

User's Manual
for
MAC Valves Profibus
SM8 Serial Manifold
4/11/00

1. SYSTEM OVERVIEW

1-1 Profibus

The Profibus System is an open architecture control system based on the DIN Standard format which supports high speed transfer of control information. A Profibus network is an open network consisting of one or more master devices and multiple slave devices. Because it is an open network, the system will consist of products from a wide variety of vendors. The organization which has overall control of bus issues is the Profibus Trade Organization (PTO). We support the Profibus-DP version of the protocol.

The master (a PC or PLC with its network scanner) and slave devices are connected via a standard shield cable which uses 9 pin sub-D type connectors. There are a number of vendors which manufacture Profibus approved cables which may be used for network wiring.

The communications port which connects each slave device to the network is organized by node addresses. There can be up to 127 slaves on a given network. However, we support only 0-99 node numbers. Each slave device along with the master is assigned a node number (or address) so it can communicate with the network.

The commissioning (introduction) of a new product on the network varies slightly from master to master but in general, the process is as follows:

1. Set the address rotary switches on the slave to correspond to the required node number.
2. Wire the communications bus on the new product.
3. Place power on the new node (product).
4. Initialize the master.
5. Load in the Electronic Data Sheet or GSD (more about that later) into the master.
6. Attach the GSD for the slave to the node assigned it in the master.
7. Program the master for the required work.

1-2 MAC Valves SM8 Serial Manifold

The MAC Serial Manifold (SM8) is a slave device within the Profibus network. Thus, it will respond to all of the commands associated with the network like any other node of its type. The PLC programmer will not have to make any special allowances with this product.

Since the MAC SM8 Unit is nothing more than a node on the Profibus network, it can also be used in conjunction with our Serial Input Manifold (SIM), SLIM, or any other Profibus compatible device.

Each SM8 occupies a single node in the network. The output portion consumes 2 bytes (16 bits) and produces 2 bytes (16 bits) so that the system can control up to 16 MAC solenoid valves and read up to 16 user supplied sensors. We will discuss the inputs later in this document. The memory location and addressing of these bytes also will be discussed later in this document.

Along with 16 output channels, the SM8 has the capability to read 16 input channels. These inputs are interfaced to the product by up to four micro connectors on top of the electronics module (which can read up to four input channels, one channel per connector) or all sixteen inputs (one channel per connector) by way of a tethered input box. The inputs which are accepted by our electronics can be either NPN or PNP type. The polarity must be set before powering the unit. **If tethered inputs are used, the polarity jumper must be removed from the SM8 and set inside the tethered input module.** If this is not done, damage to the SM8 is possible. Refer to Figure 4 for the location of the polarity jumper. Also, if the inputs are improperly wired, damage can occur to the switches.

Each SM8 is mounted directly to the MAC Valve manifold and is connected to the PLC network via the Profibus standard cable rather than individual wires for each solenoid and each input as would be the case for discretely wired manifolds. This greatly reduces both the amount of wiring and the time required to get the product on line compared to conventionally wired system.

MAC Valve SM8s have pre-wired solenoid connections. It is only necessary to make the communication and power connections to the Serial Interface terminals and to set the node address switches located on the side of the electronics box at the time of installation. The MAC SM8 system comes with a standard 9 pin sub-D female type communications connector. It also can be order with a variety of power connectors. Thus, the amount of wiring by way of the connectors is minimized.

2. SYSTEM STRUCTURE

2.1 Applicable PLCs

The following is a partial list of scanners and cabling approved by the Profibus governing body at the time of this wiring.

Table 1

Company	Product
Siemens	Scanners, PC Cards, Cabling
Belden Wire and Cable	Cables
Crouse-Hinds	Connectors
Daniel Woodhead	Cables, Connectors
Lumberg	Connectors
Molex	Cables, Connectors
Turck	Cables, Connectors
S-S Technologies	Scanners
Huron Networks	Scanners
Synergetic Micro Systems	Scanners
Toshiba	Scanners
Hilscher GmbH	Scanners

2.2 Applicable MAC Valve Series for the SM8

The following are the valves which can be used with the SM8 Valve Manifold:

- 34 Series
- 35 Series
- 37 Series
- 44 Series
- 45 Series
- 47 Series
- 82 Series
- 92 Series
- 93 Series
- 6200 Series
- 6300 Series
- 6500 Series
- 6600 Series
- ISO Series

The maximum wattage per channel is 5.4W which corresponds to 0.225A at 24VDC. The total output current load is a maximum of 4.0A.

3. SPECIFICATIONS

3-1 General Specifications

Table 2

Item	Specifications
Operating ambient temperature	0~+50°C (consult the factory for higher temperature operation)
Operating ambient humidity	10~90% RH (no condensation)
Vibrating resistance	5G (10~55 Hz, 0.5mm)
Impact resistance	10G
Dielectric strength	500VAC 60 Hz for 1 sec. (between external terminal and case)
Insulation resistance	10Mohm
Operating atmosphere	No corrosive gases

3-2 Performance Specifications

Table 3

Item	Specification
Applicable PLC	Refer to Table 1
DeviceNet Processor/Scanner	Refer to Table 1
Max. # of SI Units per Master Station	(Refer to Table 1)
Transmission Speed	9.6kb-12Mb
Transmission Distance	Consult Profibus Wiring Guide
Transmission Path	Refer to Table 1

3-3 SM8 Unit Specifications

Table 4

Item	Specification
Power supply voltage	For solenoid valves 24VDC +/-10% For SM8 (internal) 24VDC +/-10%
Power consumption	For solenoid valves Max. 4.0A For SM8 Node Power Max. 200mA plus Input switch power Consult switch company for their requirements
Output points	16 points 5.4W/Channel Max (24VDC) 2 bytes consumed
Input points	16 points (24VDC) 2 bytes produced
Residual voltage	1.0 V or less
Weight (Main Electronics Module)	0.75kg
Dimensions (Without Connectors)	34x71x144mm

4 Rotary Switch Settings/Electronic Data Sheet (GSD)

4-1 Addressing

The Profibus system uses node numbers as a bases for addressing. The SM8 system has a capacity of 100 (0-99) addresses. Of these addresses, one is used for the master scanner, and one could be used for the system monitor (this arrangement depends on the company used for the communications). From this, we can have as many as 99 SM8s on a given system. Each SM8 must have a unique address for this to work correctly. Please consult the company from which the scanner is obtained for complete scanner specifications and operational methods.

With the power supply OFF, remove the SM8 from its base. On the side of the unit, remove the cover plate and access the two rotary switches. Refer to Figure 1 for the switch locations.

Use a small anti-static screwdriver to set the positions of the 2 switches for the unit's node address. The Least Significant Bit (LSB) is the left most switch (farthest from the LEDs) and the Most Significant Bit (MSB) is the switch closest to the LEDs. Note, when the switch is in the position pointing toward the card edge connector, it is set for a value of "0".

4-2 Electronic Data Sheet (GSD)

The second part of commissioning a node in Profibus is to attached the GSD File to the software in the master node. This product will use GSD part number S-0010 Rev A. Due to the differences in the software for a given scanner, please consult the scanner company's manual for instructions on GSD usage.

The following is a printed copy of the GSD file used for the MAC Valves/Profibus SM8 A disk copy is available upon request.

```
;GSD-FILE HMS_1000.GSD 14.01.97
#Profibus_DP
Vendor_Name =      "HMS Fieldbus Systems AB" ;max. 32 char.
Model_Name =      "PROFIBUS DP-32 MODULE"  ;max. 32 char.
Revision =        "Version 1.4"           ;max. 32 char.
Ident_Number =    0x1000                   ;unsigned 16
Protocol_Ident =   0                       ;0=Slave
Station_Type =    0                       ;0=DP only
FMS_supp =        0                       ;0=kein support
Hardware_Release = "Version 1.0"          ;max. 32 char.
Software_Release = "Version 1.0"         ;max. 32 char.
```



```
9.6_supp = 1 ;baud rate supported
19.2_supp = 1 ;baud rate supported
93.75_supp = 1 ;baud rate supported
187.5_supp = 1 ;baud rate supported
500_supp = 1 ;baud rate supported
1.5M_supp = 1 ;baud rate supported
3M_supp = 1
6M_supp = 1
12M_supp = 1
; Duration to answer a request by a responder
MaxTsd_r_9.6 = 60
MaxTsd_r_19.2 = 60
MaxTsd_r_93.75 = 60
MaxTsd_r_187.5 = 60
MaxTsd_r_500 = 100
MaxTsd_r_1.5M = 150
MaxTsd_r_3M = 250
MaxTsd_r_6M = 450
MaxTsd_r_12M = 800
;
Redundancy = 0 ;no redundancy
Repeater_Ctrl_Sig = 2 ;RTS=TTL level
24V_Pins = 0 ;not available
Freeze_Mode_supp = 1 ;freeze mode is supported
Sync_Mode_supp = 1 ;sync mode is supported
Auto_Baud_supp = 1 ;baud rate search is supp.
Set_Slave_Add_supp = 0 ;no support, EEPROM necess.
User_Prm_Data_Len = 5 ;LSPM2 / SPM2
User_Prm_Data = 0x00,0x00,0x00,0x00,0x00
Min_Slave_Intervall = 0x000B ;1.1msec.
Modular_Station = 0 ;compact device
;Max_Module necessary if Modular_Station = 1
;Max_Input_Len necessary if Modular_Station = 1
;Max_Output_Len necessary if Modular_Station = 1
;Max_Data_Len necessary if Modular_Station = 1
;Unit_Diag_Bit optional
;Unit_Diag_Area optional
Module = "AB-PDP-32 I/O" 0x21,0x11 ;
EndModule
```

5 Wiring/Installation

All Wiring and installation steps should be performed with the system power supply off.

5-1 Communications

The communications comes from the 9 pin sub-D connector on the side of the SM8 box. The wiring inside the SM8 from the connector is performed by the factory. The user must only connect a standard Profibus connector and compatible cable to establish communications. Refer to Figure 2 for terminal identification during installation.

5-2 Valve Power

There is a second connector on the top of the SM8 box. Depending on the type of connector required, the unit can have a variety of combinations of power to the valves.

5-4 Input Wiring

If your system has Input capability (connectors) installed, the wiring for the detectors should follow the pattern shown in Figure 2. The detector manufacturer's recommendations should be followed for the type of module used and the wiring which should be followed.

In some cases damage to the switch or detector could result from incorrect wiring. If there are questions, please consult the factory.

The MAC SM8 employs the industry standard Eurostyle micro four pin female connector for the modules. There are many companies which have lines of pre-assembled wire harnesses which will connect the electronics to a variety of sensors.

Also note the type of switch logic must be known prior to turning the circuit on. The type (NPN or PNP) is selected by way of a jumper next to the dip switches shown in Figure 4.

5-7 Fusing/Circuit Protection

The SM8 uses a multi-tiered approach to isolation and protection of the electronics and bus systems. The first line of defense are the two fuses located on the bottom of the unit. One of these fuses is for the valve power circuit, the other is used to protect the electronics and inputs circuit. Inside this circuit is a blocking diode to prevent any damage from reverse power wiring. Next in line is the opto-isolation employed for the separation of any electronic interference which might be created by either the valves or input and the communications bus. Along the valve circuits, we have both blocking and spike separation diodes to significantly reduce the valve's de-energized spike from reaching the electronics.

Table 6
Fuse Size/Replacement

Fuse Designation	Value	Protects	Replace P/N
F1	4A	Valve Power	Littelfuse 273 004
F2	1A	Electronics Power	Littelfuse 273 001

6 Output Programming/Bit Map

The outputs to the SM8 unit are mapped according to the node address inside the Profibus scanner. Due to the large variety of scanners, please refer to their User’s Manual for complete programming instructions.

The MAC Valves SM8 will consume two consecutive bytes (16 bits) which are assigned for use by the output section of the SM8 unit to the PLC memory for programming.

Table 7

Bit	Location	Channel
1	Valve Solenoid 1	1
2	Valve Solenoid 2	2
3	Valve Solenoid 3	3
4	Valve Solenoid 4	4
5	Valve Solenoid 5	5
6	Valve Solenoid 6	6
7	Valve Solenoid 7	7
8	Valve Solenoid 8	8
9	Valve Solenoid 9	9
10	Valve Solenoid 10	10
11	Valve Solenoid 11	11
12	Valve Solenoid 12	12
13	Valve Solenoid 13	13
14	Valve Solenoid 14	14
15	Valve Solenoid 15	15
16	Valve Solenoid 16	16

7 Input Programming/Bit Map

Like the outputs, the inputs to the SM8 are mapped according to the node address. The SM8 will produce two consecutive bytes (16 bits) which are assigned for use by the input section of the unit to the PLC memory for programming.

In the table below, Top refers to input connectors on top of the electronics, Tether refers to input connectors on the Tethered Input Module. Note, when using the Tethered Input, all inputs are controlled by the Tethered Module.

Table 8

Bit	Location	Channel
1	Top or Tether 1	1
2	Top 2 or Tether 2	2
3	Top 3 or Tether 3 or Water 2	3
4	Top 4 or Tether 4 or Water 1	4
5	Tether 5	5
6	Tether 6	6
7	Tether 7	7
8	Tether 8	8
9	Tether 9	9
10	Tether 10	10
11	Tether 11	11
12	Tether 12	12
13	Tether 13	13
14	Tether 14	14
15	Tether 15	15
16	Tether 16	16

The location of the Input Connectors can be see in Figure 3. Notice each connector has assignments for one input channel as noted in the above table.

There are two basic types of inputs based on the direction of current flow. We call the two types Positive Common and Negative Common. The Inputs are factory set by way of a jumper to either of these type. One word of caution, by setting the jumper for the mode of operation for the module, the whole module is that type (Positive Common or Negative Common). There is no option for connector by connector setting of type.

Refer to Figure 3 in selecting the desired mode of operation for the inputs. The terms “sinking” and “sourcing” are not used due to the possibility of confusion. In our terminology, Positive Common is used when the load is connected between the signal pins 4 and the positive voltage terminal pin 1 (typical for PNP logic switches). Negative Common is used when the load is connected between the signal pins 4 and the negative voltage terminal pin 3 (typical for NPN logic switches). **Also, if the tethered input module is used instead of the SM8 module inputs, the SM8 polarity jumper must be removed.**

8 Troubleshooting Guide

In the event of difficulties in either operation or installation of the SM8 Manifold, your local MAC Valves Distributor and the factory are ready and able to assist you in solving any problems which might be encountered.

Below is a table of some typical problems, symptoms, and their solutions. All troubleshooting LEDs are visible on the top of the electronics module. They are for Electronics Power (Power), DIA (Not Used), and Bus Error (Err). The other set (for the output channels and valve power) is along the module top edge.

Table 9

Problem	Symptoms	Solutions
Does not operate	Valve Power LED off Power LED off Err LED off No Output LEDs on No Valve operation	1. Verify primary 24VDC supply 2. Check fuses F1, F2/ replace if blown
Does not operate	Valve Power LED on Power LED on Err LED red No Output LEDs on No Valve Operation	1. Verify communications cable properly connected 2. Verify correct address
Does not operate	Valve Power LED on Power LED on Err LED off No Output LEDs on No Valve Operation	1. Unit On-line but not connected
Profibus is active/does not drive valves	Valve Power LED off Power LED on Err LED off No Output LEDs on No Valve Operation	1. Check Output fuse F1 2. Check wiring for power

<p>Profibus is active/individual valve does not operate</p>	<p>Valve Power LED on Power LED on Err LED off Valve Output LED on</p>	<p>1. Check connection of valve</p>
<p>Profibus is active/Input Channel does not sense change in input detector on PLC</p>	<p>Valve Power LED on Power LED on Err LED off Valve Operation Normal No Input Activity On PLC</p>	<p>1. Check Memory Map 2. Check whether correct module type (positive common or negative common) is used for application</p>

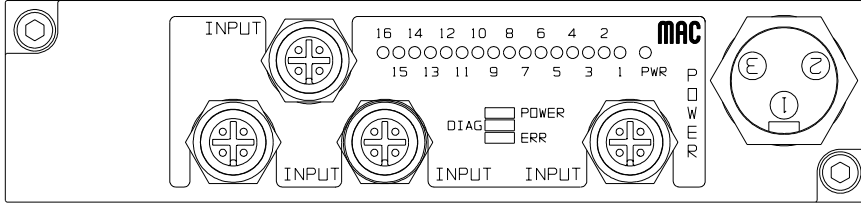
Warning:

Under no circumstances are MAC Valves to be used in any application or system where failure of the valves or related components to operate as intended could result in injury to the operator or any other person.

- Do not operate outside of prescribed pressure or temperature ranges.
- Air supply must be clean. Contamination of valve can affect proper operation.
- Before attempting to perform any service on valve, consult catalog, P & O sheet, or factory for proper maintenance procedures. Never attempt service with air pressure to valve.
- If air line lubrication is used, consult catalog, P & O sheet, or factory for recommended lubricants.
- Before interfacing the product to any bus or serial system, consult the controller and bus manuals for proper usage.

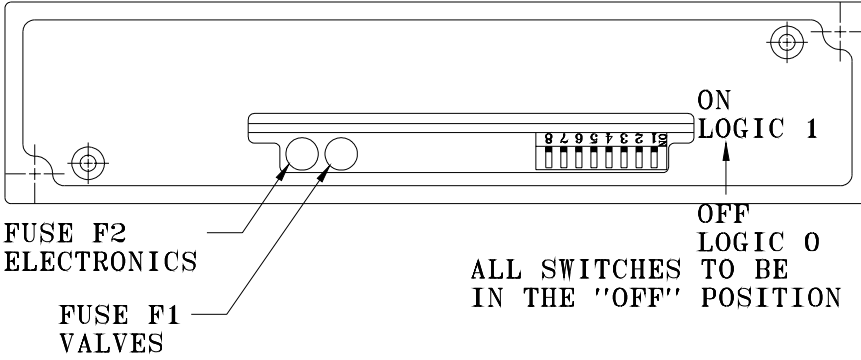
DIP SWITCH/FUSE GUIDE FIGURE 1

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REV A
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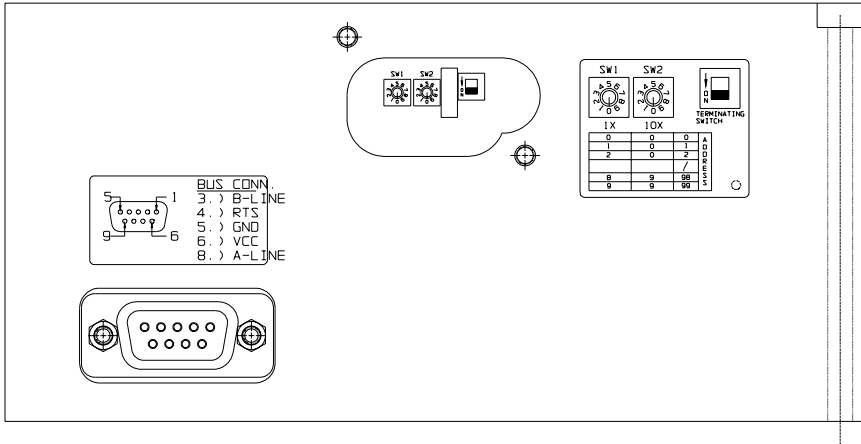


TOP VIEW

BOTTOM VIEW

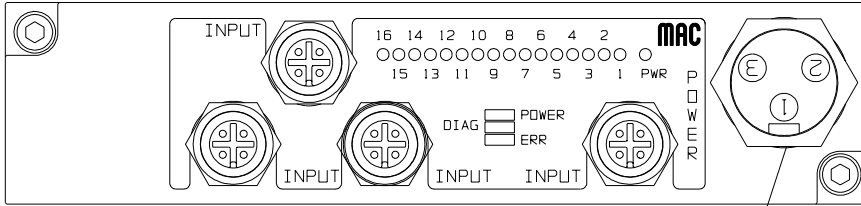


SIDE VIEW
WITH CONNECTORS REMOVED

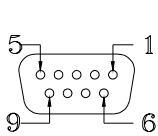


CONNECTOR GUIDE FIGURE 2

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TOP VIEW



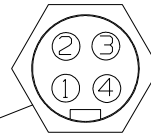
- BUS CONN.**
 3.) B-LINE
 4.) RTS
 5.) GND
 6.) VCC
 8.) A-LINE

POWER CONNECTOR

VIEWED FROM
MALE SIDE OF
CONNECTOR

- MINI
3 PIN
(SHOWN)**
- 1 EARTH GROUND
 - 2 24VDC +
 - 3 24VDC -

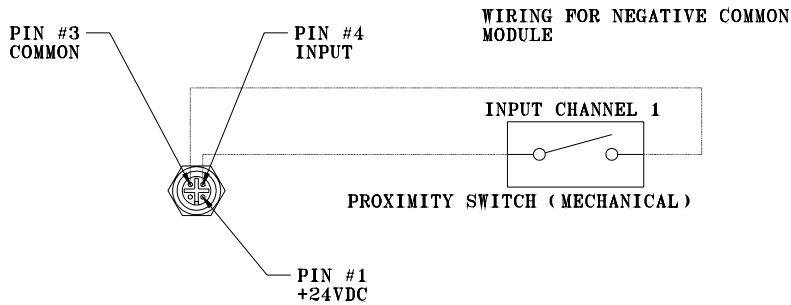
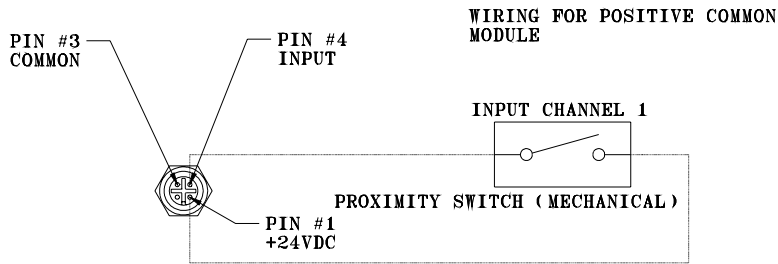
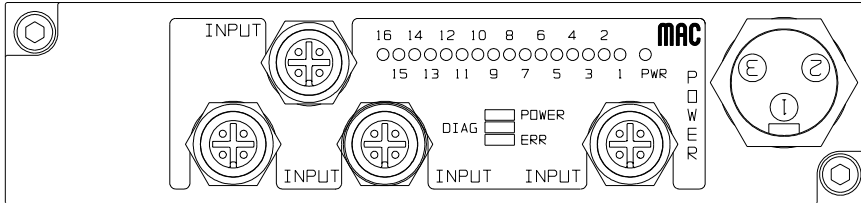
- MINI
4 PIN**
- 1 ELECTRONICS +
 - 2 VALVE +
 - 3 ELECTRONICS -
 - 4 VALVE -



NOTE:
 OTHER CONNECTORS AND CONFIGURATIONS
 AVAILABLE UPON REQUEST. PLEASE CONSULT
 THE FACTORY.

INPUT CONNECTOR GUIDE FIGURE 3

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REV A
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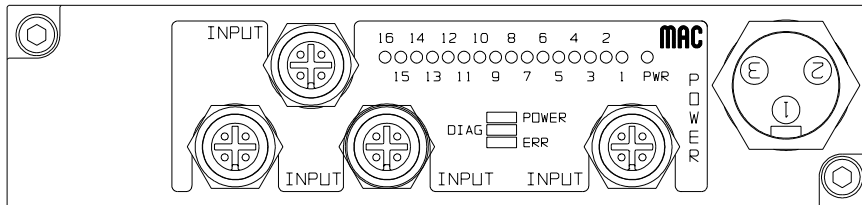


NOTE. FOR ELECTRONIC SWITCHES, CONSULT THE MANUFACTURER'S RECOMMENDED WIRING PROCEDURE.

JUMPER LOCATION

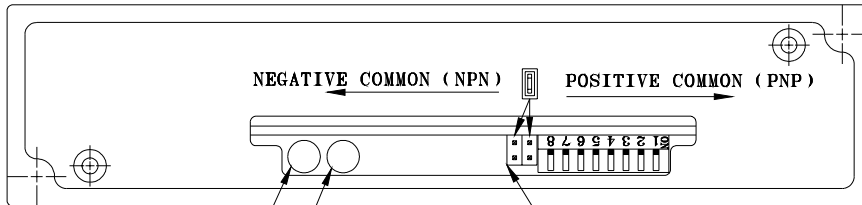
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FIGURE 4



TOP VIEW

BOTTOM VIEW



FUSE F2
ELECTRONICS

FUSE F1
VALVES

JUMPER LOCATION

NOTE, REMOVE PLASTIC JUMPER FROM THE PINS SHOWN FOR TETHERED INPUT MODULE APPLICATION

