ELECTROMAGNETIC FLOWMETER

iSOLV

INNOVATIVE SOLUTIONS

analytical

bulk flow

distance

FLOW

level

pressure

temperature

industrial communication

FLOTECH

PROCESS CONTROL & INSTRUMENTATION

ELECTROMAGNETIC FLOWMETER

Electromagnetic Flow Sensor

By virtue of it's working principle, only electrically conductive fluids can be measured.

Measurement is determined by Faraday's law of induction, according to which a voltage is induced by an electrically conductive fluid passing through a magnetic field. The following equation is applicable to the induced voltage.:

$$U = K \times B \times \bar{v} \times D \quad \text{(A)}$$

Where:

U	Induced voltage
K	Instrument constant
B	Magnetic field strength
$\bar{v}$	Mean velocity
D	Pipe cross-section

The volumetric flow rate qv can be calculated according to

$$q_v = \bar{v} \times D^2 \times \frac{\pi}{4}$$

From equation A that

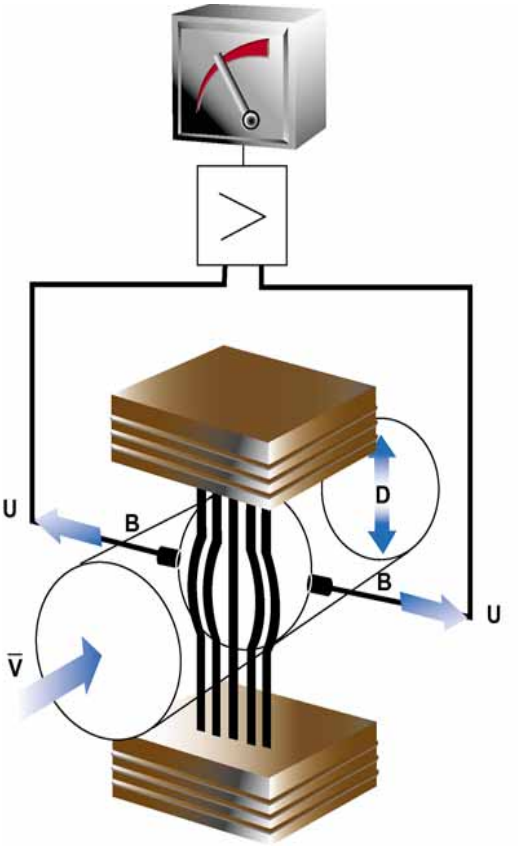
$$\bar{v} = \frac{U}{K \times B \times D}$$

Therefore:

$$q_v = \frac{U}{k \times B} \times D \times \frac{\pi}{4}$$

Thus the induced voltage is proportional to the mean flow velocity, given a constant magnetic field strength.

Inside the electromagnetic flow sensor, the fluid cuts through a magnetic field applied perpendicular to the direction of flow. Voltage is induced by the flow of the electrically conductive liquid. The induced voltage is proportional to the mean flow velocity and thus to the volume of fluid. The induced voltage signal is picked up by a pair of electrodes which are in conductive contact with the fluid and transmitted to a flow transmitter to produce various standardised output signals.



Applications

iSolv electromagnetic flowmeters are used across many industries, for various flow measurement applications:

- Chemical industry
- Water and wastewater
- Pulp and paper
- Pharmaceutical
- Food and beverage
- Building automation (HVAC)

EFS 800/CFT180 Integral Flow Transmitter

EFS 800/RFT200 or RFT200/B Remote Flow Transmitter

Electromagnetic Flow Sensor

Model:	EFS 800
Size:	DN10 - DN3800
Electrical Conductivity:	≥5µS/cm
Measuring Tube:	SS 304
Liner:	Hard Rubber, PTFE, others on request
Accuracy:	0.3 to 0.5%
Flow Velocity:	0.5 to 10 m/s
Electrode:	316 SS, HC, Ti, Ta, Pt
Electrode Construction:	Fixed (Standard), Removable (Optional)
Field Coils:	E Class ≤ 130°C H Class ≤ 180°C
Medium Temperature:	-25°C to 180°C depending on liner material and coil insulation class
Protection Class:	IP67, IP68
Connection Flanges:	DIN 2501, ANSI, AWWA, JIS. Higher pressure rating on request
Flange Material:	Carbon Steel (Standard),SS 304 on request
Housing:	Die-cast aluminum with epoxy paint (DN10 - DN300) / Steel with epoxy paint (DN350 - DN3800)
Grounding Rings:	Standard for non-conductive pipes, Protective Ring for flow sensor with Teflon Liner and Cylinder Neck Type for abrasive liquid service.

Flow Transmitter

Model	CFT180 (Integral) / RFT200 (Remote) or RFT200/B (Remote)
Power	18 - 36 VDC, 85 - 253 VAC
Signal Output	4-20mA, ≤ 5 KHz Frequency
Flow Direction	Forward / Reverse
Protection	IP65
Environmental Temp.	-20°C to 60°C
Integral Converter	CFT180 - up to DN1000
Remote Converter	RFT 200 - up to DN1000 RFT200/B - DN1200 to DN 3800
Communication	Profibus DP, Profibus PA, RS485 available on request

Flowmeter Sizing and Selection

Proper selection, sizing and installation of electromagnetic flowmeter will ensure trouble - free operation and cost saving. The following information will be required:

1) Type of liquid - consider suitability of liner and electrodes
2) Conductivity >5µS/cm
3) Maximum / minimum temperature
4) Maximum / minimum pressure. Negative pressure?
5) Maximum / minimum flow rates
6) Solids content

Flow Table

Meter Size	Qmin (m3/h)	Qmax (m3/h)
10	0.14	2.83
15	0.32	6.36
20	0.57	11.31
25	0.88	17.67
32	1.45	28.95
40	2.26	45.24
50	3.53	70.69
65	5.97	119.46
80	9.05	180.96
100	14.14	282.74
125	22.09	441.79
150	31.81	636.17
200	56.55	1,130.97
250	88.36	1,767.15
300	127.23	2,544.69
350	173.18	3,463.61
400	226.19	4,523.89
450	286.28	5,725.55
500	353.43	7,068.58
600	508.94	10,178.76
700	692.72	13,854.42
800	904.78	18,095.57
900	1,145.11	22,902.21
1000	1,413.72	28,274.33
1200	2,035.75	40,715.04
1400	2,770.88	55,417.69
1600	3,619.11	72,382.29
1800	4,580.44	91,608.84
2000	5,654.87	113,097.34
2200	6,842.39	136,847.78
2400	8,143.01	162,860.16
2600	9,556.72	191,134.50
2800	11,083.54	221,670.78
3000	12,723.45	254,469.00

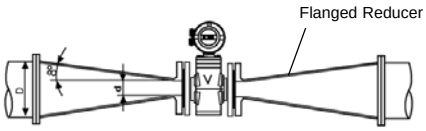
Installations in Larger Pipeline Sizes

The flow sensor can readily be installed in larger pipeline sizes using standard reducers. The pressure drop resulting from the size reduction can be determined from the Chart for flow sensor pressure drop. The procedure for determining the pressure drop is as follows:

1) Calculate the diameter ratio d/D.

2) Determine the flow velocity.

3) Read the pressure drop on the Y-Axis.



d = Flow sensor inside diameter
D = Pipeline inside diameter
v = Flow velocity [m/s]
Δp = Pressure drop [mbar]

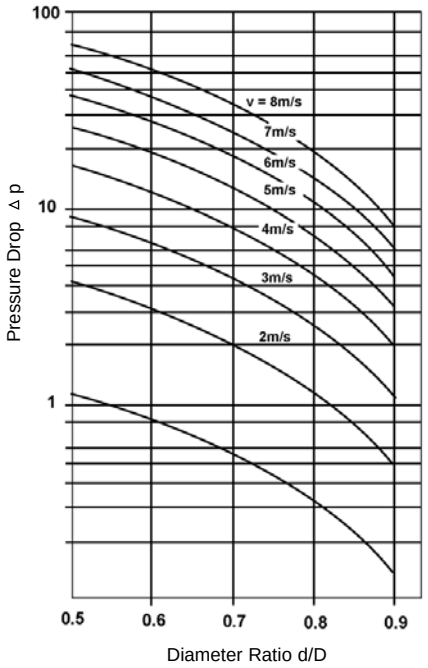
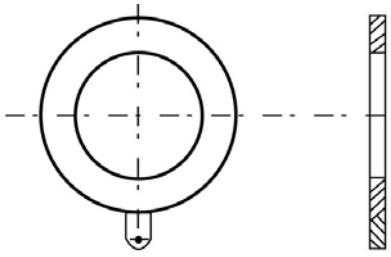


Chart for flow sensor pressure drop

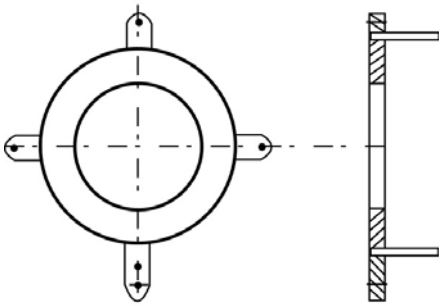
Protection Classes to IEC 529 / EN 60529			
IP 65, equivalent to NEMA 4 and 4X	Protection against contact with means of any kind	Total protection against ingress of dust (dust-proof enclosure)	Protection against jets of water any direction (hose-proof)
IP 66, equivalent to NEMA 4 and 4X	Protection against contact with means of any kind	Total protection against ingress of dust (dust-proof enclosure)	Protection against jets of water and heavy seas
IP 67	Protection against contact with means of any kind	Total protection against ingress of dust (dust-proof enclosure)	Protection against immersion of water
IP 68 equivalent to NEMA 6	Protection against contact with means of any kind	Total protection against ingress of dust (dust-proof enclosure)	Protection against ingress of water under pressure (water-tight)

Grounding / Protective Rings
Material: Stainless Steel 304 (Standard)
Thickness: 3mm

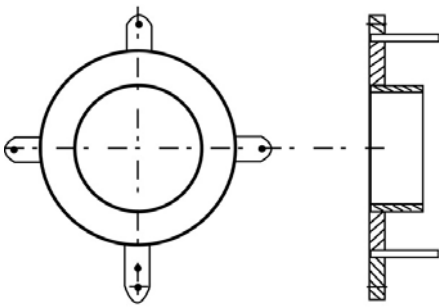
A



B



C



To ensure accurate and reliable flow measurement, the fluid must be grounded. When good grounding is lacking in pipes upstream and downstream of the flow sensor, example pipes with corrosion-resistance internal coating or liner, or are made entirely of non-metal materials.
In such cases, protective rings must be installed on both sides of the flow sensor.

A) Standard Protective Rings

B) Pre-Installed Protective Rings

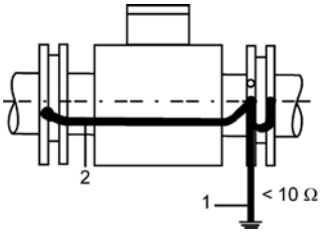
Recommended for primary heads with - PTFE liner. Prevents damage to the PTFE faced flanges during transportation and installation. These protective rings can also serve as earthing rings, in non-conductive pipes.

C) Cylindrical Neck Protective Rings

With cylindrical neck of ≥ 25mm

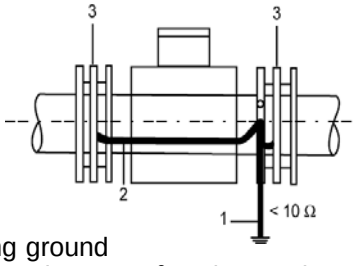
Recommended for fluids with high solids content. Examples: Pulp & paper and mining applications.

Primary flow sensor in metal pipe



1) Measuring ground
2) Grounding wire 10mm²Cu (AWG 7)

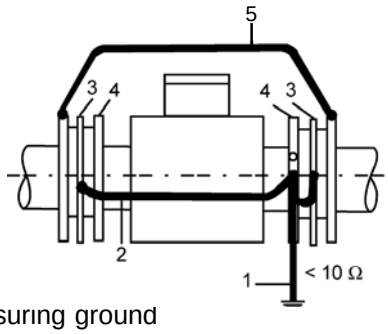
Primary flow sensor in plastic pipe or in metal pipe with insulating coating / lining / painting



1) Measuring ground
2) Grounding wire 10mm²Cu (AWG 7)
3) Grounding rings

Primary flow sensor in pipe runs with cathodic protection

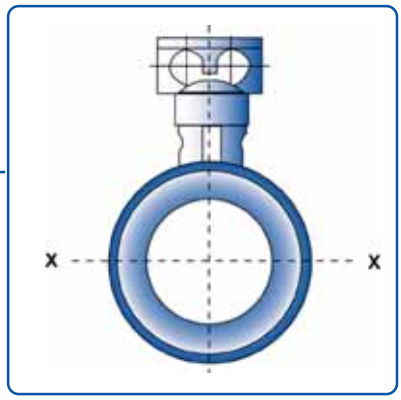
Primary flow sensor must be electrically isolated from the pipe. Protective rings for good grounding are compulsory.



1) Measuring ground
2) Grounding wire 10mm²Cu (AWG 7)
3) Grounding rings
4) Screw bolts (insulated)
5) Connecting wire 10mm²Cu (AWG 7)

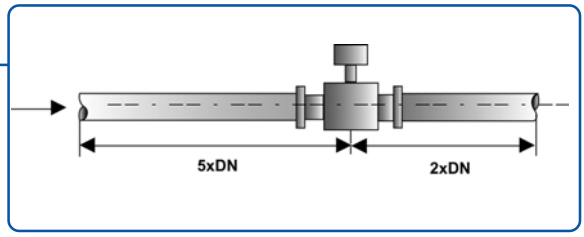
Installation

Location and position as required, but electrode axis (x.....x) must be approximately horizontal.



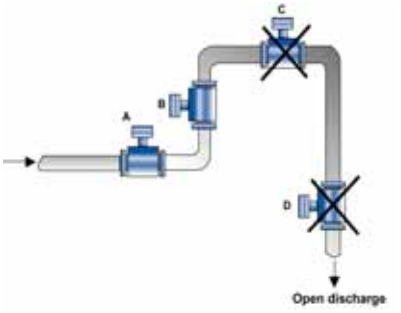
- Pipe must be completely filled at all times.
- Flow direction - Avoid top / bottom
- Ensure there is sufficient clearance for installation and maintenance work.

Straight inlet run minimum of 5xDN and outlet 2xDN (DN= meter size) measured from the electrode axis.



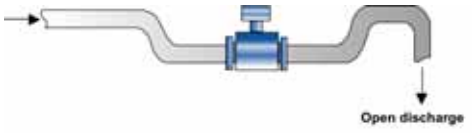
- Support the pipeline on both sides of the flowmeter to minimise vibrations.
- Do not install flowmeter in vicinity of strong electromagnetic fields.
  Example: High-tension electrical cables
- Install protective rings for plastic pipes and internally coated metal pipelines for proper grounding.

Some Typical Installations

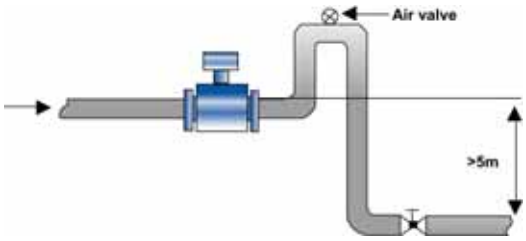


- A & B - Preferred locations. (Pipe is fully filled!)
- C - Highest point of pipe run (Air bubbles accumulate in measuring tube causing incorrect or unstable measurements)
- D - Top/bottom flow direction to drain does not create a fully filled pipe condition causing unstable or inaccurate reading.

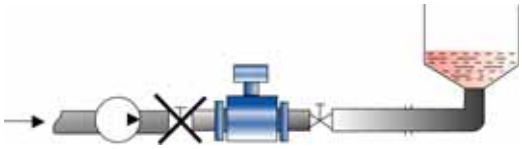
- Install in slightly ascending pipe section. If not possible, ensure adequate velocity to prevent air, gas or vapour from concentrating in the flow sensor.



- Install flow sensor in lower section of pipe.

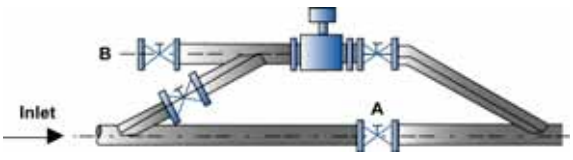


- Install air valve ⊗ downstream of flowmeter. Negative pressure (Vacuum) may damage the liner.

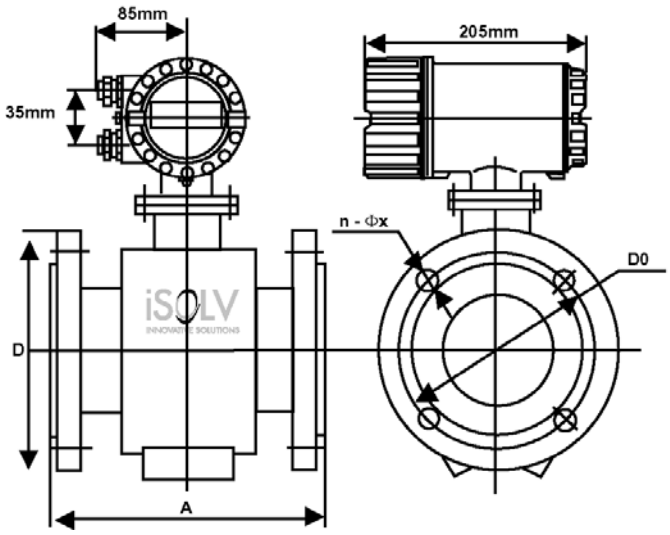


- Always install control and shutoff valves downstream of flowmeter to avoid flow profile distortion or possible negative pressure (Vacuum)

- Never install flow sensor on pump suction side (Vacuum!). May cause damage to the liner.



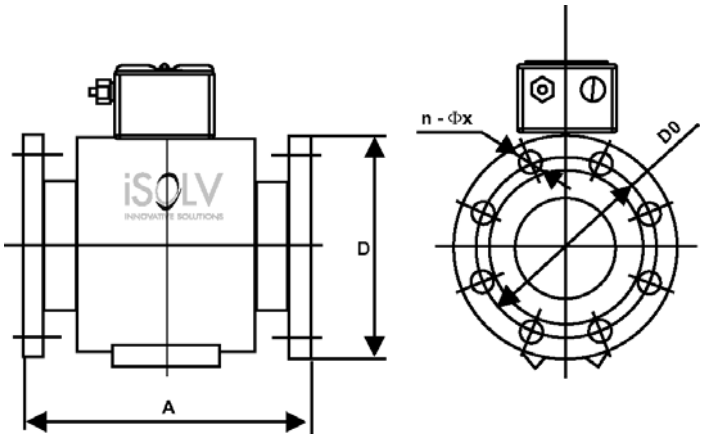
- Install flowmeter in bypass for heavily contaminated fluids.
  A) Flowmeter
  B) Flushing and cleaning without interrupting system operation



EFS 800 / CFT180

Dimensions for integral flow transmitter and flow sensor

Size	Pressure Rating	Dimension			
(mm)	Bar	A	D	D0	n-Φx
10	40	200	90	60	4-Φ14
15	40	200	95	65	4-Φ14
20	40	200	105	75	4-Φ14
25	40	200	115	85	4-Φ14
32	40	200	140	100	4-Φ18
40	40	200	150	110	4-Φ18
50	40	200	165	125	4-Φ18
65	40	200	185	145	8-Φ18
80	40	200	200	160	8-Φ18
100	16	250	220	180	8-Φ18
125	16	250	250	210	8-Φ18
150	16	300	285	240	8-Φ22
200	10	350	340	295	8-Φ22
250	10	450	395	350	12-Φ22
300	10	500	445	400	12-Φ22
350	10	500	505	460	16-Φ22
400	10	600	565	515	16-Φ26
450	10	600	615	565	20-Φ26
500	10	600	670	620	20-Φ26
600	10	700	780	725	20-Φ30
700	10	700	895	840	24-Φ30
800	10	800	1015	950	24-Φ33
900	10	900	1115	1050	28-Φ33
1000	10	1000	1230	1160	28-Φ36

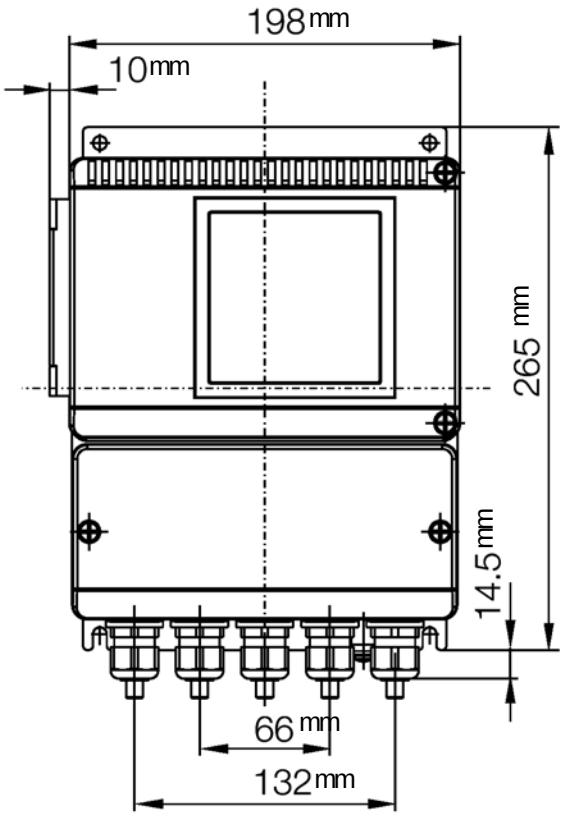


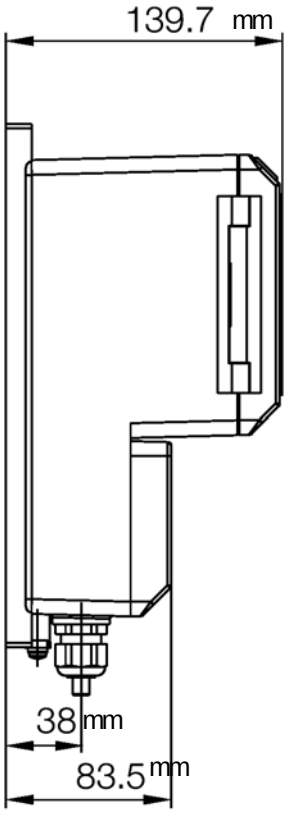
EFS 800 / RFT 200 (≤ DN1000) or RFT 200/B (≥DN1200)

Dimensions for remote flow sensor

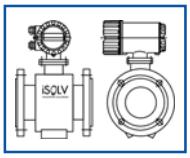
Size	Pressure Rating	Dimension			
(mm)	Bar	A	D	D0	n-Φx
10	40	200	90	60	4-Φ14
15	40	200	95	65	4-Φ14
20	40	200	105	75	4-Φ14
25	40	200	115	85	4-Φ14
32	40	200	140	100	4-Φ18
40	40	200	150	110	4-Φ18
50	40	200	165	125	4-Φ18
65	40	200	185	145	8-Φ18
80	40	200	200	160	8-Φ18
100	16	250	220	180	8-Φ18
125	16	250	250	210	8-Φ18
150	16	300	285	240	8-Φ22
200	10	350	340	295	8-Φ22
250	10	450	395	350	12-Φ22
300	10	500	445	400	12-Φ22
350	10	500	505	460	16-Φ22
400	10	600	565	515	16-Φ26
450	10	600	615	565	20-Φ26
500	10	600	670	620	20-Φ26
600	10	700	780	725	20-Φ30
700	10	700	895	840	24-Φ30
800	10	800	1015	950	24-Φ33
900	10	900	1115	1050	28-Φ33
1000	10	1000	1230	1160	28-Φ36
1200	6	1200	1405	1340	32-Φ33
1400	6	1400	1630	1560	36-Φ36
1600	6	1600	1830	1760	40-Φ36
1800	6	1800	2045	1970	44-Φ39
2000	6	2000	2265	2180	48-Φ42
2200	2.5	2200	2405	2340	52-Φ33
2400	2.5	2400	2605	2540	56-Φ33
2600	2.5	2600	2805	2740	60-Φ33
2800	2.5	2800	3030	2960	64-Φ36
3000	2.5	3000	3230	3160	68-Φ36
≥3200	2.5	Upon Request			

RFT200 or RFT200/B Remote Flow Transmitter





Ordering Information
Compact Version - EFS 800 / CFT 180 (For DN 10 - 1000)



Liner

H	Hard Rubber 1” - 40” [DN 25 - DN 1000]
T	PTFE 3/8” - 36” [DN 10 - 900]

Meter Size

			Working Pressure (Standard)
10	3/8”	DN10	PN40
15	1/2”	DN15	PN40
20	3/4”	DN20	PN40
25	1”	DN25	PN40
32	1 1/4”	DN32	PN40
40	1 1/2”	DN40	PN40
50	2”	DN50	PN40
65	2 1/2”	DN65	PN40
80	3”	DN80	PN40
1H	4”	DN100	PN16
1Q	5”	DN125	PN16
1F	6”	DN150	PN16
2H	8”	DN200	PN10
2F	10”	DN250	PN10
3H	12”	DN300	PN10
3F	14”	DN350	PN10
4H	16”	DN400	PN10
4F	18”	DN450	PN10
5H	20”	DN500	PN10
6H	24”	DN600	PN10
7H	28”	DN700	PN10
8H	32”	DN800	PN10
9H	36”	DN900	PN10
1T	40”	DN1000	PN10

Electrode

		Ground Electrode Material
S	SS 316Ti/1.4571	None (Standard)
B	Hastelloy B-2	None
H	Hastelloy C-4	None
M	Titanium	None
T	Tantalum	None
	Platinum-Iridium	
P	a) Meter Size < DN300	None
P	b) Meter Size > or = DN300	None
E	SS 316Ti / 1.4571	With
N	Hastelloy B-2	With
O	Hastelloy C-4	With
I	Titanium	With
Q	Tantalum	With
	Platinum-Iridium	
G	a) Meter Size < DN300	With
G	b) Meter Size > or = DN300	With

EFS 800 / CFT180 [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]

To be continue

Ordering Information
Compact Version - EFS 800 / CFT 180

Pressure Rating

A	PN 2.5
B	PN 6
C	PN 10
D	PN 16
E	PN 25
F	PN 40
Z	Others

Flange Material

1	Steel
3	SS 304

Accessories

A	None
C	Grounding / Protective Ring - SS 304 (Standard)

Temperature Range

S	Standard Temperature < 130°C

Protection Class

2	IP 67 (threads)

Power Supply

G	High voltage 85 - 253 VAC
K	Low voltage 16.8 - 26.4 VAC/ 16.8 - 31.2 VDC

Display

D	Magnet Stick operation and lighted display

In-/Output Options

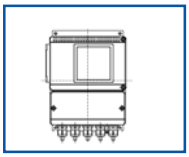
O1	Current output + Pulse output active + Contact input + Contact Output
O2	Current output + Pulse output active + Contact input + Contact Output + HART- Protocol
O3	Current output + Pulse output passive + Contact input + Contact Output
O4	Current output + Pulse output passive + Contact input + Contact Output + HART- Protocol
O5	Current output + Pulse output passive + Contact Output + RS 485
O6	Pulse output passive + Contact Output + Profibus DP
14	Profibus PA 3.0
15	Foundation Fieldbus

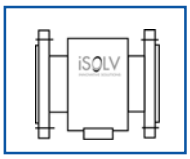
Application

0	Converter housing with threads for cable connector M 20 X 1.5 (Standard)
2	Converter housing with threads for cable connector NPT 1/2"

Ordering Information

Remote Version - EFS 800 / RFT 200 (For DN 10 - 1000) or RFT 200/B (For DN 1200 - 3800)





Liner

H	Hard Rubber 1" - 152" [DN 25 - DN 3800]
T	PTFE 3/8" - 36" [DN 10 - 900]

Meter Size

			Working Pressure (Standard)
10	3/8"	DN10	PN40
15	1/2"	DN15	PN40
20	3/4"	DN20	PN40
25	1"	DN25	PN40
32	1 1/4"	DN32	PN40
40	1 1/2"	DN40	PN40
50	2"	DN50	PN40
65	2 1/2"	DN65	PN40
80	3"	DN80	PN40
1H	4"	DN100	PN16
1Q	5"	DN125	PN16
1F	6"	DN150	PN16
2H	8"	DN200	PN10
2F	10"	DN250	PN10
3H	12"	DN300	PN10
3F	14"	DN350	PN10
4H	16"	DN400	PN10
4F	18"	DN450	PN10
5H	20"	DN500	PN10
6H	24"	DN600	PN10
7H	28"	DN700	PN10
8H	32"	DN800	PN10
9H	36"	DN900	PN10
1T	40"	DN1000	PN10
12	48"	DN 1200	PN 6
14	56"	DN 1400	PN 6
16	64"	DN 1600	PN 6
18	72"	DN 1800	PN 6
2T	80"	DN 2000	PN 6
22	88"	DN 2200	PN 2.5
24	96"	DN 2400	PN 2.5
26	104"	DN 2600	PN 2.5
28	112"	DN 2800	PN 2.5
30	120"	DN 3000	PN 2.5
3Q	128"	DN 3200	PN 2.5
34	136"	DN 3400	PN 2.5
36	144"	DN 3600	PN 2.5
38	152"	DN 3800	PN 2.5
99	Others	Others	UR

Electrode		**Ground Electrode Material**
S	SS 316Ti/1.4571	None (Standard)
B	Hastelloy B-2	None
H	Hastelloy C-4	None
M	Titanium	None
T	Tantalum	None
	Platinum-Iridium	
P	a) Meter Size < DN300	None
P	b) Meter Size >or = DN300	None
E	SS 316Ti / 1.4571	With
N	Hastelloy B-2	With
O	Hastelloy C-4	With
I	Titanium	With
Q	Tantalum	With
	Platinum-Iridium	
G	a) Meter Size < DN300	With
G	b) Meter Size >or = DN300	With

EFS 800 / RFT 200 or RFT 200/B

To be continue

Ordering Information
Remote Version - EFS 800 / RFT 200 (For DN 10 - 1000) or RFT 200/B (For DN 1200 - 3800)

Pressure Rating

A	PN 2.5
B	PN 6
C	PN 10
D	PN 16
E	PN 25
F	PN 40
Z	Others

Flange Material

1	Steel
3	SS 304

Accessories

A	None
C	Grounding / Protective Ring - SS 304 (Standard)

Temperature Range

S	Standard Temperature < 130°C
H	High Temperature < or = 180°C (Meter come with H Coils + PTFE Liner)

Protection Class

2	IP 67 (With standard cable connection M20 X 1.5)
3	IP 68
4	IP 67 (With standard cable connection NPT)

Power Supply

G	High voltage 85 - 253 VAC
K	Low voltage 16.8 - 26.4 VAC/ 16.8 - 31.2 VDC

Display

D	Magnet Stick operation and lighted display

In-/Output Options

O1	Current output + Pulse output active + Contact input + Contact Output
O2	Current output + Pulse output active + Contact input + Contact Output + HART-Protocol
O3	Current output + Pulse output passive + Contact input + Contact Output
O4	Current output + Pulse output passive + Contact input + Contact Output + HART-Protocol
O5	Current output + Pulse output passive + Contact Output + RS 485
O6	Pulse output passive + Contact Output + Profibus DP
14	Profibus PA 3.0
15	Foundation Fieldbus

Application

0	Converter housing with threads for cable connector M 20 X 1.5 (Standard)
2	Converter housing with threads for cable connector NPT 1/2"
3	Converter housing with threads for cable connector PF 1/2"

FLOTECH

PROCESS CONTROL & INSTRUMENTATION

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