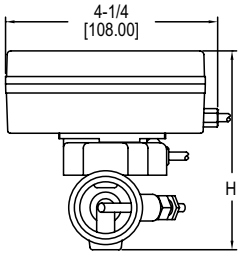
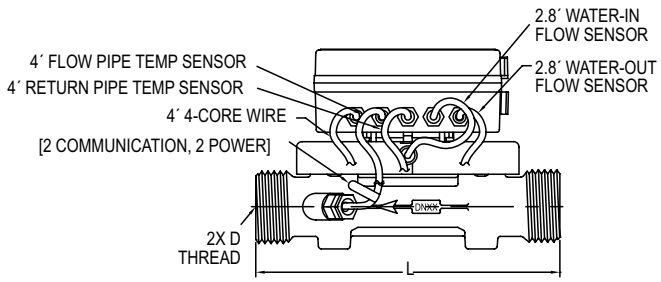
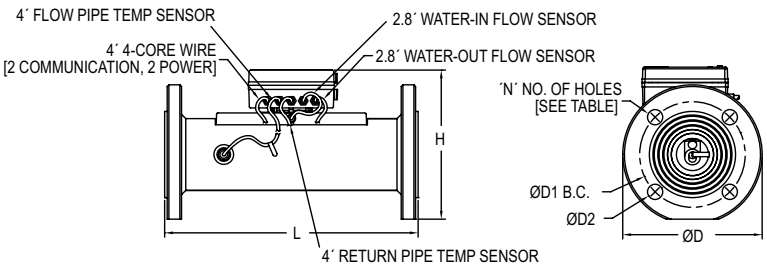
Series TUF Ultrasonic Energy Meter with BACnet Communication

Specifications - Installation and Operating Instructions







Model	Dimensions in [mm]			Flow Rate GPM [LPM]			Weight lb [kg]
	L	D	H	Max Flow (Qs)	Nominal Flow Range (Qp)	Min Flow (Qi)	
TUF-150-XX	4-21/64 [110.00]	G3/4B	3-31/32 [101.00]	13 [50]	6.6 [25]	0.1 [0.5]	3.1 [1.4]
TUF-200-XX	5-1/8 [130.00]	G1B	3-31/32 [101.00]	22 [83]	11 [42]	0.2 [0.8]	3.1 [1.4]
TUF-250-XX	6-19/64 [160.00]	G11/4B	4-11/64 [106.00]	31 [117]	15 [58]	0.3 [1.2]	4.1 [1.8]
TUF-320-XX	7-3/32 [180.00]	G11/2B	4-29/64 [113.00]	53 [200]	26 [100]	0.5 [2]	5.2 [2.3]
TUF-400-XX	7-7/8 [200.00]	G2B	4-49/64 [121.00]	88 [333]	44 [167]	0.9 [3.3]	6.6 [3.0]

Model	Dimensions in [mm]						Flow Rate GPM [LPM]			Weight lb [kg]
	L	ØD	H	ØD1	ØD2	N	Max Flow (Qs)	Nominal Flow Range (Qp)	Min Flow (Qi)	
TUF-500-XX	11-13/16 [300.00]	6-1/2 [165.00]	6-57/64 [175.00]	4-59/64 [125.00]	45/64 [18.00]	4	132 [500]	66 [250]	0.7 [2.5]	30.8 [14]
TUF-650-XX	11-13/16 [300.00]	7-9/32 [185.00]	7-23/32 [196.00]	5-45/64 [145.00]	45/64 [18.00]	4	220 [833]	110 [417]	1.1 [4.2]	30.2 [13.7]
TUF-800-XX	13-25/32 [350.00]	7-7/8 [200.00]	8-1/2 [216.00]	6-19/64 [160.00]	45/64 [18.00]	8	352 [1333]	176 [667]	1.8 [6.7]	37.5 [17]
TUF-1000-XX	13-25/32 [350.00]	8-21/32 [220.00]	9-11/64 [233.00]	7-3/32 [180.00]	45/64 [18.00]	8	528 [2000]	264 [1000]	2.6 [10]	41.8 [19]
TUF-1250-XX	13-25/32 [350.00]	9-27/32 [250.00]	10-25/64 [264.00]	8-17/64 [210.00]	45/64 [18.00]	8	881 [3333]	440 [1667]	4.4 [17]	57.3 [26]
TUF-1500-XX	11-13/16 [300.00]	11-7/32 [285.00]	11-29/64 [291.00]	9-29/64 [240.00]	55/64 [22.00]	8	1321 [5000]	660 [2500]	6.6 [25]	70.5 [32]
TUF-2000-XX	11-13/16 [350.00]	13-25/64 [340.00]	13-21/32 [347.00]	11-39/64 [295.00]	55/64 [22.00]	12	2202 [8333]	1101 [4167]	11 [42]	141 [64]

MODEL CHART

Model	Process Connection	Corresponding Pipe Fitting	Power	Model	Process Connection	Corresponding Pipe Fitting	Power
TUF-150-XX	G-3/4	1/2″ NPT or BSPT	24 VAC/VDC	**TUF-150-XX-DC**	G-3/4	1/2″ NPT or BSPT	24 VDC
TUF-200-XX	G1	3/4″ NPT or BSPT	24 VAC/VDC	**TUF-200-XX-DC**	G1	3/4″ NPT or BSPT	24 VDC
TUF-250-XX	G1-1/4	1″ NPT or BSPT	24 VAC/VDC	**TUF-250-XX-DC**	G1-1/4	1″ NPT or BSPT	24 VDC
TUF-320-XX	G1-1/2	1-1/4″ NPT or BSPT	24 VAC/VDC	**TUF-320-XX-DC**	G1-1/2	1-1/4″ NPT or BSPT	24 VDC
TUF-400-XX	G2	1-1/2″ NPT or BSPT	24 VAC/VDC	**TUF-400-XX-DC**	G2	1-1/2″ NPT or BSPT	24 VDC
TUF-500-XX	GB9119 flange	2″ DN 50 PN 16 flange	24 VAC/VDC	**TUF-500-XX-DC**	GB9119 flange	2″ DN 50 PN 16 flange	24 VDC
TUF-650-XX	GB9119 flange	2-1/2″ DN 65 flange	24 VAC/VDC	**TUF-650-XX-DC**	GB9119 flange	2-1/2″ DN 65 flange	24 VDC
TUF-800-XX	GB9119 flange	3″ DN 80 flange	24 VAC/VDC	**TUF-800-XX-DC**	GB9119 flange	3″ DN 80 flange	24 VDC
TUF-1000-XX	GB9119 flange	4″ DN 100 flange	24 VAC/VDC	**TUF-1000-XX-DC**	GB9119 flange	4″ DN 100 flange	24 VDC
TUF-1250-XX	GB9119 flange	5″ DN 125 flange	24 VAC/VDC	**TUF-1250-XX-DC**	GB9119 flange	5″ DN 125 flange	24 VDC

The **Series TUF Ultrasonic Energy Meter** is a highly accurate and stable energy meter that utilizes ultrasonic technology to measure heating and cooling energy consumption. The Series TUF is a compact meter with a flowmeter and energy calculator in one, making it great for installation on chillers and boilers.

FEATURES/BENEFITS
- Lower maintenance costs with local parameter display and no moving parts
- Serial communication output allows for easy transfer of data
- Flow and temperature monitor in one unit eliminates the need for multiple units

APPLICATIONS
- Heat metering
- Utilities billing
- Tenant billing
- Monitoring of water heating or cooling: radiators, fan coils

INSTRUCTIONS FOR ORDERING
- Choose 1 ultrasonic energy meter model
- Choose 2 pipe fitting models given the appropriate fitting size (for DN15 to DN40 only)*

Example: TUF-150-MD, Fitting Size: A, select pipe fitting Model WM-ACC-C01 or WM-ACC-C11.
Note: Series TUF units are factory set for supply line installation. (Can be modified in the field via communication protocol.)

SPECIFICATIONS

Service: Clean, compatible liquids.
Wetted Materials: Brass and 316L SS.
Range: See chart.
Display: 8-digit LED.
Accuracy: BTU: EN1434/CJ128 Class 2; Flow: ±(2+(0.02 Qp / Q))%; Temperature: ±0.1°C .
Power Requirements: 24 VAC/VDC (model dependent)* or 3.6 V ER26500 lithium metal battery, user supplied and installed, battery acts as back-up if power is lost.
Power Consumption: 1 W.
Temperature Limits: Ambient: 41 to 131°F (5 to 55°C); Process: 36 to 203°F (2 to 95°C).
Humidity Limit: < 93%.
Pressure Limits: 232 psi (16 bar) for DN15 to DN40; 362 psi (25 bar) for >DN50.
Pressure Drop: < 1.5 psi (10 kPa).
Process Connection: See chart.
Serial Communications: Modbus® RTU or BACnet MSTP (model selectable)**.
Enclosure Rating: IP65.
Enclosure Material: Plastic.
Repeatability: Flowmeter: 1%.
Electrical Connections: 3 ft (0.91 m) 4x0.2 mm2 cable with terminal block.
Flow Direction: Unidirectional.
Mounting Orientation: Horizontal or vertical.
Weight: See chart.
Agency Approvals: CE.

*Power supply must be floating, not grounded. Model numbers ending in "-DC" are for DC only applications.
**M-BUS available upon request.

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ELECTRICAL WIRING

NOTICE Wiring should comply with *Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems, TIA/EIA-485-A-1998*, Telecommunications Industry Association, 1998.

NOTICE Wiring should comply with *ANSI/ASHRAE Standard 135-2010 BACnet A Data Communication Protocol for Building Automation and Control Networks,* American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 2010.

NOTICE Communications wiring must be in a daisy-chain fashion. Star connections are not permitted.

Figure 1 shows how to connect the TUF in a network containing a common power supply. Use a cable containing two twisted pairs. One pair is to be used for RS 485/BACnet [+] and [-]. The other pair is used for power and common. This configuration is suitable for AC and DC supplies. Care should be taken that there are not too many devices powered from the same supply as voltage drops will occur in the wiring. If you have many devices, or have long cable runs, the local supply configuration may be a better choice.

Figure 2 also shows how to connect the TUF in a network containing individual local supplies. Use a cable containing a twisted pair and a single conductor. The pair is to be used for [+] and [-]. The single conductor is to be used for common.

All devices in the network should be daisy chained. Star connections and T connections are not permitted.

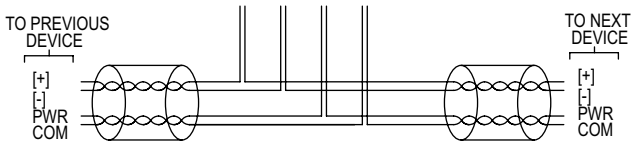


Figure 1: Common local power supply

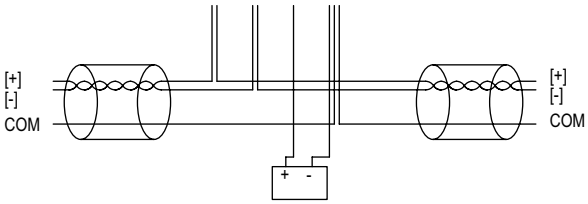


Figure 2: Local power supply

The TUF meter is provided standard with a 3 ft (0.91 m) cable with 4 x 0.2 mm^2 wires that are Red, Black, Green and Yellow. As displayed in Figure 3, the Red wire is Power [+], Black wire is Common [-], and the Green and Yellow wires are for RS 485 BACnet Communication where Green is [-] and Yellow is [+].

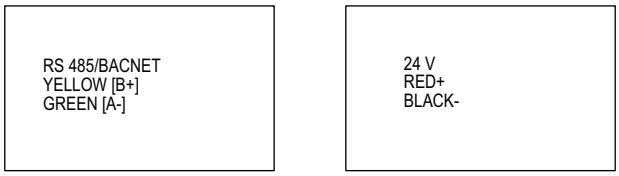


Figure 3: Cable labels

PROGRAMMING MENUS

Programing Via BACnet MS/TP Communication Protocol

Supported BACnet Communication Protocol MS/TP Configuration

Supported Baud Rates	Data Size	Parity	Stop Bits
38400	8	None	1

BACnet Communication Protocol Object Overview
The device Supports the following objects

Object Type	Dynamically Creatable	Dynamically Deletable	Object Identifier	Object Name
Device	No	No	32001	TUF
Analog Input	No	No	AI0	Inlet Water Temperature
Analog Input	No	No	AI1	Outlet Water Temperature
Analog Input	No	No	AI2	Flow velocity
Analog Input	No	No	AI3	Power
Analog Input	No	No	AI4	TUF Communication Status
Analog Input	No	No	AI5	Total Flow
Analog Input	No	No	AI6	Total Heat
Analog Input	No	No	AI7	Total Cool
Analog Input	No	No	AI8	The Status of Write
Analog Input	No	No	AI9	The Version of TUF
Analog Input	No	No	AI10	The Version of SSU
Analog Input	No	No	AI11	SSU ID
Analog Value	No	No	AV0	Meter Mode
Analog Value	No	No	AV1	Balance Sheet Date
Analog Value	No	No	AV2	Local Date
Analog Value	No	No	AV3	Local Time
Analog Value	No	No	AV4	TUF Address

Device Information

The default device object identifier is 32001. The object identifier will change as the MS/TP MAC address changes.

NOTICE Changes to Max Master and Max Info frames require a power cycle/reset to take effect.

Accessing the Measurements

The analog input object AI1 through AI4 are for viewing the pressure measurement in the desired engineering units. The object property tables for these analog input objects can be found in Appendix III.

Analog value object AV1 through AV4 are for viewing the Air Velocity or Air Flow calculated values in the desired engineering units. The object property tables for the analog value objects can be found in Appendix IV.

Accessing the Measurements

The analog input object AI0 through AI2 and AI5 through AI7 are for viewing unit measurements in specific engineering units. The object property tables for these analog input objects with appropriate engineering units can be found in Appendix II.

Analog value object AV0 through AV21 are for viewing additional information such as meter mode, balance sheet and time. The object property table for the analog value objects with appropriate units and formats can be found in Appendix III and IV.

ADDITIONAL NOTES:

1. The communication write status features a power off save, where the last communicated information will be saved upon powering off the unit.
2. Information is accessed at a rate of 1 per minute.
3. Communication time is linked to the meter clock, and will automatically reset on power on. If the time needs to be corrected and is updated via the communications the meter clock will automatically update.
4. With respect to the accumulative heating capacity, accumulative cooling capacity and accumulative flow in the variable table, when this information is transferred via communication only whole numbers will be uploaded. The decimal portion of the reading will only be displayed on the TUF meter LCD screen.

INSTALLATION INSTRUCTIONS

1. Install the meter as shown in either Figure 1 or Figure 2.
2. Mount the temperature sensor with the blue tag on the corresponding return pipe on application. The sensor with the red tag has already been installed in the meter.
3. Flush the system in the proper direction until:
   - No impurities remain in the filter and pipe.
   - No water leaks when pressure is added to the system.
   - The humidity inside the enclosure containing the meter does not exceed 93%.
4. After flushing for a period of time; close the ball valves on either side of the meter and flush the impurities out of all filters.

*3.6 V ER26500 battery may be purchased separately to power display only.

INSTALLATION REQUIREMENTS

NOTICE If the following requirements are not followed, then large air particles and impurities in the pipe could influence the meter's measuring accuracy.

1. Ensure that there is a 10 diameter straight run of pipe upstream and a 5 diameter straight run of pipe downstream form the meter.
2. See the installation positions in Figure 3, in which A and B are the proper installation positions, while C and D are the improper positions.
3. If the meter is installed on the horizontal pipe, it must be oriented at least 45° from horizontal (see Figure 4). If the meter's face is horizontal, then debris accumulation can increase inaccuracies (see figure 5 for correct and incorrect orientations). There is no special requirement when installing on the vertical pipe work.

Note: the meter can be installed on the return pipe or the supply pipe according to user's needs, but it should be selected in advance.

INSTALLATION NOTES

NOTICE If not specified at time of order, refer to appendix III to change from supply to return programming.
Change from supply to return, and vice-versa, is only possible using digital communication protocols.

NOTICE Do not directly weld the meter on to the pipe; the extreme heat will damage the BTU meter's internal elements.

⚠ CAUTION Do not install the meter near a high temperature heat source such as during electro gas welding. Doing so after installing an optional battery could cause the battery to explode and cause injury to people and damage the meter.

1. Avoid tugging on the temperature probe's cables.
2. Ensure the water is flowing in the direction indicated by the arrow on the meter's body.
3. If several meters are installed on the same vertical pipe work, each meter should be separated from the others to avoid pipe leakage or fallen debris that could affect the other meters' operation.

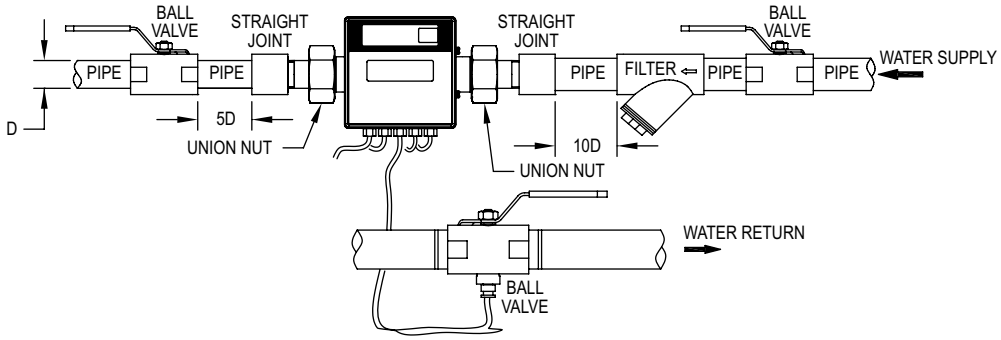


Figure 1: Installation diagram for TUF-150 to TUF-400

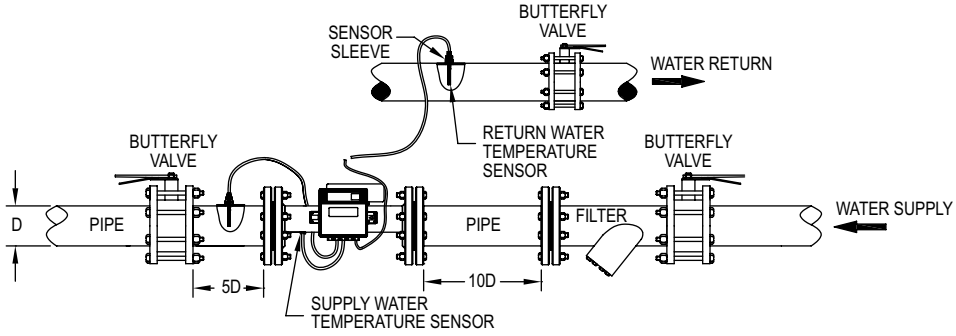


Figure 2: Installation diagram for TUF-500 to TUF-2000

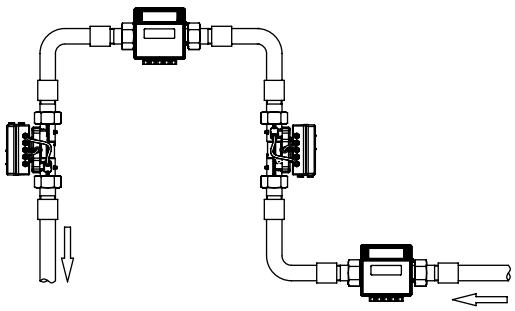


Figure 3: Installation positions

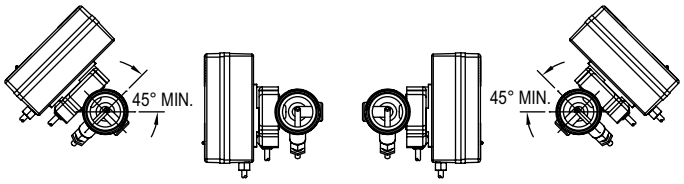
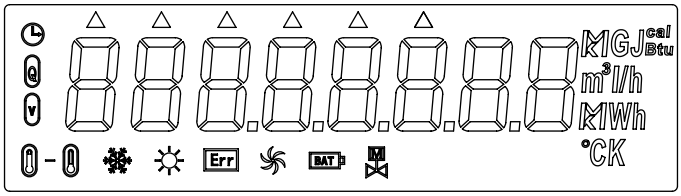


Figure 4: Mounting rotation

FEATURES
- Works with both heating and cooling systems
- High accuracy
  The high quality ultrasonic transducer and advanced electronic measurement technology work together to ensure the meter's high accuracy and stability
- No moving parts
  This decreases the maintenance cost and ensures that the meter is resistant to dirty water
- PT1000 platinum thermisters
- Low starting flow-rate
  The U-shaped acoustic path widens the dynamic flow-rate measurement range and increases the accuracy of low and high end measurements where other, more narrow ranged, devices are inaccurate
- Horizontal or vertical installation
- Communication output ports can be used for automated meter reading
- Automatic diagnostic function. An error code will be displayed on the screen to indicate the problem
- Ability to install an optional 3.6 V battery that can last up to 6 years

NOTES
1. If meter is not in use during freezing conditions, drain all water from the connecting pipe. Low temperatures will cause the water to freeze in the pipe and damage the meter.
2. This device is intended to be used with clean water. While dirty water will not damage the meter, it will cause errors in the reading.
3. A filter should be mounted near the meter and cleaned regularly.
4. If the heat exchanging system is operating normally, but the instantaneous flow-rate of the heat meter reduces significantly, then there is too much dirt in the filter. This will narrow the pipe and reduce the flow. Cleaning the filter will fix the problem.
5. To protect the meter and avoid damage from harsh conditions, it is recommended that the meter be encased in an enclosure.
6. Primary Address: first 2 digits of Manufacturer ID
7. Secondary Address: later 8 digits of Manufacturer ID
8. Company Code: BAS (08 33)
   - Version: 54



DISPLAY
1. Switching Between Information
   Holding down the button for > 1s will switch the sections from curren information ▲, to monthly information ▲▲, and then to other information ▲▲▲. Once in the desired section, pressing the key will switch the information shown for the given section.
2. Display Units
   Energy is displayed in kW•h, power is displayed in kW, flow volume is displayed as m^3, and flow-rate is displayed in m^3/h.
3. Display Details
   a. "Monthly Reading Date" is displayed as "Pd= XX", in which XX is the end date of the current month's energy summation. The factory default value is 31, meaning that the monthly recording period ends at midnight on the 31st day of the month. At this time the current month's cumulated energy will be stored and the system will begin to record the next month's energy.

   b. The meter can store and display the recordings from the past 18 months.

   c. The units for "Sum of Working Time" (hours) is displayed as h.

   d. "Software and Protocol Editions" are displayed as "UEr.X.X X.X". The first X.X is the software edition code and the second X.X is the communication protocol edition code.

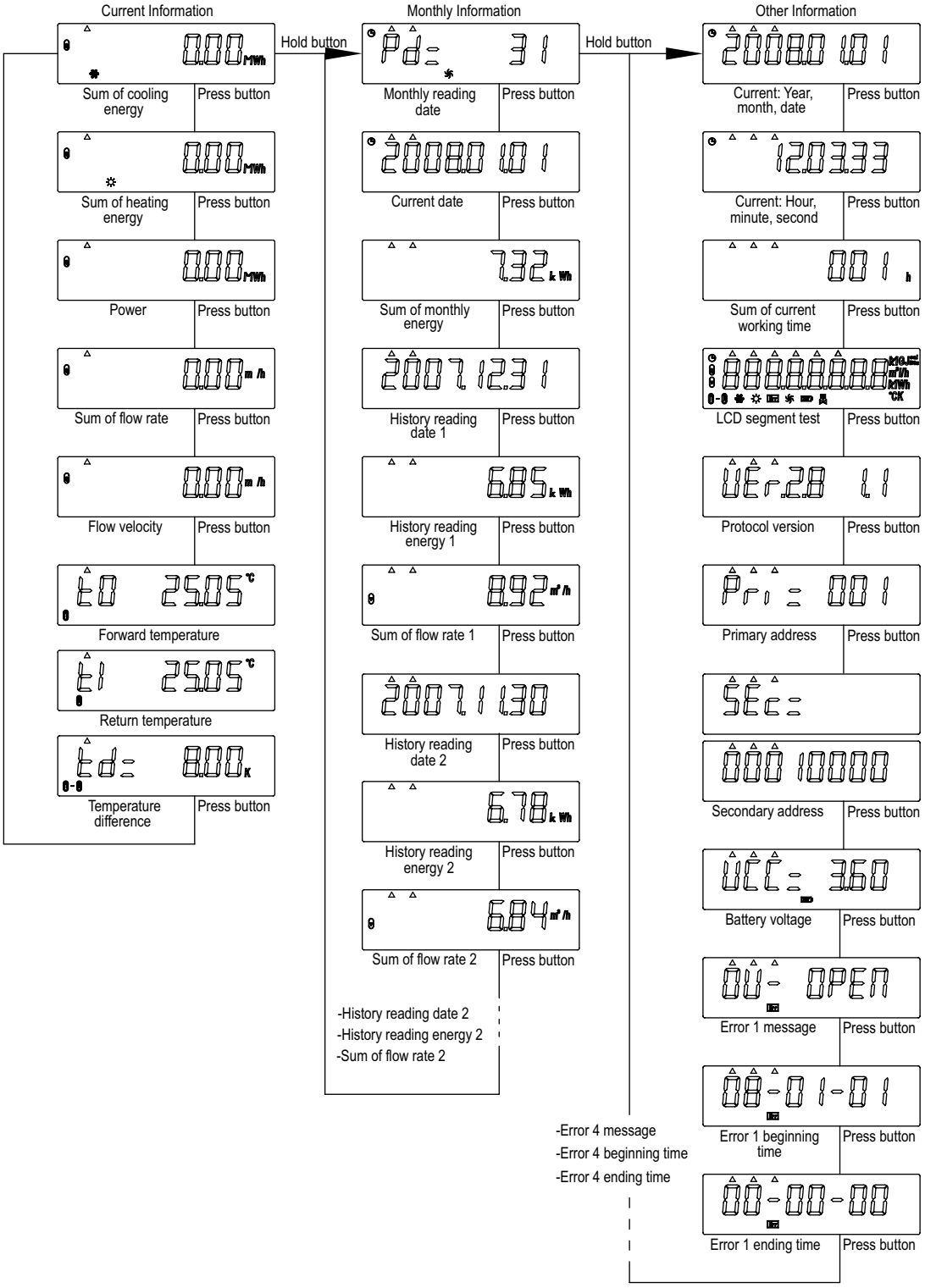
   e. "Leaving-factory serial number" is the meter's identification number, which is the same as the one in the external label. This serial number is a unique number set by the factory; it is also the secondary address in M-BUS system.

   f. Battery Voltage displays "UCC=X.XX" (the default unit is Volts). When the battery's voltage capacity is lower than 2.9±0.1 V, " " will appear on the display. This symbol will not appear if no battery is installed.

   g. If there are any unresolved errors, the start date will display as normal but the end date will display "00-00-00", and then the error message will be displayed.

Error Message Table	
Error Messages	**Explanation**
IN—CLOSE	Temperature sensor of water supply is in closed state
IN—OPEN	Temperature sensor of water supply is in open state
OU—CLOSE	Temperature sensor of return water is in closed state
OU—OPEN	Temperature sensor of return water is in open state
FL-OPEN	Flow sensor failure. (Could be caused by air in the meter, the absence of water, or water flowing in the wrong direction)
COD=XXXX	There is an error in malfunction record. "XXXX" is the error code

4. Display Menus



WARRANTY/RETURN
Refer to “Terms and Conditions of Sale” in our catalog and on our website. Contact customer service to receive a Return Goods Authorization number before shipping the product back for repair. Be sure to include a brief description of the problem plus any additional application notes.

APPENDIX I: DEVICE OBJECT PROPERTY TABLE			
Property	**Default Value**	**Property Data Type**	**Access**
Object Identifier	32001	BACnetObjectIdentifier	Read/Write
Object Name	Ultrasonic BTU Meter	CharacterString (32)	Read/Write
Object Type	DEVICE (8)	BACnetObjectiveType	Read
System Status	Operation (0)	BACnet Device Status	Read
Vendor Name	Dwyer Instruments, Inc.	CharacterString	Read
Vendor Identifier	607	Unsigned	Read
Model Name	TUF-XX-BN	CharacterString	Read
Firmware Revision	“X.X”	CharacterString	Read
Application Software Version	“X.X”	CharacterString	Read
Description	Basic Protocol Converter	CharacterString (32)	Read/Write
Protocol Version	1	Unsigned	Read
Protocol Revision	5	Unsigned	Read
Protocol Services Supported	Read Property; write property; who-is	BACnet ServicesSupported	Read
Protocol Object Types Supported	Analog Input, Analog Value, Device	BACnetObjectTypes Supported	
Object List	See Table on page 3	BACnetArray	Read
Maximum APDU Length Accepted	50	Unsigned	Read
Segmentation Supported	NO_SEGMENTS (3)	BACnet Segmentation	Read

APPENDIX II: ANALOG INPUT OBJECT PRODUCT TABLE			
Property	**Default Value**	**Property Data Type**	**Access**
Object Identifier	AI0	BACnetObjectIdentifier	Read
Object Name	Inlet Water Temperature	CharacterString	Read
Object Type	ANALOG_INPUT (0)	BACnetObjectType	Read
Present Value	Current Reading	Real	Read
Status Flags	0	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Units	Celsius (62)	BACnetEngineeringUnits	Read

APPENDIX II: ANALOG INPUT OBJECT PRODUCT TABLE			
Property	**Default Value**	**Property Data Type**	**Access**
Object Identifier	AI1	BACnetObjectIdentifier	Read
Object Name	Outlet Water Temperature	CharacterString	Read
Object Type	ANALOG_INPUT (0)	BACnetObjectType	Read
Present Value	Current Reading	Real	Read
Status Flags	0	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Units	Celsius (62)	BACnetEngineeringUnits	Read

APPENDIX II: ANALOG INPUT OBJECT PRODUCT TABLE			
Property	**Default Value**	**Property Data Type**	**Access**
Object Identifier	AI2	BACnetObjectIdentifier	Read
Object Name	Volume	CharacterString	Read
Object Type	ANALOG_INPUT (0)	BACnetObjectType	Read
Present Value	Current Reading	Real	Read
Status Flags	0	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Units	Cubic meter per hour (135)	BACnetEngineeringUnits	Read

APPENDIX II: ANALOG INPUT OBJECT PRODUCT TABLE			
Property	**Default Value**	**Property Data Type**	**Access**
Object Identifier	AI3	BACnetObjectIdentifier	Read
Object Name	Power	CharacterString	Read
Object Type	ANALOG_INPUT (0)	BACnetObjectType	Read
Present Value	Current Reading	Real	Read
Status Flags	0	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Units	Kilowatts (48)	BACnetEngineeringUnits	Read

APPENDIX II: ANALOG INPUT OBJECT PRODUCT TABLE			
Property	**Default Value**	**Property Data Type**	**Access**
Object Identifier	AI4	BACnetObjectIdentifier	Read
Object Name	TUF Communication Status	CharacterString	Read
Object Type	ANALOG_INPUT (0)	BACnetObjectType	Read
Present Value	Current Reading	Real	Read
Status Flags	0	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Units	No units (95)	BACnetEngineeringUnits	Read

APPENDIX II: ANALOG INPUT OBJECT PRODUCT TABLE			
Property	**Default Value**	**Property Data Type**	**Access**
Object Identifier	AI5	BACnetObjectIdentifier	Read
Object Name	Total Flow	CharacterString	Read
Object Type	ANALOG_INPUT (0)	BACnetObjectType	Read
Present Value	Current Reading	Real	Read
Status Flags	0	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Units	Cubic meters (80)	BACnetEngineeringUnits	Read

APPENDIX II: ANALOG INPUT OBJECT PRODUCT TABLE			
Property	**Default Value**	**Property Data Type**	**Access**
Object Identifier	AI6	BACnetObjectIdentifier	Read
Object Name	Total Heat	CharacterString	Read
Object Type	ANALOG_INPUT (0)	BACnetObjectType	Read
Present Value	Current Reading	Real	Read
Status Flags	0	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Units	Kilowatt hours (19)	BACnetEngineeringUnits	Read

APPENDIX II: ANALOG INPUT OBJECT PRODUCT TABLE			
Property	**Default Value**	**Property Data Type**	**Access**
Object Identifier	AI7	BACnetObjectIdentifier	Read
Object Name	Total Cool	CharacterString	Read
Object Type	ANALOG_INPUT (0)	BACnetObjectType	Read
Present Value	Current Reading	Real	Read
Status Flags	0	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Units	Kilowatt hours (19)	BACnetEngineeringUnits	Read

APPENDIX II: ANALOG INPUT OBJECT PRODUCT TABLE			
Property	**Default Value**	**Property Data Type**	**Access**
Object Identifier	AI8	BACnetObjectIdentifier	Read
Object Name	The Status of Write	CharacterString	Read
Object Type	ANALOG_INPUT (0)	BACnetObjectType	Read
Present Value	Current Reading	Real	Read
Status Flags	0	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Units	No units (95)	BACnetEngineeringUnits	Read

APPENDIX II: ANALOG INPUT OBJECT PRODUCT TABLE			
Property	**Default Value**	**Property Data Type**	**Access**
Object Identifier	AI9	BACnetObjectIdentifier	Read
Object Name	The version of TUF	CharacterString	Read
Object Type	ANALOG_INPUT (0)	BACnetObjectType	Read
Present Value	Current Reading	Real	Read
Status Flags	0	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Units	No units (95)	BACnetEngineeringUnits	Read

APPENDIX II: ANALOG INPUT OBJECT PRODUCT TABLE			
Property	**Default Value**	**Property Data Type**	**Access**
Object Identifier	AI10	BACnetObjectIdentifier	Read
Object Name	The version of SSU	CharacterString	Read
Object Type	ANALOG_INPUT (0)	BACnetObjectType	Read
Present Value	Current Reading	Real	Read
Status Flags	0	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Units	No units (95)	BACnetEngineeringUnits	Read

APPENDIX II: ANALOG INPUT OBJECT PRODUCT TABLE			
Property	**Default Value**	**Property Data Type**	**Access**
Object Identifier	AI11	BACnetObjectIdentifier	Read
Object Name	SSU ID	CharacterString	Read
Object Type	ANALOG_INPUT (0)	BACnetObjectType	Read
Present Value	Current Reading	Real	Read
Status Flags	0	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Units	No units (95)	BACnetEngineeringUnits	Read

APPENDIX III: ANALOG VALUE OBJECT PROPERTY TABLE			
Property	**Default Value**	**Property Data Type**	**Access**
Object Identifier	AV0	BACnetObjectIdentifier	Read
Object Name	Meter Mode	CharacterString	Read
Object Type	ANALOG_VALUE (2)	BACnetObjectType	Read
Present Value	1	Real	Read
Status Flags	0	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Units	No units (95)	BACnetEngineeringUnits	Read

APPENDIX III: ANALOG VALUE OBJECT PROPERTY TABLE			
Property	**Default Value**	**Property Data Type**	**Access**
Object Identifier	AV1	BACnetObjectIdentifier	Read
Object Name	Balance Sheet Date	CharacterString	Read
Object Type	ANALOG_VALUE (2)	BACnetObjectType	Read
Present Value	31	Real	Read
Status Flags	0	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Units	No units (95)	BACnetEngineeringUnits	Read

APPENDIX III: ANALOG VALUE OBJECT PROPERTY TABLE			
Property	**Default Value**	**Property Data Type**	**Access**
Object Identifier	AV2	BACnetObjectIdentifier	Read
Object Name	Local Date	CharacterString	Read
Object Type	ANALOG_VALUE (2)	BACnetObjectType	Read
Present Value	Current Date	Real	Read
Status Flags	0	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Units	No units (95)	BACnetEngineeringUnits	Read

APPENDIX III: ANALOG VALUE OBJECT PROPERTY TABLE			
Property	**Default Value**	**Property Data Type**	**Access**
Object Identifier	AV3	BACnetObjectIdentifier	Read
Object Name	Current Time	CharacterString	Read
Object Type	ANALOG_VALUE (2)	BACnetObjectType	Read
Present Value	Current Reading	Real	Read
Status Flags	0	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Units	No units (95)	BACnetEngineeringUnits	Read

APPENDIX III: ANALOG VALUE OBJECT PROPERTY TABLE			
Property	**Default Value**	**Property Data Type**	**Access**
Object Identifier	AV4	BACnetObjectIdentifier	Read
Object Name	TUF Address	CharacterString	Read
Object Type	ANALOG_VALUE (2)	BACnetObjectType	Read
Present Value	127	Real	Read
Status Flags	0	BACnetStatusFlags	Read
Event State	NORMAL (0)	BACnetEventState	Read
Units	No units (95)	BACnetEngineeringUnits	Read

APPENDIX III: ANALOG VALUE OBJECT PROPERTY TABLE			
Property	**Default Value**	**Property Data Type**	**Access**
Object Identifier	AV21	BACnetObjectIdentifier	Read
Object Name	Temperature Compensation Mode	CharacterString	Read
Object Type	ANALOG_VALUE (2)	BACnetObjectType	Read
Present Value	0	Real	Read
Status Flags	0	BACnetStatusFlags	Read
Event State	SUPPLY (0)	BACnetEventState	Read
Units	No units (95)	BACnetEngineeringUnits	Read

APPENDIX IV: VARIABLE TYPE/FORMAT		
Object Identifier	**Description**	**Type/Format**
AI0	Inlet Water Temperature	Forward flow temperature (temperature forward)
AI1	Outlet Water Temperature	Return flow temperature (temperature return)
AI2	Flow velocity	Flow rate of TUF
AI3	Power	Power of TUF
AI4	TUF Communication Status	TUF meter: 0: success 1: failure
AI5	Total Flow	Accumulative flow of TUF
AI6	Total Heat	Total heat quantity of TUF
AI7	Total Cool	Total cold quantity of TUF
AI8	The Status of Write	1: failure 0: success
AI9	The Version of TUF	Meter version
AI10	The Version of SSU	Communication version
AI11	SSU ID	Communication ID
AV0	Meter Mode	0: cold mode 1: heat mode
AV1	Balance Sheet Date	1~31 available
AV2	Local Date	Format: year month date [Example: 151213 means 13 December 2015]
AV3	Local Time	Format: week hour minute second [Example: 17125630 means Sunday 12:56:30 (7 is Sunday, 1 is Monday….)]
AV4	TUF Address	0 to 127
AV21	Temperature Compensation Mode	0: Unit installed on supply 1: Unit installed on return 2, 3: Reserved for factory use only

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