

## DOPPLER ULTRASONIC FLOW METER

Two transducer types are available with the DFX meter:

**Series DT9** clamp-on, non-intrusive transducer is recommended for use on most pipes constructed from metal or plastic. The DT9 is rated to Type 6 (IP-67) and has the ability to work with temperatures up to +400 °F (+200 °C).

**Series DP7** hot-tappable insertion probe transducer is available for installations on pipe systems that do not permit ultrasound penetration. The DP7 inserts into the pipe wall and directly contacts the flowing liquid.



(DT94 Clamp-on transducer and DP7 Insertion probe shown)

### Features

- Non-intrusive, clamp-on transducers for most pipes from ¼" (6 mm) and above.
- Wide velocity range: 0.15 to 30 FPS (0.05 to 9 MPS).
- Flexibility: with automatic gain control and in-field linearization, the DFX will adapt to a wide variety of applications.
- Inherent immunity to VFD and other electronic/ultrasonic noise.
- Hot-tappable Insertion probe transducer available for concrete, FRP/GRP, or woodstave pipes.
- Microprocessor-based system; configuration and accumulation data stored in non-volatile flash ROM.

### 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 the process down for installation or maintenance.
- Lower maintenance costs: with no moving parts, there is nothing on the DFX to wear down.

### Product Application

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

1. 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.
  - Sewage
  - Primary Sludge
  - RAS and WAS
  - Dredging
  - Paper Stock
  - Mining Slurry
2. A significant portion of the ultrasound energy generated by the transducer must reach the sonic reflectors. In the case of a clamp-on transducer,

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®-lined pipes and fiberglass reinforced pipes. Pipes that do not readily pass ultrasound are candidates for the DP7 insertion probe transducer.

3. 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.



## Principles of Operation/Transducer Options

The DFX flow meter operates by transmitting ultrasonic sound from its transmitting transducer through the pipe wall or from the probe tip into the flowing liquid. Each transducer and probe tip 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.

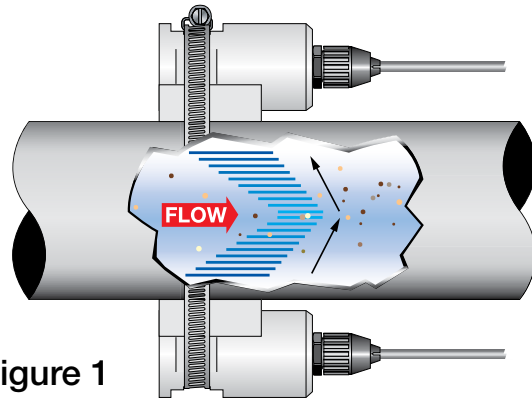
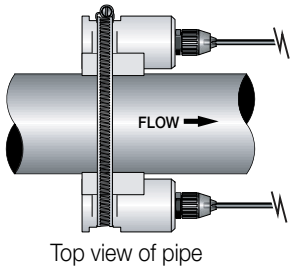


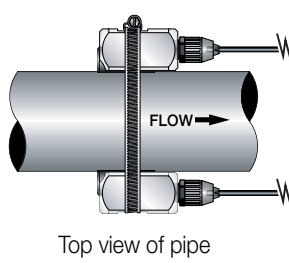
Figure 1

## Clamp-On Transducer Options

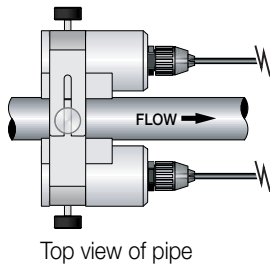
Standard temperature  
Standard pipe system (DT94)



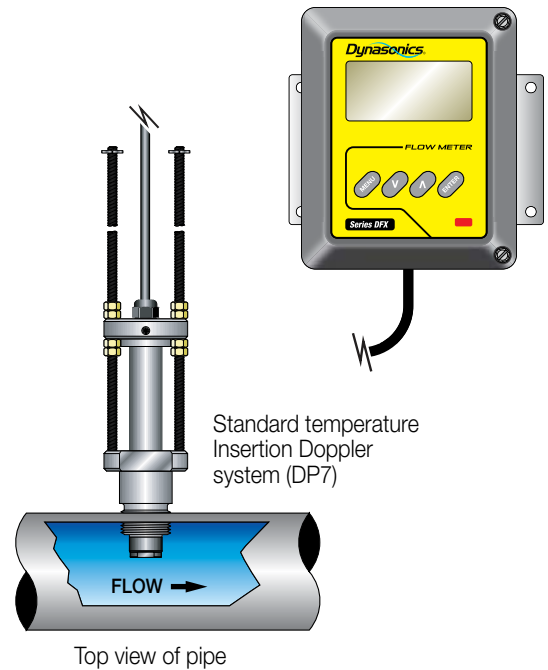
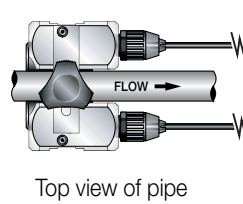
High temperature  
Standard pipe system (DT96)



Standard temperature  
Small pipe system (DT95)



High temperature  
Small pipe system (DT97)

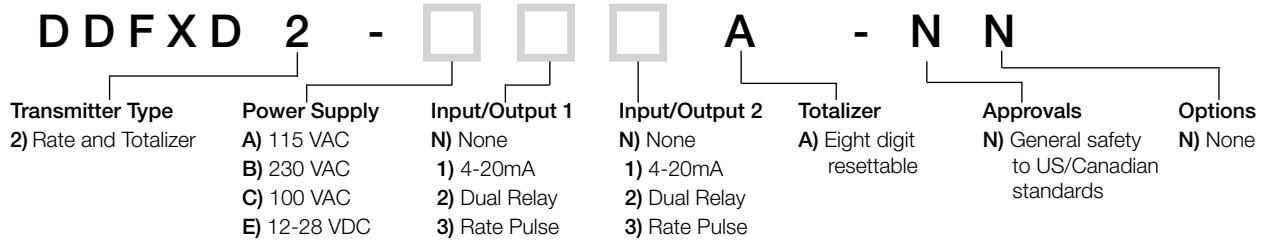


## Specifications

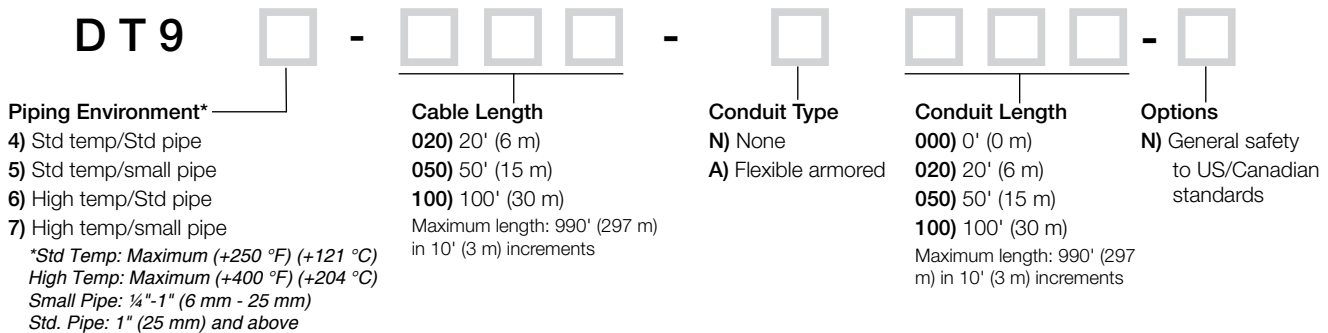
<b>Velocity Range</b>	0.15-30 FPS (0.05-9 MPS)	<b>Multiple Meters</b>	Synchronization provision included—utilized for multiple meter, single pipe/manifold system. Up to four meters may be interconnected, up to 100 feet (30 meters) apart
<b>Accuracy</b>	±2% full scale, over calibrated span	<b>Keypad</b>	4-key, tactile
<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>Ambient Conditions</b>	-40 °F to +185 °F (-40 °C to +85 °C) 0 to 95% relative humidity (non-condensing)
<b>Monitor Enclosure</b>	NEMA 4X (IP 66), polycarbonate, stainless steel, brass, plated-steel mounting brackets 7.00" H x 5.75" W x 3.88" D (178 mm x 146 mm x 99 mm)	<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>Power Supply</b>	115/100/230 VAC 50/60 Hz ±15% @ 17 VA max; 12-28 VDC @ 7 VA max	<b>Transducer Type</b>	Compression-mode Ultrasonic; 625 kHz
<b>Display</b>	2-line x 8 character LCD; LED backlighting; 8-digit rate 8-digit total (resettable)	<b>Construction</b>	Standard Clamp-On: Type 6* (IP 67) -40 °F to +250 °F (-40 °C to +121 °C) CPVC, Ultem®, Nylon, PVC (Cable Jacket), Aluminum (small pipe) High Temp Clamp-On: NEMA 4 (IP 65) -40 °F to +400 °F (-40 °C to +204 °C) Vespel®, Anodized Aluminum, Nickel-plated brass, Teflon® (Cable Jacket) Doppler Probe: Type 6* (IP 67) -40 °F to +210 °F (-40 °C to +99 °C); 700 PSI (48 Bar) max. 316 Stainless Steel, Ultem®, Viton®, Nylon, PVC (Cable Jacket) Optional Flexible Armored Conduit: Zinc-plated steel, PVC *Depth of 1 meter for 30 minutes
<b>Units</b>	User configured - Feet, gallons, ft³, Mil-gal, meters, liters, Mil-ft³, m³, Mil-liters, acre-feet, oil barrels (42 gallons), liquid barrel (32.5 gallons), lbs., Kg	<b>Pipe Sizes</b>	Standard Clamp-On Transducers: 1 inch (25 mm) and above Small Pipe Clamp-On Transducers: ¼ to 1 inch (6 to 25 mm) Probe Transducers: 4 to 120 inch (101 to 3050 mm)
<b>Rate Interval</b>	Second, minute, hour, day. Totalizer exponent: E-2 to E+6 (x 1/100 to x 1,000,000)	<b>Cable Length</b>	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
<b>Response Time</b>	User selectable: 6-60 seconds		
<b>Outputs</b>	4-20mA: 800 ohms max; internal or external power supply; 12-bit resolution; optically isolated Dual Relay; independently configured; Form C, 200 VAC @ 0.5 A resistive; rate alarm, totalizer pulse, error Rate Pulse: two output types – 500 mVAC or open collector; 2,500 Hz max; 12-bit resolution; 500 mVAC into 2K ohm minimum; Open collector 1 A at 100 V max		

## Part Number Construction

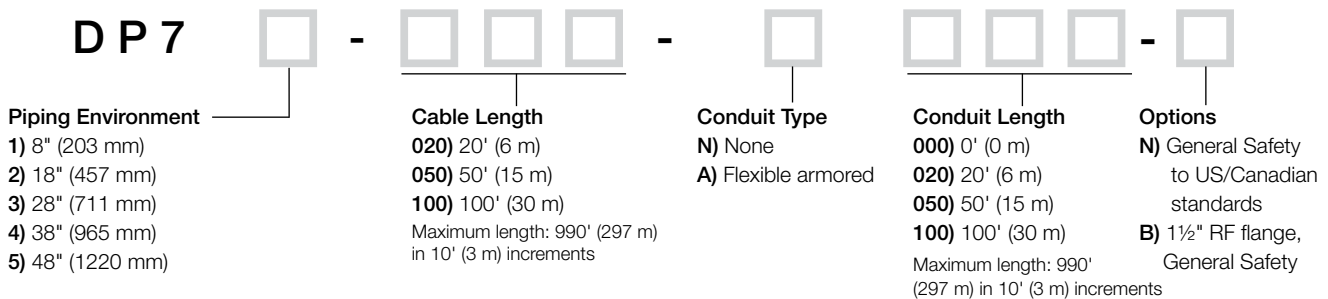
### DDFX Digital Doppler Ultrasonic Flow Transmitter



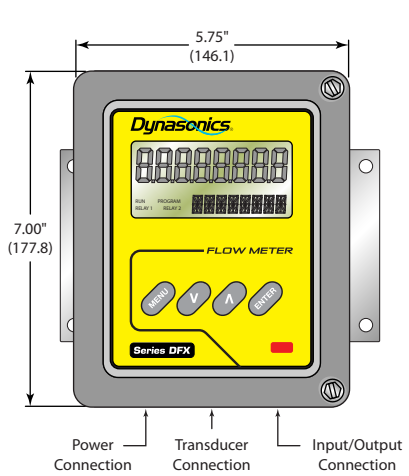
### DT9 Doppler Ultrasonic Transducer Set



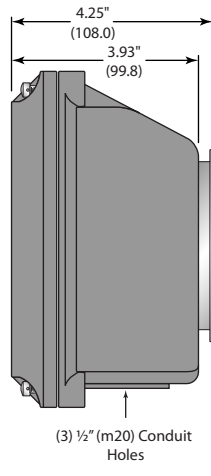
### DP7 Insertion Doppler Probe



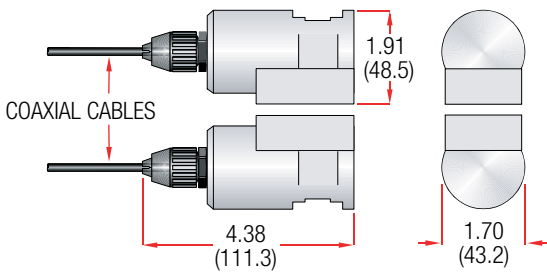
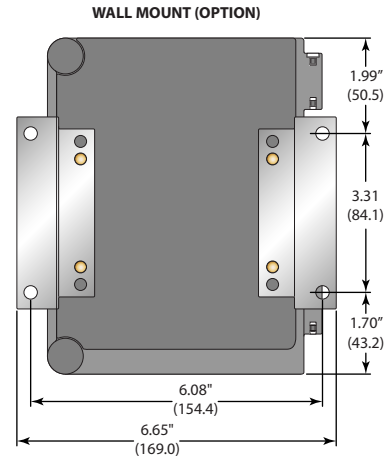
**Dimensional Specifications: Inches (mm)**



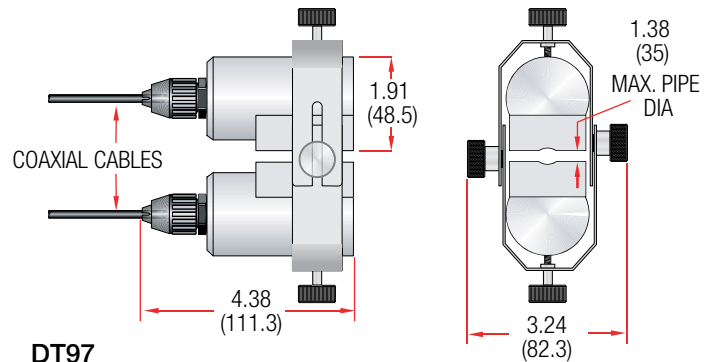
**DT94**



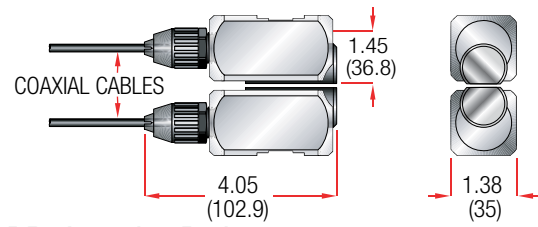
**DT95**



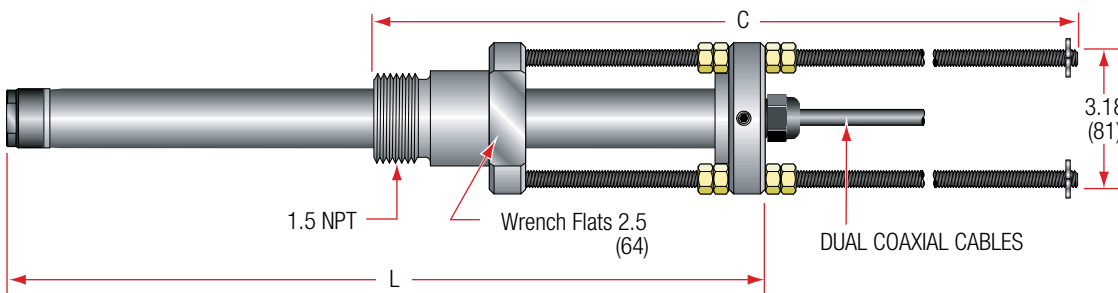
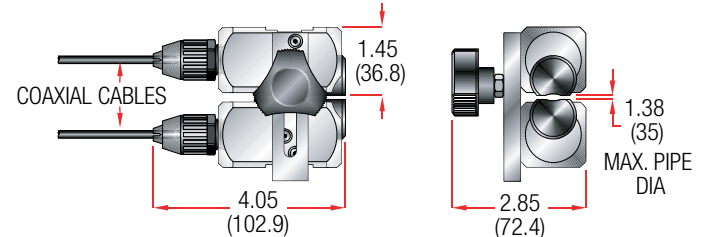
**DT96**



**DT97**



**DP7 Insertion Probe**



Model	L Inches (mm)	C Inches (mm)
DP71	9.50 (241)	11.31 (287)
DP72	19.50 (495)	21.31 (541)
DP73	29.50 (749)	31.31 (795)
DP74	39.50 (1003)	41.31 (1049)
DP75	49.50 (1257)	51.31 (1303)



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8635 Washington Ave. Racine, WI 53406-3738 USA  
 Tel: 262-639-6770 800-535-3569 US & Canada  
 Fax: 262-639-2267 800-732-8354 US & Canada  
 dynasonics.com dynasonics\_sales@racinefed.com

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