



# Model 9010 and 9020 Monitoring Systems

## Instruction Manual

### WARNING

THIS MANUAL MUST BE CAREFULLY READ BY ALL INDIVIDUALS WHO HAVE OR WILL HAVE THE RESPONSIBILITY FOR USING OR SERVICING THE PRODUCT. Like any piece of complex equipment, this instrument will perform as designed only if it is 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 the product are voided if the product is not 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.

In North America, to contact your nearest stocking location, dial toll-free 1-800-MSA-INST  
To contact MSA International, dial 1-412-967-3354

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Manufactured by

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## MSA Permanent Instrument Warranty

- 1. 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, sensor elements, 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 goods sold under this contract. Seller makes no warranty concerning components or accessories not manufactured by the Seller, but will pass onto 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.**
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- 3. 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 non-operation 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 and Cautions

### WARNING

1. The Monitors 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 housings must be located in non-hazardous areas.
3. Use only 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 9010 and 9020 Monitors, beyond the scope of these maintenance instructions or by anyone other than authorized MSA service personnel, could cause the product to fail to perform as designed and persons who rely on this product for their safety could sustain serious personal injury or death.
4. If a fault occurs with a portion of the system, remaining system functions may not operate properly. In this case, do not use the system until proper repairs are made.

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

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# Chapter 1, General Information

## General Description

The 9010 and 9020 control modules enable monitoring of one or two sensor inputs, respectively. The control module is available in the following configurations:

- Full 19" rack which accommodates up to 10 modules (20 channels for 9020 model or 10 channels for 9010 model)
- NEMA 4X sheet metal with up to five modules
- NEMA 4X sheet metal with up to 10 modules
- NEMA 4X stainless steel with up to five modules
- NEMA 4X stainless steel with up to 10 modules
- Wall mount plastic enclosure for single, dual or multiple channels
- Explosion-proof for single, dual, or multiple channels.

The control module's front panel provides an LCD display (one for each channel with the 9020 module) and multiple LEDs to display alarm status. Three input keys are also provided for such tasks as configuring the control module and silencing alarms.

The 9010/9020 control module connects to a 32-pin terminal board to interface with all customer connections including:

- Control module AC/DC power input
- Transmitters / Sensors (one connection for the 9010 module and two for the 9020 module)
- Sensor power supply
- Software selectable analog output
- RS485 output with MODBUS
- Switching outputs for controlling alarm equipment.

The 9010/9020 control module also provides self-diagnostic monitoring and sensor signal conditioning.

## Model 9010 Description

The 9010 control module allows monitoring of a single sensor input.

- The front panel contains one LCD for monitoring the attached sensor.
- Four LEDs are present above the LCD display to indicate control module status.
  - The Red Caution, Warning, and Alarm LEDs indicate status based on the transmitter / sensor input.
  - The Yellow Failure LED indicates a Failure occurred.
- Three keys are mounted on the bottom of the control panel:
  - A Left-handed Enter key ↵ containing a green LED is used to configure the 9010 module.
  - Up and Down arrow keys provide multiple functions, including scrolling through configuration selections and silencing alarms.

NOTE: Use of these keys is described in more detail in applicable sections throughout this manual.



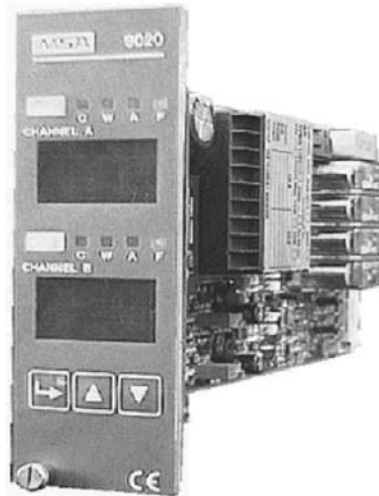
**Figure 1-1. Model 9010 Unit**



## Model 9020 Description

The 9020 control module allows for the monitoring of two sensor inputs.

- The front panel contains two LCDs for monitoring both connected sensors simultaneously.
- Four LEDs are present above each LCD display to indicate Caution, Warning, Alarm, and Failure states for both sensors being monitored.
- The front panel contains three keys as described previously. These keys are common to both channels on the 9020 control module.



**Figure 1-2. Model 9020 Unit**

**Table 1-1. Specifications**

<b>PCB DIMENSIONS</b>		3.9" wide x 8.6" long (100 mm wide x 220 mm long) for 19" rack system
<b>FRONT PLATE</b>		1.6" wide x 5.0" high (40 mm wide x 128.5mm high) 3 Units x 8 Units
<b>WEIGHT</b>		1.6 lbs. (720 g) with 25 VA transformer
<b>OPERATING TEMPERATURE</b>		14° - +122°F (-10° - +50°C)
<b>STORAGE TEMPERATURE</b>		-40 - +158°F (-40° - +70°C)
<b>HUMIDITY</b>		10 - 90 % relative humidity, non-condensing
<b>VIBRATIONS</b>		10 - 55 Hz; 0.15 mm amplitude
<b>ENCLOSURES</b>		
<b>(R) RACK MOUNT</b>	<b>DIMENSIONS</b>	5.25" high x 19" wide x 10.5" deep (133 mm high x 482.6 mm wide x 266.7 mm deep)
	<b>WEIGHT</b>	23 lbs. (10.4 kg)
<b>(P) GENERAL PURPOSE</b>	<b>DIMENSIONS</b>	7.5" high x 11.5" wide x 5.25" deep (180 mm high x 254 mm wide x 89 mm deep)
	<b>WEIGHT</b>	4 lbs. (1.8 kg)
<b>(XS) SINGLE BOARD EXPLOSION-PROOF</b>	<b>DIMENSIONS</b>	15.50" high x 14.12" wide x 8.63" deep (393 mm high x 58 mm wide x 219 mm deep)
	<b>WEIGHT</b>	52 lbs. (23.6 kg)
<b>(XD) DUAL BOARD EXPLOSION-PROOF</b>	<b>DIMENSIONS</b>	17" high x 18.29" wide x 10.25" deep (431 mm high x 464 mm wide x 260 mm deep)
	<b>WEIGHT</b>	86 lbs. (39 kg)
<b>(MS) NEMA 4X METAL (5 CARD)</b>	<b>DIMENSIONS</b>	22" high x 17" wide x 14.14" deep (558 mm high x 431 mm wide x 359 mm deep)
	<b>WEIGHT</b>	67 lbs. (30.4 kg)
<b>(MD) NEMA 4X METAL (10 CARD)</b>	<b>DIMENSIONS</b>	24" high x 24" wide x 14.14" deep (609 mm high x 609 mm wide x 359 mm deep)
	<b>WEIGHT</b>	102 lbs. (46.2 kg)
<b>(SS) NEMA 4X - STAINLESS STEEL (5 CARD)</b>	<b>DIMENSIONS</b>	22" high x 17" wide x 14.14" deep (558 mm high x 431 mm wide x 359 mm deep)
	<b>WEIGHT</b>	67 lbs. (30.4 kg)
<b>(SD) NEMA 4X STAINLESS STEEL (10 CARD)</b>	<b>DIMENSIONS</b>	24" high x 24" wide x 14.14" deep (609 mm high x 609 mm wide x 359 mm deep)
	<b>WEIGHT</b>	104 lbs. (47.3 kg)

<b>INSTALLATION OUTLINE</b>		
<b>DRAWINGS</b>	<b>R</b>	DSK 3015-1001
	<b>P</b>	DSK 3015-1002
	<b>XS</b>	DSK 3015-1003
	<b>XD</b>	DSK 3015-1004
	<b>MS &amp; SS</b>	DSK 3015-1005
	<b>MD &amp; SD</b>	DSK 3015-1006
<b>CONTROL UNIT POWER SUPPLY</b>		115 - 230 VAC $\pm$ 15%; 50 - 60 Hz and/or 24 VDC +15% to -20%
<b>AC CONSUMPTION</b>	<b>MODEL 9010</b>	13 VAC
	<b>MODEL 9020</b>	15 VAC
<b>DC POWER CONSUMPTION</b>	<b>MODEL 9010</b>	3 W
	<b>MODEL 9020</b>	4 W
<b>INPUT SIGNALS</b>		10 -200 mV as measuring spread 4 - 20 mA
<b>RESPONSE TIME</b>	<b>WITHOUT SENSOR</b>	< 0.5 sec. for 100% measuring range
<b>ZERO AND SENSITIVITY DRIFT</b>	<b>WITHOUT SENSOR</b>	< $\pm$ 0.5% of measuring range
<b>REPEATABILITY</b>	<b>WITHOUT SENSOR</b>	< $\pm$ 1% for 100% of measuring range
<b>ANALOG OUTPUT SIGNALS</b>		0 - 20 mA, 4 - 20 mA (linear) maximum load: 500 Ohms
<b>ANALOG ERROR SIGNALS</b>		0, 2, 4, 20 mA or frozen (selectable)
<b>SENSOR CONNECTIONS</b>		Two-, three, or four-wire connection
<b>PERMITTED WIRE CROSS-SECTION</b>		0.75 - 2.5mm <sup>2</sup>
<b>RELAY OUTPUTS SPDT</b>		Warning (W), Alarm (A), Failure (F) & horn
<b>REDUNDANT SPST</b>		Failure (F)
<b>MAXIMUM RELAY CONTACT LOAD</b>		5 Amps, 24 VDC, 250 VAC resistive load (on Model 9020 relay outputs are common to both channels)
<b>APPROVALS</b>		cFMus 61010-1 Fire and Shock, ISA 12.13.01, CSA 152 Performance, FM 6340 Oxygen Performance
<b>ALARM RESET</b>		Automatic or manual reset with front panel arrow keys or external reset switch
<b>ALARM DELAY</b>		0 - 9999 seconds (software selectable)
<b>DISPLAY</b>		4 digit, 7 segment, permanently back-lit LCD (Model 9020 has a separate display for each channel)
<b>PROTECTION FUNCTIONS</b>		Access code, security code, password, time-out function, automatic AC/DC supply switching, mode fault/incorrect calibration indication

## **Chapter 2, Configuration**

This section of the manual describes the various configuration options that are available for the 9010/9020 control module.

Refer to Chapter 4 for a detailed description of each Access Code and how to make selections using the front panel.

### **Output Signals**

#### **Output relay configuration**

The 9010/9020 control modules are equipped with four standard voltage-free relays: Alarm, Warning, Failure, and Horn.

- The Alarm and Warning relays are SPDT.
- The Failure and Horn relays are SPST.
  - The Failure relay consists of two SPST relays connected in series for redundancy. The Failure relay is energized and closed during normal operation.

These relay outputs are common to both channels for the 9020 control module.

NOTE: There is no dedicated Caution relay. When a Caution is encountered, the front panel Caution LED illuminates and the Horn relay activates.

#### **Analog Output Signal - (Access Code 4 /P19)**

The analog output signal is user-selectable with Access Code 4, step 19.

The following options are available:

- 0-20 mA, 4-20 mA, 20-0 mA and 20-4 mA.

## **Failure Output Signal - (Access Code 4 / P20)**

The analog output due to a Failure is configured using Access Code 4, step 20. The following options are available:

- 0 mA, 2 mA, 4 mA, 20 mA or h (selection "h" freezes the output signal at the time of a Failure).

Failures that occur during operation are also indicated by a yellow LED on the front panel, just above the LCD display. The 9020 module contains one of these LEDs above each display (one for each channel).

## **RS485 signal - (Access Code 7)**

RS485 serial output is configured using Access Code 7 and can be used with a Supervision System, PLC, DCS, etc. The data is transmitted on an RS485 half-duplex type serial bus using the MODBUS protocol.

## **Alarms**

Alarms are configured using Access Code 4. The alarm set-points are designated as follows:

- Caution "C"
- Warning "W"
- Alarm "A".

When an alarm threshold is exceeded, the corresponding red LED on the front panel illuminates and the relay switches according to the configured settings:

- Rising or Falling signal
- Normal status (energized or de-energized)
- Alarm Reset Mode
- Alarm delay.

Alarms can be acknowledged / reset by using the arrow keys on the front panel, or by using an external push-button connected to the RESET terminal (see Appendix A for terminal connections). Refer to the Alarm Reset Mode section in Chapter 4 for details on reset modes.

NOTE: The normal status (i.e., normally energized or de-energized) for each of the 9020 control module relays is common to both channels.

## Overrange

The 'over-range' function provides a warning when the gas reading exceeds 100% full-scale.

If enabled:

- over-range is indicated by EEEE on the display and
- the horn relay activates.

The EEEE indication is latched and displayed as long as the signal remains higher than full scale.

- When the signal falls below full scale the:
  - EEEE indication alternates with current gas concentration:
    - four second display of the EEEE indication
    - one second display of the gas concentration
  - horn relay is enabled again.
    - To silence the horn, press the HORN/ALARM ACKNOWLEDGE button one time.
    - To acknowledge, the button must be pressed a second time.

The reset mode for all alarm thresholds automatically switches to 1 M, ignoring the previously made selection, except when configured for reset mode 2M.

When the signal falls below the alarm threshold and the alarm is manually reset, the:

- EEEE indication is deleted
- alarm reset modes remain as configured.

NOTE: See Chapter 4, "Alarm Reset Modes".

Model 9010 / 9020 Control Units are default configured to accept an Ultima X three-wire or two-wire, 100% LEL.

Depending on the type of sensor used, the user must re-configure Access Code 4:

- P4 - selection of measuring unit
- P6 - setting of full scale value, and
- P21 - decimals setting.

## Chapter 3, Installation

### General information

- For safety reasons, on rack mount installations, ensure that all electronics behind the front panel are not accessible to the user.
- Select the installation location that meets the environmental conditions indicated in the technical data.
- When installing the 9010/9020 the following conditions must be met to comply with the safety standards:
  - To connect devices to the main power supply, an interference-free earth ground connection must be provided.
  - All sensor and control cables must be shielded.
  - Control and sensor cables must be installed physically separate from power supply cables.
- (For MS, SS, MD and SD systems) from left to right, card slot 1 must always contain a control module.
- (For XD systems) the bottom module referred to as 'module 2' must always be in place for the instrument to function properly.
- The 9010/9020 Modules can be powered by 115 VAC, 230 VAC or 24 VDC.

### AC Power

- The mains supply input is protected by fuse F1 and must be the correct value. See Chapter 5, TABLE 5-2, Replacement Parts or contact MSA Service at 1-800-INST.
- Per UL/CSA 61010, the user is required to provide a disconnecting means to their equipment from each operating energy source. The disconnecting means shall disconnect all current carrying conductors. (For example, this disconnecting means might be a circuit breaker.)
- Ensure that the circuit breaker supplying the 9010/9020 Controller does not exceed 15 amps and is as close to the equipment as possible.
- Ensure that the power supply wiring is rated for the maximum fault current of 15 amps and is approved by a recognized testing authority.

## Power from External DC Supply

- Model 9010/9020 plug-in control system modules can be operated from an external 24 VDC +15% / -20% voltage connected to terminals 4 (+) and 5 (-) on the terminal board. Use certified SELV power supply.
- External 24 VDC supply voltage is protected by fuse F3 (2 Amp).
- If preconfigured for AC voltage, the 9010/9020 can be simultaneously connected to AC mains voltage and 24 VDC for a backup supply, in which case, power automatically switches over if the AC main supply should fail.
- For proper operation, check that jumper CV18 is in position (2 - 3). (See TABLE 4-1 for more information.)

## Sensor Connection

- The connection diagrams for approved MSA sensors are shown in Appendix A. Further information and calibration instructions can be found in the relevant sensor instruction manual.

## Cable Lengths

- Sensors must be connected to the control unit with shielded cables.
- The number of wires and the maximum cable length for each sensor type can be found on the relevant sensor instruction manual
- For other conductor cross-sections, the maximum cable lengths can be calculated using the following correction factor.

**Table 3-1. Cable Length Correction Factors**

<b>CONDUCTOR CROSS-SECTION</b>	<b>CORRECTION FACTOR FOR MAXIMUM CABLE LENGTH</b>
1.0mm <sup>2</sup>	0.67
1.5mm <sup>2</sup>	1.00
2.5mm <sup>2</sup>	1.66

- The sensor cable shield must be connected to the screw terminal or the plug-in earth ground on the controller terminal board.
- The sensor cable shield must only be connected to an earth terminal at the controller end.



- A Model 9020 control unit requires shorter cable length than a Model 9010 control unit for the same sensor types. TABLE 3-2 shows typical values for maximum cable length for Ultima XE, XIR, and XI sensors for both the Model 9010 and 9020 control units.

**Table 3-2.**  
**Typical Cable Lengths for Ultima XE, XIR, and XI Sensors**

	XE (catalytic)	XIR	XI	NOTES
POWER SUPPLY	7 - 30 VDC			
NUMBER OF CONDUCTORS	3			
24 VDC CURRENT CONSUMPTION TYPICAL	150 mA	200 mA	200 mA	
OUTPUT SIGNAL	4 - 20 mA			Source type
<b>CONNECTION CABLE DATA</b>				
CABLE TYPE	At least 80% Shielded			
MAX LINE LENGTH (9010)	2950 ft. with relays	1640 ft. with relays	1640 ft.	1.5 mm <sup>2</sup> wire
MAX LINE LENGTH (9020)	2295 ft.	820 ft.	1145 ft.	1.5 mm <sup>2</sup> wire
MAX LOAD AT 4 - 20 mA	600 Ohms			At 24 VDC

The data refer to the nominal voltages and with a wire having a 1.5 mm<sup>2</sup> cross-section. Distances must be derated by approx. 25 - 30% if nominal voltages drop by 15 - 20%

# Chapter 4, Operation

## Start-up

- The system performs a self-test once the supply voltage is connected.
  - During this self-test:
    - all alarm outputs are inhibited, as indicated by ALARM INHIBIT blinking on each display
    - all parameter settings display consecutively for each channel.
  - The test takes approximately one minute per channel to complete.
  - The system then switches to Measuring mode.

NOTE: Before attempting to calibrate the sensors, allow sufficient time for each sensor to stabilize.

## Operation

- All 9010/9020 Controller parameters are configured by internal software, selected by using Access Codes.
- Access Codes used to change system settings are protected by a Security Code and a Password.
- All parameters can be entered using the three front-panel keys.

## (Left-hand) Enter ↵ Key Functions

- The green LED on the ENTER key illuminates during operation to indicate that power is connected.
- Pressing the input key for approximately three seconds (until the green LED flashes):
  - starts the software configuration input mode.
  - Inhibits the alarm outputs
  - flashes ALARM INHIBIT on the display.
    - The top, four-character display (Channel A) indicates "0", ready to enter an access code.
  - The required Access Code is entered by using the arrow keys (e.g., 52 = Access Code for Basic Settings) and confirmed by pressing the ENTER key ↵.
    - **P1** displays to set relay output. (Also see the Chapter 4 Access Code TABLES.)
- Pressing the input key twice within one second returns the controller to the previous sub-menu and back to Normal mode.
  - This also occurs automatically through the time-out function after the selected time has elapsed (e.g., two minutes).

## Arrow Key Functions

- Arrow keys:
  - are used to increase or decrease the required inputs and settings, which are then only accepted after being confirmed by pressing the ENTER key.
  - can only be used in Input mode to change settings or parameters.
- When an arrow key is held down, the display number:
  - initially changes in increments of one
  - then changes in increments of 10
  - finally changes in increments of 100.
- The exception is, if an alarm is triggered, either arrow key can then be used to acknowledge and reset the alarm.
  - The first press will acknowledge the alarm
  - The second press will reset it, depending on the alarm threshold and gas concentration.

NOTE: Alarm acknowledge and reset can also be achieved using the external RESET switch.

## Entering Access Codes

### General

To enter an Access Code:

1. Press and hold the ENTER key for approximately three seconds, until the green LED in the ENTER key flashes.
  - Each channel will display 0
  - the flag ALARM INHIBIT will flash.
2. Use the UP and DOWN keys to set the number for the required Access Code.
  - Only Access Codes 1, 3, 123, and 223 can be entered directly
  - Only the number is displayed.
3. Press the ENTER key to confirm.
4. For all other Access Codes, it is necessary to:
  - Press and hold the ENTER key while switching ON the Controller or
  - Enter the Access Code 123 if the Controller is already ON.
5. After entering Access Code 123, confirm by pressing the ENTER key.
  - The display will show four dashes.
6. Press the ENTER key again; then, enter the required Access Code.

### Model 9010

1. Hold the ENTER key pressed until the built-in green LED flashes.
2. Press the UP key until the number of the required Access Code is displayed.
3. Confirm the selection by pressing the ENTER key once.
  - P1 is displayed.
4. Press the ENTER key again to enter the P1 Step.

5. To use a different 'P' Step, press the UP or DOWN key until the desired number is displayed.
6. To enter the displayed 'P' number, press the ENTER key once.
7. To leave any Access Code, press the ENTER key twice within two seconds

NOTE: Depending on the position inside an Access Code, it may be necessary to repeat this step two or three times to return to the gas display screen.

If no keys are pressed for two minutes, the time-out function automatically returns to the previous sub-menu. This repeats until the control module resumes normal operation.

If required, the time-out function can be disabled with Access Code 2.

## **Model 9020**

### **To Use Channel A**

1. Hold the ENTER key pressed until the built-in green LED flashes.
2. Press the UP key until the number of the required Access Code is displayed.
3. Confirm the selection by pressing the ENTER key once.
  - CHa is displayed on the upper display.
4. Press the ENTER key once to work with channel A.
  - P1 appears on the upper display.
5. Press the ENTER key again to enter the P1 Step.

### **To Use Channel B**

1. When CHa is displayed, press the UP key once.
  - CHb appears on the upper display.
2. Press the ENTER key to work with channel B.
  - P1 appears on the lower display.
3. Press the ENTER key again to enter the P1 Step.

## **Standard Version**

The Control Unit operates as follows when:

- any Access Code is entered
- the ENTER key is released and
- the green LED is blinking.
- The ALARM INHIBIT tag flashes on both channel displays.
- All alarm thresholds are inhibited and frozen at the status when the ACCESS CODE was entered.
- If the horn is enabled, it will be disabled.

NOTE: The exception is, when EEEE is displayed, the horn status remains unchanged.

The status of the analog output signals is as follows, depending on the selected Access Code:

### **Access Code 2, 7, 123 and 223**

- The analog output of both channels continues to follow/track the gas concentration if the Access Code entry was done by Access Code 123.
- The analog output of both channels will be 0 mA if the Access Code entry was done by pressing the ENTER key when switching the Control Unit ON.

### **Access Code 3**

- The analog output of both channels continues to follow/track the gas concentration.

### Access Code 4 and 52

- The analog output of the selected channel goes to zero
- If the Access Code has been entered through Access Code 123 the analog output of the other channel continues to follow/track the gas concentration.
- If the Access Code was entered by holding down the ENTER key ↵ when switching the Control Unit ON, the analog output of both channels will be zero.

**Table 4-1. 9010 / 9020 Hardware Configuration  
Factory Service Only**

SOLDER BRIDGE	LINK	POSITION	FUNCTION	COMMENT
CV 13-17				Factory settings
	CV 18	1-2	24 VDC power supply generated within the board	Jumper, component side
		2-3	24 VDC power supply from outside board	Jumper, component side
CV 19		1-2	Horn contact normally closed	Drop of solder, solder side
		2-3	Horn contact normally open	Drop of solder, solder side
CV 20-24				Factory settings
	CV 25	1-2	Watchdog activation	Jumper, component side

NOTE: The selection between the 230 VAC and 115 VAC is made by using a switch on the board.

### **⚠ WARNING**

**Do not attempt to service the power supply input voltage jumpers; they are factory-set and not user-serviceable. Adjusting may cause a fault to the system.**



**Table 4-2. Parameter Settings Using Access Codes**

ACCESS CODE	DESCRIPTION / FUNCTION	PASSWORD
1	Calibration	None
2	Settings for special operating conditions	123
3	Simulation and function test	None
4	Parameter setting of each channel	123
7	Setting the RS-485 address	123
52	Pre-settings	123
123	Password for: 2, 4, 7, 52 (settings changed here)	N/A
223	Changing the password	N/A

**Table 4-3. Access Code 1 - Calibration**

NOTE: Calibration is not required for sensors using 4-20 mA signal.

	FUNCTION	ADDITIONAL INFORMATION
P1	Zero point calibration	Apply zero gas, wait for reading to stabilize and confirm with enter key ↵ - display steps to P2
P2	Set calibration gas concentration	Enter calibration gas concentration using arrow keys and confirm with enter key ↵ - display steps to P3
P3	Gas calibration	Apply calibration gas, wait for reading to stabilize and confirm with enter key ↵ - display steps to P4
P4	Display of gas concentration measured by sensor	Display of sensor signal = Test gas concentration
P5	Display of input signal rating	Display of signal rating between 0 (minimum signal) and 100 (maximum signal)  With passive sensors: Display value x 2 = Ux sensor signal mV
P6	Set the calibration interval in days	0 to 999 days can be set  After number of days set, "CAL" appears on the display
P7	Calibration enabled / disabled (Only for 4/20 mA configured boards)	A = activated  nA = not activated
P8	Indication enabled / disabled with the CAL tag for reduction of the sensor signal under 50% with respect to the preceding calibration	A = activated  nA = not activated
P20	Storage of board configuration per customer calibration data sheet	

**Table 4-4. Access Code 2 - Special Operating Conditions**

FUNCTION	ADDITIONAL INFORMATION
P1 Time-out for both channels on Model 9020	A = activated D = deactivated (flashing display)
P2 Analog output signal in calibration mode	h (hold) F (floating – tracks gas concentration) 0 (mA); 4 (mA); 20 (mA)
P3 Alarm suppression	A = activated nA = not activated
P4 Low external 24 VDC indication indication	A = activated nA = not activated Failure relay activates and Display alternates between concentration and LOU 1
P5 Low 115/230 VAC indication	A = activated nA = not activated Failure relay activates and Display alternates between concentration and LOU 2

**Table 4-5. Access code 3 - Function check / Alarm output locked**

FUNCTION	ADDITIONAL INFORMATION
P1 Test LCD Display	All possible display readouts are shown flashing alternately with P1 -> confirm with ↵ key -> P2
P2 Simulation of sensor input signal using arrow keys	Set alarms are displayed on front panel (C, W, A) No alarm output from relay locked
P3 Set sensor supply current	Constant current setting displayed in mA (only with constant supply current) "Vol" is displayed for supply voltage
P4 Measured sensor current	Constant current setting displayed in mA
P5 Set measuring point parameters	All set parameters for this measuring point are displayed in a consecutive sequence
P6 STEL or TWA Average value for "W"	Refers to set "W" threshold (only available with ppm measuring ranges)
P7 STEL or TWA Average value for "A"	Refers to set "A" threshold (only available with ppm measuring ranges)
P11 Signal simulation with alarm output	The arrow keys can be used to simulate signals Function test with alarm connection for relay outputs
P12 Switch output test	1 -> all relay outputs OFF 2 -> all relay outputs ON; Automatic reset on exit

**Table 4-6. Access Code 4 (Configuration settings for each channel)**

FUNCTION	ADDITIONAL INFORMATION
P1 Constant current supply for sensor	Permitted value: 0 - 500 mA (bridge current) This step is automatically skipped if constant voltage is used
P2 Sensor supply current failure	Separate for each channel: 0 - 500 mA If the current is less than the set value, the FAILURE relay is activated and the Yellow LED "F" on front panel is ON
P3 Gas reading negative drift warning	Permitted value: -1% to -10% of measuring range if the set value is exceeded 'd1' is displayed. Factory preset is equal to -4% to ensure proper fault indication when used with Ultima X sensors
P4 Measuring unit selection: LEL, LEL.m, PPM, %VOL, g / m3, blank (see Access Code 52 /P3 for fire and smoke sensors)	(% Vol O <sub>2</sub> , selection only possible in access code 52 /P3 option 2 or 3)
P5 Setting the measuring range zero value	Permitted values: 0-9000 Caution! Changing the measuring range zero value automatically adjusts the alarm and calibration settings
P6 Setting the measuring range full scale value	Permitted values: 0-9000 Caution! Changing the measuring range full-scale value automatically adjusts the alarm and calibration settings

**Table 4-7. Caution "C" (Threshold settings)**

FUNCTION	ADDITIONAL INFORMATION
P7 Alarm direction and threshold U – upward (rising) d – downward (falling)	Alarm threshold: 1 -100% of measuring range
P8 Normal status	E –energized dE –de-energized
P9 Alarm reset mode	1A or 2A - automatic 1 M or 2M - manual
P10 Alarm delay	Permitted values: 0 to 9999 seconds

**Table 4-8. Warning "W" (Threshold settings)**

	<b>FUNCTION</b>	<b>ADDITIONAL INFORMATION</b>
P11	Alarm direction and threshold U – upward (rising) d – downward (falling)	Alarm threshold: 1 -100% of measuring range
P12	Normal status of relay	E –energized dE –de-energized
P13	Alarm reset mode	1A or 2A - automatic 1 M or 2M - manual
P14	Setting the alarm delay	Permitted values: 0 to 9999 seconds With ppm measurements: STeL / TuA (TWA) / norM are displayed for the alarm delay setting

**Table 4-9. Alarm "A" (Threshold settings)**

	<b>FUNCTION</b>	<b>ADDITIONAL INFORMATION</b>
P15	Alarm direction and threshold U – upward (rising) d – downward (falling)	Alarm threshold: 1 -100% of measuring range
P16	Normal status of relay	E –energized dE –de-energized
P17	Alarm reset mode	1A or 2A - automatic 1 M or 2M - manual
P18	Setting the alarm delay	Permitted values: 0 to 9999 seconds With PPM measurements: STeL / TuA (TWA) / norM are displayed for the alarm delay setting
P19	Analog output range	0 to 20 mA; 4 to 20 mA; 20 to 0 mA; 20 to 4 mA
P20	Output failure signal	0 mA, 2 mA, 4 mA, 20 mA or h (holding)
P21	Setting decimal places	0 to 2 decimal places
P22	Configuration for output failure manual reset (1M)	A = latching, manual reset via arrow keys nA = non-latching, auto reset
P23	Adjustment for 4 mA output signal	
P24	Adjustment for 20 mA output signal	

**Table 4-10. Access code 7 –(RS-485 address)**

	<b>FUNCTION</b>	<b>ADDITIONAL INFORMATION</b>
P1	Set device address	Settable from 0 to 255 Confirm with enter key ↵
P2	Setting the zone	Can be set from 1 to 60 Individual for each channel
P3	RS485 redundancy	A = enabled nA = disabled

RS485 baud rate is factor configured at 9600.

NOTE: Device address is common to channel A and B for the 9020 control module.

**Table 4-11. Access code 52 (Basic settings)**

	<b>FUNCTION</b>	<b>ADDITIONAL INFORMATION</b>
P1	Setting relay output	(common to both channels – set using channel A) 1 = Relay
P2	Sensor power supply (channel-related)	1 = constant current 2 = constant voltage
P3	Sensor input signal (select for each channel)	1 = analog input (mV) 2 = analog input (4 - 20 mA / 2-wire circuit) 3 = analog input (4 - 20 mA / 3-wire circuit) 4 = analog input (4 – 20 mA / 2 wire for thermosensitive cable) 5 = analog input (4 – 20 mA / 2 wire for thermocontact detectors) 6 = analog input (4 – 20mA / wire for smoke detectors) 7= analog input (4 –20mA / 3 wire for flame detectors) 8 = analog input (4-20mA / 2 wire for Manual Call Point)

NOTE: Dedicated measuring units are assigned to sensor input signals 4, 5, 6, 7 and 8

**Table 4-12. Sensor input Signal Dedicated Measuring Units**

SENSOR INPUT SIGNAL	MEASURING UNITS
4	FirE
5	tEmP
6	Smo
7	FirE
8	MCP

**Access Code 123**

For all access codes to be used for changing parameter settings, the password 123 must be preselected to ensure additional security.

This applies to access codes 2, 4, 7 and 52 (see "Entering Access Codes" earlier in this Chapter).

**Table 4-13. Access Code 223 - Password Setting**

P1 Setting 'Password'	1. Press and hold Enter key until green LED flashes
	2. Use arrow keys to set Access Code 223
	3. Press Enter key
	4. P1 is displayed
	5. Press Enter key – '0000' is displayed
	6. Use arrow keys to enter a number between 1 and 9999 as a password and confirm with Enter key ↵
	7. Exit by pressing Enter key ↵ twice

**Using the Password**

1. Press and hold Enter key until green LED flashes.
  - Display shows '0000'.
2. Use arrow keys to set password.
3. Press Enter key ↵.
4. Enter Access Code required.

NOTE: If incorrect password is entered, controller returns to normal gas measurement mode.

### **Changing the Password**

1. Press and hold ENTER key until green LED flashes.
2. Enter valid password and confirm with Enter key ↵.
3. Enter 223 and confirm with Enter key ↵.
  - Display shows P1.
4. Confirm with Enter key ↵ again and valid password is displayed.
5. Use arrow keys to set new password and confirm with Enter key ↵
6. Exit by pressing Enter key ↵ twice.

NOTE: Contact MSA Customer Service if you forget your password.

## **Alarm Reset Modes**

### **Alarm Mode 1A (Non-latching)**

In this mode, the alarm is automatically reset when the gas concentration falls below the alarm threshold.

- When the gas concentration exceeds the alarm threshold, the:
  - LED flashes
  - Relay outputs activate
  - HORN relay activates.
- If the gas concentration falls below the alarm threshold, the:
  - LED stops flashing
  - Relay outputs reset
  - HORN relay resets.
- During an alarm, the UP or DOWN arrow keys or the external reset pushbutton can be pressed to acknowledge/accept the alarm; the:
  - Alarm LED changes to steady state
  - Relay outputs remain active
  - HORN relay resets.
    - If the gas concentration now falls below the alarm threshold, the:
      - LED turns OFF
      - Relay outputs reset
      - HORN relay remains inactive.

## **Alarm Mode 1 M (Latching)**

In this mode, the alarm must be reset manually by pressing the UP or DOWN arrow keys or the external reset pushbutton.

- When the gas concentration exceeds the alarm threshold, the:
  - LED flashes
  - Relay outputs activate
  - HORN relay activates.
    - If either arrow key, or if the external reset pushbutton is pressed:
      - LED remains steady ON
      - Relay outputs remain ACTIVE
      - HORN relay resets.
- If the gas concentration falls below the alarm threshold, the:
  - LED flashes
  - Relay outputs remain ACTIVE
  - HORN relay remains ACTIVE.
    - If either arrow key or the external reset pushbutton is pressed:
      - LED turns steady ON
      - Relay outputs remain ACTIVE
      - HORN relay resets.
        - If the arrow keys or the external reset pushbutton are pressed:
          - LED turns OFF
          - Relay outputs reset
          - HORN relay resets.



## **Alarm Mode 2A (Non-latching)**

- When the gas concentration exceeds the alarm threshold, the:
  - alarm LED flashes at 5 Hz
  - relay and horn output activate.
- If the gas concentration falls below the alarm threshold, the:
  - LED flash rate changes to 1 Hz
  - alarm relay and horn output automatically reset and return to the no alarm state
    - If either arrow key is now pressed, the alarm LED goes OFF.
    - If the gas concentration again increases above the alarm threshold, the alarm LED flash rate returns to 5 Hz.
- During an alarm, if the UP or DOWN arrow key is pressed, the:
  - audible alarm silences
  - alarm LED changes to steady state.
- If the gas concentration now falls below the alarm threshold, the alarm LED flashes at 1 Hz and the alarm relay automatically returns to the no alarm state.
  - Pressing the UP or DOWN arrow key causes the alarm LED to turn OFF.

## **Alarm Mode 2M (Latching)**

- When the gas concentration exceeds the alarm threshold, the:
  - alarm LED flashes at 5Hz
  - relay and horn output are activated.
- If the gas concentration falls below the alarm threshold, the:
  - LED continues to flash at 5Hz
  - horn remains active
  - output relay remains active.
- If either arrow key is pressed from this state, the alarm LED flashes at 1 Hz and the horn deactivates. The relay output remains active.
- Pressing either of the arrow keys a second time turns OFF the LED and resets the output relay.
- If the gas concentration again increases above the alarm threshold, the alarm LED flash rate returns to 5 Hz.
- During an alarm, if the UP or DOWN arrow key is pressed, the:
  - audible alarm is silenced
  - output relay remains active
  - alarm LED changes to steady state.
- If the gas concentration now falls below the alarm threshold, the alarm LED flashes at 1 Hz and the output relay remains active. From this state, pressing the UP or DOWN arrow key causes the:
  - alarm LED to turn OFF
  - alarm relay automatically returns to the no alarm state.

## Chapter 5, Maintenance

The Control Unit does not require any special maintenance, except for cleaning and periodic functional checks as specified for Access Code 1 (Calibration) and Access Code 3 (Function check) step 12.

### Fault Messages

In case of a fault, the Control unit 9010/20 shows following messages on the display.

**Table 5-1. Troubleshooting Guidelines**

<b>READ- OUT</b>	<b>POSSIBLE CAUSE</b>	<b>CORRECTIVE ACTION</b>
F 1	Sensor incorrectly connected / Cable break / Short circuit	Check cable, check hardware configuration, Check software parameters,  Current drawn may be less than 'Failure Current' set A.C. 4 / P2
F 2	Faulty sensor or input amplifier	Check sensor, or send 9010/9020 to MSA for repair
F 3	EEPROM in 9010/9020 faulty	Send 9010/9020 to MSA for repair
F 4	Incorrect operation	Press ENTER key for Restart
F 5	Analogue / digital converter faulty	Send 9010/9020 to MSA for repair
F 6	RAM module in processor faulty	Send 9010/9020 to MSA for repair
F 7	EPROM - check Irregularities	Change EPROM or send 9010/9020 to MSA for repair
F 8	RAM check in MC Irregularities	Error test using access code 53

**Table 5-2. Replacement Parts List**

<b>REPLACEMENT PART</b>	<b>PART NO.</b>
Display Assembly (for XS and XD versions), Model 9010	10061926
Display Assembly (for XS and XD versions), Model 9020	10061927
Pushbutton Switch (XS and XD versions)	633512
Pushbutton Operator (XS and XD versions)	636669
Contact Block (XS and XD models)	636670
Fan Assembly (MS, SS, MD and SD models, 120 V)	486552
Fan Assembly (MS, SS, MD and SD models, 24 VDC)	10063105
Fan Assembly (P versions)	10065669
Blank Panel, Models 9010/9020	10060665
Sensor Simulator, Two-Wire	10086969
Sensor Simulator, Three-Wire	10086970

<b>REPLACEMENT PART</b>	<b>PART NO.</b>
Fuse F1, 500 mA for 115 VAC	10091974
Fuse F1, 250 mA for 230 VAC	10091975
Fuse F3, 2 Amp	10029845
Fuse F2, 1 Amp for Secondary Transformer	10029844
Rear Terminal Board (MS, SS, MD and SD versions)	10029373
Rear Terminal Board (P, XS and XD versions)	10061934
Display Cable (XS model)	10061150
Display Cable (XD model)	10060357
Connector Plug, Five-position	10060759
Connector Plug, Two-position	10034401
Connector Plug, Three-position	637462
Overlay/Keypad Replacement, Model 9020 (P version)	10066535
Overlay/Keypad Replacement, Model 9010 (P version)	10066536
Display PCBA, Model 9020 (P version)	10066932
Display PCBA, Model 9010 (P version)	10066931
Tamper-proof Latch (MS, SS, MD and SD versions)	10069823
Tamper-proof Latch Key (MS, SS, MD and SD versions)	10069824
Tamper-proof Screw (R version)	10069879
Tamper-proof Key (P version)	10069880
Latch for SS and SD versions	10078938

MODEL 9010/9020

A - 9000 - MODULE -      -      -      -       
①    ①   ②   ③   ④

① MATRIX REVISION LEVEL

① ENCLOSURE TYPE:

- R - Rack Mount
- P - General Purpose Plastic
- MS - Nema 4X Metal, 5 Board
- MD - Nema 4X Metal, 10 Board
- XS - XP Single Board
- XD - XP Dual Board
- SS - Nema 4X Stainless Steel, 5 Board
- SD - Nema 4X Stainless Steel, 10 Board

② SENSOR CHANNEL

- A - 9020 - 2 WIRE
- B - 9010 - 2 WIRE
- C - 9020 - 3 WIRE
- D - 9010 - 3 WIRE

③ POWER VOLTAGE:

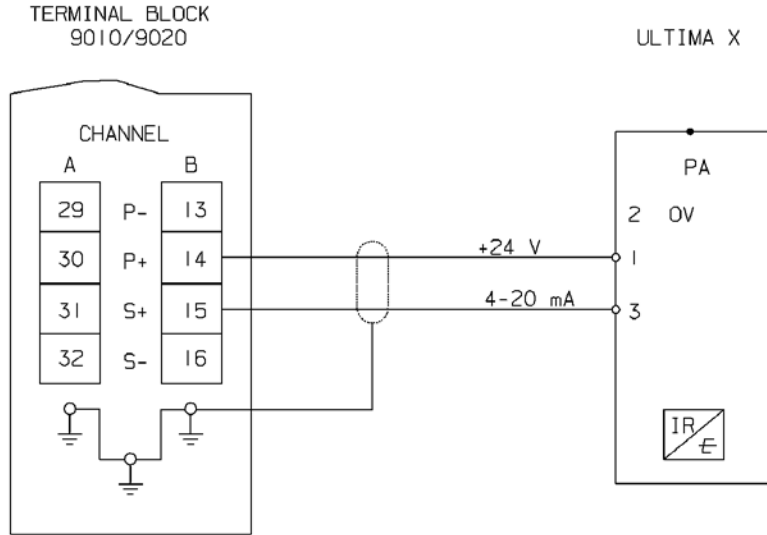
- 1 - 110 VAC
- 2 - 220 VAC
- 3 - 24 VDC

④ TLV STEL AND TWA FUNCTIONS:

- 0 - INCLUDED, STANDARD

**Figure 5-1. Replacement Parts Configuration Matrix**

# Appendix A, Wiring Diagrams

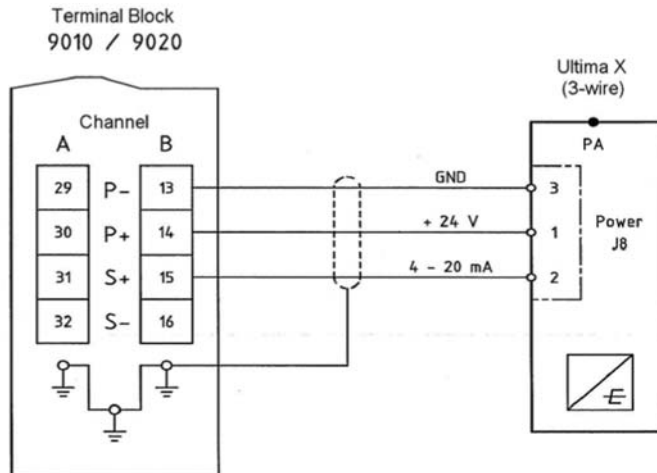


**Figure A-1. Ultima X (Two-wire) Sensor Wiring Diagram**

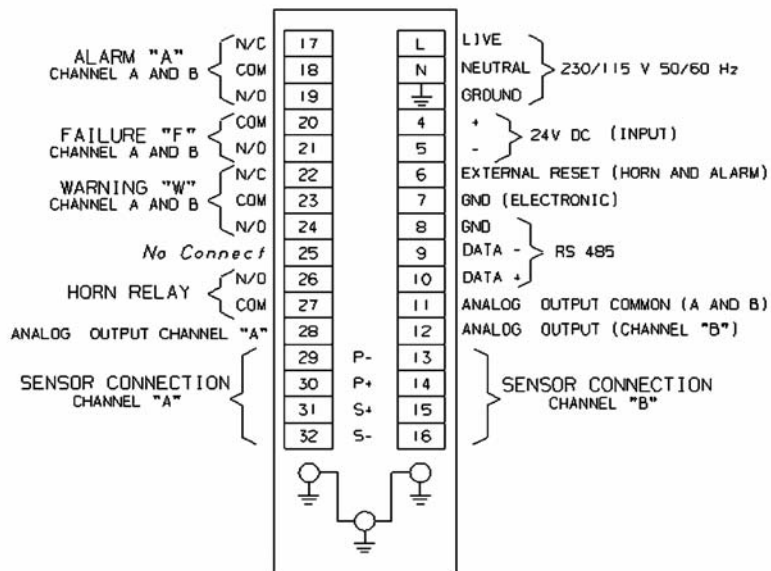
**⚠ CAUTION**

For specific information on Ultima X operation, see Ultima X instruction manual (P/N 10036101).

NOTE: Typical installation shown in FIGURE A-1.  
 Model 9010 should connect to Channel "A".  
 Model 9020 can connect to Channels "A" and "B".



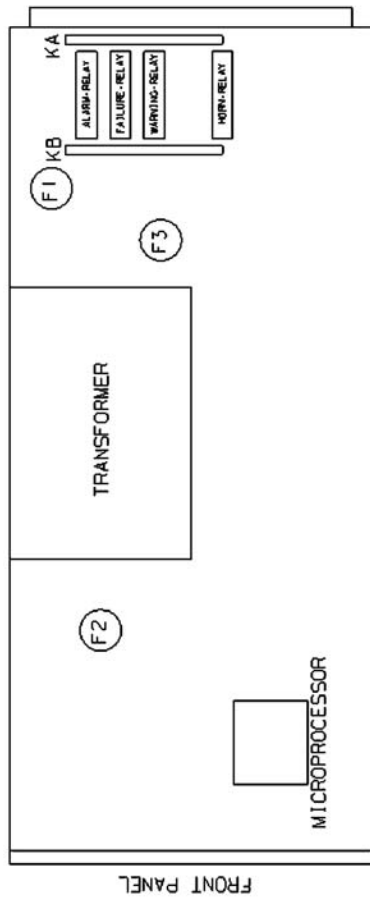
**Figure A-2. Ultima XE (Three-wire) Wiring Diagram**



*TYPICAL TERMINAL BOARD FOR RACK MOUNT ASSEMBLIES*

**Figure A-3. Typical Terminal Board for Rack Mount (R) Assemblies**

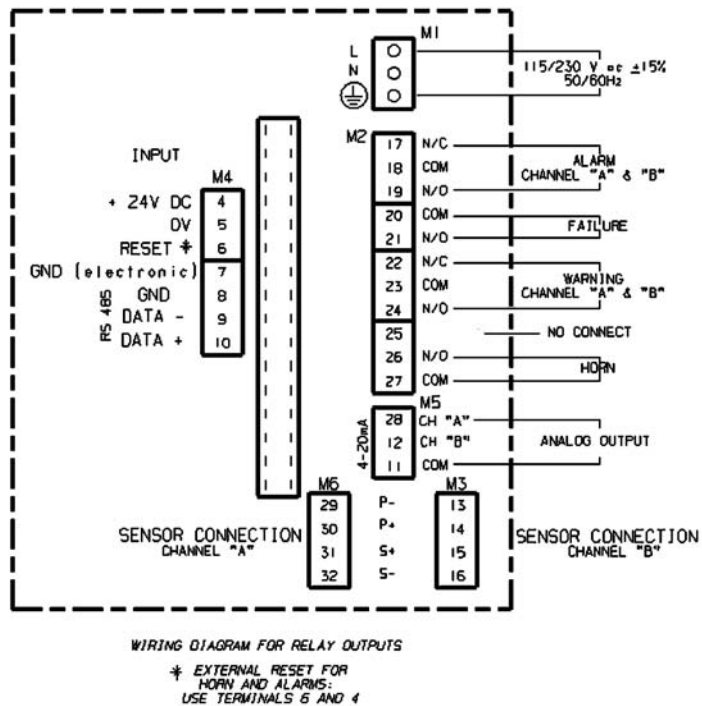




SYSTEM CIRCUIT BOARD LAYOUT FOR JUMPERS AND SOLDER BRIDGES  
CV 17 AND CV7 ON THE SOLDER SIDE

F1	MAINS FUSING	115 VAC	230 VAC
	25W TRANSFORMER	500mA	250mA
F2	TRANSFORMER SECONDARY	1 A	
F3	24 V DC SUPPLY	2 A	

Figure A-4. System Circuit Board Layout for Jumpers and Solder Bridges



**Figure A-5. Wiring Diagram for P, XS, and XD Assemblies**

NOTE: The reset switches are connected to the first module power at pin 14 in all configurations.