

MULTIPLE-PIPE, MULTIPLE-PATH CLAMP-ON ULTRASONIC FLOW METER FOR LIQUIDS



Series TFXM Multiple-Pipe, Multiple-Path Transit Time Flow Meters feature advanced non-invasive flow measurement technology - providing a measuring system with superior accuracy, versatility, low cost of installation and low cost of ownership. The TFXM system installs quickly onto liquid piping systems with its non-invasive, non-fouling transducers and can be configured and operational within minutes. Mathematical formulas can be applied to discrete flow measurements - up to eight discrete channels/pipes - to display and output average flow, flow difference, proportions or sums.

TFXM is designed for indoor and outdoor fixed installations and is designed to operate on both AC and DC power sources. The backlit graphics display provides four lines of user-selected flow information including rate, totalizer, liquid sound speed and signal strength - for any meter connected to the TFXM network. An integral optical interface is used with the optional Windows® *ULTRALINK™* software utility and allows simple in-field programming, calibration and software upgrades. All TFX systems utilize digital signal processing, cross-correlation, and field replaceable input/output modules.

A TFXM flow measurement system is a cost effective versatile investment that can be readily configured for piping from ½ inch (12 mm) and higher.

FEATURES

- Multiple-path, single-pipe installations ensure accurate flow measurements without the need for long runs of straight pipe.
- User configurable rate and totalizer units include: feet, gallons, ft³, million-gal, barrels (liquid & oil), acre-feet, lbs, meters, liters, m³, million-liters and kg.
- Each measurement channel contains integral 4-20 mA, dual-relay and RS485 communications. Field replaceable output and communication module options include: 200,000-event data logger, rate pulse, and Heatflow/RTD.
- Automatic Reynolds Number compensation ensures accurate measurements through the laminar, transition and turbulent system flow regions.
- Ultralink software utility (free download) enables in-field flow configuration, calibration and troubleshooting, via laptop PC.

BENEFITS

- Non-invasive clamp-on transducers are simple and cost efficient. Since the transducers do not contact the liquid, fouling, pressure drop, leaks and maintenance are eliminated.
- Reduced installation time: no need to break into pipelines. Meter can be configured and operational in minutes.
- Reduced down-time: installation may be performed on full pipes. No need to shut the process down for installation or maintenance.
- Low ownership costs: no repair kits, replacement parts, or ongoing maintenance is necessary.



Series TFXM

PRINCIPLES OF OPERATION

TFX transit time flow meters utilize two transducers, shown as elements A and B in Figure 1, which function as both ultrasonic transmitters and receivers. The transducers are clamped on the outside of a closed pipe at a specific distance from each other. (The transducers can be mounted in V-mode as shown in Figure 1, W-mode where the sound transverses the pipe four times, or in Z-mode where the transducers are mounted on opposite sides of the pipe. This selection is based on pipe and liquid characteristics.) The flow meter operates 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. If the fluid is not moving, the time of flight difference will be zero and the flow meter will indicate zero flow.

The sound's time of flight is accurately measured in both directions and the difference in time of flight is 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.

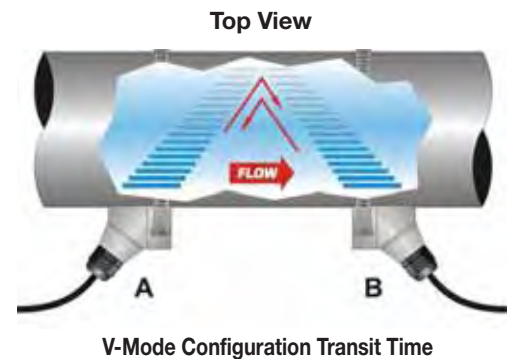


Figure 1

PART NUMBER CONSTRUCTION

TRANSMITTER-Wall mount bracket kit included

D T F X M [] - [] [] [] [] [] - **N** [] []

Channels

- 1) One Internal Channel
- 2) Two Internal Channels

Power Supply*

- A) 115 VAC
- B) 230 VAC

Channel 1 Input/Output

(RS485 is Standard on all Models)

- 1) 4-20 mA and Dual-Relay
- 2) Dual-Relay and One Option
- 3) 4-20 mA and One Option

Channel 1 Option Input/Output

N) None (If "1" is selected previously)

- 1) 4-20 mA (Secondary)
- 2) Dual Relay (Secondary)
- 3) Rate Pulse
- 6) Data Logger
- 7) Heatflow/RTD

Channel 2 Input/Output (TFXM2)

N) None - (TFXM1)

- 1) 4-20 mA and Dual Relay
- 2) Dual Relay and one Option
- 3) 4-20 mA and One option

Channel 2 Input/Output (TFXM2)

N) None - (TFXM1 or if "1" is selected previously)

- 1) 4-20 mA (Secondary)
- 2) Dual Relay (Secondary)
- 3) Rate Pulse
- 6) Data Logger
- 7) Heatflow/RTD

Installation

N) General Purpose

Options

- N) None
- 2) 2 MHz DTTS/DTTC transducers

TRANSDUCER-Pipes larger than 2" (50 mm)

D T T [] - [] [] [] [] - [] [] [] [] - [] [] [] []

Construction

- N) Standard: +250 °F (+121 °C) (CPVC, Ultem®)
- H) High Temp: +350 °F (+176 °C) (PTFE, Vespel®)

Conduit Type

- N) None-RG59 Cable
- A) Flexible Armored

Cable Length

- 020) 20 feet (6 m)
 - 050) 50 feet (15 m)
 - 100) 100 feet (30 m)
- Maximum length: 990 feet (300 m) in 10 ft. (3 m) increments

Conduit Length

(Standard construction: Conduit length = Cable length)

- 000) None
 - 020) 20 feet (6 m)
 - 050) 50 feet (15 m)
 - 100) 100 feet (30 m)
- Maximum length: 990 feet (300 m) in 10 ft. (3 m) increments

Installation

- N) General Purpose
- F) CSA Class I, Div. 1, Groups C & D

Small Pipes - 1/2" to 2" (12 mm to 50 mm)

D T T [] [] [] - [] [] [] [] - [] [] [] []

Type

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

Cable Length

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

Conduit Length

- 000) None
- 020) 20 feet (6 m)
- 050) 50 feet (15 m)
- 100) 100 feet (30 m)

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) Rigid Tubing

Conduit Type

- N) None - RG59 Cable
- A) Flexible Armored

*All TFXM units will also function in 10-28 VDC

SPECIFICATIONS

TRANSMITTER

DESCRIPTION	SPECIFICATION
Power Requirements	10-28 VDC @ 8 VA maximum; 115/230 VAC 50/60 Hz \pm 15% @ 14 VA maximum
Velocity	-40 to +40 FPS (-12 to +12 MPS)
Outputs	All output modules are optically isolated from earth and system grounds
Standard (integrated)	RS485 standard (Important: RS485 in the TFXM is dedicated to intra-TFX communications only. Connection of PCs or other network devices to the TFXM network is not possible.)
Options (plug-in)	4-20 mA (secondary) 800 Ohms maximum; 12-bit resolution; passive or active Dual Relay (secondary) Two separate Form C relays, 200 VAC maximum @ 0.5 A resistive Rate Pulse FET output (open collector action), 0-2,500 Hz maximum, 1 A maximum Data Logger 200,000-event, 16-bit, DB-9 connection, can be removed and installed without disconnecting system power Heatflow (see TFX Energy); Supports two 1000 Ω RTDs, multiplexed, 12-bit resolution
Display	128 x 64 pixel graphics LCD, LED back lit. Two user selectable font sizes 0.35" (8.9 mm), or 0.2" (5.0 mm); configure for either two or four data lines
Data	Can be displayed for up to 8 pipes or paths: 8 digit rate, 8 digit totalizer, liquid sound speed, signal strength
Units	User configured - feet, gallons, ft ³ , mil-gal, barrels (liquid & oil), acre-feet, lbs., liters, meters, m ³ , Kg
Rate	Rate time: sec, min, hr, day
Totalizer	Forward, reverse, batch and net total
Ambient Conditions	-40 to +185 °F (-40 to +85 °C), 0-95% relative humidity, non-condensing
Enclosure	NEMA 4 (IP-66) epoxy-coated steel, polycarbonate keypad and SS hardware. 11.0H x 11.4W x 4.2D inches (280H x 290W x 106D mm); 11.5 lbs. (5.2 Kg)
Accuracy Flow Rate	DTTN/DTTH \pm 1% of reading at rates > 1 FPS (0.3 MPS), \pm 0.01 FPS (\pm 0.003 MPS) at rates lower than FPS; DTTS/DTTC 1" and larger units \pm 1% of reading from 10-100% of measuring range, \pm 0.01 FPS (\pm 0.003 MPS) at rates lower than 10% of measuring range; ½" and ¾" units \pm 1% FS. Refer to the Dimensional Specifications page for applicable measuring ranges for each DTTS/DTTN transducer model.
Sensitivity	Flow: 0.001 FPS (0.0003 MPS)
Repeatability	\pm 0.5% of reading
Response Time	Flow: 0.3-300 seconds, user configured, to 100% of value, step change in flow
Security	Keypad lockout, user selected four digit access code
ULTRALINK™ Utility	IBM compatible, Windows® 98/2000/XP/Vista® operating system

TRANSDUCER

DESCRIPTION	SPECIFICATION
Liquid Types Supported	Virtually all non-aerated liquids
Transducer to Transmitter Distance	(Std.) 20, 50, 100 feet (6, 15, 30 meters); (Opt.) lengths to 990 feet (300 meters) RG59 - 75 OHM Coaxial cable
Pipe Sizes	DTTN/DTTH: Larger than 2 inch (50 mm) DTTS/DTTC: ½ inch to 2 inch (12 mm to 50 mm)
Pipe Surface Temperature	DTTN/DTTC: -40 to +250 °F (-40 to +121 °C); DTTH: -40 to +350 °F (-40 to +176 °C) DTTS: -40 to +185 °F (-40 to +85 °C)
Environment	DTTN/DTTH: NEMA 6P (IP-68) DTTS/DTTC: NEMA 4X (IP-66); 0-95% relative humidity, non-condensing
Housing Material	DTTN/DTTC: CPVC, Ultem® and Nylon; DTTH: PTFE, Vespel® and Nickel-Plated Brass; DTTS: PVC, Ultem® and Nylon

Installation	DTTN Transducer (-N option) General purpose	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: UL 913 Energy Management Equipment: UL 916
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ISO-MOD INPUT/ OUTPUT MODULES

General

The standard TFXM provides integral RS485 communications in addition to two relays per measurement channel and one 4-20 mA output per measurement channel. TFXM permits the selection of one other input/output device, selected from the list below, per measurement channel. If an optional input/output device is required, either the 4-20 mA or the dual-relay device must be disabled for that particular measurement channel. All output electronics and modules are 2,500 V optically isolated from TFXM power and Earth grounds – eliminating the potential for ground loops and reducing the chance of severe damage in the event of an electrical surge.

Five ISO-MOD options are available for TFXM including: 4-20 mA (secondary), dual-relay (secondary), rate pulse, 200,000-event data logger, and Heatflow/RTD. All modules are field configurable by utilizing the keypad or *ULTRALINK™* interface. Features of the various ISO-MODs are described below. See the TFX Energy datasheet for details regarding the Heatflow/RTD module option.

4-20 mA Output Module

Easily configured via switch selections into either an internally powered or externally powered mode, the 4-20 mA Output Module interfaces with virtually all recording and logging systems by transmitting an analog current signal that is proportional to system flow energy rate. Independent 4 mA and 20 mA span settings are established in software. These settings can span negative and positive flow directions to output bi-directional flow data. Output resolution of the module is 12-bits (4,096 discrete points) and because of its low insertion loss characteristics (less than 5 V typical) the module can drive more than 800 ohms of load with a 24 V power source.

Dual Relay Module

Two independent SPDT (single-pole, double-throw, Form C) relays are contained in this module. The relay operations are user-configured via software to act in either a flow rate alarm, signal strength alarm, water meter pulser or totalizer/batching mode. The relays are rated for 200 VAC max. and have a current rating of 0.5 A resistive load (175 VDC @ 0.25 A resistive). It is highly recommended that a secondary relay be utilized whenever the Control Relay ISO-MOD is used to control inductive loads such as solenoids and motors.



Rate Pulse Output Module

The Rate Pulse Output Module is utilized to transmit information to external counters and PID systems via a frequency output that is proportional to system flow energy rate. Independent Zero and Span settings are established in software using the Flow Measuring Range entries. These settings can span negative and positive flow directions to output bi-directional flow data. Output resolution of the module is 12-bits (4,096 discrete points) and the maximum output frequency setting is 2,500 Hz – other frequency ranges may be available, please consult the Dynasonics factory. The module has a MOSFET output with an “On” resistance of 0.21 ohms and is rated at 100 V, 1 A continuous operation.

Data Logger Module

This powerful 200,000-event data logger/electronic stripchart recorder can be configured to match user applications. The logger stores time-stamped, high resolution (16-bit) data at user-selected intervals ranging from 1 to 1,000 seconds.

A computer can be connected to the DB9 connector without removing the logger from the flow meter. Data can be extracted via the supplied Windows® compatible software utility.

ULTRALINK™ SOFTWARE UTILITY

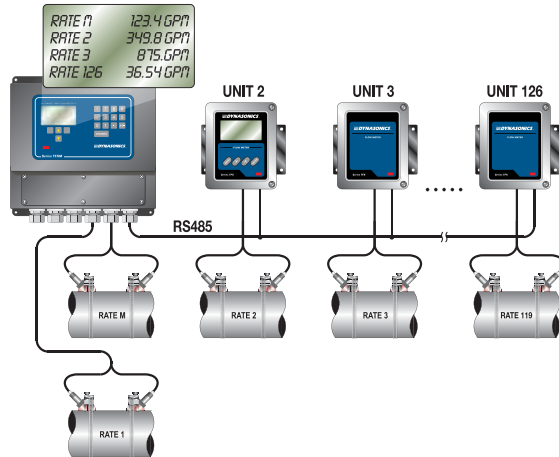


Real-Time Infrared Communications. Configuration and calibration are quick and simple using *ULTRALINK™* and your PC. Dynasonics Infrared Serial Adapter (P.N. D005-2115-001) allows full programming access without the need to open the TFXM enclosure or connect wires.

Designed with the user/operator in mind, configuration and calibration of transit time ultrasonic flow meters have never been as simple and straight-forward as with Series TFXM. Integration of your PC, the TFXM flow meter and *ULTRALINK™* provide the ultimate in operator control. *ULTRALINK™* is a software utility that operates on a Windows® PC operating system and communicates with TFXM flow meters through a serial communications port and infrared serial adapter (P.N.D005-2115-001). Since the communication link is infrared light, the user need only be within 10 feet (3 meters) of the TFXM meter – interconnection wires are not necessary.

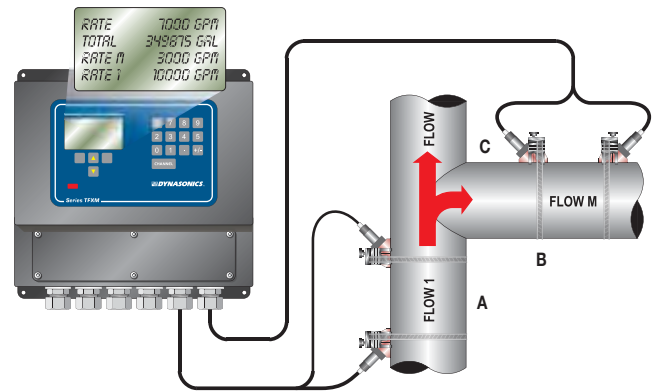
Note: Series TFXM does not require *ULTRALINK™* or the use of a computer for configuration. However, the software and a computer are requirements for in-field calibration and some advanced functions of TFXM systems.

PRODUCT INSTALLATION



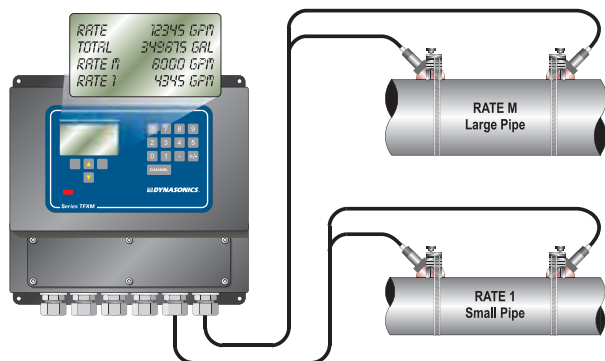
Multiple-Pipe Master Flow Meter

Multiple pipes can be configured and displayed on the TFXM console.



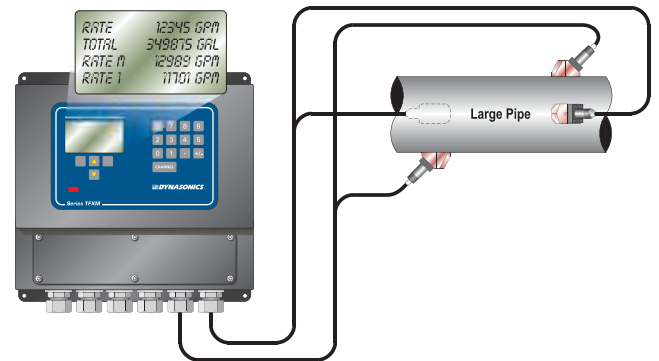
Multiple-Pipe Difference Flow Meter

Displays the actual flow of pipes and the difference flow of a non-measured pipe.



Multiple-Pipe Summation Flow Meter

Displays the actual flow of multiple pipes as well as the sum of multiple flow rates.

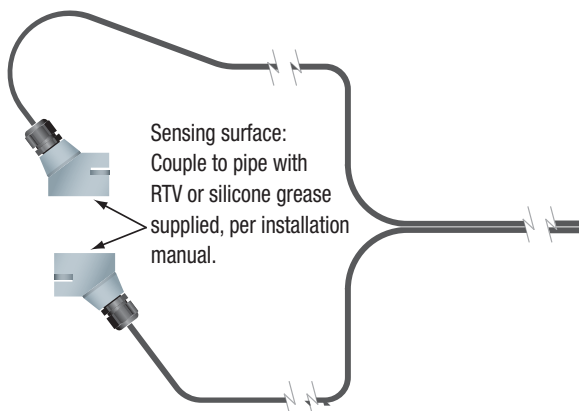


Multiple-Path Single-Pipe Flow Meter

By averaging multiple paths on a single pipe, stability and accuracy of measurements can be improved.

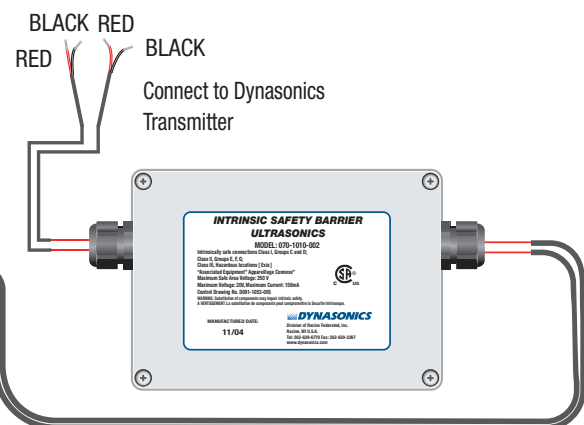
Hazardous (Classified) Location

Class I, Division 1 Groups C and D
Maximum Ambient Temperature: -40° to +85 °C



Non-Hazardous Location

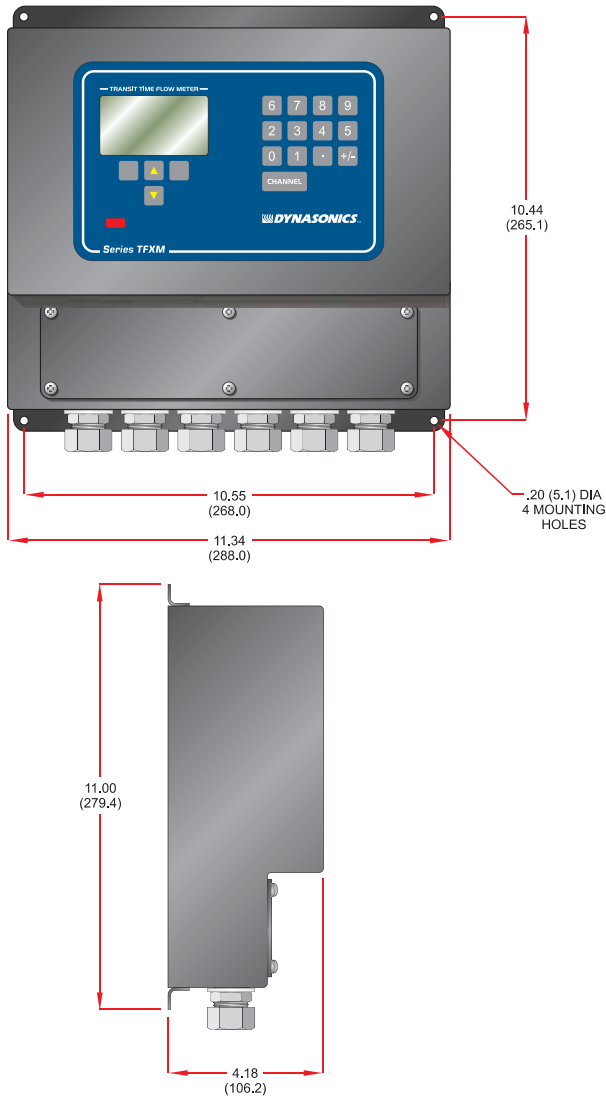
Maximum Ambient Temperature: -40 °C to +50 °C



Series TFXM

DIMENSIONAL SPECIFICATIONS

MECHANICAL DIMENSIONS: INCHES (MM)



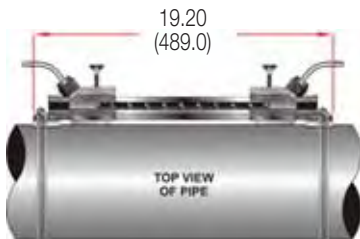
DTTS/DTTC TRANSDUCER DIMENSIONS: INCHES (MM)

Pipe Size	Pipe Material	A	B	C	D	Measuring Range
1/2"	ANSI	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	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	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	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 GPM
1-1/2"	ANSI	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	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

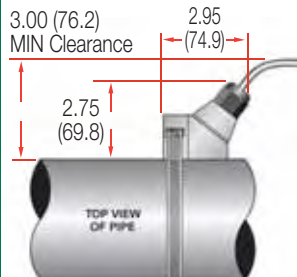
10" (250 mm) Scaled Mounting Track

[Optional 16" (405 mm) track also available]



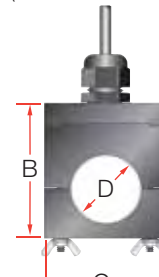
DTTN/DTTH

Pipes larger than 2" (50 mm)



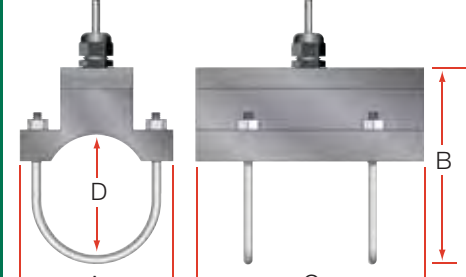
DTTS/DTTC

Pipes 1/2" to 2" (12 mm to 50 mm)



DTTS/DTTC U-Bolt Connections

[ANSI & Copper 2" (50 mm) Models]



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FORM TFXD 6/08

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