EnduroFlow™ Series EF10

LIQUID

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 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 tear and wear. No maintenance required
- NIST-traceable factory calibration
- Suitable for pure liquids and liquids with less than 1% particle concentration and particle size < 75um
- No dependency on conductivity
- Suitable for all commonly used metal and plasic pipes
- Built-in daily and monthly data log. Optional SD data logger.
- Easy to use and set up
- Communication: RS485/MODBUS. Optional GPRS, BACnet / MSTP

- Compatible with various types of transducers:
  - Clamp-on transducer: non-contact, non-invasive, easy and economical installation, no pipe work 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

SPIRE METERING TECHNOLOGY

EnduroFlow™ Series EF10
Ultrasonic Transit-Time Flowmeter For Permanent Installation

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 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 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 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.
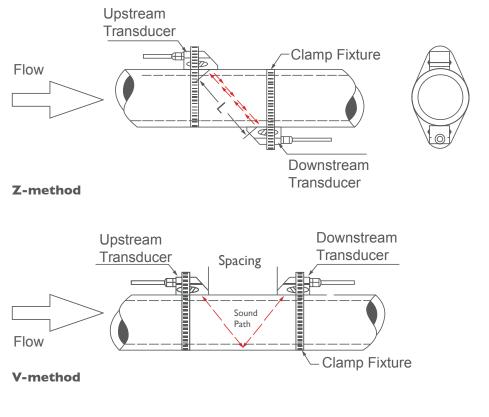
MEASURE **TODAY.** ENSURE **TOMORROW.**

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.
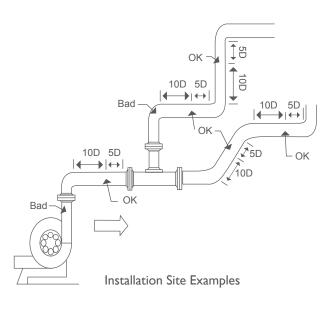

Z-method

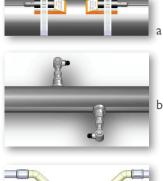**V-method**

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.
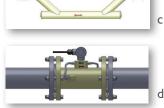
Transducer Mounting Site Selection

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

Specifications: Flow Transmitter (Main Unit)

Flow Velocity	± 12 m/s (± 40 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	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: • 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

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 BACnet / GPRS module for networking, remote monitoring and remote control	
Software	StufManager PC software available upon request	
Telemetry	uGalaxy_GPRS 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 0.15m/s (0.5ft/s) Flowrate is calculated by multiplying velocity with the inner cross-section area of the pipe.
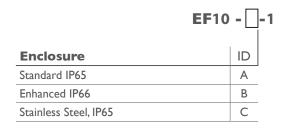
** For uGalaxy Telemetry System solution, please contact solutions@spiremt.com.

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

⚠️ **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.
USA Standard Plug	WA-PWC-1
British Standard Plug	WA-PWC-2

Optional Accessories

External Adapter	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-YR228
PC Software (485-USB or 485-Ethernet adapter required for PC software use)	**Model No.**
StufManager (for real-time data acquisition)	SW-STMGR
uGalaxy Telemetry System	Please contact us
Data Logger	**Model No.**
2GB SD data logger (for recording flow, temperature, and energy)	WA-SD

SPIRE METERING TECHNOLOGY

Specifications: Clamp-On Transducer

Model	Picture	Description
Type: RM1 **PN#:** TWC-RM1		**Standard temperature, clamp-on WITH mounting rail, 1MHz** **Temperature** 32˚F~300˚F (0˚C~150˚C) **TWC-RM1:** 1MHz transducer WITH mounting rail for pipe size DN65-700 (2 ½"-28")
Type: S1HT **PN#:** TWC-S1HT		**High temperature, clamp-on WITHOUT mounting rail, 1MHz** **High temperature** 32˚F~300˚F (0˚C~150˚C) **TWC-S1HT:** 1MHz high temp transducer WITHOUT mounting rail for pipe sizes DN40-100 (1 ½" -4")

How To Order Clamp-on Transducer

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

TWC - ☐

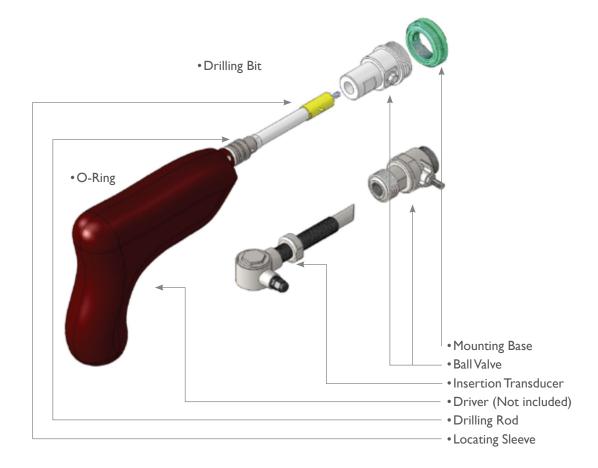| Transducer Type	ID
1MHz transducer WITH mounting rail for pipe sizes DN65-700 (2 ½"-28")	RM1
1MHz high temp transducer WITHOUT mounting rail for pipe sizes DN40-100 (1 ½" -4")	S1HT

Required Accessories (choose one from each category)

Transducer Cable	Model No.
5m (15ft) shielded transducer cable (in pair)	TW-CBL-5M
15m (50ft) shielded transducer cable (in pair)	TW-CBL-15M
50m (150ft) shielded transducer cable (in pair)	TW-CBL-50M
100m (300ft) shielded transducer cable (in pair)	TW-CBL-100M
Clamp Fixture	**Model No.**
Metal clamp for DN20-50 (¾"-2") pipe	TW-CLP-1
Metal clamp for DN50-100 (2"-4") pipe	TW-CLP-2
Metal clamp for DN125-200 (5"-8") pipe	TW-CLP-3
Metal clamp for DN250-300 (10"-12") pipe	TW-CLP-4
Metal clamp for DN350-400 (14"-16") pipe	TW-CLP-5
Metal clamp for DN450-500 (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" (DN80-1000) Temperature range 32˚F - 300˚F (0˚C - 150˚C).
Type: PN#: TWI-HTK		Hot-tapping tool kit for insertion transducer installation

• Drilling Bit

• O-Ring

• Mounting Base
• Ball Valve
• Insertion Transducer
• Driver (Not included)
• Drilling Rod
• Locating Sleeve

SPIRE METERING TECHNOLOGY

How To Order Insertion Transducer

Please select one option (ID) from each category.

TWI - ☐ - ☐ - ☐ - ☐

Type	ID
Vertical	V

Pipe Size	ID
3"- 40" (DN80-DN1000mm)	1
40" -120" (DN1000-DN3000mm)	2

Pipe Material	ID
Steel	1
Plastic (Saddle is required. SpireMT does not provide.)	2
Concrete (Saddle is required. SpireMT does not provide.)	3

Pressure	ID
0.6MPa (87psig)	A
1MPa (145psig)	B
1.6MPa (232psig)	C

Required Accessories

Cable Length	Model No.
5m (15ft)	TW-CBL-5M
15m (50ft)	TW-CBL-15M
50m (150ft)	TW-CBL-50M
100m (300ft)	TW-CBL-100M
Hot-tapping Tool Kit	TW-HTT

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EnduroFlow™ Series EF10
Ultrasonic Transit-Time Flowmeter For Permanent Installation

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.*

Flow Cell	Pipe Size Range	Temperature Range	Flow Vel. Range	Pipe Joint
PI-type	⅜" ~ 1 ½"	32° - 266°F	±15ft/s	Thread/Flange
Standard-type	2" ~ 40"	32° - 266°F	±24ft/s	Flange

PI Type Flow-cell ANSI 150# Flange Transducer

Unit: IN
Max Pressure Rating: 362psig

Nominal Size	Length	Flange Dimension ANSI RF#150					Flange Thickness
in	L	D	D1	D-Φ	D2	f	C
⅜"							
½"	12.60	3 ½	2 ⅜	4 * ½	1 ⅜	1/16	7/16
¾"	14.17	3 ⅞	2 ¾	4 * ½	1-11/16	1/16	½
1"	15.35	4 ¼	3 ⅛	4 * ½	2	1/16	9/16
1 ¼"	17.72	4 ⅝	3 ½	4 * ½	2 ½	1/16	⅝
1 ½"	19.69	5	3 ⅞	4 * ½	2 ⅞	1/16	11/16

SPIRE METERING TECHNOLOGY

EnduroFlow™ Series EF10
Ultrasonic Transit-Time Flowmeter For Permanent Installation

Standard Type Flow-cell DIN Flange 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, see next page for details.*
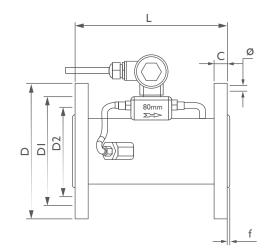- *For sizes larger than DN500 (20"), please consult us before placing order.*

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Standard Type Flow-cell ANSI 150# Flange Transducer

Unit: IN
Max Pressure Rating: 232psig

Nominal Size	length	Flange Dimension ANSI RF#150					Flange Thickness
in	L	D	D1	D-Φ	D2	f	C
2″	7.87	6	4 ¾	4 * ⅝	3 ⅝	1/16	¾
2 ½″	7.87	7	5 ½	4 * ⅝	4 ⅛	1/16	⅞
3″	8.86	7 ½	6	4 * ⅝	5	1/16	15/16
4″	9.84	9	7 ½	8 * ⅝	6-3/16	1/16	15/16
5″	9.84	10	8 ½	8 * ¾	7-5/16	1/16	15/16
6″	11.81	11	9 ½	8 * ¾	8 ½	1/16	1
8″	13.78	13 ½	11 ¾	8 * ¾	10 ⅝	1/16	1 ⅛
10″	17.72	16	14 ¼	12 * ⅞	12 ¾	1/16	1-3/16
12″	19.69	19	17	12 * ⅞	15	1/16	1 ¼
14″	21.65	21	18 ¾	12 * 1	16 ¼	1/16	1 ⅜
16″	23.62	23 ½	21 ¼	12 * 1	18 ½	1/16	1-7/16
18″	27.56	25	22 ¾	16 * 1 ⅛	21	1/16	1-9/16
20″	31.50	27 ½	25	20 * 1 ⅛	23	1/16	1-11/16
24″	39.37	32	29 ½	20 * 1 ¼	27 ¼	1/16	1 ⅞

Notes :

- The above flange is ANSI type.
- For sizes larger than 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		Flow-cell Size		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

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

Required Accessories

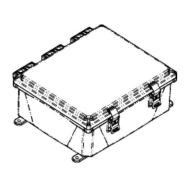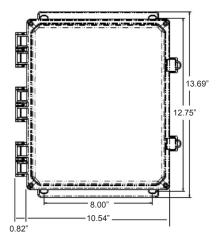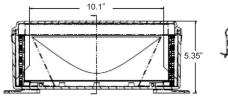| Cable Length	Model No.
5m (15ft)	TW-CBL-5M
15m (50ft)	TW-CBL-15M
50m (150ft)	TW-CBL-50M
100m (300ft)	TW-CBL-100M

Dimensions

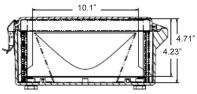## Standard Enclosure (EF10-A)

Enhanced Enclosure (EF10-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-A-1
WA-PWC-1

Clamp-on Transducer (pair):
TWC-RM1
TW-CBL-5M
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 (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 GPRS wireless option.

Flow transmitter:
EF10-B-1
WA-PWC-1
WA-YR280
WA-SD

Clamp-on Transducer (Pair):
TWC-RM1
TW-CBL-5M
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 solutions. To find out how we can help today, please tell us about your application.

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