EMCO FLOW SYSTEMS

ChannelMag CM2 Series

Magnetic Flow Meters

EMCO's ChannelMag CM2 Magnetic Flow Meter System consists of the patented ChannelMag Flow Sensor and 4411e Transmitter. ChannelMag flow meters are suitable for raw sewage and storm water in new or existing channels.

Features

- Solid state sensors; no moving parts
- Patented AC coil excitation (high coil current and high pulsation frequency)
- Often installed under flow conditions; no bypass pumping necessary
- Suitable for existing channels up to 200 feet (60m) wide
- Sensor reference coils
- Internal grounding electrodes
- Calibrated accuracy with NIST traceability
- 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 ChannelMag CM2.

The ChannelMag is a bi-directional magnetic flow meter system for open channels from 6 inches to 200 feet (150mm to 60m). ChannelMag sensors may be used singularly or in multiples, dependant on the width of the channel and the required accuracy.

A high resolution ultrasonic or hydrostatic transducer determined the level measurement, with compensation for change in air density.

A remote 4411e bi-directional transmitter calculates volumetric flow from the mean velocity and level sensor inputs. It displays rate and totals, and is programmable to show new forward totals from storm water back up. Transmission signals include two 4-20 mA outputs form separate terminals, a scaleable pulse frequency output, and RS232 communication as standard supply.

Application Guide

Maximum Media Temperature	140°F (60°C)
Maximum Level	33 feet (10m)
Minimum Level Above Channel Base	5.0" (125mm) with ramps; 2.0" (60mm) without ramps
Adjustable Mean Velocity Range	0 to 2 fps (0 to 0.6 m/s) to 0 to 10 fps (0 to 3 m/s)
Maximum Recommended Velocity for Installation Under Flow Conditions	1 fps (0.3 m/s) using Insertion Frame

Media Conductivity

Minimum media electrical conductivity: 1 µS/cm (water is typically 200 to 600 µS/cm)

Performance Specifications

Accuracy and Traceability[1]	
High Calibrated Accuracy	±2.0% of rate for mean velocities > 2 fps (0.6 m/s) ±0.04 fps (± 0.012 m/s) for mean velocities < 2 fps (0.6 m/s)
Standard Calibrated Accuracy	±4.0% of rate for mean velocities > 2 fps (0.6 m/s) ±0.08 fps (± 0.024 m/s) for mean velocities < 2 fps (0.6 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.
Straight Run Requirements	10 Channel widths upstream 5 Channel widths downstream (From end of ramps if supplied)

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.

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	Body material: HDPE with stainless steel fittings Electrode material: AISI 316 stainless steel or Hastelloy C Electrode seals: Viton
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

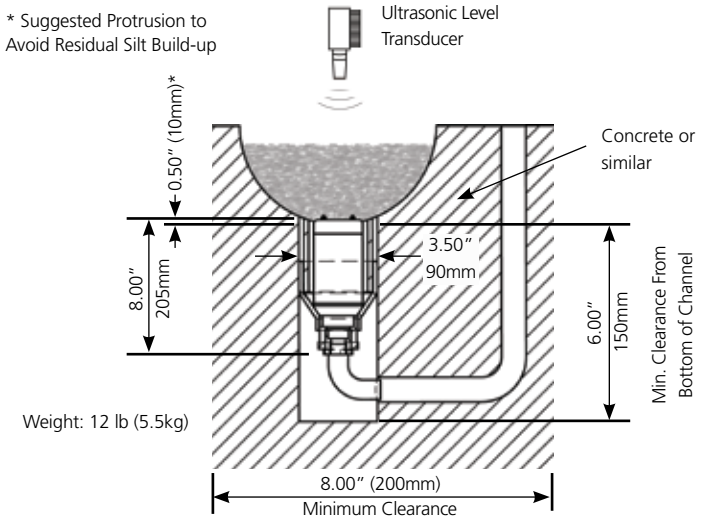
ChannelMag Types, Channel Widths, Calibrated Accuracy

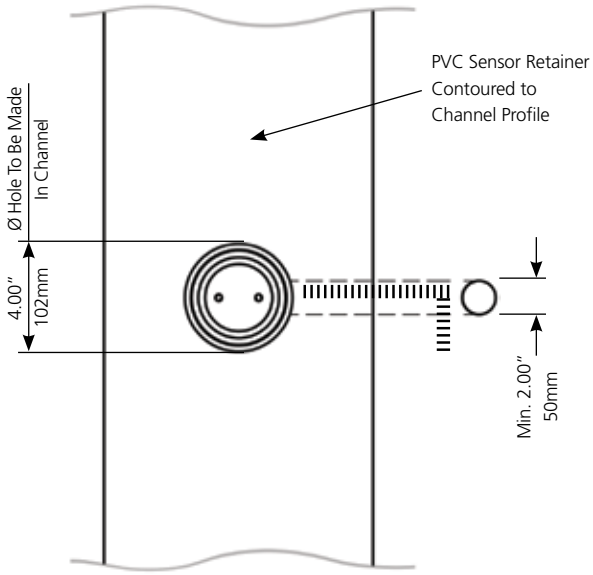
<table>
<tr><th colspan="2">Open Channel Width/Diameter</th><th colspan="2">High Accuracy, Empty Channel Installation</th><th colspan="2">Standard Accuracy, Empty Channel Installation</th></tr>
<tr><th>Inches</th><th>mm</th><th>1L = 1 Level of Sensors
Levels ≤ 60” (1500mm)</th><th>2L = 2 Levels of Sensors
Levels > 60” (1500mm)</th><th>1L = 1 Level of Sensors
Levels ≤ 60” (1500mm)</th><th>2L = 2 Levels of Sensors
Levels > 60” (1500mm)</th></tr>
<tr><td>6” - 20”</td><td>150 - 500</td><td colspan="2">CM2/D Not Available</td><td>1 x CM2/D</td><td>CM2/D Not Available</td></tr>
<tr><td>10” - 30”</td><td>250 - 750</td><td>1 x CM2/8”
On Base Center</td><td>—</td><td>High Accuracy
Only</td><td>—</td></tr>
<tr><td>31” - 50”</td><td>755 - 1250</td><td>2 x CM2/8”
1 Pair on Base</td><td>2 x CM2/8”
Version 1L Only
1 Each Side</td><td>1 x CM2/8”
On Base Center</td><td>—</td></tr>
<tr><td>51” - 90”</td><td>1255 - 2250</td><td>3 x CM2/8”
All 3 on Base</td><td>3 x CM2/8”
1 Each Side, 1 on Base</td><td>2 x CM2/8”
1 Pair on Base</td><td>2 x CM2/8”
Version 1L Only
1 Each Side</td></tr>
<tr><td>91” - 240”</td><td>2255 - 6000</td><td>4 x CM2/8”
All 4 on Base</td><td>4 x CM2/8”
2 Each Side, 2 on Base</td><td>3 x CM2/8”
All 3 on Base</td><td>3 x CM2/8”
1 Each Side, 1 on Base</td></tr>
<tr><td colspan="4" rowspan="3">River Flow Standard Accuracy Only
Calibrated for Point Velocity[1]</td><td colspan="2">Flowing River Installation[1]</td></tr>
<tr><td>2 x CM2/8”</td><td>4 x CM2/8”</td></tr>
<tr><td>1 Pair on Bed</td><td>2 on Each Side, 2 on Bed</td></tr>
</table>

[1] Optional volumetric river flow calibration to USA Geological Society procedure or similar is available on request. See separate data sheet.

Dimensions and Weights

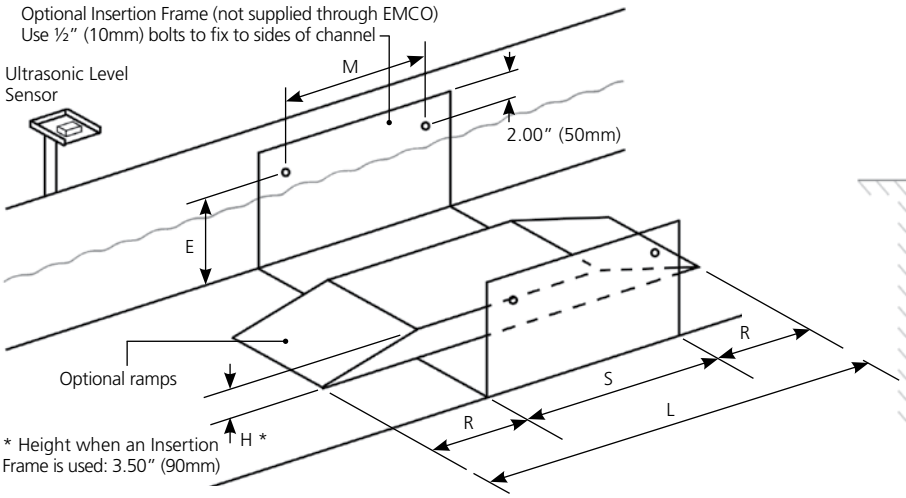
ChannelMag CM2/D

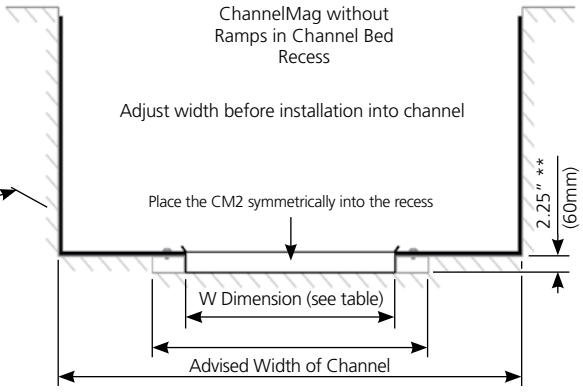




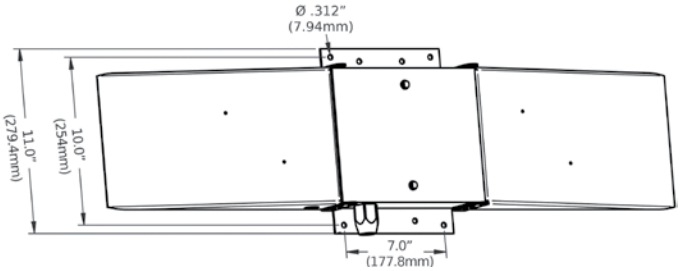
Dimensions and Weights

ChannelMag CM2/8"





** Top of CM2 is 0.25" (6mm) above channel bed
Should not be > 1.00" (25mm)



CM2/8" Sensor Mounting Holes for Installation in Empty / Partially Empty Channels

ChannelMag CM2/8" Dimensions Without Ramps							
Nominal CM2 Width		Depth		Width		Length	
Inches	mm	Inches	mm	Inches	mm	Inches	mm
8"	200	2.25"	60	18.0"	460	11.0"	280

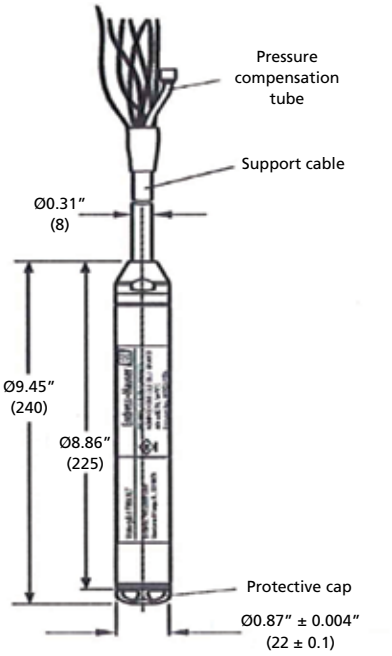
ChannelMag CM2/8" Dimensions With Ramps															
Nominal CM2 Width		Actual CM2 Width W		L		S		R		H *		M		Weight Each *	
Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm	lb	kg
8"	200	10.0"	254	40.0"	1016	11.5"	290	15.0"	380	2.5"	64	6.0"	152	25	12

NOTE: The height "E" of the Insertion Frame normally extends 4" (100 mm) nominally above the maximum level. EMCO does not supply insertion frames.
* Weight of ramps less 10 lb (5 kg) per CM2 Sensor. Customer responsible to model specific application.

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. The hydrostatic level transducer is normally an integral part of the ChannelMag velocity sensor type PM2.

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	Interference emission to EN 61326 for CE requirements
Protection	NEMA 6 and IP68 indefinately 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 disphragm: aluminum trioxide ceramic Internal seal: standard Viton, optional EPDM Protective cap: high density polyethelene 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)



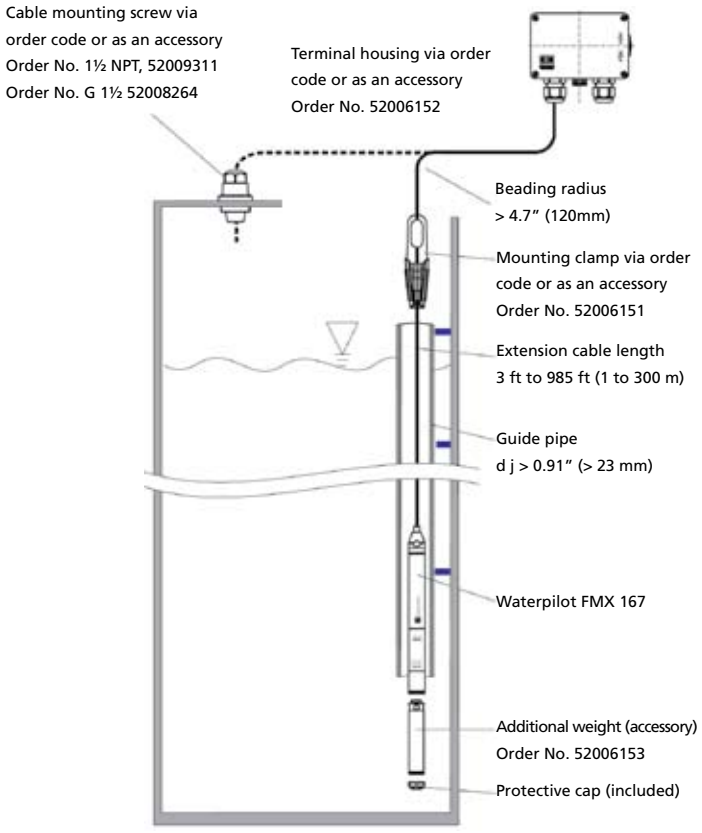
FMX 167 – 1 2 3 4 5 6 7

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

Junction Box used for cables > 33 feet (10 m)



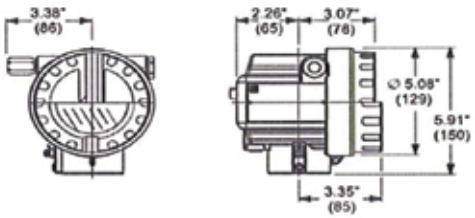
The FMX is normally installed inside the ramps of a PM2 sensor. Alternatively, it may be mounted in a stilling well, most conveniently a PVC tube of internal diameter > 0.9" (25 mm). The cable contains a breather tube and is normally terminated in the 4411e transmitter. This cable must not be kinked 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

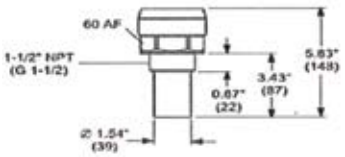
As an alternative to the hydrostatic level transducer, an ultrasonic level transducer may be incorporated in a convenient man hole. This must be at least 1 diameter upstream or downstream of the end of the ramps of the PM2 ChannelMag sensor ramps. This avoids critical flow rise or fall errors.

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)

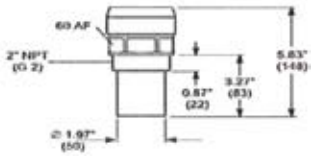
F12 Housing



FMU 40



FMU 41



FMU 40 -- 1 2 3 4 5 6 ☐☐☐☐☐☐

1. 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

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

3. 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

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

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

6. 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

FMU 41 -- 1 2 3 4 5 6 ☐☐☐☐☐☐

1. 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

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

3. 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
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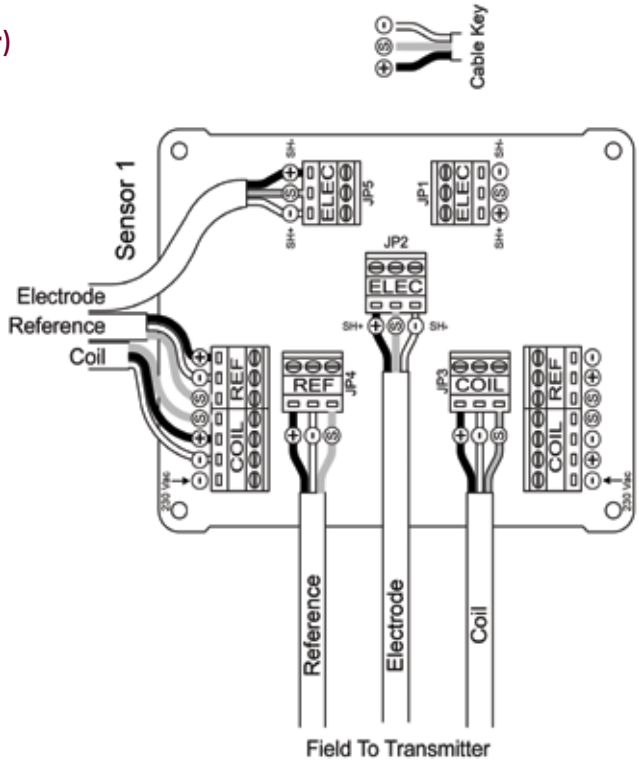
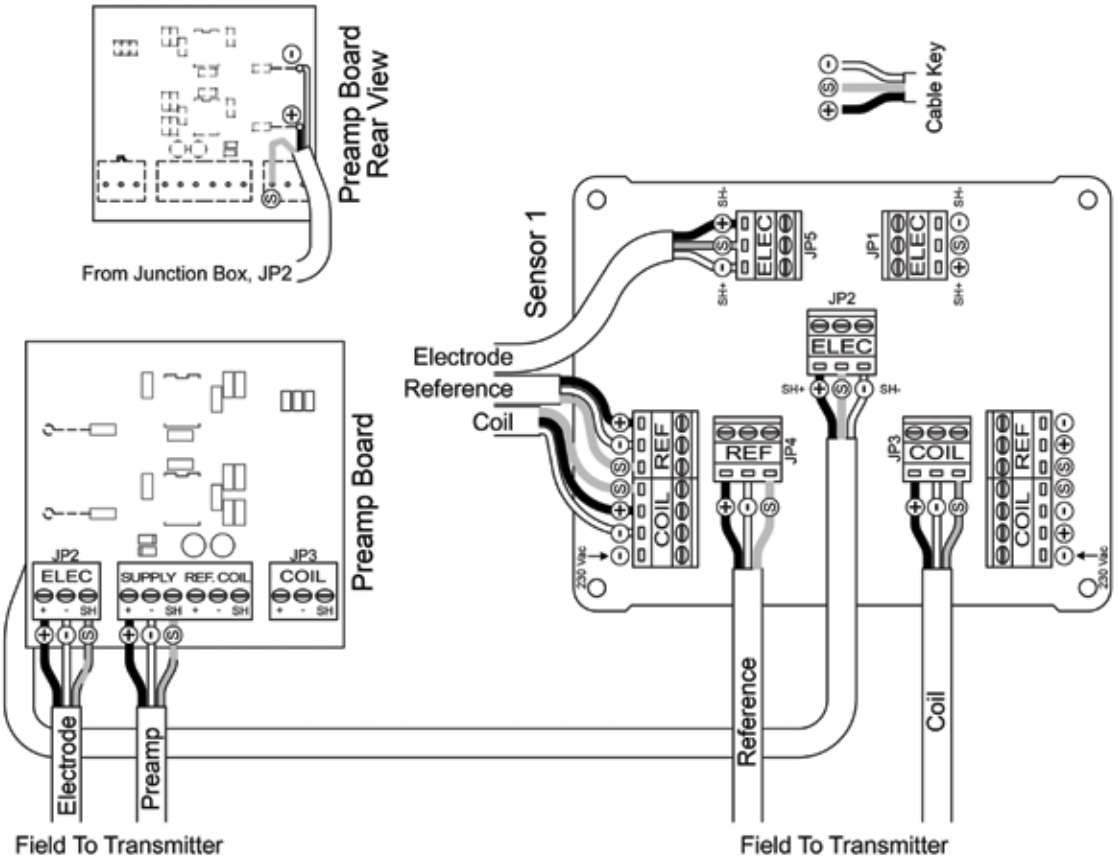
Wiring Diagrams

Junction Box Wiring (1 Sensor)



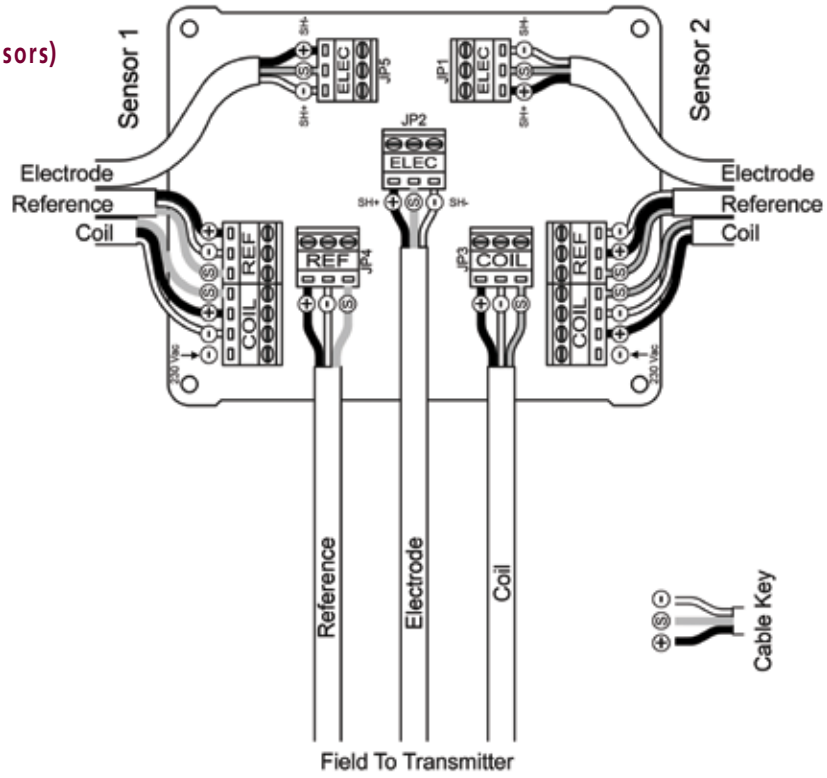
Wiring Diagrams

Junction Box Wiring (1 Sensor With Pre-amp)



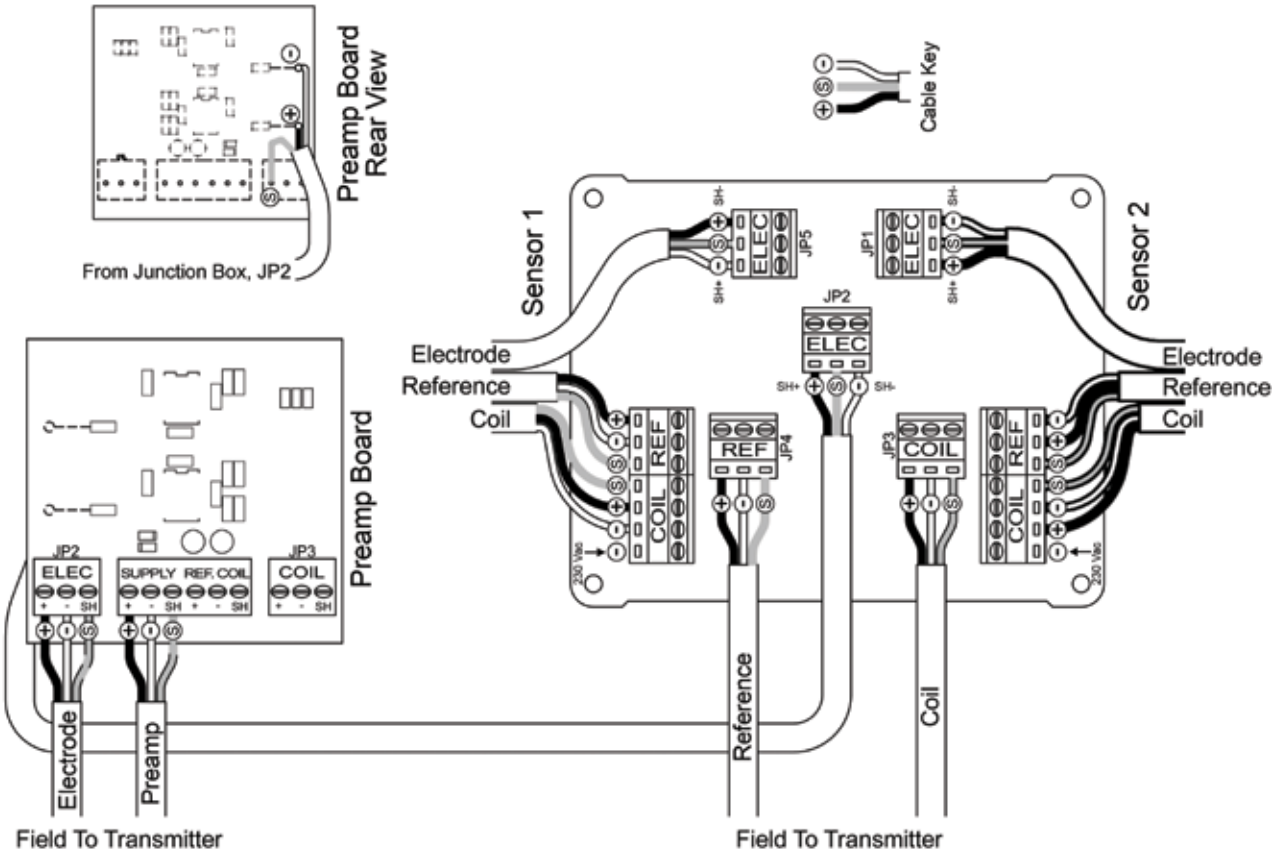
Wiring Diagrams

Junction Box Wiring (2 Sensors)



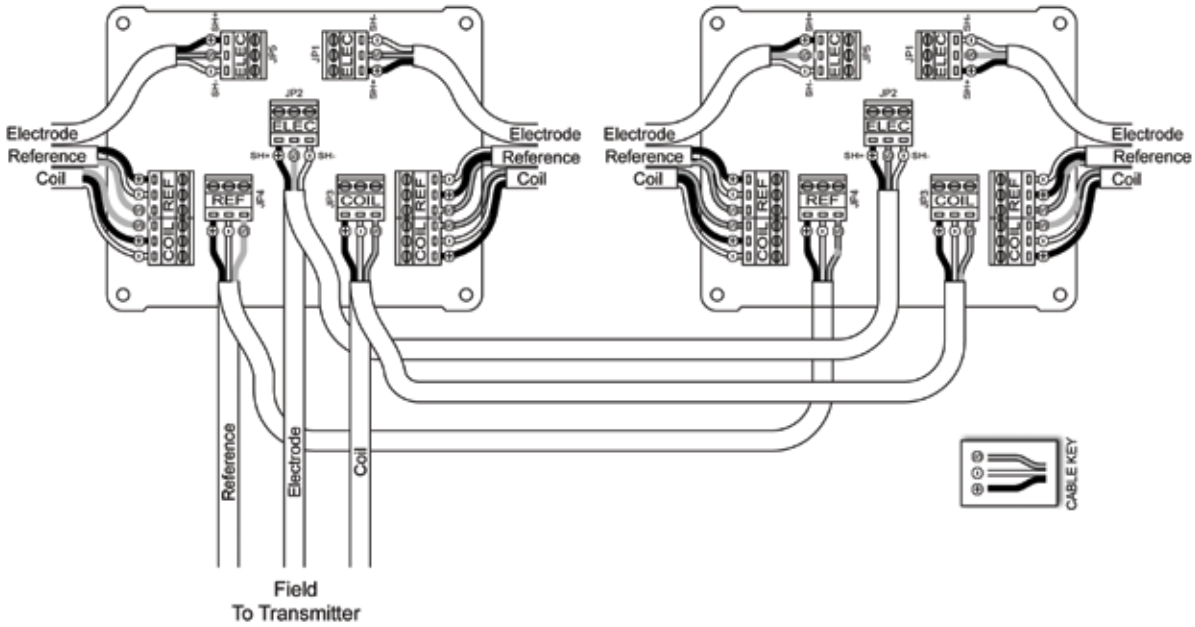
Wiring Diagrams

Junction Box Wiring (2 Sensors With Pre-amp)



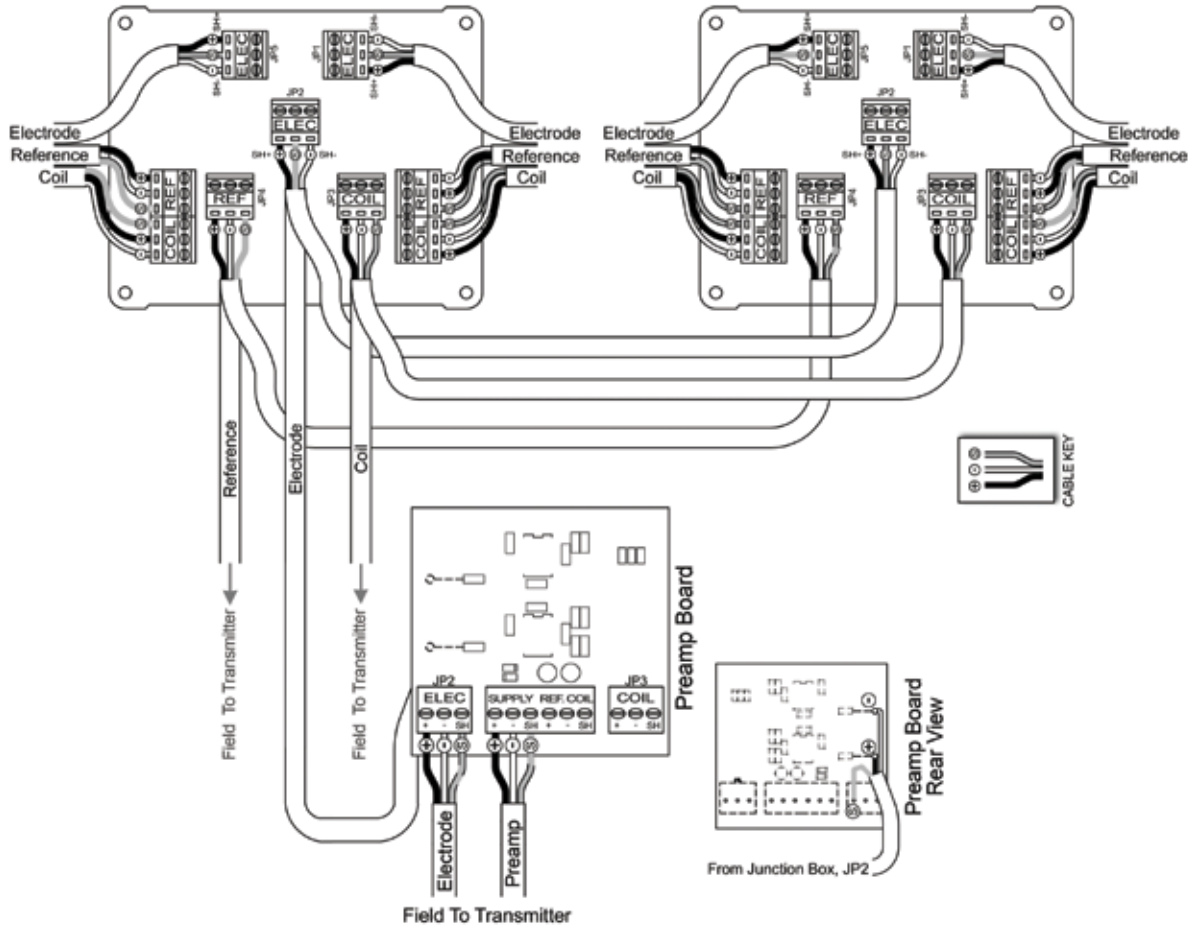
Wiring Diagrams

Junction Box Wiring (4 Sensors)



Wiring Diagrams

Junction Box Wiring (4 Sensors With Pre-amp)



Model and Suffix Codes

Category	Suffix Codes								
Model									
ChannelMag CM2/8" Basic Type and Quantity	2 x CM2/8"								
ChannelMag CM2/D ChannelMag for Half Circle	1 x CM2/D								
Channel Width									
6" - 200' (150mm - 60m) at Channel Top T		006"T - 200'T							
Half Circle		_ _ _ -D							
Special[1]		S							
Channel Bottom Width									
6" - 200' (150mm - 60m) at Channel Bottom B			006"B - 200'B						
Half Circle			000						
Special[1]			S						
Media Level									
001" - 999" (25mm - 25000mm) at Media Level L				001"L - 999"L					
Special[1]				S					
Accuracy									
Standard Accuracy					R				
High Accuracy					H				
Special[1]					S				
Ramps[2]									
Ramps Included						R			
Ramps Not Included						N			
Special[1]						S			
Cables									
Standard Cable Length[3]							C		
ATEX Zone 2 With Standard Cable							A		
NEC Class 1, Div. 2 With Standard Cable							E		
Pre-Amp for Cables > 150 feet (50m)							P		
Special, Including Special Cable Length[4]							S		
Coil Supply									
120V Coil Supply								A	
230V Coil Supply								B	
Special[1]								S	

Category	Suffix Codes								
Levels of Sensors									
1 Level of CM2 Sensors									1L
2 Levels of CM2 Sensors With Remote Single Relay Junction Box									2L
	2 x CM2/8"	090"T	072"B	048"L	R	R	C	W	1L

Note: EMCO does not supply insertion frames. Customer responsible to model specific application.

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

2 ChannelMag CM2/8" sensors are always supplied with ramps when the CM2 sensor lies on the bed of the channel.

3 C = 50 feet (15m) UL approved buryable and submersible cable from CM2 sensor(s) to the junction box. Multiple sensor cable lengths are of the same length. Cables terminate in the junction box, potted on-site with re-enterable potting gel. Junction box and gel supplied. Further cables from the junction box to the transmitter are as standard 50 feet (15m).

4 Use for special details, including combinations. All special orders must include a complete description along with the ordering code. Always specify separately:

- Cable length from CM2 sensor(s) to junction box
- From junction box to 4411e transmitter

For cable lengths > 150 feet (50m) from the junction box, a pre-amp is required.

Астана +7(77172)727-132 Волгоград (844)278-03-48 Воронеж (473)204-51-73 Екатеринбург (343)384-55-89
Казань (843)206-01-48 Краснодар (861)203-40-90 Красноярск (391)204-63-61 Москва (495)268-04-70
Нижний Новгород (831)429-08-12 Новосибирск (383)227-86-73 Ростов-на-Дону (863)308-18-15
Самара (846)206-03-16 Санкт-Петербург (812)309-46-40 Саратов (845)249-38 Уфа (347)229-48-12
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Единый адрес для всех регионов: emp@nt-rt.ru || www.emco.nt-rt.ru