

# Hybrid Ultrasonic Flow Meter

## DXN Portable Ultrasonic Flow and Energy Meter

### DESCRIPTION

The DXN Portable Ultrasonic Flow and Energy Meter is a true hybrid instrument, capable of measuring liquid flow with multiple technologies, including: Doppler, transit time and liquid thermal (heat energy) flow. Easy to install by clamping onto the outside of the pipe, the DXN measures flow using non-invasive ultrasonic sensors. Compatible with a pipe wall thickness gauge, inside pipe diameter can be verified to ensure accurate ultrasonic measurements when piping details are unknown or unavailable.

The DXN has a number of advanced features including a touchscreen interface, full-color graphing, wizard-based start-up configuration, USB connectivity, and Modbus TCP/IP connectivity. These features make it easy for technicians to obtain accurate readings while capturing flow surges and high-speed batch operations. The DXN captures and displays multiple user-defined and application parameters at once and can record the data with an easy-to-use data logging function. The ability to monitor and record several parameters at once allows technicians to verify and troubleshoot permanent flow installations with ease.

### OPERATION

Transit time flow meters measure the time difference between the travel time of an ultrasound wave going with the fluid flow and then against the fluid flow. This time difference is used to calculate the velocity of the fluid traveling in a closed-pipe system. The transducers used in transit time measurements operate alternately as transmitters and receivers. Transit time measurements are bi-directional and are most effective for fluids that have low concentrations of suspended solids.

Doppler flow meters operate by transmitting an ultrasonic wave from a transducer through the pipe wall and into the moving liquid. The sound wave is "reflected" by suspended particles or bubbles moving with the liquid and ultimately gathered by the receiving transducer. A frequency shift (Doppler effect) will occur that is directly proportional to the speed of the moving particles or bubbles. This shift in frequency is interpreted by the digital signal processor (DSP) and converted to a fluid velocity measurement.

Using its built-in hybrid technology, the DXN will automatically choose which type of flow measurement to read based on signal quality during operation. Regardless of the method used to determine velocity, multiplying the pipe's cross-sectional area by the fluid velocity produces a volumetric flow rate. The measurement also presumes that the pipe is completely full during the measurement cycle.

When used in conjunction with flow measurement, temperature measurements can yield energy usage readings in the form of heat flow. To find the net heat loss or gain, energy usage is calculated by multiplying the flow rate of the heat transfer fluid by the change of heat content in the fluid after it has done some kind of work

An ultrasonic meter equipped with heat flow capabilities measures the rate and quantity of heat delivered or removed from devices such as heat exchangers. The instrument measures the volumetric flow rate of the heat exchanger liquid, the temperature at the inlet pipe and the temperature at the outlet pipe.



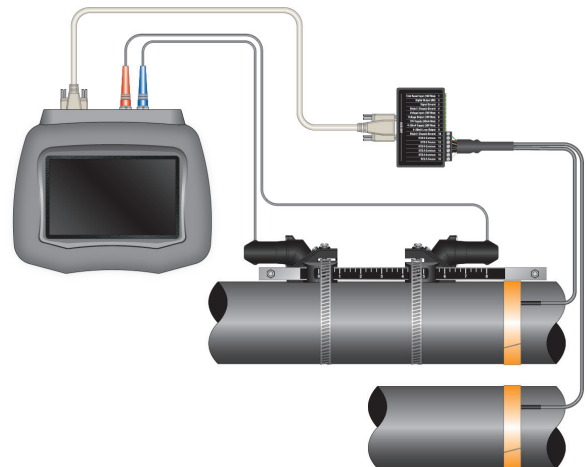
Full kit includes meter, transducers, RTDs, cables, thickness gauge, power cord, and carrying case

$$\text{Rate of Heat Delivery} = Q * (T_{in} - T_{out}) * C * \rho$$

Where...

- Q = Volumetric flow rate
- T<sub>in</sub> = Temperature at the Inlet
- T<sub>out</sub> = Temperature at the Outlet
- C = Heat Capacity
- ρ = Density of fluid

By applying a scaling factor, this heat flow measurement can be expressed in the units of your choosing (Btu, Watts, Joules, Kilowatts and so on).



## SPECIFICATIONS

### System

<b>Measurement Type</b>	<b>Flow:</b> Ultrasonic transit time and Doppler (reflection of acoustic signals); hybrid operation; liquid thermal energy		
	<b>Pipe wall thickness:</b> Ultrasonic transit time of acoustic signals		
<b>Liquid Types</b>	Liquid dominant fluids, acoustically conductive		
<b>Velocity Range</b>	<b>Transit Time:</b>	<b>Medium and large pipes:</b> Bi-directional up to 40 ft/s (12 m/s), depending on pipe and fluid <b>Small pipes (DTTSU):</b> Bi-directional up to 20 ft/s (6 m/s), depending on pipe and fluid	<b>Doppler:</b> Uni-directional to 40 FPS (12 MPS)
<b>Flow Rate Accuracy</b>	<b>Transit Time:</b>	<b>1 in. (25 mm) and larger:</b> ±1% of reading ±0.03 ft/s (0.01 m/s) <b>3/4 in. (20 mm) and smaller:</b> ±1% of full scale	<b>Doppler:</b> 2% of full scale
<b>Flow Sensitivity</b>	0.001 FPS (0.0003 MPS)		
<b>Repeatability</b>	±0.2% of reading		
<b>Temperature Accuracy</b>	<b>Absolute:</b> 0.5° F (1° C)	<b>Difference:</b> 0.2° F (0.5° C)	<b>Resolution:</b> 0.02° F (0.01° C)
<b>Logging</b>	Greater than 300 sites stored in 1 GB; download to USB flash drive		
<b>Update Time</b>	0.1...10 seconds update/filter rate. Transit time, up to 50 Hz high speed mode		
<b>Battery</b>	Internal 11.1V lithium ion battery, 75 W-hr. Provides 6...9 hr of continuous operation with battery and indefinitely on external power. Complete charge at 32...104° F (0...40° C), 4 hours when powered off.		
<b>Power Requirements</b>	<b>Transmitter:</b> 10...30V DC via 3-pin connector, 40 W, minimum; 3.6 A re-settable fuse <b>Supplies:</b> Wall adapter: 100...240V AC 50/60 Hz 50 W 10...18 V; Cigarette lighter adapter: 5 A fused		
<b>Power Cords</b>	North American plug (2 flat & 1 round prong; NEMA 5/15P); Chinese plug (3 flat prongs; GB2099); Euro plug (2 round prongs; CEE7/7); U.K./Singapore plug (3 rectangular prongs; BS1363A) Japanese plug (2 flat & 1 round, JIS8303, w/ 3-2 prong adapter) Australian plug (3 flat prongs, AS3112)		
<b>Display</b>	800 × 480 WVGA color outdoor readable display; gloved-operation resistive touch screen 6 in. × 3.6 in. (152.4 mm × 41.44 mm)		
<b>Ambient Conditions</b>	<b>Battery powered:</b> -4...110° F (-20...45° C)		<b>Externally powered:</b> -20...140° F (-30...60° C)
<b>Storage Temperature</b>	Do not exceed 175° F (80° C)		
<b>Enclosure</b>	Water/dust resistant		
<b>User Menu</b>	<b>Multi-language:</b> English, Spanish, German, French, Portuguese, Japanese, Russian, Italian, Dutch, Norwegian, Swedish, Korean, simplified Chinese, Polish		
<b>Compliance</b>	<b>Safety:</b> UL61010-1, CSA C22.2 No. 61010-1, EN61010-1 <b>Directives:</b> 2006/95/EC low Voltage, 2004/108/EC EMC		

### Transducers

<b>Pipe Sizes</b>	1/2 in. and larger; US standard pipe tables are built into user Interface			
<b>Housing Material</b>	<b>DTTSU:</b> CPVC, Ultem®, and anodized aluminum track system; nickel-plated brass connector with Teflon® insulation	<b>DTTR:</b> PBT glass filled, Ultem, Nylon cord grip, PVC cable jacket	<b>DTTL/DT94:</b> CPVC, Ultem®; nickel-plated brass connector with Teflon® insulation	<b>DTTH:</b> PTFE, Vespel, Nickel-plated brass cord grip PFA cable jacket
<b>Pipe Surface Temperature</b>	<b>DTTSU/DTTL:</b> -40...194° F (-40...90° C)	<b>DTTR:</b> -40...250° F (-40...121° C)	<b>DT94:</b> -40...194° F (-40...90° C)	<b>DTTH:</b> -40...350° F (-40...176° C)
<b>Transducer Frequency</b>	<b>DTTSU:</b> 2 MHz	<b>DTTR/DTTH:</b> 1 MHz	<b>DTTL:</b> 500 kHz	<b>DT94:</b> 625 kHz
<b>Cable Length</b>	Transit time: 20 ft (6 m) paired coaxial cable, BNC to BNC, Doppler: 20 ft (6 m) paired coaxial cable, BNC to 4-pin			
<b>Pipe Thickness</b>	Dual mode transducer with 6 ft (1.8 m) of cable (BNC ends), ± 0.03 in. (0.76 mm), stainless steel, carbon steel, pipe, polypropylene, PVC pipes			
<b>RTDs</b>	2 × platinum TCR 0.00385, 1000 Ohm, 3-wire PVC jacketed cable standard with quick connector			

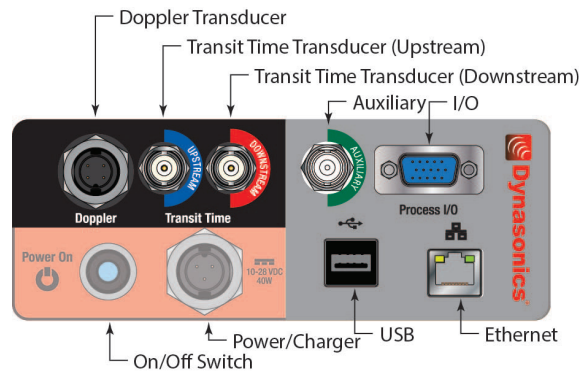
## Process Monitoring Inputs/Outputs

<b>Connector</b>	15-pin high-density DSUB	
<b>Breakout Box</b>	0.2 in. quick disconnect screw terminal; 15-pin to adapter box; 6 ft (1.8 m) of cable (DSUB to DSUB connectors)	
<b>RTD Input</b>	Energy/Temperature (2) tab type PT1000 RTDs. Can handle various temperature ranges from -58...392° F (-50...200° C), based on RTD type	
<b>Current Output</b>	4...20 mA active/passive 1% accuracy	
<b>Voltage Input</b>	0...5V or 0...10V, 1% accuracy, Software scaling and control, 80 k Ohms input impedance, Data log capable	
<b>Voltage Output</b>	0...5V or 0...10V output voltage, 1% accuracy, Software scaling and control, 100 Ohms output impedance	
<b>Sensor Supply</b>	14V @ 50 mA max for powering current or voltage sensors	
<b>Digital Output</b>	Open collector, external pull-up; Rate or total pulse user selectable	
	<b>Rate pulse:</b> 0...1000 Hz	<b>Total pulse:</b> 33 ms duration
<b>Digital Input</b>	Totalizer reset, external pull-up, software enabled	

## MOUNTING SYSTEM

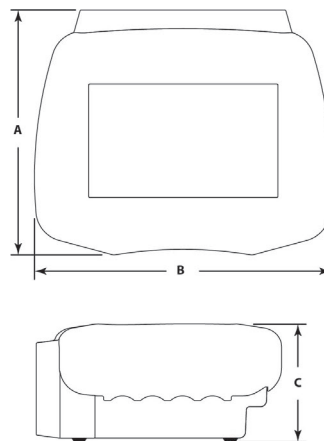
For DTR transducers, the rail mounting kit aids in installation and positioning of the transducers. Transducers slide on the rails, which have measurement markings that are used for proper spacing of transducers.

## DXN CONNECTION PANEL



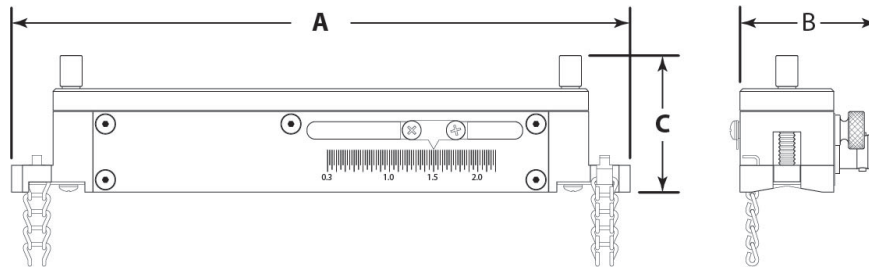
## DIMENSIONS

### DXN Transmitter

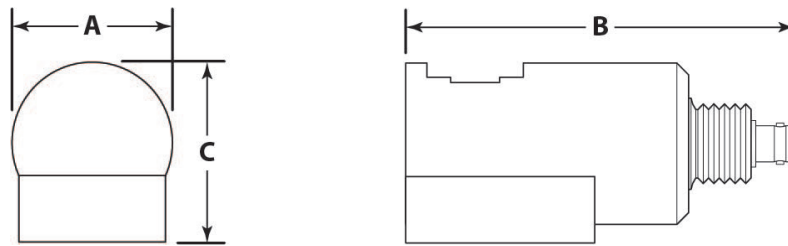


A	B	C
7.8 in. (198 mm)	9.4 in. (240 mm)	3.8 in. (96 mm)

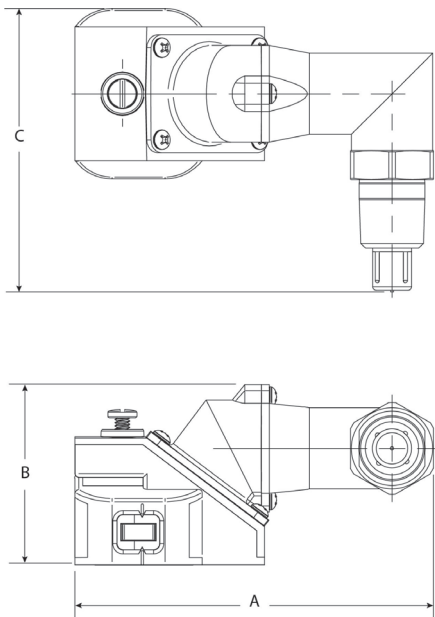
## Transducers



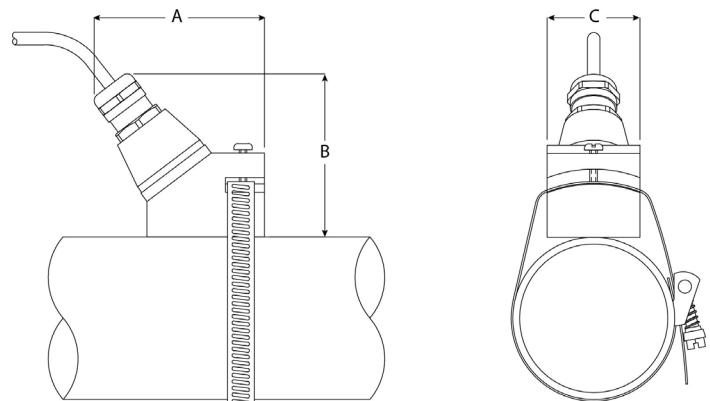
DTTSU Transit Time Transducer



DT94 Doppler Transducer



DTTR Transit Time Transducer



DTTL/DTTH Transit Time Transducer

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>Minimum Pipe O.D.</b>	<b>Maximum Pipe O.D.</b>
<b>DTTSU</b>	7 in. (178 mm)	1.6 in. (42 mm)	1.5 in. (39 mm)	—	0.5 in. (12 mm)	2.4 in. (60 mm)
<b>DT94</b>	1.7 in. (43 mm)	4.1 in. (105 mm)	1.9 in. (48 mm)	—	1 in. (25 mm)	60 in. (1524 mm)
<b>DTTR</b>	4.6 in. (117mm)	2.3 in. (58 mm)	3.6 in. (91 mm)	—	2 in. (50 mm)	98 in. (2500 mm)
<b>DTTL</b>	2.5 in. (63 mm)	4.2 in. (107 mm)	2.5 in. (63 mm)	3.9 in. (99 mm)	16 in. (400 mm)	120 in. (3050 mm)
<b>DTTH</b>	3.1 in. (79 mm)	2.9 in. (75 mm)	1.7 in. (43 mm)	3 in. (76 mm)	2 in. (50 mm)	98 in. (2500 mm)

## PART NUMBER CONSTRUCTION

### DXN Portable Transit Time/Doppler Flow Meter

	DXN	P	-			S	-	N	N
<b>MODEL</b>									
Portable Ultrasonic Flow Meter									
<b>POWER CORD (see image below for details) <sup>1</sup></b>									
North American									
Chinese									
European									
Japanese									
United Kingdom									
Australian									
<b>SENSOR AND HARDWARE KIT</b>									
Basic									
High Temperature									
Transit Time									
Hybrid									
Hybrid All									
Energy									
Full									
<b>CARRYING CASE</b>									
DXN Shoulder Strap and Outer Carrying Case									
<b>APPROVALS</b>									
CE; General Safety, U.S., Canada and Europe									
<b>OPTIONS</b>									
None									

<sup>1</sup> Includes Universal AC Power Converter; 95 ... 264V AC 50/60 Hz - C14 Connection

### SENSOR AND HARDWARE KIT OPTIONS

<b>Basic</b>	Small pipe and standard pipe transit time transducers and 20 ft cables (1) Couplant, grease; 5.3 oz; Dow 111 (1) Couplant, Ultrasound gel; 0.25 liter bottle (4) Stainless steel straps (1/2 in. wide, 12-5/16 in. max dia., worm drive clamp)
<b>Transit Time Standard Temperature</b>	Basic kit and large pipe transducers
<b>High Temperature</b>	Basic kit and high temperature pipe transducers
<b>Hybrid</b>	Basic kit, Doppler transducers and 20 ft cables for Doppler transducers
<b>Hybrid All Sizes</b>	Basic kit, large pipe transducers, Doppler transducers and 20 ft cables for Doppler transducers
<b>Energy</b>	Basic kit and non-invasive RTDs (1) Silicone Heat Sink Compound; 5 oz. syringe (1) RTD Installation tape, 36 feet
<b>Full</b>	Basic kit plus all, transit time, Doppler, RTDs and pipe wall thickness gauge (1) Silicone Heat Sink Compound; 5 oz. syringe RTD Installation tape, 36 feet (2) Stainless steel straps (1/2 in. wide, 21-1/4 in. max dia., worm drive clamp)

## PARTS AND ACCESSORIES

### Power Cords and Cables

Part Number	Description
D005-2109-013	North American Plug (2 flat & 1 round prong; NEMA 5/15P)
D005-2109-015	UK Plug (3 rectangular prongs; BS1363A)
D005-2109-016	European Plug (2 round prongs; CEE7/7)
D005-2109-017	Japan Plug (2 flat & 1 round, JIS8303, w/ 3-2 prong adapter)
D005-2109-014	China Plug (3 flat prongs; GB2099)
D005-2109-018	Australian Power Plug (3 Flat Prongs; AS3112)
D005-2129-020	Transit Time Cables, 20 ft (6 m)
D005-2129-050	Transit Time Cables, 50 ft (15 m)
D005-2129-100	Transit Time Cables, 100 ft (30 m)
D005-2130-020	Doppler Cables, 20 ft (6 m)
D005-2130-050	Doppler Cables, 50 ft (15 m)
D005-2130-100	Doppler Cables, 100 ft (30 m)

### Transducers (Heads with Case)

Part Number	Description	Minimum Pipe O.D.	Maximum Pipe O.D.
D010-2200-002-C	DTTSU Universal Small Pipe	0.5 in. (12 mm)	2.4 in. (60 mm)
D071-0107-302-C	DTTR Standard Pipe	2 in. (50 mm)	98 in. (2500 mm)
D071-0110-200-C	DTTL Large Pipe	16 in. (400 mm)	120 in. (3050 mm)
D071-0112-001-C	DT94 Doppler Transducer	1 in. (25 mm)	60 in. (1524 mm)
DTTH-020-D000-N-C	DTTH High Temperature, Standard Pipe Kit	2 in. (50 mm)	98 in. (2500 mm)

### Spare Parts

Part Number	Description
D002-2007-004	0...392° F (0...200° C) RTD Silicone stretch tape
D002-2007-001	36 in. (914 mm) SS Hose clamp / transducer strap
D002-2007-005	72 in. (1829 mm) SS Hose clamp / transducer strap
D002-2011-014	AcquaSonic 100
D002-2011-001	Acoustic couplant, grease (Dow 111), 150° F (65° C) 5.3 oz (150.2 gram) tube
D002-2011-011	Acoustic couplant, paste high temperature, 5 oz (142 gram) tube, 392° F (200° C)
D010-2102-310	DTTR rail
D040-0115-003-T	Wall thickness gauge, 6 ft (1.83 m)
D010-3000-128	Industrial RTD Kit <sup>1</sup> , 1000 Ohm, 392° F (200° C); 20 ft (6 m) cable
D010-3000-130	Industrial RTD Kit <sup>1</sup> , 1000 Ohm, 392° F (200° C); 50 ft (15 m) cable
D010-3000-132	Industrial RTD Kit <sup>1</sup> , 1000 Ohm, 392° F (200° C); 100 ft (30 m) cable

<sup>1</sup> RTD Kits include 2 RTDs, heat sink compound and installation tape.

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