Electromagnetic Flowmeters
Combined type
Model : F950

Spec. sheet no. FD09-03

Description

The Electromagnetic Flowmeter can be used to accurately measure the flowrate of liquids, paper pulp, slurry and mineral slurry which has an electrical conductivity greater than 10 μs/cm.
F950 is a flow measurement system in a compact design which integrates the primary and signal converter.

Sensor and Transmitter

Grounding Ring
(Accessory)

Specification

Type
Combined type

Size
15 ~ 1,000A (⅜"~40")

Process connection
Flange type [ANSI, ASME, DIN, JIS, KS, ETC.]

Measuring range
0.2 - 10 m/s

Accuracy
±0.5 % F.S (15 ~ 800A)
±1.0 % F.S (900A ~ : It needs for site calibration.)

Lining
Standard : Hard rubber (0 ~ 60 °C)
Option : Teflon (-10 ~ 160 °C) Max. 400A

Ambient temperature
-10 ~ 60 °C

Conductivity
Standard : ≥ 10 μs/cm
Option : ≥ 5 μs/cm

Power supply
Standard : AC 85 ~ 250 V, 50 ~ 60 Hz
Option : DC 24 V [2-Wire Loop Power]

Power consumption
Max. 15 VA

Display
LCD Display with back light
Flowrate : 5-Digit Display
Total : 9-Digit Display

Output
Analog : DC 4 ~ 20 mA (Isolated) - Active
Pulse : Open collector pulse
Communication : RS485

Protection class
IP66

Special feature
Self check
Empty pipe
Enable to reverse flow direction
Data logging
Error message

Main order — Ordering information

1. Base model

F950	Electromagnetic flowmeter Combined type

2. Meter size

A	15A (½")	**O**	350A (14")
B	20A (¾")	**P**	400A (16")
C	25A (1")	**Q**	450A (18")
D	32A (1¼")	**R**	500A (20")
E	40A (1½")	**S**	550A (22")
F	50A (2")	**T**	600A (24")
G	65A (2½")	**U**	650A (26")
H	80A (3")	**V**	700A (28")
I	100A (4")	**W**	750A (30")
J	125A (5")	**X**	800A (32")
K	150A (6")	**Y**	900A (36")
L	200A (8")	**Z**	1000A (40")
M	250A (10")	**1**	Other
N	300A (12")		

3. Connection flange

A	ANSI 150Lb	**H**	KS 10K
B	ANSI 300Lb	**I**	KS 16K
C	ASME 150Lb	**J**	KS 20K
D	ASME 300Lb	**K**	DIN PN 10
E	JIS 10K	**L**	DIN PN 16
F	JIS 16K	**M**	DIN PN 20
G	JIS 20K	**O**	Other

4. Electrode material

1	Titanium
2	316L SS
3	Hastelloy-C
4	Platinum Iridium
5	Tantalum
6	Other

5. Ground ring material

1	None
2	316L SS
3	Hastelloy-C
4	Platinum Iridium
5	Titanium
6	Tantalum
7	Other

6. Lining material

1	Hard rubber (Flange : A105)
2	PTFE (Flange : A182 F304)
3	Other (Hard Rubber w/Flange : A182 F304 PTFE w/Flange : A182 F316, etc.)

Sample ordering code

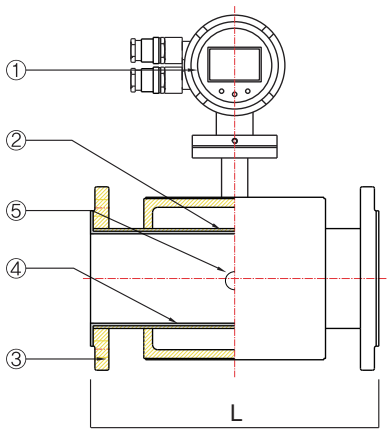
1	2	3	4	5	6
F950	**A**	**A**	**1**	**1**	**1**

*** Example Specification**

1. Connection : 4" ANSI 150Lb RF
2. Electrode Material : Titanium
3. Ground Ring : None
4. Lining Material : Hard Rubber (Flange : A105)

Standard material

No.	Description	Material
1	Head	Cast Aluminium
2	Body	304SS
3	Flange	Standard : Carbon steel Option : 304SS, etc.
4	Lining	Standard : Hard Rubber Option : Teflon
5	Electrode	Standard :Titanium Option : 316L SS Hastelloy-C Platium Iridium Tantalum



Principle of Electromagnetic Flowmeter

Principle of operation

The electromagnetic flowmeters are the ideal flowmeters for metering the flow of all liquids, slurries and sludges that have a specific minimum electrical conductivity. These flowmeters measure accurately, create no additional pressure drop, contain no moving or protruding parts, are wear free and corrosion resistant. Installations are possible in any existing piping system.
The electromagnetic flowmeters has proven itself over many decades and is the preferred flowmeter in the Chemical, Pharmaceutical and Cosmetic Industries. Municipal Water and Waste Water treatment facilities and in the Food and Paper industries.

Measurement operation

Faraday's Laws of induction form the basis form the basis for the electromagnetic flowmeter which states that a voltage is generated in a conductor as it moves through a magnetic field.
This principle is applied to a conductive fluid which flows through the meter tube perpendicular to the direction of the magnetic field. (see the figure 1.)

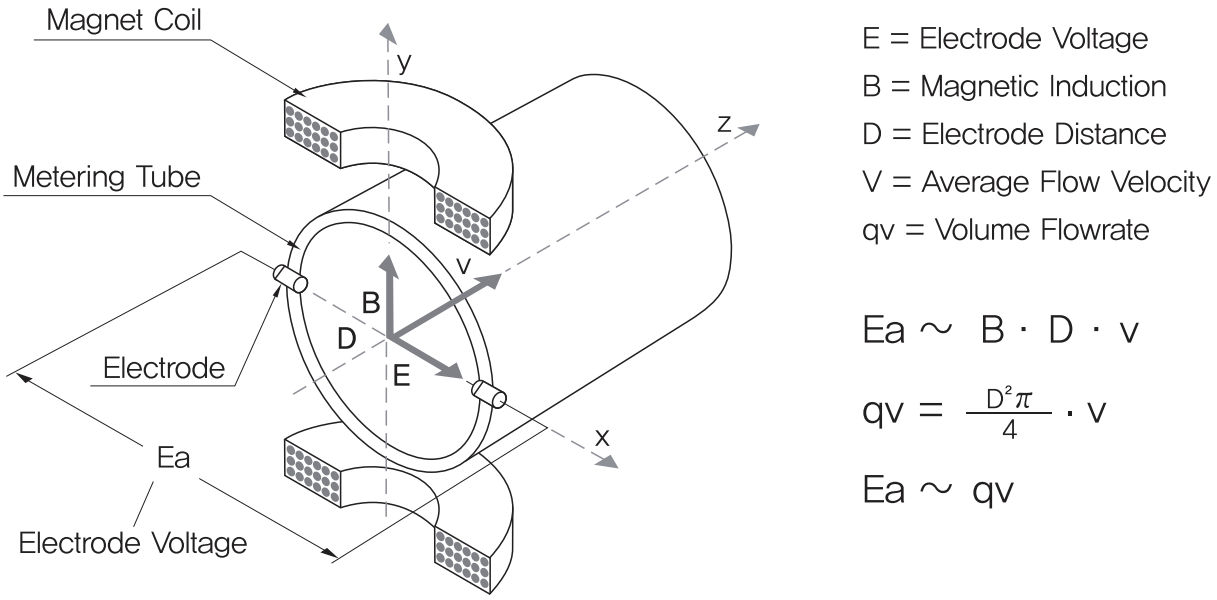


Figure 1. Basic operating principle of an Electromagnetic Flowmeter

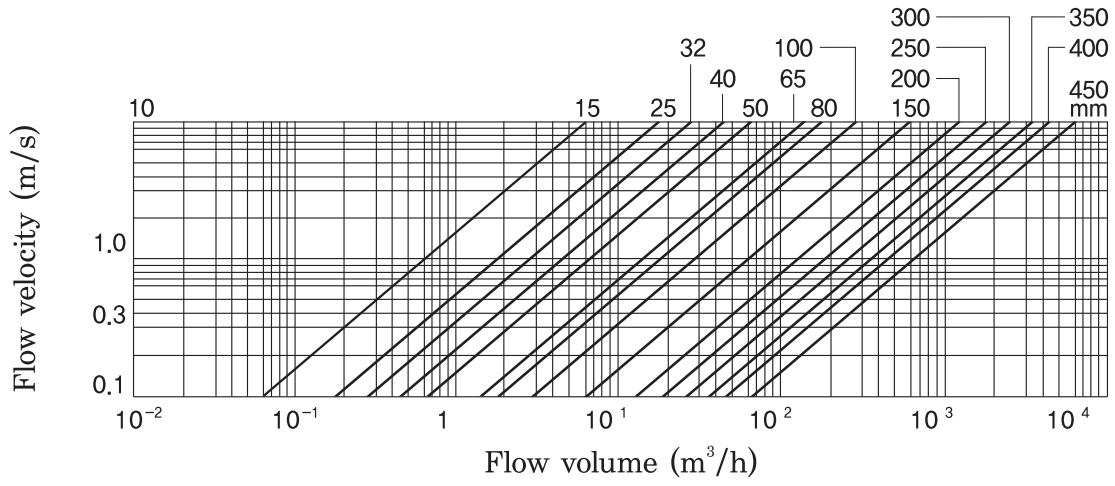
The voltage induced in the fluid is measured by two electrodes located diametrically opposite to each other.
This electrode voltage "Ea" is proportional to the magnetic induction "B", the electrode distance "D" and the average flow velocity "V". Nothing that the magnetic induction "B" and the electrode distance "D" are constant values indicates that a proportionality existes between the electrode voltage "Ea" and the average flow velocity "V".
From the equation for calculating the volume flowrate "Ea~qv", it follows that the signal voltage is linear and proportional to the volumetric flowrate.

Measuring range

In the normal industry application it is better to set the measured medium speed as 2~4m/s.
Under the special situation the minimum speed should be more than 0.2m/s and maximum speed less than 8m/s.
If there are solid granules in liquid the usual speed should be less than 3m/s for purpose to avoid the over-attrition between lining and electrical poles.
For viscid liquid the speed can choose as 2m/s the fast flow speed makes for the automatic elimination of obstructive substances glued on poles, therefore improve the inspection's preciseness.

Size (mm)	Flow range				Dimension "L" (mm)	Max. Working Pressure (bar)	Approx Weight (Kg)
	Minimum		Maximum				
	Velocity (m/s)	Flow rate (m³/h)	Velocity (m/s)	Flow rate (m³/h)			
15A		0.19		6.35			7
20A		0.34		11.29			7
25A		0.53		17.64			8
32A		0.87		28.91	200	40	8
40A		1.36		45.71			9
50A		2.12		70.58			10
65A		3.58		119.28			11
80A		5.43		180.68			13
100A		8.48		282.32	250		17
125A		13.25		441.12		16	20
150A	0.2	19.08	10.0	636.21	300		30
200A		33.91		1,129.27	350		41
250A		52.99		1,764.48	400		58
300A		76.30		2,540.86	500		70
350A		103.86		3,458.39			82
400A		135.65		4,517.08			106
450A		171.68		5,716.93	600	10	116
500A		211.95		7,057.94			130
600A		305.21		10,163.43			185
700A		415.42		13,833.55	700		230
800A		542.59		18,068.31	800		300
900A		686.72		22,867.71	900		380
1000A		847.80		28,231.74	1,000	6	480

Graph Illustration of diameter, Flow speed and Volume of flowmeter



Grounding

General information on ground connections

Observe the following items when grounding the device ;
- The flowmeter grounding is one of the most important things for flowmeter installation.
- For plastic pipes or pipes with insulating lining, the grounding is provided by the grounding ring.
- When stray potentials are present, install a grounding ring upstream and downstream of the flowmeter sensor.
- For measurement-related reasons the potential in the station ground and in the pipeline should be identical.

※ Important Notice

If the flowmeter sensor is installed in plastic or earthenware pipelines, or in pipelines with an insulating lining, transient current may flow through the grounding electrode in special cases.
In the long term, it may destroy the sensor, since the ground electrode will turn in degrade electrochemically.
In these special cases the connection to the ground must be performed using grounding plates.
Install a grounding ring upstream and downstream of the device in this case.

Metal pipe with fixed flanges

Use a copper wire (at least 2.5 mm²) to establish the ground connection between the sensor, the pipeline flanges and an appropriate grounding point.

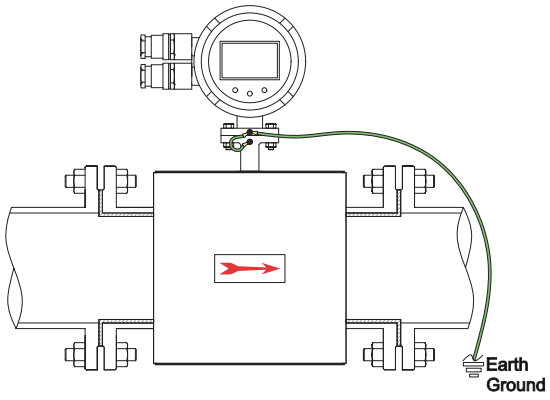


Figure 2. Metal pipe, without liner
(Over 50A sizes)

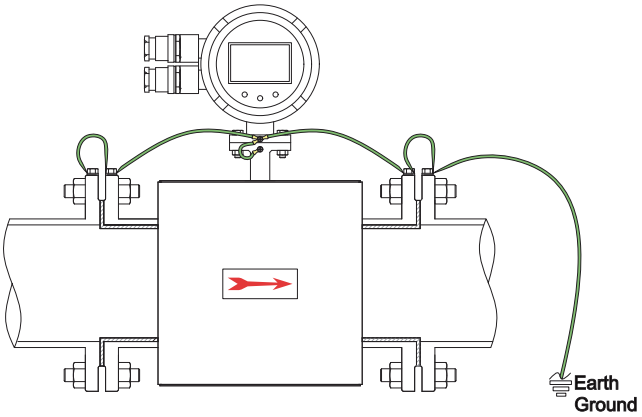


Figure 3. Metal pipe, without liner
(From 10 to 40A sizes)

Plastic pipes, non-metallic pipes or pipes with insulating liner

For plastic pipes or pipes with insulating lining, the ground for the measuring agent is provided by the grounding ring.
If grounding electrodes are used the grounding ring is not necessary.

a) Install the flowmeter sensor with grounding ring in the pipeline.
b) Connect the terminal lug for the grounding ring and grounding connection on the flowmeter sensor with the grounding strap.
c) Use a copper wire (min. 2.5 mm²) to link the ground connection to a suitable grounding point.
※ It is essential to use this grounding method in an electrolysis process at a plating factory.

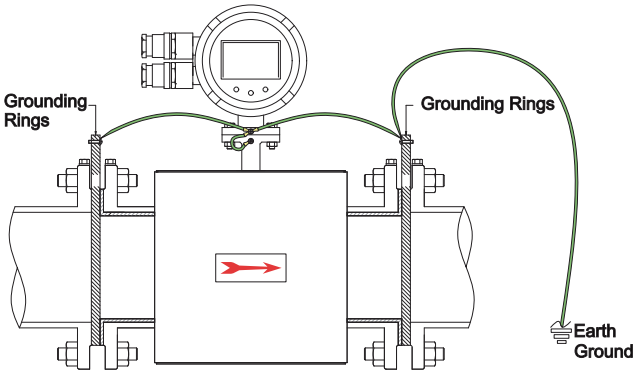


Figure 4. Plastic pipes, non-metallic pipes or pipes with insulating liner

Grounding

Ground for pipes with flexible connection

For pipes with flexible connection, it should be welded M16 or 1/4 sized bolts on both sides of the pipes as shown the figure 5 to get proper ground results.
Make sure to use a copper wire (min. 2.5 mm²) to link the ground connection to a suitable grounding point.

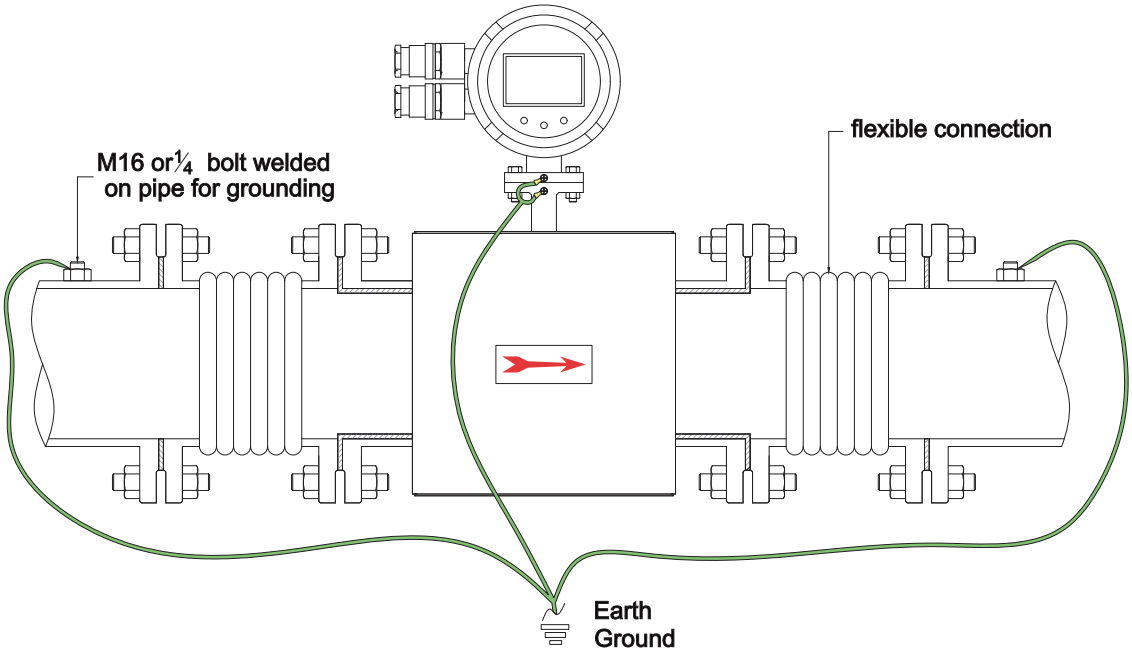
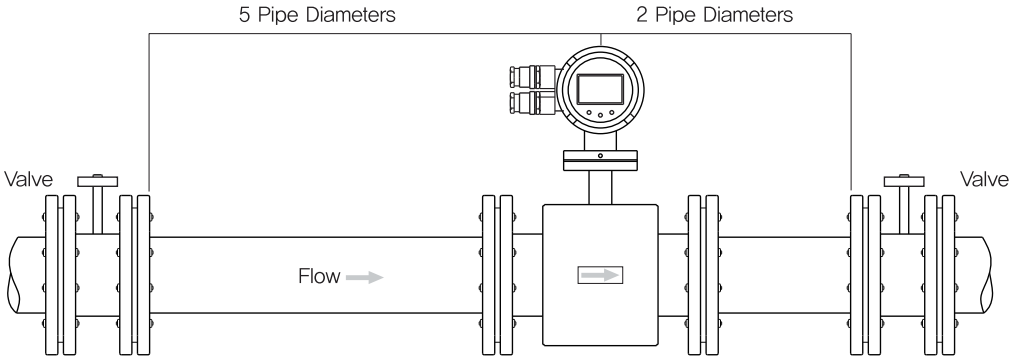


Figure 5. Ground for pipes with flexible connection

Piping installation

Upstream downstream piping installation methods (Standard)

To ensure specific accuracy over widely varying process conditions install the flowtube with a minimum of five straight upstream and two pipe diameters downstream from the electrode plan as shown below.

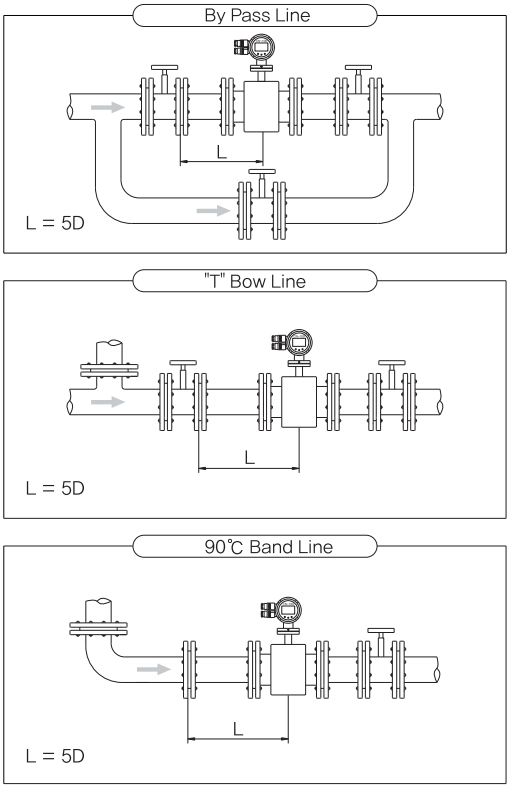


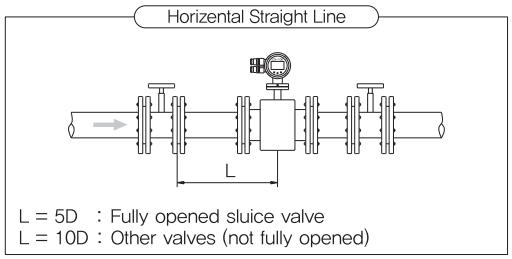
Upstream and Downstream straight pipe diameter

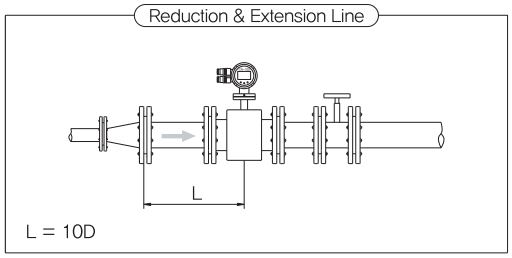
※ Note : It can be measured a correct flowrate only when a detector is full with fluid inside completely.
Make sure to operate it with fluid in full inside.

Required pipe length in piping connections

If various joints are used upstream of the detector outlet the straight pipe length as show in figure below is required.







※ Note

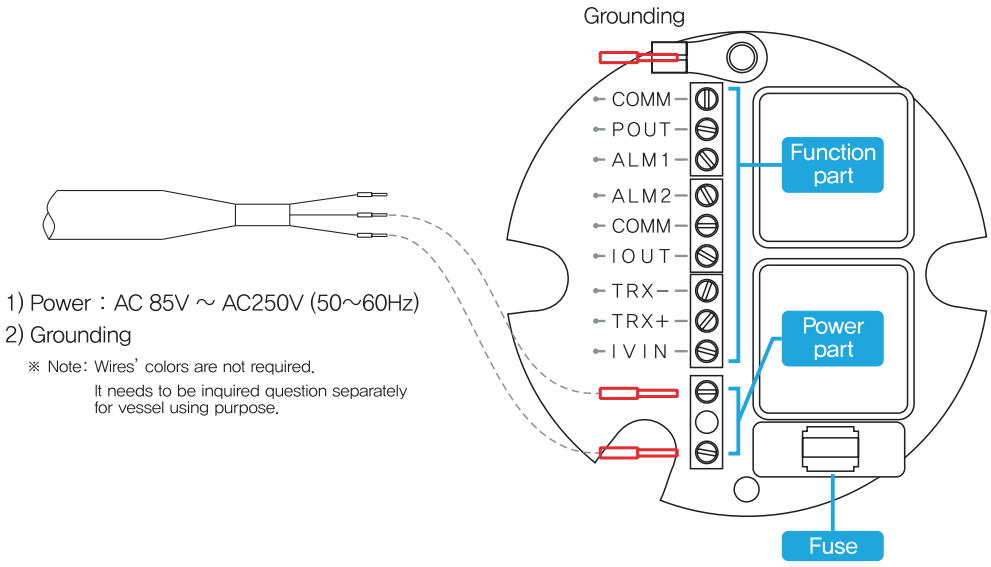
L : Required straight pipe length–straight pipe length plus half length of the detector.

D : Normal bore size (diameter)

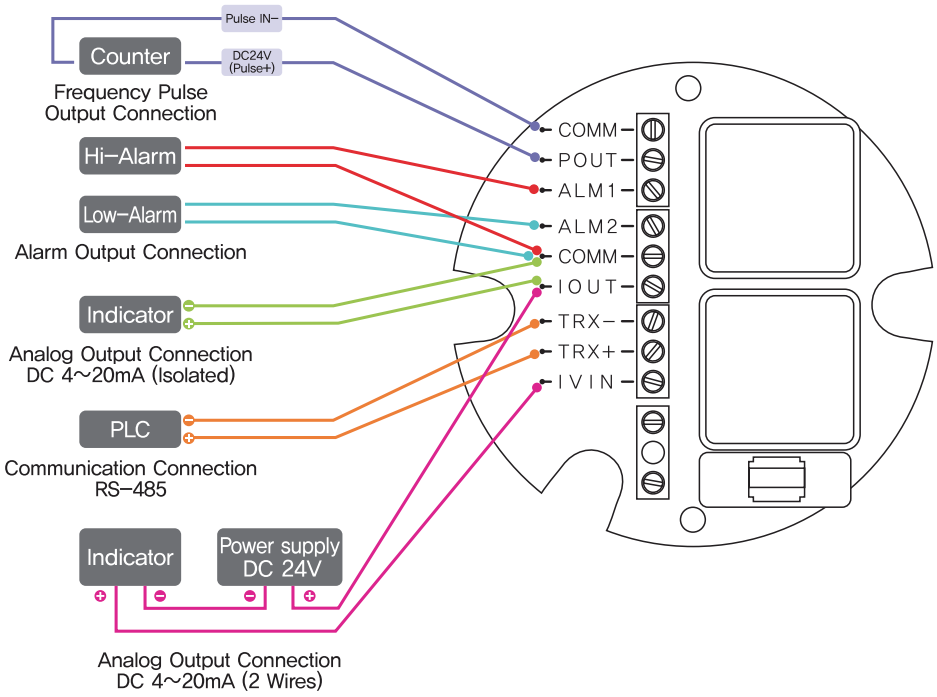
The figure above required straight pipe length on the upstream side

Wiring

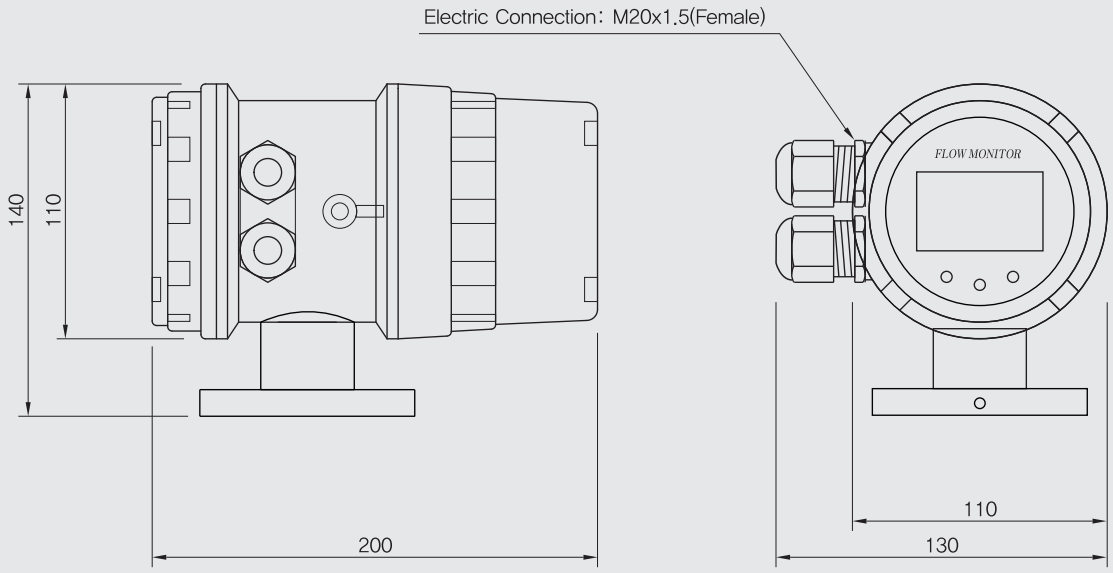
Description for PCB connection functions	
COMM	Frequency and Pulse
POUT	Frequency (Pulse) Output for Bi-directional Flow
ALM1	Alarm Output for Upper Limit
ALM2	Alarm Output for Low Limit
COMM	Current and Alarm Common
IOUT	Current Output for Flux (Two Routes Out) Isolated
TRX-	- Communication Signal Input
TRX+	+ Communication Signal Input
IVIN	External DC Power 24 V
LN-	Power Supply (AC Power)
LN+	Power Supply (AC Power)



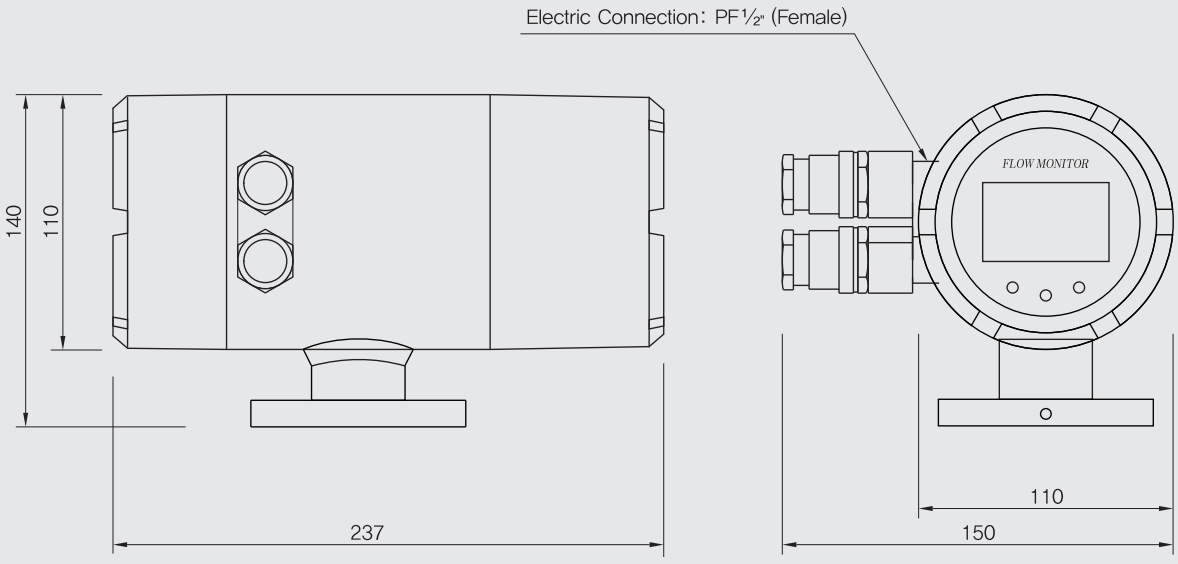
Controller wiring connection function



Dimension



Normal combined type



Ex-proof combined type

Memo