

### DESCRIPTION

The DFX ultrasonic Doppler flow meter measures flows of liquids containing suspended particles or aerated liquids. Used with the DT9 clamp-on, non-intrusive transducers, the meter is suitable for sewage and mud slurries and can be used on most pipes constructed from metal or plastic.

The DT9 transducer for the DFX meter is rated to Type 6 (IP-67) and has the ability to work with temperatures up to 400° F (200° C).

### APPLICATIONS

Successful application of Doppler ultrasonic flow meters relies on three physical constraints:

- The liquid flowing within the pipe must contain 100 ppm of useful sonic suspended reflectors. Dissolved solids do not generate reflections and are not relevant.
- A significant portion of the ultrasound energy generated by the transducer must reach the sonic reflectors. The ultrasonic transducer must be acoustically coupled to the outside of a pipe (using grease or RTV couplant) and the pipe must permit ultrasound to pass without significant attenuation. Most pipes constructed of solid, homogenous materials meet this qualification. Pipes that cause application difficulty include concrete pressure pipes, woodstave pipes, Teflon<sup>®</sup>-lined pipes and fiberglass reinforced pipes.
- The pipe must be completely filled with liquid when measurements are made. The DFX microprocessor assumes that the pipe is completely full when it calculates flow rate. Use on partially-filled pipes may result in inaccurate readings.

### BENEFITS

- Minimal installation time: the DFX may be installed and fully operational within minutes. For most homogeneous pipe materials, there is no need to break into pipelines.
- Minimal material costs: clamp-on sensor eliminates the need for in-line flanges, pipe fittings, strainers or filters.
- Reduced down-time: installation may be performed on full pipes and active systems. There is no need to shut down the process for installation or maintenance.
- Lower maintenance costs: with no moving parts, there is nothing on the DFX to wear down.

### FEATURES

- Non-intrusive, clamp-on transducers for most pipes from 0.25 in. (6 mm) and above.
- Wide velocity range: 0.15...30 fps (0.0...9 mps).
- Flexibility: with automatic gain control and in-field linearization, the DFX will adapt to a wide variety of applications.



### OPERATION

The DFX flow meter operates by transmitting ultrasonic sound from its transmitting transducer through the pipe wall into the flowing liquid. Each transducer contains piezoelectric crystals to transmit this signal. The sound will be reflected by useful sonic reflectors suspended within the liquid and recorded by the receiving transducer (see *Figure 1*). If the reflectors are moving within the sound transmission path, sound waves will be reflected at a frequency shifted (Doppler shift) from the transmitted frequency. The difference between the reflected frequencies and transmitted frequencies is directly proportional to the speed of the sonic reflectors, resulting in a liquid flow rate that is converted to various user defined measuring units.

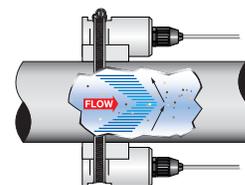
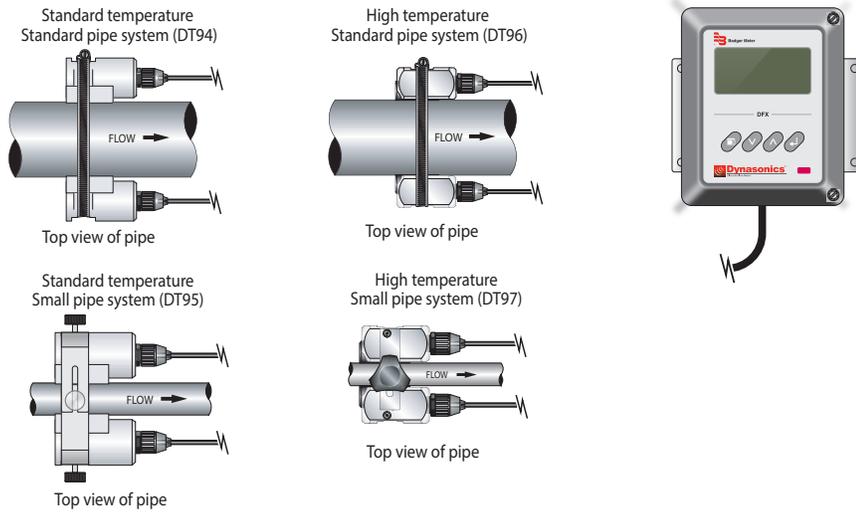


Figure 1: DFX operation

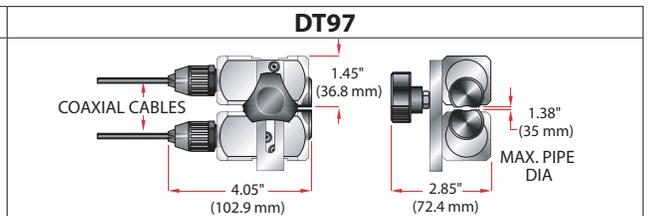
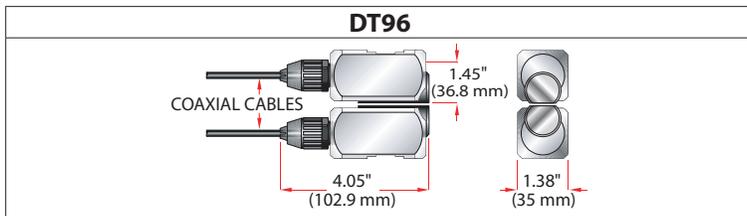
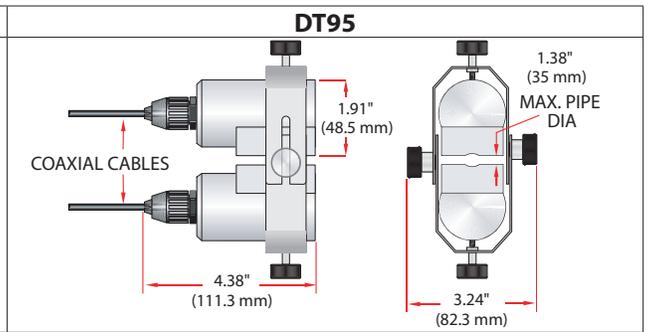
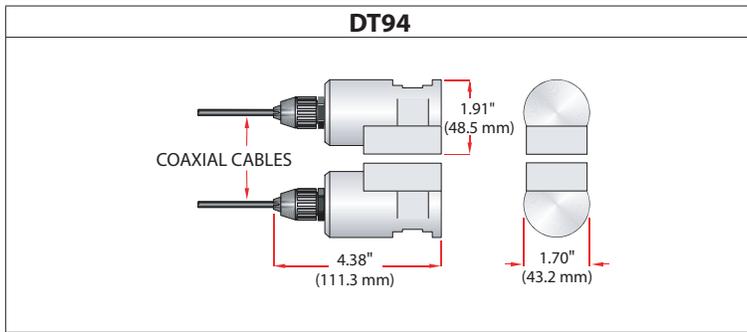
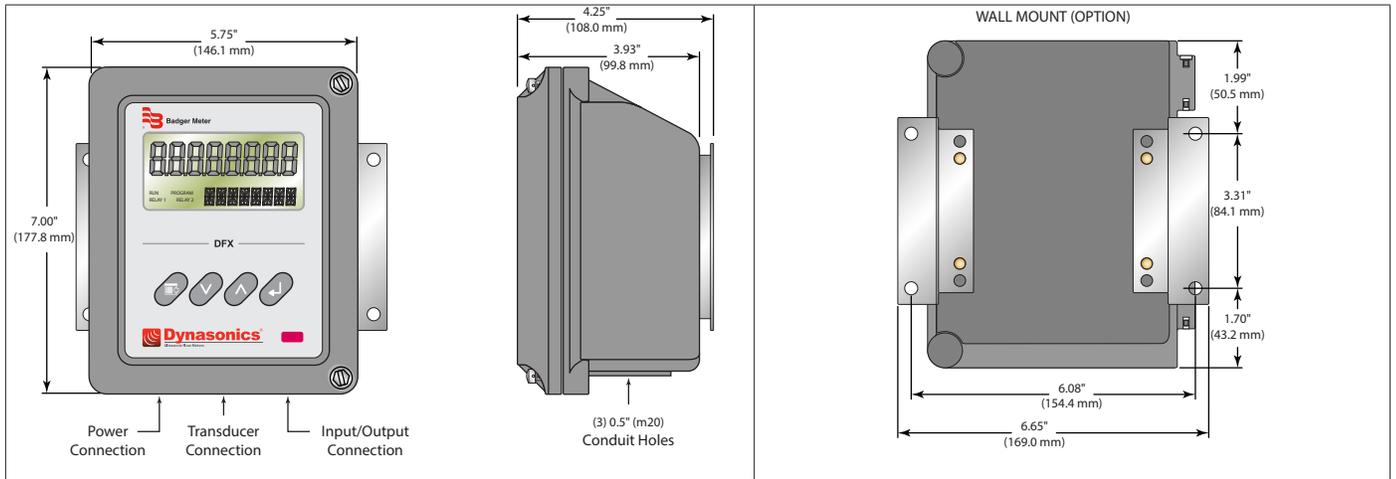
## CLAMP-ON TRANSDUCER OPTIONS



## SPECIFICATIONS

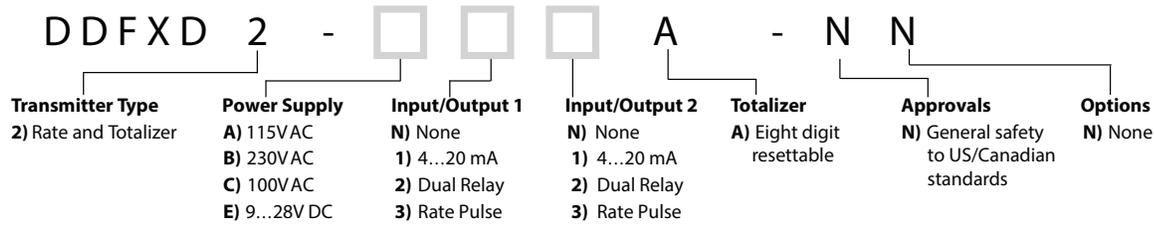
<b>Velocity Range</b>	0.15...30 fps (0.05...9 mps)		
<b>Accuracy</b>	±2% full scale, over calibrated span		
<b>Liquid Types</b>	Liquids containing a minimum of 100 ppm of useful sonic suspended reflectors greater than 35 micron size, and at least 25% of the overall particle volume is larger than 100 microns		
<b>Monitor Enclosure</b>	NEMA 4X (IP 66), polycarbonate, stainless steel, brass, plated-steel mounting brackets 7.00 in. H x 5.75 in. W x 3.88 in. D (178 mm x 146 mm x 99 mm)		
<b>Power Supply</b>	115/100/230V AC 50/60 Hz ±15% @ 17V A max; 12...28V DC @ 7V A max		
<b>Display</b>	2-line x 8 character LCD; LED backlighting; 8-digit rate, 8-digit total (resettable)		
<b>Units</b>	User configured: Feet, US gallons, ft <sup>3</sup> , Mil-gal, meters, liters, Mil-ft <sup>3</sup> , m <sup>3</sup> , Mil-liters, acre-feet, oil barrels (42 US gallons), liquid barrel (32.5 US gallons), lb, Kg		
<b>Rate Interval</b>	Second, minute, hour, day. Totalizer exponent: E-2 to E+6 (x <sup>1</sup> /100 to x 1,000,000)		
<b>Response Time</b>	User selectable: 6...60 seconds		
<b>Output Options</b>	4...20 mA	800 ohms max, internal or external power supply, 12-bit resolution	
	Optically Isolated Dual Relay	Independently configured; Form C, 200V AC @ 0.5 A resistive; rate alarm, totalizer pulse, error	
	Rate Pulse	500 mV AC	2500 Hz max, 12-bit resolution, 500 mV AC into 2 K Ohm minimum;
		Open collector	2500 Hz max, 1 A at 100 V max
<b>Multiple Meters</b>	Synchronization provision included—utilized for multiple meter, single pipe/manifold system. Up to four meters may be interconnected, up to 100 feet (30 meters) apart		
<b>Keypad</b>	4-key, tactile		
<b>Ambient Conditions</b>	-40...185° F (-40...85° C); 0...95% relative humidity (non-condensing)		
<b>Approvals</b>	(Std.) General Safety US and Canada. Certified to UL 61010-1 and CSA C22.2 No. 61010-1; compliant with EMC directive 2004/108/EC		
<b>Transducer Type</b>	Compression-mode Ultrasonic; 625 kHz		
<b>Construction</b>	Standard Clamp-On	Type 6* (IP 67) -40...194° F (-40...90° C) CPVC, Ultem®, Nylon, PVC (Cable Jacket), Aluminum (small pipe) *Depth of 1 meter for 30 minutes	
	High Temp Clamp-On	NEMA 4 (IP 65) -40...400° F (-40...204° C) Vespel®, Anodized Aluminum, Nickel-plated brass, Teflon® (Cable Jacket)	
	Optional Flexible Armored Conduit	Zinc-plated steel, PVC	
<b>Pipe Sizes</b>	Standard Clamp-On Transducers	1 inch (25 mm) and above	
	Small Pipe Clamp-On Transducers	0.25...1 inch (6...25 mm)	
	Standard Lengths	20, 50 and 100 foot (6.1, 15 and 30 meter), 78 Ohm twinax cable	
	Optional Lengths	To 990 feet (297 meters), 75 Ohm RG59 cable	

**DIMENSIONS**

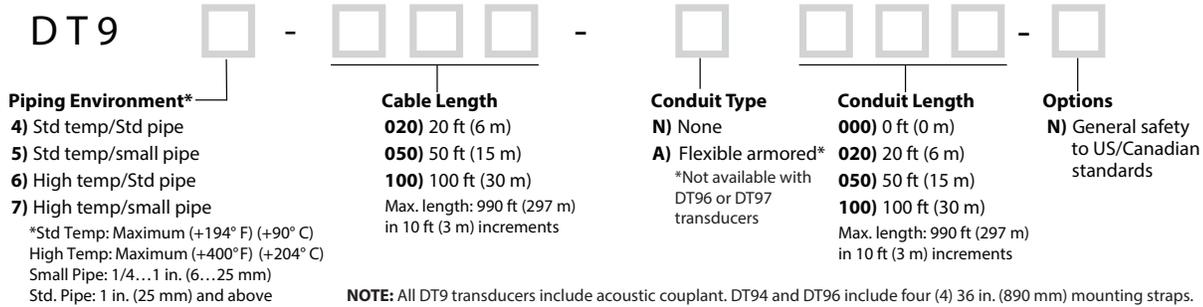


## PART NUMBER CONSTRUCTION

### DDFX Digital Doppler Ultrasonic Flow Transmitter



### DT9 Doppler Ultrasonic Transducer Set



## Control. Manage. Optimize.

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