Dynasonics®
Ultrasonic Flow Meters

Transit Time Ultrasonic Flow Meters

TFX-500w Clamp-On Meter BACnet® MS/TP Protocol

Badger Meter

TTM-UM-02773-EN-04 (January 2022)

User Manual

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SUPPORTED FEATURES

TFX-500w meters include an EIA-485 port that is selectable for Modbus RTU or BACnet MS/TP protocol. The meter can be wired on a single daisy chain network and be queried for flow rate and totalizer readings along with diagnostic and other information.

For further information on the proper installation of the transmitter, see the TFX-500w user manual.

EIA-485 port on the TFX-500w automatically detects which lines are A and B for transmitting and receiving. The hardware automatically corrects for the RS485 negative and positive connections being swapped.

WIRING

RS485 Output

The RS485 feature allows up to 126 transmitters to be placed on a single three-wire cable up to 4000 feet. All transmitters are assigned a unique numeric address that allows all of the transmitters on the cable network to be independently accessed. Either Modbus RTU or BACnet MS/TP protocol is used to interrogate the transmitters.

Flow rate and total can be monitored over the digital communications bus.

When a USB programming cable is connected, the RS485 and frequency outputs are disabled.

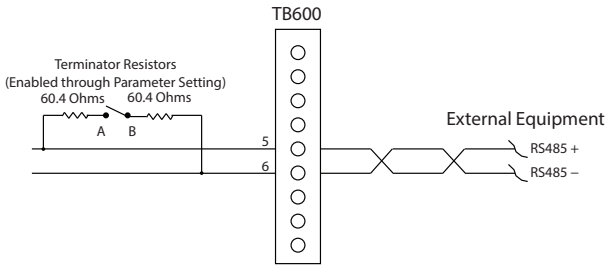

Figure 1: Typical RS485 interface

COMMUNICATION SETTINGS

To set up the meter for BACnet MS/TP:

1. Go to Main Menu > System Setup > Communication menu.
2. Select BACnet MS/TP.
3. Set the MAC address (1…254) and the BACnet ID (0…4194303).
4. Check that the baud rate, parity, stop bits and maximum MAC address match the master device.
5. Enable the terminating resistor if the meter is the last device in the network. TFX-500w meters have a built-in resistor that can be selected through the communication setting.
6. Select whether the master can read and write or only read the data.

BACNET OBJECT

Descriptive Name	Description	Network Access	Analog Value (Single Precision 32-bit floating point)	Large Analog Value (Double Precision 64-bit floating point)	Notes
READINGS					
Flow Rate on Screen	Flow rate displayed on home screen	R	AV600		Units are based on the selections for the home screen
Velocity on Screen	Fluid velocity displayed on home screen	R	AV601		Units are based on the selections for the home screen
Delta Time Filtered (ns)	Time of flight difference between upstream and downstream used to calculated the flow rate. Units are nanoseconds.	R	AV602		
Flow Rate (gal/min)	Flow rate in gallons/minute	R	AV800		
Velocity (ft/sec)	Fluid velocity in feet/second	R	AV801		
Flow Rate (l/min)	Flow rate in liters/minute	R	AV1000		
Velocity (m/sec)	Fluid velocity in meters/second	R	AV1001		
TOTALS					
Net Flow Totalizer (home screen units)	Total volume as forward flow minus reverse flow. A negative total results when reverse flow is greater than forward flow.	R	AV2300	LAV2600	Units are based on the selections for the totalizer on the home screen
Positive Flow Totalizer (home screen units)	Total volume of flow in forward direction. Reverse flow is not accounted for in the total.	R	AV2301	LAV2601	Units are based on the selections for the totalizer on the home screen
Negative Flow Totalizer (home screen units)	Total volume of flow in reverse direction. Forward flow is not accounted for in the total.	R	AV2302	LAV2602	Units are based on the selections for the totalizer on the home screen
Gross Flow Totalizer (home screen units)	Total volume of forward and reverse flow.	R	AV2303	LAV2603	Units are based on the selections for the totalizer on the home screen
Totalizer Overflow Counter (Net)	Number of times the net flow total overruns when the net flow totalizer units are based on the home screen.	R	AV2304		
Totalizer Overflow Counter (Positive)	Number of times the positive flow total overruns when the positive flow totalizer units are based on the home screen.	R	AV2305		
Totalizer Overflow Counter (Negative)	Number of times the negative flow total overruns when the negative flow totalizer units are based on the home screen.	R	AV2306		
Totalizer Overflow Counter (Gross)	Number of times the gross flow total overruns when the gross flow totalizer units are based on the home screen.	R	AV2307		
Net Flow Totalizer (gal)	Total volume as forward flow minus reverse flow. A negative total results when reverse flow is greater than forward flow.	R	AV2400	LAV2700	
Positive Flow Totalizer (gal)	Total volume of flow in forward direction. Reverse flow is not accounted for in the total.	R	AV2401	LAV2701	
Negative Flow Totalizer (gal)	Total volume of flow in reverse direction. Forward flow is not accounted for in the total.	R	AV2402	LAV2702	
Gross Flow Totalizer (gal)	Total volume of forward and reverse flow.	R	AV2403	LAV2703	
Net Flow Totalizer (liters)	Total volume as forward flow minus reverse flow. A negative total results when reverse flow is greater than forward flow.	R	AV2500	LAV2800	
Positive Flow Totalizer (liters)	Total volume of flow in forward direction. Reverse flow is not accounted for in the total.	R	AV2501	LAV2801	
Negative Flow Totalizer (liters)	Total volume of flow in reverse direction. Forward flow is not accounted for in the total.	R	AV2502	LAV2802	
Gross Flow Totalizer (liters)	Total volume of forward and reverse flow.	R	AV2503	LAV2803	
Flow Rate Units	Flow rate units on home screen as defined in parameter settings	R	MV3000		

Descriptive Name	Description	Network Access	Analog Value (Single Precision 32-bit floating point)	Large Analog Value (Double Precision 64-bit floating point)	Notes
Velocity Units	Velocity units on home screen as defined in parameter settings	R	MV3002		
Flow Total Units	Total volume units on home screen as defined in parameter settings	R	MV3003		
SETUP					
Low Flow Cutoff	Setting to display flow rate as zero & stop totalizing when flow rate goes below this value	R/W	AV4000		
Low Signal Cutoff	Setting to display flow rate as zero & stop totalizing when signal strength goes below this value and trigger a low signal error message	R/W	AV4001		
High Signal Cutoff	Setting to display flow rate as zero & stop totalizing when signal strength goes above this value and trigger an oversaturate error message	R/W	AV4002		
DIAGNOSTICS - Measurements					
Signal Strength	Indicates the strength of the ultrasonic signal	R	AV5500		

Descriptive Name	Description	Network Access	Binary Output	Notes
ACTIONS				
Reset Totalizers	Resets all flow totals in meter to zero	W	BO0	
Unlatch Alarms	Unlatches outputs in alarm latched state	W	BO1	
Clear Alarm History	Clears all errors, alarms and event codes from alarm history	W	BO2	
Reboot Device	Reboots the meter	W	BO3	

TROUBLESHOOTING

Symptoms	Possible Causes	Recommended Action
No communication	Transmit and receive are wired incorrectly.	Check the network wiring from the meter.
	Baud rate does not match master.	Check the baud rate of the master and ensure the baud rate of the meter matches the master. If it does not match, change the Baud Rate setting in the Modbus RTU Communication menu.
	Parity and stop bits do not match the master.	Check that the settings are compatible with the master. If it does not match, change the Parity or Stop Bit setting in the BACnet MS/TP Communication menu.
	MAC address is not unique. Another device is on the network with the same address.	Check the addresses of the other devices on the network. Check that the slave address is not 1.
	Cable is not terminated properly.	For BACnet MS/TP on EIA-485 network, devices can be daisy chained together. The two devices on the end of the chain need to have terminated resistors. Terminating resistors can be enabled through the BACnet MS/TP Communication menu.
	Cable or chain longer than 4000 feet.	For BACnet MS/TP on EIA-485 network, the full length of the network cannot exceed 4000 feet. Check the length of the cabling.
Intermittent communication	Cable is not properly shielded.	Communication cables must have shielding to protect the quality of the communication signals from electromagnetic interference (EMI). Check that the cable has a shield. Typically, one end of the shield drain is connected to a clean ground to dissipate EMI and prevent ground loops. However, depending on the ground quality, cable length and type of interference, other methods can be employed.
	Cable routed near power cables such a variable frequency drives.	Cables carrying high currents cause a high degree of electromagnetic interference that can interfere with the quality of the communication signals. Route signal cables away from power cables.
	Cable is not terminated properly.	For BACnet MS/TP on EIA-485 network, devices can be daisy chained together. The two devices on the end of the chain need to have terminated resistors. Terminating resistors can be enabled through the BACnet MS/TP Communication menu.
	Cable or chain longer than 4000 feet.	For BACnet MS/TP on EIA-485 network, the full length of the network cannot exceed 4000 feet. Check the length of the cabling.
Unable to write specific parameters	Transmitter is set up for read-only.	These settings are commonly used to prevent accidental or unauthorized changes to a device over a network. Check the Access setting in the BACnet MS/TP menu.

CONFORMANCE STATEMENT

ANNEX A - PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT (NORMATIVE)
(This annex is part of this Standard and is required for its use.)

BACnet Protocol Implementation Conformance Statement

Date: 5/14/18
Vendor Name: Badger Meter, Inc.
Product Name: TFX-500w Ultrasonic Clamp-on Flow Meter
Product Model Number: TFX-500w
Application Software Version: N/A Firmware Revision: v2.00.278 BACnet Protocol Revision: 12

Product Description:
Clamp-on ultrasonic flow meter designed for measuring water.

BACnet Standardized Device Profile (Annex L):

☐ **BACnet Operator Workstation (B-OWS)**
☐ **BACnet Advanced Operator Workstation (B-AWS)**
☐ **BACnet Operator Display (B-OD)**
☐ **BACnet Building Controller (B-BC)**
☐ **BACnet Advanced Application Controller (B-AAC)**
■ **BACnet Application Specific Controller (B-ASC)**
☐ **BACnet Smart Sensor (B-SS)**
☐ **BACnet Smart Actuator (B-SA)**

List all BACnet Interoperability Building Blocks Supported (Annex K):
- Data Sharing-ReadProperty-B (DS-RP-B)
- Data Sharing-WriteProperty-B (DS-WP-B)
- Data Sharing - ReadProperty Multiple - B (DS-RPM-B)
- Data Sharing - WriteProperty Multiple - B (DS-WPM-B)
- Device Management-Dynamic Device Binding-B (DM-DDB-B)
- Device Management-Dynamic Object Binding-B (DM-DOB-B)
- Device Management-DeviceCommunicationControl-B (DM-DCC-B)

Segmentation Capability:

☐ Able to transmit segmented messages Window Size _____
☐ Able to receive segmented messages Window Size _____

Standard Object Types Supported:
- 1 Device Object
- 8 Analog Input Objects
- 22 Analog Value Objects
- 12 Large Analog Value Objects
- 4 Binary Outputs

ANNEX A - PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT (NORMATIVE)

Data Link Layer Options:

☐ BACnet IP, (Annex J)
☐ BACnet IP, (Annex J), Foreign Device
☐ ISO 8802-3, Ethernet (Clause 7)
☐ ATA 878.1, 2.5 Mb. ARCNET (Clause 8)
☐ ATA 878.1, EIA-485 ARCNET (Clause 8), baud rate(s) _____
■ MS/TP master (Clause 9), baud rate(s): 9600, 19200, 38400, 57600, 76800, 115,200
☐ MS/TP slave (Clause 9), baud rate(s): _____
☐ Point-To-Point, EIA 232 (Clause 10), baud rate(s):_____
☐ Point-To-Point, modem, (Clause 10), baud rate(s): _____
☐ LonTalk, (Clause 11), medium: _____
☐ BACnet/ZigBee (ANNEX O)
☐ Other: _____

Device Address Binding:

Is static device binding supported? (This is currently necessary for two-way communication with MS/TP slaves and certain other devices.) ☐ Yes ■ No

Networking Options:

☐ Router, Clause 6 - List all routing configurations, e.g., ARCNET-Ethernet, Ethernet-MS/TP, etc.
☐ Annex H, BACnet Tunneling Router over IP
☐ BACnet/IP Broadcast Management Device (BBMD)
Does the BBMD support registrations by Foreign Devices? ☐ Yes ■ No
Does the BBMD support network address translation? ☐ Yes ■ No

Network Security Options:

■ Non-secure Device - is capable of operating without BACnet Network Security
☐ Secure Device - is capable of using BACnet Network Security (NS-SD BIBB)
☐ Multiple Application-Specific Keys:
☐ Supports encryption (NS-ED BIBB)
☐ Key Server (NS-KS BIBB)

Character Sets Supported:

Indicating support for multiple character sets does not imply that they can all be supported simultaneously.

■ ISO 10646 (UTF-8/ ANSI X3.4) ☐ IBM™/Microsoft™ DBCS ☐ ISO 8859-1
☐ ISO 10646 (UCS-2) ☐ ISO 10646 (UCS-4) ☐ JIS X 0208

If this product is a communication gateway, describe the types of non-BACnet equipment/networks(s) that the gateway supports:

Not supported.

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