EnduroFlow™ Series EF10

Ultrasonic Transit-Time Flowmeter For Permanent Installation

Applications

- Water / Wastewater
- Hot / Chilled Water / Mixture of Water and Glycol
- Chemical Liquids and Solvents
- Petroleum Products
- Oil / Crude Oil / Fuel Oil / Diesel / Lubricant Oil /Hydraulic Oil
- Water management in buildings, metropolitans, water / wastewater treatment plants, irrigation systems, and more
- Flow monitoring and control in Desalination plants, steel plants, power plants, machining plants
- Liquid process control in chemical plants and industrial automation
- Oil / fuel / chemicals and other liquid transfer
- Retrofit capability, to upgrade or augment existing systems
- Automated batching and scheduling
- Efficiency monitoring and improvement of liquid-based heating / cooling systems, including solar / geothermal systems

- Beverage, food and pharmaceutical processors where non-contact is essential
- Remote flow monitoring network and leakage detection

Features And Benefits

- Accurate bi-directional flow measurement
- Economical and non-intrusive
- No moving parts to tear and wear. No maintenance required
- NIST-traceable factory calibration
- Suitable for pure liquids and liquids with some particles. No dependency on conductivity
- Suitable for all commonly used pipes
- Wide pipe size range
- Easy to use and set up
- Communication: RS485/MODBUS. Optional GPRS, GSM, RF wireless
- Compatible with various types of transducers:
  - Clamp-on transducer: non-contact, non-invasive, easy and economical installation, no pipe working
  - Insertion transducer: robust, excellent long-term stability, hot-tapping installation, no need to shut down the flow
  - Flow-cell transducer: most accurate and robust. Plug and play. Excellent long-term performance
- Velocity, flowrate, volumetric total, scheduler, batch controller and more
- Compatible with Spire Metering's uGalaxy wireless telemetry system

SPIRE METERING TECHNOLOGY

Spire Metering Technology LLC, 14B Craig Road, Acton, MA 01720, USA
Tel +1 978 263-7100 / 888 738-0188 (toll-free) **Fax** +1 978 418-9170 sales@spiremt.com www.SpireMT.com

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A member of the EnduroFlow™ Series, the EF10 General Purpose Wall-Mount Ultrasonic Flowmeter is the first member of the 3rd generation ultrasonic flow meters from Spire Metering. Compared with its predecessors, the 3rd generation flowmeters offer better performance and a richer feature set.

The EF10 ultrasonic flowmeter is designed to be installed at a fixed location for long-term flow measurement on a closed pipe carrying pure liquids or liquids with some suspended particles. EF10 can be equipped with clamp-on or wetted (insertion or flow-cell) type transducers to meet various application challenges.

Signal Quality Tracking

The EF10 flowmeter utilizes cutting-edge technologies such as advanced transducer design, low voltage transmission, digital signal processing, self adaptation, and others, to achieve high performance. Its proprietary quality tracking mechanism analyzes the quality of the received signal and automatically tunes the meter system to its optimized condition. This mechanism leads the system to be easily adaptable to pipe material variations and liquid property changes.

Transducer Pairing and Wetted Calibration

As QUALITY is of crucial importance, all transducers are carefully paired, and all flowmeters are wet-calibrated on a flow loop in the factory to further ensure the system's accuracy and reliability.

Versatile Interfaces

EF10 provides versatile input/output interfaces, such as digital and relay outputs, batch control, alarm and flow totalizing, 4-20mA output and optional thermal energy measurement, which can be easily used by a host computer, PLC or a flow controller for process monitoring and control. Additionally, the built-in isolated RS-485 port and the optional GPRS/GSM module make remote flow monitoring easy and reliable.

Non-intrusive. Non-obstructive

With clamp-on transducers, the installation becomes very simple and easy. No pipe work is required and there is no risk of leaking or contamination. With wetted transducers, there is no obstruction to the flow, thus, there is no pressure drop.

Economical to Operate. Economical to Own

The ultrasonic transducers are made from crystal, and there are no moving parts to wear and tear. The whole meter system is completely solid state, and therefore, the EF10 is both a robust and reliable system. It does not require maintenance or downtime which eliminates any potential incurred costs.

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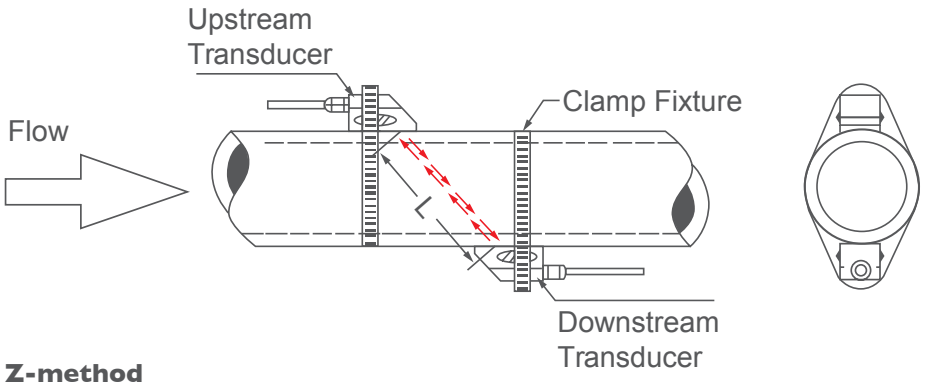
Measurement Principle

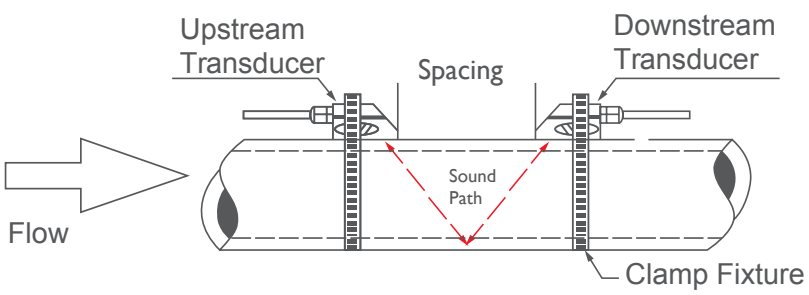
The EnduroFlow™ Series flowmeters are based on the transit-time measurement principle. The system utilizes a pair of sensors (A and B in figure below) that function as both ultrasonic transmitter and receiver. The sensors are installed on the pipe wall, either clamped on the outside of the pipe or inserted into the pipe at a specific distance from each other, and the flow meter operates by alternately transmitting and receiving a coded burst of sound energy between those two sensors and measuring the transit time it takes for sound to travel between the two sensors. The difference in the transit time is directly related to the velocity of the liquid in the pipe. The flowrate is then calculated based on the transit-time difference, the geometry of the pipe and the fluid dynamics formula.

The sensors are commonly mounted with the Z-method or the V-method. With the Z-method, the two sensors are installed on opposite side of a pipe. This method offers shorter sound path, thus, better signal strength. It is often used for large size pipes where signal strength is more important. With the V-method, the two sensors are installed on the same side of the pipe. The sound path is doubled, and as a result, the measurement accuracy is better. This method is often used for small and medium size pipes.

For insertion and flow-cell type transducers, however, only the Z-method is used.



Z-method



V-method

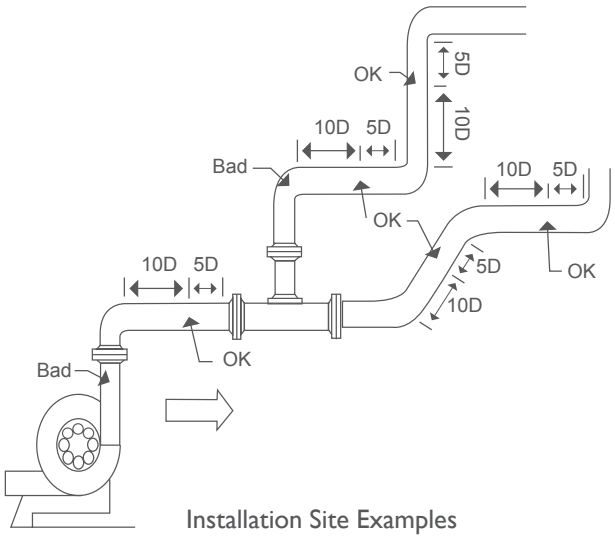
Typical Transducer Installation

The four figures below illustrate how the transducers are installed on a pipe. The clamp-on transducer (figure a) is mounted on the outside of a pipe with a mounting fixture using the V-method. The insertion transducer (figure b) is hot-tapped or cold tapped onto the pipe using the Z-method. The flow-cell (spool-piece) transducer comes in two varieties: for size DN40 (1 ½") or smaller, PI-type transducer (figure c) is used, where its pipe joint could be threaded or flanged. For size DN50 (2") or larger, the transducer is a standard spool-piece with two ultrasonic sensors installed using the Z-method (figure d) where it is normally connected to a pipe line using a flange connection.

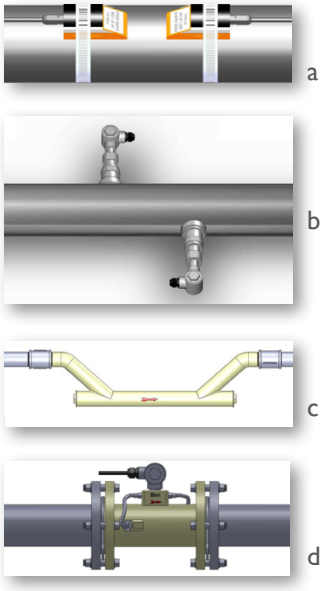
Transducer Mounting Site Selection

The site of the transducer installation is very important. Here are some recommendations for selecting the right site:

- In order to achieve good accuracy, it is recommended to have 15D straight-pipe run: upstream 10D and downstream 5D, where D is pipe diameter.
- If there is a valve upstream and the valve is not fully open, it could generate flow disturbance. A longer upstream straight pipe is recommended.
- If there is a pump upstream, we recommend to have 25D straight pipe run.
- If the pipe is vertical, make sure the flow is going upward, not downward. Downward flow could have air gaps if the flow is free fall.
- If the pipe is horizontal, make sure the pipe is full! The transducers should be installed on the side of the pipe, not on the top or bottom of the pipe.



Installation Site Examples



EnduroFlow™ Series EF10

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Specifications: Flow Transmitter (Main Unit)

Flow Velocity	± 10 m/s (± 32 ft/s). Bi-directional
Accuracy	±1% of reading ±0.008m/s (±0.03ft/s) in velocity*
Repeatability	0.2%
Response Time	0.5s. Configurable between 0.5s and 99s
Display/Keypad	LCD with backlight. 2 x 20 letters. 4 x 4 tactile-feedback membrane keypad. Displays instantaneous flow rate, flow total (positive, negative and net), velocity, time, temperature, energy, analog outputs/inputs
Units	English (U.S.) or metric
Physical Quantity	Volumetric flow rate, total flow, velocity, analog inputs
Totalizers	Positive totalizer, negative totalizer, net totalizer, daily totalizer, monthly totalizer, yearly totalizer, manual totalizer
Security	Keypad can be locked with password
Outputs	
• Current Output	0/4-20mA isolated output for flowrate, velocity or sound speed. Impedance 0-1k. Accuracy 0.1%
• Digital Output	Optically isolated OCT (Open Collector Transistor) output. Up to 0.5A load. Can be programmed as: • Pulse signal for flow totalization • ON/OFF signal for special event such as overflow, no flow, reverse flow, leakage alarming, and more • START/STOP signal for batch control Can be used to drive pulse counter, external relay, alarm, PLC counter
• Relay Output	1A@125VAC or 2A@30VDC. Can be programmed as: • Pulse signal for flow totalization • ON/OFF signal for special event such as overflow, no flow, reverse flow, leakage alarming, and more • START/STOP signal for batch control Can be used to drive pulse counter, external relay, alarm, PLC counter, or, to control pump, valve, light
• Sound Alarm	One sound alarm, programmable to specific event such as overflow, no flow, reverse flow, leakage alarming

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Inputs	One 4-20mA input for temperature, pressure or liquid level transmitter Two temperature channels for accommodating two PT100 4-wire temperature sensors. This function is only available upon request	
Recording	Automatically records the daily total of the last 512 days and the monthly total of the last 128 months Optional SD data logger (2GB space) for recording velocity, flow, status, etc.	
Communication Interface	Isolated RS-485 with power surge protection. Supports the MODBUS protocol Optional RF / GPRS / GSM module for wireless networking, remote monitoring and remote control	
Software	uGalaxy_GPRS and uGalaxy_GSM wireless telemetry systems are available upon request	
Telemetry	uGalaxy_GPRS and uGalaxy_GSM wireless telemetry systems are available upon request**	
Enclosure	Standard (EF10-x-A)	Enhanced (EF10-x-B)
• Protection	IP65	IP66 (NEMA 4X)
• Dimensions	280mm x 190mm x 54mm (11" x 7.5" x 2.1")	305mm x 254mm x 102mm (12" x 10" x 4")
• Features	Weather-proof Aluminum, power coded	Weather-proof Polycarbonate. High-impact, UV resistant. UL-50/c-UL Listed
Weight	5kg (10lbs)	7.5kg (15lbs)
Environment Temp	60°C (140°F)	60°C (140°F)
Power sources	12-24 VDC, 90-260 VAC 50/60 Hz <2W @12VDC	12-24 VDC, 90-260 VAC 50/60 Hz <2W @12VDC

Notes:

* Under reference condition and velocity should be above 0.5ft/s. Flowrate is calculated by multiplying velocity with the inner cross-section area of the pipe.

** For wireless telemetry system solution, please contact solutions@spiremt.com.

EnduroFlow™ Series EF10

Ultrasonic Transit-Time Flowmeter For Permanent Installation

How To Order Flow Transmitter (Main Unit)

Please select one option (ID) from each category.

EF10-□-□-□-□-□-□-□-□

Type	ID
Clamp-on (See page 9 for transducer configuration)	C
Insertion (See page 11 for transducer configuration)	I
Flow-cell (See page 14 for transducer configuration)	F

Enclosure	ID
Standard IP65	A
Enhanced IP66	B
Other, please specify	C

Power Supply	ID
110VAC & 12-24VDC	1
220VAC & 12-24VDC	2

Data Logger	ID
None	N
2GB SD data logger for recording flow with programmable interval	Y

Wireless	ID
None	0
GSM	1
GPRS	2
RF	3
Other, please specify	4

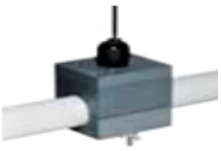
External Adapter	ID
None	A
485-USB (to connect to a PC)	B
485-Ethernet (to connect to an Ethernet network)	C
Other, please specify	D

PC Software [485-USB or 485-Ethernet adapter required for PC software use]	ID
None	0
StufManager (for real-time data acquisition)	1
uGalaxy Telemetry System	2

Attention

You must order both flow transmitter (main unit) and flow transducer to make a complete flowmeter system.

Specifications: Clamp-On Transducer

Model	Picture	Description
Type: HFx PN#: TWC-X (x=1-5)	 (shape may vary)	**Standard temperature, FITTED** Temperature range 0˚F-140˚F (-20˚C - 60˚C). Compact 2MHz transducer. Fit to one pipe size only TWC-HF1: for ½" (DN15) pipe TWC-HF2: for ¾" (DN20) pipe TWC-HF3: for 1" (DN25) pipe TWC-HF4: for 1 ¼" (DN32) pipe TWC-HF5: for 1 ½" (DN40) pipe
Type: HF0 PN#: TWC-6		**Standard temperature, clamp-on, 2MHz** Temperature 0˚F - 176˚F (-20˚C - 80˚C) Clamp-on 2MHz transducer TWC-HF0: for ¾" - 2" (DN20-DN50) pipes
Type: M1 PN#: TWC-7		**Standard temperature, clamp-on, 1MHz** Temperature 0˚F - 176˚F (-20˚C - 80˚C) Clamp-on 1MHz transducer (magnetic) For medium size pipes 2" - 28" (DN50-DN700)
Type: LF PN#: TWC-8		**Standard temperature, clamp-on, 0.5MHz** Temperature 0˚F - 176˚F (-20˚C - 80˚C) Clamp-on 0.5MHz transducer. For large size pipes 12" - 120" (DN300- DN3000)
Type: HF0HT PN#: TWC-9		**High temperature, clamp-on** High temperature 32˚F - 300˚F (0˚C - 150˚C) Clamp-on 2MHz transducer For ¾" - 2" (DN20-DN50) pipes
Type: M1HT PN#: TWC-10		**High temperature, clamp-on** High temperature 32˚F - 300˚F (0˚C - 150˚C) Clamp-on 1MHz transducer For medium size pipes 2" - 28" (DN50-DN700)

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How To Order Clamp-On Transducer:

Please select one option **(ID)** from each category.

TWC - □-□□□□-□-□-□-□-□-□

Flow Transducer Type	ID
Standard temperature, FITTED:	
HF1 - 2MHz, for pipe size ½"	1
HF2 - 2MHz, for pipe size ¾"	2
HF3 - 2MHz, for pipe size 1"	3
HF4 - 2MHz, for pipe size 1 ¼"	4
HF5 - 2MHz, for pipe size 1 ½"	5
Standard temperature, clamp-on, 2MHz:	
HF0 - 2MHz, for pipe sizes ¾" - 2"	6
Standard temperature, clamp-on, 1MHz:	
M1 - 1MHz, for pipe size 2" - 28"	7
Standard temperature, clamp-on, 0.5MHz:	
LF - 0.5MHz, for pipe size 12" - 120"	8
High temperature, clamp-on:	
HF0HT - 2MHz, for pipe size ¾" - 2"	9
M1HT - 1MHz, for pipe size 2" - 28"	10

Pipe Size
Please write nominal pipe size.

**Please reference example shown on the right.*

Pipe Size Unit	ID
Inch	I
Millimeter	M

Pipe Type	ID
Copper	A
Rigid Tubing	B
ANSI Plastic	C
ANSI Metal	D
Stainless Steel	E
Other, please specify	F

Cable Length	ID
5m (15ft)	1
15m (50ft)	2
50m (150ft)	3
Other, please specify	4

***Attention**

When indicating nominal pipe size please reference the following:

For 1/2 inch → **0.50**
For DN15 → **0015**
For 1.5 inch → **01.5**

ID	Clamp Fixture	
0	None	
1	½" - 2"	(DN15-50)
2	2" - 4"	(DN50-100)
3	5" - 8"	(DN125-200)
4	10" - 12"	(DN250-300)
5	14" - 16"	(DN350-400)
6	18" - 20"	(DN450-500)
7	Other, please specify	

ID	Liquid Temperature
A	32° - 176°F (0° - 80°C)
B	32° - 300°F (0° - 150°C)
C	Other, please specify

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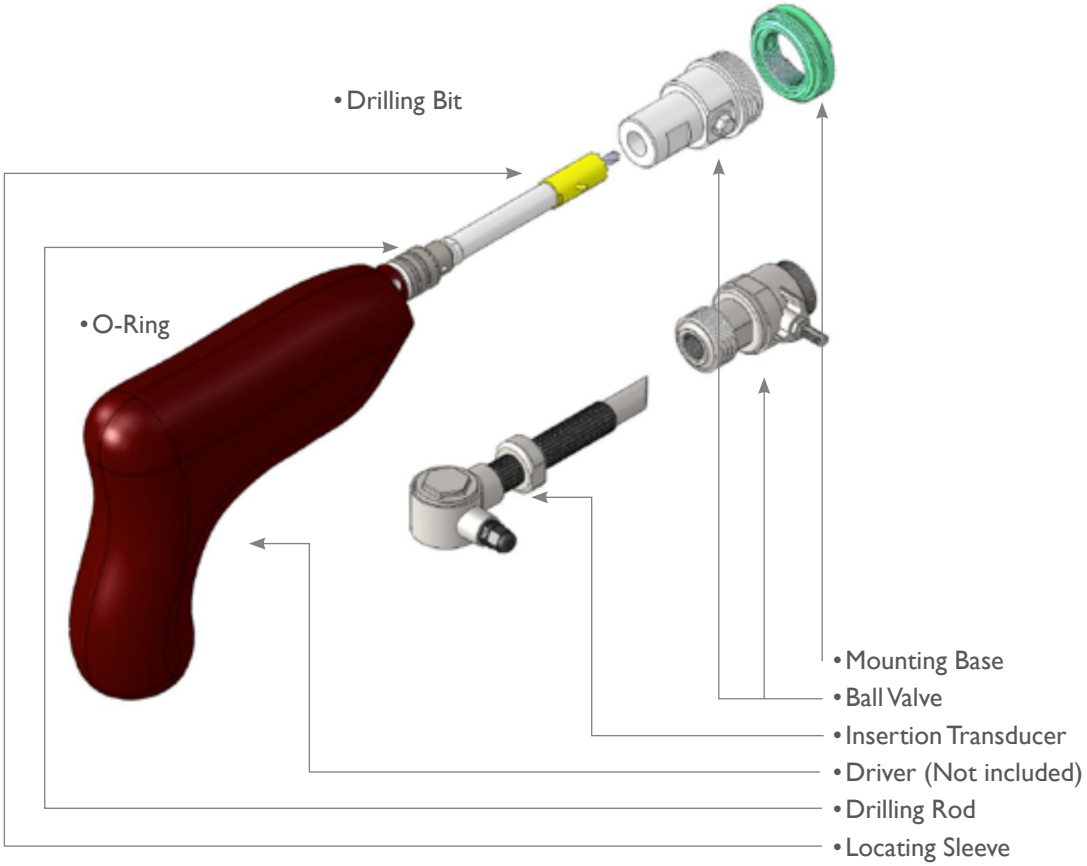
Specifications: Insertion Transducer

Model	Picture	Description
Type: INS PN#: TWI-V		Insertion transducer, vertical type, 1MHz. For pipe size 3" - 40" (DN80-1000) Temperature range 32˚F - 300˚F (0˚C - 150˚C).
Type: INS PN#: TWI-I		Insertion transducer, inclined type, 1MHz. For pipe size 3" - 40" (DN80-1000) Temperature range 32˚F - 300˚F (0˚C - 150˚C). (Not recommended)
Type: PN#: TWI-HTK		Hot-tapping tool kit for insertion transducer installation



How To Order Insertion Transducer

Please select one option (ID) from each category.

TWI -□-□-□-□□□□

Type	ID
Vertical	V
Inclined	I

Cable Length	ID
None	0
5m (15ft)	I
15m (50ft)	2
50m (150ft)	3
Other, please specify	4

Hot-tapping Tool Kit	ID
Yes	Y
None	N

Pipe Size	ID
3"- 40" (DN80-DN1000mm)	I
40" -120" (DN1000-DN3000mm)	2

Pipe Material	ID
Steel	I
Plastic	2
Concrete	3
Other, please specify	4

Pressure	ID
0.6MPa (87psig)	A
1MPa (145psig)	B
1.6MPa (232psig)	C
2.5MPa (362psig)	D
Other, please specify	E

Liquid Temperature	ID
32-176°F (0-80°C)	I
32-300°F (0-150°C)	2
Other, please specify	3

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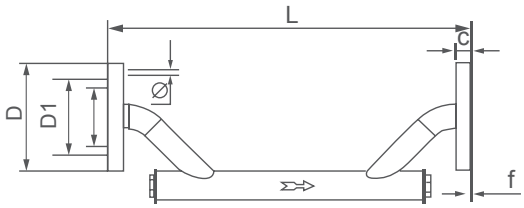
Specifications: Flow-Cell Transducer

Flow Cell	Pipe Size Range	Temperature Range	Flow Vel. Range	Pipe Joint
PI-type	⅜" - 1 ½" (DN10-40)	32° - 266°F (0° - 130°C)	±15ft/s (±5m/s)	Thread/Flange
Standard-type	2" - 40" (DN50-1000)	32° - 266°F (0° - 130°C)	±24ft/s (±8m/s)	Flange

PI Type Flow-cell Transducer

Unit: mm
Max Pressure Rating: 2.5MPa (362psig)

Nominal Size DN		Length L	Flange Dimension (DIN)					Flange Thickness C
mm	in		D	D1	D-Φ	D2	f	
10	⅜"	300	90	60	4-14	41	2	14
15	½"	320	95	65	4-14	46	2	14
20	¾"	360	105	75	4-14	56	2	16
25	1"	390	115	85	4-14	65	3	16
32	1 ¼"	450	140	100	4-18	76	3	18
40	1 ½"	500	150	110	4-18	84	3	18



Notes :

- The above flange is DIN type. ANSI flange is available upon request.
- Threaded pipe joint, BSP or NPT, is available upon request.

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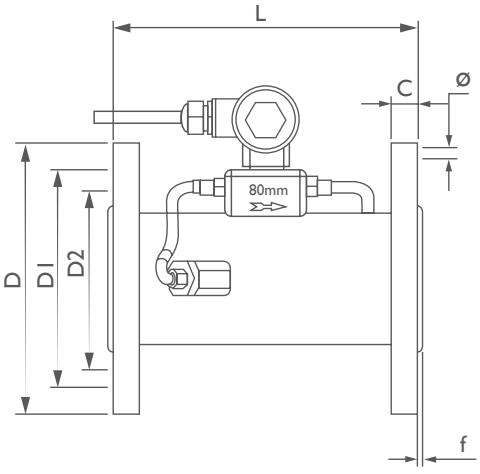
Standard Type Flow-cell Transducer

Unit: mm
Max Pressure Rating: 1.6MPa (232psig)

Nominal Size DN		length L	Flange Dimension (DIN)			Sealing Face		Thickness
mm	in		D	D1	Φ X n	D2	f	C
50	2”	200	165	125	18x4	99	3	20
65	2 ½”	200	185	145	18x4	118	3	20
80	3”	225	200	160	18x4	132	3	20
100	4”	250	220	180	18x8	156	3	22
125	5”	250	250	210	18x8	184	3	22
150	6”	300	280	240	22x8	211	3	24
200	8”	350	340	295	22x12	266	3	24
250	10”	450	405	355	26x12	319	3	26
300	12”	500	460	410	26x12	370	4	28
350	14”	550	520	470	26x12	429	4	30
400	16”	600	580	525	26x12	480	4	32
450	18”	700	640	585	30x20	548	4	34
500	20”	800	715	650	33x20	609	4	36
600	24”	1000	840	770	36x20	702	5	38
700	28”	1100	910	840	36x24	794	5	40
800	32”	1200	1025	950	39x24	901	5	42
900	36”	1300	1125	1050	39x28	1001	5	44
1000	40”	1400	1255	1170	42x28	1112	5	46



Notes :

- The above flange is DIN type.
  We also offer ANSI RF150 flange as the pipe joint upon request.
- For sizes larger than DN500 (20”), please consult us before placing order.

How To Order Flow-Cell Transducer

Please select one option (ID) from each category.

TWF - □□-□-□-□-□-□-□

Flow-cell Size		ID			ID
⅜"	(DN10)	01	8"	(DN200)	13
½"	(DN15)	02	10"	(DN250)	14
¾"	(DN20)	03	12"	(DN300)	15
1"	(DN25)	04	14"	(DN350)	16
1 ¼"	(DN32)	05	16"	(DN400)	17
1 ½"	(DN40)	06	18"	(DN450)	18
2"	(DN50)	07	20"	(DN500)	19
2 ½"	(DN65)	08	24"	(DN600)	20
3"	(DN80)	09	28"	(DN700)	21
4"	(DN100)	10	32"	(DN800)	22
5"	(DN125)	11	36"	(DN900)	23
6"	(DN150)	12	40"	(DN1000)	24

Pipe Joint	ID
BSP Threading (only available for size <DN50/2")	A
NPT Threading (only available for size <DN50/2")	B
DIN Flange	C
ANSI 150# Flange	D
Other, please specify	E

Flow-cell Material	ID
Carbon Steel (default)	1
Stainless Steel	2
Plastic	3
Other, please specify	4

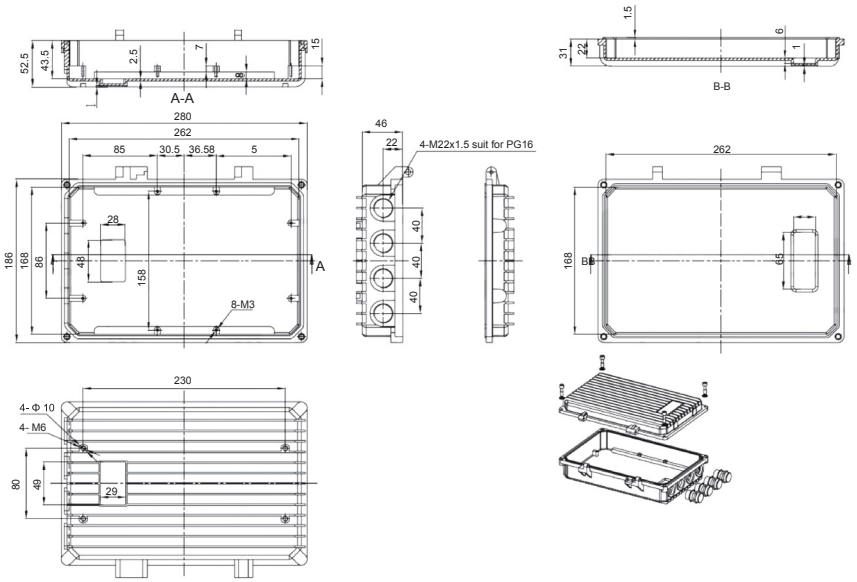
Pressure	ID
0.6MPa (87psig) (for sizes >DN500/20")	A
1MPa (145psig) (for sizes from DN300/12" to DN500/20")	B
1.6MPa (232psig) (for sizes from DN50/2" to DN250/10")	C
2.5MPa (362psig) (for sizes <DN50/2")	D
Other, please specify	E

ID	Cable Length
A	None
B	5m (15ft) (default)
C	15m (50ft)
D	50m (150ft)
E	Other, please specify

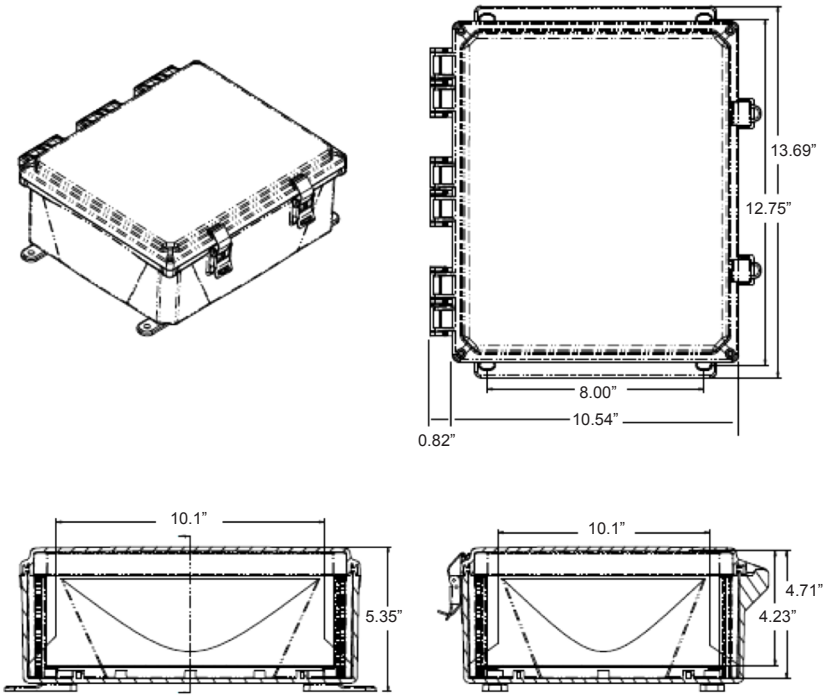
ID	Liquid Temperature
1	0° - 176°F (-20° - 80°C)
2	32° - 300°F (0° - 150°C)

Dimensions

Standard Enclosure (EF10-x-A)



Enhanced Enclosure (EF10-x-B)



Application Examples

Example 1: Chiller System
Company A has a chiller pipe, 8" size, carbon steel, schedule 40. They want to monitor the flowrate in the pipe with clamp-on technology. There is a 10ft straight pipe run after an elbow and the flow transmitter (main unit) will be installed in a control room which is 15 feet away from the transducer location.

In this application, the customer needs to use the following:

Flow transmitter: EF10-C-I-A-I-N-0
Clamp-on Transducer (pair):

Example 2: Geothermal System
Company B has a geothermal hot water system. They need to measure how much hot water has been generated each day. The main pipe is a 4" copper pipe with the water temperature being around 160°F (71.1 °C). They want to use a non-intrusive method to measure the flow, and the flow data needs to be logged every 5 minutes for 3 months.

The operator of this geothermal plant wants to use their cell phone to check the flow so to further monitor the system status anywhere they go. Also, in case the flow is over the limit or below certain flowrate requirements, which could indicate a pump failure, the operator wants to receive an alarm message from the flowmeter immediately.

In this application, the customer needs to use the following: EF10-C clamp-on flowmeter with GSM wireless option.

Flow transmitter: EF10-C-I-A-I-Y-I
Clamp-on Transducer (Pair):
TWC-7-00041-D-I-A-2

About Spire Metering Technology

Formerly Shenitech, Spire Metering is a global leader in flow and energy management solutions. Through continuous innovation, we transform cutting-edge technologies into affordable, reliable solutions for accurate flow and energy measurement. Spire Metering offers water, heat, electricity and gas meters as well as AMR/AMI solutions. To find out how we can help today, please tell us about your application.