UniMag DT Series

Electromagnetic Flow Tubes

EMCO's UniMag DT Electromagnetic Flow Meter System consists of the patented UniMag Flow Tube and 4411e Transmitter. UniMag sensors are unique because they do not require a liner and can be replaced in the field.

Features

- Totally encapsulated sensor components
- No liner required for flow tube operation; liners available for abrasive media
- Low conductivity media > 0.08 mS / cm
- Patented AC coil excitation (high coil current and high pulsation frequency)
- Large conical electrodes to project through non-fluidic coatings
- Field replaceable sensors
- Inherent redundancy from multiple 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
- High signal-to-noise ratio for immunity to media noise

The UniMag DT, shown with 2 sensors (left) and 4 sensors (right).

EMCO UniMag DT flow meters are comprised of the flow tube (spool piece), sensors and junction box. Liner options are available but are not necessary for operation.

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.

DT Series UniMags are Entela certified to Class 1, Div. 2 CD, ATEX II 3 G EExnAL IIB T3 X and evaluated to CSA 14, 142, 213 IEC 60079-15, 61010, UL 508, NEC, EN50021.

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.

Lined or Unlined Flow Tubes

- Each UniMag sensor is a complete solid-state insulated magmeter; a liner is not necessary for insulation.
- Flow tube liner options are available if required by the application.

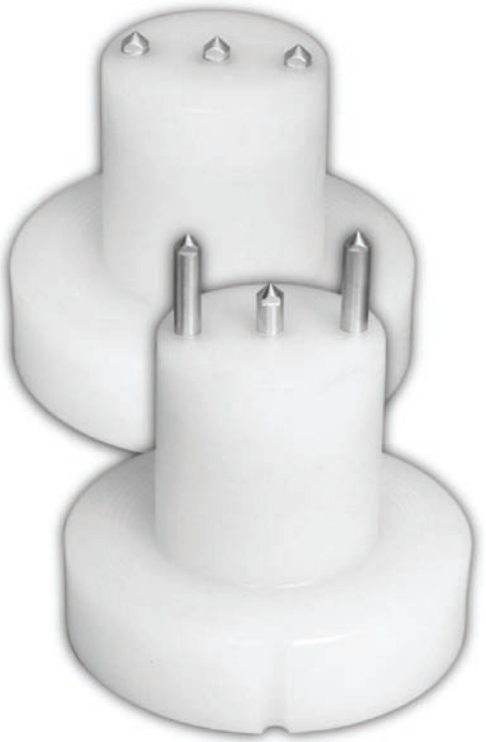
Modular Construction / True Field Repairability

- 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.
- Output continues if one sensor fails, with 1% to 3% of rate typical accuracy.
- Costly bypass pumping is unnecessary since sensors can be removed and immediately replaced.

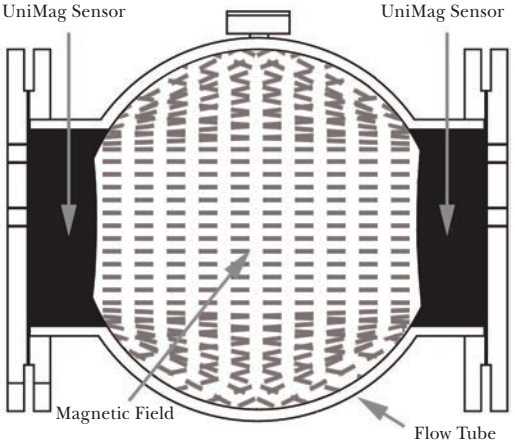
Configurations for a Variety of Applications

There are four basic UniMag configurations:

- Sensors with conical electrodes, fusion bonded epoxy or polyurethane protected metal or HDPE flow tubes: used for water, sewage and similar applications
- As above, except with extended conical electrodes: used when media coats the flow tube thick enough to cover standard electrodes
- Concave sensors with flat electrodes, no internal coating, external fusion bonded epoxy: used for dredging slurries and similar moderately abrasive media
- Thick polyurethane liner covering the entire flow tube interior and sensors, with sensors protruding through the liner: used for highly abrasive media such as mining and dredging slurries



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

	Temperature Range		Maximum Pressure[1]		Notes
	°F	°C	psi	bar	
Liners and Coatings					
Fusion Bonded Epoxy	-40 to 240	-40 to 116	based on sensor		Conforms to USA National Sanitation Foundation Standard NSF61 and AWWA Standard C213 for drinking water.
Polyurethane[2]	175 max.	80 max.	based on sensor		Conforms to NSF61 and AWWA C213 for drinking water. Heavy duty polyurethane is suitable for mining slurries and similar media.
Tefzel™	240 max.	115 max.	based on sensor		Temperatures based on water. Not recommended for high vacuum applications. Other media may reduce this temperature.
Ryton™	250 max.	121 max.	based on sensor		Used for paper mill liquors, lime muds and similar high conductivity media.
Sensors					
Polyurethane	175 max.	80 max.	150	10	Conforms to NSF61 and AWWA C213 for drinking water.
PVDF	240 max.	115 max.	150	10	Full vacuum capability. Temperature rating is for water and may be lower for other media. PVDF is approved by the US FDA #21 CFR 177.2510
UHMWPE	175 max.	80 max.	150	10	
PEEK	250 max.	121 max.	356	25	Full vacuum capability.
Sensor Notes	Sensor assembly includes a non-wetted carbon steel cover flange, fusion bonded polyethylene protected. Sensor assemblies are supplied with outer cover flanges, 30 feet (10m) cables, re-enterable potting gel, junction box, conduit and stainless steel bolts. Special length cable on request. Standard 2-year warranty against material defects and bad workmanship, not including media compatibility, erosion and abrasion, or for media > 180°F / 80°C.				

1 Maximum pressure at maximum temperature with appropriate connection.

2 Temperature differential between process and ambient limited to 140°F / 60°C for polyurethane sensor, and 212°F / 100°C for PVDF sensor.

Media Conductivity

Typical required conductivity: ≥ 5 µS/cm (5 micromhos/cm)

Low conductivity option: for conductivities > 0.08 or < 5 µS/cm use the UniMag pre-amplifier option

For deionized, distilled or demineralized water, consult EMCO.

Performance Specifications

Accuracy and Traceability	
Accuracy	±0.5% of rate for flows ≥ 1.5 fps (0.45 m/s) ±0.0075 fps (± 0.00225 m/s) for flows < 1.5 fps (0.45 m/s)
Traceability	Accuracy is traceable to the National Institute of Science and Technology. A NIST traceable Calibration Certificate is provided with each flow tube.
Accuracy Notes	Accuracy is unaffected by electrode coatings such as sewage, grease, calcium carbonate, algae or similar.

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 $50D^2$ 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

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 or HDPE (high density polyethylene)
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) Entela approved to NEC/CSA Class 1, Division 2, Groups C, D, Temp. T4 Entela approved to ATEX Zone 2 explosive atmospheres
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

Measurable Flow Rates at 0.5% Accuracy

Line Size		Minimum Flow Rate Velocity		Maximum Flow Rate Velocity	
inches	mm	fps	gpm	fps	gpm
2	50	1.5	15	50	490
2.5	65	1.5	23	50	766
3	80	1.5	33	50	1,103
4	100	1.5	59	50	1,960
6	125	1.5	132	50	4,410
8	150	1.5	235	50	7,840
10	200	1.5	368	50	12,250
12	250	1.5	529	50	17,640
14	300	1.5	720	50	24,010
16	350	1.5	941	50	31,360
18	400	1.5	1,191	50	39,690
20	450	1.5	1,470	50	49,000
22	500	1.5	1,779	50	59,290
24	600	1.5	2,117	50	70,560
28	700	1.5	2,881	50	96,040
32	760	1.5	3,763	50	125,440
36	800	1.5	4,763	50	158,760
42	900	1.5	6,483	50	216,090
48	1000	1.5	8,467	50	282,240
54	1200	1.5	10,716	50	357,210
56	1400	1.5	11,525	50	384,160
60	1600	1.5	13,230	50	441,000
66	1700	1.5	16,008	50	533,610
72	1800	1.5	19,051	50	635,040
80	2000	1.5	23,520	50	784,000

Straight Run Piping Requirements

Piping	Upstream	Downstream
Minimum requirement	5 D	3 D
Single elbow or tee upstream	5 D	3 D
Two elbows, coupled in the same plane	5 D	3 D
Two elbows, close coupled and out of plane	10 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

Other Installation Considerations

Mounting Recommendations

The UniMag may be mounted into a pipeline in any attitude, taking note of the flow direction arrow on the flow tube. To obtain accurate measurement, the pipe must be completely full and air must not be entrained in the flow.

Straight Run Requirements

For particularly poor velocity profiles caused, for example, by upstream bends in two or more planes or partially open valves, the UniMag DT requires a minimum of 10 pipe diameters of straight pipe upstream from the flow tube, and a minimum of 5 diameters downstream.

Non-Homogenous Media

For particularly non-homogenous slurries, pulps or pastes, the flow tube should be mounted in a vertical pipe to obtain the most even distribution of solids and fibers. There must be a minimum of 20 pipe diameters between any media mixing point and the UniMag DT flow tube.

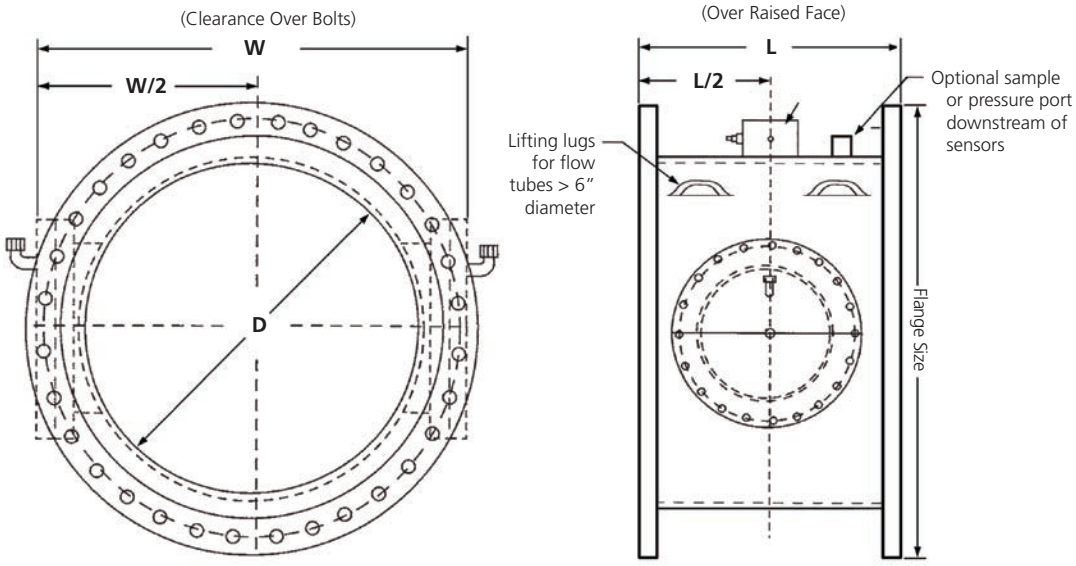
Partially Closed Valves

If the piping is horizontal and includes a partially closed valve, the valve should always be installed downstream of the UniMag. This will allow the head pressure in the system to be adjusted, reducing the chance of air entrainment in the flow, and will prevent excessive irregular profiles forming upstream of the flow tube.

Vacuum Conditions

For vacuum conditions caused, for example, by a pump downstream from the UniMag flow tube, use internally coated fusion bonded epoxy, or no liner at all. For full vacuum, use PEEK sensors only.

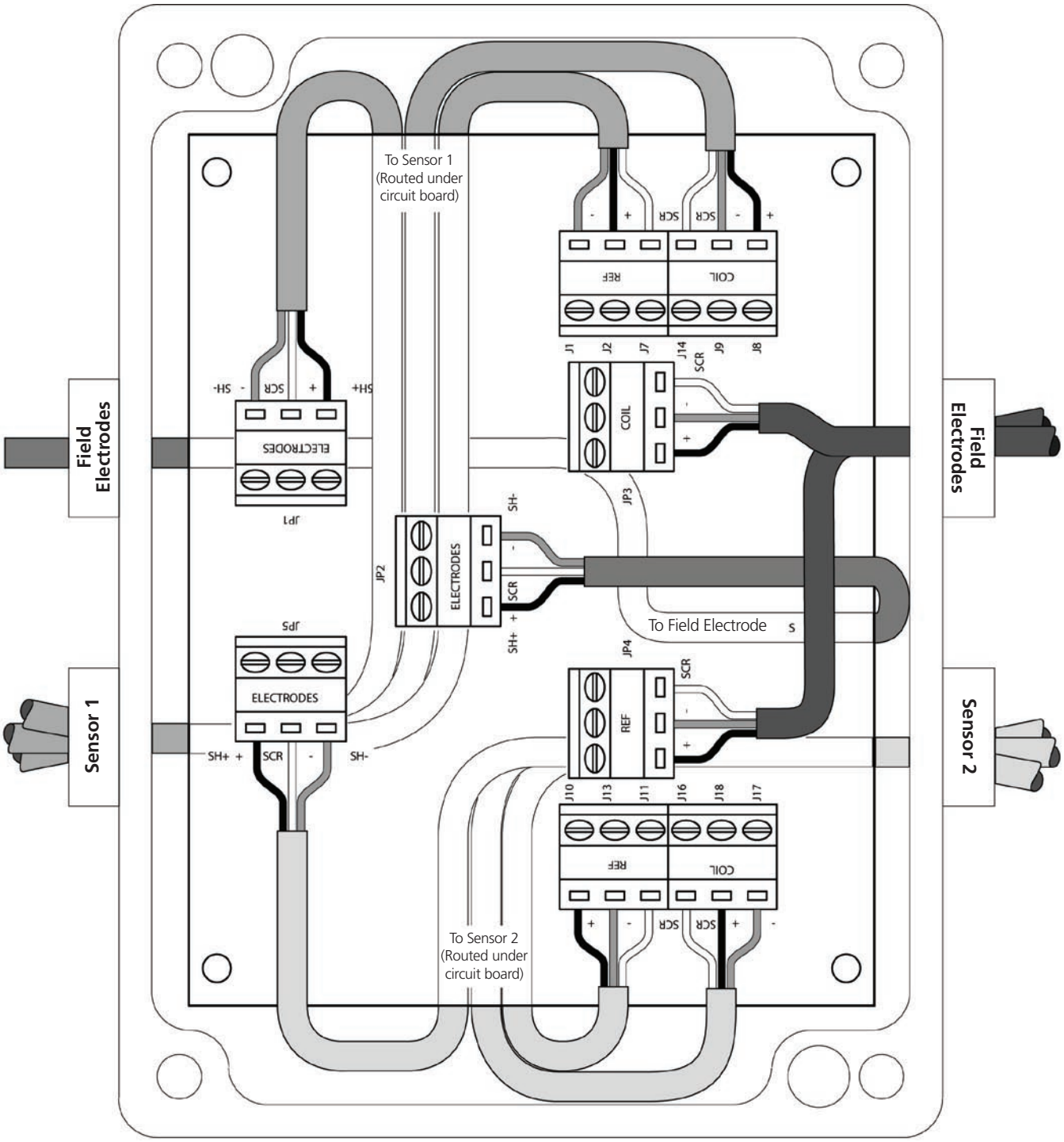
Dimensions and Weights



Nominal Size D		Dimension L*		Dimension W		Approximate Weight	
Inches	mm	Inches	mm	Inches	mm	LB	KG
2	50	10	254	13.05	332	43	20
2.5	65	10	254	13.55	344	50	23
3	80	10	254	14.35	365	55	25
4	100	12	305	16.35	416	80	36
5	125	12	305	17.55	446	92	42
6	150	12	305	18.65	474	100	46
8	200	18	457	21.25	540	185	84
10	250	18	457	23.55	598	225	102
12	300	18	457	25.75	654	301	137
14	350	18	457	27.05	687	335	152
16	400	20	508	30.25	769	490	223
18	450	20	508	32.45	824	515	234
20	500	20	508	34.55	878	615	280
24	600	24	610	38.85	987	840	382
28	700	30	762	41.75	1061	980	445
30	760	30	762	43.85	1114	1280	580
32	800	30	762	46.05	1170	1310	595
36	900	30	762	50.25	1277	1625	740
42	1000	40	1016	56.45	1434	1980	900
48	1200	40	1016	62.55	1589	2210	1015
56	1400	48	1219	70.55	1792	2860	1300
60	1600	48	1219	78.65	1998	2930	1335
66	1800	48	1219	84.65	2150	3270	1480
72	1700	48	1219	90.45	2218	3609	1633
80	2000	48	1219	98.45	2501	3898	1764

Wiring Diagrams

Junction Box Wiring (2 Sensors)



Color Key

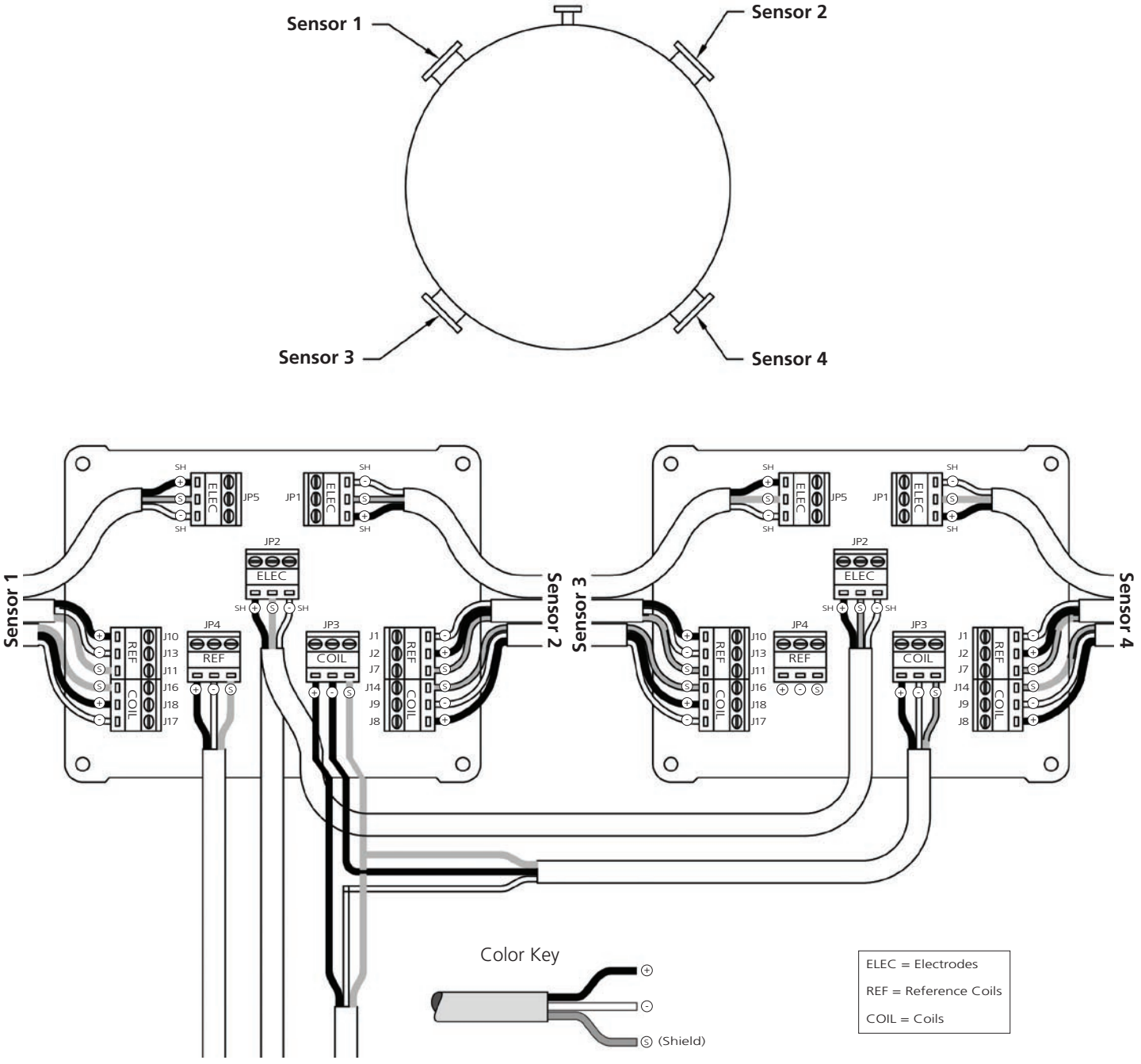
BLACK

SHIELD

RED or CLEAR

Wiring Diagrams

Junction Box Wiring (4 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.

Model and Suffix Codes

Category	Suffix Codes									
Model										
UniMag DT Series Flow Tube	DT									
Nominal Size										
2 Inches (50mm)		02								
2½ inches (65mm)		2H								
3 inches to 80 inches (80 to 2000mm)		03-80								
Flowtube / Flange Materials										
Carbon Steel (Water & Waste)			C							
All AISI 316 Stainless Steel			T							
316 Stainless Steel Flow Tube, Carbon Steel Flanges			A							
Sensor Materials[1]										
PVDF with Elastomer Gaskets, Viton Seals (2" - 14" diameters only) (Water & Waste)				E						
PVDF with Teflon Gaskets, Viton Seals				D						
Polyurethane with Elastomer Gaskets, Viton Seals (16" and larger) (Water & Waste)				P						
PVDF with Teflon Gaskets, Kalrez Seals				F						
PEEK with Klinger Gaskets, Chemraz Seals[2]				K						
UHMWPE Concave[3], Elastomer Gaskets, Viton Seals				U						
PEEK, Klinger Gaskets, Fused Electrodes[4]				H						
Polyurethane Concave[3], Elastomer Gaskets, Viton Seals (16" - 34" Ø only)				C						
Concave Teflon, Teflon Gaskets, Kalrez Seals				T						
Electrodes[5]										
AISI 316 Stainless Steel (Water & Waste)					T					
Hastelloy B (Small)					B					
Hastelloy C (Small)					C					
Titanium					I					
Hastelloy C (Large)[6]					W					
Hastelloy B (Large)[6]					X					
Tantalum					A					
Hastelloy C Fused In[4]					H					
Monel					M					

Category	Suffix Codes									
Flow Tube Liners and Coatings										
Fusion Bonded Epoxy Coating Inside and Outside (Water & Waste)						X				
Polyurethane Inside and Outside[7]						P				
Heavy Duty Polyurethane Inside, Epoxy Enamel Outside[8]						M				
Heavy Duty Tefzel (ETFE)[9]						Z				
No Coating Inside, Fusion Bonded Epoxy Outside[10]						N				
Ryton Coated Inside, Epoxy Enamel Outside						R				
Installation (all options include 50 feet / 15m cables)										
NEMA 6/IP68 Indefinitely Submersible to 30 foot water column							R			
Entela Approved to NEC/CSA Class 1, Div. 2, Grp. C, D, Temp T4							X			
Entela Approved to ATEX Zone 2							C			
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	*Options 4, 5 ,6 have the same dimensions up to 6 inches (150mm)*							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[11]									A	
Extra-Long 316 Stainless Steel Electrodes[5]									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 only for combinations)									S	

Category	Suffix Codes									
Coil Supply										
120V Supply										A
230V Supply										B
	DT	08	C	E	T	X	R	1	O	A

1 For PVDF, PEEK, UHMWPE and Teflon sensors greater than 14" (350mm) diameter, consult EMCO.

2 Ryton coating is used for liquors, lime muds, paper pulp and similar media normally found in the paper industry. We recommend Ryton coating as follows:
- Maximum 220°F (104°C): Use K sensors with W or X electrodes and grounding
- Maximum 250°F (176°C): Use H sensors with H electrodes and grounding

3 For highly abrasive materials used with **uncoated** internal flow tubes as a lower cost alternative to M (heavy duty polyurethane) liners.

4 Use H electrodes on paper mill liquors and lime muds greater than 200°F (93°C). Use with H sensors and R (Ryton) coating only. See note 3, above.

5 Extra-long electrodes are provided for thick, non-fluidic coating applications. Advise thickness. For other materials, consult EMCO.

6 Use W or X electrodes with K (PEEK) sensors only. See note 3, above.

7 Option P (polyurethane) is intended as an alternative in the Water & Waste industry only to meet inferior engineering specifications. It is not as effective as an X (fusion bonded epoxy) coating and is not intended for abrasive material.

8 Recommended for mining slurries and similar fluids. Please include internal piping diameter of mating pipe so the UniMag can be manufactured to match.

9 Tefzel is a fusion bonded ETFE, similar to Teflon. It is intended for use with acids or similar non-abrasive or corrosive media.

10 Non-internally coated flow tubes are intended for use with concave sensors, normally up to 16" flow tube diameter, for highly abrasive media. The wear rate of the sensor equals the wear rate of the flow tube. This is a lower cost alternative to M liners, but service life is typically 25% less than with an M liner. The internal diameter must match the i.d. of the mating pipe work.

11 A pre-amplifier is required in the junction box for media conductivity < 5 µS/cm or for cables greater than 150 feet (50m).

Please specify the following information with your order:

- Fluid type or composition
- Maximum, minimum and normal operating flow rate
- Maximum, minimum and normal operating temperatures
- Maximum, minimum and normal operating pressures
- Internal diameter of mating pipe work

EMCO FLOW SYSTEMS

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

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SL-UNIMAGDT-350-01 2M 7/06