



Economical, Non-Invasive
Flow Meter



Badger Meter

TFXL Ultrasonic Transit Time

Clamp-On Ultrasonic Flow Meter for Liquids

The Series TFXL ultrasonic flow meter clamps onto the outside of a pipe and does not contact the internal liquid. This advanced product provides instantaneous rate and accumulated flows along with 4-20 mA and pulse outputs. Compact integral mount systems can accommodate pipes/tubing two inches (DN 50 mm) and smaller. Remote mount systems are also available for pipe/tubing sizes 1/2 inch (DN 15 mm) and higher.

Features

- Measures liquids with small amounts of suspended solids or aeration (e.g., surface water, sewage).
- Bi-directional flow measurement system. Totalizer options include forward, reverse and net total.
- ULTRALINK software utility enables in-field flow meter configuration, calibration and troubleshooting, via laptop PC.
- Compact enclosure uses large, easy-to-read digital display.

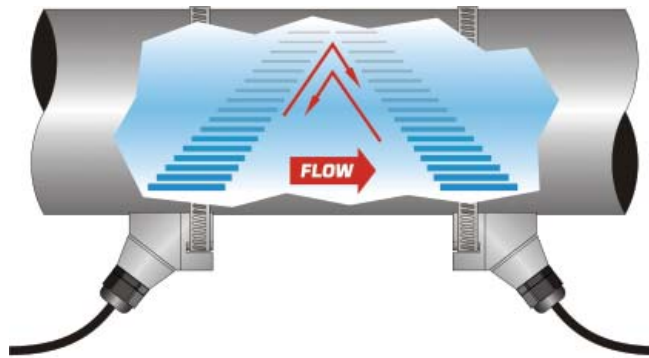
Benefits

- Reduced material costs: clamp-on sensor eliminates the need for in-line flanges, pipe fittings, strainers, and filters.
- Reduced installation time: may be installed and fully operational within minutes. No need to break into pipelines.
- Reduced maintenance costs: with no moving parts, there is nothing on the TFXL to wear down – no repair kits or replacement parts are needed.
- Easy retrofit: with three standard outputs (4-20 mA, TTL pulse, and simulated turbine frequency), the TFXL drops easily into existing DCS and flow monitoring systems.
- Reduced down-time: installation may be performed on full pipes. No need to shut the process down for installation or maintenance.

Transit-Time
Ultrasonic
Measurement

Principle of Operation

Transit time flow meters utilize two transducers which function as both ultrasonic transmitters and receivers. The flow meters operate by alternately transmitting and receiving a frequency modulated burst of sound energy between the two transducers. The burst is first transmitted in the direction of fluid flow and then against fluid flow. Since sound energy in a moving liquid is carried faster when it travels in the direction of fluid flow (downstream) than it does when it travels against fluid flow (upstream), a differential in the times of flight will occur. The sound's time of flight is accurately measured in both directions and the difference in time of flight calculated. The liquid velocity (V) inside the pipe can be related to the difference in time of flight (dt) through the following equation: $V = K \cdot D \cdot dt$, where K is a constant and D is the distance between the transducers.



V-Mode Configuration
Transit Time

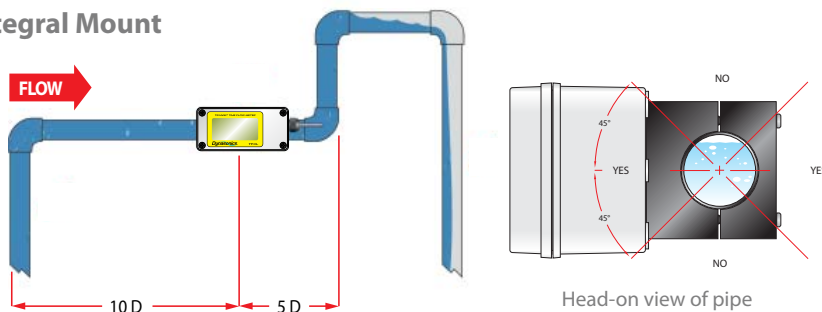
Remote Mount
or Integral Mount
Encoders



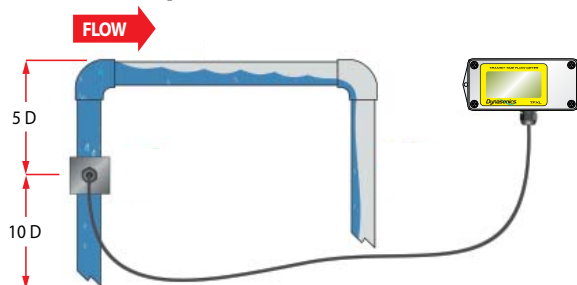
Installation Options

The optimum mounting location for the Series TFXL ultrasonic flow meter is a full pipe with at least 10 straight pipe diameters upstream and five pipe diameters downstream with no flow disturbances. Mount the flow meter or remote transducers onto a horizontal pipe with transducers located at approximately a 45-degree angle on the side of the pipe. On vertical pipes with upward flow, the transducers can be mounted in any radial orientation.

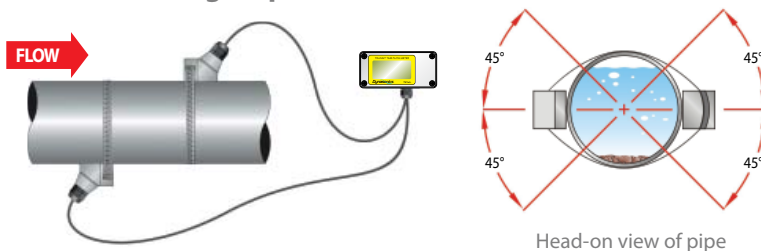
Integral Mount



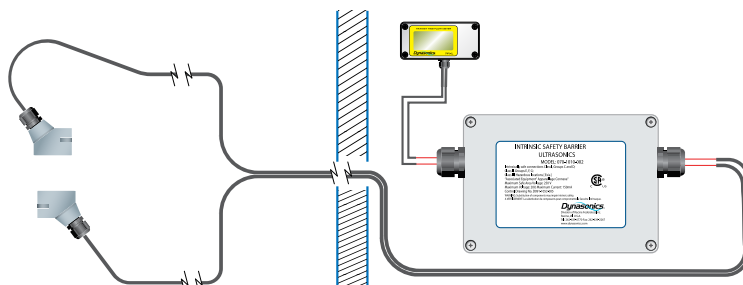
Remote Mount—Small Pipe



Remote Mount—Large Pipe



Hazardous Locations



Mounting Locations
and Orientation

Part Number Construction

Integral System 1/2...2 in. (12...50 mm)

Part Number: DTFXL - - N

Display Options

- 1) ABS enclosure – No display
- 2) ABS enclosure – Rate & Totalizer display

Connector Options

- N) 1/2" Conduit Hole (2)
- A) Water-tight Cable Clamp(2)
- C) 4-Pin (male) Brad Harrison® Micro-Change® Connector
- D) 1/2" Flexible Conduit Connectors (2)

Pipe Size


A) 1/2" ANSI Pipe (DN 15)	D) 1-1/4" ANSI Pipe (DN 32)	G) 1/2" Copper	J) 1-1/4" Copper	M) 1/2" Tubing	Q) 1-1/4" Tubing
B) 3/4" ANSI Pipe (DN 20)	E) 1-1/2" ANSI Pipe (DN 40)	H) 3/4" Copper	K) 1-1/2" Copper	N) 3/4" Tubing	R) 1-1/2" Tubing
C) 1" ANSI Pipe (DN 25)	F) 2" ANSI Pipe (DN 50)	I) 1" Copper	L) 2" Copper	P) 1" Tubing	S) 2" Tubing

Output

- 1) 4-20 mA & TTL Pulse
- 3) Totalizer Pulse

Options

- N) None
- C) CPVC Transducer
- Material (Integral-mount Options Only)
- F) I.S. DTTN Transducer (Remote Option X Only)



Remote System 1/2 in. and larger (12 mm and larger)

A system consists of one DTFXL part number and a choice of one large or small pipe transducer part number.

DTFXL - - N N

System Size

- X) Large Pipe
- Y) Small Pipe

Select Options from Integral System Table

Standard Pipe Transducer
Pipes larger than 2" (DN 50 mm)

DTT - - -

Piping Environment

- N) Standard: 250° F (121° C) Max. Temp.
- L) Large Pipe: 250° F (121° C) Max. Temp.
- H) High Temp: 350° F (176° C) Max. Temp.

Cable Length

- 020) 20 feet (6 m)
- 050) 50 feet (15 m)
- 100) 100 feet (30 m)

Transducer Options

- N) None
- S) Submersible (IP68)
- A) Flexible armored
- P) BNC Connectors

Area Options

- N) None
- F) Class I, Div. 1, Groups C & D w/I.S. barrier
- P) Portable w/I.S. barrier

Conduit Length

- 000) 0 feet (0 m)
- 020) 20 feet (6 m)
- 050) 50 feet (15 m)
- 100) 100 feet (30 m)

Small Pipe Transducer
Pipes 1/2...2" (12...50 mm)

DTT - - -

Piping Environment

- S) Standard: 185° F (85° C) (PVC, Ultem®)
- C) High Temp: 250° F (121° C) (CPVC, Ultem®)

Nominal Pipe Size

- D) 1/2"
- F) 3/4"
- G) 1"
- H) 1-1/4"
- J) 1-1/2"
- L) 2"

Pipe Type

- P) ANSI Pipe
- C) Copper Pipe
- T) Tubing

Cable Length



- 020) 20 ft. (6.1 m)
- 050) 50 ft. (15 m)
- 100) 100 ft. (30 m)

Conduit Type

- N) None
- A) Flexible Armored
- P) BNC Connectors

Conduit Length

- 000) 0 ft. (0 m)
- 020) 20 ft. (6.1 m)
- 050) 50 ft. (15 m)
- 100) 100 ft. (30 m)

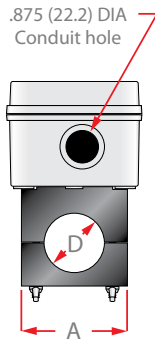
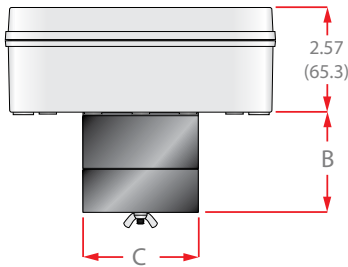
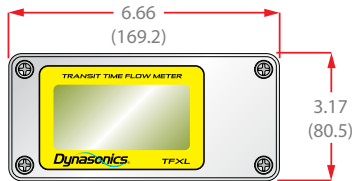
Specifications

Liquid Types	Most clean liquids or liquids containing small amounts of suspended solids			
Power Requirements	11-28VDC @ 0.25A			
Protection	Reverse polarity, surge suppression			
Velocity	0.1...40 fps (0.03...12 mps)			
Inputs/Outputs	4-20mA Output (Standard Output)		Totalizer Pulse	
	Resolution	12-bit for all outputs	Operation	Normal state high; pulses low with display total increments
	Power	Source		
	Insertion loss	5V Max.		
	Loop impedance	900 Ohms Max.	Pulse duration	30mSec min.
	Isolation	Can share ground common with power supply isolated from piping system	Source/sink	2 mA max.
			Logic	5 VDC
	Turbine Frequency Output/TTL—Pulse Output (Switch selectable)			
	Type	Non-grounded referenced AC/ground referenced square wave		
	Amplitude	500mVpp min. /5 VDC		
Frequency range	0...1,000Hz			
Duty cycle	50% ± 10%			
Display	Type: 2 line x 8 character LCD Rate: 8 maximum digits with lead zero blanking Total: 8 maximum digits with exponential multipliers from -1...6			
Units	Engineering units: Feet, gallons, ft³, million-gal, barrels (liquid & oil), acre-feet. lbs, meters, m³, liters, million-liters, kg Rate: second, minute, hour, day			
Enclosure – Rating: Dimensions:	NEMA 3 (Type 3) ABS, PVC and Ultem® (integral system), brass or SS hardware 3"W x 2.5" H x 6" D (75 mm x 63 mm x 150 mm)			
Transducer Type:	Clamp-on, uses time of flight ultrasonics			
Ambient Temperature:	General purpose: -40° F...185° F (-40° C...85° C); Hazardous locations integral mount: 0° F...105° F (-20° C...40° C); Hazardous locations DTTN: -40° F...185° F (-40° C...85° C)			
Transducer Ratings:	DTTN/DTTC: NEMA 6* (IP 67), CPVC, Ultem, Nylon cord grip, PVC cable jacket; -40...250° F (-40...121° C) Construction DTTN: NEMA 6P* (IP 68) option, CPVC, Ultem, Nylon cord grip, Polyethylene cable jacket; -40...250° F (-40...121° C) DTTH: NEMA 6* (IP 67), PTFE, Vespel®, Nickel-plated brass cord grip, PFA cable jacket; -40...350° F (-40...176° C) DTTS: NEMA 6* (IP 67), PVC, Ultem, Nylon cord grip, PVC cable jacket; -40...185° F (-40...85° C) *NEMA 6 units: to a depth of 3 ft. (1 m) for 30 days max. NEMA 6P units: to a depth of 100 ft. (30 m) seawater equivalent density indefinitely.			
Pipe/Tubing Sizes:	1/2" (12 mm) and larger			
Pipe/Tubing Materials:	Carbon steel, stainless steel, copper and plastic			
Accuracy:	DTTN/DTTH ±1% of reading at rates >1 FPS (0.3 MPS), ±0.01 FPS (±0.003 MPS) at rates lower than 1 FPS; DTTS/DTTC 1" and larger units ±1% of reading from 10-100% of measuring range, ±0.01 FPS (±0.003 MPS) at rates lower than 10% of measuring range; ¾" and smaller units ±1% FS. Refer to the Dimensional Specifications page for applicable measuring ranges for each DTTS/DTTN transducer models.			
Repeatability:	±0.5% of reading			
Response Time:	0.3...30 seconds, adjustable			
Certifications:	All TFXL Models General Requirements: UL 61010-1 and CSA C22.2 No. 61010-1 Hazardous Locations: Class I Div. 2 Groups C&D T4 to UL 1604 and CSA 22.2 No. 213		DTTN Transducer and IS Barrier (-F option) Hazardous Location Designation: Class I Div 1, Groups C & D; T5 Intrinsically Safe Exia Process Control Equipment: CSA C22.2 No. 142 Intrinsically Safe Equipment: CSA C22.2 No. 157 Intrinsically Safe & Associated Apparatus: UL913 Energy Management Equipment: UL916	
ULTRALINK™ Utility:	Software utility, requires serial communication cable Windows 2000, Windows XP, Windows Vista®, and Windows® 7 compatible			

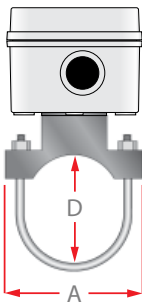
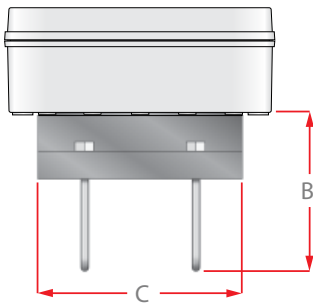
Dimensions:

Inches (mm)

Integral System



U-Bolt Connections (ANSI & Copper 2 inch Models)

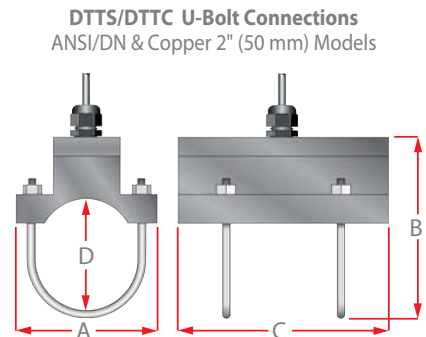
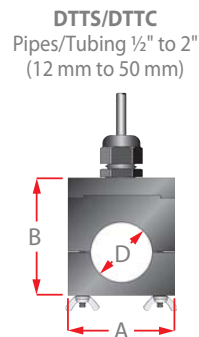
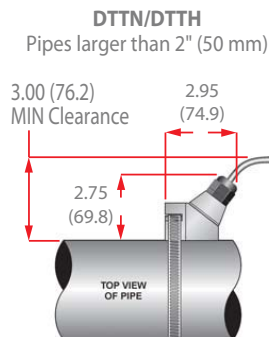
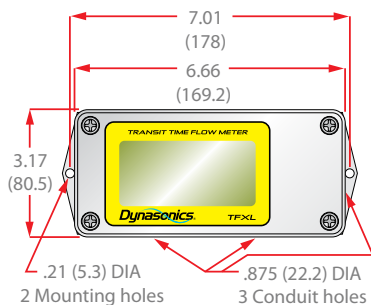


DTTS and DTTC Transducers

PIPE SIZE	PIPE MATERIAL	A	B	C	D	MEASURING RANGE
1/2"	ANSI/DN	2.46 (62.5)	2.36 (59.9)	2.66 (67.6)	0.84 (21.3)	2...38 gpm 8...144 lpm
	Copper	2.46 (62.5)	2.36 (59.9)	3.33 (84.6)	0.63 (15.9)	1.8...27 gpm 7...102 lpm
	Tubing	2.46 (62.5)	2.28 (57.9)	3.72 (94.5)	0.50 (12.7)	1.5...18 gpm 6...68 lpm
3/4"	ANSI/DN	2.46 (62.5)	2.57 (65.3)	2.66 (67.6)	1.05 (26.7)	2.75...66 gpm 10...250 lpm
	Copper	2.46 (62.5)	2.50 (63.5)	3.56 (90.4)	0.88 (22.2)	2.5...54 gpm 10...204 lpm
	Tubing	2.46 (62.5)	2.50 (63.5)	3.56 (90.4)	0.75 (19.0)	2.5...45 gpm 10...170 lpm
1"	ANSI/DN	2.46 (62.5)	2.92 (74.2)	2.86 (72.6)	1.32 (33.4)	3.5...108 gpm 13...409 lpm
	Copper	2.46 (62.5)	2.87 (72.9)	3.80 (96.5)	1.13 (28.6)	3.5...95 gpm 13...360 lpm
	Tubing	2.46 (62.5)	2.75 (69.9)	3.80 (96.5)	1.00 (25.4)	3.5...85 gpm 13...320 lpm
1-1/4"	ANSI/DN	2.80 (71.0)	3.18 (80.8)	3.14 (79.8)	1.66 (42.2)	5...186 gpm 19...704 lpm
	Copper	2.46 (62.5)	3.00 (76.2)	4.04 (102.6)	1.38 (34.9)	4.5...152 gpm 17...575 lpm
	Tubing	2.46 (62.5)	3.00 (76.2)	4.04 (102.6)	1.25 (31.8)	4...136 gpm 15...514 lpm
1-1/2"	ANSI/DN	3.02 (76.7)	3.42 (86.9)	3.33 (84.6)	1.90 (48.3)	6...250 gpm 23...946 lpm
	Copper	2.71 (68.8)	2.86 (72.6)	4.28 (108.7)	1.63 (41.3)	5...215 gpm 19...814 lpm
	Tubing	2.71 (68.8)	3.31 (84.1)	4.28 (108.7)	1.50 (38.1)	5...200 gpm 19...757 lpm
2"	ANSI/DN	3.70 (94.0)	3.42 (86.9)*	5.50 (139.7)	2.375 (60.3)*	8...420 gpm 30...1590 lpm
	Copper	3.70 (94.0)	3.38 (85.9)*	5.50 (139.7)	2.125 (54.0)*	8...375 gpm 30...1419 lpm
	Tubing	3.21 (81.5)	3.85 (98.0)	4.75 (120.7)	2.00 (50.8)	8...365 gpm 30...1381 lpm

*Varies due to U-bolt configuration

Remote System





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