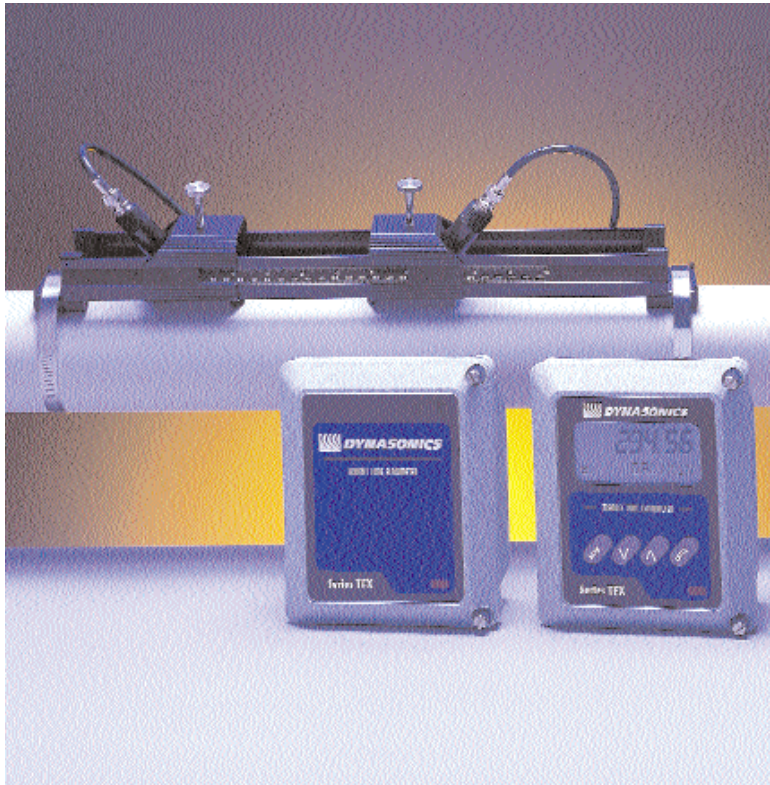


## FIXED LOCATION TRANSIT TIME



Series TFXD Transit Time Flowmeters feature the world's most advanced non-invasive flow measurement technology available – providing a measuring system with unsurpassed accuracy, versatility, low-cost of installation and low-cost of ownership. The TFXD system installs quickly onto liquid piping systems with its non-invasive, non-fouling transducers and can be configured and operational within minutes.

TFXD is designed for fixed-location installation on liquid systems and is available in both blind [TFXD1] and displayed [TFXD2] configurations. TFXD2 has an oversized LCD and integral keypad that allows field configuration without the use of a computer. TFXD also provides an optical interface which can be used with the optional Windows® **ULTRALINK™** software utility. The software utility allows simple in-field programming, calibration and software upgrades. All systems utilize Dynasonics' proprietary dual time-base time expansion software algorithm, digital cross-correlation, optically isolated input-output busses and field replaceable input/output modules.

The TFXD flow measurement systems are a cost effective, versatile investment that can be readily configured for piping from 2" [50 mm] to 100" [2540 mm]. For pipes 1/2" [12 mm] to 2" [50 mm] see small pipe transducer data sheet series DTTS.

## FEATURES

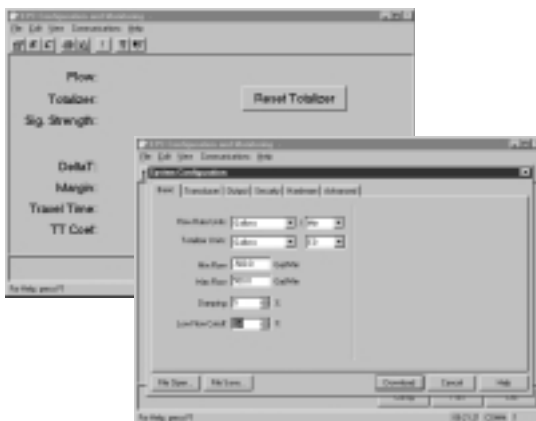
- Non-invasive, NEMA 6 [IP-68] clamp-on transducers are simple and cost efficient to install. Since the transducers do not contact the liquid, fouling and maintenance are eliminated.
- TFXD has a flow measuring range that exceeds 4000:1. This feature allows the instrument to measure normal process flow rates as well as flows resulting from leaks in piping and valves.
- Automatic Reynolds Number compensation assures accurate measurements through the laminar, transition and turbulent system flow regions.
- User configurable rate and totalizer units include: feet, gallons, ft<sup>3</sup>, million-gal, barrels, acre-feet, lbs, meters, liters, m<sup>3</sup>, million-liters and kg.
- Low power consumption. The TFXD system operates on less than 2.5W allowing operation on UPS, solar panel and battery operated power sources.
- Field replaceable I/O module options include: 200K-event data logger, 4-20 mA, rate pulse, RTD (see Series TFX BTU-Pro data sheet), dual relay, RS232C and RS485.
- The measurement range of the TFXD system includes zero flow. Reading accuracy and reliability, especially at low flow rates, are improved versus mechanical, DP and vortex shedding flowmeter performance.
- An integral optical interface and optional Windows® software utility provides complete control of system configuration, calibration and diagnostics – without opening the NEMA 4X [IP-66] enclosure.

## ULTRALINK™ SOFTWARE UTILITY



Windows®-based Software Utility. A complete meter configuration, calibration and troubleshooting tool.

- Provides quick access to all configuration parameters with pop-up windows and pull-down menus.
- Assists in selection of proper position and mounting locations of system transducers.
- Selection of Units of Measure and Measuring Range.
- Contains a powerful in-field multi-point calibration routine.
- Displays error codes and logs reset functions.
- Stores meter configurations to a disk that can be archived or used to configure additional meters.



**User Friendly Operations.** Configuration of the TFXD is provided through a simple menu structure. Selection of units of measure, measuring range, input/output options and configurations storage are available.

Designed with the user/operator in mind, configuration and calibration of ultrasonic flowmeters has never been as simple and straight-forward as with Series TFXD. Integration of your PC, the TFXD flowmeter and **ULTRALINK™** provides the ultimate in operator control. **ULTRALINK™** is a Windows® 95/98/2000/XP software utility that communicates with TFXD flowmeters through a PC serial communications port and infrared serial adapter (Dynasonics P.N. D005-2115-001 shown below). Since the communication link is infrared light, the user need only be within 10 feet [3 meters] of the TFXD meter — interconnection wires are not necessary.

Note: Model TFXD2 (model with integral keypad and display) does not require **ULTRALINK™** or the use of a computer for configuration. Model TFXD1 (model without keypad and display) does require the software and computer for system configuration. The software and computer are requirements for in-field calibration of TFXD systems and to access advanced features of the TFXD system.

Order Dynasonics P.N. D005-2115-100. Kit includes **ULTRALINK™** software and one infrared serial adapter.



Real-Time Infrared Communications. Configurations and calibration are quick and simple using **ULTRALINK™** and your PC. Dynasonics Infrared Serial Adapter (P.N. D005-2115-001) allows full programming access.

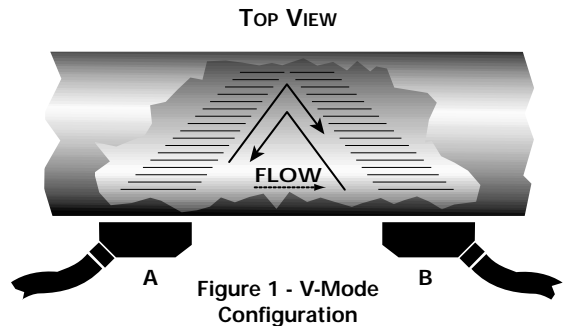


Infrared Serial Adapter. Dynasonics P.N. D005-2115-001 transmits and receives data from TFXD flowmeters from up to 10 feet [3 meters] away. Simply point the front of the adapter at TFXD and start **ULTRALINK™** on your PC.

# FIXED LOCATION TRANSIT TIME

## PRINCIPLES OF OPERATION

TFXD transit time flowmeters 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 flowmeter 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 flowmeter 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.



## PART NUMBER CONSTRUCTION

### INSTRUMENT

**DTFXD** [ ] - [ ] [ ] [ ] [ ] - [ ] [ ] [ ]

**Transmitter Type**

- 1) Blind
- 2) Rate and Totalizer Display

**Power Supply**

- A) 115 VAC
- B) 230 VAC
- E) 10-28 VDC

**Input/Output 1**

- N) None
- 1) 4-20 mA
- 2) Relay
- 3) Rate Pulse
- 4) RS232C
- 5) RS485
- 6) Data Logger
- 7) Heat Flow  
(See TFX BTU-Pro Data Sheet)

**Option Input/Output 2**

Same as Input/Output 1

**Totalizer**

(Not available on DTFXD1)

- N) (Std on DTFXD1) None
- A) (Std on DTFXD2) Eight Digit Resettable

**Options**

- N) None

**Approvals**

- N) Ordinary Area
- X) Class I Div. 1 (Pending)

### TRANSDUCER

**DTT** [ ] - [ ] [ ] [ ] - [ ] [ ] [ ] [ ] - [ ] [ ] [ ] [ ]

**Construction**

- N) Standard [CPVC, Ultem®]
- H) High Temp [PTFE, Vespel®]

**Cable Length**

- 020) 20 feet [6.1 m]
- 050) 50 feet [15 m]
- 100) 100 feet [30 m]

Maximum length: 990 feet [300 m] in 10 ft. [3 m] increments

**Conduit Type**

- A) Flexible Armored
- N) None

**Conduit Length**

(Standard Construction: Conduit Length = Cable Length)

- 000) None
- 020) 20 feet [6.1 m]
- 050) 50 feet [15 m]
- 100) 100 feet [30 m]

Maximum length: 990 feet [300 m] in 10 ft. [3 m] increments

One tube of silicone couplant is included with a transducer order. Mounting straps are not included.

Stainless Steel Mounting Straps  
P.N. D002-2007-001: 36 inches [0.92 m] long, and require some overlap.

Number of straps required (round up to the next even number) =

Pipe Outside Diameter [inches] x 6.28  
-----  
32 inches

## SPECIFICATIONS

### TRANSMITTER

DESCRIPTION	SPECIFICATION
<b>Power Requirements</b>	(Std) 10-28 VDC @ 2.5 VA max. 115/230 VAC 50/60 Hz ±15% @ 5 VA max.
<b>Velocity</b>	-40 to +40 FPS [-12 to +12 MPS]
<b>Inputs/Outputs</b>	All modules are optically isolated from earth and system grounds. A maximum of two modules may be installed.
<b>Optional</b>	<b>4-20 mA</b> 800 Ohms max.; 12-bit resolution; internal or external power <b>Relay</b> Two separate Form C relays, 200 VAC max. @ 0.5 A resistive <b>Pulse Output</b> open collector, 0-2,500 Hz max., 1.0 A max. <b>RS232C</b> data rate to 57.6K <b>RS485</b> supports up to 119 drops <b>Data Logger</b> 200,000 event, 16-bit, integral DB-9 RS232C connection, can be removed and installed without disconnecting system power <b>Heat Flow</b> supports two, two or three wire 1000 Ω RTDs, multiplexed, 12-bit resolution (See TFX BTU-Pro Data Sheet)
<b>Display [TFXD2 only]</b>	2 line x 8 character LCD, back lit. Top row: 7-segment digit height 0.7 inches [18 mm], Bottom row: 14-segment digit height 0.35 inches [9 mm]; 8 digit rate, 8 digit totalizer (resettable)
<b>Units:</b>	User configured
<b>Rate</b>	Feet, gallons, ft <sup>3</sup> , mil-gal, barrels, acre-feet, lbs., meters, liters, m <sup>3</sup> , mil-liters, kg (Heatflow option: BTUs, calories, watts) [rate time: sec, min, hr, day]
<b>Totalizer</b>	(NET, FWD, REV or BATCH) gallons, ft <sup>3</sup> , barrels, acre-feet, lbs., liters, m <sup>3</sup> , kg (with Heatflow option: BTU, calories, Watts)
<b>Ambient Conditions</b>	-40° to +185°F [-40° to +85°C], 0-95% relative humidity, non-condensing.
<b>Enclosure</b>	NEMA 4X, [IP-66] polycarbonate SS, brass and plated steel. 7.00H x 5.75W x 3.88D inches [178H x 146W x 99D mm]
<b>Accuracy Flow Rate</b>	±0.5% of reading at rates > 1 FPS [0.3 MPS] for field calibrated systems; ±1% of reading at rates > 1 FPS [0.3 MPS] uncalibrated; ±0.01 FPS [0.003 MPS] at rates < 1 FPS
<b>Sensitivity</b>	Flow: 0.001 FPS [0.0003 MPS]
<b>Repeatability</b>	±0.01% of reading
<b>Response Time</b>	Flow: 0.3-30 seconds, user configured, to 100% of value, step change in flow.
<b>Security</b>	Keypad lockout, user selected four digit access code
<b>Approvals</b>	(Std) Ordinary Area; (Opt) Explosion proof Class I, II, III Div. 1 Groups C-G (pending)
<b>ULTRALINK™</b>	IBM compatible, Windows® 95/98/2000/XP operating system

### TRANSDUCER

DESCRIPTION	SPECIFICATION
<b>Liquid Types Supported</b>	Virtually all non-aerated liquids
<b>Transducer to Transmitter Distance</b>	(Std) 20, 50, 100 Feet [6, 15, 30 meters], (Opt) lengths to 990 feet [300 meters]
<b>Pipe Sizes</b>	(Std.) 2 - 100 inches [50 - 2540 mm] pipe. See Series DTTS for 1/2 inch to 2 inch [12 - 50 mm] pipe.
<b>Environment</b>	DTTN: -40° to +250°F [-40° to +121°C]; DTTH: -40° to +400°F [-40° to +200°C] (Std) NEMA 6
<b>Housing Material</b>	DTTN: CPVC, Ultem™ and Nylon; DTTH: PTFE, Vespel™, Nickel-Plated Brass
<b>Mounting</b>	(Std) Stainless strap; (Opt) Aluminum track assembly w/graduated scale
<b>Approvals</b>	(Std) Ordinary Area; (Opt) Class I Div. 1 Groups C and D; Class II Div. 1 Groups E, F and G



## ISO-MOD INPUT/OUTPUT MODULES

### Field-Replaceable Electronic Modules for System Integration

#### General

ISO-MODs are epoxy encapsulated electronic input/output modules that are simple to install and replace in the field. All modules are 2,500  $\Omega$  optically isolated from TFXD power and Earth grounds — eliminating the potential for ground loops and reducing the chance of severe damage in the event of an electrical surge.

Seven ISO-MOD options are available including: 4-20 mA, dual-relay, rate pulse, RS232C, RS485, 200K event data logger and RTD heat-delivered option. TFXD supports any two ISO-MOD input/output modules. All modules are field configurable by utilizing the keyboard or **ULTRALINK™** interface. Field wiring connections to ISO-MODs are quick and easy using pluggable terminals. Features of the various ISO-MODs are described below. See Series TFX BTU-Pro data sheet for details regarding the RTD Heatflow module option.

#### 4-20 mA Output Module

Easily configured via jumper 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.

#### Control 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.



Modules Shown in Series TFXD



#### RS232C Input/Output Module

The RS232 Module can be interfaced with the serial communication ports of PCs, PLCs and SCADA systems that are used to monitor flow rate information in piping systems. The RS232 Module may also be used to form a hardwire connection to a PC that is running the **ULTRALINK™** software utility. Baud rates up to 57.6K are supported.

#### RS485 Input/Output Module

The RS485 Module allows up to 119 TFX systems to be placed on a single three-wire cable bus. All meters are assigned a unique serial number that allows all of the meters on the cable network to be independently accessed. Baud rates up to 57.6K and cable lengths to 1,000 feet [300 meters] are supported.

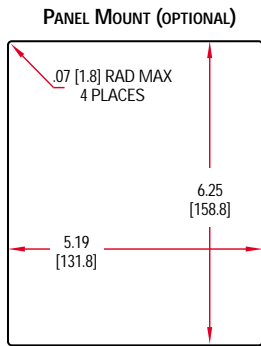
#### Data Logger Module

This powerful 200,000-event data logger/electronic stripchart recorder is available as an option in the TFXD and TFXP systems and 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. Configuration of and data retrieval from the logger can be accomplished in two ways:

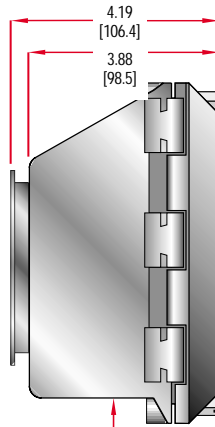
- The module is hot-swappable – that is, it can be installed, removed from or replaced within the flowmeter without disconnecting power. The module can be carried in a shirt pocket back to the office and plugged into a PC serial port via the module's integral DB9 connector. This eliminates the requirement to carry a laptop computer to the flowmeter site.
- 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® software utility.

## DIMENSIONAL SPECIFICATIONS

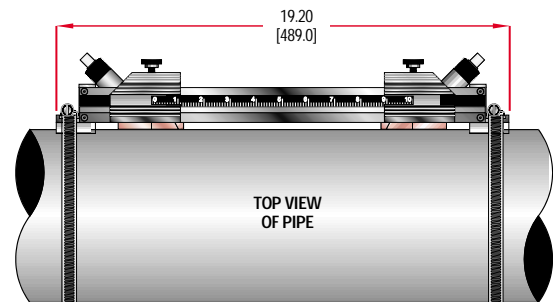
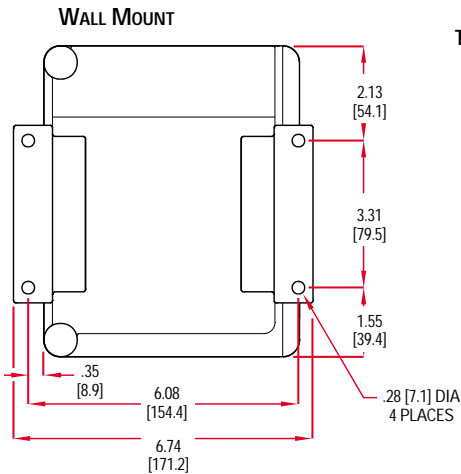
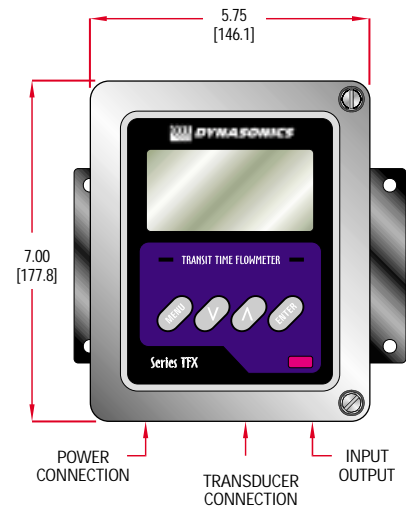
MECHANICAL DIMENSIONS: INCHES [MM]



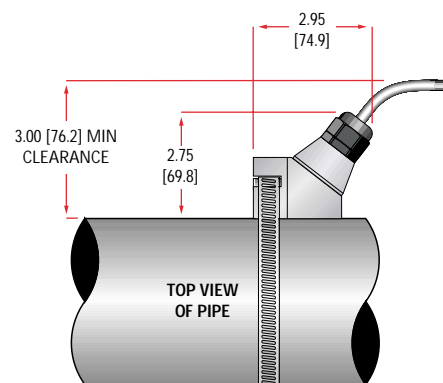
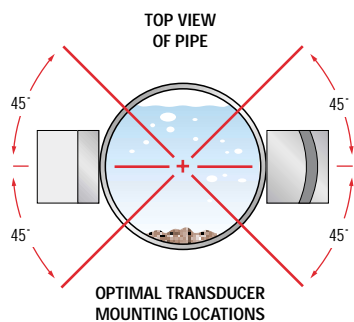
**PANEL CUT-OUT**  
panel thickness: 0.5" [12mm] MAX



(3) 1/2" CONDUIT HOLES  
TFXD2 TRANSMITTER SHOWN



PIPE 2" TO 10" [50-250mm] DIA  
OPTIONAL TRACK SHOWN P.N. D010-2102-010



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