



TFX Ultra Transit Time Flow Meter

Transit Time Ultrasonic Product Family

DESCRIPTION

The TFX Ultra transit time meter measures clean liquids as well as those with small amounts of suspended solids or aeration such as surface water or sewage.

FEATURES:

- Bi-directional flow measurement system. Totalizer options include forward, reverse and net total
- Modbus RTU and BACnet MSTP over RS485; Ethernet connections including BACnet/IP, EtherNet/IP, and Modbus TCP/IP protocols
- Large, easy-to-read digital display
- Rugged, aluminum enclosure ensures a long service life in harsh environments
- Certified for hazardous area installation in North America and Europe

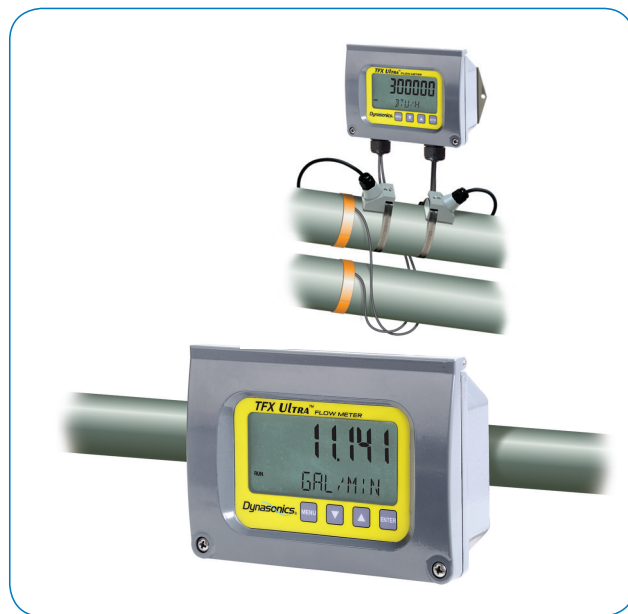
APPLICATIONS

TFX Ultra ultrasonic flow and energy meters clamp onto the outside of pipes and do not contact the internal liquid. The technology has inherent advantages over alternate devices including: low-cost installation, no pressure head loss, no moving parts to maintain or replace, no fluid compatibility issue, and a large, bi-directional measuring range that ensures reliable readings even at very low and high flow rates. The TFX Ultra is available in a variety of configurations that permit the user to select a meter with features suitable to meet particular application requirements.

The TFX Ultra is available in two versions: a flow meter, and an energy flow meter used in conjunction with dual clamp-on RTDs for temperature measurement. The energy flow meter measures energy usage in BTU, mBTU, mmBTU, Tons, kJ, kW, MW and is ideal for retrofit, hydronic process, and HVAC applications.

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.



Temperature measurements, when used in conjunction with flow measurement, 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 that 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.

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

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 including BTU, Watts, Joules, Kilowatts, and others.



Badger Meter

SPECIFICATIONS

System	
Liquid Types	Most clean liquids or liquids containing small amounts of suspended solids or gas bubbles
Velocity Range	Bi-directional to greater than 40 FPS (12 MPS)
Flow Accuracy	DTTN/DTTH/DTTL: $\pm 1\%$ of reading or ± 0.01 FPS (0.003 MPS), whichever is greater DTTS/DTTC: 1" (25 mm) and larger – $\pm 1\%$ of reading or ± 0.04 FPS (0.012 MPS), whichever is greater DTTS/DTTC: 3/4" (19 mm) and smaller – $\pm 1\%$ of Full Scale (refer...Dimensional Specifications page)
Temperature Accuracy (Energy Meters Only)	Option A: 32...122° F (0...50° C); Absolute: 0.22° F (0.12° C) Difference: 0.09° F (0.05° C) Option B: 32...212° F (0...100° C); Absolute: 0.45° F (0.25° C) Difference: 0.18° F (0.1° C) Option C: -40...350° F (-40...177° C); Absolute: 1.1° F (0.6° C) Difference: 0.45° F (0.25° C) Option D: -4...85° F (-20...30° C); Absolute: 0.22° F (0.12° C) Difference: 0.09° F (0.05° C)
Sensitivity	Flow: 0.001 FPS (0.0003 MPS) Temperature: Option A: 0.03° F (0.012° C); Option B: 0.05° F (0.025° C); Option C: 0.1° F (0.06° C); Option D: 0.03° F (0.012° C)
Repeatability	0.5% of reading
Installation Compliance	General Safety (all models): UL 61010-1, CSA C22.2 No. 61010-1; (power options A and D only) EN 61010-1 Hazardous Location (power supply options A and D only): Class I Div. 2 Groups C, D, T4; Class II, Division 2, Groups F, G, T4; Class III Division 2 for US/CAN; ATEX II 2 G Ex nA II T4: UL 1604, CSA 22.2 No. 213, EN 60079-0 and EN 60079-15 Compliant with directives 2004/108/EC, 2006/95/EC and 94/9/EC on meter systems with integral flow transducers, transducers constructed with twinaxial cable (all transducers with cables 100 ft (30 m) and shorter) or remote transducers with conduit
Transmitter	
Power Requirements	AC: 95...264 V AC 47...63 Hz @ 17 VA max. or 20...28 V AC 47...63 Hz @ 0.35 A max. DC: 10...28 V DC @ 5 W max. Protection: auto re-settable fuse, reverse polarity and transient suppression
Display	Two line LCD, LED backlit; Top row 0.7 inch (18 mm) height, 7-segment; Bottom row 0.35 inch (9 mm) height, 14-segment Icons: RUN, PROGRAM, RELAY1, RELAY2 Flow rate indication: 8-digit positive, 7-digit negative max.; auto decimal, lead zero blanking Flow accumulator (totalizer): 8-digit positive, 7-digit negative max. (reset via keypad press, ULTRALINK, network command or momentary contact closure)
Enclosure	Type 4 (IP-65) Construction: powder-coated aluminum, polycarbonate, stainless steel, polyurethane, nickel-plated steel mounting brackets Size (electronic enclosure only): 6.0" W x 4.4" H x 2.2" D (152 mm W x 112 mm H x 56 mm D) Conduit Holes: (2) 1/2" NPT female; (1) 3/4" NPT female; Optional Cable Gland Kit
Temperature Configuration	-40° F...185° F (-40° C...85° C) Via optional keypad or PC running ULTRALINK software (Note: not all configuration parameters are available from the keypad – i.e. flow and temperature calibration and advanced filter settings)
Engineering Units	Flow Meter: Feet, gallons, cubic feet, million gallons, barrels (liquid and oil), acre-feet, lbs., meters, cubic meters, liters, million liters, kg Energy Meter: BTU, mBTU, mmBTU, Tons, kJ, kW, MW, and the Flow Meter list from above
Inputs/Outputs	USB 2.0: for connection of a PC running ULTRALINK configuration utility RS485: Modbus RTU command set; optional BACnet MSTP 9600 baud standard, other baud rates are available (consult factory) 10/100 Base-T: RJ45, communication via Modbus TCP/IP, EtherNet/IP, or BACnet/IP 4-20 mA: 12-bit, internal power, can span negative to positive flow/energy rates Energy Meter Model Only: Total Pulse Option: Opto isolated open collector transistor Flow Meter Model Only: 0...1000 Hz: open-collector, 12-bit, can span negative to positive rates; square-wave or turbine meter simulation outputs Two Alarm Outputs: open-collector, configure as rate alarm, signal strength alarm or totalizer pulse

Transducers

Construction	DTTN/DTTC/DTTL: NEMA 6* (IP-67), CPVC, Ultem, Nylon cord grip, PVC cable jacket; -40...250° F (-40...121° C)
	DTTN/DTTL: 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.
Frequency	DTTS/DTTC: 2 MHz DTTN/DTTH: 1 MHz DTTL: 500 KHz
Cables	RG59 Coaxial, 75 ohm or Twinaxial, 78 ohm (optional armored conduit)
Cable Length	990 ft (300 meter) max. in 10 ft (3 m) increments; Submersible Conduit limited to 100 ft (30 m)
RTDs	Energy Meters Only: Platinum 385, 1000 ohm, 3-wire; PVC jacket cable
Installation	DTTN (-N option) /DTTS/DTTH/DTTC: General and Hazardous Location (see Installation Compliance above)
	DTTN Transducer and IS Barrier (-F option): Class I Div. 1, Groups C&D T5 Intrinsically Safe Ex ia;
	CSA C22.2 No. 142 & 157; UL 913 & 916

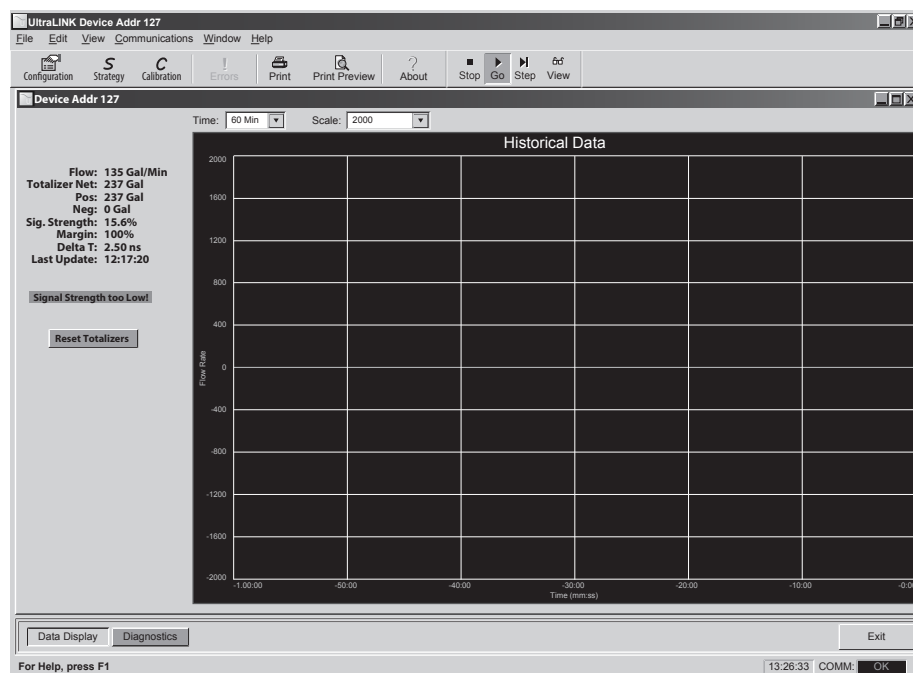
**Software Utilities**

ULTRALINK	Utilized to configure, calibrate and troubleshoot Flow and Energy meters. Connection via USB A/B cable; software is compatible with Windows 2000, Windows XP, Windows Vista and Windows 7
EnergyLink	Utilized to monitor a network of Flow and Energy meters. Connection via RS485. Operates within Microsoft Excel 2003, Microsoft Excel 2007, Microsoft Excel 2010. (32-bit O.S. only)

ULTRALINK SOFTWARE UTILITY

In addition to, or as a replacement for, the keypad entry programming, the flow meter can be used with the ULTRALINK software utility. The software is used to configure, calibrate and communicate with TFX Ultra flow meters. Additionally, it has numerous troubleshooting tools to make diagnosing and correcting installation problems easier.

A PC can be hard-wired to the TFX Ultra through a standard USB connection found on most current computers.

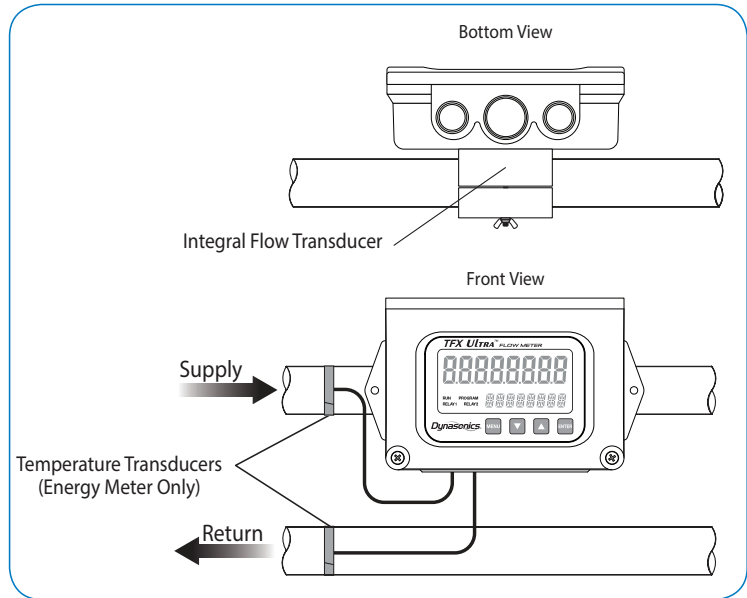


METER WITH INTEGRAL FLOW TRANSDUCER

For pipe/tubing sizes of 2" (50 mm) and smaller, Ultra is available with a clamp-on transducer mounted and wired directly to the flow meter display/electronics enclosure. This design provides a convenient installation in areas where the user requires local indication. PVC constructed transducers are rated to 185° F (85° C) and CPVC are rated to 250° F (121° C).

Common Features:

- Rate-Total Backlit Display
- 4-20 mA Output
- 0...1000 Hz Rate Pulse and Dual Alarm Outputs (Flow Meter Model Only)
- USB Programming Port
- RS485 Modbus Network Connection
- Remote Totalizer Reset



PART NUMBER CONSTRUCTION

DTFX - - - -

Model

- B) Flow Meter Model
- E) Energy Meter Model

Pipe Size/Measurement Range

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

Power

- A) A/C 95...264 V AC
- C) A/C (20...28 V AC)
- D) D/C (10...28 V DC)

Keypad

- K) Keypad
- N) No Keypad

Transducer Material/Temperature

- P) PVC, -40...185° F (-40...85° C)
- C) CPVC, -40...250° F (-40...121° C)

Advanced Communications

- E) 10/100 Base-T (EtherNet/IP, BACnet/IP, Modbus TCP/IP)
- B) BACnet MSTP
- C) BACnet MSTP; 10/100 Base -T (EtherNet/IP, BACnet/IP, Modbus TCP/IP)
- N) None
- P) Total Pulse Output (Energy Meter model only)
- H) BACnet MSTP 76800 Baud

Language

- (Leave blank for English)
- F) French
- S) Spanish

Options

- N) None
- C) 4- Pin (male); Brad Harrison Micro-Change (Available for D/C Power Only)
- A) Cable Gland Kit

Area Approvals

- F) General Safety, Hazardous Locations, and CE (see Specifications Page)
- N) General Safety (Power Supply C Only)

Energy Temperature Range

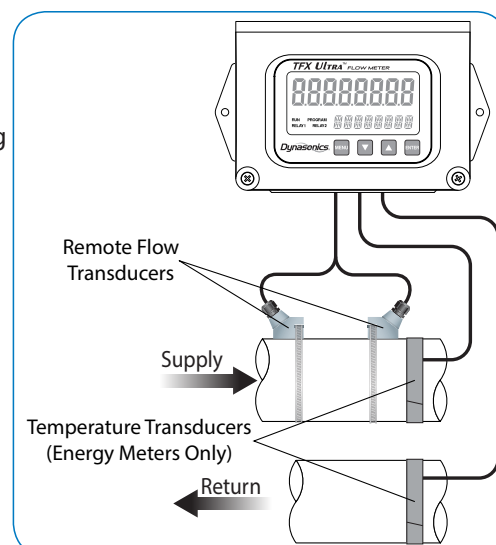
- N) None (Select for Flow Meter Model B)
- A) 32...122° F (0...50° C)
- B) 32...212° F (0...100° C)
- C) -40...350° F (-40...177° C)
- D) -4...85° F (-20...30° C)

METER WITH REMOTE FLOW TRANSDUCER

The TFX Ultra is available with remote mounted transducers that permit separation of up to 990 feet (300 m). This design is utilized on larger pipes or when pipes are located in areas that are not convenient for viewing, or on piping systems with severe vibration. PVC constructed transducers are rated to 185° F (85° C), CPVC are rated to 250° F (121° C) and PTFE are rated to 350° F (176° C).

Common Features:

- Rate-Total Backlit Display
- 4-20 mA Output
- 0...1000 Hz Rate Pulse and Dual Alarm Outputs (Flow Meter Model Only)
- USB Programming Port
- RS485 Modbus Network Connection
- Remote Totalizer Reset



PART NUMBER CONSTRUCTION

DTFX		-	ZN	-		-		-		-		-	
Transmitter Type			Power Supply		Keypad		Approvals		Options		Language		
B) Flow Meter Model			A) A/C (95...264 V AC)		K) Keypad		F) General Safety, Hazardous		N) None		(Leave blank for English)		
E) Energy Meter Model			C) A/C (20...28 V AC)		N) No Keypad		Locations, and CE		C) 4-Pin (male);				
			D) D/C (10...28 V DC)				(See Specifications Page)		Brad Harrison		F) French		
Remote Transmitter					Advanced Communications		N) General Safety		Micro-Change		S) Spanish		
Use with DTTN/DTTH/DTTL					E) 10/100 Base-T (Ethernet/IP, Bacnet/IP, Modbus TCP/IP)		(Power Supply C Only)		(Available for D/C Power Only)				
Large Pipe Transducers					B) BACnet MSTP				A) Cable Gland Kit				
(pipes larger than 2") or					C) BACnet MSTP; 10/100 Base-T								
DTTS/DTTC Small Pipe					(EtherNet/IP, BACnet/IP, Modbus TCP/IP)								
Transducers (pipes 1/2"...2")					N) None		Energy Temperature Range						
					P) Total Pulse Output		N) None (Selected for Flow Meter Model B)						
					(Energy Meter Model Only)		A) 32...122° F (0...50° C)						
					H) BACnet MSTP 76800 Baud		B) 32...212° F (0...100° C)						
							C) -40...350° F (-40...177° C)						
							D) -4...85° F (-20...30° C)						

Flow Transducer – Pipes larger than 2" (DN 50mm)

DTT		-		-		-		-		-	
Construction			Cable Length		Conduit Type		Conduit Length		Installation		
N) Standard: 250° F (121° C)			020) 20' (6 m)		N) None		(Standard construction: Conduit length = Cable length)		N) General Purpose		
(CPVC, Ultem)			050) 50' (15 m)		A) Flexible Armored				F) Class I, Div. 1,		
H) High Temp: 350° F (176° C)			100) 100' (30 m)		S) Submersible		000) None		Groups C & D		
(PTFE, Vespel)					(DTTN and DTTL		020) 20' (6 m)		(DTTN Only)		
L) Large Pipe - 500 KHz:					Only) Limited to		050) 50' (15 m)				
250° F (121° C) (CPVC, Ultem)*					100 feet (30 m)		100) 100' (30 m) ¹				

Flow Transducers - Small Pipes 1/2"...2" (12 mm...50 mm)

DTT		-		-		-		-		-	
Type			Nominal Pipe Size		Pipe Type		Cable Length		Conduit Type		Conduit Length
S) Standard: 185° F (85° C)			D) 1/2" H) 1-1/4"		P) ANSI Pipe		020) 20' (6 m)		N) None		000) None
(PVC, Ultem)			F) 3/4" J) 1-1/2"		C) Copper Pipe		050) 50' (15 m)		A) Flexible		020) 20' (6 m)
C) High Temp: 250° F (121° C)			G) 1" L) 2"		T) Rigid Tubing		100) 100' (30 m) ¹		Armored		050) 50' (15 m)
(CPVC, Ultem)											100) 100' (30 m) ¹

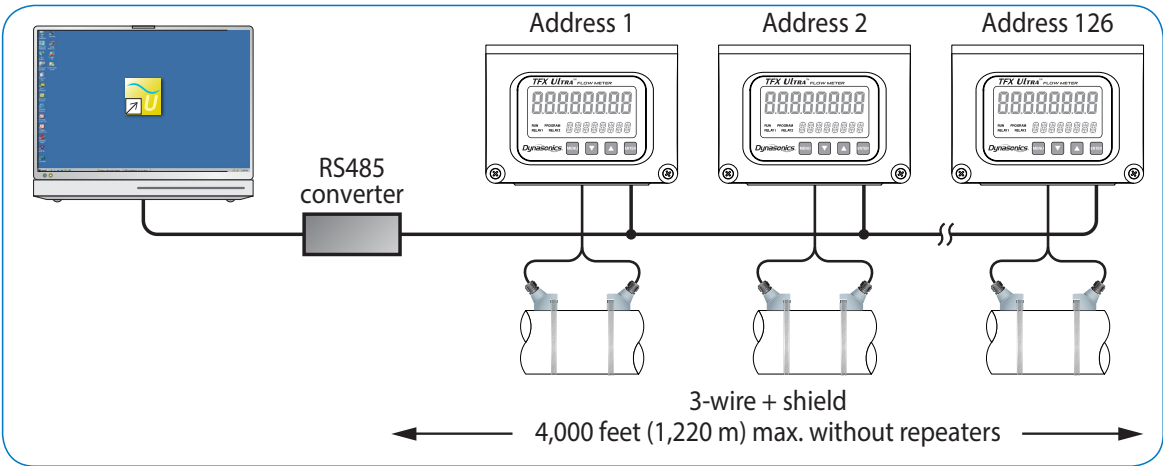
¹Maximum length: 990' (300 m) in 10' (3 m) increments

* Recommended for pipe sizes larger than 24" (610 mm)

NETWORK OPTIONS

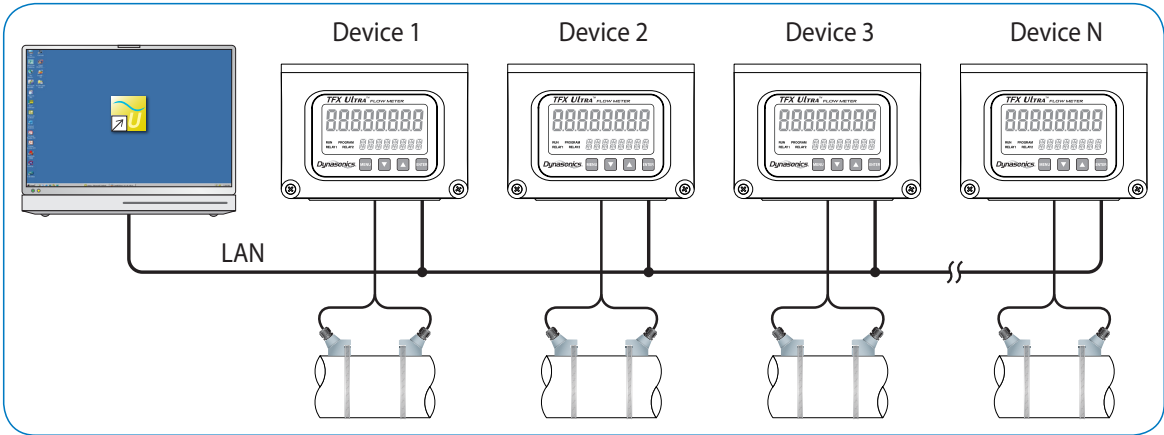
RS485 Network

All TFX Ultra meters come equipped with RS485 drivers and utilize a Modbus RTU command set (data can be returned in single-precision, double-precision, integer or floating point values) or an optional BACnet MSTP protocol. Up to 126 Ultra products can be run on a single daisy-chain network and be individually queried for flow rate, positive flow accumulator, negative flow accumulator, supply temperature, return temperature and signal strength. Flow accumulators can be cleared at discrete addresses or globally. The RS485 network is also compatible with the EnergyLink, direct to Excel, application. (EnergyLink compatible with Modbus RTU only.)



10/100 Base-T Network

If equipped with the optional Ethernet communications module, the TFX Ultra can be plugged into a LAN and queried for flow rate, positive flow accumulator, negative flow accumulator, supply temperature, return temperature, and signal strength. The module contains Modbus TCP/IP, EtherNet/IP, and BACnet/IP network compatibility.

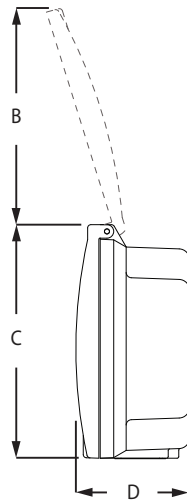
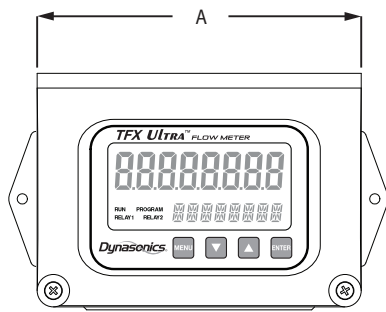


RTD KITS FOR INTEGRAL AND REMOTE ENERGY MEASUREMENT METERS

D010-3000-120	RTD Kit ¹ , clamp on, 130° C, 1000 Ohm, 20'	D010-3000-200	Insertion RTD Kit ² , 3", 1/4" O.D., 260° C, 1000 Ohm, 20'
D010-3000-121	RTD Kit ¹ , clamp on, 130° C, 1000 Ohm, 50'	D010-3000-201	Insertion RTD Kit ² , 3", 1/4" O.D., 260° C, 1000 Ohm, 50'
D010-3000-122	RTD Kit ¹ , clamp on, 130° C, 1000 Ohm, 100'	D010-3000-202	Insertion RTD Kit ² , 3", 1/4" O.D., 260° C, 1000 Ohm, 100'
D010-3000-123	RTD Kit ¹ , clamp on, 200° C, 1000 Ohm, 25'	¹ RTD Kits include: 2 RTDs, heat sink compound and installation tape	
D010-3000-124	RTD Kit ¹ , clamp on, 200° C, 1000 Ohm, 50'	² Insertion RTD Kits include a set of 2 RTDs	
D010-3000-125	RTD Kit ¹ , clamp on, 200° C, 1000 Ohm, 100'		

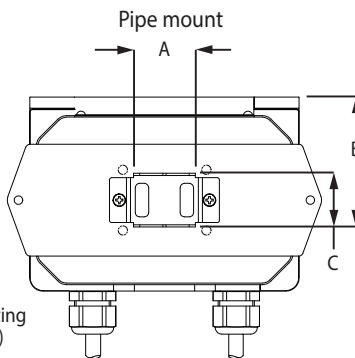
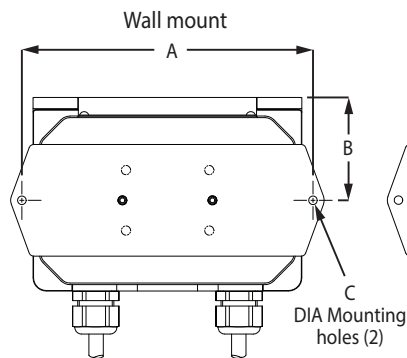
PHYSICAL DIMENSIONS

Remote System



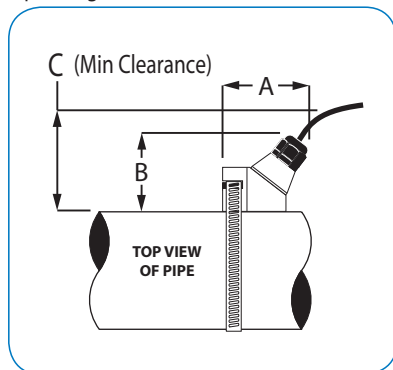
Meter

	Enclosure	Wall Mount	Pipe Mount
A	6.00" (132.4 mm)	6.50" (165.1 mm)	1.38" (35.1 mm)
B	4.20" (106.7 mm)	2.30" (58.4 mm)	2.90" (73.7 mm)
C	4.32" (110 mm)	0.19" (4.8 mm)	1.20" (30.5 mm)
D	2.12" (53.8 mm)		



DTTN/DTTH/DTTL

Pipes Larger Than 2" (50 mm)

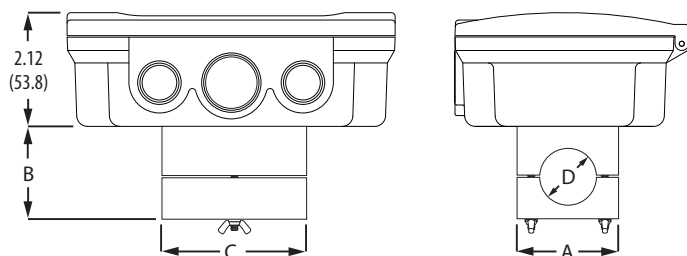


DTTN/DTTH/DDTTL Transducers

	A	B	C
DTTN	2.95" (74.9 mm)	2.75" (69.8 mm)	3.00" (76.2 mm)
DTTH	2.95" (74.9 mm)	2.75" (69.8 mm)	3.00" (76.2 mm)
DTTL	3.40" (86.4 mm)	2.94" (74.7 mm)	3.20" (81.3 mm)

PHYSICAL DIMENSIONS

Integral System



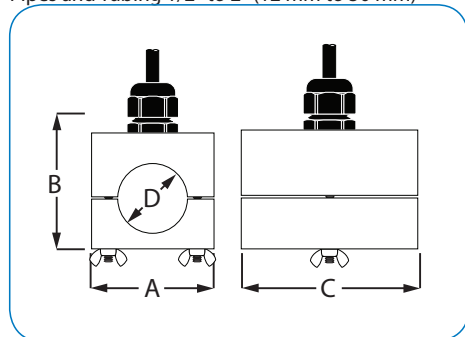
DTTS/DTTC Transducers

Pipe Size	Pipe Material	A	B	C	D	Measuring Range
1/2"	ANSI/DN	2.46" (62.5 mm)	2.36" (59.9 mm)	2.66" (67.6 mm)	0.84" (21.3 mm)	2...38 gpm (8...144 lpm)
	Copper	2.46" (62.5 mm)	2.36" (59.9 mm)	3.33" (84.6 mm)	0.63" (15.9 mm)	1.8...27 gpm (7...102 lpm)
	Tubing	2.46" (62.5 mm)	2.28" (57.9 mm)	3.72" (94.5 mm)	0.50" (12.7 mm)	1.5...18 gpm (6...68 lpm)
3/4"	ANSI/DN	2.46" (62.5 mm)	2.57" (65.3 mm)	2.66" (67.6 mm)	1.05" (26.7 mm)	2.75...66 gpm (10...250 lpm)
	Copper	2.46" (62.5 mm)	2.50" (63.5 mm)	3.56" (90.4 mm)	0.88" (22.2 mm)	2.5...54 gpm (10...204 lpm)
	Tubing	2.46" (62.5 mm)	2.50" (63.5 mm)	3.56" (90.4 mm)	0.75" (19.0 mm)	2.5...45 gpm (10...170 lpm)
1"	ANSI/DN	2.46" (62.5 mm)	2.92" (74.2 mm)	2.86" (72.6 mm)	1.32" (33.4 mm)	3.5...108 gpm (13...409 lpm)
	Copper	2.46" (62.5 mm)	2.87" (72.9 mm)	3.80" (96.5 mm)	1.13" (28.6 mm)	3.5...95 gpm (13...320 lpm)
	Tubing	2.46" (62.5 mm)	2.75" (69.9 mm)	3.80" (96.5 mm)	1.00" (25.4 mm)	3.5...85 gpm (13...320 lpm)
1-1/4"	ANSI/DN	2.80" (71.0 mm)	3.18" (80.8 mm)	3.14" (79.8 mm)	1.66" (42.2 mm)	5...186 gpm (19...704 lpm)
	Copper	2.46" (62.5 mm)	3.00" (76.2 mm)	4.04" (102.6 mm)	1.38" (34.9 mm)	4.5...152 gpm (17...575 lpm)
	Tubing	2.46" (62.5 mm)	3.00" (76.2 mm)	4.04" (102.6 mm)	1.25" (31.8 mm)	4...136 gpm (15...514 lpm)
1-1/2"	ANSI/DN	3.02" (76.7 mm)	3.4" (86.9 mm)	3.33" (84.6 mm)	1.90" (48.3 mm)	6...250 gpm (23...946 lpm)
	Copper	2.71" (68.8 mm)	2.86" (72.6 mm)	4.28" (108.7 mm)	1.63" (41.3 mm)	5...215 gpm (19...814 lpm)
	Tubing	2.71" (68.8 mm)	3.31" (84.1 mm)	4.28" (108.7 mm)	1.50" (38.1 mm)	5...200 gpm (19...757 lpm)
2"	ANSI/DN	3.70" (94.0 mm)	3.42" (86.9 mm)*	5.50" (139.7 mm)	2.375" (60.3 mm)*	8...420 gpm (30...1590 lpm)
	Copper	3.70" (94.0 mm)	3.38" (85.9 mm)*	5.50" (139.7 mm)	2.125" (54.0 mm)*	8...375 gpm (30...1419 lpm)
	Tubing	3.21" (81.5 mm)	3.85" (98.0 mm)	4.75" (120.7 mm)	2.00" (50.8 mm)	8...365 gpm (30...1381 lpm)

*Varies due to U-bolt configuration

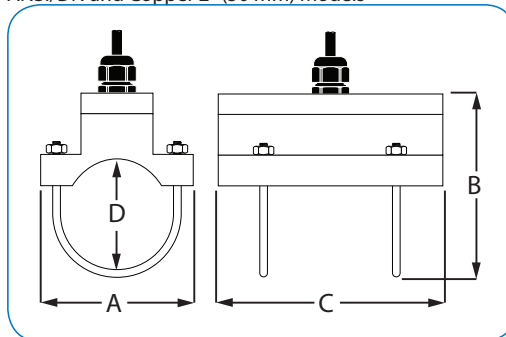
DTTS/DTTC

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



DTTS/DTTC U-BOLT CONNECTONS

ANSI/DN and Copper 2" (50 mm) Models



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www.badgermeter.com

The Americas | Badger Meter | 4545 West Brown Deer Rd | PO Box 245036 | Milwaukee, WI 53224-9536 | 800-876-3837 | 414-355-0400
 México | Badger Meter de las Americas, S.A. de C.V. | Pedro Luis Ogazón N°32 | Esq. Angelina N°24 | Colonia Guadalupe Inn | CP 01050 | México, DF | México | +52-55-5662-0882
 Europe, Middle East and Africa | Badger Meter Europa GmbH | Nurtlinger Str 76 | 72639 Neuffen | Germany | +49-7025-9208-0
 Czech Republic | Badger Meter Czech Republic s.r.o. | Mařikova 2082/26 | 621 00 Brno, Czech Republic | +420-5-41420411
 Slovakia | Badger Meter Slovakia s.r.o. | Racianska 109/B | 831 02 Bratislava, Slovakia | +421-2-44 63 83 01
 Asia Pacific | Badger Meter | 80 Marine Parade Rd | 21-04 Parkway Parade | Singapore 449269 | +65-63464836
 China | Badger Meter | 7-1202 | 99 Hangzhong Road | Minhang District | Shanghai | China 201101 | +86-21-5763 5412