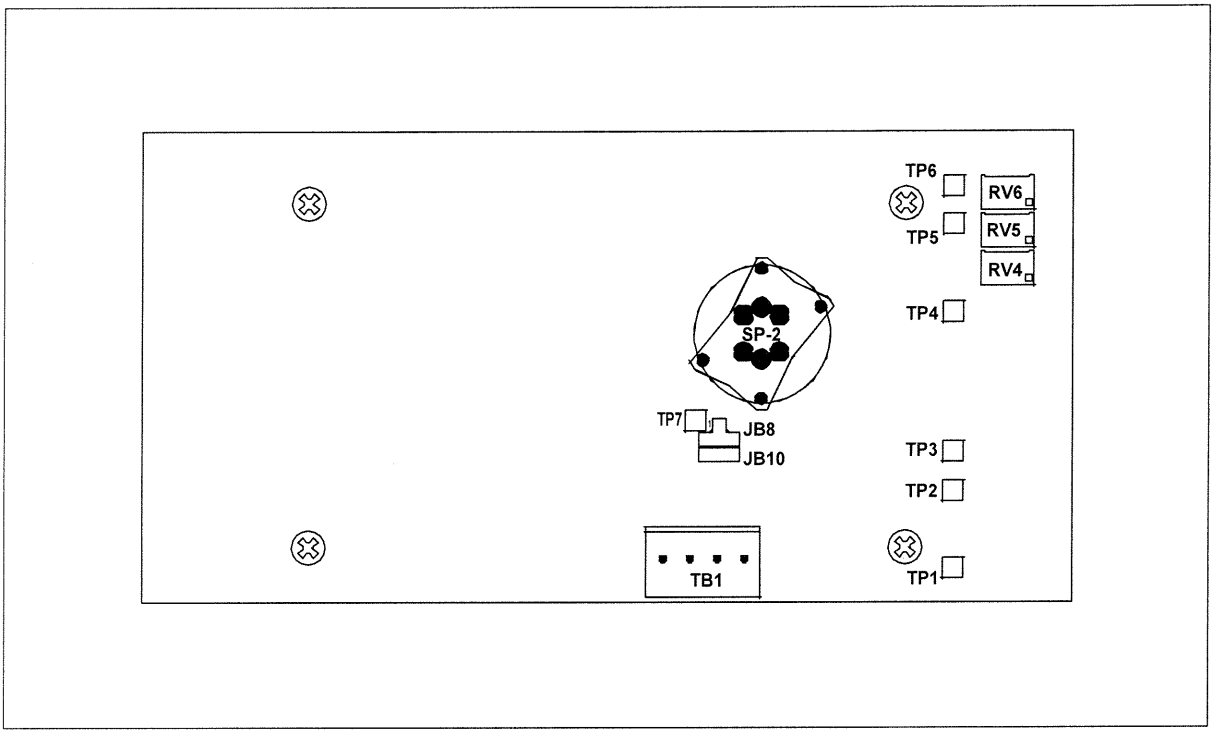

FIGURE 15: Gas Monitor 1A1 Test Points and Trimpots.

5.6.1 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 20 mA DC signal to the monitor. This translates to a 0.4 to 2.0 volt DC signal at TP4. The alarms are set to correspond to some fraction of the transmitters full scale calibration. The WARNING threshold is set using trimpot RV5. The ALARM threshold is set using trimpot RV6.

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 transmitter to the Gas Monitor.

5.6.1.1 Equipment Required

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

5.6.1.2 Trip Threshold Adjustment

Ensure that the interface is configured for 4-20 mA transmitters.
The formula below is used to determine the voltage the thresholds are adjusted to with the trimpots.

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

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
- $C_{full\ scale}$ - The gas concentration corresponding to full scale (20 mA)
- I_{Range} – Calibrated at transmitter, typically 16 mA for full range.
  - $I_{Range} + I_{base}$ typically add to 20 mA.
- I_{base} – fixed at 4.0 mA
- $R_{termination}$ – fixed internally on Gas Monitor at 250 ohms
- $K_{Gas\ Monitor\ 1A}$ – 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 4-20 mA transmitter calibrated for 20 mA for a concentration of 100 PPM;

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

5.6.1.3 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.

5.6.2 AMC-S2e

This section discusses the adjustment of the WARNING and ALARM thresholds on the Gas Monitor when connected to an on-board AMC-S2e.

The AMC-S2e may be installed on the PCB in the SP-2 location or externally in either a AMC-3700 or AMC-3705. See sections 4.2.3.1.2 AMC-S2e Sensor; 4.2.3.2.4 AMC-3700 Remote Sensor and 4.2.3.2.5 AMC-3705 Remote Sensor for connecting the AMC-S2e to the Gas Monitor.

The AMC-S2e supplies a linear 1.0 to 3.3V DC signal to the monitor. This translates to a 0.4 to 1.32 volt DC signal at TP4. The alarms are set to correspond to some fraction of the transmitters full scale calibration. The WARNING threshold is set using trimpot RV5. The ALARM threshold is set using trimpot RV6.

The calibration of the AMC-S2e is specified in the AMC-S2e specific manual.

5.6.2.1 Equipment Required

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

5.6.2.2 Calibration

The AMC-S2e is delivered already calibrated from the factory. When the AMC-S2e-CO is calibrated, it will have a 3.3V at TB1 (or 1.32V at TP4) output in the presence of 100 PPM CO gas. The zero gas output of the AMC-S2e varies from unit to unit. This calibration procedure allows alarm thresholds to be set between no gas and full range gas levels.

Connect the negative lead of the multimeter to TP7 AGND

In the presence of clean air (0 PPM CO), measure the signal at TP4.

- Record this value as V_{LOW}

Use the following formula to determine what value to set the threshold to;

$$V_{ALARM} = ((C_{ALARM} / C_{full\ scale}) * (1.32V - V_{LOW})) + V_{LOW}$$

Where

- V_{ALARM} is the voltage the alarm trip point will be set to.
- C_{ALARM} is the gas concentration at which the alarm is to be triggered.
- $C_{full\ scale}$ is 100 PPM for the AMC-S2e-CO.
- 1.32V is level the AMC-S2e has been factory calibrated to for 100 PPM CO.
- V_{LOW} is the voltage measured in the previous step, representing the zero gas output level

Adjust to appropriate alarm trimpot for the desired threshold.

- For increasing thresholds, the ALARM threshold must be higher than the WARNING threshold.

EXAMPLE 1: To set an ALARM threshold of 50 PPM with the AMC-S2e;

- Install AMC-S2e, wait the stabilization period and measure the output signal at TP4 and record as V_{LOW} (use 0.380V for this example).
- C_{alarm}: 50 PPM

- $C_{full\ scale}$: 100 PPM (AMC-S2e is calibrated to this value at the factory)
- V_{alarm} = ((50 PPM / 100 PPM) * (1.320V – 0.380V)) + 0.380V
  = 0.850V

RV6 would be adjusted so that 0.850V is measured at TP6.

EXAMPLE 2: To set a WARNING threshold of 25 PPM with the AMC-S2e;

- Install AMC-S2e, wait the stabilization period and measure the output signal at TP4 and record as V_{LOW} (use 0.380V for this example).
- C_{alarm}: 25 PPM
- $C_{full\ scale}$: 100 PPM (AMC-S2e is calibrated to this value at the factory)
- V_{alarm} = ((25 PPM / 100 PPM) * (1.320V – 0.380V)) + 0.380V
  = 0.615V

RV5 would be adjusted so that 0.615V is measured at TP5.

5.6.2.3 Recalibration

Refer to the AMC-S2e manual for recommended recalibration & replacement periods. Whenever the AMC-S2e is recalibrated or replaced, the Gas Monitor should also be recalibrated.

5.6.3 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-CK2700. For additional reference see the AMC-CK2700 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.

5.6.3.1 Setting Up Chamber and Applying Gas

Prior to applying gas to the sensor, follow the procedure shown in Figure 16 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 Figures 17 and 18. Measure the gas sample in the 1cc syringe to obtain the desired concentration. Please refer to the following gas concentration chart.

Table 7: 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.

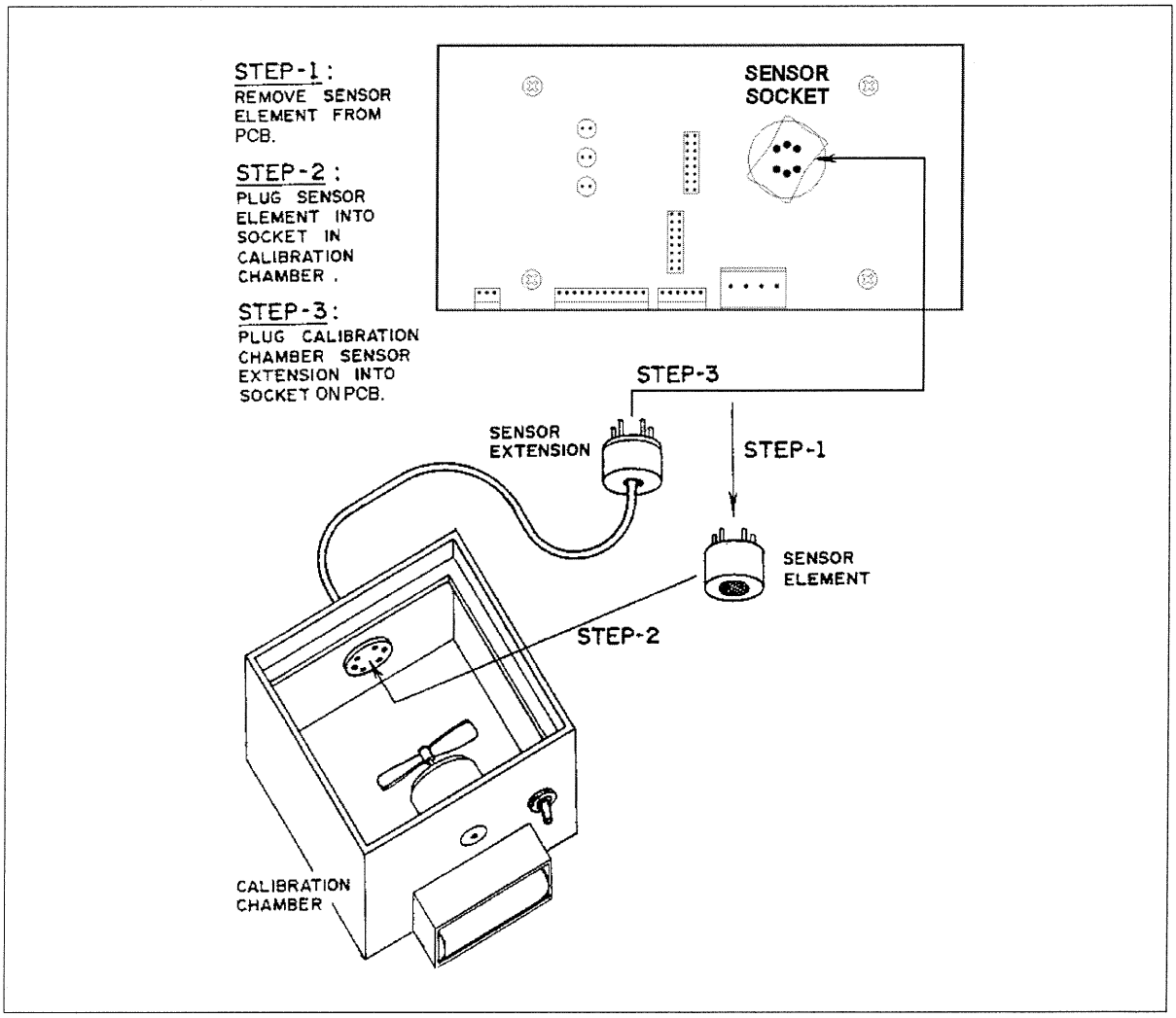

Figure 16: Calibration chamber set-up procedure.

5.6.3.2 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 15.

Trimpot RV5 is 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 is 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.

Trimpot RV4 is 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 point TP4, see Figure 19. 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 16.

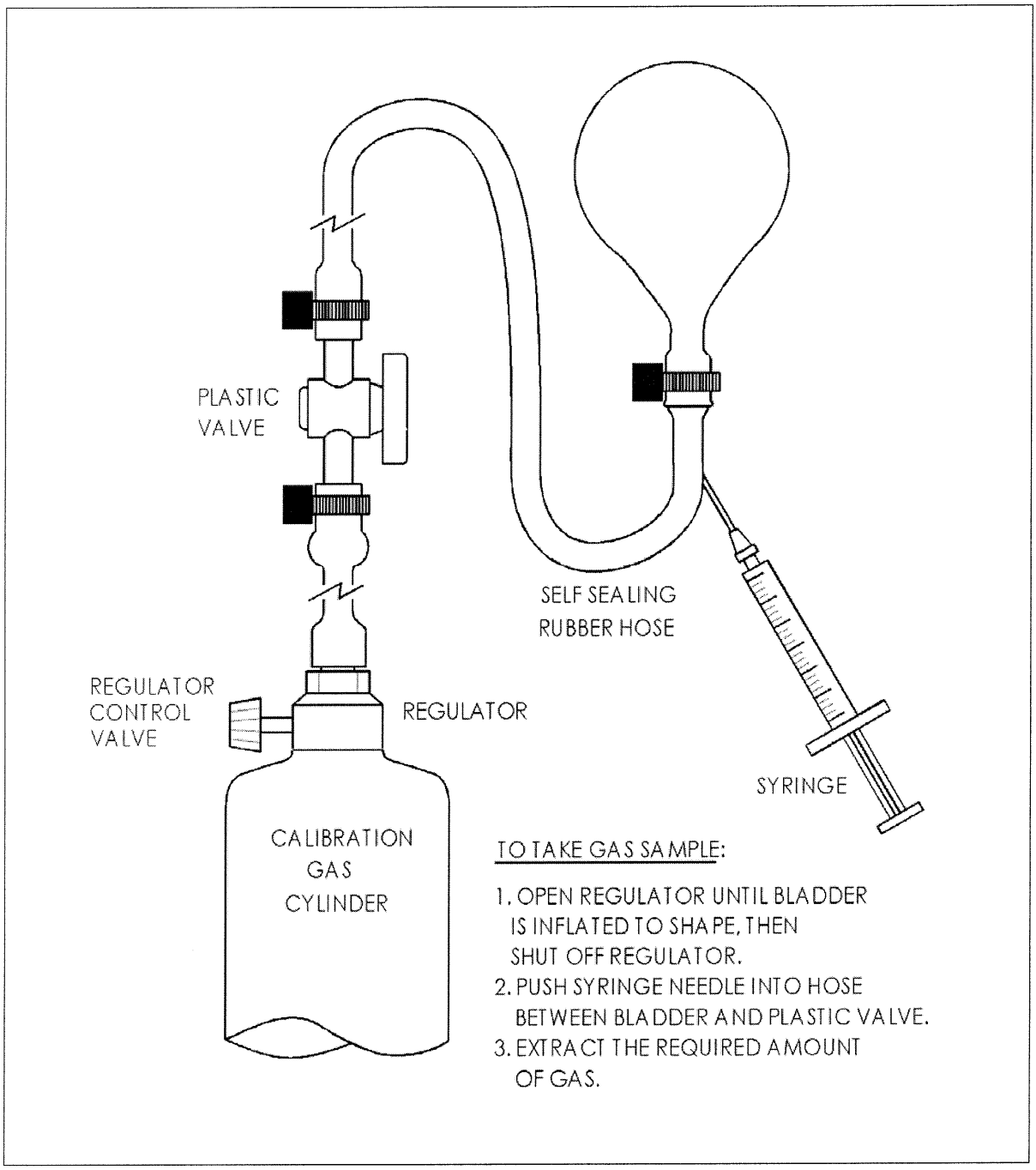

Figure 17: Taking gas sample

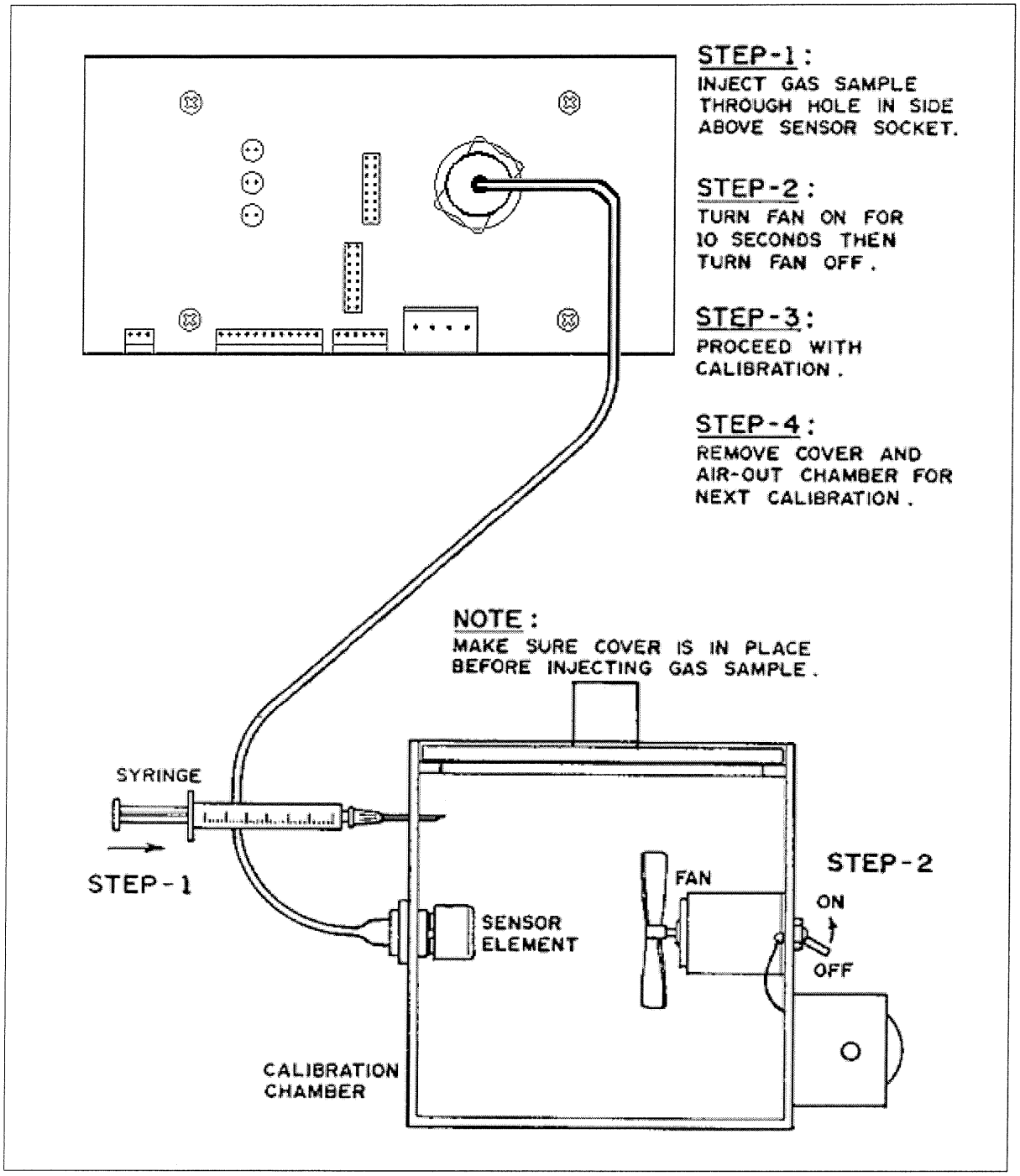

Figure 18: Injecting gas sample for calibration

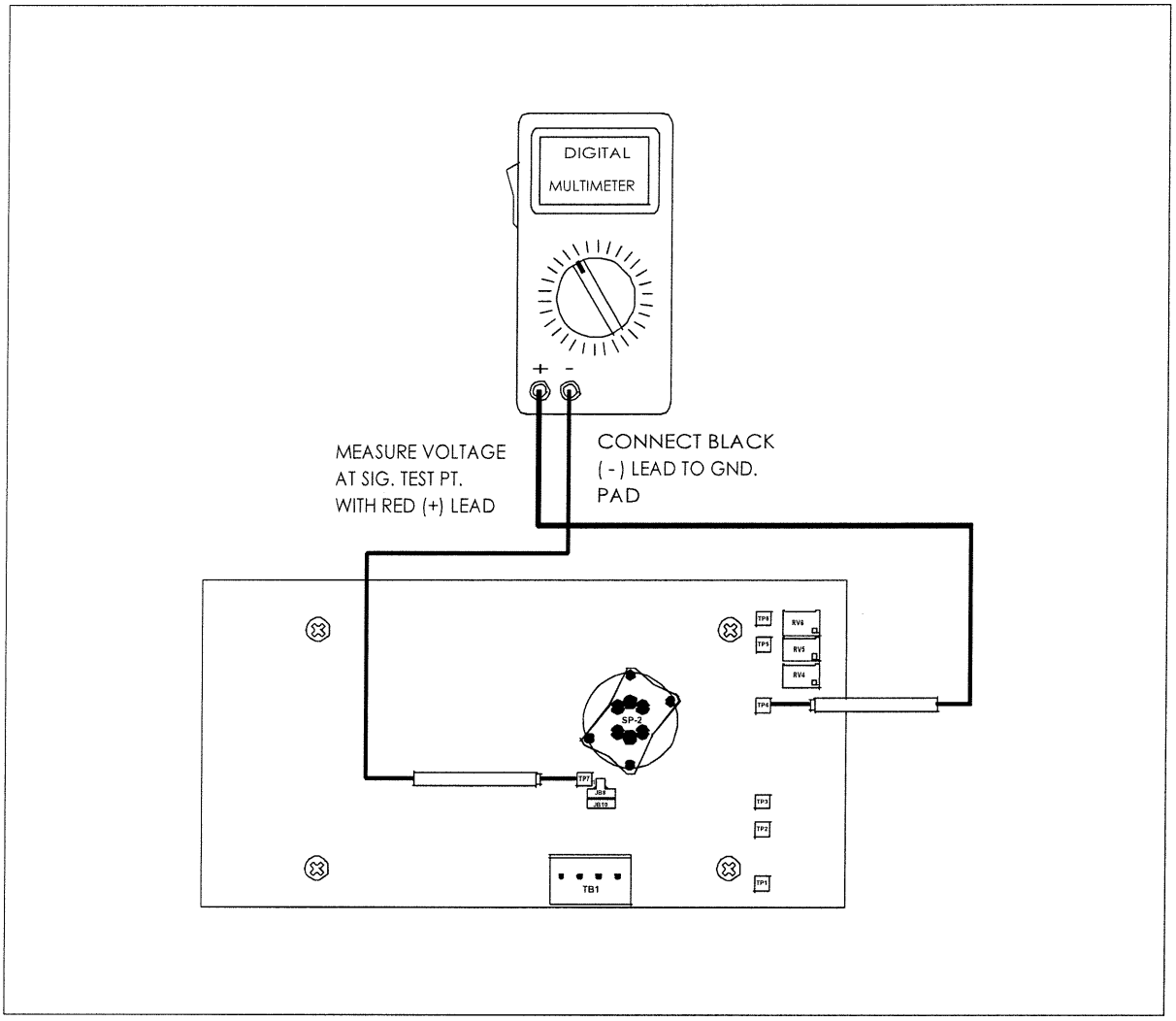

Figure 19: Trimmer adjustment and test point locations

5.6.4 AMC122X FAMILY OF MULTIDROP MODULES

This section discusses the principle of the WARNING and ALARM thresholds on the Gas Monitor when connected to a multidrop voltage 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 8: 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 multidrop module, the monitor is factory set to simply recognize their sittings; therefore, no user adjustments reside in the monitor.

Calibration is preformed at the multidrop module as specified in the module specific manual.

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

6 PREVENTIVE MAINTENANCE

This section covers all aspects of the Gas Monitor 1A1 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 operation.

6.3 SENSOR REPLACEMENT

CAUTION

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

The first indication that a sensor should be replaced is when the RUN/FAULT/OFF green LED is flashing (Fault condition). If the green LED is flashing, refer to the corresponding calibration section and follow the calibration steps. If the sensor will not calibrate properly, replace the sensor.

ON-BOARD AND REMOTE SENSOR:

Refer to the corresponding installation section; 4.2.3.1.1 Solid State Sensor or 4.2.3.1.2 AMC-S2e 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 AMC-S2e or 5.6.3 Solid State; On-Board and Remote Sensors.

TRANSMITTER OR MULTIDROP:

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

7 INSTALLATION TIPS AND TRICKS

CABLING

- Cabling – use 2 conductor with 2 wire transmitter and 3 conductor with everything else, generally 18 gauge but not true in all cases, shielded wire to connect all gas sensors.
- Route cabling in conduit to avoid damage to cabling.
- Sensor cable sheath must be grounded at the monitor end only; the cable sheath at the sensor 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 source of electro-magnetic interference (EMI) or radio frequency interference (RFI) such as power transformers, electric motors, etc.
- 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 due.
- Ensure a balanced layout of sensors to cover the intended area.
- Ensure that sensors are not in close proximity to clean air sources.

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.