



# Model 5100 Monitoring System

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## Instruction Manual

### **WARNING**

**THIS MANUAL MUST BE CAREFULLY READ BY ALL INDIVIDUALS WHO HAVE OR WILL HAVE THE RESPONSIBILITY FOR USING, MAINTAINING OR SERVICING THIS PRODUCT. Like any piece of complex equipment, this product will perform as designed only if installed, used and serviced in accordance with the manufacturer's instructions. OTHERWISE, IT COULD FAIL TO PERFORM AS DESIGNED AND PERSONS WHO RELY ON THIS PRODUCT FOR THEIR SAFETY COULD SUSTAIN SEVERE PERSONAL INJURY OR DEATH.**

The warranties made by Mine Safety Appliances Company with respect to this product are voided if the product is not installed, used and serviced in accordance with the instructions in this manual. Please protect yourself and others by following them. We encourage our customers to write or call regarding this equipment prior to use or for any additional information relative to use or repairs.

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Manufactured by  
**MINE SAFETY APPLIANCES COMPANY**  
PITTSBURGH, PENNSYLVANIA 15230

# MSA

## Permanent Instrument Warranty

- Warranty-** Seller warrants that this product will be free from mechanical defect or faulty workmanship for a period of eighteen (18) months from date of shipment or one (1) year from installation, whichever occurs first, provided it is maintained and used in accordance with Seller's instructions and/or recommendations. This warranty does not apply to expendable or consumable parts whose normal life expectancy is less than one (1) year such as, but not limited to, non-rechargeable batteries, filament units, filter, lamps, fuses etc. The Seller shall be released from all obligations under this warranty in the event repairs or modifications are made by persons other than its own or authorized service personnel or if the warranty claim results from physical abuse or misuse of the product. No agent, employee or representative of the Seller has any authority to bind the Seller to any affirmation, representation or warranty concerning the product. Seller makes no warranty concerning components or accessories not manufactured by the Seller, but will pass on to the Purchaser all warranties of manufacturers of such components. **THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY, AND IS STRICTLY LIMITED TO THE TERMS HEREOF. SELLER SPECIFICALLY DISCLAIMS ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.**
- Exclusive Remedy-** It is expressly agreed that Purchaser's sole and exclusive remedy for breach of the above warranty, for any tortious conduct of Seller, or for any other cause of action, shall be the repair and/or replacement at Seller's option, of any equipment or parts thereof, which after examination by Seller is proven to be defective. Replacement equipment and/or parts will be provided at no cost to Purchaser, F.O.B. Seller's Plant. Failure of Seller to successfully repair any nonconforming product shall not cause the remedy established hereby to fail of its essential purpose.
- Exclusion of Consequential Damage-** Purchaser specifically understands and agrees that under no circumstances will seller be liable to purchaser for economic, special, incidental or consequential damages or losses of any kind whatsoever, including but not limited to, loss of anticipated profits and any other loss caused by reason of nonoperation of the goods. This exclusion is applicable to claims for breach of warranty, tortious conduct or any other cause of action against seller.

# General Warnings

## WARNING

1. The Monitor described in this manual must be installed, operated and maintained in strict accordance with its labels, cautions, warnings, instructions, and within the limitations stated.
  2. The control module housing must be located in a nonhazardous area.
  3. Use genuine MSA replacement parts when performing any maintenance procedures
- provided in this manual. Failure to do so may seriously impair instrument performance. Repair or alteration of the Model 5100 Monitor, beyond the scope of these instructions or by anyone other than a certified MSA serviceman, could cause the product to fail to perform as designed and persons who rely on this product for their safety could sustain severe bodily injury or death.

**Failure to follow the above warnings can result in serious personal injury or death.**

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# Section 1 General Information

## General Description

The Model 5100 Monitoring System is designed to monitor various sensors.

There are two models: a frequency type of sensor input and a 4 to 20 mA type of sensor input. This manual applies to both models. To identify your model, see Appendix A "Installation Outline Drawing." This drawing

describes the assemble-to-order (ATO) code. Locate your ATO code from the invoice or packing slip and determine the options you have ordered.

Each Monitor has three set points per channel to offer the user maximum Hazard Level set point flexibility. The Monitor is a dual-channel, wall-mount indicating and alarm unit for independent monitoring of two sensors.

Table 1-1. General Specifications		
Electrical Characteristics		
POWER REQUIREMENT	AC	85 to 264 VAC, 50/60 Hz, 35 VA max. input
	DC	12 Volts (9.2 - 16); 24 Volts (19 - 32); 48 Volts (38 - 63). 25 Watts max.
SENSOR CAPACITY		Two sensors, one per channel
SENSOR POWER		+12 Volts/+24 Volts, 0.75 A per sensor max.
READ-OUT		Three digit LED display per channel; 3/8" digits
SET POINTS	HAZARD LEVEL	Three Hazard set points per channel (CAUTION, WARNING and ALARM with indicating DESCRIPTORS (C, W & A)
	FULL SCALE INDICATION	Variable .1 to 99.9 or 1 to 999 or commonly used pre-sets
HYSTERESIS		2% of the selected full-scale range for all set points
RELAYS	HAZARD LEVEL	One discrete relay for each Hazard Level (six total)
	TROUBLE	One (common)
	HORN	One (common)
	STATUS	All (except horn) have one LED to indicate coil voltage
	TERMINALS	#12 gauge maximum wire size
CONTACTS		Single-pole, double-throw (form C); Rated 120 VAC, 5 amps, resistive
AUDIBLE ALARM		Piezo electric horn: approximately 75 decibels at 3 feet with door open
CURRENT LOOP OUTPUT		4-20 mA output ( $\pm 1\%$ of full-scale) per channel Non-isolated, 250 Ohm load (maximum), Current sourcing
RECEIVER INPUT	DUAL CHANNEL	Frequency reception 4-9 KHz range (nominal) 200 mV peak-to-peak sensitivity
		4 to 20 mA, non-isolated, sinking, 30 ohms input resistance to common (-)
OPERATING RANGE	RELATIVE HUMIDITY	15 to 95%*
	TEMPERATURE	Operating: 32° to 104°F (0° to 40°C); Storage: -40° to 131°F (-40° to 55°C)
CLASSIFICATION	NEMA 4X	Type 4X enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, and hose-directed water. They shall meet the hose-down, dust, external icing, and corrosion-resistance design tests. They are not intended to provide protection against conditions such as internal condensation or internal icing. This enclosure should only be used in non-hazardous areas.
Physical Characteristics		
GENERAL-PURPOSE NEMA 4X ENCLOSURE DIMENSIONS		15.50 in. high x 11.75 in. wide x 7.62 in. deep; (393 mm. high x 298 mm. wide x 194 mm. deep)
NEMA 4X CASE WEIGHT		Approximately 13 lbs. (5.9 KG.)
*Tested to 85% relative humidity by UL.		

# Features

## One-man Calibration

Model 5100 Monitor calibration requires only one person at the sensor. No calibration adjustments are made at the Model 5100.

## Protected Hazard Level Set Point Values

All Hazard Level set point settings, made via the front-panel, are placed into the Monitor's memory. These values remain unchanged during power outages and when the Monitor is turned OFF. There are no back-up batteries to monitor or replace.

## User Read-out Range Select

The Monitor Processor Board includes a READ-OUT RANGE SELECTOR SWITCH for each channel (SW2 and SW3, FIGURE 1-1). These switches enable the user to connect a different type of sensor for each channel, and to select the proper read-out full scale indication for each

application. It is also possible to select a different full scale indication than the ones given in TABLE 3-1. This allows any full scale reading from .1 to 99.9 in .1 increments or 1 to 999 in 1.0 increments.

## User Function Select

The warning and alarm Hazard Level set points can be activated upon excursions above or below a set value of the LED display. Either or both channels may be disabled when not in use to avoid misleading Trouble indications. Each channel's warning and alarm Hazard Level set points may

be selected to provide either an all latching or an all non-latching operation. This is done via the two FUNCTION SELECTOR SWITCHES on the Processor Board (SW1 and SW4, FIGURE 1-1).

**⚠ CAUTION**

To comply with FMRC, the alarm must be in the Latching Mode.

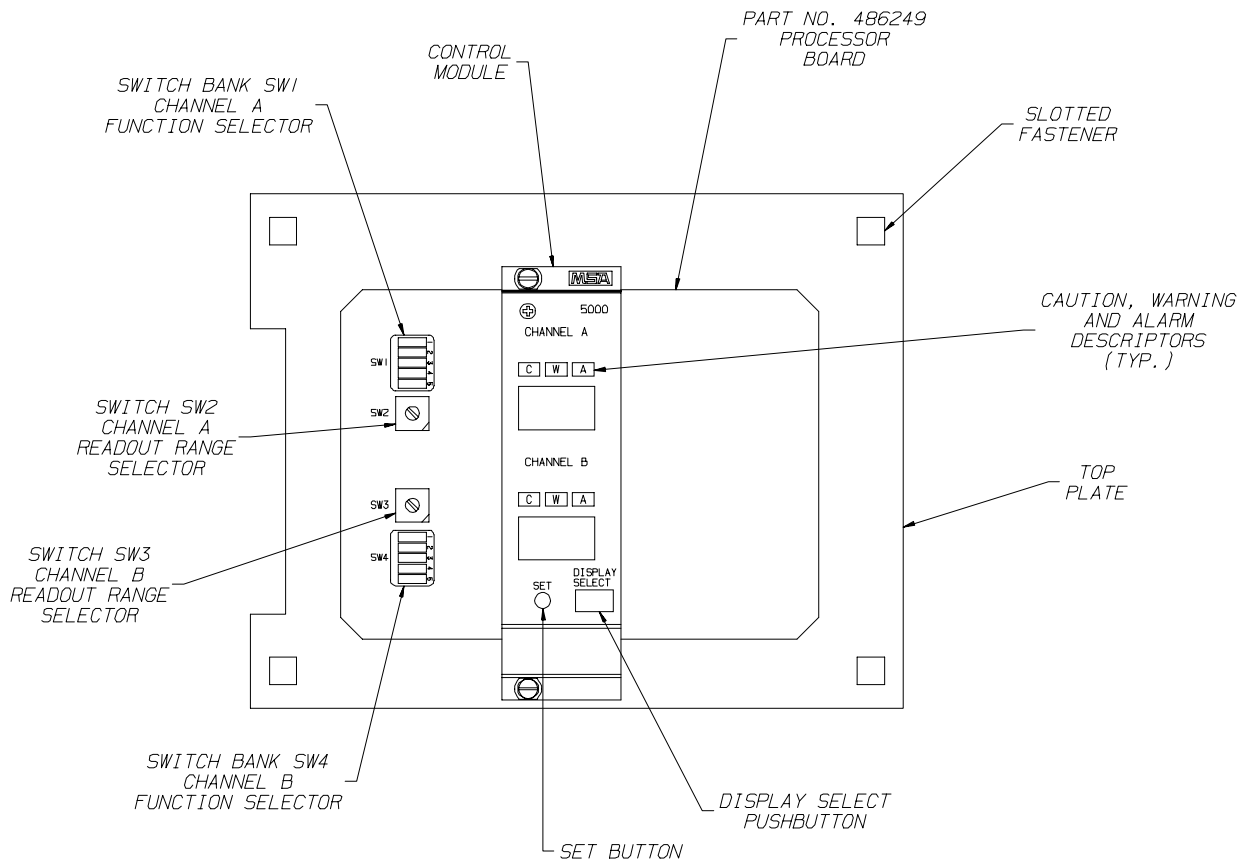


Figure 1-1.

Model 5100 Monitor, Two-Channel Front Panel and Processor Board Functions

### Relay Printed Circuit Board (PCB)

Any or all of the six Hazard Level relays may be selected to provide a normally energized (fail-safe) or normally non-energized mode of operation by jumper selection on the Relay Board (FIGURE 1-2). The normally energized relay (fail-safe) de-energizes and transfers contact on loss of power or when Trouble is indicated on any channel.

### Wireless Remote Control (Non-intrusive Option)

The Wireless Remote Controller allows the Model 5200 functions to be accessed without opening the front cover. The Receiver/Decoder is mounted close to the read-out inside the window and the Transmitter Wireless Remote can perform the following functions:

Front Panel Commands	
ACK	This command will act as a remote HORN ACKNOWLEDGE. Only a brief signal duration is needed
SELECT	This command, when used in repeated actuations, serves as a remote DISPLAY SELECT
SET	This command, when used in a continuous mode, will scroll numeric values in order to SET the desired alarm points. Similarly, numerical values may be scrolled to SET the desired full scale range. This command may be used in repeated actuations so that the SET value may be approached in an incremental basis
CAL	A single activation of this command will force the module into the CALIBRATION mode for Channels A and B. When actuated during the initialization period for a given Channel, the full scale range scrolling feature is enabled

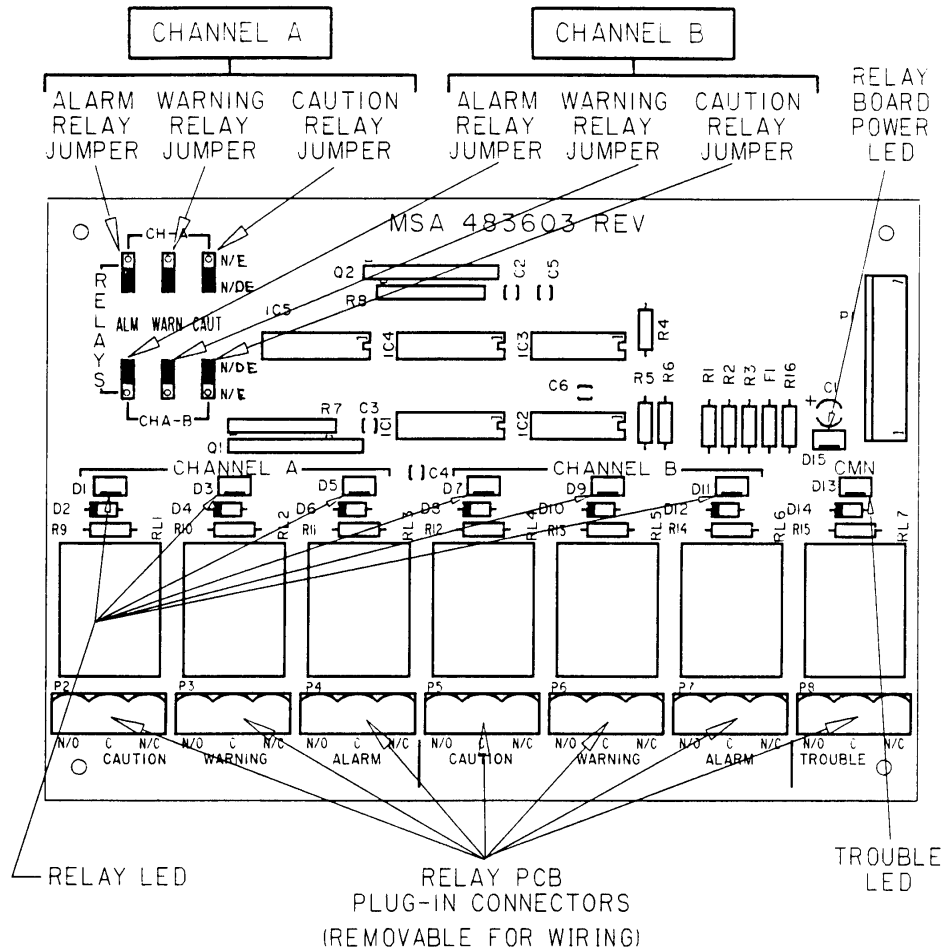


Figure 1-2.

Relay Printed Circuit Board (PCB) Functions

## Section 2 Installation

### Mounting the System

1. Choose a mounting location that is as free as possible from shock, vibration, physical damage and water. (See Appendix A, Installation Outline Drawing.)

#### **⚠ CAUTION**

Make sure that the front panel of the Control Module is not blocked; otherwise, the front-panel lights and controls will be obscured from view.

2. The Model 5100 Monitor is designed for easy installation and can be removed from the case to allow the user to create sensor and power entries before final Monitor installation.

#### **Model 5100 Monitor Installation** (See Appendix A Drawing)

- 1) Loosen the six captive screws on the Monitor front door, and open the front door.
- 2) Remove the two wires from the HORN/ALARM ACKNOWLEDGE PUSH BUTTON inside the front door.
- 3) Remove the four corner screws from the bottom mounting plate.
- 4) Lift the complete Monitor from the case.
- 5) Create sensor and power entries. Use NEMA 4X rated components to maintain the rating of the enclosure.
- 6) Re-insert Monitor into its case, fastening it via the four corner screws on the bottom mounting plate.
- 7) Re-attach the wires on the HORN /ALARM ACKNOWLEDGE PUSH BUTTON on the inside of the front door.
- 8) Close Monitor front door, and tighten the six captive screws.
- 9) Mount the Monitor, using 1/4-inch diameter bolts (not supplied).

### Connections

Perform all wiring connections and conduit runs according to accepted commercial wiring practices. Install the Model 5100 Monitor in compliance with the applicable requirements of

the National Electrical Code and/or any other local code requirements. Use NEMA 4X rated components to maintain the rating of the enclosure.

### Primary Power Connections

#### **⚠ WARNING**

Before wiring the Control Module, disconnect the main power; otherwise, an electrical shock could occur.

**NOTE:** The Model 5100 Monitor does not include an ON/OFF switch; a convenient disconnect should be installed.

1. Route power, ground and signal wiring through electrical entry holes in the housing. Power and ground wiring must be separated from signal wiring. See Appendix A, Installation Outline Drawing for recommended entry locations.
2. Connect the Monitor power source to the POWER BLOCK, located at the base of the chassis (FIGURE 2-1). See "Power Connections" portion of Appendix A, Installation Outline Drawing.

#### **⚠ CAUTION**

Improper application of the primary power to the Monitor may cause damage to the unit. If unsure of the available power, contact your local power utility for clarification. Verify that the unit's voltage rating matches the power supply line.

To determine the type of power supply module in your Monitor, check the base plate label.

### Sensor Connections

There are four basic versions of the Model 5100 Monitor designed to accommodate a wide range of sensor types:

- +12 V, frequency input
- +12 V, 4 to 20 mA input
- +12 V/+24 V, frequency input
- +12 V, +12 V, 4 to 20 mA input

Refer to Appendix A, "Sensor Connections" portion of the Installation Outline Drawing for your Model 5100 sensor connection information.

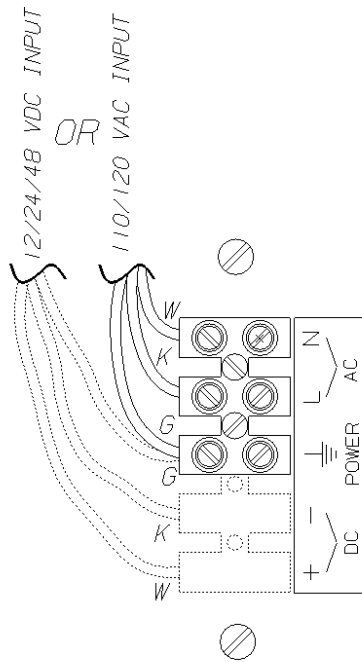


Figure 2-1.  
Power Terminal Block and Bracket

### Remote Device Connections

#### Relay Connections 4 to 20 mA Output Connections

(See "Current Output" portion of Appendix A, Installation Outline Drawing)

All monitors provide a 4 to 20 mA output from each channel for use with remote readout or control device(s). Connections can be made with a two-conductor, shielded cable. Connections are made to the positive (+) and negative (-) terminals of each channel. The Shield Ground screws are available for the cable shield(s). Route remote wiring through electrical entry holes, separate from AC power wiring.

**NOTE:** This signal is non-isolated and can drive a 250-0hm load max.

Make connections to relay terminals as required for the installation; see Appendix A Drawing for terminal descriptions.

**NOTES:**

- 1) The Horn and Horn Relay (located on the Input/Output Board) energizes with all Hazard Levels configured as latching. They are dedicated Latching, and will remain energized until acknowledged.

On any Hazard Levels configured as non-latching, the Horn and Horn Relay will not activate upon Hazard Level conditions.

- 2) The Trouble relay (located on the Relay Board) is normally energized, and de-energizes when Trouble is detected.

The common Trouble and common Horn relays cannot be programmed

- 3) The dedicated relays (Channel A or B CAUTION, WARNING and ALARM) are located on the Relay Board and are selectable for normally-energized (N/E) or normally non-energized (N/DE) modes of operation.
- 4) Establish and verify the intended function before wiring.
- 5) In order to prolong Relay Printed Circuit Board life and to reduce noise, it is recommended that the user install capacitor-resistor protective devices [such as the Paktron Quencharc™ (MSA Part No. 630413) at the load]. Ratings must correspond to the line voltage and load.

## Front-Panel Indicator and Control Description

The Control Module front-panel contains 3-digit LED displays and Hazard Level DESCRIPTORS for each channel, as well as a SET PUSH BUTTON and a DISPLAY SELECT PUSH BUTTON (FIGURE 1-1). The Hazard Level indicators are outlined in TABLE 2-1.

HAZARD LEVELS	FRONT-PANEL DESCRIPTORS	COLOR CODE
CAUTION	C	YELLOW
WARNING	W	ORANGE
ALARM	A	RED

### Front-Panel Push Buttons

When the power is ON during and after start-up, the front-panel push buttons enable the user to:

- 1) Change the Caution, Warning and Alarm set points for each Channel
- 2) Place Channel A and/or Channel B of the Control Module into the CALIBRATE mode

- 3) Monitor the value from the sensors
- 4) Change the full scale indication reading.

**⚠ CAUTION**

Set the "FULL SCALE" indication to *match* that of the sensor. Otherwise, a hazardous situation may go unnoticed.

## Processor Printed Circuit Board Rocker Switches

When the power is OFF before start-up, the processor printed circuit board ROCKER SWITCHES (SW1 and SW4) enable the user to:

- 1) Disable or enable channels
- 2) Set Latching or Non-Latching remote relay status when a warning or alarm set point is exceeded (See TABLE 3-2 for definitions)
- 3) Set the warning and alarm set point for response on an increasing or decreasing value.

## Processor Printed Circuit Board Rotary Switches

ROTARY SWITCHES (SW2 and SW3) enable the user to select the digital, full-scale readout designated for that channel's application.

# Section 3 Start-Up and Operation

## Initial Power-up

Before turning ON the main power, ensure that the proper voltage is available as described in Section 2, "Power Connections."

## Start-up Procedure

### Setting Full-Scale Indication

1. Before powering the Monitor, loosen the six captive screws on the front of the NEMA 4X enclosure cover, and open the cover. This allows direct access to the Processor Printed Circuit Board.

#### ⚠ WARNING

Always remove power from the Monitor before performing any internal operation on the instrument; otherwise, an electrical shock could occur.

2. Verify channel application and sensor type; determine the proper full scale indication required for the application.
3. Set the desired full scale indication for the front-panel displays for Channels A and B to match the FS of the sensor, via the rotary READ-OUT SELECTOR SWITCHES SW2 and SW3 (FIGURE 1-1), according to TABLE 3-1.

#### ⚠ CAUTION

Full scale settings must match that of the sensor.

4. If the desired full scale indication is not found on TABLE 3-1, place the corresponding READ-OUT SELECTOR SWITCH SW2 or SW3 in position 7 (position 7 is not FMRC approved). The full scale indication must be selected to match the FS of the sensor. This is accomplished during the start-up sequence.

**NOTE:** If the READ-OUT RANGE SELECTOR SWITCH position is changed, the Hazard Level set point values automatically correspond to the same percentage of new full-scale display reading. Do not change RANGE position with power ON.

**Example:**

A Hazard Level set point of 40.0 on RANGE 6 (0-100) of READ-OUT SELECTOR SWITCH will change to 20 when RANGE 4 (0-50) is selected.

#### ⚠ WARNING

Do not change the RANGE position while power is ON; otherwise, the indication will not switch from the previous selection, and erroneous readings will result.

## Channel Enable and Alarm Function Selection

(FIGURE 1-1 and TABLE 3-2)

1. With power OFF, function selections are made via Processor Board CHANNEL A and B FUNCTION SELECTOR SWITCH BANKS SW1 and SW4; these switches are accessed by opening the enclosure.
 

**NOTE:** The depressed side of the rocker switch indicates the switch position.
2. Enable or disable channels by turning the first rocker switch OFF or ON, respectively, of Channel A (SW1) and Channel B (SW4). See TABLE 3-2.
 

**NOTE:** If an unused channel is left enabled, a continuous TROUBLE indication will result.
3. Latching and Non-Latching Warning and Alarm functions are set by using the second or third rocker switch (see TABLE 3-2 and FIGURE 1-1).

**Table 3-1.  
Setting Full-Scale Indications**

SELECTOR SWITCH POSITIONS FOR CHANNEL A (SW2) OR CHANNEL B (SW3)	FULL-SCALE INDICATION	RESOLUTION
0	0.0 to 10.0	0.1
1 †	0 to 100	1.0
2 †	0.0 to 25.0	0.1
3	0 to 250	1.0
4 †	0.0 to 50.0	0.1
5	0 to 500	1.0
*6 †	*0 to 100	1.0
**7	.1 to 99.9	.1
	1 to 999	1.0
8 & 9	DO NOT USE	---

**\*CAUTION**  
switch position 6 prohibits set point settings of above 60% of full-scale. FMRC approval void if position 6 not used with combustible sensors.

**\*\*Variable**, Default 999 full scale

† Approved by FMRC; All other positions void FMRC approval.

**Table 3-2.**  
**Setting Channel Enable and Hazard Response Functions (Function Selector Switches)**

CHANNEL A SW1 SWITCH	CHANNEL B SW4 SWITCH	ROCKER SWITCH OFF (PRESSED AT LEFT)	ROCKER SWITCH ON (PRESSED AT RIGHT)
1	1	Channel enabled †	Channel disabled (for unused channel)
2	2	* NON-LATCHING: WARNING	* LATCHING: WARNING †
3	3	* NON-LATCHING: ALARM	* LATCHING: ALARM †
4	4	** Warns upon exceeding WARNING level set point †	*** Warns upon dropping below WARNING level set point
5	5	** Alarms upon exceeding ALARM level set point †	*** Alarms upon dropping below ALARM level set point
† Factory-Set Position			
* LATCHING/NON-LATCHING DEFINITIONS: LATCHING: Even though the alarm condition may no longer exist, the descriptors and horn remain ON until the HORN/ALARM ACKNOWLEDGE PUSH-BUTTON pressed. NON-LATCHING: When alarm condition no longer exists, the descriptors turn OFF. FMRC approval is void if Non-Latching position is chosen.			
** Descriptor ON when sensor signal goes above set point.			
***Descriptor ON when sensor signal goes below set point.			

- ROCKER SWITCHES 4 and 5 allow selection of the Warning and Alarm Hazard Level outputs for signal increasing or decreasing in value through set points.

**NOTE:** The Caution Hazard Level is factory-set for non-latching and activation on increasing signal. It is not user changeable.

## Setting the Relay Printed Circuit Board

(FIGURES 1-2 and 3-1)

### Relay Set-Up

- Remove power to Monitor via a conveniently located breaker (Appendix A, Installation Outline Drawing).

### **⚠ WARNING**

**Always remove power from Monitor before performing any internal operation on the instrument; otherwise, an electrical shock may occur.**

- Loosen the six captive cover screws to reveal the metal TOP PLATE assembly (FIGURE 1-1). Remove the TOP PLATE cover by turning the four black slotted fasteners 90° and lifting the TOP PLATE. This allows access to the Relay Printed Circuit Board (FIGURE 1-2).
- For normally energized operation (de-energizes at Hazard Level set point) of any relay, place the associated JUMPER on the Relay Printed Circuit Board over the prongs marked N/E (FIGURE 3-1).
- For normally de-energized operation (energizes at Hazard Level set point) of any relay, place the associated JUMPER on the Relay Printed Circuit Board over the prongs marked N/DE (FIGURE 3-1).

- Re-assemble the top plate to the chassis, and close and secure the cover after relay functions are set.

## 30-Second Menu Sequence at Instrument Start-Up and Reset

(FIGURE 1-1)

Turn ON the main power which feeds the Monitor; there is no power switch on the instrument.

- The green RELAY BOARD POWER LED (FIGURE 1-2) should turn ON.

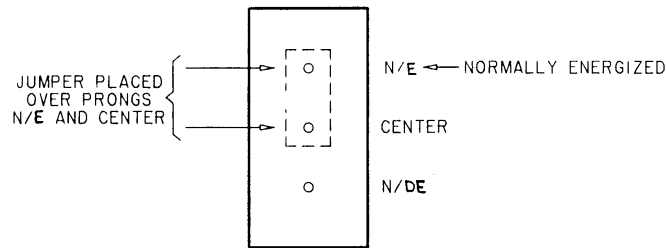
**NOTE:** To view the RELAY BOARD POWER LED, remove the TOP PLATE of the Monitor (FIGURE 1-1). If the LED does *not* turn ON, refer to SECTION 5, "Troubleshooting Guidelines" for proper diagnostic steps.

- The Control Module automatically runs a 30-second menu sequence for Channels A and B.
- During this 30-second period:
  - All alarms are disabled
  - The 4-20 mA remote output will go to approximately 4 mA
  - Sensors stabilize without erroneous Hazard indications
  - The Trouble relay drops out

**The 30-Second Menu Sequence Is Divided Into two 15-second Modes:**

- The Full Scale Mode and
- The Lamp Test Mode.

EXAMPLE 1. RELAY NORMALLY ENERGIZED WHEN JUMPER PLACED OVER PRONGS N/E AND CENTER



EXAMPLE 2. RELAY NORMALLY DE-ENERGIZED WHEN JUMPER PLACED OVER PRONGS N/DE AND CENTER

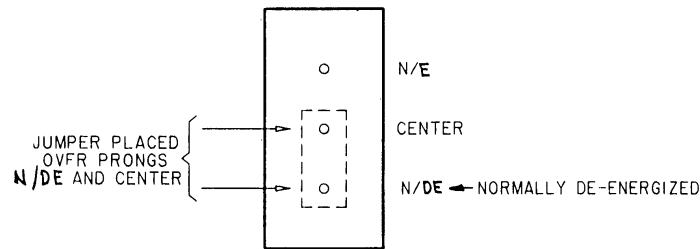


Figure 3-1.

Model 5100 Relay PC Board Relay Set-Up

- As CHANNEL A performs the Full Scale Mode, CHANNEL B performs the Lamp Test Mode.
- Fifteen seconds into the Menu sequence, CHANNEL A switches to the Lamp Test Mode and CHANNEL B switches to the Full Scale Mode.

**Full Scale Mode**

When power is applied, the Monitor provides the full scale indication for the channel currently in the Full Scale Mode:

- 1) The 3-digit reading provides the following data:
  - a) ALL THREE DIGITS (XX.X or XXX) denote the actual Full Scale Setting.  
 Example:  
 99.9 = Actual Full Scale Setting

- b) During the Full Scale Mode, observe the front-panel DESCRIPTORS (C, W and A LEDs, FIGURE 1-1) to determine if the Hazard Level set point provides an increasing or decreasing alarm according to TABLE 3-3.
- 2) Direct Full Scale setting Capability: (application when in position 7 on the RANGE SWITCH). If the DISPLAY SELECT PUSH

<b>Table 3-3. Determine Increasing/Decreasing Hazard Level Set Points</b>	
C, W AND A LED STATUS DURING COUNTDOWN MODE	ASSOCIATED HAZARD LEVEL SET POINT TYPE
ON	LATCHING AND INCREASING HAZARD
OFF	NON-LATCHING AND INCREASING HAZARD
BLINKING	LATCHING OR NON-LATCHING/ DECREASING HAZARD

BUTTON is pressed during the start-up sequence, the channel displaying its full scale range will blink. It is, in effect, asking the user for a new full scale value. By pressing the SET button, it is possible to scroll to a new full scale range. This value (which must correspond to the sensor full scale) will be stored in memory. All hazard levels will be scaled to reflect the new full scale indication. Pressing the DISPLAY SELECT again allows the module to continue its start up sequence. The other channel is programmed in the same way.

If the DISPLAY SELECT is not pushed during the start up sequence, the module will use the default 999 full scale value or a full scale value that was entered previously.

### Lamp Test Mode

During the channel Lamp Test Mode, the channel:

- Displays a front-panel digital reading of 88.8
- Turns ON the C, W and A DESCRIPTORS to verify that all lamps are working properly.

## Control Module Factory-Set Values

### Full Scale Selector SW2 and SW3

TABLE 3-1 and FIGURE 1-1

The normal factory-setting is position 6, 0 to 100 full scale.

**NOTE:** If position 7 (variable full scale) is selected, the pre-set full scale is 999.

### Hazard Level Set Point Values

The Hazard Level set point values for each channel are factory-set as follows:

- Caution set point: 20
- Warning set point: 30
- Alarm set point: 40

These set point values can be changed (See Section 3, "Changing Hazard Level Set Points" and TABLE 3-1). The user must verify that the Monitor is set up to meet his requirements.

### Function Selector Switch Position

(TABLE 3-2 and FIGURE 1-1)

All FUNCTION SELECTOR SWITCHES are normally factory-set for the following operation:

SW1 and SW4 FACTORY SET-UP		
NUMBER	FUNCTION	POSITION
1	Channel enabled	OFF
2	Latching Warning	ON
3	Latching Alarm	ON
4	Warns upon exceeding WARNING set point	OFF
5	Alarms upon exceeding ALARM set point	OFF

## Relay Printed Circuit Board Factory-Settings

### Relay Jumpers

All relay jumpers are factory-set in the N position (normally energized relays) (FIGURES 1-2 and 3-1).

## Viewing Existing Hazard Level Set Points On Front-Panel Display Select Menu

(FIGURE 1-1 and TABLE 3-4)

To view the existing Hazard Level set points, step through the Display Select Menu by pressing the front-panel DISPLAY/SELECT PUSH BUTTON (FIGURE 1-1) the number of times indicated in column 1 of TABLE 3-4.

## Changing Hazard Level Set Points

(FIGURE 1-1 and TABLE 3-4)

### To Change the Hazard Level Set Points:

1. Press the front-panel DISPLAY/SELECT PUSH BUTTON on the Control Module the number of times indicated in TABLE 3-4 until reaching the set point to be changed.
  - The appropriate Caution, Warning or Alarm DESCRIPTOR will turn ON (steady).
  - The existing set point value will flash.
2. Using a small device such as a screwdriver, press the Control Module front-panel SET push button, via the hole in the front-panel.
3. Hold down the SET push button, and allow the set point values to scroll. When the desired set point is displayed, release the button.
4. Press the DISPLAY/SELECT push button to manually place the Module in the RUN MODE. This also enters the new set point into the memory. The display will now show the sensor value. The new set point can be verified by stepping through the menu per TABLE 3-4.

**Table 3-4. Front-Panel Display/Select Menu**

TIMES DISPLAY SELECT BUTTON PUSHED	ASSOCIATED DISPLAY SELECTED	ASSOCIATED CHANNEL	FRONT-PANEL DISPLAY DESCRIPTION (SEE "NOTES" BELOW)	
START	RUN MODE			SENSOR VALUE SHOWN
1	CAUTION SET POINT	A	(*)	CAUTION DESCRIPTOR ON
2	RUN MODE			SENSOR VALUE SHOWN
3	WARNING SET POINT	A	(*)	WARNING DESCRIPTOR ON
4	RUN MODE			SENSOR VALUE SHOWN
5	ALARM SET POINT	A	(*)	ALARM DESCRIPTOR ON
6	RUN MODE			SENSOR VALUE SHOWN
7	CAUTION SET POINT	B	(*)	CAUTION DESCRIPTOR ON
8	RUN MODE			SENSOR VALUE SHOWN
9	WARNING SET POINT	B	(*)	WARNING DESCRIPTOR ON
10	RUN MODE			SENSOR VALUE SHOWN
11	ALARM SET POINT	B	(*)	ALARM DESCRIPTOR ON
12	RUN MODE			SENSOR VALUE SHOWN
13	CALIBRATE MODE	A	(**)	Flashes sensor value; sensor can now be calibrated with Calibration Box and appropriate calibration procedure
14	RUN MODE			SENSOR VALUE SHOWN
15	CALIBRATE MODE	B	(**)	Flashes sensor value; sensor can now be calibrated with Calibration Box and appropriate calibration procedure
16	RUN MODE			SENSOR VALUE SHOWN
17	CALIBRATE MODE	A & B	(**)(***)	Can calibrate 2 sensors simultaneously
START	RUN MODE			Repeat cycle

**CAUTION:** Do not leave the instrument in the CALIBRATE mode; otherwise, the instrument will not actuate the Horn or relays to alert the user of any dangerous conditions that may develop. There is a two hour time limit. After the time limit, the instrument returns to the RUN MODE.

**NOTES:**  
 (\*) When in this Select Mode, the display flashes existing value of Hazard Level set points. The 4-20 mA signal continues to follow the sensor output signal.  
 If left idle, the System automatically reverts to the RUN mode in several minutes.  
 (\*\*) When in this Select Mode, the 4-20 mA output of that channel will hold at that channel's preceding RUN Mode output value.  
 (\*\*\*) It is possible to go direct to calibration of both channels by pressing both the DISPLAY SELECT and the SET push buttons simultaneously.

- Repeat steps 1 through 4 above until the desired set point change for the second Channel of the Control Module is completed.

## Interpreting Control Module Front-Panel Display Indications

(FIGURE 1-1 and TABLE 3-5)

TABLE 3-5 identifies Control Module front-panel, three-digit displays for TROUBLE, OVER RANGE, UNDER RANGE and CALIBRATION conditions.

## Responding to Hazard Level Conditions

**When the Sensor Value Digital Reading Exceeds a Hazard Level Set Point:**

**NOTE:** Decreasing value may be for oxygen deficiency monitoring.

- With the *non-latching* function selected (TABLE 3-2):
  - The digital reading and the hazard level descriptor of the exceeded set point will flash simultaneously, and any relay selected for that descriptor will transfer. This condition will continue until acknowledged or until that hazard condition no longer exists.

**Acknowledge:**

- Pressing the HORN/ALARM ACKNOWLEDGE PUSH BUTTON *while the hazard condition still exists* will:
  - Stop the flashing of the digital reading and descriptor (they will remain steadily ON)
  - Allow any selected relay to remain transferred until that hazard condition no longer exists.

Table 3-5. Control Module Front-Panel Display Indications

LED READ-OUT	ASSOCIATED INDICATION	DESCRIPTION
— — —	*TROUBLE	No signal received; Sensor reading below -15% of full-scale
— 0 —	*OVER RANGE	Sensor reading above range select value
— U —	UNDER RANGE	Displayed below -10% of full-scale; System still operates, but warns operator to calibrate sensor before reading falls to -15% of full-scale and TROUBLE indication occurs
0.0	CENTERED ZERO	Extra precision zero in "CALIBRATION" only
FLASHES SENSOR VALUE	**CALIBRATION	Sensor can be calibrated without inadvertently tripping an ALARM. During calibration, if set points are exceeded, that descriptor will flash alternately with the digital reading, but no alarms will activate
<p><b>*WARNING:</b> A hazardous and over limit condition may exist at the sensor location when the OVER RANGE or Trouble indication is displayed on the LED read-out.</p> <p><b>**CAUTION:</b> Do not leave the Monitor in the CALIBRATION mode; otherwise, the instrument will not monitor the sensors or alert the user of any dangerous conditions that may develop. There is a two hour time limit. After the time limit, the instrument returns to the run mode.</p>		

- 2) Pressing the HORN/ALARM ACKNOWLEDGE PUSH BUTTON *after the hazard condition no longer exists* will:

Clear all hazard indications, silence the horn, and de-energize the horn relay.

2. With the *latching* function selected:

- a) The digital reading and the Hazard Level descriptor of the exceeded set point will flash simultaneously, and any relay selected for the descriptor will transfer. This condition will continue until acknowledged.
- b) The horn will sound, and the horn relay will energize.

**Acknowledge:**

- 1) Pressing the HORN/ALARM ACKNOWLEDGE PUSH BUTTON *while the hazard condition still exists* will:
- a) Silence the horn, and de-energize the horn relay

- b) Stop the flashing of the digital reading and descriptor (they will remain steadily ON)

- c) Allow any selected relay to remain transferred (see "NOTE").

**NOTE:** When the Latching Function is selected, the HORN/ALARM ACKNOWLEDGE PUSH BUTTON must be pressed *again* when the hazard condition no longer exists in order to clear all hazard indications. Otherwise, the Monitor will not respond to a repeat of that hazard condition for that sensor (horn will not sound, etc.).

- 2) Pressing the HORN/ALARM ACKNOWLEDGE PUSH BUTTON *after the Hazard condition no longer exists* will:

Clear all hazard indications, silence the horn, and de-energize the horn relay.

# Section 4

## Calibration and Maintenance

### Calibration

1. Press the DISPLAY SELECT PUSH BUTTON until the CALIBRATE mode appears on the display (TABLE 3-4) or by pressing both DISPLAY SELECT and SET PUSH BUTTONS simultaneously.
2. The sensor can be calibrated with the appropriate calibration procedure. Refer to the sensor instruction manual for details

### WARNING

Do not leave the instrument in the CALIBRATE mode during normal use; otherwise, the instrument will not actuate the Horn or relays to alert the user of any dangerous conditions that may develop. There is a two hour time limit. After the time limit, the instrument returns to the RUN mode

### Maintenance

See the following "Troubleshooting Guidelines."

<b>Troubleshooting Guidelines</b>		
<b>SYMPTOM</b>	<b>CAUSE</b>	<b>SOLUTION</b>
<b>RELAY BOARD POWER LED fails to turn ON</b>	1) Customer input power interrupted	1)* Check and correct input power
	2) Bad connection between power cable and terminal block	2)* Check power terminal block
	3) Inoperative LED	3) Replace Relay PCB
	4) Inoperative Relay PCB	4) Replace Relay PCB
<b>TROUBLE (---) indication turns ON</b>	1) Open or shorted cable between the control unit and the sensor assembly	1) Check for continuity of sensor cable, or tighten sensor-to-pc board connections
	2) Uncalibrated sensor	2) Calibrate sensor
	3) Inoperative sensor	3) Replace sensor
	4) Blown sensor fuse	4) Replace sensor fuse
<b>OVER RANGE (-O-) indication turns ON</b>	1) Uncalibrated sensor	1) Calibrate sensor
	2) Loose sensor connections	2) Tighten sensor-to-pc board connections
	3) Inoperative sensor	3) Replace sensor
	4) Inoperative processor board	4) Replace processor board
<b>UNDER RANGE (-U-) indication sensor turns ON</b>	1) Uncalibrated sensor	1) Calibrate sensor
	2) Inoperative sensor	2) Replace sensor
	3) Inoperative processor board	3) Replace processor board
<b>Hazard Level (AAA) error</b>	1) Accidental Hazard Level changes	1) Verify setpoints; Replace processor board if condition persists
<b>If known CAUTION WARNING and/or or ALARM conditions exist, and digital read-out is correct, but DESCRIPTORS do not turn ON</b>	1) CAUTION, WARNING and/or ALARM set points set too high	1) Re-set set points
<b>*CAUTION: Exercise caution as potential shock hazard exists.</b>		

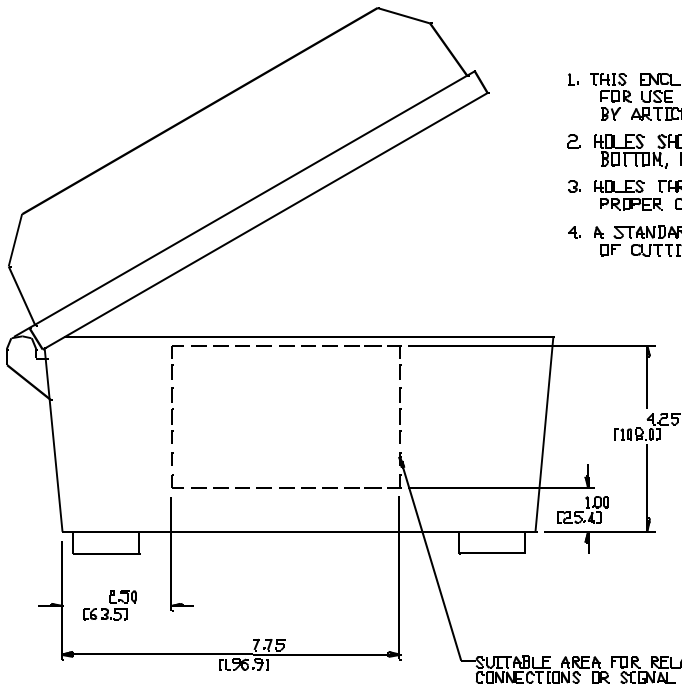
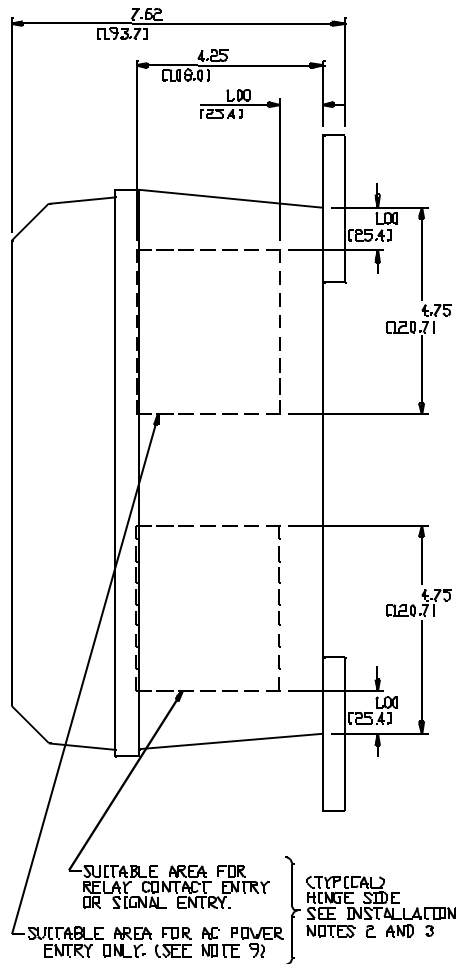
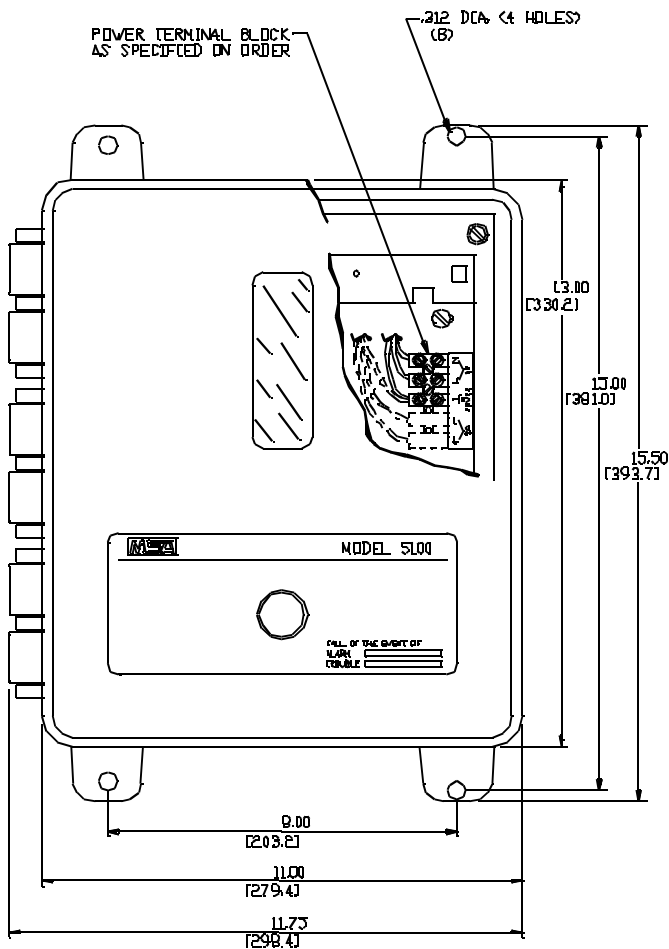
<b>Troubleshooting Guidelines</b>		
<b>SYMPTOM</b>	<b>CAUSE</b>	<b>SOLUTION</b>
<b>Digital read-out does not indicate condition</b>	1) Uncalibrated sensor	1) Calibrate sensor
	2) Inoperative or dirty sensor	2) Replace Sensor
	3) Disabled processor board	3) Verify and re-power the instrument; replace board if necessary
<b>Digital read-out blank</b>	1) Channels disabled	1) Verify that FUNCTION SELECTOR SWITCH #1 of SWITCH BANKS SW1 and SW4 are in the OFF position
<b>CAUTION, WARNING and/or ALARM DESCRIPTORS will not turn OFF, and digital read-out indicates non-hazard condition</b>	1) Latched function selected	1) Reset
	2) Improperly set CAUTION, WARNING and/or ALARM set points	2) Re-adjust set points
	3) Printed circuit board failure	3) Replace processor board
<b>Remote devices fail to operate</b>	1) Remote devices improperly connected	1) Verify remote device wiring connections
	2) Improperly seated relay PCB	2) Re-install Relay PCB
	3) Relay PCB controls improperly set	3) Verify and re-set Relay PCB
	4) No output from current loop connections	4) Verify and re-connect current output connections
	5) Low output from current loop connections	5) Reduce external load to 250 Ohms or less; check at 4 and 20 mA
<b>HORN does not sound when Hazard condition exists</b>	1) Improperly set level points	1) Re-set levels; then, verify
	2) Loose interconnecting cables	2) Re-connect interconnecting cables
	3) Inoperative User I/O PC Board	3) Replace User I/O PC Board
<b>TROUBLE relay de-activates (Trouble LED on Relay PCB is OFF)</b>	1) Loose interconnecting cables	1) Re-connect interconnecting cables
	2) Inoperative Relay PCB	2) Replace Relay PCB

## Section 5 Parts List

ITEM	MSA PART NO.
<b>SUB-ASSEMBLIES</b>	
Display Board	479767
Processor Board *	486249
Processor Board, VR-CS Type **	801003
Processor Board, 4 to 20 mA Input	815684
Relay Board *	483603
User I/O Board (12 V Sensors) *	482452
User I/O Board (12 V and 24 V Sensors)	10012966
AC Power Supply, Universal 110/220 VAC (12 V Sensors)*	488524
AC Power Supply, Universal 110/220 VAC (12 V and 24 V Sensors)	638454
DC Power Supplies	
• 12 VDC (9.2 to 16 VDC Input)	655794
• 12 VDC (19 to 32 VDC Input)	655795
• 12 VDC (38 to 63 VDC Input)	655796
Interconnect Cable (Processor to Display Board) *	486137
Wiring Harness Assembly with Connectors (12 V Sensors)*	486136
Wiring Harness Assembly with Connectors (12 V and 24 V Sensors)	10017359
<b>ACCESSORIES</b>	
Paktron Quencharc™	630413
*Only the indicated to be used for FMRC approval	
**For CSA-approved instruments	

# Appendix A

# Installation Outline Drawing



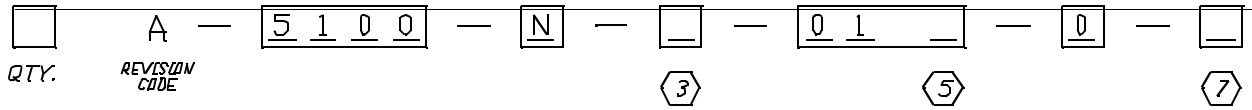
INSTALLATION NOTES

1. THIS ENCLOSURE IS NOT DESIGNED, NOR INTENDED FOR USE IN HAZARDOUS LOCATIONS AS DEFINED BY ARTICLE 500 OF THE NATIONAL CODE.
2. HOLES SHOULD NOT BE LOCATED WITHIN 1' OF TOP, BOTTOM, HINGES, CORNERS OR ANY STRUCTURAL BOSS.
3. HOLES THROUGH STRUCTURAL BOSES WILL NOT PERMIT PROPER CONDUIT TERMINATION.
4. A STANDARD HOLE SAW IS THE PREFERRED METHOD OF CUTTING ENTRY HOLES.

INSTRUMENT WEIGHT: APPROX. 14 LBS. (6.4kg)

ENCLOSURE MATERIAL: FLAM POLYPHENYLENE OXIDE PLASTIC (NORYL) NEMA 4X RATING

Model 5100 General-Purpose Enclosure Installation Outline Drawing (SK3015-140 rev 13, sheet 1 of 2)

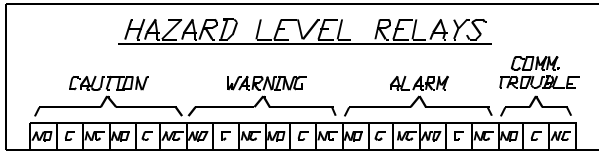


**3 POWER SUPPLY VOLTAGE**  
 1 = 110/220 VAC, 50/60 HZ  
 3 = 12 VDC (9.2-16V)  
 4 = 24 VDC (19-32V)  
 5 = 48 VDC (38-63V)

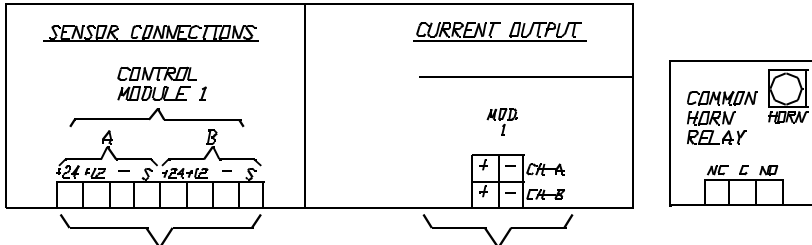
**5 CONTROL MODULE INPUT**  
 N = 4-20mA INPUT  
 F = FREQUENCY INPUT  
 C = CSA APPROVED FREQUENCY INPUT

**7 CUSTOM FEATURES**  
 0 = NONE  
 T = CUSTOM TAGGING  
 ALUMINUM TAG  
 STAINLESS STEEL TAG  
 V = 24 VDC SENSOR POWER (5100/5200 ONLY)

**ELECTRICAL CONNECTIONS**

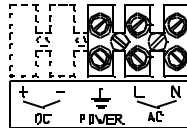


**RELAYS**  
 1. SINGLE POLE, DOUBLE THROW (FORM C), CONTACT RATINGS: 3A RESISTIVE AT 250VAC OR 24VDC.  
 2. HORN, CAUTION, WARNING AND ALARM RELAY CONTACTS ARE UNPOWERED.  
 3. TROUBLE CONTACTS ARE ENERGIZED DURING NORMAL SYSTEM OPERATION.



(-) IS THE INTERNAL +12V SUPPLY OR +24V (USER SELECTABLE)  
 (-) IS THE INTERNAL +12V AND +24V RETURN, COMMON  
 (-) IS THE FREQUENCY OR CURRENT SIGNAL INPUTS  
 FOR FREQUENCY MODULES: MSA PROPRIETARY FREQUENCY TYPE 4-9KHZ RANGE (NOMINAL)  
 FOR CURRENT MODULES: STANDARD 4-20mA TYPE, NON-ISOLATED, SINKING, 30 OHM INPUT RESISTANCE SIGNAL(S) TO COMMON (-).

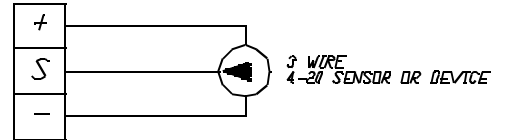
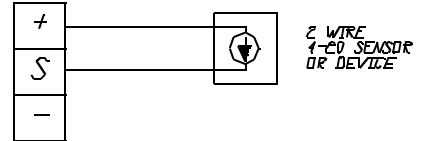
SEE INSET A FOR TYPICAL RECEIVER/SENSOR WIRING CONFIGURATIONS.  
 REFER TO SENSOR INSTRUCTIONS FOR MAXIMUM WIRE LENGTHS AND WIRE GAUGES.



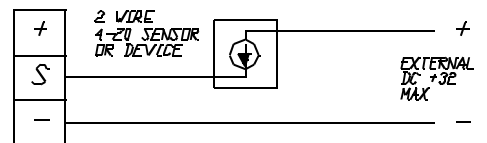
**INSET A**

**TYPICAL SENSOR CONFIGURATIONS**

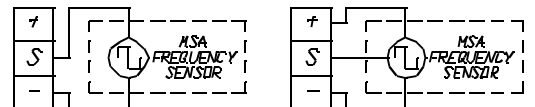
**CURRENT OUTPUT SENSORS - MSA MODULE POWERED (+12V)**



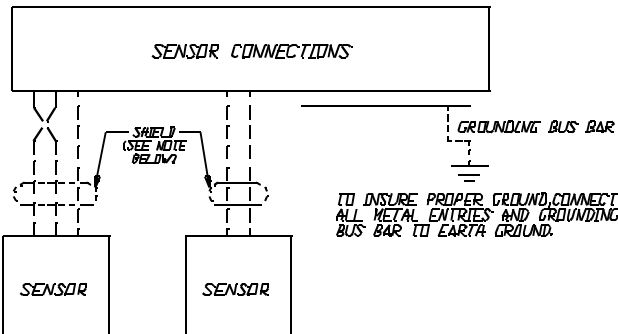
**CURRENT OUTPUT SENSOR - EXTERNALLY POWERED**



**FREQUENCY FREQUENCY OUTPUT SENSORS**



**GROUNDING/SHIELDING INFORMATION**



TO INSURE PROPER GROUND, CONNECT ALL METAL ENTRIES AND GROUNDING BUS BAR TO EARTH GROUND.

**SHIELD -** GROUND AT ONE POINT IN SYSTEM. REFER TO SENSOR MANUAL FOR SPECIFIC REQUIREMENTS

CUSTOMER \_\_\_\_\_  
 P.O. # \_\_\_\_\_  
 LOCATION \_\_\_\_\_  
 TAG # \_\_\_\_\_