



# 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, metropolitan areas, 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 wear and tear
- No maintenance required
- NIST-traceable factory calibration
- Suitable for pure liquids and liquids with minimal particles
- No dependency on conductivity
- Suitable for all commonly used metal and plastic pipes
- Built-in daily and monthly data log. Optional SD data logger
- Easy to use and set up
- Communication: RS485/MODBUS. Optional GPRS, BACnet / MTSP
- Compatible with various types of transducers
- Clamp-on transducer: non-contact, non-invasive, easy and economical installation, no pipe work or plumbing needed
- Insertion transducer: sturdy, 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



DS-EF10-1205\_Rev.5



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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 (no more than 1% and particle size less than 75um. 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 at 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 BACnet / GPRS 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 Own and Operate

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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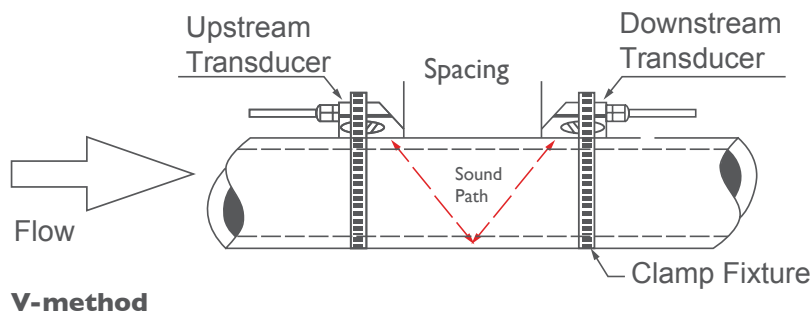
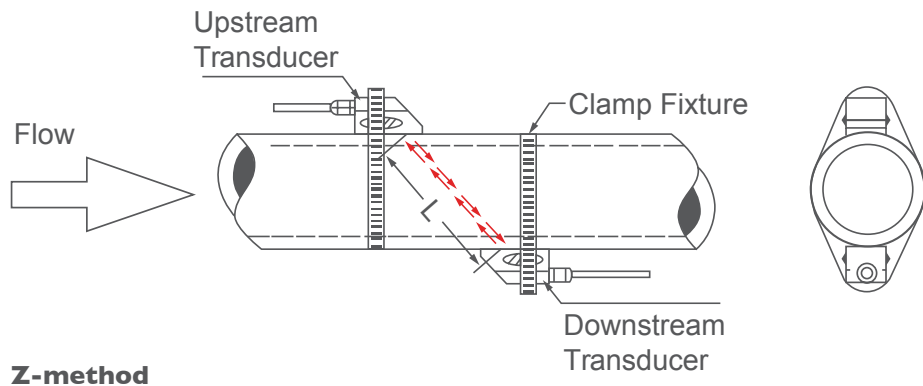
Ultrasonic Transit-Time Flowmeter For Permanent Installation

## 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 sides 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.





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## Typical Transducer Installation

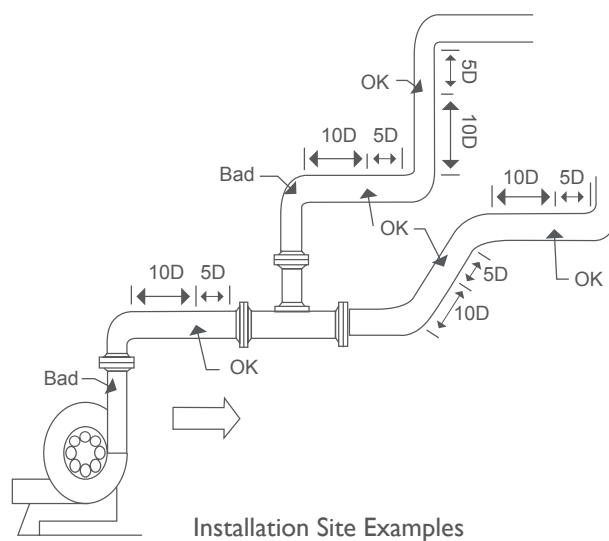
The four figures below illustrate how the transducers are installed on a pipe. The clamp-on transducer (figure a) is mounted on the outside of a pipe with a mounting fixture using the V-method. The insertion transducer (figure b) is hot-tapped or cold-tapped onto the pipe using the Z-method. The flow-cell (spool-piece) transducer comes in two varieties. For sizes

1½" or smaller, PI-type transducers (figure c) are used and the pipe joint could be threaded or flanged. For sizes 2" and larger, the transducers are configured in a standard spool-piece with two ultrasonic sensors installed via the Z-method (figure d). The spool-piece is normally connected to a pipe line using a flange.

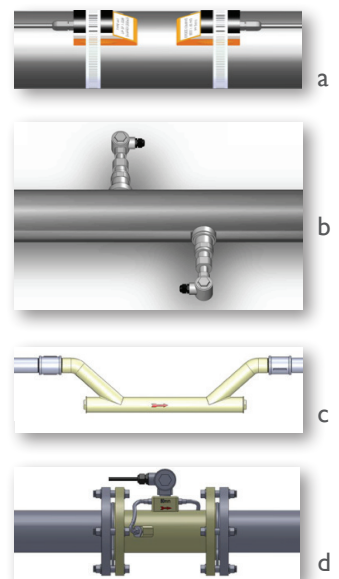
## Transducer Mounting Site Selection

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 in a 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)

<b>Flow Velocity</b>	±32 ft/s. Bi-directional
<b>Accuracy</b>	±1% of reading ±0.03ft/s in velocity*
<b>Repeatability</b>	0.2%
<b>Response Time</b>	0.5s. Configurable between 0.5s and 99s
<b>Display/Keypad</b>	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
<b>Units</b>	English (U.S.) or metric
<b>Physical Quantity</b>	Volumetric flow rate, total flow, velocity, analog inputs
<b>Totalizers</b>	Positive totalizer, negative totalizer, net totalizer, daily totalizer, monthly totalizer, yearly totalizer, manual totalizer
<b>Security</b>	Keypad can be locked with password
<b>Outputs</b>	See below for 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: <ul style="list-style-type: none"> <li>• Pulse signal for flow totalization</li> <li>• ON/OFF signal for special event such as overflow, no flow, reverse flow, leakage alarming, and more</li> <li>• START/STOP signal for batch control</li> </ul> Can be used to drive pulse counter, external relay, alarm, PLC counter
• Relay Output	1A@125VAC or 2A@30VDC. Can be programmed as: <ul style="list-style-type: none"> <li>• Pulse signal for flow totalization</li> <li>• ON/OFF signal for special event such as overflow, no flow, reverse flow, leakage alarming, and more</li> <li>• START/STOP signal for batch control</li> </ul> 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 alarm





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<b>Inputs</b>	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.	
<b>Recording</b>	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.	
<b>Communication Interface</b>	Isolated RS-485 with power surge protection. Supports the MODBUS protocol Optional BACnet MSTP or GPRS module for networking, remote monitoring and remote control	
<b>Software</b>	StufManager PC software available upon request	
<b>Telemetry</b>	uGalaxy_GPRS wireless telemetry systems are available upon request**	
<b>Enclosure</b>	Standard (EF10-x-A)	Enhanced (EF10-x-B)
• Protection	IP65	IP66 (NEMA 4X)
• Dimensions	11" x 7.5" x 2.1"	12" x 10" x 4"
• Features	Weather-proof Aluminum, power coded	Weather-proof Polycarbonate. High-impact, UV resistant. UL-50/c-UL Listed
<b>Weight</b>	10lbs	15lbs
<b>Environment Temp</b>	140°F	140°F
<b>Power sources</b>	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](mailto:solutions@spiremt.com).



# EnduroFlow™ Series EF10

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## How To Order Flow Transmitter (Main Unit)

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

EF10 -  -1

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



### Attention

You must order both flow transmitter (main unit) and Transducer pair to make a complete flowmeter system. Both flow transmitter and transducer should have the same frequency.

### Required Accessories

Power Supply Cable	Model No.
110VAC (American Standard Plug)	WA-PWC-1

### Optional Accessories

External Adapter (please select only one)	Model No.
485-USB (to connect to a PC)	WA-485USB
485-BACnet / MSTP (to connect to a BACnet Gateway)	WA-BACMSTP
485-GPRS (Must select the Enhanced IP66 Enclosure option)	WA-EP228
Disc Antenna	WA-EPANT
PC Software (485-USB adapter required for PC software use)	Model No.
StufManager (for real-time data acquisition)	SW-STMGR
Telemetry System (required for 485-GPRS adapter)	Please contact us
Data Logger	Model No.
2GB SD data logger (for recording flow, temperature, and energy)	WA-SD



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## Specifications: Clamp-On Transducer

Model	Picture	Description
Type: RM1 PN#: TWC-RM1		<b>Standard temperature, clamp-on WITH mounting rail, 1MHz</b> Temperature 0°F~176°F TWC-RM1: 1MHz transducer WITH mounting rail for pipe size 2½"~28"
Type: RM1HT PN#: TWC-RM1HT		<b>High temperature, clamp-on WITH mounting rail, 1MHz</b> High temperature 32°F~300°F TWC-RM1HT: 1MHz high temp transducer WITH mounting rail for pipe sizes 3"~28"
Type: S1HT PN#: TWC-S1HT		<b>High temperature, clamp-on WITHOUT mounting rail, 1MHz</b> High temperature 32°F~300°F TWC-S1HT: 1MHz high temp transducer WITHOUT mounting rail for pipe sizes 1½"~4"
Type: M1HT PN#: TWC-M1HT		<b>High temperature, clamp-on WITHOUT mounting rail, 1MHz</b> High temperature 32°F~300°F TWC-M1HT: 1MHz high temp transducer WITHOUT mounting rail for pipe sizes 3"~28"





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## How To Order Clamp-on Transducer:

Please select one option (ID) from each category.

TWC -

Transducer Type	ID
<b>Standard temperature (32~176°F), clamp-on</b>	
1MHz transducer WITH mounting rail for pipe sizes 2½"~28"	RM1
<b>High temperature (32~300°F), clamp-on</b>	
1MHz high temp transducer WITH mounting rail for pipe sizes 3"~28"	RM1HT
1MHz high temp transducer WITHOUT mounting rail for pipe sizes 1½"~4"	S1HT
1MHz high temp transducer WITHOUT mounting rail for pipe sizes 3"~28"	M1HT

### Required Accessories (choose one from each category)

Transducer Cable	Model No.
15ft shielded transducer cable (in pair)	TW-CBL-15Ft
50ft shielded transducer cable (in pair)	TW-CBL-50Ft
150ft shielded transducer cable (in pair)	TW-CBL-150Ft
300ft shielded transducer cable (in pair)	TW-CBL-300Ft
Clamp Fixture	Model No.
Metal strip clamp for ¾"~2" pipe	TW-CLP-1
Metal strip clamp for 2"~4" pipe	TW-CLP-2
Metal strip clamp for 5"~8" pipe	TW-CLP-3
Metal strip clamp for 10"~12" pipe	TW-CLP-4
Metal strip clamp for 14"~16" pipe	TW-CLP-5
Metal strip clamp for 18"~20" pipe	TW-CLP-6

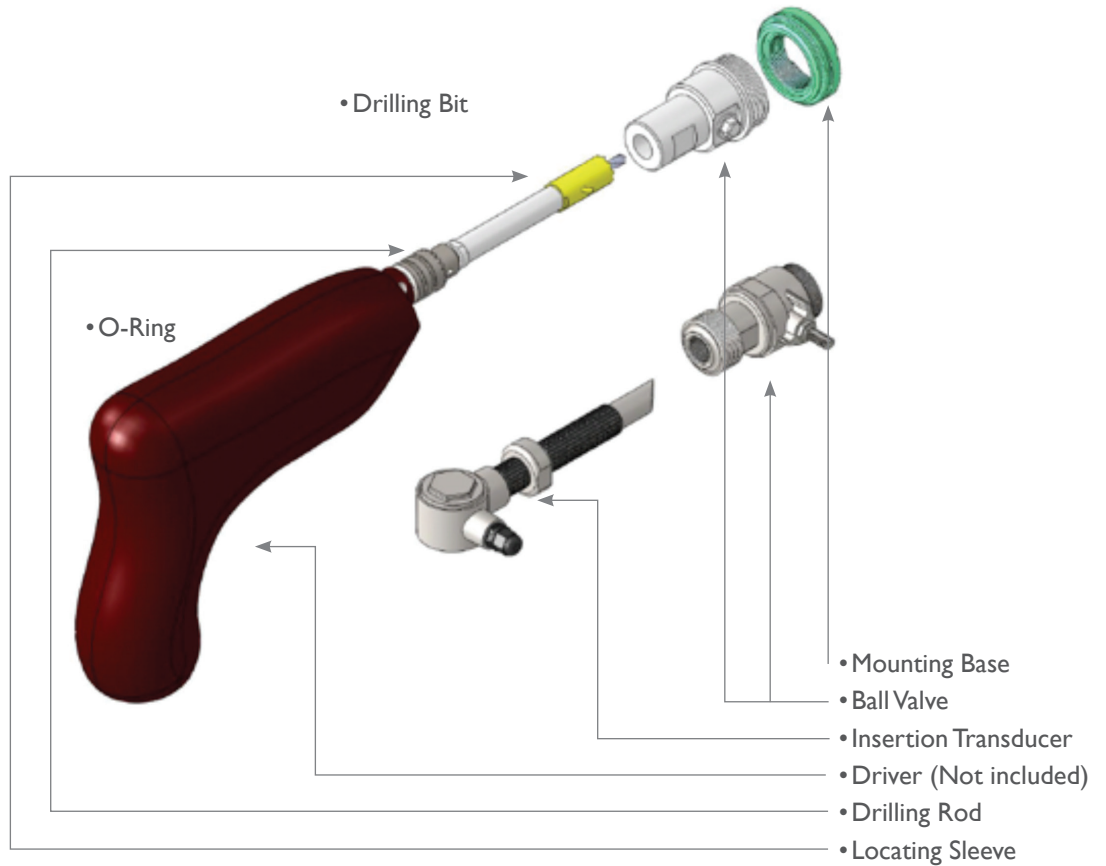


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## Specifications: Insertion Transducer

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





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Ultrasonic Transit-Time Flowmeter For Permanent Installation

## How To Order Insertion Transducer

Please select one option (ID) from each category.

TWI -  -  -  -

Type	ID
Vertical	V
Inclined	I

Pipe Size	ID
3"~40"	1
40"~120"	2

Pipe Material	ID
Steel	1
Plastic	2
Concrete	3
Other, please specify	4

ID	Pressure
A	87psig
B	145psig
C	232psig
D	362psig
E	Other, please specify

### Required Accessories

Cable Length	Model No.
15ft	TW-CBL-15Ft
50ft	TW-CBL-50Ft
150ft	TW-CBL-150Ft
300ft	TW-CBL-300Ft
Hot-tapping Tool Kit	TWI-HTK



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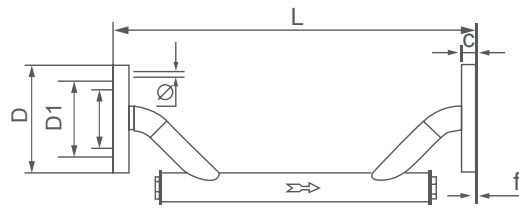
## Specifications: Flow-Cell Transducer

Flow Cell	Pipe Size Range	Temperature Range	Flow Vel. Range	Pipe Joint
PI-type	3/8"~1 1/2"	32°F~266°F	±15ft/s	Thread / Flange
Standard-type	2"~40"	32°F~266°F	±24ft/s	Flange

Unit: IN  
Max Pressure Rating: 362psig

### PI Type Flow-cell Transducer

Nominal Size in	Length L	Flange Dimension ANSI RF#150					Flange Thickness C
		D	D1	D-Φ	D2	f	
3/8"							
1/2"	12.60	3 1/2	2 3/8	4 * 1/2	1 3/8	1/16	7/16
3/4"	14.17	3 7/8	2 3/4	4 * 1/2	1-11/16	1/16	1/2
1"	15.35	4 1/4	3 1/8	4 * 1/2	2	1/16	9/16
1 1/4"	17.72	4 5/8	3 1/2	4 * 1/2	2 1/2	1/16	5/8
1 1/2"	19.69	5	3 7/8	4 * 1/2	2 7/8	1/16	11/16



### 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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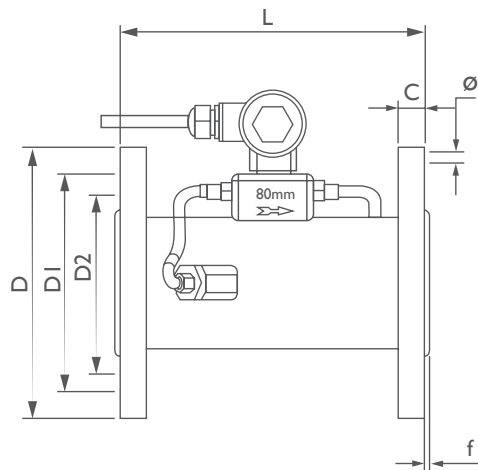
Ultrasonic Transit-Time Flowmeter For Permanent Installation

Unit: IN

Max Pressure Rating: 232psig

## Standard Type Flow-cell Transducer

Nominal Size	Length	Flange Dimension ANSI RF#150					Flange Thickness
		D	D1	D-Φ	D2	f	
2"	7.87	6	4¾	4 * 5/8	3 5/8	1/16	¾
2½"	7.87	7	5½	4 * 5/8	4 1/8	1/16	7/8
3"	8.86	7½	6	4 * 5/8	5	1/16	15/16
4"	9.84	9	7½	8 * 5/8	6-3/16	1/16	15/16
5"	9.84	10	8½	8 * ¾	7-5/16	1/16	15/16
6"	11.81	11	9½	8 * ¾	8½	1/16	1
8"	13.78	13½	11¾	8 * ¾	10 5/8	1/16	1 1/8
10"	17.72	16	14¼	12 * 7/8	12¾	1/16	1-3/16
12"	19.69	19	17	12 * 7/8	15	1/16	1¼
14"	21.65	21	18¾	12 * 1	16¼	1/16	1 3/8
16"	23.62	23½	21¼	16 * 1	18½	1/16	1-7/16
18"	27.56	25	22¾	16 * 1 1/8	21	1/16	1-9/16
20"	31.50	27½	25	20 * 1 1/8	23	1/16	1-11/16
24"	39.37	32	29½	20 * 1 1/4	27¼	1/16	1 7/8



### Notes :

- The above flange is ANSI type.
- For sizes larger than 20", please consult us before placing order.



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## How To Order Flow-Cell Transducer

Please select one option (ID) from each category.

TWF -  -  -  -

Flow-cell Size	ID
3/8"	01
1/2"	02
3/4"	03
1"	04
1 1/4"	05
1 1/2"	06
2"	07
2 1/2"	08
3"	09
4"	10
5"	11
6"	12
8"	13
10"	14
12"	15
14"	16
16"	17
18"	18
20"	19
24"	20
28"	21
32"	22
36"	23
40"	24

ID	Pressure
A	87psig for sizes >20"
B	145psig for sizes from 12" to 20"
C	232psig for sizes from 2" to 10"
D	362psig for sizes <2"
E	Other, please specify

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

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

### Required Accessories

Cable Length	Model No.
15ft	TW-CBL-15Ft
50ft	TW-CBL-50Ft
150ft	TW-CBL-150Ft
300ft	TW-CBL-300Ft

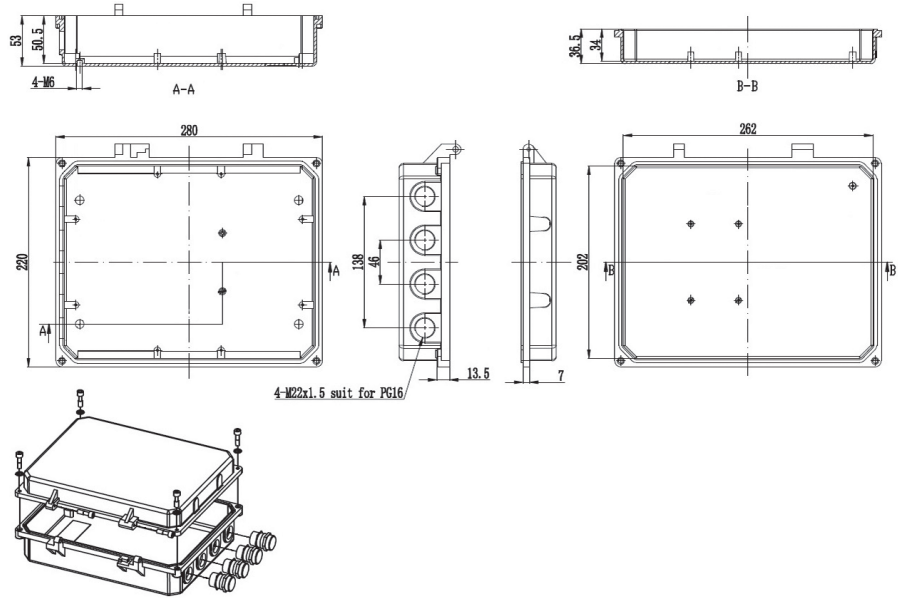


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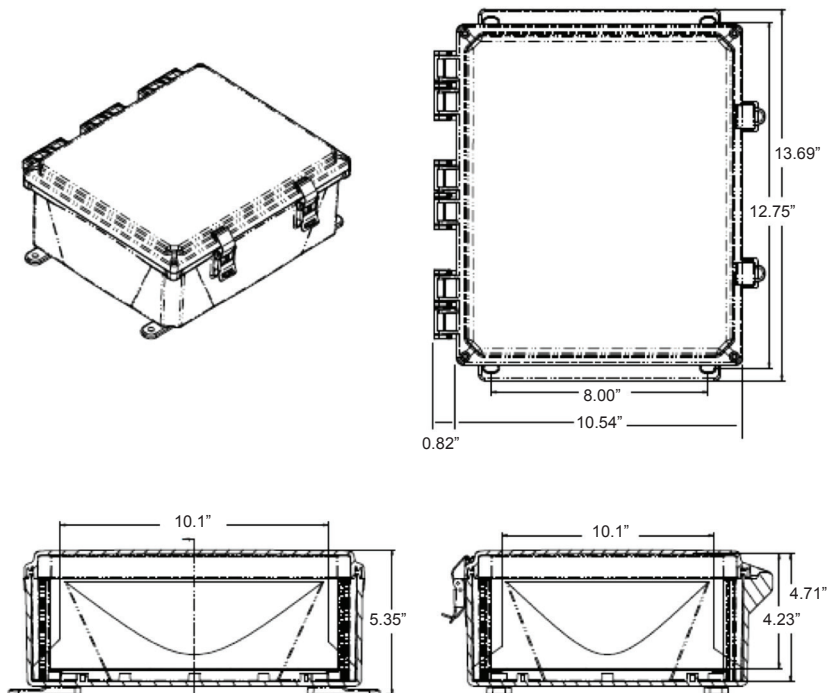
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## Dimensions

### Standard Enclosure (EF10-A)



### Enhanced Enclosure (EF10-B)





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## 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-A-0  
WA-PWC-1

Clamp-on Transducer (pair):  
TWC-RM1  
TW-CBL-15Ft  
TW-CLP-IN008

### 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. 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 GPRS wireless option.

Flow transmitter:  
EF10-B-0  
WA-PWC-1  
WA-EP228  
WA-SD

Clamp-on Transducer (Pair):  
TWC-M1  
TW-CBL-15Ft  
TW-CLP-IN004

## About Spire Metering Technology

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 and billing solutions. Let us help you with your application today.

