

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 measuring 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.

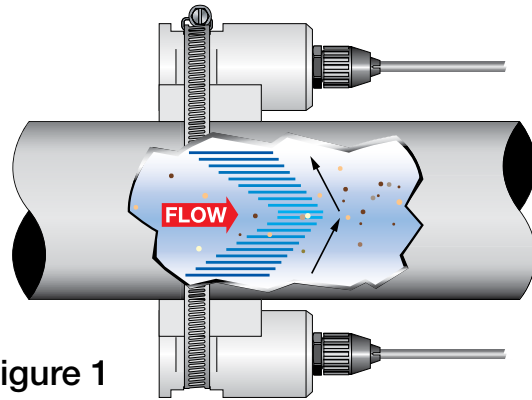
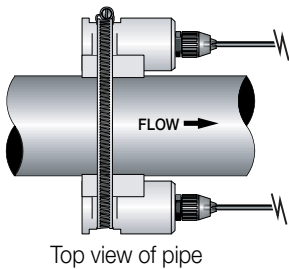


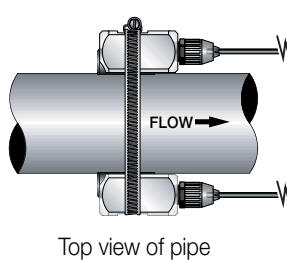
Figure 1

Clamp-On Transducer Options

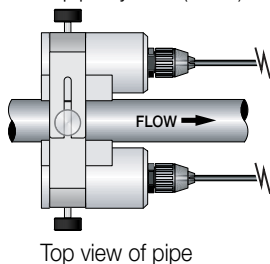
Standard temperature
Standard pipe system (DT94)



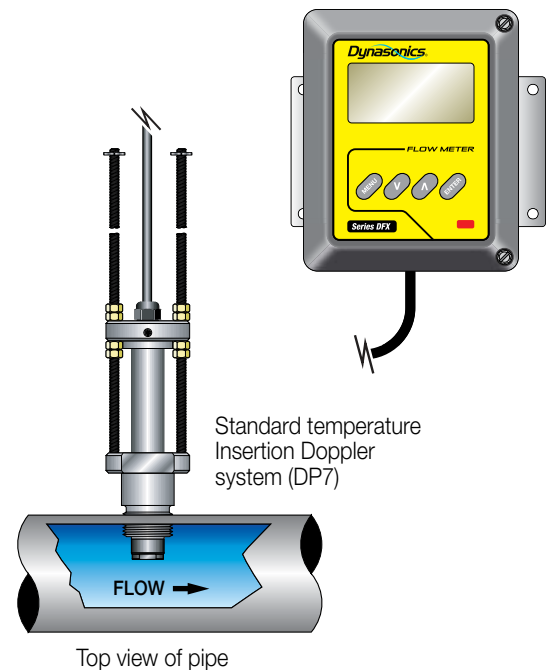
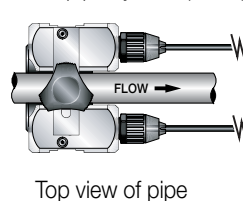
High temperature
Standard pipe system (DT96)



Standard temperature
Small pipe system (DT95)



High temperature
Small pipe system (DT97)

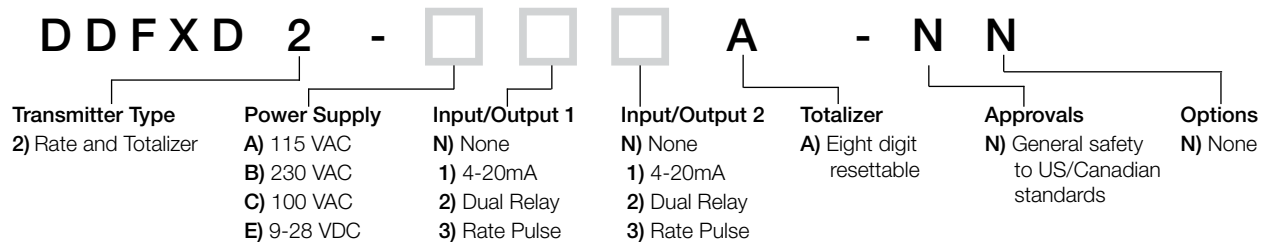


Specifications

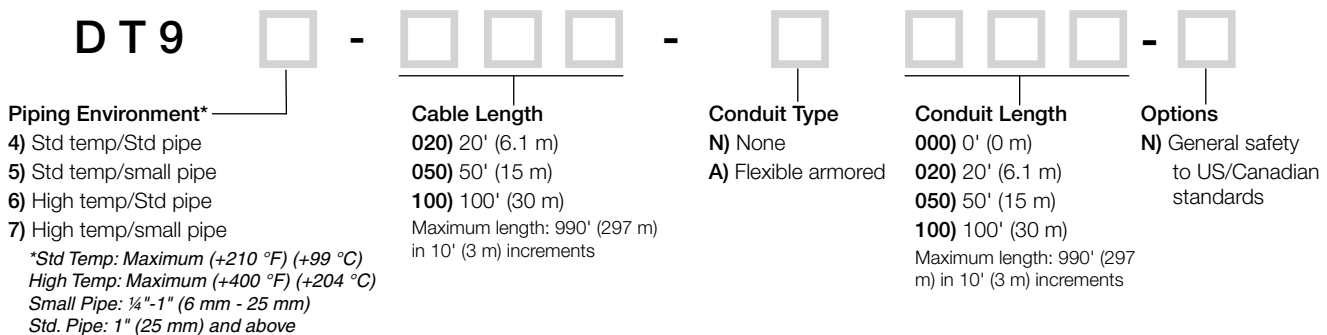
Flow Velocity Range	0.15-30 FPS (0.05-9 MPS)	Multiple Meters	Synchronization provision included—utilized for multiple meter, single pipe/manifold system. Up to four meters may be interconnected, up to 100 feet (30 meters) apart
Accuracy	±2% full scale, over calibrated span	Keypad	4-key, tactile
Liquid Types	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	Ambient Conditions	-40 °F to +185 °F (-40 °C to +85 °C)
Monitor Enclosure	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)	Approvals	(Std.) General Safety US and Canada. Certified to UL 61010-1 and CSA C22.2 No. 61010-1; meets IEC 61326-1:2005
Power Supply	115/100/230 VAC 50/60 Hz ±15% @ 17 VA max; 9-28 VDC @ 7 VA max	Transducer Type	Compression-mode Ultrasonic; 625 kHz
Display	2-line x 8 character LCD; LED backlighting; 8-digit rate 8-digit total (resettable)	Construction	Standard Clamp-On: Type 6" (IP 67) -40 °F to +210 °F (-40 °C to +99 °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 +100 °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
Units	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	Pipe Sizes	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)
Rate Interval	Second, minute, hour, day. Totalizer exponent: E-2 to E+6 (x 1/100 to x 1,000,000)	Cable Length	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
Response Time	User selectable: 6-60 seconds		
Outputs	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

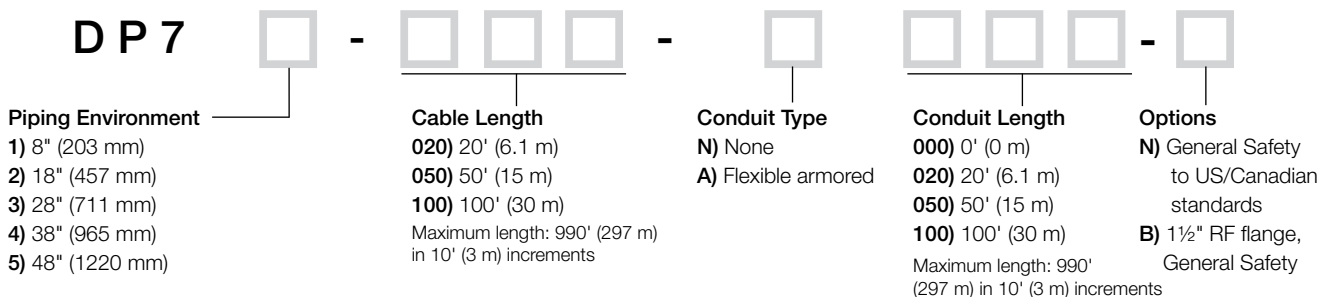
DDFX Digital Doppler Ultrasonic Flow Transmitter



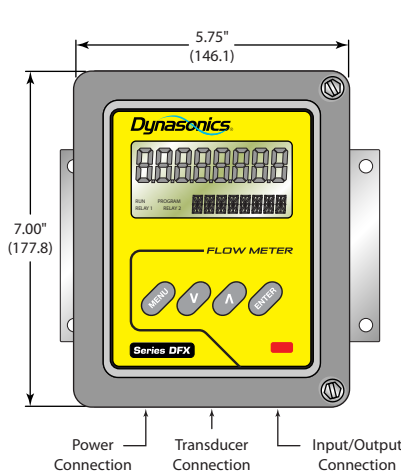
DT9 Doppler Ultrasonic Transducer Set



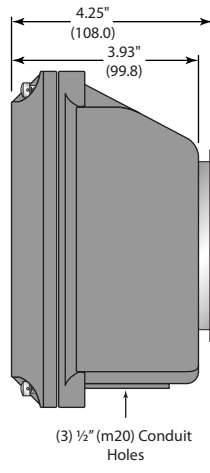
DP7 Insertion Doppler Probe



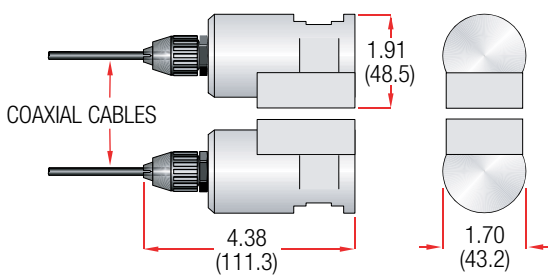
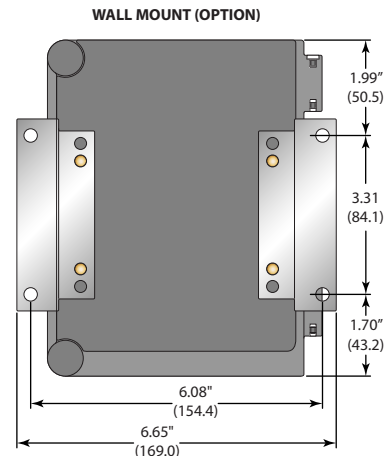
Dimensional Specifications: Inches (mm)



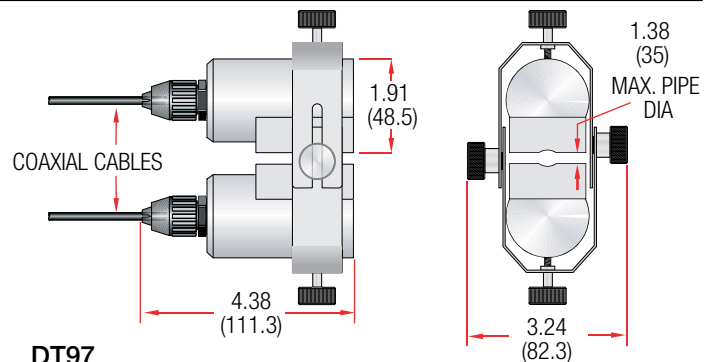
DT94



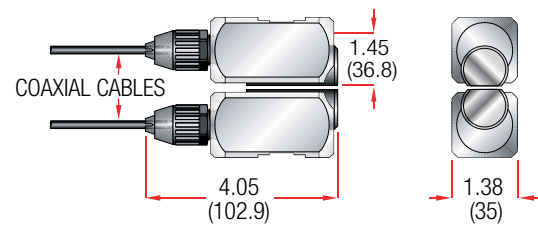
DT95



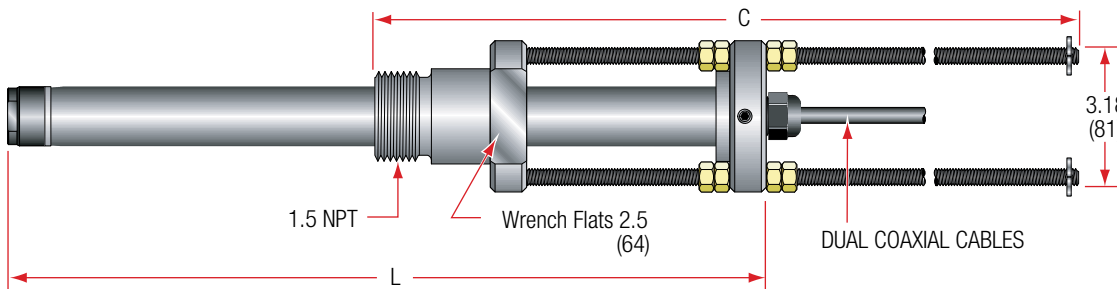
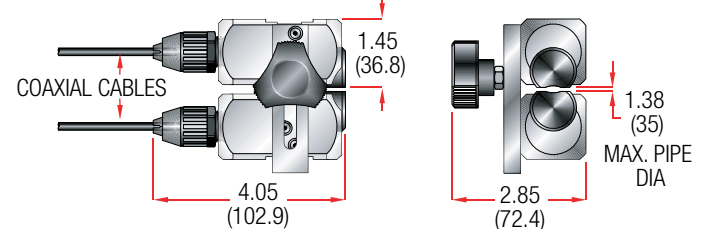
DT96



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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