

M2 Series

Magnetic Water Flow Meters



Product Description

M2... series water flow meters utilize the conductive nature of water to accurately measure flow rate without any mechanical interaction with the medium. The system consists of a measurement section and a transmitter, which can be mounted either on the meter or remotely.

Recommended Installation Tools

1. Torque wrench and sockets according to ANSI flange bolt size of selected meter (see Table 1)
2. Open-ended wrench of same size as torque wrench sockets
3. 13mm open-ended wrench
4. 2mm flathead screwdriver
5. ¼" flathead screwdriver

Additional Required Hardware

1. (4x) Flange gaskets according to flange size, water temperature, and pressure class (see Table 1)
2. Flange bolts, nuts, and washers according to ANSI flange size and pressure class (see Table 1)
3. 24 VDC power supply, 20 Watts minimum (see Table 3 for specifications)

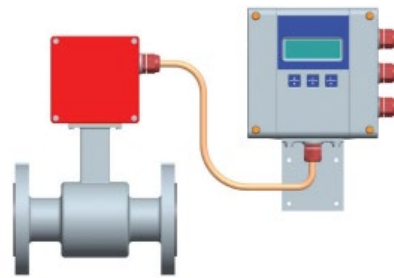
Components Supplied

Figure 1 shows the components supplied with the M2... flow meter:

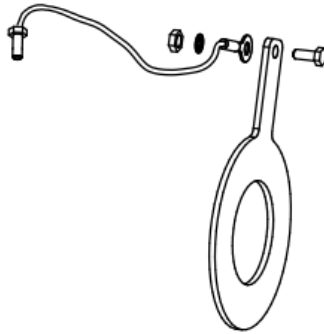
1. Standard Mount



Remote Mount



2.



1. (Standard mounting) MAG flow meter & transmitter

(Remote mounting) MAG flow meter, junction box, cable (according to length ordered), and transmitter

2. Grounding ring, strap, and mounting hardware (2x)

Installation Conditions

There are two methods of installation for the M2... flow meter: standard mount and remote mount. Standard mounting allows viewing the readout and adjusting parameters directly where the meter is located, while remote mounting allows the display interface to be located away from the meter body itself. Remote mounting also allows the meter to be used with water up to 302°F, while the standard-mounted configuration is limited to 212°F.

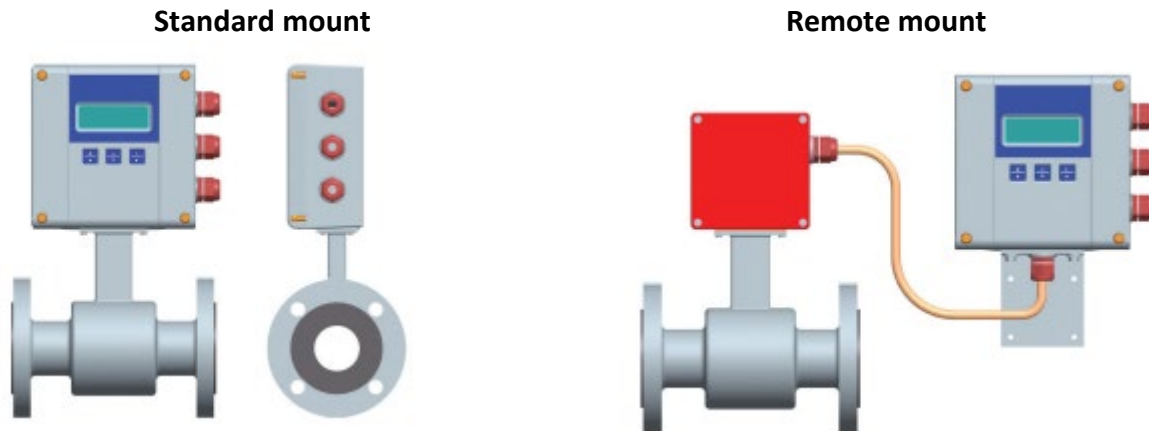


Figure 1: Standard and Remote Mounted Transmitters

The following conditions should be met to ensure proper operation of the M2... flow meter:

1. Do not install standard mount meter on pipes with extreme vibrations. If vibrations cannot be restrained, use the remote mount configuration of the transmitter.
2. Install meter the appropriate distance away from elements that cause flow disturbances, as outlined on page 5
3. Do not install sensor on the suction side of pumps
4. Do not install sensor on the outlet side of piston or diaphragm pumps
5. Minimize sensor exposure to equipment that produces electrical interference
6. Ensure both ends of signal cables are securely fastened
7. Place power and signal cables in separate conduits
8. Place meter in accessible location for installation and maintenance tasks
9. Install meter with flow direction arrow matching pipeline flow direction
10. If using a remote mount meter, do not cut the provided cable – the cable length is taken into account when the meter is calibrated before shipping

Installation Conditions (continued)

Meter Orientation

M2... flow meters can be installed in any orientation, as long as the pipe section remains completely full. A “forward flow” directional arrow is printed on the body of the meter, and it should be installed accordingly. The meters can be mounted either horizontally or vertically; if they are mounted vertically, it should be done so that the water flows upward through the meter.

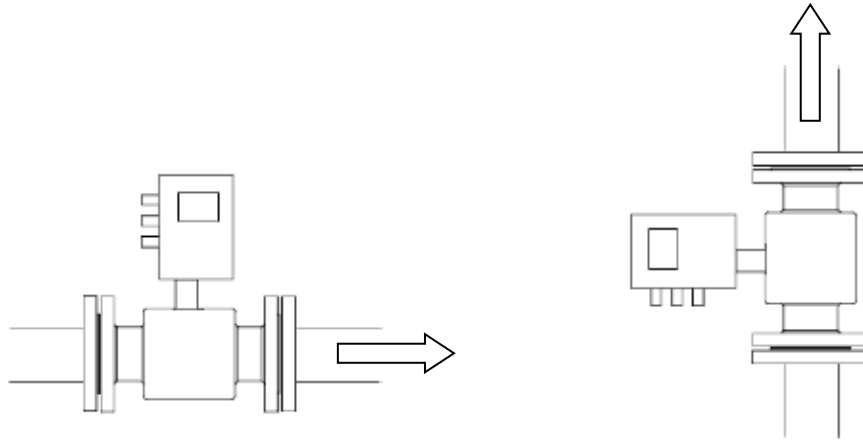


Figure 2: Horizontal and Vertical Mounting

Mounted horizontally, the meter should be mounted so that the low-flow measuring electrode axis is on a horizontal plane as shown below. These electrodes are visible inside of the meter pipe section.

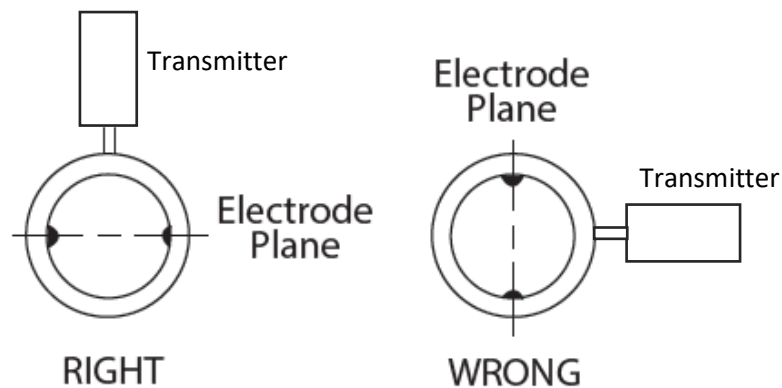


Figure 3: Meter Rotation

If the pipe is not full for more than five seconds, the M2... meter will display an error message and stop measuring flow.

Installation Conditions (continued)

Straight Pipe Requirements

Sufficient upstream and downstream straight pipe sections ensure maximum flow measurement accuracy. After an elbow, tee, or gate valve, 3 upstream pipe diameters are recommended. After a check valve, globe valve, butterfly valve, or pump, 7 upstream pipe diameters are recommended. Downstream, 2 pipe diameters are recommended.

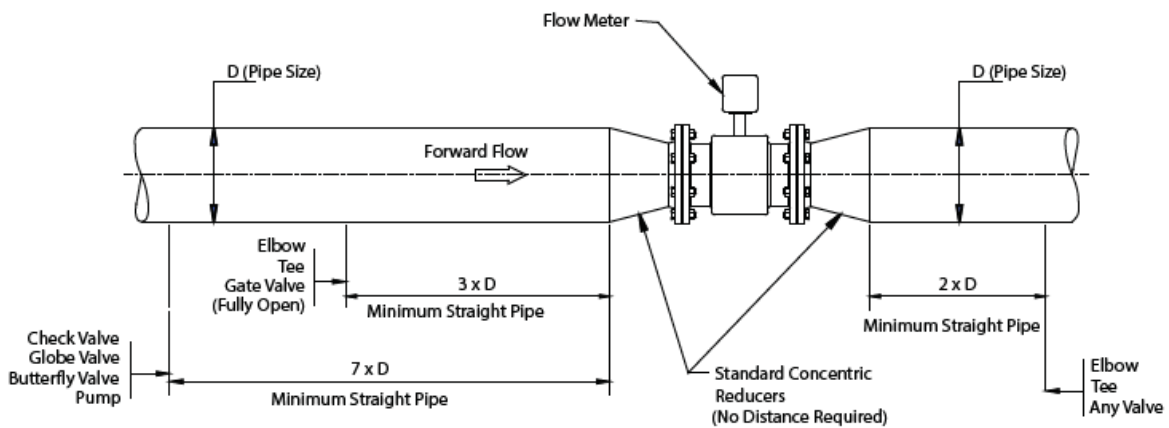


Figure 4: Upstream/Downstream Straight Length Requirements for Maximum Accuracy

Due to its method of operation, the M2... meter is capable of operating with 0 upstream straight length and still maintaining an accuracy of $\pm 1\%$ of flow rate at greater than 0.5 ft/s (0.15 m/s) velocity.

Mounting

Installation of the meter in the pipe section should follow the standard flange bolt tightening procedure, where the bolts are tightened in a star pattern to distribute forces evenly.

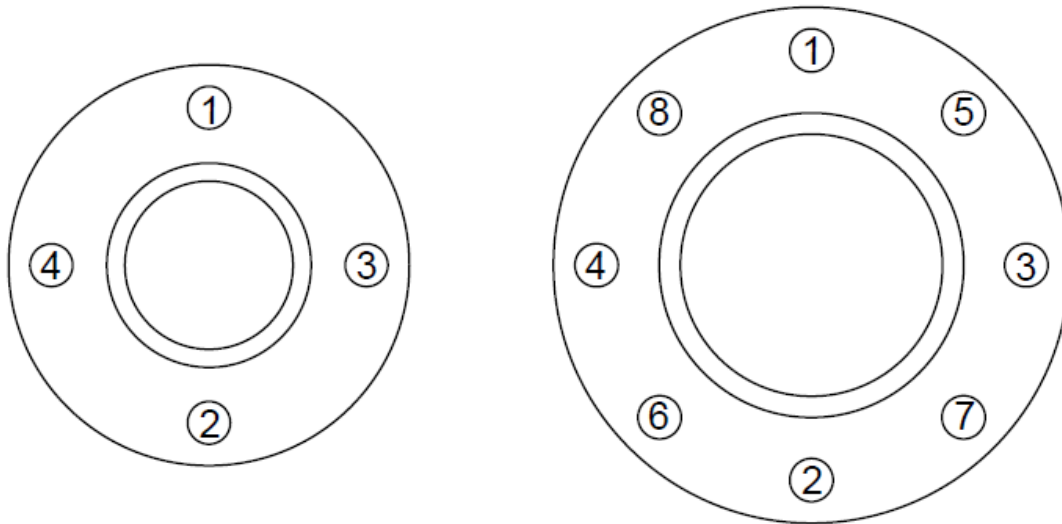


Figure 5: ANSI 150/300# Flange Bolt Tightening Order

Tighten flange bolts according to the table below.

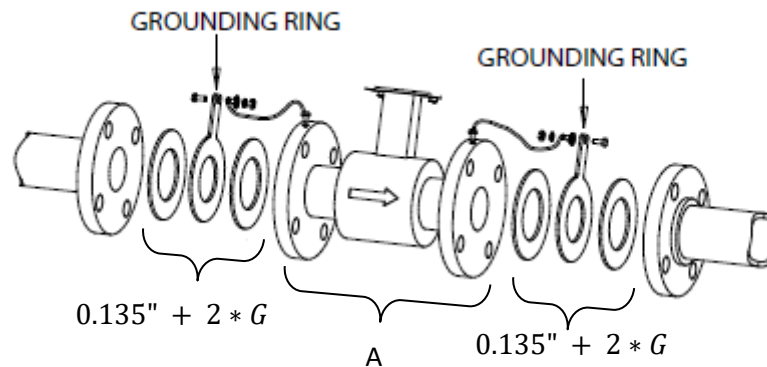
Table 1: Flange Bolt Torque Values

Pipe Size	ANSI 150#				ANSI 300#			
	Bolt Count	Bolt Diameter	Recommended Torque (ft lb)		Bolt Count	Bolt Diameter	Recommended Torque (ft lb)	
			Min	Max			Min	Max
1/2"	4	1/2"	40	50	4	1/2"	80	90
3/4"	4	1/2"	40	50	4	5/8"	80	90
1"	4	1/2"	40	50	4	5/8"	110	120
1 1/4"	4	1/2"	40	50	4	5/8"	110	120
1 1/2"	4	1/2"	40	50	4	3/4"	110	120
2"	4	5/8"	80	90	8	5/8"	110	120
2 1/2"	4	5/8"	80	90	8	3/4"	150	170
3"	4	5/8"	110	120	8	3/4"	150	170
4"	8	5/8"	100	110	8	3/4"	180	200

Mounting (continued)

For the installation section length of the meter, the two grounding rings and four gaskets must be taken into account. The total length is given in figure 8 below, while Table 2 gives the values for dimension A. Dimension G represents the thickness of one gasket.

The grounding rings are supplied with the M2... meter when purchased. The standard thickness of one ring is 0.135". For the proper pipe section installation dimension, the sum of dimension A, two grounding rings, and two gaskets should be used. Use gaskets appropriate for the flange size, water temperature, and pressure class of the application.



$$\text{Total installation section width} = 0.27'' + 4 * G + A$$

Table 2: 'A' Dimension for Available Sizes

Size		A Std* in. (mm)
in.	DN	
1/2	15	6.7 (170)
3/4	20	6.7 (170)
1	25	8.9 (225)
1-1/4	32	8.9 (225)
1-1/2	40	8.9 (225)
2	50	8.9 (225)
2-1/2	65	11 (280)
3	80	11 (280)
4	100	11 (280)

Grounding

The M2... flow meters come with an included pair of grounding rings, which matches the electric potential of the water to that of the electrode. This allows for accurate measurement of the flow rate, and therefore they are critical to install for proper operation. Gaskets (not provided) should be installed between the sensor, grounding ring, and pipe section, as shown below to ensure proper sealing.

The meter's flange has a threaded hole that can be used to mount a grounding lug. This grounded lug is attached to the grounding ring using the included hardware, thus grounding the ring to the meter body.

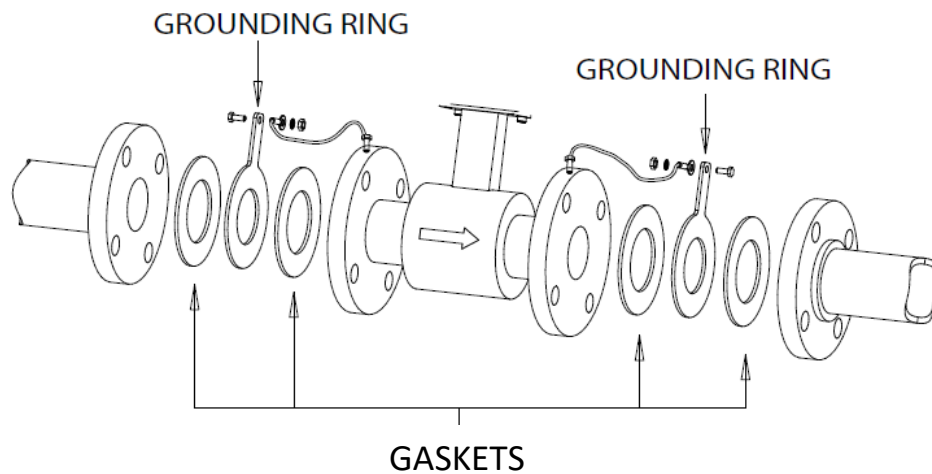


Figure 6: Grounding Ring Installation Location

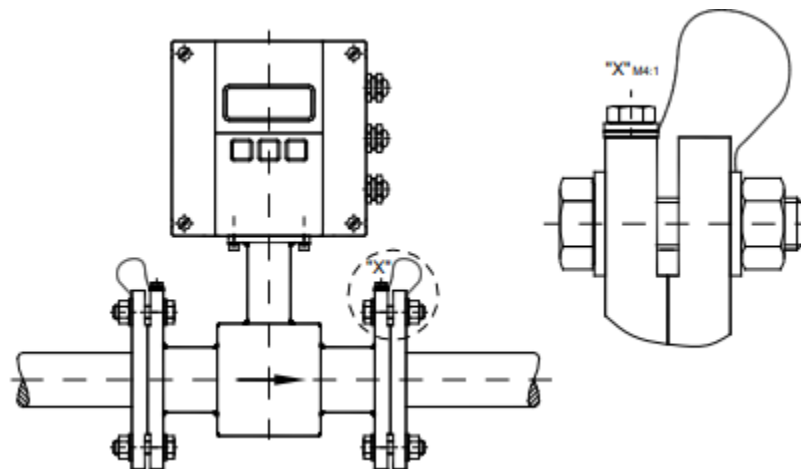


Figure 7: Grounding Lugs

Wiring

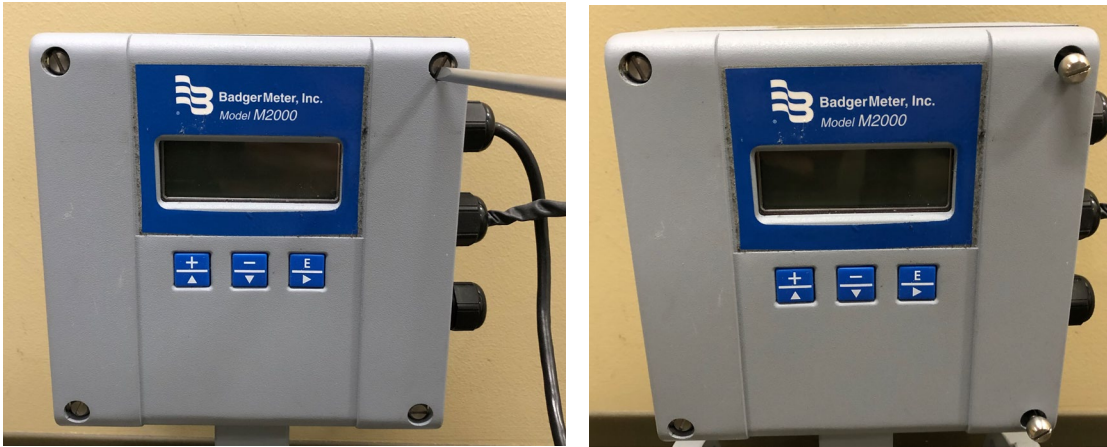
To access the main circuit board of the M2... meter, begin by opening the meter's cover.

Tools required for opening the transmitter:

1. ¼" flat blade screwdriver

The M2... meter uses ball screws that double as hinges to secure the display cover. To access the circuit board of the M2... meter:

1. Disconnect power to the unit
2. Use the ¼" flathead screwdriver to back out the two screws on the right-hand side completely



3. Loosen the two ball screws on the left-hand side partially, until the display hinges open on the left-hand ball screws



Wiring (continued)

The M2000 transmitter comes pre-configured for either local or remote mounting. However, the optional communication modules must be manually installed to the circuit board. The module inserts into the communication interface slot.

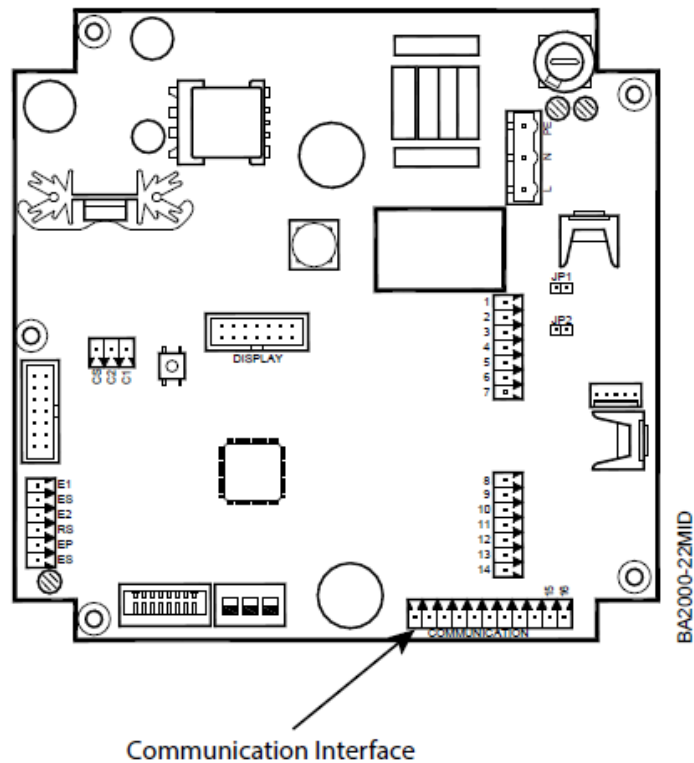


Figure 8: Communication Interface Location on Main Circuit Board

Wiring (continued)

The M2... flow meter can be connected to an SCC Master Panel to transmit flow data via analog signal. The analog output on the meter has an internally sourced 24 VDC power supply, and therefore does not need to be loop powered. Table 3 and Figure 8 below provide technical data for the analog output and power supply wiring.

Tools required for wiring:

1. 2mm flat blade screwdriver

Table 3: Power Supply Data

Maximum resistive load for analog output circuit	800Ω
Power supply typical load	10 Watts
Power supply maximum load	14 Watts
Suggested power supply	10...36 VDC 20 Watts minimum

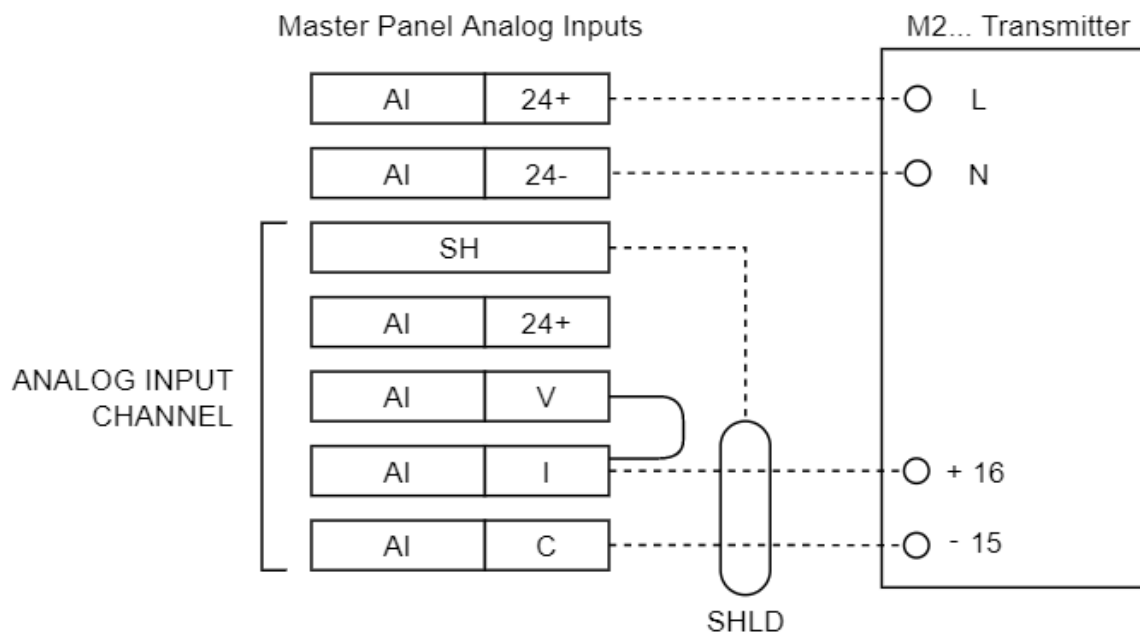


Figure 8: Analog Output Wiring to Master Panel

Wiring (continued)

Figure 9 below shows the components of the main circuit board in the M2... meter. Table 4 on the following page provides further details.

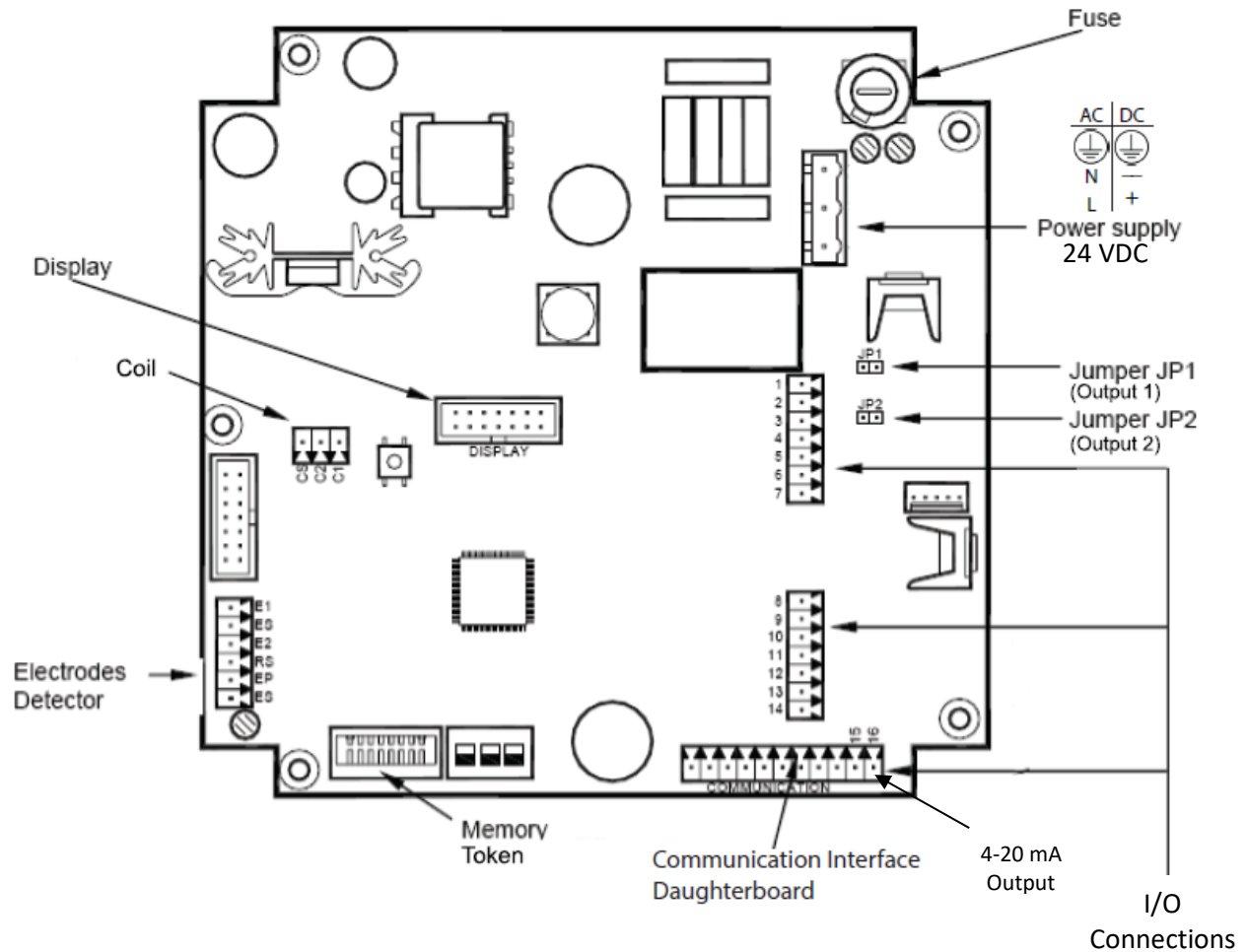


Figure 9: Main Circuit Board Layout

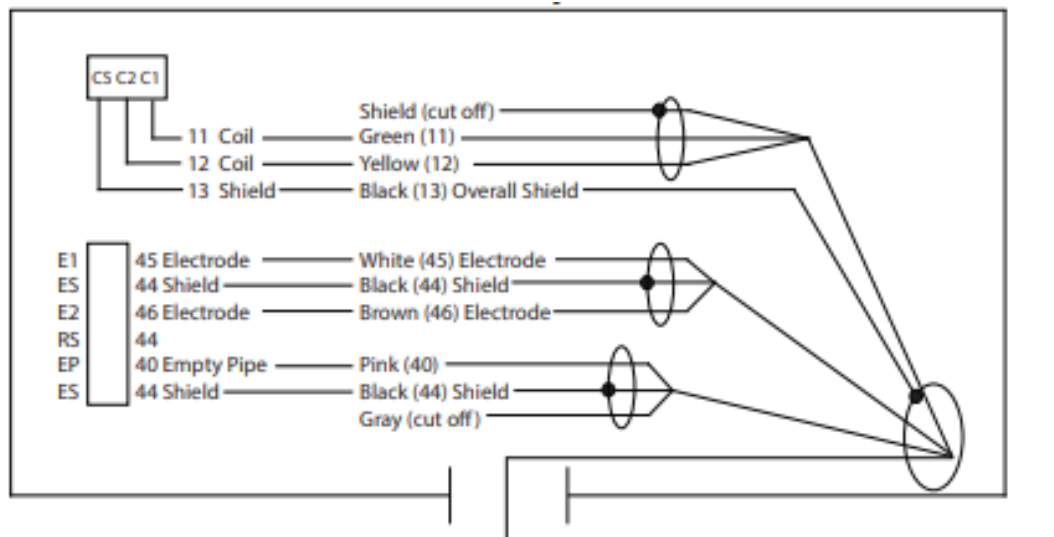
Wiring (continued)**Table 4:** Inputs and Outputs on Circuit Board

Input/Output	Description	Terminal
Power In	10 – 36 VDC, minimum 20 watts	L (+) N (-) G (Ground)
Analog Output	0...20 mA Resistive Load < 800 ohms 4...20 mA Resistive Load < 800 ohms 0...10 mA Resistive Load < 800 ohms 2...10 mA Resistive Load < 800 ohms	16 (+) 15 (-)
Digital Output 1	Passive maximum 30V DC, 100 mA Active 24V DC, 50 mA (set Jumper JP1) Maximum Frequency 10 kHz	1 (+) and 2 (-)
Digital Output 2	Passive maximum 30V DC, 100 mA Active 24V DC, 50 mA (set Jumper JP2) Maximum Frequency 10 kHz	3 (+) and 4 (-)
Digital Output 3	Passive Max 30V DC, 100 mA, 10 kHz Solid State Relay 48V AC, 500 mA, 1 kHz * Software configurable	10 (+) and 9 (-) 10 (+) and 11 (-)
Digital Output 4	Passive Max 30V DC, 100 mA, 10 kHz Solid State Relay 48V AC, 500 mA, 1 kHz * Software configurable	13 (+) and 12(-) 13 (+) and 14 (-)
Digital Input	5...30V DC	8 (+) and 9 (-)
RS 232	RS232, configurable, MODBUS RTU, Remote Menu, or Primo 3.1 Emulation	7 GND 6 Rx 5 Tx
Communication	Optional communications ports like HART, Profibus DP, ModBus® RS 485, M-Bus	Communication

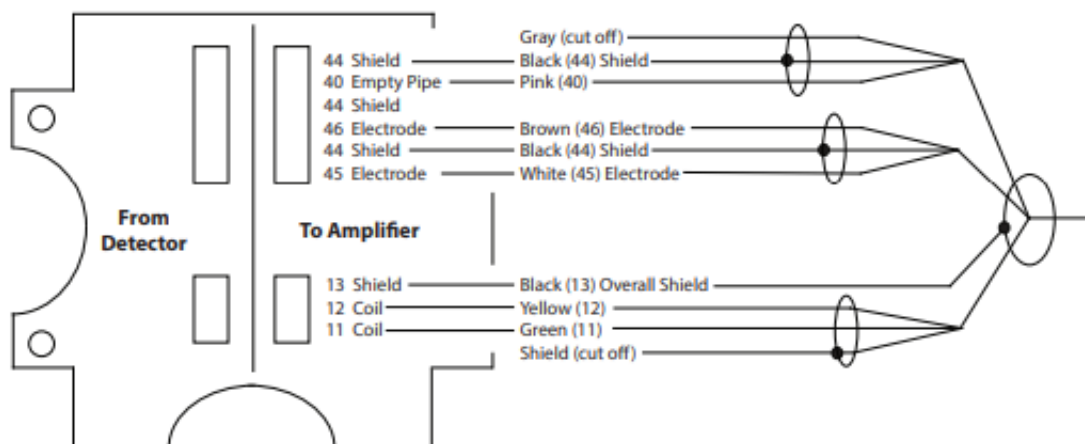
Wiring (continued)

When a M2... meter is remote mounted, the measuring section is mounted on a junction box. The diagram below shows the wiring of the junction box to the remote amplifier, which is where the display interface is mounted. The connection should be made with the provided section of cable, and the cable cannot be cut to a shorter length as the M2... meter is shipped calibrated for the specific length of cable. The connections are detailed in Table 5 on the next page.

M2... Transmitter



Junction Box (Mounted on Meter)



Wiring (continued)**Table 5:** Connections for Remote Mounting

From Junction Box			To M2000 Transmitter
Connection No.	Description	Wire Color	Connection Label
11	Coil	Green	C1
12	Coil	Yellow	C2
13	Main Shield	Black (Red Ferrule)	Cs
45	Electrode	White	E1
44*	Electrode Shield	Black	ES
46	Electrode	Brown	E2
40	Empty Pipe	Pink	EP
44*	Empty Pipe Shield	Black	ES
<i>*Connections with the No. 44 are lying on the same potential</i>			

Programming

While the M2000 meter comes pre-programmed from the factory, there may be some settings the user wishes to change.

The programming is navigated with the three buttons on the face of the unit. Options are selected/deselected with the “E” key. The “Up/+” key is the “next step” or “scroll text up” key. The “Down/-” key is the “previous step” key.



Figure 11: Navigation Buttons

Note that the “Up/+” key moves the content of the menu up, effectively selecting the option below. Consider the following example, where pressing the up key moves the selection from “exit this menu” to “main menu”:

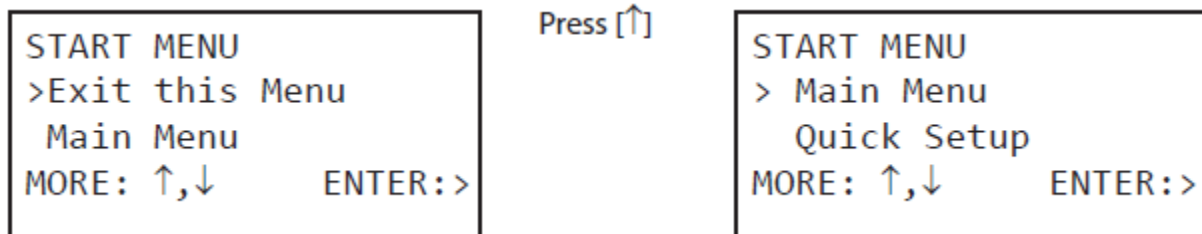


Figure 12: Navigating with the Arrow Keys, Selecting Next

Similarly, the Down/- key performs the opposite function, moving the menu text down and therefore selecting the previous item.

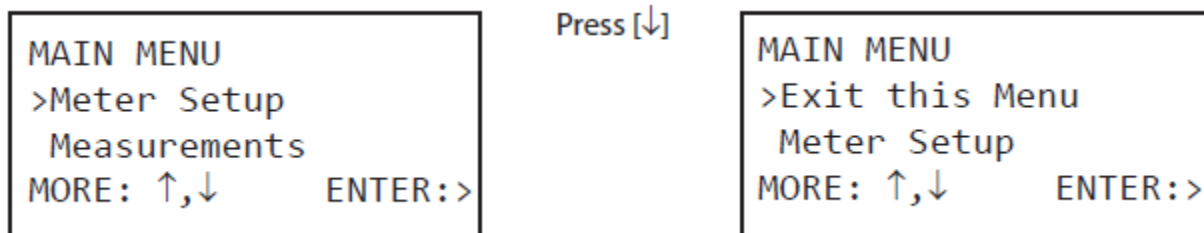


Figure 13: Navigating with The Arrow Keys, Selecting Previous

Programming (continued)

When a menu item is selected to edit the value, the format of the numeric entry screen appears as below:



Figure 14: Numeric Entry Interface

The top line shows the name of the parameter. The second line shows a description of the value. The third line displays the current value for the parameter. The bottom line shows directions for editing the parameter.

When modifying a numeric value, the + and – keys change the value of the number, and the E key moves the cursor one digit to the right. The E key will loop back to the left-most digit if it reaches the end of the number. The bottom line will update to show the current functions of each key while editing the parameter.

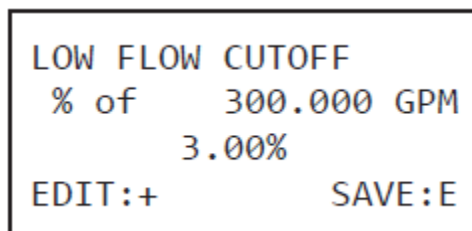


Figure 15: The Bottom Line Changes to Show the Function Of Each Key

Programming (continued)

The M2... meter is capable of password protection for different levels of access, which protect certain parameters. They are as follows:

Administration: Allows access to all menu configuration screens

Service: Allows access to service-level and user-level menu configuration screens

User: Allows access only to user-level menu configuration screens

Setting a PIN

1. Select **Main Menu > Advanced > Security** to view the *Security* menu.
2. Select **Set [Level] PIN** to view the *[Level] PIN* display (for User, Service, or Admin)
3. Set the five-digit PIN number.
4. Press **[E]** to save the PIN and to return to the *Security* menu.

Parameters

The table below shows the menu paths to all parameters. The commonly modified parameters are marked with a star.

Quick Setup	Flow Unit ★		
	Totalizer Unit ★		
	Full Scale Flow ★		
	Low Flow Cutoff ★		
Main Menu	Meter Setup	Scale Factor	
		Empty Pipe Detection	
		Power Line Freq	
		Excitation Freq	
		Pipe Diameter	
		Detector Factor	
		Detector Offset	
	Measurements	Velocity Unit	
		Flow Unit	
		Totalizer Unit	
		Full Scale Flow	
		Low Flow Cutoff	
		Flow Direction	
		Damping Factor	
	Inputs/Outputs	Analog Output	Range ★
			Alarm Mode ★
		Digital Input	None
			Remote Reset
			Batch Reset
			Pos Zero Return
			ADE
		Digital Output #1	Pulses/Units
			Pulse Width
			Full Scale Freq.
			Preset Amount
			Set Point Min.
			Set Point Max.
			Output Type
Select Function			
Digital Output #2		Pulses/Units	
		Pulse Width	
		Full Scale Freq.	
		Preset Amount	
		Set Point Min.	
	Set Point Max.		
	Output Type		
Select Function			

Parameters (continued)

Main Menu	Inputs/Outputs	Digital Output #3	Full Scale Freq.
			Preset Amount
			Set Point Min.
			Set Point Max.
			Output Type
			Hardware Select
			Select Function
		Digital Output #4	Full Scale Freq.
			Preset Amount
			Set Point Min.
			Set Point Max.
			Output Type
			Hardware Select
			Select Function
	Clear Totals	Flow Simulation	
		TN	
		T+	
		T-	
		PS	
	Communications	Port A Settings	Interface
			Port Address
			Baud Rate
			Data Bits
Parity			
Stop Bits			
Port B Settings		Port Address	
		Ext. Port Address	
		Baud Rate	
		Data Bits	
		Parity	
Diagnostics	Stop Bits		

Parameters (continued)

Main Menu	Advanced	Data Logger	Logging Interval
			View System Clock
			Set System Clock
		Token Copy	Configuration
			Store to Token
			Restore from Token
		Encoder Protocol	
		Totalizer Dials	
		Totalizer Resolution	
		Backlight Controls	
		Analog Calibrate	
		Software Filter	MDN-Filter ★
			ACC-Filter
			ZFS-Filter
			IIR-Filter
		Empty Pipe Cal.	
		Security	Set Admin Pin ★
	Set Service Pin ★		
	Set User Pin ★		
	Info/Help	Error Counts	
		Rollover Counts	
		PowerUp Counter	
		PowerOff Totalizer	
		Version Info	
		Serial Number	
		Meter Tag Name	
		Daughterboard Info	
Polarization Volt.			
Restore Default			
Language Select			

Parameters (continued)

Commonly-used parameters are defined in the table below.

Table 6: Commonly Used Parameters

Parameter	Function																		
Flow Unit	Set the units for flow (GPM* , GPH , F³/s...) *Typically set for GPM																		
Totalizer Unit	Set units for flow totalization (L, USG, Lb, CFt...)																		
Full scale flow	Set maximum flow expected by system. As a rule of thumb, take BHP divided by 14 and add 25%. Maximum flow rates in BHP for available meter sizes are as follows: <table border="1" data-bbox="423 835 1474 909"> <thead> <tr> <th>½"</th> <th>¾"</th> <th>1"</th> <th>1-1/4"</th> <th>1-1/2"</th> <th>2"</th> <th>2-1/2"</th> <th>3"</th> <th>4"</th> </tr> </thead> <tbody> <tr> <td>526</td> <td>922</td> <td>1,494</td> <td>2,586</td> <td>3,521</td> <td>5,803</td> <td>8,280</td> <td>12,786</td> <td>22,017</td> </tr> </tbody> </table>	½"	¾"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"	526	922	1,494	2,586	3,521	5,803	8,280	12,786	22,017
½"	¾"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"											
526	922	1,494	2,586	3,521	5,803	8,280	12,786	22,017											
Low flow cutoff	Set % between (0... 10%) of full scale flow at which output is forced to zero. Used to eliminate effects of noise at low flow. Recommended setting of 1%.																		
Analog output range	Select 0-10 mA, 0-20 mA, 2-10 mA, or 4-20 mA																		
Analog output alarm mode	OFF: Analog signal only based on low rate, stays within configured range LOW: During alarm conditions, analog output is 2 mA less than bottom of configured range HIGH: During alarm conditions, analog signal is 2mA higher than top of configured range																		
MDN-Filter	Median filter, used to stabilize flow measurements by filtering noise.																		

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