

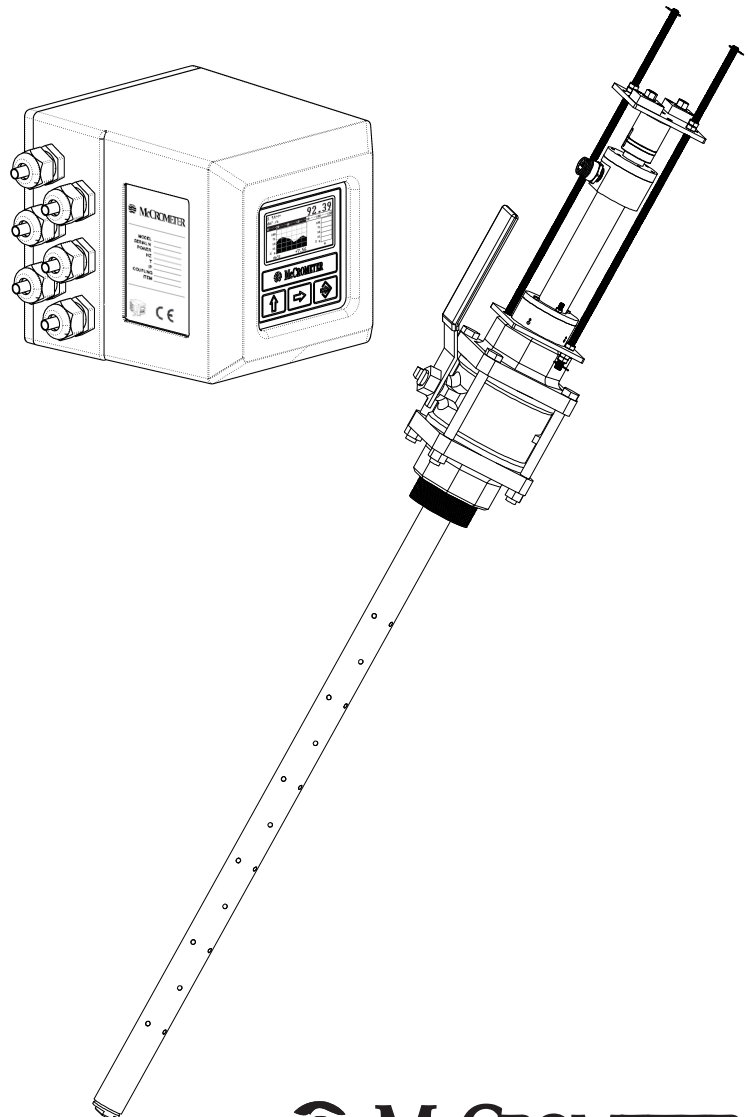


## Model 394L Full Profile Insertion Electromagnetic Flowmeter

### Quick Start Guide

24511-08 Rev. 1.0

February 2011



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## Introduction:

This FPI Mag Quick Start Guide contains certain important excerpts regarding the installation of the sensor and converter from the Installation, Operation & Maintenance Manual supplied with this meter. It is important to read the entire supplied manual before installing either the sensor or converter.

NOTE: The section and Figure numbering remain as they appear in the Manual for easy reference.

## 1.0 Safety

### 1.2 Safety Warnings

When installing, operating, and maintaining McCrometer equipment where hazards may be present, you must protect yourself by wearing Personal Protective Equipment (PPE) and be trained to enter confined spaces. Examples of confined spaces are manholes, pumping stations, pipelines, pits, septic tanks, sewage digesters, vaults, degreasers, storage tanks, boilers, and furnaces.

You must follow all state and local laws, as well as Occupational Safety and Health Administration (OSHA) regulations concerning Personal Protective Equipment, confined-space entry, and exposure to bloodborne pathogens. Specific requirements can be found in the OSHA section of the Code of Federal Regulations: *29 CFR, 1910.132 - 1910.140, Personal Protective Equipment; CFR Title 29, Part 1910.146, Permit-Required Confined-Spaces; and 29 CFR, 1910.1030, Bloodborne Pathogens.*



**WARNING!**

Incorrect installation or removal of FPI-Mag meters can result in serious injury or death. Read the instructions in this manual on the proper procedures carefully.



**WARNING!**

**Never enter a confined space without testing the air at the top, middle, and bottom of the space.** The air may be toxic, oxygen deficient, or explosive. Do not trust your senses to determine if the air is safe. You cannot see or smell many toxic gases.



**WARNING!**

**Never enter a confined space without the proper safety equipment.** You may need a respirator, gas detector, tripod, lifeline, and other safety equipment.



**WARNING!**

Never enter a confined space without standby/rescue personnel within earshot. Standby/rescue personnel must know what action to take in case of an emergency.



**WARNING!**

**Pressurized pipes should only be hot tapped, cut, or drilled by qualified personnel. If possible, depressurize and drain the pipe before attempting any installation.**



**WARNING!**

**Carefully read all safety warning tags attached to the meter.**

## 4.0 Installation

Please read the following information before installing the FPI-Mag sensor.

### 4.1 Site Selection

While the FPI-Mag is very flexible regarding its placement, when installing the sensor at a location with flow disturbers such as elbows, T-junctions, Y-junctions, and active valves, contact your local McCrometer representative for a site review and sensor location recommendation.

### 4.2 Sensor Clearance

The sensor will protrude from the pipe when installed demanding sufficient clearance (distance H, in Figure 5 below) from any obstruction. This distance accounts for the length of the sensor, the distance from the outer pipe wall to the top of the valve plus: 18" is recommended; 12" is the minimum. See App. 3.0 Submittal Sheet located in the Appendix for the proper calculations for clearance distance.

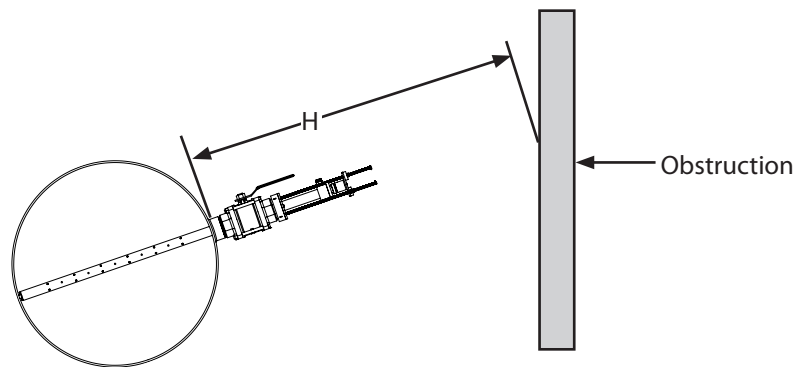


Figure 5: Sensor Clearance distance

### 4.3 Pipe Valve Installation

#### **WARNING!**

Pressurized pipes should only be hot tapped, cut, or drilled by qualified personnel using high quality saddles, valves and stainless steel nipples. If possible, depressurize the pipe before attempting any installation.

Install a 2" (50mm) full port valve or corporation stop with a 2" (50mm) NPT female pipe thread output for the sensor. Follow any and all installation instructions provided for the valve that you have chosen. The valve or corporation stop can be installed onto a welded coupling or pipe saddle. See Figure 6. Alternative ball valve or corporation stop sizes may be used or required. Consult factory for alternative configurations.

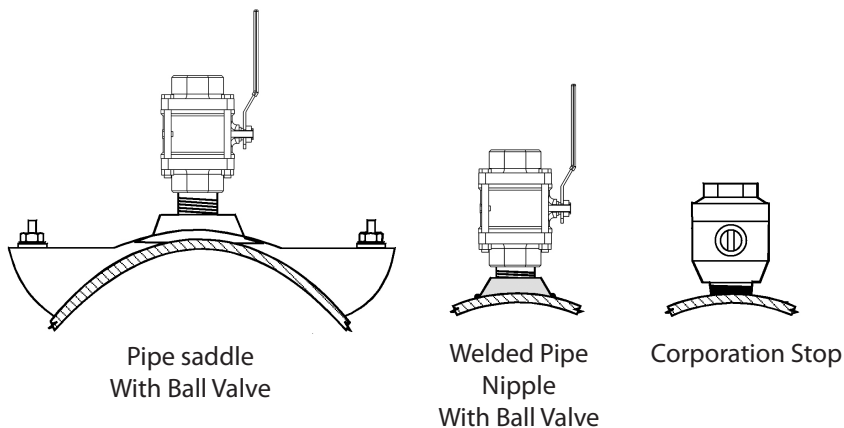


Figure 6: Installation Valve Options

#### 4.4 Meter Disassembly For Installation

When installing large meters, it can be desirable to remove the compression seal assembly from the rest of the meter and install it onto the valve separately. The following steps describe the separation of the sensor, top-plate and retaining rods from the compression seal assembly.

4.4.1 Loosen the bolts on the compression seal relieving the pressure on the compression seal. Do not remove the bolts.

4.4.2 On the compression seal assembly, remove the locking cotter pins from the bottom of the two retaining rods under the 3/8" nuts.

4.4.3 Remove the 3/8" nuts from the retaining rods.

4.4.4 Slide the sensor out of the compression seal. The retaining rods will also slide out of the compression seal assembly. Carefully set the sensor and attached hardware to the side.

4.4.5 At this point the compression seal assembly can be installed onto the valve.

#### 4.5 Compression Seal Assembly Installation

The sensor assembly uses a compression seal, which keeps the sensor watertight when the pipe is under pressure. Care must be taken when installing the sensor, to avoid leaks.

4.5.1 Visually inspect all elements of the installation to insure they are structurally sound and of high quality materials, including all welds, couplings and nipples. To prevent future corrosion, nipples should be high quality stainless steel.

4.5.2 Put a generous amount of the pipe sealant (supplied with the sensor) on the compression seal threads. (Teflon tape may also be used.) NOTE: if pipe sealant gets on the sensor electrodes the velocity signal may be lost.

4.5.3 Place the compression seal threads over the pipe valve. Turn the entire sensor assembly clockwise to secure the assembly to the valve.

4.5.4 The seal is secure when a large amount of force is required to turn the assembly. Line up the arrow (on the top plate) with the direction of the flow. The sides of the bottom plate should be parallel with the pipe.

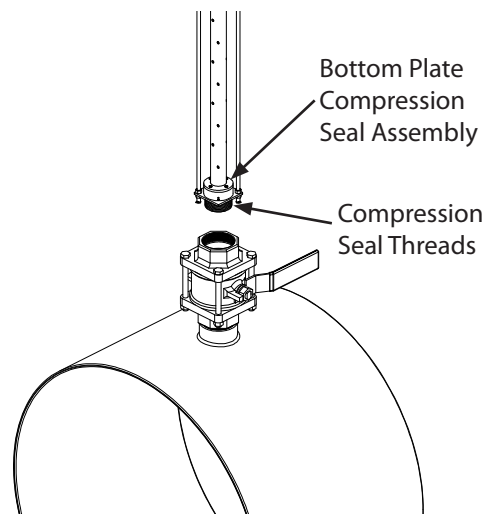


Figure 7: Sensor Installation

## 4.6 Meter Re-assembly After Compression Seal Assembly Installation

4.6.1 Apply liquid soap, such as Simple Green, to the interior surface of the seal gland. This will act as a lubricant to facilitate the insertion of the sensor and ensure its proper axial loading. Insert the sensor into the compression seal in the bottom plate while inserting the two retaining rods into their respective holes in the bottom plate and secure with 3/8" nuts. Insure the two nuts above and below the compression seal assembly are sufficiently tightened to prevent the threaded rod from rotating.

4.6.2 Insert the locking cotter pins through the small holes in the bottom of the retaining rods, just below the 3/8" nuts.

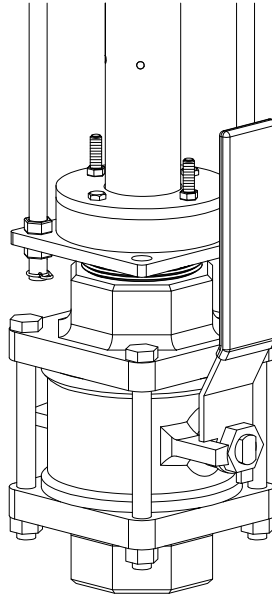


Figure 8: Sensor Installation

## 4.7 Inserting The Sensor

The sensor can be installed while the line is under flowing conditions. The line water velocity should be as low as possible to prevent sensor vibration during the insertion process. The velocity must be under 5 ft./sec.



### **WARNING!**

The compression seal/sensor assembly may be under pressure. Serious injury may result if proper procedures are not followed. Do not attempt to install the sensor without the retaining rods fully assembled.

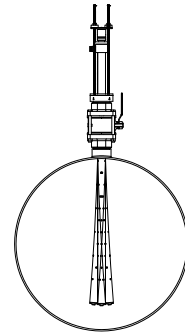


Figure 9: Sensor vibration

If the meter was disassembled to assist in the installation of the compression seal assembly on to the valve (Section 4.4) it is important to insure that the meter is properly reassembled with both retaining rods completely installed with the 3/8" nuts properly tightened.

4.7.1 Insure the two compression seal bolts are hand tightened.

4.7.2 Barely crack open the valve and tighten compression seal bolts as required to minimize leaks. A towel draped around the compression seal can reduce spray if necessary.

4.7.3 Open the valve completely. Failure to open the valve completely will cause the valve to scrape the sensor during insertions and may result in permanent damage to the sensor.

4.7.4 Insert the sensor into the pipe by simultaneously rotating the two captive nuts on the top plate clockwise with the two ratchet wrenches provided until the foot of the sensor reaches the far wall of the pipe and the load spring is compressed. See Section 4.7.5. It is recommended that the sensor insertion tool (p/n 75031) be used to rotate the captive nuts to insure the top plate compresses evenly. See Section 4.8.

**i** **IMPORTANT**  
 If the captive nuts are not tightened simultaneously, the top plate will become crooked and cause the sensor to be inserted at an angle and may cause permanent damage to the sensor.

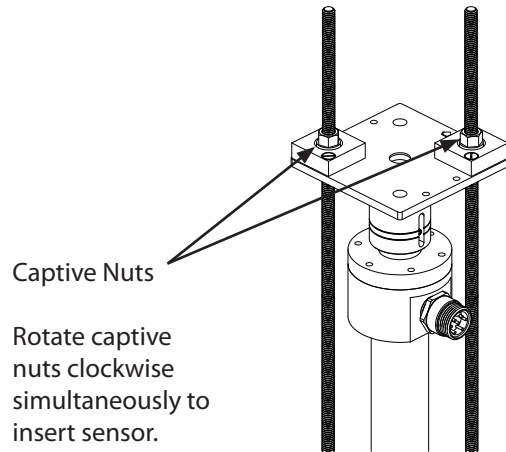


Figure 10: Captive Nuts

**i** **NOTE**  
 If the short retaining rods are not used (see Section 4.11), run a 3/8" nut down against each captive nut to prevent the captive nut from rotating.

4.7.5 A load is now applied at the top of the sensor forcing the bottom of the sensor to seat against the far wall. This keeps the sensor firmly in place against the far wall of the pipe. The amount of load is indicated by the three lines and set screw at the top of the sensor. See Figure 11. The bottom line indicates a 300-lb. load.

Recommended sensor loads are 300 lbs. or less for low pressure plastic pipes and 450 lbs. for low pressure metal pipes.

For applications other than low pressure the sensor load should be increased. Follow the instructions below until the set screw is between the top and middle lines. Consult factory for the appropriate loading for your application.

4.7.6 Rotate the two captive nuts on the top plate until the proper load is indicated. If using the Insertion Tool, rotate the two captive nuts using only the **low** gear shaft until the proper load is indicated. **DO NOT** use the high gears on the insertion tool as this may create too much load too fast and damage the sensor or the pipe.

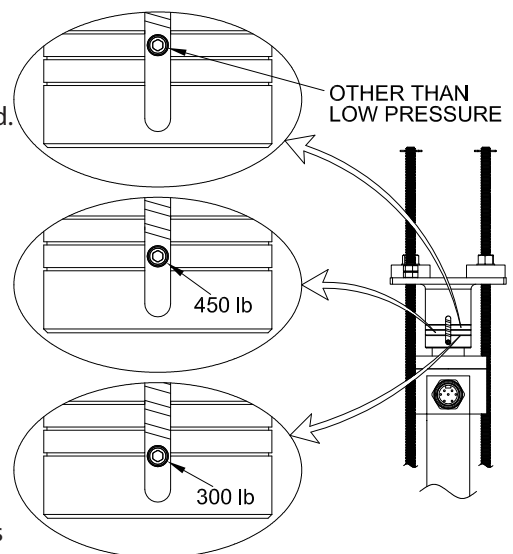


Figure 11: Sensor Load Indicators

4.7.7 Tighten the compression seal bolts again. The bolts should be tightened down firmly.

## 4.8 Sensor Insertion Tool

McCrometer recommends using a sensor insertion tool (P/N 75031) to help with inserting the sensor and to avoid any damage to the sensor. Place the profiling insertion tool over the captive nuts and lock it into place with spring locks located on the bottom of the tool. Using the provided wrench rotate the high gear shaft clockwise until the bottom of the sensor reaches the far wall of the pipe. The low gear shaft is used to apply pressure to the sensor once the sensor has reached the far wall of the pipe. See Section 4.7.5.

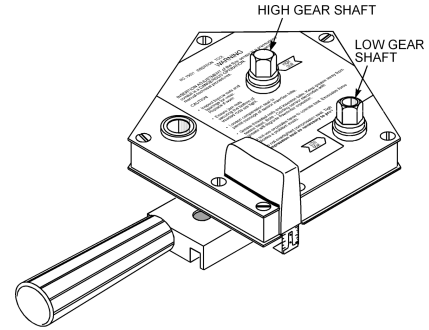


Figure 12: Insertion Tool

## 4.9 Installing The Short Retaining Rods

After the sensor has been inserted and the load adjusted, shorter retaining rods can be installed and the longer ones removed. This will make the sensor assembly more compact.



### IMPORTANT

The long retaining rods are matched to each sensor and are required for removal of the sensor. It is important to safely store the long retaining rods and label them with the meter serial number.

- 4.9.1. Secure the short retaining rods to the compression seal assembly following the instructions at Section 4.6.
- 4.9.2. Secure the short retaining rods to the top plate with one 3/8" nut per rod.
- 4.9.3. Remove the long retaining rods.
- 4.9.4. Check and adjust the "Sensor Load" as necessary. See section 4.7.5.
- 4.9.5. Secure the 3/8" nuts on the top plate by running a second jam nut down and tightening it against the first nut.

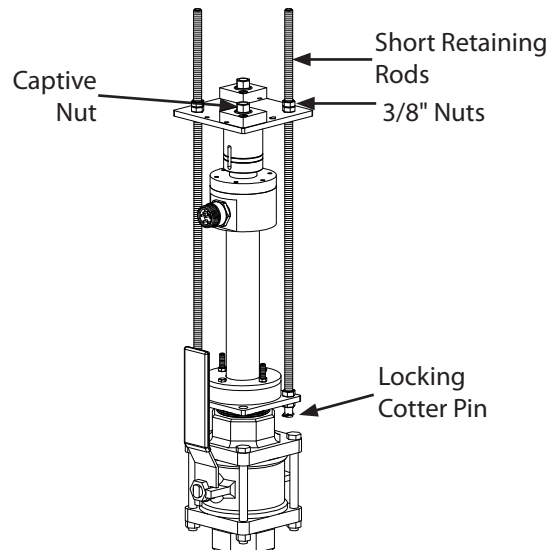


Figure 13: Short Retaining Rods Installation on 2" Meter



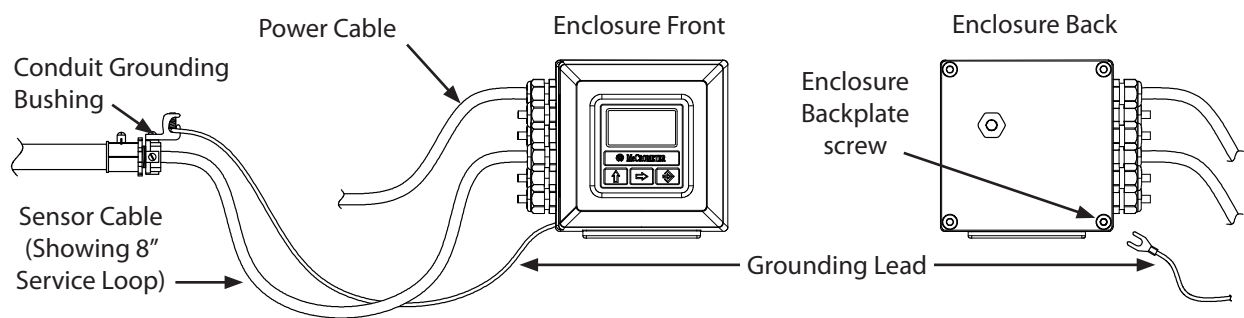
## 6.2 Installing Cables To Converter And Service Loop

Conduit of any kind **CANNOT** be attached directly to the electronics enclosure. Attaching conduit directly to the enclosure will introduce dangerous gasses and moisture into the enclosure creating a dangerous condition, and will remove the enclosure's IP67 rating. **Attaching conduit to the enclosure or altering the enclosure in any way will void the warranty.**

Any cable running through a conduit must exit the conduit and have a minimum of an 8" service loop before entering the electronics enclosure through the cable glands. This allows the electronics enclosure to be rotated and the rear panel to be accessed. If electrically bonding (grounding) the enclosure to metallic conduit or raceways, secure a lead wire to the enclosures back panel screw and attach the lead to a listed and approved conduit grounding bushing. See *Figure 16*. To insure IP67 rating use only round cable 0.125" to 0.375" in diameter.



**WARNING:** Do not connect any form of conduit directly to the converter enclosure. Doing so will allow moisture and potentially dangerous gasses to enter directly into the converter. Attaching any conduit to the enclosure, or altering the enclosure in any way will void the warranty.



**IMPORTANT:** All cables must have a minimum 8" service loop.

Figure 16: Cable Installation, Service Loop And Bonding To Metallic Conduit

## 6.3 Pulling Sensor Cable Through Electrical Conduit

It is very important to protect the end of the sensor cable when pulling it through a conduit. Water can accumulate in low portions of conduit. Always use the factory supplied cable plug, or similar method, to seal the end of the cable against water when pulling the cable through conduit. See *Figure 17*. This will insure proper operation of the meter.

Pulling The Sensor Cable:

1. Tie a rope or cable-snake securely around the middle of the cable plug.
2. Carefully pull the rope or snake until the sensor cable end clears the conduit.
3. Bring the cable end to the converter location. If necessary, secure the cable so that it does not fall back through the conduit.
4. Remove the cable plug by pulling the rip-wire. The cable plug will tear off (discard the plug).



**Caution:** Do not cut the cable cover off. Doing so may damage the sensor cable and adversely effect the calibration of the meter.

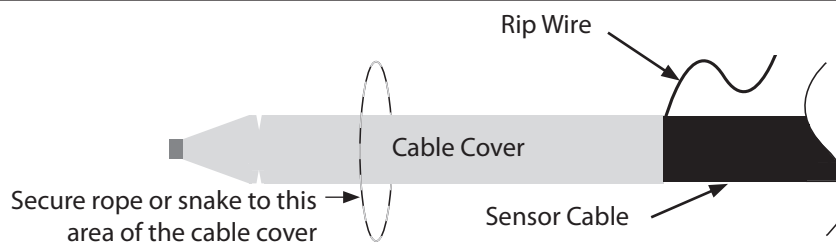


Figure 17: Cable Cover

## 6.4 Electrical Cable Connections



### CAUTION

Always disconnect the AC power cord before attempting any electrical connections.

All electrical cables enter the unit through compression fittings located on the side of the converter. Ensure that all unused fittings are plugged so the case remains sealed.

## 6.5 Terminal Board

All connections are made on the terminal board. To access the terminal board, loosen the four screws on the back of the converter to remove the rear cover.

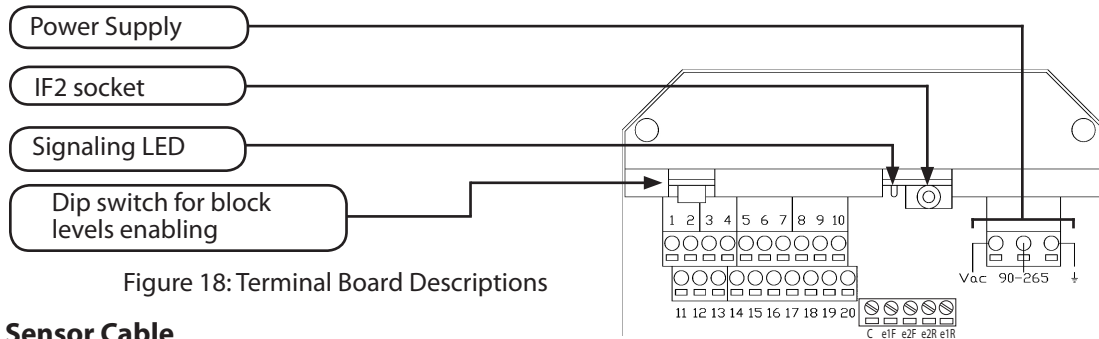


Figure 18: Terminal Board Descriptions

## 6.6 Sensor Cable

The terminals for the bi-directional sensor cable connection are numbers 12, 13 on Terminal Block M1 and C, e1F, e2F, e2R and e1R on the electrode terminal block. Connect the sensor cable wires using the color code table below. NOTE: the terminal blocks unplug from the circuit board for easy connection.

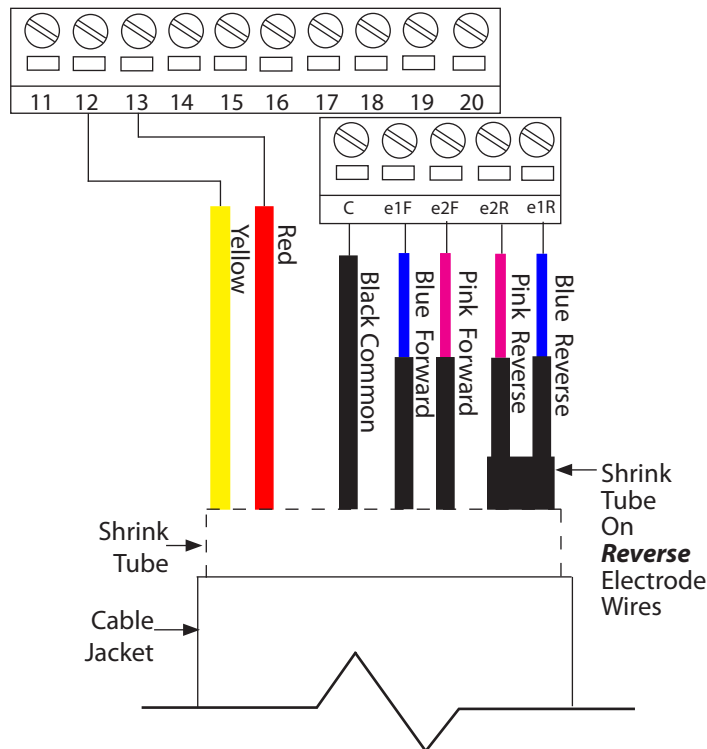


Figure 20: Sensor Cable Connections

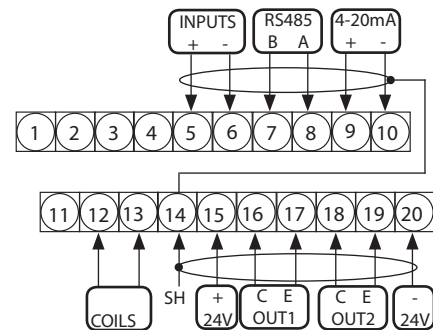


Figure 19: Terminal Block M1 Assignments

Terminal	Wire Color	Connected To
#12	Yellow	Coil
#13	Red	Coil
C	Black	Ground electrodes
e1F	Blue	Forward Electrodes 1
e2F	Pink	Forward electrodes 2
e2R	Pink (In shrink tube)	Reverse electrodes 2
e1R	Blue (In shrink tube)	Reverse electrodes 1

## 6.7 4-20mA Hook-Up

Isolated 4-20mA current loops are used to output flow data to external devices. Maximum load impedance is 1,000Ω, and the maximum voltage without load is 27VDC. The converter has the capability to detect a loss of load on this output. To disable this function set the value “mA Val. Fault” (Section: Main Menu, Sec.. 4.7) under the ALARMS menu to zero. A graphical example of the usage of the current loop with external device is shown below:

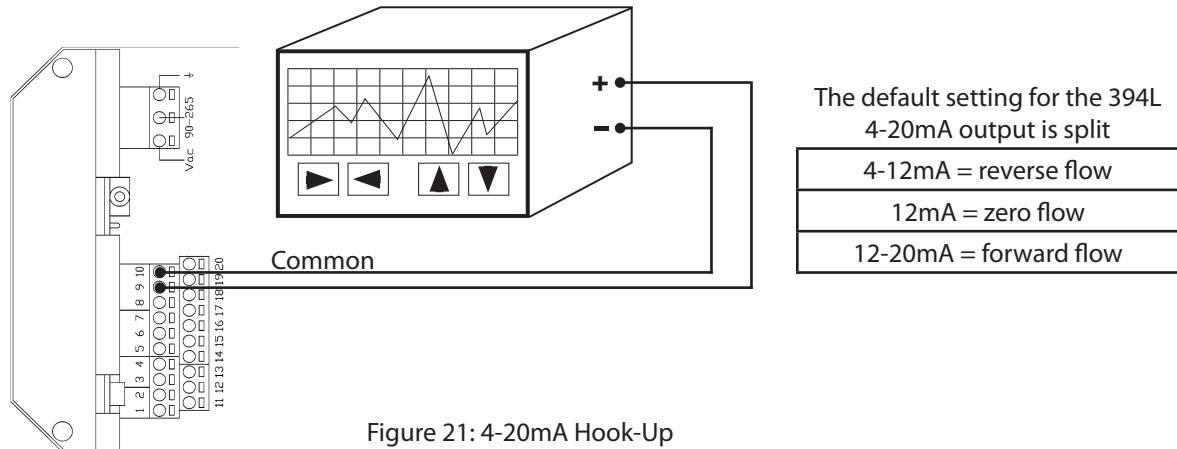


Figure 21: 4-20mA Hook-Up

If the external device requires a voltage input, a precision resistor placed across the input terminals of the external device will change the current to voltage. Calculate the required resistor using Ohm's law ( $V = I \times R$ ). For example, a 250Ω resistor will provide an input voltage of one to five volts with the transmitter range being set from 4mA to 20mA.

## 6.8 Converter Power Hook-Up

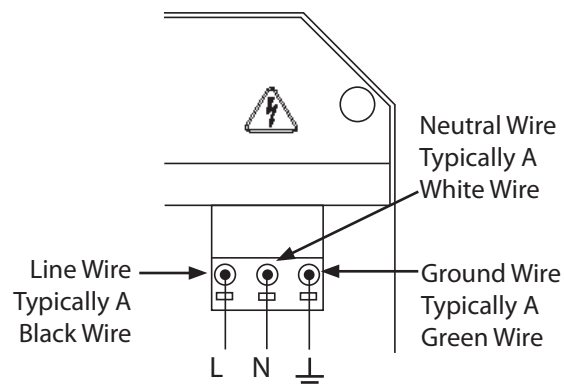


**WARNING!!** Hazardous supply voltage can shock, burn, or cause death.

The power supply line must be equipped with external surge protection for current overload (fuse or circuit breaker with limiting capacity not greater than 10A). It must be easily accessible for the operator and clearly identified.

Power connection is made using the power terminal block on the upper right side of the terminal board. NOTE: the terminal block unplugs from the circuit board for easy connection. Connect earth ground to the protective grounding terminal before making other connections. The power supply of a standard converter is 90-265VAC, 44-66Hz at maximum 20W. DC converter is available as an option.

Figure 25: Power Supply Terminal Block



## 7.0 Converter Start-Up







Before starting up the converter please verify the following:

- Power supply voltage must correspond to that specified on the name plate
- Electric connections must be wired as described in this manual
- Ground connections must be properly installed

When the instrument is powered and exhibits different operating conditions than those at the last shutdown, it initiates a verification cycle of the converter. During the verification cycle the converter displays an incrementing diagnostic number from 0 through 90. When the diagnostic is complete an error number will be displayed referencing the chart at the back of this manual. A text message will also be displayed on the alarm screen (to view alarms, press the UP arrow key from the main display screen).

## 7.1 Menu Navigation

To navigate through the menus on the converter, the keys on the keypad use the following conventions:

Key:	Function:
	UP ARROW KEY (for moving cursor up or down) <b>SHORT PRESSING (&lt; 1 SECOND):</b> It moves the cursor up to the previous subject on the menu It increases the numeric figure of the parameter highlighted by the cursor Batch start/stop (when enabled)
	<b>LONG PRESSING (&gt; 1 SECOND):</b> It moves the cursor down to the next subject on the menu It decreases the numeric figure of the parameter highlighted by the cursor
	RIGHT ARROW KEY (for moving cursor right or left) <b>SHORT PRESSING (&lt; 1 SECOND):</b> It moves the cursor to the right on the input field It moves the cursor to the following subject of the menu It changes the display of the process data
	<b>LONG PRESSING (&gt; 1 SECOND):</b> It moves the cursor to the left on the input field It moves the cursor to the previous subject on the menu
	RIGHT COMMAND KEY (for changing settings) <b>SHORT PRESSING (&lt; 1 SECOND):</b> It opens the main menu for the instrument configuration It enters/leaves the selected function It cancels the selected function under progress
	<b>LONG PRESSING (&gt; 1 SECOND):</b> It confirms the selected function It leaves the current menu It enables the totalizer reset request (when enabled)

# NOTES:

## OTHER McCROMETER PRODUCTS INCLUDE:



Magnetic Flowmeters



Magnetic Flowmeters



Magnetic Flowmeters



Propeller Flowmeters



Remote Telemetry System



Propeller Flowmeters



Differential Pressure Flowmeter:



Differential Pressure Flowmeter:

Represented By: \_\_\_\_\_