

EMCO's UniMag NFP Magnetic Flow Meter System consists of the patented UniMag NFP Flow Tube, level transducer, and 4411e Transmitter. UniMag NFP flow tubes measure volumetric flow in partially full pipes, and do not require a liner.

Features

- Measures flow in partially full pipes
- Totally encapsulated sensor components
- No liner; no meter failure due to a defective liner
- Low conductivity media > 0.8 mS / cm
- Patented AC coil excitation (high coil current and high pulsation frequency)
- Field replaceable sensors
- Sensor reference coils
- Internal grounding electrodes
- Flow tubes can be manufactured to any length
- Various flow tube materials, including carbon steel for powerful magnetic field retention
- Accuracy unaffected by media coatings such as calcium carbonate, raw sewage, grease, algae and similar materials
- High signal-to-noise ratio for immunity to media noise



The UniMag NFP.

EMCO UniMag NFP flow meters for non-full pipes are comprised of the flow tube (spool piece), sensor(s), level transducer and junction box. UniMag NFP flow tubes do not have a liner and therefore will never fail due to a defective liner.

Each sensor includes an exciter coil and reference coil. Voltage is generated in the flow tube by the media in accordance with Faraday's Law, from which volumetric flow is calculated. Level measurement is determined by a hydrostatic or ultrasonic level transducer.

UniMag Technology

Innovative Sensor Technology

- UniMag sensors include an exciter coil and a reference coil, and are available in various electrically insulative materials.
- A unique electrode design distributes the magnetic field over the flow tube's entire cross section.
- These combined effects, along with a uniquely powerful field strength, provide a truly weighted velocity signal.
- Each sensor includes a reference coil, separate from the exciter coil.

No Liners

- Each UniMag sensor is a complete solid-state insulated magnetometer; a liner is not necessary for insulation.
- NFP Series UniMags have no liner, therefore will never fail due to a defective liner.

Partially Full Pipe Measurement

- Level measurement is accomplished by an FMU ultrasonic or FMX hydrostatic level transducer.
- The type of transducer used is determined by whether there is convenient access to the top (FMU) or bottom (FMX) of the flow tube. Type FMU is not available for pipe diameters < 12" (300mm).

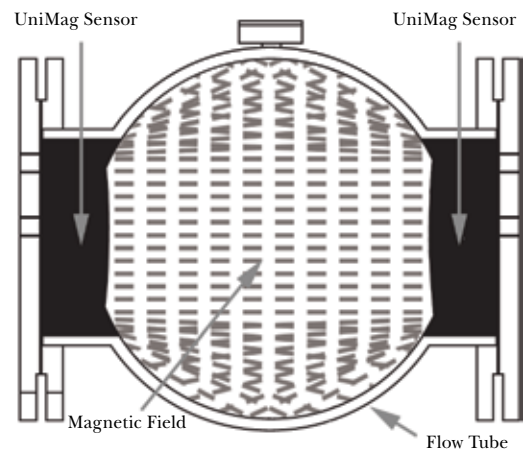
Modular Construction / True Field Repairability

- Flow sensors can be replaced in the field, meaning minimal downtime and no need to ship the flow tube back to the manufacturer.
- Spare sensors can be kept in stock for easy replacement if needed.
- Costly bypass pumping is unnecessary since sensors can be removed and immediately replaced.



UniMag Sensors

Sensor with standard conical electrodes (top) and extended conical electrodes (bottom). Cones wear off with abrasive media. This has no effect on accuracy.



UniMag Magnetic Field

Large UniMag sensors create a magnetic field over the entire flow tube cross section. The flow signal represents the true weighted velocity of the media and is highly insensitive to velocity profile distortion and swirl effects.

Application Guide

	Maximum Temperature		Maximum Pressure	
	°F	°C	psi	bar
Flow Tube Material				
Carbon Steel	175	80	30	2
Stainless Steel	175	80	30	2
PVC	150	65	20	1.3
	110	30	30	2

Media Conductivity

Typical required conductivity: > 1 µS/cm (1 micromho/cm)

Low conductivity option: for conductivities > 0.8 and < 5 µS/cm use the UniMag pre-amplifier option

For deionized, distilled or demineralized water, consult EMCO.

Performance Specifications

Accuracy and Traceability	
Accuracy	±2.0% of rate for flows ≥ 2 fps (0.61 m/s) ±0.0075 fps (± 0.00225 m/s) for flows < 2 fps (0.61 m/s) When used with the FMU 40/41 or FMX 167 level transducer, total system accuracy is ± 2% of rate for flows > 2 fps (0.61 m/s) PLUS ±0.2% of full scale or 0.072" (1.83mm) whichever is greater.
Traceability	Calibrated in accordance with NIST standards
Accuracy Notes	Accuracy is unaffected by electrode coatings such as sewage, grease, calcium carbonate, algae or similar materials

1 For media such as ferric chloride, ferric sulfate (Odophos) or similar highly conductive media, flow meter performance can be adversely affected.

Please consult EMCO for these types of applications, otherwise performance guarantee is null and void.

Operating Specifications

Flow Range	Minimum	Maximum	Notes
fps and m/s	0 to 2 fps (0 to .6 m/s)	50 fps (15 m/s)	
gpm	0 to 4.8D ² gpm	120D ² gpm	Where D is in inches
m ³ /h	0 to 0.002D ² m ³ /h	0.04D ² m ³ /h	Where D is in millimeters

Unless otherwise advised, the maximum required flow rate will be considered at full pipe (maximum level) conditions.

Minimum Level

Line Size	Minimum Media Level
Pipes 6" - 36" (150 - 900 mm)	2" (50 mm)
Pipes 42" (1000 mm) and Greater	8" (200 mm)

Power Requirements for 4411e Flow Transmitter

Power Supply Options	120V, 60Hz 230V, 50Hz 120V, 50Hz
Analog Output	2 x 4-20 mA 2-wire system
Pulse Output	2-wire potential-free output

Physical Specifications

Materials of Construction	Flanges and flow tubes: Carbon steel, 316 stainless steel, HDPE (high density polyethylene) or PVC
Flange Notes	Maximum pressure and temperature rating of the flow tube may be limited by the flange type selected. Flow tubes can be specially ordered with plain ends or with butt weld ends. For pressure and temperature ratings of HDPE flow tubes, consult EMCO.
Installation Options	NEMA 6/IP68 indefinitely submersible to 30 foot water column up to 175°F (80°C) NEMA 4X/IP65 for temperatures greater than 175°F (80°C)
Process Connections	ANSI 150 RF (<28 in.); ANSI/AWWA C207 Class D FF (≥28 in.) ANSI 300 RF AWWA FF (specify class) DIN/BS4504 PN6 DIN/BS4504 PN10 DIN/BS4504 PN16 JIS10krf BS/AS2129 Table D BS/AS2129 Table E

Straight Run Piping Requirements

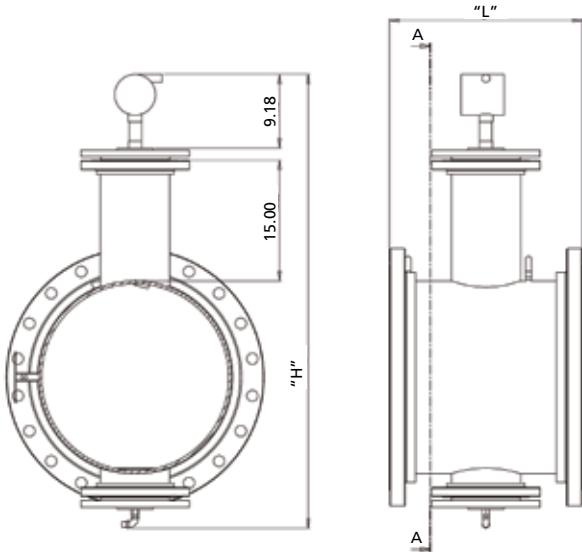
Piping	Upstream	Downstream
Minimum requirement	7 D	3 D
Single elbow or tee upstream	7 D	3 D
Two elbows, coupled in the same plane	7 D	3 D
Two elbows, close coupled and out of plane	12 D	3 D
Pump, blending point, control valve upstream	20 D	3 D
Pump, control valve downstream	--	5 D

D is equal to the internal diameter of the pipe

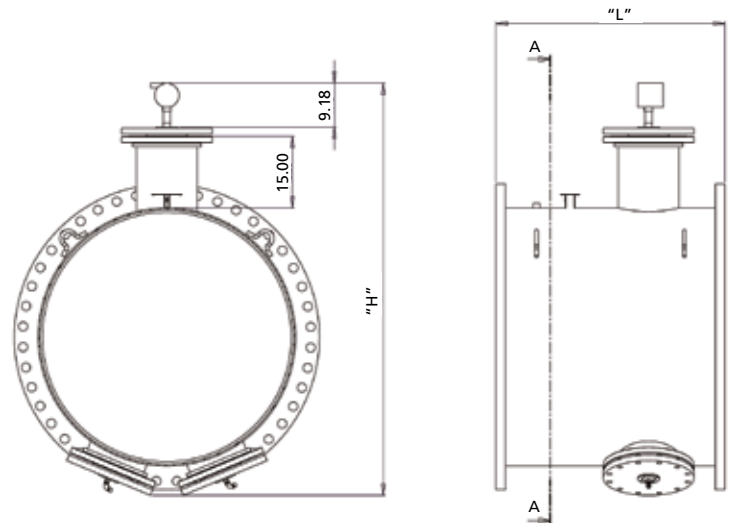
Measurable Flow Rates at 2.0% Accuracy

Line Size		Minimum Flow Rate Velocity		Maximum Flow Rate Velocity	
inches	mm	fps	gpm	fps	gpm
6	150	2	176	50	4,412
8	200	2	314	50	7,843
10	250	2	490	50	12,254
12	300	2	760	50	17,647
14	350	2	961	50	24,020
16	400	2	1,255	50	31,373
18	450	2	1,588	50	39,706
20	500	2	1,961	50	49,019
24	600	2	2,824	50	70,588
28	700	2	3,843	50	96,078
30	760	2	4,412	50	110,294
32	800	2	5,020	50	125,490
36	900	2	6,353	50	158,823
42	1000	2	8,647	50	216,176
48	1200	2	11,294	50	282,352
56	1400	2	15,373	50	384,313
60	1600	2	17,647	50	441,176
66	1700	2	21,353	50	533,824
72	1800	2	25,412	50	635,294
80	2000	2	31,373	50	784,313

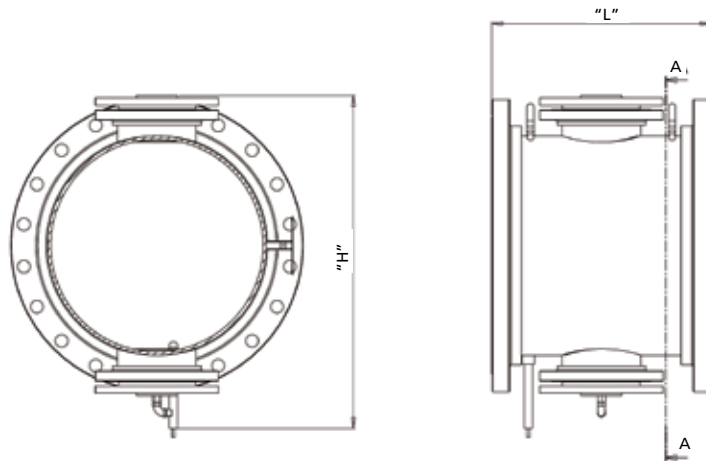
Dimensions and Weights



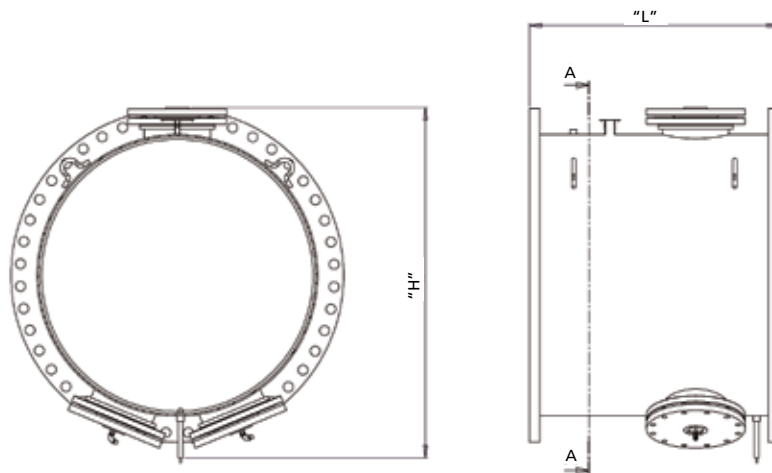
**Flowtube Assemblies 24" - 36" (600 - 900 mm)
with FMU Ultrasonic Level Transducer**



**Flowtube Assemblies 42" (1000 mm) and Greater
with FMU Ultrasonic Level Transducer**



**Flowtube Assemblies 6" - 36" (150 - 900 mm) and Greater
with FMX Hydrostatic Level Transducer**



**Flowtube Assemblies 42" (1000 mm) and Greater
with FMX Hydrostatic Level Transducer**

Dimensions and Weights

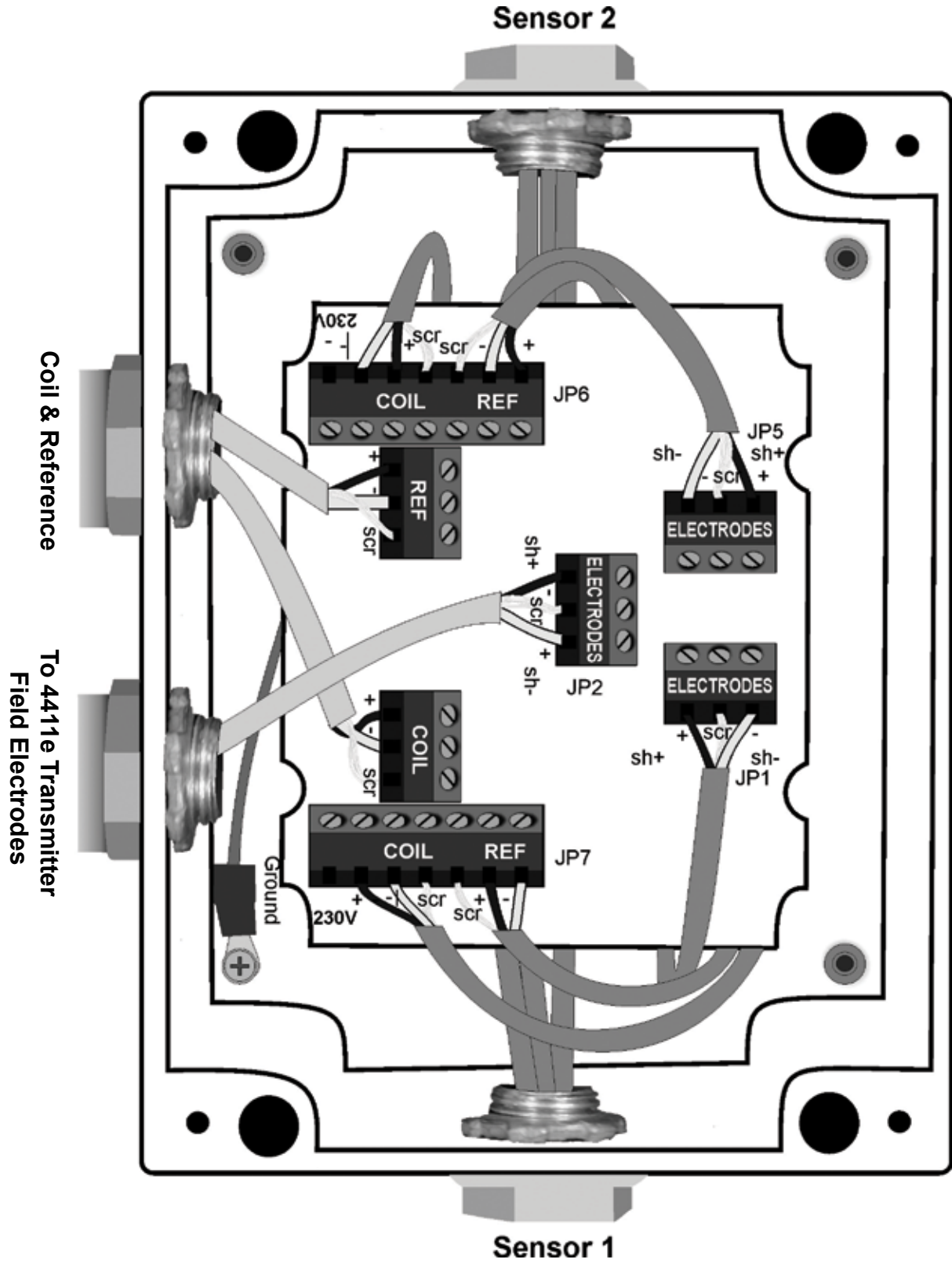
Nominal Size D		Dimension L *		Dimension H with FMU Ultrasonic Level Transducer ¹		Dimension H with FMX Hydrostatic Level Transducer ¹		Approximate Weight	
Inches	mm	Inches	mm	Inches	mm	Inches	mm	LB	KG
6	150	12	305	-	-	22	540	100	46
8	200	18	457	-	-	24	597	185	84
10	250	18	457	-	-	26	652	225	102
12	300	18	457	45	1123	28	705	301	137
14	350	18	457	46	1155	29	737	335	152
16	400	20	508	49	1220	32	802	490	223
18	450	20	508	51	1273	34	854	515	234
20	500	20	508	53	1324	36	906	615	280
24	600	24	610	57	1428	40	1009	840	382
28	700	30	762	61	1514	44	1096	980	445
30	760	30	762	63	1565	46	1147	1280	580
32	800	30	762	65	1618	48	1199	1310	595
36	900	30	762	69	1720	52	1302	1625	740
42	1000	40	1016	75	1873	58	1454	1980	900
48	1200	40	1016	81	2024	64	1606	2210	1015
56	1400	48	1219	89	2224	72	1806	2860	1300
60	1600	48	1219	95	2375	78	1957	2930	1335
66	1700	48	1219	101	2565	84	2134	3270	1480
72	1800	48	1219	107	2673	90	2254	3609	1633
80	2000	48	1219	115	2873	98	2454	3898	1764

* Notes:

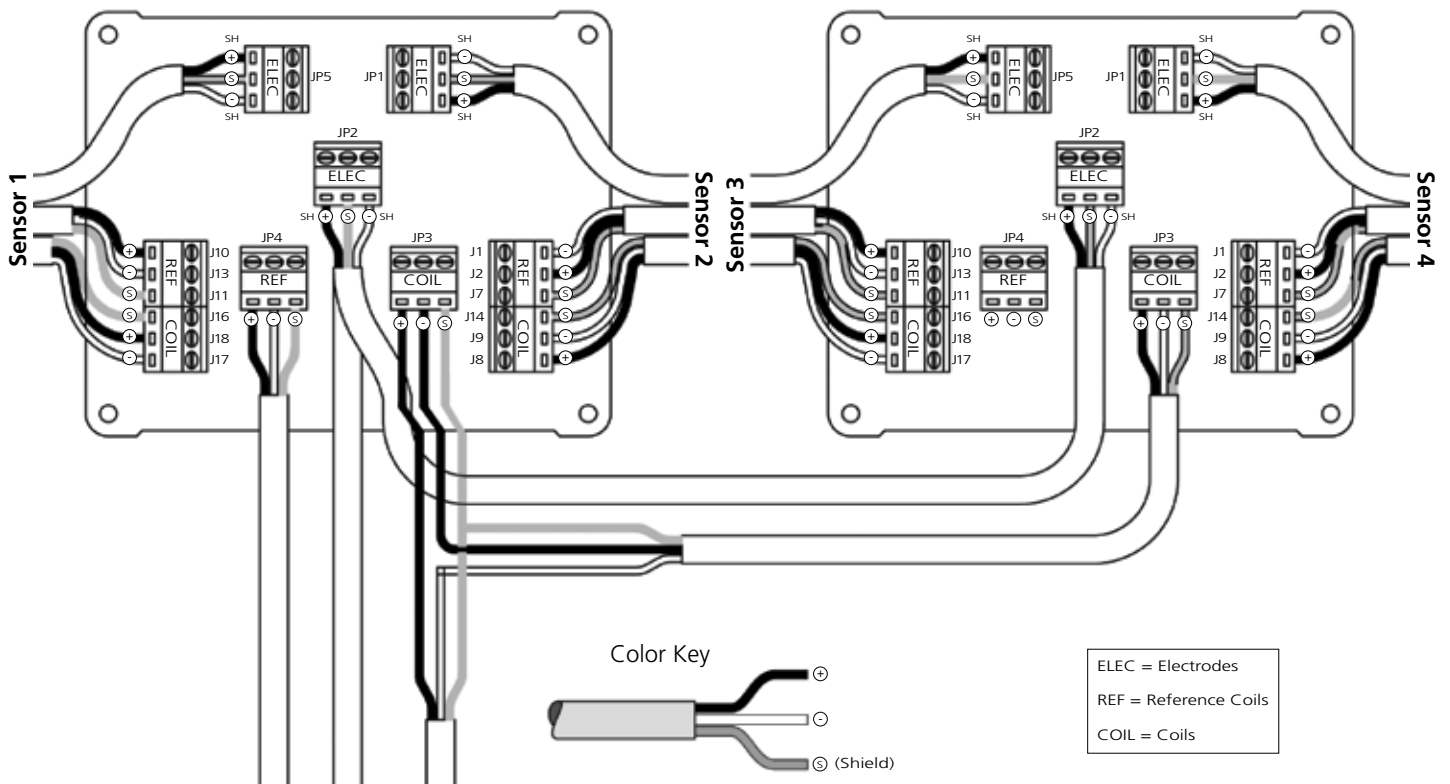
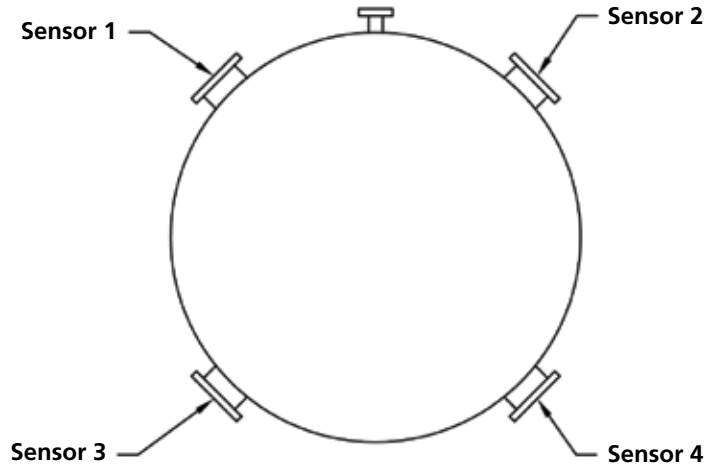
- For flowtubes 6" Ø (150 mm) having ¾" or 1½" NPT sampling or pressure ports, or for installation with FMX hydrostatic level transducer, Dimension L = 15.0" (380 mm)
- For outside flange diameter, see appropriate flange specification.
- For larger sizes consult EMCO.

1. FMX Hydrostatic Level Transducer Dimension H is shown with the transducer inserted 1/2" into bottom of flowtube. Actual H may vary.

Wiring Diagrams



Junction Box Wiring (2 Sensors)



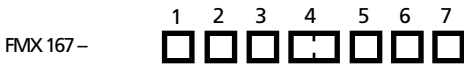
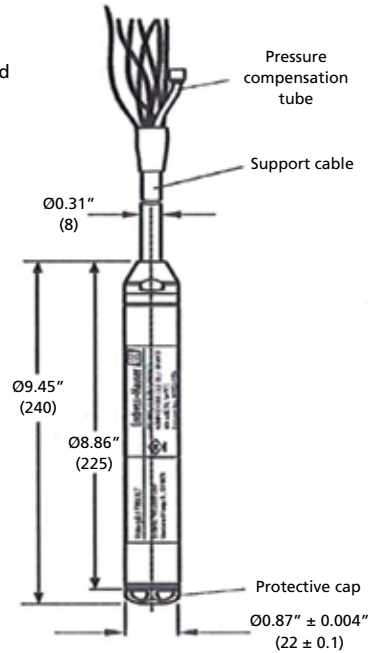
Notes

1. Electrodes are connected in parallel.
2. Coils are connected with opposite pairs in parallel, each pair in series.
3. Two reference coils make one set.

FMX 167 Hydrostatic Level Transducer

A hydrostatic pressure transducer is standard supply for measuring level in partially filled pipes. It is also normally used when the level sensor needs to be hidden from view, or if there is substantial froth on the surface of the media.

Basic Type	FMX167
Range	0 - 20" (0 - 500 mm) to 0 - 600 feet (0 - 180 m)
Accuracy	± 0.2% full scale or 0.072" (1.83 mm) eg. accuracy at 10" level = 0.072/20 x 100 = 0.36% accuracy at 36" level = 0.072/36 x 100 = 0.2%
Barometric Pressure Change	Cable contains "breather" tube for compensation Mounted integrally on PM2 ChannelMag sensors Mounted at side of channel for widths < 8" (200 mm)
Cable Length	See ordering code. Normally same length as PM2 cables. Max. length 1000 feet (300 m)
2-wire 4411e Signal	4 - 20mA, 2 wire system, 18 VDC.
Electromagnetic Compatibility Protection	Interference emission to EN 61326 for CE requirements NEMA 6 and IP68 indefinitely to 700 feet (200 m) w.c Porous Gore-Tex Teflon filter protects internals
Ambient Temperature	14 to 158 degrees F (-10 to 70 degrees C)
Materials of Construction	Transducer housing: 316L stainless steel Sensor diaphragm: aluminum trioxide ceramic Internal seal: standard Viton, optional EPDM Protective cap: high density polyethylene Cable: polyethelene with Gore-Tex Teflon filter
Explosive Atmospheres	See ordering code
Weight	Probe: 0.63 lb (0.3 kg) Cable: Add 0.13 lb/foot (0.05 kg/m)



1. Certificate

- | | |
|------------------|-------------------------------|
| A = Standard | EEx Ia IIC T6 |
| B = ATEX II 2 G | EEx nA IIC T6 |
| C = ATEX II 3 G | IS, Class I, Div. 1, Grps A-D |
| D = FM approved | IS, Class I, Div. 1, Grps A-D |
| E = CSA approved | General purpose |
| F = CSA | |

2. Mechanical Connection (cable suspension)

- 1 = None
- 2 = Mounting clamp, 316L SS
- 3 = Cable mounting screw G 1½ A 304 SS
- 4 = Cable mounting screw 1½" NPT, 304 SS
- 9 = Special version

3. Measuring Cell Tube Material

- A = 316L SS cell enclosure
- Y = Special version

4. Measuring Range

		Max. Overload
FA = 0 to 3 ftH ₂ O	MA = 0 to 1 mH ₂ O	73 psi
FB = 0 to 6 ftH ₂ O	MB = 0 to 2 mH ₂ O	73 psi
FC = 0 to 15 ftH ₂ O	MC = 0 to 4 mH ₂ O	101 psi
FD = 0 to 20 ftH ₂ O	MD = 0 to 6 mH ₂ O	145 psi
FE = 0 to 30 ftH ₂ O	ME = 0 to 10 mH ₂ O	145 psi
FF = 0 to 60 ftH ₂ O	MF = 0 to 20 mH ₂ O	261 psi
FG = 0 to 150 ftH ₂ O	MG = 0 to 40 mH ₂ O	352 psi
FH = 0 to 300 ftH ₂ O	MH = 10 to 100 mH ₂ O	580 psi
FK = 0 to 600 ftH ₂ O	MK = 0 to 200 mH ₂ O	580 psi
VV = Adjusted to customer specifications from 0 _____		
YY = Special version		

5. Measuring Cell Seal

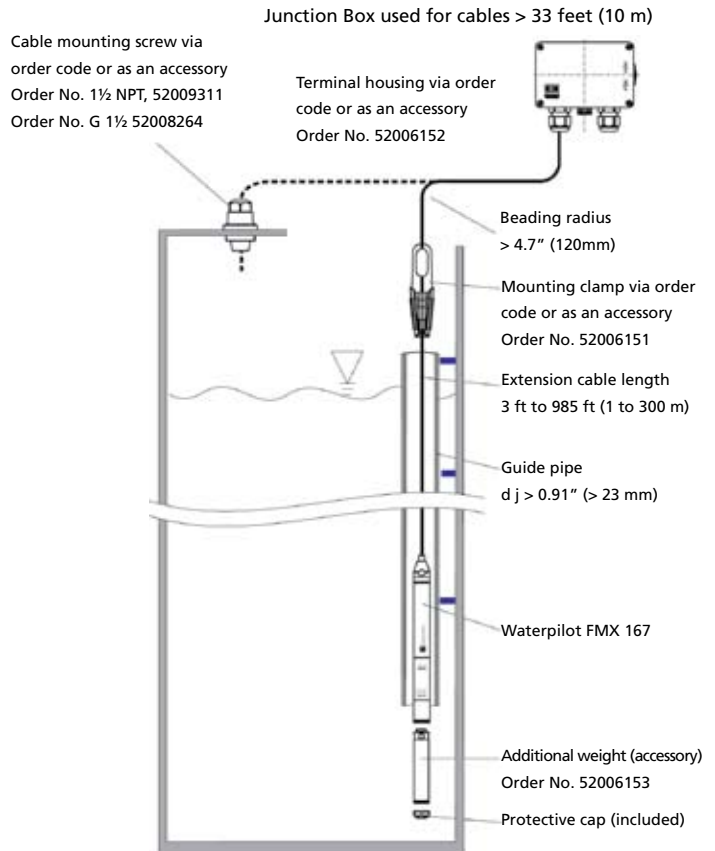
- 1 = Viton
- 2 = EPDM
- 9 = Special version

6. Extension Cable

- A = Length in _____ meters, PE cable
- B = 10m PE cable, can be shortened
- C = 20m PE cable, can be shortened
- E = 30 ft cable, PE, can be shortened
- F = 60 ft cable, PE, can be shortened
- G = Length in _____ feet, PE cable
- Y = Special version

7. Additional Equipment

- 1 = Probe with integrated Pt 100, 4-wire
- 3 = Terminal housing with GORE-TEX® filter, NEMA 4X

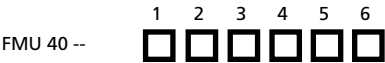
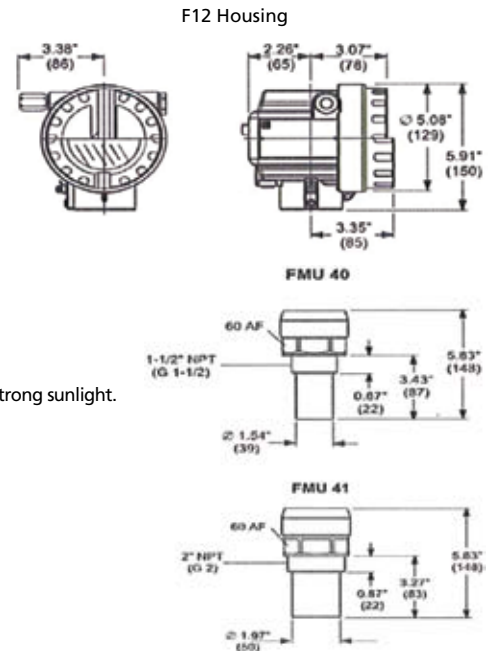


The FMX is normally installed inside the ramps of a PM2 sensor. Alternatively, it may be mounted in a stilling well, most conveniently a PVC tube of internal diameter > 0.9" (25 mm). The cable contains a breather tube and is normally terminated in the 4411e transmitter. This cable must not be kinked or blocked. An intermediate terminal housing is available, as well as a cable mounting screw or mounting clamp, as shown. Terminal housing supplied for level transducer cable greater than 50 feet (15 m). Breather tube ends in terminal housing. Extended cable from terminal housing not normally included. Extended cable may be same 2-core cable as PM2 cable.

FMU 40 & FMU 41 Ultrasonic Level Transducer

As an alternative to the hydrostatic level transducer, an ultrasonic level transducer may be incorporated in a convenient man hole.

Basic Type	FMU 40
Range	0 - 200" (0 - 5000 mm)
Basic Type	FMU 41
Range	0 - 315" (0 - 8000 mm)
Accuracy	± 0.2% full scale
Minimum Dead Band	10" (250 mm)
Air Density Changes	Automatic temperature compensation
Connection	1½" NPT male for FMU 40 2" NPT male for FMU 41
2-Wire 4411e Signal	4 - 20mA, 2 wire system, 18VDC
HART Communication	Included
Protection	NEMA 6 and IP68 for 24 hours @ 6 feet w.c
Electromagnetic Compatibility	Interference emission to EN 61326
Indication	4 digit LCD
Ambient Temperature	-5 to +40 degrees F (-20 to +60 degrees C)
Note: Outside these temperatures the LCD function is restricted. A protective cover is recommended if operating in strong sunlight.	
Cable Entry	½" NPT
Materials of Construction	PVDF sensor with EPDM seal Aluminum enclosure, chromed and powder coated, sea water resistant.
Housing	F12 housing is standard
Explosive Atmospheres	FM and CSA Class 1 Div. 1 or 2 optional
Weight	FMU 40 approx. 5.5 lb (2.5 kg) FMU 41 approx. 6 lb (2.6 kg)



- Certificate
 - A = Non-hazardous version
 - S = FM IS Cl. I, II, III; Div. 1, Grps A - G
 - FM NI Cl. I, Div. 2
 - T = FM XP Cl. I, II, III; Div. 1, Grps A - G
 - U = CSA IS Cl. I, II, III; Div. 1, Grps A - G
 - CSA NI Cl. I, Div. 2
 - V = CSA XP Cl. I, II, III; Div. 1, Grps A - G
 - N = CSA General Purpose

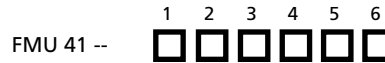
- Process Connection
 - R = G 1½, ISO 228
 - N = 1½" NPT

- Power Supply / Communication
 - B = 2-wire, 4 to 20 mA loop-powered / HART
 - H = 4-wire, 10.5 to 32 VDC / 4 to 20 mA HART
 - G = 4-wire, 90 to 253 VAC / 4 to 20 mA HART
 - D = 2-wire PROFIBUS-PA
 - F = 2-wire Foundation Fieldbus

- Display / Operation
 - 1 = Without LCD
 - 2 = With LCD VU 331 / on-site operation

- Housing
 - A = F12 aluminum housing, coated, NEMA 6P
 - C = T12 aluminum housing with separate terminal compartment, coated, NEMA 6P

- Cable Entry
 - 2 = M 20 x 1.5
 - 3 = G ½
 - 4 = ½" NPT
 - 5 = M 12 PROFIBUS-PA plug-in connector
 - 6 = 7/8" Foundation Fieldbus plug-in connector



- Certificate
 - A = Non-hazardous version
 - S = FM IS Cl. I, II, III; Div. 1, Grps A - G
 - FM NI Cl. I, Div. 2
 - T = FM XP Cl. I, II, III; Div. 1, Grps A - G
 - U = CSA IS Cl. I, II, III; Div. 1, Grps A - G
 - CSA NI Cl. I, Div. 2
 - V = CSA XP Cl. I, II, III; Div. 1, Grps A - G
 - N = CSA General Purpose

- Process Connection
 - R = G 2, ISO 228
 - N = 2" NPT

- Power Supply / Communication
 - B = 2-wire, 4 to 20 mA loop-powered / HART
 - H = 4-wire, 10.5 to 32 VDC / 4 to 20 mA HART
 - G = 4-wire, 90 to 253 VAC / 4 to 20 mA HART
 - D = 2-wire PROFIBUS-PA
 - F = 2-wire Foundation Fieldbus

- Display / Operation
 - 1 = Without LCD
 - 2 = With LCD VU 331 / on-site operation

- Housing
 - A = F12 aluminum housing, coated, NEMA 6P
 - C = T12 aluminum housing with separate terminal compartment, coated, NEMA 6P

- Cable Entry
 - 2 = M 20 x 1.5
 - 3 = G ½
 - 4 = ½" NPT
 - 5 = M 12 PROFIBUS-PA plug-in connector
 - 6 = 7/8" Foundation Fieldbus plug-in connector

Model and Suffix Codes

Category	Suffix Codes										
Model											
UniMag NFP Flow Tube for Non-Full Pipes	NFP										
Nominal Size											
6" (150mm) Minimum Size		06									
80" (2000mm) Maximum Size ¹		80									
Flowtube / Flange Materials											
Carbon Steel			C								
AISI 316 Stainless Steel Flow Tube, Carbon Steel Flanges ²			A								
PVC Flow Tube (Maximum Size 12" / 300mm) ²			P								
Sensor Materials											
PVDF with Elastomer Gaskets, Viton Seals (6" - 14" / 150mm - 350mm diameters only)				E							
PVDF with Teflon Gaskets, Viton Seals (6" - 14" / 150mm - 350mm diameters only)				D							
Polyurethane with Elastomer Gaskets, Viton Seals (16" / 400mm and larger)				P							
Electrodes (Viton Seals)³											
AISI 316 Stainless Steel					T						
Hastelloy C					C						
Titanium					I						
Flow Tube Liners and Coatings											
Fusion Bonded Epoxy Coating Inside and Outside						X					
Installation (all options include 50 feet / 15m cables)											
NEMA 6/IP68 Indefinitely Submersible to 30 foot water column							R				

1 Larger sizes available upon request.

2 Consult EMCO when selecting this option.

3 A pre-amplifier is required in the junction box for media conductivity < 5 µS/cm or for cables greater than 150 feet (50m). For deionized, distilled or demineralized water, consult EMCO.

4 Extra-long electrodes are provided for thick, non-fluidic coating or residual silt build-up. Advise thickness. For other materials, consult EMCO.

5 All special orders must include a complete description along with the ordering code. Always use the "Special" option for combinations.

6 Type FMU (option U) is not available for pipe diameter <12" (300mm)

Category	Suffix Codes										
Process Connections											
ANSI 150 RF (<28"); ANSI / AWWA C207 Class D FF (≥28")									1		
ANSI 300 RF									2		
AWWA FF (Specify Class)									3		
DIN / BS4504 PN6									4		
DIN / BS4504 PN10									5		
DIN / BS4504 PN16									6		
JIS10krf									7		
BS / AS2129 Table D									8		
BS / AS2129 Table E									9		
Plain Ends									C		
Options											
Pre-Amplifier ³										A	
Extra-Long 316 Stainless Steel Electrodes ⁴										B	
Extra Length Cables										E	
Special Lay Length										L	
Sampling Port ¾" NPT Female										P	
Sampling Port 1½" NPT Female										N	
No Options										O	
Special (use for combinations) ⁵										S	
Coil Supply											
120V Supply											A
230V Supply											B
Transducer Fitting											
Provided With 1" NPT Locking Gland, Suitable for Hydrostatic Level Transducer FMX 167											H
Provided With Standard and Fitting Suitable for Ultrasonic Level Transducer FMU 40 ⁶											U
Special, Including When Transducer is Supplied by Others ⁵											S
NFP 08 C E T X R 1 O A H											



EMCO Flow Systems is a division of Spirax Sarco, Inc. • 1150 Northpoint Blvd. • Blythewood, SC 29016

For information on EMCO flow products, contact:

EMCO Flow Systems • 2150 Miller Drive • Longmont, Colorado 80501
T: 800.356.9362 or 303.682.7060 • F: 303.682.7069 • sales@emcoflow.com • www.emcoflow.com

© Spirax Sarco, Inc. 2006
All rights reserved. Printed in U.S.A.
SL-UNIMAGNFP-350-01 1M 8/07