



FPI-X™
FULL PROFILE INSERTION
ELECTROMAGNETIC FLOW METER
MODEL 395X MAG METER SUBMITTAL

From

McCROMETER
3255 WEST STETSON AVENUE
HEMET, CA 92545

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Date:

Project Name:

Purchase Order
No.:

Date:

Customer Name:

Submitted By:

Other Project
Information:



Equipment to be Supplied to McCrometer, Inc.

PART NUMBER	DESCRIPTION	METER 1 QTY.	METER 2 QTY.	METER 3 QTY.
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Model 395X	FPI-X™ Meter Forward Flow Nominal Pipe Size in inches (12" to 138")			
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(1) M-Series Electronic Unit, including:

- (1) IP67 Enclosure
- (1) Three-Button Key Pad
- (1) Back-Lit Graphical LCD Display
- (4) Programmable Opto-Isolated Digital Outputs
- (2) 4-20mA Programmable Output for Forward Flow
- (1) 90-265 VAC Powered

(1) Electromagnetic Averaging Sensor, including:

- (2) 2" Stainless Steel Full Port Ball Valves with (2) 2 x Close Stainless Steel Nipples
- (1) 3M Fusion Bonded Epoxy Protective Coating
- (1) Quick Connect Cable Connector (IP68)
- (20) Feet of Submersible Sensor Cable
- (1) Compression Seal
- (1) Set of Retaining/Installation Rods
- (1) Top Plate

(1) Instruction Manual

BUILT-IN OPTIONS

Additional Sensor Cable: Specified Total Length In Feet (Leave Blank For None)

Special 10 to 35 VDC Powered

Special Compression Gland Seals (instead of Quick Connects at sensor)

ACCESSORIES

75031/75032 Insertion Tool

0624B339001 Sun Shield

170007101 Stainless Steel Tag



IMPORTANT: The MINIMUM port inside diameter for all installation valves is 1-7/8" (48mm).



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PROJECT NOTES

Meter 1:

Meter 2:

Meter 3:



FPI Mag™ Model 395X Suggested Specifications

DUAL SENSOR ELECTROMAGNETIC FLOWMETER

PART 1 - GENERAL

1.1 SCOPE

- A. This section describes the requirements for a Dual Sensor Full Profile Insertion electromagnetic flow meter and microprocessor-based signal converter. Under this item, the contractor shall furnish and install the magmeter equipment and accessories as indicated on the plans and as herein specified.

1.2 SUBMITTALS

- A. The following information shall be included in the submittal for this section:
1. Data sheets and catalog literature for the 395X Insertion Mag meter and the microprocessor-based signal converter.
 2. Connection diagrams for equipment wiring.
 3. List of spare parts and optional equipment.

PART 2 - PRODUCTS

2.1 DUAL SENSOR ELECTROMAGNETIC FLOWMETER (FULL PROFILE INSERTION MAGMETER)

- A. The electromagnetic flow meter shall consist of two flow sensors based on Faraday's Law of Electromagnetic Induction and microprocessor-based signal converter.
- B. Sensor:
1. Operating principle: Utilizing Faraday's Law of Electromagnetic Induction, the flow of a conductive liquid around the sensors induces an electrical voltage that is proportional to the velocity of the flow.
 2. Construction: The sensor material shall be constructed of 316 Stainless Steel and coated with NSF 61 certified approved epoxy coating.
 3. Hastelloy Electrodes (Optional) shall be used when corrosive fluid is present.
 4. Sensor operating Temp: +14 to +170° F @ 250 PSI
 5. Electronics operating temperature (Converter): -4 to +140 degrees F.
 6. Size: 12" to 138" diameter (see instrument schedule)
 7. Installation hardware shall include a Stainless Steel 2" full ported valve with a Stainless Steel nipple.
 8. Submergence:
 - a. The sensors shall be NEMA 6P or IP68 rated to be permanently submerged up to 6 feet.
 - b. The sensors shall be NEMA 6P or IP68 rated to be permanently submerged up to 30 feet (option with IP68 rated strain relief connection only).
 9. Converter enclosure: NEMA 4X or IP67 enclosure
 10. Display: Background illumination with a three button menu driven alphanumeric 5-line, 40-character display to indicate flow rate, totalized values, settings, and faults
 11. Power supply: 90/265 VAC or 11-35VDC.
 12. Outputs: 4-20 mA (0 – 21mA) into 800 ohms max.
 13. Two separate digital programmable outputs: open collector transistor usable for pulse, frequency, or alarm settings.
 14. Communications: Option: HART, RS-485 Modbus and Profibus Protocols

15. Sensors and signal converter performance:
 - a. Flow Range: 0.3 fps to 32* fps for accuracies stated below. *Maximum velocities may be restricted to less than 32 fps in larger diameter applications.
 - b. Accuracy: +/- 0.5% of actual flow for flow range of 1 f/s to 32 f/s, and +/-1% from .3 f/s to 1f/s.
 - c. Separation: Maximum distance of 200 feet between signal converter and sensor
16. Totalizer: Three eight-digit counters for forward flow, reverse flow and net.
17. The electromagnetic insertion flow meter shall be McCrometer 395X Full Profile Insertion Mag Meter or equal.

2.2 SPARE PARTS

- A. Spare parts for the equipment shall include the following, unless otherwise noted.
- B. One set of manufacturers recommended spare parts.
- C. Extra operation manuals as required.

2.3 OPERATOR FUNCTIONS

- A. Calibration
 1. Each flow sensor shall be N.I.S.T. wet calibrated and all of the calibration information and factory settings matching the sensor shall be stored integrally within the converter's non – volatile memory. At initial commissioning, the flow meter commences measurement without any initial programming. Should the signal converter need to be replaced, the new signal converter will upload all previous settings and resume measurement without any need for reprogramming or rewiring.
 2. An N.I.S.T traceable certificate of calibration shall accompany each flow sensor.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Follow manufacturer's recommendation for the minimum upstream and downstream installation requirements for the flow sensor.
- B. Wiring between flow sensors and remote mounted signal converters shall use cable type and procedures as per the manufacturers' recommendations.

3.2 MANUFACTURER'S ASSISTANCE

- A. Warranty
 1. The manufacturer of the electromagnetic flow meter shall guarantee for two years of operation that the equipment shall be free from defects in design, workmanship, or materials.
 2. In the event a component fails to perform as specified, or is proven defective in service during the guarantee period, the manufacturer shall promptly repair or replace the defective part at no cost to the owner.

FPI-X™ Dual Sensor Electromagnetic Flow Meter

Standard Configuration - This full pipe averaging flow meter comes complete with a 2 Sensor X-Design with 5' of cable to the Junction Box, Mounting Hardware, 1 AC Converter with forward flow 20mA output, 20 feet of Submersible Cable from the Junction Box to the converter with quick connects at sensors, Stainless Steel body, 316 Stainless Steel electrodes, NSF Approved Fusion Bonded Epoxy Coating, 2-Year Warranty, (2) 2-inch Stainless Steel Ball valve and 2-inch x Close Stainless Steel nipples.

MEASUREMENT

Volumetric flow in filled flow conduits 12" (300 mm) to 138" (3,500 mm) utilizing two insertable electromagnetic averaging sensors. Flow indication in English Standard or Metric units.

FLOW MEASUREMENT

Method: Electromagnetic
Accuracy for Forward and Bidirectional Sensors:
± 0.5% from 1 ft/s to 32 ft/s (0.3 m/s to 10 m/s)
± 1% from 0.3 ft/s to 1 ft/s (0.1 m/s to 0.3 m/s)
Linearity: 0.3% of Reading
Repeatability: 0.2% of Range
395L sensor: forward flow measurement and reverse flow indication.

POWER REQUIREMENTS

AC: 90-265 VAC / 44-66 Hz (20 W/25 VA) or
DC: 10-35 VDC (20 W)
AC or DC must be specified at time of ordering.

MATERIALS

Fusion bonded epoxy (NSF 61 approved) coated 316 SS
Stainless steel isolation valve (included)
Insertion Hardware: 316 Stainless Steel
Compression Seal: Silicone Rubber
Sensor Electrodes: 316 Stainless Steel

STANDARD OUTPUTS:

Single¹ or Dual² 4-20mA Outputs: Galvanically isolated and fully programmable for zero and full scale (0-21 mA rangability)

Two¹ or Four² separate digital programmable outputs: open collector transistor usable for pulse, frequency, or alarm settings.

- Volumetric Pulse
- Flow Rate (Frequency)
- Hardware Alarm
- High/Low Flow Alarms
- Empty Pipe
- Directional Indication
- Range Indication

Maximum switching voltage: 40 VDC
Maximum switching current: 100mA
Maximum switching frequency: 1250 Hz
Insulation from other secondary circuits: 500V

OPTIONAL OUTPUTS:

- Modbus²
- Profibus¹
- HART¹

1: Available with Single 4-20mA only. Forward flow only.
2: Available with Single or Dual 4-20mA.

ENGINEERING UNITS

Cubic Meter; Cubic Centimeter; Milliliter; Liter; Cubic Decimeter; Decaliter; Hectoliter; Cubic Inches; US Gallons; Imperial Gallons; Cubic Feet; Kilo Cubic Feet; Standard Barrel; Oil Barrel; US Kilogallon; Ten Thousands of Gallons; Imperial Kilogallon; Acre Feet; Megagallon; Imperial Megagallon; Hundred Cubic Feet, Megaliters

ISOLATION

All inputs / outputs are galvanically isolated from power supply up to 500 V

CONDUCTIVITY

Minimum conductivity of 5µS/cm

CONVERTER ENCLOSURE

IP67 Die Cast Aluminum
5.75" H x 5.75" W x 6.69" D
(14.6 cm. H x 14.6 cm. W x 17 cm D)

ELECTRICAL CONNECTIONS

Sensor: Quick-Connect (IP68)
Converter: Compression gland seals for 0.125" to 0.375" diameter round cable.

RATINGS

IP68 Submersible Sensors
IP67 Die Cast Aluminum Converter

CERTIFICATIONS AND APPROVALS

Safety: Listed by CSA to 61010-1: Certified by CSA to UL 61010-1 and CSA C22.2 No.61010-1-04
ISO 9001:2008 certified quality management system
CE: Certified (Converter Only)

ENVIRONMENTAL

Pressure / Temperature Limits:
Sensor: Flow temperature range
14° to 170° F (-10° to 77° C) @ 250 PSI
Sensor is submersible (IP68)
Electronics: Operating and storage temperature:
-4° to 140° F (-20° to 60° C)



SYSTEM OPTIONS FORWARD AND BIDIRECTIONAL

- Hastelloy® Electrodes
- DC Power
- Sun Shield
- Extended Warranties
- Additional sensor cable up to 180'*(Max 200')
- Extension to hardware clearance
- Annual Verification / Calibration
- Sensor Insertion Tool
- Stainless Steel ID Tag

KEYPAD AND DISPLAY

Can be used to access and change set-up parameters using three membrane keys and an LCD display.



FPI-X™ Dual Sensor Electromagnetic Flow Meter

Pipe Size (Nominal)	Pipe ID Range		Flow Ranges (GPM Standard)		Standard Program Defaults		Hardware Clearance*	Required Installation Clearance*	
	Min Pipe ID	Max Pipe ID	Min (GPM)	Max (GPM)	20mA=GPM	Totalizer Units			
12"	11.00	12.99	110	11000	5500	KGAL	28"	59"	
14"	13.00	14.99	150	15000	7500	KGAL	28"	59"	
16"	15.00	16.75	190	20000	9500	KGAL	28"	59"	
18"	16.76	18.80	240	26000	12000	KGAL	28"	63"	
20"	18.81	20.99	300	32000	15000	KGAL	28"	63"	
22"	21.00	22.49	400	38000	20000	KGAL	28"	67"	
24"	22.50	25.99	410	46000	20500	KGAL	28"	67"	
30"	26.00	31.99	600	72000	30000	KGAL	28"	71.25"	
36"	32.00	37.99	1000	104000	50000	KGAL	28"	77.25"	
42"	38.00	43.99	1300	141000	65000	KGAL	28"	83.25"	
48"	44.00	49.99	1700	185000	85000	KGAL	28"	89.25"	
54"	50.00	55.99	2200	234000	110000	KGAL	28"	95.25"	
60"	56.00	61.99	2600	289000	130000	KGAL	28"	101.25"	
66"	62.00	67.99	3200	349000	160000	KGAL	28"	107.25"	
72"	68.00	73.99	3800	416000	190000	KGAL	28"	113.25"	
78"-138"	74.00	138.00	Available - Call Factory at 1-800-220-2279						

* Hardware clearances apply to both sensors. See the FPI-X manual Lit. No. 30121-38. Available for download at www.mccrometer.com.

! required informa

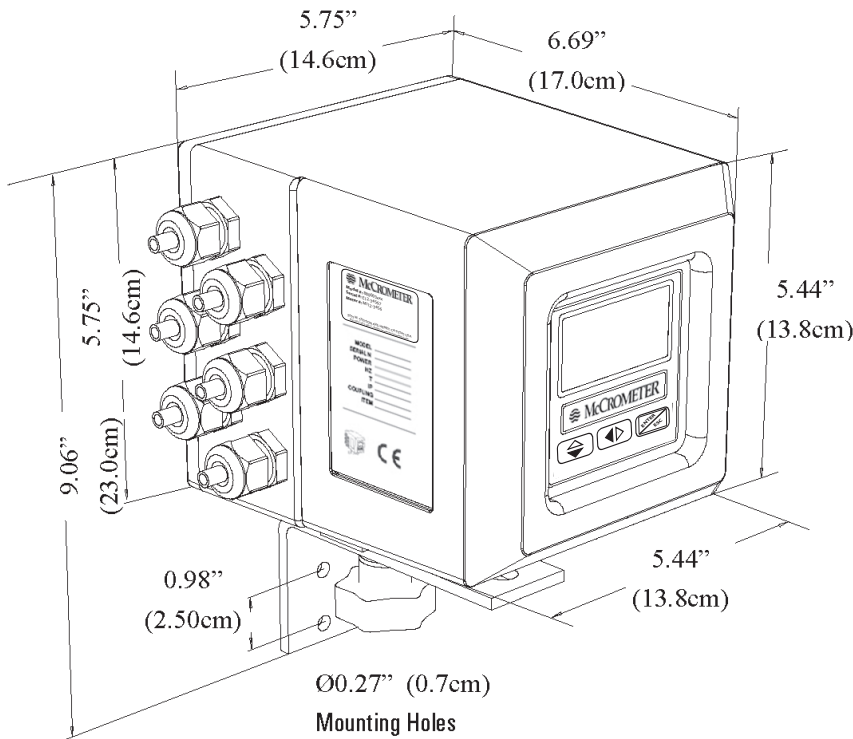
At the time of ordering, please be prepared to provide the following information:

1. Pipe ID and Pipe OD
2. Unit of Measure (US Gallons is Default)
3. Maximum pressure

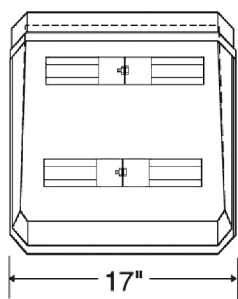
Consult factory if any chemicals are in use.



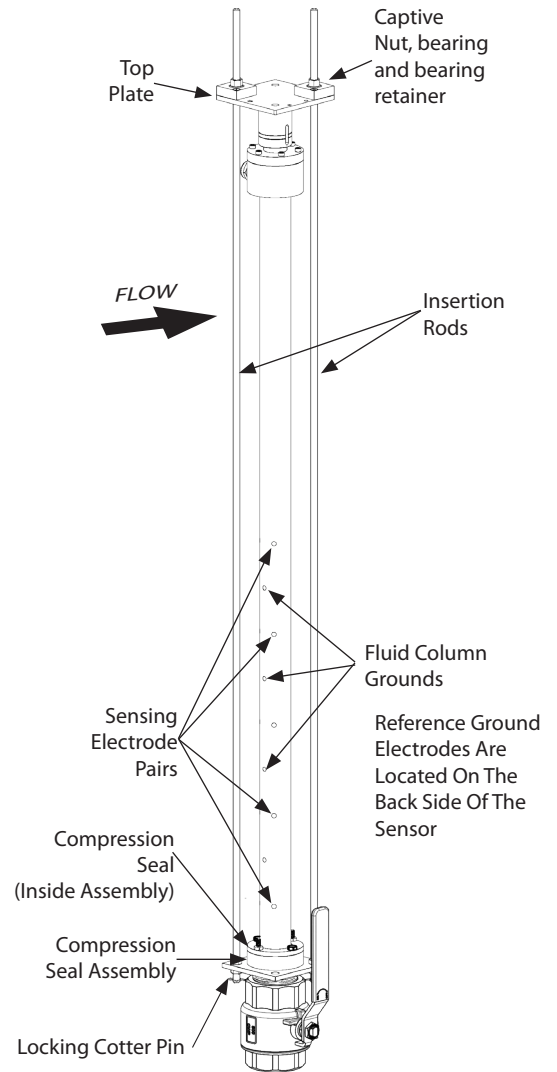
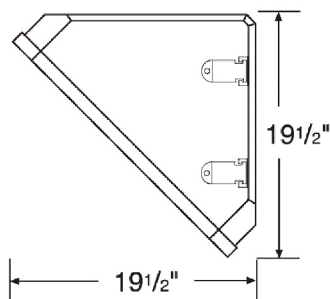
FPI-X™ Model 395X Meter Technical Information



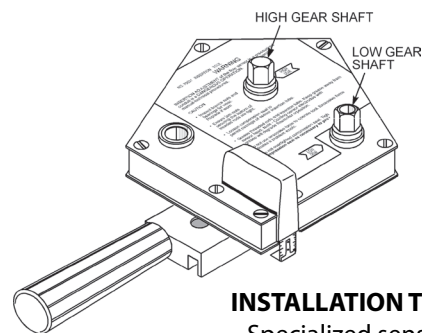
M-SERIES CONVERTER DIMENSIONS



SUN SHIELD (OPTIONAL)



SENSOR ASSEMBLY



INSTALLATION TOOL (OPTIONAL)

Specialized sensor insertion tool used for installation, profiling, and maintenance of the sensor.

Converter Electrical Cable Connections

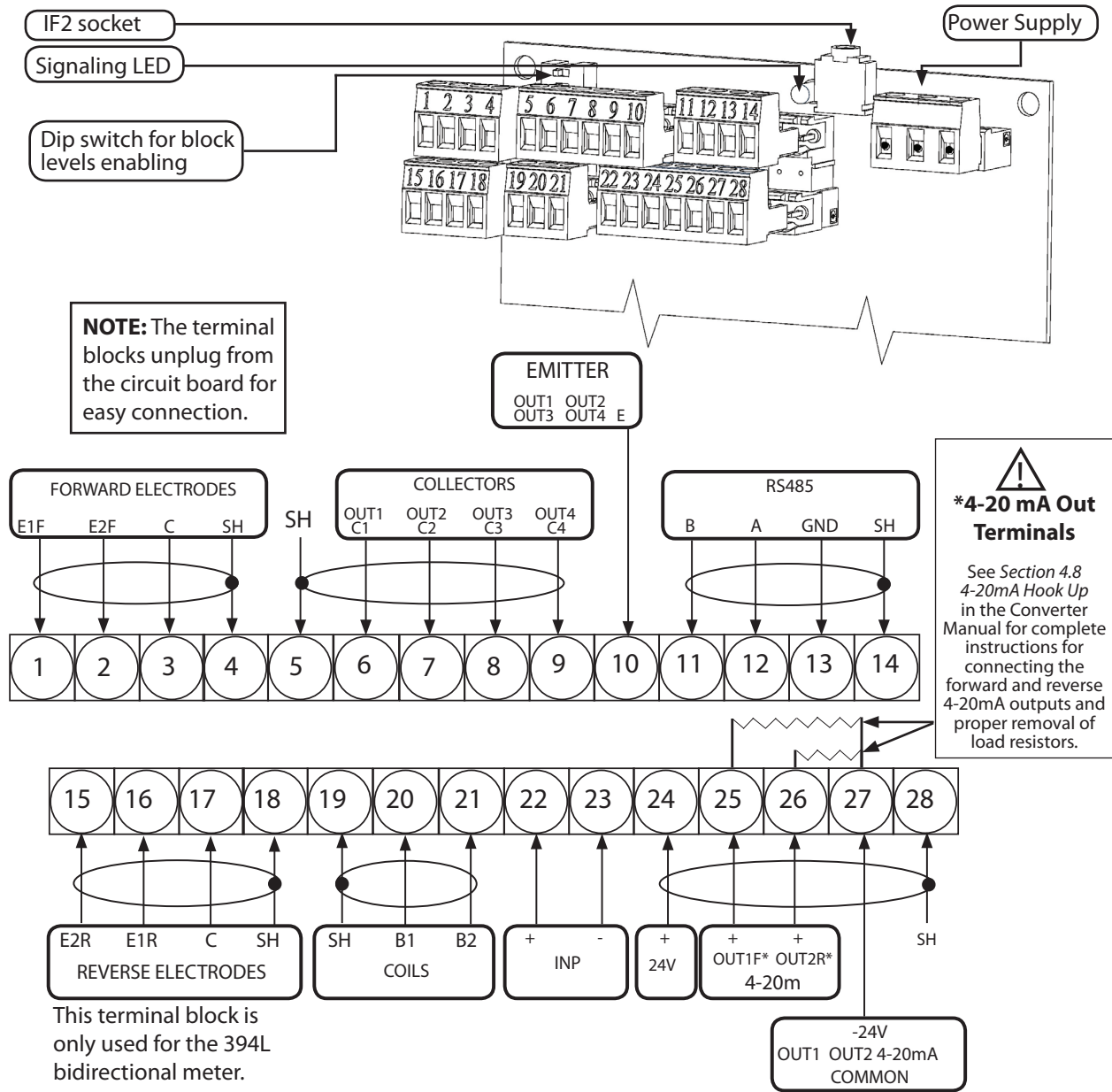


CAUTION - Always disconnect the power cord before attempting any electrical connections.

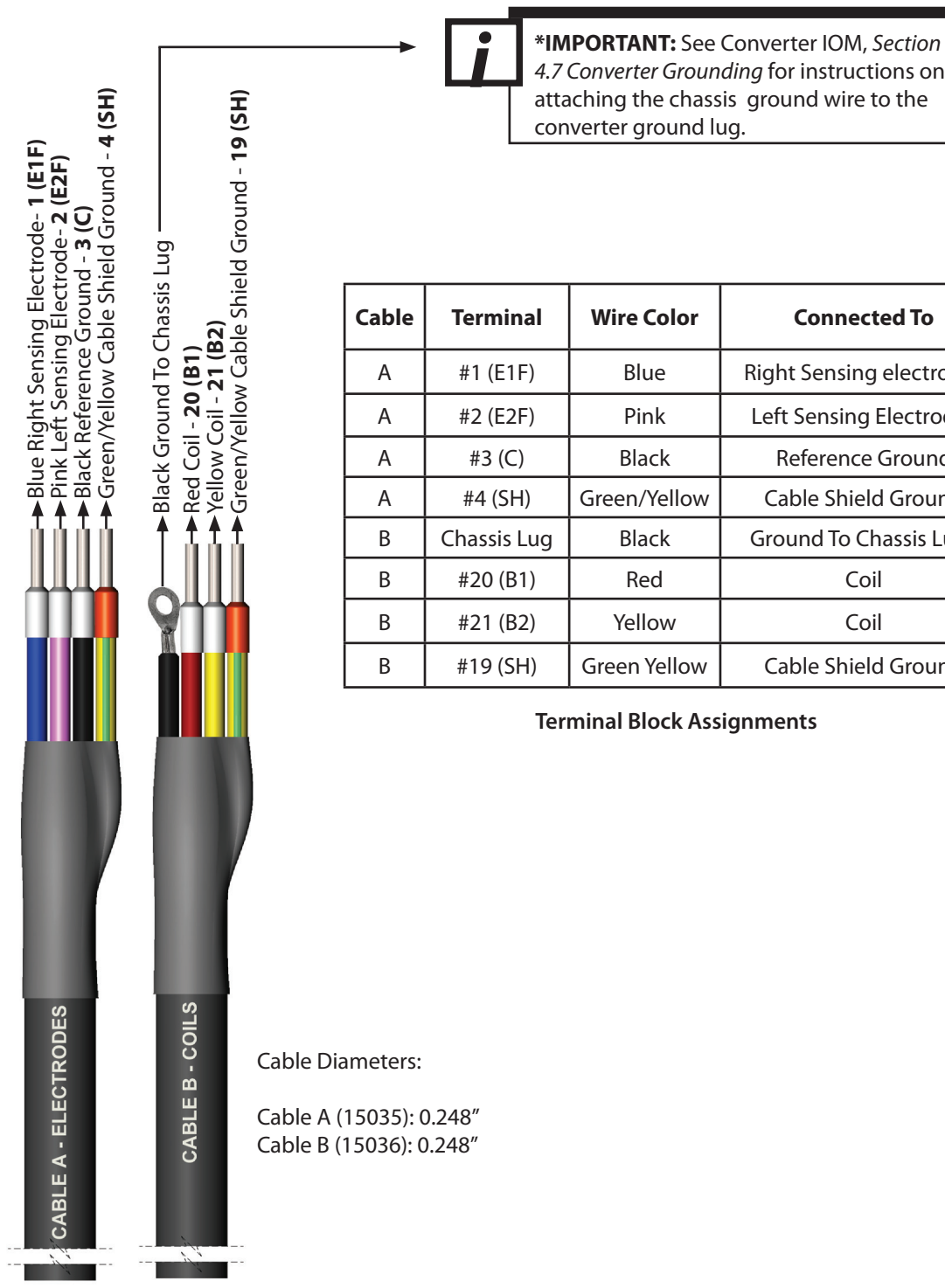
All electrical cables enter the converter through compression fittings located on the side of the converter. Ensure that all compression glands are properly tightened and all unused fittings are plugged so the case remains sealed.

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.



Terminal Board Descriptions



Cable	Terminal	Wire Color	Connected To
A	#1 (E1F)	Blue	Right Sensing electrodes
A	#2 (E2F)	Pink	Left Sensing Electrodes
A	#3 (C)	Black	Reference Ground
A	#4 (SH)	Green/Yellow	Cable Shield Ground
B	Chassis Lug	Black	Ground To Chassis Lug*
B	#20 (B1)	Red	Coil
B	#21 (B2)	Yellow	Coil
B	#19 (SH)	Green Yellow	Cable Shield Ground

Terminal Block Assignments

Cable Diameters:

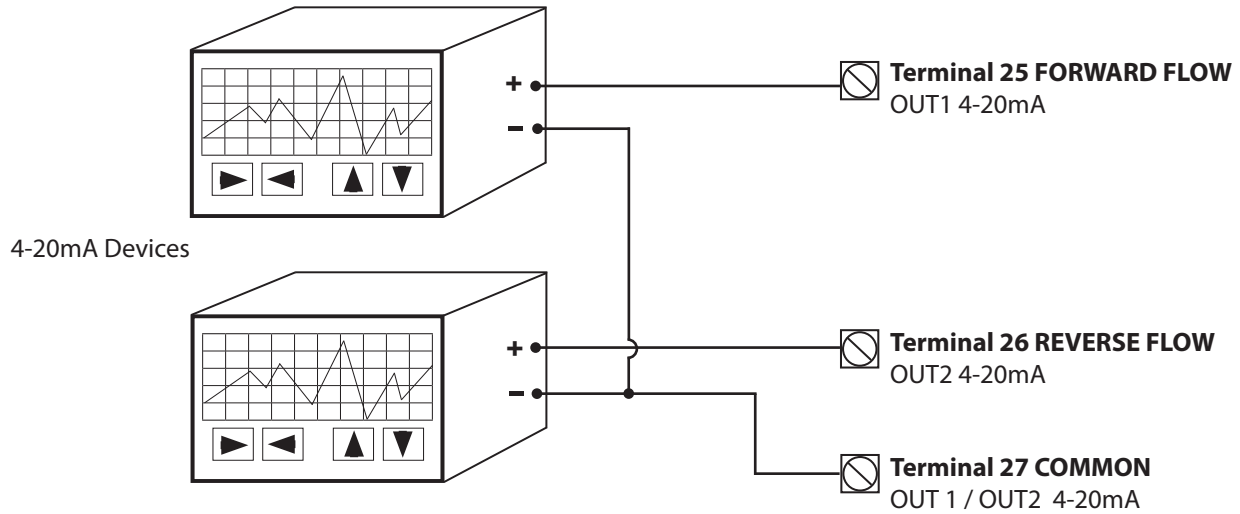
Cable A (15035): 0.248"

Cable B (15036): 0.248"

FPI-X 395X Sensor Cable Connections

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” under the ALARMS menu to zero (See Section 8.4.6). A graphical example of the usage of the current loop with external device is shown below:



IMPORTANT - RESISTOR REMOVAL FOR 4-20mA OUTPUTS

It is required to remove the resistors from terminals 25 & 27 and/or 26 & 27 before attaching 4-20mA cables.

FORWARD FLOW: Remove the resistor from terminals 25 and 27.

REVERSE FLOW: Remove the resistor from terminals 26 and 27.

See Section 4.2 Terminal Board, Figure 5.

Figure 15: 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. An additional 4 to 20mA loop output is available.

IMPORTANT

The converter powers the 4-20mA loops. Do not use external power for the 4-20mA loop as it may cause permanent damage to the converter.



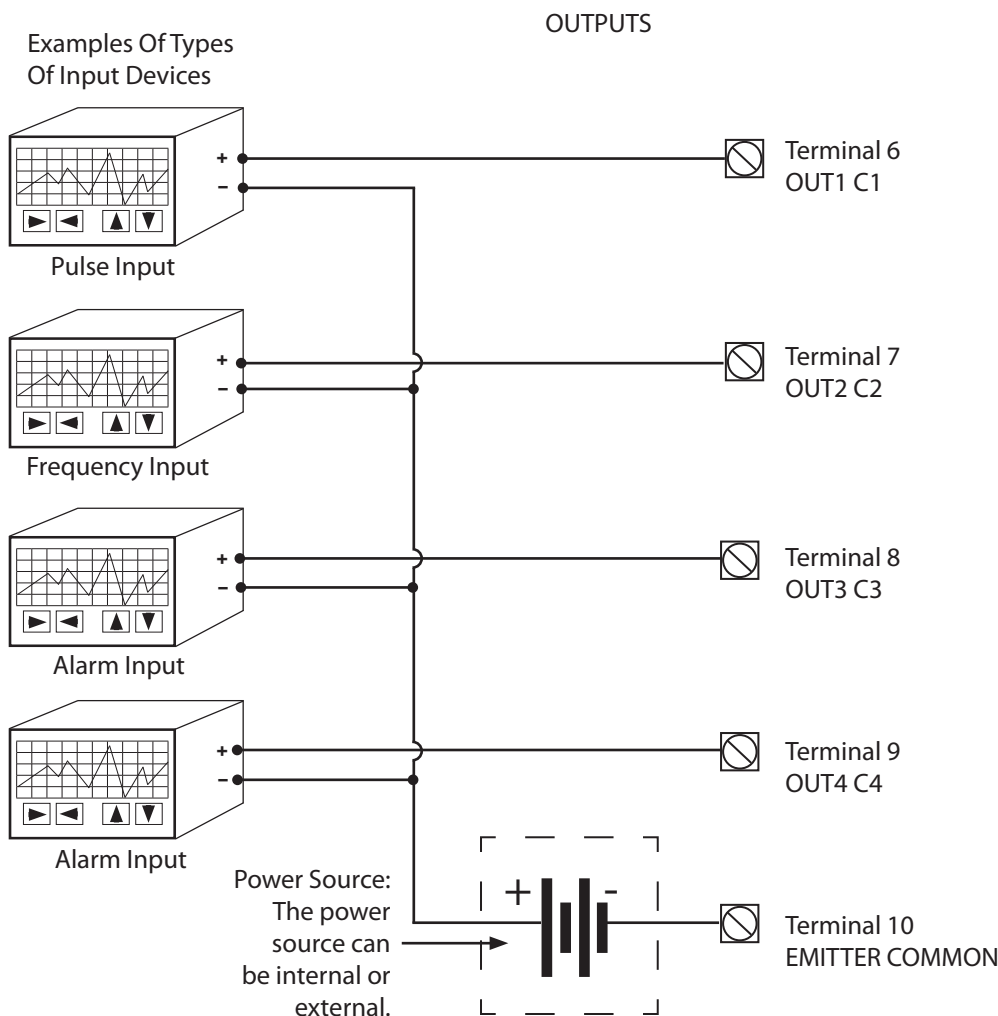
Opto-Isolated Pulse Output Hook-Up

Opto-Isolated Pulse Output Hook-Up

The four outputs are open collector transistor outputs used to communicate with or activate external devices when the flow reaches a predetermined set point.

- Opto-isolated output with collector and emitter terminals floating and freely connectable
- Maximum switching voltage: 40 VDC
- Maximum switching current: 100mA
- Maximum saturation voltage between collector and emitter 1.2V@100mA
- Maximum switching frequency (load on the collector or emitter, $R_L=470\Omega$, $V_{OUT}=24VDC$): 1250Hz
- Maximum reverse current bearable on the input during an accidental polarity reversion (VEC): 100mA
- Insulation from other secondary circuits: 500 V

A common application of outputs should be connected as follows:



IMPORTANT

Outputs are not isolated from each other. All outputs MUST use the same power source.

Opto-Isolated Pulse Output Diagram

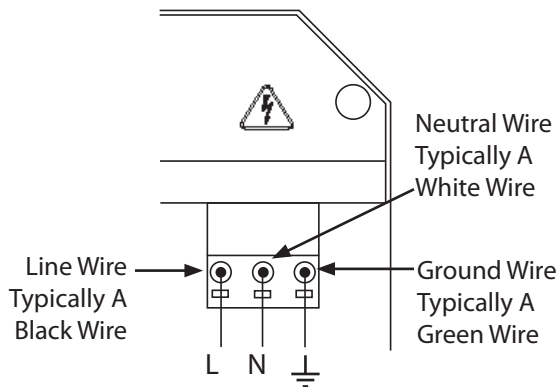
Converter Power Hook-Up



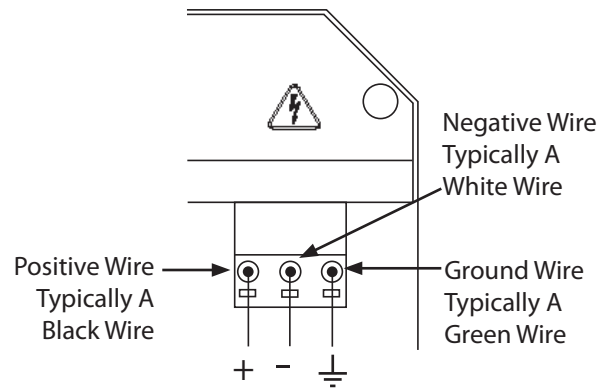
WARNING!! Hazardous supply voltage can shock, burn, or cause death.

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.



AC Power Supply Terminal Block



Optional DC Power Supply Terminal Block

SPECIFICATION DATA SHEET
Models FPI-X

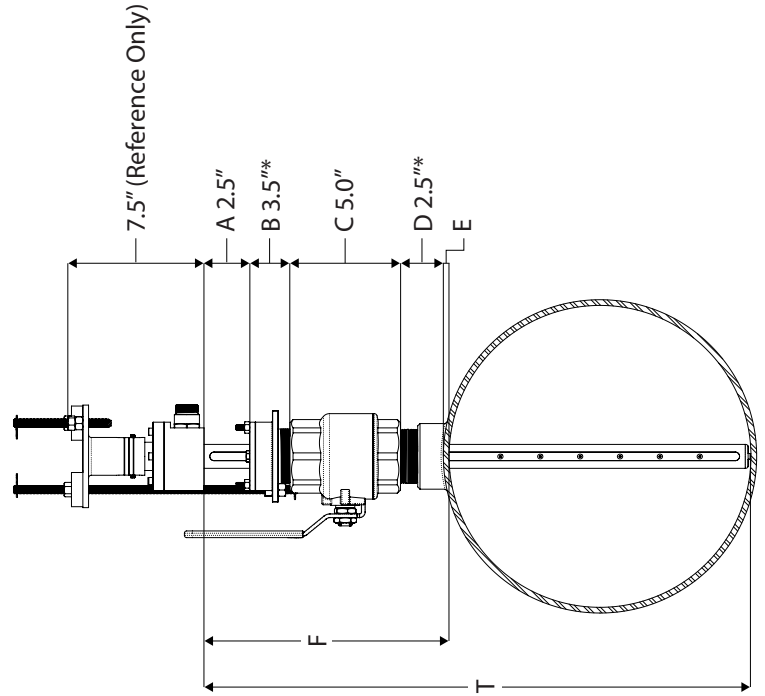
NOTE: Custom sensors cannot be manufactured without this information

Current Date	
End User	
Customer Contact	
Rep Name	
Site Name (Ex. Well #1)	
Application (Ex. Well Output)	
Metered Fluid (Ex. Raw Water)	
Model	395-X
Converter Power	<input type="checkbox"/> 90-265 VAC <input type="checkbox"/> 10-35 VDC
Converter Options*	<input type="checkbox"/> Standard <input type="checkbox"/> Modbus <input type="checkbox"/> Profibus <input type="checkbox"/> HART
Sensor Cable Length in Feet	

Date received by McCrometer	
Maximum Flow (Ex. 2500 GPM)	
Minimum Flow (Ex. 100 GPM)	
Average Flow (Ex. 1500 GPM)	
Full Scale (Ex. 2500 GPM)	
Maximum Line Pressure (250 PSI)	
Maximum Temperature	
Authorized Customer Signature:	

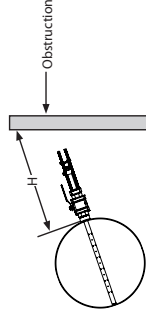
The above signature authorizes McCrometer to rely upon the provided specifications.

* See Configuration Sheet (Lit# 30121-75) for converter information.



A	2.5
B	
C	5.0
D	2.5*
E	1.0
F	
ID	
T	
H	

- Critical Spacing (Standard 2.5")
- Compression Seal Height (If ID is less than or equal to 24.99", enter 1.5"; If ID is greater than or equal to 25.00", enter 3.5")
- Valve Height (McCrometer Supplied Bronze or Stainless Steel = 5.0")
- Nipple and Coupling/Saddle Height (*McCrometer Supplied Close Nipple is 1.0"; Industry Standard Coupling or Saddle Default = 1.5"), OR Customer Supplied Dimension
- Pipe Wall Thickness - Default 1.0"; OR Customer Supplied Dimension
- F = A + B + C + D + E
- Inside Pipe Diameter (Not Nominal Pipe Size)
- T = Total Sensor Length (F + ID)
- Calculated Distance When Close to an Obstruction



IMPORTANT: Distance H must be at least one sensor length T + C + D + 18"

$$H = T + C + D + 18"$$

IMPORTANT: The MINIMUM inside diameter for the installation valve and pipe cut-out to avoid damage to the sensor is 1-7/8" (48mm).