DXN Portable Clamp-On Ultrasonic Flow Meter

Transit Time Plus Doppler Flow and Energy Measurement

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.

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

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 is designed to measure 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.

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

Where

Q	=	Volumetric flow rate
T_{in}	=	Temperature at the inlet
T_{out}	=	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, etc.

Badger Meter

06-HYB-DS-00482-EN (March 2013)

Product Data Sheet

PART NUMBER CONSTRUCTION

DXN P - □ □ S - N N

Model	Power Cord	Sensor & Hardware Kit	Carrying Case	Approvals	Options
P) Portable	**A)** North American	**B)** Basic	**S)** Standard – Outer case with shoulder strap	**N)** CE + General Safety, U.S., Canada, and EU	**N)** None
	U) U.K., Singapore	**T)** All Transit Time			
	E) Euro	**H)** Hybrid			
	J) Japan	**E)** Energy			
	C) China	**F)** Full			

SENSOR AND HARDWARE KIT OPTIONS

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

PARTS AND ACCESSORIES

Power Cords/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	Euro 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)
D005-2129-020	Transit time Cables, 20' (6 m)
D005-2129-050	Transit time Cables, 50' (15 m)
D005-2129-100	Transit time Cables, 100' (30 m)
D005-2130-020	Doppler Cables, 20' (6 m)
D005-2130-050	Doppler Cables, 50' (15 m)
D005-2130-100	Doppler Cables, 100' (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" (12 mm)	2.4" (60.3 mm)
D071-0110-000-C	DTTN standard pipe	2" (50 mm)	98" (2500 mm)
D071-0110-200-C	DTTL large pipe	16" (400 mm)	120" (3050 mm)
D071-0112-001-C	DT94 Doppler transducer	1" (25 mm)	60" (1524 mm)

RTDs/Accessories/Spare Parts

Part Number	Description
D002-2007-004	0… 392º F (200º C) RTD Silicone stretch tape
D002-2007-001	36" (914 mm) SS Hose clamp / transducer strap
D002-2007-005	72" (1829 mm) SS Hose clamp / transducer strap
D002-2011-001	Acoustic couplant, grease (Dow 111), 150° F (65° C) 5.3 oz tube
D002-2011-011	Acoustic couplant, paste high temperature, 142 gram tube, 392° F (200° C)
D010-3000-128	Industrial RTD Kit,[1] 1000 Ohm, 392° F (200° C); 20' (6 m) cable
D010-3000-129	Building Automation RTD Kit,[1] 1000 Ohm, 266° F (130° C); 20' (6 m) cable

[1] RTD Kits include: 2 RTDs, heat sink compound and installation tape.

SPECIFICATIONS

SYSTEM

Measurement Type
- Flow: Ultrasonic transit time and Doppler (reflection of acoustic signals); Hybrid operation.
- Pipe wall thickness: Ultrasonic transit time of acoustic signals; liquid thermal energy

Liquid Types
Liquid dominant fluids

Velocity Range
- Transit Time: Bi-directional to 40 FPS (12 MPS)
- Doppler: Uni-directional to 40 FPS (12 MPS)

Flow Rate Accuracy
- Transit Time: ±1% of reading or ±0.01 FPS (0.003 MPS), whichever is greater
- Doppler: 2% of full scale

Flow Sensitivity
0.001 FPS (0.0003 MPS)

Repeatability
±0.1% of reading

Temperature Accuracy
Absolute 0.5º F (1º C); Difference 0.2º F (0.5º C); Resolution 0.02º F (0.01º C)

Measurement Update
0.1…10 seconds update/filter rate. Transit time, up to 50 Hz high speed mode

Battery
Internal 11.1V lithium ion battery, 75W-hr. Provides 6…9 hrs of continuous operation with battery and indefinitely on external power. Charging (0…40º C), 12 hours while in use; 4 hours powered off

Power Requirements
- 10-30 VDC via-3-pin connector, 40 W min; 3.6A resettable fuse
- Supplies: Desktop adapter: 100-240 VAC 50/60 Hz 50 W 10V-18V; Cigarette lighter adapter: 5A fused

Power Cords
North American plug (2 flat & 1 round prong; NEMA 5/15P); China plug (3 flat prongs; GB2099); Euro plug (2 round prongs; CEE7/7); U.K. plug (3 rectangular prongs; BS1363A) Japan Plug (2 flat & 1 round, JIS8303, w/ 3-2 prong adapter)

Display
800 × 480 WVGA Color Outdoor Readable Display; Gloved-operation resistive touch screen

Ambient Conditions
- Battery powered: -4º F…110º F (-20º C…45º C)
- Externally powered: -20º F…140º F (-30º C…60º C)

Storage Temperature
Do not exceed 175º F (80º C)

Enclosure
Water/Dust resistant [IP 64]

User Menu
Windows .NET fully integrated user menu; multi-language: English, Spanish, German, French, Portuguese, Japanese, Russian, Italian, Dutch, Norwegian, and Swedish

Internal PC
500 MHz AMD PC, 256 MB RAM, 1GB user storage; Licensed Windows Embedded Standard 2009

Compliance
- Safety: UL61010-1, CSA C22.2 No. 61010-1, EN61010-1
- Directives: 2006/95/EC Low Voltage, 2004/108/EC EMC

TRANSDUCERS

Logging
>300 sites stored in 1 GB; downloads to USB Flash drive

Pipe Sizes
1/2" and larger; US standard pipe tables are built into User Interface

Housing Material
- DTTSU: CPVC, Ultem®, and anodized aluminum track system; Nickel-plated brass connector with Teflon® insulation
- DTTN/DTTL/DT94: CPVC, Ultem®; Nickel-plated brass connector with Teflon® insulation

Pipe Surface Temperature
DTTSU/DTTN/DTTL: -40º F…250º F (-40º C…121º C)
DT94: -40º F…250º F (-40º C…121º C)

Transducer Frequency
DTTSU: 2 MHz, DTTN: 1 MHz, DTTL: 500 kHz DT94: 625 kHz

Cable Length
Transit time: 20' (6 m) paired coaxial cable, BNC to BNC, Doppler: 20' (6 m) paired coaxial cable, BNC to 4-pin

Pipe Thickness
Dual mode transducer with 6' (1.8 m) of cable (BNC ends)

RTDs
2x platinum 385, 1000 Ohm, 3-wire PVC jacketed cable standard with quick connector

PROCESS MONITORING INPUTS/OUTPUTS

Connector
15-pin high-density DSUB

Breakout Box
0.2" quick disconnect screw terminal; 15 pin to adapter box; 6' (1.8 m) of cable (DSUB to DSUB connectors)

Inputs/Outputs

Energy/Temperature
2x RTDs PT1000 tab type; can handle various temperature ranges from -58º F…570º F (-50º C…300º C), based on RTD type

Current Output
4-20 mA active/passive 1% accuracy

Sensor Supply
14V @ 50mA max for powering current or voltage sensors

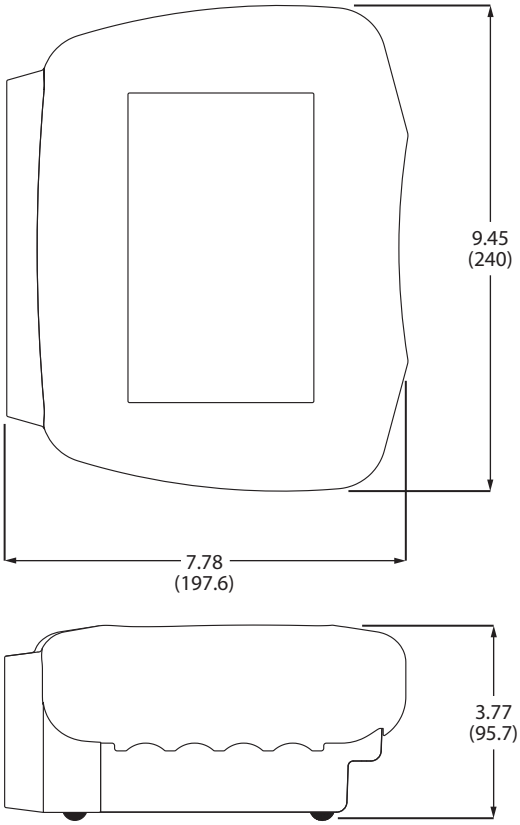
Digital Output
- Open collector, external pull-up
- Rate or total pulse user selectable
- Rate pulse: 0…1000 Hz
- Total pulse: 33ms duration

Digital Input
Totalizer reset, external pull-up

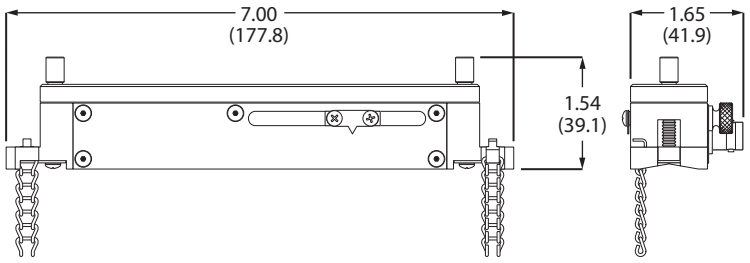
Auxiliary Inputs
- Voltage input. 0…5 V or 0…10 V, 1% accuracy
- Software scaling and control
- 80 k Ohms input impedance

Voltage Output
- 0…5V or 0…10V output voltage, 1% accuracy
- Software scaling and control
- 100 Ohms output impedance

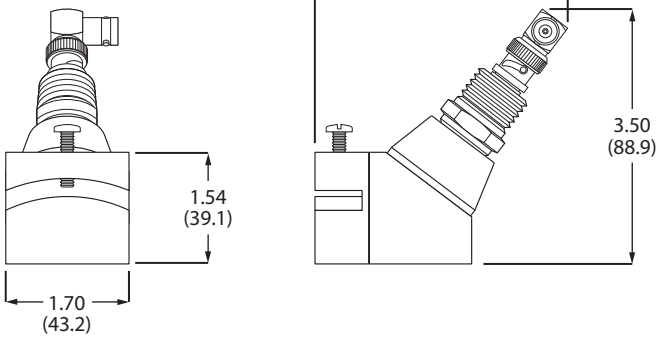
DIMENSIONS: Inches (millimeters)



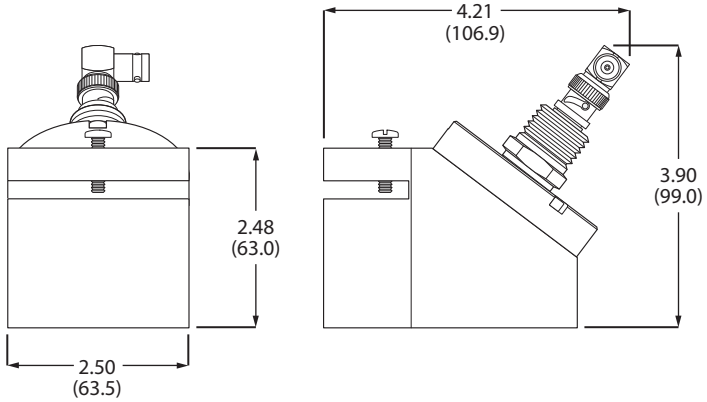
DTTSU Transit Time Transducer



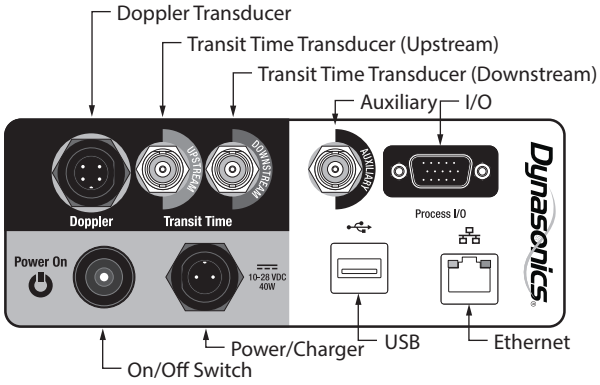
DTTN Transit Time Transducer



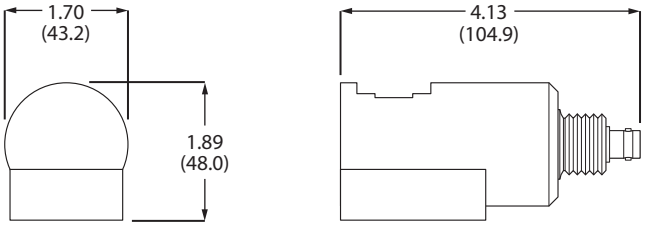
DTTL Transit Time Transducer



DXN Connection Panel



DT94 Doppler Transducer



Transducer Pipe Size Requirements

	Minimum Pipe O.D.	Maximum Pipe O.D.
DTTSU	.5" (12 mm)	2.4" (60.3 mm)
DTTN	2" (50 mm)	98" (2500 mm)
DTTL	16" (400 mm)	120" (3050 mm)
DT94	1" (25 mm)	60" (1524 mm)

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