F-3200 Series
Inline Electromagnetic Flow Meter
Installation & Basic Operation Guide

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SAFETY INFORMATION

This meter was calibrated at the factory before shipment. To ensure correct use of the meter, please read this manual thoroughly.

Regarding this Manual:

- This manual should be passed on to the end user.
- Before use, read this manual thoroughly to comprehend its contents.
- The contents of this manual may be changed without prior notice.
- All rights reserved. No part of this manual may be reproduced in any form without ONICON's written permission.
- ONICON makes no warranty of any kind with regard to this material, including, but not limited to, implied warranties of merchantability and suitability for a particular purpose.
- All reasonable effort has been made to ensure the accuracy of the contents of this manual. However, if any errors are found, please inform ONICON.
- ONICON assumes no responsibilities for this product except as stated in the warranty.
- If the customer or any third party is harmed by the use of this product, ONICON assumes no responsibility for any such harm owing to any defects in the product which were not predictable, or for any indirect damages.

Safety Precautions:

The following general safety precautions must be observed during all phases of installation, operation, service, and repair of this product. Failure to comply with these precautions or with specific WARNINGS given elsewhere in this manual violates safety standards of design, manufacture, and intended use of the product. ONICON Incorporated assumes no liability for the customer's failure to comply with these requirements. If this product is used in a manner not specified in this manual, the protection provided by this product may be impaired.

The following symbols are used in this manual:

WARNING

Messages identified as "Warning" contain information regarding the personal safety of individuals involved in the installation, operation or service of this product.

CAUTION

Messages identified as "Caution" contain information regarding potential damage to the product or other ancillary products.

IMPORTANT NOTE

Messages identified as "Important Note" contain information critical to the proper operation of the product.

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SECTION 1.0: INTRODUCTION

1.1 PURPOSE OF THIS GUIDE

The purpose of this guide is to provide installation and commissioning procedures and basic operating instructions for the F-3200 Inline Electromagnetic Flow Meter.

1.2 PRINCIPLE OF OPERATION

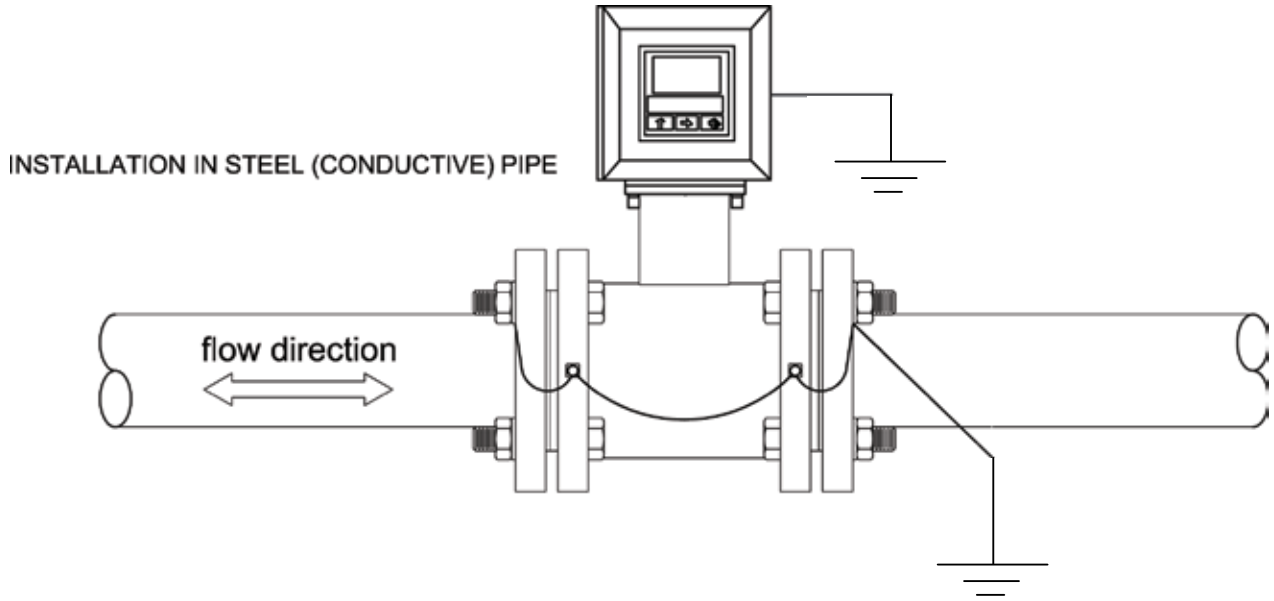
The operating principles of ONICON F-3200 Inline Electromagnetic Flow Meters are based on Faraday's Law of Electromagnetic Induction. Faraday's Law states that a voltage will be induced in a conductor (water or other conductive liquid) when it passes through a magnetic field (generated by the meter), and the induced voltage will be directly proportional to the velocity of the conductor. By placing electrodes on opposite sides of the flow tube, it is possible to accurately measure the induced voltage and determine the corresponding velocity of the flowing liquid.

WARNING

Only qualified service personnel should attempt to install or service this product. Serious injury may result from the improper installation or use of this product.

1.3 TYPICAL FLOW METER INSTALLATION

ONICON'S F-3200 Inline Electromagnetic Flow Meters are suitable for volumetric flow measurement of electrically conductive liquids in a wide variety of applications including bidirectional applications.



1.4 STANDARD FEATURES AND SPECIFICATIONS

- A built-in user interface & graphic display
- A single 4 – 20 mA output for flow rate
- Two programmable open collector pulse outputs. Outputs may be programmed to provide:
  * an indication of flow direction
  * a scaled pulse for totalizing flow
  * a high resolution frequency output to drive peripheral devices
  * an indication of an alarm condition
- Empty pipe detector
- Internal self-diagnostic functions & fault alarms

CALIBRATION

Flow meters are wet calibrated in a flow laboratory against standards that are directly traceable to government standards. A certificate of calibration accompanies every meter.

ACCURACY

Accurate to within:
± 0.2% of reading from 1.6 to 33 ft/s
± 0.0033 ft/s at flows less than 1.6 ft/s

PROGRAMMING

Factory programmed for specific application

MEMORY

Nonvolatile memory retains all program parameters and totalized values in the event of power loss.

DISPLAY

Alphanumeric LCD displays total flow, flow rate, flow direction & alarm conditions

OUTPUT SIGNALS

Isolated 4 – 20 mA analog output for flow rate
2 isolated programmable opto-coupled open collector digital/pulse outputs
(Configurable for frequency, pulse, alarm or directional flow)
40 VDC, 100 mA and 1250 Hz maximum

(Optional) Redundant output option with second isolated analog output for flow rate and 2 additional isolated programmable opto-coupled open collector digital/pulse outputs
(Pulse outputs configurable for frequency, pulse, alarm or directional flow)
40 VDC, 100 mA and 1250 Hz maximum

TEMPERATURE RANGE

Liquid temperature range:
Polypropylene liner: 32° to 140°F
Ebonite liner: 23° to 175°F
PTFE liner: -4° to 212° F (266° F with remote electronics)
Ambient temperature range: -4° to 140°F

FLUID CONDUCTIVITY

5 µS/cm minimum

MAINTENANCE

Periodically inspect the power supply cables, cable glands and the enclosure for signs of damage. Inspect installation and mounting hardware for loose connections.

MECHANICAL

Electronics Enclosure:
Standard: Painted Aluminum NEMA 6
(Optional) Remote mount maximum distance from sensor - up to 325 ft @ conductivities ≥ 200µS/cm

Outer Body Material:
Standard: Carbon Steel, Painted
Optional: 316 Stainless Steel

Flow Tube (Internal):
304 Stainless Steel

Connection Type:
Standard: ANSI 150 Class Flange
Optional: ANSI 300 Class Flange
Optional: Wafer
Optional: Threaded Process Connection

ELECTRICAL

This equipment is intended for INSTALLATION CATEGORY (OVERVOLTAGE CATEGORY) II applications.

Input Power - Factory Selectable:
Standard - 100 - 240 VAC, 45 - 66 Hz, 12 VA typical
Optional - 18 - 45 VDC, 10 W typical
OR 18 - 45 VAC, 45 - 66 Hz, 12 VA typical

Overcurrent Protective Device Ratings:
Supply mains overcurrent protective devices with the following ratings:
- 120 VAC 50/60 Hz – 15 A
- 230 VAC 50 Hz – 6 A

Wiring:
Flow signals - Use 18-22 AWG shielded cable
Standard input power - Use a three wire service with one wire a protective earth ground. The installation must comply with all local, state and federal building codes.

Optional input power - Use PVC jacketed copper cable with a wire gauge suitable for the length of run and required maximum current carrying capacity. The installation must comply with all local, state and federal building codes.

Note: Specifications are subject to change without notice.

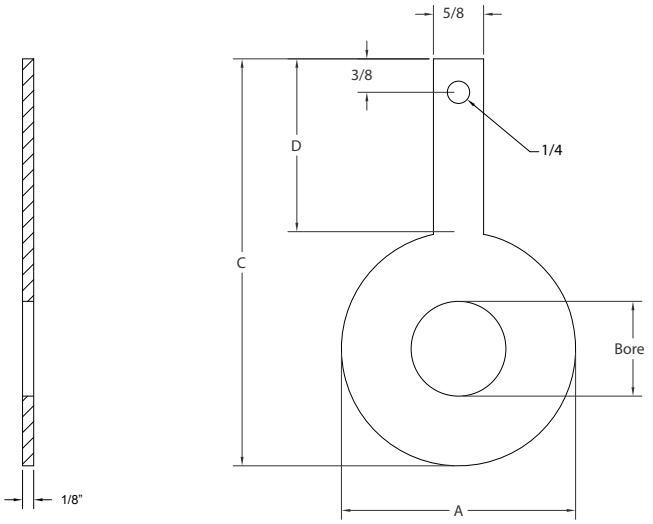
Approvals:

CE NSF - 61

1.5 ADDITIONAL HARDWARE THAT MAY BE REQUIRED

1.5.1 Grounding Rings

Grounding rings may be required whenever meters are installed in non-metallic or lined pipes. Grounding rings placed before and after the meter eliminates electrical noise that will interfere with the proper operation of the meter. ONICON provides grounding rings as an optional accessory. Grounding ring dimensional information and part numbers are listed below. For proper operation, grounding rings are required before and after the meter.



Grounding Ring Dimensions & ONICON Part Numbers						
Nominal Size	**Bore**	**A**	**C**	**D**	**T**	**316 SS Part #**
1”	1 - 1/16	2 - 5/8	4 - 9/16	1 - 15/16	1/8	15212
1.5”	1 – 9/16	3 – 3/8	5 - 5/16	1 - 15/16	1/8	15213
2”	2 – 1/16	4 – 1/8	6 - 1/16	1 - 15/16	1/8	15214
3”	3 – 1/16	5 – 3/8	7 - 5/16	1 - 15/16	1/8	15215
4”	4 – 1/16	6 – 7/8	8 - 13/16	1 - 15/16	1/8	15216
6”	6	8 – 3/4	10 - 11/16	1 - 15/16	1/8	15217
8”	8	11	12 - 15/16	1 - 15/16	1/8	15218
10”	9 – 1/2	13 – 3/8	15 - 5/8	2 - 1/4	1/8	15219
12”	11 – 9/16	16 – 1/8	18 - 9/16	2 - 7/16	1/8	15220
14”	13 – 1/2	17 – 3/4	20 - 3/8	2 - 5/8	1/8	15221
16”	15 – 1/4	20 – 1/4	22 - 7/8	2 - 5/8	1/8	15222
18”	17 – 3/8	21 – 5/8	24 - 1/4	2 - 5/8	1/8	15223
20”	19	23 - 7/8	26 - 11/16	2 - 13/16	1/8	15224
24”	23	28 – 1/4	31 - 1/8	2 - 7/8	1/8	15225
30”	29	34 – 3/4	38	3 - 1/2	1/8	15226
36”	35	41 – 1/4	45 - 1/4	4	1/8	15227
42”	41	48	52 - 1/2	4 - 1/2	1/8	15228

1.5.2 Gaskets

Gaskets are required for sensor bodies with ebonite and polypropylene liners and are strongly recommended for meters with PTFE liners. Gasket dimensions must comply with ASME B16.5 flange standards. ONICON is not a gasket manufacturer and does not supply gaskets for this product.

The following general suggestions are provided to assist the installer in choosing the proper gasket material. In all cases, the responsibility of selecting the appropriate material rests with the installer.

Gaskets are used to create a seal between the flow meter liner surface and the surface of the mating flange. The proper choice of gasket material will allow for a leak free connection at the time of installation and maintain that seal over time. How well the gasket works depends on a number of factors. Each of these should be considered when choosing a gasket material.

- Is it chemically compatible with the fluid?
- Will it withstand the expected minimum and maximum operating temperatures?
- Does it provide enough resiliency and creep resistance to maintain loading over time?
- Will it deform enough to create a seal by filling imperfections in the sealing surfaces?
- Is it thick enough to take up variations in flatness of the surface?

In many cases a simple 1/8" red rubber gasket with a Shore A hardness (Durometer) of 60 – 80 will suffice. Your local gasket supplier should be able to guide you in selecting the best material for your application.

1.6 WORKING ENVIRONMENT

The F-3200 was designed for installation and use in typical industrial environments that are free of corrosive liquids and fumes, direct liquid exposure, direct sunlight, temperature extremes and vibrations.

The operating ambient air temperature range is -4° F to 140° F.

The electrical power should be relatively clean, free of high frequency noise, large voltage transients, and protected from power surges and brown outs.

1.7 SERIAL NUMBER

Serial Number

The F-3200 has 2 separate serial numbers. The transmitter serial number is located on the identification plate located on the electronics enclosure. The sensor serial number is located on the identification plate located on the sensor body.

SECTION 2.0: UNPACKING

The F-3200 is generally shipped in one package unless optional hardware or equipment is ordered. Notify the freight carrier (all products are shipped insured) and ONICON if any items are damaged in transit.

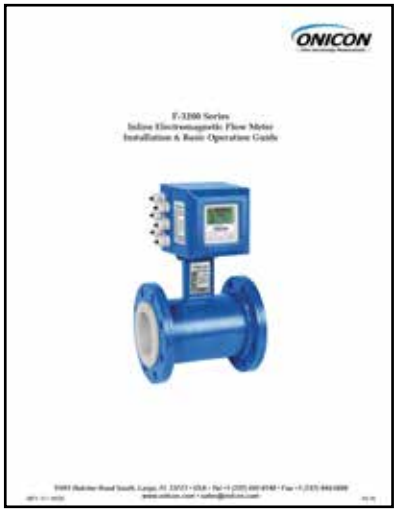
2.1 CHECKING THAT YOU HAVE RECEIVED EVERYTHING

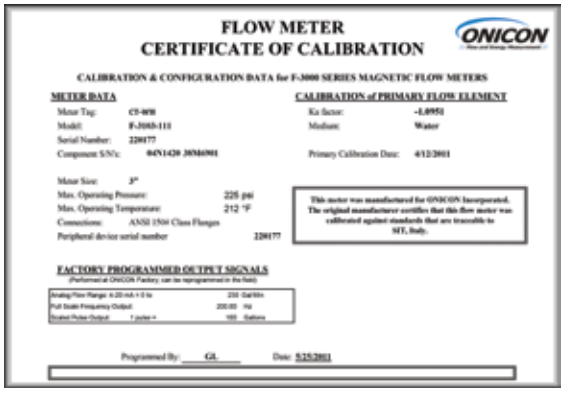
- **Standard Documentation**

  Enclosed with each F-3200 is a comprehensive documentation package that includes the following items:

  The F-3200 Installation and Operation Guide
  Certificate of Calibration

  Please notify ONICON if any of these items are missing.





- **Integral Mount Transmitter**

  F-3200 inline magnetic flow meters with integrally mounted transmitters are shipped fully assembled. Remove the meter from the shipping carton and inspect it for physical damage.

- **Remote Mount Transmitter**

  F-3200 inline magnetic flow meters ordered with the remote transmitter mounting option will be provided in one carton that contains the flow sensor body, the transmitter with mounting hardware and the necessary cable to connect the two together. Remove each and inspect it for physical damage.

IMPORTANT NOTE

F-3200 transmitters and sensor bodies are two parts of one uniquely calibrated system and must be installed together. Mixing components from other systems will result in significant calibration errors.

- **Grounding Rings**

  Grounding rings are optional accessories that may be required for proper installation. Grounding rings may be shipped in a separate carton. Remove each and inspect it for physical damage.

SECTION 3.0: INSTALLATION

The F-3200 Inline Electromagnetic Flow Meter should be installed by experienced plumbers, electricians and others with related knowledge and experience in the heating, cooling, and fluid metering fields. ONICON will be happy to assist with technical recommendations and to provide guidance by telephone and/or e-mail. On-site field engineering, installation and service are also available at an additional cost.

The installer should use good trade practices and must adhere to all state and local building or other applicable codes.

3.1 SITE SELECTION

Careful attention during the site selection process will help the installers with the initial installation, reduce start-up problems, and make future maintenance easier. For example, do not install the flow meter where it will be difficult for personnel to perform periodic maintenance. When selecting a site for mounting, consider the criteria under Section 1.6, WORKING ENVIRONMENT, as well as the following:

IMPORTANT NOTE

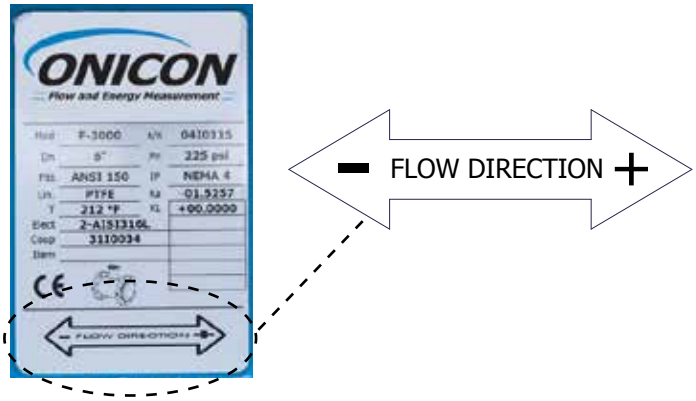
Proper site selection is critical to the performance of this flow meter. The flow meter must be properly located within the piping system in order to ensure an accurate flow measurement.

3.1.1 General Guidelines

When properly installed, the flow meter will only measure flow associated with that portion of the piping system for which the flow measurement is being made. Choose the location with the longest straight unobstructed run of pipe, keeping in mind that in some applications it may be possible to locate the meter in either the supply or return pipe.

3.1.2 Flow Direction

F-3200 flow meters are inherently bidirectional and changes in flow direction are indicated by a change in polarity of the sensing signal. In order for the meter to display the correct polarity, it is necessary to orient the meter relative to flow direction during the installation process. The sign of the flow rate is positive when the flow direction is from – to + as printed on the tag plate as shown below. Prior to installation, determine the direction of flow in the piping system and orient the meter accordingly.



Flow in this direction will display as positive on the LCD display.

FLOW DIRECTION +

Flow in this direction will display as negative on the LCD display.

– FLOW DIRECTION

IMPORTANT NOTE

Flow direction is indicated by polarity symbols (+/-) and flow totals are accumulated separately based on direction. The polarity of the flow indication may be reversed by reversing the polarity of the Ka coefficient.

3.1.3 Remote Mounted Transmitter

Find an easily accessible location where wire connections can be made and meter readings can be taken from floor level. Mount the transmitter on a vibration free surface. Avoid locations that contain electric motors or other strong sources of electrical interference.

IMPORTANT NOTE

The maximum distance between the transmitter and sensor body is 325 ft at conductivities > 200µS/cm.

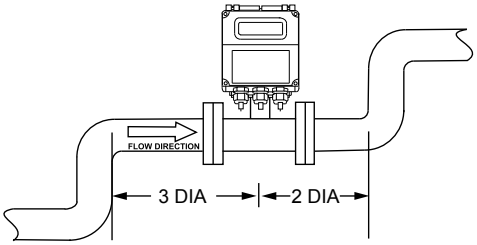
3.1.4 Pipe System Requirements

The straight run requirements presented below represent the minimum requirements for accurate flow measurement. For optimum performance, provide as much additional straight run as possible.

IMPORTANT NOTE

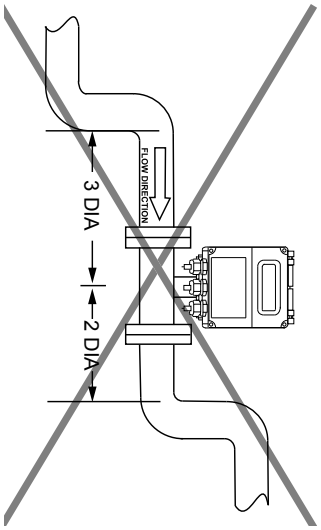
For proper operation, install the flow meter in a straight run of pipe free of bends, tees, valves, transitions and obstructions for a distance of **at least 3 diameters upstream and 2 diameters downstream.**

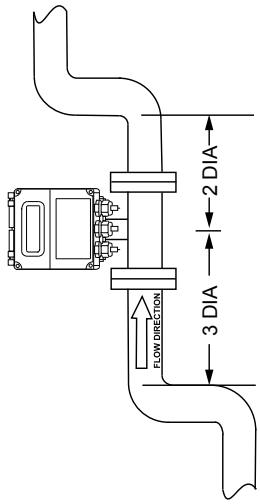
Recommended Installation



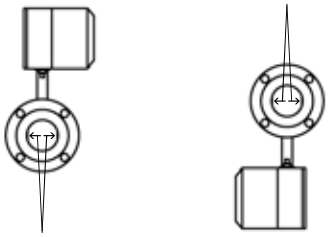
Place pipe at least 3 pipe diameters downstream and 2 pipe diameters upstream from bends and obstructions.

Avoid these installations



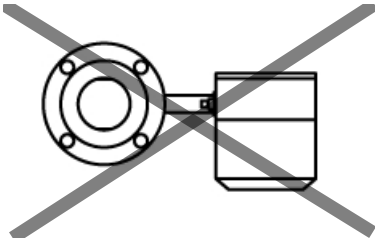


Avoid downward flow which can lead to partially filled pipes.



Electrode Location

The electrodes should be located in the horizontal axis (3 o'clock and 9 o'clock) in order to prevent sediment from settling on them.

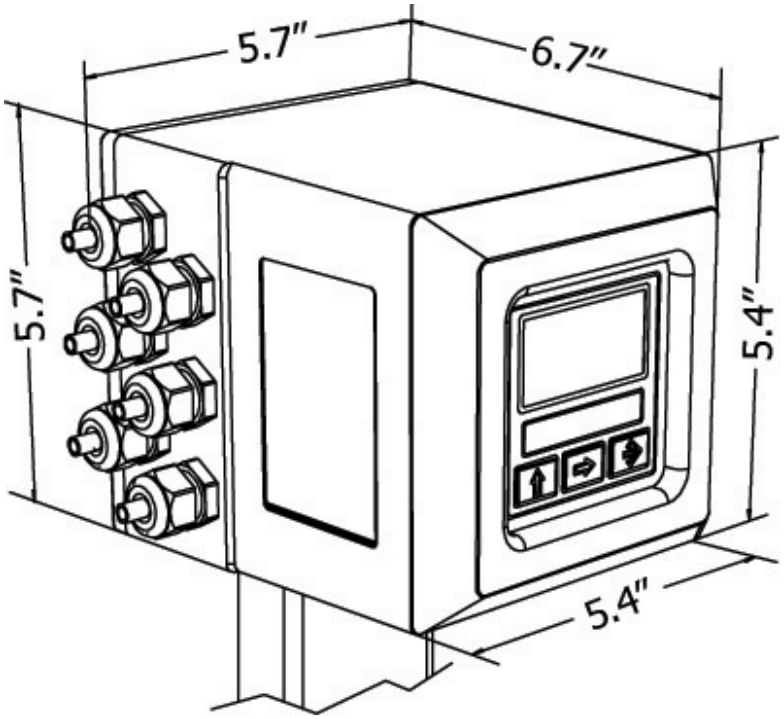


3.2 MECHANICAL INSTALLATION

IMPORTANT NOTE

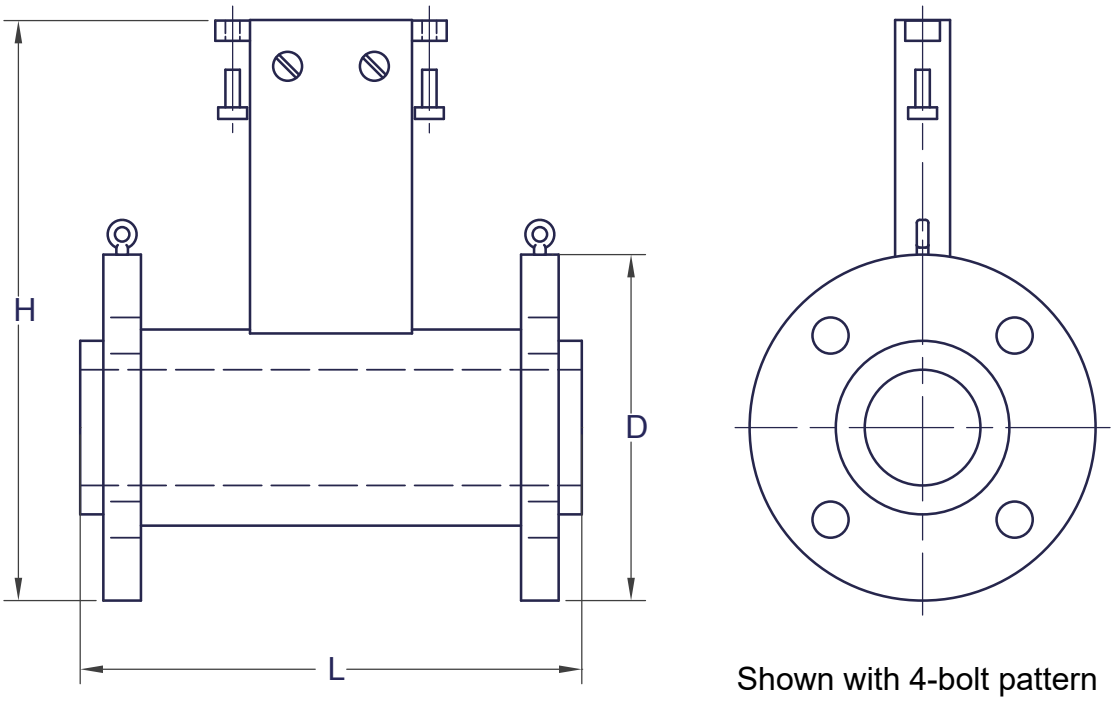
F-3200 transmitters and sensor bodies are two parts of one uniquely calibrated system and must be installed together. Mixing components from other systems will result in significant calibration errors.

3.2.1 Standard Transmitter Dimensions



3.2.2 Sensor Dimensions & Weights

ANSI Class 150 Flanged Sensor Overall Dimension



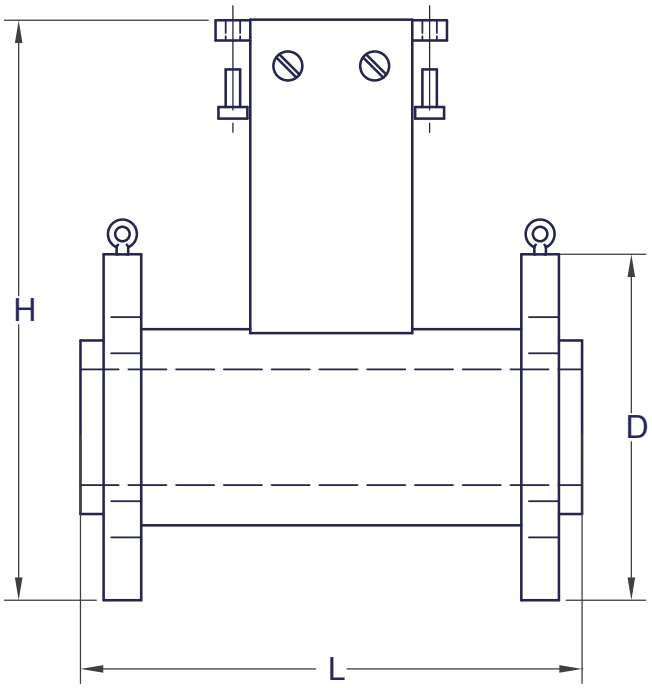
Shown with 4-bolt pattern

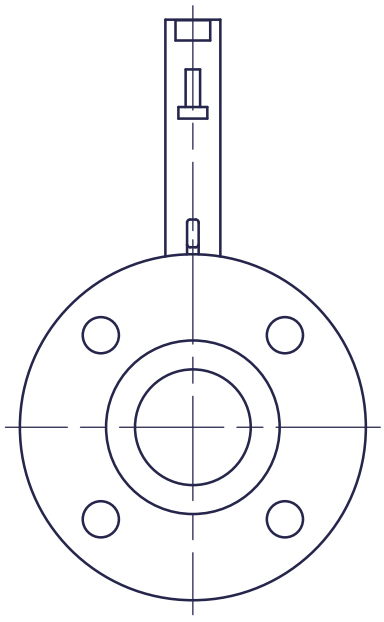
	Sensor Size											
Nominal Diameter	1”	1.25”	1.5”	2”	2.5”	3”	4”	5”	6”	8”	10”	12”
Length (L above)	7.87	7.87	7.87	7.87	7.87	7.87	9.84	9.84	11.81	13.78	17.72	19.68
Height (H above)	7.13	7.55	8.15	8.74	9.64	10.20	11.34	12.40	13.43	15.79	18.15	20.75
Flange Dia (D above)	4.24	4.64	5.00	5.98	7.00	7.52	9.02	10.00	10.98	13.50	15.98	19.02
Weight in lbs	6.60	6.60	7.70	13.20	17.60	24.20	35.20	39.60	57.20	88	132	220

	Sensor Size										
Nominal Diameter	14”	16”	18”	20”	24”	26”	30”	34”	36”	42”	48”
Length (L above)	21.65	23.62	23.62	23.62	23.62	25.59	29.53	33.46	35.43	41.33	47.24
Height (H above)	22.91	25.16	27.08	29.57	34.09	36.26	40.63	45.24	47.48	53.34	60.23
Flange Dia (D above)	20.98	23.50	25.00	27.52	32.01	34.25	38.74	43.74	45.98	53.00	59.49
Weight in lbs	275	396	484	550	650	726	990	1276	1320	2112	2500

Sensor Dimensions & Weights

ANSI Class 300 Flanged Sensor Overall Dimension



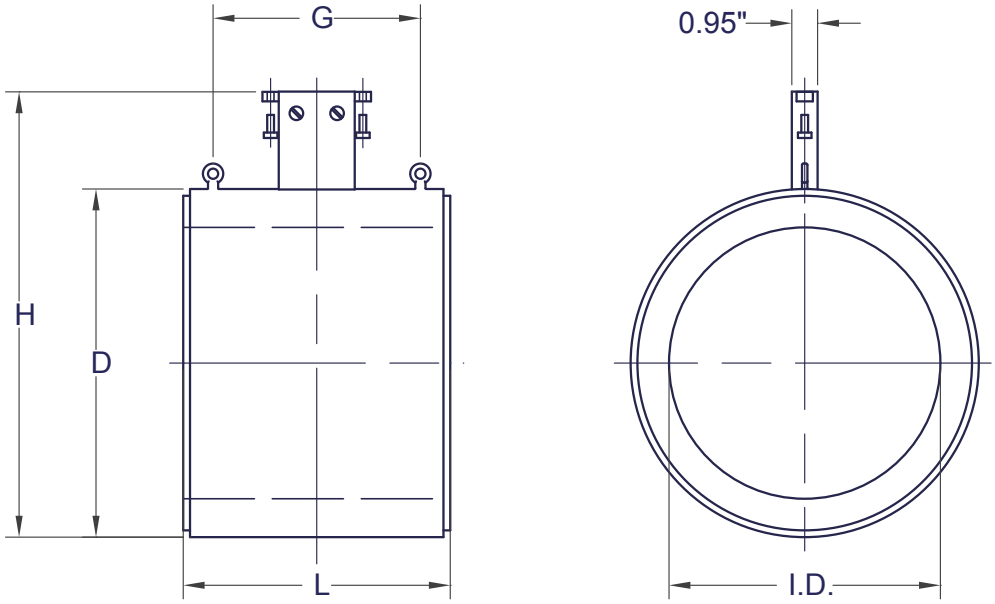


Shown with 4-bolt pattern

	Sensor Size											
Nominal Diameter	1”	1.25”	1.5”	2”	2.5”	3”	4”	5”	6”	8”	10”	12”
Length (L above)	7.87	7.87	7.87	7.87	7.87	7.87	9.84	9.84	11.81	13.78	17.72	19.68
Height (H above)	7.48	7.83	8.70	8.98	9.88	10.55	11.81	12.91	14.17	16.54	18.90	21.50
Flange Dia (D above)	4.88	5.24	6.14	6.50	7.52	8.27	10.00	10.98	12.52	15.00	17.52	20.51
Weight in lbs	11.00	11.00	15.40	19.80	24.20	28.60	44.00	52.80	66	154	220	286

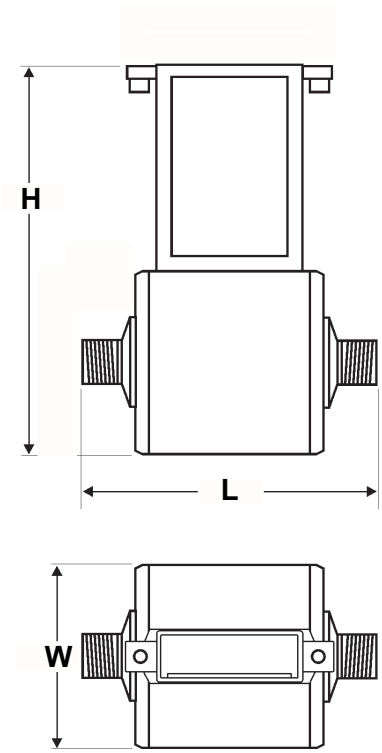
	Sensor Size								
Nominal Diameter	14”	16”	18”	20”	24”	26”	30”	34”	36”
Length (L above)	21.65	23.62	23.62	23.62	23.62	25.59	29.53	33.46	35.43
Height (H above)	23.90	26.14	28.58	30.31	36.06	39.45	44.13	48.43	50.87
Flange Dia (D above)	22.99	25.51	27.99	30.51	35.98	38.27	42.99	47.52	50.00
Weight in lbs	396	528	805	970	1489	1712	Inquire	Inquire	Inquire

Wafer Style Sensor Overall Dimensions



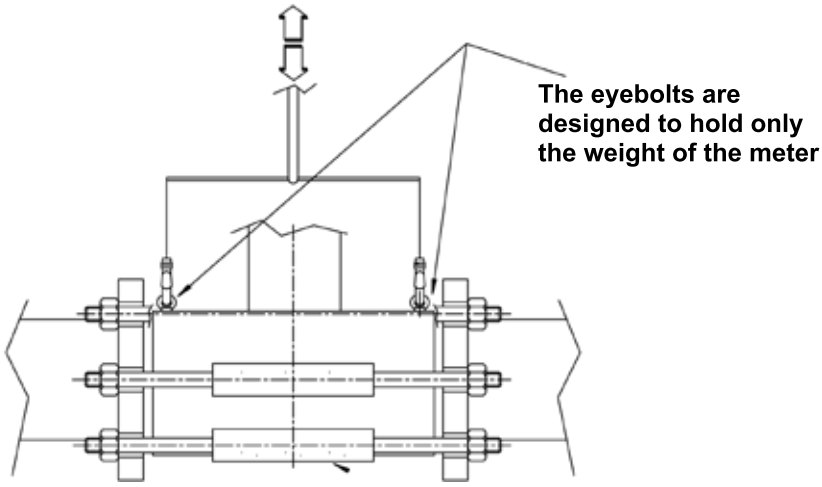
	Sensor Size													
Nominal Diameter	1”	1.25”	1.5”	2”	2.5”	3”	4”	5”	6”	8”	10”	12”	14”	16”
L	3.94	3.94	3.94	3.94	5.90	5.90	5.90	7.09	7.09	7.87	9.84	11.81	13.78	15.75
H	5.79	6.02	6.34	6.97	7.83	8.23	9.25	10.35	11.46	14.25	16.42	18.39	20.75	22.80
D	2.20	2.44	2.76	3.39	4.25	4.65	5.67	6.77	7.87	10.67	12.83	14.80	17.17	19.21
G	-	-	-	-	-	-	-	-	-	5.67	7.64	9.60	11.57	13.54
Net Weight in lbs	2.6	3.5	4.0	4.4	7.9	8.4	11	17.2	18	40	53	59	70	86

Threaded Version



	Polypropylene	Stainless Steele
Weight	4.85 lbs	4.85 lbs
L	5.5”	4.72”
H	7.4”	6.69”
W	3.8”	3.07”

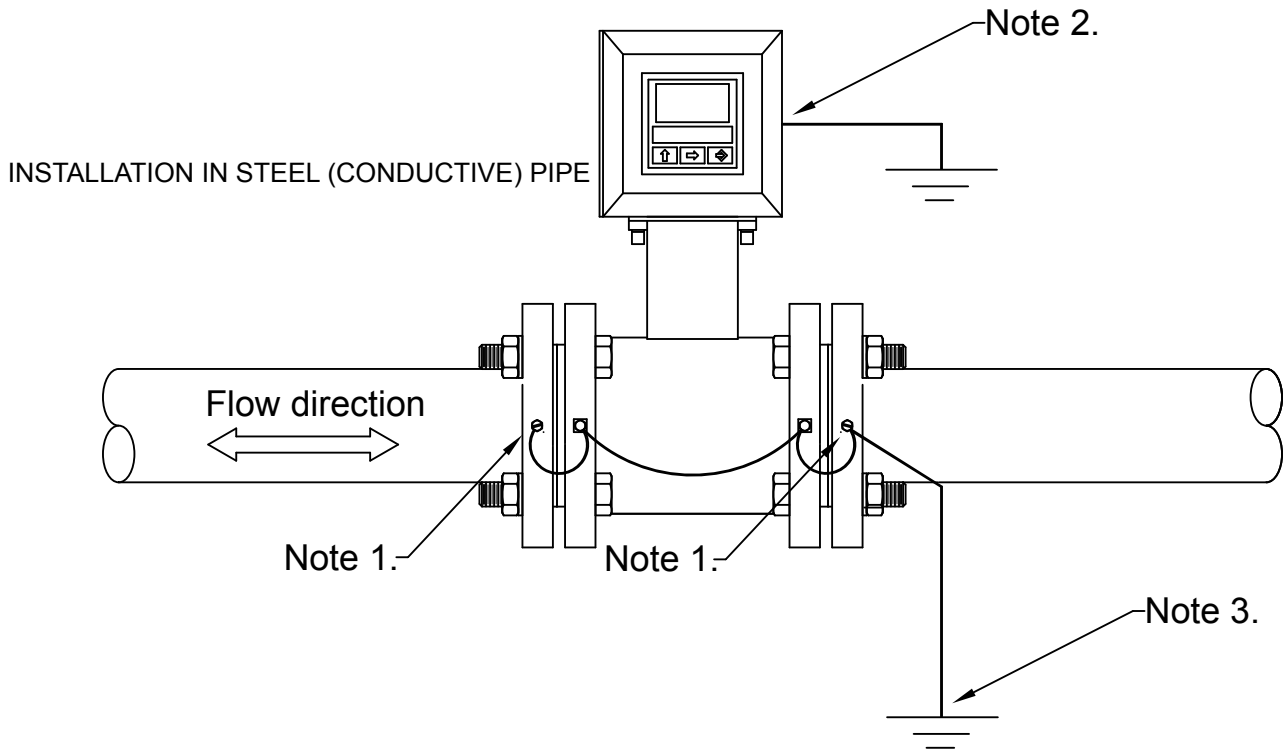
Recommended method for lifting all sensors with eyebolts



WARNING

Eyebolts are provided to assist in the safe installation of meters with a nominal diameter greater than 6 inches. The eyebolts are only designed to hold the weight of the meter. Do not attempt to place an additional load on the eyebolts during installation.

3.2.3 Installation Drawings for Conductive Pipe



Note 1. Using a #21 (0.159") drill bit, drill a ½" deep hole in edge of each mating flange. Tap each hole using a 10-32 tap. Secure the ring connectors (provided) and grounding wires to the flange using the green grounding screws (provided).

(Alternate method: Weld 10-32 studs (not provided) to the flange faces and attach ring connectors with 10-32 nuts (not provided).

Note 2. Provide a ground connection at the input power terminals inside the transmitter enclosure.

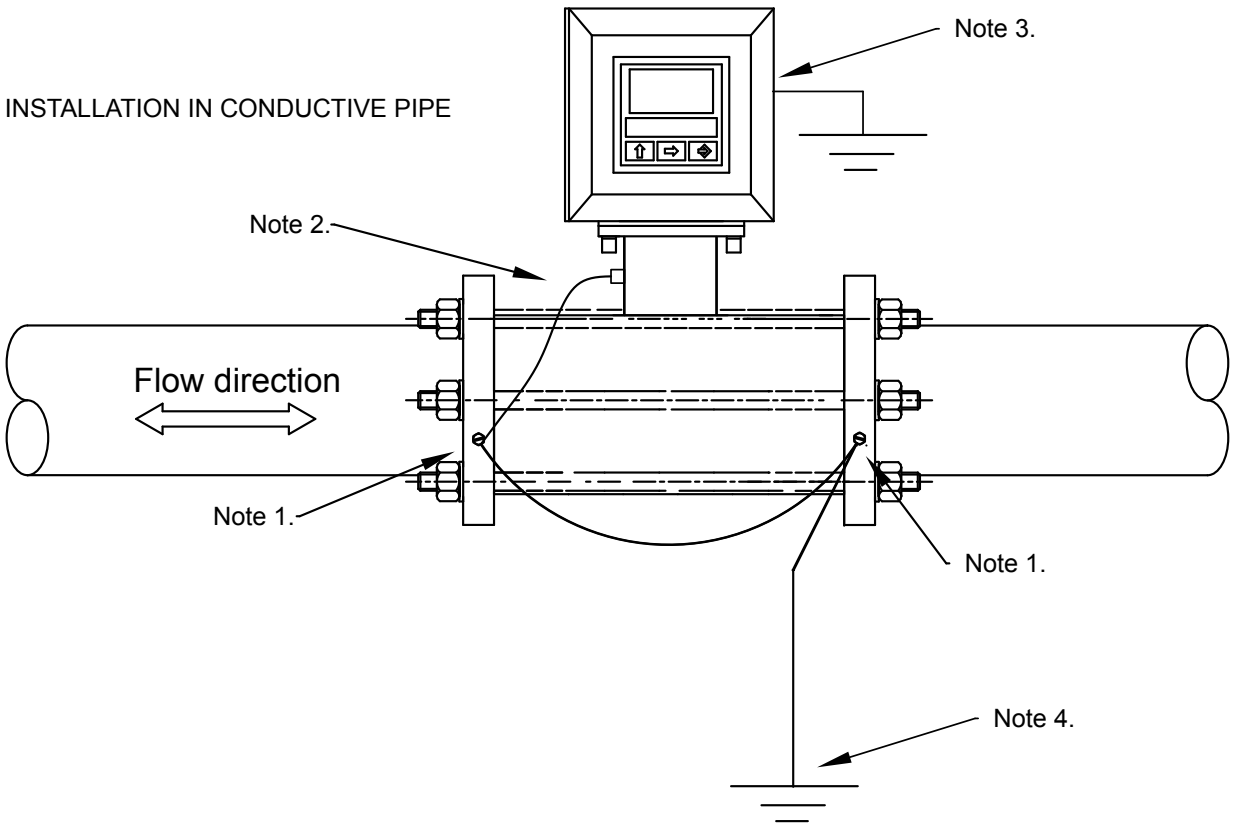
Note 3. Provide a quality earth ground connection to the meter.

From best to worst, grounding options include:

1. Earth grounding rod driven into the soil.
2. Earth wire connected directly to the building electrical service panel.
3. Earth wire connection inside an electrical outlet near the meter.

CAUTION

The earth connections must be made as shown. Failure to do so will result in erratic operation of the meter.



Note 1. Using a #21 (0.159") drill bit, drill a ½" deep hole in edge of each mating flange. Tap each hole using a 10-32 tap. Secure the ring connectors (provided) and grounding wires to the flange using the green grounding screws (provided).

(Alternate method: Weld 10-32 studs (not provided) to the flange faces and attach ring connectors with 10-32 nuts (not provided).

Note 2. For meters provided with a grounding electrode connect grounding wire to terminal on the meter neck as shown.

Note 3. Provide a ground connection at the input power terminals inside the transmitter enclosure.

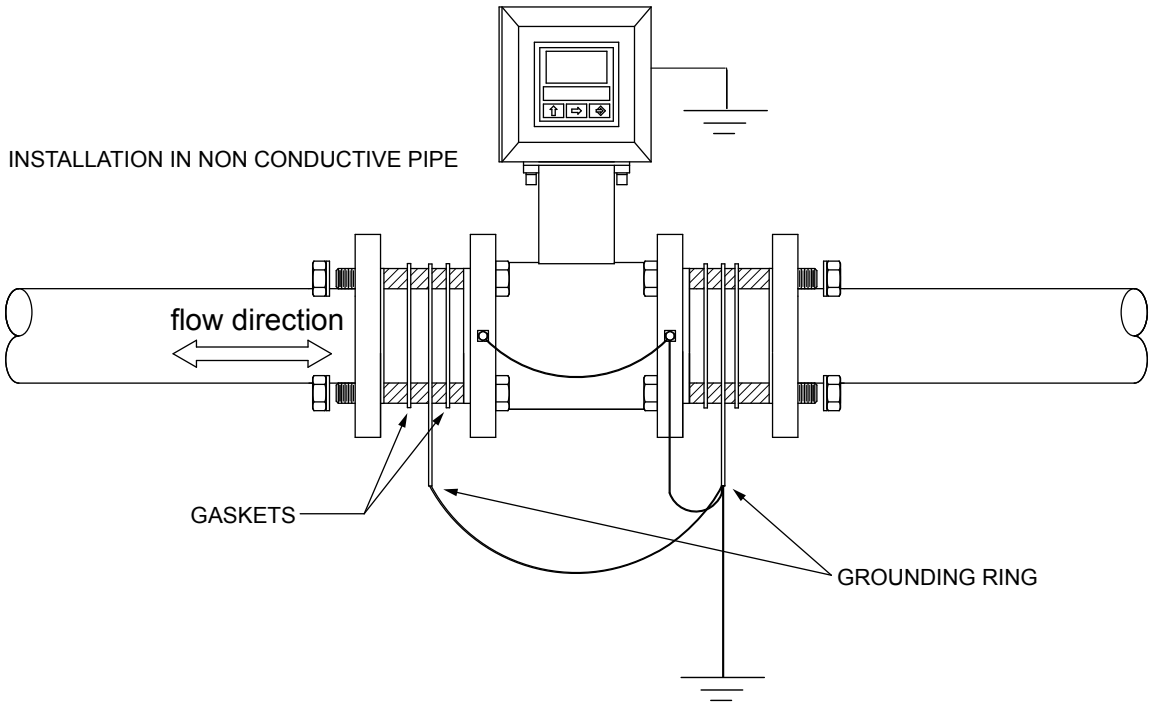
Note 4. From best to worst, grounding options include:

1. Earth grounding rod driven into the soil.
2. Earth wire connected directly to the building electrical service panel.
3. Earth wire connection inside an electrical outlet near the meter.

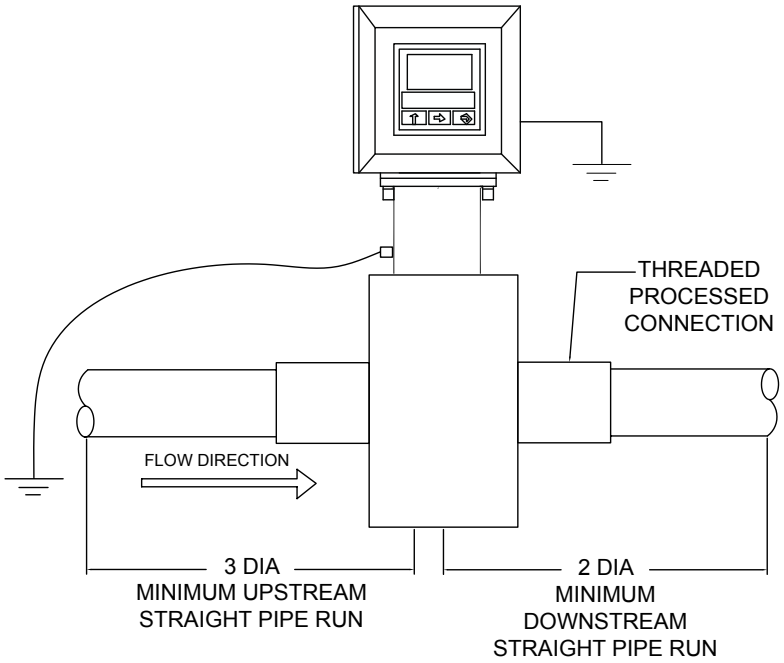
CAUTION

The earth connections must be made as shown. Failure to do so will result in erratic operation of the meter.

3.2.4 Installation Drawing for Non-Conductive Pipe



3.2.5 Installation Drawing for Threaded Connections



CAUTION

The earth connections must be made as shown. Failure to do so will result in erratic operation of the meter.

3.2.6 Installation Instructions

WARNING

Installation of this product should only be attempted by qualified trades persons and must comply with all local, state and federal building codes.

1. Thoroughly clean all flange surfaces removing all traces of any old gasket material or any adhesive residue.

2. Inspect all flange surfaces for warping, pitting or other surface imperfections that may prevent a good seal.

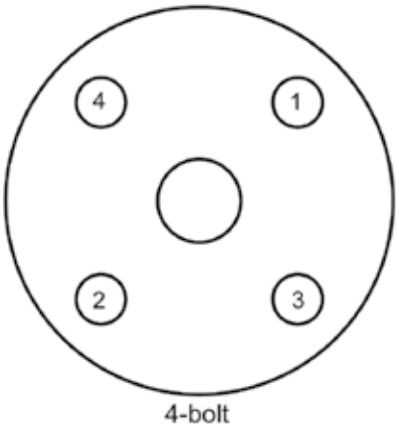
3. Use new bolts, nuts and hardened washers. ONICON recommends the use of B7 nuts, bolts and washers. Prior to installation, lubricate the bolt threads, nuts, washer faces and the underside of the bolt head with lubricant (Fel Pro C5A or equivalent). This lubricant is necessary to ensure uniform stress distribution on the sealing surface. Use care not to get any lubricant on the liner or gasket material.

4. Center the new gasket on the liner surface. Do not allow the gasket to protrude into the flow stream.

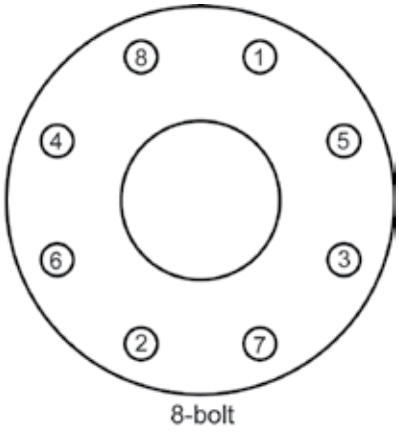
5. Use the torque specifications shown below to determine the recommended final bolt torque requirements.

6. Using a torque wrench, tighten the bolts in at least three stages (30%, 60% & 100%) using a repeating pattern sequence shown in the diagrams below.

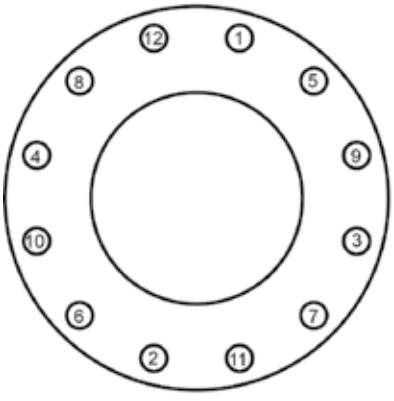
ANSI Class 150 Flange Bolt Tightening Sequence



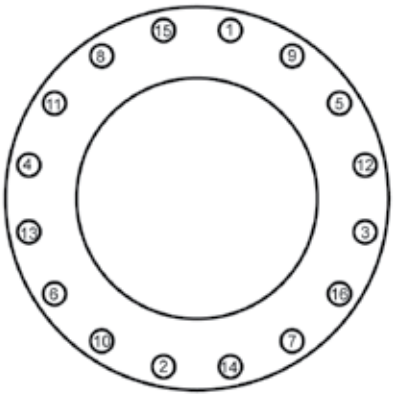
4-bolt



8-bolt

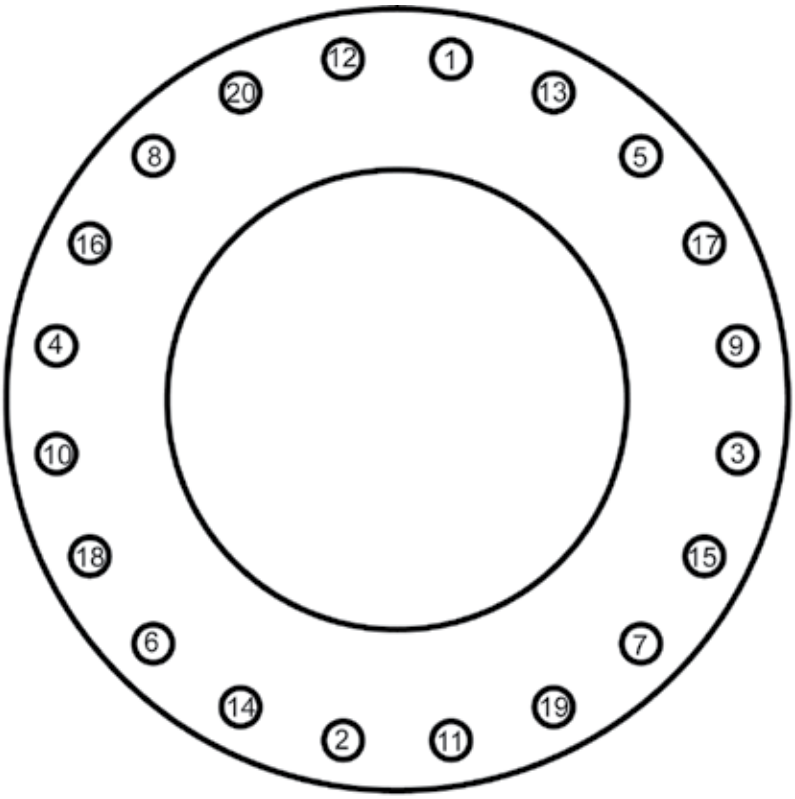


12-bolt

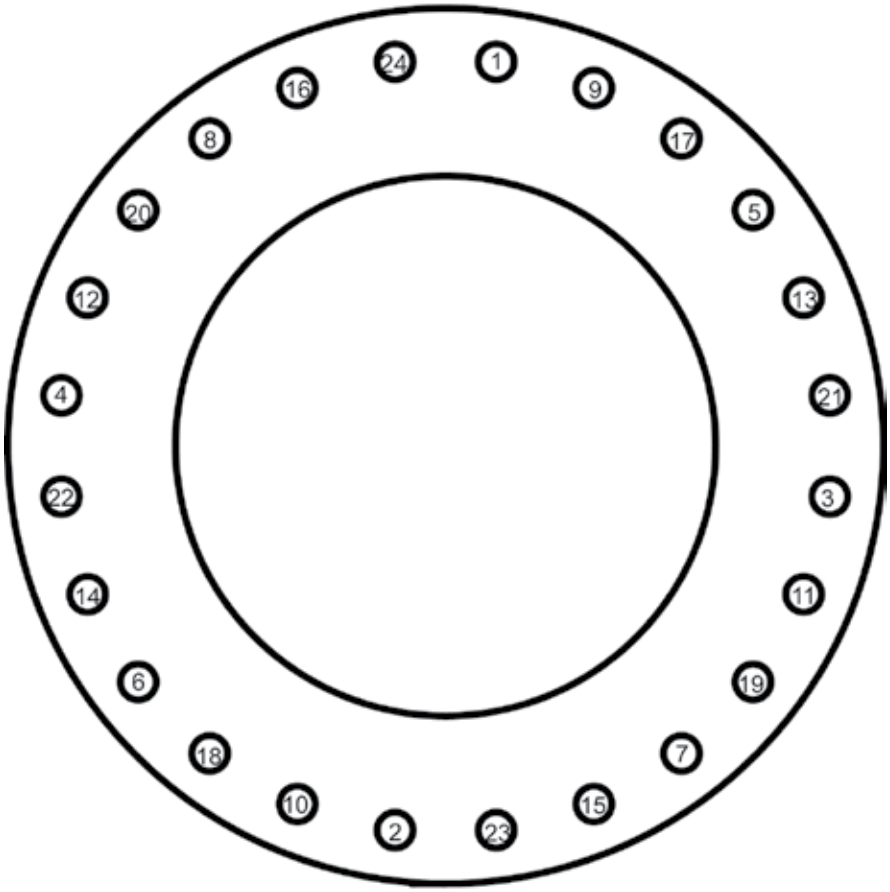


16-bolt

ANSI Class 150 Flange Bolt Tightening Sequence



20-bolt



24-bolt

3.2.7 Torque Specifications

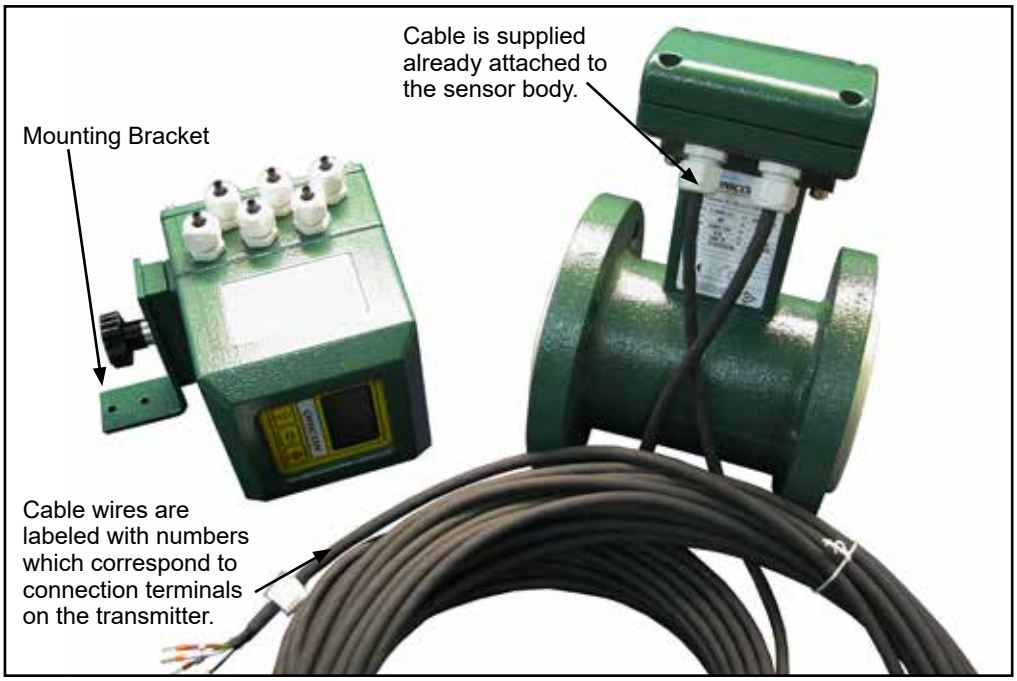
Tighten uniformly in a diagonal sequence as per the table below. Contact ONICON for torque specifications for meters with a nominal diameter larger than 40 inches.

Maximum Flange Bolt Torque Specifications in lb-ft (N-m)										
Nom. Dia. (DN)	Class 150			Class 300		PN16			PN25	
	Polypro	Ebonite	PTFE	Ebonite	PTFE	Polypro	Ebonite	PTFE	Ebonite	PTFE
1” (25)	14		15		24	14 (19)		18 (25)		18 (25)
1¼” (32)	21		19		30	21 (28)		32 (43)		32 (43)
1½” (40)	27		24		46	27 (36)		39 (53)		39 (53)
2” (50)	38		44		26	38 (52)		50 (68)		50 (68)
2½” (65)	55		58		39	55 (75)		66 (90)		33 (45)
3” (80)	30		66		50	30 (41)		39 (53)		39 (53)
4” (100)	41		52		69	41 (56)		44 (59)		61 (83)
5” (125)	52		69		96	52 (71)		57 (77)		83 (112)
6” (150)	78		78		83	78 (106)		80 (108)		100 (135)
8” (200)		319	109	383	131		212 (288)	73 (99)	288 (391)	99 (134)
10” (250)		336	115	398	136		301 (408)	103 (140)	439 (595)	150 (204)
12” (300)		504	173	592	203		376 (510)	129 (175)	434 (588)	148 (201)
14” (350)		698	240	684	235		441 (598)	151 (205)	697 (945)	239 (324)
16” (400)		672	230	884	303		606 (821)	208 (282)	917 (1243)	314 (426)
18” (450)		683	248	856	294		724 (981)	207 (281)		
20” (500)		682	234	1000	343		821 (1113)	282 (382)		
24” (600)		996	342	1665	571		1223 (1658)	419 (568)		
30” (750)		970	333	2377	815					
36” (900)		1330	456	3028	1038		1117 (1515)	383 (519)		
40” (1000)		1583	543	3439	1179		1553 (2105)	532 (721)		

Maximum Flange Bolt Torque Specifications in lb-ft					
Nom. Dia. (DN)	PN10		PN40		PN64
	Ebonite	PTFE	Ebonite	PTFE	Ebonite
1” (25)				18 (25)	29 (39)
1¼” (32)				32 (43)	39 (53)
1½” (40)				39 (53)	53 (72)
2” (50)				50 (68)	60 (81)
2½” (65)				33 (45)	43 (58)
3” (80)				39 (53)	46 (62)
4” (100)				61 (83)	64 (87)
5” (125)				83 (112)	109 (148)
6” (150)				100 (135)	160 (217)
8” (200)	319 (432)	109 (148)	384 (391)	131 (178)	
10” (250)	265 (359)	91 (123)	575 (595)	197 (267)	
12” (300)	306 (415)	105 (142)	599 (588)	205 (278)	
14” (350)	370 (502)	127 (172)	908 (945)	311 (422)	
16” (400)	466 (632)	160 (217)	1331 (1243)	457 (619)	
18” (450)	416 (564)	143 (194)			
20” (500)	481 (652)	165 (224)			
24” (600)	695 (942)	238 (323)			
30” (750)					
36” (900)	968 (1312)	332 (450)			
40” (1000)	1253 (1699)	429 (582)			

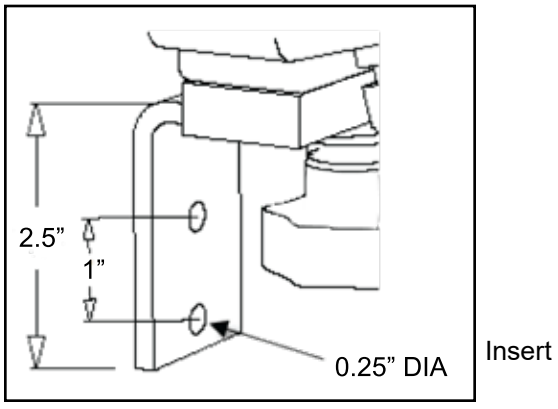
3.2.8 Remote Mount Transmitter

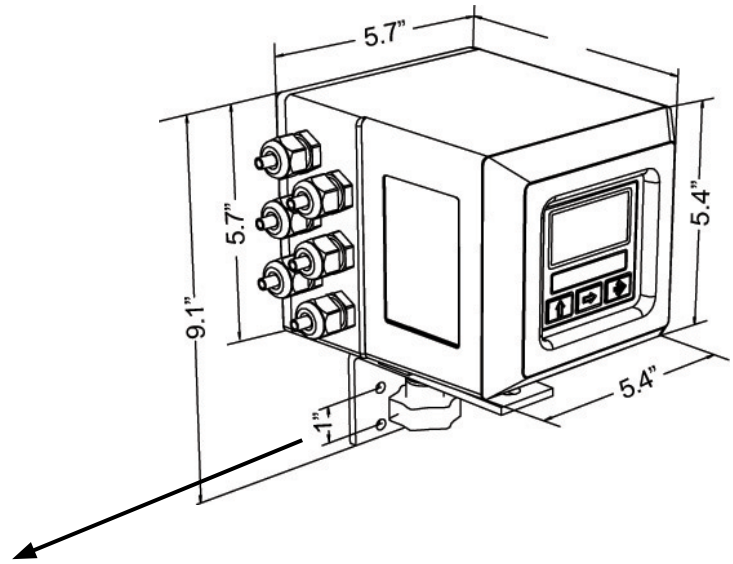
Remote mount transmitters are provided with a single “L” bracket with 2 - ¼” mounting holes. The bracket is secured to the transmitter by means of a large bolt with a knurled knob for a head. To mount the bracket, first separate it from the transmitter housing and attach it to the wall or other vertical surface. Cable from the sensor body is attached to the transmitter using the center strain relief.



CAUTION

DO NOT drill holes in the main unit. Use only the openings that are provided. DO NOT cut the remote cable. Coil excess cable at one end.





3.3 ELECTRICAL INSTALLATION

3.3.1 Input Power Requirements

F-3000 Electromagnetic Flow Meters equipped with advanced transmitters are available with two different options for input power. This is not a user selectable function and must be configured at the factory.

Special care is required to ensure that the F-3200 is properly connected to earth through an earth wire. This connection is required to prevent random electrical noise from interfering with the operation of the meter. (See section 3.3.3 for details.)

* Low Voltage: 18 – 45 VDC, 18 – 45 VAC 45/66 Hz, 300 mA maximum
* High Voltage (Mains): 100 – 240 VAC 45/66 Hz, 35 mA maximum

IMPORTANT NOTE

This option is not field selectable. Contact the factory if you need to change the input voltage rating.

CAUTION/WARNING

This product must be connected to earth ground for proper operation. Failure to do so will result in erratic operation and an increased risk of injury.

WARNING

All mains voltage connections must be made through pre-drilled conduit/strain relief opening located at the bottom of the enclosure. Failure to do so will result in an increased risk of injury.

3.3.2 Analog and Pulse Output Signals

The primary output signals from ONICON F-3200 series electromagnetic flow meters include a single analog output for flow rate and two programmable pulse outputs for use as frequency, scaled pulse, alarm and flow direction signals. The three outputs have 500 VDC of electrical isolation between the flow sensing circuitry, the microprocessor circuitry, and the pulse and analog output circuitry. In addition, the output circuits operate from dedicated power supply circuitry that is isolated from all other internal power sources and from earth.

Redundant Output Option

The redundant output option for the F-3200 series electromagnetic flow meter provides complete signal redundancy for the three primary output signals from the meter. It provides an additional 4-20 mA output and two additional programmable pulse outputs and is designed with the same 500 VDC electrical isolation as the primary outputs. The redundant output transmitter is controlled directly from the microprocessor and is completely independent of the primary output circuitry.

3.3.3 Power and Output Signal Wiring Instructions

Factory Default Output Configurations

ONICON pre-programs the analog and pulse outputs based on application specific data provided at the time the meter is ordered. The tables on the next page show how the pulse outputs are configured based on whether the application has bidirectional flow and if the meter will be connected to an ONICON peripheral device such as an ONICON BTU meter or display module.

In all applications the analog 4-20 mA output is available at:
Analog Output #1: terminals 9 (+) and 10 (-).
Analog Output #2: terminals 28 (+) and 20(-) - Optional output available only if the meter was ordered with the redundant output option.

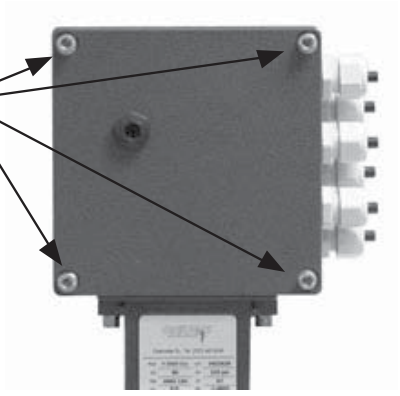
Application	Pulse Output #1 Terminals: 16 (+) & 17 (-)	Pulse Output #2 Terminals: 18 (+) & 19 (-)
Standard	Frequency	Scaled Pulse
Bidirectional	*Scaled Output	Flow Direction

* This output will be configured for frequency if the flow meter is provided with a peripheral device.

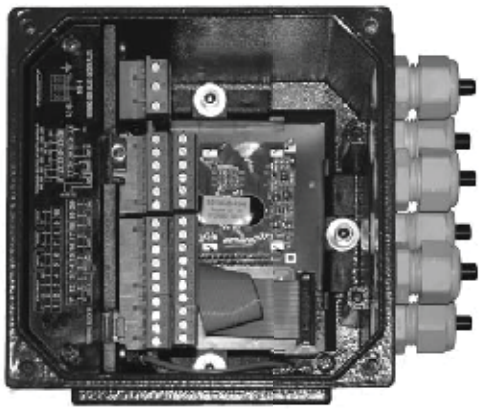
Optional Auxiliary Pulse Outputs		
Application	**Pulse Output #3, Terminals: 22 (+) & 21(-)**	**Pulse Output #4, Terminals: 30(+) & 29(-)**
Standard	Flow Direction	OFF
Bidirectional	Flow Direction	OFF

* This output will be configured for frequency if the flow meter is provided with a peripheral device.

Step 1: Remove the 4 Allen screws using a 5mm Allen wrench.



Step 2: Remove the cover exposing the connection terminals.



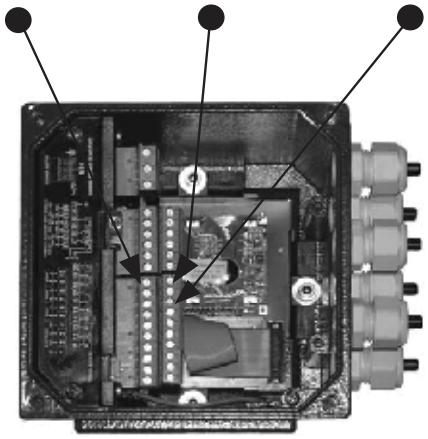
CAUTION

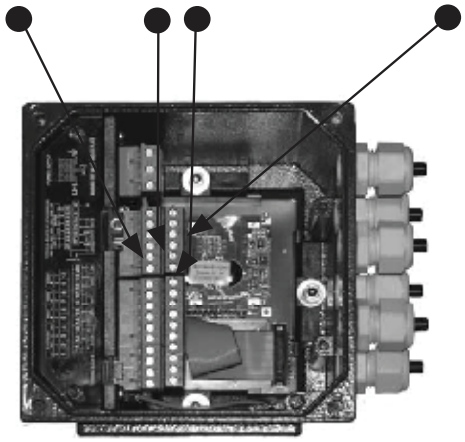
The transmitter earth connection at the input voltage terminals and the sensor body earth terminals must both be connected to earth to ensure proper operation.

Step 3: Make SIGNAL connections as shown
Pull straight out on connectors to remove them.

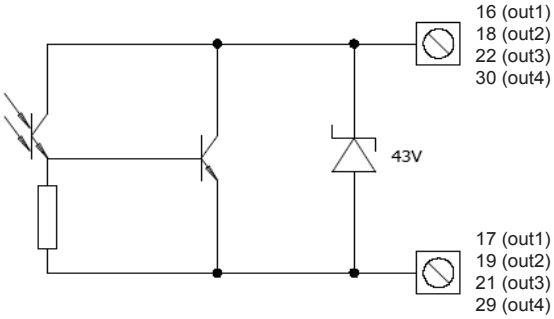
SIGNAL CONNECTIONS		
4-20 mA Output 1 Pin 9 - Pos (+) Pin 10 - Neg (-)	Pulse Out 2 Pin 18 - Pos (+) Pin 19 - Neg (-)	Pulse Out 1 Pin 16 - Pos (+) Pin 17 - Neg (-)

AUX SIGNAL CONNECTIONS		
Pulse Out 3 Pin 22 - Pos (+) Pin 21 - Neg (-)	4 - 20 mA Output 2 Pin 28 - Pos (+) Pin 20 - Neg (-)	Pulse Out 4 Pin 30 - Pos (+) Pin 29 - Neg (-)



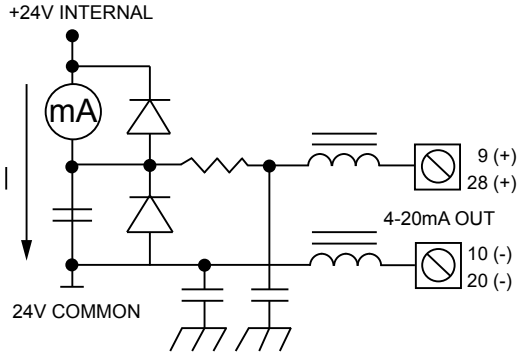


Pulse Output 1 / 2 / 3 / 4

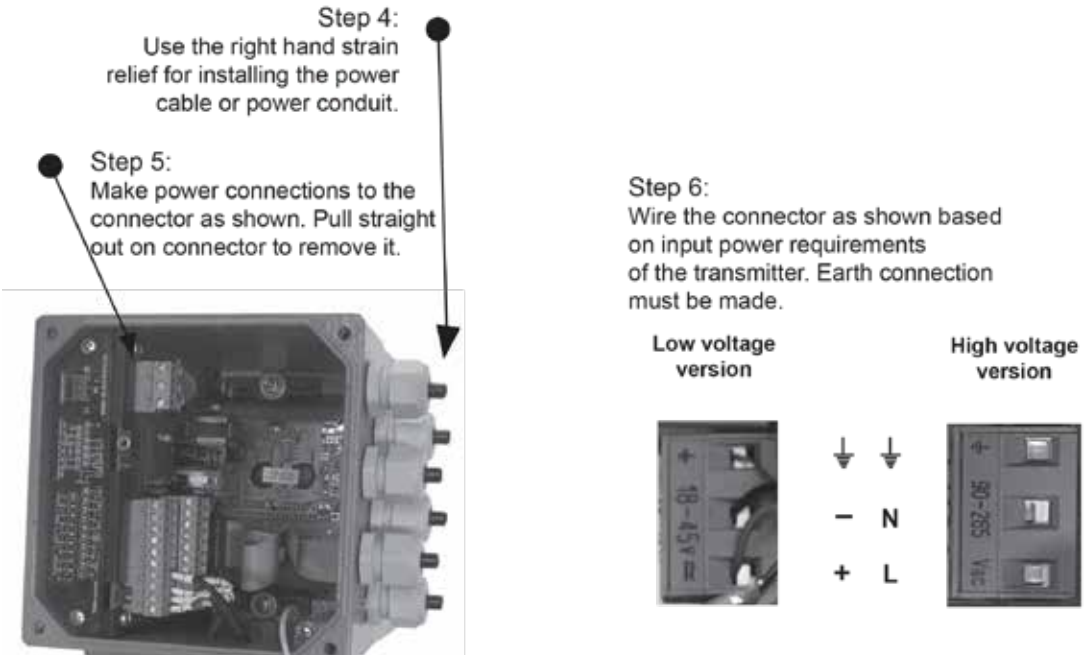


Opto-coupled open collector pulse outputs
Maximum voltage: 40VDC
Maximum current: 100mA
Maximum saturation voltage
collector/emitter @ 100mA: 3 VDC
Maximum Frequency: 1,250 Hz

4-20 mA OUTPUT



- Opto-coupled output
- Maximum load: 1000Ω
- Internally Powered Loop
- Maximum voltage without load: 27V
- Refresh frequency is the same of the sample frequency of the connected sensor body
- Protected against persistent over voltages to maximum 30V



3.3.4 Earth Connection

F-3100 Electromagnetic Flow Meters are designed to detect microvolt signal levels at the electrodes located in the flow meter body. These signals are generated as conductive fluids flow through the magnetic field generated by the meter. If enough random electrical noise is present at the electrodes, it can interfere with the flow measurement. Care must be taken during installation to minimize the effects of electrical noise on the flow meter.

The most effective way to minimize the effects of electrical noise is to make sure that the pipe, fluid, flow meter body and flow meter transmitter are all connected to the same earth ground. This accomplishes two important goals. First, it ensures that the pipe, fluid, flow meter body and electronics are all at the same electrical potential, and second, it ensures that this electrical potential is the same as earth ground.

In order to be certain that the meter is properly connected to earth, the flow meter body earth connections (at the flanges or on the neck of wafer meters) and the transmitter earth connection should be run directly to a known earth connection. The length of this earth cable should be as short as practically possible, preferably ≤25 feet in length. The table below lists earth connections from best to worst.

IMPORTANT NOTE

Non-metallic pipes are more susceptible to electrical noise. Grounding rings installed upstream and downstream of the flow meter body to reduce the electrical noise present in the pipe may be required for proper operation.

CAUTION

Do not use bolts that hold pressure to make earth connections. Using flange bolts may result in poor electrical connections due to the presence of paint and/or lubricants. Use the dedicated flange earth connections or the dedicated earth connection on the neck of wafer style meters.

Earth Connections (stranded wire 14 - 18 AWG)	
Best	Earth grounding rod driven into the ground.
	Earth wire connected directly to the building electrical service panel.
Worst	Earth wire connection inside an electrical outlet near the meter.

3.3.5 Remote Mount Cable Wiring Instructions

CAUTION

Do not cut the remote mount cable. The wires are not color coded.

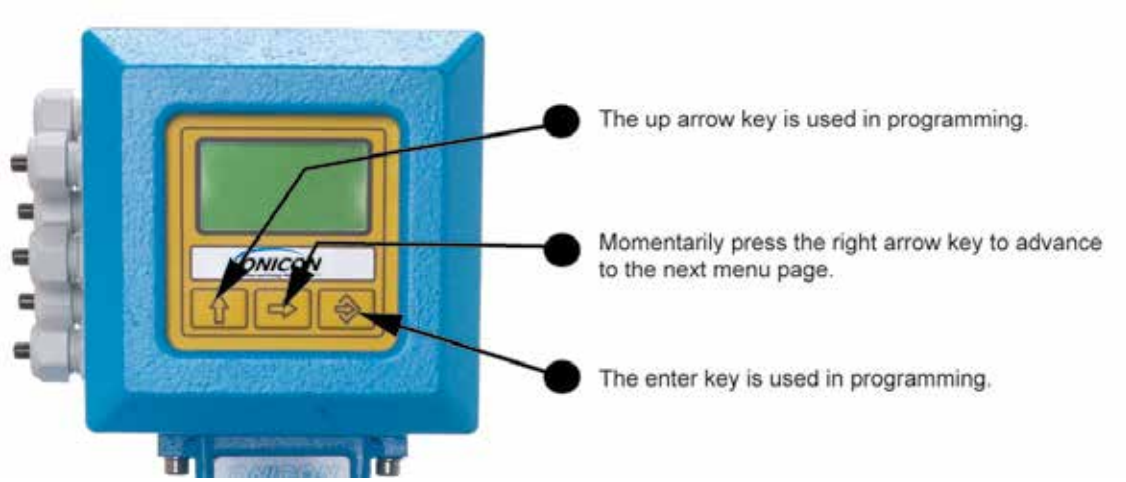
Install remote cables through the two strain reliefs as shown.

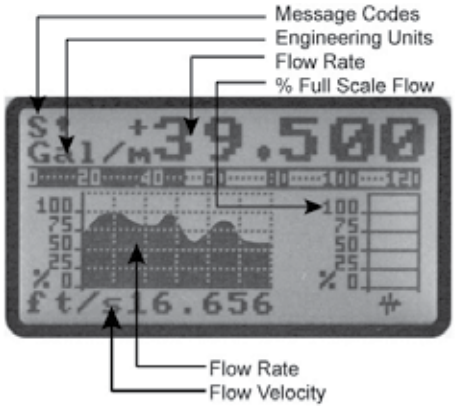
Connect the coil and electrode wires to the appropriate terminals according to the numbered tags on each wire.

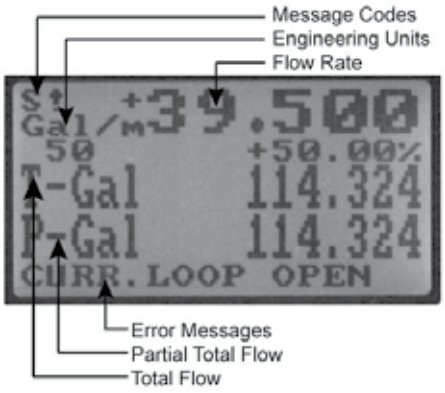
SECTION 4.0: METER START UP & COMMISSIONING

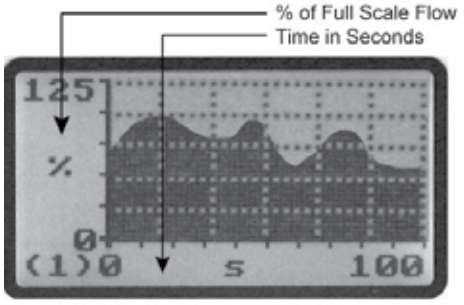
4.1 DISPLAY AND USER INTERFACE

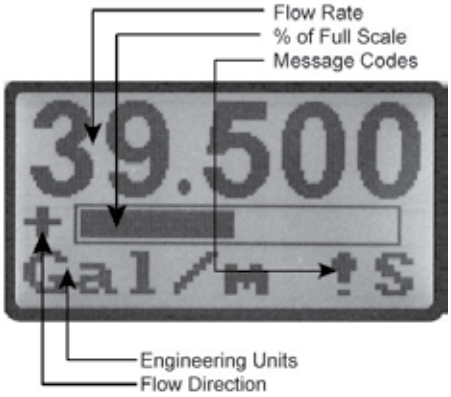
The F-3200 advanced transmitter is equipped with a backlit graphic LCD capable of displaying alphanumeric and graphical data. It is also capable of displaying alarm and error messages. Three push button keys located on the membrane panel immediately below the display are used to view the displayed data and access program functions.











4.2 HELPFUL HINTS FOR START-UP AND COMMISSIONING

A step-by-step procedure and companion worksheet are located on the next two pages. Please read all installation instructions and these helpful hints carefully before proceeding with installation, start-up and commissioning.

1. ONICON flow meters are individually calibrated for a particular application. Be sure to verify the pipe size and location.
2. The electronic sensing system will not work in air. The pipe must be full for proper operation.
3. When measuring analog output signals, remember that currents (mA) must be measured in series, while voltages are measured in parallel. If the 4-20 mA signal is already connected to a control system, you must break the connection and measure the signal in series.
4. When measuring frequency outputs in hertz, take your multimeter out of "auto range mode" and manually set range for a voltage level above 15 VDC. This will prevent false readings when signal is not present.
5. Never connect power to analog or frequency output signal wires. ONICON F-3200 Flow Meters are not "loop powered" devices.

4.3 START-UP AND COMMISSIONING

Please read the entire procedure carefully before proceeding. Wiring instructions are located on pages 21 - 24 of this manual. A worksheet for checking off the following steps and recording measured values is located on the next page.

1.	Confirm flow meter location and adequate straight pipe run to achieve desired results.	Is the meter located in the correct location as required by the plans? Compare actual straight pipe upstream and downstream of the meter location to recommended distances identified in this manual.
2.	Confirm control system programming.	Confirm that the control system input point is properly configured for the analog range (or scale factor) identified on the calibration certificate.
3.	Confirm connection to correct ONICON display or Btu meter (if ordered).	Confirm that the flow meter serial number matches the ONICON display or Btu meter serial number (when ordered together).
4.	Verify wiring before connecting power.	Prior to connecting the power, verify that the wiring is correct as shown in this manual and/or the additional wiring diagram provided with ONICON display or Btu meter. If in doubt, call factory for assistance before proceeding further.
5.	Verify that the input voltage available to power the meter is appropriate for the meter version. (Check label inside transmitter enclosure LV=Low voltage, HV=High voltage.	Low voltage: 18 - 63 VDC or 15 - 45 VAC 45/66 Hz, 300 mA maximum High voltage: 90 - 265 VAC 45/66 Hz, 35 mA maximum
6.	Connect power.	Wait approximately 45 seconds after power-on before proceeding further.

The following steps require flow in the pipe. Flow signal readings should be taken while holding the flow rate constant if possible. Otherwise, take the various output readings as quickly as possible.

7.	Measure and record analog or binary outputs. Current Output: Scaled Output:	Refer to flow meter wiring diagram for the various outputs available, based on your particular flow meter model. Use the following formulas to calculate flow rate from measured analog signals: GPM = $\frac{\text{(measured current in mA - 4)}}{16}$ X Full Scale Analog Flow Rate Each contact closure = unit volume identified as "Scale Factor" (measure and record time interval between contact closures)
8.	Compare various output signals to each other and to the flow rate displayed and to the control system.	Compare the flow rates calculated in STEP 7 to the flow rate indicated by the display and the control system. Refer to troubleshooting guide when readings are inconsistent.

4.4 START-UP AND COMMISSIONING WORKSHEET

Please read all installation instructions carefully prior to proceeding with these steps. Use the following worksheet for checking off the commissioning steps and recording measured values.

STEP	TEST/MEASUREMENT	S/N: _____	S/N: _____	S/N: _____	S/N: _____
1.	Meter location:				
2.	Control system programming:				
3.	Match display or Btu meter serial # (S/N) if ordered:				
4.	Signal connections verified:				
5.	Supply voltage verified:				
6.	Connect power:				

The following steps require flow in the pipe. Flow signal readings should be taken while holding the flow rate constant if possible, otherwise, take the various output readings as quickly as possible.

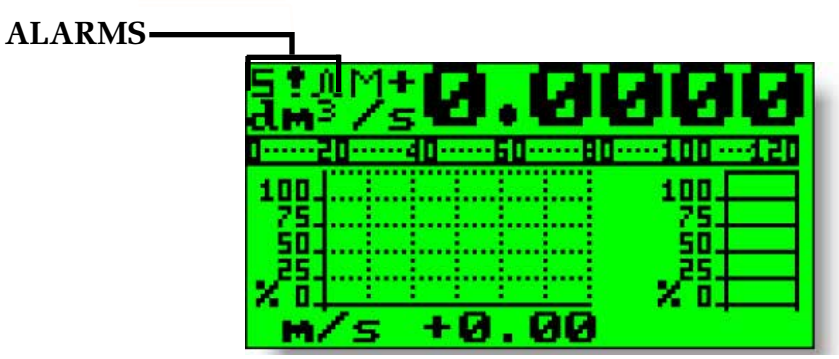
10.	Analog or binary outputs 4-20 mA signal:	_____ mA	_____ mA	_____ mA	_____ mA
	scaled output interval	_____	_____	_____	_____
	Calculated flow rate:	_____ GPM	_____ GPM	_____ GPM	_____ GPM
11	Flow rates displayed by: meter display:	_____ GPM	_____ GPM	_____ GPM	_____ GPM
	control system:	_____ GPM	_____ GPM	_____ GPM	_____ GPM

4.5 TROUBLESHOOTING GUIDE

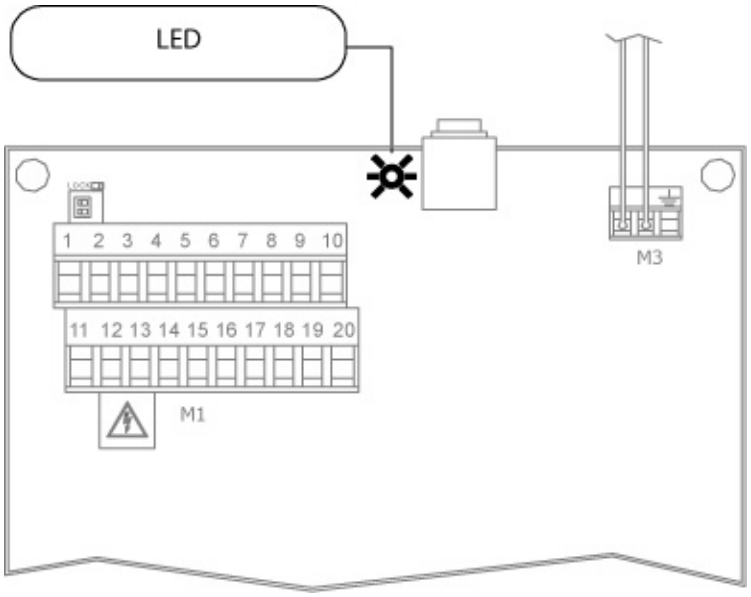
NOTE: Also refer to the START-UP AND COMMISSIONING GUIDE located on the proceeding pages.

REPORTED PROBLEM	POSSIBLE SOLUTIONS
No signal	• Verify correct wiring to control system (See wiring diagram.) • Check display for alarm messages. Verify that the pipe is full. • Verify that the sensor body and transmitter are both connected to earth ground.
Reading is too high or low	• Verify correct wiring to control system (see wiring diagram). • Confirm that the output signals are consistent (frequency vs. analog, etc). • Confirm that the control system is programmed for correct flow range or scale factor.
Analog signal seems high or low and does not correspond to frequency output	• Check for ground loop or offset voltage: • Verify that the sensor body and transmitter are both connected to earth ground. • Disconnect analog signal input from control system and measure analog outputs directly from the flow meter. • Re-connect signal input to control system and measure the analog signals again. • Any difference between these readings indicates a potential ground loop or offset voltage. • Please contact ONICON for further assistance.
Control system displays flow rate, but no flow rate is indicated on the local display module or Btu meter.	• Verify that all wires from the flow meter are connected to the display module or Btu meter. • The frequency output wire must be connected for any ONICON display or Btu meter.

4.6 ALARMS INTERPRETATION AND LED's



Alarm Indicators	
Symbol	Description
M	When activated, this symbol indicates flow in excess of the set point. Range: 0-125% of full scale
m	When activated, this symbol indicates flow below the set point. Range: 0-125% of full scale
!	• Open coil connection • Signal error • When activated, indicates empty pipe.
C	Calibration running
S	Transmitter in simulated output mode
Ω	Pulse output saturated (change pulse rate or duration)



Status LED
Continuously ON: Initialization of firmware
Flashing LED: (1 second rate): Normal operation
Flashing LED: (<1 second rate): Alarm condition

4.7 ALARM MESSAGES AND ACTION TO TAKE

The F-3200 advanced transmitter is equipped with a backlit graphic LCD capable of displaying alphanumeric and graphical data. It is also capable of displaying alarm and error messages. Three push button keys located on the membrane panel immediately below the display are used to view the displayed data and access program functions.

Alarm Messages & Action to Take		
Messages	Description	Action to Take
No Alarms	Meter functioning normally	None
Max Alarm	Threshold setting for maximum flow alarm. Set as a percentage of the full scale flow from 0-125%.	Check to see if the threshold is set high enough. Re-confirm the design maximum flow rate.
Min Alarm	Threshold setting for minimum flow alarm. Set as a percentage of the full scale flow from 0 – 125%	Check to see if the threshold is set correctly. Re-confirm the design minimum flow rate.
Flow Rate > FS	Flow rate exceeds the maximum full scale value.	Re-confirm the design maximum flow rate and the full scale flow rate setting.
Pulse / Freq > FS	Pulse rate or frequency output exceeds the maximum rate.	Re-confirm the design maximum flow rate and the full scale pulse rate of frequency setting.
Empty Pipe	The pipe is empty or the empty pipe detector needs calibration.	Calibrate the empty pipe detector.
Batch Alarm	Contact ONICON	Contact ONICON
Input Noisy	Excessive noise detected at the sensor electrodes or the remote cable has an open connection.	Re-check all earth ground connections and check for open signal cable connections.
Excitation Fail	The coils or the connecting cables are open.	Check all cable connections. Contact ONICON.
Curr. Loop Open	The 4- 20 mA output is not connected properly or there is a load resistance of greater than 1000 ohms.	Re-check wiring connections. Measure input resistance and confirm it is less than 1000 ohms.
P. Supply Fail	Power supply is different from that indicated on the label.	Verify that the correct voltages are supplied to the meter.

APPENDIX

A-1/A-3 FIELD REMOTE MOUNTING THE TRANSMITTER

Field Remote Mounting the Transmitter
Wiring Instructions

Section 1: Removing the Transmitter
Before attempting to remote mount the transmitter, disconnect power at the source.

Step 1
Remove rear cover.

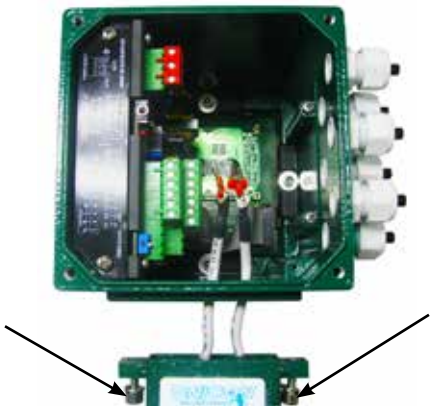
Step 2
Open rear compartment to expose power connection.

Step 3
Remove power connector from its socket. Remove wires from the connector and set aside.

Step 4
Remove electrode and coil connectors from their sockets.

Step 5
Remove electrode and coil wires from connectors and set aside.

Step 6
Remove mounting screws from the bottom of the enclosure. Screws do not need to be fully removed.



Step 7
Carefully separate the electronics enclosure from the sensor body. As the two come apart, feed the sensor wires through the opening in the bottom of the enclosure.

Section 2: Installing the Remote Mount Junction Box

Step 1
Remove the cover and circuit board from the remote mount junction box.

Step 2
Feed the cables through the holes in the bottom of the junction box and mount it in place.

Step 3
Re-install the circuit board.

Step 4
Attach the cables to the terminal blocks as shown.

(Note: Each wire is labeled with a number that corresponds to a terminal location.)

Step 5
Install the remote mount cables through the strain relief supplied with the junction box. Connect cables to the numbered terminal blocks as shown.

Step 6
Cables should be connected as shown.

Step 7
Re-install the cover.

Section 3: Wiring the Transmitter

Step 1
Remove the retaining nut and black plastic plug from the center strain relief on the enclosure and feed the nut over the end of the cable. Then feed the cable through the strain relief. Repeat process for second cable.

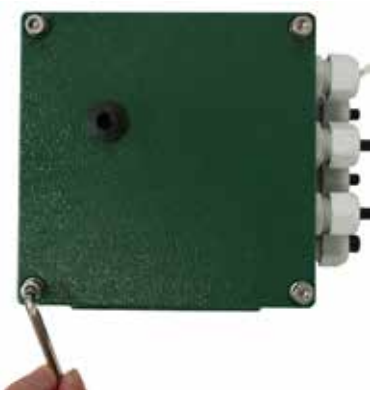
Step 2
Attach the green connectors to the end of the cable. Numbers on each wire correspond to the numbers on the connectors.

Step 3
Re-install the connectors and tighten the strain relief. Re-install the power cable and connector.

Step 4
Remove the o-ring from the remote mount bracket and place it into the gland on the bottom of the enclosure as shown.

Step 5
Attach the mounting bracket using the screws and lock washers supplied in the kit.

Step 6
Close and fasten the cover.



IMPORTANT NOTE

Transmitter programming must be changed to complete the remote mount installation.